Panasonic
ideas for life

Relay Catalogue 2005

Part 1: Electromechanical Relays

Part 2: PhotoMOS and Semiconductor Relays

07/2005

Notes and Guidelines

Panasonic is part of a large worldwide group selling relays and associated switching products under different brand names in different territories. The conditions of use in some territories may differ from those customary in Europe. In particular there are often major differences in regard to national and international specifications, such as UL, CSA, VDE, SEV, EVE, SEMKO, etc. Thus, when considering contact loads as stated in this catalogue (e.g. 10 A, 30 VDC for the SP relay) it should be understood that these values are not necessarily an absolute maximum but tested ratings. Mostly the stated value has been tested for a certain life expectancy as stated by the manufacturer or the respective test house. Thus, under different conditions, the stated “maximum” may, in practice, be safely exceeded.

Therefore consideration should be given to each specific application for:

- rating and type of load
- switching frequency - cycles per second (or minute)
- environmental conditions

A general statement of compliance on data sheets, publicity, etc. concerning industrial standards, approvals or certification may imply compliance to a certain standard is available. However, because of the multiplicity of types available, in general not all types within the product family are covered to the same extent by the standard. Thus, in the event of a specific query regarding a particular product and its compliance with the standard, users are asked to refer to Panasonic for detailed information.

In case of uncertainty, contact should be made with Panasonic locally to ascertain the likelihood of the relay meeting the required life expectancy in the specific planned operational circumstances. It is also pointed out that in this book, and in deviation from EN / IEC 61810-1, operational life data is given under a normal ambient temperature of about 25°C.

The features and specifications quoted have been carefully tested using modern methods and represent the values which are to be expected with a product in new condition at room temperature. They are not guaranteed values and may change during operational life or due to ambient influences. Statistical test information covering major operating features is available on request. Panasonic reserves the right to make alterations and changes to specifications without notice from time to time as may be deemed necessary.

Application of the EC Directives to All-or-Nothing Relays

As of this moment, none of the directives require CE marking for all-or-nothing relays[1]. With respect to the three EC directives potentially to be taken into account, the following applies to all-or-nothing relays.

1 EMC Directive

All-or-nothing - be they electro-mechanical relays or solid state relays - shall not be labeled with a CE marking nor shall a declaration of conformity be issued within the scope of the EMC Directive.

The EMC Directive concerns primarily the finished products. In applying the Directive to components, the Guidelines[2] should be consulted to determine whether the component in question has a “direct function”. Electric motors, power supply units or temperature controls represent examples of such components with “direct function”. These types of components must be provided with a CE marking.

Components which are integrated into a device, such as relays, do not have an independent function of their own. A given relay may perform differing functions in different devices. Consequently, all-or-nothing relays must be considered components without “direct function” which are not subject to the EMC Directive.

2 Low Voltage Directive

Relays with terminals for printed boards/plug-and-socket connections do not come within the purview of the Low Voltage Directive.

The Low Voltage Directive concerns electrical equipment intended for incorporation into a device as well as equipment intended for direct use. In the case of electrical equipment which is considered a basic component intended for incorporation into other electrical equipment, the properties and safety of the final product will be largely dependent on how it is integrated: as such, these components do not come within the Machinery Directive and shall not be CE marked. The Guidelines[3] specifically cite electro-mechanical basic components such as connectors, relays with terminals for printed circuit boards and micro switches.

Except for larger relays which may, for example, find application in switching cabinets, the same considerations apply to common-place relays with plug-in connections available also with printed board terminals. Here again, safety is a function of the individual application. In evaluating these relays’ performance from the perspective of the Low Voltage Directive, the same conclusion is reached as with the printed board relay. As such, CE marking is not mandatory for this type of relay.

3 Machinery Directive

The Machinery Directive differentiates between machines, machine parts and safety components. Relays are not part of any of these categories. The listing of safety components in Appendix IV is conclusive and does not include relays.

Consequently, a CE marking shall not be affixed nor shall a declaration of conformity or manufacturer’s declaration be issued under the Machinery Directive.

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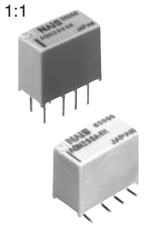
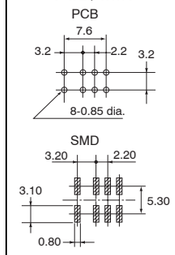
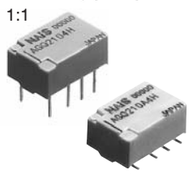
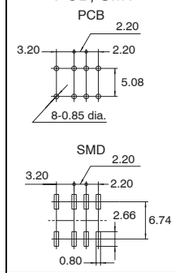
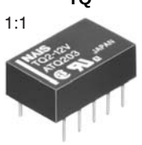
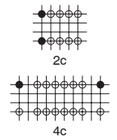
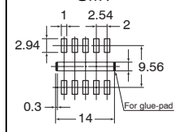
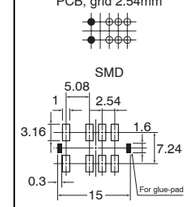
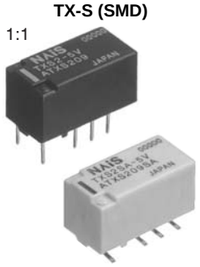
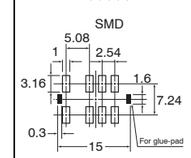
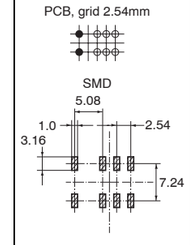
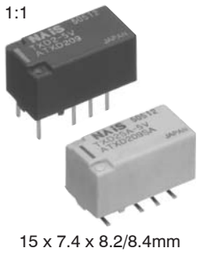
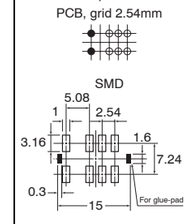
1. This writing deals exclusively with “non-specified-time all-or-nothing relays”. The abbreviated term “all-or-nothing relay” has been introduced merely for purposes of convenience. The term includes solid state all-or-nothing relays.
2. Guidelines (version dated May 26, 1997) for the Application of the Council Directive 89/336/EEC.
3. Guidelines (version dated July 1997) for the Application of the Council Directive 73/23/EEC.

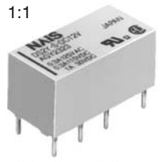
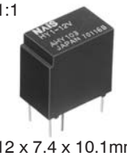
Table of Contents

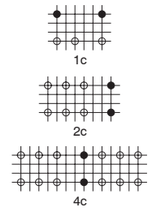
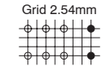
About the Selector Chart

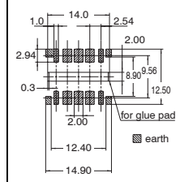
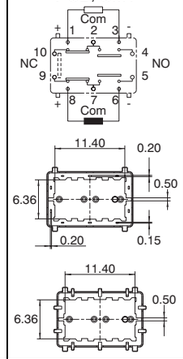
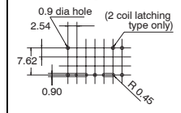
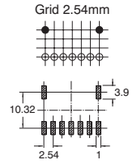
This selector chart is designed to help you quickly select a relay best suited for your needs. Please note: the values given for switching current and switching voltage do not necessarily indicate standard operating conditions. For the nominal switching capacity and other critical values, please refer to the respective data sheet. In case of doubt, please contact your Panasonic representative.

Type ✪ = PopularType (Picture scale: DIN A4)	Features	Switching current (max., min.)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage: Between open contacts	Breakdown voltage: Between contact sets	Breakdown voltage: Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
✪**GN (SMD)** 1:1  10.6 x 5.7 x 9.0mm	• Compact slim body saves space • Outstanding surge resistance • The use of twin crossbar contacts ensures high contact reliability • RoHS compliant	**Max:** 1A **Min:** 10µA	• 110V DC • 125V AC	2c	(DC) 1.5, 3, 4.5, 6, 9, 12, 24V	**Single side stable:** 140mW (1.5 - 12V DC) 230mW (24V DC) **1 coil latching:** 100mW (1.5V - 12V DC) 120mW (24V DC)	750Vrms	1000Vrms	1500Vrms	1,500V FCC 2,500V Bellcore	PCB, SMT 	45 UL, CSA, BSI
✪**GQ (SMD)** 1:1  10.6 x 7.2 x 5.2/5.4mm	• Compact flat body saves space • Outstanding surge resistance • The use of twin crossbar contacts ensures high contact reliability • RoHS compliant	**Max:** 1A **Min:** 10µA	• 110V DC • 125V AC	2c	(DC) 1.5, 3, 4.5, 6, 9, 12, 24V	**Single side stable:** 140mW (1.5 - 12V DC) 230mW (24V DC) **1 coil latching:** 100mW (1.5V - 12V DC) 120mW (24V DC)	750Vrms	1000Vrms	1500Vrms	1,500V FCC 2,500V Bellcore	PCB, SMT 	49 UL, CSA, BSI
✪**TQ** 1:1  14 x 9 x 5mm	• 1,500V FCC 4-pole model available • RoHS compliant	**Max:** 1A **Min:** 10µA	• 110V DC • 125V AC	2c, 4c	(DC) 3, 4.5, 5, 6, 9, 12, 24, 48V	**Single side stable:** 140mW (3 - 12V DC) 200mW (24V DC) 300mW (48V DC) **1 coil latching:** 100mW (3 - 12V DC) 150mW (24V DC) **2 coil latching:** 200mW (3 - 12V DC) 300mW (24V DC)	750Vrms	1000Vrms	1000Vrms	1,500V FCC	PCB Grid 2.54mm 	70 UL, CSA, BSI
✪**TQ (SMD)** 1:1  14 x 9 x 5.6mm	• Ultra low profile 5.8mm • Surge withstand 2,500V • 3 types of surface-mount terminals available • RoHS compliant	**Max:** 2A **Min:** 10µA	• 220V DC • 125V AC	2c	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V	**Single side stable:** 140mW (up to 12V DC) 200mW (24V DC) 300mW (48V DC) **1 coil latching:** 70mW (up to 12V DC) 100mW (24V DC) **2 coil latching:** 140mW (up to 12V DC) 200mW (24V DC)	1000Vrms	1500Vrms	1500Vrms	1,500V FCC 2,500V Bellcore	SMT 	77 UL, CSA

Type ✪ = PopularType (Picture scale: DIN A4)	Features	Switching current (max., min.)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage Between open contacts	Breakdown voltage Between contact sets	Breakdown voltage Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
✪**TX (SMD)** 1:1  15 x 7.4 x 8.2mm	• Surge withstand 2,500V • High contact capacity 2A 30V DC • Breakdown voltage between contacts and coil 2,000V • 3 types of surface-mount terminals available • RoHS compliant	**Max:** 2A **Min:** 10µA	• 220V DC • 220V AC	2c	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V	**Single side stable:** 140mW (up to 24V DC) 270mW (48V DC) **1 coil latching:** 100mW **2 coil latching:** 300mW	1000Vrms	1000Vrms	2000Vrms	1,500V FCC 2,500V Bellcore	PCB, SMT PCB, grid 2.54mm  	82 UL, CSA, BSI
TX-S (SMD) 1:1  15 x 7.4 x 8.2/8.4mm	• Higher sensitivity • Nominal operating power, 50mW • 1,500V FCC • 3 types of surface-mount terminals available • RoHS compliant	**Max:** 1A **Min:** 10µA	• 110V DC • 125V AC	2c	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24V(DC)	**Single side stable:** 50mW (1.5 - 12V DC) 70mW (24V DC) **1 coil latching:** 35mW (1.5 - 12V DC) 50mW (24V DC) **2 coil latching:** 70mW (1.5 - 12V DC) 150mW (24V DC)	750Vrms	1000Vrms	1800Vrms	1,500VFCC 2,500V Bellcore	PCB, SMT PCB, grid 2.54mm  	96 UL, CSA, BSI
SX (SMD) 1:1  15 x 7.4 x 8.2/10mm	• High contact reliability over a long life has been made possible for low level loads • High sensitivity of 50mW • Low thermal electromotive force • RoHS compliant	**Max:** 0.01A **Min:** 10µA	• 10V DC	2c	(DC) 1.5, 3, 4.5, 6, 9, 12, 24V	**Single side stable:** 50mW (1.5 - 12V DC) 230mW (24V DC) **1 coil latching:** 35mW (1.5 - 12V DC) 50mW (24V DC) **2 coil latching:** 70mW (1.5 - 12V DC) 150mW (24V DC)	750Vrms	1000Vrms	1500Vrms	-	PCB, SMT PCB, grid 2.54mm  	56 UL, CSA, BSI
TX-D (SMD) 1:1  15 x 7.4 x 8.2/8.4mm	• High-insulation relay that conforms to the insulation level provided for in the EN41003 • 3 types of surface-mount terminals available • RoHS compliant	**Max:** 2A **Min:** 10µA	Break Before Make: • 220V DC • 250V AC Make Before Break: • 125V DC • 125V AC	2c	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24V	**Single side stable:** 200mW (1.5 - 12V DC) 230mW (24V DC) **1 coil latching:** 150mW (1.5 - 12V DC) 170mW (24V DC)	1000Vrms	1000Vrms	2000Vrms	1,500V FCC 2,500V Bellcore	PCB, SMT PCB, grid 2.54mm  	89 UL, CSA, BSI
TN 1:1  14 x 5.6 x 9.8mm	• Slim size • 1,500V FCC • RoHS compliant	**Max:** 1A **Min:** 10µA	• 110V DC • 125V AC	2c	(DC) 3, 4.5, 5, 6, 9, 12, 24, 48V	**Single side stable:** 140mW (up to 12V DC) 200mW (24V DC) 300mW (48V DC) **1 coil latching:** 100mW (3 - 12V DC) 150mW (24V DC) **2 coil latching:** 200mW (3 - 12V DC) 300mW (24V DC)	750Vrms	1000Vrms	1000Vrms	1,500V FCC	PCB Grid 2.54mm 	66 UL, CSA

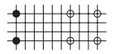
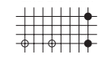
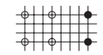
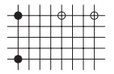
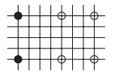
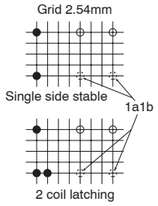
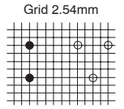
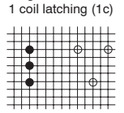
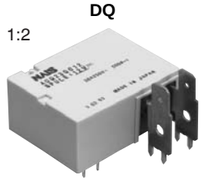
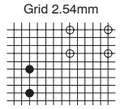
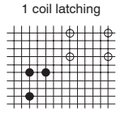
Type ✪ = PopularType (Picture scale: DIN A4)	Features	Switching current (max., min.)	Max. switching voltage	Contact arrangement	Coil voltage
TK 1:1  10.6 x 9 x 4mm	• Low profile 4mm • High contact capacity 2A • Surge withstand voltage between contact and coil 2,500V • RoHS compliant	**Max:** 2A **Min:** 10µA	• 220V DC • 220V AC	1c	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24V
DS 1:1  20 x 9.9 x 9.8mm	• 1500V FCC • High switching power • RoHS compliant	**Max:** 2A **Min:** 10µA	• 220V DC • 250V AC	1c, 2c, 4c	(DC) 1.5, 3, 5, 6, 9, 12, 24, 48V
✪**DS2Y** 1:1  20 x 9.9 x 9.3mm	• High sensitivity • 2 Form C contact • 1,500V FCC • Sealed construction • RoHS compliant	**Max:** 2A **Min:** 10µA	• 220V DC • 250V AC	2c	(DC) 1.5, 3, 5, 6, 9, 12, 24, 48V
HY 1:1  12 x 7.4 x 10.1mm	• High sensitivity 150mW / 200mW • RoHS compliant	**Max:** 1A 30V DC **Min:** 1mA 1V DC	• 60V DC	1c	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24V

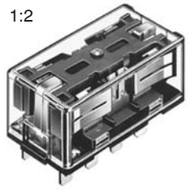
Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
	Between open contacts	Between contact sets	Contacts to coil			
Single side stable: 140mW (up to 12V DC) 270mW (24V DC) **1 coil latching:** 100mW (3 - 12V DC) 150mW (24V DC) **2 coil latching:** 200mW (1.5 - 9V DC) 250mW (12V DC) 400mW (24V DC)	750Vrms	1000Vrms	1500Vrms	1,500V FCC 2,500V Bellcore	PCB Grid 2.54mm 	61 UL, CSA
M type: **Single side stable:** 400mW **1 coil latching:** 180mW **2 coil latching:** 360mW **S type:** **Single side stable:** 200mW **1 coil latching:** 90mW **2 coil latching:** 180mW	1000Vrms (DS1-S: 500Vrms)	1000Vrms	1500Vrms (1000Vrms for DS1-S)	1,500V FCC	PCB Grid 2.54mm  1c 2c 4c	36 UL, CSA
Single side stable: 200mW (300mW: 48V) **2 coil latching:** 180mW (360mW: 48V)	750Vrms	1000Vrms	1000Vrms	1,500V FCC	PCB Grid 2.54mm 	42 UL, CSA
Standard: 200mW **High sensitivity:** 150mW	500Vrms	-	1000Vrms	-	PCB Grid 2.54mm 	53 UL, CSA

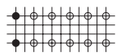
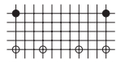
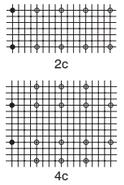
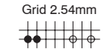
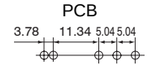
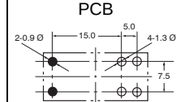
Type ✪ = PopularType (Picture scale: DIN A4)	Features	Switching current (max., min.)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage: Between open contacts	Breakdown voltage: Between contact sets	Breakdown voltage: Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
RA 1:1  14.7 x 9.7 x 5.9mm	• HF relay in SMT version • Up to 1GHz • Impedance 50Ω • RoHS compliant HF Characteristics at 1GHz: • Isolation min. 20dB • Insertion loss max. 0.3dB • V.S.W.R. max. 1.2	**DC:** 1A **HF:** 3W (1GHz)	• 30V DC	2c	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V	**Single side stable:** 140mW (1.5 - 12V) 200mW (24V) 300mW (48V) **1 coil latching:** 70mW (1.5 - 12V) 100mW (24V) **2 coil latching:** 140mW (1.5 - 12V) 200mW (24V)	750Vrms	1000Vrms	1000Vrms	-	SMT Suggested mounting pads (Top view) 	104 -
✪**RJ** 1:1  14 x 9 x 8.2mm	• Shielded HF relay • Up to 5GHz • Impedance 50Ω • RoHS compliant HF Characteristics at 5GHz: • Isolation min. 35dB • Insertion loss max. 0.5dB • V.S.W.R. max.1.25	**DC:** 0.3A **HF:** 1W (5GHz)	• 30V DC	2c	(DC) 3, 4.5, 12, 24V	**Single side stable:** 200mW **2 coil latching:** 150mW	500Vrms	500Vrms	500Vrms	-	PCB, SMT 	122 -
RX 1:1  20.5 x 12.4 x 9.4mm	• Shielded HF-Relay • Up to 3 GHz • Impedance 50Ω • RoHS compliant HF Characteristics at 2.5GHz • Isolation min. 60dB • Insertion loss max. 0.2dB • V.S.W.R. max. 1.2	**DC:** 0.5A **HF:** 10W (2.5GHz)	• 30 V DC	1c	(DC) 3, 4.5, 6, 9, 12, 24V	**Single side stable:** 200mW **1 coil latching:** 200mW **2 coil latching:** 400mW	500Vrms	-	1000Vrms	-	PCB 	135 -
✪**RE (SMD)** 1:1  20.2 x 11.2 x 8.9/9.6mm	• HF relay for broadcasting • Up to 2.6GHz • Impedance 50/75Ω • RoHS compliant HF Characteristics at 2.6GHz • Isolation min 30dB • Insertion loss max. 0.7dB • V.S.W.R. max. 1.7 • SMT and PCB version available •	**DC:** 0.5A **HF:** 10W (2.6GHz)	• 30V DC	1c	(DC) 3, 4.5, 6, 9, 12, 24V	**Single side stable:** 200mW	500Vrms	-	1000Vrms	-	PCB, SMT Grid 2.54mm 	118 -
RK 1:1  20.2 x 11.2 x 9.7mm	• HF relay for broadcasting • Up to 1.5GHz • Impedance 50/75Ω • RoHS compliant HF Characteristics: • Isolation min. 60dB (at 1.5GHz) • Insertion loss max. 0.3dB (at 900MHz) • V.S.W.R. max. 1.5dB (at 900MHz) • Latching types available	**DC:** 0.5A **HF:** 10W (1.2GHz)	• 30V DC	1c	(DC) 3, 4.5, 5, 6, 9, 12, 24V	**Single side stable:** 200mW **1 coil latching:** 200mW **2 coil latching:** 400mW	500Vrms	-	1000Vrms	-	PCB Grid 2.54mm  Single side stable 1 coil latching	126 -

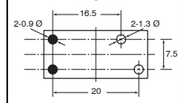
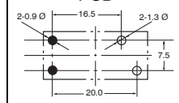
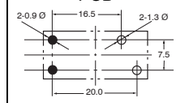
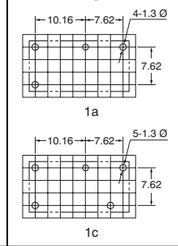
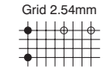
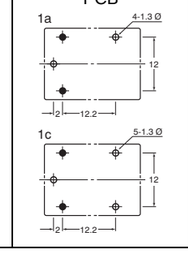
Type ✪ = PopularType (Picture scale: DIN A4)	Features	Switching current (max., min.)	Max. switching voltage	Contact arrangement	Coil voltage
✪**RD SPDT** 1:2  34 x 13.2 x 39mm	• Coaxial relay • Up to 26.5GHz (18GHz) • Impedance 50Ω • RoHS compliant HF Characteristics at 18GHz: • Isolation min. 60dB • Insertion loss max. 0.5dB • V.S.W.R. max. 1.5 • TTL Version available • SPST high power version available	**DC:** 100mA **HF:** 120W (3GHz)	• 30V DC	SPDT	(DC) 4.5, 12, 24V
✪**RD TRANSFER** 1:2  32 x 32 x 39mm	• Coaxial relay • Up to 26.5GHz (18GHz) • Impedance 50Ω • RoHS compliant HF Characteristics at 18GHz: • Isolation min. 60dB • Insertion loss max. 0.5dB • V.S.W.R. max. 1.5 • TTL Version available • SPST high power version available	**DC:** 100mA **HF:** 120W (3GHz)	• 5V DC	DPDT	(DC) 5, 12, 24V
RP 1:1  10.6 x 9 x 4mm	• Low profile HF relay • Up to 1.8GHz • Impedance 50Ω • RoHS compliant HF Characteristics at 1.8GHz: • Isolation min. 10dB • Insertion loss max. 1dB • V.S.W.R. max. 1.3	**DC:** 0.1A **HF:** 1W (1.8GHz)	• 30V DC	1c	(DC) 1.5, 3, 4.5, 5, 6, 9, 12,24V

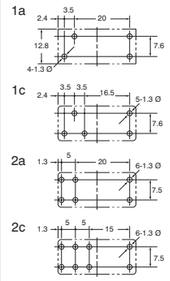
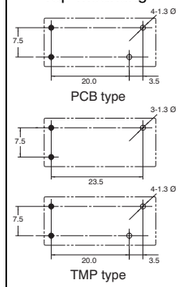
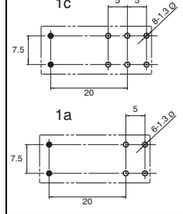
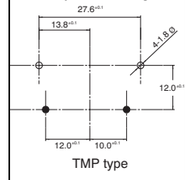
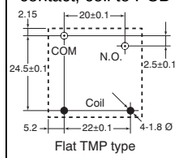
Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
	Between open contacts	Between contact sets	Contacts to coil			
Single side stable: 840-970mW (4.5, 12, 24V) **2 coil latching:** 700-900mW (4.5, 12, 24V) **Latching with TTL driver (with self cut-off function):** 5, 12, 24V	500Vrms	500Vrms	500Vrms	-	SMA -	108 -
Single side stable: 1540-1670mW (4.5, 12, 24V) **2 coil latching:** 1200-1400mW (4.5, 12, 24V) **Latching with TTL driver (with self cut-off function):** 5, 12, 24V	500Vrms	500Vrms	500Vrms	-	SMA -	108 -
Single side stable: 140mW (1.5 - 12V) 270mW (24V)	750Vrms	-	1500Vrms	-	PCB Grid 2.54mm 	131 -

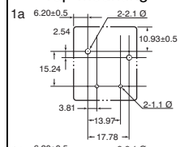
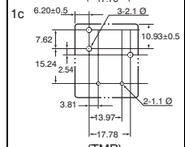
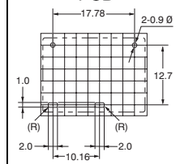
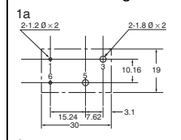
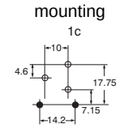
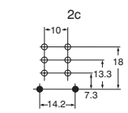
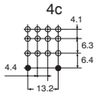
Type ✪ = PopularType (Picture scale: DIN A4)	Features	Switching current (max., min.)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage Between open contacts	 Between contact sets	 Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
Polarized Power Relays												
✪ **DE** 1:2  25 x 12.5 x 12.5mm	• Conforms to VDE0631 • Low operating power • Compact body saves space • Creepage&clearance dis-tance >Min 8mm • RoHS compliant	**Max:** • 8A (1a1b, 2a) • 10/16A (1a)	• 230V DC • 440V AC	1a, 1a1b, 2a	(DC) 1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V	**Single side stable:** 200mW **1 coil latching:** 100mW **2 coil latching:** 200mW	1000Vrms	4000Vrms (1a1b, 2a)	5000Vrms	12,000V	PCB Grid 2.54mm 	140 UL, CSA, VDE, TÜV
DSP 1:2  20.2 x 11 x 10.5mm	• High switching capacity • High sensitivity • High contact welding resis-tance • High breakdown voltage • RoHS-compliant types avail-able	**Max:** • 8A (1a) • 5A (1a1b, 2a)	• 220V DC • 400V AC	1a, 1a1b, 2a	(DC) 3, 5, 6, 9, 12, 24V	**Single side stable:** 300mW **1 coil latching:** 150mW **2 coil latching:** 300mW	1000Vrms	2000Vrms (1a1b, 2a)	3000Vrms	5,000V	PCB Grid 2.54mm  1a  1a1b, 2a	160 TÜV, UL, CSA, SEV
DK 1:2  20 x 15 x 10mm	• Large capacity in small size • High sensitivity • High breakdown voltage • RoHS-compliant types avail-able	**Max:** • 10A (1a) • 8A (1a1b, 2a)	• 125V DC • 400V AC	1a, 1a1b, 2a	(DC) 3, 5, 6, 9, 12, 24V	**Single side stable:** 200mW **2 coil latching:** 200mW	1000Vrms	4000Vrms	4000Vrms	10,000V	PCB Grid 2.54mm  1a  1a1b, 2a	153 VDE, TÜV, UL, CSA, SEV
DY 1:2  20 x 15 x 9.7mm	• Latching types available • ROHS compliant • Socket available	**Max:** • 10A (1a) • 8A (1a,1b)	• 125V DC • 380V AC	1a, 1a1b	(DC) 3, 5, 6, 12, 24V	**Single side stable:** 200mW **2 coil latching:** 200mW	1000Vrms	4000Vrms	4000Vrms	10,000V	PCB Grid 2.54mm  Single side stable 1a1b 2 coil latching	166 -
✪ **DJ** 1:2  29 x 13 x 16/16.5mm	• Latching type • Compact with high capacity • Creepage & clearance dis-tance > 8mm • Optional available with man-ual test button • RoHS compliant	**Max:** 16A	• 125V DC • 400V AC	1a, 1b, 1c, 1a1b, 2a, 2b, 2c	(DC) 5, 6, 12, 24, 48V	**Single side stable:** 250mW **1 coil latching:** 150mW **2 coil latching:** 250mW	1000Vrms	-	4000Vrms	10,000V	PCB Grid 2.54mm  Single side stable, 1 coil latching (1c)  2 coil latching (1c)	144 VDE, TÜV, UL, CSA, SEV
DQ 1:2  38 x 29 x 17.3mm	• Latching type • Compact with high capacity • High insulation • RoHS compliant	**Max:** 30A	• 250V DC • 250V AC	1a	(DC) 4.5, 6, 9, 12, 24V	**1 coil latching:** 500mW **2 coil latching:** 1000mW	1500Vrms	-	4000Vrms	10,000V	PCB Grid 2.54mm  1 coil latching  2 coil latching	158 UL, CSA

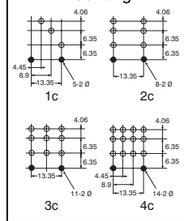
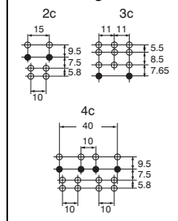
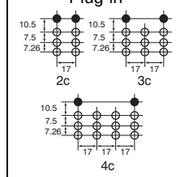
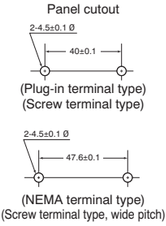
Type ✪ = PopularType (Picture scale: DIN A4)	Features	Switching current (max., min.)	Max. switching voltage	Contact arrangement	Coil voltage
S 1:2  28 x 12 x 10.4mm	• High sensitivity • High vibration and shock resistance • Low thermal electromotive force (approx. 3µV) • RoHS compliant	**Max:** 4A **Min:** 100µA	• 200V DC • 250V AC	2a2b, 3a1b, 4a	(DC) 3, 5, 6, 12, 24, 48V
ST 1:2  31 x 14 x 11.3mm	• High capacity in small size • High inrush capability • RoHS-compliant types available	**Max:** 8A **Min:** 1mA	• 250V DC • 400V AC	1a1b, 2a	(DC) 3, 5, 6, 9, 12, 24, 48V
SP 1:2  2c: 50 x 25.6 x 22mm 4c: 50 x 36.8 x 22mm	• High sensitivity • High vibration and shock resistance • Wide switching range • RoHS compliant	**Max:** 15A	• 110V DC • 250V AC	2c, 4c	(DC) 3, 5, 6, 12, 24, 48V
Non-Polarized Power Relays					
✪**LD** 1:2  20.3 x 7 x 15mm	• Slim type: width 7mm • RoHS compliant	**Max:** 3A	• 30V DC • 277V AC	1a	(DC) 4.5, 5, 6, 9, 12, 18, 24V
PA 1:2  20 x 5 x 12.5mm	• Slim size permits higher density mounting • Wide switching capacity • High surge voltage 4,000V • High breakdown voltage 2,000V • RoHS compliant	**Max:** 5A	• 110V DC • 250V AC	1a	(DC) 5, 6, 9, 12, 18, 24V
✪**PE** 1:2  28 x 5 x 15mm	• Slim size permits higher density mounting • Wide switching capacity • High surge voltage 6,000V • High breakdown voltage 4,000V • Creepage & clearance distance > 8mm • 1 Form B available upon request • RoHS compliant	**Max:** 6A	• 300V DC • 400V AC	1a, 1c	(DC) 4.5, 5, 6, 12, 18, 24, 48, 60V
LA 1:2  24 x 12 x 25mm	• Slim type: 2 Form A • High insulation resistance between contact and coil • RoHS compliant	**Standard:** Max: 3A (3A rated) **Power type:** Max: 5A (5A, TV-4 rated)	• 30V DC • 277V AC	2a	(DC) 12, 24V

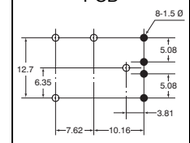
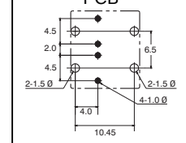
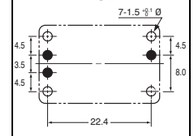
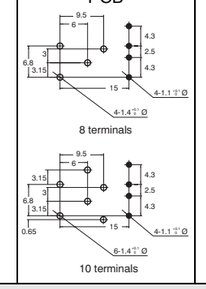
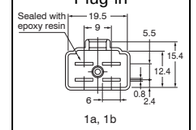
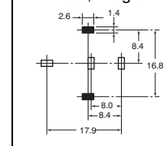
Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
	Between open contacts	Between contact sets	Contacts to coil			
Single side stable: 80 - 355mW **1 coil latching:** 100mW **2 coil latching:** 200mW	750Vrms	1000Vrms	1500Vrms	-	PCB Grid 2.54mm 	169 UL, CSA
Single side stable 240mW **1 coil latching:** 130mW **2 coil latching:** 240mW	1200Vrms	2000Vrms	3750Vrms	6,000V	PCB Grid 2.54mm  (Single side stable)	180 UL, CSA, SEV, VDE, TV rating
Single side stable: 300mW **2 coil latching:** 300mW	1500Vrms	3000Vrms	3000Vrms	-	PCB, Plug-in Grid 2.54mm  2c 4c	174 UL, CSA, TÜV
200mW	750Vrms	-	4000Vrms	10,000V	PCB	268 TÜV, UL, CSA, VDE
120mW (5 - 18V) 180mW (24V)	1000Vrms	-	2000Vrms	4,000V	PCB Grid 2.54mm 	294 TÜV, UL, CSA
170mW (5 - 24V) 217mW (48V) 175mW (60V)	1000Vrms	-	4000Vrms	6,000V	PCB 	297 UL, CSA, VDE
530mW	1000Vrms	1000Vrms	4000Vrms	10,000V	PCB 	265 TÜV, UL, CSA, SEV, SEMKO

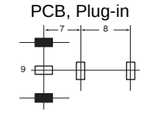
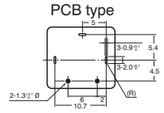
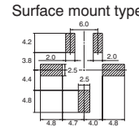
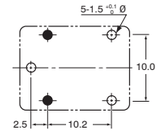
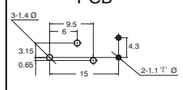
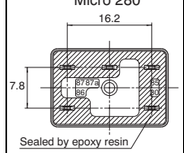
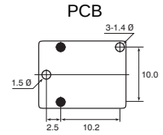
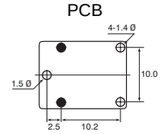
Type ✪ = PopularType (Picture scale: DIN A4)	Features	Switching current (max., min.)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage Between open contacts	 Between contact sets	 Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
LK 1:2  24 x 11 x 25mm	• High inrush current capability • High insulation resistance between contact and coil • RoHS compliant	**Max:** 5A	• 30V DC • 277V AC	1a	(DC) 5, 9, 12, 24V	530mW	1000Vrms	-	4000Vrms	10,000V	PCB 	278 UL, CSA, TÜV, SEV, SEMKO, VDE, TV rating
LK-P 1:2  24 x 11 x 25mm	• High switching capacity • High insulation • High inrush current capability • RoHS compliant	**Max.:** 10A	• 30V DC • 277V AC	1a	(DC) 12, 24V	530mW	1000Vrms	-	4000Vrms	10,000V	PCB 	281 UL, CSA, TÜV, SEV, SEMKO, VDE, TV rating
LK-S 1:2  24 x 11 x 25mm	• High sensitivity 250mV • High inrush current capability • High insulation resistance between contact and coil • RoHS compliant	**Max.:** 5A	• 30V DC • 277V AC	1a	(DC) 5, 9, 12, 24V	250mW	1000Vrms	-	4000Vrms	10,000V	PCB 	284 UL, CSA, TÜV, SEV, SEMKO, VDE, TV-rating
✪ **JQ** 1:2  20 x 10 x 15.6mm	• High electrical noise immunity • High switching capacity • High surge voltage 8,000V • RoHS-compliant types available	**Max:** 10A	• 110V DC • 277V AC	1a, 1c	(DC) 3, 5, 6, 9, 12,18, 24, 48V	200mW (1a) 400mW (1c)	• 1000Vrms (1a) • 750Vrms (1c)	-	4000Vrms	8,000V	PCB 	247 UL, CSA, TÜV, VDE, SEMKO
PQ 1:2  20 x 10 x 15.6mm	• High electrical noise immunity • High sensitivity 200mW • High surge voltage 8,000V • RoHS compliant	**Max:** 5A	• 110V DC • 250V AC	1a	(DC) 3, 5, 6, 9, 12, 18, 24V	200mW	1000Vrms	-	4000Vrms	8,000V	PCB Grid 2.54mm 	300 UL, CSA, TÜV, SEV, SEMKO, VDE
✪ **JS** 1:2  22 x 16 x 16mm	• Ultra-miniature size with universal terminal footprint • High switching capacity 10A • RoHS-compliant types available	**Max:** 10A	• 100V DC • 277V AC	1a, 1c	(DC) 5, 6, 9, 12, 18, 24, 48V	360mW	750Vrms	-	1500Vrms	-	PCB 	252 TÜV, VDE, UL, CSA, complies with TV5

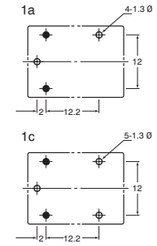
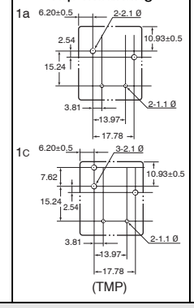
Type ✪ = PopularType (Picture scale: DIN A4)	Features	Switching current (max., min.)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage Between open contacts	 Between contact sets	 Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
✪ **JW** 1:2  28.6 x 12.8 x 20mm	• High dielectric withstanding for transient protection • Class B coil insulation types available • RoHS-compliant types available	**Standard:** **Max:** 5A (2a, 2c) **High capacity:** **Max:** 10A (1a, 1c)	• 100V DC • 440V AC	1a, 1c, 2a, 2c	(DC) 5, 6, 9, 12, 18, 24, 48V	530mW	1000Vrms	3000Vrms (2a, 2c)	5000Vrms	10,000V	PCB 	260 TÜV, VDE, UL, CSA, SEV, complies with TV5, SEMKO
✪ **LE** 1:2  28.6 x 12.4 x 24.9mm	• Ideal for magnetron and heater loads • Excellent heat resistance • High sensitive version available • RoHS compliant	**Max:** 16A	• 277/400V AC	1a	(DC) 5, 6, 9, 12, 18, 24, 48V	**Standard:** 400mW **High sensitivity:** 200mW	1000Vrms	-	4000Vrms	10,000V	PCB, Top-mounting 	271 TÜV, UL, CSA, VDE
✪ **LZ** 1:2  28.8 x 12.5 x 15.7mm	• Low profile relay (15.7mm) • Low operating power (400mV) • High temperature resistant (105°C) • RoHS compliant	**Max:** 16A	• 250V DC • 440V AC	1a, 1c	(DC) 5, 9, 12, 18, 24, 48V	400mW	1000Vrms	-	5000Vrms	10,000V	PCB 	287 VDE, UL, CSA
✪ **LF** 1:2  30.1 x 15.7 x 23.3mm	• Ideal for compressor and inverter loads • High insulation resistance • RoHS compliant	**Max:** 25A	• 250V AC	1a	(DC) 5, 6, 9, 12, 18, 24V	900mW	1000Vrms	-	5000Vrms	10,000V	PCB, Top-mounting 	275 UL, CSA, TÜV, VDE, SEMKO
JM 1:2  Slim: 30.4 x 16 x 26.5mm Flat: 31 x 28.5 x 17.2mm	• Super welding resistance • High surge resistance • Compact high capacity relay for inductive load • RoHS-compliant types available	**Max:** 20A	• 100V DC • 250V AC	1a	(DC) 5, 6, 9, 12, 24, 48V	900mW	1000Vrms	-	5000Vrms	10,000V	PCB, Top mount contact, coil to PCB 	243 TÜV, UL, CSA, VDE

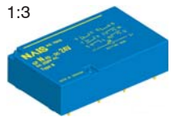
Type ✪ = PopularType (Picture scale: DIN A4)	Features	Switching current (max., min.)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage Between open contacts	Breakdown voltage Between contact sets	Breakdown voltage Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
JT-V 1:2  PCB: 31.9 x 26.9 x 20.2mm TMP: 32.2 x 27.4 x 27.9mm	• Surge withstand voltage: Min. 6kV • High switching capacity • 2 contact arrangements • Class F type as standard • RoHS compliant	**Max:** 30A	• 30V DC • 277V AC	1a, 1c	(DC) 12, 18, 24, 48V	1000mW	-	1200Vrms	3500Vrms	6,000V	PCB Top-mounting 1a  1c  (TMP)	255 UL, C-UL
JV-N 1:2  22 x 16 x 10.9mm	• Compact, flat type with low 10.9mm profile • RoHS-compliant types available	**Max:** 16A	• 110V DC • 277V AC	1a	(DC) 4.5, 6, 9, 12, 24, 48, 100V	200mW 600mW (100V coil)	1000Vrms	-	2500Vrms	4,500V	PCB 	258 UL, CSA, TÜV
JC 1:2  30 x 19 x 30.4mm	• Class B coil type available • TV-rated type available • High dielectric withstanding 10,000V surge • Special type with blow-out magnet for high DC loads available • RoHS-compliant types available	**Max:** 15A	• 250V AC **Blow-out magnet type:** • 250V DC	1a, 2a	(DC) 5, 6, 12, 24, 48V	900mW (1a) 1000mW (2a)	2000Vrms	2000Vrms (2a)	4000Vrms	10,000V	PCB, Plug-in, Top-mounting 1a  2a 	231 UL, VDE, SEV, SEMKO CSA, complies with TV5
HL 1:2  27.2 x 20.8 x 35.4mm	• Large capacity • Compact size • Footprint compatible with competitive types • RoHS-compliant types available	**Max:** 15A **Min:** 1mA	• 30V DC • 250V AC	1c, 2c	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 120, 240	(DC) 900 - 1000mW (AC) 1.2 - 1.3VA	1000Vrms	1500Vrms	2000Vrms	-	PCB, Plug-in, Top-mounting 1c  2c 	216 UL, CSA, complies with TV5
HJ 1:2  28 x 21.5 x 35/38mm	• 2 contact arrangements same footprint as our popular HC relay • Coil breakdown detection-function (AC type with LED only) • Convenient Screw terminal sockets with finger protection also available • Test button type available • RoHS compliant	**Max:** 7A	• 30V DC • 250V AC	2c, 4c	(DC) 12, 24, 48, 110V (AC) 12, 24, 48, 100, 120, 200, 220/240V	(DC) 900mW (AC) 1.2 - 1.5VA	1000Vrms	2000 Vrms	2000Vrms	-	Plug-in 2c  4c 	209 VDE, UL, CSA, SEV, TV rating

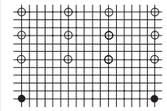
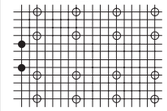
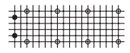
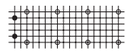
Type ✪ = PopularType (Picture scale: DIN A4)	Features	Switching current (max., min.)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
							Between open contacts	Between contact sets	Contacts to coil			
HC 1:2  27.2 x 20.8 x 35.2mm	• Wide applications • Versatile range • Foot print compatible with competitive types • RoHS-compliant types available	**Max:** 10A **Min:** 1mA	• 30V DC • 250V AC	1c, 2c, 3c, 4c	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48,120, 240V	(DC) 900mW (AC) 1.2VA	700Vrms	700Vrms	2000Vrms	-	PCB, Plug-in, Top-mounting 	186 VDE, UL, CSA, SEV, TV rating
HN 1:2  29 x 13 x 28mm	• Slim and compact size • High reliability • RoHS compliant	**Max:** 5A	• 30V DC • 250V AC	1c, 2c	(DC) 5, 6, 12, 24, 48V (AC) 100, 120, 240V	(DC) 530mW (AC) 0.9VA	1000Vrms	3000Vrms	5000Vrms	-	Plug-in, Screw terminal -	237 UL, C-UL, (VDE)
HP 1:2  36 x 25 x 44.5mm	• High reliability • RoHS-compliant types available	**Max:** 10A	• 125V DC • 250V AC	2c, 3c, 4c	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 115, 220, 240V	(DC) 1500mW (AC) 1.9 - 4.9VA	2000Vrms	2000Vrms	2000Vrms	-	Plug-in 	220 VDE, UL, CSA, SEV
HG 1:3  2c: 44 x 36 x 56mm 3c: 36 x 36 x 56mm 4c: 68 x 36 x 56mm	• High capacity 20A • RoHS-compliant types available	**Max:** 20A	• 125V DC • 250V AC	2c, 3c, 4c	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 115, 220, 240V	(DC) 1400 - 2100mW (AC) 3.6 - 7.6VA	2000Vrms	2000Vrms	2000Vrms	-	Plug-in 	204 UL, CSA
HE 1:3  50 x 33 x 35.8mm	• High dielectric withstanding 10,000V surge • High inrush resistance (TV-15: 1 form A) (TV-10: 2 form A) • RoHS compliant	**Max:** 30A	• 100V DC • 277V AC	1a, 2a	(DC) 6, 12, 24, 48, 110V (AC) 12, 24, 48,120, 240V	(DC) 1920mW (AC) 1.7 - 2.7VA	2000Vrms	4000Vrms	5000Vrms	10,000V	Top-mounting Panel cutout 	198 TÜV, UL, CSA, VDE, TV rating
MC 1:3  45.2 x 40 x 45.5mm	• Minicontactor for controlling motor, air-conditioning and heating loads • Energy saving • Also available in PCB version • 3mm contact opening	**Max:** 16A	• 440V DC • 400V AC	4a, 3a1b, 2a2b	(DC) 3, 5, 6, 12, 24, 48V (AC) 24, 42, 60,110, 125, 200, 220; 240, 380V	(DC) 500mW (AC) 1VA	2500Vrms	2500Vrms	2500Vrms	-	PCB, screw, plug-in, DIN rail -	290 UL, CSA

Type ✪ = PopularType (Picture scale: DIN A4)	Features	Switching current (max., min.)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage Between open contacts	 Between contact sets	 Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
Twin												
CF 1:2  22.5 x 16.5 x 16.5mm	• 7A steady/30A inrush current capability • Simple footprint enables ease of PC board layout • RoHS compliant	**Max:** • 20A (N.O.) • 10A (N.C.)	• 16V DC	1c x 2	(DC) 12V	640mW	1000Vrms	-	1000Vrms	-	PCB 	318 -
✪**CJ** 1:2  13.7 x 12.2 x 13.5mm	• Super miniature size 13.7(L) x 12.2(W) x 13.5(H) • High capacity (25A) in a compact body • RoHS compliant	**Max:** • 20A (N.O.) • 10A (N.C.)	• 14V DC	1c x 2	(DC) 12V	**Standard:** 800mW **High sensitivity:** 640mW	500Vrms	-	500Vrms	-	PCB 	321 -
CR 1:2  24.6 x 17 x 18.5mm	• Quiet • Twin (1 Form C x 2) • Simple footprint enable ease of PC board layout • RoHS compliant	**Max:** • 20A (N.O.) • 10A (N.C.)	• 16V DC	1c x 2	(DC) 12V	640mW	500Vrms	-	500Vrms		PCB 	338 -
✪**CT** 1:2  17.4 x 14 x 13.5mm	• Ultra small size • Twin (1 Form C x 2) • H-bridge type available • Pin&Paste type available • RoHS compliant	**Max:** • 20A (N.O.) • 10A (N.C.)	• 16V DC	1c, 1c x 2	(DC) 12V	800mW	500Vrms	-	500Vrms	-	PCB 	342 -
Single												
CA 1:2  21.5 x 14.4 x 37mm	• Small size • Light weight • Completely water tight • Automotive direct plug-in • RoHS compliant	**Max:** • 20A (1a, 1.4W type) • 30A (1a, 1.8W type) • 20A (1b, 1c)	• 15V DC (1c; 12V DC type) • 16V DC (1a, 1b; 12V DC type) • 30V DC (1c; 24V DC type)	1a, 1b, 1c	(DC) 12, 24V	1800mW 1400mW (type S)	500Vrms	-	500Vrms	-	Plug-in 	304 -
CB 1:2  26 x 22 x 25mm	• 40 A rating at 85°C (185°F) • ISO type terminals • High shock resistance for drop test requirements • Low temperature rise • RoHS compliant	**Max:** • 70A (H type) • 40A (1a, 1c N.O.) • 30A (1c)	• 16V DC (12V DC type) • 32V DC (24V DC type)	1a, 1c	(DC) 12, 24V	1400mW (12V DC type) 1800mW (24V DC type) 1800mW (12V DC, H type)	500Vrms	-	500Vrms	-	PCB, Plug-in  (PCB standard type)	310 -

Type ✪ = PopularType (Picture scale: DIN A4)	Features	Switching current (max., min.)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
							Between open contacts	Between contact sets	Contacts to coil			
✪**CM** 1:2  20 x 15 x 22mm	• Half the size, replaces Mini-ISO relay • Wide line-up • Micro-ISO terminal type • RoHS compliant	**Max:** • 35A (N.O.) • 20A (N.C.)	• 16V DC (12V DC type) • 32V DC (24V DC type)	1a, 1c	(DC) 12, 24V	1500mW (12V DC type) 1800mW (24V DC type)	500Vrms	-	500Vrms	-	PCB, Plug-in 	325 -
✪**CP (SMD)** 1:2  14 x 13 x 9.5mm	• Low profile • High capacity • Simple footprint enables ease of PC board layout • RoHS compliant	**Max:** • 20A (N.O.) • 10A (N.C.)	• 16V DC	1a, 1c	(DC) 12V, 24V	640mW	500Vrms	-	500Vrms	-	PCB, SMT PCB type  Surface mount type 	330 -
CQ 1:2  17 x 13 x 16.6mm	• Quiet • Less space required • RoHS compliant	**Max:** • 20A (N.O.) • 10A (N.C.)	• 16V DC	1c	(DC) 12V	640mW	500Vrms	-	500Vrms	-	PCB 	334 -
✪**CT** 1:2  17.4 x 7.2 x 13.5mm	• Ultra small size • Twin (1 Form C x 2) • H-bridge type available • Pin&Paste type available • RoHS compliant	**Max:** • 20A (N.O.) • 10A (N.C.)	• 16V DC	1c, 1c x 2	(DC) 12V	800mW	500Vrms	-	500Vrms	-	PCB 	342 -
CV 1:2  22.5 x 15 x 15.7mm	• Low profile • Low temperature rise • Low sound pressure level • Wide line-up • Micro-ISO terminal type • RoHS compliant	**Max:** • 20A (N.O.) • 10A (N.C.)	• 16V DC	1a, 1c	(DC) 12V	800mW	500Vrms	-	500Vrms	-	PCB, Plug-in Micro 280  Sealed by epoxy resin	347 -
✪**JJM** 1:2  15.5 x 12 x 13.9mm	• Compact (half-size) • Perfect for automobile electrical systems • RoHS compliant	**Max:** • 20A (N.O.) • 10A (N.C.)	• 16V DC	1a, 1c	(DC) 12V	640mW	500Vrms	-	500Vrms	-	PCB 	358 -
JJM-DM 1:2  15.5 x 12 x 13.9mm	• Small size • Standard terminal pitch employed • Double make contact arrangement • RoHS compliant	**Max:** 2 x 6A	• 16V DC	Double make contact	(DC) 12V	1000mW	500Vrms	-	500Vrms	-	PCB 	362 -

Type ✪ = PopularType (Picture scale: DIN A4)	Features	Switching current (max., min.)	Max. switching voltage	Contact arrangement	Coil voltage	Coil power	Breakdown voltage Between open contacts	Breakdown voltage Between contact sets	Breakdown voltage Contacts to coil	Surge withstand voltage	Mounting method (bottom view)	Page Approvals
JS-M 1:2  22 x 16 x 16.4mm	• Low pick-up voltage for high ambient use • RoHS compliant	**Standard:** **Max:** 10A **High capacity:** **Max:** 15A	• 16V DC	1a, 1c	(DC) 9, 12V	640mW	750Vrms	-	1500Vrms	-	PCB 	365 -
JT-N 1:2  PCB: 31.9 x 26.9 x 20.2mm TMP: 32.2 x 27.4 x 27.9mm	• High switching capacity • RoHS compliant	**Max:** • 30A (1a) • 20A (1c N.O.) • 10A (1c N.C.)	• 30V DC • 277V AC	1a, 1c	(DC) 5, 6, 9, 12, 15, 18, 24V	800mW	1200Vrms	-	2500Vrms	-	PCB, Top-mounting  (TMP)	368 UL, CSA
Special Types												
EV 1:4  88 x 87 x 87mm  80 x 38 x 71mm	• Small size & light weight • No arc space is required • Safety construction • Low operating noise • High contact reliability • RoHS-compliant types available	**Max:** • 150A (1a, 2a) • 60A (1a) • 30A (1a)	• 400V DC	1a (30A/60A/150A) 2a (150A)	(DC) 12, 24V	5W (stable) 35W (inrush for 150A type)	2500Vrms	-	2500Vrms	-	Screw terminal -	352 -

Type ✪ = PopularType (Picture scale: DIN A4)	Features	Switching current (max., min.)	Max. switching voltage	Contact arrangement	Coil voltage
SFN4D 1:3  53.3 x 33 x 14.5mm	• Polarised relay with forcibly guided contacts according to EN 50205 • Safety double contact • Extremely small total power loss • Relay height: 14.5mm • RoHS compliant	**Max:** 8A **Min:** 10mA	• 500V DC • 500V AC	4a2b	(DC) 5, 9, 12, 16, 18, 21, 24, 36, 48, 60V
SF4D 1:3  53.3 x 33 x 16.5mm	• Polarised relay with forcibly guided contacts according to EN 50205 • Safety double contact • RoHS compliant	**Max:** 8A **Min:** 10mA	• 400V DC • 400V AC	4a4b	(DC) 5, 9, 12, 18, 21, 24, 36, 48, 60V
SF2D 1:3  53.3 x 25 x 16.5mm	• Polarised relay with forcibly guided contacts according to EN 5020 • Safety double contact • RoHS compliant	**Max:** 8A **Min:** 10mA	• 400V DC • 400V AC	2a2b	(DC) 5, 9, 12, 18, 21, 24, 36, 48, 60V
SF3 1:3  53.3 x 25 x 16.5mm	• Polarised relay with forcibly guided contacts according to EN 50205 • RoHS compliant	**Max:** 8A **Min:** 10mA	• 400V DC • 400V AC	3a1b	(DC) 5, 9, 12, 18, 21, 24, 36, 48, 60V

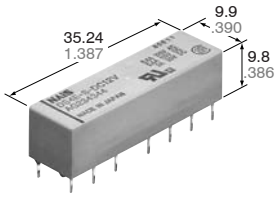
Coil power	Breakdown voltage			Surge withstand voltage	Mounting method (bottom view)	Page Approvals
	Between open contacts	Between contact sets	Contacts to coil			
390mW (5 - 24V) 420mW (36 - 60V)	2500Vrms	4000Vrms	5000Vrms	-	PCB Grid 2.5mm  4a2b	381 UL, CSA, SEV, TÜV
500mW	2500Vrms	2500Vrms	2500Vrms	-	PCB Grid 2.54mm  4a4b	378 UL, CSA, SEV, TÜV
500mW	2500Vrms	2500Vrms	2500Vrms	-	PCB Grid 2.54mm  2a2b	372 UL, CSA, SEV, TÜV
500mW	2500Vrms	2500Vrms	2500Vrms	-	PCB Grid 2.54mm  3a1b	375 UL, CSA, SEV, TÜV

Signal Relays

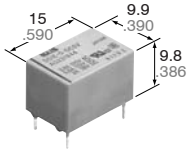
Panasonic
ideas for life

HIGHLY SENSITIVE 1500 V FCC SURGE WITHSTANDING MINIATURE RELAY

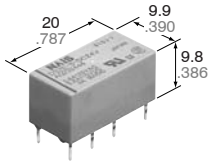
DS RELAYS



DS4E



DS1E



DS2E

mm inch

FEATURES

- **High sensitivity: 200 mW pick-up power**
  100 mW pick-up power types available
- **Latching types available**
- **High switching capacity: 60 W, 125 V A**
- **High breakdown voltage: 1,500 V FCC surge between open contacts**
  1,000 V AC between open contacts
- **DIP-1C type can be used with 14 pin IC socket**
  2C type can be used with 16 pin IC socket,
  4C type can be used with 2 sets of 14 pin IC sockets
- **Gold-cap silver palladium types available for 2 Form C type**
- **Bifurcated contacts are standard**

SPECIFICATIONS

Contact

Arrangement		1 Form C, 2 Form C, 4 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		50 mΩ
Contact material		Gold-clad silver
Rating (resistive)	Max. switching power	60 W, 125 VA
	Max. switching voltage	220 V DC, 250 V AC
	Max. switching current	2 A DC, AC
	Max. carrying current	3 A DC, AC
Expected life (min. operations)	Mechanical (at 600 cpm)	10^8 (10^7 1 Form C 2 coil latching type)
	Electrical 2 A 30 VDC resistive	5×10^5

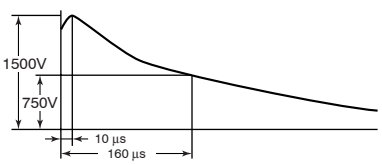
* Gold capped silver-palladium contact also available for 2 Form C 10^7 operations at 0.1 A 50 V DC resistive

Coil (polarized) (at 20°C 68°F)

M type	Single side stable	Minimum operating power	Approx. 200 mW
		Nominal operating power	Approx. 400 mW
	1 coil latching	Minimum set and reset power	Approx. 90 mW
		Nominal set and reset power	Approx. 180 mW
	2 coil latching	Minimum set and reset power	Approx. 180 mW
		Nominal set and reset power	Approx. 360 mW
S type	Single side stable	Minimum operating power	Approx. 100 mW (128 mW)*
		Nominal operating power	Approx. 200 mW
	1 coil latching	Minimum set and reset power	Approx. 45 mW (58 mW)*
		Nominal set and reset power	Approx. 90 mW
	2 coil latching	Minimum set and reset power	Approx. 90 mW (115 mW)*
		Nominal set and reset power	Approx. 180 mW

* For 1 Form C high sensitive types.

FCC (Federal Communication Commission) requests following standard as Breakdown Voltage specification.



Characteristics (at 20°C 68°F)

Max. operating speed		20 cpm at rated load 50 cps at low level load	
Initial insulation resistance*1		Min. 100 MΩ (at 500 V DC)	
Initial breakdown voltage*2	Type of relay	(DS1-S type)	(Other types)
	Between open contacts	500 Vrms	1,000 Vrms
	Between contacts sets	—	1,000 Vrms
	Between contacts and coil	1,000 Vrms	1,500 Vrms
FCC surge voltage between contacts and coil		1,500 V (Expect DS1-S type)	
Operate time*3 (at nominal voltage)		Approx. 3 ms	
Release time (without diode)*3 (at nominal voltage)		Approx. 2 ms	
Set time*3 (at nominal voltage)		Approx. 3 ms	
Reset time*3 (at nominal voltage)		Approx. 3 ms	
Temperature rise (at nominal voltage, Contact current: 2A)		Max. 65°C	
Shock resistance	Functional*4	1C, 2C:Min. 490 m/s² {50 G} 4C:Min. 294 m/s² {30 G}	
	Destructive*5	Min. 980 m/s² {100 G}	
Vibration resistance	Functional*6	10 to 55 Hz at double amplitude of 3.3 mm	
	Destructive	10 to 55 Hz at double amplitude of 5 mm	
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F	
	Humidity	5 to 85% R.H.	
Unit weight	1 Form C	Approx. 3.2g .11oz	
	2 Form C	Approx. 4g .14oz	
	4 Form C	Approx. 7g .25oz	

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10 mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10µs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10µs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

TYPICAL APPLICATIONS

- Telecommunication equipment
- Office equipment
- Computer peripherals
- Security equipment
- Measuring instrumentation

ORDERING INFORMATION

Ex DS [2] [E] — [M] [L2] – [DC 48 V] — [R] *

Contact arrangement	Classification of type	Sensitivity	Operating function	Coil voltage
1: 1 Form C 2: 2 Form C 4: 4 Form C	E: Amber sealed type	M: 400 mW nominal operating power S: 200 mW nominal operating power	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	DC 1.5, 3, 5, 6, 9, 12, 24, 48 V

*Reverse polarity types available (add suffix-R). Standard packing: Carton: 50 pcs.; Case: 500 pcs.

TYPES

Single side stable

	Nominal Voltage, V DC	Part No.		
		1 Form C	2 Form C	4 Form C
M (400 mW) type	1.5	DS1E-M-DC1.5V	DS2E-M-DC1.5V	DS4E-M-DC1.5V
	3	DS1E-M-DC3V	DS2E-M-DC3V	DS4E-M-DC3V
	5	DS1E-M-DC5V	DS2E-M-DC5V	DS4E-M-DC5V
	6	DS1E-M-DC6V	DS2E-M-DC6V	DS4E-M-DC6V
	9	DS1E-M-DC9V	DS2E-M-DC9V	DS4E-M-DC9V
	12	DS1E-M-DC12V	DS2E-M-DC12V	DS4E-M-DC12V
	24	DS1E-M-DC24V	DS2E-M-DC24V	DS4E-M-DC24V
	48	DS1E-M-DC48V	DS2E-M-DC48V	DS4E-M-DC48V
S (200 mW) type	1.5	DS1E-S-DC1.5V	DS2E-S-DC1.5V	DS4E-S-DC1.5V
	3	DS1E-S-DC3V	DS2E-S-DC3V	DS4E-S-DC3V
	5	DS1E-S-DC5V	DS2E-S-DC5V	DS4E-S-DC5V
	6	DS1E-S-DC6V	DS2E-S-DC6V	DS4E-S-DC6V
	9	DS1E-S-DC9V	DS2E-S-DC9V	DS4E-S-DC9V
	12	DS1E-S-DC12V	DS2E-S-DC12V	DS4E-S-DC12V
	24	DS1E-S-DC24V	DS2E-S-DC24V	DS4E-S-DC24V
	48	DS1E-S-DC48V	DS2E-S-DC48V	DS4E-S-DC48V

1 coil latching

	Nominal Voltage, V DC	Part No.		
		1 Form C	2 Form C	4 Form C
M (180 mW) type	1.5	DS1E-ML-DC1.5V	DS2E-ML-DC1.5V	DS4E-ML-DC1.5V
	3	DS1E-ML-DC3V	DS2E-ML-DC3V	DS4E-ML-DC3V
	5	DS1E-ML-DC5V	DS2E-ML-DC5V	DS4E-ML-DC5V
	6	DS1E-ML-DC6V	DS2E-ML-DC6V	DS4E-ML-DC6V
	9	DS1E-ML-DC9V	DS2E-ML-DC9V	DS4E-ML-DC9V
	12	DS1E-ML-DC12V	DS2E-ML-DC12V	DS4E-ML-DC12V
	24	DS1E-ML-DC24V	DS2E-ML-DC24V	DS4E-ML-DC24V
	48	DS1E-ML-DC48V	DS2E-ML-DC48V	DS4E-ML-DC48V
S (90 mW) type	1.5	DS1E-SL-DC1.5V	DS2E-SL-DC1.5V	DS4E-SL-DC1.5V
	3	DS1E-SL-DC3V	DS2E-SL-DC3V	DS4E-SL-DC3V
	5	DS1E-SL-DC5V	DS2E-SL-DC5V	DS4E-SL-DC5V
	6	DS1E-SL-DC6V	DS2E-SL-DC6V	DS4E-SL-DC6V
	9	DS1E-SL-DC9V	DS2E-SL-DC9V	DS4E-SL-DC9V
	12	DS1E-SL-DC12V	DS2E-SL-DC12V	DS4E-SL-DC12V
	24	DS1E-SL-DC24V	DS2E-SL-DC24V	DS4E-SL-DC24V
	48	DS1E-SL-DC48V	DS2E-SL-DC48V	DS4E-SL-DC48V

2 coil latching

	Nominal Voltage, V DC	Part No.		
		1 Form C	2 Form C	4 Form C
M (360 mW) type	1.5	DS1E-ML2-DC1.5V	DS2E-ML2-DC1.5V	DS4E-ML2-DC1.5V
	3	DS1E-ML2-DC3V	DS2E-ML2-DC3V	DS4E-ML2-DC3V
	5	DS1E-ML2-DC5V	DS2E-ML2-DC5V	DS4E-ML2-DC5V
	6	DS1E-ML2-DC6V	DS2E-ML2-DC6V	DS4E-ML2-DC6V
	9	DS1E-ML2-DC9V	DS2E-ML2-DC9V	DS4E-ML2-DC9V
	12	DS1E-ML2-DC12V	DS2E-ML2-DC12V	DS4E-ML2-DC12V
	24	DS1E-ML2-DC24V	DS2E-ML2-DC24V	DS4E-ML2-DC24V
	48	DS1E-ML2-DC48V	DS2E-ML2-DC48V	DS4E-ML2-DC48V
S (180 mW) type	1.5	DS1E-SL2-DC1.5V	DS2E-SL2-DC1.5V	DS4E-SL2-DC1.5V
	3	DS1E-SL2-DC3V	DS2E-SL2-DC3V	DS4E-SL2-DC3V
	5	DS1E-SL2-DC5V	DS2E-SL2-DC5V	DS4E-SL2-DC5V
	6	DS1E-SL2-DC6V	DS2E-SL2-DC6V	DS4E-SL2-DC6V
	9	DS1E-SL2-DC9V	DS2E-SL2-DC9V	DS4E-SL2-DC9V
	12	DS1E-SL2-DC12V	DS2E-SL2-DC12V	DS4E-SL2-DC12V
	24	DS1E-SL2-DC24V	DS2E-SL2-DC24V	DS4E-SL2-DC24V
	48	DS1E-SL2-DC48V	DS2E-SL2-DC48V	DS4E-SL2-DC48V

Notes: 1. Reverse polarity types available (add suffix-R).
2. Standard packing: carton: 50 pcs.; case: 500 pcs.

COIL DATA (at 20°C 68°F)

Single side stable

	Nominal voltage, V DC	Pick-up voltage, V DC (max.)		Drop-out voltage, V DC (min.)	Coil resistance, Ω (±10%)	Maximum allowable, V DC (at 50°C 122°F)	
		1 Form C	2, 4 Form C			1 Form C	2, 4 Form C
M type	1.5	1.05	1.05	0.15	5.63	1.8	2.25
	3	2.1	2.1	0.3	22.5	3.6	4.5
	5	3.5	3.5	0.5	62.5	6	7.5
	6	4.2	4.2	0.6	90	7.2	9
	9	6.3	6.3	0.9	203	10.8	13.5
	12	8.4	8.4	1.2	360	14.4	18
	24	16.8	16.8	2.4	1440	28.8	36
	48	33.6	33.6	4.8	5760	57.6	72
S type	1.5	1.2	1.05	0.15	11.3	2.4	3
	3	2.4	2.1	0.3	45	4.8	6
	5	4.0	3.5	0.5	125	8.0	10
	6	4.8	4.2	0.6	180	9.6	12
	9	7.2	6.3	0.9	405	14.4	18
	12	9.6	8.4	1.2	720	19.2	24
	24	19.2	16.8	2.4	2880	38.4	48
	48	38.4	33.6	4.8	11520	76.8	96

1 coil latching

	Nominal voltage, V DC	Reset Set, V DC (max.)		Coil resistance, Ω (±10%)	Maximum allowable, V DC (at 50°C 122°F)	
		1 Form C	2, 4 Form C		1 Form C	2, 4 Form C
M type	1.5	1.05	1.05	12.5	1.8	2.25
	3	2.1	2.1	50	3.6	4.5
	5	3.5	3.5	139	6	7.5
	6	4.2	4.2	200	7.2	9
	9	6.3	6.3	450	10.8	13.5
	12	8.4	8.4	800	14.4	18
	24	16.8	16.8	3200	28.8	36
	48	33.6	33.6	12800	57.6	72
S type	1.5	1.2	1.05	25	2.4	3
	3	2.4	2.1	100	4.8	6
	5	4.0	3.5	278	8.0	10
	6	4.8	4.2	400	9.6	12
	9	7.2	6.3	900	14.4	18
	12	9.6	8.4	1600	19.2	24
	24	19.2	16.8	6400	38.4	48
	48	38.4	33.6	25600	76.8	96

2 coil latching

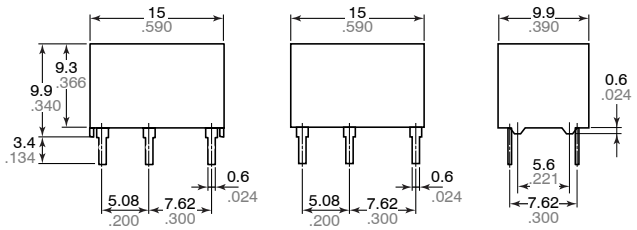
	Nominal voltage, V DC	Reset Set, V DC (max.)		Coil resistance, Ω (±10%)		Maximum allowable, V DC (at 50°C 122°F)	
		1 Form C	2,4 Form C	Coil I	Coil II	1 Form C	2,4 Form C
M type	1.5	1.05	1.05	6.25		1.8	2.25
	3	2.1	2.1	25		3.6	4.5
	5	3.5	3.5	69.4		6	7.5
	6	4.2	4.2	100		7.2	9
	9	6.3	6.3	225		10.8	13.5
	12	8.4	8.4	400		14.4	18
	24	16.8	16.8	1600		28.8	36
	48	33.6	33.6	6400		57.6	72
S type	1.5	1.2	1.05	12.5		2.4	3
	3	2.4	2.1	50		4.8	6
	5	4.0	3.5	139		8.0	10
	6	4.8	4.2	200		9.6	12
	9	7.2	6.3	450		14.4	18
	12	9.6	8.4	800		19.2	24
	24	19.2	16.8	3200		38.4	48
	48	38.4	33.6	12800		76.8	96

DIMENSIONS

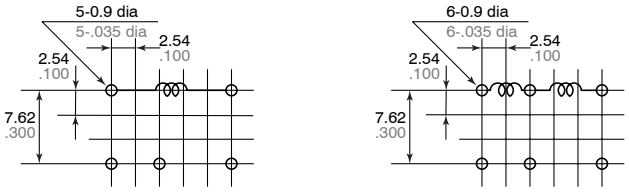
mm inch

1 Form C

Single side stable, 1 coil latching, 2 coil latching



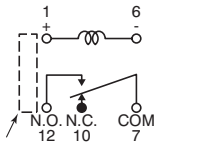
PC board pattern (Copper-side view)
Single side stable, 1 coil latching 2 coil latching



Tolerance: ±0.1 ±.004

General tolerance: ±0.3 ±.012

Schematic (Bottom view)
Single side stable
Deenergized condition



• A polarity bar showing the relay direction can replace the schematic.

1 coil latching

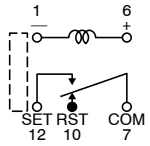


Diagram shows the “reset” position when terminals 1 and 6 are energized.
Energize with reverse polarity to transfer contacts.

2 coil latching

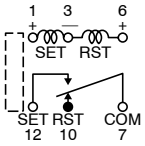
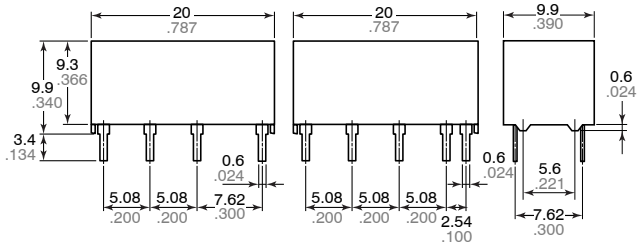


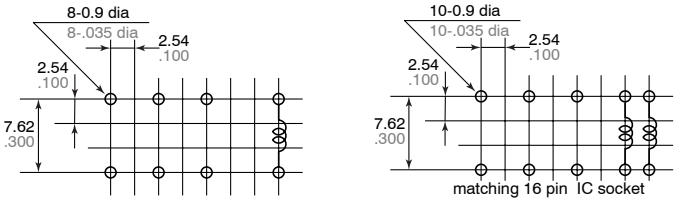
Diagram shows the “reset” position when terminals 3 and 6 are energized.
Energize terminals 1 and 3 to transfer contacts.

2 Form C

Single side stable, 1 coil latching, 2 coil latching



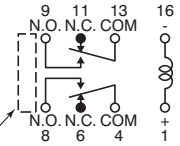
PC board pattern (Copper-side view)
Single side stable, 1 coil latching 2 coil latching



Tolerance: ±0.1 ±.004

General tolerance: ±0.3 ±.012

Schematic (Bottom view)
Single side stable
Deenergized condition



• A polarity bar showing the relay direction can replace the schematic.

1 coil latching

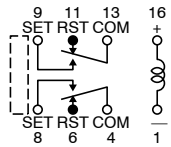


Diagram shows the “reset” position when terminals 1 and 16 are energized.
Energize with reverse polarity to transfer contacts.

2 coil latching

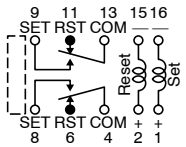
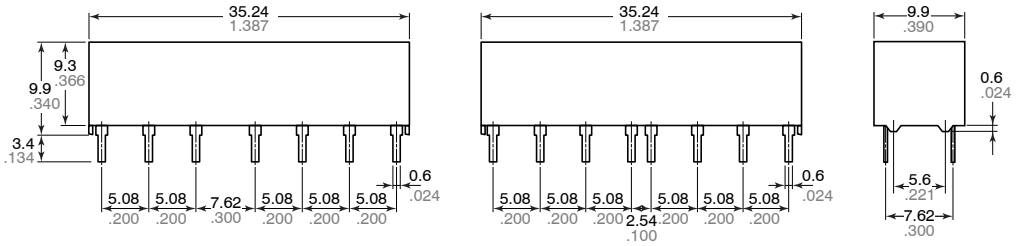


Diagram shows the “reset” position when terminals 2 and 15 are energized.
Energize terminals 1 and 16 to transfer contacts.

4 Form C

mm inch

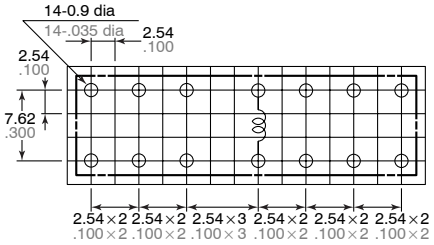
Single side stable, 1 coil latching, 2 coil latching



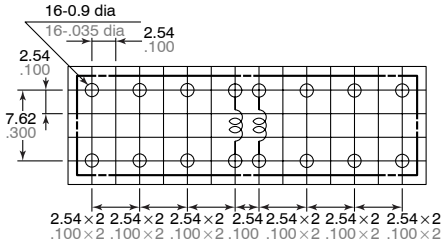
General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)

Single side stable, 1 coil latching



2 coil latching

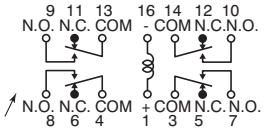


Tolerance: ±0.1 ±.004

Schematic (Bottom view)

Single side stable

Deenergized condition



• A polarity bar showing the relay direction can replace the schematic.

1 coil latching

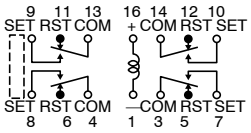


Diagram shows the “reset” position when terminals 1 and 16 are energized.
Energize with reverse polarity to transfer contacts.

2 coil latching

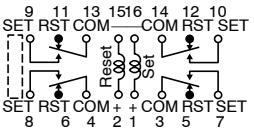
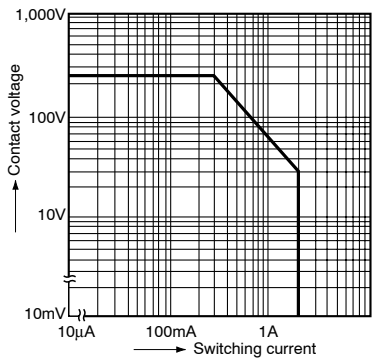


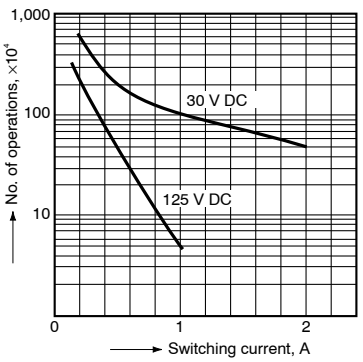
Diagram shows the “reset” position when terminals 2 and 15 are energized.
Energize terminals 1 and 16 to transfer contacts.

REFERENCE DATA

1. Maximum switching capacity

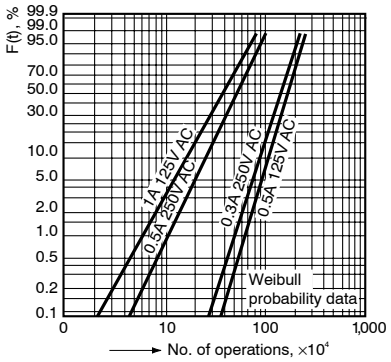


2. Life curve (Resistive load)

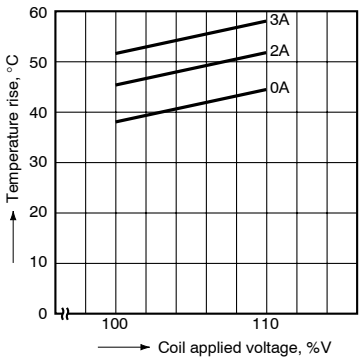


3. Contact reliability for AC loads

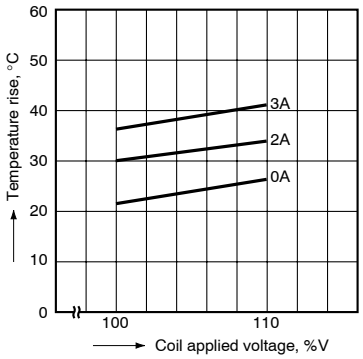
Sample: DS2E-M-DC24V 10 pcs.
Cycle rate: 20 cpm.
Detection level: 200 mΩ



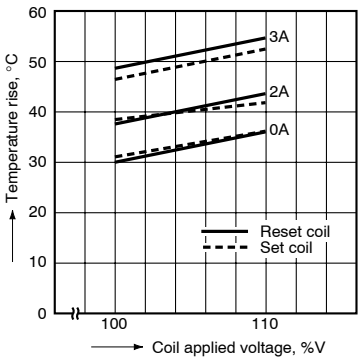
4-(1). Coil temperature rise
(2 Form C single side stable type)
Point measured: Inside the coil
Ambient temperature: 18° to 19°C 64° to 66°F



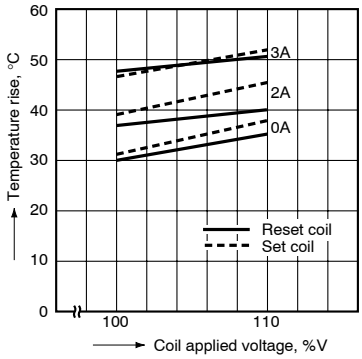
4-(2). Coil temperature rise
(4 Form C single side stable type)
Point measured: Inside the coil
Ambient temperature: 17° to 18°C 63° to 64°F



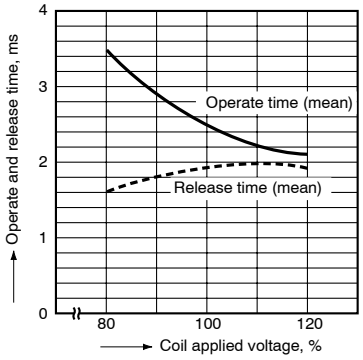
4-(3). Coil temperature rise
(2 Form C 2 coil latching type)
Point measured: Inside the coil
Ambient temperature: 20° to 21°C 68° to 70°F



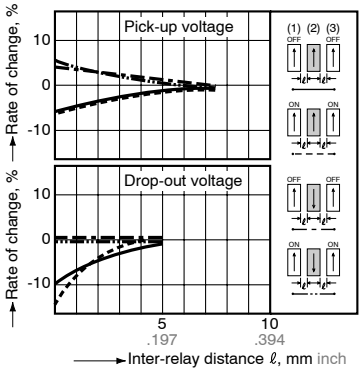
4-(4). Coil temperature rise
(4 Form C 2 coil latching type)
Point measured: Inside the coil
Ambient temperature: 20°C 68°F



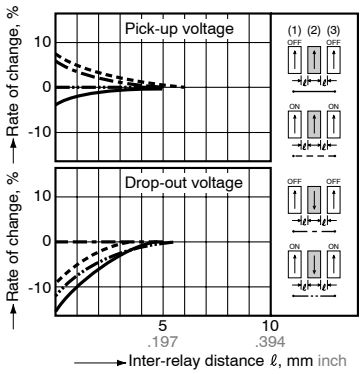
5. Operate and release time characteristics
(2 Form C single side stable type)
Test condition: Without diode connected to coil in parallel



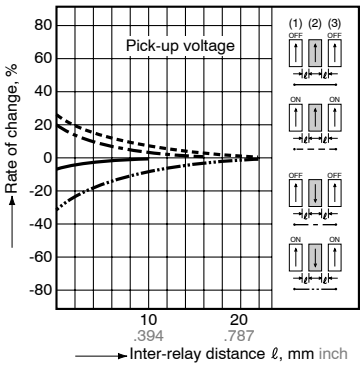
6-(1). Influence of adjacent mounting
(1 Form C)

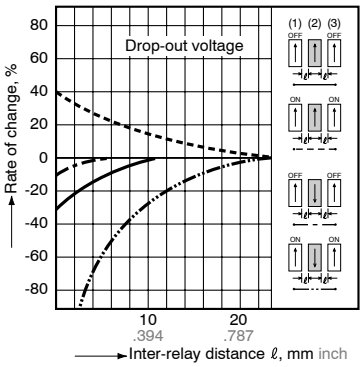


6-(2). Influence of adjacent mounting
(2 Form C)



6-(3). Influence of adjacent mounting
(4 Form C)



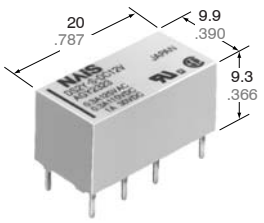


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

MINIATURE RELAY

DS2Y RELAYS



mm inch

FEATURES

- **2 Form C contact**
- **High sensitivity-200 mW nominal operating power**
- **High breakdown voltage**
  1500 V FCC surge between open contacts
- **DIP-2C type matching 16 pin IC socket**
- **Sealed construction**

SPECIFICATIONS

Contact

Arrangement			2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			50 mΩ
Contact material			Gold-clad sliver
Rating (resistive)	Max. switching power		60 W, 62.5 VA
	Max. switching voltage		220 V DC, 250 V AC
	Max. switching current		2 A
	Max. carrying current		3 A
Expected life (min. operations)	Mechanical		1×10^8
	Electrical	1 A 30 V DC	5×10^5
		2 A 30 V DC	1×10^5

Coil (polarized) (at 20°C 68°F)

Single side stable	Minimum operating power	Approx. 98 mW (147 mW: 48 V)
	Nominal operating power	Approx. 200 mW (300 mW: 48 V)
2 coil latching	Minimum set and reset power	Approx. 88 mW (177 mW: 48 V)
	Nominal set and reset power	Approx. 180 mW (360 mW: 48 V)

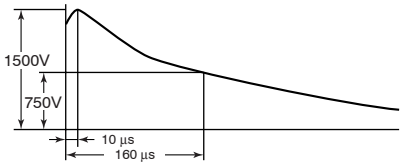
Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms, detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics (at 20°C 68°F)

Initial insulation resistance*1		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	750 Vrms
	Between contact sets	1,000 Vrms
	Between contact and coil	1,000 Vrms
FCC surge voltage between contacts and coil		1,500 V
Operate time*3 (at nominal voltage)		Approx. 4 ms
Release time*3 (at nominal voltage)		Approx. 3 ms
Set time*3 (latching) (at nominal voltage)		Approx. 3 ms
Reset time*3 (latching) (at nominal voltage)		Approx. 3 ms
Temperature rise		Max. 65°C with nominal voltage across coil and at nominal switching capacity
Shock resistance	Functional*4	Min. 490 m/s² {50 G}
	Destructive*5	Min. 980 m/s² {100 G}
Vibration resistance	Functional*6	10 to 55 Hz at double amplitude of 3.3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 4 g 14 oz.

FCC (Federal Communication Commission) requests following standard as Breakdown Voltage specification.



TYPICAL APPLICATIONS

- Telecommunication equipment
- Office equipment
- Computer peripherals
- Security alarm systems
- Medical equipment

ORDERING INFORMATION

Ex DS2Y-S | L2 | DC12 V | R

Operating function	Coil voltage	Polarity
Nil: Single side stable L2: 2 coil latching	DC 1.5, 3, 5, 6, 9, 12, 24, 48 V	Nil: Standard polarity R: Reverse polarity

(Notes) 1. Standard packing: Carton: 50 pcs. Case: 500 pcs.
2. 1 coil latching type available.

TYPES AND COIL DATA (at 20°C 68°F)

Single side stable

Nominal voltage, V DC	Part No.	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power mW	Maximum allowable voltage, V DC (at 50°C 122°F)
1.5	DS2Y-S-DC1.5V	1.05	0.15	132.7	11.3	200	3
3	DS2Y-S-DC3V	2.10	0.3	66.7	45	200	6
5	DS2Y-S-DC5V	3.5	0.5	40	125	200	10
6	DS2Y-S-DC6V	4.2	0.6	33.3	180	200	12
9	DS2Y-S-DC9V	6.3	0.9	22.2	405	200	18
12	DS2Y-S-DC12V	8.4	1.2	16.7	720	200	24
24	DS2Y-S-DC24V	16.8	2.4	8.3	2,880	200	48
48	DS2Y-S-DC48V	33.6	4.8	6.3	7,680	300	86

(Note) Standard packing: Carton: 50 pcs. Case: 500 pcs.

2 coil latching

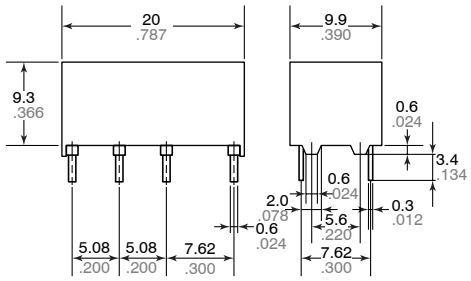
Nominal voltage, V DC	Part No.	Reset set, V DC (max.)	Nominal operating current mA (±10%)		Coil resistance, Ω (±10%)		Nominal operating power, mW		Maximum allowable voltage, V DC (at 50°C 122°F)
			Set	Reset	Set	Reset	Set	Reset	
1.5	DS2Y-SL2-DC1.5V	1.05	120	120	12.5	12.5	180	180	3
3	DS2Y-SL2-DC3V	2.1	60	60	50	50	180	180	6
5	DS2Y-SL2-DC5V	3.5	36	36	139	139	180	180	10
6	DS2Y-SL2-DC6V	4.2	30	30	200	200	180	180	12
9	DS2Y-SL2-DC9V	6.3	20	20	450	450	180	180	18
12	DS2Y-SL2-DC12V	8.4	15	15	800	800	180	180	24
24	DS2Y-SL2-DC24V	16.8	7.5	7.5	3,200	3,200	180	180	48
48	DS2Y-SL2-DC48V	33.6	7.5	7.5	6,400	6,400	360	360	72

(Note) Standard packing: Carton: 50 pcs. Case: 500 pcs.

DIMENSIONS

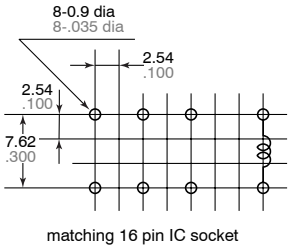
mm inch

Single side stable



General tolerance: ±0.3 ±.012

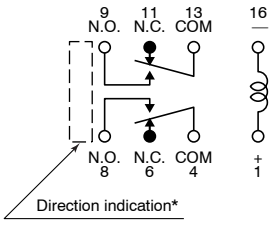
PC board pattern (Copper-side view)



matching 16 pin IC socket

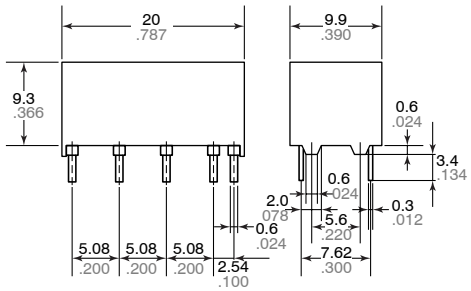
Tolerance: ±0.1 ±.004

Schematic (Bottom view)
(Deenergized position)



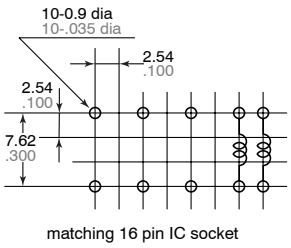
*A polarity bar shows the relay direction.

2 coil latching



General tolerance: ±0.3 ±.012

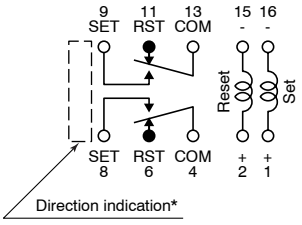
PC board pattern (Copper-side view)



matching 16 pin IC socket

Tolerance: ±0.1 ±.004

Schematic (Bottom view)
(Reset position)

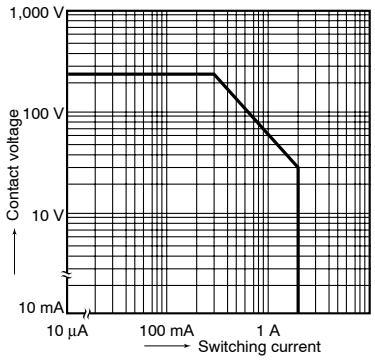


*A polarity bar shows the relay direction.

Diagram shows the "reset" position when terminals 2 and 15 are energized. Energize terminals 1 and 16 to transfer contacts.

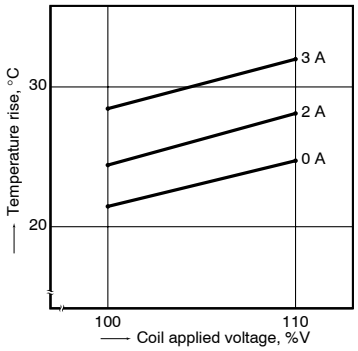
REFERENCE DATA

1. Maximum switching capacity



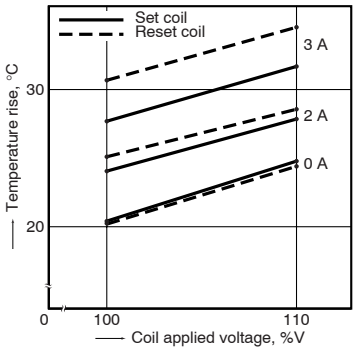
2-(1) Coil temperature rise (Single side stable)

Tested sample: DS2Y-S-DC12V, 5 pcs.
Measured portion: Inside the coil
Ambient temperature: 21°C to 25°C 70°F to 77°F



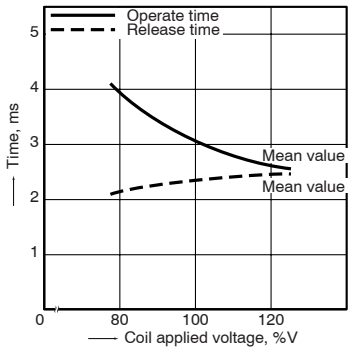
2-(2) Coil temperature rise 2 coil latching

Tested sample: DS2Y-SL2-DC12V, 5 pcs.
Measured portion: Inside the coil
Ambient temperature: 21°C to 25°C 70°F to 77°F



3. Operate/release time for single side stable (Without diode)

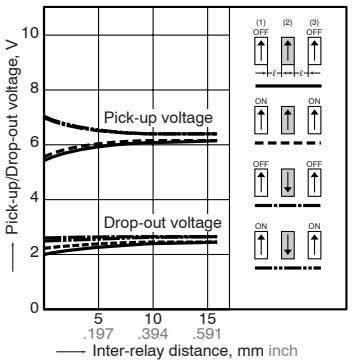
Tested sample: DS2Y-S-DC12V, 10 pcs.
Ambient temperature: 20°C 68°F



4-(1) Influence of adjacent mounting

Tested sample: DS2Y-S-DC12V, 10 pcs.
Ambient temperature: 20°C 68°F

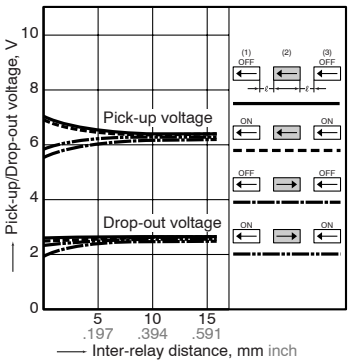
TEST METHOD
1. Apply nominal voltage to No. (1) and (3) DS2Y relays.
2. Measure pick-up voltage and drop-out voltage of No. (2) relay when inter-relay distance (ℓ) changes.



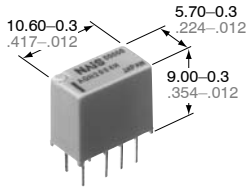
4-(2) Influence of adjacent mounting

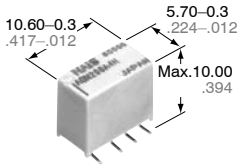
Tested sample: DS2Y-S-DC12V, 10 pcs.
Ambient temperature: 20°C 68°F

TEST METHOD
1. Apply nominal voltage to No. (1) and (3) DS2Y relays.
2. Measure pick-up voltage and drop-out voltage of No. (2) relay when inter-relay distance (ℓ) changes.



For Cautions for Use, see Relay Technical Information (page 390).





mm inch

FEATURES

• Compact slim body saves space
Thanks to the small surface area of 5.7 mm × 10.6 mm .224 inch × .417 inch and low height of 9.0 mm .354 inch, the packaging density can be increased to allow for much smaller designs.

• Outstanding surge resistance.
Surge withstand between open contacts: 1,500 V 10×160 μs (FCC part 68)
Surge withstand between contacts and coil: 2,500 V 2×10 μs (Telcordia)

• The use of twin crossbar contacts ensures high contact reliability.
AgPd contact is used because of its good sulfide resistance. Adopting low-gas molding material. Coil assembly molding technology which avoids generating volatile gas from coil.

• Increased packaging density
Due to highly efficient magnetic circuit design, leakage flux is reduced and changes in electrical characteristics from components being mounted close-together are minimized. This all means a packaging density higher than ever before.

• Nominal operating power: 140 mW

• Outstanding vibration and shock resistance.
Functional shock resistance:
750 m/s² {75G}
Destructive shock resistance:
1,000 m/s² {100G}
Functional vibration resistance:
10 to 55 Hz (at double amplitude of 3.3 mm .130 inch)
Destructive vibration resistance:
10 to 55 Hz (at double amplitude of 5 mm .197 inch)

SPECIFICATIONS

Contact

Arrangement			2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1A)			100 mΩ
Contact material			Stationary: AgPd+Au clad Movable: AgPd
Rating	Nominal switching capacity (resistive load)		1 A 30 V DC 0.3 A 125 V AC
	Max. switching power (resistive load)		30 W, 37.5 V A
	Max. switching voltage		110 V DC, 125 V AC
	Max. switching current		1 A
	Min. switching capacity ❋1		10 μA 10 mV DC
Nominal operating power	Single side stable		140mW (1.5 to 12 V DC) 230mW (24 V DC)
	1 coil latching		100mW (1.5 to 12 V DC) 120mW (24 V DC)
Expected life (min. operations)	Mechanical (at 180 cpm)		5×10^7
	Electrical (at 20 cpm)	1 A 30 V DC resistive	10^5
		0.3 A 125 V AC resistive	10^5

Remarks:
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA.
*3 Nominal voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil; contact carrying current: 1 A.
*5 Half-wave pulse of sine wave: 6 ms; detection time: 10μs.
*6 Half-wave pulse of sine wave: 6 ms.
*7 Detection time: 10μs.
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

Initial insulation resistance*1		Min. 1,000MΩ (at 500V DC)
Initial breakdown voltage*2	Between open contacts	750 Vrms for 1min.
	Between contact sets	1,000 Vrms for 1min.
	Between contacts and coil	1,500 Vrms for 1min.
Initial surge voltage	Between open contacts (10×160 μs)	1,500 V (FCC Part 68)
	Between contacts and coil (2×10 μs)	2,500 V (Telcordia)
Operate time [Set time]*3 (at 20°C)		Max. 4 ms (Approx. 2 ms) [Max. 4 ms (Approx. 2 ms)]
Release time (without diode) [Reset time]*3 (at 20°C)		Max. 4 ms (Approx. 1 ms) [Max. 4 ms (Approx. 2 ms)]
Temperature rise*4 (at 20°C)		Max. 50°C
Shock resistance	Functional*5	Min. 750 m/s²{75G]
	Destructive*6	Min. 1,000 m/s²{100G]
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 3.3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temperature ❋2	–40°C to 85°C –40°F to 185°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 1 g .035 oz

Notes:
❋1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
❋2 The upper limit for the ambient temperature is the maximum temperature that can satisfy the coil temperature rise. Under the packing condition, allowable temperature range is from –40 to +70°C –40° to +158°F.

TYPICAL APPLICATIONS

- **Communications (XDSL, Transmission)**
- **Measurement**
- **Security**
- **Home appliances, and audio/visual equipment**
- **Automotive equipment**
- **Medical equipment**

ORDERING INFORMATION

Ex. AGN 2 0 0 A 1 H Z

Contact arrangement	Operating function	Type of operation	Terminal shape	Coil voltage (DC)	Packing style
2: 2 Form C	0: Single side stable 1: 1 coil latching	0: Standard type (B.B.M.)	Nil: Standard PC board terminal A: Surface-mount terminal A type S: Surface-mount terminal S type	1H: 1.5V 09 : 9V 03 : 3V 12 : 12V 4H: 4.5V 24 : 24V 06 : 6V	Nil: Tube packing Z: Tape and reel packing (picked from 5/6/7/8 pin side)

Note: Tape and reel packing symbol "-Z" is not marked on the relay. "X" type tape and reel packing (picked from 1/2/3/4-pin side) is also available. Suffix "X" instead of "Z".

TYPES AND COIL DATA (at 20°C 68°F)

(1) Standard PC board terminal

Operating Function	Part No. Standard PC board terminal	Coil Rating, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	AGN2001H	1.5	1.13	0.15	93.8	16	140	2.25
	AGN20003	3	2.25	0.3	46.7	64.2	140	4.5
	AGN2004H	4.5	3.38	0.45	31	145	140	6.75
	AGN20006	6	4.5	0.6	23.3	257	140	9
	AGN20009	9	6.75	0.9	15.5	579	140	13.5
	AGN20012	12	9	1.2	11.7	1,028	140	18
	AGN20024	24	18	2.4	9.6	2,504	230	28.8

Operating Function	Part No. Standard PC board terminal	Coil Rating, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
1 coil latching	AGN2101H	1.5	1.13	1.13	66.7	22.5	100	2.25
	AGN21003	3	2.25	2.25	33.3	90	100	4.5
	AGN2104H	4.5	3.38	3.38	22.2	202.5	100	6.75
	AGN21006	6	4.5	4.5	16.7	360	100	9
	AGN21009	9	6.75	6.75	11.1	810	100	13.5
	AGN21012	12	9	9	8.3	1,440	100	18
	AGN21024	24	18	18	5.0	4,800	120	36

1) Standard packing: 50 pcs. in an inner package (tube); 1,000 pcs. in an outer package
2) Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.

(2) Surface-mount terminal

Operating Function	Part No. Tube packing	Part No. Tape and reel packing	Coil Rating, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	AGN200❍1H	AGN200❍1HZ	1.5	1.13	0.15	93.8	16	140	2.25
	AGN200❍03	AGN200❍03Z	3	2.25	0.3	46.7	64.2	140	4.5
	AGN200❍4H	AGN200❍4HZ	4.5	3.38	0.45	31	145	140	6.75
	AGN200❍06	AGN200❍06Z	6	4.5	0.6	23.3	257	140	9
	AGN200❍09	AGN200❍09Z	9	6.75	0.9	15.5	579	140	13.5
	AGN200❍12	AGN200❍12Z	12	9	1.2	11.7	1,028	140	18
	AGN200❍24	AGN200❍24Z	24	18	2.4	9.6	2,504	230	28.8

❍: For each surface-mounted terminal variation, input the following letter.
A type: A, S type: S
1) Standard packing: 50 pcs.(tube), 500pcs. (tape and reel)in an inner package; 1,000 pcs. in an outer package
2) Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.

Operating Function	Part No.		Coil Rating, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
	Tube packing	Tape and reel packing							
1 coil latching	AGN210❍1H	AGN210❍1HZ	1.5	1.13	1.13	66.7	22.5	100	2.25
	AGN210❍03	AGN210❍03Z	3	2.25	2.25	33.3	90	100	4.5
	AGN210❍4H	AGN210❍4HZ	4.5	3.38	3.38	22.2	202.5	100	6.75
	AGN210❍06	AGN210❍06Z	6	4.5	4.5	16.7	360	100	9
	AGN210❍09	AGN210❍09Z	9	6.75	6.75	11.1	810	100	13.5
	AGN210❍12	AGN210❍12Z	12	9	9	8.3	1,440	100	18
	AGN210❍24	AGN210❍24Z	24	18	18	5.0	4,800	120	36

❍: For each surface-mounted terminal variation, input the following letter.
A type: A, S type: S

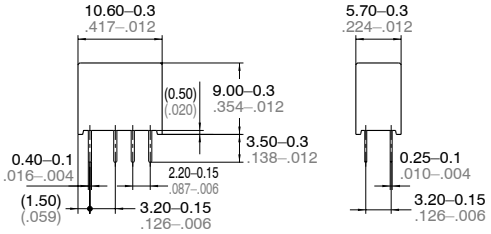
1) Standard packing: 50 pcs.(tube), 500pcs. (tape and reel)in an inner package; 1,000 pcs. in an outer package

2) Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.

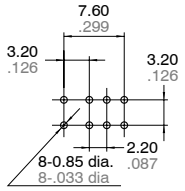
DIMENSIONS

mm inch

1. PC board terminal



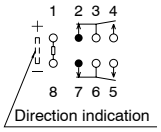
PC board pattern



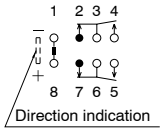
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

Single side stable (Deenergized condition)

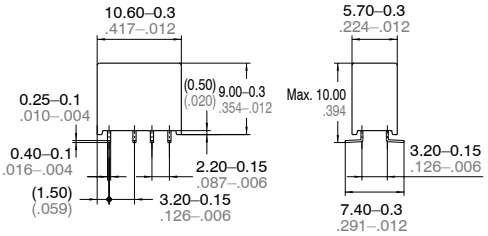


1 coil latching (Reset condition)

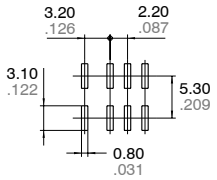


2. Surface-mount terminal

1) A type



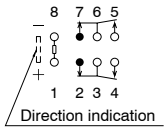
Suggested mounting pad



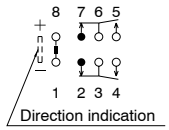
Tolerance: ±0.1 ±.004

Schematic (Top view)

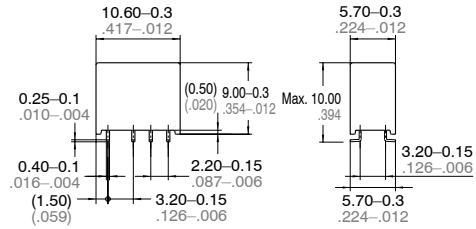
Single side stable (Deenergized condition)



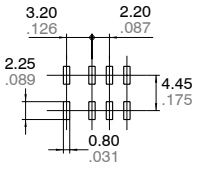
1 coil latching (Reset condition)



1) S type



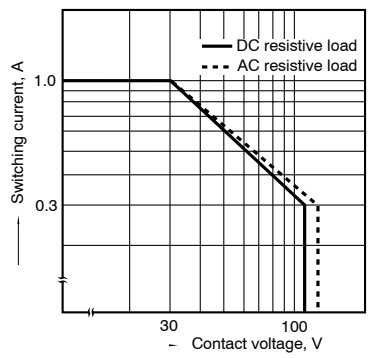
Suggested mounting pad



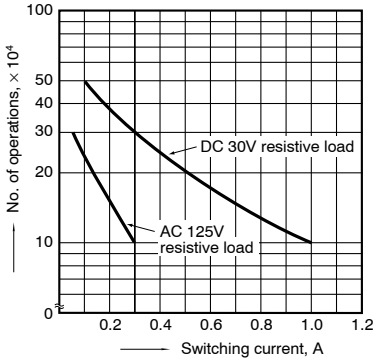
Tolerance: ±0.1 ±.004

REFERENCE DATA

1. Max. switching capacity



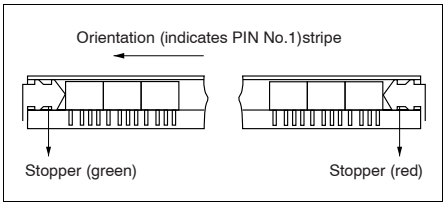
2. Life curve



NOTES

1. Packing style

1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.

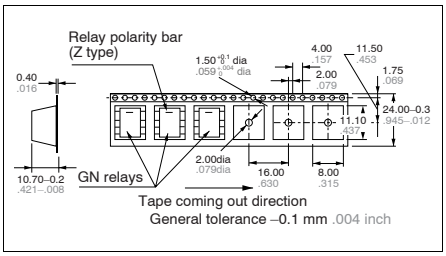


2) Tape and reel packing

(A type)

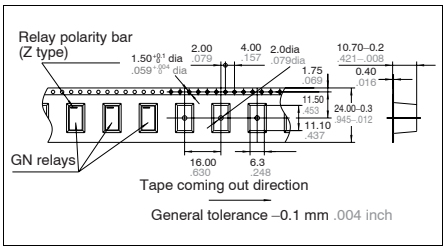
(1)-1 Tape dimensions

mm inch



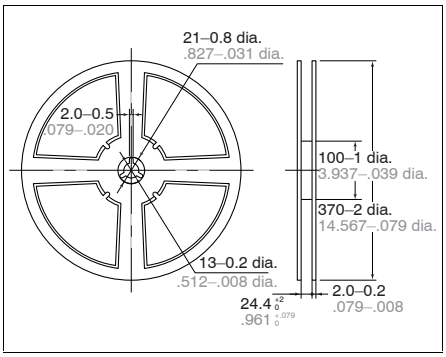
(S type)

(1)-2 Tape dimensions



(2) Dimensions of plastic peel

mm inch



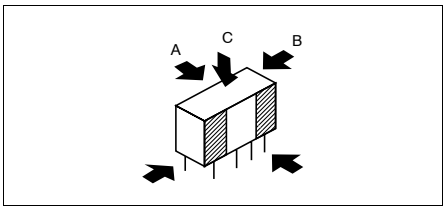
2. Automatic insertion

To maintain the internal function of the relay, the chucking pressure should not exceed the values below.

Chucking pressure in the direction A:
4.9 N {500gf} or less

Chucking pressure in the direction B:
9.8 N {1 kgf} or less

Chucking pressure in the direction C:
9.8 N {1 kgf} or less



Please chuck the ▨ portion.

Avoid chucking the center of the relay.

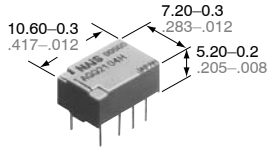
In addition, excessive chucking pressure to the pinpoint of the relay should be avoided.

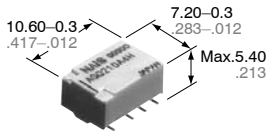
For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

ULTRA-SMALL PACKAGE FLAT POLARIZED RELAY

GQ RELAYS (AGQ)





mm inch

FEATURES

• Compact flat body saves space
With a small footprint of 10.6 mm (L) × 7.2 mm (W) .417 inch (L) × .283 inch (W) for space savings, it also has a very short height of 5.2 mm .205 inch. (Standard PC board type.)

• Outstanding surge resistance.
Surge withstand between open contacts: 1,500 V 10×160 μs (FCC part 68)
Surge withstand between contacts and coil: 2,500 V 2×10 μs (Telcordia)

• The use of twin crossbar contacts ensures high contact reliability.
AgPd contact is used because of its good sulfide resistance. Adopting low-gas molding material. Coil assembly molding technology which avoids generating volatile gas from coil.

• Increased packaging density
Due to highly efficient magnetic circuit design, leakage flux is reduced and changes in electrical characteristics from components being mounted close-together are minimized. This all means a packaging density higher than ever before.

• Nominal operating power: 140 mW

• Outstanding vibration and shock resistance.
Functional shock resistance:
750 m/s² {75G}
Destructive shock resistance:
1,000 m/s² {100G}
Functional vibration resistance:
10 to 55 Hz (at double amplitude of 3.3 mm .130 inch)
Destructive vibration resistance:
10 to 55 Hz (at double amplitude of 5 mm .197 inch)

SPECIFICATIONS

Contact

Arrangement			2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1A)			100 mΩ
Contact material			Stationary: AgPd+Au clad Movable: AgPd
Rating	Nominal switching capacity (resistive load)		1 A 30 V DC 0.3 A 125 V AC
	Max. switching power (resistive load)		30 W, 37.5 V A
	Max. switching voltage		110 V DC, 125 V AC
	Max. switching current		1 A
	Min. switching capacity ❋1		10 μA 10 mV DC
Nominal operating power	Single side stable		140mW (1.5 to 12 V DC) 230mW (24 V DC)
	1 coil latching		100mW (1.5 to 12 V DC) 120mW (24 V DC)
Expected life (min. operations)	Mechanical (at 180 cpm)		5×10^7
	Electrical (at 20 cpm)	1 A 30 V DC resistive	10^5
		0.3 A 125 V AC resistive	10^5

Remarks:
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA.
*3 Nominal voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil; contact carrying current: 1 A.
*5 Half-wave pulse of sine wave: 6 ms;detection time: 10μs.
*6 Half-wave pulse of sine wave: 6 ms.
*7 Detection time: 10μs.
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

Initial insulation resistance*1		Min. 1,000MΩ (at 500V DC)
Initial breakdown voltage*2	Between open contacts	750 Vrms for 1min.
	Between contact sets	1,000 Vrms for 1min.
	Between contacts and coil	1,500 Vrms for 1min.
Initial surge voltage	Between open contacts (10×160 μs)	1,500 V(FCC Part 68)
	Between contacts and coil (2×10 μs)	2,500 V(Telcordia)
Operate time [Set time]*3 (at 20°C)		Max. 4 ms (Approx. 2 ms) [Max. 4 ms (Approx. 2 ms)]
Release time (without diode) [Reset time]*3 (at 20°C)		Max. 4 ms (Approx. 1 ms) [Max. 4 ms (Approx. 2 ms)]
Temperature rise*4 (at 20°C)		Max. 50°C
Shock resistance	Functional*5	Min. 750 m/s²{75G]
	Destructive*6	Min. 1,000 m/s²{100G]
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 3.3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temperature ❋2	–40°C to 85°C –40°F to 185°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 1 g .035 oz

Notes:
❋1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
❋2 The upper limit for the ambient temperature is the maximum temperature that can satisfy the coil temperature rise. Under the packing condition, allowable temperature range is from –40 to +70°C –40° to +158°F.

TYPICAL APPLICATIONS

- **Communications (XDSL, Transmission)**
- **Measurement**
- **Security**
- **Home appliances, and audio/visual equipment**
- **Automotive equipment**
- **Medical equipment**

ORDERING INFORMATION

Ex. AGQ [2] [0] [0] [A] [1] [H] [Z]

Contact arrangement	Operating function	Type of operation	Terminal shape	Coil voltage (DC)	Packing style
2: 2 Form C	0: Single side stable 1: 1 coil latching	0: Standard type (B.B.M.)	Nil: Standard PC board terminal A: Surface-mount terminal A type S: Surface-mount terminal S type	1H: 1.5V 09 : 9V 03 : 3V 12 : 12V 4H: 4.5V 24 : 24V 06 : 6V	Nil: Tube packing Z: Tape and reel packing (picked from 5/6/7/8 pin side)

Note: Tape and reel packing symbol "-Z" is not marked on the relay. "X" type tape and reel packing (picked from 1/2/3/4-pin side) is also available. Suffix "X" instead of "Z".

TYPES AND COIL DATA (at 20°C 68°F)

(1) Standard PC board terminal

Operating Function	Part No. Standard PC board terminal	Coil Rating, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	AGQ2001H	1.5	1.13	0.15	93.8	16	140	2.25
	AGQ20003	3	2.25	0.3	46.7	64.2	140	4.5
	AGQ2004H	4.5	3.38	0.45	31	145	140	6.75
	AGQ20006	6	4.5	0.6	23.3	257	140	9
	AGQ20009	9	6.75	0.9	15.5	579	140	13.5
	AGQ20012	12	9	1.2	11.7	1,028	140	18
	AGQ20024	24	18	2.4	9.6	2,504	230	28.8

Operating Function	Part No. Standard PC board terminal	Coil Rating, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
1 coil latching	AGQ2101H	1.5	1.13	1.13	66.7	22.5	100	2.25
	AGQ21003	3	2.25	2.25	33.3	90	100	4.5
	AGQ2104H	4.5	3.38	3.38	22.2	202.5	100	6.75
	AGQ21006	6	4.5	4.5	16.7	360	100	9
	AGQ21009	9	6.75	6.75	11.1	810	100	13.5
	AGQ21012	12	9	9	8.3	1,440	100	18
	AGQ21024	24	18	18	5.0	4,800	120	36

1) Standard packing: 50 pcs. in an inner package (tube); 1,000 pcs. in an outer package
2) Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.

(2) Surface-mount terminal

Operating Function	Part No. Tube packing	Part No. Tape and reel packing	Coil Rating, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	AGQ200❍1H	AGQ200❍1HZ	1.5	1.13	0.15	93.8	16	140	2.25
	AGQ200❍03	AGQ200❍03Z	3	2.25	0.3	46.7	64.2	140	4.5
	AGQ200❍4H	AGQ200❍4HZ	4.5	3.38	0.45	31	145	140	6.75
	AGQ200❍06	AGQ200❍06Z	6	4.5	0.6	23.3	257	140	9
	AGQ200❍09	AGQ200❍09Z	9	6.75	0.9	15.5	579	140	13.5
	AGQ200❍12	AGQ200❍12Z	12	9	1.2	11.7	1,028	140	18
	AGQ200❍24	AGQ200❍24Z	24	18	2.4	9.6	2,504	230	28.8

❍: For each surface-mounted terminal variation, input the following letter.
A type: A, S type: S
1) Standard packing: 50 pcs.(tube), 900pcs. (tape and reel)in an inner package; 1,000 pcs.(tube), 1,800pcs. (tape and reel) in an outer package
2) Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.

Operating Function	Part No.		Coil Rating, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
	Tube packing	Tape and reel packing							
1 coil latching	AGQ210❍1H	AGQ210❍1HZ	1.5	1.13	1.13	66.7	22.5	100	2.25
	AGQ210❍03	AGQ210❍03Z	3	2.25	2.25	33.3	90	100	4.5
	AGQ210❍4H	AGQ210❍4HZ	4.5	3.38	3.38	22.2	202.5	100	6.75
	AGQ210❍06	AGQ210❍06Z	6	4.5	4.5	16.7	360	100	9
	AGQ210❍09	AGQ210❍09Z	9	6.75	6.75	11.1	810	100	13.5
	AGQ210❍12	AGQ210❍12Z	12	9	9	8.3	1,440	100	18
	AGQ210❍24	AGQ210❍24Z	24	18	18	5.0	4,800	120	36

❍: For each surface-mounted terminal variation, input the following letter.
A type: A, S type: S

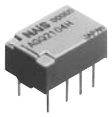
1) Standard packing: 50 pcs.(tube), 900pcs. (tape and reel)in an inner package; 1,000 pcs.(tube), 1,800pcs. (tape and reel) in an outer package

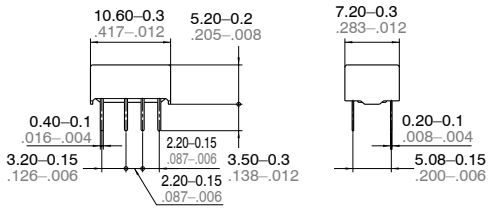
2) Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.

DIMENSIONS

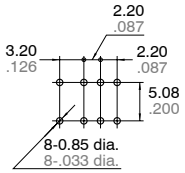
mm inch

1. PC board terminal



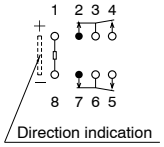


PC board pattern

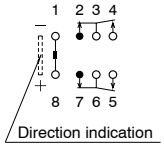


Schematic (Bottom view)

Single side stable (Deenergized condition)



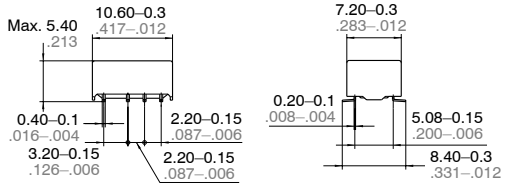
1 coil latching (Reset condition)



Tolerance: ±0.1 ±.004

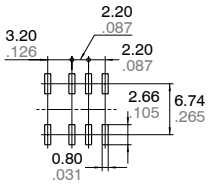
2. Surface-mount terminal

1) A type



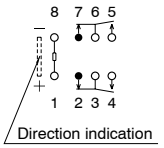
Suggested mounting pad

Single side stable/ 1 coil latching

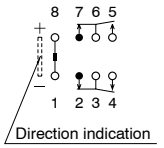


Schematic (Top view)

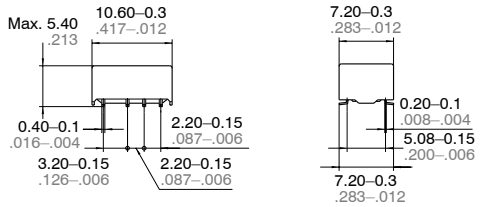
Single side stable (Deenergized condition)



1 coil latcing (Reset condition)

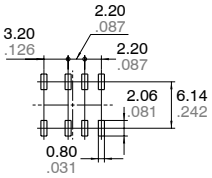


1) S type



Suggested mounting pad

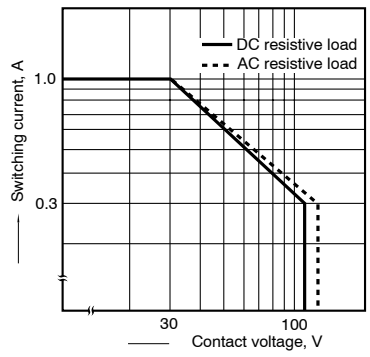
Single side stable/ 1 coil latching



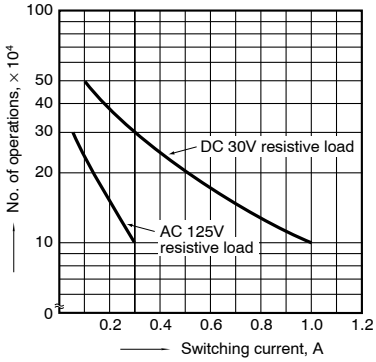
Tolerance: ±0.1 ±.004

REFERENCE DATA

1. Max. switching capacity



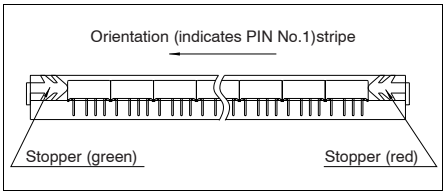
2. Life curve

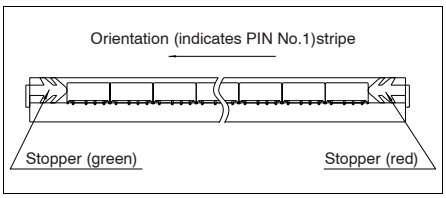


NOTES

1. Packing style

1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.



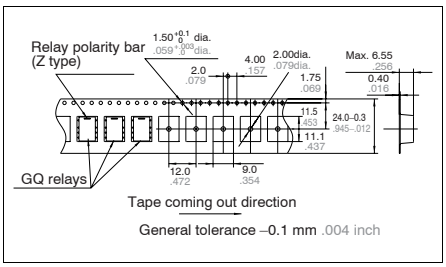


2) Tape and reel packing

(A type)

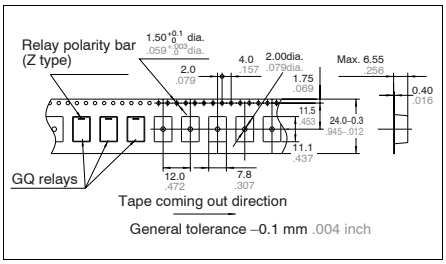
(1)-1 Tape dimensions

mm inch



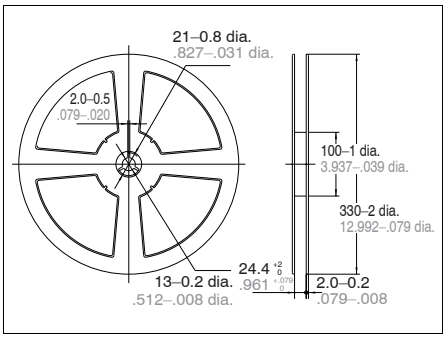
(S type)

(1)-2 Tape dimensions



(2) Dimensions of plastic peel

mm inch



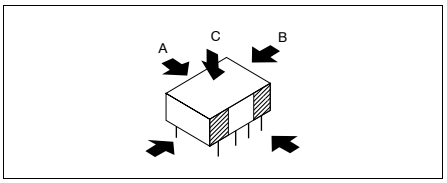
2. Automatic insertion

To maintain the internal function of the relay, the chucking pressure should not exceed the values below.

Chucking pressure in the direction A : 9.8 N {1 kgf} or less

Chucking pressure in the direction B : 9.8 N {1 kgf} or less

Chucking pressure in the direction C : 9.8 N {1 kgf} or less



Please chuck the ▨ portion.

Avoid chucking the center of the relay.

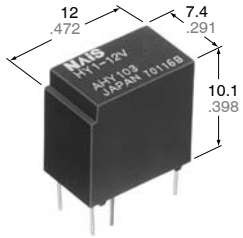
In addition, excessive chucking pressure to the pinpoint of the relay should be also avoided.

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

Non-polarized
1 Form C Relay

HY RELAYS



mm inch

FEATURES

- **High sensitivity: 150 mW/200 mW**
- **A wide range of ambient temperature: –40°C to +70°C –40°F to +158°F**
- **Sealed construction**
- **Rating: 1 A 30 V DC**

SPECIFICATIONS

Contact

Arrangement		1 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ
Contact material		Gold-clad silver
Rating (resistive)	Nominal switching capacity	1 A 30 V DC
	Max. switching power	30 W
	Max. switching voltage	60 V DC
	Max. switching current	1 A
	Max. carrying current	2 A
Expected life (min. operations)	Mechanical (at 180 cpm)	10^7
	Electrical (at 20 cpm) 1 A 30 V DC	10^5

Coil

Nominal operating power	Standard type	200 mW
	High sensitivity type	150 mW

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as “Initial breakdown voltage” section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics (at 25°C 77°F, 50% Relative humidity)

Max. operating speed		20 cpm (at nominal voltage)
Initial insulation resistance*1	Between contacts	Min. 100 MΩ at 500 V DC
	Between contact and coil	Min. 100 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	500 Vrms
	Between contacts and coil	1,000 Vrms
Operate time*3 (at nominal voltage)		Max. 5 ms (approx. 2 ms)
Release time (without diode)*3 (at nominal voltage)		Max. 4 ms (approx. 1 ms)
Temperature rise at nominal voltage Contact carrying current 1 A at 20°C		Max. 50°C
Shock resistance	Functional*4	Min. 98 m/s² (10 G)
	Destructive*5	Min. 980 m/s² (100 G)
Vibration resistance	Functional*6	58.8 m/s² {6 G}, 10 to 55 Hz at double amplitude of 1 mm
	Destructive	117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		1.8 g .063 oz

TYPICAL APPLICATIONS

- Automotive: Switching to small motor
  1) Automirrow controller
  2)Retractable head light controller
- Push button device: Dial pulsing
- Low-voltage signal switching and motor control of small home appliances such as portable video tape recorders and audio devices.
- Operating of dish-control motors for PCs and word processors

ORDERING INFORMATION

Ex. HY [1] [Z] — [3V]

Contact arrangement	Sensitivity	Coil voltage (DC)
1: 1 Form C	Nil: High sensitivity 150 mW Z: Standard 200 mW	1.5, 3, 4.5, 5, 6, 9, 12, 24 V

Standard packing: Carton: 100 pcs. Case 500 pcs.

TYPES AND COIL DATA (at 20°C 68°F)

Standard packing: Carton: 50 pcs. Case: 2,000 pcs.

200 mW Standard type

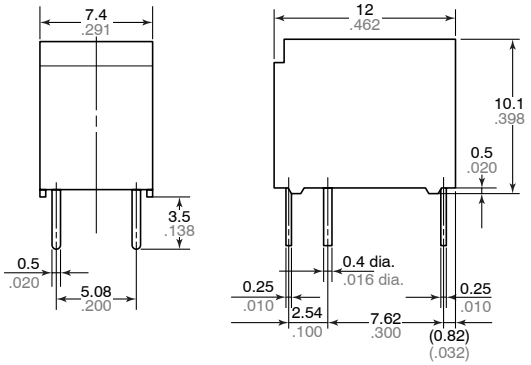
Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Max. allowable voltage, V DC (at 70°C 158°F)
HY1Z-1.5V	1.5	1.125	0.15	11.25	133.3	200	1.8
HY1Z-3V	3	2.25	0.3	45	66.7	200	3.6
HY1Z-4.5V	4.5	3.375	0.45	101.2	44.5	200	5.4
HY1Z-5V	5	3.75	0.5	125	40	200	6
HY1Z-6V	6	4.5	0.6	180	33.3	200	7.2
HY1Z-9V	9	6.75	0.9	405	22.2	200	10.8
HY1Z-12V	12	9	1.2	720	16.7	200	14.4
HY1Z-24V	24	18	2.4	2,880	8.3	200	28.8

150 mW High sensitivity type

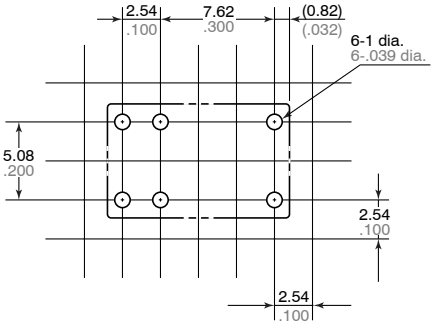
Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Max. allowable voltage, V DC (at 70°C 158°F)
HY1-1.5V	1.5	1.125	0.15	15	100	150	2.1
HY1-3V	3	2.25	0.3	60	50	150	4.2
HY1-4.5V	4.5	3.375	0.45	135	33.3	150	6.3
HY1-5V	5	3.75	0.5	166	30.1	150	7
HY1-6V	6	4.5	0.6	240	25	150	8.4
HY1-9V	9	6.75	0.9	540	16.7	150	12.6
HY1-12V	12	9	1.2	960	12.5	150	16.8
HY1-24V	24	18	2.4	3,840	6.25	150	33.6

DIMENSIONS

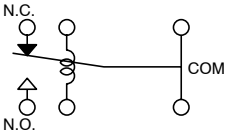
mm inch



PC board pattern (Copper-side view)



Schematic (Bottom view)

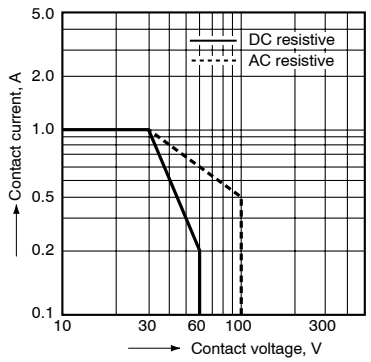


General tolerance: ±0.3 ±.012

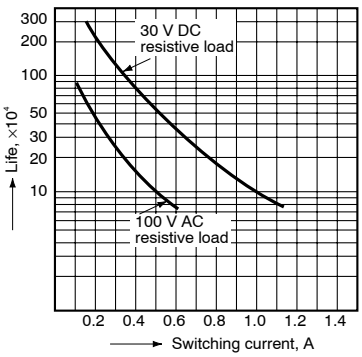
Tolerance: ±0.1 ±.004

REFERENCE DATA

1. Maximum switching power



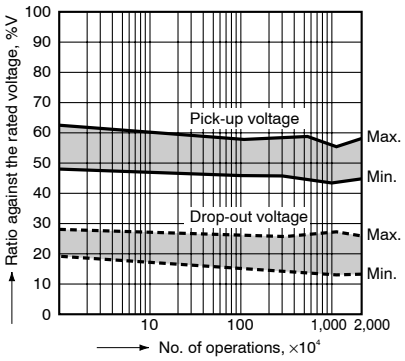
2. Life curve



3. Mechanical life

Tested sample: HY1Z-12V, 10 pcs.

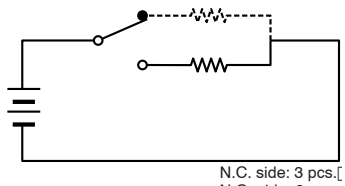
Ambient temperature: 20°C to 25°C 68°F to 77°F



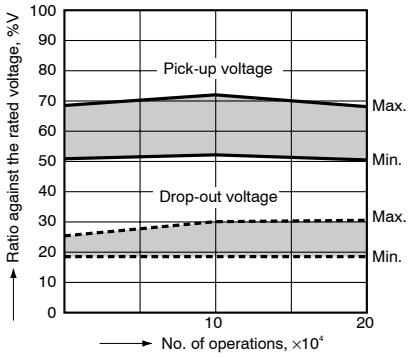
4. Electrical life

Tested sample: HY1-12V, 6 pcs.
Condition: 1 A 30 V DC resistive load, 30 cpm

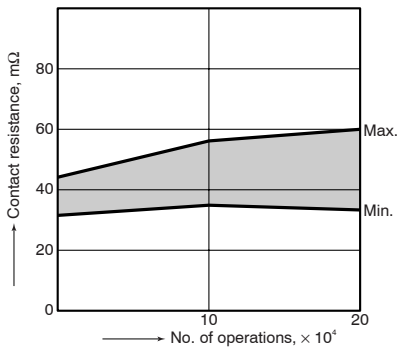
Circuit:



Change of pick-up and drop-out voltage

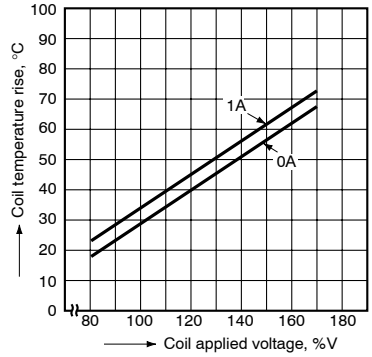


Change of contact resistance



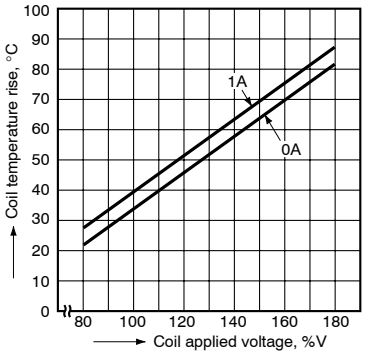
5-(1). Coil temperature rise
(150 mW high sensitivity type)

Tested sample: HY1-9V, 5 pcs.
Ambient temperature:24°C 75°F



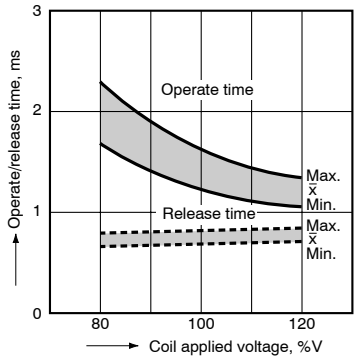
5-(2). Coil temperature rise
(200 mW Standard type)

Tested sample: HY1Z-12V, 5 pcs.
Ambient temperature: 23°C 74°F



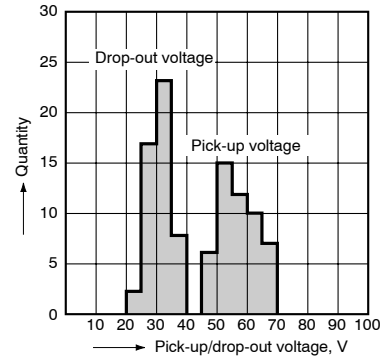
6. Operate/release time characteristics

Tested sample: HY1Z-12V, 5 pcs.
Ambient temperature: 25°C 77°F



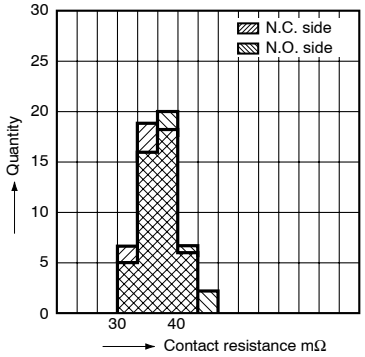
7. Distribution of pick-up and drop-out voltages

Tested sample: HY1-12V, 50 pcs.
Ambient temperature: 23°C 74°F



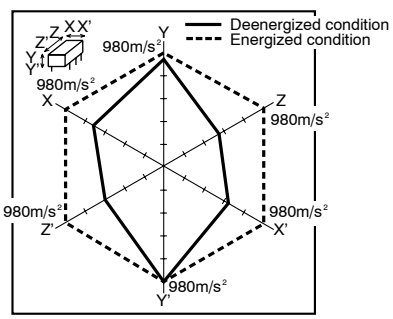
8. Distribution of contact resistance

Tested sample: HY1-12V, 50 pcs.
N.C. side N.O. side



9. Malfunction shock

Tested sample: HY1Z-12V, 6 pcs.



NOTE

Soldering and cleaning

HY relays have the sealed construction. It is possible to do automatic soldering and automatic cleaning, but avoid the ultrasonic cleaning.

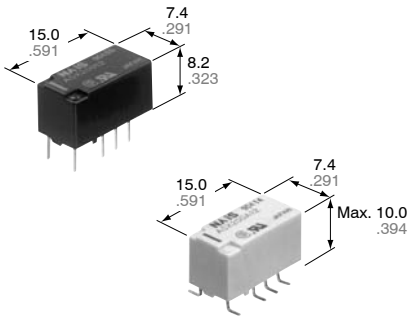
For cleaning, it is recommended that a fluorinated hydrocarbon or other alcoholic solvent be used.

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

HIGH SENSITIVITY RELAY WITH GUARANTEED LOW LEVEL SWITCHING CAPACITY

SX RELAYS (ASX)



mm inch

FEATURES

1. High contact reliability over a long life has been made possible for low level loads.
Using a low level load (1 mV 10μA to 10 V 10 mA) 10^7 operations were achieved with a static contact resistance of Max. 100 mΩ (voltage drop of 20 mV, 1 mA, 1 kHz) and a dynamic contact resistance of Max. 1 Ω (Measurement delay 10 ms, voltage drop of 20 mV, 1 mA, 1 kHz).

2. High sensitivity of 50 mW
By using the highly efficient polar magnetic circuit "seesaw balance armature mechanism", a rated power consumption of 50 mW (for single side stable type) has been achieved.

3. Low thermal electromotive force
Reducing the heat from the coil enables a thermal electromotive force of 3 μV or less.

SPECIFICATIONS

Contact

Arrangement		2 Form C
Static contact resistance (During initial and electric life tests)*1 (By voltage drop of 20 mV 1 mA [1kHz])		Max. 100 mΩ
Dynamic contact resistance (During initial and electric life tests)*1 (By voltage drop of 20 mV 1 mA[1 kHz], Measurement delay 10 ms after applying nominal coil voltage)		Max. 1 Ω
Contact material		Gold-clad silver alloy
Rating	Nominal switching capacity (resistive load)	10 mA 10 VDC
	Max. switching power	0.1 W
	Max. switching voltage	10 VDC
	Max. switching current	10 mA DC
	Min. switching capacity**1	10 μA 1 mVDC
Nominal operating power	Single side stable	50mW (1.5 to 12 V DC) 70mW (24 V DC)
	1 coil latching	35mW (1.5 to 12 V DC) 50mW (24 V DC)
	2 coil latching	70mW (1.5 to 12 V DC) 150mW (24 V DC)
Thermal electromotive force, max. (at nominal voltage applied to the coil**2)		3 μV
Expected life (min. operations)	Mechanical (at 750 cpm)	5×10^7
	Electrical (at 750 cpm) (10 mA 10 V DC resistive load)	10^7

Notes:
**1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
**2 For single side stable only.

Characteristics

Initial insulation resistance*2		Min. 10,000MΩ (at 500V DC)
Initial breakdown voltage*3	Between open contacts	750 Vrms for 1min.
	Between contact sets	1,000 Vrms for 1min.
	Between contact and coil	1,800 Vrms for 1min.
Operate time [Set time]*4 (at 20°C)		Max. 5 ms (Approx. 3 ms) [Max. 5 ms (Approx. 3 ms)]
Release time (without diode) [Reset time]*4 (at 20°C)		Max. 5 ms (Approx. 1.5 ms) [Max. 5 ms (Approx. 3 ms)]
Temperature rise*5 (at 20°C)		Max. 50°C
Shock resistance	Functional*6	Min. 750 m/s²{75G]
	Destructive*7	Min. 1,000 m/s²{100G]
Vibration resistance	Functional*8	10 to 55 Hz at double amplitude of 3.3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*9 (Not freezing and condensing at low temperature)	Ambient temperature	–40°C to 70°C –40°F to 158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 2 g .071 oz

Remarks:
* Specifications will vary with foreign standards certification ratings.
*1 By nominal switching capacity: No. of operations: 10^7
*2 Measurement at same location as "Initial breakdown voltage" section.
*3 Detection current: 10mA.
*4 Nominal voltage applied to the coil, excluding contact bounce time.
*5 By resistive method, nominal voltage applied to the coil; contact carrying current: 10mA.
*6 Half-wave pulse of sine wave: 6 ms; detection time: 10μs.
*7 Half-wave pulse of sine wave: 6 ms.
*8 Detection time: 10μs.
*9 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

TYPICAL APPLICATIONS

This relay will be used for the small load for measuring instruments or others where a stable contact resistance is required.

ORDERING INFORMATION

Ex. ASX 2 0 0 A 1 H Z

Contact arrangement	Operating function	Type of operation	Terminal shape	Coil voltage (DC)	Packing style
2: 2 Form C	0: Single side stable 1: 1 coil latching 2: 2 coil latching	0: Standard type (B.B.M.)	Nil: Standard PC board terminal A: Surface-mount terminal	1H: 1.5V 09 : 9V 03 : 3V 12 : 12V 4H: 4.5V 24 : 24V 06 : 6V	Nil: Tube packing Z: Tape and reel packing (piked from 8/9/10/12 pin side)

Note: Tape and reel packing symbol "-Z" is not marked on the relay. "X" type tape and reel packing (picked from 1/3/4/5-pin side) is also available. Suffix "X" instead of "Z".

TYPES AND COIL DATA (at 20°C 68°F)

(1) Standard PC board terminal

1) Standard packing: 40 pcs. in an inner package (tube); 1,000 pcs. in an outer package

2) Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.

Single side stable

Part No. Standard PC board terminal	Coil Rating, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
ASX2001H	1.5	1.2	0.15	33.3	45	50	2.25
ASX20003	3	2.4	0.3	16.7	180	50	4.5
ASX2004H	4.5	3.6	0.45	11.1	405	50	6.75
ASX20006	6	4.8	0.6	8.3	720	50	9
ASX20009	9	7.2	0.9	5.6	1,620	50	13.5
ASX20012	12	9.6	1.2	4.2	2,880	50	18
ASX20024	24	19.2	2.4	2.9	8,229	70	36

1 coil latching

Part No. Standard PC board terminal	Coil Rating, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
ASX2101H	1.5	1.2	1.2	23.3	64.3	35	2.25
ASX21003	3	2.4	2.4	11.7	257	35	4.5
ASX2104H	4.5	3.6	3.6	7.8	579	35	6.75
ASX21006	6	4.8	4.8	5.8	1,029	35	9
ASX21009	9	7.2	7.2	3.9	2,314	35	13.5
ASX21012	12	9.6	9.6	2.9	4,114	35	18
ASX21024	24	19.2	19.2	2.1	11,520	50	36

2 coil latching

Part No. Standard PC board terminal	Coil Rating, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)		Coil resistance, Ω (±10%)		Nominal operating power, mW		Max. allowable voltage, V DC
				Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
ASX2201H	1.5	1.2	1.2	46.7	46.7	32.1	32.1	70	70	2.25
ASX22003	3	2.4	2.4	23.3	23.3	129	129	70	70	4.5
ASX2204H	4.5	3.6	3.6	15.6	15.6	289	289	70	70	6.75
ASX22006	6	4.8	4.8	11.7	11.7	514	514	70	70	9
ASX22009	9	7.2	7.2	7.8	7.8	1,157	1,157	70	70	13.5
ASX22012	12	9.6	9.6	5.8	5.8	2,057	2,057	70	70	18
ASX22024	24	19.2	19.2	6.3	6.3	3,840	3,840	150	150	36

(2) Surface-mount terminal

1) Standard packing: 40 pcs.(tube), 1,000pcs. (tape and reel)in an inner package; 500 pcs.(tube), 1,000pcs. (tape and reel)in an outer package

2) Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.

Single side stable

Part No.		Coil Rating, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Tube packing	Tape and reel packing							
ASX200A1H	ASX200A1HZ	1.5	1.2	0.15	33.3	45	50	2.25
ASX200A03	ASX200A03Z	3	2.4	0.3	16.7	180	50	4.5
ASX200A4H	ASX200A4HZ	4.5	3.6	0.45	11.1	405	50	6.75
ASX200A06	ASX200A06Z	6	4.8	0.6	8.3	720	50	9
ASX200A09	ASX200A09Z	9	7.2	0.9	5.6	1,620	50	13.5
ASX200A12	ASX200A12Z	12	9.6	1.2	4.2	2,880	50	18
ASX200A24	ASX200A24Z	24	19.2	2.4	2.9	8,229	70	36

1 coil latching type

Part No.		Coil Rating, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Tube packing	Tape and reel packing							
ASX210A1H	ASX210A1HZ	1.5	1.2	1.2	23.3	64.3	35	2.25
ASX210A03	ASX210A03Z	3	2.4	2.4	11.7	257	35	4.5
ASX210A4H	ASX210A4HZ	4.5	3.6	3.6	7.8	579	35	6.75
ASX210A06	ASX210A06Z	6	4.8	4.8	5.8	1,029	35	9
ASX210A09	ASX210A09Z	9	7.2	7.2	3.9	2,314	35	13.5
ASX210A12	ASX210A12Z	12	9.6	9.6	2.9	4,114	35	18
ASX210A24	ASX210A24Z	24	19.2	19.2	2.1	11,520	50	36

2 coil latching type

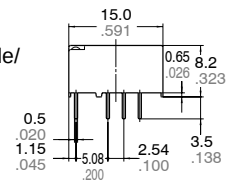
Part No.		Coil Rating, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)		Coil resistance, Ω (±10%)		Nominal operating power, mW		Max. allowable voltage, V DC
Tube packing	Tape and reel packing				Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
ASX220A1H	ASX220A1HZ	1.5	1.2	1.2	46.7	46.7	32.1	32.1	70	70	2.25
ASX220A03	ASX220A03Z	3	2.4	2.4	23.3	23.3	129	129	70	70	4.5
ASX220A4H	ASX220A4HZ	4.5	3.6	3.6	15.6	15.6	289	289	70	70	6.75
ASX220A06	ASX220A06Z	6	4.8	4.8	11.7	11.7	514	514	70	70	9
ASX220A09	ASX220A09Z	9	7.2	7.2	7.8	7.8	1,157	1,157	70	70	13.5
ASX220A12	ASX220A12Z	12	9.6	9.6	5.8	5.8	2,057	2,057	70	70	18
ASX220A24	ASX220A24Z	24	19.2	19.2	6.3	6.3	3,840	3,840	150	150	36

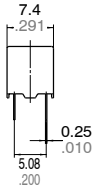
DIMENSIONS

mm inch

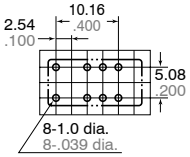
1. PC board terminal

Single side stable/
1 coil latching



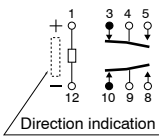


PC board pattern

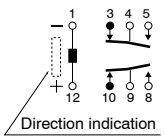


Schematic (Bottom view)

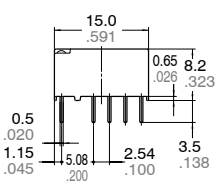
Single side stable
(Deenergized condition)

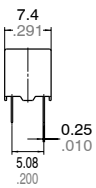


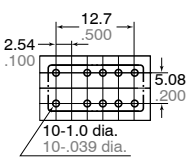
1 coil latching
(Reset condition)



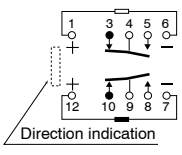
2 coil latching







2 coil latching
(Reset condition)

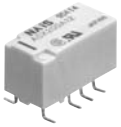


General tolerance: ±0.3 ±.012

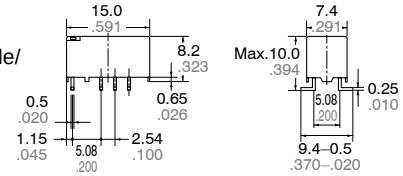
Tolerance: ±0.1 ±.004

2. Surface-mount terminal

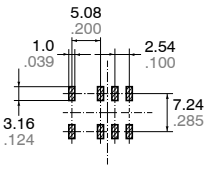
mm inch



Single side stable/
1 coil latching

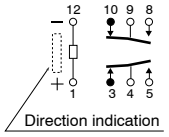


Suggested mounting pad

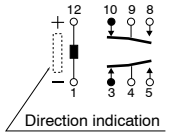


Schematic (Top view)

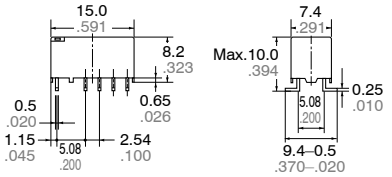
Single side stable (Deenergized condition)



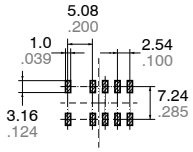
1 coil latching (Reset condition)



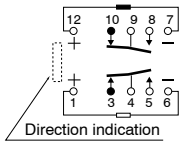
2 coil latching



Suggested mounting pad



2 coil latching (Reset condition)



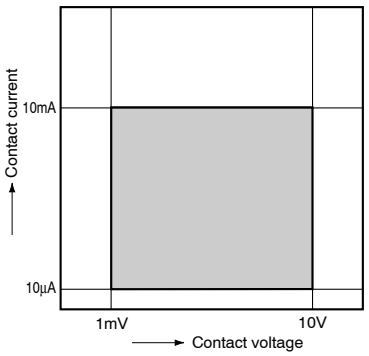
General tolerance: ±0.3 ±.012

Tolerance: ±0.1 ±.004

Signal

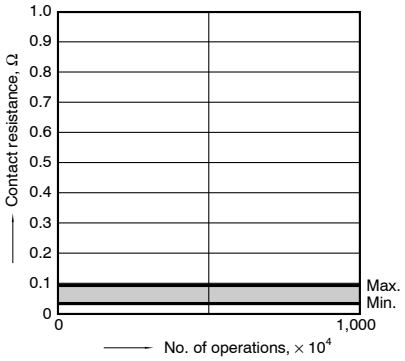
REFERENCE DATA

1. Switching capacity range



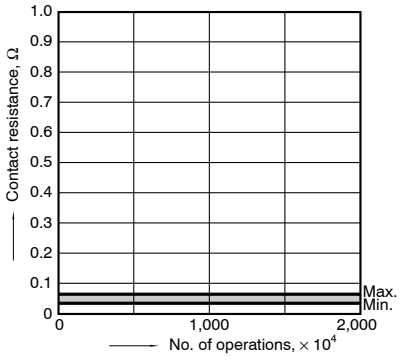
2-(1). Change in dynamic contact resistance (10 mA 10 V DC resistive load)

Tested: ASX20012, Quantity: n=10
Operating frequency: 750 cpm
Measured condition: 10 ms after applying nominal coil voltage, using voltage drop of 20 mV, 1 mA, 1 kHz.



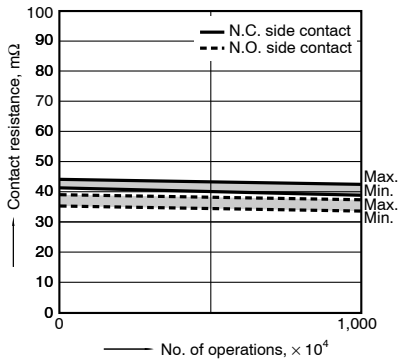
2-(2). Change in dynamic contact resistance (10 μA 1 mV DC resistive load)

Tested: ASX20012, Quantity: n=10
Operating frequency: 750 cpm
Measured condition: 10 ms after applying nominal coil voltage, using voltage drop of 20 mV, 1 mA, 1 kHz.



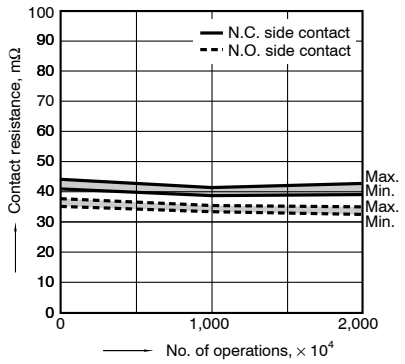
3-(1). Change in static contact resistance (10 mA 10 V DC resistive load)

Tested: ASX20012, Quantity: n=10
Operating frequency: 750 cpm



3-(2). Change in static contact resistance (10 μA 1 mV DC resistive load)

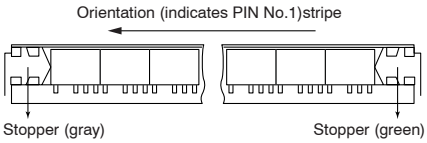
Tested: ASX20012, Quantity: n=10
Operating frequency: 750 cpm



NOTES

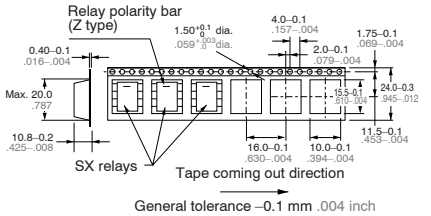
1. Packing style

1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.

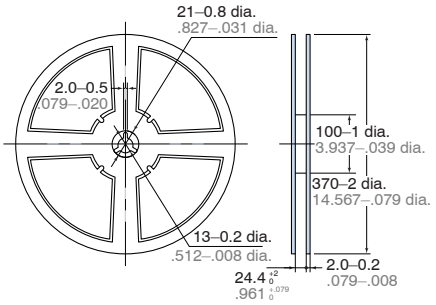


2) Tape and reel packing

(1) Tape dimensions mm inch



(2) Dimensions of plastic reel mm inch

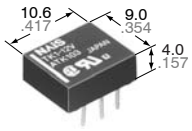


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

ULTRA LOW PROFILE 2 A POLARIZED RELAY

TK RELAYS



mm inch

FEATURES

- **Low profile 4 mm .157 inch height**
- **High contact capacity: 2 A**
- **Surge withstand voltage between contact and coil: 2,500 V (Telcordia)**

SPECIFICATIONS

Contact

Arrangement			1 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			50 mΩ
Contact material			Gold-clad silver alloy
Rating	Nominal switching capacity (resistive load)		2 A 30 V DC
	Max. Switching power (resistive load)		60 W
	Max. switching voltage		220 V DC
	Max. switching current		2 A
	Min. switching capacity ※1		10 μA 10 mV DC
Nominal operating power	Single side stable		140 mW (1.5 to 12 V DC) 270 mW (24 V DC)
	1 coil latching		100 mW (1.5 to 12 V DC) 150 mW (24 V DC)
	2 coil latching		200 mW (1.5 to 9 V DC) 250 mW (12 V DC) 400 mW (24 V DC)
Expected life (min. operations)	Mechanical (at 180 cpm)		10^8 (Single side stable)
			5×10^7 (1 or 2 coil latching)
	Electrical (at 20 cpm)	2 A 30 V DC resistive	10^5

Note:

※1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10 μA 1 mV DC – 10 mA 10 V DC])

Characteristics

Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage	Between open contacts	750 Vrms for 1 min. (Detection current: 10 mA)
	Between contact and coil	1,500 Vrms for 1 min. (Detection current: 10 mA)
FCC surge voltage between open contacts (10×160 μs)		1,500 V
Surge voltage between contacts and coil (2×10 μs) [Telcordia]		2,500 V
Temperature rise*2 (at 20°C)		Max. 50°C
Operate time [Set time]*3 (at 20°C)		Max. 3 ms (Approx. 1.5 ms) [Max. 3 ms (Approx. 1 ms)]
Release time [Reset time]*4 (at 20°C)		Max. 2 ms (Approx. 1 ms) [Max. 3 ms (Approx. 1 ms)]
Shock resistance	Functional*5	Min. 750 m/s² {75 G}
	Destructive*6	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*7	196 m/s² {20G}, 10 to 55 Hz at double amplitude of 3.3 mm
	Destructive	294 m/s² {30G}, 10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low	Ambient temperature*9	–40°C to +85°C –40°F to +185°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 1 g .035 oz.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 By resistive method, nominal voltage applied to the coil; contact carrying current: 2 A.
*3 Nominal voltage applied to the coil, excluding contact bounce time.
*4 Nominal voltage applied to the coil, excluding contact bounce time without diode.
*5 Half-wave pulse of sine wave: 6 ms; detection time: 10 μs.
*6 Half-wave pulse of sine wave: 6 ms.
*7 Detection time: 10 μs.
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).
*9 The maximum ambient temperature allows for coil temperature rise at maximum allowable coil voltage.
As for the applicable range of continuous carrying current against temperature, please refer to "Maximum value of continuous carrying current" chart. (Page 63)

ORDERING INFORMATION

EX. TK [1] — [L2] — [H] — [12V]

Contact arrangement	Operating function	Terminal shape	Coil voltage (DC)
1: 1 Form C	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	Nil: Standard PC board terminal H: Self-clinching terminal	1.5, 3, 4.5, 5, 6, 9, 12, 24V

TYPES AND COIL DATA (at 20°C 68°F)

1. Single side stable

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TK1-1.5 V	TK1-H-1.5 V	1.5	1.125	0.15	93.8	16	140	2.25
TK1-3 V	TK1-H-3 V	3	2.25	0.3	46.7	64.3	140	4.5
TK1-4.5 V	TK1-H-4.5 V	4.5	3.38	0.45	31.1	145	140	6.7
TK1-5 V	TK1-H-5 V	5	3.75	0.5	28.1	178	140	7.5
TK1-6 V	TK1-H-6 V	6	4.5	0.6	23.3	257	140	9
TK1-9 V	TK1-H-9 V	9	6.75	0.9	15.5	579	140	13.5
TK1-12 V	TK1-H-12 V	12	9	1.2	11.7	1,028	140	18
TK1-24 V	TK1-H-24 V	24	18	2.4	11.3	2,133	270	28.8

2. 1 Coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TK1-L-1.5 V	TK1-L-H-1.5 V	1.5	1.125	1.125	66.7	22.5	100	2.25
TK1-L-3 V	TK1-L-H-3 V	3	2.25	2.25	33.3	90	100	4.5
TK1-L-4.5 V	TK1-L-H-4.5 V	4.5	3.38	3.38	22.2	202.5	100	6.7
TK1-L-5 V	TK1-L-H-5 V	5	3.75	3.75	20	250	100	7.5
TK1-L-6 V	TK1-L-H-6 V	6	4.5	4.5	16.7	360	100	9
TK1-L-9 V	TK1-L-H-9 V	9	6.75	6.75	11.1	810	100	13.5
TK1-L-12 V	TK1-L-H-12 V	12	9	9	8.3	1,440	100	18
TK1-L-24 V	TK1-L-H-24 V	24	18	18	6.3	3,840	150	28.8

3. 2 Coil latching

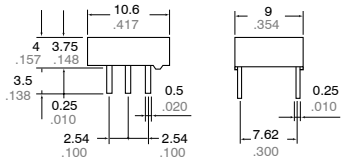
Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TK1-L2-1.5 V	TK1-L2-H-1.5 V	1.5	1.125	1.125	133.9	11.2	200	2.25
TK1-L2-3 V	TK1-L2-H-3 V	3	2.25	2.25	66.7	45	200	4.5
TK1-L2-4.5 V	TK1-L2-H-4.5 V	4.5	3.38	3.38	44.5	101.2	200	6.7
TK1-L2-5 V	TK1-L2-H-5 V	5	3.75	3.75	40	125	200	7.5
TK1-L2-6 V	TK1-L2-H-6 V	6	4.5	4.5	33.3	180	200	9
TK1-L2-9 V	TK1-L2-H-9 V	9	6.75	6.75	22.2	405	200	13.5
TK1-L2-12 V	TK1-L2-H-12 V	12	9	9	20.8	576	250	14.4
TK1-L2-24 V	TK1-L2-H-24 V	24	18	18	16.7	1,440	400	26.4

Notes:
1. Specified value of the pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 50 pcs.; Case; 1,000 pcs.
3. In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

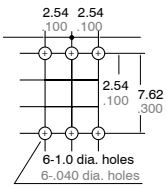
DIMENSIONS

mm inch

Standard PC board terminal

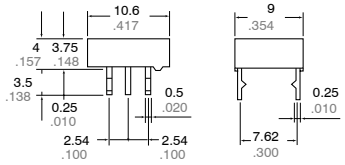


PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

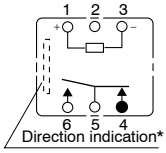
Self-clinching terminal



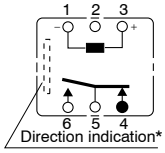
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

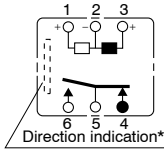
• Single side stable (Deenergized condition)



• 1-coil latching (Reset condition)



• 2-coil latching (Reset condition)

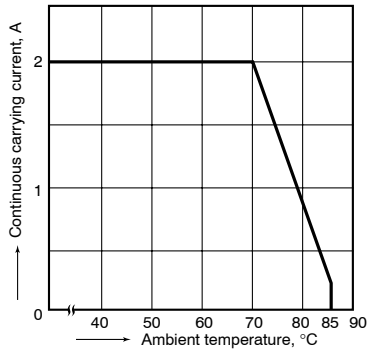


*Orientation stripe located on top of relay.

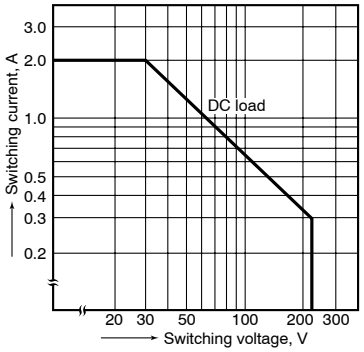
REFERENCE DATA

1. Maximum value of continuous carrying current

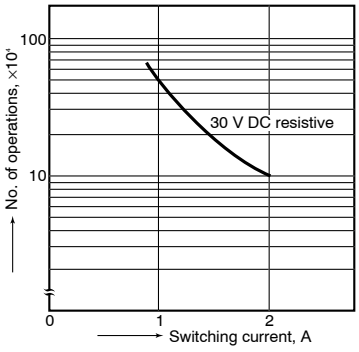
Test conditions:
Coil applied voltage: 110% of rated voltage
Continuous carrying current: 1,000 hours



2. Maximum switching capacity

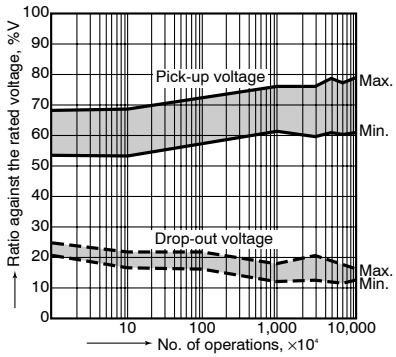


3. Life curve



4. Mechanical life

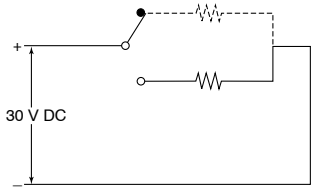
Tested sample: TK1-12V, 8 pcs.
Switching frequency: 30 Hz



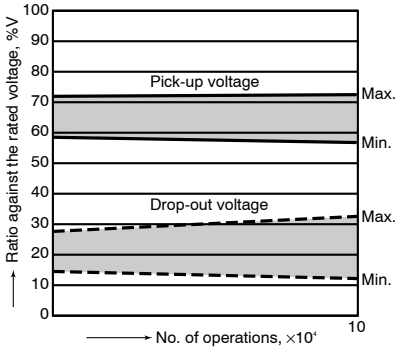
5. Electrical life (DC load)

Tested sample: TK1-12V, 10 pcs.
Condition: 2 A 30 V DC resistive load, 20 cpm

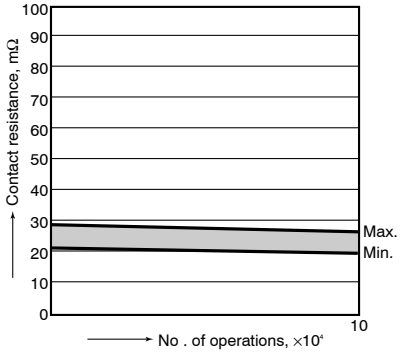
Circuit



Change of pick-up and drop-out voltage

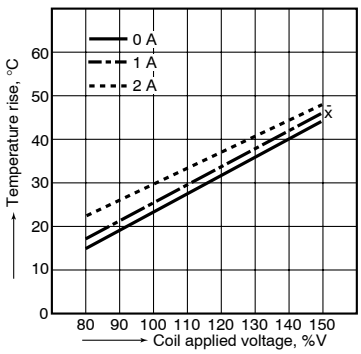


Change of contact resistance

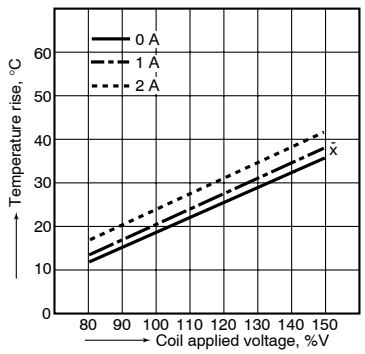


6. Coil temperature rise

Tested sample: TK1-12V, 6 pcs.
Measured portion: Inside the coil
Carrying current: 0 A, 1 A, 2 A
Ambient temperature: 25°C 77°F



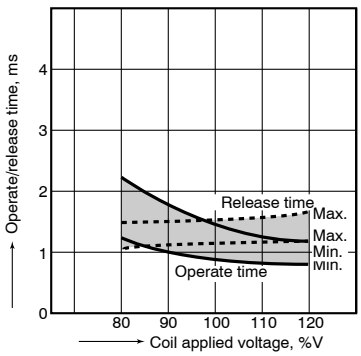
Ambient temperature: 70°C 158°F



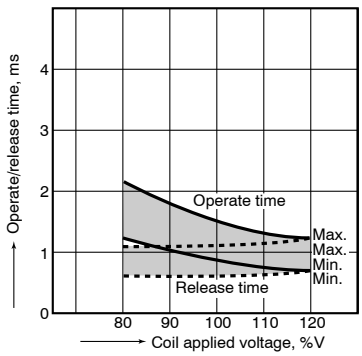
7. Operate/release time characteristics

Tested sample: TK1-5 V, 50 pcs.

<With diode>

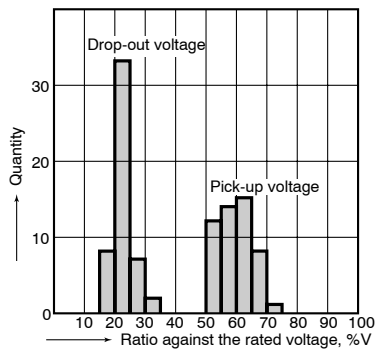


<Without diode>

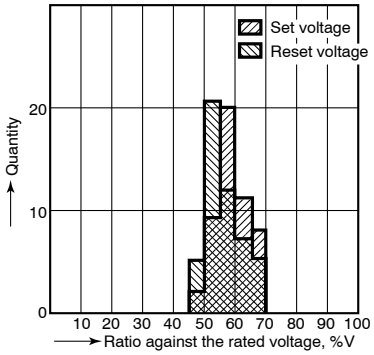


8. Distribution of pick-up and drop-out voltage

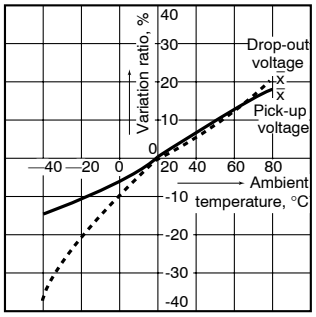
Tested sample: TK1-5V, 50 pcs.



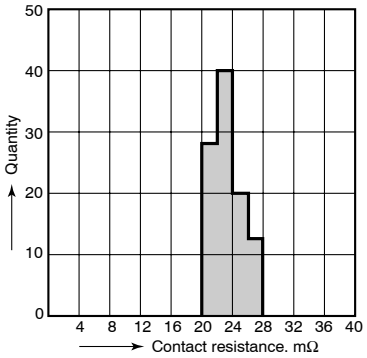
9. Distribution of set and reset voltage
Tested sample: TK1-L2-12V, 50 pcs.



10. Ambient temperature characteristics
Tested sample: TK1-12V, 5 pcs.

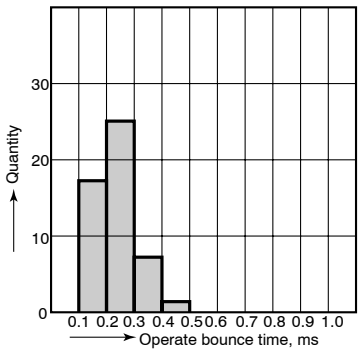


11. Distribution of contact resistance
Tested sample TK1-5V, 50 pcs. (50×2 contacts)

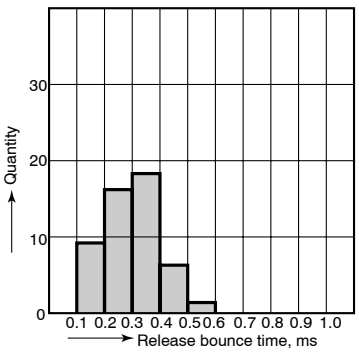


12. Distribution of operate/release bounce time
Tested sample: TK1-5V, 50 pcs.

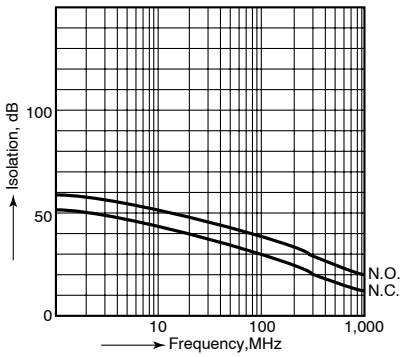
<Operate bounce time>



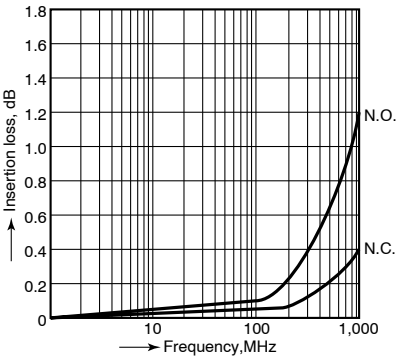
<Release bounce time>



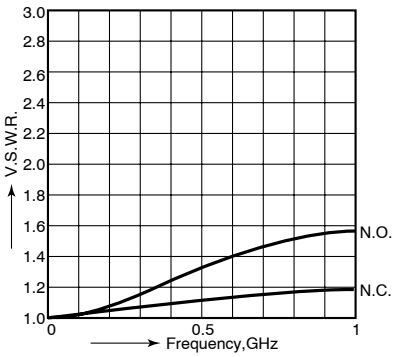
13.-(1) High-frequency characteristics
Isolation characteristics



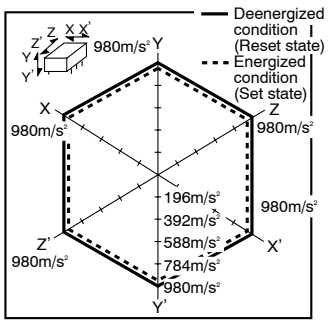
13.-(2) High-frequency characteristics
Insertion loss characteristics



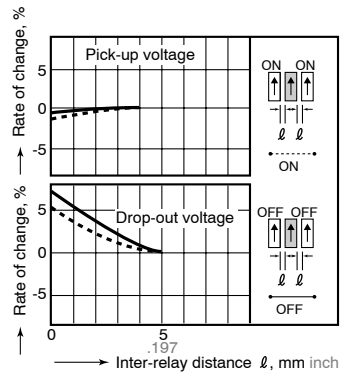
13.-(3) High-frequency characteristics
V.S.W.R.



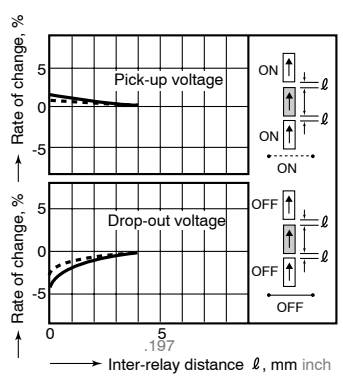
14. Malfunctional shock
Tested sample: TK1-12V, 6 pcs. (single side stable);
TK1-L2-12V, 6 pcs. (latching)



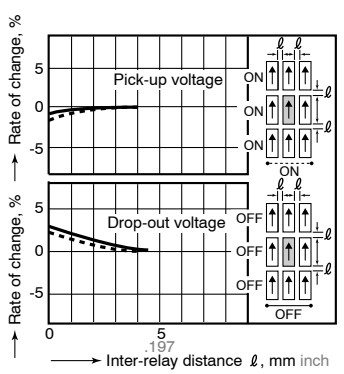
15.-(1) Influence of adjacent mounting



15.-(2) Influence of adjacent mounting

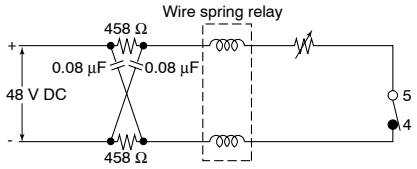


15.-(3) Influence of adjacent mounting

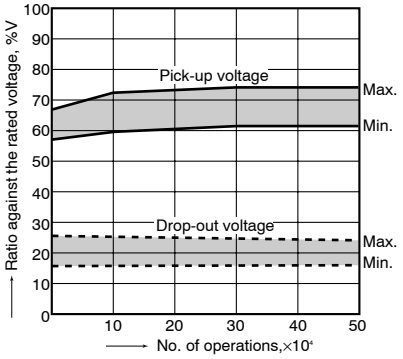


16. Actual load test (35 mA 48 V DC wire spring relay load)

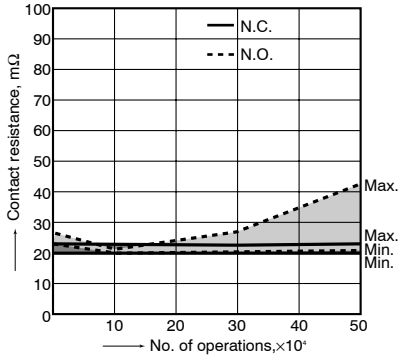
Circuit



Change of pick-up and drop-out voltage



Change of contact resistance

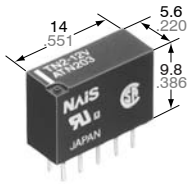


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

SLIM POLARIZED RELAY

TN RELAYS



mm inch

FEATURES

- **Small header area makes higher density mounting possible**
- **High sensitivity: 140 mW nominal operating power (single side stable 3-12 V type)**
- **Surge voltage withstand: 1500 V FCC Part 68**
- **Self-clinching terminal also available**

SPECIFICATIONS

Contact

Arrangement			2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1A)			60 mΩ
Contact material			Gold-clad silver
Rating	Nominal switching capacity (resistive load)		1 A 30 V DC, 0.5 A 125 V AC
	Max. switching power (resistive load)		30 W, 62.5 VA
	Max. switching voltage		110 V DC,125 V AC
	Max. switching current		1 A
	Min. switching capacity ※1		10 μA 10 mV DC
Nominal operating power	Single side stable		140 mW (3 to 12 V DC) 200 mW (24 V DC) 300 mW (48 V DC)
	1 coil latching		100 mW (3 to 12 V DC) 150 mW (24 V DC)
	2 coil latching		200 mW (3 to 12 V DC) 300 mW (24 V DC)
Expected life (min. operations)	Mechanical (at 180 cpm)		10^8
	Electrical (at 20 cpm)	1 A 30 V DC resistive load	2×10^5
		0.5 A 125 V AC resistive load	10^5

Note:

※1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10 μA 1 mV DC – 10 mA 10 V DC])

Characteristics

Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage	Between open contacts	750 Vrms for 1 min. (Detection current: 10 mA)
	Between contact and coil	1,000 Vrms for 1 min. (Detection current: 10 mA)
	Between contact sets	1,000 Vrms for 1 min. (Detection current: 10 mA)
FCC surge voltage between open contacts		1,500 V
Temperature rise*2 (at 20°C)		Max. 50°C
Operate time [Set time]*3 (at 20°C)		Max. 3 ms (Approx. 2 ms) [Max. 3 ms (Approx. 2 ms)]
Release time [Reset time]*4 (at 20°C)		Max. 3 ms (Approx. 1 ms) [Max. 3 ms (Approx. 2 ms)]
Shock resistance	Functional*5	Min. 490 m/s² {50G}
	Destructive*6	Min. 980 m/s² {100G}
Vibration resistance	Functional*7	176.4 m/s² {18G}, 10 to 55 Hz at double amplitude of 3 mm
	Destructive	294 m/s² {30G}, 10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temperature	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 1.5 g .053 oz

Remarks

* Specifications will vary with foreign standards certification ratings.

*1 Measurement at same location as "Initial breakdown voltage" section.

*2 By resistive method, nominal voltage applied to the coil; contact carrying current: 1 A.

*3 Nominal voltage applied to the coil, excluding contact bounce time.

*4 Nominal voltage applied to the coil, excluding contact bounce time without diode.

*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs.

*6 Half-wave pulse of sine wave: 6 ms.

*7 Detection time: 10 μs.

*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

ORDERING INFORMATION

Ex. TN 2 — L2 — H — 12V

Contact arrangement	Operating function	Terminal shape	Coil voltage(DC)
2: 2 Form C	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	Nil: Standard PC board terminal H: Self-clinching terminal	3,4.5,5,6,9,12, 24,48*V

*48 V coil type: Single side stable only

Note: AgPd stationary contact types available for high resistance against contact sticking. When ordering, please add suffix "-3" like TN2-12V-3.

TYPES AND COIL DATA (at 20°C 68°F)

1. Single side stable

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TN2-3 V	TN2-H-3 V	3	2.25	0.3	46.7	64.3	140	4.5
TN2-4.5 V	TN2-H-4.5 V	4.5	3.38	0.45	31.1	145	140	6.7
TN2-5 V	TN2-H-5 V	5	3.75	0.5	28.1	178	140	7.5
TN2-6 V	TN2-H-6 V	6	4.5	0.6	23.3	257	140	9
TN2-9 V	TN2-H-9 V	9	6.75	0.9	15.5	579	140	13.5
TN2-12 V	TN2-H-12 V	12	9	1.2	11.7	1,028	140	18
TN2-24 V	TN2-H-24 V	24	18	2.4	8.3	2,880	200	36
TN2-48 V	TN2-H-48 V	48	36	4.8	6.25	7,680	300	57.6

2. 1 Coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TN2-L-3 V	TN2-L-H-3 V	3	2.25	2.25	33.3	90	100	4.5
TN2-L-4.5 V	TN2-L-H-4.5 V	4.5	3.38	3.38	22.2	202.5	100	6.7
TN2-L-5 V	TN2-L-H-5 V	5	3.75	3.75	20	250	100	7.5
TN2-L-6 V	TN2-L-H-6 V	6	4.5	4.5	16.7	360	100	9
TN2-L-9 V	TN2-L-H-9 V	9	6.75	6.75	11.1	810	100	13.5
TN2-L-12 V	TN2-L-H-12 V	12	9	9	8.3	1,440	100	18
TN2-L-24 V	TN2-L-H-24 V	24	18	18	6.3	3,840	150	36

3. 2 Coil latching

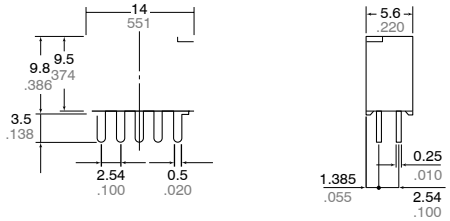
Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TN2-L2-3 V	TN2-L2-H-3 V	3	2.25	2.25	66.7	45	200	4.5
TN2-L2-4.5 V	TN2-L2-H-4.5 V	4.5	3.38	3.38	44.4	101.2	200	6.7
TN2-L2-5 V	TN2-L2-H-5 V	5	3.75	3.75	40	125	200	7.5
TN2-L2-6 V	TN2-L2-H-6 V	6	4.5	4.5	33.3	180	200	9
TN2-L2-9 V	TN2-L2-H-9 V	9	6.75	6.75	22.2	405	200	13.5
TN2-L2-12 V	TN2-L2-H-12 V	12	9	9	16.7	720	200	18
TN2-L2-24 V	TN2-L2-H-24 V	24	18	18	12.5	1,920	300	28.8

Notes:
1. Specified value of the pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.
3. In case of 5 V drive circuit, it is recommended to use 4.5 V type relay.
4. AgPd stationary contact types available for high resistance against contact sticking. When ordering, please add suffix "–3" like TN2-12V-3.

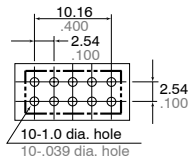
DIMENSIONS

mm inch

Standard PC board terminal

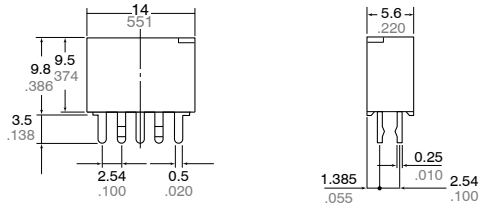


PC board pattern (Copper-side view)



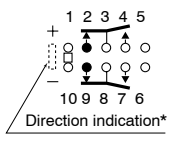
Tolerance: ±0.1 ±.004

Self-clinching terminal

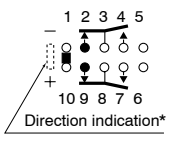


Schematic (Bottom view)

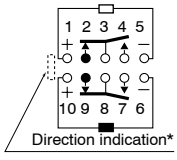
• Single side stable (Deenergized condition)



• 1-coil latching (Reset condition)



• 2-coil latching (Reset condition)

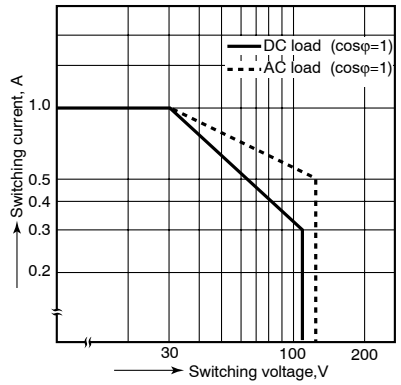


*Orientation stripe located on top of relay

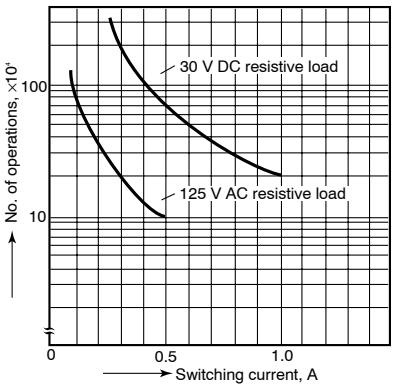
General tolerance: ±0.3 ±.012

REFERENCE DATA

1. Maximum switching capacity

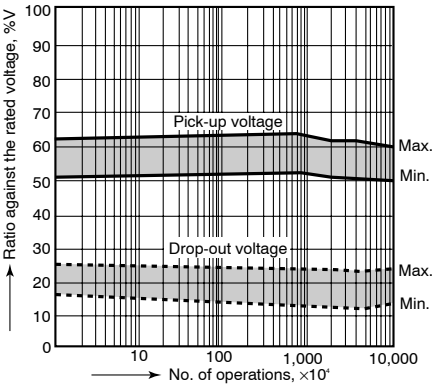


2. Life curve



3. Mechanical life

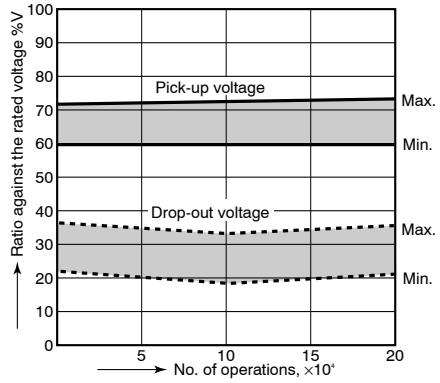
Tested sample: TN2-12V, 10 pcs.



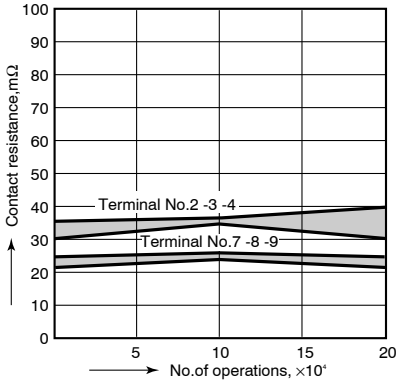
4. Electrical life (DC load)

Tested sample: TN2-12V, 10 pcs.
Condition: 1 A 30 V DC resistive load, 20 cpm

Change of pick-up and drop-out voltage

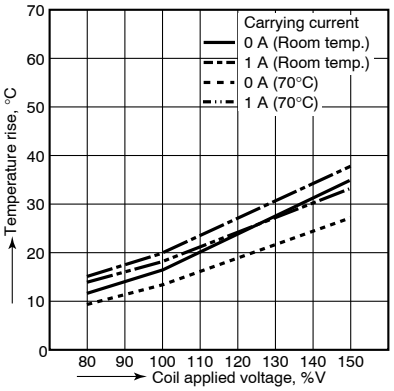


Change of contact resistance



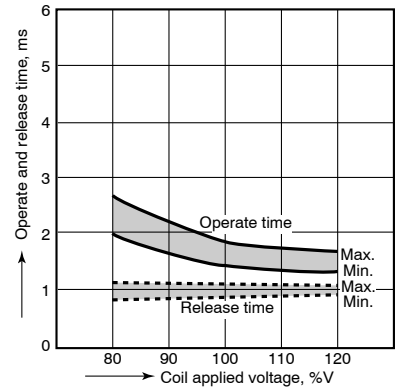
5. Coil temperature rise

Tested sample: TN2-12V
Point measured: Inside the coil
Ambient temperature: Room temperature (25° to 26°C), 70°C (77° to 79°F), 158°F



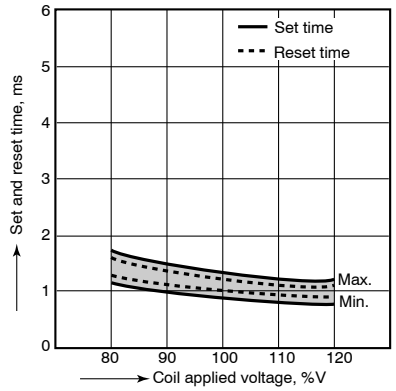
6. Operate/release time characteristics

Tested sample: TN2-12V, 5 pcs.



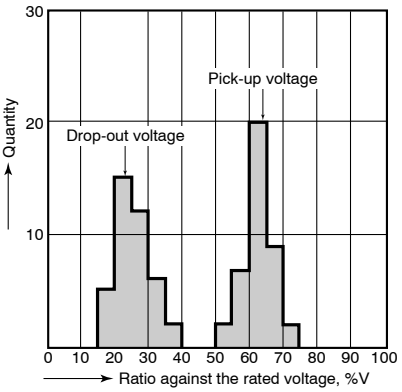
7. Set/reset time characteristics

Tested sample: TN2-L2-12V, 5 pcs.



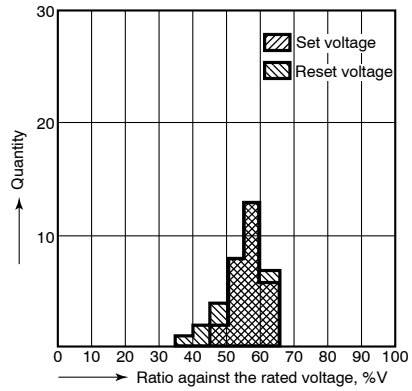
8. Distribution of pick-up and drop-out voltages

Tested sample: TN2-12V, 40 pcs.



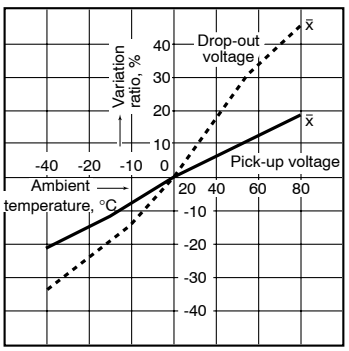
9. Distribution of set and reset voltage

Tested sample: TN2-L2-12V, 32 pcs.



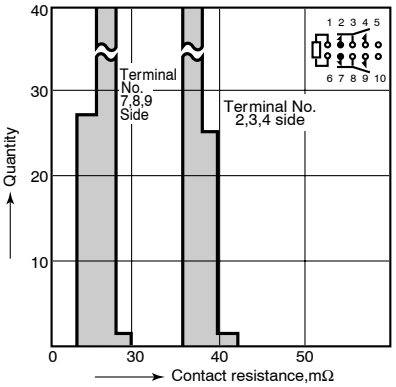
10. Ambient temperature characteristics

Tested sample: TN2-12V, 5 pcs.

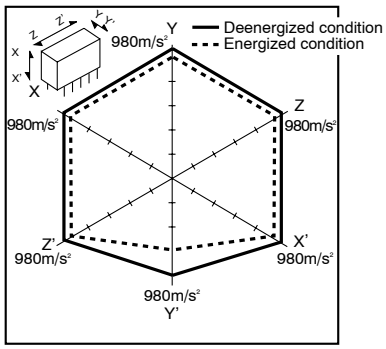


11. Distribution of contact resistance

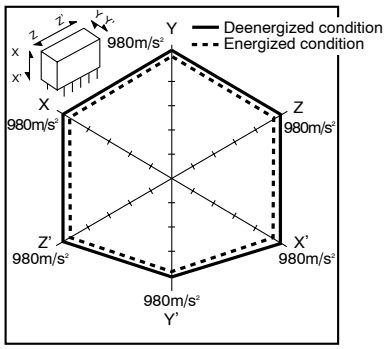
Tested sample: TN2-12V, 38 pcs. (38×4 contacts)



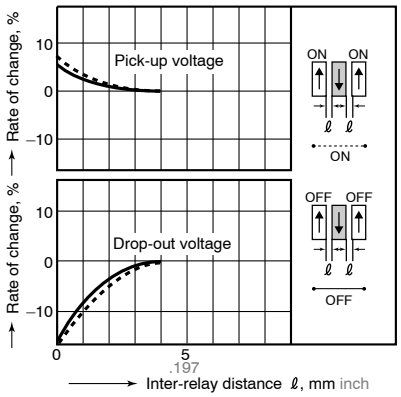
12-(1). Malfunctional shock (single side stable)
Tested sample: TN2-12V, 6 pcs.



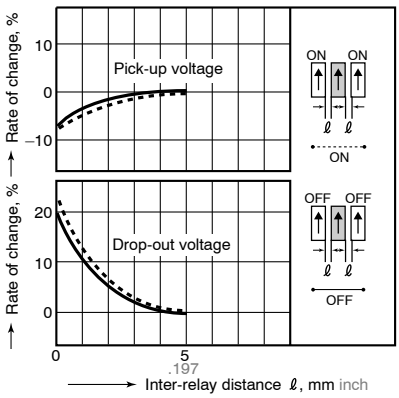
12-(2). Malfunctional shock (latching)
Tested sample: TN2-L2-12V, 6 pcs.



13-(1). Influence of adjacent mounting

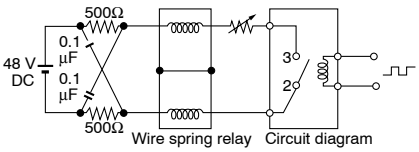


13-(2). Influence of adjacent mounting

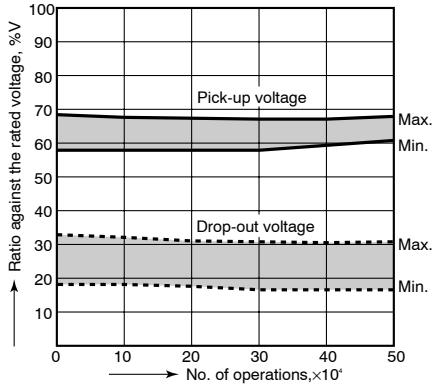


14. Actual load test
(35 mA 48 V DC wire spring relay load)

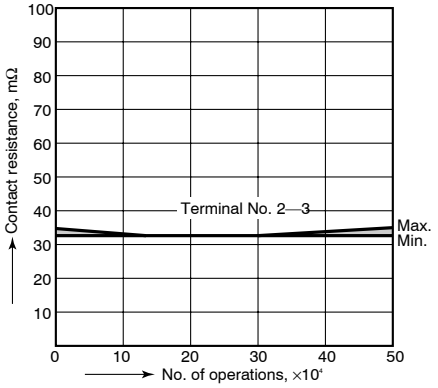
Circuit



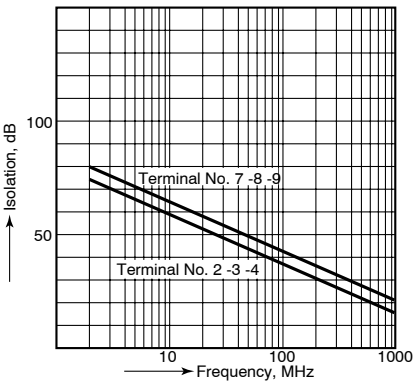
Change of pick-up and drop-out voltage



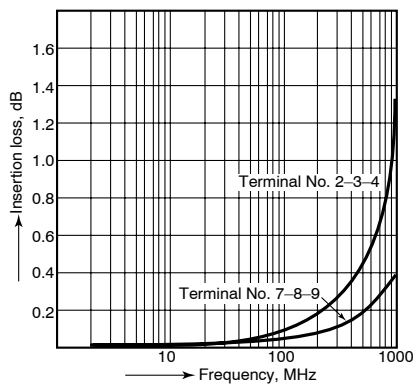
Change of contact resistance



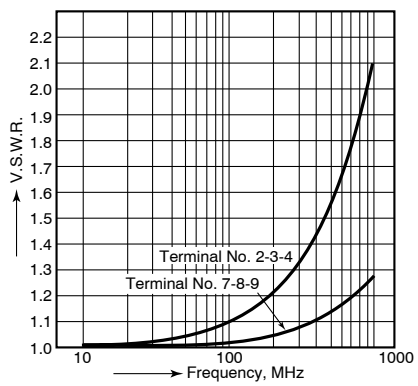
15-(1). High-frequency characteristics
Tested sample: TN2-xxV
Isolation characteristics



15-(2). High-frequency characteristics
Tested sample: TN2-xxV
Insertion loss characteristics



15-(3). High-frequency characteristics
Tested sample: TN2-xxV
V.S.W.R.

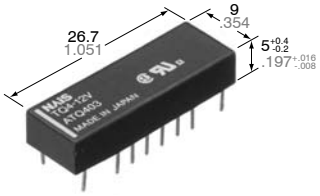


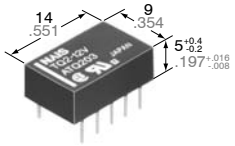
For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

LOW PROFILE
2 FORM C RELAY

TQ RELAYS





mm inch

FEATURES

- **High sensitivity:**
  2 Form C: 140 mW power consumption (single side stable type)
  4 Form C: 280 mW power consumption (single side stable type)
- **Surge voltage withstand: 1500 V FCC Part 68**
- **Sealed construction allows automatic washing**
- **Self-clinching terminal also available**
- **M.B.B. contact types available**

SPECIFICATIONS

Contact

			Standard (B.B.M) type		M.B.B.type
Arrangement			2 Form C	4 Form C	2 Form D
Initial contact resistance, max. (By voltage drop 6 V DC 1A)			50 mΩ		
Contact material			Gold-clad silver		
Rating	Nominal switching capacity (resistive load)		1 A 30 V DC 0.5 A 125 V AC		1 A 30 V DC
	Max. switching power (resistive load)		30 W, 62.5 V A		30 W
	Max. switching voltage		110 V DC, 125 V AC		110 V DC
	Max. switching current		1 A		
	Min. switching capacity ※1		10 μA 10 mV DC		
Nominal operating power	Single side stable		140 mW (3 to 12 V DC) 200 mW (24 V DC) 300 mW (48 V DC)	280 mW (3 to 24 V DC) 400 mW (48 V DC)	200 mW
	1 coil latching		100 mW (3 to 12 V DC) 150 mW (24 V DC)	200 mW	—
	2 coil latching		200 mW (3 to 12 V DC) 300 mW (24 V DC)	400 mW	—
Expected life (min. operations)	Mechanical (at 180 cpm)		10^8		10^7
	Electrical (at 20 cpm) (1 A 30 V DC resistive)	1 A 30 V DC resistive	2×10^5		10^5
		0.5 A 125 V AC resistive	10^5		—

Note:

※1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10 μA 1 mV DC – 10 mA 10 V DC])

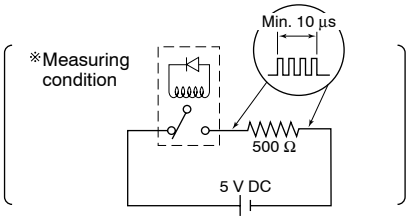
Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 By resistive method, nominal voltage applied to the coil; contact carrying current: 1 A.
*3 Nominal voltage applied to the coil, excluding contact bounce time.
*4 Nominal voltage applied to the coil, excluding contact bounce time without diode.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs.
*6 Half-wave pulse of sine wave: 6 ms.
*7 Detection time: 10 μs.

Characteristics

		Standard (B.B.M) type	M.B.B.type
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)	
Initial breakdown voltage	Between open contacts	750 Vrms for 1 min. (Detection current: 10 mA)	300 Vrms for 1 min. (Detection current: 10 mA)
	Between contact and coil	1,000 Vrms for 1 min. (Detection current: 10 mA)	
	Between contact sets	1,000 Vrms for 1 min. (Detection current: 10 mA)	
FCC surge voltage between open contacts		1,500 V	
Operate time [Set time]*3 (at 20°C)		Max. 3 ms (Approx. 2 ms) [Max. 3 ms (Approx. 2 ms)]	
Release time [Reset time]*4 (at 20°C)		Max. 3 ms (Approx. 1 ms) [Max. 3 ms (Approx. 2 ms)]	
M.B.B. time*8		—	Min. 10 μs.
Temperature rise*2 (at 20°C)		Max. 50°C	
Shock resistance	Functional*5	Min. 490 m/s² {50G}	
	Destructive*6	Min. 980 m/s² {100G}	
Vibration resistance	Functional*7	176.4 m/s² {18G}, 10 to 55 Hz at double amplitude of 3 mm	
	Destructive	294 m/s² {30G}, 10 to 55 Hz at double amplitude of 5 mm	
Conditions for operation, transport and storage*9 (Not freezing and condensing at low temperature)	Ambient temperature	–40°C to +70°C –40°F to +158°F	–40°C to +50°C –40°F to +122°F
	Humidity	5 to 85% R.H.	
Unit weight	2 Form C:	Approx. 1.5 g .053 oz	
	4 Form C:	Approx. 3 g .106 oz.	—

*8 M.B.B. time:



*9 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

ORDERING INFORMATION

EX. TQ [2] [H] — [L2] — [2M] — [3V]

Contact arrangement	Terminal shape	Operating function	MBB function	Coil voltage (DC)
2: 2 Form C 4: 4 Form C	Nil: Standard PC board terminal H: Self-clinching terminal	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	Nil: Standard (B.B.M.) type 2M: 2M.B.B. type	3, 4.5, 5, 6, 9, 12, 24, 48* V

*48 V coil type: Single side stable only

Notes: 1. AgPd stationary contact types available for high resistance against contact sticking. When ordering, please add suffix "-3" like TQ2-12V-3.
2. M.B.B. contact types are available only for TQ2 type.

TYPES AND COIL DATA (at 20°C 68°F)

1. Standard (B.B.M.) type

2 Form C type

1. Single side stable

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TQ2-3 V	TQ2H-3 V	3	2.25	0.3	46.7	64.3	140	4.5
TQ2-4.5 V	TQ2H-4.5 V	4.5	3.38	0.45	31.1	144.6	140	6.7
TQ2-5 V	TQ2H-5 V	5	3.75	0.5	28.1	178	140	7.5
TQ2-6 V	TQ2H-6 V	6	4.5	0.6	23.3	257	140	9
TQ2-9 V	TQ2H-9 V	9	6.75	0.9	15.5	579	140	13.5
TQ2-12 V	TQ2H-12 V	12	9	1.2	11.7	1,028	140	18
TQ2-24 V	TQ2H-24 V	24	18	2.4	8.3	2,880	200	36
TQ2-48 V	TQ2H-48 V	48	36	4.8	6.25	7,680	300	57.6

2. 1 Coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TQ2-L-3 V	TQ2H-L-3 V	3	2.25	2.25	33.3	90	100	4.5
TQ2-L-4.5 V	TQ2H-L-4.5 V	4.5	3.38	3.38	22.2	202.5	100	6.7
TQ2-L-5 V	TQ2H-L-5 V	5	3.75	3.75	20	250	100	7.5
TQ2-L-6 V	TQ2H-L-6 V	6	4.5	4.5	16.7	360	100	9
TQ2-L-9 V	TQ2H-L-9 V	9	6.75	6.75	11.1	810	100	13.5
TQ2-L-12 V	TQ2H-L-12 V	12	9	9	8.3	1,440	100	18
TQ2-L-24 V	TQ2H-L-24 V	24	18	18	6.3	3,840	150	36

3. 2 Coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TQ2-L2-3 V	TQ2H-L2-3 V	3	2.25	2.25	66.7	45	200	4.5
TQ2-L2-4.5 V	TQ2H-L2-4.5 V	4.5	3.38	3.38	44.4	101.2	200	6.7
TQ2-L2-5 V	TQ2H-L2-5 V	5	3.75	3.75	40	125	200	7.5
TQ2-L2-6 V	TQ2H-L2-6 V	6	4.5	4.5	33.3	180	200	9
TQ2-L2-9 V	TQ2H-L2-9 V	9	6.75	6.75	22.2	405	200	13.5
TQ2-L2-12 V	TQ2H-L2-12 V	12	9	9	16.7	720	200	18
TQ2-L2-24 V	TQ2H-L2-24 V	24	18	18	12.5	1,920	300	28.8

Notes: 1. Specified value of the pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.
3. In case of 5 V transistor drive circuit, it is recommend to use 4.5 V type relay.
4. AgPd stationary contact types available for high resistance against contact sticking. When ordering, please add suffix “–3” like TQ2-12V-3.

4 Form C type

1. Single side stable

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TQ4-3 V	TQ4H-3 V	3	2.25	0.3	93.8	32	280	4.5
TQ4-4.5 V	TQ4H-4.5 V	4.5	3.38	0.45	62.2	72.3	280	6.7
TQ4-5 V	TQ4H-5 V	5	3.75	0.5	56.2	89	280	7.5
TQ4-6 V	TQ4H-6 V	6	4.5	0.6	46.5	129	280	9
TQ4-9 V	TQ4H-9 V	9	6.75	0.9	31.1	289	280	13.5
TQ4-12 V	TQ4H-12 V	12	9	1.2	23.3	514	280	18
TQ4-24 V	TQ4H-24 V	24	18	2.4	11.7	2,056	280	36
TQ4-48 V	TQ4H-48 V	48	36	4.8	8.3	5,760	400	57.6

2. 1 Coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TQ4-L-3 V	TQ4H-L-3 V	3	2.25	2.25	66.6	45	200	4.5
TQ4-L-4.5 V	TQ4H-L-4.5 V	4.5	3.38	3.38	44.4	101.2	200	6.7
TQ4-L-5 V	TQ4H-L-5 V	5	3.75	3.75	40	125	200	7.5
TQ4-L-6 V	TQ4H-L-6 V	6	4.5	4.5	33.3	180	200	9
TQ4-L-9 V	TQ4H-L-9 V	9	6.75	6.75	22.2	405	200	13.5
TQ4-L-12 V	TQ4H-L-12 V	12	9	9	16.7	720	200	18
TQ4-L-24 V	TQ4H-L-24 V	24	18	18	8.3	2,880	200	36

3. 2 Coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TQ4-L2-3 V	TQ4H-L2-3 V	3	2.25	2.25	133	22.5	400	4.5
TQ4-L2-4.5 V	TQ4H-L2-4.5 V	4.5	3.38	3.38	88.9	50.6	400	6.7
TQ4-L2-5 V	TQ4H-L2-5 V	5	3.75	3.75	80	62.5	400	7.5
TQ4-L2-6 V	TQ4H-L2-6 V	6	4.5	4.5	66.6	90	400	9
TQ4-L2-9 V	TQ4H-L2-9 V	9	6.75	6.75	44.4	202.5	400	13.5
TQ4-L2-12 V	TQ4H-L2-12 V	12	9	9	33.3	360	400	18
TQ4-L2-24 V	TQ4H-L2-24 V	24	18	18	16.7	1,440	400	36

Notes: 1. Specified value of the pick-up, drop-out, voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.
3. In case of 5 V transistor drive circuit, it is recommend to use 4.5 V type relay.
4. 1 coil latching and 2 coil latching types are also available by request. Please consult us for details.
5. AgPd stationary contact types available for high resistance against contact sticking. When ordering, please add suffix “–3” like TQ2-12V-3.

2. M.B.B. type

Single side stable

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TQ2-2M-3 V	TQ2H-2M-3 V	3	2.4	0.3	66.7	45	200	4.5
TQ2-2M-4.5 V	TQ2H-2M-4.5 V	4.5	3.6	0.45	44.4	101	200	6.7
TQ2-2M-5 V	TQ2H-2M-5 V	5	4	0.5	40	125	200	7.5
TQ2-2M-6 V	TQ2H-2M-6 V	6	4.8	0.6	33.3	180	200	9
TQ2-2M-9 V	TQ2H-2M-9 V	9	7.2	0.9	22.2	405	200	13.5
TQ2-2M-12 V	TQ2H-2M-12 V	12	9.6	1.2	16.7	720	200	18
TQ2-2M-24 V	TQ2H-2M-24 V	24	19.2	2.4	8.3	2,880	200	36

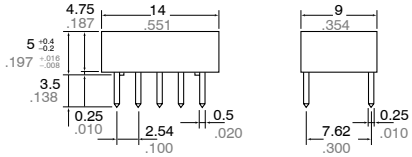
Notes: 1. Specified value of the pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 50 pcs.; Case: 1,000 pcs.
3. In case of 5 V transistor drive circuit, it is recommend to use 4.5 V type relay.
4. AgPd stationary contact types available for high resistance against contact sticking. When ordering, please add suffix “–3” like TQ2-12V-3.

DIMENSIONS

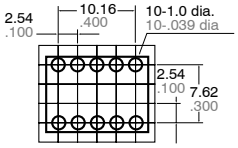
mm inch

1) 2 Form C, 2 Form D

Standard PC board terminal

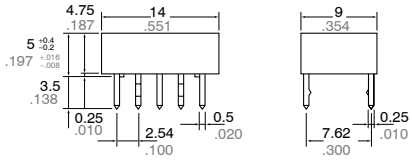


PC board pattern (Copper-side view)



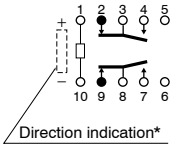
Tolerance: ±0.1 ±.004

Self-clinching terminal

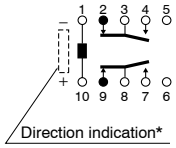


Schematic (Bottom view)

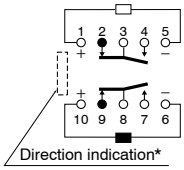
• Single side stable (Deenergized condition)



• 1-coil latching (Reset condition)



• 2-coil latching (Reset condition)

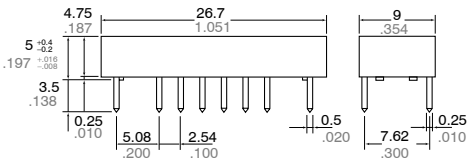


*Orientation stripe typical-located on top of relay

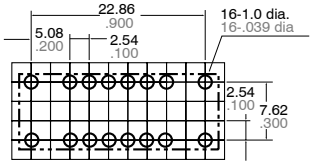
General tolerance: ±0.3 ±.012

2) 4 Form C

Standard PC board terminal

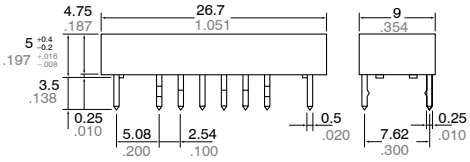


PC board pattern (Copper-side view)



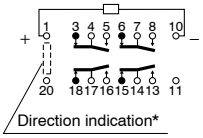
Tolerance: ±0.1 ±.004

Self-clinching terminal

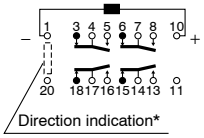


Schematic (Bottom view)

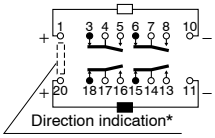
• Single side stable (Deenergized condition)



• 1-coil latching (Reset condition)



• 2-coil latching (Reset condition)

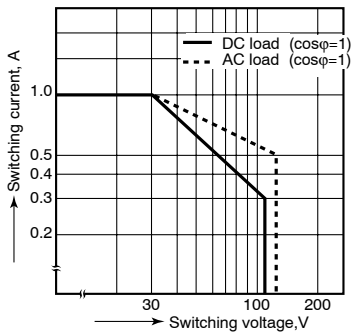


*Orientation stripe typical-located on top of relay

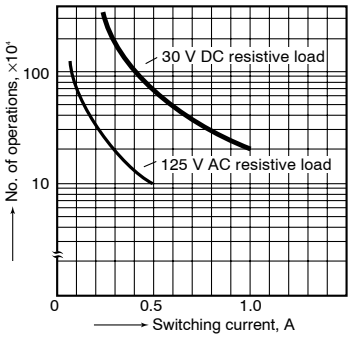
General tolerance: ±0.3 ±.012

REFERENCE DATA

1. Maximum switching capacity

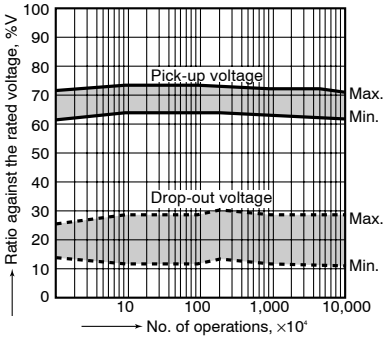


2. Life curve

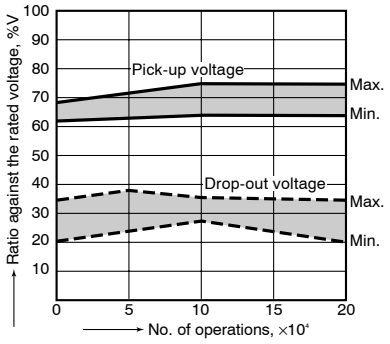


3. Mechanical life

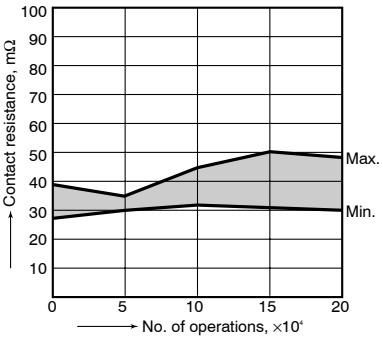
Tested sample: TQ2-12V, 10 pcs.



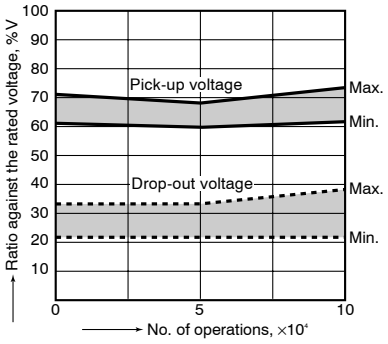
4.-(1) Electrical life (DC load)
Tested sample: TQ2-12V, 6 pcs.
Condition: 1 A 30 V DC resistive load, 20 cpm
Change of pick-up and drop-out voltage



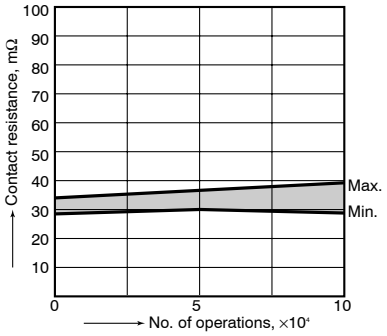
Change of contact resistance



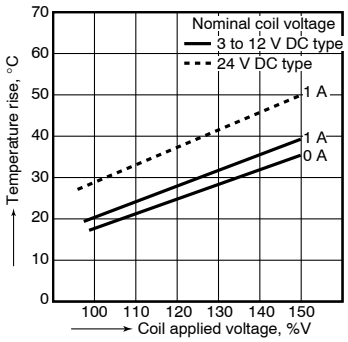
4.-(2) Electrical life (AC load)
Tested sample: TQ2-12V, 6 pcs.
Condition: 0.5 A 125 V AC resistive load, 20 cpm
Change of pick-up and drop-out voltage



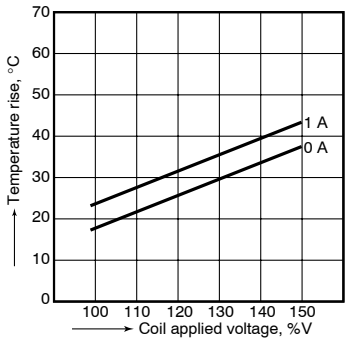
Change of contact resistance



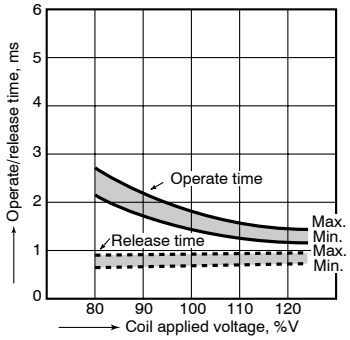
5.-(1) Coil temperature rise (2C)
Tested sample: TQ2-12V
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



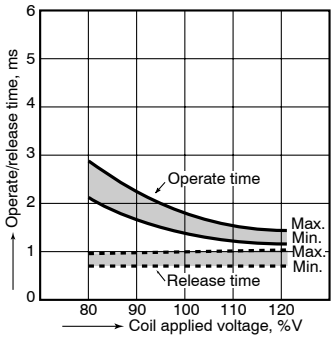
5.-(2) Coil temperature rise (4C)
Tested sample: TQ4-12V
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



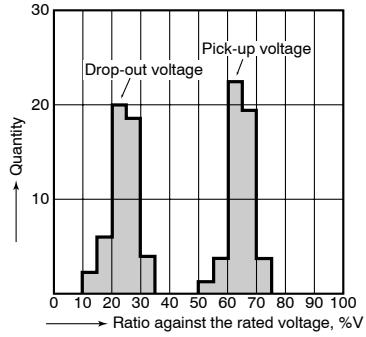
6.-(1) Operate/release time characteristics
Tested sample: TQ2-12V, 10 pcs.



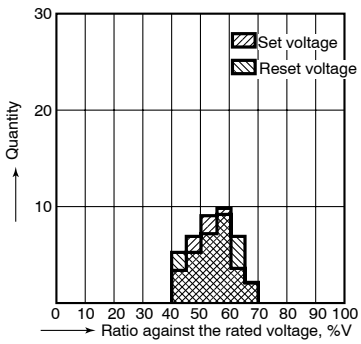
6.-(2) Operate/release time characteristics
Tested sample: TQ4-12V, 10 pcs.



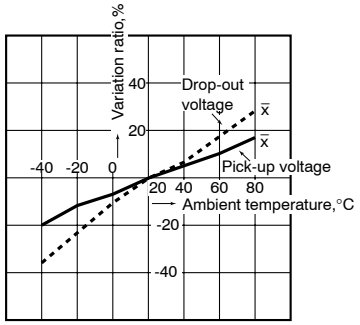
7. Distribution of pick-up and drop-out voltages
Tested sample: TQ2-12V, 50 pcs.



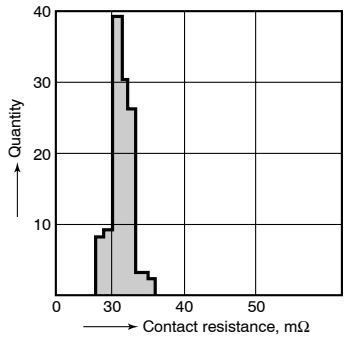
8. Distribution of set and reset voltage
Tested sample: TQ2-L2-12V, 35 pcs.



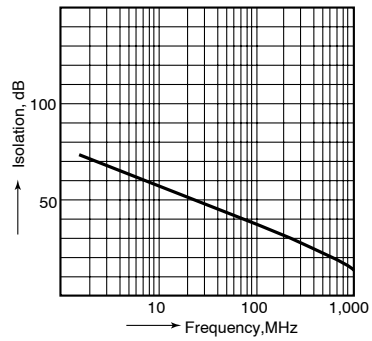
9. Ambient temperature characteristics
Tested sample: TQ2-12V, 5 pcs.



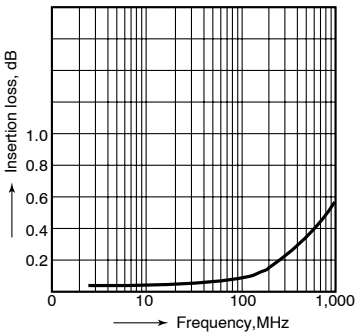
10. Distribution of contact resistance
Tested sample: TQ2-12V, 30 pcs. (30×4 contacts)



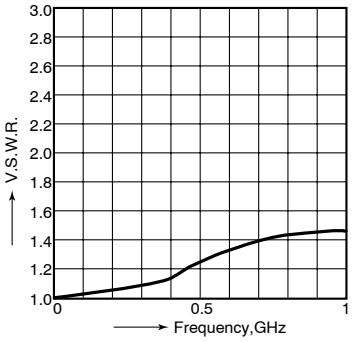
11.-(1) High-frequency characteristics
Isolation characteristics



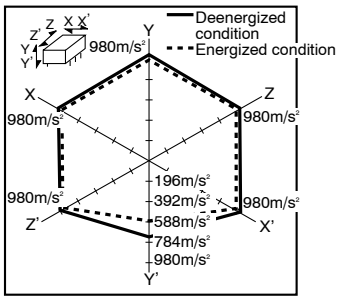
11.-(2) High-frequency characteristics
Insertion loss characteristics



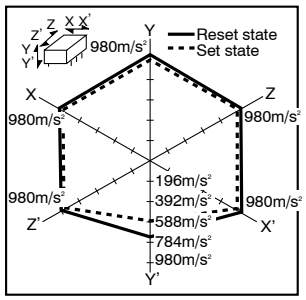
11.-(3) High-frequency characteristics
V.S.W.R.



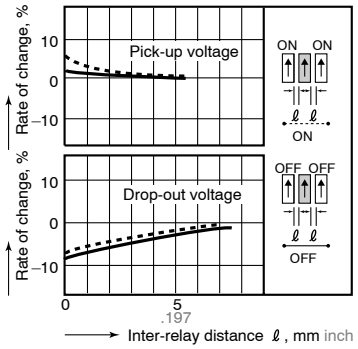
12.-(1) Malfunctional shock (single side stable)
Tested sample: TQ2-12V, 6 pcs.



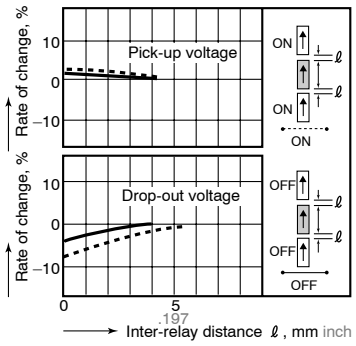
12.-(2) Malfunctional shock (latching)
Tested sample: TQ2-L-12V, 6 pcs.



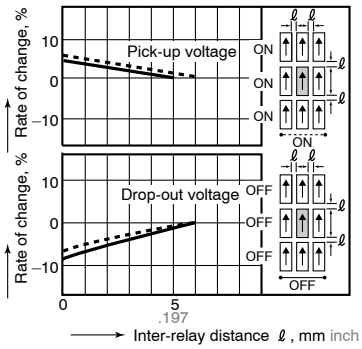
13.-(1) Influence of adjacent mounting



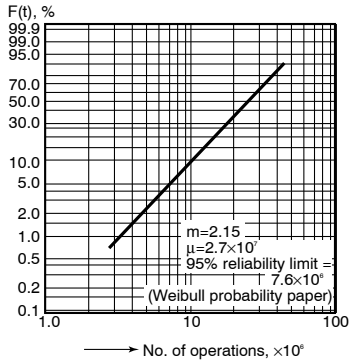
13.-(2) Influence of adjacent mounting



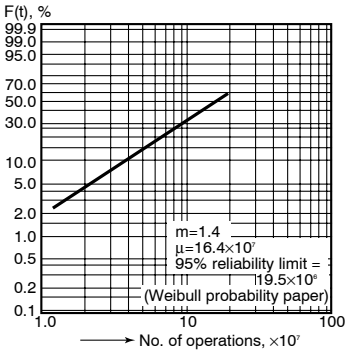
13.-(3) Influence of adjacent mounting



14.-(1) Contact reliability
(1 mA 5 V DC resistive load)
Tested sample: TQ2-12V
Condition: Detection level 10 W

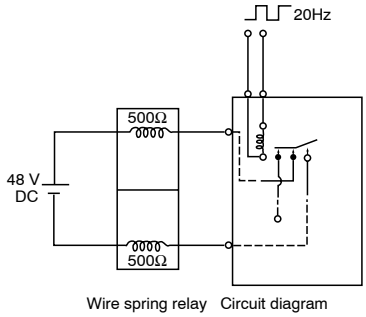


14.-(2) Contact reliability
(100 μA 5 V DC resistive load)
Tested sample: TQ2-12V
Condition: Detection level 100 Ω



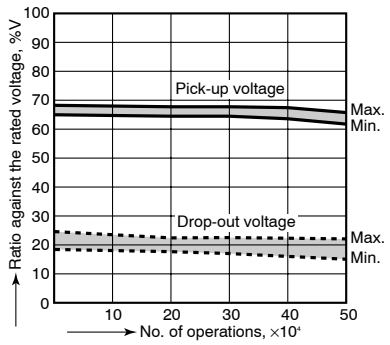
15. Actual load test (35 mA 48 V DC wire spring relay load)

Circuit

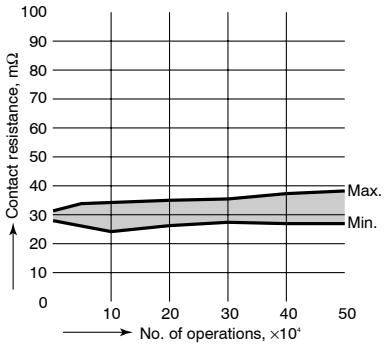


Wire spring relay Circuit diagram

Change of pick-up and drop-out voltage

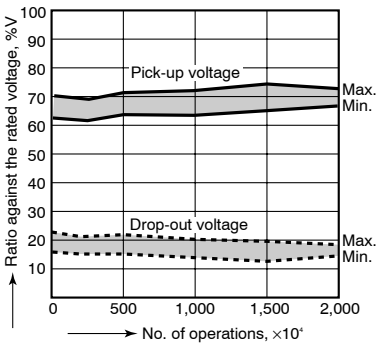


Change of contact resistance

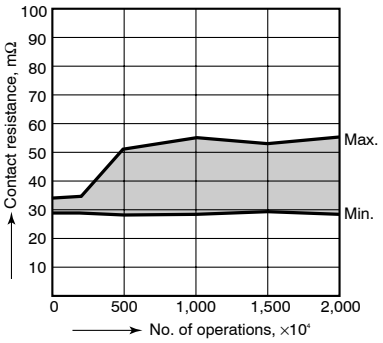


16. 0.1 A 53 V DC resistive load test

Change of pick-up and drop-out voltage



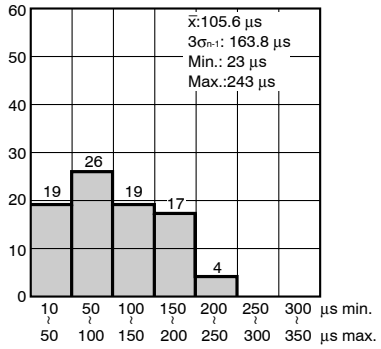
Change of contact resistance



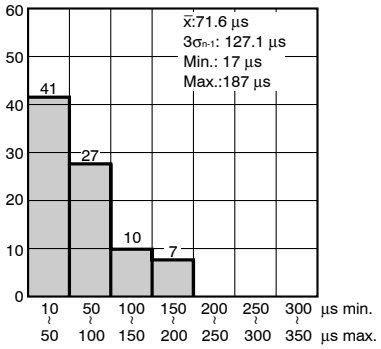
17.-(1) Distribution of M.B.B. time

Sample: TQ2-2M-5V, 85 pcs.

Terminal Nos. 2-3-4: ON



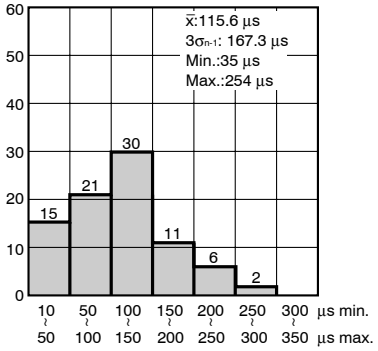
Terminal Nos. 2-3-4: OFF



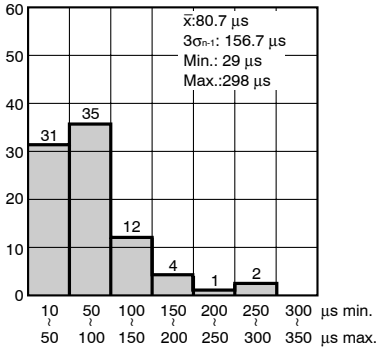
17.-(2) Distribution of M.B.B. time

Sample: TQ2-2M-5V, 85 pcs.

Terminal Nos. 7-8-9: ON



Terminal Nos. 7-8-9: OFF

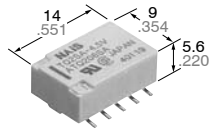


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

LOW-PROFILE SURFACE-MOUNT RELAY

TQ SMD RELAYS



mm inch

FEATURES

- **Low-profile: 6 mm .236 inch (Tape height: max. 6.5 mm .256 inch)**
- **Tape and reel package is available as standard packing style**
- **Surge withstand between contacts and coil: 2,500 V**
- **Breakdown voltage between contacts and coil: 1,500 V**
- **Capacity: 2 A**
- **High sensitivity:**
  2 Form C; 140 mW power consumption (Single side stable type)

SPECIFICATIONS

Contact

Arrangement			2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			75 mΩ
Contact material			Gold-clad silver alloy
Rating	Nominal switching capacity (resistive load)		2 A 30 V DC, 0.5 A 125 V AC
	Max. switching power (resistive load)		60 W, 62.5 VA
	Max. switching voltage		220 V DC, 125 V AC
	Max. switching current		2 A
	Min. switching capacity ※1		10 μA 10 mV DC
Nominal operating power	Single side stable		140 mW (1.5 to 12 V DC) 200 mW (24 V DC) 300 mW (48 V DC)
	1 coil latching		70 mW (1.5 to 12 V DC) 100 mW (24 V DC)
	2 coil latching		140 mW (1.5 to 12 V DC) 200 mW (24 V DC)
Expected life (min. operations)	Mechanical (at 180 cpm)		10^8
	Electrical (at 20 cpm)	2 A 30 V DC resistive	10^5
		1 A 30 V DC resistive	2×10^5
		0.5 A 125 V AC resistive	10^5

Note:

※1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10 μA 1 mV DC – 10 mA 10 V DC])

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 By resistive method, nominal voltage applied to the coil; contact carrying current: 2 A.
*3 Nominal voltage applied to the coil, excluding contact bounce time.
*4 Nominal voltage applied to the coil, excluding contact bounce time without diode.
*5 Half-wave pulse of sine wave: 6 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

Initial insulation resistance*1			Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage	Between open contacts		1,000 Vrms for 1 min. (Detection current: 10 mA)
	Between contact sets		1,500 Vrms for 1 min. (Detection current: 10 mA)
	Between contact and coil		1,500 Vrms for 1 min. (Detection current: 10 mA)
Initial surge voltage	Between open contacts (10×160 μs)		1,500 V (FCC Part 68)
	Between contacts and coil (2×10 μs)		2,500 V (Telcordia)
Temperature rise*2 (at 20°C)			Max. 50°C
Operate time [Set time]*3 (at 20°C)			Max. 4 ms (Approx. 2 ms) [Max. 4 ms (Approx. 2 ms)]
Release time [Reset time]*4 (at 20°C)			Max. 4 ms (Approx. 1 ms) [Max. 4 ms (Approx. 2 ms)]
Shock resistance		Functional*5	Min. 750 m/s² {75 G}
		Destructive*6	Min. 1,000 m/s² {100 G}
Vibration resistance		Functional*7	200 m/s² {20G}, 10 to 55 Hz at double amplitude of 3.3 mm
		Destructive	294 m/s² {30G}, 10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)		Ambient temperature	–40°C to +85°C*3 –40°F to +185°F
		Humidity	5 to 85% R.H.
Unit weight			Approx. 2 g .071 oz

ORDERING INFORMATION

Ex. TQ | 2 | SA | - | L | - | 3V | - | Z

Contact arrangement	Surface-mount availability	Operating function	Coil voltage (DC)	Packing style
2: 2 Form C	SA: Standard surface-mount terminal type SL: High connection reliability surface-mount terminal type SS: Space saving surface-mount terminal type	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48* V	Nil: Tube packing Z: Tape and reel packing (picked from the 6/7/8/9/10-pin side)

*48 V coil type: Single side stable only

Notes: 1. Tape and reel (picked from 1/2/3/4/5-pin side) is also available by request.
Part No. suffix "-X" is needed when ordering. (ex.) TQ2SA-3V-X
2. Tape and reel packing symbol "-Z" or "-X" are not marked on the relay.

TYPES

1. Single side stable

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
TQ2S❍-1.5 V	1.5	1.13	0.15	93.8	16	140	2.2
TQ2S❍-3 V	3	2.25	0.3	46.7	64.3	140	4.5
TQ2S❍-4.5 V	4.5	3.38	0.45	31	145	140	6.7
TQ2S❍-5 V	5	3.75	0.5	28.1	178	140	7.5
TQ2S❍-6 V	6	4.5	0.6	23.3	257	140	9
TQ2S❍-9 V	9	6.75	0.9	15.5	579	140	13.5
TQ2S❍-12 V	12	9	1.2	11.7	1,028	140	18
TQ2S❍-24 V	24	18	2.4	8.3	2,880	200	36
TQ2S❍-48 V	48	36	4.8	6.3	7,680	300	57.6

2. 1 coil latching

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
TQ2S❍-L-1.5 V	1.5	1.13	1.13	46.9	32	70	2.2
TQ2S❍-L-3 V	3	2.25	2.25	23.3	128.6	70	4.5
TQ2S❍-L-4.5 V	4.5	3.38	3.38	15.6	289.3	70	6.7
TQ2S❍-L-5 V	5	3.75	3.75	14	357	70	7.5
TQ2S❍-L-6 V	6	4.5	4.5	11.7	514	70	9
TQ2S❍-L-9 V	9	6.75	6.75	7.8	1,157	70	13.5
TQ2S❍-L-12 V	12	9	9	5.8	2,057	70	18
TQ2S❍-L-24 V	24	18	18	4.2	5,760	100	36

3. 2 coil latching

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
TQ2S❍-L2-1.5 V	1.5	1.13	1.13	93.8	16	140	2.2
TQ2S❍-L2-3 V	3	2.25	2.25	46.7	64.3	140	4.5
TQ2S❍-L2-4.5 V	4.5	3.38	3.38	31	145	140	6.7
TQ2S❍-L2-5 V	5	3.75	3.75	28.1	178	140	7.5
TQ2S❍-L2-6 V	6	4.5	4.5	23.3	257	140	9
TQ2S❍-L2-9 V	9	6.75	6.75	15.5	579	140	13.5
TQ2S❍-L2-12 V	12	9	9	11.7	1,028	140	18
TQ2S❍-L2-24 V	24	18	18	8.3	2,880	200	36

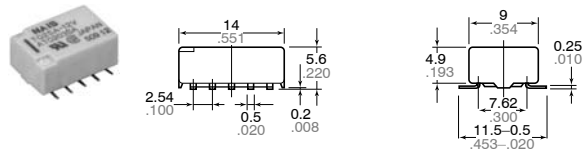
❍: For each surface-mounted terminal variation, input the following letter.
SA type: A, SL type: L, SS type: S

Notes: 1. Specified value of the pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 50 pcs.; Case; 1,000 pcs.; Tape and reel: 500 pcs./reel
3. In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

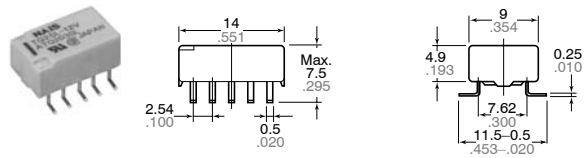
DIMENSIONS

mm inch

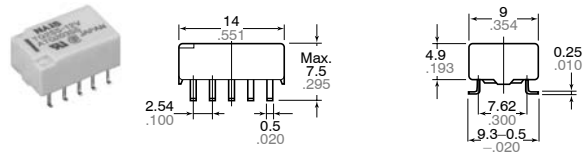
SA type



SL type



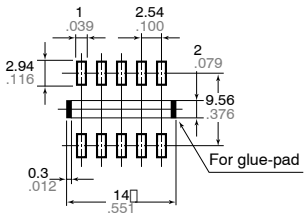
SS type



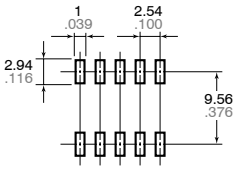
General tolerance: ±0.3 ±.012

Recommendable mounting pad (Top view)

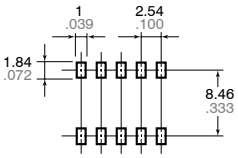
SA type



SL type



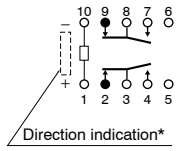
SS type



Tolerance: ±0.1 ±.004

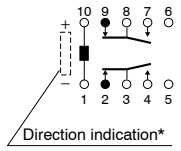
Schematic (Top view)

•Single side stable (Deenergized condition)



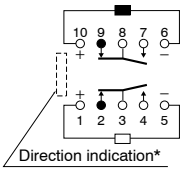
*Orientation stripe located on top of relay.

•1-coil latching (Reset condition)



*Orientation stripe located on top of relay.

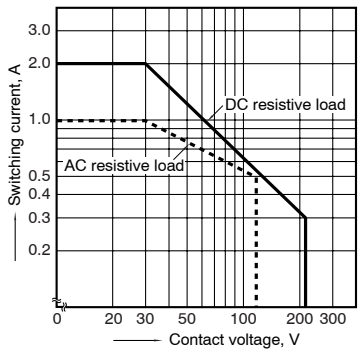
•2-coil latching (Reset condition)



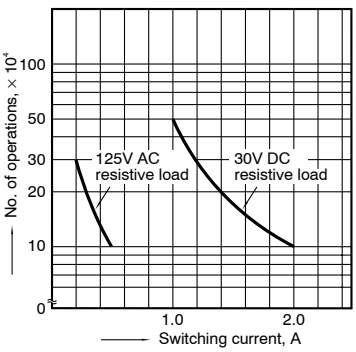
*Orientation stripe located on top of relay.

REFERENCE DATA

1. Maximum switching capacity

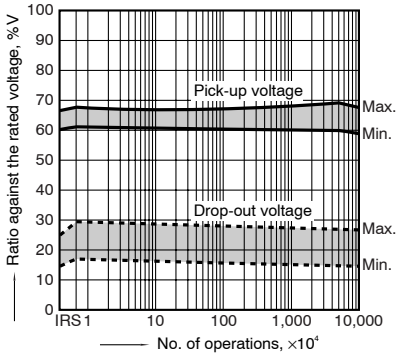


2. Life curve



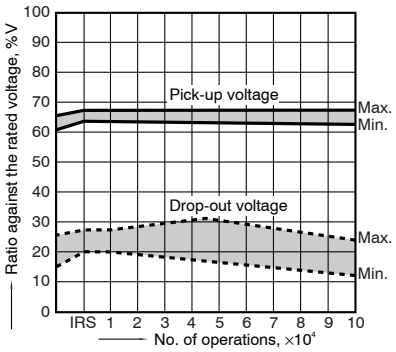
3. Mechanical life (mounting by IRS method)

Tested sample: TQ2SA-12V, 10 pcs.

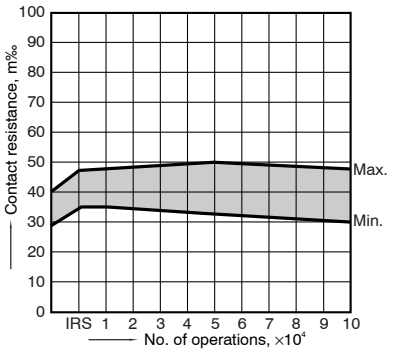


4.-(1) Electrical life (2 A 30 V DC resistive load)

Tested sample: TQ2SA-12V, 6 pcs.
Operating frequency: 20 cpm
Change of pick-up and drop-out voltage
(mounting by IRS method)

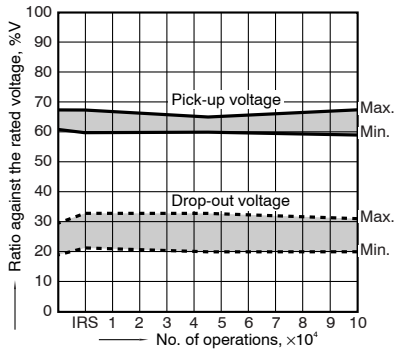


Change of contact resistance
(mounting by IRS method)

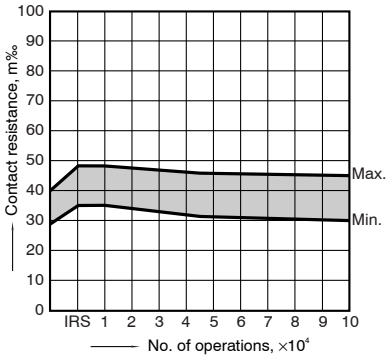


4.-(2) Electrical life (0.5 A 125 V AC resistive load)

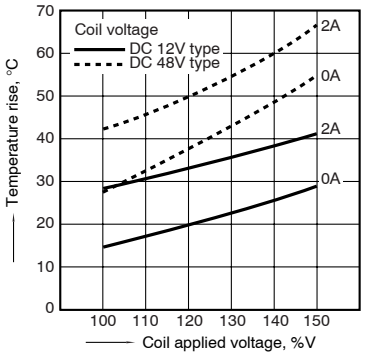
Tested sample: TQ2SA-12V, 6 pcs
Operating frequency: 20 cpm
Change of pick-up and drop-out voltage
(mounting by IRS method)



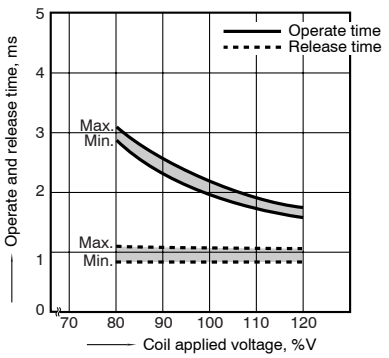
Change of contact resistance
(mounting by IRS method)



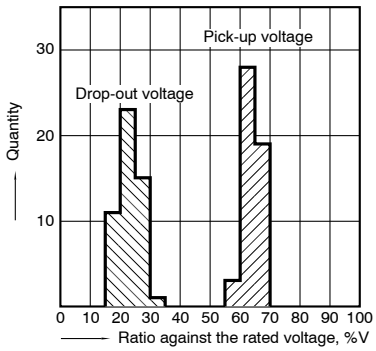
5. Coil temperature rise
Tested sample: TQ2SA-12V, 6 pcs.
Point measured: Inside the coil
Ambient temperature: 25°C 77°F



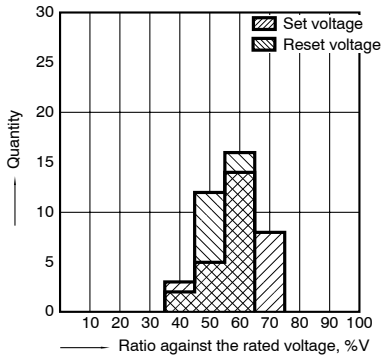
6. Operate/release time
Tested sample: TQ2SA-12V, 6 pcs.



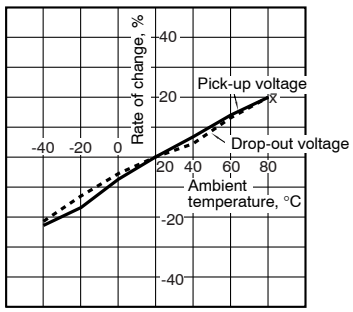
7. Distribution of pick-up and drop out voltage
Tested sample: TQ2SA-12V, 50 pcs.



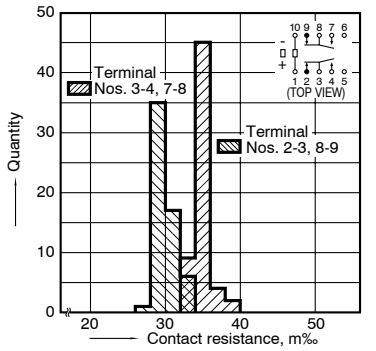
8. Distribution of set and reset voltage
Tested sample: TQ2SA-L-12V, 30 pcs.



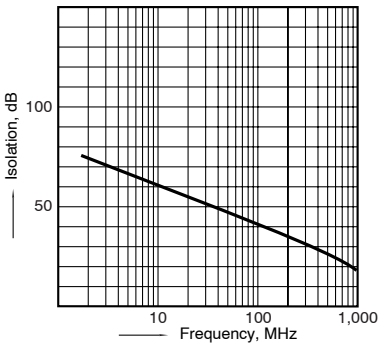
9. Ambient temperature characteristics
Tested sample: TQ2SA-12V, 5 pcs.



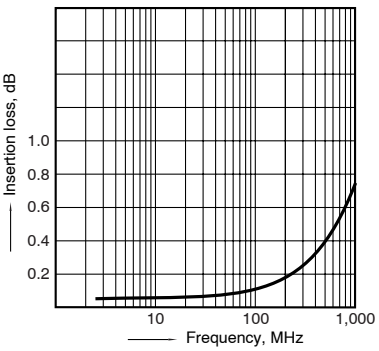
10. Distribution of contact resistance
Tested sample: TQ2SA-5V, 30 pcs. (30 × 4 contacts)



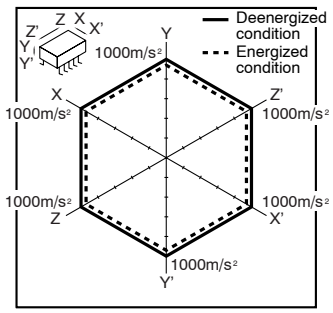
11.-(1) High-frequency characteristics
Isolation characteristics



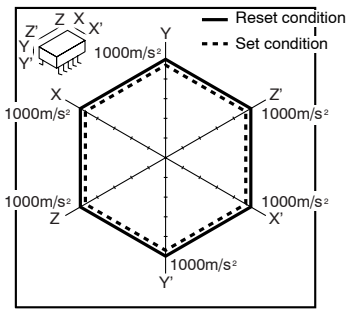
11.-(2) High-frequency characteristics
Insertion loss characteristics



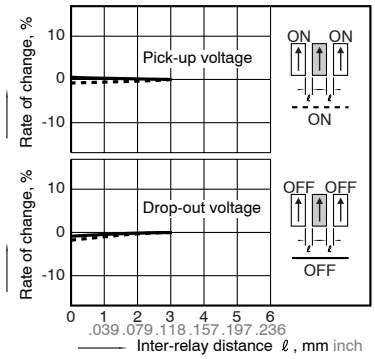
12.-(1) Malfunctional shock (single side stable)
Tested sample: TQ2SA-12V, 6 pcs



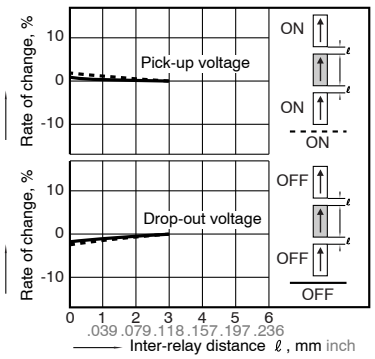
12.-(2) Malfunctional shock (latching)
Tested sample: TQ2SA-L2-12V, 6 pcs.



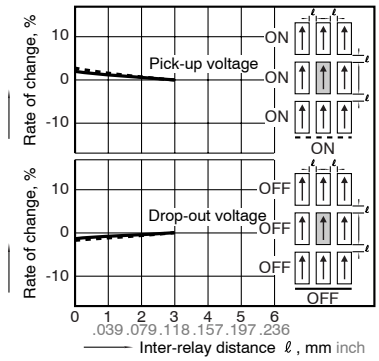
13.-(1) Influence of adjacent mounting
Tested sample: TQ2SA-12V, 5 pcs.



13.-(2) Influence of adjacent mounting
Tested sample: TQ2SA-12V, 6 pcs.

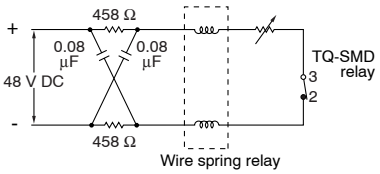


13.-(3) Influence of adjacent mounting
Tested sample: TQ2SA-12V, 6 pcs.

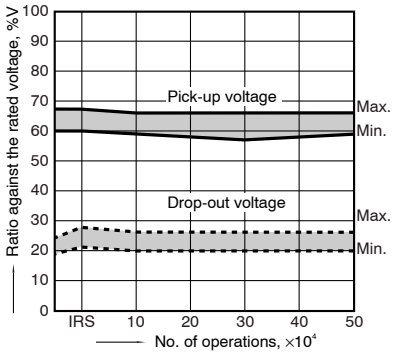


Signal

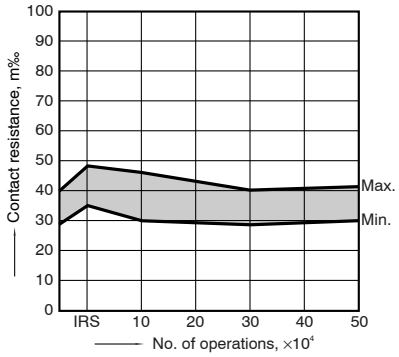
14. Pulse dialing test
Tested sample: TQ2SA-12V, 6 pcs.
(35 mA 48 V DC wire spring relay load)
Circuit



Change of pick-up and drop-out voltage
(mounting by IRS method)



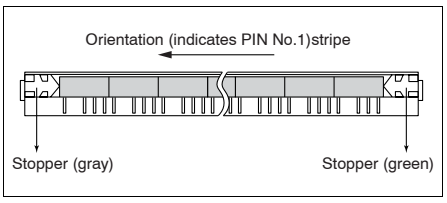
Change of contact resistance
(mounting by IRS method)



NOTES

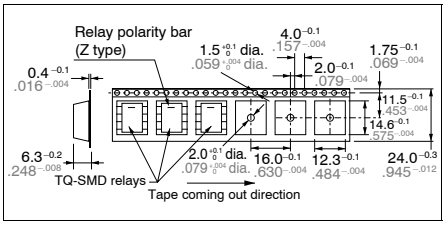
1. Packing style

1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.



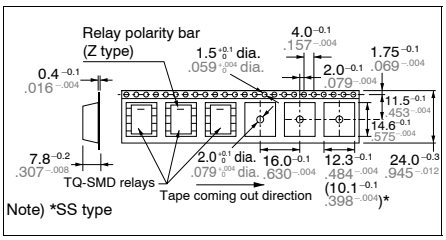
2) Tape and reel packing (surface-mount terminal type)
(1) Tape dimensions
(i) SA type

mm inch



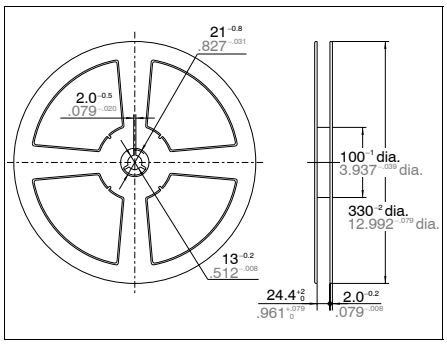
(ii) SL, SS type

mm inch



(2) Dimensions of plastic reel

mm inch

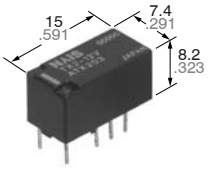


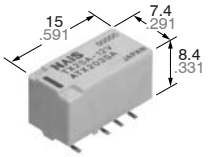
For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

2 A CAPACITY RELAY WITH HIGH SURGE VOLTAGE & HIGH BREAKDOWN VOLTAGE

TX RELAYS





mm inch

FEATURES

- **Breakdown voltage between contacts and coil: 2,000 V**
- **Surge withstand between contacts and coil: 2,500 V**
- **High contact capacity: 2 A 30 V DC**
- **Surface-mount type available**

SPECIFICATIONS

Contact

Arrangement			2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			100 mΩ
Contact material			Gold-clad silver alloy
Rating	Nominal switching capacity (resistive load)		2 A 30 V DC
	Max. switching power (resistive load)		60 W
	Max. switching voltage		220 V DC
	Max. switching current		2 A
	Min. switching capacity ※1		10 μA 10 mV DC
Nominal operating power	Single side stable		140 mW (1.5 to 24 V DC) 270 mW (48 V DC)
	1 coil latching		100 mW (1.5 to 24 V DC)
	2 coil latching		200 mW (1.5 to 24 V DC)
Expected life (min. operations)	Mechanical (at 180 cpm)		10^8
	Electrical (at 20 cpm)	2 A 30 V DC resistive	10^5
		1 A 30 V DC resistive	5×10^5

Notes:

※1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10 μA 1 mV DC – 10 mA 10 V DC])

※2 The upper limit for the ambient temperature is the maximum temperature that can satisfy the coil temperature rise. Under the packing condition, allowable temperature range is from –40 to +70°C –40°C to +158°F.

Remarks

* Specifications will vary with foreign standards certification ratings.

*1 Measurement at same location as "Initial breakdown voltage" section.

*2 By resistive method, nominal voltage applied to the coil; contact carrying current: 2 A.

*3 Nominal voltage applied to the coil, excluding contact bounce time.

*4 Nominal voltage applied to the coil, excluding contact bounce time without diode.

*5 Half-wave pulse of sine wave: 6 ms; detection time: 10 μs.

*6 Half-wave pulse of sine wave: 6 ms.

*7 Detection time: 10 μs.

*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage	Between open contacts	1,000 Vrms for 1 min. (Detection current: 10 mA)
	Between contact sets	1,000 Vrms for 1 min. (Detection current: 10 mA)
	Between contact and coil	2,000 Vrms for 1 min. (Detection current: 10 mA)
Initial surge voltage	Between open contacts (10×160 μs)	1,500 V (FCC Part 68)
	Between contacts and coil (2×10 μs)	2,500 V (Telcordia)
Temperature rise*2 (at 20°C)		Max. 50°C
Operate time [Set time]*3 (at 20°C)		Max. 4 ms (Approx. 2 ms) [Max. 4 ms (Approx. 2 ms)]
Release time [Reset time]*4 (at 20°C)		Max. 4 ms (Approx. 1 ms) [Max. 4 ms (Approx. 2 ms)]
Shock resistance	Functional*5	Min. 750 m/s² {75 G}
	Destructive*6	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*7	196 m/s² {20 G}, 10 to 55 Hz at double amplitude of 3.3 mm
	Destructive	294 m/s² {30G}, 10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temperature ※2	–40°C to +85°C (up to 24 V coil) –40°F to +185°F (up to 24 V coil) –40°C to +70°C (48 V coil) –40°F to +158°F (48 V coil)
	Humidity	5 to 85% R.H.
Unit weight		Approx. 2 g .071 oz

ORDERING INFORMATION

Ex. TX [2] [SA] — [L] — [H] — [3V] — [Z]

Contact arrangement	Surface-mount availability	Operating function	Terminal shape	Coil voltage (DC)	Packing style
2: 2 Form C	Nil: Standard PC board terminal type or self-clinching terminal type SA: Standard surface-mount terminal type SL: High connection reliability surface-mount terminal type SS: Space saving surface-mount terminal type	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	Nil: Standard PC board terminal or surface-mount terminal H: Self-clinching terminal	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48* V	Nil: Tube packing Z: Tape and reel packing(picked from the 8/9/10/12 -pin side

Notes: 1. Tape and reel (picked from 1/3/4/5-pin side) is also available by request. Part number suffix "-X" is needed when ordering.
(ex.) TX2SA-3 V-X
2. Tape and reel packing symbol "-Z" or "-X" are not marked on the relay.

*48 V coil type: Single side stable only

TYPES AND COIL DATA (at 20°C 68°F)

1) Standard PC board terminal type and self-clinching terminal type

1. Single side stable

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TX2-1.5 V	TX2-H-1.5 V	1.5	1.13	0.15	93.8	16	140	2.2
TX2-3 V	TX2-H-3 V	3	2.25	0.3	46.7	64.3	140	4.5
TX2-4.5 V	TX2-H-4.5 V	4.5	3.38	0.45	31	145	140	6.7
TX2-5 V	TX2-H-5 V	5	3.75	0.5	28.1	178	140	7.5
TX2-6 V	TX2-H-6 V	6	4.5	0.6	23.3	257	140	9
TX2-9 V	TX2-H-9 V	9	6.75	0.9	15.5	579	140	13.5
TX2-12 V	TX2-H-12 V	12	9	1.2	11.7	1,028	140	18
TX2-24 V	TX2-H-24 V	24	18	2.4	5.8	4,114	140	36
TX2-48 V	TX2-H-48 V	48	36	4.8	5.6	8,533	270	57.6

2. 1 Coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TX2-L-1.5 V	TX2-L-H-1.5 V	1.5	1.13	1.13	66.7	22.5	100	2.2
TX2-L-3 V	TX2-L-H-3 V	3	2.25	2.25	33.3	90	100	4.5
TX2-L-4.5 V	TX2-L-H-4.5 V	4.5	3.38	3.38	22.2	202.5	100	6.7
TX2-L-5 V	TX2-L-H-5 V	5	3.75	3.75	20	250	100	7.5
TX2-L-6 V	TX2-L-H-6 V	6	4.5	4.5	16.7	360	100	9
TX2-L-9 V	TX2-L-H-9 V	9	6.75	6.75	11.1	810	100	13.5
TX2-L-12 V	TX2-L-H-12 V	12	9	9	8.3	1,440	100	18
TX2-L-24 V	TX2-L-H-24 V	24	18	18	4.2	5,760	100	36

3. 2 Coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TX2-L2-1.5 V	TX2-L2-H-1.5 V	1.5	1.13	1.13	133.9	11.2	200	2.2
TX2-L2-3 V	TX2-L2-H-3 V	3	2.25	2.25	66.7	45	200	4.5
TX2-L2-4.5 V	TX2-L2-H-4.5 V	4.5	3.38	3.38	44.5	101.2	200	6.7
TX2-L2-5 V	TX2-L2-H-5 V	5	3.75	3.75	40	125	200	7.5
TX2-L2-6 V	TX2-L2-H-6 V	6	4.5	4.5	33.3	180	200	9
TX2-L2-9 V	TX2-L2-H-9 V	9	6.75	6.75	22.2	405	200	13.5
TX2-L2-12 V	TX2-L2-H-12 V	12	9	9	16.7	720	200	18
TX2-L2-24 V	TX2-L2-H-24 V	24	18	18	8.3	2,880	200	36

Notes:
1. Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.
3. In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

2) Surface-mount terminal type

1. Single side stable

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
TX2S❍-1.5 V	1.5	1.13	0.15	93.8	16	140	2.2
TX2S❍-3 V	3	2.25	0.3	46.7	64.3	140	4.5
TX2S❍-4.5 V	4.5	3.38	0.45	31	145	140	6.7
TX2S❍-5 V	5	3.75	0.5	28.1	178	140	7.5
TX2S❍-6 V	6	4.5	0.6	23.3	257	140	9
TX2S❍-9 V	9	6.75	0.9	15.5	579	140	13.5
TX2S❍-12 V	12	9	1.2	11.7	1,028	140	18
TX2S❍-24 V	24	18	2.4	5.8	4,114	140	36
TX2S❍-48 V	48	36	4.8	5.6	8,533	270	57.6

2. 1 coil latching

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
TX2S❍-L-1.5 V	1.5	1.13	1.13	66.7	22.5	100	2.2
TX2S❍-L-3 V	3	2.25	2.25	33.3	90	100	4.5
TX2S❍-L-4.5 V	4.5	3.38	3.38	22.2	202.5	100	6.7
TX2S❍-L-5 V	5	3.75	3.75	20	250	100	7.5
TX2S❍-L-6 V	6	4.5	4.5	16.7	360	100	9
TX2S❍-L-9 V	9	6.75	6.75	11.1	810	100	13.5
TX2S❍-L-12 V	12	9	9	8.3	1,440	100	18
TX2S❍-L-24 V	24	18	18	4.2	5,760	100	36

3. 2 coil latching

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
TX2S❍-L2-1.5 V	1.5	1.13	1.13	133.9	11.2	200	2.2
TX2S❍-L2-3 V	3	2.25	2.25	66.7	45	200	4.5
TX2S❍-L2-4.5 V	4.5	3.38	3.38	44.5	101.2	200	6.7
TX2S❍-L2-5 V	5	3.75	3.75	40	125	200	7.5
TX2S❍-L2-6 V	6	4.5	4.5	33.3	180	200	9
TX2S❍-L2-9 V	9	6.75	6.75	22.2	405	200	13.5
TX2S❍-L2-12 V	12	9	9	16.7	720	200	18
TX2S❍-L2-24 V	24	18	18	8.3	2,880	200	36

❍: For each surface-mounted terminal variation, input the following letter.

SA type: A , SL type: L , SS type: S

Notes:

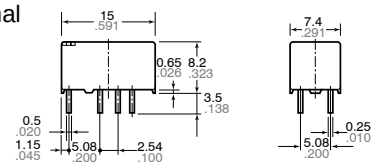
1. Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.
3. Tape and reel packing is also available for surface-mount type by request. Part number suffix “-X” or “-Z” is needed when ordering.
   In this case, “X” or “Z” are not marked on the relay.
   Quantity in tape and reel: 500 pcs.
   (ex.) • TX2SA-3V-X
   └Picked from the 1/3/4/5-pin side
   • TX2SA-L-3V-Z
   └Picked from the 8/9/10/12-pin side
4. In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

DIMENSIONS

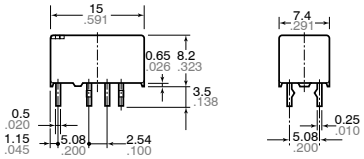
mm inch

1. Single side stable and 1 coil latching type

Standard PC board terminal

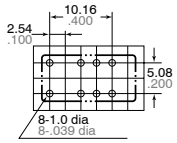


Self clinching terminal



General tolerance: ±0.3 ±.012

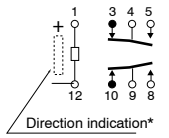
PC board pattern (Copper-side view)



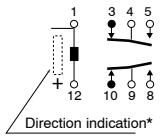
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

Single side stable (Deenergized condition)

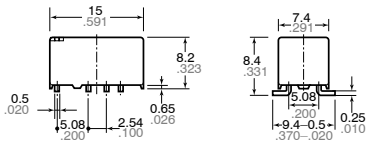


1 coil latching (Reset condition)

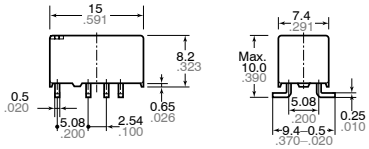


*Orientation stripe located on top of relay.

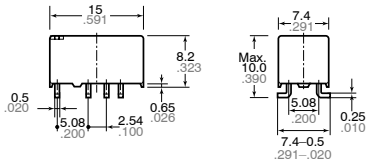
Surface-mount terminal
SA type



SL type

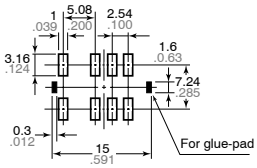


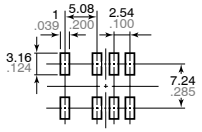
SS type

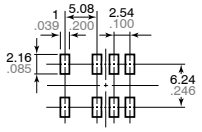


General tolerance: ±0.3 ±.012

Suggested mounting pad (Top view)



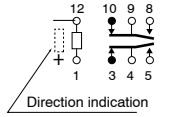




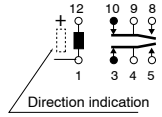
Tolerance: ±0.1 ±.004

Schematic (Top view)

Single side stable (Deenergized condition)

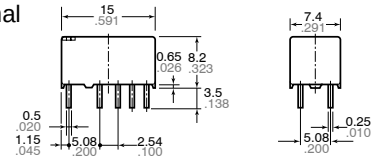


1 coil latching (Reset condition)

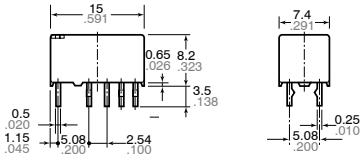


2. Coil latching type

Standard PC board terminal

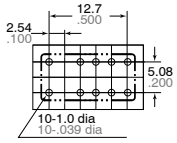


Self clinching terminal



General tolerance: ±0.3 ±.012

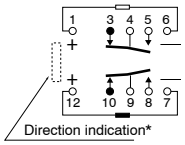
PC board pattern (Copper side view)



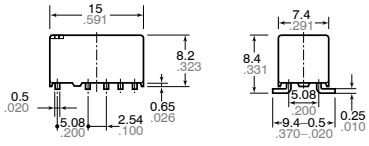
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

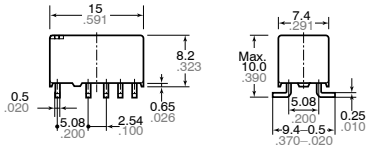
2 coil latching (Reset condition)



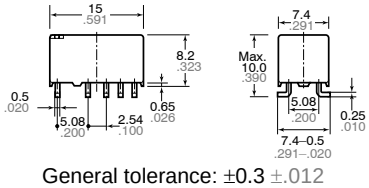
Surface-mount terminal
SA type



SL type

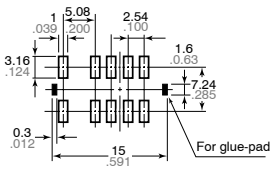


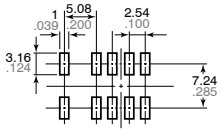
SS type

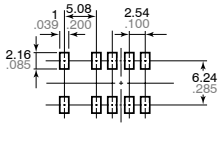


General tolerance: ±0.3 ±.012

Suggested mounting pad (Top view)



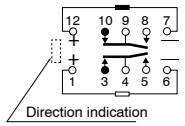




Tolerance: ±0.1 ±.004

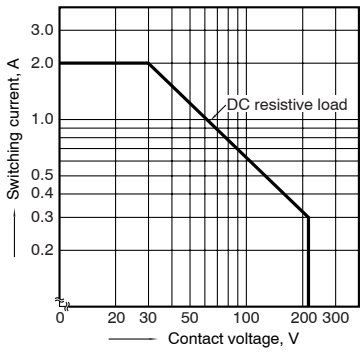
Schematic (Top view)

2 coil latching (Reset condition)

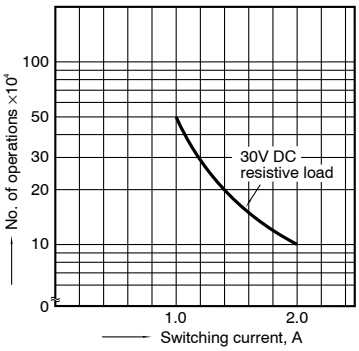


REFERENCE DATA

1. Maximum switching capacity

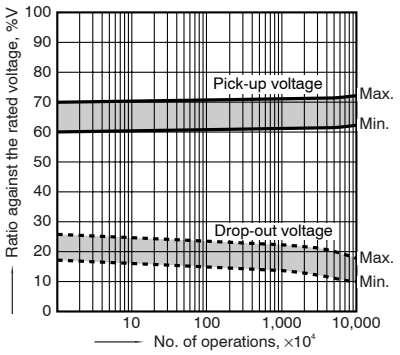


2. Life curve



3. Mechanical life

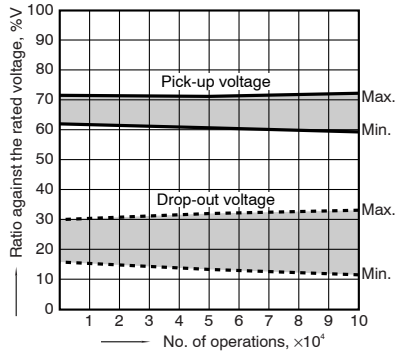
Tested sample: TX2-5V, 10 pcs.
Operating frequency: 180 cpm



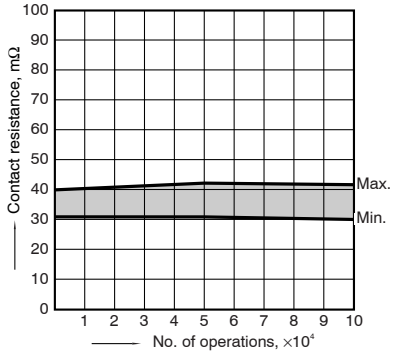
4. Electrical life

Tested sample: TX2-5V, 6 pcs.
Operating frequency: 20 cpm

Change of pick-up and drop-out voltage

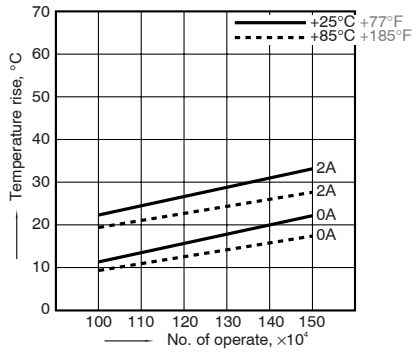


Change of contact resistance



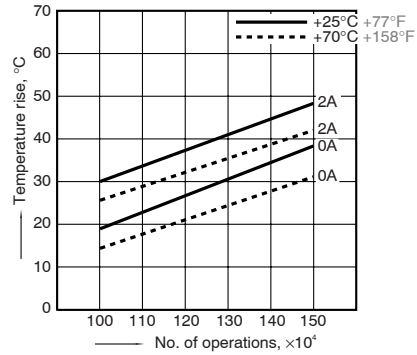
5-(1). Coil temperature rise

Tested sample: TX2-5V, 6 pcs.
Point measured: Inside the coil
Ambient temperature: 25°C 77°F, 85°C 185°F



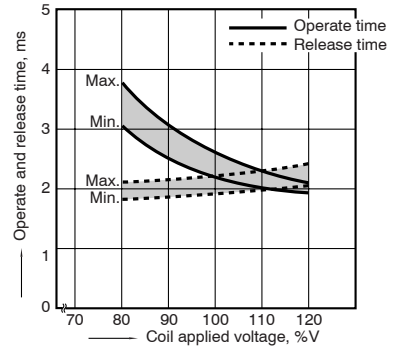
5-(2). Coil temperature rise

Tested sample: TX2-48V, 6 pcs.
Point measured: Inside the coil
Ambient temperature: 25°C 77°F, 70°C 158°F

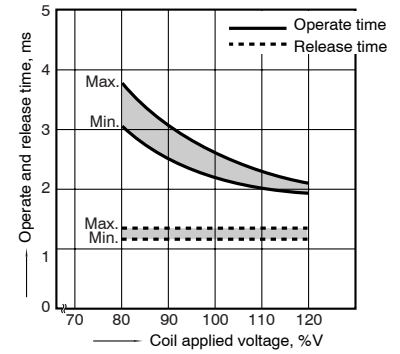


6-(1). Operate and release time (with diode)

Tested sample: TX2-5V, 10 pcs.

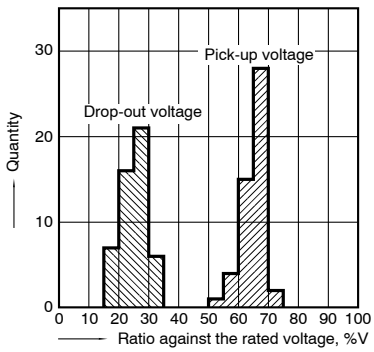


6-(2). Operate and release time (without diode)



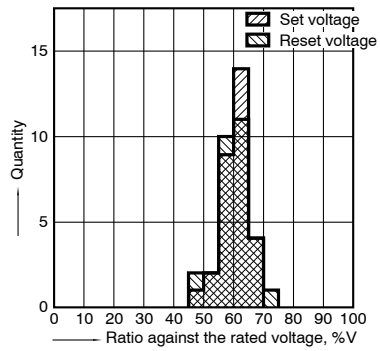
7. Distribution of pick-up and drop-out voltage

Tested sample: TX2-5V, 50 pcs.



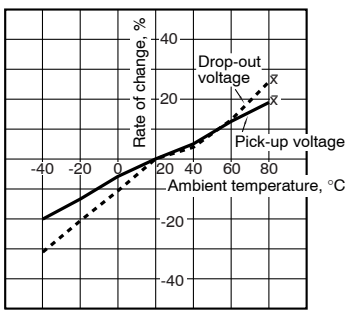
8. Distribution of set and reset voltage

Tested sample: TX2-L2-12V, 30 pcs.

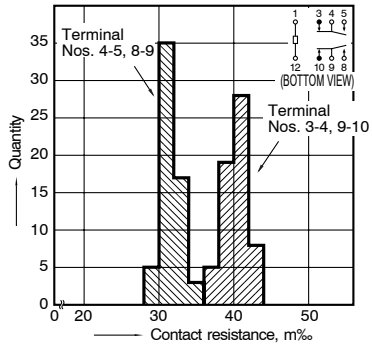


9. Ambient temperature characteristics

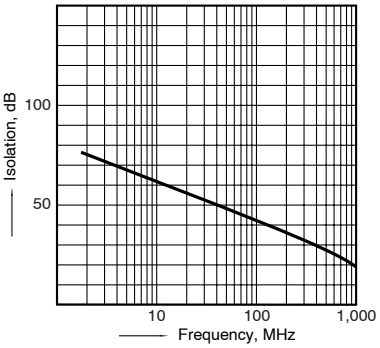
Tested sample: TX2-5V, 5 pcs.



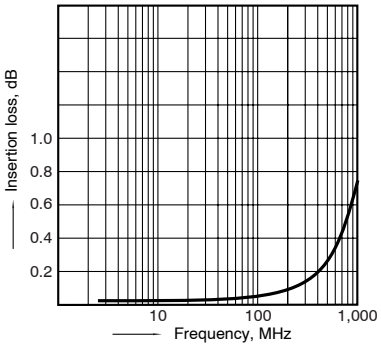
10. Distribution of contact resistance
Tested sample: TX2-5V, 30 pcs. (30 × 4 contacts)



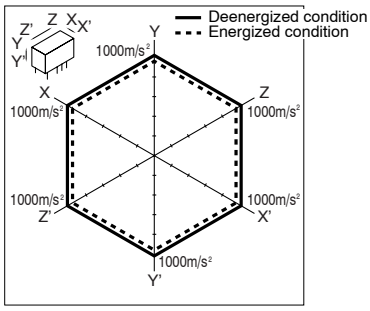
11-(1). High frequency characteristics
Tested sample: TX2-12V, 2 pcs.
Isolation characteristics



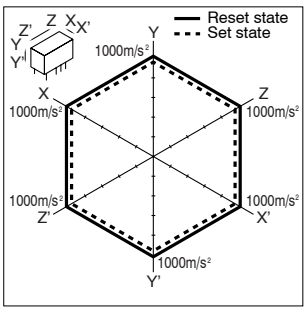
11-(2). High frequency characteristics
Tested sample: TX2-12V, 2 pcs.
Insertion loss characteristics



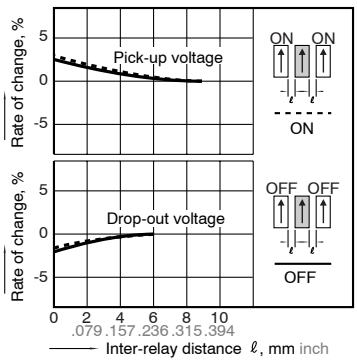
12-(1). Malfunctional shock (single side stable)
Tested sample: TX2-5V, 6 pcs



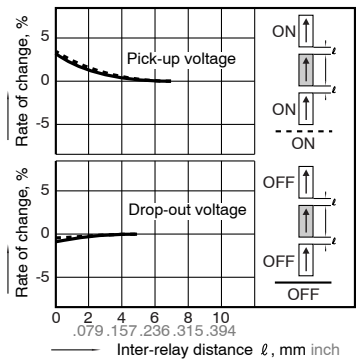
12-(2). Malfunctional shock (latching)
Tested sample: TX2-L2-12V, 6 pcs.



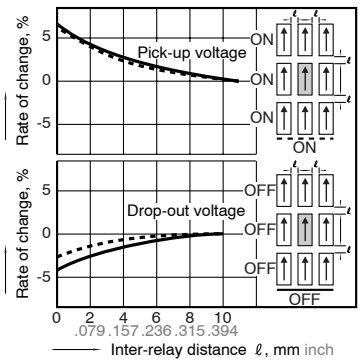
13-(1). Influence of adjacent mounting



13-(2). Influence of adjacent mounting

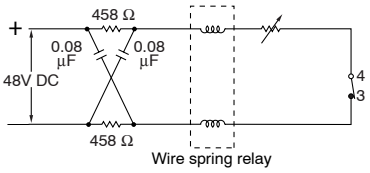


13-(3). Influence of adjacent mounting

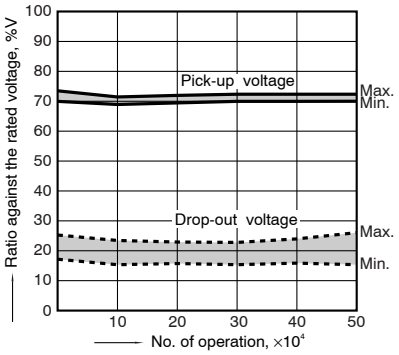


14. Pulse dialing test
Tested sample: TX2-5V, 6 pcs.
(35 mA 48 V DC wire spring relay load)

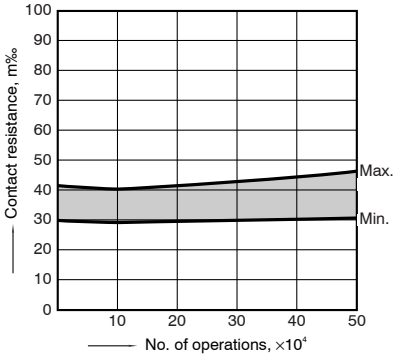
Circuit



Change of pick-up and drop-out voltage



Change of contact resistance

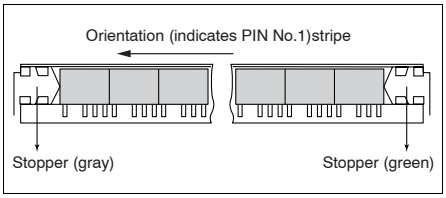


Note: Data of surface-mount type are the same as those of PC board terminal type.

NOTES

1. Packing style

1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.

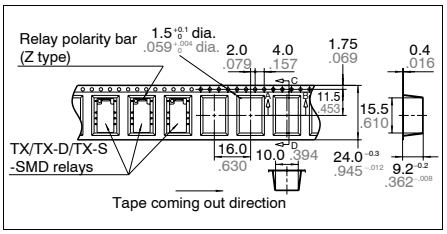


2) Tape and reel packing (surface-mount terminal type)

(1) Tape dimensions

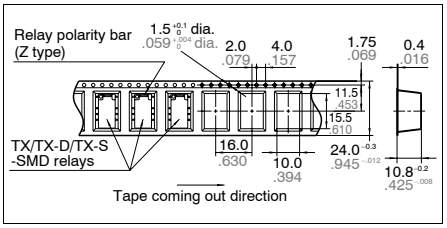
(i) SA type

mm inch



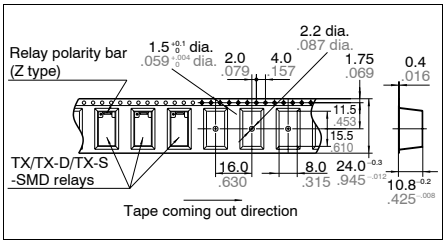
(ii) SL type

mm inch



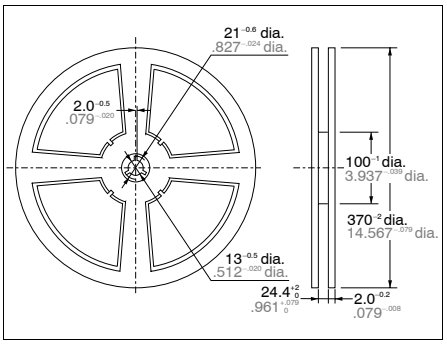
(iii) SS type

mm inch



(2) Dimensions of plastic reel

mm inch

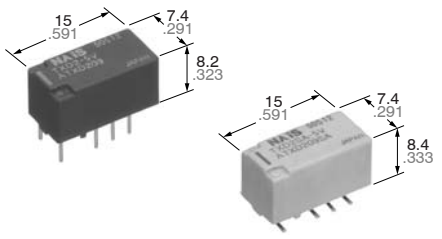


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

HIGH INSULATION RELAYS (Conforming to the supplementary insulation class of EN Standards (EN41003))

TX-D RELAYS



mm inch

FEATURES

• Approved to the supplementary insulation class in the EN standards (EN41003).
The insulation distance between the contact and coil meet the supplementary insulation class of the EN41003 standards as required for equipment connected to the telephone lines in Europe.
Satisfies the following conditions:
• Clearances: 2.0 mm .079 inch or more
• Creepage distance: 2.5 mm .098 inch or more

• 2,000 V breakdown voltage between contact and coil.
• Outstanding surge resistance.
Surge withstand between open contacts: 1,500 V 10×160 μsec. (FCC part 68)
Surge withstand between contact and coil: 2,500 V 2×10 μsec. (Telcordia)
• High contact capacity: 2 A 30 V DC (Standard type)
• M.B.B. type available
• The use of gold-clad twin crossbar contacts ensures high contact reliability.

SPECIFICATIONS

Contact

			Standard (B.B.M) type	M.B.B.type
Arrangement			2 Form C	2 Form D
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			100 mΩ	
Contact material			Gold-clad silver	
Rating	Nominal switching capacity (resistive load)		2 A 30 V DC	1 A 30 V DC
	Max. switching power (resistive load)		60 W	30 W
	Max. switching voltage		220 V DC	110 V DC
	Max. switching current		2 A	1 A
	Min. switching capacity ※1		10 μA 10 mV DC	
	Nominal operating power	Single side stable	200 mW (1.5 to 12 V DC) 230 mW (24 V DC)	250 mW (1.5 to 12 V DC) 270 mW (24 V DC)
		1 coil latching	150 mW (1.5 to 12 V DC) 170 mW (24 V DC)	—
Expected life (min. operations)	Mechanical (at 180 cpm)		10^8	10^7
	Electrical (at 20 cpm)		10^5 (2 A 30 V DC resistive), 5×10^5 (1 A 30 V DC resistive)	10^5 (1 A 30 V DC resistive)

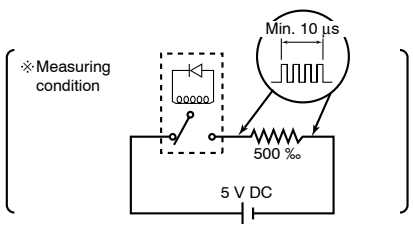
Notes:
※1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10 μA 1 mV DC – 10 mA 10 V DC])
※2 The upper limit for the ambient temperature is the maximum temperature that can satisfy the coil temperature rise. Under the packing condition, allowable temperature range is from –40 to +70°C –40°C to +158°F.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10 mA
*3 By resistive method; nominal voltage applied to the coil; contact carrying current: 2 A.
*4 By resistive method; nominal voltage applied to the coil; contact carrying current: 1 A.
*5 Nominal voltage applied to the coil, excluding contact bounce time.
*6 Nominal voltage applied to the coil, excluding contact bounce time without diode.
*7 Half-wave pulse of sine wave: 6 ms.; detection time: 10 μs.
*8 Half-wave pulse of sine wave: 11 ms.; detection time: 10 μs.
*9 Half-wave pulse of sine wave: 6 ms.
*10 Detection time: 10 μs.
*11 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

		Standard (B.B.M) type	M.B.B.type
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)	
Initial break-down voltage*2	Between open contacts	1,000 Vrms for 1 min.	500 Vrms for 1 min.
	Between contact and coil	2,000 Vrms for 1 min.	
	Between contact sets	1,000 Vrms for 1 min.	
Initial surge voltage	Between contacts, 10 ×160 μs	1,500 V [FCC Part 68]	–
	Between contact and coil, 2×10 μs	2,500 V [Telcordia]	
Temperature rise (at 20°C)		Max. 50°C*3	Max. 50°C*4
Operate time [Set time]*5 (at 20°C)		Max. 4 ms (Approx. 2 ms) [Max. 4 ms (Approx. 2 ms)]	Max. 4 ms (Approx. 2 ms)
Release time [Reset time]*6 (at 20°C)		Max. 4 ms (Approx. 1 ms) [Max. 4 ms (Approx. 2 ms)]	Max. 4 ms (Approx. 1 ms)
M.B.B. time*12		—	Min. 10 μs
Shock resistance	Functional	Min. 750 m/s² {75 G}*7	Min. 500 m/s² {50 G}*8
	Destructive*9	Min. 1,000 m/s² {100 G}	
Vibration resistance	Functional*10	10 to 55 Hz at double amplitude of 3.3 mm	
	Destructive	10 to 55 Hz at double amplitude of 5 mm	
Conditions for operation, transport and storage*11 (Not freezing and condensing at low temperature)	Ambient temp. ※2	–40°C to +85°C –40°F to +185°F	
	Humidity	5 to 85%R.H.	
Unit weight		Approx. 2 g .071 oz.	

*12 M.B.B. time:



TYPICAL APPLICATIONS

- **Communications (XDSL, Transmission)**
- **Measurement**
- **Security**
- **Home appliances, and audio/visual equipment**
- **Automotive equipment**
- **Medical equipment**

ORDERING INFORMATION

1) Standard (B.B.M.)type

Ex. TXD [2] [SA] — [L] — [ ] — [4.5V] — [Z]

Contact arrangement	Surface-mount availability	Operating function	Terminal shape	Coil voltage (DC)	Packing style
2: 2 Form C	Nil: Standard PC board terminal or self-clinching terminal SA: Standard surface-mount terminal SL: High connection reliability surface-mount terminal type SS: Space saving surface-mount terminal type	Nil: Single side stable L: 1 coil latching	Nil: Standard PC board terminal or surface-mount type H: Self-clinching terminal	1.5, 3, 4.5, 5, 6, 9, 12, 24 V	Nil: Tube packing Z: Tape and reel packing (Picked from the 8/9/10/12-pin side)

2) M.B.B.type

Ex. TXD [2] [SA] — [2M] — [ ] — [4.5V] — [Z]

Contact arrangement	Surface-mount availability	Operating function	Terminal shape	Coil voltage (DC)	Packing style
2: 2 Form D	Nil: Standard PC board terminal or self-clinching terminal SA: Standard surface-mount terminal SL: High connection reliability surface-mount terminal type SS: Space saving surface-mount terminal type	2M: 2 M.B.B. type	Nil: Standard PC board terminal or surface-mount type H: Self- clinching terminal	1.5, 3, 4.5, 5, 6, 9, 12, 24 V	Nil: Tube packing Z: Tape and reel packing (Picked from the 8/9/10/12-pin side)

Notes: 1. Tape and reel (picked from 1/3/4/5-pin side) is also available by request. Part number: suffix "-X" is needed when ordering.
(ex.) TXD2SA-3V-X
2. Tape and reel packing symbol "-Z" or "-X" are not marked on the relay.

TYPES AND COIL DATA (at 20°C 68°F)

1. Standard (B.B.M.) type

(1) Standard PC board terminal and self-clinching terminal

1. Single side stable

Coil Rating, V DC	Part No. V DC		Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
	Standard PC board terminal	Self-clinching terminal						
1.5	TXD2-1.5V	TXD2-H-1.5V	1.13	0.15	132.7	11	200	1.8
3	TXD2-3V	TXD2-H-3V	2.25	0.3	66.7	45	200	3.6
4.5	TXD2-4.5V	TXD2-H-4.5V	3.38	0.45	44.4	101	200	5.4
5	TXD2-5V	TXD2-H-5V	3.75	0.5	40.0	125	200	6
6	TXD2-6V	TXD2-H-6V	4.5	0.6	33.3	180	200	7.2
9	TXD2-9V	TXD2-H-9V	6.75	0.9	22.2	405	200	10.8
12	TXD2-12V	TXD2-H-12V	9	1.2	16.7	720	200	14.4
24	TXD2-24V	TXD2-H-24V	18	2.4	9.6	2,504	230	28.8

2. 1 coil latching

Coil Rating, V DC	Part No.		Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
	Standard PC board terminal	Self-clinching terminal						
1.5	TXD2-L-1.5V	TXD2-L-H-1.5V	1.13	1.13	100.0	15	150	1.8
3	TXD2-L-3V	TXD2-L-H-3V	2.25	2.25	50.0	60	150	3.6
4.5	TXD2-L-4.5V	TXD2-L-H-4.5V	3.38	3.38	33.3	135	150	5.4
5	TXD2-L-5V	TXD2-L-H-5V	3.75	3.75	30.0	166	150	6
6	TXD2-L-6V	TXD2-L-H-6V	4.5	4.5	25.0	240	150	7.2
9	TXD2-L-9V	TXD2-L-H-9V	6.75	6.75	16.7	540	150	10.8
12	TXD2-L-12V	TXD2-L-H-12V	9	9	12.5	960	150	14.4
24	TXD2-L-24V	TXD2-L-H-24V	18	18	7.1	3,388	170	28.8

Standard packing: 40 pcs. in an inner package (tube); 1,000 pcs. in an outer package.
Note: In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

(2) Surface-mount terminal

1. Single side stable

Coil Rating, V DC	Part No.		Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
	Tube packing	Tape and reel packing						
1.5	TXD2S❍-1.5V	TXD2S❍-1.5V-Z	1.13	0.15	132.7	11	200	1.8
3	TXD2S❍-3V	TXD2S❍-3V-Z	2.25	0.3	66.7	45	200	3.6
4.5	TXD2S❍-4.5V	TXD2S❍-4.5V-Z	3.38	0.45	44.4	101	200	5.4
5	TXD2S❍-5V	TXD2S❍-5V-Z	3.75	0.5	40.0	125	200	6
6	TXD2S❍-6V	TXD2S❍-6V-Z	4.5	0.6	33.3	180	200	7.2
9	TXD2S❍-9V	TXD2S❍-9V-Z	6.75	0.9	22.2	405	200	10.8
12	TXD2S❍-12V	TXD2S❍-12V-Z	9	1.2	16.7	720	200	14.4
24	TXD2S❍-24V	TXD2S❍-24V-Z	18	2.4	9.6	2,504	230	28.8

2. 1 coil latching

Coil Rating, V DC	Part No.		Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
	Tube packing	Tape and reel packing						
1.5	TXD2S❍-L-1.5V	TXD2S❍-L-1.5V-Z	1.13	1.13	100.0	15	150	1.8
3	TXD2S❍-L-3V	TXD2S❍-L-3V-Z	2.25	2.25	50.0	60	150	3.6
4.5	TXD2S❍-L-4.5V	TXD2S❍-L-4.5V-Z	3.38	3.38	33.3	135	150	5.4
5	TXD2S❍-L-5V	TXD2S❍-L-5V-Z	3.75	3.75	30.0	166	150	6
6	TXD2S❍-L-6V	TXD2S❍-L-6V-Z	4.5	4.5	25.0	240	150	7.2
9	TXD2S❍-L-9V	TXD2S❍-L-9V-Z	6.75	6.75	16.7	540	150	10.8
12	TXD2S❍-L-12V	TXD2S❍-L-12V-Z	9	9	12.5	960	150	14.4
24	TXD2S❍-L-24V	TXD2S❍-L-24V-Z	18	18	7.1	3,388	170	28.8

❍: For each surface-mounted terminal variation, input the following letter.
SA type: A , SL type: L , SS type: S
Standard packing:40 pcs. (tube), 500 pcs. (tape and reel) in an inner package; 1,000 pcs. in an outer package
Notes:
1. Tape and reel packing symbol “-Z” is not marked on the relay. “X” type tape and reel packing (picked from 1/3/4/5-pin side) is also available.
2. In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

2. M.B.B. Type

(1) Standard PC board terminal and self-clinching terminal

Single side stable

Coil Rating, V DC	Part No.		Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
	Standard PC board terminal	Self-clinching terminal						
1.5	TXD2-2M-1.5V	TXD2-2M-H-1.5V	1.13	0.15	166.7	9	250	1.8
3	TXD2-2M-3V	TXD2-2M-H-3V	2.25	0.3	83.3	36	250	3.6
4.5	TXD2-2M-4.5V	TXD2-2M-H-4.5V	3.38	0.45	55.6	81	250	5.4
5	TXD2-2M-5V	TXD2-2M-H-5V	3.75	0.5	50.0	100	250	6
6	TXD2-2M-6V	TXD2-2M-H-6V	4.5	0.6	41.7	144	250	7.2
9	TXD2-2M-9V	TXD2-2M-H-9V	6.75	0.9	27.8	324	250	10.8
12	TXD2-2M-12V	TXD2-2M-H-12V	9	1.2	20.8	576	250	14.4
24	TXD2-2M-24V	TXD2-2M-H-24V	18	2.4	11.3	2,133	270	28.8

Standard packing: 40 pcs. in an inner package (tube); 1,000 pcs. in an outer package

(2) Surface-mount terminal

Single side stable

Coil Rating, V DC	Part No.		Set voltage, V DC (max.)	Reset voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
	Tube packing	Tape and reel packing						
1.5	TXD2S❍-2M-1.5V	TXD2S❍-2M-1.5V-Z	1.13	0.15	166.7	9	250	1.8
3	TXD2S❍-2M-3V	TXD2S❍-2M-3V-Z	2.25	0.3	83.3	36	250	3.6
4.5	TXD2S❍-2M-4.5V	TXD2S❍-2M-4.5V-Z	3.38	0.45	55.6	81	250	5.4
5	TXD2S❍-2M-5V	TXD2S❍-2M-5V-Z	3.75	0.5	50.0	100	250	6
6	TXD2S❍-2M-6	TXD2S❍-2M-6V-Z	4.5	0.6	41.7	144	250	7.2
9	TXD2S❍-2M-9	TXD2S❍-2M-9V-Z	6.75	0.9	27.8	324	250	10.8
12	TXD2S❍-2M-12	TXD2S❍-2M-12V-Z	9	1.2	20.8	576	250	14.4
24	TXD2S❍-2M-24	TXD2S❍-2M-24V-Z	18	2.4	11.3	2,133	270	28.8

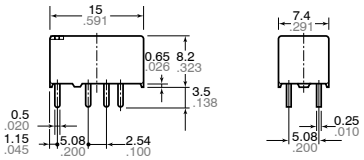
❍: For each surface-mounted terminal variation, input the following letter.
SA type: A , SL type: L , SS type: S
Standard packing: 40 pcs. (tube), 500 pcs. (tape and reel) in an inner package; 1,000 pcs. in an outer package
Notes:
1. Tape and reel packing symbol “-Z” is not marked on the relay. “X” type tape and reel packing (picked from 1/3/4/5-pin side) is also available.
2. In case of 5 V transistor drive circuit, it is recommended to use 4.5 V type relay.

DIMENSIONS

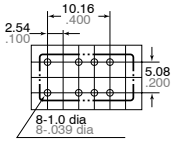
mm inch

1. Standard PC board terminal and self-clinching terminal

Standard PC board terminal



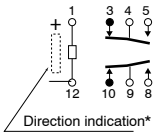
PC board pattern (Copper side view)



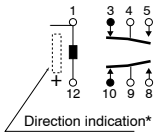
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

Single side stable (Deenergized condition)

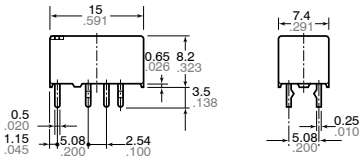


1 coil latching (Reset condition)



*Orientation stride located on top of relay.

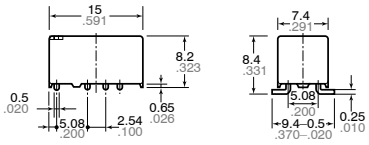
Self clinching terminal



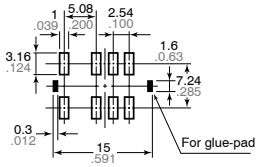
General tolerance: ±0.3 ±.012

2. Surface-mount terminal

SA type

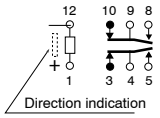


Suggested mounting pad (Top view)

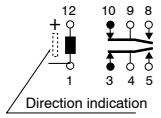


Schematic (Top view)

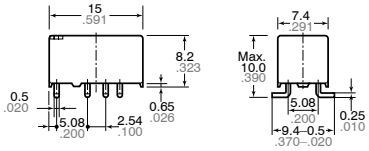
Single side stable (Deenergized condition)

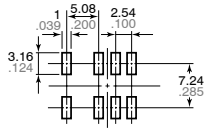


1 coil latching (Reset condition)

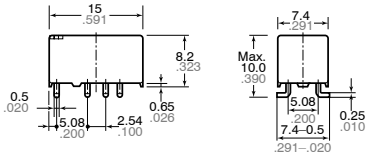


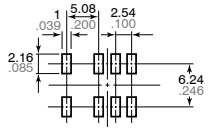
SL type





SS type



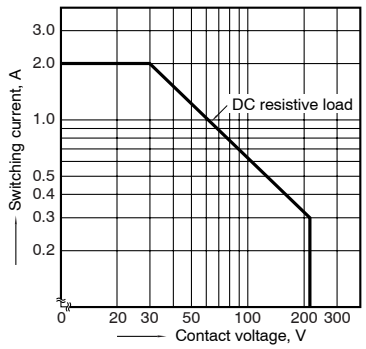


General tolerance: ±0.3 ±.012

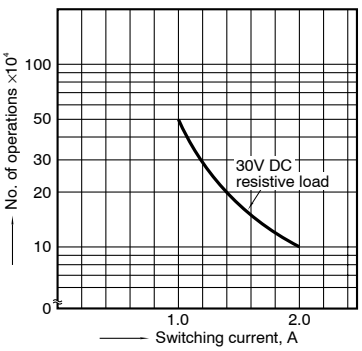
Tolerance: ±0.1 ±.004

REFERENCE DATA

1. Maximum switching capacity

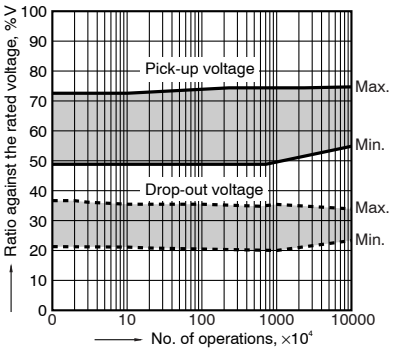


2. Life curve



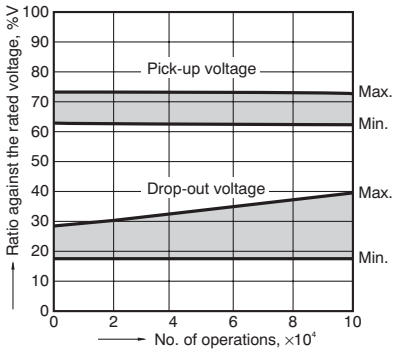
3. Mechanical life

Tested sample: TXD2-5V, 10 pcs.
Operating frequency: 180 cpm

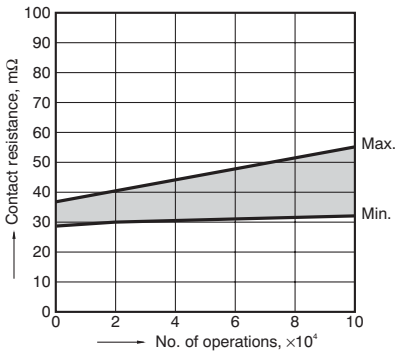


4. Electrical life (2 A 30 V DC resistive load)
Tested sample: TXD2-5V, 6 pcs.
Operating frequency: 20 cpm

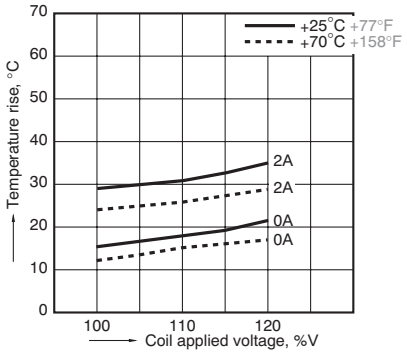
Change of pick-up and drop-out voltage



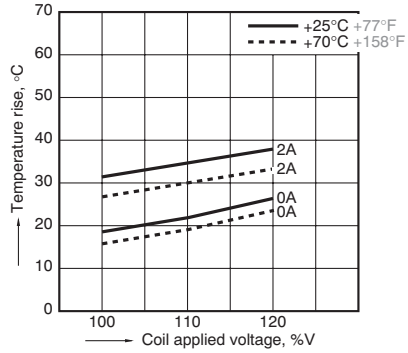
Change of contact resistance



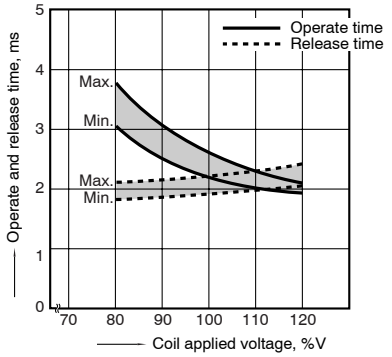
5-(1). Coil temperature rise
Tested sample: TXD2-5V, 6 pcs.
Measured portion: Inside the coil
Ambient temperature: 25°C 77°F, 70°C 158°F



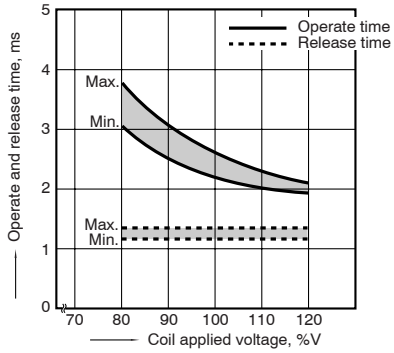
5-(2). Coil temperature rise
Tested sample: TXD2-24V, 6 pcs.
Measured portion: Inside the coil
Ambient temperature: 25°C 77°F, 70°C 158°F



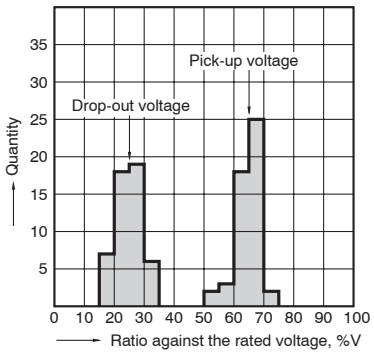
6-(1). Operate/release time characteristics (with diode)
Tested sample: TXD2-5V, 10 pcs.



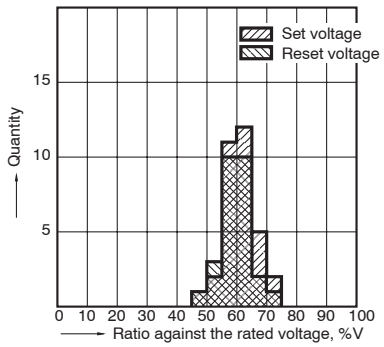
6-(2). Operate/release time characteristics (without diode)
Tested sample: TXD2-5V, 10 pcs.



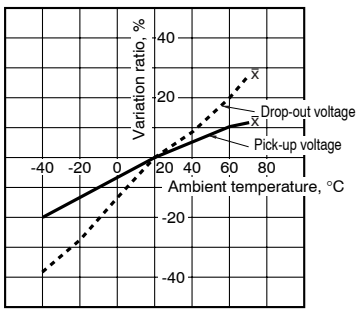
7. Distribution of pick-up and drop-out voltage
Tested sample: TXD2-5V, 50 pcs.



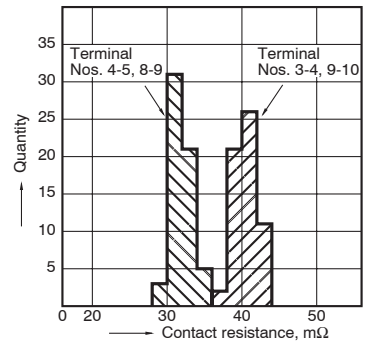
8. Distribution of set and reset voltage
Tested sample: TXD2-L-12V, 30 pcs.



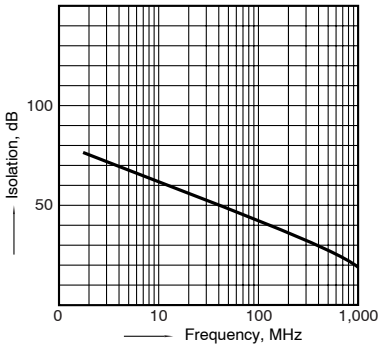
9. Ambient temperature characteristics
Tested sample: TXD2-5V, 5 pcs.



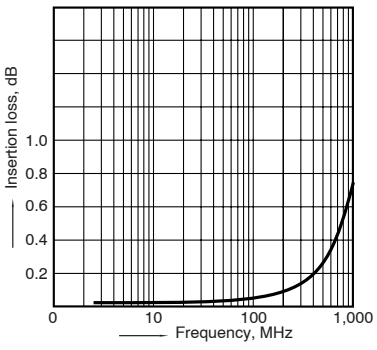
10. Distribution of contact resistance
Tested sample: TXD2-5V, 30 pcs. (30 × 4 contacts)



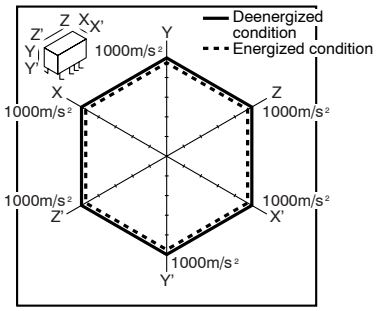
11-(1). High-frequency characteristics
Isolation characteristics
Tested sample: TXD2-12V, 2 pcs.



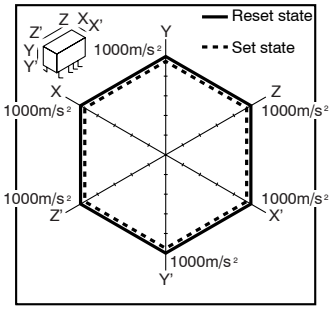
11-(2). High-frequency characteristics
Insertion loss characteristics
Tested sample: TXD2-12V, 2 pcs.



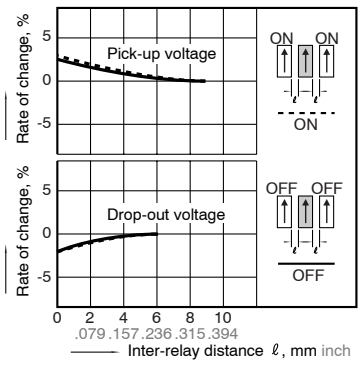
12-(1). Malfunctional shock (single side stable)
Tested sample: TXD2-5V, 6 pcs



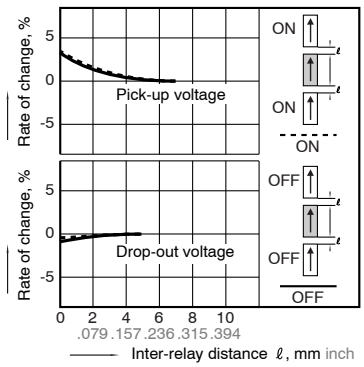
12-(2). Malfunctional shock (latching)
Tested sample: TXD2-L-12V, 6 pcs.



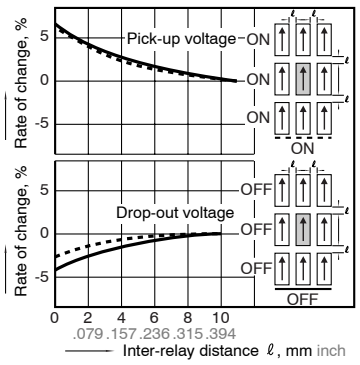
13-(1). Influence of adjacent mounting
Tested sample: TXD2-12V, 6 pcs.



13-(2). Influence of adjacent mounting
Tested sample: TXD2-12V, 6 pcs.

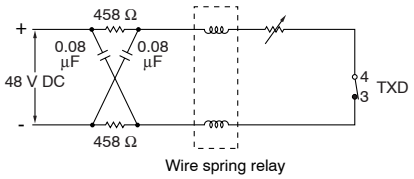


13-(3). Influence of adjacent mounting
Tested sample: TXD2-12V, 6 pcs.

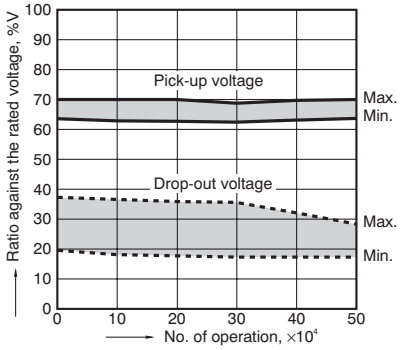


14. Actual load test (35 mA 48 V DC wire spring relay load)
Tested sample: TXD2-5V, 6 pcs.

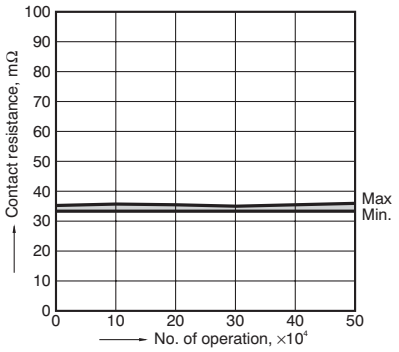
Circuit



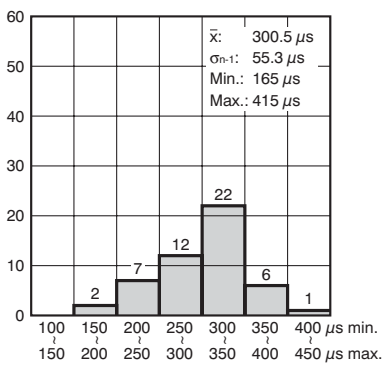
Change of pick-up and drop-out voltage



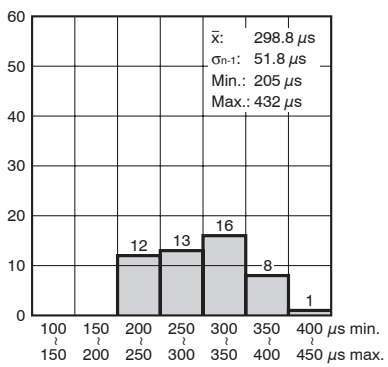
Change of contact resistance



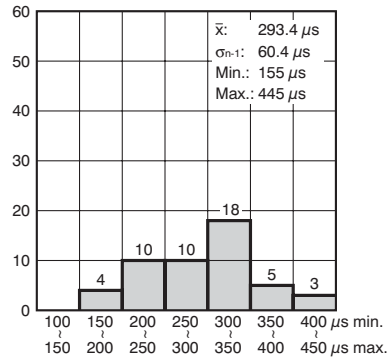
15-(1). Distribution of M.B.B. time
Tested sample: TXD2-2M-5V, 50 pcs.
Terminal No. 3-4-5: ON



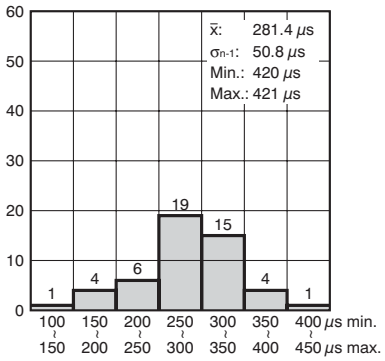
Terminal No. 3-4-5: OFF



15-(2). Distribution of M.B.B. time
Tested sample: TXD2-2M-5V, 50 pcs.
Terminal No. 8-9-10: ON



Terminal No. 8-9-10: OFF

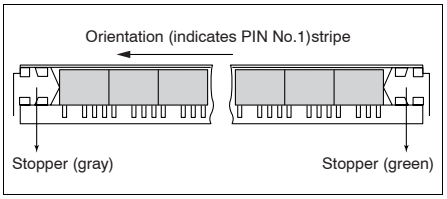


Signal

NOTES

1. Packing style

1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.

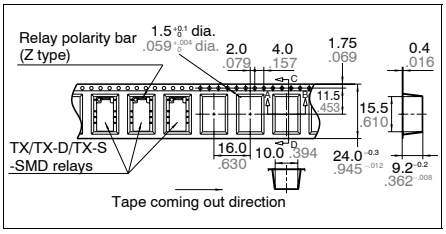


2) Tape and reel packing (surface-mount terminal type)

(1) Tape dimensions

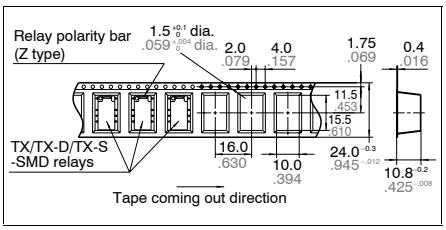
(i) SA type

mm inch



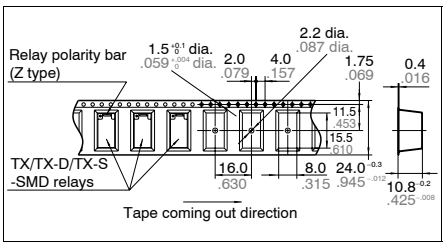
(ii) SL type

mm inch



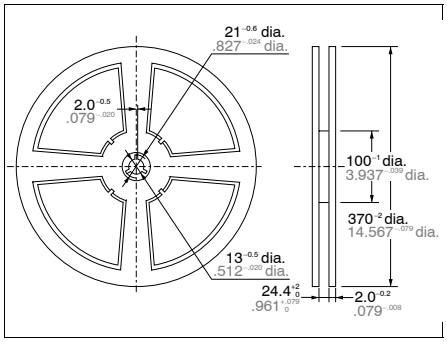
(iii) SS type

mm inch



(2) Dimensions of plastic reel

mm inch

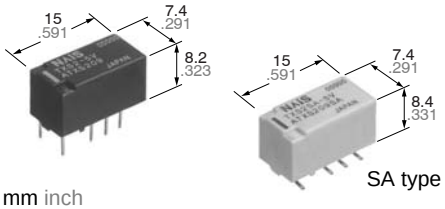


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

SMALL POLARIZED RELAY WITH HIGH SENSITIVITY 50mW

TX-S RELAYS



mm inch

SA type

FEATURES

High sensitivity

• 50mW nominal operating power (single side stable 1.5-12V)

• Useful for electric-power-saving

Approx. 0.3μV low thermal electromotive force

Outstanding surge resistance

Surge withstand between open contacts:
1,500V 10×160μs (FCC part 68)

Surge withstand between contacts and coil:
2,500V 2×10μs (Telcordia)

SPECIFICATIONS

Contact

Arrangement			2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			100 mΩ
Contact material			Gold-clad silver alloy
Rating	Nominal switching capacity (resistive load)		1 A 30 V DC
	Max. switching power (resistive load)		30 W (DC)
	Max. switching voltage		110 V DC
	Max. switching current		1 A
	Min. switching capacity ※1		10 μA 10 mV DC
Nominal operating power	Single side stable		50 mW (1.5 to 12 V DC) 70 mW (24 V DC)
	1 coil latching		35 mW (1.5 to 12 V DC) 50 mW (24 V DC)
	2 coil latching		70 mW (1.5 to 12 V DC) 150 mW (24 V DC)
Expected life (min. operations)	Mechanical (at 180 cpm)		5×10^7
	Electrical (at 20 cpm)	1 A 30 V DC resistive	2×10^5

Note:

※1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load. (SX relays are available for low level load switching [10 μA 1 mV DC – 10 mA 10 V DC])

Remarks

* Specifications will vary with foreign standards certification ratings.

*1 Measurement at same location as "Initial breakdown voltage" section.

*2 Detection current: 10mA

*3 Excluding contact bounce time.

*4 By resistive method; nominal voltage applied to the coil; contact carrying current: 1 A.

Characteristics

Initial insulation resistance*1		Min. 1,000 MW (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	750 Vrms for 1min.
	Between contact sets	1,000 Vrms for 1min.
	Between contacts and coil	1,800 Vrms for 1min.
Initial surge voltage	Between open contacts (10 × 160μs)	1,500V (FCC Part 68)
	Between contacts and coil (2 × 10 μs)	2,500V (Telcordia)
Operate time [Set time]*3 (at 20°C)(at nominal voltage)		Max. 5 ms (Approx. 3 ms) [Max. 5 ms (Approx. 3 ms)]
Release time (without diode) [Reset time]*3 (at 20°C)(at nominal voltage)		Max. 5 ms (Approx. 1.5 ms) [Max. 5 ms (Approx. 3 ms)]
Temperature rise*4 (at 20°C)		Max. 50°C
Shock resistance	Functional*5	Min. 750 m/s² {75 G}
	Destructive*6	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 3.3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temperature	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 2 g .071 oz

*5 Half-wave pulse of sine wave: 6 ms; detection time: 10 μs

*6 Half-wave pulse of sine wave: 6 ms

*7 Detection time: 10 μs

*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

TYPICAL APPLICATIONS

- **Communications (XDSL, Transmission)**
- **Measurement**
- **Security**
- **Home appliances, and audio/visual equipment**
- **Automotive equipment**
- **Medical equipment**

ORDERING INFORMATION

Ex. TXS [2] [SA] — [L] — [H] — [3V] — [Z]

Contact arrangement	Surface-mount availability	Operating function	Terminal shape	Coil voltage (DC)	Packing style
2: 2 Form C	Nil: Standard PC board terminal type or self-clinching terminal type SA: Standard surface-mount terminal type SL: High connection reliability surface-mount terminal type SS: Space saving surface-mount terminal type	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	Nil: Standard PC board terminal or surface-mount terminal H: Self-clinching terminal	1.5, 3, 4.5, 6, 9, 12, 24 V	Nil: Tube packing Z: Tape and reel packing(piked from the 8/9/10/12 -pin side

Notes: 1. Tape and reel (picked from 1/3/4/5-pin side) is also available by request. Part number suffix □-X□ is needed when ordering. (ex.) TXS2SA-3 V-X

2. Tape and reel packing symbol "-Z" or "-X" are not marked on the relay.

TYPES AND COIL DATA (at 20°C 68°F)

1) Standard PC board terminal type and self-clinching terminal type

Single side stable

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. Allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TXS2-1.5V	TXS2-H-1.5V	1.5	1.2	0.15	33.3	45	50	2.2
TXS2-3V	TXS2-H-3V	3	2.4	0.3	16.7	180	50	4.5
TXS2-4.5V	TXS2-H-4.5V	4.5	3.6	0.45	11.1	405	50	6.7
TXS2-6V	TXS2-H-6V	6	4.8	0.6	8.3	720	50	9
TXS2-9V	TXS2-H-9V	9	7.2	0.9	5.6	1,620	50	13.5
TXS2-12V	TXS2-H-12V	12	9.6	1.2	4.2	2,880	50	18
TXS2-24V	TXS2-H-24V	24	19.2	2.4	2.9	8,229	70	36

1 coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (Max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. Allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TXS2-L-1.5V	TXS2-L-H-1.5V	1.5	1.2	1.2	23.3	64.3	35	2.2
TXS2-L-3V	TXS2-L-H-3V	3	2.4	2.4	11.7	257	35	4.5
TXS2-L-4.5V	TXS2-L-H-4.5V	4.5	3.6	3.6	7.8	579	35	6.7
TXS2-L-6V	TXS2-L-H-6V	6	4.8	4.8	5.8	1,029	35	9
TXS2-L-9V	TXS2-L-H-9V	9	7.2	7.2	3.9	2,314	35	13.5
TXS2-L-12V	TXS2-L-H-12V	12	9.6	9.6	2.9	4,114	35	18
TXS2-L-24V	TXS2-L-H-24V	24	19.2	19.2	2.1	11,520	50	36

2 coil latching

Part No.		Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (Max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. Allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
TXS2-L2-1.5V	TXS2-L2-H-1.5V	1.5	1.2	1.2	46.7	32.1	70	2.2
TXS2-L2-3V	TXS2-L2-H-3V	3	2.4	2.4	23.3	129	70	4.5
TXS2-L2-4.5V	TXS2-L2-H-4.5V	4.5	3.6	3.6	15.6	289	70	6.7
TXS2-L2-6V	TXS2-L2-H-6V	6	4.8	4.8	11.7	514	70	9
TXS2-L2-9V	TXS2-L2-H-9V	9	7.2	7.2	7.8	1,157	70	13.5
TXS2-L2-12V	TXS2-L2-H-12V	12	9.6	9.6	5.8	2,057	70	18
TXS2-L2-24V	TXS2-L2-H-24V	24	19.2	19.2	6.3	3,840	150	36

Notes:
1. Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 40 pcs.; Case: 1,000 pcs.

2) Surface-mount terminal type

Single side stable

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. Allowable voltage, V DC
TXS2S❍-1.5 V	1.5	1.2	0.15	33.3	45	50	2.2
TXS2S❍-3 V	3	2.4	0.3	16.7	180	50	4.5
TXS2S❍-4.5 V	4.5	3.6	0.45	11.1	405	50	6.7
TXS2S❍-6 V	6	4.8	0.6	8.3	720	50	9
TXS2S❍-9 V	9	7.2	0.9	5.6	1,620	50	13.5
TXS2S❍-12 V	12	9.6	1.2	4.2	2,880	50	18
TXS2S❍-24 V	24	19.2	2.4	2.9	8,229	70	36

1 coil latching

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. Allowable voltage, V DC
TXS2S❍-L-1.5 V	1.5	1.2	1.2	23.3	64.3	35	2.2
TXS2S❍-L-3 V	3	2.4	2.4	11.7	257	35	4.5
TXS2S❍-L-4.5 V	4.5	3.6	3.6	7.8	579	35	6.7
TXS2S❍-L-6 V	6	4.8	4.8	5.8	1,029	35	9
TXS2S❍-L-9 V	9	7.2	7.2	3.9	2,314	35	13.5
TXS2S❍-L-12 V	12	9.6	9.6	2.9	4,114	35	18
TXS2S❍-L-24 V	24	19.2	19.2	2.1	11,520	50	36

2 coil latching

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. Allowable voltage, V DC
TXS2S❍-L2-1.5 V	1.5	1.2	1.2	46.7	32.1	70	2.2
TXS2S❍-L2-3 V	3	2.4	2.4	23.3	129	70	4.5
TXS2S❍-L2-4.5 V	4.5	3.6	3.6	15.6	289	70	6.7
TXS2S❍-L2-6 V	6	4.8	4.8	11.7	514	70	9
TXS2S❍-L2-9 V	9	7.2	7.2	7.8	1,157	70	13.5
TXS2S❍-L2-12 V	12	9.6	9.6	5.8	2,057	70	18
TXS2S❍-L2-24 V	24	19.2	19.2	6.3	3,840	150	36

❍: For each surface-mounted terminal variation, input the following letter.
SA type: A, SL type: L, SS type: S

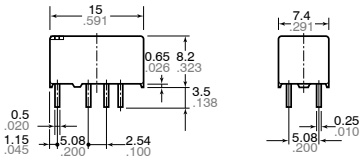
Notes:
1. Specified value of pick-up, drop-out, set and reset voltage is with the condition of square wave coil pulse.
2. Standard packing: Tube: 40 pcs. ; Case: 1,000 pcs.
3. Tape and reel packing is also available for surface-mount type by request. Part number suffix "-X" or "-Z" is needed when ordering.
In this case, "X" or "Z" are not marked on the relay.
Quantity in tape and reel: 500 pcs.
(ex.) • TXS2SA-3V-X
└Picked from the 1/3/4/5-pin side
• TXS2SA-L-3V-Z
└Picked from the 8/9/10/12-pin side

DIMENSIONS

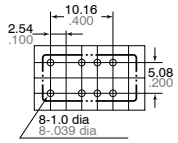
mm inch

1. Single side stable and 1 coil latching type

Standard PC board terminal



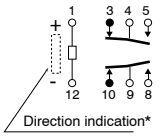
PC board pattern (Copper-side view)



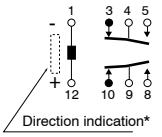
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

Single side stable (Deenergized condition)

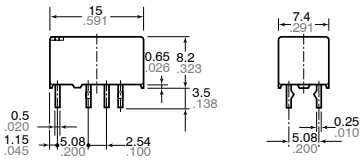


1 coil latching (Reset condition)



*Orientation stripe located on top of relay.

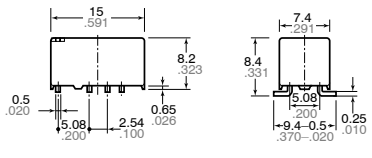
Self clinching terminal



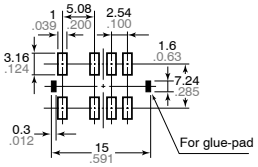
General tolerance: ±0.3 ±.012

Surface-mount terminal
SA type

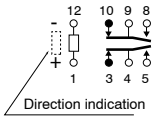
mm inch



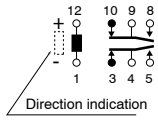
Suggested mounting pad
(Top view)



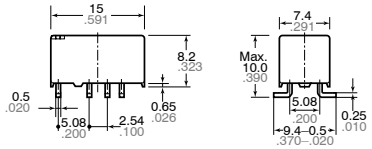
Schematic (Top view)
Single side stable
(Deenergized condition)

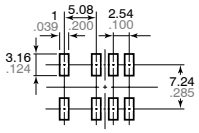


1 coil latching
(Reset condition)

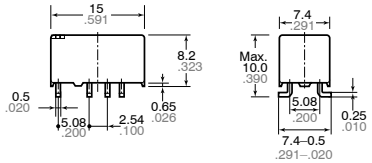


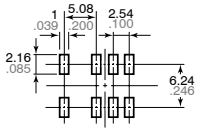
SL type





SS type

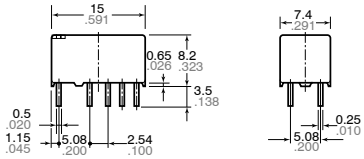




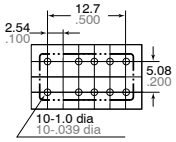
General tolerance: ±0.3 ±.012

Tolerance: ±0.1 ±.004

2. Coil latching type
Standard PC board terminal

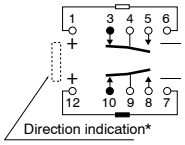


PC board pattern
(Copper side view)

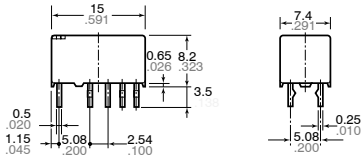


Tolerance: ±0.1 ±.004

Schematic (Bottom view)
2 coil latching
(Reset condition)



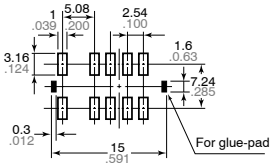
Self clinching terminal



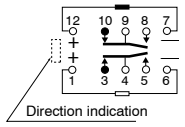
General tolerance: ±0.3 ±.012

Surface-mount terminal
SA type

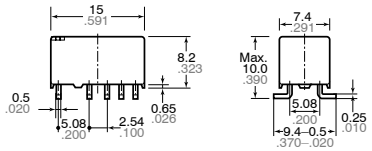
Suggested mounting pad
(Top view)

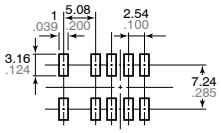


Schematic (Top view)
2 coil latching
(Reset condition)

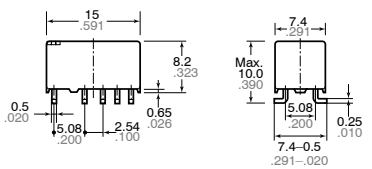


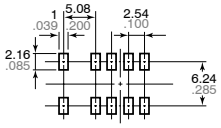
SL type





SS type



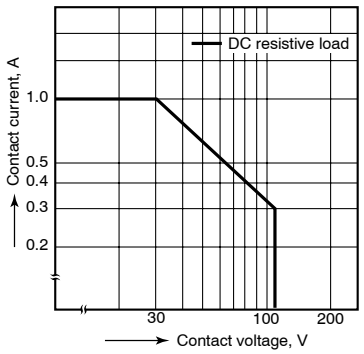


General tolerance: ±0.3 ±.012

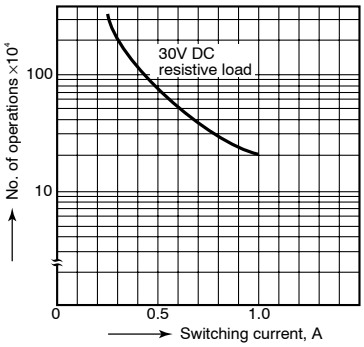
Tolerance: ±0.1 ±.004

REFERENCE DATA

1. Maximum switching capacity

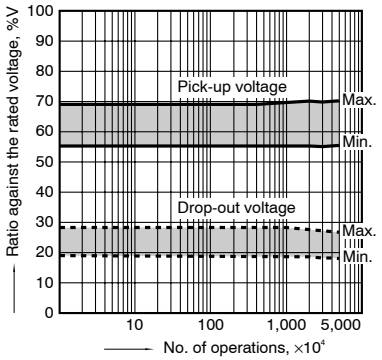


2. Life curve



3. Mechanical life

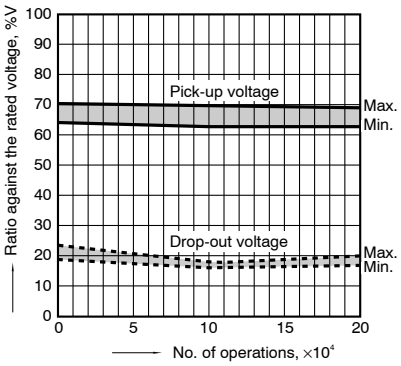
Tested sample: TXS2-4.5V, 10 pcs.
Operating frequency: 180 cpm



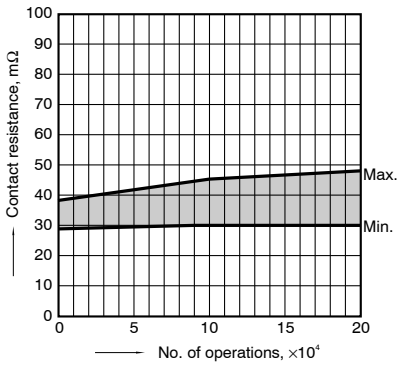
4. Electrical life (1 A 30 V DC resistive load)

Tested sample: TXS2-4.5V, 6 pcs.
Operating frequency: 20 cpm

Change of pick-up and drop-out voltage

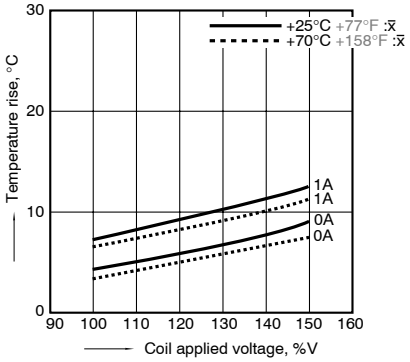


Change of contact resistance



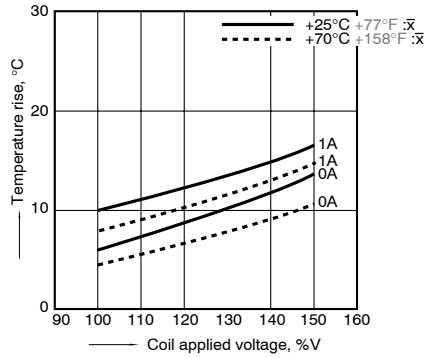
5-(1). Coil temperature rise

Tested sample: TXS2-4.5V, 6 pcs.
Point measured: Inside the coil
Ambient temperature: 25°C 77°F, 70°C 158°F



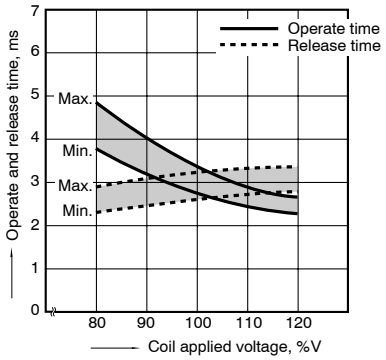
5-(2). Coil temperature rise

Tested sample: TXS2-24V, 6 pcs.
Point measured: Inside the coil
Ambient temperature: 25°C 77°F, 70°C 158°F



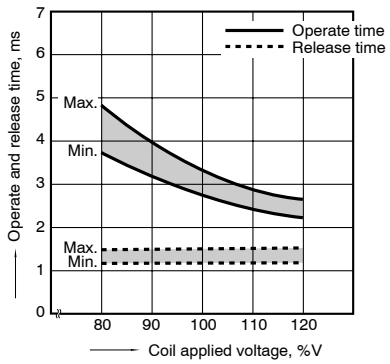
6-(1). Operate and release time (with diode)

Tested sample: TXS2-4.5V, 10 pcs.



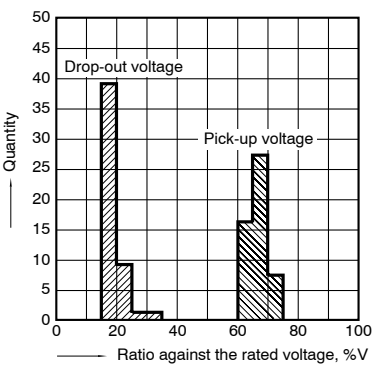
6-(2). Operate and release time (without diode)

Tested sample: TXS2-4.5V, 10 pcs.



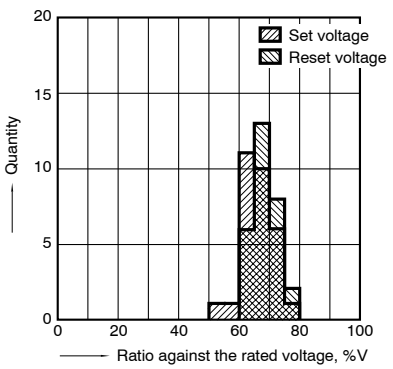
7. Distribution of pick-up and drop-out voltage

Tested sample: TXS2-4.5V, 50 pcs.



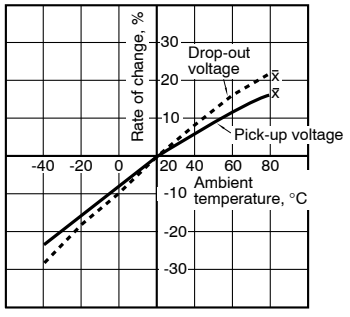
8. Distribution of set and reset voltage

Tested sample: TXS2-4.5V 30 pcs.

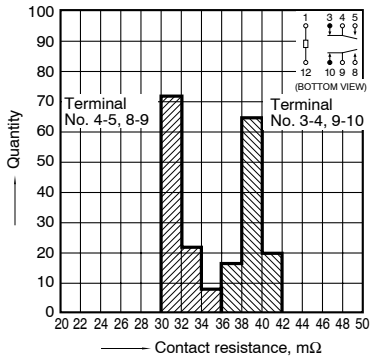


9. Ambient temperature characteristics

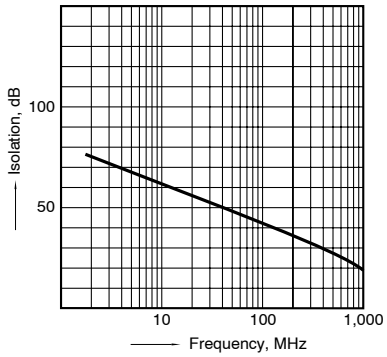
Tested sample: TXS2-4.5V 5 pcs.



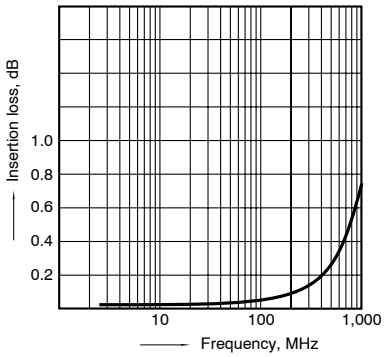
10. Distribution of contact resistance
Tested sample: TXS2-4.5V, 50 pcs. (50x4 contacts)



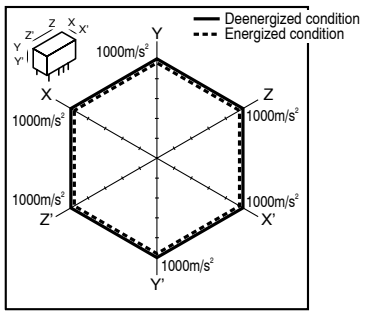
11-(1). High frequency characteristics
Tested sample: TXS2-4.5V, 2 pcs.
Isolation characteristics



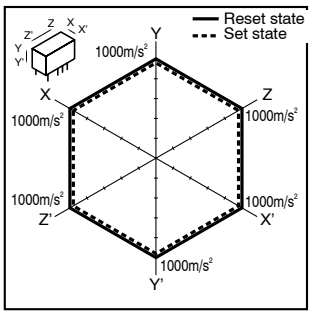
11-(2). High frequency characteristics
Tested sample: TXS2-4.5V, 2 pcs.
Insertion loss characteristics



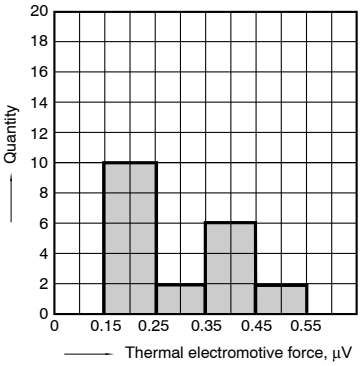
12-(1). Malfunctional shock (single side stable)
Tested sample: TXS2-4.5V, 6 pcs.



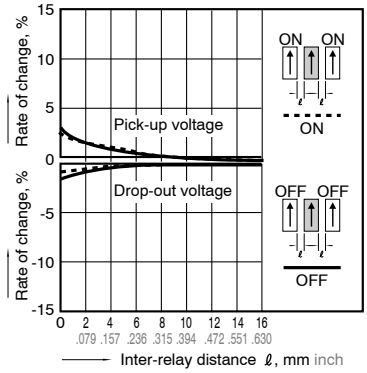
12-(2). Malfunctional shock (latching)
Tested sample: TXS2-L2-4.5V, 6 pcs.



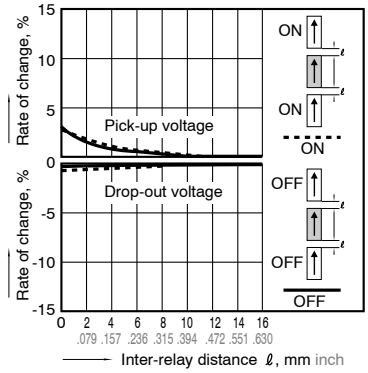
13. Thermal electromotive force
Tested sample: TXS2-4.5V, 10 pcs.



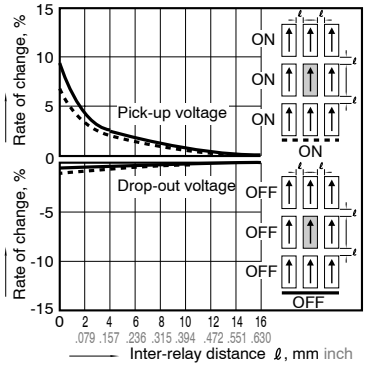
14-(1). Influence of adjacent mounting
Tested sample: TXS2-4.5V, 6 pcs.



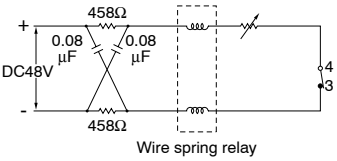
14-(2). Influence of adjacent mounting
Tested sample: TXS2-4.5V, 6 pcs.



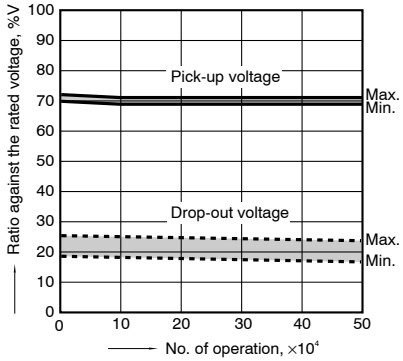
14-(3). Influence of adjacent mounting
Tested sample: TXS2-4.5V, 6 pcs.



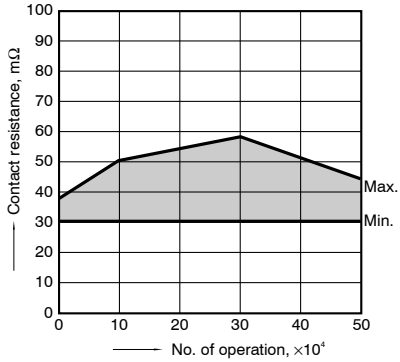
15. Pulse dialing test
Tested sample: TXS2-4.5V, 6 pcs.
(35 mA 48V DC wire spring relay load)



Change of pick-up and drop-out voltage



Change of contact resistance

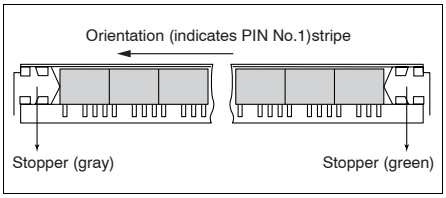


Note: Data of surface-mount type are the same as those of PC board terminal type.

NOTES

1. Packing style

1) The relay is packed in a tube with the relay orientation mark on the left side, as shown in the figure below.

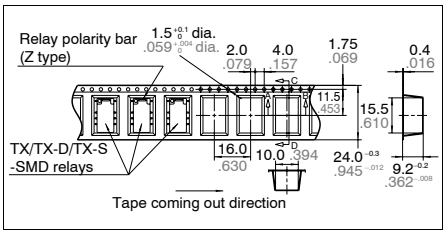


2) Tape and reel packing (surface-mount terminal type)

(1) Tape dimensions

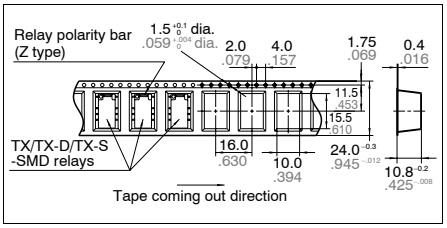
(i) SA type

mm inch



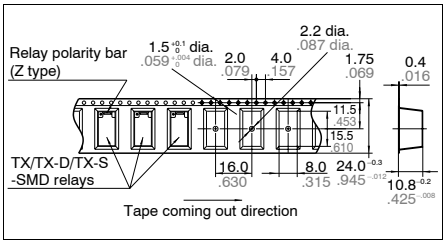
(ii) SL type

mm inch



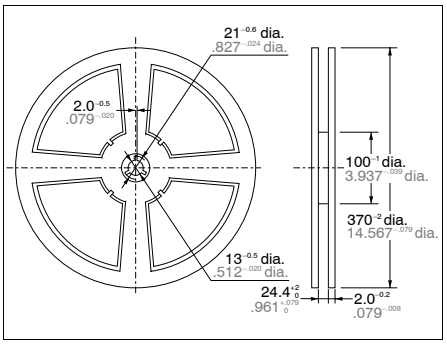
(iii) SS type

mm inch



(2) Dimensions of plastic reel

mm inch



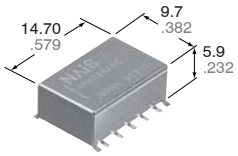
For Cautions for Use, see Relay Technical Information (page 390).

High-Frequency Relays

Panasonic
ideas for life

2.6 GHz SMALL MICROWAVE RELAYS

RA RELAYS (ARA)



mm inch

FEATURES

1. High frequency characteristics (Impedance 50Ω, ~1.0GHz)

- Insertion loss; Max. 0.3dB
- Isolation; Min. 20dB (Between open contacts)
  Min. 30dB (Between contact sets)
- V.S.W.R.; Max. 1.2

2. Surface mount terminal

This relay is a surface-mounted model with excellent high-frequency properties. In addition, it can use a microstrip line in the base circuit design which spares the labor of machining the base.

3. Low profile small type

9.7(W)×14.7(L)×5.9(H) mm
.382(W)×.579(L)×.232(H) inch

4. High sensitivity: 140 mW nominal operating power

5. High contact reliability

Electrical life: Min. 10^7 (10mA 10V DC)

TYPICAL APPLICATIONS

- **Measurement instruments**
  Oscilloscope attenuator circuit

SPECIFICATIONS

Contact

Arrangement			2 Form C
Contact material			Gold-clad silver alloy
Initial contact resistance			Max. 75mΩ
Rating	Contact rating (resistive)		10mA 10 V DC 1A 30 V DC
	Contact carrying power		Max. 3W (at 1.0GHz, impedance 50Ω, V.S.W.R. max.1.2)
	Max. switching voltage		30 V DC
	Max. switching current		1A
High frequency characteristics (~1GHz, Impedance 50Ω)	Isolation	Between open contacts	Min. 20dB
		Between contact sets	Min. 30dB
	Insertion loss		Max. 0.3dB
	V.S.W.R.		Max. 1.2
	Input power		Max. 3W (at 1.0GHz, impedance 50Ω, V.S.W.R. max.1.2)
Nominal operating power	Single side stable		140mW (1.5 to 12V) 200mW (24V) 300mW (48V)
	1 coil latching		70 mW (1.5 to 12V) 100mW (24V)
	2 coil latching		140mW (1.5 to 12V) 200mW (24V)
Expected life (min. operation)	Mechanical (at 180 cpm)		10^8
	Electrical (at 20 cpm)	10mA 10 V DC (resistive load)	10^7
		1A 30 V DC (resistive load)	10^5

Characteristics

Initial insulation resistance *1		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage *2	Between open contacts	750 Vrms for 1 min.
	Between contact sets	1,000 Vrms for 1 min.
	Between contact and coil	1,000 Vrms for 1 min.
	Between contact and earth terminal	1,000 Vrms for 1 min.
Operate time [Set time] *3 (at 20°C)		Max. 4ms (Approx. 2ms) [Max. 4ms (Approx. 2ms)]
Release time (without diode) [Reset time] *3 (at 20°C)		Max. 4ms (Approx. 1ms) [Max. 4ms (Approx. 2ms)]
Temperature rise (at 20°C) *4		Max. 60°C
Shock resistance	Functional *5	Min. 500 m/s²
	Destructive *6	Min. 1,000 m/s²
Vibration resistance	Functional *7	10 to 55 Hz at double amplitude of 3mm
	Destructive	10 to 55 Hz at double amplitude of 5mm
Conditions for operation, transport and storage *8 (Not freezing and condensing at low temperature)	Ambient temp	–40°C to +85°C –40°F to +185°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 2g .07oz

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Nominal operating voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil: 3W contact carrying power: at 1.0GHz, Impedance 50Ω, V.S.W.R. Max.1.2
*5 Half-wave pulse of sine wave: 11ms, detection time: 10μs.
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

ORDERING INFORMATION

Ex. A | RA | 2 | 0 | 0 | A | 03 | [ ]

Product name	Contact arrangement	Operating function	Type of operation	Terminal shape	Coil voltage, V DC	Packing style
RA	2: 2 Form C	0: Single side stable 1: 1 coil latching 2: 2 coil latching	0: Standard type (B.B.M)	A: Surface-mount terminal	1H: 1.5 09: 9 03: 3 12: 12 4H: 4.5 24: 24 05: 5 48: 48 06: 6	Nil: Tube packing X: Tape and reel packing (picked from 1/2/3 pin side) Z: Tape and reel packing (picked from 8/9/10 pin side)

Note: Packing style; Nil: Tube packing 40 pcs. in an inner package, 1,000 pcs. in an outer package
Z: Tape and reel packing 500 pcs. in an inner package, 1,000 pcs. in an outer package

TYPES ANE COIL DATA (at 20°C 68°F)

• Single side stable type

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
ARA200A1H(Z)	1.5	1.125	0.15	16	93.8	140	2.25
ARA200A03(Z)	3	2.25	0.3	64.3	46.7	140	4.5
ARA200A4H(Z)	4.5	3.375	0.45	145	31	140	6.75
ARA200A05(Z)	5	3.75	0.5	178	28.1	140	7.5
ARA200A06(Z)	6	4.5	0.6	257	23.3	140	9
ARA200A09(Z)	9	6.75	0.9	579	15.5	140	13.5
ARA200A12(Z)	12	9	1.2	1,028	11.7	140	18
ARA200A24(Z)	24	18	2.4	2,880	8.3	200	36
ARA200A48(Z)	48	36	4.8	7,680	6.3	300	57.6

• 1 coil latching type

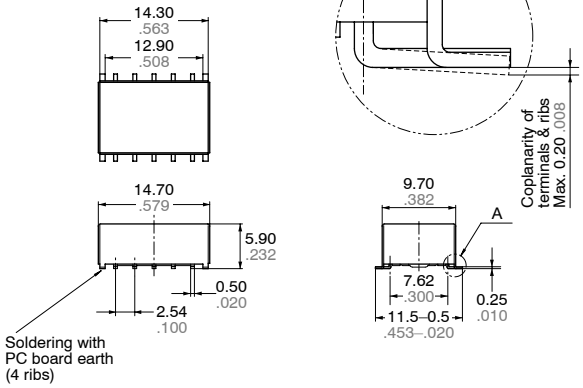
Part No.	Nominal voltage, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
ARA210A1H(Z)	1.5	1.125	1.125	32	46.9	70	2.25
ARA210A03(Z)	3	2.25	2.25	128.6	23.3	70	4.5
ARA210A4H(Z)	4.5	3.375	3.375	289.3	15.6	70	6.75
ARA210A05(Z)	5	3.75	3.75	357	14	70	7.5
ARA210A06(Z)	6	4.5	4.5	514	11.7	70	9
ARA210A09(Z)	9	6.75	6.75	1,157	7.8	70	13.5
ARA210A12(Z)	12	9	9	2,057	5.8	70	18
ARA210A24(Z)	24	18	18	5,760	4.2	100	36

• 2 coil latching type

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
ARA220A1H(Z)	1.5	1.125	1.125	16	93.8	140	2.25
ARA220A03(Z)	3	2.25	2.25	64.3	46.7	140	4.5
ARA220A4H(Z)	4.5	3.375	3.375	145	31	140	6.75
ARA220A05(Z)	5	3.75	3.75	178	28.1	140	7.5
ARA220A06(Z)	6	4.5	4.5	257	23.3	140	9
ARA220A09(Z)	9	6.75	6.75	579	15.5	140	13.5
ARA220A12(Z)	12	9	9	1,028	11.7	140	18
ARA220A24(Z)	24	18	18	2,880	8.3	200	36

DIMENSIONS

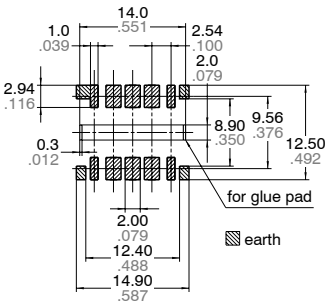
mm inch



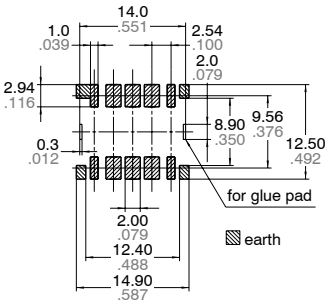
Tolerance: ±0.3 ±.012

Suggested Mounting Pads (Top view)

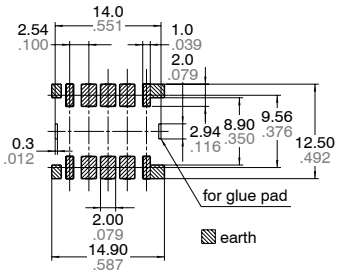
Single side stable



1 coil latching



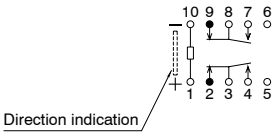
2 coil latching



Tolerance: ±0.1 ±.004

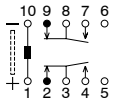
Schematic (Top view)

Single side stable



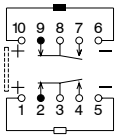
(Deenergized condition)

1 coil latching



(Reset condition)

2 coil latching



(Reset condition)

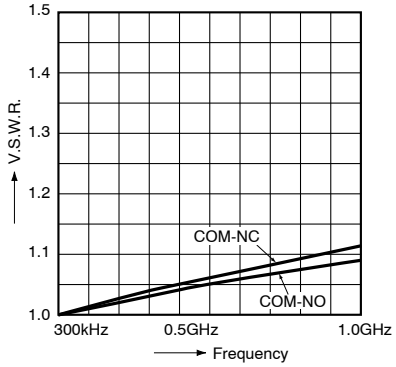
REFERENCE DATA

1-(1). High frequency characteristics (Impedance 50Ω)

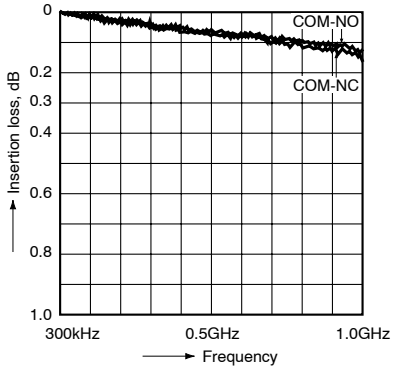
Sample: ARA200A12

Measuring method: Measured with HP network analyzer (HP8753C).

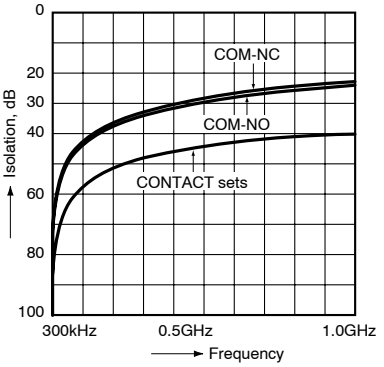
• V.S.W.R.



• Insertion loss

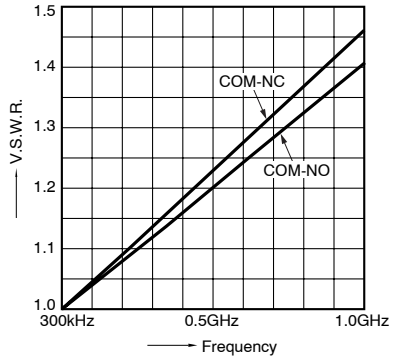


• Isolation

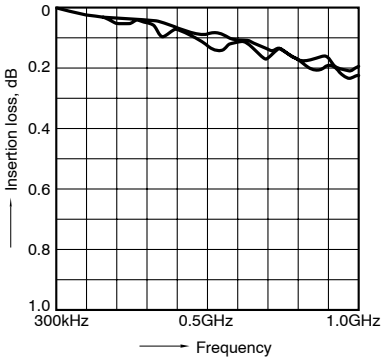


1-(2). High frequency characteristics (Impedance 75Ω)
Sample: ARA200A12
Measuring method: Measured with HP network analyzer (HP8753C).

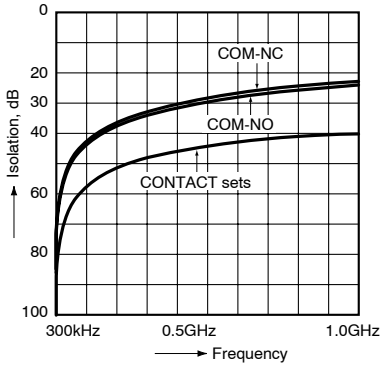
• V.S.W.R.



• Insertion loss



• Isolation



For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

26.5GHz, 18GHz COAXIAL SWITCH

RD COAXIAL SWITCHES (ARD)

FEATURES

1. Excellent high frequency characteristics (SPDT, transfer) up to 26.5 GHz.

2. SPDT, transfer and SPST type is available

3. High sensitivity
Nominal operating power:
840 mW (SPDT, Failsafe type)
1540 mW (Transfer, Failsafe type)

4. Long life: 5×10^6 (SPDT, transfer)

5. Latching type is also available

TYPICAL APPLICATIONS

Wireless and mobile communication
- Cellular phone base stations
- Amplifier switching

Digital broadcasting
- Broadcasting equipment

Measurement instruments
- All types of inspection equipment

SPECIFICATIONS

Contact

Arrangement		SPDT			Transfer			SPST
Contact material		Gold plating						
Initial contact resistance		Max. 100mΩ						
Rating	Contact input power*1	120W 3GHz (V.S.W.R. 1.15 or less, no contact switching, ambient temperature 40°C [SPDT], 25°C [Transfer])#1						120W 2.2GHz (V.S.W.R. 1.2 or less, no contact switching) 150W 2.2GHz (V.S.W.R. 1.2 or less, no contact switching when cooling fan is used)
Indicator rating	Contact rating	Max. 30V 100mA			Max. 5V 100mA			—
	Initial contact resistance (Measured by 5V 100mA)	Max. 1Ω						—
High frequency characteristics (Impedance 50Ω)		to 1 GHz	1 to 4	4 to 8	8 to12.4	12.4 to 18	18 to 26.5#2	—
	V.S.W.R. (max.)	1.1	1.15	1.25	1.35	1.5	1.7	See “REFERENCE DATA”
	Insertion loss (dB, max.)	0.2		0.3	0.4	0.5	0.8	
	Isolation (dB, min.)	85	80	70	65	60	55	
Expected life (min. operation)	Mechanical (at 180 cpm)	5×10^6						10^4
	Electrical (at 20 cpm)	5×10^6 (5W, to 3GHz, impedance 50Ω, V.S.W.R.; max. 1.2)						10^4 (80W, to 2.2GHz, impedance 50Ω, V.S.W.R.; max. 1.2, ambient temperature; max. 40°C 104°F)

#1 Factors such as heating of the connected connector influence the high frequency characteristics; therefore, please verify under actual conditions of use.
#2 18 to 26.5 GHz characteristics apply to the 26.5 GHz type only.

Characteristics

			SPDT	Transfer	SPST
Initial insulation resistance*2			Min. 1,000 MΩ (at 500 V DC)		
Initial breakdown voltage*3	Between open contacts		500 Vrms for 1 min.		
	Between contact and coil		500 Vrms for 1 min.		
	Between contact and earth terminal		500 Vrms for 1 min.		
	Between coil and earth terminal		500 Vrms for 1 min.		
Operate time*4 (at 20°C)			Max. 15ms	Max. 20ms	Max. 15ms
Shock resistance		Functional*5	Min. 500 m/s² {50G}		Min. 200 m/s² {20G}
		Destructive*6	Min. 1,000 m/s² {100G}		
Vibration resistance		Functional*7	10 to 55 Hz at double amplitude of 3mm		
		Destructive	10 to 55 Hz at double amplitude of 5mm		
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)		Ambient temp	–55°C to +85°C –67°F to +185°F		
		Humidity	5 to 85% R.H.		
Unit weight (Approx.)			50g 1.76oz	110g 3.88oz	20g .71oz

Remarks
*1 Please verify the usability of input power under actual conditions because heat generated from connectors can influence connection.
*2 Measurement at same location as “Initial breakdown voltage” section.
*3 Detection current: 10mA
*4 Nominal operating voltage applied to the coil, excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11ms, detection time: 10μs.
*6 Half-wave pulse of sine wave: 11ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

ORDERING INFORMATION

Ex. A RD □ □□ □□ □ □

Product name	Frequency	Operating function	Nominal operating voltage, V DC	Operation terminal	HF data attached (SPDT, Transfer)
RD	0: to 3GHz (SPST) 1: to 18GHz (SPDT) 2: to 18GHz (Transfer) 5: to 26.5GHz (SPDT) 6: to 26.5GHz (Transfer)	00: Failsafe 10: Latching (SPST) 20: Latching (SPDT, Transfer) 51: Latching with TTL driver (with self cut-off function) (SPDT, Transfer)	4H: 4.5V (Failsafe, Latching type only) 05: 5V (Latching with TTL driver type only) 12: 12V 24: 24V	Nil: Solder terminal (SPDT, Transfer), Lead wire (SPST) C: Connector cable (SPDT type only)	Nil: No HF test data attached Q: HF test data attached

Note: Sealed types are also available. (SPDT type only)

TYPES

1. SPDT

1) Solder terminal

Operating function	Nominal operating voltage, V DC	18GHz type		26.5GHz type	
		No HF datasheet attached	HF datasheet attached	No HF datasheet attached	HF datasheet attached
Failsafe	4.5	ARD1004H	ARD1004HQ	ARD5004H	ARD5004HQ
	12	ARD10012	ARD10012Q	ARD50012	ARD50012Q
	24	ARD10024	ARD10024Q	ARD50024	ARD50024Q
Latching	4.5	ARD1204H	ARD1204HQ	ARD5204H	ARD5204HQ
	12	ARD12012	ARD12012Q	ARD52012	ARD52012Q
	24	ARD12024	ARD12024Q	ARD52024	ARD52024Q
Latching with TTL driver (with self cut-off function)	5	ARD15105	ARD15105Q	ARD55105	ARD55105Q
	12	ARD15112	ARD15112Q	ARD55112	ARD55112Q
	24	ARD15124	ARD15124Q	ARD55124	ARD55124Q

Note: Standard packing; Carton: 1 pc. Case: 20 pcs.

2) Connector cable

Operating function	Nominal operating voltage, V DC	18GHz type		26.5GHz type	
		No HF datasheet attached	HF datasheet attached	No HF datasheet attached	HF datasheet attached
Failsafe	4.5	ARD1004HC	ARD1004HCQ	ARD5004HC	ARD5004HCQ
	12	ARD10012C	ARD10012CQ	ARD50012C	ARD50012CQ
	24	ARD10024C	ARD10024CQ	ARD50024C	ARD50024CQ
Latching	4.5	ARD1204HC	ARD1204HCQ	ARD5204HC	ARD5204HCQ
	12	ARD12012C	ARD12012CQ	ARD52012C	ARD52012CQ
	24	ARD12024C	ARD12024CQ	ARD52024C	ARD52024CQ
Latching with TTL driver (with self cut-off function)	5	ARD15105C	ARD15105CQ	ARD55105C	ARD55105CQ
	12	ARD15112C	ARD15112CQ	ARD55112C	ARD55112CQ
	24	ARD15124C	ARD15124CQ	ARD55124C	ARD55124CQ

Note: Standard packing; Carton: 1 pc. Case: 10 pcs.

2. Transfer

1) Solder terminal

Operating function	Nominal operating voltage, V DC	18GHz type		26.5GHz type	
		No HF datasheet attached	HF datasheet attached	No HF datasheet attached	HF datasheet attached
Failsafe	4.5	ARD2004H	ARD2004HQ	ARD6004H	ARD6004HQ
	12	ARD20012	ARD20012Q	ARD60012	ARD60012Q
	24	ARD20024	ARD20024Q	ARD60024	ARD60024Q
Latching	4.5	ARD2204H	ARD2204HQ	ARD6204H	ARD6204HQ
	12	ARD22012	ARD22012Q	ARD62012	ARD62012Q
	24	ARD22024	ARD22024Q	ARD62024	ARD62024Q
Latching with TTL driver (with self cut-off function)	5	ARD25105	ARD25105Q	ARD65105	ARD65105Q
	12	ARD25112	ARD25112Q	ARD65112	ARD65112Q
	24	ARD25124	ARD25124Q	ARD65124	ARD65124Q

Note: Standard packing; Carton: 1 pc. Case: 10 pcs.

3. SPST

Operating function	Nominal operating voltage, V DC	Part No.
Failsafe	4.5	ARD0004H
	12	ARD00012
	24	ARD00024
Latching	4.5	ARD0104H
	12	ARD01012
	24	ARD01024

Note: Standard packing; Carton: 1 pc. Case: 20 pcs.

COIL DATA (at 20°C 68°F)

1. SPDT

1) Failsafe type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%)	Nominal power consumption, mW
4.5	186.7	840
12	70.0	840
24	40.4	970

2) Latching type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%)	Nominal power consumption, mW
4.5	155.6	700
12	62.5	750
24	37.5	900

3) Latching with TTL driver type (with self cut-off function)

Nominal operating voltage, V DC	TTL logic level (see TTL logic level range)		Switching frequency
	ON	OFF	
5	2.4 to 5.5V	0 to 0.5V	Max. 180 cpm (ON time : OFF time = 1 : 1)
12			
24			

2. Transfer

1) Failsafe type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%)	Nominal power consumption, mW
4.5	342.2	1540
12	128.3	1540
24	69.6	1670

2) Latching type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%)	Nominal power consumption, mW
4.5	266.7	1200
12	104.2	1250
24	58.3	1400

3) Latching with TTL driver type (with self cut-off function)

Nominal operating voltage, V DC	TTL logic level (see TTL logic level range)		Switching frequency
	ON	OFF	
5	2.4 to 5.5V	0 to 0.5V	Max. 180 cpm (ON time : OFF time = 1 : 1)
12			
24			

3. SPST

1) Failsafe type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%)	Nominal power consumption, mW
4.5	400	1800
12	150	
24	75	

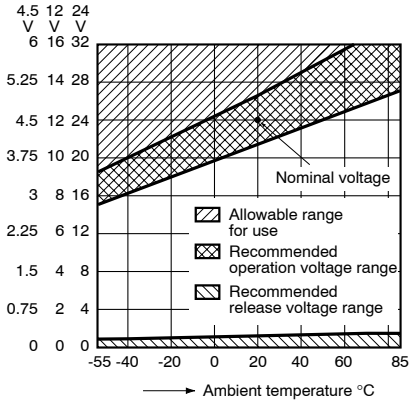
2) Latching type

Nominal operating voltage, V DC	Nominal operating current, mA (+10%/–15%)	Nominal power consumption, mW
4.5	400	1800
12	150	
24	75	

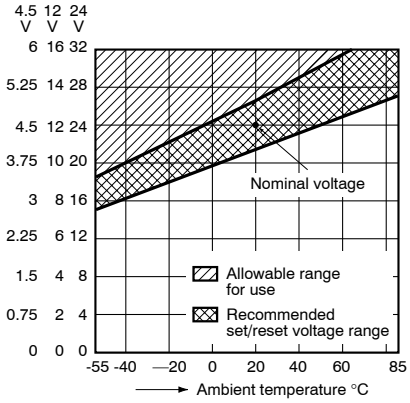
• Operating voltage range

(1) SPDT, Transfer type

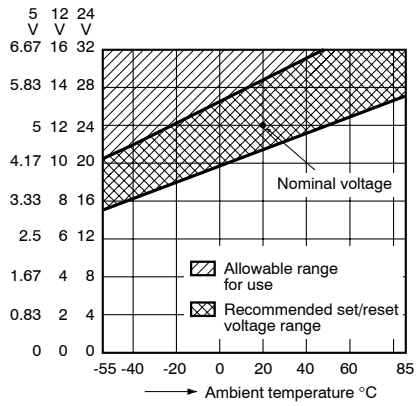
1) Failsafe type



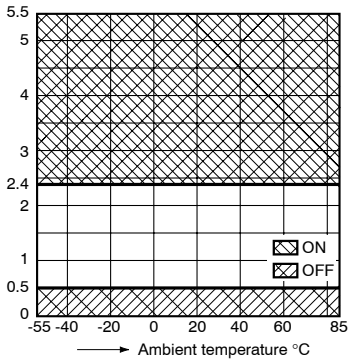
2) Latching type



3) Latching with TTL driver type (with self cut-off function)



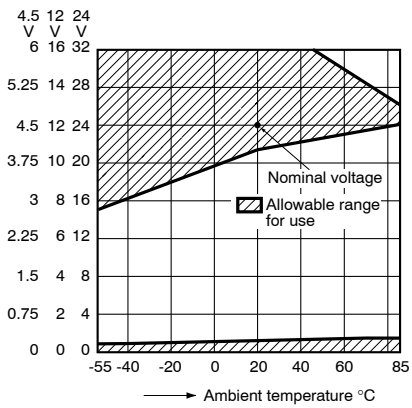
4) TTL Logic level range



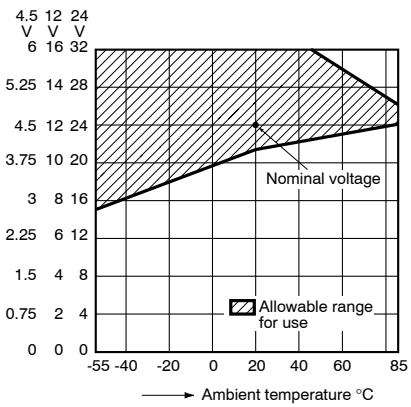
Note) Please consult us for use that is outside this range.

(2) SPST type

1) Failsafe type



2) Latching type

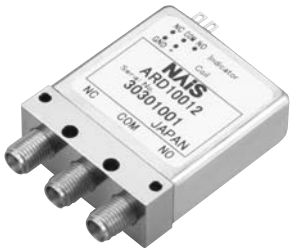


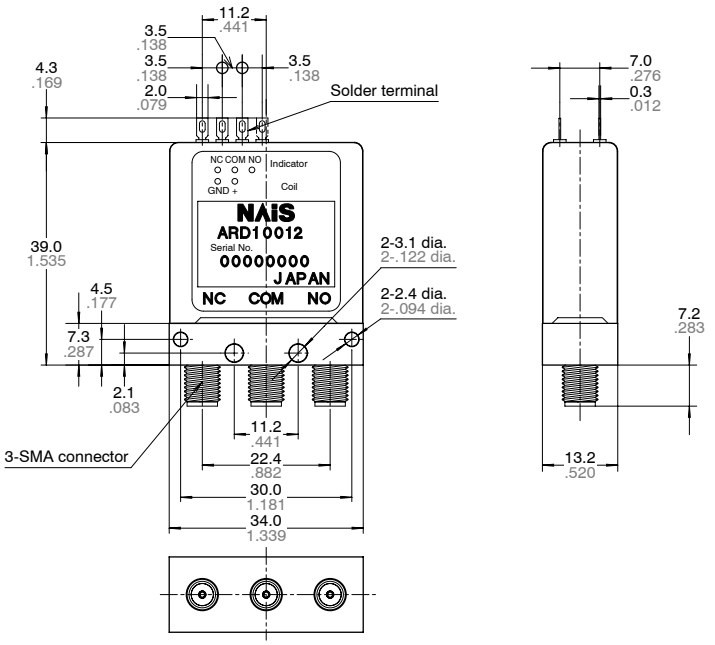
DIMENSIONS

mm inch

1. SPDT

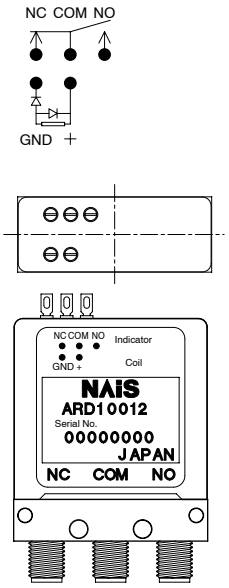
1) Solder terminal



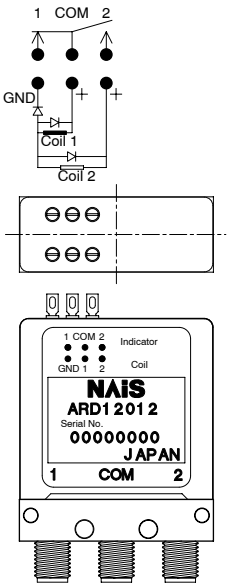


Tolerance: ±0.3 ±.012

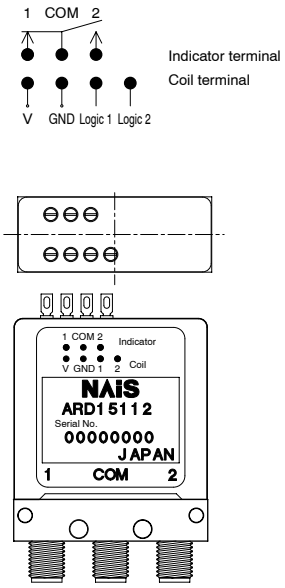
Failsafe



Latching



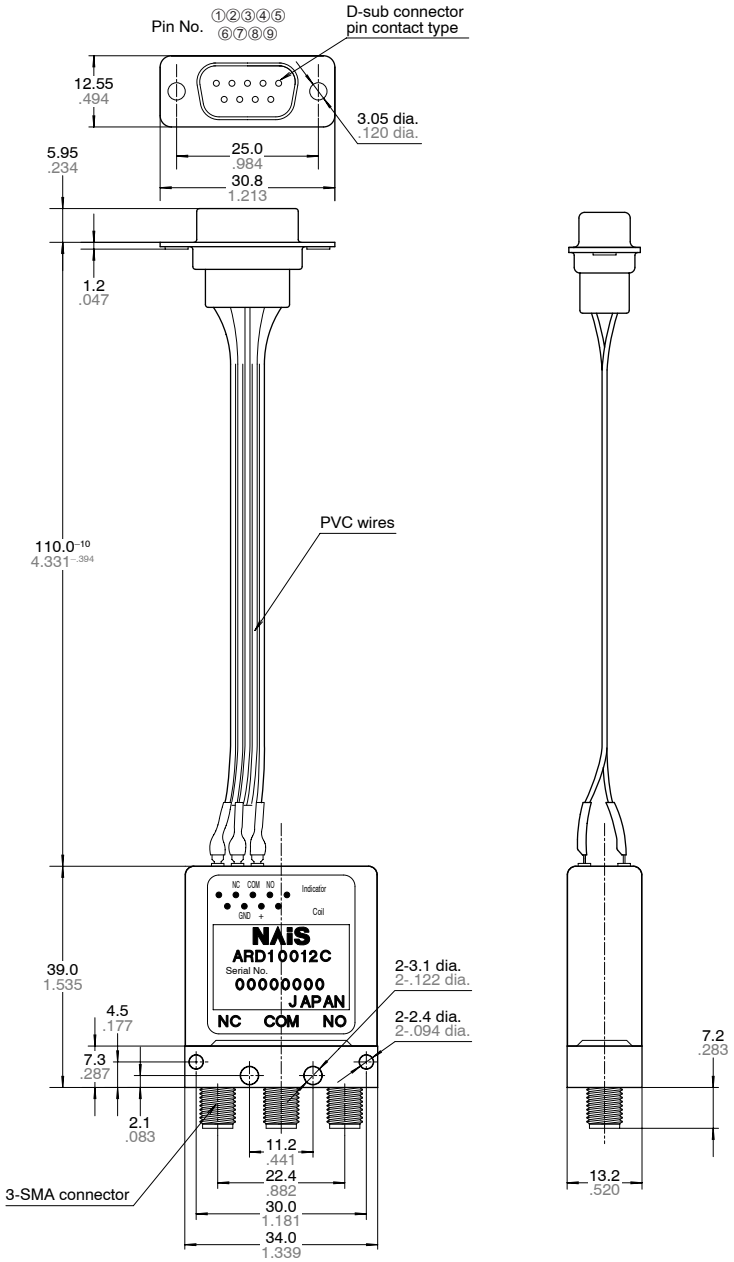
Latching with TTL driver
(with self cut-off function)



2) Connector cable

mm inch

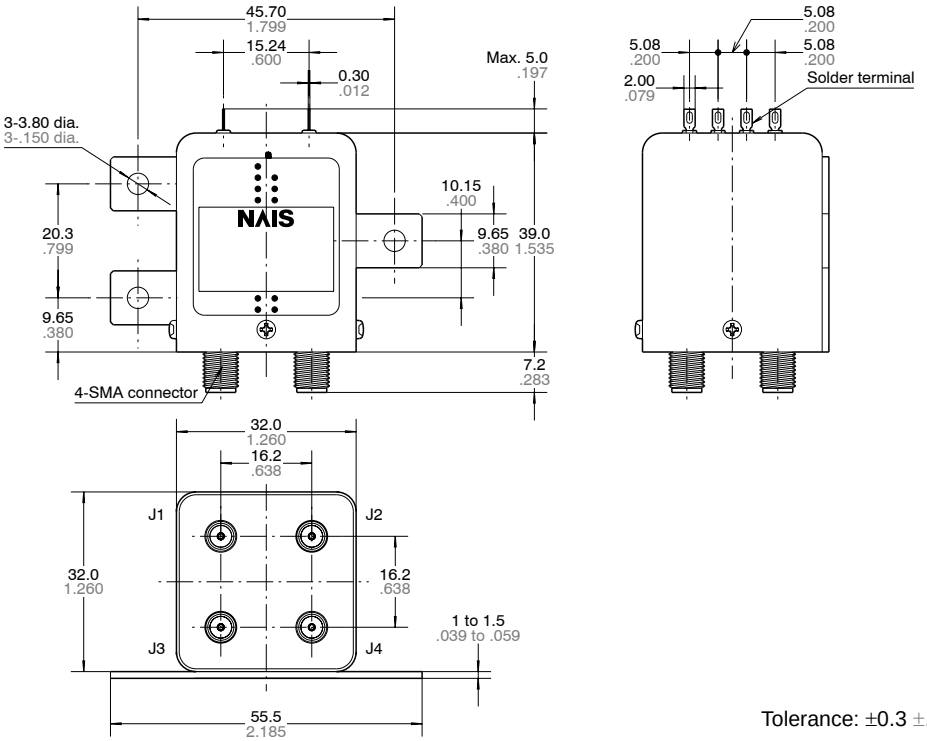
	Indicator					Coil			
Pin No.	①	②	③	④	⑤	⑥	⑦	⑧	⑨
Fail safe	–	NC	COM	NO	–	–	GND	+	–
Latching	–	1	COM	2	–	–	GND	1	2
Latching with TTL driver	–	1	COM	2	–	V	GND	Logic 1	Logic 2



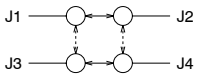
Tolerance: ±0.3 ±.012

2. Transfer

mm inch

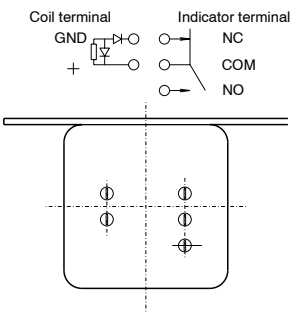


Tolerance: ±0.3 ±.012

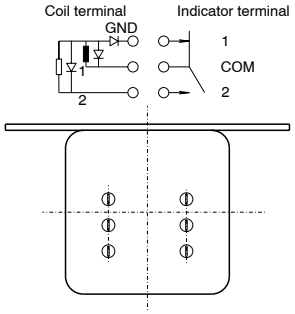


Fail safe	NC: J1-J2, J3-J4 NO: J1-J3, J2-J4
Latching	POS1: J1-J2, J3-J4 POS2: J1-J3, J2-J4
Latching with TTL driver	POS1: J1-J2, J3-J4 POS2: J1-J3, J2-J4

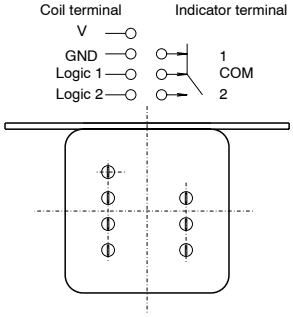
Failsafe



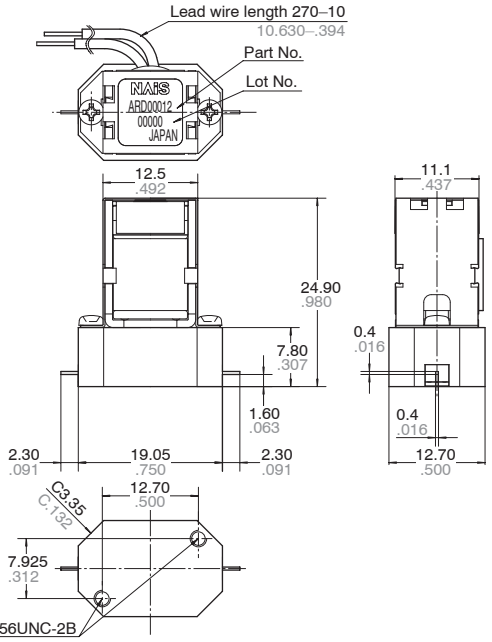
Latching



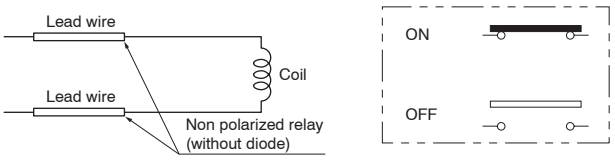
Latching with TTL driver
(with self cut-off function)



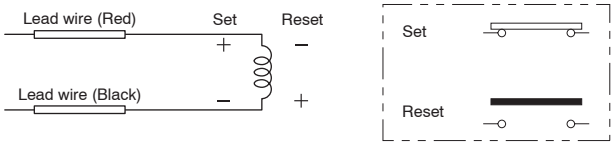
3. SPST



Fail safe type



Latching type

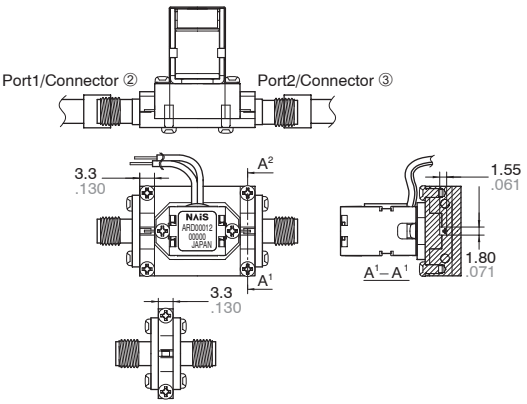


Tolerance: ±0.3 ±.012

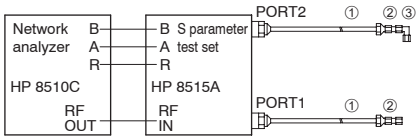
High-Frequency

• Measuring method (Impedance 50Ω)

(V.S.W.R.) The contact must be ON.
(Insertion loss) The contact must be ON.
(without DUT board's loss)
(Isolation) The contact must be OFF.
At that time, conduct measurement with an averaging of 64 times and 1% smoothing.



• Measuring equipment



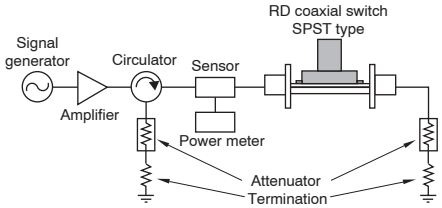
3.5mm calibration kit (HP85052B)

• Connector

No.	Contents	Product name
①	3.5 mm testport, Extention cable	HP85131-60013
②	3.5 mm coaxial adaptor	HP83059
③	SMA adaptor	HP125.771.000

• Input power test

Sample: ARD01024, Quantity: n = 5
Frequency: 2.2 GHz, Ambient temperature: Room temperature
Test circuit:



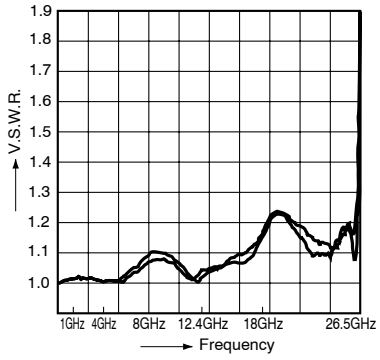
Sample	Cooling fan	Input power, W												
		80	90	100	110	120	130	140	150	160	170	180	190	200
No. 1	Without		○	○	→	→	→	→	○					
No. 2				○	→	○	→	→	○					
No. 3						○	○	→	○					
No. 4	With			○	→	○	→	→	○	→	○	○	→	○
No. 5									○	→	○	○	○	○

○: No abnormality for high frequency and operating characteristics were observed after 30 min. power carrying. (→; Test sequence)

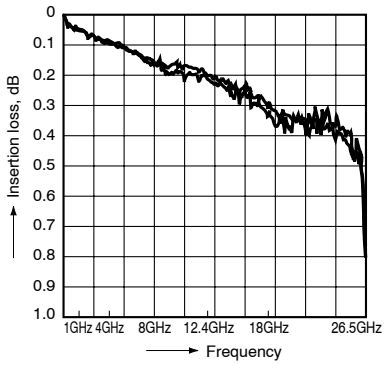
REFERENCE DATA

1-(1). High frequency characteristics (SPDT)
Sample: ARD10012
Measuring method: Measured with HP network analyzer (HP8510).

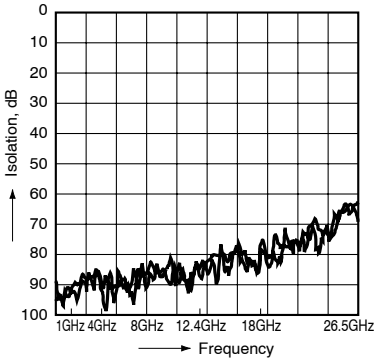
• V.S.W.R.



• Insertion loss

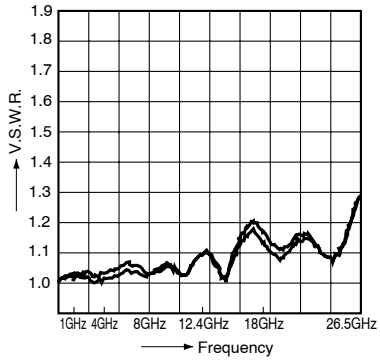


• Isolation

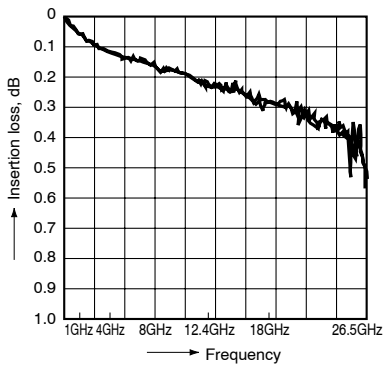


1-(2). High frequency characteristics (Transfer)
Sample: ARD60012
Measuring method: Measured with HP network analyzer (HP8510).

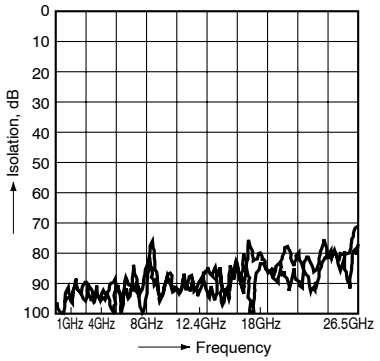
• V.S.W.R.



• Insertion loss

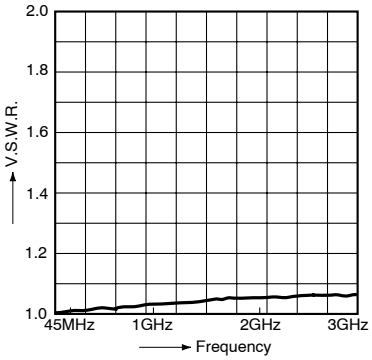


• Isolation

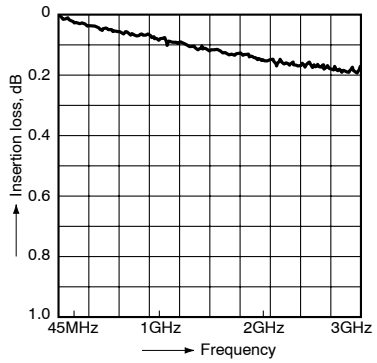


1-(3). High frequency characteristics (SPST)
Measuring method: Measured with HP network analyzer (HP8510).

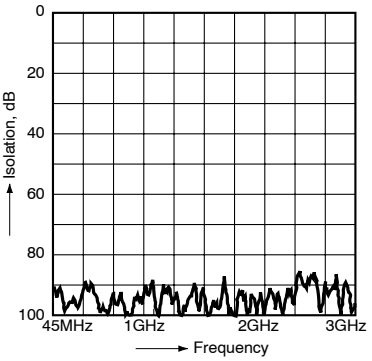
• V.S.W.R.



• Insertion loss



• Isolation



NOTES

1. Coil connection
When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction. (Only SPST failsafe type is non polarized relay)

2. Connection of coil indicator and washing conditions (SPDT, Transfer)
1) The connection of coil indicator terminal shall be done by soldering.
Soldering conditions
Max. 260°C 500°F (solder temp) within 10sec (soldering time)
Max. 350°C 662°F (solder temp) within 3sec (soldering time)
2) This product is not sealed type, therefore washing is not allowed.

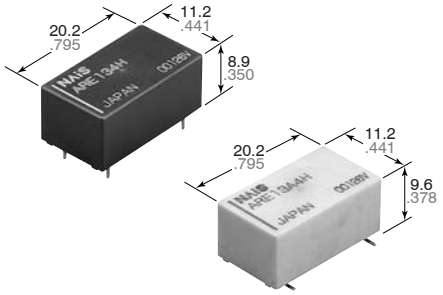
3. Other handling precautions.
For SMA connectors, we recommend a torque of 0.90±0.1 N·m for installation, which falls within the prescribed torque of MIL-C-39012. Please be aware that conditions might be different depending on the connector materials and how it interacts with surrounding materials.

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

2.6 GHz SMALL MICROWAVE RELAYS

RE RELAYS (ARE)



mm inch

FEATURES

• Excellent high frequency characteristics (to 2.6GHz)

Type	Frequency	900MHz	2.6GHz
Impedance 50Ω	V.S.W.R. (Max.)	1.3	1.7
	Insertion loss (dB, Max.)	0.2	0.7
	Isolation (dB, Min.)	60	30
Impedance 75Ω	V.S.W.R. (Max.)	1.2	1.5
	Insertion loss (dB, Max.)	0.2	0.5
	Isolation (dB, Min.)	60	30

• Surface-mount type also available

• Compact and slim size
Size: 20.2(L) × 11.2(W) × 8.9(H)* mm
.795(L) × .441(W) × .350(H) inch
*Surface-mount terminal is 9.6 mm .378 inch size.

TYPICAL APPLICATIONS

1. Broadcasting and video markets.
• Digital broadcasting market
• STB/tuner market, etc.

2. Communications market
• Antennae switching
• All types of wireless devices

SPECIFICATIONS

Contact

Arrangement			1 Form C
Contact material			Gold
Initial contact resistance			Max. 100mΩ
Rating	Contact rating		1W (at 2.6 GHz [Impedance 75 Ω, V.S.W.R. Max.1.5] [Impedance 50 Ω, V.S.W.R. Max.1.7]) 10mA 24V DC (resistive load)
	Contact carrying power		10W (at 2.6GHz [Impedance 75 Ω, V.S.W.R. Max.1.5] [Impedance 50 Ω, V.S.W.R. Max.1.7])
	Max. switching voltage		30 V DC
	Max. switching current		0.5 A DC
High frequency characteristics (Impedance 75Ω)	V.S.W.R.		Max. 1.2 (to 900MHz) Max. 1.5 (to 2.6GHz)
	Insertion loss		Max. 0.2dB (to 900MHz) Max. 0.5dB (to 2.6GHz)
	Isolation		Min. 60dB (to 900MHz) Min. 30dB (to 2.6GHz)
High frequency characteristics (Impedance 50Ω)	V.S.W.R.		Max. 1.3 (to 900MHz) Max. 1.7 (to 2.6GHz)
	Insertion loss		Max. 0.2dB (to 900MHz) Max. 0.7dB (to 2.6GHz)
	Isolation		Min. 60dB (to 900MHz) Min. 30dB (to 2.6GHz)
Expected life (min. operations)	Mechanical (at 180 cpm)		10^6
	Electrical	1W, 2.6GHz, [Impedance 75Ω, V.S.W.R. & 1.5] [Impedance 50Ω, V.S.W.R. & 1.7]	3×10^5
		10mA 24V DC (resistive load) (at 20cpm)	3×10^5

Coil (at 20°C, 68°F)

Nominal operating power	200 mW

Characteristics

Initial insulation resistance*1			Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts		500 Vrms
	Between contact and coil		1,000 Vrms
	Between contact and ground terminal		500 Vrms
Operate time*3 (at 20°C)			Max. 10ms
Release time (without diode)*3 (at 20°C)			Max. 5ms
Temperature rise (at 20°C)*4			Max. 60°C
Shock resistance	Functional*5		Min. 500 m/s²{50 G}
	Destructive*6		Min. 1,000 m/s²{100 G}
Vibration resistance	Functional*7		10 to 55 Hz at double amplitude of 3 mm
	Destructive		10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)		Ambient temp.	–40°C to 70°C –40°F to 158°F
		Humidity	5 to 85% R.H.
Unit weight			Approx. 5 g .18 oz

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Nominal operating voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil: Contact carrying power: 10W, at 2.6GHz, [Impedance 75Ω, V.S.W.R. & 1.5] [Impedance 50Ω, V.S.W.R. & 1.7]
*5 Half-wave pulse of sine wave: 11ms, detection time: 10μs.
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

ORDERING INFORMATION

Ex. ARE 1 ☐ ☐ ☐ ☐

Contact arrangement	Operating function	Terminal shape	Coil voltage (DC)	Packing style
1: 1 Form C	0: Single side stable type (Impedance 50Ω) 3: Single side stable type (Impedance 75Ω)	Nil: Standard PC board terminal A: Surface-mount terminal	03: 3 V 4H: 4.5 V 06: 6 V 09: 9 V 12: 12 V 24: 24 V	Nil: Carton packing (Standard PC board terminal only) Tube packing (Surface-mount terminal only) Z: Tape and reel packing (picked from 12/13/14 pin side)

Note: Tape and reel packing symbol "-Z" is not marked on the relay.
"X" type tape and reel packing (picked from 8/9/10/11/12/13/14-pin side) is also available.
Suffix "X" instead of "Z".

TYPES AND COIL DATA (at 20°C 68°F)

• Single side stable type (Impedance 50Ω)
• Packing of standard PC board terminal: 50 pcs. in an inner package (carton); 500 pcs. in an outer package.
• Packing of surface-mount terminal: 25 pcs. in an inner package (tube); 200 pcs. in an outer package.
• Packing of surface-mount terminal: 400 pcs. in an inner package (tape and reel); 800 pcs. in an outer package.

Standard PC board terminal	Surface-mount terminal	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C)
ARE1003	ARE10A03	3	2.25	0.3	45	66.7	200	3.3
ARE104H	ARE10A4H	4.5	3.375	0.45	101	44.4	200	4.95
ARE1006	ARE10A06	6	4.5	0.6	180	33.3	200	6.6
ARE1009	ARE10A09	9	6.75	0.9	405	22.2	200	9.9
ARE1012	ARE10A12	12	9	1.2	720	16.7	200	13.2
ARE1024	ARE10A24	24	18	2.4	2,880	8.3	200	26.4

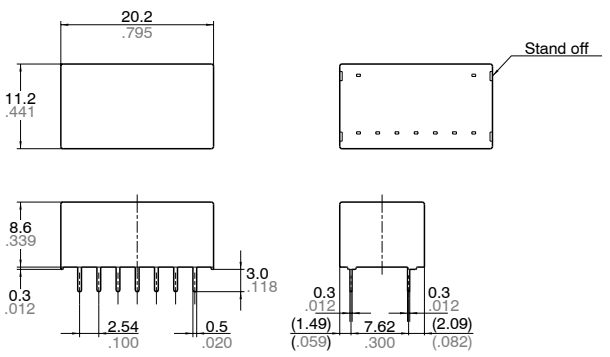
• Single side stable type (Impedance 75Ω)
• Packing of standard PC board terminal: 50 pcs. in an inner package (carton); 500 pcs. in an outer package.
• Packing of surface-mount terminal: 25 pcs. in an inner package (tube); 200 pcs. in an outer package.
• Packing of surface-mount terminal: 400 pcs. in an inner package (tape and reel); 800 pcs. in an outer package.

Standard PC board terminal	Surface-mount terminal	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C)
ARE1303	ARE13A03	3	2.25	0.3	45	66.7	200	3.3
ARE134H	ARE13A4H	4.5	3.375	0.45	101	44.4	200	4.95
ARE1306	ARE13A06	6	4.5	0.6	180	33.3	200	6.6
ARE1309	ARE13A09	9	6.75	0.9	405	22.2	200	9.9
ARE1312	ARE13A12	12	9	1.2	720	16.7	200	13.2
ARE1324	ARE13A24	24	18	2.4	2,880	8.3	200	26.4

DIMENSIONS

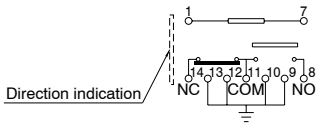
mm inch

1. Standard PC board terminal (75Ω, 50Ω type)



General tolerance: ±0.3 ±.012

Schematic (Bottom view)

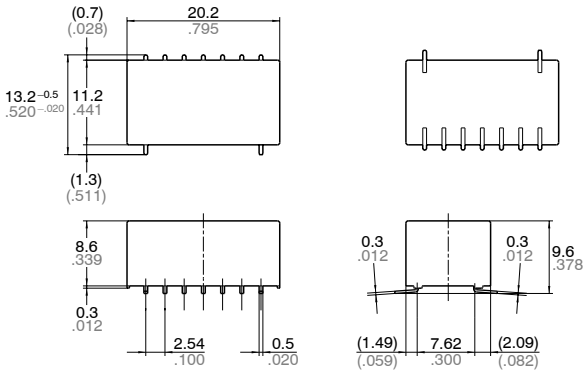


(Deenergized condition)

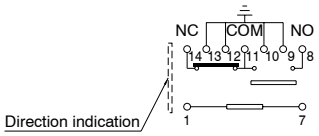
2. Surface mount terminal

mm inch

• 75Ω type



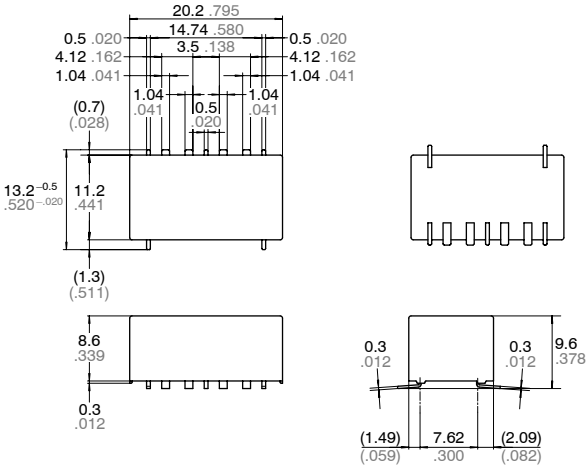
Schematic (Top view)



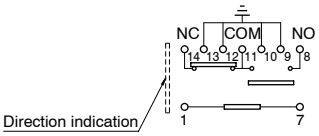
(Deenergized condition)

General tolerance: ±0.3 ±.012

• 50Ω type



Schematic (Top view)



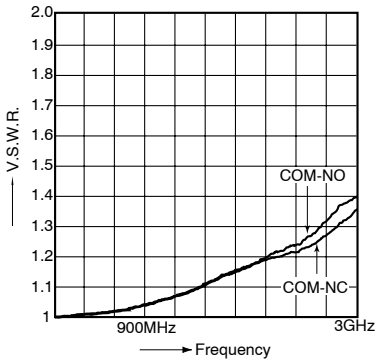
(Deenergized condition)

General tolerance: ±0.3 ±.012

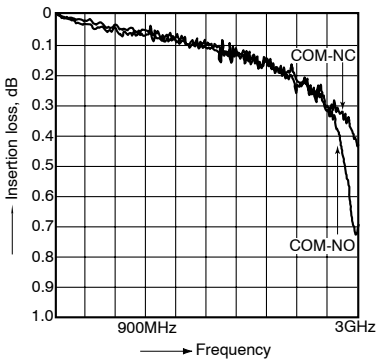
REFERENCE DATA

1-(1). High frequency characteristics (75Ω type) (Standard PC board terminal)

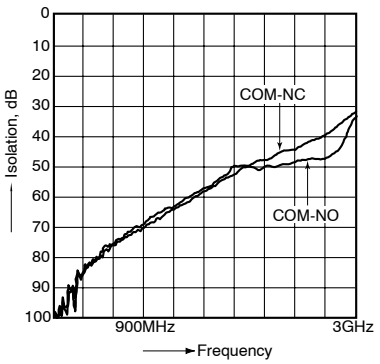
• V.S.W.R. characteristics



• Insertion loss characteristics

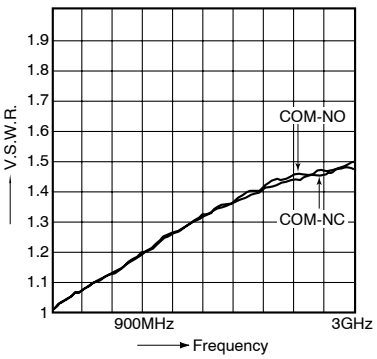


• Isolation characteristics

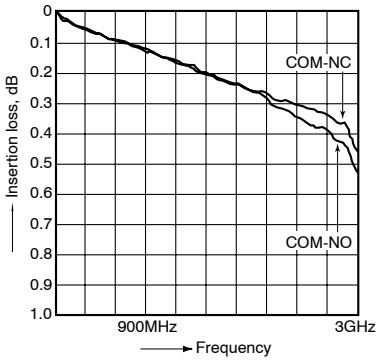


1-(2). High frequency characteristics (50Ω type) (Standard PC board terminal)

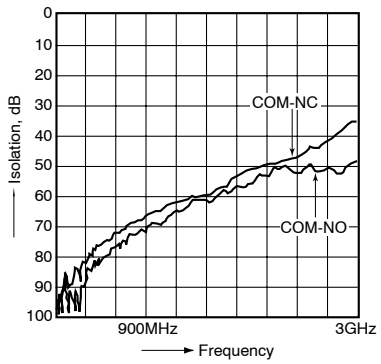
• V.S.W.R. characteristics



• Insertion loss characteristics



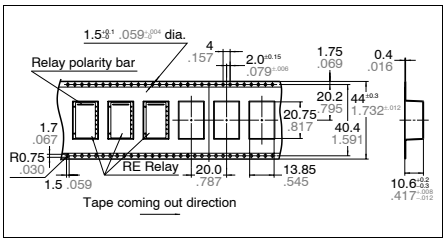
• Isolation characteristics



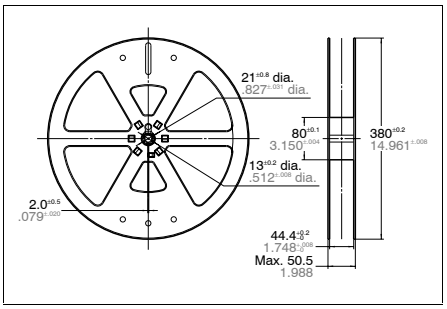
NOTES

1. Packing style

1) Tape dimensions



2) Dimensions of plastic reel



For Cautions for Use, see Relay Technical Information (page 390).

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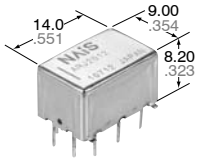
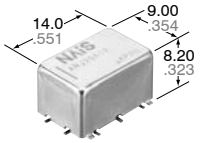
SMD RELAYS WITH 8GHz CAPABILITIES

RJ RELAYS (ARJ)





FEATURES

• Excellent high frequency characteristics (50Ω, at 5GHz)
V.S.W.R.: Max. 1.25
Insertion loss: Max. 0.5dB
Isolation: Min. 35dB
(Between open contacts)
Min. 30dB
(Between contact sets)

• Surface mount terminal
Surface mount terminals are now standard so there is much less work in designing PC boards.

• Small size
Size: 14.00 (L)×9.00 (W)×8.20 (H) mm
.551 (L)×.354 (W)×.323 (H) inch

TYPICAL APPLICATIONS

Measurement equipment market
Attenuator circuits, spectrum analyzer, oscilloscope, mobile equipment, tester

Mobile telecommunication market
IMT2000, microwave communication

Medical instruments market

SPECIFICATIONS

Contact

Arrangement			2 Form C
Contact material			Gold alloy
Initial contact resistance			Max. 150mΩ
Rating	Contact rating		1W (at 5 GHz, Impedance 50Ω, V.S.W.R. &1.25) 10mA 10V DC (resistive load)
	Contact carrying power		1W (at 5 GHz, Impedance 50Ω, V.S.W.R. &1.25)
	Max. switching voltage		30 V DC
	Max. switching current		0.3 A DC
High frequency characteristics (Initial) (~5GHz, Impedance 50Ω)	V.S.W.R.		Max. 1.25
	Insertion loss (without D.U.T. board's loss)		Max. 0.5dB
	Isolation	Between open contacts	Min. 35dB
		Between contact sets	Min. 30dB
	Input power		1W (at 5GHz, impedance 50Ω, V.S.W.R. &1.25, at 20°C)
Expected life (min. operations)	Mechanical (at 180 cpm)		10^7
	Electrical (at 20cpm)	1W, at 5GHz, V.S.W.R. & 1.25	10^6
		10mA 10V DC (resistive load)	10^6

Coil (at 20°C, 68°F)

	Nominal operating power
Single side stable	200 mW
2 coil latching	150 mW

Characteristics

Initial insulation resistance*1		Min. 500 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	500 Vrms
	Between contact sets	500 Vrms
	Between contact and coil	500 Vrms
	Between coil and earth terminal	500 Vrms
	Between contact and earth terminal	500 Vrms
Operate time [Set time]*3 (at 20°C)		Max. 5ms
Release time (without diode)[Reset time]*3 (at 20°C)		Max. 5ms
Temperature rise (at 20°C)*4		Max. 50°C
Shock resistance	Functional*5	Min. 500 m/s²
	Destructive*6	Min. 1,000 m/s²
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–30°C to 70°C –22°F to 158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 3 g .11 oz

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Nominal operating voltage applied to the coil, excluding contact bounce time.
*4 By resistive method, nominal voltage applied to the coil, 5GHz, V.S.W.R. & 1.25
*5 Half-wave pulse of sine wave: 6ms, detection time: 10μs.
*6 Pulse of sine wave: 11ms.
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

ORDERING INFORMATION

Ex. ARJ [2] [ ] [ ] [ ] [ ]

Contact arrangement	Operating function	Terminal shape	Coil voltage (DC)	Packing style
2: 2 Form C	0: Single side stable 2: 2 coil latching	Nil: Standard PC board terminal A: Surface-mount terminal	03 : 3V 4H: 4.5V 12 : 12V 24 : 24V	Nil: Carton packing X: Tape end reel packing (picked from 1/2/3-pin side) Z: Tape and reel packing (picked from 6/7/8-pin side)

Note: Tape and reel packing symbol "-Z" is not marked on the relay. "X" type tape and reel packing (picked from 1/2/3-pin side) is also available. Suffix "X" instead of "Z".

TYPES AND COIL DATA (at 20°C 68°F)

1. Standard PC board terminal

• Packing of standard PC board terminal: 50 pcs. in an inner package (carton); 500 pcs. in an outer package

Operating function	Coil Rating, V DC	Part No. Standard PC board terminal	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	3	ARJ2003	2.25	0.3	66.6	45	200	3.3
	4.5	ARJ204H	3.375	0.45	44.4	101.2	200	4.95
	12	ARJ2012	9	1.2	16.6	720	200	13.2
	24	ARJ2024	18	2.4	8.3	2,880	200	26.4

Operating function	Coil Rating, V DC	Part No. Standard PC board terminal	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
2 coil latching	3	ARJ2203	2.25	2.25	50	60	150	3.3
	4.5	ARJ224H	3.375	3.375	33.3	135	150	4.95
	12	ARJ2212	9	9	12.5	960	150	13.2
	24	ARJ2224	18	18	6.3	3,840	150	26.4

2. Surface-mount terminal

• Packing of surface-mount terminal: 50 pcs. in an inner package (carton); 500 pcs. in an outer package

• Packing of surface-mount terminal: 500 pcs. in an inner package (tape and reel); 500 pcs. in an outer package

Operating function	Coil Rating, V DC	Part No. Carton packing	Part No. Tape and reel packing	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Single side stable	3	ARJ20A03	ARJ20A03Z	2.25	0.3	66.6	45	200	3.3
	4.5	ARJ20A4H	ARJ20A4HZ	3.375	0.45	44.4	101.2	200	4.95
	12	ARJ20A12	ARJ20A12Z	9	1.2	16.6	720	200	13.2
	24	ARJ20A24	ARJ20A24Z	18	2.4	8.3	2,880	200	26.4

Operating function	Coil Rating, V DC	Part No. Carton packing	Part No. Tape and reel packing	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
2 coil latching	3	ARJ22A03	ARJ22A03Z	2.25	2.25	50	60	150	3.3
	4.5	ARJ22A4H	ARJ22A4HZ	3.375	3.375	33.3	135	150	4.95
	12	ARJ22A12	ARJ22A12Z	9	9	12.5	960	150	13.2
	24	ARJ22A24	ARJ22A24Z	18	18	6.3	3,840	150	26.4

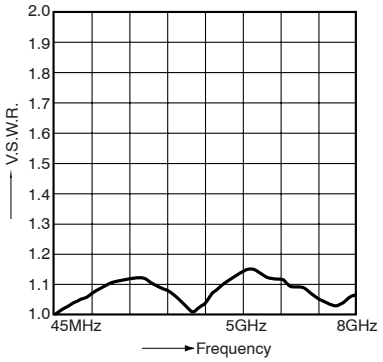
REFERENCE DATA

1. High frequency characteristics

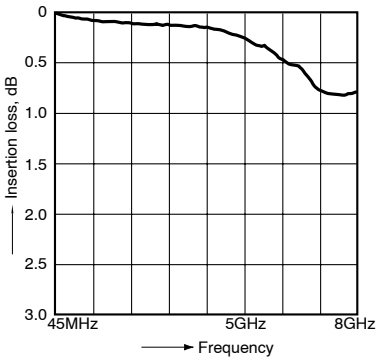
Sample: ARJ20A12

Measuring method: Measured with MEW PC board by HP network analyzer (HP8510C).

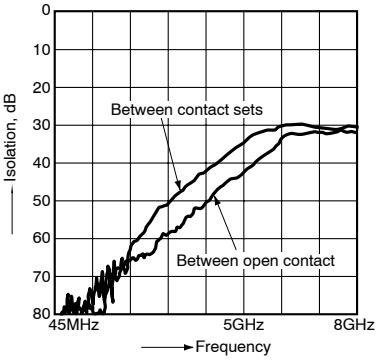
• V.S.W.R. characteristics



• Insertion loss characteristics (without D.U.T. board's loss)



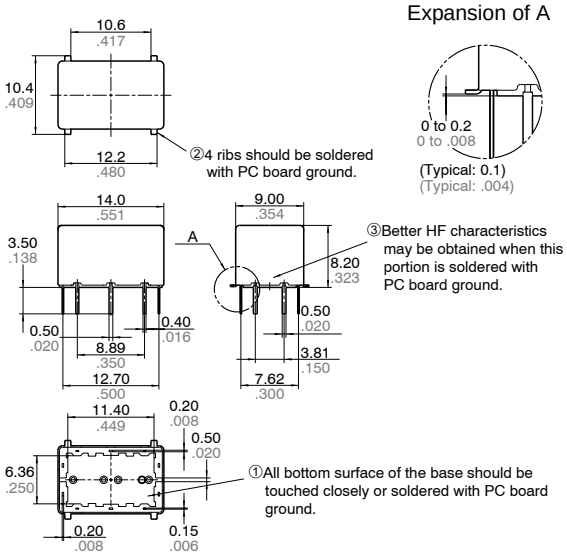
• Isolation characteristics



DIMENSIONS

mm inch

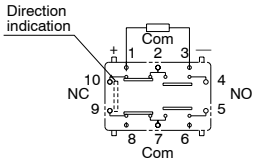
1. Standard PC board terminal



Expansion of A

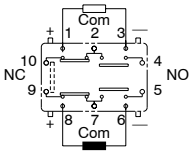
Schematic (Bottom view)

Single side stable



(Deenergized condition)

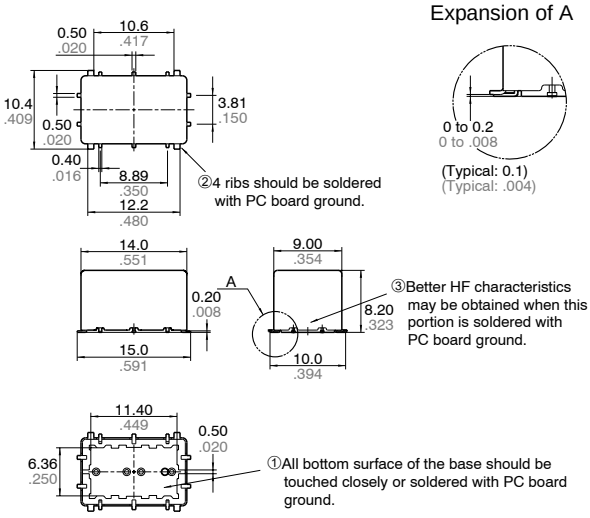
2 coil latching



(Reset condition)

General tolerance: ±0.3 ±.012

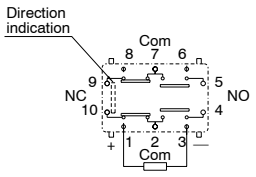
2. Surface mount terminal



Expansion of A

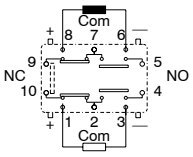
Schematic (Top view)

Single side stable



(Deenergized condition)

2 coil latching



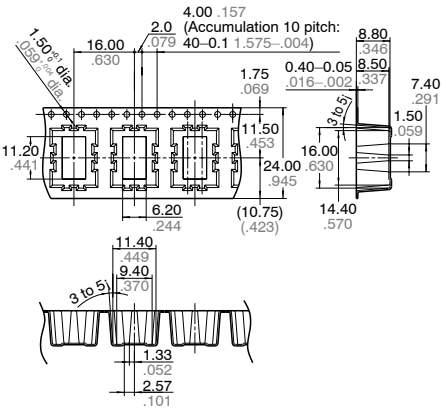
(Reset condition)

General tolerance: ±0.3 ±.012

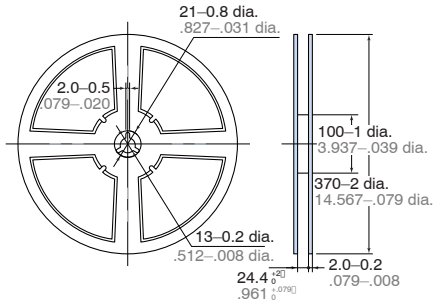
NOTES

1. Tape and reel packing

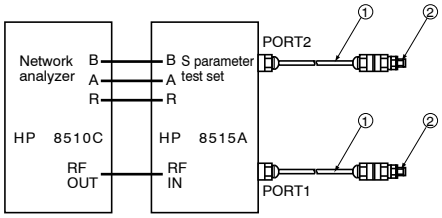
1) Tape dimensions



2) Dimensions of plastic reel



2. Measuring method (Impedance 50Ω)



Connector

No.	Product name	Contents
1	HP 85131-60013	3.5 mm testport, Extension cable
2	HP 83059	3.5 mm coaxial adaptor

(Step 1) Calibrate the test system with HP calibration kit [HP85052B]

(Step 2) After calibration, connect the D.U.T. board and measure. Connect 50 Ω terminals on connectors other than those for measurement.

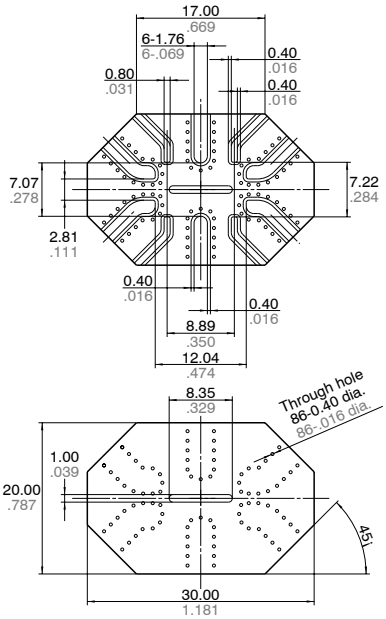
Notes)

1. All bottom surface of the base should be touched closely or soldered with PC board ground.
2. 4 ribs should be soldered with PC board ground.

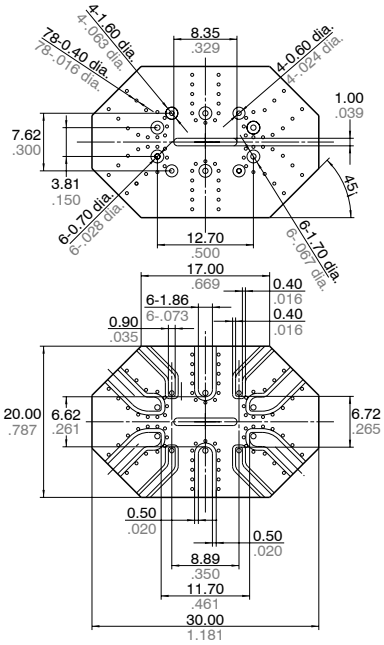
Measuring board

1) Dimensions

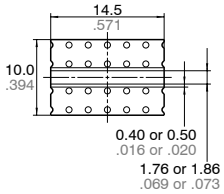
<Surface mount terminal>



<Standard PC board terminal>



<Calibration board>



2) Material: Glass PTFE double-sided through hole PC board R-4737 (Matsushita Electric Works)

3) Board thickness: t = 0.8 mm

4) Copper plating: 18μm

• Connector (SMA type receptacle)
Product name: R125 510 (RADIALL)

Insertion loss compensation

The insertion loss of relay itself is given by subtracting the insertion loss of short-circuit the Com and the NC (or NO). (signal path and two connectors)

High-Frequency

For Cautions for Use, see Relay Technical Information (page 390).

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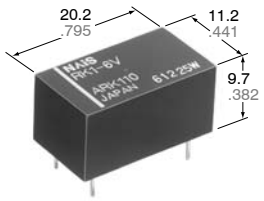
1.5 GHz MICROWAVE RELAY RK RELAYS



mm inch

- **Excellent high frequency characteristics**
  Isolation: Min. 60dB (at 1.5 GHz)
  Insertion loss: Max. 0.3dB (at 900 MHz)
- **V.S.W.R.: Max. 1.5 (at 900MHz)**
- **High sensitivity in small size**
  Size: 20.2 × 11.2 × 9.7 mm .795 × .441 × .382 inch
  Nominal power consumption: 200 mW (single side stable type)
- **Sealed construction for automatic cleaning**
- **Latching types are also available**

SPECIFICATIONS

Contact

Arrangement			1 Form C
Contact material			Gold-clad
Initial contact resistance, max. (By HP4328A)			100 mΩ
Rating	Max. switching power		10 W
	Max. switching voltage		30 V DC
	Max. switching current		0.5 A
	Nominal switching capacity		0.01 A 24 V DC 10 W (at 1.2 GHz, Impedance 50Ω)
High frequency characteristics (Impedance 50Ω)	V.S.W.R.		Max. 1.5 (at 900 MHz)
	Insertion loss		Max. 0.3 dB (at 900 MHz)
	Isolation		Min. 60 dB (at 1.5 GHz)
Expected life (min. operations)	Mechanical		5×10^6
	Electrical	0.01 A 24 V DC	3×10^5
		10 W 1.2 GHz	10^5

Coil (at 25°C, 68°F)

	Nominal operating power
Single side stable	200 mW
1 coil latching	200 mW
2 coil latching	400 mW

Characteristics

Initial insulation resistance*1		Min. 100 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	500 Vrms
	Between contact and coil	1,000 Vrms
	Between contact and earth terminal	500 Vrms
Operate time [Set time]*3 (at nominal voltage)		Approx. 6 ms [Approx. 5ms]
Release time (without diode) [Reset time]*3 (at nominal voltage)		Approx. 3 ms [Approx. 5ms]
Temperature rise		Max. 60°C with nominal coil voltage across coil and at nominal switching capacity
Shock resistance	Functional*4	Min. 196 m/s² {20 G}
	Destructive*5	Min. 980 m/s² {100 G}
Vibration resistance	Functional*6	10 to 55 Hz at double amplitude of 3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage (Not freezing and condensing at low temperature)	Ambient temp.	-40°C to 70°C -40°F to 158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 4.4 g .155 oz

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms, detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs

TYPICAL APPLICATIONS

- **Audio visual equipment broadcast satellite tuners VCRs, CATVs, TVs**
- **Communication equipment automobile telephones maritime telephones emergency and disaster prevention communications, PCM switches**
- **Instrumentation test equipment measuring equipment**

ORDERING INFORMATION

Ex. RK [1] — [L2] — [24V]

Contact arrangement	Operating function	Coil voltage, DC
1: Standard type 1R: R type (See Schematic on next page.)	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	3, 4.5, 5, 6, 9, 12, 24 V

Note: Standard packing; Carton: 50 pcs. Case 500 pcs.

TYPES AND COIL DATA (at 20°C 68°F)

• Single side stable type

Part No.		Nominal voltage, V DC	Pick-up voltage, max. V DC	Drop-out voltage, min. V DC	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Maximum. allowable voltage, V DC (at 60°C 140°F)
RK1-3V	RK1R-3V	3	2.25	0.3	45	66.7	200	3.3
RK1-4.5V	RK1R-4.5V	4.5	3.38	0.45	101	44.4	200	4.95
RK1-5V	RK1R-5V	5	3.75	0.5	125	40.7	200	5.5
RK1-6V	RK1R-6V	6	4.5	0.6	180	33.3	200	6.6
RK1-9V	RK1R-9V	9	6.75	0.9	405	22.2	200	9.9
RK1-12V	RK1R-12V	12	9	1.2	720	16.7	200	13.2
RK1-24V	RK1R-24V	24	18	2.4	2,880	8.3	200	26.4

• 1 coil latching type

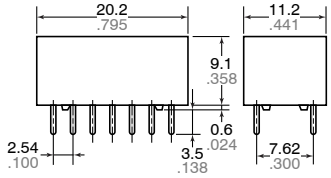
Part No.		Nominal voltage, V DC	Set voltage, max. V DC	Reset voltage, max. V DC	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Maximum. allowable voltage, V DC (at 60°C 140°F)
RK1-L-3V	RK1R-L-3V	3	2.25	2.25	45	66.7	200	3.3
RK1-L-4.5V	RK1R-L-4.5V	4.5	3.38	3.38	101	44.4	200	4.95
RK1-L-5V	RK1R-L-5V	5	3.75	3.75	125	40	200	5.5
RK1-L-6V	RK1R-L-6V	6	4.5	4.5	180	33.3	200	6.6
RK1-L-9V	RK1R-L-9V	9	6.75	6.75	405	22.2	200	9.9
RK1-L-12V	RK1R-L-12V	12	9	9	720	16.7	200	13.2
RK1-L-24V	RK1R-L-24V	24	18	18	2,880	8.3	200	26.4

• 2 coil latching type

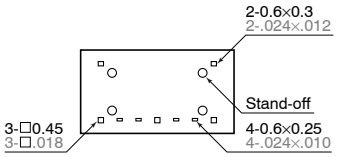
Part No.		Nominal voltage, V DC	Set voltage, max. V DC	Reset voltage, max. V DC	Coil resistance, Ω (±10%)	Nominal operating current, mA	Nominal operating power, mW	Maximum. allowable voltage, V DC (at 60°C 140°F)
RK1-L2-3V	RK1R-L2-3V	3	2.25	2.25	22.5	133.3	400	3.3
RK1-L2-4.5V	RK1R-L2-4.5V	4.5	3.38	3.38	50.6	88.9	400	4.95
RK1-L2-5V	RK1R-L2-5V	5	3.75	3.75	62.5	80	400	5.5
RK1-L2-6V	RK1R-L2-6V	6	4.5	4.5	90	66.7	400	6.6
RK1-L2-9V	RK1R-L2-9V	9	6.75	6.75	202.5	44.4	400	9.9
RK1-L2-12V	RK1R-L2-12V	12	9	9	360	33.3	400	13.2
RK1-L2-24V	RK1R-L2-24V	24	18	18	1,440	16.7	400	26.4

DIMENSIONS

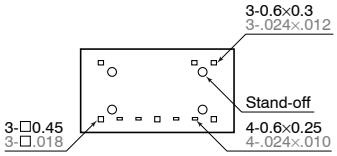
mm inch



Single side stable and
1 coil latching



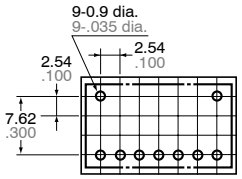
2 coil latching



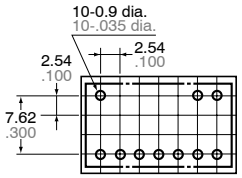
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)

Single side stable and
1 coil latching



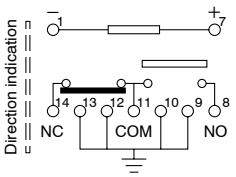
2 coil latching



Tolerance: ±0.1 ±.003

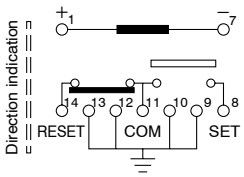
Schematic (Bottom view)

Single side stable



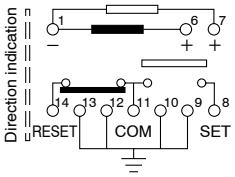
(Deenergized condition)

1 coil latching



(Reset condition)

2 coil latching

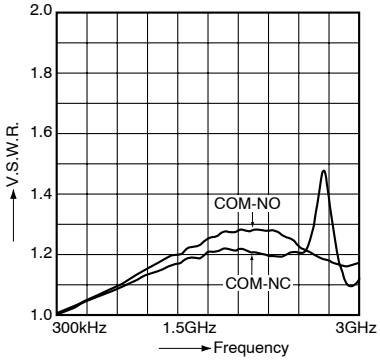


(Reset condition)

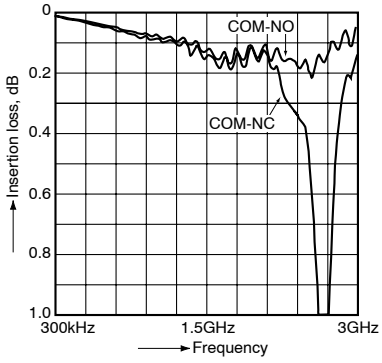
REFERENCE DATA

1.-(1) High frequency characteristics (Impedance 75Ω)
Sample: RK1-12V
Measuring method: Measured with HP network analyzer (HP8753C)

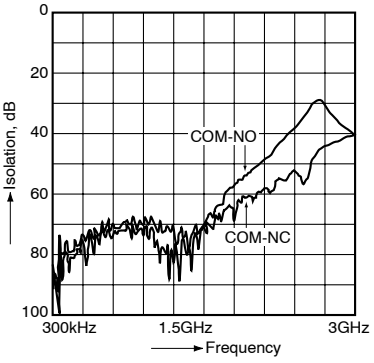
• V.S.W.R. characteristics



• Insertion loss characteristics

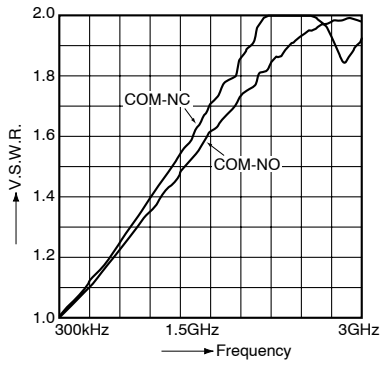


• Isolation characteristics

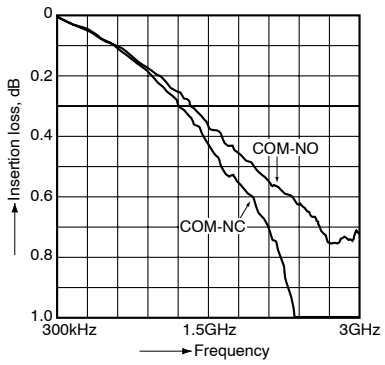


1.-(2) High frequency characteristics (Impedance 50Ω)
Sample: RK1-5V
Measuring method: Measured with HP network analyzer (HP8753C)

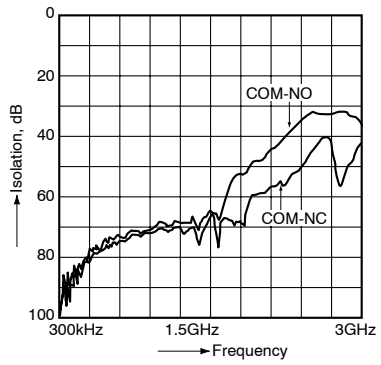
• V.S.W.R. characteristics



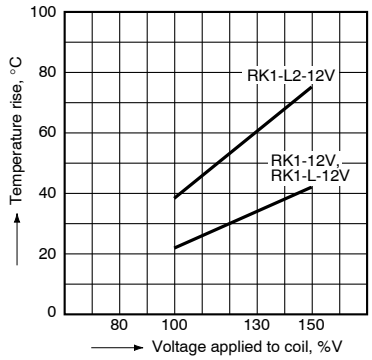
• Insertion loss characteristics



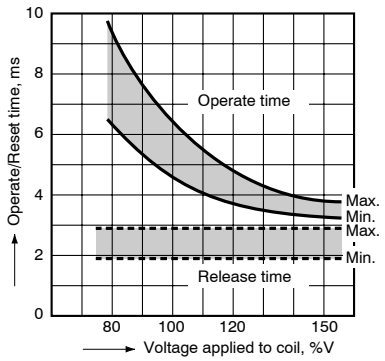
• Isolation characteristics



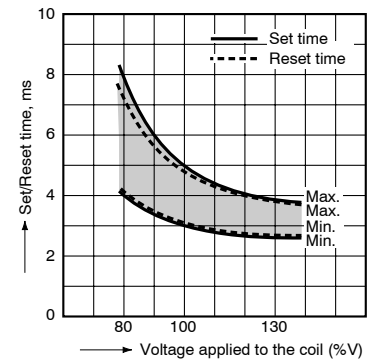
2. Coil temperature rise
Sample: RK1-12V, RK1-L-12V, RK1-L2-12V
No. of samples: n = 6
Carrying current: 10 mA
Ambient temperature: 25°C 77°F



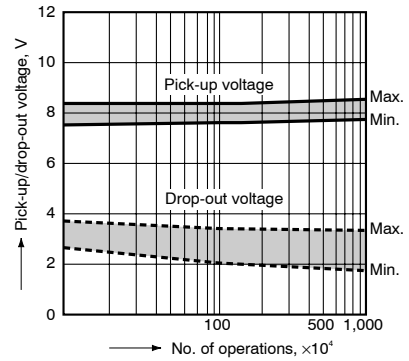
3.-(1) Operate/Release time
(Single side stable)
Sample: RK1-12V; No. of samples: n = 6



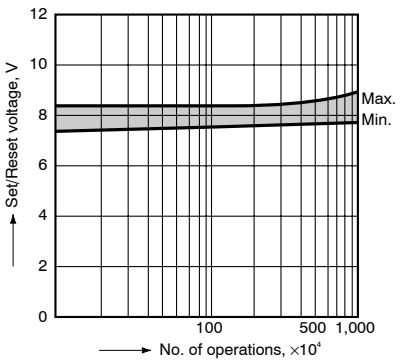
3.-(2) Set/Reset time (Latching)
Sample: RK1-L-12V, RK1-L2-12V
No. of samples: n = 12



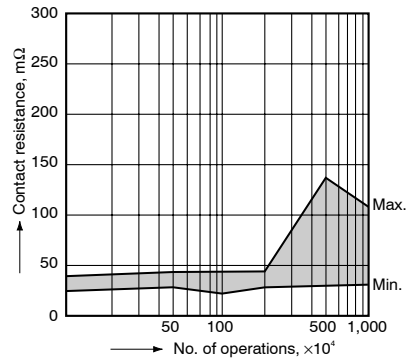
4.-(1) Mechanical life test (Single side stable)
Sample: RK1-12V; No. of samples: n = 12



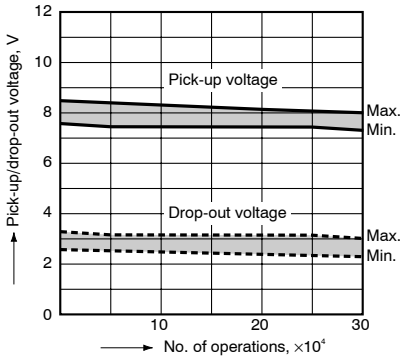
4.-(2) Mechanical life test (Latching)
Sample: RK1-L2-12V
No. of samples: n = 12



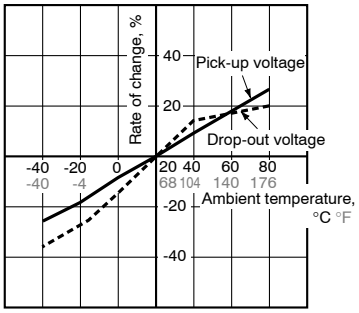
4.-(3) Mechanical life test
Sample: RK1-12V
No. of samples: n = 20 (20 × 2 contacts)



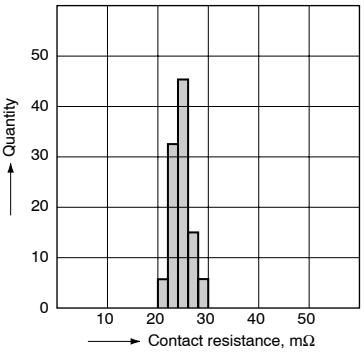
5. Electrical life test (0.01 A 24 V DC)
Sample: RK1-12V; No. of samples: n = 6



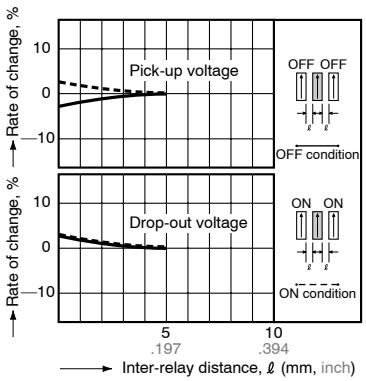
6. Ambient temperature characteristics
Sample: RK1-12V; No. of samples: n = 6



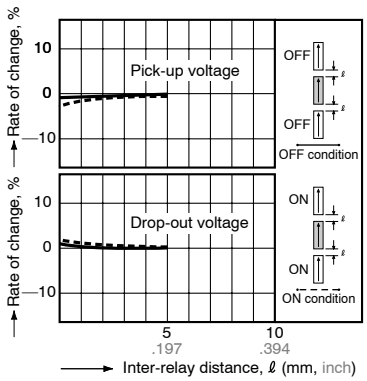
7. Contact resistance distribution (initial)
Sample: RK1-12V
No. of samples: n = 50 (50 × 2 contacts)



8.-(1) Influence of adjacent mounting
Sample: RK1-12V; No. of sample: n = 10



8.-(2) Influence of adjacent mounting
Sample: RK1-12V; No. of samples: n = 10

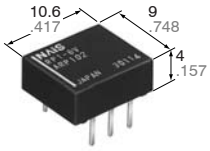


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

LOW PROFILE HIGH FREQUENCY RELAY

RP RELAYS



mm inch

- **High frequency relay with the low profile of 4 mm .157 inch**
- **Excellent high frequency characteristics**
  Isolation: Min. 10dB (at 1.8 GHz)
  Insertion loss: Max. 1.0dB (at 1.8 GHz)
  V.S.W.R.: Max. 1.3 (at 1.8 GHz)
- **High sensitivity in small size**
  Size: 10.6 × 9 × 4 mm .417 × .354 × .157 inch
  Nominal operating power: 140 mW
- **Utilizes tube package for automatic mounting.**
- **Self-clinching terminal also available**

SPECIFICATIONS

Contact

Arrangement		1 Form C
Contact material	Movable	Silver alloy
	Stationary	Gold-clad silver
Initial contact resistance, max. (By voltage drop 6 V DC 0.1 A)		50 mΩ
Rating	Nominal switching capacity	0.1 A 30 V DC Contact switching power: 1 W (Max. 1.8 GHz); Contact carrying power: 3 W (Max. 1.2 GHz) 1 W (Max. 1.8 GHz)
High frequency characteristics (Impedance 50Ω)	V.S.W.R.	Max. 1.2 (at 1 GHz) Max. 1.3 (at 1.8 GHz)
	Insertion loss	Max. 0.5 dB (at 1 GHz) Max. 1 dB (at 1.8 GHz)
	Isolation	Min. 15 dB (at 1 GHz) Min. 10 dB (at 1.8 GHz)
Expected life (min. operations)	Mechanical (at 180 cpm)	5×10^6
	Electrical (at 20 cpm)	10^5 (0.1 A 30 V DC resistive load)
		10^5 (1 W at 1.8 GHz; V.S.W.R.: max. 1.3)

Coil (at 25°C, 68°F)

Voltage type	Nominal operating power
1.5 to 12 V DC	140 mW
24 V DC	270 mW

Characteristics

Max. operating speed (at rated load)		20 cpm
Initial insulation resistance*1		Min. 1,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	750 Vrms for 1 min.
	Between contacts and coil	1,500 Vrms for 1 min.
Operate time*3 (at nominal voltage)		Max. 3 ms (Approx. 1.5 ms)
Release time(without diode)*3 (at nominal voltage)		Max. 2 ms (Approx. 1 ms)
Temperature rise		Max. 50°C with nominal coil voltage across coil and at nominal switching capacity
Shock resistance	Functional*4	Min. 500 m/s² {50 G}
	Destructive*5	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*6	10 to 55 Hz at double amplitude of 3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage (Not freezing and condensing at low temperature)	Ambient temp.	-40°C to 70°C -40°F to 158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 1 g .04 oz

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms, detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs

TYPICAL APPLICATIONS

- Antenna switching of mobile phone
- Switching signal of measuring equipment
- All types of compact wireless devices

ORDERING INFORMATION

Ex. RP 1 ☐ ☐ ☐

Contact arrangement	Operating function	Terminal shape	Coil voltage (DC)
1: 1 Form C	Nil: Single side stable	Nil: Standard PC board terminal H: Self-clinching terminal	1.5, 3, 4.5, 5, 6, 9, 12, 24 V

Note: Standard packing; Carton: 50 pcs. Case 1,000 pcs.

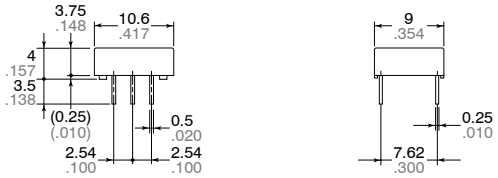
TYPES ANE COIL DATA (at 20°C 68°F)

Part No.		Nominal voltage, V DC	Pick-up voltage, max. V DC	Drop-out voltage, min. V DC	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Maximum. allowable voltage, V DC
Standard PC board terminal	Self-clinching terminal							
RP1-1.5V	RP1-H-1.5V	1.5	1.125	0.15	16	93.8	140	2.25
RP1-3V	RP1-H-3V	3	2.25	0.3	64.3	46.7	140	4.5
RP1-4.5V	RP1-H-4.5V	4.5	3.375	0.45	145	31.1	140	6.75
RP1-5V	RP1-H-5V	5	3.75	0.5	178	28	140	7.5
RP1-6V	RP1-H-6V	6	4.5	0.6	257	23.3	140	9
RP1-9V	RP1-H-9V	9	6.75	0.9	579	15.6	140	13.5
RP1-12V	RP1-H-12V	12	9	1.2	1,028	11.7	140	18
RP1-24V	RP1-H-24V	24	18	2.4	2,133	11.3	270	28.8

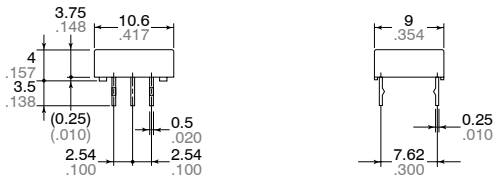
DIMENSIONS

mm inch

Standard PC board terminal

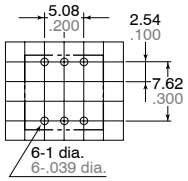


Self-clinching terminal



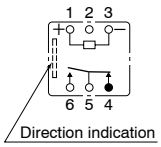
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



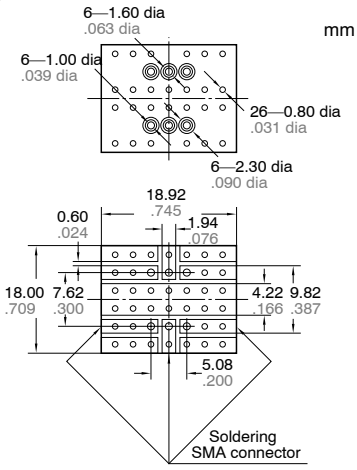
Deenergized condition

REFERENCE DATA

1. High frequency characteristics

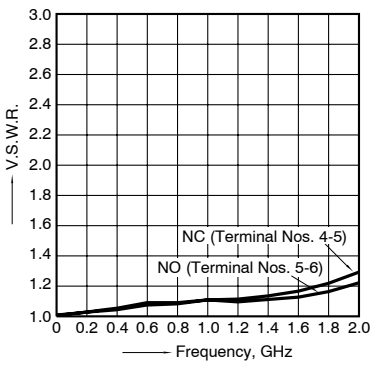
Sample: RP1-6V
Measuring method: Impedance 50Ω
Measuring tool:

mm inch

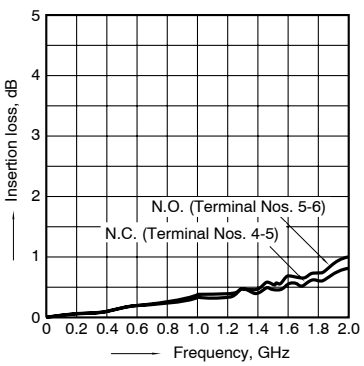


PC board
- Double-sided through hole
- Material: Glass-epoxy resin
- t = 1.0mm .039 inch
- Copper plated thickness: 35 μm

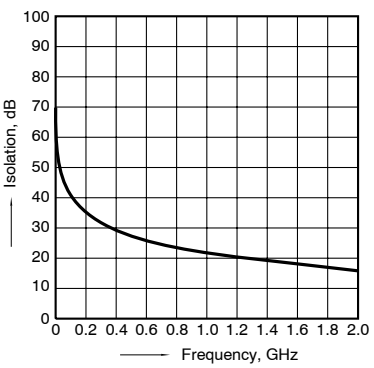
• V.S.W.R



• Insertion loss

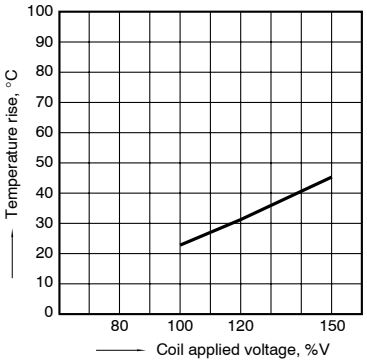


• Isolation



2. Coil temperature rise

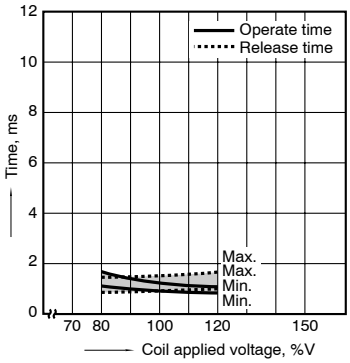
Sample: RP1-6V; No. of samples: n = 5
Carrying current: 0.1 A
Ambient temperature: 25°C 77°F



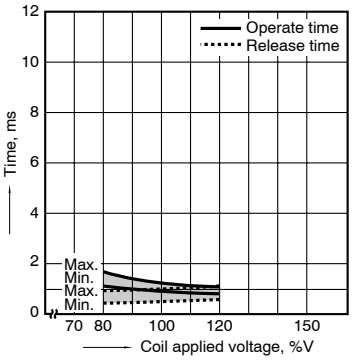
3. Operate/release time

Sample: RP1-9V; No. of samples: n = 50

• With diode



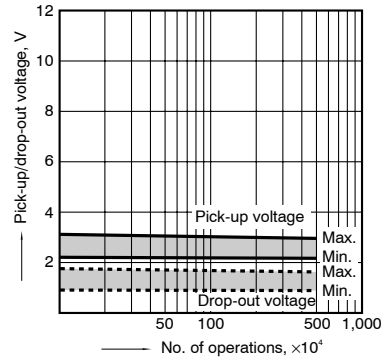
• Without diode



4. Mechanical life

Sample: RP1-5V; No. of samples: n = 8

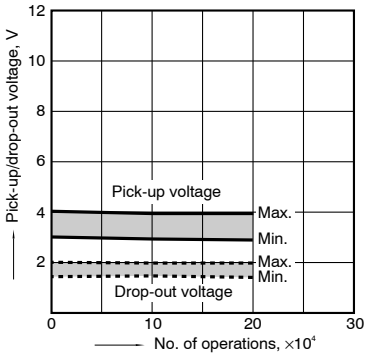
• Change of pick-up, drop-out voltage



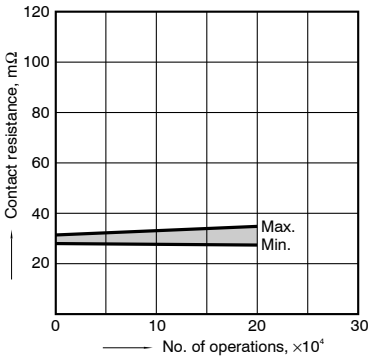
5. Electrical life (0.1 A 30 V DC)

Sample: RP1-6V; No. of samples: n = 6

• Change of pick-up/drop-out voltage

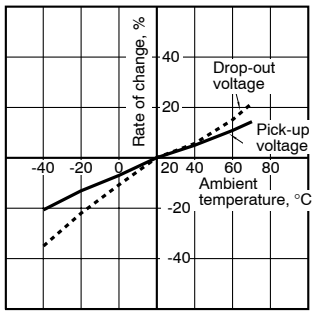


• Change of contact resistance



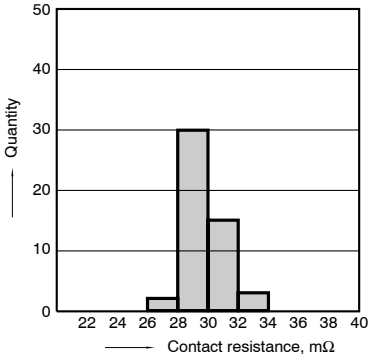
6. Ambient temperature characteristics

Sample: RP1-6V; No. of samples: n = 5



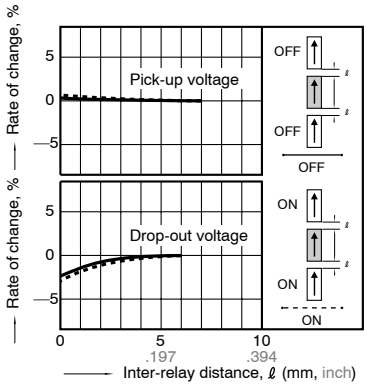
7. Contact resistance distribution (initial)

Sample: RP1-12V; No. of samples: n = 25



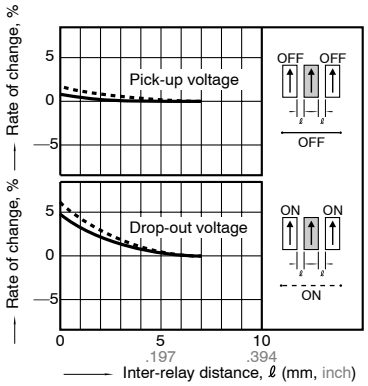
8.-(1) Influence of adjacent mounting

Sample: RP1-12V; No. of samples: n = 6



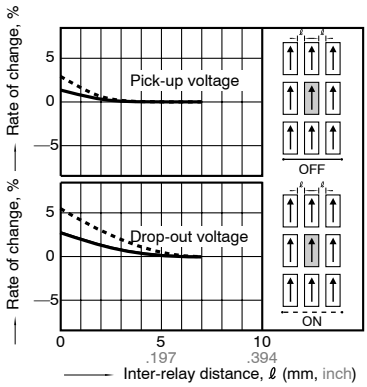
8.-(2) Influence of adjacent mounting

Sample: RP1-12V; No. of samples: n = 6

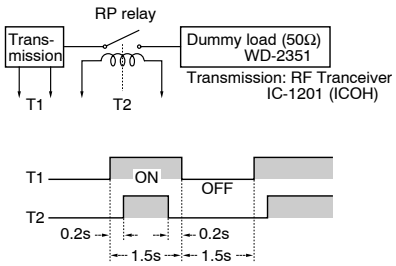


8.-(3) Influence of adjacent mounting

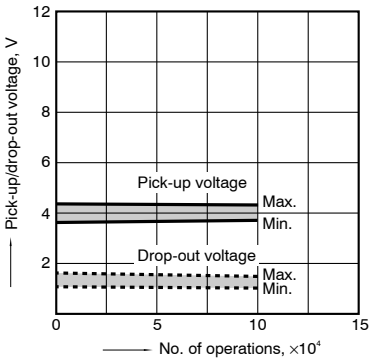
Sample: RP1-12V; No. of samples: n = 6



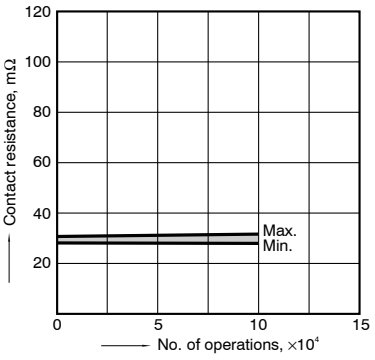
9. High frequency switching test (1.2 GHz, 1 W)
Sample: RP1-6V; No. of samples: n = 6
Ambient temperature: 20°C 68°F



• Change of pick-up/drop-out voltage



• Change of contact resistance



For Cautions for Use, see Relay Technical Information (page 390).

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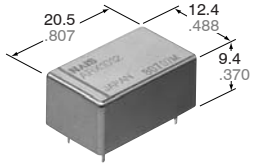
3 GHz SMALL MICROWAVE RELAY

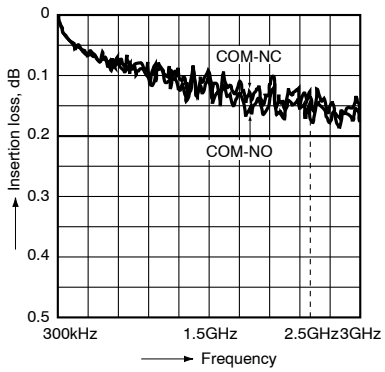
RX RELAYS (ARX)



mm inch

1. Excellent high frequency characteristics (~2.5GHz, Impedance 50Ω)
- Insertion loss: 0.2 dB or less
- Isolation: 60 dB or more

- Insertion loss



- V.S.W.R./ Return loss: 1.2dB or less/ 20.8dB or more

2. High sensitivity
- Nominal operating power: 200 mW

3. Small size
- Size: 20.5(L) × 12.4(W) × 9.4(H) mm .807(L) × .488(W) × .370(H) inch

*Also available for unit support (contact us for more details).

High-Frequency

SPECIFICATIONS

Contact

Arrangement			1 Form C
Contact material			Gold
Initial contact resistance			Max. 100 mΩ
Rating	Contact rating		10W (2.5 GHz, Impedance 50Ω, V.S.W.R.&1.2) 10mA 24V DC (resistive load)
	Contact carrying power		Max. 20W (at 40°C, V.S.W.R.&1.2, Average)
	Max. switching voltage		30 V DC
	Max. switching current		0.5 A DC
High frequency characteristics (~2.5GHz, Impedance 50Ω)	V.S.W.R. (Return loss)		Max. 1.2 (Min. 20.8dB)
	Insertion loss		Max. 0.2 dB
	Isolation		Min. 60 dB
	Input power		Max. 20W (at 40°C, V.S.W.R.&1.2, Average)
Expected life (min. operations)	Mechanical (at 180 cpm)		5×10^6
	Electrical	10mA 24 V DC (resistive load)	3×10^5
		10W 2.5 GHz, Impedance 50Ω, V.S.W.R.&1.2	10^5

Coil (at 20°C, 68°F)

	Nominal operating power
Single side stable	200 mW
1 coil latching	200 mW
2 coil latching	400 mW

Characteristics

Initial insulation resistance*1		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	500 Vrms
	Between contact and coil	1,000 Vrms
	Between contact and earth terminal	500 Vrms
Operate time [Set time]*3 (at 20°C)		Max. 10ms (Approx. 6ms) [Max. 10ms (Approx. 5ms)]
Release time (without diode) [Reset time]*3		Max. 6ms (Approx. 3ms) [Max. 10ms (Approx. 5ms)]
Temperature rise (at 20°C)*4		Max. 60°C
Shock resistance	Functional*5	Min. 200 m/s² {20 G}
	Destructive*6	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 3 mm
	Destructive	10 to 55 Hz at double amplitude of 5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to 70°C –40°F to 158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 5 g .18 oz

Remarks
- *1 Measurement at same location as "Initial breakdown voltage" section.
- *2 Detection current: 10mA
- *3 Nominal operating voltage applied to the coil, excluding contact bounce time.
- *4 By resistive method, nominal voltage applied to the coil: Contact carrying power: 20W, at 2.5GHz, Impedance 50Ω, V.S.W.R.&1.2
- *5 Half-wave pulse of sine wave: 11ms, detection time: 10μs.
- *6 Half-wave pulse of sine wave: 6ms
- *7 Detection time: 10μs
- *8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

TYPICAL APPLICATIONS

- Cellular phone base station (W-CDMA, FPLMTS, IMT-2000, PCS, DCS)
- Cellular phone-related measurement devices (SP3T/SP4T switches, etc)
- Wireless LAN
- Wireless Local Loop

ORDERING INFORMATION

Ex. A | RX | 1 | 0 | 12

Product name	Contact arrangement	Operating function	Coil voltage, V DC	
RX	1: 1 Form C	0: Single side stable 1: 1 coil latching 2: 2 coil latching	03: 3 4H: 4.5 06: 6	09: 9 12: 12 24: 24

Note: Standard packing; Carton: 50 pcs. Case 500 pcs.

TYPES ANE COIL DATA (at 20°C 68°F)

• Single side stable type

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)(initial)	Drop-out voltage, V DC (min.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C)
ARX1003	3	2.25	0.3	45	66.7	200	3.3
ARX104H	4.5	3.375	0.45	101	44.4	200	4.95
ARX1006	6	4.5	0.6	180	33.3	200	6.6
ARX1009	9	6.75	0.9	405	22.2	200	9.9
ARX1012	12	9	1.2	720	16.7	200	13.2
ARX1024	24	18	2.4	2,880	8.3	200	26.4

• 1 coil latching type

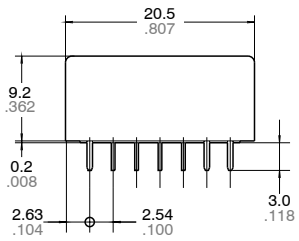
Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)(initial)	Reset voltage, V DC (max.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C)
ARX1103	3	2.25	2.25	45	66.7	200	3.3
ARX114H	4.5	3.375	3.375	101	44.4	200	4.95
ARX1106	6	4.5	4.5	180	33.3	200	6.6
ARX1109	9	6.75	6.75	405	22.2	200	9.9
ARX1112	12	9	9	720	16.7	200	13.2
ARX1124	24	18	18	2,880	8.3	200	26.4

• 2 coil latching type

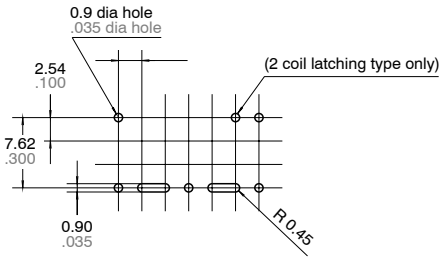
Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)(initial)	Reset voltage, V DC (max.)(initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 60°C)
ARX1203	3	2.25	2.25	22.5	133.3	400	3.3
ARX124H	4.5	3.375	3.375	50.6	88.9	400	4.95
ARX1206	6	4.5	4.5	90	66.7	400	6.6
ARX1209	9	6.75	6.75	202.5	44.4	400	9.9
ARX1212	12	9	9	360	33.3	400	13.2
ARX1224	24	18	18	1,440	16.7	400	26.4

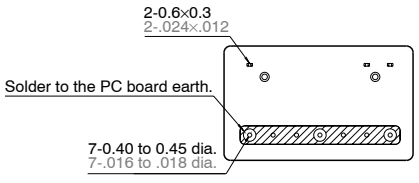
DIMENSIONS

mm inch



PC board pattern (Bottom view)

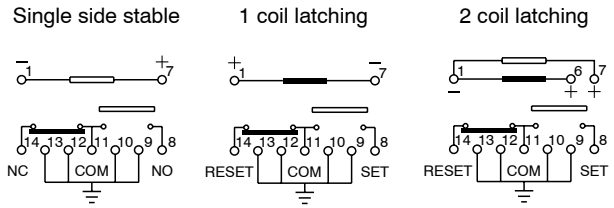




Tolerance: –0.1 –.004

General tolerance: –0.3 –.012

Schematic (Bottom view)



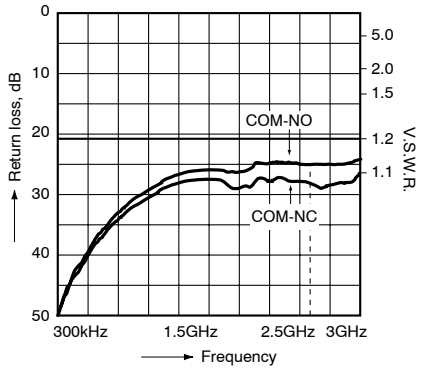
(Deenergized condition) (Reset condition) (Reset condition)

REFERENCE DATA

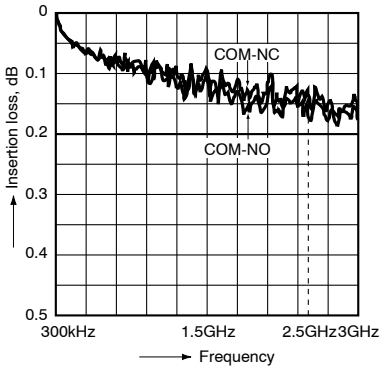
1. High frequency characteristics
Sample: ARX1012
Measuring method: Measured with HP network analyzer (HP8753C).

The details for the high frequency characteristics and the measurement procedures and conditions are listed in the RX relay test report.

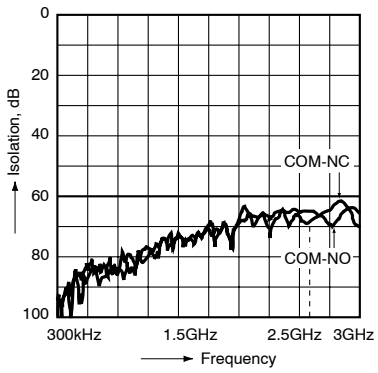
• V.S.W.R. (Return loss)



• Insertion loss



• Isolation



High-Frequency

For Cautions for Use, see Relay Technical Information (page 390).

RX (ARX)

Polarized Power Relays

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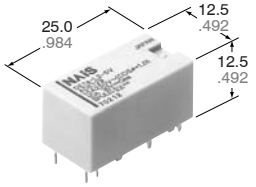
ideas for life

COMPACT HIGH-INSULATION POLARIZED POWER RELAY

DE RELAYS (ADE)



mm inch

FEATURES

- **Conforms to VDE0631.**
  Insulating distance between coil and contacts:
  Clearance Min. 8mm .315 inch
  Creepage distance Min. 8mm .315 inch
- **Extensive product line-up.**
- **Surge voltage between contact and coil 12 kV**
- **Low operating power**
  Nominal operating power at 200 mW (Single side stable, 2 coil latching)
- **Compact body saves space**
  Size: 12.5(W) × 25.0(L) × 12.5(H) mm
  .492(W) × .984(L) × .492(H) inch
  UL/CSA, VDE approved

SPECIFICATIONS

Contact

Arrangement		1 Form A	1 Form A 1 Form B	2 Form A
Contact material		Silver alloy		
Initial contact resistance, max. (By voltage drop 6V DC 1A)		30mΩ		
Rating (resistive load)	Nominal switching capacity	10A 250V AC, 10A 30V DC	8A 250V AC, 8A 30V DC	8A 250V AC, 8A 30V DC
	Max. switching power	2,500 VA*, 300W	2,000 VA*, 240W	2,000 VA*, 240W
	Max. switching voltage	440V AC, 230V DC	440V AC, 230V DC	440V AC, 230V DC
	Max. switching current	10A (16A)*	8A (16A)*	8A (16A)*
	Min. switching capacity#1	100 mA, 5 V DC		
Expected life (min. operations)	Mechanical (at 300cpm)	10^7		
	Electrical (at 20 cpm) (resistive load)	10^5	10^5(AC) 5×10^4(DC)	
	Electrical (16A / 230 V AC resistive)*	25000	20000	

Coil (at 20°C, 68°F)

	Nominal operating power
Single side stable	200 mW
1 coil latching	100 mW
2 coil latching	200 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* 16A possible for one contact set only with max. 4000 VA switching power.

Characteristics

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms
	Between contact sets	4,000 Vrms (2 Form A, 1 Form A 1 Form B)
	Between contact and coil	5,000 Vrms
Surge voltage between contact and coil*3		Min. 12,000 V (initial)
Operate time [Set time]*4		Max. 10ms (typ. 5ms) [Max. 10ms (typ. 4ms)] (at 20°C 68°F)
Release time (without diode) [Reset time]*4		Max. 5ms (typ. 2ms) [Max. 10ms (typ. 4ms)] (at 20°C 68°F)
Temperature rise (at 70°C)*5		Max. 50°C
Shock resistance	Functional*6	Min. 196 m/s²{20 G}
	Destructive*7	Min. 980 m/s²{100 G}
Vibration resistance	Functional*8	10 to 55 Hz at double amplitude of 2 mm
	Destructive	10 to 55 Hz at double amplitude of 3 mm
Conditions for operation, transport and storage*9 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to 70°C –40°F to 158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 7 g .25 oz

*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Nominal operating voltage applied to the coil, excluding contact bounce time.
*5 By resistive method
*6 Half-wave pulse of sine wave: 11ms, detection time: 10ms.
*7 Half-wave pulse of sine wave: 6ms
*8 Detection time: 10ms
*9 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408)

TYPICAL APPLICATIONS

- **Temperature controller**
- **Automatic meter reading**
- **OA equipment**
- **FA equipment**

ORDERING INFORMATION

Ex. DE — 1a — L — 3 V

Product name	Contact arrangement	Operating function	Coil voltage, V DC
DE	1a: 1 Form A 1a1b: 1 Form A 1 Form B 2a: 2 Form A	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48**

Notes: 1) Standard packing; Carton (tube package) 20 pcs. Case 500 pcs.

2) UL/CSA, VDE approved type is standard.

**just for single side stable

TYPES AND COIL DATA (at 20°C 68°F)

• Single side stable type

1 Form A, 1 Form A 1 Form B, 2 Form A

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
DE❑-1.5V	1.5	1.05	0.15	11.3	132.7	200	1.95
DE❑-3V	3	2.1	0.3	45	66.6	200	3.9
DE❑-4.5V	4.5	3.15	0.45	101	44.5	200	5.85
DE❑-5V	5	3.5	0.5	125	40	200	6.5
DE❑-6V	6	4.2	0.6	180	33.3	200	7.8
DE❑-9V	9	6.3	0.9	405	22.2	200	11.7
DE❑-12V	12	8.4	1.2	720	16.6	200	15.6
DE❑-24V	24	16.8	2.4	2,880	8.3	200	31.2
DE❑-48V	48	33.6	4.8	11,520	4.2	200	62.4

• 1 coil latching type

1 Form A

Part No.	Nominal voltage, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (min.) (initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
DE❑-L-1.5V	1.5	1.05	1.05	22.5	66.6	100	1.95
DE❑-L-3V	3	2.1	2.1	90	33.3	100	3.9
DE❑-L-4.5V	4.5	3.15	3.15	202	22.3	100	5.85
DE❑-L-5V	5	3.5	3.5	250	20	100	6.5
DE❑-L-6V	6	4.2	4.2	360	16.7	100	7.8
DE❑-L-9V	9	6.3	6.3	812	11.1	100	11.7
DE❑-L-12V	12	8.4	8.4	1,440	8.3	100	15.6
DE❑-L-24V	24	16.8	16.8	5,760	4.2	100	31.2

• 2 coil latching type

1 Form A

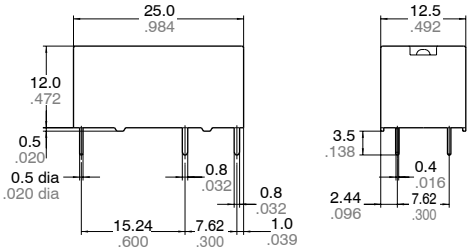
Part No.	Nominal voltage, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (min.) (initial)	Coil resistance, Ω (±10%)		Nominal operating current, mA (±10%)		Nominal operating power, mW		Max. allowable voltage, V DC
				Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
DE❑-L-1.5V	1.5	1.05	1.05	11.3	11.3	66.6	66.6	200	200	1.95
DE❑-L2-3V	3	2.1	2.1	45	45	66.6	66.6	200	200	3.9
DE❑-L2-4.5V	4.5	3.15	3.15	101	101	44.5	44.5	200	200	5.85
DE❑-L2-5V	5	3.5	3.5	125	125	40	40	200	200	6.5
DE❑-L2-6V	6	4.2	4.2	180	180	33.3	33.3	200	200	7.8
DE❑-L2-9V	9	6.3	6.3	405	405	22.2	22.2	200	200	11.7
DE❑-L2-12V	12	8.4	8.4	720	720	16.6	16.6	200	200	15.6
DE❑-L2-24V	24	16.8	16.8	2,880	2,880	8.3	8.3	200	200	31.2

Note: Insert contact arrangement, e.g.1a, 1a1b, 2a, in ❑ for contact form required.

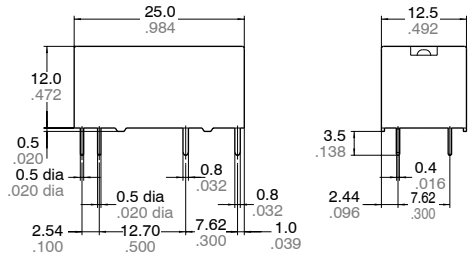
DIMENSIONS

mm inch

Single side stable
1 coil latching type



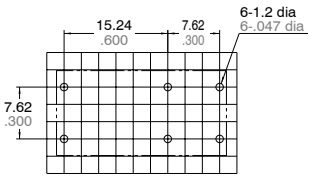
2 coil latching type



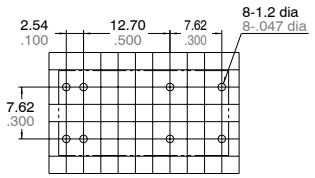
Tolerance: ±0.3 ±.012

PC board pattern (Bottom view)

Single side stable
1 coil latching type



2 coil latching type

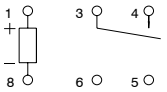


Tolerance : ±0.1 ±.004

Schematic (Bottom view)

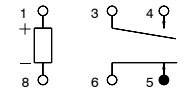
Single side stable

(1 Form A)



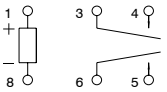
(5,6: dummy terminal)

(1 Form A 1 Form B)



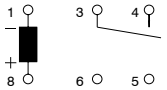
(Deenergized condition)

(2 Form A)



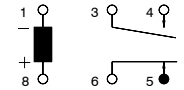
1coil latching type

(1 Form A)



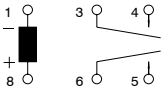
(5,6: dummy terminal)

(1 Form A 1 Form B)



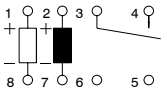
(Reset condition)

(2 Form A)



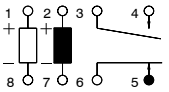
2coil latching type

(1 Form A)



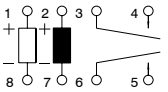
(5,6: dummy terminal)

(1 Form A 1 Form B)



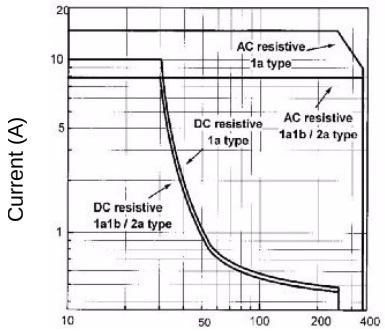
(Reset condition)

(2 Form A)



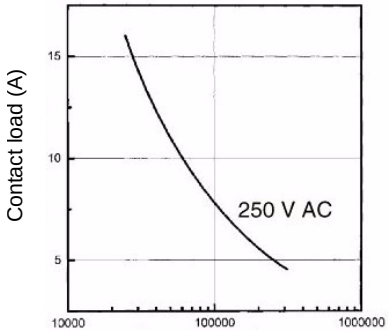
REFERENCE DATA

1. Max. switching power



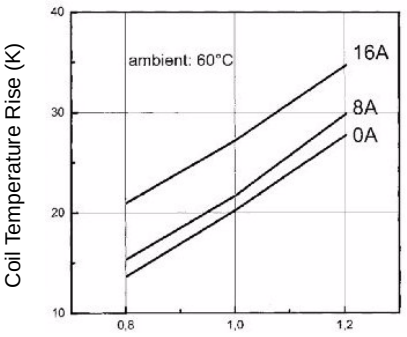
Contact voltage

2. Life curve



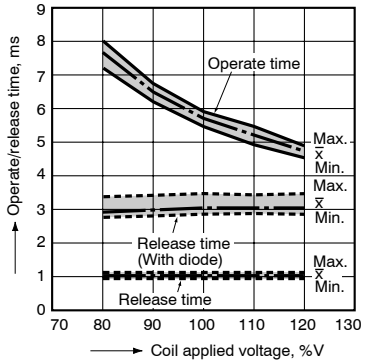
No. of operations

3. Coil Temperature Rise

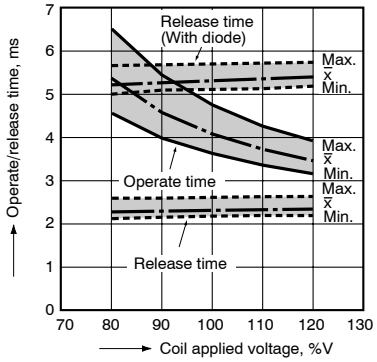


Coil Temperature Rise (% of nominal)

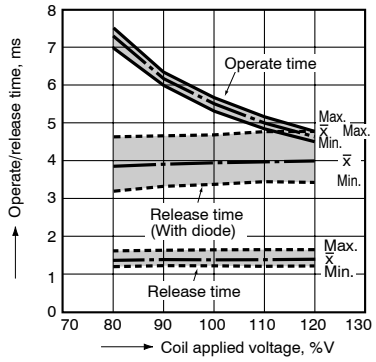
4-1. Operate/release time (1 Form A)
Tested sample: DE1a-5V
Quantity: n=5



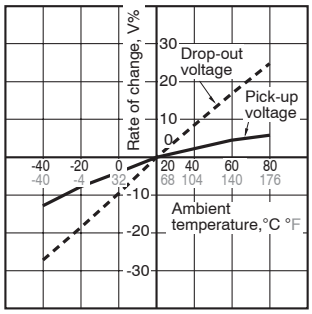
4-2. Operate/release time (1 Form A 1 Form B)
Tested sample: DE1a1b-5V, Quantity: n=5



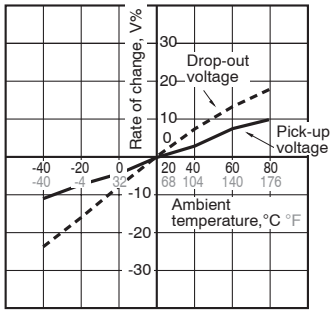
4-3. Operate/release time (2 Form A)
Tested sample: DE2a-5V, Quantity: n=5



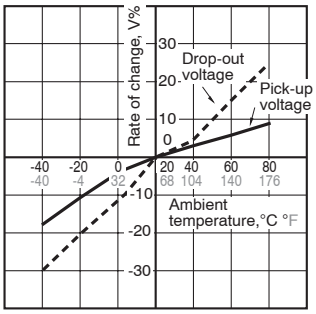
5-1. Ambient temperature characteristics (1 Form A)
Tested sample: DE1a-5V, Ambient temperature: –40°C to 80°C –40°F to 176°F, Quantity: n=6



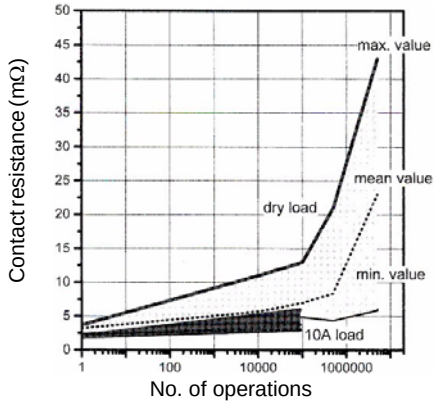
5-2. Ambient temperature characteristics (1 Form A 1 Form B)
Tested sample: DE1a1b-5V, Ambient temperature: –40°C to 80°C –40°F to 176°F, Quantity: n=6



5-3. Ambient temperature characteristics (2 Form A)
Tested sample: DE2a-5V, Ambient temperature: –40°C to 80°C –40°F to 176°F, Quantity: n=6



6. Change of contact resistance



For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

16A, COMPACT AND HIGH INSULATION POWER LATCHING RELAY

DJ RELAYS (ADJ)


Without test button


With test button

FEATURES

1. Variety of contact arrangements
Wide lineup of 1 Form C, 1 Form A, 1 Form B, 2 Form C, 2 Form A, 2 Form B, 1 Form A 1 Form B.

2. Latching operation
Latching via a polarized magnetic circuit structure allows remote operation and lower energy consumption

3. Compact with high capacity
16A (1-pole type) contact rating in a compact 29×13×16.5 mm (L×W×H) size.

4. Low power consumption
1 coil latching: 150mW
2 coil latching, single side stable: 250mW

5. High insulation
Both clearance and creepage distance between coil and contact are at 8 mm min.

6. With operation verification function
A test button (manual lever) type to facilitate circuit checks is also available (1 Form C, 1 Form A, 1 Form B types only).

TYPICAL APPLICATIONS

- FA equipment (brake circuits of industrial machine and robots, etc.)
- Electric power devices (remote surveillance devices, etc.)
- Household appliance networks (Motor control and lighting control, etc.)
- Time switches

SPECIFICATIONS

Contact

Arrangement		1 Form C, 1 Form A, 1 Form B, 1 Form A 1 Form B, 2 Form C, 2 Form A, 2 Form B
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ
Contact material		Silver alloy
Rating (resistive load)	Nominal switching capacity	16 A 250V AC (1 Form C, 1 Form A, 1 Form B) 10 A 250V AC (2 Form C, 2 Form A, 2 Form B, 1 Form A 1 Form B)
	Max. switching power	4,000 V A
	Max. switching voltage	250V AC
	Max. switching current	16 A
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	5×10^6
	Electrical (Resistive load)*1 (at 20 cpm)	1 Form C, 1 Form A, 1 Form B: 10^5 (at 16A 250V AC) 2 Form C, 2 Form A, 2 Form B, 1 Form A 1 Form B: : 10^5 (at 10A 250V AC)

Coil

Nominal operating power	1 coil latching	150mW
	Single side stable, 2 coil latching	250mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
*1 With breathing holes open
*2 Measurement at same location as "Initial breakdown voltage" section.
*3 Detection current: 10mA
*4 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*5 Excluding contact bounce time.
*6 By resistive method, max. switching current
*7 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*8 Half-wave pulse of sine wave: 6 ms
*9 Detection time: 10 μs
*10 Refer to 5. Conditions for operation, transport and storage mentioned in NOTES (page 152).

Characteristics

Initial insulation resistance*2		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*3	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	4,000 Vrms for 1 min.
Surge voltage between contact and coil*4		Min. 10,000 V (initial)
Operate time [Set time]*5 (at nominal voltage)		Approx. 10ms
Release time [Reset time]*5 (at nominal voltage)		Approx. 10ms
Temperature rise (at 70°C)*6		Max. 55°C
Shock resistance	Functional*7	Min. 200 m/s²{20 G}
	Destructive*8	Min. 1,000 m/s²{100 G}
Vibration resistance	Functional*9	10 to 55Hz at double amplitude of 2.0mm
	Destructive	10 to 55Hz at double amplitude of 3.0mm
Conditions for operation, transport and storage*10 (Not freezing and condensing at low temperature)	Ambient temperature	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 14 g .49 oz

ORDERING INFORMATION

Ex. ADJ □ □ □ □□

Contact arrangement	Operating function and protective construction	Auxiliary function	Coil voltage (DC)
1: 1 Form C 2: 1 Form A 3: 1 Form B 4: 1 Form A 1 Form B 5: 2 Form C 6: 2 Form A 7: 2 Form B	1: 1 coil latching, Flux-resistant type* 2: 1 coil latching, Sealed type 3: 2 coil latching, Flux-resistant type* 4: 2 coil latching, Sealed type 5: Single side stable, Flux-resistant type* 6: Single side stable, Sealed type	0: Without test button 1: With test button	05: 5 V 12: 12 V 06: 6 V 24: 24 V 48: 48 V

Notes: Standard packing: Carton: 100 pcs, Case: 500 pcs
*Only available with test button

TYPES

1. Without test button
Sealed type

Contact arrangement	Coil voltage, V DC	Single side stable type	1 coil latching type	2 coil latching type
		Part No.	Part No.	Part No.
1 Form C	5	ADJ16005	ADJ12005	ADJ14005
	6	ADJ16006	ADJ12006	ADJ14006
	12	ADJ16012	ADJ12012	ADJ14012
	24	ADJ16024	ADJ12024	ADJ14024
	48	ADJ16048	ADJ12048	ADJ14048
1 Form A	5	ADJ26005	ADJ22005	ADJ24005
	6	ADJ26006	ADJ22006	ADJ24006
	12	ADJ26012	ADJ22012	ADJ24012
	24	ADJ26024	ADJ22024	ADJ24024
	48	ADJ26048	ADJ22048	ADJ24048
1 Form B	5	ADJ36005	Please use 1 Form A.	Please use 1 Form A.
	6	ADJ36006		
	12	ADJ36012		
	24	ADJ36024		
	48	ADJ36048		
1 Form A 1 Form B	5	ADJ46005	ADJ42005	ADJ44005
	6	ADJ46006	ADJ42006	ADJ44006
	12	ADJ46012	ADJ42012	ADJ44012
	24	ADJ46024	ADJ42024	ADJ44024
	48	ADJ46048	ADJ42048	ADJ44048
2 Form C	5	ADJ56005	ADJ52005	ADJ54005
	6	ADJ56006	ADJ52006	ADJ54006
	12	ADJ56012	ADJ52012	ADJ54012
	24	ADJ56024	ADJ52024	ADJ54024
	48	ADJ56048	ADJ52048	ADJ54048
2 Form A	5	ADJ66005	ADJ62005	ADJ64005
	6	ADJ66006	ADJ62006	ADJ64006
	12	ADJ66012	ADJ62012	ADJ64012
	24	ADJ66024	ADJ62024	ADJ64024
	48	ADJ66048	ADJ62048	ADJ64048
2 Form B	5	ADJ76005	Please use 2 Form A.	Please use 2 Form A.
	6	ADJ76006		
	12	ADJ76012		
	24	ADJ76024		
	48	ADJ76048		

2. With test button
Flux-resistant type

Contact arrangement	Coil voltage, V DC	Single side stable type	1 coil latching type	2 coil latching type
		Part No.	Part No.	Part No.
1 Form C	5	ADJ15105	ADJ11105	ADJ13105
	6	ADJ15106	ADJ11106	ADJ13106
	12	ADJ15112	ADJ11112	ADJ13112
	24	ADJ15124	ADJ11124	ADJ13124
	48	ADJ15148	ADJ11148	ADJ13148
1 Form A	5	ADJ25105	ADJ21105	ADJ23105
	6	ADJ25106	ADJ21106	ADJ23106
	12	ADJ25112	ADJ21112	ADJ23112
	24	ADJ25124	ADJ21124	ADJ23124
	48	ADJ25148	ADJ21148	ADJ23148
1 Form B	5	ADJ35105	Please use 1 Form A.	Please use 1 Form A.
	6	ADJ35106		
	12	ADJ35112		
	24	ADJ35124		
	48	ADJ35148		

COIL DATA (at 20°C 68°F)

• Single side stable type

Nominal voltage, V DC	Set voltage, max. V DC (initial)	Reset voltage, max. V DC (initial)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
5	3.75	0.5	100	250	6.5
6	4.5	0.6	144		7.8
12	9	1.2	576		15.6
24	18	2.4	2,304		31.2
48	36	4.8	9,216		62.4

• 1 coil latching type

Nominal voltage, V DC	Set voltage, max. V DC (initial)	Reset voltage, max. V DC (initial)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
5	3.5	3.5	167	150	6.5
6	4.2	4.2	240		7.8
12	8.4	8.4	960		15.6
24	16.8	16.8	3,840		31.2
48	33.6	33.6	15,360		62.4

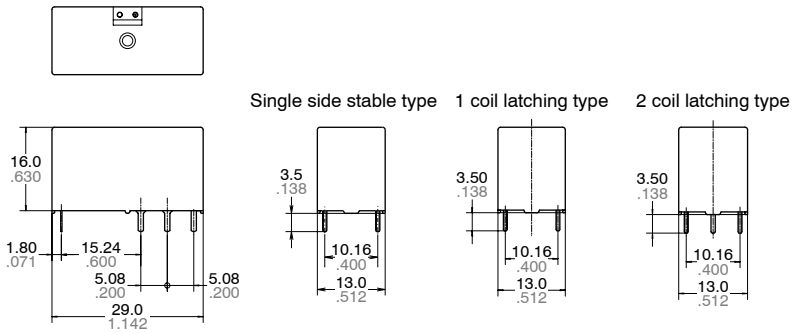
• 2 coil latching type

Nominal voltage, V DC	Set voltage, max. V DC (initial)	Reset voltage, max. V DC (initial)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
5	3.5	3.5	100	250	6.5
6	4.2	4.2	144		7.8
12	8.4	8.4	576		15.6
24	16.8	16.8	2,304		31.2
48	33.6	33.6	9,216		62.4

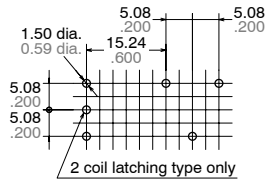
DIMENSIONS

mm inch

1. 1 Form C, without test button



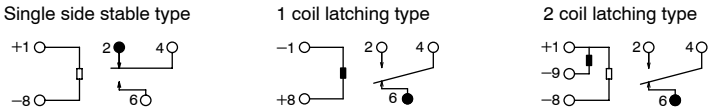
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

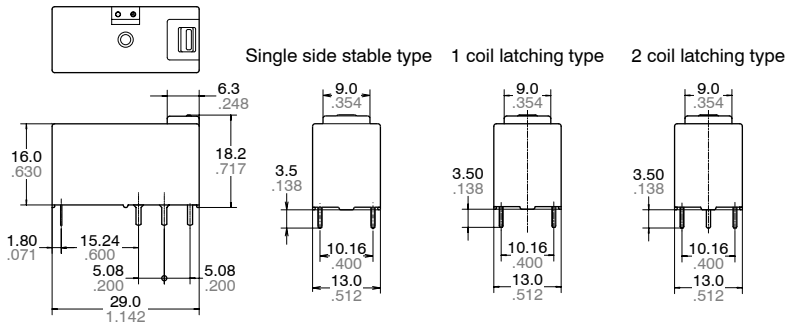
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

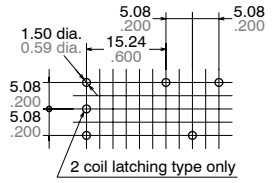


2. 1 Form C, with test button

mm inch



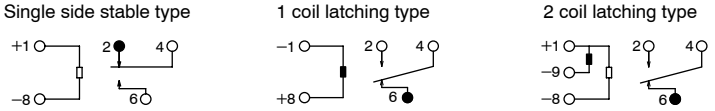
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

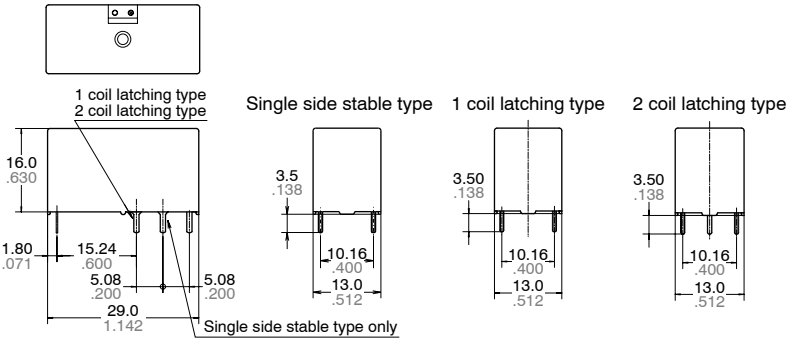
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

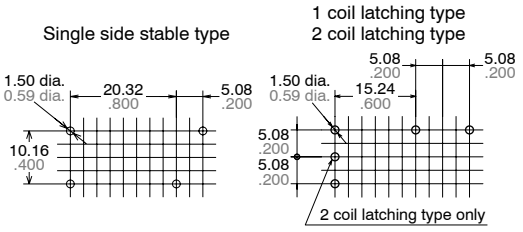


Polarized Power

3. 1 Form A, without test button



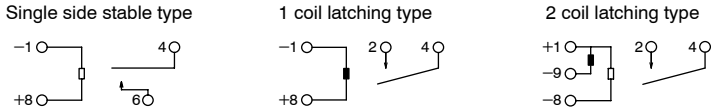
PC board pattern (Bottom view)



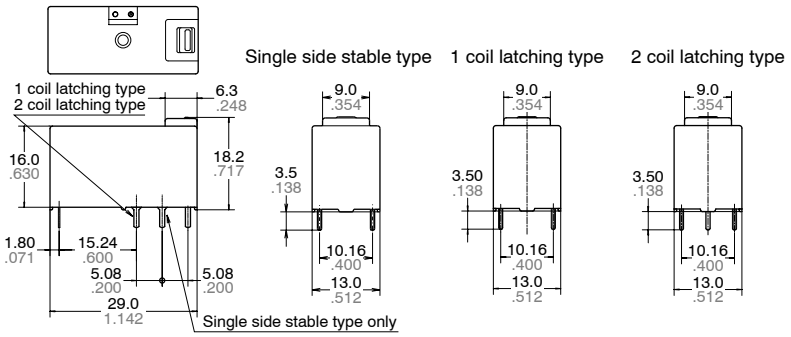
Tolerance: ±0.1 ±.004

General tolerance: ±0.3 ±.012

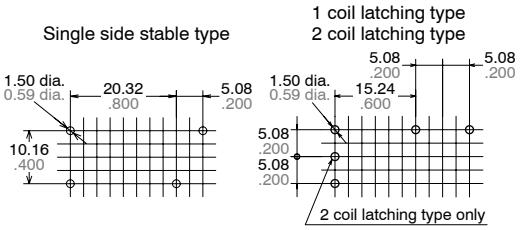
Schematic (Bottom view)



4. 1 Form A, with test button



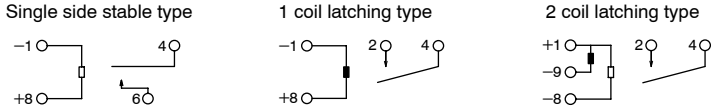
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

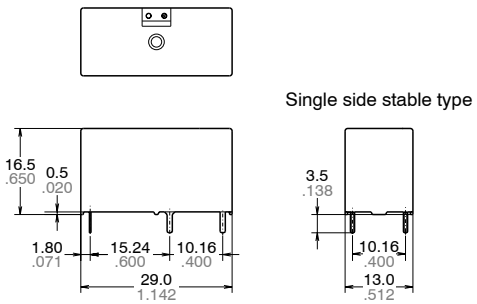
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

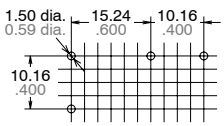


5. 1 Form B, without test button

mm inch



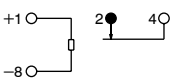
PC board pattern (Bottom view)



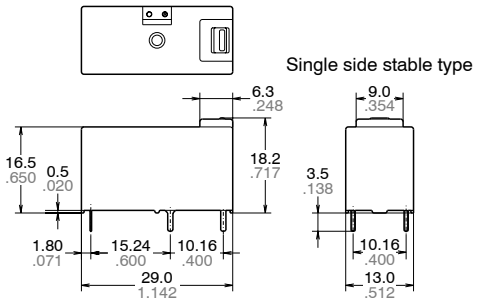
Tolerance: ±0.1 ±.004

General tolerance: ±0.3 ±.012

Schematic (Bottom view)

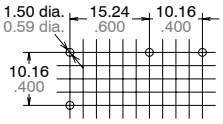


6. 1 Form B, with test button



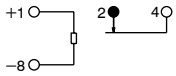
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)

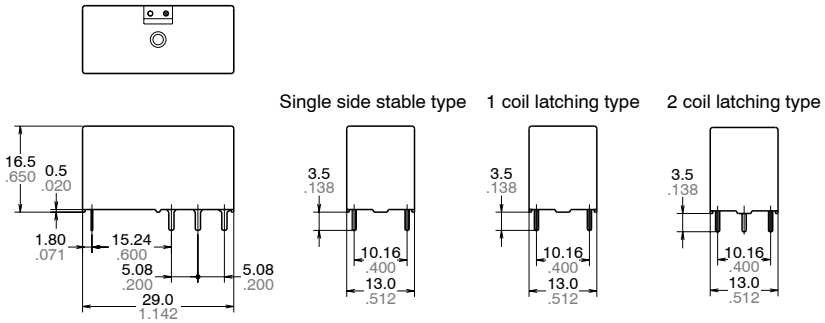


Tolerance: ±0.1 ±.004

Schematic (Bottom view)

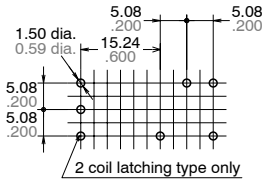


7. 1 Form A 1 Form B, without test button



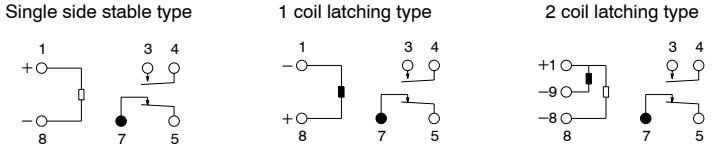
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



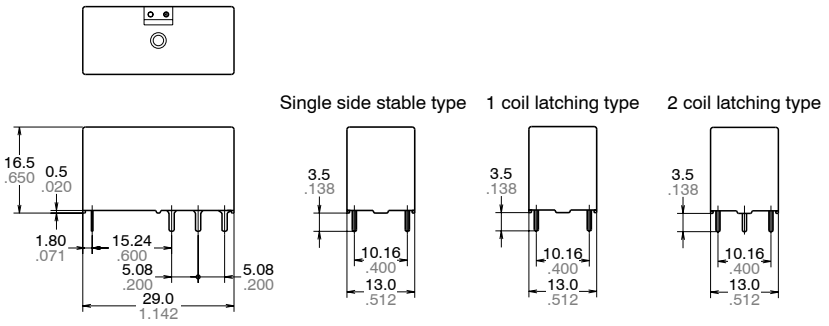
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

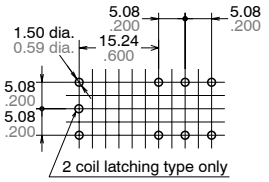


8. 2 Form C, without test button

mm inch



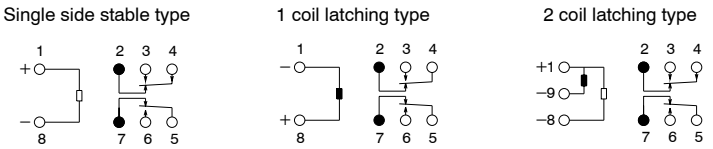
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

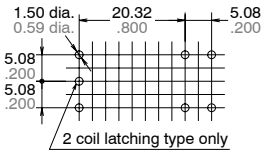
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

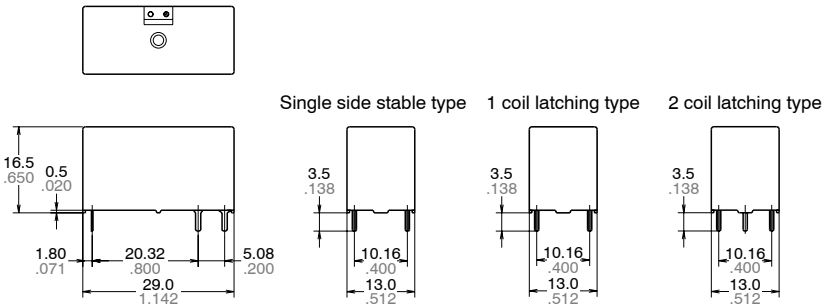


9. 2 Form A, without test button

PC board pattern (Bottom view)

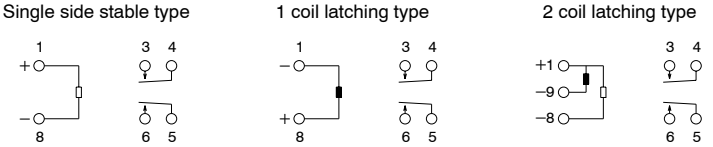


Tolerance: ±0.1 ±.004



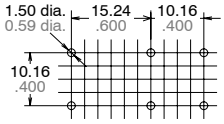
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

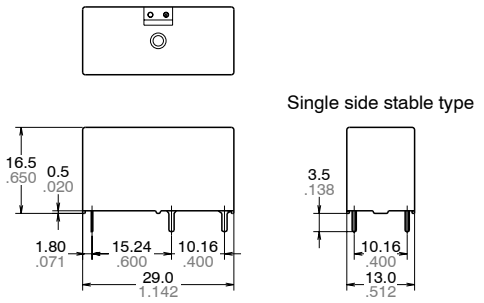


10. 2 Form B, without test button

PC board pattern (Bottom view)

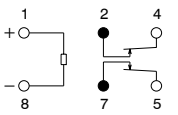


Tolerance: ±0.1 ±.004



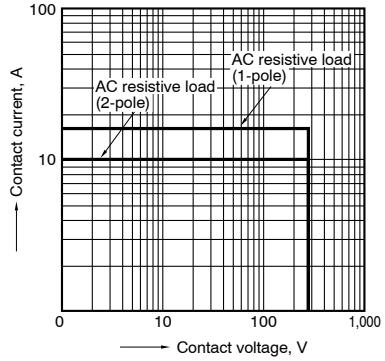
General tolerance: ±0.3 ±.012

Schematic (Bottom view)



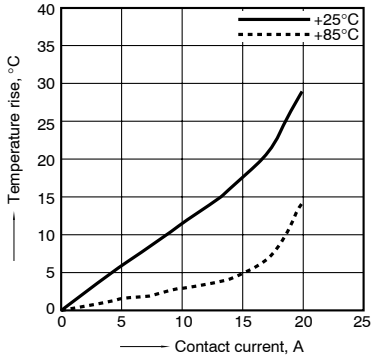
REFERENCE DATA

1. Max. switching capacity



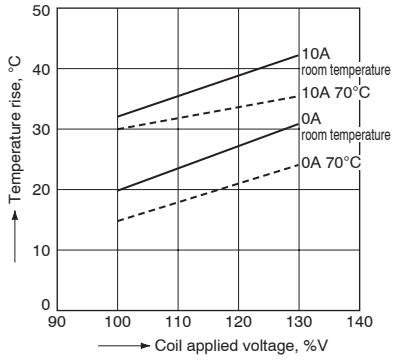
2. Temperature rise

Sample: ADJ12024, 6 pcs.
Coil applied voltage: 0 %V, Contact current: 16 A, 20 A
Measured portion: Contact, Ambient temperature: 25°C 77°F, 85°C 185°F



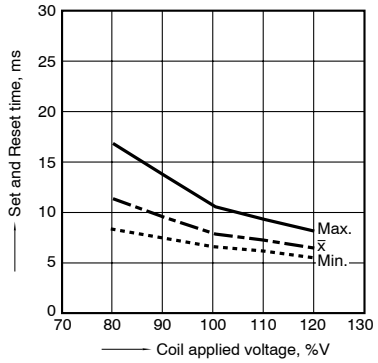
3. Coil temperature rise

Sample: ADJ56024, 6 pcs.
Coil applied voltage: 100 %V, 130 %V of rating
Contact current: 0 A, 10 A
Measured portion: Inside the coil, Ambient temperature: Room temperature, 70°C 158°F



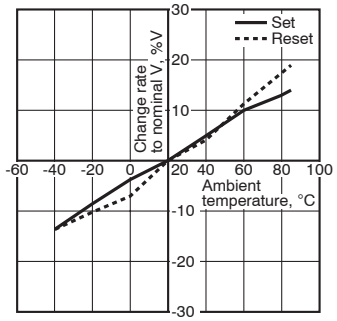
4. Set and Reset time

Sample: ADJ12024, 10 pcs
Coil applied voltage: 80 %V, 100 %V, 120 %V of rating



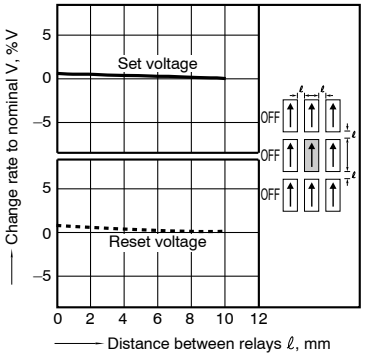
5. Ambient temperature characteristics

Sample: ADJ12024, 6pcs
Ambient temperature: –40°C to 85°C –40°F to 185°F



6. Influence of adjacent mounting

Sample: ADJ12024, 6pcs
Ambient temperature: Room temperature



NOTES

1. Coil operating power

Pure DC current should be applied to the coil. The wave form should be rectangular. If it includes ripple, the ripple factor should be less than 5%. However, check it with the actual circuit since the characteristics may be slightly different.

2. Coil connection

When connecting coils, refer to the wiring diagram to prevent mis-operation or malfunction.

3. Soldering

We recommend the following soldering conditions

Soldering: 250°C 482°F, max. 5 s

4. Others

1) If the relay has been dropped, the appearance and characteristics should always be checked before use.

2) The cycle lifetime is defined under the standard test condition specified in the JIS* C 5442-1996 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 85%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase,ambient conditions and other factors.

Also, be especially careful of loads such as those listed below.

• When used for AC load-operating and the operating phase is synchronous. Rocking and fusing can easily occur due to contact shifting.

• High-frequency load-operating

When high-frequency opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.

Three countermeasures for these are listed here.

• Incorporate an arc-extinguishing circuit.

• Lower the operating frequency

• Lower the ambient humidity

3) For secure operations, the voltage applied to the coil should be nominal voltage. In addition, please note that pick-up and drop-out voltage will vary according to the ambient temperature and operation conditions.

4) Heat, smoke, and even a fire may occur if the relay is used in conditions outside of the allowable ranges for the coil ratings, contact ratings, operating cycle lifetime, and other specifications. Therefore, do not use the relay if these ratings are exceeded. Also, make sure that the relay is wired correctly.

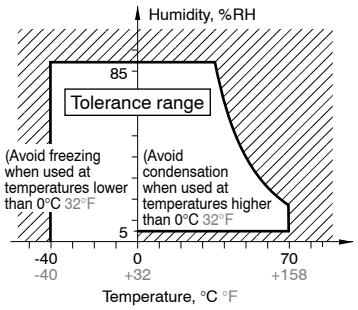
5) Incorrect wiring may cause unexpected events or the generation of heat or flames.

6) Check the ambient conditions when storing or transporting the relays and devices containing the relays. Freezing or condensation may occur in the relay, causing functional damage. Avoid subjecting the relays to heavy loads, or strong vibration and shocks.

5. Usage, transport and storage conditions

1) Ambient temperature, humidity, and atmospheric pressure during usage, transport, and storage of the relay:

- Temperature:
  –40 to +70°C –40 to +158°F
- Humidity: 5 to 85% RH
  (Avoid freezing and condensation.)
  The humidity range varies with the temperature. Use within the range indicated in the graph below.



- Atmospheric pressure: 86 to 106 kPa
  Temperature and humidity range for usage, transport, and storage

2) Condensation

Condensation forms when there is a sudden change in temperature under high temperature and high humidity conditions. Condensation will cause deterioration of the relay insulation.

3) Freezing

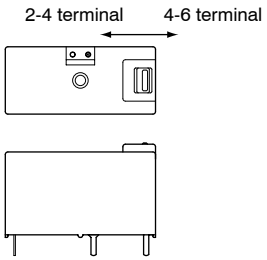
Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F. This causes problems such as sticking of movable parts or operational time lags.

4) Low temperature, low humidity environments

The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

6. Test button (manual lever) operation

The relay contacts switch over as follows:

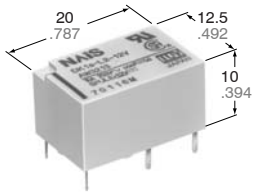


For Cautions for Use, see Relay Technical Information (page 390).

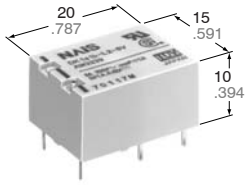
Panasonic
ideas for life

10 A MINIATURE POWER RELAY

DK RELAYS



1a



1a1b

mm inch

FEATURES

- **Large capacity in small size: 10 A 250 V AC (1a)**
- **High sensitivity: 200 mW nominal operating power**
- **High breakdown voltage 4,000 Vrms between contacts and coil 1,000 Vrms between open contacts Meeting FCC Part 68**
- **Sealed construction**
- **Latching types available**

SPECIFICATIONS

Contact

Arrangement		1 Form A	2 Form A, 1 Form A 1 Form B
Initial contact resistance, max. (By voltage drop 6 V DC 1A)		30 mΩ	
Contact material		Gold flash over silver alloy	
Rating (resistive)	Nominal switching capacity	10 A 250 V AC 10 A 30 V DC	8 A 250 V AC 8 A 30 V DC
	Max. switching power	300 W, 2,500 VA	240 W, 2,000 VA
	Max. switching voltage	250 V AC, 30 V DC	250 V AC, 30 V DC
	Max. switching current	10 A	8 A
	Min. switching capacity#1	10 mA, 5 V DC	
Expected life (min. operations)	Mechanical	5×10^7	
	Electrical (resistive)	10^5 (10 A 250 V AC, 10 A 30 V DC)	10^5 (8 A 250 V AC, 8 A 30 V DC)

Coil

Nominal operating power	200 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10 mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		Min. 1,000 mΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms
	Between contacts and coil	4,000 Vrms
Surge voltage between coil and contact*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Max. 10 ms (Approx. 5 ms)
Release time (without diode)*4 (at nominal voltage)		Max. 8 ms (Approx. 3 ms)
Temperature rise (at nominal voltage)		Max. 40°C with nominal coil voltage and at 10 A switching current
Shock resistance	Functional*5	Min. 98 m/s² {10 G}
	Destructive*6	Min. 980 m/s² {100 G}
Vibration resistance	Functional*7	88.2 m/s² {9 G}, 10 to 55 Hz at double amplitude of 1.5 mm
	Destructive	176.4 m/s² {18 G}, 10 to 55 Hz at double amplitude of 3.0 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +65°C –40°F to +149°F
	Humidity	5 to 85% R.H.
Unit weight	1 Form A	Approx. 5.6 g .20 oz
	1 Form A 1 Form B, 2 Form A	Approx. 6 g .21 oz

TYPICAL APPLICATIONS

- Switching power supply
- Power switching for various OA equipment
- Control or driving relays for industrial machines (robotics, numerical control machines, etc.)
- Output relays for programmable logic controllers, temperature controllers, timers and so on.
- Home appliances

ORDERING INFORMATION

Ex. DK [1a] — [L2] — [12V] — [F]

Contact arrangement	Operating function	Coil voltage	Environmental support
1a: 1 Form A 2a: 2 Form A 1a1b: 1 Form A 1 Form B	Nil: Single side stable L2: 2 coil latching	3, 5, 6, 9, 12, 24V	• RoHS Directive conforming type ($AgSnO_2$ type) F: 1a Nil: 2a, 1a1b • RoHS Directive non-conforming type (AgCdO type) Nil: 1a

Notes: 1. Standard packing Carton: 50 pcs.; Case: 500 pcs.
UL/CSA, TÜV approved type is standard.
2. 1 coil latching type available.

TYPES AND COIL DATA (at 20°C 68°F)

Single side stable

	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Maximum allowable voltage, V DC (at 65°C 149°F)
1 Form A	DK1a-3V (-F)	3	2.1	0.3	66.6	45	200	3.9
	DK1a-5V (-F)	5	3.5	0.5	40	125	200	6.5
	DK1a-6V (-F)	6	4.2	0.6	33.3	180	200	7.8
	DK1a-9V (-F)	9	6.3	0.9	22.2	405	200	11.7
	DK1a-12V (-F)	12	8.4	1.2	16.6	720	200	15.6
	DK1a-24V (-F)	24	16.8	2.4	8.3	2,880	200	31.2
1 Form A 1 Form B	DK1a1b-3V	3	2.1	0.3	66.6	45	200	3.9
	DK1a1b-5V	5	3.5	0.5	40	125	200	6.5
	DK1a1b-6V	6	4.2	0.6	33.3	180	200	7.8
	DK1a1b-9V	9	6.3	0.9	22.2	405	200	11.7
	DK1a1b-12V	12	8.4	1.2	16.6	720	200	15.6
	DK1a1b-24V	24	16.8	2.4	8.3	2,880	200	31.2
2 Form A	DK2a-3V	3	2.1	0.3	66.6	45	200	3.9
	DK2a-5V	5	3.5	0.5	40	125	200	6.5
	DK2a-6V	6	4.2	0.6	33.3	180	200	7.8
	DK2a-9V	9	6.3	0.9	22.2	405	200	11.7
	DK2a-12V	12	8.4	1.2	16.6	720	200	15.6
	DK2a-24V	24	16.8	2.4	8.3	2,880	200	31.2

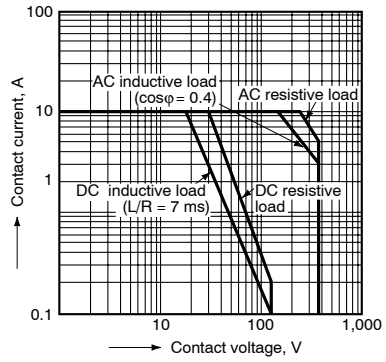
2 coil latching

	Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA (±10%)		Coil resistance, Ω (±10%)		Nominal operating power, mW		Maximum allowable voltage, V DC (at 65°C 149°F)
					Set	Reset	Set	Reset	Set	Reset	
1 Form A	DK1a-L2-3V (-F)	3	2.1	2.1	66.6	66.6	45	45	200	200	3.9
	DK1a-L2-5V (-F)	5	3.5	3.5	40	40	125	125	200	200	6.5
	DK1a-L2-6V (-F)	6	4.2	4.2	33.3	33.3	180	180	200	200	7.8
	DK1a-L2-9V (-F)	9	6.3	6.3	22.2	22.2	405	405	200	200	11.7
	DK1a-L2-12V (-F)	12	8.4	8.4	16.6	16.6	720	720	200	200	15.6
	DK1a-L2-24V (-F)	24	16.8	16.8	8.3	8.3	2,880	2,880	200	200	31.2
1 Form A 1 Form B	DK1a1b-L2-3V	3	2.1	2.1	66.6	66.6	45	45	200	200	3.9
	DK1a1b-L2-5V	5	3.5	3.5	40	40	125	125	200	200	6.5
	DK1a1b-L2-6V	6	4.2	4.2	33.3	33.3	180	180	200	200	7.8
	DK1a1b-L2-9V	9	6.3	6.3	22.2	22.2	405	405	200	200	11.7
	DK1a1b-L2-12V	12	8.4	8.4	16.6	16.6	720	720	200	200	15.6
	DK1a1b-L2-24V	24	16.8	16.8	8.3	8.3	2,880	2,880	200	200	31.2
2 Form A	DK2a-L2-3V	3	2.1	2.1	66.6	66.6	45	45	200	200	3.9
	DK2a-L2-5V	5	3.5	3.5	40	40	125	125	200	200	6.5
	DK2a-L2-6V	6	4.2	4.2	33.3	33.3	180	180	200	200	7.8
	DK2a-L2-9V	9	6.3	6.3	22.2	22.2	405	405	200	200	11.7
	DK2a-L2-12V	12	8.4	8.4	16.6	16.6	720	720	200	200	15.6
	DK2a-L2-24V	24	16.8	16.8	8.3	8.3	2,880	2,880	200	200	31.2

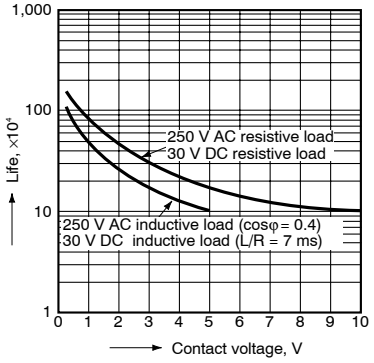
REFERENCE DATA

1. 1 Form A type

1. Maximum operating power

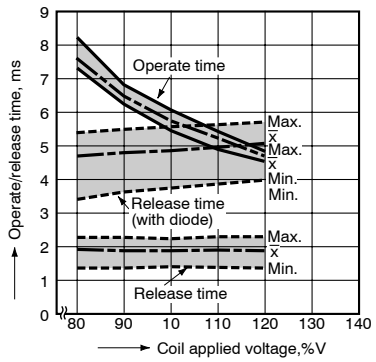


2. Life curve



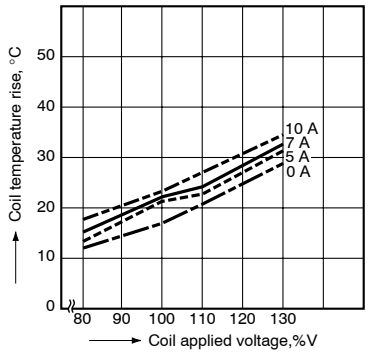
3. Operate/Release time

Sample: DK1a-24V, 5 pcs.



4. Coil temperature rise (at 30°C 68°F)

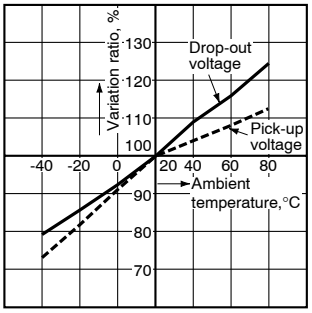
Sample: DK1a-12V, 5 pcs.



5. Ambient temperature characteristics

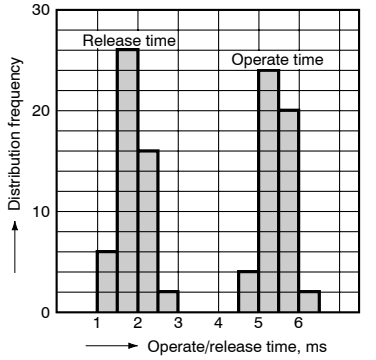
Sample: DK1a-24V, 6 pcs

Ambient temperature: –40°C to +80°C
–40°F to +176°F



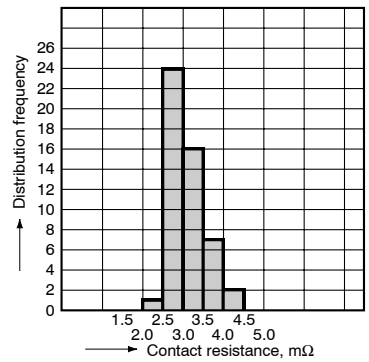
6. Operate/Release time (at 20°C 68°F)

Sample: DK1a-24V (50 pcs.)



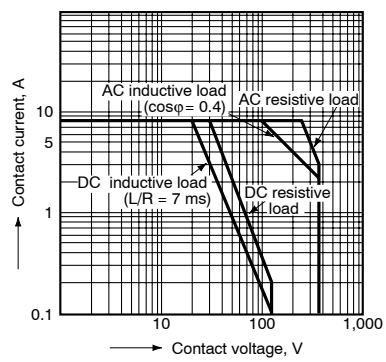
7. Contact resistance (at 20°C 68°F)

Sample: DK1a-24V (50 pcs.)

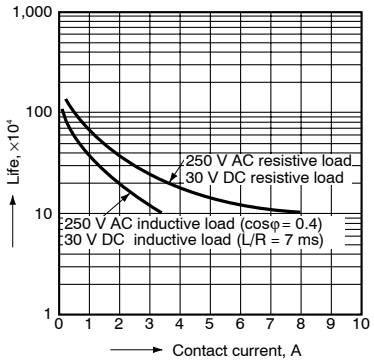


2. 1 Form A 1 Form B type, 2 Form A type1. 1 Form A type

1. Maximum operating power

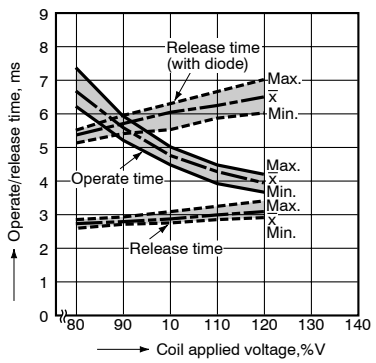


2. Life curve



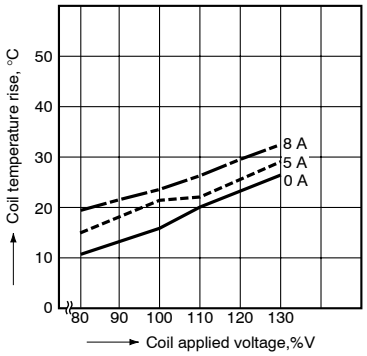
3. Operate/Release time (at 20°C 68°F)

Sample: DK1a1b-12V, 5 pcs.

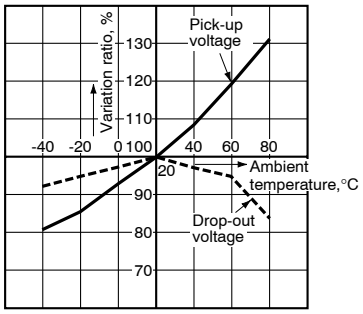


4. Coil temperature rise

Sample: DK1a1b-12V, 5 pcs.
Ambient temperature: 20°C 68°F



5. Ambient temperature characteristics

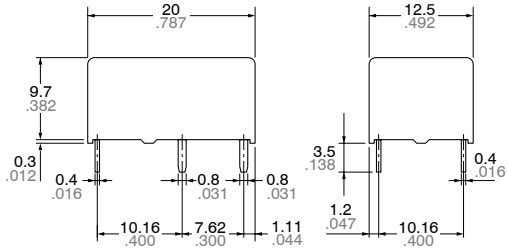


DIMENSIONS

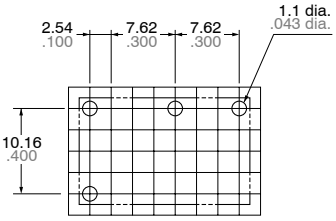
mm inch

1. 1 Form A type

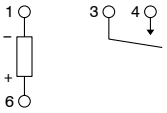
Single side stable type



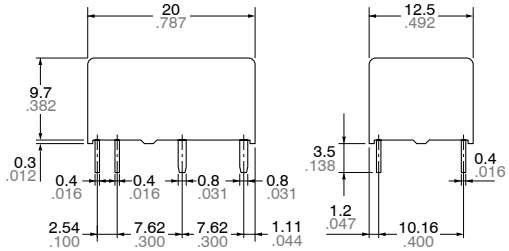
PC board pattern (Copper-side view)

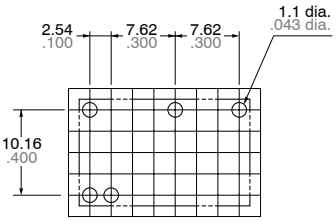


Schematic (Bottom view)
Single side stable
(Deenergized condition)



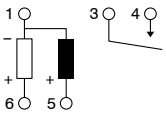
2 coil latching type





The above shows 2 coil latching type. No.5 terminal is eliminated on single side stable type.

2 coil latching
(Reset condition)



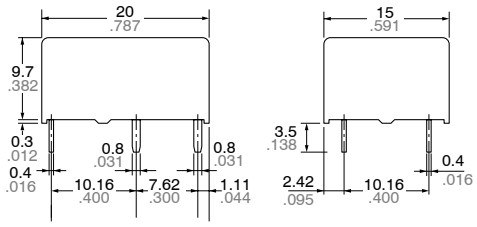
Since this is a polarized relay, the connection to the coil should be done according to the above schematic.

General tolerance: ±0.3 ±.012

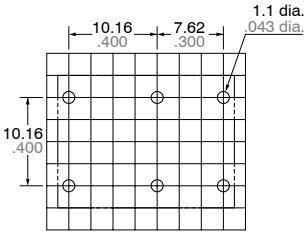
Tolerance: ±0.1 ±.004

2. 1 Form A 1 Form B type, 2 Form A type

Single side stable type

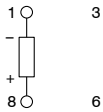


PC board pattern (Copper-side view)

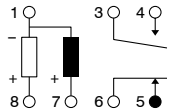


Schematic (Bottom view)
<1 Form A 1 Form B type>

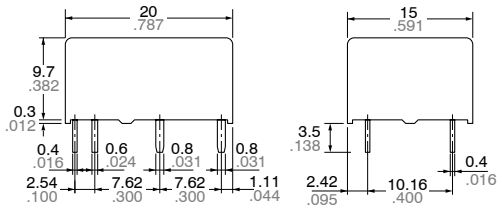
Single side stable (Deenergized condition)

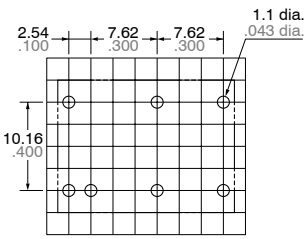


2 coil latching (Reset condition)



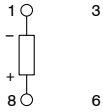
2 coil latching type



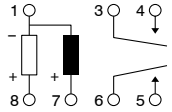


<2 Form A>

Single side stable (Deenergized condition)



2 coil latching (Reset condition)



Since this is a polarized relay, the connection to the coil should be done according to the above schematic.

Note:
Relay out-line and PC board pattern are common for both 1 Form A 1 Form B type and 2 Form A type.

General tolerance: ±0.3 ±.012

Tolerance: ±0.1 ±.004

DK relay socket

TYPES AND RELAY COMPATIBILITY

Relay \ Socket		1 Form A		1 Form A 1 Form B, 2 Form A	
		Single side stable type	2 coil latching type	Single side stable type	2 coil latching type
1 Form A	Single side stable type	DK1a-PS	DK1a-PSL2	—	—
	2 coil latching type	—	DK1a-PSL2	—	—
1 Form A 1 Form B 2 Form A	Single side stable type	—	—	DK2a-PS	DK2a-PSL2
	2 coil latching type	—	—	—	DK2a-PSL2

SPECIFICATIONS

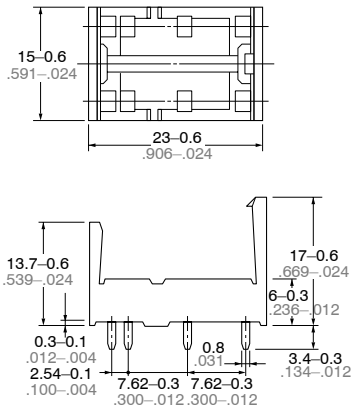
Breakdown voltage*1	4,000 Vrms (Except the portion between coil terminals)
Insulation resistance	Min. 1,000 mΩ (at 500 V DC)
Heat resistance	150°C (for 1 hour)
Max. continuous current	10 A (DK1a-PS, DK1a-PSL2), 8 A (DK2a-PS, DK2a-PSL2)

Remarks
*1 Detection current: 10 mA

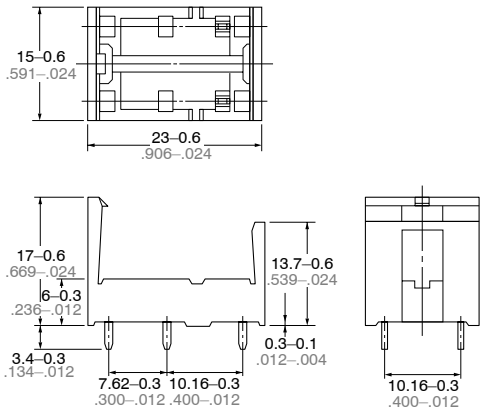
DIMENSIONS

mm inch

1 Form A type

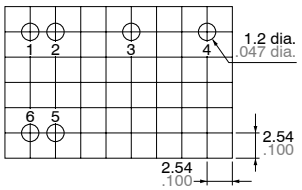


1 Form A 1 Form B type, 2 Form A type

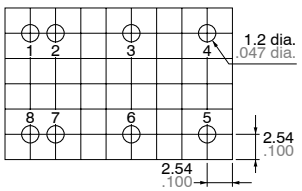


PC board pattern (Copper-side view)

1 Form A



1 Form A 1 Form B



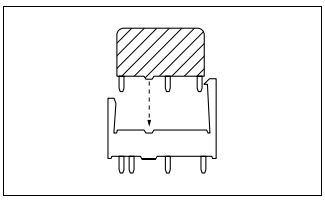
The above shows 2 coil latching type. No.2 and 5 terminal are eliminated on single side stable type.

General tolerance: ±0.3 ±.012

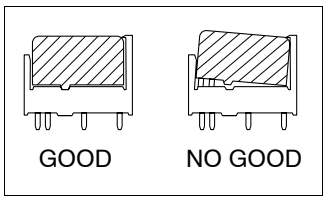
Tolerance: ±0.1 ±.004

FIXING AND REMOVAL METHOD

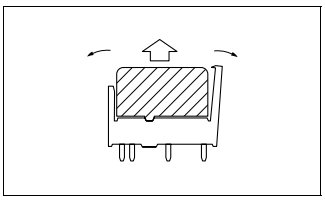
1. Match the direction of relay and socket.



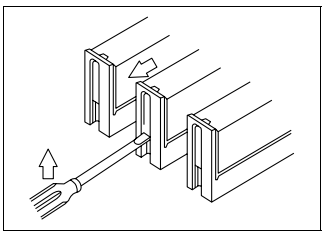
2. Both ends of the relay are to be secured firmly so that the socket hooks on the top surface of the relay.



3. Remove the relay, applying force in the direction shown below.

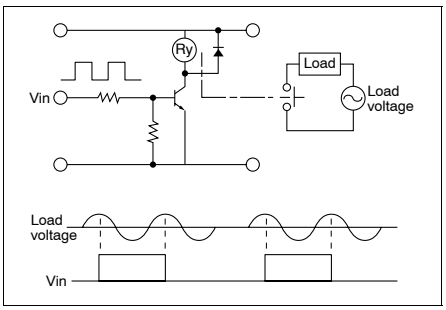


4. In case there is not enough space to grasp relay with fingers, use screwdrivers in the way shown below.



NOTES

1. Phase synchronization of AC-load switching
In case of switching the contact synchronized with phase of load voltage, the life of contact might be shorter or contact failure might be caused. Please confirm this matter in the actual system in this case. If necessary, the phase control would be recommended.



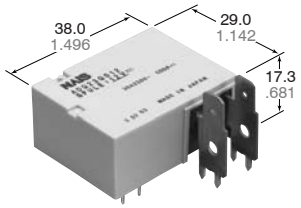
2. Soldering should be done under the following conditions:
250°C 482°F within 10s
300°C 572°F within 5s
350°C 662°F within 3s

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

30A POWER LATCHING RELAY

DQ RELAYS (ADQ)



FEATURES

1. 30A capacity in small size

2. Latching type

3. High insulation
4,000V AC (between contacts and coil)
Surge 10,000V (between contacts and coil)

4. Sealed construction

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		30 mΩ
Contact material		Silver alloy
Rating (resistive load)	Nominal switching capacity	30 A 250V AC
	Max. switching power	7,500 V A
	Max. switching voltage	250V AC
	Max. switching current	30 A
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	10^6
	Electrical (Resistive load)	10^{4*1}

Coil

	Nominal operating power
1 coil latching	500 mW
2 coil latching	1,000 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed (at rated load)		10 cpm
Initial insulation resistance*2		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*3	Between open contacts	1,500 Vrms for 1 min.
	Between contacts and coil	4,000 Vrms for 1 min.
Surge voltage between contact and coil*4		Min. 10,000 V (initial)
Set time*5 (at 20°C) (at nominal voltage)		Max. 20ms
Reset time*5 (at 20°C) (at nominal voltage)		Max. 20ms
Temperature rise (at 65°C)*6		Max. 50°C (Coil; de-energized)
Shock resistance	Functional*7	Min. 200 m/s²{20 G}
	Destructive*8	Min. 1,000 m/s²{100 G}
Vibration resistance	Functional*9	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 2.0mm
Conditions for operation, transport and storage*10 (Not freezing and condensing at low temperature)	Ambient temperature*11	–40°C to +65°C –40°F to +149°F
	Humidity	5 to 75% R.H.
Unit weight		Approx. 35 g 1.23 oz

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 At nominal switching capacity, operating frequency: 3s ON, 3s OFF
*2 Measurement at same location as "Initial breakdown voltage" section.
*3 Detection current: 10mA
*4 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*5 Excluding contact bounce time.
*6 By resistive method, max. switching current
*7 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*8 Half-wave pulse of sine wave: 6 ms
*9 Detection time: 10 μs
*10 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).
*11 Under the packing condition, allowable temperature range is from –40 to +65°C –40° to +149°F.

TYPICAL APPLICATIONS

- Time switches
- Electric water heaters
- Remote control of electric power meters

ORDERING INFORMATION

ADQ [ ] [3] [Q] [0] [ ]

Operating function	Contact capacity	Terminal shape	Contact characteristics	Coil voltage (DC)
1: 1 coil latching 2: 2 coil latching	3: 30 A	Q: 250 Faston terminal	0: Standard contact	4H: 4.5 V 12: 12 V 06: 6 V 24: 24 V 09: 9 V

TYPES AND COIL DATA (at 20°C 68°F)

• 1 coil latching type

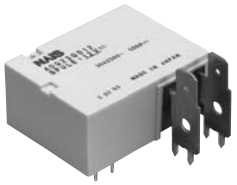
Contact arrangement	Part No.	Nominal voltage, V DC	Set voltage, max. V DC (initial)	Reset voltage, max. V DC (initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
1 Form A	ADQ13Q04H	4.5	3.15	3.15	40.5	111.1	500	5.85
	ADQ13Q006	6	4.2	4.2	72	83.3	500	7.8
	ADQ13Q009	9	6.3	6.3	162	55.6	500	11.7
	ADQ13Q012	12	8.4	8.4	288	41.7	500	15.6
	ADQ13Q024	24	16.8	16.8	1,152	20.8	500	31.2

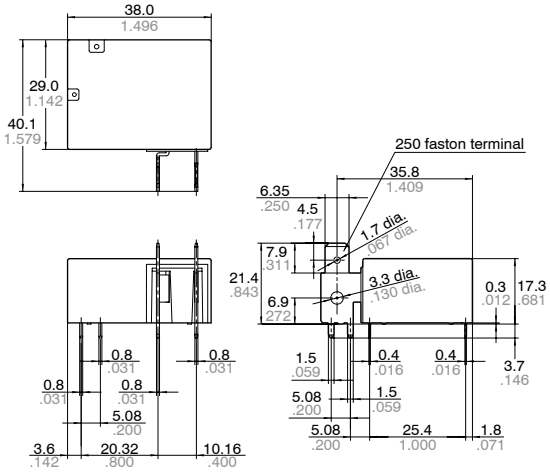
• 2 coil latching type

Contact arrangement	Part No.	Nominal voltage, V DC	Set voltage, max. V DC (initial)	Reset voltage, max. V DC (initial)	Coil resistance, Ω (±10%)		Nominal operating current, mA (±10%)		Nominal operating power, mW		Max. allowable voltage, V DC
					Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
1 Form A	ADQ23Q04H	4.5	3.15	3.15	20.3	20.3	221.7	221.7	1,000	1,000	5.85
	ADQ23Q006	6	4.2	4.2	36	36	166.7	166.7	1,000	1,000	7.8
	ADQ23Q009	9	6.3	6.3	81	81	111.1	111.1	1,000	1,000	11.7
	ADQ23Q012	12	8.4	8.4	144	144	83.3	83.3	1,000	1,000	15.6
	ADQ23Q024	24	16.8	16.8	576	576	41.7	41.7	1,000	1,000	31.2

DIMENSIONS

mm inch

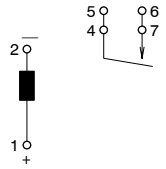




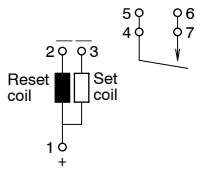
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

1 coil latching type (Reset condition)

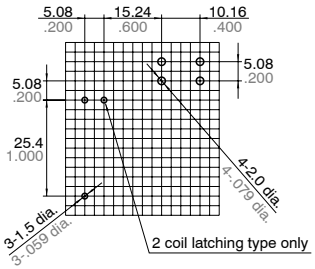


2 coil latching type (Reset condition)



Note) Terminal No.3 is only for 2 coil latching type.

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

NOTES

If the relay is used over 20A current through plug-in terminal, plug-in terminal should be soldered on receptacle terminal for preventing the loose contact during long time using.

For Cautions for Use, see Relay Technical Information (page 390).

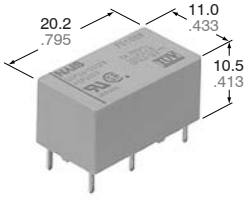
Panasonic
ideas for life

8 A MINIATURE POWER RELAY IN DS RELAY SERIES

DSP RELAYS

DSP1a

DSP1



DSP2a

mm inch

FEATURES

- **Power types added to DS relay series**
- **High switching capacity: 1a: 8 A 250 V AC / 1a1b, 2a: 5 A 250 V AC**
- **High sensitivity: 190 mW pick-up power**
- **High contact welding resistance**
- **Latching types available**
- **High breakdown voltage 3,000 Vrms between contacts and coil 1,000 Vrms between open contacts Meeting FCC Part 68**
- **Sealed types are standard**

SPECIFICATIONS (at 20°C 68°F)

Contact

Arrangement		1a	1a1b	2a
Contact material		Gold flash over silver alloy		
Initial contact resistance, max. (By voltage drop 6 V DC 1A)		30 mΩ		
Nominal switching capacity		8A 250 VAC 5A 30 VDC	5A 250 VAC 5A 30 VDC	
Rating (resistive)	Max. switching power	2,000 VA 150 W	1,250 VA 150 W	
	Max. switching voltage	250 V AC, 30 V DC		
	Max. switching current	8 A	5 A	
	Min. switching capacity#1	10 mA, 5 V DC		
Expected life (min. operations)	Mechanical (at 180 cpm)	5×10^7		
	Electrical	10^5		

Coil (polarized) (at 20°C 68°F)

Minimum operating power	Single side stable	192 mW
	1 coil latching	96 mW
	2 coil latching	192 mW
Nominal operating power	Single side stable	300 mW
	1 coil latching	150 mW
	2 coil latching	300 mW

Note: All specifications are based on the condition of 25°C 77°F, 50% R.H. unless otherwise specified.

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed		30 cps. at rated load
Initial insulation resistance*1		Min. 1,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	1,000 Vrms
	Between contact sets	2,000 Vrms (1a1b, 2a)
	Between contacts and coil	3,000 Vrms
Surge voltage between contacts and coil		Min. 5,000 V
Set time*3 (at nominal voltage)		Max. 10 ms (Approx. 5 ms)
Reset time*3 (at nominal voltage)		Max. 10 ms (Approx. 4 ms)
Operate time*3 (at nominal voltage)		Max. 10 ms (Approx. 5 ms)
Release time(without diode)*3 (at nominal voltage)		Max. 5 ms (Approx. 4 ms)
Temperature rise		Max. 40°C (1a1b type) Max. 55°C (1a, 2a types)
Soldering temperature		250°C (10 s) 300°C (5 s), 350°C (3 s)
Shock resistance	Functional*4	Min. 196 m/s² {20 G}
	Destructive*5	Min. 980 m/s² {100 G}
Vibration resistance	Functional*6	117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2 mm
	Destructive	205.8 m/s² {21 G}, 10 to 55 Hz at double amplitude of 3.5 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)		–40°C to +65°C – 40°F 149°F
Unit weight		Approx. 4.3 g .15 oz

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

TYPICAL APPLICATIONS

Office and industrial electronic devices
• Terminal devices of information processing equipment, such as printer, data recorder.
• Office equipment (copier, facsimile)
• Measuring instruments
• NC machines, temperature controllers and programmable logic controllers.

ORDERING INFORMATION

Ex. DSP [1] —— [L] —— [DC12V] —— [R]

Contact arrangement	Operating function	Coil voltage	Polarity
1: 1a1b 1a: 1a 2a: 2a	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	DC: 3, 5, 6, 9, 12, 24 V	Nil: Standard polarity R: Reverse polarity

Note: Standard packing: Carton: 50 pcs.; Case: 500 pcs.
UL/CSA, VDE approved type is standard.

TYPES AND COIL DATA (at 20°C 68°F)

Single side stable

Type	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA	Nominal operating power, mW	Coil resistance, Ω (±10%)	Max. allowable voltage, at 50°C, V DC
Single side stable	DSP❑-DC3V	3	2.4	0.3	100	300	30	3.9
	DSP❑-DC5V	5	4.0	0.5	60	300	83	6.5
	DSP❑-DC6V	6	4.8	0.6	50	300	120	7.8
	DSP❑-DC9V	9	7.2	0.9	33.3	300	270	11.7
	DSP❑-DC12V	12	9.6	1.2	25	300	480	15.6
	DSP❑-DC24V	24	19.2	2.4	12.5	300	1,920	31.2

1 coil latching

Type	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA	Nominal operating power, mW	Coil resistance, Ω (±10%)	Max. allowable voltage, at 50°C, V DC
1 coil latching	DSP❑-L-DC3V	3	2.4	2.4	50	150	60	3.9
	DSP❑-L-DC5V	5	4.0	4.0	30	150	167	6.5
	DSP❑-L-DC6V	6	4.8	4.8	25	150	240	7.8
	DSP❑-L-DC9V	9	7.2	7.2	16.7	150	540	11.7
	DSP❑-L-DC12V	12	9.6	9.6	12.5	150	960	15.6
	DSP❑-L-DC24V	24	19.2	19.2	6.3	150	3,840	31.2

2 coil latching

Type	Part No.	Nominal voltage, V DC	Set voltage, V DC (max.)	Reset voltage, V DC (max.)	Nominal operating current, mA	Nominal operating power, mW	Coil resistance, Ω (±10%)	Max. allowable voltage, at 50°C, V DC
2 coil latching	DSP❑-L2-DC3V	3	2.4	2.4	100	300	30	3.9
	DSP❑-L2-DC5V	5	4.0	4.0	60	300	83	6.5
	DSP❑-L2-DC6V	6	4.8	4.8	50	300	120	7.8
	DSP❑-L2-DC9V	9	7.2	7.2	33.3	300	270	11.7
	DSP❑-L2-DC12V	12	9.6	9.6	25.5	300	480	15.6
	DSP❑-L2-DC24V	24	19.2	19.2	12.5	300	1,920	31.2

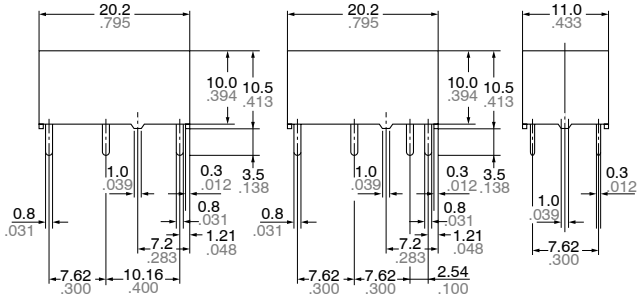
Note: Insert 1a, 1 or 2a in, 2 ❑ for contact form required.

DIMENSIONS

mm inch

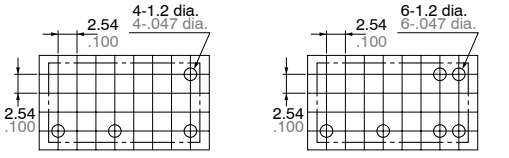
1a type (DSP1a)

Single side stable
1 coil latching 2 coil latching



General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)
Single side stable 2 coil latching



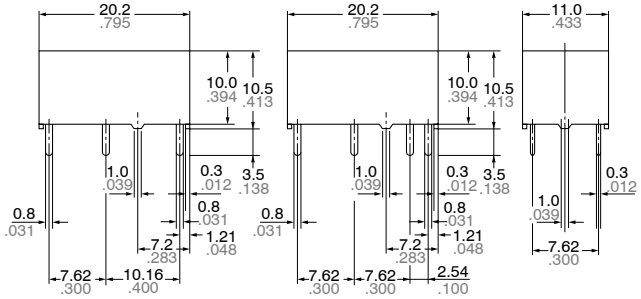
Tolerance: ±0.1 ±.004

Schematic (Bottom view)
Single side stable 2 coil latching

(Deenergized condition) (Reset condition)

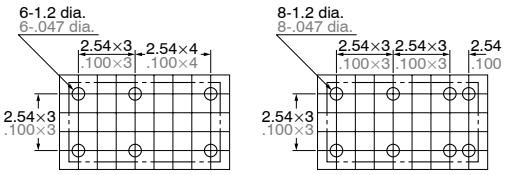
1a1b type (DSP1)

Single side stable
1 coil latching 2 coil latching



General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)
Single side stable 2 coil latching



Tolerance: ±0.1 ±.004

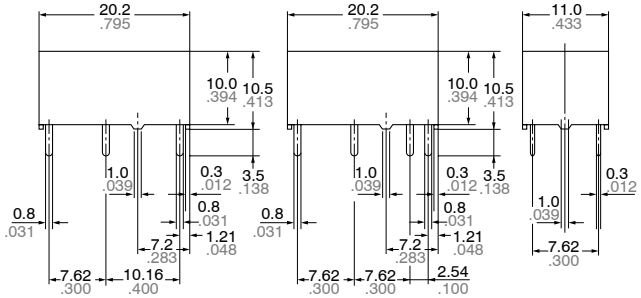
Schematic (Bottom view)
Single side stable 2 coil latching

(Deenergized condition) (Reset condition)

2a type (DSP2a)

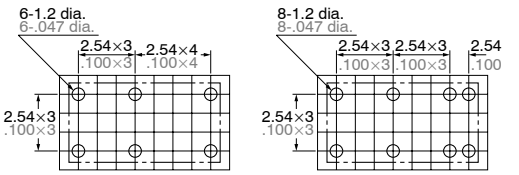
mm inch

Single side stable
1 coil latching 2 coil latching



General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)
Single side stable 2 coil latching



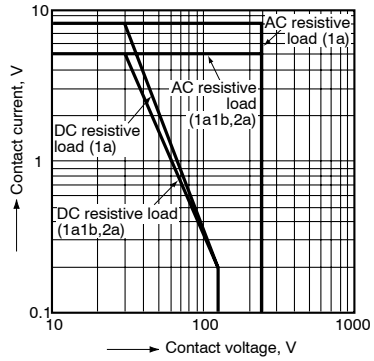
Tolerance: ±0.1 ±.004

Schematic (Bottom view)
Single side stable 2 coil latching

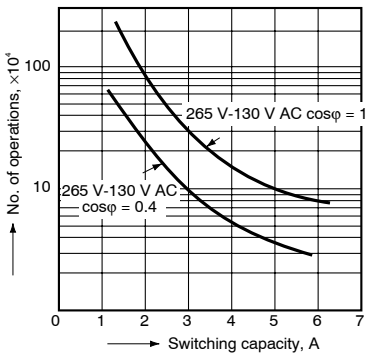
(Deenergized condition) (Reset condition)

REFERENCE DATA

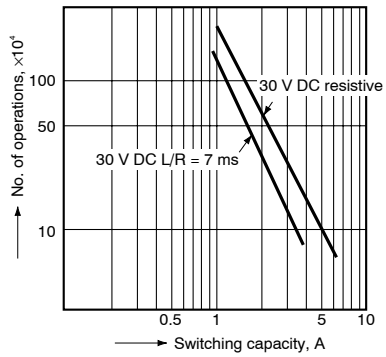
1. Max. switching capacity



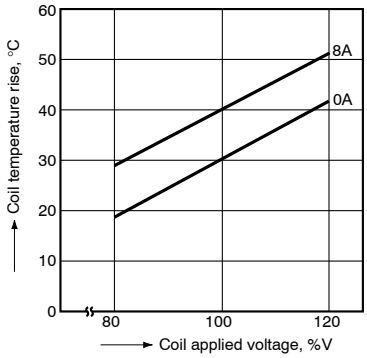
2.-(1) Life curve (1a1b type)



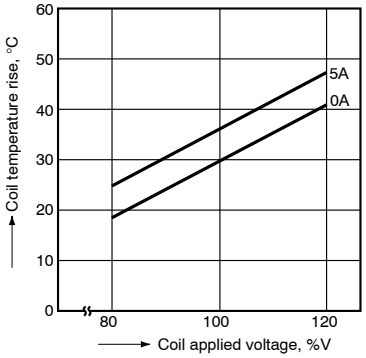
2.-(2) Life curve (1a1b type)



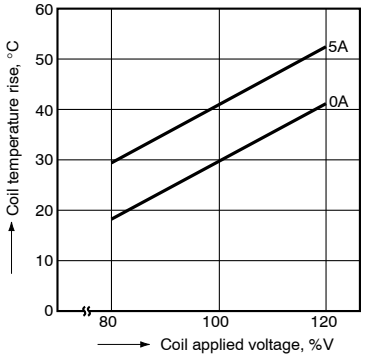
3.-(1) Coil temperature rise (1a type)
Sample: DSP1a-DC12V, 5 pcs.



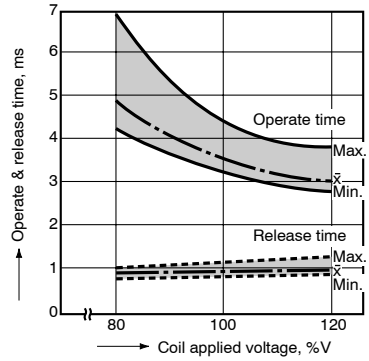
3.-(2) Coil temperature rise (1a1b type)
Sample: DSP1-DC12V, 5 pcs.



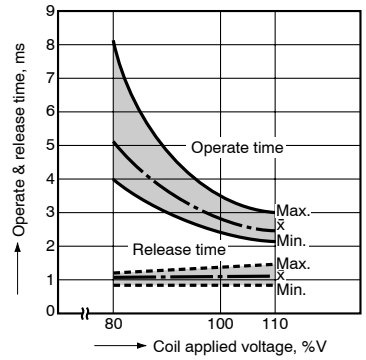
3.-(3) Coil temperature rise (2a type)
Sample: DSP2a-DC12V, 5 pcs.



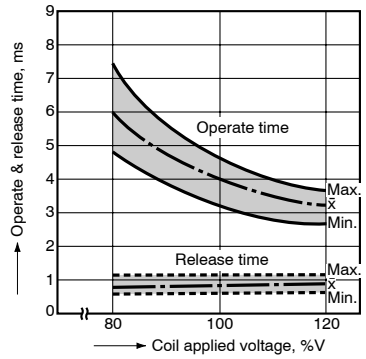
4.-(1) Operate & release time
(without diode, 1a type)
Sample: DSP1a-DC12V, 5 pcs.



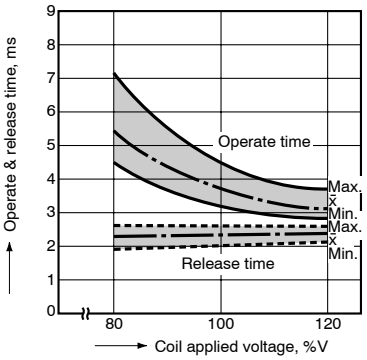
4.-(2) Operate & release time
(without diode, 1a1b type)
Sample: DSP1-DC12V, 5 pcs.



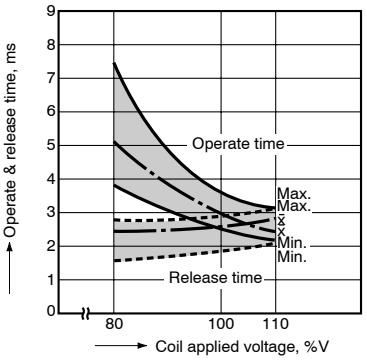
4.-(3) Operate & release time
(without diode, 2a type)
Sample: DSP2a-DC12V, 5 pcs.)



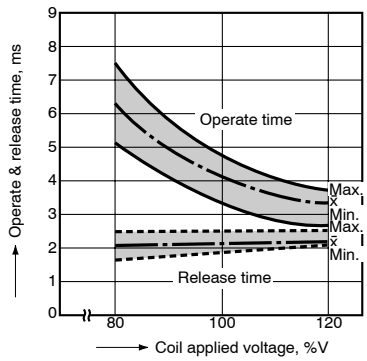
4.-(4) Operate & release time
(with diode, 1a type)
Sample: DSP1a-DC12V, 5 pcs.



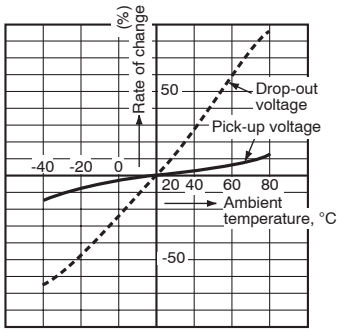
4.-(5) Operate & release time
(with diode, 1a1b type)
Sample: DSP1-DC12V, 5 pcs.



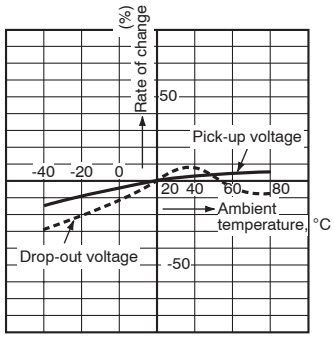
4.-(6) Operate & release time
(with diode, 2a type)
Sample: DSP2a-DC12V, 5 pcs.



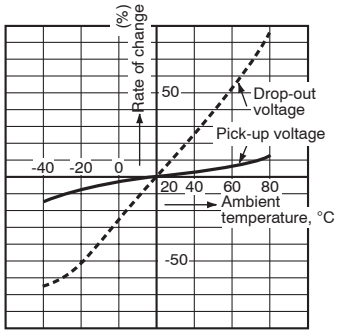
5.-(1) Change of pick-up and drop-out voltage (1a type)
Sample: DSP1a-DC12V, 5 pcs.



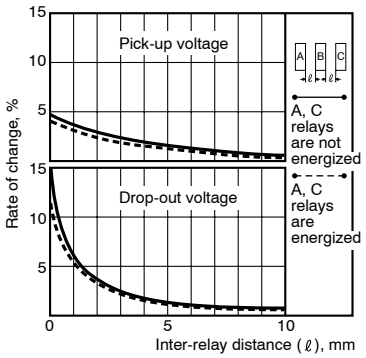
5.-(2) Change of pick-up and drop-out voltage (1a1b type)
Sample: DSP1-DC12V, 5 pcs.



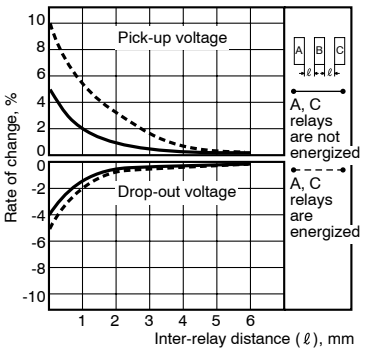
5.-(3) Change of pick-up and drop-out voltage (2a type)
Sample: DSP2a-DC12V, 5 pcs.



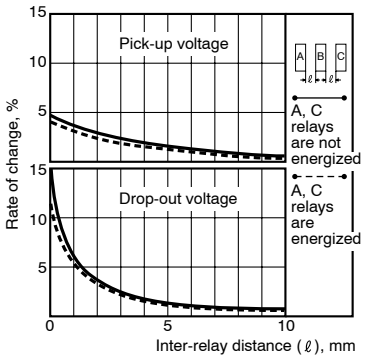
6.-(1) Influence of adjacent mounting (1a type)
Sample: DSP1a-DC12V, 5 pcs.



6.-(2) Influence of adjacent mounting (1a1b type)
Sample: DSP1-DC12V, 5 pcs.



6.-(3) Influence of adjacent mounting (2a type)
Sample: DSP2a-DC12V, 5 pcs.

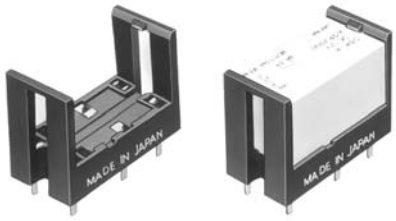


NOTES

Soldering should be done under the following conditions:
250°C 482°F within 10 s
300°C 572°F within 5 s
350°C 662°F within 3 s

For Cautions for Use, see Relay Technical Information (page 390).

SOCKETS FOR DSP RELAYS



TYPES AND APPLICABLE RELAYS

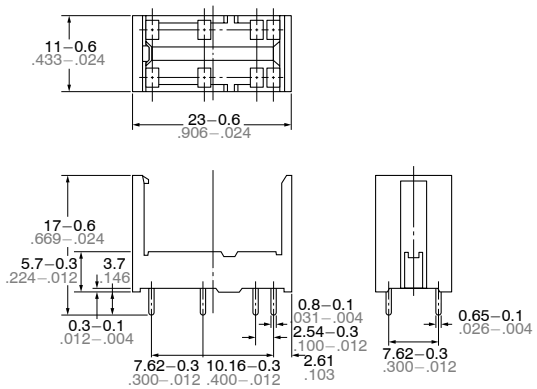
Applicable relays \ Type No.	For DSP1a		For DSP1a, DSP1, DSP2a	
	DSP1a-PS	DSP1a-PSL2	DSP2a-PS	DSP2a-PSL2
DSP1a relays	OK	OK	OK	OK
DSP1a-L2 relays		OK		OK
DSP1 relays			OK	OK
DSP1-L2 relays				OK
DSP2a relays			OK	OK
DSP2a-L2 relays				OK

SPECIFICATIONS

Item	Specifications
Breakdown voltage	3,000 Vrms between terminals (Except for the portion between coil terminals)
Insulation resistance	1,000 MΩ between terminals at 500 V
Heat resistance	150°C for 1 hour
Max. continuous current	1a: 8 A 2a: 5 A

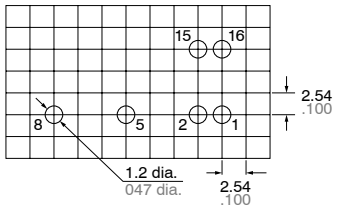
DIMENSIONS

mm inch



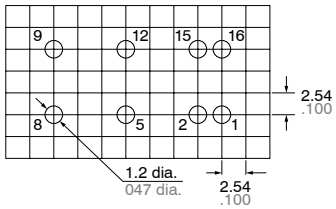
PC board pattern (Copper-side view)

DSP1a-PS, DSP1a-PSL2



Terminal No.2 and 15 are for DSP1a-PSL2 only.

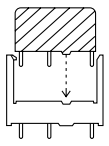
DSP2a-PS, DSP2a-PSL2



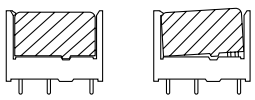
Terminal No.2 and 15 are for DSP2a-PSL2 only.

FIXING AND REMOVAL METHOD

1. Match the direction of relay and socket.

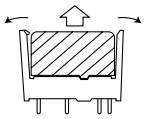


2. Both ends of relays are fixed so surely that the socket hooks on the top surface of relays.

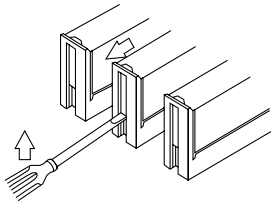


Good No good

3. Remove the relay, applying force in the direction shown below.



4. In case there is not enough space for finger to pick relay up, use screw drivers in the way shown below.



Panasonic
ideas for life

10A MINIATURE POWER RELAY

DY RELAYS (ADY)

FEATURES

- **Latching types available**
- **Electrical life of Min. 2 × 10^5 times (1 Form A type) realized with inductive load (cosφ=0.4, L/R=7ms, 5A 250V AC)**
- **Lead- and cadmium-free.**
- **Socket also available.**

	Part No.
Single side stable type	DK2a-PS
2 coil latching type	DK2a-PSL2

TYPICAL APPLICATIONS

- Control for industrial machines (machine tools, robotics)
- Output relays for temperature controllers, PLCs, timers, sensors.
- Measuring equipment
- Security equipment

SPECIFICATIONS

Contact

			1 Form A	1 Form A 1 Form B
Arrangement				
Initial contact resistance, max. (By voltage drop 6 V DC 1A)			30 mΩ	
Contact material			Gold-flashed silver alloy	
Rating	Nominal switching capacity	Resistive load	10A 250V AC 10A 30V DC	8A 250V AC 8A 30V DC
		Inductive load (cosφ = 0.4, L/R = 7ms)	5A 250V AC	3.5A 250V AC
	Max. switching capacity (Reference)	Resistive load	2,500V A, 300W	2,000V A, 240W
		Inductive load (cosφ = 0.4, L/R = 7ms)	1,250V A	875V A
	Max. switching voltage		380V AC, 125V DC	
	Max. switching current		10 A	8 A
	Min. switching capacity#1		5V 10mA	
Expected life (min. operations)	Mechanical (at 300cpm)		5×10^7	
	Electrical (at 20cpm)	1 Form A inductive load	2×10^5	
		1 Form A resistive load 1 Form A 1 Form B resistive load 1 Form A 1 Form B inductive load	10^5	

Coil

Nominal operating power	200 mW

Characteristics

		1 Form A	1 Form A 1 Form B
Max. operating speed		20 cpm (at rated load)	
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)	
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min.	
	Between contacts and coil	4,000 Vrms for 1 min.	
Surge voltage between coil and contact*3		Min. 10,000 V (initial)	
Operate time [Set time]*4 (at nominal voltage) (at 20°C)		Max. 10ms (Approx. 5ms) [Max. 10ms (Approx. 5ms)]	
Release time [Reset time] (without diode)*4 (at nominal voltage) (at 20°C)		Max. 8ms (Approx. 3ms) [Max. 10ms (Approx. 3ms)]	
Temperature rise (at 70°C)*5		Max. 40°C	
Shock resistance	Functional*6	Min. 98 m/s² {10 G}	
	Destructive*7	Min. 980 m/s² {100 G}	
Vibration resistance	Functional*8	10 to 55 Hz at double amplitude of 1.5 mm	
	Destructive	10 to 55 Hz at double amplitude of 3.0 mm	
Conditions for operation, transport and storage*9 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F	
	Humidity	5 to 85% R.H.	
Unit weight		Approx. 6g .21oz	

Remarks

#1 This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10 mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 By resistive method, nominal voltage applied to the coil, max. switching current
*6 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*7 Half-wave pulse of sine wave: 6ms
*8 Detection time: 10μs
*9 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

ORDERING INFORMATION

ADY □ □ 0 □

Contact arrangement	Operating function	Contact characteristics	Coil voltage (DC)
1: 1 Form A 3: 1 Form A, 1 Form B	0: Single side stable 2: 2 coil latching	0: Standard contact	03: 3 V 12: 12 V 05: 5 V 24: 24 V 06: 6 V

Notes: 1) Standard packing-Carton: 50 pcs.; Case: 500 pcs.
2) UL/CSA approved type is standard.

TYPES AND COIL DATA (at 20°C 68°F)

• Single side stable type

Contact arrangement	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (initial)	Drop-out voltage, V DC (min.) (initial)	Nominal operating current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
1 Form A	ADY10003	3	2.1	0.3	66.6	45	200	3.9
	ADY10005	5	3.5	0.5	40	125	200	6.5
	ADY10006	6	4.2	0.6	33.3	180	200	7.8
	ADY10012	12	8.4	1.2	16.6	720	200	15.6
	ADY10024	24	16.8	2.4	8.3	2,880	200	31.2
1 Form A 1 Form B	ADY30003	3	2.1	0.3	66.6	45	200	3.9
	ADY30005	5	3.5	0.5	40	125	200	6.5
	ADY30006	6	4.2	0.6	33.3	180	200	7.8
	ADY30012	12	8.4	1.2	16.6	720	200	15.6
	ADY30024	24	16.8	2.4	8.3	2,880	200	31.2

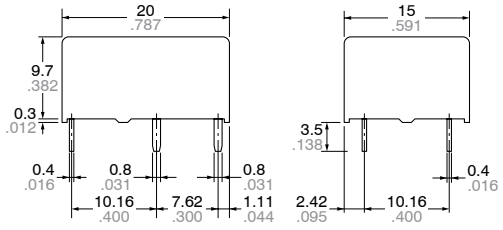
• 2 coil latching type

Contact arrangement	Part No.	Nominal voltage, V DC	Set voltage, V DC (max.) (initial)	Reset voltage, V DC (max.) (initial)	Nominal operating current, mA (±10%)		Coil resistance, Ω (±10%)		Nominal operating power, mW		Max. allowable voltage, V DC
					Set coil	Reset coil	Set coil	Reset coil	Set coil	Reset coil	
1 Form A	ADY12003	3	2.1	2.1	66.6	66.6	45	45	200	200	3.9
	ADY12005	5	3.5	3.5	40	40	125	125	200	200	6.5
	ADY12006	6	4.2	4.2	33.3	33.3	180	180	200	200	7.8
	ADY12012	12	8.4	8.4	16.6	16.6	720	720	200	200	15.6
	ADY12024	24	16.8	16.8	8.3	8.3	2,880	2,880	200	200	31.2
1 Form A 1 Form B	ADY32003	3	2.1	2.1	66.6	66.6	45	45	200	200	3.9
	ADY32005	5	3.5	3.5	40	40	125	125	200	200	6.5
	ADY32006	6	4.2	4.2	33.3	33.3	180	180	200	200	7.8
	ADY32012	12	8.4	8.4	16.6	16.6	720	720	200	200	15.6
	ADY32024	24	16.8	16.8	8.3	8.3	2,880	2,880	200	200	31.2

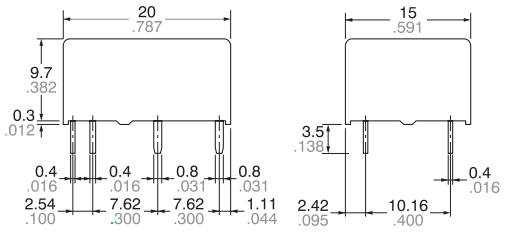
DIMENSIONS

mm inch

Single side stable type

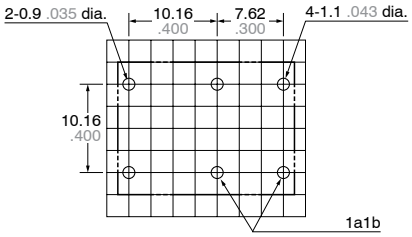


2 coil latching type

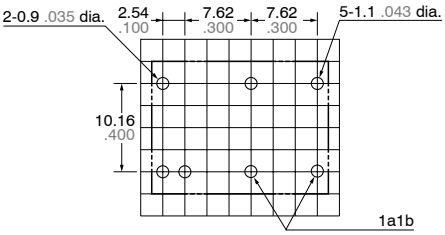


PC board pattern (BOTTOM VIEW)

Single side stable type



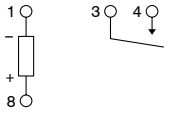
2 coil latching type



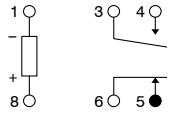
Tolerance: ±0.1 ±.004

Schematic (BOTTOM VIEW)

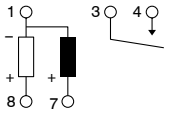
Single side stable (1 Form A)



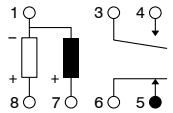
Single side stable (1 Form A 1 Form B)



2 coil latching type (Reset condition)



2 coil latching type (Reset condition)



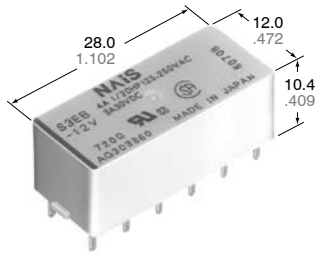
General tolerance: ±0.3 ±.012

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

4 A CAPACITY, THE VARIETY OF CONTACT ARRANGEMENTS

S RELAYS



mm inch

FEATURES

- **The variety of contact arrangements 2 Form A 2 Form B, 3 Form A 1 Form B, 4 Form A**
- **Latching types available**
- **High sensitivity in small size 100 mW pick-up and 200 mW nominal operating power**
- **High shock and vibration resistance Shock: 50 G Vibration: 10 to 55 Hz at double amplitude of 3 mm .118 inch**
- **Wide switching range From 100μA 100 mV DC to 4 A 250 V AC**
- **Low thermal electromotive force Approx. 3 μV**
- **Dual-In-Line packaging arrangement**

SPECIFICATIONS

Contacts

Arrangement			2 Form A 2 Form B, 3 Form A 1 Form B, 4 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			50 mΩ
Initial contact pressure			Approx. 12 g .42 oz
Contact material			Gold clad silver alloy
Electrostatic capacitance			Approx. 3pF
Thermal electromotive force (at nominal coil voltage)			Approx. 3μV
Rating (resistive)	Nominal switching capacity		4 A 250 V AC, 3 A 30 V DC
	Maximum switching power		1,000 VA, 90 W
	Maximum switching voltage		250 V AC, 30 V DC (48 VDC at less than 0.5 A)
	Max. switching current		4 A (AC), 3 A (DC)
	Min. switching capacity#1		100μA 100 m V DC
Expected life (min. operations)	Mechanical (at 50 cps)		10^8
	Electrical (at 20 cpm)	4 A 250 V AC	10^5
		3 A 30 V DC	2×10^5

Coil (polarized) (at 20°C 68°F)

Single side stable	Minimum operating power	Approx. 100 mW
	Nominal operating power	Approx. 200 mW
Latching	Minimum set and reset	Approx. 100 mW
	Nominal set and reset	Approx. 200 mW

Notes:

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics (at 25°C 77°F 50% Relative humidity)

Max. operating speed			20 cpm for maximum load, 50 cps for low-level load (1 mA 1 V DC)
Initial insulation resistance*1			10,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts		750 Vrms
	Between contact sets		1,000 Vrms
	Between contacts and coil		1,500 Vrms
Operate time*3 (at nominal voltage)(at 20°C)			Max. 15 ms (Approx. 8 ms)
Release time (without diode)*3 (at nominal voltage)(at 20°C)			Max. 10 ms (Approx. 5 ms)
Set time*3 (latching) (at nominal voltage)(at 20°C)			Max. 15 ms (Approx. 8 ms)
Reset time*3 (latching) (at nominal voltage)(at 20°C)			Max. 15 ms (Approx. 8 ms)
Initial contact bounce, max.			1 ms
Temperature rise (at nominal voltage)(at 20°C)			Max. 35°C with nominal coil voltage and at maximum switching current
Shock resistance	Functional*4		Min. 490 m/s² {50 G}
	Destructive*5		Min. 980 m/s² {100 G}
Vibration resistance	Functional*6		176.4 m/s² {18 G}, 10 to 55 Hz at double amplitude of 3 mm
	Destructive		235.2 m/s² {24 G}, 10 to 55 Hz at double amplitude of 4 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)		Ambient temp.	–40°C to +65°C –40°F to +149°F
		Humidity	5 to 85% R.H.
Unit weight			Approx. 8 g .28 oz

TYPICAL APPLICATIONS

Telecommunications equipment, data processing equipment, facsimiles, alarm equipment, measuring equipment.

ORDERING INFORMATION

Ex. S — 2 — L2 — 48 V

Product name	Contact arrangement	Operating function	Coil voltage, V DC
S	2: 2 Form A 2 Form B 3: 3 Form A 1 Form B 4: 4 Form A	Nil: Single side stable L: 1 coil latching L2: 2 coil latching	3, 5, 6,12, 24, 48

Notes: 1) Standard packing; Carton 50 pcs. Case 500 pcs.
2) UL/CSA approved type is standard.

TYPES AND COIL DATA at 20°C 68°F

Single side stable

Type	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA	Coil resistance, Ω (±10%)	Inductance, mH	Nominal operating power, mW	Maximum allowable voltage, V DC (40°C)
S❑-3V	3	2.1	0.3	66.7	45	23	200	5.5
S❑-5V	5	3.5	0.5	38.5	130	65	192	9.0
S❑-6V	6	4.2	0.6	33.3	180	93	200	11.0
S❑-12V	12	8.4	1.2	16.7	720	370	200	22.0
S❑-24V	24	16.8	2.4	8.4	2,850	1,427	202	44.0
S❑-48V	48	33.6	4.8	5.6	8,500	3,410	271	75.0

1 coil latching

Type	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage V DC (min.)	Nominal operating current, mA	Coil resistance, Ω (±10%)	Inductance, mH	Nominal operating power, mW	Maximum allowable voltage, V DC (40°C)
S❑-L1-3V	3	2.1	0.3	33	90	0.04	99	8.4
S❑-L1-5V	5	3.5	0.5	16	300	0.14	80	15.3
S❑-L1-6V	6	4.2	0.6	16	360	0.14	96	16.8
S❑-L1-12V	12	8.4	1.2	8	1450	0.6	96	33.7
S❑-L1-24V	24	16.8	2.4	4	5700	2.05	96	66.7
S❑-L1-48V	48	33.6	4.8	3	16,000	8.9	144	111

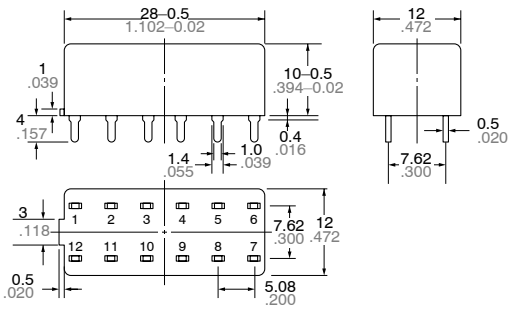
2 coil latching

Type	Nominal voltage, V DC	Set and reset voltage, V DC (max.)	Nominal operating current, mA	Coil resistance, Ω (±10%)		Inductance, mH		Nominal operating power, mW	Maximum allowable voltage, V DC (40°C)
				Coil I	Coil II	Coil I	Coil II		
S❑-L2-3V	3	2.1	66.7	45	45	10	10	200	5.5
S❑-L2-5V	5	3.5	38.5	130	130	31	31	192	9.0
S❑-L2-6V	6	4.2	33.7	180	180	40	40	200	11.0
S❑-L2-12V	12	8.4	16.7	720	720	170	170	200	22.0
S❑-L2-24V	24	16.8	8.4	2,850	2,850	680	680	202	44.0
S❑-L2-48V	48	33.6	7.4	6,500	6,500	1,250	1,250	355	65.0

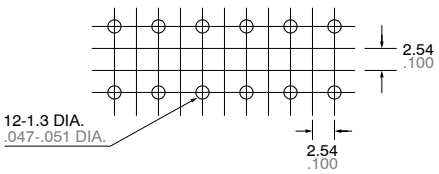
Note: Insert 2, 3 or 4 in ❑ for contact form required.

DIMENSIONS

mm inch



PC board pattern (Copper-side view)



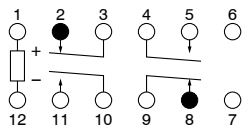
General tolerance: ±0.3 ±.012

Tolerance: ±0.1 ±.003

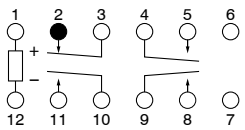
Schematic (Bottom view)

Single side stable
Deenergized position

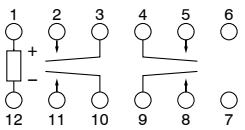
2a2b



3a1b

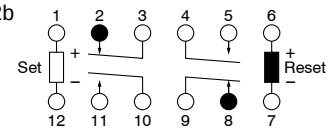


4a

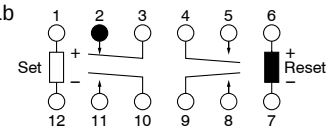


2 coil latching
Diagram shows the “reset” position when terminals 6 and 7 are energized. Energize terminals 1 and 12 to transfer contacts.

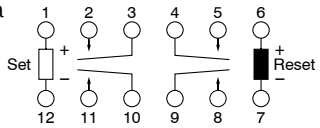
2a2b



3a1b

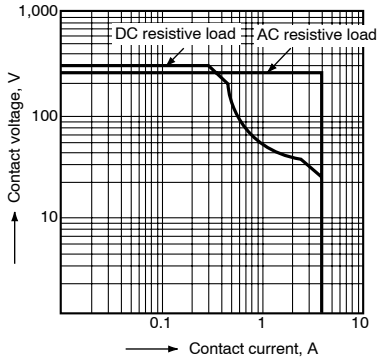


4a

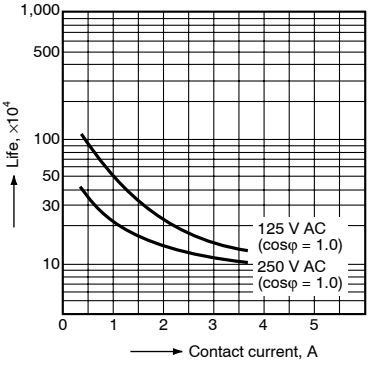


REFERENCE DATA

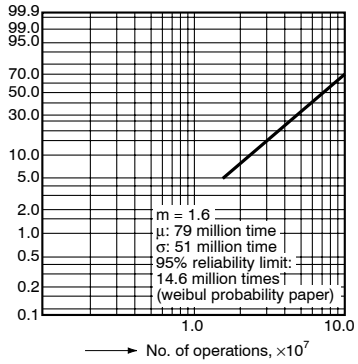
1. Maximum switching power



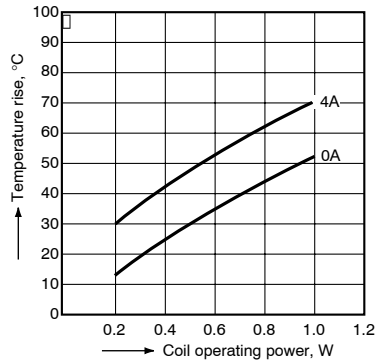
2. Life curve



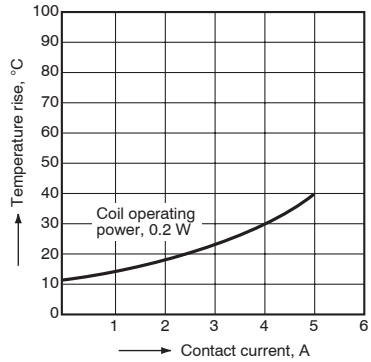
3. Contact reliability
Condition: 1V DC, 1mA
Detection level 10 Ω
Tasted Sample: S4-24V, 10pcs



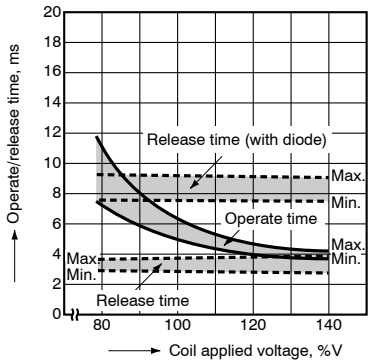
4.-(1) Coil temperature rise
Tested Sample: S4-24V, 4 Form A



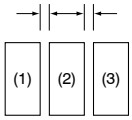
4.-(2) Coil temperature rise
Tested Sample: S4-24V, 4 Form A



5. Operate and release time
(Single side stable type)
Tested Sample: S4-24V, 10pcs

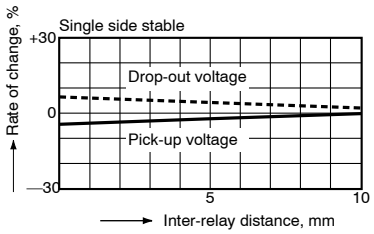


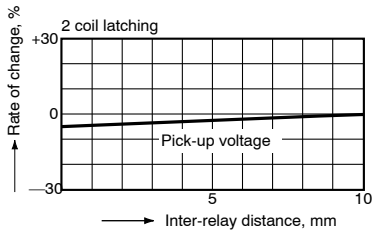
6. Influence of adjacent mounting



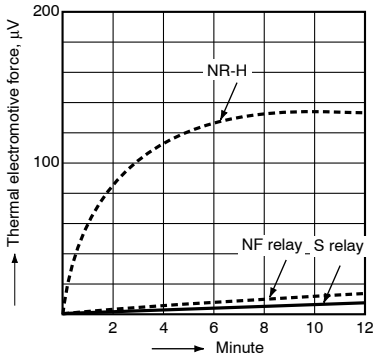
(1) & (3) relays are energized

Note: When installing an S-relay near another, and there is no effect from an external magnetic field, be sure to leave at least 10 mm .394 inch between relays in order to achieve the performance listed in the catalog.

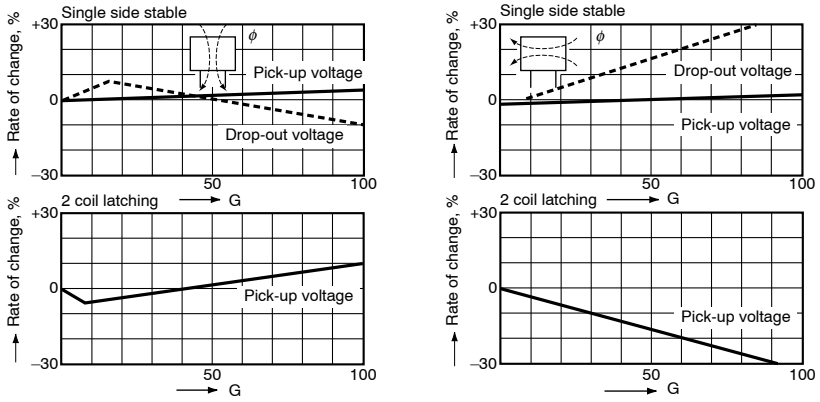




7. Thermal electromotive force



8. Effect from an external magnetic field



ACCESSORIES

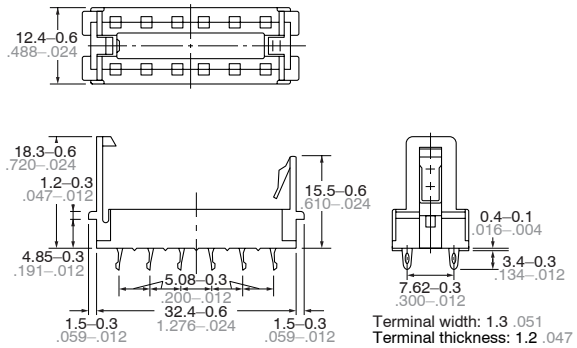
S Relay Socket, S-PS

Specifications

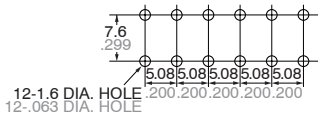
Breakdown voltage	1,500 Vrms between terminals
Insulation resistance	More than 100 MΩ between terminals at 500 V DC Mega
Heat resistance	150 ±3°C (302 ±5.4°F) for 1 hour.
Maximum continuous current	4 A

(Note: Don't insert or remove relays while in the energized condition.)

Dimensions mm inch



PC board pattern (Copper-side view)



Inserting and removing method

Inserting method: Insert the relay as shown in Fig. 1 unit the rib of the relay snaps into the clip of the socket.

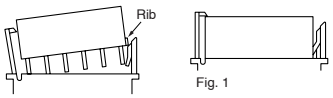


Fig. 1

Removing method:
(1) Remove the relay straight from the socket holding the shaded portion of the relay as shown in Fig. 2.

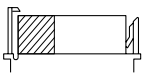


Fig. 2

(2) When sockets are mounted in close proximity, use a slotted screw driver as shown in Fig. 3.

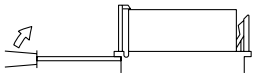
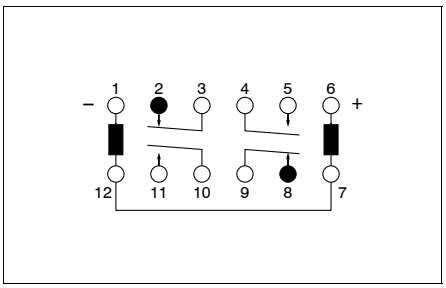


Fig. 3

NOTES

1. Special use of 2 coil latching types: 2 ways can be considered if 2 coil latching types are used as 1 coil latching types.
(A) Reverse polarity is applied to the set coil of 2 coil latching type.
(B) By shorting terminals 12 and 7, apply plus to 1, minus to 6 at set and plus to 6, minus to 1 at reset. Applied coil voltage should be the same as the nominal. Operating power will be reduced to one-half.

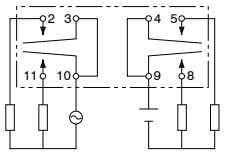
Reset position of 2a2b type



2. Soldering operations should be accomplished as quick as possible; within 10 seconds at 250°C 482°F solder temperature or 3 seconds at 350°C 662°F. The header portion being sealed with epoxy resin, undue subjection to heat may cause loss of seal. Solder should not be permitted to remain on the header.

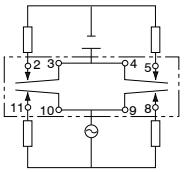
CAUTIONS FOR USE

Based on regulations regarding insulation distance, there is a restriction on same-channel load connections between terminals No. 2, 3 and 4, 5, as well as between No. 8, 9 and 10, 11. See the figure below for an example.



● Between 2, 3 and 4, 5: different channels, therefore not possible
● Between 10, 11 and 8, 9: different channels, therefore not possible

No good



● Between 2, 3 and 4, 5: same channels, therefore possible
● Between 10, 11 and 8, 9: same channels, therefore possible

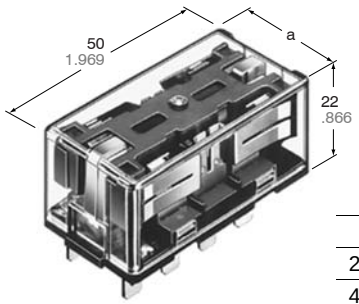
Good

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

15A (2C), 10A (4C) COMPACT POWER RELAYS WITH HIGH SENSITIVITY

SP RELAYS



mm inch

	a
2C	25.6 1.008
4C	36.8 1.449

FEATURES

- **High Vibration/Shock Resistance**
  Vibration resistance: 18 G, amplitude 3 mm (10 to 55 Hz)
  Shock resistance: 40 G (11 ms)
- **Latching types available**
- **High Sensitivity in Small Size 150 mW pick-up, 300 mW nominal operating power**
- **Wide Switching Range**
  From 1 mA to 15 A (2C) and 10 A (4C)

SPECIFICATIONS

Contacts

Arrangement				2 Form C, 4 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)				30 mΩ
Initial contact pressure				2C: Approx. 0.392 N (40 g 1.41 oz) 4C: Approx. 0.196 N (20 g 0.71 oz)
Contact material				Stationary contact: Gold flashed silver alloy
				Movable contact: Silver alloy
Rating (resistive load)	Nominal switching capacity			2C: 15 A 250 V AC, 10 A 30 V DC 4C: 10 A 250 V AC, 10 A 30 V DC
	Max. switching power			2C: 3,750 VA, 300 W 4C: 2,500 VA, 300 W
	Max. switching voltage			2C, 4C: 250 V AC, 30 V DC
	Max. switching current			2C: 15 A (AC) 10 A (DC), 4C: 10 A
	Min. switching capacity#1			100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)			5×10^7
	Electrical (at 20 cpm) (resistive load)	2C	15 A 250 V AC	10^5
			10 A 30 V DC	10^5
		4C	10 A 250 V AC	10^5
			10 A 30 V DC	10^5

Coil (polarized) at 20°C 68°F

Single side stable	Nominal operating power	300 mW
Latching	Minimum set and reset power	150 mW
	Nominal set and reset power	300 mW

Characteristics (at 25°C 77°F 50% Relative humidity)

Max. operating speed (at rated load)		20 cpm
Initial insulation resistance*1		1,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	1,500 Vrms
	Between contact sets	3,000 Vrms
	Between contact and coil	3,000 Vrms
Operate time*3(at nominal voltage)		Max. 30 ms (Approx. 25 ms)
Release time(without diode)*3 (at nominal voltage)		Max. 20 ms (Approx. 15 ms)
Temperature rise (at nominal voltage)		Max. 40°C with nominal coil voltage and at nominal switching capacity
Shock resistance	Functional*4	Min. 392 m/s² {40 G}
	Destructive*5	Min. 980 m/s² {100 G}
Vibration resistance	Functional*6	176.4 m/s² {18 G}, 10 to 55 Hz at double amplitude of 3 mm
	Destructive	176.4 m/s² {18 G}, 10 to 55 Hz at double amplitude of 3 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–50°C to +60°C –58°F to +140°F
	Humidity	5 to 85% R.H.
Unit weight		2C: 50 g 1.76 oz ; 4C: 65 g 2.29 oz

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10 mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

TYPICAL APPLICATIONS

NC machines, remote control panels, sophisticated business equipment.

ORDERING INFORMATION

Ex. SP 2 — P — L2 — DC24V

Contact arrangement	Mounting classification	Operating function	Coil voltage
2: 2 Form C 4: 4 Form C	NIL: standard type with FASTON terminals P: PC board type Standard - 1.4 mm x 0.5 mm (without UL/CSA marking) Optional - 2.0 x 0.5 mm (with UL/CSA marking)	Nil: Single side stable L2: 2 coil latching	DC 3, 5, 6, 12, 24, 48 V

(Notes) 1. For PC board terminal types, please consult us for details.
2. 2 Form C: Carton: 20 pcs., Case: 200 pcs.
4 Form C: Carton: 10 pcs., Case: 100 pcs.
3. UL/CSA, TÜV approved type is standard.
4. 1 coil latching type available.

TYPES AND COIL DATA (at 20°C 68°F)

Single side stable

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA	Coil resistance, Ω (±10%) 20°C	Inductance, H (at 120 Hz)	Nominal operating power, mW	Maximum allowable voltage, V DC (40°C)
2 Form C	4 Form C								
SP2-DC3V	SP4-DC3V	3	2.1	0.3	100.0	30	Approx. 0.05	300	4.5
SP2-DC5V	SP4-DC5V	5	3.5	0.5	60.2	83	0.1	300	7.5
SP2-DC6V	SP4-DC6V	6	4.2	0.6	50.0	120	0.2	300	9
SP2-DC12V	SP4-DC12V	12	8.4	1.2	25.0	480	0.7	300	18
SP2-DC24V	SP4-DC24V	24	16.8	2.4	12.5	1,920	3.0	300	36
SP2-DC48V	SP4-DC48V	48	33.6	4.8	6.2	7,700	11.2	300	72

2-coil latching

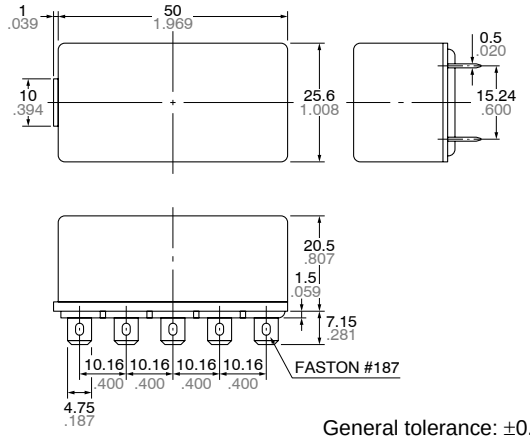
Part No.		Nominal voltage, V DC	Set and reset voltage, V DC (max.)	Nominal operating current, mA	Coil resistance, Ω (±10%)		Inductance, H (at 120 Hz)		Nominal operating power, mW	Maximum allowable voltage, V DC (40°C)
2 Form C	4 Form C				Coil I	Coil II	Coil I	Coil II		
SP2-L2-DC3V	SP4-L2-DC3V	3	2.1	100.0	30	30	Approx. 0.03	Approx. 0.03	300	4.5
SP2-L2-DC5V	SP4-L2-DC5V	5	3.5	60.2	83	83	0.07	0.07	300	7.5
SP2-L2-DC6V	SP4-L2-DC6V	6	4.2	50.0	120	120	0.1	0.1	300	9
SP2-L2-DC12V	SP4-L2-DC12V	12	8.4	25.0	480	480	0.4	0.4	300	18
SP2-L2-DC24V	SP4-L2-DC24V	24	16.8	12.5	1,920	1,920	1.4	1.4	300	36
SP2-L2-DC48V	SP4-L2-DC48V	48	33.6	6.2	7,680	7,680	5.6	5.6	300	72

DIMENSIONS

mm inch

2 Form C

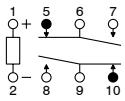
Plug-in terminal



General tolerance: ±0.3 ±.012

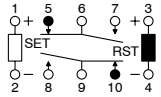
Schematic (Bottom view)

Single side stable



(Deenergized condition)

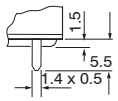
2 coil latching



(Reset condition)

Diagram shows the “reset” position when terminals 3 and 4 are energized. Energize terminals 1 and 2 to transfer contacts.

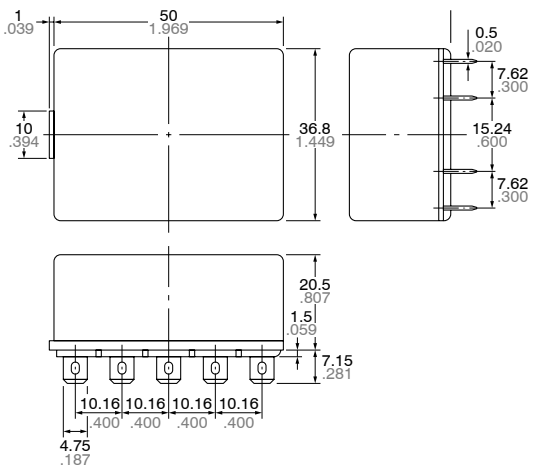
PC board terminal



With UL/CSA approval:
pin 2 mm x 0.5 mm
standard type:
pin 1.4 mm x 0.5 mm

4 Form C

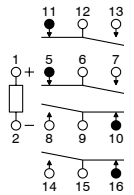
Plug-in terminal



General tolerance: ±0.3 ±.012

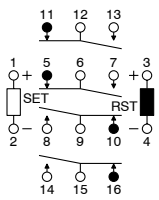
Schematic (Bottom view)

Single side stable



(Deenergized condition)

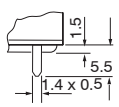
2 coil latching



(Reset condition)

Diagram shows the “reset” position when terminals 3 and 4 are energized. Energize terminals 1 and 2 to transfer contacts.

PC board terminal

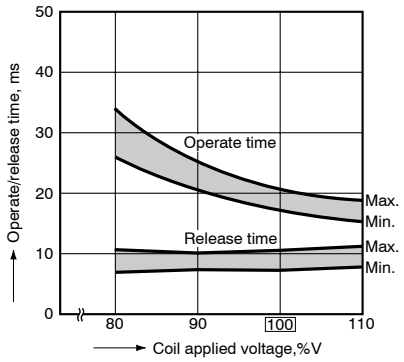


With UL/CSA approval:
pin 2 mm x 0.5 mm
standard type:
pin 1.4 mm x 0.5 mm

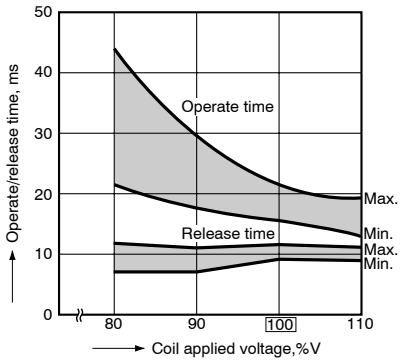
REFERENCE DATA

Operate and release time (Single side stable)

SP2



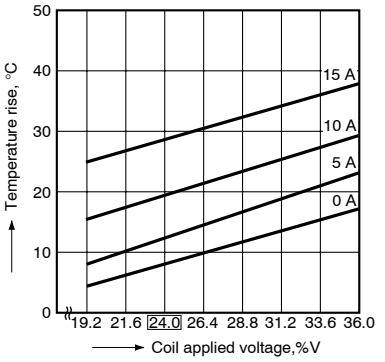
SP4



Coil temperature rise

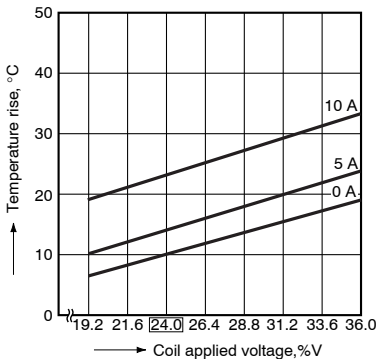
Sample: SP2-DC24V

Ambient temperature: 20 to 22°C 68 to 72°F

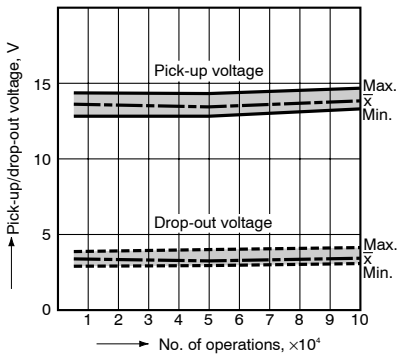


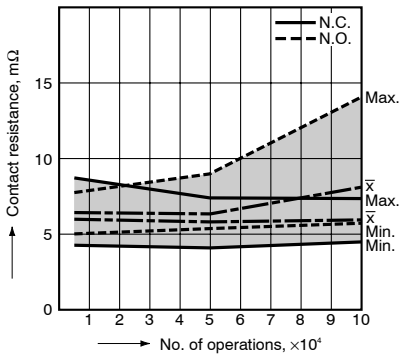
Sample: SP4-DC24V

Ambient temperature: 27 to 29°C 81 to 84°F

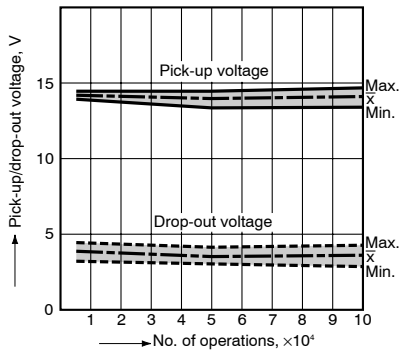


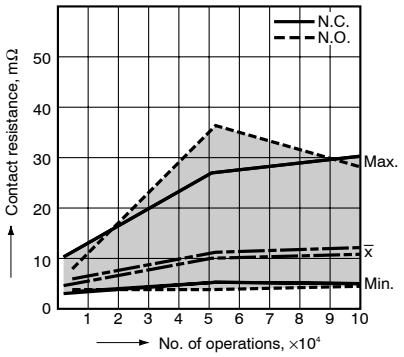
Electrical life (SP2, 15 A 250 V AC resistive load)





Electrical life (SP4, 10 A 250 V AC resistive load)



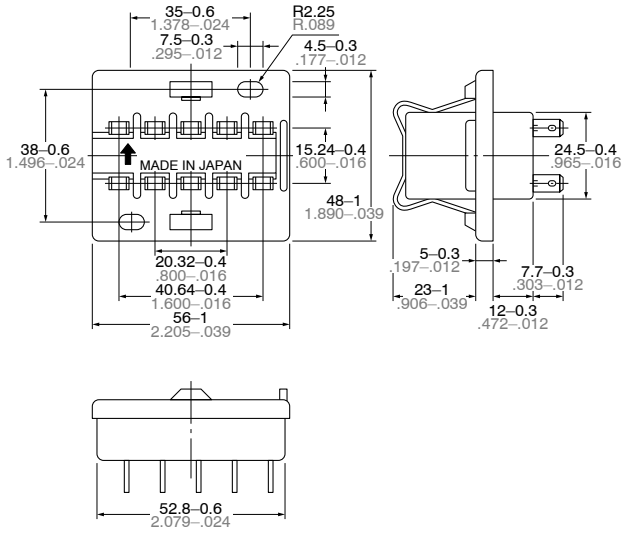


ACCESSORIES

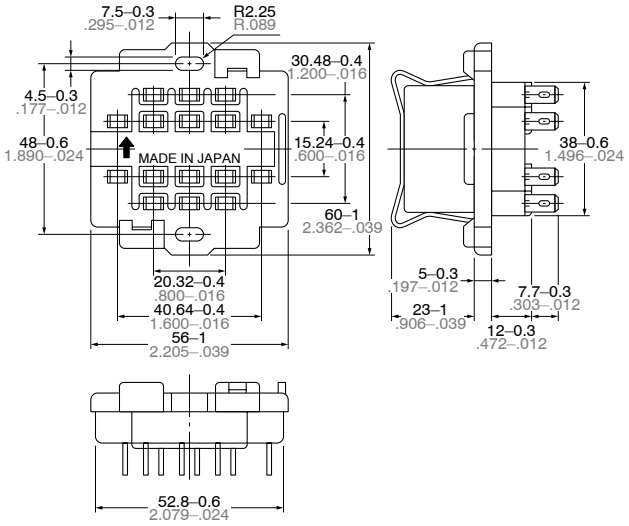
mm inch

Soldering socket

SP2-SS

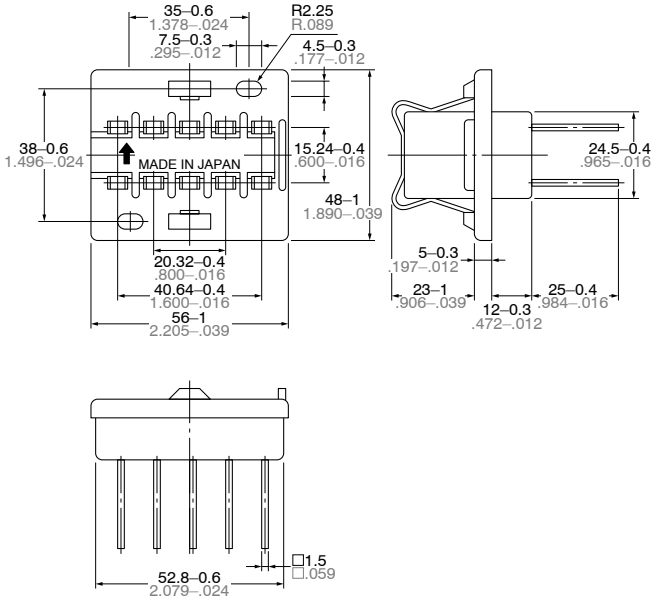


SP4-SS

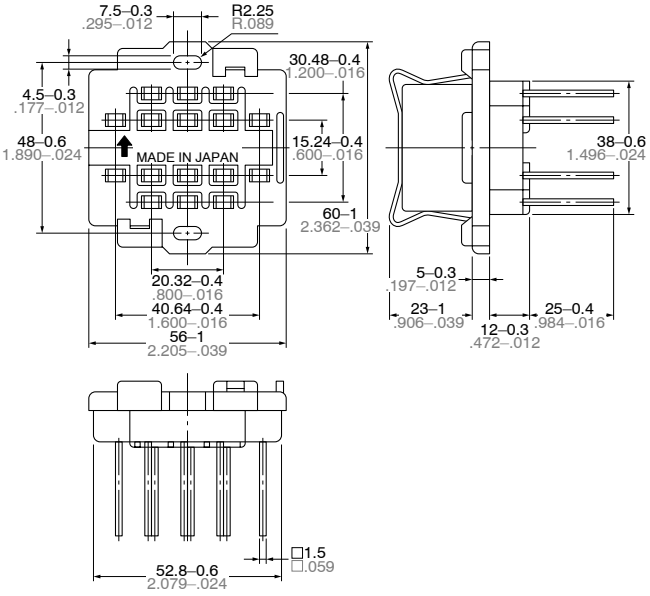


Wrapping socket

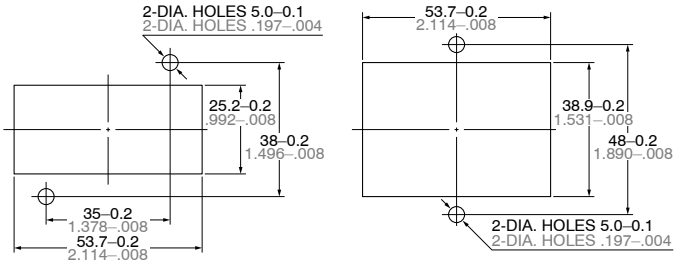
SP2-WS



SP4-WS



Mounting hole drilling diagram



Performance profile

Item	SP2, socket with solder	SP4, socket with solder	SP2, wrapping socket	SP4, wrapping socket
Withstand voltage	AC 3,000V, 1 min., between each terminal			
Insulation resistance	1,000 MΩ min			
Ambient working temperature	–50 to +60°C –58 to +140°F			
Maximum current, ON current	15 A	10 A	12 A	10 A

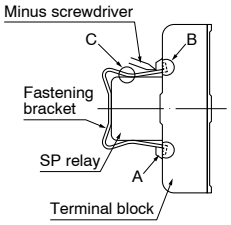
Note: Do not remove the relay while it is ON.

Notes:
(1) Mounting screws and the fastening bracket are included in the package.
(2) Mount the relay with the proper mounting direction — i.e. with the direction of the NAiS mark on top of the relay case matching the direction of the NAiS mark on the terminal block. (The ; direction of the terminal block is the upward direction of the relay.)

Mounting and removal of fastening bracket

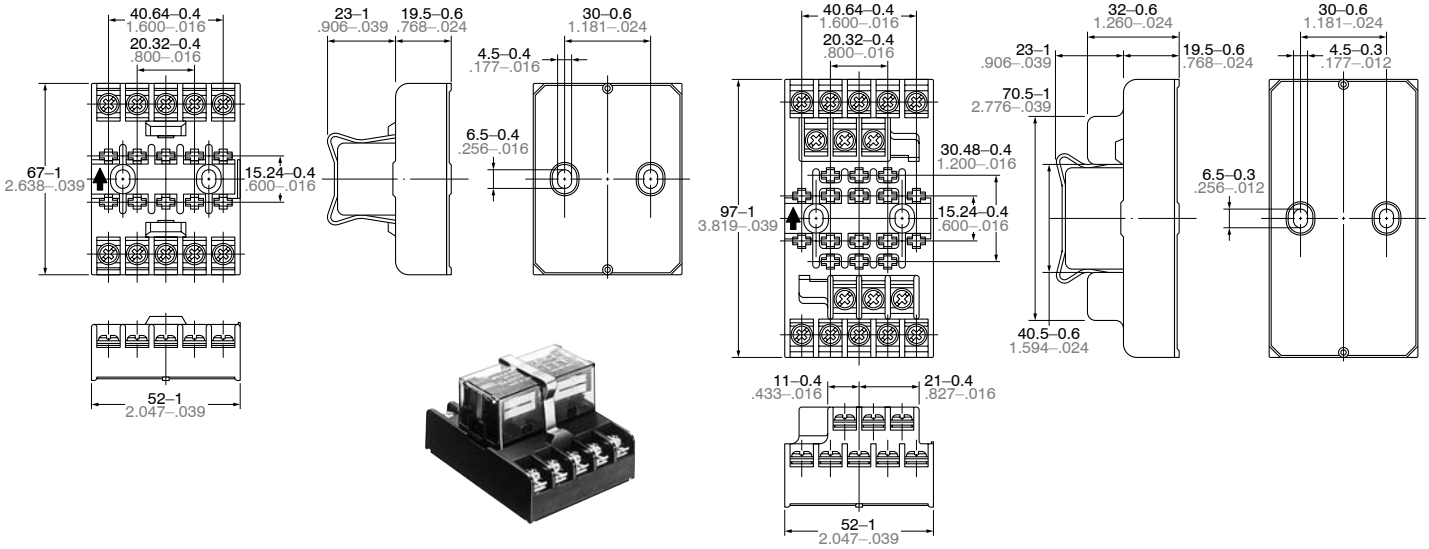
1. Mounting
Insert the A part of the fastening bracket into the mounting groove of the socket, and then fit the B part into groove, while pressing with the tip of a minus screwdriver.

2. Removal
Slide the B part of the fastening bracket from the groove in the socket, while pressing with the tip of a minus screwdriver. While the bracket is in this position, keep pressing the C part of the bracket to the relay side with your finger, and lift up to the left side and remove from the groove, as in the diagram at right.

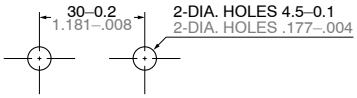


Screw terminal socket

mm inch



Mounting hole drilling diagram

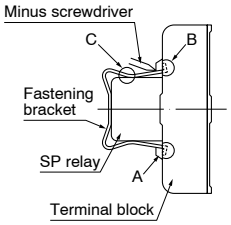


Notes:
(1) Mounting screws and the fastening bracket are included in the package.
(2) Mount the relay with the proper mounting direction — i.e. with the direction of the NAIS mark on top of the relay case matching the direction of the NAIS mark on the terminal block. (The ; direction of the terminal block is the upward direction of the relay.)

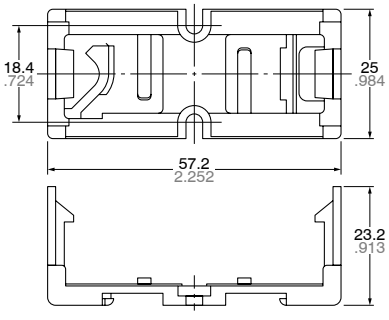
Fastening bracket mounting and removal

1. Mounting
Insert the A part of the fastening bracket into the mounting groove of the terminal block, and then fit the B part into groove, while pressing with the tip of a minus screwdriver.

2. Removal
Slide the B part of the fastening bracket from the groove in the terminal block, while pressing with the tip of a minus screwdriver. While the bracket is in this position, keep pressing the C part of the bracket to the relay side with your finger, and lift up to the left side and remove from the groove, as in the diagram at right.

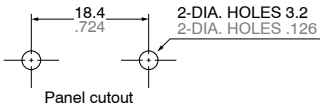


Mounting plate



SP-MA

The SP-Relay with SP-MA attached



Tolerance: ±0.1 ±.004

Direct chassis mounting possible, and applicable to DIN rail.
[DIN 46277 (35 mm width) is applicable.]

Use method

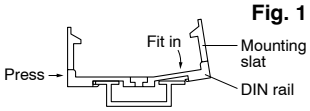
1. Both the SP relay 2c and 4c can be mounted to the mounting slats.
2. Use the mounting slats either by attaching them directly to the chassis, or by mounting with a DIN rail.

(A) When attaching directly to chassis
Use two M3 screws.
For the mounting pitch, refer to the specification diagram.

(B) When mounting on a DIN rail
Use a 35mm 1.378inch wide DIN rail (DIN46277).
The mounting method should be as indicated in the diagram at right.

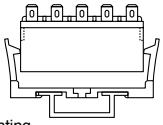
Method for mounting on DIN rail

Fig. 1



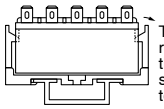
Press relay in

Fig. 2



Fit into mounting grooves.

Fig. 3



To remove the relay, press down the mounting slats so the claws move to the outside.

(1) First fit the arc shaped claw of the mounting slat into the DIN rail.
(2) Press on the side as shown in the diagram below.
(3) Fit in the claw part on the opposite side.

Precautions for use

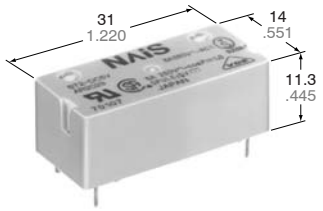
When mounting to a DIN rail, use a commercially available fastening bracket if there is a need to stop sliding of the mounting slat in the rail direction.

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

IC DRIVABLE PC BOARD RELAY FOR FIELD LOAD SWITCHING

ST RELAYS



mm inch

FEATURES

- **Sealed to meet the combination process of automatic wave soldering and cleaning needs**
- **Latching types available**
- **High switching capacity and high sensitivity in subminiature size 150 mW pick-up, 8 A inrush capacity: 51 A for 1a1b, 35 A for 2a**
- **High shock and vibration resistance Shock: 20 G, Vibration: 10 to 55 Hz at double amplitude of 2 mm**

SPECIFICATIONS

Contacts

Arrangement			1 Form A 1 Form B	2 Form A
Contact material			Gold flash over silver alloy	
Initial contact resistance, max.			30 mΩ	
Rating (resistive)	Max. switching power		2,000 VA, 150 W	
	Max. switching voltage		380 V AC, 250 V DC	
	Max. switching current		8 A	
	Min. switching capacity#1		100 mA, 5 V DC	
HP rating			1/4 HP 125, 250 V AC	
Inrush current capability			51 A (TV-3 equivalence) for 1a1b 35 A (TV-1 equivalence) for 2a	
Expected life (min. operations)	Mechanical (at 180 cpm)		10^7	
	Electrical	8 A 250 V AC (resistive)	10^5	
		5 A 30 V DC (resistive)	2×10^5	
		3 A 100 V AC (lamp)	3×10^4	—
		1 A 100 V AC (lamp)	—	3×10^4

Coil (polarized) (at 25°C 77°F)

Single side stable	Nominal operating power	Approx. 240 mW
Latching	Nominal set and reset power	Approx. 240 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10 mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

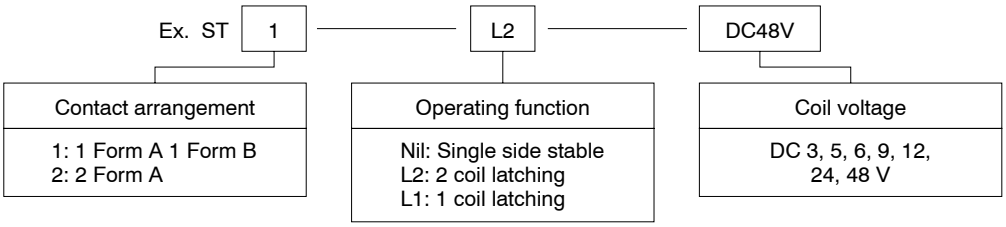
Characteristics (at 25°C 77°F 50% Relative humidity)

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		1,000 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between contact sets	2,000 Vrms
	Between open contacts	1,200 Vrms
	Between contacts and coil	3,750 Vrms
Surge voltage between coil and contact*3		Min. 6,000 V
Operate time*4 (at nominal voltage)		Max. 15 ms (Approx. 10 ms)
Release time (without diode)*4 (at nominal voltage)		Max. 10 ms (Approx. 8 ms)
Set time*4 (latching) (at nominal voltage)		Max. 10 ms (Approx. 8 ms)
Reset time*4 (latching) (at nominal voltage)		Max. 10 ms (Approx. 8 ms)
Temperature rise (at 60°C)		Max. 55°C with nominal coil voltage and at 8 A switching current
Shock resistance	Functional*5	Min. 196 m/s² {20 G}
	Destructive*6	Min. 980 m/s² {100 G}
Vibration resistance	Functional*7	117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2 mm
	Destructive	176.4 m/s² {18 G}, 10 to 55 Hz at double amplitude of 3 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +60°C –40°Fto +140°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 10g .353 oz

TYPICAL APPLICATIONS

Sequence controllers, facsimiles, telephone controls, remote control security devices and security equipment.

ORDERING INFORMATION



(Note) Standard packing: Carton; 50 pcs., Case; 500 pcs.

TYPES AND COIL DATA (at 20°C 68°F)

Single side stable

Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Maximum allowable voltage, V DC (60°C 140°F)	Coil resistance, Ω (±10%)	Nominal operating current, mA
1 Form A 1 Form B	2 Form A						
ST1-DC3V	ST2-DC3V	3	2.4	0.3	4.5	38	78.9
ST1-DC5V	ST2-DC5V	5	4.0	0.5	7.5	105	47.6
ST1-DC6V	ST2-DC6V	6	4.8	0.6	9.0	150	40
ST1-DC9V	ST2-DC9V	9	7.2	0.9	13.5	360	25
ST1-DC12V	ST2-DC12V	12	9.6	1.2	18.0	600	20
ST1-DC24V	ST2-DC24V	24	19.2	2.4	36.0	2,400	10
ST1-DC48V	ST2-DC48V	48	38.4	4.8	72.0	9,000	5.3

1 coil latching

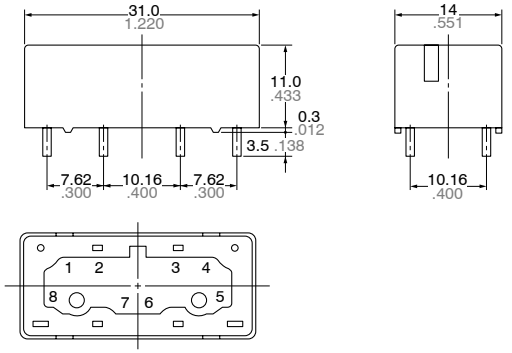
Part No.		Nominal voltage, V DC	Set and reset voltage, V DC (max.)	Maximum allowable voltage, V DC (60°C 140°F)	Coil resistance, Ω (±10%)	Nominal operating current, mA
1 Form A 1 Form B	2 Form A					
ST1-L1-DC3V	ST2-L1-DC3V	3	2.4	4.5	80	37.5
ST1-L1-DC5V	ST2-L1-DC5V	5	4.0	7.5	230	21.7
ST1-L1-DC6V	ST2-L1-DC6V	6	4.8	9.0	330	18.2
ST1-L1-DC9V	ST2-L1-DC9V	9	7.2	13.5	730	12.3
ST1-L1-DC12V	ST2-L1-DC12V	12	9.6	18.0	1,300	9.2
ST1-L1-DC24V	ST2-L1-DC24V	24	19.2	36.0	5,000	4.8
ST1-L1-DC48V	ST2-L1-DC48V	48	38.4	72.0	18,000	2.7

2 coil latching

Part No.		Nominal voltage, V DC	Set and reset voltage, V DC (max.)	Maximum allowable voltage, V DC (60°C 140°F)	Coil resistance, Ω (±10%)	Nominal operating current, mA
1 Form A 1 Form B	2 Form A					
ST1-L2-DC3V	ST2-L2-DC3V	3	2.4	4.5	40	75
ST1-L2-DC5V	ST2-L2-DC5V	5	4.0	7.5	110	45.5
ST1-L2-DC6V	ST2-L2-DC6V	6	4.8	9.0	155	38.7
ST1-L2-DC9V	ST2-L2-DC9V	9	7.2	13.5	360	25
ST1-L2-DC12V	ST2-L2-DC12V	12	9.6	18.0	640	18.8
ST1-L2-DC24V	ST2-L2-DC24V	24	19.2	36.0	2,400	10
ST1-L2-DC48V	ST2-L2-DC48V	48	38.4	72.0	10,200	4.7

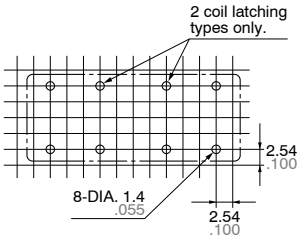
DIMENSIONS

mm inch



General tolerance: ±0.2 ±.008

PC board pattern
(Copper-side view)

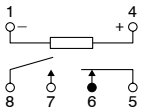


Tolerance: ±0.1 ±.004

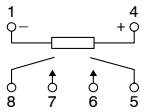
Schematics (Bottom view)

Single side stable

1a1b



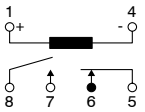
2a



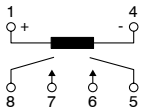
(Deenergized condition)

1 coil latching

1a1b



2a

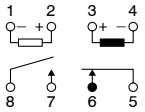


(Reset condition)

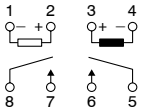
Diagrams show the "reset" position when terminals 1 and 4 are energized.

2 coil latching

1a1b



2a

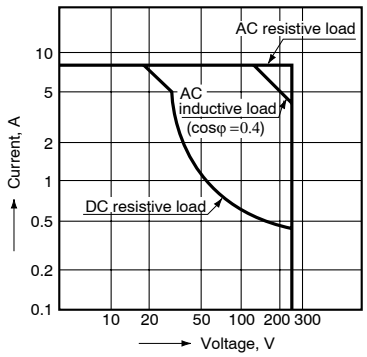


(Reset condition)

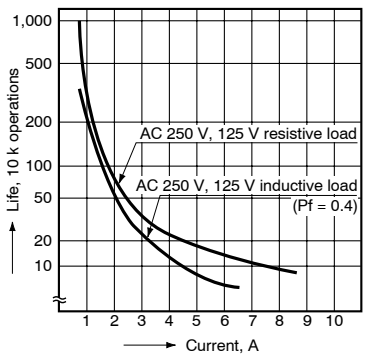
Diagram shows the “reset” position when terminals 3 and 4 are energized. Energize terminals 1 and 2 to transfer contacts.

REFERENCE DATA

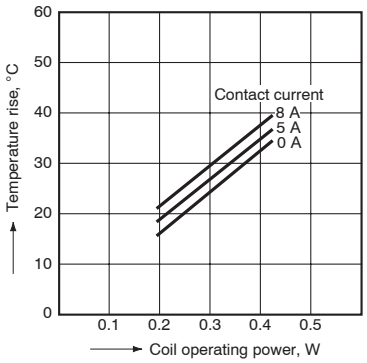
1. Max. switching power



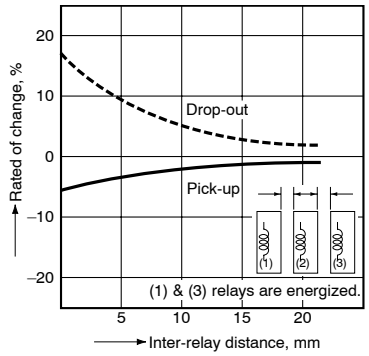
2. Life curve



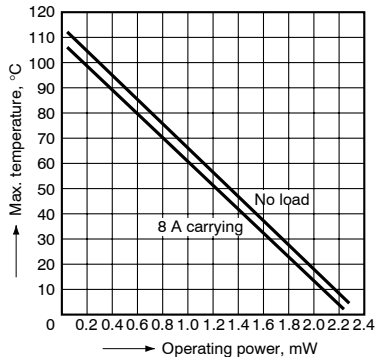
3. Coil temperature rise
Sample: ST1-DC24V



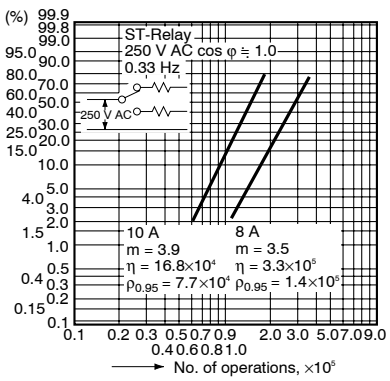
4. Influence of adjacent mounting
Sample: ST1-DC24V



5. Max. ambient temperature by operating power



6. Contact reliability



ST relay socket

ST-SS
Solder terminal socket

ST-PS
PC board terminal socket

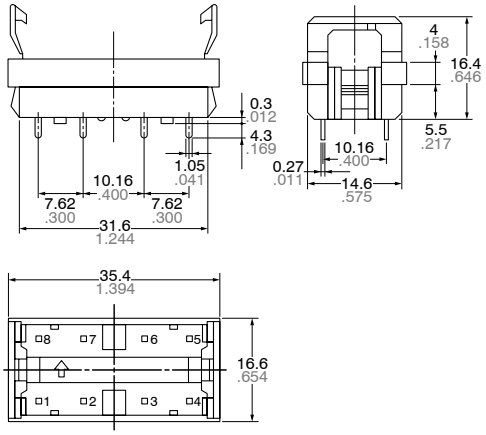
Specifications

Breakdown voltage	4,000 Vrms Coil/Contacts 2,000 Vrms Contacts/Contacts
Insulation resistance	More than 1,000 MΩ between terminals
Heat resistance	150°C (302°F) for 1 hr
Max. continuous current	10 A
Relay insertion life	15 times

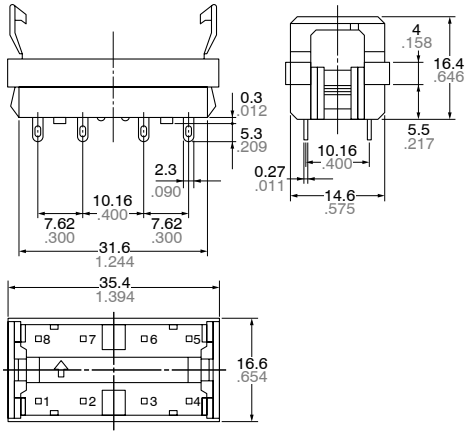
DIMENSIONS

mm inch

ST-PS



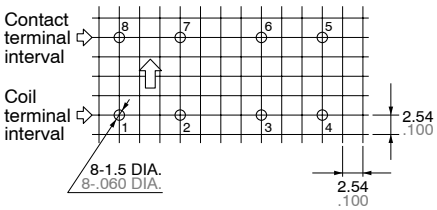
ST-SS



Precautions for use (socket)

1. PC board mounting method

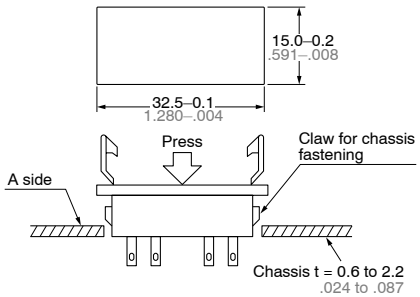
PC board pattern



The terminal configuration is symmetrical on the left and right, so an arrow mark ; is stamped on the socket to prevent mis-insertion. We recommend printing the same arrow mark ; on the component mounting side (side opposite from pattern) of the PC board. In this case, the terminal configuration becomes the terminal nos. noted near the drilling holes.

2. Chassis cutout

Chassis cutting dimensions

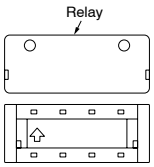


If the chassis hole is punched with a press, set so the release R on the front side (A side).

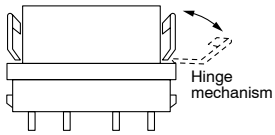
The range for chassis thickness is 0.6 to 2.2 mm .024 to .087 inch.

3. Relay mounting and removal

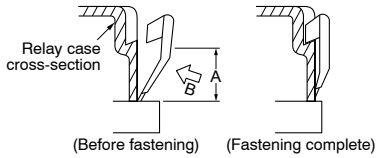
(1) Align the directions of the relay and socket.



(2) Insert the relay all the way in, so it is securely in place.



(3) Press the part indicated by A in the B direction, and fasten by placing the hook on the relay.



(4). When removing the relay, completely release the hooks on both sides and pull the relay out.

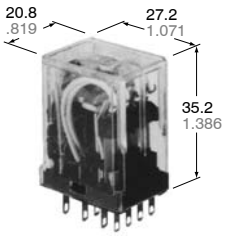
For Cautions for Use, see Relay Technical Information (page 390).

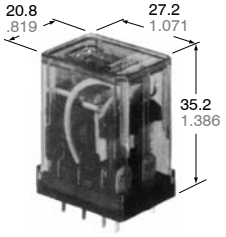
Non-Polarized Power Relays

Panasonic
ideas for life

MINIATURE RELAY FOR WIDER APPLICATIONS

HC RELAYS





mm inch

HCE Amber Relays

FEATURES

- **Extra long life — Min. 10^8 mechanical operations (DC type)**
- **4 contact arrangements**

4 Form C (for 5 A 250 V AC),
3 Form C (for 7 A 250 V AC),
2 Form C (for 7 A 250 V AC),
1 Form C (for 10 A 250 V AC)

- **Applicable to low to high level loads (100μA to 10A)**
- **Amber sealed types available**
- **Bifurcated contact types available as HC4D**

SPECIFICATIONS

Contacts

Arrangement		1 Form C	2 Form C	3 Form C	4 Form C
Initial current resistance, max. (By voltage drop 6 V DC 1 A)		30 mΩ			
Contact material		Gold-flashed silver alloy			Gold-clad silver nickel
Rating (resistive)	Nominal switching capacity	10 A 250 V AC	7 A 250 V AC	7 A 250 V AC	5 A 250 V AC
	Max. switching power	2,500 VA	1,750 VA	1,750 VA	1,250 VA
	Max. switching voltage	250 V AC			
	Max. switching current	10 A	7 A	7 A	5 A
	Min. switching capacity#1	1 mA, 1 V DC			

Coil

Nominal operating power	AC (50Hz): 1.3VA, AC (60Hz): 1.2 VA DC:0.9 to 1.1W

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Detection current: 10 mA
*2 Excluding contact bounce time
*3 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*4 Half-wave pulse of sine wave: 6ms

Characteristics

Max. operating speed		20 cpm (at max. rating)
Initial insulation resistance		Min. 1,000 MW at 500 V DC
Initial breakdown voltage*1	Between open contacts	700 Vrms for 1 min.
	Between contact sets	700 Vrms for 1 min.
	Between contact and coil	2,000 Vrms for 1 min.
Operate time*2 (at nominal voltage) (at 20°C)		Max. 20 ms (DC, AC type)
Release time (without diode)*2 (at nominal voltage) (at 20°C)		Max. 20 ms (DC, AC type)
Temperature rise, max. (at 70°C) (at nominal voltage)		80°C
Shock resistance	Functional*3	Min. 196 m/s² {20 G}
	Destructive*4	Min. 980 m/s² {100 G}
Vibration resistance	Functional*5	10 to 55 Hz at double amplitude of 1 mm
	Destructive	10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*6 (Not freezing and condensing at low temperature)	Ambient temp.	–50°C to +70°C –58°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 30g 1.06 oz

*5 Detection time: 10μs
*6 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Expected life (min. operations)

Electrical (at 20 cpm)

Voltage		125 V AC		250 V AC		30 V DC		Expected life
Load		Resistive (cos φ = 1)	Inductive (cos φ ≅ 0.4)	Resistive (cos φ = 1)	Inductive (cos φ ≅ 0.4)	Resistive	Inductive	
HC1 (1 Form C)	Current	10A	5A	10A	3A	—	—	2×10^5
		7A	3A	7A	2.5A	3A	1A	5×10^5
		5A	2A	5A	1.5A	—	—	1×10^6
HC2 (2 Form C)	Current	7A	3.5A	7A	2A	—	—	2×10^5
		5A	2.5A	5A	1.5A	3A	0.6A	5×10^5
		3A	1.5A	3A	1A	—	—	1×10^6
HC3 (3 Form C)	Current	7A	—	7A	—	—	—	1×10^5
		—	3.5A	—	2A	—	—	2×10^5
		5A	—	5A	—	3A	0.4A	5×10^5
HC4 (4 Form C)	Current	5A	2A	5A	1A	—	—	2×10^5
		3A	1A	3A	0.8A	3A	0.4A	5×10^5
		2A	0.5A	2A	0.4A	—	—	1×10^6

Mechanical life (at 180 cpm)	DC type: 10^8 , AC type: 5×10^7

TYPICAL APPLICATIONS

Transportation, power station control equipment, refrigerators, building control equipment, office machines, coin operated machines, amusement devices, medical equipment, etc.

ORDERING INFORMATION

EX. HC [4] [D] — [H] — [AC 240V] — [F]

Contact arrangement

1: 1 Form C
2: 2 Form C
3: 3 Form C
4: 4 Form C

Type classifications

Nil: Standard type
D: Bifurcated contact type (HC4D only. See Page 302.)
K: Latching relay type (HC2K only. See Page 303.)

Terminal arrangement

H: Plug-in
HP: PC board terminal
HTM: Top mounting
HL: Light emitting diode wired, plug-in
HPL: Light emitting diode wired, PC board

Coil voltage

AC 6, 12, 24, 48, 120/240 V
DC 6, 12, 24, 48, 110 V

Contact Material

	$AgSnO_2$ type	AgNi type	AgCdO type
1 Form C	F		Nil
2 Form C	F		Nil
3 Form C	F		Nil
4 Form C		Nil	
4 Form C Bifurcated		Nil	

Notes:
1. When ordering VDE recognized types, add suffix VDE.
2. HC3 (3 Form C) series are not approved by VDE.
3. AC 48 V type is not available for LED wiring.
4. Standard packing Carton: 20 pcs.; Case: 200 pcs.
5. UL/CSA approved type is standard.

COIL DATA (Common for Standard, Amber sealed and Bifurcated contact types)

DC Type at 20°C 68°F

Coil voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Max. allowable voltage, V DC	Coil resistance, Ω (±10%)	Nominal coil current, mA (±10%)	Operating power, W	
						Nominal	Minimum
6	4.8	0.6	6.6	40	150	0.9	0.58
12	9.6	1.2	13.2	160	75	0.9	0.58
24	19.2	2.4	26.4	650	37	0.9	0.58
48	38.4	4.8	52.8	2,600	18.5	0.9	0.58
110	88.0	11.0	121.0	10,000	10	1.0	0.64

AC Types (50/60 Hz) at 60 Hz, 20°C 68°F

Coil voltage, V AC	Pick-up voltage, V AC (max.)	Drop-out voltage, V AC (min.)	Max. allowable voltage, V AC	Nominal coil current, mA (±20%)	Operating power, VA	
					Nominal	Minimum
6	4.8	1.8	6.6	200	1.20	0.77
12	9.6	3.6	13.2	100		
24	19.2	7.2	26.4	50		
48	38.4	14.4	52.8	25		
110/120	96	36	132	10.9/11.9		
220/240	176.0	66.0	264.0	6.0/6.5		

NOTES:

1. The range of coil current is ±15% for AC (60 Hz), and ±10% for DC, at 20°C.
2. The relay is applicable to the range of 80 % to 110% of the nominal coil voltage. However, it is recommended that the relay be used in the range of 85% to 110% to take temporary voltage variations into consideration.
3. The coil resistance of DC types is the measured value at a coil temperature of 20°C. Please compensate coil resistance by ±0.4% for each degree centigrade coil temperature change.
4. All AC 240 V types are rated for double coil voltages, both AC 220 V and AC 240 V.
5. For use with 220 V or 240 V DC, connect a resistor as suggested in the chart below, in series with the 110 V DC relay.

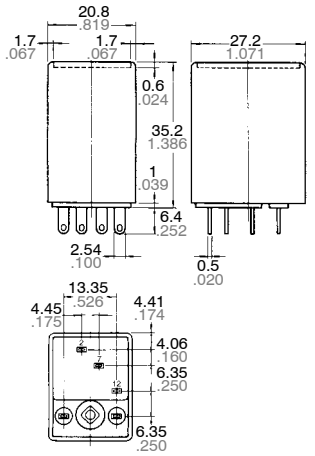
Voltage	1 Form C, 2 Form C, 3 Form C, 4 Form C
220 V DC	11 kΩ (5 W)
240 V DC	13 kΩ (5 W)

DIMENSIONS (Common for standard, Amber sealed and Bifurcated contact (4C only) types)

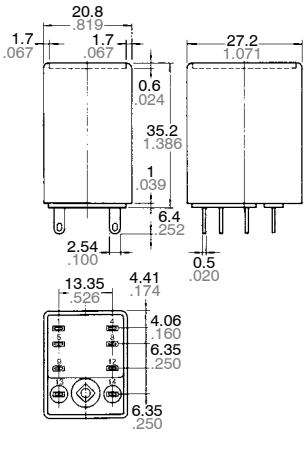
mm inch

Plug-in type

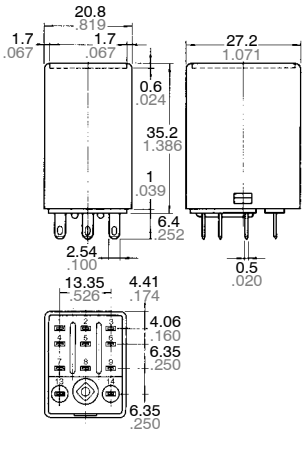
HC1-H (1 Form C)



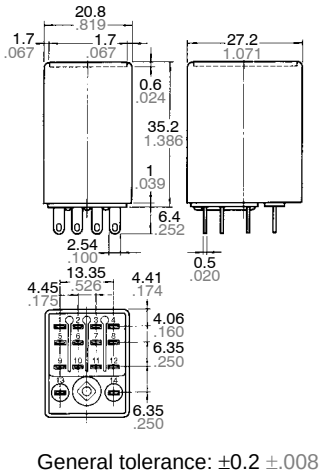
HC2-H (2 Form C)



HC3-H (3 Form C)



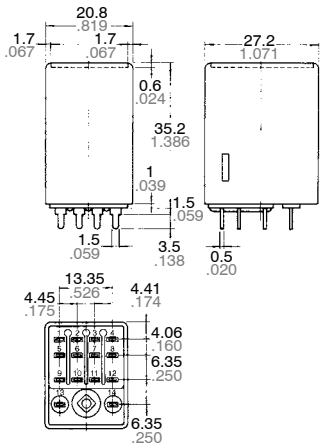
HC4-H (4 Form C)



General tolerance: ±0.2 ±.008

PC board type

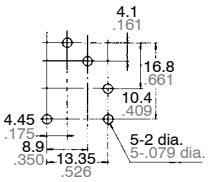
HC4-H (4 Form C)



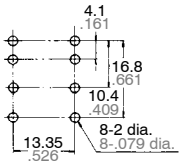
Dimensions of HC1-HP, HC2-HP, HC3-HP are the same as those of plug-in type except shapes of terminals.

PC board pattern (Copper-side view)

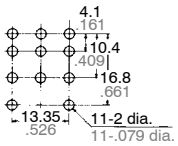
1c



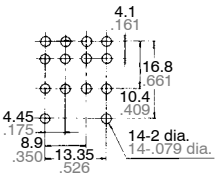
2c



3c



4c

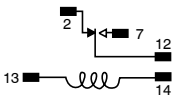


Tolerance: ±0.1 ±.004

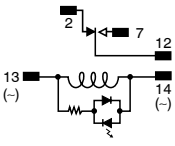
Note: Special PC terminal with 0.9 mm (.035 inch) width available with suffix “-31”.

Schematic (bottom view)

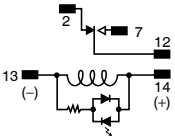
HC1-H, HC1-HP (1 Form C)



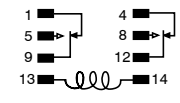
LED AC type



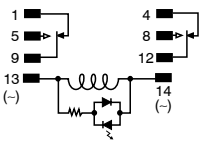
LED DC type



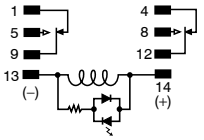
HC2-H, HC2-HP (2 Form C)



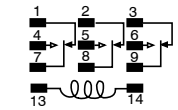
LED AC type



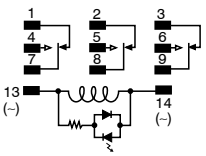
LED DC type



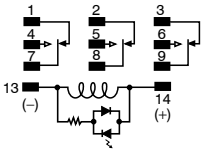
HC3-H, HC3-HP (3 Form C)



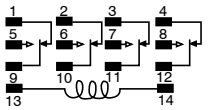
LED AC type



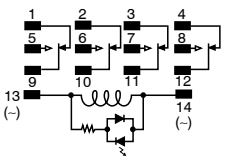
LED DC type



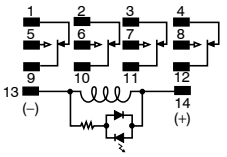
HC4-H, HC4-HP (4 Form C)



LED AC type



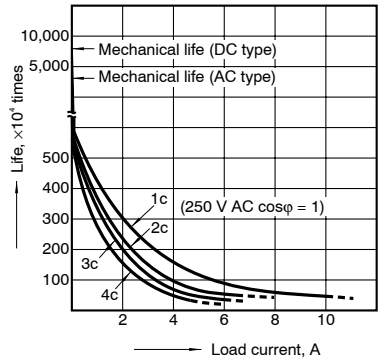
LED DC type



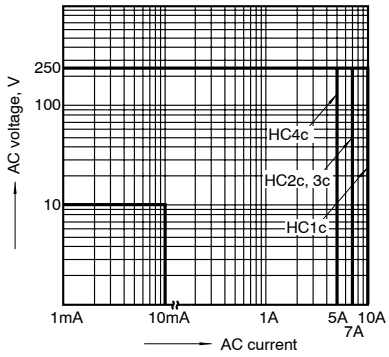
REFERENCE DATA

1. Life curve

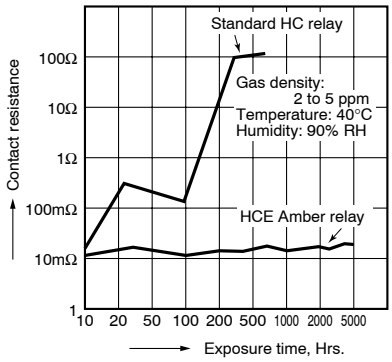
Load: 250 V AC resistive load



2. Switching capacity range



3. H2S gas test

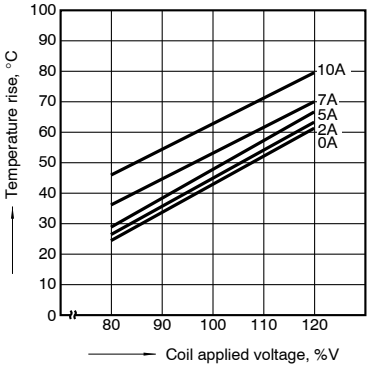


4. Coil temperature rise

Measured portion: Inside the coil Note: When the nominal voltage is applied to AC 120 or 240 V coil types respectively, the figures of coil temperature rise increase by approx. 10 degrees to the ones shown on each graph.

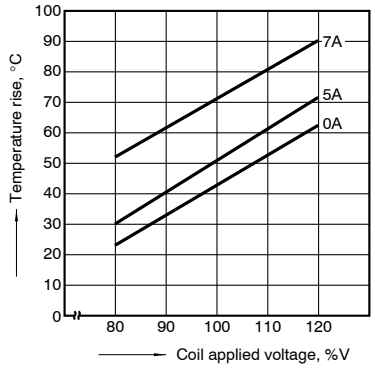
HC1 AC coil

Ambient temperature: 25°C 77°F



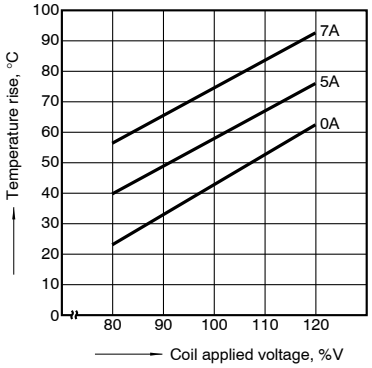
HC2 AC coil

Ambient temperature: 30°C 86°F



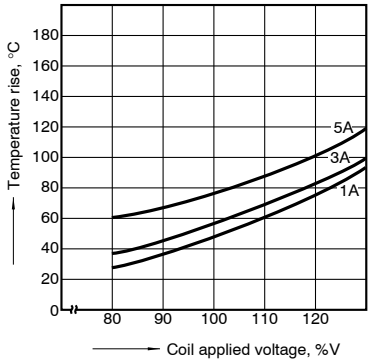
HC3 AC coil

Ambient temperature: 18°C 64°F



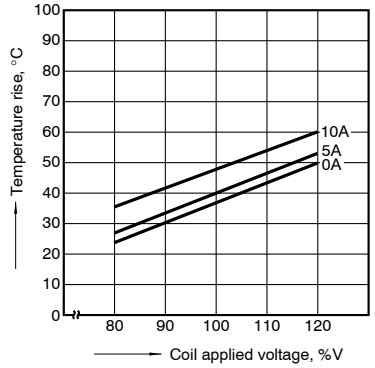
HC4 AC coil

Ambient temperature: 15 to 21°C 59 to 70°F



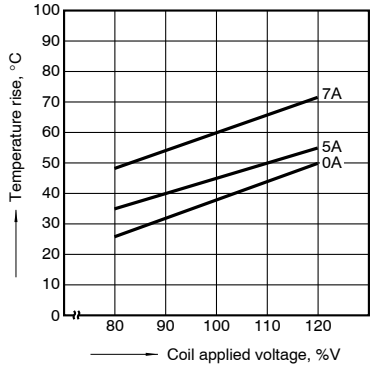
HC1 DC coil

Ambient temperature: 29°C 84°F



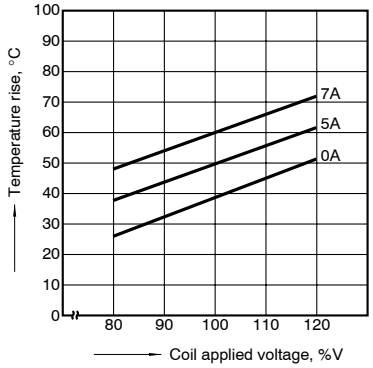
HC2 DC coil

Ambient temperature: 29°C 84°F



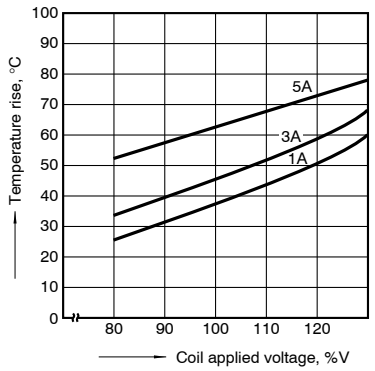
HC3 DC coil

Ambient temperature: 29°C 84°F



HC4 DC coil

Ambient temperature: 17 to 18°C 62 to 64°F



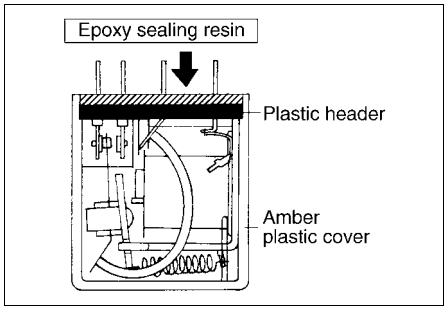
Amber Relays HCE

HC sealed relays are version of the HC relays and are recommended for use in switching medium loads under adverse ambient conditions. They show highly stable contact resistance even after long use, due to their sealed construction and reliable gold plated contacts. Amber relays also make the combined process of automatic wave soldering and cleaning process possible with their resultant savings in cost and labor. Contact arrangements of 1 Form C, 2C, and 4C are available for plug-in, PC board and top-mount.

Construction

The diagram at right shows a cross-section of the plastic sealed relay. All the plastic parts are annealed and out-gassed to ensure fully the stability of both chemical and physical characteristics.

Sealed construction



SPECIFICATIONS

Contacts

Contact arrangement		1 Form C	2 Form C	4 Form C
Rating (resistive)	Nominal switching capacity	5 A 250 V AC	3 A 250 V AC	2 A 250 V AC
	Max. switching power	1,250 VA	700 VA	500 VA
	Max. switching voltage	250 V AC		
	Max. switching current	5 A	3 A	2 A
	Min. switching capacity#1	1 mA, 100 mV DC		
Conditions for operation, transport and storage (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +60°C –40°F to +140°F		
	Humidity	5 to 85% R.H.		
Ambient air pressure		760 mmHg +20% (1.013 mb +20%)		

Expected life (min. operations)

	Voltage		125 V AC	250 V AC	30 V DC		Expected life
	Load		Resistive (cos φ = 1)	Resistive (cos φ = 1)	Resistive	Inductive	
Electrical (at 20 cpm)	HC1E (1 Form C)	Current	5 A	5 A	3 A	1 A	2×10^5
	HC2E (2 Form C)	Current	3 A	3 A	2 A	1.7 A	
	HC4E (4 Form C)	Current	2 A	2 A	2 A	0.6 A	
Mechanical life (at 180 cpm)	DC type: 10^8 , AC type: 5×10^7						

Characteristics

Operate time	Max. 20 ms
Release time	Max. 20 ms

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

ORDERING INFORMATION

EX. HC | 4 | E | D | — | HP | — | AC 240V | — | F

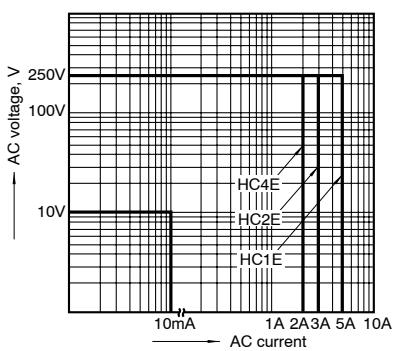
Contact arrangement	Type classifications	Terminal arrangement	Coil voltage	Contact Material
1: 1 Form C 2: 2 Form C 4: 4 Form C	Nil: Standard type D: Bifurcated contact type (HC4D only. See Page 302.)	H: Plug-in HP: PC board terminal HTM: Top mounting L: Light emitting diode wired, plug-in PL: Light emitting diode wired, PC board	AC 6, 12, 24, 48, 120, 240 V DC 6, 12, 24, 48, 110 V	

	$AgSnO_2$ type	AgNi type	AgCdO type
1 Form C	F		Nil
2 Form C	F		Nil
4 Form C		Nil	
4 Form C Bifurcated		Nil	

UL/CSA approved type is standard.

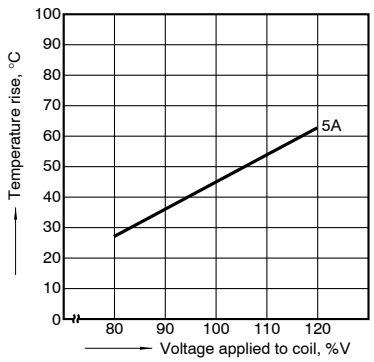
REFERENCE DATA (HC Amber Relays)

1. Switching capacity range



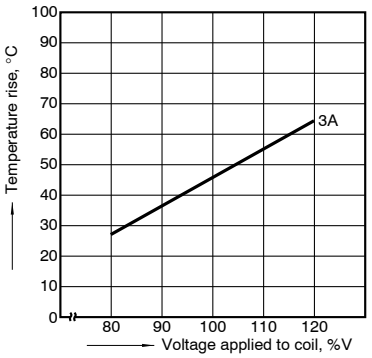
2.-(1) Coil temperature rise (1c AC type)

Measured portion: Inside the coil
Ambient temperature 30°C 86°F

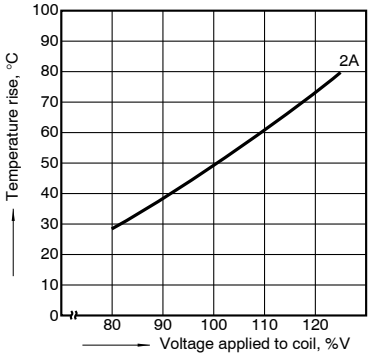


2.-(2) Coil temperature rise (2c AC type)

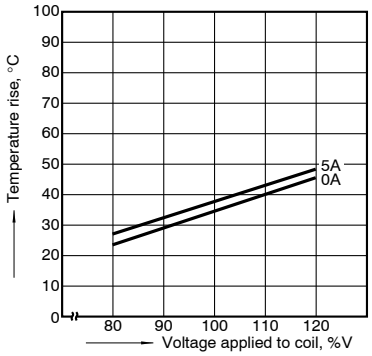
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



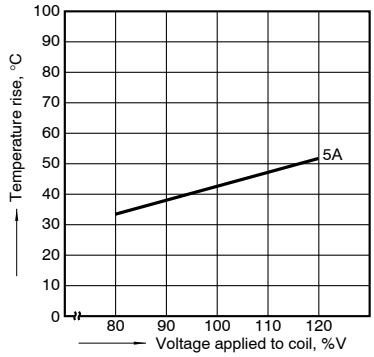
2.-(3) Coil temperature rise (4c AC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



2.-(4) Coil temperature rise (1c DC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F

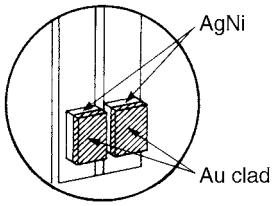


2.-(5) Coil temperature rise (2c DC type)
Measured portion: Inside the coil
Ambient temperature: 30°C 86°F



Bifurcated contact types HC4D

Extremely high contact reliability has been made possible by adoption of gold-clad bifurcated contacts for both movable and stationary contacts.
HC4D type can be used from the dry circuit 100 μA at 10 V DC to the power circuit 3 A at 250 V AC resistive load. Therefore, with HC4D type such a usage is possible that one contact switches 100 μA and another contact switches 3 A load. Also Amber sealed types are available as HC4ED relays.



SPECIFICATIONS

Contacts

Contact arrangement		4 Form C only
Contact material		Gold-clad silver nickel
Rating (resistive)	Nominal switching capacity	3 A 250 V AC
	Max. switching power	750 VA
	Max. switching current	3A
	Min. switching capacity#1	(HC4D) 100 μA, 1 V DC (HC4ED) 100 μA, 100 mV DC

Characteristics

Operate time (Approx.)	Max. 20 ms
Release time (Approx.)	Max. 20 ms

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Expected life (min. operations)

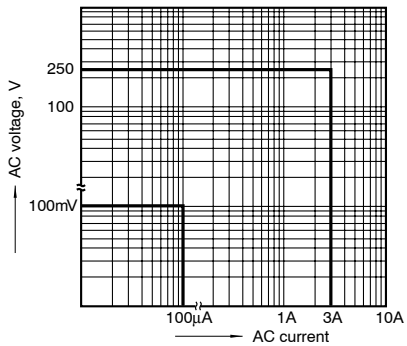
Electrical (at 20 cpm)

Voltage	125 V AC		250 V AC		30 V DC	Expected life
Load	Resistive (cos φ = 1)	Inductive (cos φ ≅ 0.4)	Resistive (cos φ = 1)	Inductive (cos φ ≅ 0.4)	Resistive	
HC4D	3 A	1 A	3 A	0.8 A	3 A	2×10^5
HC4ED	1 A	—	1 A	—	—	

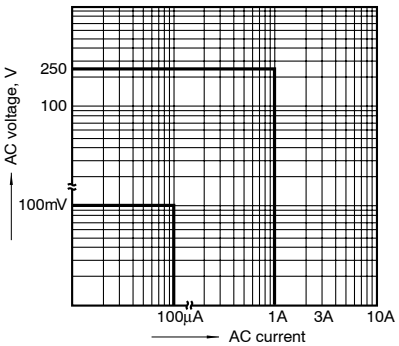
REFERENCE DATA

1. Switching capacity range

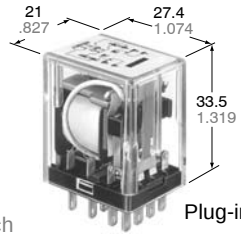
Standard type



Amber type



Latching relay types: HC2K



mm inch

Plug-in

HC magnetic latching relays are particularly suitable for various vending machines, remote control devices, parking meters, conveyor, NC machinery, etc.

TYPES AND COIL DATA

DC coils at 20°C 68°F

UL, CSA recognized

Part No.		Nominal coil current (mA)		Nominal operating power (VA)		Coil voltage	
Plug-in	PC board terminal	set	reset	set	reset	Pick-up	Max. allowable
HC2K-DC6V (-F)	HC2K-P-DC6V (-F)	207	107	1.24	0.64	80% of Nominal voltage	110% of Nominal voltage
HC2K-DC12V (-F)	HC2K-P-DC12V (-F)	100	52.2	1.20	0.63		
HC2K-DC24V (-F)	HC2K-P-DC24V (-F)	51.1	25.5	1.23	0.61		
HC2K-DC48V (-F)	HC2K-P-DC48V (-F)	25.3	13.7	1.21	0.66		
HC2K-DC100V (-F)	HC2K-P-DC100V (-F)	15.6	5.8	1.56	0.58		

Plug-in

AC coils

Part No.		Nominal coil current (mA)		Nominal operating power (VA)		Coil voltage	
Plug-in	PC board terminal	set	reset	set	reset	Pick-up	Max. allowable
HC2K-AC6V (-F)	HC2K-P-AC6V (-F)	206	103	1.23	0.62	80% of Nominal voltage	110% of Nominal voltage
HC2K-AC12V (-F)	HC2K-P-AC12V (-F)	100	52	1.20	0.62		
HC2K-AC24V (-F)	HC2K-P-AC24V (-F)	51	21.4	1.22	0.51		
HC2K-AC48V (-F)	HC2K-P-AC48V (-F)	25.2	18.5	1.2	0.88		
HC2K-AC115V (-F)	HC2K-P-AC115V (-F)	10.4	5.4	1.20	0.621		

PC board terminal

HC2K AC types are not recognized by UL, CSA.

Notes: 1. The coil current range is ±10% of the nominal coil current.
2. The relay is suitable to the range of 80% — 110% of the nominal coil voltage. However, it is recommended that the relay be used in the range of 85% — 110% of the nominal coil voltage, with the temporary voltage variation taken into consideration.
3. UL/CSA approved type is standard.

SPECIFICATIONS

Contacts

Arrangement		2 Form C only
Initial contact resistance max. (By voltage drop 6 V DC 1 A)		50 mΩ
Rating (resistive)	Nominal switching capacity	3 A 250 V AC
	Max. switching power	750 VA
	Max. switching current	3A
	Min. switching capacity#1	1 mA, 1 V DC

Coil

Nominal operating power	Set coil	1.2 VA to 1.33 VA
	Reset coil	0.51 VA to 0.88 VA

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

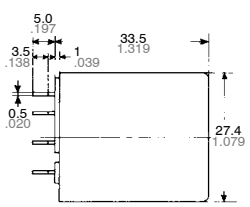
Characteristics

Initial breakdown voltage	Between contact and coil	1,500 Vrms for 1 min.
Set time (at nominal voltage) (at 20°C)		AC, DC: Approx. 20 ms
Reset time (at nominal voltage)		AC: Approx. 30 ms DC: Approx. 50 ms
Temperature rise (at nominal voltage)	Set coil	Max. 80°C
	Reset coil	Max. 50°C
Shock/vibration resistance		Min. 98 m/s² {10 G}
Expected life (min. operations)	Mechanical (at 180 cpm)	10^7
	Electrical (resistive) (at 20 cpm)	2×10^5
Ambient temperature		–40°C to +50°C –40°F to +122°F (Not freezing and condensing at low temperature)

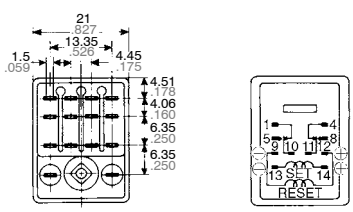
DIMENSIONS AND CIRCUIT DIAGRAM

mm inch

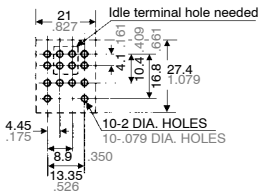
Dimensions



Circuit diagram



PC board pattern (Copper-side)



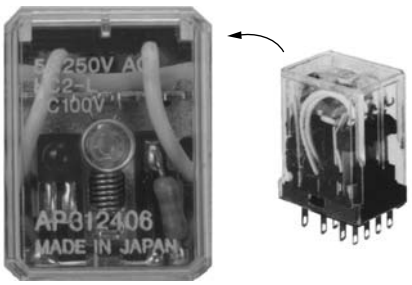
General tolerance: ±0.5 ±.020

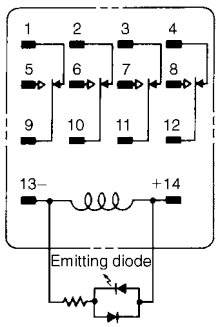
Tolerance: ±0.1 ±.004

Notes:
1. Configuration and dimensions of HC2K types are the same as those of standard HC4 types. Standard sockets and screw terminal sockets of HC4 can be used: HC4-SS-K, HC4-PS-K, HC4-WS-K, and HC4-HSF-K.
2. Please note that circuit diagram of HC2K is different from HC4.
3. Avoid operation by capacitor since latching force varies according to input pulse voltage.

LED wired types: HC-L

The built-in indication LED (Light emitting diode) Series are suitable for instant indication of operate function in applications where numerous relays are to be used. The HC-L relays are supplied with LED wired in parallel with the coil for visual indication that the relay is functioning. A Red LED is used for AC type and green one for DC.





Protection diode
(BOTTOM VIEW)

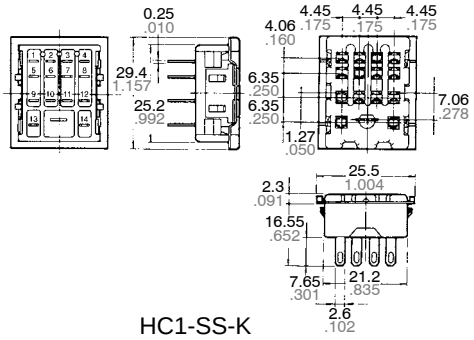
ACCESSORIES

Socket \ Relay	HC1 (1 Form C)	HC2 (2 Form C)	HC3 (3 Form C)	HC4 (4 Form C)
Socket with solder tab (with hold-down clip)	 HC1-SS-K	 HC2-SS-K	 HC3-SS-K	 HC4-SS-K
PC board socket (with hold-down clip)	 HC1-PS-K	 HC2-PS-K	 HC3-PS-K	 HC4-PS-K
Socket for wrap wiring (with hold-down clip)	—	—	—	 HC4-WS-K
Screw terminal socket for front wiring (with hold-down clip)	—	 HC2-SF-K Exclusively for HC2-H	 HC3-HSF-K For HC2-H, HC3-H	 HC4-HSF-K For HC1-H, HC2-H, HC4-H
Screw terminal socket for DIN rail assembly (with hold-down clip)		 HC2-SFD-S HC2-SFD-K Exclusively for HC2-H	 HC3-SFD-K For HC2-H, HC3-H	 HC4-SFD-K For HC1-H, HC2-H, HC4-H

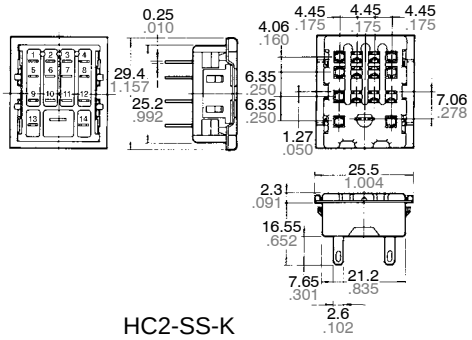
DIMENSIONS

mm inch

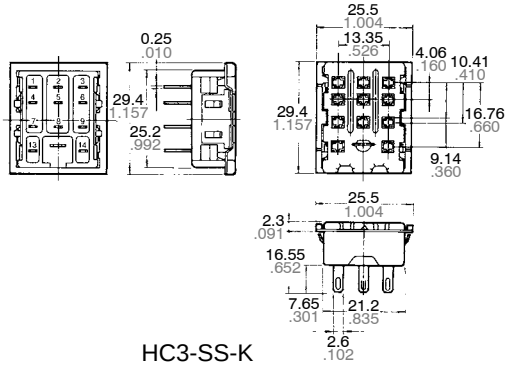
Socket with solder tab (with hold-down clip)



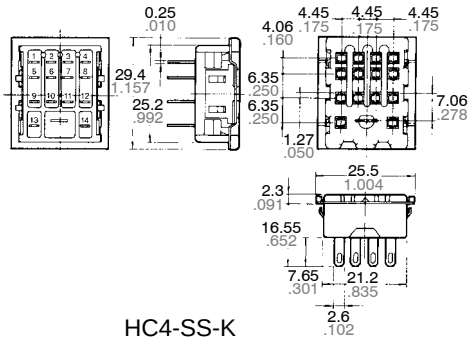
HC1-SS-K



HC2-SS-K

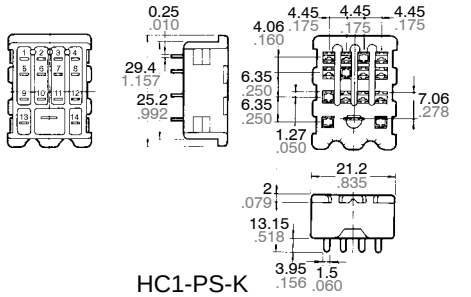


HC3-SS-K

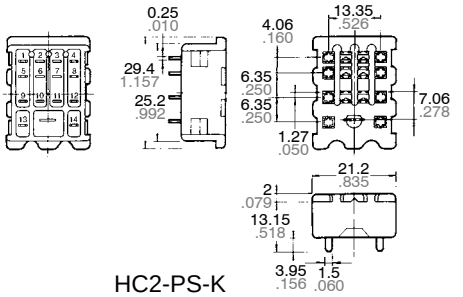


HC4-SS-K

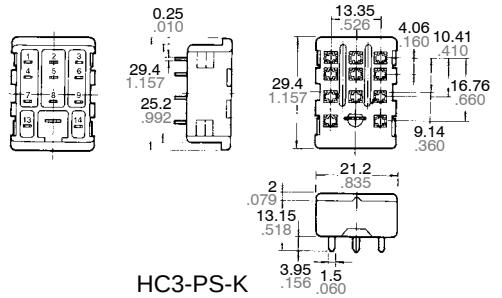
PC board socket (with hold-down clip)



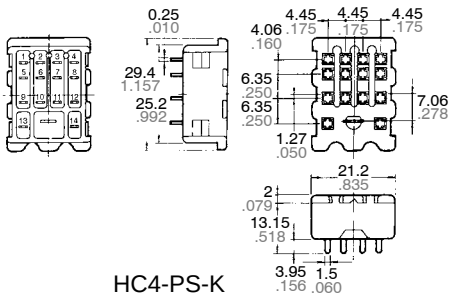
HC1-PS-K



HC2-PS-K

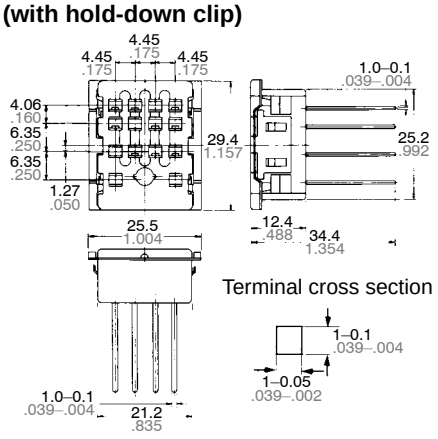


HC3-PS-K



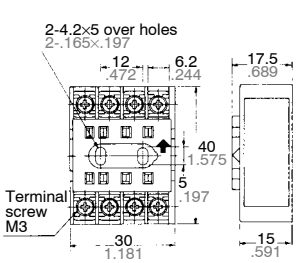
HC4-PS-K

Socket for wrapping (with hold-down clip)

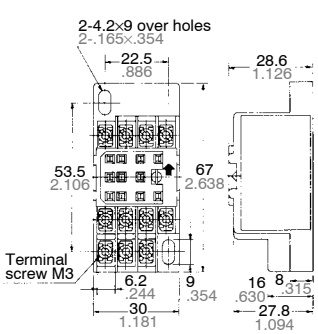


HC4-WS-K

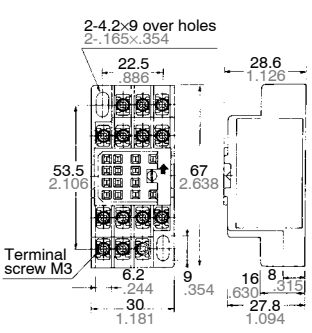
Screw terminal socket for front wiring (with hold-down clip)



HC2-SF-K



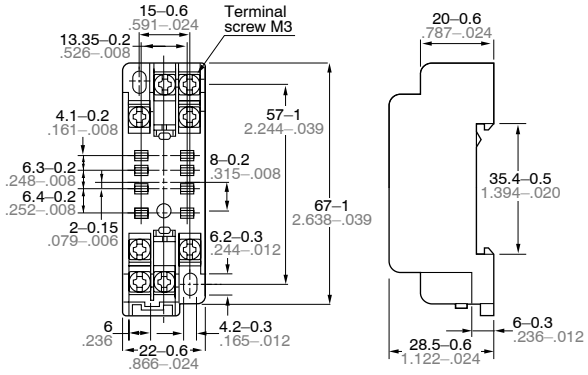
HC3-HSF-K



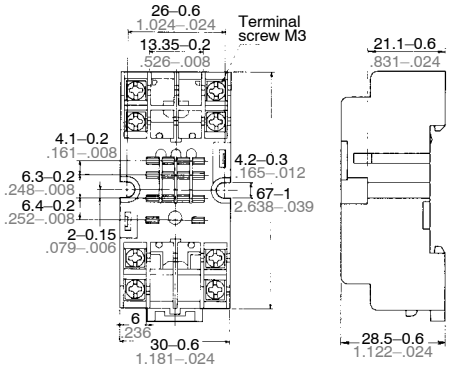
HC4-HSF-K

Screw terminal socket for DIN rail assembly (with hold-down clip)

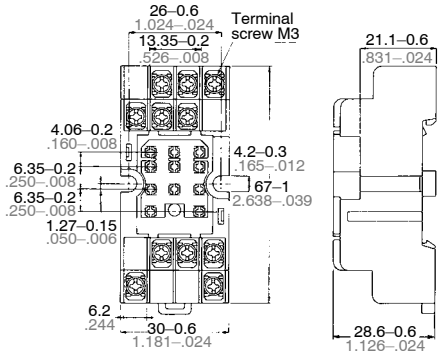
mm inch



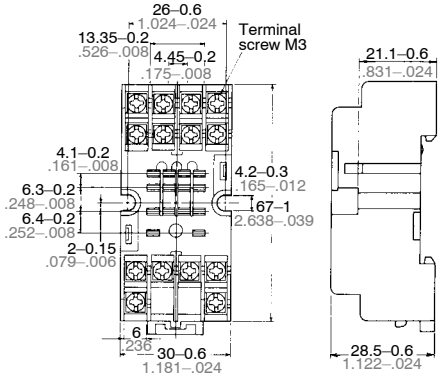
HC2-SFD-S



HC2-SFD-K



HC3-SFD-K

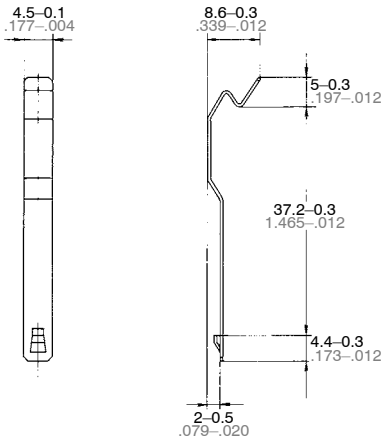


HC4-SFD-K

Hold-down clip

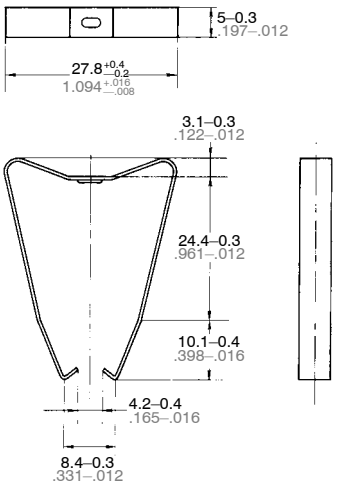
(1) Leaf spring: Applied to HC1-SS-K, HC2-SS-K, HC3-SS-K, HC4-SS-K, HC1-PS-K, HC2-PS-K, HC3-PS-K, HC4-PS-K, HC2-SF-K, HC3-HSF-K, HC4-HSF-K

Part No.: HC/HL-LEAF-SPRING-K



(2) “M shape” leaf spring: Applied to HC4-WS-K

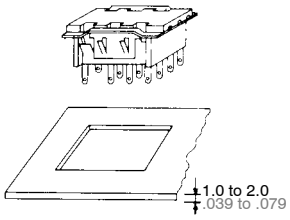
Part No.: HC/HL-LEAF-SPRING-MK



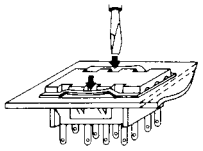
MOUNTING DIMENSIONS AND METHOD

mm inch

Solder and wrapping socket mount

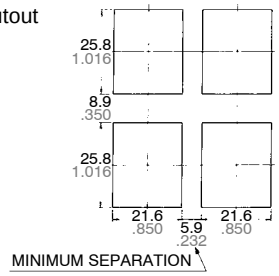


Chassis thickness



Quick mounting

Chassis cutout

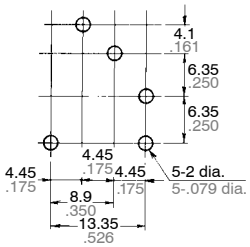


Tolerance: ±0.1 ±.004

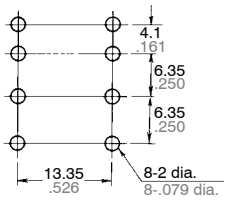
PC board pattern for PC board socket (Copper-side view)

For socket-mount

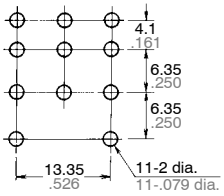
HC1-PS-K



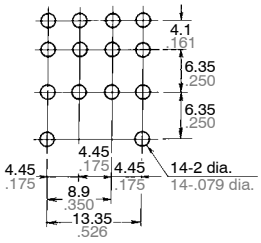
HC2-PS-K



HC3-PS-K



HC4-PS-K

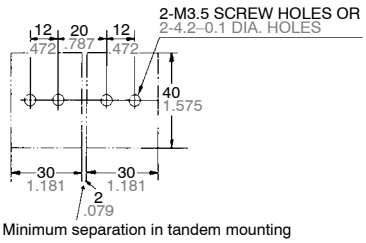


General tolerance: ±0.5 ±.020

Screw socket mounts (Top view)

HC2-SF-K

Chassis cutout

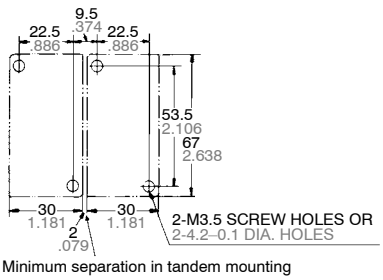


Minimum separation in tandem mounting

Schematic

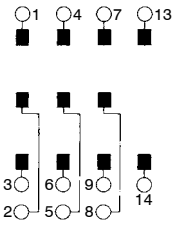
HC3-HSF-K

Chassis cutout



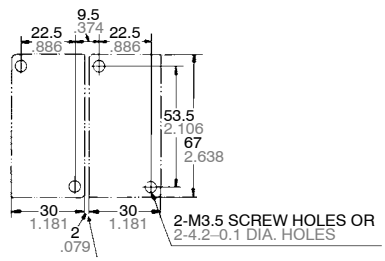
Minimum separation in tandem mounting

Schematic



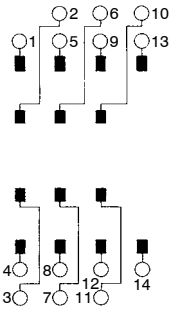
HC4-HSF-K

Chassis cutout



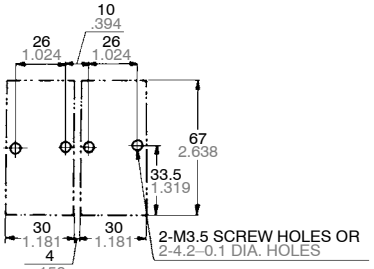
Minimum separation in tandem mounting

Schematic



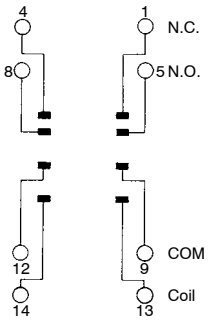
HC2-SFD-K

Chassis cutout



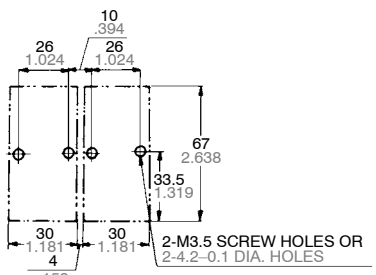
Minimum separation in tandem mounting

Schematic



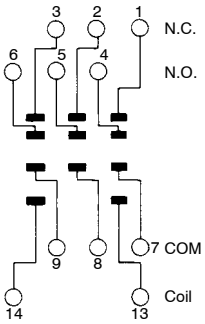
HC3-SFD-K

Chassis cutout



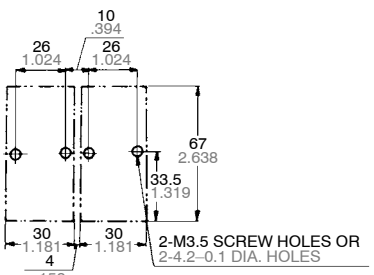
Minimum separation in tandem mounting

Schematic



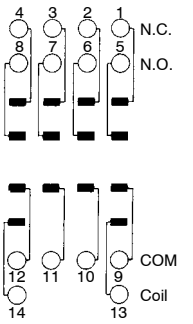
HC4-SFD-K

Chassis cutout



Minimum separation in tandem mounting

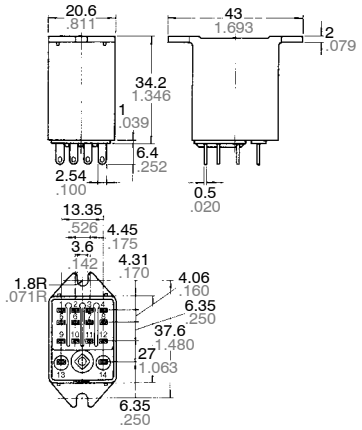
Schematic



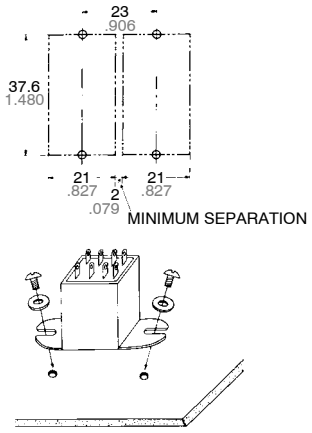
Direct mount for HC-TM relay siries

HC-HTM

4 Form C



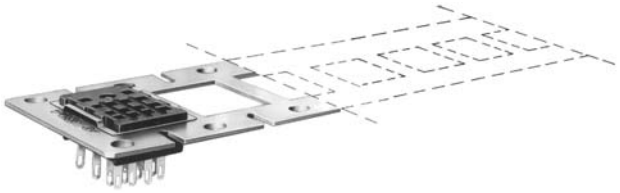
CHASSIS CUTOUT
IN TANDEM MOUNTING



Notes:
1. HC 1-HTM, HC2-HTM, HC3-HTM, HC4-HTM types all have dimensions in common except for the number of terminals.
2. For the specifications, please refer to page 186.
3. In mounting, use M3 screw and M3 washer.

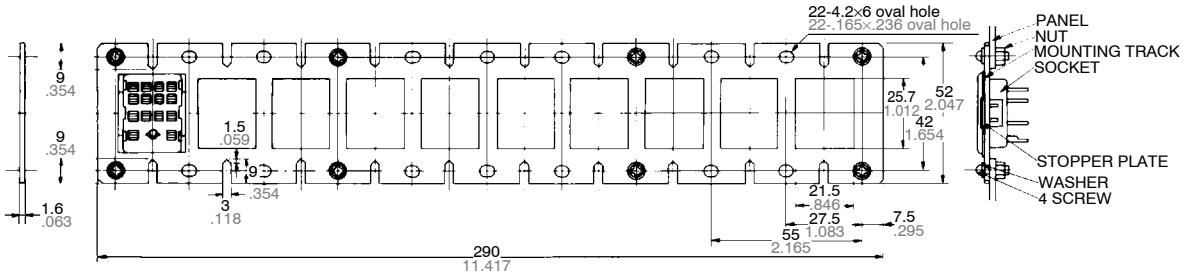
Tolerance: ±0.1 ±.004

Mounting track for solder socket



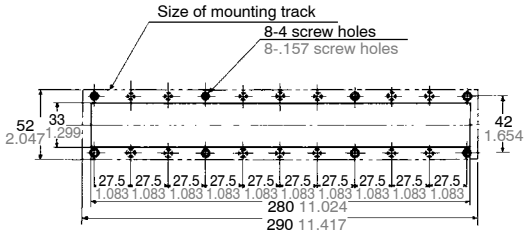
Up to 10 sockets per track.
Cut at notch for desired track length.

Track-mounted solder log sockets
HC-MOUNTING TRACK

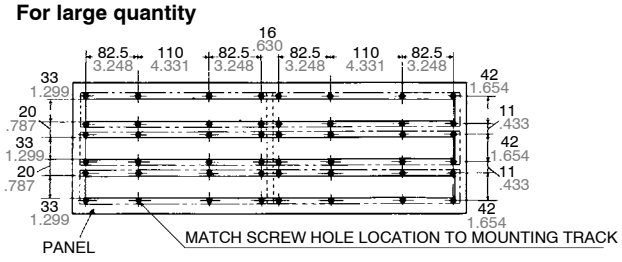


Chassis

For small quantity



For large quantity



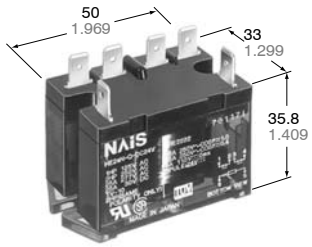
Tolerance: ±0.1 ±.004

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

TV-15, 30 AMP (1 Form A) Power Relay

HE RELAYS



mm inch

FEATURES

• High contact capacity with superior inrush current characteristics;

	1 Form A	2 Form A
Rating	30 A 277 V AC	25 A 277 V AC
TV rating	TV-15	TV-10

• Excellent high heat-resistance;

• High dielectric strength: 10,000 V surge Conforming to VDE0806 (Insulation gap: 8 mm .315 inch) VDE, TÜV also approved

SPECIFICATIONS

Contacts

Type		DC coil type		AC coil type	
Arrangement		1a	2a	1a	2a
Contact material		Silver alloy			
Initial contact resistance, max. (By voltage drop 6 V DC 1A)		100 mΩ			
Rating (resistive)	Nominal switching capacity	30 A 277 V AC	25 A 277 V AC	30 A 277 V AC	25 A 277 V AC
	Max. switching power	8,310 VA	6,925 VA	8,310 VA	6,925 VA
	Max. switching voltage	277 V AC, 30 V DC			
	Max. switching current	30 A	25 A	30 A	25 A
	Min. switching capacity#1	100 mA, 5 V DC			
Expected life (min. operations)	Mechanical (at 180 cpm)	10^7		5×10^6	
	Electrical (at 20 cpm)	10^5 (1a: 30 A 277 V AC, 2a: 25 A 277 V AC) 2×10^5 (1a: 30 A 250 V AC, 2a: 20 A 250 V AC)			

Coil (at 20°C 68°F)

	DC coil type	AC coil type
Nominal operating power	1.92 W	See Coil data (next page)

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "initial breakdown voltage" section
*2 Detection current: 10 mA
*3 Wave is standard shock voltage of ±1.2×50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

		DC coil type	AC coil type
Maximum operating speed		20 cpm	
Initial insulation resistance*1		Min. 1,000 MΩ at 500 V DC	
Initial breakdown voltage*2	Between open contacts	2,000 Vrms for 1 min.	
	Between contacts and coil	5,000 Vrms for 1 min.	
	Between contact sets (2a)	4,000 Vrms for 1 min.	
Surge voltage between coil and contact*3		Min. 10,000 V	
Operate time*4 (at nominal voltage)		Max. 30 ms	
Release time*4 (at nominal voltage)		Max. 10 ms	Max. 30 ms
Temperature rise, max. (resistive load)(at 55°C)		60°C	65°C
Shock resistance	Functional*5	98 m/s² {10 G}	
	Destructive*6	980 m/s² {100 G}	
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 1 mm	
	Destructive	10 to 55 Hz at double amplitude of 1.5 mm	
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–50°C to +55°C –58°F to +131°F	
	Humidity	5 to 85% R.H.	
	Air pressure	86 to 106 kPa	
Unit weight		Approx. 90 g 3.17 oz (Plug-in type)	

TYPICAL APPLICATIONS

1. Home appliances
   - Air conditioners
   - Microwave ovens
   - TV sets
   - Heaters
   - Stereo
2. Office equipment
   - Copiers
   - Vending machines

ORDERING INFORMATION

HE [1a] [N] — [S] — [DC12] V

Contact arrangement	Pick-up voltage	Terminals	Coil voltage
1a: 1 Form A 2a: 2 Form A	N: 70% of nominal voltage	Nil: Plug-in terminal type S: Screw terminal type SW: Screw terminal type (wide pitch) Q: NEMA terminal type P: PC board terminal type*	DC: 6, 12, 24, 48, 110 V AC: 12, 24, 48, 120, 240 V

Standard packing: Carton: 20 pcs.; Case: 100 pcs.
* PC board terminal are available only for 1 Form A type of DC coil voltage.
UL/CSA, TÜV approved type is standard.

TYPES

	Terminal shape	Contact arrangement	
		1 Form A	2 Form A
DC type	Plug-in terminal	HE1aN-DC6V	HE2aN-DC6V
		HE1aN-DC12V	HE2aN-DC12V
		HE1aN-DC24V	HE2aN-DC24V
		HE1aN-DC48V	HE2aN-DC48V
		HE1aN-DC110V	HE2aN-DC110V
	Screw terminal	HE1aN-S-DC6V	HE2aN-S-DC6V
		HE1aN-S-DC12V	HE2aN-S-DC12V
		HE1aN-S-DC24V	HE2aN-S-DC24V
		HE1aN-S-DC48V	HE2aN-S-DC48V
		HE1aN-S-DC110V	HE2aN-S-DC110V
	Screw terminal (wide pitch)	HE1aN-SW-DC6V	HE2aN-SW-DC6V
		HE1aN-SW-DC12V	HE2aN-SW-DC12V
		HE1aN-SW-DC24V	HE2aN-SW-DC24V
		HE1aN-SW-DC48V	HE2aN-SW-DC48V
		HE1aN-SW-DC110V	HE2aN-SW-DC110V
	NEMA terminal	HE1aN-Q-DC6V	HE2aN-Q-DC6V
		HE1aN-Q-DC12V	HE2aN-Q-DC12V
		HE1aN-Q-DC24V	HE2aN-Q-DC24V
		HE1aN-Q-DC48V	HE2aN-Q-DC48V
		HE1aN-Q-DC110V	HE2aN-Q-DC110V
	PC board terminal	HE1aN-P-DC6V	—
		HE1aN-P-DC12V	—
		HE1aN-P-DC24V	—
		HE1aN-P-DC48V	—
		HE1aN-P-DC110V	—

	Terminal shape	Contact arrangement	
		1 Form A	2 Form A
AC type	Plug-in terminal	HE1aN-AC12V	HE2aN-AC12V
		HE1aN-AC24V	HE2aN-AC24V
		HE1aN-AC48V	HE2aN-AC48V
		HE1aN-AC120V	HE2aN-AC120V
		HE1aN-AC240V	HE2aN-AC240V
	Screw terminal	HE1aN-S-AC12V	HE2aN-S-AC12V
		HE1aN-S-AC24V	HE2aN-S-AC24V
		HE1aN-S-AC48V	HE2aN-S-AC48V
		HE1aN-S-AC120V	HE2aN-S-AC120V
		HE1aN-S-AC240V	HE2aN-S-AC240V
	Screw terminal (wide pitch)	HE1aN-SW-AC12V	HE2aN-SW-AC12V
		HE1aN-SW-AC24V	HE2aN-SW-AC24V
		HE1aN-SW-AC48V	HE2aN-SW-AC48V
		HE1aN-SW-AC120V	HE2aN-SW-AC120V
		HE1aN-SW-AC240V	HE2aN-SW-AC240V
	NEMA terminal	HE1aN-Q-AC12V	HE2aN-Q-AC12V
		HE1aN-Q-AC24V	HE2aN-Q-AC24V
		HE1aN-Q-AC48V	HE2aN-Q-AC48V
		HE1aN-Q-AC120V	HE2aN-Q-AC120V
		HE1aN-Q-AC240V	HE2aN-Q-AC240V

COIL DATA at 20°C 68°F

	Nominal voltage	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal coil current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, W	Max. allowable voltage (at 50°C 122°F), V DC
DC coil type	6 V DC	4.2	0.6	320.9	18.8	1.92	6.6
	12 V DC	8.4	1.2	160	75	1.92	13.2
	24 V DC	16.8	2.4	80	300	1.92	26.4
	48 V DC	33.6	4.8	40	1200	1.92	52.8
	110 V DC	77.0	11.0	17.5	6300	1.92	121.0

	Nominal voltage	Pick-up voltage, V AC (max.)	Drop-out voltage, V AC (min.)	Nominal coil current, mA (±10%)	Coil resistance, Ω (±10%)	Nominal operating power, VA	Max. allowable voltage (at 50°C 122°F), V AC
AC coil type	12 V AC	8.4	1.8	138*	75	1.7	13.2
	24 V AC	16.8	3.6	74*	300	1.8	26.4
	48 V AC	33.6	7.2	39*	1200	1.9	52.8
	120 V AC	70.0	18.0	22.1*	5200	2.7	132.0
	240 V AC	140.0	36.0	10.8*	20800	2.6	264.0

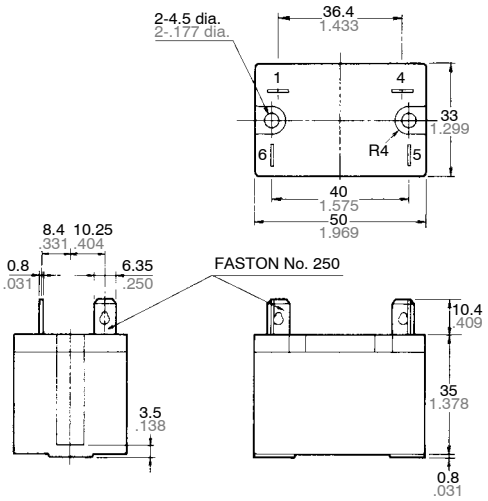
*Value at 60 Hz

DIMENSIONS

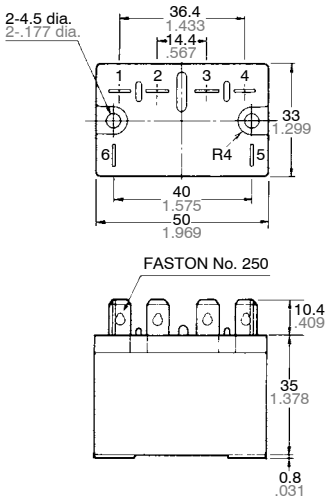
mm inch

1. Plug-in terminal type

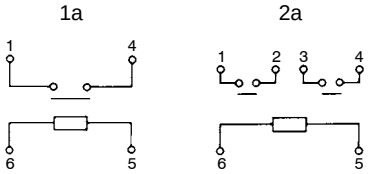
1a



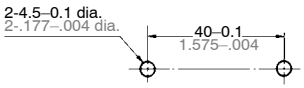
2a



Schematic



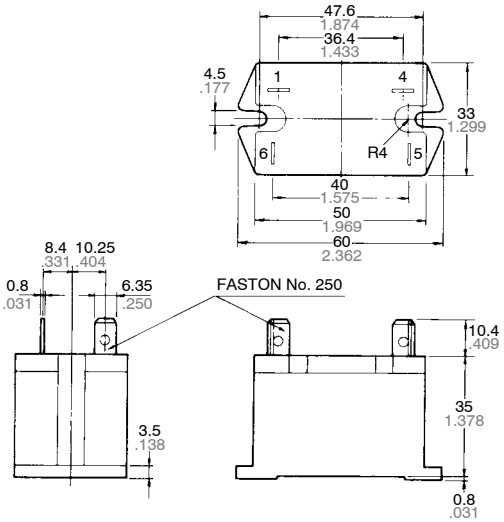
Panel cutout



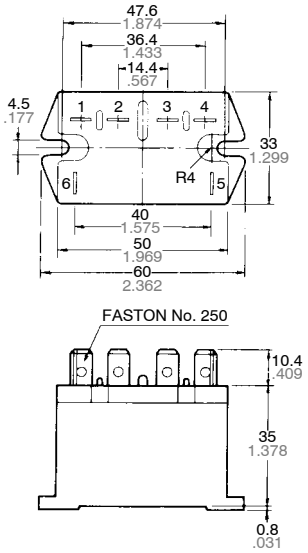
General tolerance: ±0.3 ±.012

2. NEMA terminal type

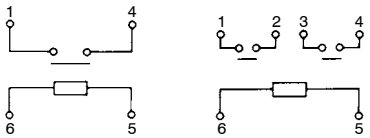
1a



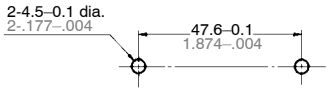
2a



Schematic



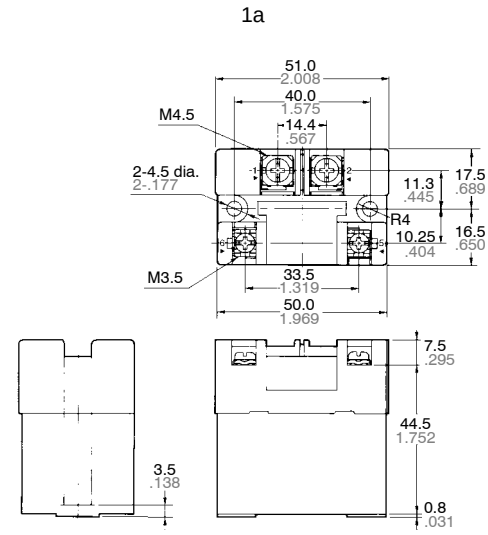
Panel cutout



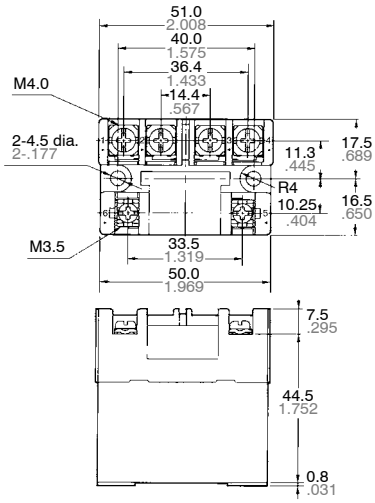
General tolerance: ±0.3 ±.012

3. Screw terminal type

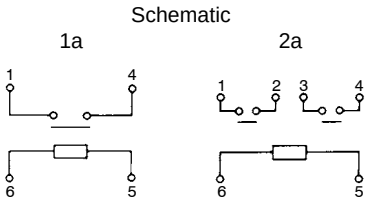
1a



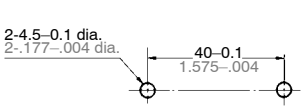
2a



Schematic



Panel cutout

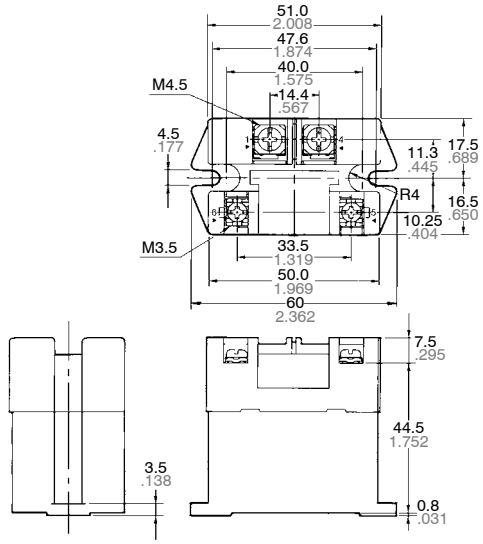


General tolerance: ±0.3 ±.012

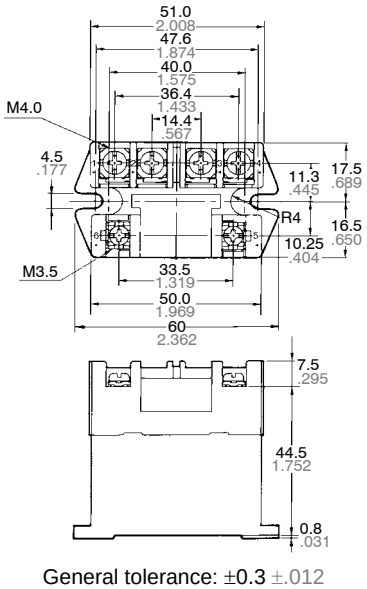
4. Screw terminal type (wide pitch)

mm inch

1a

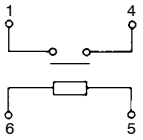


2a

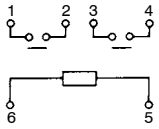


Schematic

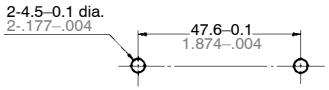
1a



2a

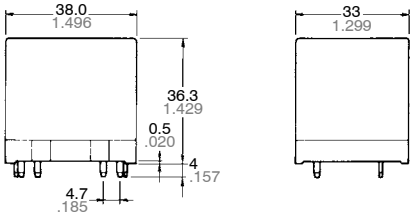


Panel cutout

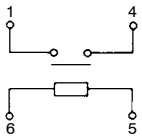


General tolerance: ±0.3 ±.012

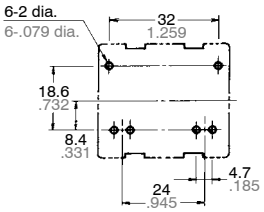
5. PC board terminal type



Schematic (Bottom view)



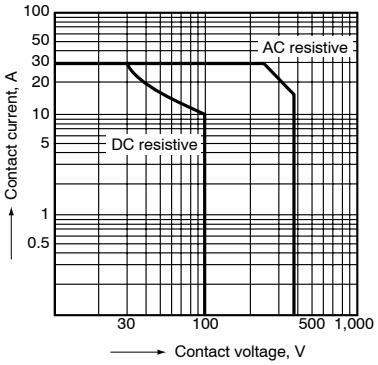
PC board pattern (Copper-side view)



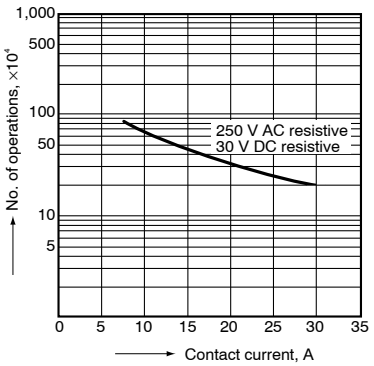
REFERENCE DATA

1 Form A Type

1. Maximum switching power

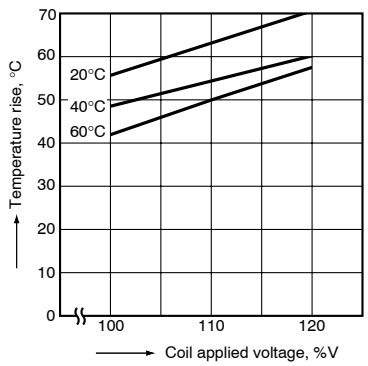


2. Life curve



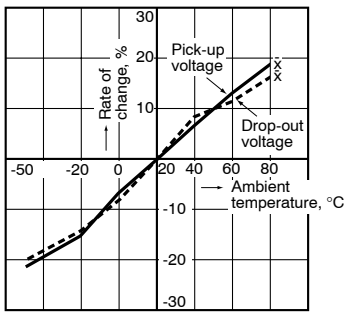
3. Contact temperature rise (DC type)

Measured portion: Inside the coil
Contact current: 30 A



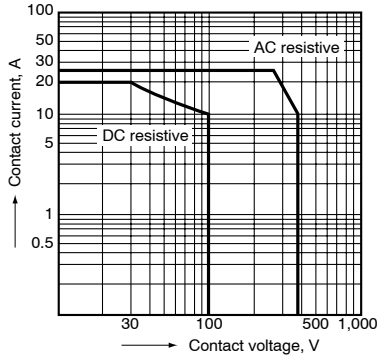
4. Ambient temperature characteristics

Sample: HE1aN-AC120V, 6 pcs.

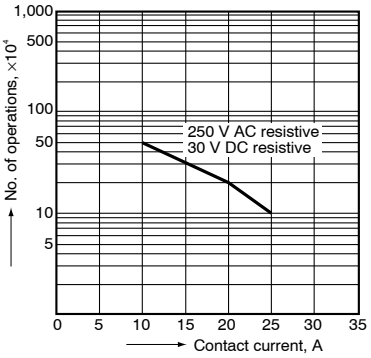


1 Form A Type

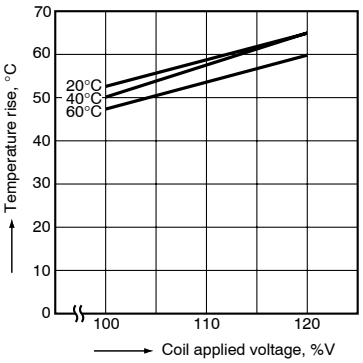
1. Maximum switching power



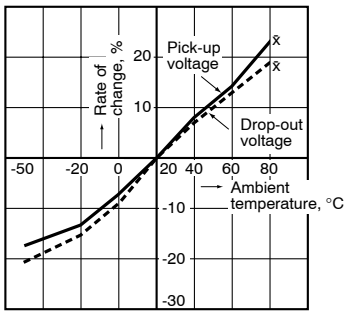
2. Life curve



3. Contact temperature rise (DC type)
Measured portion: Inside the coil
Contact current: 30 A

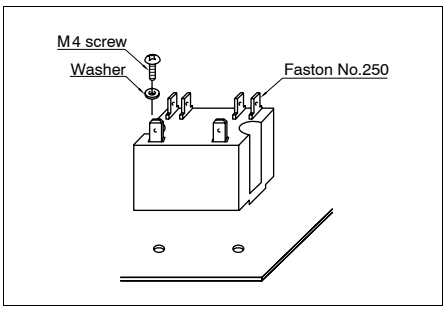


4. Ambient temperature characteristics
Sample: HE2aN-AC120V, 6 pcs.

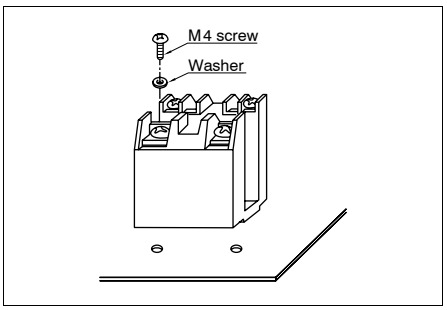


MOUNTING METHOD

1. Plug-in terminal type



2. Screw terminal type



3. Allowable installation wiring size for screw terminal types and terminal blocks

1a type	2.6 mm or 5.5 mm²
2a type	2.0 mm or 3.5 mm²

Due to the UP terminals, it is possible to either directly connect the wires or use crimped terminal

NOTES

1. The dust cover should not be removed since doing so may alter the characteristics.
2. Avoid use under severe environmental conditions, such as high humidity, organic gas or in dust, oily locations and locations subjected to extremely frequent shock or vibrations.
3. When mounting, use spring washers. Optimum fastening torque ranges from 5 kg to 7 kg·cm 4.5 to 6 pounds·inch.
4. Firmly insert the receptacles so that there is no slack or looseness. To remove a receptacle, 2 to 4 kg of pulling strength is required. Do not remove more than one receptacle at one time.Always remove one receptacle at a time and pull it straight outwards.
5. Install the relay so that it lies in direction A (up-down direction). (Pick-up voltage and drop-out voltage values are those when installed in direction A.)
6. When using the AC type, the operate time due to the in-rush phase is 20 ms or more. Therefore, it is necessary for you to verify the characteristics for your actual circuit. Moreover, the release time for the NC side of the 2a1b type requires the same verification.
7. When using the push-on blocks for the screw terminal type, use crimped terminals and tighten the screw-down terminals to the torque's listed below.

M4.5 screw	147 N-cm to 166.6 N-cm (15 to 17 kg·cm)
M4 screw	117.6 N-cm to 137 N-cm (12 to 14 kg·cm)
M3.5 screw	78.4 N-m to 98 N-cm (8 to 10 kg·cm)

8. All AC240V types are rated for double coil voltage, both AC 220V AC 240V.

For Cautions for Use, see Relay Technical Information (page 390).

HE RELAY ACCESSORIES

Terminal socket instantly attachable to DIN rail

TYPES

Part No.	Applicable relays
JH1-SF	HE1a/JH1a
JH2-SF	HE2a/JH2a

SPECIFICATIONS

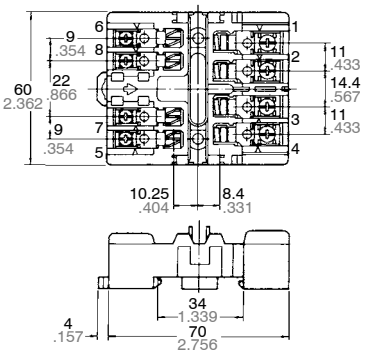
Part No.	JH1, JH2
Maximum continuous current*	20 A 250 V AC (1a: 30 A 250 V AC)
Breakdown voltage	2,000 Vrms between terminals
Insulation resistance	More than 1,000 MΩ between poles
Heat resistance	150°C ±3°C for 1 hour

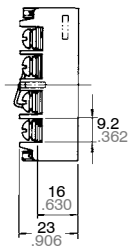
* Don't insert or remove relays while in the energized condition.

DIMENSIONS

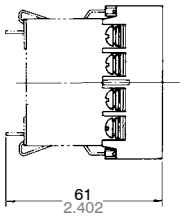
mm inch

1 Form A, 2 Form A

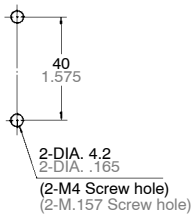




Relay mounting diagram



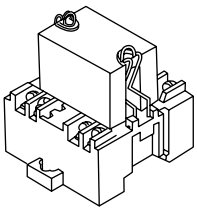
Panel cutout



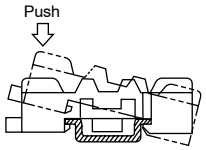
Note:
JH1-SF does not have receptacles (tooth rests) for numbers 2, 3, 7, and 8.
JH2-SF does not have receptacles (tooth rests) for numbers 7 and 8.

MOUNTING METHOD

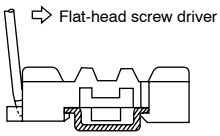
1. Relay mounting



2. Installing to a DIN rail



3. Removing from a DIN rail



NOTE

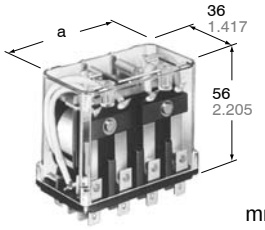
1. Be careful not to drop the relay. It is made of heat-hardened resin and may break.

2. Be sure to tighten the screw- down terminals firmly. Loose terminals may lead to the generation of heat.

Panasonic
ideas for life

20 AMP POWER RELAY

HG RELAYS



mm inch

	a
HG2	34.0 1.339
HG3	50.0 1.969
HG4	68.0 2.667

FEATURES

- **Large capacity — 20 A 250 V AC resistive and 1.5 kW 3 phase 220 V AC motor loads**
- **High contact reliability after long use**
- **Usable with direct soldering, quick-connect and plug-in terminals. (.250)**

SPECIFICATIONS

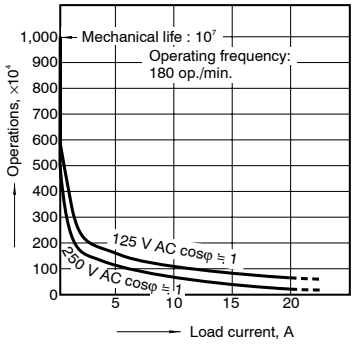
Contacts

Arrangement	2 Form C, 3 Form C, 4 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1A)	15 mΩ
Contact material	Silver alloy
Nominal switching capacity	20 A 250 V AC (resistive)
Min. switching capacity#1	100 mA, 5 V DC

Expected life (min. operations)

Mechanical (at 180 cpm)	AC type: 10^7, DC type: 10^6

Life curve for AC types



#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section

Characteristics (at 60 Hz, 20°C 68°F)

Maximum operating speed		20 cpm
Initial insulation resistance*1		Min. 100 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	2,000 Vrms for 1 min.
	Between contacts sets	2,000 Vrms for 1 min.
	Between contacts and coil	2,000 Vrms for 1 min.
Operate time*3 (approx.) (at nominal voltage)	2 Form C type	Max. 30 ms
	3 Form C & 4 Form C type	Max. 40 ms
Release time (without diode)*3 (approx.) (at nominal voltage)	2 Form C type	Max. 30 ms
	3 Form C & 4 Form C type	Max. 40 ms
Shock resistance	Functional*4	98 m/s² {10 G} (except for the contact moving direction)
	Destructive*5	980 m/s² {100 G}
Vibration resistance	Functional*6	10 to 55 Hz at 1 mm double amplitude
	Destructive	10 to 55 Hz at 2 mm double amplitude
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–50°C to +40°C –58°F to +104°F
	Humidity	5 to 85% R.H.
Unit weight	2 Form C type	Approx. 130 g 4.59 oz
	3 Form C type	Approx. 185 g 6.53 oz
	4 Form C type	Approx. 240 g 8.47 oz

*2 Detection current: 10 mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Electrical life with AC load

AC load	Voltage, V AC	Current, A	Expected life (min. operations)
Resistive (cos φ ≅ 1)	125	20	5×10^5
		15	7.5×10^5
	250	20	2×10^5
		15	5×10^5
		10	7.5×10^5
Inductive (cos φ ≅ 0.4)	125	15	2×10^5
		10	5×10^5
	250	10	2×10^5
		7.5	5×10^5

AC load		Voltage, V AC	Capacity, kW	Expected life (min. operations)
Lamp		125	0.5	2×10^5
			0.3	5×10^5
Motor	Single phase	125	0.75	2×10^5
			0.4	5×10^5
		250	0.75	2×10^5
			0.4	5×10^5
	Three phase	250	1.5	2×10^5
			0.75	5×10^5

Note: In case of an electromagnet or exiting coil load (solenoid, etc.), the value of the motor or lamp load is applicable.

Electrical life with DC load

DC load	Voltage, V DC	Current, A	Expected life (min. operations)
Resistive	24	15	5×10^5
	125	0.8	5×10^5
Inductive (L/R ≅ 7 ms)	24	10	5×10^5
	125	0.4	5×10^5

Note: For DC inductive load, use of an arc extinguishing circuit is recommended.

TYPICAL APPLICATIONS

Industrial machinery, machine tools, food processing and packing machines, office machines, transportation equipment and amusement devices.

ORDERING INFORMATION

Ex. HG 2 — AC 240 V

Contact arrangement	Coil voltage
2: 2 Form C 3: 3 Form C 4: 4 Form C	AC 6, 12, 24, 48, 115, 220, 240 V DC 6, 12, 24, 48, 110, 200 V

(Note) Standard packing Carton: HG2 20 pcs. Case: HG2 100 pcs.
HG3, HG4 10 pcs. HG3, HG4 50 pcs.
UL/CSA approved type is standard.

TYPES AND COIL DATA

DC TYPES at 20°C 68°F

Type	Part No.	Nominal coil voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Max. allowable, V DC voltage	Coil resistance, Ω (±10%)	Nominal coil current, mA	Operating power, W
HG2 (2 Form C)	HG2-DC6V	6	4.8	0.9	6.6	26.4	230	(approx.) 1.4
	HG2-DC12V	12	9.6	1.8	13.2	100	119.6	(approx.) 1.4
	HG2-DC24V	24	19.2	3.6	26.4	416	57.6	(approx.) 1.4
	HG2-DC48V	48	38.4	7.2	52.8	1585	30.3	(approx.) 1.4
	HG2-DC110V	110	88	16.5	121	7650	14.4	(approx.) 1.4
	HG2-DC200V	200	160	20	220	27,800	7.2	(approx.) 1.4
HG3 (3 Form C)	HG3-DC6V	6	4.8	0.9	6.6	22.7	264	(approx.) 1.6
	HG3-DC12V	12	9.6	1.8	13.2	89.5	134	(approx.) 1.6
	HG3-DC24V	24	19.2	3.6	26.4	364	66	(approx.) 1.6
	HG3-DC48V	48	38.4	7.2	52.8	1450	33.1	(approx.) 1.6
	HG3-DC110V	110	88	16.5	121	6670	16.5	(approx.) 1.6
	HG3-DC200V	200	160	20	220	23,800	8.4	(approx.) 1.6
HG4 (4 Form C)	HG4-DC6V	6	4.8	0.9	6.6	18.5	325	(approx.) 2.1
	HG4-DC12V	12	9.6	1.8	13.2	71.4	168	(approx.) 2.1
	HG4-DC24V	24	19.2	3.6	26.4	296	81.2	(approx.) 2.1
	HG4-DC48V	48	38.4	7.2	52.8	1050	45.7	(approx.) 2.1
	HG4-DC110V	110	88	16.5	121	5420	20.3	(approx.) 2.1
	HG4-DC200V	200	160	20	220	15,500	12.9	(approx.) 2.1

AC TYPES (50/60 Hz) at 60 HZ, 20°C 68°F

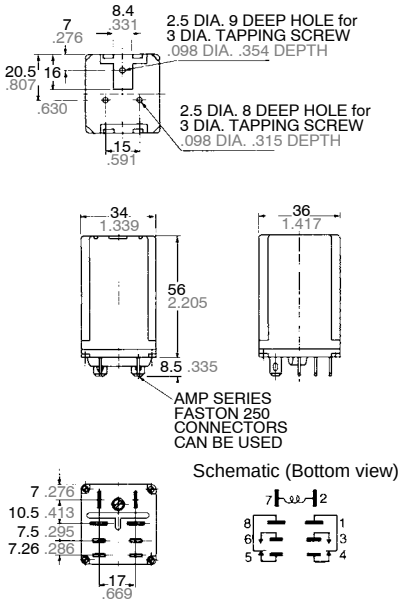
Type	Part No.	Nominal coil voltage, V AC	Pick-up voltage, V AC (max.)	Drop-out voltage, V AC (min.)	Max. allowable, V AC voltage	Inductance, H	Nominal coil current, mA	Operating power, VA
HG2 (2 Form C)	HG2-AC6V	6	4.8	1.8	6.6	0.026	600	(approx.) 3.6
	HG2-AC12V	12	9.6	3.6	13.2	0.104	300	(approx.) 3.6
	HG2-AC24V	24	19.2	7.2	26.4	0.416	150	(approx.) 3.6
	HG2-AC48V	48	38.4	14.4	52.8	1.660	75	(approx.) 3.6
	HG2-AC115V	115	92	34.5	126.5	9.531	31.3	(approx.) 3.6
	HG2-AC220V	220	176	66	242	34.96	16.4	(approx.) 3.6
	HG2-AC240V	240	192	72	264	41.68	15	(approx.) 3.6
HG3 (3 Form C)	HG3-AC6V	6	4.8	1.8	6.6	0.018	864	(approx.) 5.2
	HG3-AC12V	12	9.6	3.6	13.2	0.073	432	(approx.) 5.2
	HG3-AC24V	24	19.2	7.2	26.4	0.290	216	(approx.) 5.2
	HG3-AC48V	48	38.4	14.4	52.8	1.163	108	(approx.) 5.2
	HG3-AC115V	115	92	34.5	126.5	6.648	45.2	(approx.) 5.2
	HG3-AC220V	220	176	66	242	24.26	23.6	(approx.) 5.2
	HG3-AC240V	240	192	72	264	29.06	21.6	(approx.) 5.2
HG4 (4 Form C)	HG4-AC6V	6	4.8	1.8	6.6	0.012	1264	(approx.) 7.6
	HG4-AC12V	12	9.6	3.6	13.2	0.050	632	(approx.) 7.6
	HG4-AC24V	24	19.2	7.2	26.4	0.199	316	(approx.) 7.6
	HG4-AC48V	48	38.4	14.4	52.8	0.795	158	(approx.) 7.6
	HG4-AC115V	115	92	34.5	126.5	4.557	66.1	(approx.) 7.6
	HG4-AC220V	220	176	66	242	16.89	34	(approx.) 7.6
	HG4-AC240V	240	192	72	264	19.87	31.6	(approx.) 7.6

Notes:
1. The coil current ranges is ±15% for AC (60 Hz), ±10% for DC (20°C 68°F).
2. These relays are applicable to a range of 80% to 110% of the nominal coil voltage. However, it is recommended that the relay be used in a range of 85% to 110% of the nominal coil voltage, taking the temporary voltage variation into consideration. For AC types, when operating voltage is 70% of nominal coil voltage, "buzzing" will occur, and a large amount of current will flow, burning the coil.
3. Each coil resistance of DC types is the measured value at coil temperature of 20°C 68°F. Please compensate the coil resistance by ±0.4%, each time the coil temperature changes by ±1°C.

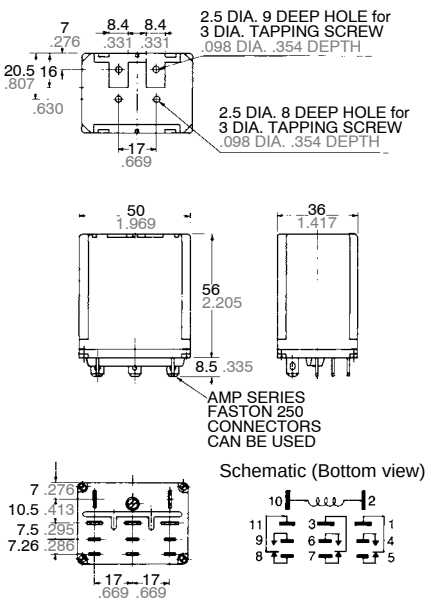
DIMENSIONS

mm inch

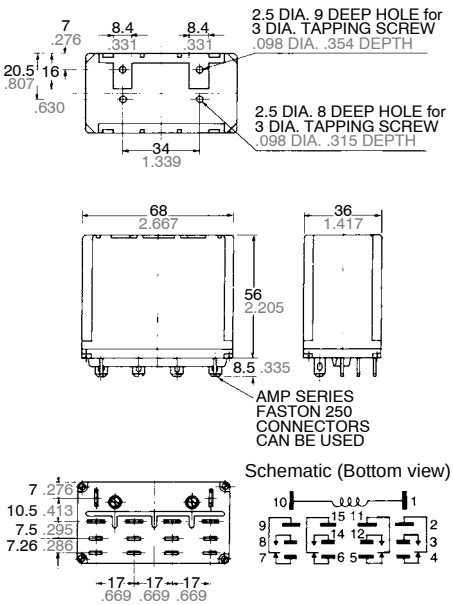
HG2 (2 Form C)



HG3 (3 Form C)



HG4 (4 Form C)



General tolerance: ±0.5 ±.020

ACCESSORIES

Please refer to “MOUNTING METHOD” for further information.

HG	Relay	Screw terminal socket for DIN rail assembly (with hold-down clip)	Solder terminal socket for rectangular hole (with hold-down clip)	Bracket for direct mounting
HG2 (2 Form C)		HG2-SFD 	HG2-SS 	HP-BRACKET  1 pc.
HG3 (3 Form C)		HG3-SFD 	HG3-SS 	HP-BRACKET  2 pcs.
HG4 (4 Form C)		No screw terminal socket for HG4 use 2 screw terminal sockets (HG2-SFD)	HG4-SS 	HP-BRACKET  2 pcs.

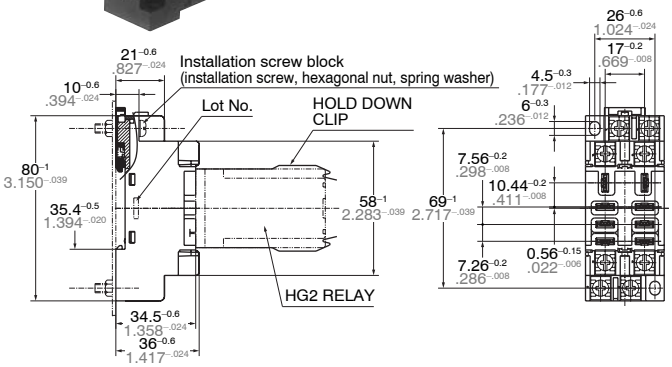
Note: Tapping-screw holes are provided on the cover top for direct mounting.

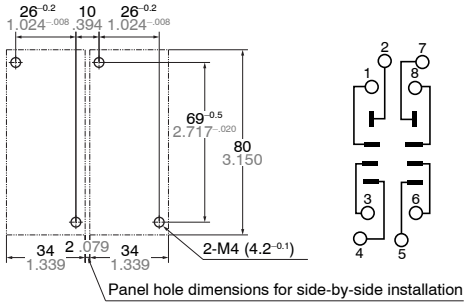
MOUNTING METHOD AND DIMENSIONS

mm inch

Screw terminal socket (Hold-down clips included)

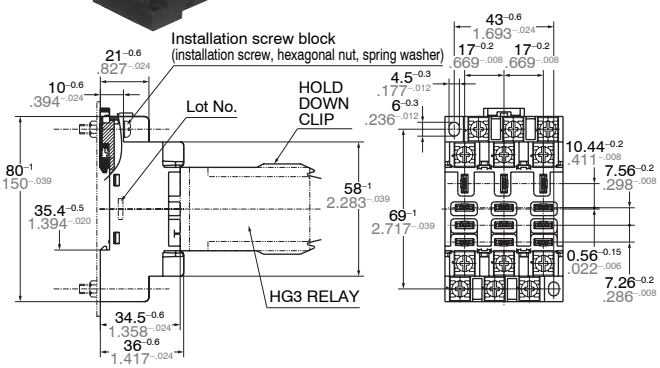
HG2-SFD

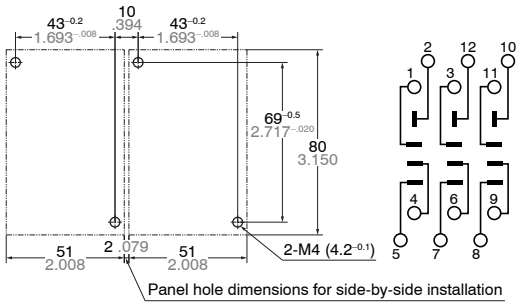




Note: Hold down clip and installation screw block are included in package.

HG3-SFD

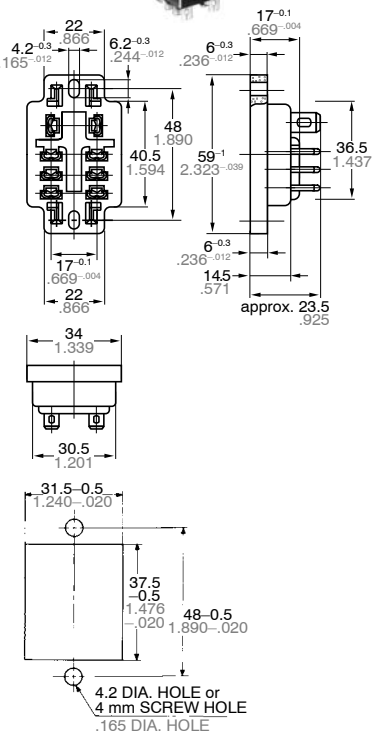




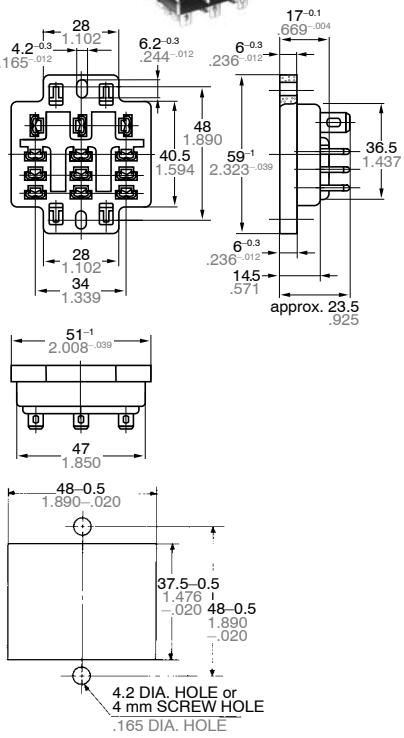
Note: Hold down clip and installation screw block are included in package.

Solder terminal socket (Hold-down clips included)

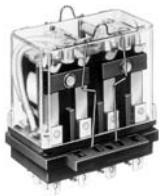
HG2-SS

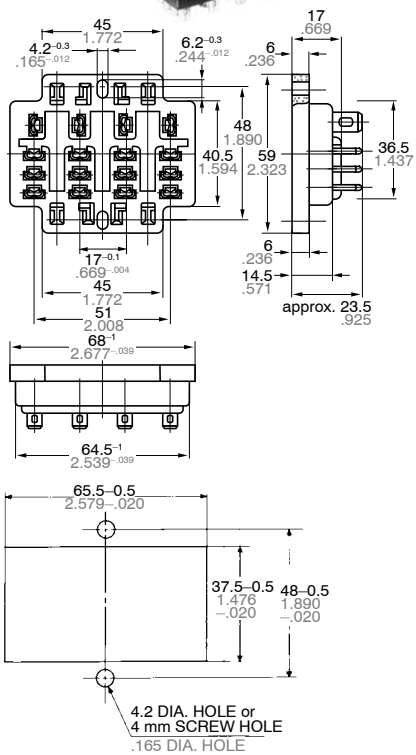


HG3-SS



HG4-SS



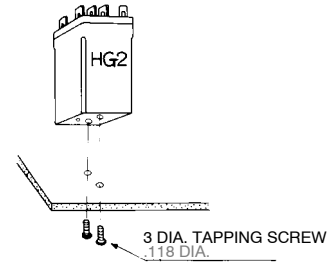


Note: HG sockets accept Faston 250.

General tolerance: ±0.6 ±.024

Direct mounting

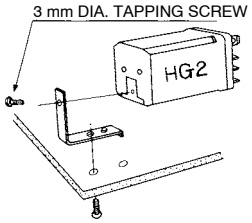
Faston 250 series quick-connectors can be used.

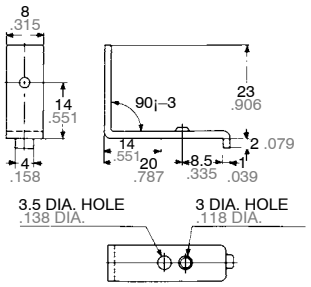


A: HG 2: 15mm .591
HG 3: 17mm .669
HG 4: 34mm 1.339

Direct mounting with HP-BRACKET

Faston 250 series quick-connectors can be used.

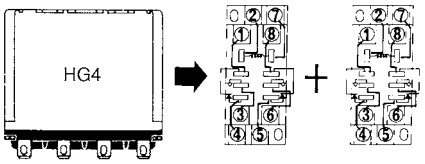




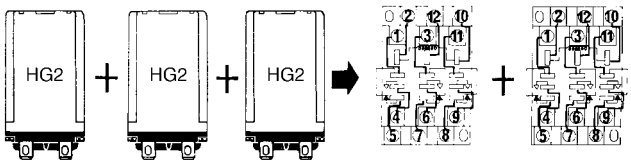
Use two brackets for HG3 and HG4

Notes:
1. This bracket is unavailable for UL, CSA and VDE applications.
2. When using any other non-standard bracket mounting-screw length should not exceed bracket thickness plus 7 mm .276 inch to avoid damage to relay coils.

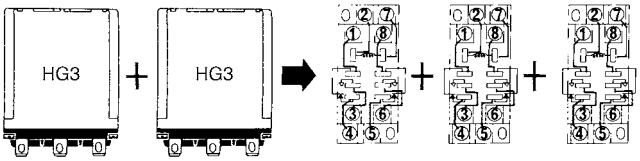
Socket Combinations



HG2-SFD+HG2-SFD



HG3-SFD+HG3-SFD



HG2-SFD+HG2-SFD+HG2-SFD

NOTES

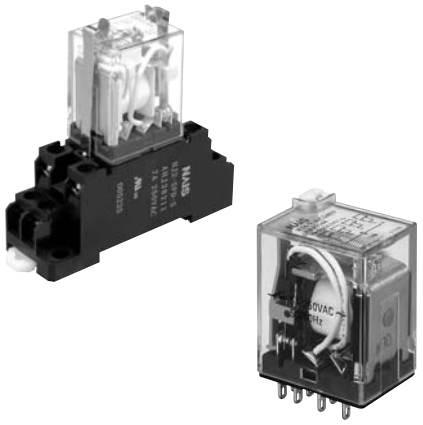
Please use the hold-down clip whenever HG relays will be used in applications where strong vibrating or shock force occurs. When used in such applications, mount the relay so that this force does not parallel the direction of contact movement.

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

MINIATURE RELAY FOR WIDER APPLICATIONS

HJ RELAYS



FEATURES

- **2 contact arrangements**
  4 Form C (for 5 A 250 V AC),
  2 Form C (for 7 A 250 V AC)
- **Excellent contact reliability by Au plating**
- **Environmentally friendly Cd-free contacts**
- **Coil breakdown detection function (AC type with LED only)**
- **Convenient Screw terminal sockets with finger protection also available**
- **Test button type available**
- **Built-in diode and CR for surge suppression type available**

TYPICAL APPLICATIONS

Control panels
Power supply units
Molding machines
Machine tools
Welding equipment
Agricultural equipment
Office equipment
Vending machines
Communications equipment
Amusement machines

ORDERING INFORMATION

Ex. HJ □ – □ – □ – □ – □ – □

Contact arrangement	Operation indication	Test button	Coil voltage	Surge suppression	Contact surface
2: 2 Form C 4: 4 Form C	Nil: Without LED indication L: With LED indication	Nil: Without test button T: With test button	AC 12, 24, 48, 100/110, 110/120, 200/220, 220/240 V DC 12, 24, 48, 100/110 V	Nil: Without D: With diode R: With CR	Nil: Without 6: With Au plating

Power

SPECIFICATIONS

Contacts

Arrangement		2 Form C	4 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		50mΩ	
Contact material		Au plating Silver alloy (Au plating type) Silver alloy (without Au plating type)	
Rating (resistive load)	Nominal switching capacity	7A 250V AC	5A 250V AC
	Max. switching power	1,750 VA	1,250 VA
	Max. switching voltage	250 V AC	
	Max. switching current	7 A	5 A
	Min. switching current*9	1 V 1 mA (Au plating type only)	
Expected life (min. operations)	Mechanical (at 180 cpm)	2×10^7	
	Electrical (at 20 cpm) (resistive load)	10^5 (7A 250 V AC) 5×10^5 (5A 250 V AC)	10^5 (5A 250 V AC) 2×10^5 (3A 250 V AC)

Coil

Nominal operating power	0.9W 1.2V A

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 For the AC coil types, the operate/release time will differ depending on the phase.
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).
*9 This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

		2 Form C	4 Form C
Max. operating speed		20 cpm (at max. rating)	
Initial insulation resistance*1		Min. 100 MΩ at 500 V DC	
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min.	
	Between contact sets	2,000 Vrms for 1 min.	
	Between contact and coil	2,000 Vrms for 1 min.	
Operate time*3 (at nominal voltage)		Max. 20 ms*4	
Release time (without diode)*3 (at nominal voltage)		Max. 20 ms*4	
Temperature rise, max. (at 70°C) (at nominal voltage)		60°C	
Shock resistance	Functional*5	Min. 100 m/s² {10 G}	
	Destructive*6	Min. 1,000 m/s² {100 G}	
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 1.0 mm	
	Destructive	10 to 55 Hz at double amplitude of 1.0 mm	
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F	
	Humidity	5 to 85% R.H.	
Unit weight	Without test button	Approx. 31g 1.09 oz	Approx. 32g 1.13 oz
	Test button	Approx. 34g 1.20 oz	Approx. 34g 1.20 oz

TYPES

[Au plating type]

1. Plug-in type

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-DC 12V-6	HJ4-DC 12V-6
24V DC	HJ2-DC 24V-6	HJ4-DC 24V-6
48V DC	HJ2-DC 48V-6	HJ4-DC 48V-6
100/110V DC	HJ2-DC110V-6	HJ4-DC110V-6
12V AC	HJ2-AC 12V-6	HJ4-AC 12V-6
24V AC	HJ2-AC 24V-6	HJ4-AC 24V-6
48V AC	HJ2-AC 48V-6	HJ4-AC 48V-6
100/110V AC	HJ2-AC100V-6	HJ4-AC100V-6
110/120V AC	HJ2-AC120V-6	HJ4-AC120V-6
200/220V AC	HJ2-AC200V-6	HJ4-AC200V-6
220/240V AC	HJ2-AC220/240V-6	HJ4-AC220/240V-6

2. Plug-in type (with LED indication)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-DC 12V-6	HJ4-L-DC 12V-6
24V DC	HJ2-L-DC 24V-6	HJ4-L-DC 24V-6
48V DC	HJ2-L-DC 48V-6	HJ4-L-DC 48V-6
100/110V DC	HJ2-L-DC110V-6	HJ4-L-DC110V-6
12V AC	HJ2-L-AC 12V-6	HJ4-L-AC 12V-6
24V AC	HJ2-L-AC 24V-6	HJ4-L-AC 24V-6
48V AC	HJ2-L-AC 48V-6	HJ4-L-AC 48V-6
100/110V AC	HJ2-L-AC100V-6	HJ4-L-AC100V-6
110/120V AC	HJ2-L-AC120V-6	HJ4-L-AC120V-6
200/220V AC	HJ2-L-AC200V-6	HJ4-L-AC200V-6
220/240V AC	HJ2-L-AC220/240V-6	HJ4-L-AC220/240V-6

3. Plug-in type (with diode)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-DC 12V-D-6	HJ4-DC 12V-D-6
24V DC	HJ2-DC 24V-D-6	HJ4-DC 24V-D-6
48V DC	HJ2-DC 48V-D-6	HJ4-DC 48V-D-6
100/110V DC	HJ2-DC110V-D-6	HJ4-DC110V-D-6

4. Plug-in type (with diode and LED indication)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-DC 12V-D-6	HJ4-L-DC 12V-D-6
24V DC	HJ2-L-DC 24V-D-6	HJ4-L-DC 24V-D-6
48V DC	HJ2-L-DC 48V-D-6	HJ4-L-DC 48V-D-6
100/110V DC	HJ2-L-DC110V-D-6	HJ4-L-DC110V-D-6

5. Plug-in type (with CR)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
100/110V AC	HJ2-AC100V-R-6	HJ4-AC100V-R-6
110/120V AC	HJ2-AC120V-R-6	HJ4-AC120V-R-6
200/220V AC	HJ2-AC200V-R-6	HJ4-AC200V-R-6
220/240V AC	HJ2-AC220/240V-R-6	HJ4-AC220/240V-R-6

6. Plug-in type (with CR and LED indication)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
100/110V AC	HJ2-L-AC100V-R-6	HJ4-L-AC100V-R-6
110/120V AC	HJ2-L-AC120V-R-6	HJ4-L-AC120V-R-6
200/220V AC	HJ2-L-AC200V-R-6	HJ4-L-AC200V-R-6
220/240V AC	HJ2-L-AC220/240V-R-6	HJ4-L-AC220/240V-R-6

Note) Packing quantity: 20pcs. (Inner carton), 200pcs. (Outer carton)

[Without Au plating type]

1. Plug-in type

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-DC 12V	HJ4-DC 12V
24V DC	HJ2-DC 24V	HJ4-DC 24V
48V DC	HJ2-DC 48V	HJ4-DC 48V
100/110V DC	HJ2-DC110V	HJ4-DC110V
12V AC	HJ2-AC 12V	HJ4-AC 12V
24V AC	HJ2-AC 24V	HJ4-AC 24V
48V AC	HJ2-AC 48V	HJ4-AC 48V
100/110V AC	HJ2-AC100V	HJ4-AC100V
110/120V AC	HJ2-AC120V	HJ4-AC120V
200/220V AC	HJ2-AC200V	HJ4-AC200V
220/240V AC	HJ2-AC220/240V	HJ4-AC220/240V

2. Plug-in type (with LED indication)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-DC 12V	HJ4-L-DC 12V
24V DC	HJ2-L-DC 24V	HJ4-L-DC 24V
48V DC	HJ2-L-DC 48V	HJ4-L-DC 48V
100/110V DC	HJ2-L-DC110V	HJ4-L-DC110V
12V AC	HJ2-L-AC 12V	HJ4-L-AC 12V
24V AC	HJ2-L-AC 24V	HJ4-L-AC 24V
48V AC	HJ2-L-AC 48V	HJ4-L-AC 48V
100/110V AC	HJ2-L-AC100V	HJ4-L-AC100V
110/120V AC	HJ2-L-AC120V	HJ4-L-AC120V
200/220V AC	HJ2-L-AC200V	HJ4-L-AC200V
220/240V AC	HJ2-L-AC220/240V	HJ4-L-AC220/240V

3. Plug-in type (with test button)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-T-DC 12V	HJ4-T-DC 12V
24V DC	HJ2-T-DC 24V	HJ4-T-DC 24V
48V DC	HJ2-T-DC 48V	HJ4-T-DC 48V
100/110V DC	HJ2-T-DC110V	HJ4-T-DC110V
12V AC	HJ2-T-AC 12V	HJ4-T-AC 12V
24V AC	HJ2-T-AC 24V	HJ4-T-AC 24V
48V AC	HJ2-T-AC 48V	HJ4-T-AC 48V
100/110V AC	HJ2-T-AC100V	HJ4-T-AC100V
110/120V AC	HJ2-T-AC120V	HJ4-T-AC120V
200/220V AC	HJ2-T-AC200V	HJ4-T-AC200V
220/240V AC	HJ2-T-AC220/240V	HJ4-T-AC220/240V

4. Plug-in type (with LED indication and test button)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-T-DC 12V	HJ4-L-T-DC 12V
24V DC	HJ2-L-T-DC 24V	HJ4-L-T-DC 24V
48V DC	HJ2-L-T-DC 48V	HJ4-L-T-DC 48V
100/110V DC	HJ2-L-T-DC110V	HJ4-L-T-DC110V
12V AC	HJ2-L-T-AC 12V	HJ4-L-T-AC 12V
24V AC	HJ2-L-T-AC 24V	HJ4-L-T-AC 24V
48V AC	HJ2-L-T-AC 48V	HJ4-L-T-AC 48V
100/110V AC	HJ2-L-T-AC100V	HJ4-L-T-AC100V
110/120V AC	HJ2-L-T-AC120V	HJ4-L-T-AC120V
200/220V AC	HJ2-L-T-AC200V	HJ4-L-T-AC200V
220/240V AC	HJ2-L-T-AC220/240V	HJ4-L-T-AC220/240V

5. Plug-in type (with diode)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-DC 12V-D	HJ4-DC 12V-D
24V DC	HJ2-DC 24V-D	HJ4-DC 24V-D
48V DC	HJ2-DC 48V-D	HJ4-DC 48V-D
100/110V DC	HJ2-DC110V-D	HJ4-DC110V-D

6. Plug-in type (with diode and LED indication)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
12V DC	HJ2-L-DC 12V-D	HJ4-L-DC 12V-D
24V DC	HJ2-L-DC 24V-D	HJ4-L-DC 24V-D
48V DC	HJ2-L-DC 48V-D	HJ4-L-DC 48V-D
100/110V DC	HJ2-L-DC110V-D	HJ4-L-DC110V-D

7. Plug-in type (with CR)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
100/110V AC	HJ2-AC100V-R	HJ4-AC100V-R
110/120V AC	HJ2-AC120V-R	HJ4-AC120V-R
200/220V AC	HJ2-AC200V-R	HJ4-AC200V-R
220/240V AC	HJ2-AC220/240V-R	HJ4-AC220/240V-R

8. Plug-in type (with CR and LED indication)

Coil voltage	2 Form C	4 Form C
	Part No.	Part No.
100/110V AC	HJ2-L-AC100V-R	HJ4-L-AC100V-R
110/120V AC	HJ2-L-AC120V-R	HJ4-L-AC120V-R
200/220V AC	HJ2-L-AC200V-R	HJ4-L-AC200V-R
220/240V AC	HJ2-L-AC220/240V-R	HJ4-L-AC220/240V-R

Note) Packing quantity: 20pcs. (Inner carton), 200pcs. (Outer carton)

[Accessories]

Type	No. of channels	Item	Part No.
Terminal socket	2 channels	HJ2 terminal socket	HJ2-SFD
		HJ2 terminal socket (Finger protect type)	HJ2-SFD-S
	2/4 channels (common)	HJ4 terminal socket	HJ4-SFD
		HJ4 terminal socket (Finger protect type)	HJ4-SFD-S

Notes) 1. Packing quantity: 10pcs. (Inner carton), 100pcs. (Outer carton)
2. Use the retainer that is shipped with the terminal socket.
3. Products conform to UL, CSA and TÜV, as standard.
4. In order to prevent breakage and disfiguring, the screw tightening torque for the terminal socket should be within the range of 0.5 to 0.8 N•m.
5. When attaching directly to a chassis, please use an M3.5 × 0.6 metric coarse screw thread, a spring washer, and a hexagonal nut.
6. For S1DX timer, use the retainer (Part No. ADX18012).

COIL DATA

DC coils

Coil voltage V DC	Pick-up voltage, V DC (max.) (at 20°C 68°F) (Initial)	Drop-out voltage, V DC (max.) (at 20°C 68°F) (Initial)	Nominal coil current, mA (±20%)	Coil resistance, Ω (at 20°C 68°F) (±20%)	Nominal operating power, W (±20%)	Max. allowable voltage, V DC (at 70°C 158°F)
12	9.6	1.2	75	160 (±10%)	0.9	13.2
24	19.2	2.4	37	650 (±10%)	0.9	26.4
48	38.4	4.8	18	2,600 (±15%)	0.9	52.8
100/110	80	11	9.1/10	11,000 (±15%)	1.1	121

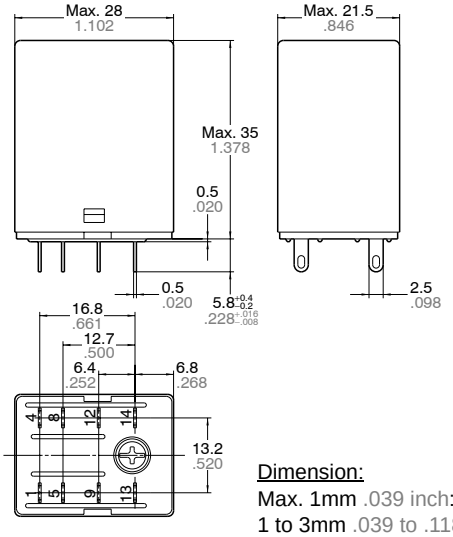
AC coils (50/60Hz)

Coil voltage V AC	Pick-up voltage, V AC (max.) (at 20°C 68°F) (Initial)	Drop-out voltage, V AC (max.) (at 20°C 68°F) (Initial)	Nominal coil current, mA (±20%)		Nominal operating power, V A (±20%)		Max. allowable voltage, V AC (at 70°C 158°F)
			50Hz	60Hz	50Hz	60Hz	
12	9.6	3.6	102.9	85.4	Approx. 1.2 to 1.5	Approx. 1.0 to 1.3	13.2
24	19.2	7.2	54.5	45.6			26.4
48	38.4	14.4	30.7	25.9			52.8
100/110	80	33	11.8/13.9	10.0/11.6			121
110/120	88	36	10.9/12.5	9.1/10.3			132
200/220	160	66	6.8/8.1	5.7/6.7			242
220/240	176	72	6.8/7.8	5.6/6.4			264

DIMENSIONS

mm inch

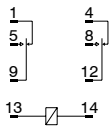
1. Plug-in type 2 Form C (including diode/CR)



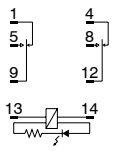
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

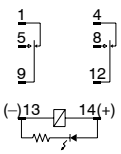
Standard type



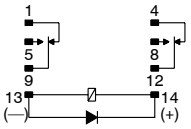
LED AC type



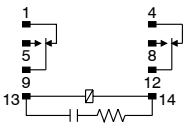
LED DC type



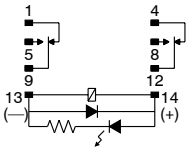
Diode DC type



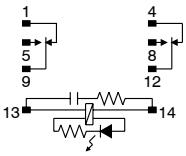
CR AC type



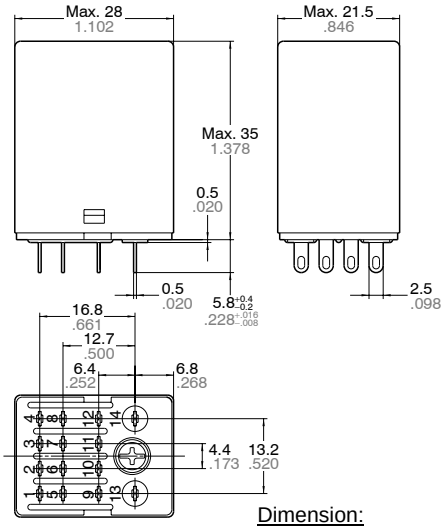
Diode/LED DC type



CR/LED AC type



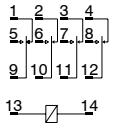
2. Plug-in type 4 Form C (including diode/CR)



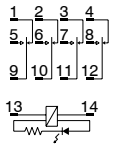
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

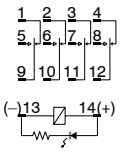
Standard type



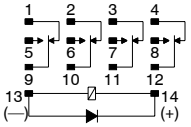
LED AC type



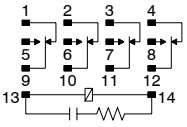
LED DC type



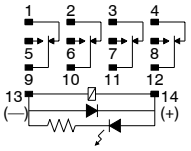
Diode DC type



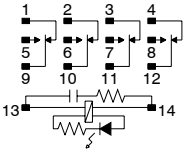
CR AC type



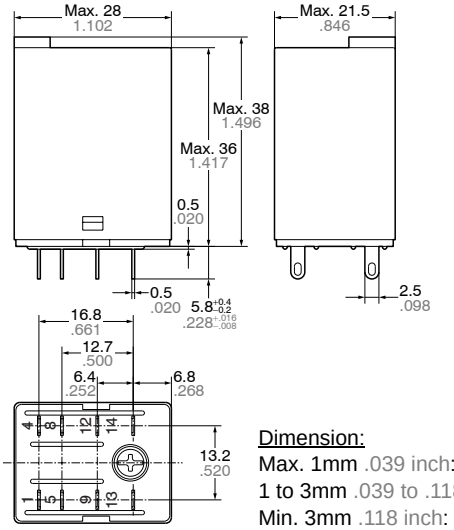
Diode/LED DC type



CR/LED AC type



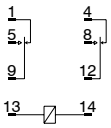
3. Plug-in type with test button 2 Form C



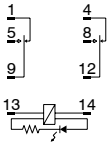
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

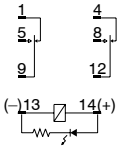
Standard type



LED AC type

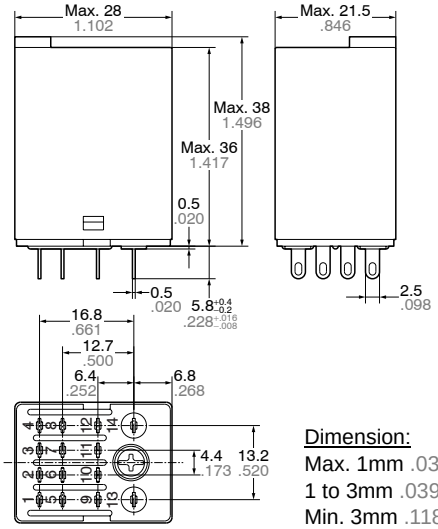


LED DC type

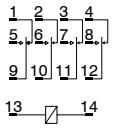


4. Plug-in type with test button 4 Form C

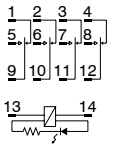
mm inch



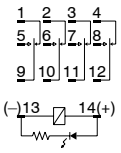
Schematic (Bottom view)
Standard type



LED AC type



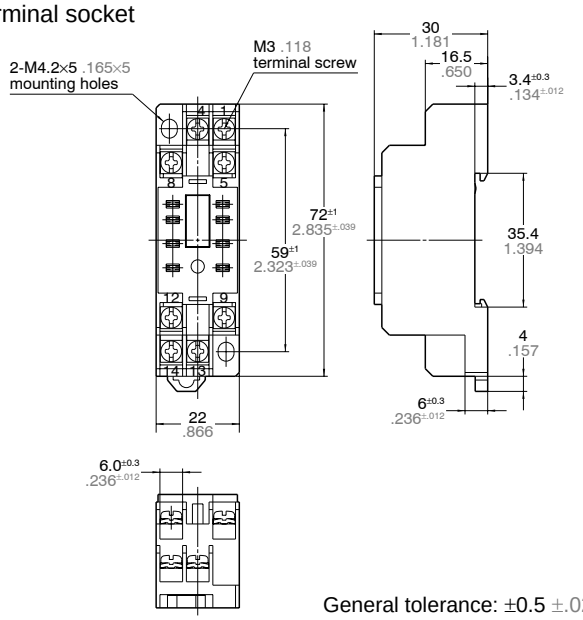
LED DC type



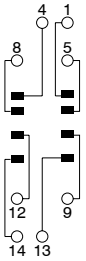
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

5. Terminal socket

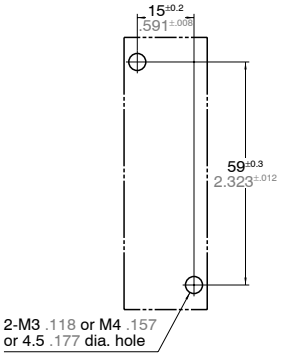
HJ2 terminal socket



Schematic (Bottom view)

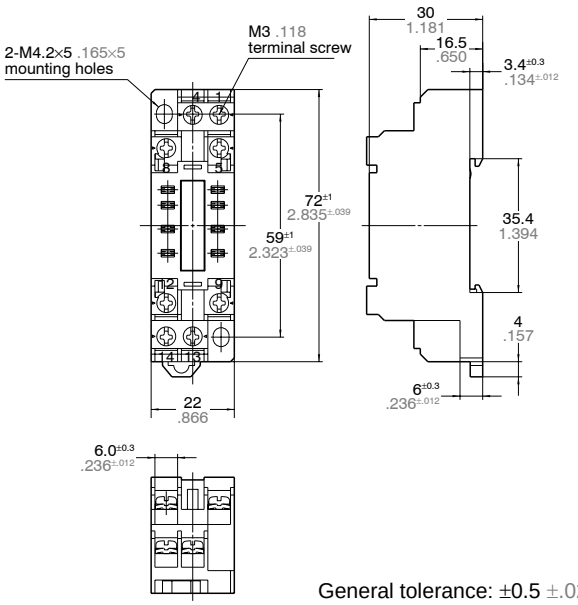


Mounting hole dimensions

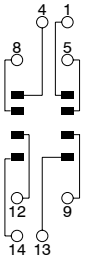


General tolerance: ±0.5 ±.020

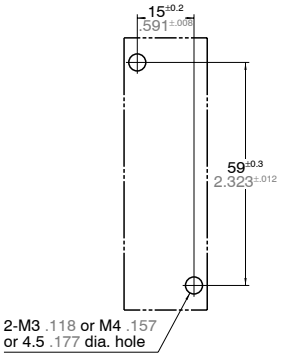
HJ2 terminal socket (Finger protect type)



Schematic (Bottom view)



Mounting hole dimensions



General tolerance: ±0.5 ±.020

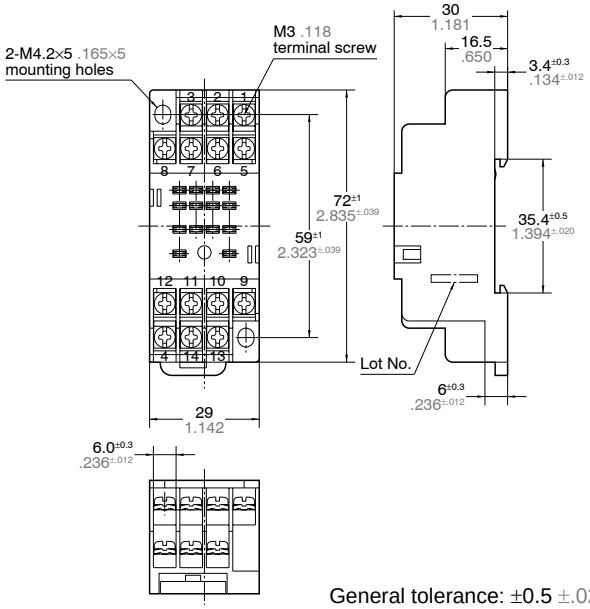
Note) Round type terminal is unable to attach.

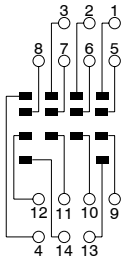
HJ4 terminal socket

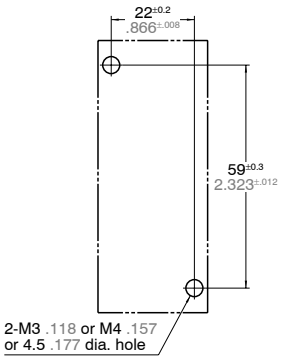
mm inch

Schematic (Bottom view)

Mounting hole dimensions





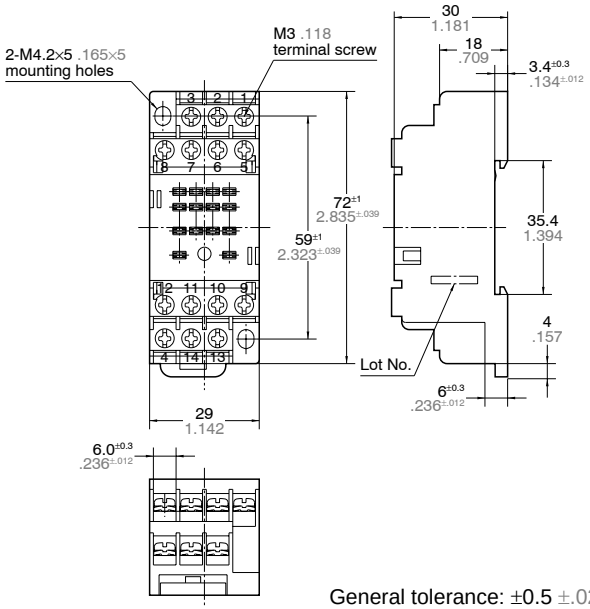


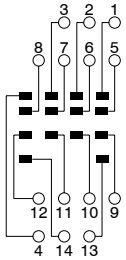
General tolerance: ±0.5 ±.020

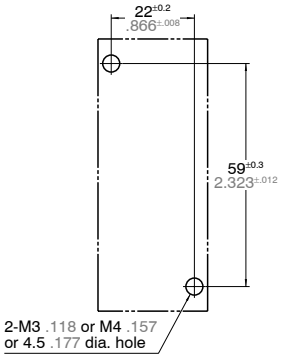
HJ4 terminal socket (Finger protect type)

Schematic (Bottom view)

Mounting hole dimensions





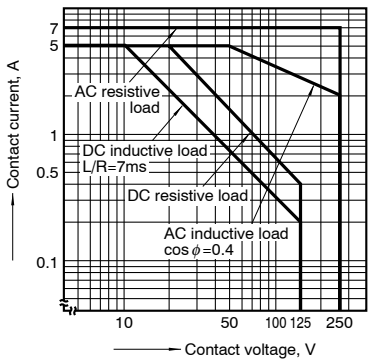


General tolerance: ±0.5 ±.020

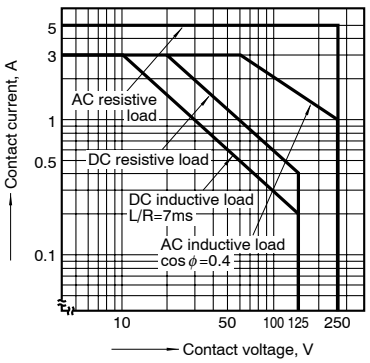
Note) Round type terminal is unable to attach.

REFERENCE DATA

1-(1). Max. switching capacity (2 Form C type)

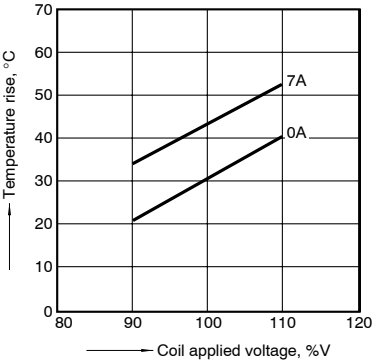


1-(2). Max. switching capacity (4 Form C type)

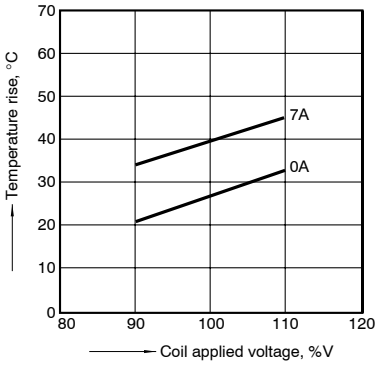


2-(1). Coil temperature rise (2 Form C/AC type)

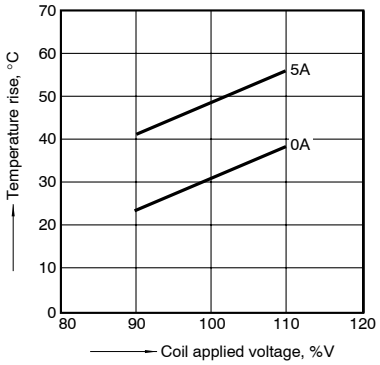
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



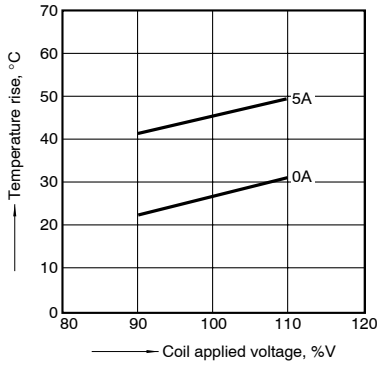
2-(2). Coil temperature rise (2 Form C/DC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



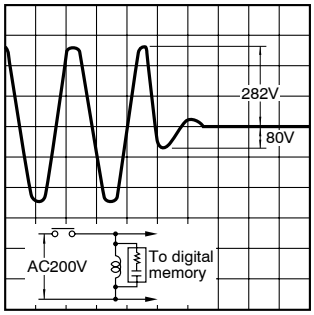
2-(3). Coil temperature rise (4 Form C/AC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



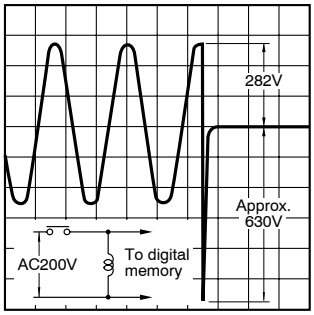
2-(4). Coil temperature rise (4 Form C/DC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



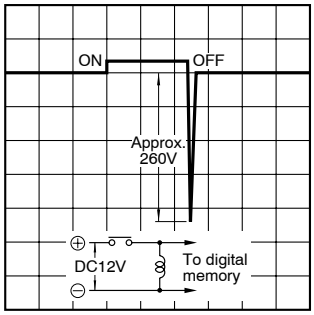
3-(1). AC coil surge voltage waveform (With CR)
Tested sample: HJ4-AC200V-R



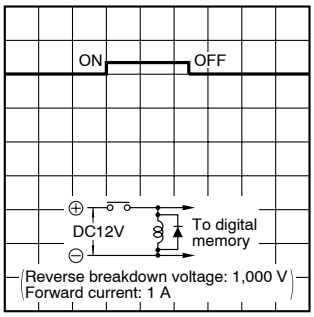
3-(2). AC coil surge voltage waveform (Without CR)
Tested sample: HJ4-AC200V



4-(1). DC coil surge voltage waveform (Without diode)



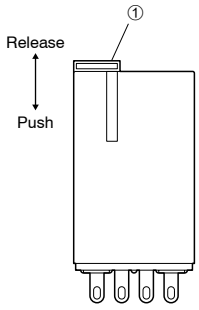
4-(2). DC coil surge voltage waveform (With diode)
Diode characteristics:
Reverse breakdown voltage: 1,000 V
Forward current: 1 A



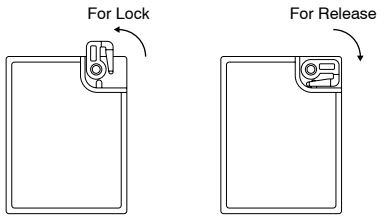
NOTES

1. Operation method for test button

1) Push and release ① gently to confirm relay switching.



2) To lock to one side turn 90° counter-clockwise while pushing lock and turn 90° clockwise to release.



2. Rating

Standard	File No.	Ratings	
		2 Form C	4 Form C
UL	E43149	7A 250 V AC 7A 30V DC	5A 250 V AC 5A 30V DC
TÜV	Std. type R 2024382	7A 250 V~ (cosϕ=1) 7A 30V⎓ (0ms)	5A 250 V~ (cosϕ=1) 5A 30V⎓ (0ms)
	Test button R 2-50006950		
	CR, Diode Au plating R 50006950		

(CSA: C-UL approved)

3. Diode characteristics

1) Reverse breakdown voltage: 1,000 V
2) Forward current: 1 A

4. Diode and CR built-in type

Since the diode and CR inside the relay coil are designed to absorb the counter emf, the element may be damaged if a large surge, etc., is applied to the diode and CR. If there is the possibility of a large surge voltage from the outside, please implement measures to absorb it.

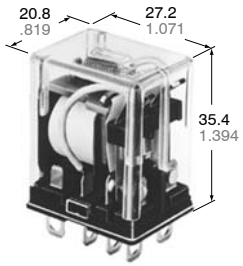
Power

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

15A (1C), 10 A (2C) SPACE SAVING POWER RELAY

HL RELAYS



mm inch

FEATURES

- **High switching capacity in a compact size**

1 Form C (15 A 125 V AC), 2 Form C (10 A 250 V AC)

- **Rugged construction for tough applications**
- **Long life**

Mechanical: Min. 10^8 operations (DC),
Min. 5×10^7 operations (AC)
Electrical: Min. 5×10^5 operations

SPECIFICATIONS

Contacts

Arrangement			1 Form C	2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			50 mΩ	
Contact material			Silver alloy	
Rating (resistive)	Nominal switching capacity		15 A 125 V AC, 10 A 250 V AC	10 A 250 V AC
	Max. switching power		AC: 2,500 VA DC: 90 W	AC: 2,500 VA DC: 90 W
	Max. switching voltage		250 V AC 30 V DC	250 V AC 30 V DC
	Max. switching current		15 A	10 A
	Min. switching capacity#1		100 mA, 5 V DC	
Expected life	Mechanical (at 180 cpm)		5×10^7 (AC), 10^6 (DC)	
	Electrical (resistive)	15 A 125 V AC	5×10^5	—
		10 A 250 V AC	5×10^5	5×10^5
		3 A 30 V DC	5×10^5	5×10^5

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10 mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics (at 25°C 77°F, 50% Relative humidity)

Max. operating speed		20 cpm
Initial insulation resistance*1		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between contact sets	1,500 Vrms for 1 min.
	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	2,000 Vrms for 1 min.
Operate time (at nominal voltage)		Max. 25 ms (DC type) Max. 25 ms (AC type)
Release time*3 (without diode) (at nominal voltage)		Max. 25 ms (DC type) Max. 25 ms (AC type)
Temperature rise, max. (at nominal voltage)		Max. 80°C
Shock resistance	Functional*4	Min. 196 m/s² {20 G}
	Destructive*5	Min. 980 m/s² {100 G}
Vibration resistance	Functional*6	10 to 55 Hz at double amplitude of 1 mm
	Destructive	10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temperature	–50°C to +70°C –58°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 35 g 1.25 oz

TYPICAL APPLICATIONS

Power station control equipment, refrigerators, building control equipment, office machines, and medical equipment.

ORDERING INFORMATION

Ex. HL 2 — H — AC240V

Contact arrangement	Terminal arrangement	Coil voltage
1: 1 Form C 2: 2 Form C	H: Plug-in HP: PC board HTM: Top mounting L: Light emitting diode wired, plug-in PL: Light emitting diode wired, PC board	AC 6, 12, 24, 48, 120, 240 V DC 6, 12, 24, 48, 110 V

Note: Standard packing Carton: 20 pcs., Case: 200 pcs.
UL/CSA approved type is standard.

COIL DATA (at 20°C 68°F)

DC coils

Coil voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Max. allowable voltage, V DC	Coil resistance, Ω (±10%)	Nominal coil current, mA	Operating power, W	
						Nominal	Minimum
6	4.8	0.6	6.6	40	150	0.90	0.58
12	9.6	1.2	13.2	160	75		
24	19.2	2.4	26.4	650	37		
48	38.4	4.8	52.8	2,600	18.5		
110	88.0	11.0	121.0	10,000	10	1.0	0.64

AC coils at 60 Hz

Coil voltage, V DC	Pick-up voltage, V AC (max.)	Drop-out voltage, V AC (min.)	Max. allowable voltage, V AC	Nominal coil current, mA	Operating power, VA	
					Nominal	Minimum
6	4.8	1.8	6.6	200	1.20	0.77
12	9.6	3.6	13.2	100		
24	19.2	7.2	26.4	50		
48	38.4	14.4	52.8	25		
110/120	88	36	132	10.9/11.9		
220/240	176	72	264	6.0/6.5		

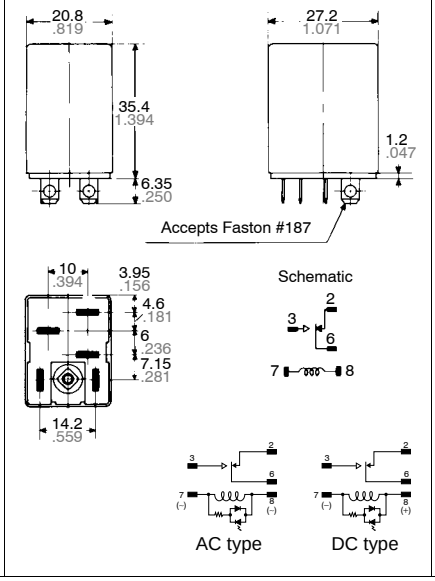
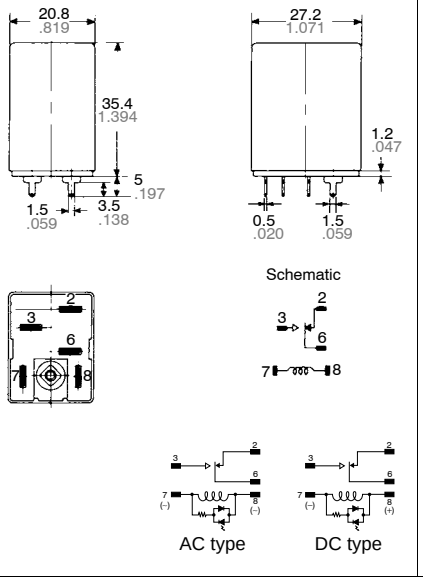
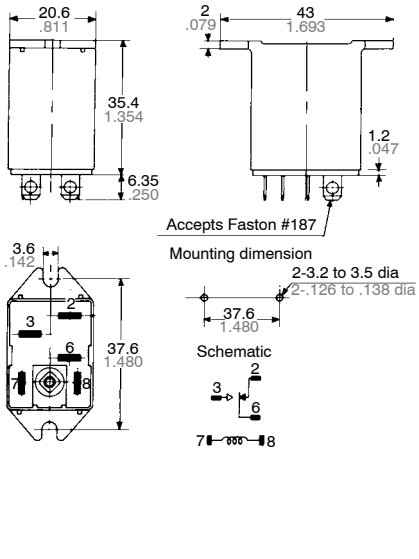
Notes:

1. The range of coil current is ±15% for AC (60 Hz), ±10% for DC, at 20°C.
2. The relay may be used in the range of 80% to 110% of the nominal coil voltage. However, it is recommended that the relay be used at 85% to 110% nominal voltage to take temporary voltage variations into consideration.
3. Each coil resistance of DC types is the measured value at a coil temperature of 20°C. Please allow a compensation of ±0.4% resistance for each coil temperature change of ±1°C.
4. All AC 240 V types are rated for double coil voltages, both AC 220 V and AC 240 V.
5. For use with 220 or 240 V DC, connect a resistor, as suggested below, in series with the 110 V DC relay.

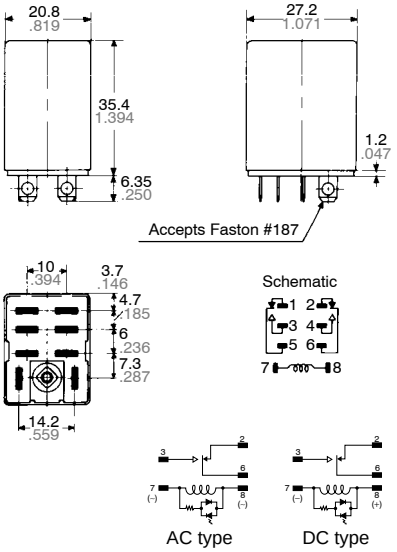
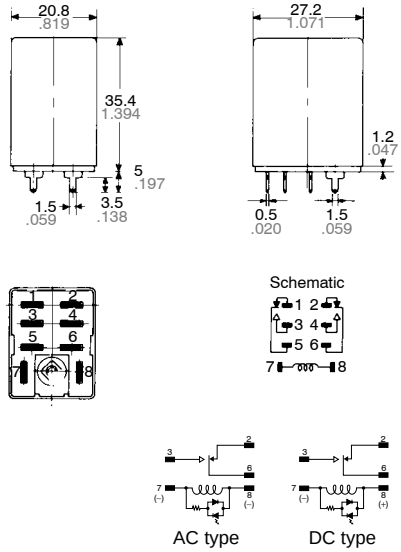
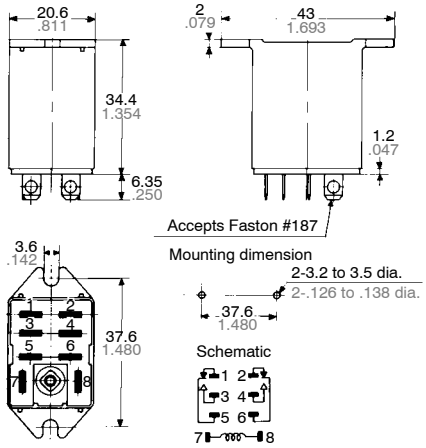
Voltage	1 Form C, 2 Form C
220 V DC 240 V DC	11 kW (5 W) 13 kW (5 W)

DIMENSIONS

mm inch

	Plug-in	PC board*1	Top mounting
HL1 (1 Form C)			

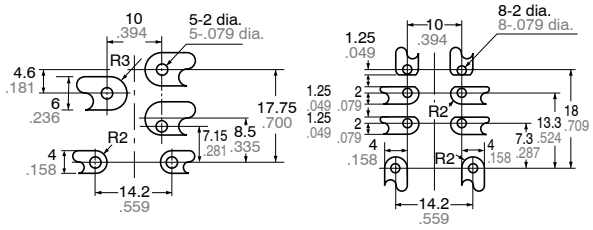
mm inch

	Plug-in	PC board*1	Top mounting
HL2 (2 Form C)			

Tolerance: ±0.5 ±.020

*1 PC board pattern

Copper-side view

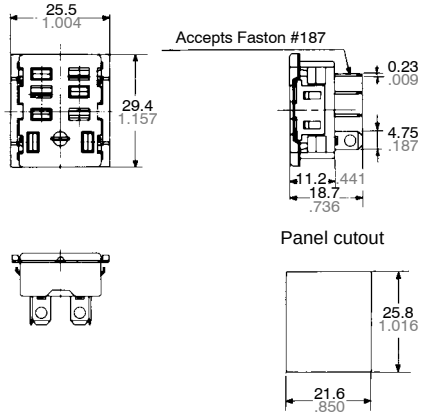


Tolerance: ±0.1 ±.004

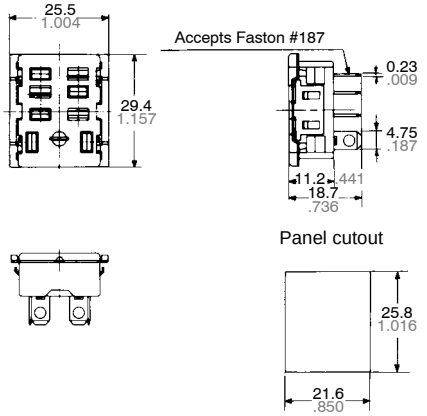
ACCESSORIES

mm inch

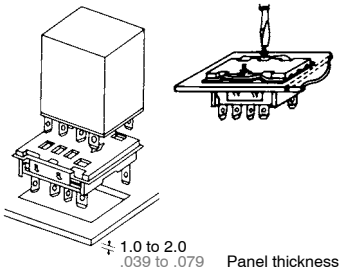
HL1-SS-K (with hold-down clip)



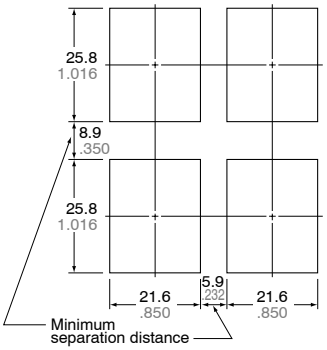
HL2-SS-K (with hold-down clip)



Plug-in terminal socket mount
Simply insert socket into panel hole and push down as indicated to lock socket in place.



Panel cutout for tandem mounting

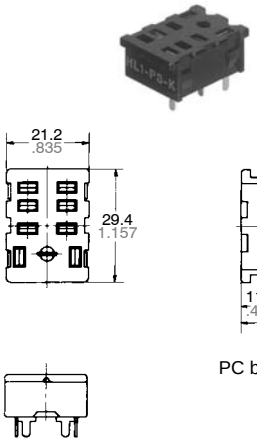


Tolerance: ±0.1 ±.004

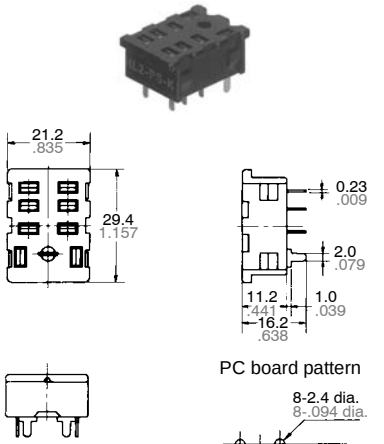
2. PC board terminal socket

mm inch

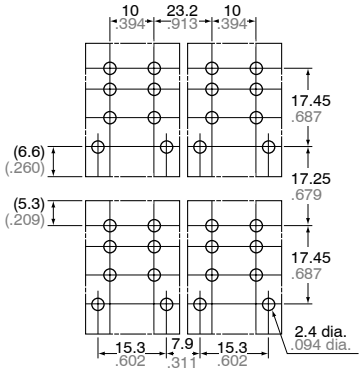
HL1-PS-K



HL2-PS-K



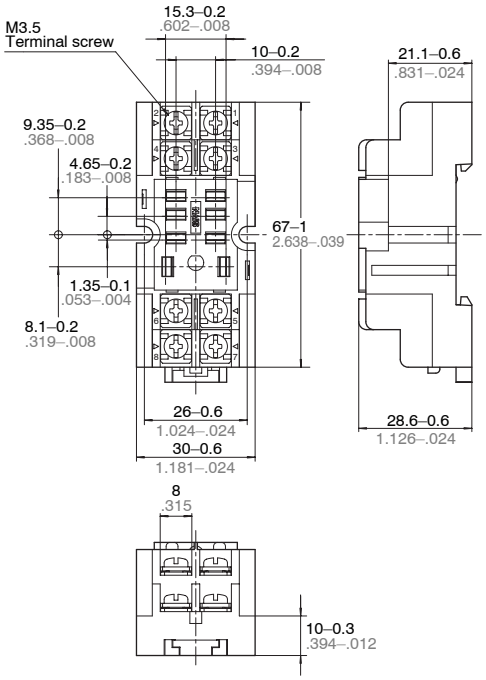
Layout for tandem mounting
(2 Form C)



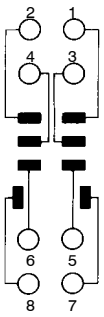
Tolerance: ±0.1 ±.004

3. Screw terminal socket for DIN rail assembly

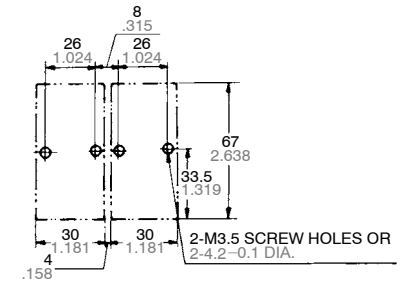
HL2-SFD-K (with hold-down clip)



Schematic



Layout for tandem mounting



Minimum separation in tandem mounting

Tolerance: ±0.1 ±.004

(Remark) Max. continuous current of all HL sockets is 10 A.

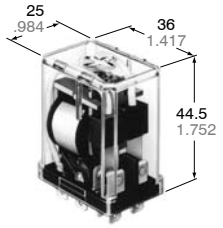
For Cautions for Use, see Relay Technical Information (page 390).

VDE 2c, 3c

Panasonic
ideas for life

10 AMP POWER RELAY

HP RELAYS



mm inch

FEATURES

- **Interchangeable with existing models**
- **Long life and high reliability**
- **High contact capacity up to 10 A 250 V AC**
- **Available with plug-in/solder and quick-connect terminals**

SPECIFICATIONS (at 20°C 68°F)

Contacts

Arrangement		2 Form C	3 Form C	4 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		15 mΩ		
Contact material		Silver		Silver alloy
Rating	Nominal switching capacity	10 A 250 V AC (resistive)		
	Min. switching capacity#1	100 mA, 5 V DC		

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "initial breakdown voltage" section
*2 Detection current; 10 mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics (at 60 Hz, 20°C 68°F)

		2 Form C	3 Form C	4 Form C
Maximum operating speed		20 cpm		
Initial insulation resistance*1		more than 100 MΩ at 500 V DC		
Breakdown voltage*2	Between open contacts	1,000 Vrms	2,000 Vrms	1,000 Vrms
	Between contact sets	1,500 Vrms	2,000 Vrms	1,500 Vrms
	Between contact and coil	1,500 Vrms	2,000 Vrms	1,500 Vrms
Operate time*3 (at nominal voltage)		Max. 25 ms	Max. 30 ms	
Release time (without diode)*3 (at nominal voltage)		Max. 25 ms	Max. 30 ms	
Temperature rise		Max. 65°C		
Shock resistance	Functional*4	98 m/s² {10 G}		
	Destructive*5	980 m/s² {100 G}		
Vibration resistance	Functional*6	10 to 55 Hz at 1 mm double amplitude		
	Destructive	10 to 55 Hz at 2 mm double amplitude		
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–50°C to +40°C –58°F to +104°F		
	Humidity	5 to 85% R.H.		
Unit weight		Approx. 60g 2.12 oz	Approx. 100g 3.53 oz	Approx. 125g 4.41 oz

LIFE DATA

Contact rating and expected life For AC load type

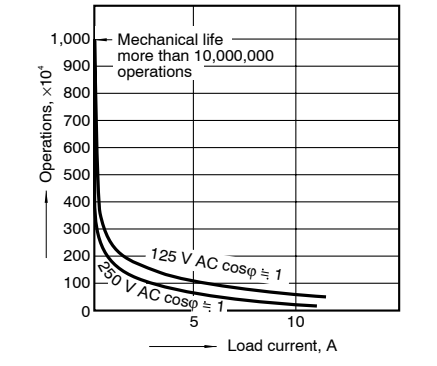
	Voltage	125 V AC		250 V AC		Expected life (min. operations)
	Load	Resistive (cos φ ≅ 1)	Inductive (cos φ ≅ 0.4)	Resistive (cos φ ≅ 1)	Inductive (cos φ ≅ 0.4)	
Electrical life	Current	—	—	10 A	7.5 A	2×10^5
		10 A	7.5 A	7.5 A	5 A	5×10^5
		5 A	3 A	3 A	2 A	1×10^6
		1A	0.7 A	0.6 A	0.4 A	2×10^6
Mechanical life						1×10^7

Note: When the electromagnet or exciting coil (Solenoid, etc.) is the load, the value of motor or lamp load is applicable.

Contact rating and expected life For DC load type

	Voltage	24 V DC		125 V DC		Expected life (min. operations)
	Load	Resistive (cos φ ≅ 1)	Inductive (cos φ ≅ 0.4)	Resistive (cosφ ≅ 1)	Inductive (cos φ ≅ 0.4)	
Electrical life	Current	—	7 A	—	—	2×10^5
		7.5 A	5 A	0.5 A	0.4 A	5×10^5
		5 A	3 A	0.3 A	0.2 A	1×10^6
		1A	0.6 A	0.1 A	0.06 A	2×10^6
Mechanical life						1×10^7

Life curve



Notes:
1. For DC inductive loads, use an arc suppressing circuit.
2. When used under a DC load operating at high repetition rate with considerable arcing, corrosion of the contacts and/or the contact blades is likely to occur. When using the relay under conditions of high temperature, humidity or high repetition rate, it is suggested that the relay cover be removed to facilitate extended operation.

TYPICAL APPLICATIONS

HP relays enjoy wide use in various applications, particularly in automation controls and remote controls.
Applications include:
Industrial machinery
Machine tool
Food processing packing machines
Office equipment
Coin operate devices
Home appliances
Transportation
Communication and measuring devices
Amusement devices

ORDERING INFORMATION

Ex. HP [3] — [M] — [AC240V]

Contact arrangement	Terminal	Coil voltage
2: 2 Form C 3: 3 Form C 4: 4 Form C	Nil: Standard plug-in terminal M: Direct mounting (3 Form C only) TM: Top mounting (2 Form C only) L: Lamp wired, standard plug-in terminal	AC 6, 12, 24, 48, 115, 220, 240 V DC 6, 12, 24, 48, 110 V

(Notes) 1. For UL/CSA or VDE recognized types, add suffix UL/CSA or VDE (HP2-TM type VDE application under way)
2. Standard packing Carton: 50 pcs. Case: 200 pcs.
3. UL/CSA approved type is standard.

TYPES AND COIL DATA

1. Standard plug-in terminal type (without lamp wired)

DC TYPES at 20°C 68°F

Type	Part No.	Nominal coil voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Max. allowable voltage, V DC	Coil resistance, Ω (±10%)	Nominal coil current, mA	Nominal operating power, W
2 Form C	HP2-DC6V	6	4.8	0.9	6.6	25	240	1.5
	HP2-DC12V	12	9.6	1.8	13.2	110	109	1.3
	HP2-DC24V	24	19.2	3.6	26.4	440	54.5	1.3
	HP2-DC48V	48	38.4	7.2	52.8	1,800	26.7	1.3
	HP2-DC110V	110	88	16.5	121	7,300	15.0	1.7
3 Form C	HP3-DC6V	6	4.8	0.9	6.6	24	250	1.5
	HP3-DC12V	12	9.6	1.8	13.2	100	120	1.4
	HP3-DC24V	24	19.2	3.6	26.4	400	60	1.4
	HP3-DC48V	48	38.4	7.2	52.8	1,560	31	1.5
	HP3-DC110V	110	88	16.5	121	7,450	14.9	1.6
4 Form C	HP4-DC6V	6	4.8	0.9	6.6	22	273	1.6
	HP4-DC12V	12	9.6	1.8	13.2	95	127	1.5
	HP4-DC24V	24	19.2	3.6	26.4	380	63	1.5
	HP4-DC48V	48	38.4	7.2	52.8	1,500	32	1.5
	HP4-DC110V	110	88	16.5	121	7,000	15.7	1.7

AC TYPE (50/60 Hz) at 60 Hz, 20°C 68°F

Type	Part No.	Nominal coil voltage, V AC	Pick-up voltage, V AC (max.)	Drop-out voltage, V AC (min.)	Max. allowable voltage, V AC	Inductance, H	Nominal coil current, mA	Nominal operating power, VA
2 Form C	HP2-AC6V	6	4.8	1.8	6.6	0.049	310	1.9
	HP2-AC12V	12	9.6	3.6	13.2	0.190	160	1.9
	HP2-AC24V	24	19.2	7.2	26.4	0.776	78	1.9
	HP2-AC48V	48	38.4	14.4	52.8	3.106	39	1.9
	HP2-AC115V	115	92	34.5	126.5	15.83	18	2.1
	HP2-AC220V	220	176	66	242	57.90	9.5	2.1
	HP2-AC240V	240	192	72	264	66.26	9.0	2.2
3 Form C	HP3-AC6V	6	4.8	1.8	6.6	0.030	520	3.1
	HP3-AC12V	12	9.6	3.6	13.2	0.119	260	3.1
	HP3-AC24V	24	19.2	7.2	26.4	0.475	130	3.1
	HP3-AC48V	48	38.4	14.4	52.8	1.899	65	3.1
	HP3-AC115V	115	92	34.5	126.5	10.36	28.5	3.3
	HP3-AC220V	220	176	66	242	39.32	14.2	3.1
	HP3-AC240V	240	192	72	264	44.05	13.9	3.3
4 Form C	HP4-AC6V	6	4.8	1.8	6.6	0.019	800	4.8
	HP4-AC12V	12	9.6	3.6	13.2	0.077	400	4.8
	HP4-AC24V	24	19.2	7.2	26.4	0.309	200	4.8
	HP4-AC48V	48	38.4	14.4	52.8	1.292	95	4.6
	HP4-AC115V	115	92	34.5	126.5	6.953	42	4.8
	HP4-AC220V	220	176	66	242	26.57	21	4.6
	HP4-AC240V	240	192	72	264	29.75	20.5	4.9

NOTES

1. The range of coil current for AC relays is ±15% (60 Hz). For DC relays it is ±10% at 20°C, 68°F.
2. The HP relay will operate in a range from 80% to 110% of the nominal coil voltage. It is, however, recommended that the relay be used in the range of 85% to 110% of the nominal coil voltage, with the temporary voltage variation taken into consideration.
3. When the operating voltage of AC relays drops below 80% of the nominal coil voltage, the relay will generate a considerable amount of heat which is not recommended for maximum efficiency.
4. The coil resistance of DC types is the measured value of the coil at a temperature of 20°C 68°F. If the coil temperature changes by ±1°C, the measured value of the coil resistance should be increased or decreased by 0.4%.
5. For applications from 220 V to 240 V DC, connect a resistor in series with the relay coil. See chart for resistor values.

Voltage	2 Form C	3 Form C	4 Form C
220 V DC	7.3 kΩ (5 W)	7.45 kΩ (5 W)	7 kΩ (5 W)
240 V DC	8.7 kΩ (5 W)	8.8 kΩ (5 W)	8.3 kΩ (5 W)

2. Standard plug-in terminal type (with lamp wired)

DC TYPES at 20°C 68°F

Type		Part No.	Nominal coil voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Max. allowable voltage, V DC	Coil resistance, Ω (±10%)	Nominal coil current, mA	Nominal operating power, W
2 Form C	LED	HP2-L-DC6V	6	4.8	0.9	6.6	25	240	1.5
		HP2-L-DC12V	12	9.6	1.8	13.2	110	109	1.3
		HP2-L-DC24V	24	19.2	3.6	26.4	440	54.5	1.3
		HP2-L-DC48V	48	38.4	7.2	52.8	1,800	26.7	1.3
	Neon lamp	HP2-L-DC110V	110	88	16.5	121	7,300	15.0	1.7
3 Form C	LED	HP3-L-DC6V	6	4.8	0.9	6.6	24	250	1.5
		HP3-L-DC12V	12	9.6	1.8	13.2	100	120	1.4
		HP3-L-DC24V	24	19.2	3.6	26.4	400	60	1.4
		HP3-L-DC48V	48	38.4	7.2	52.8	1,560	31	1.5
	Neon lamp	HP3-L-DC110V	110	88	16.5	121	7,450	14.9	1.6
4 Form C	LED	HP4-L-DC6V	6	4.8	0.9	6.6	22	273	1.6
		HP4-L-DC12V	12	9.6	1.8	13.2	95	127	1.5
		HP4-L-DC24V	24	19.2	3.6	26.4	380	63	1.5
		HP4-L-DC48V	48	38.4	7.2	52.8	1,500	32	1.5
	Neon lamp	HP4-L-DC110V	110	88	16.5	121	7,000	15.7	1.7

AC TYPE (50/60 Hz) at 60 Hz, 20°C 68°F

Type		Part No.	Nominal coil voltage, V AC	Pick-up voltage, V AC (max.)	Drop-out voltage, V AC (min.)	Max. allowable voltage, V AC	Inductance, H	Nominal coil current, mA	Nominal operating power, VA
2 Form C	LED	HP2-L-AC6V	6	4.8	1.8	6.6	0.049	310	1.9
		HP2-L-AC12V	12	9.6	3.6	13.2	0.190	160	1.9
		HP2-L-AC24V	24	19.2	7.2	26.4	0.776	78	1.9
	Neon lamp	HP2-L-AC115V	115	92	34.5	126.5	15.83	18	2.1
		HP2-L-AC220V	220	176	66	242	57.90	9.5	2.1
		HP2-L-AC240V	240	192	72	264	66.26	9.0	2.2
3 Form C	LED	HP3-L-AC6V	6	4.8	1.8	6.6	0.030	520	3.1
		HP3-L-AC12V	12	9.6	3.6	13.2	0.119	260	3.1
		HP3-L-AC24V	24	19.2	7.2	26.4	0.475	130	3.1
	Neon lamp	HP3-L-AC115V	115	92	34.5	126.5	10.36	28.5	3.3
		HP3-L-AC220V	220	176	66	242	39.32	14.2	3.1
		HP3-L-AC240V	240	192	72	264	44.05	13.9	3.3
4 Form C	LED	HP4-L-AC6V	6	4.8	1.8	6.6	0.019	800	4.8
		HP4-L-AC12V	12	9.6	3.6	13.2	0.077	400	4.8
		HP4-L-AC24V	24	19.2	7.2	26.4	0.309	200	4.8
	Neon lamp	HP4-L-AC115V	115	92	34.5	126.5	6.953	42	4.8
		HP4-L-AC220V	220	176	66	242	26.57	21	4.6
		HP4-L-AC240V	240	192	72	264	29.75	20.5	4.9

3. Top Mounting (TM) and direct mounting (M) type

DC TYPES at 20°C 68°F

Type	Part No.	Nominal coil voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Max. allowable voltage, V DC	Coil resistance, Ω (±10%)	Nominal coil current, mA	Nominal operating power, W
2 Form C Top Mounting Type (TM)	HP2-TM-DC6V	6	4.8	0.9	6.6	25	240	1.5
	HP2-TM-DC12V	12	9.6	1.8	13.2	110	109	1.3
	HP2-TM-DC24V	24	19.2	3.6	26.4	440	54.5	1.3
	HP2-TM-DC48V	48	38.4	7.2	52.8	1,800	26.7	1.3
	HP2-TM-DC110V	110	88	16.5	121	7,300	15.0	1.7
3 Form C Direct Mounting Type (TM)	HP3-M-DC6V	6	4.8	0.9	6.6	24	250	1.5
	HP3-M-DC12V	12	9.6	1.8	13.2	100	120	1.4
	HP3-M-DC24V	24	19.2	3.6	26.4	400	60	1.4
	HP3-M-DC48V	48	38.4	7.2	52.8	1,560	31	1.5
	HP3-M-DC110V	110	88	16.5	121	7,450	14.9	1.6

AC TYPE (50/60 Hz) at 60 Hz, 20°C 68°F

Type	Part No.	Nominal coil voltage, V AC	Pick-up voltage, V AC (max.)	Drop-out voltage, V AC (min.)	Max. allowable voltage, V AC	Inductance, H	Nominal coil current, mA	Nominal operating power, VA
2 Form C Top Mounting Type (TM)	HP2-TM-AC6V	6	4.8	1.8	6.6	0.049	310	1.9
	HP2-TM-AC12V	12	9.6	3.6	13.2	0.190	160	1.9
	HP2-TM-AC24V	24	19.2	7.2	26.4	0.776	78	1.9
	HP2-TM-AC48V	48	38.4	14.4	52.8	3.106	39	1.9
	HP2-TM-AC115V	115	92	34.5	126.5	15.83	18	2.1
	HP2-TM-AC220V	220	176	66	242	57.90	9.5	2.1
	HP2-TM-AC240V	240	192	72	264	66.26	9.0	2.2
3 Form C Direct Mounting Type (M)	HP3-M-AC6V	6	4.8	1.8	6.6	0.030	520	3.1
	HP3-M-AC12V	12	9.6	3.6	13.2	0.119	260	3.1
	HP3-M-AC24V	24	19.2	7.2	26.4	0.475	130	3.1
	HP3-M-AC48V	48	38.4	14.4	52.8	1.899	65	3.1
	HP3-M-AC115V	115	92	34.5	126.5	10.36	28.5	3.3
	HP3-M-AC220V	220	176	66	242	39.32	14.2	3.1
	HP3-M-AC240V	240	192	72	264	44.05	13.9	3.3

4. Direct mounting (with lamp wired) type

DC TYPES

Type	Part No.	Nominal coil voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Max. allowable voltage, V DC	Coil resistance, Ω (±10%)	Nominal coil current, mA	Nominal operating power, W
3 Form C Neon lamp	HP3-ML-DC110V	110	88	16.5	121	7,450	14.9	1.6

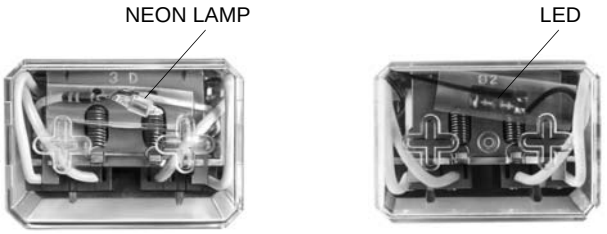
AC TYPE (50/60 Hz) at 60 Hz, 20°C 68°F

Type	Part No.	Nominal coil voltage, V AC	Pick-up voltage, V AC (max.)	Drop-out voltage, V AC (min.)	Max. allowable voltage, V AC	Inductance, H	Nominal coil current, mA	Nominal operating power, VA
3 Form C Neon lamp	HP3-ML-AC115V	115 V	92	34.5	126.5	10.36	28.5	3.3
	HP3-ML-AC220V	220 V	176	66	242	39.32	14.2	3.1
	HP3-ML-AC240V	240 V	192	72	264	44.05	13.9	3.3

LAMP-WIRED RELAYS

Specifications

Life of neon lamp....continuous: more than 25,000 hours (more than 3 years)
on/off = 1: more than 6 years
Life of LED .....continuous: more than 50,000 hours (more than 5.5 years)
on/off = 1: more than 100,000 hours (more than 11 years)

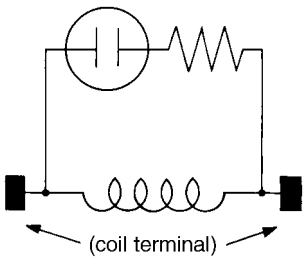
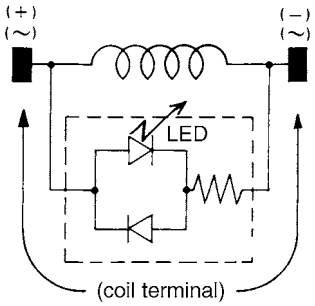


Variation

Type	Coil Voltage		
	AC	DC	
HP2-L HP3-L HP3-ML HP4-L	6 V	6 V	LED (Light emitting diode)
	12 V	12 V	
	24 V	24 V	
	—	48 V	
	115 V	110 V	Neon lamp
	220 V	—	
	240 V	—	

Notes:
1. AC 48 V type is not available for lamp wiring.

Circuit diagrams

Neon lamp type	LED type
	

Terminal No. (DC type)

Polarity \ Type	HP2-L	HP3-L HP3-ML	HP4-L
(+)	7	10	10
(–)	2	2	1

Notes:
1. Pay attention to the polarity of coil See circuit diagram (LED type only).

Operating current of LED

Coil Voltage	Operating current of LED
DC 6V	DC 6.4 mA
DC 12V	DC 5.7 mA
DC 24V	DC 4.7 mA
DC 48V	DC 4.5 mA
AC 6V	AC 10.5 mA
AC 12V	AC 9.0 mA
AC 24V	AC 7.7 mA

Notes:
1. Operating current of relays should be increased by the value of LED operating current. Please refer the table. Operating current of neon lamp is approx. 0.3 mA to 0.4 mA.
2. To use the HP relay in the inductive load circuit, the contact protection circuit is recommended.

ACCESSORIES

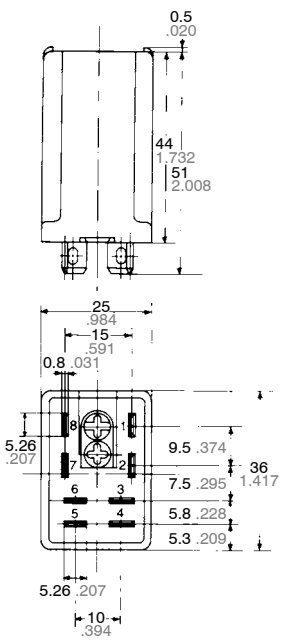
Please refer to “MOUNTING METHODS” for further information.
UL, CSA recognized except BRACKET and INSERTING PLATE.

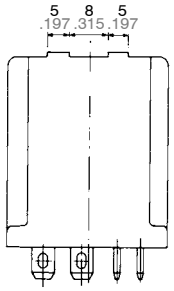
HP	Relay	Solder terminal socket for rectangular hold boring (with hold-down clip)	Screw terminal socket for DIN rail assembly (with hold-down clip)	For HP2, HP4
HP2		HP2-SRS  (UL, CSA, VDE)	HP2-SFD  (UL, CSA)	HP-BRACKET for direct mounting 
HP3		HP3-SRS  (UL, CSA, VDE)	HP3-SFD  (UL, CSA)	HP INSERTION PLATE for P/C board mounting 
HP4		HP4-SRS  (UL, CSA)	HP4-SFD  (UL, CSA)	

DIMENSIONS AND WIRING DIAGRAM

mm inch

HP2 (2 Form C) Plug-in terminal types





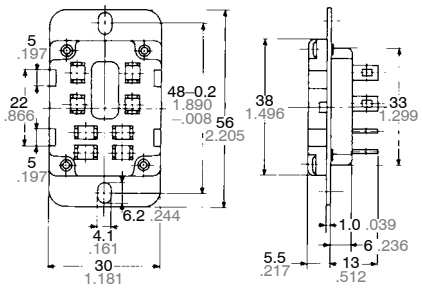
Circuit diagram

Accepts
Faston 205

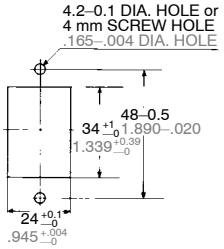
Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

HP2-SRS (with hold-down clip)

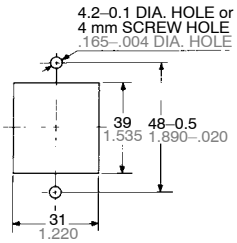
Optimum space-saving panel cut-out.
Can be mounted from either the front or the rear of the panel.



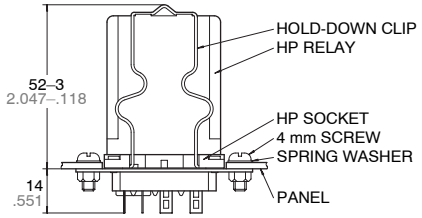
Front surface-mounting

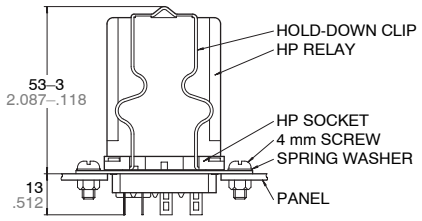


Rear surface-mounting



mm inch

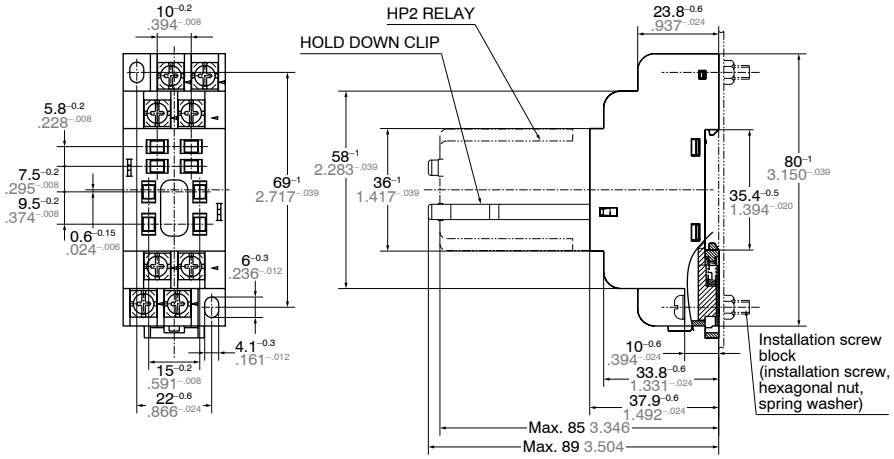




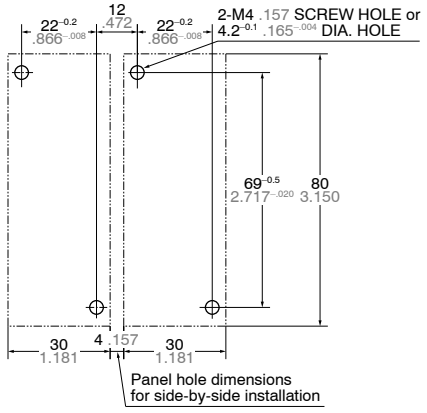
Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

HP2-SFD (with hold-down clip)

Front wiring in restricted space



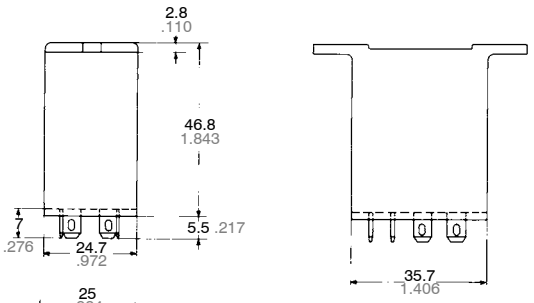
Mounting dimensions



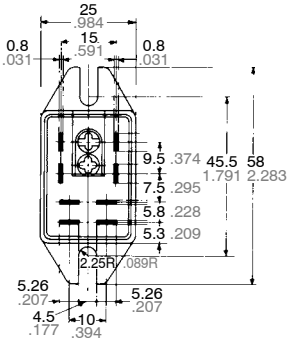
Note: Hold down clip and installation screw block are included in package.

Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

HP2-TM (2 Form C) Top mounting types

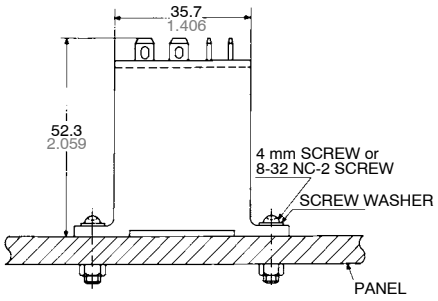


Circuit diagram

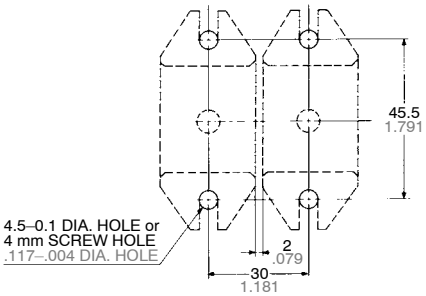


Accepts Faston 205

Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

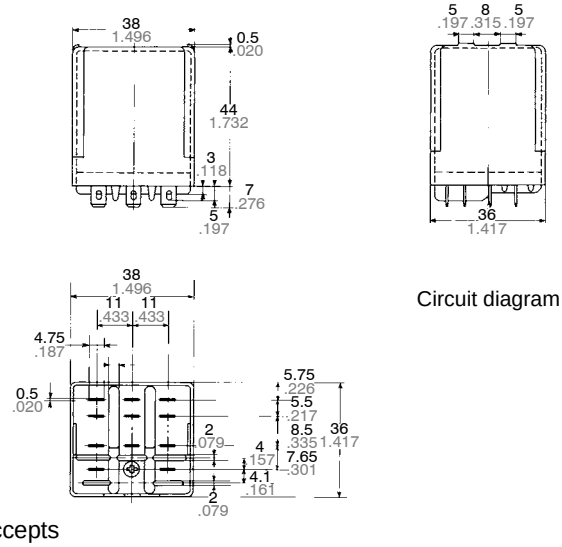


Mounting dimensions



HP3 (3 Form C) Plug-in terminal types

mm inch



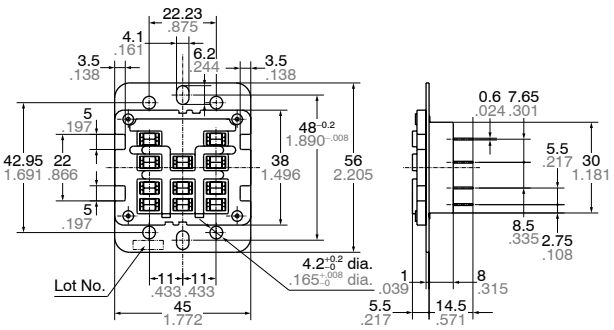
Circuit diagram

Accepts
Faston 187

Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

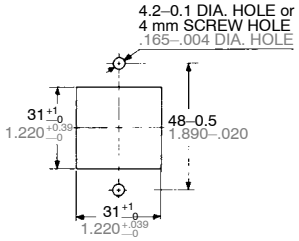
HP3-SRS (with hold-down clip)

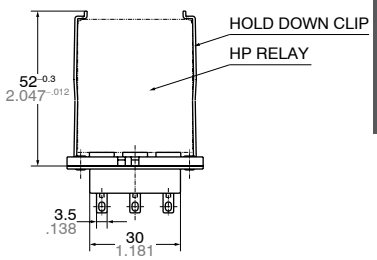
Optimum space-saving panel cut-out.
Can be mounted from either the front or the rear of the panel.



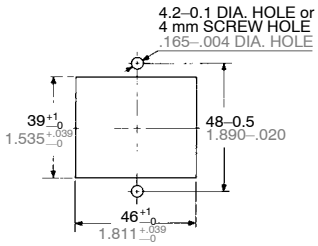
Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

Front surface-mounting



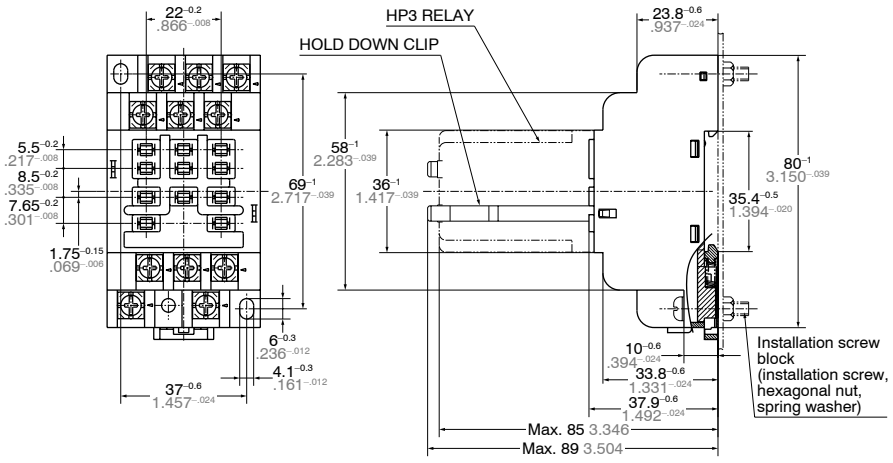


Rear surface-mounting



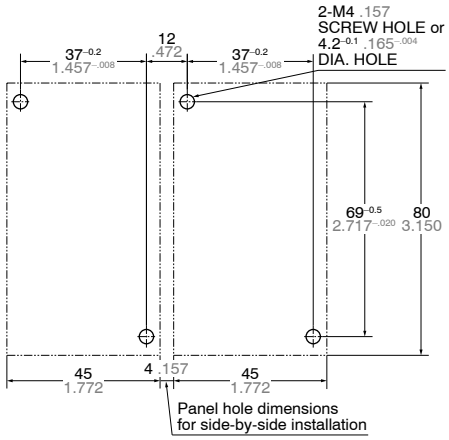
HP3-SFD (with hold-down clip)

Front wiring in restricted space



Note: Hold down clip and installation screw block are included in package.

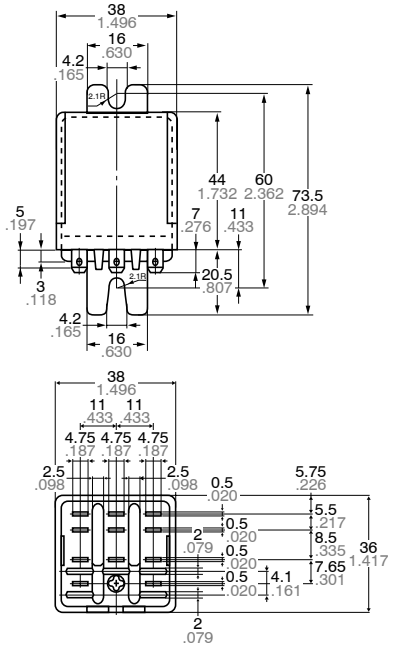
Mounting dimensions

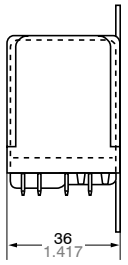


Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

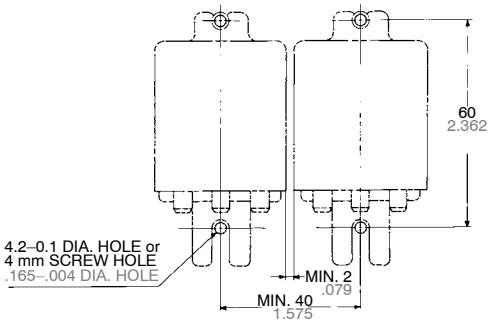
HP3-M (3 Form C) Direct mounting types

mm inch

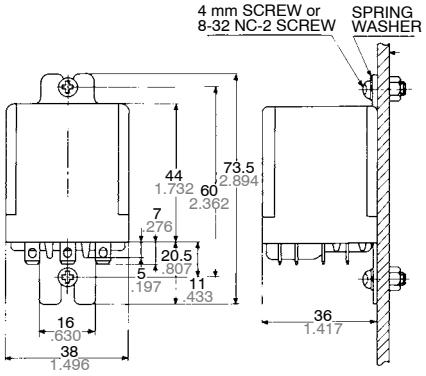




Mounting dimension



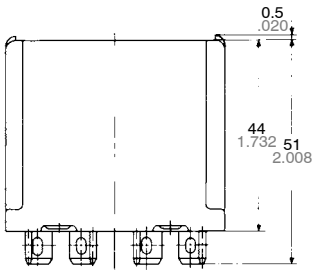
Circuit diagram

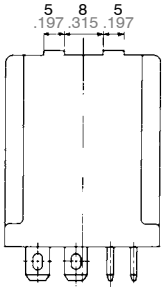


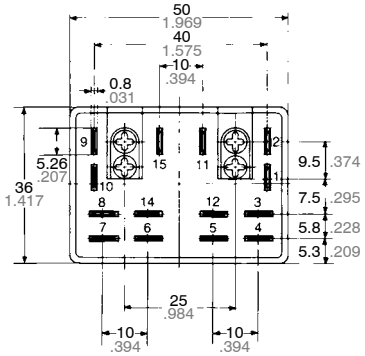
Accepts
Faston 187

Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

HP4 (4 Form C) Plug-in terminal types







Circuit diagram

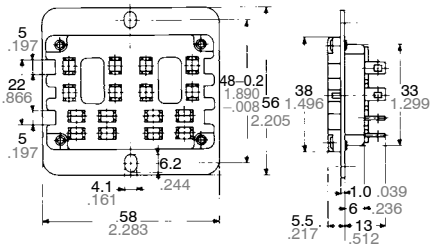
Accepts
Faston 187

Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

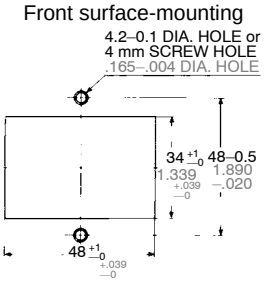
mm inch

HP4-SRS (with hold-down clip)

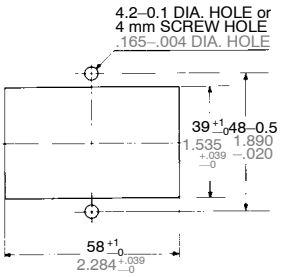
Optimum space-saving panel cut-out.
Can be mounted from either the front or the rear of the panel.

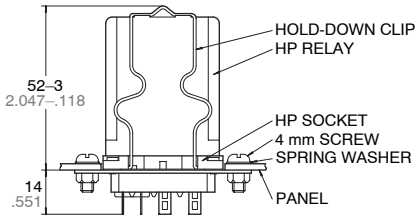


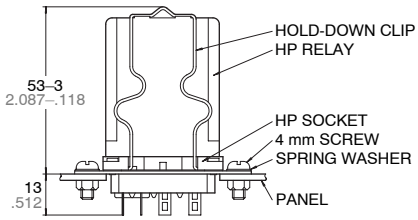
Front surface-mounting



Rear surface-mounting



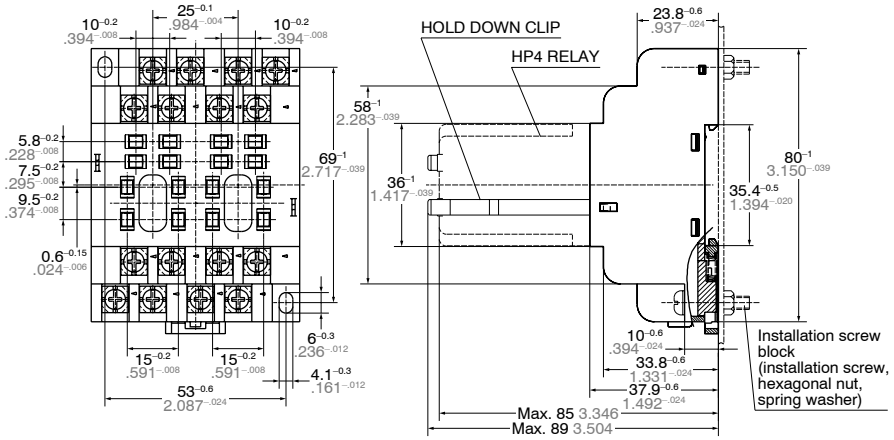




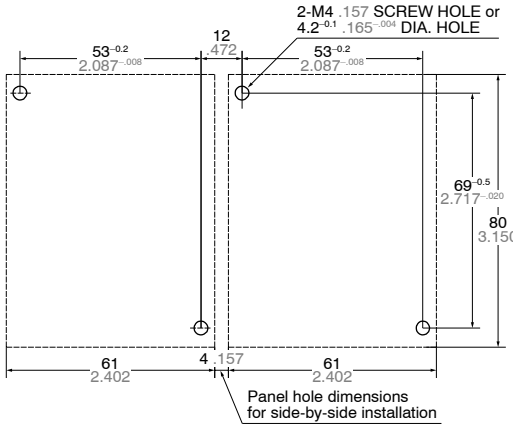
Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

HP4-SFD (with hold-down clip)

Front wiring in restricted space.
Two HP2 relays can be mounted in one socket.



Mounting dimensions



Note: Hold down clip and installation screw block are included in package.

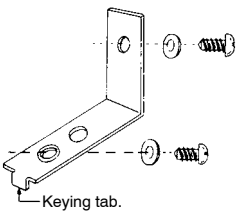
Dimension :	General tolerance
Max. 2mm .079 inch:	±0.2 ±.008
2 to 9mm .079 to .354 inch:	±0.5 ±.020
9 to 20mm .354 to .787 inch:	±1.0 ±.039
Min. 20mm .787 inch:	±1.5 ±.059

ACCESSORIES for HP2 and HP4 types

HP Bracket (with 2 screws, 2 washers)
The HP Bracket is used for mounting HP2 relays and HP4 relays directly to the panel. It facilitates soldering or quick connections with Faston 205 tab 0.8 mm .031 inch.

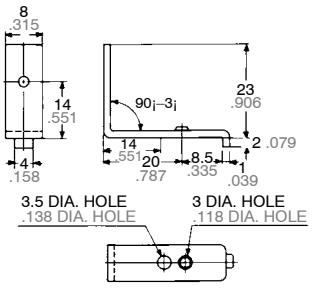
Notes:
1. This bracket is unavailable for UL, CSA and VDE applications.
2. When using the special bracket, it is recommended to use the screws and washers called out in the chart in the next page in order to eliminate any possible damage to the relay coil.

Mounting methods
(a) Remove the M3 × 7 screw (red colored) fixed to the relay, and place the bracket on the relay with the attaching M3 × 7 screw (blue colored) and the spring washer.



(b) Use the additional M3 × 7 screw and washer for attaching the bracket to the panel.

For the HP4 type relay two brackets are used



Power

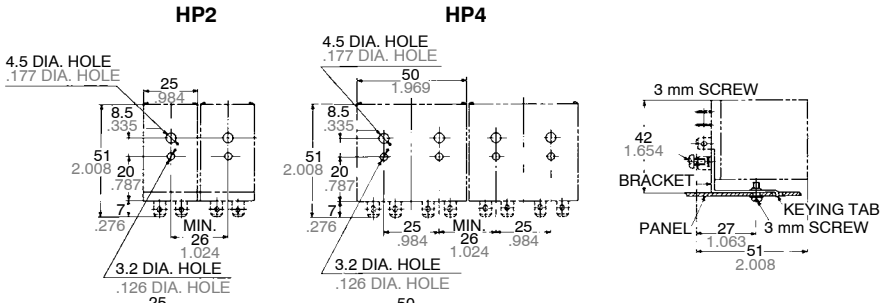
Thickness of a special bracket	1.0 mm (.039 inch)	1.6 mm (.063 inch)	2.0 mm (.079 inch)
A suitable screw	M3 × 7-M3 × 8	M3 × 8	M3 × 8-M3 × 10
A suitable washer	for M3	for M3	for M3

Screw M 3 × 7

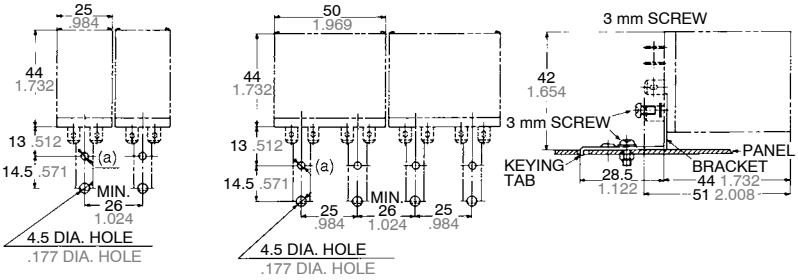
- Millimeter
- 3mm .118inch diameter
- 7mm .276inch length

Dimensions and mounting method mm inch

1. Rear-surface mounting



2. Front-surface mounting



HP Inserting Plate for HP2 and HP4 types

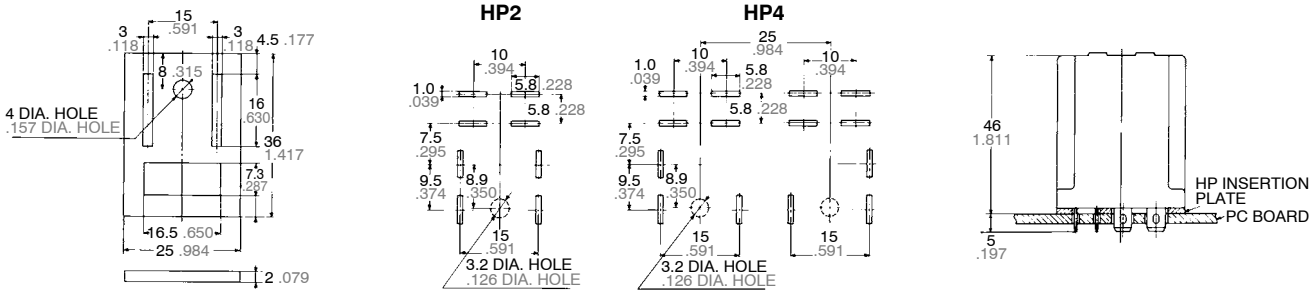
1. HP inserting plate is used for mounting HP2 and HP4 relays on a printed board to adjust the length of the terminals.

2. If adjustment by soldering is not suitable, bore 1/8" diameter hole on the printed circuit board and mount the relay with a M3 × 10 screw. The chart to the right suggests the proper screws for different printed circuit boards.

3. Two plates are used for the HP4 type relay.

Thickness of P/C board	Suitable screw
1.0 mm .039 inch	M3 × 10
1.2 mm .047 inch	M3 × 10

PC board pattern



Please refer to the above second instruction.

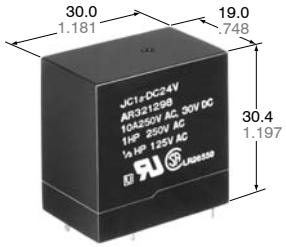
Tolerance: ±0.1 ±.004

For Cautions for Use, see Relay Technical Information (page 390).

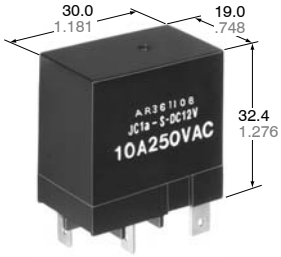
Panasonic
ideas for life

COMPACT POWER RELAYS

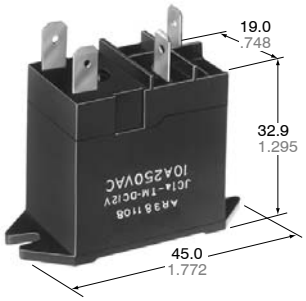
JC RELAYS



PC board type



Plug-in type



TM type

mm inch

FEATURES

- **High inrush current capability**
  1 Form A: 163 A inrush (TV-8)
  2 Form A: 111 A inrush (TV-5)
- **High dielectric withstanding for transient protection:**
  JC can withstand 10,000 V surge in μs between coil and contact.
- **Electrical life:**
  1 Form A: 10^5 ope. at 15 A 250 V AC resistive load
  2 Form A: 10^5 ope. at 10 A 250 V AC resistive load
- **UL/CSA, VDE, TÜV, SEMKO also approved.**

SPECIFICATIONS

Contact

Arrangement			1 Form A	2 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			30 mΩ (Cd free type: 100 mΩ)	
Contact material			Silver alloy	
Contact force, min.			30 g	
Rating (resistive load)	Maximum switching power		3,750 VA	2,500 VA
	Maximum switching voltage		250 V AC	250 V AC
	Max. switching current		15 A	10 A
	Min. switching capacity#1		100 mA, 5 V DC	
Expected life (min. operation)	Mechanical		5×10^6	
	Electrical (resistive)	10 A 250 V AC	10^5	—
		5A 250 V AC	—	10^5

Coil

Nominal operating power	900 mW	1,000 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement of same location as "Intial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

Maximum operating speed			20 cpm.
Initial insulation resistance*1			Min. 100 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts		2,000 V rms for 1 min.
	Between contacts sets		2,000 Vrms for 1 min.
	Between contacts and coil		4,000 Vrms for 1 min.
Operate time*3 (at nominal voltage)			Max. 30 ms
Release time(without diode)*3 (at nominal voltage)			Max. 10 ms
Temperature rise (at nominal voltage)			Max. 55°C
Shock resistance	Functional*4		196 m/s² {20 G}
	Destructive*5		980 m/s² {100 G}
Vibration resistance	Functional*6		98 m/s² {10 G}, 10 to 55 Hz at double amplitude of 1.6 mm
	Destructive		117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)		Ambient temp.	–50°C to +60°C –58°F to +140°F
		Humidity	5 to 85%R.H.
Unit weight			Approx. 31 g 1.09 oz

TYPICAL APPLICATIONS

Automatic garage door openers
Microwave ovens
Dryers
Vending machines
Copiers
Air conditioners
Stereo equipment
TV sets

ORDERING INFORMATION

Ex. JC [1a] F — [TM] — [DC12V] — [F]

Contact arrangement	Mounting classification	Coil voltage	Environmental support
1a: 1 Form A 2a: 2 Form A	Nil: PC board terminal S: Plug-in terminal TM: Top mounting	DC 5, 6, 12, 24, 48 V	F: RoHS Directive conforming type ($AgSnO_2$ type) Nil: RoHS Directive non-conforming type (AgCdO type)

(Notes) 1. TV rated types available 1 Form A: TV-8; 2 Form A: TV-5.
2. Standard packing Carton: 50 pcs.; Case: 200 pcs.
3. UL/CSA, VDE, TÜV, and SEMKO certified products can also be supported. Please consult us.

COIL DATA (at 20°C 68°F)

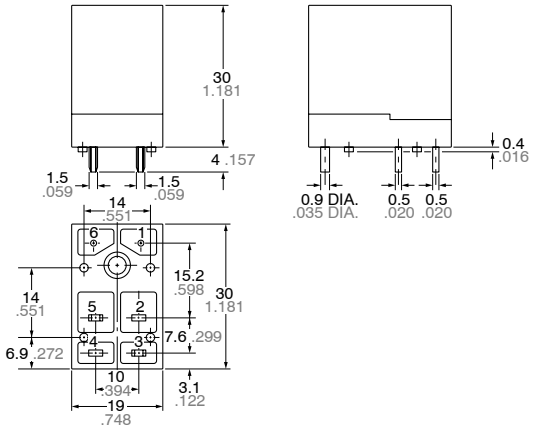
Contact arrangement	Nominal voltage. V DC	Pick-up voltage. V DC (max.)	Drop-out voltage. V DC (min.)	Coil resistance, Ω(±10%)	Nominal operating current, mA	Nominal operating power, W	Maximum allowable voltage, V DC (at 60°C)
1 Form A	6	4.8	0.6	40	150	0.9	6.6
	12	9.6	1.2	160	75	0.9	13.2
	24	19.2	2.4	640	37.5	0.9	26.4
	48	38.4	4.8	2,560	18.8	0.9	52.8
2 Form A	6	4.8	0.6	36	166.6	1.0	6.6
	12	9.6	1.2	144	83.3	1.0	13.2
	24	19.2	2.4	576	41.6	1.0	26.4
	48	38.4	4.8	2,304	20.8	1.0	52.8

DIMENSIONS

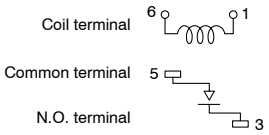
mm inch

PC board type

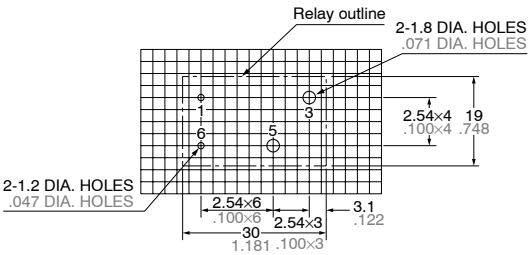
JC1a



Schematic

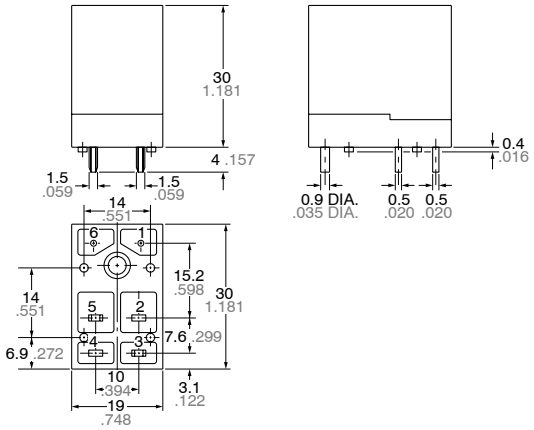


PC board pattern (Bottom view)

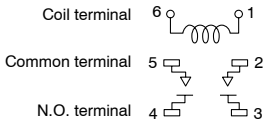


PC board type

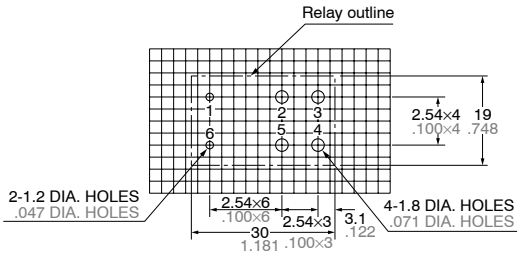
JC2a



Schematic



PC board pattern (Bottom view)



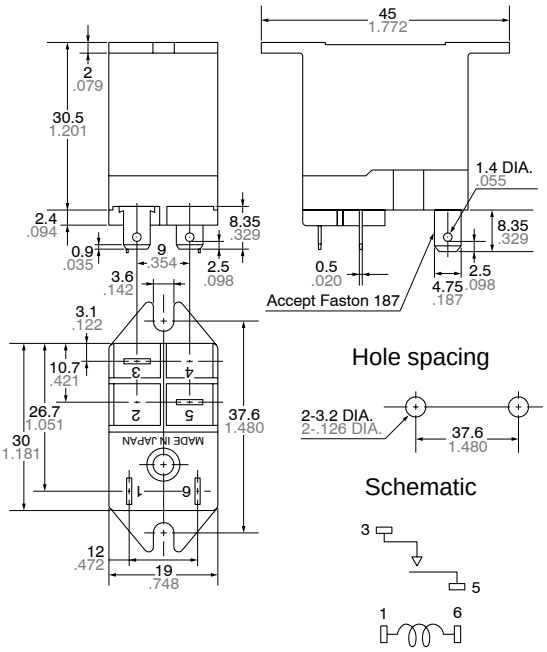
General tolerance: ±0.3 ±.012

Tolerance: ±0.1 ±.004

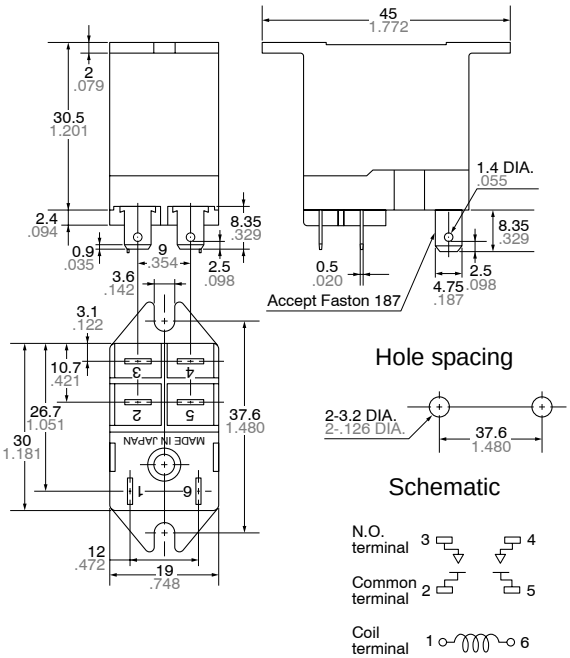
Top mount type

mm inch

1a

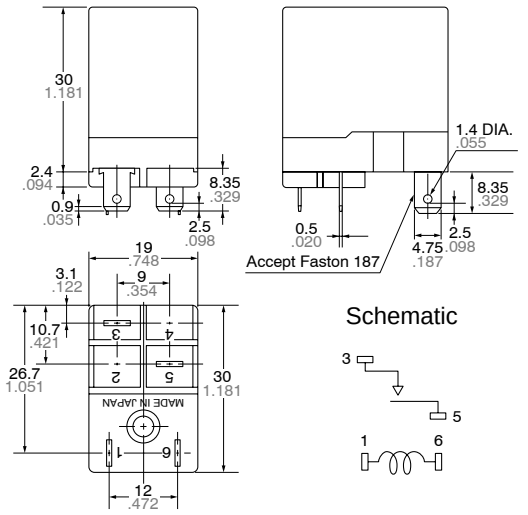


2a

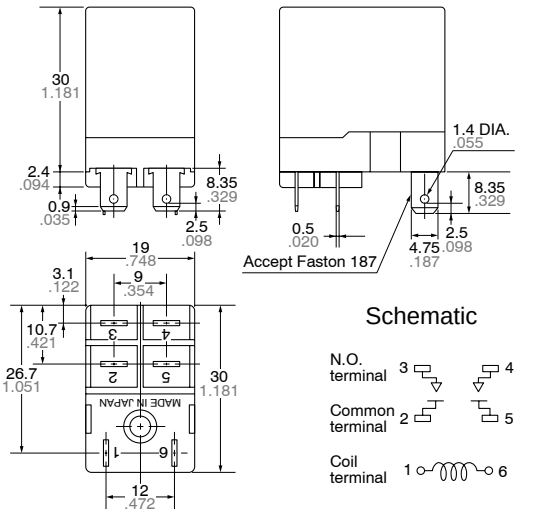


Plug-in type

1a



2a

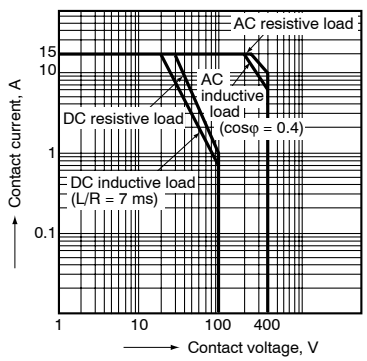


General tolerance: ±0.3 ±.012

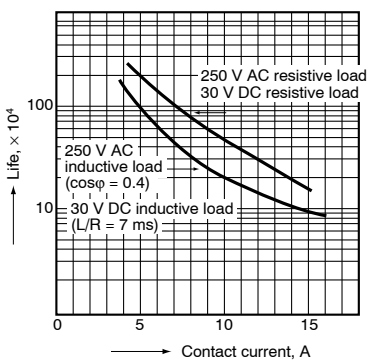
REFERENCE DATA

JC1a type

1. Maximum value for switching capacity

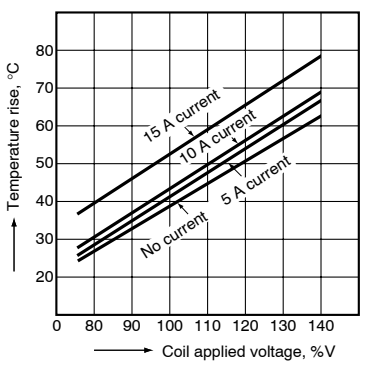


2. Life curve

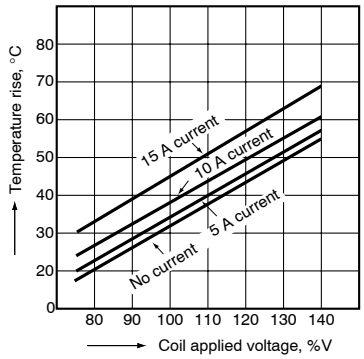


3.-(1) Coil temperature rise

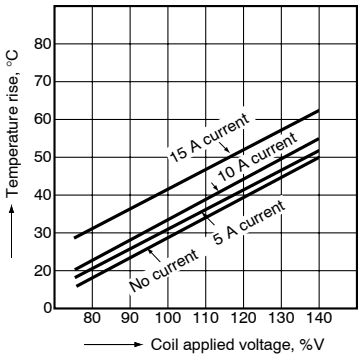
Point measured: Inside the coil
Ambient temperature: 26°C 79°F



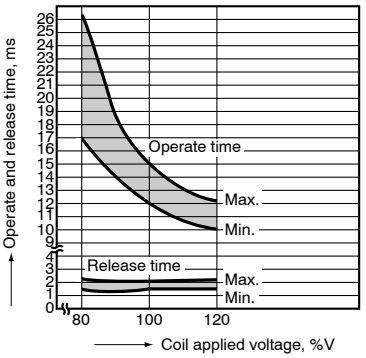
3.-(2) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 40°C 104°F



3.-(3) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 60°C 140°F

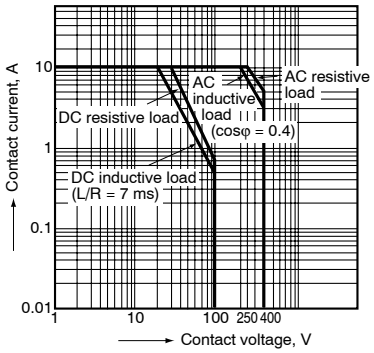


4. Operate / release time

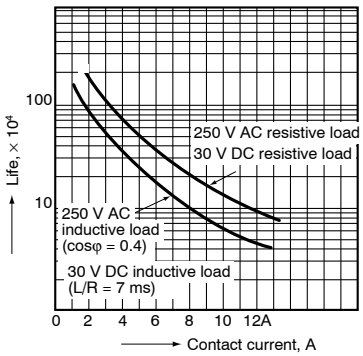


JC2a type

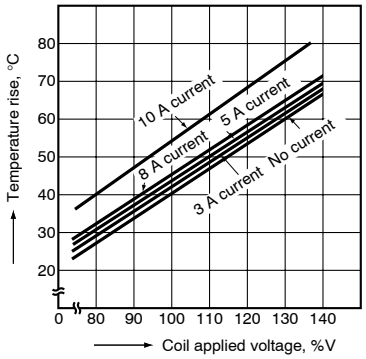
1. Maximum value for switching capacity



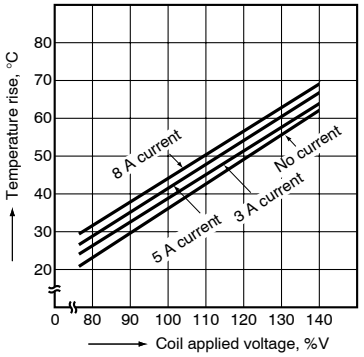
2. Life curve



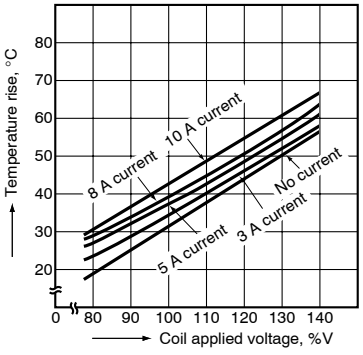
3.-(1) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 26°C 79°F



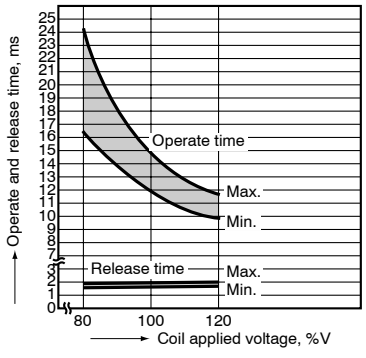
3.-(2) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 40°C 104°F



3.-(3) Coil temperature rise
Point measured: Inside the coil
Ambient temperature: 60°C 140°F



4. Operate / release time



ACCESSORIES

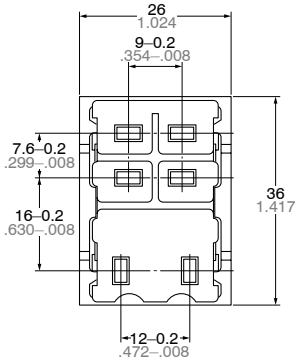
JC1-SS

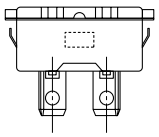
JC2-SS

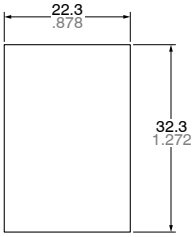
JC1-PS

JC2-PS

JC2-SS



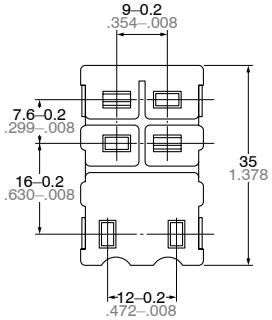


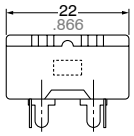


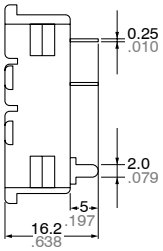
Panel cutout

Tolerance: ±0.1 ±.004

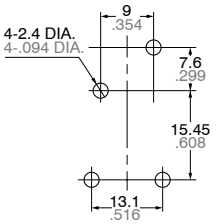
JC2-PS



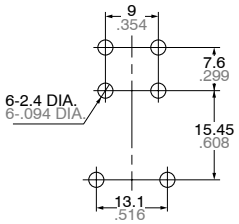




JC1-PS



JC2-PS



PC board Pattern

Tolerance: ±0.1 ±.004

mm inch

Tolerance: ±0.5 ±.020

(Note)
Outward dimensions and chassis cutout dimensions for JC1-SS and JC1-PS are same as those of JC2-SS and JC2-PS respectively.
UL/CSA approved type is standard.

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

COMPACT POWER RELAYS FOR HIGH DC LOADS

JC RELAY (Special Type)

Data sheet addition for JC Relay

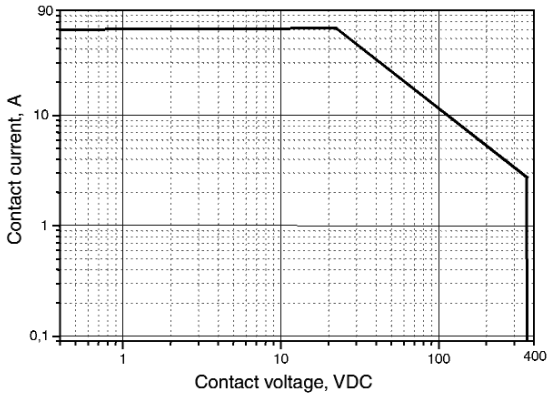
- **Integrated arc-blowing magnet for high DC loads [H73 type]**
- **High switching capacity: 20A / 60V DC**
- **Clearance and creepage distance contact / coil: 8 mm**
- **Two contacts connected in series ensures even higher life expectancy**

APPLICATIONS:

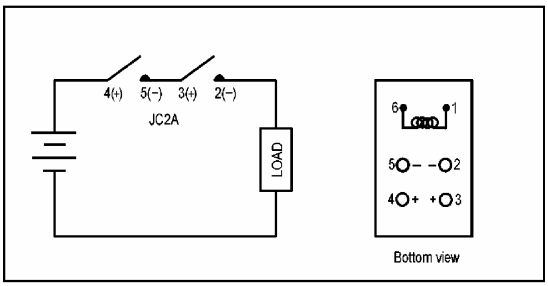
Switching of DC loads in devices such as
- Control of Industrial DC motors
- Emergency power-off for DC loads

Arrangement		**2 Form A**	
Contact material		**AgCdO, AgNi**	
Contact connection		one contact	two contacts in series
Rating (resistive) load	250VDC / 5A	1×10^4 ops.	2×10^4 ops.
	250VDC / 4A	3×10^4 ops.	4×10^4 ops.
Special loads test data (min. operations at 20°C)	220VDC / 1,6A; L/R = 14.6ms (1s On, 4s Off)	2×10^4	3×10^4
	220VDC / 1A; L/R = 17.4ms (1s On, 4s Off)	2×10^4	3×10^4
	60VDC / 20A; resistive load (30s On, 30s Off)	1×10^4	2×10^4
Mechanical, endurance and coil data according to JC-datasheet			

Load limit curve for connection in series



Connection diagram



Attention: For the Blow-out effect, the polarity must be defined as: (-) at contacts: 2, 5
(+) at contacts: 3, 4

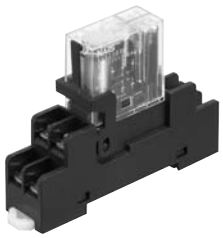
ORDERING AND TYPE INFORMATION (values at 20°C)

Type	Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Nominal operating power, W	Coil resistance, Ω (±10%)
JC2aF-DC5V-Y1-H73	5	4.0	0.5	1	25
JC2aF-DC6V-Y1-H73	6	4.8	0.6	1	36
JC2aF-DC12V-Y1-H73	12	9.6	1.2	1	144
JC2aF-DC24V-Y1-H73	24	19.2	2.4	1	576
JC2aF-DC48V-Y1-H73	48	38.4	4.8	1	2304

Panasonic
ideas for life

SLIM AND COMPACT RELAY FOR WIDER APPLICATIONS

HN RELAYS (AHN)



FEATURES

• Slim and compact size
20% more compact (width and height) than existing model* (with the condition of screw terminal socket for DIN rail)
*Compared with our HC/HJ relay.

• High-capacity and high reliability
Max. switching current:
16 A (for 1 Form C type at AC load)
Uses gold-flashed contacts for highly reliable contact (for 2 Form C type).

• Environmentally friendly
Compliance with RoHS Directive (2002/95/EC)
(Note: HN2 screw terminal socket only conformable from April, 2005.)

• Slim screw terminal socket
Utilizes relay-securing hook for easy relay removal.

TYPICAL APPLICATIONS

Control panels
Power supply units
Molding machines
Machine tools
Welding equipment
Agricultural equipment
Office equipment
Vending machines
Communications equipment
Amusement machines, etc.

SPECIFICATIONS

Contacts

Contact arrangement		1 Form C	2 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100mΩ	50mΩ
Contact material		Silver alloy	Gold-flashed silver alloy
Rating (resistive load)	Nominal switching capacity	10A 250V AC, 10A 30V DC	5A 250V AC, 5A 30V DC
	Max. switching power	4,000 VA, 300W	1,250 VA, 150W
	Max. switching voltage	250V AC, 30V DC	250V AC, 30V DC
	Max. switching current	16 A (at AC load), 10 A (at DC load)	5 A
	Min. switching current*9	5V 100mA DC	1V 1 mA DC
Expected life (min. operations)	Mechanical (at 300 cpm)	AC: 10^7 DC: 2×10^7	
	Electrical (at 20 cpm) (at rated load)	10^5	

Coil

Nominal operating power	0.53W 0.9VA

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as “Initial breakdown voltage” section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 For the AC coil types, the operate/release time will differ depending on the phase.
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).
*9 This value can change due to the switching frequency, environmental conditions and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed		20 cpm (at max. rating)
Initial insulation resistance*1		Min. 1,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min.
	Between contact sets	3,000 Vrms for 1 min. (2 Form C type only)
	Between contact and coil	5,000 Vrms for 1 min.
Operate time*3 (at nominal voltage)		Max. 15 ms*4
Release time (without diode)*3 (at nominal voltage)		Max. 10 ms*4
Temperature rise, max. (at 70°C) (at nominal voltage)		60°C
Shock resistance	Functional*5	Min. 100 m/s² {10 G}
	Destructive*6	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 1.5 mm
	Destructive	10 to 55 Hz at double amplitude of 1.5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 19g .67 oz

ORDERING INFORMATION

Ex. AHN □ □ □ □

Contact arrangement	Terminal arrangement	Type classification	Coil voltage
1: 1 Form C 2: 2 Form C	1: AC plug-in type 2: DC plug-in type	0: Standard 1: With LED indication 2: With diode 3: With diode and LED indication	05: 5 V, 06: 6 V, 12: 12 V, 24: 24 V, 48: 48 V X0: 100/110 V AC, 100 V DC X1: 110/120 V AC, 110 V DC Y0: 200/220 V AC, Y2: 220/240 V AC

Note: Products conform to UL/C-UL and VDE, as standard (VDE pending: 1 Form C type).

TYPES

1. Plug-in type

Coil voltage	1 Form C	2 Form C
	Part No.	Part No.
5V DC	AHN12005	AHN22005
6V DC	AHN12006	AHN22006
12V DC	AHN12012	AHN22012
24V DC	AHN12024	AHN22024
48V DC	AHN12048	AHN22048
100V DC	AHN120X0	AHN220X0
110V DC	AHN120X1	AHN220X1
12V AC	AHN11012	AHN21012
24V AC	AHN11024	AHN21024
100/110V AC	AHN110X0	AHN210X0
110/120V AC	AHN110X1	AHN210X1
200/220V AC	AHN110Y0	AHN210Y0
220/240V AC	AHN110Y2	AHN210Y2

Note: Packing quantity; Inner carton: 50 pcs, Outer carton: 500 pcs.

2. Plug-in with LED indication type

Coil voltage	1 Form C	2 Form C
	Part No.	Part No.
5V DC	AHN12105	AHN22105
6V DC	AHN12106	AHN22106
12V DC	AHN12112	AHN22112
24V DC	AHN12124	AHN22124
48V DC	AHN12148	AHN22148
100V DC	AHN121X0	AHN221X0
110V DC	AHN121X1	AHN221X1
12V AC	AHN11112	AHN21112
24V AC	AHN11124	AHN21124
100/110V AC	AHN111X0	AHN211X0
110/120V AC	AHN111X1	AHN211X1
200/220V AC	AHN111Y0	AHN211Y0
220/240V AC	AHN111Y2	AHN211Y2

Note: Packing quantity; Inner carton: 50 pcs, Outer carton: 500 pcs.

3. Plug-in with diode type

Coil voltage	1 Form C	2 Form C
	Part No.	Part No.
5V DC	AHN12205	AHN22205
6V DC	AHN12206	AHN22206
12V DC	AHN12212	AHN22212
24V DC	AHN12224	AHN22224
48V DC	AHN12248	AHN22248
100V DC	AHN122X0	AHN222X0
110V DC	AHN122X1	AHN222X1

Note: Packing quantity; Inner carton: 50 pcs, Outer carton: 500 pcs.

4. Plug-in with diode and LED indication type

Coil voltage	1 Form C	2 Form C
	Part No.	Part No.
5V DC	AHN12305	AHN22305
6V DC	AHN12306	AHN22306
12V DC	AHN12312	AHN22312
24V DC	AHN12324	AHN22324
48V DC	AHN12348	AHN22348
100V DC	AHN123X0	AHN223X0
110V DC	AHN123X1	AHN223X1

Note: Packing quantity; Inner carton: 50 pcs, Outer carton: 500 pcs.

5. Screw terminal socket

Type	No. of channels	Item	Part No.
For DIN rail assembly	1 channel	HN1 screw terminal socket	AHNA11
	2 channels	HN2 screw terminal socket	AHNA21

Notes) 1. Packing quantity: 10pcs. (Inner carton), 100pcs. (Outer carton)
2. Products conform to UL, C-UL, as standard.
3. In order to prevent breakage and disfiguring, the screw tightening torque for the terminal socket should be within the range of 0.5 to 0.8 N•m.
4. When attaching directly to a chassis, please use an M3 × 16 metric coarse screw thread.
5. To prevent damage and deformity, please use the relay-securing hook at 10 N or less.
6. When using with current of 16 A (for HN1 screw terminal socket), the maximum ambient temperature is 50°C. When using in an ambient temperature of 70°C, the maximum current is 14 A.

COIL DATA (at 20°C 68°F)

DC coils

Coil voltage V DC	Pick-up voltage, V DC (max.) (Initial)	Drop-out voltage, V DC (min.) (Initial)	Nominal coil current, mA (±20%)	Coil resistance, Ω (±10%)	Nominal operating power, W	Max. allowable voltage, V DC
5	3.5	0.5	105.9	47	0.53	8.5
6	4.2	0.6	88.4	68		10.2
12	8.4	1.2	44.2	270		20.4
24	16.8	2.4	22.1	1,090		40.8
48	33.6	4.8	11	4,350		81.6
100	70	10	5.3	18,870		170
110	77	11	4.8	22,830		187

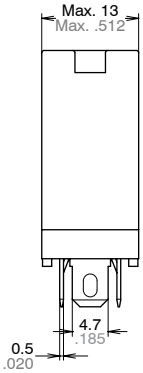
AC coils (50/60Hz)

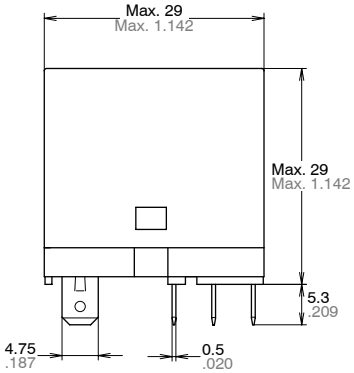
Coil voltage V AC	Pick-up voltage, V AC (max.) (Initial)	Drop-out voltage, V AC (min.) (Initial)	Nominal coil current, mA (±20%)		Nominal operating power, VA		Max. allowable voltage, V AC
			50Hz	60Hz	50Hz	60Hz	
12	9.6	3.6	93	75	Approx. 1.1 to 1.4	Approx. 0.9 to 1.2	16.8
24	19.2	7.2	46.5	37.5			33.6
100/110	80/88	30/33	11.0/13.0	9.0/10.6			140/154
110/120	88/96	33/36	10.0/11.8	8.2/9.7			154/168
200/220	160/176	60/66	5.5/6.5	4.5/5.3			280/308
220/240	176/192	66/72	5.0/5.9	4.1/4.8			308/336

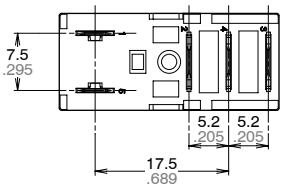
DIMENSIONS

mm inch

1. Plug-in type 1 Form C

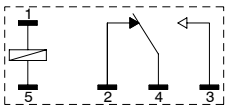




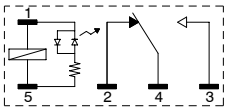


Schematic (Bottom view)

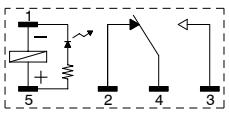
Standard type



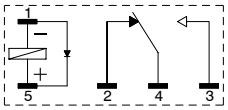
With LED AC type



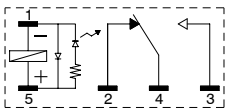
With LED DC type



With Diode type

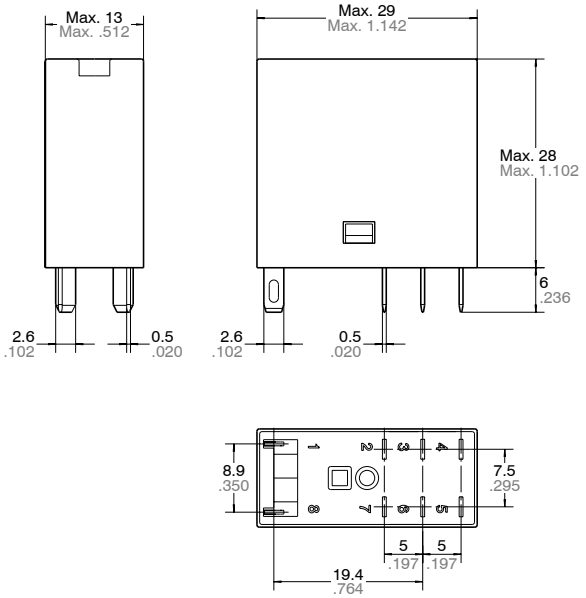


With Diode and LED type



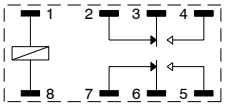
Dimension :	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

2. Plug-in type 2 Form C

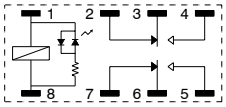


Schematic (Bottom view)

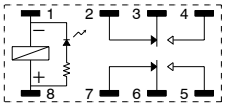
Standard type



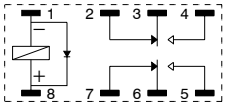
With LED AC type



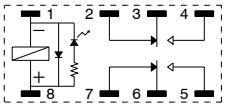
With LED DC type



With Diode type

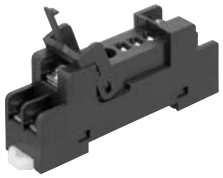


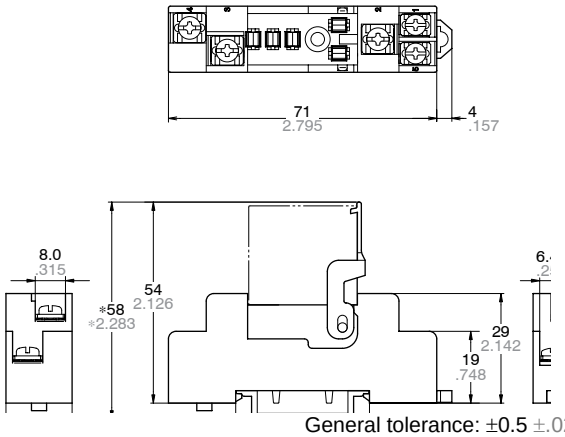
With Diode and LED type



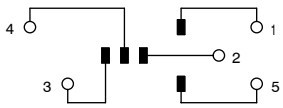
Dimension :	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

3. HN1 Screw terminal socket

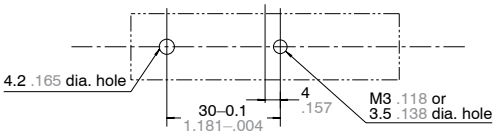




Schematic (Top view)



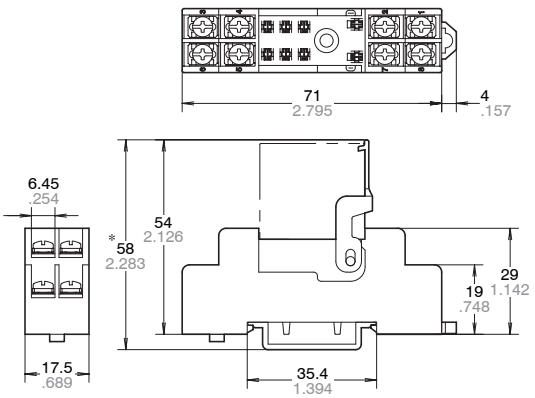
Mounting hole dimensions



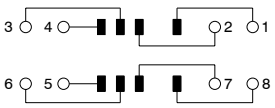
General tolerance: ±0.5 ±.020

∗ Reference in case of using DIN rail (ATA48011)

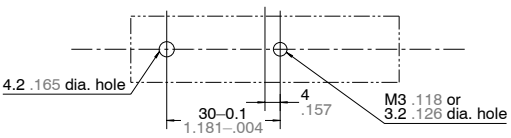
4. HN2 Screw terminal socket



Schematic (Top view)



Mounting hole dimensions

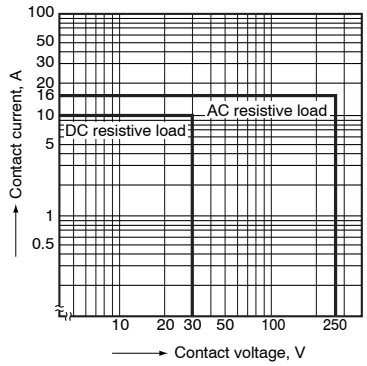


General tolerance: ±0.5 ±.020

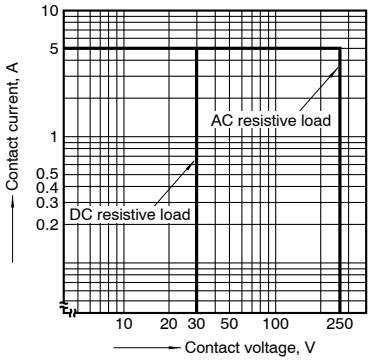
∗ Reference in case of using DIN rail (ATA48011)

REFERENCE DATA

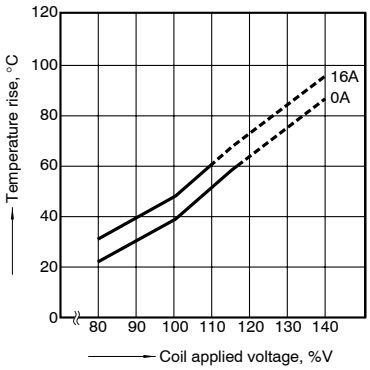
1-(1). Max. switching capacity (1 Form C)



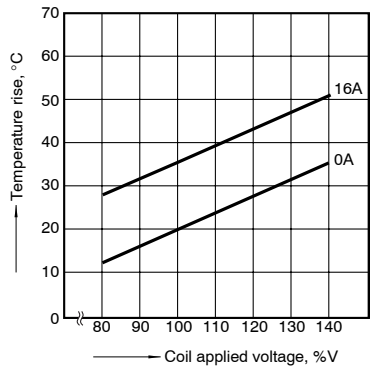
1-(2). Max. switching capacity (2 Form C)



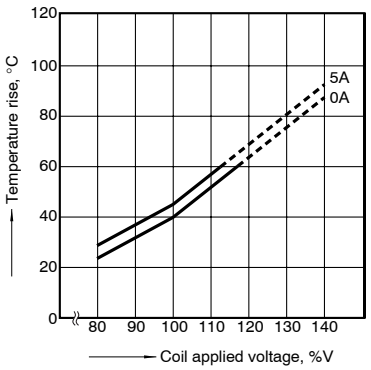
2-(1). Coil temperature rise (1 Form C/AC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



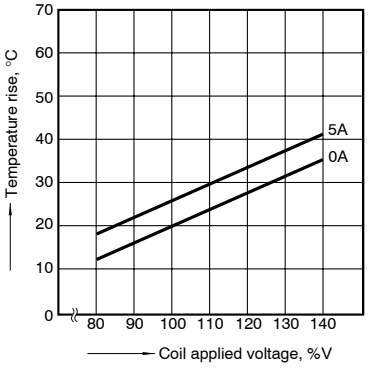
2-(2). Coil temperature rise (1 Form C/DC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



2-(3). Coil temperature rise (2 Form C/AC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



2-(4). Coil temperature rise (2 Form C/DC type)
Measured portion: Inside the coil
Ambient temperature: 70°C 158°F



NOTES

1. Coil operating power

To ensure proper operation, the voltage applied to both terminals of the coil should be ±5% (at 20°C 68°F) the rated operating voltage of the coil.

Also, be aware that the pick-up and drop-out voltages will fluctuate depending on the ambient temperature and operating conditions.

2. LED indications

The light of the light emitting diode is what displays operation. If voltage remains after relay dropout, the LED might illuminate briefly.

3. Switching lifetime

The switching lifetime is defined under the standard test condition specified in the JIS C 5442-1996 standard (temperature 15 to 35°C 59 to 95°F, humidity 25 to 75%). Check this with the real device as it is affected by coil driving circuit, load type, activation frequency, activation phase,ambient conditions and other factors.

Also, be especially careful of loads such as those listed below.

(1) When used for AC load-operating and the operating phase is synchronous.

Rocking and fusing can easily occur due to contact shifting.

(2) High-frequency load-operating

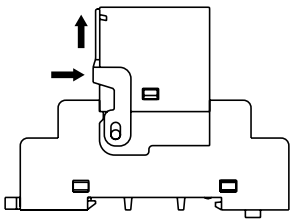
When high-frequency opening and closing of the relay is performed with a load that causes arcs at the contacts, nitrogen and oxygen in the air is fused by the arc energy and HNO_3 is formed. This can corrode metal materials.

Three countermeasures for these are listed here.

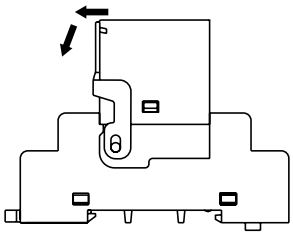
1. Incorporate an arc-extinguishing circuit.
2. Lower the operating frequency
3. Lower the ambient humidity

4. About the relay-securing hook

1) Installation of the securing hook is easily performed by pressing upward in the direction of the arrows.



2) Removal of the securing hook is easily performed by releasing the hook and pressing down, as shown in the figure.



5. Diode characteristics

1) Reverse breakdown voltage:
90V (5 to 48V DC type)
250V (100, 110V DC type)

6. Diode type

Since the diode inside the relay coil are designed to absorb the counter emf, the element may be damaged if a large surge, etc., is applied to the diode.

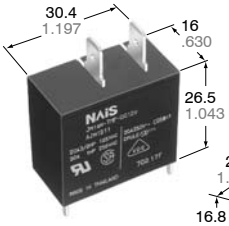
If there is the possibility of a large surge voltage from the outside, please implement measures to absorb it.

For Cautions for Use, see Relay Technical Information (page 390).

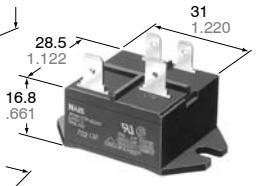
Panasonic
ideas for life

COMPACT POWER RELAY FOR INDUCTIVE LOAD

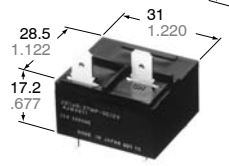
JM RELAYS



Slim TMP type



Flat TM type



Flat TMP type

mm inch

FEATURES

• Compact, high-capacity, and resistant to inductive loads
The relay is a compact 16×30.4×26.5 mm .630×1.197×1.043 inch. It can control an inductive load (cosφ = 0.7) with inrush current of 70 A and steady state current of 20 A.

• Excellent contact welding resistance
High contact pressure, a forced opening mechanism, and a forced wiping mechanism realizes an excellent contact welding resistance.

• High breakdown voltage and surge resistant relay
More than 6.4 mm .252 inch maintained for the insulation distance between contacts and coil, and the breakdown voltage between contacts and coil is 5,000 V for 1 minute. In addition, the surge resistance between contacts and coil is greater than 10,000 V.

• Resistant to external force
An absorber mechanism is used on the load terminals, giving a large improvement in characteristics variations caused by the external force during FASTON placement/removal.

• Flux resistance mechanism
The terminal area is plugged with resin to prevent flux seepage during PCB mounting. (TMP type)

• Conforms to the various safety standards
UL, CSA approved.
TÜV, VDE under application.

• The line up can support economical mounting methods.
The relay are equipped with a drive terminal (coil terminal) on one side for PCBs, and a load terminal (tab terminal #250) on the reverse side. The line up includes the TM type which can be attached directly to the PCB composing a drive circuit, and the TMP type which supports economical wiring. The TMP type can also be directly attached, and a high capacity load can be wired to the tab terminal.

Power

SPECIFICATIONS

Contact

Arrangement				1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)				30 mΩ (Cd free type: 100 mΩ)
Contact material				Silver alloy
Rating (resistive load)	Nominal switching capacity			20 A 250 V AC
	Max. switching power			5,000 VA
	Max. switching voltage			250 V AC
	Max. switching current			20 A
	Min. switching capacity#1			100 mA, 5 V DC
Expected life (min. ope.)	Mechanical (at 180 cpm)			10^6
	Electrical Life (at 20 cpm)	Resistive load 20 A, 250 V AC (cosφ = 1)		10^5
		Inductive load	Inrush 70 A, Steady 20 A (250 V AC cosφ = 0.7)	10^5
			Inrush 80 A, Cut-off 80 A (When the motor is locked) (250 V AC cosφ = 0.7)	1.5×10^3

Coil

Nominal operating power	900 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

Max. operating speed			180 cpm
Initial insulation resistance*1			Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts		1,000 Vrms for 1 min.
	Between contacts and coil		5,000 Vrms for 1 min.
Surge voltage between contact and coil*3			Min. 10,000 V
Operate time*4 (at nominal voltage)(at 20°C)			Max. 20ms (Approx. 8 ms)
Release time (without diode)*4 (at nominal voltage)(at 20°C)			Max. 10ms (Approx. 3 ms)
Temperature rise (at 60°C)			Max. 55°C (Contact switching current: 20 A/voltage applied to coil: 100%V)
Shock resistance	Functional*5		Min. 98 m/s² {10 G}
	Destructive*6		Min. 980 m/s² {100 G}
Vibration resistance	Functional*7		10 to 55 Hz at double amplitude of 1.6 mm
	Destructive		10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)		Ambient temp.	–40°C to +60°C –40°F to +140°F
		Humidity	5 to 85% R.H.
Unit weight	Slim TMP		Approx. 28 g .99 oz
	Flat TMP		Approx. 32 g 1.13 oz
	Flat TM		Approx. 33 g 1.16 oz

TYPICAL APPLICATIONS

- Compressor and heater control in air conditioners
- Power control in hot air type heaters
- Magnetron control in microwave ovens
- Lamp and motor control in OA equipment such as copiers and facsimiles.

ORDERING INFORMATION

Ex. JM [1a] [N] — [Z] [TMP] — [DC 24V] — [F]

Contact arrangement	Pickup voltage	Classification of type	Mounting classification	Coil voltage	Environmental support
1a: 1 Form A	N: 70% of nominal voltage	Nil: Slim type Z: Flat type	TMP: TMP type TM: TM type (Flat type) P: PCB type(Slim type)	DC 5, 6, 9, 12, 24, 48 V	F: RoHS Directive conforming type ($AgSnO_2$ type) Nil: RoHS Directive non-conforming type (AgCdO type)

(Note) 1. Standard packing: Carton: 50pcs. Case: 200pcs.
UL/CSA, VDE approved type is standard.

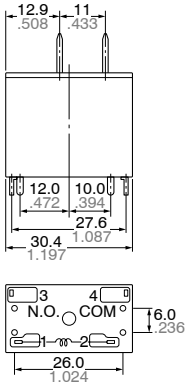
TYPES AND COIL DATA (at 20°C 68°F)

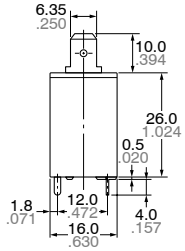
Part No.				Nominal voltage, V DC	Pick-up voltage	Drop-out voltage,	Nominal operating current, mA	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Slim		Flat								
TMP	PCB	TMP	TM							
JM1aN-TMP-DC5V (-F)	JM1aN-P-DC5V (-F)	JM1aN-ZTMP-DC5V (-F)	JM1aN-ZTM-DC5V (-F)	5	3.5	0.5	180	27.8	900	5.5
JM1aN-TMP-DC6V (-F)	JM1aN-P-DC6V (-F)	JM1aN-ZTMP-DC6V (-F)	JM1aN-ZTM-DC6V (-F)	6	4.2	0.6	150	40	900	6.6
JM1aN-TMP-DC9V (-F)	JM1aN-P-DC9V (-F)	JM1aN-ZTMP-DC9V (-F)	JM1aN-ZTM-DC9V (-F)	9	6.3	0.9	100	90	900	9.9
JM1aN-TMP-DC12V (-F)	JM1aN-P-DC12V (-F)	JM1aN-ZTMP-DC12V (-F)	JM1aN-ZTM-DC12V (-F)	12	8.4	1.2	75	160	900	13.2
JM1aN-TMP-DC24V (-F)	JM1aN-P-DC24V (-F)	JM1aN-ZTMP-DC24V (-F)	JM1aN-ZTM-DC24V (-F)	24	16.8	2.4	37.5	640	900	26.4
JM1aN-TMP-DC48V (-F)	JM1aN-P-DC48V (-F)	JM1aN-ZTMP-DC48V (-F)	JM1aN-ZTM-DC48V (-F)	48	33.6	4.8	18.75	2,560	900	52.8

DIMENSIONS

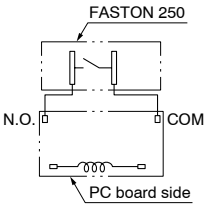
mm inch

Slim TMP type



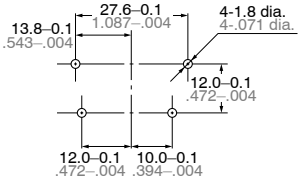


Schematic



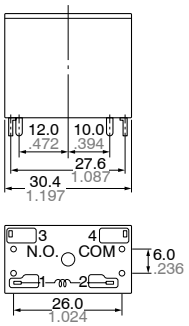
PC board pattern

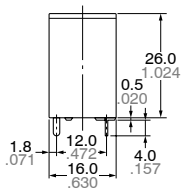
(Copper-side view)



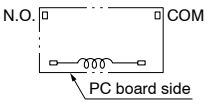
General tolerance: ±0.4 ±.016

Slim PCB type



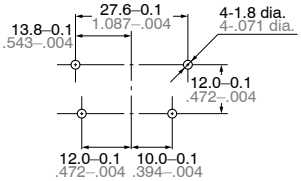


Schematic



PC board pattern

(Copper-side view)

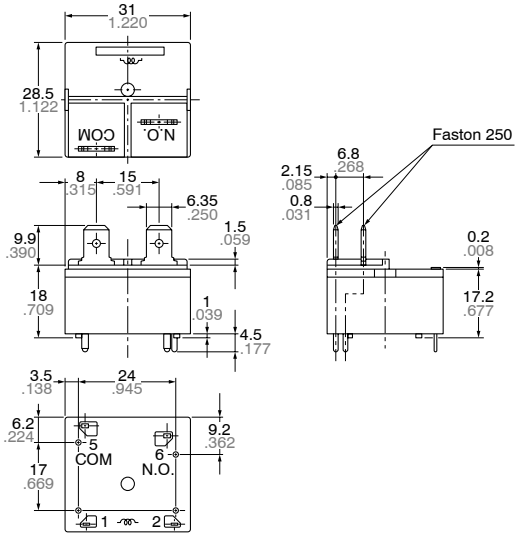


General tolerance: ±0.4 ±.016

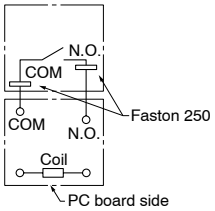
Tolerance: ±0.1 ±.004

Flat TMP type

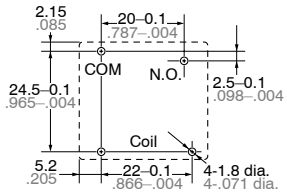
mm inch



Schematic



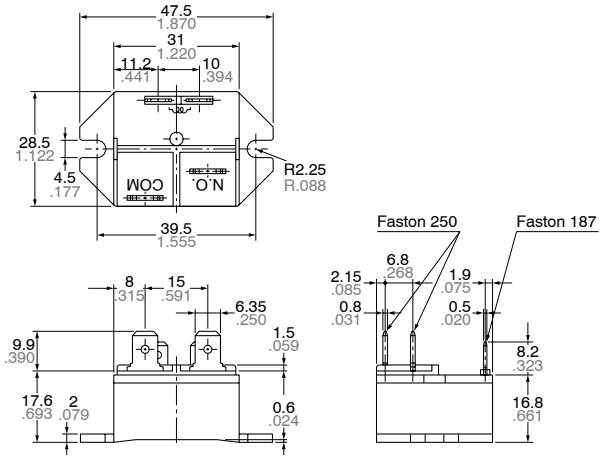
PC board pattern (Bottom view)



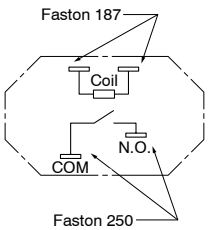
General tolerance: ±0.4 ±.016

Tolerance: ±0.1 ±.004

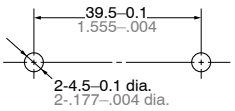
Flat TM type



Schematic



Panel cutout

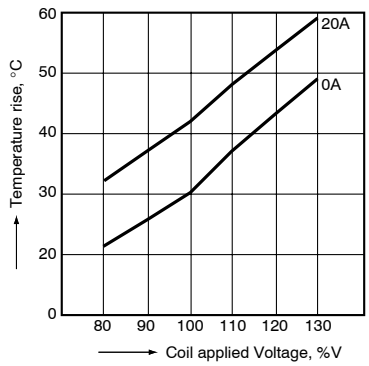


General tolerance: ±0.4 ±.016

REFERENCE DATA

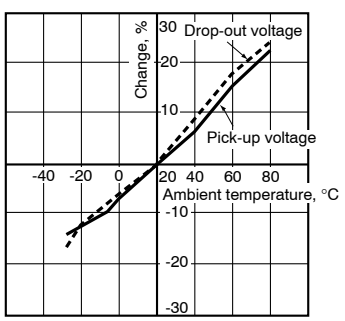
1. Coil temperature rise

Place to be measured: Inside of coil
Ambient temperature: 25°C 77°F



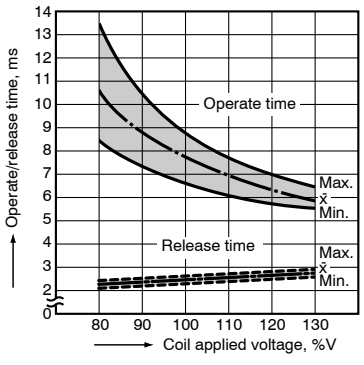
2. Ambient temperature characteristics

Sample: JM1aN-TMP-DC24V, 5 pcs.

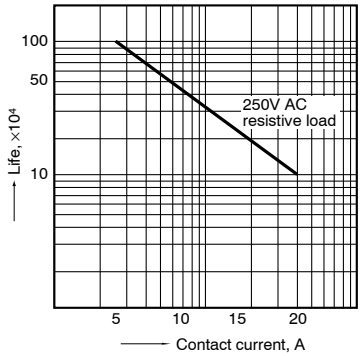


3. Operate/release time

Sample: JM1aN-TMP-DC24V, 5 pcs.

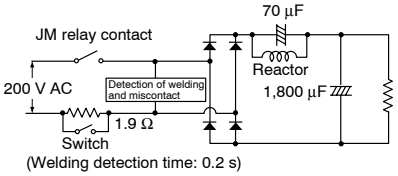


4. Life curve

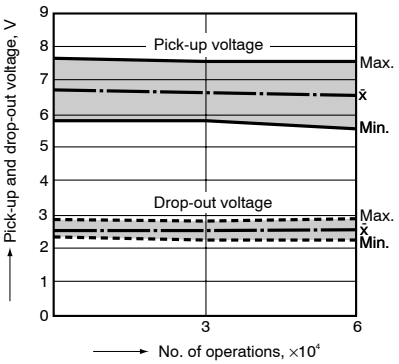


5-(1). 200 V AC electrical life test (200 V AC inverter dummy load)

Sample: JM1aN-TMP-DC12V, 6 pcs.
Load: Inrush 108 A, Steady 15 A,
Inverter dummy 200 V AC
Switching frequency: ON 5 s, OFF 5 s
Circuit



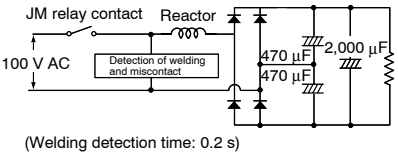
Change of pick-up and drop-out voltage



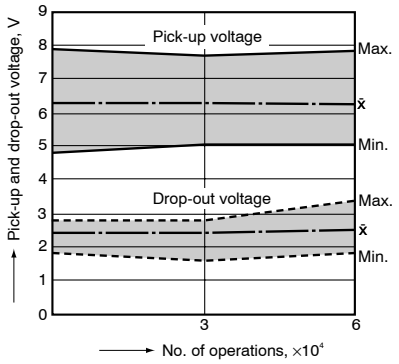
Contact welding: 0 time
Miscontact: 0 time

5-(2). 100 V AC electrical life test (100 V AC inverter dummy load)

Sample: JM1aN-TMP-DC12V, 20 pcs.
Load: Inrush 224 A, Steady 20A,
Inverter dummy 100 V AC
Switching frequency: ON 10 s, OFF 10 s
Circuit



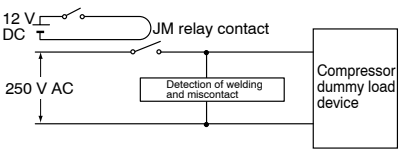
Change of pick-up and drop-out voltage



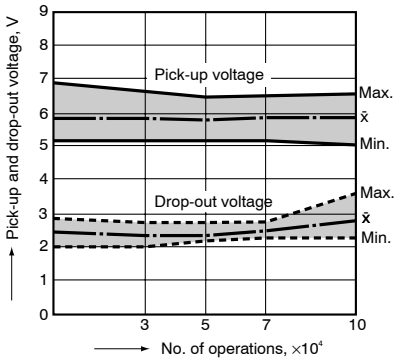
Contact welding: 0 time
Miscontact: 0 time

5-(3). Inrush 70 A, Steady 20 A, 250 V AC compressor dummy load

Sample: JM1aN-TMP-DC12V, 6 pcs.
Load: (Endurance) inrush 70 A cosφ = 0.7 (0.3 s),
steady 20A pf = 0.9,
250V AC compressor dummy
(Overload) 80A cosφ = 0.7, 250 V AC
No. of operations: (Endurance) 10^5 times
(Overload) 1,000 times (after endurance test)
Switching frequency: (Endurance) ON 1.5 s,
OFF 1.5 s
(Overload) ON 3 s,
OFF 2 min., 57 s
Circuit (endurance)



Change of pick-up and drop-out voltage



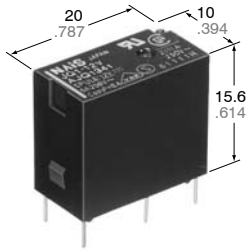
Contact welding: 0 time
Miscontact: 0 time

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

HIGH ELECTRICAL & MECHANICAL NOISE IMMUNITY RELAY

JQ RELAYS



mm inch

FEATURES

- **High electrical noise immunity**
- **High switching capacity in a compact package**
- **High sensitivity: 200 mW (1a), 400 mW (1c)**
- **High surge voltage: 8,000 V between contacts and coil**
- **UL, CSA, VDE, TÜV, SEMKO approved**
- **Class B coil insulation type available**

SPECIFICATIONS

Contact

				Standard type	High capacity type
Arrangement				1 Form A, 1 Form C	
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)				100 mΩ	
Contact material				Silver alloy	
Rating (resistive)	Nominal switching capacity	1a		5 A 125 V AC 2 A 250 V AC 5 A 30 V DC	10 A 125 V AC 5 A 250 V AC 5 A 30 V DC
		1c	N.O.	5 A 125 V AC 2 A 250 V AC 3 A 30 V AC	10 A 125 V AC 5 A 250 V AC 5 A 30 V DC
			N.C.	2 A 125 V AC 1 A 250 V AC 1 A 30 V DC	3 A 125 V AC 2 A 250 V AC 1 A 30 V DC
	Max. switching power	1a		625 VA, 150 W	1,250 VA, 150 W
		1c	N.O.	625 VA, 90 W	1,250 V AC, 150 W
			N.C.	250 VA, 30 W	500 V AC, 30 W
	Max. switching voltage			250 V AC, 110 V DC (0.3A)	
	Max. switching current			N.O.: 5 A N.C.: 2 A	N.O.: 10 A N.C.: 3 A
	Min. switching capacity#1			100 mA, 5 V DC	
Expected mechanical life (at 180 cpm)(min. operations)				10^7	

Expected electrical life (min. operations)

Type			Switching capacity	No. of operations
Standard type	1a		5 A 125 V AC 3 A 125 V AC 2 A 250 V AC 5 A 30 V DC	5×10^4 2×10^5 2×10^5 10^5
	1c	N.O.	5 A 125 V AC 2 A 250 V AC 3 A 30 V DC	5×10^4 2×10^5 10^5
		N.C.	2 A 125 V AC 1 A 250 V AC 1 A 30 V DC	2×10^5 2×10^5 10^5
High capacity type	1a		10 A 125 V AC 5 A 250 V AC 5 A 30 V DC	5×10^4 5×10^4 10^5
	1c	N.O.	10 A 125 V AC 5 A 250 V AC 5 A 30 V DC	5×10^4 5×10^4 10^5
		N.C.	3 A 125 V AC 2 A 250 V AC 1 A 30 V DC	2×10^5 2×10^5 10^5

Coil (at 20°C 68°F)

Nominal operating power	1a: 200 mW	1c: 400 mW

Characteristics

Max. operating speed			20 cpm
Initial insulation resistance*1			Min. 1,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts		1a: 1,000 Vrms for 1 min. 1c: 750 Vrms for 1 min.
	Between contacts and coil		4,000 Vrms for 1 min.
Surge voltage between contact and coil*3			8,000 V
Operate time*4 (at nominal voltage)			Approx. 5 ms
Release time*4 (at nominal voltage)(without diode)			Approx. 2 ms
Temperature rise*5			Max. 45°C
Shock resistance	Functional*6		Min. 294 m/s² {30 G}
	Destructive*7		Min. 980 m/s² {100 G}
Vibration resistance	Functional*8		98 m/s² {10 G}, 10 to 55 Hz at double amplitude of 1.6 mm
	Destructive		117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2.0 mm
Conditions for operation, transport and storage*9 (Not freezing and condensing at low temperature)		Ambient temp.*10	–40°C to +85°C –40°F to +185°F
		Humidity	5 to 85% R.H.
Unit weight			Approx. 7 g .25 oz

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10 mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 Measured conditions

Standard type	Resistive, nominal voltage applied to the coil. Contact carrying current: 5 A, at 70°C 158°F
High capacity type	Resistive, nominal voltage applied to the coil. Contact carrying current: 10 A, at 70°C 158°F

*6 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*7 Half-wave pulse of sine wave: 6ms
*8 Detection time: 10μs
*9 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).
*10 When using relays in a high ambient temperature, consider the pick-up voltage rise due to the high temperature (a rise of approx. 0.4% V for each 1°C 33.8°F with 20°C 68°F as a reference) and use a coil impressed voltage that is within the maximum allowable voltage range.

Power

TYPICAL APPLICATIONS

- Air conditioners
- Refrigerators
- Microwave ovens
- Heaters

ORDERING INFORMATION

Ex. JQ [1a] [P] — [B] — [12] V — [F]

Contact arrangement	Contact capacity	Coil insulation class	Coil voltage (DC)	Environmental support
1a: 1 Form A 1: 1 Form C	Nil: Standard P: High capacity	Nil: Class E coil insulation B: Class B coil insulation	5, 6, 9, 12, 18, 24, 48* V	F: RoHS Directive conforming type ($AgSnO_2$ type) Nil: RoHS Directive non-conforming type (AgCdO type)

UL/CSA, VDE, SEMKO approved type is standard.
* Available only for 1 Form C type

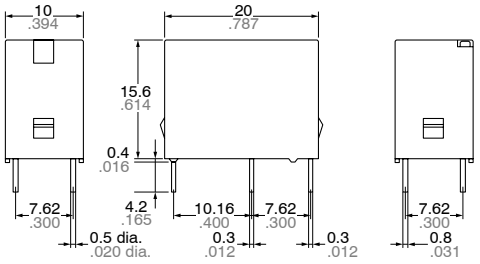
TYPES AND COIL DATA at 20°C 68°F

		Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (min.)	Drop-out voltage, V DC (min.)	Nominal operating current, mA	Nominal operating power, mW	Coil resistance, Ω (±10%)	Max. allowable voltage, V DC
1 Form A	Standard type	JQ1a-5V (-F)	5	3.75	0.25	40	200	125	180% of nominal voltage (at 20°C 68°F)
		JQ1a-6V (-F)	6	4.5	0.3	33.3		180	
		JQ1a-9V (-F)	9	6.75	0.45	22.2		405	
		JQ1a-12V (-F)	12	9	0.6	16.7		720	
		JQ1a-18V (-F)	18	13.5	0.9	11.1		1,620	
		JQ1a-24V (-F)	24	18	1.2	8.3		2,880	
	High capacity type	JQ1aP-5V (-F)	5	4	0.25	40	200	125	130% of nominal voltage (at 85°C 185°F)
		JQ1aP-6V (-F)	6	4.8	0.3	33.3		180	
		JQ1aP-9V (-F)	9	7.2	0.45	22.2		405	
		JQ1aP-12V (-F)	12	9.6	0.6	16.7		720	
		JQ1aP-18V (-F)	18	14.4	0.9	11.1		1,620	
		JQ1aP-24V (-F)	24	19.2	1.2	8.3		2,880	
1 Form C	Standard type	JQ1-5V (-F)	5	3.75	0.25	80	400	62.5	150% of nominal voltage (at 20°C 68°F)
		JQ1-6V (-F)	6	4.5	0.3	66.7		90	
		JQ1-9V (-F)	9	6.75	0.45	44.4		202.5	
		JQ1-12V (-F)	12	9	0.6	33.3		360	
		JQ1-18V (-F)	18	13.5	0.9	22.2		810	
		JQ1-24V (-F)	24	18	1.2	16.7		1,440	
		JQ1-48V (-F)	48	36	2.4	8.3		5,760	
	High capacity type	JQ1P-5V (-F)	5	4	0.25	80	400	62.5	110% of nominal voltage (at 85°C 185°F)
		JQ1P-6V (-F)	6	4.8	0.3	66.7		90	
		JQ1P-9V (-F)	9	7.2	0.45	44.4		202.5	
		JQ1P-12V (-F)	12	9.6	0.6	33.3		360	
		JQ1P-18V (-F)	18	14.4	0.9	22.2		810	
		JQ1P-24V (-F)	24	19.2	1.2	16.7		1,440	
		JQ1P-48V (-F)	48	38.4	2.4	8.3		5,760	

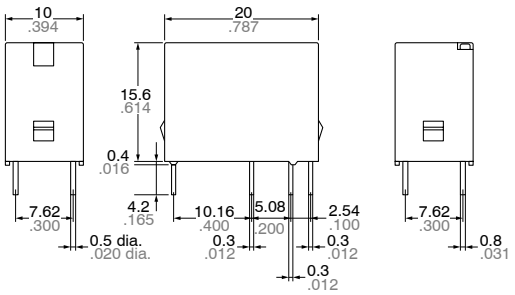
DIMENSIONS

mm inch

1 Form A

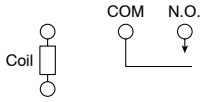


1 Form C

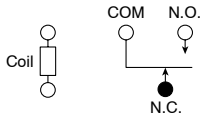


Schematic (Bottom view)

1 Form A

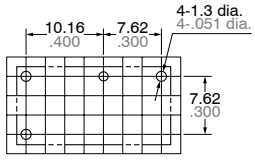


1 Form C

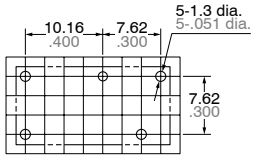


PC board pattern (Bottom view)

1 Form A



1FormC



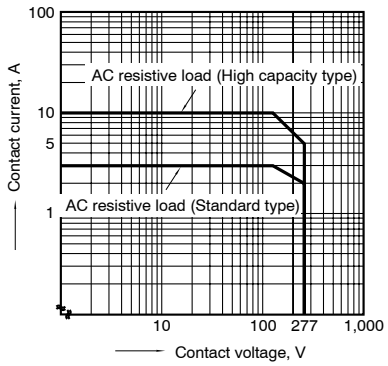
Tolerance: ±0.1 ±.004

Dimension :	General tolerance
Max. 1mm .039 inch	±0.2 ±.008
1 to 5mm .039 to .118 inch	±0.3 ±.012
Min. 5mm .118 inch	±0.4 ±.016

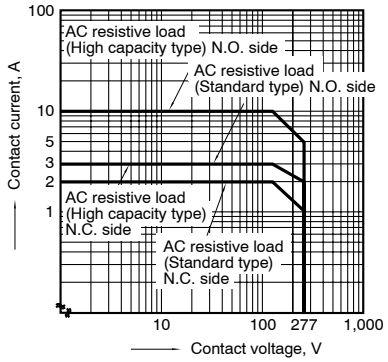
Power

REFERENCE DATA

Max. switching capacity (1 Form A type)

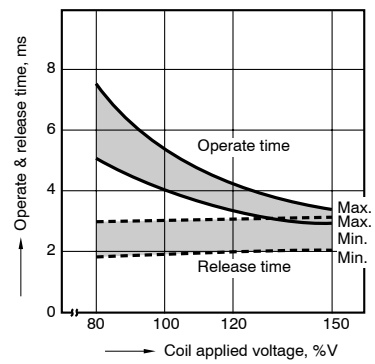


Max. switching capacity (1 Form C type)

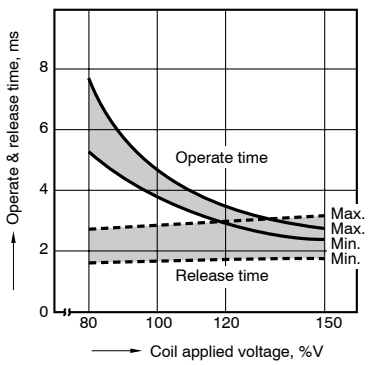


Standard type

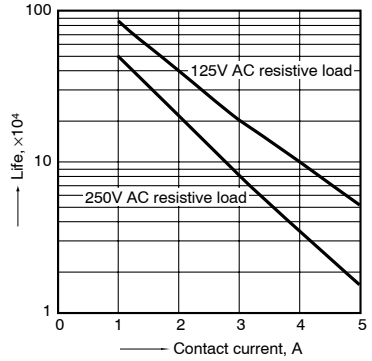
1-(1). Operate & release time (1 Form A type)
Tested sample: JQ1a-12V, 25 pcs.



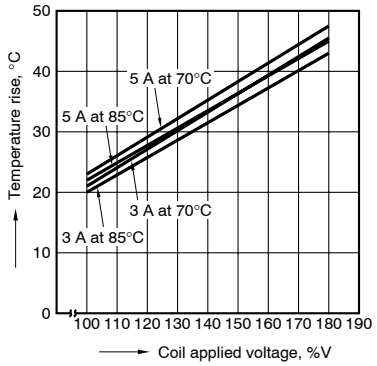
1-(2). Operate & release time (1 Form C type)
Tested sample: JQ1-24V, 25 pcs.



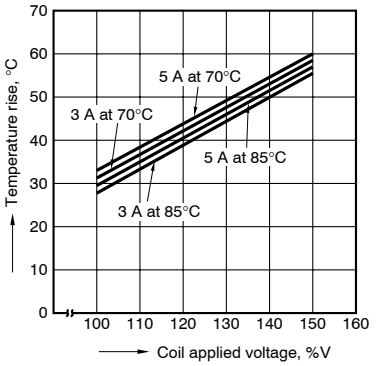
2. Life curve
Ambient temperature: room temperature



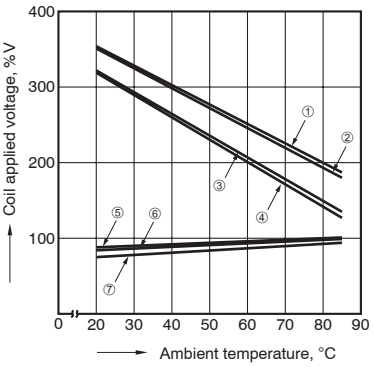
3-(1). Coil temperature rise (1 Form A type)
Contact carrying current: 3 A, 5 A
Measured portion: Inside the coil



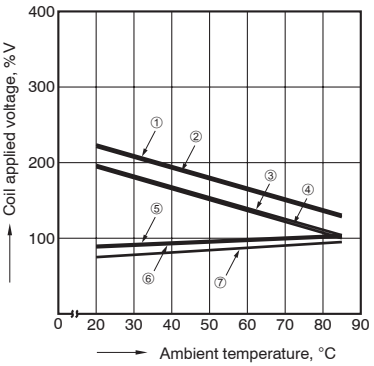
3-(2). Coil temperature rise (1 Form C type)
Contact carrying current: 3 A, 5 A
Measured portion: Inside the coil



4-(1). Ambient temperature characteristics (1 Form A type)
Tested sample: JQ1a-24V
Contact carrying current: 3 A, 5 A



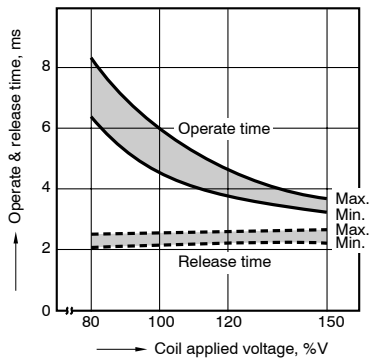
4-(2). Ambient temperature characteristics (1 Form C type)
Tested sample: JQ1-24V
Contact carrying current: 3 A, 5 A



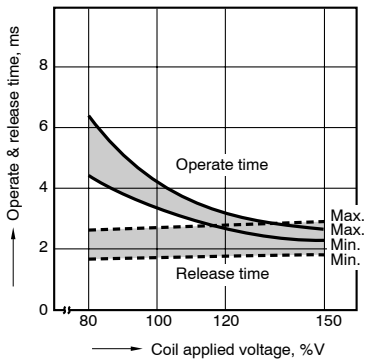
① Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 130°C 266°F) (Carrying current: 3 A)
② Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 130°C 266°F) (Carrying current: 5 A)
③ Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 115°C 239°F) (Carrying current: 3 A)
④ Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 115°C 239°F) (Carrying current: 5 A)
⑤ Pick-up voltage with a hot-start condition of 100%V on the coil (Carrying current: 5 A)
⑥ Pick-up voltage with a hot-start condition of 100%V on the coil (Carrying current: 3 A)
⑦ Pick-up voltage

High capacity type

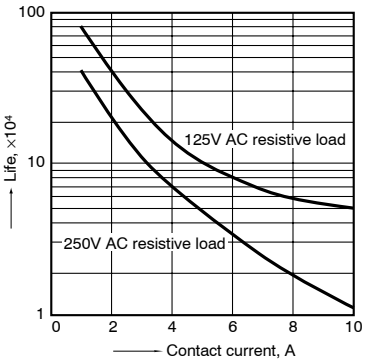
1-(1). Operate & release time (1 Form A type)
Tested sample: JQ1aP-12V, 25 pcs.



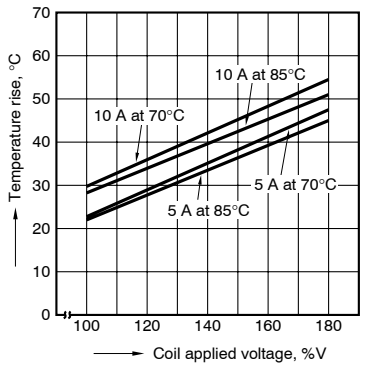
1-(2). Operate & release time (1 Form C type)
Tested sample: JQ1P-12V, 25 pcs.



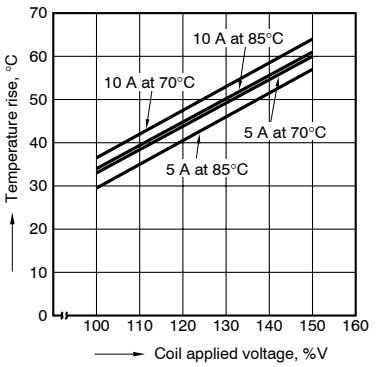
2. Life curve
Ambient temperature: room temperature



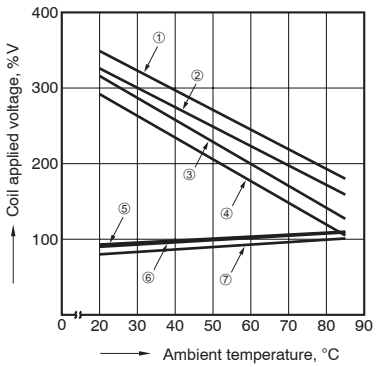
3-(1). Coil temperature rise (1 Form A type)
Contact carrying current: 5 A, 10 A
Measured portion: Inside the coil



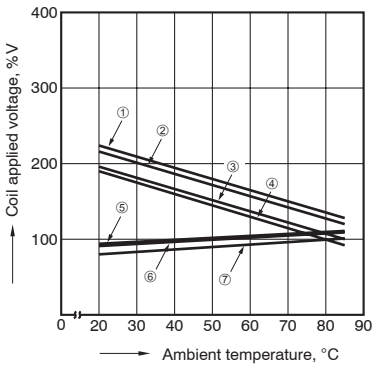
3-(2). Coil temperature rise (1 Form C type)
Contact carrying current: 5 A, 10 A
Measured portion: Inside the coil



4-(1). Ambient temperature characteristics
(1 Form A type)
Tested sample: JQ1aP-24V
Contact carrying current: 5 A, 10 A



4-(2). Ambient temperature characteristics
(1 Form C type)
Tested sample: JQ1P-24V
Contact carrying current: 5 A, 10 A



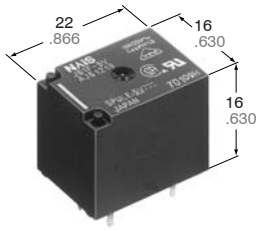
① Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 130°C 266°F) (Carrying current: 5 A)
② Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 130°C 266°F) (Carrying current: 10 A)
③ Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 115°C 239°F) (Carrying current: 5 A)
④ Allowable ambient temperature against % coil voltage (max. inside the coil temperature set as 115°C 239°F) (Carrying current: 10 A)
⑤ Pick-up voltage with a hot-start condition of 100%V on the coil (Carrying current: 10 A)
⑥ Pick-up voltage with a hot-start condition of 100%V on the coil (Carrying current: 5 A)
⑦ Pick-up voltage

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

MINIATURE PC BOARD TYPE POWER RELAY

JS RELAYS



mm inch

FEATURES

- **Miniature size with universal terminal footprint**
- **High contact capacity: 10 A**
- **Class B coil insulation type available**
- **TV-5 type available (Standard type)**
  1 Form A type → TV-5
  1 Form C type → TV-5 (N.O. side only)
- **VDE, TÜV also approved**
- **Sealed construction for automatic cleaning (Standard type)**

SPECIFICATIONS

Contact

Types		Standard type	High power type
Arrangement		1 Form A, 1 Form C	1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ	
Contact material		Silver alloy	
Rating (resistive load)	Nominal switching capacity	10 A 250 V AC 10 A 125 V AC 6 A 277 V AC	10 A 250 V AC 10 A 125 V AC 10 A 277 V AC
	Max. switching power	2,500 VA	
	Max. switching voltage	250 V AC, 100 V DC	
	Max. switching current	10 A (AC), 5 A (DC)	
	Min. switching capacity#1	100 mA, 5 V DC	
Expected life (min. ope.)	Mechanical (at 180 cpm)	10^7	
	Electrical at 10 A 125 V AC, 6 A 277 V AC resistive (standard) 10 A 277 V AC resistive (High power)	10^5	2×10^5
	10 A 250 V AC resistive (Standard: at 20 cpm) (High power: at 20 cpm, 105°C 221°F)**	5×10^4 (No contact only)	1.5×10^5

** Holding voltage should be 60% V of nominal voltage

Coil

Nominal operating power	360 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

*1 Detection current: 10mA
*2 Excluding contact bounce time
*3 Half-wave pulse of sine wave: 11ms; detection time: 10μs

Characteristics

Max. operating speed		20 cpm	
Types		Standard type	High power type
Initial insulation resistance		Min. 100 MΩ (at 500 V DC)	
Initial breakdown voltage*1	Between open contacts	750 Vrms for 1 min.	
	Between contacts and coil	1,500 Vrms for 1 min.	
Operate time*2 (at nominal voltage)		Approx. 10 ms	
Release time(without diode)*2 (at nominal voltage)		Approx. 10 ms	
Temperature rise (at nominal voltage)		Max. 35°C, resistive, nominal voltage applied to coil. Contact carrying current: 10A, at 85°C 185°F	
Shock resistance	Functional*3	Min. 98 m/s² {10 G}	
	Destructive*4	Min. 980 m/s² {100 G}	
Vibration resistance	Functional*5	Approx. 98 m/s² {10 G}, 10 to 55 Hz at double amplitude of 1.6 mm	
	Destructive	Approx. 117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2 mm	
Conditions for operation, transport and storage*6 (Not freezing and condensing at low temperature)	Ambient temp.*7	–40°C to +85°C –40°F to +185°F	–40°C to +105°C –40°F to +221°F
	Humidity	5 to 85% R.H.	
Unit weight		Approx.12 g .423 oz	

*4 Half-wave pulse of sine wave: 6ms
*5 Detection time: 10μs
*6 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).
*7 When using relays in a high ambient temperature, consider the pick-up voltage rise due to the high temperature (a rise of approx. 0.4% V for each 1°C 33.8°F with 20°C 68°F as a reference) and use a coil impressed voltage that is within the maximum allowable voltage range.

TYPICAL APPLICATIONS

1. Home appliances
   Air conditioner, heater, etc.
2. Automotive
   Power-window, car antenna, door-lock, etc.
3. Office machines
   PPC, facsimile, etc.
4. Vending machines

ORDERING INFORMATION

Ex. JS [1a] [F] — [B] — [12V] — [F]

Contact arrangement	Protective construction	Coil insulation class	Coil voltage (DC)	Environmental support
1: 1 Form C (Standard) 1a: 1 Form A (Standard) 1aP: 1 Form A (High Power)	Nil: Sealed type F: Flux-resistant type	Nil: Class E insulation B: Class B insulation	5, 6, 9, 12, 18, 24, 48 V	F: RoHS Directive conforming type ($AgSnO_2$ type) Nil: RoHS Directive non-conforming type (AgCdO type)

UL/CSA, VDE, TÜV (Standard type only) approved type is standard.

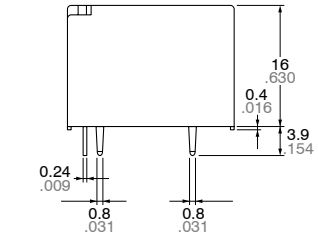
Notes: 1. Standard packing: Carton: 100 pcs. Case: 500 pcs.
2. When ordering TV rated (TV-5) types, add suffix -TV.
3. Contact arrangement 1aP type is Flux-resistant type only (class B or class F insulation). Please consult us for coil insulation class F.

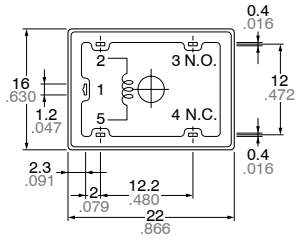
COIL DATA

Part No.					Nominal voltage, V DC	Pick-up voltage, V DC (max.) (at 20°C 68°F)	Drop-out voltage, V DC (min.) (at 20°C 68°F)	Coil resistance, Ω (±10%) (at 20°C 68°F)	Nominal operating current, mA (±10%) (at 20°C 68°F)	Nominal operating power, mW (at 20°C 68°F)	Max. allowable voltage (at 85°C 185°F)
Standard type				High Power type							
Sealed type		Flux-resistant type		Flux-resistant type							
1 Form A	1 Form C	1 Form A	1 Form C	1 Form A							
JS1a-5V (-F)	JS1-5V (-F)	JS1aF-5V (-F)	JS1F-5V (-F)	JS1aPF-B-5V (-F)	5	3.5	0.5	69.4	72	360	130%V of nominal voltage
JS1a-6V (-F)	JS1-6V (-F)	JS1aF-6V (-F)	JS1F-6V (-F)	JS1aPF-B-6V (-F)	6	4.2	0.6	100	60		
JS1a-9V (-F)	JS1-9V (-F)	JS1aF-9V (-F)	JS1F-9V (-F)	JS1aPF-B-9V (-F)	9	6.3	0.9	225	40		
JS1a-12V (-F)	JS1-12V (-F)	JS1aF-12V (-F)	JS1F-12V (-F)	JS1aPF-B-12V (-F)	12	8.4	1.2	400	30		
JS1a-18V (-F)	JS1-18V (-F)	JS1aF-18V (-F)	JS1F-18V (-F)	JS1aPF-B-18V (-F)	18	12.6	1.8	900	20		
JS1a-24V (-F)	JS1-24V (-F)	JS1aF-24V (-F)	JS1F-24V (-F)	JS1aPF-B-24V (-F)	24	16.8	2.4	1,600	15		
JS1a-48V (-F)	JS1-48V (-F)	JS1aF-48V (-F)	JS1F-48V (-F)	JS1aPF-B-48V (-F)	48	33.6	4.8	6,400	7.5		

DIMENSIONS

mm inch



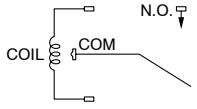


Note: Terminal No. 4 is only for Standard 1 Form C type

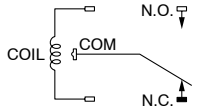
General tolerance: ±0.3 ±.012

Schematic (Bottom view)

1a



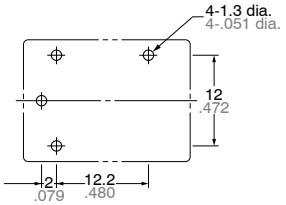
1c



PC board pattern (Bottom view)

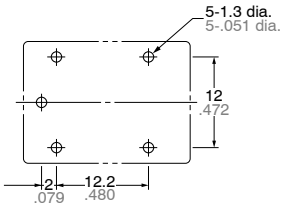
1a

(Standard, High Power)



1c

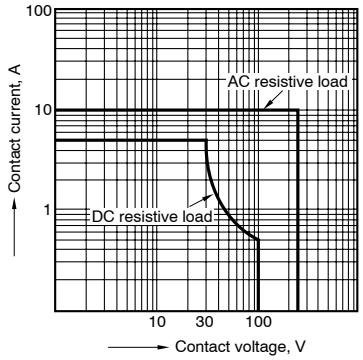
(Standard)



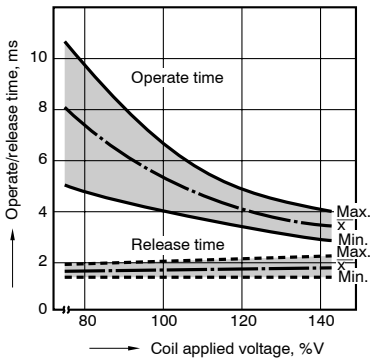
Tolerance: ±0.1 ±.004

REFERENCE DATA

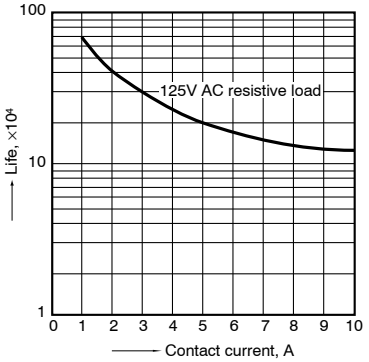
1. Maximum value for switching capacity



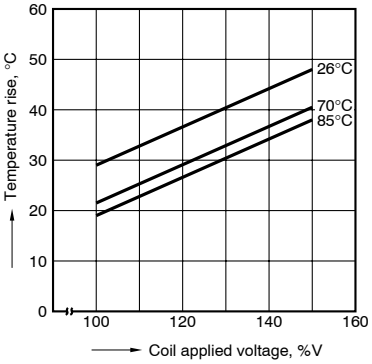
2. Operate/release time
Sample: 25 pcs., JS1-12V



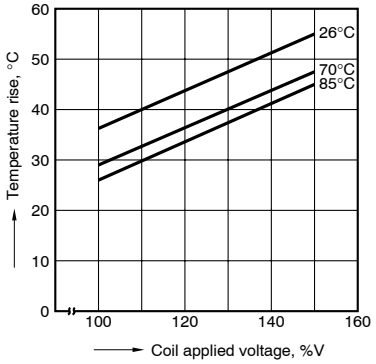
3. Life curve
Ambient temperature: Room temperature



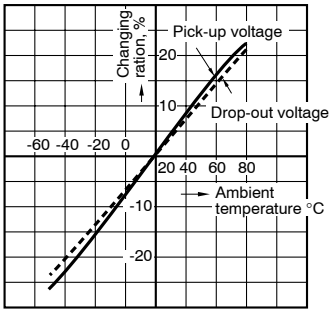
4-(1). Coil temperature rise
Sample: 5 pcs., JS1a-24V
Measured portion: Inside the coil
Contact current: 5 A



4-(2). Coil temperature rise
Sample: 5 pcs., JS1a-24V
Measured portion: Inside the coil
Contact current: 10 A

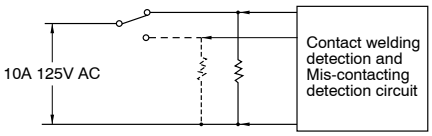


5. Ambient temperature characteristics
Sample: 6 pcs., JS1-12V

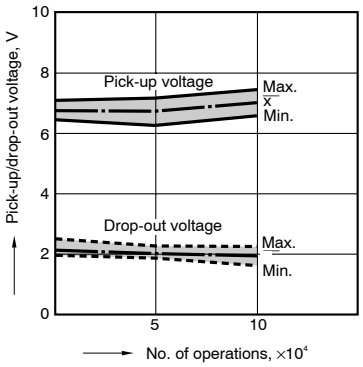


6. Electrical life test
(10 A 125 V AC, resistive load)
Sample: 6 pcs., JS1-12V
Operating speed: 20 cpm
Ambient temperature: room temperature

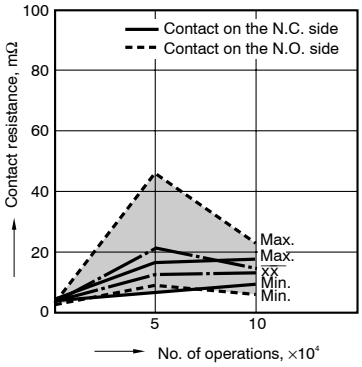
(Circuit)



Change of pick-up and drop-out voltage



Change of contact resistance



For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

SURGE VOLTAGE 6,000 V 30 AMP. RELAY

JT-V RELAYS

PCB type

TMP type

FEATURES

- **Surge withstand voltage: Min. 6,000 V**
- **High switching capacity — 30 A for 1 Form A**
- **2 contact arrangements — 1 Form A or 1 Form C**
- **"TMP" types available**
- **UL/C-UL recognized**
- **Class F types standard**

SPECIFICATIONS

Contacts

		PCB & TMP type	
Arrangement		1 Form A	1 Form C
Initial contact resistance, max. (By voltage drop method, 6 V DC 1 A)		50 mΩ	
Contact material		Silver alloy	
Rating	Max. switching power	8310 VA	N.C.: 2770 VA N.O.: 5540 VA
	Max. switching voltage	277 V AC	
	Max. switching current	30 A	N.C.: 10 A N.O.: 20 A
	Min. switching capacity#1	100 mA, 5 V DC	
Expected life	Mechanical	Min. 1×10^7	
	Electrical (Resistive load)	20 A 277 V AC Min. 1×10^5*	N.O.: 20 A 277 V AC Min. 1×10^5* N.C.: 10 A 277 V AC Min. 1×10^5*

* The life is for open venting-hole condition.

Coil at 20°C 68°F

	PCB & TMP type
Nominal operating power	Approx. 1,000 mW

Characteristics

		PCB & TMP type
Initial insulation resistance*1		Min. 100 MΩ at 500 V DC
Initial breakdown voltage*2	Between contacts	1,200 Vrms
	Between contacts and coil	3,500 Vrms
Initial surge voltage between contact and coil		Min. 6,000 V*3
Operate time*4 (at nominal voltage)		Max. 15 ms
Release time (without diode)*4 (at nominal voltage)		Max. 10 ms
Shock resistance	Functional*5	Min. 98 m/s² {10 G}
	Destructive*6	Min. 980 m/s² {100 G}
Vibration resistance	Functional*7	Max. 88.2 m/s² {9 G}, 10 to 55 Hz at double amplitude of 1.5 mm
	Destructive	Max. 117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–55°C to +85°C –67°F to +185°F
	Humidity	5 to 85% R.H.
Unit weight		PCB type: Approx. 25 g (.88 oz) TMP type: Approx. 30 g (1.06 oz)

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Intial breakdown voltage" section
*2 Detection current: 10 mA
*3 Ware is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981.
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

TYPICAL APPLICATIONS

- Oven
- Heating & ventilation
- Home appliance

ORDERING INFORMATION

JT-V Relays (PCB and TMP type)

JTV | 1a | S | TMP | 12V

Contact arrangement	Protective construction	Mounting classification	Coil voltage
1a: 1 Form A 1: 1 Form C	S: Sealed type G: Dust cover type	PA: PCB type TMP: TMP type	DC 12, 18, 24, 48 V

Notes: 1. UL/C-UL approved type is standard.
2. 5 V, 6 V, 9 V DC types are also available. Please contact us for details.
3. Standard packing: PCB type: Carton: 50 pcs. Case: 500 pcs.
TMP type: Carton: 50 pcs. Case: 300 pcs.

COIL DATA (at 20°C 68°F)

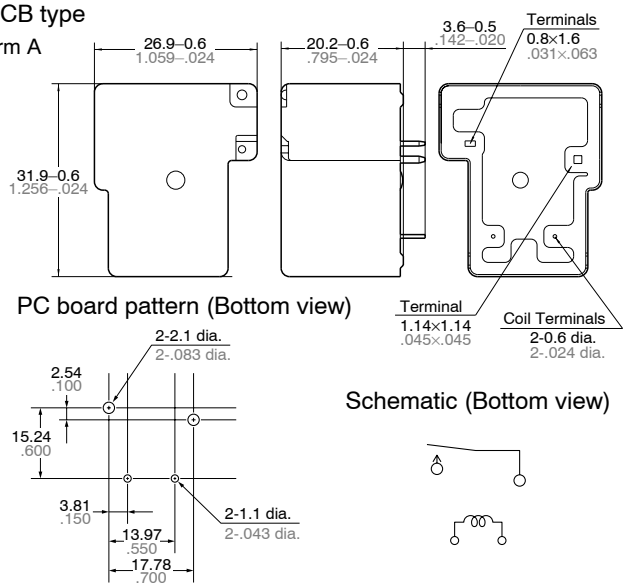
Nominal voltage, V DC	Pick-up voltage, V DC (max.) (Initial)	Drop-out voltage, V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 70°C 158°F)
			PCB & TMP	PCB & TMP	
12	9.0	1.2	144	1000	14.4
18	13.5	1.8	324	1000	21.6
24	18.0	2.4	576	1000	28.8
48	36.0	4.8	2304	1000	57.6

DIMENSIONS

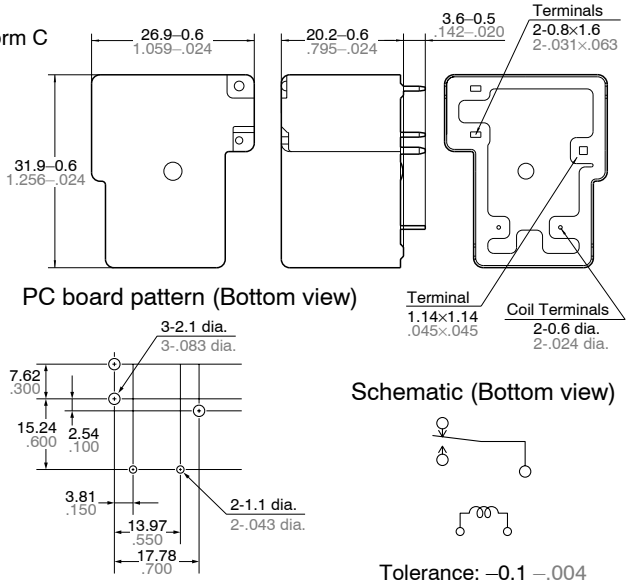
mm inch

1. PCB type

1 Form A



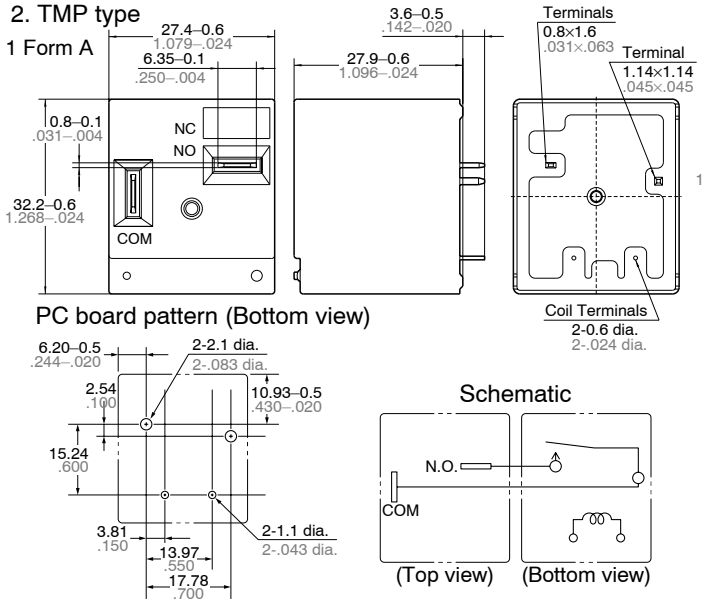
1 Form C



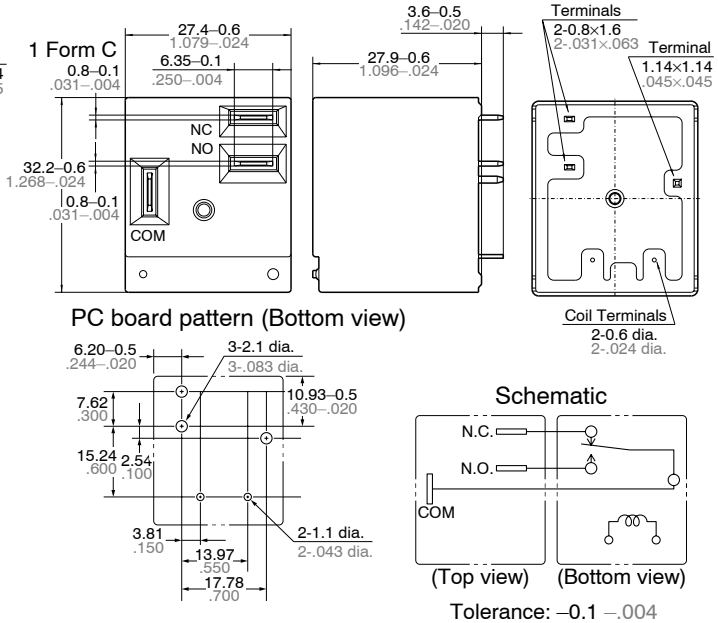
Tolerance: –0.1 –.004

2. TMP type

1 Form A



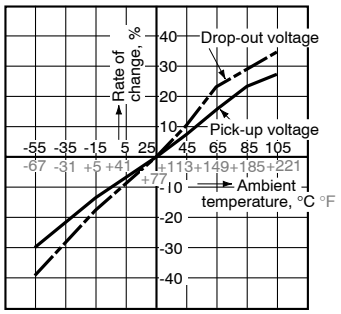
1 Form C



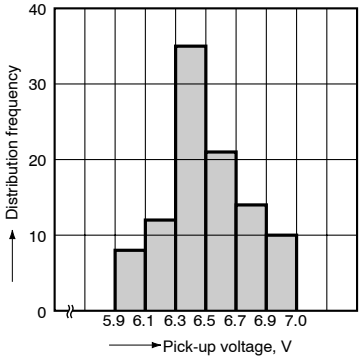
Tolerance: –0.1 –.004

REFERENCE DATA

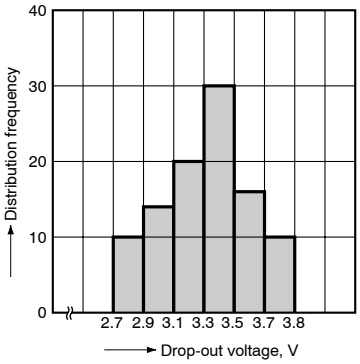
1. Change of rate of pick-up and drop-out voltage (at 20°C 68°F)
Sample: JTV1S-TMP-24V (6 pcs.)



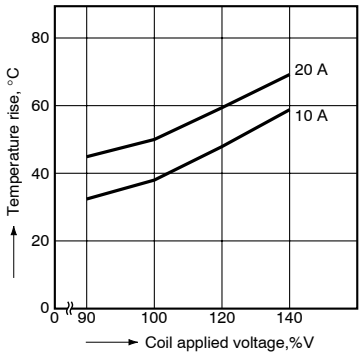
2. Distribution frequency of pick-up voltage (at 20°C 68°F)
Sample: JTV1S-TMP-12V (100 pcs.)



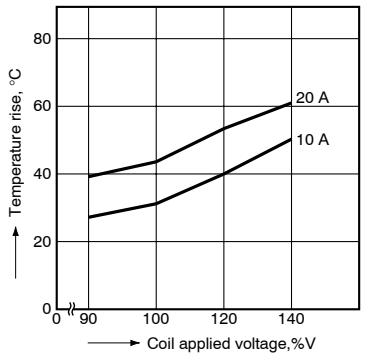
3. Distribution frequency of drop-out voltage (at 20°C 68°F)
Sample: JTV1S-TMP-12V (100 pcs.)



4.-(1) Coil temperature rise (TMP type)*
Ambient temperature: 25°C 77°F
Sample: JTV1aS-TMP-12V (6 pcs.)



Ambient temperature: 85°C 185°F
Sample: JTV1aS-TMP-12V (6 pcs.)



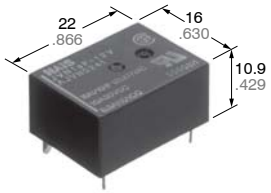
* Coil temperature rise of sealed types are same as data of the dust cover type.

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

COMPACT FLAT POWER RELAY FOR HEATER LOADS

JV-N RELAYS



FEATURES

• High 16 A capacity
The contacts are high capacity 16A, 125 V AC.

• Compact, flat type with low 10.9 mm .429 inch height
Compact flat type with low surface area of 16 × 22 mm .630 × .866 inch and height of 10.9 mm .429 inch.

• High sensitivity at 200 mW
High sensitivity at 200 mW coil power consumption.

• Represses contact terminal heat
The contact terminals are larger and thicker compared to the existing JV relay. This limits the rise in temperature of the terminals when there is a large current flowing to approx. 28°C 62°F (normal current of 16 A).

• Conforms to the various safety standards
UL/CSA, TÜV approved.

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		Max. 30 mΩ
Contact material		Silver alloy
Rating (resistive load)	Nominal switching capacity	16 A 125 V AC, 10 A 277 V AC 10 A 30 V DC, 10 A 125 V AC
	Max. switching power	2,770 VA, 300 W
	Max. switching voltage	277 V AC, 30 V DC
	Max. switching current	16 A (AC 125 V), 10 A (DC)
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. ope.) Mechanical (at 180 cpm)		2×10^7
Electrical at resistive load (at 20 cpm)	Sealed type 16 A 125 V AC, 10 A 30 V DC	10^5
	Flux-resistant type 10 A 125 V AC	3×10^5

Coil

Nominal operating power	200 mW (DC 4.5 to 48 V) 600 mW (DC 100 V)

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Excluding contact bounce time
*2 Excluding contact bounce time, without diode
*3 By resistive method; nominal voltage applied to the coil; contact carrying current: 16A, at 70°C 158°F
*4 Nominal voltage applied to the coil, at 60°C 140°F
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

Max. operating speed		20 cpm
Operate time*1 (at nominal voltage)		Max. 12 ms (DC 4.5 V to 48 V) Max. 8 ms (DC 100 V)
Release time*2 (at nominal voltage)		Max. 5 ms
Initial insulation resistance		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage (Detection current: 10 mA	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	2,500 Vrms for 1 min.
Surge voltage between contact and coil		Min. 4,500 V
Temperature rise		Max. 45°C (DC 4.5 V to 48 V) *3 Max. 55°C (DC 100 V)*4
Conditions in case of operation, transport and storage*8		Ambient temperature –40 to 70°C –40 to 158°F (DC 4.5 to 48 V) –40 to 60°C –40 to 140°F (DC 100V) Humidity: 5 to 85 % R.H. (Note freezing and condensing at low temperature) Air pressure: 86 to 106 kPa
Shock resistance	Functional	Min. 200 m/s²{20G}*5
	Destructive	Min. 1,000 m/s²{100G}*6
Vibration resistance	Functional	10 to 55 Hz *7 at double amplitude of 1.6 mm
	Destructive	10 to 55 Hz at double amplitude of 2 mm
Unit weight		Approx. 8g .28 oz

TYPICAL APPLICATIONS

- AV equipment: TV's, VTR's, etc.
- OA equipment
- HA equipment

ORDERING INFORMATIONS

Ex. JVN [1a] [F] – [4.5 V]

Contact arrangement	Protective construction	Coil voltage (DC)
1a: 1 Form A	Nil: Sealed type F: Flux-resistant type	4.5, 6, 9, 12, 18, 24, 48, 100 V

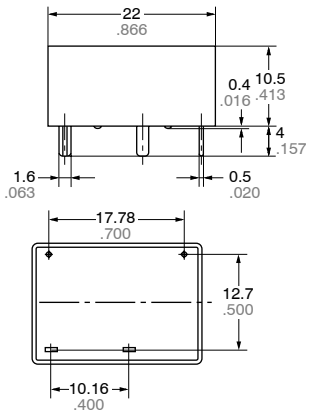
UL/CSA, TÜV approved type is standard.

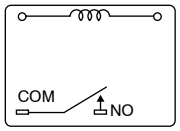
TYPES AND COIL DATA (at 20°C 68°F)

Part No.		Nominal voltage, V DC	Pick-up voltage V DC (max.)	Drop-out voltage V DC (min.)	Coil resistance, W (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC
Sealed type	Flux-resistant type							
JVN1a-4.5V	JVN1aF-4.5V	4.5	3.375	0.23	101	44.4	200	6.75
JVN1a-6V	JVN1aF-6V	6	4.5	0.3	180	33.3	200	9
JVN1a-9V	JVN1aF-9V	9	6.75	0.45	405	22.2	200	13.5
JVN1a-12V	JVN1aF-12V	12	9	0.6	720	16.7	200	18
JVN1a-18V	JVN1aF-18V	18	13.5	0.9	1,620	11.1	200	27
JVN1a-24V	JVN1aF-24V	24	18	1.2	2,880	8.3	200	36
JVN1a-48V	JVN1aF-48V	48	36	2.4	11,520	4.2	200	72
JVN1a-100V	JVN1aF-100V	100	60	4	16,600	6	600	110

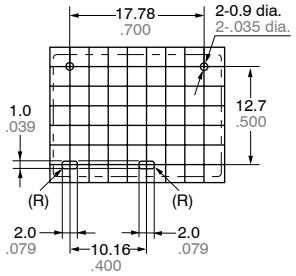
DIMENSIONS

mm inch





PC board pattern

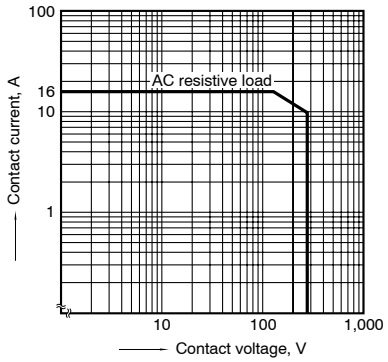


Dimension:

	General tolerance
Max. 1mm .039 inch:	±0.2 ±.008
1 to 5mm .039 to .197 inch:	±0.3 ±.012
Min. 5mm .197 inch:	±0.4 ±.016

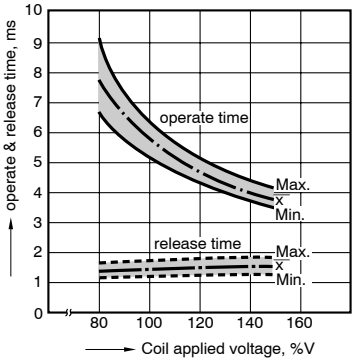
REFERENCE DATA

1. Max. switching power



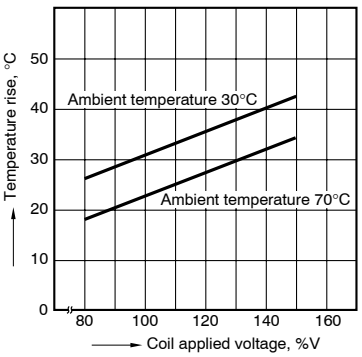
2. Operate/release time

Sample: JVN1aF-12 V, 6 pcs.



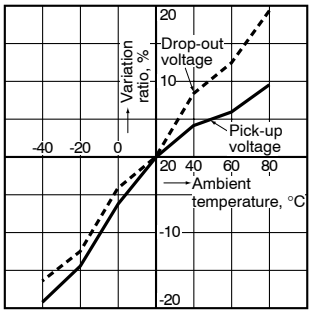
3. Coil temperature rise

Sample: JVN1aF-12 V, 6 pcs.
point measured: coil inside
Contact current: 16 A



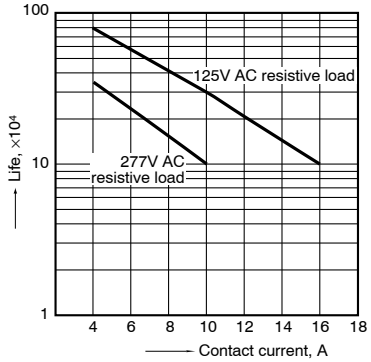
4. Ambient temperature characteristics

Sample: JVN1aF-12 V, 6 pcs.



5. Life curve

Operation frequency: 20 times/min.
Ambient temperature: room temperature

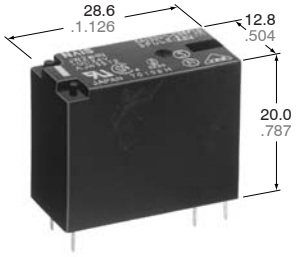


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

COMPACT PC BOARD POWER RELAY

JW RELAYS



mm inch

FEATURES

- **Miniature package with universal terminal footprint**
- **High dielectric withstanding for transient protection: 10,000 V surge in μs between coil and contact**
- **Sealed construction**
- **Class B coil insulation types available**
- **TV rated (TV-5) types available (only for 1 Form A type)**
- **VDE, TÜV, SEMKO, SEV, FIMKO, TV-5 also approved**

SPECIFICATIONS

Contact

		Standard type	High capacity type
Arrangement		1 Form A, 1 Form C, 2 Form A, 2 Form C	1 Form A, 1 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ	
Contact material		Silver alloy	
Rating (resistive load)	Nominal switching capacity	5 A 250 V AC, 5 A 30 V DC	10 A 250 V AC, 10 A 30 V DC
	Max. switching power	1,250 VA, 150 W	2,500 VA, 300 W
	Max. switching voltage	250 V AC, 30 V DC	
	Max. switching current	5 A	10 A
	Min. switching capacity#1	100 mA, 5 V DC	
Expected life (min. ope.)	Mechanical (at 180 cpm)	5×10^6	
	Electrical (at 6 cpm) (Resistive load)	10^5	

Coil

Nominal operating power	530 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Detection current: 10mA
*2 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).
*8 When using relays in a high ambient temperature, consider the pick-up voltage rise due to the high temperature (a rise of approx. 0.4% V for each 1°C 33.8°F with 20°C 68°F as a reference) and use a coil impressed voltage that is within the maximum allowable voltage range.

Characteristics

			Standard type	High capacity type
Max. operating speed (at rated load)			6 cpm	
Initial insulation resistance			Min. 1,000 MΩ at 500 V DC	
Initial breakdown voltage*1	Between open contacts		1,000 Vrms for 1 min.	
	Between contacts and coil		5,000 Vrms for 1 min.	
	Between contact sets		3,000 Vrms for 1 min. (2 Form A, 2 Form C)	
Initial surge voltage between contacts and coil*2			Min. 10,000 V	
Operate time*3 (at nominal voltage)			Max. 15 ms	
Release time (without diode)*3 (at nominal voltage)			Max. 5 ms	
Temperature rise (at 20°C) (at nominal voltage) (with nominal coil voltage and at nominal switching capacity)			1a: max. 39°C 1c, 2a, 2c: max. 55°C (resistance method)	1a: max. 45°C 1c: max. 55°C (resistance method)
Shock resistance	Functional*4		Min. 98 m/s² {10 G}	
	Destructive*5		Min. 980 m/s² {100 G}	
Vibration resistance	Functional*6		Approx. 98 m/s² {10 G}, 10 to 55 Hz at double amplitude of 1.6 mm	
	Destructive		Approx. 117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2.0 mm	
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)		Ambient temp.*8	–40°C to +85°C –40°F to +185°F	
		Humidity	5 to 85% R.H.	
Unit weight			Approx. 13 g .46 oz	

TYPICAL APPLICATIONS

1. Home appliances
   TV sets, VCR, Microwave ovens
2. Office machines
   Photocopiers, Vending machines
3. Industrial equipment
   NC machines, Robots, Temperature controllers

ORDERING INFORMATION

Ex. JW [1] [F] [S] [N] [B] [DC5V] — [ ]

Contact arrangement	Contact capacity	Protective construction	Pick-up voltage	Coil insulation class	Coil voltage	Environmental support
1: 1 Form C 1a: 1 Form A 2: 2 Form C 2a: 2 Form A	Nil: Standard (5 A) F: High capacity (10 A)*	S: Sealed type	N: 70% of nominal voltage	Nil: Class E insulation B: Class B insulation	DC 5, 6, 9, 12, 18, 24, 48 V	• RoHS Directive conforming type ($AgSnO_2$ type) F: 1a (Standard/High capacity) Nil: 1c (Standard/High capacity), 2a (Standard), 2c (Standard) • RoHS Directive non-conforming type (AgCdO type) Nil: 1a (Standard/High capacity)

*Only for 1 Form A and 1 Form C type
UL/CSA, VDE, SEMKO, FIMKO, SEV approved type is standard.
Notes: 1. When ordering TV rated (TV-5) types, add suffix-TV (available only for 1 Form A type).
2. Standard packing: Carton: 100 pcs. Case: 500 pcs.

TYPES

Standard (5A) types

Contact arrangement	Coil voltage, V DC	Part No.	Contact arrangement	Coil voltage, V DC	Part No.
1 Form A	5	JW1aSN-DC5V (-F)	2 Form A	5	JW2aSN-DC5V
	6	JW1aSN-DC6V (-F)		6	JW2aSN-DC6V
	9	JW1aSN-DC9V (-F)		9	JW2aSN-DC9V
	12	JW1aSN-DC12V (-F)		12	JW2aSN-DC12V
	18	JW1aSN-DC18V (-F)		18	JW2aSN-DC18V
	24	JW1aSN-DC24V (-F)		24	JW2aSN-DC24V
	48	JW1aSN-DC48V (-F)		48	JW2aSN-DC48V
1 Form C	5	JW1SN-DC5V	2 Form C	5	JW2SN-DC5V
	6	JW1SN-DC6V		6	JW2SN-DC6V
	9	JW1SN-DC9V		9	JW2SN-DC9V
	12	JW1SN-DC12V		12	JW2SN-DC12V
	18	JW1SN-DC18V		18	JW2SN-DC18V
	24	JW1SN-DC24V		24	JW2SN-DC24V
	48	JW1SN-DC48V		48	JW2SN-DC48V

High capacity (10 A) types

Contact arrangement	Coil voltage, V DC	Part No.	Contact arrangement	Coil voltage, V DC	Part No.
1 Form A	5	JW1aFSN-DC5V (-F)	1 Form C	5	JW1FSN-DC5V
	6	JW1aFSN-DC6V (-F)		6	JW1FSN-DC6V
	9	JW1aFSN-DC9V (-F)		9	JW1FSN-DC9V
	12	JW1aFSN-DC12V (-F)		12	JW1FSN-DC12V
	18	JW1aFSN-DC18V (-F)		18	JW1FSN-DC18V
	24	JW1aFSN-DC24V (-F)		24	JW1FSN-DC24V
	48	JW1aFSN-DC48V (-F)		48	JW1FSN-DC48V

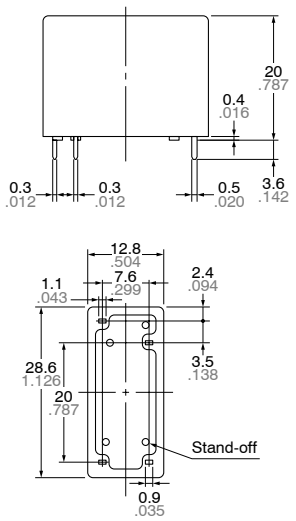
COIL DATA (at 20°C 68°F)

Nominal voltage, V DC	Pick-up voltage, V DC (max.) (Initial)	Drop-out voltage, V DC (min.) (Initial)	Nominal operating current, mA (±10%)	Coil resistance, W (±10%)	Nominal operating power, mW	Max. allowable voltage
5	3.5	0.5	106	47	530	130% V of Nominal Voltage (at 60°C 140°F) 120% V of Nominal Voltage (at 85°C 185°F)
6	4.2	0.6	88	68		
9	6.3	0.9	58	155		
12	8.4	1.2	44	270		
18	12.6	1.8	29	611		
24	16.8	2.4	22	1,100		
48	33.6	4.8	11	4,400		

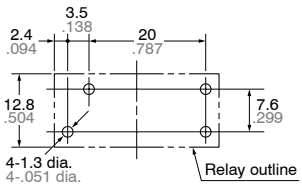
DIMENSIONS

mm inch

1 Form A

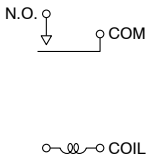


PC board pattern (Copper-side view)

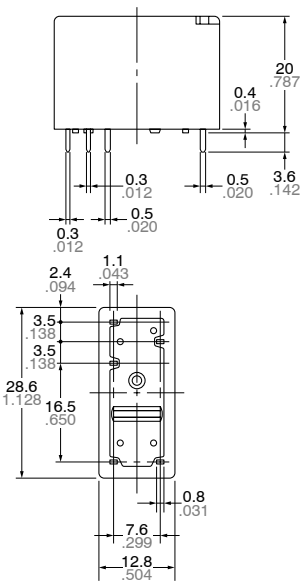


Tolerance: ±0.1 ±.004

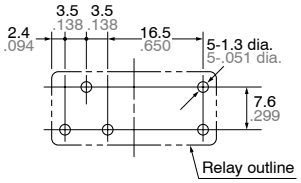
Wiring diagram (Bottom view)



1 Form C

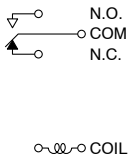


PC board pattern (Copper-side view)



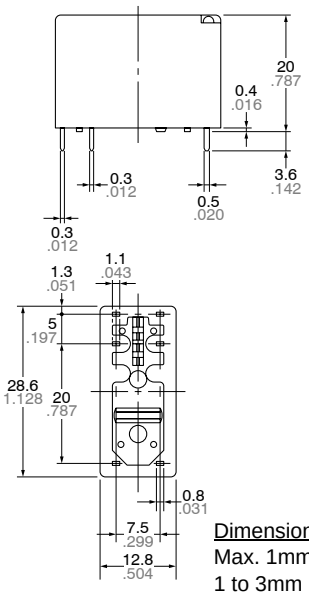
Tolerance: ±0.1 ±.004

Wiring diagram (Bottom view)

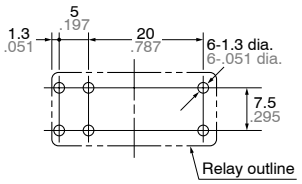


Dimension :	General tolerance
Max. 1mm .039 inch	±0.1 ±.004
1 to 3mm .039 to .118 inch	±0.2 ±.008
Min. 3mm .118 inch	±0.3 ±.012

2 Form A

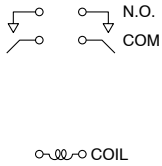


PC board pattern (Copper-side view)

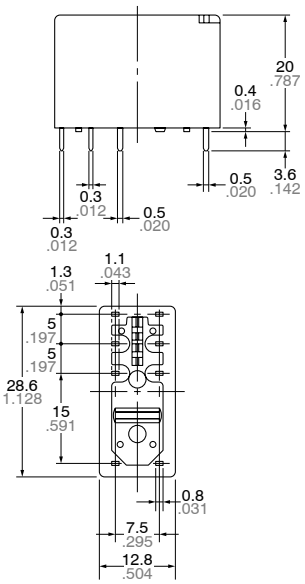


Tolerance: ±0.1 ±.004

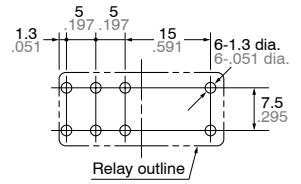
Wiring diagram (Bottom view)



2 Form C

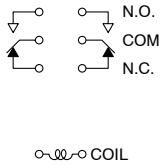


PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

Wiring diagram (Bottom view)

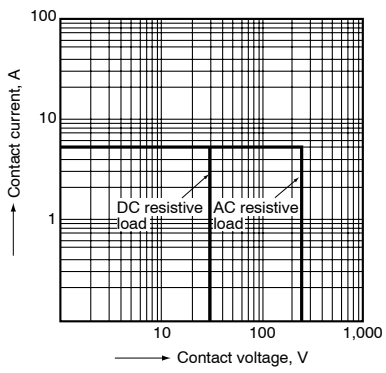


Dimension :	General tolerance
Max. 1mm .039 inch	±0.1 ±.004
1 to 3mm .039 to .118 inch	±0.2 ±.008
Min. 3mm .118 inch	±0.3 ±.012

REFERENCE DATA

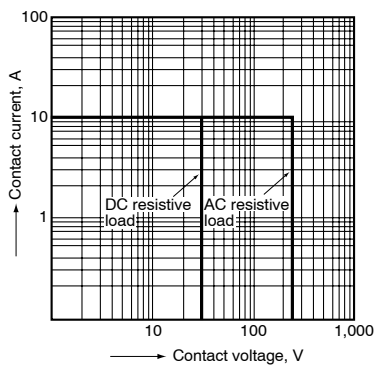
1-(1). Maximum operating power

1 Form A Standard (5 A) type



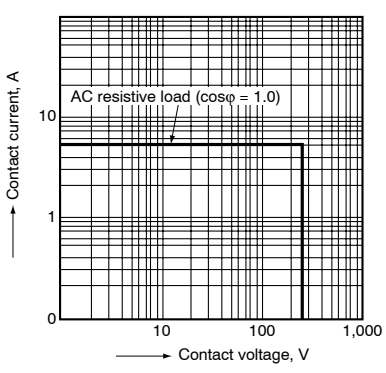
1-(2). Maximum operating power

1 Form A High Capacity (10 A) type

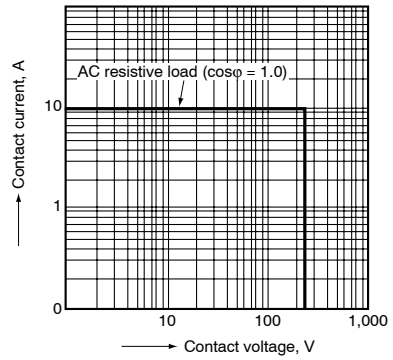


1-(3). Maximum operating power

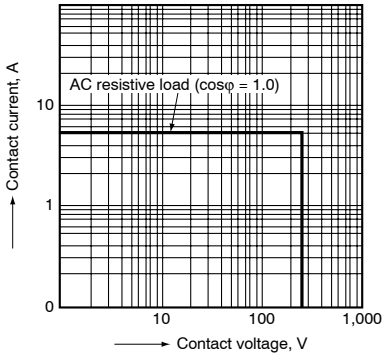
1 Form C Standard (5 A) type



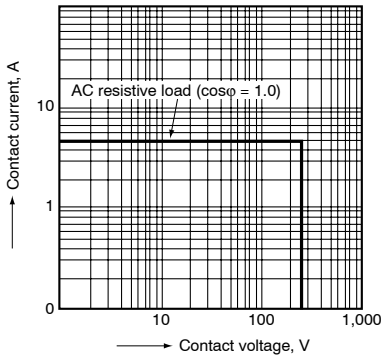
1-(4). Maximum operating power
1 Form C High Capacity (10 A) type



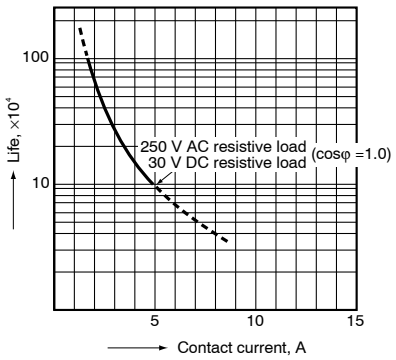
1-(5). Maximum operating power
2 Form A Standard (5 A) type



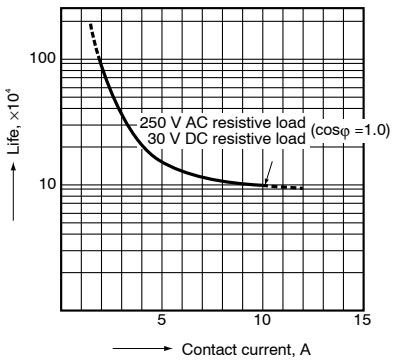
1-(6). Maximum operating power
2 Form C Standard (5 A) type



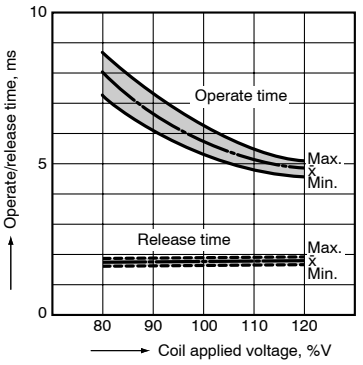
2-(1). Life curve
1 Form A Standard (5 A) type



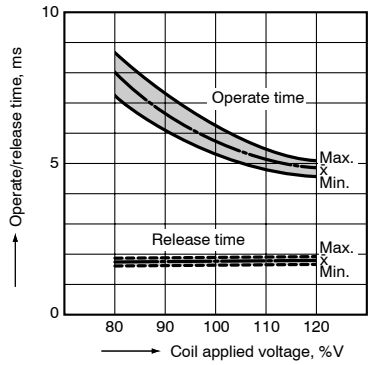
2-(2). Life curve
1 Form A High Capacity (10 A) type



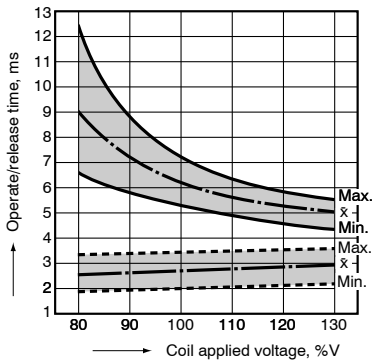
3-(1). Operate/release time
Sample: JW1aSN-DC12V, 10 pcs.
Ambient temperature: 20°C 68°F



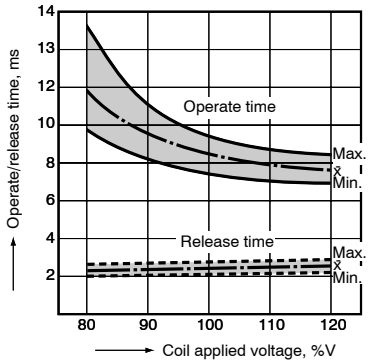
3-(2). Operate/release time
Sample: JW1aFSN-DC12V, 10 pcs.
Ambient temperature: 20°C 68°F



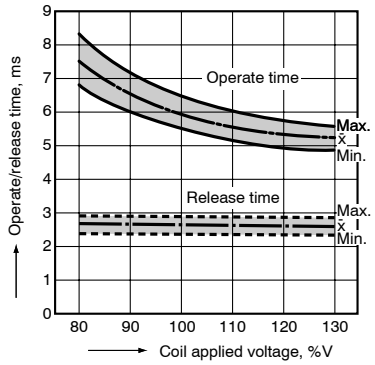
3-(3). Operate/release time
Sample: JW1SN-DC12V, 6 pcs.
Ambient temperature: 20°C 68°F



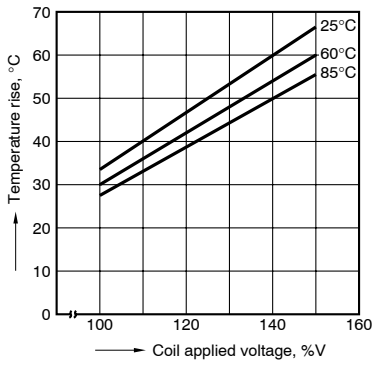
3-(4). Operate/release time
Sample: JW2aSN-DC24V, 6 pcs.
Ambient temperature: 20°C 68°F



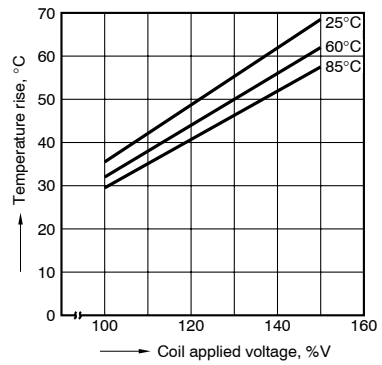
3-(5). Operate/release time
Sample: JW2SN-DC12V, 6 pcs.
Ambient temperature: 20°C 68°F



4-(1). Coil temperature rise
(Contact carrying current: 5A)
Sample JW1aFSN-DC12V, 6 pcs.
Point measured: Inside the coil



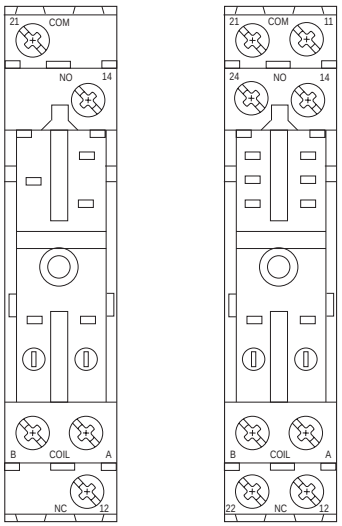
4-(2). Coil temperature rise
(Contact carrying current: 10 A)
Sample: JW1aFSN-DC12V, 6 pcs.
Point measured: Inside the coil



ACCESSORIES

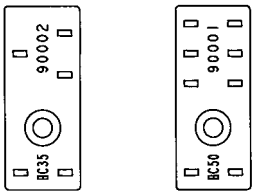
DIN terminal sockets

JW1SI **JW2SI**



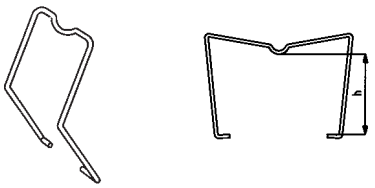
Plug-in sockets

JW1PI **JW2PI**



Retaining springs

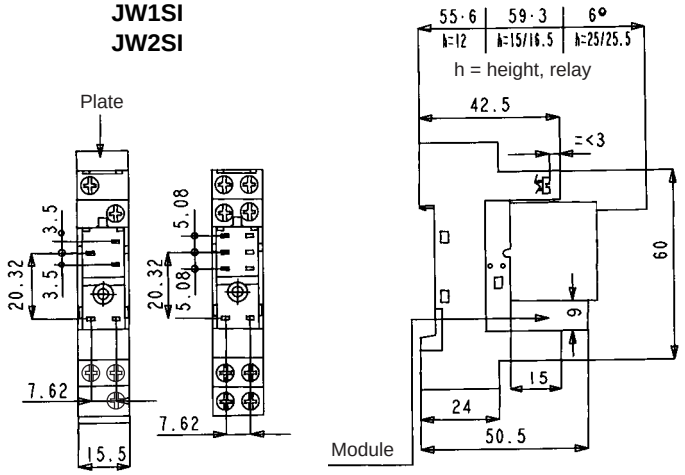
JWHFSI **JWHFI**



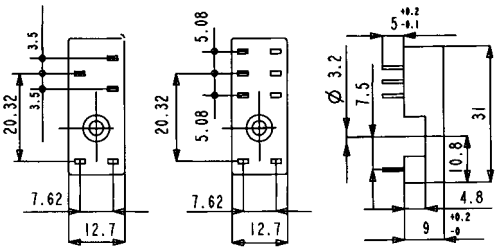
h (relay height) = 20.4 mm

DIMENSIONS

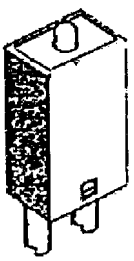
JW1SI
JW2SI

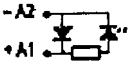
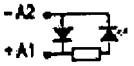
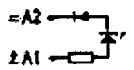
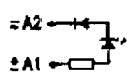


JW1PI **JW2PI**



MODULES supporting the JW relay



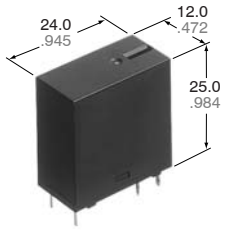
Description	Voltage	Schematic	LED color	Type
Module with diode and LED. Protection against inverting polarity plus illuminated signal.	6 / 24 V DC		LED red	42
	24 / 60 V DC		LED red	42 B
Module with signal LED. No protection against inverting polarity. AC or DC power supply possible.	6 / 24 V AC/DC		LED red	62
	24 / 60 V AC/DC		LED red	62B

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

2 Form A slim power relay

LA RELAYS (ALA)



mm inch

FEATURES

1. 2 Form A slim type
24(L) × 12(W) × 25(H) mm
.945(L)×.472(W)×.984(H) inch

2. 3A type and 5A TV type
3A type: Contact reliability and break performance best suited for protecting and switching speakers.
5A TV type: Tough against inrush current and optimal for turning on and off the power supply. Rated TV-4 (UL/CSA).

3. High insulation resistance
• Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch (In compliance with IEC65)
• Surge withstand voltage between contact and coil: 10,000 V or more.

4. High noise immunity realized by the card separation structure between contact and coil

5. Conforms to the various safety standards
• UL/CSA, VDE, TÜV, SEMKO, SEV approved

SPECIFICATIONS

Contact

Type		3A rated	5A TV rated
Arrangement		2 Form A	
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		Max. 50 mΩ	Max. 100 mΩ
Contact material		Gold-clad silver alloy	Silver alloy
Rating (resistive load)	Nominal switching capacity	3 A 125 V AC	5 A 277 V AC
	Max. switching power	625 VA	1,385 V A
	Max. switching voltage	125 V AC	277 V AC
	Max. switching current	5 A (AC)	
	Min. switching capacity#1	100 mA, 5 V DC	
Expected life (min. operations)	Mechanical (at 180 cpm)	10^6	
	Electrical (at 20 cpm) (at rated load)	5×10^4 (ON: OFF=1.5s: 1.5s)	

Coil

Nominal operating power	530 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50ms according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

Type		3A rated	5A TV rated
Max. operating speed		20 cpm	
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)	
Initial *2 breakdown voltage	Between contact sets	1,000 Vrms for 1 min.	
	Between open contacts	1,000 Vrms for 1 min.	
	Between contact and coil	4,000 Vrms for 1 min.	
Surge voltage between contact and coil*3		Min. 10,000 V	
Operate time*4 (at nominal voltage)		Max. 15ms (at 20°C 68°F)	
Release time (with diode)*4 (at nominal voltage)		Max. 15ms (at 20°C 68°F)	
Temperature rise (at 70°C)		Max. 45°C with nominal coil voltage and at 3 A contact carrying current	Max. 45°C with nominal coil voltage and at 5 A contact carrying current
Shock resistance	Functional*5	Min. 200 m/s²{approx. 20 G}	
	Destructive*6	Min. 1,000 m/s²{approx. 100 G}	
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm	
	Destructive	10 to 55Hz at double amplitude of 1.5mm	
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F	
	Humidity	5 to 85% R.H.	
	Air pressure	86 to 106 kPa	
Unit weight		Approx. 13 g .46 oz	

ORDERING INFORMATION

Ex. A | LA | 2 | P | F | 12

Product name	Contact arrangement	Contact capacity	Protective construction	Coil voltage(V DC)
LA	2: 2 Form A	Nil: 3A P: 5A TV-4	F: Flux-resistant type	12, 24

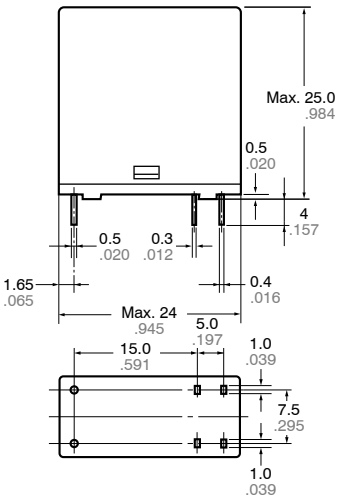
UL/CSA, VDE, TÜV, SEMKO, TV-4 approved type is standard.
Notes: 1. Standard packing Carton: 100 pcs. Case: 500 pcs.
2. 4.5V, 5V, 9V and 18V DC types are also available. Please consult us for details.

TYPES AND COIL DATA (at 20°C 68°F)

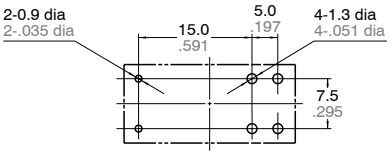
Part No.		Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Maximum allowable voltage, V DC
3 A type	5A TV type							
ALA2F12	ALA2PF12	12	(Initial) 9	(Initial) 0.6	272	44.2	530	15.6
ALA2F24	ALA2PF24	24	(Initial) 18	(Initial) 1.2	1,087	22.1	530	31.2

DIMENSIONS

mm inch



PC board pattern (Bottom view)



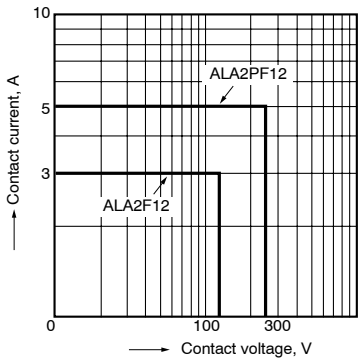
Tolerance : ±0.1 ±.004

Schematic (Bottom view)

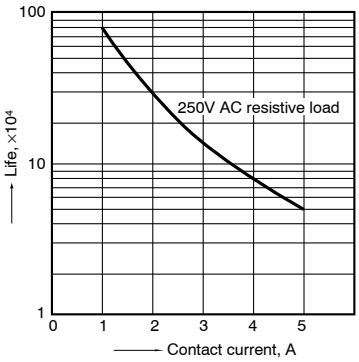
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

REFERENCE DATA

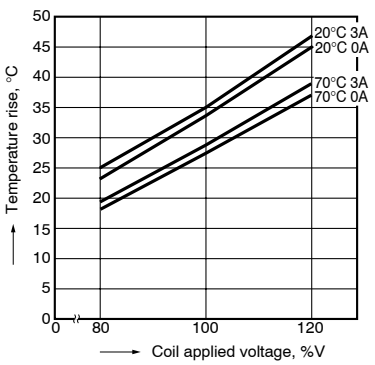
1. Max. switching power (AC resistive load)



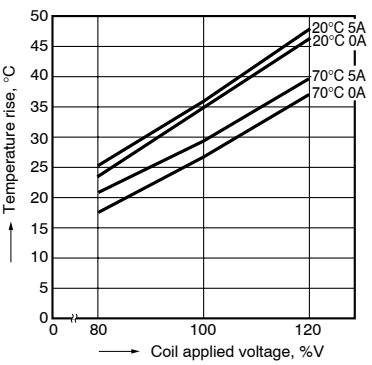
2. Life curve (250 V AC resistive load)



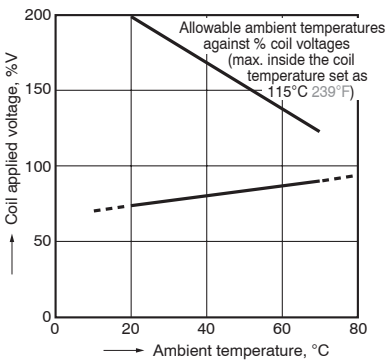
3-(1). Coil temperature rise
Sample: ALA2F12, 6 pcs.
Measured portion: coil inside
Contact current: 0 A, 3A



3-(2). Coil temperature rise
Sample: ALA2PF12, 6 pcs.
Measured portion: coil inside
Contact current: 0 A, 5A

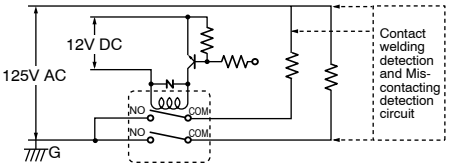


4. Ambient temperature characteristics and coil applied voltage
Contact current: ALA2F=3A
ALA2PF=5A

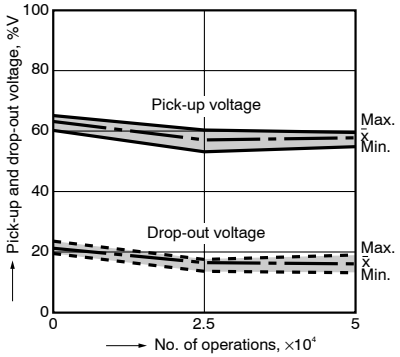


5-(1). Electrical life test
(3 A 125 V AC, resistive load)
Sample: ALA2F12, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 20°C 68°F

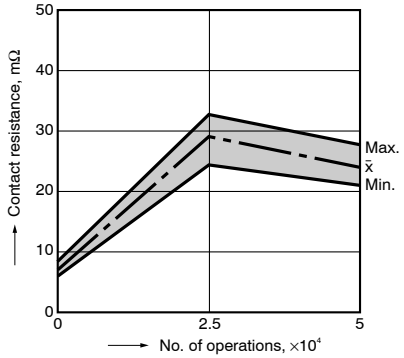
Circuit:



Change of pick-up and drop-out voltage

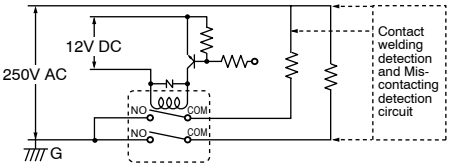


Change of contact resistance

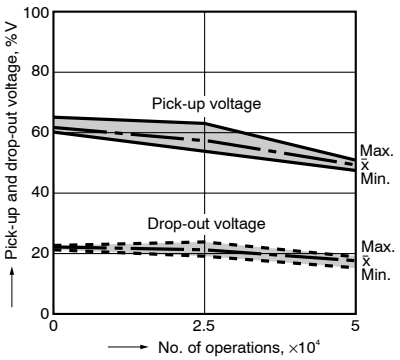


5-(2). Electrical life test
(5 A 250 V AC, resistive load)
Sample: ALA2PF12, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 20°C 68°F

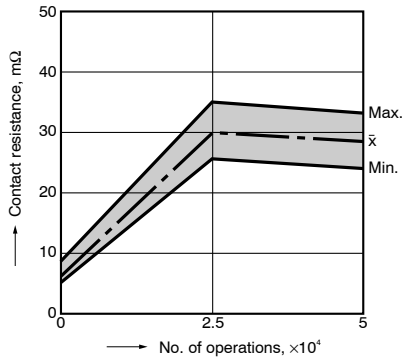
Circuit:



Change of pick-up and drop-out voltage

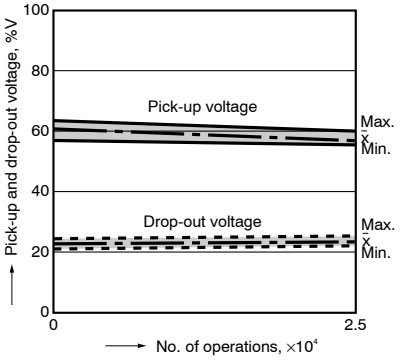


Change of contact resistance

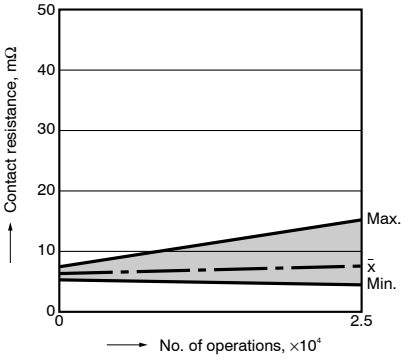


5-(3). Electrical life test
(UL lamp load test TV-4)
Tested sample: ALA2PF12, 6 pcs.
• Overload test
Load: 6.0 A 120 V AC (60 Hz),
Inrush: 91 A
Operation frequency: 10 times/min
(ON: OFF = 1 s: 5 s)
No. of operations: 50 ope.
• Endurance test
Load: 4A 120 V AC (60 Hz),
Inrush: 65 A
Operation frequency: 10 times/min
(ON: OFF = 1 s: 5 s)
No. of operations: 25,000 ope.

Change of pick-up and drop-out voltage



Change of contact resistance

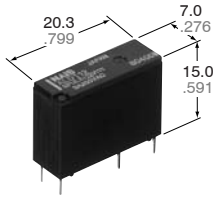


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

1 Form A Slim Power Relay

LD RELAYS (ALD)



mm inch

FEATURES

1. Slim type: Width 7 mm .276 inch.
20.3(L)×7.0(W)×15.0(H) mm
.799(L)×.276(W)×.591(H) inch

2. Perfect for small load switching of home appliances
10^5 switching operations possible with a 3A 250V AC resistive load.

3. Low operating power
Compact size, nominal operating power as low as 200mW.

4. High shock resistance
The relay withstands a functional shock resistance of 300m/s² [approx. 30 G more]

5. High insulation resistance
• Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch (In compliance with IEC65)
• Surge withstand voltage between contact and coil: 10,000 V or more.

6. UL/CSA, VDE, TÜV approved.

SPECIFICATIONS

Contact

Arrangement			1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			Max. 100 mΩ
Contact material			Silver alloy
Rating (resistive load)	Nominal switching capacity		3 A 277 V AC, 3 A 30V DC
	Max. switching power		831 V A (AC), 90W (DC)
	Max. switching voltage		277 V AC, 30 V DC
	Max. switching current		3 A
	Min. switching capacity#1		100 mA, 5 V DC
Expected life (min.operations)	Mechanical (at 180 cpm)		5×10^6
	Electrical (at 20 cpm) (at rated load)	3A 125V AC, 3A 30V DC	2×10^5
		3A 250V AC	10^5
		5A 250V AC	5×10^4

Coil

Nominal operating power	200 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2×50ms according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial*2 breakdown voltage	Between open contacts	750 Vrms for 1 min.
	Between contact and coil	4,000 Vrms for 1 min.
Initial surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Max. 10ms (at 20°C 68°F)
Release time (with diode)*4 (at nominal voltage)		Max. 10ms (at 20°C 68°F)
Temperature rise (at 70°C 158°F)		Max. 45°C with nominal coil voltage and at 3 A contact carrying current (resistance method)
Shock resistance	Functional*5	Min. 300 m/s²{approx. 30 G}
	Destructive*6	Min. 1,000 m/s²{approx. 100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 4 g .14 oz

TYPICAL APPLICATIONS

- **Air conditioner**
- **Refrigerator**
- **Hot water units**
- **Microwave ovens**
- **Fan heaters**

ORDERING INFORMATION

Ex. A | LD | 1 | 12 | W

Product name	Contact arrangement	Coil voltage (V DC)	Packing style
LD	1: 1 Form A	4H: 4.5, 09: 9, 24: 24 05: 5, 12: 12 06: 6, 18: 18	Nil: Tube packing W: Carton packing

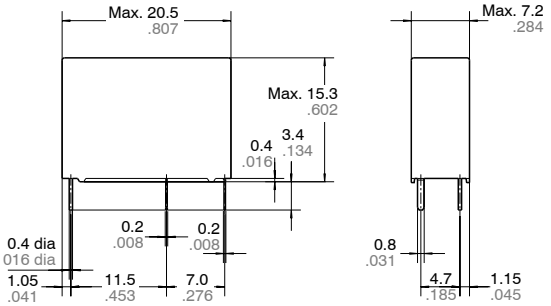
UL/CSA, TÜV, VDE approved type is standard.
Note: Tube packing: Tube: 50pcs, Case: 1,000pcs
Carton packing: Carton: 100pcs, Case: 500pcs

TYPES AND COIL DATA (at 20°C 68°F)

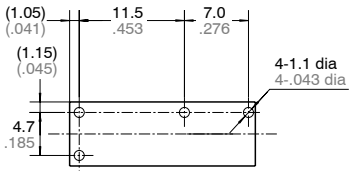
Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (Initial)	Drop-out voltage, V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Maximum allowable voltage, V DC (at 20°C 68°F)
ALD14H	4.5	3.38	0.22	101	44.6	200	5.85
ALD105	5	3.75	0.25	125	40.0	200	6.5
ALD106	6	4.5	0.3	180	33.3	200	7.8
ALD109	9	6.75	0.45	405	22.2	200	11.7
ALD112	12	9	0.6	720	16.7	200	15.6
ALD118	18	13.5	0.9	1,620	11.1	200	23.4
ALD124	24	18	1.2	2,880	8.3	200	31.2

DIMENSIONS

mm inch

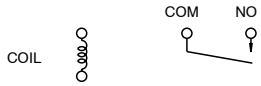


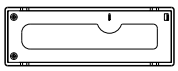
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



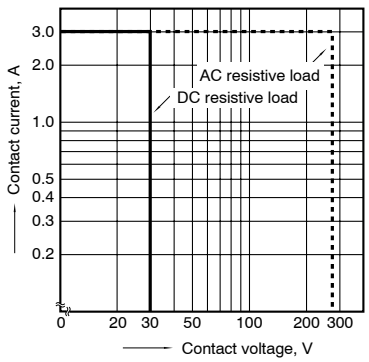


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

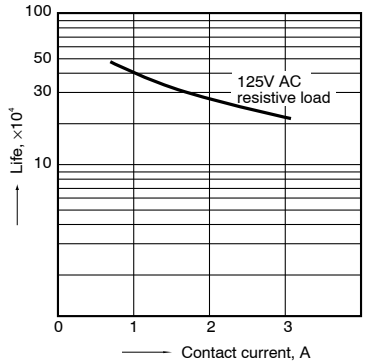
Power

REFERENCE DATA

1. Max. switching power

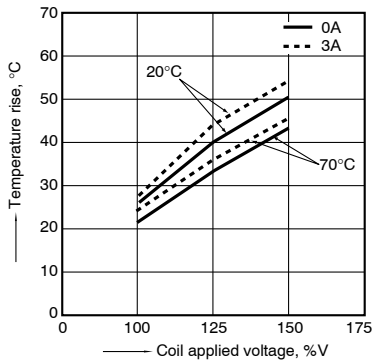


2. Life curve



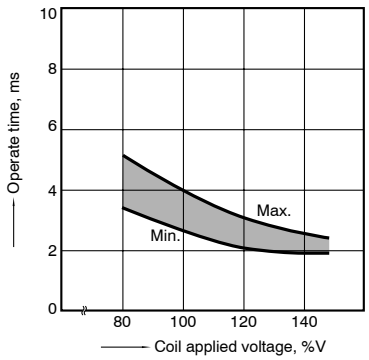
3. Coil temperature rise

Sample: ALD112, 6 pcs.
Point measured: inside the coil
Contact current: 0 A, 3 A



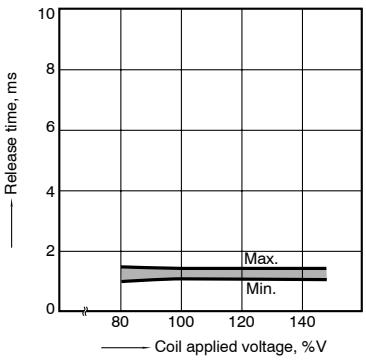
4-(1). Operate time

Sample: ALD112, 6 pcs.



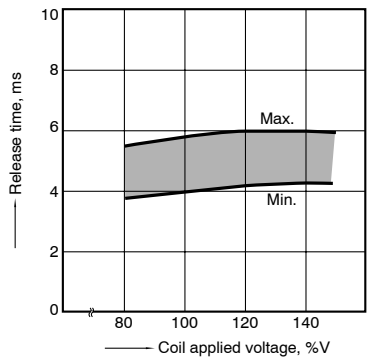
4-(2). Release time (without diode)

Sample: ALD112, 6 pcs.

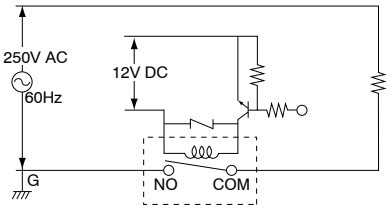


4-(3). Release time (with diode)

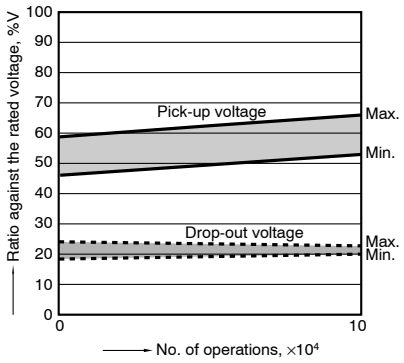
Sample: ALD112, 6 pcs.



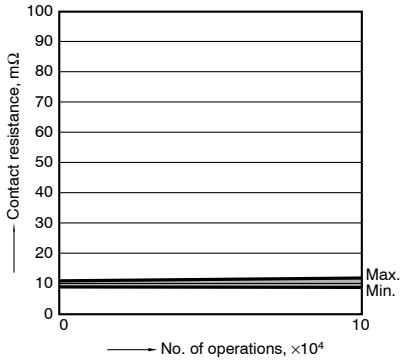
5-(1). Electrical life test
(3 A 250 V AC, resistive load)
Sample: ALD112, 6 pcs.
Operating speed: 20 cpm
Ambient temperature: room temperature
circuit:



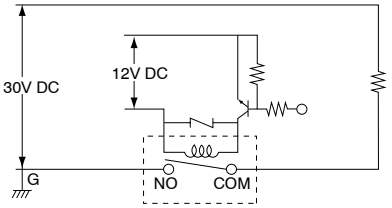
Change of pick-up and drop-out voltage



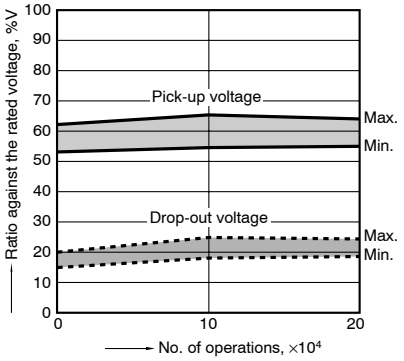
Change of contact resistance



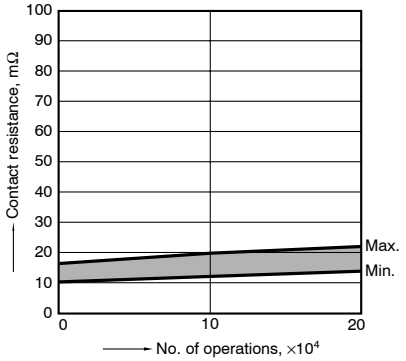
5-(2). Electrical life test
(3 A 30 V DC, resistive load)
Sample: ALD112, 6 pcs.
Operating speed: 20 cpm
Ambient temperature: room temperature
circuit:



Change of pick-up and drop-out voltage



Change of contact resistance

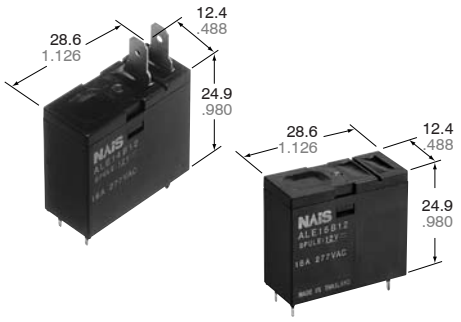


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

16A Power Relay For Micro wave oven

LE RELAYS (ALE)



mm inch

FEATURES

1. Ideal for magnetron and heater loads

2. Excellent heat resistance
- This satisfies UL coil insulation class B/ class F available

3. High insulation resistance
- Creepage distance and clearances between contact and coil: Min. 8 mm .315 inch
- Surge withstand voltage: Min. 10,000V

4. Low operating power
- Nominal operating power: 400mW/ 200mW (High sensitive type)

5. A wide variety of types
- Product line consists of 4 types with different shapes and pins

6. Conforms to the various safety standards:
- UL/CSA, TÜV, VDE approved and SEMKO available

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ
Contact material		Silver alloy
Rating (resistive load)	Nominal switching capacity	16 A 277 V AC
	Max. switching power	4,432 V A
	Max. switching voltage	277 V AC
	Max. switching current	16 A
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	2×10^6
	Electrical (at 20 cpm) (Resistive load)	10^5

Coil

Type	Standard	High sensitive
Nominal operating power	400 mW	200 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

Max. operating speed (at rated load)		20 cpm
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	4,000 Vrms for 1 min.
Initial surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage) (at 20°C 68°F)		Max. 20ms
Release time (with diode)*4 (at nominal voltage) (at 20°C 68°F)		Max. 20ms Max. 25ms (200 mW type)
Temperature rise (at nominal voltage) (resistance method, contact current 16 A, 20°C 68°F)		Max. 55°C Max. 45°C (200 mW type)
Shock resistance	Functional*5	Min. 200 m/s²{20 G}
	Destructive*6	Min. 1,000 m/s²{100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +85°C –40°F to +185°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 17 g .60 oz

TYPICAL APPLICATIONS

- **Microwave ovens**
- **Refrigerators**
- **OA equipment**

ORDERING INFORMATION

Ex. A | LE | 1 | 2 | B | 12

Product name	Contact arrangement	Terminal shape	Coil insulation class	Coil voltage, V DC
LE	1: 1 Form A 7: 1 Form A (200 mW)	2: TMP type/PCB side three terminals (includes one dummy terminal) 3: TMP type/PCB side three terminals 4: TMP type/PCB side four terminals 5: PCB type (No tab terminals)	B: Class B insulation F: Class F insulation	05: 5 18: 18 06: 6 24: 24 09: 9 48: 48 12: 12

UL/CSA, TÜV, VDE approved type is standard.
Note: Standard packing; Carton: 100 pcs. Case 500 pcs.

Power

TYPES

1. Standard type

Contact arrangement	Coil voltage, V DC	TMP type/PCB side three terminals (includes one dummy terminal)	TMP type/PCB side three terminals	TMP type/PCB side four terminals	PCB type (No tab terminals)
		Part No.	Part No.	Part No.	Part No.
1 Form A	5	ALE12❍05	ALE13❍05	ALE14❍05	ALE15❍05
	6	ALE12❍06	ALE13❍06	ALE14❍06	ALE15❍06
	9	ALE12❍09	ALE13❍09	ALE14❍09	ALE15❍09
	12	ALE12❍12	ALE13❍12	ALE14❍12	ALE15❍12
	18	ALE12❍18	ALE13❍18	ALE14❍18	ALE15❍18
	24	ALE12❍24	ALE13❍24	ALE14❍24	ALE15❍24
	48	ALE12❍48	ALE13❍48	ALE14❍48	ALE15❍48

❍: Input the following letter. Class B: B, Class F: F

2. High sensitive type

Contact arrangement	Coil voltage, V DC	TMP type/PCB side three terminals (includes one dummy terminal)	TMP type/PCB side three terminals	TMP type/PCB side four terminals	PCB type (No tab terminals)
		Part No.	Part No.	Part No.	Part No.
1 Form A (High sensitivity: 200mW)	5	ALE72❍05	ALE73❍05	ALE74❍05	ALE75❍05
	6	ALE72❍06	ALE73❍06	ALE74❍06	ALE75❍06
	9	ALE72❍09	ALE73❍09	ALE74❍09	ALE75❍09
	12	ALE72❍12	ALE73❍12	ALE74❍12	ALE75❍12
	18	ALE72❍18	ALE73❍18	ALE74❍18	ALE75❍18
	24	ALE72❍24	ALE73❍24	ALE74❍24	ALE75❍24
	48	ALE72❍48	ALE73❍48	ALE74❍48	ALE75❍48

❍: Input the following letter. Class B: B, Class F: F

COIL DATA (at 20°C 68°F)

1. Standard type

Nominal voltage, V DC	Pick-up voltage, V DC (max.) (at 20°C 68°F)	Drop-out voltage, V DC (min.) (at 20°C 68°F)	Coil resistance, Ω (±10%) (at 20°C 68°F)	Nominal operating current, mA (±10%) (at 20°C 68°F)	Nominal operating power, mW (at 20°C 68°F)	Maximum allowable voltage, V DC (at 20°C 68°F)
5	3.75	0.25	63	80	400	7.25
6	4.5	0.3	90	66.7		8.7
9	6.75	0.45	203	44.4		13.05
12	9	0.6	360	33.3		17.4
18	13.5	0.9	810	22.2		26.1
24	18	1.2	1,440	16.7		34.8
48	36	2.4	5,760	8.3		69.6

2. High sensitive type

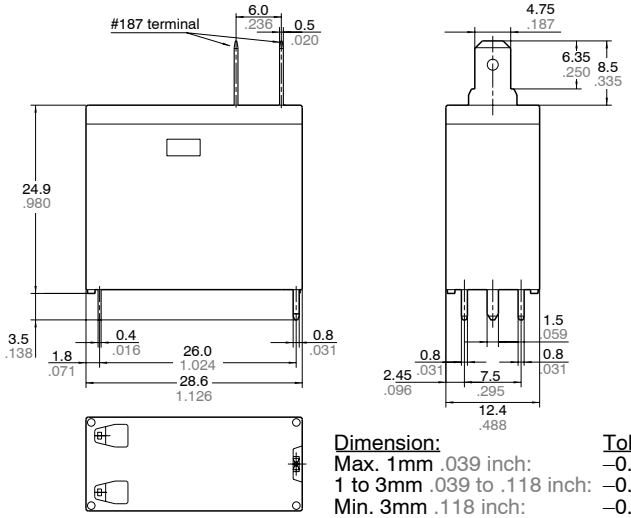
Nominal voltage, V DC	Pick-up voltage, V DC (max.) (at 20°C 68°F)	Drop-out voltage, V DC (min.) (at 20°C 68°F)	Coil resistance, Ω (±10%) (at 20°C 68°F)	Nominal operating current, mA (±10%) (at 20°C 68°F)	Nominal operating power, mW (at 20°C 68°F)	Maximum allowable voltage, V DC (at 20°C 68°F)
5	3.75	0.25	125	40	200	7.25
6	4.5	0.3	180	33.3		8.7
9	6.75	0.45	405	22.2		13.05
12	9	0.6	720	16.7		17.4
18	13.5	0.9	1,620	11.1		26.1
24	18	1.2	2,880	8.3		34.8
48	36	2.4	11,520	4.2		69.6

DIMENSIONS

mm inch

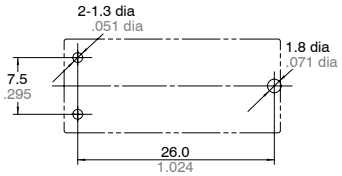
1. TMP type

PCB side three terminals
(includes one dummy terminal)



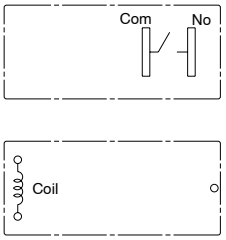
Dimension:	Tolerance
Max. 1mm .039 inch:	–0.1 –.004
1 to 3mm .039 to .118 inch:	–0.2 –.008
Min. 3mm .118 inch:	–0.3 –.012

PC board pattern (Bottom view)

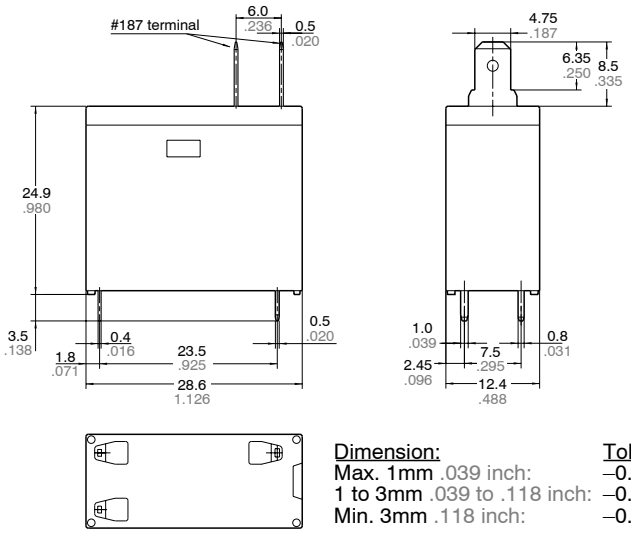


Tolerance : –0.1 –.004

Schematic (Bottom view)

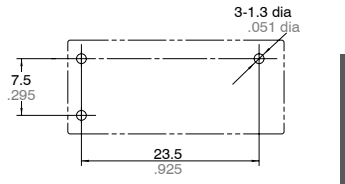


PCB side three terminals



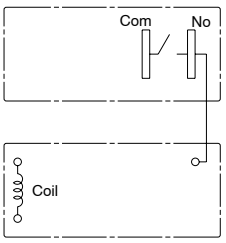
Dimension:	Tolerance
Max. 1mm .039 inch:	–0.1 –.004
1 to 3mm .039 to .118 inch:	–0.2 –.008
Min. 3mm .118 inch:	–0.3 –.012

PC board pattern (Bottom view)

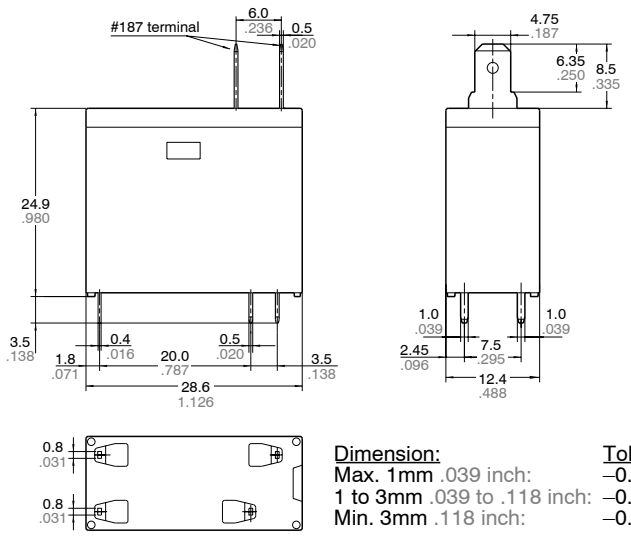


Tolerance : –0.1 –.004

Schematic (Bottom view)

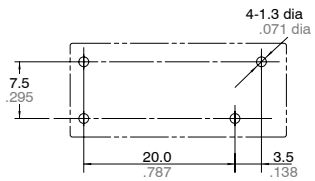


PCB side four terminals



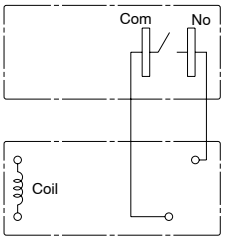
Dimension:	Tolerance
Max. 1mm .039 inch:	–0.1 –.004
1 to 3mm .039 to .118 inch:	–0.2 –.008
Min. 3mm .118 inch:	–0.3 –.012

PC board pattern (Bottom view)



Tolerance : –0.1 –.004

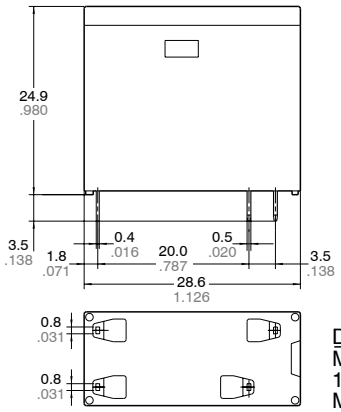
Schematic (Bottom view)

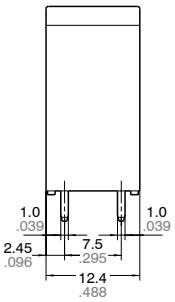


2. PCB type

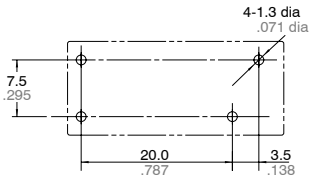
PCB side four terminals
(No tab terminals)

mm inch





PC board pattern (Bottom view)



Tolerance : –0.1 –.004

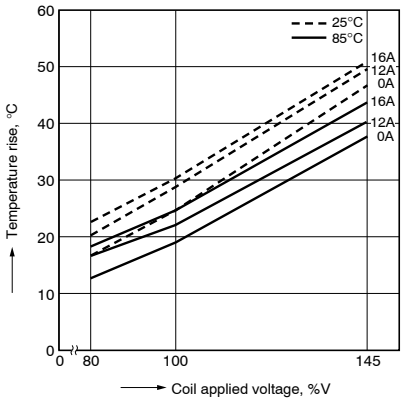
Dimension:	Tolerance
Max. 1mm .039 inch:	–0.1 –.004
1 to 3mm .039 to .118 inch:	–0.2 –.008
Min. 3mm .118 inch:	–0.3 –.012

Schematic (Bottom view)

REFERENCE DATA

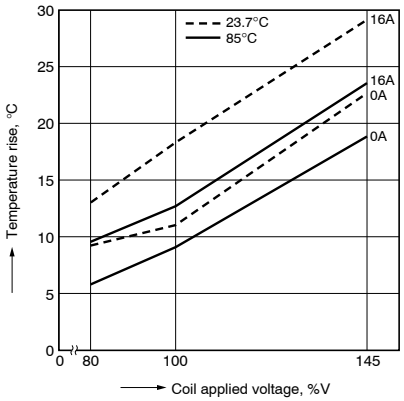
1-1. Coil temperature rise (400mW type)

Sample: ALE15B12, 6 pcs.
Point measured: coil inside
Ambient temperature: 25°C 77°F, 85°C 185°F

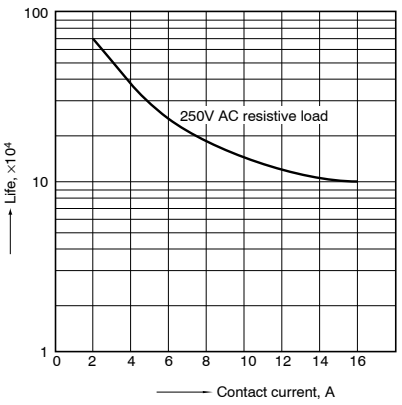


1-2. Coil temperature rise (200mW type)

Sample: ALE75B12, 6 pcs.
Point measured: coil inside
Ambient temperature: 23.7°C 74.66°F, 85°C 185°F

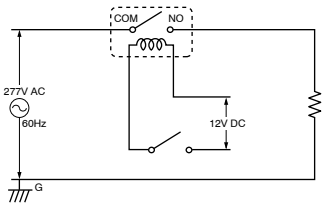


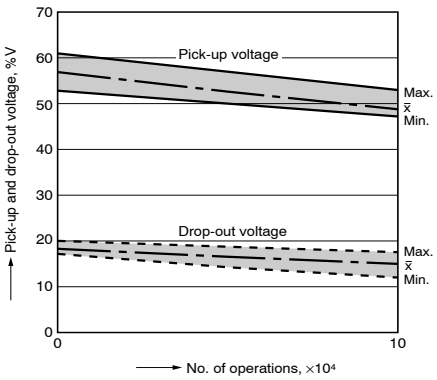
2. Life curve



3. Electrical life test (16 A 277 V AC, resistive load)

Sample: ALE15B12, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: Room temperature
Circuit:



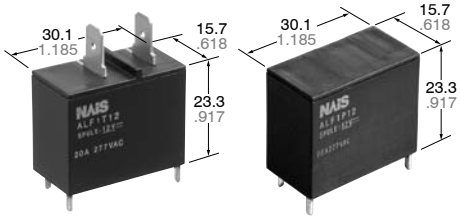


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

20A Power Relay For Home appliances

LF RELAYS (ALF)



TMP type PCB type

mm inch

FEATURES

1. Ideal for compressor and inverter loads

1) Compressor load: 20A 250V AC
2) Inverter load: 20A 100V AC,
10A 200V AC

2. High insulation resistance

- Creepage distance and clearances between contact and coil;
  Creepage Min. 9.5mm .374inch/
  Clearance Min. 8mm .315inch
- Surge withstand voltage: Min. 10,000V

3. "PCB" and "TMP" types available

4. Conforms to the various safety standards:

UL/CSA, TÜV, VDE approved

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ
Contact material		Silver alloy
Rating (resistive load)	Nominal switching capacity	20 A 250V AC
	Max. switching power	6,250 V A
	Max. switching voltage	250V AC
	Max. switching current	25 A
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	2×10^6
	Electrical (at 20 cpm) (Resistive load)	10^5

Coil

Nominal operating power	900 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

Max. operating speed (at rated load)		20 cpm
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	5,000 Vrms for 1 min.
Surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Approx. 15ms
Release time (without diode)*4 (at nominal voltage)		Approx. 15ms
Temperature rise (at nominal voltage)		Max. 45°C (resistance method, contact current 20 A, rated coil voltage, 60°C 140°F)
Shock resistance	Functional*5	Min. 100 m/s²{10 G}
	Destructive*6	Min. 1,000 m/s²{100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +60°C –40°F to +140°F
	Humidity	5 to 85% R.H.
Unit weight		Approx. 23 g .81 oz

Power

TYPICAL APPLICATIONS

- **Air conditioner**
- **Refrigerators**
- **OA equipment**

ORDERING INFORMATION

Ex. A LF 1 T 12

Product Name	Contact arrangement	Terminal shape	Coil voltage, V DC
LF	1: 1 Form A	T: TMP type P: PCB type	05: 5 12: 12 06: 6 18: 18 09: 9 24: 24

Note: Standard packing; Carton: 50 pcs. Case 200 pcs.
UL/CSA,VDE, TÜV approved type is standard.

TYPES

Contact arrangement	Coil voltage, V DC	TMP type	PCB type
1 Form A	5	ALF1T05	ALF1P05
	6	ALF1T06	ALF1P06
	9	ALF1T09	ALF1P09
	12	ALF1T12	ALF1P12
	18	ALF1T18	ALF1P18
	24	ALF1T24	ALF1P24

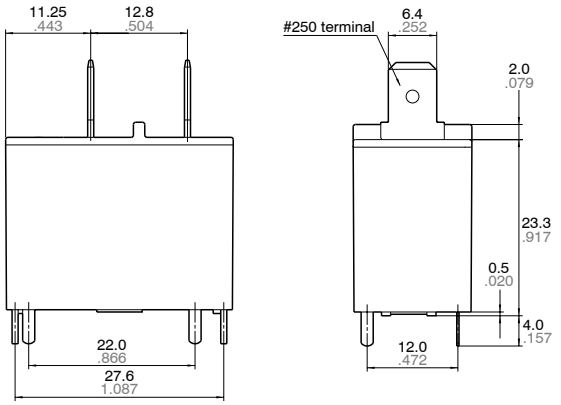
COIL DATA

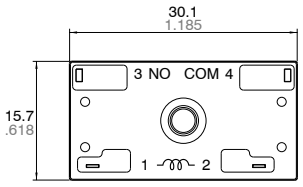
Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance, Ω(±10%)	Nominal operating current, mA (±10%)	Nominal operating power, W	Maximum allowable voltage, V DC
5	3.5	0.5	27.8	180	0.9	5.5
6	4.2	0.6	40	150		6.6
9	6.3	0.9	90	100		9.9
12	8.4	1.2	160	75		13.2
18	12.6	1.8	360	50		19.8
24	16.8	2.4	640	37.5		26.4

DIMENSIONS

mm inch

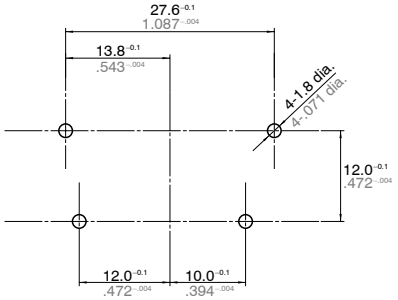
1. TMP type





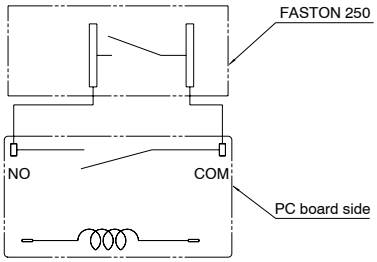
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)

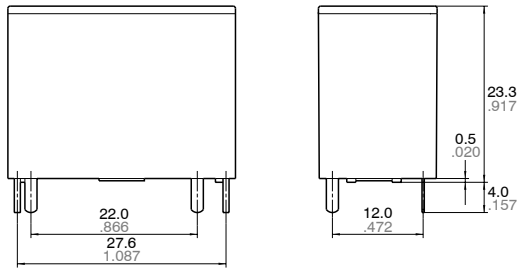


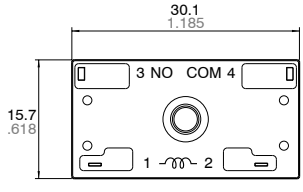
Tolerance: ±0.1 ±.004

Schematic (Bottom view)



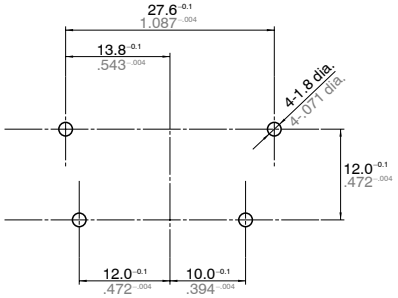
2. PCB type





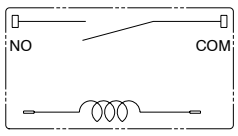
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

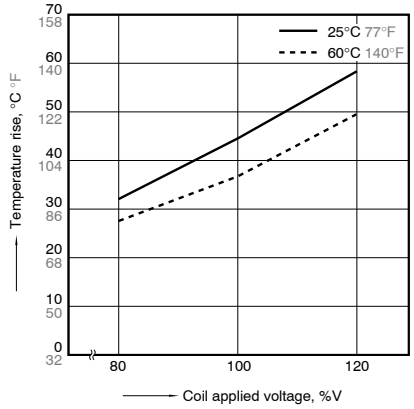
Schematic (Bottom view)



REFERENCE DATA

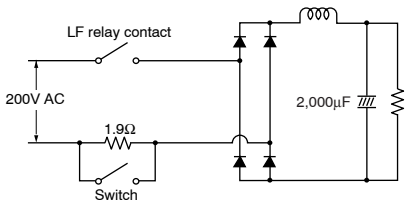
1. Coil temperature rise

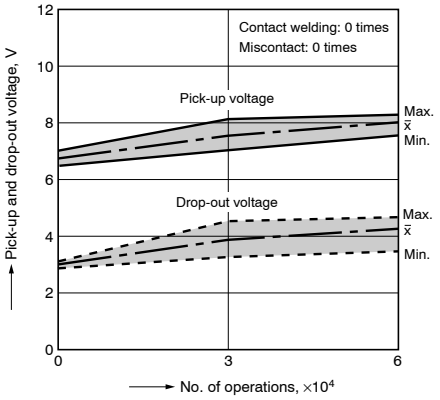
Sample: ALF1T12, 6 pcs.
Point measured: coil inside
Contact current: 20A
Ambient temperature: 25°C 77°F, 60°C 140°F



2-(1). 200V AC electrical life test (200V AC, inverter load)

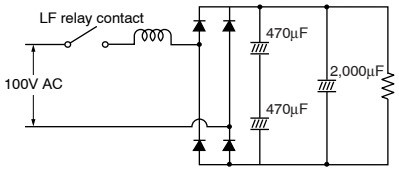
Sample: ALF1T12, 6 pcs.
Load: Inrush 102A (wave peak value),
Steady 14.4A (wave peak value)
Inverter dummy 200V AC
Switching frequency: ON 1s, OFF 5s
Circuit:

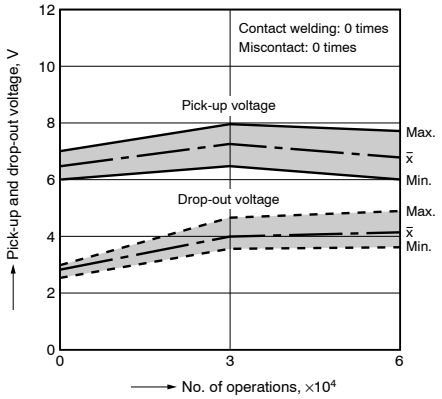




2-(2). 100V AC electrical life test (100V AC, inverter load)

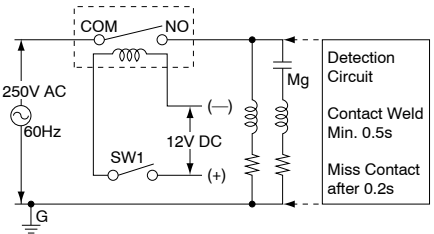
Sample: ALF1T12, 6 pcs.
Load: Inrush 224A (wave peak value),
Steady 30.5A (wave peak value)
Inverter dummy 100V AC
Switching frequency: ON 1s, OFF 5s
Circuit:

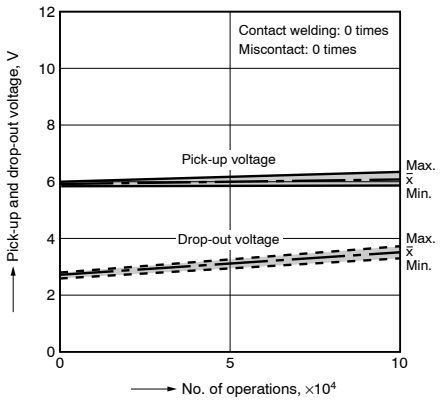




2-(3). Inrush 70.7A, Steady 20A, 250V AC electrical life test (Compressor dummy load)

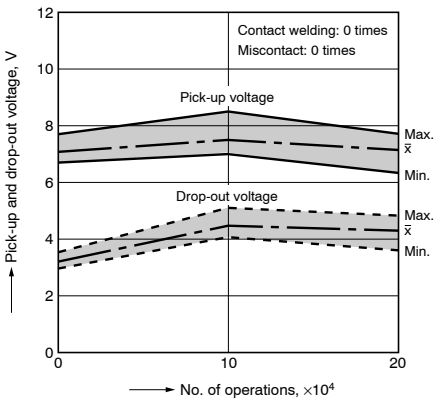
Sample: ALF1T12, 3 pcs.
Load: Inrush 70.7A, cosϕ = 0.7
Steady 20A, cosϕ 0.9
250V AC compressor dummy
Switching frequency: ON 1.5s, OFF 1.5s
Circuit:





2-(4). Electrical life test (20A 250V AC, resistive load)

Sample: ALF1T12, 6 pcs.
Switching frequency: ON 1.5s, OFF 1.5s

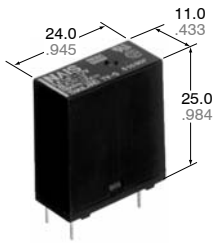


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

SLIM POWER RELAY WITH HIGH INRUSH CURRENT CAPABILITY

LK RELAYS



mm inch

FEATURES

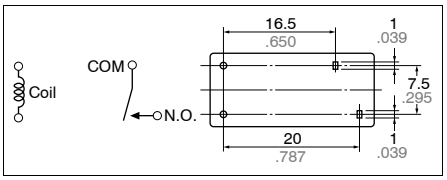
1. High inrush current capability
1) Operating load capability:
inrush 100 A, steady 5 A
2) UL/CSA, TV-5

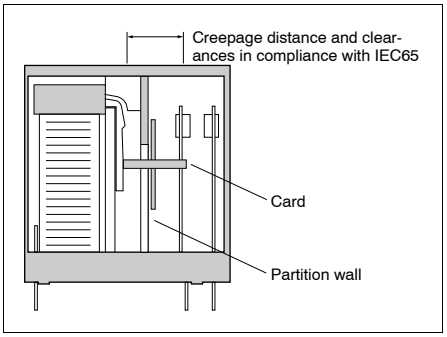
2. High insulation resistance between contact and coil
1) Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch (In compliance with IEC65)
2) Surge withstand voltage between contact and coil: 10,000 V or more

3. High noise immunity realized by the card separation structure between contact and coil

4. Popular terminal pitch in AV equipment field

mm inch





5. Space-saving slim type
Base area: Width 11 × Length 24 mm
Width .433 × Length .945 inch

6. Conforms to the various safety standards
UL, CSA, VDE, TÜV, SEMKO, SEV, BSI approved

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		Max. 100 mΩ
Contact material		Silver alloy
Rating (resistive load)	Nominal switching capacity	5 A 277 V AC, 5 A 30 V DC
	Max. switching power	1,385 VA, 150 W
	Max. switching voltage	277 V AC, 30 V DC
	Max. switching current	5A (AC), 5 A (DC)
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. ope.)	Mechanical (at 180 cpm)	2×10^6
	Electrical (at 20 cpm) (at rated load)	10^5

Coil

Nominal operating power	530 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

Max. operating speed		20 cpm
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min
	Between contacts and coil	4,000 Vrms for 1 min
Initial surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Approx. 7 ms (at 20°C 68°F)
Release time (without diode)*4 (at nominal voltage)		Approx. 2 ms (at 20°C 68°F)
Temperature rise (at 70°C)		Max. 35°C with nominal coil voltage at 5A contact carrying current (resistance method)
Shock resistance	Functional*5	Min. 200 m/s²
	Destructive*6	Min. 1,000 m/s²
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 1.5 mm
	Destructive	10 to 55 Hz at double amplitude of 1.5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40 to +70°C –40 to +158°F
	Humidity	5 to 85%R.H.
	Air pressure	86 to 106 kPa
Unit weight		Approx. 12 g .42 oz

TYPICAL APPLICATIONS

- AV equipment: TV's, VTR's, etc.
- OA equipment
- HA equipment

ORDERING INFORMATION

Ex. LK [1a] [F] —— [24V]

Contact arrangement	Protective construction	Coil voltage (DC)
1a: 1 Form A	F: Flux-resistant type	5, 6, 9, 12, 18, 24 V

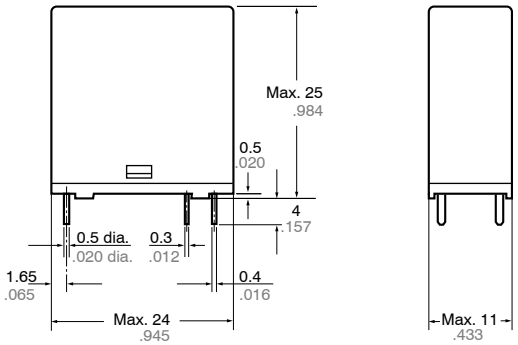
UL/CSA, TÜV, SEMKO, TV-5 approved type is standard.
(Note) Standard packing Carton: 100 pcs. Case: 500 pcs.

TYPES AND COIL DATA (at 20°C 68°F)

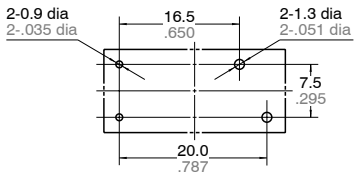
Part No.	Nominal voltage, V DC	Pick-up voltage V DC (max.) (Initial)	Drop-out voltage V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 20°C 68°F)
LK1aF-5V	5	3.5	0.5	47	106.4	530	6.5
LK1aF-6V	6	4.2	0.6	68	88.3	530	7.8
LK1aF-9V	9	6.3	0.9	153	58.8	530	11.7
LK1aF-12V	12	8.4	1.2	272	44.2	530	15.6
LK1aF-18V	18	12.6	1.8	611	29.5	530	23.4
LK1aF-24V	24	16.8	2.4	1,087	22.1	530	31.2

DIMENSIONS

mm inch

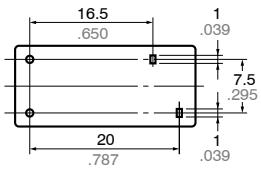


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)



Dimension : General tolerance

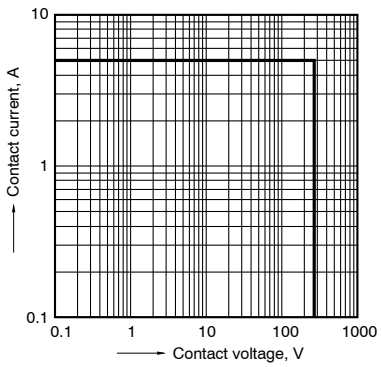
Max. 1mm .039 inch: ±0.1 ±.004

1 to 3mm .039 to .118 inch: ±0.2 ±.008

Min. 3mm .118 inch: ±0.3 ±.012

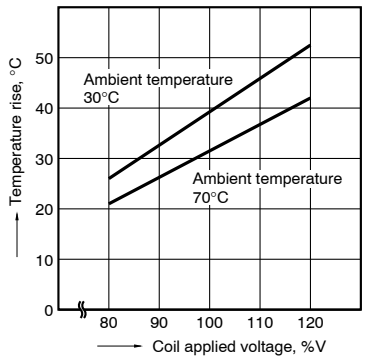
REFERENCE DATA

1. Max. switching power (AC resistive load)



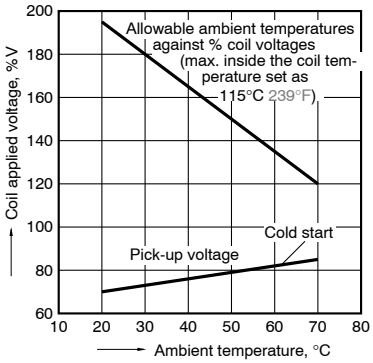
2. Coil temperature rise

Sample: LK1aF-12V, 6 pcs.
Point measured: coil inside
Contact current: 5 A



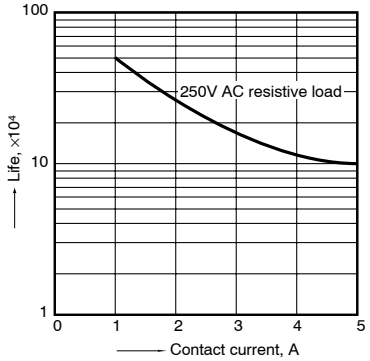
3. Ambient temperature characteristics

Contact current: 5 A



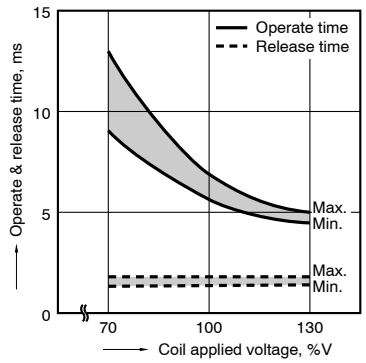
4. Life curve

Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: room temperature



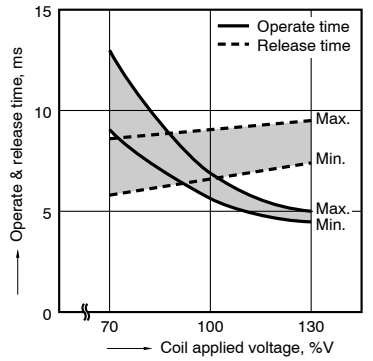
5-1. Operate & release time (without diode)

Sample: LK1aF-12V, 20 pcs.



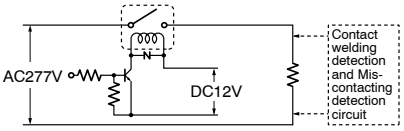
5-2. Operate & release time (with diode)

Sample: LK1aF-12V, 20 pcs.

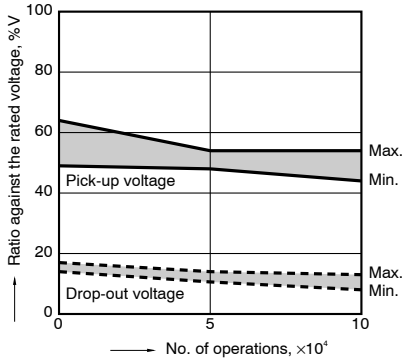


6-1. Electrical life test
(5 A 277 V AC, resistive load)
Sample: LK1aF-12V, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 26°C 79°F

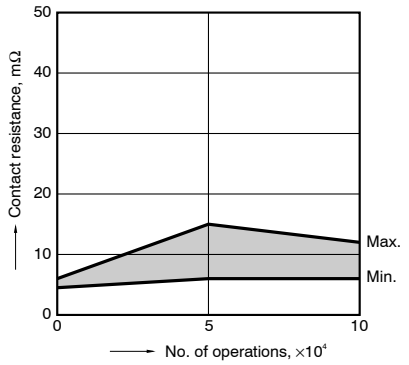
Circuit:



Change of pick-up and drop-out voltage

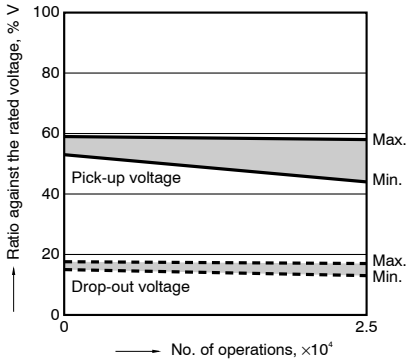


Change of contact resistance

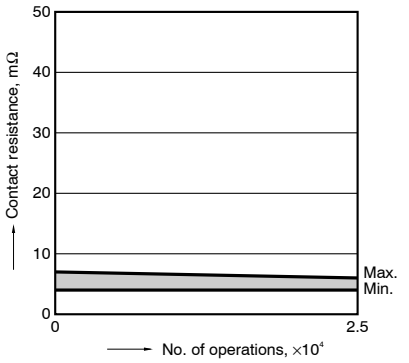


6-2. Electrical life test
(UL lamp load test TV-5)
Tested sample: LK1aF-12V, 6 pcs.
• Overload test
Load: 7.5 A 120 V AC (60 Hz),
Inrush: 111 A
Operation frequency: 10 times/min
(ON: OFF = 1 s: 5 s)
No. of operations: 50 ope.
• Endurance test
Load: 5A 120 V AC (60 Hz),
Inrush: 78 A
Operation frequency: 10 times/min
(ON: OFF = 1 s: 5 s)
No. of operations: 25,000 ope.

Change of pick-up and drop-out voltage



Change of contact resistance



NOTES

1. Cleaning
This relay is not the sealed type, so it cannot be immersion cleaned. Be careful that flux does not overflow onto the PC board or penetrate inside the relay.

2. Soldering
We recommend the following soldering conditions.
1) Automatic soldering
* Preheating: 100°C 212°F, within 2 mins (PC board solder surface)
* Soldering: 260°C 500°F, within 5 s

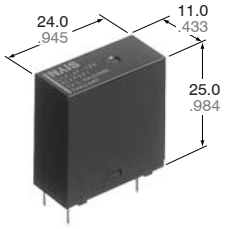
2) Hand soldering
* Iron tip temperature: 280 to 300°C 536 to 571°F
* Soldering iron: 30 to 60W
* Soldering time: Within 3 s

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

10 A Slim Power Relay

LK-P RELAYS



mm inch

FEATURES

1. High switching capacity: 10 A 277V AC

2. High insulation resistance between contact and coil

1) Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch (In compliance with IEC65)

2) Surge withstand voltage between contact and coil: 10,000 V or more

3. High noise immunity realized by the card separation structure between contact and coil

4. Popular terminal pitch in AV equipment field

5. Space-saving slim type

Base area: Width 11 × Length 24 mm
Width .433 × Length .945 inch

6. Conforms to the various safety standards

UL/CSA, VDE, TÜV and SEMKO, SEV approved

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		Max. 100 mΩ
Contact material		Silver alloy
Rating (resistive load)	Nominal switching capacity	10 A 277 V AC, 5 A 30V DC
	Max. switching power	2,770 V A, 150W
	Max. switching voltage	277 V AC, 30 V DC
	Max. switching current	10 A (AC), 5A (DC)
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	2×10^6
	Electrical (at 20 cpm) (at rated load)	10^5

Coil

Nominal operating power	530 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial *2 breakdown voltage	Between open contacts	1,000 Vrms for 1 min.
	Between contact and coil	4,000 Vrms for 1 min.
Initial surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Approx. 7 ms (at 20°C 68°F)
Release time (without diode)*4 (at nominal voltage)		Approx. 2 ms (at 20°C 68°F)
Temperature rise (at 70°C)		Max. 45°C with nominal coil voltage and at 10 A contact carrying current (resistance method)
Shock resistance	Functional*5	Min. 200 m/s²{approx. 20 G}
	Destructive*6	Min. 1,000 m/s²{approx. 100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
	Air pressure	86 to 106 kPa
Unit weight		Approx. 12 g .42 oz

Power

TYPICAL APPLICATIONS

- Audio visual equipment
  TVs, VTRs
- Office equipment
  LBP, CRT
- Home appliances
  Refrigerator, Air conditioner

ORDERING INFORMATION

Ex. LKP [1a] [F] — [12V]

Contact arrangement	Protective construction	Coil voltage(DC)
1a: 1 Form A	F: Flux-resistant type	5, 6, 9, 12, 18, 24V

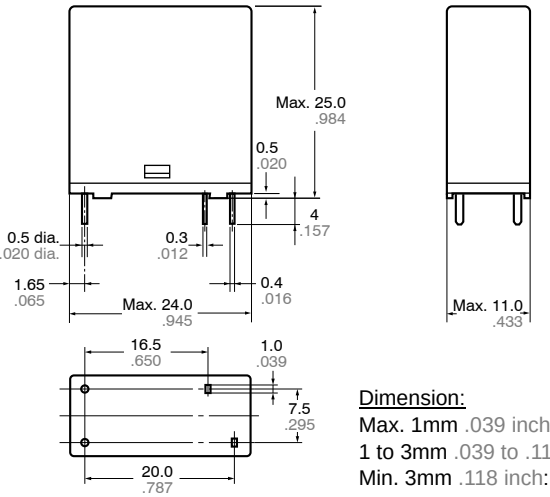
UL/CSA, TÜV, SEMKO, TV-5 approved type is standard.
Notes 1. Standard packing Carton: 100 pcs. Case: 500 pcs.
2. 5 V, 9 V, 18 V DC types are also available. Please consult us for details.

TYPES AND COIL DATA (at 20°C 68°F)

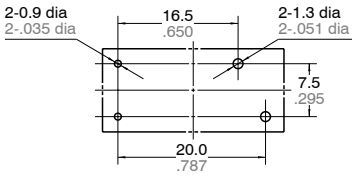
Part No.	Nominal voltage, V DC	Pick-up voltage V DC (max.) (Initial)	Drop-out voltage V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 20°C 68°F)
LKP1aF-5V	5	3.5	0.5	47	106.4	530	6.5
LKP1aF-6V	6	4.2	0.6	68	88.3	530	7.8
LKP1aF-9V	9	6.3	0.9	153	58.8	530	11.7
LKP1aF-12V	12	8.4	1.2	272	44.2	530	15.6
LKP1aF-18V	18	12.6	1.8	611	29.5	530	23.4
LKP1aF-24V	24	16.8	2.4	1,087	22.1	530	31.2

DIMENSIONS

mm inch



PC board pattern (Bottom view)



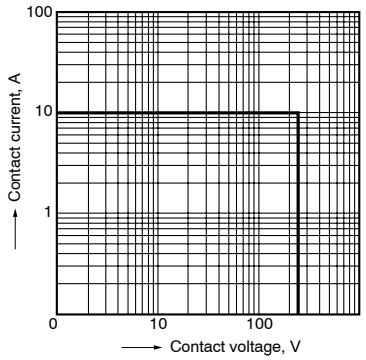
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

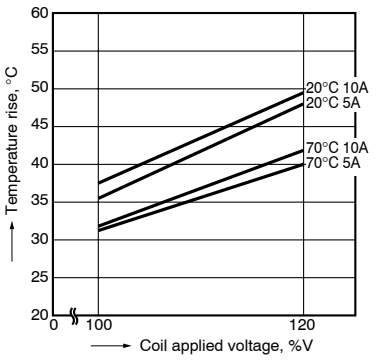
REFERENCE DATA

1. Max. switching power



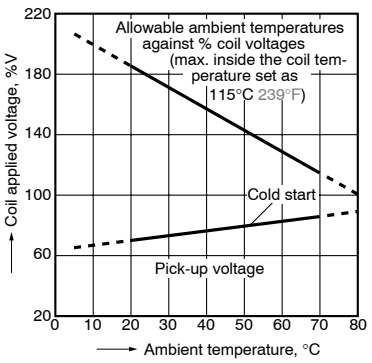
2. Coil temperature rise

Sample: LKP1aF-12V, 6 pcs.
Point measured: coil inside
Contact current: 5 A, 10 A



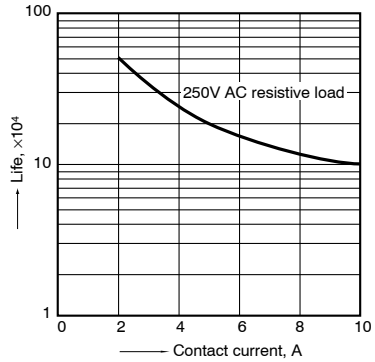
3. Ambient temperature characteristics and coil applied voltage

Contact current: 10 A



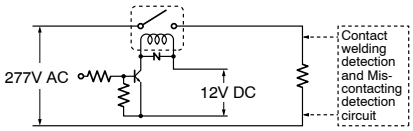
4. Life curve

Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: room temperature

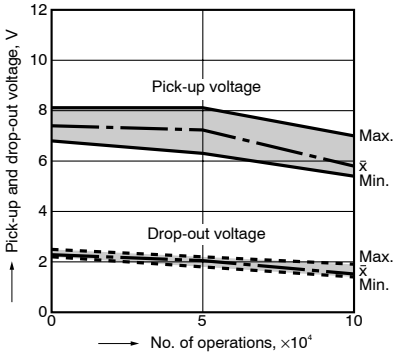


5. Electrical life test
(10 A 277 V AC, resistive load)
Sample: LKP1aF-12V, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 20°C 68°F

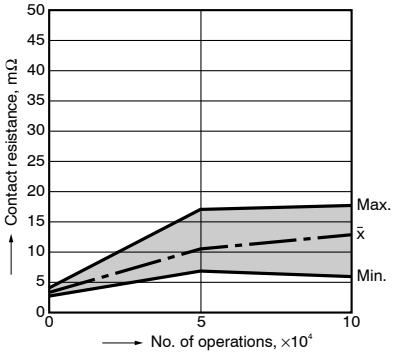
Circuit:



Change of pick-up and drop-out voltage



Change of contact resistance

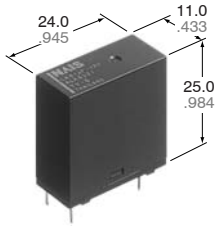


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

250 mW Slim Power Relay

LK-S RELAYS



mm inch

FEATURES

1. High sensitivity: 250mW
The power-saving relay is highly sensitive at the nominal operating power of 250 mW (530 mW power consumption on LK relays).

2. High insulation resistance between contact and coil
1) Creepage distance and clearances between contact and coil: Min. 6 mm .236 inch (In compliance with IEC65)
2) Surge withstand voltage between contact and coil: 10,000 V or more

3. High noise immunity realized by the card separation structure between contact and coil

4. Popular terminal pitch in AV equipment field

5. Space-saving slim type
Base area: Width 11 × Length 24 mm
Width .433 × Length .945 inch

6. Conforms to the various safety standards
UL/CSA, VDE, TÜV and SEMKO SEV approved

SPECIFICATIONS

Contact

Arrangement		1 Form A
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		Max. 100 mΩ
Contact material		Silver alloy
Rating (resistive load)	Nominal switching capacity	5 A 277 V AC
	Max. switching power	1,385 V A
	Max. switching voltage	277 V AC
	Max. switching current	5 A (AC)
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	10^6
	Electrical (at 20 cpm) (at rated load)	10^5

Coil

Nominal operating power	250 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial *2 breakdown voltage	Between open contacts	1,000 Vrms for 1 min.
	Between contact and coil	4,000 Vrms for 1 min.
Initial surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Approx. 7 ms (at 20°C 68°F)
Release time (without diode)*4 (at nominal voltage)		Approx. 2 ms (at 20°C 68°F)
Temperature rise (at 70°C)		Max. 35°C with nominal coil voltage and at 5 A contact carrying current (resistance method)
Shock resistance	Functional*5	Min. 200 m/s²{approx. 20 G}
	Destructive*6	Min. 1,000 m/s²{approx. 100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85% R.H.
	Air pressure	86 to 106 kPa
Unit weight		Approx. 12 g .42 oz

TYPICAL APPLICATIONS

- Audio visual equipment
- Office equipment
- Home appliances

ORDERING INFORMATION

Ex. LKS [1a] [F] — [12V]

Contact arrangement	Protective construction	Coil voltage(DC)
1a: 1 Form A	F: Flux-resistant type	5, 6, 9, 12, 18, 24V

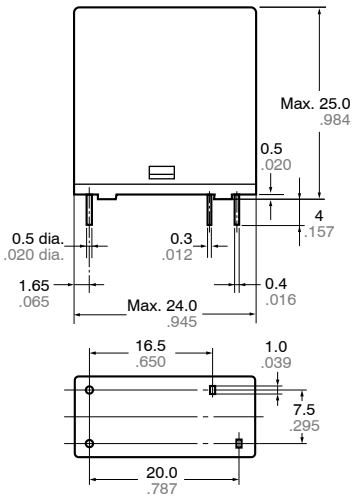
UL/CSA, TÜV, SEMKO, TV-5 approved type is standard.
Notes 1. Standard packing Carton: 100 pcs. Case: 500 pcs.
2. 6 V, 18 V DC types are also available. Please consult us for details.

TYPES AND COIL DATA (at 20°C 68°F)

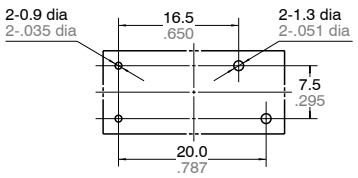
Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (max.) (Initial)	Drop-out voltage, V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Maximum allowable voltage, V DC (at 20°C 68°F)
LKS1aF-5V	5	3.5	0.5	100	50	250	6.5
LKS1aF-6V	6	4.2	0.6	144	41.7	250	7.8
LKS1aF-9V	9	6.3	0.9	324	27.8	250	11.7
LKS1aF-12V	12	8.4	1.2	576	20.8	250	15.6
LKS1aF-18V	18	12.6	1.8	1,296	13.9	250	23.4
LKS1aF-24V	24	16.8	2.4	2,304	10.4	250	31.2

DIMENSIONS

mm inch



PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

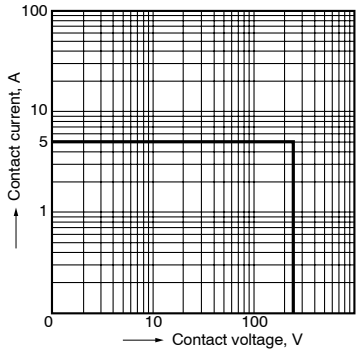
Dimension:

	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Power

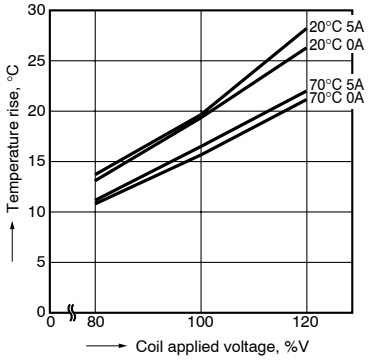
REFERENCE DATA

1. Max. switching power (AC resistive load)



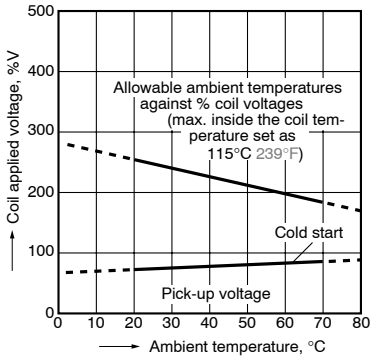
2. Coil temperature rise

Sample: LKS1aF-12V, 6 pcs.
Point measured: coil inside
Contact current: 0 A, 5A



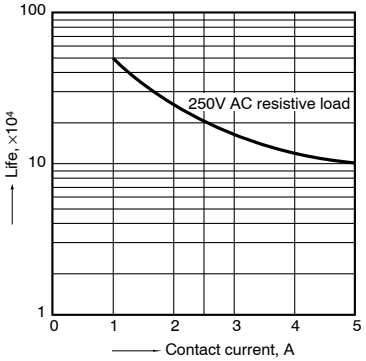
3. Ambient temperature characteristics and coil applied voltage

Contact current: 5 A



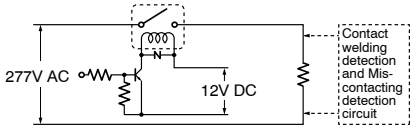
4. Life curve

Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: Room temperature

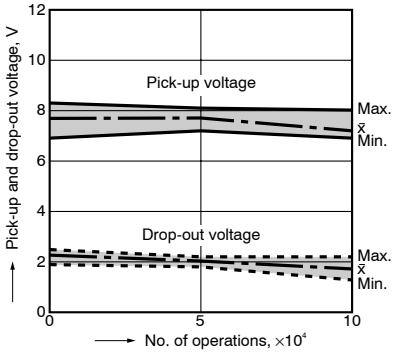


5-(1). Electrical life test
(5 A 277 V AC, resistive load)
Sample: LKS1aF-12V, 6 pcs.
Operation frequency: 20 times/min.
(ON/OFF = 1.5s: 1.5s)
Ambient temperature: 20°C 68°F

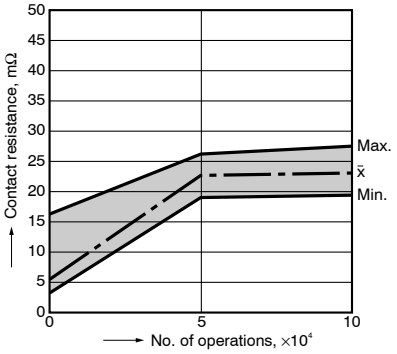
Circuit:



Change of pick-up and drop-out voltage

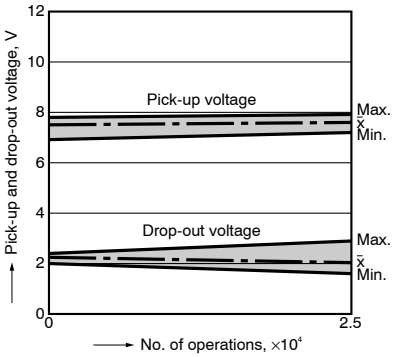


Change of contact resistance

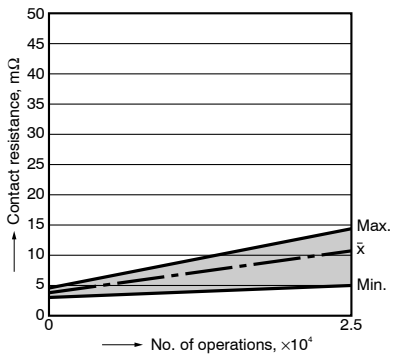


5-(2). Electrical life test
(UL lamp load test TV-5)
Tested sample: LKS1aF-12V, 6 pcs.
• Overload test
Load: 7.5 A 120 V AC (60 Hz),
Inrush: 111 A
Operation frequency: 10 times/min
(ON: OFF = 1 s: 5 s)
No. of operations: 50 ope.
• Endurance test
Load: 5A 120 V AC (60 Hz),
Inrush: 78 A
Operation frequency: 10 times/min
(ON: OFF = 1 s: 5 s)
No. of operations: 25,000 ope.

Change of pick-up and drop-out voltage



Change of contact resistance

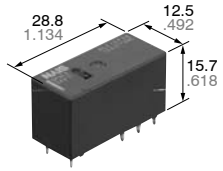


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

16A Low Profile Power Relay

LZ RELAYS (ALZ)



mm inch

FEATURES

1. Low profile size: Height 15.7 mm
28.8 (L)×12.5 (W)×15.7(H) mm
1.134 (L)×.492 (W)×.618(H) inch

2. High insulation resistance
Creepage distance and clearances between contact and coil: Min. 10 mm

3. UL coil insulation class B (85°C 185°F) or class F (105°C 221°F).

4. Pb free and Cd free

5. Low operating power
• Nominal operating power: 400mW

6. Conforms to the various safety standards:
• UL/CSA, VDE approved.

SPECIFICATIONS

Contact

Arrangement		1 Form A, 1 Form C
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ
Contact material		Silver alloy
Rating (resistive load)	Nominal switching capacity	16 A 250 V AC
	Max. switching power	4,000 V A
	Max. switching voltage	440 V AC
	Max. switching current	16 A
	Min. switching capacity#1	100 mA, 5 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	1×10^7
	Electrical (at 20 cpm)*10 (Rated load)	N.O.: 10^5 N.C.: 5×10^4

Coil

Nominal operating power	400 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section.
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).
*9 Class F type is ambient temperature 105°C 221°F.
*10 Electrical life was evaluated with the breathing hole open.

Characteristics

Max. operating speed		20 cpm (at rated load)
Initial insulation resistance*1		Min. 1,000 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	5,000 Vrms for 1 min.
Initial surge voltage between contact and coil*3		Min. 10,000 V
Operate time*4 (at nominal voltage)		Max. 15ms (at 20°C 68°F)
Release time (with diode)*4 (at nominal voltage)		Max. 5ms (at 20°C 68°F)
Temperature rise (20°C 68°C)		Max. 55°C with nominal coil voltage and at 16 A contact carrying current (resistance method)
Shock resistance	Functional*5	Min. 100 m/s²{approx. 10 G}
	Destructive*6	Min. 1,000 m/s²{approx. 100 G}
Vibration resistance	Functional*7	10 to 55Hz at double amplitude of 1.5mm (NO), 0.82mm (NC)
	Destructive	10 to 55Hz at double amplitude of 1.5mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +85°C –40°F to +185°F (Class B)*9
	Humidity	5 to 85% R.H.
Unit weight		Approx. 12 g .42 oz

TYPICAL APPLICATIONS

• HVAC
• Oven ranges
• Refrigerators

ORDERING INFORMATION

Ex. A LZ 1 1 B 12 W

Product name	Contact arrangement	Protective construction	Coil insulation class	Coil voltage, V DC	Packing style
LZ	1: 1 Form C 2: 1 Form A	1: Flux-resistant type 2: Sealed type	B: Class B insulation F: Class F insulation	05: 5 18: 18 09: 9 24: 24 12: 12 48: 48	Nil: Tube packing W: Carton packing

UL/CSA VDE approved type is standard.

Notes: 1. Tube packing: Inner carton: 20pcs.; Case: 800pcs.
2. Carton packing: Inner carton: 100pcs.; Case: 500pcs.
3. Carton packing symbol "W" is not marked on the relay.

TYPES

Contact arrangement	Coil voltage, V DC	Flux-resistant type		Sealed type	
		Class B	Class F	Class B	Class F
1 Form A	5	ALZ21B05	ALZ21F05	ALZ22B05	ALZ22F05
	9	ALZ21B09	ALZ21F09	ALZ22B09	ALZ22F09
	12	ALZ21B12	ALZ21F12	ALZ22B12	ALZ22F12
	18	ALZ21B18	ALZ21F18	ALZ22B18	ALZ22F18
	24	ALZ21B24	ALZ21F24	ALZ22B24	ALZ22F24
	48	ALZ21B48	ALZ21F48	ALZ22B48	ALZ22F48
1 Form C	5	ALZ11B05	ALZ11F05	ALZ12B05	ALZ12F05
	9	ALZ11B09	ALZ11F09	ALZ12B09	ALZ12F09
	12	ALZ11B12	ALZ11F12	ALZ12B12	ALZ12F12
	18	ALZ11B18	ALZ11F18	ALZ12B18	ALZ12F18
	24	ALZ11B24	ALZ11F24	ALZ12B24	ALZ12F24
	48	ALZ11B48	ALZ11F48	ALZ12B48	ALZ12F48

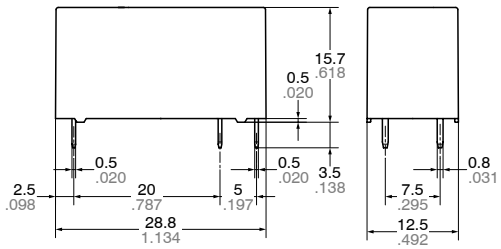
COIL DATA

Nominal voltage, V DC	Pick-up voltage, V DC (max.)	Drop-out voltage, V DC (min.)	Coil resistance, Ω (±10%)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Maximum allowable voltage, V DC
5	3.5	0.5	63	80	400	6.5
9	6.3	0.9	203	44.4	400	11.7
12	8.4	1.2	360	33.3	400	15.6
18	12.6	1.8	810	22.2	400	23.4
24	16.8	2.4	1,440	16.7	400	31.2
48	33.6	4.8	5,760	8.3	400	62.4

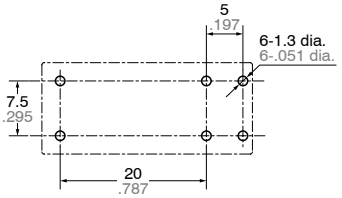
DIMENSIONS

mm inch

1. 1 Form A type

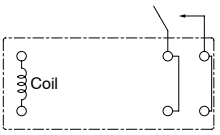


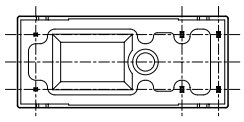
PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

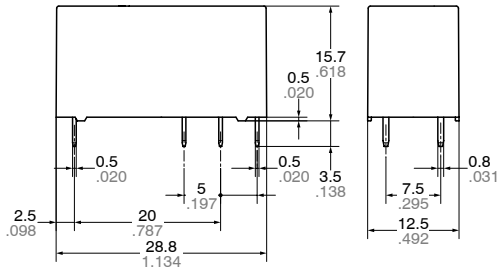
Schematic (Bottom view)

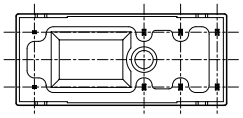




Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

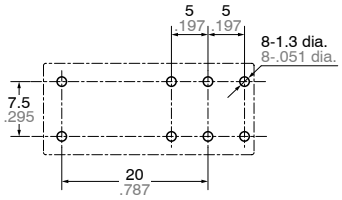
2. 1 Form C type





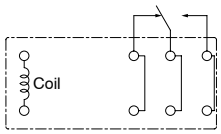
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

PC board pattern (Bottom view)



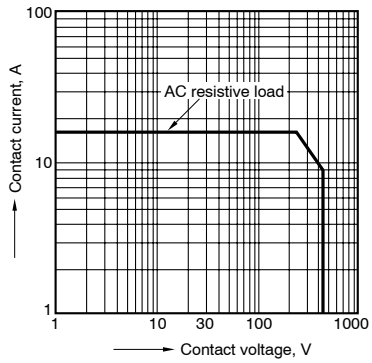
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

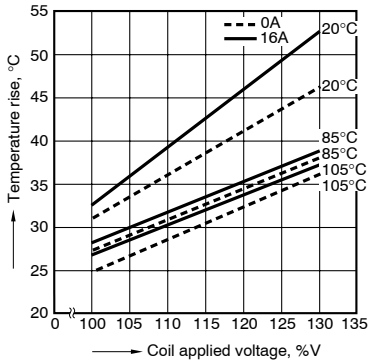


REFERENCE DATA

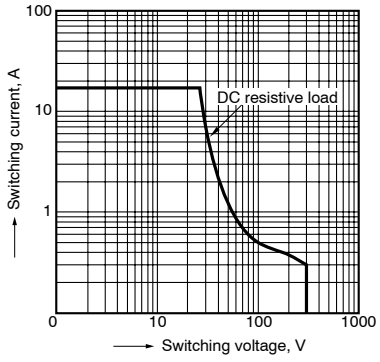
1. Max. switching power



2. Coil temperature rise



3. DC breaking capacity



Power

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

Polarized motor contactor monostable or latching

MC Mini-Contactor

Screw terminal (4a)

Fasten terminal type

PCB terminal type

FEATURES

- **Suitable for AC3 and AC11 loads**
- **Low noise**
- **Forced operation contacts**
- **Low power consumption, hence ideal as interface module**
- **Mono- or bistable**

TÜV, UL, C-UL RATINGS

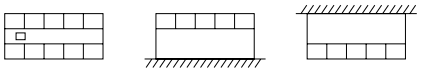
Type No.		DC coil type		**MC-SM, MC-SA**	**MC-SMF, MC-SAF**	**MC-SMP, MC-SAP**
		AC coil type		**MC-NM, MC-NA**	**MC-NMF, MC-NAF**	**MC-NMP, MC-NAP**
Terminal form				Screw terminal	Fasten terminal	PCB terminal
TÜV rating	Rated switching voltage			400 VAC		
	Rated current			15 A		8 A
	Motor load (IEC AC3)	Single phase	120 VAC	0.4 kW 9.5 A		0.37 kW 8 A
			240 VAC	0.75 kW 8 A		0.75 kW 8 A
		Three phase	240 VAC	2.5 kW 11 A		2.2 kW 8 A
			400 VAC	4.0 kW 9 A		3.8 kW 8 A
	Auxiliary contact rating	AC15		6A 120 VAC , 6 A 240 VAC, 4A 380 VAC		
		AC12		10A 120 VAC , 10 A 240 VAC, 10A 380 VAC		

UL / C-UL rating	"a" contact	Motor load	Single phase	120 VAC	F.L.A.* 10 A, L.R.A.** 60 A
				240 VAC	F.L.A. 10 A, L.R.A. 60 A
			Three phase	240 VAC	F.L.A. 10 A, L.R.A. 60 A
		General use			15 A, 120 VAC, 10 A 240 VAC
		Tungsten lamp			6 A 240 VAC
	"b" contact	General use			10 A 240 VAC
		Pilot duty			A300

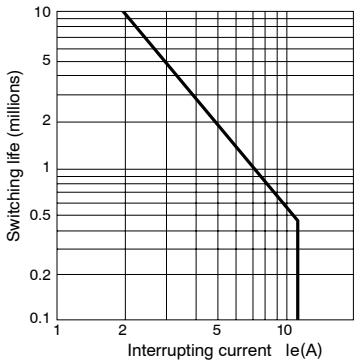
*F.L.A. = Full load amperage

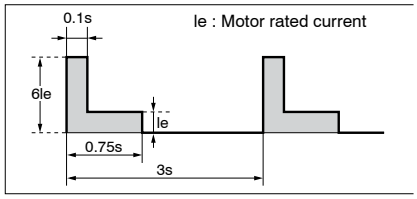
**L.R.A. = Locked rotor amperage

SPECIFICATIONS

	DC coil type	AC coil type
Mechanical life	> 10^7	> 5 x 10^6
Insulation resistance	More than 10Ω by 500 VDC megger (initial)	
Dielectric strength	2,500 VAC for more than 1 minute (initial)	
Coil surge voltage	< 50 V	--
Impulse resistance of surge absorption circuit	> 500 V	--
Usable range of coil voltage	80% to 120% V (cold) 85% to 120% V (hot)	80% to 110% V (cold) 85% to 110% V (hot)
Usable temp. & humidity	-10°C to + 60°C 14°F to + 140°F, < 85% R.H.	
Permissible mounting direction		
Weight	Screw: 150g, Fasten/PCB: 140g	Screw: 130g, Fasten/PCB: 120g

AC3 220 V LIFE CURVE (Average) for Screw and Fasten Types





3 ϕ 220V 60Hz COS ϕ = 0.35
Switching frequency : 20 cycles/minute

COIL SPECIFICATIONS

Rated coil voltage	Pick-up voltage (at 20°C)	Drop-out voltage (at 20°C)	Rated energized current (at 20°C)	Rated power consumption	Operating speed	
					Making	Breaking
12 VDC	Max. 9.6 VDC	Min. 1.2 VDC	42 mA	500 mW	< 100 ms	< 30 ms
24 VDC	Max. 19.2 VDC	Min. 2.4 VDC	21 mA	500 mW	< 100 ms	< 30 ms

Coil voltage	Frequency	Pick-up voltage (at 20°C)	Drop-out voltage (at 20°C)	Power capacity		Operating speed	
				Inrush	Sealed	Making	Breaking
120 VAC	60 Hz	Max. 96 VAC	Min. 24 VAC	Max. 22 VA	Max. 5 VA	< 30 ms	< 30 ms
240 VAC	50 Hz	Max. 176 VAC	Min. 44 VAC	Max. 24 VA	Max. 7 VA	< 30 ms	< 30 ms

ORDERING INFORMATION

Ex. MC — S M P — 3a1b — 24VDC

	Screw terminal
F	Fasten terminal
P	PCB terminal

S	DC coil type*
N	AC coil type

M	AC3 Motor loads
A	AC15 Electro-magnetic loads

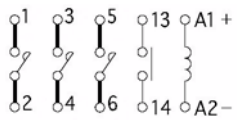
Contact Configuration
4a or 3a1b
2a2b

Coil Voltage
(DC coil)
5VDC
6VDC
12VDC
24VDC
48VDC
(AC coil)50/60Hz
24VAC
120VAC
220VAC
240VAC

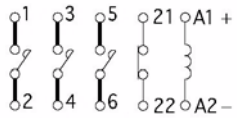
*As for DC coil types, latch versions are available. (but no approval of TUV, UL, C-UL nor CE marking) Please add the ordering code of "L" after Terminal Form code like an example of MC-SML-4a-12VDC.

COIL CONFIGURATION

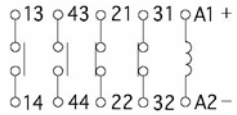
4a



3a1b

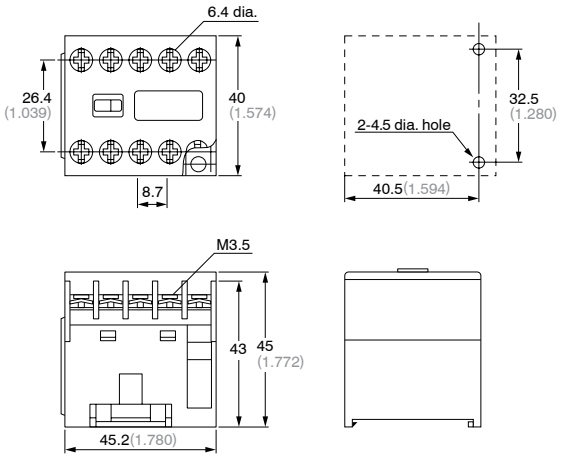


2a2b

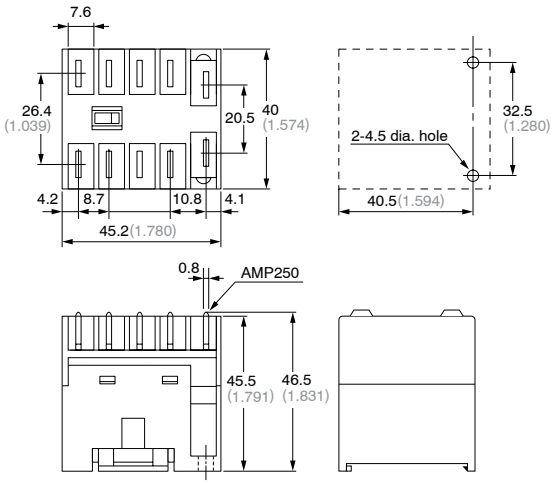


DIMENSIONS

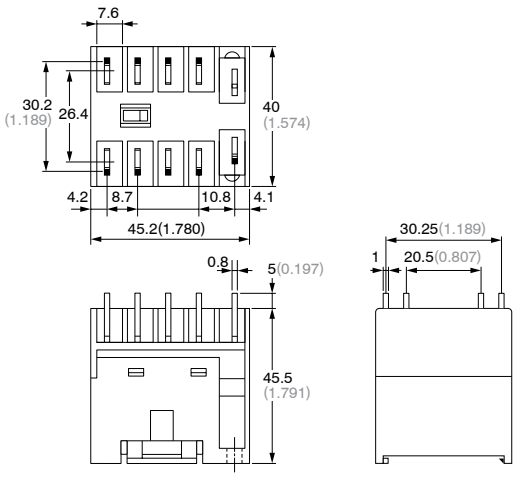
(1) Screw type

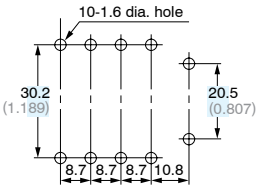


(2) Fasten type



(3) PCB type





WIRING

1) Connection to Screw terminals

Terminal screw	Wire size, max.	Compatible solderless terminal	Standard tightening torque N/m
M3.5	diameter 1.6, 2mm² AWG14	2-3.5 2Y-3.5	approx. 0.8 - 1.2 N•m

2) Connection to Fasten terminals

- **Applicable receptacles are AMP 250 Series (Straight type, Flag type) and AMP's positive lock (17207).**
- **Firmly insert the receptacles so that they cannot be easily pulled out. Do not attempt to pull out two or more receptacles at one time.**

3) Connection to PCB terminals

- **Hand soldering is recommended to avoid flux penetration. Especiallythe use of rosin-flux is recommended since this type of flux makes cleaning unnecessary.**
- **Since the materials of cover is polycarbonate resin, use an alcohol solvent for cleaning.**
- **SinceMC is not a sealed contactor, be careful thecleaning solvent does not get inside.**

INSTALLATION ENVIRONMENT

- **Handle the device with care. Excessive physical impact may cause malfunction.**
- **Do not install the device in a location where it will be exposed to extreme temperatures or humidity, excessive dust, corrosive gases, vibration, physical impact, direct sunlight or water.**
- **Please avoid using in an area where external magnetic field is large.**
- **For the DC coil type, the contactor will not move when coil connection plus and minus is incorrect, because the device is polarized.**

TIPS FOR SAFE OPERATION

- **The life of the contactor may be reduced under extreme operating conditions (high temperature or humidity, exposure to oil vapor, etc.). Choose a model with sufficient operating margin to withstand such conditions.**
- **The MC contactor is not suitable for applications involving jogging (inching) or plug breaking (plugging).**
- **The MC contactor is factory-adjusted and should not be disassembled. Do not attempt to replace the contacts or the coil.**

Panasonic
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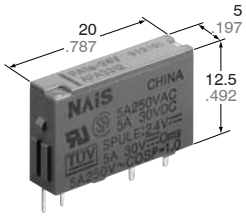
THE SLIM POWER RELAY

PA RELAYS



mm inch

FEATURES

- **Slim size (width 5 mm .197 inch, height 12.5 mm .492 inch) permits higher density mounting**
- **Wide switching capacity: Control from 100μA 100 mV to 5 A 250 V AC, 30 V DC**
- **High sensitivity: 120 mW (Nominal) (5 to 18 V DC type)**
- **High surge voltage (4000 V) and high breakdown voltage (2000 V)**
- **Shock & vibration resistance (functional): Min. 147m/s² {15 G}**
- **SIL (single in line) terminal layout**
- **Reinforced according to IEC1131-2 (TÜV)**
  PAD type: 3.1 mm clearance
  3.6 mm creepage distance

SPECIFICATIONS (at 20°C 68°F)

Contacts

Arrangement		1a
Contact material		Gold-clad silver alloy
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		30 mΩ
Rating (resistive)	Nominal switching capacity	5 A 250 V AC, 5 A 30 V DC
	Maximum switching power	1250 VA, 150 W
	Maximum switching voltage	250 V AC, 110 V DC
	Max. switching current	5 A
	Min. switching capacity#1	100μA, 100 mV DC
Expected life (min. operations)	Mechanical	2×10^7
	Electrical (at 20 cpm)	3 A 250 V AC, 3 A 30 V DC, 10^5 5 A 250 V AC, 5 A 30 V DC, 5×10^4

Coil (at 25°C 77°F, 50% R.H.)

Nominal operating power	5 to 18 V DC	120 mW
	24 V DC	180 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Intial breakdown voltage" section
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2×50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

Max. operating speed		20 cpm at rated load
Initial insulation resistance*1		Min. 1,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	1,000 Vrms
	Between contacts and coil	2,000 Vrms
Surge voltage between contacts and coil*3		4,000 V
Operate time*4 (at nominal voltage)		Max. 10 ms
Release time (without diode)*4 (at nominal voltage)		Max. 5 ms
Temperature rise		Max. 45°C with nominal coil voltage across coil and at nominal switching capacity
Shock resistance	Functional*5	Min. 147 m/s² {15 G}
	Destructive*6	Min. 980 m/s² {100 G}
Vibration resistance	Functional*7	Min. 147 m/s² {15 G}, 10 to 55 Hz at double amplitude of 2.5 mm
	Destructive	Min. 205.8 m/s² {21 G}, 10 to 55 Hz at double amplitude of 3.5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85%R.H.
Unit weight		Approx. 3 g .15 oz

TYPICAL APPLICATIONS

- Interface relays for programmable controllers
- Output relays for measuring equipment, timers, counters and temperature controllers
- Industrial equipment, office equipment

ORDERING INFORMATION

Ex. PA(D) [1a] —— [12V]

Contact arrangement	Coil voltage (DC)
1a: 1 Form A	5, 6, 9, 12, 18, 24V

Notes: 1) The PAD type offers slightly higher clearance (3.1 mm) and creepage distance (3.6 mm).
2) Standard packing: Tube: 25 pcs.; Case: 1,000 pcs.
UL/CSA, TÜV approved type is standard.

TYPES AND COIL DATA (at 20°C 68°F)

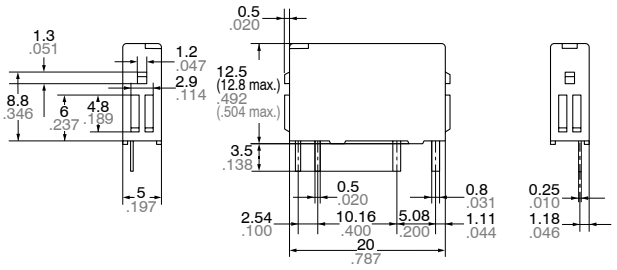
Part No.	Nominal voltage, V DC	Pick-up voltage,* V DC (max.)	Drop-out voltage,* V DC (min.)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Coil resistance, Ω (±10%)	Max. allowable voltage, V DC
PA(D)1a-5V	5	3.5	0.25	24	120	208	6
PA(D)1a-6V	6	4.2	0.3	20	120	300	7.2
PA(D)1a-9V	9	6.3	0.45	13.3	120	675	10.8
PA(D)1a-12V	12	8.4	0.6	10	120	1,200	14.4
PA(D)1a-18V	18	12.6	0.9	6.7	120	2,700	21.6
PA(D)1a-24V	24	16.8	1.2	7.5	180	3,200	28.8

*1 Pulse driving

DIMENSIONS

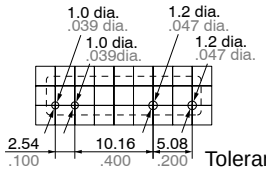
mm inch

1. PA relay



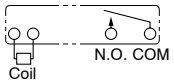
General tolerance: ±0.3 ±.012

PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

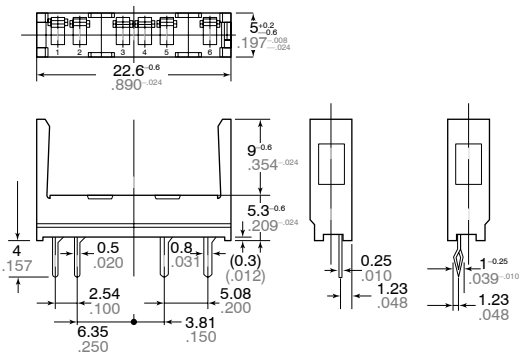
Schematic (Bottom view)



2. Socket

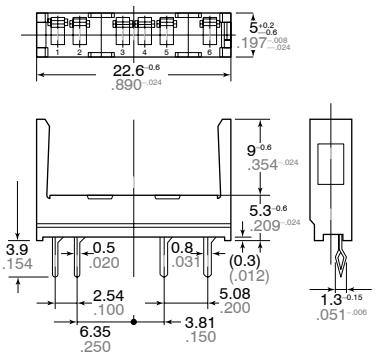
Standard type

PA1a-PS



PA1a-PS

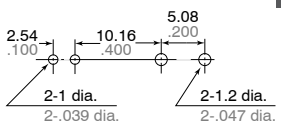
Self clinching type



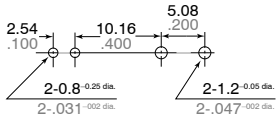
PA1a-PS-H

PC board pattern (Copper-side view)

Standard type



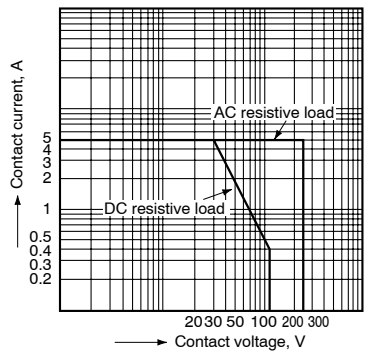
Self clinching type



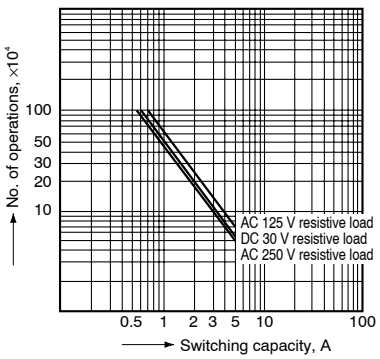
Tolerance: ±0.1 ±.004

REFERENCE DATA

1. Max. switching capacity

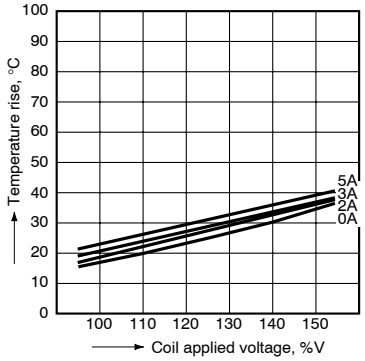


2. Life curve

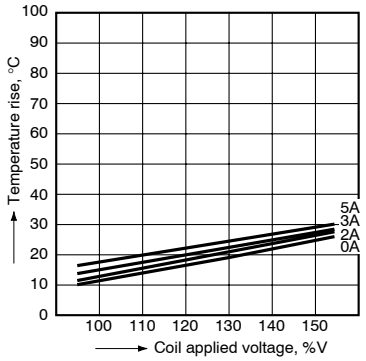


3.-(1) Coil temperature rise (120 mW)

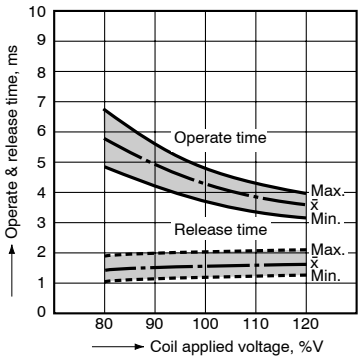
Sample: PA1a-12V
Ambient temperature: 20°C 68°F
Measured portion: Inside the coil



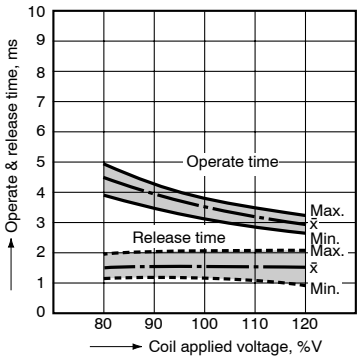
3.-(2) Coil temperature rise (180 mW)
Sample: PA1a-24V
Ambient temperature: 20°C 68°F
Measured portion: Inside the coil



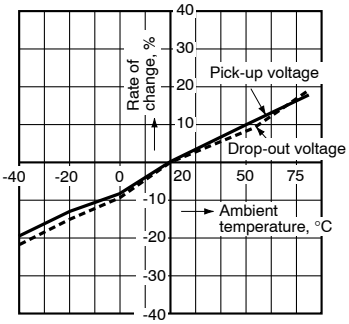
4.-(1) Operate & release time (120 mW)
Sample: PA1a-12V
No. of samples: n = 20



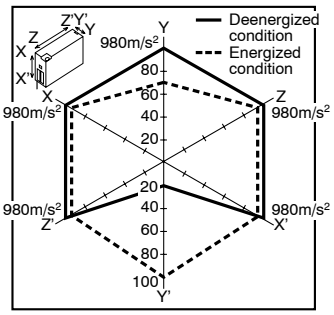
4.-(2) Operate & release time (180 mW)
Sample: PA1a-24V
No. of samples: n = 20



5. Ambient temperature characteristics
Sample: PA1a-12V
No. of samples: n = 6

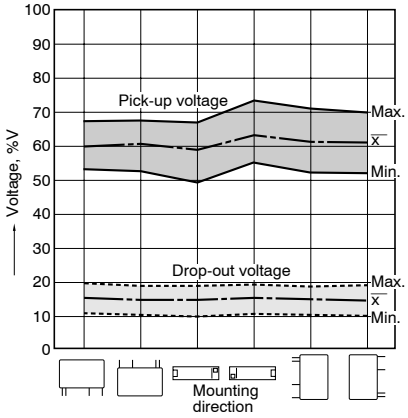


6. Malfunctional shock
Sample: PA1a-12V
No. of samples: n = 6

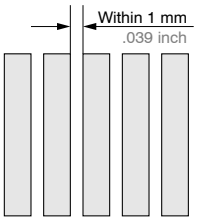


NOTES

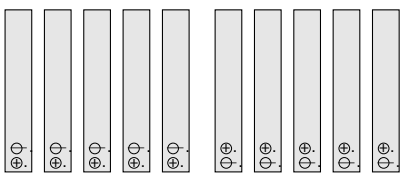
1. Specification values for pick-up and drop-out voltages are for the relay mounting with its terminals below.



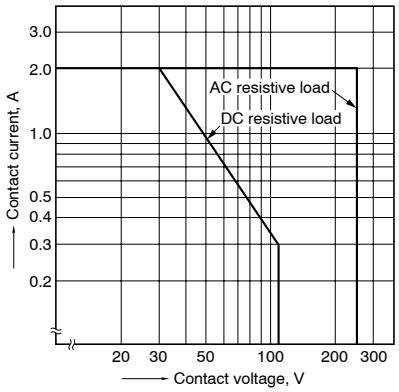
2. When mounting the relays within 1 mm .039 inch, please notice the condition below.
1) Mount the relays in the same direction.

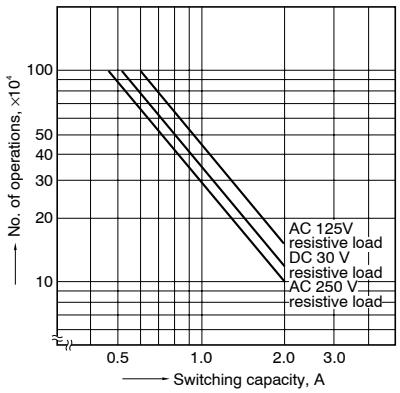


2) Coil terminals (Terminal No. 1 & 2) polarity should be arranged in the same direction.



3) Allowable contact current is 2 A.
4) About the electrical life for close mounting, please refer to data below.





For Cautions for Use, see Relay Technical Information (page 390).

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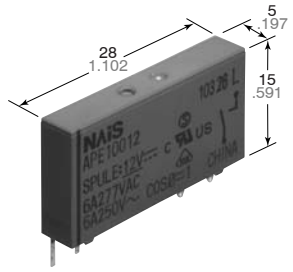
THE SLIM POWER RELAY

PE RELAYS (APE)



FEATURES

- **Slim size**
  28 mm (L)×5 mm (W)×15 mm (H)
  1.102 inch (L)×.197 inch (W)×.591 inch (H)
  permits high density mounting
- **Wide switching capacity:**
  100 mA/12 V DC-6A/250 V AC
- **High sensitivity: 170mW**
- **High breakdown (4,000 V) and surge (6,000 V) voltage between contacts and coil**
- **Clearance/creepage distance: 8/8 mm**
- **1 Form A/1 Form C contact.**

Insulation complying to following standards:

EN 60255 General specification for electrical relays
EN 60335 For use in house-hold appliances
EN 60730 For use in temperature sensing appliances
EN 60950 For use in electrical business equipment
EN 60065 For use in entertainment electronics (radio, HiFi-sets)
EN 50178 For use in industrial range

Notes / Rating

Standard	File No.	Rating
UL	E43149	6 A 277 V AC
VDE	122402ÜG	6 A 250 V AC ($\cos\phi$ = 1) 1 A 250 V AC ($\cos\phi$ = 0.4)
SEV	CH-99.1 10483.2A1	6 A 250 V AC ($\cos\phi$ = 1)

SPECIFICATIONS

Contacts

Arrangement		1 Form A, 1 Form C	
Contact material		Silver alloy	Au-plated silver alloy
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)		100 mΩ	30 mΩ
Rating (resistive)	Nominal switching capacity	6 A 250 V AC	
	Maximum switching power	1,500 VA	
	Maximum switching voltage	250V AC	
	Max. switching current	6 A (AC)	
	Min. switching capacity#1	100 mA, 5 V DC	1 mA, 1 V DC
Expected life (min. operations)	Mechanical (at 180 cpm)	5×10^6	
	Electrical (at 6 cpm) (at rated load)	N.O.: 5×10^4 N.C.: 3×10^4	

Coil (at 25°C 77°F, 50% R.H.)

Nominal operating power	170 mW (4.5 to 24 V DC) 217 mW (48 V DC) 175 mW (60 V DC)

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Intial breakdown voltage" section
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ±1.2×50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 50ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 11ms

Characteristics

Initial insulation resistance*1		Min. 1,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	1,000 Vrms
	Between contacts and coil	4,000 Vrms
Surge voltage between contacts and coil*3		Min. 6,000 V (Initial)
Operate time*4 (at nominal voltage)		Max. 8 ms (approx. 5 ms)
Release time (without diode)*4 (at nominal voltage)		Max. 4 ms (approx. 2.5 ms)
Temperature rise		Max. 30°C with nominal coil voltage across coil and at nominal switching capacity
Shock resistance	Functional*5	1 Form C: Min. 49 m/s²{5 G} 1 Form A: Min. 98 m/s²{10 G}
	Destructive*6	Min. 980 m/s² {100 G}
Vibration resistance	Functional*7	10 to 55 Hz at double amplitude of 1.0 mm/6 G
	Destructive	10 to 55 Hz at double amplitude of 1.5 mm/9 G
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +85°C –40°F to +185°F
	Humidity	5 to 85%R.H.
Unit weight		Approx. 4 g .14 oz

*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

TYPICAL APPLICATIONS

- Interface relays for programmable controllers
- Output relays for measuring equipment, timers, counters and temperature controllers
- Industrial equipment, office equipment
- House-hold appliances for Europe

ORDERING INFORMATION

Ex. APE [1] [0] [1] [4H]

Contact arrangement	Contact type	Contact material	Coil voltage, V DC	
1: 1 Form A 3: 1 Form C	0: Single contact	0: Silver alloy 1: Au–plated silver alloy	4H: 4.5 V 05: 5 V 06: 6 V 12: 12V	18: 18 V 24: 24 V 48: 48 V 60: 60 V

Notes: 1. Standard packing: Tube: 20 pcs.; Case: 1,000 pcs.
2. 1 Form B is also available.

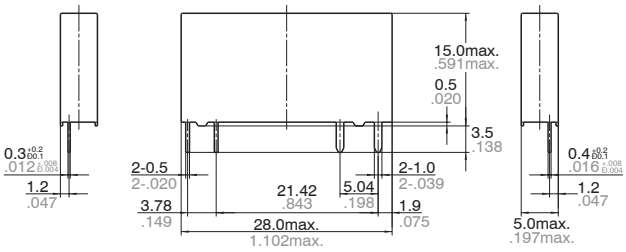
TYPES AND COIL DATA (at 20°C 68°F)

Part No.	Contact arrangement	Nominal voltage, V DC	Pick-up voltage, (Initial) V DC (max.)	Drop-out voltage, (Initial) V DC (min.)	Nominal operating current, mA (±10%)	Nominal operating power, mW	Coil resistance, Ω (±10%)	Max. allowable voltage, V DC
APE1004H	1 Form A (without Au-plated)	4.5	2.97	0.225	38	170	119	5.4
APE10005		5	3.3	0.25	34		148	6
APE10006		6	3.96	0.3	28		212	7.2
APE10012		12	7.92	0.6	14		847	14.4
APE10018		18	11.88	0.9	9		1,906	21.6
APE10024		24	15.84	1.2	7		3,388	28.8
APE10048		48	31.68	2.4	5	217	10,618	57.6
APE10060		60	39.6	3	3	175	20,572	72
APE1014H	1 Form A (with Au-plated)	4.5	2.97	0.225	38	170	119	5.4
APE10105		5	3.3	0.25	34		148	6
APE10106		6	3.96	0.3	28		212	7.2
APE10112		12	7.92	0.6	14		847	14.4
APE10118		18	11.88	0.9	9		1,906	21.6
APE10124		24	15.84	1.2	7		3,388	28.8
APE10148		48	31.68	2.4	5	217	10,618	57.6
APE10160		60	39.6	3	3	175	20,572	72
APE3004H	1 Form C (without Au-plated)	4.5	2.97	0.225	38	170	119	5.4
APE30005		5	3.3	0.25	34		148	6
APE30006		6	3.96	0.3	28		212	7.2
APE30012		12	7.92	0.6	14		847	14.4
APE30018		18	11.88	0.9	9		1,906	21.6
APE30024		24	15.84	1.2	7		3,388	28.8
APE30048		48	31.68	2.4	5	217	10,618	57.6
APE30060		60	39.6	3	3	175	20,572	72
APE3014H	1 Form C (with Au-plated)	4.5	2.97	0.225	38	170	119	5.4
APE30105		5	3.3	0.25	34		148	6
APE30106		6	3.96	0.3	28		212	7.2
APE30112		12	7.92	0.6	14		847	14.4
APE30118		18	11.88	0.9	9		1,906	21.6
APE30124		24	15.84	1.2	7		3,388	28.8
APE30148		48	31.68	2.4	5	217	10,618	57.6
APE30160		60	39.6	3	3	175	20,570	72

DIMENSIONS

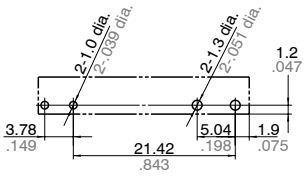
mm inch

1. 1 Form A type



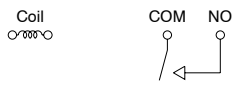
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)

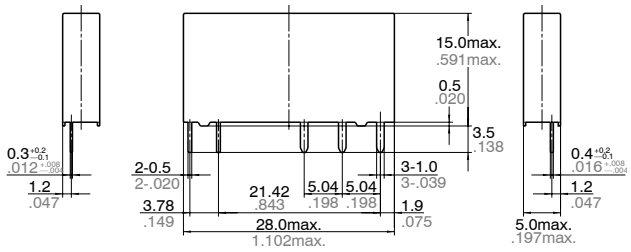


Tolerance: ±0.1 ±.004

Schematic (Bottom view)

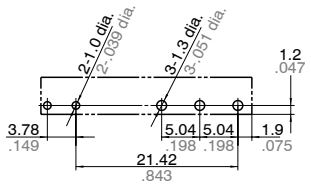


2. 1 Form C type



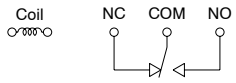
General tolerance: ±0.3 ±.012

PC board pattern (Bottom view)



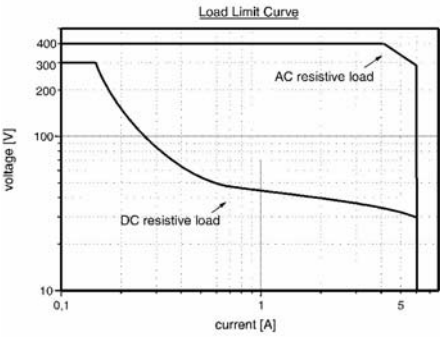
Tolerance: ±0.1 ±.004

Schematic (Bottom view)

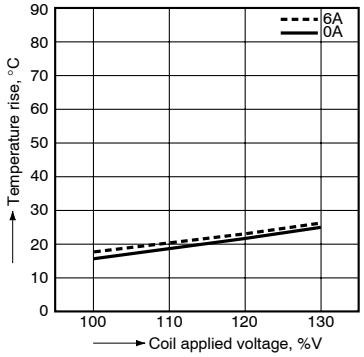


REFERENCE DATA

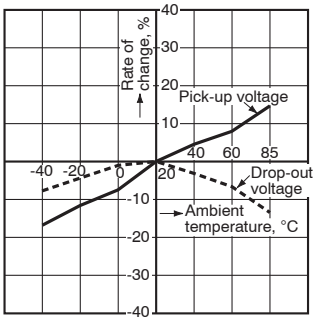
1. Max. switching capacity



2. Coil temperature rise
Sample: APE30012
Measured portion: Inside the coil
Ambient temperature: 28°C 82°F

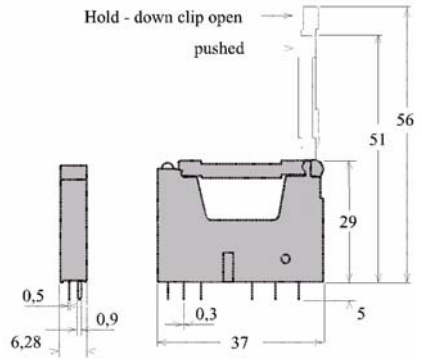


3. Ambient temperature characteristics
Sample: APE30012
No. of samples: n = 6

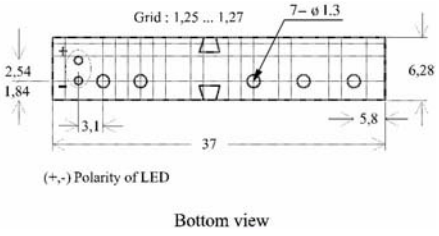


PE RELAY SOCKET

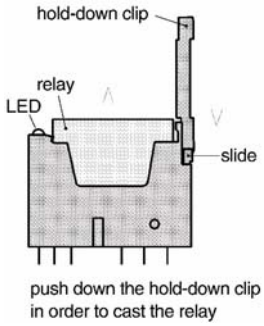
1. Dimensions

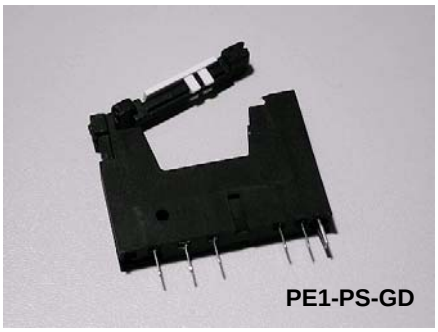


2. Pin Layout



3. Handling





Specifications

LED		Pins rating
nominal voltage	24 V DC	see above
nominal current	appr. 4.2 mA	
diameter	3 mm	
colour	green*	

*other LED-colours on request

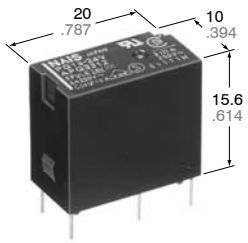
Socket incorporates LED-indication, hold-down clip and an integrated casting mechanism; PCB-mounting.

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

HIGH ELECTRICAL & MECHANICAL NOISE IMMUNITY RELAY

PQ RELAYS



mm inch

FEATURES

- **High electrical noise immunity**
- **Bifurcated contact type with higher contact reliability**
- **High switching capacity: 5 A 250 V AC**
- **High sensitivity: 200 mW (Nominal)**
- **High surge voltage between contacts and coil: 8,000 V**
- **Compatible with DS-P relay terminal layout**

SPECIFICATIONS

Contacts

Arrangement			1 Form A (Bifurcated)
Contact material			Silver alloy
Initial contact resistance, max. (By voltage drop 6 V DC 1 A)			50 mΩ
Rating (resistive)	Nominal switching capacity		5 A 250 V AC, 5 A 30 V DC
	Max. switching power		1,250 VA, 150 W
	Max. switching voltage		250 V AC, 110 V (0.3 A)
	Min. switching capacity#1		100 μA, 100 mV DC
Expected life (min. ope.)	Mechanical (at 180 cpm)		2×10^7
	Electrical (at 20 cpm)	5 A 125 V AC	2×10^5
		5 A 250 V AC	10^5

Coil (at 20°C 68°F)

Nominal operating power	200 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Wave is standard shock voltage of ± 1.2 × 50μs according to JEC-212-1981
*4 Excluding contact bounce time
*5 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*6 Half-wave pulse of sine wave: 6ms
*7 Detection time: 10μs
*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

Max. operating speed		20 cpm at rated load
Initial insulation resistance*1		Min. 1,000 MΩ at 500 V DC
Initial breakdown voltage*2	Between open contacts	1,000 Vrms
	Between contacts and coil	4,000 Vrms
Surge voltage between contacts and coil*3		8,000 V
Operate time*4 (at nominal voltage)		Max. 20 ms
Release time (without diode)*4 (at nominal voltage)		Max. 10 ms
Coil temperature rise (Resistive at nominal voltage, contact carrying current: 5 A, at 70°C)		Max. 45°C
Shock resistance	Functional*5	294 m/s² {30 G}
	Destructive*6	980 m/s² {100 G}
Vibration resistance	Functional*7	117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2.0 mm
	Destructive	205.8 m/s² {21 G}, 10 to 55 Hz at double amplitude of 3.5 mm
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +70°C –40°F to +158°F
	Humidity	5 to 85%R.H.
Unit weight		Approx. 7 g .25 oz

TYPICAL APPLICATIONS

- Programmable controllers
- Interface relays for Factory Automation and Communication equipment
- Output relays for measuring equipment, timers, counters and temperature controllers

ORDERING INFORMATION

Ex. PQ [1a] — [12V]

Contact arrangement	Coil voltage (DC)
1a: 1 Form A (Bifurcated)	3, 5, 6, 9, 12, 18, 24 V

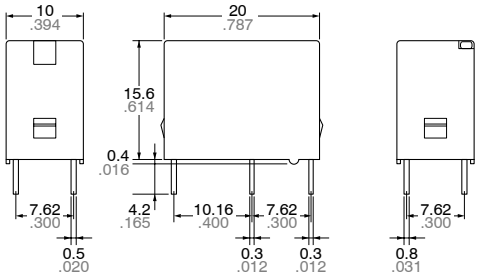
Note: Standard packing: Carton: 100 pcs.; Case: 500 pcs.
UL/CSA, VDE, SEMKO approved type is standard.

TYPES AND COIL DATA (at 20°C 68°F)

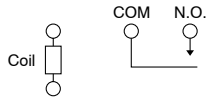
Part No.	Nominal voltage, V DC	Pick-up voltage, (max.)	Drop-out voltage, (min.)	Nominal operating current, mA	Nominal operating power, mW	Coil resistance, Ω (±10%)	Max. allowable voltage, V DC
PQ1a-3V	3	2.25	0.15	66.7	200	45	180% V of nominal voltage (at 20°C 68°F) 130% V of the nominal voltage (at 70°C 158°F)
PQ1a-5V	5	3.75	0.25	40	200	125	
PQ1a-6V	6	4.5	0.3	33.3	200	180	
PQ1a-9V	9	6.75	0.45	22.2	200	405	
PQ1a-12V	12	9	0.6	16.7	200	720	
PQ1a-18V	18	13.5	0.9	11.1	200	1,620	
PQ1a-24V	24	18	1.2	8.3	200	2,880	

DIMENSIONS

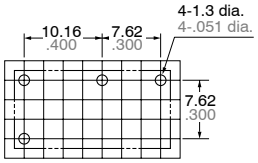
mm inch



Schematic (Bottom view)



PC board pattern
(Copper-side view)

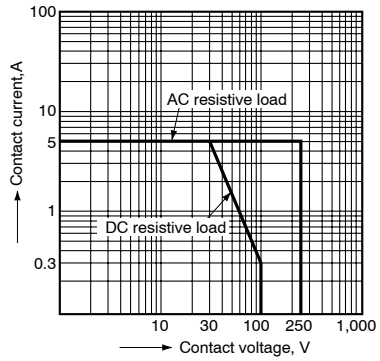


Dimension :	General tolerance
Max. 1mm .039 inch	±0.2 ±.008
1 to 5mm .039 to .118 inch	±0.3 ±.012
Min. 5mm .118 inch	±0.4 ±.016

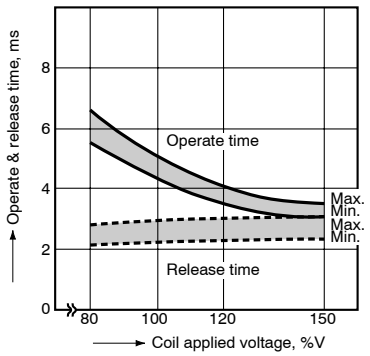
Tolerance: ±0.1 ±.004

REFERENCE DATA

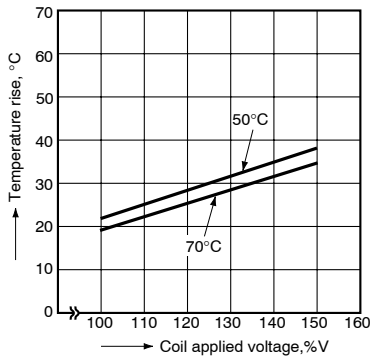
1. Max. switching capacity



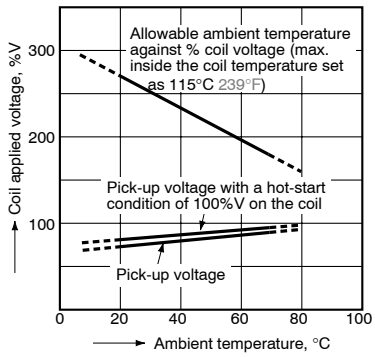
2. Operate & release time
Tested sample: PQ1a-24V, 25 pcs.



3. Coil temperature rise
Measured portion: Inside the coil
Contact carrying current: 5 A



4. Ambient temperature characteristics
Tested sample: PQ1a-24V
Contact carrying current: 5 A



For Cautions for Use, see Relay Technical Information (page 390).

PQ

Automotive Relays

Panasonic
ideas for life

AUTOMOTIVE POWER RELAYS — SMALL SIZE, LIGHT WEIGHT

CA RELAYS

FEATURES

1. Small size and light weight
For space saving, the outside dimensions of the main body are reduced to be 21.5 mm (length) × 14.4 mm (width) × 37 mm (height) (.846 × .567 × 1.457 inch), and the weight is also reduced to be approx. 19 g .67 oz (direct coupling 1 Form A, 1 Form B type).

2. Low operating power (1.4W) type is available (1 Form A, 1 Form B)

3. Since the terminal arrangement complies with JIS D5011 B4-M1, commercial connectors are available for these types of relays.

SPECIFICATIONS

Contact

Type			12 V DC			24 V DC
Arrangement			1 Form A	1 Form B	1 Form C	1 Form C
Initial contact resistance (By voltage drop 6 V DC 1A)			Max. 50 mΩ			
Contact material			Silver alloy			
Contact voltage drop			Max. 0.3 V After electrical life test, by voltage drop 12 V DC 20 A (1.4 W type), 12 V DC 30 A (1.8 W type)	Max. 0.3 V After electrical life test, by voltage drop 12 V DC 20 A	Max. 0.4 V After electrical life test, by voltage drop 12 V DC 20 A	Max. 0.4 V After electrical life test, by voltage drop 24 V DC 10 A
Rating	Nominal switching capacity (resistive load)		20 A 12 V DC (1.4 W type) 30 A 12 V DC (1.8 W type)	20 A 12 V DC		10 A 24 V DC (ON: 2s, OFF: 2s)
	Max. switching voltage		16 V		15 V	30 V
	Max. switching current		120 A (1.4 W type) 150 A (1.8 W type)	120 A	100 A	50 A (Inrush current)
	Max. carrying current		20 A continuous (1.4 W type) 30 A for 1 min (1.8 W type)	20 A continuous	20 A continuous	10 A continuous
	Min. switching capacity#1		1 A 12 V DC			1 A 24 V DC
Nominal operating power			1.4 W / 1.8 W		1.8 W	
Expected life (min. operations)	Mechanical (at 120 cpm)		10^6		5×10^5	
	Electrical	20 A (1.4 W, 1.8 W type)	10^5 (ON: 2s, OFF: 2s)	10^5 (ON 2s, OFF 2s)		10^5 (ON 2s, OFF 2s)
		30 A (1.8 W type)	2×10^4 (ON: 3s, OFF: 15s)			

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics (at 20°C 68°F)

Type			12 V DC		24 V DC
Max. operating speed			15 cpm (1.4 W type: at nominal load; 1.8 W type: at 20 A)	15 cpm (at nominal load)	
Initial insulation resistance			Min. 10 MΩ at 500 V DC		
Initial breakdown voltage*1	Between open contacts		500 V rms for 1 min.		
	Between contacts and coil		500 V rms for 1 min.		
Operate time*2 (at nominal voltage)			Max. 10 ms at 20°C (initial)		Max. 10 ms (initial)
Release time (without diode)*2 (at nominal voltage)			Max. 10 ms at 20°C (initial)		Max. 10 ms (initial)
Shock resistance		Functional*3	Min. 200 m/s² {20 G}	Min. 100 m/s² {10 G}	Min. 100 m/s² {10 G}
		Destructive*4	Min. 1,000 m/s² {100 G}		
Vibration resistance		Functional*5	Rubber bracket A type: Min. 100 m/s² {10 G}, 50 Hz to 500 Hz Direct coupling type or Screw-mounting type: Min. 44.1 m/s² {4.5 G}, 33Hz		Min. 44.1 m/s² {4.5 G}, 33 Hz
		Destructive*6	Rubber bracket A type: Min. 100m/s² {10 G}, 50 Hz to 500 Hz Direct coupling type or Screw-mounting type: Min. 44.1 m/s² {4.5 G}, 33Hz		Min. 44.1 m/s² {4.5 G}, 33 Hz
Conditions for operation, transport and storage*7 (Not freezing and condensing low temperature)		Ambient temp.	–30°C to +80°C –22°F to +176°F		
		Humidity	5% R.H. to 85% R.H.		
Water-proof standard			Plastic sealed type: JIS DO203S2, Dust cover type: JIS DO203R2		JIS DO203S2
Mass			Rubber bracket A type: 23 g .81 oz Direct coupling type or Screw-mounting type: 19 g .67 oz	31 g 1.09 oz	

Electrical life (min. operation)

	Nominal coil voltage, V DC	Motor load (operating frequency ON: 2 s, OFF: 2 s)	Halogen lamp load (operating frequency ON: 1 s, OFF: 14 s)
1 Form A, 1 Form B	12	10^5, 20 A 12 V DC	10^5, 20 A 12 V DC
1 Form C	12	10^5, 20 A 12 V DC	10^5, 20 A 12 V DC
	24	10^5, 10 A 24 V DC	10^5, 6 A 24 V DC

Remarks

*1 Detection current: 10 mA
*2 Excluding contact bounce time
*3 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*4 Half-wave pulse of sine wave: 6ms
*5 Detection time: 10μs
*6 Time of vibration for each direction; X, Y, direction: 2 hours, Z direction: 4 hours
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT(page 408).

ORDERING INFORMATION

CA [1a] [F] [S] — [12 V] — [A] — [5]

Contact arrangement	Protective construction	Nominal operating power	Coil voltage (DC)	Mounting method	Classification by type
1a: 1 Form A 1b: 1 Form B 1 : 1 Form C	Nil: Plastic sealed type F: Dust cover type	Nil: Standard type (1.8 W) S: Low operating power type (1.4 W) (1 Form A, 1 Form B)	12 V 24 V (1 Form C only)	A: Rubber bracket A type (1 Form A, 1 Form B) N: Screw mounting type C: Direct coupling type	Nil: 1 Form C 5: 1 Form A or 1 Form B

Notes: 1. Type with resistor/diode inside are available as options. Please consult our sales office.
2. Standard packing: Carton: 20 pcs. Case: 200 pcs.

COIL DATA

1) Standard type

Contact arrangement	Mounting type	Plastic sealed type	Dust cover type	Nominal voltage, V DC	Pick-up voltage, V DC (at 20°C 68°F)	Drop-out voltage, V DC (at 20°C 68°F)	Nominal operating current, mA (at 20°C 68°F)	Coil resistance, Ω (at 20°C 68°F)	Nominal operating power, mW (at 20°C 68°F)	Usable voltage range, V DC
1 Form A	Rubber bracket A	CA1a-12V-A-5	CA1aF-12V-A-5	12	Max. 8	Min. 0.6 to 6	150±10%	80±10%	1.8	10 to 16
	Screw-mounting	CA1a-12V-N-5	CA1aF-12V-N-5	12	Max. 8	Min. 0.6 to 6	150±10%	80±10%	1.8	10 to 16
	Direct coupling	CA1a-12V-C-5	CA1aF-12V-C-5	12	Max. 8	Min. 0.6 to 6	150±10%	80±10%	1.8	10 to 16
1 Form B	Rubber bracket A	CA1b-12V-A-5	CA1bF-12V-A-5	12	Max. 8	Min. 0.6 to 6	150±10%	80±10%	1.8	10 to 16
	Screw-mounting	CA1b-12V-N-5	CA1bF-12V-N-5	12	Max. 8	Min. 0.6 to 6	150±10%	80±10%	1.8	10 to 16
	Direct coupling	CA1b-12V-C-5	CA1bF-12V-C-5	12	Max. 8	Min. 0.6 to 6	150±10%	80±10%	1.8	10 to 16
1 Form C	Screw-mounting	CA1-DC12V-N	–	12	Max. 8	Min. 0.6	150±10%	80±10%	1.8	10 to 15
	Direct coupling	CA1-DC12V-C	–	12	Max. 8	Min. 0.6	150±10%	80±10%	1.8	10 to 15
	Screw-mounting	CA1-DC24V-N	–	24	Max. 16	Min. 1.2	75±10%	320±10%	1.8	20 to 30
	Direct coupling	CA1-DC24V-C	–	24	Max. 16	Min. 1.2	75±10%	320±10%	1.8	20 to 30

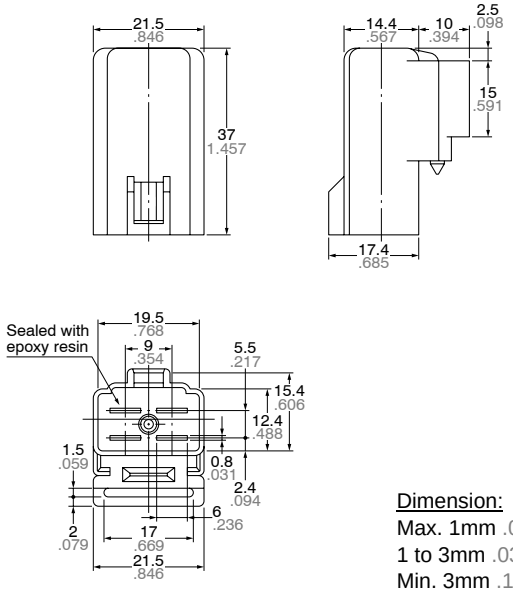
2) Low operating power type

Contact arrangement	Mounting type	Plastic sealed type	Dust cover type	Nominal voltage, V DC	Pick-up voltage, V DC (at 20°C 68°F)	Drop-out voltage, V DC (at 20°C 68°F)	Nominal operating current, mA (at 20°C 68°F)	Coil resistance, Ω (at 20°C 68°F)	Nominal operating power, mW (at 20°C 68°F)	Usable voltage range, V DC
1 Form A	Rubber bracket A	CA1aS-12V-A-5	CA1aFS-12V-A-5	12	Max. 8	Min. 0.6 to 6	120±10%	100±10%	1.4	10 to 16
	Screw-mounting	CA1aS-12V-N-5	CA1aFS-12V-N-5	12	Max. 8	Min. 0.6 to 6	120±10%	100±10%	1.4	10 to 16
	Direct coupling	CA1aS-12V-C-5	CA1aFS-12V-C-5	12	Max. 8	Min. 0.6 to 6	120±10%	100±10%	1.4	10 to 16
1 Form B	Rubber bracket A	CA1bS-12V-A-5	CA1bFS-12V-A-5	12	Max. 8	Min. 0.6 to 6	120±10%	100±10%	1.4	10 to 16
	Screw-mounting	CA1bS-12V-N-5	CA1bFS-12V-N-5	12	Max. 8	Min. 0.6 to 6	120±10%	100±10%	1.4	10 to 16
	Direct coupling	CA1bS-12V-C-5	CA1bFS-12V-C-5	12	Max. 8	Min. 0.6 to 6	120±10%	100±10%	1.4	10 to 16

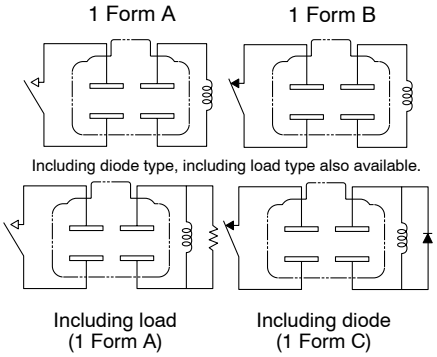
DIMENSIONS

mm inch

1. 1 Form A/1 Form B
Rubber bracket A type

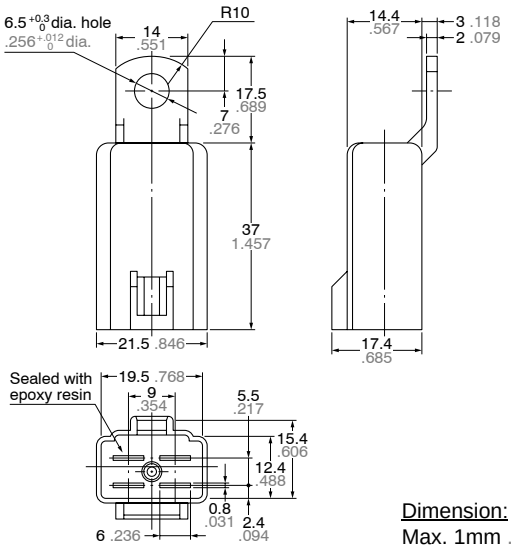


SCHEMATIC (Bottom View)

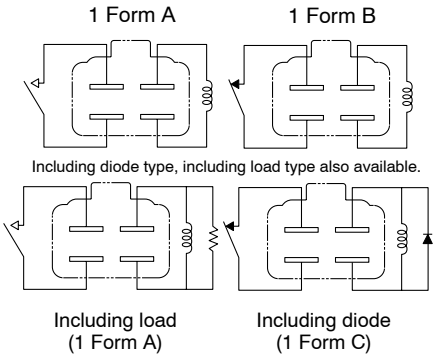


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

2. 1 Form A/1 Form B
Screw-mounting type



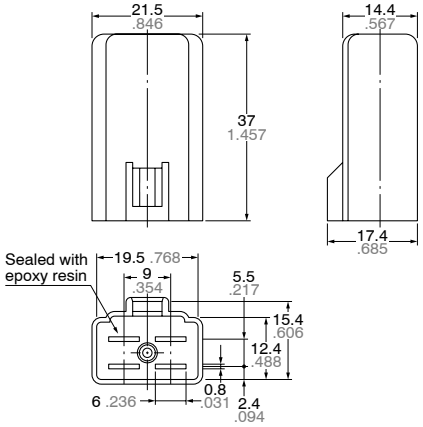
SCHEMATIC (Bottom View)



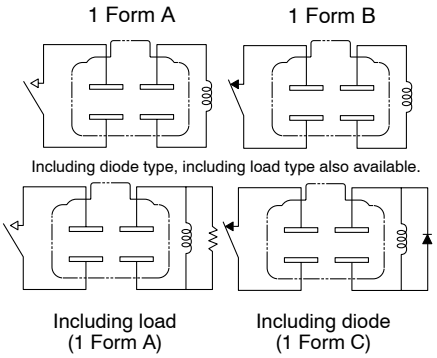
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

3. 1 Form A/1 Form B
Direct coupling type

mm inch

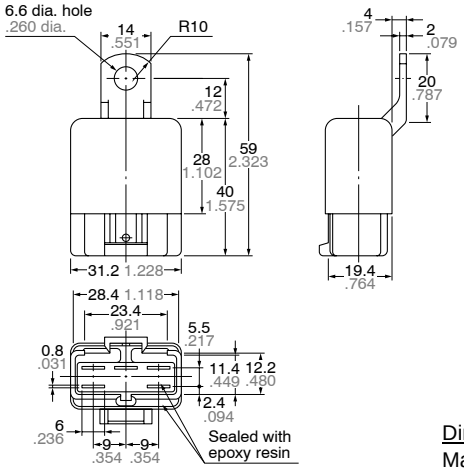


SCHEMATIC (Bottom View)

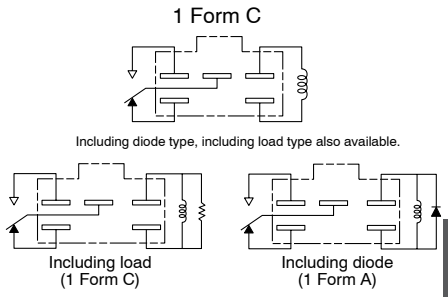


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

4. 1 Form C
Screw-mounting type

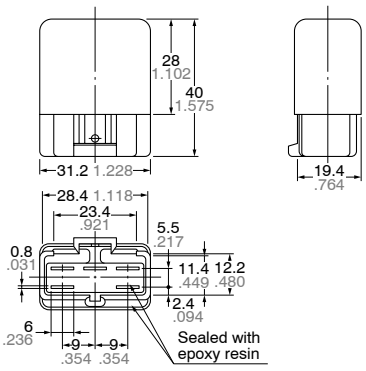


SCHEMATIC (Bottom View)

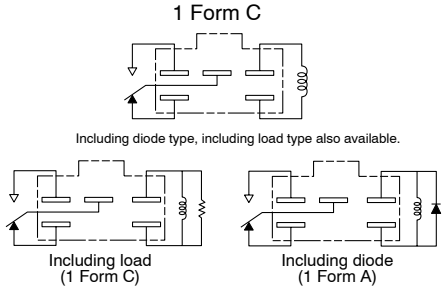


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

5. 1 Form C
Direct coupling type



SCHEMATIC (Bottom View)

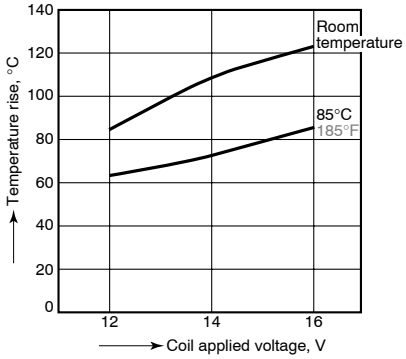


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

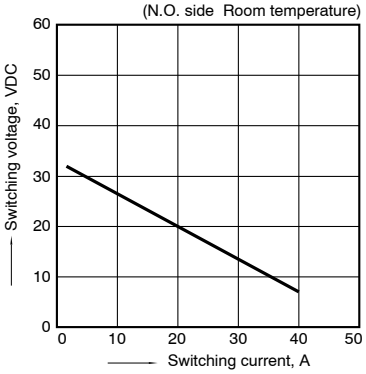
REFERENCE DATA

1. Coil temperature rise

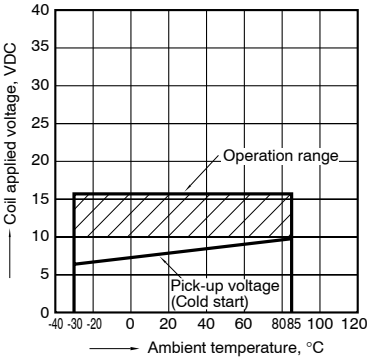
Samples: CA1aS-12V-N-5, 5pcs.
Measured portion: Inside the coil
Contact carrying current: 20A
Ambient temperature: Room temperature, 85°C
185°F



2. Max. switching capability (Resistive load)

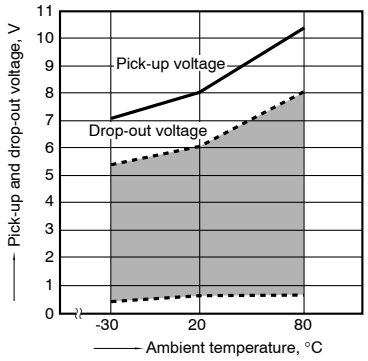


3. Ambient temperature and operating temperature range



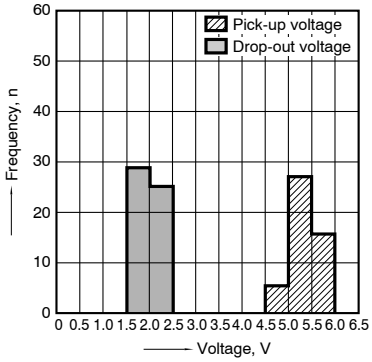
4. Ambient temperature characteristics (Cold start)

Samples: CA1bS-12V-N-5



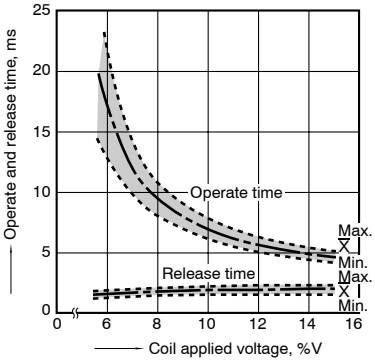
5. Distribution of pick-up and drop-out voltage

Quantity: 50pcs.



6. Distribution of operate and release time

Sample: CA1a-12V-N-5, 10pcs.

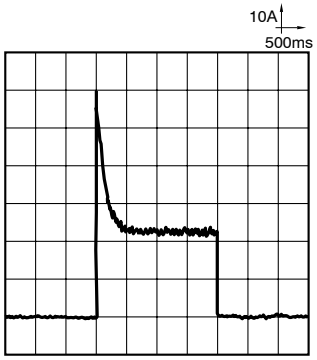


7-(1). Electrical life test (Motor load)

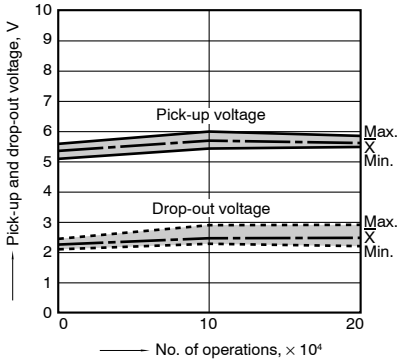
Sample: CA1a-12V-C, 3pcs.
Load: Inrush current: 63A, steady current: 23A
Blower fan motor actual load (motor free)
Switching frequency: (ON:OFF = 2s:2s)
Ambient temperature: Room temperature

Load current waveform

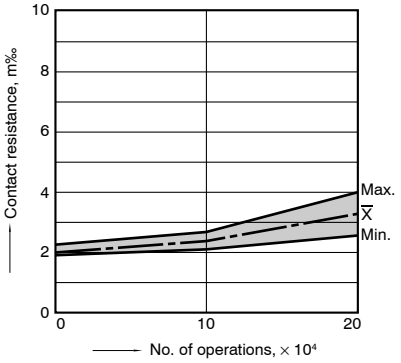
Load: Inrush current: 63A, steady current: 23A,



Change of pick-up and drop-out voltage

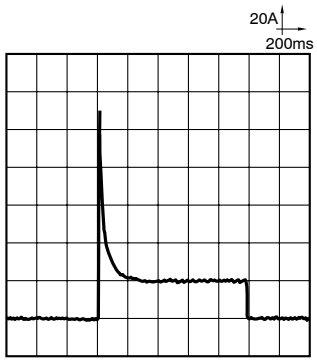


Change of contact resistance

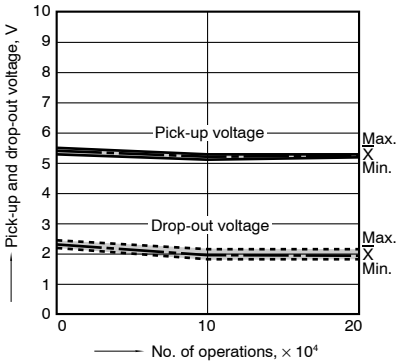


7-(2). Electrical life test (Lamp load)
Sample: CA1a-12V-C, 3pcs.
Load: 60Wx4, Inrush current: 110A, steady current: 20A
Halogen lamp actual load
Switching frequency: (ON:OFF = 1s:14s)
Ambient temperature: Room temperature

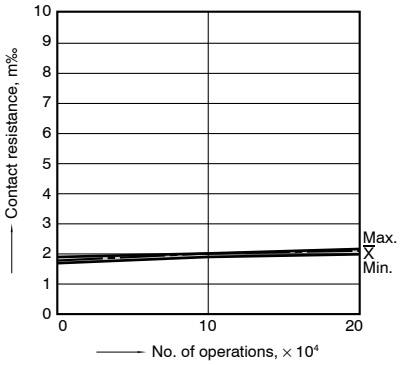
Load current waveform
Load: Inrush current: 110A, steady current: 20A,



Change of pick-up and drop-out voltage



Change of contact resistance



Cautions regarding the protection element

1. Part numbers without protection elements

1) 12 V models

When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 24 V or higher, or a resistor (680Ω to 1,000Ω). When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2) 24 V models

When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 48 V or higher, or a resistor (2,800Ω to 4,700Ω).

When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2. Part numbers with diodes

These relays use a diode in the coil surge protection element. Therefore, the release time is slower and the working life might be shorter compared to part numbers without protection elements and part numbers with resistors.

Be sure to use only after evaluating under actual load conditions.

3. Part numbers with resistors

This part number employs a resistor in the coil surge protection circuit; therefore, an external surge protection element is not required. In particular, when a diode is connected in parallel with a coil, the revert time becomes slower which could adversely affect working life. Please check the circuit and make sure that a diode is not connected in parallel with the coil drive circuit.

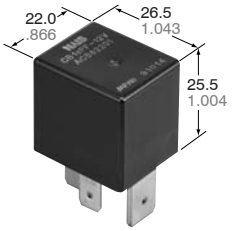
Automotive

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

HIGH POWER AUTOMOTIVE RELAY

CB RELAYS



mm inch

FEATURES

- **40 A rating at 85°C 185°F**
- **ISO type terminals**
- **High shock resistance for drop test requirements (2 meters 6.6 feet)**
- **Low temperature rise — all current carrying material is copper.**
- **Plug-in and PC board type**

SPECIFICATIONS

Contact

(1) Standard type (12V coil voltage)

Arrangement		1 Form A	1 Form C	High contact capacity (1 Form A)
Rating	Nominal switching capacity	40 A 14 V DC	N.O.: 40 A 14 V DC N.C.: 30 A 14 V DC	70 A 14 V DC (at 20°C 68°F) 50 A 14 V DC (at 85°C 185°F)
	Max. switching current (at 85°C 185°F)	N.O.: 40 A 14 V DC	N.O.: 40 A 14 V DC N.C.: 30 A 14 V DC	N.O.: 40 A 14 V DC
Initial contact resistance (By voltage drop 6 V DC 1 A)		Max. 15mΩ		
Contact material		Silver alloy		
Min. switching capacity#1		1 A 12 V DC (12 V DC), 1 A 24 V DC (24 V DC),		
Expected life	Mechanical (at 120 cpm)	Min. 10^6		
	Electrical (at rated load)	Flux-resistant type: Min. 10^{5}*1 Sealed type: Min. 5×10^4		

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

(2) Standard type (24V coil voltage)

Arrangement		1 Form A	1 Form C	High contact capacity (1 Form A)
Rating	Nominal switching capacity	20 A 28V DC	N.O.: 20 A 28 V DC N.C.: 10 A 28 V DC	20 A 28V DC
	Max. switching current (at 85°C 185°F)	20 A 28 V DC	N.O.: 20 A 28 V DC N.C.: 10 A 28 V DC	20 A 28 V DC

*1 All other specifications are the same as those of standard type (12V coil voltage)

(3) Heat resistant type (12V, 24V coil voltage)

Type		12V coil voltage		24V coil voltage	
Arrangement		1 Form A	1 Form C	1 Form A	1 Form C
Rating	Nominal switching capacity	40 A 14V DC	N.O.: 40 A 14 V DC N.C.: 30 A 14 V DC	20 A 28 V DC	N.O.: 20 A 28 V DC N.C.: 10 A 28 V DC
	Max. switching current (at 85°C 185°F)	40 A 14 V DC	N.O.: 40 A 14 V DC N.C.: 30 A 14 V DC	20 A 28V DC	N.O.: 20 A 28 V DC N.C.: 10 A 28 V DC

*1 All other specifications are the same as those of standard type (12V coil voltage)

Coil

Arrangement	Coil voltage	Nominal operating power
1 Form A, 1 Form C	12V DC	1.4W
	24V DC	1.8W
High contact capacity (1 Form A)	12V DC	1.8W
	24V DC	1.8W

Characteristics

Max. operating speed (at rated load)			15 cpm
Initial insulation resistance*2			Min. 20 MΩ (at 500 V DC)
Initial breakdown voltage*3	Between open contacts		500 Vrms for 1 min.
	Between contacts and coil		500 Vrms for 1 min.
Operate time*4 (at nominal voltage)			Max. 15 ms (Initial)
Release time (without diode)*4 (at nominal voltage)			Max. 15 ms (Initial)
Shock resistance		Functional	Min. 200 m/s² {20 G}
		Destructive	Min. 1,000 m/s² {100 G}
Vibration resistance		Functional	10 Hz to 500 Hz, Min. 44.1m/s² {4.5G}
		Functional*5	10 Hz to 2,000 Hz, Min. 44.1m/s² {4.5G}
Conditions for operation, transport and storage*6 (Not freezing and condensing at low temperature)		Ambient temp.	–40°C to +85°C –40°F to +185°F (Heat resistant type: –40°C to +125°C –40°F to +257°F)
		Humidity	5% R.H. to 85% R.H.
Mass			Approx. 33 g 1.16 oz

Remarks

*1 At nominal switching capacity, operating frequency: 2s ON, 2s OFF
*2 Measurement at same location as "Initial breakdown voltage" section
*3 Detection current: 10 mA
*4 Excluding contact bounce time
*5 Time of vibration for each direction; X, Y, Z direction: 4 hours

*6 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT(page 408).

TYPICAL APPLICATIONS

- **Head lights**
- **Head Lamp**
- **Starters**
- **Air conditioner**
- **ABS**
- **Tracter, Combine**

ORDERING INFORMATION

CB | 1 | F | — | T | — | M | — | 12 V

Contact arrangement	Protective construction	Heat resistant of types	Mounting classification	Coil voltage (DC)
1a: 1 Form A 1: 1 Form C 1aH: High contact capacity (1 Form A)	Nil: Sealed type F: Flux-resistant type	Nil: Standard type T: Heat resistant type*1 D: Diode R: Resistor	Nil: Plug-in type P: PC board type M: Bracket type	12, 24 V

Note: Bulk package: 50 pcs.; Case: 200 pcs.

*1 Heat resistant type with high contact capacity is not available. (See "2. Heat resistant type" in "TYPES" below.

TYPES

1. Standard type

Contact arrangement	Mounting classification	Coil voltage, V DC	Part No.	
			Sealed type	Flux-resistant type
1 Form A	PC board type	12V	CB1a-P-12V	CB1aF-P-12V
		24V	CB1a-P-24V	CB1aF-P-24V
	Plug-in type	12V	CB1a-12V	CB1aF-12V
		24V	CB1a-24V	CB1aF-24V
	Bracket type	12V	CB1a-M-12V	CB1aF-M-12V
		24V	CB1a-M-24V	CB1aF-M-24V
1 Form C	PC board type	12V	CB1-P-12V	CB1F-P-12V
		24V	CB1-P-24V	CB1F-P-24V
	Plug-in type	12V	CB1-12V	CB1F-12V
		24V	CB1-24V	CB1F-24V
	Bracket type	12V	CB1-M-12V	CB1F-M-12V
		24V	CB1-M-24V	CB1F-M-24V
High contact capacity (1 Form A)	Plug-in type	12V	CB1aH-12V	CB1aHF-12V
		24V	CB1aH-24V	CB1aHF-24V

* High contact capacity PC board type is also available. Please contact us for details.

2. Heat resistant type

Contact arrangement	Mounting classification	Coil voltage, V DC	Part No.	
			Sealed type	Flux-resistant type
1 Form A	PC board type	12V	CB1a-T-P-12V	CB1aF-T-P-12V
		24V	CB1a-T-P-24V	CB1aF-T-P-24V
	Plug-in type	12V	CB1a-T-12V	CB1aF-T-12V
		24V	CB1a-T-24V	CB1aF-T-24V
	Bracket type	12V	CB1a-T-M-12V	CB1aF-T-M-12V
		24V	CB1a-T-M-24V	CB1aF-T-M-24V
1 Form C	PC board type	12V	CB1-T-P-12V	CB1F-T-P-12V
		24V	CB1-T-P-24V	CB1F-T-P-24V
	Plug-in type	12V	CB1-T-12V	CB1F-T-12V
		24V	CB1-T-24V	CB1F-T-24V
	Bracket type	12V	CB1-T-M-12V	CB1F-T-M-12V
		24V	CB1-T-M-24V	CB1F-T-M-24V

COIL DATA (at 20°C 68°F)

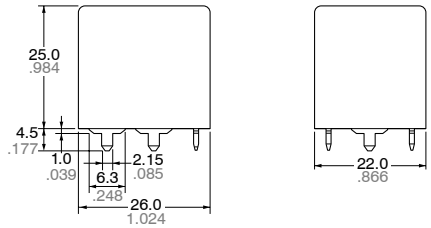
Contact arrangement	Nominal voltage, V DC	Pick-up voltage, V DC*	Drop-out voltage, V DC	Nominal current, mA	Coil resistance, Ω	Nominal operating power, W	Usable voltage range, V DC
1 Form A 1 Form C	12	Max. 3 to 7	Min. 1.2 to 4.2	117±10%	103±10%	1.4	10 to 16
	24	Max. 6 to 14	Min. 2.4 to 8.4	75±10%	320±10%	1.8	20 to 32
High contact capacity (1 Form A)	12	Max. 3 to 7	Min. 1.2 to 4.2	150±10%	80±10%	1.8	10 to 16

* Other pick-up voltage types are also available. Please contact us for details.

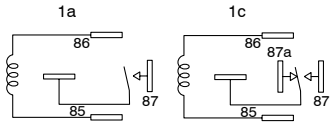
DIMENSIONS

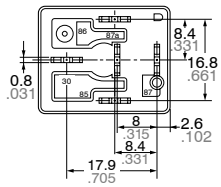
mm inch

1. PC board type



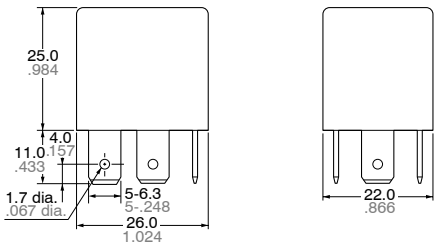
Schematic (Bottom view)



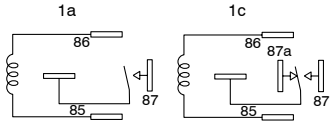


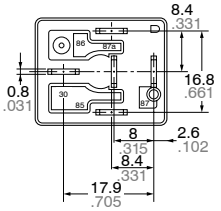
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

2. Plug-in type



Schematic (Bottom view)

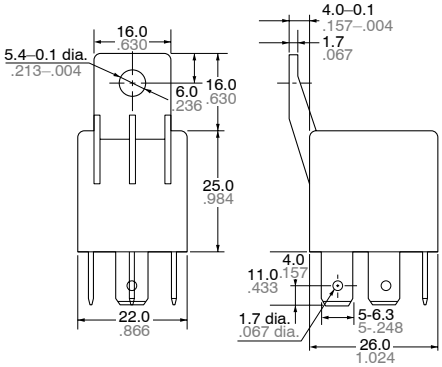




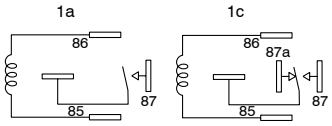
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

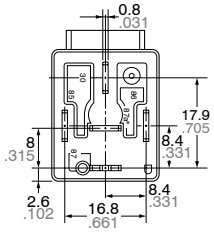
3. Bracket type

mm inch



Schematic (Bottom view)

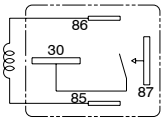


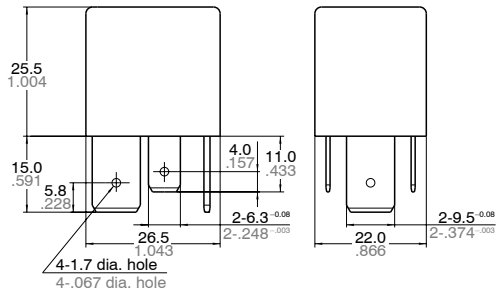


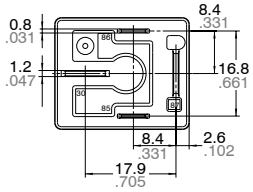
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

4. High contact capacity type (Plug-in terminal type)

Schematic (Bottom view)



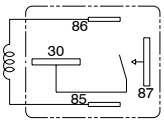


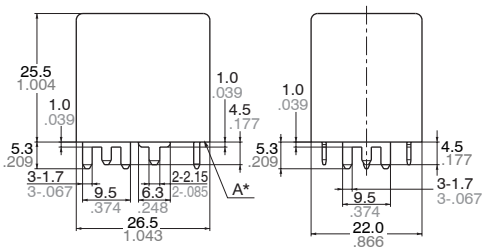


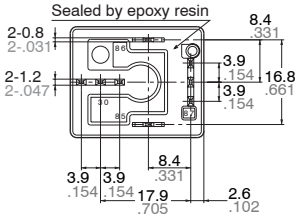
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

High contact capacity type (PC board terminal type)

Schematic (Bottom view)







Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

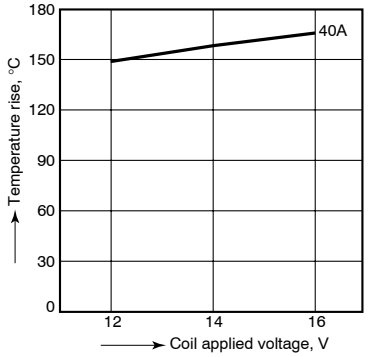
* Intervals between terminals is measured at A surface level.

REFERENCE DATA

CB (Standard type)

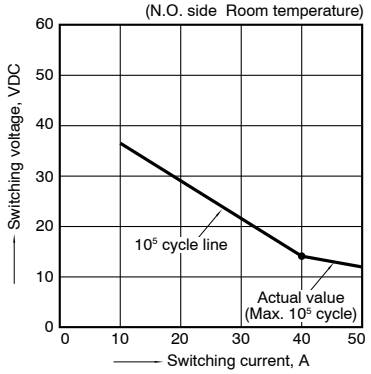
1. Coil temperature rise

Sample: CB1aF-P-12V, 3pcs.
Measured potion: Inside the coil
Contact carrying current: 40A
Ambient temperature: 85°C 185°F



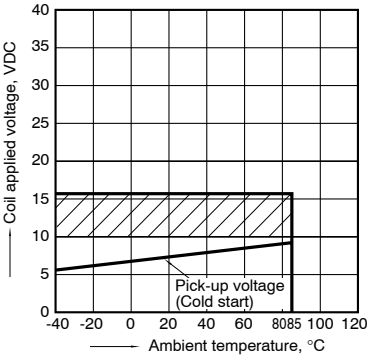
2. Max. switching capability (Resistive load)

(Standard type)



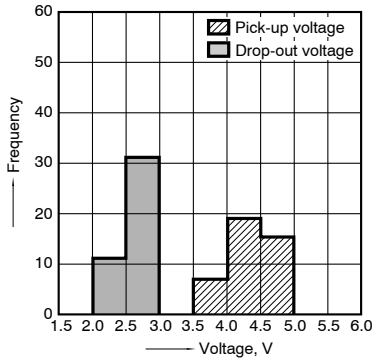
3. Ambient temperature and operating temperature range

(Standard type)



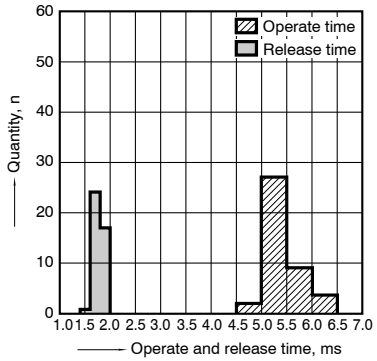
4. Distribution of pick-up and drop-out voltage

Sample: CB1-P-12V, 42pcs.



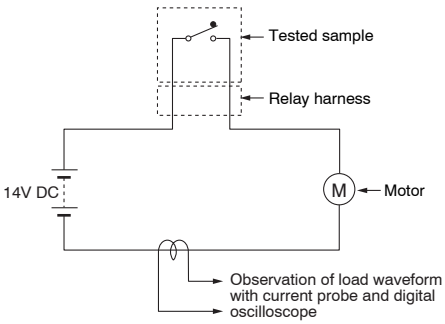
5. Distribution of operate and release time

Sample: CB1-P-24V, 42pcs.
* Without diode



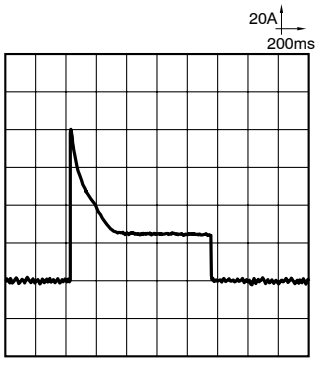
6-(1). Electrical life test (Motor free)

Sample: CB1F-12V, 5pcs.
Load: 25A 14V DC, motor free actual load
Switching frequency: (ON:OFF = 1s:9s)
Ambient temperature: Room temperature
Circuit

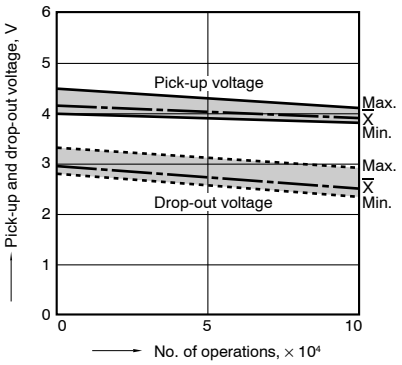


Load current waveform

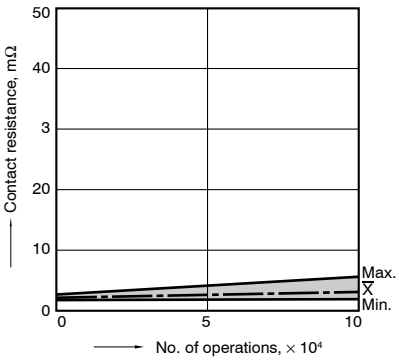
Inrush current: 80A, Steady current: 25A,



Change of pick-up and drop-out voltage



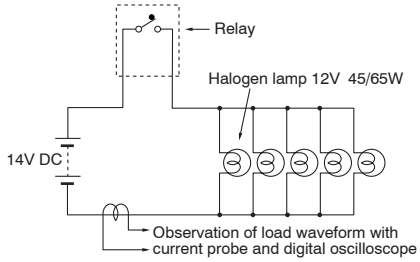
Change of contact resistance



6-(2). Electrical life test (Lamp load)

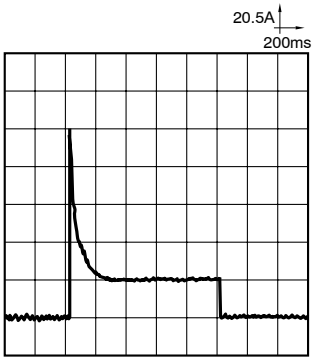
Sample: CB1F-12V, 5pcs.
Load: 45/65Wx5 parallel, 14V DC, halogen lamp actual load
Switching frequency: (ON:OFF = 1s:8s)
Ambient temperature: Room temperature

Circuit

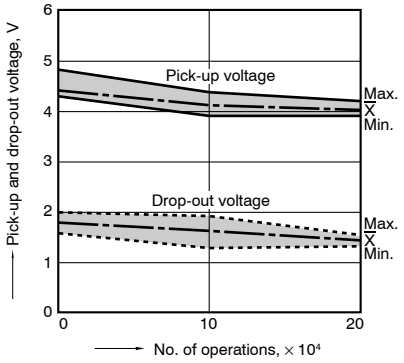


Load current waveform

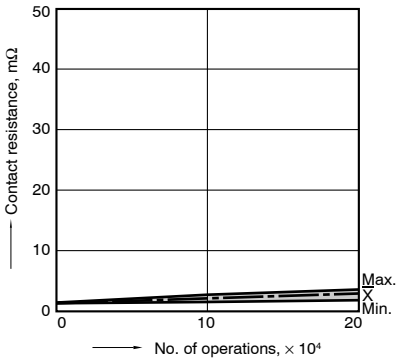
Inrush current: 100A, Steady current: 20A,



Change of pick-up and drop-out voltage



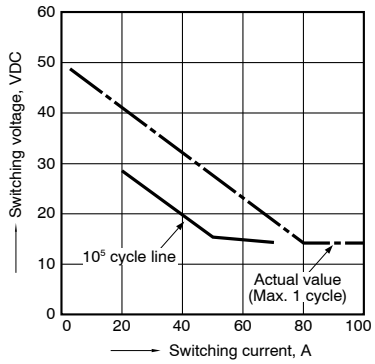
Change of contact resistance



CB (High capacity type)

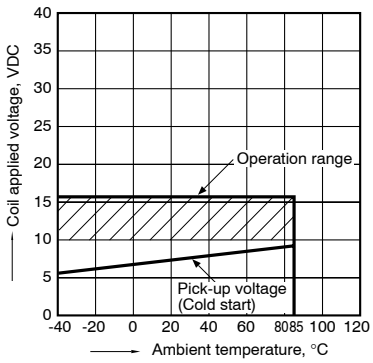
1. Max. switching capability

(High capacity type)



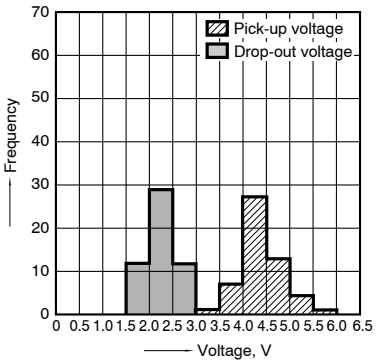
2. Ambient temperature and operating temperature range

(High capacity type)



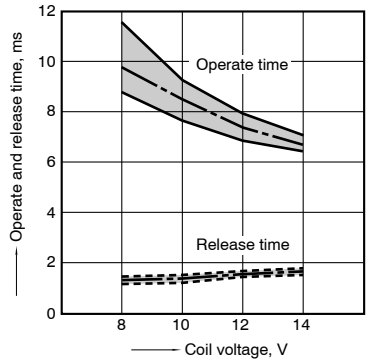
3. Distribution of pick-up and drop-out voltage

Sample: CB1aHF-12V, 53pcs.



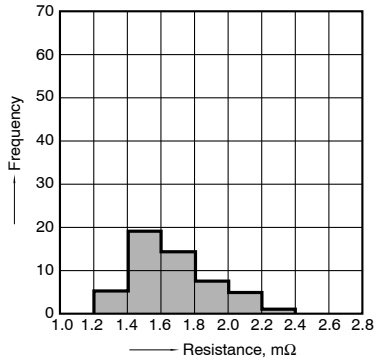
4. Distribution of operate and release time

Sample: CB1aHF-12V, 53pcs.



5. Contact resistance

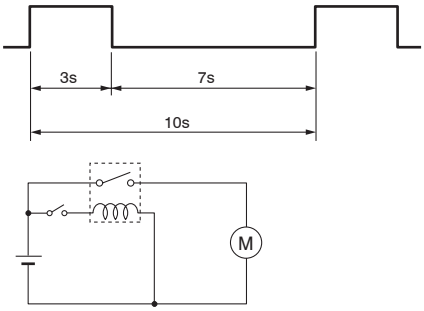
Sample: CB1aHF-12V, 53pcs.
(By voltage drop 6V DC 1A)



6-(1). Electrical life test (Motor free)

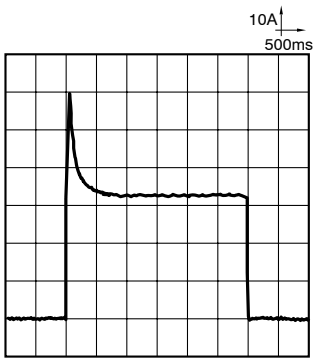
Sample: CB1aH-12V, 3pcs.
Load: Inrush current: 64A/Steady current: 35A
Fan motor actual load (motor free) 12V DC
Switching frequency: (ON:OFF = 3s:7s)
Ambient temperature: Room temperature

Circuit

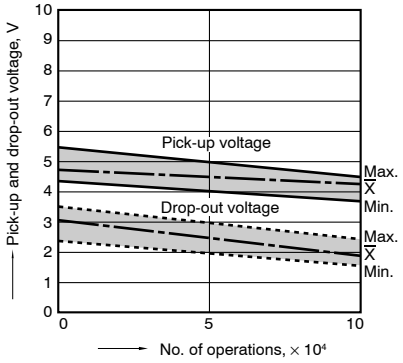


Load current waveform

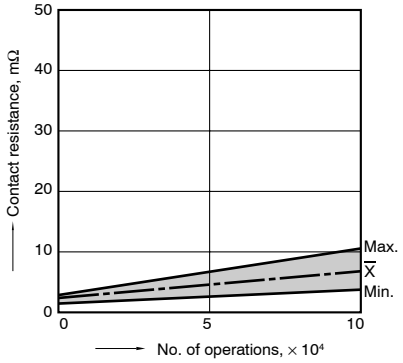
Inrush current: 64A, Steady current: 35A,



Change of pick-up and drop-out voltage



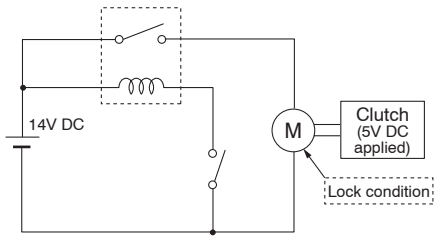
Change of contact resistance



6-(2). Electrical life test (Motor lock)

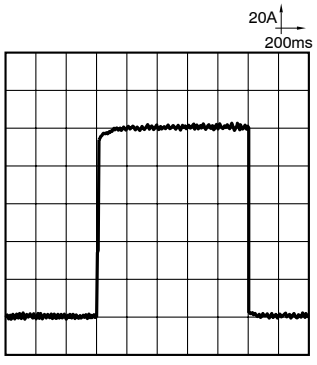
Sample: CB1aH-12V, 5pcs.
Load: 100A 14V DC
Magnet clutch actual load (lock condition)
Switching frequency: (ON:OFF = 1s:9s)
Ambient temperature: Room temperature

Circuit

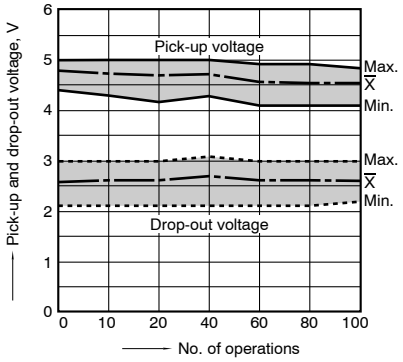


Load current waveform

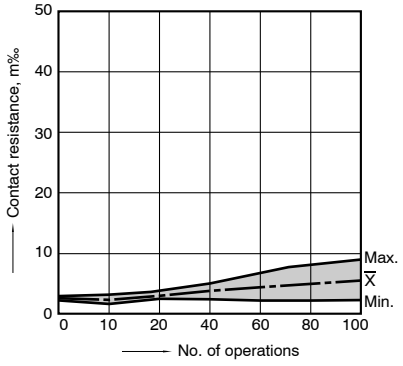
100A 14V DC



Change of pick-up and drop-out voltage



Change of contact resistance



Cautions regarding the protection element

1. Part numbers without protection elements

1) 12 V models

When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 24 V or higher, or a resistor (680Ω to 1,000Ω). When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2) 24 V models

When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 48 V or higher, or a resistor (2,800Ω to 4,700Ω). When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2. Part numbers with diodes

These relays use a diode in the coil surge protection element. Therefore, the release time is slower and the working life might be shorter compared to part numbers without protection elements and part numbers with resistors.
Be sure to use only after evaluating under actual load conditions.

3. Part numbers with resistors

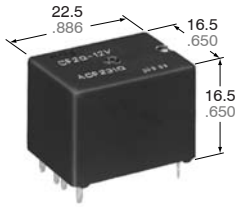
This part number employs a resistor in the coil surge protection circuit; therefore, an external surge protection element is not required. In particular, when a diode is connected in parallel with a coil, the revert time becomes slower which could adversely affect working life. Please check the circuit and make sure that a diode is not connected in parallel with the coil drive circuit.

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

TWIN POWER AUTOMOTIVE RELAY

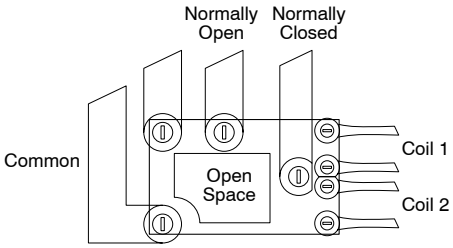
CF RELAYS



mm inch

FEATURES

- **7 Amp Steady/30 Amp Inrush current capability**
- **Simple footprint enables ease of PC board layout**



SPECIFICATIONS

Contact

Arrangement			1 Form C×2 (H bridge)
Contact material			Silver alloy
Initial contact resistance (By voltage drop 6 V DC 1 A)			Max. 50 mΩ
Initial contact voltage drop			Max. 0.2 V (at 20 A)
Rating	Nominal switching capacity		N.O.: 20A 14 V DC N.C.: 10A 14 V DC
	Max. switching power		140 W
	Max. switching voltage		16 V DC
	Max. make current		10 A (Continuous), 30 A (within 1 min.; coil applied voltage: 12 V, at 20°C)
	Max. carrying current		30 A (2 minutes), 20 A (1 hour) (coil applied voltage: 12 V, at 20°C) 25 A (2 minutes), 15 A (1 hour) (coil applied voltage: 12 V, at 85°C)
	Min. switching capacity#1		1 A 12 V DC
Expected life (min. ope.)	Mechanical (at 120 cpm)		10^6
	Electrical	resistive load	Min.10^5
		7 A 14 V DC, Inrush 30 A (Motor load)	2×10^5
		20 A 14 V DC (Motor lock)	Min.5×10^4

Coil

Nominal operating power	640 mW

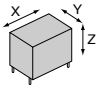
#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed (at rated load)		6 cpm
Initial insulation resistance*1		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	1,000 Vrms for 1 min.
	Between contacts and coil	1,000 Vrms for 1 min.
Operate time*3 (at nominal voltage)		Max. 10 ms
Release time*3 (at nominal voltage)		Max. 10 ms
Shock resistance	Functional*4	Min. 100 m/s² {10 G}
	Destructive*5	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*6	Approx. 44.1 m/s2 {4.5 G}, 10 Hz to 100 Hz
	Destructive*7	Approx. 44.1 m/s² {4.5 G}, 10 Hz to 500 Hz
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to + 85°C –40°F to +185°F
	Humidity	5%R.H. to 85%R.H.
Mass	Standard type	Approx. 15 g .529 oz

Remarks

*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Time of vibration for each direction;



X, Y, direction: 2 hours
Z direction: 4 hours

*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

TYPICAL APPLICATIONS

- Power windows
- Auto door lock
- Electrically powered sunroof
- Electrically powered mirrors
- Powered seats
- Lift gates
- Slide door closers, etc. (for DC motor forward/ reverse control circuits)

ORDERING INFORMATION

Ex. CF 2 – 12 V

Contact arrangement	Coil voltage (DC)
1 Form C × 2	12 V

Standard packing: Tube: 35pcs.; Outer carton: 700pcs.

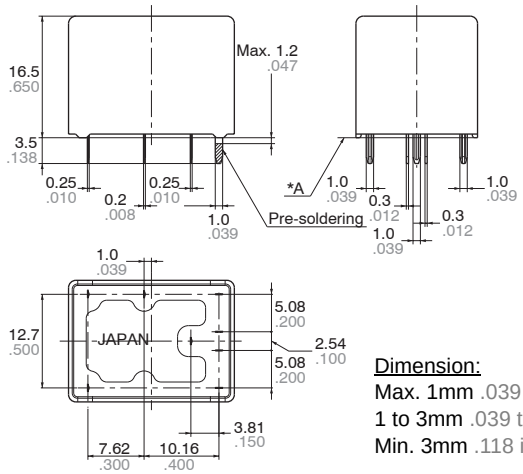
TYPES AND COIL DATA (at 20°C 68°F)

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance, Ω	Nominal operating current, mA	Nominal operating Power, mW	Usable voltage range, VDC
CF2-12V	12	Max. 7.2	Min. 1.0	225±10%	53.3±10%	640	10 to 16

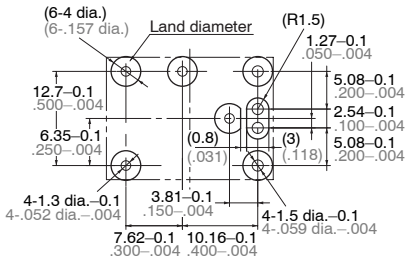
* Other pick-up voltage types are also available. Please contact us for details.

DIMENSIONS

mm inch

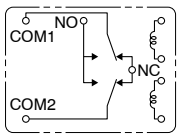


Recommended PC board pattern



Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

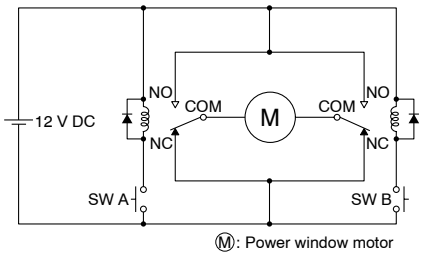
Schematic



* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

EXAMPLE OF CIRCUITS

Forward/reverse control circuits of DC motor for power window



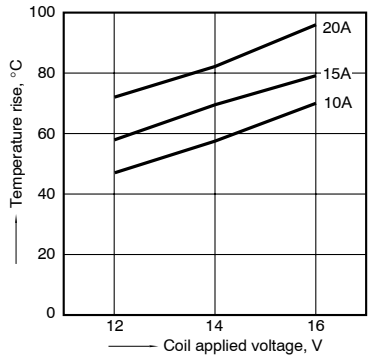
Ⓜ: Power window motor

SW A	SW B	Motor
OFF	OFF	Stop
ON	OFF	Forward
OFF	ON	Reverse

REFERENCE DATA

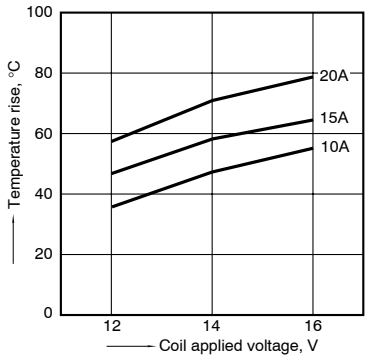
1-(1). Coil temperature rise (at room temperature)

Sample: CF2-12V, 6pcs.
Measured potion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: Room temperature

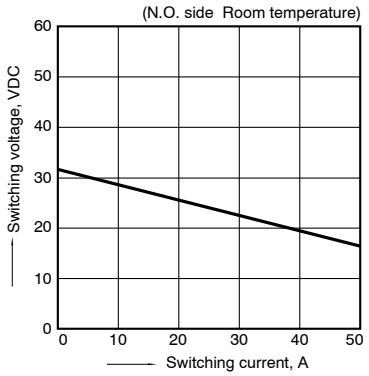


1-(2). Coil temperature rise (at 85°C 185°F)

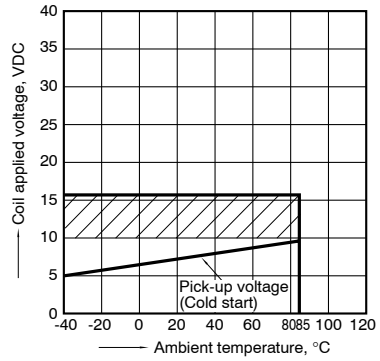
Sample: CF2-12V, 6pcs.
Measured potion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: 85°C 185°F



2. Max. switching capability (Resistive load)

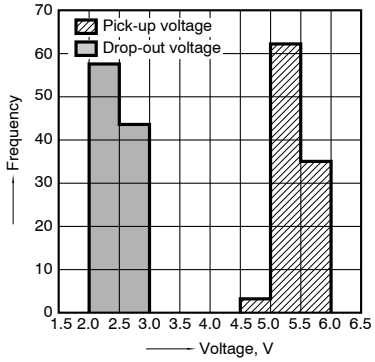


3. Ambient temperature and operating temperature range



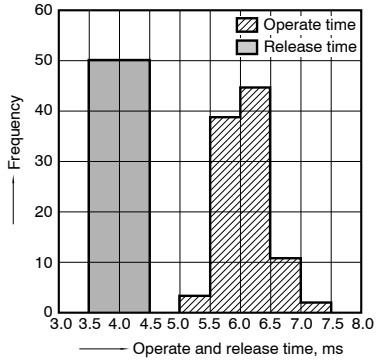
4. Distribution of pick-up and drop-out voltage

Sample: CF2-12V, 100pcs.



5. Distribution of operate and release time

Sample: CF2-12V, 100pcs.
* With diode

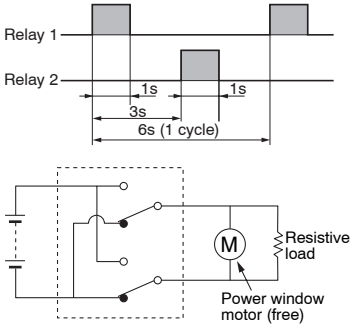


Automotive

6-(1). Electrical life test (Motor free)

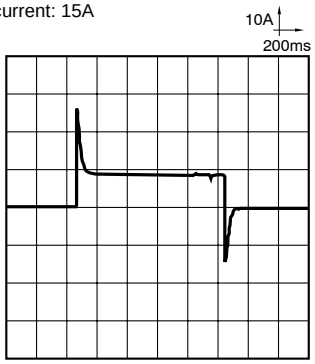
Sample: CF2-12V, 3pcs.
Load: Inrush current: 30A, Steady current: 7A,
Power window motor actual load (free condition)
Switching frequency: (ON:OFF = 1s:5s)
Ambient temperature: Room temperature

Circuit

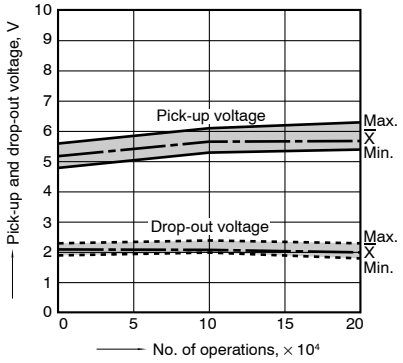


Load current waveform

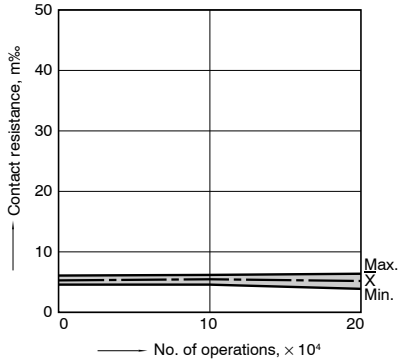
Inrush current: 27A, Steady current: 8.4A
Brake current: 15A



Change of pick-up and drop-out voltage



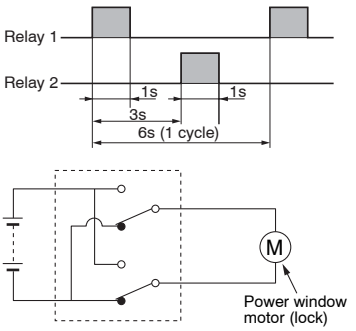
Change of contact resistance



6-(2). Electrical life test (Motor lock)

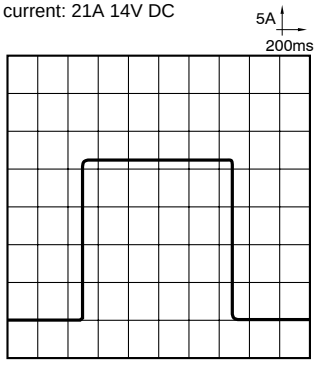
Sample: CF2-12V, 3pcs.
Load: 20A 14V DC,
Power window motor actual load (lock condition)
Switching frequency: (ON:OFF = 1s:5s)
Ambient temperature: Room temperature

Circuit

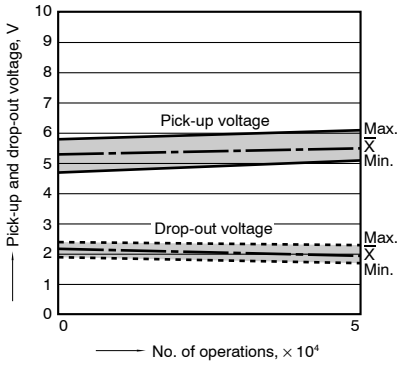


Load current waveform

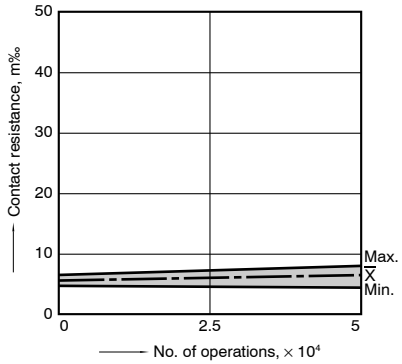
Steady current: 21A 14V DC



Change of pick-up and drop-out voltage



Change of contact resistance



For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

SUPER MINIATURE TWIN TYPE AUTOMOTIVE RELAY

CJ RELAYS (ACJ)

FEATURES

• Smallest in its class, it is extremely compact at approximately 2/3 the size of previous products.
It takes up only about two thirds the space and volume of our previous twin type CT compact relay. It is perfect for making compact relay units.

• Compact and high-capacity 25 A load switching.
High capacity control is possible while being compact and capable of motor lock load switching at 25 A, 14 V DC.

Sealed type
Sealed type makes automatic cleaning possible.

TYPICAL APPLICATIONS

- Powered windows
- Automatic door locks
- Electrically powered mirrors
- Powered sun roofs
- Powered seats
- Lift gates
- Slide door closers, etc.
  (for DC motor forward/reverse control circuits)

SPECIFICATIONS

Contact

Arrangement			1 Form C×2
Contact material			Silver alloy
Initial contact resistance (By voltage drop 6 V DC 1 A)			Max. 100mΩ
Rating	Nominal switching capacity		N.O.: 20 A 14 V DC N.C.: 10 A 14 V DC
	Max. carrying current		30 A for 2 minutes, 20 A for 1 hour (14 V, at 20°C 68°F)
	Min. switching capacity**[1]		1A 12V DC
Expected life (min. operation)	Mechanical (at 120 cpm)		Min. 10^7
	Electrical	Resistive load*[1]	Min. 10^5
		Motor load*[2]	N.O.; 5A 14V DC, Inrush 25A (motor load): Min. 2×10^5
			N.O.; 25A 14V DC (motor lock): Min. 10^5
			N.C.; 20A (brake) 14V DC: Min. 2×10^5

Coil

Nominal operating power	640mW (ACJ2212) 800mW (ACJ2112)

Characteristics

Max. operating speed (at nominal switching capacity)		6 cpm
Initial insulation resistance *[3]		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage *[4]	Between open contacts	500 Vrms for 1 min.
	Between contacts and coil	500 Vrms for 1 min.
Operate time *[5] (at nominal voltage) (at 20°C 68° F)		Max. 10ms (Initial)
Release time (without diode)*[5] (at nominal voltage) (at 20°C 68° F)		Max. 10ms (Initial)
Shock resistance	Functional *[6]	Min. 100 m/s²{10G}
	Destructive *[7]	Min. 1,000 m/s²{100G}
Vibration resistance	Functional *[8]	10 Hz to 100 Hz, Min. 44.1m/s²{4.5G}
	Destructive	10 Hz to 500 Hz, Min. 44.1m/s²{4.5G}
Conditions for operation, transport and storage *[9] (Not freezing and condensing at low temperature)	Ambient temp	–40°C to +85°C – 40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 6.5g .23oz

Remarks

**[1] This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.
*[1] At nominal switching capacity, operating frequency: 1s ON, 9s OFF
*[2] At operating frequency: 0.5s ON, 9.5s OFF
*[3] Measurement at same location as “Initial breakdown voltage” section
*[4] Detection current: 10mA
*[5] Excluding contact bounce time
*[6] Half-wave pulse of sine wave: 11ms; detection time: 10μs
*[7] Half-wave pulse of sine wave: 6ms
*[8] Detection time: 10μs
*[9] Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Automotive

ORDERING INFORMATION

ACJ [2] [ ] [12]

Contact arrangement	Nominal operating power	Coil voltage (V DC)
2: 1 Form C × 2	2: 640 mW 1: 800 mW	12: 12

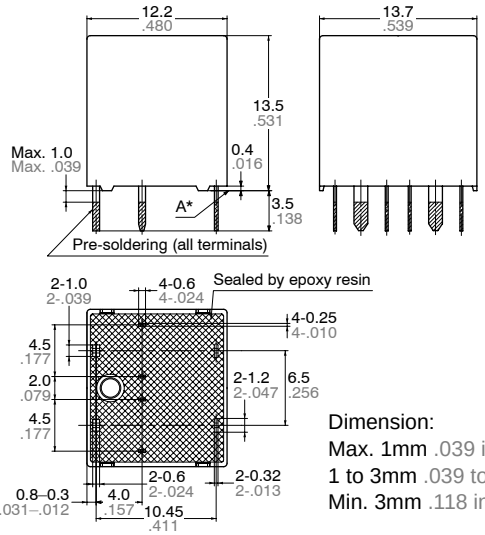
Standard packing: Carton(tube package) 40 pcs; Case 1,000 pcs.

TYPES AND COIL DATA (at 20°C 68°F).

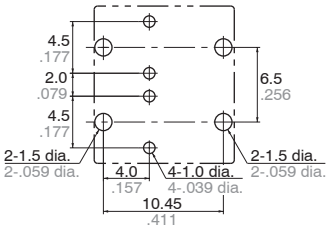
Contact arrangement	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance, Ω	Nominal operating current, mA	Nominal operating power, mW	Usable voltage range, V DC
1 Form C ×2	ACJ2212	12	Max. 7.2	Min. 1.0	225±10%	53.3±10%	640	10 to 16
	ACJ2112	12	Max. 6.5	Min. 0.8	180±10%	66.7±10%	800	10 to 16

DIMENSIONS

mm inch

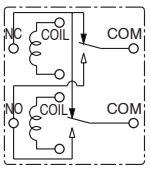


PC board pattern (Bottom view)



Tolerance: ±0.1±.004

Schematic (Bottom view)

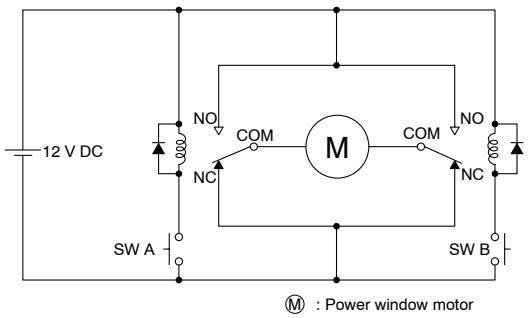


Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

EXAMPLE OF CIRCUIT

Forward/reverse control circuits of DC motor

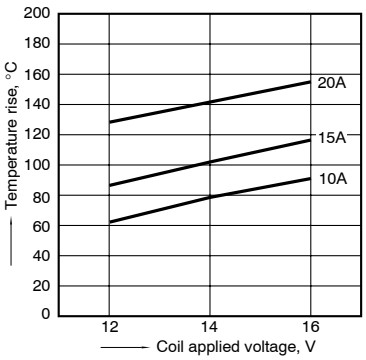


Ⓜ : Power window motor

REFERENCE DATA

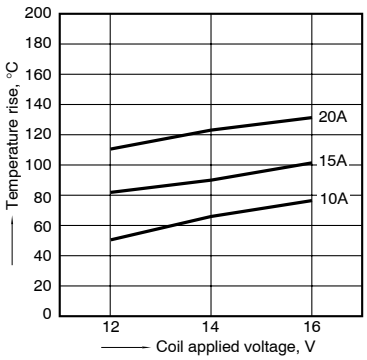
1-(1). Coil temperature rise (at room temperature)

Sample: ACJ2212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: 25°C 77°F



1-(2). Coil temperature rise (at 85°C 185°F)

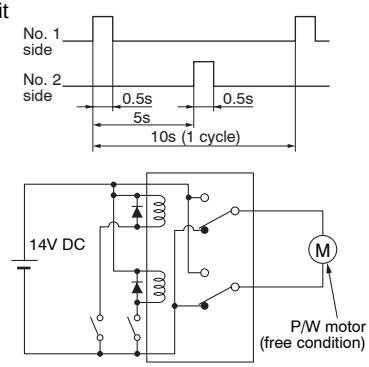
Sample: ACJ2212, 3pcs
Measured portion: Inside the coil
Contact carrying current: 10A, 15A, 20A
Ambient temperature: 85°C 185°F



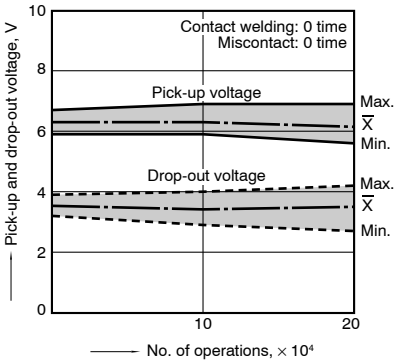
2-(1). Electrical life test (Motor free)

Sample: ACJ2212, 3pcs; Load: Inrush current: 25A/ Steady current: 5A, Power window motor actual load (free condition); Tested voltage: 14V DC; Switching frequency: (ON:OFF = 0.5s:9.5s); Switching cycle: 2×10^5; Ambient temperature: Room temperature

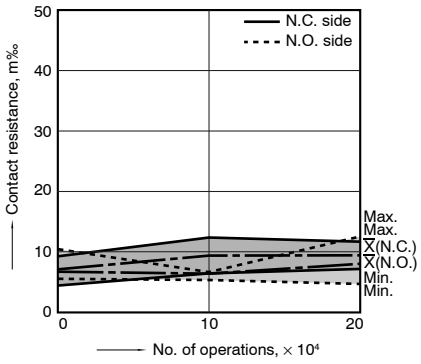
Circuit



Change of pick-up and drop-out voltage

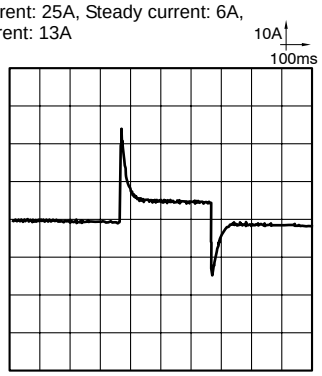


Change of contact resistance



Load current waveform

Inrush current: 25A, Steady current: 6A, Brake current: 13A

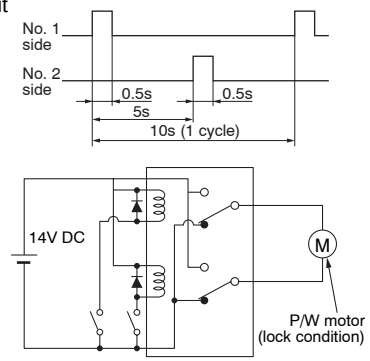


Automotive

2-(2). Electrical life test (Motor lock)

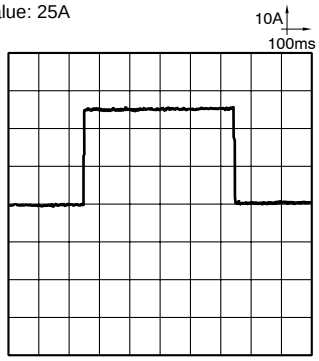
Sample: ACJ2212, 3pcs; Load: Steady current: 25A, Power window motor actual load (lock condition); Tested voltage: 14V DC; Switching frequency: (ON:OFF = 0.5s:9.5s); Switching cycle: 10^5; Ambient temperature: Room temperature

Circuit

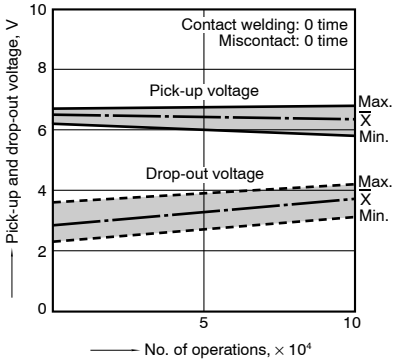


Load current waveform

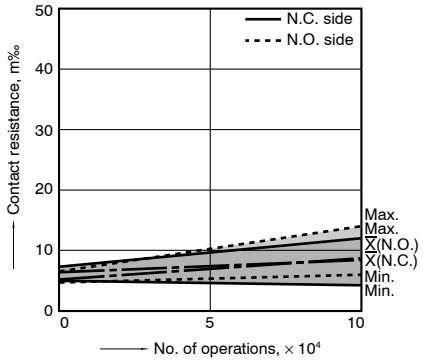
Current value: 25A



Change of pick-up and drop-out voltage



Change of contact resistance

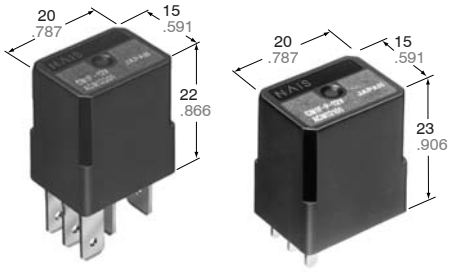


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

AUTOMOTIVE MICRO-ISO RELAY

CM RELAYS



mm inch

FEATURES

- **Small size:**
20 mm(L)×15 mm(W)×22 mm(H)
.787 inch(L)×.591 inch(L)×.866 inch(H)
- **Wide line-up**
PC board and Plug-in type, Resistor and diode inside type.
24V DC type is also available.
- **Compact and high-capacity 35A load switching**
N.O.: 35A 14V DC, N.C.: 20A 14V DC (Sealed type)
Min. 5×10^4
N.O.: 35A 14V DC, N.C.: 20A 14V DC (Flux-resistant type)
Min. 10^5 *12V DC type
- **Micro-ISO type terminals**

TYPICAL APPLICATIONS

- Fan motor
- Heater
- Head lump
- Air Compressor
- EPS
- ABS
- Blower fan
- Defogger, etc.

SPECIFICATIONS

Contact

Type		12 V coil voltage	24 V coil voltage
Arrangement		1 Form A, 1 Form C	
Contact material		Silver alloy	
Initial contact resistance (By voltage drop 6 V DC 1 A)		Max. 15mΩ	
Contact voltage drop		Max. N.O.: 0.5 V (at 35 A 14 V DC) Max. N.C.: 0.3 V (at 20 A 14 V DC)	Max. N.O.: 0.3 V (at 15 A 28 V DC) Max. N.C.: 0.2 V (at 8 A 28 V DC)
Rating (resistive load)	Nominal switching capacity	N.O.: 35 A 14 V DC N.C.: 20 A 14 V DC	N.O.: 15 A 28 V DC N.C.: 8 A 28 V DC
	Max. carrying current	N.O.: 20 A (14 V DC, at 85°C 185°F) N.C.: 10 A (14 V DC, at 85°C 185°F)	N.O.: 15 A (28 V DC, at 85°C 185°F) N.C.: 8 A (28 V DC, at 85°C 185°F)
	Min. switching capacity#1	1 A 12 V DC	1 A 24 V DC
Expected life	Mechanical (at 120 cpm)	Min. 10^6	
	Electrical (at rated load)	Flux-resistant type: Min. 10^5*1 Sealed type: Min. 5×10^4	

Coil

Nominal operating power	1.5 W 1.7 W (Internal resistor type)	1.8 W 2.0 W (Internal resistor type)

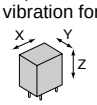
#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Type		24V coil type	12V coil type
Max. operating speed (at nominal switching capacity)		15 cpm	
Initial insulation resistance*2		Min. 20 MΩ (at 500 V DC)	
Initial breakdown voltage*3	Between open contacts	500 Vrms for 1 min.	
	Between contacts and coil	500 Vrms for 1 min.	
Operate time*4 (at nominal voltage) (at 20°C 85°F)		Max. 10 ms	
Release time*4 (at nominal voltage) (at 20°C 85°F)		Max. 10 ms Max. 15 ms (with diode)	
Shock resistance	Functional*5	Min. 200 m/s² {20G}	
	Destructive*6	Min. 1,000m/s² {100G}	
Vibration resistance	Functional	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5 G}	
	Destructive*7	10 Hz to 2,000 Hz, Min. 44.1 m/s² {4.5 G}	
Conditions for operation, transport and storage*8 (Not freezing and condensing at low temperature)	Ambient temp.*9	–40°C to + 85°C –40°F to + 185°F	
	Humidity	5% R.H. to 85% R.H.	
Mass		Approx. 20g .71oz	

Remarks

*1 At nominal switching capacity, operating frequency: 2s ON, 2s OFF
*2 Measurement at same location as "Initial breakdown voltage" section.
*3 Detection current: 10mA
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Time of vibration for each direction; X, Y, Z direction: 4 hours



*8 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).
*9 Ambient temperature 125°C 257°F type is also available. Please contact us for details.

Automotive

ORDERING INFORMATION

CM [1] [F] — [R] — [P] — [12V]

Contact arrangement	Protective construction	Classification of types	Mounting classification	Coil voltage (DC)
1a: 1 Form A 1: 1 Form C	Nil: Sealed type F: Flux-resistant type	Nil: Standard type D: with diode inside R: with resistor inside	Nil: Plug-in type P: PC board type	12 V 24 V

Note: Bulk package: 50 pcs.; Case: 200 pcs.

TYPES

Packing quantity: Inner 50pcs, Outer 200pcs.

Contact arrangement	Part No.	Coil voltage	Mounting classification	Protective construction
1 Form A	CM1a-12V	12 V DC	Plug-in type	Sealed type
	CM1aF-12V			Flux-resistant type
	CM1a-P-12V		PC board type	Sealed type
	CM1aF-P-12V			Flux-resistant type
1 Form C	CM1-12V		Plug-in type	Sealed type
	CM1F-12V			Flux-resistant type
	CM1-P-12V		PC board type	Sealed type
	CM1F-P-12V			Flux-resistant type

Contact arrangement	Part No.	Coil voltage	Mounting classification	Protective construction
1 Form A	CM1a-24V	24 V DC	Plug-in type	Sealed type
	CM1aF-24V			Flux-resistant type
	CM1a-P-24V		PC board type	Sealed type
	CM1aF-P-24V			Flux-resistant type
1 Form C	CM1-24V		Plug-in type	Sealed type
	CM1F-24V			Flux-resistant type
	CM1-P-24V		PC board type	Sealed type
	CM1F-P-24V			Flux-resistant type

COIL DATA (at 20°C 68°F)

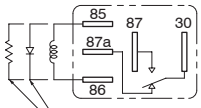
Nominal voltage, V DC	Pick-up voltage, V DC	Drop-out voltage, V DC	Nominal current, mA	Coil resistance, ohm	Nominal operating power, W	Usable voltage range, V DC
12	3 to 7	1.2 to 4.2	125±10%	96±10%	1.5	10 to 16
24	6 to 14	2.4 to 8.4	75±10%	320±10%	1.8	20 to 32

DIMENSIONS

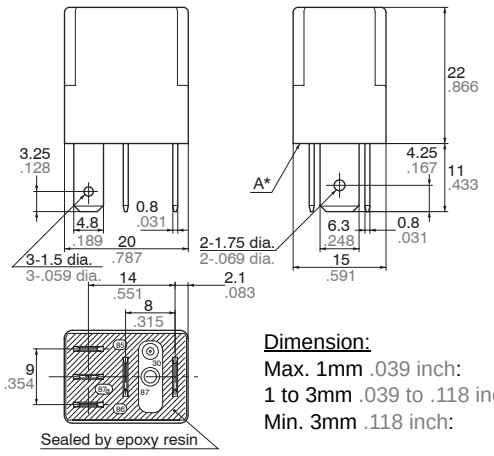
mm inch

1. Micro-ISO Plug-in type (1 Form C)

Schematic (Bottom view)



Including diode type,
including resistor type also available

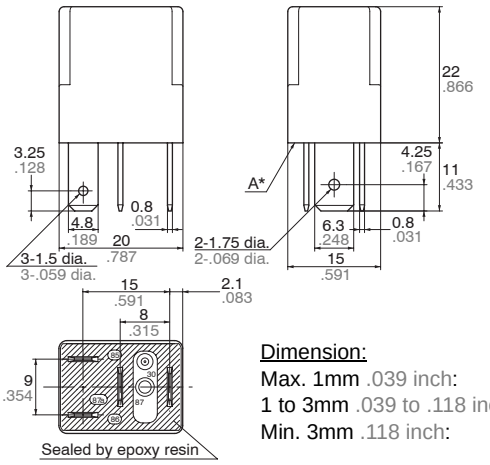


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

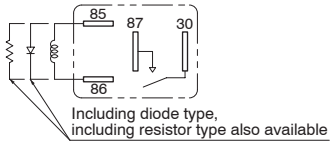
* Intervals between terminals is measured at A surface level.

2. Micro-ISO Plug-in type (1 Form A)

mm inch



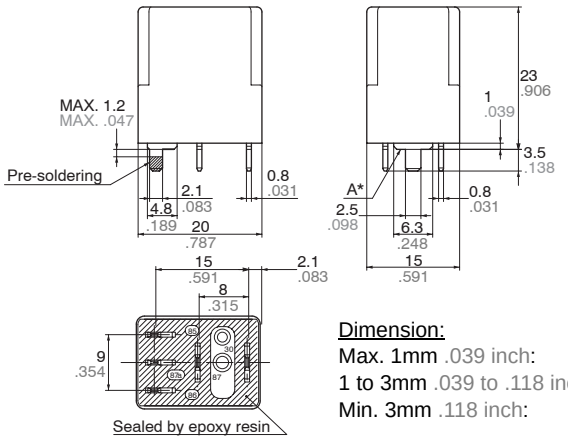
Schematic (Bottom view)



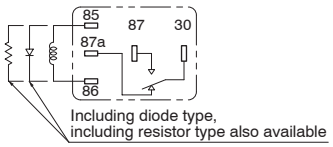
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Intervals between terminals is measured at A surface level.

3. Micro-ISO PC board type (1 Form C)



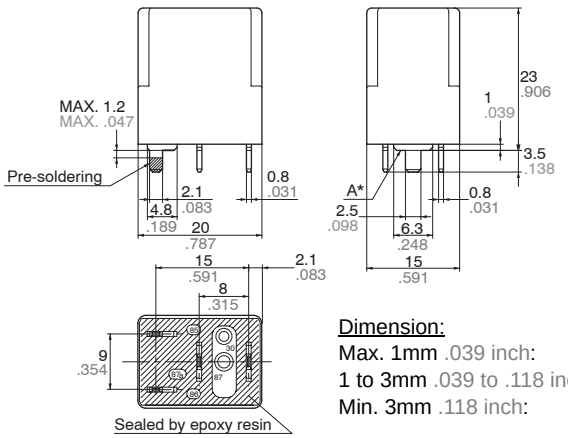
Schematic (Bottom view)



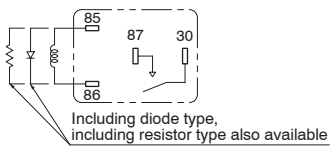
Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

4. Micro-ISO PC board type (1 Form A)



Schematic (Bottom view)

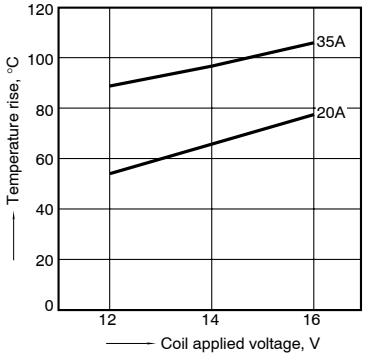


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

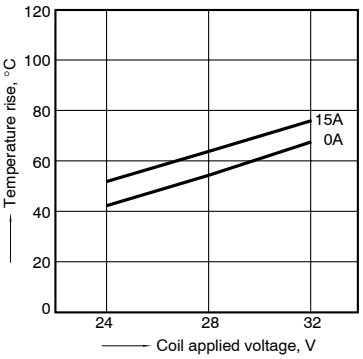
* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

REFERENCE DATA

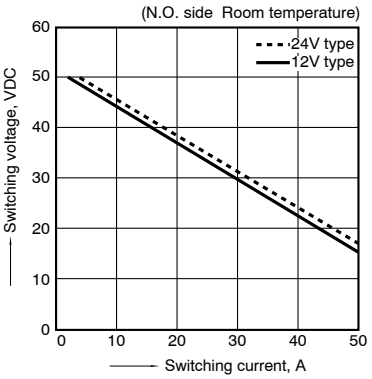
1-(1). Coil temperature rise (12V type)
Sample: CM1F-12V, 3 pcs.
Measured portion: Inside the coil
Contact carrying current: 20A, 35A
Ambient temperature: 85°C 185°F



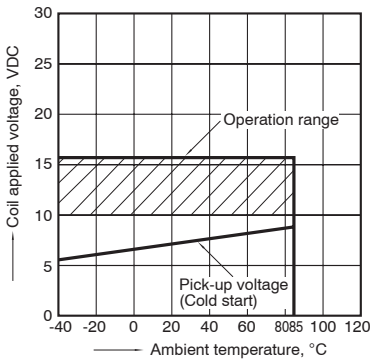
1-(2). Coil temperature rise (24V type)
Sample: CM1F-24V, 4 pcs.
Measured portion: Inside the coil
Contact carrying current: 0A, 15A
Ambient temperature: 85°C 185°F



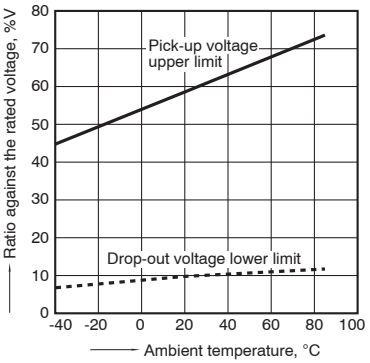
2. Max. switching capability (Resistive load)



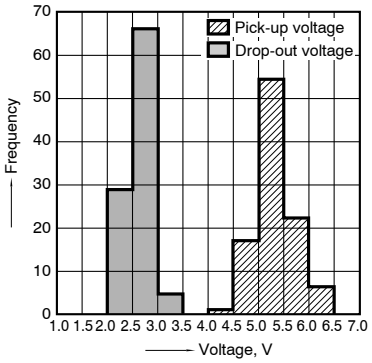
3. Ambient temperature and operating temperature range (12V type)



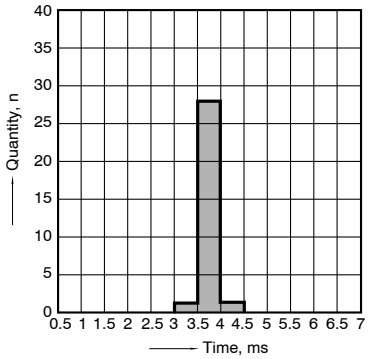
4. Ambient temperature characteristics (Cold/initial)



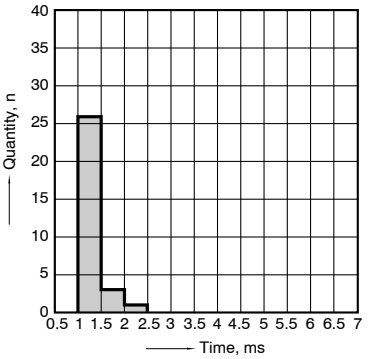
5. Distribution of pick-up and drop-out voltage
Sample: CM1F-12V, 100pcs.



6. Distribution of operate time
Sample: CM1F-12V, 30pcs.
* Max. 10ms standard (excluding contact bounce)

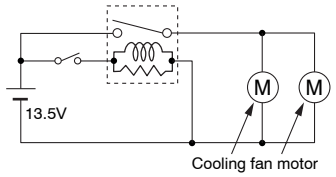


7. Distribution of release time
Sample: CM1F-12V, 30pcs.
* Max. 10ms standard (excluding contact bounce)
Without diode

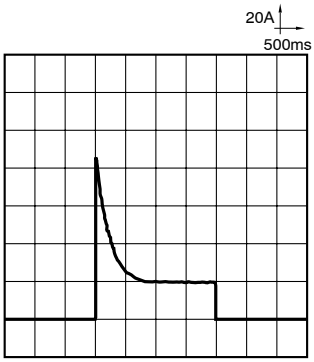


8-(1). Electrical life test (Motor free)
Sample: CM1aF-R-12V, 6pcs.
Load: Cooling fan motor actual load (free condition)
Switching frequency: (ON:OFF = 2s:6s)
Ambient temperature: Room temperature

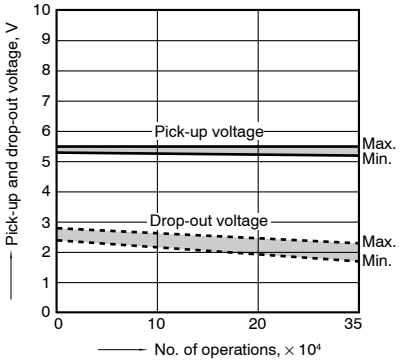
Circuit



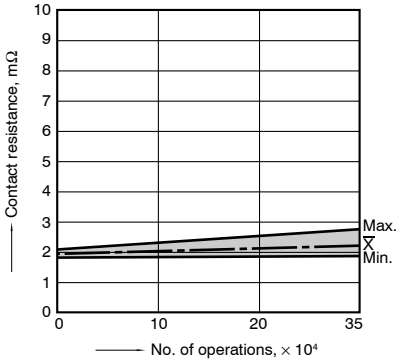
Load current waveform
Inrush current: 85A, Steady current: 18A,



Change of pick-up and drop-out voltage

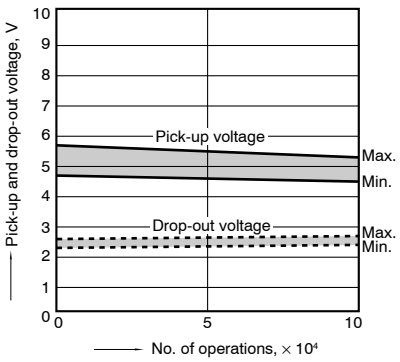


Change of contact resistance

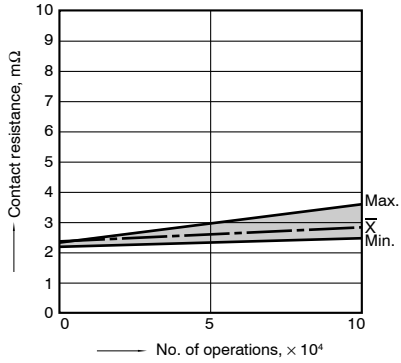


8-(2). Electrical life test (Halogen lamp load)
Sample: CM1aF-R-12V, 6pcs.
Load: 20A 13.5V DC
Switching frequency: (ON:OFF = 1s:14s)
Ambient temperature: Room temperature

Change of pick-up and drop-out voltage



Change of contact resistance



Cautions regarding the protection element

1. Part numbers without protection elements

1) 12 V models
When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 24 V or higher, or a resistor (680Ω to 1,000Ω). When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2) 24 V models
When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 48 V or higher, or a resistor (2,800Ω to 4,700Ω).
When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2. Part numbers with diodes

These relays use a diode in the coil surge protection element. Therefore, the release time is slower and the working life might be shorter compared to part numbers without protection elements and part numbers with resistors.
Be sure to use only after evaluating under actual load conditions.

3. Part numbers with resistors

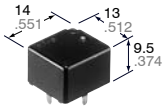
This part number employs a resistor in the coil surge protection circuit; therefore, an external surge protection element is not required. In particular, when a diode is connected in parallel with a coil, the revert time becomes slower which could adversely affect working life. Please check the circuit and make sure that a diode is not connected in parallel with the coil drive circuit.

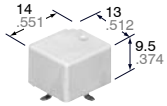
For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

MINIATURE, LOW PROFILE AUTOMOTIVE RELAY

CP RELAYS





mm inch

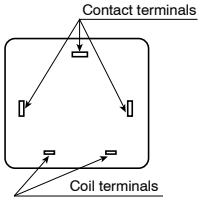
FEATURES

• Low profile
<Height>
PC board terminal type:
9.5 mm .374 inch
Surface-mount terminal type:
10.5mm .413inch

• High capacity
CP Relay provides low profile spacesaving advantages while offering high continuous current of 25 A(1 hour).

• Sealed construction suitable for harsh environments

• Simple footprint pattern enables ease of PC board layout



• "PC board terminal" and "Surface mount terminal" types available
SMD automatic mounting is possible for surface mount terminal types because tube packaging is used.

TYPICAL APPLICATIONS

- Power windows
- Auto door lock
- Power sunroof
- Memory sheet
- Wiper
- Defogger
- Blower fan
- EPS
- ABS etc.

SPECIFICATIONS

Contact

Arrangement			1 Form A	1 Form C
Contact material			Silver alloy	
Initial contact resistance (By voltage drop 6V DC 1A)			Max. 100 mΩ	
Rating	Nominal switching capacity		20 A 14 V DC	20 A 14 V DC (N.O.) 10 A 14 V DC (N.C.)
	Max. switching voltage		16 V DC	
	Max. carrying current		40 A for 2 minutes 30 A for 1 hour (12 V at 20°C 68°F) 35 A for 2 minutes 25 A for 1 hour (12 V at 85°C 185°F)	
	Min. switching capacity#1		1 A 12 V DC	
Expected life (min. operations)	Mechanical (at 120cpm)		10^7	
	Electrical (at 6cpm)	Resistive load	Min. 10^5*1	
		Motor load	Min. 2×10^5*2	
			Min. 10^5*3	
		Lamp load	Min. 10^5*4	

Coil

Nominal operating power	640 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed (at rated load)		6cpm
Initial insulation resistance*5		Min. 100MΩ (at 500 V DC)
Initial breakdown voltage*6	Between open contacts	500 Vrms for 1min.
	Between contact and coil	500 Vrms for 1min.
Operate time*7		Max. 10ms (at 20°C 68°F)
Release time (without diode)*7 (at nominal voltage)		Max. 10ms (at 20°C 68°F)
Shock resistance	Functional*8	Min. 100 m/s² {10 G}
	Destructive*9	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*10	10 Hz to 100 Hz, Min.44.1 m/s² {4.5 G}
	Destructive	10 Hz to 500 Hz, Min.44.1 m/s² {4.5 G}
Conditions in case of operation, transport and storage*11 (Not freezing and condensing at low temperature)	Ambient temp	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 4g .14 oz

Remarks
*1 At nominal switching capacity, operating frequency: 1s ON, 9s OFF
*2 N.O.: at 5A (steady), 25A (inrush)/N.C.: at 20A (brake) 14V DC, operating frequency: 0.5s ON, 9.5s OFF
*3 At 20A 14V DC (Motor lock), operating frequency: 0.5s ON, 9.5s OFF
*4 N.O.: at 5A (steady), 40A (inrush)14V DC, operating frequency: 1s ON, 14s OFF
*5 Measurement at same location as "Initial breakdown voltage" section
*6 Detection current: 10mA
*7 Excluding contact bounce time
*8 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*9 Half-wave pulse of sine wave: 6ms
*10 Detection time: 10μs
*11 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

ORDERING INFORMATION

Ex. CP [1a] [SA] — [12V] — [X]

Contact arrangement	Mounting classification	Coil voltage (DC)	Packing style
1a: 1 Form A 1: 1 Form C	Nil: PC board terminal SA: Surface-mount terminal	12 V	Nil: Tube packing X: Tape and reel packing (picked from the NC terminal side) Z: Tape and reel packing (picked from the coil terminal side)

Notes: 1. Tube packing: Carton (Tube): 40 pcs.; Case: 1,000 pcs. * PC board terminal type only.
2. Tape and reel packing: Carton (Tape and reel): 300 pcs.; Case: 900 pcs. * Surface-mount terminal type only.
3. Surface-mount terminal type is available only for 1 form C contact arrangement.

TYPES

1. PC board terminal type

Contact arrangement	Coil voltage	Part No.
1 Form A	12V DC	CP1a-12V
1 Form C	12V DC	CP1-12V

2. Surface mount terminal type

Contact arrangement	Coil voltage*1	Part No.
1 Form C	12V DC	CP1SA-12V-X
1 Form C	12V DC	CP1SA-12V-Z

Notes:
1. *1 24V DC type is also available by request. Please contact us for details.
2. Tape and reel packing symbol "-z" or "-x" are not marked on the relay.

COIL DATA (at 20°C 68°F)

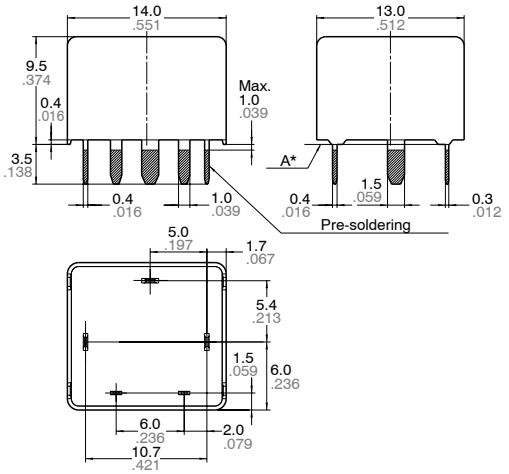
Nominal voltage, V DC	Pick-up voltage, V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance Ω	Nominal operating current mA	Nominal operating power mW	Usable voltage range, V DC
12	Max. 7.2	Min. 1.0	225±10%	53.3±10%	640	10 to 16

* Other pick-up voltage types are also available. Please contact us for details.

DIMENSIONS

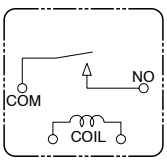
mm inch

1. PC board terminal type

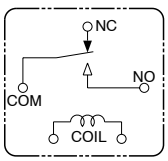


Schematic (Bottom view)

1a

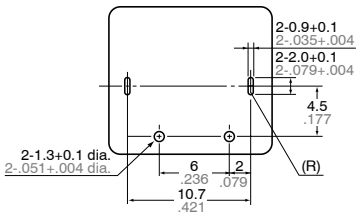


1c

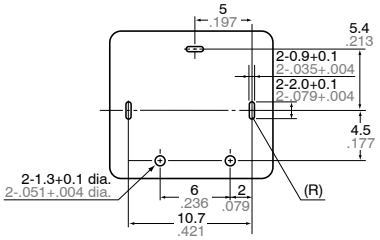


PC board pattern (Bottom view)

1a



1c

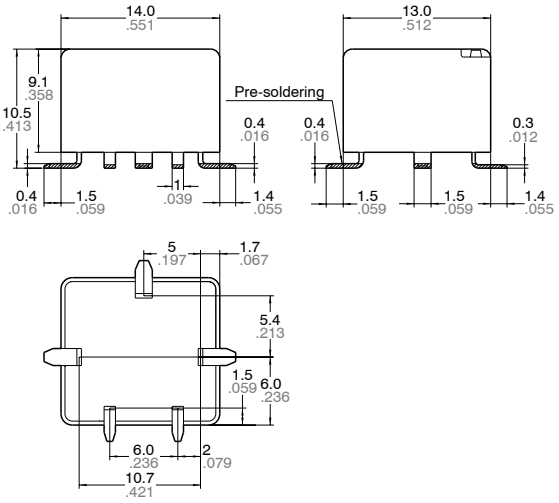


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

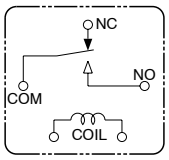
* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

2. Surface mount terminal type

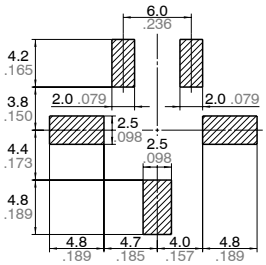
mm inch



Schematic



Recommended mounting pad (Top view)

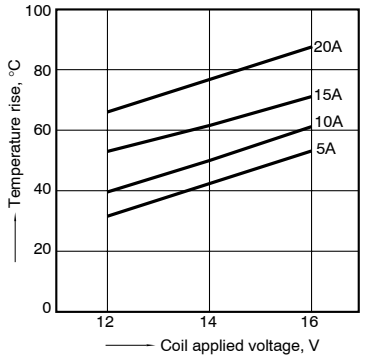


Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

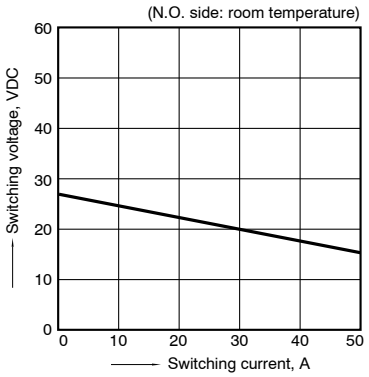
REFERENCE DATA

1. Coil temperature rise

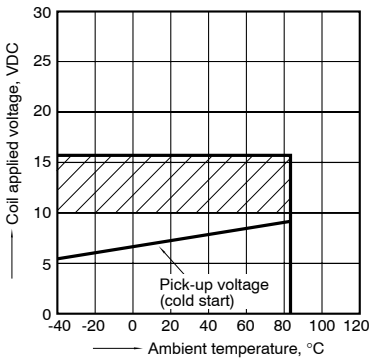
Sample : CP1-12V, 6pcs
Point measured : Inside the coil
Contact carrying current, 5A, 10A, 15A, 20A
Resistance method, ambient temperature 85°C 185°F



2. Max. switching capability (Resistive load)

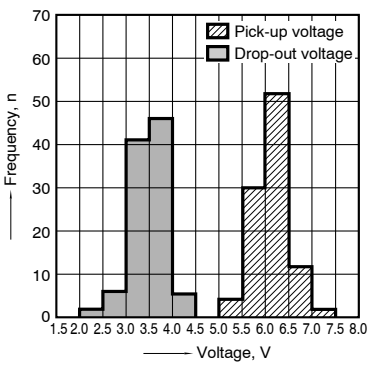


3. Ambient temperature and operating voltage range



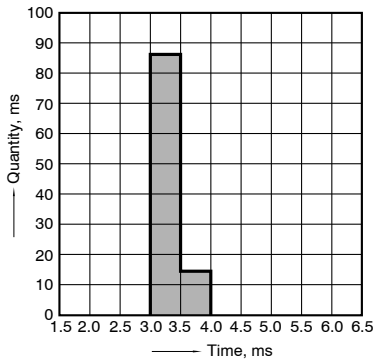
4. Distribution of pick-up and drop-out voltage

Sample : CP1-12V, 100pcs
Ambient temperature : 20°C 68°F



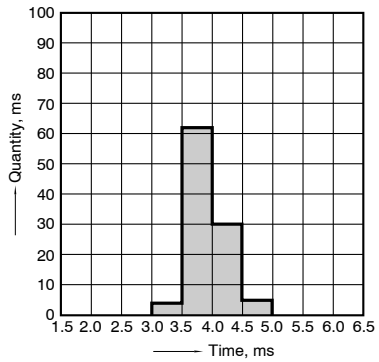
5. Distribution of operate time

Sample : CP1-12V, 100pcs
Ambient temperature : 20°C 68°F



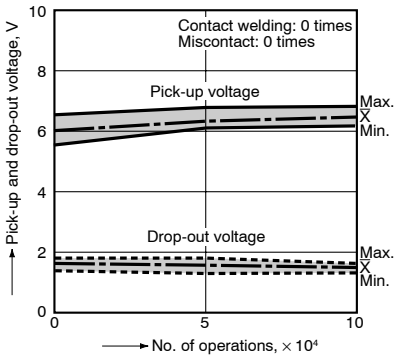
6. Distribution of release time

Sample : CP1-12V, 100pcs
Ambient temperature : 20°C 68°F
* With diode



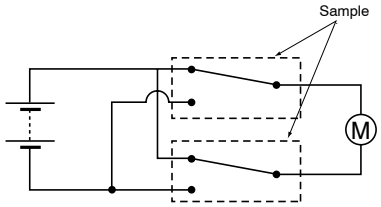
7-(1). Electrical life test (at rated load)
Sample : CP1-12V
Quantity : n = 4 (NC = 2, NO = 2)
Load : Resistive load (NC side : 10A 14 V DC, NO side : 20 A 14 V DC)
Operating frequency : ON 1s, OFF 9s

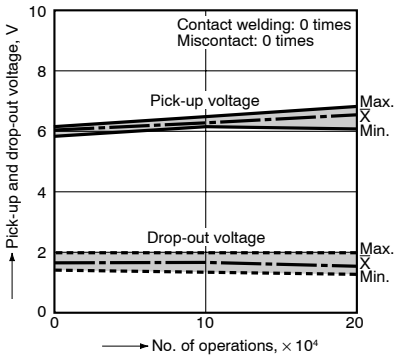
Ambient temperature : Room temperature



7-(2). Electrical life test (Motor free)
Sample : CP1-12V, 3pcs.
Load : 5A, Inrush 25A, Brake current 15A,
Power window motor load (Free condition).
Operating frequency : (ON : OFF = 0.5s : 9.5s)
Ambient temperature : Room temperature

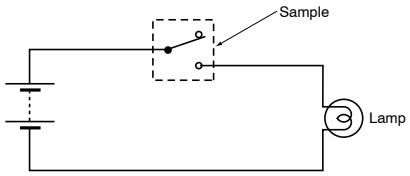
Circuit :

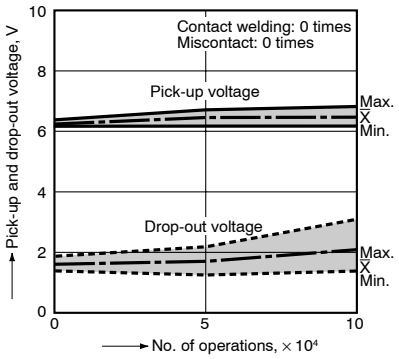




7-(3). Electrical life test (Lamp load)
Sample : CP1-12V, 3pcs.
Load : 5A, Inrush 40A, 14VDC lamp load
Operating frequency : (ON : OFF = 1s : 14s)
Ambient temperature : Room temperature

Circuit :



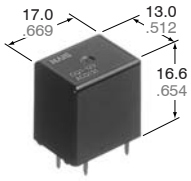


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

1 FORM C AUTOMOTIVE SILENT RELAY

CQ RELAYS



mm inch

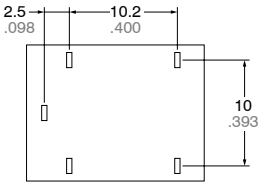
FEATURES

• Silent
Noise has been reduced by approximately 20 dB, using our own silencing design.

• Less space required
Measuring only 17(L)×13(W)mm (.669(L)×.512(W) inches), this product ranks first among automotive quiet relays in terms of saving space.

• Sealed construction

• Next-generation standard terminal pitch employed
The terminal array used is identical to that used in JJM relays.



SPECIFICATIONS

Contact

Arrangement			1 Form C
Contact material			Silver alloy
Initial contact resistance (By voltage drop 6 V DC 1A)			Max. 100 mΩ
Contact voltage drop			Max. 0.2V (at 10 A)
Rating	Nominal switching capacity		N.O.: 20 A 14 V DC N.C.: 10 A 14 V DC
	Max. carrying current		35 A for 2 minutes, 25 A for 1 hour (12 V, at 20°C 68°F) 30 A for 2 minutes, 20 A for 1 hour (12 V, at 85°C 185°F)
	Min. switching capacity#1		1 A 12 V DC
Expected life (min. operations)	Mechanical (at 120 cpm)		Min. 10^7
	Electrical	Resistive load	Min.10^5*1
		Motor load	Min. 3×10^5*2

Coil

Nominal operating power	640 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

*1 At nominal switching capacity, operating frequency: 1s ON, 9s OFF
*2 N.O.: at 5 A (steady), 30 A (inrush)/N.C.: at 20 A (brake) 14 V DC, operating frequency: 1s ON, 2s OFF
*3 Measurement at same location as “Initial breakdown voltage” section
*4 Detection current: 10mA
*5 Excluding contact bounce time
*6 Half-wave pulse of sine wave: 11ms; detection: 10μs
*7 Half-wave pulse of sine wave: 6ms
*8 Detection time: 10μs

Characteristics

Max. operating speed (at nominal switching capacity)		6 cpm
Initial insulation resistance*3		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*4	Between open contacts	500 Vrms for 1 min.
	Between contacts and coil	500 Vrms for 1 min.
Operate time*5 (at nominal voltage)(at 20°C68°F)		Max. 10 ms (initial)
Release time*5 (at nominal voltage)(at 20°C68°F)		Max. 10 ms (initial)
Shock resistance	Functional*6	Min. 100 m/s² {10G}
	Destructive*7	Min. 1,000 m/s² {100G}
Vibration resistance	Functional*8	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G}
	Destructive*9	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}
Conditions for operation, transport and storage*10 (Not freezing and condensing at low temperature)	Ambient temperature	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 6.5g .23 oz

*9 Time of vibration for each direction;

X, Y, direction: 2 hours
Z direction: 4 hours

*10 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

TYPICAL APPLICATIONS

- Intermittent wiper
- Cruise control
- Power windows
- Auto door lock
- Car stereo
- Car air-conditioner
- Electrically powered seats
- Electrically powered sunroof, etc.

ORDERING INFORMATION

Ex. CQ [1] — [12 V]

Contact arrangement	Coil voltage(DC)
1 Form C	12 V

Standard packing: Carton(tube package) 40pcs. Case: 800pcs.

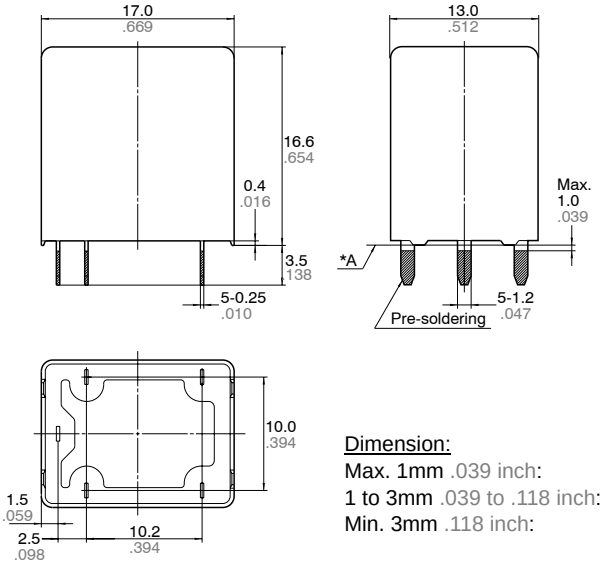
TYPES AND COIL DATA (at 20°C 68°F)

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)*	Drop-out voltage, V DC (Initial)	Coil resistance, Ω	Nominal operating current, mA	Nominal operating power, mW	Usable voltage range, V DC
CQ1-12V	12	Max. 7.2	Min. 1.0	225±10%	53.3±10%	640	10 to 16

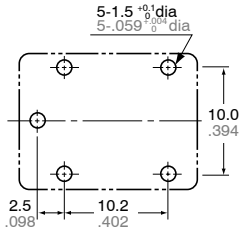
* Other pick-up voltage types are also available. Please contact us for details.

DIMENSIONS

mm inch

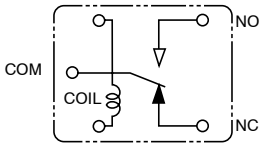


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

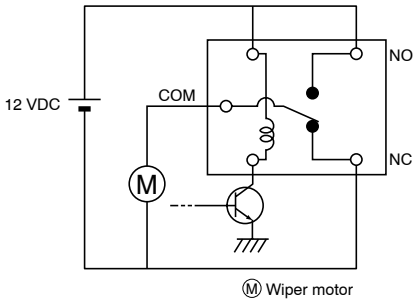


Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

EXAMPLE OF CIRCUIT

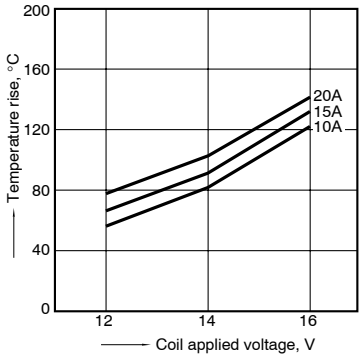
Control circuit for intermittent wiper motor



REFERENCE DATA

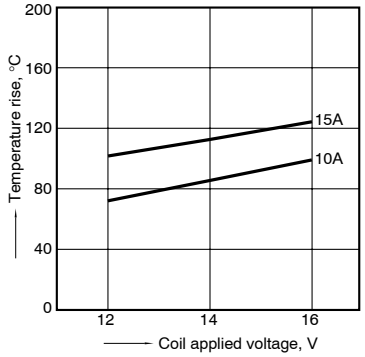
1-(1). Coil temperature rise (at room temperature)

Sample: CQ1-12V, 5pcs
Contact carrying current: 10A, 15A, 20A
Ambient temperature: Room temperature

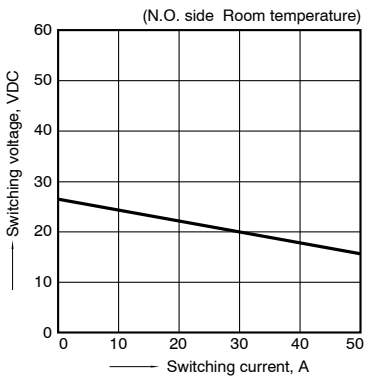


1-(2). Coil temperature rise (at 85°C 185°F)

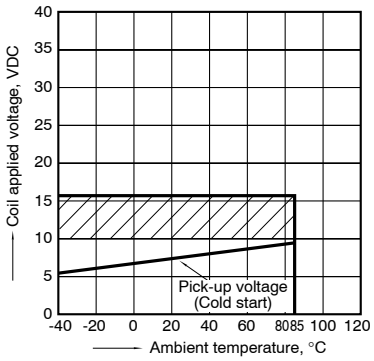
Sample: CQ1-12V, 5pcs
Contact carrying current: 10A, 15A
Ambient temperature: 85°C 185°F



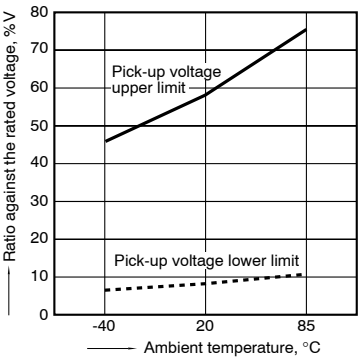
2. Max. switching capability (Resistive load)



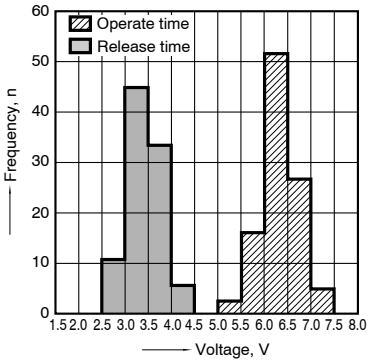
3. Ambient temperature and operating temperature range



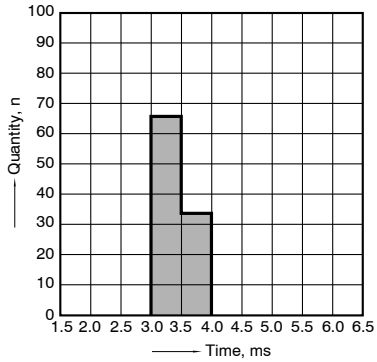
4. Ambient temperature characteristics



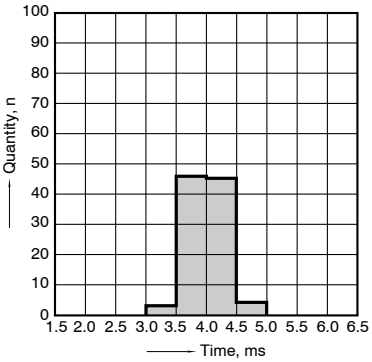
5. Distribution of pick-up and drop-out voltage
Sample: CQ1-12V, 100pcs



6. Distribution of operate time
Sample: CQ1-12V, 100pcs

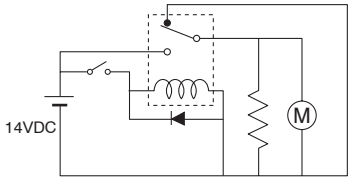


7. Distribution of release time
Sample: CQ1-12V, 100pcs
* With diode

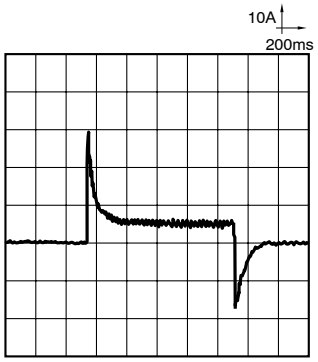


8. Electrical life test (Motor free)
Sample: CQ1-12V, 3pcs
Load: Inrush current: 30A, Steady current: 5A,
Brake current: 17A,
wiper motor actual load (free condition)
Tested voltage: 14V DC
Switching frequency: (ON:OFF = 1s:2s)
Ambient temperature: Room temperature

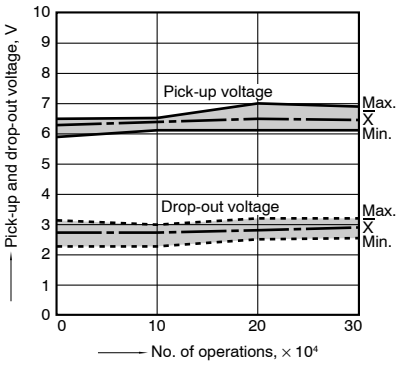
Circuit



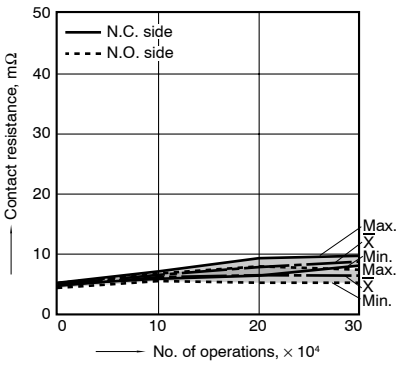
Load current waveform
Inrush current: 30A, Steady current: 5A,
Brake current: 17A



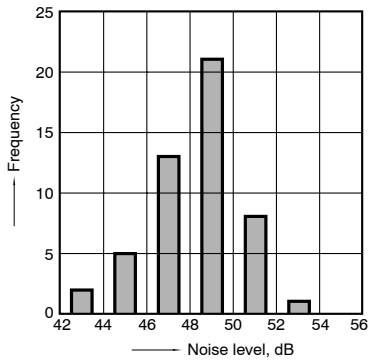
Change of pick-up and drop-out voltage



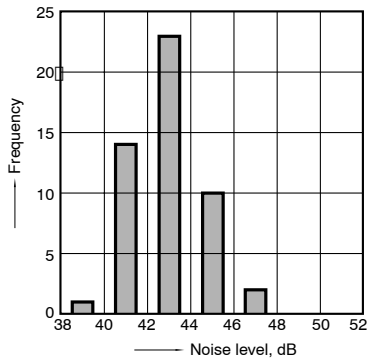
Change of contact resistance



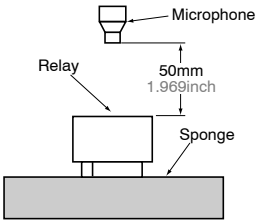
9-(1). Operation noise distribution
When actuated



9-(2). Operation noise distribution
When released



Measuring conditions
Sample: CQ1-12 V, 50 pcs.
Equipment setting: “A” weighted, Fast, Max. hold
Coil voltage: 12V DC
Coil connection device: Diode
Background noise: Approx. 20dB

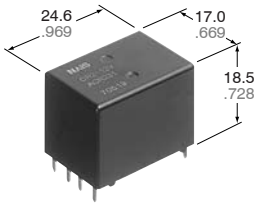


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

TWIN POWER SILENT AUTOMOTIVE RELAY

CR RELAYS

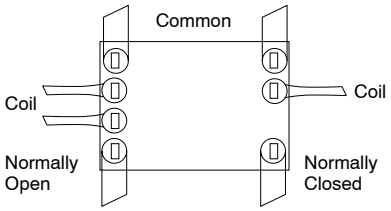


mm inch

FEATURES

- **Silent**
Noise has been reduced by approximately 20 dB, using our own silencing design.
- **Twin (1 Form C × 2)**
Forward/reverse motor control is possible with a single relay.
- **Sealed construction**
- Simple footprint enable ease of PC

board layout



SPECIFICATIONS

Contact

Arrangement			1 Form C × 2 (H bridge)
Contact material			Silver alloy
Initial contact resistance (By voltage drop 6 V DC 1A)			Max. 100 mΩ
Contact voltage drop			Max. 0.2V (at 10 A)
Rating	Nominal switching capacity		N.O.: 20 A 14 V DC N.C.: 10 A 14 V DC
	Max. carrying current		35 A for 2 minutes, 25 A for 1 hour (12 V, at 20°C68°F) 30 A for 2 minutes, 20 A for 1 hour (12 V, at 85°C185°F)
	Min. switching capacity#1		1 A 12 V DC
Expected life (min. operations)	Mechanical (at 120 cpm)		Min. 10^7
	Electrical	Resistive load	Min. 10^5*1
		Motor load	Min. 2×10^5*2
			Min. 10^5*3

Coil

Nominal operating power	640 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

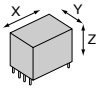
Remarks

*1 At nominal switching capacity, operating frequency: 1s ON, 9s OFF
*2 N.O.: at 5 A (steady), 25 A (inrush)/N.C.: at 20 A (brake) 14 V DC, operating frequency: 0.5s ON, 9.5s OFF
*3 At 20A 14 V DC (Motor lock), operating frequency: 0.5s ON, 9.5s OFF
*4 Measurement at same location as "Initial breakdown voltage" section
*5 Detection current: 10mA
*6 Excluding contact bounce time
*7 Half-wave pulse of sine wave: 11ms; detection: 10μs
*8 Half-wave pulse of sine wave: 6ms

Characteristics

Max. operating speed (at nominal switching capacity)		6 cpm
Initial insulation resistance*4		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*5	Between open contacts	500 Vrms for 1 min.
	Between contacts and coil	500 Vrms for 1 min.
Operate time*6 (at nominal voltage)(at 20°C68°F)		Max. 10 ms (initial)
Release time*6 (at nominal voltage)(at 20°C68°F)		Max. 10 ms (initial)
Shock resistance	Functional*7	Min. 100 m/s² {10G}
	Destructive*8	Min. 1,000 m/s² {100G}
Vibration resistance	Functional*9	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5G}
	Destructive*10	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5G}
Conditions for operation, transport and storage*11 (Not freezing and condensing at low temperature)	Ambient temperature	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 12.5g.44 oz

*9 Detection time: 10μs
*10 Time of vibration for each direction;



X, Y, direction: 2 hours
Z direction: 4 hours

*11 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

TYPICAL APPLICATIONS

- Power windows
- Auto door lock
- Electrically powered sunroof
- Electrically powered mirror, etc.

ORDERING INFORMATION

Ex. CR [2] — [12 V]

Contact arrangement	Coil voltage(DC)
1 Form C × 2	12 V

Standard packing: Carton(tube package) 32pcs. Case: 800pcs.

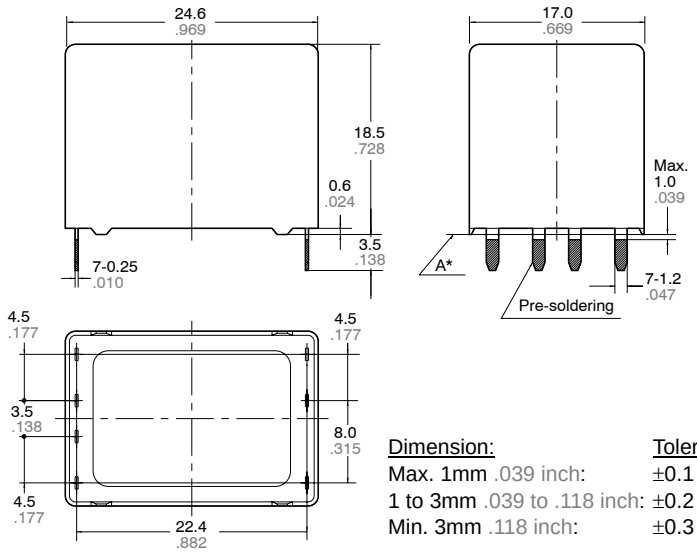
TYPES AND COIL DATA (at 20°C 68°F)

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)*	Drop-out voltage, V DC (Initial)	Coil resistance, Ω	Nominal operating current, mA	Nominal operating power, mW	Usable voltage range, V DC
CR2-12V	12	Max. 7.2	Min. 1.0	225±10%	53.3±10%	640	10 to 16

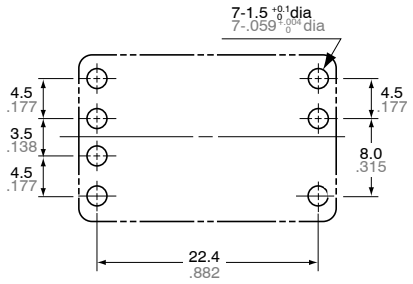
* Other pick-up voltage types are also available. Please contact us for details.

DIMENSIONS

mm inch

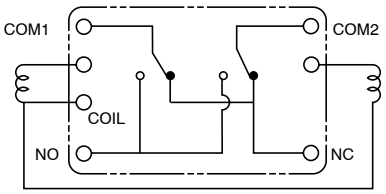


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

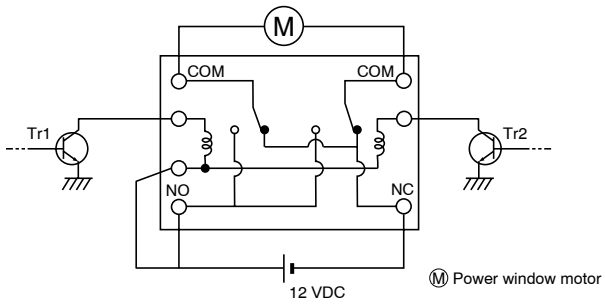


Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

EXAMPLE OF CIRCUIT

Forward/reverse control circuits of DC motor for power window

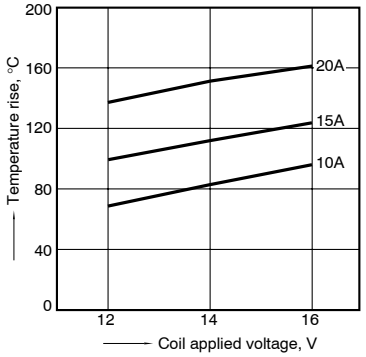


Tr1	Tr2	Motor
OFF	OFF	Stop
ON	OFF	Forward
OFF	ON	Reverse

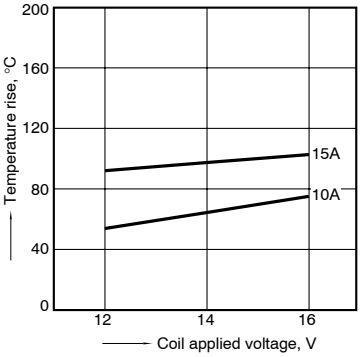
Automotive

REFERENCE DATA

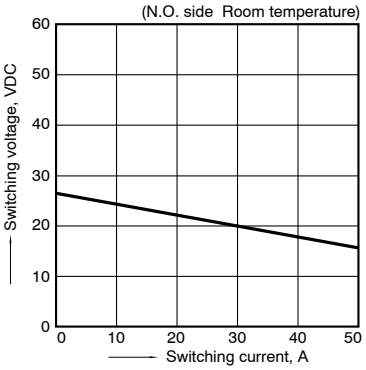
1-(1). Coil temperature rise (at room temperature)
Sample: CR2-12V, 5pcs
Contact carrying current: 10A, 15A, 20A
Ambient temperature: Room temperature



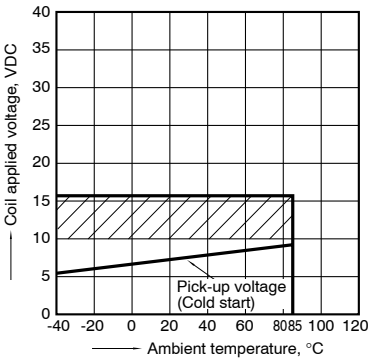
1-(2). Coil temperature rise (at 85°C 185°F)
Sample: CR2-12V, 5pcs
Contact carrying current: 10A, 15A
Ambient temperature: 85°C 185°F



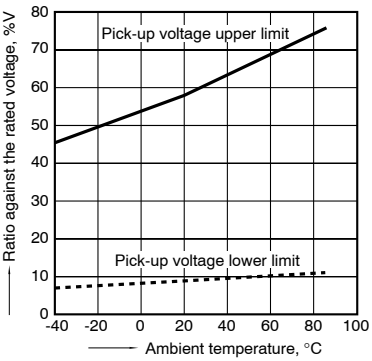
2. Max. switching capability (Resistive load)



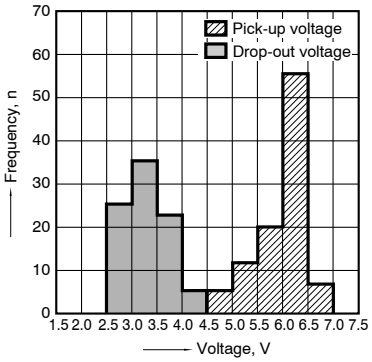
3. Ambient temperature and operating temperature range



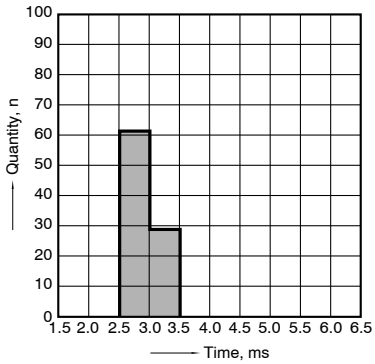
4. Ambient temperature characteristics



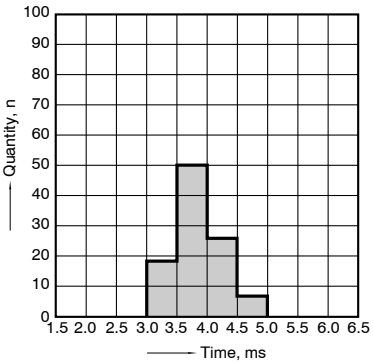
5. Distribution of pick-up and drop-out voltage
Sample: CR2-12V, 100pcs



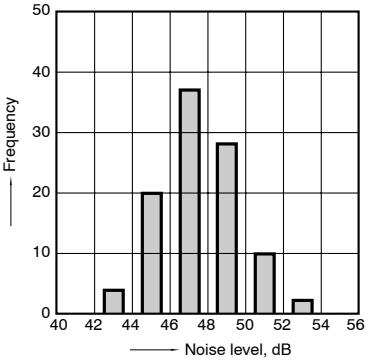
6. Distribution of operate time
Sample: CR2-12V, 100pcs



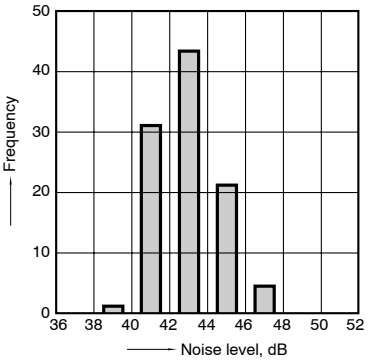
7. Distribution of release time
Sample: CR2-12V, 100pcs
* With diode



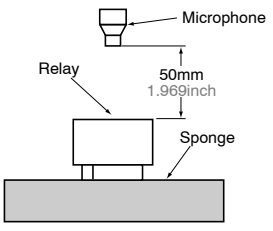
8-(1). Operation noise distribution
When actuated



8-(2). Operation noise distribution
When released



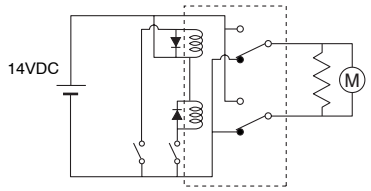
Measuring conditions
Sample: CR2-12 V, 50 pcs.
Equipment setting: “A” weighted, Fast, Max. hold
Coil voltage: 12V DC
Coil connection device: Diode
Background noise: Approx. 20dB



9-(1). Electrical life test (Motor free)

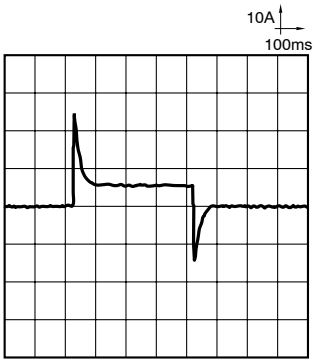
Sample: CR2-12V, 3pcs
Load: Inrush current: 25A, Steady current: 6A,
Brake current: 15A,
power window motor actual load (free condition)
Tested voltage: 14V DC
Ambient temperature: Room temperature

Circuit

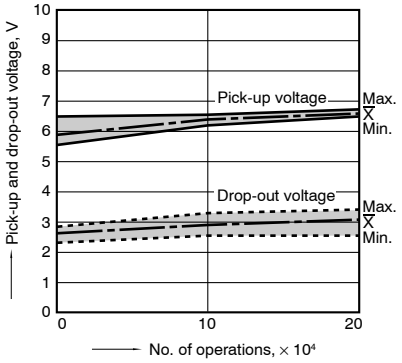


Load current waveform

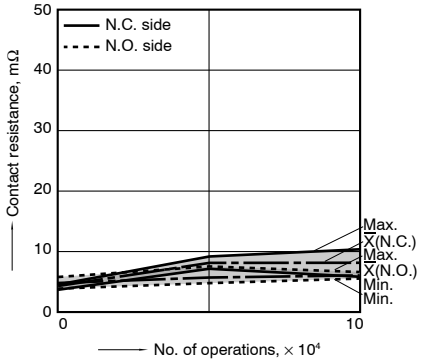
Inrush current: 25A, Steady current: 6A,
Brake current: 15A
Tested voltage: 14V DC



Change of pick-up and drop-out voltage



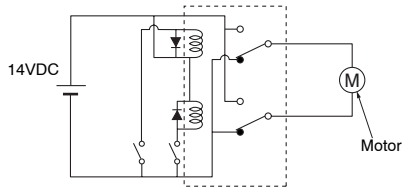
Change of contact resistance



9-(2). Electrical life test (Motor lock)

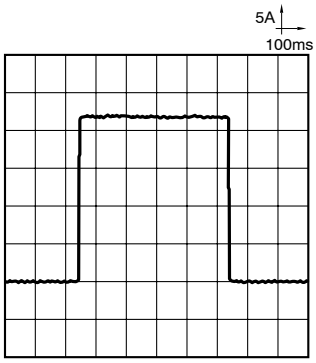
Sample: CR2-12V, 3pcs
Brake current: 22A,
power window motor actual load (lock condition)
Tested voltage: 14V DC
Switching frequency: (ON:OFF = 0.5s:9.5s)
Ambient temperature: Room temperature

Circuit

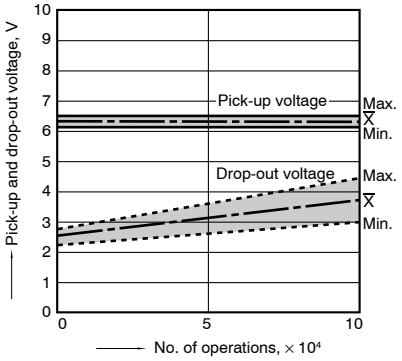


Load current waveform

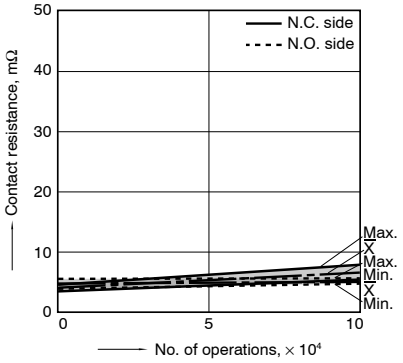
Brake current: 22A
Tested voltage: 14V DC



Change of pick-up and drop-out voltage



Change of contact resistance

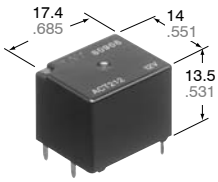


For Cautions for Use, see Relay Technical Information (page 390).

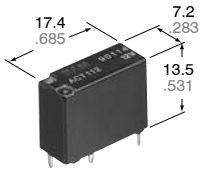
Panasonic
ideas for life

SUPER MINIATURE TWIN TYPE AUTOMOTIVE RELAY

CT RELAYS (ACT)



Twin type (8 terminals)



mm inch

Slim 1c type

FEATURES

• Small & slim size

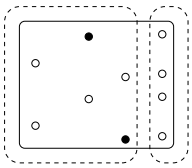
Twin type: 17.4(L)×14.0(W)×13.5(H)mm
.685(L)×.551(W)×.531(H)inch
Slim 1c type: 17.4(L)×7.2(W)×13.5(H)mm
.685(L)×.283(W)×.531(H)inch

• Twin (1 Form C × 2)

Forward/reverse motor control is possible with a single relay.

• Simple footprint enables ease of PC board layout

※10 terminals layout



○ = 8 terminals

TYPICAL APPLICATIONS

- Power windows
- Auto door lock
- Power sunroof
- Electrically powered mirrors
- Powered seats
- Lift gates
- Slide door closers, etc.
  (for DC motor forward/reverse control circuits)

SPECIFICATIONS

Contact

Arrangement			1 Form C×2, 1 Form C
Contact material			Silver alloy
Initial contact resistance (By voltage drop 6 V DC 1 A)			Max. 100mΩ
Initial contact voltage drop			Max. 0.2 V (at 10 A)
Rating	Nominal switching capacity		N.O.: 20 A 14 V DC N.C.: 10 A 14 V DC
	Max. carrying current		35 A for 2 minutes, 25 A for 1 hour (14 V, at 20°C 68°F) 30 A for 2 minutes, 20 A for 1 hour (14 V, at 85°C 185°F)
	Min. switching capacity#1		1 A 12 V DC
Expected life (min. operation)	Mechanical (at 120 cpm)		Min. 10^7
	Electrical	Resistive load	Min. 10^{5}*1
		Motor load	Min. 2×10^{5}*2 (free)
			Min. 10^{5}*3 (lock)

Coil

Nominal operating power	800 mW

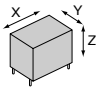
#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed (at nominal switching capacity)		6 cpm
Initial insulation resistance*4		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*5	Between open contacts	500 Vrms for 1 min.
	Between contacts and coil	500 Vrms for 1 min.
Operate time*6 (at nominal voltage) (at 20°C 68° F)		Max. 10ms (Initial)
Release time*6 (at nominal voltage) (at 20°C 68° F)		Max. 10ms (Initial)
Shock resistance	Functional*7	Min. 100 m/s² {10G}
	Destructive*8	Min. 1,000 m/s² {100G}
Vibration resistance	Functional*9	10 Hz to 100 Hz, Min. 44.1m/s² {4.5G}
	Destructive*10	10 Hz to 500 Hz, Min. 44.1m/s² {4.5G}
Conditions for operation, transport and storage*11 (Not freezing and condensing at low temperature)	Ambient temp	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 8.0g .28oz (Twin type) Approx. 4.0g .14oz (Slim 1c type)

Remarks

*1 At nominal switching capacity, operating frequency: 1s ON, 9s OFF
*2 N.O.: at 5 A (steady), 25 A (inrush)/N.C.: at 20 A (brake) 14 V DC, operating frequency: 0.5s ON, 9.5s OFF
*3 At 25A 14 V DC (Motor lock), operating frequency: 0.5s ON, 9.5s OFF
*4 Measurement at same location as "Initial breakdown voltage" section
*5 Detection current: 10mA
*6 Excluding contact bounce time
*7 Half-wave pulse of sine wave: 11ms; detection: 10μs
*8 Half-wave pulse of sine wave: 6ms
*9 Detection time: 10μs
*10 Time of vibration for each direction;



X, Y, direction: 2 hours
Z direction: 4 hours

*11 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

ORDERING INFORMATION

Ex. A CT 1 12

Product name	Contact arrangement	Coil voltage (V DC)
CT	1: 1 Form C 2: 1 Form C × 2 (8 terminals type) 5: 1 Form C × 2 (10 terminals type)	12: 12

Standard packing; 1 Form C: Carton(tube package) 30pcs. Case 1,500pcs.
1 Form C × 2: Carton(tube package) 30pcs. Case 900pcs.

TYPES AND COIL DATA (at 20°C 68°F)

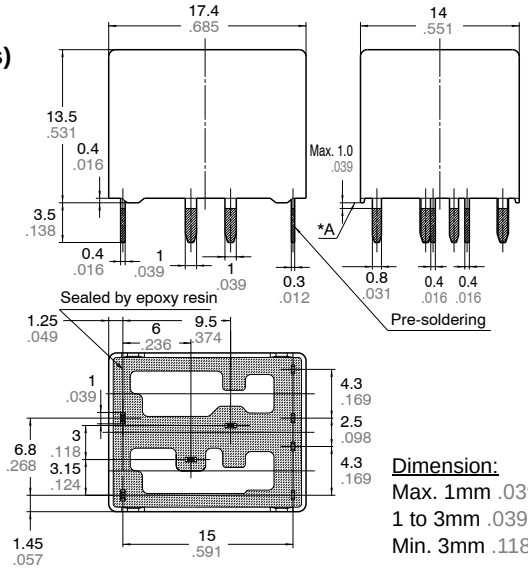
Contact arrangement	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance, Ω	Nominal operating current, mA	Nominal operating power, mW	Usable voltage range, V DC
1c	ACT112	12	Max. 7.2	Min. 1.0	180±10%	66.7±10%	800	10 to 16
1c × 2 (8 terminals type)	ACT212	12	Max. 7.2	Min. 1.0	180±10%	66.7±10%	800	10 to 16
1c × 2 (10 terminals type)	ACT512	12	Max. 7.2	Min. 1.0	180±10%	66.7±10%	800	10 to 16

* Other pick-up voltage types are also available. Please contact us for details.

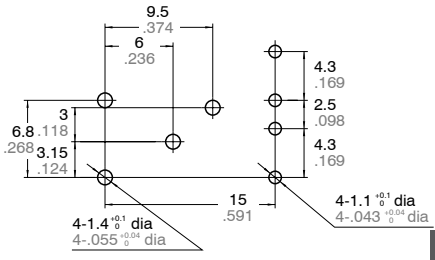
DIMENSIONS

mm inch

1. Twin type (8 terminals)

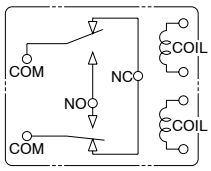


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

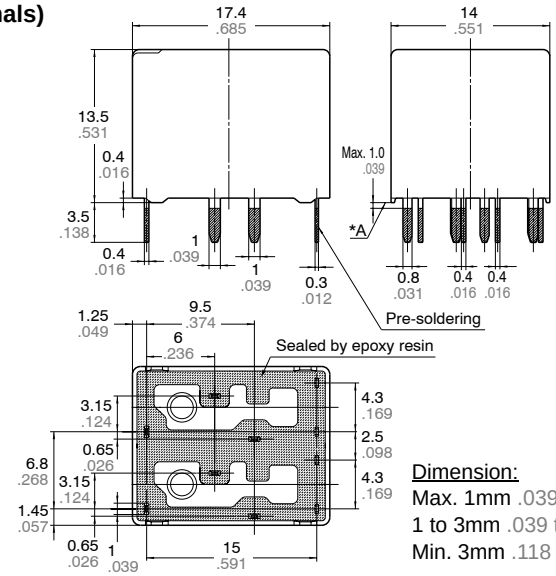
Schematic (Bottom view)



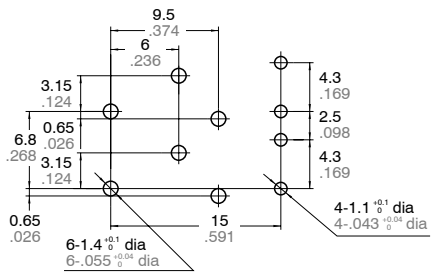
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

2. Twin type (10 terminals)

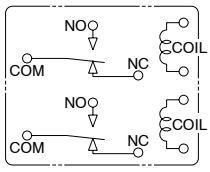


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

Schematic (Bottom view)

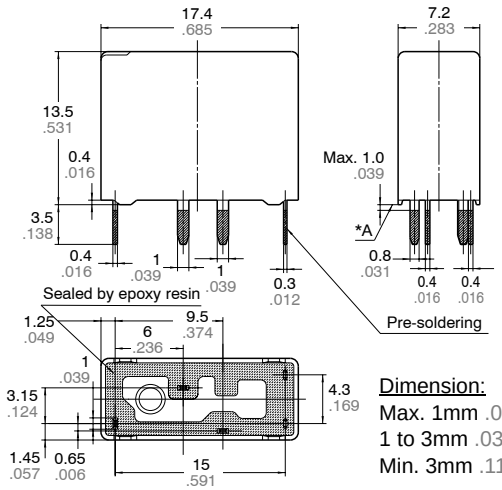


Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

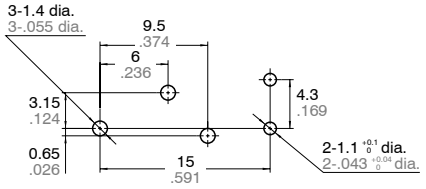
* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

3. Slim 1c type

mm inch



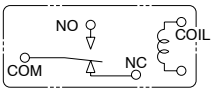
PC board pattern (Bottom view)



Tolerance: ±0.1±.004

Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

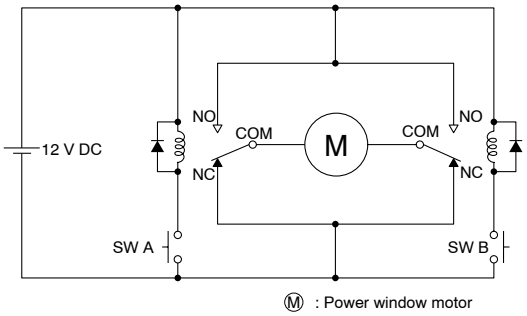
Schematic (Bottom view)



* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

EXAMPLE OF CIRCUIT

Forward/reverse control circuits of DC motor for power windows

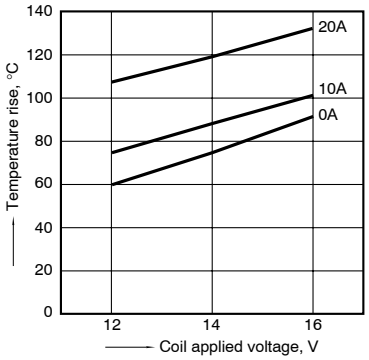


Ⓜ : Power window motor

REFERENCE DATA

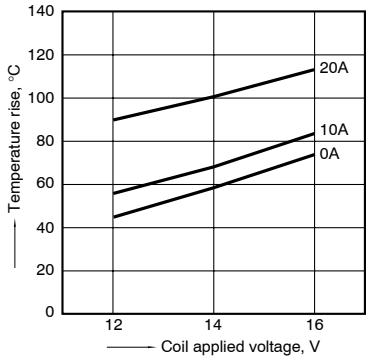
1-(1). Coil temperature rise (at room temperature

Sample: ACT212, 3pcs.
Contact carrying current: 0A, 10A, 20A

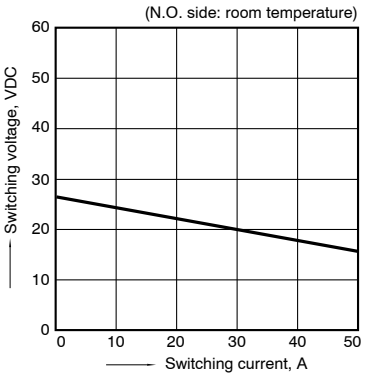


1-(2). Coil temperature rise (at 85°C 185°F)

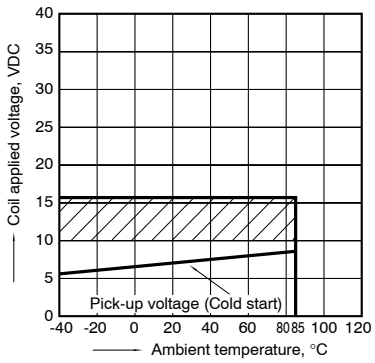
Sample: ACT212, 3pcs.
Contact carrying current: 0A, 10A, 20A



2. Max. switching capability (Resistive load)

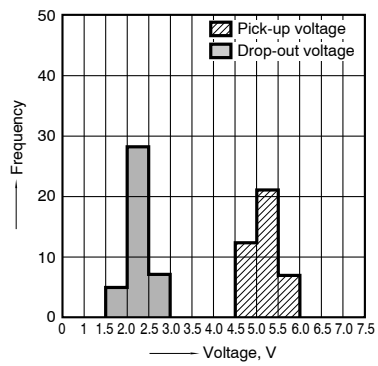


3. Ambient temperature and operating voltage range



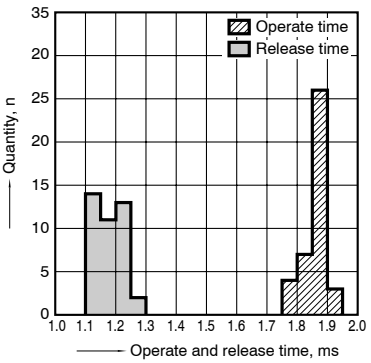
4. Distribution of pick-up and drop-out voltage

Sample: ACT212, 40pcs.



5. Distribution of operate and release time

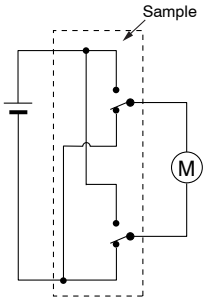
Sample: ACT212, 40pcs.
* Without diode



6-(1). Electrical life test (Motor free)

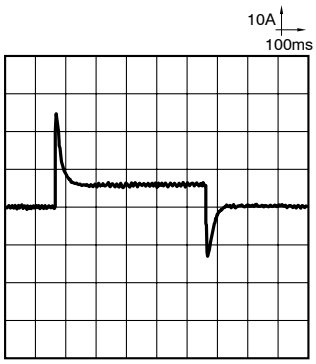
Sample: ACT212, 3pcs.
Load: 5A steady, Inrush 25A, 14V DC
Brake current: 13A 14V DC,
Power window motor actual load (free condition)
Operating frequency: (ON : OFF = 0.5s : 9.5s)
Ambient temperature: Room temperature

Circuit:

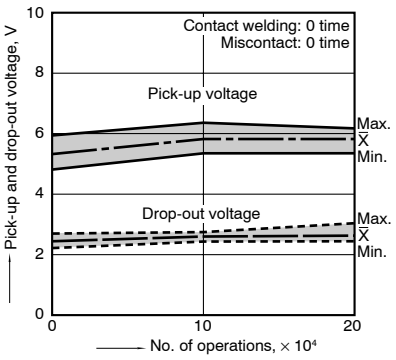


Load current waveform

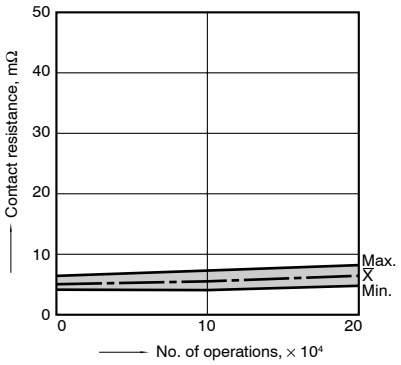
Inrush current: 25A, Steady current: 6A
Brake current: 13A



Change of pick-up and drop-out voltage



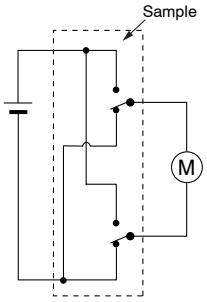
Change of contact resistance



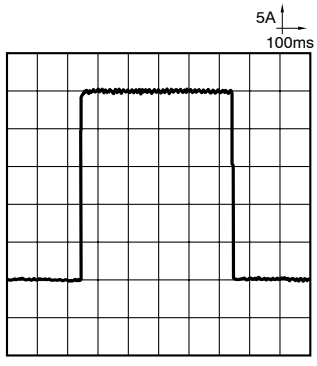
6-(2). Electrical life test (Motor lock)

Sample: ACT212, 3pcs.
Load: 25A 14V DC
Switching frequency: (ON : OFF = 0.5s : 9.5s)
Ambient temperature: Room temperature

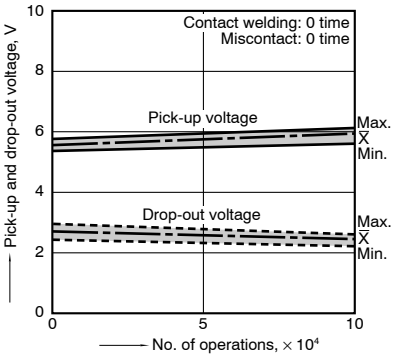
Circuit:



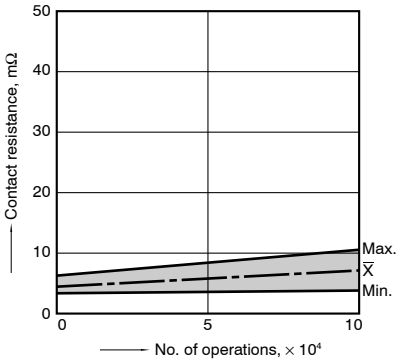
Load current waveform



Change of pick-up and drop-out voltage



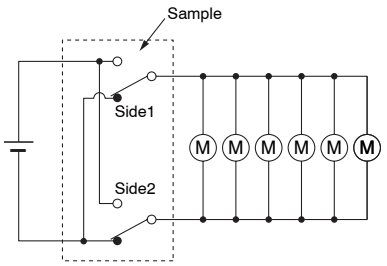
Change of contact resistance

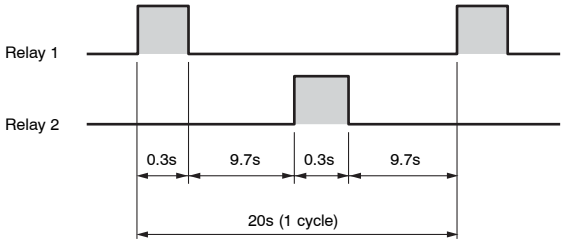


6-(3). Electrical life test (Motor lock)

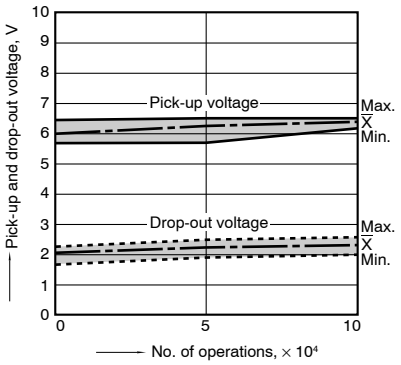
Sample: ACT212, 3pcs.
Load: 20A 14V DC,
door lock motor actual load (Lock condition)
Switching frequency: (ON : OFF = 0.3s : 19.7s)
Ambient temperature: Room temperature

Circuit:

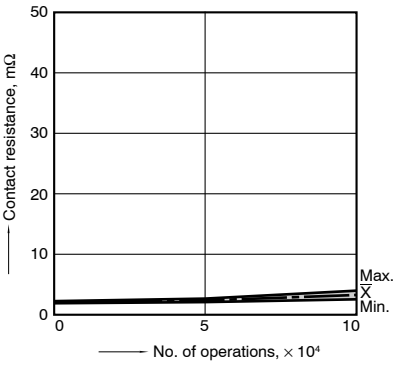




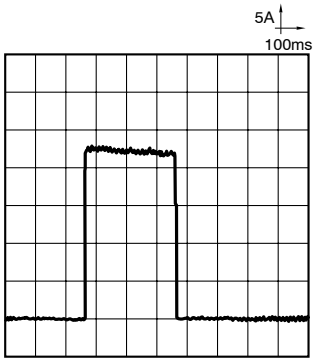
Change of pick-up and drop-out voltage



Change of contact resistance



Load current waveform



For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

AUTOMOTIVE LOW PROFILE MICRO-ISO/MICRO-280 RELAY

CV RELAYS (ACV)

Micro ISO 1c type

Micro ISO 1a type

Micro 280 plug-in type

Micro 280 PCB type

FEATURES

• Low profile:
22.5 mm(L)×15 mm(W)×15.7 mm(H)
.886 inch(L)×.591 inch(W)×.618 inch(H)

• Low temperature rise
Terminal temperature has been reduced compared with using our conventional product

• Low sound pressure level
Noise level has been reduced approx.10dB compared with using our conventional product.

• Wide line-up
Micro ISO/Micro 280 terminal types and resistor and diode inside type, PCB terminal type (Micro 280 only).

• Plastic sealed type
Plastically sealed for automatic cleaning.

• Compact and high-capacity 20A load switching
N.O.: 20A 14V DC, N.C.: 10A 14V DC
(Max. carrying current: at 85°C 185°F)

TYPICAL APPLICATIONS

- Headlights
- Magnetic clutches
- Radiator fans
- Blowers
- Fog lamps
- Tail lights
- Heaters
- Defoggers
- Horns
- Condenser fans, etc.

SPECIFICATIONS

Contact

Arrangement		1 Form A	1 Form C
Contact material		Silver alloy	
Initial contact resistance (By voltage drop 6 V DC 1 A)		Max. 50mΩ	
Contact voltage drop		Max. N.O.: 0.2 V (at 20 A)	Max. N.O.: 0.2 V (at 20 A switching) Max. N.C.: 0.5 V (at 10 A switching)
Rating	Nominal switching capacity	N.O.: 20 A 14 V DC	N.O.: 20 A 14 V DC N.C.: 10 A 14 V DC
	Max. carrying current	N.O.: 20 A (Continuous, at 85°C 185°F) 50 A for 2 minutes, 40 A for 1 hour (at 20°C 68°F) 40 A for 2 minutes, 30 A for 1 hour (at 85°C 185°F)	<N.O.> N.O.: 20 A (Continuous, at 85°C 185°F) 50 A for 2 minutes, 40 A for 1 hour (at 20°C 68°F) <N.C.> N.C.: 10 A (Continuous, at 85°C 185°F) 40 A for 2 minutes, 30 A for 1 hour (at 85°C 185°F)
	Min. switching capacity#1	1 A 12 V DC	
Expected life (min. operation)	Mechanical (at 120 cpm)	Min. 10^6	
	Electrical (at rated load)	Min. 10^5*1	

Coil

Nominal operating power	0.8 W, 1.0 W (with resister inside type)

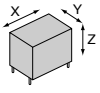
#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Characteristics

Max. operating speed (at nominal switching capacity)		15cpm
Initial insulation resistance*2		Min. 20MΩ (at 500 V DC)
Initial breakdown voltage*3	Between open contacts	500 Vrms for 1min.
	Between contacts and coil	500 Vrms for 1min.
Operate time*4 (at nominal voltage) (at 20°C 68°F) (initial)		Max. 10ms
Release time*4 (at nominal voltage) (at 20°C 68°F) (initial)		Max. 10ms Max. 15ms (with diode inside type)
Shock resistance	Functional*5	Min. 100 m/s²{10 G}
	Destructive*6	Min. 1,000 m/s²{100 G}
Vibration resistance	Functional*7	10 Hz to 100 Hz, Min.44.1 m/s² {4.5 G}
	Destructive*8	10 Hz to 500 Hz, Min.44.1 m/s² {4.5 G}
Conditions in case of operation, transport and storage*9 (Not freezing and condensing at low temperature)	Ambient temp*10	–40°C to +85°C –40°F to +185°F
	Humidity	25% R.H. to 85% R.H.
Mass		Approx. 15.0g .53 oz

Remarks

*1 At nominal switching capacity, operating frequency: 2s ON, 2s OFF
*2 Measurement at same location as "Initial breakdown voltage" section.
*3 Detection current: 10mA
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Time of vibration for each direction;
X, Y, Z direction: 4 hours



*9 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).
*10 Ambient temperature 125°C 257°F type is also available. Please contact us for details.

Automotive

ORDERING INFORMATION

Ex. A CV 1 2 0 12

Product name	Contact arrangement	Mounting classification	Type classification	Coil voltage, V DC
CV	1: 1 Form C 3: 1 Form A	1: Micro ISO plug-in type 2: Micro 280 plug-in type 3: Micro 280 PC board type	0: Standard type 1: With diode inside 2: With resistor inside	12: 12

Note: Standard packing; Carton (Tube): 50 pcs.; Case: 200 pcs.

TYPES

1. Micro ISO terminal type

Coil voltage (DC)	Contact arrangement	Mounting classification	Type classification	Part No.
12 V	1 Form A	Plug-in terminal	Standard type	ACV31012
			With diode inside type	ACV31112
			With resistor inside type	ACV31212
	1 Form C		Standard type	ACV11012
			With diode inside type	ACV11112
			With resistor inside type	ACV11212

2. Micro 280 terminal type

Coil voltage (DC)	Contact arrangement	Mounting classification	Type classification	Part No.
12 V	1 Form A	Plug-in terminal	Standard type	ACV32012
			With diode inside type	ACV32112
			With resistor inside type	ACV32212
		PC board terminal	Standard type	ACV33012
			With diode inside type	ACV33112
			With resistor inside type	ACV33212
	1 Form C	Plug-in terminal	Standard type	ACV12012
			With diode inside type	ACV12112
			With resistor inside type	ACV12212
		PC board terminal	Standard type	ACV13012
			With diode inside type	ACV13112
			With resistor inside type	ACV13212

COIL DATA (at 20°C 68°F)

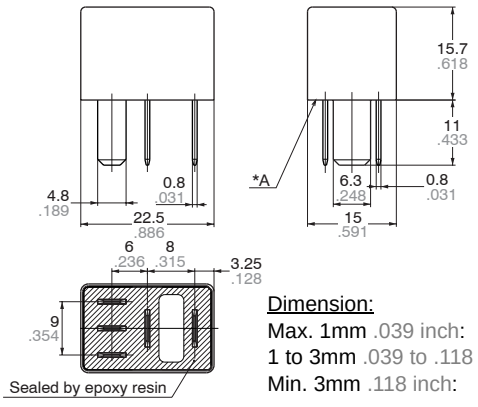
Nominal voltage, V DC	Pick-up voltage, * V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance, W	Nominal operating current, mA	Nominal operating power, W	Usable voltage range, V DC
12	Max. 7.0	Min. 0.6	180±10% 142.3±10% (with resistor)	67±10% 84±10% (with resistor)	0.8 1.0 (with resistor)	10 to 16

* Other pick-up voltage types are also available. Please contact us for details.

DIMENSIONS

mm inch

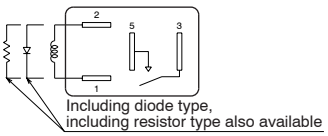
1. Micro ISO terminal type



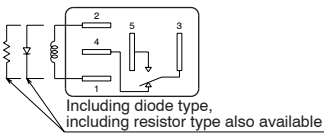
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

1 Form A



1 Form C

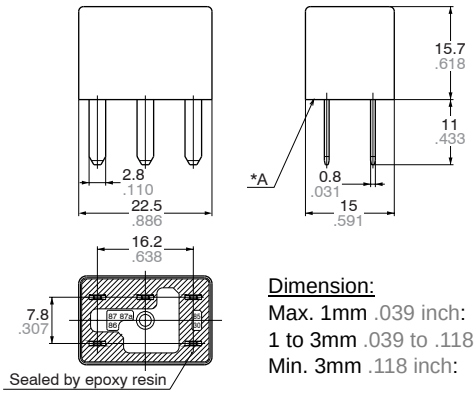


* Intervals between terminals is measured at A surface level.

2. Micro 280 terminal type

mm inch

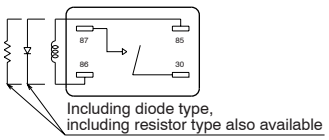
1). Plug-in type



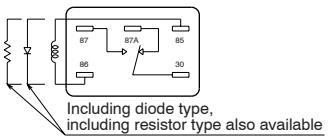
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

1 Form A

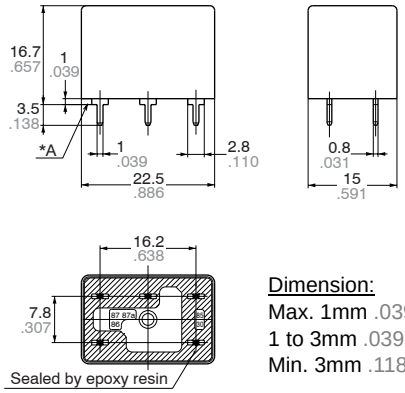


1 Form C



* Intervals between terminals is measured at A surface level.

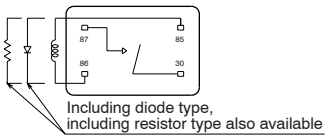
2). PC board type



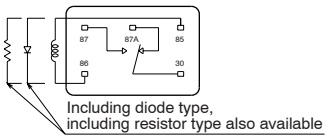
Dimension:	Tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

Schematic (Bottom view)

1 Form A



1 Form C



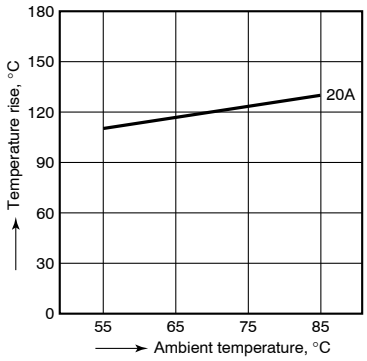
* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

Automotive

REFERENCE DATA

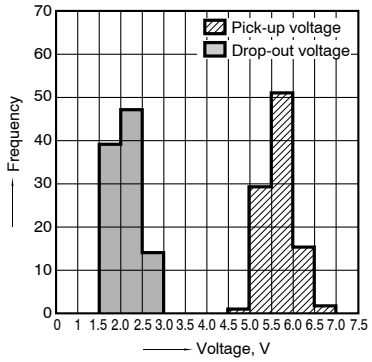
1. Coil temperature rise (20A)

Point measured: Inside the coil
Contact carrying current: 20A
Coli applied voltage: 13.5V



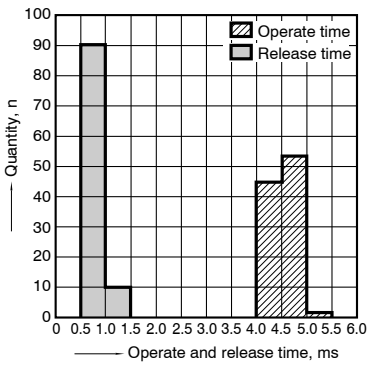
2. Distribution of pick-up and drop-out voltage

Sample: ACV11012, 100pcs



3. Distribution of operate and release time

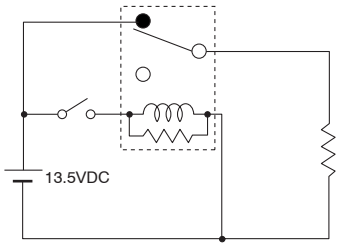
Sample: ACV11012, 100pcs.



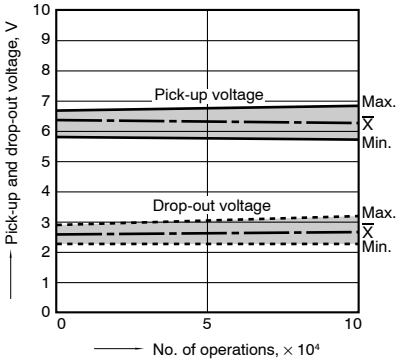
4-(1). Electrical life test (Resistive load)

Sample: ACV12212, 3pcs.
Load: Resistive load (NC switching) 11A
Switching frequency: (ON : OFF = 1s : 1s)
Ambient temperature: Room temperature

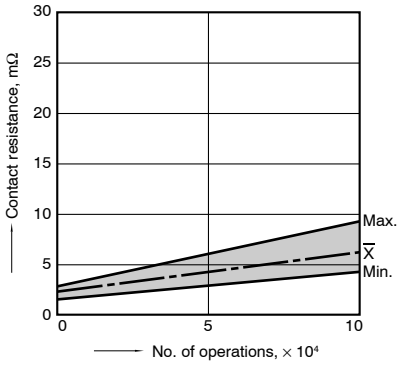
Circuit



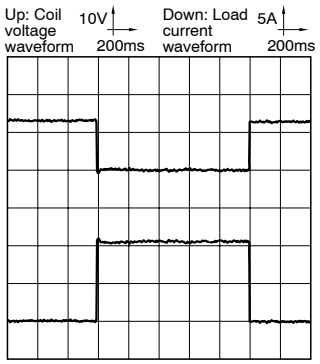
Change of pick-up and drop-out voltage



Change of contact resistance



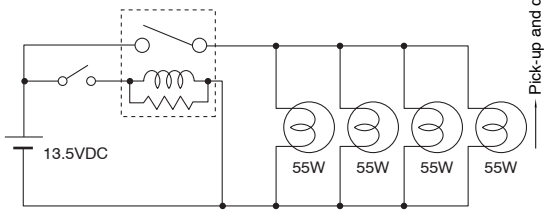
Load current waveform



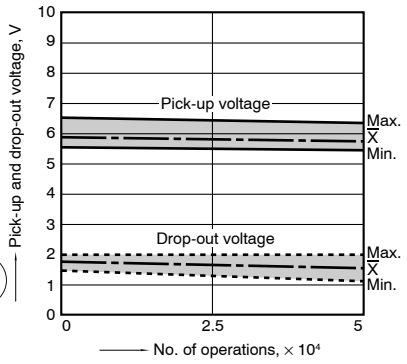
4-(2). Electrical life test (Lamp load)

Sample: ACV12212, 3pcs.
Load: 55Wx4, inrush: 90A/steady: 20A,
lamp actual load
Switching frequency: (ON : OFF = 1s : 14s)
Ambient temperature: Room temperature

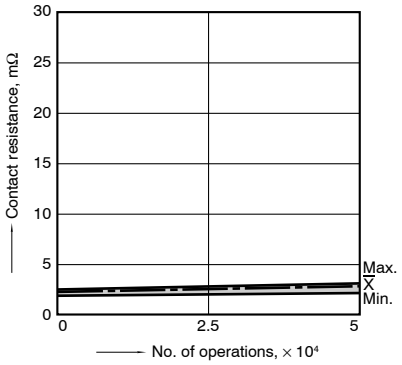
Circuit



Change of pick-up and drop-out voltage

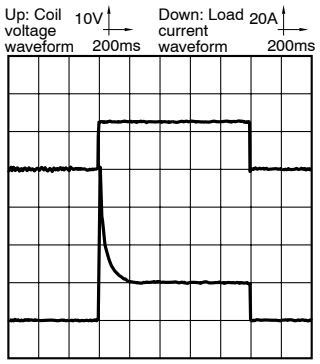


Change of contact resistance



Load current waveform

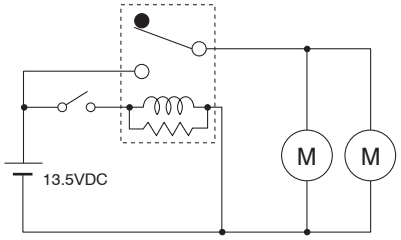
Inrush current: 90A, steady current: 20A



4-(3). Electrical life test (Motor load)

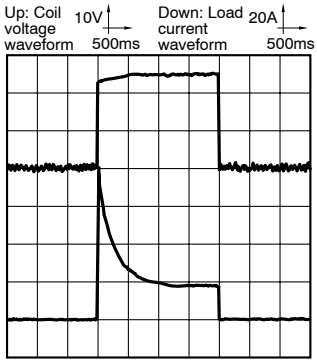
Sample: ACV12212, 3pcs.
Load: inrush: 80A/steady: 18A,
radiator fan actual load (motor free)
Switching frequency: (ON : OFF = 2s : 6s)
Ambient temperature: Room temperature

Circuit

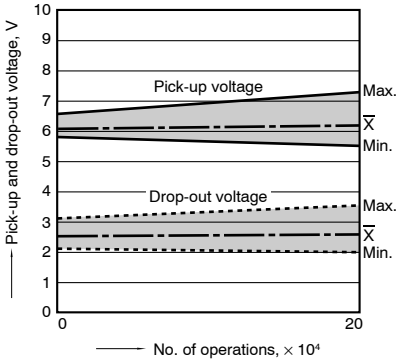


Load current waveform

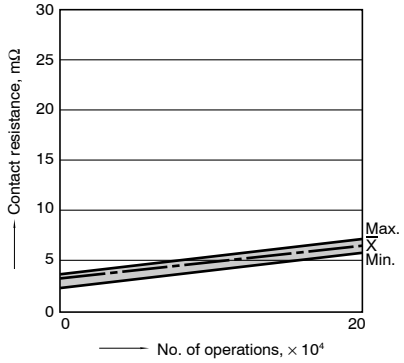
Inrush current: 80A, steady current: 18A



Change of pick-up and drop-out voltage



Change of contact resistance



Cautions regarding the protection element

1. Part numbers without protection elements

• 12 V models

When connecting a coil surge protection circuit to these relays, we recommend a Zener diode with a Zener voltage of 24 V or higher, or a resistor (680Ω to 1,000Ω). When a diode is connected to the coil in parallel, the release time will slow down and working life may shorten. Before use, please check the circuit and verify that the diode is not connected in parallel to the coil drive circuit.

2. Part numbers with diodes

These relays use a diode in the coil surge protection element. Therefore, the release time is slower and the working life might be shorter compared to part numbers without protection elements and part numbers with resistors.
Be sure to use only after evaluating under actual load conditions.

3. Part numbers with resistors

This part number employs a resistor in the coil surge protection circuit; therefore, an external surge protection element is not required. In particular, when a diode is connected in parallel with a coil, the revert time becomes slower which could adversely affect working life. Please check the circuit and make sure that a diode is not connected in parallel with the coil drive circuit.

Automotive

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

COMPACT BUT CUT OFF DC POWER CURRENT, POWER CAPSULE CONTACT RELAY.

EV RELAYS (AEV)


150A 2a


150A 1a


60a


30a

FEATURES

• Small size & light weight: size 1/4, weight 1/2 (compared to conventional contactors)

• No arc space is required: size including arc space 1/9 (compared to conventional contactors)

The arc is not exposed to the outside, therefore, no arc space is not required.

• Safety construction

The arc is not exposed, therefore, the contactor is explosion proof and intrinsically safe.

• Quiet: operation noise 1/4 (compared to conventional contactors).

Along with the above-mentioned miniaturization, the operation noise has been reduced to 70dB, and, in addition, the operation noise remains unchanged when a current of 1000A or more is interrupted.

• High contact reliability

The contact part is hermetically sealed with H_2 mixed gas, hence the contact resistance remains stable regardless of the ambient conditions.

• Mounting direction is not specified

The weight of the movable parts is light, and also the restoring force is large, hence the contactor is relatively unaffected by gravity.

• Line-up of indicator Type (150A Type only)

A line-up of relays with indicator that can monitor the relay operation.

• Coil voltage 24V DC type is also available

SPECIFICATIONS

Contact

Type		150A type	60A type	30A type
Arrangement		1 Form A, 2 Form A	1 Form A	1 Form A
Rating	Nominal switching capacity (resistive load)	150A 400V DC	60A 400V DC	30A 400V DC
	Short term current	300A (10min) ($40mm^2$)	120A (15min) ($15mm^2$)	60A (5min) ($5.5mm^2$)
	Max. cut-off current	2,500A 300V DC (3 cycles)#1	600A 300V DC (5 cycles)#3	—
	Overload opening/ closing rating	600A 300V DC (25 cycles)	120A 400V DC (50 cycles)#3	120A 400V DC (50 cycles)#3
	Reverse direction cut-off	–300A 200V DC (25 cycles)	–120A 200V DC (50 cycles)#3	–60A 200V DC (50 cycles)#3
	Contact voltage drop	Max. 0.1V When current (is 150A per 1) contact set	Max. 0.1V When current (is 60A per 1) contact set	Max. 0.2V When current (is 30A per 1) contact set
Nominal operating power		35W (Inrush, approx 0.1s) 5W (Stable)	Max. 5W	Max. 5W
Expected life (min. operations)	Mechanical	1 Form A: 10^5 2 Form A: 5×10^4	10^5	
	Electrical	150A 400V DC 10^3 L/R q 1ms	60A 400V DC 10^3 L/R q 1ms#3	30A 400V DC 3×10^4 L/R q 1ms#3

Characteristics

Initial insulation resistance		Min. 100 MΩ (at 500 V DC)*1
Initial breakdown voltage	Between open contacts	AC 2,500 Vrms for 1 min.*2
	Between contact and coil	AC 2,500 Vrms for 1 min.*2
Operate time (at 20°C) (at nominal voltage)		Max. 50ms*3
Reset time (without diode) (at 20°C) (at nominal voltage)		Max. 30ms*4
Shock resistance	Functional	Min. 196 m/s² {20 G}*5
	Destructive	Min. 490 m/s² {50 G}*6
Vibration resistance	Functional	43 m/s² {4.4 G} 10 Hz to 200 Hz*7
	Destructive	43 m/s² {4.4 G} 10 Hz to 200 Hz*8
Conditions for operation, transport and storage (Not freezing and condensing at low temperature)	Ambient temperature	–40°C to +80°C*9 –40°F to +176°F
	Humidity	5% R.H. to 85% R.H.
Mass		150 A 1 Form A: 600 g 21.16oz 150 A 2 Form A: 1,100 g 38.80oz 60 A: 330 g 11.64oz 30 A: 310 g 10.93oz

Remarks

*1 Measurement at same location as “Initial breakdown voltage” section.
*2 Detection current: 10mA.
*3 Nominal voltage applied to the coil,excluding bounce time.
*4 Nominal voltage applied to the coil.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10μs.
*6 Half-wave pulse of sine wave: 6 ms.
*7 Detection time: 10 μs.
*8 3 directions, each 4 hours.
*9 Storage: Max.85°C 185°F.

Notes

* Same specifications as the 12 V type.
#1 Condition: Nominal switching 100 cycles,each cut off 2,500 A.
#2 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).
#3 The electrical load performance value for the 60 A and 30 A types applies when a varistor is connected in parallel to the coil. Please be warned that working life will be reduced when a diode is used.

Indicator ratings

Arrangement	1 Form A	1 Form B
Material	Gold-clad	
Rating (resistive load)	0.1 A 30 V DC (Low level load = min. 1 mA)	
Contact resistance	Max. 100 mΩ	

Note:
Indicator type is only available for the 150 A type.

TYPICAL APPLICATIONS

- Electric Vehicle
- Hybrid Electric Vehicle

ORDERING INFORMATION

Ex. A EV 1 5 0 12

Product Name	Contact arrangement	Contact rating	Indicator contact arrangement	Coil voltage
EV	1: 1 Form A 2: 2 Form A (150A type)	3: 30A 5: 150A 6: 60A	0: without indicator contact 1: a contact (150A type only) 3: b contact (150A type only)	12: 12V DC 24: 24V DC

Packing quantity

Types	Inner	Outer
150A 2 Form A	1pc.	5pcs.
150A 1 Form A	1pc.	10pcs.
60A 1 Form A	1pc.	20pcs.
30A 1 Form A	1pc.	20pcs.

SPARE PARTS

Installing parts	Part No.	Packing Quantity
M8 nut with washer for 150A type	AEV801	2pcs.
M5 screw for 60A type	AEV802	2pcs.
M4 screw for 30A type	AEV803	2pcs.
Bus bar for 60A type	AEV804	2pcs.

TYPES AND COIL DATA (at 20°C 68°F)

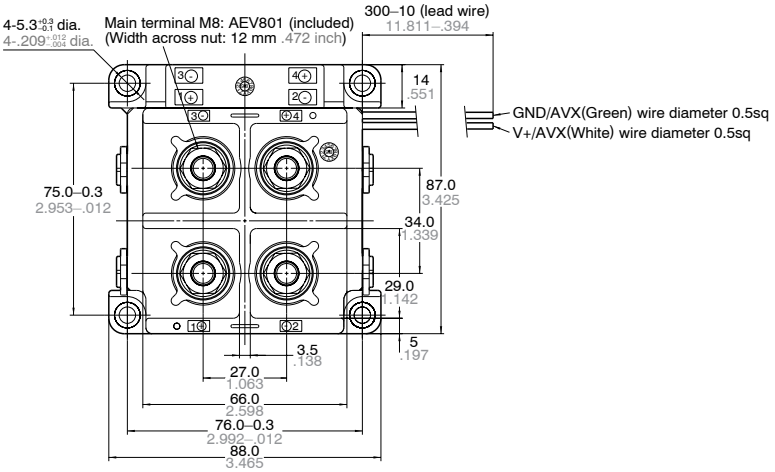
Part No.	Coil voltage, V DC	Pick-up voltage, V DC	Drop-out voltage, V DC	Nominal coil current	Operating power, W (12 V DC)	Max. allowable voltage, V DC
AEV25012*	12 V DC	Max. 9 V DC	Min. 1 V DC	2.8 A ±10% (at peak)*	35W (Inrush, approx. 0.1S) 5W (Stable)	16 V DC
AEV15012*						
AEV16012				0.415 A ±10%	Max. 5W	
AEV13012						
AEV25024*	24 V DC	Max. 18 V DC	Min. 2 V DC	1.9 A ±10% (at peak)*	35W (Inrush, approx. 0.1S) Max. 5W (1 Form A) Max. 6W (2 Form A)	32 V DC
AEV15024*				2.2 A ±10% (at peak)*		
AEV16024				0.208 A ±10%	Max. 5W	
AEV13024						

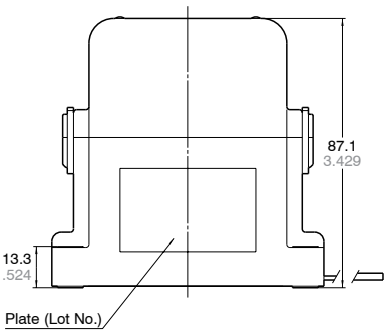
Note:
* Same coil data as Indicator type.

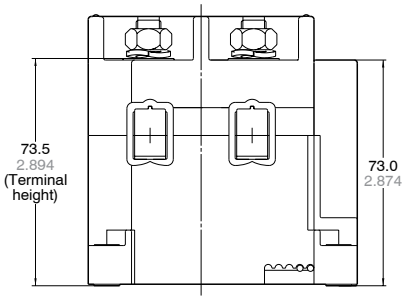
DIMENSIONS

mm inch

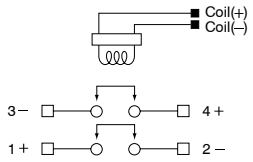
150A 2a





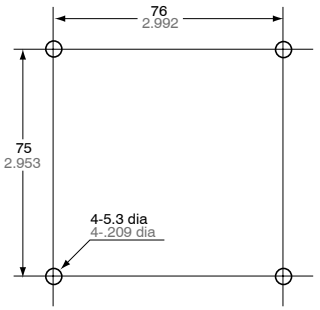


Schematic (TOP VIEW)



output side has polarities (+) and (-)

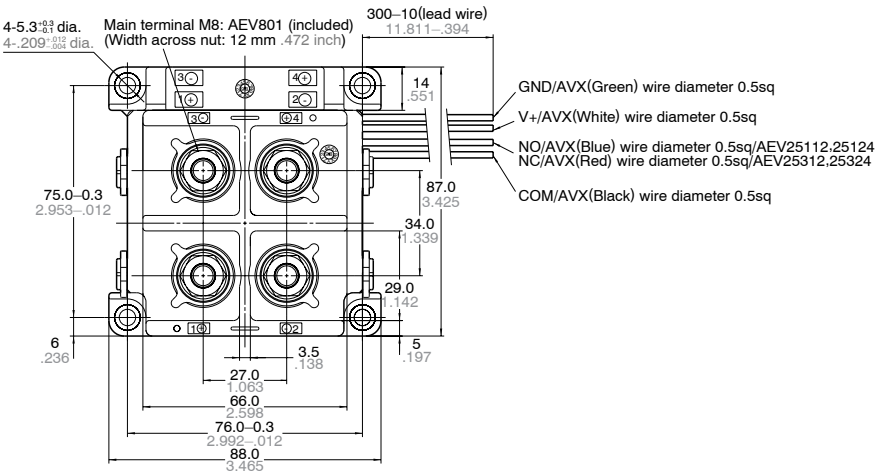
Mounting dimensions

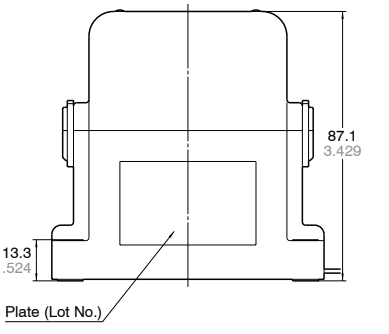


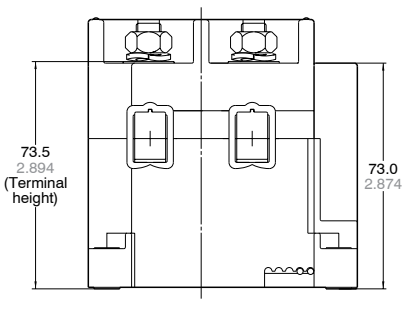
General tolerance:

less than 10 (.394)	±0.3 (±.012)
10 (.394) to 50 (1.969)	±0.6 (±.024)
more than 50 (1.969)	±1.0 (±.039)

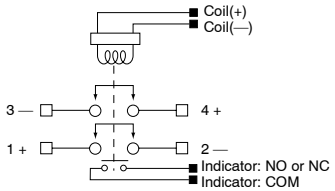
150A 2a Indicator Type





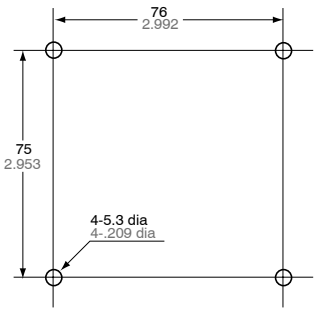


Schematic (TOP VIEW)



output side has polarities (+) and (-)

Mounting dimensions

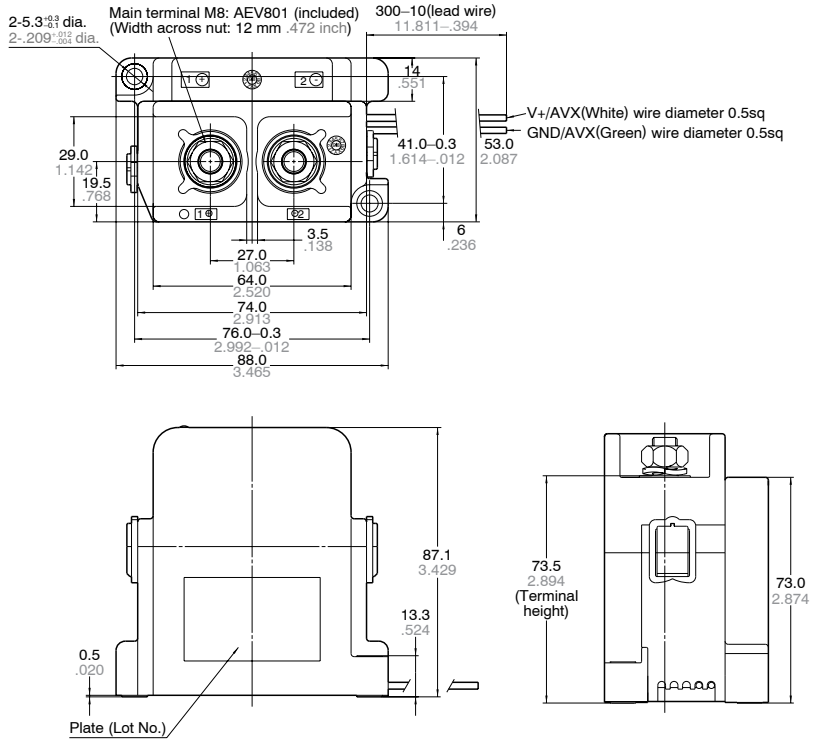


General tolerance:

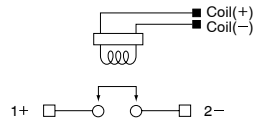
less than 10 (.394)	±0.3 (±.012)
10 (.394) to 50 (1.969)	±0.6 (±.024)
more than 50 (1.969)	±1.0 (±.039)

150A 1a

mm inch

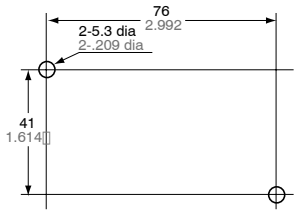


Schematic (TOP VIEW)



output side has polarities (+) and (-)

Mounting dimensions



General tolerance:

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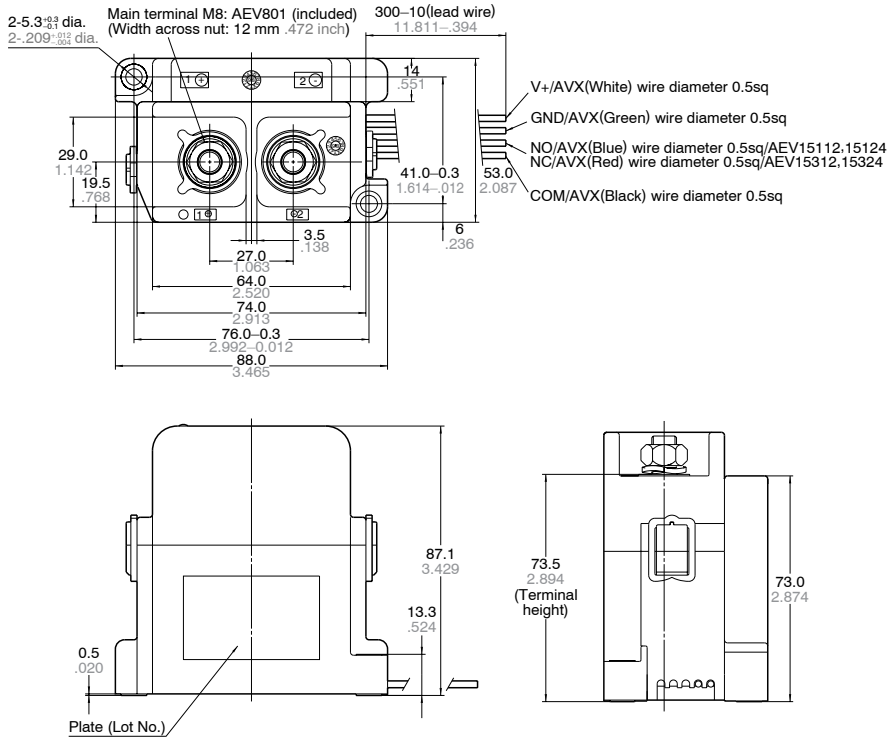
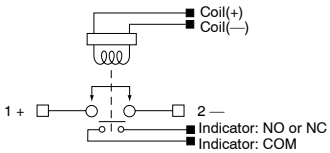
10 (.394) to 50 (1.969)	±0.6 (±.024)
more than 50 (1.969)	±1.0 (±.039)

150A 1a Indicator Type

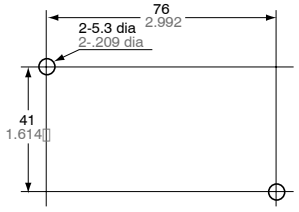


Schematic (TOP VIEW)



output side has polarities (+) and (-)

Mounting dimensions

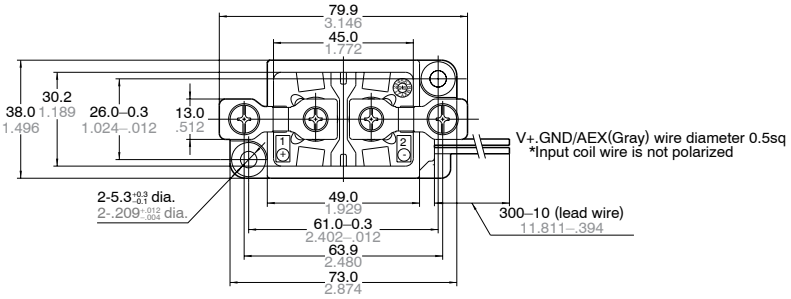


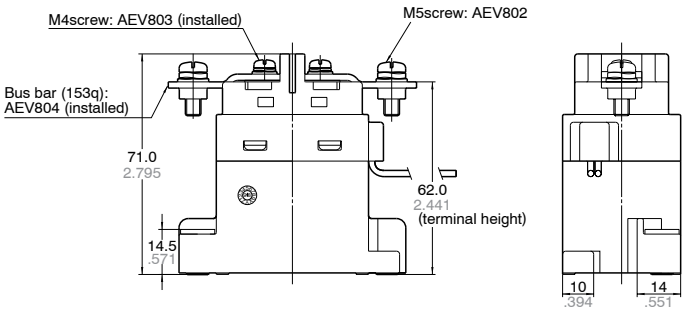
General tolerance:

less than 10 (.394)	±0.3 (±.012)
10 (.394) to 50 (1.969)	±0.6 (±.024)
more than 50 (1.969)	±1.0 (±.039)

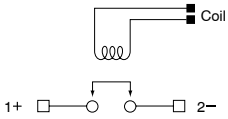
60A

mm inch



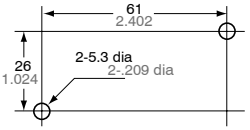


Schematic (TOP VIEW)



output side has polarities (+) and (-)

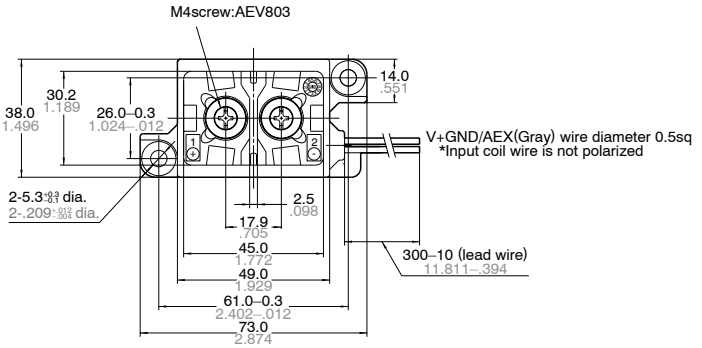
Mounting dimension

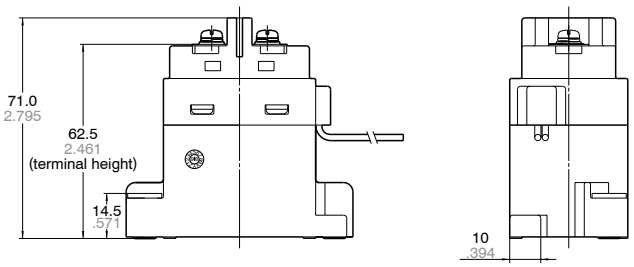


General tolerance:

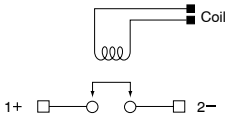
less than 10 (.394)	±0.3 (±.012)
10 (.394) to 50 (1.969)	±0.6 (±.024)
more than 50 (1.969)	±1.0 (±.039)

30A



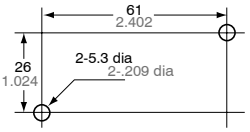


Schematic (TOP VIEW)



output side has polarities (+) and (-)

Mounting dimension

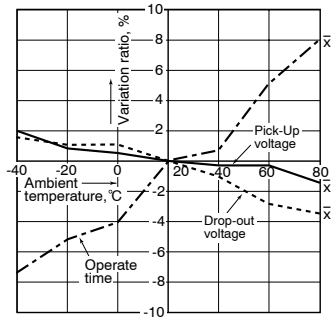


General tolerance:

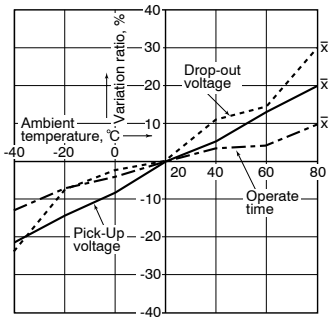
less than 10 (.394)	±0.3 (±.012)
10 (.394) to 50 (1.969)	±0.6 (±.024)
more than 50 (1.969)	±1.0 (±.039)

REFERENCE DATA

1-(1) Ambient temperature characteristics (150A type)
Sample: AEV15012,3pcs



1-(2) Ambient temperature characteristics (60A type)
Sample: AEV16012,3pcs



NOTES

1. When installing the relay, always use washers to prevent loosening of the screws.
Tighten each of the screws within the rated ranges given below. Exceeding the maximum torque may result in breakage. Mounting is possible in either direction.
• M8 screw (for 150 A main terminal): 8 to 10 N·m
• M5 screw (150 A, 60 A, 30 A main unit mounting section)
(60 A main terminal): 2.5 to 3.6 N·m
• M4 screw (30 A terminal): 1.8 to 2.7 N·m

2. The coils (150 A type) and contacts (30 A, 60 A, 150 A) of the relay are polarized, so follow the instructions in the connection schematic when connecting the coils and contacts.
Type 150 A has contains a reverse surge voltage absorption circuit;
therefore a surge protector is not needed. We recommend installing a surge protector varistor (ZNR) for the 30 A and 60 A types. Avoid using a diode as this may result in decreased cut-off capability.

3. As a general rule, do not use a relay if it has been dropped.

4. Avoid mounting the relay in strong magnetic fields (near a transformer or magnet) or close to an object that radiates heat.

5. Electrical life
This relay is a high-voltage direct-current switch. In its final breakdown mode, it may lose the ability to provide the proper cut-off. Therefore, do not exceed the indicated switching capacity and life. (Please treat the relay as a product with limited life and replace it when necessary.)
In the event that the relay loses cut-off ability, there is a possibility that burning may spread to surrounding parts, so configure the layout so that the power is turned off within one second.
When using the 30 A type, to prevent increases in the contact resistance, do not allow switching without any load.

6. Permeation life of internal gas
This relay uses a hermetically encased contact (capsule contact) with gas inside. The gas has a permeation life that is affected by the temperature inside the capsule contact (ambient temperature + temperature rise due to flow of electrical current). For this reason, make sure the ambient operating temperature is between –40 and 80°C –40 and +176°F, and the ambient storage temperature is between –40 and 85°C –40 and +185°F.

7. If the power is turned off and then immediately on after applying the rated voltage (current) continuously to the relay's coil and contact, the resistance of the coil will increase due to a rise in the coil temperature.
This causes the pick-up voltage to rise, and possibly exceed the rated pick-up voltage. In these circumstances, take measures such as reducing the load current, limiting the duration of current flow, and applying a coil voltage higher than the rated operating voltage (quick start).

8. Main contact ratings in the ratings apply to when there is a resistive load.
If you are using an inductive load (L load) such that L/R > 1 ms, add surge protection in parallel with the inductive load.
If this is not done, the electrical life will decrease and cut-off failure may occur.

9. When using the 150 A type, mount it as far away as possible from amateur wireless transmitters or devices that may generate large surges.
To prevent malfunctioning due to high emission levels, it may be necessary to take measures for E.M.I., such as adding a line noise filter or an electromagnetic shield.

10. Since coil current control is performed, a slight amount of superimposed line noise may be generated in the input line system. If this noise must be removed, install a line noise filter.

11. Be careful that foreign matter and oils and fats kind doesn't stick to the main terminal part because it is likely to cause a terminal part to give off unusual heat.

12. Avoid excessive load applied to the terminal in case of installing such as a bus bar etc., because it might give bad influence to the opening and closing performance.
• M8 screw terminal (150A main terminal part)
Terminal pulling up strength; Max.100N per terminal
The up-down rotation torque applied to the terminal; Max.15N·m

13. When the 150 A type is driven, sufficient current capacity is required when power is applied. When stabilized DC voltage is used, please verify that nominal coil current during peeks has a capacity of 150% or more for each relay.

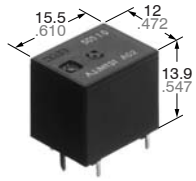
Automotive

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

COMPACT SIZE AUTOMOTIVE RELAY

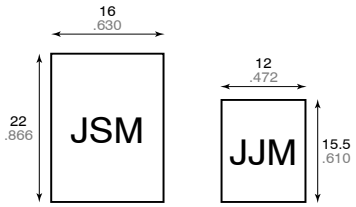
JJ-M RELAYS



mm inch

FEATURES

• Compact (half-size).
The base area is approximately half the size of conventional (JS-M) relays. The controller unit can be made more compact.
Base area has been reduced by one half



• Perfect for automobile electrical systems.
Over 2 × 10^5 openings possible with a 14 V DC motor load, an inrush current of 25 A, and steady state current of 5 A. (N.O. side)

• Standard terminal pitch employed
The terminal array used is identical to that used in small automotive relays.

• Plastic sealed type.
Plastically sealed for automatic cleaning.

• Line-up of 1 Form A and 1 Form C.

TYPICAL APPLICATIONS

- Power windows
- Auto door lock
- Electrically powered sun roof
- Electrically powered mirror
- Cornerring lamp, etc.

SPECIFICATIONS

Contact

Arrangement			1 Form A	1 Form C
Contact material			Silver alloy	
Initial contact resistance (By voltage drop 6V DC 1A)			Max. 100 mΩ	
Rating (resistive load)	Nominal switching capacity		20 A 14 V DC	20 A 14 V DC (N.O.) 10 A 14 V DC (N.C.)
	Min. switching capacity#1		1 A 12 V DC	
	Max. carrying current		35 A (12V, at 20°C 68°F for 2 minutes) 25 A (12V, at 20°C 68°F for 1 hour) 30 A (12V, at 85°C 185°F for 2 minutes) 20 A (12V, at 85°C 185°F for 1 hour)	
Expected life (min. operations)	Mechanical (at 120cpm)		10^7	
	Electrical (at rated load)	Resistive	10^5 *1	10^5 (N.O.)*2 10^5 (N.C.)*3
		Motor load	2×10^5 *4 5×10^4 *5	2×10^5 (N.O.)*6 5×10^4 (N.O.)*7 2×10^5 (N.C.)*8

Coil

Nominal operating power	640 mW

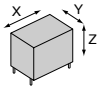
#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
*1 at 20 A 14 V DC, at 20 cpm, operating frequency: 1s ON, 9s OFF
*2 at 20 A 14 V DC, operating frequency: 1s ON, 9s OFF
*3 at 10 A 14 V DC, at 20 cpm, operating frequency: 1s ON, 9s OFF
*4 at 5 A (steady), 25 A (inrush) 14 V DC
*5 at 20 A 14 V DC (Motor lock), operating frequency: 0.5 s ON, 9.5 s OFF
*6 at 5A (steady), 25 A (inrush) 14 V DC

Characteristics

Max. operating speed (at rated load)		6 cpm
Initial insulation resistance*9		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*10	Between open contacts	500 Vrms for 1min.
	Between contact and coil	500 Vrms for 1min.
Operate time*11 (at nominal voltage)		Max. 10 ms (at 20°C 68°F)
Release time (without diode)*11 (at nominal voltage) (Initial)		Max. 10 ms (at 20°C 68°F)
Shock resistance	Functional*12	Min. 100 m/s² {10 G}
	Destructive*13	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*14	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5 G}
	Destructive*15	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5 G}
Conditions in case of operation, transport and storage*16 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 5 g .176 oz

*7 at 20 A 14 V DC (Motor lock)
*8 at peak 20 A 14 V DC (Braking current) operating frequency: 0.5 s ON, 9.5 s OFF
*9 Measurement at same location as “Initial break down voltage” section.
*10 Detection current: 10mA
*11 Excluding contact bounce time.
*12 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*13 Half-wave pulse of sine wave: 6 ms
*14 Detection time: 10 μs
*15 Time of vibration for each direction; X, Y, Z direction: 2 hours



*16 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

ORDERING INFORMATION

Ex. JJM [1a] - [12 V]

Contact arrangement	Coil voltage(DC)
1a: 1 Form A 1: 1 Form C	12 V

(Note) Standard packing: Carton: 50 pcs.; Case: 1,000 pcs.

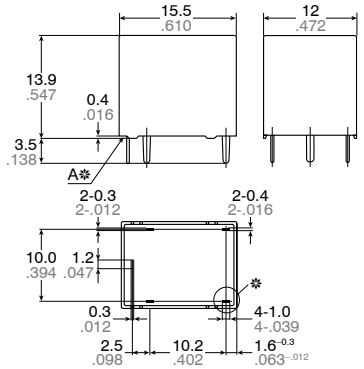
TYPES AND COIL DATA (at 20°C 68°F)

Contact arrangement	Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance Ω	Nominal operating current mA	Nominal operating power mW	Usable voltage range, V DC
1 Form A	JJM1a-12 V	12	Max. 7.2	Min. 1.0	225±10%	53.3±10%	640	10 to 16
1 Form C	JJM1-12 V	12	Max. 7.2	Min. 1.0	225±10%	53.3±10%	640	10 to 16

* Other pick-up voltage types are also available. Please contact us for details.

DIMENSIONS

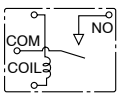
mm inch



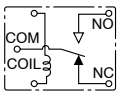
Note: ✻Marked terminal is only for 1Form C type

Schematic (Bottom view)

1a

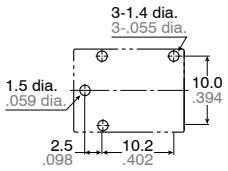


1c

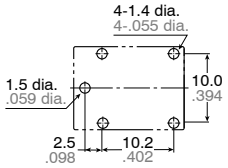


PC board pattern (Bottom view)

1a



1c



* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

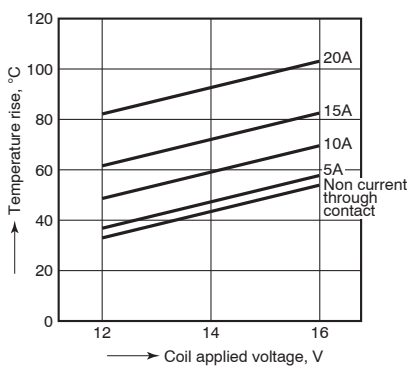
Tolerance: ±0.1 ±.004

Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

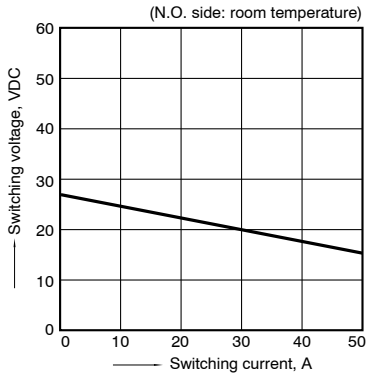
REFERENCE DATA

1. Coil temperature rise

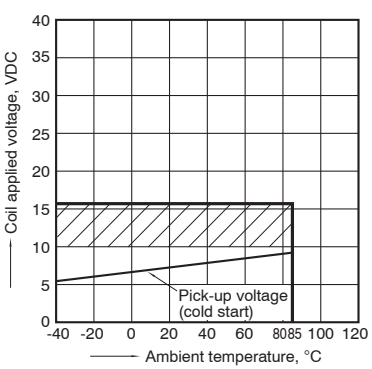
Sample: JJM1-12V, 6pcs
Point measured: Inside the coil
Contact current: Now current through contact, 5A, 10A, 15A, 20A
Resistance method, ambient temperature 85°C 185°F



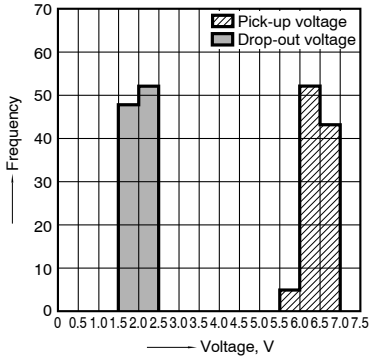
2. Max. switching capability (Resistive load)



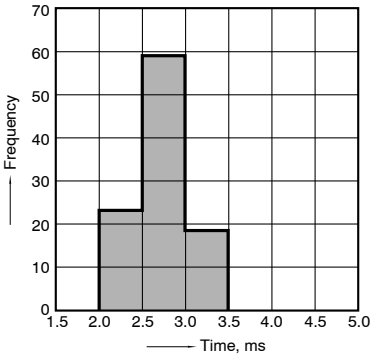
3. Ambient temperature and operating voltage range



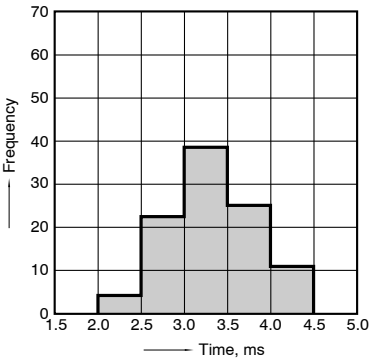
4. Distribution of pick-up and drop-out voltage
Sample: JJM1-12V, 100pcs



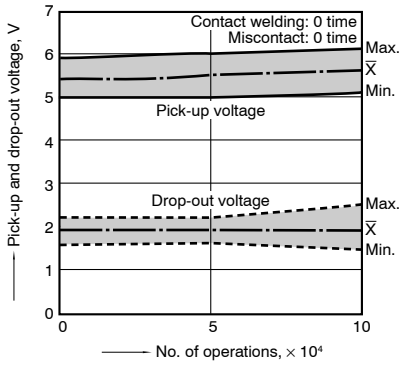
5. Distribution of operate time
Sample: JJM1-12V, 100pcs



6. Distribution of release time
Sample: JJM1-12V, 100pcs
* With diode

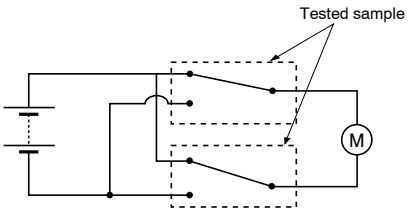


7-(1). Electrical life test (at rated load)
Sample: JJM1-12V
Quantity: n = 6 (NC = 3, NO = 3)
Load: Resistive load (NC side: 10A 14 V DC, NO side: 20 A 14 V DC); Operating frequency: ON 1s, OFF 9s
Ambient temperature: Room temperature

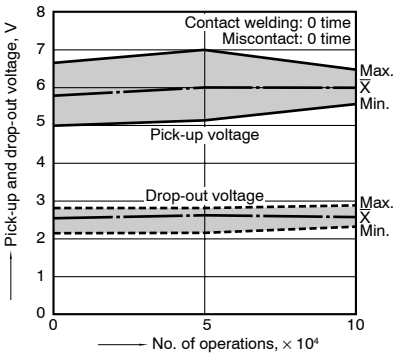


7-(2). Electrical life test (Motor free)
Sample: JJM1-12V, 6pcs.
Load: 5A, Inrush 25A, Brake current 18A 14V DC,
Power window motor load (Free condition).
Operating frequency: (ON : OFF = 0.5s : 9.5s)
Ambient temperature: Room temperature

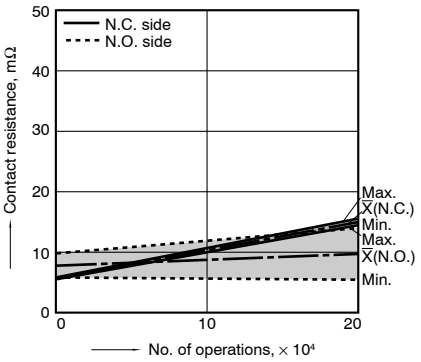
Circuit :



Change of pick-up and drop-out voltage

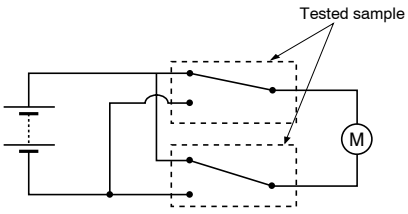


Change of contact resistance

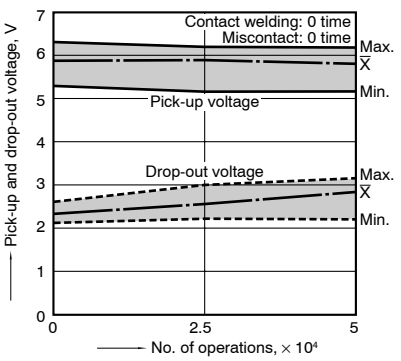


7-(3). Electrical life test (Motor lock)
Sample: JJM1-12V, 6pcs.
Load: 20A, 14VDC,
Power window motor actual load (lock condition).
Operating frequency: (ON : OFF = 1s : 5s)
Ambient temperature: Room temperature

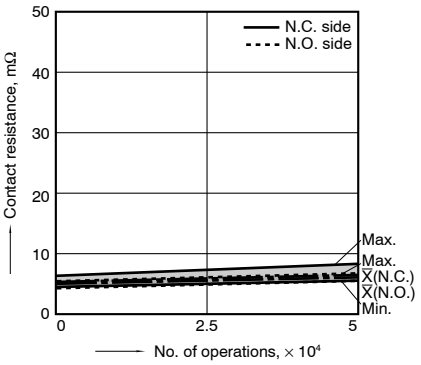
Circuit :



Change of pick-up and drop-out voltage



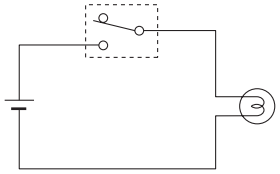
Change of contact resistance



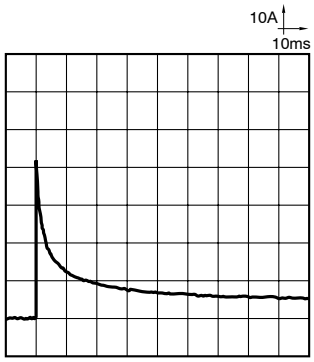
7-(4). Electrical life test (Lamp load)

Sample: JJM1-12V, 6pcs.
Load: 27W+21W, min. 4A (steady), Lamp actual load
Operating frequency: ON 2s, OFF 13s
Ambient temperature: Room temperature

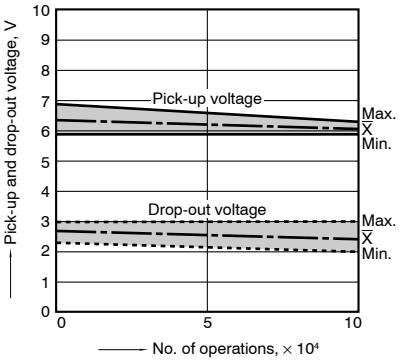
Circuit :



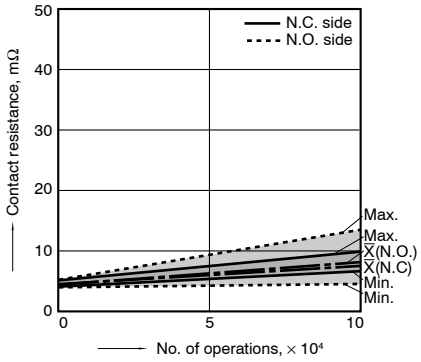
Inrush current: 42A, Steady current: 4.4A



Change of pick-up and drop-out voltage



Change of contact resistance



For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
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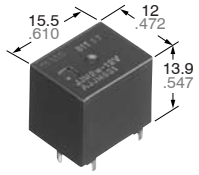
DOUBLE MAKE CONTACT AUTOMOTIVE RELAY

JJ-M RELAYS
(Double make type)



mm inch

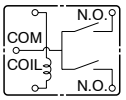
FEATURES

• Small size
The smallest double make type relay 12.0(W)×15.5(L)×13.9(H) mm .472(W)×.610(L)×.547(H) inch

• Pattern design simplification
Simplified pattern design is possible because, while double make construction is employed, the external COM terminal is single.

• Standard terminal pitch employed
The terminal array used is identical to that used in JJM relays(1c type).

• Plastic sealed type
Plastically sealed for automotive cleaning.



<Schematic>

SPECIFICATIONS

Contact

Arrangement		Double make contact
Contact material		Silver alloy
Initial contact resistance (By voltage drop 6V DC 1A)		Max. 100 mΩ
Contact voltage drop		Max. 0.25V (at 2 × 6A)
Rating	Nominal switching capacity	12A 14V DC (at 2 × 6A, lamp load)
	Max. carrying current	2 × 6A (12V, at 20°C 68°F), 2 × 4A (12V, at 85°C 185°F)
	Min. switching capacity#1	1A 12V DC
Expected life (min. operations)	Mechanical (at 120cpm)	Min. 10^7
	Electrical (lamp load)	Min. 10^5*1

Coil

Nominal operating power	1,000 mW

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks
*1 At 12A 14V DC (lamp), operating frequency: 1s ON, 14s OFF
*2 Measurement at same location as "initial breakdown voltage" section.
*3 Detection current: 10mA
*4 Excluding contact bounce time.
*5 Half-wave pulse of sine wave: 11 ms; detection time: 10 μs
*6 Half-wave pulse of sine wave: 6 ms
*7 Detection time: 10 μs
*8 Time of vibration for each direction; X, Y direction: 2 hours Z direction: 4 hours

*9 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

Characteristics

Max. operating speed (at nominal switching capacity)		4 cpm
Initial insulation resistance*2		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*3	Between open contacts	500 Vrms for 1min.
	Between contact and coil	500 Vrms for 1min.
Operate time*4 (at nominal voltage)(at 20°C 68°F)		Max. 10 ms (Initial)
Release time (without diode)*4 (at nominal voltage)(at 20°C 68°F)		Max. 10 ms (Initial)
Shock resistance	Functional*5	Min. 100 m/s² {10 G}
	Destructive*6	Min. 1,000 m/s² {100 G}
Vibration resistance	Functional*7	10 Hz to 100 Hz, Min. 44.1 m/s² {4.5 G}
	Destructive*8	10 Hz to 500 Hz, Min. 44.1 m/s² {4.5 G}
Conditions in case of operation, transport and storage*9 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 5 g .176 oz

TYPICAL APPLICATIONS

Car alarm system flashing lamp etc.

ORDERING INFORMATION

Ex. JJM [2w] [12V]

Contact arrangement	Coil voltage (DC)
Double make contact	12V

Standard packing: Carton(tube package) 50pcs. Case: 1,000pcs.

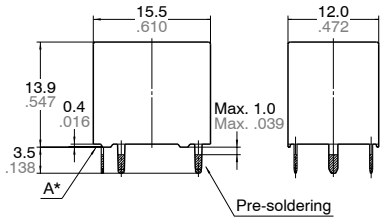
TYPES AND COIL DATA (at 20°C 68°F)

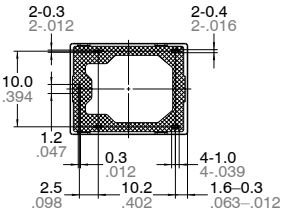
• Single side stable type

Part No.	Nominal voltage, V DC	Pick-up voltage, V DC (Initial)	Drop-out voltage, V DC (Initial)	Coil resistance Ω	Nominal operating current, mA	Nominal operating power, mW	Usable voltage range, V DC
JJM2w-12V	12	Max. 6.9	Min. 1.0	144±10%	83.3±10%	1,000	10 to 16

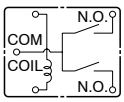
DIMENSIONS

mm inch

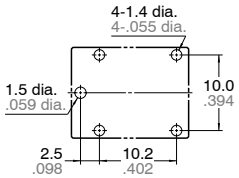




Schematic (Bottom view)



PC board pattern (Bottom view)



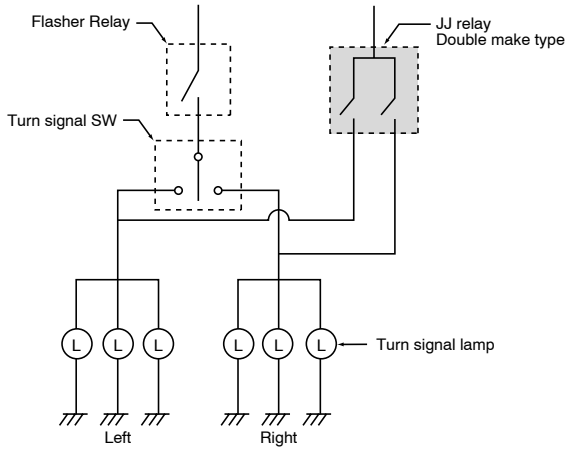
Tolerance: ±0.1 ±.004

Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

* Dimensions (thickness and width) of terminal in this catalog is measured before pre-soldering.
Intervals between terminals is measured at A surface level.

EXAMPLE OF CIRCUIT

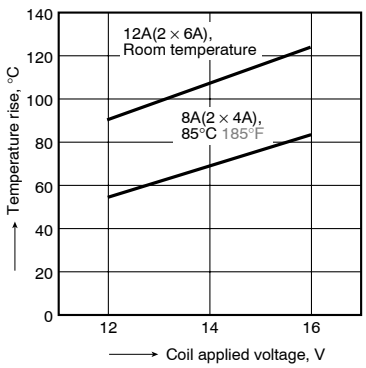
Control circuit for signal lights (security system)



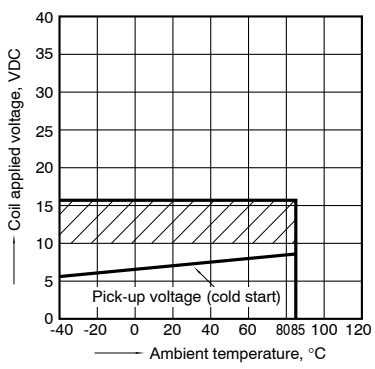
REFERENCE DATA

1. Coil temperature rise

Sample: JJM2w-12V, 6pcs.
Point measured: Inside the coil
Contact carrying current: 2 × 6A, 2 × 4A
Ambient temperature: Room temperature, 85°C 185°F

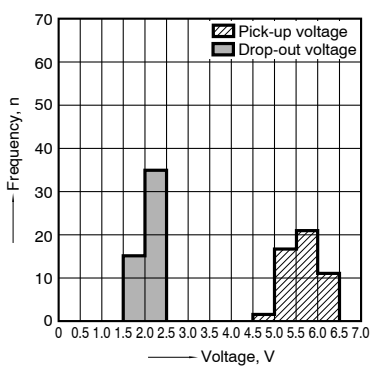


2. Ambient temperature and operating voltage range

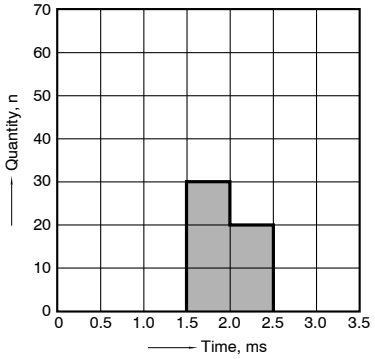


3. Distribution of pick-up and drop-out voltage

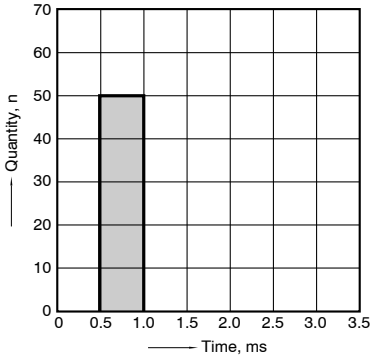
Sample: JJM2W-12V, 50pcs.



4. Distribution of operate time
Sample: JJM2W-12V, 50pcs.

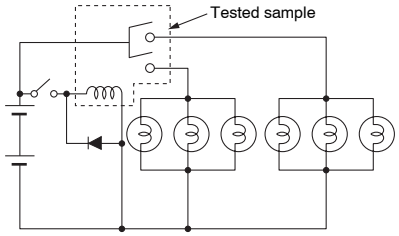


5. Distribution of release time
Sample: JJM2W-12V, 50pcs.
* Without diode

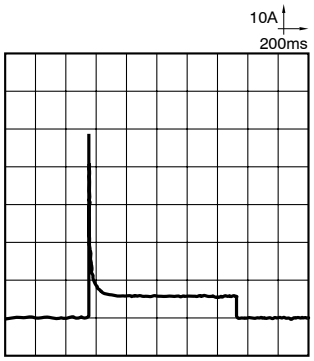


6. Electrical life test (Lamp load)
Sample: JJM2w-12V, 6pcs.
Load: 5.5A, inrush 48A, 6 × 21W
Operating frequency: (ON : OFF = 1s : 14s)
Ambient temperature: Room temperature

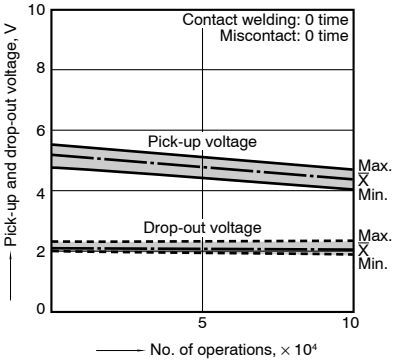
Circuit:



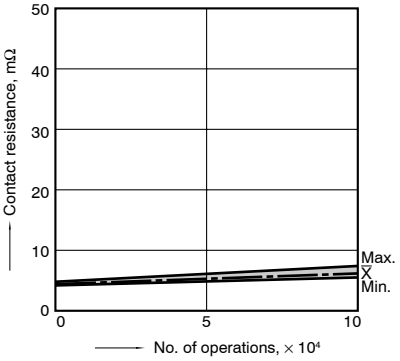
Load current waveform
Current value per contact on one side
Inrush current: 48A, Steady current: 5.5A



Change of pick-up and drop-out voltage



Change of contact resistance

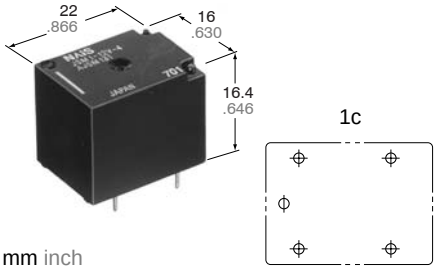


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

Global Standard Terminal Pitch Automotive Power Relay

JS-M RELAYS



mm inch

FEATURES

- **Low pick-up voltage for high ambient use**
- **Sealed construction**
- **Global standard terminal pitch**
- **Usable at high temperature: 85°C 185°F**

TYPICAL APPLICATIONS

- Power-window
- Car antenna
- Door lock
- Intermittent wiper
- Interior lighting
- Power seat
- Power sunroof
- Car stereo
- Horn
- Lift gate, etc.

SPECIFICATIONS

Contact

			Standard type	High capacity type
Arrangement			1 Form A, 1 Form C	
Contact material			Silver alloy	
Initial contact resistance (By voltage drop 6 V DC 1 A)			*Max. 100 mΩ	*Max. 100 mΩ
Contact voltage drop			Max. 0.2 V (at 10 A 12 V DC)	
Rating	Nominal switching capacity		10 A 16 V DC (resistive)	15 A 16 V DC (resistive)
	Max. carrying current		25 A (at 20°C 68°F for 2 minutes) 15 A (at 20°C 68°F for 1 hour) 20 A (at 85°C 185°F for 2 minutes) 10 A (at 85°C 185°F for 1 hour)	
	Max. switching power		160 W	
	Max. switching voltage		16 V DC	
	Max. switching current		10 A	15 A (10 A max. at 85°C)
	Min. switching capacity#1		1 A 12 V DC	
Expected life (min. ope.)	Mechanical life (at 180 cpm)		10^7	
	Electrical (at 15 cpm)	Resistive	10^5	N.O.: 10^5 N.C.: 5×10^4

* Measured after operating 5 times at the rated load

Coil

Nominal operating power	640 mW

Contact rating

Load	Standard type			High capacity type		
	Form A	Form C		Form A	Form C	
		N.O.	N.C.		N.O.	N.C.
Max. carry current	15 A	15 A	15 A	15 A	15 A	15 A
Max. make current	25 A	25 A	10 A	50 A	50 A	15 A
Max. break current	10 A	10 A	10 A	15 A	15 A	15 A

Characteristics

Max. operating speed (at rated load)		15 cps.
Initial insulation resistance*1		Min. 100 MΩ (at 500 V DC)
Initial breakdown voltage*2	Between open contacts	750 Vrms for 1 min.
	Between contacts and coil	1,500 Vrms for 1 min.
Operate time*3 (at nominal voltage)		Approx. 10 ms
Release time (without diode)*3 (at nominal voltage)		Approx. 10 ms
Shock resistance	Functional*4	Min. 98 m/s² {10 G}
	Destructive*5	Min. 980 m/s² {100 G}
Vibration resistance	Functional*6	10 Hz to 55 Hz at double amplitude of 1.6 mm
	Destructive	10 Hz to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–40°C to +85°C –40°F to +185°F
	Humidity	5% R.H. to 85% R.H.
Mass		Approx. 12 g .423 oz

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

*1 Measurement at same location as "Initial breakdown voltage" section
*2 Detection current: 10mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

ORDERING INFORMATION

Ex. JSM [1a] [F] —— [12V] —— [4]

Contact arrangement	Protective construction	Coil voltage (DC)	Contact material
1a: 1 Form A 1: 1 Form C	Nil: Sealed construction F: Flux-resistant type	12 V	4: Standard type (10 A) 5: High capacity type (15 A)

Note: Standard packing: Carton: 100 pcs. Case: 500 pcs.

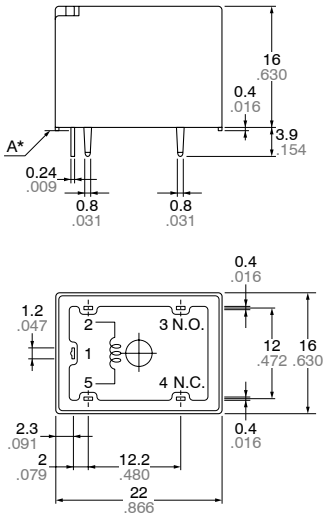
TYPES AND COIL DATA (at 20°C 68°F)

Contact arrangement	Coil voltage, V DC	Standard type (10 A)		High capacity type (15 A)		Nominal voltage, V DC	Pick-up voltage, V DC	Drop-out voltage, V DC	Coil resistance Ω	Nominal operating current, mA	Nominal operating power, mW	Max. allowable voltage, V DC (at 80°C 176°F)
		Sealed type	Flux-resistant type	Sealed type	Flux-resistant type							
1 Form A	12	JSM1a-12V-4	JSM1aF-12V-4	JSM1a-12V-5	JSM1aF-12V-5	12	Max. 6.3	Min. 0.9	225±10%	53.3±10%	640	16
1 Form C	12	JSM1-12V-4	JSM1F-12V-4	JSM1-12V-5	JSM1F-12V-5	12	Max. 6.3	Min. 0.9	225±10%	53.3±10%	640	16

* Other pick-up voltage types are also available. Please contact us for details.

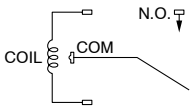
DIMENSIONS

mm inch

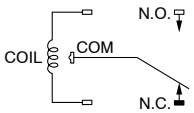


Schematic (Bottom view)

1a

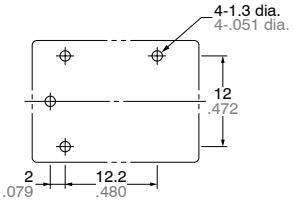


1c

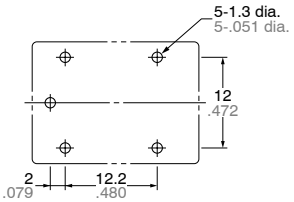


PC board pattern (Bottom view)

1a



1c



Dimension:	General tolerance
Max. 1mm .039 inch:	±0.1 ±.004
1 to 3mm .039 to .118 inch:	±0.2 ±.008
Min. 3mm .118 inch:	±0.3 ±.012

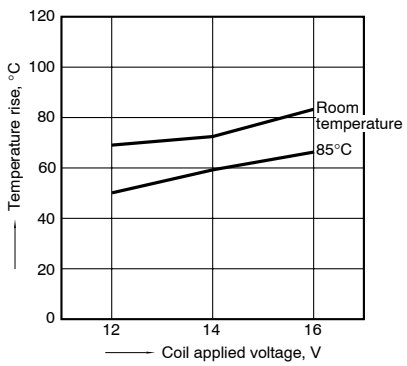
* Dimensions (thickness and width) of terminal specified in this catalog is measured before pre-soldering. Intervals between terminals is measured at A surface level.

Tolerance: ±0.1 ±.004

REFERENCE DATA

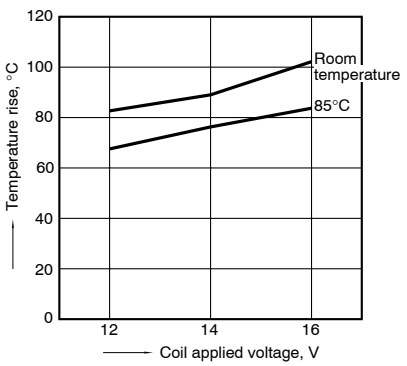
1-(1). Coil temperature rise (10A)

Measured portion: Inside the coil
Contact carrying current, 10A
Ambient temperature: Room temperature, 85°C 185°F

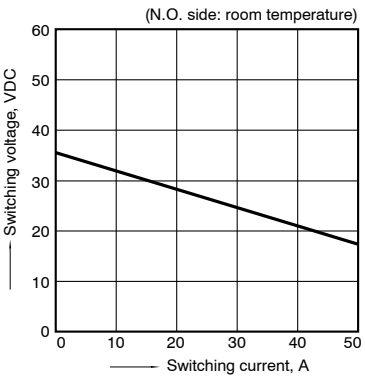


1-(2). Coil temperature rise (15A)

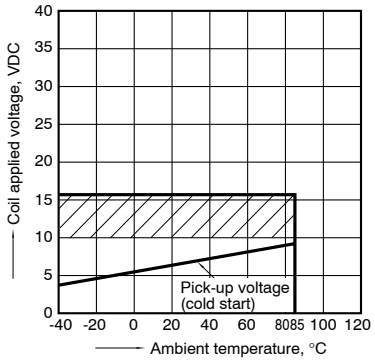
Measured portion: Inside the coil
Contact carrying current, 15A
Ambient temperature: Room temperature, 85°C 185°F



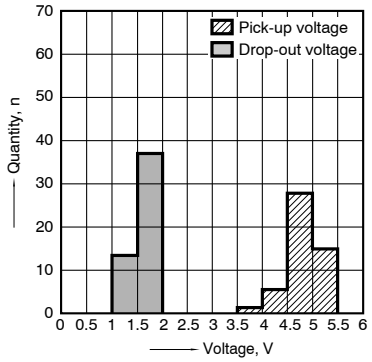
2. Max. switching capability (Resistive load)



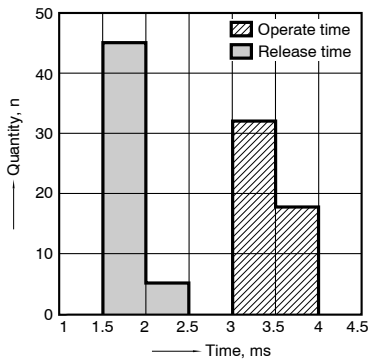
3. Ambient temperature and operating voltage range



4. Distribution of pick-up and drop-out voltage
Sample: JSM1-12V-5, 50pcs.

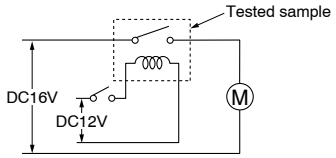


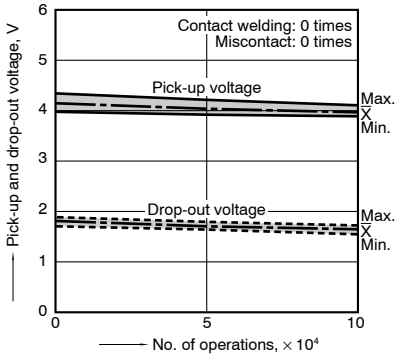
5. Distribution of operate and release time
Sample: JSM1-12V-5, 50pcs.
Coil both side without diode



6-(1). Electrical life test (Motor load)
Sample: JSM1-12V-5, 3pcs.
Load: 50A (Inrush), 10A 16V DC (Steady)
Switching frequency: (ON : OFF = 1s : 9s)

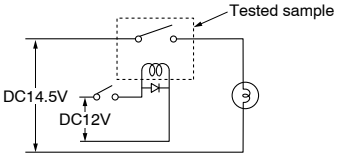
Circuit :

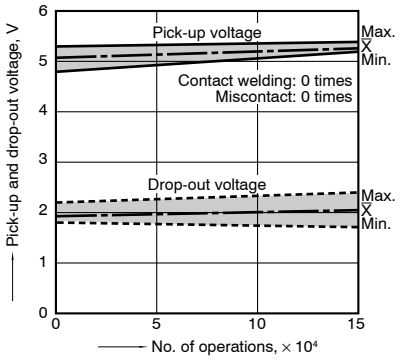




6-(2). Electrical life test (Lamp load)
Sample: JSM1-12V-5, 4pcs.
Load: 55.2A (Inrush), 9.6A 14.5V DC (Steady)
Switching frequency: (ON : OFF = 1s : 3s)

Circuit :





Automotive

For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

COMPACT ECONOMICAL 30 AMP. RELAY

JT-N RELAYS

PCB type

TMP type

FEATURES

- **High switching capacity — 30 A for 1 Form A**
- **2 contact arrangements — 1 Form A or 1 Form C**
- **"TMP" types available**
- **UL/CSA recognized**
- **Class F types standard**

SPECIFICATIONS

Contacts

		PCB & TMP type	
Arrangement		1 Form A	1 Form C
Initial contact resistance, max. (By voltage drop method, 6 V DC 1 A)		50 mΩ	
Contact material		Silver alloy	
Rating	Max. switching power	8310 VA	N.C.: 2770 VA N.O.: 5540 VA
	Max. switching voltage	277 V AC	
	Max. switching current	30 A	N.C.: 10 A N.O.: 20 A
	Min. switching capacity#1	100 mA, 5 V DC	
Expected life	Mechanical	Min. 1×10^7	
	Electrical (Resistive load)	20 A 277 V AC Min. 1×10^5*	N.O.: 20 A 277 V AC Min. 1×10^5* N.C.: 10 A 277 V AC Min. 1×10^5*

* The life is for open venting-hole condition.

Coil at 20°C 68°F

Nominal operating power	Approx. 800 mW

Characteristics

		PCB & TMP type
Initial insulation resistance*1		Min. 100 MΩ at 500 V DC
Initial breakdown voltage*2	Between contacts	1,200 Vrms
	Between contacts and coil	2,500 Vrms
Operate time*3 (at nominal voltage)		Max. 20 ms
Release time (without diode)*3 (at nominal voltage)		Max. 10 ms
Shock resistance	Functional*4	Min. 98 m/s² {10 G}
	Destructive*5	Min. 980 m/s² {100 G}
Vibration resistance	Functional*6	Max. 88.2 m/s² {9 G}, 10 to 55 Hz at double amplitude of 1.5 mm
	Destructive	Max. 117.6 m/s² {12 G}, 10 to 55 Hz at double amplitude of 2 mm
Conditions for operation, transport and storage*7 (Not freezing and condensing at low temperature)	Ambient temp.	–55°C to +85°C –67°F to +185°F
	Humidity	5 to 85% R.H.
Unit weight		PCB type: Approx. 25 g (.88 oz) TMP type: Approx. 30 g (1.06 oz)

#1 This value can change due to the switching frequency, environmental conditions, and desired reliability level, therefore it is recommended to check this with the actual load.

Remarks

* Specifications will vary with foreign standards certification ratings.
*1 Measurement at same location as "Intial breakdown voltage" section
*2 Detection current: 10 mA
*3 Excluding contact bounce time
*4 Half-wave pulse of sine wave: 11ms; detection time: 10μs
*5 Half-wave pulse of sine wave: 6ms
*6 Detection time: 10μs
*7 Refer to 6. Conditions for operation, transport and storage mentioned in AMBIENT ENVIRONMENT (page 408).

TYPICAL APPLICATIONS

- Automotive
- Air conditioner
- Heating & ventilation
- Home appliance

ORDERING INFORMATION

JT-N Relays (PCB and TMP type)

JTN | 1a | S | TMP | F | DC12V

Contact arrangement	Protective construction	Mounting classification	Coil insulation	Coil voltage
1a: 1 Form A 1: 1 Form C	S: Sealed type	PA: PCB type TMP: TMP type	F: Class F	DC 5, 6, 9, 12, 15, 18, 24 V

Notes: 1. UL/CSA approved type is standard.
2. Standard packing: PCB type: Carton: 50 pcs. Case: 500 pcs.
TMP type: Carton: 50 pcs. Case: 300 pcs.

COIL DATA (at 20°C 68°F)

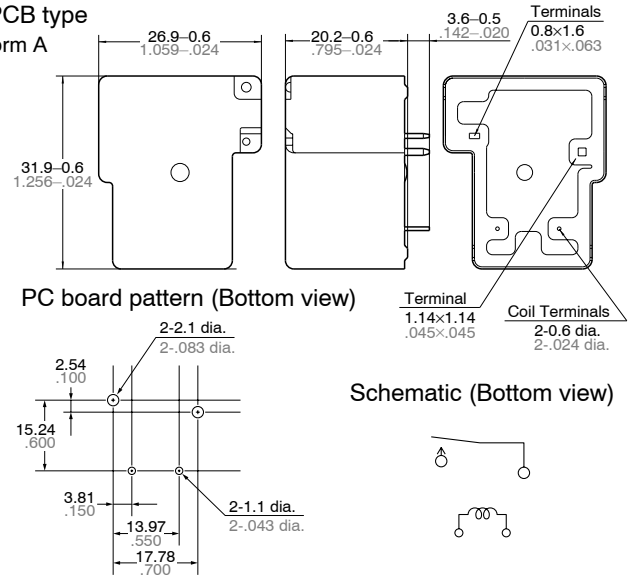
Nominal voltage, V DC	Pick-up voltage, V DC (max.) (Initial)	Drop-out voltage, V DC (min.) (Initial)	Coil resistance, Ω (±10%)	Nominal operating power, mW	Max. allowable voltage, V DC (at 70°C 158°F)
			PCB & TMP	PCB & TMP	
5	3.75	0.5	31	800	6
6	4.5	0.6	45	800	7.2
9	6.75	0.9	101	800	10.8
12	9.0	1.2	180	800	14.4
15	11.25	1.5	281	800	18
18	13.5	1.8	405	800	21.6
24	18.0	2.4	720	800	28.8

DIMENSIONS

mm inch

1. PCB type

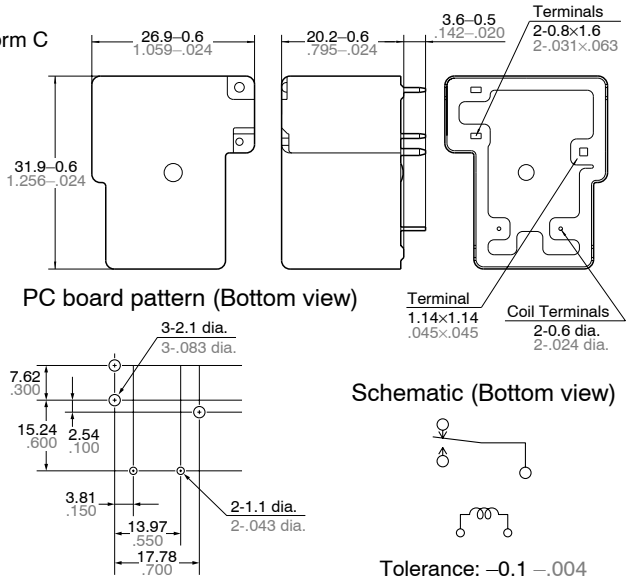
1 Form A



PC board pattern (Bottom view)

Schematic (Bottom view)

1 Form C



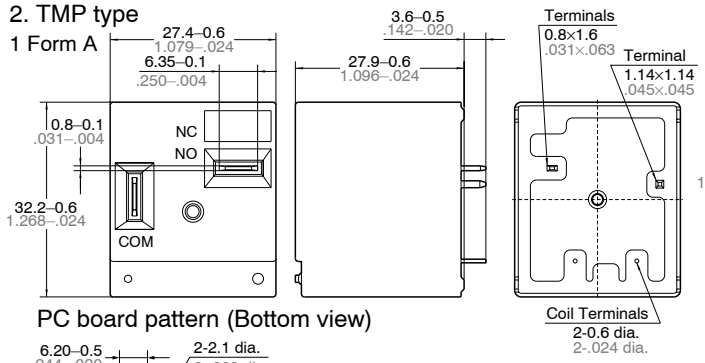
PC board pattern (Bottom view)

Schematic (Bottom view)

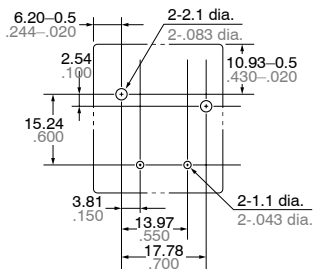
Tolerance: –0.1 –.004

2. TMP type

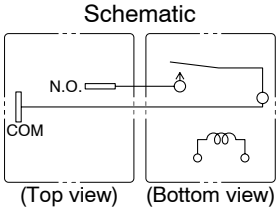
1 Form A



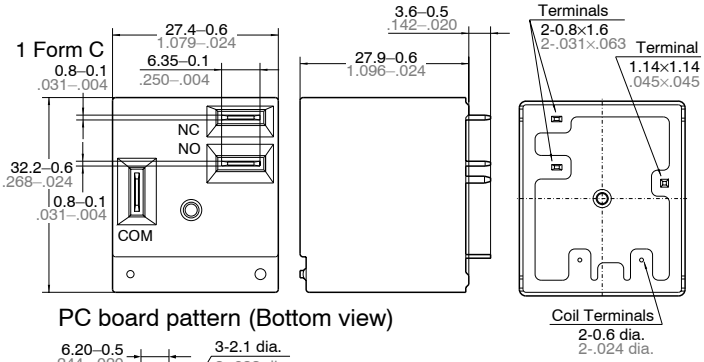
PC board pattern (Bottom view)



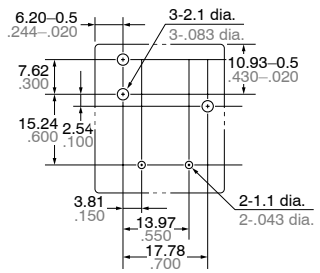
Schematic



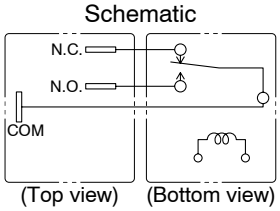
1 Form C



PC board pattern (Bottom view)



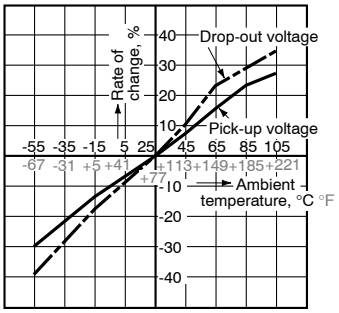
Schematic



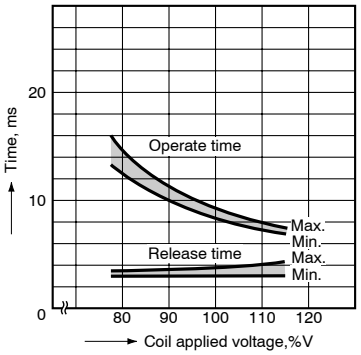
Tolerance: –0.1 –.004

REFERENCE DATA

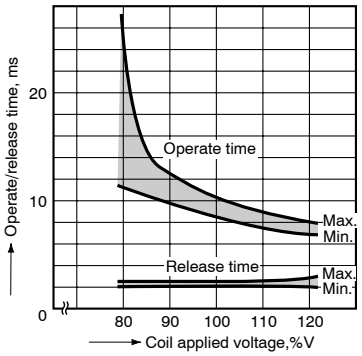
1. Change of rate of pick-up and drop-out voltage (at 20°C 68°F)
Sample: JTN1S-TMP-F-DC24V (6 pcs.)



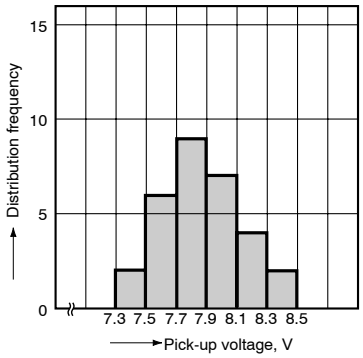
2. Operate & release time (at 20°C 68°F)
Sample: JTN1S-TMP-F-DC24V (6 pcs.)



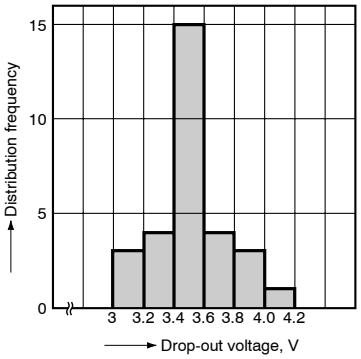
3. Operate & release time (at 20°C 68°F)
Sample: JTN1aS-PA-F-DC24V (6 pcs.)



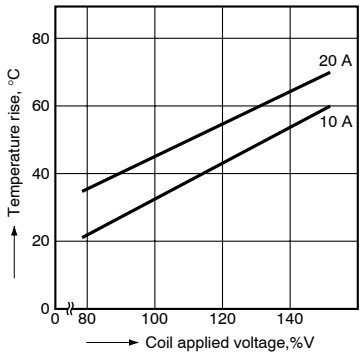
4. Distribution frequency of pick-up voltage (at 20°C 68°F)
Sample: JTN1S-TMP-F-DC12V (30 pcs.)



5. Distribution frequency of drop-out voltage (at 20°C 68°F)
Sample: JTN1S-TMP-F-DC12V (30 pcs.)

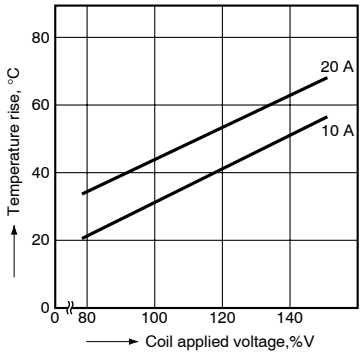


6.-(1) Coil temperature rise (TMP type)*
Ambient temperature: 20°C 68°F
Sample: JTN1aS-TMP-F-DC12V (6 pcs.)

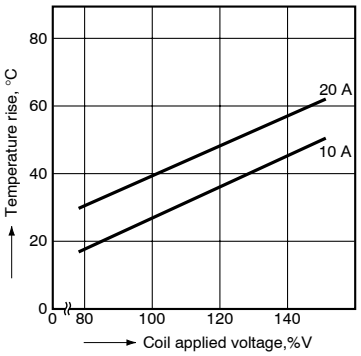


* Coil temperature rise of sealed types are same as data of the dust cover type.

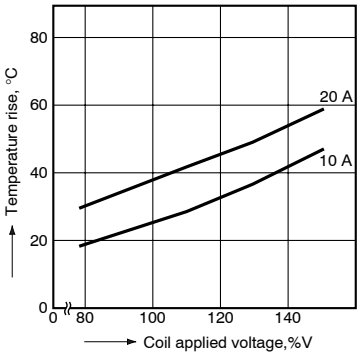
Ambient temperature: 55°C 131°F
Sample: JTN1aS-TMP-F-DC12V (6 pcs.)



Ambient temperature: 85°C 185°F
Sample: JTN1aS-TMP-F-DC12V (6 pcs.)



Ambient temperature: 105°C 221°F
Sample: JTN1aS-TMP-F-DC12V (6 pcs.)



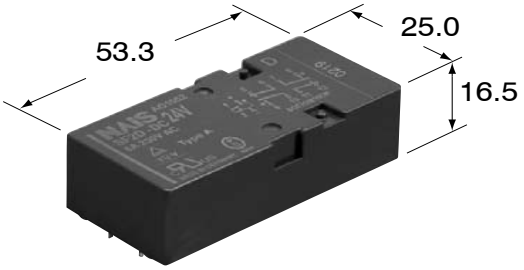
For Cautions for Use, see Relay Technical Information (page 390).

Safety Relays

Panasonic
ideas for life

POLARIZED, MONOSTABLE SAFETY RELAY WITH FORCIBLY GUIDED DOUBLE CONTACTS

SF2D RELAY



Tolerance ± 0.3mm
Weight approx. 47g

Features

- **Relay complies with EN 50205, Type A**
- **Overvoltage category as per IEC 60664-1 III / 4kV**
- **Rated voltage as per IEC 60664-1 basic insulation**

	Polution degree		
	2 inside	2 outside	3 inside
Coil-contact	400V	400V	250V
Contact-contact	400V	400V	400V

SPECIFICATIONS

Contact

Contact configuration (a = normally open / NO, b = normally closed / NC)	2a2b
Contact material	$AgSnO_2$, with Au flash
Contact resistance (initial at 6V DC, 1A)	30mΩ
Making and breaking capacities (breathing hole open)*1	6A 250V / 3A 24V
Max. switching voltage	400V
Min. switching voltage / min. switching current	10V / 10mA
Pick-up / drop-out / bounce time (approx. values at $U_{nominal}$)	17.5 / 7 / 2ms
Mechanical life	10^7ops

Coil

Operate / release voltage (% of $U_{nominal}$ at 20°C)	75% / 10%
Pick-up/nominal power consumption at 20°C	280 / 500mW

Remarks

*1 According to EN 60947-5-1: 1997, table 4 AC15 / DC13
*2 Contact interruption <10μs
*3 Breathing hole open

Characteristics

Max. switching frequency (without load)	10Hz
Permissible ambient temperature at nominal power consumption	-40°C to +70°C
Upper temperature limit	105°C
Test voltage: open contact / contact-contact / contact-coil	2500 / 2500 / $2500V_{rms}$
Insulation resistance at 500V DC (initial)	$10^9\Omega$
Shock resistance (11ms) NO/NC*2	30G
Vibration resistance 10 – 200 Hz (10 – 55 Hz, amplitude 2 mm)*2	10G
Degree of protection	IP67 / IP30*3

Important: Relay characteristics may be influenced by:

- strong external magnetic fields
- magnetic conductive materials near the relay
- narrow top-to-top mounting (printed surface to printed surface)

Note:

Suitable for most common washing methods except ultrasonic cleaning.

ORDERING INFORMATION

Ex. SF2D — DC12 V

Coil voltage (DC)
5, 9, 12, 18, 21 24, 36, 48, 60

COIL DATA

Part number	Coil nominal voltage V DC	Operate voltage V DC	Release voltage V DC	Coil resistance Ω (±10%, 20°C)	Coil inductance (mH)
SF2D-DC5V	5	3.75	0.5	50	47
SF2D-DC9V	9	6.75	0.9	162	145
SF2D-DC12V	12	9.00	1.2	288	252
SF2D-DC18V	18	13.50	1.8	648	551
SF2D-DC21V	21	15.75	2.1	882	742
SF2D-DC24V	24	18.00	2.4	1152	959
SF2D-DC36V	36	27.00	3.6	2592	2097
SF2D-DC48V	48	36.00	4.8	4608	3654
SF2D-DC60V	60	45.00	6.0	7200	5612

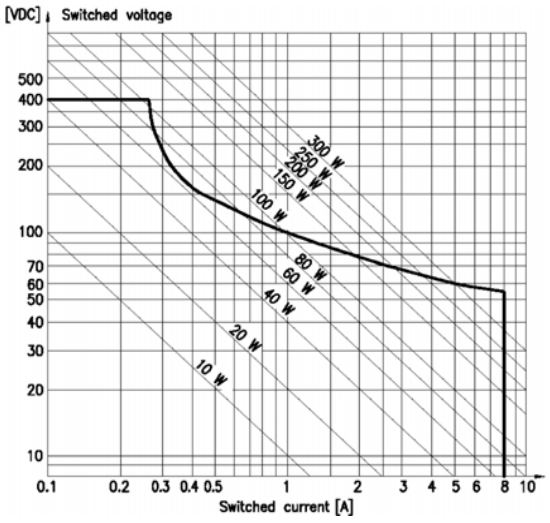
ELECTRICAL LIFE

Voltage	Current	Load type	Frequency	Duty cycle	No. of contacts	No. of ops.
230V AC	8A	AC 1	0.25Hz	25%	2*2	85,000*5
250V AC	6A	AC 1	0.33Hz	50%	4*2	100,000*5
230V AC	6A	AC 1	0.33Hz	10%	2*3	200,000*4,*5
230V AC	30 / 3A	AC 15*1	0.33Hz	10%	1*3	150,000*4,*5
24V DC	8A	DC 1	0.33Hz	10%	2*3	200,000*4,*5
24V DC	3A	DC 13*1	0.33Hz	10%	1*3	50,000*4,*5
24V DC	3A	L/R = 40ms	0.33Hz	10%	1*3	100,000*4,*5

*1 EN 60947-5-1: 1997; table C.1
*2 Breathing hole closed
*3 Breathing hole open
*4 Ambient temperature +70°C
*5 Dielectric strength according to EN61810-1:2004.

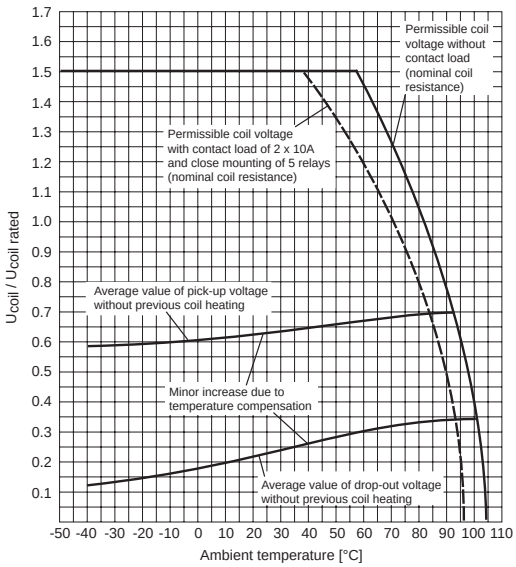
REFERENCE DATA

Load limit curve



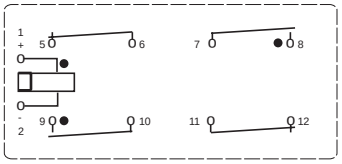
Loads in the range under the curve can be switched safely. The arc will extinguish before the opposite contact makes.

Coil voltage characteristics



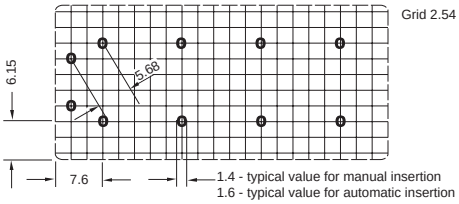
Permissable coil voltages and pick-up and drop-out characteristics at various ambient temperatures.

Connection diagram and pcb bore hole data

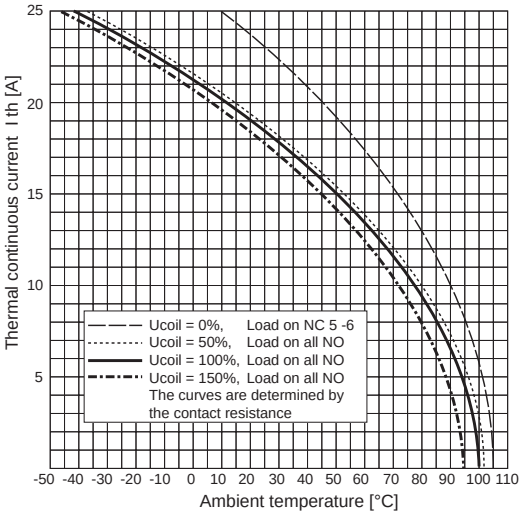


Bottom view

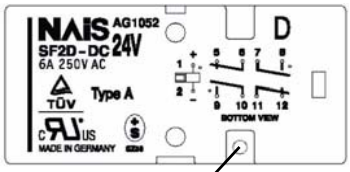
The contacts are shown in the deenergized condition.



Contact current characteristics



APPLICATION NOTES



Nipple

If required a breathing hole can be made in the cover by removing the nipple.
However be aware that the degree of protection will reduce from IP67 to IP30!

For Cautions for Use, see Relay Technical Information (page 390).

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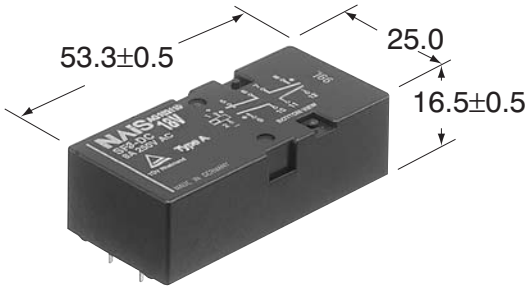
POLARIZED, MONOSTABLE SAFETY RELAY WITH FORCIBLY GUIDED CONTACTS

SF3 RELAY



Tolerance ± 0.3mm
Weight approx. 47g

Features

- **Relay complies with EN 50205, Type A**
- **Overvoltage category as per IEC 60664-1 III / 4kV**
- **Rated voltage as per IEC 60664-1 basic insulation**

	Polution degree		
	2 inside	2 outside	3 outside
Coil-contact	400V	400V	250V
Contact-contact	400V	400V	400V

SPECIFICATIONS

Contact

Contact configuration (a = normally open / NO, b = normally closed / NC)	3a1b
Contact material	$AgSnO_2$, with Au flash
Contact resistance (initial at 6V DC, 1A)	≤30mΩ
Making and breaking capacities (breathing hole open)*1, *3	6A 250V / 3A 24V
Max. switching voltage	400V
Min. switching voltage / min. switching current	10V / 10mA
Pick-up / drop-out / bounce time (approx. values at $U_{nominal}$)	16.5 / 7 / 3ms
Mechanical life	10^7ops

Coil

Operate / release voltage (% of $U_{nominal}$ at 20°C)	75% / 10%
Pick-up/nominal power consumption at 20°C	280 / 500mW

Remarks

*1 According to EN 60947-5-1: 1997, table 4 AC15 / DC13
*2 Contact interruption <10µs
*3 Breathing hole open

Characteristics

Max. switching frequency (without load)	10Hz
Permissible ambient temperature at nominal power consumption	-40°C to +70°C
Upper temperature limit	105°C
Test voltage: open contact / contact-contact / contact-coil	2500 / 2500 / $2500V_{rms}$
Insulation resistance at 500V DC (initial)	$10^9\Omega$
Shock resistance (11ms) NO/NC*2	30G
Vibration resistance 10 – 200 Hz (10 – 55 Hz, amplitude 2 mm)*2	10G
Solder bath temperature, maximum duration	260°C, 5s
Degree of protection	IP67 / IP30*3

Important: Relay characteristics may be influenced by:

- strong external magnetic fields
- magnetic conductive materials near the relay
- narrow top-to-top mounting (printed surface to printed surface)

Note:

Suitable for most common washing methods except ultrasonic cleaning.

Safety

ORDERING INFORMATION

Ex. SF3 — DC12 V

Coil voltage (DC)
5, 9, 12, 18, 21 24, 36, 48, 60

COIL DATA

Part number	Coil nominal voltage V DC	Operate voltage V DC	Release voltage V DC	Coil resistance Ω (±10%, 20°C)	Coil inductance (mH)
SF3-5V	5	3.75	0.5	50	47
SF3-9V	9	6.75	0.9	162	145
SF3-12V	12	9.00	1.2	288	252
SF3-18V	18	13.50	1.8	648	551
SF3-21V	21	15.75	2.1	882	742
SF3-24V	24	18.00	2.4	1152	959
SF3-36V	36	27.00	3.6	2592	2097
SF3-48V	48	36.00	4.8	4608	3654
SF3-60V	60	45.00	6.0	7200	5612

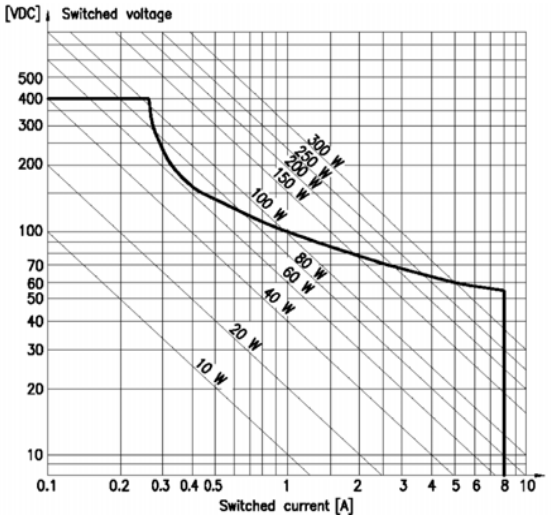
ELECTRICAL LIFE

Voltage	Current	Load type	Frequency	Duty cycle	No. of contacts	No. of ops.
250V AC	8A	cos φ = 1	0.33Hz	50%	2*2,*6	30,000*4,*5
250V AC	6A	cos φ = 1	0.33Hz	50%	4*2	100,000*4,*5
250V AC	2A	cos φ = 1	0.33Hz	50%	4*2	500,000*4,*5
220V AC	30 / 3A	AC 15*1	0.10Hz	10%	1*3	200,000*4,*5
220V AC	5.10A	cos φ = 0.60	0.20Hz	10%	1*3	100,000*4,*5
220V AC	4.43A	cos φ = 0.35	0.20Hz	50%	1*3	100,000*4,*5
220V AC	1.45A	cos φ = 0.35	0.20Hz	50%	1*3	300,000*4,*5
24V DC	6A	resistive	0.33Hz	50%	4*2	400,000*4,*5
24V DC	2A	resistive	0.50Hz	50%	4*2	2,000,000*4,*5
24V DC	3A	DC 13*1	0.33Hz	10%	1*3	50,000*4,*5
24V DC	3A	L/R = 40ms	0.33Hz	10%	1*3	100,000*4,*5

*1 EN 60947-5-1: 1997; table C.1
*2 Breathing hole closed
*3 Breathing hole open
*4 Ambient temperature +70°C
*5 Dielectric strength according to EN61810-1:2004.
*6 Normally open contacts

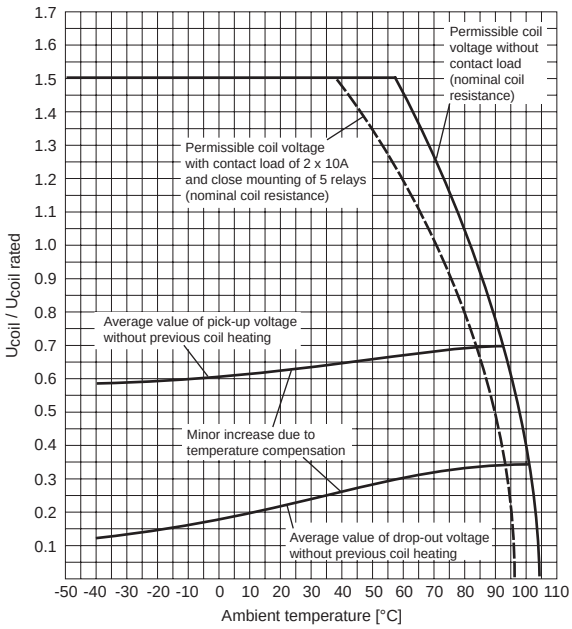
REFERENCE DATA

Load limit curve



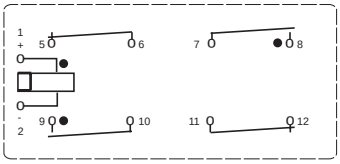
Loads in the range under the curve can be switched safely. The arc will extinguish before the opposite contact makes.

Coil voltage characteristics

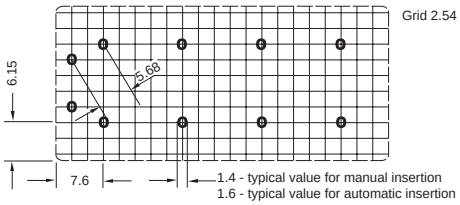


Permissable coil voltages and pick-up and drop-out characteristics at various ambient temperatures.

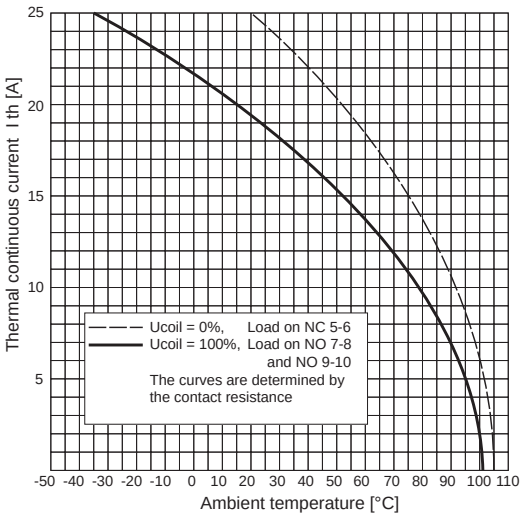
Connection diagram and pcb bore hole data



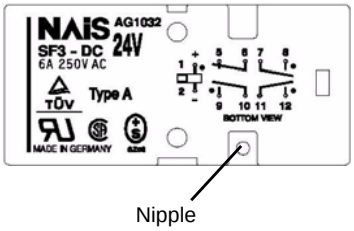
Bottom view
The contacts are shown in the deenergized condition.



Contact current characteristics



APPLICATION NOTES



If required a breathing hole can be made in the cover by removing the nipple.
However be aware that the degree of protection will reduce from IP67 to IP30!

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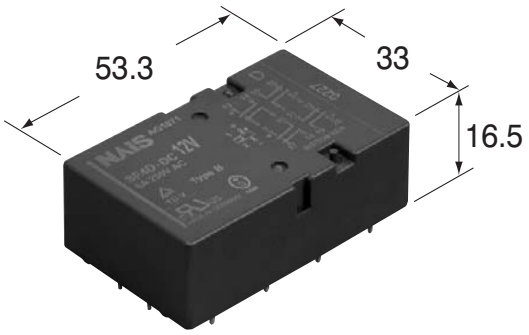
POLARIZED, MONOSTABLE SAFETY RELAY WITH FORCIBLY GUIDED CONTACTS

SF4D RELAY



Tolerance± 0.3mm
Weight approx. 47g

Features

- **Relay complies with EN 50205, Type B**
- **Overvoltage category as per IEC 60664-1 III / 4kV**
- **Rated voltage as per IEC 60664-1 basic insulation**

		Polution degree		
		2 inside	2 outside	3 inside
Coil-contact		400V	400V	250V
Contact-contact	forcibly linked pair only	250V	250V	250V
	all other contacts	400V	400V	400V

SPECIFICATIONS

Contact

Contact configuration (a = normally open / NO, b = normally closed / NC)	4a4b
Contact material	$AgSnO_2$, with Au flash
Contact resistance (initial at 6V DC, 1A)	≤30mΩ
Making and breaking capacities (breathing hole open)*1	6A 250V / 3A 24V
Max. switching voltage	400V
Min. switching voltage / min. switching current	10V / 10mA
Pick-up / drop-out / bounce time (approx. values at $U_{nominal}$)	18.5 / 7.5 / 3ms
Mechanical life	10^7ops

Coil

Operate / release voltage (% of $U_{nominal}$ at 20°C)	75% / 15%
Pick-up/nominal power consumption at 20°C	280 / 500mW

Remarks

*1 According to EN 60947-5-1: 1997, table 4 AC15 / DC13
*2 Contact interruption <10μs
*3 Breathing hole open

Characteristics

Max. switching frequency (without load)	10Hz
Permissible ambient temperature at nominal power consumption	-40°C to +70°C
Upper temperature limit	105°C
Test voltage: open contact / contact-contact / contact-coil	2500 / 2500 / $2500V_{rms}$
Insulation resistance at 500V DC (initial)	$10^9\Omega$
Shock resistance (11ms) NO/NC*2	30G
Vibration resistance 10 – 200 Hz (10 – 55 Hz, amplitude 2 mm)*2	10G
Degree of protection	IP67 / IP30*3

Important: Relay characteristics may be influenced by:

- strong external magnetic fields
- magnetic conductive materials near the relay
- narrow top-to-top mounting (printed surface to printed surface)

Note:

Suitable for most common washing methods except ultrasonic cleaning.

ORDERING INFORMATION

Ex. SF4D — DC12 V

Coil voltage (DC)
5, 9, 12, 18, 21 24, 36, 48, 60

COIL DATA

Part number	Coil nominal voltage V DC	Operate voltage V DC	Release voltage V DC	Coil resistance Ω (±10%, 20°C)	Coil inductance (mH)
SF4D-DC5V	5	3.75	0.75	50	47
SF4D-DC9V	9	6.75	1.35	162	145
SF4D-DC12V	12	9.00	1.80	288	252
SF4D-DC18V	18	13.50	2.70	648	551
SF4D-DC21V	21	15.75	3.15	882	742
SF4D-DC24V	24	18.00	3.60	1152	959
SF4D-DC36V	36	27.00	5.40	2592	2097
SF4D-DC48V	48	36.00	7.20	4608	3654
SF4D-DC60V	60	45.00	9.00	7200	5612

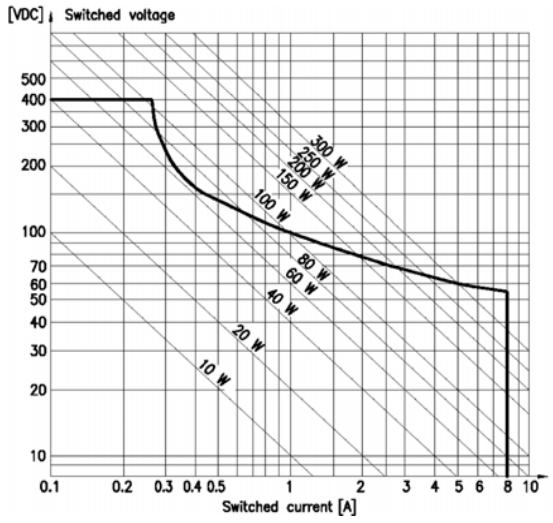
ELECTRICAL LIFE

Voltage	Current	Load type	Frequency	Duty cycle	No. of contacts	No. of ops.
230V AC	8A	AC 1	0.25Hz	25%	4*2	85,000*5
250V AC	6A	AC 1	0.33Hz	50%	4*2 / 8*3	100,000*5
230V AC	6A	AC 1	0.33Hz	10%	2*3	200,000*4,*5
230V AC	30 / 3A	AC 15*1	0.33Hz	10%	1*3	200,000*4,*5
24V DC	8A	DC 1	0.33Hz	10%	2*3	200,000*4,*5
24V DC	3A	DC 13*1	0.33Hz	10%	1*3	50,000*4,*5
24V DC	3A	L/R = 40ms	0.33Hz	10%	1*3	100,000*4,*5

*1 EN 60947-5-1: 1997; table C.1
*2 Breathing hole closed
*3 Breathing hole open
*4 Ambient temperature +70°C
*5 Dielectric strength according to EN61810-1:2004.

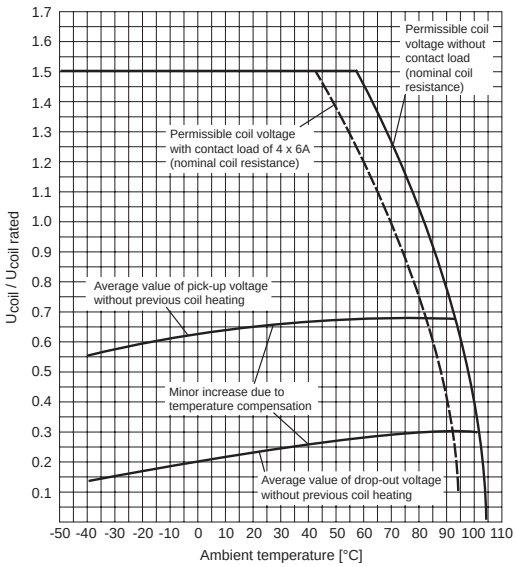
REFERENCE DATA

Load limit curve



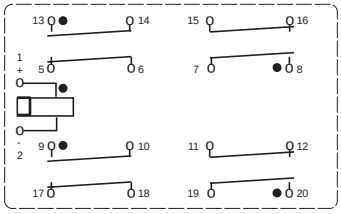
Loads in the range under the curve can be switched safely. The arc will extinguish before the opposite contact makes.

Coil voltage characteristics



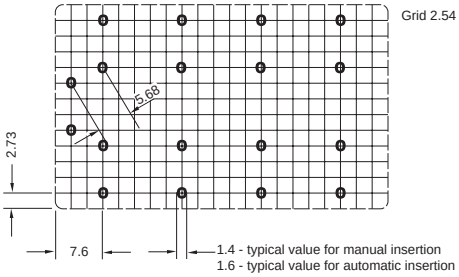
Permissable coil voltages and pick-up and drop-out characteristics at various ambient temperatures.

Connection diagram and pcb bore hole data

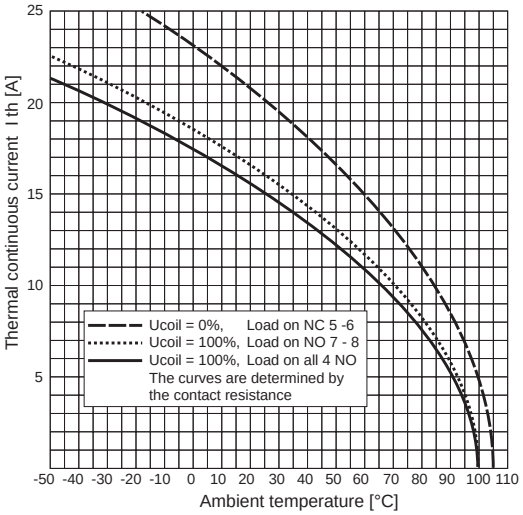


Bottom view

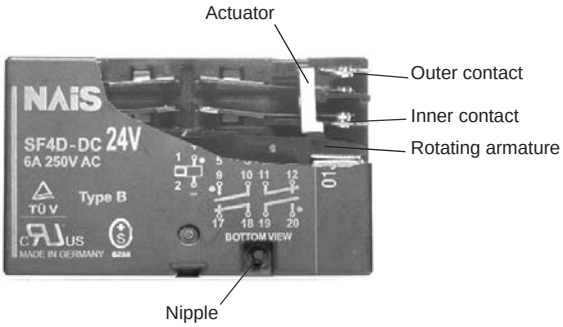
The contacts are shown in the deenergized condition.



Contact current characteristics



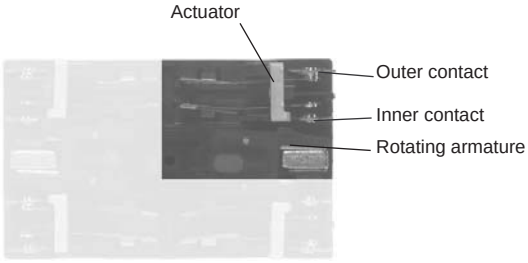
APPLICATION NOTES



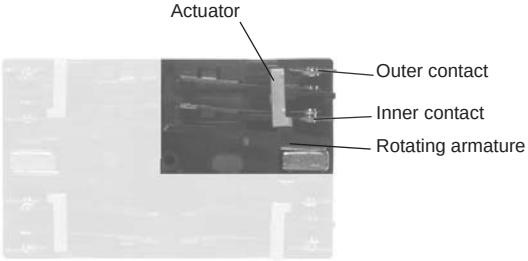
If required a breathing hole can be made in the cover by removing the nipple.
However be aware that the degree of protection will reduce from IP67 to IP30!

Operation of forcibly guided contacts, Type B

If an outer contact should weld, then the forced operated inner contacts driven by the actuator remain open.
The rotating armature remains free to move.
The unaffected contact pairs can operate normally, i.e. their function to make or break remains unaffected.



If an inner contact should weld, then the movement of the rotating armature is blocked via the actuator.
Open contacts of all four contact pairs remain open.
This arrangement corresponds to a conventional forcibly guided contact operation.

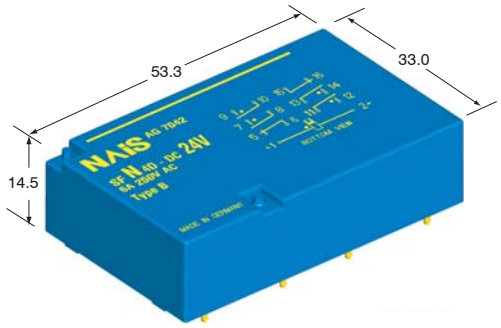


For Cautions for Use, see Relay Technical Information (page 390).

Panasonic
ideas for life

LOW PROFILE SAFETY RELAY WITH FORCIBLY GUIDED CONTACTS

SFN4D RELAY



Tolerance ±0.3 mm
Weight approx. 42 g

Features

- **Relay complies with EN 50205, Type B**
- **Polarized magnet system with snap action function**
- **Extremely small total power loss**
  - Nominal coil power consumption of 390mW
  - Double contacts with low contact resistance,
  e.g. [(6A)^2 × 2.5mΩ] × 4NO = 360mW
- **Relay height, 14.5mm**
- **Reinforced insulation according to EN 50178**
  - between coil-contacts and contacts-contacts
  - rated voltage of the circuits 230 / 400V or 277 / 480Vrms
  - rated impulse voltage of 6kV → clearance ≥ 5.5 mm
  - pollution degree 2 → creepage distance ≥ 5.5mm

SPECIFICATIONS

Contact

Contact configuration (a = normally open / NO, b = normally closed / NC)	4a2b
Contact material	$AgSnO_2$, with Au flash
Contact resistance (initial at 6V DC, 1A) Typical contact resistance	≤30mΩ 2.5mΩ
Max. switching capacity	6A/8A*1 250V AC
Max. switching voltage	500V AC / DC
Min. switching voltage / min. switching current	Reference 10V / 10mA
Pick-up / drop-out / bounce time (approx. values at $U_{nominal}$)	23 / 6*2 / 2ms
Mechanical life	10^7ops

Coil

Operate / release and holding at 20°C (% of $U_{nominal}$)*3	75% / 25% min. 48%
Pick-up/nominal power consumption	219-236 / 390-420mW

Characteristics

Max. switching frequency (without load)	5Hz
Permissible ambient temperature at nominal power consumption*3	-25°C to 92°C
Upper temperature limit	105°C
Test voltage: open contact / contact-contact / contact-coil	2500 / 4000 / 5000V_{rms}
Insulation resistance at 500V DC (initial)	10^9Ω
Shock resistance (11ms) NO/NC*4	20 / 15G
Vibration resistance 10 – 200 Hz (10 – 55 Hz, amplitude 2 mm)*4	10G
Degree of protection	RT III*5

Important: Relay characteristics may be influenced by:

- strong external magnetic fields
- magnetic conductive materials near the relay
- narrow top-to-top mounting (printed surface to printed surface)

*1 See "ELECTRICAL LIFE (Reference Data)*1" on page 382.
*2 Without diode
*3 See also "REFERENCE DATA" on page 383.
*4 Contact interruption <10μs
*5 According to EN 61810-1: 2004, table 2

ORDERING INFORMATION

Ex. SFN4D — DC12 V

Coil voltage (DC)
5, 9, 12, 16, 18, 21 24, 36, 48, 60

Other coil voltage available upon request

COIL DATA (at 20°C)

Part number	Coil nominal voltage V DC	Operate voltage*1 V DC	Release voltage*1 V DC	Coil resistance Ω (±10%, 20°C)
SFN4D-DC5V	5	3.75	1.25	64.1
SFN4D-DC9V	9	6.75	2.25	207.7
SFN4D-DC12V	12	9.00	3.00	369.2
SFN4D-DC16V	16	12.00	4.00	656.4
SFN4D-DC18V	18	13.5	4.50	830.8
SFN4D-DC21V	21	15.75	5.25	1130.8
SFN4D-DC24V	24	18.00	6.00	1476.9
SFN4D-DC36V	36	27.00	9.00	3085.7
SFN4D-DC48V	48	36.00	12.00	5485.7
SFN4D-DC60V	60	45.00	15.00	8571.4

*1 Operate and release voltage at different temperatures, see “REFERENCE DATA” on page 383, coil voltage characteristics.

SWITCHING CAPABILITY

- Making / breaking capacities according to EN 60947-5-1: 2000, table 4 / 5; AC15: 6A 230V AC / DC13: 6A 24V DC
- Endurance / overload test according to UL 508 16 edition, sections 42 / 43; 6A 250V AC / 6A 24V DC; B300 / R300; File E120782

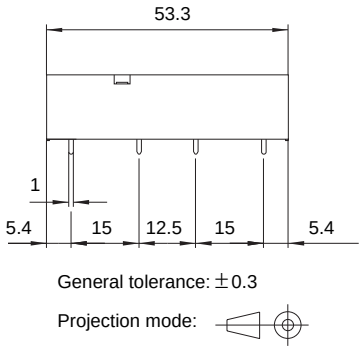
ELECTRICAL LIFE (Reference Data)*1

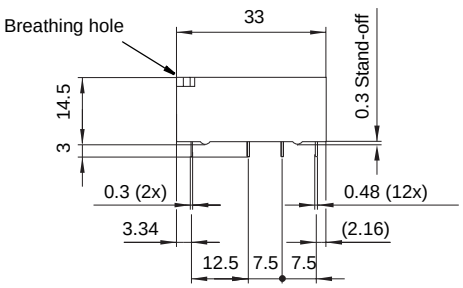
Voltage	Current (A)	Load type	Frequency	Duty cycle	No. of contacts	No. of ops.
230V AC	8	AC 1	0.25Hz	25%	4	85,000
230V AC	6	AC 1	0.25Hz	25%	4	200,000
230V AC	2.5	AC 1	0.25Hz	25%	4	1,500,000
230V AC	60 / 6	AC 15	0.20Hz	20%	3	30,000*2
24V DC	6	DC 1	0.25Hz	25%	4	2,000,000
250V DC	0.27	DC 13	0.10Hz	10%	4	>1,000,000*2

*1 Test conditions: Room temperature, breathing hole closed, dielectric strength according to EN61810-1:2004.
*2 Has to be confirmed
Further data is under preparation.

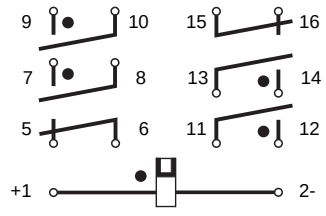
DIMENSIONS

Outer dimensions

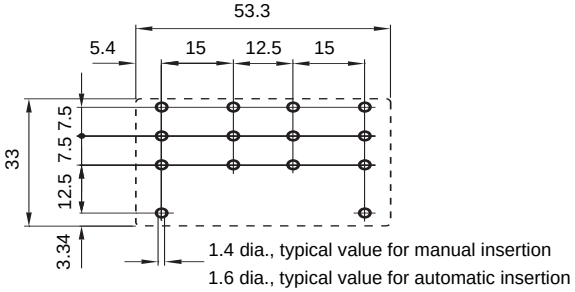




Schematic (Bottom view)

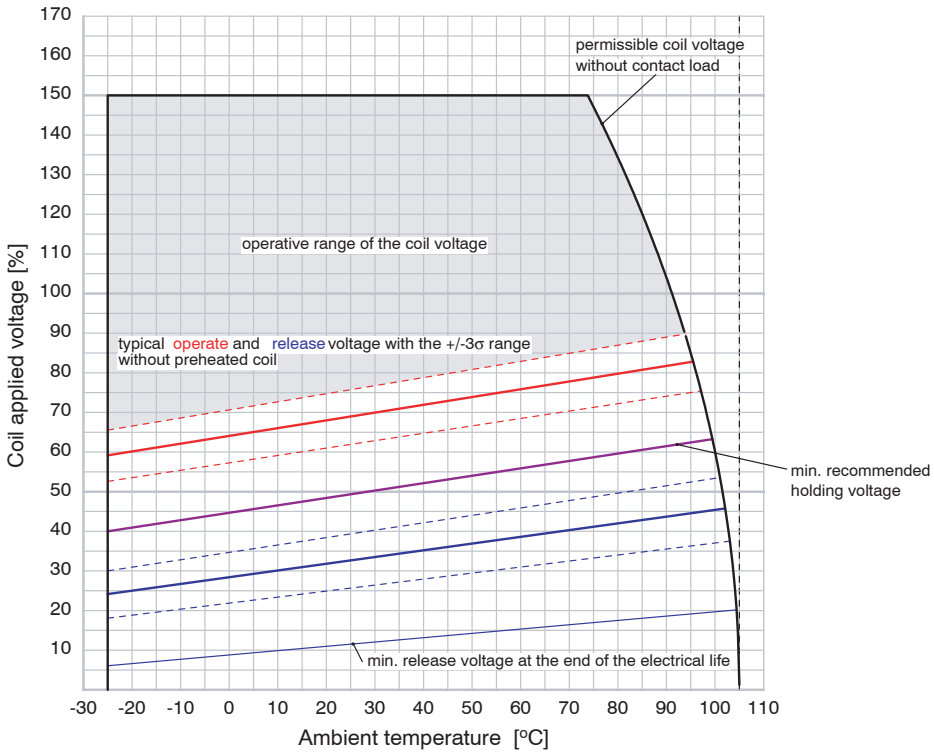


PC board pattern (Bottom view)

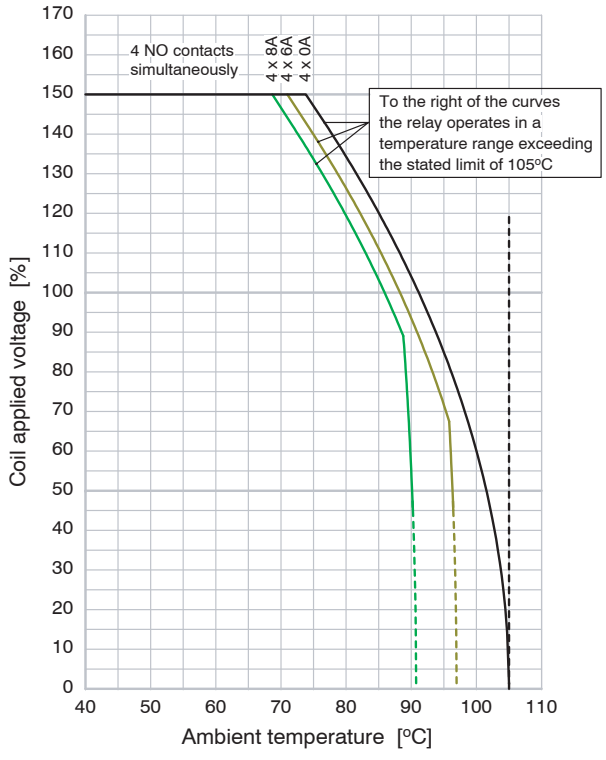


REFERENCE DATA

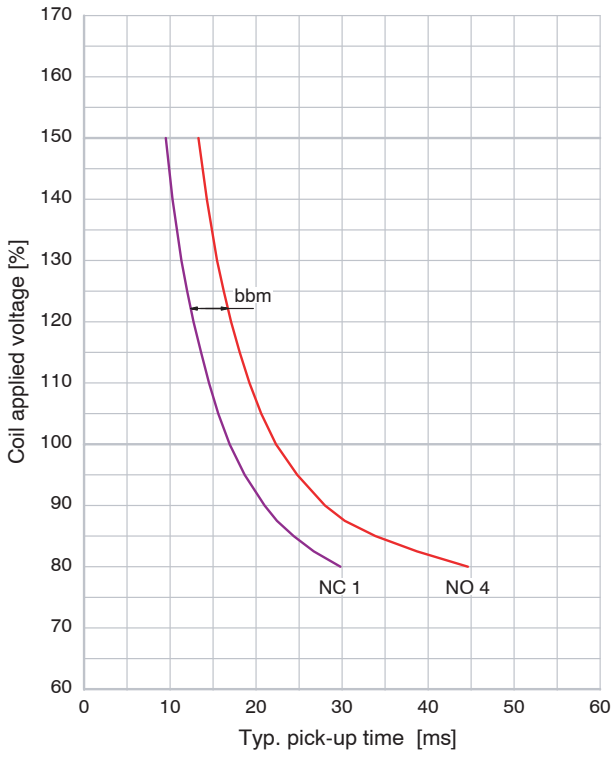
Coil voltage characteristics



Thermic operating range



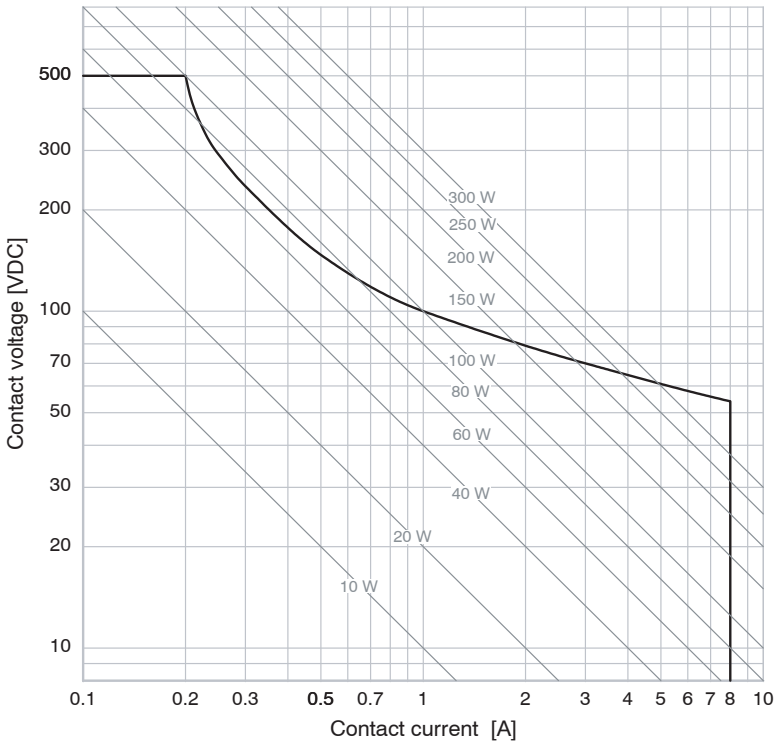
Switching time in relation to coil excitement at 20°C



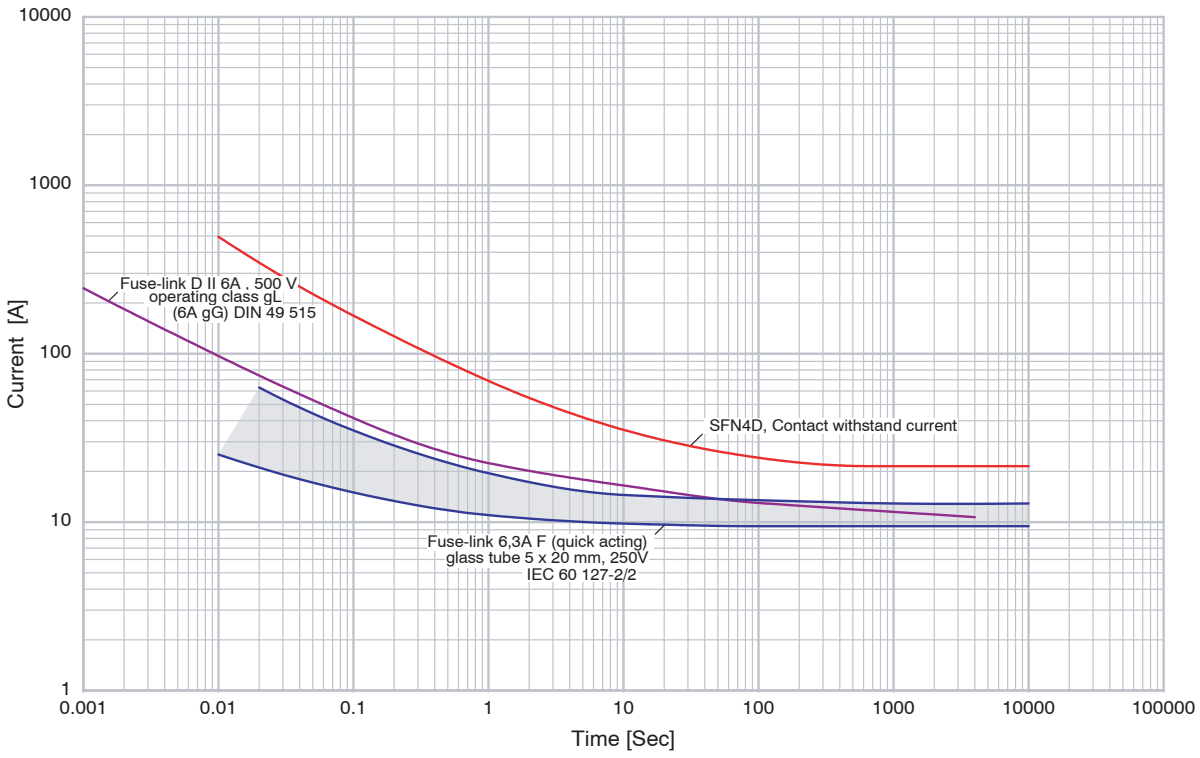
Safety

REFERENCE DATA, continued

Load limit curve

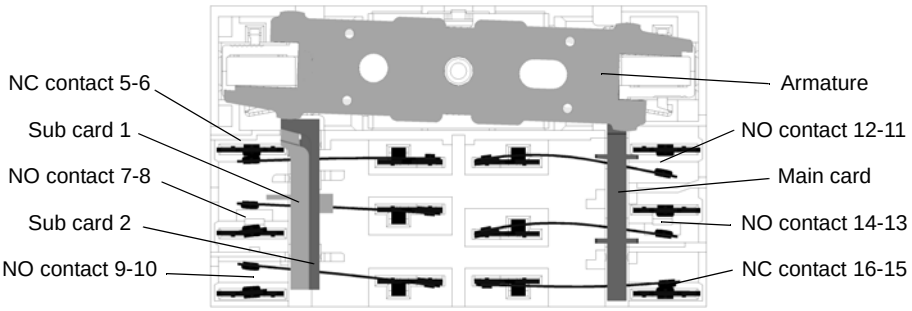


Time / current characteristic

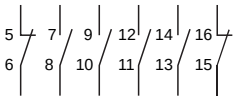


APPLICATION NOTES

The SFN4D Safety Relay



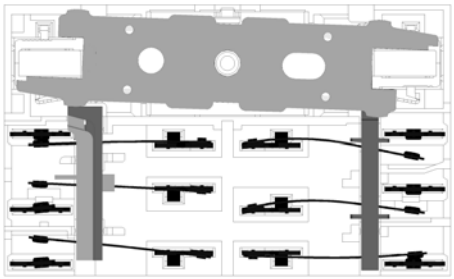
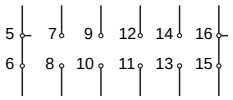
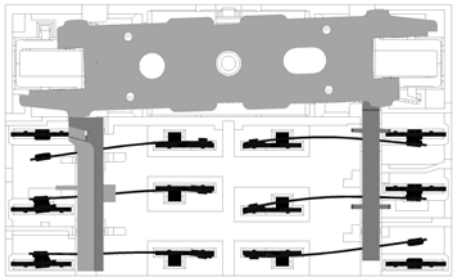
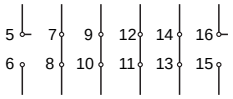
Remark:
Only NC 5-6 monitors all NO contacts!



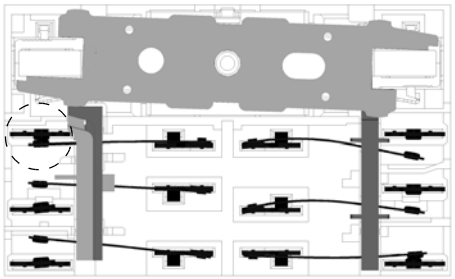
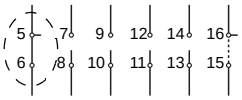
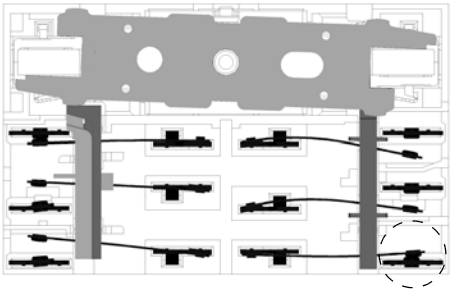
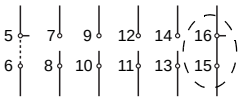
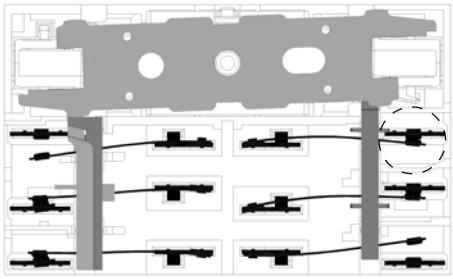
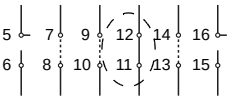
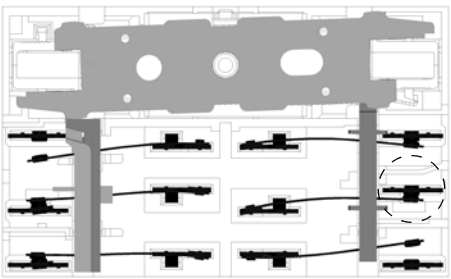
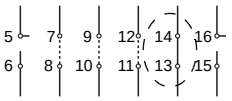
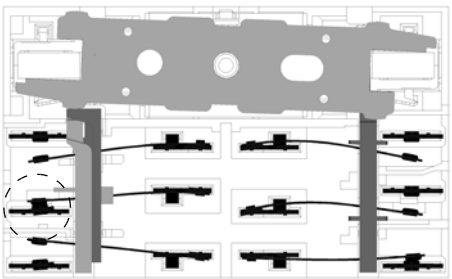
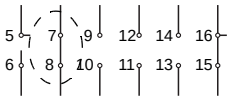
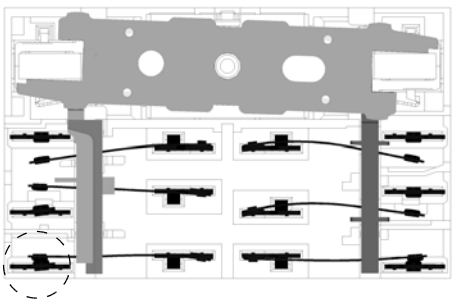
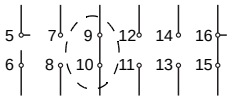
Legend for interpreting contact conditions

Contact	NC (Normally Closed)				NO (Normally Open)			
Condition	Closed	Fully open	Open	Open or closed	Closed	Fully open	Open	Open or closed
Symbol								
Contact gap	0	Maximum (~1.5mm)	>0.5mm (forcibly guided)	Not defined	0	Maximum (~1.5mm)	>0.5mm (forcibly guided)	Not defined

The SFN4D under normal operating conditions

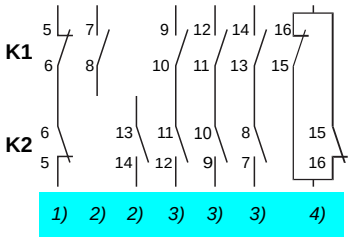
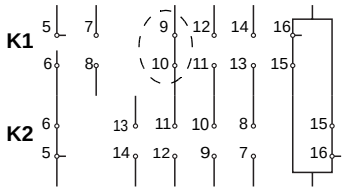
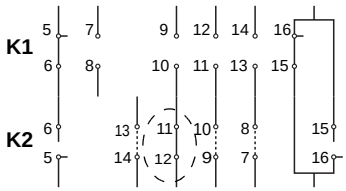
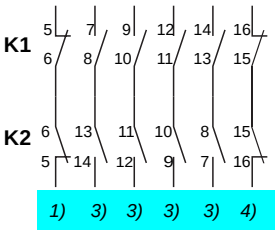
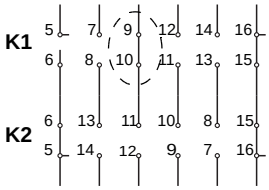
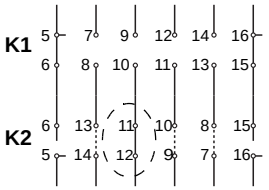
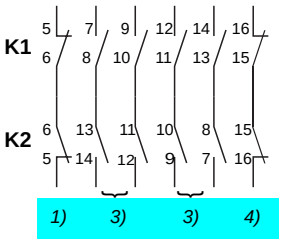
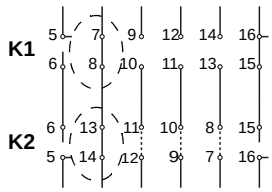
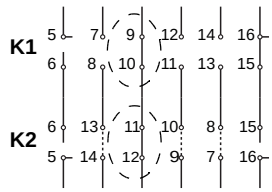
Condition	Illustration of Relay State	Condition of Contacts
- Coil deenergized. - Armature in deenergized position. - NC contacts closed. - NO contacts have a contact gap of approx. 1.5mm.		
- Coil energized. - Armature in energized position. - NO contacts closed. - NC contacts have a contact gap of approx. 1.5mm.		

The SFN4D safety relay with welded contacts

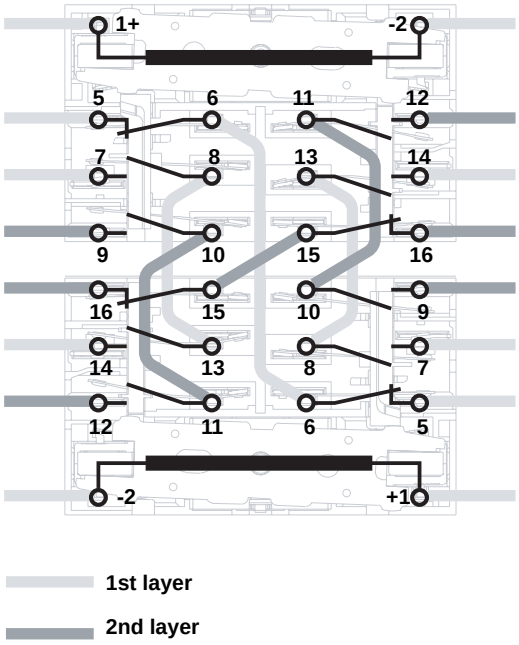
Condition	Illustration of Relay State	Condition of Contacts
- NC 5-6 welded. - Coil energized. - Armature nearly in deenergized position.		 - All NO contacts are forcibly guided. - The NO contact gaps are min. 0.5mm. - For NC 16-15, the contact condition is not defined.
- NC 16-15 welded. - Coil energized. - Armature nearly in deenergized position.		 - All NO contacts are forcibly guided. - The NO contact gaps are min. 0.5mm. - For NC 5-6, the contact condition is not defined.
- NO 12-11 welded. - Coil deenergized. - Armature nearly in energized position.		 - All (both) NC contacts are forcibly guided. - The NC contact gaps are min. 0.5mm. - For all NO contacts, the contact condition is not defined.
- NO 14-13 welded. - Coil deenergized. - Armature in nearly energized position.		 - All (both) NC contacts are forcibly guided. - The NC contact gaps are min. 0.5mm. - For all NO contacts, the contact condition is not defined.
- NO 7-8 welded. - Coil deenergized. - Armature in deenergized position.		 - **NC 16-15 is closed!!** - **All non-welded NO contacts show their max. contact gap.** - NC 5-6 forcibly guided to the welded contact by sub card 1. The contact gap is min. 0.5mm.
- NO 9-10 welded. - Coil deenergized. - Armature in deenergized position.		 - **NC 16-15 is closed!!** - **All non-welded NO contacts show their max. contact gap.** - NC 5-6 forcibly guided to the welded contact by sub card 2. The contact gap is min. 0.5mm.

Failure modes, application examples

1) Feedback loop, 2) Self-holding circuit, 3) Safety circuit, 4) Auxilliary contacts

1. Self-holding circuit, three safety circuits  	One contact welded, e.g. NO 9-10 of K1.	Condition of contacts at deenergized coil 
	One contact welded, e.g. NO 12-11 of K2.	Condition of contacts at deenergized coil 
2.1. Four safety circuits  (see wiring example, p. 388)	One contact welded, e.g. NO 9-10 of K1.	Condition of contacts at deenergized coil 
	One contact welded, e.g. NO 12-11 of K2.	Condition of contacts at deenergized coil 
2.2. Two safety circuits  (see wiring example, p. 388)	Both contacts of one path are welded, e.g. NO 7-8 and NO 14-13. A safety circuit needs two paths in this failure mode. The contacts 9-10, 12-11, and 14-13 of K1 interrupt the load.	Condition of contacts at deenergized coil 
	Both contacts of one path are welded, e.g. NO 9-10 and NO 12-11. A safety circuit needs two paths in this failure mode. The contacts 7-8, 12-11, and 14-13 of K1 interrupt the load.	Condition of contacts at deenergized coil 

Wiring for application examples 2.1 and 2.2



For Cautions for Use, see Relay Technical Information (page 390).

Relay Technical Information

Definition of Relay Terminology

COIL (also referred to as primary or input)

• **Nominal Coil Voltage** (Rated Coil Voltage)
A single value (or narrow range) of source voltage intended by design to be applied to the coil or input.

• **Pick-Up Voltage** (Pull-In Voltage or Must Operate Voltage)
As the voltage on an unoperated relay is increased, the value at or below which all contacts must function (transfer).

• **Drop-Out Voltage** (Release or Must Release Voltage)
As the voltage on an operated relay is decreased, the value at or above which all contacts must revert to their unoperated position.

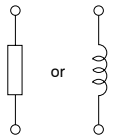
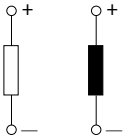
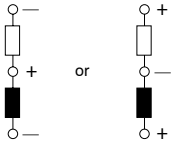
• **Maximum Continuous Voltage**
The maximum voltage that can be applied continuously to the coil without causing damage. Short duration spikes of a higher voltage may be tolerable, but this should not be assumed without first checking with the manufacturer.

• **Nominal Operating Current**
The value of current flow in the coil when nominal voltage is impressed on the coil

• Nominal Operating Power
The value of power used by the coil at nominal voltage. For DC coils expressed in watts; AC expressed as volt amperes. Nominal Power (W or VA) = Nominal Voltage × Nominal Current.

• **Coil Resistance**
This is the DC resistance of the coil in DC type relays for the temperature conditions listed in the catalog. (Note that for certain types of relays, the DC resistance may be for temperatures other than the standard 20°C 68°F.)

• **Coil Designation**

Single side stable type		1 coil latching type	2 coil latching type	
Non-polarized	Polarized		4-terminal	3-terminal
				

A black coil represents the energized state. For latching relays, schematic diagrams generally show the coil in its reset state. Therefore, the coil symbol is also shown for the reset coil in its reset state.

CONTACTS (secondary or output)

• Contact Forms
Denotes the contact mechanism and number of contacts in the contact circuit.

• Contact Symbols

Form A contacts (normally open contacts)	
Form B contacts (normally closed contacts)	
Form C contacts (changeover contacts)	

Form A contacts are also called N.O. contacts or make contacts.
Form B contacts are also called N.C. contacts or break contacts.
Form C contacts are also called changeover contacts or transfer contacts.

• MBB Contacts
Abbreviation for make-before-break contacts. Contact mechanism where Form A contacts (normally open contacts) close before Form B contacts open (normally closed contacts).

• Rated Switching Power
The design value in watts (DC) or volt amperes (AC) which can safely be switched by the contacts. This value is the product of switching voltage x switching current, and will be lower than the maximum voltage and maximum current product.

• Maximum Switching Voltage
The maximum open circuit voltage which can safely be switched by the contacts. AC and DC voltage maximums will differ in most cases.

• Maximum Switching Current
The maximum current which can safely be switched by the contacts. AC and DC current maximums may differ.

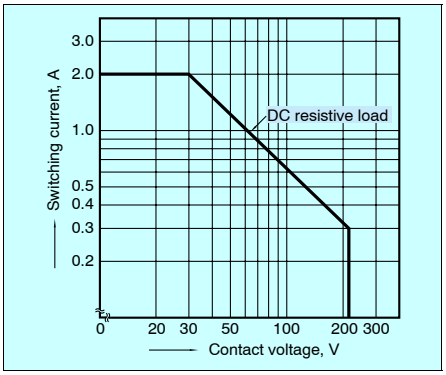
• Maximum Switching Power
The upper limit of power which can be switched by the contacts. Care should be taken not to exceed this value.

• Maximum Carrying Current
The maximum current which after closing or prior to opening, the contacts can safely pass without being subject to temperature rise in excess of their design limit, or the design limit of other temperature sensitive components in the relay (coil, springs, insulation, etc.). This value is usually in excess of the maximum switching current.

• Minimum switching capability
This value is a guideline as to the lowest possible level at which it will be possible for a low level load to allow switching. The level of reliability of this value depends on switching frequency, ambient conditions, change in the desired contact resistance, and the absolute value. Please use a relay with AgPd contacts if your needs analog low level loads, control, or a contact resistance of 100 mΩ or less.
We recommend that you verify with one of our sales offices regarding usage.

• Maximum Switching Capacity
This is listed in the data column for each type of relay as the maximum value of the contact capacity and is an interrelationship of the maximum switching power, maximum switching voltage, and maximum switching current. The switching current and switching voltage can be obtained from this graph. For example, if the switching voltage is fixed in a certain application, the maximum switching current can be obtained from the intersection between the voltage on the axis and the maximum switching power.

Maximum Switching Capacity (TX relay)
Example: Using TX relay at a switching voltage of 60V DC, the maximum switching current is 1A.
(Maximum switching capacity is given for a resistive load. Be sure to carefully check the actual load before use.)



• Contact Resistance
This value is the combined resistance of the resistance when the contacts are touching each other, the resistance of the terminals and contact spring. The contact resistance is measured using the voltage-drop method as shown below. The measuring currents are designated in Fig. 1.

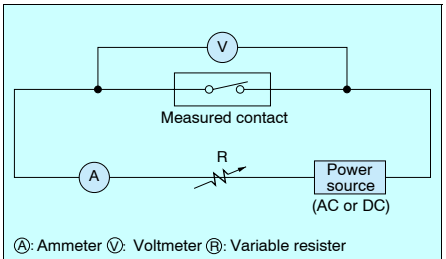


Fig. 1

Test Currents

Rated Contact Current or Switching Current (A)	Test Current (mA)
Less than 0.01	1
0.01 or more and less than 0.1	10
0.1 or more and less than 1	100
1 or more	1,000

The resistance can be measured with reasonable accuracy on a YHP 4328A milliohmmeter.
In general, for relays with a contact rating of 1A or more, measure using the voltage-drop method at 1A 6V DC.

• Capacitance
This value is measured between the terminals at 1kHz and 20°C 68°F.

PERFORMANCE

• Insulation Resistance
The resistance value between all mutually isolated conducting sections of the relay, i.e. between coil and contacts, across open contacts and between coil or contacts to any core or frame at ground potential. This value is usually expressed as “initial insulation resistance” and may decrease with time, due to material degradation and the accumulation of contaminants.

• Breakdown Voltage (Hi-Pot or Dielectric Strength)
The maximum voltage which can be tolerated by the relay without damage for a specified period of time, usually measured at the same points as insulation resistance. Usually the stated value is in VAC (RMS) for one minute duration.

• Surge Withstand Voltage
The ability of the device to withstand an abnormal externally produced power surge, as in a lightning strike, or other phenomenon. An impulse test waveform is usually specified, indicating rise time, peak value and fall time. (Fig. 2)

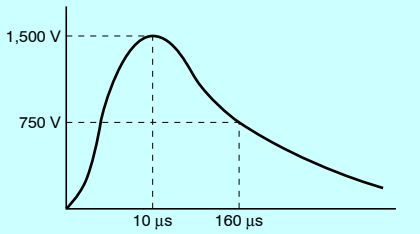


Fig. 2

• Operate Time (Pull-In or Pick-Up Time)
The elapsed time from the initial application of power to the coil, until the closure of the normally open contacts. (With multiple pole devices the time until the last contact closes.) This time does not include any bounce time.

• Release Time (Drop-Out Time)
The elapsed time from the initial removal of coil power until the reclosure of the normally closed contacts (last contact with multi-pole) this time does not include bounce.

• Set Time
Term used to describe operate time of a latching relay.

• Reset Time
Term used to describe release time of a latching relay. With a 2-coil magnetic latching relay the time is from the first application of power to the reset coil until the reclosure of the reset contacts. With a single coil latching relay, the time is measured from the first application of reverse coil voltage until the reclosure of the reset contact.

• Contact Bounce (Time)
Generally expressed in time (ms), this refers to the intermittent switching phenomenon of the contacts which occurs due to the collision between the movable metal parts or contacts, when the relay is operated or released.

• Operate Bounce Time
The time period immediately following operate time during which the contacts are still dynamic, and ending once all bounce has ceased.

• Release Bounce Time
The time period immediately following release time during which the contacts are still dynamic, ending when all bounce has ceased.

• Shock Resistance, Destructive
The acceleration which can be withstood by the relay during shipping or installation without it suffering damage, and without causing a change in its operating characteristics. Usually expressed in “G”s.

• Shock Resistance, Functional
The acceleration which can be tolerated by the relay during service without causing the closed contacts to open for more than the specified time. (usually 10µs)

• Vibration Resistance, Destructive
The vibration which can be withstood by the relay during shipping, installation or use without it suffering damage, and without causing a change in its operating characteristics. Expressed as an acceleration in G’s or displacement, and frequency range.

• Vibration Resistance, Functional
The vibration which can be tolerated by the relay during service, without causing the closed contacts to open for more than the specified time.

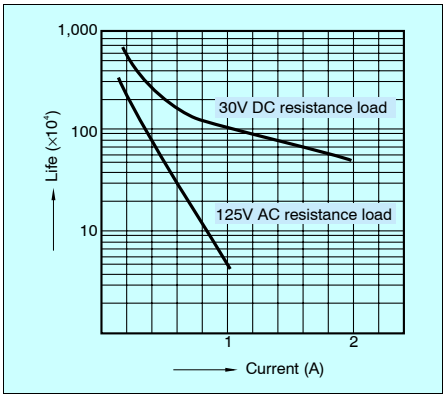
• Mechanical Life
The minimum number of times the relay can be operated under nominal conditions (coil voltage, temperature, humidity, etc.) with no load on the contacts.

• Electrical Life
The minimum number of times the relay can be operated under nominal conditions with a specific load being switched by the contacts.

• Maximum Switching Frequency
This refers to the maximum switching frequency which satisfies the mechanical life or electrical life under repeated operations by applying a pulse train at the rated voltage to the operating coil.

Life Curve
This is listed in the data column for each type of relay. The life (number of operations) can be estimated from the switching voltage and switching current. For example, for a DS relay operating at:
Switching voltage = 125V AC
Switching current = 0.6A
The life expectancy is 300,000 operations. However, this value is for a resistive load. Be sure to carefully check the actual load before use.

Life Curve



HIGH FREQUENCY CHARACTERISTICS

• Isolation
High frequency signals leak through the stray capacitance across contacts even if the contacts are separated. This leak is called isolation. The symbol dB (decibel) is used to express the magnitude of the leak signal. This is expressed as the logarithm of the magnitude ratio of the signal generated by the leak with respect to the input signal. The larger the magnitude, the better the isolation.

• Insertion Loss
At the high frequency region, signal disturbance occurs from self-induction, resistance, and dielectric loss as well as from reflection due to impedance mismatching in circuits. Loss due to any of these types of disturbances is called insertion loss. Therefore, this refers to the magnitude of loss of the input signal. The smaller the magnitude, the better the relay.

• V.S.W.R. (Voltage Standing Wave Ratio)
High frequency resonance is generated from the interference between the input signal and reflected (wave) signal. V.S.W.R. refers to the ratio of the maximum value to minimum value of the waveform. The V.S.W.R. is 1 when there is no reflected wave. It usually becomes greater than 1.

Notes:
1. Except where otherwise specified, the tests above are conducted under standard temperature and humidity (15°C to 35°C 59°F to 95°F, 25 to 75%).
2. The coil impressed voltage in the switching tests is a rectangular wave at the rated voltage.
3. The phase of the AC load operation is random.

PROTECTIVE CONSTRUCTION

Several different degrees of protection are provided for different relay types, for resistance to dust, flux, contaminating environments, automatic cleaning, etc.

• Open Type
For reasons of cost, some devices are not provided with any enclosure. It is usually assumed that the end application will be in an overall enclosure or protective environment.

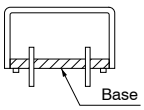
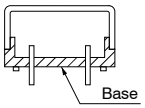
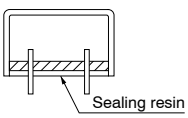
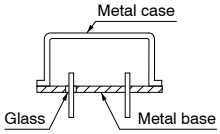
• Dust Cover Type
Most standard relays are provided with a dust cover of some type. This protects the relay from large particulate contamination, and also may protect user personnel from a shock hazard.

• Flux-Resistant Type
In this type of construction, solder flux penetration is curtailed by either insert molding the terminals with the header, or by a simple sealing operation during manufacturing.

• Sealed Type
This type of sealed relay totally excludes the ingress of contaminants by way of a sealing compound being applied to the header/cover interface. The constituent components are annealed for physical and chemical stability. This annealing process drives off residual volatiles in the plastics, insuring a contaminant free environment inside the sealed relay, resulting in more stable contact resistance over life.

• Hermetic Seal
The plastic sealed type is not a true hermetic seal, there is an exchange of gas molecules through the plastic cover over time. The only true hermetic seals are metal to metal and glass to metal. The entire device is purged with dry nitrogen gas prior to sealing, improving reliability.

CONSTRUCTION AND CHARACTERISTIC

Type	Construction	Characteristics	Automatic Soldering	Automatic Cleaning	Harmful Gas Resistance
Dust Cover Type		Most basic construction where the case and base (or body) are fitted together.	No	No	No
Flux-Resistant Type		Terminals are sealed or molded simultaneously. The joint between the case and base is higher than the surface of the PC board.	Yes	No	No
Sealed Type		Terminals, case, and base are filled with sealing resin.	Yes	Yes	Yes
Metallic Hermetic Seal Type		Hermetically sealed with metal case and metal base. Terminals are sealed with glass.	Yes	Yes	Yes

OPERATIONAL FUNCTION

• Single Side Stable Type

Relay which turns on when the coil is energized and turns off when de-energized. (Fig. 3)

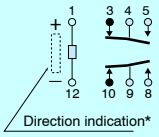


Fig. 3

• 1 Coil Latching Type

Relay with a latching construction that can maintain the on or off state with a pulse input. With one coil, the relay is set or reset by applying signals of opposite polarities. (Fig. 4)

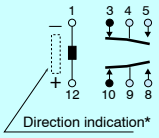


Fig. 4

• 2 Coil Latching Type

Relay with a latching construction composed of 2 coils: set coil and reset coil. The relay is set or reset by alternately applying pulse signals of the same polarity. (Fig. 5)

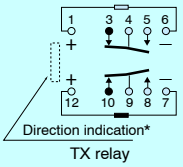


Fig. 5

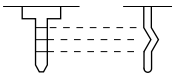
• Operation Indication

Indicates the set and reset states either electrically or mechanically for easy maintenance. An LED wired type (LED wired HC relay), lamp type (lamp wired HP relay) are available. (Fig. 6)

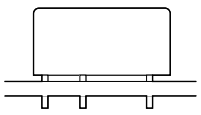
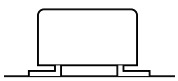
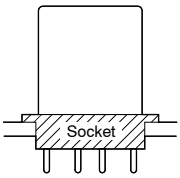
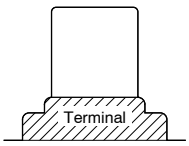
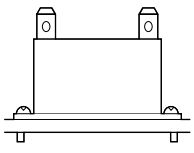
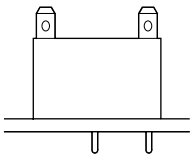
LED wired
HC relay

Fig. 6

TERMINAL CONFIGURATION

Type	PC board through hole terminal	PC board self-clinching terminal	PC board surface-mount terminal	Plug-in terminal	Quick connect terminal	Screw terminal
Typical relay type						
Terminal configuration						
Typical relay type	GQ, GN, TQ, TN, TK, TX, TX-D relay, DS relay, DS-BT relay, RP relay, JS relay, JW relay, SEB relay, JQ relay, PQ relay	TQ, TN, TK, TX, TX-D relay	GQ-SMD, GN-SMD, TX-SMD, TQ-SMD	HJ relay, HC relay HP relay, HE relay HL relay, HK relay HN relay	JC relay JR relay	HE relay EP relay EJ relay

MOUNTING METHOD

Type	Insertion mount	Surface mount	Socket mount	Terminal socket mount	TM relay	TMP type
Mounting configuration						
Typical relay type	GQ, GN, TQ, TN, TK, TX, TX-D relay, DS relay, DS-BT relay, RP relay, SEB relay	GQ-SMD, GN-SMD, TX-SMD, TQ-SMD	NC relay HC relay HL relay	HJ relay, HC relay HP relay, HG relay HL relay, HK relay HN relay	HC relay JR relay JC relay	JR relay LF relay JT-N relay

Notes: 1. Sockets are available for certain PC board relays. (SEB relay, ST relay, etc.)
2. M type (solder type) for direct screw mounting of case is also available. (HG relay)

General Application Guidelines

A relay may encounter a variety of ambient conditions during actual use resulting in unexpected failure. Therefore, testing over a practical range under actual operating conditions is necessary. Application considerations should be reviewed and determined for proper use of the relay.

CAUTIONS REGARDING SAFETY

• Be absolutely sure not to exceed the specification ranges, such as coil rating, contact rating and switching life. Doing so may lead to abnormal heating, smoke, and fire.

• Be absolutely sure not to touch the charging part when the relay is on. Doing so may cause electrical shock. Be sure to turn off the power when installing, maintaining and troubleshooting the relay (including connecting parts such as the terminal block and socket).

• Perform terminal connections correctly after verifying the internal wiring diagrams in the catalog. Connecting incorrectly may cause unexpected malfunction, abnormal heating, and fire, etc.

• Prepare with a redundant safety device construction if there is a possibility that such things as adhesion, contact failure or disconnection could cause bodily harm or property damage.

METHOD OF DETERMINING SPECIFICATIONS

Failsafe

Specification item		Consideration points regarding selection
Coil	a) Rating b) Pick-up voltage (current) c) Drop-out voltage (current) d) Maximum continuous impressed voltage (current) e) Coil resistance f) Impedance g) Temperature rise h) Input frequency for AC type	1) Select relay with consideration for power source ripple. 2) Give sufficient consideration to ambient temperature, for the coil temperature rise and hot start. 3) When used in conjunction with semiconductors, additional attention to the application should be taken.
Contacts	a) Contact arrangement b) Contact rating c) Contact material d) Life e) Contact pressure f) Contact resistance	1) It is desirable to use a standard product with more than the required number of contacts. 2) It is beneficial to have the relay life balanced with the life of the device it is used in. 3) Is the contact material matched to the type of load? It is necessary to take care particularly with low level usage. 4) The rated life may become reduced when used at high temperatures. Life should be verified in the actual atmosphere used. 5) Depending on the circuit, the relay drive may synchronize with the AC load. As this will cause a drastic shortening of life should be verified with the actual machine.
Operate time	a) Operate time b) Release time c) Bounce time d) Switching frequency	1) It is beneficial to make the bounce time short for sound circuits and similar applications.
Mechanical characteristics	a) Vibration resistance b) Shock resistance c) Ambient temperature d) Life	1) Give consideration to performance under vibration and shock in the use location. 2) In particular, when used in high temperature applications, relay with class B or class F coil insulation may be required.
Other items	a) Mounting method b) Cover c) Size	1) Selection can be made for connection method with plug-in type, printed circuit board type, soldering, tab terminals, and screw fastening type. 2) For use in an adverse atmosphere, sealed construction type should be selected. 3) Are there any special conditions?

BASICS ON RELAY HANDLING

• To maintain initial performance, care should be taken to avoid dropping or hitting the relay.
• Under normal use, the relay is designed so that the case will not detach. To maintain initial performance, the case should not be removed. Relay characteristics cannot be guaranteed if the case is removed.
• Use of the relay in an atmosphere at standard temperature and humidity with minimal amounts of dust, SO_2, H_2S, or organic gases is recommended.
• Please avoid the use of silicon-based resins near the relay, because doing so may result in contact failure. (This applies to plastic sealed type relays, too.)
• Care should be taken to observe correct coil polarity (+, –) for polarized relays.
• Proper usage requires that the rated voltage be impressed on the coil. Use rectangular waves for DC coils and sine waves for AC coils.
• Be sure the coil impressed voltage does not continuously exceed the maximum allowable voltage.
• Absolutely avoid using switching voltages and currents that exceed the designated values.
• The rated switching power and life are given only as guides. The physical phenomena at the contacts and contact life greatly vary depending on the type of load and the operating conditions. Therefore, be sure to carefully check the type of load and operating conditions before use.
• Do not exceed the usable ambient temperature values listed in the catalog.
• Use the flux-resistant type or sealed type if automatic soldering is to be used.
• Use alcohol based cleaning solvents when cleaning is to be performed using a sealed type relay.
• Avoid ultrasonic cleaning of all types of relays.
• Avoid bending terminals, because it may cause malfunction.
• As a guide, use a Faston mounting pressure of 40 to 70N {4 to 7kgf} for relays with tab terminals.
• For proper use, read the main text for details.

PROBLEM POINTS WITH REGARD TO USE

In the actual use of relays, various ambient conditions are encountered, and because unforeseen events occur which can not be thought of on the drawing board, with regard to such conditions, tests are necessary under the possible range of operation. For example, consideration must always be given to variation of performance when relay characteristics are being reviewed. The relay is a mass production item, and as a matter of principle, it must be recognized that the relay is to be used to the extent of such variations without the need for adjustment.

RELAY COIL

• AC operation type

For the operation of AC relays, the power source is almost always a commercial frequency (50 or 60Hz) with standard voltages of 6, 12, 24, 48, 115, and 240V AC. Because of this, when the voltage is other than the standard voltage, the product is a special order item, and the factors of price, delivery, and stability of characteristics may create inconveniences. To the extent that it is possible, the standard voltages should be selected.

Also, in the AC type, shading coil resistance loss, magnetic circuit eddy current loss, and hysteresis loss exit, and because of lower coil efficiency, it is normal for the temperature rise to be greater than that for the DC type. Furthermore, because humming occurs when below the pick-up voltage and when above the rated voltage, care is required with regard to power source voltage fluctuations.

For example, in the case of motor starting, if the power source voltage drops, and during the humming of the relay, if it reverts to the restored condition, the contacts suffer a burn damage and welding, with the occurrence of a false operation self-maintaining condition.

For the AC type, there is an inrush current during the operation time (for the separated condition of the armature, the impedance is low and a current greater than rated current flows; for the adhered condition of the armature, the impedance is high and the rated value of current flows), and because of this, for the case of several relays being used in parallel connection, it is necessary to give consideration to power consumption.

• DC operation type

For the operation of DC relays, standards exist for power source voltage and current, with DC voltage standards set at 5, 6, 12, 24, 48, and 100V, but with regard to current, the values as expressed in catalogs in milliamperes of pick-up current.

However, because this value of pick-up current is nothing more than a guarantee of just barely moving the armature, the variation in energizing voltage and resistance values, and the increase in coil resistance due to temperature rise, must be given consideration for the worst possible condition of relay operation, making it necessary to consider the current value as 1.5 to 2 times the pick-up current. Also, because of the extensive use of relays as limit devices in place of meters for both voltage and current, and because of the gradual increase or decrease of current impressed on the coil causing possible delay in movement of the contacts, there is the possibility that the designated control capacity may not be satisfied. Thus it is necessary to exercise care. The DC type relay coil resistance varies due to ambient temperature as well as to its own heat generation to the extent of about 0.4%/°C, and accordingly, if the temperature increases, because of the increase in pic k-up and drop-out voltages, care is required.

• Energizing voltage of AC coil

In order to have stable operation of the relay, the energizing voltage should be basically within the range of +10%/-15% of the rated voltage. However, it is necessary that the waveform of the voltage impressed on the coil be a sine wave. There is no problem if the power source is commercially provided power, but when a stabilized AC power source is used, there is a waveform distortion due to that equipment, and there is the possibility of abnormal overheating. By means of a shading coil for the AC coil, humming is stopped, but with a distorted waveform, that function is not displayed. Fig. 1 below shows an example of waveform distortion.

If the power source for the relay operating circuit is connected to the same line as motors, solenoids, transformers, and other loads, when these loads operate, the line voltage drops, and because of this the relay contacts suffer the effect of vibration and subsequent burn damage. In particular, if a small type transformer is used and its capacity has no margin of safety, when there is long wiring, or in the case of household used or small sales shop use where the wiring is slender, it is necessary to take precautions because of the normal voltage fluctuations combined with these other factors. When trouble develops, a survey of the voltage situation should be made using a synchroscope or similar means, and the necessary counter-measures should be taken, and together with this determine whether a special relay with suitable excitation characteristics should be used, or make a change in the DC circuit as shown in Fig. 2 in which a capacitor is inserted to absorb the voltage fluctuations.

In particular, when a magnetic switch is being used, because the load becomes like that of a motor, depending upon the application, separation of the operating circuit and power circuit should be tried and investigated.

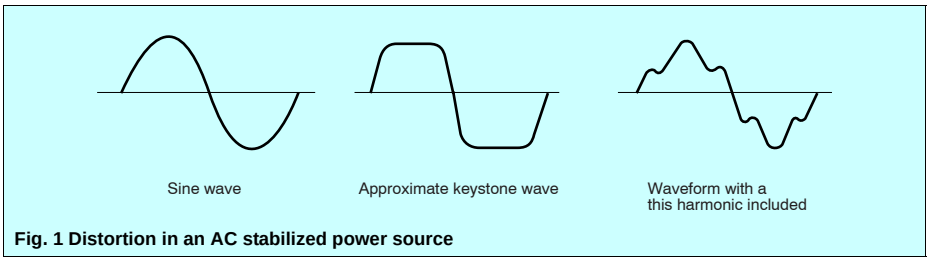


Fig. 1 Distortion in an AC stabilized power source

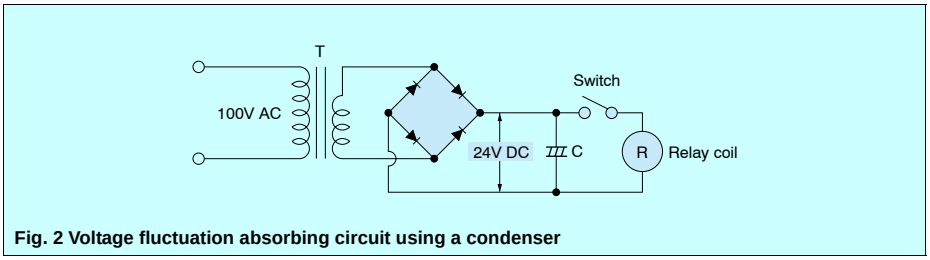


Fig. 2 Voltage fluctuation absorbing circuit using a condenser

• Power source for DC input

As a power source for the DC type relay, a battery or either a half wave or full wave rectifier circuit with a smoothing capacitor is used. The characteristics with regard to the excitation voltage of the relay will change depending upon the type of power source, and because of this, in order to display stable characteristics, the most desirable method is perfect DC.

In the case of ripple included in the DC power source, particularly in the case of half wave rectifier circuit with a smoothing capacitor, if the capacity of the capacitor is too small, due to the influence of the ripple, humming develops and an unsatisfactory condition is produced.

With the actual circuit to be used, it is absolutely necessary to confirm the characteristics. (Fig. 3)

With regard to our T-Series (TQ, TN, TK, TX, TX-D, TQ-SMD) and SEB relays, it is necessary to give consideration to the use of a power source with less than a 5% ripple, but for the J series, NC relays, there is no hindrance to the operation. However, the pull-up force becomes somewhat weakened, and it is necessary to take care since the resistance to vibration and shock is reduced. Also ordinarily the following must be given thought.

[1] It is desirable to have less than a 5% ripple for the reed type relay.

[2] For the hinge type relay, a half wave rectifier cannot be used, alone unless you use a smoothing capacitor. The ripple and the characteristics must be evaluated for proper usage.

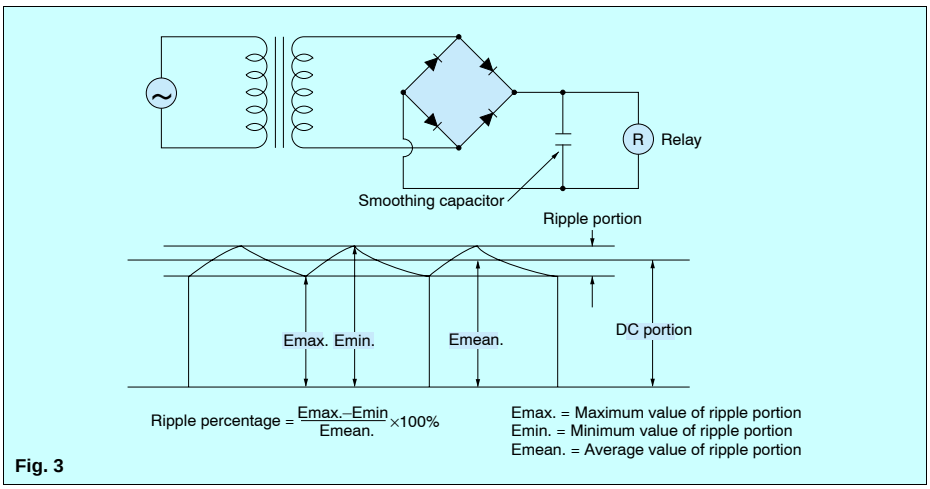


Fig. 3

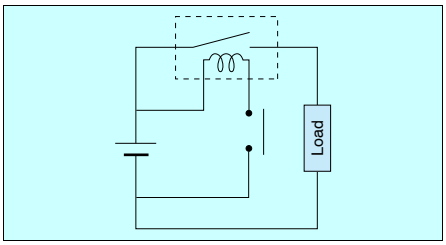
[3] For the hinge type relay, there are certain applications that may or maynot use the full wave rectifier on it's own. Please check specifications with the original manufacture.

Shown on the right, is a circuit driven by the same power supply (battery, etc.) for both the coil and contact.

[4] Coil applied voltage and the drop in voltage.

Please verify that the actual voltage is applied to the coil at the actual load.

Electrical life will be affected by the drop in voltage in the coil when load is turned on.



• Coil temperature rise

In addition to being a requirement for relay operation stability, the maximum continuous impressed coil voltage is an important constraint for the prevention of such problems as thermal deterioration or deformity of the insulation material, or the occurrence of fire hazards.

In actual use with E-type insulation, when the ambient temperature is 40°C 104°F, a temperature rise limit of 80°C 176°F is thought to be reasonable according to the resistance method. However, when complying with the Electrical Appliance and Material Safety Law, this becomes 75°C 167°F.

• Temperature rise due to pulse voltage

When a pulse voltage with ON time of less than 2 minutes is used, the coil temperature rise bares no relationship to the ON time. This varies with the ratio of ON time to OFF time, and compared with continuous current passage, it is rather small. The various relays are essentially the same in this respect. (Fig. 4)

Current passage time	%
For continuous passage	Temperature rise value is 100%
ON : OFF = 3 : 1	About 80%
ON : OFF = 1 : 1	About 50%
ON : OFF = 1 : 3	About 35%

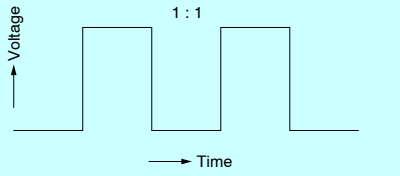


Fig. 4

• Pick-up voltage change due to coil temperature rise (hot start)

In DC relays, after continuous passage of current in the coil, if the current is turned OFF, then immediately turned ON again, due to the temperature rise in the coil, the pick-up voltage will become somewhat higher. Also, it will be the same as using it in a higher temperature atmosphere. The resistance/temperature relationship for copper wire is about 0.4% for 1°C, and with this ratio the coil resistance increases. That is, in order to operate of the relay, it is necessary that the voltage be higher than the pick-up voltage and the pick-up voltage rises in accordance with the increase in the resistance value. However, for some polarized relays, this rate of change is considerably smaller.

• Operate time

In the case of AC operation, there is extensive variation in operate time depending upon the point in the phase at which the switch is turned ON for coil excitation, and it is expressed as a certain range, but for miniature types it is for the most part 1/2 cycle (about 10ms). However, for the somewhat large type relay where bounce is large, the operate time is 7 to 16ms, with release time in the order of 9 to 18ms Also, in the case of DC operation, to the extent of large coil input, the operating time is rapid, but if it is too rapid, the “A” contact bounce time is extended.

• Stray circuits (bypass circuits)

In the case of sequence circuit construction, because of bypass flow or alternate routing, it is necessary to take care not to have erroneous operation or abnormal operation. To understand this condition while preparing sequence circuits, as shown in Fig. 5, with 2 lines written as the power source lines, the upper line is always ⊕ and the lower line ⊖ (when the circuit is AC, the same thinking applies). Accordingly the ⊕ side is necessarily the side for making contact connections (contacts for relays, timers, limit switches, etc.), and the ⊖ side is the load circuit side (relay coil, timer coil, magnet coil, solenoid coil, motor, lamp, etc.).

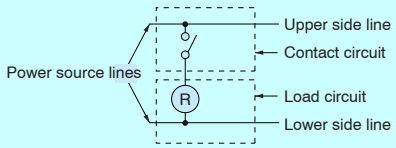


Fig. 5 Example of a vertically written sequence circuit

Fig. 6 shows an example of stray circuits. In Fig. 6 (a), with contacts A, B, and C closed, after relays R_1, R_2, and R_3 operate, if contacts B and C open, there is a series circuit through A, R_1, R_2, and R_3, and the relays will hum and sometimes not be restored to the drop out condition.

The connections shown in Fig. 6 (b) are correctly made. In addition, with regard to the DC circuit, because it is simple by means of a diode to prevent stray circuits, proper application should be made.

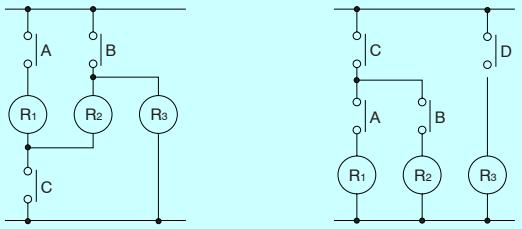


Fig. 6 Stray circuits

• Gradual increase of coil impressed voltage and suicide circuit

When the voltage impressed on the coil is increased slowly, the relay transferring operation is unstable, the contact pressure drops, contact bounce increases, and an unstable condition of contact occurs. This method of applying voltage to the coil should not be used, and consideration should be given to the method of impressing voltage on the coil (use of switching circuit). Also, in the case of latching relays, using self contacts "B," the method of self coil circuit for complete interruption is used, but because of the possibility of trouble developing, care should be taken.

The circuit shown in Fig. 7 causes a timing and sequential operation using a reed type relay, but this is not a good example with mixture of gradual increase of impressed voltage for the coil and a sucide circuit. In the timing portion for relay R_1, when the timing times out, chattering occurs causing trouble. In the initial test (trial production), it shows favorable operation, but as the number of operations increases, contact blackening (carbonization) plus the chattering of the relay creates instability in performance.

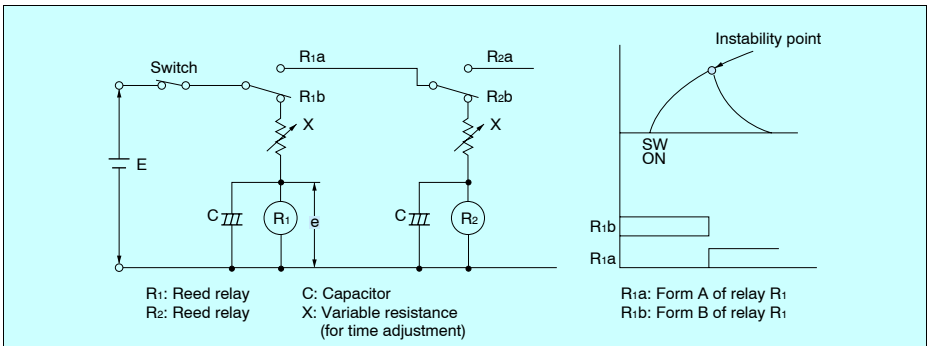


Fig. 7 A timing and sequential operation using a reed type relay

• Phase synchronization in AC load switching

If switching of the relay contacts is synchronized with the phase of the AC power, reduced electrical life, welded contacts, or a locking phenomenon (incomplete release) due to contact material transfer may occur. Therefore, check the relay while it is operating in the actual system. When driving relays with timers, micro computers and thyristors, etc., there may be synchronization with the power supply phase. (Fig. 8)

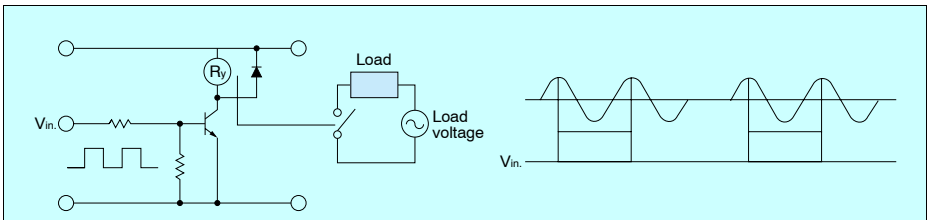


Fig. 8

• Erroneous operation due to inductive interference

For long wire runs, when the line for the control circuit and the line for power line use a single conduit, induction voltage, caused by induction from the power line, will be applied to the operation coil regardless of whether or not the control signal is off. In this case the relay and timer may not revert. Therefore, when wiring spans a long distance please remember that along with inductive interference, connection failure may be caused by a problem with distribution capacity or the device might break down due to the influence of externally caused surges, such as that caused by lightning.

• Long term current carrying

A circuit designed for non-excitation when left running is desirable for circuits (circuits for emergency lamps, alarm devices and error inspection that, for example, revert only during malfunction and output warnings with form B contacts) that will be carrying a current continuously for long periods without relay switching operation.

Continuous, long-term current to the coil will facilitate deterioration of coil insulation and characteristics due to heating of the coil itself.

For circuits such as these, please use a magnetic-hold type latching relay. If you must use a single stable relay, use a sealed type relay that is not easily affected by ambient conditions and provide a failsafe circuit design that considers the possibility of contact failure or disconnection.

• Usage with infrequent switching

Please carry out periodic contact conductivity inspections when the frequency of switching is once or fewer times per month. When no switching of the contacts occurs for long periods, organic membrane may form on the contact surfaces and lead to contact instability.

• Regarding electrolytic corrosion of coils

In the case of comparatively high voltage coil circuits (in particular above 48 V DC), when such relays are used in high temperature and high humidity atmospheres or with continuous passage of current, the corrosion can be said to be the result of the occurrence of electrolytic corrosion. Because of the possibility of open circuits occurring, attention should be given to the following points.

[1] The ⊕ side of the power source should be connected to the chassis. (Refer to Fig. 9) (Common to all relays)

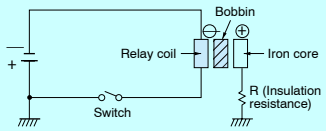
[2] In the case where unavoidably the ⊖ side is grounded, or in the case where grounding is not possible.
(1) Insert the contacts (or switch) in the ⊕ side of the power source, and connect the start of the coil winding the ⊖ side. (Refer to Fig. 10) (Common to all relays)
(2) When a grounding is not required, connect the ground terminal to the ⊕ side of the coil. (Refer to Fig. 11) (NF and NR with ground terminal)

[3] When the ⊖ side of the power source is grounded, always avoid interting the contacts (and switches) in the ⊖ side. (Refer to Fig. 12) (Common to all relays)

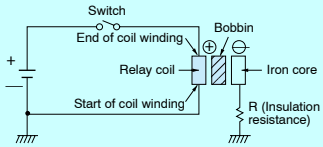
[4] In the case of relays provided with a ground terminal, when the ground terminal is not considered effective, not making a connection to ground plays an important role as a method for preventing electrolytic corrosion.

Note: The designation on the drawing indicates the insertion of insulation between the iron core and the chassis. In relays where a ground terminal is provided, the iron core can be grounded directly to the chassis, but in consideration of electrolytic corrosion, it is more expedient not to make the connection.

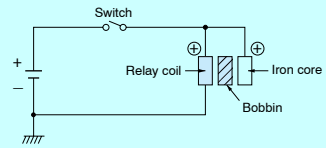
Judgement: Good (Fig. 9)



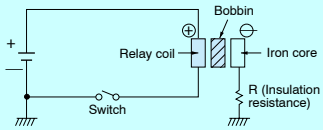
Judgement: Good (Fig. 10)



Judgement: Good (Fig. 11)



Judgement: No good (Fig. 12)



CONTACT

The contacts are the most important elements of relay construction. Contact performance conspicuously influenced by contact material, and voltage and current values applied to the contacts (in particular, the voltage and current waveforms at the time of application and release), the type of load, frequency of switching, ambient atmosphere, form of contact, contact switching speed, and of bounce.

Because of contact transfer, welding, abnormal wear, increase in contact resistance, and the various other damages which bring about unsuitable operation, the following items require full investigation.

*We recommend that you verify with one of our sales offices.

1. Contact circuit voltage, current, and load

[Voltage, AC and DC]

When there is inductance included in the circuit, a rather high counter emf is generated as a contact circuit voltage, and since, to the extent of the value of that voltage, the energy applied to the contacts causes damage with consequent wear of the contacts, and transfer of the contacts, it is necessary to exercise care with regard to control capacity. In the case of DC, there is no zero current point such as there is with AC, and accordingly, once a cathode arc has been generated, because it is difficult to quench that arc, the extended time of the arc is a major cause. In addition, due to the direction of the current being fixed, the phenomenon of contact shift, as noted separately below, occurs in relation to the contact wear. Ordinarily, the approximate control capacity is mentioned in catalogs or similar data sheets, but this alone is not sufficient. With special contact circuits, for the individual case, the maker either estimates from the past experience or makes test on each occasion. Also, in catalogs and similar data sheets, the control capacity that is mentioned is limited to resistive load, but there is a broad meaning indicated for that class of relay, and ordinarily it is proper to think of current capacity as that for 125V AC circuits.

Minimum applicable loads are given in the catalog; however, these are only provided as a guide to the lower limit that the relay is able to switch and are not guaranteed values. The level of reliability of these values depends on switching frequency, ambient conditions, change in the desired contact resistance, and the absolute value. Please use relays with AgPd contacts when minute analog load control or contact resistance no higher than 100 mΩ is desired (for measurement and wireless applications, etc.).

[Current]

The current at both the closing and opening time of the contact circuit exerts important influence. For example, when the load is either a motor or a lamp, to the extent of the inrush current at the time of closing the circuit, wear of the contacts, and the amount of contact transfer increase, and contact welding and contact transfer make contact separation impossible.

2. Characteristics of Common Contact Materials

Characteristics of contact materials are given below. Refer to them when selecting a relay.

Contact Material	Ag (silver)	Electrical conductivity and thermal conductivity are the highest of all metals. Exhibits low contact resistance, is inexpensive and widely used. A disadvantage is it easily develops a sulfide film in a sulfide atmosphere. Care is required at low voltage and low current levels.
	AgCd (silver-cadmium)	Exhibits the conductivity and low contact resistance of silver as well as excellent resistance to welding. Like silver, it easily develops a sulfide film in a sulfide atmosphere.
	AgW (silver-tungsten)	Hardness and melting point are high, arc resistance is excellent, and it is highly resistant to material transfer. However, high contact pressure is required. Furthermore, contact resistance is relatively high and resistance to corrosion is poor. Also, there are constraints on processing and mounting to contact springs.
	AgNi (silver-nickel)	Equals the electrical conductivity of silver. Excellent arc resistance.
	AgPd (silver-palladium)	At standard temperature, good corrosion resistance and good sulfidation resistance. However, in dry circuits, organic gases adhere and it easily develops a polymer. Gold clad is used to prevent polymer buildup. Expensive.
Surface Finish	Rh plating (rhodium)	Combines perfect corrosion resistance and hardness. As plated contacts, used for relatively light loads. In an organic gas atmosphere, care is required as polymers may develop. Therefore, it is used in hermetic seal relays (reed relays, etc.) . Expensive.
	Au clad (gold clad)	Au with its excellent corrosion resistance is pressure welded onto a base metal. Special characteristics are uniform thickness and the nonexistence of pinholes. Greatly effective especially for low level loads under relatively adverse atmospheres. Often difficult to implement clad contacts in existing relays due to design and installation.
	Au plating (gold plating)	Similar effect to Au cladding. Depending on the plating process used, supervision is important as there is the possibility of pinholes and cracks. Relatively easy to implement gold plating in existing relays.
	Au flash plating (gold thin-film plating)	Purpose is to protect the contact base metal during storage of the switch or device with built-in switch. However, a certain degree of contact stability can be obtained even when switching loads.

3. Contact Protection

• Counter EMF

When switching inductive loads with a DC relay such as relay sequence circuits, DC motors, DC clutches, and DC solenoids, it is always important to absorb surges (e.g. with a diode) to protect the contacts.

When these inductive loads are switched off, a counter emf of several hundred to several thousand volts develops which can severely damage contacts and greatly shorten life. If the current in these loads is relatively small at around 1A or less, the counter emf will cause the ignition of a glow or arc discharge. The discharge decomposes organic matter contained in the air and causes black deposits (oxides, carbides) to develop on the contacts. This may result in contact failure.

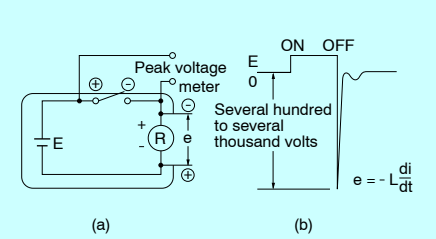


Fig. 13

In Fig. 13 (a), an emf (e = –L di/dt) with a steep waveform is generated across the coil with the polarity shown in Fig. 13 (b) at the instant the inductive load is switched off. The counter emf passes through the power supply line and reaches both contacts.

Generally, the critical dielectric breakdown voltage at standard temperature and pressure in air is about 200 to 300 volts. Therefore, if the counter emf exceeds this, discharge occurs at the contacts to dissipate the energy ($^1/_2Li^2$) stored in the coil. For this reason, it is desirable to absorb the counter emf so that it is 200V or less.

• Material Transfer Phenomenon

Material transfer of contacts occurs when one contact melts or boils and the contact material transfers to the other contact. As the number of switching operations increases, uneven contact surfaces develop such as those shown in Fig. 14. After a while, the uneven contacts lock as if they were welded together. This often occurs in circuits where sparks are produced at the moment the contacts “make” such as when the DC current is large for DC inductive or capacitive loads or when the inrush current is large (several amperes or several tens of amperes).

Contact protection circuits and contact materials resistant to material transfer such as AgSnO, AgW or AgCu are used as countermeasures. Generally, a concave formation appears on the cathode and a convex formation appears on the anode. For DC capacitive loads (several amperes to several tens of amperes), it is always necessary to conduct actual confirmation tests.

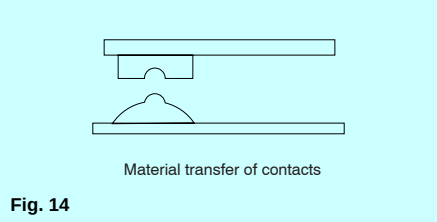
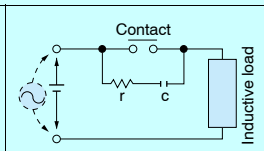
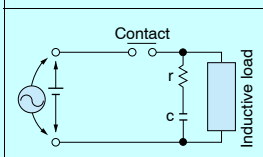
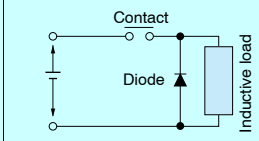
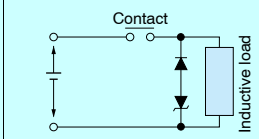
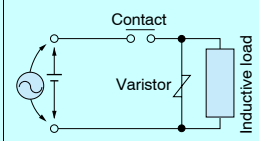


Fig. 14

• Contact Protection Circuit

Use of contact protective devices or protection circuits can suppress the counter emf to a low level. However, note that incorrect use will result in an adverse effect. Typical contact protection circuits are given in the table below.

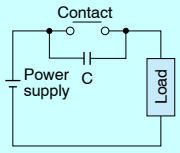
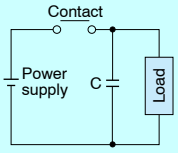
(G: Good NG: No Good)

Circuit		Application AC	Application DC	Features/Others	Devices Selection
CR circuit		*	G	If the load is a timer, leakage current flows through the CR circuit causing faulty operation. * If used with AC voltage, be sure the impedance of the load is sufficiently smaller than that of the CR circuit	As a guide in selecting r and c, r: 0.5 to 1Ω per 1V contact voltage c: 0.5 to 1μF per 1A contact current Values vary depending on the properties of the load and variations in relay characteristics. Capacitor c acts to suppress the discharge the moment the contacts open. Resistor r acts to limit the current when the power is turned on the next time. Test to confirm. Use a capacitor with a breakdown voltage of 200 to 300V. Use AC type capacitors (non-polarized) for AC circuits.
		G	G	If the load is a relay or solenoid, the release time lengthens. Effective when connected to both contacts if the power supply voltage is 24 or 48V and the voltage across the load is 100 to 200V.	
Diode circuit		NG	G	The diode connected in parallel causes the energy stored in the coil to flow to the coil in the form of current and dissipates it as joule heat at the resistance component of the inductive load. This circuit further delays the release time compared to the CR circuit. (2 to 5 times the release time listed in the catalog)	Use a diode with a reverse breakdown voltage at least 10 times the circuit voltage and a forward current at least as large as the load current. In electronic circuits where the circuit voltages are not so high, a diode can be used with a reverse breakdown voltage of about 2 to 3 times the power supply voltage.
Diode and zener diode circuit		NG	G	Effective when the release time in the diode circuit is too long.	Use a zener diode with a zener voltage about the same as the power supply voltage.
Varistor circuit		G	G	Using the stable voltage characteristics of the varistor, this circuit prevents excessively high voltages from being applied across the contacts. This circuit also slightly delays the release time. Effective when connected to both contacts if the power supply voltage is 24 or 48V and the voltage across the load is 100 to 200V.	—

• Avoid using the protection circuits shown in the figures below.

Although DC inductive loads are usually more difficult to switch than resistive loads, use of the proper protection circuit will raise the characteristics to that for resistive loads. (Fig. 15)

Fig. 15

No good 	No good 
Although extremely effective in arc suppression as the contacts open, the contacts are susceptible to welding since energy is stored in C when the contacts open and discharge current flows from C when the contacts close.	Although extremely effective in arc suppression as the contacts open, the contacts are susceptible to welding since charging current flows to C when the contacts close.

• Mounting the Protective Device
In the actual circuit, it is necessary to locate the protective device (diode, resistor, capacitor, varistor, etc.) in the immediate vicinity of the load or contact. If located too far away, the effectiveness of the protective device may diminish. As a guide, the distance should be within 50cm.

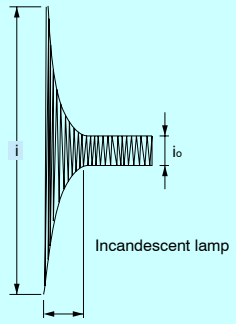
• Abnormal Corrosion during High Frequency Switching of DC Loads (spark generation)
If, for example, a DC valve or clutch is switched at a high frequency, blue-green rust may develop. This occurs from the reaction of nitrogen and oxygen in the air when sparks (arc discharge) are generated during switching.

• Type of Load and Inrush Current
The type of load and its inrush current characteristics, together with the switching frequency, are important factors which cause contact welding. Particularly for loads with inrush currents, measure the steady state and inrush current.
Then select a relay which provides an ample margin of safety. The table on the right shows the relationship between typical loads and their inrush currents. Also, verify the actual polarity used since, depending on the relay, electrical life is affected by the polarity of COM and NO.

Type of load	Inrush current
Resistive load	Steady state current
Solenoid load	10 to 20 times the steady state current
Motor load	5 to 10 times the steady state current
Incandescent lamp load	10 to 15 times the steady state current
Mercury lamp load	Approx. 3 times the steady state current
Sodium vapor lamp load	1 to 3 times the steady state current
Capacitive load	20 to 40 times the steady state current
Transformer load	5 to 15 times the steady state current

Load Inrush Current Wave and Time

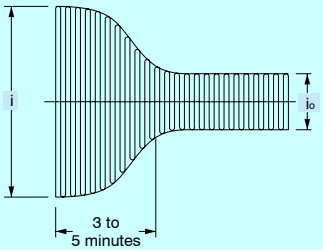
(1) Incandescent Lamp Load



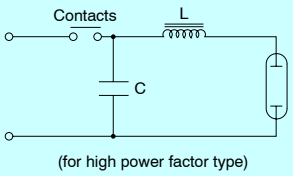
Approx. 1/3 second

Inrush current/rated current
=i/io = 10 to 15 times

(2) Mercury Lamp Load
i/io ≅ 3 times

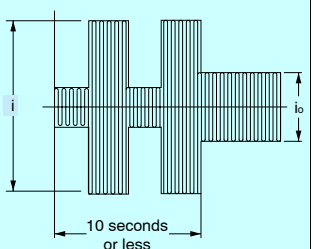


The discharge tube, transformer, choke coil, capacitor, etc., are combined in common discharge lamp circuits. Note that the inrush current may be 20 to 40 times, especially if the power supply impedance is low in the high power factor type.

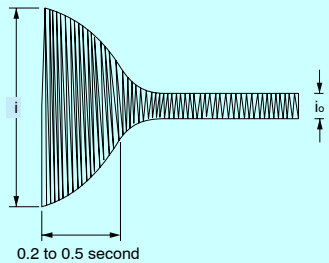


(for high power factor type)

(3) Fluorescent Lamp Load
i/io ≅ 5 to 10 times



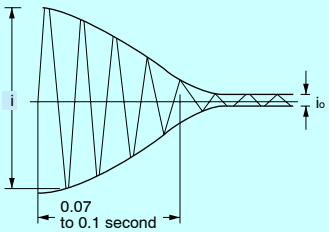
(4) Motor Load i/io ≅ 5 to 10 times



0.2 to 0.5 second

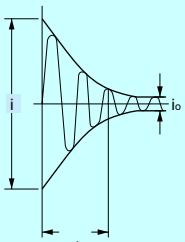
Conditions become more harsh if plugging or inchings performed since state transitions are repeated. When using a relay to control a DC motor and brake, the on time surge current, normal current and off time brake current differ depending on whether the load to the motor is free or locked. In particular, with non-polarized relays, when using from b contact of from contact for the DC motor brake, mechanical life might be affected by the brake current. Therefore, please verify current at the actual load.

(5) Solenoid Load
i/io ≅ 10 to 20 times



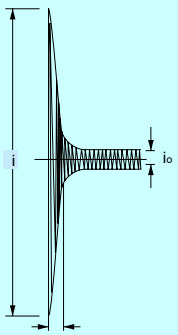
Note that since inductance is great, the arc lasts longer when power is cut. The contact may become easily worn.

(6) Electromagnetic Contact Load
i/io ≅ 3 to 10 times



1 to 2 cycles
(1/60 to 1/30 seconds)

(7) Capacitive Load
i/io ≅ 20 to 40 times



1/2 to 2 cycles (1/120 to 1/30 seconds)

• When Using Long Wires

If long wires (100 to 300m) are to be used in a relay contact circuit, inrush current may become a problem due to the stray capacitance existing between wires. Add a resistor (approx. 10 to 50Ω) in series with the contacts. (Fig. 16)

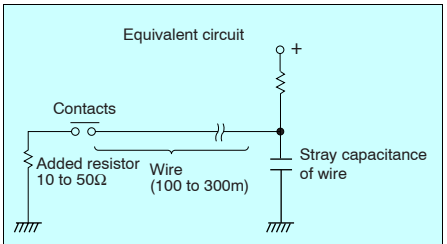


Fig. 16

• Electrical life at high temperatures

Verify at the actual use condition since electrical life may be affected by use at high temperatures.

• Phase Synchronization in Switching AC Loads

If switching of the relay contacts is synchronized with the phase of the AC power, reduced electrical life, welded contacts, or a locking phenomenon (incomplete release) due to contact material transfer may occur. Therefore, check the relay while it is operating in the actual system. However, if problems develop, control the relay using an appropriate phase. (Fig. 17)

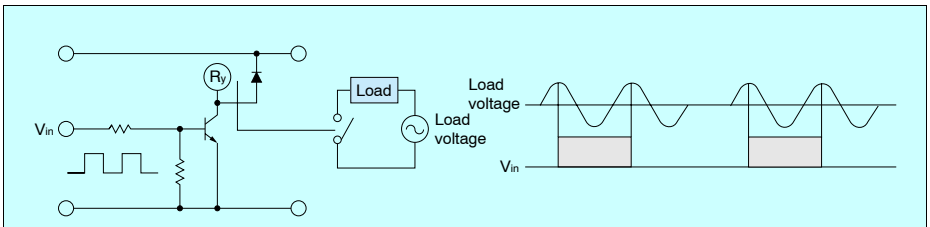


Fig. 17

4. Cautions on Use Related to Contacts

• Connection of load and contacts

Connect the load to one side of the power supply as shown in Fig. 18 (a). Connect the contacts to the other side. This prevents high voltages from developing between contacts. If contacts are connected to both side of the power supply as shown in Fig. 18 (b), there is a risk of shorting the power supply when relatively close contacts short.

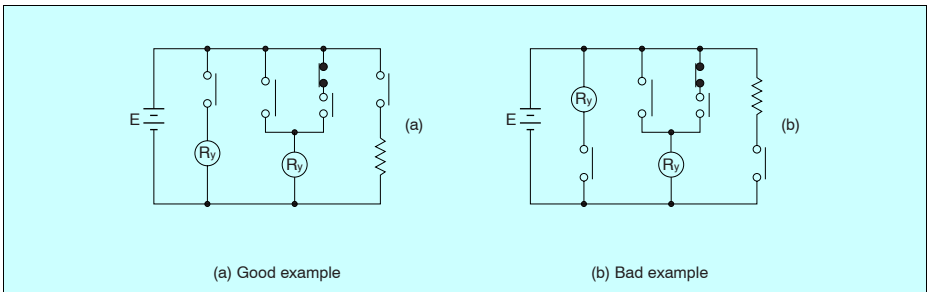


Fig. 18

• Dummy Resistor

Since voltage levels at the contacts used in low current circuits (dry circuits) are low, poor conduction is often the result. One method to increase reliability is to add a dummy resistor in parallel with the load to intentionally raise the load current reaching the contacts.

• Avoid Circuits Where Shorts Occur Between Form A and B Contacts (Fig. 19)

1) The clearance between form A and B contacts in compact control components is small. The occurrence of shorts due to arcing must be assumed.

2) Even if the three N.C., and COM contacts are connected so that they short, a circuit must never be designed to allow the possibility of burning or generating an overcurrent.

3) A forward and reverse motor rotation circuit using switching of form A and B contacts must never be designed.

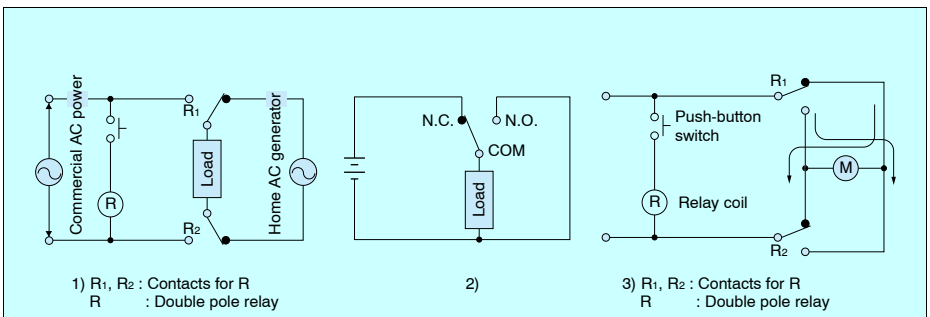


Fig. 19

• Shorts Between Different Electrodes

Although there is a tendency to select miniature control components because of the trend toward miniaturizing electrical control units, care must be taken when selecting the type of relay in circuits where different voltages are applied between electrodes in a multi-pole relay, especially when switching two different power supply circuits. This is not a problem that can be determined from sequence circuit diagrams. The construction of the control component itself must be examined and sufficient margin of safety must be provided especially in creepage between electrodes, space distance, presence of barrier, etc.

LATCHING RELAYS

• Latching relays are shipped from the factory in the reset state. A shock to the relay during shipping or installation may cause it to change to the set state. Therefore, it is recommended that the relay be used in a circuit which initializes the relay to the required state (set or reset) whenever the power is turned on.
• Avoid impressing voltages to the set coil and reset coil at the same time.
• Connect a diode as shown since latching may be compromised when the relay is used in the following circuits.
If set coils or reset coils are to be connected together in parallel, connect a diode in series to each coil. Fig. 20 (a), Fig. 20 (b) Also, if the set coil of a relay and the reset coil of another relay are connected in parallel, connect a diode to the coils in series. Fig. 20 (c)
If the set coil or reset coil is to be connected in parallel with an inductive load (e.g. another electromagnetic relay coil, motor, transformer, etc.), connect a diode to the set coil or reset coil in series. Fig. 20 (d)

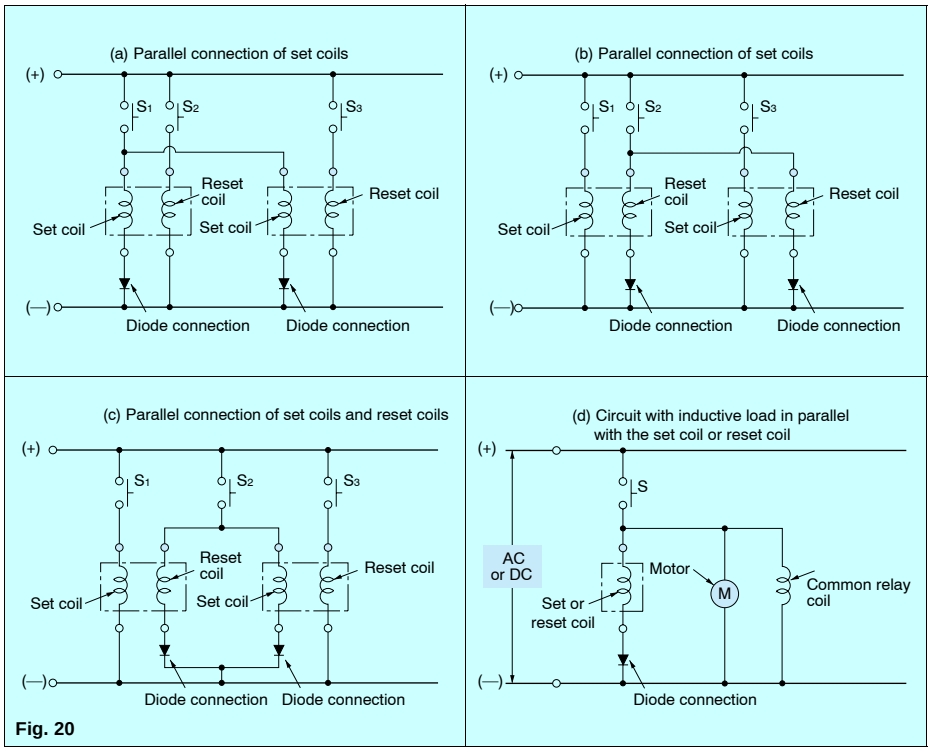


Fig. 20

Use a diode having an ample margin of safety for repeated DC reverse voltage and peak reverse voltage applications and having an average rectified current greater than or equal to the coil current.
• Avoid applications in which conditions include frequent surges to the power supply.
• Avoid using the following circuit since self-excitation at the contacts will inhibit the normal keep state. (Fig. 21)

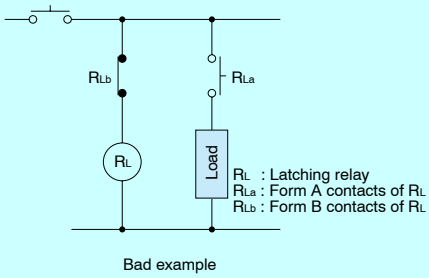


Fig. 21

• Four-Terminal Latching Relay
In the 2 coil latching type circuit in Fig. 22, one terminal at one end of the set coil and one terminal at one end of the reset coil are connected in common and voltages of the same polarity are applied to the other side for the set and reset operations. In this type of circuit, short 2 terminals of the relay as noted in the next table. This helps to keep the insulation high between the two winding.

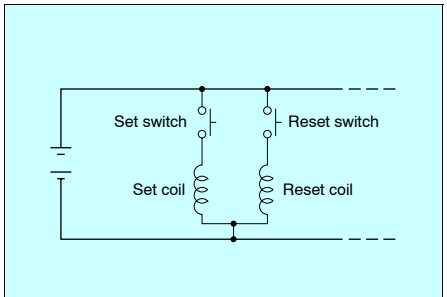


Fig. 22

Relay Type		Terminal Nos.
DS	1c	—
	2c	15 & 16
	4c	*
NC	Flat	5 & 6
	Slim	3 & 4
ST		*
SP		2 & 4
DE		1 & 2
JH		6 & 8

Notes: 1. *DS4c and ST relays are constructed so that the set coil and reset coil are separated for high insulation resistance.
2. DSP, TQ, TQ-SMD, TN, TX, and SEB relays are not applicable due to polarity.

• Two Coil Latch Induction Voltage
Each coil in a 2-coil latch relay is wound with a set coil and a reset coil on the same iron cores. Accordingly, induction voltage is generated on the reverse side coil when voltage is applied and shut off to each coil. Although the amount of induction voltage is about the same as the rated relay voltage, you must be careful of the reverse bias voltage when driving transistors.

AMBIENT ENVIRONMENT

1. Ambient Temperature and Atmosphere

Be sure the ambient temperature at the installation does not exceed the value listed in the catalog. Furthermore, environmentally sealed types (plastic sealed type, metallic hermetic seal type) should be considered for applications in an atmosphere with dust, sulfur gases (SO_2, H_2S), or organic gases.

2. Silicon Atmosphere

Please use something other than silicon based materials (silicon rubber, silicon oil, silicon-based coatings, and silicon bulking agents, etc.) in the vicinity of the relay since their use will generate volatile gas. When contacts are switched in such an environment, silicon may adhere to the contacts and lead to contact failure (in plastic seal types, too).

3. NOx Generation

When a plastic sealed type relay is used in an atmosphere high in humidity to switch a load which easily produces an arc, the NOx created by the arc and the water absorbed from outside the relay combine to produce nitric acid. This corrodes the internal metal parts and adversely affects operation.

Avoid use at an ambient humidity of 85%RH or higher (at 20°C 68°F). If use at high humidity is unavoidable, consult us.

4. Vibration and Shock

If a relay and magnetic switch are mounted next to each other on a single plate, the relay contacts may separate momentarily from the shock produced when the magnetic switch is operated and result in faulty operation.

Countermeasures include mounting them on separate plates, using a rubber sheet to absorb the shock, and changing the direction of the shock to a perpendicular angle.

5. Influence of External Magnetic Fields

Permanent magnets are used in reed relays and polarized relays (including NR relays), and their movable parts are constructed of ferrous materials. For this reason, when a magnet or permanent magnet in any other large relay, transformer, or speaker is located nearby, the relay characteristics may change and faulty operations may result. The influence depends on the strength of the magnetic field and it should be checked at the installation.

6. Usage, storage, and transport conditions

1) During usage, storage, or transportation, avoid locations subject to direct sunlight and maintain normal temperature, humidity, and pressure conditions.

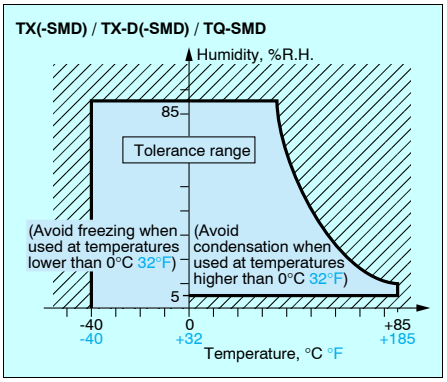
The allowable specifications for environments suitable for usage, storage, and transportation are given below.

• Temperature: The allowable temperature range differs for each relay, so refer to the relay's individual specifications.

In addition, when transporting or storing relays while they are tube packaged, there are cases when the temperature may differ from the allowable range.

In this situation, be sure to consult the individual specifications.

• Humidity: 5 to 85 % R.H.



• Pressure: 86 to 106 kPa

The humidity range varies with the temperature. Use within the range indicated in the graph above.

2) Condensation

Condensation forms when there is a sudden change in temperature under high temperature, high humidity conditions.

Condensation will cause deterioration of the relay insulation.

3) Freezing

Condensation or other moisture may freeze on the relay when the temperatures is lower than 0°C 32°F.

This causes problems such as sticking of movable parts or operational time lags.

4) Low temperature, low humidity environments

The plastic becomes brittle if the relay is exposed to a low temperature, low humidity environment for long periods of time.

• Be aware that plastic may become brittle in low-temperature, low-humidity environments.

When stored in high-temperature, high-humidity environments, and in environments with organic or sulfide gases for long periods of time (including during transport), sulfide or oxide membrane will form on the surfaces of the contacts, which may lead to contact instability or malfunction, as well as functional disorder. Please verify the environment for storing and transporting.

• Packaging should be designed to reduce, as much as possible, the influence of humidity, organic gas and sulfide gas when packaging.

• Since the SMD type is sensitive to humidity it is packaged with tightly sealed anti-humidity packaging. However, when storing, please be careful of the following.

(1) Please use promptly once the anti-humidity pack is opened. (As a guide, use within one week.)

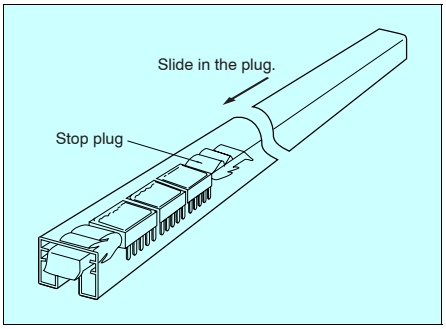
(2) When storing for a long period after opening the anti-humidity pack, storage in a humidity-controlled desicator or in anti-humidity packaging with an anti-humidity bag to which silica gel has been added, is recommended. (As a guide, storage can be for three months.)

7. Vibration, Impact and Pressure when Shipping

When shipping, if strong vibration, impact or heavy weight is applied to a device in which a relay is installed, functional damage may occur. Therefore, please package in a way, using shock absorbing material, etc., so that the allowable range for vibration and impact is not exceeded

HANDLING CAUTIONS FOR TUBE PACKAGING

Some types of relays are supplied in tube packaging. If you remove any relays from the tube packaging, be sure to slide the stop plug at one end to hold the remaining relays firmly together so they would not move in the tube. Failing to do this may lead to the appearance and/or performance being damaged.



ENVIRONMENTALLY SEALED TYPE RELAYS

Sealed type relays are available. They are effective when problems arise during PC board mounting (e.g. automatic soldering and cleaning). They also, of course, feature excellent corrosion resistance. Note the cautions below regarding the features and use of environmentally sealed type relays to avoid problems when using them in applications.

1. Operating Environment

Plastic sealed type relays are not suited for use in environments that especially require air tightness. Although there is no problem if they are used at sea level, avoid atmospheric pressures beyond 96±10kPa. Also avoid using them in an atmosphere containing flammable or explosive gases. Use the metallic hermetic seal types for these applications.

PROCESSING CONSIDERATIONS

1. Handling

State of the art relays are precision mechanical devices and as such are sensitive to abusive handling practices. Every attempt is made during their manufacture to preclude any anomalies. Relays are packed in a variety of ways to best protect them during shipment and subsequent handling. These include the use of “Egg Crate” type inserts which support the relay and prevent damage to the terminals, foam trays which prevent shock damage, and tubes similar to those used by semiconductor manufacturers for machine dispensing and assembly. During incoming inspection and subsequent customer handling operations, care should be taken so as not to degrade the device which has been supplied in prime condition. Some key areas of concern:

(1) Terminals should not be handled in order to prevent contamination of the surface finish. This could lead to solderability problems.

(2) Terminal layout and P.C. board hole pattern should match. Any misalignment caused by mis-registered P.C. board holes can lead to severe stress on the relay, compromising performance and reliability (seal integrity).

(3) The storage temperature specification should be observed.

(4) Relays should be stored and handled in a suitably clean area.

2. Fluxing

Depending upon the type of relay involved, fluxing procedures should be researched carefully. An unsealed relay is prone to internal flux contamination which can compromise contact performance, and ideally should be hand soldered. “Flux-resistant” relays are available which will prevent flux migration through the terminal-header interface. These and “sealed” relays are compatible with mist foam or spray fluxing operations, however “Flux-resistant” types are not totally sealed which precludes washing operations, and makes a non-active flux almost a necessity.

Pre-heating the board assembly prior to soldering “Flux-resistant” types will dry the flux and further help to prevent flux being driven into the relay during the soldering operation.

3. Soldering

As with fluxing, automated soldering processes can, unless controlled carefully, compromise the performance of unsealed relays.

Flux-resistant and sealed types are compatible with mist dip or wave soldering procedures. Some state-of-the-art relays are suitable for various reflow processes, such as I.R. or vapor phase maximum soldering temperatures and times will vary from relay type to relay type, and should not be exceeded. The use of an I.R. reflow process with a relay not specifically designed to withstand the process, will in all probability degrade the relay and cause performance problems. A safe practice would be to review the thermal profile of the process on a case by case basis with your local Matsushita office.

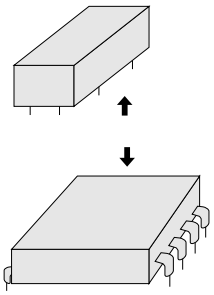
4. Cleaning

Any cleaning process which involves potential contamination of an unsealed relay should be avoided. Sealed devices can be immersion cleaned in a suitable solvent (see solvent compatibility chart). Cleaning in a ultrasonic bath should also be avoided. A harmonic of the bath frequency may be induced in the contacts causing friction welding and subsequent contact sticking. Relays with a removable “vent” tab should be vented after cooling to room temperature following cleaning and drying.

MOUNTING CONSIDERATIONS

• Top View and Bottom View

Relays used for PC boards, especially the flat type relays, have their top or bottom surface indicated in the terminal wiring diagrams.



Relay with terminals viewed from the bottom (terminals cannot be seen from the top)

Relay with terminals viewed from the top (all terminals can be seen from the top)

Note during PC board pattern design (NL, NC)

• Mounting Direction

Mounting direction is important for optimum relay characteristics.

• Shock Resistance

It is ideal to mount the relay so that the movement of the contacts and movable parts is perpendicular to the direction of vibration or shock. Especially note that the vibration and shock resistance of Form B contacts while the coil is not excited is greatly affected by the mounting direction of the relay.

• Contact Reliability

Mounting the relay so the surfaces of its contacts (fixed contacts or movable contacts) are vertical prevents dirt and dust as well as scattered contact material (produced due to large loads from which arcs are generated) and powdered metal from adhering to them.

Furthermore, it is not desirable to switch both a large load and a low level load with a single relay. The scattered contact material produced when switching the large load adheres to the contacts when switching the low level load and may cause contact failure. Therefore, avoid mounting the relay with its low level load contacts located below the large load contacts.

• Adjacent Mounting

When many relays are mounted close together, abnormally high temperatures may result from the combined heat generated. Mount relays with sufficient spacing between them to prevent heat buildup.

This also applies when a large number of boards mounted with relays are installed as in a card rack. Be sure the ambient temperature of the relay does not exceed the value listed in the catalog.

• Influence of Adjacent Mounting of Polarized Relays

When polarized relays are mounted close together, their characteristics change. Since the affect of adjacent mounting differs according to the type of relay, refer to the data for the particular type.

• Panel Mounting

-Do not remove the panel. It has a special function. (It will not come off under normal handling.)

-When installing please use washers to prevent damage and deformation. Please keep the tightening torque to within 0.49 to 68.6 N (5 to 7 kgf). Also, please use a spring washer to prevent it from coming loose.

• Tab Terminals

As a guide, use a quick connect mounting pressure of 40 to 70N {4 to 7 kgf} for relays with tab terminals.

METHOD OF MOUNTING

• The direction of mounting is not specifically designated, but to the extent possible, the direction of contact movement should be such that vibration and shock will not be applied.

When a terminal socket is used

• After drilling the mounting holes, the terminal socket should be mounted making certain the mounting screws are not loose. DIN standard sockets are available for one-touch mounting on DIN rail of 35mm 1.378 inch width.

When reversible terminal sockets are used

• The reversible terminal sockets (HC, HL socket) are for one-touch mounting. (A panel thickness of 1 to 2mm .039 to .079 inch should be used.) (Fig. 23)

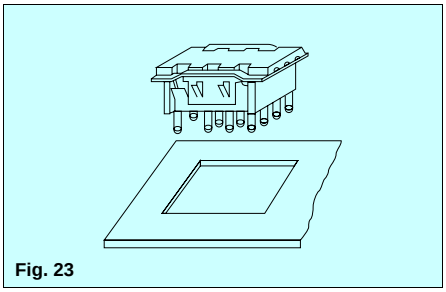


Fig. 23

• The socket should be pushed through the opening in the mounting panel until the projections on the side of the mounting bracket extend out over the back surface. (Fig. 24)

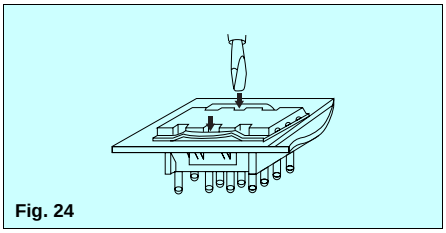


Fig. 24

• When all four of the projections are visible from the back side of the mounting panel, the mounting is completed and the socket is fastened.

• To remove the socket, the projections on the side of the mounting bracket should be pushed inward and at the same time the body of the socket should be pushed lightly from the back side. The socket can then be removed from the panel.

REGARDING CONNECTION OF LEAD WIRES

• When making the connections, depending upon the size of load, the wire cross-section should be at least as large as the values shown in the table below.

Permissible current	Cross-section (mm^2)
2	0.2
3	0.3
5	0.5
7.5	0.75
12.5	1.25
15	2
20	2
30	3.5

• When the terminal board uses screw fastening connections, either pressure terminals or other means should be used to make secure fastening of the wire.
To prevent damage and deformity, please use a torque within the following range when tightening the push screw block of the terminal block.
M4.5 screw:
1.47 to 1.666 N·m (15 to 17 kgf·cm)
M4 screw:
1.176 to 1.37 N·m (12 to 14 kgf·cm)
M3.5 screw:
0.784 to 0.98 N·m (8 to 10 kgf·cm)
M3 screw:
0.49 to 0.69 N·m (5 to 7 kgf·cm)

CAUTIONS FOR USE–Check List

	Check item
Coil Drive Input	1. Is the correct rated voltage applied? 2. Is the applied coil voltage within the allowable continuous voltage limit? 3. Is the ripple in the coil voltage within the allowable level? 4. For voltage applied to a polarized coil, is polarity observed? 5. When hot start is required, is the increase in coil resistance resulting from coil temperature rise taken into account in setting coil voltage? 6. Is the coil voltage free from momentary drop caused by load current? (Pay special attention for self-holding relays.) 7. Is supply voltage fluctuation taken into account when setting the rated coil voltage? 8. The relay status may become unstable if the coil voltage (current) is gradually increased or decreased. Was the relay tested in a real circuit or with a real load? 9. When driving with transistors, did you consider voltage drops?
Load (Relay contacts)	1. Is the load rated within the contact ratings? 2. Does the load exceed the contacts' minimum switching capacity? 3. Special attention is required for contact welding when the load is a lamp, motor, solenoid, or electromagnetic contractor. 4. Was the relay tested with a real load? A DC load may cause contact lock-up due to large contact transfer. Was the relay tested with a real load? 5. For an inductive load, is a surge absorber used across the contacts? 6. When an inductive load causes heavy arc discharge across the relay contacts, the contacts may be corroded by chemical reaction with nitrogen in the atmosphere. Was the relay tested with a real load? 7. Platinum contacts may generate brown powder due to a catalyzer effect or vibration energy. Was the relay tested with a real load? 8. Is the contact switching frequency below the specification? 9. When there are more than two sets of contacts (2T) in a relay, metallic powder shed from one set of contacts may cause a contact failure on the other set (particularly for light loads). Was the relay tested in a real circuit? 10. A delay capacitor used across relay contacts may cause contact welding. Was the relay tested with a real load? 11. For an AC relay, a large contact bounce may cause contact welding. Was the relay tested in a real circuit or with a real load? 12. A high voltage may be induced at transformer load. Was the relay tested with a real load?
Circuit Design	1. Does circuit design take into account electrolytic corrosion of the coil? 2. Are transistors and other circuit components protected rom counter electromotive force that develops across the relay coil? 3. Is the circuit designed so the relay coil is left deenergized while the relay is inactive for long period of time? 4. Is the relay operated within the ratings approved by the relevant international standard (if compliance is required)? 5. Is the circuit protected from malfunction when the relay's activation and/or deactivation time varies considerably? 6. Is the circuit protected from malfunctions that might result from relay contact bounce? 7. Is the circuit protected from malfunction when a high-sensitivity self-holding relay, such as NR type, is to be used? 8. When there are two or more sets of contacts (2T) in a relay, arc discharges from load switching may cause short circuits across the two or more sets of contacts. Is the circuit designed to suppress such arc discharges? 9. Item 8 above also requires special attention when loads are supplied from separate power sources. 10. Does the post-installation insulation distance comply with the requirement of the relevant international standard or the Electrical Appliance and Material Control Law? 11. Is the circuit protected from malfunction when the relay is to be driven by transistors? 12. When the SCR is used for on/off control, the relay activation tends to synchronize with the line frequency, resulting in an extremely shortened life. Was the relay tested in a real circuit or with a real load? 13. Does the PC board design take into account use of on-board relay? 14. RF signals may leak across relay's open contacts. Check for adequate contact isolation and use RF relays as needed.

	Check item
Operating Environment	1. Is the ambient temperature in the allowable operating temperature range? 2. Is relative humidity below 85 percent? 3. Is the operating atmosphere free from organic and sulfide gases? 4. Is the operating atmosphere free from silicon gas? Depending on the load type, silicon gas may cause a black substance to from on the contacts, leading to contact failure. 5. Is the operating atmosphere free from excessive airborne dust? 6. Is the relay protected from oil and water splashes? 7. Is the relay protected from vibration and impact which may cause poor contact with the socket? 8. Is ambient vibration and impact below the level allowable for the relay? 9. Is the relay free from mechanical resonance after it is installed in position? 10. Is insulation coating applied to the relay along with the PC board? Depending on the load type, a black substance may form to cause contact failure.
Installation and Connection	1. Is the relay protected from solder chips and flux when it is manually soldered? 2. Are preparations for flux application and automatic soldering complete? 3. Is the PC board cleaning process designed to minimize adverse affects to the relays? 4. Are adequate separations provided between polarized or reed relays to prevent magnetic coupling? 5. Are the relay terminals free from stress in the socket? 6. Polarized relay's characteristics may be affected by strong external magnetic field. Are the relays installed away from such fields? 7. If very long leads (100 to 300 meters) are used to connect the load, the stray capacity existing across the leads may cause a surge current. Was the relay tested with a real load? 8. Unless otherwise specified, all relay terminals should be soldered at 250°C 482°F within 5 sec. or at 350°C 662°F within 3 sec. 9. A badly warped PC board can cause stress to the relay terminals which may lead to degraded relay characteristics. 10. Glass shot should not be used to clean the PC board of solder flux. This may cause relay malfunction due to glass powder becoming lodged in the relay's internal structure. 11. Relays should always be used with their plastic shields installed, or degraded relay performance may result. 12. Do not cut away any relay terminal as the stress may cause degraded relay performance.
Storage and Transport	1. Is the relay subject to freezing or condensation (especially when shipping)? 2. Is the temperature in the allowable temperature range? 3. Is the humidity in the allowable humidity range? 4. Is the storing atmosphere free from organic and sulfide gases? 5. Is the storing atmosphere free from excessive airborne dust? 6. Is the relay protected from oil and water splashes? 7. Is the relay subject to the application of heavy weight? 8. When shipping does vibration and impact exceed the allowable range?

Reliability

• What is Reliability?

1. Reliability in a Narrow Sense of the Term

In the industrial world, reliability is an index of how long a particular product serves without failure.

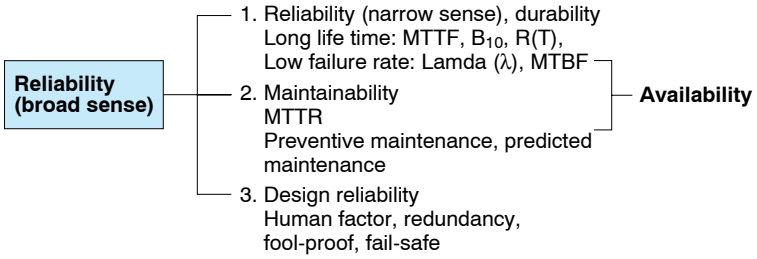
2. Reliability in a Board Sense of the Term

Every product has a finite service lifetime. This means that no product can continue normal service infinitely. When a product has broken down, the user may throw it away or repair it. The reliability of repairable products is recognized as "reliability in a broad sense of the term". For repairable products, their serviceability or maintainability is another problem. In addition, reliability of product design is becoming a serious concern for the manufacturing industry. In short, reliability has three senses: i.e. reliability of the product itself, serviceability of the product, and reliability of product design.

3. Intrinsic Reliability and Reliability of Use

Reliability is "built" into products. This is referred to as intrinsic reliability which consists mainly of reliability in the narrow sense.

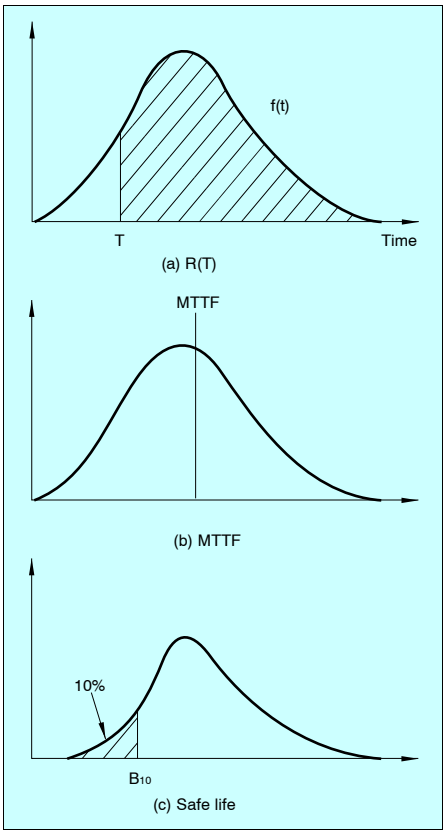
Product reliability at the user's site is called "reliability of use", which consists mainly of reliability in the broad sense. In the relay industry, reliability of use has a significance in aspects of servicing.



• Reliability Measures

The following list contains some of the most popular reliability measures:

Reliability measure	Sample representation
Degree of reliability R(T)	99.9%
MTBF	100 hours
MTTF	100 hours
Failure rate λ	20 fit, 1%/hour
Safe life B_{10}	50 hours



1. Degree of Reliability

Degree of reliability represents percentage ratio of reliability. For example, if none of 10 light bulbs has failed for 100 hours, the degree of reliability defined in, 100 hours of time is 10/10 = 100%. If only three bulbs remained alive, the degree of reliability is 3/10 = 30%.

The JIS Z8115 standard defines the degree of reliability as follows:

The probability at which a system, equipment, or part provides the specified functions over the intended duration under the specified conditions.

2. MTBF

MTBF is an acronym of mean time between failures. It indicates the mean time period in which a system, equipment, or part operates normally between two incidences of repair. MTBF only applies to repairable products. MTBF tells how long a product can be used without the need for repair. Sometimes MTBF is used to represent the service lifetime before failure.

3. MTTF

MTTF is an acronym of mean time to failure. It indicates the mean time period until a product becomes faulty MTTF normally applies to unrepairable products such as parts and materials.

The relay is one of such objective of MTTF.

4. Failure Rate

Failure rate includes mean failure rate and momentary failure rate.

Mean failure rate is defined as follows:

Mean failure rate = Total failure count/ total operating hours

In general, failure rate refers to momentary failure rate. This represents the probability at which a system, equipment, or part, which has continued normal operation to a certain point of time, becomes faulty in the subsequent specified time period.

Failure rate is often represented in the unit of percent/hours. For parts with low failure rates, "failure unit (Fit) = 10^9 /hour" is often used instead of failure rate. Percent/count is normally used for relays.

5. Safe Life

Safe life is an inverse of degree of reliability. It is given as value B which makes the following equation true:

$1 - R(B) = t$ %

In general, "B[1 – R(B)] = 10%" is more often used. In some cases this represents a more practical value of reliability than MTTF.

• Failure

[1] What is Failure?

Failure is defined as a state of system, equipment, or component in which part of all of its functions are impaired or lost.

[2] Bathtub Curve

Product's failure rate throughout its lifetime is depicted as a bathtub curve, as shown below. Failure rate is high at the beginning and end of its service lifetime.

(I) Initial failure period

The high failure rate in the initial failure period is derived from latent design errors, process errors, and many other causes. Initial failures are screened at manufacturer's site through burn-in process. This process is called debugging, performing aging or screening.

(II) Accidental failure period

The initial failure period is followed by a long period with low, stable failure rate. In this period, called accidental failure period, failures occurs at random along the time axis. While zero accidental failure rate is desirable, this is actually not practical in the real world.

(III) Wear-out failure period

In the final stage of the product's service lifetime comes the wear-out failure period, in which the life of the product expires due to wear of fatigue. Preventive maintenance is effective for this type of failure. The timing of a relay's wear-out failure can be predicted with a certain accuracy from the past record of uses. The use of a relay is intended only in the accidental failure period, and this period virtually represents the service lifetime of the relay.

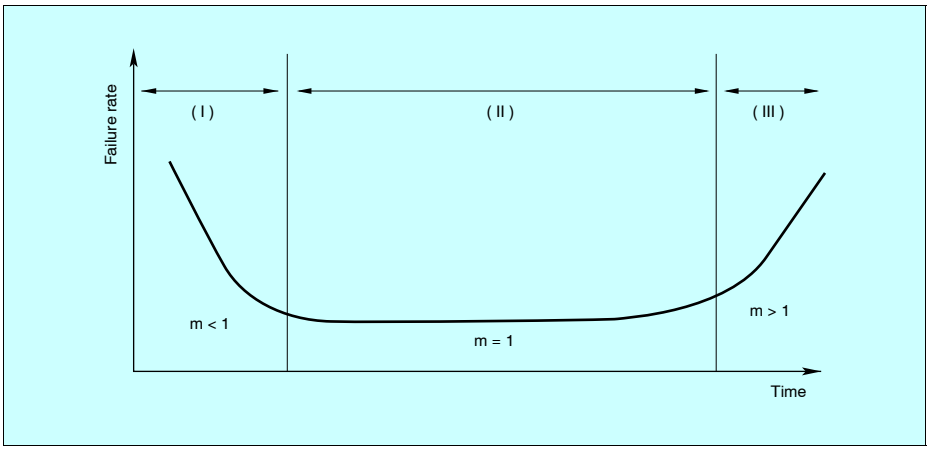
[3] Weibull Analysis

Weibull analysis is often used for classifying a product's failure patterns and to determine its lifetime. Weibull distribution is expressed by the following equation:

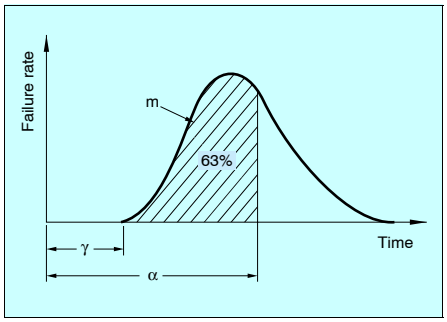
$$f(x) = \frac{m}{\alpha}(\chi-\gamma)^{m-1} e^{-\frac{(\chi-\gamma)^m}{\alpha}}$$

where

m : Figure parameter
α : Measurement parameter
γ : Position parameter



Weibull distribution can be adopted to the actual failure rate distribution if the three variables above are estimated.



The Weibull probability chart is a simpler alternative of complex calculation formulas. The chart provides the following advantages:

(1) The Weibull distribution has the closest proximity to the actual failure rate distribution.

(2) The Weibull probability chart is easy to use.

(3) Different types of failures can be identified on the chart.

The following describes the correlation with the bathtub curve. The value of the parameter "m" represents the type of the failure.

(1) When m < 1: Initial failures

(2) When m = 1: Accidental failures

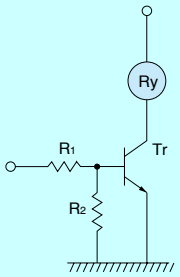
(3) When m > 1: Wear-out failures

Applications of Relays in Electronic Circuits

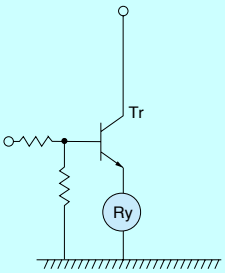
RELAY DRIVE BY MEANS OF A TRANSISTOR

• Connection method

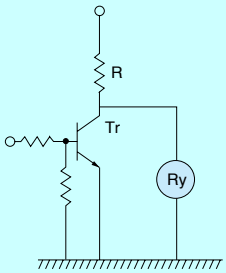
The voltage impressed on the relay is always full rated voltage, and in the OFF time, the voltage is completely zero for avoidance of trouble in use. (Fig. 1)



(Good) Collector connection
With this most common connection, operation is stable.



(Care) Emitter connection
When the circumstances make the use of this connection unavoidable, if the voltage is not completely impressed on the relay, the transistor does not conduct completely and operation is uncertain.



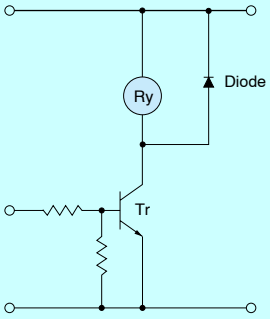
(Care) Parallel connection
When the power consumed by the complete circuit becomes large, consideration of the relay voltage is necessary.

Fig. 1

• Countermeasures for surge voltage of relay control transistor

If the coil current is suddenly interrupted, a sudden high voltage pulse is developed in the coil. If this voltage exceeds the voltage resistance of the transistor, the transistor will be degraded, and this will lead to damage. It is absolutely necessary to connect a diode in the circuit as a means of preventing damage from the counter emf.

As suitable ratings for this diode, the current should be equivalent to the average rectified current to the coil, and the inverse blocking voltage should be about 3 times the value of the power source voltage. (Fig. 2)



Take care of ASO.

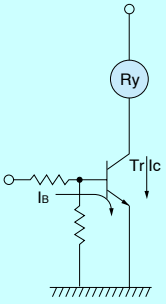
Fig. 2

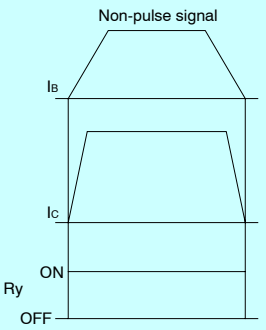
• Snap action

(Characteristic of relay with voltage rise and fall of voltage)

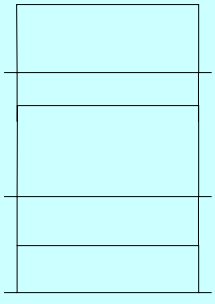
Unlike the characteristic when voltage is impressed slowly on the relay coil, this is the case where it is necessary to impress the rated voltage in a short time and also to drop the voltage in a short time. (Fig. 3)

As a guide, the rising time and falling time are 1 ms or less.





(No Good) Without snap action



(Good) Snap action

Fig. 3

• Schmitt circuit (Snap action circuit)
(Wave rectifying circuit)
When the input signal does not produce a snap action, ordinarily a Schmitt trigger circuit is used to produce safe snap action.

Characteristic points

1. The common emitter resistor RE must have a value sufficiently small compared with the resistance of the relay coil. (The voltage impressed on the relay must not be greater than the excitation voltage.)

2. Due to the relay coil current, the difference in the voltage at point P when T_2 is conducting and at point P when T_1 is conducting creates hysteresis in the detection capability of Schmitt circuit, and care must be taken in setting the values.

3. When there is chattering in the input signal because of waveform oscillation, an RC time constant circuit should be inserted in the stage before the Schmitt trigger circuit. (However, the response speed drops.) (Fig. 4)

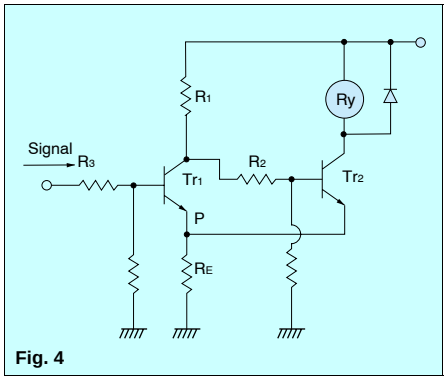
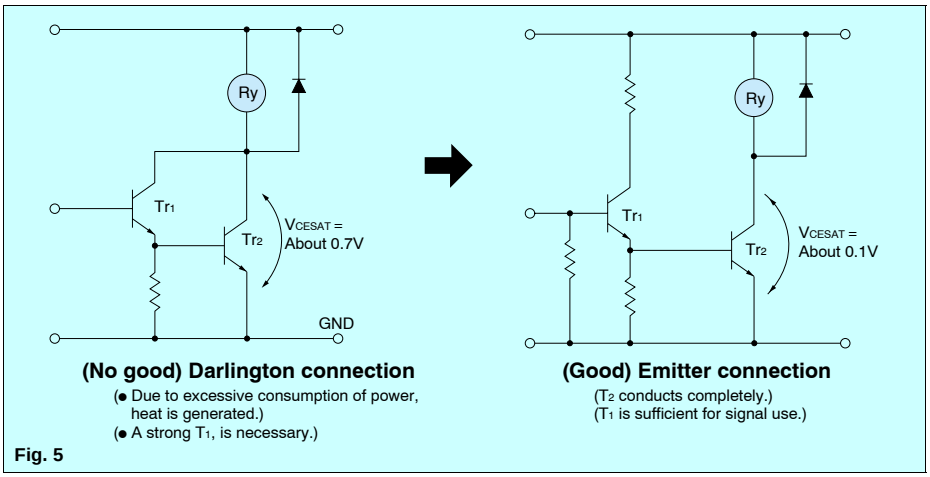


Fig. 4

• Avoid Darlington circuit connections.
(High amplification)
This circuit is a trap into which it is easy to fall when dealing with high circuit technology. This does not mean that it is immediately connected to the defect, but it is linked to troubles that occur after long periods of use and with many units in operation. (Fig. 5)

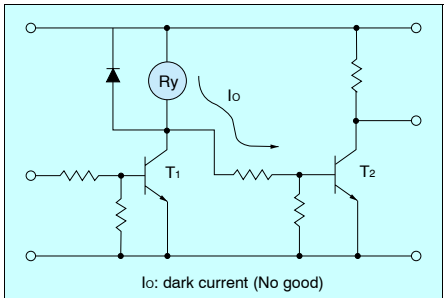


(No good) Darlington connection
(● Due to excessive consumption of power, heat is generated.)
(● A strong T_1, is necessary.)

(Good) Emitter connection
(T_2 conducts completely.)
(T_1 is sufficient for signal use.)

Fig. 5

• Residual Coil Voltage
In switching applications where a semiconductor (transistor, UJT, etc.) is connected to the coil, a residual voltage is retained at the relay coil which may cause incomplete restoration and faulty operation. By using DC coils, there may be a reduction in; the danger of incomplete restoration, the contact pressure, and the vibration resistance. This is because the drop-out voltage is 10% or more of the rated voltage, a low value compared to that for AC coil, and also there is a tendency to increase the life by lowering the drop-out voltage. When the signal from the transistor's collector is taken and used to drive another circuit as shown in the figure on the right, a minute dark current flows to the relay even if the transistor is off. This may cause the problems described above. (Fig. 6)



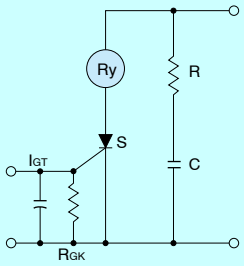
Io: dark current (No good)

Fig. 6 Connection to the next stage through collector

RELAY DRIVE BY MEANS OF SCR

• Ordinary drive method

For SCR drive, it is necessary to take particular care with regard to gate sensitivity and erroneous operation due to noise. (Fig. 7)



I_{GT} : There is no problem even with more than 3 times the rated current.
R_{GK} : 1K ohms must be connected.
R,C : This is for prevention of isolation point error due to a sudden rise in the power source or to noise. (dv/dt countermeasure)

Fig. 7

• Caution points regarding ON/OFF control circuits

(When used for temperature or similar control circuits)

When the relay contacts close simultaneously with an AC single phase power source, because the electrical life of the contacts suffers extreme shortening, care is necessary. (Fig. 8)

1. When the relay is turned ON and OFF using a SCR, the SCR serves as a half wave power source as it is, and there are ample cases where the SCR is easily restored.
2. In this manner the relay operation and restoration timing are easily synchronized with the power source frequency, and the timing of the load switching also is easily synchronized.
3. When the load for the temperature control is a high current load such as a heater, the switching can occur only at peak values and it can occur only at zero phase values as a phenomenon of this type of control. (Depending upon the sensitivity and response speed of the relay)
4. Accordingly, either an extremely long life or an extremely short life results with wide variation, and it is necessary to take care with the initial device quality check.

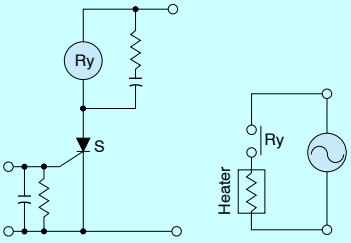


Fig. 8

RELAY DRIVE FROM EXTERNAL CONTACTS

Relays for PC board use have high sensitivity and high speed response characteristics, and because they respond sufficiently to chattering and bouncing, it is necessary to take care in their drive.

When the frequency of use is low, with the delay in response time caused by a condenser, it is possible to absorb the chattering and bouncing. (Fig. 9)
(However, it is not possible to use only a condenser. A resistor should also be used with the capacitor.)

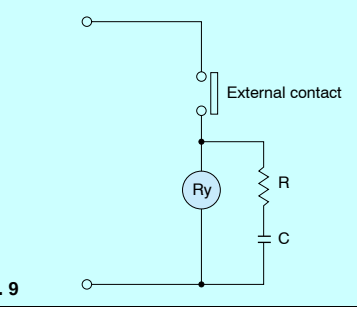
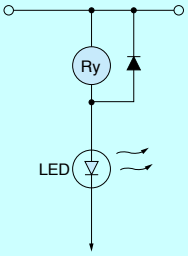


Fig. 9

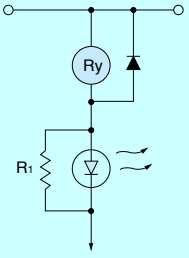
LED SERIES AND PARALLEL CONNECTIONS

1. In series with relay



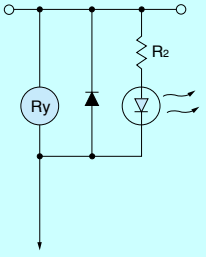
Power consumption:
In common with relay (Good)
Defective LED:
Relay does not operate (No good)
Low voltage circuit:
With LED, 1.5V down (No good)
No. of parts: (Good)

2. R in parallel with LED



Power consumption:
In common with relay (Good)
Defective LED:
Relay operate (No good)
Low voltage circuit:
With LED, 1.5V down (No good)
No. of parts: R_1 (Care)

3. In parallel connection with relay



Power consumption:
Current limiting resistor R_2 (Care)
Defective LED:
Relay operate stable (Good)
Low voltage circuit: (Good)
No. of parts: R_2 (Care)

ELECTRONIC CIRCUIT DRIVE BY MEANS OF A RELAY

• Chatterless electronic circuit

Even though a chatterless characteristic is a feature of relays, this is to the fullest extent a chatterless electrical circuit, much the same as a mercury relay. To meet the requirement for such circuits as the input to a binary counter, there is an electronic chatterless method in which chattering is absolutely not permissible. Even if chattering develops on one side, either the N.O. side contacts or the N.C. side contacts, the flip flop does not reverse, and the counter circuit can be fed pulsed without a miss. (However, bouncing from the N.O. side to N.C. side must be absolutely avoided.) (Fig. 10)

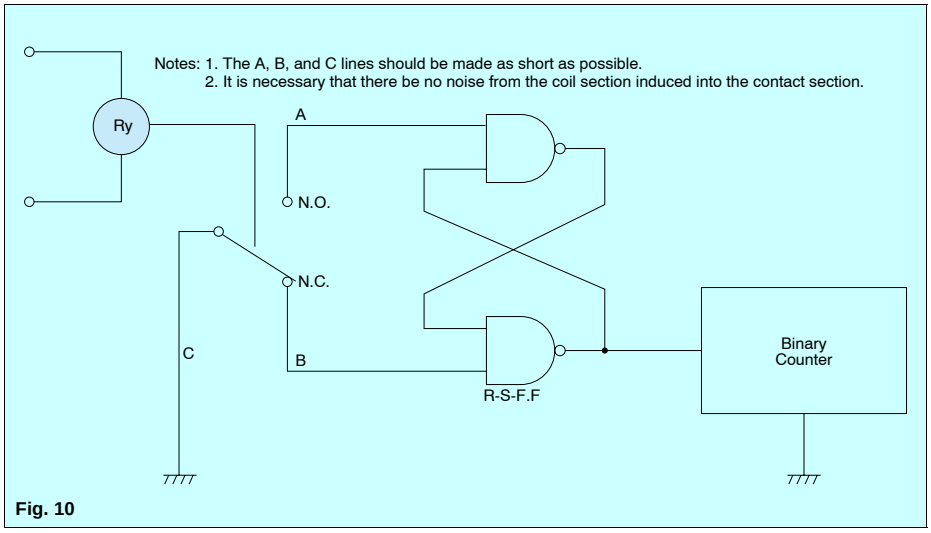


Fig. 10

• Triac drive

When an electronic circuit using a direct drive from a triac, the electronic circuit will not be isolated from the power circuit, and because of this, troubles due to erroneous operation and damage can develop easily. The introduction of a relay drive is the most economical and most effective solution. (Photo coupler and pulse transformer circuits are complicated.)

When a zero cross switching characteristic is necessary, a solid state relay (SSR) should be used. (Fig. 11)

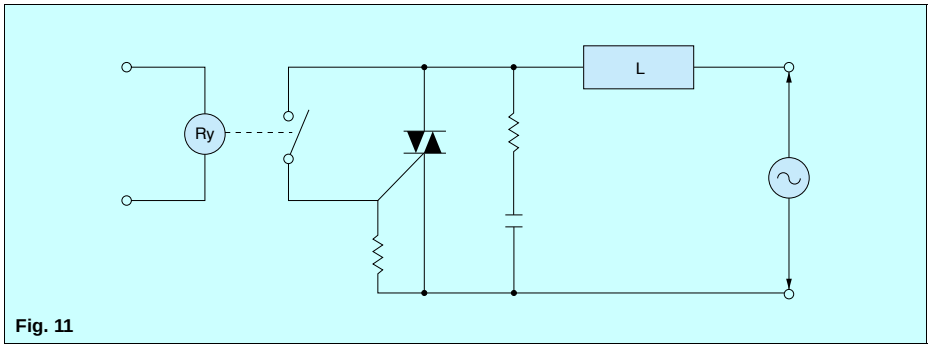


Fig. 11

ASSURANCE OF POWER SOURCE FOR RELAY AND ELECTRONIC CIRCUIT

• Constant Voltage circuit and PC board pattern

Ordinarily, it is extremely undesirable to have ripple and voltage variation in an electronic circuit power source. This is naturally true also for relay power sources but not to the same extent as for the electronic circuit. Accordingly, it is desirable to have a constant voltage circuit for dedicated use of the electronic circuit with a sufficient margin of current. Roughly speaking, this is also good for the relay, but from a practical viewpoint, the relay should be operated within the standards set for ripple and voltage variation. Similarly, in the circuit diagram shown in Fig. 12, but means of the manner in which the PC board pattern is designed, the ON/OFF operation of the relay coil, lamp, etc., will exert no influence on the electronic circuit. This is just a matter of technique that is necessary.

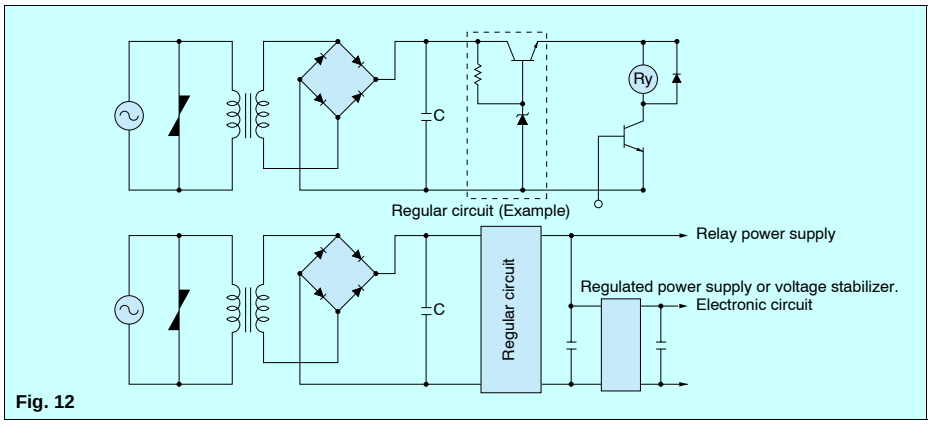


Fig. 12

• Prevention of Voltage Drop Due to Rush Current

In the circuit shown in Fig. 13 (a), rush current flows from the lamp or capacitor. The instant the contacts close, the voltage drops and the relay releases or chatters.

In this case it is necessary to raise the transformer's capacity or add a smoothing circuit.

Fig. 13 (b) shows an example of the modified circuit.

Fig. 13 (C) shows a battery-powered version.

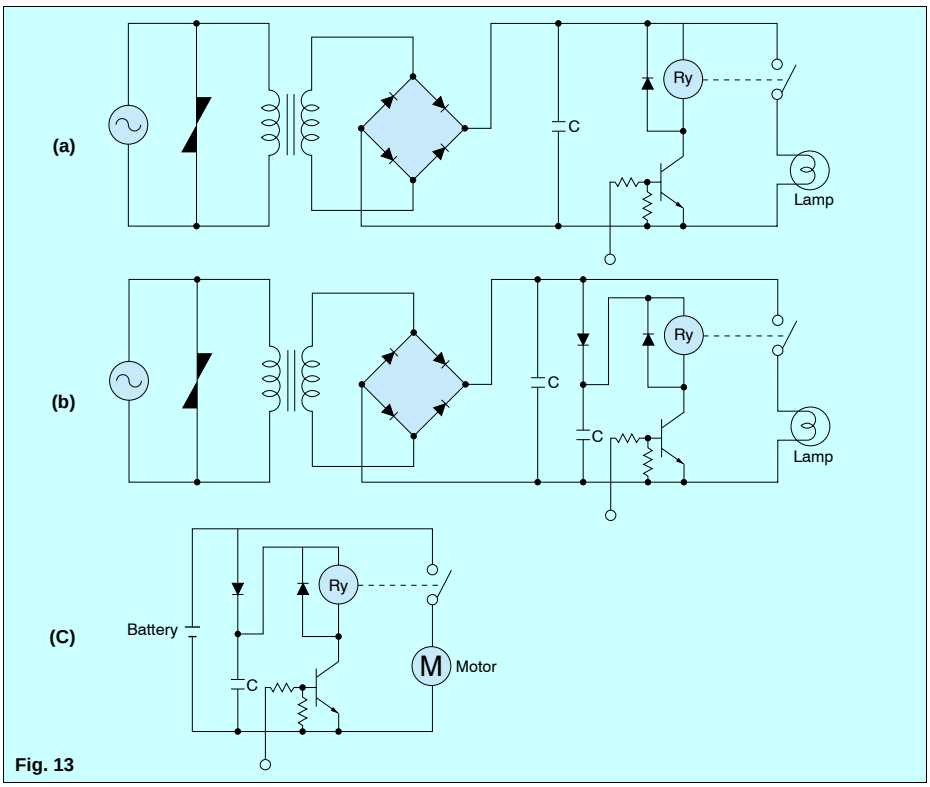


Fig. 13

PC BOARD DESIGN CONSIDERATIONS

• Pattern Layout for Relays

Since relays affect electronic circuits by generating noise, the following points should be noted.

Keep relays away from semiconductor devices. Design the pattern traces for shortest lengths. Place the surge arrester (diode, etc.) near the relay coil. Avoid routing pattern traces susceptible to noise (such as for audio signals) underneath the relay coil section. Avoid through-holes in places which cannot be seen from the top (e.g. at the base of the relay). Solder flowing up through such a hole may cause damage such as a broken seal. Even for the same circuit, pattern design considerations which minimize the influence of the on/off operations of the relay coil and lamp on other electronic circuits are necessary. (Fig. 14)

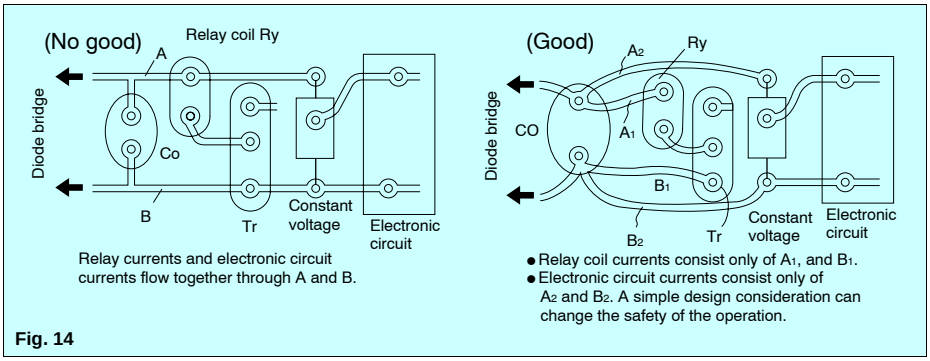


Fig. 14

• When it is necessary to use hand soldering for one part of a component after dip soldering has been done

By providing a narrow slot in the circular part of the foil pattern, the slot will prevent the hole from being plugged with solder. (Fig. 15)

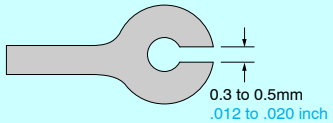


Fig. 15

• When the printed circuit board itself is used as a connector

[1] The edge should be beveled. (This prevents peeling of the foil when the board is inserted into its socket.)

[2] When only a single side is used as the connector blade, if there is distortion in the circuit board, contact will be defective. Care should be taken. (Fig. 16)

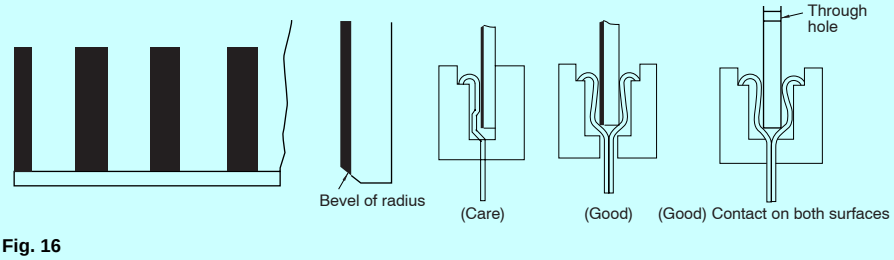


Fig. 16

PC BOARD REFERENCE DATA

(This data has been derived from samples of this company's products. Use this data as a reference when designing printed circuit boards.)

• Conductor width

The allowable current for the conductor was determined from the safety aspect and the effect on the performance of the conductor due to the rise in saturation temperature when current is flowing. (The narrower the conductor width and the thinner the copper foil, the larger the temperature rise.) For example, too high a rise in temperature causes degradation of the characteristic and color changes of the laminate. In general, the allowable current capacity of the conductor is determined so that the rise is temperature is less than 10 degrees C. It is necessary to design the conductor width from this allowable conductor current capacity. Fig. 17, Fig. 18, Fig. 19 show the relationship between the current and the conductor width for each rise in temperature for different copper foils. It is also necessary to give consideration to preventing abnormal currents from exceeding the destruction current of the conductor. Fig. 21 shows the relationship between the conductor width and the destruction current.

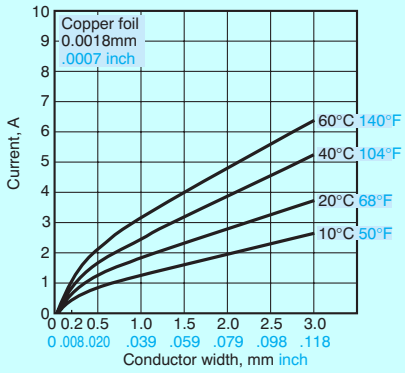


Fig. 17

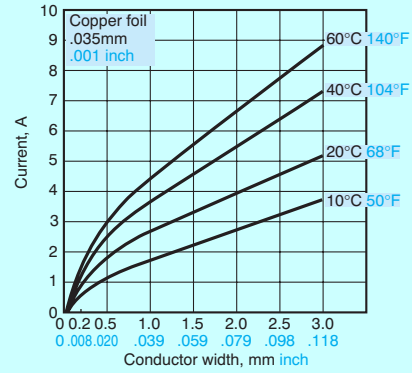


Fig. 18

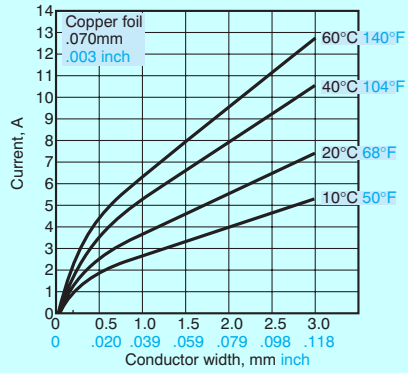


Fig. 19

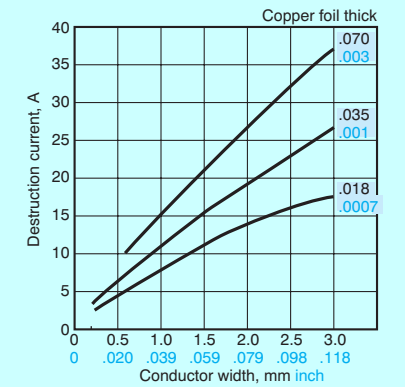


Fig. 20

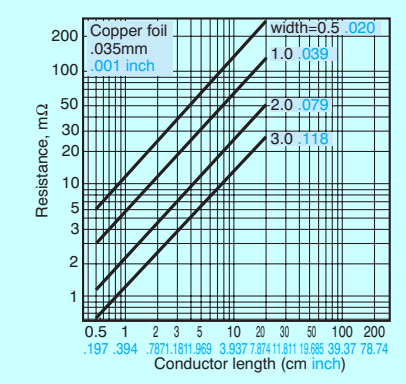


Fig. 21

• Hole and land diameter

The hole diameter and land are made with the hole slightly larger than the lead wire so that the component may be inserted easily. Also, when soldering, the solder will build up in an eyelet condition, increasing the mounting strength. The standard dimensions for the hole diameter and land are shown in the table below.

Standard dimensions for hole and land diameter mm inch

Standard hole diameter	Tolerance	Land diameter
0.8 .031	±0.1 ±.039	2.0 to 3.0 .079 to .118
1.0 .039		
1.2 .047		3.5 to 4.5 .138 to .177
1.6 .063		

Remarks

1. The hole diameter is made 0.2 to 0.5mm .008 to .020inch larger than the lead diameter. However, if the jet method (wave type, jet type) of soldering is used, because of the fear of solder passing through to the component side, it is more suitable to make the hole diameter equal to the lead diameter +0.2mm.
2. The land diameter should be 2 to 3 times the hole diameter.
3. Do not put more than 1 lead in one hole.

• Expansion and shrinkage of copperclad laminates

Because copperclad laminates have a longitudinal and lateral direction, the manner of punching fabrication and layout must be observed with care. The expansion and shrinkage in the longitudinal direction due to heat is 1/15 to 1/2 that in the lateral, and accordingly, after the punching fabrication, the distortion in the longitudinal direction will be 1/15 to 1/2 that of the lateral direction. The mechanical strength in the longitudinal direction is 10 to 15% greater than that in the lateral direction. Because of this difference between the longitudinal and lateral directions, when products having long configurations are to be fabricated, the lengthwise direction of the configuration should be made in the longitudinal direction, and PC boards having a connector section should be made with the connector along the longitudinal side. (Fig. 22)

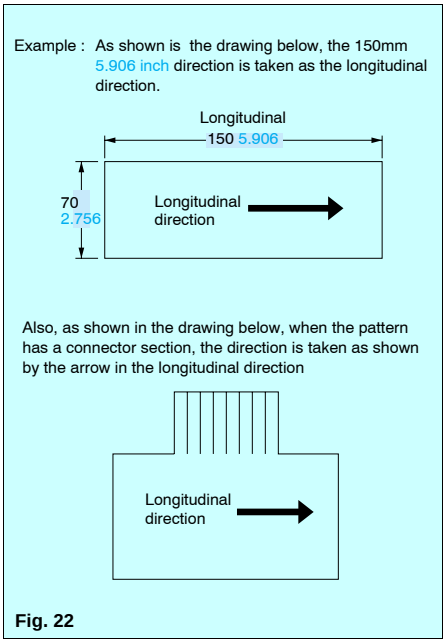


Fig. 22

Space between conductors

Fig. 23 shows the relationship between the spacing between conductors and the destruction voltage. This destruction voltage is not the destruction voltage of the PCB; it is the flash over voltage (insulation breakdown voltage of the space between circuits.) Coating the surface of the conductor with an insulating resin such as a solder resist increases the flash over voltage, but because of the pin holes of the solder resist, it is necessary to consider the conductor destruction voltage without the solder resist. In fact, it is necessary to add an ample safety factor when determining the spacing between conductors. Table 1 shows an example of a design for the spacing between conductors. (Taken from the JIS C5010 standards.) However, when the product is covered by the electrical products control law, UL standards or other safety standards, it is necessary to conform to the regulations.

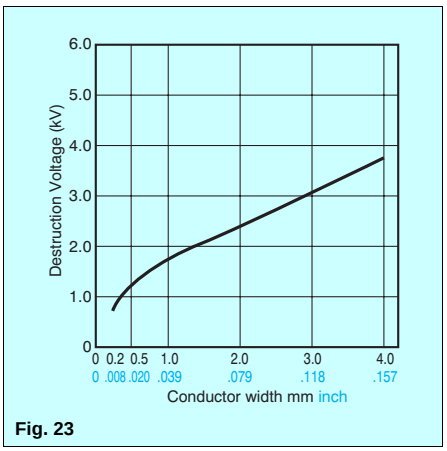


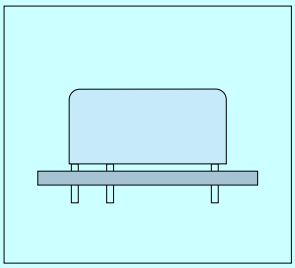
Fig. 23

Table 1. Example of conductor spacing design

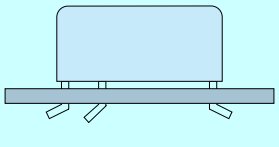
Maximum DC and AC Voltage Between Conductors (V)	Minimum Conductor Spacing (mm inch)
0 to 50	0.381 .015
51 to 150	0.635 .025
151 to 300	1.27 .050
301 to 500	2.54 .100
500 or more	Calculated at 0.00508 mm/V

Relay Soldering and Cleaning Guidelines

1. Mounting of Relay

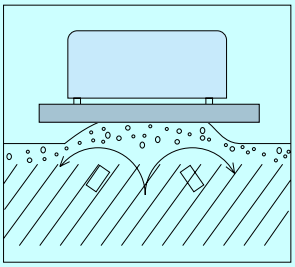


• Avoid bending the terminals to make the relay self-clinching. Relay performance cannot be guaranteed if the terminals are bent. Self-clinching terminal types are available depending on the type of relay.
• Correctly drill the PC board according to the given PC board pattern illustration.
• Stick packaging for automatic mounting is available depending on the type of relay.

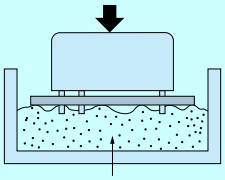


Bad example

2. Flux Application

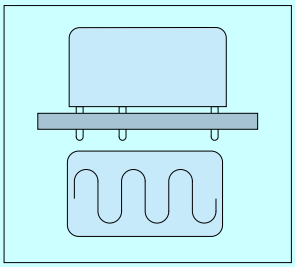


• Adjust the position of the PC board so that flux does not overflow onto the top of it. This must be observed especially for dust-cover type relays.
• Use rosin-based non-corrosive flux.
• If the PC board is pressed down into a flux-soaked sponge as shown on the right, the flux can easily penetrate a dust-cover type relay. Never use this method. Note that if the PC board is pressed down hard enough, flux may even penetrate a flux-resistant type relay.



Bad example

3. Preheating



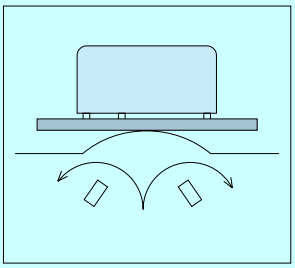
• Be sure to preheat before using automatic soldering. For dust-cover type relays and flux-resistant type relays, preheating acts to prevent the penetration of flux into the relay when soldering. Solderability also improves.
• Preheat according to the following conditions.

Temperature	120°C 248°F or less
Time	Within approx. 2 minutes

• Note that long exposure to high temperatures (e.g. due to a malfunctioning unit) may affect relay characteristics.

Relay Soldering and Cleaning Guidelines

4. Soldering



Please consult us regarding lead-free solder. .

Automatic Soldering

• Flow solder is the optimum method for soldering.
• Adjust the level of solder so that it does not overflow onto the top of the PC board.
• Unless otherwise specified, solder under the following conditions depending on the type of relay.

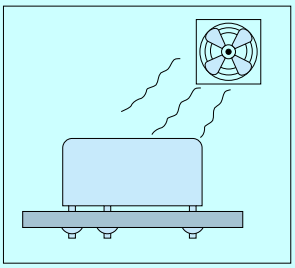
Solder Temperature	Approx. 260°C 500°F
Soldering Time	Within approx. 6 seconds

Hand Soldering

• Keep the tip of the soldering iron clean.

Soldering Iron	30W to 60W
Iron Tip Temperature	Approx. 400°C 752°F
Soldering Time	Within approx. 3 seconds

5. Cooling



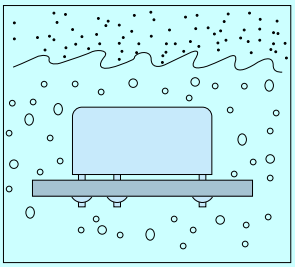
Automatic Soldering

• Immediate air cooling is recommend to prevent deterioration of the relay and surrounding parts due of soldering heat.
• Although the environmentally sealed type relay (plastic sealed type, etc.) can be cleaned, avoid immersing the relay into cold liquid (such as cleaning solvent) immediately after soldering. Doing so may deteriorate the sealing performance.

Hand Soldering

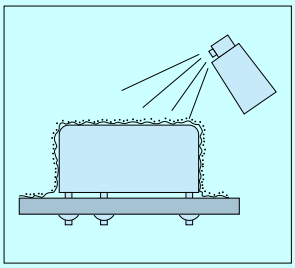
—

6. Cleaning



• Do not clean dust-cover type relays and flux-resistant type relays by immersion. Even if only the bottom surface of the PC board is cleaned (e.g. with a brush), careless cleaning may cause cleaning solvent to penetrate the relay.
• Plastic sealed type relays can be cleaned by immersion. Use a Freon- or alcohol-based cleaning solvent. Use of other cleaning solvents (e.g. Trichlene, chloroethene, thinner) may damage the relay case. However, some types of relays use materials which are chemical resistant. Select the suitable relay or solvent by referring to the cleaning solvent compatibility chart below.
• Cleaning with the boiling method is recommended. Avoid ultrasonic cleaning on relays. Use of ultrasonic cleaning may cause breaks in the coil or slight sticking of the contacts due to the ultrasonic energy.

7. Coating



• If the PC board is to be coated to prevent the insulation of the PC board from deteriorating due to corrosive gases and high temperatures, note the following.
• Do not coat dust-cover type relays and flux-resistant type relays, since the coating material may penetrate the relay and cause contact failure. Or, mount the relay after coating.
• Depending on the type, some coating materials may have an adverse affect on relays. Furthermore, solvents (e.g. xylene, toluene, MEK, I.P.A.) may damage the case or chemically dissolve the epoxy and break the seal. Select coating materials carefully.

Type	Suitability for Relays	Features
Epoxy-base	Good	• Good electrical insulation. • Although slightly difficult to apply, does not affect relay contacts.
Urethane-base	Care	• Good electrical insulation, easy to apply. • Solvent may damage case. Check before use.
Silicon-base	No Good	• Silicon gas becomes the cause of contact failure. (also plastic sealed types) • Use a substitute that is not a silicon-base

• If the relay and all components (e.g. ICs) are to be coated, be sure to carefully check the flexibility of the coating material. The solder may peel off from thermal stress.
• Transporting when mounted on PCBs
Whether mounted or not, since relays are precision devices, do not apply vibration and shock that exceeds the stipulated value. Initial performance, as shipped from the factory, may be lost if undue vibration or shock is applied to the relay.

SMT Soldering Guidelines

CAUTIONS FOR SURFACE MOUNT RELAY INSTALLATION

To meet the market demand for downsizing to smaller, lighter, and thinner products, PC boards also need to proceed from Insertion mounting to surface mounting technology. To meet this need, we offer a line of surface mount relays. The following describes some cautions required for surface mount relay installation to prevent malfunction and incorrect operation.

• What is a Surface Mount Relay?

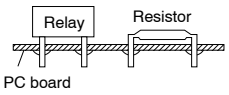
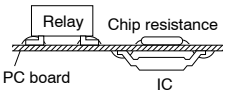
1. From IMT to SMT

Conventional insertion mount technology (IMT) with some 30 years of history is now being replaced with surface mount technology (SMT).

Solid-state components such as resistors, ICs, and diodes can withstand high heat stresses from reflow soldering because they use no mechanical parts. In contrast, the conventional electro-mechanical relays consisting of solenoid coils, springs, and armatures are very sensitive to thermal stress from reflow soldering.

We applied the experience gained from our advanced relay technologies to produce high-performance electromagnetic relays compatible with surface mount technologies such as IRS and VPS.

• Insertion Mount Technology vs. Surface Mount Technology

Insertion Mounting Technology: IMT	Components' leads are inserted into lead holes of PC board and are soldered to copper pads on the other side of the board using flow-soldering techniques.	
Surface Mount Technology (SMT)	Components are placed on copper pads precoated with paste solder and the board assembly is heated to solder the components on the pads (reflow soldering).	

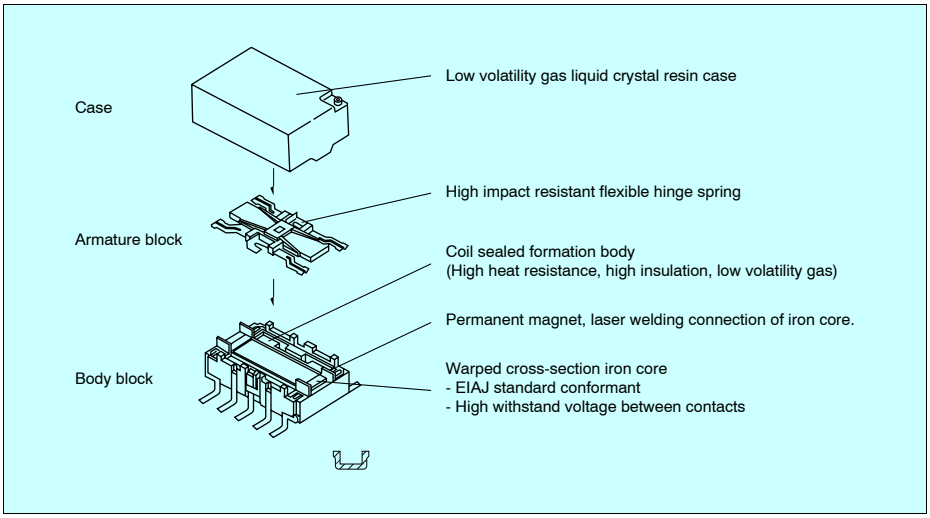
2. Features and Effects

Features	Effects
• Allows high density mounting • Components can be installed on both sides of a board • Ceramic PC boards can be used	System downsizing
• Compatible with automatic placement by robots • Drilling for lead holes is not required • Compact system designs are possible due to high density mounting	Overall cost reduction
• High heat resistance • Anti-gas measures	High reliability

The surface mount relay is manufactured with the following advanced technologies:

- Heat-resistance encapsulation technique
- Gas analysis
- Reliability assessment
- Precision molding technique for heat-resistant materials

• TQ-SMD Relay

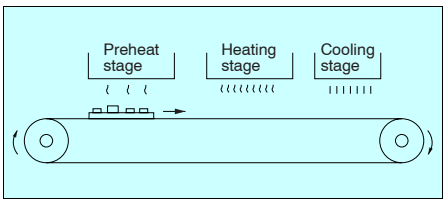


3. Examples of SMT Applications

The following describes some examples of typical SMT applications:

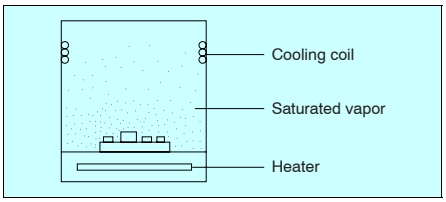
(1) Infrared Reflow Soldering (IRS)

IRS is the most popular reflow soldering technology now available for surface mounting. It uses a sheath heater or infrared lamp as its heat source. PC board assemblies are continuously soldered as they are transferred through a tunnel furnace comprised of a preheating, heating, and cooling-stages.



(2) Vapor Phase Soldering (VPS)

With VPS technology, PCB assemblies are carried through a special inactive solvent, such as Fluorinert FC-70, that has been heated to a vapor state. As the saturated vapor condenses on the PC board surface, the resulting evaporation heat provides the energy for reflow soldering.



(3) Belt conveyer reflow furnace

As PCB assemblies are transferred on a thin, heat-resistant belt conveyer, they are soldered by the heat from hotplates placed beneath the conveyer belt.

(4) Double Wave Soldering (DWS)

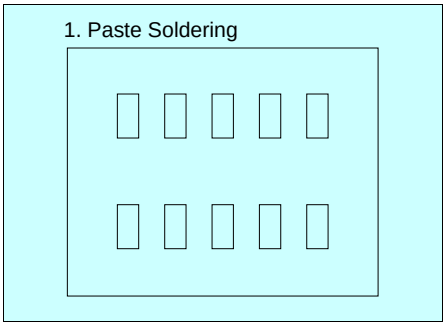
Components are glued to the PC board surface. The board assembly is transferred through a molten solder fountain (with the component side facing down), and the components are soldered to the board.

(5) Other Technologies

Other reflow soldering technologies include those utilizing lasers, hot air, and pulse heaters.

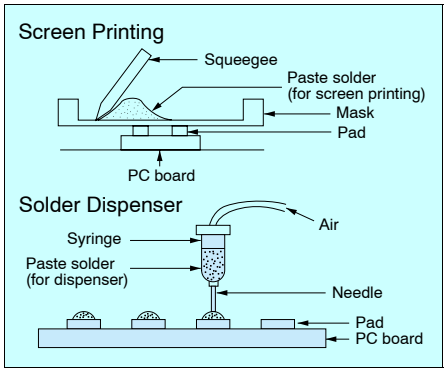
• Cautions for installation

1. Paste Soldering

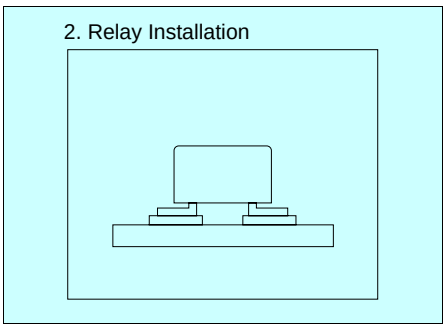


• Mounting pads on PC boards must be designed to absorb placement errors while taking account of solderability and insulation. Refer to the suggested mounting pad layout in the application data for the required relay product.

• Paste solder may be applied on the board with screen printing or dispenser techniques. For either method, the paste solder must be coated to appropriate thickness and shapes to achieve good solder wetting and adequate insulation.



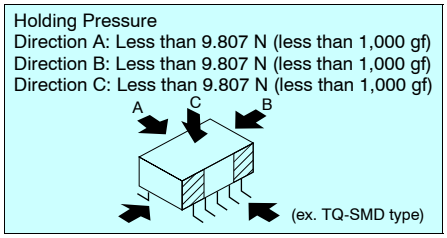
2. Relay Installation



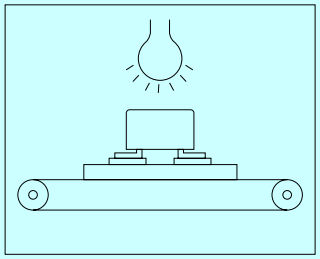
• For small, lightweight components Such as chip components, a self-alignment effect can be expected if small placement errors exist. However, this effect is not as expected for electro-mechanical components such as relays, and they require precise positioning on their soldering pads.

• If SMT relays sustain excessive mechanical stress from the placement machine's pickup head, their performance cannot be guaranteed.

• Our SMT relays are supplied in stick packaging compatible with automatic placement processes. We also offer tape packaging at customer request.



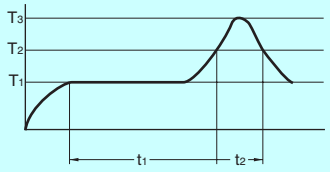
3. Reflow



<Reference>

Recommended temperature profile condition during reflow when using lead-free solder.

Please consult us for correspondending products.

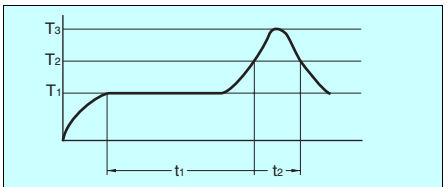


T1 = 150 to 180°C 302 to 356°F
T2 = 230°C 446°F and higher
T3 = Within 250°C 482°F
t1 = 60 to 120 sec.
t2 = Within 30 sec.

• Reflow soldering under inadequate soldering conditions may result in unreliable relay performance or even physical damage to the relay (even if the relay is of surface mount type with high heat resistance).

Example of Recommended Soldering Condition for Surface Mount Relays.

(1) IRS technique

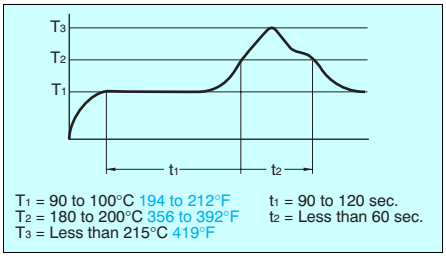


T1 = 155 to 165°C 311 to 329°F
T2 = 180 to 200°C 356 to 392°F
T3 = Less than 245°C 473°F
t1 = Less than 120 sec.
t2 = Less than 30 sec.

• It is recommended that the soldered pad be immediately cooled to prevent thermal damage to the relay and its associated components.

• While surface mount relays are solvent washable, do not immerse the relay in cold cleaning solvent immediately after soldering.

(2) VPS technique



T1 = 90 to 100°C 194 to 212°F
T2 = 180 to 200°C 356 to 392°F
T3 = Less than 215°C 419°F
t1 = 90 to 120 sec.
t2 = Less than 60 sec.

(3) Manual soldering

Soldering iron tip temperature: 280 to 300°C 536 to 572°F

Soldering iron wattage: 30 to 60 watts

Soldering time: Less than 5 sec.

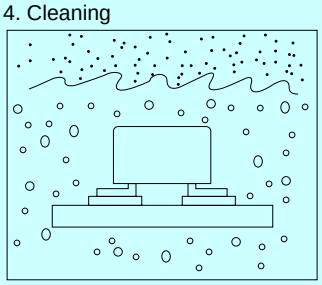
(4) Others

When a soldering technique other than above is to be used (hot air, hotplate, laser, or pulse heater technique), carefully investigate the suitability of the technique.

Notes:

1. The soldering temperature profile indicates the pad temperature. In some cases, the ambient temperature may be greatly increased. Check for the specific mounting condition.
2. The preheating conditions for the VPS technique are identical to those for the IRS technique.

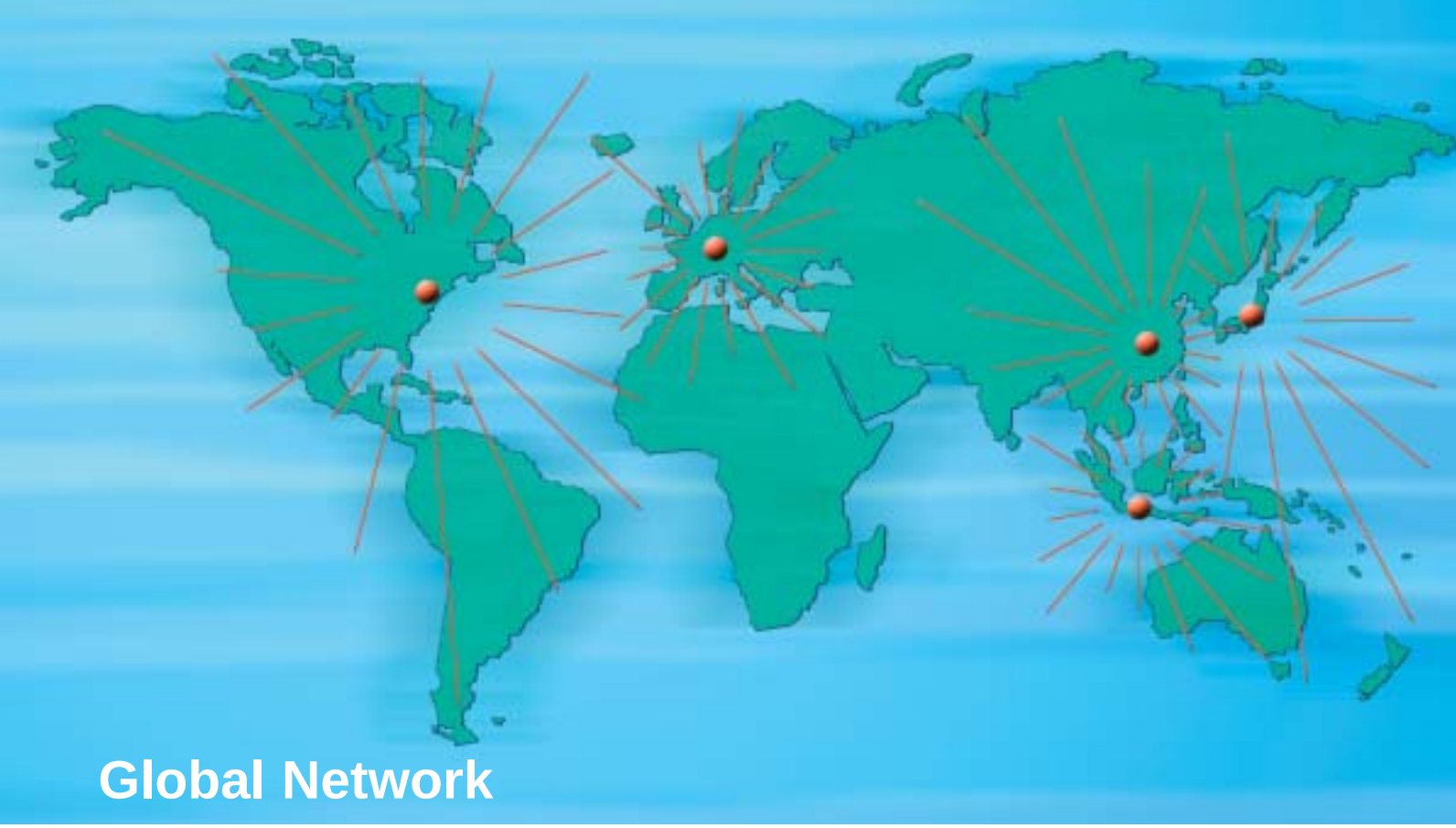
4. Cleaning



• The surface mount relays are solvent washable. Use alcohol or an equivalent solvent for cleaning.

• Boiled cleaning is approved for surface mount relays. Ultrasonic cleaning may cause coil damage or light contact sticking.

* Please consult us regarding lead-free solder.



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