Panasonic

ideas for life

Relay Catalogue 2005

Part 2: PhotoMOS & Solid State Relays

Part 1: Electromechanical 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.

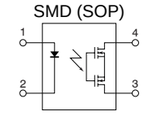
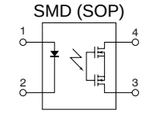
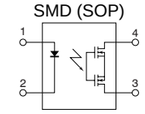
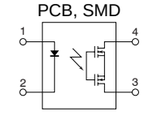
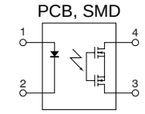
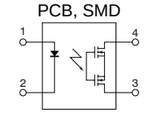
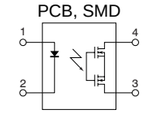
Consequently, a CE marking shall not be affixed nor shall a declaration of conformity or manufacturer’s declaration be issued under the Machinery Directive.

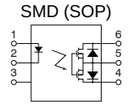
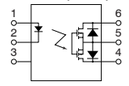
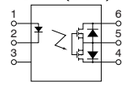
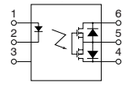
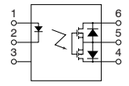
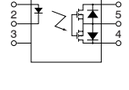
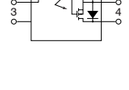
---

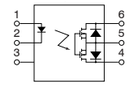
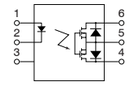
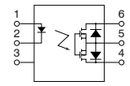
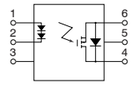
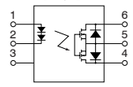
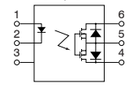
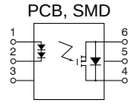
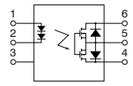
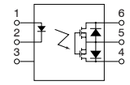
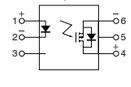
1. This writing deals exclusively with “non-specified-time all-or-nothing relays”. The abbreviated term “all-or-nothing relay” has been introduced merely for purposes of convenience. The term includes solid state all-or-nothing relays.
2. Guidelines (version dated May 26, 1997) for the Application of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

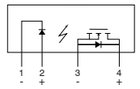
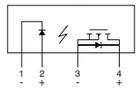
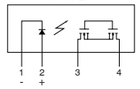
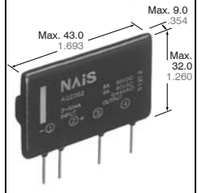
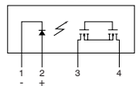
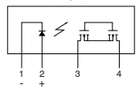
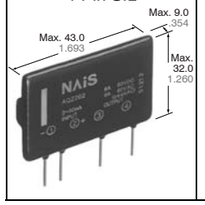
For standard housings and dimensions, see “PhotoMOS Relay Dimensions” on page 52.

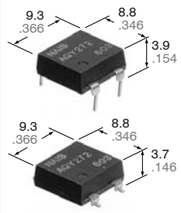
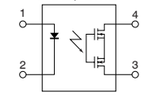
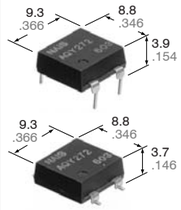
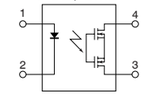
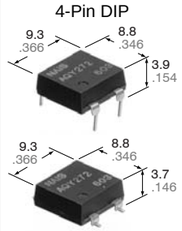
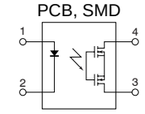
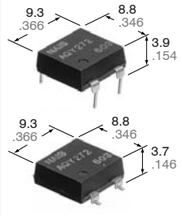
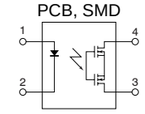
Type ✪ = PopularType	Features	Output						Input				Switching speed (I LED = 5mA)		Total power dissipation	I/O isolation voltage	Connection type Switching diagram	Page Approvals
		Peak load V DC/AC	Continuous load current	Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	Leakage current (typical/max.)	LED forward current (max.)	LED operate current (max.)	LED turn-off current (min.)	LED dropout voltage (max.)	Turn-on time (max.)	Turn-off time (max.)				
✪ **AQY212GS** 4-Pin SOP	• Increased load current • Ultra small SMD housing	60V	1.0A	3.0A	0.34/0.7Ω	220pF	1/1000nA	50mA	3.0mA	0.3mA	1.5V	5.0ms	0.5ms	350mW	1,500V AC	SMD (SOP) 	72 UL, C-UL, TÜV, VDE
✪ **AQY212S** 4-Pin SOP	• Ultra small SMD housing	60V	0.5A	1.0A	0.83/2.5Ω	80pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	0.2ms	350mW	1,500V AC		75 UL, C-UL, BSI, CSA, TÜV
AQY210LS 4-Pin SOP	• Ultra small SMD housing • Current limiting type current limit 180mA	350V	0.12A	- 0.18A (Output limit current [typ.])	20/25Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	1.0ms	350mW	1,500V AC	SMD (SOP) 	121 UL, C-UL, BSI, CSA, TÜV
✪ **AQY210S** 4-Pin SOP	• Increased load current • Ultra small SMD housing	350V	0.12A	0.3A	17/25Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	350mW	1,500V AC		75 UL, C-UL, BSI, CSA, TÜV
✪ **AQY210KS** 4-Pin SOP	• Ultra small SMD housing • Short circuit protection	350V	0.12A	- 0.2A (Cut off current [typ.])	23.5/35Ω	42pF	1/1000nA	50mA	3.0mA	0.3mA	1.5V	2.0ms	1.0ms	350mW	1,500V AC	SMD (SOP) 	113 UL, C-UL, BSI, CSA, TÜV
✪ **AQY214S** 4-Pin SOP	• Ultra small SMD housing	400V	0.1A	0.24A	25/35Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	350mW	1,500V AC		75 UL, C-UL, BSI, CSA, TÜV
✪ **AQY211EH** 4-Pin DIP/SMD	• Low cost type • DIP and standard SMD housing • 5000V breakdown voltage	30V	1.0A	3.0A	0.25/0.5Ω	240pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	5.0ms	1.0ms	550mW	5,000V AC	PCB, SMD 	133 UL, C-UL, CSA, TÜV, BSI, VDE
✪ **AQY212EH** 4-Pin DIP/SMD	• Low cost type • DIP and standard SMD housing • 5000V breakdown voltage	60V	0.55A	1.5A	0.85/2.5Ω	80pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	4.0ms	1.0ms	550mW	5,000V AC		133 UL, C-UL, CSA, TÜV, BSI, VDE
✪ **AQY212GH** 4-Pin DIP/SMD	• High voltage type • DIP and standard SMD housing • 5000V breakdown voltage	60V	1.1A	3.0A	0.34/0.7Ω	220pF	1/1000nA	50mA	3.0mA	0.3mA	1.5V	5.0ms	0.5ms	550mW	5,000V AC	PCB, SMD 	81 UL, C-UL, VDE
✪ **AQY214EH** 4-Pin DIP/SMD	• Low cost type • DIP and standard SMD housing • 5000V breakdown voltage	400V	0.12A	0.3A	26/35Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	1.0ms	550mW	5,000V AC		133 UL, C-UL, CSA, TÜV, BSI, VDE
✪ **AQY210EH** 4-Pin DIP/SMD	• Low cost type • DIP and standard SMD housing • 5000V breakdown voltage	350V	0.13A	0.4A	18/25Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	1.0ms	550mW	5,000V AC		133 UL, C-UL, CSA, TÜV, BSI, VDE
AQY210HL 4-Pin DIP/SMD	• DIP and standard SMD housing • 5000V breakdown voltage • Current limit function	350V	0.12A	- 0.18A (Output limit current [typ.])	20/25Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	1.0ms	550mW	5,000V AC	PCB, SMD 	127 UL, BSI, C-UL, CSA, TÜV
✪ **AQY216EH** 4-Pin DIP/SMD	• DIP and standard SMD housing • 5000V breakdown voltage	600V	0.05A	0.15A	52/120Ω	35pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	1.0ms	550mW	5,000V AC	PCB, SMD 	133 UL, C-UL, CSA, TÜV, BSI, VDE

Type ✪ = PopularType	Features	Output						Input				Switching speed (I LED = 5mA)		Total power dissipation	I/O isolation voltage	Connection type Switching diagram	Page Approvals
		Peak load V DC/AC	Continuous load current	Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	Leakage current (typical/max.)	LED forward current (max.)	LED operate current (max.)	LED turn-off current (min.)	LED dropout voltage (max.)	Turn-on time (max.)	Turn-off time (max.)				
✪ **AQV212S** 6-Pin SOP	• Ultra small SMD housing (Small Outline Package=SOP)	60V	0.5A	1.0A	0.83/2.5Ω	150pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	0.2ms	500mW	1,500V AC	SMD (SOP) 	78 UL, C-UL, CSA, TÜV
AQV215S 6-Pin SOP	• Ultra small SMD housing (Small Outline Package=SOP)	100V	0.3A	0.9A	2.3/4.0Ω	110pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	0.2ms	500mW	1,500V AC		78 UL, C-UL, CSA, TÜV
AQV217S 6-Pin SOP	• Ultra small SMD housing (Small Outline Package=SOP)	200V	0.16A	0.48A	11/15Ω	70pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	1.0ms	0.2ms	500mW	1,500V AC	SMD (SOP) 	78 UL, C-UL, CSA, TÜV
AQV210S 6-Pin SOP	• Ultra small SMD housing (Small Outline Package=SOP)	350V	0.12A	0.3A	23/35Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	500mW	1,500V AC		78 UL, C-UL, CSA, TÜV
AQV214S 6-Pin SOP	• Ultra small SMD housing (Small Outline Package=SOP)	400V	0.1A	0.3A	30/50Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	500mW	1,500V AC	SMD (SOP) 	78 UL, C-UL, CSA, TÜV
AQV216S 6-Pin SOP	• Ultra small SMD housing (Small Outline Package=SOP)	600V	0.04A	0.12A	70/120Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	500mW	1,500V AC		78 UL, C-UL, CSA, TÜV
✪ **AQV212** 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing	60V	0.55A	1.2A	0.83/2.5Ω	80pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	0.2ms	550mW	1,500V AC	PCB, SMD 	84 UL, C-UL, CSA, TÜV
✪ **AQV252G** 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing • Low ON-resistance • High voltage type	60V	2.5A	6.0A	0.08/0.12Ω	500pF	1/1000nA	50mA	3.0mA	0.2mA	1.5V	5.0ms	0.5ms	550mW	1,500V AC		202 UL, C-UL, CSA, TÜV, VDE
AQV215 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing	100V	0.32A	0.96A	2.3/4.0Ω	110pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	0.2ms	550mW	1,500V AC	PCB, SMD 	84 UL, C-UL, CSA, TÜV
AQV217 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing	200V	0.18A	0.54A	11/15Ω	70pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	1.0ms	0.2ms	550mW	1,500V AC		84 UL, C-UL, CSA, TÜV
AQV210 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing	350V	0.13A	0.4A	23/35Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	550mW	1,500V AC	PCB, SMD 	84 UL, C-UL, CSA, TÜV
AQV210E 6-Pin DIP/SMD	• Low cost type • DIP and standard SMD housing	350V	0.13A	0.4A	23/35Ω	45pF	1/1000nA	50mA	3.0mA	1.0mA	1.5V	2.0ms	1.0ms	550mW	1,500V AC		137 UL, C-UL, CSA, TÜV
✪ **AQV210EH** 6-Pin DIP/SMD	• Low cost type • DIP and standard SMD housing • 5000V breakdown voltage	350V	0.13A	0.4A	23/35Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	1.0ms	550mW	1,500V AC	PCB, SMD 	140 UL, C-UL, CSA, TÜV, BSI, VDE
AQV210HL 6-Pin DIP/SMD	• DIP and standard SMD housing • 5000V breakdown voltage • Current limit function	350V	0.13A	- 0.18A (Output limit current [typ.])	20/25Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	1.0ms	550mW	5,000V AC		124 UL, C-UL, BSI, CSA

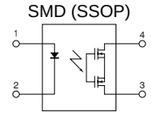
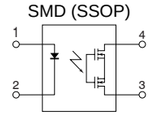
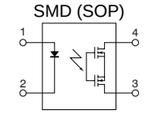
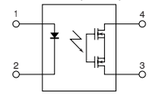
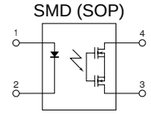
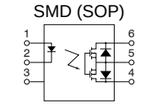
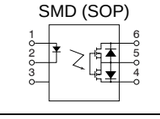
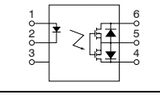
Type ✪ = PopularType	Features	Output						Input				Switching speed (I LED = 5mA)		Total power dissipation	I/O isolation voltage	Connection type Switching diagram	Page Approvals
		Peak load V DC/AC	Continuous load current	Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	Leakage current (typical/max.)	LED forward current (max.)	LED operate current (max.)	LED turn-off current (min.)	LED dropout voltage (max.)	Turn-on time (max.)	Turn-off time (max.)				
AQV214 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing	400V	0.12A	0.3A	30/50Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	550mW	1,500V AC	PCB, SMD 	84 UL, C-UL, CSA, TÜV
AQV214E 6-Pin DIP/SMD	• Low-cost type • DIP and standard SMD housing	400V	0.12A	0.3A	30/50Ω	45pF	1/1000nA	50mA	3.0mA	0.3mA	1.5V	2.0ms	1.0ms	550mW	1,500V AC		137 UL, C-UL, CSA, TÜV
✪ **AQV214EH** 6-Pin DIP/SMD	• Low-cost type • DIP and standard SMD housing • 5000V breakdown voltage	400V	0.12A	0.3A	30/50Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	1.0ms	550mW	5,000V AC	PCB, SMD 	137 UL, C-UL, CSA, TÜV, BSI, VDE
AQV214H 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing • 5000V breakdown voltage	400V	0.12A	0.3A	30/50Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	0.8ms	0.2ms	550mW	5,000V AC		84 UL, C-UL, CSA, TÜV, BSI, VDE
AQV216 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing	600V	0.05A	0.15A	70/120Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	550mW	1,500V AC	PCB, SMD 	84 UL, C-UL, CSA, TÜV
AQV101 6-Pin DIP/SMD	• Low ON-resistance • Control with an input current of 10mA	40V DC	0.7A	1.8A	0.3/0.5Ω	600pF	1/1000nA	50mA	5.0mA	0.8mA	3V	1.0ms	1.0ms	410mW	1,500V AC	PCB, SMD 	222 UL, C-UL, TÜV
AQV201 6-Pin DIP/SMD	• Low ON-resistance • Control with an input current of 10mA	40V	0.5A	1.8A	0.6/1Ω	350pF	1/1000nA	50mA	5.0mA	0.8mA	3V	1.0ms	1.0ms	410mW	1,500V AC	PCB, SMD 	222 UL, C-UL, TÜV
AQV251 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing • Low ON-resistance	40V	0.5A	1.8A	0.6/1.0Ω	350pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	3.0ms	0.2ms	410mW	1,500V AC	PCB, SMD 	205 UL, C-UL, CSA, TÜV
AQV102 6-Pin DIP/SMD	• Low ON-resistance • Control with an input current of 10mA	60V DC	0.6A	1.5A	0.37/0.7Ω	600pF	1/1000nA	50mA	5.0mA	0.8mA	3V	1.0ms	1.0ms	410mW	1,500V AC	PCB, SMD 	222 UL, C-UL, TÜV
AQV202 6-Pin DIP/SMD	• Low ON-resistance • Control with an input current of 10mA	60V	0.4A	1.5A	0.74/1.4Ω	350pF	1/1000nA	50mA	5.0mA	0.8mA	3V	1.0ms	1.0ms	410mW	1,500V AC	PCB, SMD 	222 UL, C-UL, TÜV
AQV252 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing • Low ON-resistance	60V	0.4A	1.5A	0.74/1.4Ω	350pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	1.4ms	0.2ms	410mW	1,500V AC	PCB, SMD 	205 UL, C-UL, CSA, TÜV
✪ **AQV112KL** 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing • Short circuit protection • Self-healing • Only DC	60V	0.5A	-	0.55/2Ω	300pF	1/1000nA	50mA	10mA	0.3mA	1.5V	2.0ms	1.0ms	550mW	1,500V AC	PCB, SMD 	117 UL, C-UL, CSA, TÜV, VDE

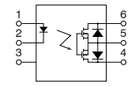
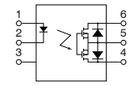
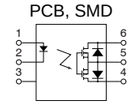
Type ✪ = PopularType	Features	Output						Input				Switching speed (I LED = 5mA)		Total power dissipation	I/O isolation voltage	Connection type Switching diagram	Page Approvals
		Peak load V DC/AC	Continuous load current	Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	Leakage current (typical/max.)	LED forward current (max.)	LED operate current (max.)	LED turn-off current (min.)	LED dropout voltage (max.)	Turn-on time (max.)	Turn-off time (max.)				
AQV255 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing • Low ON-resistance	100V	0.35A	1.0A	1.8/2.5Ω	350pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	0.2ms	410mW	1,500V AC	PCB, SMD	205 UL, C-UL, CSA, TÜV
AQV257 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing • Low ON-resistance	200V	0.25A	0.75A	2.6/4.0Ω	170pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	3.0ms	0.2ms	410mW	1,500V AC		205 UL, C-UL, CSA, TÜV
AQV103 6-Pin DIP/SMD	• Low ON-resistance • Control with an input current of 10mA	250V DC	0.3A	0.6A	2.7/4Ω	300pF	1/1000nA	50mA	5.0mA	0.8mA	3V	1.0ms	1.0ms	410mW	1,500V AC	PCB, SMD	222 UL, C-UL, TÜV
AQV203 6-Pin DIP/SMD	• Low ON-resistance • Control with an input current of 10mA	250V	0.2A	0.6A	5.5/8Ω	170pF	1/1000nA	50mA	5.0mA	0.8mA	3V	1.0ms	1.0ms	410mW	1,500V AC	PCB, SMD	222 UL, C-UL, TÜV
AQV253 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing • Low ON-resistance	250V	0.2A	0.6A	5.5/8.0Ω	170pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	0.2ms	410mW	1,500V AC	PCB, SMD	205 UL, C-UL, CSA, TÜV
AQV253H 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing • Low ON-resistance • 5000V breakdown voltage	250V	0.2A	0.6A	5.5/8Ω	170pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	4.0ms	0.2ms	410mW	1,500V AC		205 UL, C-UL, CSA, TÜV BSI, VDE
AQV104 6-Pin DIP/SMD	• Low ON-resistance • Control with an input current of 10mA	400V DC	0.18A	0.5A	6.3/8Ω	300pF	1/1000nA	50mA	5.0mA	0.8mA	3V	1.0ms	1.0ms	410mW	1,500V AC	PCB, SMD	222 UL, C-UL, TÜV
AQV204 6-Pin DIP/SMD	• Low ON-resistance • Control with an input current of 10mA	400V	0.15A	0.5A	12.4/16Ω	170pF	1/1000nA	50mA	5.0mA	0.8mA	3V	1.0ms	1.0ms	410mW	1,500V AC	PCB, SMD	222 UL, C-UL, TÜV
AQV234 6-Pin DIP/SMD	• DIP and standard SMD housing • High sensitivity version with operate current of typical 0.31mA	400V	0.12A	0.3A	30/50Ω	45pF	1/1000nA	50mA	0.31mA	0.1mA	1.5V	2.0ms	1.0ms	550mW	1,500V AC	PCB, SMD	227 UL, C-UL, CSA, TÜV
AQV254 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing • Low ON-resistance	400V	0.15A	0.5A	12.4/16Ω	170pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	0.2ms	410mW	1,500V AC		205 UL, C-UL, CSA, TÜV
AQV254H 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing • Low ON-resistance • 5000V breakdown voltage	400V	0.15A	0.5A	12.4/16Ω	170pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	3.0ms	0.2ms	410mW	5,000V AC	PCB, SMD	205 UL, C-UL, CSA, TÜV BSI, VDE
AQV259 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing • Low ON-resistance	1000V	0.03A	0.09A	80/200Ω	80pF	10/10000nA	50mA	3.0mA	0.4mA	1.5V	1.0ms	0.2ms	410mW	1,500V AC		205 UL, C-UL, CSA, TÜV
AQV258 6-Pin DIP/SMD	• DIP (dual inline) and standard SMD housing • Low ON-resistance	1,500V	0.02A	0.06A	345/500Ω	80pF	10/10000nA	50mA	3.0mA	0.4mA	1.5V	1.0ms	0.2ms	410mW	1,500V AC	PCB, SMD	205 UL, C-UL, CSA, TÜV

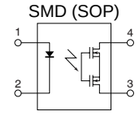
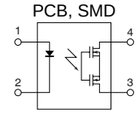
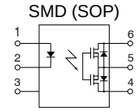
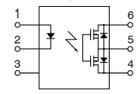
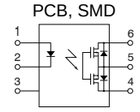
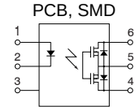
Type ✪ = PopularType	Features	Output						Input				Switching speed (I LED = 5mA)		Total power dissipation	I/O isolation voltage	Connection type Switching diagram	Page Approvals
		Peak load V DC/AC	Continuous load current	Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	Leakage current (typical/max.)	LED forward current (max.)	LED operate current (max.)	LED turn-off current (min.)	LED dropout voltage (max.)	Turn-on time (max.)	Turn-off time (max.)				
✪ **AQZ102** 4-Pin SIL	• High capacity DC type in 4-pin SIL (SIL=Single Inline) housing	60V DC	4.0A	9.0A	0.05/0.09Ω	1700pF	1/10µA	50mA	3.0mA	0.4mA	1.5V	5.0ms	3.0ms	1.35W	2,500V AC	PCB 	235 UL, C-UL, CSA, TÜV
AQZ105 4-Pin SIL	• High capacity DC type in 4-pin SIL (SIL=Single Inline) housing	100V DC	2.6A	6.0A	0.081/0.17Ω	1700pF	1/10µA	50mA	3.0mA	0.4mA	1.5V	5.0ms	3.0ms	1.35W	2,500V AC		235 UL, C-UL, CSA, TÜV
AQZ107 4-Pin SIL	• High capacity DC type in 4-pin SIL (SIL=Single Inline) housing	200V DC	1.3A	3.0A	0.34/0.55Ω	900pF	1/10µA	50mA	3.0mA	0.4mA	1.5V	5.0ms	3.0ms	1.35W	2,500V AC	PCB 	235 UL, C-UL, CSA, TÜV
AQZ104 4-Pin SIL	• High capacity DC type in 4-pin SIL (SIL=Single Inline) housing	400V DC	0.7A	1.5A	1.06/1.6Ω	900pF	1/10µA	50mA	3.0mA	0.4mA	1.5V	5.0ms	3.0ms	1.35W	2,500V AC		235 UL, C-UL, CSA, TÜV
✪ **AQZ202** 4-Pin SIL	• High capacity AC/DC type in 4-pin SIL (SIL=Single Inline) housing	60V	3.0A	9.0A	0.11/0.18Ω	1400pF	1/10µA	50mA	3.0mA	0.4mA	1.5V	5.0ms	3.0ms	1.6W	2,500V AC	PCB 	235 UL, C-UL, CSA, TÜV
AQZ262 4-Pin SIL 	• High capacity AC/DC in 4-pin housing • Low ON-resistance	60V	6.0A	10.0A	0.036/0.05Ω	1400pF	1/10µA	50mA.	3.0mA	0.4mA	1.5V	10.0ms	3.0ms	3.0W	1,500V AC		250 UL, CSA
✪ **AQZ205** 4-Pin SIL	• High capacity AC/DC type in 4-pin SIL (SIL=Single Inline) housing	100V	2.0A	6.0A	0.23/0.34Ω	1400pF	1/10µA	50mA.	3.0mA	0.4mA	1.5V	5.0ms	3.0ms	1.6W	2,500V AC	PCB 	235 UL, C-UL, CSA, TÜV
AQZ207 4-Pin SIL	• High capacity AC/DC type in 4-pin SIL (SIL=Single Inline) housing	200V	1.0A	3.0A	0.7/1.1Ω	600pF	1/10µA	50mA	3.0mA	0.4mA	1.5V	5.0ms	3.0ms	1.6W	2,500V AC		235 UL, C-UL, CSA, TÜV
✪ **AQZ204** 4-Pin SIL	• High capacity AC/DC type in 4-pin SIL (SIL=Single Inline) housing	400V	0.5A	1.5A	2.1/3.2Ω	600pF	1/10µA	50mA	3.0mA	0.4mA	1.5V	5.0ms	3.0ms	1.6W	2,500V AC	PCB 	235 UL, C-UL, CSA, TÜV
AQZ264 4-Pin SIL 	• High capacity AC/DC in 4-pin housing • Low ON-resistance	400V	1.0A	3.0A	1.0/1.4Ω	600pF	1/10µA	50mA	3.0mA	0.4mA	1.5V	10.0ms	3.0ms	3.0W	1,500V AC		250 UL, CSA

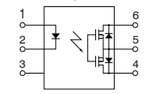
Type ✪ = PopularType	Features	Output						Input				Switching speed (I LED = 5mA)		Total power dissipation	I/O isolation voltage	Connection type Switching diagram	Page Approvals
		Peak load V DC/AC	Continuous load current	Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	Leakage current (typical/max.)	LED forward current (max.)	LED operate current (max.)	LED turn-off current (min.)	LED dropout voltage (max.)	Turn-on time (max.)	Turn-off time (max.)				
AQY272 4-Pin DIP 	• DIP standard SMD housing • High sensitivity • Flat DIP version • High capacity AC/DC type in 4-pin housing	60V	2.0A	6.0A	0.11/0.18Ω	1400pF	1/10µA	50mA	3.0mA	0.4mA	1.5V	5.0ms	3.0ms	750mW	2,500V AC	PCB, SMD 	230 UL, C-UL, CSA
AQY275 4-Pin DIP 	• DIP standard SMD housing • High sensitivity • Flat DIP version • High capacity AC/DC type in 4-pin housing	100V	1.3A	4.0A	0.23/0.34Ω	1400pF	1/10µA	50mA	3.0mA	0.4mA	1.5V	5.0ms	3.0ms	750mW	2,500V AC	PCB, SMD 	230 UL, C-UL, CSA
AQY277 4-Pin DIP 	• DIP standard SMD housing • High sensitivity • Flat DIP version • High capacity AC/DC type in 4-pin housing	200V	0.65A	2.0A	0.7/1.1Ω	600pF	1/10µA	50mA	3.0mA	0.4mA	1.5V	5.0ms	3.0ms	750mW	2,500V AC	PCB, SMD 	230 UL, C-UL, CSA
AQY274 4-Pin DIP 	• DIP standard SMD housing • High sensitivity • Flat DIP version • High capacity AC/DC type in 4-pin housing	400V	0.35A	1.0A	2.1/3.2Ω	600pF	1/10µA	50mA	3.0mA	0.4mA	1.5V	5.0ms	3.0ms	750mW	2,500V AC	PCB, SMD 	230 UL, C-UL, CSA

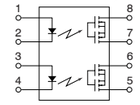
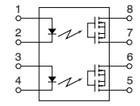
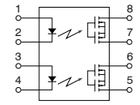
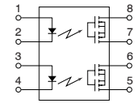
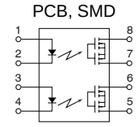
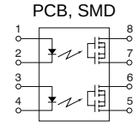
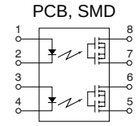
Type ✪ = PopularType	Features	Output						Input				Switching speed (I LED = 10mA)		Total power dissipation	I/O isolation voltage	Connection type Switching diagram	Page Approvals
		Peak load V DC/AC	Continuous load current	Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	Leakage current (typical/max.)	Input voltage (max.)	Operate voltage (max.)	Turn-off voltage (min.)	Input current (typ.)	Turn-on time (max.)	Turn-off time (max.)				
AQZ102D 4-Pin SIL	• High capacity DC type in 4-pin SIL (SIL = Single Inline) housing • Integrated current source available (control voltage 4-30V DC) • LED current 10mA	60V DC	3.6A	9.0A	0.033/0.09Ω	1700pF	1/10µA	30V	4V	0.8V	6.5mA	10.0ms	3.0ms	1.35W	2,500 V AC	PCB	245 UL, CSA, TÜV
AQZ202D 4-Pin SIL	• High capacity AC/DC type in 4-pin SIL (SIL = Single Inline) housing • Integrated current source available (control voltage 4-30V DC) • LED current 10mA	60V	2.7A	9.0A	0.066/0.18Ω	1400pF	1/10µA	30V	4V	0.8V	6.5mA	10.0ms	3.0ms	1.6W	2,500 V AC	PCB	245 UL, CSA, TÜV
AQZ105D 4-Pin SIL	• High capacity DC type in 4-pin SIL (SIL=Single Inline) housing • Integrated current source available (control voltage 4-30V DC) • LED current 10mA	100V DC	2.3A	6.0A	0.090/0.17Ω	1700pF	1/10µA	30V	4V	0.8V	6.5mA	10.0ms	3.0ms	1.35W	2,500 V AC	PCB	245 UL, CSA, TÜV
AQZ205D 4-Pin SIL	• High capacity AC/DC type in 4-pin SIL (SIL = Single Inline) housing • Integrated current source available (control voltage 4-30V DC) • LED current 10mA	100V	1.8A	6.0A	0.18/0.34Ω	1400pF	1/10µA	30V	4V	0.8V	6.5mA	10.0ms	3.0ms	1.6W	2,500 V AC	PCB	245 UL, CSA, TÜV
AQZ107D 4-Pin SIL	• High capacity DC type in 4-pin SIL (SIL=Single Inline) housing • Integrated current source available (control voltage 4-30V DC) • LED current 10mA	200V DC	1.1A	3.0A	0.33/0.55Ω	900pF	1/10µA	30V	4V	0.8V	6.5mA	10.0ms	3.0ms	1.35W	2,500 V AC	PCB	245 UL, CSA, TÜV
AQZ207D 4-Pin SIL	• High capacity AC/DC type in 4-pin SIL (SIL = Single Inline) housing • Integrated current source available (control voltage 4-30V DC) • LED current 10mA	200V	0.9A	3.0A	0.64/1.1Ω	600pF	1/10µA	30V	4V	0.8V	6.5mA	10.0ms	3.0ms	1.6W	2,500 V AC	PCB	245 UL, CSA, TÜV
AQZ104D 4-Pin SIL	• High capacity DC type in 4-pin SIL (SIL=Single Inline) housing • Integrated current source available (control voltage 4-30V DC) • LED current 10mA	400V DC	0.6A	1.5A	1.23/1.6Ω	900pF	1/10µA	30V	4V	0.8V	6.5mA	10.0ms	3.0ms	1.35W	2,500 V AC	PCB	245 UL, CSA, TÜV
AQZ204D 4-Pin SIL	• High capacity AC/DC type in 4-pin SIL (SIL = Single Inline) housing • Integrated current source available (control voltage 4-30V DC) • LED current 10mA	400V	0.45A	1.5A	2.4/3.2Ω	600pF	1/10µA	30V	4V	0.8V	6.5mA	10.0ms	3.0ms	1.6W	2,500 V AC	PCB	245 UL, CSA, TÜV

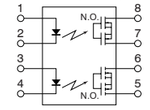
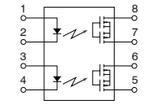
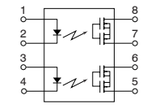
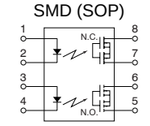
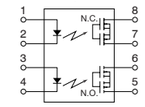
Type ✪ = PopularType	Features	Output						Input				Switching speed (I LED = 5mA)		Total power dissipation	I/O isolation voltage	Connection type Switching diagram	Page Approvals
		Peak load V DC/AC	Continuous load current	Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	Leakage current (typical/max.)	LED forward current (max.)	LED operate current (max.)	LED turn-off current (min.)	LED dropout voltage (max.)	Turn-on time (max.)	Turn-off time (max.)				
✪ **AQY221N3V** 4-Pin SSOP	• Further special types on request • Ultra small SSOP housing • High speed switching • Very good RF characteristics	25V	0.15A	0.4A	5.5/7.5Ω	1.0pF	30pA/10nA	50mA	3.0mA	0.2mA	1.5V	0.2ms	0.2ms	300mW	1,500V AC	SMD (SSOP) 	161 Pending: UL, C-UL
✪ **AQY221N2V** 4-Pin SSOP		40V	0.12A	0.3A	9.5/12.5Ω	1.0pF	0.01/10nA	50mA	3.0mA	0.2mA	1.5V	0.5ms	0.2ms	300mW	1,500V AC		
✪ **AQY221R2V** 4-Pin SSOP	• Further special types on request • Low ON-resistance with low output capacitance	40V	0.25A	0.75A	0.75/1.25Ω	12.5pF	10pA/10nA	50mA	3.0mA	0.1mA	1.5V	0.5ms	0.2ms	300mW	1,500V AC	SMD (SSOP) 	165 Pending: UL, C-UL
✪ **AQY221N1S** 4-Pin SOP	• Further special types on request • Extremely low output capacitance • Very short switching times • Ultra small SMD housing • Very good RF characteristics (Small Outline Package=SOP)	40V	0.12A	0.3A	9.8/12.5Ω	2.0pF	0.01/10nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	350mW	1,500V AC	SMD (SOP) 	173 UL, CSA, TÜV
✪ **AQY221N2S** 4-Pin SOP		40V	0.12A	0.3A	9.5/12.5Ω	1.0pF	0.01/10nA	50mA	3.0mA	0.2mA	1.5V	0.5ms	0.2ms	350mW	1,500V AC		
✪ **AQY221R2S** 4-Pin SOP	• Further special types on request • Low ON-resistance with low output capacitance	40V	0.25A	0.75A	0.8/1.25Ω	13pF	0.03/10nA	50mA	3.0mA	0.1mA	1.5V	0.5ms	0.2ms	350mW	500V AC	SMD (SOP) 	169 UL, CSA, TÜV
AQY225NS 4-Pin SOP	• Further special types on request • Extremely low output capacitance • Very short switching times • Ultra small SMD housing (SOP) • Very good RF characteristics	80V	0.1A	0.3A	7/10Ω	10pF	0.02/10nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	350mW	1,500V AC	SMD (SOP) 	184 UL, CSA, TÜV
AQY224NS 4-Pin SOP		400V	0.03A	0.3A	70/100Ω	10pF	3pA/10nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	350mW	1,500V AC		184 UL, CSA, TÜV
AQV225NS 6-Pin SOP	• Further special types on request • High switch speed • Ultra small SMD housing (Small Outline Package = SOP)	80V	0.12A	0.36A	7/10Ω	10pF	0.01/10nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	500mW	1,500V AC	SMD (SOP) 	184 UL, CSA, TÜV
AQV227NS 6-Pin SOP	• High switch speed • Ultra small SMD housing (Small Outline Package = SOP)	200V	0.05A	0.15A	30/50Ω	10pF	0.01/10nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	500mW	1,500V AC	SMD (SOP) 	184 UL, CSA, TÜV
AQV224NS 6-Pin SOP		400V	0.04A	0.12A	70/100Ω	10pF	0.01/10nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	500mW	1,500V AC		
AQV221 6-Pin DIP/SMD	• Further special types on request	40V	0.08A	0.18A	22/35Ω	5.6pF	0.01/10nA	50mA	3.0mA	0.4mA	1.5V	0.3ms	0.1ms	280mW	1,500V AC	PCB, SMD 	158 UL, CSA, TÜV

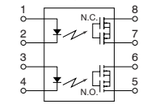
Type ✪ = PopularType	Features	Output						Input				Switching speed (I LED = 5mA)		Total power dissipation	I/O isolation voltage	Connection type Switching diagram	Page Approvals
		Peak load V DC/AC	Continuous load current	Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	Leakage current (typical/max.)	LED forward current (max.)	LED operate current (max.)	LED turn-off current (min.)	LED dropout voltage (max.)	Turn-on time (max.)	Turn-off time (max.)				
AQV221N 6-Pin DIP/SMD	• Further special types on request • Low ON-resistance	40V	0.15A	0.45A	9.8/15Ω	3.9pF	0.01/10nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	410mW	1,500V AC	PCB, SMD 	177 UL, CSA, TÜV
AQV225 6-Pin DIP/SMD	• Further special types on request	80V	0.05A	0.15A	36/50Ω	4.8pF	0.01/10nA	50mA	3.0mA	0.4mA	1.5V	0.3ms	0.1ms	280mW	1,500V AC		158 UL, CSA, TÜV
AQV225N 6-Pin DIP/SMD	• Further special types on request • Low ON-resistance	80V	0.15A	0.15A	7/10Ω	10pF	0.01/10nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	500mW	1,500V AC	PCB, SMD 	187 UL, CSA, TÜV
AQV227N 6-Pin DIP/SMD	• Further special types on request • Low ON-resistance	200V	0.07A	0.21A	30/50Ω	10pF	0.01/10nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	410mW	1,500V AC		187 UL, CSA, TÜV
AQV224N 6-Pin DIP/SMD	• Further special types on request • Low ON-resistance	400V	0.05A	0.15A	70/100Ω	10pF	0.01/10nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	410mW	1,500V AC	PCB, SMD 	187 UL, CSA, TÜV

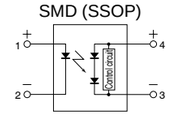
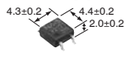
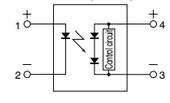
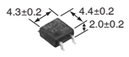
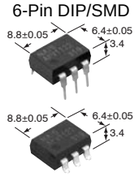
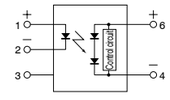
Type ✪ = PopularType	Features	Output						Input				Switching speed (I LED = 5mA)		Total power dissipation	I/O isolation voltage	Connection type Switching diagram	Page Approvals
		Peak load V DC/AC	Continuous load current	Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	Leakage current (typical/max.)	LED forward current (max.)	LED operate current (max.)	LED turn-off current (min.)	LED dropout voltage (max.)	Turn-on time (max.)	Turn-off time (max.)				
1 Form B Signal Relays																	
AQY412S 4-Pin SOP	• Ultra small SMD housing (Small outline Package=SOP) • Low ON-resistance	60V	0.5A	1.5A	1/2.5Ω	450pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	3.0ms	1.0ms	350mW	1,500V AC	SMD (SOP) 	94 UL, CSA, VDE
✪ **AQY410S** 4-Pin SOP	• Ultra small SMD housing (Small outline Package=SOP)	350V	0.12A	0.3A	18/25Ω	110pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	1.0ms	1.0ms	350mW	1,500V AC		94 UL, CSA, TÜV, BSI
AQY414S 4-Pin SOP	• Ultra small SMD housing (Small outline Package=SOP)	400V	0.1A	0.24A	26/35Ω	100pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	1.0ms	1.0ms	350mW	1,500V AC		187 UL, CSA, TÜV, BSI
AQY412EH 4-Pin DIP	• DIP and standard SMD housing • 5000V breakdown voltage • Low ON-resistance	60V	0.55A	1.5A	1/2.5Ω	480pF	100/ 10000nA	50mA	3.0mA	0.4mA	1.5V	10.0ms	1.0ms	550mW	5,000V AC	PCB, SMD 	144 UL, CSA, VDE
✪ **AQY410EH** 4-Pin DIP	• DIP and standard SMD housing • 5000V breakdown voltage	350V	0.13A	0.4A	18/25Ω	110pF	100/ 10000nA	50mA	3.0mA	0.4mA	1.5V	3.0ms	1.0ms	550mW	5,000V AC		144 UL, CSA, BSI
AQY414EH 4-Pin DIP	• DIP and standard SMD housing • 5000V breakdown voltage	400V	0.12A	0.3A	26/35Ω	100pF	100/ 10000nA	50mA	3.0mA	0.4mA	1.5V	3.0ms	1.0ms	550mW	5,000V AC		144 UL, CSA, BSI
AQV414S 6-Pin SOP	• Ultra small SMD housing (Small Outline Package=SOP)	400V	0.1A	0.3A	26/50Ω	100pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	1.0ms	1.0ms	500mW	1,500V AC	SMD (SOP) 	98 UL, CSA, TÜV
AQV410EH 6-Pin DIP/SMD	• Low-cost type • DIP and standard SMD housing • 5000V breakdown voltage	350V	0.13A	0.4A	18/35Ω	110pF	100/ 10000nA	50mA	3.0mA	0.4mA	1.5V	3.0ms	1.5ms	550mW	5,000V AC	PCB, SMD 	147 UL, CSA, TÜV, BSI, VDE
AQV412EH 6-Pin DIP/SMD	• 5000V breakdown voltage • DIP and standard SMD housing • Low ON-resistance	60V	0.55A	1.5A	1/2.5Ω	480pF	100/ 10000nA	50mA	3.0mA	0.4mA	1.5V	10.0ms	1.5ms	550mW	5,000V AC		147 UL, CSA, TÜV, VDE
AQV414E 6-Pin DIP/SMD	• Low-cost type • DIP and standard SMD housing	400V	0.12A	0.3A	26/50Ω	100pF	1/1000nA	50mA	3.0mA	0.3mA	1.5V	2.0ms	1.0ms	550mW	1,500V AC		147 UL, CSA, TÜV
AQV414EH 6-Pin DIP/SMD	• Low-cost type • DIP and standard SMD housing • 5000V breakdown voltage	400V	0.12A	0.3A	26/50Ω	100pF	100/ 10000nA	50mA	3.0mA	0.4mA	1.5V	3.0ms	1.5ms	550mW	5,000V AC	PCB, SMD 	147 UL, CSA, TÜV, BSI, VDE
AQV453 6-Pin DIP/SMD	• Low ON-resistance	250V	0.2A	0.6A	5.5/8.0Ω	350pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	3.0ms	1.0ms	410mW	1,500V AC		212 UL, CSA
AQV414 6-Pin DIP/SMD	• Normally-closed type (1 Form B)	400V	0.12A	0.3A	26/50Ω	100pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	1.0ms	1.0ms	550mW	1,500V AC	PCB, SMD 	101 UL, CSA, TÜV

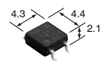
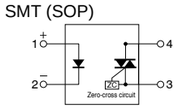
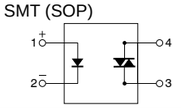
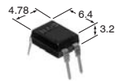
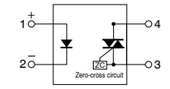
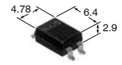
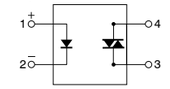
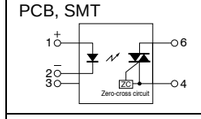
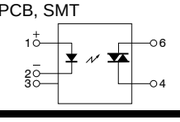
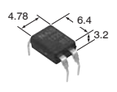
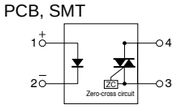
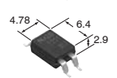
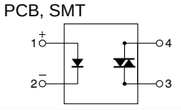
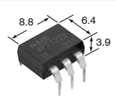
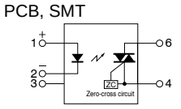
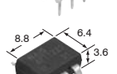
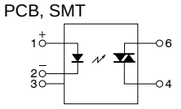
Type ✪ = PopularType	Features	Output						Input				Switching speed (I LED = 5mA)		Total power dissipation	I/O isolation voltage	Connection type Switching diagram	Page Approvals
		Peak load V DC/AC	Continuous load current	Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	Leakage current (typical/max.)	LED forward current (max.)	LED operate current (max.)	LED turn-off current (min.)	LED dropout voltage (max.)	Turn-on time (max.)	Turn-off time (max.)				
AQV454 6-Pin DIP/SMD	• Low ON-resistance	400V	0.15A	0.5A	10.5/16Ω	170pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	1.0ms	410mW	1,500V AC	PCB, SMD 	212 UL, CSA, TÜV
AQV454H 6-Pin DIP/SMD	• 5000V breakdown voltage	400V	0.15A	0.5A	10.5/16Ω	170pF	10/10000nA	50mA	3.0mA	0.4mA	1.5V	3.0ms	1.0ms	410mW	5,000V AC		212 UL, CSA, TÜV
1 Form B Power Relays																	
AQZ404 4-Pin SIL	• High capacity AC/DC with breakcontact in 4-pin SIL housing	400V	0.5A	1.5A	2.8/4.0Ω	2000pF	1000/ 10000nA	50mA	3.0mA	0.4mA	1.5V	7.5ms	3.0ms	1.6W	2,500V AC	PCB 	241 UL, CSA

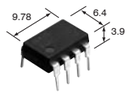
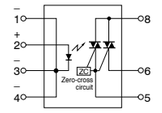
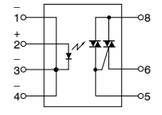
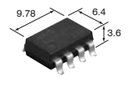
Type ✪ = PopularType	Features	Output						Input				Switching speed (I LED = 5mA)		Total power dissipation	I/O isolation voltage	Connection type Switching diagram	Page Approvals
		Peak load V DC/AC	Continuous load current	Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	Leakage current (typical/max.)	LED forward current (max.)	LED operate current (max.)	LED turn-off current (min.)	LED dropout voltage (max.)	Turn-on time (max.)	Turn-off time (max.)				
✪ **AQW210S** 8-Pin SOP	• Ultra small SMD housing (Small Outline Package=SOP)	350V	0.1A	0.3A	16/35Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	650mW	1,500V AC	SMD (SOP) 	88 UL, CSA, TÜV
✪ **AQW214S** 8-Pin SOP	• Ultra small SMD housing (Small Outline Package=SOP)	400V	0.08A	0.24A	30/50Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	650mW	1,500V AC		88 UL, CSA, TÜV
✪ **AQW212EH** 8-Pin DIP/SMD	• Low-cost type • DIP and standard SMD housing • 5000V breakdown voltage	60V	0.5A	1.5A	0.83/2.5Ω	80pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	4.0ms	1.0ms	850mW	5,000V AC	PCB, SMD 	140 UL, CSA, TÜV
✪ **AQW210EH** 8-Pin DIP/SMD	• Low-cost type • DIP and standard SMD housing • 5000V breakdown voltage	350V	0.12A	0.36A	18/25Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	1.0ms	850mW	5,000V AC		140 UL, CSA, TÜV
AQW210HL 8-Pin DIP/SMD	• DIP and standard SMD housing • 5000V breakdown voltage • Current limit function	350V	0.1A	- 0.18A (Output limit current [typ.])	20/25Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	1.0ms	850mW	5,000V AC	PCB, SMD 	130 UL, CSA, TÜV
✪ **AQW214EH** 8-Pin DIP/SMD	• Low-cost type • DIP and standard SMD housing • 5000V breakdown voltage	400V	0.1A	0.3A	26/35Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	1.0ms	850mW	5,000V AC		140 UL, CSA, TÜV
✪ **AQW216EH** 8-Pin DIP/SMD	• Low-cost type • DIP and standard SMD housing • 5000V breakdown voltage	600V	0.04A	0.12A	26/35Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	1.0ms	850mW	5,000V AC	PCB, SMD 	140 UL, CSA, TÜV
AQW212 8-Pin DIP/SMD	• DIP and standard SMD housing	60V	0.6A	1.0A	0.83/2.5Ω	150pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	0.2ms	850mW	1,500V AC		91 UL, CSA, TÜV
AQW215 8-Pin DIP/SMD	• DIP and standard SMD housing	100V	0.3A	0.9A	2.3/4.0Ω	110pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	0.2ms	850mW	1,500V AC	PCB, SMD 	91 UL, CSA, TÜV
AQW217 8-Pin DIP/SMD	• DIP and standard SMD housing	200V	0.16A	0.48A	11/15Ω	70pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	0.2ms	850mW	1,500V AC		91 UL, CSA, TÜV
AQW210 8-Pin DIP/SMD	• DIP and standard SMD housing	350V	0.12A	0.36A	23/35Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.05ms	850mW	1,500V AC	PCB, SMD 	91 UL, CSA, TÜV
AQW214 8-Pin DIP/SMD	• DIP and standard SMD housing	400V	0.1A	0.3A	30/50Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.05ms	850mW	1,500V AC		91 UL, CSA, TÜV
AQW254 8-Pin DIP/SMD	• Low ON-resistance • DIP and standard SMD housing	400V	0.12A	0.36A	12.4/16Ω	170pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	0.2ms	850mW	1,500V AC	PCB, SMD 	209 UL, CSA, TÜV
AQW216 8-Pin DIP/SMD	• DIP and standard SMD housing	600V	0.04A	0.12A	70/120Ω	45pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	850mW	1,500V AC		91 UL, CSA, TÜV

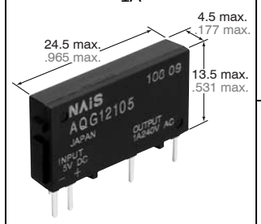
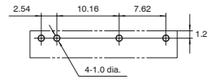
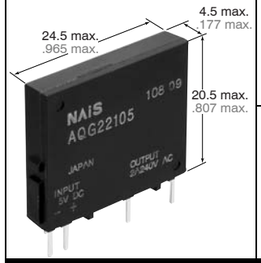
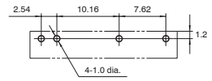
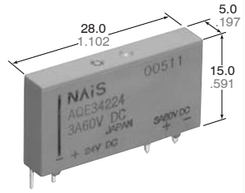
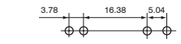
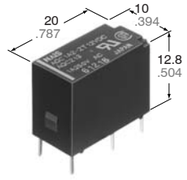
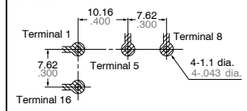
Type ✪ = PopularType	Features	Output						Input				Switching speed (I LED = 5mA)		Total power dissipation	I/O isolation voltage	Connection type Switching diagram	Page Approvals
		Peak load V DC/AC	Continuous load current	Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	Leakage current (typical/max.)	LED forward current (max.)	LED operate current (max.)	LED turn-off current (min.)	LED dropout voltage (max.)	Turn-on time (max.)	Turn-off time (max.)				
2 Form A Low CxR																	
AQW227NS 8-Pin SOP	• Low ON-resistance type • Ultra small SMD housing (Small Outline Package=SOP)	200V	0.04A	0.15A	30/50Ω	10pF	10nA (max.)	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	650mW	1,500V AC	SMD (SOP) 	193 UL, C-UL, TÜV
AQW225N 8-Pin DIP/SMD	• Further special types on request • Low ON-resistance	60V	0.12A	0.36A	7/10Ω	10pF	10nA (max.)	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	850mW	1,500V AC	PCB, SMD 	190 UL, CSA, TÜV
AQW227N 8-Pin DIP/SMD	• Further special types on request • Low ON-resistance	200V	0.05A	0.15A	30/50Ω	10pF	10nA (max.)	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	850mW	1,500V AC		190 UL, CSA, TÜV
AQW224N 8-Pin DIP/SMD	• Further special types on request • Low ON-resistance	400V	0.04A	0.12A	70/100Ω	10pF	10nA (max.)	50mA	3.0mA	0.4mA	1.5V	0.5ms	0.2ms	850mW	1,500V AC		190 UL, CSA, TÜV
2 Form B																	
✪**AQW414EH** 8-Pin DIP/SMD	• Low-cost type • DIP and standard SMD housing • 5000V breakdown voltage	400V	0.1A	0.3A	26/35Ω	100pF	10/10000nA	50mA	3.0mA	0.4mA	1.5V	3.0ms	1.0ms	850mW	5,000V AC	PCB, SMD 	151 UL, CSA, TÜV, BSI
AQW414 8-Pin DIP/SMD	• DIP and standard SMD housing	400V	0.1A	0.3A	26/50Ω	100pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	1.0ms	1.0ms	850mW	1,500V AC		104 UL, CSA, TÜV
AQW454 8-Pin DIP/SMD	• DIP and standard SMD housing • Low ON-resistance	400V	0.12A	0.36A	11/16Ω	170pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	2.0ms	1.0ms	850mW	1,500V AC		215 UL, CSA, TÜV
1 Form A / 1 Form B																	
AQW612S 8-Pin SOP	• Ultra small SMD housing (Small outline Package=SOP) • Low ON-resistance	60V	0.45A	1.5A	1/2.5Ω	80pF (N.O.) 450pF (N.C.)	1/1000nA	50mA	3.0mA	0.4mA	1.5V	3.0ms	1.0m	650mW	1,500V AC	SMD (SOP) 	107 UL, CSA, TÜV, VDE
✪**AQW610S** 8-Pin SOP	• Ultra small SMD housing (Small Outline Package=SOP)	350V	0.1A	0.3A	18/25Ω	45pF (N.O), 100pF (N.C.)	1/1000nA	50mA	3.0mA	0.4mA	1.5V	1.0ms	1.0ms	650mW	1,500V AC		107 UL, CSA, TÜV, BSI
AQW612EH 8-Pin DIP/SMD	• DIP and standard SMD housing • Low ON-resistance	60V	0.5A	1.5A	1/2.5Ω	80pF (N.O.) 480pF (N.C.)	1/1000nA (N.O.) 100/ 10000nA (N.C.)	50mA	3.0mA	0.4mA	1.5V	4.0ms (N.O.) 10.0ms (N.C.)	1.0ms	850mW	5,000V AC	PCB, SMD 	154 UL, CSA, TÜV, VDE
✪**AQW610EH** 8-Pin DIP/SMD	• Low-cost type • DIP and standard SMD housing	350V	0.12A	0.36A	18/25Ω	45pF (N.O.), 100pF (N.C.)	1/1000nA (N.O.) 100/ 10000nA (N.C.)	50mA	3.0mA	0.4mA	1.5V	3.0ms	1.0ms	850mW	5,000V AC		154 UL, CSA, TÜV, BSI
✪**AQW614EH** 8-Pin DIP/SMD	• Low-cost type • DIP and standard SMD housing	400V	0.1A	0.3A	26/35Ω	45pF (N.O.), 100pF (N.C.)	1/1000nA (N.O.) 100/ 10000nA (N.C.)	50mA	3.0mA	0.4mA	1.5V	3.0ms	1.0ms	850mW	5,000V AC		154 UL, CSA, TÜV, BSI

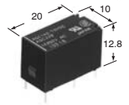
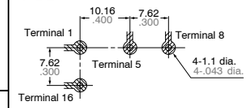
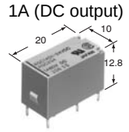
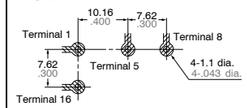
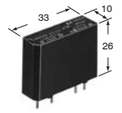
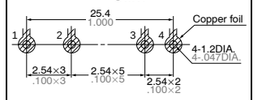
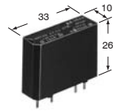
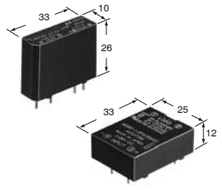
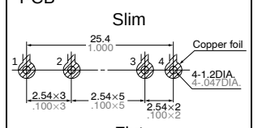
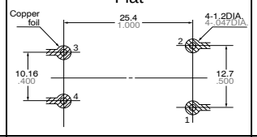
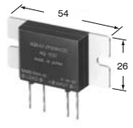
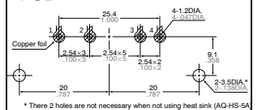
Type ✪ = PopularType	Features	Output						Input				Switching speed (I LED = 5mA)		Total power dissipation	I/O isolation voltage	Connection type Switching diagram	Page Approvals
		Peak load V DC/AC	Continuous load current	Peak load current (100ms)	ON resistance (typical/max.)	Output capacitance (typical)	Leakage current (typical/max.)	LED forward current (max.)	LED operate current (max.)	LED turn-off current (min.)	LED dropout voltage (max.)	Turn-on time (max.)	Turn-off time (max.)				
AQW614 8-Pin DIP/SMD	• DIP and standard SMD housing	400V	0.1A	0.3A	27/50Ω	45pF (N.O.), 100pF (N.C.)	1/1000nA (N.O.) 10000nA (N.C.)	50mA	3.0mA	0.4mA	1.5V	1.0ms	1.0ms	850mW	1,500V AC	PCB, SMD 	110 UL, CSA, TÜV
AQW654 8-Pin DIP/SMD	• DIP and standard SMD housing • Low ON-resistance	400V	0.12A	0.36A	• N.O.: 10/16Ω • N.C.: 11/16Ω	170pF	1/1000nA	50mA	3.0mA	0.4mA	1.5V	3.0ms	1.0ms	850mW	1,500V AC		218 UL, CSA, TÜV
Multichannel																	
AQS221N2S 16-Pin SOP	• Low output capacitance between output terminals and low ON-resistance	40V	0.06A	0.12A	9.5/12.5Ω	1pF	20pA/10nA	50mA	3.0mA	0.1mA	1.5V	0.2ms	0.2ms	650mW	500V AC	SMD (SOP) 	181 UL, CSA, TÜV
AQS225S 16-Pin SOP	• 4 channel RF-PhotoMOS relay	80V	0.05A	0.15A	21/35Ω	4.5pF	30pA/10nA	50mA	3.0mA	0.3mA	1.5V	0.3ms	0.1ms	650mW	1,500V AC		196 UL, CSA, TÜV
AQS225R2S 16-Pin SOP	• 4 channel RF-PhotoMOS relay	80V	0.07A	0.2A	10.5/15.0Ω	4.5pF	10pA/10nA	50mA	3.0mA	0.3mA	1.5V	0.3ms	0.2ms	650mW	1,500V AC		199 UL, CSA, TÜV

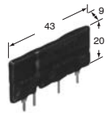
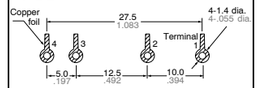
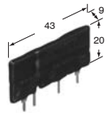
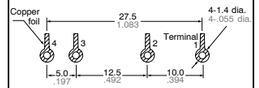
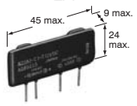
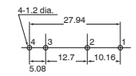
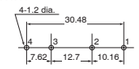
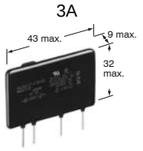
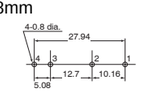
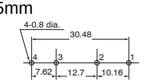
Type ✪ = PopularType	Features	Output		Input		Input		Switching speed (I LED = 5mA)		I/O isolation voltage	Connection type Switching diagram	Page Approvals
		Open voltage (typical/min.)	Short current (typical/min.)	LED forward current (max.)	LED operate current (max.)	LED turn-off current (min.)	LED dropout voltage (max.)	Turn-on time (typical)	Turn-off time (typical)			
✪ **APV2111V** 4-Pin SSOP 	• Ultra small SSOP housing	8.2/5.0V	8/3µA	50mA	3.mA	0.2mA	1.5V	0.8ms	0.1ms	1,500V AC	SMD (SSOP) 	255 UL, TÜV, CSA pending
APV1121S 4-Pin SOP 	• Ultra small SMD (SOP) housing	8.7/6.0V	14/5µA	50mA	3.mA	0.2mA	1.5V	0.4ms	0.1ms	2,500V AC	SMD (SOP) 	255 UL, TÜV, CSA pending
APV2121S 4-Pin SOP 	• Ultra small SMD (SOP) housing	8.2/5.0V	8/3µA	50mA	3.mA	0.2mA	1.5V	0.8ms	0.1ms	2,500V AC		
APV1122 6-Pin DIP/SMD 	• 5000V breakdown voltage	8.7/6.0	14/5µA	50mA	3.mA	0.2mA	1.5V	0.4ms	0.1ms	5,000V AC	PCB, SMD 	255 UL, TÜV, CSA pending

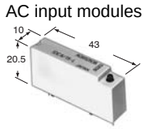
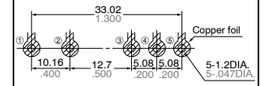
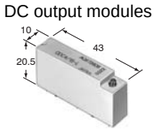
Type	Features	Photo with Dimensions	Output					Input				Zero-cross voltage (max.)	I/O isolation voltage	Connection type Switching diagram	Page Approvals
			Repetitive peak OFF-state voltage	Max. load current	Non-repetitive surge current (1 cycle, 60Hz)	Peak ON-state voltage (max.)	Peak OFF-state current (max.)	LED forward current (max.)	LED trigger current (max.)	LED drop-out voltage (max.)	Turn-on time (max.)				
APT1211S	• Zero-cross • SOP 4 pin		600V	0.05A	0.6A	2.5V	1μA	50mA	10mA	1.3V	0.1ms	50V	3,750V	SMT (SOP) 	275 UL, C-UL, VDE
APT1221S	• SOP 4 pin • Non zero-cross											-		SMT (SOP) 	
APT1211	• Zero-cross • DIP 4 pin		600V	0.1A	1.2A	2.5V	1μA	50mA	10mA	1.3V	0.1ms	50V	5,000V	PCB, SMT 	
APT1221	• DIP 4 pin • Non zero-cross											-		PCB, SMT 	
APT1212	• Zero-cross • DIP 6 pin		600V	0.1A	1.2A	2.5V	1μA	50mA	10mA	1.3V	0.1ms	50V	5,000V	PCB, SMT 	275 UL, C-UL, VDE
APT1222	• DIP 6 pin • Non zero-cross											-		PCB, SMT 	
APT1211W	• Zero-cross • DIP 4 pin wide terminal		600V	0.1A	1.2A	2.5V	1μA	50mA	10mA	1.3V	0.1ms	50V	5,000V	PCB, SMT 	279 UL, C-UL, VDE
APT1221W	• DIP 4 pin wide terminal • Non zero-cross											-		PCB, SMT 	
APT1212W	• Zero-cross • DIP 6 pin wide terminal		600V	0.1A	1.2A	2.5V	1μA	50mA	10mA	1.3V	0.1ms	50V	5,000V	PCB, SMT 	
APT1222W	• DIP 6 pin wide terminal • Non zero-cross											-		PCB, SMT 	

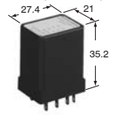
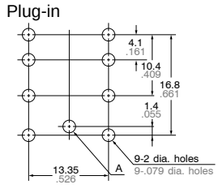
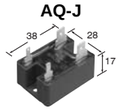
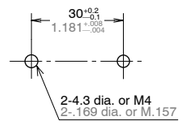
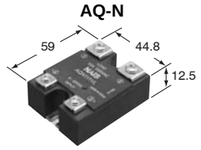
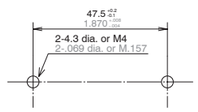
Type	Features	Photo with Dimensions	Output					Input				Zero-cross voltage (max.)	I/O isolation voltage	Connection type Switching diagram	Page Approvals
			Repetitive peak OFF-state voltage	Max. load current	Non-repetitive surge current (1 cycle, 60Hz)	Peak ON-state voltage (max.)	Peak OFF-state current (max.)	LED forward current (max.)	LED trigger current (max.)	LED drop-out voltage (max.)	Turn-on time (max.)				
AQH0213	• Photo-Triac • Zero-cross		600V	0.3A	3A	2.5V	100µA	50mA	10mA	1.3V	0.1ms	50V	5,000V	PCB, SMT With zero-cross switch:  Without zero-cross switch: 	283 UL, C-UL, VDE
AQH0223	• Photo-Triac • Non zero-cross											-			
AQH1213	• Photo-Triac • Zero-cross		600V	0.6A	6A	2.5V	100µA	50mA	10mA	1.3V	0.1ms	50V	5,000V		
AQH0223	• Photo-Triac • Non zero-cross											-			
AQH2213	• Photo-Triac • Zero-cross		600V	0.9A	9A	2.5V	100µA	50mA	10mA	1.3V	0.1ms	50V	5,000V		
AQH2223	• Photo-Triac • Non zero-cross											-			
AQH3213	• Photo-Triac • Zero-cross		600V	1.2A	12A	2.5V	100µA	50mA	10mA	1.3V	0.1ms	50V	5,000V		
AQH3223	• Photo-Triac • Non zero-cross											-			

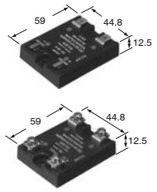
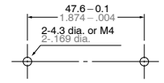
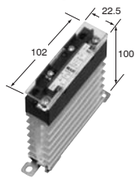
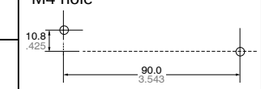
Type	Features	Output				Input		Input			Breakdown voltage	Connection type Terminal layout	Page Approvals
		Load voltage	Max. load current	Non-repetitive surge current (1 cycle, 60Hz)	OFF-state leakage current (max.)	Input voltage	Input impedance	Drop-out voltage (min.)	Operate time	Release time			
AQG 1A 	• Photo-Triac • Zero-cross • Integrated snubber circuit	75 - 264V AC	1A	8A	1.5mA	4 - 6V DC	0.3kΩ	1V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	3,000V AC	PCB 	286 UL, C-UL, VDE
						9.6 - 14.4V DC	0.8kΩ						
						19.2 - 28.8V DC	1.6kΩ						
	• Photo-Triac • Non zero-cross • Integrated snubber circuit	75 - 264V AC	1A	8A	1.5mA	4 - 6V DC	0.3kΩ	1V	1ms	½ cycle of voltage sine wave + 1ms	3,000V AC		
						9.6 - 14.4V DC	0.8kΩ						
						19.2 - 28.8V DC	1.6kΩ						
AQG 2A 	• Photo-Triac • Zero-cross • Integrated snubber circuit	75 - 264V AC	2A	30A	1.5mA	4 - 6V DC	0.3kΩ	1V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	3,000V AC	PCB 	
						9.6 - 14.4V DC	0.8kΩ						
						19.2 - 28.8V DC	1.6kΩ						
	• Photo-Triac • Non zero-cross • Integrated snubber circuit	75 - 264V AC	2A	30A	1.5mA	4 - 6V DC	0.3kΩ	1V	1ms	½ cycle of voltage sine wave + 1ms	3,000V AC		
						9.6 - 14.4V DC	0.8kΩ						
						19.2 - 28.8V DC	1.6kΩ						
AQE 	• Photo-Triac • Zero-cross • AC output type with integrated snubber circuit	75 - 250V AC	1A	20A	1.5mA	4 - 6V DC	0.5kΩ	0.5V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	2,500V AC	PCB 	289 UL, C-UL, VDE
						9.6 - 14.4V DC	1.3kΩ	1.2V					
						21.6 - 26.4V DC	3kΩ	2.4V					
	• Photo-Diode • DC output type	3 - 60V DC	3A	15A (10ms)	10μA	4 - 6V DC	0.5kΩ	0.5V	~2ms	~0.4ms	2,500V AC		
						9.6 - 14.4V DC	1.3kΩ	1.2V					
						21.6 - 26.4V DC	3kΩ	2.4V					
AQ-C • AC input, DC input 	• Photo-Transistor • AC input type	4 - 32V DC	25mA	-	5μA	80 - 250V AC	-	10V AC	20ms	20ms	2,500V AC	PCB 	292 UL, CSA, TÜV
	• Photo-Transistor • DC input type	4 - 32V DC	25mA	-	5μA	3 - 32V DC	-	1V DC	5ms	5ms	2,500V AC		

Type	Features	Output				Input		Input			Breakdown voltage	Connection type Terminal layout	Page Approvals
		Load voltage	Max. load current	Non-repetitive surge current (1 cycle, 60Hz)	OFF-state leakage current (max.)	Input voltage	Input impedance	Drop-out voltage (min.)	Operate time	Release time			
AQ-C 1A (AC output) 	• Photo-Triac • Zero-cross	• 75 -125V AC • 75 - 250V AC	1A	20A	1.1mA	4 - 6V DC	0.3kΩ	0.5V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	2,500V AC	PCB 	292 UL, CSA, TÜV
						9.6 - 14.4V DC	0.8kΩ	1.2V					
						21.6 - 26.4V DC	1.8kΩ	2.4V					
	• Photo-Triac • Non zero-cross	• 75 -125V AC • 75 - 250V AC	1A	20A	1.1mA	4.- 6V DC	0.3kΩ	0.5V	1ms	½ cycle of voltage sine wave + 1ms	2,500V AC		
						9.6 - 14.4V DC	0.8kΩ	1.2V					
						21.6 - 26.4V DC	1.8kΩ	2.4V					
AQ-C 1A (DC output) 	• Photo-Transistor	3 - 60V DC	1A	1.5A (1s)	0.1mA	4 - 6V DC	430Ω	4V	0.5ms	1ms	2,500V AC	PCB 	292 UL, CSA, TÜV
						9.6 - 14.4V DC	1.2kΩ	9.6V					
						21.6 - 26.4V DC	2.8kΩ	21.6V					
AQ1 1A (DC output) 	• Photo-Transistor	10 - 200V DC	1A	5A (1s)	1mA	3 - 28V DC	1.6kΩ	0.8V	0.5ms	2ms	3,000V AC	PCB Slim 	296 UL, CSA, TÜV
AQ1 2A (DC output) 	• Photo-Transistor	3 - 60 V DC	2A	5A (1s)	1mA	3 - 28V DC	1.6kΩ	0.8V	0.5ms	2ms	3,000V AC		
AQ1 2A 	• Photo-Transistor • Zero-cross	75 - 250V AC	2A	80A	5mA	3 - 28V DC	1.6kΩ	0.8V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	3,000V AC	PCB Slim  Flat 	296 UL, CSA
AQ1 5Ae 	• Photo-Transistor • Zero-cross	75 - 250V AC	5A	100A	5mA	3 - 28V DC	1.6kΩ	0.8V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	• 3,000V (between input and output) • 1,500V (between input, output and case)	PCB 	296 UL, CSA

Type	Features	Output				Input		Input			Breakdown voltage	Connection type Terminal layout	Page Approvals
		Load voltage	Max. load current	Non-repetitive surge current (1 cycle, 60Hz)	OFF-state leakage current (max.)	Input voltage	Input impedance	Drop-out voltage (min.)	Operate time	Release time			
AQ-B 1A 	• Photo-Triac • Zero-cross	• 75 - 125V AC • 75 - 250V AC	1A	10A	1.1mA	3 - 6V DC	0.18kΩ	1V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	1,500V AC/4,000V AC	PCB 	301 UL, CSA, TÜV
						7 - 14V DC	0.75kΩ						
						10 - 18V DC	1.2kΩ						
						18 - 30V DC	2.15kΩ						
	• Photo-Triac • Non zero-cross	• 75 - 125V AC • 75 - 250V AC	1A	10A	1.1mA	3 - 6V DC	0.18kΩ	1V	0.5ms	½ cycle of voltage sine wave + 1ms	1,500V AC/4,000V AC		
						7 - 14V DC	0.75kΩ						
						10 - 18V DC	1.2kΩ						
						18 - 30V DC	2.15kΩ						
AQ-B 2A 	• Photo-Triac • Zero-cross	• 75 - 125V AC • 75 - 250V AC	2A	20A	1.1mA	3 - 6V DC	0.18kΩ	1V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	1,500V AC/4,000V AC	PCB 	301 UL, CSA, TÜV
						7 - 14V DC	0.75kΩ						
						10 - 18V DC	1.2kΩ						
						18 - 30V DC	2.15kΩ						
	• Photo-Triac • Non zero-cross	• 75 - 125V AC • 75 - 250V AC	2A	20A	1.1mA	3 - 6V DC	0.18kΩ	1V	0.5ms	½ cycle of voltage sine wave + 1ms	1,500V AC/4,000V AC		
						7 - 14V DC	0.75kΩ						
						10 - 18V DC	1.2kΩ						
						18 - 30V DC	2.15kΩ						
AQ8 2A 	• Photo-Triac • Zero-cross	• 75 - 125V AC • 75 - 250V AC	2A	30A	5mA	4 - 6V DC	0.18kΩ	0.5V 1.2V 2.4V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	3,000V AC	PCB Between input terminal 5.08mm  Between input terminal 7.65mm 	306 UL, CSA, TÜV, VDE
						9.6 - 14.4V DC	0.55kΩ						
						21.6 - 26.4V DC	1.4kΩ						
	• Photo-Triac • Non zero-cross	• 75 - 125V AC • 75 - 250V AC	2A	30A	5mA	4 - 6V DC	0.3kΩ	0.5V 1.2V 2.4V	1ms	½ cycle of voltage sine wave + 1ms	3,000V AC		
						9.6 - 14.4V DC	0.8kΩ						
						21.6 - 26.4V DC	1.8kΩ						
AQ8 3A 	• Photo-Triac • Zero-cross	• 75 - 125V AC • 75 - 250V AC	3A	80A	5mA	4 - 6V DC	0.18kΩ	0.5V 1.2V 2.4V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	3,000V AC	PCB Between input terminal 5.08mm  Between input terminal 7.65mm 	306 UL, CSA, TÜV, VDE
						9.6 - 14.4V DC	0.55kΩ						
						21.6 - 26.4V DC	1.4kΩ						
	• Photo-Triac • Non zero-cross	• 75 - 125V AC • 75 - 250V AC	3A	80A	5mA	4 - 6V DC	0.3kΩ	0.5V 1.2V 2.4V	1ms	½ cycle of voltage sine wave + 1ms	3,000V AC		
						9.6 - 14.4V DC	0.8kΩ						
						21.6 - 26.4V DC	1.8kΩ						

Type	Features	Output				Input		Input			Breakdown voltage	Connection type Terminal layout	Page Approvals
		Load voltage	Max. load current	Non-repetitive surge current (1 cycle, 60Hz)	OFF-state leakage current (max.)	Input voltage	Input impedance	Drop-out voltage (min.)	Operate time	Release time			
I/O RELAY AC input modules 	• Photo-Transistor	• 4 - 15V DC • 10 - 32V DC	15mA	-	100μA	80 - 140V AC	-	10V AC	20ms	20ms	4,000V AC	PCB 	337 UL, CSA
						160 - 280V AC	-	20V AC					
I/O RELAY DC input modules 	• Photo-Transistor	• 4 - 15V DC • 10 - 32V DC	15mA	-	100μA	3 - 32V DC	-	0.8V	5ms	5ms	4,000V AC		
I/O RELAY AC output modules 	• Photo-Transistor • Zero-cross	• 75 - 125V AC • 75 - 250V AC	2A	30A	5mA	3 - 15V DC	1.6kΩ	0.8V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	4,000V AC	PCB 	337 UL, CSA
						4 - 15V DC	1.7kΩ						
						10 - 32V DC	5.6kΩ						
I/O RELAY DC output modules 	• Photo-Transistor	• 3 - 60V DC • 10-200V DC	• 2A • 1A	5A (1s)	1mA	3 - 15V DC	1.6kΩ	0.8V	0.5ms	2ms	4,000V AC		
						4 - 15V DC	1.7kΩ						
						10 - 32V DC	5.6kΩ						

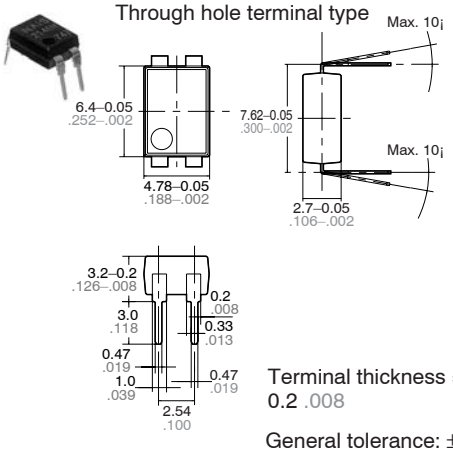
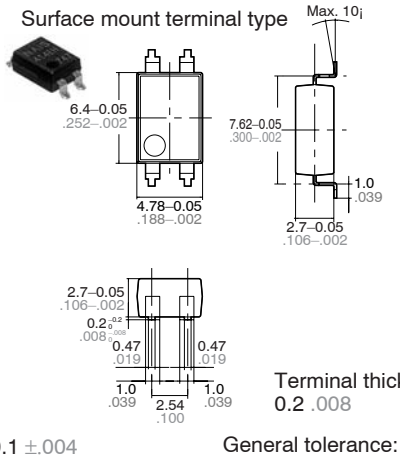
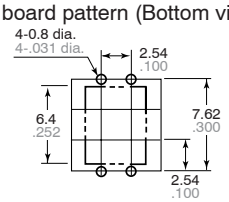
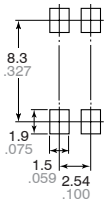
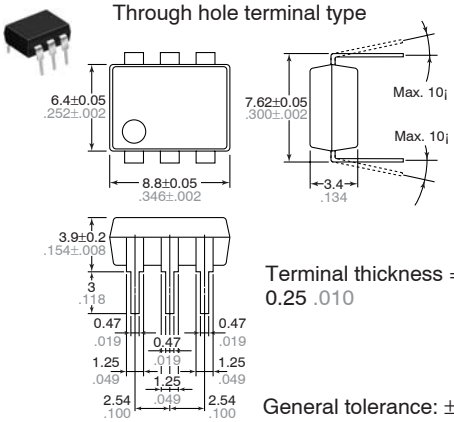
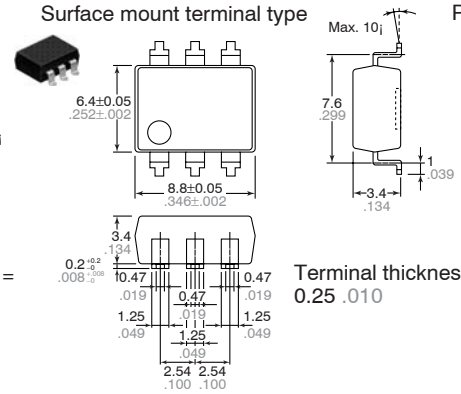
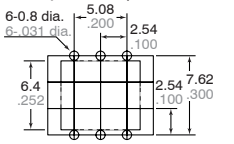
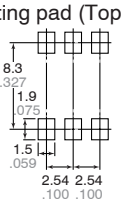
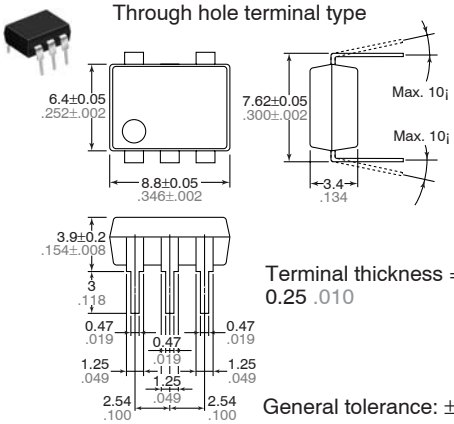
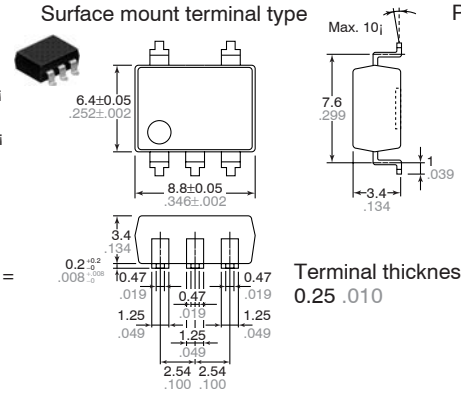
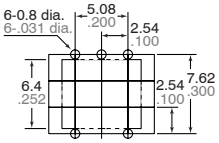
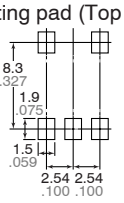
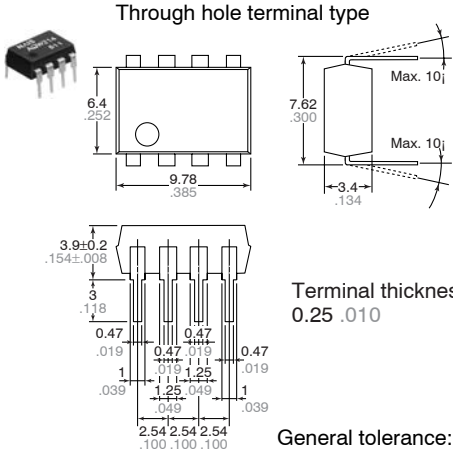
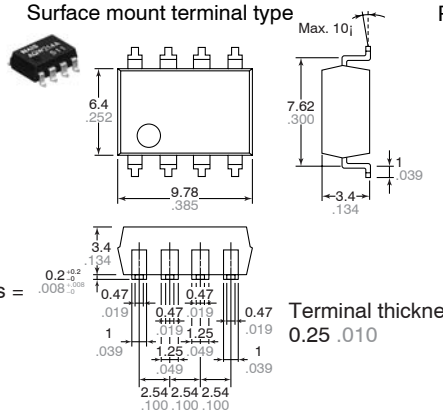
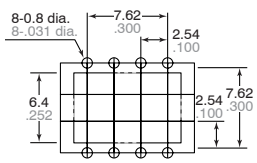
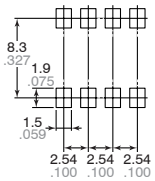
Type	Features	Output				Input		Input			Breakdown voltage	Connection type Terminal layout	Page Approvals
		Load voltage	Max. load current	Non-repetitive surge current (1 cycle, 60Hz)	OFF-state leakage current (max.)	Input voltage	Input impedance	Drop-out voltage (min.)	Operate time	Release time			
Solid State Plug-in Terminals													
AQ-F 2A/3A (AC output) 	• Photo-Triac • Zero-cross	75 - 250V AC	2A	80A	5mA	3 - 28V DC	1.6kΩ	0.8V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	2,000V AC	Plug-in 	312 UL, CSA
	• Photo-Triac • Zero-cross	75 - 250V AC	3A	80A	5mA	3 - 28V DC	1.6kΩ	0.8V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	2,000V AC		
AQ-F 2A/3A (DC output) 	• Photo-Triac	3 - 60V DC	2A	5A	1mA	3 - 28V DC	1.6kΩ	0.8V	0.5ms	2ms	2,000V AC	Plug-in 	
	• Photo-Triac	3 - 60V DC	3A	6A	1mA	3 - 28V DC	1.6kΩ	0.8V	0.5ms	2ms	2,000V AC		
Solid State Hockey Puck Types													
AQ-J 	• Photo-Triac • Zero-cross • **Ultra-compact size** • **Built-in varistor**	• 75 - 264V AC	10A	100A	5mA	4 - 6V DC	260Ω	1V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	• 3,000V AC (between input and output) • 2,500V AC (between input, output and case)	- 	317 Pending
			15A										
			25A										
			10A	150A	5mA	10 - 18V DC	800Ω						
			15A										
			25A										
			10A	250A	5mA	18 - 28V DC	1.6kΩ						
			15A										
			25A										
AQ-N 	• Photo-Triac • Zero-cross	• 75 - 250V AC	10A	100A	10mA	4 - 32V DC	- (Input current, max. 20mA)	1V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	• 4,000V AC (between input and output) • 2,500V AC (between input, output and case)	- 	321 Pending: UL, C-UL, TÜV
			15A	150A									
			20A	200A									
			25A	250A									
			40A	400A									
	• Photo-Triac • Non zero-cross	• 75 - 250V AC	10A	100A	10mA	4 - 32V DC	- (Input current, max. 20mA)	1V	1ms	½ cycle of voltage sine wave + 1ms	• 4,000V AC (between input and output) • 2,500V AC (between input, output and case)		
			15A	150A									
			20A	200A									
			25A	250A									
			40A	400A									

Type	Features	Output				Input		Input			Breakdown voltage	Connection type Terminal layout	Page Approvals
		Load voltage	Max. load current	Non-repetitive surge current (1 cycle, 60Hz)	OFF-state leakage current (max.)	Input voltage	Input impedance	Drop-out voltage (min.)	Operate time	Release time			
AQ-R 10A/15A/20A 	• Photo-Triac • Zero-cross	• 75 - 125V AC • 75 - 250V AC	10A	100A	5mA	4 - 6V DC	0.26kΩ	1V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	• 1,500V AC (between input, output and case) • 4,000V AC type also available	- 	328 UL, CSA, TÜV
						10 - 18V DC	0.86kΩ						
						18 - 28V DC	1.36kΩ						
	• Photo-Triac • Zero-cross	• 75 - 125V AC • 75 - 250V AC	15A	150A	5mA	4 - 6V DC	0.26kΩ	1V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	• 1,500V AC (between input, output and case) • 4,000V AC type also available		
						10 - 18V DC	0.86kΩ						
						18 - 28V DC	1.36kΩ						
	• Photo-Triac • Zero-cross	• 75 - 125V AC • 75 - 250V AC	20A	200A	5mA	4 - 6V DC	0.26kΩ	1V	½ cycle of voltage sine wave + 1mss	½ cycle of voltage sine wave + 1ms	• 1,500V AC (between input, output and case) • 4,000V AC type also available		
						10 - 18V DC	0.86kΩ						
						18 - 28V DC	1.36kΩ						
AQ-R 30A/40A 	• Photo-Triac • Zero-cross	• 75 - 250V AC	30A	300A	5mA	4 - 6V DC	0.26kΩ	1V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	1,500V AC	- 	328 UL, C-UL
						10 - 18V DC	0.86kΩ						
						18 - 28V DC	1.36kΩ						
	• Photo-Triac • Zero-cross	• 75 - 250V AC	40A	400A	5mA	4 - 6V DC	0.26kΩ	1V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	1,500V AC		
						10 - 18V DC	0.86kΩ						
						18 - 28V DC	1.36kΩ						
Solid State DIN Rail Types													
AQ-K 	• Photo-Triac • Zero-cross	• 75 - 250V AC	15A	150A	9mA	4.5 - 30V DC	- (Input current, max. 10mA)	1V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	2,500V AC/4,000V AC	- 35mm DIN rail mounting hole or 2-4.6mm dia. hole or M4 hole 	335 UL, C-UL, TÜV
	• Photo-Triac • Zero-cross	• 75 - 250V AC	25A	250A	9mA	4.5 - 30V DC	- (Input current, max. 10mA)	1V	½ cycle of voltage sine wave + 1ms	½ cycle of voltage sine wave + 1ms	2,500V AC/4,000V AC		

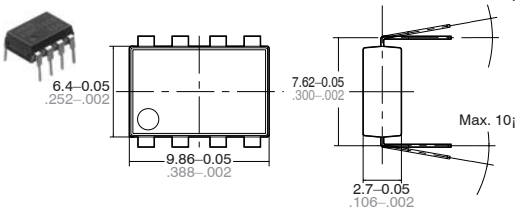
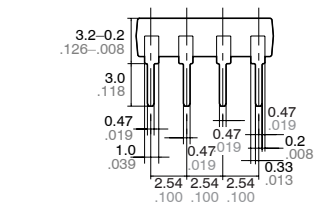
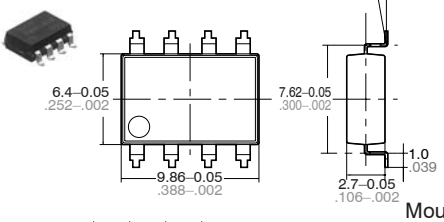
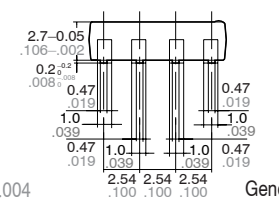
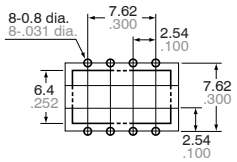
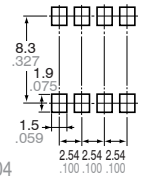
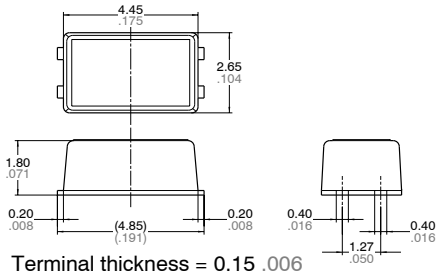
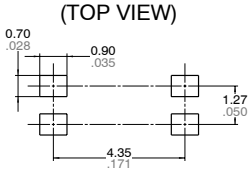
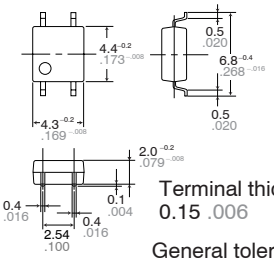
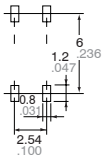
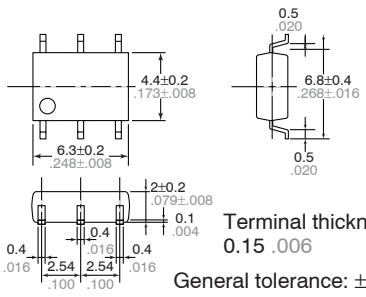
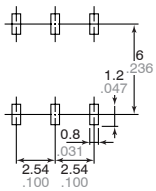
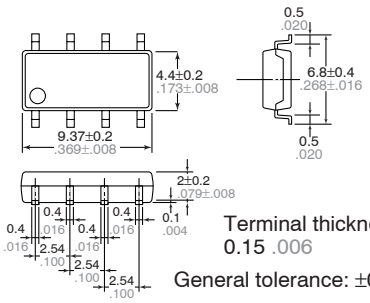
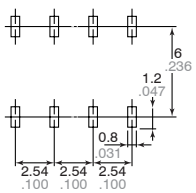
PhotoMOS Relays

PhotoMOS Relay Dimensions

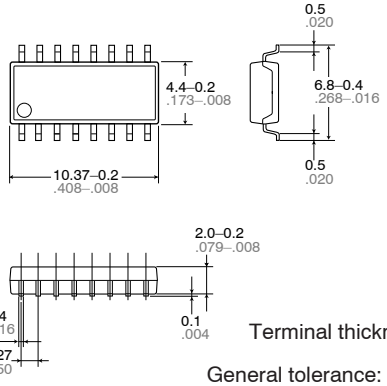
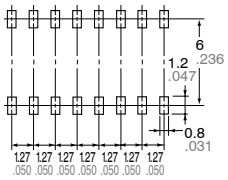
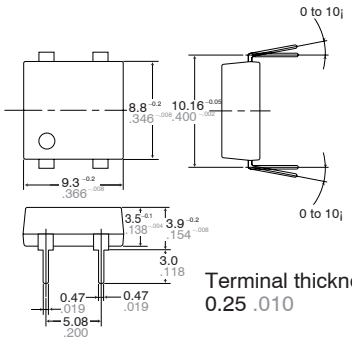
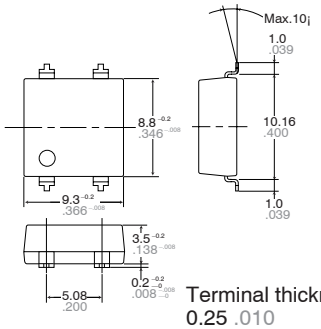
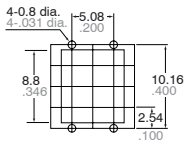
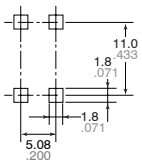
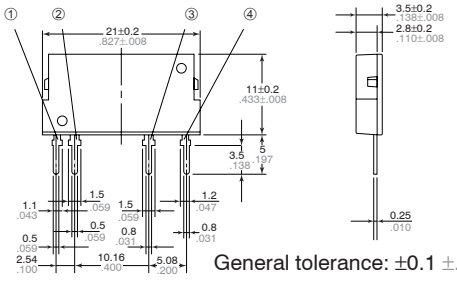
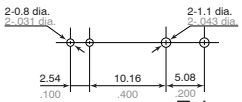
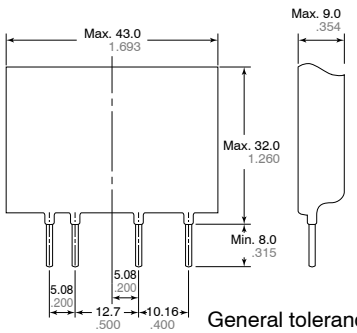
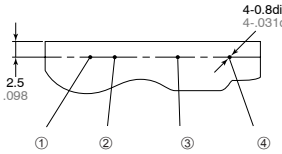
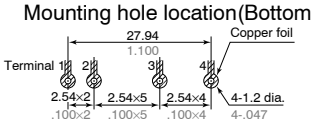
mm inch

Type	Dimensions
AQY21 AQY41 Series	Through hole terminal type  Terminal thickness = 0.2 .008 General tolerance: ±0.1 ±.004 Surface mount terminal type  Terminal thickness = 0.2 .008 General tolerance: ±0.1 ±.004 PC board pattern (Bottom view)  Tolerance:±0.1 ±.004 Mounting pad (Top view)  Tolerance: ±0.1 ±.004
AQV10 AQV20 AQV21 AQV22 AQV23 AQV25 AQV41 AQV45 Series	Through hole terminal type  Terminal thickness = 0.25 .010 General tolerance: ±0.1 ±.004 Surface mount terminal type  Terminal thickness = 0.25 .010 General tolerance: ±0.1 ±.004 PC board pattern (Bottom view)  Tolerance:±0.1 ±.004 Recommended mounting pad (Top view) 
APV1122 Series	Through hole terminal type  Terminal thickness = 0.25 .010 General tolerance: ±0.1 ±.004 Surface mount terminal type  Terminal thickness = 0.25 .010 General tolerance: ±0.1 ±.004 PC board pattern (Bottom view)  Tolerance:±0.1 ±.004 Recommended mounting pad (Top view) 
AQW21 AQW22 AQW25 AQW41 AQW45 AQW61 AQW65 Series	Through hole terminal type  Terminal thickness = 0.25 .010 General tolerance: ±0.1 ±.004 Surface mount terminal type  Terminal thickness = 0.25 .010 General tolerance: ±0.1 ±.004 PC board pattern (Bottom view)  Tolerance:±0.1 ±.004 Recommended mounting pad (Top view) 

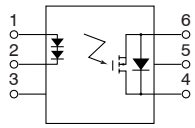
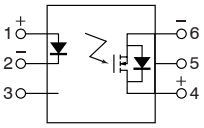
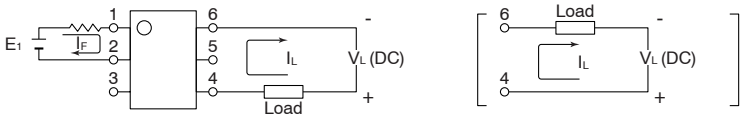
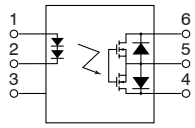
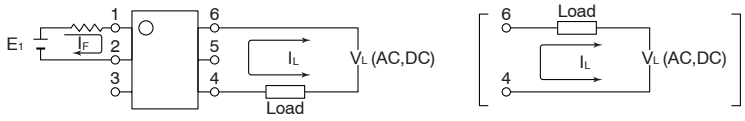
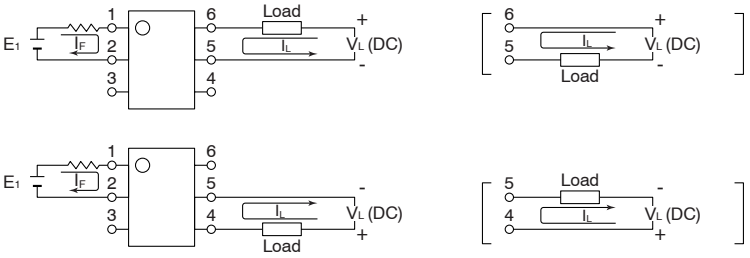
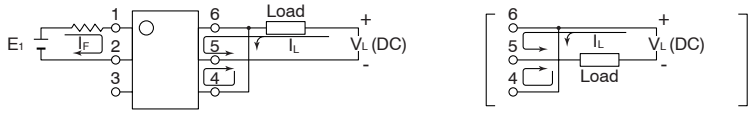
mm inch

Type	Dimensions
AQW21❍EH AQW21❍HL AQW41❍EH AQW61❍EH Series	Through hole terminal type   Terminal thickness = 0.2 .008 General tolerance: ±0.1 ±.004 Surface mount terminal type   Terminal thickness = 0.2 .008 General tolerance: ±0.1 ±.004 PC board pattern (Bottom view)  Tolerance:±0.1 ±.004 Mounting pad (Top view)  Tolerance: ±0.1 ±.004
APV21 (SSOP) AQY22 (SSOP) Series	  Terminal thickness = 0.15 .006 General tolerance: ±0.5 ±.020 Recommended mounting pad (TOP VIEW)  Tolerance: ±0.1 ±.004
APV21(SOP) APV11(SOP) AQY21(SOP) AQY22(SOP) AQY41(SOP) Series	  Terminal thickness = 0.15 .006 General tolerance: ±0.1 ±.004 Recommended mounting pad (Top view)  Tolerance: ±0.1 ±.004
AQV21(SOP) AQV22(SOP) AQV41(SOP) Series	  Terminal thickness = 0.15 .006 General tolerance: ±0.1 ±.004 Recommended mounting pad (Top view)  Tolerance: ±0.1 ±.004
AQW21(SOP) AQW61(SOP) Series	  Terminal thickness = 0.15 .006 General tolerance: ±0.1 ±.004 Recommended mounting pad (Top view)  Tolerance: ±0.1 ±.004

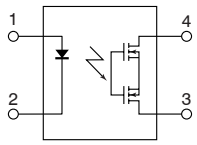
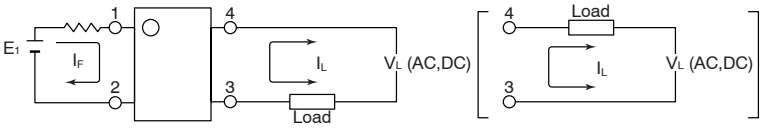
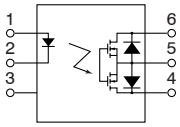
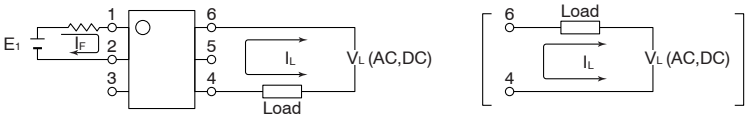
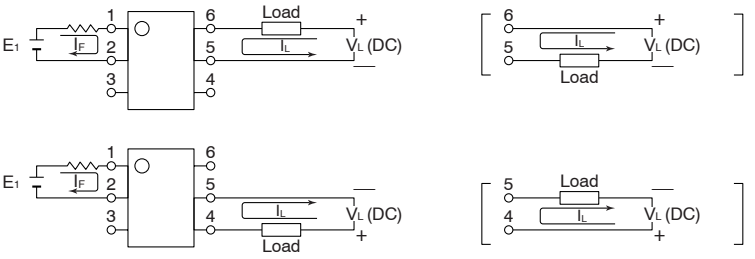
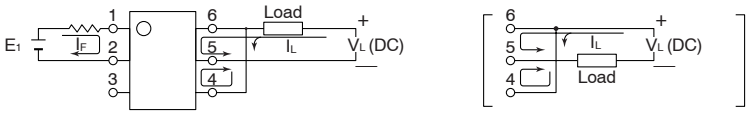
mm inch

Type	Dimensions
AQS22(SOP) Series	  Terminal thickness = 0.15 .006 General tolerance: ±0.1 ±.004 Recommended mounting pad (Top view)  Tolerance:±0.1 ±.004
AQY27 Series	Through hole terminal type   Terminal thickness = 0.25 .010 General tolerance: ±0.1 ±.004 Surface mount terminal type   Terminal thickness = 0.25 .010 General tolerance: ±0.1 ±.004 PC board pattern (Bottom view)  Tolerance: ±0.1 ±.004 Recommended mounting pad (Top view)  Tolerance: ±0.1 ±.004
AQZ10 AQZ20 AQZ40 Series	  General tolerance: ±0.1 ±.004 PC board pattern (Bottom view)  Tolerance: ±0.1 ±.004 AC/DC type ① Input: DC- ② Input: DC+ ③ Output: DC or AC ④ Output: DC or AC DC type ① Input: DC- ② Input: DC+ ③ Output: DC- ④ Output: DC+
AQZ26 Series	  General tolerance –0.5 –.020  ① Input: DC - ② Input: DC + ③ Output : AC or DC ④ Output : AC or DC Mounting hole location(Bottom view)  Pitch tolerance: –0.1 –.004

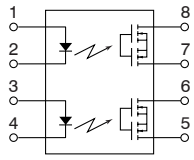
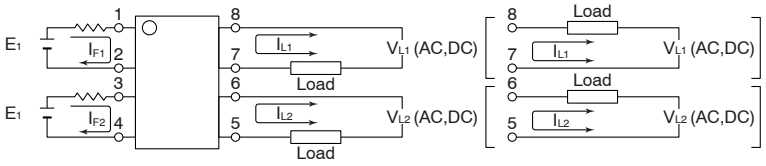
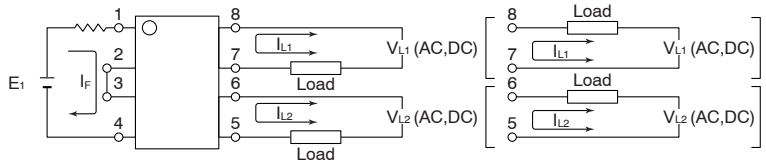
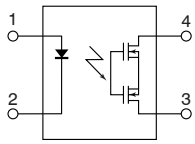
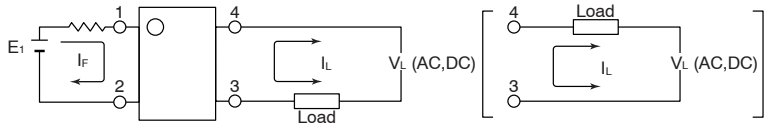
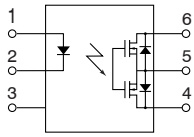
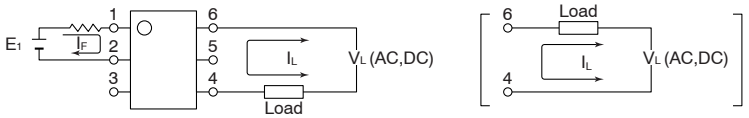
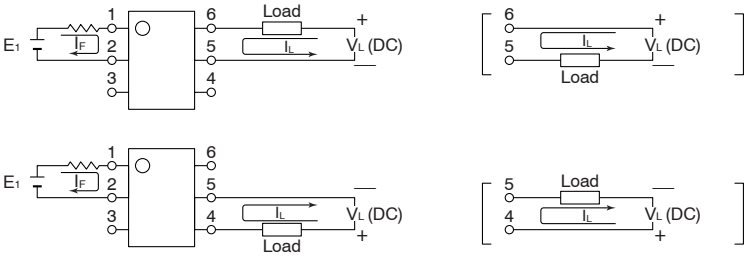
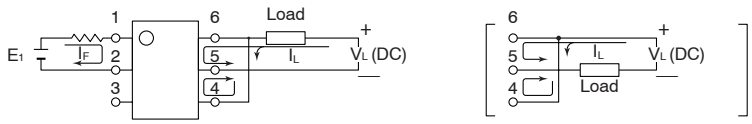
PhotoMOS Relay Schematic and Wiring Diagrams

Type	Schematic	Output configuration	Load	Connection	Wiring diagram
AQV10 AQV112KL Series	 Terminal 3 cannot be used, since it is in the internal circuit of the relay. 	1a	DC	A	
AQV20 Series	 Terminal 3 cannot be used, since it is in the internal circuit of the relay.	1a	AC/DC	A	
			DC	B	 Can be also connected as 2 Form A type. (However, the sum of the continuous load current should not exceed the absolute maximum rating.)
			DC	C	

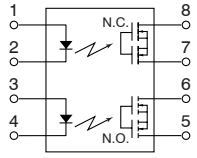
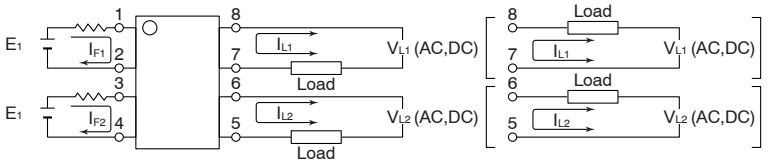
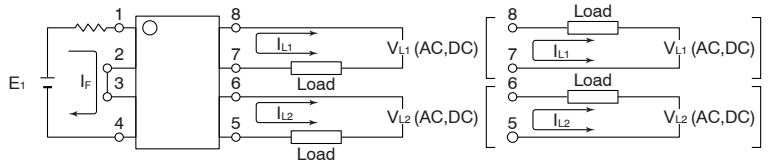
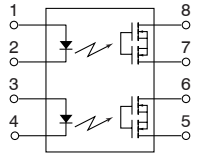
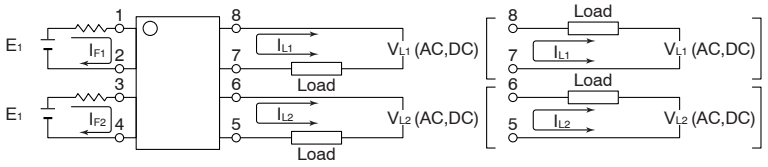
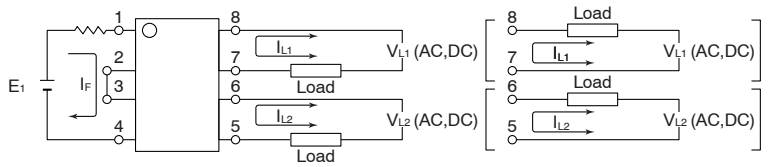
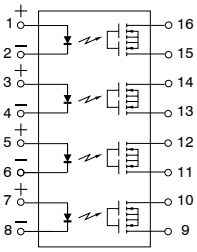
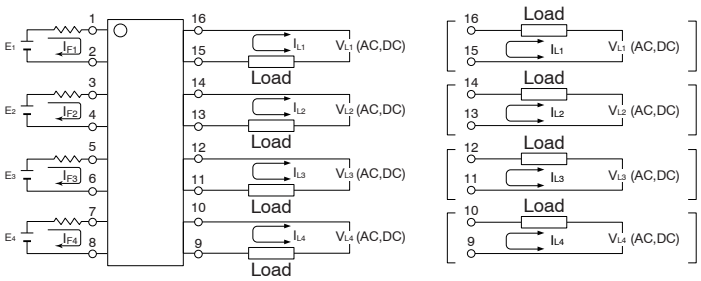
Notes: 1. E_1: Power source at input side; V_{IN}: Input voltage; I_F: LED forward current; I_{IN}: Input current; V_L: Load voltage; I_L: Load current; R: Current limit resistor.
2. Method of connecting the load at the output is divided into 3 types.

Type	Schematic	Output configuration	Load	Connection	Wiring diagram
AQY21 AQY21(SOP) AQY22 (SOP, SSOP) AQY27 Series		1a	AC/DC	—	
AQV21 AQV21(SOP) AQV22 AQV22(SOP) AQV23 AQV25 Series	 Terminal 3 cannot be used, since it is in the internal circuit of the relay.	1a	AC/DC	A	
			DC	B	 Can be also connected as 2 Form A type. (However, the sum of the continuous load current should not exceed the absolute maximum rating.)
			DC	C	

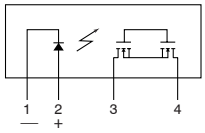
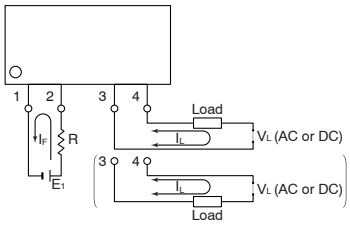
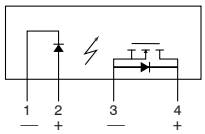
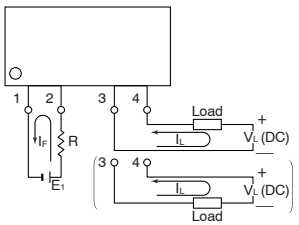
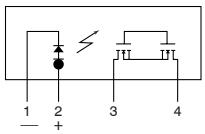
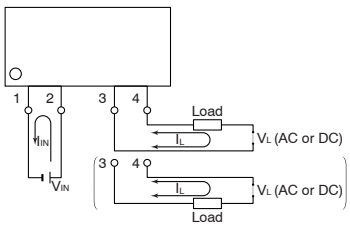
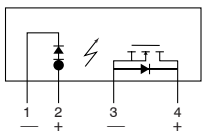
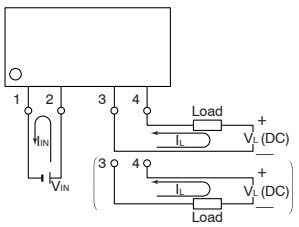
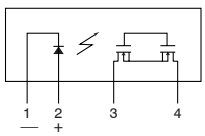
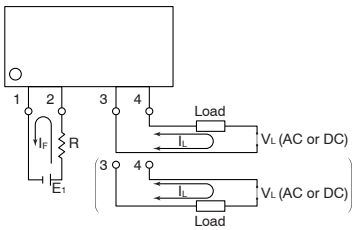
Notes: 1. E_1: Power source at input side; V_{IN}: Input voltage; I_F: LED forward current; I_{IN}: Input current; V_L: Load voltage; I_L: Load current; R: Current limit resistor.
2. Method of connecting the load at the output is divided into 3 types.

Type	Schematic	Output configuration	Load	Connection	Wiring diagram
AQW21 AQW21(SOP) AQW22 AQW25 Series		2a	AC/DC	—	(1) Two independent 1 Form A use  (2) 2 Form A use 
AQY41 AQY41(SOP) Series		1b	AC/DC	—	
AQV41 AQV41(SOP) AQV45 Series	 Terminal 3 cannot be used, since it is in the internal circuit of the relay.	1b	AC/DC	A	
			DC	B	 Can be also connected as 2 Form B type. (However, the sum of the continuous load current should not exceed the absolute maximum rating.)
			DC	C	

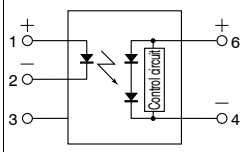
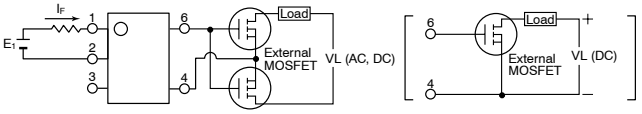
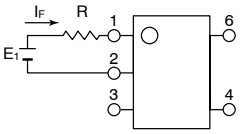
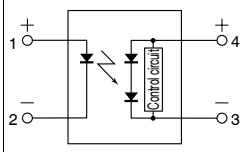
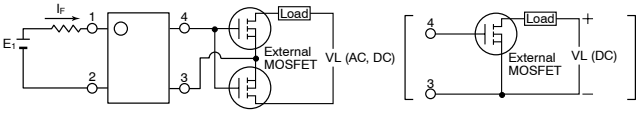
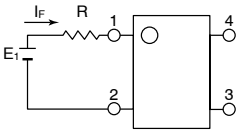
Notes: 1. E_1: Power source at input side; V_{IN}: Input voltage; I_F: LED forward current; I_{IN}: Input current; V_L: Load voltage; I_L: Load current; R: Current limit resistor.
2. Method of connecting the load at the output is divided into 3 types.

Type	Schematic	Output configuration	Load	Connection	Wiring diagram
AQW61 AQW61(SOP) AQW65 Series		1a1b	AC/DC	—	(1) Two independent 1 Form A & 1 Form B use  (2) 1 Form A 1 Form B use 
AQW41 AQW45 Series		2b	AC/DC	—	(1) Two independent 1 Form B use  (2) 2 Form B use 
AQS225S AQS225R2S		4a	AC/DC	—	

Notes: 1. E_1: Power source at input side; V_{IN}: Input voltage; I_F: LED forward current; I_{IN}: Input current; V_L: Load voltage; I_L: Load current; R: Current limit resistor.
2. Method of connecting the load at the output is divided into 3 types.

Type	Schematic	Output configu-ration	Load	Con-nection	Wiring diagram
AQZ20 AQZ26 Series		1a	AC/DC	—	
AQZ10 Series		1a	DC	—	
AQZ20❍D Series		1a	AC/DC	—	
AQZ10❍D Series		1a	DC	—	
AQZ40 Series		1b	AC/DC	—	

Notes: 1. E_1: Power source at input side; V_{IN}: Input voltage; I_F: LED forward current; I_{IN}: Input current; V_L: Load voltage; I_L: Load current; R: Current limit resistor.
2. Method of connecting the load at the output is divided into 3 types.

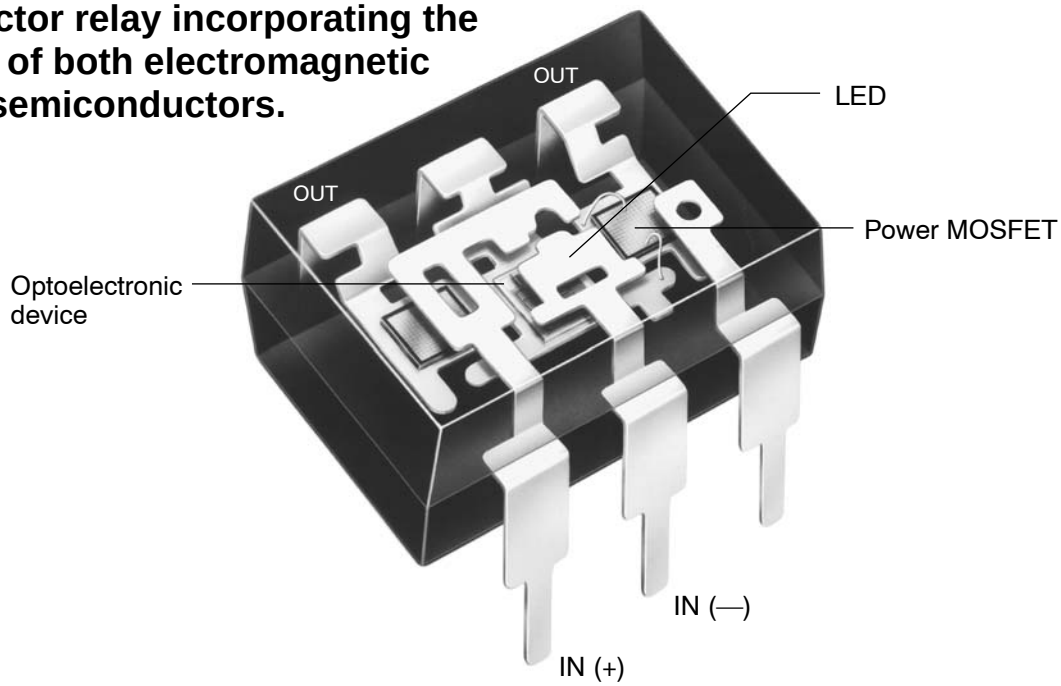
Type	Schematic	Output configuration	Load	Connection	Wiring diagram
APV1122		1a	AC/DC	—	Power MOSFET drive wiring diagram  Example of each input power supply and current limit resistors (I_F = 10mA)  E_1 / R: 5V — Approx. 380Ω; 15V — Approx. 1.4kΩ; 24V — Approx. 2.3kΩ
APV1121S APV2121S APV2111V		1a	DC	—	Power MOSFET drive wiring diagram  Example of each input power supply and current limit resistors (I_F = 10mA)  E_1 / R: 5V — Approx. 380Ω; 15V — Approx. 1.4kΩ; 24V — Approx. 2.3kΩ

Notes: 1. E_1: Power source at input side; V_{IN}: Input voltage; I_F: LED forward current; I_{IN}: Input current; V_L: Load voltage; I_L: Load current; R: Current limit resistor.
2. Method of connecting the load at the output is divided into 3 types.

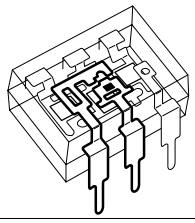
PhotoMOS Relay Technical Information

How PhotoMOS Relays Operate:

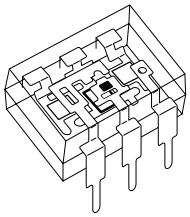
Optoelectronic device directly drives a power MOSFET. Semiconductor relay incorporating the advantages of both electromagnetic relays and semiconductors.



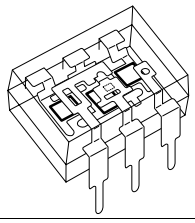
When operated



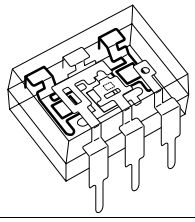
When a signal current flows to the input terminals the LED on the input side emits light.



The emitted light passes through transparent silicon and reaches the photoelectric element (solar cell) which is mounted opposite the LED.

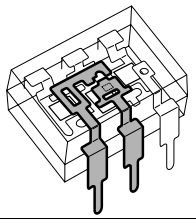


The photoelectric element converts the received light to a voltage corresponding to the quantity of light. This voltage passes through a control circuit and charges the MOSFET gate on the output side.

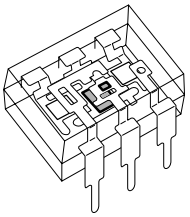


When the MOSFET gate voltage supplied from the photoelectric element reaches a preset voltage value, the MOSFET begins to conduct and turns on the load.

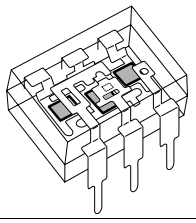
When turned off



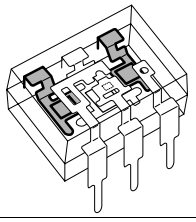
When the signal current at the input terminal is cut off, the LED stops emitting light.



When the emitted light from the LED stops, the voltage of the photoelectric element decreases.



When the voltage supplied from photoelectric element decrease, the control circuit rapidly discharges the gate charge of MOSFET.



This control circuit makes MOSFET stop conducting and immediately turns off the load.

Terminology

Term		Symbol	Description
Input	LED forward current	I_F	Current that flows between the input terminals when the input diode is forward biased.
	LED reverse voltage	V_R	Reverse breakdown voltage between the input terminals.
	Peak forward current	I_{FP}	Maximum instantaneous value of the forward current.
	LED operate current	I_{FON}	Current when the output switches on (by increasing the LED current) with a designated supply voltage and load connected between the output terminals.
	LED turn off current	I_{Foff}	Current when the output switches off (by decreasing the LED current) after operating the relay with a designated supply voltage and load connected between the output terminals.
	LED dropout voltage	V_F	Dropout voltage between the input terminals due to forward current.
	Power dissipation	P_{in}	Allowable power dissipation between the input terminals.
Output	Load voltage	V_L	Supply voltage range at the output used to normally operate the PhotoMOS relay. Represents the peak value for AC voltages.
	Continuous load current	I_L	Maximum current value that flows continuously between the output terminals of the PhotoMOS relay under designated ambient temperature conditions. Represents the peak value for AC current.
	On resistance	R_{on}	Obtained using the equation below from dropout voltage VDS (on) between the output terminals (when a designated LED current is made to flow through the input terminals and the designated load current through the output terminals.) $R_{on} = V_{DS}$ (on)/I_L
	Off state leakage current	I_{leak}	Current flowing to the output when a designated supply voltage is applied between the output terminals with no LED current flow.
	Power dissipation	P_{out}	Allowable power dissipation between the output terminals.
Electrical characteristics	Turn on time	T_{on}	Delay time until the output switches on after a designated LED current is made to flow through the input terminals.
	Turn off time	T_{off}	Delay time until the output switches off after the designated LED current flowing through the input terminals is cut off.
	I/O capacitance	C_{iso}	Capacitance between the input and output terminals.
	Output capacitance	C_{out}	Capacitance between output terminals when LED current does not flow.
	I/O isolation resistance	R_{iso}	Resistance between terminals (input and output) when a specified voltage is applied between the input and output terminals.
	Total power dissipation	P_T	Allowable power dissipation in the entire circuit between the input and output terminals.
	I/O isolation voltage	V_{iso}	Critical value before dielectric breakdown occurs, when a high voltage is applied for 1 minute between the same terminals where the I/O isolation resistance is measured.
	Operating temperature	T_{opr}	Ambient temperature range in which the PhotoMOS relay can operate normally with a designated load current conditions.
	Storage temperature	T_{stg}	Ambient temperature range in which the PhotoMOS relay can be stored without applying voltage.

Reliability tests

Classification	Item	Condition	Purpose
Life tests	High temperature storage test	T_{stg} (Max.)	Determines resistance to long term storage at high temperature.
	Low temperature storage test	T_{stg} (Min.)	Determines resistance to long term storage at low temperature.
	High temperature and high humidity storage test	85°C 185°F, R.H. 85%	Determines resistance to long term storage at high temperature and high humidity.
	Continuous operation life test	V_L = Max., I_L = Max., I_F = LED operate current (Max.)	Determines resistance to electrical stress (voltage and current).
Thermal environment tests	Temperature cycling test	Low storage temperature (T_{stg} Min.) High storage temperature (T_{stg} Max.)	Determines resistance to exposure to both low temperatures and high temperatures.
	Thermal shock test	Low temperature (0°C) (32°F), High temperature (100°C) (212°F)	Determines resistance to exposure to sudden changes in temperature.
	Solder burning resistance	260±5°C 500±41°F, 10 s	Determines resistance to thermal stress occurring while soldering.
Mechanical environment tests	Vibration test	196 m/s² {20 G}, 20 to 2,000 Hz*1	Determines the resistance to vibration sustained during shipment or operation.
	Shock test	9,800 m/s² {1,000 G} 0.5 ms*2; 4,900 m/s² {500 G} 1 ms	Determines the mechanical and structural resistance to shock.
	Drop test	Dropped at a height of 80 cm on oak board	Determines the mechanical resistance to drops sustained during shipment or operation.
	Terminal strength test	Determined from terminal shape and cross section	Determines the resistance to external force on the terminals of the PhotoMOS relay mounted on the PC board while wiring or operating.
	Solderability	230°C 446°F 5 s (with soldering flux)	Evaluates the solderability of the terminals.

*1 10 to 55 Hz at double amplitude of 3 mm for Power PhotoMOS relays.
*2 4,900 m/s², 1 ms for Power PhotoMOS relays.

PhotoMOS Relay Cautions for Use

PhotoMOS Relays excluding Power PhotoMOS Relays

SAFETY WARNINGS

• Do not use the product under conditions that exceed the range of its specifications. It may cause overheating, smoke, or fire.
• Do not touch the recharging unit while the power is on. There is a danger of electrical shock. Be sure to turn off the power when performing mounting, maintenance, or repair operations on the relay (including connecting parts such as the terminal board and socket).
• Check the connection diagrams in the catalog and be sure to connect the terminals correctly. Erroneous connections could lead to unexpected operating errors, overheating, or fire.

1. Unused terminals

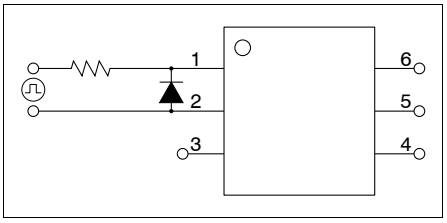
The No. 3 terminal is used with the circuit inside the relay. Therefore, do not connect it to the external circuitry with either connection method A, B or C. (1a type)

2. Short across terminals

Do not short circuit between terminals when relay is energized, since there is possibility of breaking of the internal IC.

3. Surge voltages at the input

If reverse surge voltages are present at the input terminals, connect a diode in reverse parallel across the input terminals and keep the reverse voltages below the reverse breakdown voltage.



4. Recommended LED forward current (I_F)

It is recommended that the LED forward current (I_F) of each PhotoMOS Relay should be set according to the following table.

DIP • SMD type

Standard I/O isolation type (1,500 V AC)

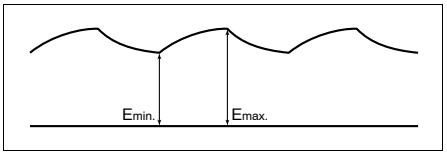
Type	Product name	Recommended LED forward current (I_F)
DIP (SMD) SOP	AQV10,20 Series AQV112KL Series	10 mA
	AQY21, 41 Series (SOP) AQV21, 41 Series (including SOP) AQV22 Series (including SOP) AQY22 Series (SOP) AQY221❍2V Series AQY221❍2S Series AQY221N3V Series AQV25, 45 Series AQW21❍ Series (including SOP) AQW41❍, 61❍ Series (including SOP) AQW22 Series AQW25, 45, 65 Series AQS Series	5mA
	AQY21❍H, 41❍H Series AQY210KS Series AQY210HL Series AQY212G❍ Series AQY27 Series AQV21❍H Series AQV25❍H, 45❍H Series AQV252G Series AQW21❍H, 41❍H, 61❍H Series AQW210HL Series	5 to 10mA
	AQV23 Series	2 mA
SIL	AQZ10, 20, 40 Series AQZ26 Series	5 to 10 mA

5. Ripple in the input power supply

If ripple is present in the input power supply, observe the following:

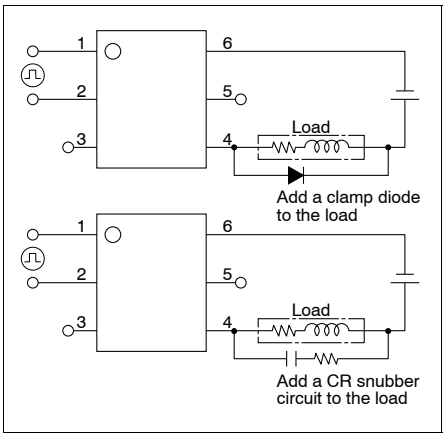
1) For LED operate current at E_{min}, maintain the value mentioned in the table of "4. Recommended LED forward current (I_F)."

2) Keep the LED operate current at 50 VmA (25 mA for PhotoMOS HE Relay with LED display type) or less at E_{max}.



6. Output spike voltages

1) If an inductive load generates spike voltages which exceed the absolute maximum rating, the spike voltage must be limited. Typical circuits are shown below.



2) Even if spike voltages generated at the load are limited with a clamp diode if the circuit wires are long, spike voltages will occur by inductance. Keep wires as short as possible to minimize inductance.

7. Cleaning solvents compatibility

The PhotoMOS relay forms an optical path by coupling a light-emitting diode (LED) and photodiode via transparent silicon resin. For this reason, unlike other directory element molded resin products (e.g., MOS transistors and bipolar transistors), avoid ultrasonic cleansing if at all possible. We recommend cleaning with an organic solvent. If you cannot avoid using ultrasonic cleansing, please ensure that the following conditions are met, and check beforehand for defects.

• Frequency: 27 to 29 kHz
• Ultrasonic output:
No greater than 0.25W/cm^2
• Cleaning time:
No longer than 30 s
• Cleanser used: Asahiklin AK-225
• Other:
Submerge in solvent in order to prevent the PCB and elements from being contacted directly by the ultrasonic vibrations.

Note: Applies to unit area ultrasonic output for ultrasonic baths.

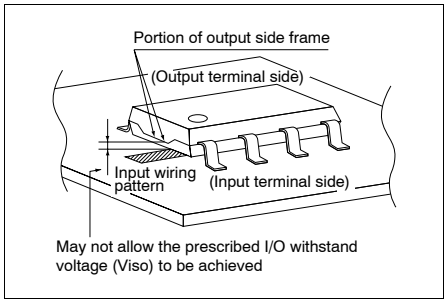
8. Notes for mounting

1) If many different packages are combined on a single substrate, then lead temperature rise is highly dependent on package size. For this reason, please make sure that the temperature of the terminal solder area of the PhotoMOS relay falls within the temperature conditions of item 9 before mounting.

2) If the mounting conditions exceed the recommended solder conditions in item 9, resin strength will fall and the nonconformity of the heat expansion coefficient of each constituent material will increase markedly, possibly causing cracks in the package, severed bonding wires, and the like. For this reason, please inquire with us about whether this use is possible.

9. Input wiring pattern

With AQY or AQW types*, AQS225S series avoid installing the input (LED side) wiring pattern to the bottom side of the package if you require the specified I/O isolation voltage (V_{iso}) after mounting the PC board. Since part of the frame on the output side is exposed, it may cause fluctuations in the I/O isolation voltage.



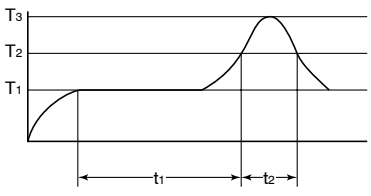
*except for GU-E (Reinforced 5,000V) type

10. Soldering

1) When soldering PC board terminals, keep soldering time within 10 s at 260°C 500°F.

2) When soldering surface-mount terminals that support lead-free solder, the following conditions are recommended.

(1) IR (Infrared reflow) soldering method



T1 = 150°C to 180°C 302°F to 356°F
T2 = 230°C 446°F and higher
T3 = within 250°C 482°F
t1 = 60 s to 120 s
t2 = within 30 s

(2) Soldering iron method

Tip temperature: 350 to 400°C 662 to 752°F
Wattage: 30 to 60 W
Soldering time: within 3 s

(3) Others

Check mounting conditions before using other soldering methods (DWS, hot-air, hot plate, pulse heater, etc.)

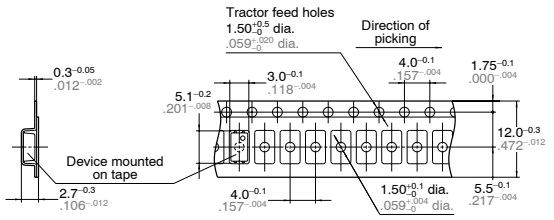
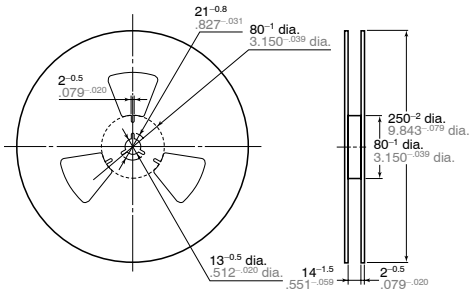
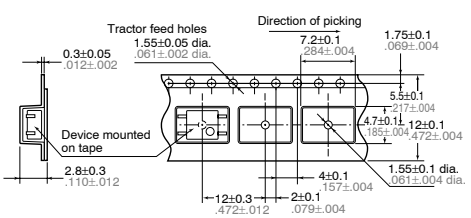
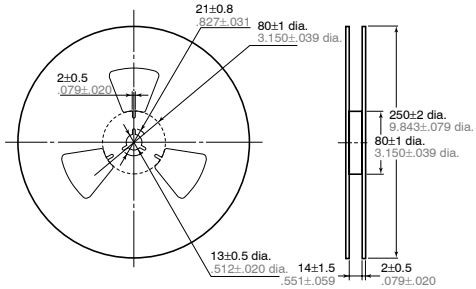
• The temperature profile indicates the temperature of the soldered terminal on the surface of the PC board. The ambient temperature may increase excessively. Check the temperature under mounting conditions.

• The conditions for the infrared reflow soldering apply when preheating using the VPS method.

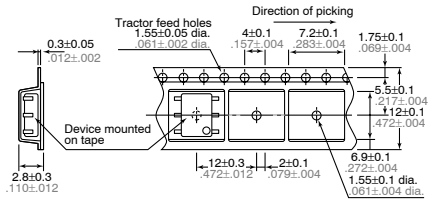
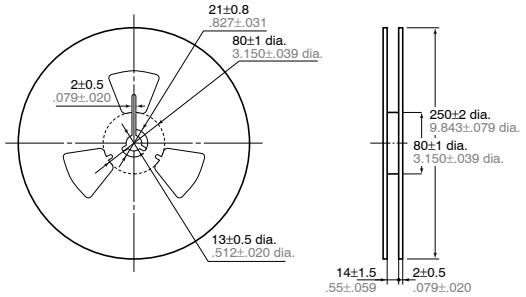
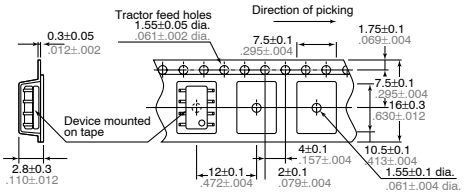
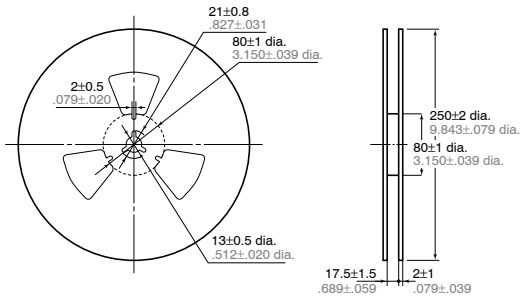
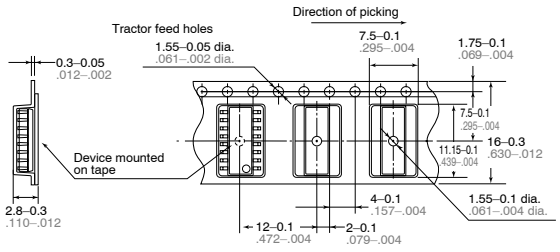
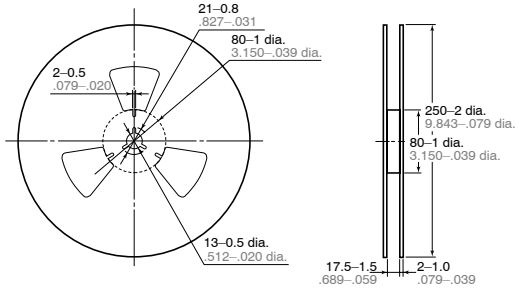
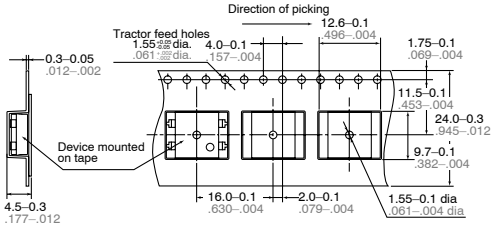
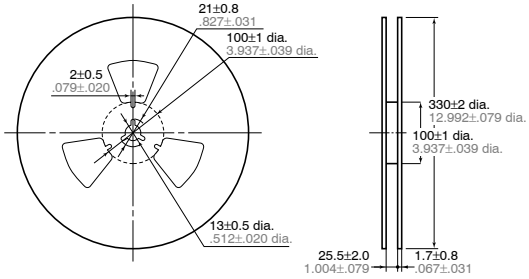
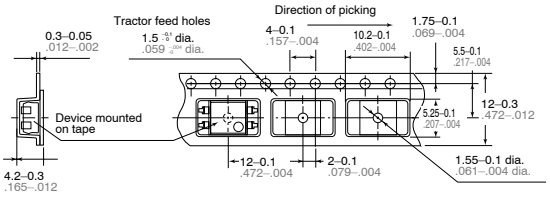
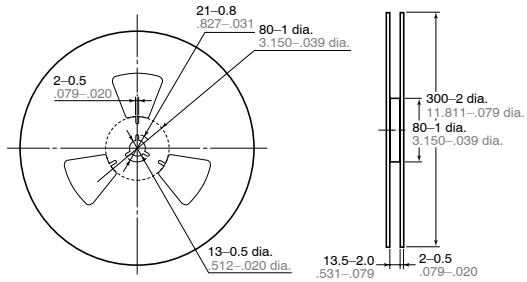
11. The following shows the packaging format

1) Tape and reel

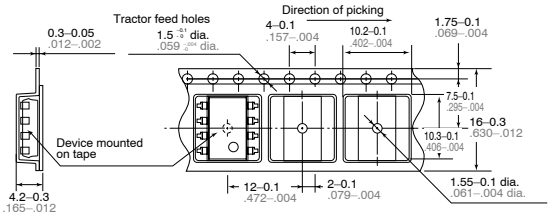
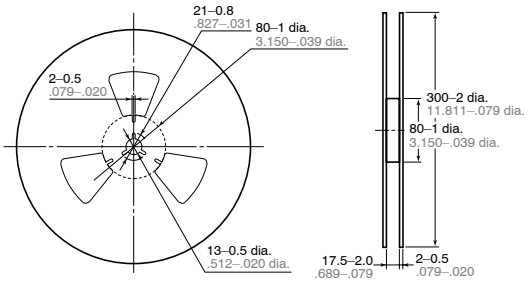
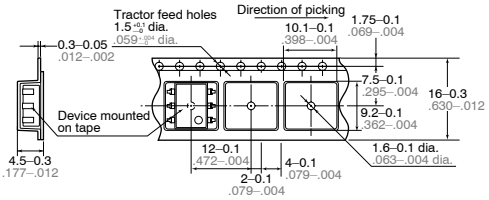
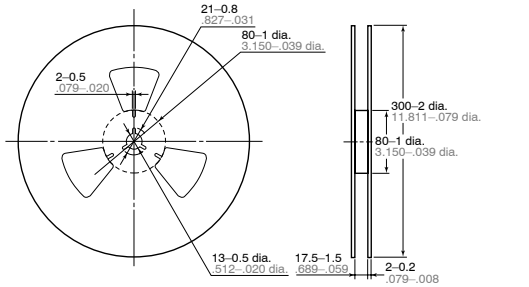
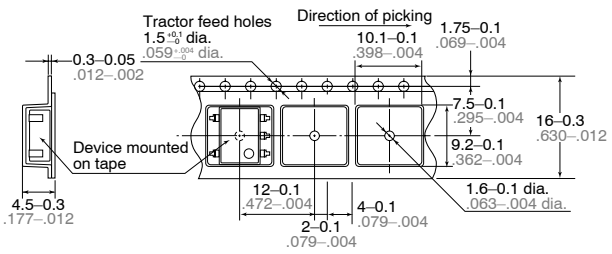
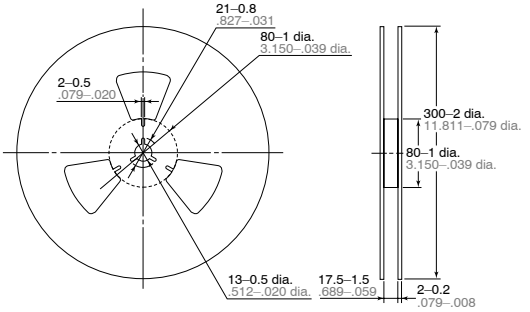
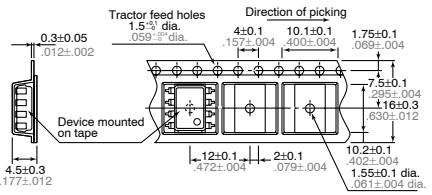
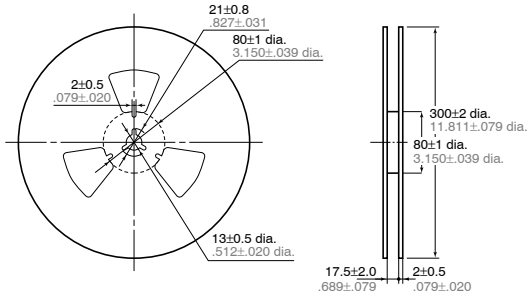
mm inch

Type	Tape dimensions	Dimensions of paper tape reel
SSOP 4-pin type		
	(1) When picked from 1 and 4-pin side: Part No. AQY221○2VY (Shown above), APV2111VY (Shown above) (2) When picked from 2 and 3-pin side: Part No. AQY221○2VW, APV2111VW	
SO package 4-pin type		
	(1) When picked from 1/2-pin side: Part No. AQY○○○SX (Shown above), APV○○○○SX (Shown above) (2) When picked from 3/4-pin side: Part No. AQY○○○SZ, APV○○○○SZ	

mm inch

Type	Tape dimensions	Dimensions of paper tape reel
SO package 6-pin type		
	(1) When picked from 1/2/3-pin side: Part No. AQV○○○SX (Shown above) (2) When picked from 4/5/6-pin side: Part No. AQV○○○SZ	
SO package 8-pin type		
	(1) When picked from 1/2/3/4-pin side: Part No. AQW○○○SX (Shown above) (2) When picked from 5/6/7/8-pin side: Part No. AQW○○○SZ	
SO package 16-pin type		
	(1) When picked from 1/2/3/4/5/6/7/8-pin side: Part No. AQS○○○SX (Shown above) (2) When picked from 9/10/11/12/13/14/15/16-pin side: Part No. AQS○○○SZ	
PD 4-pin SMD type		
	(1) When picked from 1/2-pin side: Part No. AQY○○○AX (Shown above) (2) When picked from 3/4-pin side: Part No. AQY○○○AZ	
4-pin SMD type		
	(1) When picked from 1/2-pin side: Part No. AQY○○○EHAX, AQY○○○GHAX, AQY210HLAX (Shown above) (2) When picked from 3/4-pin side: Part No. AQY○○○EHAZ, AQY○○○GHAZ, AQY210HLAZ	

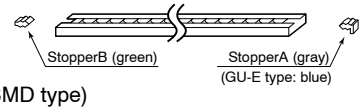
mm inch

Type	Tape dimensions	Dimensions of paper tape reel
AQW210HLA AQW❍❍❍EHA 8-pin SMD type	 (1) When picked from 1/2/3/4-pin side: Part No. AQW❍❍❍EHAX, AQW210HLAX (Shown above) (2) When picked from 5/6/7/8-pin side: Part No. AQW❍❍❍EHAZ, AQW210HLAZ	
6-pin SMD type	 (1) When picked from 1/2/3-pin side: Part No. AQV❍❍❍AX (Shown above) (2) When picked from 4/5/6-pin side: Part No. AQV❍❍❍AZ	
6-pin SMD type (Photovoltaic MOSFET driver)	 (1) When picked from 1/2/3-pin side: Part No. APV❍❍❍AX (Shown above) (2) When picked from 4/6-pin side: Part No. APV❍❍❍AZ	
8-pin SMD type	 (1) When picked from 1/2/3/4-pin side: Part No. AQW❍❍❍AX (Shown above) (2) When picked from 5/6/7/8-pin side: Part No. AQW❍❍❍AZ	

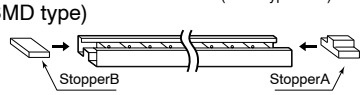
2) Tube

(1) Devices are packaged in a tube so pin No. 1 is on the stopper B side. Observe correct orientation when mounting them on PC boards.

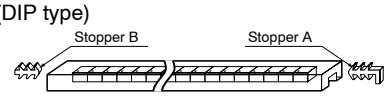
(SSOP type, SOP type, PD type, GU-E type [AQY❍EH, AQW❍EH], GU Current Limit Function Type [AQY❍HL, AQW❍HL])



(SMD type)



(DIP type)



2) Storage

PhotoMOS relays implemented in SSOP, SO packages are sensitive to moisture and come in sealed moisture-proof packages. Observe the following cautions on storage.

• After the moisture-proof package is unsealed, take the devices out of storage as soon as possible (within 1 month at the most).

• If the devices are to be left in storage for a considerable period after the moisture-proof package has been unsealed, it is recommended to keep them in another moisture-proof bag containing silica gel (within 3 months at the most).

12. Transportation and storage

1) Extreme vibration during transport will warp the lead or damage the relay. Handle the outer and inner boxes with care.

2) Storage under extreme conditions will cause soldering degradation, external appearance defects, and deterioration of the characteristics. The following storage conditions are recommended:

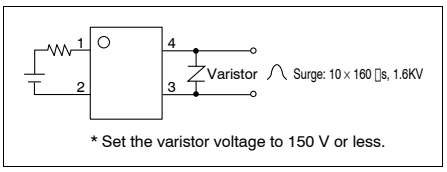
• Temperature: 0 to 45°C 32 to 113°F

• Humidity: Less than 70% R.H.

• Atmosphere: No harmful gasses such as sulfurous acid gas, minimal dust.

13. Current limit function (output current control)

1) Current limit function aims to increase resistance to surges when the switch is turned on. Before using this function, connect the varistor to the output as shown in the figure below.



2) The current limit function capability can be lost if used longer than the specified time. Be sure to set the output loss to the max. rate.

14. Applying stress that exceeds the absolute maximum rating

If the voltage or current value for any of the terminals exceeds the absolute maximum rating, internal elements will deteriorate because of the excessive voltage or current. In extreme cases, wiring may melt, or silicon P/N junctions may be destroyed.

As a result, the design should ensure that the absolute maximum ratings will never be exceeded, even momentarily.

15. Deterioration and destruction caused by discharge of static electricity (RF CXR5, 10, 20 types)

This phenomenon is generally called static electricity destruction, and occurs when static electricity generated by various factors is discharged while the relay terminals are in contact, producing internal destruction of the element.

To prevent problems from static electricity, the following precautions and measures should be taken when using your device.

1) Employees handling relays should wear anti-static clothing and should be grounded through protective resistance of 500 kΩ to 1 MΩ.

2) A conductive metal sheet should be placed over the work table. Measuring instruments and jigs should be grounded.

3) When using soldering irons, either use irons with low leakage current, or ground the tip of the soldering iron. (Use of low-voltage soldering irons is also recommended.)

4) Devices and equipment used in assembly should also be grounded.

5) When packing printed circuit boards and equipment, avoid using high-polymer materials such as foam styrene, plastic, and other materials which carry an electrostatic charge.

6) When storing or transporting relays, the environment should not be conducive to generating static electricity (for instance, the humidity should be between 45 and 60%), and relays should be protected using conductive packing materials.

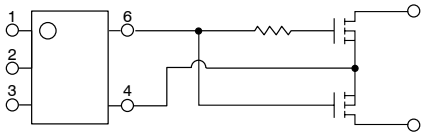
16. Short circuit protection circuit

The short circuit protection circuit is designed to protect circuits from excess current. Therefore, surge current may be detected as current overload in which case the output current will be cut and the off state maintained. For this reason, please include the inrush current in the load current and keep it below the maximum load current. Also, in order to maintain stability of internal IC operation, maintain an input current of at least 5 mA (Latch type), 10 mA (Non Latch type).

Photovoltaic MOSFET driver

1. When two external MOSFETs are connected with a common source terminal, oscillation may occur when operation is restored. Therefore, please insert a 100 to 1,000 ohms resistor between the gate terminal of the first MOSFET and the gate terminal of the second MOSFET.

A typical example of this is given in the circuit below.



2. Deterioration and destruction caused by discharge of static electricity

This phenomenon is generally called static electricity destruction, and occurs when static electricity generated by various factors is discharged while the relay terminals are in contact, producing internal destruction of the element.

To prevent problems from static electricity, the following precautions and measures should be taken when using your device.

1) Employees handling relays should wear anti-static clothing and should be grounded through protective resistance of 500 kΩ to 1 MΩ.

2) A conductive metal sheet should be placed over the work table. Measuring instruments and jigs should be grounded.

3) When using soldering irons, either use irons with low leakage current, or ground the tip of the soldering iron. (Use of low-voltage soldering irons is also recommended.)

4) Devices and equipment used in assembly should also be grounded.

5) When packing printed circuit boards and equipment, avoid using high-polymer materials such as foam styrene, plastic, and other materials which carry an electrostatic charge.

6) When storing or transporting relays, the environment should not be conducive to static electricity (for instance, the humidity should be between 45 and 60%), and relays should be protected using conductive packing materials.

3. Unused terminals

The No. 3 terminal is used with the circuit inside the relay. Therefore, do not connect it to the external circuitry. (DIP 6-pin type)

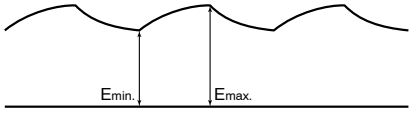
4. Short across terminals

Do not short circuit between terminals when relay is energized, since there is possibility of breaking of the internal IC.

5. Ripple in the input power supply

1) For LED operate current at E_{min}, maintain min. 10 mA

2) Keep the LED operate current at 50 mA or less at E_{max}.

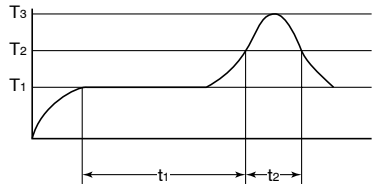


6. Soldering

1) When soldering PC board terminals, keep soldering time less than 10 s at 260°C 500°F.

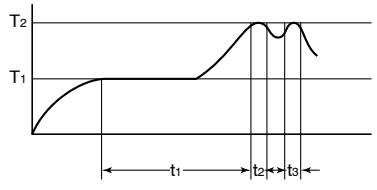
2) When soldering surface-mount terminals, the following conditions are recommended.

(1) IR (Infrared reflow) soldering method



T1 = 155 to 165¡C 311 to 329¡F
T2 = 180¡C 200¡C 356 to 392¡F
T3 = 245¡C 473¡F or less
t1 = 120 s or less
t2 = 30 s or less

(2) Double wave soldering method



T1 = 155 to 165¡C 311 to 329¡F
T2 = 260¡C 500¡F or less
t1 = 60 s or less
t2+t3 = 5 s or less

(3) Soldering iron method
Tip temperature: 280 to 300°C 536 to 572°F
Wattage: 30 to 60 W
Soldering time: within 5 s

(4) Others
Check mounting conditions before using other soldering methods (hot-air, hot plate, pulse heater, etc.)

7. Important Notes for Mounting

1) Temperature rise in the lead portion is highly dependent on package size. If multiple different packages are mounted on the same board, please check your board beforehand in an actual product, ensuring that the temperature conditions of the phototriac coupler fall within the parameters listed above.

8. Cleaning

The phototriac coupler forms an optical path by coupling a light-emitting diode (LED) and photodiode via transparent silicon resin. For this reason, unlike other directory element molded resin products (e.g., MOS transistors and bipolar transistors), avoid ultrasonic cleansing if at all possible. We recommend cleaning with an organic solvent. If you cannot avoid using ultrasonic cleansing, please ensure that the following conditions are met, and check beforehand for defects.

- Frequency: 27 to 29 kHz
- Ultrasonic output: No greater than 0.25 W/cm^2
- Cleaning time: No longer than 30 s
- Cleanser used: Asahiklin AK-225
- Other: Submerge in solvent in order to prevent the PCB and elements from being contacted directly by the ultrasonic vibrations.

Note: Applies to unit area ultrasonic output for ultrasonic baths.

9. Packaging format is please look at p.486 to p.487.

(SSOP 4-pin type, SOP 4-pin type, 6-pin SMD type)

Power PhotoMOS Relays

1.-1) Input LED current (Standard type)

For rising and dropping ratio of input LED current (di/dt), maintain min. 100 μA/s.

1.-2) Input voltage (Voltage sensitive type)

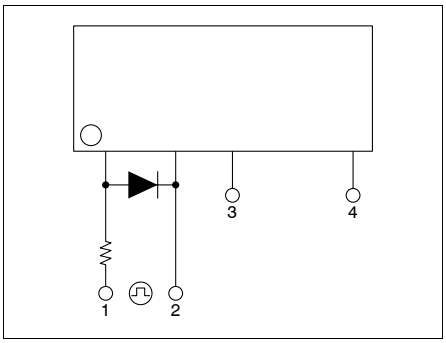
For rising and dropping ratio of input voltage (dv/dt), maintain min. 100 mV/s.

2. Short across terminals

Do not short circuit between terminals when relay is energized, since there is possibility of breaking of the internal IC.

3. Surge voltages at the input

If reverse surge voltages are present at the input terminals, connect a diode in reverse parallel across the input terminals and keep the reverse voltages be low the reverse breakdown voltage.



4. Recommended load voltage

As a guide in selecting PhotoMOS Relays, please refer to the following table.

1) Power photoMOS relays (1a)

	Type	Absolute maximum rating		Recommended load voltage
		Load voltage	Load current	
AC/DC type	AQZ202	Peak AC 60 V	Peak AC 3.0 A	12 V AC; 5,12,24 V DC
	AQZ205	Peak AC 100 V	Peak AC 2.0 A	24 V AC 48 V DC
	AQZ207	Peak AC 200 V	Peak AC 1.0 A	48 V AC 100 V DC
	AQZ204	Peak AC 400 V	Peak AC 0.5 A	100 V AC 200 V DC
DC type	AQZ102	60 V DC	4.0 A DC	5,12,24 V DC
	AQZ105	100 V DC	2.6 A DC	48 V DC
	AQZ107	200 V DC	1.3 A DC	100 V DC
	AQZ104	400 V DC	0.7 A DC	200 V DC

2) Power PhotoMOS relay high capacity type (1a)

	Type	Absolute maximum rating		Recommended load voltage
		Load voltage	Load current	
AC/DC type	AQZ262	Peak AC, DC 60V	Peak AC, DC 6A	12V AC 5,12,24V DC
	AQZ264	Peak AC, DC 400V	Peak AC, DC 1A	100V AC 200V DC

3) Power PhotoMOS relays (Voltage sensitive type) (1a)

	Type	Absolute maximum rating		Recommended load voltage
		Load voltage	Load current	
AC/DC type	AQZ202D	Peak AC 60 V	Peak AC 2.7 A	12 V AC; 5,12,24 V DC
	AQZ205D	Peak AC 100 V	Peak AC 1.8 A	24 V AC 48 V DC
	AQZ207D	Peak AC 200 V	Peak AC 0.9 A	48 V AC 100 V DC
	AQZ204D	Peak AC 400 V	Peak AC 0.45 A	100 V AC 200 V DC
DC type	AQZ102D	60 V DC	3.6 A DC	5.12,24 V DC
	AQZ105D	100 V DC	2.3 A DC	48 V DC
	AQZ107D	200 V DC	1.1 A DC	100 V DC
	AQZ104D	400 V DC	0.6 A DC	200 V DC

4) Power PhotoMOS relays (1b)

	Type	Absolute maximum rating		Recommended load voltage
		Load voltage	Load current	
AC/DC type	AQZ404	Peak AC 400 V	Peak AC 0.5 A	100 V AC 200 V DC

5.-1) Ripple in the input power supply (Standard type and high capacity type)

If ripple is present in the input power supply, observe the following:

1) For LED operate current at E_{min}, maintain min. 5 mA

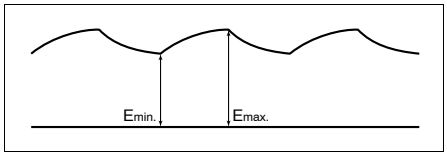
2) Keep the LED operate current at 50 mA or less at E_{max}.

5.-2) Ripple in the input power supply (Voltage sensitive type)

If ripple is present in the input power supply, observe the following:

1) For input voltage at E_{min}, maintain min. 4 V

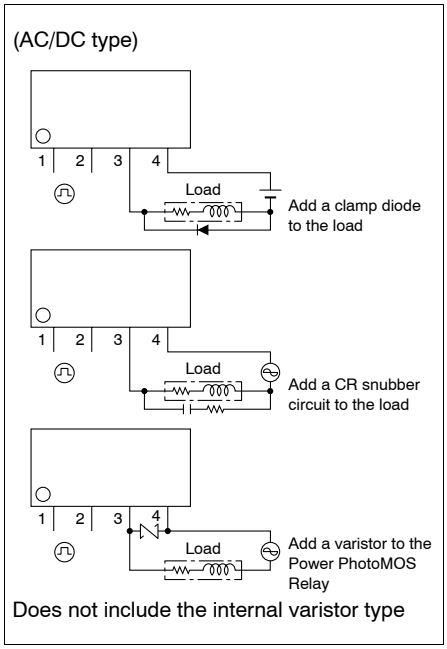
2) Keep input voltage at 30 V or less at E_{max}.



6. Output spike voltages

1) If an inductive load generates spike voltages which exceed the absolute maximum rating, the spike voltage must be limited.

Typical circuits are shown below.



2) Even if spike voltages generated at the

7. Adjacent mounting

1) When relays are mounted close together with the heat-generated devices, ambient temperature may rise abnormally. Mounting layout and ventilation should be considered.

2) When many relays are mounted close together, load current should be reduced. (Refer to the date of “Load current vs. ambient temperature characteristics in adjacent mounting.”)

8. Cleaning solvents compatibility

The PhotoMOS relay forms an optical path by coupling a light-emitting diode (LED) and photodiode via transparent silicon resin. For this reason, unlike other directory element molded resin products (e.g., MOS transistors and bipolar transistors), avoid ultrasonic cleansing if at all possible. We recommend cleaning with an organic solvent. If you cannot avoid using ultrasonic cleansing, please ensure that the following conditions are met, and check beforehand for defects.

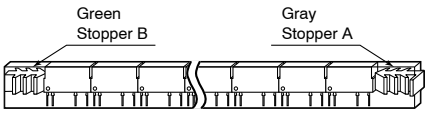
- Frequency: 27 to 29 kHz
- Ultrasonic output:
  No greater than 0.25W/cm^2
- Cleaning time:
  No longer than 30 s
- Cleanser used: Asahiklin AK-225
- Other:
  Submerge in solvent in order to prevent the PCB and elements from being contacted directly by the ultrasonic vibrations.

Note: Applies to unit area ultrasonic output for ultrasonic baths.

9. Soldering

When soldering PC board terminals, keep soldering time to within 10 s at 260°C 500°F.

10. Packing style



The power photoMOS relays are stick packed so that the number 1 terminal is in the direction of stopper B.
One stick contains 25 power photoMOS relays.

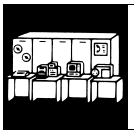
11.Transport and storage

1) If the product is subject to extreme vibration during transport, the lead may warp or the main unit may become damaged. Handle the outer and inner boxes with care.

2) If the storage environment is extremely bad, it may give rise to deterioration of the soldering, external appearance defects, and degradation the characteristics of the product. The following conditions are recommended for the storage location:

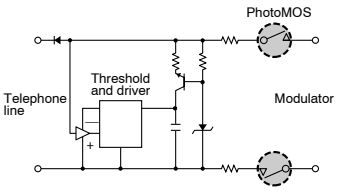
- Temperature: 5 to 30°C 41 to 86°F
- Humidity: Less than 60% R.H.
- Environment: No hazardous substances such as sulfurous acid gases, and little dust.

PhotoMOS Relays for Various Applications



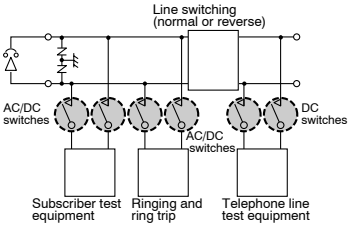
Automatic meter reading

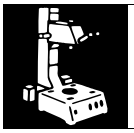
The needs of centralized remote meter reading systems for water, gas and electricity in medium and high rise apartments and new subdivisions are now increasing. PhotoMOS relays are capable of controlling from low level signals up to power signals and feature low leakage current and noise from the optoelectronic device and power MOSFET combination.



Telecommunications

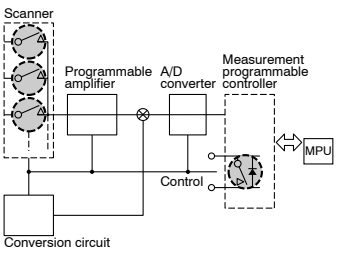
A variety of signals, with levels from millivolts (at microamperes) to tens of volts (at several hundred milliamperes), AC or DC, and even high bit-rate signals, can be superimposed on telephone lines, the heart of telecommunication networks. The switches in telecommunication circuits, which normally carry DC signals, also carry AC signals on top of the DC level when an intermittent signal (e.g. ringer signal) is being sent. PhotoMOS relays are capable of controlling small level (millivolts at microamperes) AC or DC signals.





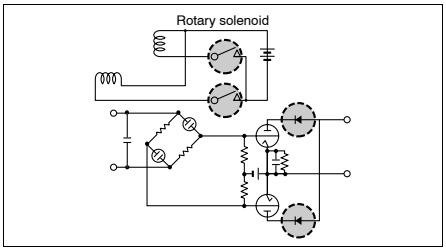
Instrumentation

With the spread of microcomputer chips, the latest instruments are required to measure a variety of signals at high speeds under various conditions. PhotoMOS relays are recommended for measurement scanning functions, automatic zero-point compensation to eliminate zero-point error, and measurement sequence interfaces (e.g. alarm interface.)



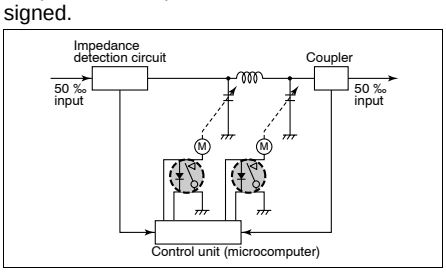
Medical equipment

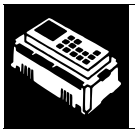
Medical equipment which processes low level signals includes electrocardiographs, electroencephalographs, and X-ray CT scanners. PhotoMOS relays accurately transfer low level signals (less than several hundred millivolts). Furthermore, they are also convenient in driving rotary solenoids such as those used to automatically switch voltage ranges.



Communications equipment

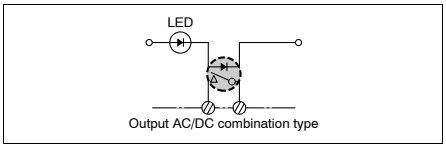
The future of communications is in satellite communications. Satellite-communications feature many advantages such as indifference to terrestrial disasters, wide service areas, simple circuit modification and simultaneous conversations. An important control operation in communications equipment is fast automatic tuning.
PhotoMOS relays can easily be connected in parallel, difficult with conventional transistor type. As a result, a variety of circuit connection are possible and power circuits can also be designed.

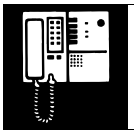




Programmable controller

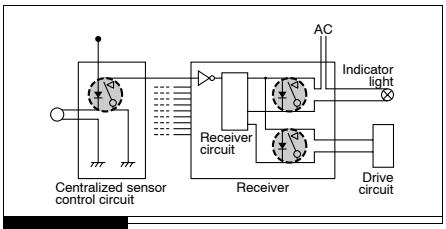
The output circuit of a programmable controller requires various interfaces to match the load type. Recently, as the computing speed and data processing speed increase, problems may arise from noise at the input interface as well as at the output interface.
PhotoMOS relays are resistant to inrush current (due to phase shift) and eliminate the need for snubber circuits as long as they are operated within the ratings. Furthermore, use of PhotoMOS relays decreases the mounting area requirements, resulting in more compact programmable controllers.

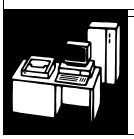




Security Equipment

There are many types of security systems from home and office security to building security. PhotoMOS relays are ideal for use as input interfaces for system sensors and output interfaces for alarms.
Input interface: Low leakage current makes use possible for low level voltage and current input.
Output interface: Outputs either AC or DC up to a load voltage of 400 V.

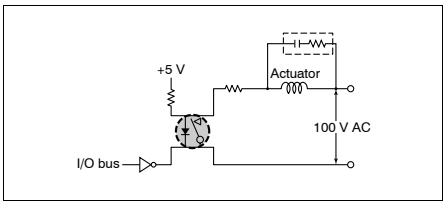




OA equipment

OA equipment usually contains a sensor control unit (for temperature, speed, torque, etc.), drive unit, power supply unit, and a processing unit which controls the overall system. It is organized similarly to compact factory automation machinery. PhotoMOS relays have wide application in the interfaces for signals which connect the functions of these units.

- Operates on a 24 mW input to enable direct control of C-MOS devices.
- Signal transfer through optical coupling achieves high resistance to noise and transients, eliminating the need for adding a snubber circuit to the output to control the load voltage.
- Advantages in the total cost and reliability in the control system result from the absence of AC leakage current related to the snubber circuit.

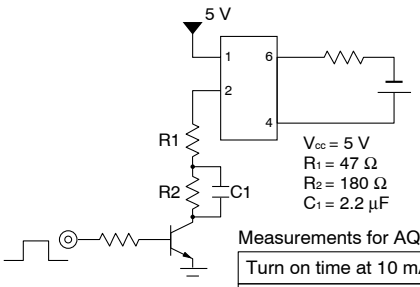


If you are a user experiencing difficulty with solid-state relays and triacs:

If you would like to control small analog signals with a photocoupler and solid-state relays.	➤	PhotoMOS relays feature low offset voltages and on resistances of 0.25 Ω or less. (AQV251 Connection)
If you require a device with a small leakage current (as opposed to bipolar devices having large internal leakage currents).	➤	PhotoMOS relays have leakage currents in the order of microamperes and can control up to 1500 V (peak). (AQV258)
If you would like to directly control analog signals and you would like a device integrating a photocoupler, driver and analog IC to simplify the circuit as much as possible.	➤	PhotoMOS relays contain all of these functions in a single package. Furthermore, circuit design is simplified as a power supply is unnecessary since the internal optoelectronic device directly drives the power MOSFET.
If you require a snubber circuit with a triac or solid-state relay, but are concerned about the snubber circuit's AC leakage current.	➤	PhotoMOS relays are resistant to transients and as long as they are operated within the maximum ratings, eliminate the need for adding a snubber circuit to the output to control the rise in load voltage. Leakage current ceases to be a problem, with cost and reliability being other advantages.
If you require a device for AC control that is resistant to ambient temperature changes and input signal noise.	➤	PhotoMOS relays do not employ the self-trigger mechanism used in SCRs and triacs. Therefore, they do not switch on accidentally. Furthermore, the noise suppression characteristics of optoelectronic devices make them highly resistant to ambient noise for operation at temperatures up to 80°C 176°F.

PhotoMOS Relay Application Examples

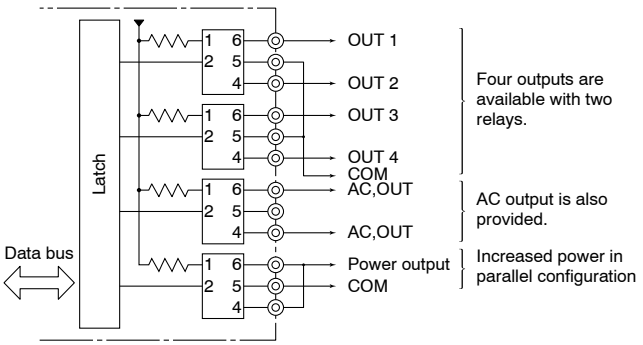
High Response Speed



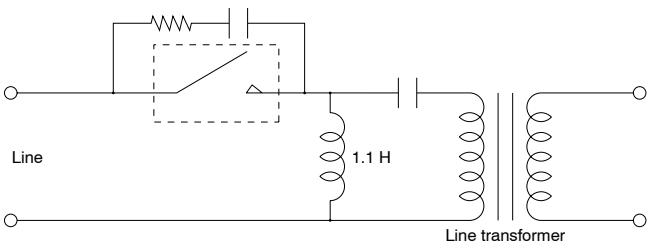
Measurements for AQV204(400V) AC/DC type

Turn on time at 10 mA LED current	0.18 ms
Turn on time with speed-increase capacitor (LED current 45 mA)	0.03 ms

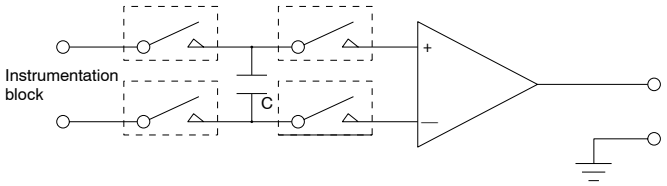
Microprocessor system I/O board



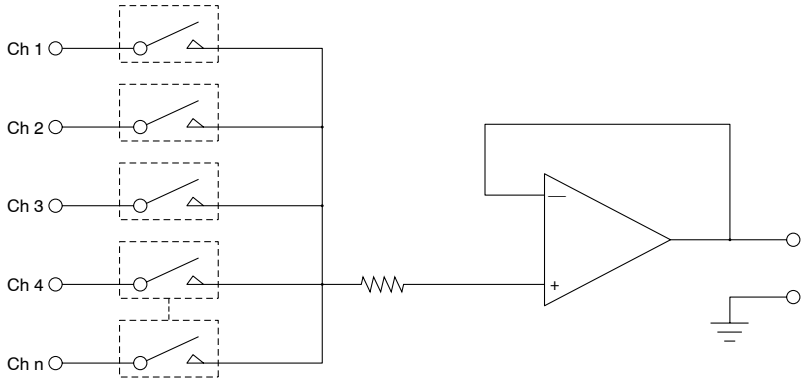
Dial Pulse Generator



Capacitor Switch Circuit



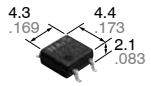
Scanner



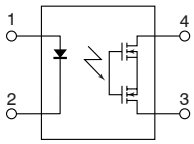
Panasonic
ideas for life

GU (General Use) Type SOP Series 1-Channel (Form A) High Capacity 4-Pin Type

GU PhotoMOS (AQY212GS)



mm inch



FEATURES

1. Greatly increased load current in the same, miniature, 4-pin SO package.

2. Greatly improved specs allow you to use this in place of mercury and mechanical relays.

TYPICAL APPLICATIONS

- Measuring instrument market
- Crime and fire prevention market (use in I/O for alarm and security devices, etc.)

TYPES

Type	Output rating*		Part No.		Packing quantity
	Load voltage	Load current	Picked from the 1/2-pin side	Picked from the 3/4-pin side	
			1 Form A	1 Form A	
AC/DC type	60 V	1.0 A	AQY212GSX	AQY212GSZ	Tape and reel: 1,000 pcs.

* Indicate the peak AC and DC values.

Notes: (1) Tape package is the standard packing style. Also available in tube. (Part No. suffix “X” or “Z” is not needed when ordering; Tube: 100 pcs.; Case: 2,000 pcs.)

(2) For space reasons, the initial letters of the product number “AQY” and “S” are omitted on the product seal. The package type indicator “X” and “Z” are omitted from the seal. (Ex. the label for product number AQY212GS is 212G).

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

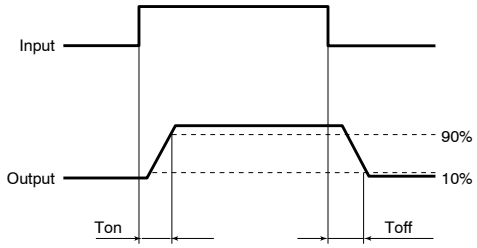
Item		Symbol	AQY212GS	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	60 V	
	Continuous load current (peak AC)	I_L	1.0 A	
	Peak load current	I_{peak}	3.0 A	100ms (1 shot), V_L = DC
	Power dissipation	P_{out}	300 mW	
Total power dissipation		P_T	350 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY212GS	Condition
Input	LED operate current	Typical	I_{Fon}	1.1 mA	I_L = 100mA
		Maximum		3 mA	
	LED turn off current	Minimum	I_{Foff}	0.3 mA	I_L = 100mA
		Typical		1.0 mA	
	LED dropout voltage	Typical	V_F	1.32 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	0.34 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		0.7 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA	I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	1.3 ms	I_F = 5 mA I_L = 100 mA V_L = 10 V
		Maximum		5.0 ms	
	Turn off time*	Typical	T_{off}	0.1 ms	I_F = 5 mA I_L = 100 mA V_L = 10 V
		Maximum		0.5 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F = 5 to 10 mA. For type of connection, see page 56.

*Turn on/Turn off time

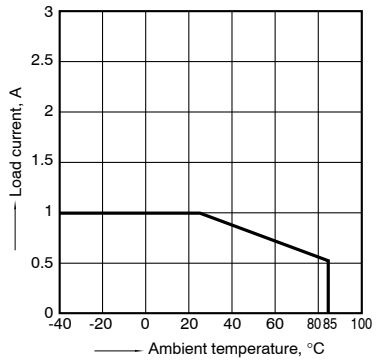


■ **For Dimensions, see page 53.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

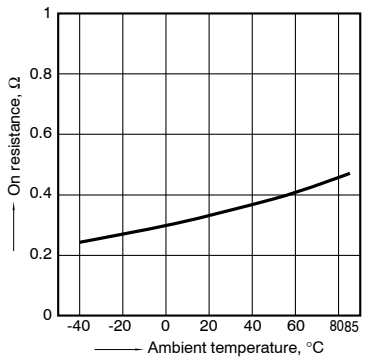
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



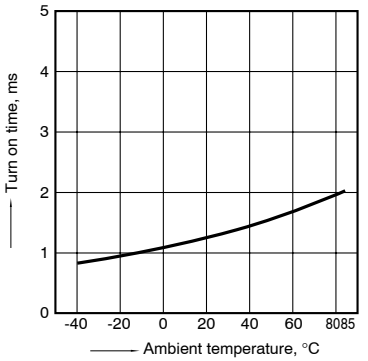
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max.(DC)



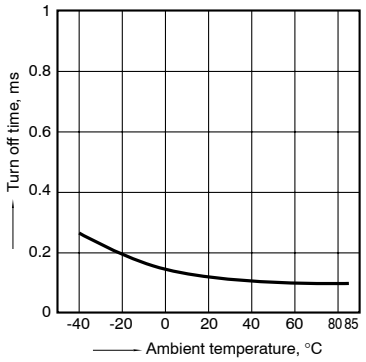
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



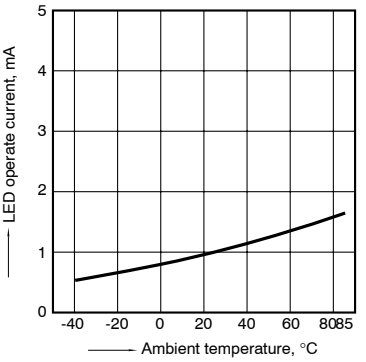
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



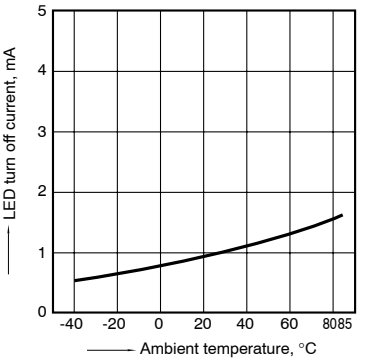
5. LED operate current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100mA (DC)



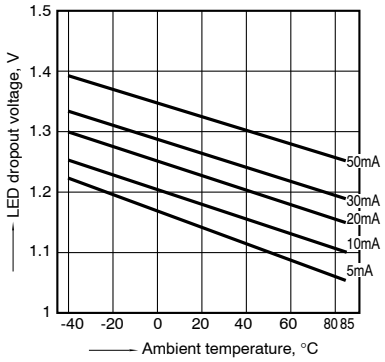
6. LED turn off current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100mA (DC)



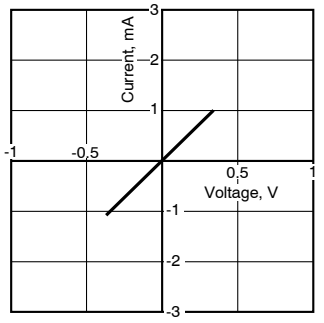
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



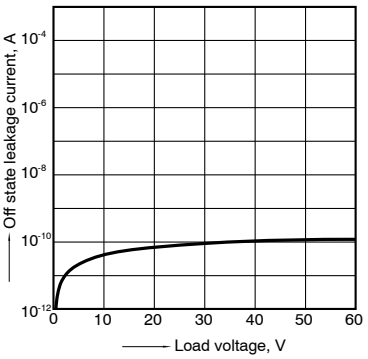
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



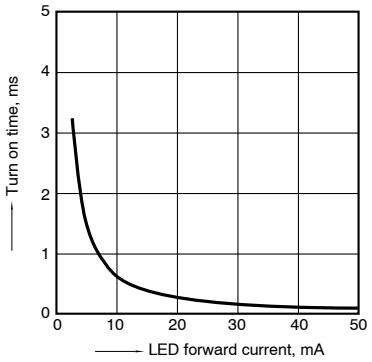
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



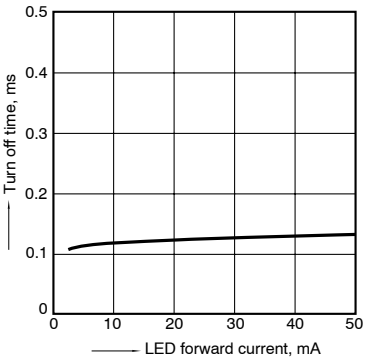
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



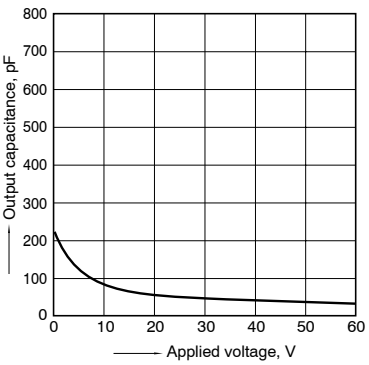
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

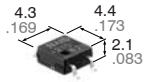
Measured portion: between terminals 3 and 4;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



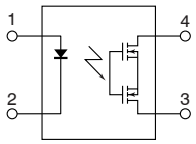
Panasonic
ideas for life

Super miniature design, SOP(1 Form A) 4-pin type Controls load voltage 60V, 350V, 400V

GU PhotoMOS (AQY21○S)

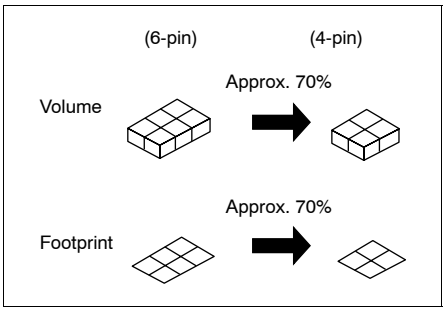


mm inch



FEATURES

1. SO package 4-Pin type in super miniature design
The device comes in a super-miniature SO package 4-Pin type measuring (W)4.3 × (L)4.4 × (H)2.1 mm (W).169 × (L).173 × (H).083 inch —approx. 70% of the volume and 70% of the footprint size of SO package 6-pin type PhotoMOS Relays.



2. Tape and reel
The device comes standard in a tape and reel (1,000 pcs./reel) to facilitate automatic insertion machines.

3. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

4. Low-level off state leakage current
In contrast to the SSR with an off state leakage current of several milliamperes, the PhotoMOS relay features a very small off state leakage current of typ. 100 pA (AQY214S) even with the rated load voltage of 400 V.

TYPICAL APPLICATIONS

- Telecommunications (PC, Electronic Notepad)
- Measuring and Testing equipment
- Factory Automation Equipment
- Security equipment
- High speed inspection machines

TYPES

AC/DC type

Output rating*		Part No.		Packing quantity in tape and reel
Load voltage	Load current	Picked from the 1/2-pin side	Picked from the 3/4-pin side	
60 V	500 mA	AQY212SX	AQY212SZ	1,000 pcs.
350 V	120 mA	AQY210SX	AQY210SZ	
400 V	100 mA	AQY214SX	AQY214SZ	

* Indicate the peak AC and DC values.

Notes: (1) Tape package is the standard packing style. Also available in tube. (Part No. suffix “X” or “Z” is not needed when ordering; Tube: 100 pcs.; Case: 2,000 pcs.)
(2) For space reasons, the top two letters of the product number “AQY” and “S” are omitted on the product seal. The package type indicator “X” and “Z” are omitted from the seal. (Ex. the label for product number AQY210S is 210).

RATING

AC/DC type

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

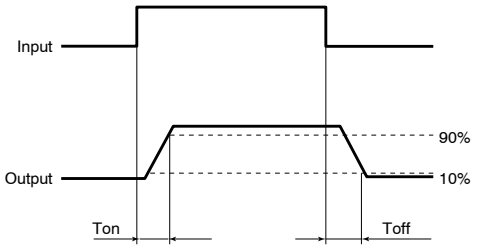
Item		Symbol	AQY212S	AQY210S	AQY214S	Remarks
Input	LED forward current	I_F	50 mA			
	LED reverse voltage	V_R	5 V			
	Peak forward current	I_{FP}	1 A			f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW			
Output	Load voltage (peak AC)	V_L	60 V	350 V	400 V	
	Continuous load current (peak AC)	I_L	0.5 A	0.12 A	0.1 A	
	Peak load current	I_{peak}	1.5 A	0.3 A	0.24 A	100ms (1 shot), V_L = DC
	Power dissipation	P_{out}	300 mW			
Total power dissipation		P_T	350 mW			
I/O isolation voltage		V_{iso}	1,500 V AC			
Tempera-ture limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F			Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F			

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY212S	AQY210S	AQY214S	Remarks
Input	LED operate current	Typical	I_{Fon}	0.9 mA			I_L = Max.
		Maximum		3 mA			
	LED turn off current	Minimum	I_{Foff}	0.4 mA			I_L = Max.
		Typical		0.85 mA			
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)			I_F = 50 mA
		Maximum		1.5 V			
Output	On resistance	Typical	R_{on}	0.83 Ω	17 Ω	25 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		2.5 Ω	25 Ω	35 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA			I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	0.65 ms	0.23 ms	0.21 ms	I_F = 5 mA I_L = Max.
		Maximum		2 ms	0.5 ms	0.5 ms	
	Turn off time*	Typical	T_{off}	0.04 ms			I_F = 5 mA I_L = Max.
		Maximum		0.2 ms			
	I/O capacitance	Maximum	C_{iso}	1.5 pF			f = 1 MHz V_B = 0 V
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ			500 V DC

Note: Recommendable LED forward current I_F = 5mA. For type of connection, see page 56.

*Turn on/Turn off time

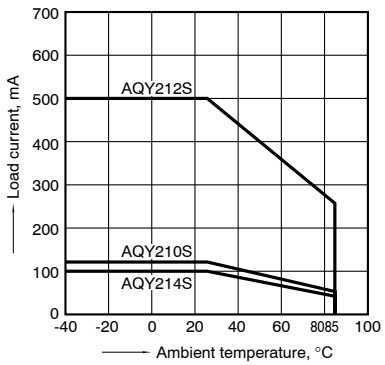


■ **For Dimensions, see page 53.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

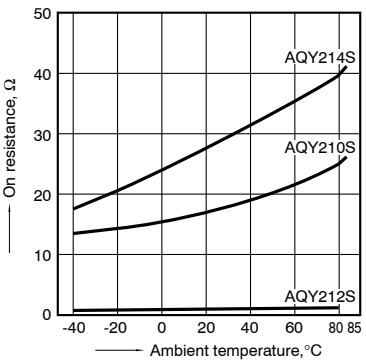
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



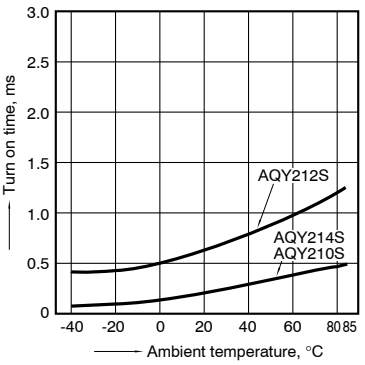
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



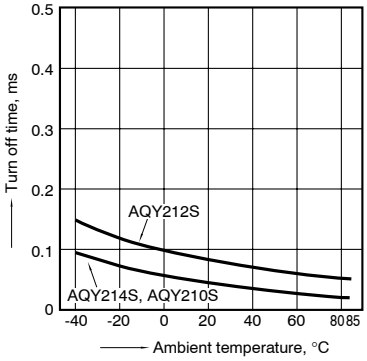
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



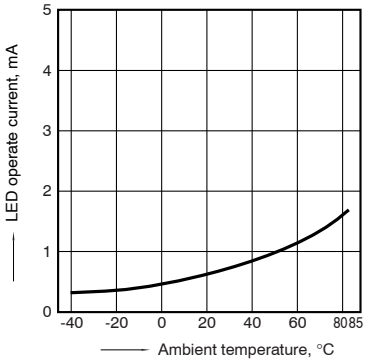
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC); Continuous load current: Max. (DC)



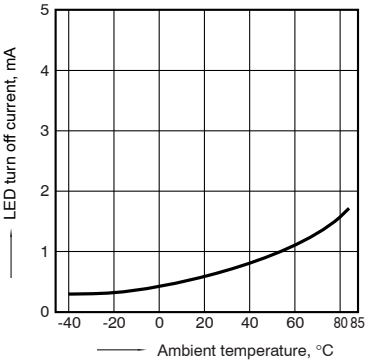
5. LED operate current vs. ambient temperature characteristics

Sample: All types; Load voltage: Max. (DC); Continuous load current: Max. (DC)



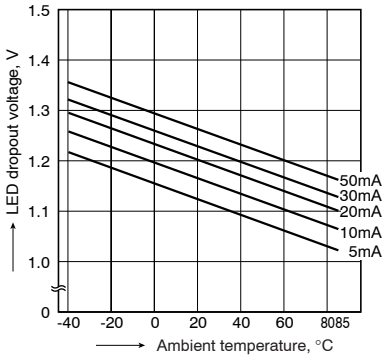
6. LED turn off current vs. ambient temperature characteristics

Sample: All types; Load voltage: Max. (DC); Continuous load current: Max. (DC)



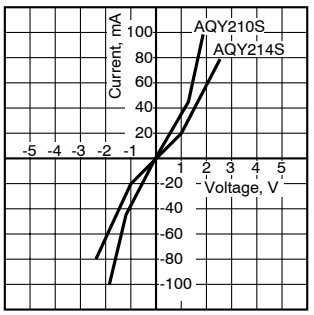
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types; LED current: 5 to 50 mA



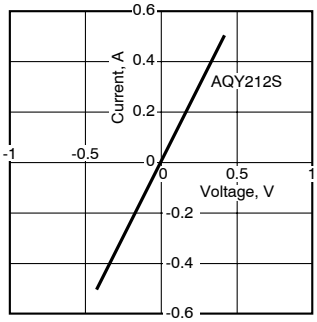
8-(1). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4; Ambient temperature: 25°C 77°F



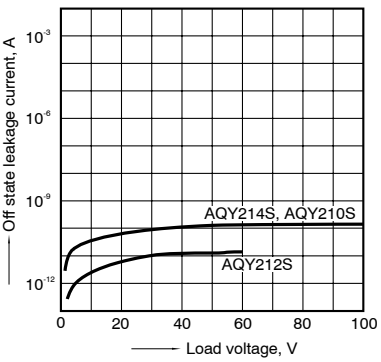
8-(2). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4; Ambient temperature: 25°C 77°F



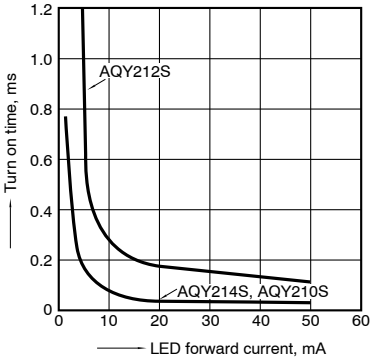
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4; Ambient temperature: 25°C 77°F



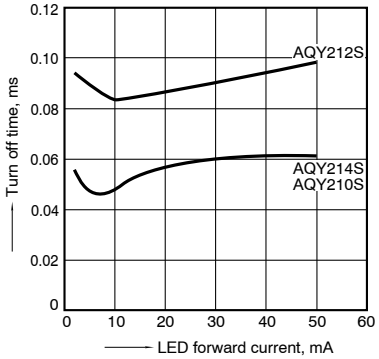
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4; Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



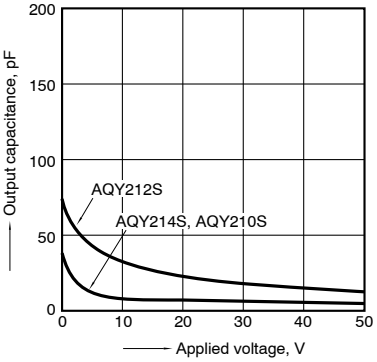
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4; Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

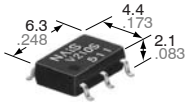
Measured portion: between terminals 3 and 4; Frequency: 1 MHz; Ambient temperature: 25°C 77°F



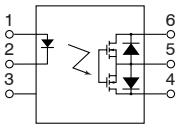
Panasonic
ideas for life

Super miniature design, SOP(1 Form A) 6-pin type. Controls load voltage 60V to 400V

GU PhotoMOS (AQV21❍S)

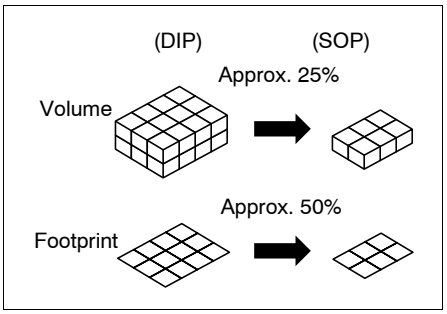


mm inch



FEATURES

1. 1 channel (Form A) in super miniature design
The device comes in a super-miniature SO package measuring (W) 4.4 × (L) 6.3 ×(H) 2.1 mm (W) .173× (L) .248×(H) .083 inch —approx. 25% of the volume and 50% of the footprint size of DIP type PhotoMOS Relays.



2. Tape and reel
The device comes standard in a tape and reel (1,000 pcs./reel) to facilitate automatic insertion machines.

3. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

4. Low-level off state leakage current
In contrast to the SSR with an off state leakage current of several milliamperes, the PhotoMOS relay features a very small off state leakage current of typ. 100 pA even at the rated load voltage of 400 V (AQV214S).

TYPICAL APPLICATIONS

- Telephones
- Measuring instruments
- Computer
- Industrial robots
- High-speed inspection machines

TYPES

Type	Output ratings*		Part No.		Packing quantity in tape and reel
			Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side	
	Load voltage	Load current	1 Form A	1 Form A	
AC/DC	60 V	500 mA	AQV212SX	AQV212SZ	1,000 pcs.
	100 V	300 mA	AQV215SX	AQV215SZ	
	200 V	160 mA	AQV217SX	AQV217SZ	
	350 V	120 mA	AQV210SX	AQV210SZ	
	400 V	100 mA	AQV214SX	AQV214SZ	
	600 V	40 mA	AQV216SX	AQV216SZ	

*Indicate the peak AC and DC values.

Notes: (1) Tape package is the standard packing style. Also available in tube. (Part No. suffix “X” ro “Z” is not needed when ordering; Tube: 75 pcs.; Case: 1,500 pcs.)
(2) For space reasons, the top two letters of the product number “AQ” are ommitted on the product seal. The package type indicator “X” and “Z” are also omitted from the seal. (Ex. the label for product number AQV214S is V214S).

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV212S	AQV215S	AQV217S	AQV210S	AQV214S	AQV216S	Remarks
Input	LED forward current	I_F		50 mA						
	LED reverse voltage	V_R		5 V						
	Peak forward current	I_{FP}		1 A						f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW						
Output	Load voltage (peak AC)	V_L		60 V	100 V	200 V	350 V	400 V	600 V	
	Continuous load current	I_L	A	0.50 A	0.30 A	0.16 A	0.12 A	0.10 A	0.04 A	A connection: Peak AC, DC B,C connection: DC
			B	0.65 A	0.40 A	0.20 A	0.13 A	0.11 A	0.05 A	
			C	0.80 A	0.56 A	0.28 A	0.15 A	0.12 A	0.06 A	
	Peak load current	I_{peak}		1.0A	0.90A	0.48A	0.3 A	0.3 A	0.12 A	A connection: 100 ms (1 shot) V_L= DC
	Power dissipation	P_{out}		450 mW						
Total power dissipation		P_T		500 mW						
I/O isolation voltage		V_{iso}		1,500 V AC						
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F						Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F						

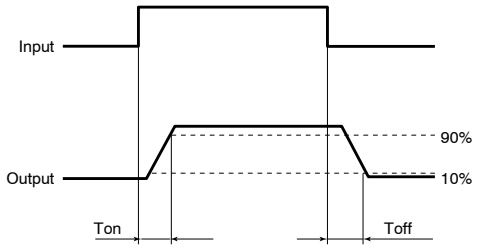
07/2005

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	Type of connection	AQV212S	AQV215S	AQV217S	AQV210S	AQV214S	AQV216S	Remarks
Input	LED operate current	Typical	I_{Fon}	—	0.7 mA						I_L= Max.
		Maximum			3 mA						
	LED turn off current	Minimum	I_{Foff}	—	0.4 mA						I_L= Max.
		Typical			0.65 mA						
	LED dropout voltage	Typical	V_F	—	1.25 V (1.14 V at I_F = 5 mA)						I_F= 50 mA
		Maximum			1.5 V						
Output	On resistance	Typical	R_{on}	A	0.83 Ω	2.3 Ω	11 Ω	23 Ω	30 Ω	70 Ω	I_F= 5 mA I_L= Max. Within 1 s on time
		Maximum			2.5 Ω	4.0 Ω	15 Ω	35 Ω	50 Ω	120 Ω	
		Typical	R_{on}	B	0.44 Ω	1.15 Ω	5.5 Ω	11.5 Ω	22.5 Ω	55 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			1.25 Ω	2.0 Ω	7.5 Ω	17.5 Ω	25 Ω	100 Ω	
		Typical	R_{on}	C	0.25 Ω	0.6 Ω	2.8 Ω	6.0 Ω	11.3 Ω	28 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			0.63 Ω	1.0 Ω	3.8 Ω	8.8 Ω	12.5 Ω	50 Ω	
	Off state leakage current	Maximum	I_{Leak}	—	1 μA						I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	—	0.65 ms	0.60 ms	0.25 ms	0.25 ms	0.25 ms	0.25 ms	I_F= 5 mA V_L = Max.
		Maximum			2.0 ms	2.0 ms	1.0 ms	0.5 ms	0.5 ms	0.5 ms	
	Turn off time	Typical	T_{off}	—	0.08 ms	0.06 ms	0.05 ms	0.05 ms	0.05 ms	0.05 ms	I_F= 5 mA V_L = Max.
		Maximum			0.2 ms						
	I/O capacitance	Typical	C_{iso}	—	0.8 pF						f = 1 MHz V_B = 0 V
		Maximum			1.5 pF						
	Initial I/C isolation resistance	Minimum	R_{iso}	—	1,000 MΩ						500 V DC

Note: Recommendable LED forward current I_F = 5mA. For type of connection, see page 56.

*Turn on/Turn off time



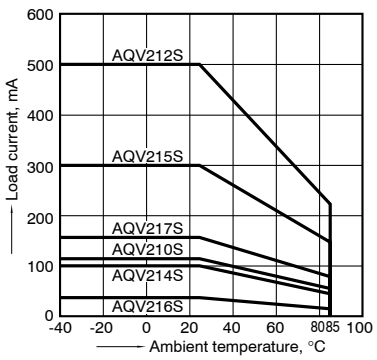
■ **For Dimensions, see page 53.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

1. Load current vs. ambient temperature characteristics

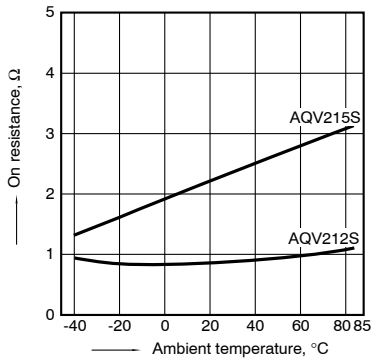
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

Type of connection: A



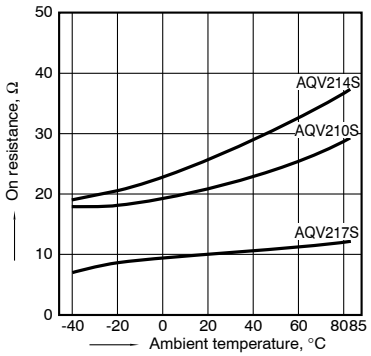
2.-(1) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)

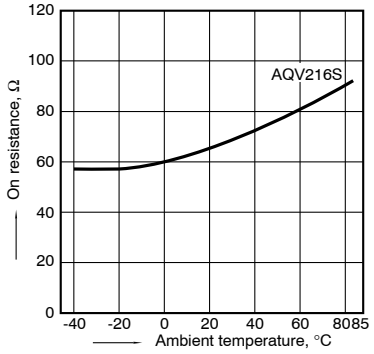


2.-(2) On resistance vs. ambient temperature characteristics

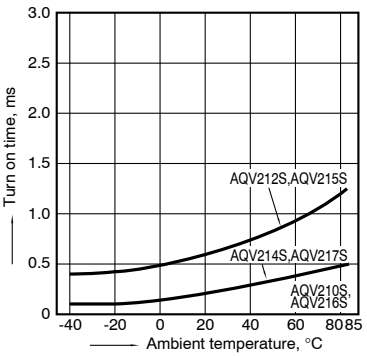
Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



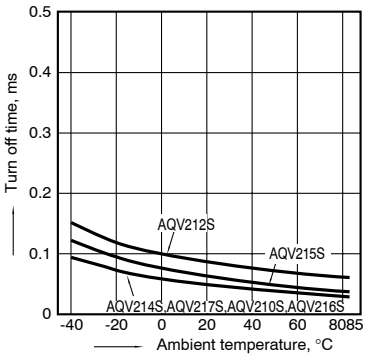
2.-(3) On resistance vs. ambient temperature characteristics
Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



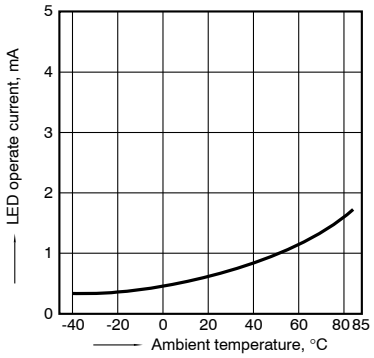
3. Turn on time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



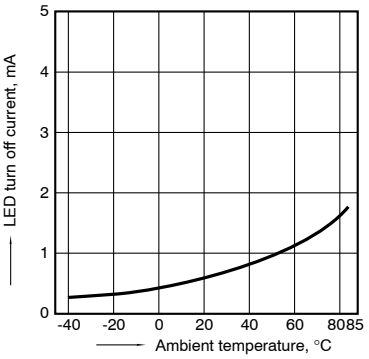
4. Turn off time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



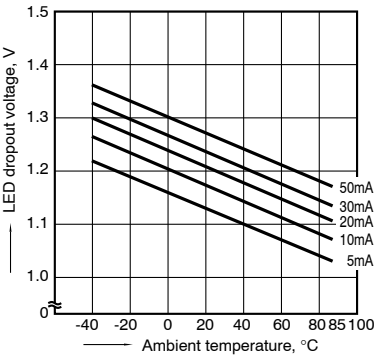
5. LED operate current vs. ambient temperature characteristics
Sample: All types;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



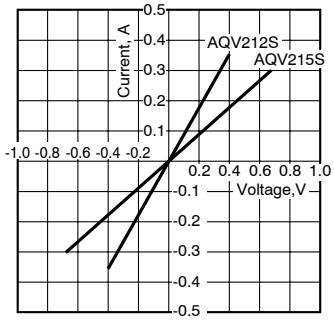
6. LED turn off current vs. ambient temperature characteristics
Sample: All types;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



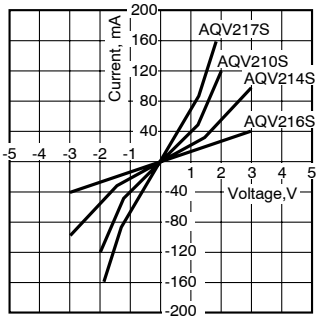
7. LED dropout voltage vs. ambient temperature characteristics
Sample: All types;
LED current: 5 to 50 mA



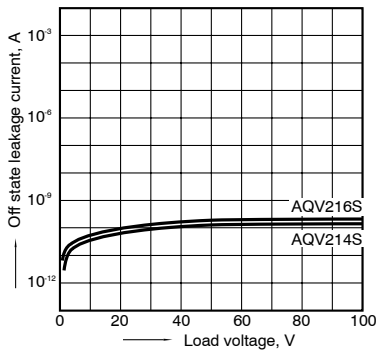
8.-(1). Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



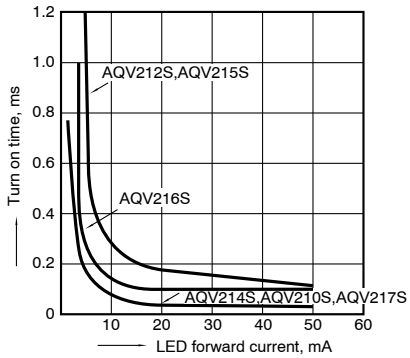
8.-(2). Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



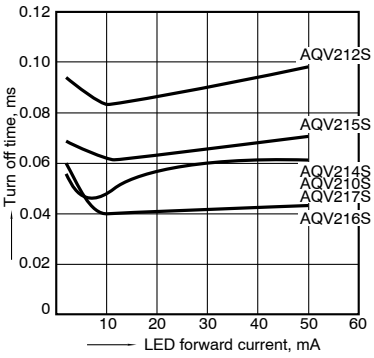
9. Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



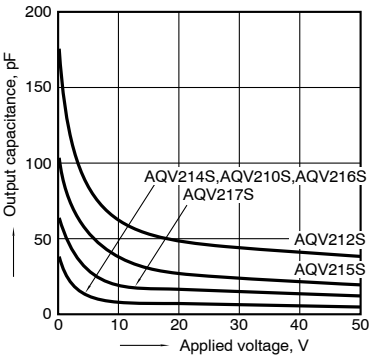
10. Turn on time vs. LED forward current characteristics
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



11. Turn off time vs. LED forward current characteristics
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



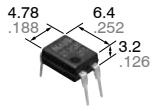
12. Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



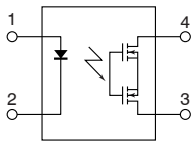
Panasonic
ideas for life

Greatly increase load current (1.1A). Load voltage is 60V. Reinforced insulation 5,000V type.

GU PhotoMOS (AQY212GH)



mm inch



FEATURES

1. Greatly increased load current.

2. Reinforced insulation 5,000 V type.

3. Greatly improved specs allow you to use this in place of mercury and mechanical relays.

4. Compact 4-pin DIP size.

TYPICAL APPLICATIONS

• Crime and fire prevention market (use in I/O for alarm and security devices, etc.)
• Measuring instrument market

TYPES

Type	I/O isolation voltage	Output rating*		Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
		Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2-pin side	Picked from the 3/4-pin side		
AC/DC type	Reinforced 5,000 V	60 V	1.1 A	AQY212GH	AQY212GHA	AQY212GHAX	AQY212GHAZ	1 tube contains 100 pcs. 1 batch contains 1,000 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.

Note: For space reasons, the initial letters of the product number “AQY”, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

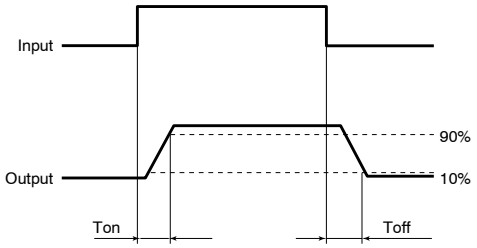
Item		Symbol	AQY212GH(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	60 V	
	Continuous load current (peak AC)	I_L	1.1 A	
	Peak load current	I_{peak}	3.0 A	100ms (1 shot), V_L = DC
	Power dissipation	P_{out}	500 mW	
Total power dissipation		P_T	550 mW	
I/O isolation voltage		V_{iso}	5,000 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY212GH(A)	Condition
Input	LED operate current	Typical	I_{Fon}	1.1 mA	I_L = 100mA
		Maximum		3 mA	
	LED turn off current	Minimum	I_{Foff}	0.3 mA	I_L = 100mA
		Typical		1.0 mA	
	LED dropout voltage	Typical	V_F	1.32 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	0.34 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		0.7 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA	I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	1.3 ms	I_F = 5 mA I_L = 100 mA V_L = 10 V
		Maximum		5.0 ms	
	Turn off time*	Typical	T_{off}	0.1 ms	I_F = 5 mA I_L = 100 mA V_L = 10 V
		Maximum		0.5 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F = 5 to 10 mA. For type of connection, see page 56.

*Turn on/Turn off time

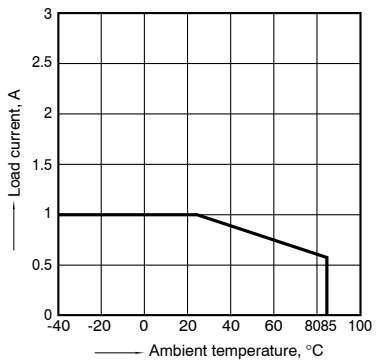


■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

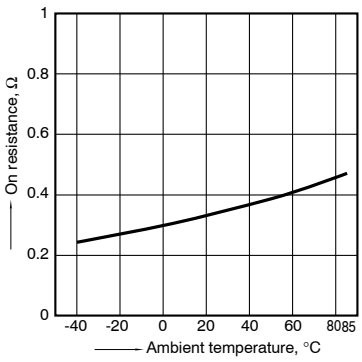
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



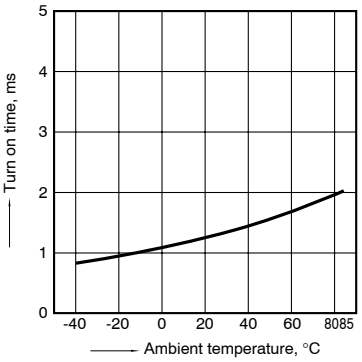
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max.(DC)

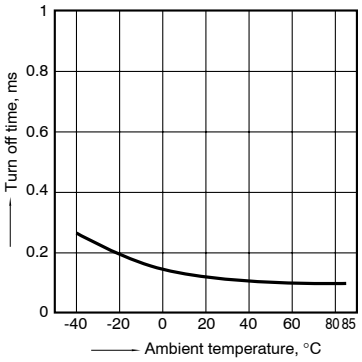


3. Turn on time vs. ambient temperature characteristics

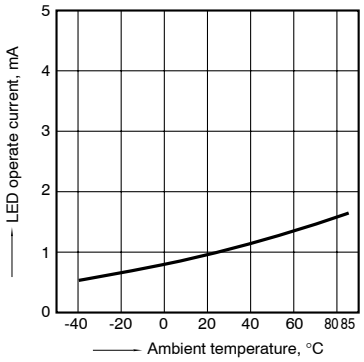
LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



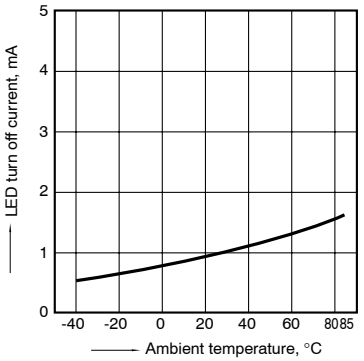
4. Turn off time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



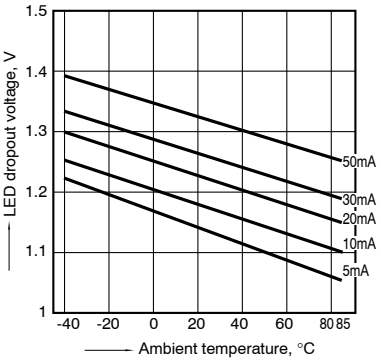
5. LED operate current vs. ambient temperature characteristics
Load voltage: 10 V (DC);
Continuous load current: 100mA (DC)



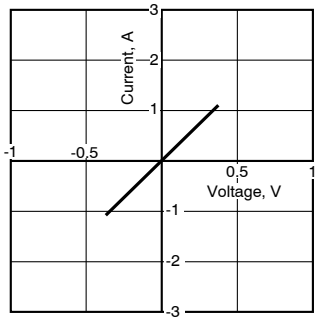
6. LED turn off current vs. ambient temperature characteristics
Load voltage: 10 V (DC);
Continuous load current: 100mA (DC)



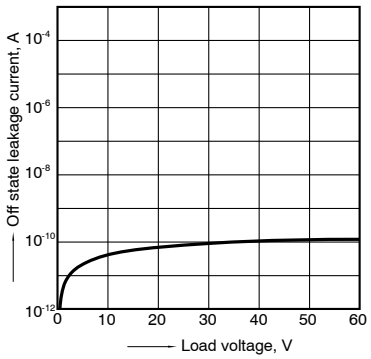
7. LED dropout voltage vs. ambient temperature characteristics
LED current: 5 to 50 mA



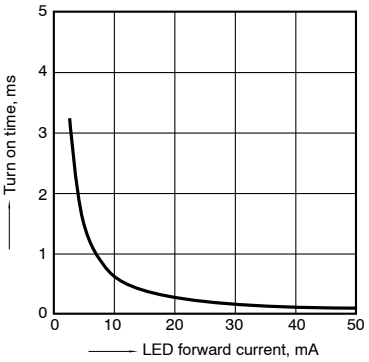
8. Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



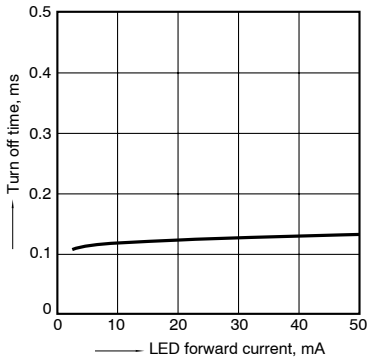
9. Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



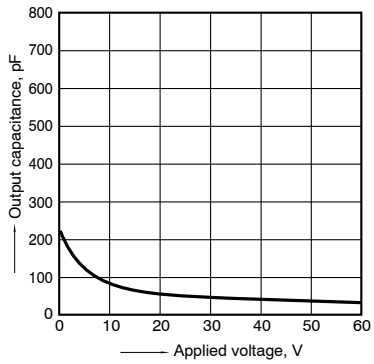
10. Turn on time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



11. Turn off time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 3 and 4;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F

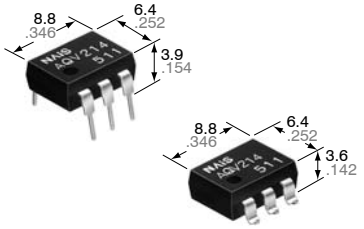


(Standard type) (Reinforced type)

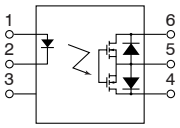
Panasonic
ideas for life

Controls low-level input signals. Controls load voltage 60V to 600V.

GU PhotoMOS (AQV21❍, AQV214H)



mm inch



FEATURES

1. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

2. Control with low-level input signals

3. Controls various types of loads such as relays, motors, lamps and solenoids.

4. Optical coupling for extremely high isolation
Unlike mechanical relays, the PhotoMOS relay combines LED and optoelectronic device to transfer signals using light for extremely high isolation.

5. Eliminates the need for a counter electromotive force protection diode in the drive circuits on the input side

6. Stable on resistance

7. Low-level off state leakage current

8. Eliminates the need for a power supply to drive the power MOSFET
A power supply used to drive the power MOSFET is unnecessary because of the built-in optoelectronic device. This results in easy circuit design and small PC board area.

9. Low thermal electromotive force (Approx. 1 μV)

TYPICAL APPLICATIONS

- High-speed inspection machines
- Telephone equipment
- Data communication equipment
- Computer

TYPES

Type	I/O isolation	Output rating*		Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
		Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC	Standard 1,500 V AC	60V	550 mA	AQV212	AQV212A	AQV212AX	AQV212AZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.
		100 V	320 mA	AQV215	AQV215A	AQV215AX	AQV215AZ		
		200 V	180 mA	AQV217	AQV217A	AQV217AX	AQV217AZ		
		350 V	130 mA	AQV210	AQV210A	AQV210AX	AQV210AZ		
		400 V	120 mA	AQV214	AQV214A	AQV214AX	AQV214AZ		
		600 V	50 mA	AQV216	AQV216A	AQV216AX	AQV216AZ		
	Reinforced 5,000 V	400 V	120 mA	AQV214H	AQV214HA	AQV214HAX	AQV214HAZ		

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

	Item		Sym-bol	Type of connec-tion	AQV212(A)	AQV215(A)	AQV217(A)	AQV210(A)	AQV214(A)	AQV216(A)	AQV214H(A)	Remarks
Input	LED forward current		I_F		50 mA							
	LED reverse voltage		V_R		5 V							
	Peak forward current		I_{FP}		1 A							f = 100 Hz, Duty factor = 0.1%
	Power dissipation		P_{in}		75 mW							
Output	Load voltage (peak AC)		V_L		60 V	100 V	200 V	350 V	400 V	600 V	400 V	
	Continuous load current		I_L	A	0.55 A	0.32 A	0.18 A	0.13 A	0.12 A	0.05 A	0.12 A	A connection: Peak AC, DC; B, C connection: DC
				B	0.65 A	0.42 A	0.22 A	0.15 A	0.13 A	0.06 A	0.13 A	
				C	0.80 A	0.60 A	0.30 A	0.17 A	0.15 A	0.08 A	0.15 A	
	Peak load current		I_{peak}		1.2 A	0.96 A	0.54 A	0.4 A	0.3 A	0.15 A	0.3 A	A connection: 100 ms (1 shot), V_L=DC
	Power dissipation		P_{out}		500 mW							
Total power dissipation			P_T		550 mW							
I/O isolation voltage			V_{iso}		1,500 V AC						5,000 V AC	
Temperature limits		Operating	T_{opr}		–40°C to +85°C –40°F to +185°F							Non-condensing at low temp.
		Storage	T_{stg}		–40°C to +100°C –40°F to +212°F							

07/2005

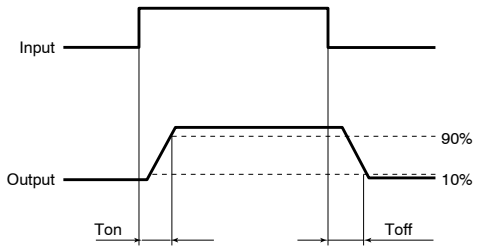
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

	Item			Symbol	Type of connection**	AQV212(A)	AQV215(A)	AQV217(A)	AQV210(A)	AQV214(A)	AQV216(A)	AQV214H(A)	Condition
Input	LED operate current		Typical	I_{Fon}	—	1 mA	1 mA	1 mA	1 mA	1 mA	1 mA	1.3 mA	I_L = Max.
			Maximum			3 mA	3 mA	3 mA	3 mA	3 mA	3 mA	3 mA	
	LED turn off current		Minimum	I_{Foff}	—	0.4 mA	0.4 mA	0.4 mA	0.4 mA	0.4 mA	0.4 mA	1.2 mA	I_L = Max.
			Typical			0.79 mA	0.79 mA	0.79 mA	0.79 mA	0.79 mA	0.79 mA	0.79 mA	
	LED dropout voltage		Typical	V_F	—	1.25 V (1.14 V at I_F = 5 mA)							I_F = 50 mA
			Maximum			1.5 V							
Output	On resistance		Typical	R_{on}	A	0.83 Ω	2.3 Ω	11.0 Ω	23 Ω	30 Ω	70 Ω	30 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum			2.5 Ω	4.0 Ω	15.0 Ω	35 Ω	50 Ω	120 Ω	50 Ω	
			Typical	R_{on}	B	0.44 Ω	1.15 Ω	5.5 Ω	11.5 Ω	22.5 Ω	55 Ω	22.5 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum			1.25 Ω	2.0 Ω	7.5 Ω	17.5 Ω	25 Ω	100 Ω	25 Ω	
			Typical	R_{on}	C	0.25 Ω	0.6 Ω	2.8 Ω	6.0 Ω	11.3 Ω	28 Ω	11.3 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum			0.63 Ω	1.0 Ω	3.8 Ω	8.8 Ω	12.5 Ω	50 Ω	12.5 Ω	
	Output capacitance		Typical	C_{out}	A	150 pF	110 pF	70 pF	45 pF	45 pF	45 pF	45 pF	I_F = 0 mA V_B = 0 V f = 1 MHz
	Off state leakage current		Maximum	—	—	1 μA							I_F = 0 mA V_L = Max.
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	—	0.65 ms	0.6 ms	0.25 ms	0.25 ms	0.21 ms	0.28 ms	0.6 ms	I_F= 5 mA** I_L=Max.
			Maximum			2 ms	2 ms	1.0 ms	0.5 ms	0.5 ms	0.5 ms	0.8 ms	
		Turn off time*	Typical	T_{off}	—	0.08 ms	0.06 ms	0.05 ms	0.05 ms	0.05 ms	0.04 ms	0.05 ms	I_F = 5 mA I_L = Max.
			Maximum			0.2 ms	0.2 ms	0.2 ms	0.2 ms	0.2 ms	0.2 ms	0.2 ms	
	I/O capacitance		Typical	C_{iso}	—	0.8 pF							f = 1 MHz V_B = 0 V
			Maximum			1.5 pF							
	Initial I/O isolation resistance		Minimum	R_{iso}	—	1,000 MΩ							500 V DC

Note: Recommendable LED forward current
Standard type: 5 mA
Reinforced type: 5 to 10 mA

For type of connection, see page 56.

*Turn on/Turn off time



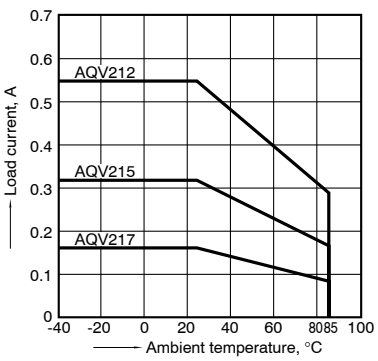
■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63**

REFERENCE DATA

1-(1). Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

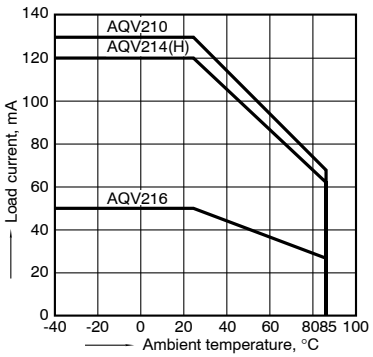
Type of connection: A



1-(2). Load current vs. ambient temperature characteristics

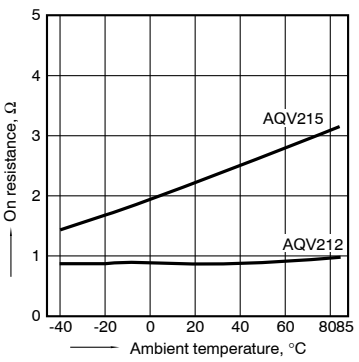
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

Type of connection: A



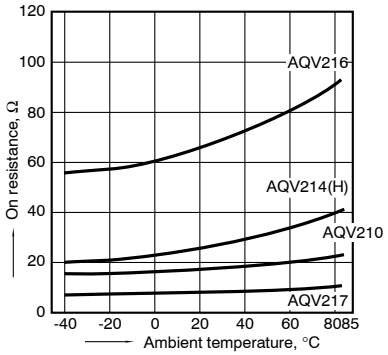
2-(1). On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max. (DC)



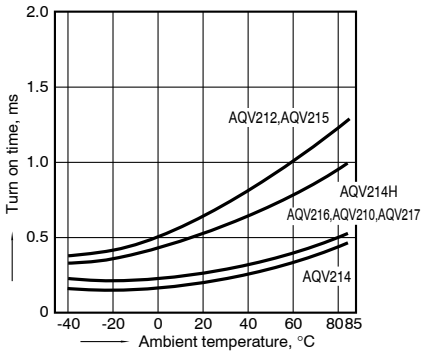
2-(2). On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max. (DC)



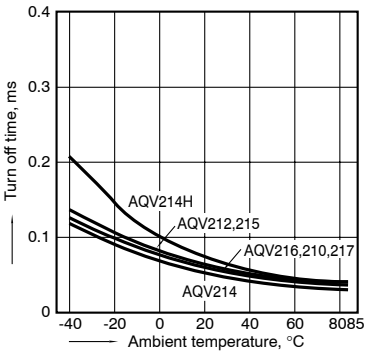
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



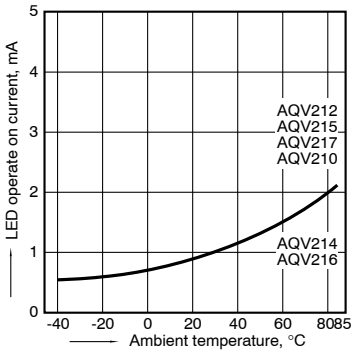
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



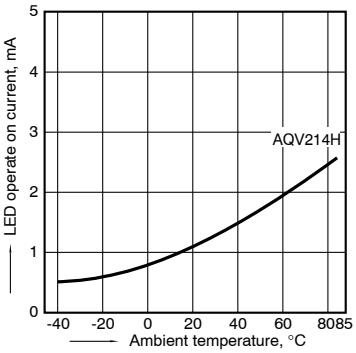
5-(1). LED operate current vs.ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



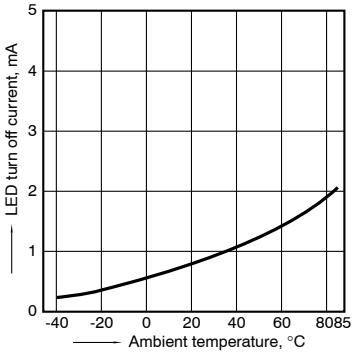
5-(2). LED operate current vs.ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



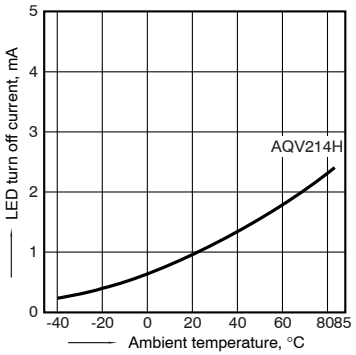
6-(1). LED turn off current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



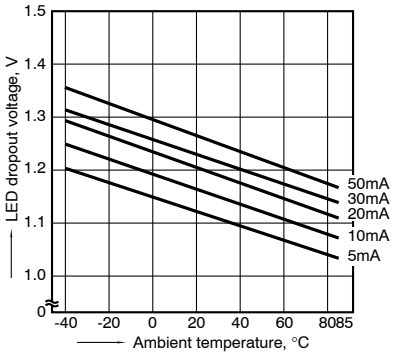
6-(2). LED turn off current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



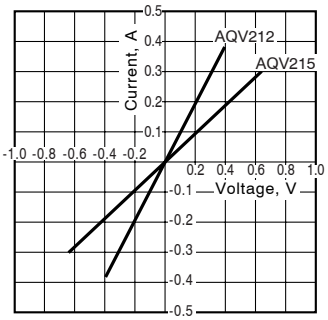
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types
LED current: 5 to 50 mA



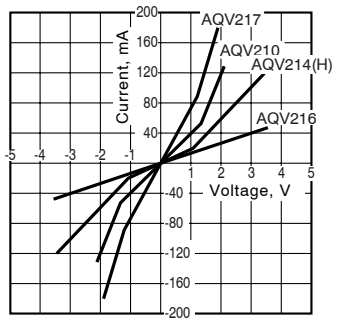
8-(1). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



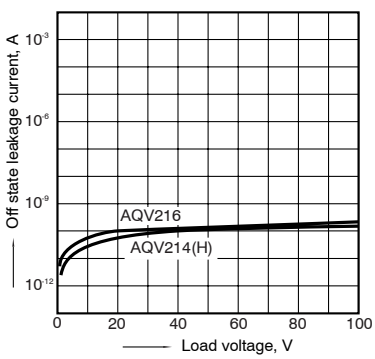
8-(2). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



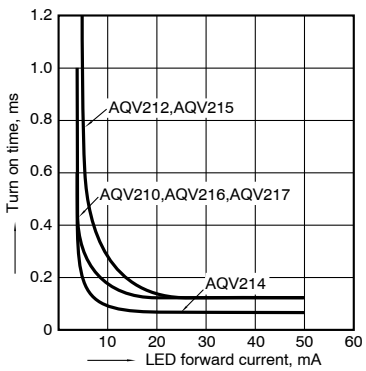
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



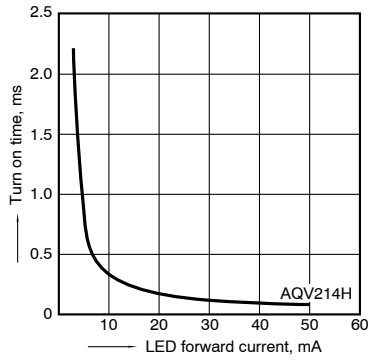
10-(1). Turn on time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



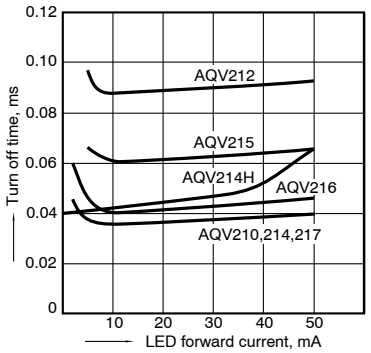
10-(2). Turn on time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 400 V (DC); Continuous load current: 120 mA (DC); Ambient temperature: 25°C 77°F



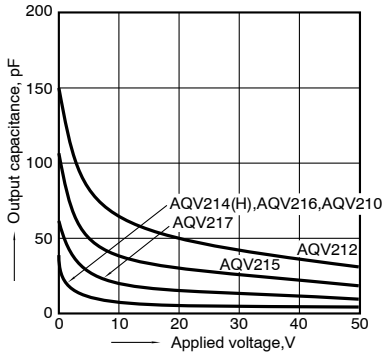
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

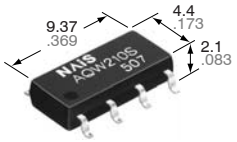
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



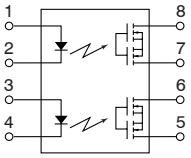
Panasonic
ideas for life

Super miniature design, SOP (2 Form A) 8-pin type. Controls load voltage 350V, 400V.

GU PhotoMOS (AQW21❍S)

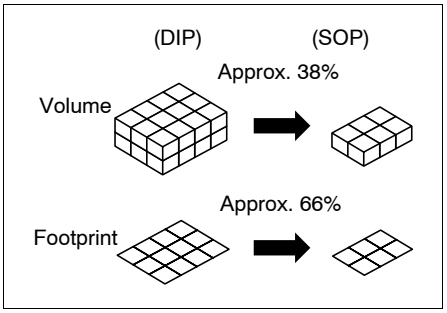


mm inch



FEATURES

1. 2 channels in super miniature design
The device comes in a super-miniature SO package measuring (W) 4.4 × (L) 9.37 × (H) 2.1 mm (W) .173× (L) .369× (H) .083 inch —approx. 38% of the volume and 66% of the footprint size of DIP type PhotoMOS Relays.



2. Tape and reel
The device comes standard in a tape and reel (1,000 pcs./reel) to facilitate automatic insertion machines.

3. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

4. Low-level off state leakage current
In contrast to the SSR with an off state leakage current of several milliamperes, the PhotoMOS relay features a very small off state leakage current of typ. 100 pA even with the rated load voltage of 400 V (AQW214S)

TYPICAL APPLICATIONS

- Telephones
- Measuring instruments
- Computer
- Industrial robots
- High-speed inspection machines.

TYPES

Type	Output rating*		Part No.		Packing quantity in tape and reel
	Load voltage	Load current	Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side	
AC/DC	350 V	100 mA	AQW210SX	AQW210SZ	1,000 pcs.
	400 V	80 mA	AQW214SX	AQW214SZ	

*Indicate the peak AC and DC values.

Notes: (1) Tape package is the standard packing style. Also available in tube. (Part No. suffix “X” or “Z” is not needed when ordering; Tube: 50 pcs.; Case: 1,000 pcs.)
(2) For space reasons, the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQW210S	AQW214S	Remarks
Input	LED forward current	I_F	50 mA		
	LED reverse voltage	V_R	5 V		
	Peak forward current	I_{FP}	1 A		f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW		
Output	Load voltage (peak AC)	V_L	350 V	400 V	
	Continuous load current	I_L	0.1 A (0.13 A)	0.08 A (0.1 A)	( ): in case of using only 1 channel Peak AC, DC
	Peak load current	I_{peak}	0.3 A	0.24 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	600 mW		
Total power dissipation		P_T	650 mW		
I/O isolation voltage		V_{iso}	1,500 V AC		
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F		

07/2005

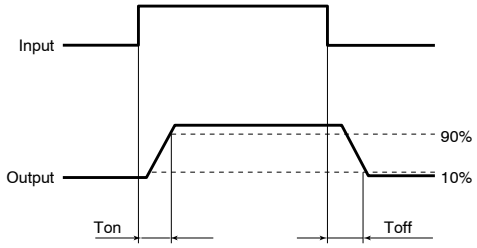
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW210S	AQW214S	Remarks
Input	LED operate current	Typical	I_{Fon}	0.9 mA		I_L = Max.
		Maximum		3 mA		
	LED turn off current	Minimum	I_{Foff}	0.4 mA		I_L = Max.
		Typical		0.8 mA		
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)		I_F = 50 mA
		Maximum		1.5 V		
Output	On resistance	Typical	R_{on}	16 Ω	30 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		35 Ω	50 Ω	
	Off state leakage current	Maximum	I_{leak}	1 μA		I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	0.23 ms	0.21 ms	I_F = 5 mA I_L = Max.
		Maximum		0.5 ms		
	Turn off time*	Typical	T_{off}	0.04 ms		I_F = 5 mA I_L = Max.
		Maximum		0.2 ms		
	I/O capacitance	Typical	C_{iso}	0.8 pF		f = 1 MHz V_B = 0 V
		Maximum		1.5 pF		
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ		500 V DC

Note: Recommendable LED forward current I_F = 5 mA.

For type of connection, see page 57.

*Turn on/ Turn off time

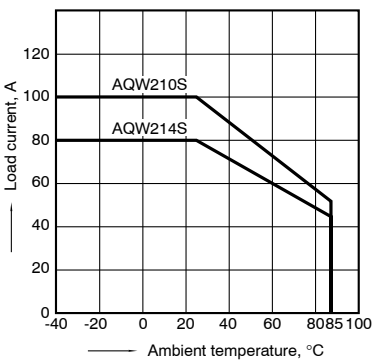


■ **For Dimensions, see page 53.**
■ **For Schematic and Wiring Diagrams, see page 57.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

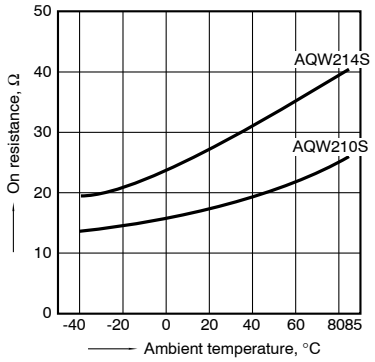
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



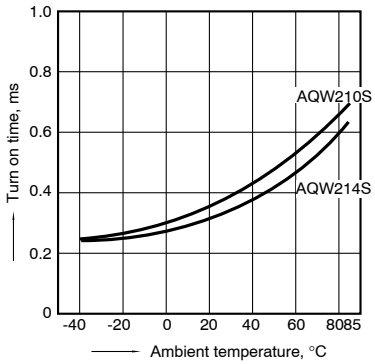
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



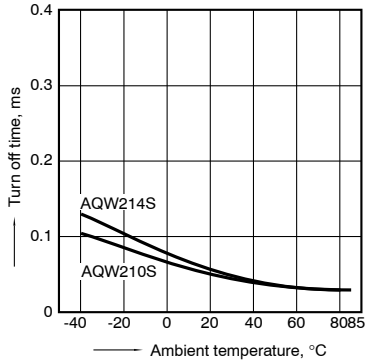
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



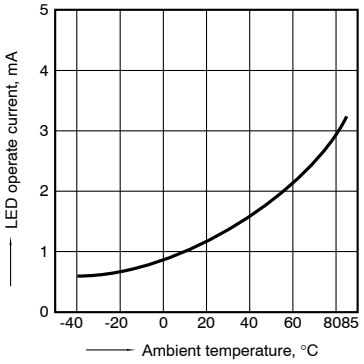
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



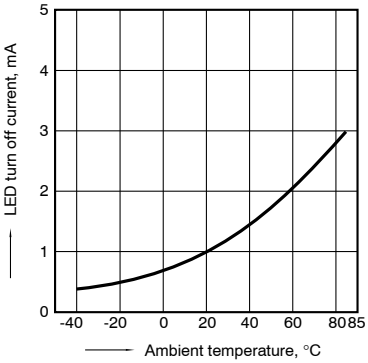
5. LED operate current vs. ambient temperature characteristics

Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



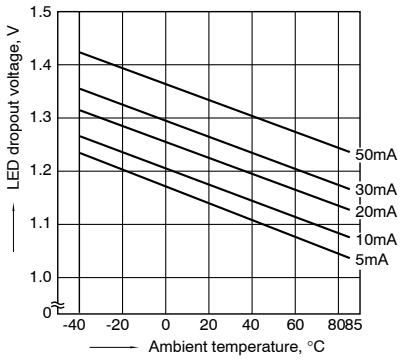
6. LED turn off current vs. ambient temperature characteristics

Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



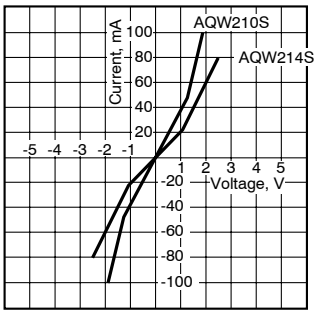
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types;
LED current: 5 to 50 mA



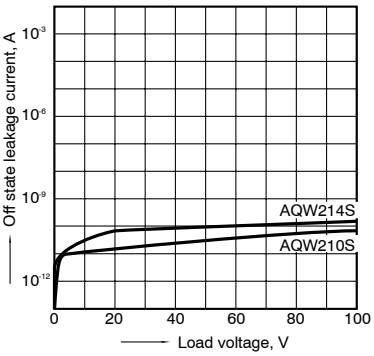
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



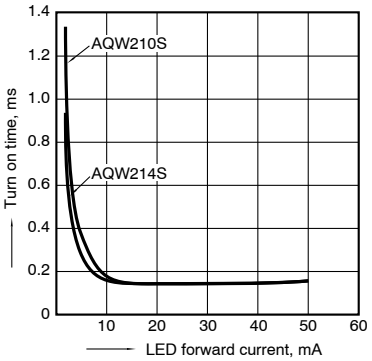
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



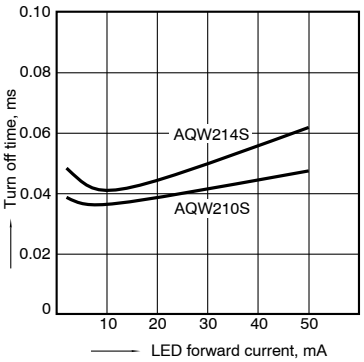
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



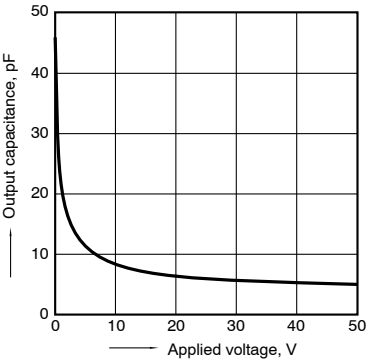
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

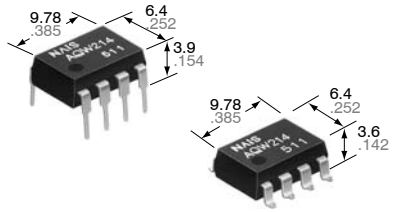
Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



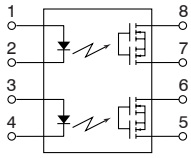
Panasonic
ideas for life

**Compact DIP (2 Form A)
8-pin type.
Controls load voltage
60V to 600V.**

GU PhotoMOS (AQW21❍)



mm inch



FEATURES

1. Compact 8-pin DIP size
The device comes in a compact (W) 6.4 × (L) 9.78 ×(H) 3.9 mm (W) .252×(L) .385×(H) .154 inch, 8-pin DIP size (through hole terminal type).
2. Applicable for 2 Form A use as well as two independent 1 Form A use
3. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.
4. High sensitivity, high speed response
Can control a maximum 0.13 A load current with a 5 mA input current. Fast operation speed of 310 μs (typical). (AQW214)
5. Low-level off state leakage current
The SSR has an off state leakage current of several milliamperes whereas the PhotoMOS relays has typ. 100 pA even with the rated load voltage of 400 V (AQW214).
6. Low-level thermal electromotive force (Approx. 1 μV)
7. Eliminates the need for a counter electromotive force protection diode in the drive circuits on the input side
8. Stable ON resistance.
9. Eliminates the need for a power supply to drive the power MOSFET

TYPICAL APPLICATIONS

- High-speed inspection machines
- Telephones equipment
- Computer

TYPES

1. AC/DC type

Output rating*		Part No.				Packing quantity	
		Through hole terminal	Surface-mount terminal				
Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
60V	500 mA	AQW212	AQW212A	AQW212AX	AQW212AZ	1 tube contains 40 pcs. 1 batch contains 400 pcs.	1,000 pcs.
100 V	300 mA	AQW215	AQW215A	AQW215AX	AQW215AZ		
200 V	160 mA	AQW217	AQW217A	AQW217AX	AQW217AZ		
350 V	120 mA	AQW210	AQW210A	AQW210AX	AQW210AZ		
400 V	100 mA	AQW214	AQW214A	AQW214AX	AQW214AZ		
600 V	40 mA	AQW216	AQW216A	AQW216AX	AQW216AZ		

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. AC/DC type
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

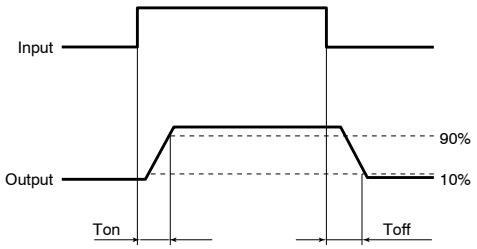
Item		Symbol	AQW212(A)	AQW215(A)	AQW217(A)	AQW210(A)	AQW214(A)	AQW216(A)	Remarks
Input	LED forward current	I_F	50 mA						
	LED reverse voltage	V_R	5 V						
	Peak forward current	I_{FP}	1 A						f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW						
Output	Load voltage (peak AC)	V_L	60 V	100 V	200 V	350 V	400 V	600 V	
	Continuous load current	I_L	0.50 A (0.60A)	0.30 A (0.35 A)	0.16 A (0.2 A)	0.12 A (0.14 A)	0.10 A (0.13 A)	0.04 A (0.05 A)	( ): in case of using only 1 channel A connection: Peak AC, DC
	Peak load current	I_{peak}	1.0 A	0.9 A	0.48 A	0.36 A	0.3 A	0.12 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	800 mW						
Total power dissipation		P_T	850 mW						
I/O isolation voltage		V_{iso}	1,500 V AC						Between input and output/ between contact sets
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F						Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F						

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW212(A)	AQW215(A)	AQW217(A)	AQW210(A)	AQW214(A)	AQW216(A)	Condition
Input	LED operate current	Typical	I_{Fon}	0.9 mA						I_L = Max.
		Maximum		3 mA						
	LED turn off current	Minimum	I_{Foff}	0.4 mA						I_L = Max.
		Typical		0.8 mA						
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)						I_F = 50 mA
		Maximum		1.5 V						
Output	On resistance	Typical	R_{on}	0.83 Ω	2.3 Ω	11 Ω	23 Ω	30 Ω	70 Ω	I_F = 5 mA I_L = Max. Within 1 son time
		Maximum		2.5 Ω	4.0 Ω	15 Ω	35 Ω	50 Ω	120 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA						I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	0.65 ms	0.60 ms	0.25 ms	0.25 ms	0.31 ms	0.28 ms	I_F = 5 mA I_L = Max.
		Maximum		2 ms	2 ms	1.0 ms	0.5 ms	0.5 ms	0.5 ms	
	Turn off time*	Typical	T_{off}	0.08 ms	0.06 ms	0.05 ms	0.05 ms	0.05 ms	0.04 ms	I_F = 5 mA I_L = Max.
		Maximum		0.2 ms						
	I/O capacitance	Typical	C_{iso}	0.8 pF						f = 1 MHz V_B = 0 V
		Maximum		1.5 pF						
	Initial I/C isolation resistance	Minimum	R_{iso}	1,000 MΩ						500 V DC

Note: Recommendable LED forward current I_F = 5mA. For type of connection, see page 57.

*Turn on/Turn off time

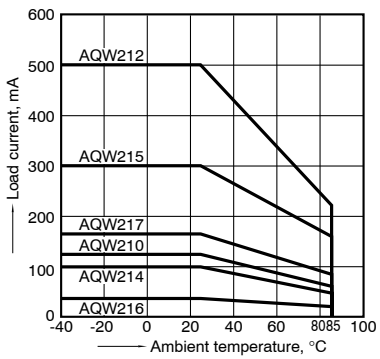


■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 57.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

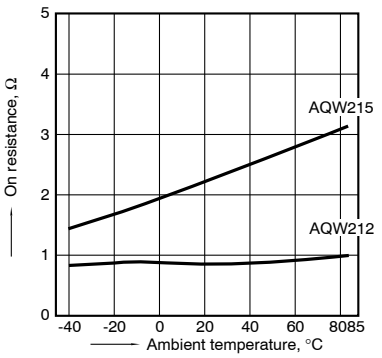
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



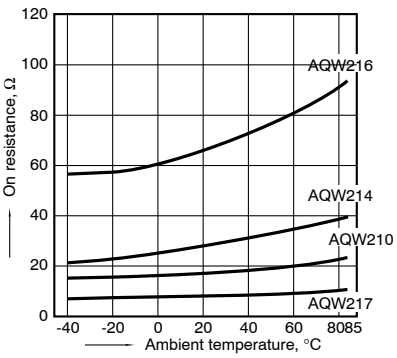
2.-(1) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



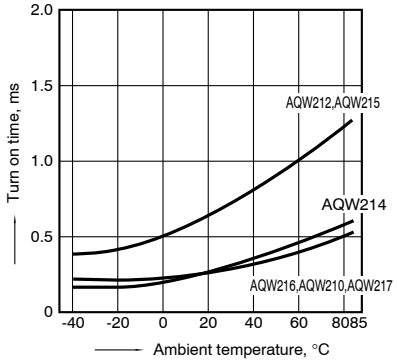
2.-(2) On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



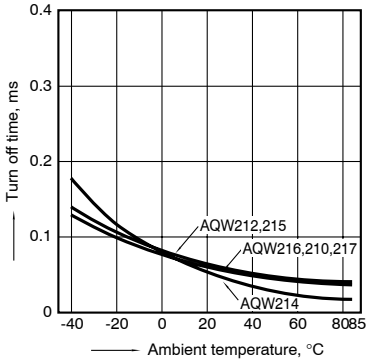
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



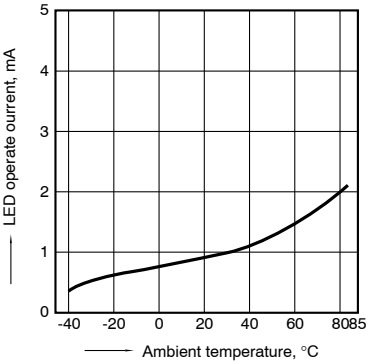
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



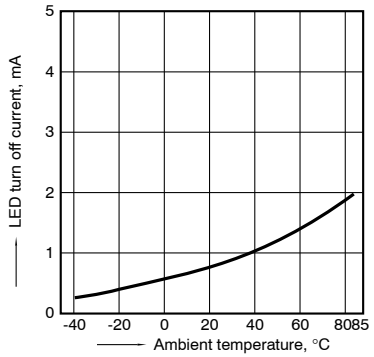
5. LED operate current vs. ambient temperature characteristics

Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



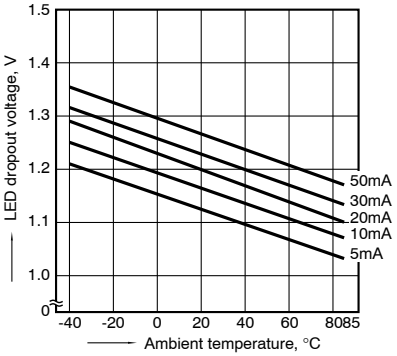
6. LED turn off current vs. ambient temperature characteristics

Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



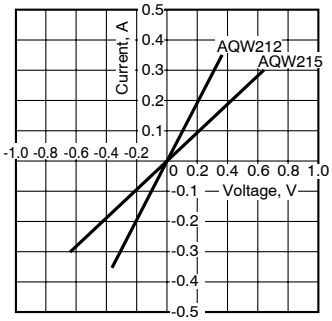
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types;
LED current: 5 to 50 mA



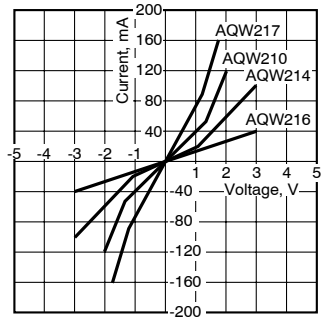
8.-(1) Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



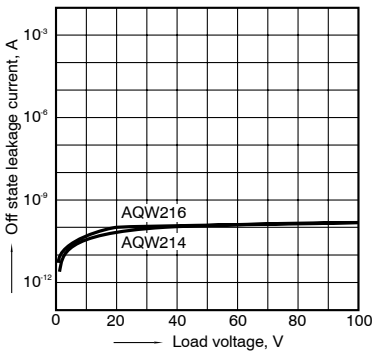
8.-(2) Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



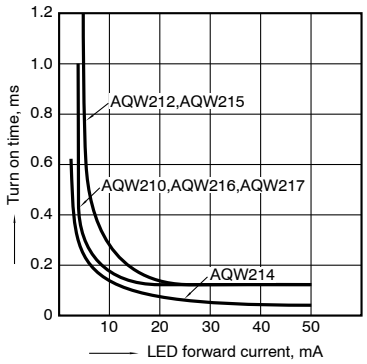
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



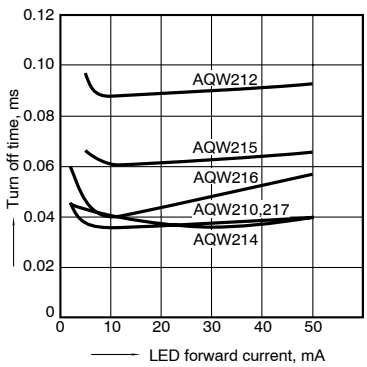
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



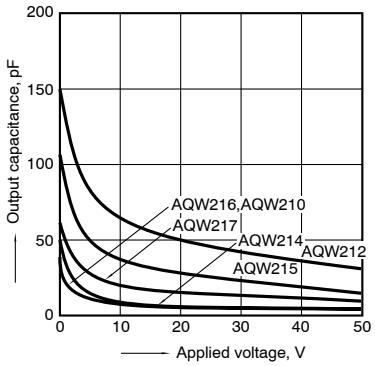
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

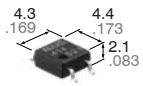
Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



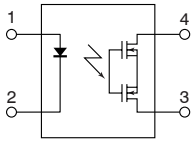
Panasonic
ideas for life

Super miniature design, SOP (1 Form B) 4-pin type. Controls load voltage 60V, 350V, 400V.

GU PhotoMOS (AQY41❍S)



mm inch



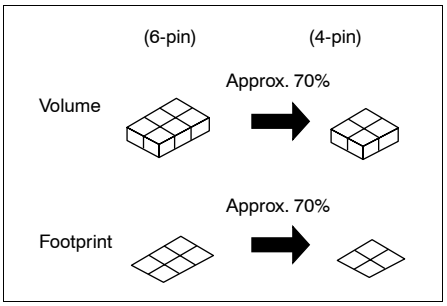
FEATURES

1. 60V type couples high capacity (0.5A) with low on-resistance (1Ω).

Item	GU SOP type	
Part No.	AQY410S	AQY412S NEW
Load voltage	350V	60V
Continuous load current	0.12A	0.5A
ON resistance (typ.)	18Ω	1Ω

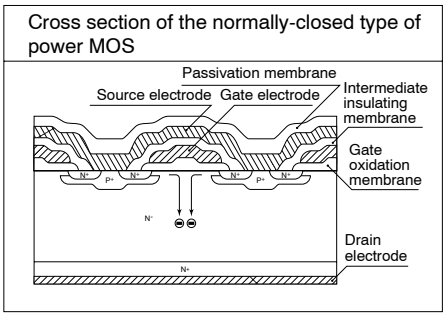
2. SO package 4-pin type in super miniature design

The device comes in a super-miniature SO package 4-pin type measuring (W) 4.3×(L) 4.4×(H) 2.1 mm (W) .169×(L) .173×(H) .083 inch —approx. 70% of the volume and 70% of the footprint size of SO package 6-pin type PhotoMOS relays.



2. Normally closed type (1 Form B) is low on-resistance.
(All AQ❍4 PhotoMOS are Form B types. And also the Form A types have a low on-resistance.)

This has been realized thanks to the built-in MOSFET processed by our proprietary method, DSD (Double-diffused and Selective Doping) method.



3. Tape and reel

The device comes standard in a tape and reel (1,000 pcs./reel) to facilitate automatic insertion machines.

4. Controls low-level analog signals

PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

5. Low-level off-state leakage current

In contrast to the SSR with an off-state leakage current of several milliamperes, the PhotoMOS relay features a very small off state leakage current of 1nA even with the rated load voltage of 400 V (AQY414S).

TYPICAL APPLICATIONS

- Power supply
- Measuring equipment
- Security equipment
- Telephone equipment
- Sensors

TYPES

AC/DC type

Output rating*		Part No.		Packing quantity in tape and reel
Load voltage	Load current	Picked from the 1/2-pin side	Picked from the 3/4-pin side	
60 V	500 mA	AQY412SX	AQY412SZ	1,000 pcs.
350 V	120 mA	AQY410SX	AQY410SZ	
400 V	100 mA	AQY414SX	AQY414SZ	

* Indicate the peak AC and DC values.

Notes: (1) Tape package is the standard packing style. Also available in tube. (Part No. suffix “X” or “Z” is not needed when ordering; Tube: 100 pcs.; Case: 2,000 pcs.)

(2) For space reasons, the top two letters of the product number “AQY” and “S” are omitted on the product seal. The package type indicator “X” and “Z” are omitted from the seal. (Ex. the label for product number AQY414S is 414).

RATING

AC/DC type

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQY412S	AQY410S	AQY414S	Remarks
Input	LED forward current	I_F	50 mA			
	LED reverse voltage	V_R	5 V			
	Peak forward current	I_{FP}	1 A			f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW			
Output	Load voltage (peak AC)	V_L	60 V	350 V	400 V	
	Continuous load current (peak AC)	I_L	0.5 A	0.12 A	0.1 A	
	Peak load current	I_{peak}	1.5 A	0.3 A	0.24 A	100ms (1 shot), V_L = DC
	Power dissipation	P_{out}	300 mW			
Total power dissipation		P_T	350 mW			
I/O isolation voltage		V_{iso}	1,500 V AC			
Temperture limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F			Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F			

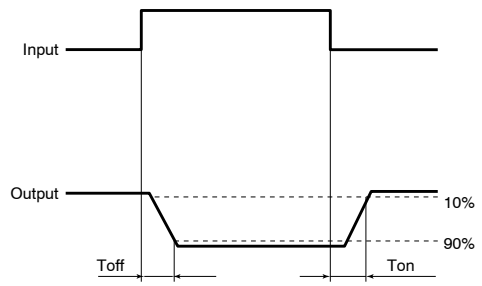
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY412S	AQY410S	AQY414S	Remarks
Input	LED operate (OFF) current	Typical	I_{Foff}	0.9 mA			I_L = Max.
		Maximum		3 mA			
	LED reverse (ON) current	Minimum	I_{Fon}	0.4 mA			I_L = Max.
		Typical		0.85 mA			
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)			I_F = 50 mA
		Maximum		1.5 V			
Output	On resistance	Typical	R_{on}	1 Ω	18 Ω	26 Ω	I_F = 0 mA I_L = Max. Within 1 s on time
		Maximum		2.5 Ω	25 Ω	35 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA			I_F = 5 mA V_L = Max.
Transfer characteristics	Operate (OFF) time*	Typical	T_{off}	0.9 ms	0.52 ms	0.47 ms	I_F = 0 mA › 5 mA I_L = Max.
		Maximum		3 ms	1 ms		
	Reverse (ON) time*	Typical	T_{on}	0.21 ms	0.23 ms	0.28 ms	I_F = 5 mA › 0 mA I_L = Max.
		Maximum		1 ms	1 ms		
	I/O capacitance	Typical	C_{iso}	0.8 pF			f = 1 MHz V_B = 0 V
		Maximum		1.5 pF			
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ			500 V DC

Note: Recommendable LED forward current I_F = 5mA.

For type of connection, see page 57.

*Operate/Reverse time

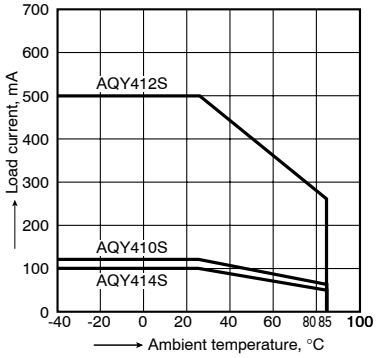


■ **For Dimensions, see page 53.**
■ **For Schematic and Wiring Diagrams, see page 57.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

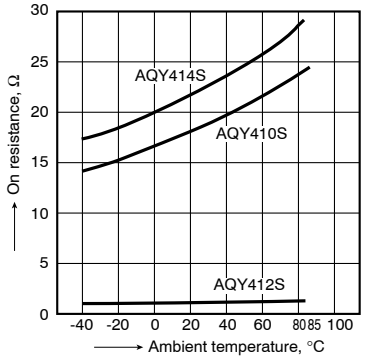
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature:
–40°C to +85°C
–40°F to +185°F



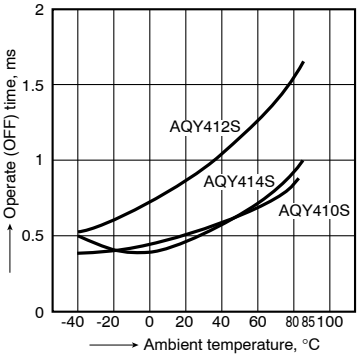
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 0 mA;
Continuous load current: Max.(DC)



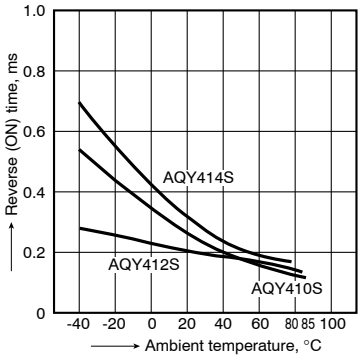
3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



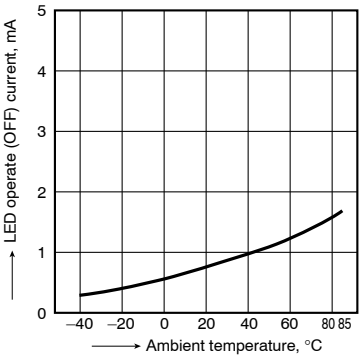
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



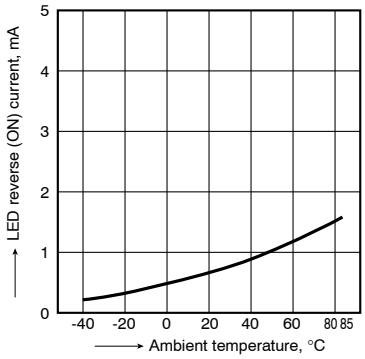
5. LED operate (OFF) current vs. ambient temperature characteristics

Sample: All types;
Load voltage: Max.(DC);
Continuous load current: Max.(DC)



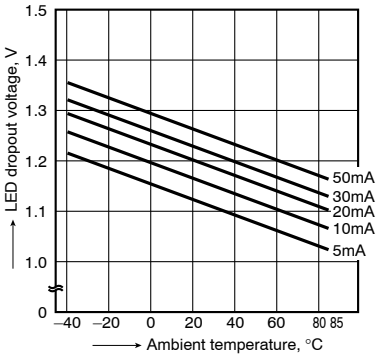
6. LED reverse (ON) current vs. ambient temperature characteristics

Sample: All types;
Load voltage: Max.(DC);
Continuous load current: Max.(DC)



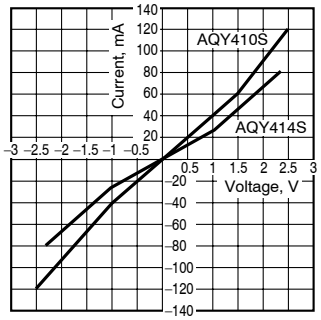
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types;
LED current: 5 to 50 mA



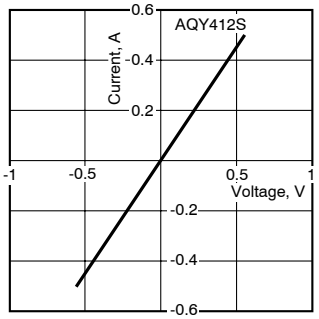
8-(1). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



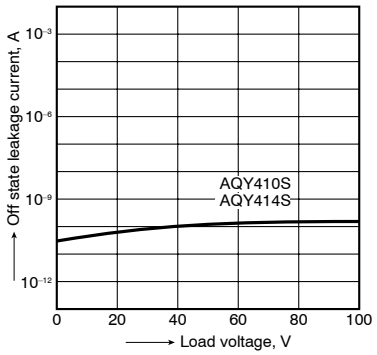
8-(2). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



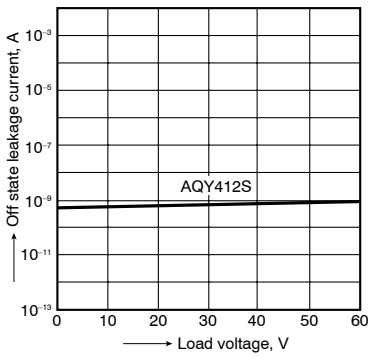
9-(1). Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Ambient temperature: 25°C 77°F



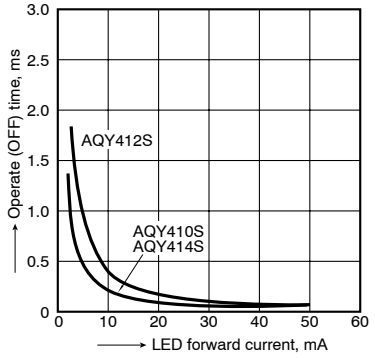
9-(2). Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Ambient temperature: 25°C 77°F



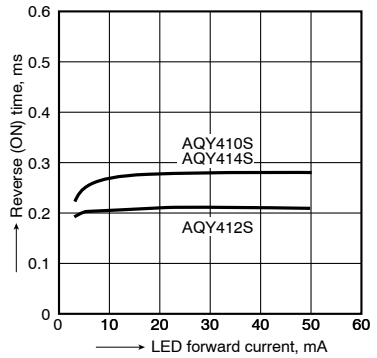
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max.(DC); Continuous load current: Max.(DC); Ambient temperature: 25°C 77°F



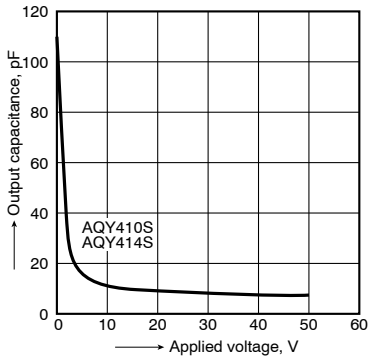
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max.(DC); Continuous load current: Max.(DC); Ambient temperature: 25°C 77°F



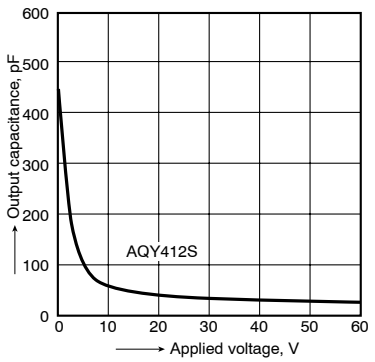
12-(1). Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



12-(2). Output capacitance vs. applied voltage characteristics

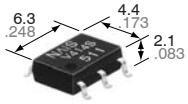
Measured portion: between terminals 3 and 4;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



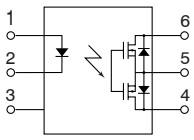
Panasonic
ideas for life

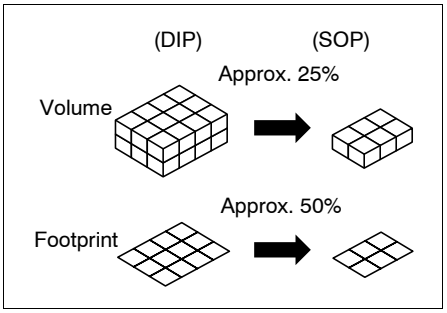
GU (General Use) Type
SOP Series
[1-Channel (Form B) Type]

GU PhotoMOS (AQV414S)



mm inch



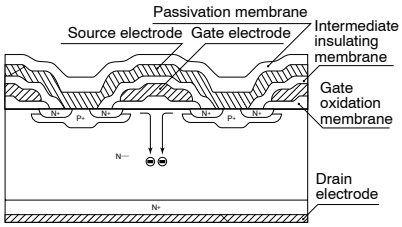


FEATURES

1. 1 channel (Form B) in super miniature design
The device comes in a super-miniature SO package measuring (W) 4.4 × (L) 6.3 ×(H) 2.1 mm (W) .173× (L) .248×(H) .083 inch —approx. 25% of the volume and 50% of the footprint size of DIP type PhotoMOS Relays.

2. Low on resistance (Max. 50 Ω) at 400 V for normally-closed type
has been achieved thanks to the built-in MOSFET processed by our proprietary method, DSD (Double-Diffused and Selective Doping) method.

Cross section of the normally-closed type of power MOS



3. Tape and reel
The device comes standard in a tape and reel (1,000 pcs./reel) to facilitate automatic insertion machines.

4. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

5. Low-level off state leakage current
In contrast to the SSR with an off state leakage current of several milliamperes, the PhotoMOS relay features a very small off state leakage current of typ. 100 pA even at the rated load voltage of 400 V.

6. Low thermal electromotive force (Approx. 1 μV)

TYPICAL APPLICATIONS

- Telephones
- Measuring instruments
- Computer
- Industrial robots
- High-speed inspection machines

TYPES

Type	Output ratings*		Part No.		Packing quantity in tape and reel
	Load voltage	Load current	Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side	
AC/DC	400 V	100 mA	AQV414SX	AQV414SZ	1,000 pcs.

*Indicate the peak AC and DC values.

Notes: (1) Tape package is the standard packing style. Also available in tube. (Part No. suffix “X” ro “Z” is not needed when ordering; Tube: 75 pcs.; Case: 1,500 pcs.)
(2) For space reasons, the top two letters of the product number "AQ" are ommitted on the product seal. The package type indicator “X” and “Z” are also omitted from the seal. (Ex. the label for product number AQV414S is V414S).

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

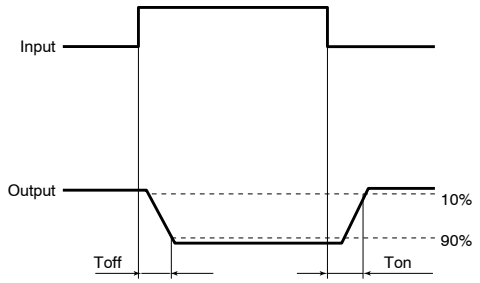
Item		Symbol	Type of connection	AQV414S	Remarks
Input	LED forward current	I_F		50 mA	
	LED reverse voltage	V_R		5 V	
	Peak forward current	I_{FP}		1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW	
Output	Load voltage (peak AC)	V_L		400 V	
	Continuous load current	I_L	A	0.10 A	A connection: Peak AC, DC B,C connection: DC
			B	0.11 A	
			C	0.12 A	
	Peak load current	I_{peak}		0.3 A	A connection: 100 ms (1 shot) V_L= DC
	Power dissipation	P_{out}		450 mW	
Total power dissipation		P_T		500 mW	
I/O isolation voltage		V_{iso}		1,500 V AC	
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	Type of connection	AQV414S	Remarks
Input	LED operate (OFF) current	Typical	I_{Foff}	—	0.6 mA	I_L= Max.
		Maximum			3 mA	
	LED reverse (ON) current	Minimum	I_{Fon}	—	0.4 mA	I_L= Max.
		Typical			0.55 mA	
	LED dropout voltage	Typical	V_F	—	1.25 V (1.14 V at I_F = 5 mA)	I_F= 50 mA
		Maximum			1.5 V	
Output	On resistance	Typical	R_{on}	A	26 Ω	I_F= 0 mA I_L= Max. Within 1 s on time
		Maximum			50 Ω	
		Typical	R_{on}	B	20 Ω	I_F = 0 mA I_L = Max. Within 1 s on time
		Maximum			25 Ω	
		Typical	R_{on}	C	10 Ω	I_F = 0 mA I_L = Max. Within 1 s on time
		Maximum			12.5 Ω	
	Off state leakage current	Maximum	I_{Leak}	—	1 μA	I_F = 5 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	—	0.47 ms	I_F= 0 mA › 5 mA V_L = Max.
		Maximum			1.0 ms	
	Turn off time	Typical	T_{off}	—	0.28 ms	I_F= 5 mA › 0 mA V_L = Max.
		Maximum			1.0 ms	
	I/O capacitance	Typical	C_{iso}	—	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum			1.5 pF	
	Initial I/C isolation resistance	Minimum	R_{iso}	—	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F = 5mA. For type of connection, see page 57.

*Turn on/Turn off time

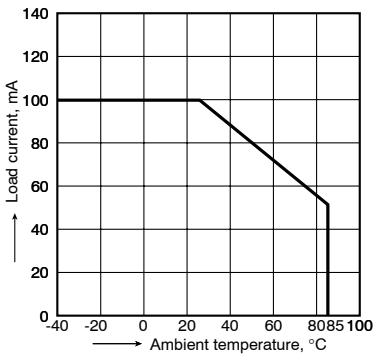


■ **For Dimensions, see page 53.**
■ **For Schematic and Wiring Diagrams, see page 57.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

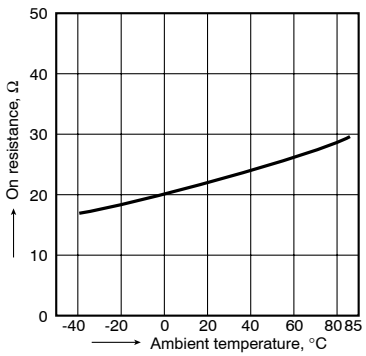
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F
Type of connection: A



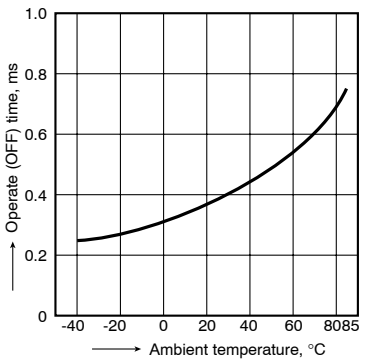
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 0 mA;
Continuous load current: 100 mA (DC)



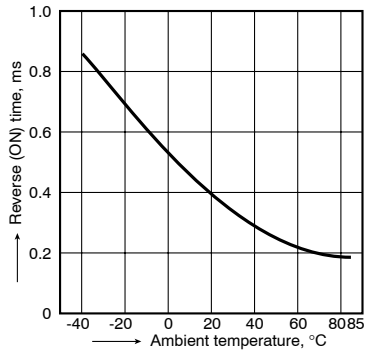
3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



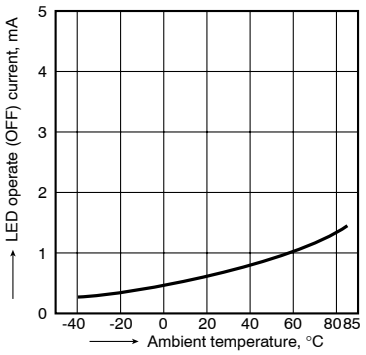
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 50 mA;
Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



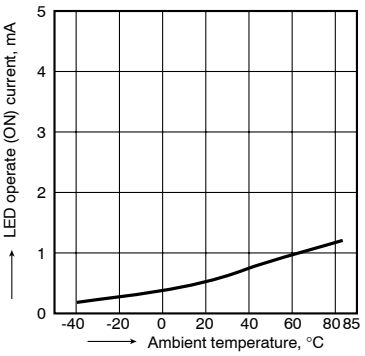
5. LED operate (OFF) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



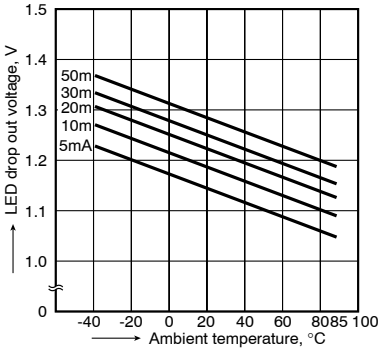
6. LED reverse (ON) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



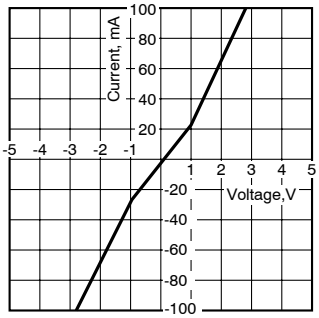
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



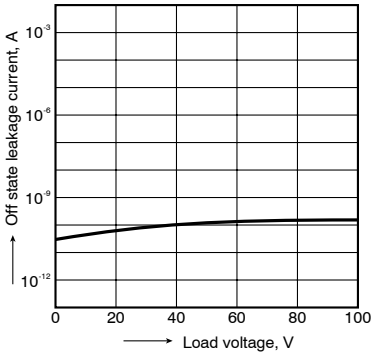
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



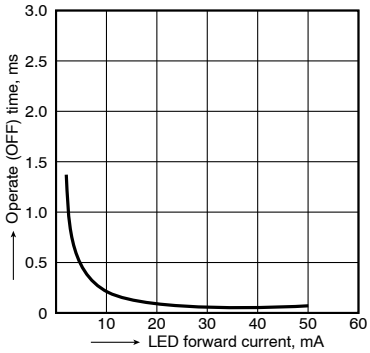
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA;
Ambient temperature: 25°C 77°F



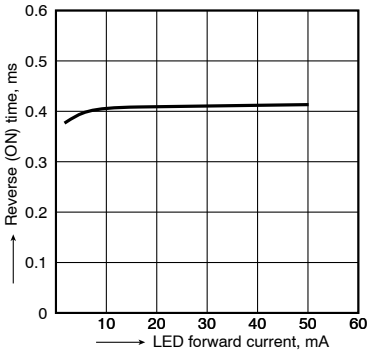
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 400 V (DC); Continuous load current: 100 mA (DC); Ambient temperature: 25°C 77°F



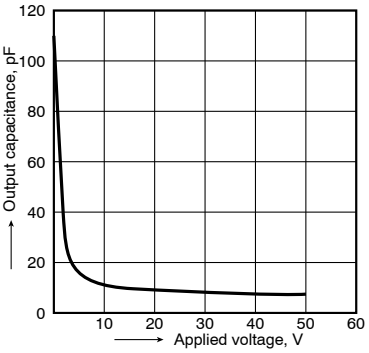
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 400 V (DC); Continuous load current: 100 mA (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

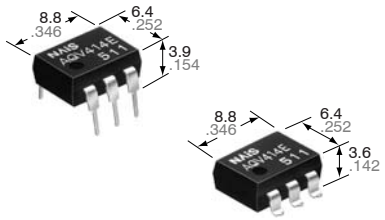
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



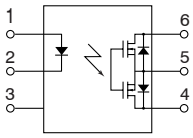
Panasonic
ideas for life

DIP (1 Form B) 6-pin type.
Controls load voltage 400V.

GU PhotoMOS (AQV414)



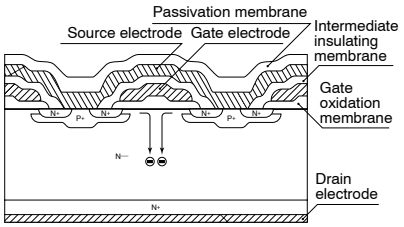
mm inch



FEATURES

1. Low on resistance for normally-closed type
This has been realized thanks to the built-in MOSFET processed by our proprietary method, DSD (Double-diffused and Selective Doping) method.

Cross section of the normally-closed type of power MOS



2. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

3. High sensitivity, low ON resistance
Can control a maximum 0.15 A load current with a 5 mA input current.

4. Low-level off state leakage current
The SSR has an off state leakage current of several milliamperes, whereas the PhotoMOS relay has typ. 100 pA even with the rated load voltage of 400 V.

TYPICAL APPLICATIONS

- Telepone equipment (Dial pulse)
- Measuring equipment

TYPES

Type	I/O isolation voltage	Output rating*		Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
		Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC type	1,500 V AC	400 V	120 mA	AQV414	AQV414A	AQV414AX	AQV414AZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV414(A)	Remarks
Input	LED forward current	I_F		50 mA	
	LED reverse voltage	V_R		5 V	
	Peak forwrd current	I_{FP}		1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW	
Output	Load voltage (peak AC)	V_L		400 V	
	Continuous load current	I_L	A	0.12 A	A connection: Peak AC, DC B,C connection: DC
			B	0.13 A	
			C	0.15 A	
	Peak load current	I_{peak}		0.3 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}		500 mW	
Total power dissipation		P_T		550 mW	
I/O isolation voltage		V_{iso}		1,500 V AC	
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F	

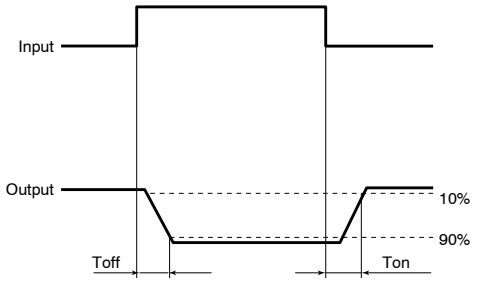
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	Type of connection	AQV414(A)	Condition
Input	LED operate (OFF) current		Typical	I_{Foff}	—	1.0 mA	I_L= 120 mA
			Maximum			3.0 mA	
	LED reverse (ON) current		Minimum	I_{Fon}	—	0.4 mA	I_L= 120 mA
			Typical			0.95 mA	
	LED dropout voltage		Typical	V_F	—	1.25 V (1.14 V at I_F= 5 mA)	I_F= 50 mA
			Maximum			1.5 V	
Output	On resistance		Typical	R_{on}	A	26 Ω	I_F = 0 mA I_L= Max. Within 1 s on time
			Maximum			50 Ω	
			Typical	R_{on}	B	20 Ω	I_F= 0 mA I_L= Max. Within 1 s on time
			Maximum			25 Ω	
			Typical	R_{on}	C	10 Ω	I_F= 0 mA I_L= Max. Within 1 s on time
			Maximum			12.5 Ω	
	Off state leakage current		Maximum	I_{Leak}	—	1 μA	I_F= 5 mA V_L = 400 V
Transfer characteristics	Switching speed	Operate (OFF) time*	Typical	T_{off}	—	0.47 ms	I_F = 0 mA › 5 mA I_L = 120 mA
			Maximum			1.0 ms	
		Reverse (ON) time*	Typical	T_{on}	—	0.28 ms	I_F= 5 mA › 0 mA I_L = 120 mA
			Maximum			1.0 ms	
	I/O capacitance		Typical	C_{iso}	—	0.8 pF	f = 1 MHz V_B = 0 V
			Maximum			1.5 pF	
	Initial I/O isolation resistance		Minimum	R_{iso}	—	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F= 5 mA.

For type of connection, see page 57.

*Operate/Reverse time



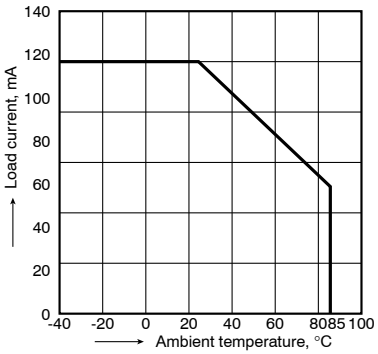
■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 57.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

1. Load current vs. ambient temperature characteristics

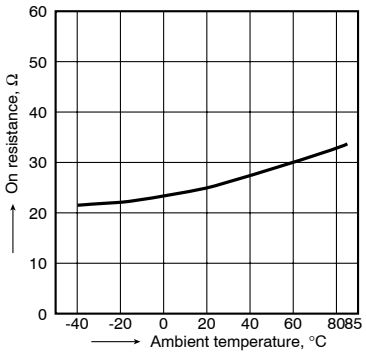
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

Type of connection: A



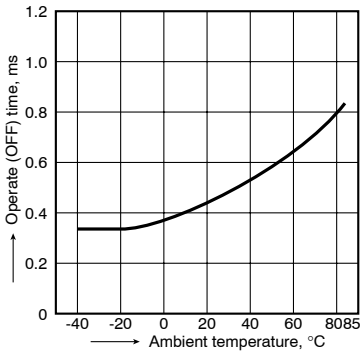
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 0 mA;
Continuous load current: 120 mA (DC)



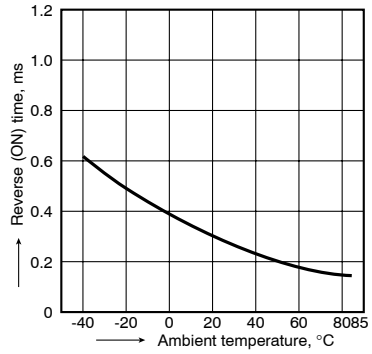
3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5mA;
Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



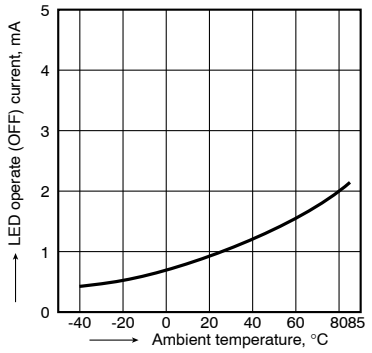
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



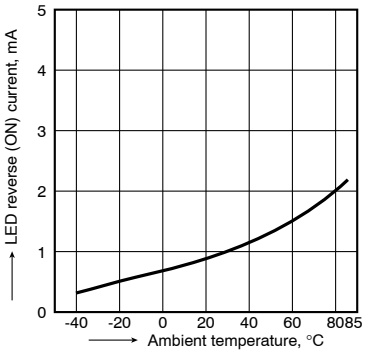
5. LED operate (OFF) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



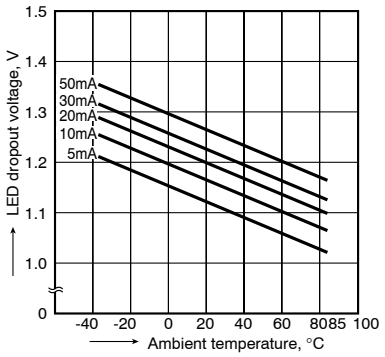
6. LED reverse (ON) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



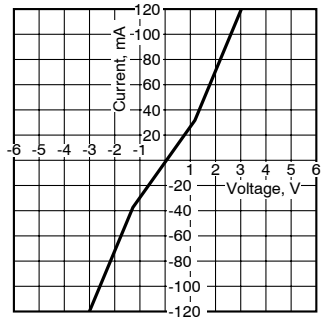
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



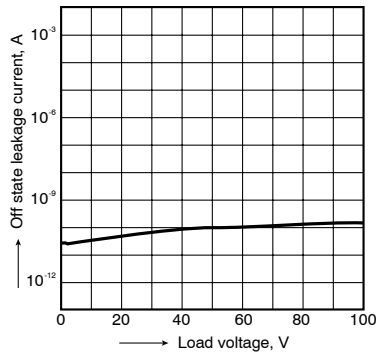
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



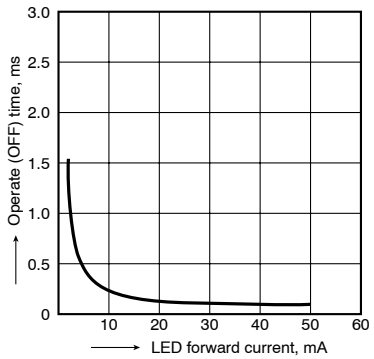
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Ambient temperature: 25°C 77°F



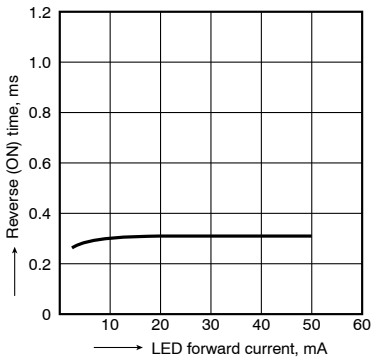
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC);
Ambient temperature: 25°C 77°F



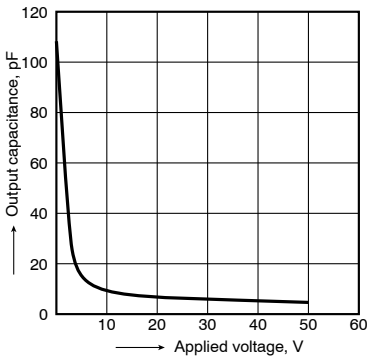
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC);
Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

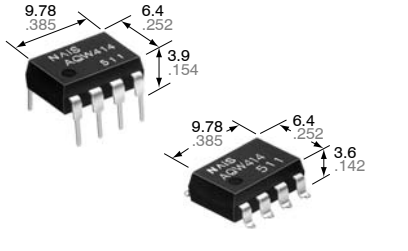
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



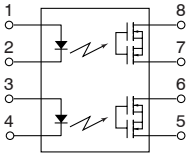
Panasonic
ideas for life

Compact DIP (2 Form B)
8-pin type.
Controls load voltage 400V.

GU PhotoMOS (AQW414)

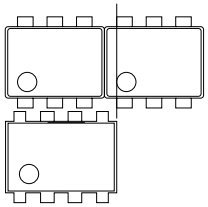


mm inch



FEATURES

1. Approx. 1/2 the space compared with the mounting of Two 1 Form B photo MOS units



Two 1 Form B units

2 Form B type

2. Applicable for 2 Form B use as well as two independent 1 Form B use

3. Low thermal electromotive force (Approx. 1 μV)

4. Eliminates the need for a counter electromotive force protection diode in the drive circuits on the input side

5. Controls load currents up to 0.13 A with an input current of 5 mA

6. High speed switching: operate time typical of 300 μs

7. Eliminates the need for a power supply to drive the power MOSFET

8. Extremely low closed-circuit offset voltages to enable control of small analog signals without distortion

9. Surface-mount model available

TYPICAL APPLICATIONS

- High-speed inspection machines
- Telephone equipment
- Computer

TYPES

Type	Output rating*		Part No.				Packing quantity	
	Load voltage	Load current	Through hole terminal	Surface-mount terminal				
			Tube packing style		Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC type	400 V	100 mA	AQW414	AQW414A	AQW414AX	AQW414AZ	1 tube contains 40 pcs. 1 batch contains 400 pcs.	1,000 pcs

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATINGS

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

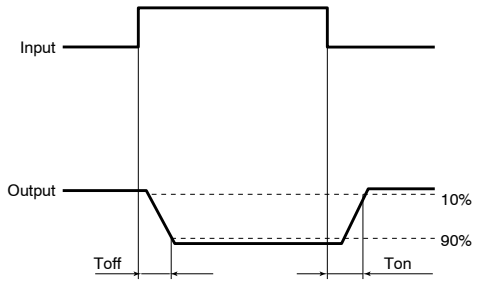
Item		Symbol	AQW414(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage	V_L	400 V	
	Continuous load current	I_L	0.1 A (0.13 A)	Peak AC, DC ( ): in case of using only 1 channel
	Peak load current	I_{peak}	0.3 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	800 mW	
Total power dissipation		P_T	850 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stag}	–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW414(A)	Condition
Input	LED operate (OFF) current	Typical	I_{Foff}	0.7 mA	I_L = Max.
		Maximum		3 mA	
	LED reverse (ON) current	Minimum	I_{Fon}	0.4 mA	I_L = Max.
		Typical		0.64 mA	
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	26 Ω	I_F = 0 mA I_L= Max. Within 1 s on time
		Maximum		50 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA	I_F = 5 mA V_L = 400 V
Transfer characteristics	Operate (OFF) time*	Typical	T_{off}	0.46 ms	I_F = 0 mA › 5 mA I_L = Max.
		Maximum		1 ms	
	Reverse (ON) time*	Typical	T_{on}	0.40 ms	I_F = 5 mA › 0 mA I_L = Max.
		Maximum		1 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F = 5 mA. For type of connection, see page 58.

*Operate/Reverse time

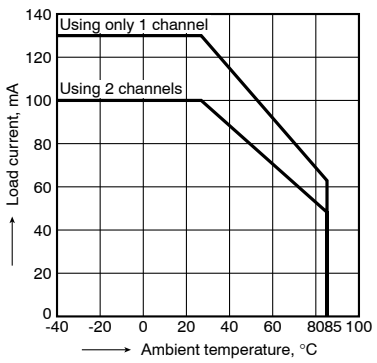


■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 58.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

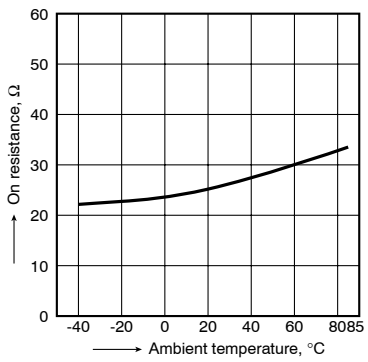
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



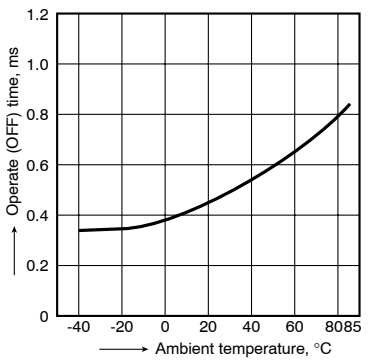
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 0 mA;
Continuous load current: 100 mA (DC)



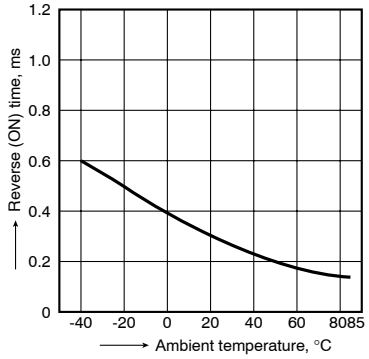
3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



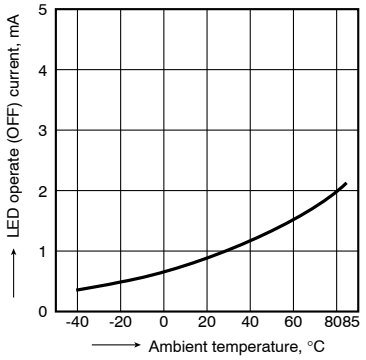
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



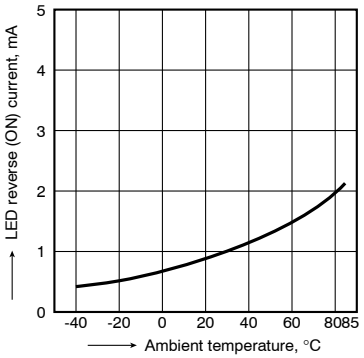
5. LED operate (OFF) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



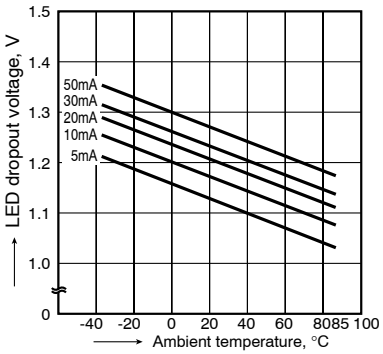
6. LED reverse (ON) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



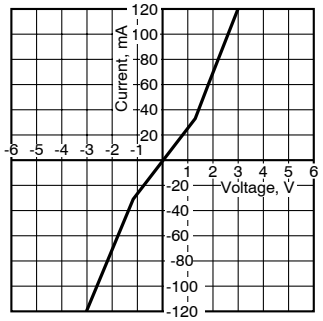
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



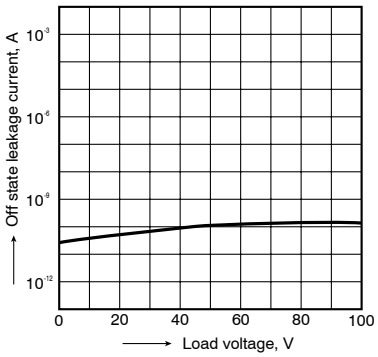
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



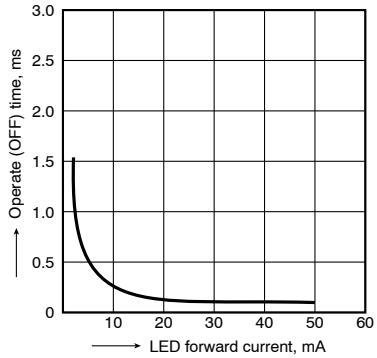
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



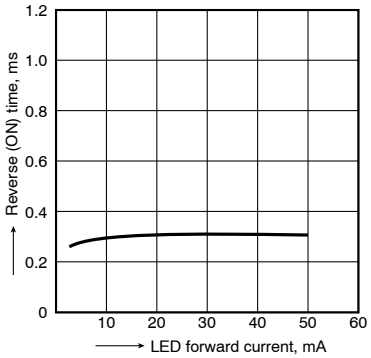
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



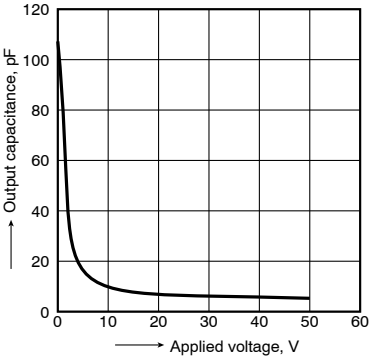
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

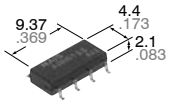
Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



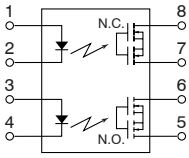
Panasonic
ideas for life

Super miniature design, SOP (1Form A/1Form B) 8-pin type. Controls load voltage 60V, 350V.

GU PhotoMOS (AQW61❍S)



mm inch



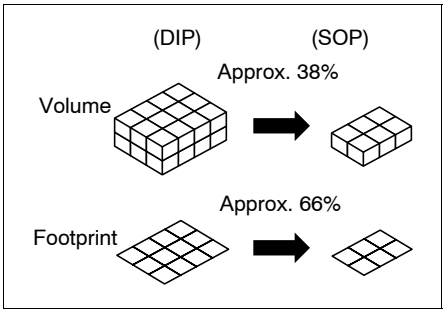
FEATURES

1. 60V type couples high capacity (0.45A) with low on-resistance (1Ω).

Item	GU SOP (1 Form A/ 1 Form B type) type	
Part No.	AQW610S	AQW612S NEW
Load voltage	350V	60V
Continuous load current	0.1A	0.45A
ON resistance (typ.)	18Ω	1Ω

2. 2 channels in super miniature design

The device comes in a super-miniature SO package measuring (W) 4.4 × (L) 9.37 × (H) 2.1 mm (W) .173× (L) .369× (H) .083 inch —approx. 38% of the volume and 66% of the footprint size of DIP type PhotoMOS relays.



3. Tape and reel

The device comes standard in a tape and reel (1,000 pcs./reel) to facilitate automatic insertion machines.

Applicable for 1 Form A 1 Form B use as well as two independent 1 Form A and 1 Form B use

Controls low-level analog signals

PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion

4. Low-level off-state leakage current

TYPICAL APPLICATIONS

- Power supply
- Measuring equipment
- Security equipment
- Telephone equipment
- Computer input machine
- Industrial robots
- High-speed inspection machines

TYPES

1. AC/DC type

Output rating*		Part No.		Packing quantity in tape and reel
Load voltage	Load current	Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side	
60 V	450 mA	AQW612SX	AQW612SZ	1,000 pcs.
350 V	100 mA	AQW610SX	AQW610SZ	1,000 pcs.

*Indicate the peak AC and DC values.

Notes: (1) Tape package is the standard packing style. Also available in tube. (Part No. suffix “X” or “Z” is not needed when ordering; Tube: 50 pcs.; Case: 1,000 pcs.)

(2) For space reasons, the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. AC/DC type

1. Absolute maximum ratings (Ambient temperature : 25°C 77°F)

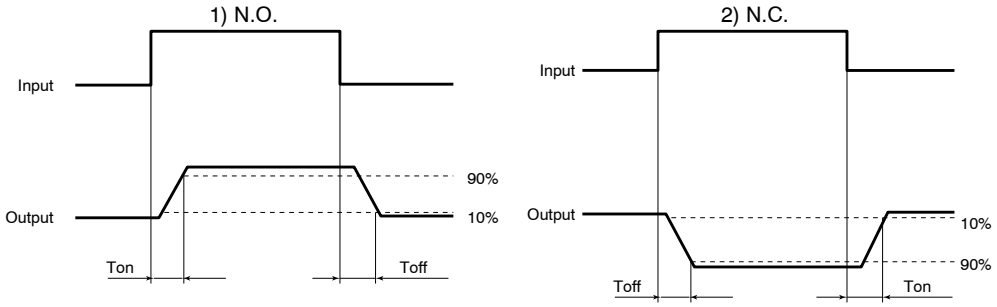
Item		Symbol	AQW612S	AQW610S	Remarks
Input	LED forward current	I_F	50 mA		
	LED reverse voltage	V_R	5 V		
	Peak forward current	I_{FP}	1 A		f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW		
Output	Load voltage (peak AC)	V_L	60 V	350 V	
	Continuous load current	I_L	0.45 A (0.55 A)	0.1 A (0.13 A)	Peak AC, DC ( ): in case of using only 1a or 1b, 1 channel
	Peak load current	I_{peak}	1.5 A	0.3 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	600 mW		
Total power dissipation		P_T	650 mW		
I/O isolation voltage		V_{iso}	1,500 V AC		
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F		

2. Electrical characteristics (Ambient temperature : 25°C 77°F)

Item			Symbol	AQW612S	AQW610S	Condition
Input	LED operate current	Typical	I_{Fon}	0.9 mA		I_L = Max.
		Maximum		3 mA		
	LED reverse current	Minimum	I_{Foff}	0.4 mA		I_L = Max.
		Typical		0.8 mA		
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)		I_F = 50 mA
		Maximum		1.5 V		
Output	On resistance	Typical	R_{on}	1 Ω	18 Ω	I_F = 5 mA (N.O.) I_F= 0 mA (N.C.) I_L = Max. Within 1 s on time
		Maximum		2.5 Ω	25 Ω	
	Off state leakage current	Maximum	I_{leak}	1 μA		I_F = 0 mA (N.O.) I_F= 5 mA (N.C.) V_L = Max.
Transfer characteristics	Operate time*	Typical	T_{on}	0.65 ms (N.O.), 0.9 ms (N.C.)	0.28 ms (N.O.), 0.52 ms (N.C.)	I_F = 0 mA › 5 mA I_L = Max.
		Maximum		3.0 ms	1.0 ms	
	Reverse time*	Typical	T_{off}	0.08 ms (N.O.), 0.2 ms (N.C.)	0.04 ms (N.O.), 0.23 ms (N.C.)	I_F = 5 mA › 0 mA I_L = Max.
		Maximum		1.0 ms	1.0 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF		f = 1 MHz V_B = 0 V
		Maximum		1.5 pF		
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ		500 V DC

Note: Recommendable LED forward current I_F = 5 mA. For type of connection, see page 58.

*Operate/Reverse time

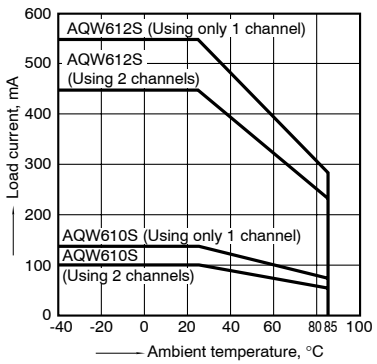


■ **For Dimensions, see page 53.**
■ **For Schematic and Wiring Diagrams, see page 58.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

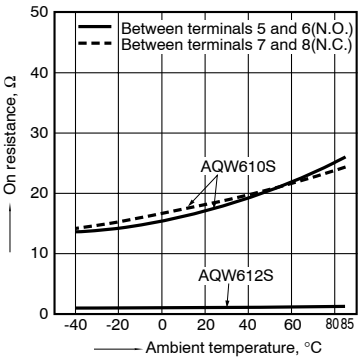
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



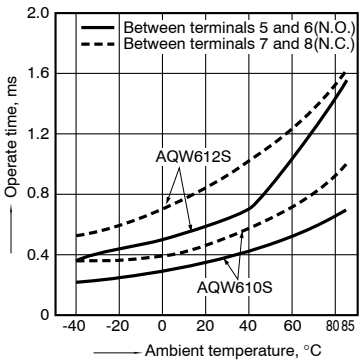
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8; LED current: 5 mA; Load voltage: Max. (DC); Continuous load current: Max. (DC)



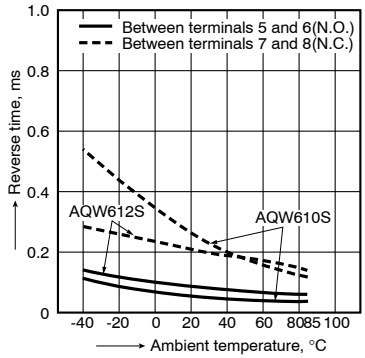
3. Operate time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



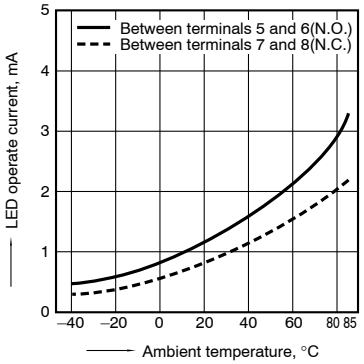
4. Reverse time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



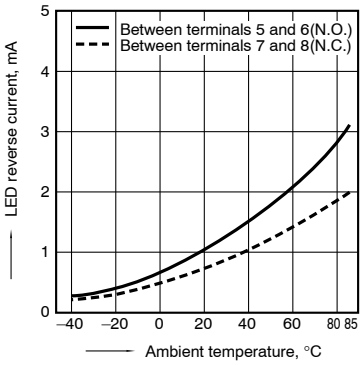
5. LED operate current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



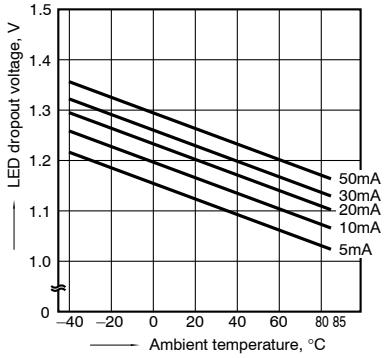
6. LED reverse current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



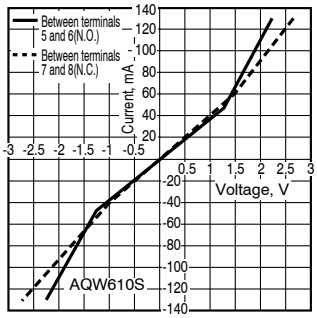
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



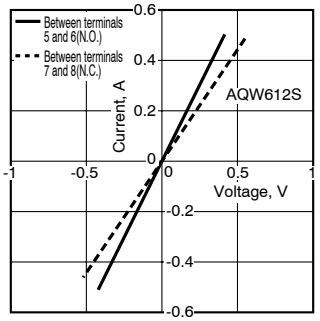
8-(1). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



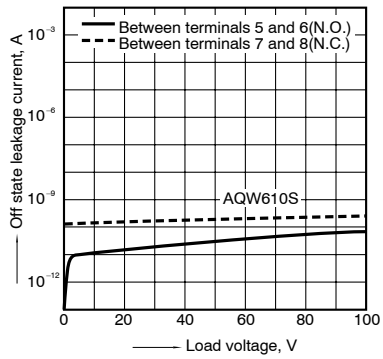
8-(2). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



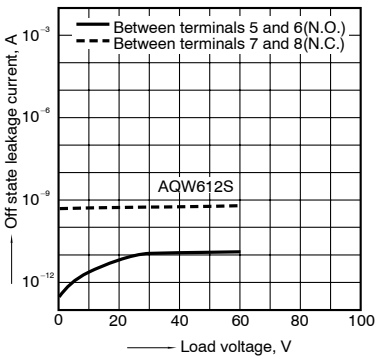
9-(1). Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



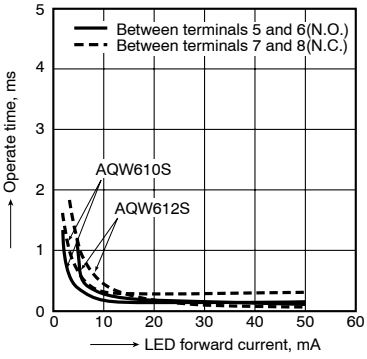
9-(2). Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



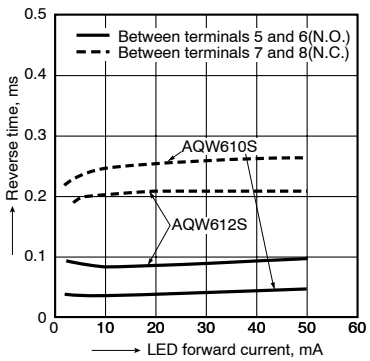
10. Operate time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



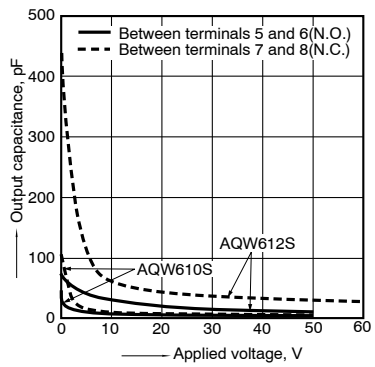
11. Reverse time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

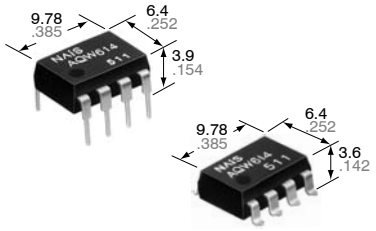
Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



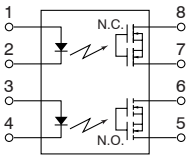
Panasonic
ideas for life

Compact DIP (1Form A/ 1Form B) 8-pin type. Controls load voltage 400V.

GU PhotoMOS (AQW614)



mm inch



FEATURES

1. Approx. 1/2 the space compared with the mounting of a set of 1 Form A and 1 Form B photoMOS relays

2. Applicable for 1 Form A 1 Form B use as well as two independent 1 Form A and 1 Form B use

3. Low thermal electromotive force (Approx. 1 μV)

4. Eliminates the need for a counter electromotive force protection diode in the drive circuits on the input side

5. Controls load currents up to 0.13 A with an input current of 5 mA with load voltage of 400 V

6. High speed switching: operate time of 300 μs typical.

7. Eliminates the need for a power supply to drive the power MOSFET

8. Extremely low closed-circuit offset voltages to enable control of small analog signals without distortion (Typical 100 pA at 400 V)

9. Stable on resistance

TYPICAL APPLICATIONS

- High-speed inspection machines
- Telephone equipment
- Computer

TYPES

Type	Output rating*		Part No.				Packing quantity	
	Load voltage	Load current	Through hole terminal	Surface-mount terminal				
			Tube packing style		Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC type	400 V	100 mA	AQW614	AQW614A	AQW614AX	AQW614AZ	1 tube contains 40 pcs. 1 batch contains 400 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.

Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATINGS

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQW614(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage	V_L	400 V	
	Continuous load current	I_L	0.1 A (0.13 A)	Peak AC, DC ( ): in case of using only 1a or 1b, 1 channel
	Peak load current	I_{peak}	0.3 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	800 mW	
Total power dissipation		P_T	850 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	Between input and output/between contact sets
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

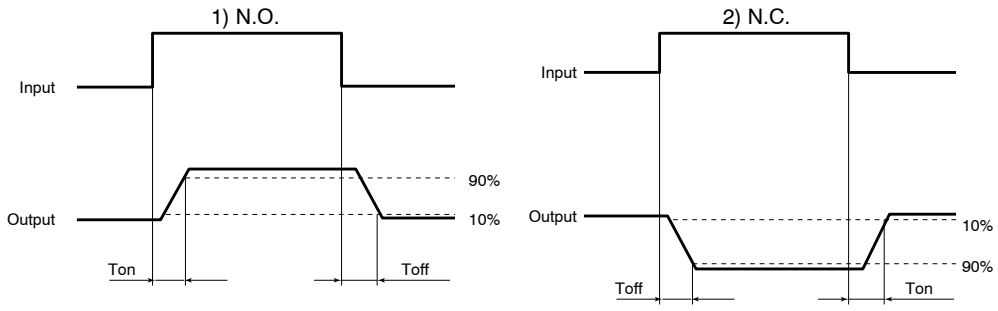
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW614(A)	Condition
Input	LED operate (OFF) current	Typical	I_{Fon} (N.O.) I_{Foff} (N.C.)	0.9 mA	I_L = 100 mA
		Maximum		3 mA	
	LED reverse (ON) current	Minimum	I_{Foff} (N.O.) I_{Fon} (N.C.)	0.4 mA	I_L = 100 mA
		Typical		0.8 mA	
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	27 Ω	I_F = 5 mA (N.O.) I_F = 0 mA (N.C.) I_L = 100 mA within 1 s on time
		Maximum		50 Ω	
	Off state leakage current	Maximum	I_{Leak}	1 μA	I_F = 0 mA (N.O.) I_F = 5 mA (N.C.) V_L = 400 V
Transfer characteristics	Operate (OFF) time*	Typical	T_{on} (N.O.) T_{off} (N.C.)	0.28 ms (N.O.) 0.43 ms (N.C.)	I_F = 0 mA › 5 mA I_L = 100 mA
		Maximum		1 ms	
	Reverse (ON) time*	Typical	T_{off} (N.O.) T_{on} (N.C.)	0.04 ms (N.O.) 0.3 ms (N.C.)	I_F = 5 mA › 0 mA I_L = 100 mA
		Maximum		1 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F = 5 mA.

For type of connection, see page 58.

*Operate/Reverse time

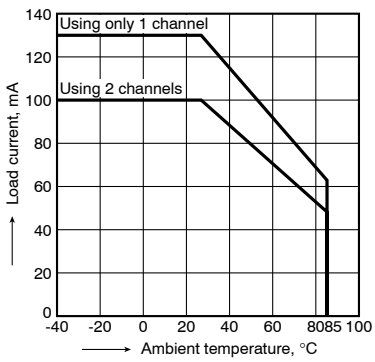


■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 58.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

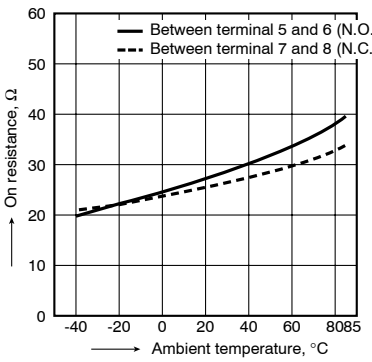
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



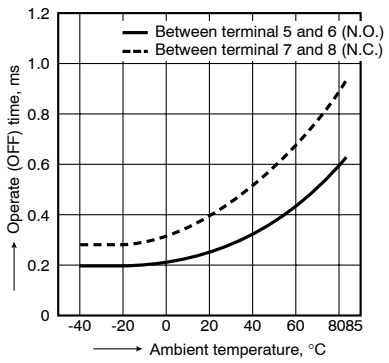
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



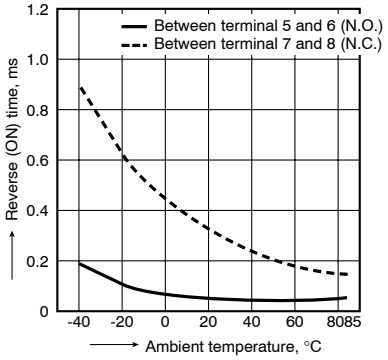
3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



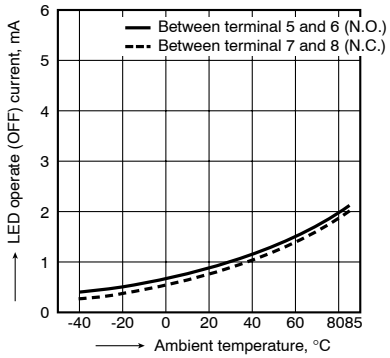
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



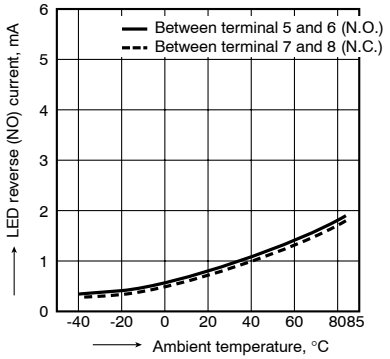
5. LED operate (OFF) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



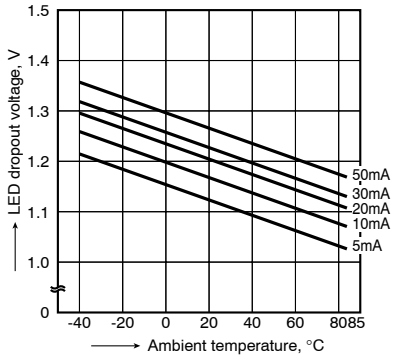
6. LED reverse (ON) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 100 mA (DC)



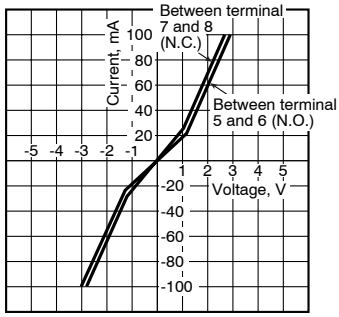
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



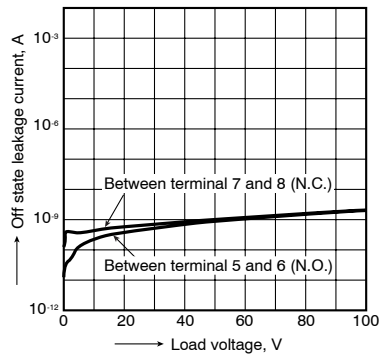
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



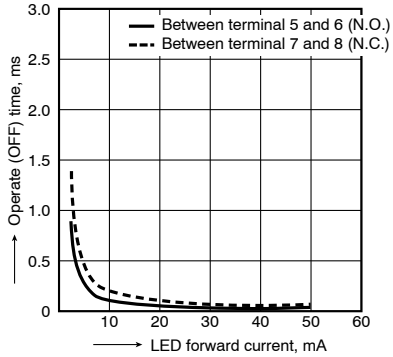
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



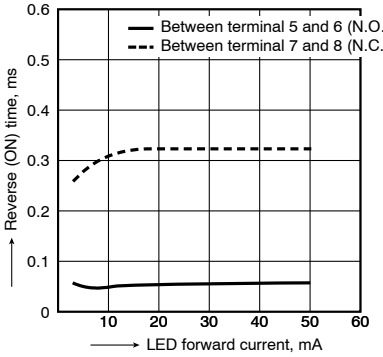
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: 400 V (DC); Continuous load current:
100 mA (DC); Ambient temperature: 25°C 77°F



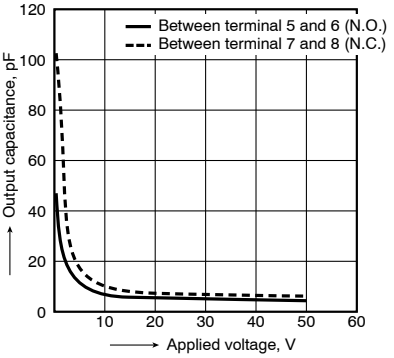
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: 400 V (DC); Continuous load current:
100 mA (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

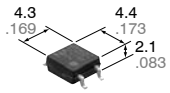
Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



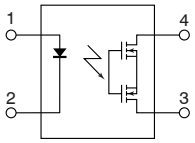
Panasonic
ideas for life

Short circuit protection (Latch type).

GU PhotoMOS (AQY210KS)



mm inch



FEATURES

1. Short circuit protection (Latch type)
When the output current exceeds a fixed amount, it is cut and the off state is maintained. The relay can be restored by turning off the input current and then turning it back on.

2. SO package 4-Piån type in super miniature design

3. Tape and reel
The device comes standard in a tape and reel (1,000 pcs./reel) to facilitate automatic insertion machines.

4. Controls low-level analog signals

5. Low-level off state leakage current

TYPICAL APPLICATIONS

- Modem and Telephone equipment
- Measuring and Testing equipment
- Security equipment
- Industrial equipment
- Traffic signal control

TYPES

Type	Output rating*		Part No.		Packing quantity in tape and reel
	Load voltage	Load current	Picked from the 1/2-pin side	Picked from the 3/4-pin side	
			1 Form A	1 Form A	
AC/DC type	350 V	120 mA	AQY210KSX	AQY210KSZ	1,000 pcs.

* Indicate the peak AC and DC values.

Notes: (1) Tape package is the standard packing style. Also available in tube. (Part No. suffix “X” or “Z” is not needed when ordering; Tube: 100 pcs.; Case: 2,000 pcs.)

(2) For space reasons, the initial letters of the product number “AQY” and “S” are omitted on the product seal. The package type indicator “X” and “Z” are omitted from the seal. (Ex. the label for product number AQY210KS is 210K).

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQY210KS	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	350 V	
	Continuous load current (peak AC)	I_L	0.12 A	
	Power dissipation	P_{out}	300 mW	
Total power dissipation		P_T	350 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

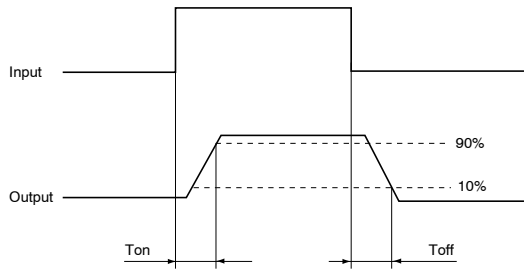
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQY210KS	Condition
Input	LED operate current		Typical	I_{Fon}	1.1 mA	I_L = Max.
			Maximum		3.0 mA	
	LED turn off current		Minimum	I_{Foff}	0.3 mA	I_L = Max.
			Typical		1.0 mA	
	LED dropout voltage		Typical	V_F	1.32 V (1.13 V at I_F = 5 mA)	I_F = 50 mA
			Maximum		1.5 V	
Output	On resistance		Typical	R_{on}	23.5Ω	I_F = 5 mA I_L = 120 mA Within 1 s on time
			Maximum		35Ω	
	Off state leakage current		Maximum	I_{Leak}	1μA	I_F = 0 mA V_L = 350 V
	Over current protection	Cut off current	Minimum	I_{shut}	160 mA	I_F = 5 mA Within 20ms on time
			Typical		200 mA	
			Maximum		240 mA	
		Detection time	Typical	T_{shut}	50μs	I_F = 5 mA V_L = 350 V DC short circuit
Transfer characteristics	Turn on time*		Typical	T_{on}	0.7 ms	I_F = 5 mA I_L = Max.
			Maximum		2 ms	
	Turn off time*		Typical	T_{off}	0.07 ms	I_F = 5 mA I_L = Max.
			Maximum		1 ms	
	I/O capacitance		Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
			Maximum		1.5 pF	
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F= 5 mA.

For type of connection, see page 56.

*Turn on/Turn off time

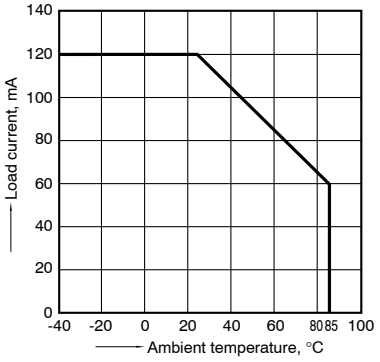


■ **For Dimensions, see page 53.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

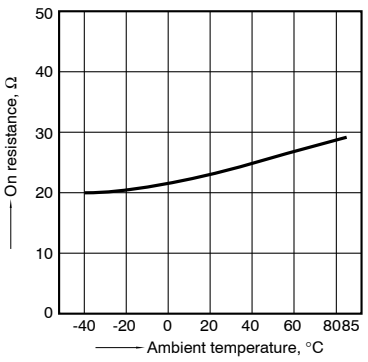
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



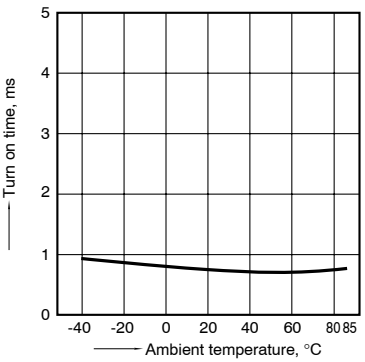
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load current: Max.(DC)

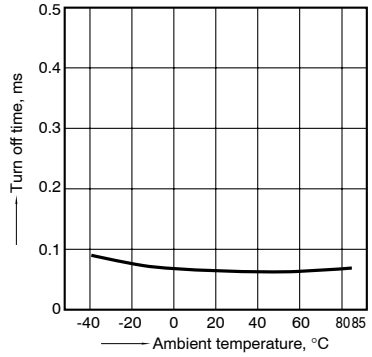


3. Turn on time vs. ambient temperature characteristics

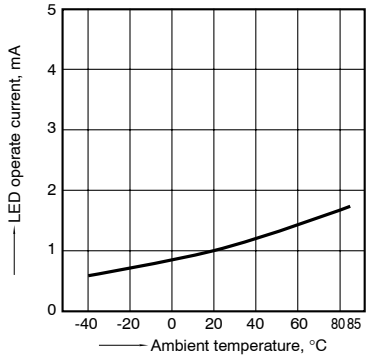
LED current: 5 mA;
Continuous load current: Max.(DC)



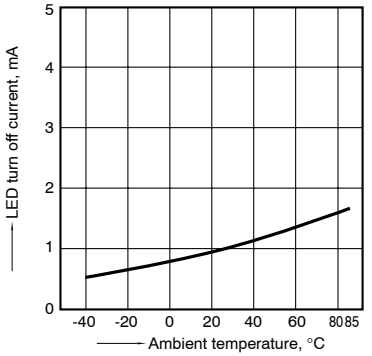
4. Turn off time vs. ambient temperature characteristics
LED current: 5 mA;
Continuous load current: Max.(DC)



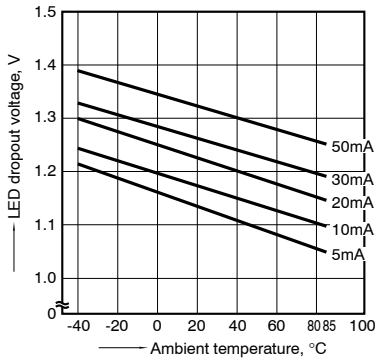
5. LED operate current vs. ambient temperature characteristics
Continuous load current: Max.(DC)



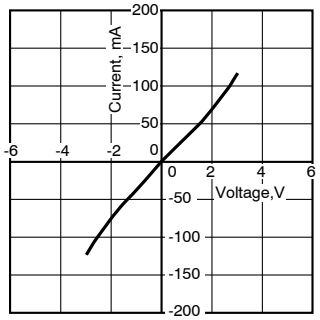
6. LED turn off current vs. ambient temperature characteristics
Continuous load current: Max.(DC)



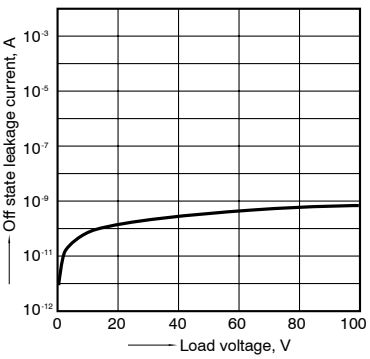
7. LED dropout voltage vs. ambient temperature characteristics
LED current: 5 to 50 mA



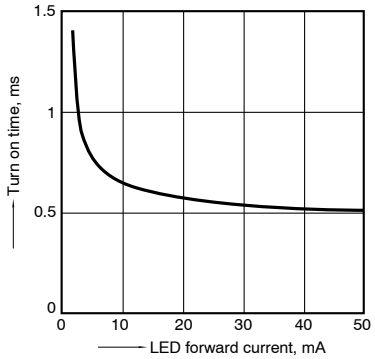
8. Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



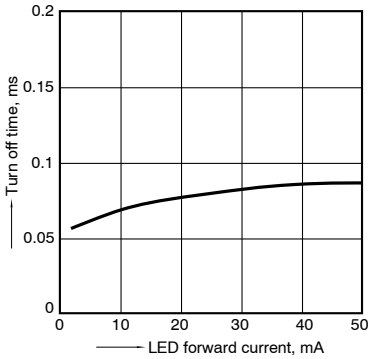
9. Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



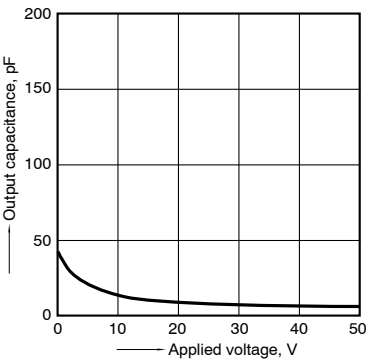
10. Turn on time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4; Load voltage: Max.(DC); Continuous load current:Max.(DC);
Ambient temperature: 25°C 77°F



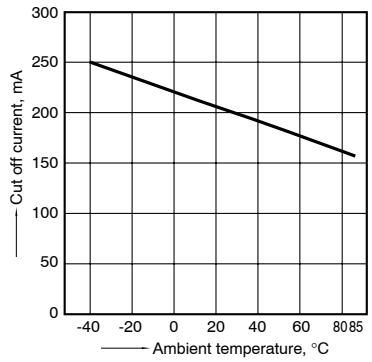
11. Turn off time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4; Load voltage: Max.(DC); Continuous load current:Max.(DC);
Ambient temperature: 25°C 77°F



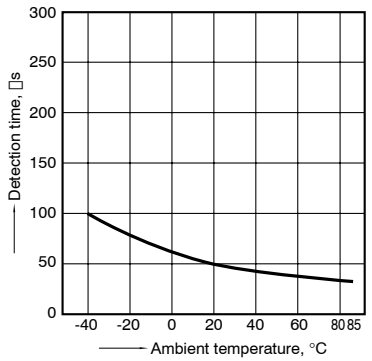
12. Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 3 and 4;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



13. Cut off current vs. ambient temperature characteristics
Measured portion: between terminals 3 and 4;
LED current: 5 mA, within 20ms on time



14. Detection time vs. ambient temperature characteristics
Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max.(DC);

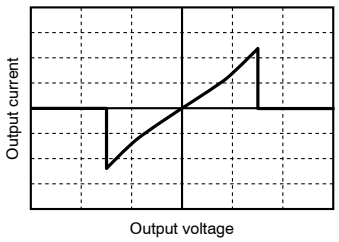


What is short circuit protection latch type?

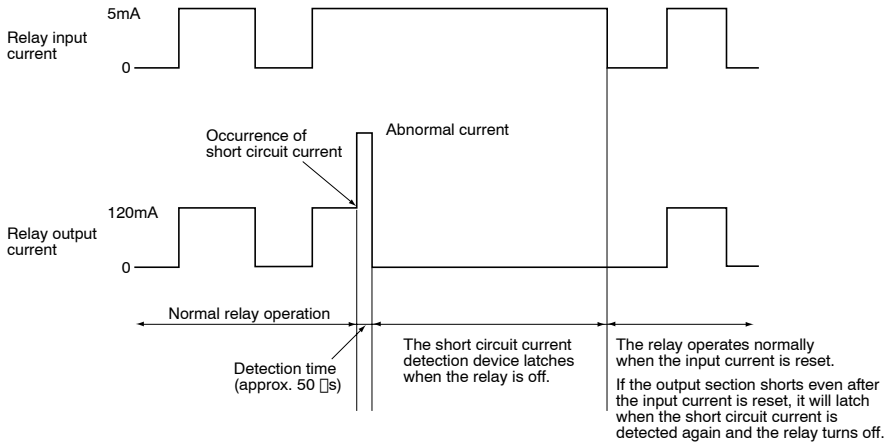
When the load current exceeds specifications, the short circuit protection function kicks in and completely cuts off the load current, thus turning off the relay. The short circuit protection inside the PhotoMOS relay instantaneously (typ. 50 µs) and completely cuts of the load current.
This protects any circuits that follow the PhotoMOS relay from excess current. There is almost no heating of the PhotoMOS relay, which prevents it from becoming damaged. To restore the function of the relay turn off the input current and then turn it back on.
In order to operate the short circuit protection function, ensure that the input current is at least I_F = 5 mA.

Output voltage and output current characteristics

V-I characteristics of PhotoMOS relay with short circuit protection circuit



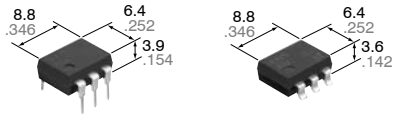
Operation chart



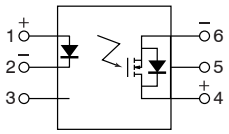
Panasonic
ideas for life

Short circuit protection (Non latch type). Controls only DC load.

GU PhotoMOS (AQV112KL)



mm inch



FEATURES

1. Protects Circuit from excess current
The short circuit protection function prevents the continued flow of short current. After short current is detected, load current is monitored, and if the load returns to normal, the relay returns to normal operation.

2. No need for fuses, polyswitches, or other protectors
The built-in short circuit protection function eliminates the need for overcurrent protectors, reducing mounting costs and space requirements.

3. High capacity
Can control up to 0.5A (60 VDC) load current.

TYPICAL APPLICATIONS

- Industrial equipment
- Traffic signal control
- Security equipment

TYPES

Type	I/O isolation voltage	Output rating*		Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
		Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
DC type	1,500 V	60 V	500 mA	AQV112KL	AQV112KLA	AQV112KLAX	AQV112KLAZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.

*Indicate the DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQV112KL(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak DC)	V_L	7 to 60V	
	Continuous load current (peak DC)	I_L	0.5 A	
	Power dissipation	P_{out}	500 mW	
Total power dissipation		P_T	550 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

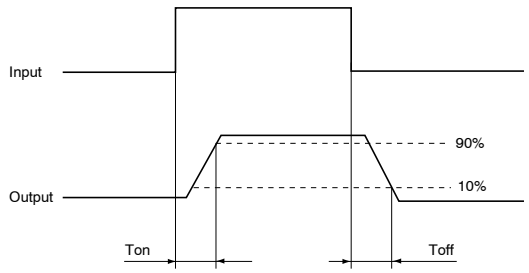
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQV112KL(A)	Condition
Input	LED operate current	Typical	I_{Fon}	0.8 mA	I_L = 100mA
		Maximum		10 mA	
	LED turn off current	Minimum	I_{Foff}	0.3 mA	I_L = 100mA
		Typical		0.7 mA	
	LED dropout voltage	Typical	V_F	1.35 V (1.17 V at I_F = 10 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	0.55 Ω	I_F = 10 mA I_L = Max.
		Maximum		2.0 Ω	
	Load short circuit detection voltage	Typical	V_{LSHT}	5 V	I_F = 10 mA
		Maximum		7 V	
	Off state leakage current	Maximum	I_{Leak}	1μA	I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	2.0 ms	I_F = 10 mA I_L = 100 mA V_L = 10 V
		Maximum		5.0 ms	
	Turn off time*	Typical	T_{off}	0.1 ms	I_F = 10 mA I_L = 100 mA V_L = 10 V
		Maximum		1.0 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F = 10 mA.

For type of connection, see page 55.

*Turn on/Turn off time

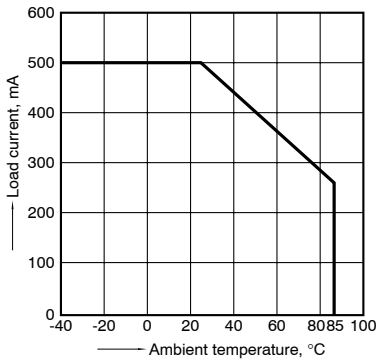


■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 55.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

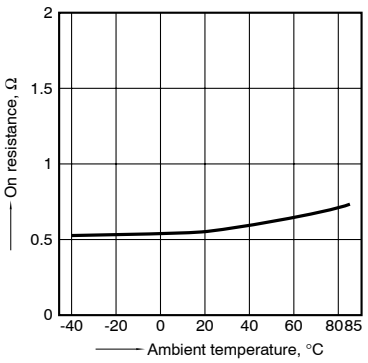
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



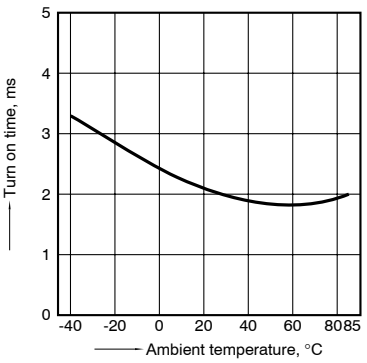
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 10 mA; Load current: Max.(DC)

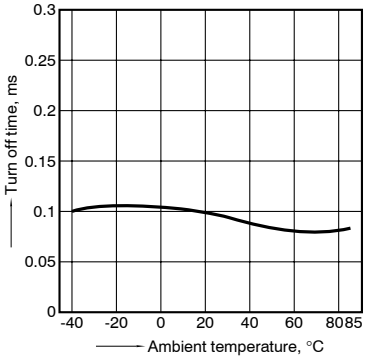


3. Turn on time vs. ambient temperature characteristics

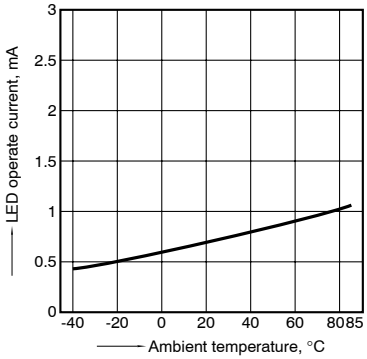
Measured portion: between terminals 4 and 6;
LED current: 10 mA; Load voltage: 10V (DC);
Load current: 100 mA



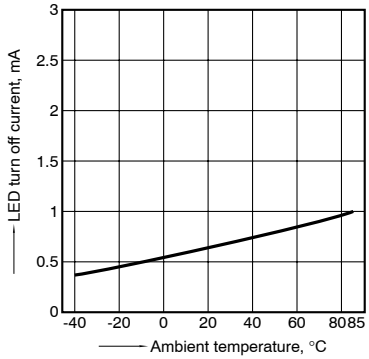
4. Turn off time vs. ambient temperature characteristics
Measured portion: between terminals 4 and 6;
LED current: 10 mA; Load voltage: 10 V (DC);
Load current: 100 mA (DC)



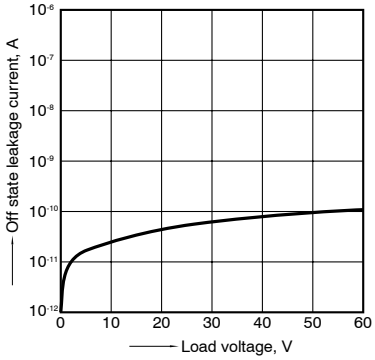
5. LED operate current vs. ambient temperature characteristics
Measured portion: between terminals 4 and 6;
Load current: 100 mA



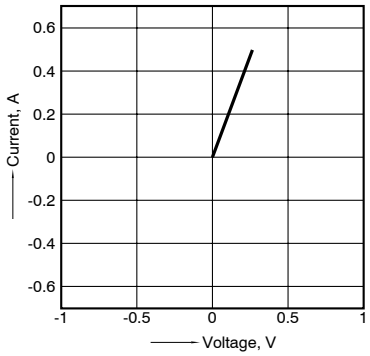
6. LED turn off current vs. ambient temperature characteristics
Measured portion: between terminals 4 and 6;
Load current: 100 mA



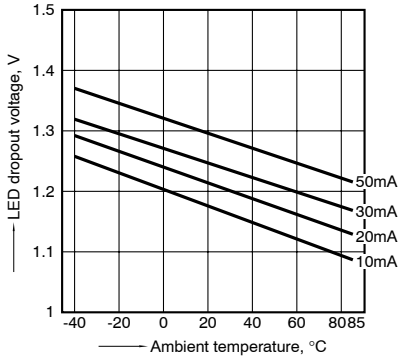
7. Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



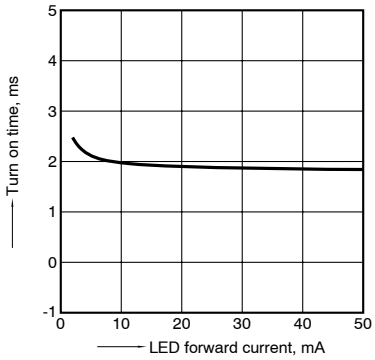
8. Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



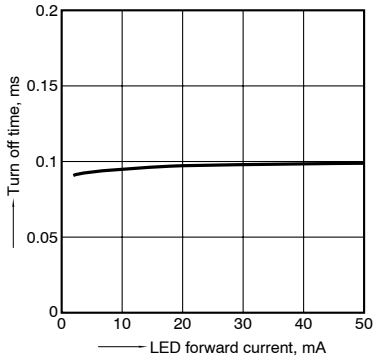
9. LED dropout voltage vs. ambient temperature characteristics
Measured portion: between terminals 1 and 2;
LED current: 10 to 50 mA



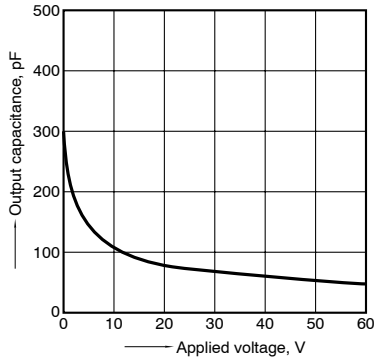
10. Turn on time vs. LED forward current characteristics
Measured portion: between terminals 4 and 6;
Load voltage: 10 V (DC); Load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



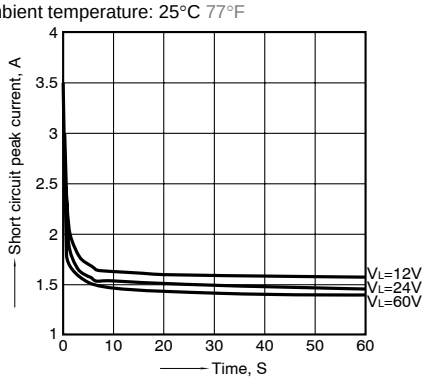
11. Turn off time vs. LED forward current characteristics
Measured portion: between terminals 4 and 6;
Load voltage: 10 V (DC); Load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



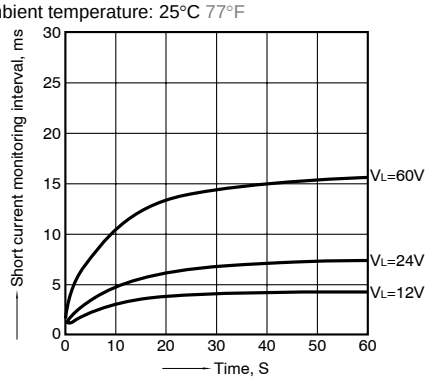
12. Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



13. Short circuit peak current vs. time characteristics
Measured portion: between terminals 4 and 6;
LED current: 10 mA; Load resistance: 0;
Ambient temperature: 25°C 77°F



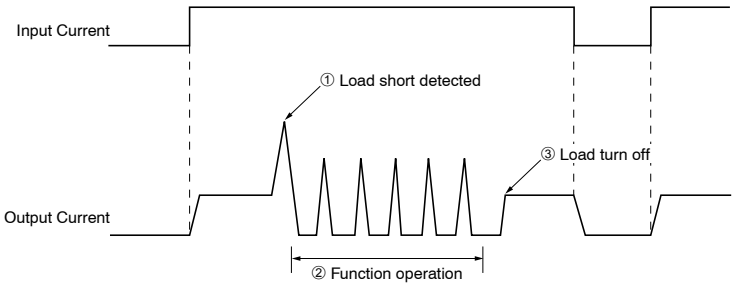
14. Short current monitoring interval vs. time characteristics
Measured portion: between terminals 4 and 6;
LED current: 10 mA; Load resistance: 0;
Ambient temperature: 25°C 77°F



What is short circuit protection Non-latch type?

If the load current reaches a predetermined overcurrent level, the output-side short circuit protection function cuts off the load current. It then monitors the load current, and if it returns to normal, automatically recovers to normal relay operation.
In order to operate the short circuit protection function, ensure that the input current is at least I_F = 10 mA.

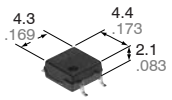
Operation chart (Non-latch type)



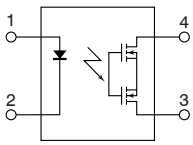
Panasonic
ideas for life

Current Limit Function.
SOP (1 Form A) 4-pin type.

GU PhotoMOS (AQY210LS)



mm inch

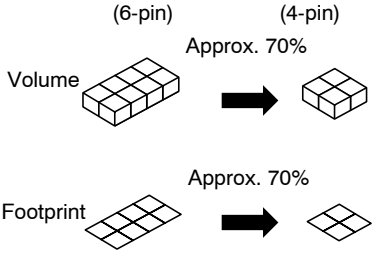


FEATURES

1. Current Limit Function
To control an over current from flowing, the current limit function has been realized. It keeps an output current at a constant value when the current reaches a specified current limit value.

2. Enhancing the capability of surge resistance between output terminals
The current limit function controls the ON time surge current to enhance the capability of surge resistance between output terminals.

3. SO package 4-Pin type in super miniature design
The device comes in a super-miniature SO package 4-Pin type measuring (W) 4.3×(L) 4.4×(H) 2.1 mm (W) .169×(L) .173×(H) .083 inch—approx. 70% of the volume and 70% of the footprint size of SO package 6-pin type PhotoMOS Relays.



4. Tape and reel
The device comes standard in a tape and reel (1,000 pcs./reel) to facilitate automatic insertion machines.

5. Controls low-level analog signals

6. Low-level off state leakage current

TYPICAL APPLICATIONS

- Telephone equipment
- Modem

TYPES

Type	Output rating*		Part No.		Packing quantity in tape and reel
	Load voltage	Load current	Picked from the 1/2-pin side	Picked from the 3/4-pin side	
			1 Form A	1 Form A	
AC/DC type	350 V	120 mA	AQY210LSX	AQY210LSZ	1,000 pcs.

* Indicate the peak AC and DC values.

Notes: (1) Tape package is the standard packing style. Also available in tube. (Part No. suffix "X" or "Z" is not needed when ordering; Tube: 100 pcs.; Case: 2,000 pcs.)
(2) For space reasons, the initial letters of the product number "AQY" and "S" are ommited on the product seal. The package type indicator "X" and "Z" are omitted from the seal. (Ex. the label for product number AQY210LS is 210L).

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQY210LS	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	350 V	
	Continuous load current	I_L	0.12 A	
	Power dissipation	P_{out}	300 mW	
Total power dissipation		P_T	350 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

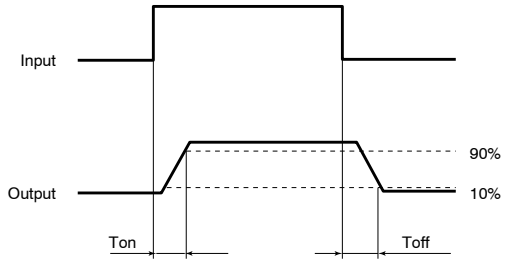
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY210LS	Condition
Input	LED operate current	Typical	I_{Fon}	1.2 mA	I_L = Max.
		Maximum		3 mA	
	LED turn off current	Minimum	I_{Foff}	0.4 mA	I_L = Max.
		Typical		1.1 mA	
	LED dropout voltage	Minimum	V_F	1.25 (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Typical		1.5 V	
Output	On resistance	Typical	R_{on}	20Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		25Ω	
	Off state leakage current	Maximum	I_{Leak}	1μA	I_F = 0 V_L = Max.
	Current limit	Typical	—	0.18 A	I_F = 5 mA
Transfer characteristics	Turn on time*	Typical	T_{on}	0.5 ms	I_F = 5 mA I_L = Max.
		Maximum		2.0 ms	
	Turn off time*	Typical	T_{off}	0.08 ms	I_F = 5 mA I_L = Max.
		Maximum		1.0 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F= 5 mA.

For type of connection, see page 56.

*Turn on/Turn off time

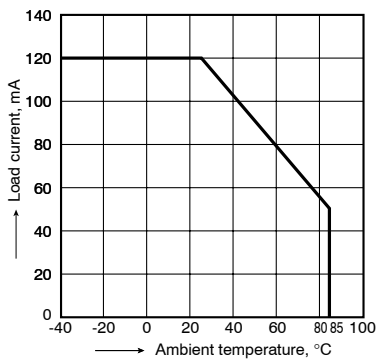


■ **For Dimensions, see page 53.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

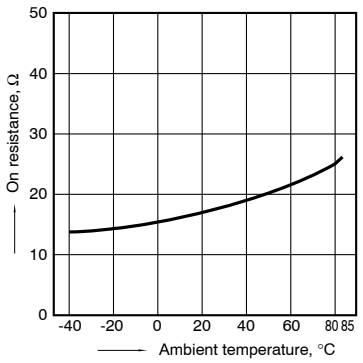
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature:
–40°C to +85°C
–40°F to +185°F



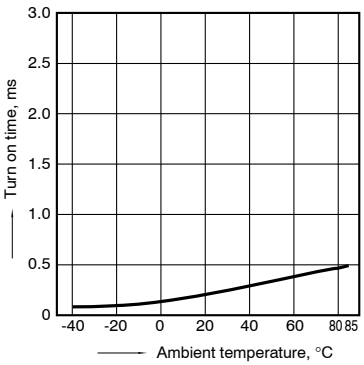
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max.(DC)

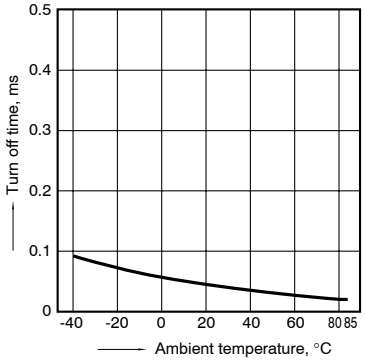


3. Turn on time vs. ambient temperature characteristics

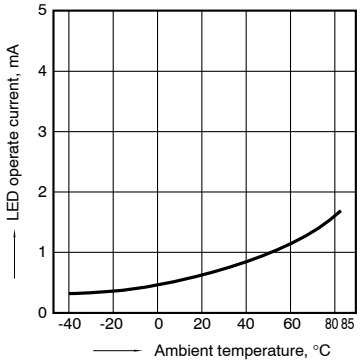
LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



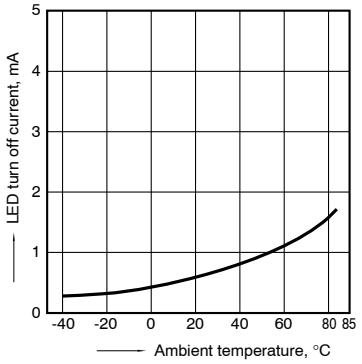
4. Turn off time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



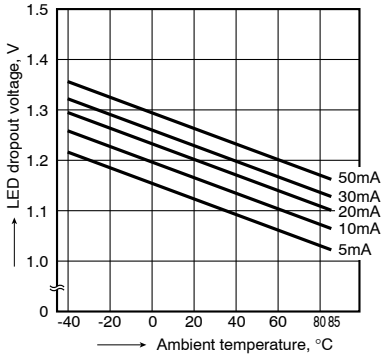
5. LED operate current vs. ambient temperature characteristics
Load voltage: Max.(DC);
Continuous load current: Max.(DC)



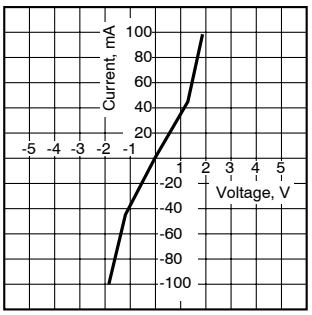
6. LED turn off current vs. ambient temperature characteristics
Load voltage: Max.(DC);
Continuous load current: Max.(DC)



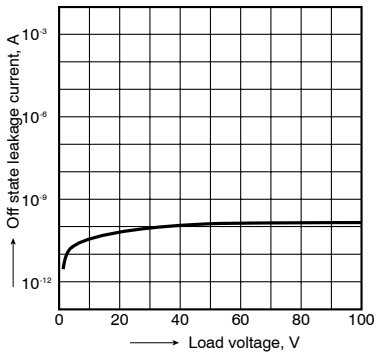
7. LED dropout voltage vs. ambient temperature characteristics
LED current: 5 to 50 mA



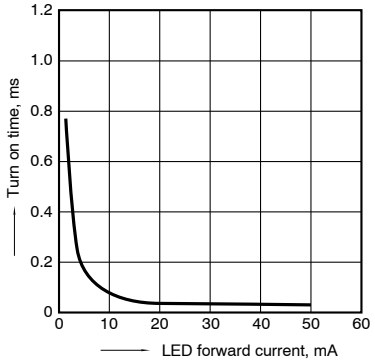
8. Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



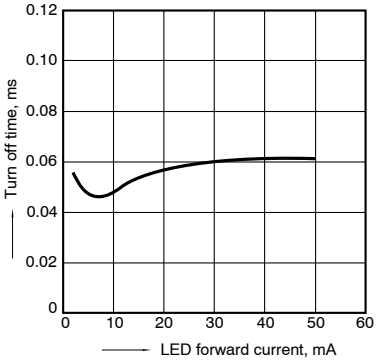
9. Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



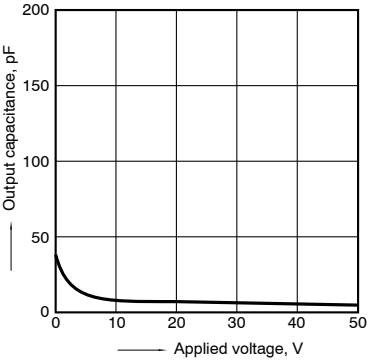
10. Turn on time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4;
Load voltage: Max.(DC); Continuous load current: Max.(DC); Ambient temperature: 25°C 77°F



11. Turn off time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4;
Load voltage: Max.(DC); Continuous load current: Max.(DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 3 and 4;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F

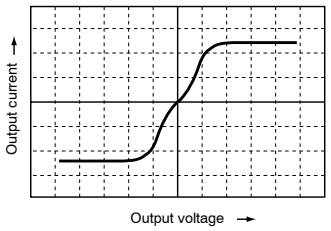


What is current limit

When a load current reaches the specified output control current, a current limit function works against the load current to keep the current a constant value.
The current limit circuit built into the PhotoMOS relay thus controls the instantaneous load current to effectively ensure circuit safety.

This safety feature protects circuits downstream of the PhotoMOS relay against over-current.
But, if the current-limiting feature is used longer than the specified time, the PhotoMOS relay can be destroyed. Therefore, set the output loss to the max. rate or less.
• Comparison of output voltage and output current characteristics

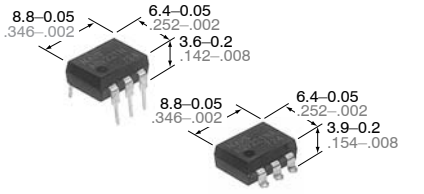
V-I Characteristics



Panasonic
ideas for life

GU (General Use) Type
1-Channel (Form A)
Current Limit Function
6-Pin Type

GU PhotoMOS (AQV210HL)



mm inch

FEATURES

1. Current Limit Function
To control an over current from flowing, the current limit function has been realized. It keeps an output current at a constant value when the current reaches a specified current limit value.

2. Enhancing the capability of surge resistance between output terminals
The current limit function controls the ON time surge current to enhance the capability of surge resistance between output terminals.

3. Reinforced insulation 5,000 V type
More than 0.4 mm internal insulation distance between inputs and outputs. Con-forms to EN41003, EN60950 (reinforced insulation).

4. Compact 6-pin DIP size
The device comes in a compact (W)6.4 × (L)8.8 × (H) 3.9mm (W).252 × (L).346 × (H).154inch, 6-pin DIP size

5. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

6. High sensitivity, low ON resistance

7. Low-level off state leakage current

TYPICAL APPLICATIONS

- High-speed inspection machines
- Telephone equipment
- Data communication equipment
- Computer

TYPES

Type	I/O isolation voltage	Output rating*		Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
		Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC type	Reinforced 5,000 V	350 V	130 mA	AQV210HL	AQV210HLA	AQV210HLAX	AQV210HLAZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.
Note: For space reasons, the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQV210HL(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	3 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	350 V	
	Continuous load current	I_L	0.13 A	
	Power dissipation	P_{out}	500 mW	
Total power dissipation		P_T	550 mW	
I/O isolation voltage		V_{iso}	5,000 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

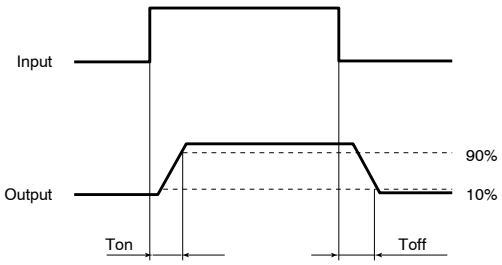
07/2005

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQV210HL(A)	Condition
Input	LED operate current	Typical	I_{Fon}	1.6 mA	I_L = Max.
		Maximum		3.0 mA	
	LED turn off current	Minimum	I_{Foff}	0.4 mA	I_L = Max.
		Typical		1.5 mA	
	LED dropout voltage	Minimum	V_F	1.14 (1.25 V at I_F = 50mA)	I_F = 5 mA
		Typical		1.5 V	
Output	On resistance	Typical	R_{on}	20Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		25Ω	
	Off state leakage current	Maximum	I_{Leak}	1μA	I_F = 0 V_L = Max.
	Current limit	Typical	—	180 mA	I_F = 5 mA
Transfer characteristics	Turn on time*	Typical	T_{on}	0.8 ms	I_F = 5 mA I_L = Max.
		Maximum		2.0 ms	
	Turn off time*	Typical	T_{off}	0.05 ms	I_F = 5 mA I_L = Max.
		Maximum		1.0 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F= 5 to 10 mA. For type of connection, see page 57.

*Turn on/Turn off time

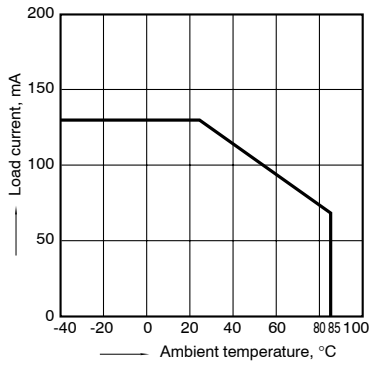


■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

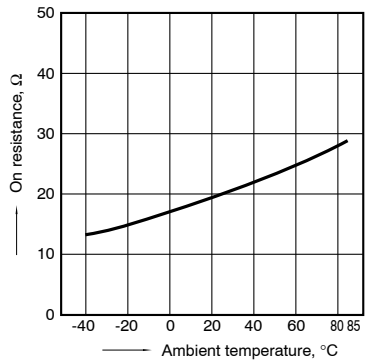
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



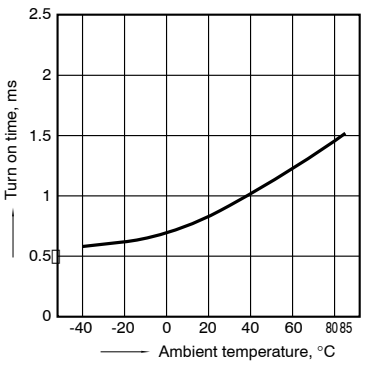
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max.(DC)

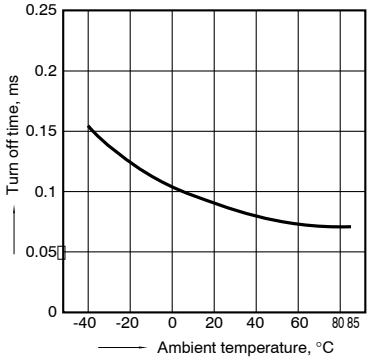


3. Turn on time vs. ambient temperature characteristics

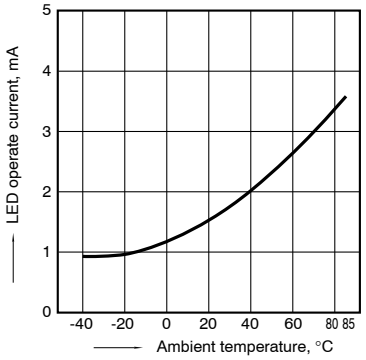
LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



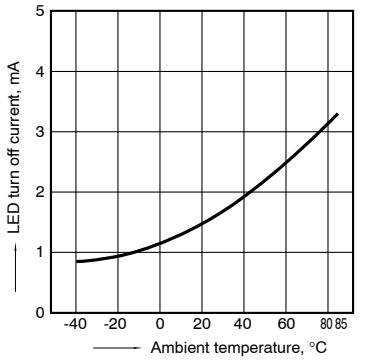
4. Turn off time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



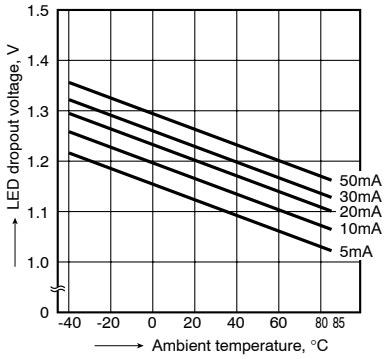
5. LED operate current vs. ambient temperature characteristics
Load voltage: Max.(DC);
Continuous load current: Max.(DC)



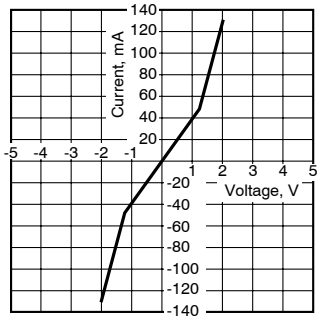
6. LED turn off current vs. ambient temperature characteristics
Load voltage: Max.(DC);
Continuous load current: Max.(DC)



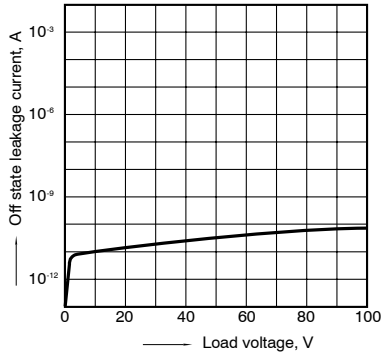
7. LED dropout voltage vs. ambient temperature characteristics
LED current: 5 to 50 mA



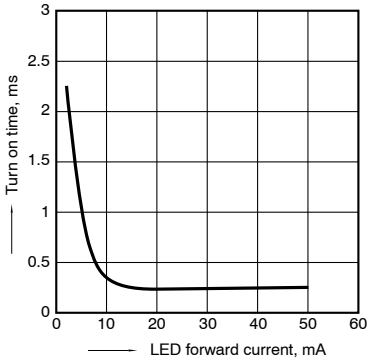
8. Voltage vs. current characteristics of output at MOS portion
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



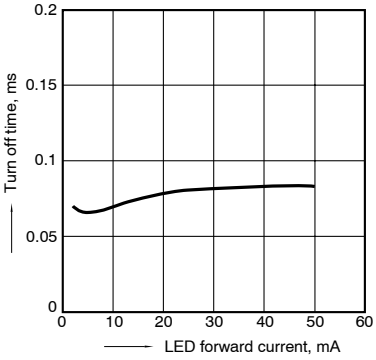
9. Off state leakage current
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



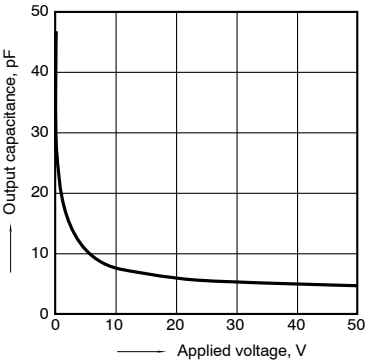
10. LED forward current vs. turn on time characteristics
Measured portion: between terminals 4 and 6;
Load voltage: Max.(DC); Continuous load current: Max.(DC); Ambient temperature: 25°C 77°F



11. LED forward current vs. turn off time characteristics
Measured portion: between terminals 4 and 6;
Load voltage: Max.(DC); Continuous load current: Max.(DC); Ambient temperature: 25°C 77°F



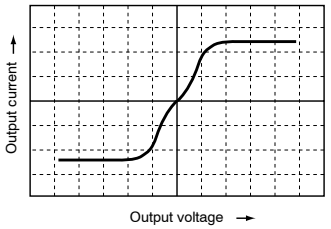
12. Applied voltage vs. output capacitance characteristics
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



What is current limit

When a load current reaches the specified output control current, a current limit function works against the load current to keep the current a constant value.
The current limit circuit built into the PhotoMOS relay thus controls the instantaneous load current to effectively ensure circuit safety.
This safety feature protects circuits downstream of the PhotoMOS relay against over-current.
But, if the current-limiting feature is used longer than the specified time, the PhotoMOS relay can be destroyed. Therefore, set the output loss to the max. rate or less.
• Comparison of output voltage and output current characteristics

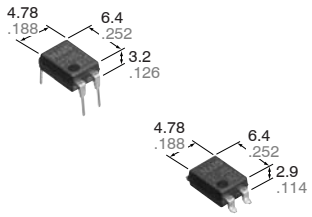
V-I Characteristics



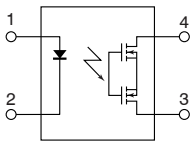
Panasonic
ideas for life

Current Limit Function. DIP (1 Form A) 4-pin type. Reinforced insulation 5,000V type.

GU PhotoMOS (AQY210HL)



mm inch



FEATURES

1. Current Limit Function
To control an over current from flowing, the current limit function has been realized. It keeps an output current at a constant value when the current reaches a specified current limit value.

2. Enhancing the capability of surge resistance between output terminals
The current limit function controls the ON time surge current to enhance the capability of surge resistance between output terminals.

3. Reinforced insulation 5,000 V type
More than 0.4 mm internal insulation distance between inputs and outputs. Con-forms to EN41003, EN60950 (reinforced insulation).

4. Compact 4-pin DIP size
The device comes in a compact (W)6.4 × (L)4.78 × (H) 3.2mm (W).252× (L).188 × (H).126inch, 4-pin DIP size

5. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

6. High sensitivity, low ON resistance

7. Low-level off state leakage current

TYPICAL APPLICATIONS

- Telephone equipment
- Modem

TYPES

Type	I/O isolation voltage	Output rating*		Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
		Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2-pin side	Picked from the 3/4-pin side		
AC/DC type	Reinforced 5,000 V	350 V	120 mA	AQY210HL	AQY210HLA	AQY210HLAX	AQY210HLAZ	1 tube contains 100 pcs. 1 batch contains 1,000 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.
Note: For space reasons, the initial letters of the product number “AQY”, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQY210HL(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	350 V	
	Continuous load current	I_L	0.12 A	
	Power dissipation	P_{out}	500 mW	
Total power dissipation		P_T	550 mW	
I/O isolation voltage		V_{iso}	5,000 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

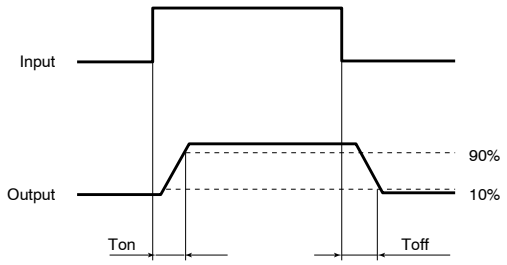
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY210HL(A)	Condition
Input	LED operate current	Typical	I_{Fon}	1.2 mA	I_L = Max.
		Maximum		3.0 mA	
	LED turn off current	Minimum	I_{Foff}	0.4 mA	I_L = Max.
		Typical		1.1 mA	
	LED dropout voltage	Minimum	V_F	1.25 (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Typical		1.5 V	
Output	On resistance	Typical	R_{on}	20Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		25Ω	
	Off state leakage current	Maximum	I_{Leak}	1μA	I_F = 0 mA V_L = Max.
	Current limit	Typical	—	0.18 A	I_F = 5 mA
Transfer characteristics	Turn on time*	Typical	T_{on}	0.5 ms	I_F = 5 mA I_L = Max.
		Maximum		2.0 ms	
	Turn off time*	Typical	T_{off}	0.08 ms	I_F = 5 mA I_L = Max.
		Maximum		1.0 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F= 5 to 10 mA.

For type of connection, see page 56.

*Turn on/Turn off time

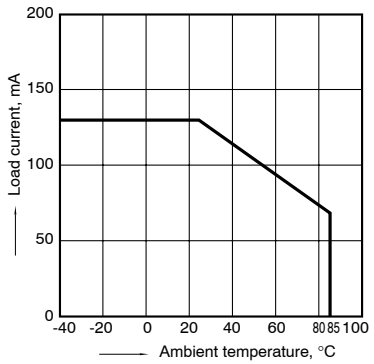


■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

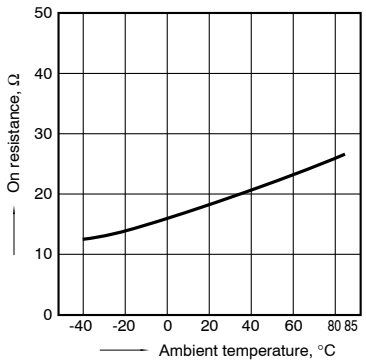
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



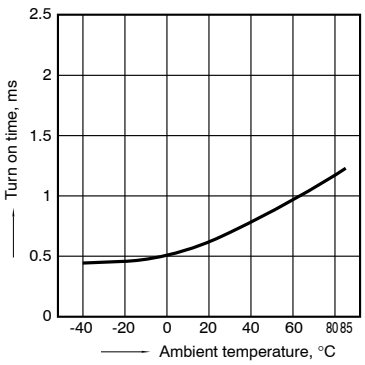
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max.(DC)

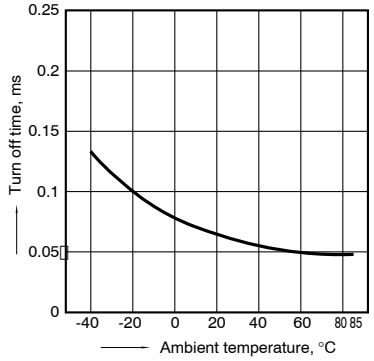


3. Turn on time vs. ambient temperature characteristics

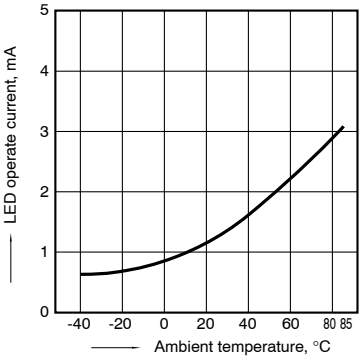
LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



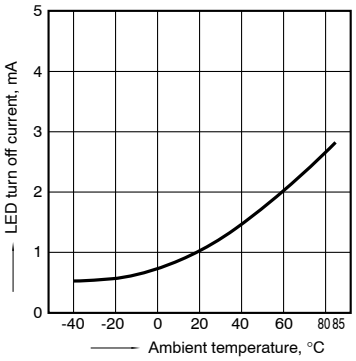
4. Turn off time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



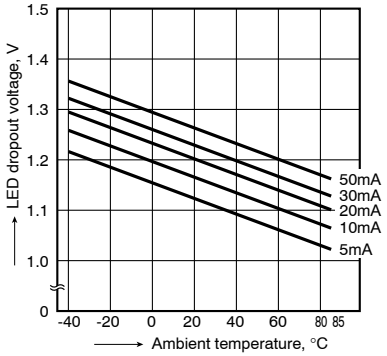
5. LED operate current vs. ambient temperature characteristics
Load voltage: Max.(DC);
Continuous load current: Max.(DC)



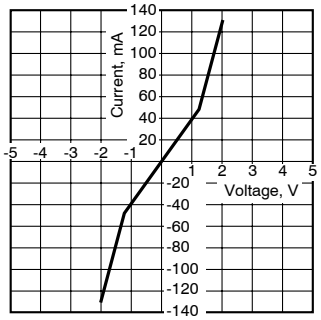
6. LED turn off current vs. ambient temperature characteristics
Load voltage: Max.(DC);
Continuous load current: Max.(DC)



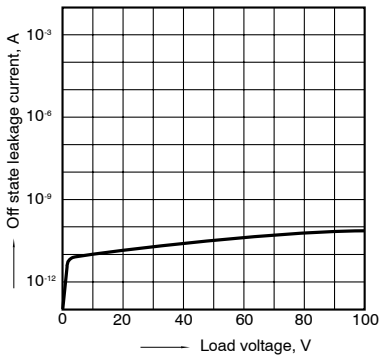
7. LED dropout voltage vs. ambient temperature characteristics
LED current: 5 to 50 mA



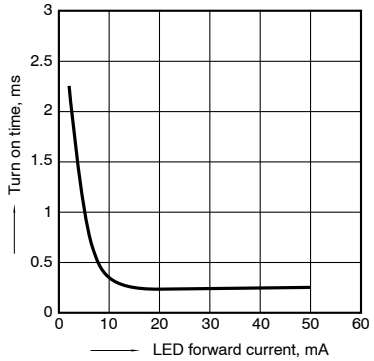
8. Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



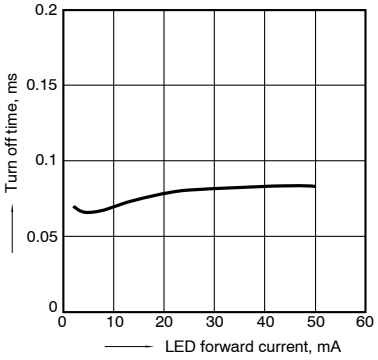
9. Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



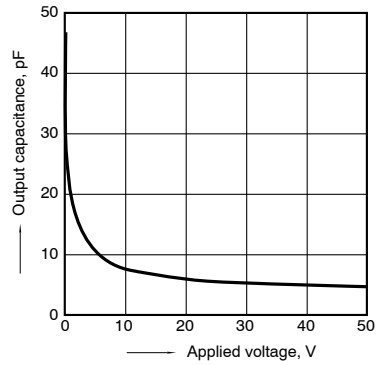
10. Turn on time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4;
Load voltage: Max.(DC); Continuous load current: Max.(DC); Ambient temperature: 25°C 77°F



11. Turn off time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4;
Load voltage: Max.(DC); Continuous load current: Max.(DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 3 and 4;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F

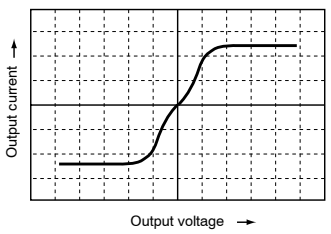


What is current limit

When a load current reaches the specified output control current, a current limit function works against the load current to keep the current a constant value.
The current limit circuit built into the PhotoMOS relay thus controls the instantaneous load current to effectively ensure circuit safety.

This safety feature protects circuits downstream of the PhotoMOS relay against over-current.
But, if the current-limiting feature is used longer than the specified time, the PhotoMOS relay can be destroyed. Therefore, set the output loss to the max. rate or less.
• Comparison of output voltage and output current characteristics

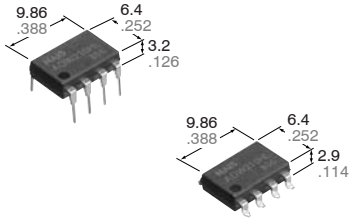
V-I Characteristics



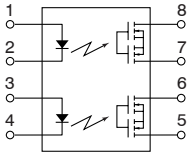
Panasonic
ideas for life

Current Limit Function.
DIP (2 Form A) 8-pin type.
Reinforced insulation
5,000V type.

GU PhotoMOS (AQW210HL)



mm inch



FEATURES

1. Current Limit Function
To control an over current from flowing, the current limit function has been realized. It keeps an output current at a constant value when the current reaches a specified current limit value.

2. Enhancing the capability of surge resistance between output terminals
The current limit function controls the ON time surge current to enhance the capability of surge resistance between output terminals.

3. Reinforced insulation 5,000 V type
More than 0.4 mm internal insulation distance between inputs and outputs. Con-forms to EN41003, EN60950 (reinforced insulation).

4. Compact 8-pin DIP size
The device comes in a compact (W)6.4 × (L)9.86 × (H) 3.2mm (W).252× (L).388 × (H).126inch, 8-pin DIP size (through hole terminal type)

5. Applicable for 2 Form A use as well as two independent 1 Form A use.

6. Controls low-level analog signals

7. High sensitivity, high speed response.
Can control a maximum 0.12 A load current with a 5 mA input current. Fast operation speed of 0.5ms (typ.)

8. Low-level off state leakage current

TYPICAL APPLICATIONS

- Telephone equipment
- Modem

TYPES

Type	I/O isolation voltage	Output rating*		Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
		Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side		
AC/DC type	Reinforced 5,000 V AC	350 V	120 mA	AQW210HL	AQW210HLA	AQW210HLAX	AQW210HLAZ	1 tube contains 40 pcs. 1 batch contains 400 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQW210HL(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	350 V	
	Continuous load current	I_L	0.1 A (0.12 A)	( ): in case of using only 1 channel Peak AC, DC
	Power dissipation	P_{out}	800 mW	
Total power dissipation		P_T	850 mW	
I/O isolation voltage		V_{iso}	5,000 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

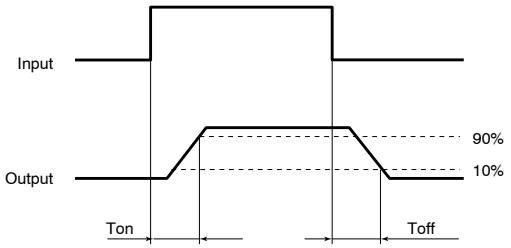
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW210HL(A)	Condition
Input	LED operate current	Typical	I_{Fon}	1.2 mA	I_L = Max.
		Maximum		3.0 mA	
	LED turn off current	Minimum	I_{Foff}	0.4 mA	I_L = Max.
		Typical		1.1 mA	
	LED dropout voltage	Minimum	V_F	1.25 (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Typical		1.5 V	
Output	On resistance	Typical	R_{on}	20Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		25Ω	
	Off state leakage current	Maximum	I_{Leak}	1μA	I_F = 0 mA V_L = Max.
	Current limit	Typical	—	0.18 A	I_F = 5 mA
Transfer characteristics	Turn on time*	Typical	T_{on}	0.5 ms	I_F = 5 mA I_L = Max.
		Maximum		2.0 ms	
	Turn off time*	Typical	T_{off}	0.08 ms	I_F = 5 mA I_L = Max.
		Maximum		1.0 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F= 5 to 10 mA.

For type of connection, see page 57.

*Turn on/Turn off time

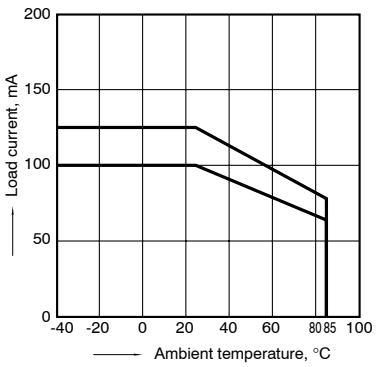


■ **For Dimensions, see page 53.**
■ **For Schematic and Wiring Diagrams, see page 57.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

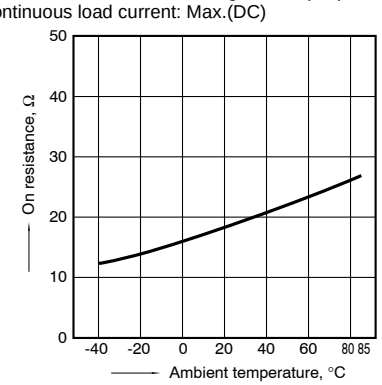
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



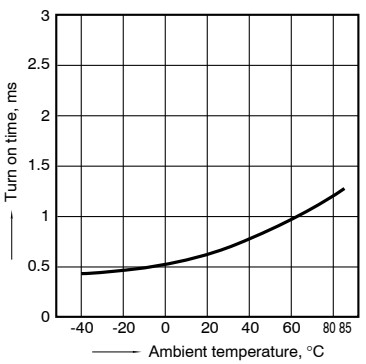
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max.(DC)



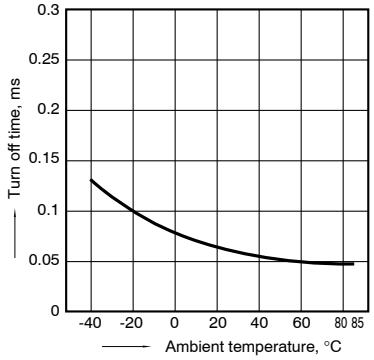
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



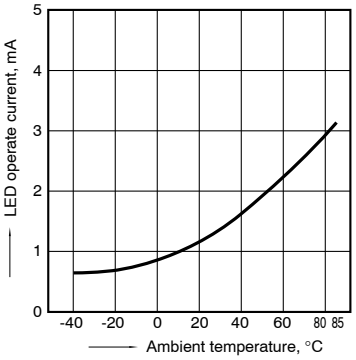
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max.(DC);
Continuous load current: Max.(DC)



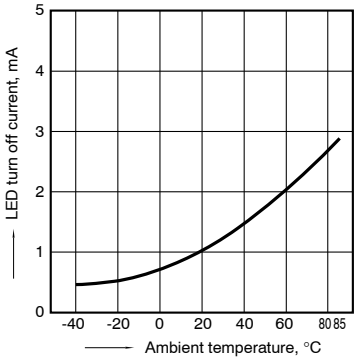
5. LED operate current vs. ambient temperature characteristics

Load voltage: Max.(DC);
Continuous load current: Max.(DC)



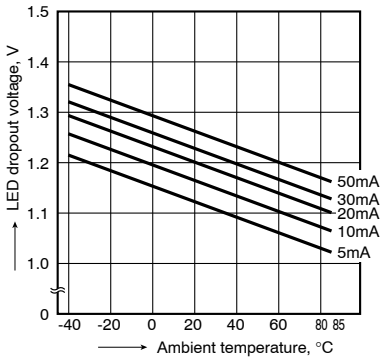
6. LED turn off current vs. ambient temperature characteristics

Load voltage: Max.(DC);
Continuous load current: Max.(DC)



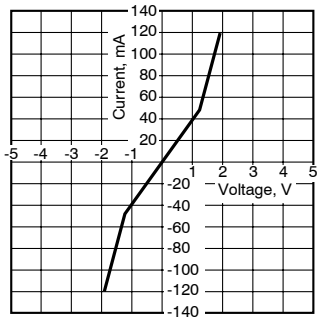
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



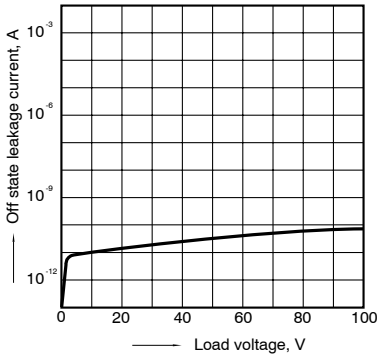
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



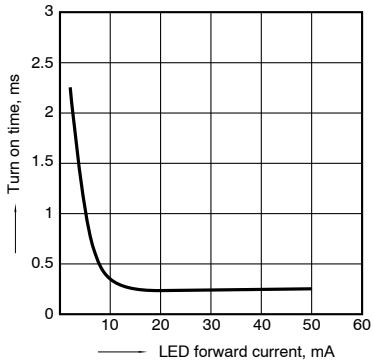
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



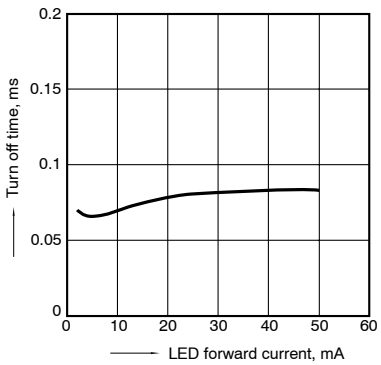
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max.(DC); Continuous load current:
Max.(DC); Ambient temperature: 25°C 77°F



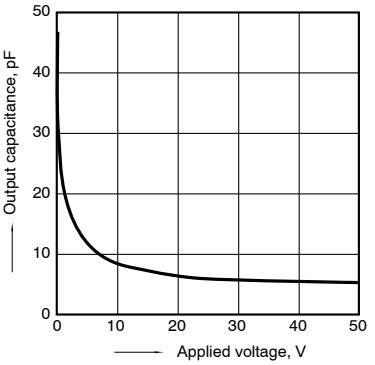
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max.(DC); Continuous load current:
Max.(DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



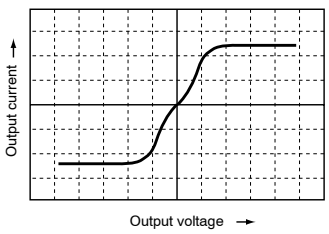
What is current limit

When a load current reaches the specified output control current, a current limit function works against the load current to keep the current a constant value.
The current limit circuit built into the PhotoMOS relay thus controls the instantaneous load current to effectively ensure circuit safety.

This safety feature protects circuits downstream of the PhotoMOS relay against over-current.
But, if the current-limiting feature is used longer than the specified time, the PhotoMOS relay can be destroyed. Therefore, set the output loss to the max. rate or less.

• Comparison of output voltage and output current characteristics

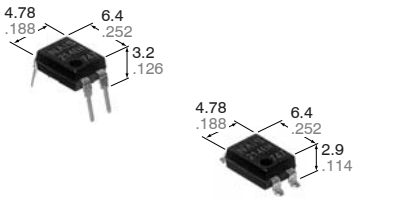
V-I Characteristics



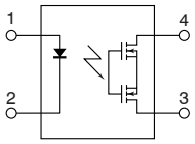
Panasonic
ideas for life

General use and economy type. DIP (1 Form A) 4-pin type. Reinforced insulation 5,000V type.

GU-E PhotoMOS (AQY21○EH)



mm inch



FEATURES

1. Reinforced insulation 5,000 V type
More than 0.4 mm internal insulation distance between inputs and outputs. Con-forms to EN41003, EN60950 (reinforced insulation).

2. Compact 4-pin DIP size
The device comes in a compact (W)6.4×(L)4.78×(H)3.2mm (W).252×(L).188×(H).126inch, 4-pin DIP size.

3. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

4. High sensitivity, low ON resistance
Can control a maximum 0.13 A load current with a 5 mA input current. Low ON resistance of 25Ω (AQY210EH). Stable operation because there are no metallic contact parts.

5. Low-level off state leakage current
The SSR has an off state leakage current of several milliamperes, whereas the PhotoMOS relay has typ. 100 pA even with the rated load voltage of 350 V (AQY210EH).

TYPICAL APPLICATIONS

- Modem
- Telephone equipment
- Security equipment
- Sensors

TYPES

Type	I/O isolation voltage	Output rating*		Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
		Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2-pin side	Picked from the 3/4-pin side		
AC/DC type	Reinforced 5,000 V	30 V	1,000 mA	AQY211EH	AQY211EHA	AQY211EHAX	AQY211EHAZ	1 tube contains 100 pcs. 1 batch contains 1,000 pcs.	1,000 pcs.
		60 V	550 mA	AQY212EH	AQY212EHA	AQY212EHAX	AQY212EHAZ		
		350 V	130 mA	AQY210EH	AQY210EHA	AQY210EHAX	AQY210EHAZ		
		400 V	120 mA	AQY214EH	AQY214EHA	AQY214EHAX	AQY214EHAZ		
		600 V	50 mA	AQY216EH	AQY216EHA	AQY216EHAX	AQY216EHAZ		

*Indicate the peak AC and DC values.
Note: For space reasons, the initial letters of the product number “AQY”, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQY211EH(A)	AQY212EH(A)	AQY210EH(A)	AQY214EH(A)	AQY216EH(A)	Remarks
Input	LED forward current	I_F	50mA					
	LED reverse voltage	V_R	5 V					
	Peak forward current	I_{FP}	1 A					f =100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75mW					
Output	Load voltage (peak AC)	V_L	30 V	60 V	350 V	400 V	600 V	
	Continuous load current	I_L	1 A	0.55 A	0.13 A	0.12 A	0.05 A	
	Peak load current	I_{peak}	3 A	1.5 A	0.4 A	0.3 A	0.15 A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	500mW					
Total power dissipation		P_T	550mW					
I/O isolation voltage		V_{iso}	5,000 V AC					
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F					Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F					

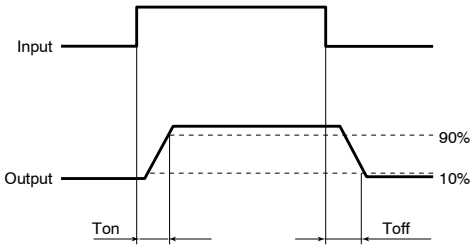
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY211EH(A)	AQY212EH(A)	AQY210EH(A)	AQY214EH(A)	AQY216EH(A)	Condition
Input	LED operate current	Typical	I_{Fon}	1.2mA					I_L=Max.
		Maximum		3.0mA					
	LED turn off current	Minimum	I_{Foff}	0.4mA					I_L=Max.
		Typical		1.1mA					
	LED dropout voltage	Typical	V_F	1.25 (1.14 V at I_F=5mA)					I_F=50mA
		Maximum		1.5V					
Output	On resistance	Typical	R_{on}	0.25Ω	0.85Ω	18Ω	26Ω	52Ω	I_F=5mA I_L=Max. Within 1 s on time
		Maximum		0.5Ω	2.5Ω	25Ω	35Ω	120Ω	
	Off state leakage current	Maximum	I_{Leak}	1μA					I_F=0mA V_L=Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	1.5ms	1ms	0.5ms			I_F=5mA I_L=Max.
		Maximum		5ms	4ms	2.0ms			
	Turn off time*	Typical	T_{off}	0.1ms	0.05ms	0.08ms		0.04ms	I_F=5mA I_L=Max.
		Maximum		1.0ms					
	I/O capacitance	Typical	C_{iso}	0.8pF					f =1MHz V_B =0V
		Maximum		1.5pF					
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000MΩ					500V DC

Note: Recommendable LED forward current I_F=5 to 10mA.

For type of connection, see page 56.

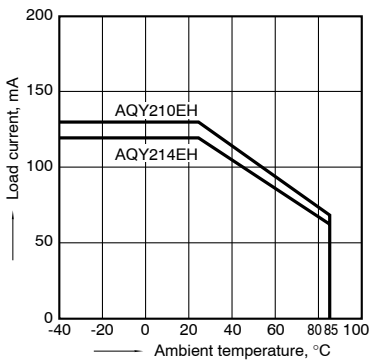
*Turn on/Turn off time



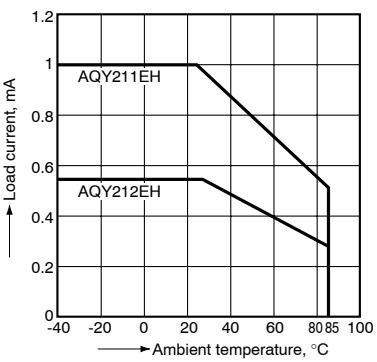
■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

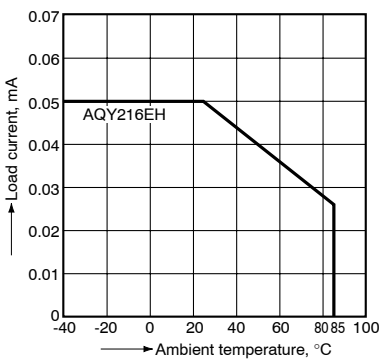
1-(1). Load current vs. ambient temperature characteristics
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



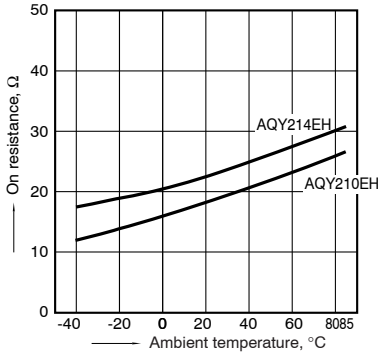
1-(2). Load current vs. ambient temperature characteristics
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



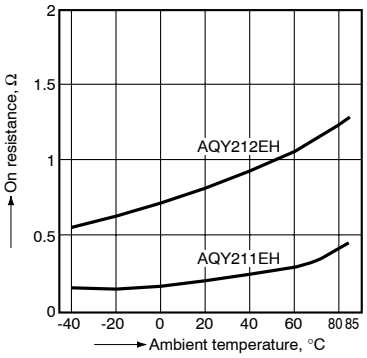
1-(3). Load current vs. ambient temperature characteristics
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



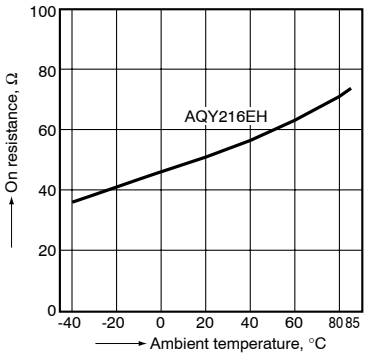
2-(1). On resistance vs. ambient temperature characteristics
Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



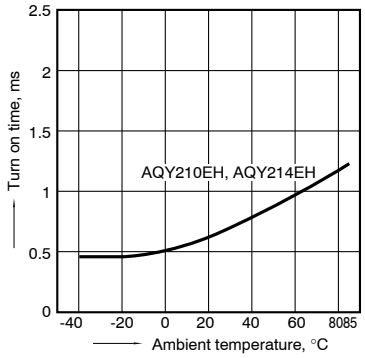
2-(2). On resistance vs. ambient temperature characteristics
Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



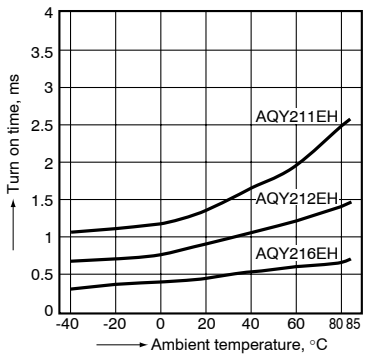
2-(3). On resistance vs. ambient temperature characteristics
Measured portion: between terminals 3 and 4;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



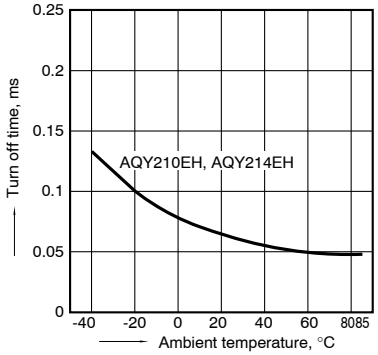
3-(1). Turn on time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



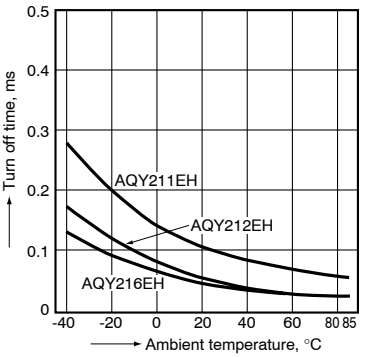
3-(2). Turn on time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



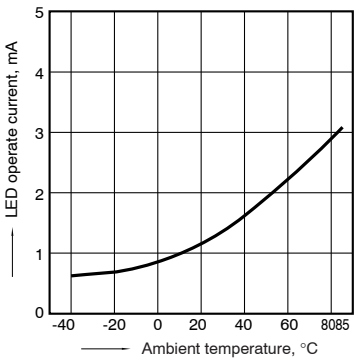
4-(1). Turn off time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



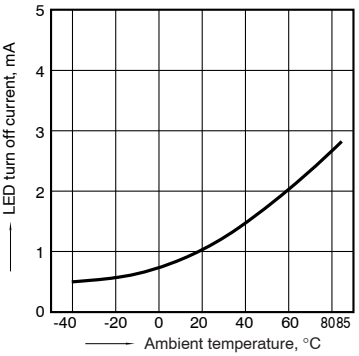
4-(2). Turn off time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



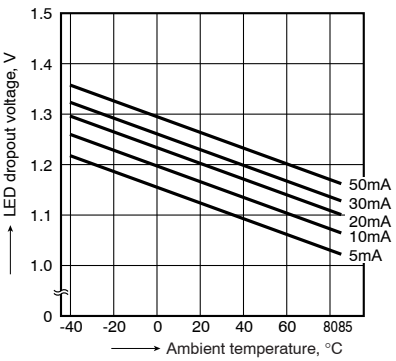
5. LED operate current vs. ambient temperature characteristics
Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



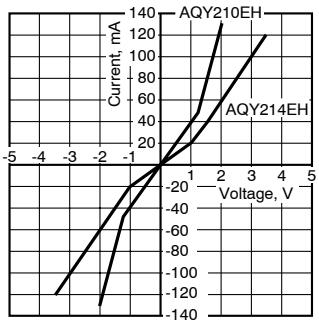
6. LED turn off current vs. ambient temperature characteristics
Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



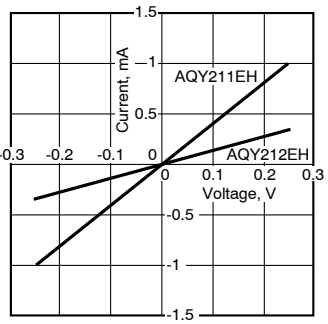
7. LED dropout voltage vs. ambient temperature characteristics
Sample: All types; LED current: 5 to 50 mA



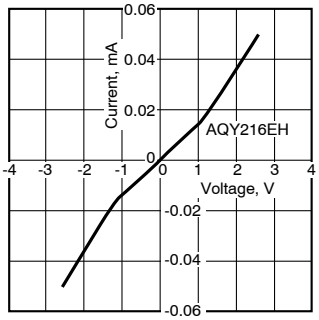
8-(1). Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



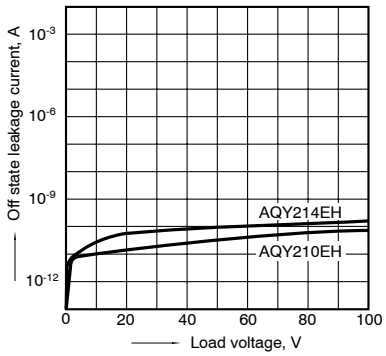
8-(2). Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



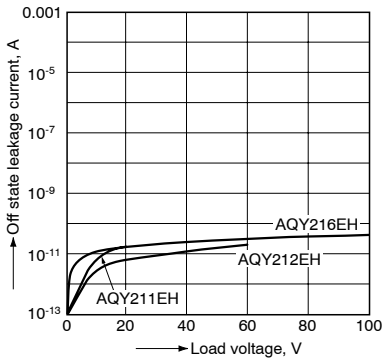
8-(3). Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



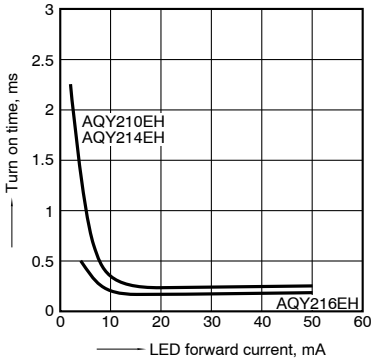
9-(1). Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



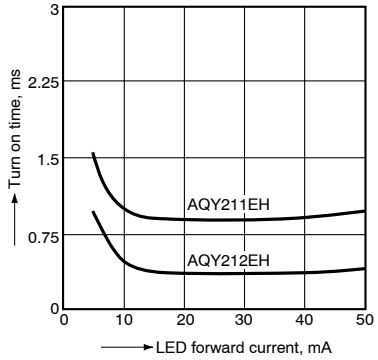
9-(2). Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



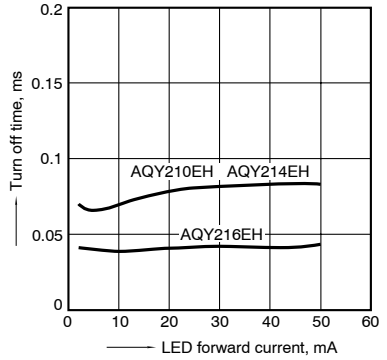
10-(1). Turn on time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



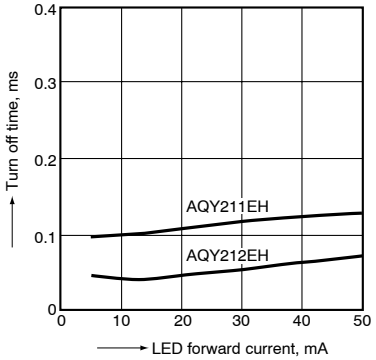
10-(2). Turn on time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



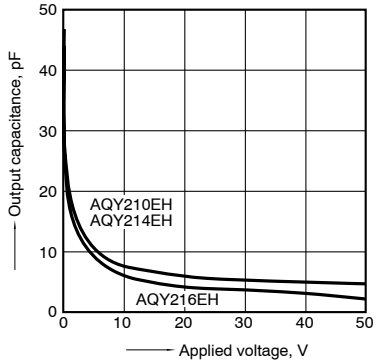
11-(1). Turn off time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



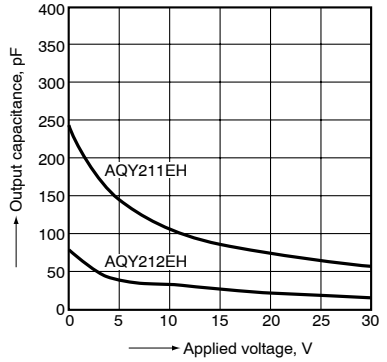
11-(2). Turn off time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



12-(1). Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 3 and 4;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



12-(2). Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 3 and 4;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F

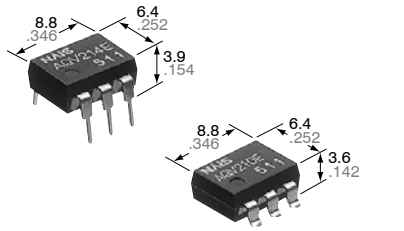


(Standard type) (Reinforced type)

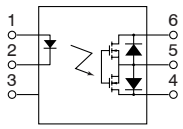
Panasonic
ideas for life

General use and economy type. DIP (1 Form A) 6-pin type. Reinforced insulation 5,000V type.

GU-E PhotoMOS (AQV210E, AQV21❍EH)



mm inch



FEATURES

1. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

2. Control with low-level input signals

3. Controls various types of loads such as relays, motors, lamps and solenoids.

4. Optical coupling for extremely high isolation
Unlike mechanical relays, the PhotoMOS relay combines LED and optoelectronic device to transfer signals using light for extremely high isolation.

5. Eliminates the need for a counter electromotive force protection diode in the drive circuits on the input side

6. Stable on resistance

7. Low-level off state leakage current

8. Eliminates the need for a power supply to drive the power MOSFET
A power supply used to drive the power MOSFET is unnecessary because of the built-in optoelectronic device. This results in easy circuit design and small PC board area.

9. Low thermal electromotive force (Approx. 1 μV)

TYPICAL APPLICATIONS

- High-speed inspection machines
- Telephone equipment
- Data communication equipment
- Computer

TYPES

Type	I/O isolation	Output rating*		Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
		Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC	Standard 1,500 V AC	350 V	130 mA	AQV210E	AQV210EA	AQV210EAX	AQV210EAZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.
		400 V	120 mA	AQV214E	AQV214EA	AQV214EAX	AQV214EAZ		
	Reinforced 5,000 V	350 V	130 mA	AQV210EH	AQV210EHA	AQV210EHAX	AQV210EHAZ		
		400 V	120 mA	AQV214EH	AQV214EHA	AQV214EHAX	AQV214EHAZ		

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

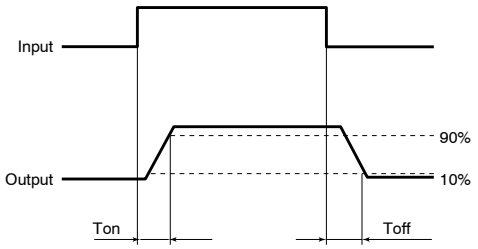
Item			Sym-bol	Type of connec-tion	AQV210E(A)	AQV214E(A)	AQV210EH(A)	AQV214EH(A)	Remarks
Input	LED forward current		I_F		50 mA				
	LED reverse voltage		V_R		5 V				
	Peak forward current		I_{FP}		1 A				f = 100 Hz, Duty factor = 0.1%
	Power dissipation		P_{in}		75 mW				
Output	Load voltage (peak AC)		V_L		350 V	400 V	350 V	400 V	
	Continuous load current		I_L	A	0.13 A	0.12 A	0.13 A	0.12 A	A connection: Peak AC, DC; B, C connection: DC
				B	0.15 A	0.13 A	0.15 A	0.13 A	
				C	0.17 A	0.15 A	0.17 A	0.15 A	
	Peak load current		I_{peak}		0.4 A	0.3 A	0.4 A	0.3 A	A connection: 100 ms (1 shot), V_L=DC
	Power dissipation		P_{out}		500 mW				
Total power dissipation			P_T		550 mW				
I/O isolation voltage			V_{iso}		1,500 V AC		5,000 V AC		
Temperature limits		Operating	T_{opr}		–40°C to +85°C –40°F to +185°F				Non-condensing at low temp.
		Storage	T_{stg}		–40°C to +100°C –40°F to +212°F				

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	Type of connection	AQV210E(A)	AQV214E(A)	AQV210EH(A)	AQV214EH(A)	Condition
Input	LED operate current		Typical	I_{Fon}	—	1.1 mA		1.6 mA		I_L = Max.
			Maximum			3 mA				
	LED turn off current		Minimum	I_{Foff}	—	0.3 mA		0.4 mA		I_L = Max.
			Typical			1.0 mA		1.5 mA		
	LED dropout voltage		Typical	V_F	—	1.25 V (1.14 V at I_F = 5 mA)				I_F = 50 mA
			Maximum			1.5 V				
Output	On resistance		Typical	R_{on}	A	23 Ω	30 Ω	23 Ω	30 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum			35 Ω	50 Ω	35 Ω	50 Ω	
			Typical	R_{on}	B	11.5 Ω	22.5 Ω	11.5 Ω	22.5 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum			17.5 Ω	25 Ω	17.5 Ω	25 Ω	
			Typical	R_{on}	C	6.0 Ω	11.3 Ω	6.0 Ω	11.3 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum			8.8 Ω	12.5 Ω	8.8 Ω	12.5 Ω	
	Output capacitance		Typical	C_{out}	A	45 pF				I_F = 0 mA V_B = 0 V f = 1 MHz
	Off state leakage current		Maximum	—	—	1 μA				I_F = 0 mA V_L = Max.
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	—	0.5 ms		0.7 ms		I_F = 0 mA → 5 mA** I_L = Max.
			Maximum			2.0 ms				
		Turn off time*	Typical	T_{off}	—	0.05 ms				I_F = 0 mA → 5 mA I_L = Max.
			Maximum			1.0 ms				
	I/O capacitance		Typical	C_{iso}	—	0.8 pF				f = 1 MHz V_B = 0 V
			Maximum			1.5 pF				
	Initial I/O isolation resistance		Minimum	R_{iso}	—	1,000 MΩ				500 V DC

*Turn on/Turn off time

For type of connection, see page 56.



** Recommendable LED forward current
Standard type: 5 mA
Reinforced type: 5 to 10 mA

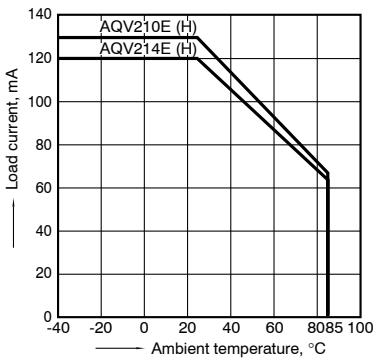
■ For Dimensions, see page 52.
■ For Schematic and Wiring Diagrams, see page 56.
■ For Cautions for Use, see page 63.

REFERENCE DATA

1. Load current vs. ambient temperature characteristics

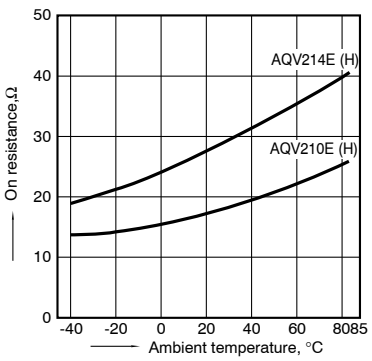
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

Type of connection:A



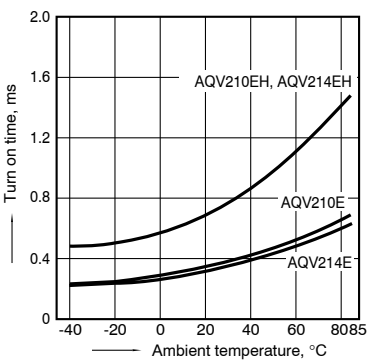
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)

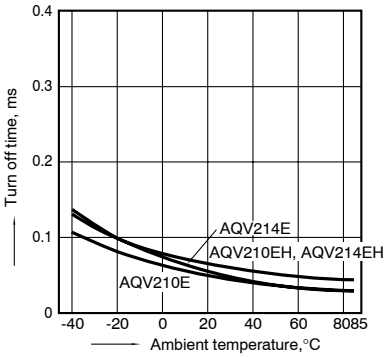


3. Turn on time vs. ambient temperature characteristics

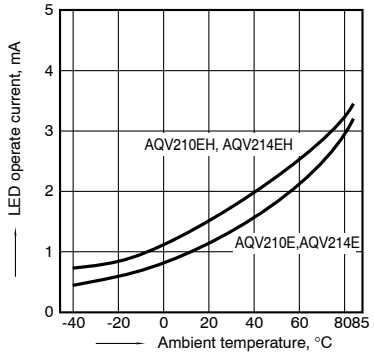
LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



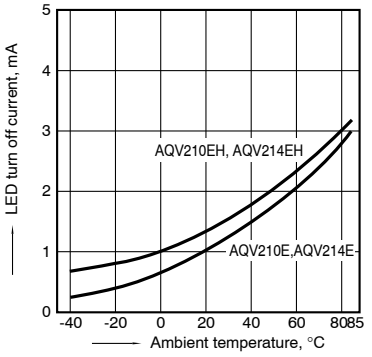
4. Turn off time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



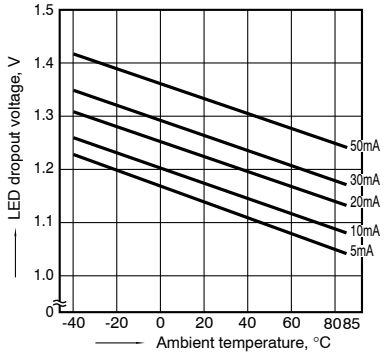
5. LED operate current vs. ambient temperature characteristics
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



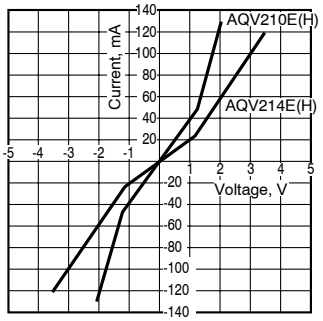
6. LED turn off current vs. ambient temperature characteristics
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



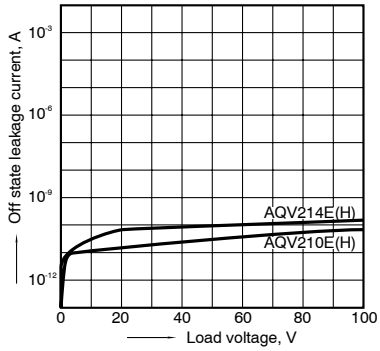
7. LED dropout voltage vs. ambient temperature characteristics
Sample: All types
LED current: 5 to 50 mA



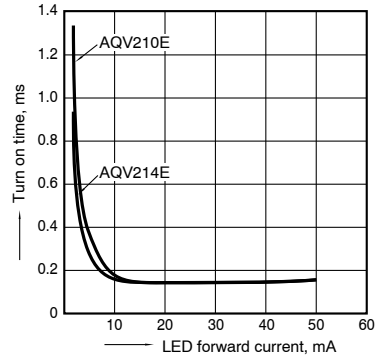
8. Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



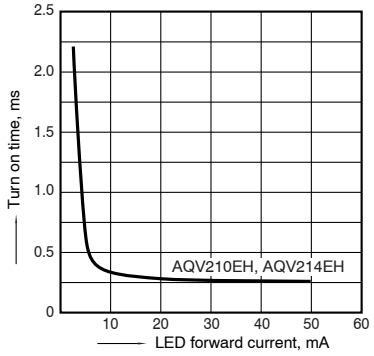
9. Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



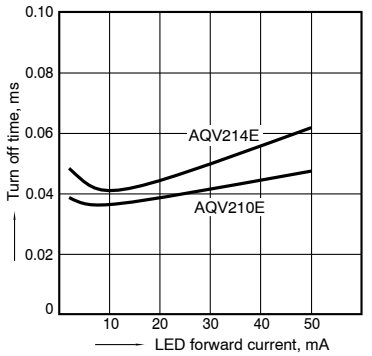
10-(1). Turn on time vs. LED forward current characteristics
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



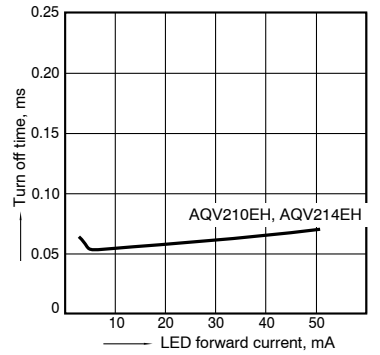
10-(2). Turn on time vs. LED forward current characteristics
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



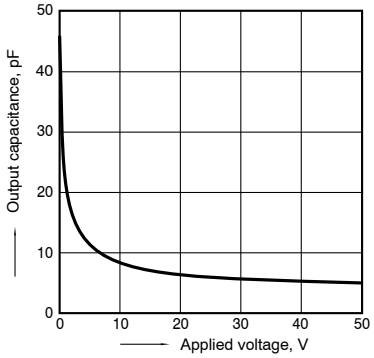
11-(1). Turn off time vs. LED forward current characteristics
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



11-(2). Turn off time vs. LED forward current characteristics
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



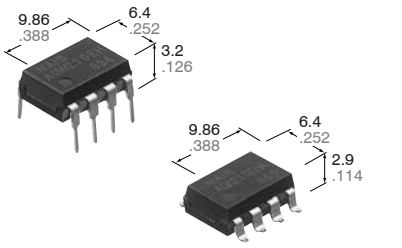
12. Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



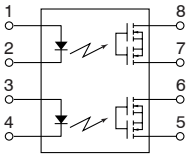
Panasonic
ideas for life

General use and economy type. DIP (2 Form A) 8-pin type. Reinforced insulation 5,000V type.

GU-E PhotoMOS (AQW21❍EH)



mm inch



FEATURES

1. Reinforced insulation 5,000 V type
More than 0.4 mm internal insulation distance between inputs and outputs. Con-forms to EN41003, EN60950 (reinforced insulation).

2. Compact 8-pin DIP size
The device comes in a compact (W)6.4×(L)9.86×(H)3.2 mm (W).252×(L).388×(H).126 inch, 8-pin DIP size (through hole terminal type).

3. Applicable for 2 Form A use as well as two independent 1 Form A use

4. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

5. High sensitivity, high speed response.
Can control a maximum 0.14 A load current with a 5 mA input current. Fast operation speed of 0.5 ms (typical). (AQW210EH)

6. Low-level off state leakage current

TYPICAL APPLICATIONS

- Modem
- Telephone equipment
- Security equipment
- Sensors

TYPES

Type	I/O isolation voltage	Output rating*		Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
		Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side		
AC/DC type	Reinforced 5,000 V	60 V	500 mA	AQW212EH	AQW212EHA	AQW212EHAX	AQW212EHAZ	1 tube contains 40 pcs. 1 batch contains 400 pcs.	1,000 pcs.
		350 V	120 mA	AQW210EH	AQW210EHA	AQW210EHAX	AQW210EHAZ		
		400 V	100 mA	AQW214EH	AQW214EHA	AQW214EHAX	AQW214EHAZ		
		600 V	40 mA	AQW216EH	AQW216EHA	AQW216EHAX	AQW216EHAZ		

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQW212EH(A)	AQW210EH(A)	AQW214EH(A)	AQW216EH(A)	Remarks
Input	LED forward current	I_F	50mA				
	LED reverse voltage	V_R	5V				
	Peak forward current	I_{FP}	1A				f =100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75mW				
Output	Load voltage (peak AC)	V_L	60 V	350 V	400 V	600 V	
	Continuous load current (peak AC)	I_L	0.5 A (0.6 A)	0.12 A (0.14 A)	0.1 A (0.13 A)	0.04 A (0.05 A)	Peak AC, DC ( ): in case of using only 1 channel
	Peak load current	I_{peak}	1.5 A	0.36 A	0.3 A	0.15 A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	800mW				
Total power dissipation		P_T	850mW				
I/O isolation voltage		V_{iso}	5,000 V AC				
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F				Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F				

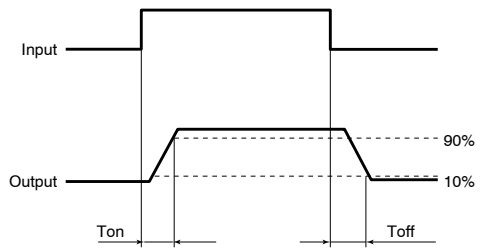
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW212EH(A)	AQW210EH(A)	AQW214EH(A)	AQW216EH(A)	Condition
Input	LED operate current	Typical	I_{Fon}	1.2mA				I_L=Max.
		Maximum		3.0mA				
	LED turn off current	Minimum	I_{Foff}	0.4mA				I_L=Max.
		Typical		1.1mA				
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F=5mA)				I_F=50mA
		Maximum		1.5V				
Output	On resistance	Typical	R_{on}	0.83Ω	18Ω	26Ω	52Ω	I_F=5mA I_L=Max. Within 1 s on time
		Maximum		2.5Ω	25Ω	35Ω	120Ω	
	Off state leakage current	Maximum	I_{Leak}	1μA				I_F=0mA V_L=Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	1ms	0.5ms			I_F=5mA I_L=Max.
		Maximum		4ms	2.0ms			
	Turn off time*	Typical	T_{off}	0.08ms			0.04ms	I_F=5mA I_L=Max.
		Maximum		1.0ms				
	I/O capacitance	Typical	C_{iso}	0.8pF				f =1MHz V_B =0V
		Maximum		1.5pF				
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000MΩ				500V DC

Note: Recommendable LED forward current I_F= 5 to 10mA.

For type of connection, see page 57.

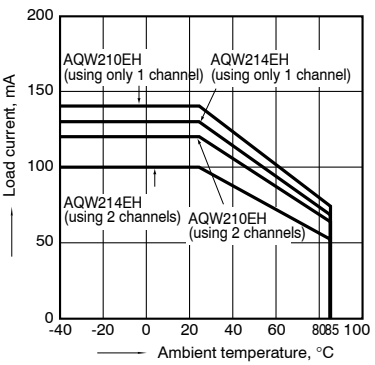
*Turn on/Turn off time



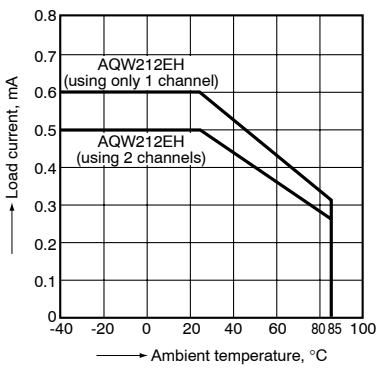
■ **For Dimensions, see page 53.**
■ **For Schematic and Wiring Diagrams, see page 57.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

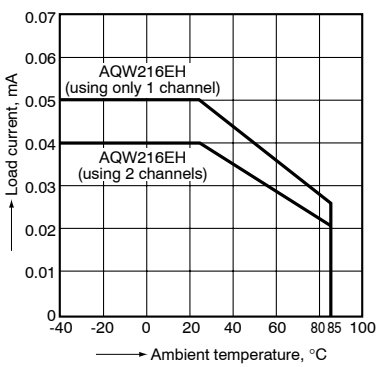
1-(1). Load current vs. ambient temperature characteristics
Allowable ambient temperature: –20°C to +85°C
–4°F to +185°F



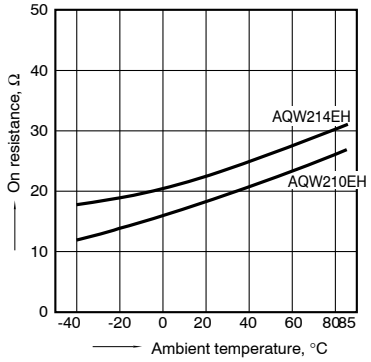
1-(2). Load current vs. ambient temperature characteristics
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



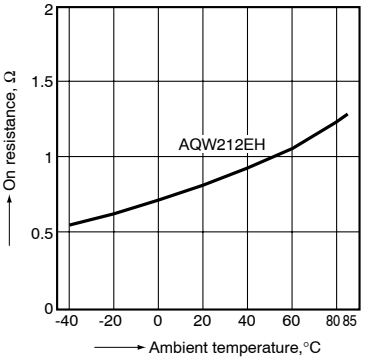
1-(3). Load current vs. ambient temperature characteristics
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



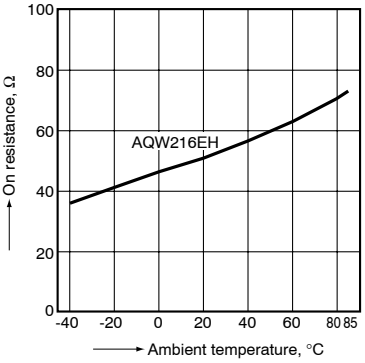
2-(1). On resistance vs. ambient temperature characteristics
Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



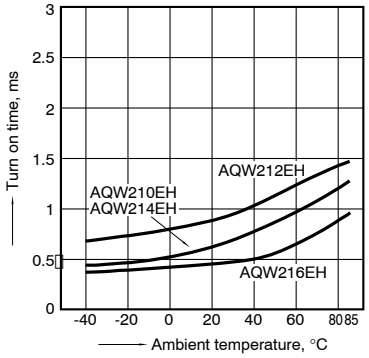
2-(2). On resistance vs. ambient temperature characteristics
Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



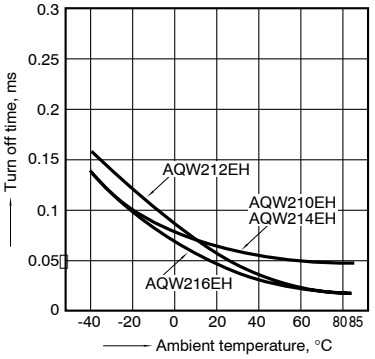
2-(3). On resistance vs. ambient temperature characteristics
Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



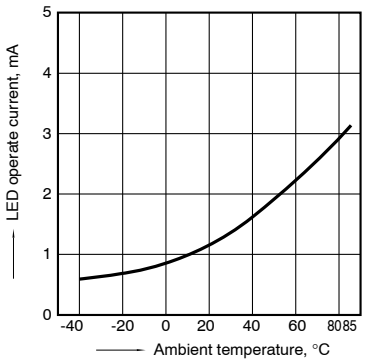
3. Turn on time vs. ambient temperature characteristics
Sample: All types
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



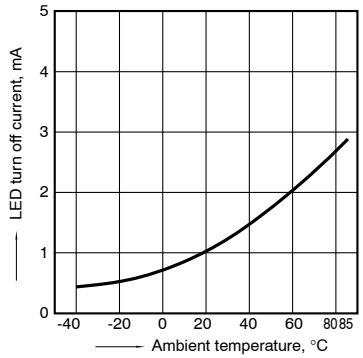
4. Turn off time vs. ambient temperature characteristics
Sample: All types
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



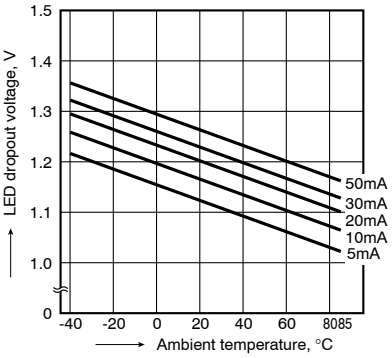
5. LED operate current vs. ambient temperature characteristics
Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



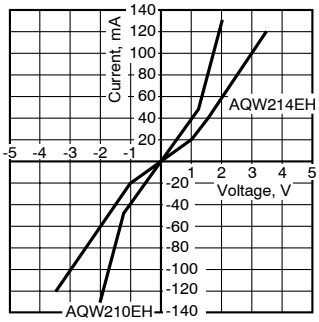
6. LED turn off current vs. ambient temperature characteristics
Sample: All types; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



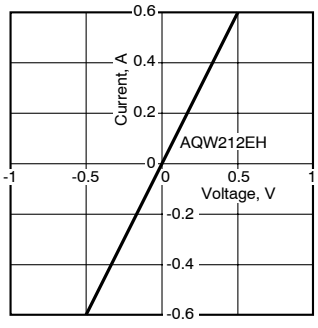
7. LED dropout voltage vs. ambient temperature characteristics
Sample: All types; LED current: 5 to 50 mA



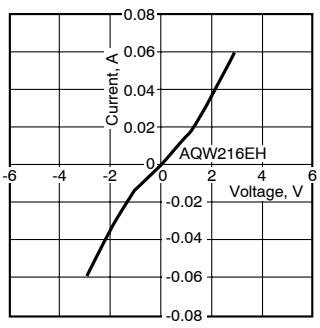
8-(1). Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



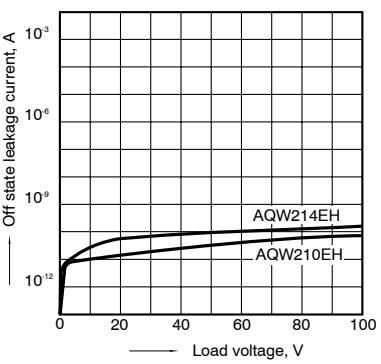
8-(2). Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



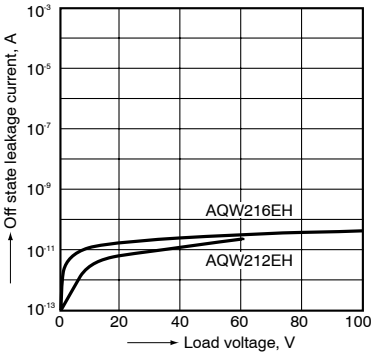
8-(3). Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



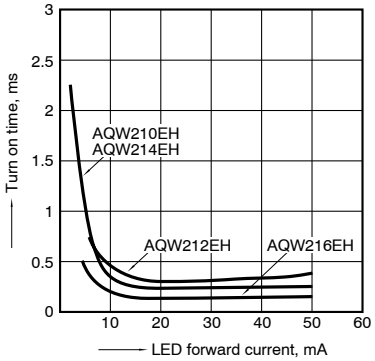
9-(1). Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



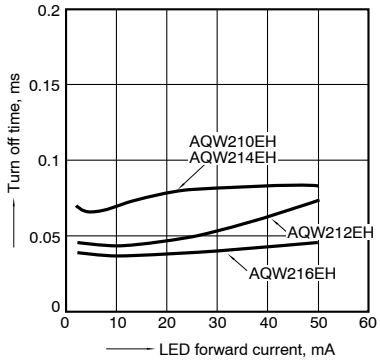
9-(2). Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



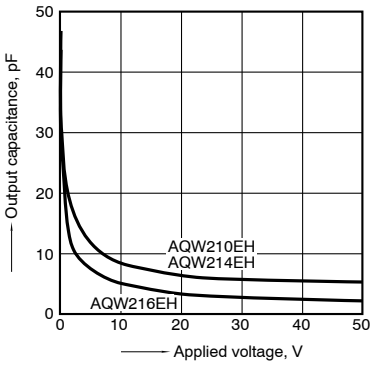
10. Turn on time vs. LED forward current characteristics
Sample: All types
Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



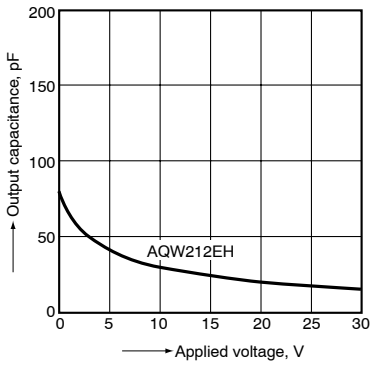
11. Turn off time vs. LED forward current characteristics
Sample: All types
Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



12-(1). Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



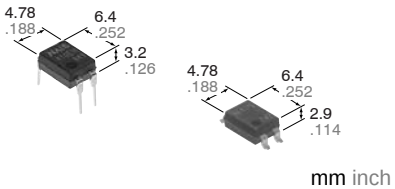
12-(2). Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



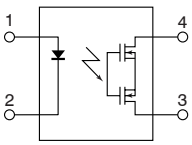
Panasonic
ideas for life

General use and economy type. DIP (1 Form B) 4-pin type. Reinforced insulation 5,000V type.

GU-E PhotoMOS (AQY41❍EH)



mm inch



FEATURES

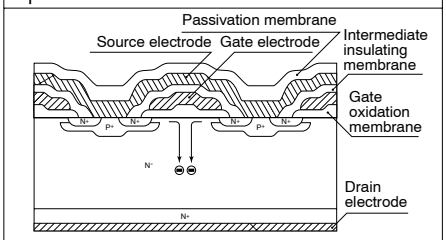
1. 60V type couples high capacity (0.55A) with low on-resistance (1Ω)

Item	GU-E type	
Part No.	AQY410EH	AQY412EH NEW
Load voltage	350V	60V
Continuous load current	0.13A	0.55A
ON resistance (typ.)	18Ω	1Ω

2. This is the low-cost version PhotoMOS 1 Form B output type relay.
The attainment of economical pricing will broaden its market even further.

3. Normally closed type (1 Form B) is low on-resistance.
(All AQ❍4 PhotoMOS are Form B types. And also the Form A types have a low on-resistance.)
This has been realized thanks to the built-in MOSFET processed by our proprietary method, DSD (Double-diffused and Selective Doping) method. Cross section of the normally-closed type of power MOS

Cross section of the normally-closed type of power MOS



4. Reinforced insulation 5,000 V type
More than 0.4 mm internal insulation distance between inputs and outputs. Conforms to EN41003, EN60950 (reinforced insulation).

5. Compact 4-pin DIP size
The device comes in a compact (W)6.4×(L)4.78×(H)3.2mm (W).252×(L).188×(H).126inch, 4-pin DIP size

6. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

7. High sensitivity, low ON resistance
Can control a maximum 0.13 A load current with a 5 mA input current. Low ON resistance of 18Ω (AQY410EH). Stable operation because there are no metallic contact parts.

6. Low-level off-state leakage current

TYPICAL APPLICATIONS

- Power supply
- Measuring equipment
- Security equipment
- Modem
- Telephone equipment
- Electricity, plant equipment
- Sensors

TYPES

Type	I/O isolation voltage	Output rating*		Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
		Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2-pin side	Picked from the 3/4-pin side		
AC/DC type	Reinforced 5,000 V	60 V	550 mA	AQY412EH	AQY412EHA	AQY412EHAX	AQY412EHAZ	1 tube contains 100 pcs. 1 batch contains 1,000 pcs.	1,000 pcs.
		350 V	130 mA	AQY410EH	AQY410EHA	AQY410EHAX	AQY410EHAZ		
		400 V	120 mA	AQY414EH	AQY414EHA	AQY414EHAX	AQY414EHAZ		

*Indicate the peak AC and DC values.

Note: For space reasons, the initial letters of the product number “AQY”, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

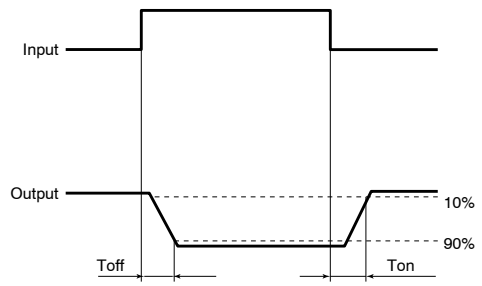
Item		Symbol	AQY412EH (A)	AQY410EH (A)	AQY414EH (A)	Remarks
Input	LED forward current	I_F	50 mA			
	LED reverse voltage	V_R	5 V			
	Peak forward current	I_{FP}	1 A			f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW			
Output	Load voltage (peak AC)	V_L	60 V	350 V	400 V	
	Continuous load current	I_L	0.55 A	0.13 A	0.12 A	
	Peak load current	I_{peak}	1.5 A	0.4 A	0.3 A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	500 mW			
Total power dissipation		P_T	550 mW			
I/O isolation voltage		V_{iso}	5,000 V AC			
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F			Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F			

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY412EH (A)	AQY410EH (A)	AQY414EH (A)	Condition
Input	LED operate (OFF) current	Typical	I_{Foff}	1.4 mA			I_L=Max.
		Maximum		3.0 mA			
	LED reverse (ON) current	Minimum	I_{Fon}	0.4 mA			I_L=Max.
		Typical		1.3 mA			
	LED dropout voltage	Typical	V_F	1.25 (1.14 V at I_F = 5 mA)			I_F = 50 mA
		Maximum		1.5 V			
Output	On resistance	Typical	R_{on}	1Ω	18Ω	26Ω	I_F = 0 mA I_L = Max. Within 1 s on time
		Maximum		2.5Ω	25Ω	35Ω	
	Off state leakage current	Maximum	I_{Leak}	10μA			I_F = 5 mA V_L = Max.
Transfer characteristics	Operate (OFF) time*	Typical	T_{off}	3.0 ms	1.0 ms	0.8 ms	I_F = 0 mA › 5 mA I_L = Max.
		Maximum		10.0 ms	3.0 ms		
	Reverse (ON) time*	Typical	T_{on}	0.2 ms	0.3 ms	0.2 ms	I_F = 5 mA › 0 mA I_L = Max.
		Maximum		1.0 ms			
	I/O capacitance	Typical	C_{iso}	0.8 pF			f =1MHz V_B = 0 V
		Maximum		1.5 pF			
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000MΩ			500 V DC

Note: Recommendable LED forward current I_F = 5 to 10mA. For type of connection, see page 57.

*Operate/Reverse time

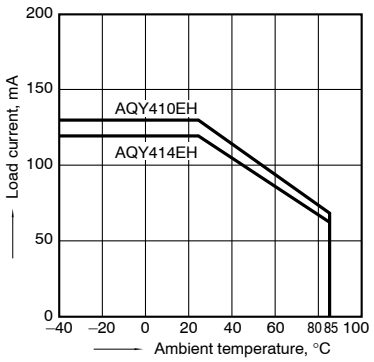


■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 57.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

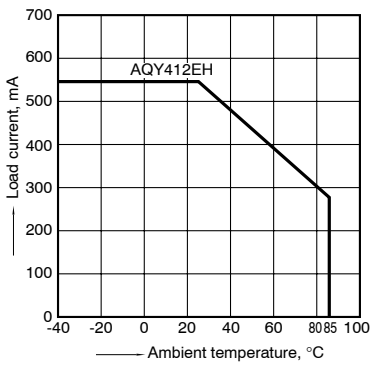
1-(1). Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



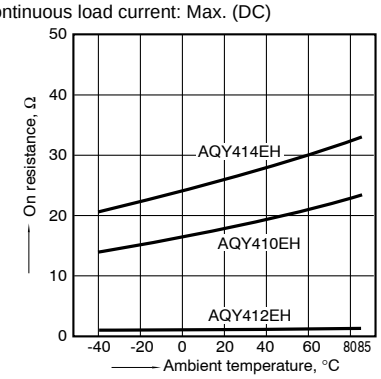
1-(2). Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



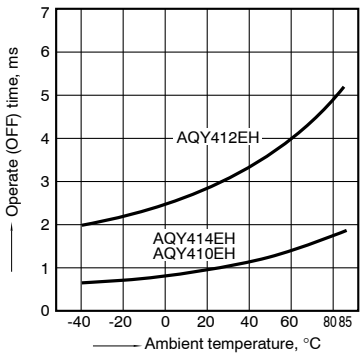
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
LED current: 0 mA; Load voltage: Max.(DC);
Continuous load current: Max. (DC)



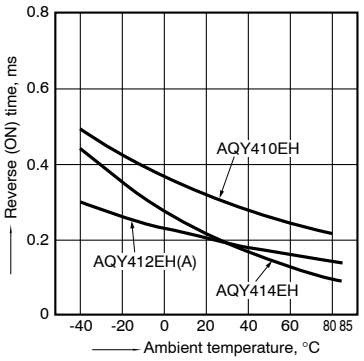
3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



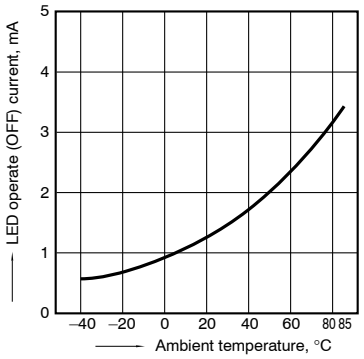
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



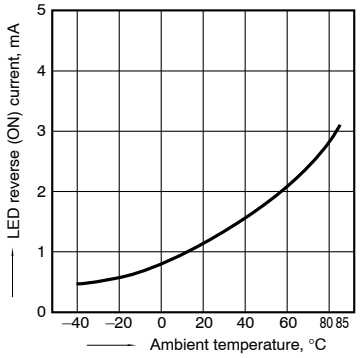
5. LED operate (OFF) current vs. ambient temperature characteristics

Sample: All types;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



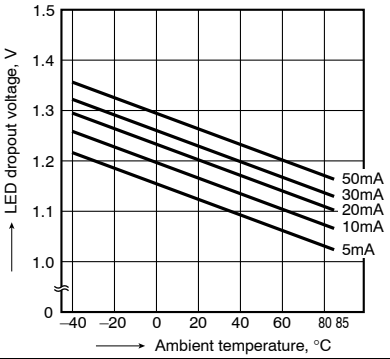
6. LED reverse (ON) current vs. ambient temperature characteristics

Sample: All types;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



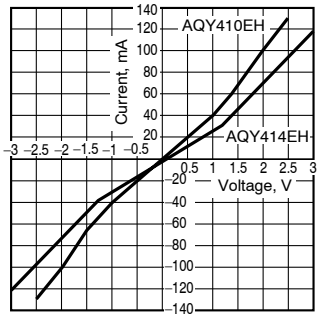
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



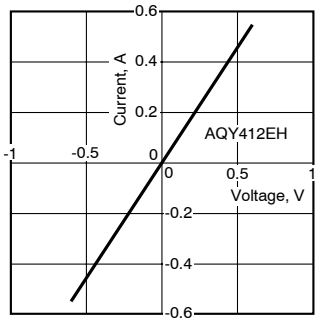
8-(1). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



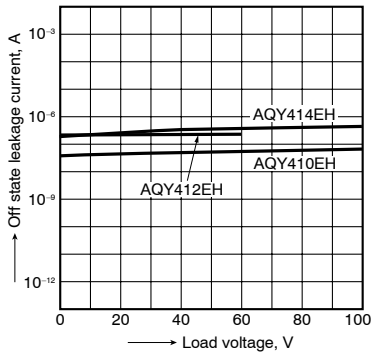
8-(2). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



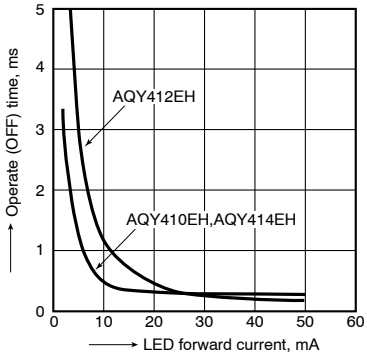
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4;
Ambient temperature: 25°C 77°F



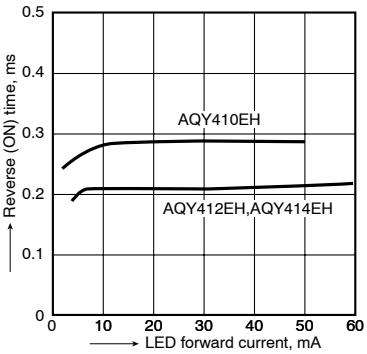
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



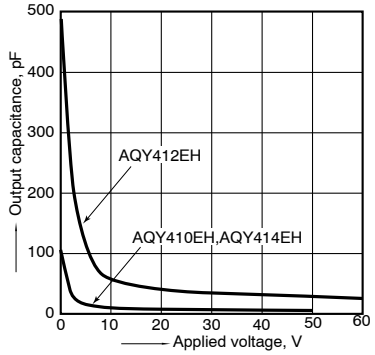
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 3 and 4;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F

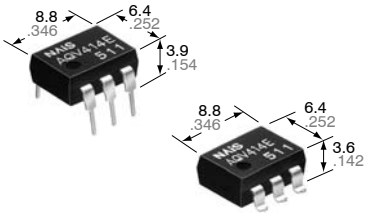


(AQV412EH) (Standard type) (AQV410EH, 414EH) (AQV410EH, 414EH) (Reinforced type)

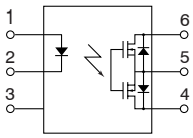
Panasonic
ideas for life

General use and economy type. DIP (1 Form B) 6-pin type. Reinforced insulation 5,000V type.

GU-E PhotoMOS (AQV414E, AQV41❍EH)



mm inch



FEATURES

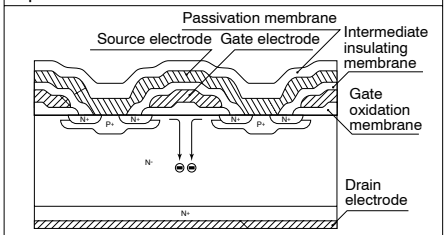
1. 60V type couples high capacity (0.55A) with low on-resistance (1Ω).

Item	GU-E (1 Form B type) type	NEW
Part No.	AQV410EH	AQV412EH
Load voltage	350V	60V
Continuous load current	0.13A	0.55A
ON resistance (typ.)	18Ω	1Ω

2. This is the low-cost version PhotoMOS 1 Form B output type relay.
Compared to the previous GU PhotoMOS 1 Form B type relay, the attainment of an economical price that is approximately 22% lower will further broaden its market.

3. Normally closed type (2 Form B) is low on-resistance.
(All AQ❍4 PhotoMOS are Form B types. And also the Form A types have a low on-resistance.)
This has been realized thanks to the built-in MOSFET processed by our proprietary method, DSD (Double-diffused and Selective Doping) method.

Cross section of the normally-closed type of power MOS



4. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

5. High sensitivity, low ON resistance
Can control a maximum 0.13 A load current with a 5 mA input current. Low ON resistance of 18 Ω (AQV410EH). Stable operation because there are no metallic contact parts.

6. Low-level off-state leakage current
The SSR has an off-state leakage current of several milliamperes, whereas the PhotoMOS relay has typ. 100 pA even with the rated load voltage of 400 V (AQV414E).

7. Reinforced insulation 5,000 V type also available.
More than 0.4 mm internal insulation distance between inputs and outputs. Conforms to EN41003, EN60950 (reinforced insulation).

TYPICAL APPLICATIONS

- Power supply
- Measuring equipment
- Security equipment
- Telephone equipment
- Sensors

TYPES

Type	I/O isolation voltage	Output rating*		Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
		Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC type	1,500 V AC (Standard)	400 V	120 mA	AQV414E	AQV414EA	AQV414EAX	AQV414EAZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.
	5,000 V AC (Reinforced)	60 V	550 mA	AQV412EH	AQV412EHA	AQV412EHAX	AQV412EHAZ		
		350 V	130 mA	AQV410EH	AQV410EHA	AQV410EHAX	AQV410EHAZ		
		400 V	120 mA	AQV414EH	AQV414EHA	AQV414EHAX	AQV414EHAZ		

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV414E(A)	AQV412EH(A)	AQV410EH(A)	AQV414EH(A)	Remarks
Input	LED forward current	I_F		50 mA				
	LED reverse voltage	V_R		5 V				
	Peak forwrd current	I_{FP}		1 A				f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW				
Output	Load voltage (peak AC)	V_L		400 V	60 V	350 V	400 V	
	Continuous load current	I_L	A	0.12 A	0.55 A	0.13 A	0.12 A	A connection: Peak AC, DC B,C connection: DC
			B	0.13 A	0.65 A	0.15 A	0.13 A	
			C	0.15 A	0.8 A	0.17 A	0.15 A	
	Peak load current	I_{peak}		0.3 A	1.5 A	0.4 A	0.3 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}		500 mW				
Total power dissipation		P_T		550 mW				
I/O isolation voltage		V_{iso}		1,500 V AC	5,000 V AC			
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F				Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F				

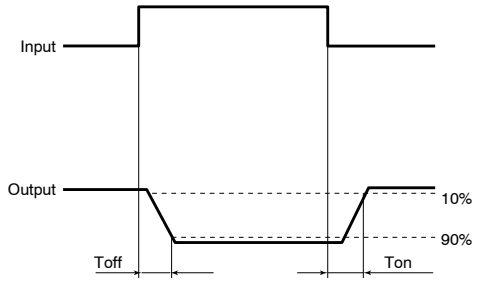
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	Type of connection	AQV414E(A)	AQV412EH(A)	AQV410EH(A)	AQV414EH(A)	Condition
Input	LED operate (OFF) current		Typical	I_{Foff}	—	1.45 mA	1.9 mA	1.9 mA	1.9 mA	I_L= Max.
			Maximum			3.0 mA				
	LED reverse (ON) current		Minimum	I_{Fon}	—	0.3 mA	0.4 mA	0.4 mA	0.4 mA	I_L= Max.
			Typical			1.40 mA	1.8 mA	1.8 mA	1.8 mA	
	LED dropout voltage		Typical	V_F	—	1.25 V (1.14 V at I_F= 5 mA)				I_F= 50 mA
			Maximum			1.5 V				
Output	On resistance		Typical	R_{on}	A	26 Ω	1 Ω	18 Ω	25.2 Ω	I_F = 0 mA I_L= Max. Within 1 s on time
			Maximum			50 Ω	2.5 Ω	35 Ω	50 Ω	
			Typical	R_{on}	B	20 Ω	0.55 Ω	13 Ω	19 Ω	I_F= 0 mA I_L= Max. Within 1 s on time
			Maximum			25 Ω	1.3 Ω	17.5 Ω	25 Ω	
			Typical	R_{on}	C	10 Ω	0.3 Ω	6.5 Ω	10 Ω	I_F= 0 mA I_L= Max. Within 1 s on time
			Maximum			12.5 Ω	0.7 Ω	8.8 Ω	12.5 Ω	
	Off state leakage current		Maximum	I_{Leak}	—	1 μA	10 μA	10 μA	10 μA	I_F= 5 mA V_L = Max.
Transfer characteristics	Switching speed	Operate (OFF) time*	Typical	T_{off}	—	0.7 ms	3 ms	1.5 ms	1.3 ms	I_F = 0 mA › 5 mA I_L = Max.
			Maximum			2.0 ms	10 ms	3.0 ms	3.0 ms	
		Reverse (ON) time*	Typical	T_{on}	—	0.1 ms	0.3 ms	0.3 ms	0.3 ms	I_F= 5 mA › 0 mA I_L = Max.
			Maximum			1.0 ms	1.5 ms	1.5 ms	1.5 ms	
	I/O capacitance		Typical	C_{iso}	—	0.8 pF				f = 1 MHz V_B = 0 V
			Maximum			1.5 pF				
	Initial I/O isolation resistance		Minimum	R_{iso}	—	1,000 MΩ				500 V DC

Note: Recommendable LED forward current
Standard type I_F = 5 mA
Reinforced type I_F = 5 to 10 mA

For type of connection, see page 57.

*Operate/Reverse time



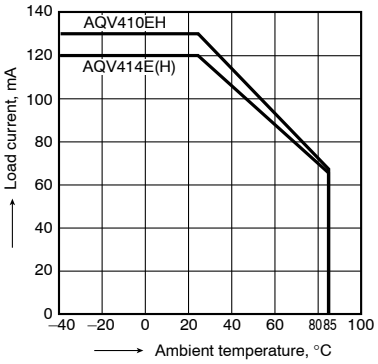
■ For Dimensions, see page 52.
■ For Schematic and Wiring Diagrams, see page 57.
■ For Cautions for Use, see page 63.

REFERENCE DATA

1-(1). Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

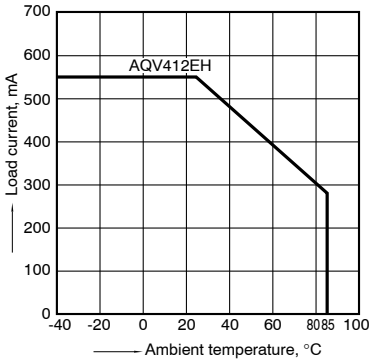
Type of connection: A



1-(2). Load current vs. ambient temperature characteristics

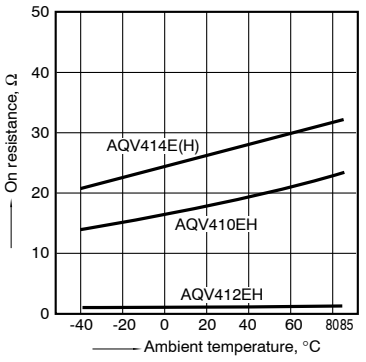
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

Type of connection: A



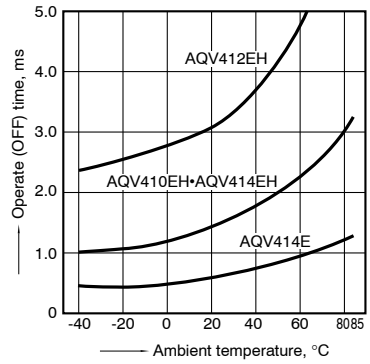
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 0 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



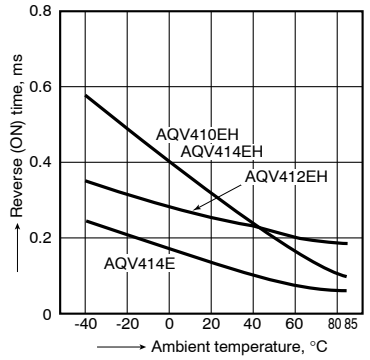
3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



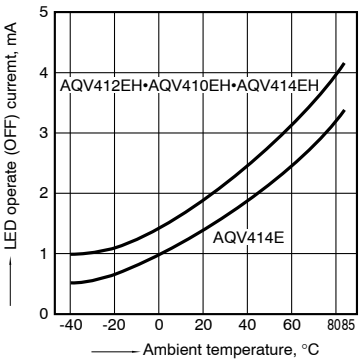
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



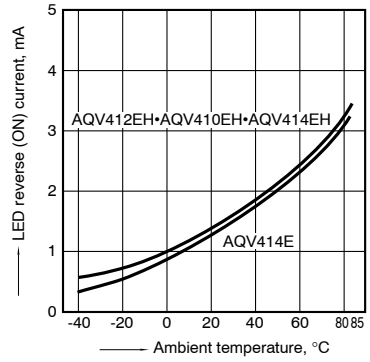
5. LED operate (OFF) current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



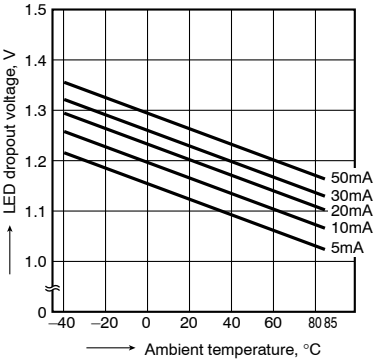
6. LED reverse (ON) current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



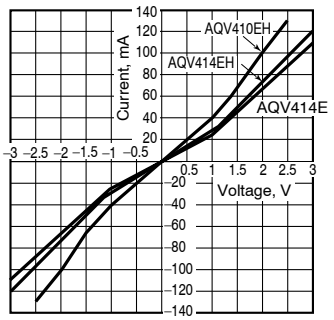
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types;
LED current: 5 to 50 mA



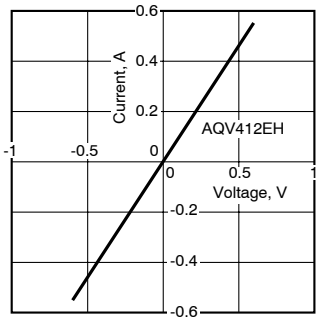
8-(1). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



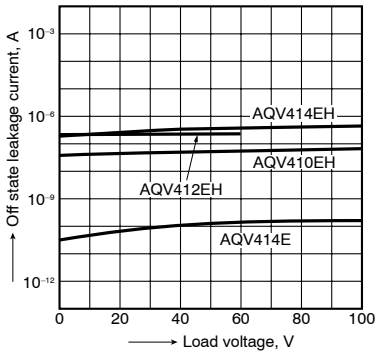
8-(2). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



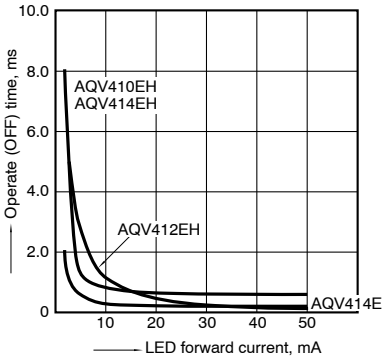
9. Off state leakage current vs. load voltage characteristics

Sample: All types;
Measured portion: between terminals 4 and 6;
LED current: 5 mA; Ambient temperature: 25°C 77°F



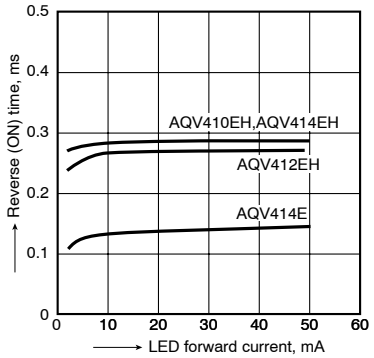
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



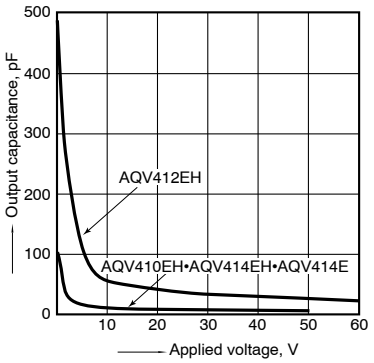
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

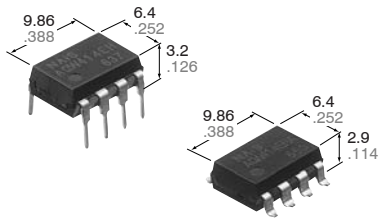
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



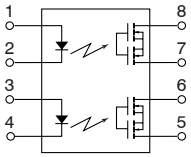
Panasonic
ideas for life

General use and economy type. DIP (2 Form B) 8-pin type. Reinforced insulation 5,000V type.

GU-E PhotoMOS (AQW414EH)



mm inch



FEATURES

1. Reinforced insulation 5,000 V type
More than 0.4 mm internal insulation distance between inputs and outputs. Con-forms to EN41003, EN60950 (reinforced insulation).

2. Compact 8-pin DIP size
The device comes in a compact (W)6.4×(L)9.86×(H)3.2 mm (W).252×(L).388×(H).126 inch, 8-pin DIP size (through hole terminal type).

3. Applicable for 2 Form B use as well as two independent 1 Form B use

4. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

5. High sensitivity, high speed response.
Can control a maximum 0.13 A load current with a 5 mA input current. Fast operation speed of 0.8 ms (typical).

6. Low-level off state leakage current

TYPICAL APPLICATIONS

- Modem
- Telephone equipment
- Security equipment
- Sensors

TYPES

Type	I/O isolation voltage	Output rating*		Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
		Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side		
AC/DC type	Reinforced 5,000 V	400 V	100 mA	AQW414EH	AQW414EHA	AQW414EHAX	AQW414EHAZ	1 tube contains 40 pcs. 1 batch contains 400 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQW414EH (A)	Remarks
Input	LED forward current	I_F	50mA	
	LED reverse voltage	V_R	5V	
	Peak forward current	I_{FP}	1A	f =100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75mW	
Output	Load voltage (peak AC)	V_L	400 V	
	Continuous load current	I_L	0.1 A (0.13 A)	Peak AC, DC ( ): in case of using only 1 channel.
	Peak load current	I_{peak}	0.3 A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	800mW	
Total power dissipation		P_T	850mW	
I/O isolation voltage		V_{iso}	5,000 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

07/2005

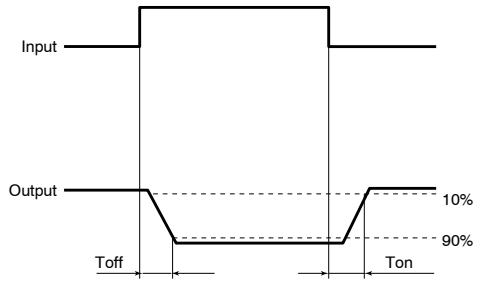
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW414EH (A)	Condition
Input	LED operate (OFF) current	Typical	I_{Foff}	1.3mA	I_L=Max.
		Maximum		3.0mA	
	LED reverse (ON) current	Minimum	I_{Fon}	0.4mA	I_L=Max.
		Typical		1.2mA	
	LED dropout voltage	Typical	V_F	1.25 (1.14 V at I_F=5mA)	I_F=50mA
		Maximum		1.5V	
Output	On resistance	Typical	R_{on}	26Ω	I_F=0mA I_L=Max. Within 1 s on time
		Maximum		35Ω	
	Off state leakage current	Maximum	I_{Leak}	10μA	I_F=5mA V_L=Max.
Transfer characteristics	Turn on time*	Typical	T_{off}	0.8ms	I_F=0mA›5mA I_L=Max.
		Maximum		3.0ms	
	Turn off time*	Typical	T_{on}	0.2ms	I_F=5mA›0mA I_L=Max.
		Maximum		1.0ms	
	I/O capacitance	Typical	C_{iso}	0.8pF	f =1MHz V_B =0V
		Maximum		1.5pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000MΩ	500V DC

Note: Recommendable LED forward current I_F= 5 to 10mA.

For type of connection, see page 58.

*Operate/Reverse time

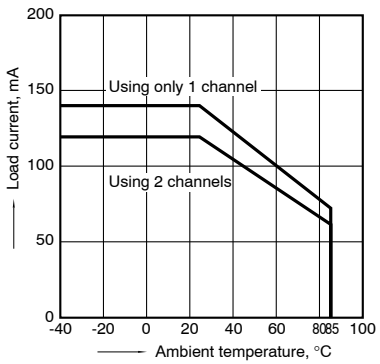


■ **For Dimensions, see page 53.**
■ **For Schematic and Wiring Diagrams, see page 58.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

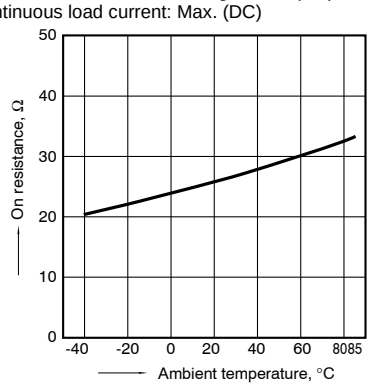
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



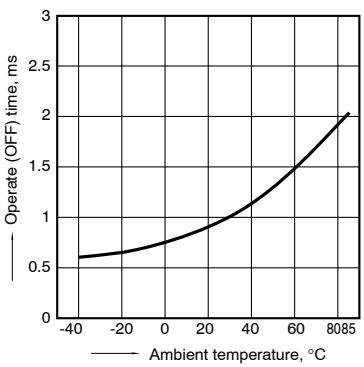
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 0 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



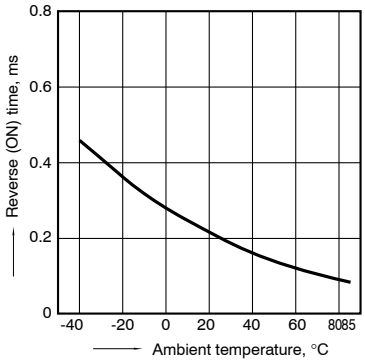
3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



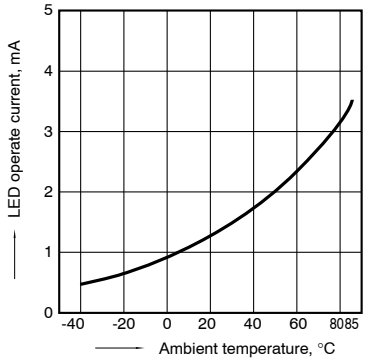
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



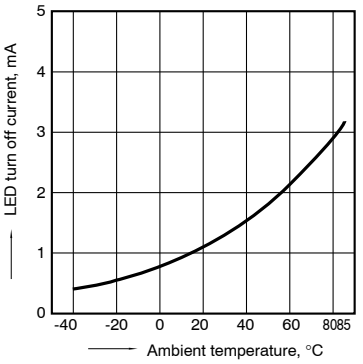
5. LED operate current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



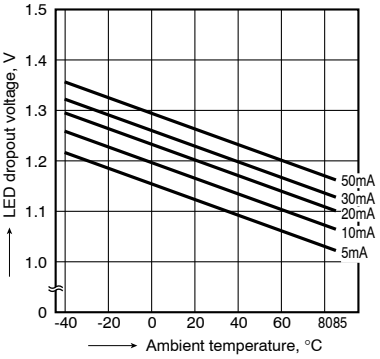
6. LED turn off current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



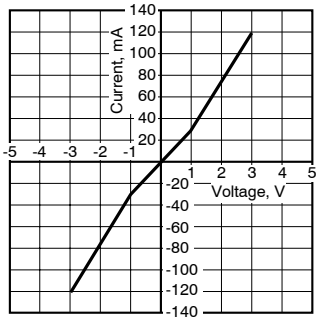
7. LED dropout voltage vs. ambient temperature characteristics;

LED current: 5 to 50 mA



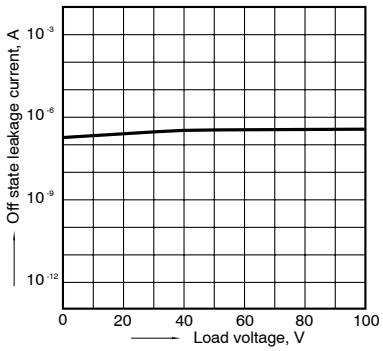
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



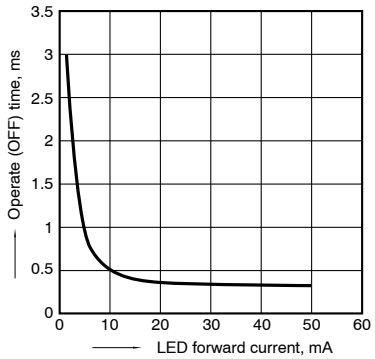
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



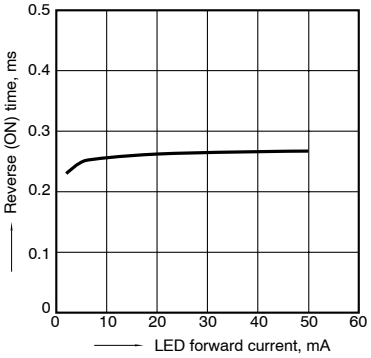
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



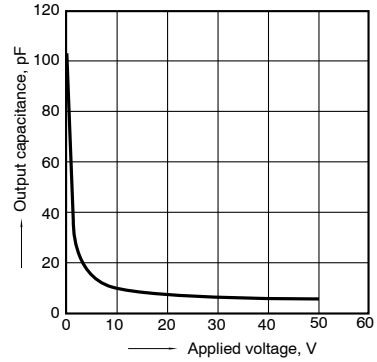
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

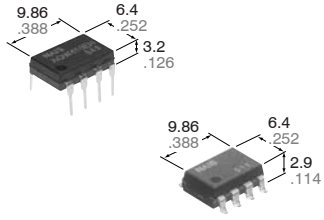
Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



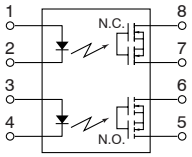
Panasonic
ideas for life

General use and economy type. DIP (1 Form A/1 Form B) 8-pin type. Reinforced insulation 5,000V type.

GU-E PhotoMOS (AQW61❍EH)



mm inch



FEATURES

1. 60V type couples high capacity (0.5A) with low on-resistance (1Ω).

Item	GU-E (1 Form A/1 Form B type) NEW	
Part No.	AQW610EH	AQW612EH
Load voltage	350V	60V
Continuous load current	0.12A	0.5A
ON resistance (typ.)	18Ω	1Ω

2. This is the PhotoMOS 1 Form A/1 Form B output type relay that has attained a low, economical price.

3. Reinforced insulation 5,000 V type
More than 0.4 mm internal insulation distance between inputs and outputs. Conforms to EN41003, EN60950 (reinforced insulation).

4. Compact 8-pin DIP size
The device comes in a compact (W) 6.4×(L)9.86×(H)3.2 mm (W).252×(L).388×(H).126 inch, 8-pin DIP size (through hole terminal type).

5. Applicable for 1 Form A 1 Form B use as well as two independent 1 Form A and 1 Form B use

6. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

7. High sensitivity, high speed response.
Can control a maximum 0.14 A load current with a 5 mA input current. Fast operation speed of 0.5ms (typ.) [N.O.].(AQW610EH)

8. Low-level off-state leakage current

TYPICAL APPLICATIONS

- Power supply
- Measuring equipment
- Security equipment
- Modem
- Telephone equipment
- Electricity, plant equipment
- Sensors

TYPES

Type	I/O isolation voltage	Output rating*		Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
		Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side		
AC/DC type	Reinforced 5,000 V	60 V	500 mA	AQW612EH	AQW612EHA	AQW612EHAX	AQW612EHAZ	1 tube contains 40 pcs. 1 batch contains 400 pcs.	1,000 pcs.
		350 V	120 mA	AQW610EH	AQW610EHA	AQW610EHAX	AQW610EHAZ		
		400 V	100 mA	AQW614EH	AQW614EHA	AQW614EHAX	AQW614EHAZ		

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

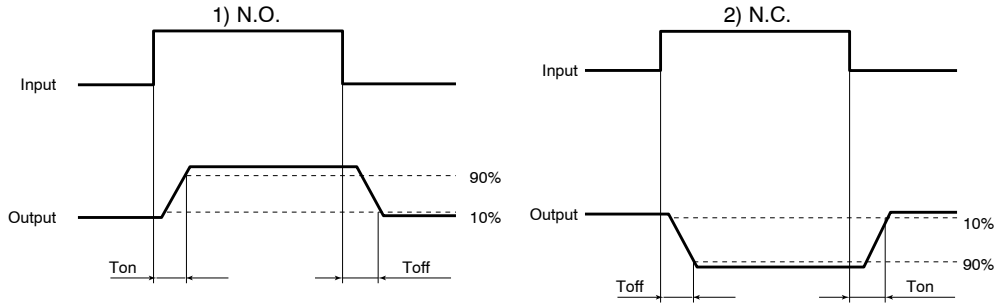
Item		Symbol	AQW612EH (A)	AQW610EH (A)	AQW614EH (A)	Remarks
Input	LED forward current	I_F	50 mA			
	LED reverse voltage	V_R	5 V			
	Peak forward current	I_{FP}	1 A			f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW			
Output	Load voltage (peak AC)	V_L	60 V	350 V	400 V	
	Continuous load current	I_L	0.5 A (0.6 A)	0.12 A (0.14 A)	0.1 A (0.13 A)	Peak AC, DC ( ): in case of using only 1a or 1b, 1 channel
	Peak load current	I_{peak}	1.5 A	0.36 A	0.3 A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	800 mW			
Total power dissipation		P_T	850 mW			
I/O isolation voltage		V_{iso}	5,000 V AC			
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F			Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F			

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQW612EH (A)	AQW610EH (A)	AQW614EH (A)	Condition
Input	LED operate current	Typical	I_{Fon}(N.O.) I_{Foff}(N.C.)	1.3 mA			I_L=Max.
		Maximum		3.0 mA			
	LED reverse current	Minimum	I_{Foff}(N.O.) I_{Fon}(N.C.)	0.4 mA			I_L=Max.
		Typical		1.3 mA			
	LED dropout voltage	Typical	V_F	1.25 (1.14 V at I_F = 5 mA)			I_F=50 mA
		Maximum		1.5 V			
Output	On resistance	Typical	R_{on}	1Ω	18Ω	26Ω	I_F=5mA (N.O.) I_F = 0mA (N.C.) I_L = Max. Within 1 s on time
		Maximum		2.5Ω	25Ω	35Ω	
	Off state leakage current	Maximum	I_{Leak}	1μA (N.O.), 10μA (N.C.)			I_F=0 mA (N.O.) I_F = 5 mA (N.C.) V_L = Max.
Transfer characteristics	Operate (OFF) time*	Typical	T_{on}(N.O.) T_{off}(N.C.)	1.0 ms (N.O.) 3.0 ms (N.C.)	0.5 ms (N.O.) 1.0 ms (N.C.)	0.5 ms (N.O.) 0.8 ms (N.C.)	I_F = 0 mA › 5 mA I_L = Max.
		Maximum		4.0 ms (N.O.) 10.0 ms (N.C.)	3.0 ms		
	Reverse (ON) time*	Typical	T_{off}(N.O.) T_{on}(N.C.)	0.05ms (N.O.), 0.2ms (N.C.)	0.08ms (N.O.), 0.3ms (N.C.)	0.08ms (N.O.), 0.2ms (N.C.)	I_F = 5 mA › 0 mA I_L = Max.
		Maximum		1.0ms			
	I/O capacitance	Typical	C_{iso}	0.8 pF			f = 1MHz V_B = 0 V
		Maximum		1.5 pF			
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000MΩ			500 V DC

Note: Recommendable LED forward current I_F = 5 to 10 mA. For type of connection, see page 58.

*Operate/Reverse time

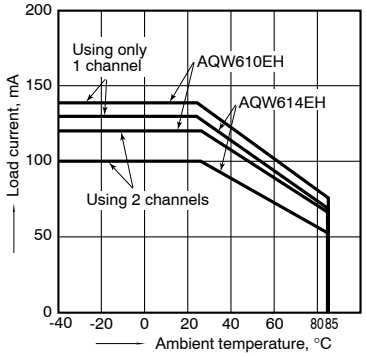


■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 58.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

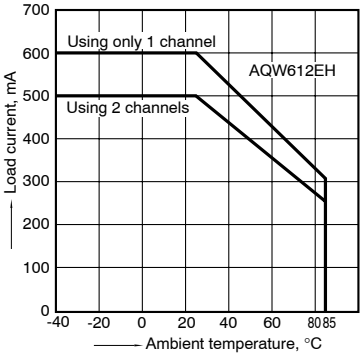
1-(1). Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



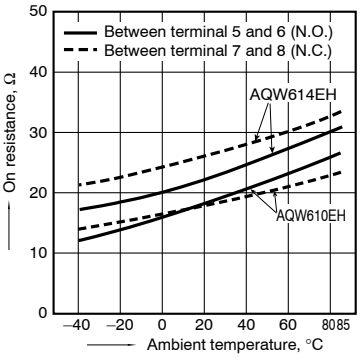
1-(2). Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



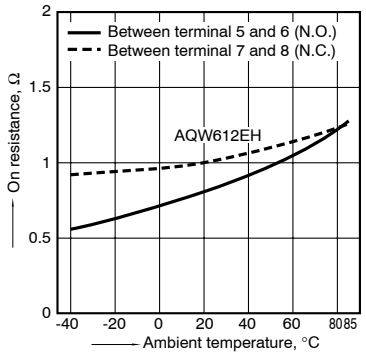
2-(1). On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage; Max. (DC)
Continuous load current: Max. (DC)



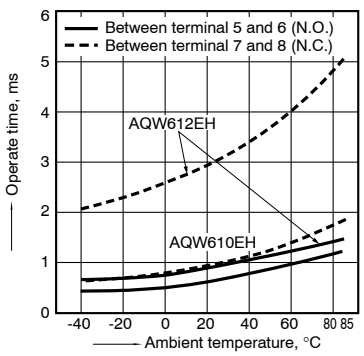
2-(2). On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
LED current: 5 mA; Load voltage; Max. (DC)
Continuous load current: Max. (DC)



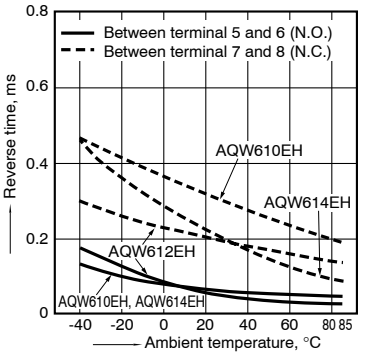
3. Operate time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



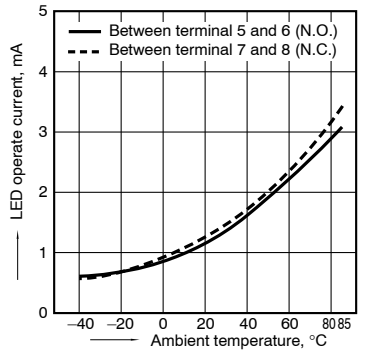
4. Reverse time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



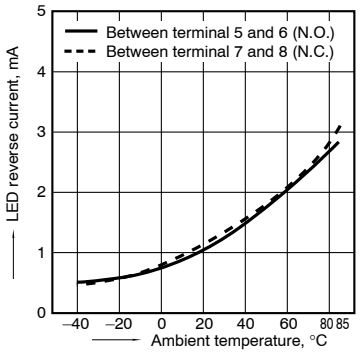
5. LED operate current vs. ambient temperature characteristics

Sample: All types;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



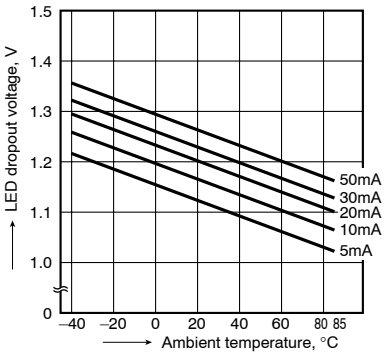
6. LED reverse current vs. ambient temperature characteristics

Sample: All types;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



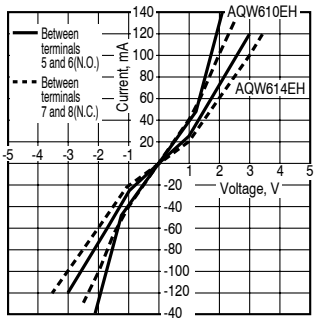
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types;
LED current: 5 to 50 mA



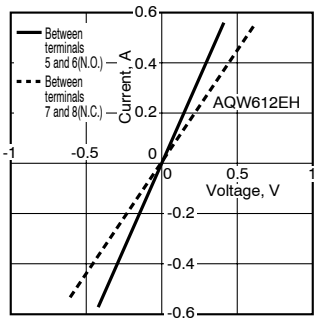
8-(1). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



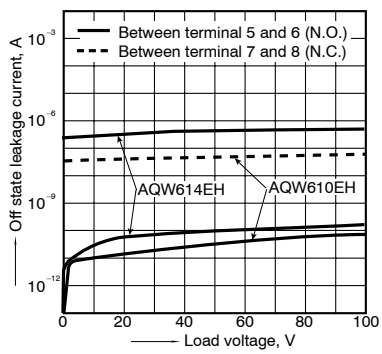
8-(2). Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



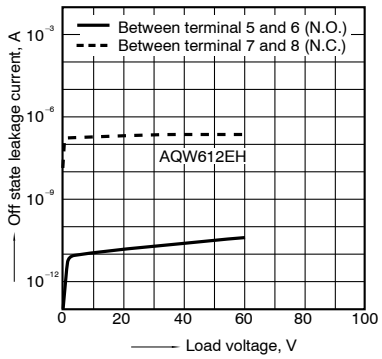
9-(1). Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



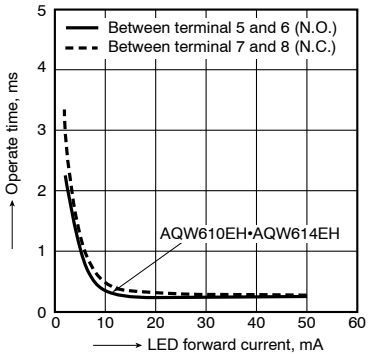
9-(2). Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



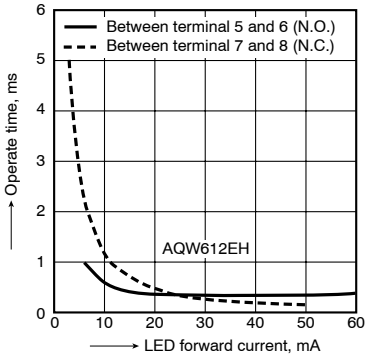
10-(1). Operate time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



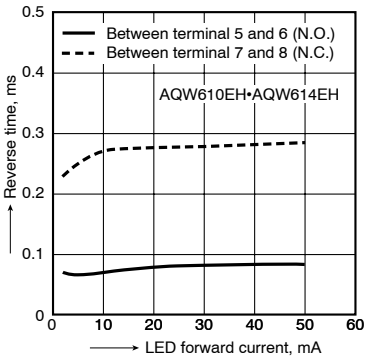
10-(2). Operate time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



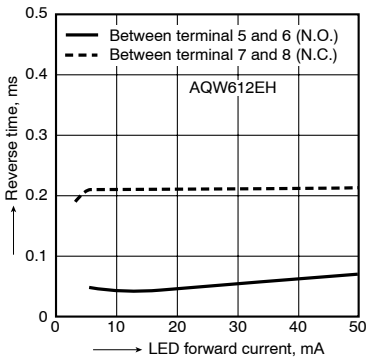
11-(1). Reverse time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



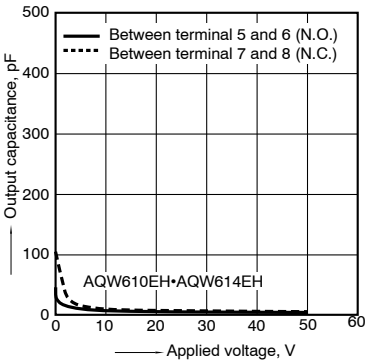
11-(2). Reverse time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



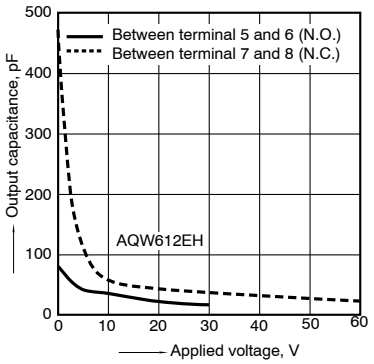
12-(1). Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



12-(2). Output capacitance vs. applied voltage characteristics

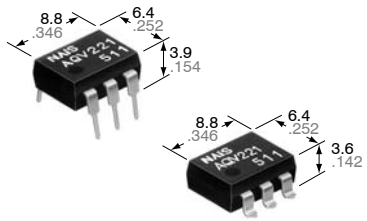
Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



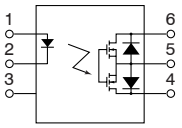
Panasonic
ideas for life

High speed switching. (Turn on time: 0.1ms, Turn off time: 0.03ms).

RF PhotoMOS (AQV22❍)



mm inch



FEATURES

1. High frequency characteristics with low capacitance between output terminals
Low capacitance: Typ. 5 pF (between output terminals)
Isolation loss: 40 dB or more (at 1 MHz)

2. High sensitivity, high speed response
Controls load current of 0.12 A (max.), with input current of 5 mA.
Operate time is 100 μs (Typical)

3. Low-level off state leakage current
PhotoMOS AQV22m types exhibit an OFF state leakage current in the order of 100 picoamperes at a load voltage of 80 V compared with several milliamperes in solid-state relay.

4. Controls low-level analog signals
PhotoMOS relay features extremely low closed-circuit offset voltages to enable control of small analog signals without distortion.

5. Low terminal electromotive force (Approx. 1 mV)

6. Small LED voltage drop on input side (Max. 1.5 V)

TYPICAL APPLICATIONS

- Measuring devices
  Scanner, IC checker, Board tester
- Audio visual equipment
  CD, VCR

TYPES

Type	Output rating*		Part No.				Packing quantity	
	Load voltage	Load current	Through hole terminal	Surface-mount terminal				
			Tube packing style		Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC type	40 V	80 mA	AQV221	AQV221A	AQV221AX	AQV221AZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs
	80 V	50 mA	AQV225	AQV225A	AQV225AX	AQV225AZ		

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV221(A)	AQV225(A)	Remarks
Input	LED forward current	I_F		50 mA		
	LED reverse voltage	V_R		5 V		
	Peak forward current	I_{FP}		1 A		f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW		
Output	Load voltage (Peak AC)	V_L		40 V	80 V	
	Continuous load current	I_L	A	0.08 A	0.05 A	A connection: Peak AC, DC B, C connection: DC
			B	0.09 A	0.06 A	
			C	0.12 A	0.075 A	
	Peak load current	I_{peak}		0.18 A	0.15 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}		230 mW		
Total power dissipation		P_T		280 mW		
I/O isolation voltage		V_{iso}		1,500 V AC		
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F		

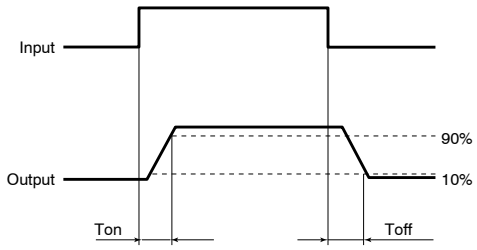
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	Type of connection	AQV221(A)	AQV225(A)	Remarks
Input	LED operate current		Typical	I_{Fon}	—	0.9 mA		I_L= Max.
			Maximum			3 mA		
	LED turn off current		Minimum	I_{Foff}	—	0.4 mA		I_L= Max.
			Typical			0.85 mA		
	LED dropout voltage		Typical	V_F	—	1.25 V (1.14 V at I_F = 5 mA)		I_F = 50 mA
			Maximum			1.5 V		
Output	On resistance		Typical	R_{on}	A	22 Ω	36 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum			35 Ω	50 Ω	
			Typical	R_{on}	B	13 Ω	21 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum			18 Ω	25 Ω	
			Typical	R_{on}	C	6.5 Ω	10.5 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum			9 Ω	12.5 Ω	
	Output capacitance		Typical	C_{out}	—	5.6 pF	4.8 pF	I_F = 0 mA V_B = 0 V f = 1 MHz
			Maximum			8 pF		
	Off state leakage current		Typical	I_{Leak}	—	30 pA		I_F = 0 mA V_L = Max.
			Maximum			10 nA		
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	—	0.10 ms		I_F = 5 mA I_L = Max.
			Maximum			0.3 ms		
		Turn off time*	Typical	T_{off}	—	0.03 ms		I_F = 5 mA I_L = Max.
			Maximum			0.1 ms		
	I/O capacitance		Typical	C_{iso}	—	0.8 pF		f = 1 MHz V_B = 0 V
			Maximum			1.5 pF		
	Initial I/O isolation resistance		Minimum	R_{iso}	—	1,000 MΩ		500 V DC

Recommendable LED forward current I_F = 5mA.

For type of connection, see page 56.

*Turn on/Turn off time



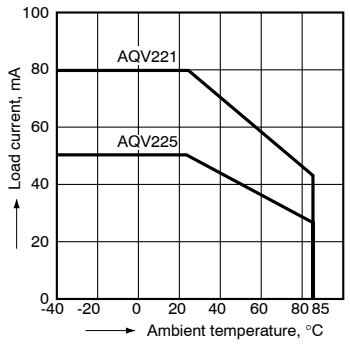
■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

1. Load current vs. ambient temperature characteristics

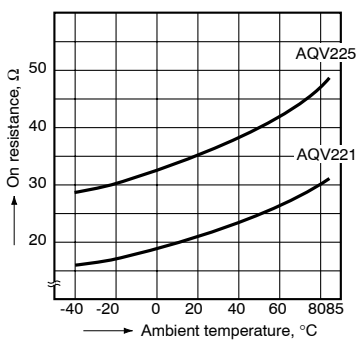
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

Type of connection: A



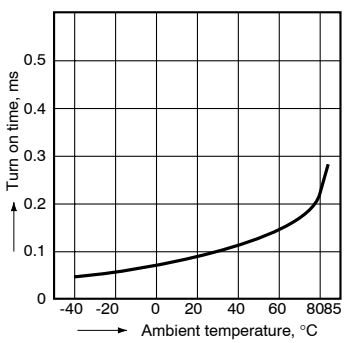
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)

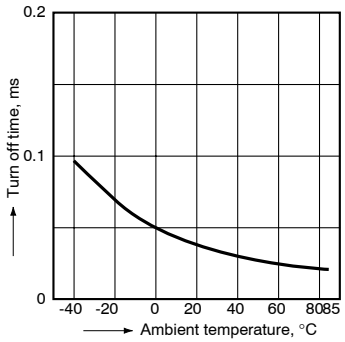


3. Turn on time vs. ambient temperature characteristics

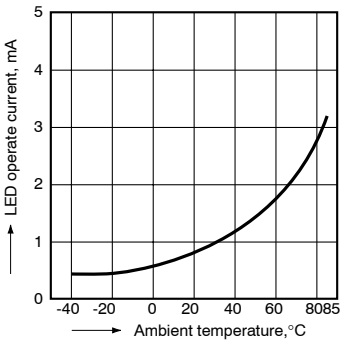
Sample: AQV221, AQV225; LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



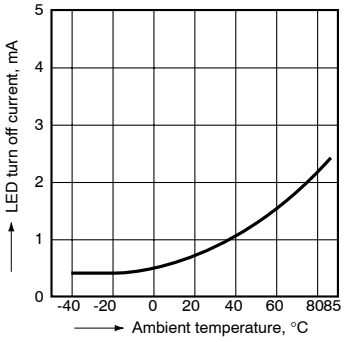
4. Turn off time vs. ambient temperature characteristics
Sample: AQV221, AQV225; LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



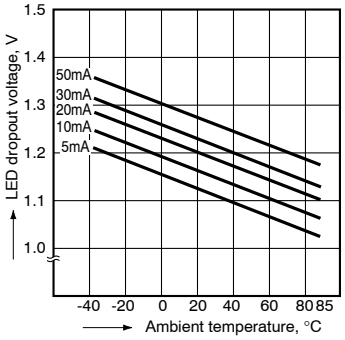
5. LED operate current vs. ambient temperature characteristics
Sample: AQV221, AQV225;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



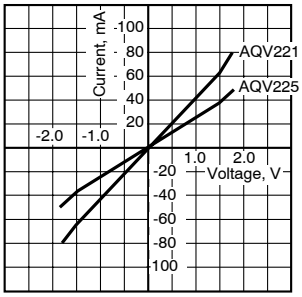
6. LED turn off current vs. ambient temperature characteristics
Sample: AQV221, AQV225;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



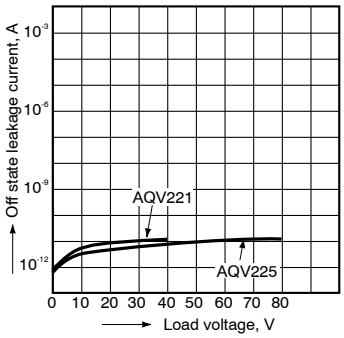
7. LED dropout voltage vs. ambient temperature characteristics
Sample: AQV221, AQV225;
LED current: 5 to 50 mA



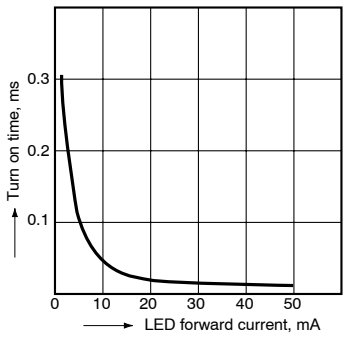
8. Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



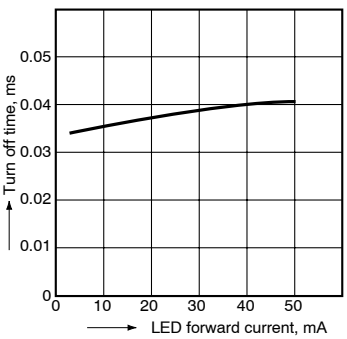
9. Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



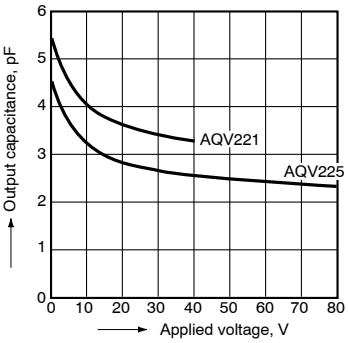
10. Turn on time vs. LED forward current characteristics
Sample: AQV221, AQV225;
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



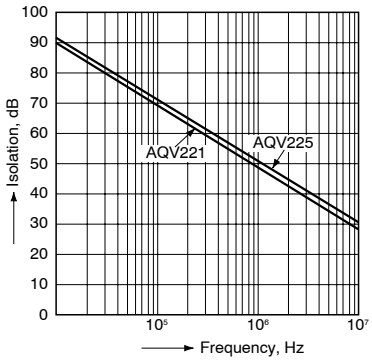
11. Turn off time vs. LED forward current characteristics
Sample: AQV221, AQV225;
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



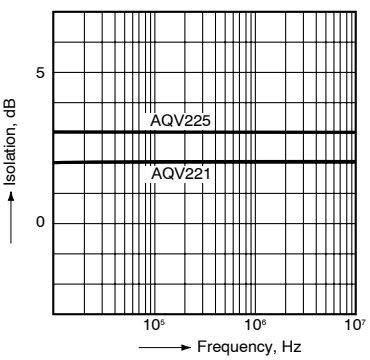
12. Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



13. Isolation vs. frequency characteristics (50Ω impedance)
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



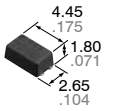
14. Insertion loss vs. frequency characteristics (50Ω impedance)
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



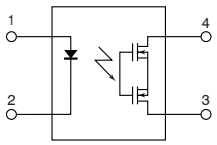
Panasonic
ideas for life

Ultra minimum package size, SSOP (1 Form A) 4-pin type. Lower output capacitance and on resistance. (C×R5)

RF PhotoMOS (AQY221N3V)



mm inch

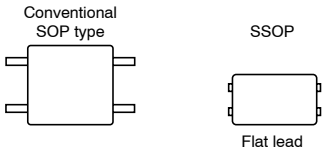


FEATURES

1. Reduced package size
Compared to conventional 4-pin SOP type, surface area has been reduced by 60% and volume by 40%, freeing up mounting space.

2. Lower output capacitance and on-resistance
Output capacitance(C): 1.0pF (typ.)
ON resistance(R): 5.5Ω (typ.)

3. Mounting space has been reduced and output signals have been improved by using new flat lead terminals.



4. High speed switching
Turn on time: 0.02ms
Turn off time: 0.02ms

TYPICAL APPLICATIONS

Measuring and testing equipment
1. Test equipment
   IC tester, Liquid crystal driver tester, semiconductor performance tester
2. Board tester
   Bare board tester, In-circuit tester, function tester
3. Medical equipment
   Ultrasonic wave diagnostic machine
4. Multi-point recorder
   Warping, thermo couple

TYPES

Circuit arrangement	Type	Output rating*		Tape and reel packing style		Packing quantity in tape and reel
		Load voltage	Load current	Picked from the 1/4-pin side	Picked from the 2/3-pin side	
1 Form A	AC/DC type	25 V	150 mA	AQY221N3VY	AQY221N3VW	3,500 pcs.

* Indicate the peak AC and DC values.
Notes: (1) Tape package is the standard packing style.
(2) For space reasons, the initial letters of the product number “AQY”, the package type indicator “Y” and “W” are omitted from the seal. (Ex. the label for product number AQY221N3V is 221N3)

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQY221N3V	Remarks
Input	LED forward current	I_F	50mA	
	LED reverse voltage	V_R	5V	
	Peak forward current	I_{FP}	1A	f=100 Hz, Duty factor=0.1%
	Power dissipation	P_{in}	75mW	
Output	Load voltage (peak AC)	V_L	25V	
	Continuous load current (peak AC)	I_L	0.15A	Peak AC,DC
	Peak load current	I_{peak}	0.4A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	250mW	
Total power dissipation		P_T	300mW	
I/O isolation voltage		V_{iso}	1,500V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

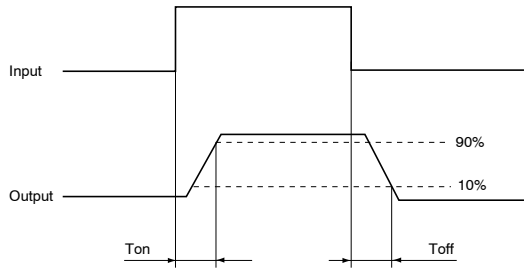
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQY221N3V	Condition
Input	LED operate current		Typical	I_{Fon}	1.0 mA	I_L = 80 mA
			Maximum		3.0 mA	
	LED turn off current		Minimum	I_{Foff}	0.2 mA	I_L = 80 mA
			Typical		0.9 mA	
	LED dropout voltage		Typical	V_F	1.35 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
			Maximum		1.5 V	
Output	On resistance		Typical	R_{on}	5.5Ω	I_F = 5 mA I_L = 80 mA Within 1 s on time
			Maximum		7.5Ω	
	Output capacitance		Typical	C_{out}	1.0 pF	I_F = 0 mA V_B = 0 V f = 1 MHz
			Maximum		1.5 pF	
	Off state leakage current		Typical	I_{Leak}	0.01 nA	I_F = 0 mA V_L = Max.
			Maximum		10 nA	
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	0.02 ms	I_F = 5 mA V_L = 10 V R_L = 125Ω
			Maximum		0.2 ms	
		Turn off time*	Typical	T_{off}	0.02 ms	I_F = 5 mA V_L = 10 V R_L = 125Ω
			Maximum		0.2 ms	
	I/O capacitance		Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
			Maximum		1.5 pF	
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000MΩ	500V DC

Note: Recommendable LED forward current I_F = 5 mA.

For type of connection, see page 56.

*Turn on/Turn off time

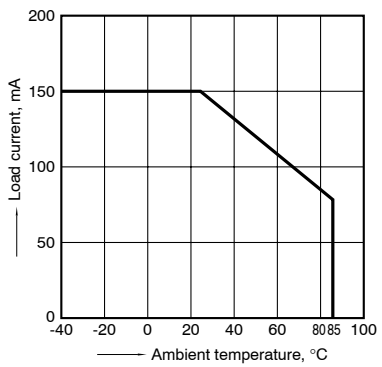


■ **For Dimensions, see page 53.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

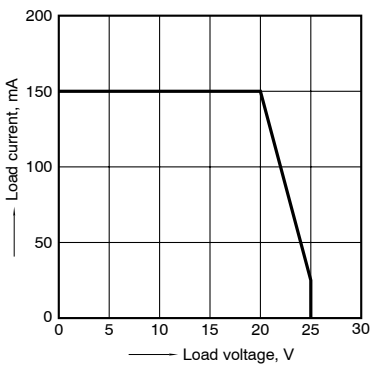
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



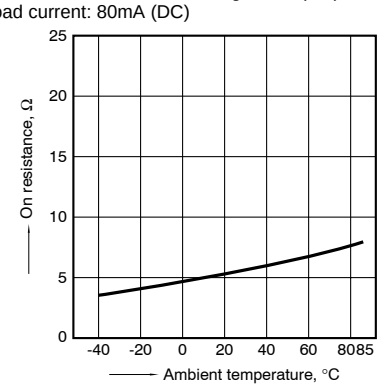
2. Load current vs. Load voltage characteristics

Ambient temperature: 25°C 77°F

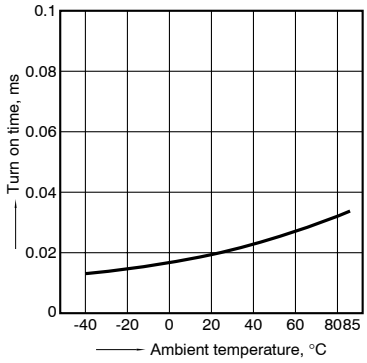


3. On resistance vs. ambient temperature characteristics

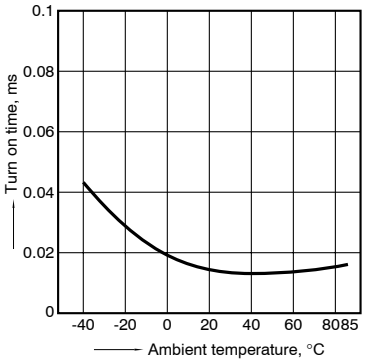
Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC);
Load current: 80mA (DC)



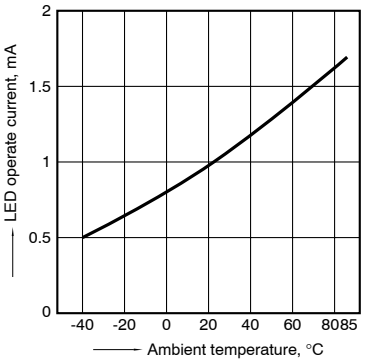
4. Turn on time vs. ambient temperature characteristics
Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC);
Continuous load current: 80mA (DC)



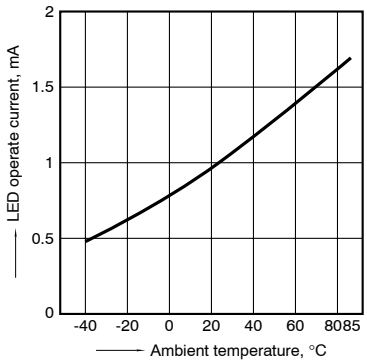
5. Turn off time vs. ambient temperature characteristics
Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC);
Continuous load current: 80mA (DC)



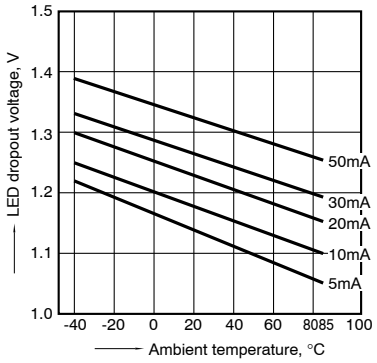
6. LED operate current vs. ambient temperature characteristics
Measured portion: between terminals 3 and 4
Load voltage: 10V (DC);
Continuous load current: 80mA (DC)



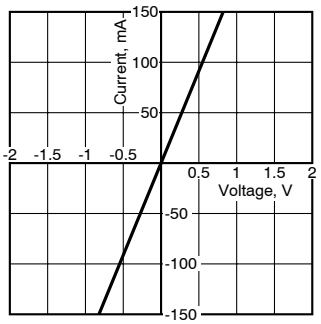
7. LED turn off current vs. ambient temperature characteristics
Measured portion: between terminals 3 and 4
Load voltage: 10V (DC);
Continuous load current: 80mA (DC)



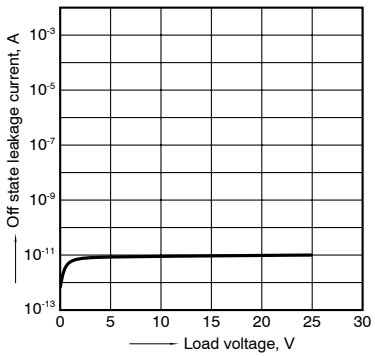
8. LED dropout voltage vs. ambient temperature characteristics
LED current: 5 to 50 mA



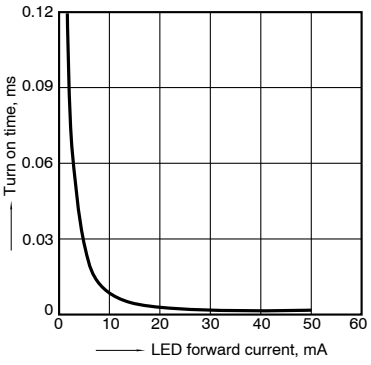
9. Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



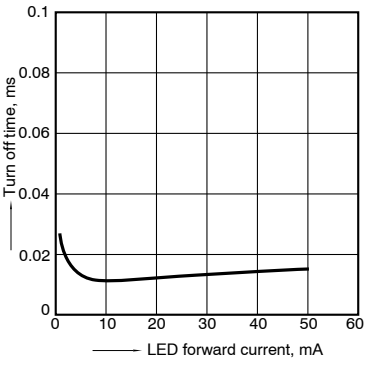
10. Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



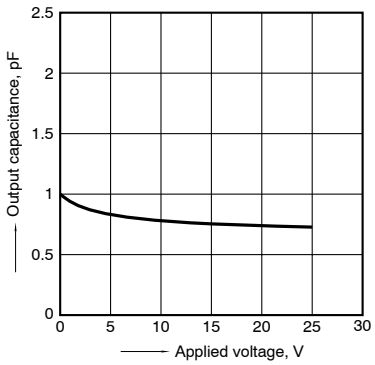
11. Turn on time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4
Load voltage: 10V (DC); Continuous load current: 80mA (DC); Ambient temperature: 25°C 77°F



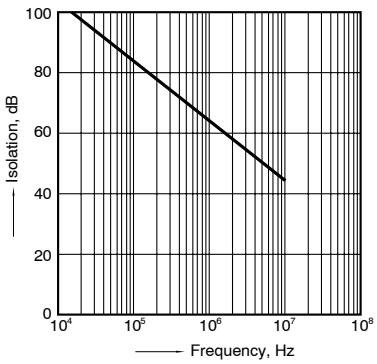
12. Turn off time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4
Load voltage: 10V (DC); Continuous load current: 80mA (DC); Ambient temperature: 25°C 77°F



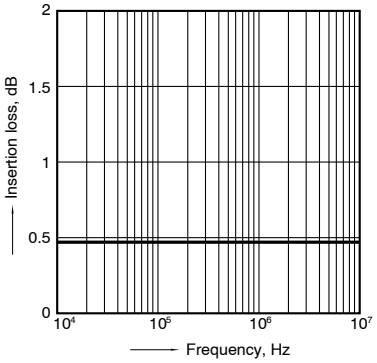
13. Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 3 and 4
Frequency: 1 MHz, 30mVrms; Ambient temperature: 25°C 77°F



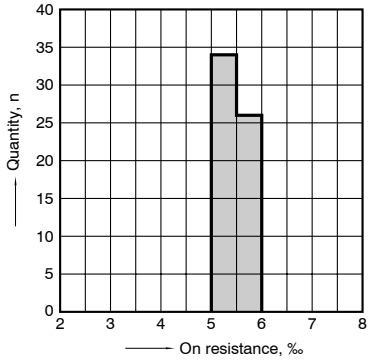
14. Isolation vs. frequency characteristics (50Ω impedance)
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



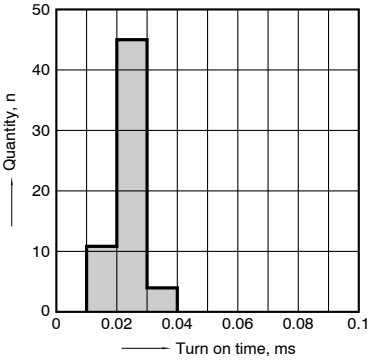
15. Insertion loss vs. frequency characteristics (50Ω impedance)
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



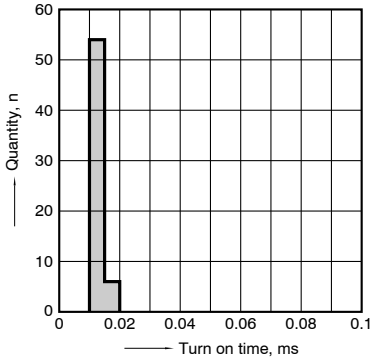
16. On resistance distribution
Measured portion: between terminals 3 and 4
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



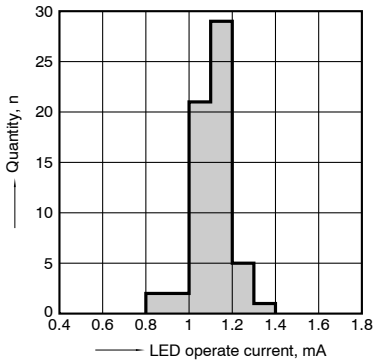
17. Turn on time distribution
Load voltage: 10V (DC)
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



18. Turn off time distribution
Load voltage: 10V (DC)
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



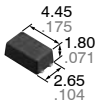
19. LED operate current distribution
Load voltage: 10V (DC)
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



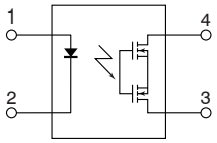
Panasonic
ideas for life

Ultra minimum package size, SSOP (1 Form A) 4-pin type. Lower output capacitance (C type) and on resistance (R type). (C × R10)

RF PhotoMOS (AQY221○2V)



mm inch



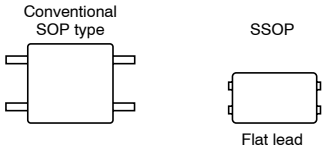
FEATURES

1. Reduced package size
Lower surface has been reduced 60% and mounting space 40% compared to conventional 4-pin SOP type.

2. Two types are available: A type with greatly reduced ON resistance, and a type with even lower output capacitance between terminals.

	AQY221R2V (R Type)	AQY221N2V (C Type)
Output capacitance (C)	12.5pF	1.0pF
ON resistance (R)	0.75Ω	9.5Ω

3. Mounting space has been reduced and output signals have been improved by using new flat lead terminals.



4. High speed switching (Part No.: AQY221N2V)
Turn on time: 0.02ms
Turn off time: 0.02ms

TYPICAL APPLICATIONS

Measuring and testing equipment
1. Test equipment
IC tester, Liquid crystal driver tester, semiconductor performance tester
2. Board tester
Bare board tester, In-circuit tester, function tester
3. Medical equipment
Ultrasonic wave diagnostic machine
4. Multi-point recorder
Strainmeter, thermo couple

TYPES

Type		Output rating*		Part No. (Tape and reel packing style)		Packing quantity
		Load voltage	Load current	Picked from the 1/4-pin side	Picked from the 2/3-pin side	
AC/DC type	Low on resistance (R Type)	40 V	250 mA	AQY221R2VY	AQY221R2VW	Tape and reel: 3,500 pcs.
	Low capacitance (C Type)	40 V	120 mA	AQY221N2VY	AQY221N2VW	

* Indicate the peak AC and DC values.

Notes: (1) Tape package is the standard packing style.
(2) For space reasons, the initial letters of the product number “AQY”, the package type indicator “Y” and “W” are omitted from the seal. (Ex. the label for product number AQY221N2V is 221N2)

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

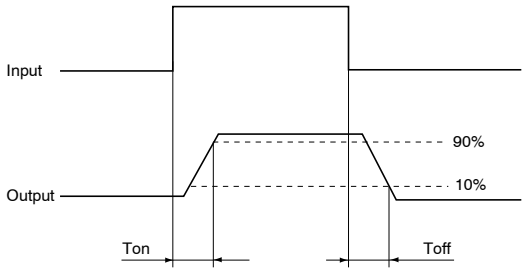
Item		Symbol	AQY221R2V	AQY221N2V	Remarks
Input	LED forward current	I_F	50mA		
	LED reverse voltage	V_R	5V		
	Peak forward current	I_{FP}	1A		f=100 Hz, Duty factor=0.1%
	Power dissipation	P_{in}	75mW		
Output	Load voltage (peak AC)	V_L	40V		
	Continuous load current (peak AC)	I_L	0.25A	0.12A	Peak AC, DC
	Peak load current	I_{peak}	0.75A	0.3A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	250mW		
Total power dissipation		P_T	300mW		
I/O isolation voltage		V_{iso}	1,500V AC		
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F		

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQY221R2V	AQY221N2V	Condition*2
Input	LED operate current		Typical	I_{Fon}	0.9 mA	1.0 mA	C type (I_L = 80 mA) R type (I_L = 250 mA)
			Maximum		3.0 mA		
	LED turn off current		Minimum	I_{Foff}	0.1 mA	0.2 mA	C type (I_L = 80 mA) R type (I_L = 250 mA)
			Typical		0.8 mA	0.9 mA	
	LED dropout voltage		Typical	V_F	1.35 V (1.14 V at I_F = 5 mA)		C type (I_F = 50 mA) R type (I_F = 50 mA)
			Maximum		1.5 V		
Output	On resistance		Typical	R_{on}	0.75Ω	9.5Ω	C type (I_F = 5 mA, I_L = 80 mA Within 1 s on time) R type (I_F = 5 mA, I_L = 250 mA Within 1 s on time)
			Maximum		1.25Ω	12.5Ω	
	Output capacitance		Typical	C_{out}	12.5 pF	1.0 pF	I_F = 0 mA V_B = 0 V f = 1 MHz
			Maximum		18 pF	1.5 pF	
	Off state leakage current		Typical	I_{Leak}	0.02 nA	0.01 nA	C type (I_F = 0 mA, V_L = Max.) R type (I_F = 0 mA, V_L = Max.)
			Maximum		10 nA		
Transfer characteristics	Switching speed	Turn on time*1	Typical	T_{on}	0.10 ms	0.02 ms	C type (I_F = 5 mA, V_L = 10 V R_L = 125Ω) R type (I_F = 5 mA, V_L = 10 V R_L = 40Ω)
			Maximum		0.5ms		
		Turn off time*1	Typical	T_{off}	0.08 ms	0.02 ms	C type (I_F = 5 mA, V_L = 10 V R_L = 125Ω) R type (I_F = 5 mA, V_L = 10 V R_L = 40Ω)
			Maximum		0.2 ms		
	I/O capacitance		Typical	C_{iso}	0.8 pF		C type (f = 1 MHz, V_B = 0 V) R type (f = 1 MHz, V_B = 0 V)
			Maximum		1.5 pF		
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000MΩ		500V DC

Notes: 1. For type of connection, see page 56.
2. Variation possible through combinations of output capacitance and ON resistance.

*1 Turn on/Turn off time



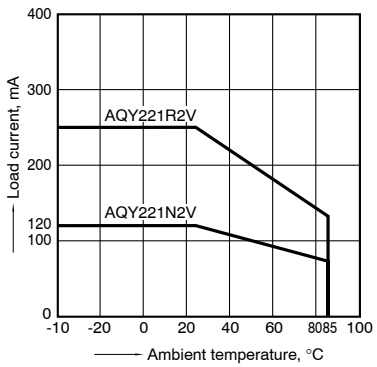
*2 Low on resistance (R type)
Low capacitance (C type)

■ **For Dimensions, see page 53.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

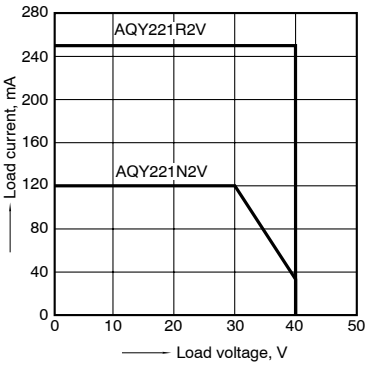
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



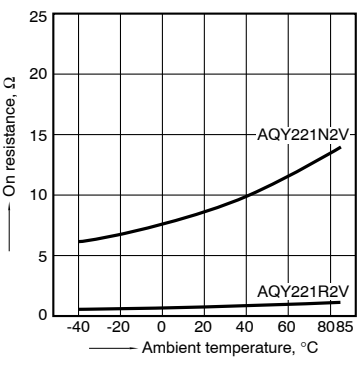
2. Load current vs. Load voltage characteristics

Ambient temperature: 25°C 77°F



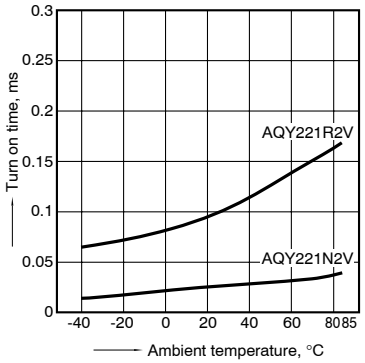
3. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: Max. (DC);
Load current: 250mA (DC) R type, 80mA (DC) C type



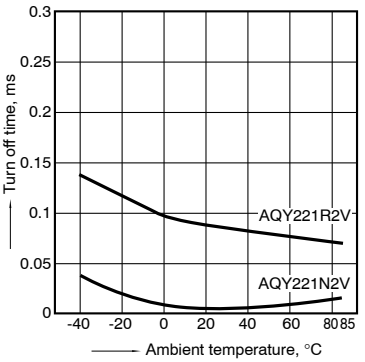
4. Turn on time vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC);
Continuous load current: 250mA (DC) R type, 80mA (DC) C type



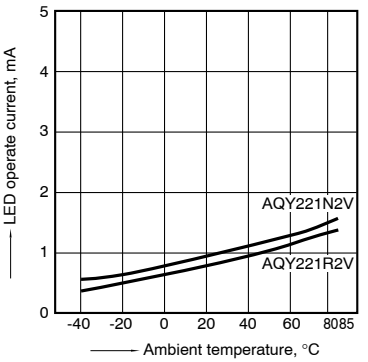
5. Turn off time vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC);
Continuous load current: 250mA (DC) R type, 80mA (DC) C type



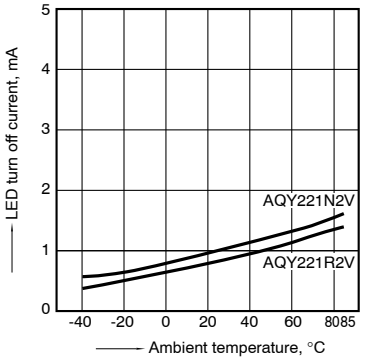
6. LED operate current vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max. (DC);
Continuous load current: 250mA (DC) R type, 80mA (DC) C type



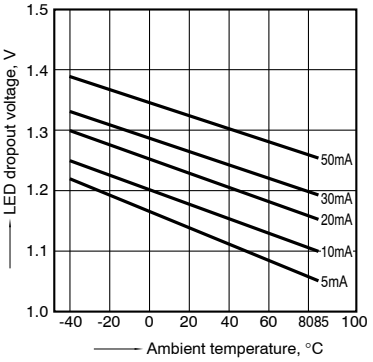
7. LED turn off current vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4;
Load voltage: Max. (DC);
Continuous load current: 250mA (DC) R type, 80mA (DC) C type



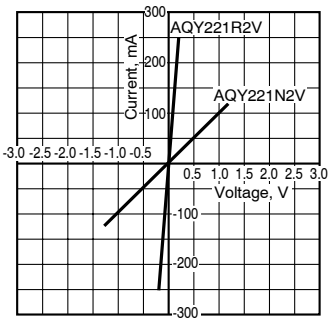
8. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



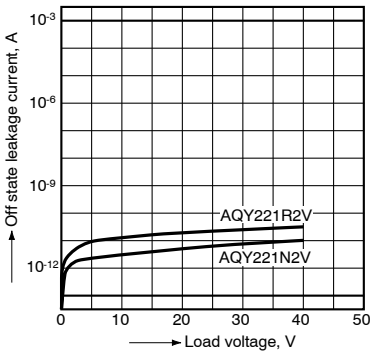
9. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



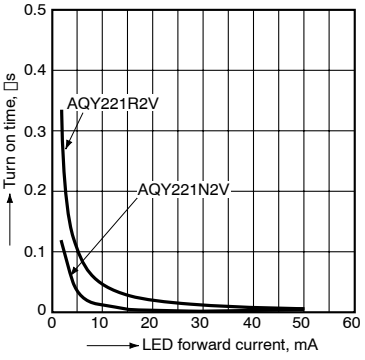
10. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



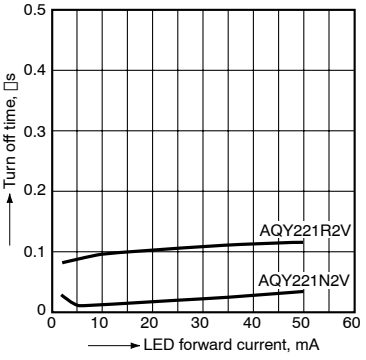
11. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 3 and 4
Load voltage: 10V (DC);
Continuous load current: 250mA (DC) R type, 80mA (DC) C type; Ambient temperature: 25°C 77°F

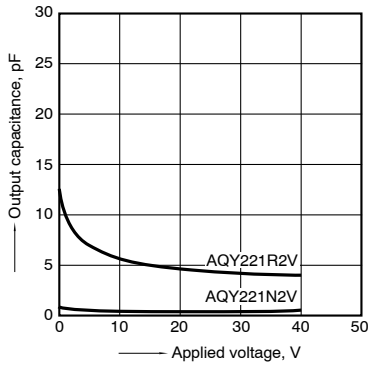


12. Turn off time vs. LED forward current characteristics

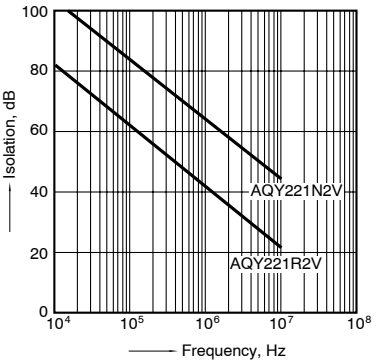
Measured portion: between terminals 3 and 4
Load voltage: 10V (DC);
Continuous load current: 250mA (DC) R type, 80mA (DC) C type; Ambient temperature: 25°C 77°F



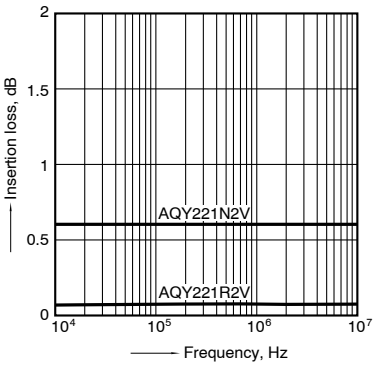
13. Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 3 and 4
Frequency: 1 MHz, 30m Vrms;
Ambient temperature: 25°C 77°F



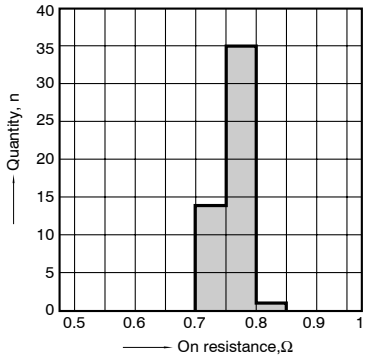
14. Isolation vs. frequency characteristics (50Ω impedance)
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



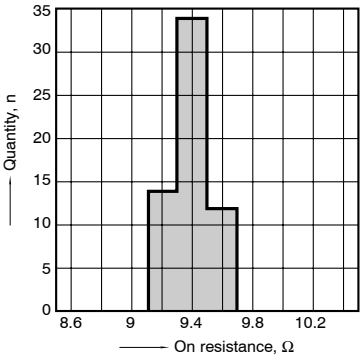
15. Insertion loss vs. frequency characteristics (50Ω impedance)
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



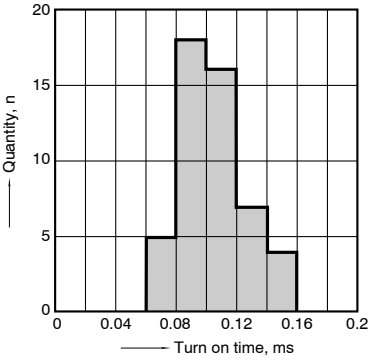
16-(1). On resistance distribution (R type)
Measured portion: between terminals 3 and 4
Continuous load current: 250mA (DC)
Ambient temperature: 25°C 77°F



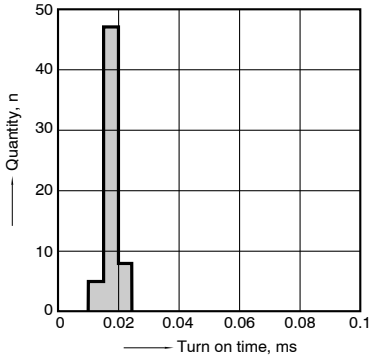
16-(2). On resistance distribution (C type)
Measured portion: between terminals 3 and 4
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



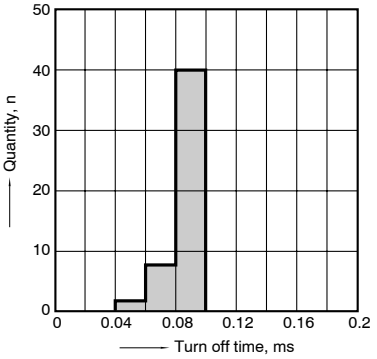
17-(1). Turn on time distribution (R type)
Load voltage: 10V (DC)
Continuous load current: 250mA (DC)
Ambient temperature: 25°C 77°F



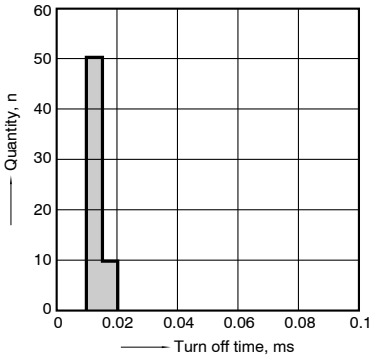
17-(2). Turn on time distribution (C type)
Load voltage: 10V (DC)
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



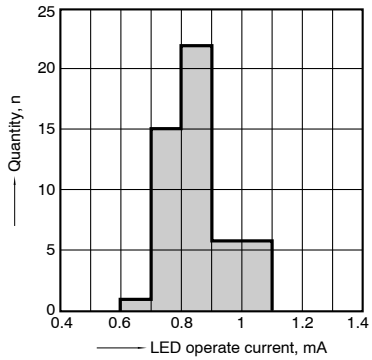
18-(1). Turn off time distribution (R type)
Load voltage: 10V (DC)
Continuous load current: 250mA (DC)
Ambient temperature: 25°C 77°F



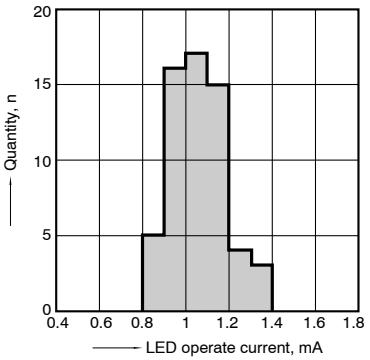
18-(2). Turn off time distribution (C type)
Load voltage: 10V (DC)
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



19-(1). LED operate current distribution (R type)
Load voltage: 10V (DC)
Continuous load current: 250mA (DC)
Ambient temperature: 25°C 77°F



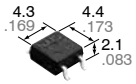
19-(2). LED operate current distribution (C type)
Load voltage: 10V (DC)
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



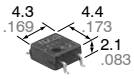
Panasonic
ideas for life

Lower output capacitance (C type) and on resistance (R type). (C × R10) High speed switching. (C type: Turn on time: 0.03ms, Turn off time: 0.03ms).

RF PhotoMOS (AQY221❍2S)

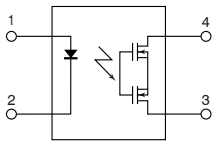


<R type>



<C type>

mm inch



FEATURES

1. Two option package available.
R type offers greatly reduced on-resistance.
C type offers lower output capacitance.

	AQY221R2S (R type)	AQY221N2S (C type)
Output capacitance: C	13pF	1pF
On resistance: R	0.8Ω	9.5Ω

2. High speed switching
Turn on time: 30μs (AQY221N2S)
Turn off time: 30μs (AQY221N2S)

3. Super miniature design
SOP 4-pin type.

4. Low-level off state leakage current of 10pA
The SSR has an off state leakage current of several milliamperes, where as this PhotoMOS relay has typ. 10pA (typical) even with the rated load voltage (AQY221N2S)

TYPICAL APPLICATIONS

Measuring and testing equipment

1. Testing equipment for semiconductor performance
IC tester, Liquid crystal driver tester, semiconductor performance tester

2. Board tester
Bare board tester, In-circuit tester, function tester

3. Medical equipment
Ultrasonic wave diagnostic machine

4. Multi-point recorder
Warping, thermo couple

TYPES

Circuit arrangement	Type	Output rating*		Tape and reel packing style		Packing quantity
		Load voltage	Load current	Picked from the 1/2-pin side	Picked from the 3/4-pin side	
1 Form A	R type	40 V	250 mA	AQY221R2SX	AQY221R2SZ	Tape and reel: 1,000 pcs.
	C type	40 V	120 mA	AQY221N2SX	AQY221N2SZ	

* Indicate the peak AC and DC values.

Notes: (1) Tape package is the standard packing style. Also available in tube.
(Part No. suffix "X" or "Z" is not needed when ordering; Tube: 100 pcs.; Case: 2,000 pcs.)
(2) For space reasons, the initial letters of the product number "AQY and S", the package type indicator "X" and "Z" are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQY221R2S (R type)	AQY221N2S (C type)	Remarks
Input	LED forward current	I_F	50mA		
	LED reverse voltage	V_R	5V		
	Peak forward current	I_{FP}	1A		f=100 Hz, Duty factor=0.1%
	Power dissipation	P_{in}	75mW		
Output	Load voltage (peak AC)	V_L	40V		
	Continuous load current	I_L	0.25A	0.12A	Peak AC,DC
	Peak load current	I_{peak}	0.75A	0.30A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	300mW		
Total power dissipation		P_T	350mW		
I/O isolation voltage		V_{iso}	500V AC	1,500V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F		

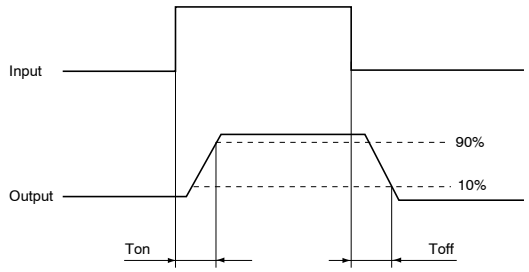
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQY221R2S (R type)	AQY221N2S (C type)	Condition
Input	LED operate current		Typical	I_{Fon}	0.5 mA	0.9 mA	I_L = 250 mA (R type) I_L = 80 mA (C type)
			Maximum		3.0 mA		
	LED turn off current		Minimum	I_{Foff}	0.1 mA	0.2 mA	I_L = 250 mA (R type) I_L = 80 mA (C type)
			Typical		0.4 mA	0.85 mA	
	LED dropout voltage		Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)		I_F = 50 mA
			Maximum		1.5 V		
Output	On resistance		Typical	R_{on}	0.8Ω	9.5Ω	I_F = 5 mA I_L = 250 mA (R type), I_L = 80 mA (C type) Within 1 s on time
			Maximum		1.25Ω	12.5Ω	
	Output capacitance		Typical	C_{out}	13 pF	1.0 pF	I_F = 0 mA V_B = 0 V f = 1 MHz
			Maximum		18 pF	1.5 pF	
	Off state leakage current		Typical	I_{Leak}	0.03 nA	0.01 nA	I_F = 0 mA V_L = Max.
			Maximum		10 nA		
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	0.1 ms	0.03 ms	I_F = 5 mA V_L = 10V R_L = 40Ω (R type), 125Ω (C type)
			Maximum		0.5ms		
		Turn off time*	Typical	T_{off}	0.06 ms	0.03 ms	I_F = 5 mA V_L = 10V R_L = 40Ω (R type), 125Ω (C type)
			Maximum		0.2 ms		
	I/O capacitance		Typical	C_{iso}	0.8 pF		f = 1 MHz V_B = 0 V
			Maximum		1.5 pF		
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000MΩ		500 V DC

Note: Recommendable LED forward current I_F = 5 mA.

For type of connection, see page 56.

*Turn on/Turn off time

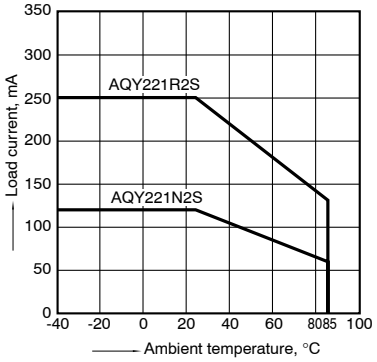


■ **For Dimensions, see page 53.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

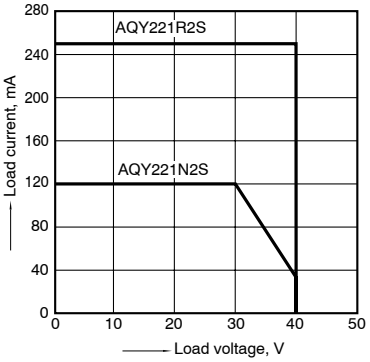
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



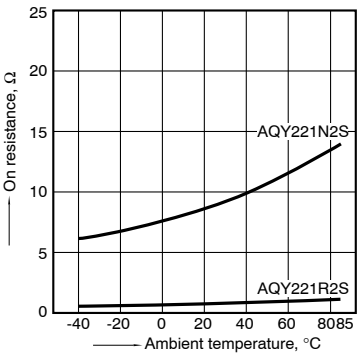
2. Load current vs. Load voltage characteristics

Ambient temperature: 25°C 77°F

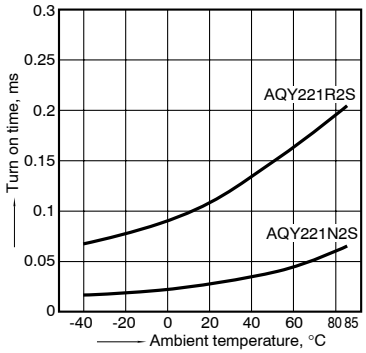


3. On resistance vs. ambient temperature characteristics

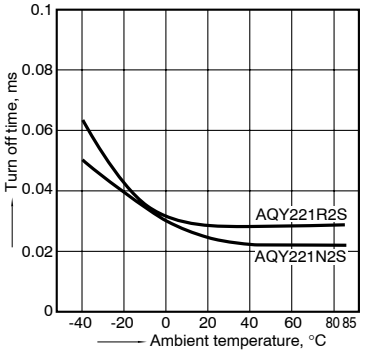
Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: Max. (DC);
Load current: 250mA (DC) [R type], 80mA (DC) [C type];



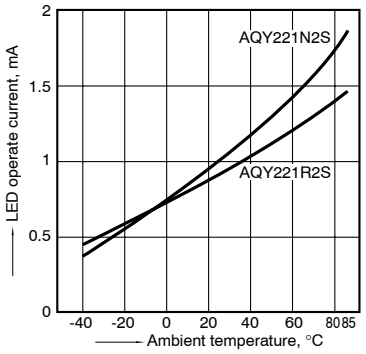
4. Turn on time vs. ambient temperature characteristics
Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: 10V (DC);
Continuous load current: 250mA (DC) [R type], 80mA (DC) [C type];



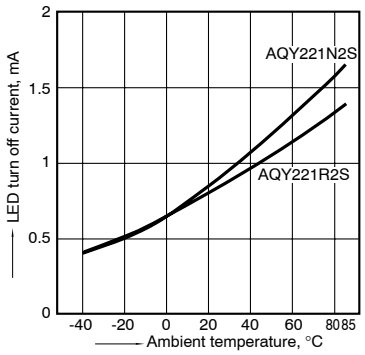
5. Turn off time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: 10V (DC);
Continuous load current: 250mA (DC) [R type], 80mA (DC) [C type];



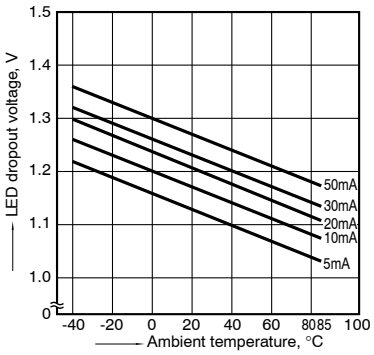
6. LED operate current vs. ambient temperature characteristics
Load voltage: Max. (DC);
Continuous load current: 250mA (DC) [R type], 80mA (DC) [C type];



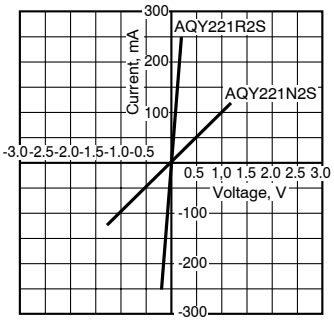
7. LED turn off current vs. ambient temperature characteristics
Load voltage: Max. (DC); Continuous load current: 250mA (DC) [R type], 80mA (DC) [C type];



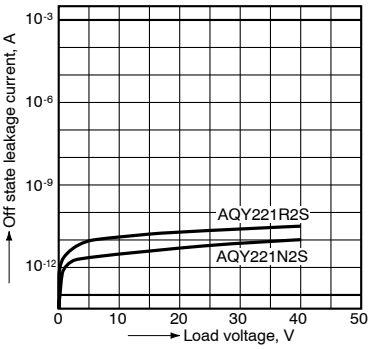
8. LED dropout voltage vs. ambient temperature characteristics
LED current: 5 to 50 mA



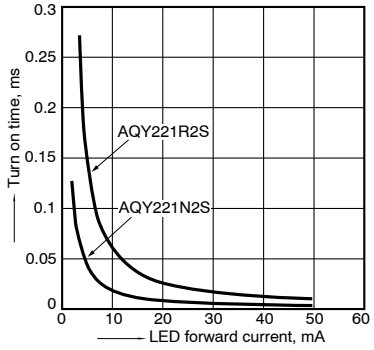
9. Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



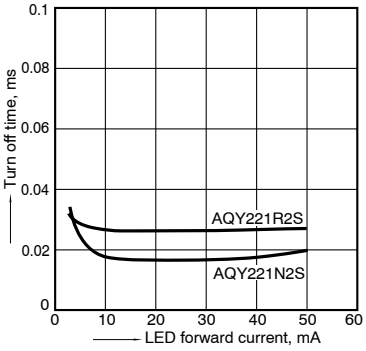
10. Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



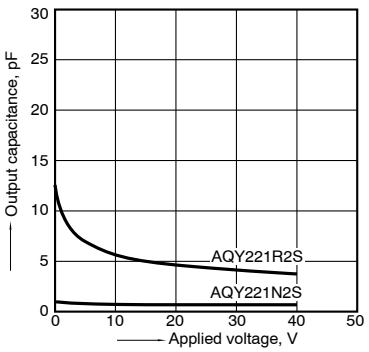
11. Turn on time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4
Load voltage: 10V (DC); Continuous load current: 250mA (DC) [R type], 80mA (DC) [C type];
Ambient temperature: 25°C 77°F



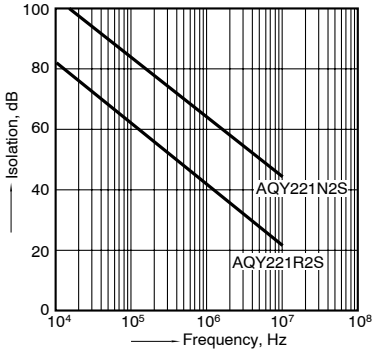
12. Turn off time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4
Load voltage: 10V (DC); Continuous load current: 250mA (DC) [R type], 80mA (DC) [C type];
Ambient temperature: 25°C 77°F



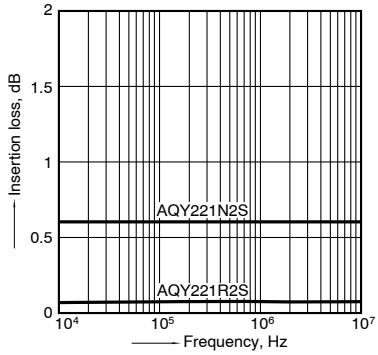
13. Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 3 and 4
Frequency: 1 MHz, 30m Vrms; Ambient temperature: 25°C 77°F



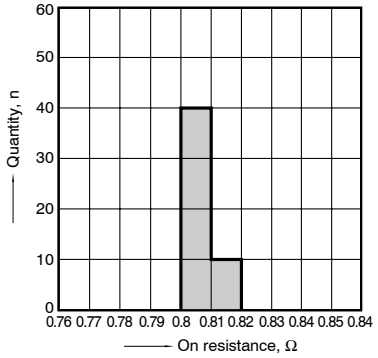
14. Isolation vs. frequency characteristics (50Ω impedance)
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



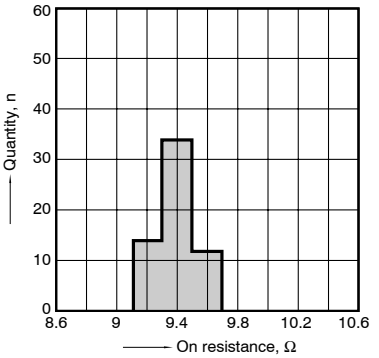
15. Insertion loss vs. frequency characteristics (50Ω impedance)
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



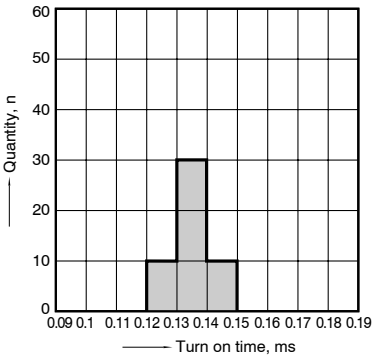
16-(1). On resistance distribution (R type)
Measured portion: between terminals 3 and 4
Continuous load current: 250mA (DC)
Ambient temperature: 25°C 77°F



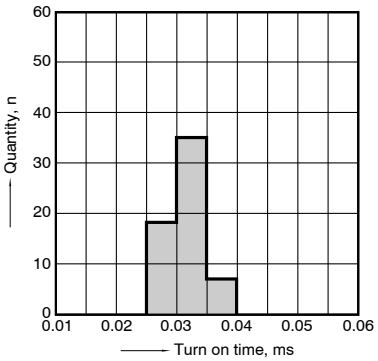
16-(2). On resistance distribution (C type)
Measured portion: between terminals 3 and 4
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



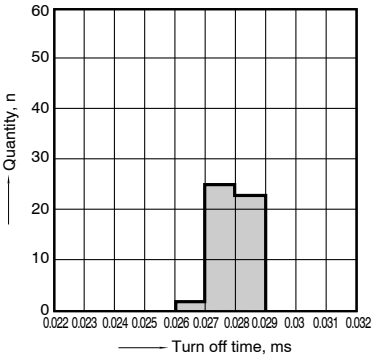
17-(1). Turn on time distribution (R type)
Load voltage: 10V (DC)
Continuous load current: 250mA (DC)
Ambient temperature: 25°C 77°F



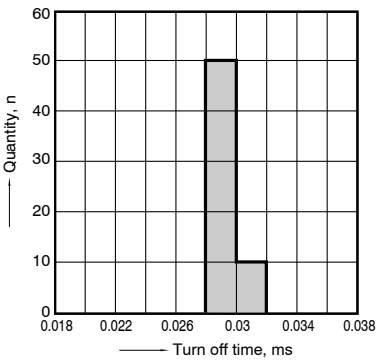
17-(2). Turn on time distribution (C type)
Load voltage: 10V (DC)
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



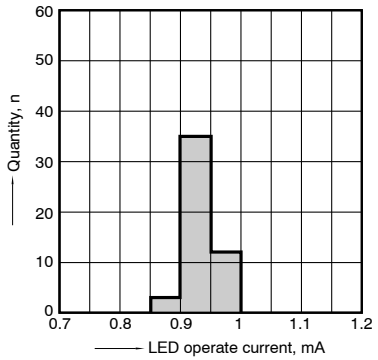
18-(1). Turn off time distribution (R type)
Load voltage: 10V (DC)
Continuous load current: 250mA (DC)
Ambient temperature: 25°C 77°F



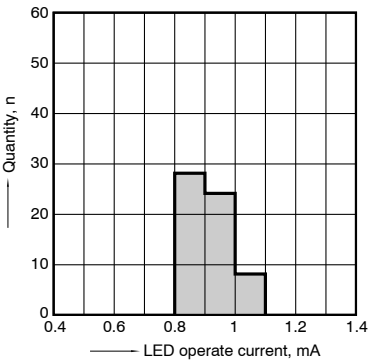
18-(2). Turn off time distribution (C type)
Load voltage: 10V (DC)
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



19-(1). LED operate current distribution (R type)
Load voltage: 10V (DC)
Continuous load current: 250mA (DC)
Ambient temperature: 25°C 77°F



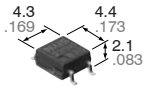
19-(2). LED operate current distribution (C type)
Load voltage: 10V (DC)
Continuous load current: 80mA (DC)
Ambient temperature: 25°C 77°F



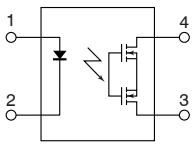
Panasonic
ideas for life

Lower output capacitance and on resistance. (C×R20) High speed switching. (Turn on time: 0.04ms, Turn off time: 0.06ms).

RF PhotoMOS (AQY221N1S)



mm inch



FEATURES

1. Low output capacitance between output terminals and low ON-resistance
Output capacitance(C): 2.0pF (typ.)
ON resistance(R): 9.8Ω (typ.)

2. High speed switching
Turn on time: 40ms
Turn off time: 60ms

3. SO package 4-pin type in super miniature design
Size: (W)4.3 × (L)4.4 × (H)2.1 mm
(W).169 × (L).173 × (H).083 inch

4. Low-level off state leakage current
The SSR has an off state leakage current of several milliamperes, where as this PhotoMOS relay has typ. 10pA (typical) even with the rated load voltage

5. Controls low-level analog signals

6. Low thermal electromotive force (Approx. 1 mV)

TYPICAL APPLICATIONS

Measuring and testing equipment
1. Testing equipment for semiconductor performance
IC tester, Liquid crystal driver tester, semiconductor performance tester
2. Board tester
Bear board tester, In-circuit tester, function tester
3. Medical equipment
Ultrasonic wave diagnostic machine
4. Multi-point recorder (warping, thermo couple)

TYPES

Type	Output rating*		Tape and reel packing style		Packing quantity	
	Load voltage	Load current	Picked from the 1/2-pin side	Picked from the 3/4-pin side	Tube	Tape and reel
AC/DC type	40V	120mA	AQY221N1SX	AQY221N1SZ	1,000 pcs	1,000 pcs

* Indicate the peak AC and DC values.
Notes: (1) Tape package is the standard packing style. Also available in tube.
(Part No. suffix “X” or “Z” is not needed when ordering; Tube: 100 pcs.; Case: 2,000 pcs.)
(2) For space reasons, the initial letters of the product number “AQY and S”, the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQY221N1S	Remarks
Input	LED forward current	I_F	50mA	
	LED reverse voltage	V_R	5V	
	Peak forward current	I_{FP}	1A	f=100 Hz, Duty factor=0.1%
	Power dissipation	P_{in}	75mW	
Output	Load voltage (peak AC)	V_L	40V	
	Continuous load current	I_L	0.12A	Peak AC,DC
	Peak load current	I_{peak}	0.30A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	300mW	
Total power dissipation		P_T	350mW	
I/O isolation voltage		V_{iso}	1,500V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

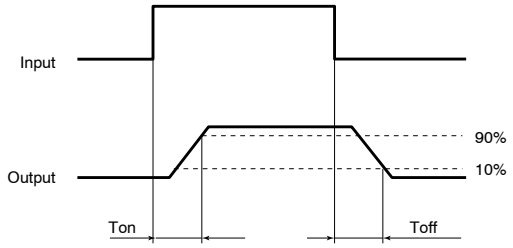
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQY221N1S	Condition
Input	LED operate current		Typical	I_{Fon}	0.9mA	I_L=100 mA
			Maximum		3.0mA	
	LED turn off current		Minimum	I_{Foff}	0.4mA	I_L=100 mA
			Typical		0.85mA	
	LED dropout voltage		Typical	V_F	1.25V (1.14V at I_F=5mA)	I_F=50mA
			Maximum		1.5V	
Output	On resistance #		Typical	R_{on}	9.8Ω	I_F=5mA I_L=100 mA Within 1 s on time
			Maximum		12.5Ω	
	Output capacitance #		Typical	C_{out}	2.2pF	I_F=0mA V_B=0V f=1 MHz
			Maximum		2.5pF	
	Off state leakage current		Typical	I_{Leak}	0.01nA	I_F=0mA V_L=Max.
			Maximum		10nA	
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	0.04ms	I_F=5mA V_L=10V R_L=100Ω
			Maximum		0.5ms	
		Turn off time*	Typical	T_{off}	0.06ms	I_F=5mA V_L=10V R_L=100Ω
			Maximum		0.2ms	
	I/O capacitance		Typical	C_{iso}	0.8pF	f=1MHz V_B=0V
			Maximum		1.5pF	
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000MΩ	500V DC

Note: Recommendable LED forward current I_F = 5mA.

For type of connection, see page 56.

*Turn on/Turn off time



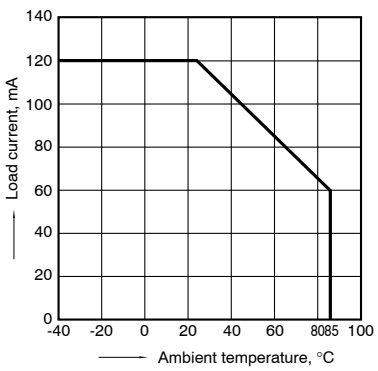
Other types of products than the C_{out} (typ. 2.0pF) and R_{on} (A connection typ. 9.8 ohm) combinations carried in this catalog are also available. (There is a trade-off between R_{on} and C_{out} both cannot be reduced at the same time.) For more information, please contact our sales office in your area.

■ **For Dimensions, see page 53.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

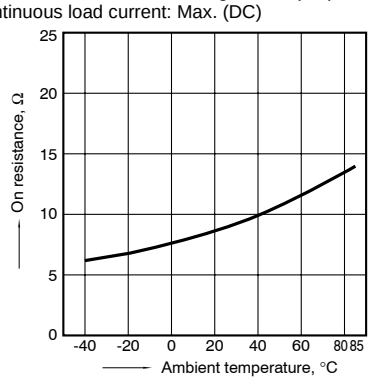
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



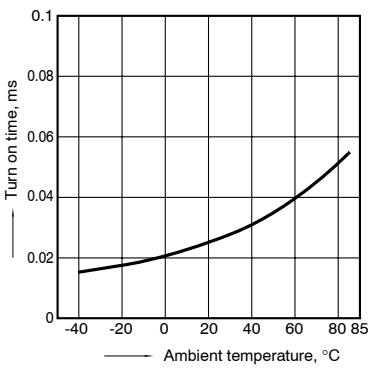
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 3 and 4
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)

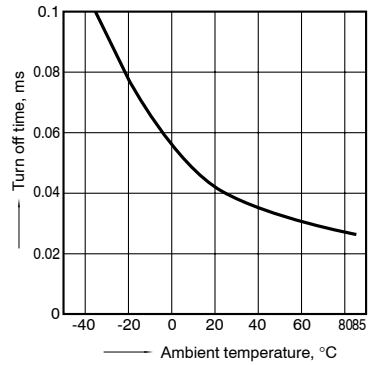


3. Turn on time vs. ambient temperature characteristics

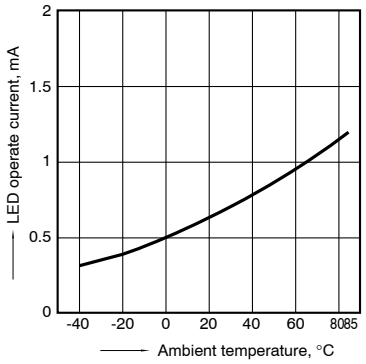
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



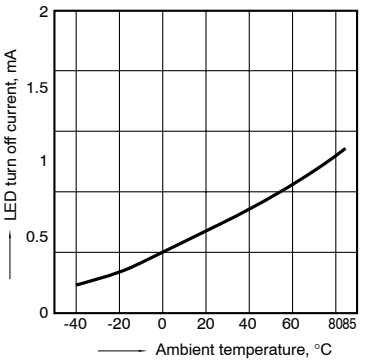
4. Turn off time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



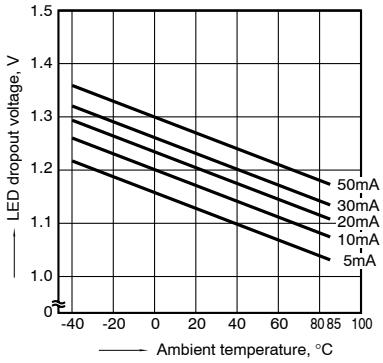
5. LED operate current vs. ambient temperature characteristics
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



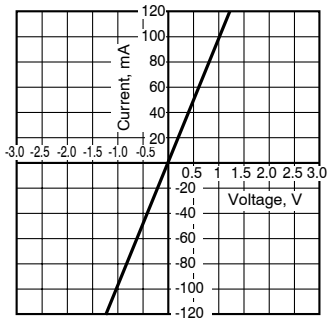
6. LED turn off current vs. ambient temperature characteristics
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



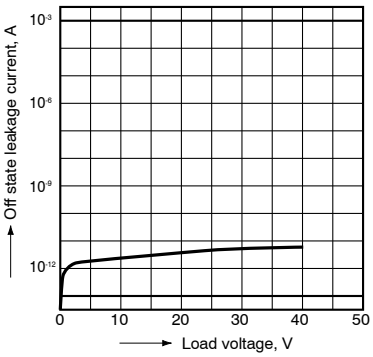
7. LED dropout voltage vs. ambient temperature characteristics
LED current: 5 to 50 mA



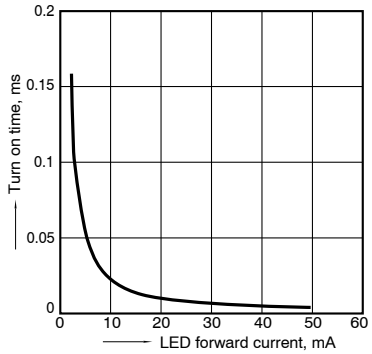
8. Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



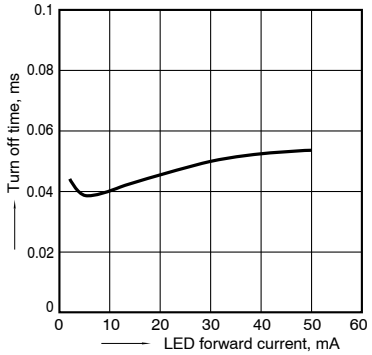
9. Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



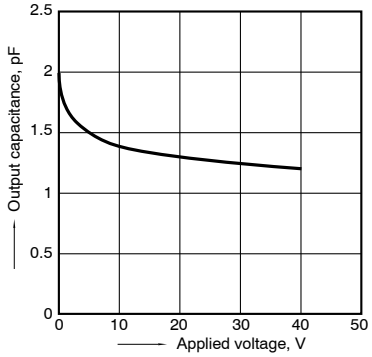
10. Turn on time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



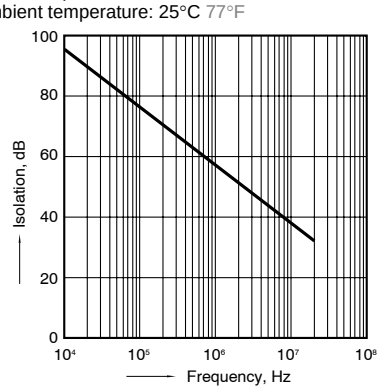
11. Turn off time vs. LED forward current characteristics
Measured portion: between terminals 3 and 4
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



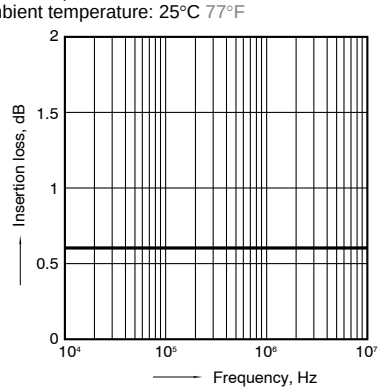
12. Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 3 and 4
Frequency: 1 MHz, 30m Vrms;
Ambient temperature: 25°C 77°F



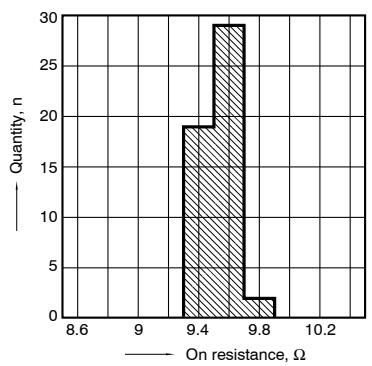
13. Isolation vs. frequency characteristics (50Ω impedance)
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F



14. Insertion loss vs. frequency characteristics (50Ω impedance)
Measured portion: between terminals 3 and 4
Ambient temperature: 25°C 77°F

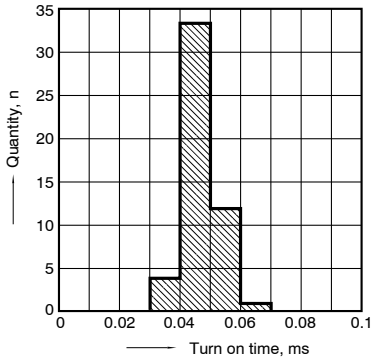


15. On resistance distribution
Measured portion: between terminals 3 and 4
Continuous load current: 120mA(DC)
Quantity, n=50; Ambient temperature: 25°C 77°F



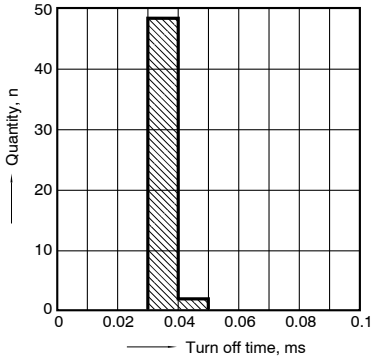
16. Turn on time distribution

Load voltage: 40V(DC)
Continuous load current: 120mA(DC)
Quantity, n=50; Ambient temperature: 25°C 77°F



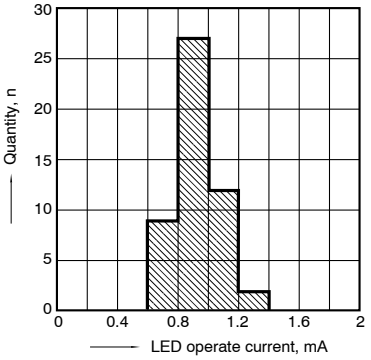
17. Turn off time distribution

Load voltage: 40V(DC)
Continuous load current: 120mA(DC)
Quantity, n=50; Ambient temperature: 25°C 77°F



18. LED operate current distribution

Load voltage: 40V(DC)
Continuous load current: 120mA(DC)
Quantity, n=50; Ambient temperature: 25°C 77°F

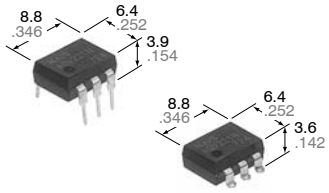


BSI pending

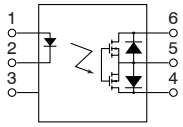
Panasonic
ideas for life

Lower output capacitance and on resistance. High speed switching. (Turn on time: 0.2ms, Turn off time: 0.08ms).

RF PhotoMOS (AQV221N)



mm inch



FEATURES

1. Low output capacitance between output terminals and low ON-resistance

2. High speed switching (Turn on time: typ. 200μs)

3. High sensitivity
Control loads up to 250mA with input current 5mA

4. Low-level off state leakage current
The SSR has an off state leakage current of several milliamperes, where as this PhotoMOS relay has typ. 20pA even with the rated load voltage

5. Controls low-level analog signals
PhotoMOS relays features extremely low-closed-circuit offset voltage to enable control of low-level analog signals without distortion

6. Low thermal electromotive force (Approx. 1 μV)

TYPICAL APPLICATIONS

Measuring and testing equipment

1. Testing equipment for semiconductor performance
   IC tester, Liquid crystal driver tester, semiconductor performance tester
2. Board tester
   Bear board tester, In-circuit tester, function tester
3. Medical equipment
   Ultrasonic wave diagnostic machine
4. Multi-point recorder
   (warping, thermo couple)

TYPES

Type	Output rating*		Part No.				Packing quantity	
			Through hole terminal	Surface-mount terminal				
	Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC type	40 V	150 mA	AQV221N	AQV221NA	AQV221NAX	AQV221NAZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

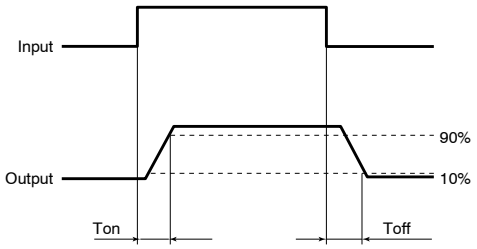
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV221N(A)	Remarks
Input	LED forward current	I_F		50 mA	
	LED reverse voltage	V_R		5 V	
	Peak forward current	I_{FP}		1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW	
Output	Load voltage (peak AC)	V_L		40 V	
	Continuous load current	I_L	A	0.15 A	A connection: Peak AC, DC B, C connection: DC
			B	0.18 A	
			C	0.25 A	
	Peak load current	I_{peak}		0.45 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}		360 mW	
Total power dissipation		P_T		410 mW	
I/O isolation voltage		V_{iso}		1,500 V AC	
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	Type of connection**	AQV221N(A)	Remarks
Input	LED operate current		Typical	I_{Fon}	—	0.90 mA	I_L = Max.
			Maximum			3.0 mA	
	LED turn off current		Minimum	I_{Foff}	—	0.4 mA	I_L = Max.
			Typical			0.85 mA	
	LED dropout voltage		Typical	V_F	—	1.25 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
			Maximum			1.5 V	
Output	On resistance #		Typical	R_{on}	A	9.8 Ω	I_F = 0 mA I_L = Max. Within 1 s on time
			Maximum			15 Ω	
			Typical	R_{on}	B	5 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum			7.5 Ω	
			Typical	R_{on}	C	2.5 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum			3.8 Ω	
	Output capacitance #		Typical	C_{out}	A	3.9 pF	I_F = 0 mA V_B = 0V f = 1 MHz
			Maximum			5 pF	
	Off state leakage current		Typical	I_{Leak}	—	20 pA	I_F = 0 mA V_L = Max.
			Maximum			10 nA	
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	—	0.2 ms	I_F = 5 mA I_L = Max.
			Maximum			0.5 ms	
		Turn off time*	Typical	T_{off}	—	0.08 ms	I_F = 5 mA I_L = Max.
			Maximum			0.2 ms	
	I/O capacitance		Typical	C_{iso}	—	0.8 pF	f = 1 MHz V_B = 0 V
			Maximum			1.5 pF	
	Initial I/O isolation resistance		Minimum	R_{iso}	—	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F = 5mA
**For type of connection, see page 56.
*Turn on/Turn off time



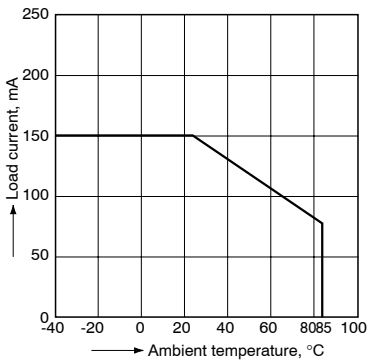
Other types of products than the C_{out} (typ. 3.9pF) and R_{on} (A connection typ. 9.8Ω) combinations carried in this catalog are also available.
(There is a trade-off between R_{on} and C_{out} both cannot be reduced at the same time.)
For more information, please contact our sales office in your area.

■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

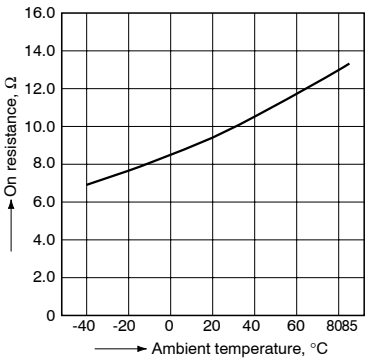
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F
Type of connection: A



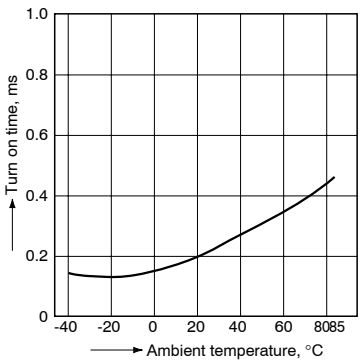
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)

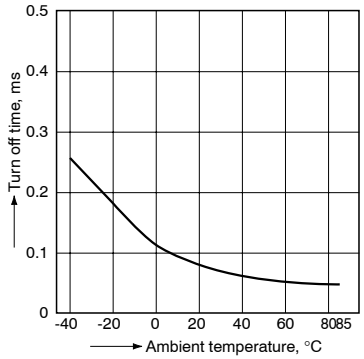


3. Turn on time vs. ambient temperature characteristics

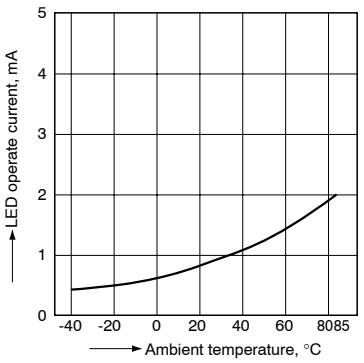
LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



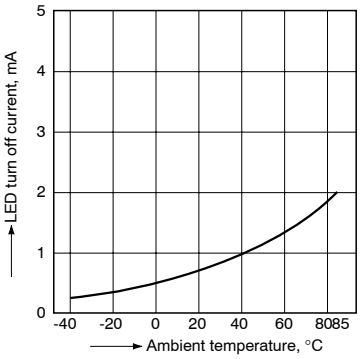
4. Turn off time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



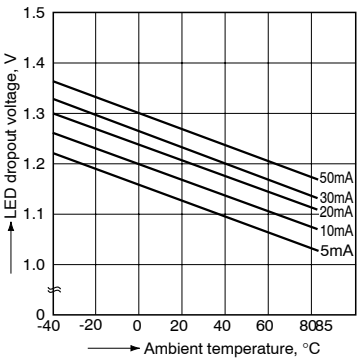
5. LED operate current vs. ambient temperature characteristics
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



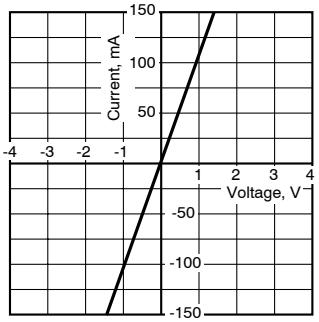
6. LED turn off current vs. ambient temperature characteristics
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



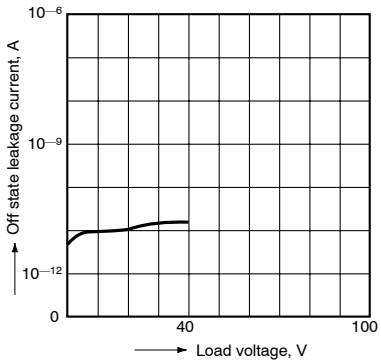
7. LED dropout voltage vs. ambient temperature characteristics
LED current: 5 to 50 mA



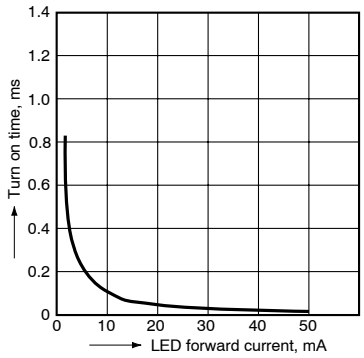
8. Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



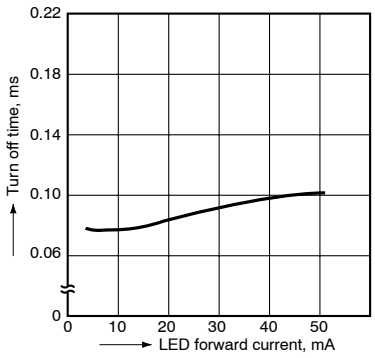
9. Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



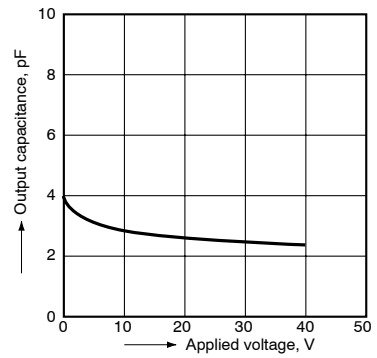
10. Turn on time vs. LED forward current characteristics
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



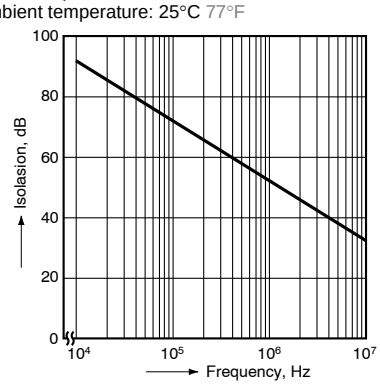
11. Turn off time vs. LED forward current characteristics
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



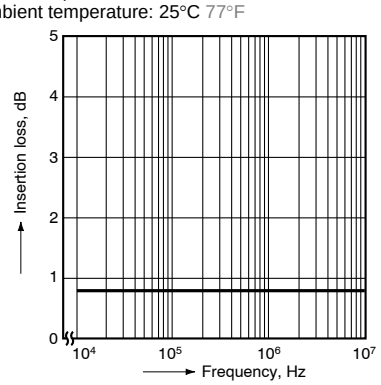
12. Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz, 30 mVrms;
Ambient temperature: 25°C 77°F



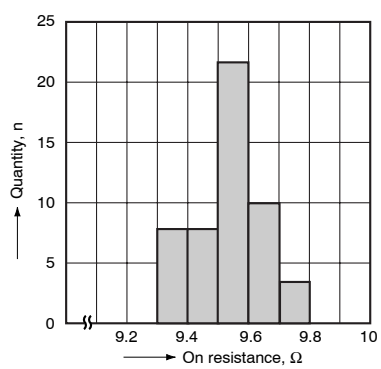
13. Isolation vs. frequency characteristics (50 Ω impedance)
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



14. Insertion loss vs. frequency characteristics (50 Ω impedance)
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F

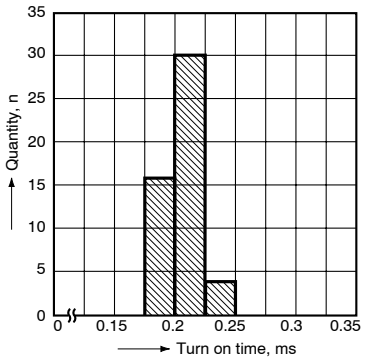


15. On resistance distribution
Measured portion: between terminals 4 and 6
Continuous load current: 150mA(DC)
Quantity, n=50; Ambient temperature: 25°C 77°F



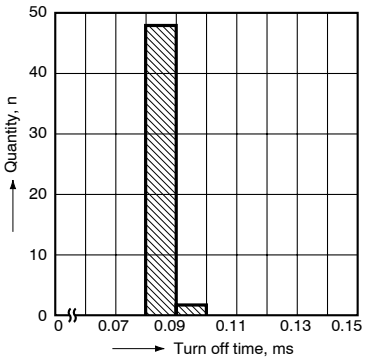
16. Turn on time distribution

Load voltage: 40V(DC)
Continuous load current: 150mA(DC)
Quantity, n=50; Ambient temperature: 25°C 77°F



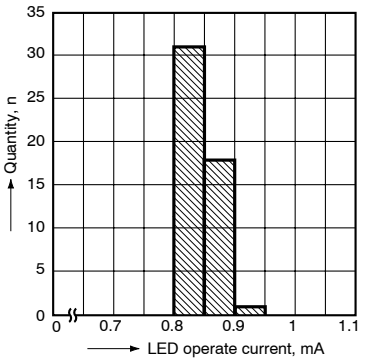
17. Turn off time distribution

Load voltage: 40V(DC)
Continuous load current: 150mA(DC)
Quantity, n=50; Ambient temperature: 25°C 77°F



18. LED operate current distribution

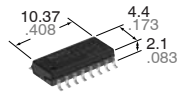
Load voltage: 40V(DC)
Continuous load current: 150mA(DC)
Quantity, n=50; Ambient temperature: 25°C 77°F



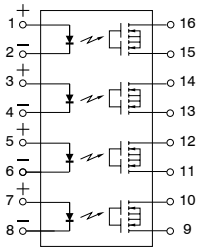
Panasonic
ideas for life

Lower output capacitance and on resistance. (C×R10) High speed switching. (Turn on time: 0.03ms, Turn off time: 0.03ms).

RF PhotoMOS (AQS221N2S)



mm inch



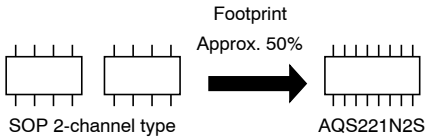
FEATURES

1. This is a CxR10 type that achieves very low output capacitance.

2. 4-channel (4 Form A) of RF PhotoMOS Relays

3. SO package 16-pin type in super miniature design

The device comes in a super-miniature SO package measuring (W)10.37 × (L)4.4 × (H)2.1mm (W) .408×(L).173× (H).083inch— approx. 50% of the footprint size of 8-pin(2-channel) type.



4. Applicable for 4 Form A use, as well as 4 independent 1 Form A

5. High speed switching

Turn on time: 30μs
Turn off time: 30μs

6. Low-level off state leakage current

The SSR has an off state leakage current of several milliamperes, whereas this PhotoMOS relay has typ. 10pA even with the rated load voltage (40V)

7. Controls low-level analog signals

PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion

TYPICAL APPLICATIONS

Measuring and testing equipment

1. Testing equipment for semiconductor performance

IC tester, Liquid crystal driver tester, semiconductor performance tester

2. Board tester

Bare board tester, In-circuit tester, function tester

3. Medical equipment

Ultrasonic wave diagnostic machine

4. Multi-point recorder

Warping, thermo couple

TYPES

Type	Output rating*		Part No.		Packing quantity in tape and reel
	Load voltage	Load current	Picked from the 1/2/3/4/5/6/7/8-pin side	Picked from the 9/10/11/12/13/14/15/16-pin side	
AC/DC type	40 V	60 mA	AQS221N2SX	AQS221N2SZ	1,000 pcs.

* Indicate the peak AC and DC values.

Notes: (1) Tape package is the standard packing style. Also available in tube. (Part No. suffix “X” or “Z” is not needed when ordering; Tube: 50 pcs.; Case: 1,000 pcs.)

(2) For space reasons, the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQS221N2S	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage	V_L	40 V	
	Continuous load current	I_L	0.06 A	
	Peak load current	I_{peak}	0.12 A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	600 mW	
Total power dissipation		P_T	650 mW	
I/O isolation voltage		V_{iso}	500 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

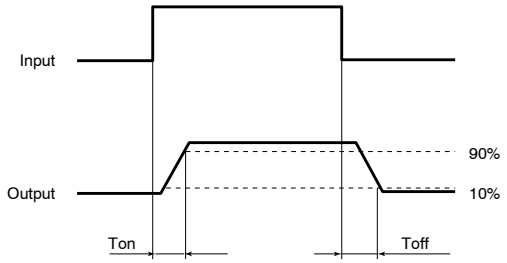
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQS221N2S	Condition
Input	LED operate current	Typical	I_{Fon}	0.9 mA	I_L = Max.
		Maximum		3.0 mA	
	LED turn off current	Minimum	I_{Foff}	0.1 mA	I_L = Max.
		Typical		0.85 mA	
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	9.5Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		12.5Ω	
	Output capacitance	Typical	C_{out}	1.0 pF	I_F = 0 mA V_B = 0 V f = 1 MHz
		Maximum		1.5 pF	
	Off state leakage current	Typical	I_{Leak}	0.01 nA	I_F = 0 mA V_L = Max.
		Maximum		10 nA	
Transfer characteristics	Turn on time*	Typical	T_{on}	0.03 ms	I_F = 5 mA V_L = 10V R_L = 500Ω
		Maximum		0.2 ms	
	Turn off time*	Typical	T_{off}	0.03 ms	I_F = 5 mA V_L = 10V R_L = 500Ω
		Maximum		0.2 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F = 5 mA.

For type of connection, see page 58.

*Turn on/Turn off time

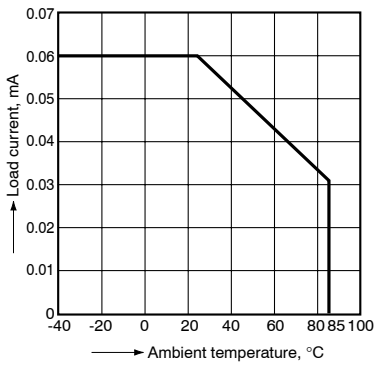


■ **For Dimensions, see page 54.**
■ **For Schematic and Wiring Diagrams, see page 58.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

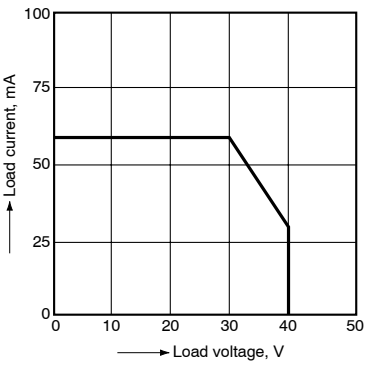
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



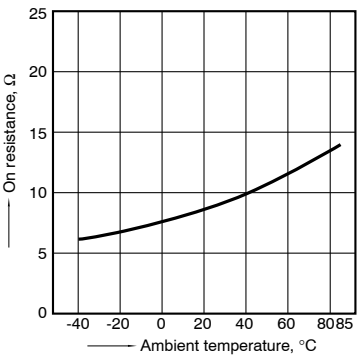
2. Load current vs. load voltage characteristics

Ambient temperature: 25°C 47°F

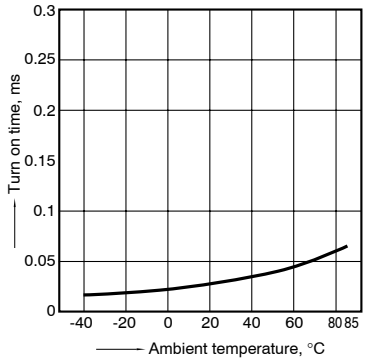


3. On resistance vs. ambient temperature characteristics

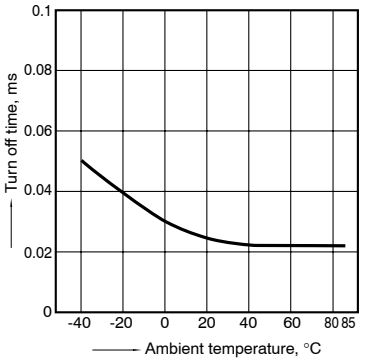
LED current: 5 mA; Load voltage: Max. (DC);
Load current: Max. (DC)



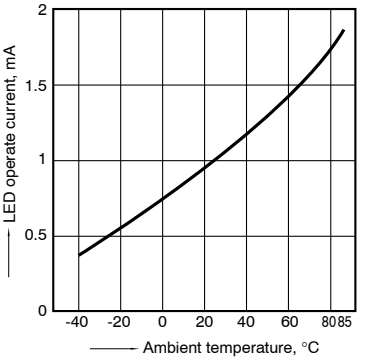
4. Turn on time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 20 mA (DC)



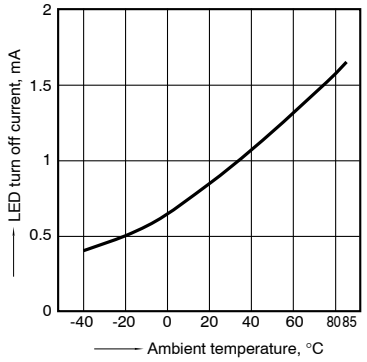
5. Turn off time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 20 mA (DC)



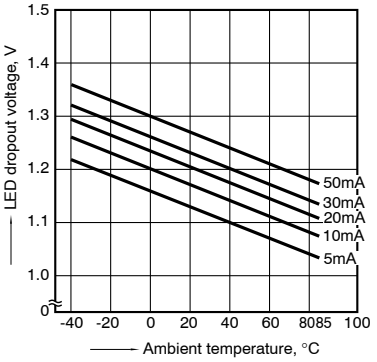
6. LED operate current vs. ambient temperature characteristics
Load voltage: 10 V (DC);
Continuous load current: 60 mA (DC)



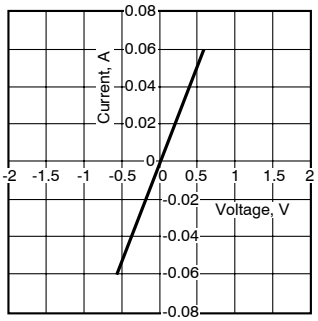
7. LED turn off current vs. ambient temperature characteristics
Load voltage: 10 V (DC);
Continuous load current: 60 mA (DC)



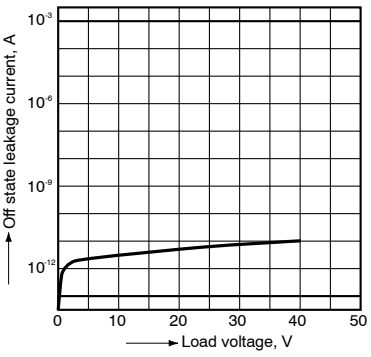
8. LED dropout voltage vs. ambient temperature characteristics
LED current: 5 to 50 mA



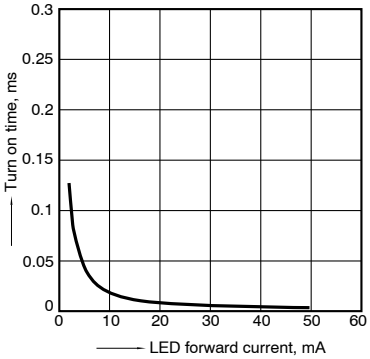
9. Current vs. voltage characteristics of output at MOS portion
Ambient temperature: 25°C 77°F



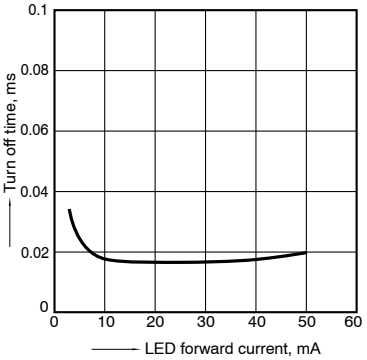
10. Off state leakage current vs. load voltage characteristics
Ambient temperature: 25°C 77°F



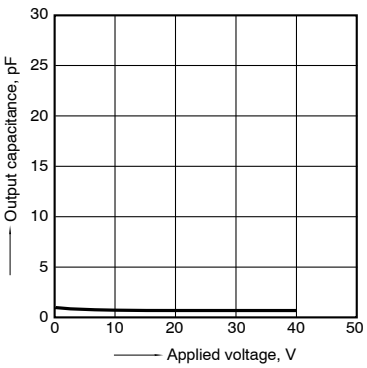
11. Turn on time vs. LED forward current characteristics
Load voltage: 10 V (DC); Continuous load current: 20 mA (DC); Ambient temperature: 25°C 77°F



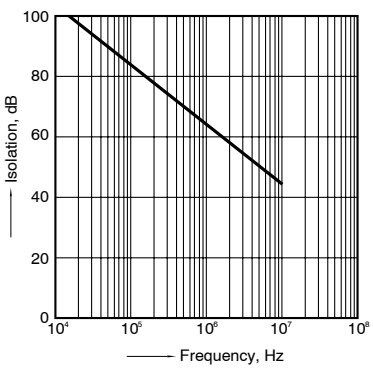
12. Turn off time vs. LED forward current characteristics
Load voltage: 10 V (DC); Continuous load current: 20 mA (DC); Ambient temperature: 25°C 77°F



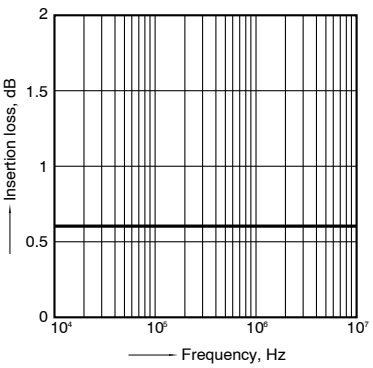
13. Output capacitance vs. applied voltage characteristics
Frequency: 1 MHz, 30 mVrms;
Ambient temperature: 25°C 77°F



14. Isolation vs. frequency characteristics (50Ω impedance)
Ambient temperature: 25°C 77°F



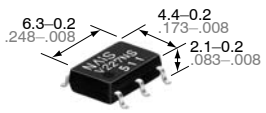
15. Insertion loss vs. frequency characteristics (50Ω impedance)
Ambient temperature: 25°C 77°F



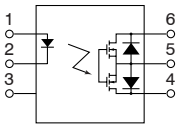
Panasonic
ideas for life

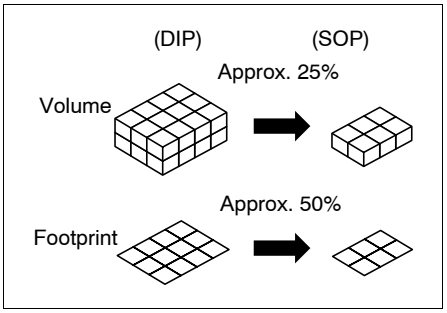
Lower output capacitance and on resistance. High speed switching. (Turn on time: 0.1ms, Turn off time: 0.05ms).

RF PhotoMOS (AQV22❍NS)



mm inch





FEATURES

1. 1-channel (Form A) in super miniature design
The device comes in a super-miniature SO package measuring (W) 4.4 × (L) 6.3 ×(H) 2.1 mm (W).173× (L) .248× (H) .083 inch —approx. 25% of the volume and 50% of the footprint size of DIP type PhotoMOS Relays.

2. Low capacitance between output terminals ensure high response speed:
The capacitance between output terminals is small, typically 10 pF. This enables for a fast operation speed of 200 μs.

3. Low-level off state leakage current:
The SSR has an off state leakage current of several milliamperes, whereas the PhotoMOS relay has only 30 pA even with the rated load voltage of 200 V (AQV227NS).

4. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

5. Tape and reel
The device comes standard in a tape and reel (1,000 pcs./reel) to facilitate automatic insertion machines.

TYPICAL APPLICATIONS

- Telephones
- Measuring instruments
- Computer
- Industrial robots
- High-speed inspection machines

TYPES

1. AC/DC type

Output rating*		Part No.		Packing quantity in tape and reel
		Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side	
Load voltage	Load current	1 Form A	1 Form A	
200 V	50 mA	AQV227NSX	AQV227NSZ	1,000 pcs.
400 V	40 mA	AQV224NSX	AQV224NSZ	

*Indicate the peak AC and DC values.

Notes: (1) Tape package is the standard packing style. Also available in tube. (Part No. suffix “X” or “Z” is not needed when ordering; Tube: 75 pcs.; Case: 1,500 pcs.)
(2) For space reasons, the top two letters of the product number “AQ” are omitted on the product seal. The package type indicator “X” and “Z” are also omitted from the seal. (Ex. the label for product number AQV224NS is V224NS).

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV227NS	AQV224NS	Remarks
Input	LED forward current	I_F		50 mA		
	LED reverse voltage	V_R		5 V		
	Peak forward current	I_{FP}		1 A		f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW		
Output	Load voltage (peak AC)	V_L		200 V	400 V	
	Continuous load current	I_L	A	0.05 A	0.04 A	A connection: Peak AC, DC B, C connection: DC
			B	0.06 A	0.05 A	
			C	0.08 A	0.06 A	
	Peak load current	I_{peak}		0.15 A	0.12 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}		450 mW		
Total power dissipation		P_T		500 mW		
I/O isolation voltage		V_{iso}		1,500 V AC		
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F		

07/2005

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	Type of connection	AQV227NS	AQV224NS	Remarks
Input	LED operate current	Typical	I_{Fon}	—	0.7 mA		I_L = Max.
		Maximum			3 mA		
	LED turn off current	Minimum	I_{Foff}	—	0.4 mA		I_L = Max.
		Typical			0.65 mA		
	LED dropout voltage	Typical	V_F	—	1.25 V (1.14 V at I_F = 5 mA)		I_F = 50 mA
		Maximum			1.5 V		
Output	On resistance	Typical	R_{on}	A	30 Ω	70 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			50 Ω	100 Ω	
		Typical	R_{on}	B	16 Ω	55 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			25 Ω	70 Ω	
		Typical	R_{on}	C	8 Ω	28 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			12.5 Ω	35 Ω	
	Output capacitance	Typical	C_{out}		10 pF		I_F = 0 V_B = 0 f = 1 MHz
		Maximum			15 pF		
	Off state leakage current	Typical	I_{leak}	—	30 pA	90 pA	I_F = 0 V_L = Max.
		Maximum			10 nA		
Transfer characteristics	Turn on time*	Typical	T_{on}	—	0.12 ms	0.1 ms	I_F = 5 mA I_L = Max.
		Maximum			0.5 ms		
	Turn off time*	Typical	T_{off}	—	0.05 ms		I_F = 5 mA I_L = Max.
		Maximum			0.2 ms		
	I/O capacitance	Typical	C_{iso}	—	0.8 pF		f = 1 MHz V_B = 0
		Maximum			1.5 pF		
	Initial I/O isolation resistance	Minimum	R_{iso}	—	1,000 MΩ		500 V DC

Note: Recommendable LED forward current I_F= 5 mA. For type of connection, see page 56.

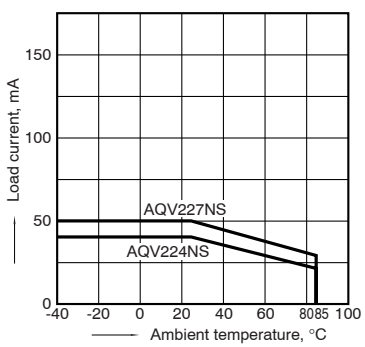
*Turn on/Turn off time

■ **For Dimensions, see page 53.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

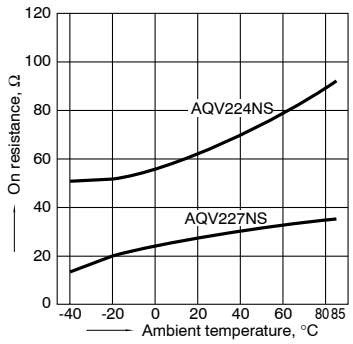
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F
Type of connection: A



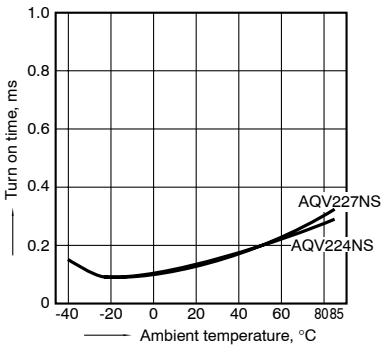
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)

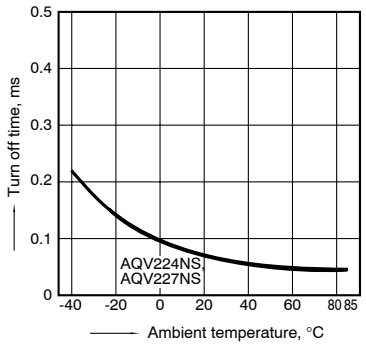


3. Turn on time vs. ambient temperature characteristics

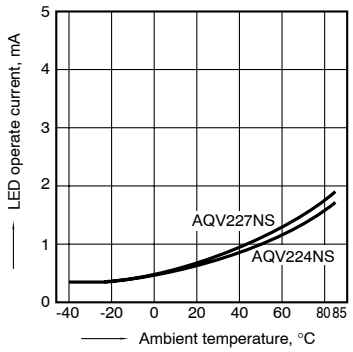
LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



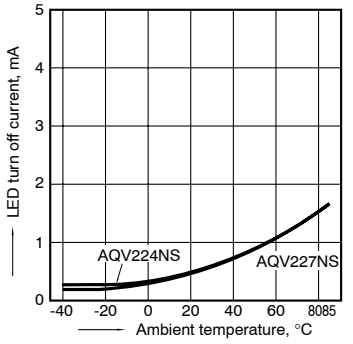
4. Turn off time vs. ambient temperature characteristics
LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



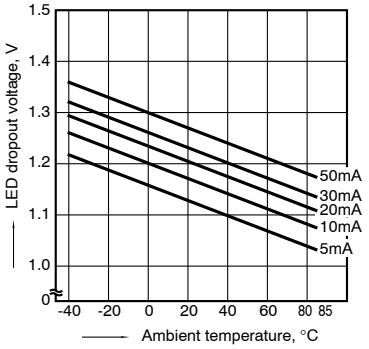
5. LED operate current vs. ambient temperature characteristics
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



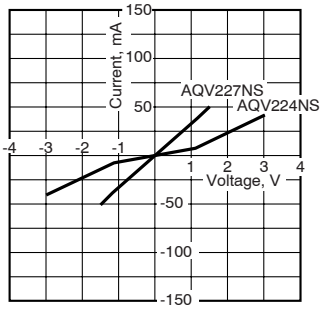
6. LED turn off current vs. ambient temperature characteristics
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



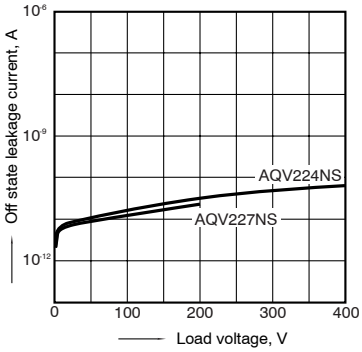
7. LED dropout voltage vs. ambient temperature characteristics
Sample: All types;
LED current: 5 to 50 mA



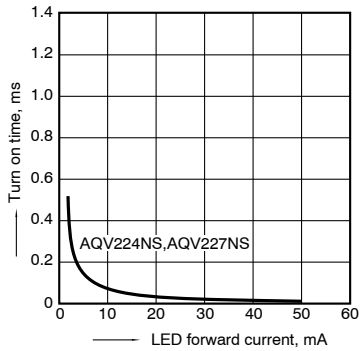
8. Voltage vs. current characteristics of output at MOS portion
Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



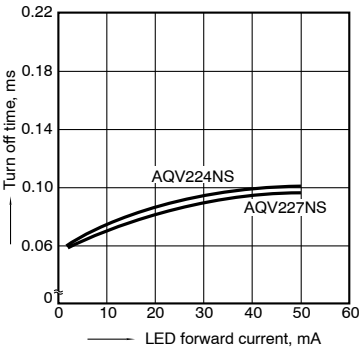
9. Off state leakage current
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



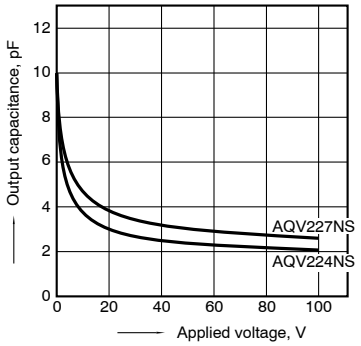
10. LED forward current vs. turn on time characteristics
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



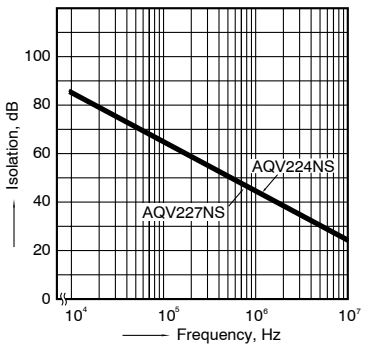
11. LED forward current vs. turn off time characteristics
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



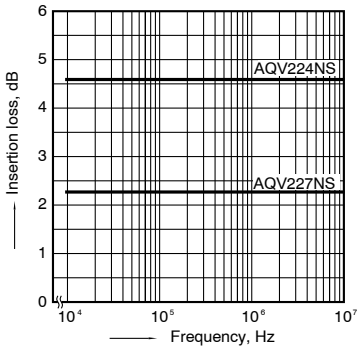
12. Applied voltage vs. output capacitance characteristics
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz, 30 mVrms;
Ambient temperature: 25°C 77°F



13. Isolation characteristics (50 Ω impedance)
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



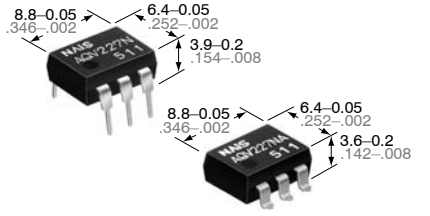
14. Insertion loss characteristics (50 Ω impedance)
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



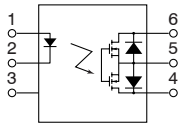
Panasonic
ideas for life

Lower output capacitance and on resistance. High speed switching. (Turn on time: 0.2ms, Turn off time: 0.08ms).

RF PhotoMOS (AQV22❍N)



mm inch



FEATURES

1. PhotoMOS relay with high response speed, low leakage current and low On resistance

2. Low capacitance between output terminals ensures high response speed:
The capacitance between output terminals is small, typically 10 pF. This enables for a fast operation speed of 200 μs.

3. High sensitivity and low On resistance
Maximum 0.1 A of load current can be controlled with input current of 5 mA. The On resistance is less than our conventional models. With no metallic contacts, the PhotoMOS relay has stable switching characteristics.

4. Low-level off state leakage current
The SSR has an off state leakage current of several milliamperes, whereas the PhotoMOS relay has only 30 pA even with the rated load voltage of 200 V (AQV227N).

5. Controls low-level analog signals
PhotoMOS relay features extremely low closed-circuit offset voltages to enable control of small analog signals without distortion.

6. Low terminals electromotive force
(approx. 1 μV)

TYPICAL APPLICATIONS

- Measuring devices
- Scanner, IC checker, Board tester

TYPES

Type	Output rating*		Part No.				Packing quantity	
			Through hole terminal	Surface-mount terminal				
	Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC type	200 V	70 mA	AQV227N	AQV227NA	AQV227NAX	AQV227NAZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.
	400 V	50 mA	AQV224N	AQV224NA	AQV224NAX	AQV224NAZ		

*Indicate the peak AC and DC values.
Note: For space reasons, the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV227N(A)	AQV224N(A)	Remarks
Input	LED forward current	I_F		50 mA		
	LED reverse voltage	V_R		5 V		
	Peak forward current	I_{FP}		1 A		f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW		
Output	Load voltage (peak AC)	V_L		200 V	400 V	
	Continuous load current	I_L	A	0.07 A	0.05 A	A connection: Peak AC, DC B, C connection: DC
			B	0.08 A	0.06 A	
			C	0.10 A	0.08 A	
	Peak load current	I_{peak}		0.21 A	0.15 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}		360 mW		
Total power dissipation		P_T		410 mW		
I/O isolation voltage		V_{iso}		1,500 V AC		
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F		

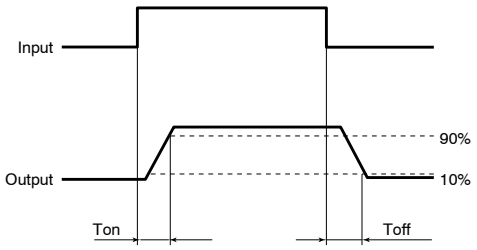
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	Type of connection	AQV227N(A)	AQV224N(A)	Remarks
Input	LED operate current		Typical	I_{Fon}	—	0.90 mA		I_L = Max.
			Maximum			3.0 mA		
	LED turn off current		Minimum	I_{Foff}	—	0.4 mA		I_L = Max.
			Typical			0.85 mA		
	LED dropout voltage		Typical	V_F	—	1.25 V (1.14 V at I_F = 5 mA)		I_F = 50 mA
			Maximum			1.5 V		
Output	On resistance		Typical	R_{on}	A	30 Ω	70 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum			50 Ω	100 Ω	
			Typical	R_{on}	B	16 Ω	55 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum			25 Ω	70 Ω	
			Typical	R_{on}	C	8 Ω	28 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum			12.5 Ω	35 Ω	
	Output capacitance		Typical	C_{out}	—	10 pF		I_F = 0 V_B = 0 f = 1 MHz
			Maximum			15 pF		
	Off state leakage current		Typical	I_{Leak}	—	30 pA	90 pA	I_F = 0 V_L = Max.
			Maximum			10 nA		
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	—	0.20 ms		I_F = 5 mA I_L = Max.
			Maximum			0.5 ms		
		Turn off time*	Typical	T_{off}	—	0.08 ms		I_F = 5 mA I_L = Max.
			Maximum			0.2 ms		
	I/O capacitance		Typical	C_{iso}	—	0.8 pF		f = 1 MHz V_B = 0
			Maximum			1.5 pF		
	Initial I/O isolation resistance		Minimum	R_{iso}	—	1,000 MΩ		500 V DC

Note: Recommendable LED forward current I_F = 5mA.

For type of connection, see page 56.

*Turn on/Turn off time



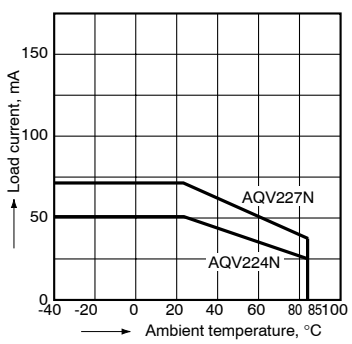
■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

1. Load current vs. ambient temperature characteristics

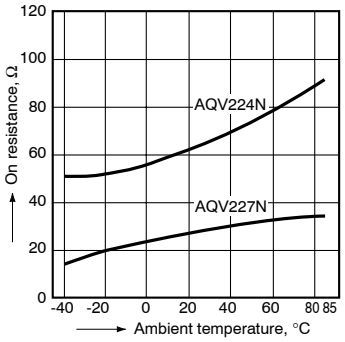
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

Type of connection: A



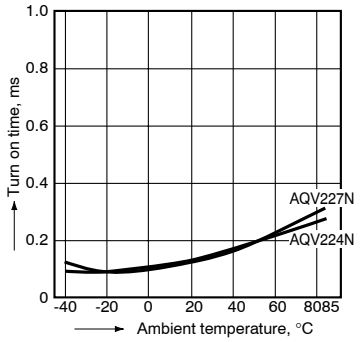
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)

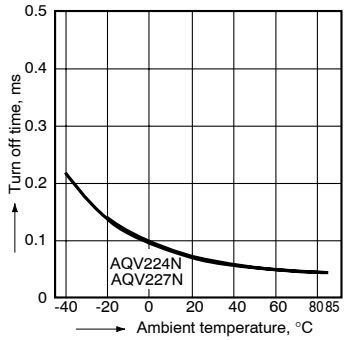


3. Turn on time vs. ambient temperature characteristics

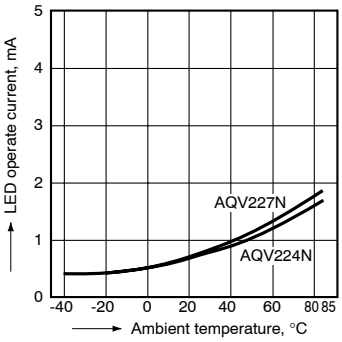
Sample: AQV227N, AQV224N;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



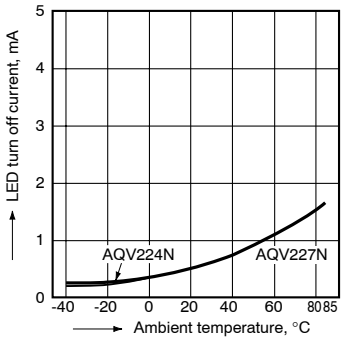
4. Turn off time vs. ambient temperature characteristics
Sample: AQV227N, AQV224N;
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



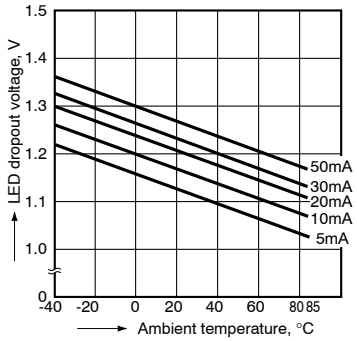
5. LED operate current vs. ambient temperature characteristics
Sample: AQV227N, AQV224N;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



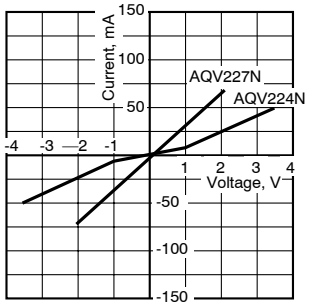
6. LED turn off current vs. ambient temperature characteristics
Sample: AQV227N, AQV224N;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



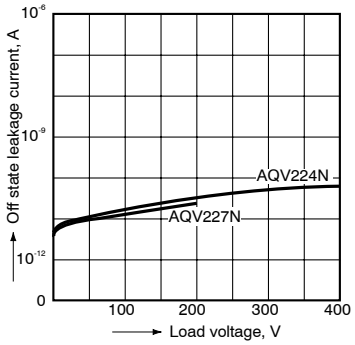
7. LED dropout voltage vs. ambient temperature characteristics
Sample: All types;
LED current: 5 to 50 mA



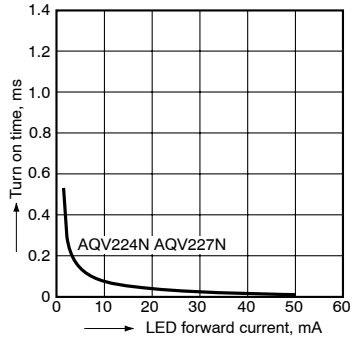
8. Current characteristics of output at MOS portion vs. voltage.
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



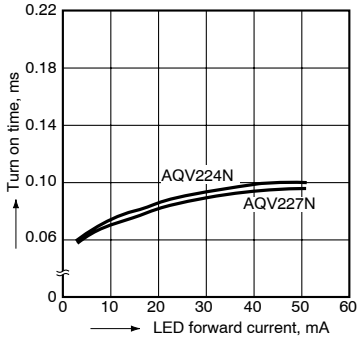
9. Off state leakage current vs. load voltage
Sample: AQV227N, AQV224N;
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



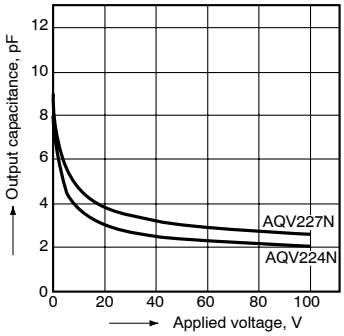
10. Turn on time characteristics vs. LED forward current
Sample: AQV227N, AQV224N;
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



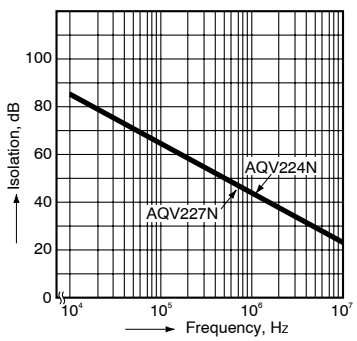
11. Turn off time characteristics vs. LED forward current
Sample: AQV227N, AQV224N;
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



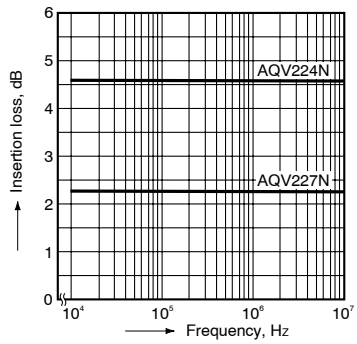
12. Output capacitance characteristics vs. applied voltage
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz, 30 mVrms;
Ambient temperature: 25°C 77°F



13. Isolation characteristics (50 Ω impedance)
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



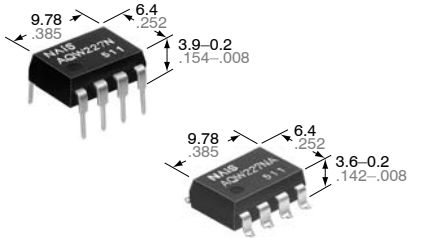
14. Insertion loss characteristics (50 Ω impedance)
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



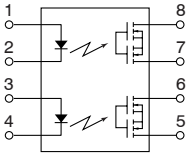
Panasonic
ideas for life

Lower output capacitance and on resistance. High speed switching. (Turn on time: 0.2ms, Turn off time: 0.08ms).

RF PhotoMOS (AQW22❍N)



mm inch



FEATURES

1. PhotoMOS relay 2-channels (Form A) type with high response speed, low leakage current and low On resistance.

2. Applicable for 2 Form A use as well as two independent 1 Form A use

3. Compact 8-pin DIP size
The device comes in a compact (W) 6.4×(L) 9.78×(H) 3.9 mm (W) .252×(L) .385×(H) .154 inch , 8-pin DIP size (through hole terminal type).

4. Low capacitance between output terminals ensures high response speed:
The capacitance between output terminals is small, typically 10 pF. This enables for a fast operation speed of 200 μs.

5. High sensitivity and low On resistance:
Maximum 0.07 A of load current can be controlled with input current of 5 mA. The On resistance is less than our conventional models. With no metallic contacts, the PhotoMOS relay has stable switching characteristics.

6. Low-level off state leakage current:
The SSR has an off state leakage current of several milliamperes, whereas the PhotoMOS relay has only 30 pA even with the rated load voltage of 200 V (AQW227N).

7. Controls low-level analog signals:
PhotoMOS relay features extremely low closed-circuit offset voltages to enable control of small analog signals without distortion.

8. Low terminals electromotive force:
(approx. 1 μV)

TYPICAL APPLICATIONS

- Measuring equipment
- Scanner, IC checker, Board tester

TYPES

Type	Output rating*		Part No.				Packing quantity	
			Through hole terminal	Surface-mount terminal				
	Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC type	200 V	50 mA	AQW227N	AQW227NA	AQW227NAX	AQW227NAZ	1 tube contains 40 pcs. 1 batch contains 400 pcs.	1,000 pcs.
	400 V	40 mA	AQW224N	AQW224NA	AQW224NAX	AQW224NAZ		

*Indicate the peak AC and DC values.
Note: For space reasons, the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQW227N(A)	AQW224N(A)	Remarks
Input	LED forward current	I_F	50 mA		
	LED reverse voltage	V_R	5 V		
	Peak forward current	I_{FP}	1 A		f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW		
Output	Load voltage (peak AC)	V_L	200 V	400 V	
	Continuous load current	I_L	0.05 A (0.07 A)	0.04 A (0.05 A)	Peak AC, DC ( ): in case of using only 1 channel
	Peak load current	I_{peak}	0.15 A	0.12 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	800 mW		
Total power dissipation		P_T	850 mW		
I/O isolation voltage		V_{iso}	1,500 V AC		
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F		Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F		

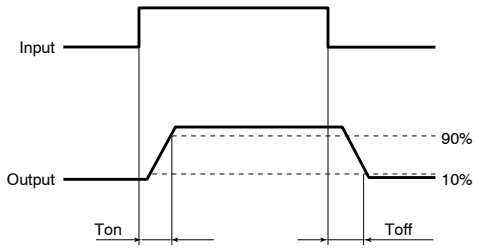
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQW227N(A)	AQW224N(A)	Remarks
Input	LED operate current		Typical	I_{Fon}	0.9 mA		I_L = Max.
			Maximum		3.0 mA		
	LED turn off current		Minimum	I_{Foff}	0.4 mA		I_L = Max.
			Typical		0.8 mA		
	LED dropout voltage		Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)		I_F = 50 mA
			Maximum		1.5 V		
Output	On resistance		Typical	R_{on}	30 Ω	70 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum		50 Ω	100 Ω	
	Output capacitance		Typical	C_{out}	10 pF		I_F = 0 V_B = 0 f = 1 MHz
			Maximum		15 pF		
	Off state leakage current		Maximum	I_{leak}	10 nA		I_F = 0 V_L = Max.
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	0.20 ms		I_F = 5 mA I_L = Max.
			Maximum		0.5 ms		
		Turn off time*	Typical	T_{off}	0.08 ms		I_F = 5 mA I_L = Max.
			Maximum		0.2 ms		
	I/O capacitance		Typical	C_{iso}	0.8 pF		f = 1 MHz V_B = 0
			Maximum		1.5 pF		
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000 MΩ		500 V DC

Note: Recommendable LED forward current I_F = 5mA.

For type of connection, see page 57.

*Turn on/Turn off time

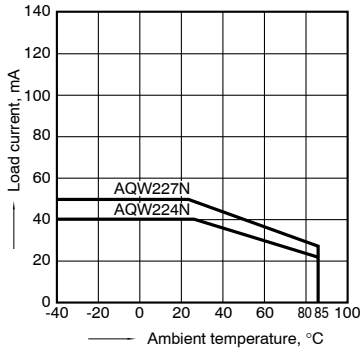


■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 57.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

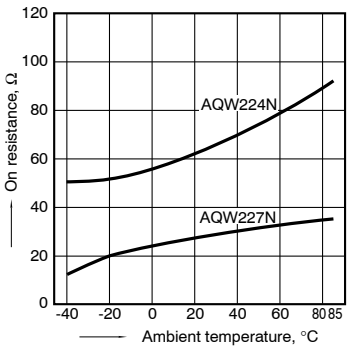
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



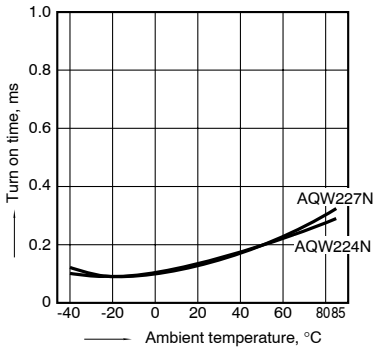
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8; LED current: 5 mA; Load voltage: Max. (DC); Continuous load current: Max. (DC)



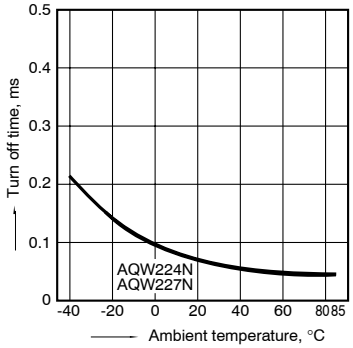
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC); Continuous load current: Max. (DC)



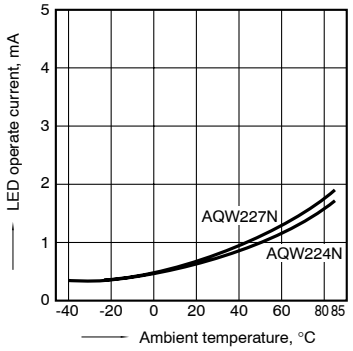
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



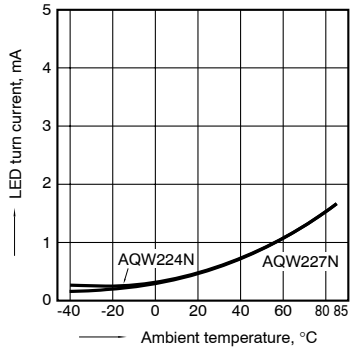
5. LED operate current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



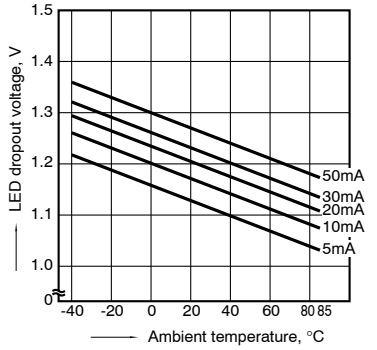
6. LED turn off current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



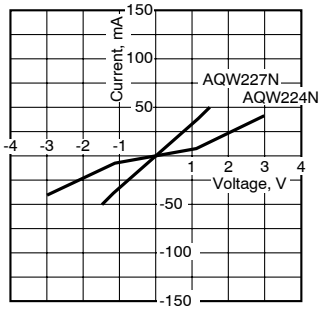
7. LED dropout voltage vs. ambient temperature characteristics

Sample: All types;
LED current: 5 to 50 mA



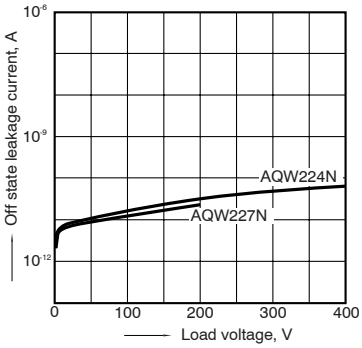
8. Voltage vs. current characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8; Ambient temperature: 25°C 77°F



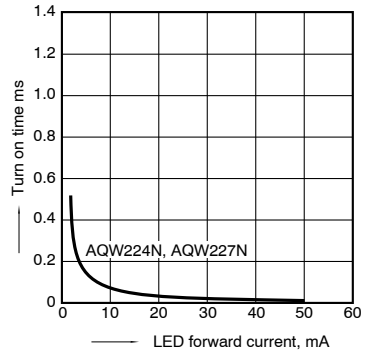
9. Off state leakage current

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



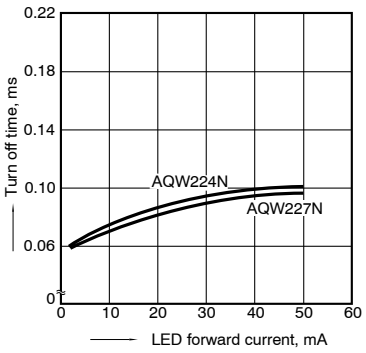
10. LED forward current vs. turn on time characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



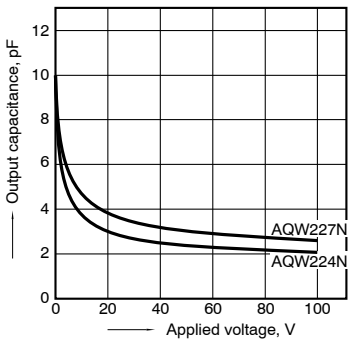
11. LED forward current vs. turn off time characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



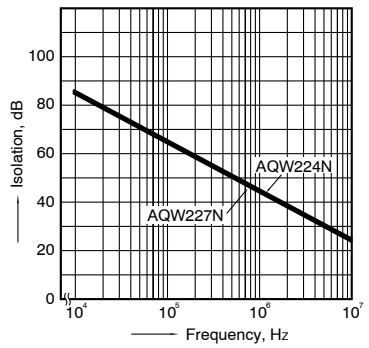
12. Applied voltage vs. output capacitance characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Frequency: 1 MHz, 30 mVrms;
Ambient temperature: 25°C 77°F



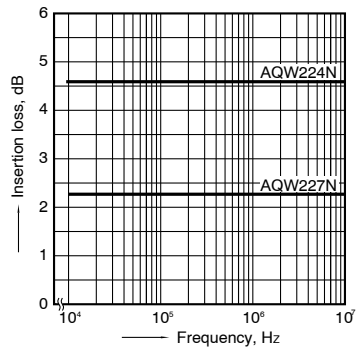
13. Isolation characteristics (50 Ω impedance)

Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



14. Insertion loss characteristics (50 Ω impedance)

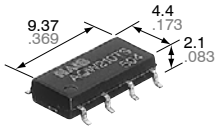
Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



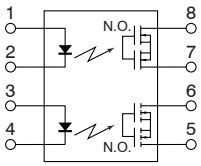
Panasonic
ideas for life

Lower output capacitance and on resistance. High speed switching. (Turn on time: 0.2ms, Turn off time: 0.08ms).

RF PhotoMOS (AQW227NS)

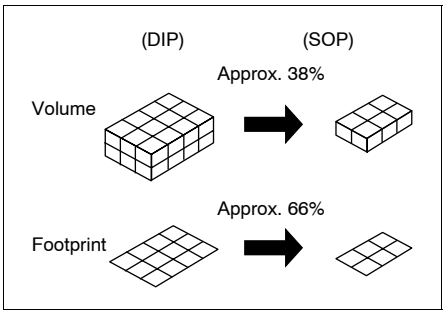


mm inch



FEATURES

1. 2-channel (Form A) in super miniature design
The device comes in a super-miniature SO package measuring (W) 4.4 × (L) 9.37 ×(H) 2.1 mm (W).173× (L) .369× (H) .083 inch —approx. 38% of the volume and 66% of the footprint size of DIP type PhotoMOS Relays.



2. Low capacitance between output terminals ensure high response speed:
The capacitance between output terminals is small, typically 10 pF. This enables a fast operation speed of 250 μs.

3. Low-level off state leakage current:
The SSR has an off state leakage current of several milliamperes, whereas the PhotoMOS relay has typ. 30 pA even with the rated load voltage of 200 V

4. Controls low-level analog signals

5. Tape and reel
The device comes standard in a tape and reel (1,000 pcs./reel) to facilitate automatic insertion machines.

TYPICAL APPLICATIONS

- Telephones
- Measuring instruments
  IC tester, semiconductor testing equipment
- Computer input machine
- Industrial robots

TYPES

Type	Output rating*		Part No.	
	Load voltage	Load current	Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side
			2 Form A	2 Form A
AC/DC type	200 V	40 mA	AQW227NSX	AQW227NSZ

* Indicate the peak AC and DC values.

Notes: (1) Tape package is the standard packing style. Also available in tube. (Part No. suffix “X” or “Z” is not needed when ordering; Tube: 50 pcs.; Case: 1,000 pcs.)
(2) For space reasons, the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

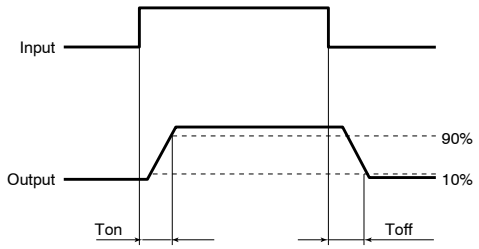
Item		Symbol	AQW227NS	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	200 V	
	Continuous load current	I_L	0.04 A (0.05 A)	Peak AC, DC ( ): in case of using only 1 channel
	Peak load current	I_{peak}	0.15 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	600 mW	
Total power dissipation		P_T	650 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQW227NS	Condition
Input	LED operate current		Typical	I_{Fon}	0.7mA	I_L=Max.
			Maximum		3.0mA	
	LED turn off current		Minimum	I_{Foff}	0.4mA	I_L=Max.
			Typical		0.65mA	
	LED dropout voltage		Typical	V_F	1.25V (1.14V at I_F=5mA)	I_F=50mA
			Maximum		1.5V	
Output	On resistance		Typical	R_{on}	30Ω	I_F=5mA I_L=Max. Within 1 s on time
			Maximum		50Ω	
	Output capacitance		Typical	C_{out}	10pF	I_F=0mA V_B=0V f=1 MHz
			Maximum		15pF	
	Off state leakage current		Maximum	I_{Leak}	10nA	I_F=0mA V_L=Max.
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	0.25ms	I_F=5mA I_L=Max.
			Maximum		0.5ms	
		Turn off time*	Typical	T_{off}	0.08ms	I_F=5mA I_L=Max.
			Maximum		0.2ms	
	I/O capacitance		Typical	C_{iso}	0.8pF	f=1MHz V_B=0V
			Maximum		1.5pF	
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000MΩ	500V DC

Note: Recommendable LED forward current I_F = 5mA. For type of connection, see page 57.

*Turn on/Turn off time

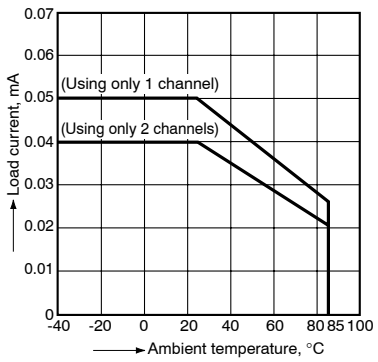


■ **For Dimensions, see page 53.**
■ **For Schematic and Wiring Diagrams, see page 57.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

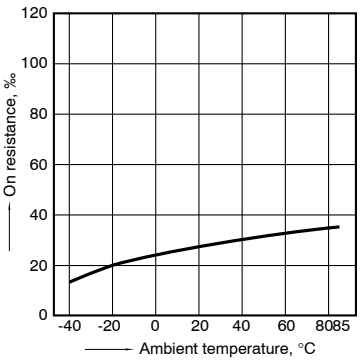
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F
Type of connection: A



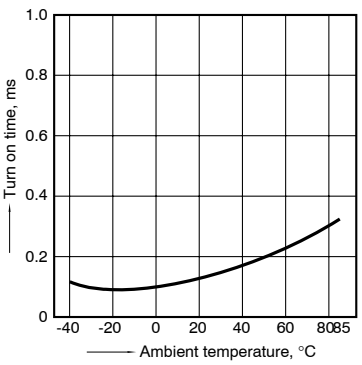
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8:
LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)

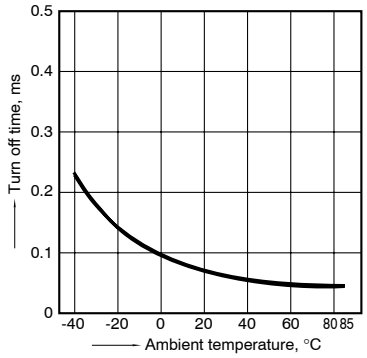


3. Turn on time vs. ambient temperature characteristics

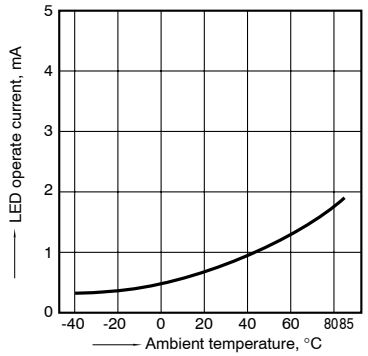
LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



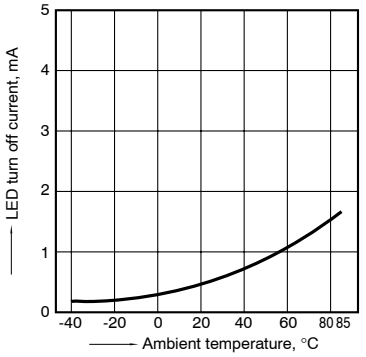
4. Turn off time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



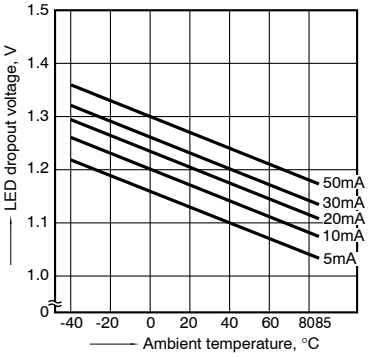
5. LED operate current vs. ambient temperature characteristics
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



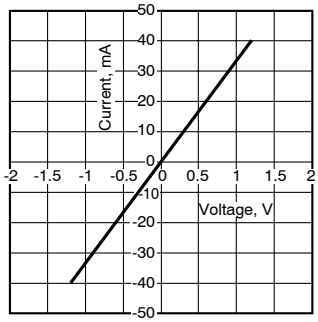
6. LED turn off current vs. ambient temperature characteristics
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



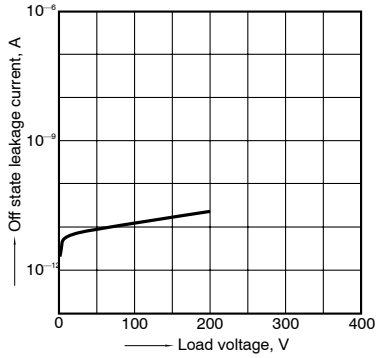
7. LED dropout voltage vs. ambient temperature characteristics
LED current: 5 to 50 mA



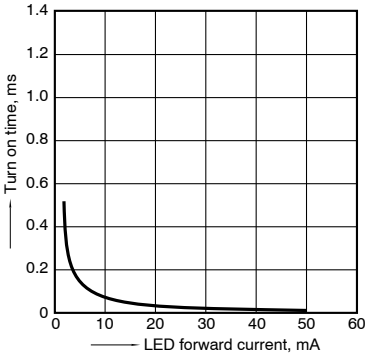
8. Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



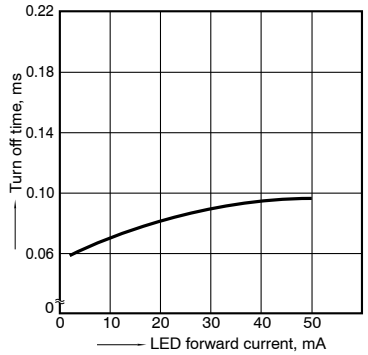
9. Off state leakage current vs. load voltage characteristics
Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



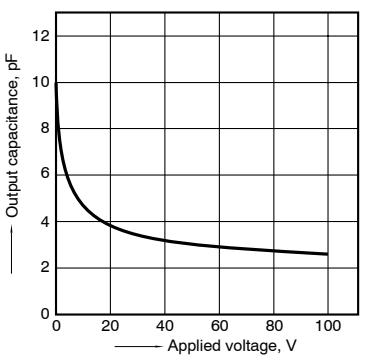
10. Turn on time vs. LED forward current characteristics
Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



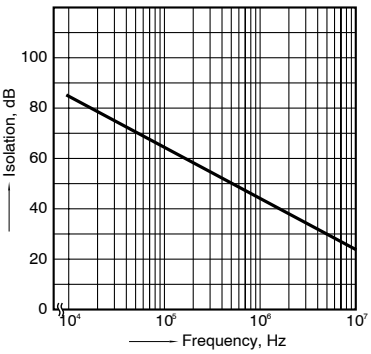
11. Turn off time vs. LED forward current characteristics
Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



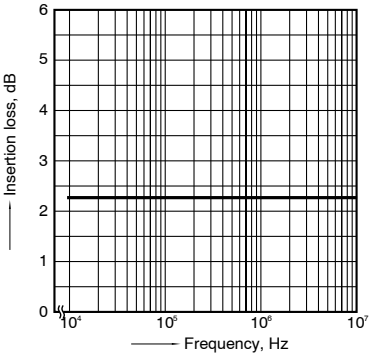
12. Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz, 30 mVrms;
Ambient temperature: 25°C 77°F



13. Isolation vs. frequency characteristics (50 Ω impedance)
Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



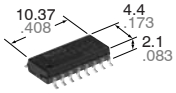
14. Insertion loss vs. frequency characteristics (50 Ω impedance)
Measured portion: between terminals 5 and 6, 7 and 8;
Ambient temperature: 25°C 77°F



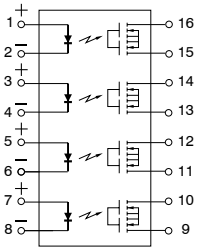
Panasonic
ideas for life

Lower output capacitance and on resistance. High speed switching. (Turn on time: 0.1ms, Turn off time: 0.03ms).

RF PhotoMOS (AQS225S)



mm inch

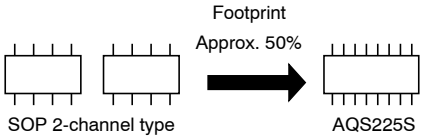


FEATURES

1. 4-channel (4 Form A) of RF PhotoMOS Relays

2. SO package 16-pin type in super miniature design

The device comes in a super-miniature SO package measuring (W)10.37 × (L)4.4 × (H)2.1mm (W) .408×(L).173× (H).083inch— approx. 50% of the footprint size of 8-pin(2-channel) type.



3. Applicable for 4 Form A use, as well as 4 independent 1 Form A

4. Low capacitance between output terminals ensure high response speed:

The capacitance between output terminals is small, typically 4.5pF. This enables for a fast operation speed of 0.1ms(typ.).

5. Low-level off state leakage current

6. Controls low-level analog signals

PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion

TYPICAL APPLICATIONS

- Telephone and data communication equipment
- Measuring equipment
- Medical equipment
- Industrial equipment

TYPES

Type	Output rating*		Part No.		Packing quantity in tape and reel
	Load voltage	Load current	Picked from the 1/2/3/4/5/6/7/8-pin side	Picked from the 9/10/11/12/13/14/15/16-pin side	
AC/DC type	80 V	50 mA	AQS225SX	AQS225SZ	1,000 pcs.

* Indicate the peak AC and DC values.

Notes: (1) Tape package is the standard packing style. Also available in tube. (Part No. suffix "X" or "Z" is not needed when ordering; Tube: 50 pcs.; Case: 1,000 pcs.)

(2) For space reasons, the package type indicator "X" and "Z" are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQS225S	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage	V_L	80 V	
	Continuous load current	I_L	0.05 A	
	Peak load current	I_{peak}	0.15 A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	600 mW	
Total power dissipation		P_T	650 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

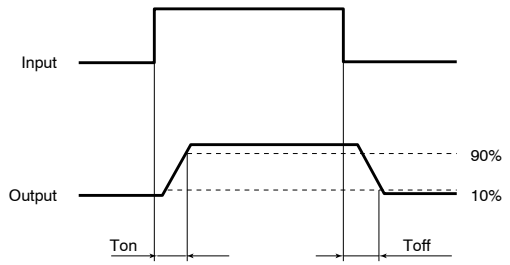
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQS225S	Condition
Input	LED operate current	Typical	I_{Fon}	0.9 mA	I_L = Max.
		Maximum		3 mA	
	LED turn off current	Minimum	I_{Foff}	0.3 mA	I_L = Max.
		Typical		0.85 mA	
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	21Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		35Ω	
	Output capacitance	Typical	C_{out}	4.5 pF	I_F = 0 mA V_B = 0 V f = 1 MHz
		Maximum		6 pF	
	Off state leakage current	Typical	I_{Leak}	30 pA	I_F = 0 mA V_L = Max.
		Maximum		10 nA	
Transfer characteristics	Turn on time*	Typical	T_{on}	0.1 ms	I_F = 5 mA I_L = Max.
		Maximum		0.3 ms	
	Turn off time*	Typical	T_{off}	0.03 ms	I_F = 5 mA I_L = Max.
		Maximum		0.1 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F= 5 mA.

For type of connection, see page 58.

*Turn on/Turn off time

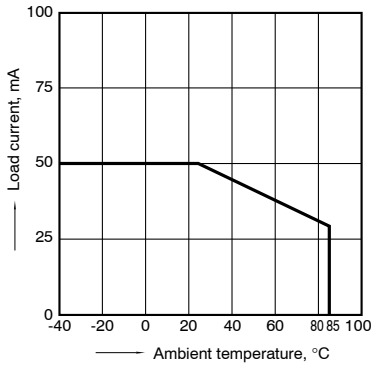


■ **For Dimensions, see page 54.**
■ **For Schematic and Wiring Diagrams, see page 58.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

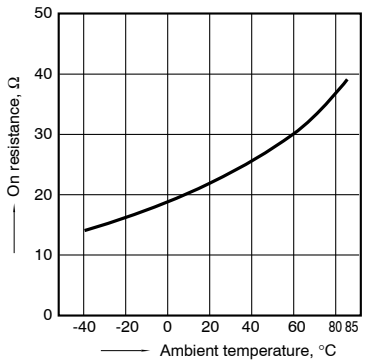
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



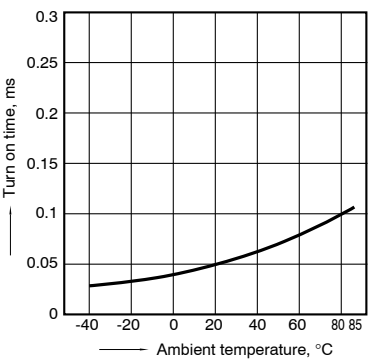
2. On resistance vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



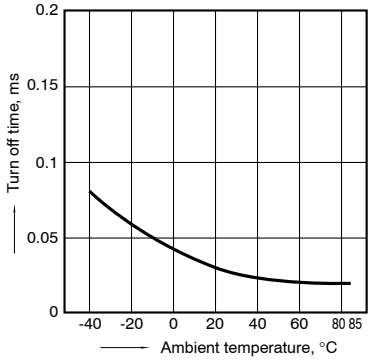
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



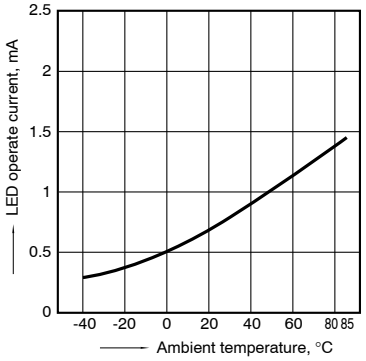
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



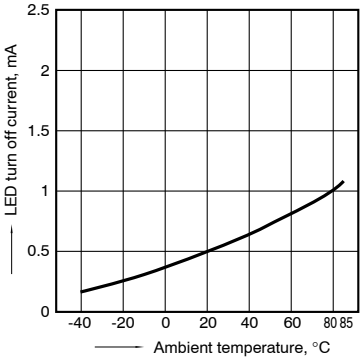
5. LED operate current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



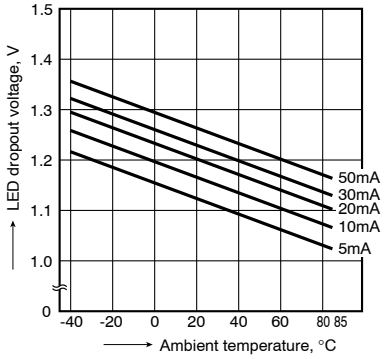
6. LED turn off current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



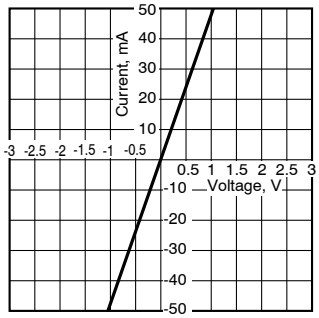
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



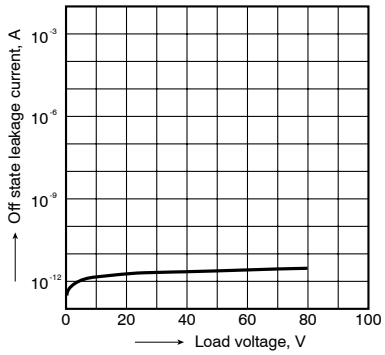
8. Current vs. voltage characteristics of output at MOS portion

Ambient temperature: 25°C 77°F



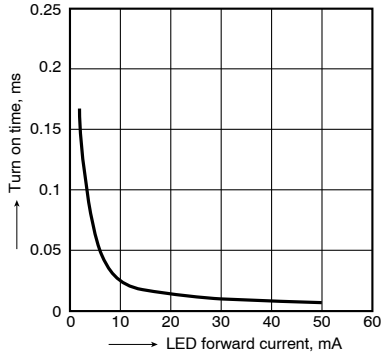
9. Off state leakage current vs. load voltage characteristics

Ambient temperature: 25°C 77°F



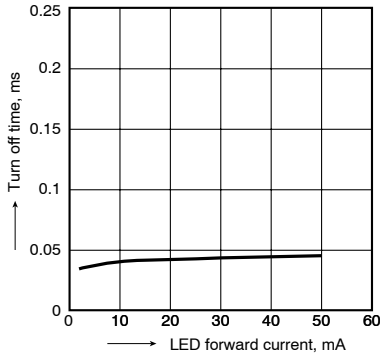
10. Turn on time vs. LED forward current characteristics

Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



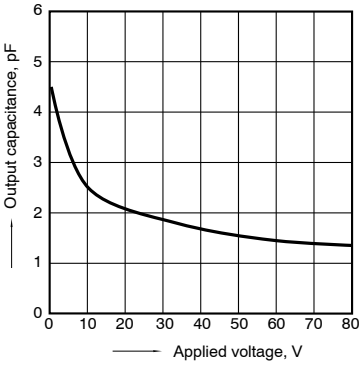
11. Turn off time vs. LED forward current characteristics

Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



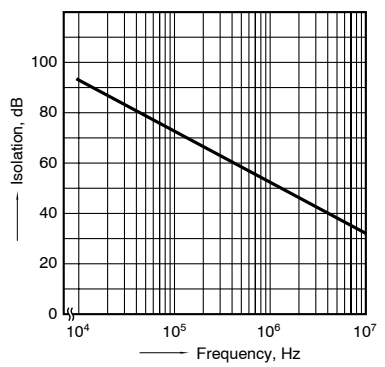
12. Output capacitance vs. applied voltage characteristics

Frequency: 1 MHz; Ambient temperature: 25°C 77°F



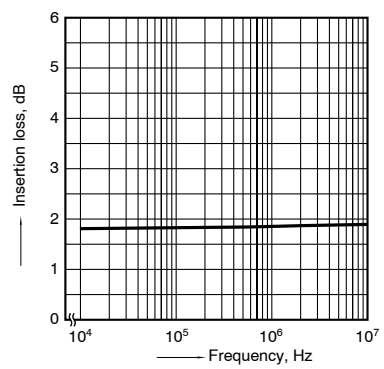
13. Isolation vs. frequency characteristics (50Ω impedance)

Ambient temperature: 25°C 77°F



14. Insertion loss vs. frequency characteristics (50Ω impedance)

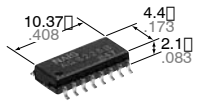
Ambient temperature: 25°C 77°F



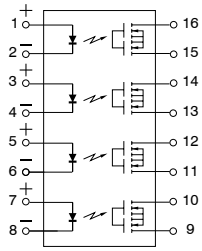
Panasonic
ideas for life

High capacity and low on resistance. RF in SOP 4 Form A type

RF PhotoMOS (AQS225R2S)



mm inch



FEATURES

1. High-level functions (high capacity and low on resistance)

Features: Compared to predecessor (AQS225S)

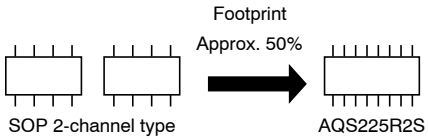
Type	AQS225S	AQS225R2S
C×R	*1 94.5pF·Ω (typ.)	*2 47.25pF·Ω (typ.)
Load current value	50mA	70mA

*1 4.5pF × 21Ω
*2 4.5pF × 10.5Ω

2. 4-channel (4 Form A) of RF PhotoMOS Relays

3. SO package 16-pin type in super miniature design

The device comes in a super-miniature SO package measuring (W)10.37 × (L)4.4 × (H)2.1mm (W) .408×(L).173×(H).083inch— approx. 50% of the footprint size of 8-pin (2-channel) type.



4. Applicable for 4 Form A use, as well as 4 independent 1 Form A

5. Low capacitance between output terminals ensure high response speed:

The capacitance between output terminals is small, typically 4.5pF. This enables for a fast operation speed of 0.04ms (typical).

6. Low-level off state leakage current

7. Controls low-level analog signals

PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion

TYPICAL APPLICATIONS

For multi-circuit switching

1. Measuring instruments
   (probe cards, etc.)
2. Test equipment
   IC tester, Liquid crystal driver tester, semiconductor performance tester
3. Board tester
   Bear board tester, In-circuit tester, function tester
4. Medical equipment
   Ultrasonic wave diagnostic machine
5. Multi-point recorder
   Warping, thermo couple

TYPES

Type	Output rating*		Part No.		Packing quantity in tape and reel
	Load voltage	Load current	Picked from the 1/2/3/4/5/6/7/8-pin side	Picked from the 9/10/11/12/13/14/15/16-pin side	
AC/DC type	80 V	70 mA	AQS225R2SX	AQS225R2SZ	1,000 pcs.

* Indicate the peak AC and DC values.
Notes: (1) Tape package is the standard packing style. Also available in tube. (Part No. suffix "X" or "Z" is not needed when ordering; Tube: 50 pcs.; Case: 1,000 pcs.)
(2) For space reasons, the package type indicator "X" and "Z" are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

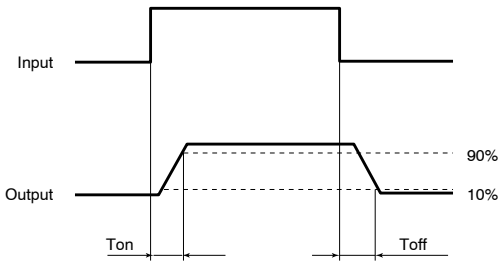
Item		Symbol	AQS225R2S	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	80 V	
	Continuous load current (peak AC)	I_L	0.07 A	
	Peak load current	I_{peak}	0.2 A	100 ms (1 shot), V_L= DC
	Power dissipation	P_{out}	600 mW	
Total power dissipation		P_T	650 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQS225R2S	Condition
Input	LED operate current	Typical	I_{Fon}	0.9 mA	I_L = Max.
		Maximum		3 mA	
	LED turn off current	Minimum	I_{Foff}	0.3 mA	I_L = Max.
		Typical		0.85 mA	
	LED dropout voltage	Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum		1.5 V	
Output	On resistance	Typical	R_{on}	10.5Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum		15Ω	
	Output capacitance	Typical	C_{out}	4.5 pF	I_F = 0 V_B = 0 V f = 1 MHz
		Maximum		6 pF	
	Off state leakage current	Typical	I_{Leak}	0.01 nA	I_F = 0 V_L = Max.
		Maximum		10 nA	
Transfer characteristics	Turn on time*	Typical	T_{on}	0.04 ms	I_F = 5 mA I_L = Max.
		Maximum		0.3 ms	
	Turn off time*	Typical	T_{off}	0.07 ms	I_F = 5 mA I_L = Max.
		Maximum		0.2 ms	
	I/O capacitance	Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0
		Maximum		1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F= 5 mA.
For type of connection, see page 57.

*Turn on/Turn off time

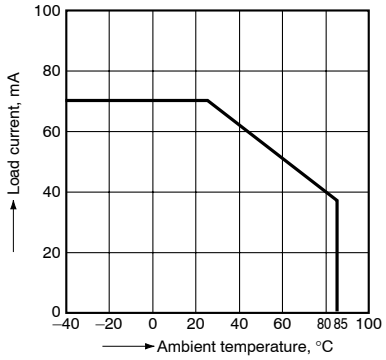


■ **For Dimensions, see page 54.**
■ **For Schematic and Wiring Diagrams, see page 58.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

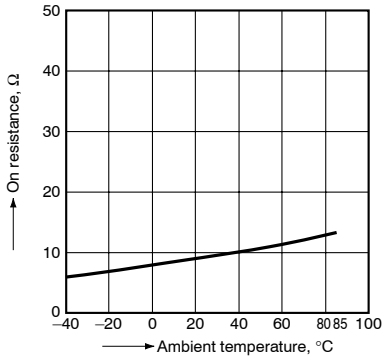
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



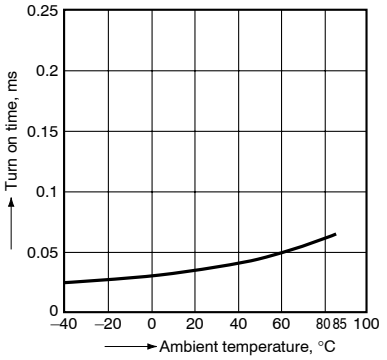
2. On resistance vs. ambient temperature characteristics

LED current: 5 mA;
Continuous load current: 70 mA (DC)

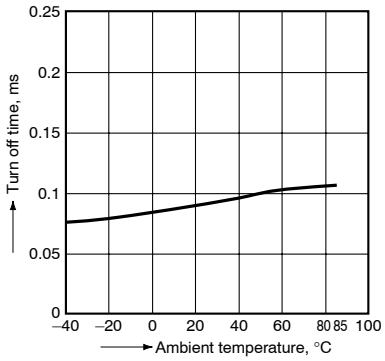


3. Turn on time vs. ambient temperature characteristics

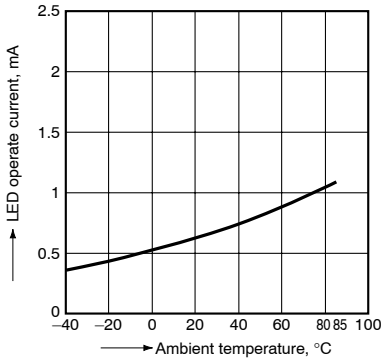
LED current: 5 mA; Load voltage: 80 V (DC);
Continuous load current: 70 mA (DC)



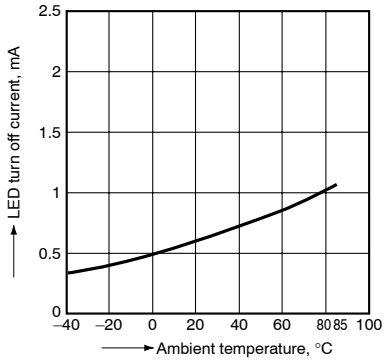
4. Turn off time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: 80 V (DC);
Continuous load current: 70 mA (DC)



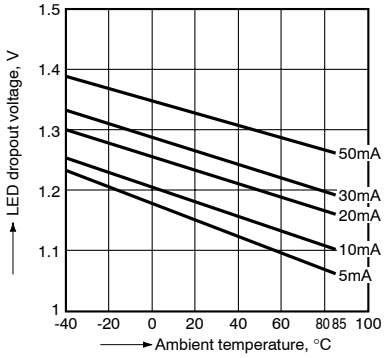
5. LED operate current vs. ambient temperature characteristics
Continuous load current: 70 mA (DC)



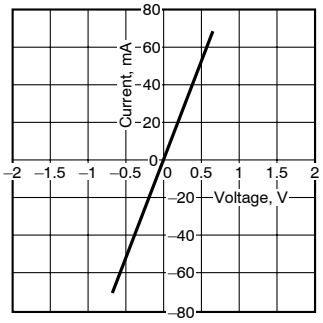
6. LED turn off current vs. ambient temperature characteristics
Continuous load current: 70 mA (DC)



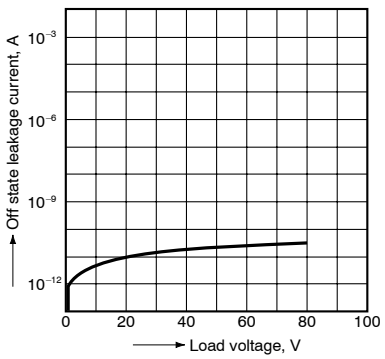
7. LED dropout voltage vs. ambient temperature characteristics
LED current: 5 to 50 mA



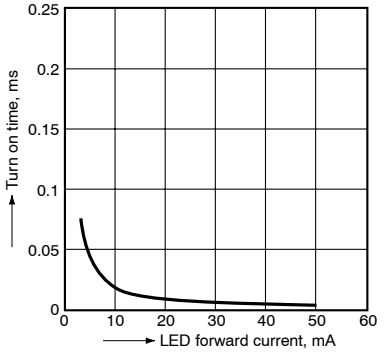
8. Current vs. voltage characteristics of output at MOS portion
Ambient temperature: 25°C 77°F



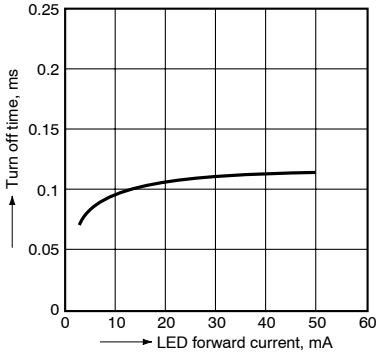
9. Off state leakage current vs. load voltage characteristics
Ambient temperature: 25°C 77°F



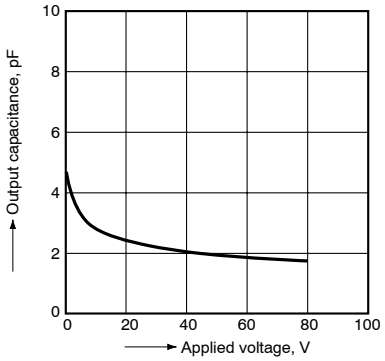
10. Turn on time vs. LED forward current characteristics
Load voltage: 80 V (DC); Continuous load current: 70 mA (DC); Ambient temperature: 25°C 77°F



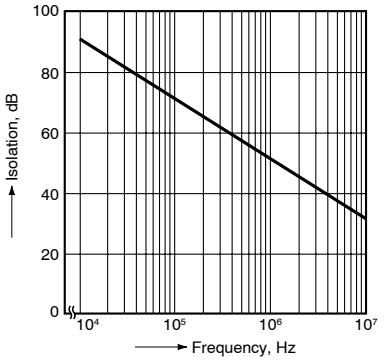
11. Turn off time vs. LED forward current characteristics
Load voltage: 80 V (DC); Continuous load current: 70 mA (DC); Ambient temperature: 25°C 77°F



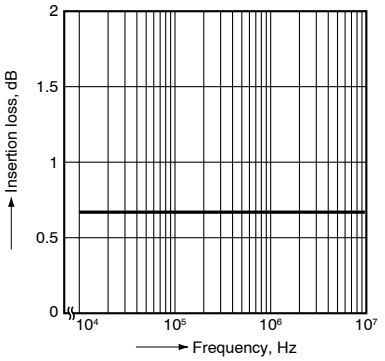
12. Output capacitance vs. applied voltage characteristics
Frequency: 1 MHz, 30 m Vrms;
Ambient temperature: 25°C 77°F



13. Isolation vs. frequency characteristics (50Ω impedance)
Ambient temperature: 25°C 77°F



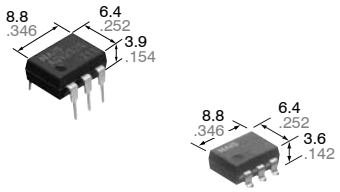
14. Insertion loss vs. frequency characteristics (50Ω impedance)
Ambient temperature: 25°C 77°F



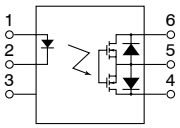
Panasonic
ideas for life

Greatly increase load current (2.5A). Load voltage is 60V.

HE PhotoMOS (AQV252G)



mm inch



FEATURES

1. Greatly increased load current in the same package size.

2. Greatly improved specs allow you to use this in place of mercury and mechanical relays.

TYPICAL APPLICATIONS

• Crime and fire prevention market (use in I/O for alarm and security devices, etc.)
• Measuring instrument market (circuit testers, etc.)

TYPES

Type	Output rating*		Part No.				Packing quantity	
			Through hole terminal	Surface-mount terminal				
	Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC type	60 V	2.5 A	AQV252G	AQV252GA	AQV252GAX	AQV252GAZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

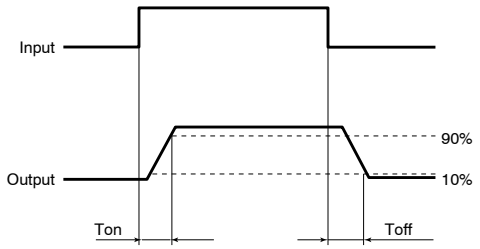
Item		Symbol	Type of connection	AQV252G(A)	Remarks
Input	LED forward current	I_F		50 mA	
	LED reverse voltage	V_R		5 V	
	Peak forward current	I_{FP}		1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW	
Output	Load voltage (peak AC)	V_L		60 V	
	Continuous load current (peak AC)	I_L	A	2.5 A	A connection: Peak AC, DC B, C connection: DC
			B	3.5 A	
			C	5.0 A	
	Peak load current	I_{peak}		6.0 A	100ms (1 shot), V_L = DC
	Power dissipation	P_{out}		500 mW	
Total power dissipation		P_T		550 mW	
I/O isolation voltage		V_{iso}		1,500 V AC	
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	Type of connection	AQV252G(A)	Condition
Input	LED operate current	Typical	I_{Fon}	—	0.5 mA	I_L = 100mA
		Maximum			3 mA	
	LED turn off current	Minimum	I_{Foff}	—	0.2 mA	I_L = 100mA
		Typical			0.45 mA	
	LED dropout voltage	Typical	V_F	—	1.32 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
		Maximum			1.5 V	
Output	On resistance	Typical	R_{on}	A	0.08 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
		Maximum			0.12 Ω	
		Typical	R_{on}	B	0.04 Ω	
		Maximum			0.06 Ω	
		Typical	R_{on}	C	0.02 Ω	
		Maximum			0.03 Ω	
	Off state leakage current	Maximum	I_{Leak}	—	1 μA	I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	—	1.1 ms	I_F = 5 mA I_L = 100 mA V_L = 10 V
		Maximum			5.0 ms	
	Turn off time*	Typical	T_{off}	—	0.25 ms	I_F = 5 mA I_L = 100 mA V_L = 10 V
		Maximum			0.5 ms	
	I/O capacitance	Typical	C_{iso}	—	0.8 pF	f = 1 MHz V_B = 0 V
		Maximum			1.5 pF	
	Initial I/O isolation resistance	Minimum	R_{iso}	—	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F = 5 to 10 mA. For type of connection, see page 56.

*Turn on/Turn off time

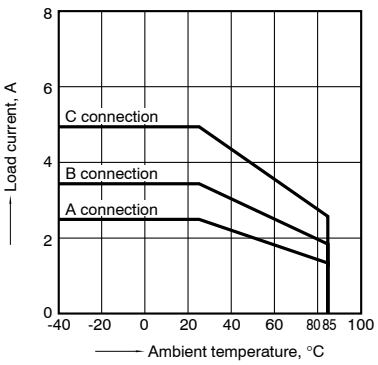


■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

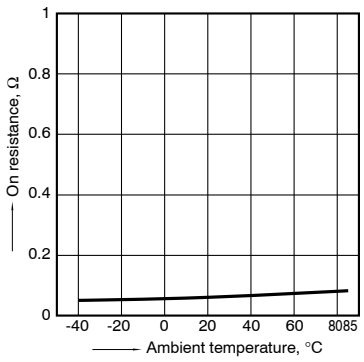
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



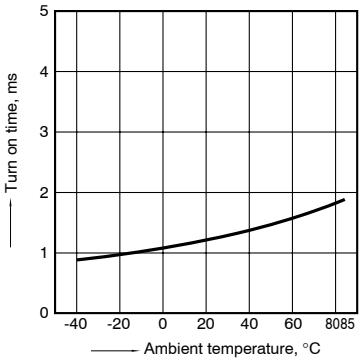
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 5 mA; Load voltage: Max. (DC)
Continuous load current: Max.(DC)



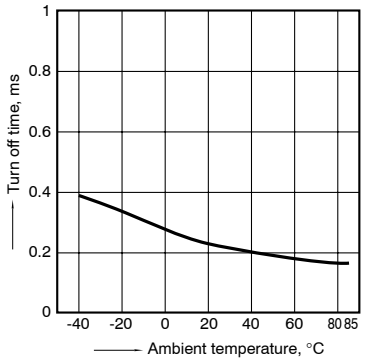
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



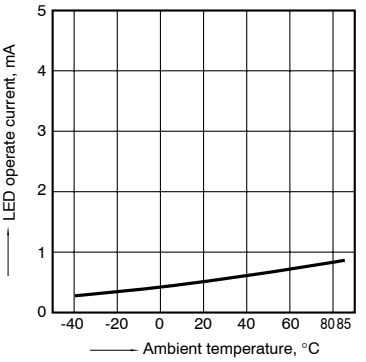
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



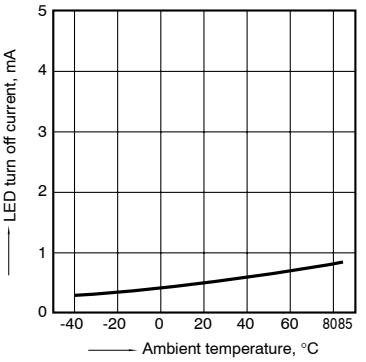
5. LED operate current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100mA (DC)



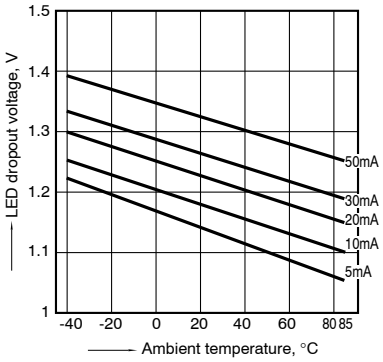
6. LED turn off current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100mA (DC)



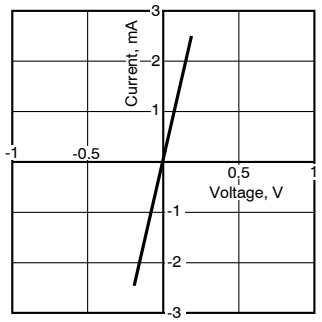
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



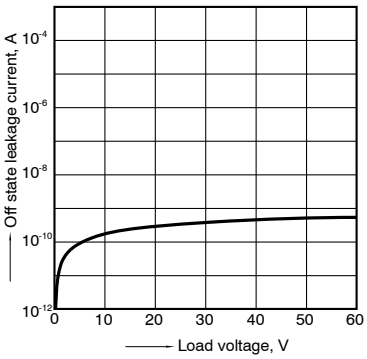
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



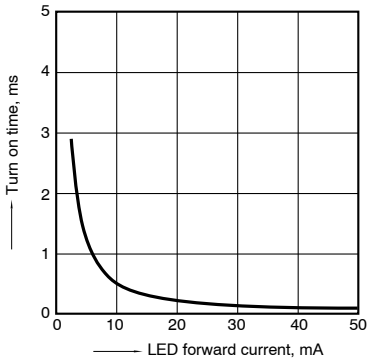
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



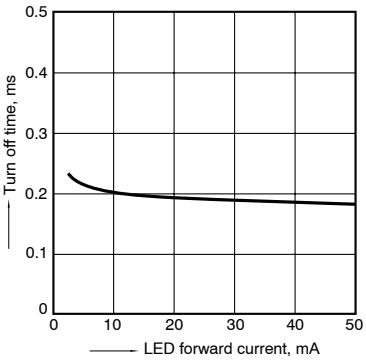
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



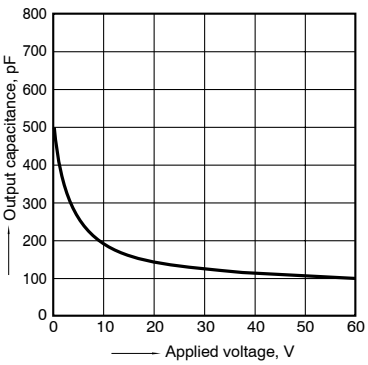
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F

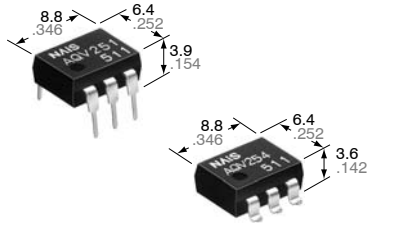


(Standard type) (Reinforced type)

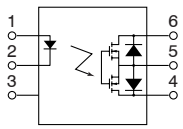
Panasonic
ideas for life

High sensitivity and low on-resistance.
DIP (1 Form A) 6-pin type.

HE PhotoMOS (AQV25❍)



mm inch



FEATURES

1. Highly sensitive and low on-resistance

2. Controls various types of loads such as relays, motors, lamps and solenoids.

3. Optical coupling for extremely high isolation
5,000 Vrms I/O isolation available.

4. Low-level off state leakage current

5. Eliminates the need for a power supply to drive the power MOSFET
A power supply used to drive the power MOSFET is unnecessary because of the built-in optoelectronic device. This results in easy circuit design and small PC board area.

6. Low thermal electromotive force (Approx. 1 μV)

TYPICAL APPLICATIONS

- High-speed inspection machines
- Telephone equipment
- Data communication equipment

TYPES

1. I/O isolation voltage: 1,500 V AC

Output rating*		Part No.				Packing quantity	
		Through hole terminal	Surface-mount terminal				
Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
				Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
40 V	500 mA	AQV251	AQV251A	AQV251AX	AQV251AZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.
60 V	400 mA	AQV252	AQV252A	AQV252AX	AQV252AZ		
100 V	350 mA	AQV255	AQV255A	AQV255AX	AQV255AZ		
200 V	250 mA	AQV257	AQV257A	AQV257AX	AQV257AZ		
250 V	200 mA	AQV253	AQV253A	AQV253AX	AQV253AZ		
400 V	150 mA	AQV254	AQV254A	AQV254AX	AQV254AZ		
1,000 V	30 mA	AQV259	AQV259A	AQV259AX	AQV259AZ		
1,500 V	20 mA	AQV258	AQV258A	AQV258AX	AQV258AZ		

2. I/O isolation voltage: Reinforced 5,000 V

Output rating*		Part No.				Packing quantity	
		Through hole terminal	Surface-mount terminal				
Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
				Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
250 V	200 mA	AQV253H	AQV253HA	AQV253HAX	AQV253HAZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.
400 V	150 mA	AQV254H	AQV254HA	AQV254HAX	AQV254HAZ		

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

	Item	Symbol	Type of connection	AQV251(A)	AQV252(A)	AQV255(A)	AQV257(A)	AQV253(A)	AQV254(A)	AQV259(A)	AQV258(A)	AQV253H(A)	AQV254H(A)	Remarks
Input	LED forward current	I_F		50 mA										
	LED reverse voltage	V_R		5 V										
	Peak forward current	I_{FP}		1 A										f = 100 Hz, Duty factor +0.1%
	Power dissipation	P_{in}		75 mW										
Output	Load voltage (peak AC)	V_L		40 V	60 V	100 V	200 V	250 V	400 V	1,000 V	1,500 V	250 V	400 V	
	Continuous load current	I_L	A	0.5 A	0.4 A	0.35 A	0.25 A	0.2 A	0.15 A	0.03 A	0.02 A	0.2 A	0.15 A	A connection: Peak AC, DC B, C connection: DC
			B	0.7 A	0.6 A	0.45 A	0.35 A	0.3 A	0.18 A	0.04 A	0.025 A	0.3 A	0.18 A	
			C	1.0 A	0.8 A	0.70 A	0.5 A	0.4 A	0.25 A	0.05 A	0.04 A	0.4 A	0.25 A	
	Peak load current	I_{peak}		1.8 A	1.5 A	1.0 A	0.75 A	0.6 A	0.5 A	0.09 A	0.06 A	0.6 A	0.5 A	A connection: 100 ms (1 shot) V_L = DC
	Power dissipation	P_{out}		360 mW										
Total power dissipation		P_T		410 mW										
I/O isolation voltage		V_{iso}		1,500 V AC								5,000 V AC		
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F										Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F										

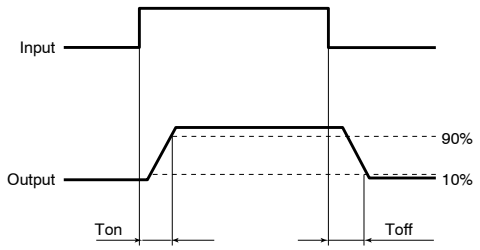
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

	Item			Symbol	Type of connection	AQV251(A)	AQV252(A)	AQV255(A)	AQV257(A)	AQV253(A)	AQV254(A)	AQV259(A)	AQV258(A)	AQV253H(A)	AQV254H(A)	Condition
Input	LED operate current		Typical	I_{Fon}	—	0.9 mA								1.4 mA		I_L = Max.
			Maximum			3 mA										
	LED turn off current		Minimum	I_{Foff}	—	0.4 mA										I_L = Max.
			Typical			0.8 mA								1.3 mA		
	LED dropout voltage		Typical	V_F	—	1.25 V (1.14 V at I_F = 5 mA)										I_F = 50 mA
			Maximum			1.5 V										
Output	On resistance		Typical	R_{on}	A	0.6 Ω	0.74 Ω	1.8 Ω	2.6 Ω	5.5 Ω	12.4 Ω	85 Ω	345 Ω	5.5 Ω	12.4 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum			1 Ω	1.4 Ω	2.5 Ω	4 Ω	8 Ω	16 Ω	200 Ω	500 Ω	8 Ω	16 Ω	
			Typical	R_{on}	B	0.3Ω	0.37 Ω	0.9 Ω	1.4 Ω	2.7 Ω	6.2 Ω	60 Ω	345 Ω	2.7 Ω	6.2 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum			0.5 Ω	0.7 Ω	1.25 Ω	2 Ω	4 Ω	8 Ω	100 Ω	500 Ω	4 Ω	8 Ω	
			Typical	R_{on}	C	0.15 Ω	0.18 Ω	0.45 Ω	0.7 Ω	1.4 Ω	3.1 Ω	30 Ω	160 Ω	1.4 Ω	3.1 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum			0.25 Ω	0.35 Ω	0.63 Ω	1 Ω	2 Ω	4 Ω	50 Ω	250 Ω	2 Ω	4 Ω	
	Off state leakage current		Maximum	—	—	1 μA						10 μA		1 μA		I_F = 0 mA V_L = Max.
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	—	1.7 ms	1.4 ms	0.9 ms	1.5 ms	0.8ms	0.8ms	0.6ms	0.35 ms	2.4ms	1.8ms	I_F = 5 mA I_L = Max.
			Maximum			3 ms		2 ms	3 ms	2 ms		1 ms		4 ms	3 ms	
		Turn off time*	Typical	T_{off}	—	0.07 ms		0.09 ms	0.1 ms	0.06 ms	0.05 ms	0.04 ms		0.06 ms	0.05 ms	I_F = 5 mA I_L = Max.
			Maximum			0.2 ms										
	I/O capacitance		Typical	C_{iso}	—	1.3 pF										f = 1 MHz V_B = 0 V
			Maximum			3 pF										
	Initial I/O isolation resistance		Minimum	R_{iso}	—	1,000 MΩ										500 V DC

Note: Recommendable LED forward current
Standard type: 5 mA
Reinforced type: 5 to 10 mA

For type of connection, see page 56.

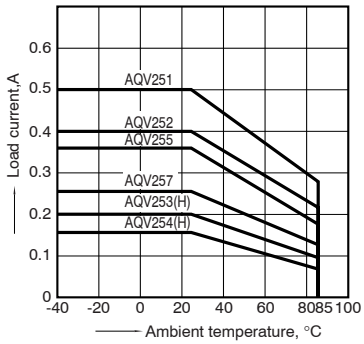
*Turn on/Turn off time



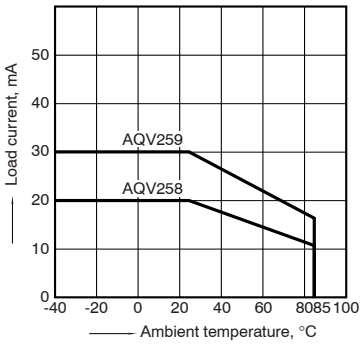
■ For Dimensions, see page 52.
■ For Schematic and Wiring Diagrams, see page 56.
■ For Cautions for Use, see page 63.

REFERENCE DATA

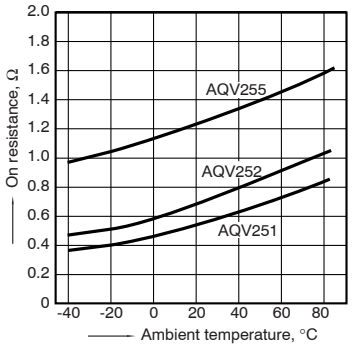
1.-(1) Load current vs. ambient temperature characteristics
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F ;
Type of connection: A



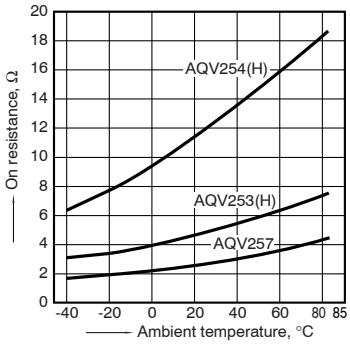
1.-(2) Load current vs. ambient temperature characteristics
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F ;
Type of connection: A



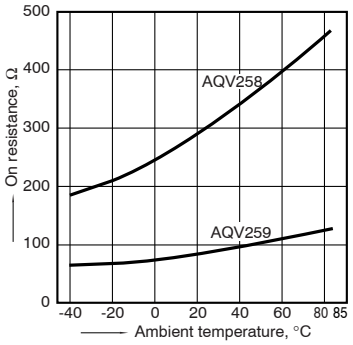
2.-(1) On resistance vs. ambient temperature characteristics
Measured portion: between terminals 4 and 6;
LED current: 5 mA;
Continuous load current: Max. (DC)



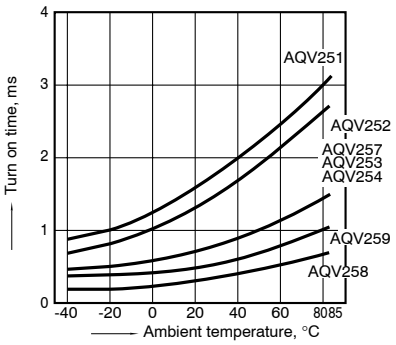
2.-(2) On resistance vs. ambient temperature characteristics
Measured portion: between terminals 4 and 6;
LED current: 5 mA;
Continuous load current: Max. (DC)



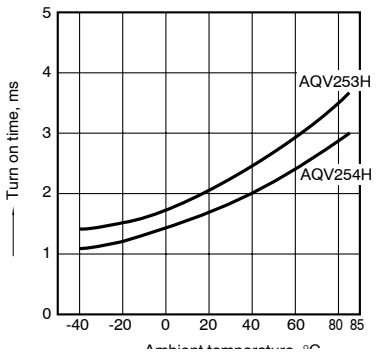
2.-(3) On resistance vs. ambient temperature characteristics
Measured portion: between terminals 4 and 6;
LED current: 5 mA;
Continuous load current: 30 mA (DC)



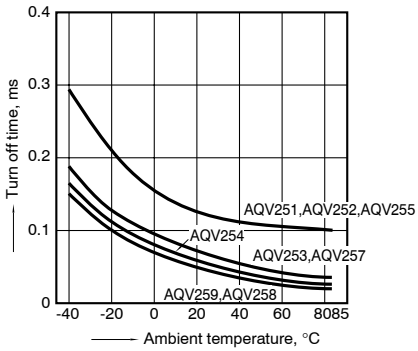
3.-(1) Turn on time vs. ambient temperature characteristics
LED current: 5 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



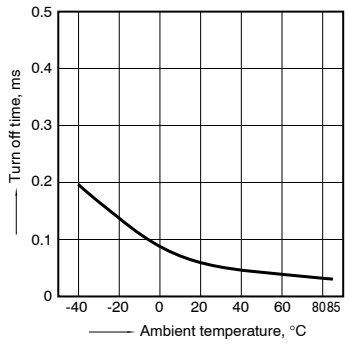
3.-(2) Turn on time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



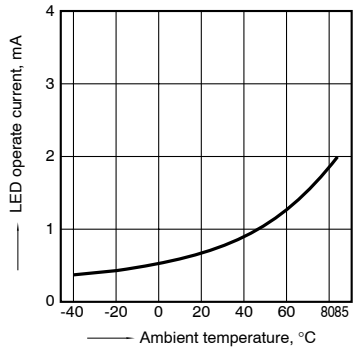
4.-(1) Turn off time vs. ambient temperature characteristics
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



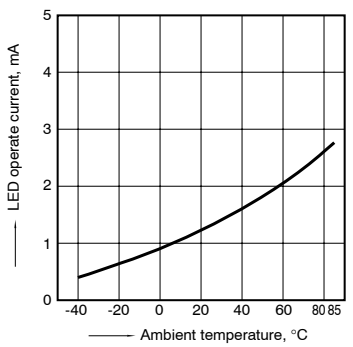
4.-(2) Turn off time vs. ambient temperature characteristics
Sample: AQV253H, AQV254H
LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



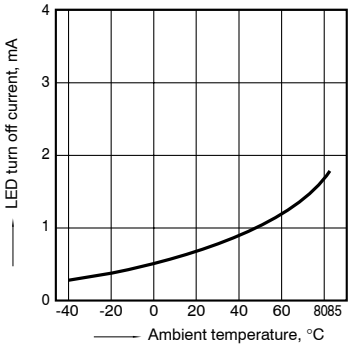
5.-(1) LED operate current vs. ambient temperature characteristics
Sample: AQV251, AQV252, AQV253, AQV254, AQV259; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



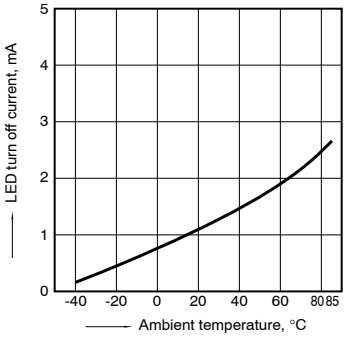
5.-(2) LED operate current vs. ambient temperature characteristics
Sample: AQV253H,AQV254H;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



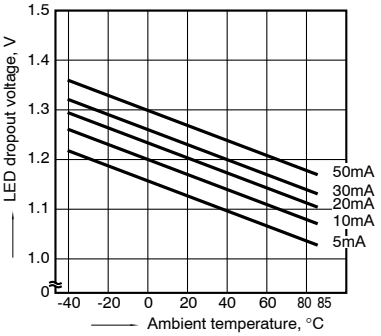
6. -(1) LED turn off current vs. ambient temperature characteristics
Sample: AQV251, AQV252, AQV253, AQV254, AQV259; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



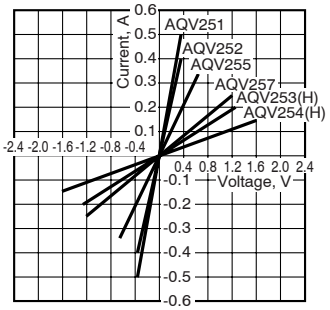
6.-(2) LED turn off current vs. ambient temperature characteristics
Sample: AQV251, AQV252, AQV253, AQV254, AQV259; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



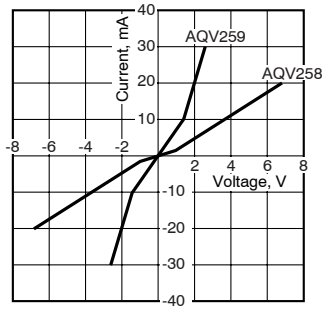
7. LED dropout voltage vs. ambient temperature characteristics
LED current: 5 to 50 mA



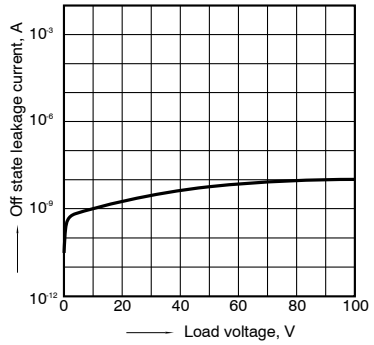
8.-(1) Current vs. voltage characteristics of output at MOS portion
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



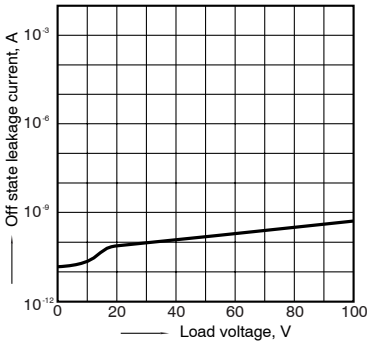
8.-(2) Current vs. voltage characteristics of output at MOS portion
Sample: AQV259
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



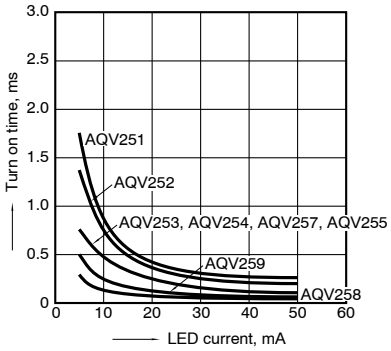
9-(1). Off state leakage current vs. load voltage characteristics
Sample: AQV259;
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



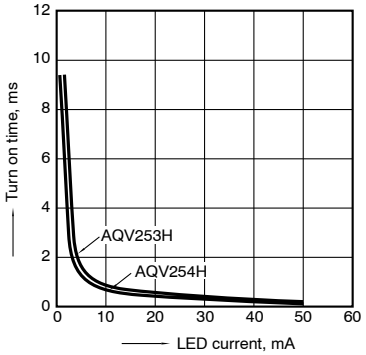
9-(2). Off state leakage current vs. load voltage characteristics
Sample: AQV254H;
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



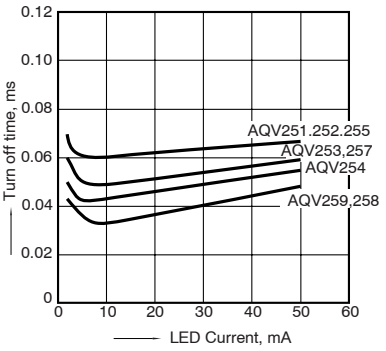
10-(1). Turn on time vs. LED forward current characteristics
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



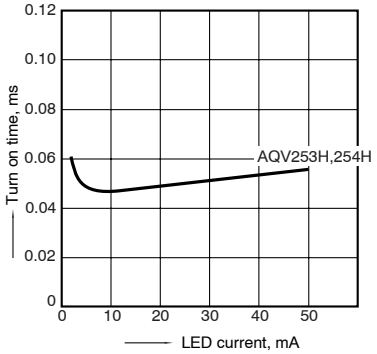
10-(2). Turn on time vs. LED forward current characteristics
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



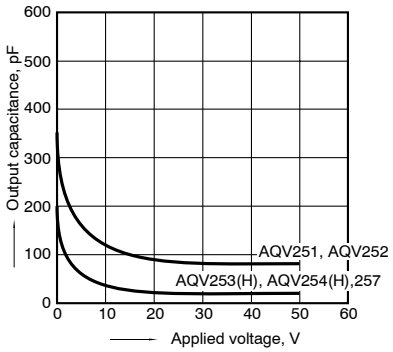
11-(1). Turn off time vs. LED forward current characteristics
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



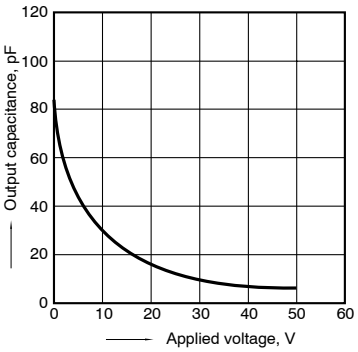
11-(2). Turn off time vs. LED forward current characteristics
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current:
Max. (DC); Ambient temperature: 25°C 77°F



12.-(1) Output capacitance vs. applied voltage characteristics
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



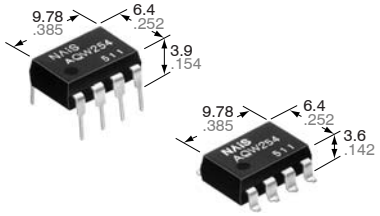
12.-(2) Output capacitance vs. applied voltage characteristics
Sample: AQV259;
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



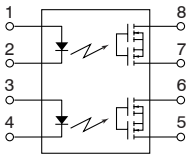
Panasonic
ideas for life

High sensitivity and low on-resistance.
DIP (2 Form A) 8-pin type.

HE PhotoMOS (AQW254)



mm inch



FEATURES

1. Compact 8-pin DIP size
The device comes in a compact (W) 6.4×(L) 9.78×(H) 3.9 mm (W) .252×(L) .385×(H) .154 inch , 8-pin DIP size (through hole terminal type).

2. Applicable for 2 Form A use as well as two independent 1 Form A use

3. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

4. High sensitivity, low ON resistance
Can control a maximum 0.16 A (AQW254) load current with a 5 mA input current. Low ON resistance of 16 Ω (AQW254). Stable operation because there are no metallic contact parts.

5. Low-level off state leakage current
The SSR has an off state leakage current of several milliamperes, whereas the PhotoMOS relay has typ. 100 pA even with the rated load voltage of 400 V (AQW254).

6. Low thermal electromotive force (Approx. 1 μV)

TYPICAL APPLICATIONS

- High-speed inspection machines
- Data communication equipment
- Telephone equipment

TYPES

Type	Output rating*		Part No.				Packing quantity	
			Through hole terminal	Surface-mount terminal				
	Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side		
AC/DC	400 V	120 mA	AQW254	AQW254A	AQW254AX	AQW254AZ	1 tube contains 40 pcs. 1 batch contains 400 pcs.	1,000 pcs

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQW254(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	400 V	
	Continuous load current	I_L	0.12 A (0.16 A)	A connection: Peak AC, DC ( ): in case of using only 1 channel
	Peak load current	I_{peak}	0.36 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	800 mW	
Total power dissipation		P_T	850 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	Between input and output/between contact sets
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

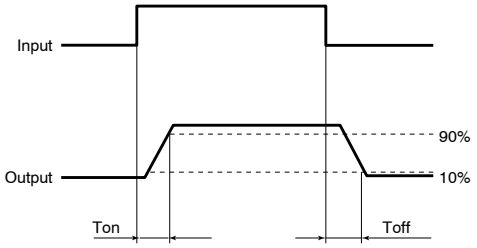
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQW254(A)	Condition
Input	LED operate current		Typical	I_{Fon}	0.9 mA	I_L= Max.
			Maximum		3 mA	
	LED turn off current		Minimum	I_{Foff}	0.4 mA	I_L= Max.
			Typical		0.8 mA	
	LED dropout voltage		Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
			Maximum		1.5 V	
Output	On resistance		Typical	R_{on}	10.2 Ω	I_F = 5 mA I_L = Max. Within 1 s on time
			Maximum		16 Ω	
	Off state leakage current		Maximum	I_{Leak}	1 μA	I_F = 0 mA V_L = Max.
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	0.8 ms	I_F = 5 mA I_L = Max.
			Maximum		2 ms	
		Turn off time*	Typical	T_{off}	0.04 ms	I_F = 5 mA I_L = Max.
			Maximum		0.2 ms	
	I/O capacitance		Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
			Maximum		1.5 pF	
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F = 5 mA.

For type of connection, see page 57.

*Turn on/Turn off time

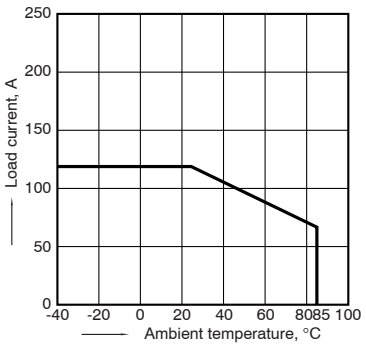


■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 57.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

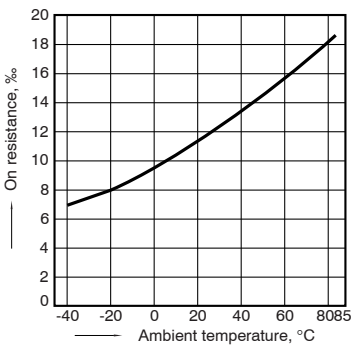
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



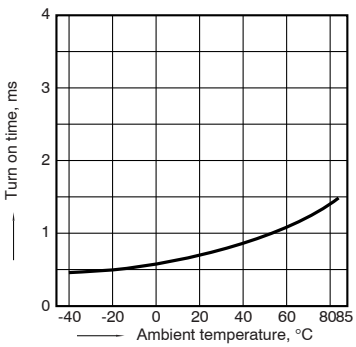
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8; LED current: 5 mA; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC)



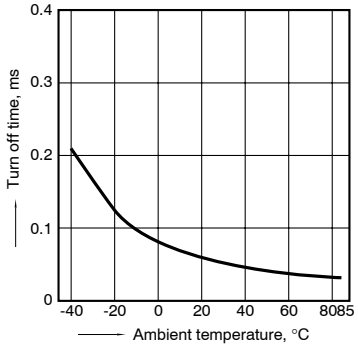
3. Turn on time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC)



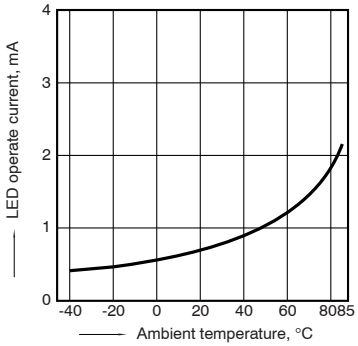
4. Turn off time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



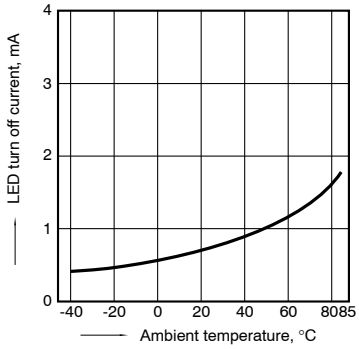
5. LED operate current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



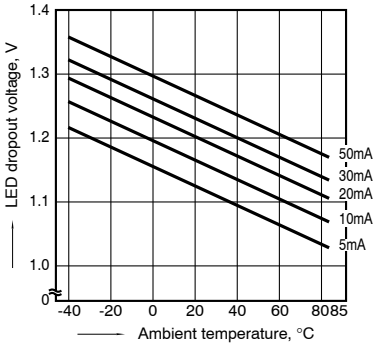
6. LED turn off current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



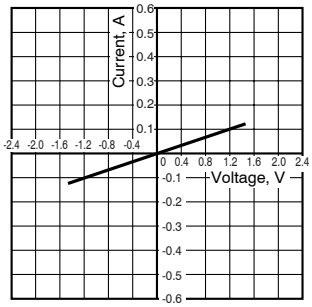
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



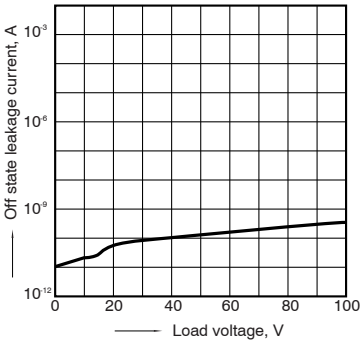
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8; Ambient temperature: 25°C 77°F



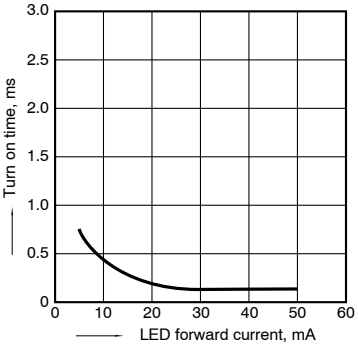
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Ambient temperature: 25°C 77°F



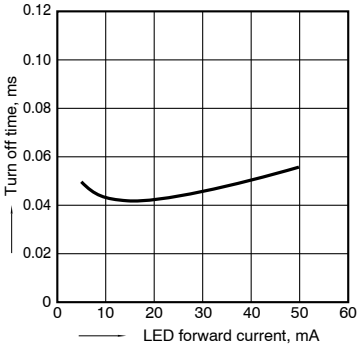
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC); Ambient temperature: 25°C 77°F



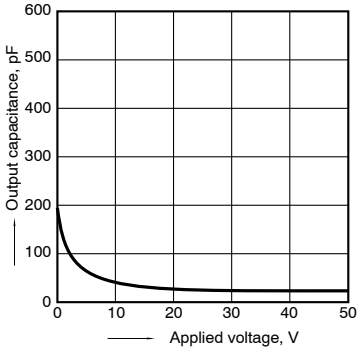
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

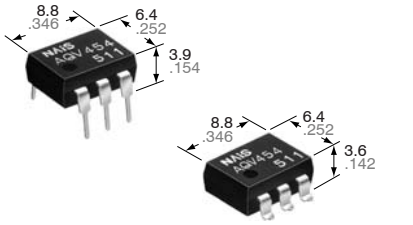
Measured portion: between terminals 5 and 6, 7 and 8; Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



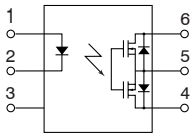
Panasonic
ideas for life

High sensitivity and low on-resistance.
DIP (1 Form B) 6-pin type.

HE PhotoMOS (AQV45❍, AQV454H)



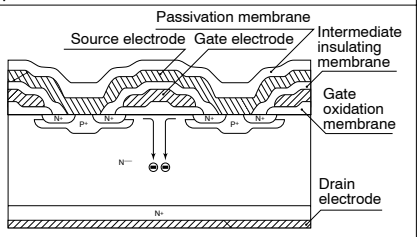
mm inch



FEATURES

1. Form B (Normally-closed) type
Has been realized thanks to the built-in MOSFET processed by our proprietary method, DSD (Double-diffused and Selective Doping) method.

Cross section of the normally-closed type of power MOS



2. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

3. High sensitivity, low ON resistance
Can control a maximum 0.15 A load current with a 5 mA input current. Low ON resistance of 16 Ω (AQV454). Stable operation because there are no metallic contact parts.

4. Controls various types of load such as relays, motors, lamps and solenoids.

5. Eliminates the need for a power supply to drive the power MOSFET
A power supply used to drive the power MOSFET is unnecessary because of the built-in optoelectronic device. This results in easy circuit design and small PC board area.

6. Low thermal electromotive force (Approx. 1 μV) (Basic insulation)

7. Reinforced insulation 5,000 V type also available.
More than 0.4 mm .016 inch internal insulation distance between inputs and outputs. Conforms to IEC950 (reinforced insulation).

TYPICAL APPLICATIONS

- Security equipment
- High-speed inspection machines
- Measuring instruments
- Telephone equipment
- Sensors

TYPES

Type	I/O isolation	Output rating*		Part No.				Packing quantity	
		Load voltage	Load current	Through hole terminal	Surface-mount terminal				
				Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC	1,500 V AC	250 V	200 mA	AQV453	AQV453A	AQV453AX	AQV453AZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.
		400 V	150 mA	AQV454	AQV454A	AQV454AX	AQV454AZ		
	Reinforced 5,000 V AC			AQV454H	AQV454HA	AQV454HAX	AQV454HAZ		

* Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X”and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV453(A)	AQV454(A)	AQV454H(A)	Remarks
Input	LED forward current	I_F		50 mA			
	LED reverse voltage	V_R		5 V			
	Peak forward current	I_{FP}		1 A			f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW			
Output	Load voltage (peak AC)	V_L		250 V	400 V		
	Continuous load current	I_L	A	0.2 A	0.15 A		A connection: Peak AC, DC B,C connection: DC
			B	0.3 A	0.18 A		
			C	0.4 A	0.25 A		
	Peak load current	I_{PEAK}		0.6 A	0.5 A		A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{OUT}		360 mW			
Total power dissipation		P_T		410 mW			
I/O isolation voltage		V_{iso}		1,500 V AC		5,000 V AC	
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F			Non-condensing at low temperatures
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F			

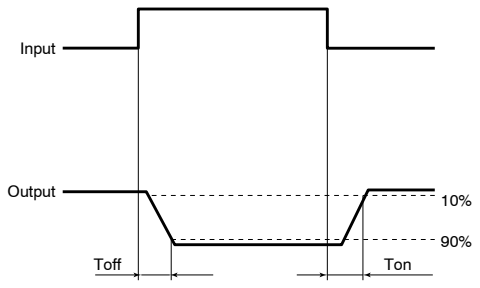
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	Type of connection	AQV453(A)	AQV454(A)	AQV454H(A)	Remarks
Input	LED operate (OFF) current		Typical	I_{Foff}	—	1 mA	0.9 mA	1.4 mA	I_L = Max.
			Maximum			3 mA			
	LED reverse (ON) current		Minimum	I_{Fon}	—	0.4 mA			I_L = Max.
			Typical			0.9 mA	0.8 mA	1.3 mA	
	LED dropout voltage		Typical	V_F	—	1.25 V (1.14 V at I_F=5 mA)			I_F = 50 mA
			Maximum			1.5 V			
Output	On resistance		Typical	R_{on}	A	5.5 Ω	12.4 Ω		I_F = 0 mA I_L= Max. Within 1 s on time
			Maximum			8 Ω	16 Ω		
			Typical	R_{on}	B	2.7 Ω	6.2 Ω		I_F = 0 mA I_L= Max. Within 1 s on time
			Maximum			4 Ω	8 Ω		
			Typical	R_{on}	C	1.4 Ω	3.1 Ω		I_F = 0 mA I_L = Max. Within 1 s on time
			Maximum			2 Ω	4 Ω		
	Off state leakage current		Maximum	I_{Leak}	—	1 μA	1 μA	10 μA	I_F= 5 mA V_L= Max.
Transfer characteristics	Switching speed	Operate (OFF) time*	Typical	T_{off}	—	1.52 ms	1.2 ms	1.8 ms	I_F = 0 mA › 5 mA I_L = Max.
			Maximum			3 ms	2.0 ms	3.0 ms	
		Reverse (ON) time*	Typical	T_{on}	—	0.4 ms	0.36 ms	0.4 ms	I_F = 5 mA › 0 mA I_L = Max.
			Maximum			1 ms			
	I/O capacitance		Typical	C_{iso}	—	1.3 pF			f = 1 MHz V_B = 0 V
			Maximum			3 pF			
	Initial I/O isolation resistance		Minimum	R_{iso}	—	1,000 MΩ			500 V DC

Note: Recommendable LED forward current.
Standard type: I_F= 5 mA
Reinforced type: I_F= 5 to 10 mA

For type of connection, see page 57.

*Operate/Reverse time



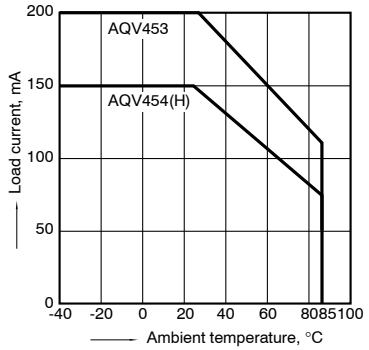
■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 57.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

1. Load current vs. ambient temperature characteristics

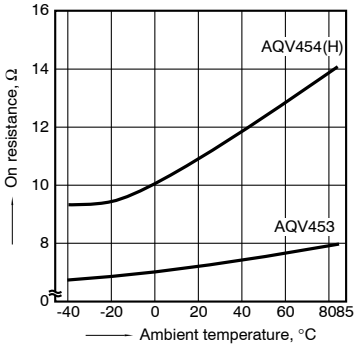
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

Type of connection: A



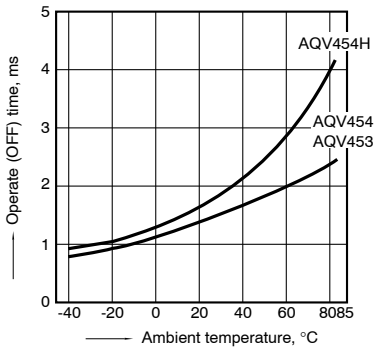
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 0 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



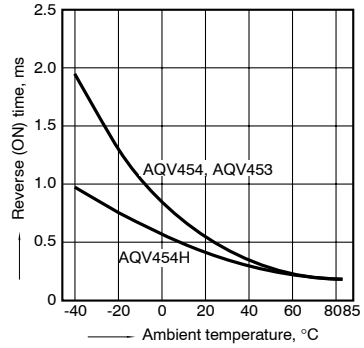
3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



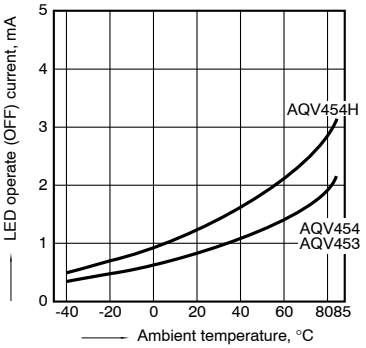
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



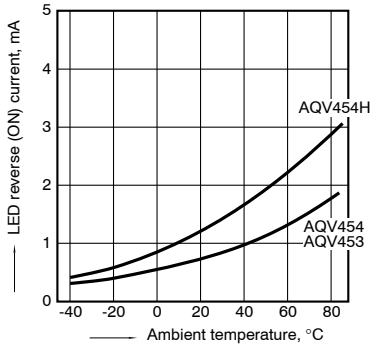
5. LED operate (OFF) current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



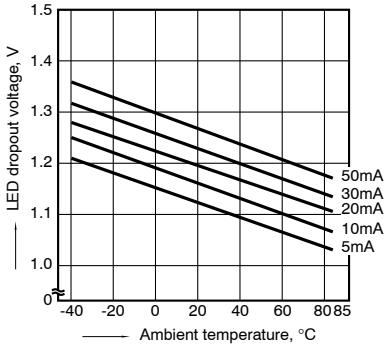
6. LED reverse (ON) current vs. ambient temperature characteristics

Load voltage: Max. (DC);
Continuous load current: Max. (DC)



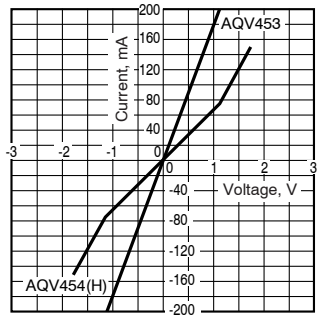
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



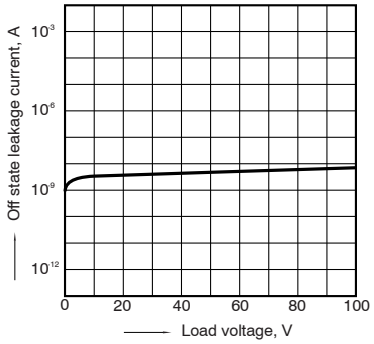
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



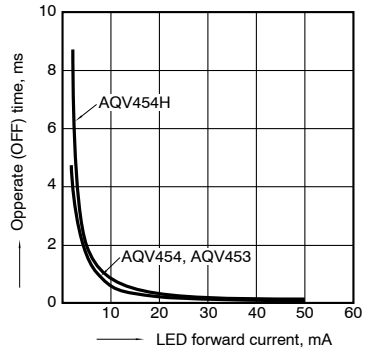
9. Off state leakage current vs. load voltage characteristics

Sample: AQV454;
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



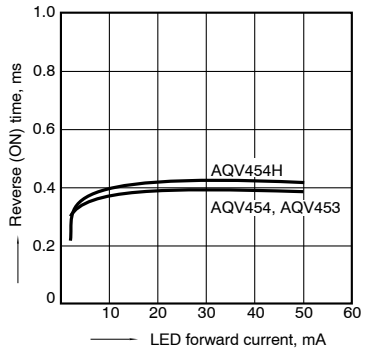
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



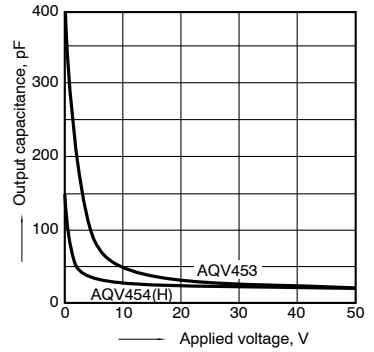
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC); Continuous load current: Max. (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

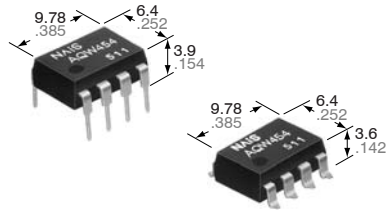
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



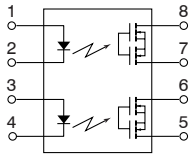
Panasonic
ideas for life

High sensitivity and low on-resistance.
DIP (2 Form B) 8-pin type.

HE PhotoMOS (AQW454)



mm inch



FEATURES

1. Compact 8-pin DIP size
The device comes in a compact (W) 6.4×(L) 9.78×(H) 3.9 mm (W) .252×(L) .385×(H) .154 inch, 8-pin DIP size (through hole terminal type).

2. Applicable for 2 Form B use as well as two independent 1 Form B use.

3. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

4. High sensitivity, low ON resistance
Can control a maximum 0.16 A (AQW454) load current with a 5 mA input current. Low ON resistance of 16 Ω (AQW454). Stable operation because there are no metallic contact parts.

5. Low-level off state leakage current
The SSR has an off state leakage current of several miliamperes, whereas the PhotoMOS relay has typ. 100 pA even with the rated load voltage of 400 V (AQW454).

6. Low thermal electromotive force (Approx. 1 μV)

TYPICAL APPLICATIONS

- Security equipment
- High-speed inspection machine
- Measuring equipment
- Telecommunication equipment
- Sensors

TYPES

Type	Output rating*		Part No.				Packing quantity	
			Through hole terminal	Surface-mount terminal				
	Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side		
AC/DC	400 V	120 mA	AQW454	AQW454A	AQW454AX	AQW454AZ	1 tube contains 40 pcs. 1 batch contains 400 pcs.	1,000 pcs

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQW454(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	400 V	
	Continuous load current	I_L	0.12 A (0.16 A)	A connection: Peak AC, DC ( ): for one 1b-circuit
	Peak load current	I_{peak}	0.36 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	800 mW	
Total power dissipation		P_T	850 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	Between input and output/between contact sets
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

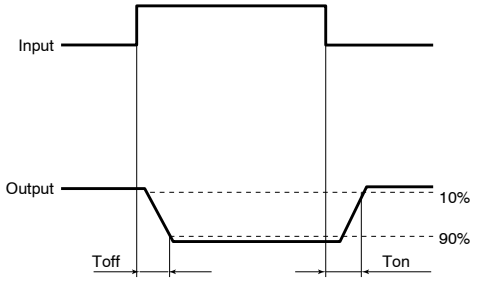
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQW454(A)	Condition
Input	LED operate (OFF) current		Typical	I_{Foff}	0.9 mA	I_L = Max.
			Maximum		3 mA	
	LED reverse (ON) current		Minimum	I_{Fon}	0.4 mA	I_L = Max.
			Typical		0.8 mA	
	LED dropout voltage		Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
			Maximum		1.5 V	
Output	On resistance		Typical	R_{on}	11 Ω	I_F = 0 mA I_L = Max. Within 1 s on time
			Maximum		16 Ω	
	Off state leakage current		Maximum	I_{Leak}	1 μA	I_F = 5 mA V_L = Max.
Transfer characteristics	Switching speed	Operate (OFF) time*	Typical	T_{off}	1.2 ms	I_F = 0 mA › 5 mA I_L = Max.
			Maximum		2 ms	
		Reverse (ON) time*	Typical	T_{on}	0.36 ms	I_F = 5 mA › 0 mA I_L = Max.
			Maximum		1 ms	
	I/O capacitance		Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
			Maximum		1.5 pF	
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F = 5 mA.

For type of connection, see page 58.

*Operate/Reverse time

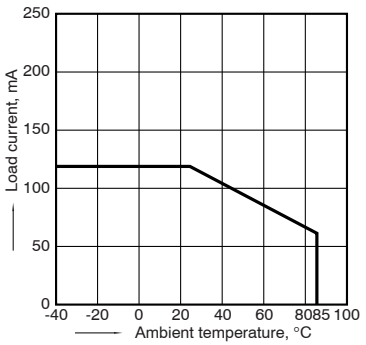


■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 58.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

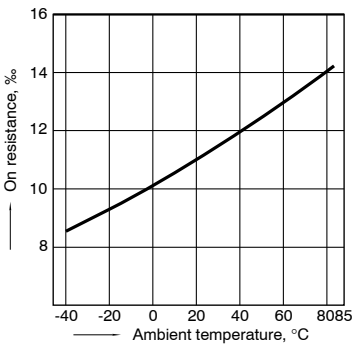
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



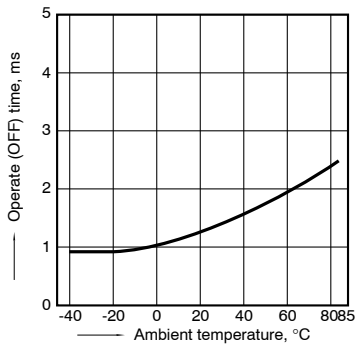
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8; LED current: 0 mA; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC)



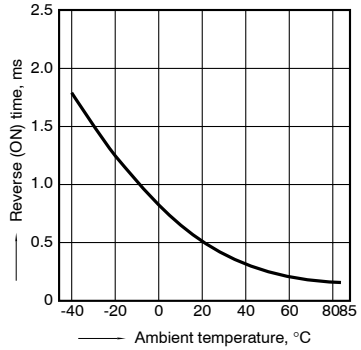
3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC)



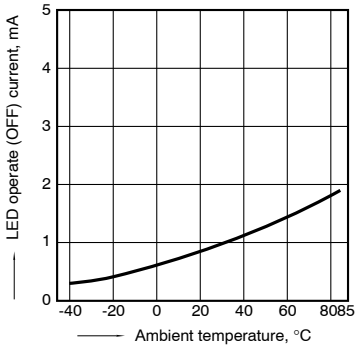
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



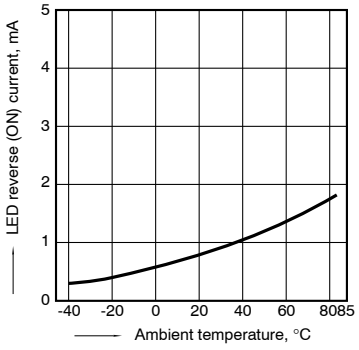
5. LED operate (OFF) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



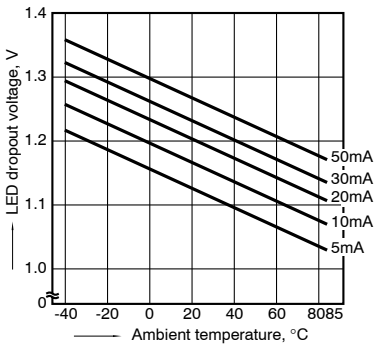
6. LED reverse (ON) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



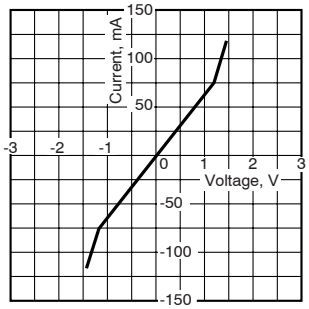
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



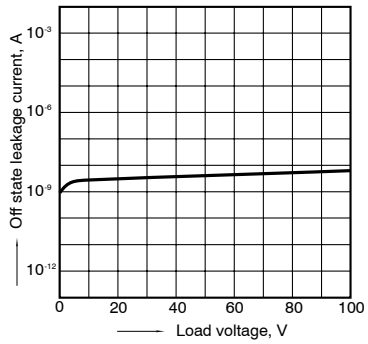
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8; Ambient temperature: 25°C 77°F



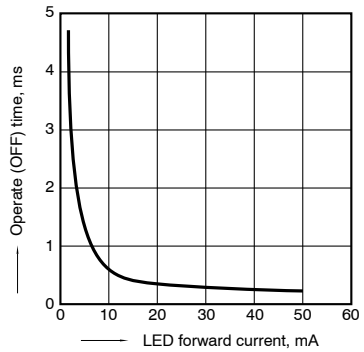
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Ambient temperature: 25°C 77°F



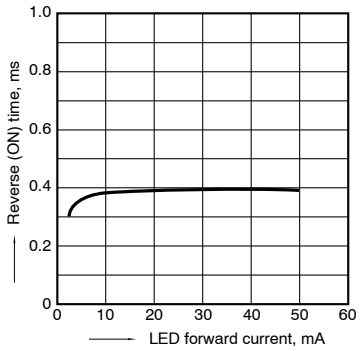
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC); Ambient temperature: 25°C 77°F



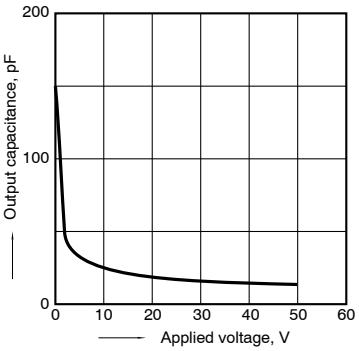
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

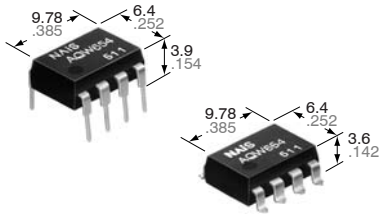
Measured portion: between terminals 5 and 6, 7 and 8; Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



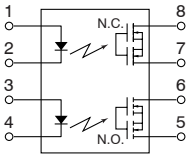
Panasonic
ideas for life

High sensitivity and low on-resistance. DIP (1 Form A/1 Form B) 8-pin type.

HE PhotoMOS (AQW654)



mm inch



FEATURES

1. Compact 8-pin DIP size
The device comes in a compact (W) 6.4×(L) 9.78×(H) 3.9 m (W) .252×(L) .385×(H) .154 inch, 8-pin DIP size (through hole terminal type).

2. Applicable for 1 Form A 1 Form B use as well as two independent 1 Form A and 1 Form B use

3. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

4. High sensitivity, low ON resistance
Can control a maximum 0.16 A (AQW654) load current with a 5 mA input current. Low ON resistance of 16 Ω (AQW654). Stable operation because there are no metallic contact parts.

5. Low-level off state leakage current
The SSR has an off state leakage current of several milliamperes, whereas the PhotoMOS relay has typ. 100 pA even with the rated load voltage of 400 V (AQW654).

6. Low thermal electromotive force (Approx. 1 μV)

TYPICAL APPLICATIONS

- High-speed inspection machines
- Data communication equipment
- Telephone equipment

TYPES

Type	Output rating*		Part No.				Packing quantity	
			Through hole terminal	Surface-mount terminal				
	Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2/3/4-pin side	Picked from the 5/6/7/8-pin side		
AC/DC	400 V	120 mA	AQW654	AQW654A	AQW654AX	AQW654AZ	1 tube contains 40 pcs. 1 batch contains 400 pcs.	1,000 pcs

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

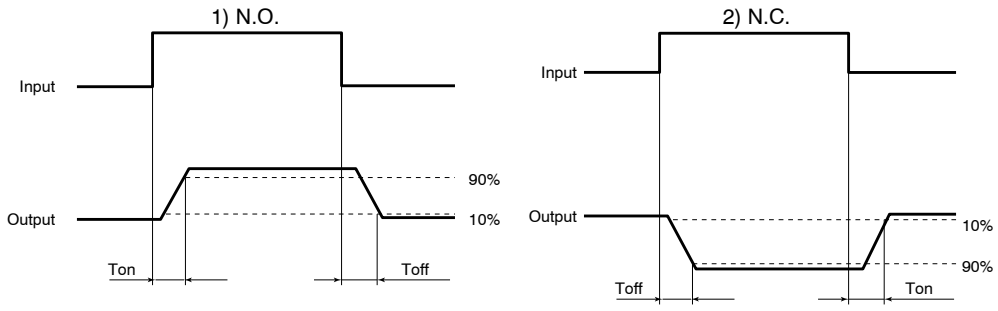
Item		Symbol	AQW654(A)	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (peak AC)	V_L	400 V	
	Continuous load current	I_L	0.12A (0.16 A)	Peak AC, DC ( ): in case of using only 1 channel
	Peak load current	I_{peak}	0.36 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	800 mW	
Total power dissipation		P_T	850 mW	
I/O isolation voltage		V_{iso}	1,500 V AC	Between input and output/between contact sets
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQW654(A)	Remarks
Input	LED operate (OFF) current		Typical	I_{Fon} (N.O.) I_{Foff} (N.C.)	0.9 mA	I_L = Max.
			Maximum		3 mA	
	LED reverse (ON) current		Minimum	I_{Foff} (N.O.) I_{Fon} (N.C.)	0.4 mA	I_L = Max.
			Typical		0.8 mA	
	LED dropout voltage		Typical	V_F	1.25 V (1.14 V at I_F = 5 mA)	I_F = 50 mA
			Maximum		1.5 V	
Output	On resistance		Typical	R_{on}	11 Ω	I_F = 5 mA (N.O.) I_F = 0 mA (N.C.) I_L = Max. Within 1 s on time
			Maximum		16 Ω	
	Off state leakage current		Maximum	I_{Leak}	1 μA	I_F = 0 mA (N.O.) I_F = 5 mA (N.C.) V_L = Max.
Transfer characteristics	Switching speed	Operate (OFF) time*	Typical	T_{on} (N.O.) T_{off} (N.C.)	0.8 ms (N.O.) 1.2 ms (N.C.)	I_F = 0 mA › 5 mA I_L = Max.
			Maximum		2 ms	
		Reverse (ON) time*	Typical	T_{off} (N.O.) T_{on} (N.C.)	0.04 ms (N.O.) 0.36 ms (N.C.)	I_F = 5 mA › 0 mA I_L = Max.
			Maximum		1 ms	
	I/O capacitance		Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
			Maximum		1.5 pF	
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F = 5 mA. For type of connection, see page 58.

*Operate/Reverse time

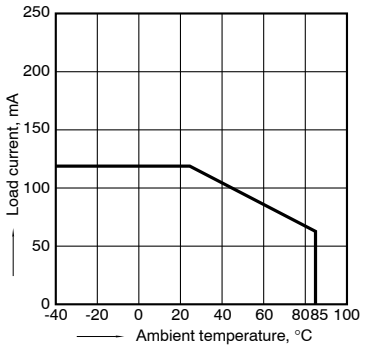


■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 58.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

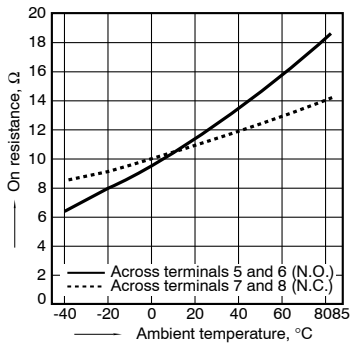
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



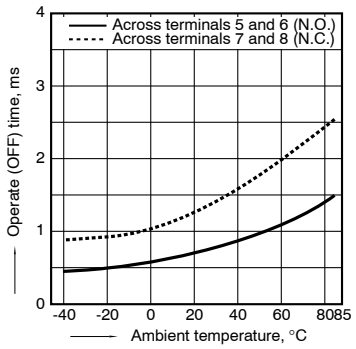
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 5 and 6, 7 and 8; LED current: 5 mA; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC)



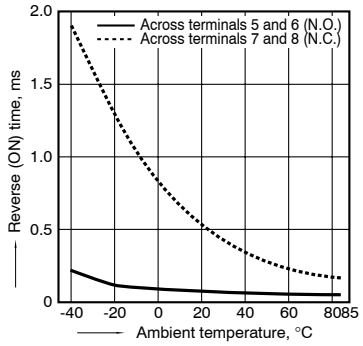
3. Operate (OFF) time vs. ambient temperature characteristics

LED current: 5 mA; Load voltage: 400 V (DC); Continuous load current: 120 mA (DC)



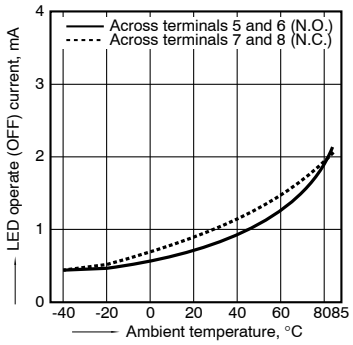
4. Reverse (ON) time vs. ambient temperature characteristics

LED current: 5 mA;
Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



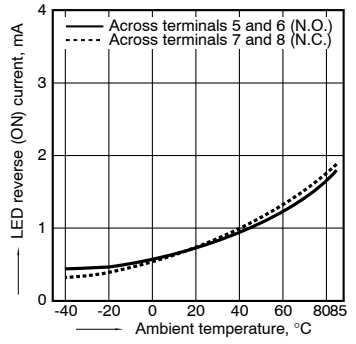
5. LED operate (OFF) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



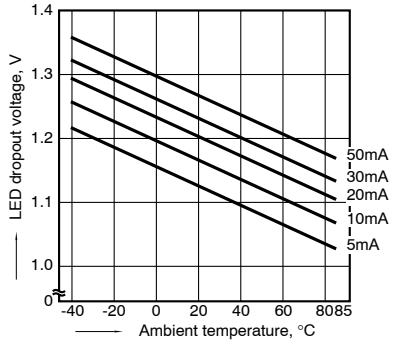
6. LED reverse (ON) current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



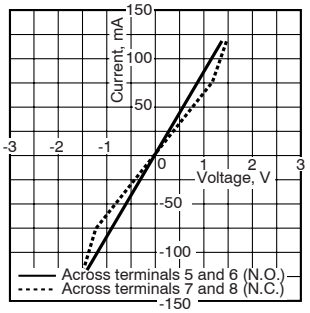
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 5 to 50 mA



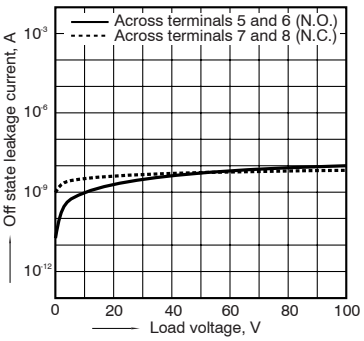
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 5 and 6, 7 and 8; Ambient temperature: 25°C 77°F



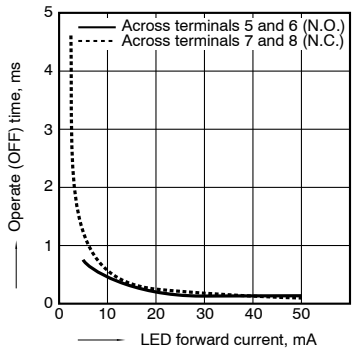
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 5 and 6, 7 and 8; Ambient temperature: 25°C 77°F



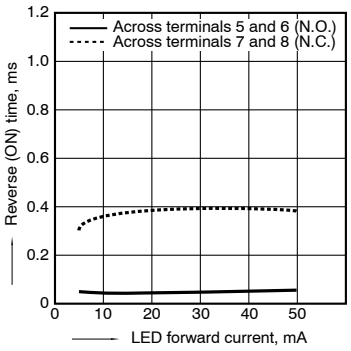
10. Operate (OFF) time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: 400 V (DC); Continuous load current: 120 mA (DC); Ambient temperature: 25°C 77°F



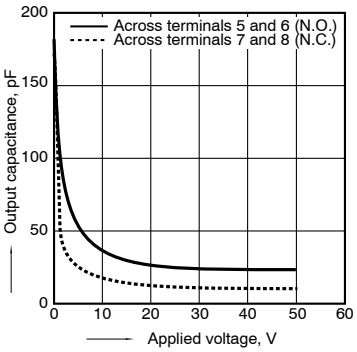
11. Reverse (ON) time vs. LED forward current characteristics

Measured portion: between terminals 5 and 6, 7 and 8;
Load voltage: 400 V (DC); Continuous load current: 120 mA (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

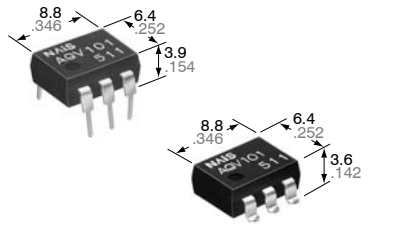
Measured portion: between terminals 5 and 6, 7 and 8;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



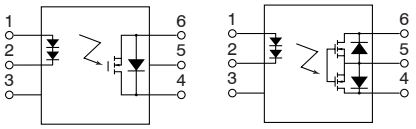
Panasonic
ideas for life

High sensitivity and low on-resistance.
DIP (1 Form B) 6-pin type.

HF PhotoMOS (AQV10❍, 20❍)



mm inch



(AQV10 series) (AQV20 series)

FEATURES

1. Controls low-level analog signals
PhotoMOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

2. Control with low-level input signals

3. Controls various types of loads such as relays, motors, lamps and solenoids.

4. Optical coupling for extremely high isolation
Unlike mechanical relays, the PhotoMOS relay combines LED and optoelectronic device to transfer signals using light for extremely high isolation.

5. Eliminates the need for a counter electromotive force protection diode in the drive circuits on the input side

6. Stable on resistance

7. Low-level off state leakage current

8. Eliminates the need for a power supply to drive the power MOSFET
A power supply used to drive the power MOSFET is unnecessary because of the built-in optoelectronic device. This results in easy circuit design and small PC board area.

9. Low thermal electromotive force (Approx. 1 μV)

TYPICAL APPLICATIONS

- High-speed inspection machines
- Telephone equipment
- Data communication equipment
- Computer

TYPES

1. DC type (AQV10 types)

Output rating*		Part No.				Packing quantity	
		Through hole terminal	Surface-mount terminal				
Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
				Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
40 V	700 mA	AQV101	AQV101A	AQV101AX	AQV101AZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs
60 V	600 mA	AQV102	AQV102A	AQV102AX	AQV102AZ		
250 V	300 mA	AQV103	AQV103A	AQV103AX	AQV103AZ		
400 V	180 mA	AQV104	AQV104A	AQV104AX	AQV104AZ		

*Indicate the peak AC and DC values.
Note: For space reasons, the package type indicator “X” and “Z” are omitted from the seal.

2. AC/DC type (AQV20 types)

Output rating*		Part No.				Packing quantity	
		Through hole terminal	Surface-mount terminal				
Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
				Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
40 V	500 mA	AQV201	AQV201A	AQV201AX	AQV201AZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs
60 V	400 mA	AQV202	AQV202A	AQV202AX	AQV202AZ		
250 V	200 mA	AQV203	AQV203A	AQV203AX	AQV203AZ		
400 V	150 mA	AQV204	AQV204A	AQV204AX	AQV204AZ		

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. DC type (AQV10 types)

1) Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQV101(A)	AQV102(A)	AQV103(A)	AQV104(A)	Remarks
Input	LED forward current	I_F	50 mA				
	LED reverse voltage	V_R	10 V				
	Peak forward current	I_{FP}	1 A				f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	150 mW				
Output	Load voltage (DC)	V_L	40 V	60 V	250 V	400 V	
	Continuous load current (DC)	I_L	0.7 A	0.6 A	0.3 A	0.18 A	
	Peak load current	I_{peak}	1.8 A	1.5 A	0.6 A	0.5 A	100 ms (1 shot)
	Power dissipation	P_{out}	360 mW				
Total power dissipation		P_T	410 mW				
I/O isolation voltage		V_{iso}	1,500 V (AC)				
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F				Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F				

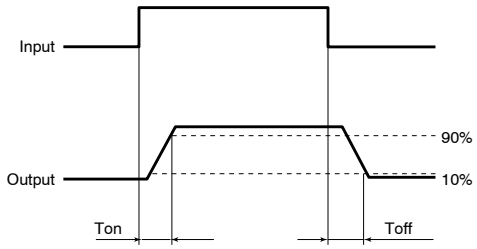
2) Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQV101(A)	AQV102(A)	AQV103(A)	AQV104(A)	Condition
Input	LED operate current		Typical	I_{Fon}	2.3 mA				I_L = Max.
			Maximum		5 mA				
	LED turn off current		Minimum	I_{Foff}	0.8 mA				I_L = Max.
			Typical		2.2 mA				
	LED dropout voltage		Typical	V_F	2.3 V				I_F = 10 mA
			Maximum		3 V				
Output	On resistance		Typical	R_{on}	0.3 Ω	0.37 Ω	2.7 Ω	6.3 Ω	I_F = 10 mA I_L = Max. Within 1 s on time
			Maximum		0.5 Ω	0.7 Ω	4 Ω	8 Ω	
	Off state leakage current		Maximum	—	1 μA				I_F = 0 mA, V_L = Max.
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	0.23 ms	0.22 ms	0.13 ms	0.09 ms	I_F = 10 mA I_L = Max.
			Maximum		1 ms				
		Turn off time*	Typical	T_{off}	0.07 ms			0.08 ms	I_F = 10 mA I_L = Max.
			Maximum		1 ms				
	I/O capacitance		Typical	C_{iso}	1.3 pF				f = 1 MHz V_B = 0 V
			Maximum		3 pF				
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000 MΩ				500 V DC

Note: Recommendable LED forward current I_F= 10 mA.

For type of connection, see page 55.

*Turn on/Turn off time



2. AC/DC type (AQV20 types)

1) Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV201(A)	AQV202(A)	AQV203(A)	AQV204(A)	Remarks
Input	LED forward current	I_F		50 mA				
	LED reverse voltage	V_R		10 V				
	Peak forward current	I_{FP}		1 A				f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		150 mW				
Output	Load voltage (peak AC)	V_L		40 V	60 V	250 V	400 V	
	Continuous load current	I_L	A	0.5 A	0.4 A	0.2 A	0.15 A	A connection: Peak AC, DC B, C connection: DC
			B	0.7 A	0.6 A	0.3 A	0.18 A	
			C	1.0 A	0.8 A	0.4 A	0.25 A	
	Peak load current	I_{peak}		1.8 A	1.5 A	0.6 A	0.5 A	A connection 100 ms (1 shot) V_L = DC
	Power dissipation	P_{out}		360 mW				
Total power dissipation		P_T		410 mW				
I/O isolation voltage		V_{iso}		1,500 V AC				
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F				Non-condensing at low temperature
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F				

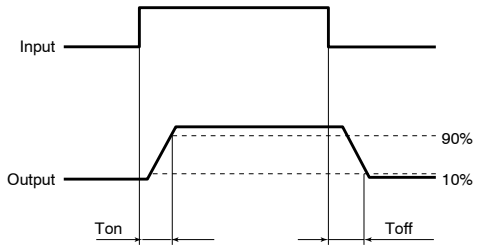
2) Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	Type of connection	AQV201(A)	AQV202(A)	AQV203(A)	AQV204(A)	Remarks
Input	LED operate current		Typical	I_{Fon}	—	2.4 mA				I_L = Max.
			Maximum			5 mA				
	LED turn off current		Minimum	I_{Foff}	—	0.8 mA				I_L = Max.
			Typical			2.2 mA				
	LED dropout voltage		Typical	V_F	—	2.3 V				I_F = 10 mA
			Maximum			3 V				
Output	On resistance		Typical	R_{on}	A	0.6 Ω	0.74 Ω	5.5 Ω	12.4 Ω	I_F = 10 mA I_L = Max. Within 1 s on time
			Maximum			1 Ω	1.4 Ω	8 Ω	16 Ω	
			Typical	R_{on}	B	0.3 Ω	0.37 Ω	2.7 Ω	6.2 Ω	I_F = 10 mA I_L = Max. Within 1 s on time
			Maximum			0.5 Ω	0.7 Ω	4 Ω	8 Ω	
			Typical	R_{on}	C	0.15 Ω	0.18 Ω	1.4 Ω	3.1 Ω	I_F = 10 mA I_L = Max. Within 1 s on time
			Maximum			0.25 Ω	0.35 Ω	2 Ω	4 Ω	
	Off state leakage current		Maximum	—	—	1 μA				I_F = 0 mA, V_L = Max.
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	—	0.38 ms	0.41 ms	0.21 ms	0.18 ms	I_F = 10 mA I_L = Max.
			Maximum			1 ms				
		Turn off time*	Typical	T_{off}	—	0.08 ms		0.07 ms		I_F = 10 mA I_L = Max.
			Maximum			1 ms				
	I/O capacitance		Typical	C_{iso}	—	1.3 pF				f = 1 MHz V_B = 0 V
			Maximum			3 pF				
	Initial I/O isolation resistance		Minimum	R_{iso}	—	1,000 MΩ				500 V DC

Note: Recommendable LED forward current I_F= 10 mA.

For type of connection, see page 55.

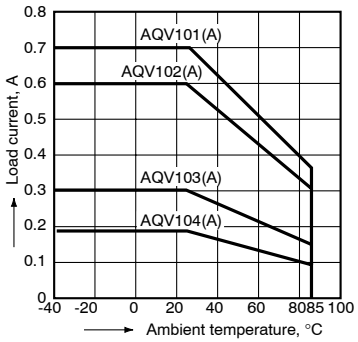
*Turn on/Turn off time



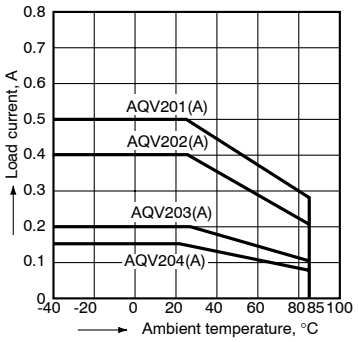
■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 55.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

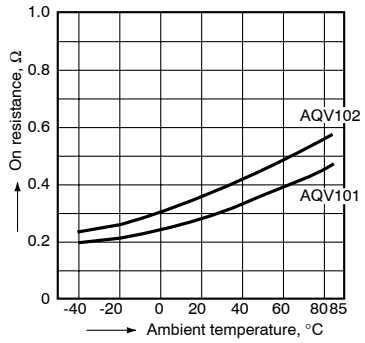
1.-(1) Load current vs. ambient temperature characteristics (DC type)
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



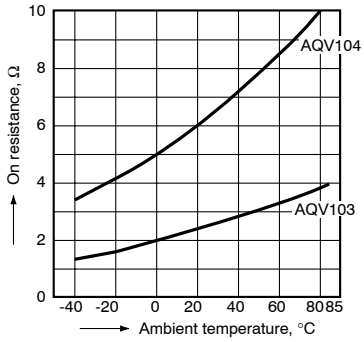
1.-(2) Load current vs. ambient temperature characteristics (AC/DC type)
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F
Type of connection: A



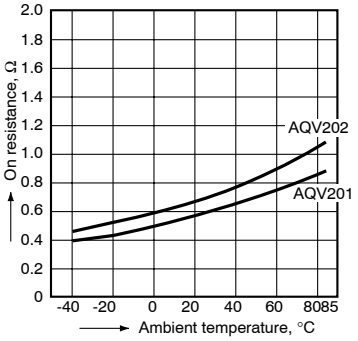
2.-(1) On resistance vs. ambient temperature characteristics (DC type: AQV101, AQV102)
LED current: 10 mA;
Continuous load current: Max. (DC)



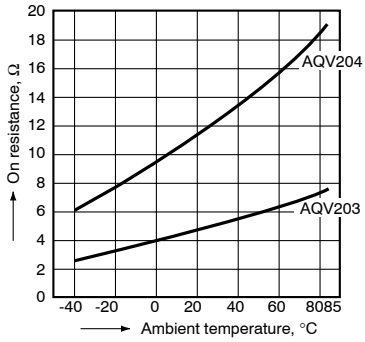
2.-(2) On resistance vs. ambient temperature characteristics (DC type: AQV103, AQV104)
LED current: 10 mA;
Continuous load current: Max. (DC)



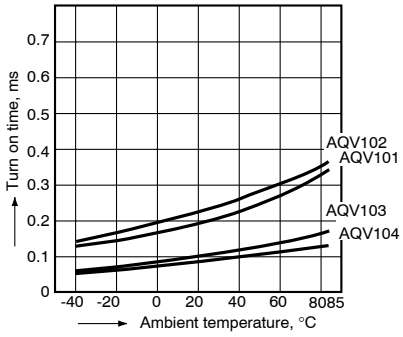
2.-(3) On resistance vs. ambient temperature characteristics
(AC/DC type: AQV201, AQV202)
Measured portion: between terminals 4 and 6;
LED current: 10 mA;
Continuous load current: Max. (DC)



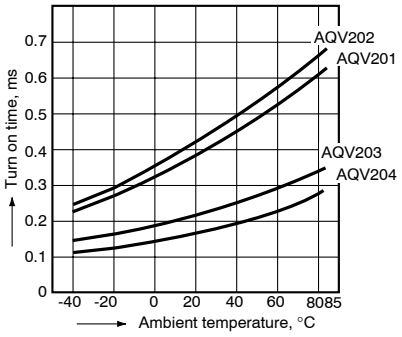
2.-(4) On resistance vs. ambient temperature characteristics
(AC/DC type: AQV203, AQV204)
Measured portion: between terminals 4 and 6;
LED current: 10 mA;
Continuous load current: Max. (DC)



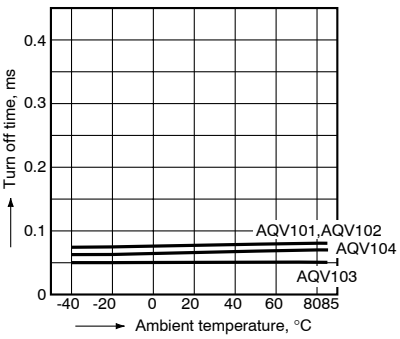
3.-(1) Turn on time vs. ambient temperature characteristics (DC type)
LED current: 10 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



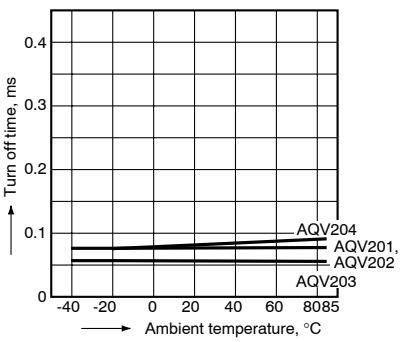
3.-(2) Turn on time vs. ambient temperature characteristics (AC/DC type)
LED current: 10 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



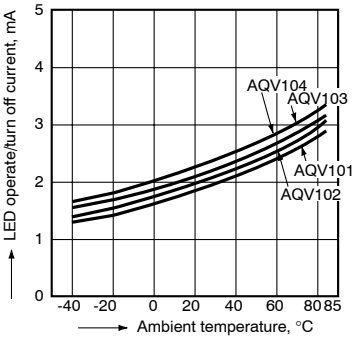
4.-(1) Turn off time vs. ambient temperature characteristics (DC type)
LED current: 10 mA;
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



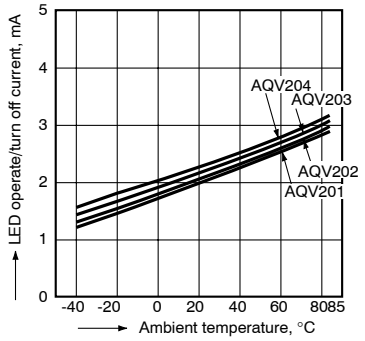
4.-(2) Turn off time vs. ambient temperature characteristics (AC/DC type)
LED current: 10 mA; Load voltage: Max. (DC);
Continuous load current: Max. (DC)



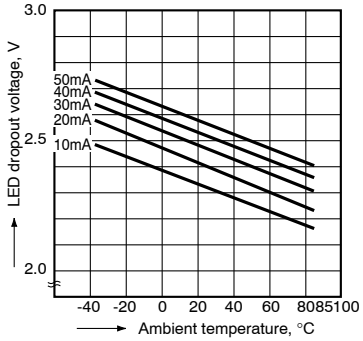
5.-(1) LED operate/turn off current vs. ambient temperature characteristics (DC type)
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



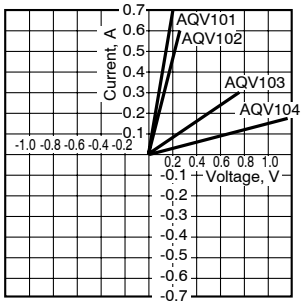
5.-(2) LED operate/turn off current vs. ambient temperature characteristics (AC/DC type)
Load voltage: Max. (DC);
Continuous load current: Max. (DC)



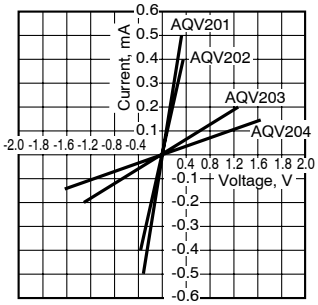
6. LED dropout voltage vs. ambient temperature characteristics
Sample: AQV202
LED current: 10 to 50 mA



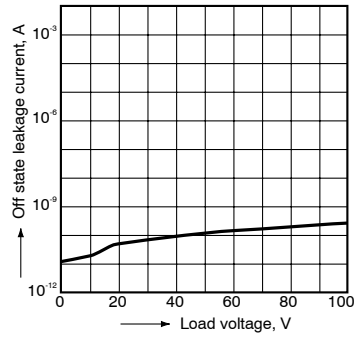
7.-(1) Current vs. voltage characteristics of output at MOS portion (DC type)
Ambient temperature: 25°C 77°F



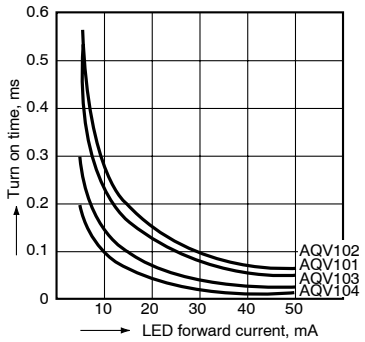
7.-(2) Current vs. voltage characteristics of output at MOS portion (AC/DC type)
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



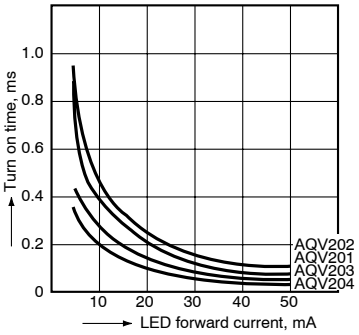
8. Off state leakage current vs. load voltage characteristics
Sample: AQV204;
Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



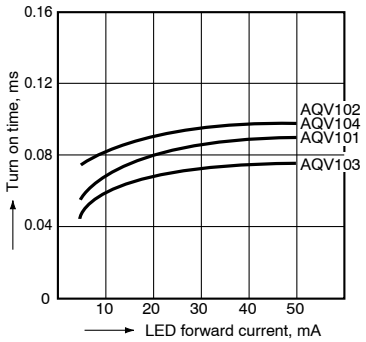
9.-(1) Turn on time vs. LED forward current characteristics (DC type)
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



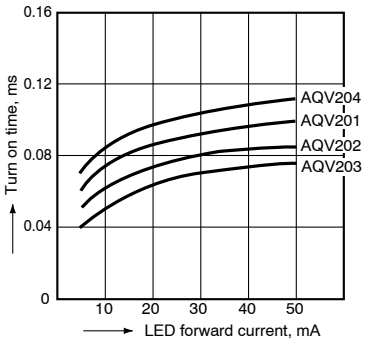
9.-(2) Turn on time vs. LED forward current characteristics (AC/DC type)
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



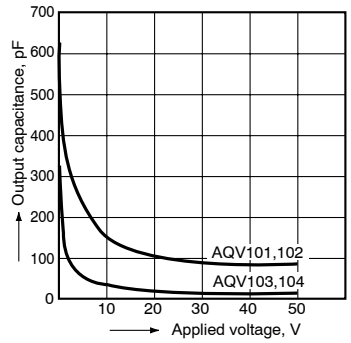
10.-(1) Turn off time vs. LED forward current characteristics (DC type)
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



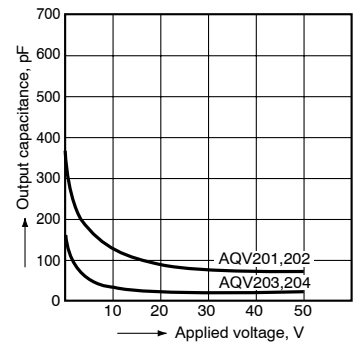
10.-(2) Turn off time vs. LED forward current characteristics (AC/DC type)
Measured portion: between terminals 4 and 6;
Load voltage: Max. (DC);
Continuous load current: Max. (DC);
Ambient temperature: 25°C 77°F



11.-(1) Output capacitance vs. applied voltage characteristics (DC type)
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



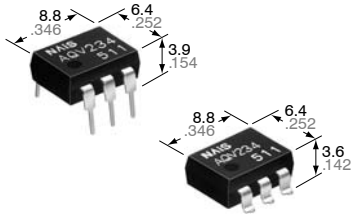
11.-(2) Output capacitance vs. applied voltage characteristics (AC/DC type)
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



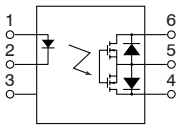
Panasonic
ideas for life

Highest sensitivity
LED operate current:
typical 0.31A

HS PhotoMOS (AQV234)



mm inch



FEATURES

1. High sensitivity type
LED operate current: typical 0.31 mA

2. Low-level off state leakage current (Typical 1 μA at 400 V load voltage)

3. Eliminates the need for a power supply to drive the power MOSFET

4. Low thermal electromotive force (Approx. 1 μV)

5. Extremely low closed-circuit offset voltages to enable control of small analog signals without distortion

6. Eliminates the need for a counter electromotive force protection diode in the drive circuits on the input side

7. Stable on resistance to help simplify circuit design

8. Surface-mount model available

TYPICAL APPLICATIONS

1. High-speed inspection machines
- Scanner
- IC checker
- Board tester

2. Telephone and data communication equipment

TYPES

Type	Output rating*		Part No.				Packing quantity	
			Through hole terminal	Surface-mount terminal				
	Load voltage	Load current	Tube packing style		Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2/3-pin side	Picked from the 4/5/6-pin side		
AC/DC type	400 V	120 mA	AQV234	AQV234A	AQV234AX	AQV234AZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.

*Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	Type of connection	AQV234(A)	Remarks
Input	LED forward current	I_F		50 mA	
	LED reverse voltage	V_R		5 V	
	Peak forward current	I_{FP}		1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}		75 mW	
Output	Load voltage (Peak AC)	V_L		400 V	
	Continuous load current	I_L	A	0.12 A	A connection: Peak AC, DC B, C connection: DC
			B	0.13 A	
			C	0.15 A	
	Peak load current	I_{peak}		0.3 A	A connection: 100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}		500 mW	
Total power dissipation		P_T		550 mW	
I/O isolation voltage		V_{iso}		1,500 V AC	
Temperature limits	Operating	T_{opr}		–40°C to +85°C –40°F to +185°F	Non-condensing at low temperature
	Storage	T_{stg}		–40°C to +100°C –40°F to +212°F	

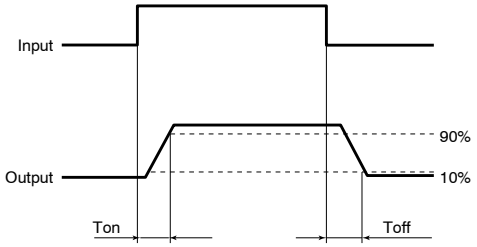
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	Type of connection	AQV234(A)	Remarks
Input	LED operate current		Typical	I_{Fon}	—	0.31 mA	$\Delta I_F/\Delta t$ Q Min. 100 μA/s I_L = Max.
			Maximum			0.5 mA	
	LED turn off current		Minimum	I_{Foff}	—	0.1 mA	$\Delta I_F/\Delta t$ Q Min. 100 μA/s I_L = Max.
			Typical			0.29 mA	
	LED dropout voltage		Typical	V_F	—	1.25 V (1.1 V at I_F = 2 mA)	I_F = 50 mA
			Maximum			1.5 V	
Output	On resistance		Typical	R_{on}	A	30 Ω	I_F = 2 mA I_L = Max. Within 1 s on time
			Maximum			50 Ω	
			Typical	R_{on}	B	22.5 Ω	I_F = 2 mA I_L = Max. Within 1 s on time
			Maximum			25 Ω	
			Typical	R_{on}	C	11.3 Ω	I_F = 2 mA I_L = Max. Within 1 s on time
			Maximum			12.5 Ω	
	Off state leakage current		Maximum	—	—	1 μA	I_F = 0 mA V_L = Max.
Transistor characteristics	Switching speed	Turn on time*	Typical	T_{on}	—	0.89 ms	I_F = 2 mA I_L = Max.
			Maximum			2 ms	
		Turn off time*	Typical	T_{off}	—	0.22 ms	I_F = 2 mA I_L = Max.
			Maximum			1 ms	
	I/O capacitance		Typical	C_{iso}	—	0.8 pF	f = 1 MHz V_B = 0 V
			Maximum			1.5 pF	
	Initial I/O isolation resistance		Minimum	R_{iso}	—	1,000 MΩ	500 V DC

Note: Recommendable LED forward current I_F = 2mA.

For type of connection, see page 56.

*Turn on/Turn off time



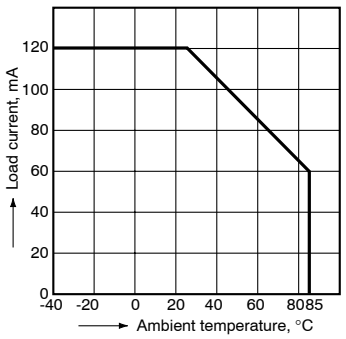
■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

1. Load current vs. ambient temperature characteristics

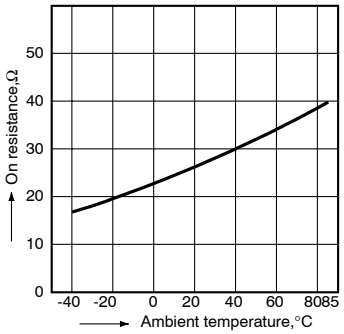
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F

Type of connection: A



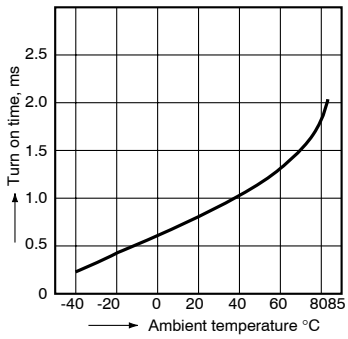
2. On resistance vs. ambient temperature characteristics

Measured portion: between terminals 4 and 6;
LED current: 2 mA; Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



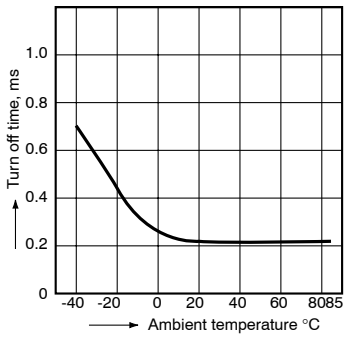
3. Turn on time vs. ambient temperature characteristics

LED current: 2 mA;
Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



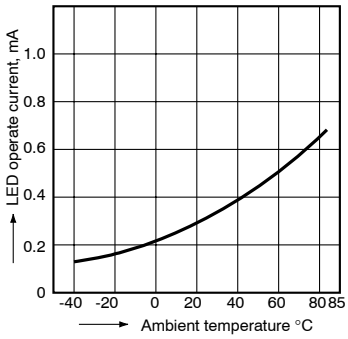
4. Turn off time vs. ambient temperature characteristics

LED current: 2 mA; Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



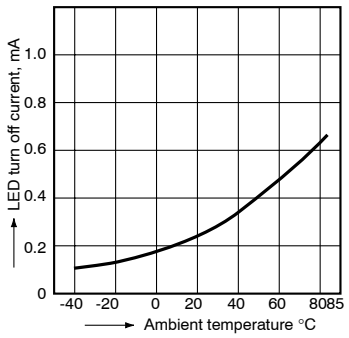
5. LED operate current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



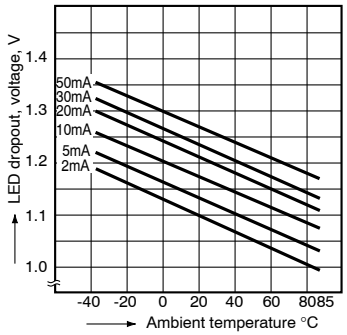
6. LED turn off current vs. ambient temperature characteristics

Load voltage: 400 V (DC);
Continuous load current: 120 mA (DC)



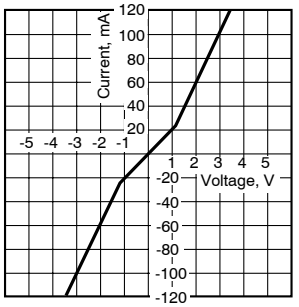
7. LED dropout voltage vs. ambient temperature characteristics

LED current: 2 to 50 mA



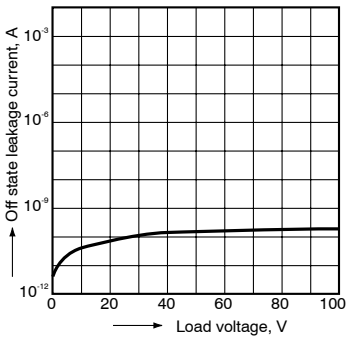
8. Current vs. voltage characteristics of output at MOS portion

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



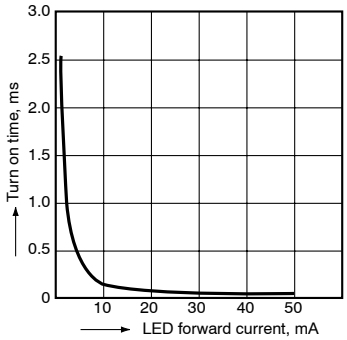
9. Off state leakage current vs. load voltage characteristics

Measured portion: between terminals 4 and 6;
Ambient temperature: 25°C 77°F



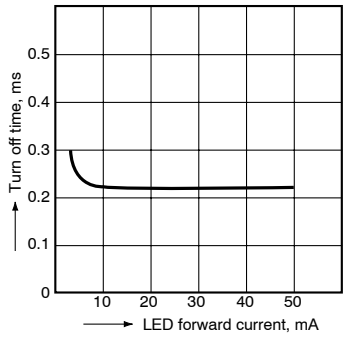
10. Turn on time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 400 V (DC); Continuous load current:
120 mA (DC); Ambient temperature: 25°C 77°F



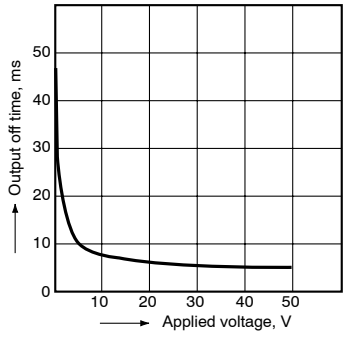
11. Turn off time vs. LED forward current characteristics

Measured portion: between terminals 4 and 6;
Load voltage: 400 V (DC); Continuous load current:
120 mA (DC); Ambient temperature: 25°C 77°F



12. Output capacitance vs. applied voltage characteristics

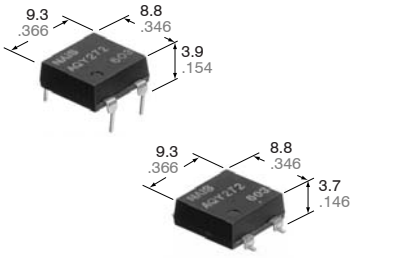
Measured portion: between terminals 4 and 6;
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



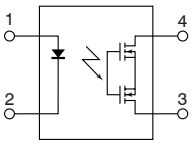
Panasonic
ideas for life

High capacity (Load current Max. 2A). Flat-Packaged type DIP (1Form A) 4-pin type.

PD PhotoMOS (AQY27❍)



mm inch



FEATURES

1. Flat-Packaged Type (W) 8.8× (D) 9.3× (H) 3.9mm (W) .346× (D) .366× (H) .154inch

2. High capacity

Supports the various types of load control, from very small loads to a maximum 2A at the rated load voltage 60V (AQY272)

3. High sensitivity

• Low ON resistance

A maximum 2A load can be controlled with a 5mA input current. The ON resistance is low at 0.11Ω (AQY272)

TYPICAL APPLICATIONS

• Measuring and Testing equipment
• IC Testers and Board Testers
• High speed inspection machines

TYPES

Type	Output rating*		Part No.				Packing quantity	
	Load voltage	Load current	Through hole terminal	Surface-mount terminal				
			Tube packing style		Tape and reel packing style		Tube	Tape and reel
					Picked from the 1/2-pin side	Picked from the 3/4-pin side		
AC/DC	60V	2.0A	AQY272	AQY272A	AQY272AX	AQY272AZ	1 tube contains 50 pcs. 1 batch contains 1,000 pcs.	1,000 pcs.
	100V	1.3A	AQY275	AQY275A	AQY275AX	AQY275AZ		
	200V	0.65A	AQY277	AQY277A	AQY277AX	AQY277AZ		
	400V	0.35A	AQY274	AQY274A	AQY274AX	AQY274AZ		

* Indicate the peak AC and DC values.
Note: For space reasons, the SMD terminal shape indicator “A” and the package type indicator “X” and “Z” are omitted from the seal.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

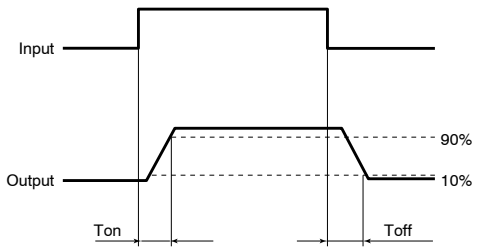
Item		Symbol	AQY272(A)	AQY275(A)	AQY277(A)	AQY274(A)	Remarks
Input	LED forward current	I_F	50 mA				
	LED reverse voltage	V_R	5 V				
	Peak forward current	I_{FP}	1 A				f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW				
Output	Load voltage (peak AC)	V_L	60 V	100 V	200 V	400 V	
	Continuous load current (Peak AC)	I_L	2.0 A	1.3 A	0.65 A	0.35 A	
	Peak load current	I_{peak}	6.0 A	4.0 A	2.0 A	1.0 A	100ms (1 shot), V_L = DC
	Power dissipation	P_{out}	700 mW				
Total power dissipation		P_T	750 mW				
I/O isolation voltage		V_{iso}	2,500 V AC				
Temperture limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F				Non-condensing at low temperatures
	Storage	Tstg	–40°C to +100°C –40°F to +212°F				

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQY272(A)	AQY275(A)	AQY277(A)	AQY274(A)	Condition
Input	LED operate current	Typical	I_{Fon}	1.0 mA				I_L = 100 mA V_L = 10 V
		Maximum		3.0 mA				
	LED turn off current	Minimum	I_{Foff}	0.4 mA				I_L = 100 mA V_L = 10 V
		Typical		0.9 mA				
	LED dropout voltage	Typical	V_F	1.25 V (1.16 V at I_F = 10 mA)				I_F = 50 mA
		Maximum		1.5 V				
Output	On resistance	Typical	R_{on}	0.11 Ω	0.23 Ω	0.7 Ω	2.1 Ω	I_F = 10 mA I_L = Max. Within 1 s on time
		Maximum		0.18 Ω	0.34 Ω	1.1 Ω	3.2 Ω	
	Off state leakage current	Maximum	I_{Leak}	10 μA				I_F = 0 mA V_L = Max.
Transfer characteristics	Turn on time*	Typical	T_{on}	2.46 ms	2.40 ms	1.12 ms	1.65 ms	I_F = 10 mA I_L = 100 mA V_L = 10 V
		Maximum		5.0 ms				
		Typical		5.64 ms	5.65 ms	2.57 ms	3.88 ms	I_F = 5 mA I_L = 100 mA V_L = 10 V
		Maximum		10.0 ms				
	Turn off time*	Typical	T_{off}	0.22 ms	0.21 ms	0.10 ms	0.08 ms	I_F = 5 mA or 10 mA I_L = 100 mA V_L = 10 V
		Maximum		3.0 ms				
	I/O capacitance	Typical	C_{iso}	0.8 pF				f = 1 MHz V_B = 0 V
		Maximum		1.5 pF				
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000 MΩ				500 V DC
	Maximum operating speed	Maximum	—	0.5 cps				I_F = 10 mA Duty factor = 50% I_L = Max. , V_L = Max.

Note: Recommendable LED forward current I_F = 5 to 10 mA. For type of connection, see page 56.

*Turn on/Turn off time

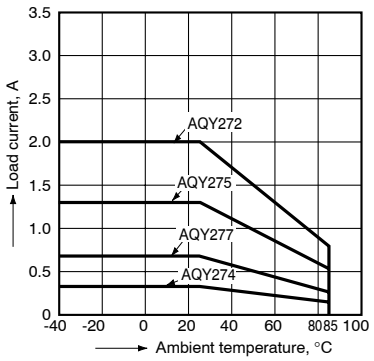


■ **For Dimensions, see page 54.**
■ **For Schematic and Wiring Diagrams, see page 56.**
■ **For Cautions for Use, see page 63.**

REFERENCE DATA

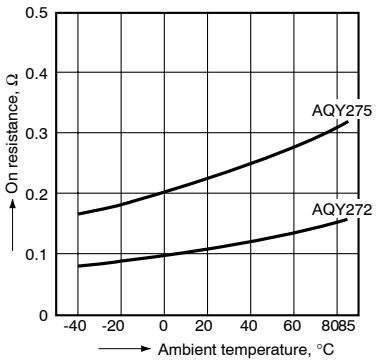
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



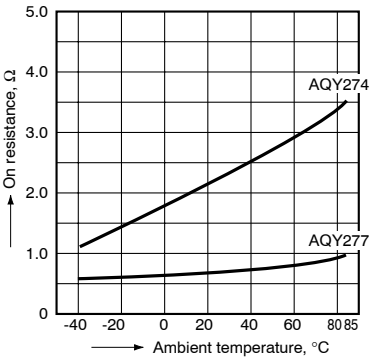
2.-(1) On resistance vs. ambient temperature characteristics

LED current: 10 mA;
Continuous load current: 2.0 A (DC) (AQY272),
1.3 A (DC) (AQY275)



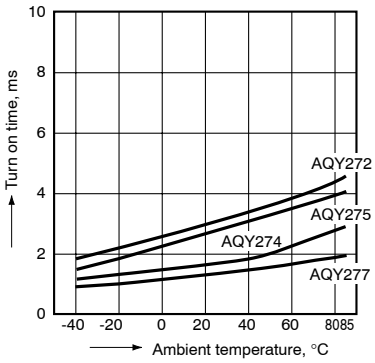
2.-(2) On resistance vs. ambient temperature characteristics

LED current: 10 mA;
Continuous load current: 0.65 A (DC) (AQY277),
0.35 A (DC) (AQY274)



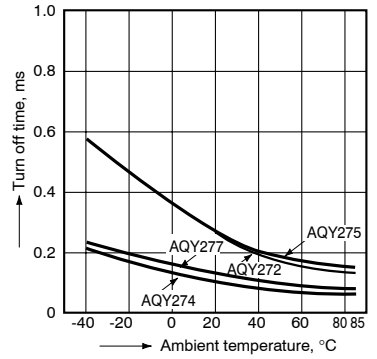
3. Turn on time vs. ambient temperature characteristics

LED current: 10 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



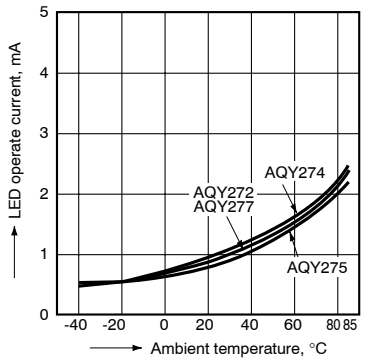
4. Turn off time vs. ambient temperature characteristics

LED current: 10 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



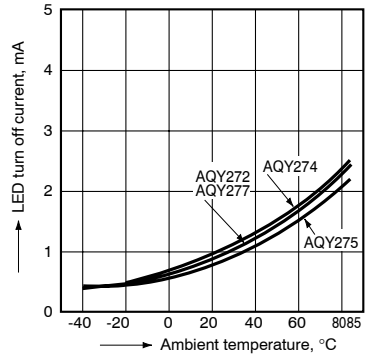
5. LED operate vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



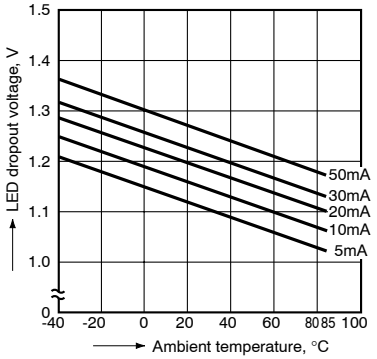
6. LED turn off current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



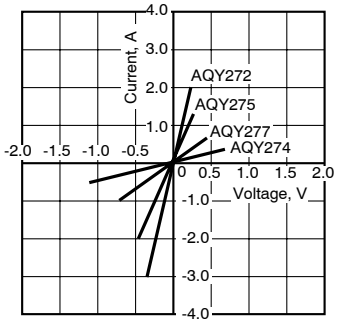
7. LED dropout voltage vs. ambient temperature characteristics

Sample: all types;
LED current: 5 to 50 mA

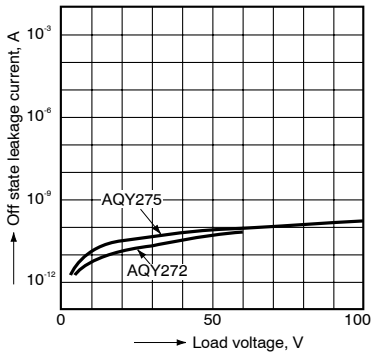


8. Current vs. voltage characteristics of output at MOS portion

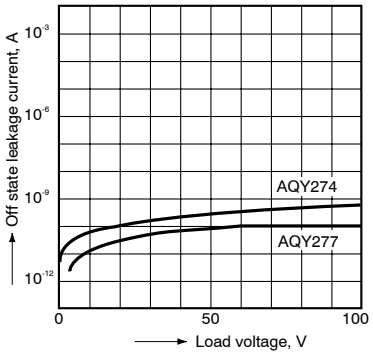
Ambient temperature: 25°C 77°F



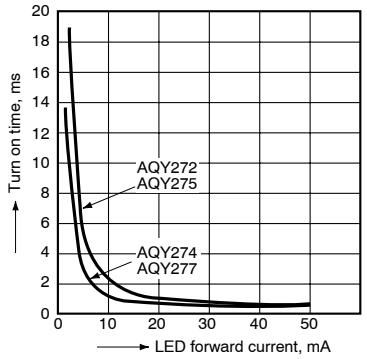
9.-(1) Off state leakage current vs. load voltage characteristics
Ambient temperature: 25°C 77°F



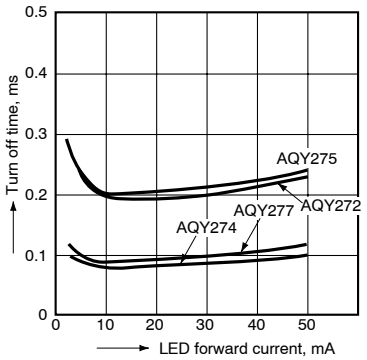
9.-(2) Off state leakage current vs. load voltage characteristics
Ambient temperature: 25°C 77°F



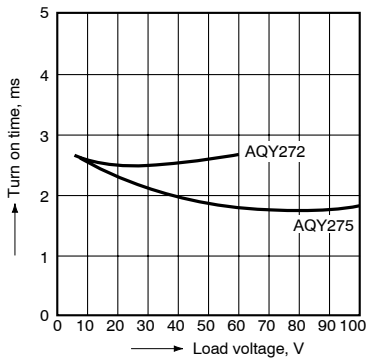
10. Turn on time vs. LED forward current characteristics
Load voltage: 10 V (DC); Continuous load current: 100 mA (DC); Ambient temperature: 25°C 77°F



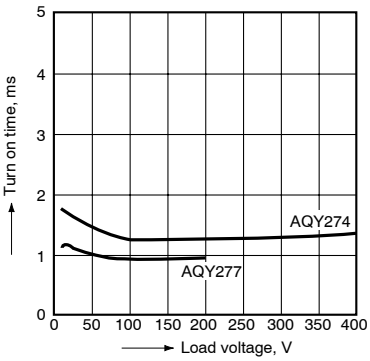
11. Turn off time vs. LED forward current characteristics
Load voltage: 10 V (DC); Continuous load current: 100 mA (DC); Ambient temperature: 25°C 77°F



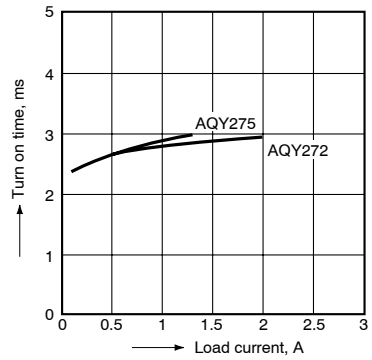
12.-(1) Turn on time vs. load voltage characteristics
LED current: 10 mA; Continuous load current: 100 mA; Ambient temperature: 25°C 77°F



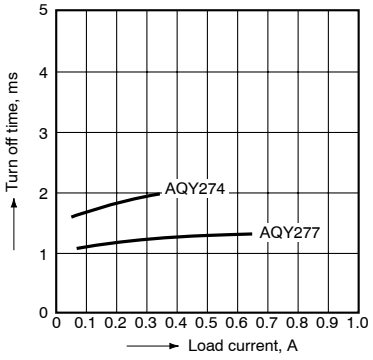
12.-(2) Turn on time vs. load voltage characteristics
LED current: 10 mA; Continuous load current: 100 mA; Ambient temperature: 25°C 77°F



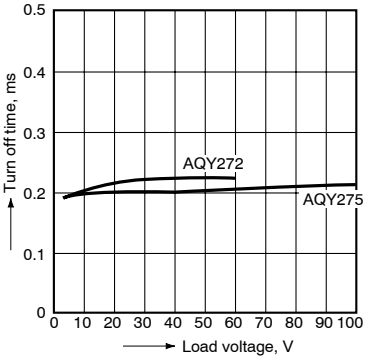
13.-(1) Turn on time vs. load current characteristics
LED current: 10 mA; Load voltage: 10 V (DC); Ambient temperature: 25°C 77°F



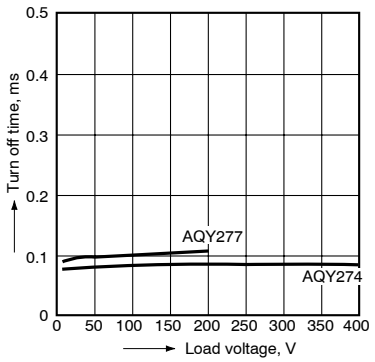
13.-(2) Turn on time vs. load current characteristics
LED current: 10 mA; Load voltage: 10 V (DC); Ambient temperature: 25°C 77°F



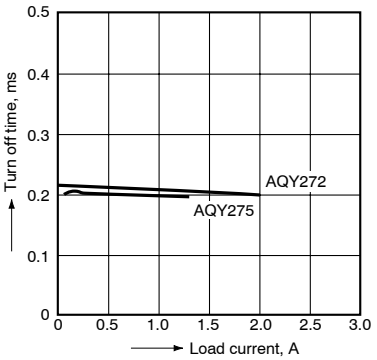
14.-(1) Turn off time vs. load voltage characteristics
LED current: 10 mA; Continuous load current: 100 mA; Ambient temperature: 25°C 77°F



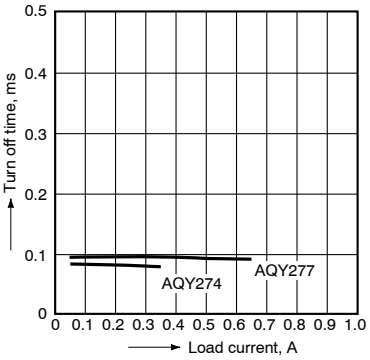
14.-(2) Turn off time vs. load voltage characteristics
LED current: 10 mA; Continuous load current: 100 mA; Ambient temperature: 25°C 77°F



15.-(1) Turn off time vs. load current characteristics
LED current: 10 mA; Load voltage 10 V (DC); Ambient temperature: 25°C 77°F

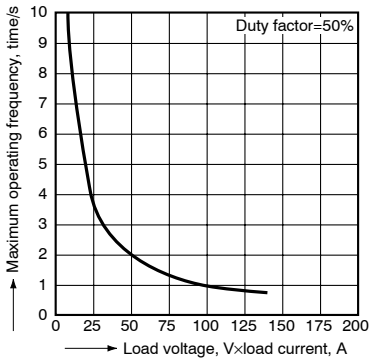


15.-(2) Turn off time vs. load current characteristics
LED current: 10 mA; Load voltage 10 V (DC); Ambient temperature: 25°C 77°F



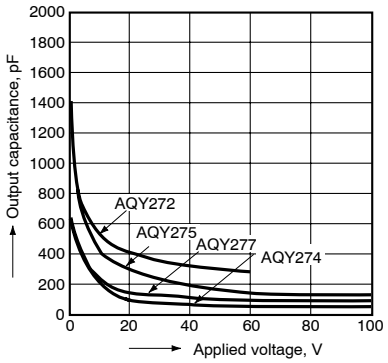
16. Maximum operating frequency vs. load voltage/current characteristics

LED current: 10 mA;
Ambient temperature: 25°C 77°F



17. Output capacitance vs. applied voltage characteristics

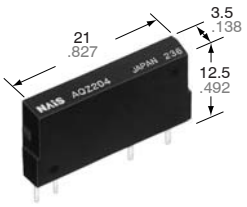
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



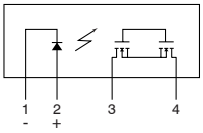
Panasonic
ideas for life

High capacity PhotoMOS Relay. (Load current Max. 4A) DC load type is available.

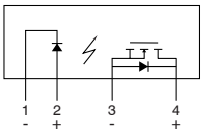
Power PhotoMOS (AQZ10❍, 20❍)



mm inch



AC/DC type



DC type

FEATURES

1. High capacity PhotoMOS Relay in a compact and slim 4-pin SIL

2. Extremely low ON resistance

3. Control low-level signal
Power Photo MOS relays feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

4. Low-level off state leakage current

5. High I/O isolation voltage 2,500 V

6. Eliminates the need for a counter electromotive protection diode in the drive circuit on the input side

7. Eliminate the need for a power supply to drive the power MOSFET

8. PC board layout is simplified

9. No restriction on mounting direction

10. Varistor incorporated type is also available.

TYPICAL APPLICATIONS

- High-speed inspection machines
- IC checker
- NC machine, Robots
- Office machines
- Telecommunication
- Automotive

TYPES

1. AC/DC type

Output rating		Part No.	Packing quantity	
Load voltage	Load current		Inner carton	Outer carton
60 V	3.0 A	AQZ202	25 pcs.	500 pcs.
100 V	2.0 A	AQZ205		
200 V	1.0 A	AQZ207		
400 V	0.5 A	AQZ204		

2. DC type

Output rating		Part No.	Packing quantity	
Load voltage	Load current		Inner carton	Outer carton
60 V	4.0 A	AQZ102	25 pcs.	500 pcs.
100 V	2.6 A	AQZ105		
200 V	1.3 A	AQZ107		
400 V	0.7 A	AQZ104		

Notes: Load voltage and current of AC/DC type: Peak AC/DC.
Load voltage and current of DC type: DC

RATING

1. AC/DC type

1) Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQZ202	AQZ205	AQZ207	AQZ204	Remarks
Input	LED forward current	I_F	50 mA				
	LED reverse voltage	V_R	5 V				
	Peak forward current	I_{FP}	1 A				f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW				
Output	Load voltage (Peak AC)	V_L	60 V	100 V	200 V	400 V	
	Continuous load current	I_L	3.0 A	2.0 A	1.0 A	0.5 A	
	Peak load current	I_{peak}	9.0 A	6.0 A	3.0 A	1.5 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	1.6 W				
Total power dissipation		P_T	1.6 W				
I/O isolation voltage		V_{iso}	2,500 V AC				
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F				Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F				

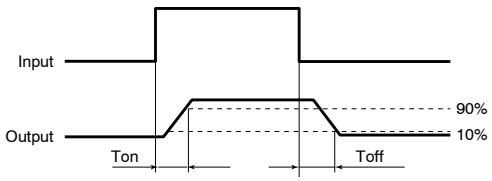
2) Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQZ202	AQZ205	AQZ207	AQZ204	Condition
Input	LED operate current		Typical	I_{Fon}	1.0 mA				I_L= 100 mA V_L= 10 V
			Maximum		3.0 mA				
	LED turn off current		Minimum	I_{Foff}	0.4 mA				I_L= 100 mA V_L= 10 V
			Typical		0.9 mA				
	LED dropout voltage		Typical	V_F	1.25 V (1.16 V at I_F = 10 mA)				I_F = 50 mA
			Maximum		1.5 V				
Output	On resistance		Typical	R_{on}	0.11 Ω	0.23 Ω	0.7 Ω	2.1 Ω	I_F = 10 mA I_L =Max. Within 1 s on time
			Maximum		0.18 Ω	0.34 Ω	1.1 Ω	3.2 Ω	
	Off state leakage current		Maximum	—	10 μA				I_F = 0 mA V_L = Max.
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	2.46 ms	2.40 ms	1.12 ms	1.65 ms	I_F = 10 mA I_L = 100 mA V_L = 10 V
			Maximum		5.0 ms				
			Typical		5.64 ms	5.65 ms	2.57 ms	3.88 ms	I_F = 5 mA I_L = 100 mA V_L = 10 V
			Maximum		10.0 ms				
		Turn off time*	Typical	T_{off}	0.22 ms	0.21 ms	0.10 ms	0.08 ms	I_F = 5 mA or 10 mA I_L = 100 mA V_L = 10 V
			Maximum		3.0 ms				
	I/O capacitance		Typical	C_{iso}	0.8 pF				f = 1 MHz V_B = 0 V
			Maximum		1.5 pF				
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000 MΩ				500 V DC
	Maximum operating speed		Maximum	—	0.5 cps				I_F = 10 mA Duty factor = 50% I_L = Max., V_L = Max.
Vibration resistance			Minimum	—	10 to 55 Hz at double amplitude of 3 mm				2 hours for 3 axes
Shock resistance			Minimum	—	4,900 m/s² {500 G}1 ms				3 times for 3 axes

Note: Recommendable LED forward current I_F= 5 to 10 mA.

For type of connection, see page 59.

*Turn on/off time



2. DC type

1) Absolute maximum ratings (Ambient temperature: 25°C 77°F)

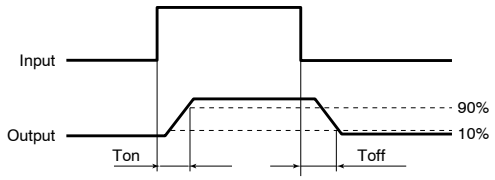
Item		Symbol	AQZ102	AQZ105	AQZ107	AQZ104	Remarks
Input	LED forward current	I_F	50 mA				
	LED reverse voltage	V_R	5 V				
	Peak forward current	I_{FP}	1 A				f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW				
Output	Load voltage (DC)	V_L	60 V	100 V	200 V	400 V	
	Continuous load current (DC)	I_L	4.0 A	2.6 A	1.3 A	0.7 A	
	Peak load current	I_{peak}	9.0 A	6.0 A	3.0 A	1.5 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	1.35 W				
Total power dissipation		P_T	1.35 W				
I/O isolation voltage		V_{iso}	2,500 V AC				
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F				Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F				

2) Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQZ102	AQZ105	AQZ107	AQZ104	Condition
Input	LED operate current		Typical	I_{Fon}	1.0 mA				I_L= 100 mA V_L= 10 V
			Maximum		3.0 mA				
	LED turn off current		Minimum	I_{Foff}	0.4 mA				I_L= 100 mA V_L= 10 V
			Typical		0.9 mA				
	LED dropout voltage		Typical	V_F	1.25 V (1.16 V at I_F = 10 mA)				I_F = 50 mA
			Maximum		1.5 V				
Output	On resistance		Typical	R_{on}	0.05 Ω	0.081 Ω	0.34 Ω	1.06 Ω	I_F = 10 mA I_L =Max. Within 1 s on time
			Maximum		0.09 Ω	0.17 Ω	0.55 Ω	1.6 Ω	
	Off state leakage current		Maximum	—	10 μA				I_F = 0 mA V_L = Max.
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	1.66 ms	1.89 ms	0.83 ms	1.01 ms	I_F = 10 mA I_L = 100 mA V_L = 10 V
			Maximum		5.0 ms				
			Typical		3.79 ms	4.50 ms	1.75 ms	2.34 ms	I_F = 5 mA I_L = 100 mA V_L = 10 V
			Maximum		10.0 ms				
		Turn off time*	Typical	T_{off}	0.15 ms	0.19 ms	0.08 ms	0.08 ms	I_F = 5 mA or 10 mA I_L = 100 mA V_L = 10 V
			Maximum		3.0 ms				
	I/O capacitance		Typical	C_{iso}	0.8 pF				f = 1 MHz V_B = 0 V
			Maximum		1.5 pF				
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000 MΩ				500 V DC
	Maximum operating speed		Maximum	—	0.5 cps				I_F = 10 mA Duty factor = 50% $I_L \times V_L$= 200 (VA)
Vibration resistance			Minimum	—	10 to 55 Hz at double amplitude of 3 mm				2 hours for 3 axes
Shock resistance			Minimum	—	4,900 m/s² {500 G} 1 ms				3 times for 3 axes

Note: Recommendable LED forward current I_F= 5 to 10 mA. For type of connection, see page 59.

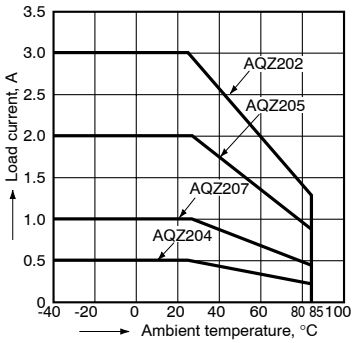
*Turn on/off time



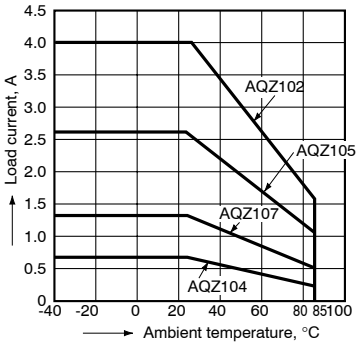
■ **For Dimensions, see page 54.**
■ **For Schematic and Wiring Diagrams, see page 59.**
■ **For Cautions for Use, see page 68.**

REFERENCE DATA

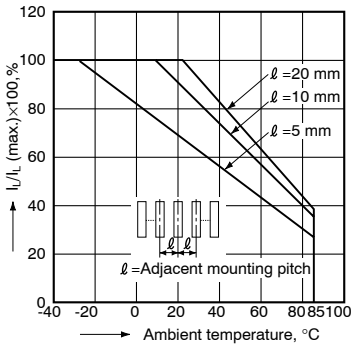
1.-(1) Load current vs. ambient temperature characteristics (AC/DC type)
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



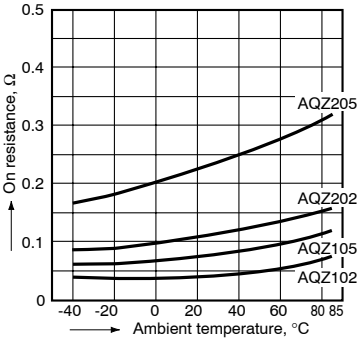
1.-(2) Load current vs. ambient temperature characteristics (DC type)
Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



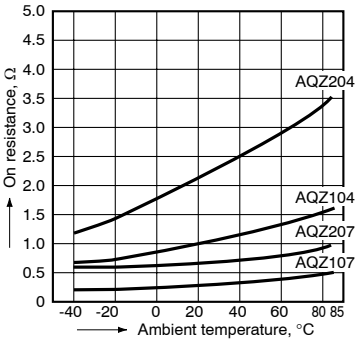
2. Load current vs. ambient temperature characteristics in adjacent mounting
I_L : Load current;
I_L (max.): Maximum continuous load current



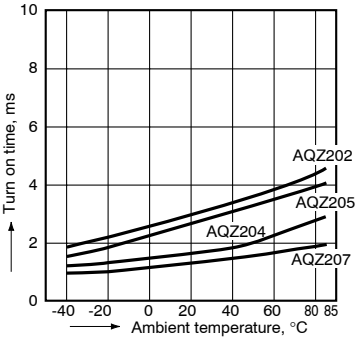
3.-(1) On resistance vs. ambient temperature characteristics
LED current: 10 mA;
Continuous load current: 1.2 A (DC) (AQZ202),
0.8 A (DC) (AQZ205),
1.6 A (DC) (AQZ102),
1.04 A (DC) (AQZ105)



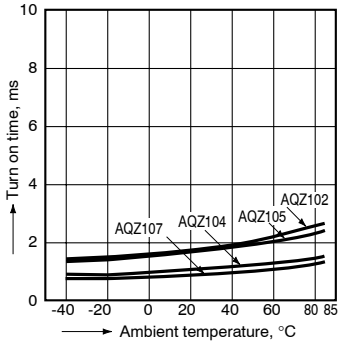
3.-(2) On resistance vs. ambient temperature characteristics
LED current: 10 mA;
Continuous load current: 0.4 A (DC) (AQZ207),
0.2 A (DC) (AQZ204),
0.52 A (DC) (AQZ107),
0.28 A (DC) (AQZ104)



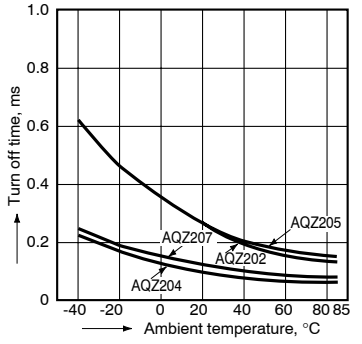
4.-(1) Turn on time vs. ambient temperature characteristics (AC/DC type)
LED current: 10 mA;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



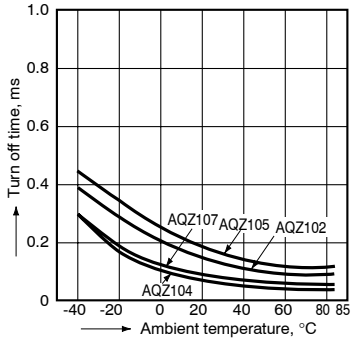
4.-(2) Turn on time vs. ambient temperature characteristics (DC type)
LED current: 10 mA;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



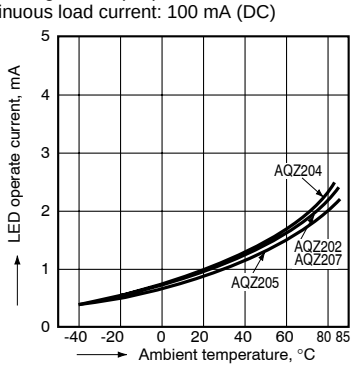
5.-(1) Turn off time vs. ambient temperature characteristics (AC/DC type)
LED current: 10 mA;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



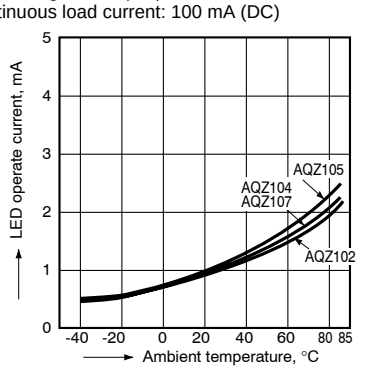
5.-(2) Turn off time vs. ambient temperature characteristics (DC type)
LED current: 10 mA;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



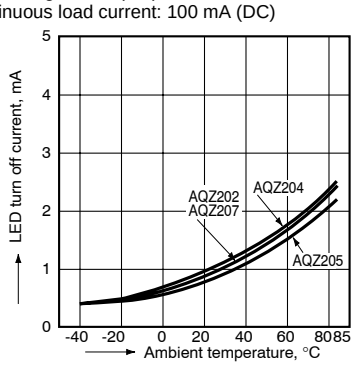
6.-(1) LED operate vs. ambient temperature characteristics (AC/DC type)
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



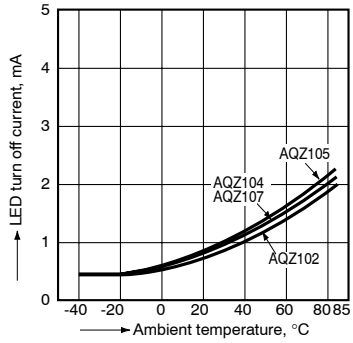
6.-(2) LED operate vs. ambient temperature characteristics (DC type)
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



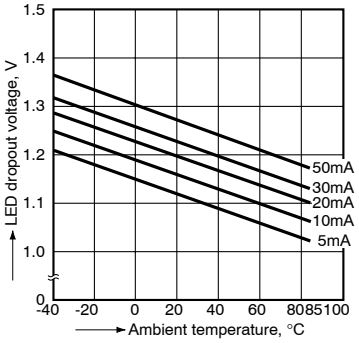
7.-(1) LED turn off current vs. ambient temperature characteristics (AC/DC type)
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



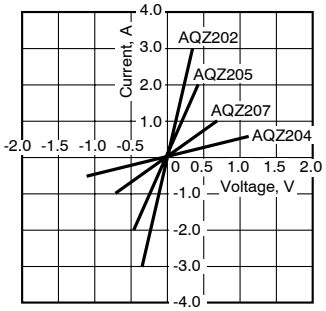
7.-(2) LED turn off current vs. ambient temperature characteristics (DC type)
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



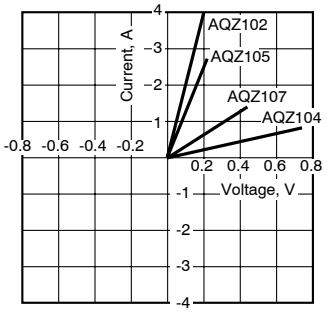
8. LED dropout voltage vs. ambient temperature characteristics
Sample: all types; LED current: 5 to 50 mA



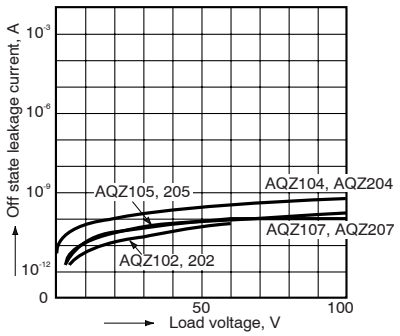
9.-(1) Current vs. voltage characteristics of output at MOS portion (AC/DC type)
Ambient temperature: 25°C 77°F



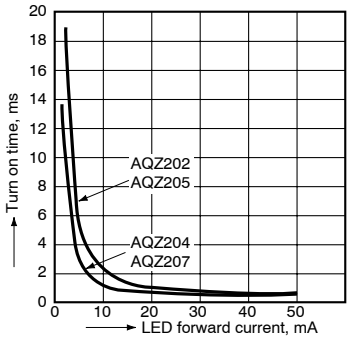
9.-(2) Current vs. voltage characteristics of output at MOS portion (DC type)
Ambient temperature: 25°C 77°F



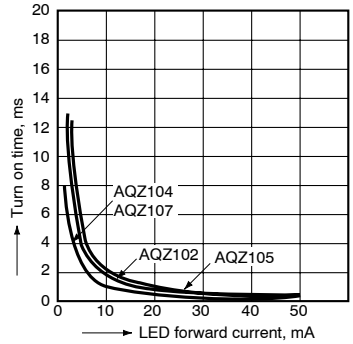
10. Off state leakage current vs. load voltage characteristics
Ambient temperature: 25°C 77°F



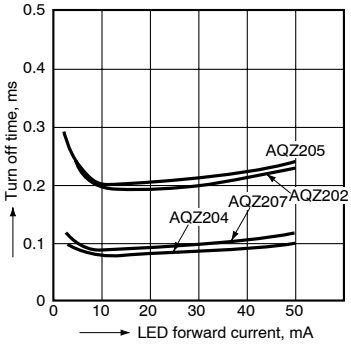
11.-(1) Turn on time vs. LED forward current characteristics (AC/DC type)
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



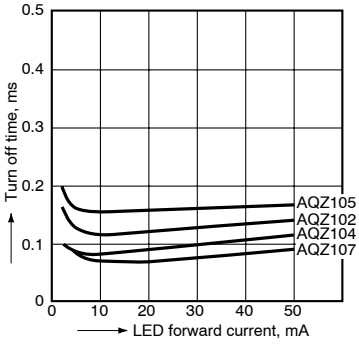
11.-(2) Turn on time vs. LED forward current characteristics (DC type)
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



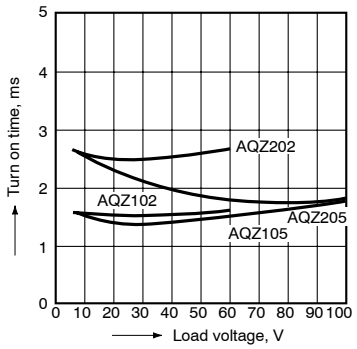
12.-(1) Turn off time vs. LED forward current characteristics (AC/DC type)
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



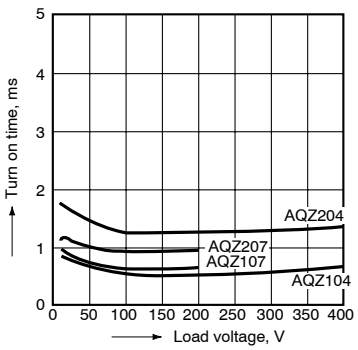
12.-(2) Turn off time vs. LED forward current characteristics (DC type)
Measured portion: between terminals 4 and 6;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC);
Ambient temperature: 25°C 77°F



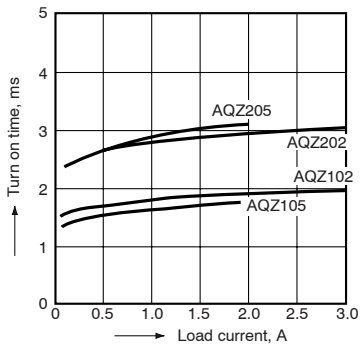
13.-(1) Turn on time vs. load voltage characteristics (Load voltage: 60, 100 V type)
LED current: 10 mA;
Continuous load current: 100 mA;
Ambient temperature: 25°C 77°F



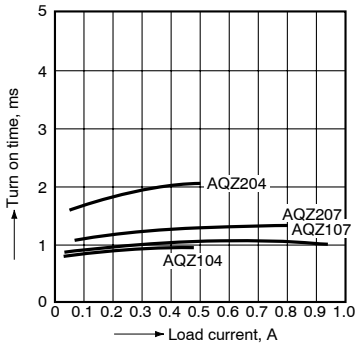
13.-(2) Turn on time vs. load voltage characteristics (Load voltage: 200, 400 V type)
LED current: 10 mA;
Continuous load current: 100 mA;
Ambient temperature: 25°C 77°F



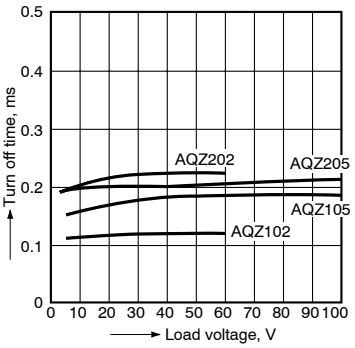
14.-(1) Turn on time vs. load current characteristics (Load voltage: 60, 100 V type)
LED current: 10 mA;
Load voltage: 10 V (DC);
Ambient temperature: 25°C 77°F



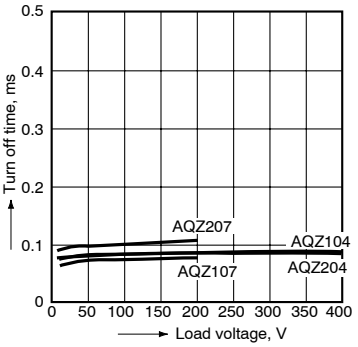
14.-(2) Turn on time vs. load current characteristics (Load voltage: 200, 400 V type)
LED current: 10 mA;
Load voltage: 10 V (DC);
Ambient temperature: 25°C 77°F



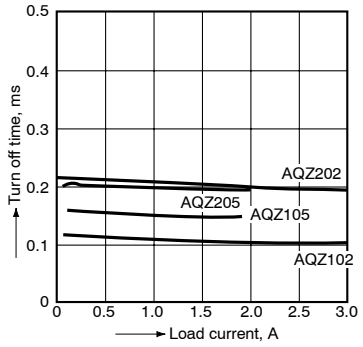
15.-(1) Turn off time vs. load voltage characteristics (Load voltage: 60, 100 V type)
LED current: 10 mA;
Continuous load current: 100 mA;
Ambient temperature: 25°C 77°F



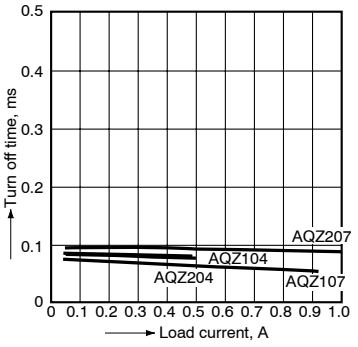
15.-(2) Turn off time vs. load voltage characteristics (Load voltage: 200, 400 V type)
LED current: 10 mA;
Continuous load current: 100 mA;
Ambient temperature: 25°C 77°F



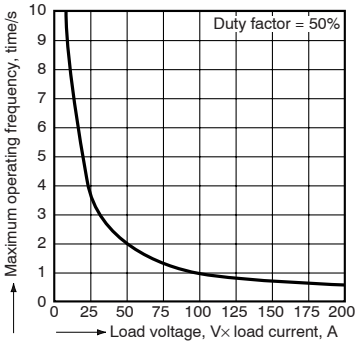
16.-(1) Turn off time vs. load current characteristics (Load voltage: 60, 100 V type)
LED current: 10 mA;
Load voltage: 10 V (DC);
Ambient temperature: 25°C 77°F



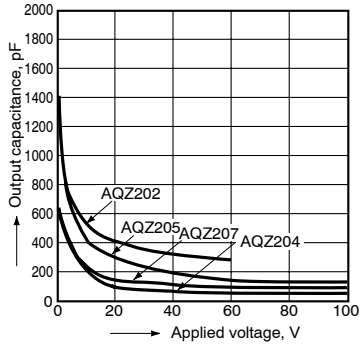
16.-(2) Turn off time vs. load current characteristics (Load voltage: 200, 400 V type)
LED current: 10 mA;
Load voltage: 10 V (DC);
Ambient temperature: 25°C 77°F



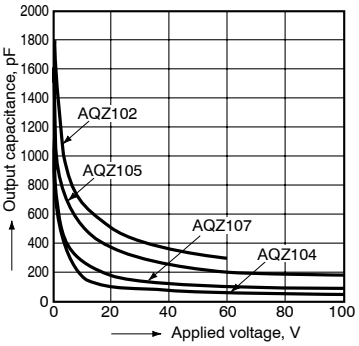
17. Maximum operating frequency vs. load voltage/current characteristics
LED current: 10 mA;
Ambient temperature: 25°C 77°F



18.-(1) Output capacitance vs. applied voltage characteristics (AC/DC type)
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



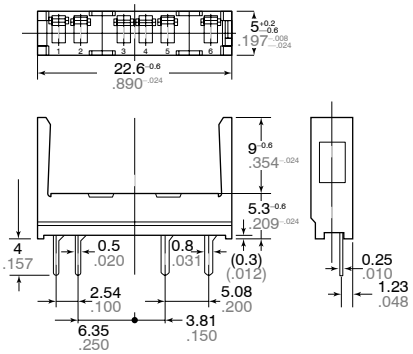
18.-(2) Output capacitance vs. applied voltage characteristics (DC type)
Frequency: 1 MHz;
Ambient temperature: 25°C 77°F



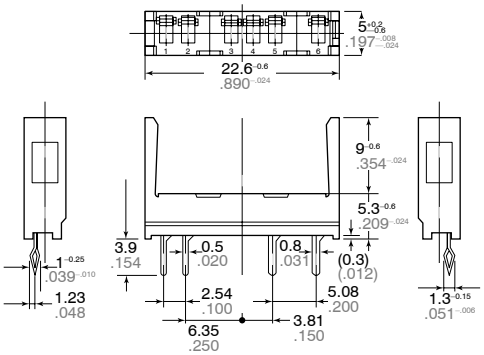
ACCESSORY

mm inch

Socket

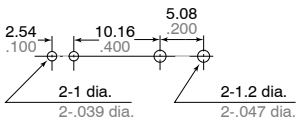


PA1a-PS

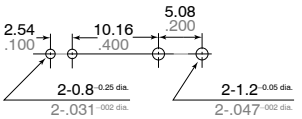


PA1a-PS-H

PC board pattern (BOTTOM VIEW)
Standard type



Self clinching type

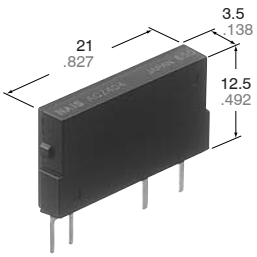


Tolerance: ±0.1 ±.004

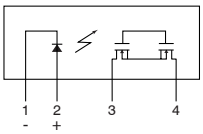
Panasonic
ideas for life

High capacity PhotoMOS Relay. (Load current Max. 0.5A) 1 Form B.

Power PhotoMOS (AQZ404)



mm inch

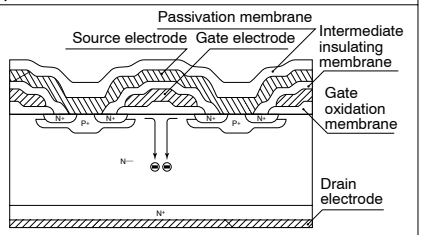


FEATURES

1. High capacity
A maximum 0.5A load can be controlled with a 5 mA input current. The ON resistance is low at 2.8Ω (typ.)

2. 1 Form B
This has been realized thanks to the built-in MOSFET processed by our proprietary method, DSD (Double-diffused and Selective Doping) method.

Cross section of the normally-closed type of power MOS



3. Compact slim-type 4-pin SIL
(W)3.5× (D)21.0× (H)12.5 mm
(W).138×(D).827×(H).492 inch×
The compact size of the 4-pin SIL package allows high density mounting.

TYPICAL APPLICATIONS

- Railroad, traffic signals
- Measurement instruments
- Testing equipment

TYPES

AC/DC type

Output rating*		Part No.	Packing quantity	
Load voltage	Load current		Inner carton	Outer carton
400 V	0.5 A	AQZ404	25 pcs	500 pcs

RATING

1) Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQZ404	Remarks
Input	LED forward current	I_F	50 mA	
	LED reverse voltage	V_R	5 V	
	Peak forward current	I_{FP}	1 A	f = 100 Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mW	
Output	Load voltage (Peak AC)	V_L	400 V	
	Continuous load current (Peak AC)	I_L	0.5 A	
	Peak load current	I_{peak}	1.5 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	1.6 W	
Total power dissipation		P_T	1.6 W	
I/O isolation voltage		V_{iso}	2,500 V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F	Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F	

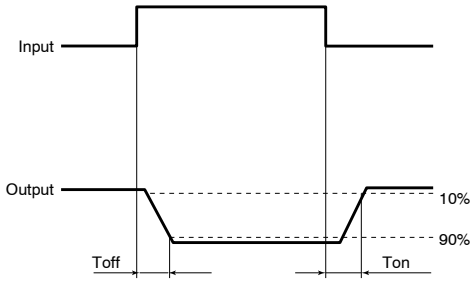
2) Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQZ404	Condition
Input	LED operate (OFF) current		Typical	I_{Foff}	1.0 mA	I_L= 100 mA V_L= 10 V
			Maximum		3.0 mA	
	LED reverse (ON) current		Minimum	I_{Fon}	0.4 mA	I_L= 100 mA V_L= 10 V
			Typical		0.9 mA	
	LED dropout voltage		Typical	V_F	1.25 V (1.16 V at I_F = 10 mA)	I_F = 50 mA
			Maximum		1.5 V	
Output	On resistance		Typical	R_{on}	2.8 Ω	I_F = 0 mA I_L = Max. Within 1 s on time
			Maximum		4.0 Ω	
	Off state leakage current		Maximum	I_{Leak}	10 μA	I_F = 10mA V_L = Max.
Transfer characteristics	Switching speed	Operating (OFF) time*	Typical	T_{off}	3.9 ms	I_F = 0 › 10 mA I_L = 100 mA V_L = 10 V
			Maximum		7.5 ms	
			Typical		9.4 ms	I_F = 0 › 5 mA I_L = 100 mA V_L = 10 V
			Maximum		15 ms	
		Reverse (ON) time*	Typical	T_{on}	0.8 ms	I_F = 5 mA › 0 or 10 mA › 0 I_L = 100 mA V_L = 10 V
			Maximum		3.0 ms	
	I/O capacitance		Typical	C_{iso}	0.8 pF	f = 1 MHz V_B = 0 V
			Maximum		1.5 pF	
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000 MΩ	500 V DC
	Maximum operating frequency		Maximum	—	0.5 cps	I_F = 10 mA Duty factor = 50% I_L=Max., V_L=Max.

Note: Recommendable LED forward current I_F= 5 to 10 mA.

For type of connection, see page 59.

*Operate/Reverse time

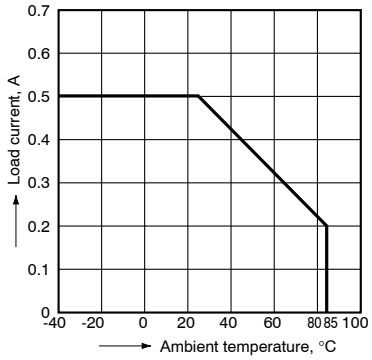


■ **For Dimensions, see page 54.**
■ **For Schematic and Wiring Diagrams, see page 59.**
■ **For Cautions for Use, see page 68.**

REFERENCE DATA

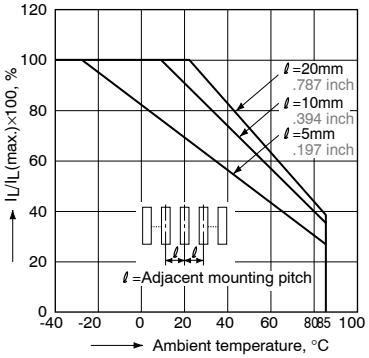
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



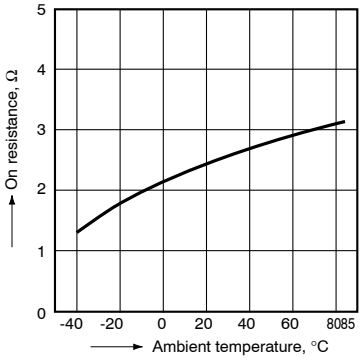
2. Load current vs. ambient temperature characteristics in adjacent mounting

I_L: Load current;
I_L (max.): Maximum continuous load current



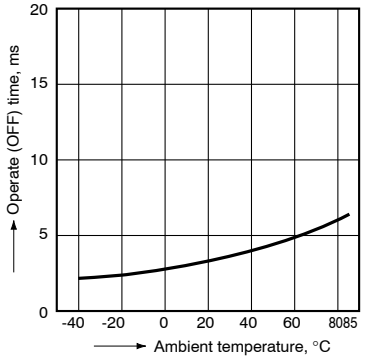
3. On resistance vs. ambient temperature characteristics

LED current: 0 mA; Load voltage: Max. (DC)
Continuous load current: Max. (DC)



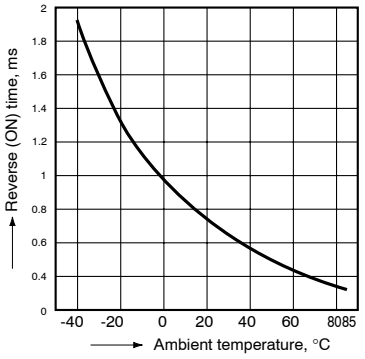
4. Operate (OFF) time vs. ambient temperature characteristics

LED current: 10 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



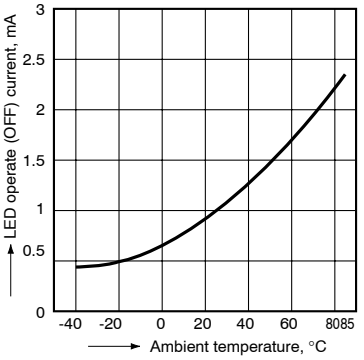
5. Reverse (ON) time vs. ambient temperature characteristics

LED current: 10 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



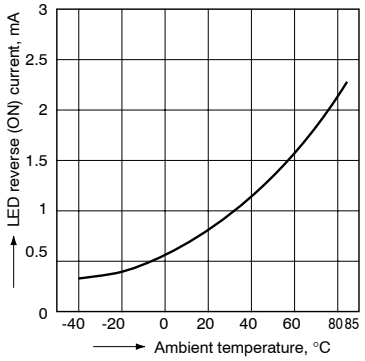
6. LED operate (OFF) current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



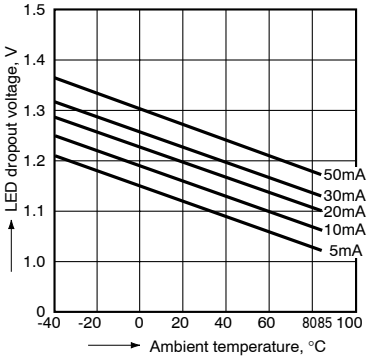
7. LED reverse (ON) current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



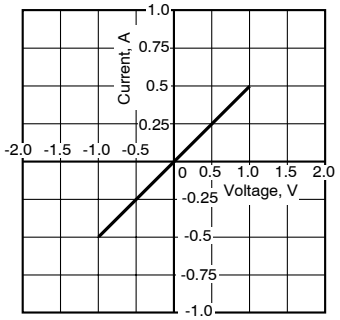
8. LED dropout voltage vs. ambient temperature characteristics

Sample: all types; LED current: 5 to 50 mA



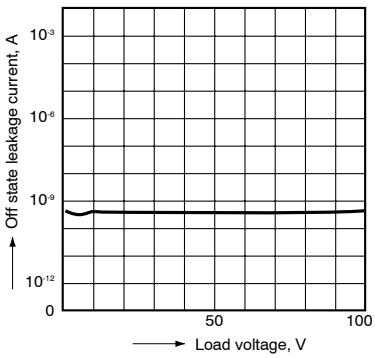
9. Current vs. voltage characteristics of output at MOS portion

Ambient temperature: 25°C 77°F



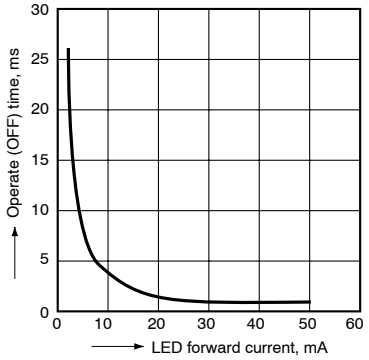
10. Off state leakage current vs. load voltage characteristics

Ambient temperature: 25°C 77°F



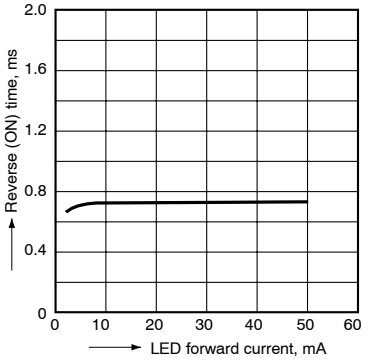
11. Operate (OFF) time vs. LED forward current characteristics

Load voltage: 10 V (DC); Continuous load current: 100 mA (DC); Ambient temperature: 25°C 77°F



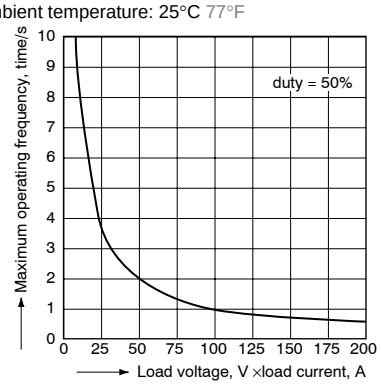
12. Reverse (ON) time vs. LED forward current characteristics

Load voltage: 10 V (DC); Continuous load current: 100 mA (DC); Ambient temperature: 25°C 77°F



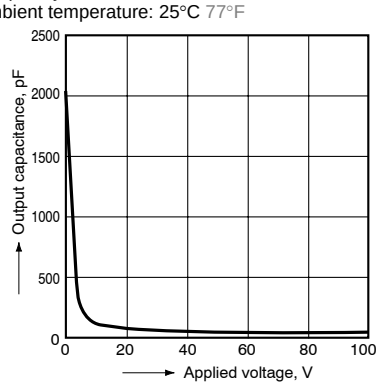
13. Maximum operating frequency vs. load voltage/current characteristics

LED current: 10 mA;
Ambient temperature: 25°C 77°F



14. Output capacitance vs. applied voltage characteristics

Frequency: 1 MHz;
Ambient temperature: 25°C 77°F

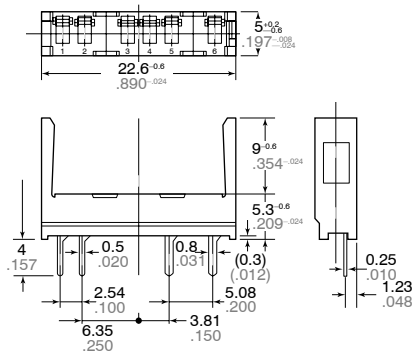


ACCESSORY

mm inch

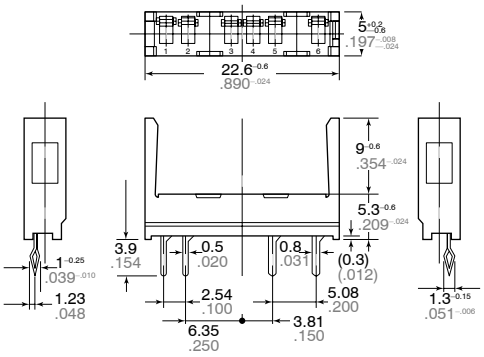
Socket

Standard type



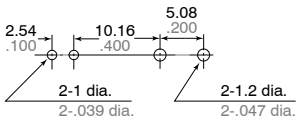
PA1a-PS

Self clinching type

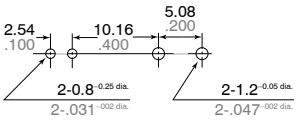


PA1a-PS-H

PC board pattern
(BOTTOM VIEW)
Standard type



Self clinching type



General Tolerance: ±0.3 ±.012

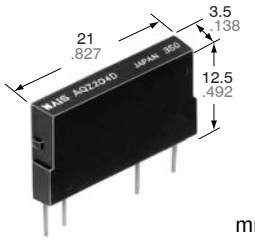
General Tolerance: ±0.3 ±.012

Tolerance: ±0.1 ±.004

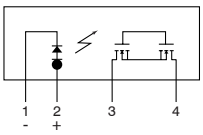
Panasonic
ideas for life

A voltage-sensitive PhotoMOS relay. DC load type is available.

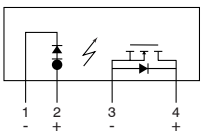
Power PhotoMOS (AQZ10❍D, 20❍D)



mm inch



AC/DC type



DC type

FEATURES

1. A voltage sensitive power PhotoMOS relay
Conventional power PhotoMOS relays are connected externally to an input limiting resistor in order to obtain the appropriate LED current. Adding an internal constant-current element renders the input limiting resistor unnecessary, making it possible for the PhotoMOS relay to be voltage driven.

2. Wide range of input voltages
Allows a wide range of input voltages from 4 to 30 V DC. The relay can be used in 5 V, 12 V or 24 V DC systems.

3. Large capacity PhotoMOS relay
Supports the various types of load control, from very small loads to a maximum 2.7 A for the AC/DC dual type, 3.6 A for the DC-only type.

4. Both AC/DC dual types and DC-only types are available
The AC/DC dual type is capable of bi-directional control, and unlike conventional SSRs, does not have to be used differently depending on the load. The DC-only type is well suited for control of DC solenoids and DC motors.

5. High sensitivity, low ON resistance
A maximum 3.6 A load can be controlled with the minimum input voltage of 4 V DC. The ON resistance is also low at 0.09 Ω (AQZ102D).

6. Small scale, slim type, 4-pin SIL
Length 21.0 mm×width 3.5 mm×height 12.5 mm. High precision mounting is possible because of the small 73.5mm² area of the 4-pin SIL.

TYPES

1. AC/DC type

Output rating		Part No.	Packing quantity	
Load voltage	Load current		Inner carton	Outer carton
60 V	2.7 A	AQZ202D	25 pcs.	500 pcs.
100 V	1.8 A	AQZ205D		
200 V	0.9 A	AQZ207D		
400 V	0.45 A	AQZ204D		

2. DC type

Output rating		Part No.	Packing quantity	
Load voltage	Load current		Inner carton	Outer carton
60 V	3.6 A	AQZ102D	25 pcs.	500 pcs.
100 V	2.3 A	AQZ105D		
200 V	1.1 A	AQZ107D		
400 V	0.6 A	AQZ104D		

Notes: Load voltage and current of AC/DC type: Peak AC/DC.
Load voltage and current of DC type: DC.

RATING

1. AC/DC type

1) Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQZ202D	AQZ205D	AQZ207D	AQZ204D	Remarks
Input	Input voltage	V_{IN}	30 V				
	Input reverse voltage	V_{RIN}	5 V				
	Power dissipation	P_{in}	300 mW				
Output	Load voltage (Peak AC)	V_L	60 V	100 V	200 V	400 V	
	Continuous load current (Peak AC)	I_L	2.7 A	1.8 A	0.9 A	0.45 A	
	Peak load current	I_{peak}	9.0 A	6.0 A	3.0 A	1.5 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	1.6 W				
Total power dissipation		P_T	1.6 W				
I/O isolation voltage		V_{iso}	2,500 V AC				
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F (4 V ≤ V_{IN} ≤ 6 V) –40°C to +75°C –40°F to +167°F (6 V < V_{IN} ≤ 15 V) –40°C to +60°C –40°F to +140°F (15 V < V_{IN} ≤ 30 V)				Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F				

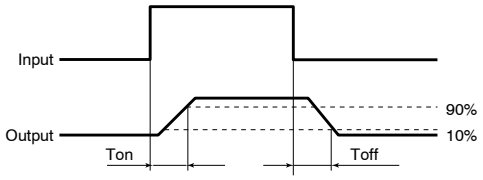
2) Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQZ202D	AQZ205D	AQZ207D	AQZ204D	Remarks
Input	Operate voltage		Typical	V_{Fon}	1.4 V				I_L = 100 mA V_L = 10 V
			Maximum		4 V				
	Turn off voltage		Minimum	V_{Foff}	0.8 V				I_L = 100 mA V_L = 10 V
			Typical		1.3 V				
	Input current		Typical	I_{IN}	6.5 mA				V_{IN} = 5 V
Output	On resistance		Typical	R_{on}	0.066 Ω	0.180 Ω	0.64 Ω	2.4 Ω	V_{IN} = 5 V I_L = Max. Within 1 s on time
			Maximum		0.18 Ω	0.34 Ω	1.1 Ω	3.2 Ω	
	Off state leakage current		Maximum	I_{leak}	10 μA				V_{IN} = 0 V V_L = Max.
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	5.8 ms	4.2 ms	2.7 ms	2.3 ms	V_{IN} = 5 V I_L = 100 mA V_L = 10 V
			Maximum		10.0 ms				
		Turn off time*	Typical	T_{off}	0.2 ms		0.1 ms		V_{IN} = 5 V I_L = 100 mA V_L= 10 V
			Maximum		3.0 ms				
	I/O capacitance		Typical	C_{iso}	0.8 pF				f = 1 MHz V_B = 0 V
			Maximum		1.5 pF				
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000 MΩ				500 V DC
	Maximum operating speed		Maximum	—	0.5 cps				V_{IN}= 5 V Duty factor = 50% $I_L \times V_L$ = 200 (VA)
Vibration resistance			Minimum	—	10 to 55 Hz at double amplitude of 3 mm				2 hours for 3 axes
Shock resistance			Minimum	—	4,900 m/s² {500 G}1 ms				3 times for 3 axes

Recommendable LED forward current I_F = 5 to 10 mA.

For type of connection, see page 59.

*Turn on/off time



2. DC type

1) Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQZ102D	AQZ105D	AQZ107D	AQZ104D	Remarks
Input	Input voltage	V_{IN}	30 V				
	Input reverse voltage	V_{RIN}	5 V				
	Power dissipation	P_{in}	300 mW				
Output	Load voltage (DC)	V_L	60 V	100 V	200 V	400 V	
	Continuous load current (DC)	I_L	3.6 A	2.3 A	1.1 A	0.6 A	
	Peak load current	I_{peak}	9.0 A	6.0 A	3.0 A	1.5 A	100 ms (1 shot), V_L = DC
	Power dissipation	P_{out}	1.35 W				
Total power dissipation		P_T	1.35 W				
I/O isolation voltage		V_{iso}	2,500 V AC				
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F (4 V ≤ V_{IN} ≤ 6 V) –40°C to +75°C –40°F to +167°F (6 V < V_{IN} ≤ 15 V) –40°C to +60°C –40°F to +140°F (15 V < V_{IN} ≤ 30 V)				Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F				

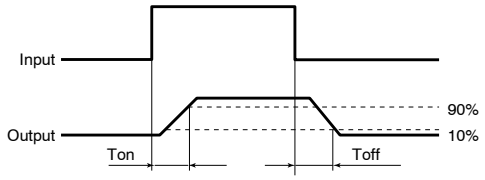
2) Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQZ102D	AQZ105D	AQZ107D	AQZ104D	Remarks
Input	Operate voltage		Typical	V_{Fon}	1.4 V				I_L = 100 mA V_L = 10 V
			Maximum		4 V				
	Turn off voltage		Minimum	V_{Foff}	0.8 V				I_L = 100 mA V_L = 10 V
			Typical		1.3 V				
	Input current		Typical	I_{IN}	6.5 mA				V_{IN} = 5 V
Output	On resistance		Typical	R_{on}	0.033 Ω	0.090 Ω	0.33 Ω	1.23 Ω	V_{IN} = 5 V I_L = Max. Within 1 s on time
			Maximum		0.09 Ω	0.17 Ω	0.55 Ω	1.6 Ω	
	Off state leakage current		Maximum	I_{leak}	10 μA				V_{IN} = 0 V V_L = Max.
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	3.3 ms	2.2 ms	1.5 ms	1.2 ms	V_{IN} = 5 V I_L = 100 mA V_L = 10 V
			Maximum		10.0 ms				
		Turn off time*	Typical	T_{off}	0.2 ms		0.1 ms		V_{IN} = 5 V I_L = 100 mA V_L= 10 V
			Maximum		3.0 ms				
	I/O capacitance		Typical	C_{iso}	0.8 pF				f = 1 MHz V_B = 0 V
			Maximum		1.5 pF				
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000 MΩ				500 V DC
	Maximum operating speed		Maximum	—	0.5 cps				V_{IN}= 5 V Duty factor = 50% $I_L \times V_L$ = 200 (VA)
Vibration resistance			Minimum	—	10 to 55 Hz at double amplitude of 3 mm				2 hours for 3 axes
Shock resistance			Minimum	—	4,900 m/s² {500 G}1 ms				3 times for 3 axes

Recommendable LED forward current I_F = 5 to 10 mA.

For type of connection, see page 59.

*Turn on/off time

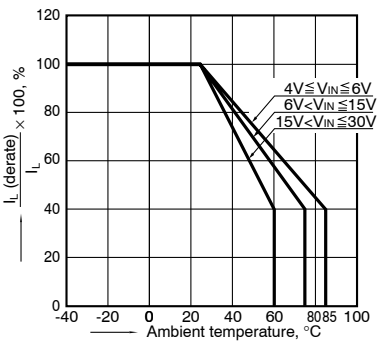


■ **For Dimensions, see page 54.**
■ **For Schematic and Wiring Diagrams, see page 59.**
■ **For Cautions for Use, see page 68.**

REFERENCE DATA

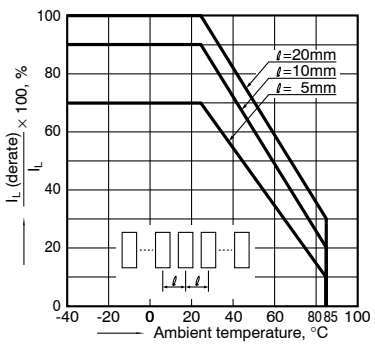
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F;
V_{IN}: Input voltage; I_L (derate):Load current (derate); I_L: Absolute maximum ratings of continuous load current



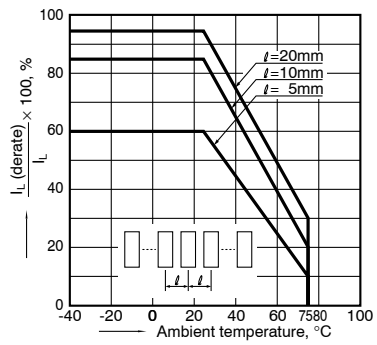
2.-(1) Load current vs. ambient temperature characteristics in adjacent mounting

Input voltage: 4V ≤ V_{IN} ≤ 6V;
I_L (derate): Load current (derate); I_L: Absolute maximum ratings of continuous load current; ℓ : Adjacent mounting pitch



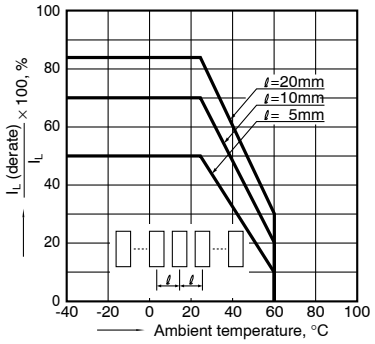
2.-(2) Load current vs. ambient temperature characteristics in adjacent mounting

Input voltage: 6V < V_{IN} ≤ 15V;
I_L (derate): Load current (derate); I_L: Absolute maximum ratings of continuous load current; ℓ : Adjacent mounting pitch



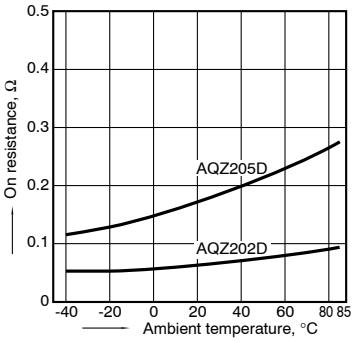
2.-(3) Load current vs. ambient temperature characteristics in adjacent mounting

Input voltage: 15V<V_{IN} ≤ 30V;
I_L (derate): Load current (derate); I_L: Absolute maximum ratings of continuous load current; ℓ : Adjacent mounting pitch



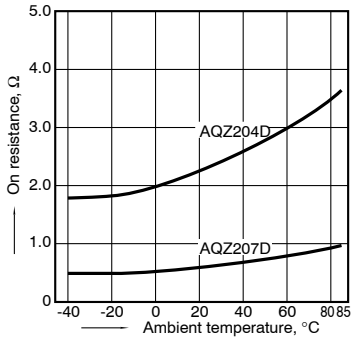
3.-(1) On resistance vs. ambient temperature characteristics (AC/DC type)

Input voltage: 5 V;
Continuous load current: 2.7 A (DC) (AQZ202D)
1.8 A (DC) (AQZ205D)



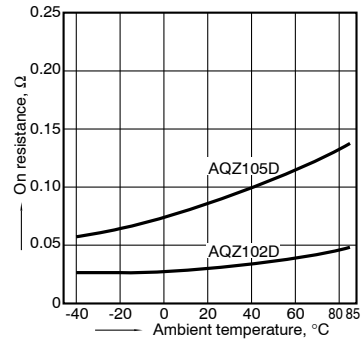
3.-(2) On resistance vs. ambient temperature characteristics (AC/DC type)

Input voltage: 5 V;
Continuous load current: 0.9 A (DC) (AQZ207D)
0.45 A (DC) (AQZ204D)



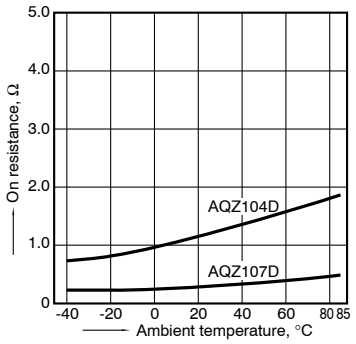
3.-(3) On resistance vs. ambient temperature characteristics (DC type)

Input voltage: 5 V;
Continuous load current: 3.6 A (DC) (AQZ102D)
2.3 A (DC) (AQZ105D)



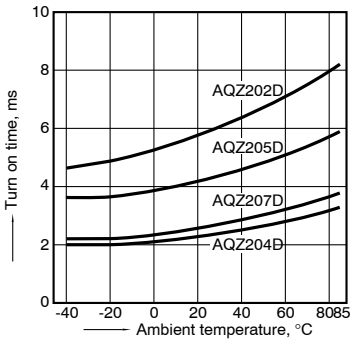
3.-(4) On resistance vs. ambient temperature characteristics (DC type)

Input voltage: 5 V;
Continuous load current: 1.1 A (DC) (AQZ107D)
0.6 A (DC) (AQZ104D)



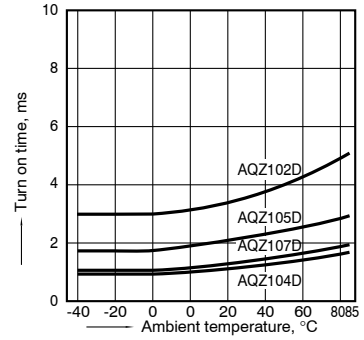
4.-(1) Turn on time vs. ambient temperature characteristics (AC/DC type)

Input voltage: 5 V;
Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



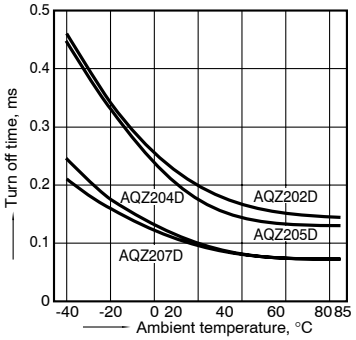
4.-(2) Turn on time vs. ambient temperature characteristics (DC type)

Input voltage: 5 V; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



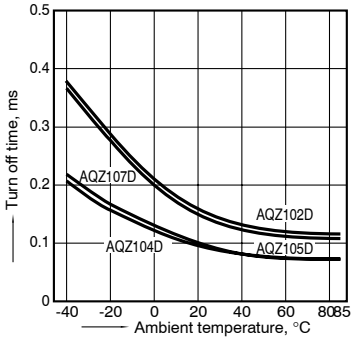
5.-(1) Turn off time vs. ambient temperature characteristics (AC/DC type)

Input voltage: 5 V; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



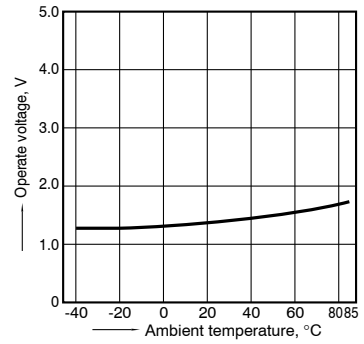
5.-(2) Turn off time vs. ambient temperature characteristics (DC type)

Input voltage: 5 V; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



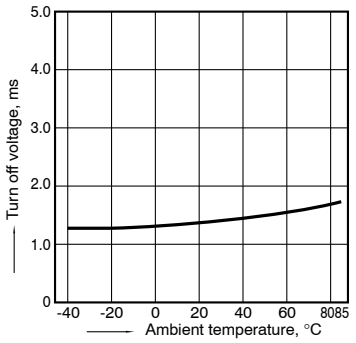
6. Operate voltage vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



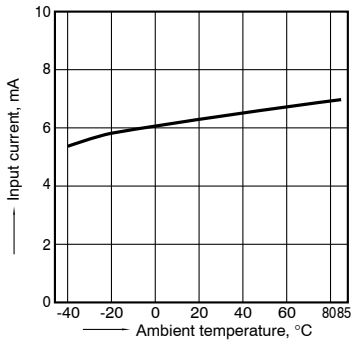
7. Turn off voltage vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)

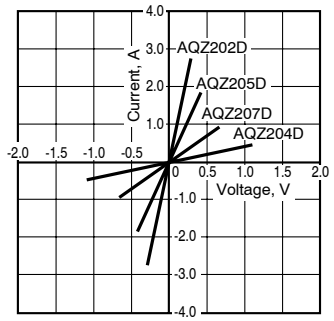


8. Input current vs. ambient temperature characteristics

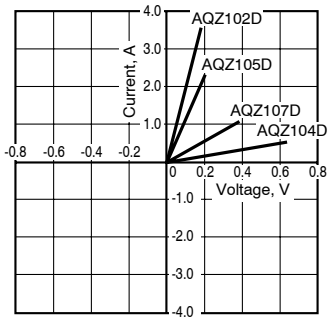
Input voltage: 5 V



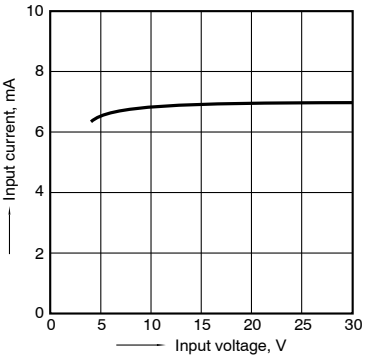
9.-(1) Current vs. voltage characteristics of output at MOS portion (AC/DC type)
Ambient temperature: 25°C 77°F



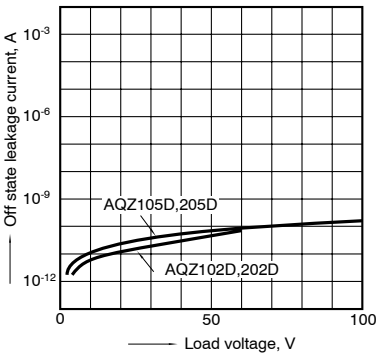
9.-(2) Current vs. voltage characteristics of output at MOS portion (DC type)
Ambient temperature: 25°C 77°F



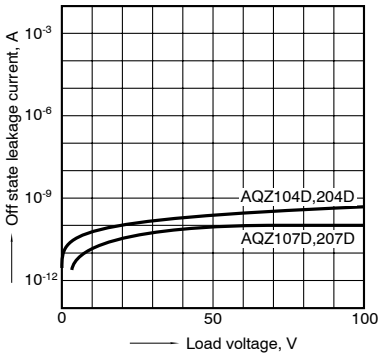
10. Input current vs. input voltage characteristics
Ambient temperature: 25°C 77°F



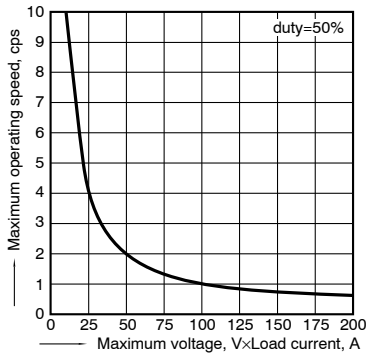
11.-(1) Off state leakage current vs. load voltage characteristics
Ambient temperature: 25°C 77°F



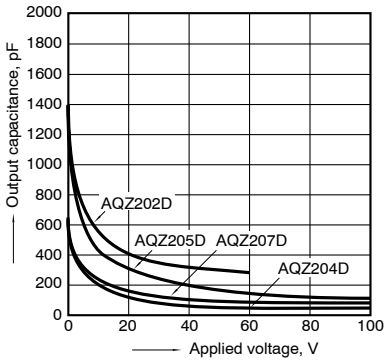
11.-(2) Off state leakage current vs. load voltage characteristics
Ambient temperature: 25°C 77°F



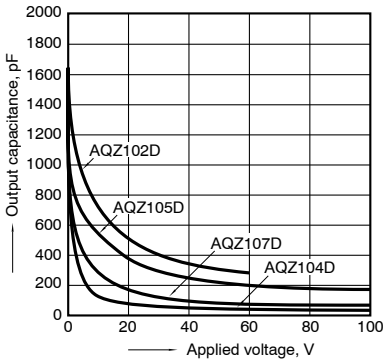
12. Maximum operating speed vs. load voltage × load current characteristics
Input voltage: 5V; Ambient temperature: 25°C 77°F



13.-(1) Output capacitance vs. applied voltage characteristics (AC/DC type)
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



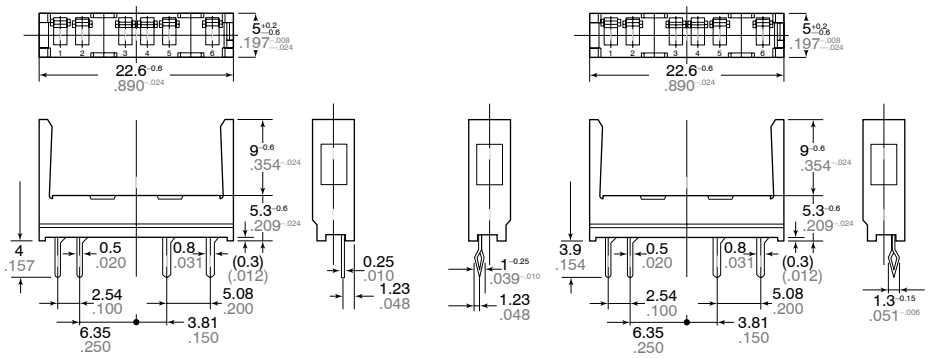
13.-(2) Output capacitance vs. applied voltage characteristics (DC type)
Frequency: 1 MHz; Ambient temperature: 25°C 77°F



ACCESSORY

mm inch

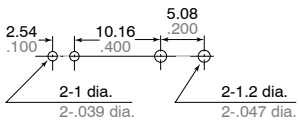
Socket



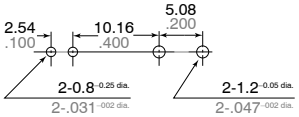
PA1a-PS

PA1a-PS-H

PC board pattern (BOTTOM VIEW)
Standard type



Self clinching type

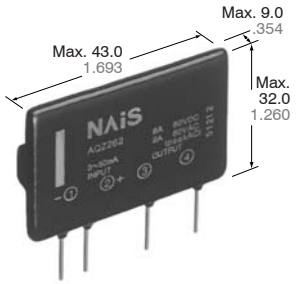


Tolerance: ±0.1 ±.004

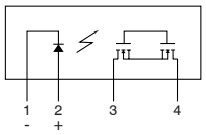
Panasonic
ideas for life

High capacity PhotoMOS relay. (Load current Max. 6A) Low on-resistance (0.036 ohm).

Power PhotoMOS (AQZ262, 264)



mm inch



FEATURES

1. High capacity type power photoMOS relay.
Can switch a wide range of currents and voltages. Can control various types of loads, from very small loads to a maximum 6A AC/DC current for sequencers, motors, and lamps.

2. Low ON resistance and high sensitivity.
Low ON resistance of less than 50 mW on a par with mechanical relays (AQZ262). High sensitivity LED operate current of 3 mA (at 25°C 77°F).

3. AC/DC dual use
Bi-directional control is possible. There is no need to differentiate depending on the load as was necessary with the conventional SSR.

4. 4-pin SIL type.
4-pin SIL type of (L) 43.0 mm × (W) 9.0 mm × (H) 32.0 mm (L) 1.693 inch× (W) .354 inch× (H) 1.260 inch.

5. Low-level off state leakage current
In contrast to the SSR with an off state leakage current of several milliamperes, the PhotoMOS relay features a very small off state leakage current of typ. 10mA even at the rated load voltage.

6. Controls low-level analog signals
The triac, photocoupler, or SSR cannot be used to control signals of less than several hundred mV. The high capacity type power PhotoMOS relay feature extremely low closed-circuit offset voltage to enable control of low-level analog signals without distortion.

TYPICAL APPLICATIONS

- Mercury relay replacement
- Railroad, traffic signals
- Compact motors, lamps, heaters
- OA equipment

TYPES

AC/DC type

Output rating*		Part No.	Packing quantity	
Load voltage	Load current		Inner carton	Outer carton
60 V	6.0 A	AQZ262	20 pcs	200 pcs
400 V	1.0 A	AQZ264		

* Indicate the peak AC and DC values.

RATING

1) Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQZ262	AQZ264	Remarks
Input	LED forward current	I_F	50 mA		
	LED reverse voltage	V_R	5 V		
	Peak forward current	I_{FP}	1 A		f = 100Hz, Duty factor = 0.1%
	Power dissipation	P_{in}	75 mA		
Output	Load voltage (Peak AC)	V_L	60 V	400 V	
	Continuous load current (Peak AC)	I_L	6.0 A	1.0 A	
	Peak load current	I_{peak}	10.0 A	3.0 A	100 ms (1shot), V_L = DC
	Power dissipation	P_{out}	3.0 W		
Total power dissipation		P_T	3.0 W		
I/O isolation voltage		Viso	1,500 V AC		
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to 185°F		Non-condensing at low temperatures
	Storage	Tstg	–40°C to +100°C –40°F to 212°F		

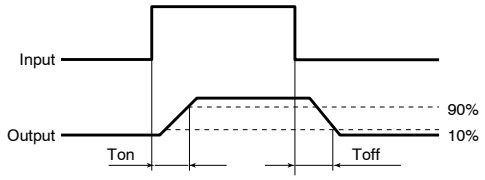
2) Electrical characteristics (Ambient temperature: 25°C 77°F)

Item				Symbol	AQZ262	AQZ264	Remarks
Input	LED operate current		Typical	I_{Fon}	1.0 mA		I_L = 100 mA V_L = 10 V
			Maximum		3.0 mA		
	LED turn off current		Minimum	I_{Foff}	0.4 mA		I_L = 100 mA V_L = 10 V
			Typical		0.9 mA		
	LED dropout voltage		Typical	V_F	1.25 V (1.16 V at I_F = 10 mA)		I_F = 50 mA
			Maximum		1.5 V		
Output	On resistance		Typical	R_{on}	0.036 Ω	1.0 Ω	I_F = 10 mA I_L = max. Within 1 s on time
			Maximum		0.05 Ω	1.4 Ω	
	Off state leakage current		Maximum	I_{Leak}	10 μA		I_F = 0 mA V_L = max.
Transfer characteristics	Switching speed	Turn on time*	Typical	T_{on}	5 ms	4 ms	I_F = 10 mA I_L = 100 mA V_L = 10 V
			Maximum		10 ms		
		Turn off time*	Typical	T_{off}	0.32 ms	0.14 ms	I_F = 10 mA I_L = 100 mA V_L = 10 V
			Maximum		3.0 ms		
	I/O capacitance		Typical	C_{iso}	2.0 pF		f = 1 MHz V_B = 0 V
			Maximum		4.0 pF		
	Initial I/O isolation resistance		Minimum	R_{iso}	1,000 MΩ		500 V DC
	Maximum operating frequency		Maximum	—	0.5 cps		I_F = 10 mA Duty factor = 50% I_L = Max., V_L = Max.

Note: Recommendable LED forward current I_F = 5 to 10 mA.

For type of connection, see page 59.

*Turn on/off time

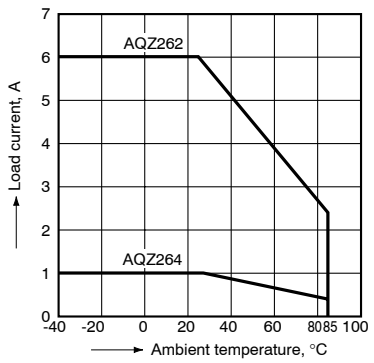


■ **For Dimensions, see page 54.**
■ **For Schematic and Wiring Diagrams, see page 59.**
■ **For Cautions for Use, see page 68.**

REFERENCE DATA

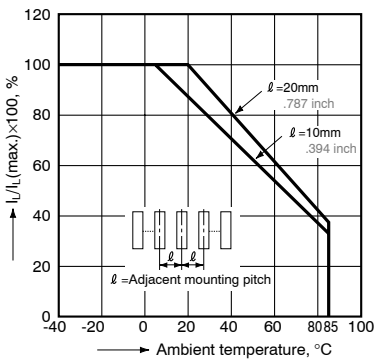
1. Load current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +85°C
–40°F to +185°F



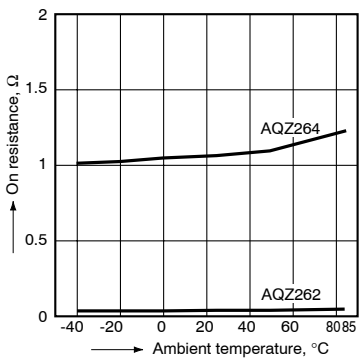
2. Load current vs. ambient temperature characteristics in adjacent mounting

I_L: Load current;
I_L (max.): Maximum continuous load current



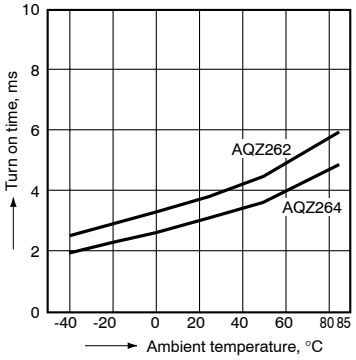
3. On resistance vs. ambient temperature characteristics

LED current: 10 mA;
Continuous load current: 6A (DC)(AQZ262)
1A (DC)(AQZ264)



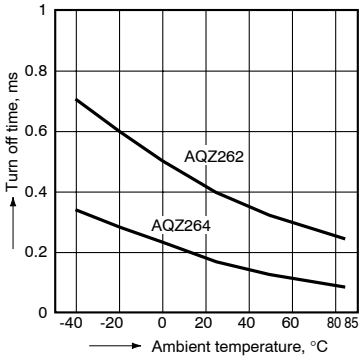
4. Turn on time vs. ambient temperature characteristics

LED current: 10 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



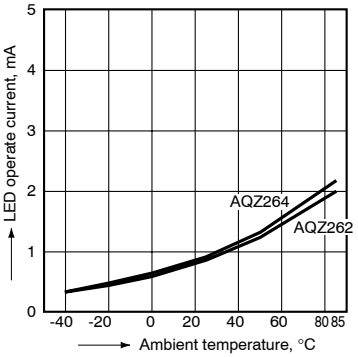
5. Turn off time vs. ambient temperature characteristics

LED current: 10 mA; Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



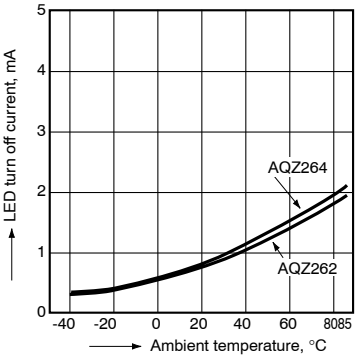
6. LED operate vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



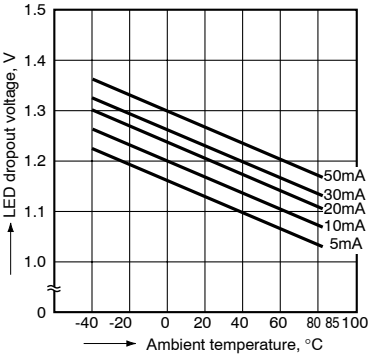
7. LED turn off current vs. ambient temperature characteristics

Load voltage: 10 V (DC);
Continuous load current: 100 mA (DC)



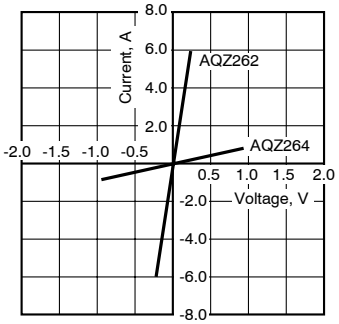
8. LED dropout voltage vs. ambient temperature characteristics

Sample: all types; LED current: 5 to 50 mA



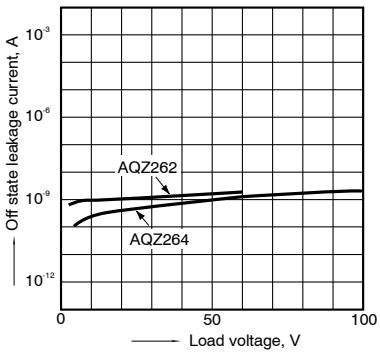
9. Current vs. voltage characteristics of output at MOS portion

Ambient temperature: 25°C 77°F



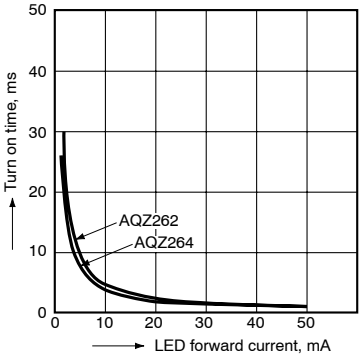
10. Off state leakage current vs. load voltage characteristics

Ambient temperature: 25°C 77°F



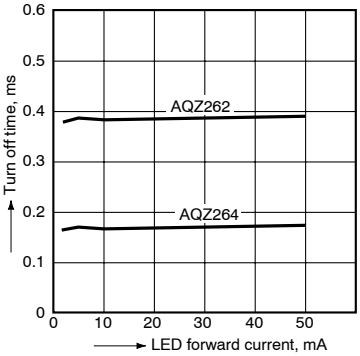
11. Turn on time vs. LED forward current characteristics

Load voltage: 10 V (DC); Continuous load current: 100 mA (DC); Ambient temperature: 25°C 77°F



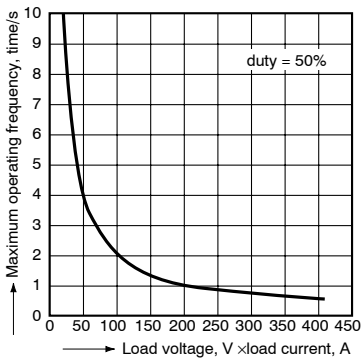
12. Turn off time vs. LED forward current characteristics

Load voltage: 10 V (DC); Continuous load current: 100 mA (DC); Ambient temperature: 25°C 77°F



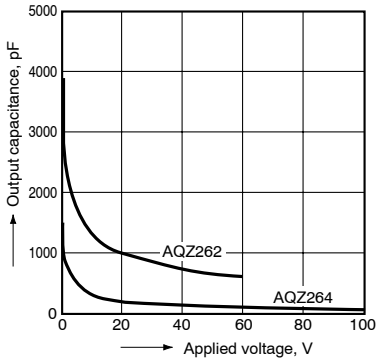
13. Maximum operating frequency vs. load voltage/current characteristics

LED current: 10 mA; Ambient temperature: 25°C 77°F



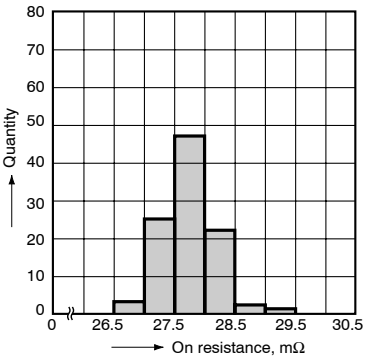
14. Output capacitance vs. applied voltage characteristics

Frequency: 10 KHz; Ambient temperature: 25°C 77°F

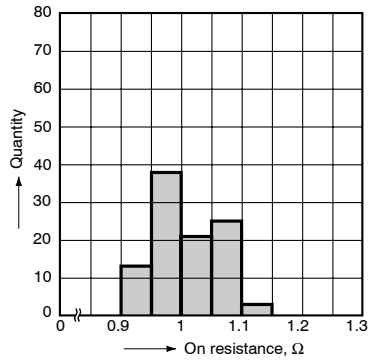


15.-(1) On resistance distribution

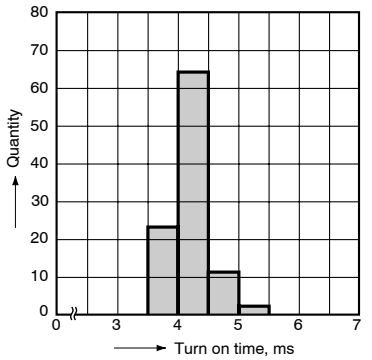
Sample: AQZ262
LED current: 10 mA; Continuous load current: 6 A (DC):
Quantity. n=100; Ambient temperature: 25°C 77°F



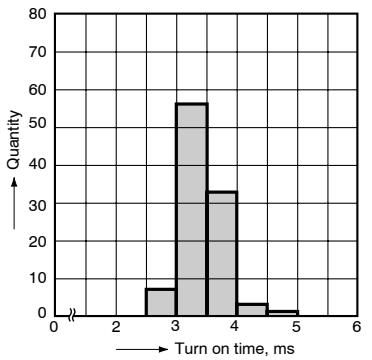
15.-(2) On resistance distribution
Sample: AQZ264
LED current: 10 mA;
Continuous load current: 1 A (DC); Quantity, n=100;
Ambient temperature: 25°C 77°F



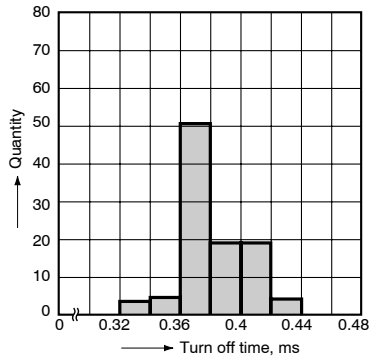
16.-(1) Turn on time distribution
Sample: AQZ262
Load voltage: 10 V (DC); Continuous load current: 100 mA (DC); Quantity, n=100;
Ambient temperature: 25°C 77°F



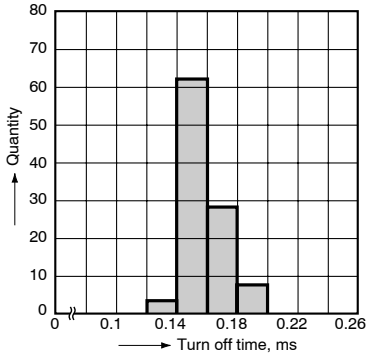
16.-(2) Turn on time distribution
Sample: AQZ264
Load voltage: 10 V (DC); Continuous load current: 100 mA (DC); Quantity, n=100;
Ambient temperature: 25°C 77°F



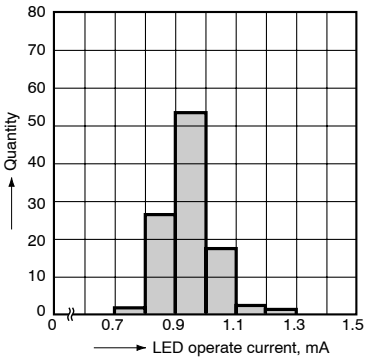
17.-(1) Turn off time distribution
Sample: AQZ262
Load voltage: 10 V (DC); Continuous load current: 100 mA (DC); Quantity, n=100;
Ambient temperature: 25°C 77°F



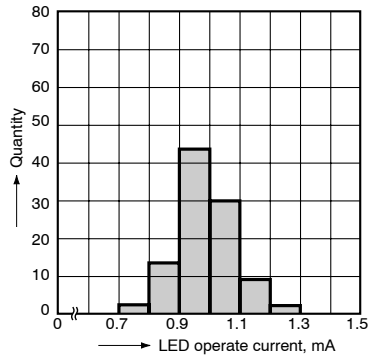
17.-(2) Turn off time distribution
Sample: AQZ264
Load voltage: 10 V (DC); Continuous load current: 100 mA (DC); Quantity, n=100;
Ambient temperature: 25°C 77°F



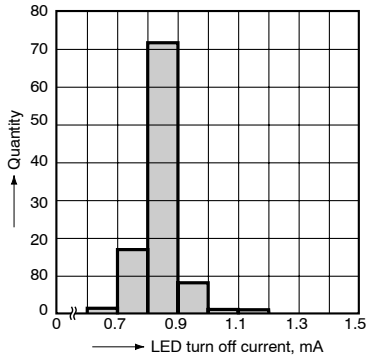
18.-(1) LED operate current distribution
Sample: AQZ262
Load voltage: 10 V (DC); Continuous load current: 100 mA (DC); Quantity, n=100;
Ambient temperature: 25°C 77°F



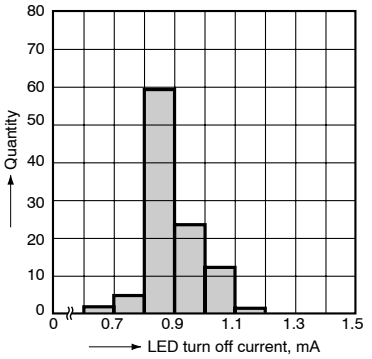
18.-(2) LED operate current distribution
Sample: AQZ264
Load voltage: 10 V (DC); Continuous load current: 100 mA (DC); Quantity, n=100;
Ambient temperature: 25°C 77°F



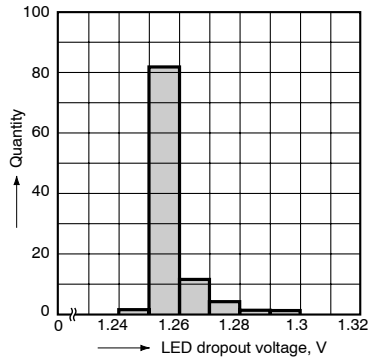
19.-(1) LED turn off current distribution
Sample: AQZ262
Load voltage: 10 V (DC); Continuous load current: 100 mA (DC); Quantity, n=100;
Ambient temperature: 25°C 77°F



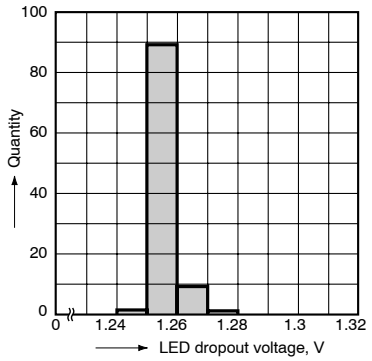
19.-(2) LED turn off current distribution
Sample: AQZ264
Load voltage: 10 V (DC); Continuous load current: 100 mA (DC); Quantity, n=100;
Ambient temperature: 25°C 77°F



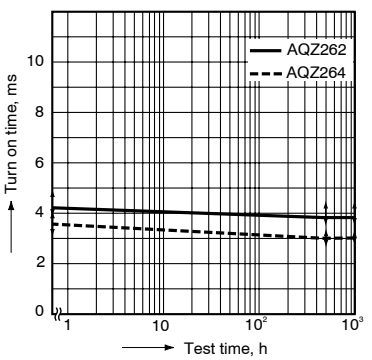
20.-(1) LED dropout voltage distribution
Sample: AQZ262
LED current: 50 mA; Quantity, n=100;
Ambient temperature: 25°C 77°F



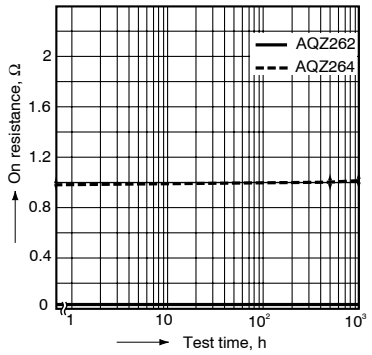
20.-(2) LED dropout voltage distribution
Sample: AQZ264
LED current: 50 mA; Quantity, n=100;
Ambient temperature: 25°C 77°F



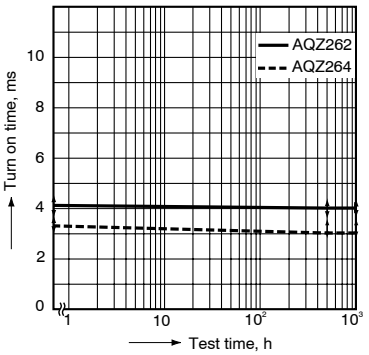
21.-(1) Bias test at high temperature and high humidity (change of turn on time)
Quantity, n=10; Ambient temperature: 85°C 185°F
Humidity: 85%, VL=Max. × 0.8



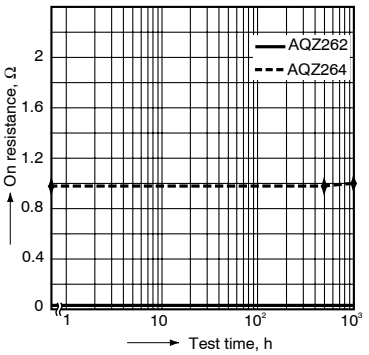
21.-(2) Bias test at high temperature and high humidity (change of on resistance)
Quantity, n=10; Ambient temperature: 85 °C 185°F
Humidity: 85%, VL=Max. × 0.8



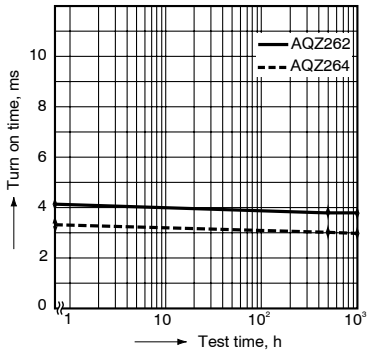
22.-(1) Low temperature storage test (change of turn on time)
Quantity, n=10; Ambient temperature: –40°C –40°F



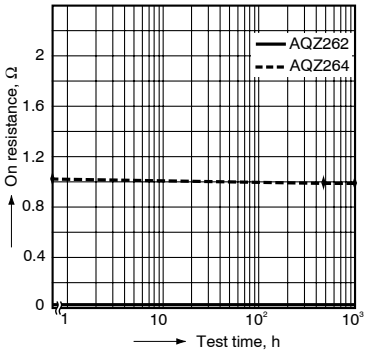
22.-(2) Low temperature storage test (change of on resistance)
Quantity, n=10; Ambient temperature: –40°C –40°F



23.-(1) High temperature storage test (change of turn on time)
Quantity, n=10; Ambient temperature: 100°C 212°F



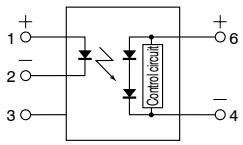
23.-(2) High temperature storage test (change of on resistance)
Quantity, n=10; Ambient temperature: 100°C 212°F

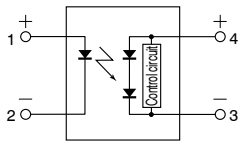


Panasonic
ideas for life

PHOTOVOLTAIC MOSFET DRIVER

PHOTOVOLTAIC MOSFET DRIVER (APV1,2)





FEATURES

1. High-speed switching
Since release time is 0.1 ms, the MOSFET or other load can be turned off quickly in urgent situations.

2. Space saving
With a built-in control circuit, an external resistor is not needed. This contributes to making substrates more compact.

3. High insulation
DIP type: 5,000 V
SOP type: 2,500 V
SSOP type: 1,500 V

4. Extensive product lineup
Products include the industry's smallest SSOP type, SOP4 type, and DIP 6 type.

TYPICAL APPLICATIONS

MOSFET driver
Power supply (Vcc) for electronic circuits

TYPES

Type	Output rating		Part No.				Packing quantity	
	Drop-out voltage (Typ.)	Short circuit current (Typ.)	Through hole terminal	Surface-mount terminal				
			Tube packing style	Tube packing style	Tape and reel packing style		Tube	Tape and reel
					Picked from 1/2/3-pin side*1	Picked from 4/5/6-pin side*2		
DIP6pin	8.7V	14µA	APV1122	APV1122A	APV1122AX	APV1122AZ	1 tube contains 50 pcs. 1 batch contains 500 pcs.	1,000 pcs.
SOP4pin	8.7V	14µA	—	—	APV1121SX	APV1121SZ	—	
SOP4pin*3	8.2V	8µA	—	—	APV2121SX	APV2121SZ		
SSOP*4	8.2V	8µA	—	—	APV2111VY	APV2111VW	—	

Notes: *1 SOP type is picked from 1/2-pin side, SSOP type is picked from 1/4-pin side
*2 SOP type is picked from 3/4-pin side, SSOP type is picked from 2/3-pin side
*3 Tape package is the standard packing style. Also available in tube.
(Part No. suffix "X" or "Y" is not needed when ordering; Tube: 100 pcs.; Case: 2,000 pcs.)
For space reasons, the initial letters of the product number "AP" and "S" are omitted on the product seal.
The package type indicator "X" and "Z" are omitted from the seal. (Ex. the label for product number APV1121SX is V1121).
*4 Tape package is the standard packing style.
For space reasons, the initial letters of the product number "AP" and "V" are omitted on the product seal.
The package type indicator "Y" and "W" are omitted from the seal. (Ex. the label for product number APV2111VY is V2111).

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	APV1122(A)	APV1121S	APV2121S	APV2111V	Remarks
Input	LED forward current	I_F	50mA				
	LED reverse voltage	V_R	5V				
	Peak forward current	I_{FP}	1A				f = 100 Hz, Duty Ratio = 0.1%
	Power dissipation	P_{in}	75mA				
I/O isolation voltage		V_{iso}	5,000V AC	2,500V AC	2,500V AC	1,500V AC	
Temperature limits	Operating	T_{opr}	–40°C to +85°C –40°F to +185°F				Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +100°C –40°F to +212°F				

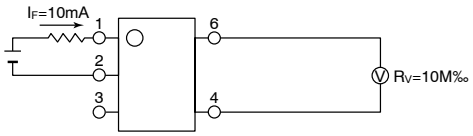
2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	APV1122(A)	APV1121S	APV2121S	APV2111V	Condition
Input	LED operate current	Typical	I_{Fon}	0.6mA		0.85mA		V_{OC} = 5V
		Maximum		3mA				
	LED turn off current	Minimum	I_{Foff}	0.2mA				V_{OC} = 1V
		Typical		0.5mA		0.75mA		
	LED dropout voltage	Typical	V_F	1.15V				I_F = 10mA
		Maximum		1.5V				
Output	Drop-out voltage*	Minimum	V_{OC}	6V		5V		I_F = 10mA R_v = 10μΩ
		Typical		8.7V		8.2V		
	Short circuit current**	Minimum	I_{SC}	5μA		3μA		I_F = 10mA R_v = 100Ω
		Typical		14μA		8μA		
Transfer characteristics	Turn on time***	Typical	T_{on}	0.4ms		0.8ms		I_F = 10mA, C_L = 1,000pF
	Turn off time***	Typical	T_{off}	0.1ms				I_F = 10mA, C_L = 1,000pF
	I/O capacitance	Typical	C_{iso}	0.8pF				V_B = 0V, f = 1MHz
		Maximum		1.5pF				
	Initial I/O isolation resistance	Minimum	R_{iso}	1,000MΩ				500V DC

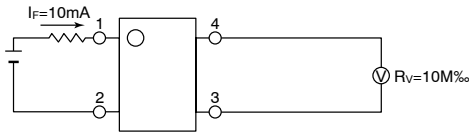
Note: Recommended LED forward current I_{FT}: 10mA.

*Drop-out voltage measurement circuit

APV1122(A)

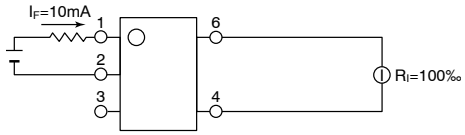


APV1121S, APV2121S, APV2111V

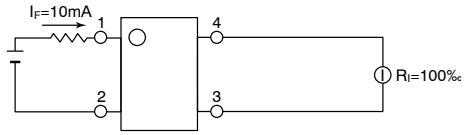


**Short circuit current measurement circuit

APV1122(A)

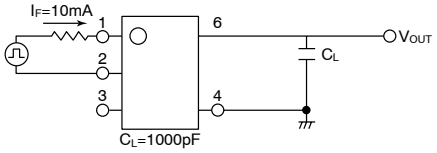


APV1121S, APV2121S, APV2111V

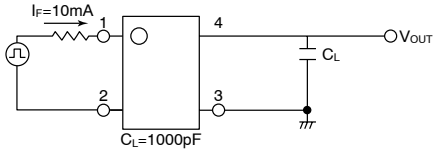


***Turn on/Turn off time measurement circuit

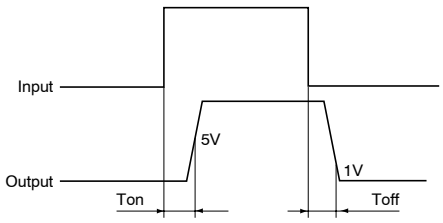
APV1122(A)



APV1121S, APV2121S, APV2111V



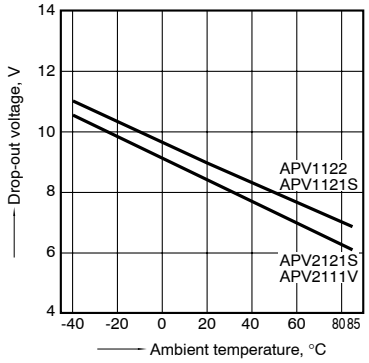
***Turn on time



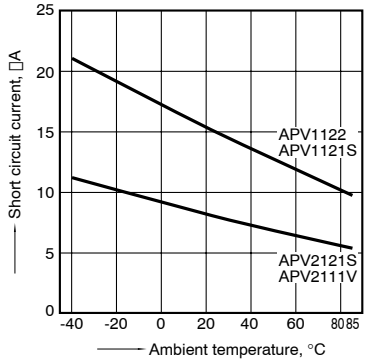
■ **For Dimensions, see page 52.**
■ **For Schematic and Wiring Diagrams, see page 60.**
■ **For Cautions for Use, see page 67.**

REFERENCE DATA

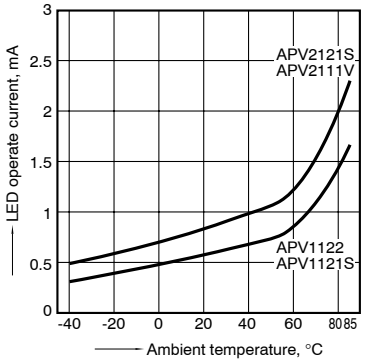
1. Drop-out voltage vs. ambient temperature characteristics
Input current: 10mA



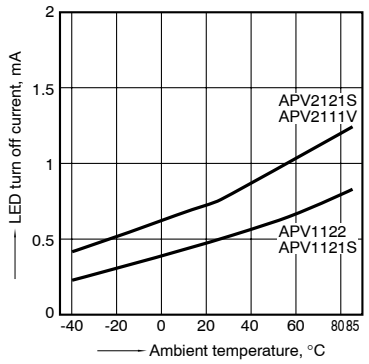
2. Short circuit current vs. ambient temperature characteristics
Input current: 10mA



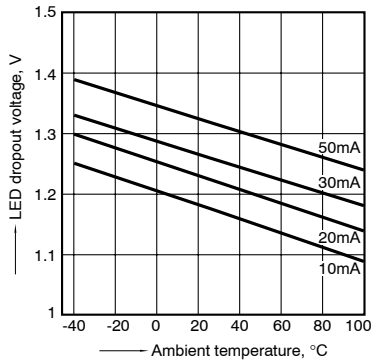
3. LED operate current vs. ambient temperature characteristics
Drop-out voltage: 5V



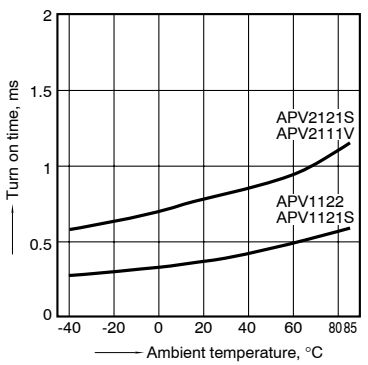
4. LED turn off current vs. ambient temperature characteristics
Drop-out voltage: 1V



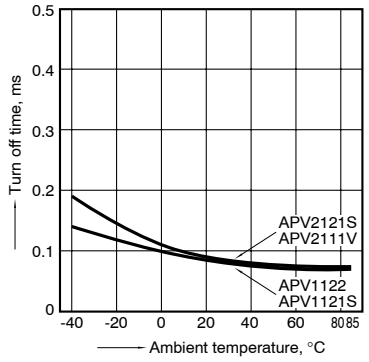
5. LED dropout voltage vs. ambient temperature characteristics
LED forward current: 5 to 50mA



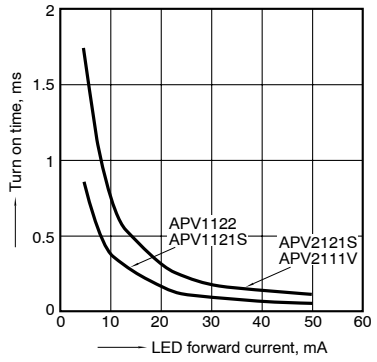
6. Turn on time vs. ambient temperature characteristics
LED forward current: 10mA
Load capacity: 1,000pF; output voltage: 5V



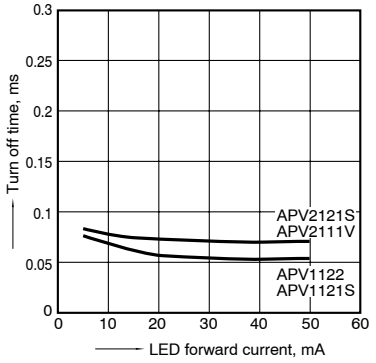
7. Turn off time vs. ambient temperature characteristics
LED forward current: 10mA
Load capacity: 1,000pF; output voltage: 1V



8. Turn on time vs. LED forward current characteristics
Load capacity: 1,000pF; output voltage: 5V



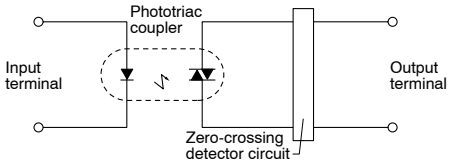
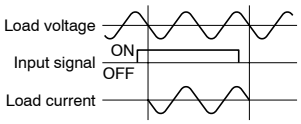
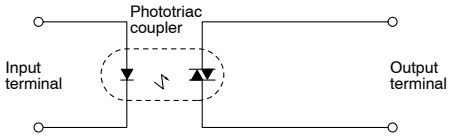
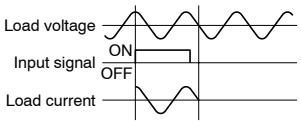
9. Turn off time vs. LED forward current characteristics
Load capacity: 1,000pF; output voltage: 1V



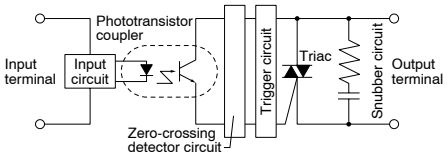
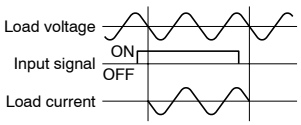
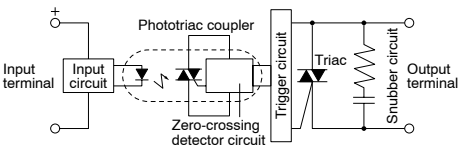
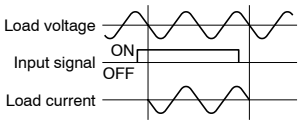
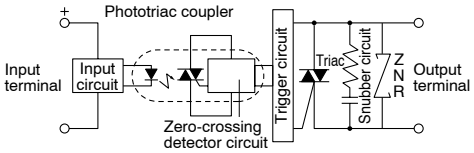
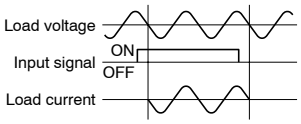
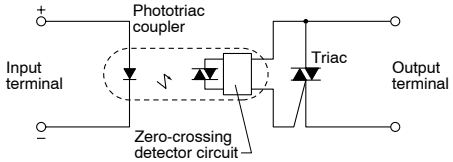
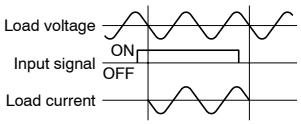
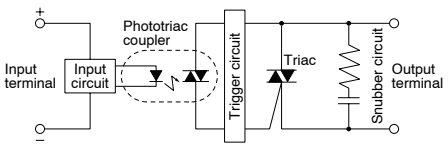
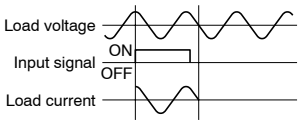
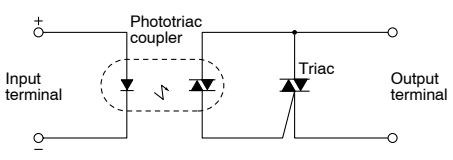
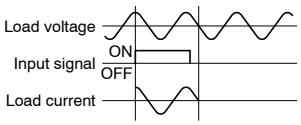
Solid State Relays

SSR Description and Circuit Configurations

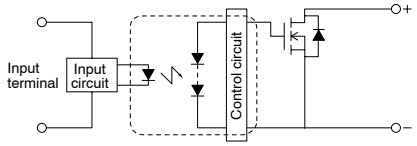
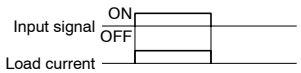
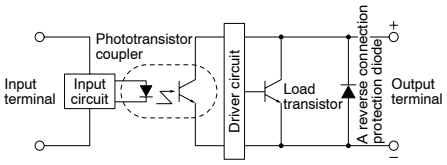
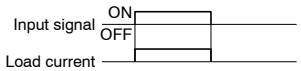
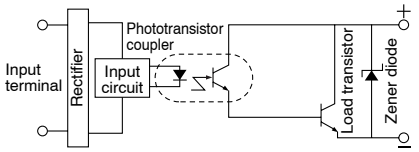
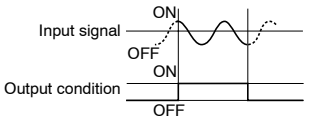
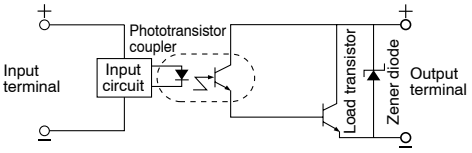
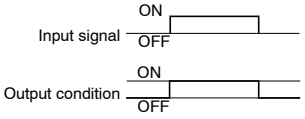
Phototriac coupler

Load	Isolation type	Zero-crossing function	Model	Circuit configuration	I/O wave form (for resistive load)
AC	Phototriac	Yes	APT		
		Non	APT		

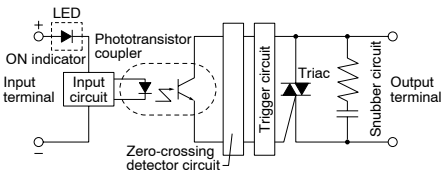
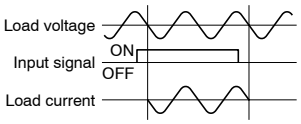
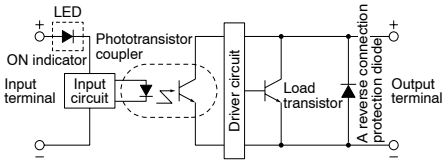
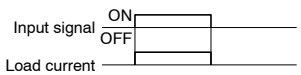
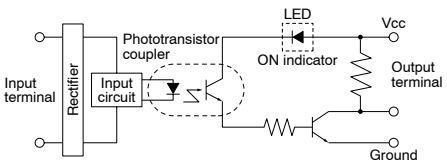
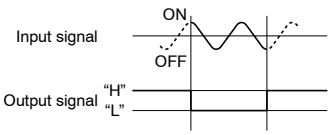
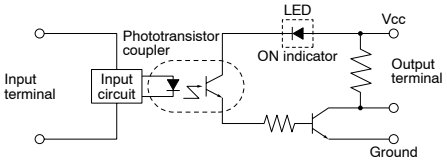
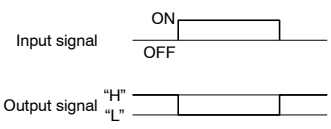
SSR

Load	Isolation type	Zero-crossing function	Model	Circuit configuration	I/O wave form (for resistive load)
AC	Phototransistor	Yes	AQ1 AQ-F		
	Phototriac	Yes	AQ8 AQ-B AQ-R AQ-C AQ-E AQ-G AQ-N		
			AQ-K		
			AQ-H		
		Non	AQ8 AQ-B AQ-C AQ-G		
			AQ-H		

SSR (continued)

Load	Isolation type	Zero-crossing function	Model	Circuit configuration	I/O wave form (for resistive load)
DC	Photodiode	—	AQ-E		
	Phototransistor	—	AQ1 AQ-F AQ-C		
DC logic output	Phototransistor	—	AQ-C (IAC)		
		—	AQ-C (IDC)		

I/O relays

Load	Isolation type	Zero-crossing function	Model	Circuit configuration	I/O wave form (for resistive load)
AC	Phototransistor	Yes	OAC		
DC	Phototransistor	—	ODC		
DC logic output	Phototransistor	—	IAC		
	Phototransistor	—	IDC		

Principle of Operation

SSR Switching Characteristics

1.SSR for AC Loads

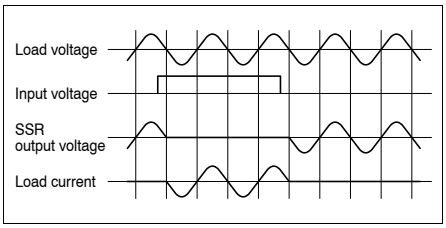
(1) Zero-crossing SSR

The zero-crossing SSR uses a phototransistor or phototriac coupler to isolate the input from the output (see the circuit configuration on the previous page). When the input signal is activated, the internal zero-crossing detector circuit triggers the triac to turn on as the AC load voltage crosses zero.

The load current is maintained by the triac's latching effect after the input signal is deactivated, until the triac is turned off when the load voltage crosses zero. The following describes voltage and current wave forms for different types of loads:

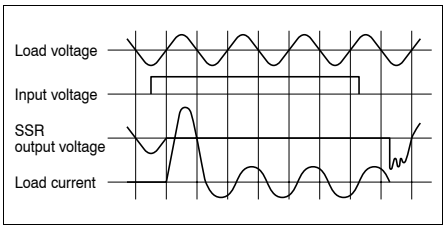
• Resistive loads

Since resistive loads cause no phase shift between the voltage and current, the triac turns on when the AC load voltage crosses zero after the input signal is activated. The SSR turns off when the AC load voltage crosses zero and the load current is turned off after the input signal is subsequently deactivated.



• Inductive loads

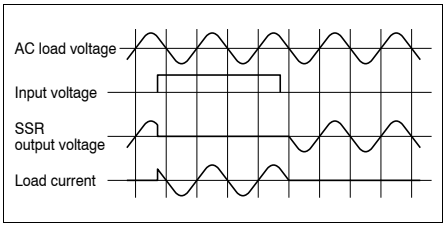
The SSR turns on when the load voltage crosses zero after the input signal is activated. It turns off when the load current subsequently crosses zero after the input signal is deactivated. A phase difference between the voltage and current may supply a transient spike to the SSR when it is turned off. While the snubber circuit absorbs this spike, an excessively large spike may result in a dv/dt error in the SSR's internal triac.



(2) Non zero-crossing SSR

The non zero-crossing SSR uses a phototriac coupler to isolate the input from the output. When the input signal is activated, the output immediately turns on, since there is no zero-crossing detector circuit. The load current is maintained by the triac's latching effect after the input signal is deactivated, until the AC load voltage crosses zero.

• Resistive loads



2. SSR for DC Loads

The SSR for DC loads uses a phototransistor coupler to isolate the input from the output. The output immediately responds to the input, since the phototransistor coupler directly turns the output transistor ON or OFF.

3. I/O Relays

(1) Input modules (Types IAC and IDC)

Interface SSRs have an input which is completely isolated from the output with a phototransistor coupler. This type of SSR outputs a logic signal that corresponds to the input signal. Two basic types are available: an IAC with an AC input, and an IDC with a DC input.

(2) Output modules (Types OAC and ODC)

The OAC type output module employs a circuit configuration identical to that of the zero-crossing SSR for AC loads; the ODC type output module employs a circuit configuration identical to that of the SSR for DC loads.

Terminology of Phototriac Coupler/AQ-H Relay's

Term		Symbol	Description
Input side	LED forward current	I_F	Current that flows between the input terminals when the input diode is forward biased.
	LED reverse voltage	V_R	Reverse breakdown voltage between the input terminals.
	Peak forward current	I_{FP}	Maximum instantaneous value of the forward current.
	LED dropout voltage	V_F	Dropout voltage between the input terminals due to forward current.
Output side	Repetitive peak OFF-state voltage	V_{DRM}	Maximum voltage with repeatability that can be applied continuously between the output terminals.
	ON-state RMS current	$I_{T(RSM)}$	Effective current value, based on designated conditions, that can flow continuously between output terminals.
	Non-repetitive surge current	I_{TSM}	Maximum current, without repeatability, that is based on designated conditions. Normally this is expressed as the wave height value of one power frequency current sinusoidal cycle.
	Peak ON-state voltage	V_{TM}	Effective value of the voltage drop when a regulated load current flows between the output terminals when device is on.
	Peak OFF-state current	I_{DRM}	Current that flows to output when a regulated load voltage is applied between the output terminals when device is off.
Electrical Characteristics	Trigger LED current	I_{FT}	Current flow when LED current is augmented and output is on, when regulated power supply voltage and load has been connected between the output terminals.
	Holding current	I_H	Load current to maintain on state after output terminals have been turned on based on designated conditions.
	Critical rate of rise of OFF-state voltage	dv/dt	Output terminals do not go to the on state from the off state based on designated conditions.
	Zero-cross voltage	V_{ZC}	In the zero-cross method, when input is turned on, the maximum voltage value when the output terminals turn on.
	Turn on time	Ton	Delay time until the output switches on after a designated LED current is made to flow through the input terminals.
	I/O capacitance	Ciso	Capacitance between the input and output terminals.
	I/O isolation resistance	Riso	Resistance between terminals (input and output) when a specified voltage is applied between the input and output terminals.

Terminology

Term		Description
Input side	Control voltage	Input voltage necessary for normal SSR operation under the specified temperature conditions.
	Activation voltage	Threshold at which the output turns on as the control voltage is gradually increased with the specified voltage applied to the loaded output.
	Recovery voltage	Threshold at which the output turns off as the control voltage is gradually decreased with the specified voltage applied to the loaded output.
	Input impedance	Resistance of the current limiting resistor used in the SSR input side.
	Input line voltage	Input voltage at which an input module SSR operates normally.
	Input current	Input current at which an input module SSR operates normally.
Load side	Max. load current	Maximum continuous current allowable across the SSR output terminals under the specified heat dissipation and ambient temperature conditions. AC current is specified in RMS units.
	Load voltage	Output supply voltage range in which the SSR operates normally. AC voltage is specified in RMS units.
	Logic supply voltage/current	Supply voltage/current range in which an input module SSR operates normally.
	Non-repetitive surge current	Maximum non-repetitive load current allowable under the specified heat dissipation and ambient temperature conditions. In general, it is given by the peak value of a single cycle of sinusoidal commercial AC current.
	“OFF-state” leakage current	Current that flows in the SSR output circuit when the specified supply voltage is applied to the output with no control voltage applied to the input.
	“ON-state” voltage drop	Output voltage drop caused by a specified load current supplied to the SSR output which is turned on by a specified input control voltage. AC voltage is specified in RMS units.
	Min. load current	Minimum load current at and above which the SSR operates normally under the specified temperature conditions. AC load current is specified in RMS units.
	Output stage breakdown voltage	Maximum voltage that can be applied across the output and ground of an input module SSR.
	Max. load current	Maximum current allowable for the output circuit of an input module SSR.
	Repetitive peak voltage, max.	Maximum repetitive voltage which can be continuously applied across the SSR output terminals. In general, a voltage of more than 400 V AC is used for 100 V AC applications, and more than 500 V AC for 200-250 V AC applications, to absorb supply voltage variations or on/off surges.
	Critical turn-off voltage rise ratio	SSRs may turn on if a turn-off voltage with a steep rising edge is applied. This phenomenon is called “dv/dt turn on.” Critical turn-off voltage rise ratio refers to the maximum turn-off voltage rise ratio at and below which the SSR remains turned off.
Electrical Characteristics	Operate time, max.	Time until the SSR output turns on after the specified control voltage is applied to the input.
	Release time, max.	Time until the SSR output turns off after the specified control voltage is removed from the input.
	Insulation resistance	Resistance measured with a specified voltage applied across the input and output, or across the input or output and frame ground.
	Breakdown voltage	Maximum voltage below which no dielectric breakdown occurs when applied for 1 minute across the same test points as those used for insulation resistance testing.
	Vibration resistance	Functional: The device sustains no damage and meets the specifications if it is exposed to vibration with its magnitude not exceeding this threshold during transit or installation. Destructive: Closed contacts of a relay remain closed for the specified time period if it is exposed to vibration with its magnitude not exceeding this threshold during operation.
	Shock resistance	Functional: The device sustains no damage and meets the specifications if it is exposed to physical impact with its magnitude not exceeding this threshold during transit or installation. Destructive: Closed contacts of a relay remain closed for the specified time period if it is exposed to physical impact with its magnitude not exceeding this threshold during operation.
	Ambient temperature	Ambient temperature range over which the SSR operates normally under the specified heat dissipation and load current conditions.
	Storage temperature	Ambient temperature range over which an SSR can be safely stored for extended periods without sustaining damage or performance degradation.

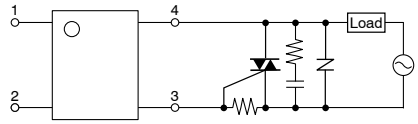
Cautions For Use of Phototriac Coupler

1. The internal IC could be damaged if a short forms between the I/O terminals while the phototriac coupler is powered.

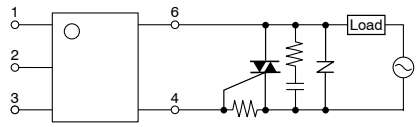
2. Output spike voltages

1) The figure below shows an ordinary triac drive circuit. Please add a snubber circuit or varistor, as noise/surge on the load side could damage the unit or cause malfunctions.

SOP4, DIP4



DIP6

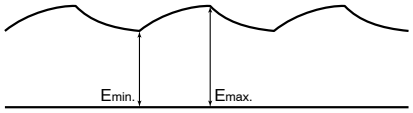


2) Even if spike voltages generated at the load are limited with a clamp diode if the circuit wires are long, spike voltages will occur by inductance. Keep wires as short as possible to minimize inductance.

3. Ripple in the input power supply

1) For LED operate current at E_{min}, maintain min. 10 mA

2) Keep the LED operate current at 50 mA or less at E_{max}.



4. Storage

Phototriac couplers implemented in SO packages (SOP 4-pin type) are sensitive to moisture and come in sealed moisture-proof packages. Observe the following cautions on storage.

• After the moisture-proof package is unsealed, take the devices out of storage as soon as possible (within 1 month at the most).

• If the devices are to be left in storage for a considerable period after the moisture-proof package has been unsealed, it is recommended to keep them in another moisture-proof bag containing silica gel (within 3 months at the most).

5. Important Notes for Mounting

1) Temperature rise in the lead portion is highly dependent on package size. If multiple different packages are mounted on the same board, please check your board beforehand in an actual product, ensuring that the temperature conditions of the phototriac coupler fall within the parameters listed above.

6. Cleaning

The phototriac coupler forms an optical path by coupling a light-emitting diode (LED) and photodiode via transparent silicon resin. For this reason, unlike other directory element molded resin products (e.g., MOS transistors and bipolar transistors), avoid ultrasonic cleansing if at all possible. We recommend cleaning with an organic solvent. If you cannot avoid using ultrasonic cleansing, please ensure that the following conditions are met, and check beforehand for defects.

• Frequency: 27 to 29 kHz
• Ultrasonic output:
  No greater than 0.25 W/cm^2
• Cleaning time:
  No longer than 30 s
• Cleanser used: Asahiklin AK-225
• Other: Submerge in solvent in order to prevent the PCB and elements from being contacted directly by the ultrasonic vibrations.

Note: Applies to unit area ultrasonic output for ultrasonic baths.

7. Transportation and storage

1) Extreme vibration during transport will warp the lead or damage the relay. Handle the outer and inner boxes with care.

2) Storage under extreme conditions will cause soldering degradation, external appearance defects, and deterioration of the characteristics. The following storage conditions are recommended:

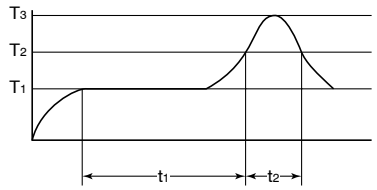
• Temperature: 0 to 45°C 32 to 113°F
• Humidity: Less than 70% R.H.
• Atmosphere: No harmful gasses such as sulfurous acid gas, minimal dust.

8. Soldering

1) When soldering PC board terminals, keep soldering time to within 10 s at 260°C 500°F.

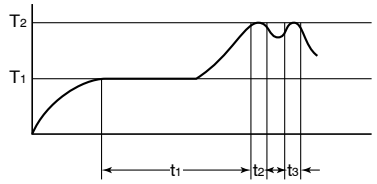
2) When soldering surface-mount terminals, the following conditions are recommended.

(1) IR (Infrared reflow) soldering method



T_1 = 155 to 165°C 311 to 329°F
T_2 = 180°C 200°C 356 to 392°F
T_3 = 245°C 473°F or less
t_1 = 120 s or less
t_2 = 30 s or less

(2) Double wave soldering method



T_1 = 120°C 248°F or less
T_2 = 260°C 500°F or less
t_1 = 60 s or less
t_2+t_3 = 5 s or less

(3) Soldering iron method

Tip temperature: 280 to 300°C 536 to 572°F

Wattage: 30 to 60 W

Soldering time: within 5 s

(4) Others

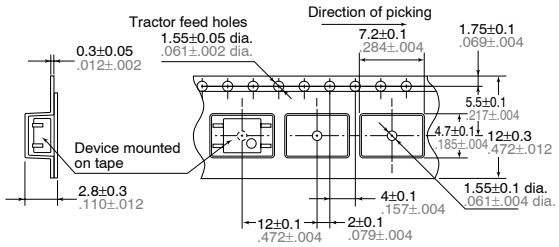
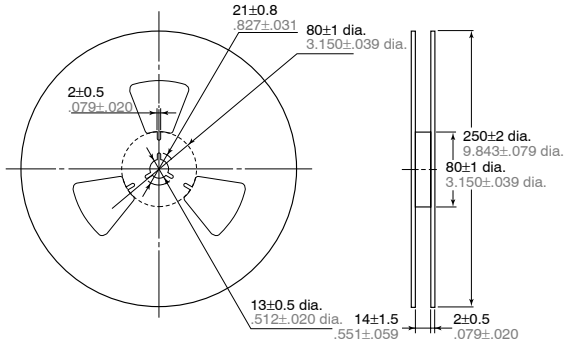
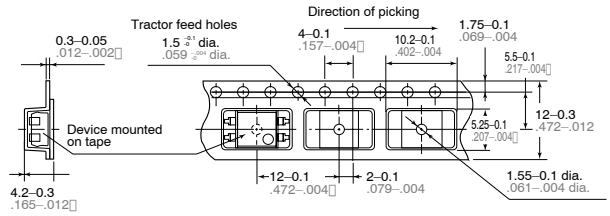
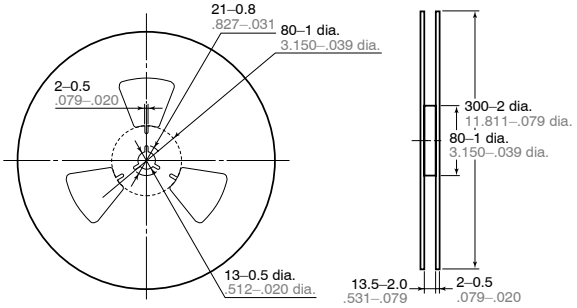
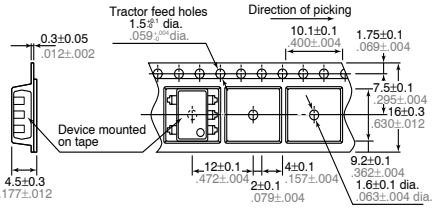
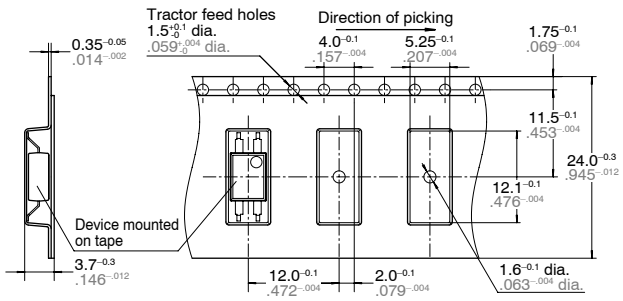
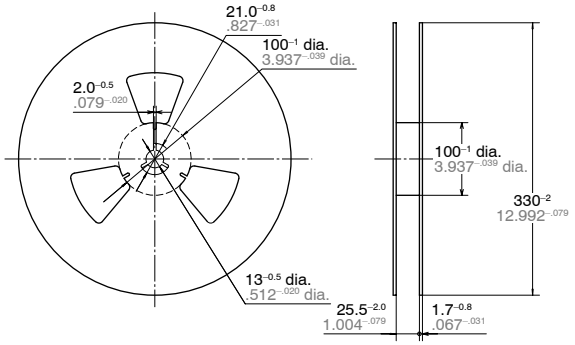
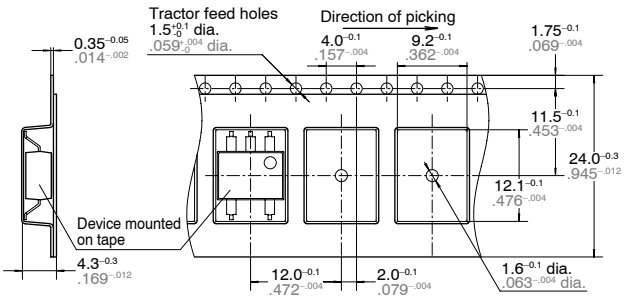
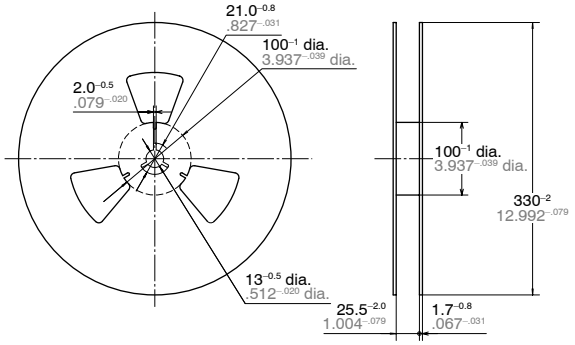
Check mounting conditions before using other soldering methods (hot-air, hot plate, pulse heater, etc.)

• The temperature profile indicates the temperature of the soldered terminal on the surface of the PC board. The ambient temperature may increase excessively. Check the temperature under mounting conditions.

9. The following shows the packaging format

1) Tape and reel

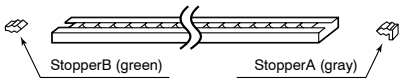
mm inch

Type	Tape dimensions	Dimensions of paper tape reel
SO package 4-pin type	 (1) When picked from 1/2-pin side: Part No. APT❍❍❍❍SX (Shown above) (2) When picked from 3/4-pin side: Part No. APT❍❍❍❍SZ	
4-pin SMD type	 (1) When picked from 1/2-pin side: Part No. APT❍❍❍❍AX (Shown above) (2) When picked from 3/4-pin side: Part No. APT❍❍❍❍AZ	
6-pin SMD type	 (1) When picked from 1/2/3-pin side: Part No. APT❍❍❍❍AX (Shown above) (2) When picked from 4/5/6-pin side: Part No. APT❍❍❍❍AZ	
DIP 4-pin wide type	 (1) When picked from 1/4-pin side: Part No. APT❍❍❍❍WAY (Shown above) (2) When picked from 2/3-pin side: Part No. APT❍❍❍❍WAW	
DIP 6-pin wide type	 (1) When picked from 1/6-pin side: Part No. APT❍❍❍❍WAY (Shown above) (2) When picked from 3/4-pin side: Part No. APT❍❍❍❍WAW	

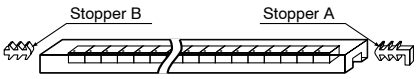
2) Tube

(1) Devices are packaged in a tube so pin No. 1 is on the stopper B side. Observe correct orientation when mounting them on PC boards.

(SOP 4-pin type)



(DIP 4-pin type)



(DIP 6-pin type)

(2) Storage

Phototriac Coupler implemented in SO packages are sensitive to moisture and come in sealed moisture-proof packages. Observe the following cautions on storage.

• After the moisture-proof package is unsealed, take the devices out of storage as soon as possible (within 1 month at the most).

• If the devices are to be left in storage for a considerable period after the moisture-proof package has been unsealed, it is recommended to keep them in another moisture-proof bag containing silica gel (within 3 months at the most).

10. Applying stress that exceeds the absolute maximum rating

If the voltage or current value for any of the terminals exceeds the absolute maximum rating, internal elements will deteriorate because of the excessive voltage or current. In extreme cases, wiring may melt, or silicon P/N junctions may be destroyed.

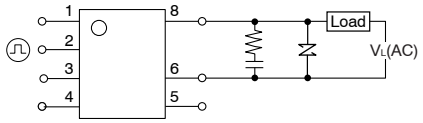
As a result, the design should ensure that the absolute maximum ratings will never be exceeded, even momentarily.

Cautions For Use of AQ-H

1. The internal IC could be damaged if a short forms between the I/O terminals while the solid state relay is powered.

2. Output spike voltages

1) The figure below shows an ordinary circuit. Please add a snubber circuit or varistor, as noise/surge on the load side could damage the unit or cause malfunctions.



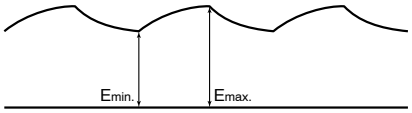
Note) Connection of an external resister, etc., to terminal No. 5 (gate) is not necessary.

2) Even if spike voltages generated at the load are limited with a clamp diode if the circuit wires are long, spike voltages will occur by inductance. Keep wires as short as possible to minimize inductance.

3. Ripple in the input power supply

1) For LED operate current at E_{min}, maintain min. 10 mA

2) Keep the LED operate current at 50 mA or less at E_{max}.



4. When soldering terminals, keep soldering time to within 10s at 260°C 500°F

5. Cleaning

The solid state relay forms an optical path by coupling a light-emitting diode (LED) and photodiode via transparent silicon resin.

For this reason, unlike other directory element molded resin products (e.g., MOS transistors and bipolar transistors), avoid ultrasonic cleansing if at all possible.

We recommend cleaning with an organic solvent. If you cannot avoid using ultrasonic cleansing, please ensure that the following conditions are met, and check beforehand for defects.

• Frequency: 27 to 29 kHz

• Ultrasonic output: No greater than 0.25 W/cm^2

• Cleaning time: No longer than 30 s

• Cleanser used: Asahiklin AK-225

• Other: Submerge in solvent in order to prevent the PCB and elements from being contacted directly by the ultrasonic vibrations.

Note: Applies to unit area ultrasonic output for ultrasonic baths.

6. Transportation and storage

1) Extreme vibration during transport will warp the lead or damage the relay. Handle the outer and inner boxes with care.

2) Storage under extreme conditions will cause soldering degradation, external appearance defects, and deterioration of the characteristics. The following storage conditions are recommended:

• Temperature: 0 to 45°C 32 to 113°F

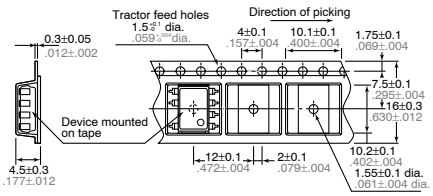
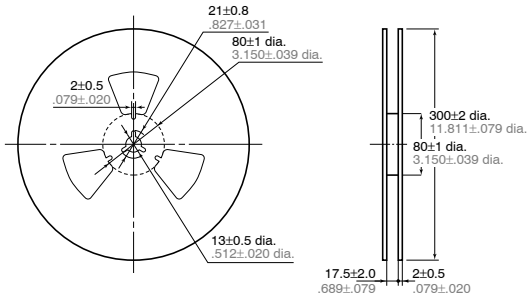
• Humidity: Less than 70% R.H.

• Atmosphere: No harmful gasses such as sulfurous acid gas, minimal dust.

7. The following shows the packaging format

1) Tape and reel

mm inch

Type	Tape dimensions	Dimensions of paper tape reel
8-pin SMD type		

(1) When picked from 1/2/3/4-pin side: Part No. AQH○○○AX (Shown above)
(2) When picked from 5/6/8-pin side: Part No. AQH○○○AZ

2) Tube

Devices are packaged in a tube so pin No. 1 is on the stopper B side. Observe correct orientation when mounting them on PC boards.

(DIP type)

Cautions for Use

SAFETY WARNINGS

• Do not use the product under conditions that exceed the range of its specifications. It may cause overheating, smoke, or fire.

• Do not touch the recharging unit while the power is on. There is a danger of electrical shock. Be sure to turn off the power when performing mounting, maintenance, or repair operations on the relay (including connecting parts such as the terminal board and socket).

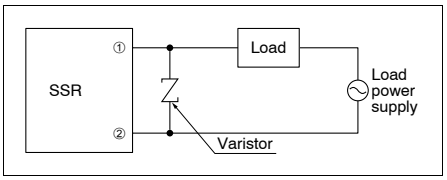
• Check the connection diagrams in the catalog and be sure to connect the terminals correctly. Erroneous connections could lead to unexpected operating errors, overheating, or fire.

Cautions for Use

1. Regarding output noise surge protection

(1) AC Output Type

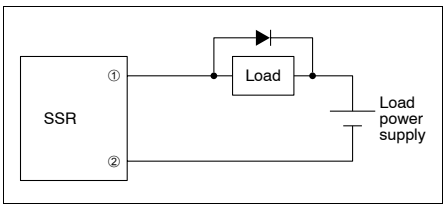
A high noise surge voltage applied to the SSR load circuit can cause malfunction or permanent damage to the device. If such a high surge is anticipated, use a varistor across the SSR output.



Note: AQ-F solid-state relay output terminals are numbered (8) and (12).

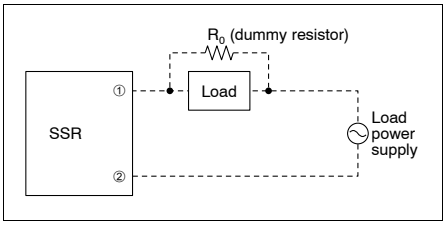
(2) DC Output Type

When the SSR is loaded with an inductive load, such as a solenoid contactor, motor, or solenoid valve, use a counter-EMF suppression diode across the load.



2. When used for the load less than rated

An SSR may malfunction if it is used below the specified load. In such an event, use a dummy resistor in parallel with the load.

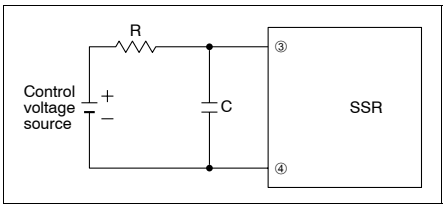


Load Specifications

Type		Load current
All AQ-G models		20 mA
AQ-E	AC output type DC output type	20 mA 1 mA
All AQ-R models		100 mA
All AQ-N models		100 mA
All AQ-K models		100 mA
AQ-F	AC output type DC output type	50 mA 5 mA
AQ-B	100 V type 200 V type	10 mA 20 mA
AQ-C	100 V type with AC output 200 V type with AC output DC output type	10 mA 20 mA 1 mA
AQ1	AC output type DC output type	50 mA 5 mA
AQ8	100 V type 200 V type	25 mA 50 mA
I/O relays	AC output module DC output module	50 mA 5 mA

3. Noise and surge protection at the input side

A high noise surge voltage applied to the SSR input circuit can cause malfunction or permanent damage to the device. If such a high surge is anticipated, use C or R noise absorber in the input circuit.

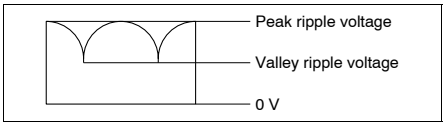


4. When the input terminals are connected with reverse polarity

Type	If the polarity of the input control voltage is reversed
AQ1 I/O relay AQ-F AQ-K AQ-N	Reversing the polarity will not cause damage to the device, due to the presence of a protection diode, but the device will not operate.
AQ-G AQ-E AQ8 AQ-B AQ-R AQ-C AQ-H	Reversing the polarity may cause permanent damage to the device. Take special care to avoid polarity reversal or use a protection diode in the input circuit.

5. In the case of operating voltage containing ripple

If the SSR control voltage contains ripple, the peak of the ripple should not exceed the maximum rated control voltage, and the bottom of the ripple should exceed the minimum rated control voltage.



6. Cleaning solvents compatibility

Dip cleaning with an organic solvent is recommended for removal of solder flux, dust, etc. Select a cleaning solvent from the following table. If ultrasonic cleaning must be used, the severity of factors such as frequency, output power and cleaning solvent selected may cause loose wires and other defects. Make sure these conditions are correct before use. For details, please consult us.

Cleaning solvent		Compatibility ❍: Yes ×: No
Chlorine-base	• Trichlene • Chloroethlene	❍
Adueous	• Indusco • Hollis • Lonco Terg	❍
Alcohol-base	• IPA • Ethanol	❍
Others	• Thinner • Gasoline	×

7. Others

(1) If an SSR is used in close proximity to another SSR or heat-generating device, its ambient temperature may exceed the allowable level. Carefully plan SSR layout and ventilation.

(2) Soldering to SSR terminals should be completed within 5 seconds at 260°C.

(3) Terminal connections should be made by referring to the associated wiring diagram.

(4) For higher reliability, check device quality under actual operating conditions.

Snubber Circuit

1. Reduce dv/dt

An SSR used with an inductive load can accidentally fire due to a high load voltage rise rate (dv/dt), even though the load voltage is below the allowable level (inductive load firing).

Our SSRs contain a snubber circuit designed to reduce dv/dt.

2. Selecting the snubber constants

1) C selection

The charging coefficient tau for C of the SSR circuit is shown in formula 1

$$\tau=(R_L+R) \times C \quad \text{----------1}$$

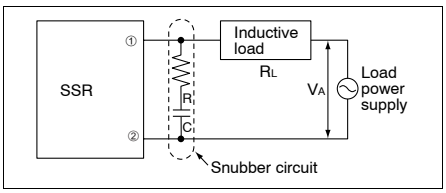
By setting formula 1 so that it is below dv/dt value you have:

$$C\frac{\tau}{(R_L+R)}=\frac{0.632V_A}{(dv/dt) \times (R_L+R)} \quad \text{-----2}$$

By setting C = 0.1 to 0.2 μF, dv/dt can be controlled to between nV/μs and n+V/μs or lower. For the condenser, use either an MP condenser metallized polyester film. For the 100 V line, use a voltage between 250 and 400 V, and for the 200 V line, use a voltage between 400 and 600 V.

07/2005

Cautions for Use



2) R selection

If there is no resistance R (the resistance R controls the discharge current from condenser C), at turn-on of the SSR, there will be a sharp rise in dv/dt and the high peak value discharge current will begin to flow. This may cause damage to the internal elements of the SSR. Therefore, it is always necessary to insert a resistance R. In normal applications, for the 100 V line, have R = 10 to 100 Ω and for the 200 V line, have R = 20 to 100 Ω. (The allowable discharge current at turn-on will differ depending on the internal elements of the SSR.) The power loss from R, written as P, caused by the discharge current and charging current from C, is shown in formula 3 below. For the 100 V line, use a power of 1/2 W, and for the 200 V line, use a power above 2 W.

$$P = \frac{C \times V_A^2 \times f}{2} \quad \text{---------- ③}$$

f = Power supply frequency

Also, at turn-off of the SSR, a ringing circuit is formed with the capacitor C and the circuit inductance L, and a spike voltage is generated at both terminals of the SSR. The resistance R serves as a control resistance to prevent this ringing. Moreover, a good non-inductive resistance for R is required. Carbon film resistors or metal film resistors are often used. For general applications, the recommended values are C = 0.1 μF and R = 20 to 100 Ω. There are cases of resonance in the inductive load, so the appropriate care must be taken when making your selections.

Thermal Design

SSRs used in high-reliability equipment require careful thermal design. In particular, junction temperature control has a significant effect on device function and life time. The rated load current for board-mounting SSRs is defined as the maximum current allowable at an ambient temperature of 40°C (30°C) and under natural cooling. If the ambient temperature exceeds 40°C (30°C), load current derating is necessary according to the load current versus ambient temperature curve. If adjacent devices act as heat sources, the SSR should be located more than 10 mm away from those devices. SSRs with a 5 A rating or more must be used with the dedicated heat sinks listed in Table 1 or equivalents. To ensure adequate thermal conduction, apply thermal conductive compound (Toshiba silicone YG6111, TSK5303 or alternate) to the SSR's mounting surface. For information on external heat sinks for our SSRs and their mounting method, refer to "Data and Cautions for Use for respective relay".

Table 1. Dedicated on-board heat sinks

Load current	Type	Heat sink
5 A	AQ5A2-ZP3/28V DC	AQ-HS-5A
10 A	AQ-R (10 to 20A)	AQP-HS-20A
	AQ-N (10 to 20A)	
15 A	AQ-R (10 to 20A)	AQP-HS-20A
	AQ-N (10 to 20A)	
20 A	AQ-R (10 to 20A)	AQP-HS-20A
	AQ-N (10 to 20A)	
25 A	AQ-N (25A)	AQP-HS-30/40A
40 A	AQ-R (40A)	
40 A	AQ-N (40A)	AQP-HS-N40

Protection Circuit

High-reliability SSR circuits require an adequate protection circuit, as well as careful study of the characteristics and maximum ratings of the device.

1. Over-Voltage Protection

The SSR load power supply requires adequate protection against over-voltage errors from various causes. The methods of over-voltage protection include the following:

(1) Use devices with a guaranteed reverse surge withstand voltage (controlled avalanche devices, etc.)

(2) Suppress transient spikes

Use a switching device in the secondary circuit of a transformer or use a switch with a slow opening speed.

(3) Use a surge absorption circuit

Use a CR surge absorber or varistor across the load power supply or SSR. Special care must be taken so power on/off surges or external surges do not exceed the device's rated load voltage. If a surge voltage exceeding the device's rated voltage is anticipated, use a surge absorption device and circuit (e.g. a ZNR from Matsushita Electronic Components).

Choosing the Rated Voltage of the ZNR

(1) Peak supply voltage

(2) Supply voltage variation

(3) Degradation of ZNR characteristic

(1 mA±10%)

(4) Tolerance of rated voltage (10%)

For application to 100 V AC lines, choose a ZNR with the following rated voltage:

(1) × (2) × (3) × (4) = (100×2) ×1.1×1.1×1.1 = 188 (V)

2. Over-Current Protection

An SSR circuit operated without over-current protection may result in damage to the device. Design the circuit so the device's rated junction temperature is not exceeded for a continuous overload current.

(e.g. Surge current into a motor or light bulb)

The surge-on current rating applies to over-current errors which occur less than several tens of times during the service life of a semiconductor device. A protection coordination device is required for this rating.

Methods of over-current protection include the following:

(1) Suppressing over-currents

Use a current limiting reactor in series with the load power supply.

(2) Use a current shut-off device

Use a current limiting fuse or circuit breaker in series with the load power supply.

Load Type Description

1. Heaters (Resistive Load)

The SSR is best suited to resistive loads. Noise levels can be drastically lowered with zero-crossing switching.

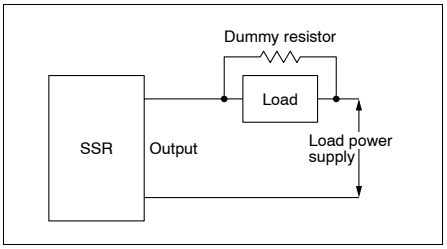
2. Lamps

Tungsten or halogen lamps draw a high inrush current when turned on (approximately 7 to 8 times the steady-state current for zero-crossing SSRs; approximately 9 to 12 times, in the worst case, for non zero-crossing SSRs). Choose an SSR so the peak of the inrush current does not exceed 50% of the SSR surge-on current.

3. Solenoids

AC-driven solenoid contactors or solenoid valves also draw inrush current when they are activated. Choose an SSR such that the peak of the inrush current does not exceed 50% of the SSR surge-on current. For small solenoid valves and AC relays in particular, a leakage current may cause the load to malfunction after the SSR turns off. In such an event, use a dummy resistor in parallel with the load.

• Using an SSR below the Specified Load



4. Motors

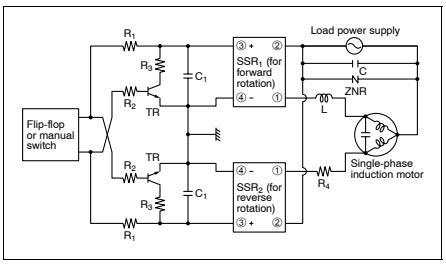
When starting, an electric motor draws a symmetrical AC starting current some 5 to 10 times the steady-state load current, superimposed on a DC current. The starting time during which this high starting current is sustained depends on the capacities of the load and load power supply. Measure the starting current and time under the motor's actual operating conditions and choose an SSR so the peak of the starting current does not exceed 50% of the SSR surge-on current. When the motor load is deactivated, a voltage exceeding the load supply voltage is applied to the SSR due to counter-EMF. This voltage is approximately 1.3 times the load supply voltage for induction motors, and approximately 2 times that for synchronous motors.

• Reversible Motor Control

When the direction of motor rotation is reversed, the transient current and time required for the reversal far exceed those required for simple starting. The reversing current and time should also be measured under actual operating conditions. For a capacitor-starting, single-phase induction motor, a capacitive discharge current appears during the reversal process. Be sure to use a current limiting resistor or reactor in series with the SSR. Also, the SSR should have a high marginal voltage rating, since a voltage twice as high as the load supply voltage develops across the SSR in the reversal process. (For reversible control on a 100 V AC line, use SSRs with a 200 V rating; for use on a 200 V AC line, contact your nearest our representative for further information.)

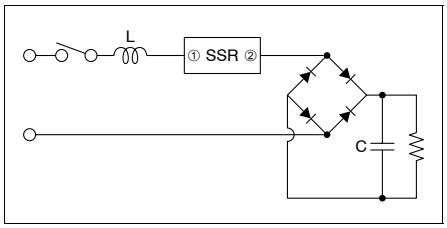
For reversible motor control, carefully design the driver circuit so the forward and reverse SSRs do not turn on at the same time.

Transistor-driven reversible motor control circuit



5. Capacitive Load

A capacitive load (switching regulator, etc.) draws an inrush current to charge the load capacitor when the SSR turns on. Choose an SSR so the peak of the inrush current does not exceed 50% of the SSR surge-on current. A timing error of up to one cycle can occur when a switch used in series with the SSR is opened or closed. If this is a problem, use an inductor (200 to 500 μH) in series to the SSR to suppress dv/dt error.

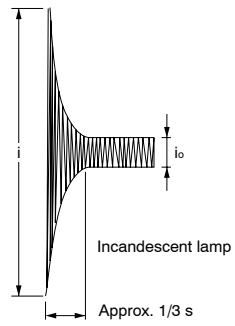


6. Other Electronic Equipment

In general, electronic equipment uses line filters in the primary supply circuit. The capacitors used in the line filters may cause the SSR to malfunction due to dv/dt turn on when the equipment is turned on or off. In such an event, use an inductor (200 to 500 μH) in series with the SSR to suppress dv/dt turn on.

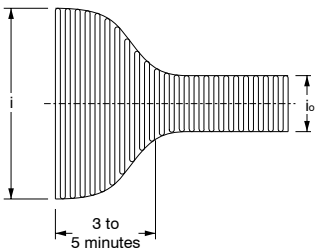
Load Inrush Current Wave Forms and Timing

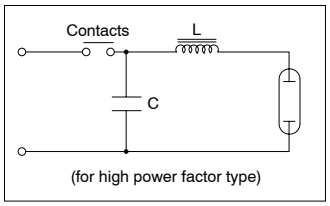
(1) Incandescent Lamp Load



Inrush current/rated current = i/i_o = 10 to 15 times

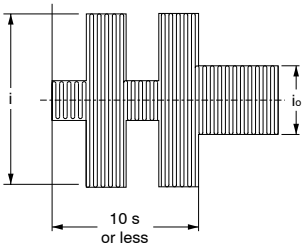
(2) Mercury Lamp Load i/i_o = 3 times



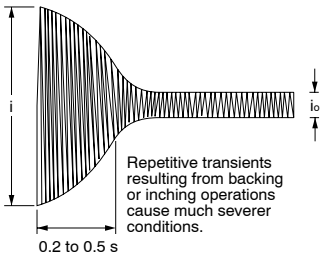


In general, discharge lamp circuits use a combination of a discharge tube, transformer, choke coils, and capacitors. Note that the lamp may draw an inrush current may be 20 to 40 times the steady-state current, especially if the supply impedance is low in the high power factor type.

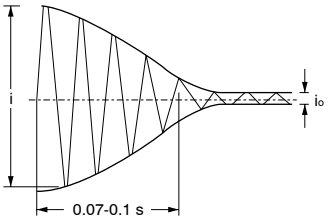
(3) Fluorescent Lamp Load i/i_o = 5 to 10 times



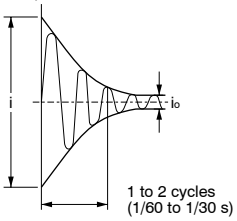
(4) Motor Load i/i_o = 5 to 10 times



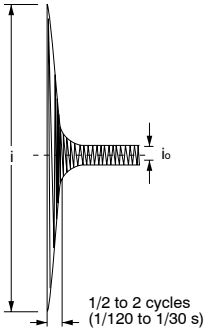
(5) Solenoid Load i/i_o = 10 to 20 times



(6) Electromagnetic Contact Load i/i_o = 3 to 10 times

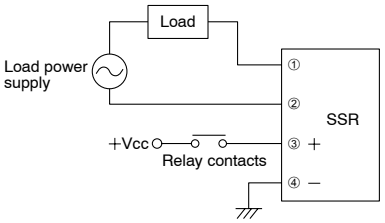


(7) Capacitive Load i/i_o = 20 to 40 times

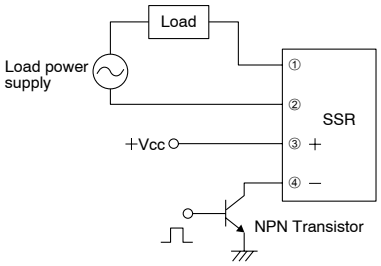


SSR Driving Circuits

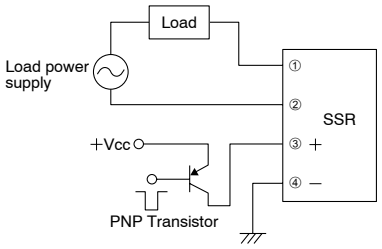
1. Recelay Driver



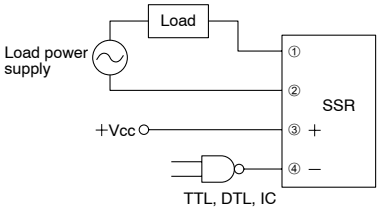
2. NPN Transistor Driver



3. PNP Transistor Driver

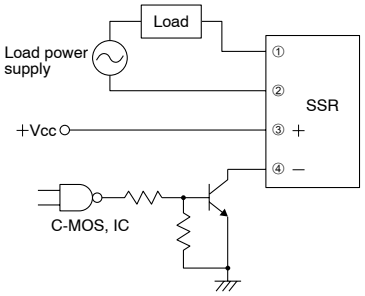


4. TTL/DTL/IC Driver

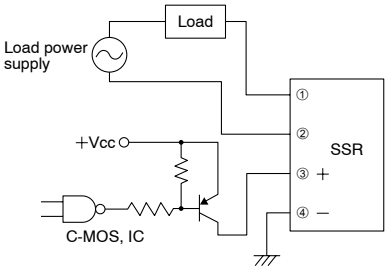


5. C-MOS/IC Driver

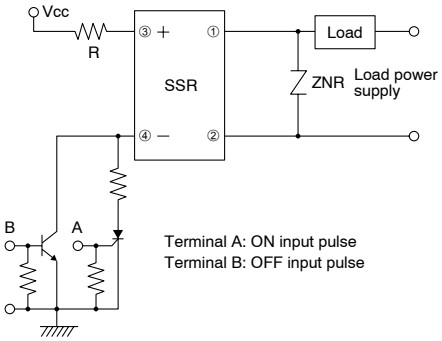
(1) SSR fires when IC output is HIGH:



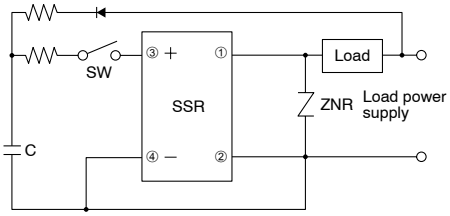
(2) SSR fires when IC output is LOW:



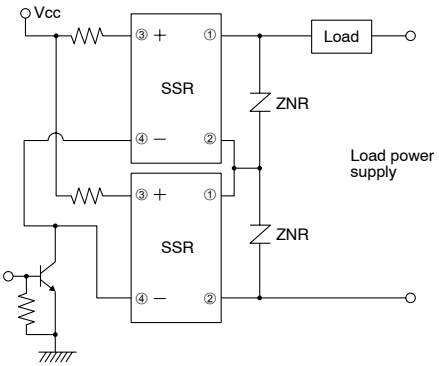
6. Self Sustaining Circuit Using SSR



7. Driving with a Shared Supply



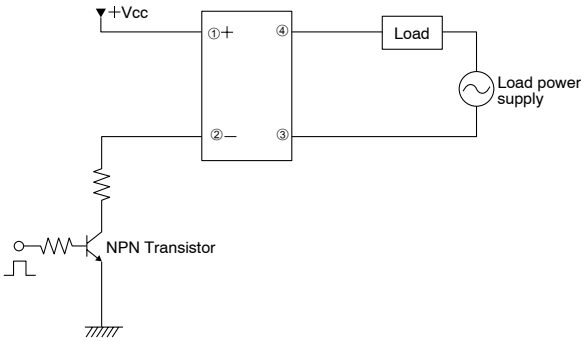
8. SSRs Used in Series



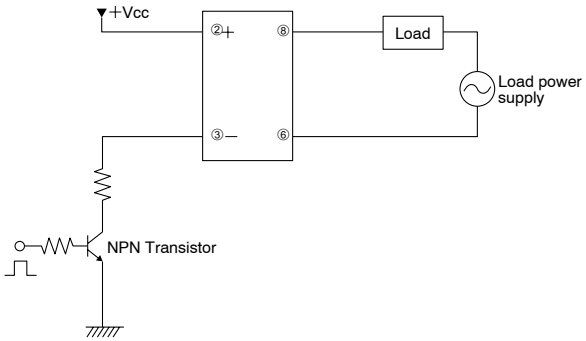
Phototriac Coupler, AQ-H Solid State Relay Driving Circuits

1. NPN Transistor Driver

1) Phototriac Coupler



2) AQ-H Solid State Relay

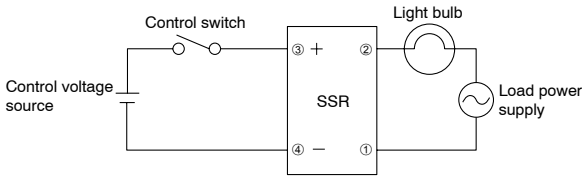


* Phototriac coupler and AQ-H is current driving type.

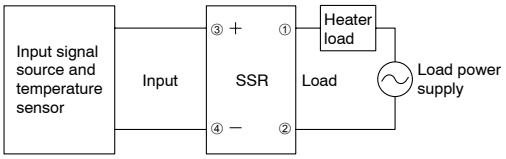
SSR Application Examples

Typical Applications

1. Light Bulb

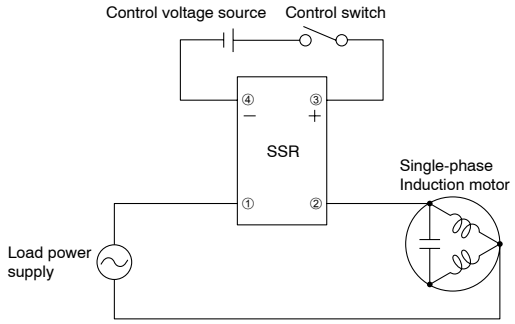


2. Electric Furnace Temperature Control

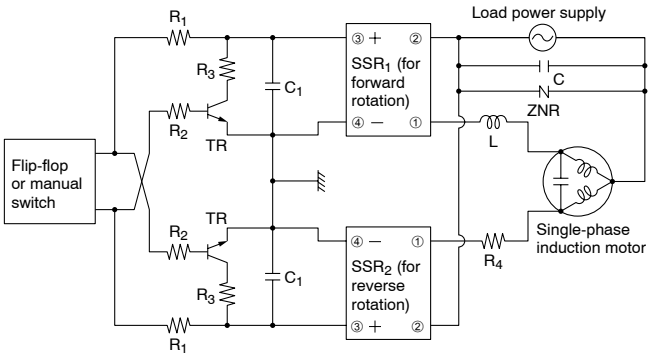


* KT Temperature Controller is available.

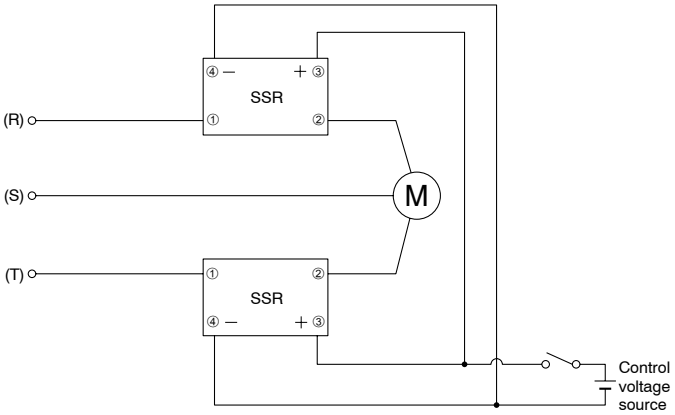
3. Single-Phase Induction Motor Control



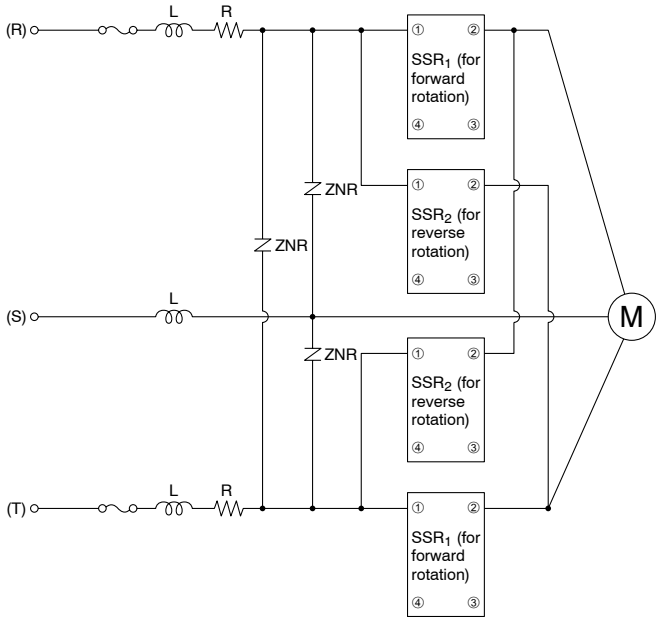
4. Reversible Control for a Single-Phase Induction Motor



5. Three-Phase Induction Motor Control



6. Reversible Control for a 3-Phase Induction Motor

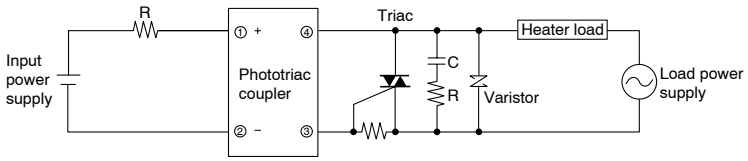


Note: Take special care in the design to ensure that both the forward and reverse SSRs do not turn on at the same time.

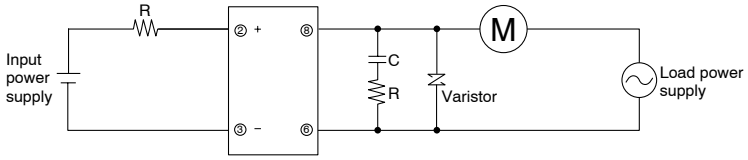
Phototriac Coupler/AQ-H Application Examples

Typical Applications

1. Temperature control for heater control



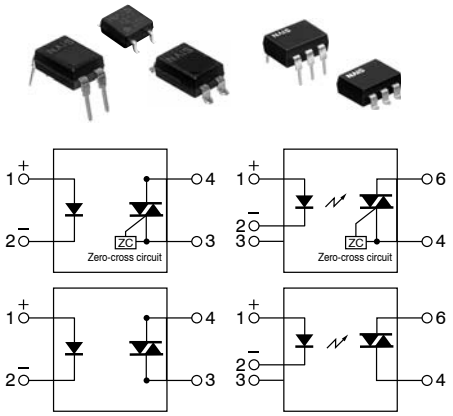
2. Airflow control for fan motors



Panasonic
ideas for life

Phototriac Coupler for the Industrial Machinery, Consumer Electronics, and SSR Markets

Phototriac Coupler (APT)



FEATURES

1. Two types available: Non zero-cross type and zero-cross type

2. Many package sizes available.

3. High dielectric strength. (Between input and output: SOP 3, 750 V; DIP 5,000 V)

4. This type is for both 100 and 200 V AC.

5. Terminal 5 of the DIP 6-pin type is completely molded.

TYPICAL APPLICATIONS

1. Industrial equipment such as NC machines, chip mounter, robots and so on
2. AC fan-motor control
3. Control of heated-water motor and flush valve for personal hygiene system
4. Heater control for copiers and other products
5. Triac driver for SSRs

TYPES

1. SOP Type

Type	Output rating*		Type	Package size	Part No.		Packing quantity in tape and reel
	Repetitive peak OFF-state voltage	ON-state RMS current			Picked from the 1/2-pin side	Picked from the 3/4-pin side	
AC type	600 V	50 mA	Zero-cross	SOP4pin	APT1211SX	APT1211SZ	1,000 pcs.
			Non zero-cross		APT1221SX	APT1221SZ	

Notes: (1) Tape package is the standard packing style. Also available in tube. (Part No. suffix "X" or "Z" is not needed when ordering; Tube: 100 pcs.; Case: 2,000 pcs.)
(2) For space reasons, the initial letters of the product number "APT" and "S" are omitted on the product seal.
The package type indicator "X" and "Z" are omitted from the seal. (Ex. the label for product number APT1221SZ is 1221).
* Repetitive peak OFF-state voltage and surge on current express the peak AC.

2. DIP Type

Type	Output rating*		Type	Package size	Part No.				Packing quantity	
	Repetitive peak OFF-state voltage	ON-state RMS current			Through hole terminal	Surface-mount terminal				
					Tube packing style		Tape and reel packing style		Tube	Tape and reel
AC type	600 V	100 mA	Zero-cross	DIP4pin	APT1211	APT1211A	APT1211AX (Picked from the 1/2-pin side)	APT1211AZ (Picked from the 1/2/3-pin side)	[DIP4pin] 1 tube contains 100 pcs. 1 batch contains 1,000 pcs. [DIP6pin] 1 tube contains 50 pcs. 1 batch contains 500 pcs.	[DIP4pin] [DIP6pin] 1,000 pcs.
			Non zero-cross		APT1221	APT1221A	APT1221AX (Picked from the 1/2-pin side)	APT1221AZ (Picked from the 1/2/3-pin side)		
			Zero-cross	DIP6pin	APT1212	APT1212A	APT1212AX (Picked from the 1/2/3-pin side)	APT1212AZ (Picked from the 4/6-pin side)		
			Non zero-cross		APT1222	APT1222A	APT1222AX (Picked from the 1/2/3-pin side)	APT1222AZ (Picked from the 4/6-pin side)		

Note: For space reasons the initial letters "APT" of the product number for the DIP 4-pin type, the letter "A", which indicates the SMD terminal shape for the DIP 4-pin and 6-pin types, and the package type indications "X" and "Z" have been omitted from the product label. (Example: The label for product number APT1221AZ is 1221.)
* Repetitive peak OFF-state voltage and surge on current express the peak AC.

Phototriac Coupler (APT)

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	APT1211S	APT1221S	APT1211	APT1221	APT1212	APT1222	Remarks
Input	LED forward current	I_F	50 mA						
	LED reverse voltage	V_R	6 V						
	Peak forward current	I_{FP}	1 A						f = 100 Hz, Duty Ratio = 0.1%
Output	Repetitive peak OFF-state voltage	V_{DRM}	600 V						
	ON-state RMS current*	$IT_{(RMS)}$	0.05 A		0.1 A				AC
	Non-repetitive surge current	I_{TSM}	0.6 A		1.2 A				In one cycle at 60Hz
Total power dissipation		P_T	350 mW		500 mW				
I/O isolation voltage		V_{iso}	3,750 V AC		5,000 V AC				
Temperature limits	Operating	T_{opr}	–40°C to +100°C –40°F to +212°F						Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +125°C –40°F to +257°F						

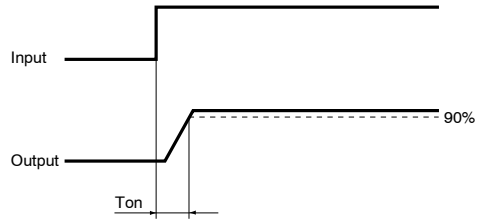
* Do not exceed 50 mA of ON state RMS current in case of following load voltage condition.
APT1211, APT1221: more than 100 V AC; APT1212, APT1222: more than 120 V AC

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	APT1211S, APT1211, APT1212	APT1221S, APT1221, APT1222	Condition
Input	LED dropout voltage	Typical	V_F	1.18 V		I_F = 10 mA
		Maximum		1.3 V		
	LED reverse current	Typical	I_R	—		V_R = 6 V
		Maximum		10 μA		
Output	Peak OFF-state current	Typical	I_{DRM}	—		I_F = 0 V_{DRM} = 600 V
		Maximum		1 μA		
	Peak On-state voltage	Typical	V_{TM}	1.3 V		I_F = 10 mA I_{TM} = 0.05 A
		Maximum		2.5 V		
	Holding current	Typical	I_H	0.3 mA		
		Maximum		3.5 mA		
	Critical rate of rise of OFF-state voltage	Minimum	dv/dt	500 V/μs		V_{DRM} = 600 V ×1/M2
Transfer characteristics	Trigger LED current*	Maximum	I_{FT}	10 mA		V_D = 6 V R_L = 100 Ω
	Zero-cross voltage**	Maximum	V_{ZC}	50 V	—	I_F = 10 mA
	Turn on time***	Maximum	T_{ON}	100 μs		I_F = 20 mA V_D = 6 V R_L = 100 Ω
	I/O capacitance	Maximum	C_{iso}	1.5 pF		f = 1 MHz V_B = 0
	I/O resistance	Minimum	R_{iso}	50 GΩ		500 V DC

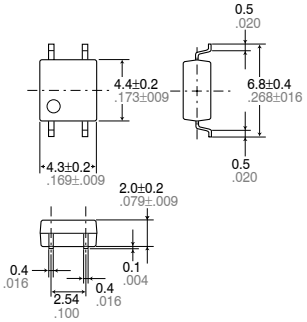
*Recommended LED current I_F = 20mA
**Applicable part numbers: APT1211S, APT1211, APT1212.
***Turn on time

Note: For type of connection, see page 277.



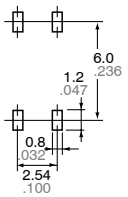
DIMENSIONS

mm inch



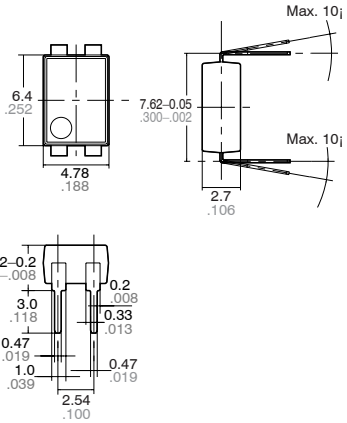
Terminal thickness = 0.15 .006
General tolerance: ±0.1 ±.004

Recommended mounting pad (TOP VIEW)



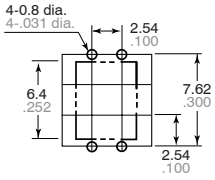
Tolerance: ±0.1 ±.004

mm inch



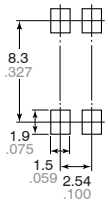
Terminal thickness = 0.15 .006
General tolerance: ±0.1 ±.004

PC board pattern (BOTTOM VIEW)

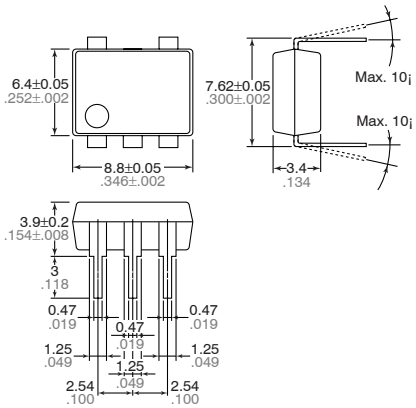


Tolerance: ±0.1 ±.004

Recommended mounting pad (TOP VIEW)

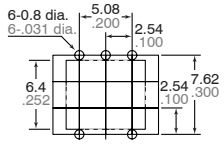


Tolerance: ±0.1 ±.004



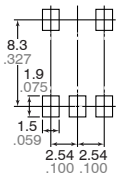
Terminal thickness = 0.15 .006
General tolerance: ±0.1 ±.004

PC board pattern (BOTTOM VIEW)



Tolerance: ±0.1 ±.004

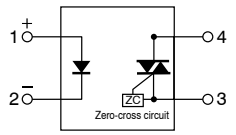
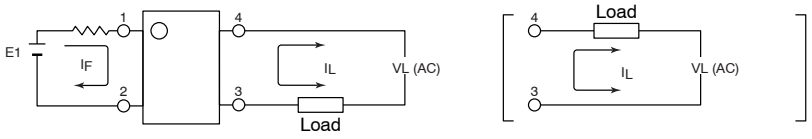
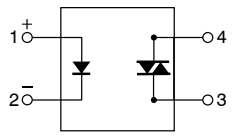
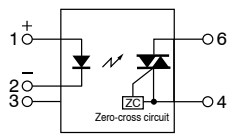
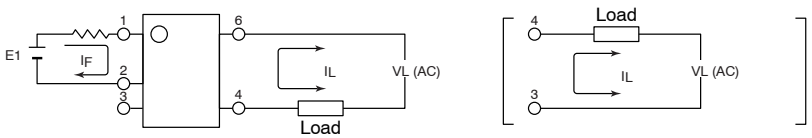
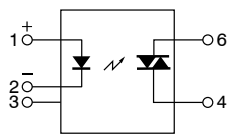
Recommended mounting pad (TOP VIEW)



Tolerance: ±0.1 ±.004

SCHEMATIC AND WIRING DIAGRAMS

Notes: E_1: Power source at input side; I_F: Trigger LED forward current; V_L: Load voltage; I_L: Load current;

Schematic	Output configuration	Load	Wiring diagram
	1a	AC	
			
			
			

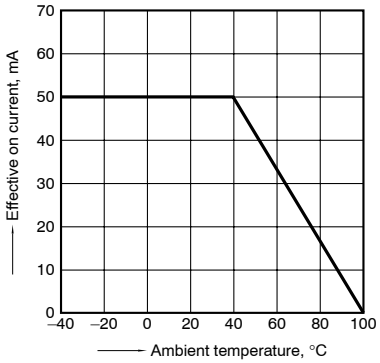
For Cautions for Use, see page 265.

REFERENCE DATA

1. Effective on current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +100°C
–40°F to +212°F

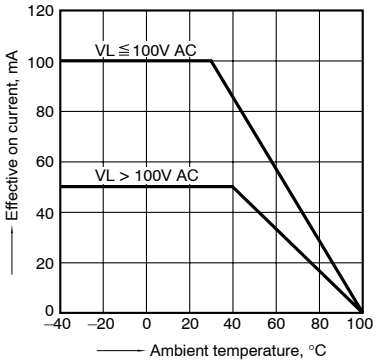
Tested sample: APT1211S, APT1221S



2. Effective on current vs. ambient temperature characteristics

Allowable ambient temperature: –40°C to +100°C
–40°F to +212°F

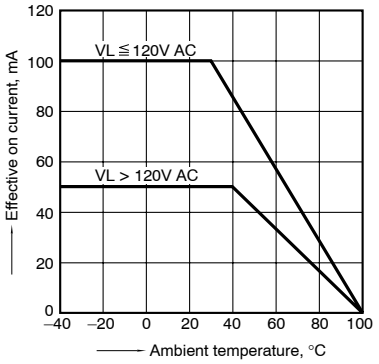
Tested sample: APT1211, APT1221



3. Effective on current vs. ambient temperature characteristics

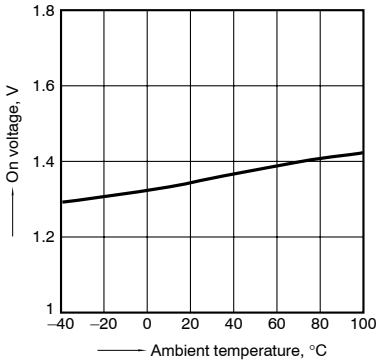
Allowable ambient temperature: –40°C to +100°C
–40°F to +212°F

Tested sample: APT1212, APT1222



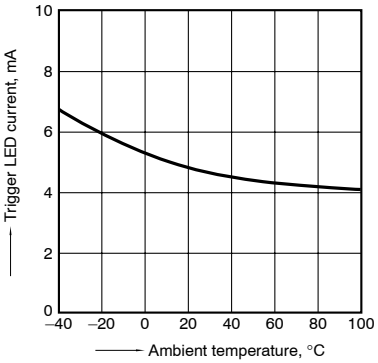
4. On voltage vs. ambient temperature characteristics

Trigger LED current: 10 mA; ON current: 50 mA (AC)

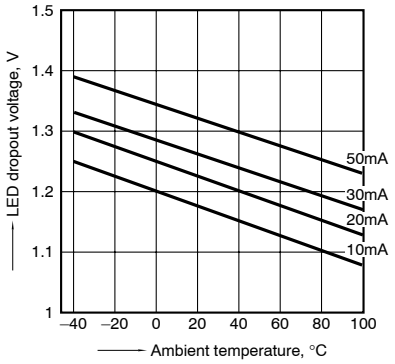


5. Trigger LED current vs. ambient temperature characteristics

Load voltage: 6 V (DC); Load resistance: 100Ω

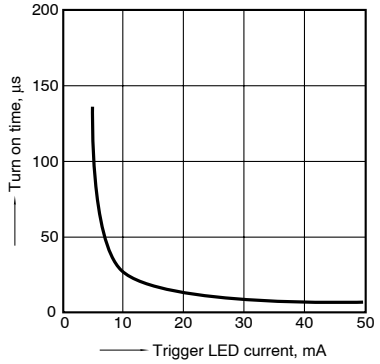


6. LED dropout voltage vs. ambient temperature characteristics



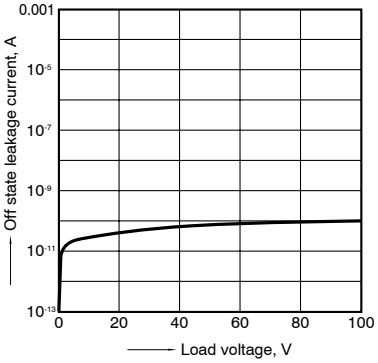
7. Turn on time vs. trigger LED current

Load voltage: 6V (DC)
Load resistance: 100Ω

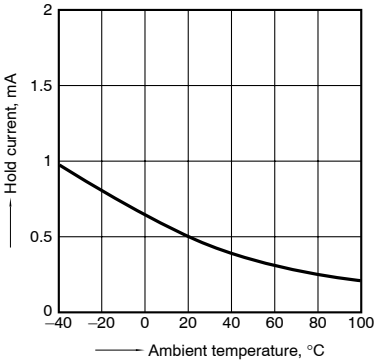


8. Off state leakage current vs. load voltage

Ambient temperature: 25°C 77°F

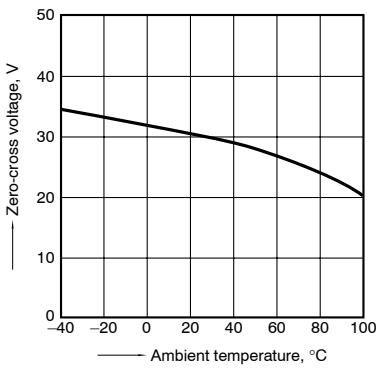


9. Hold current vs. ambient temperature characteristics



10. Zero-cross voltage vs. ambient temperature characteristics

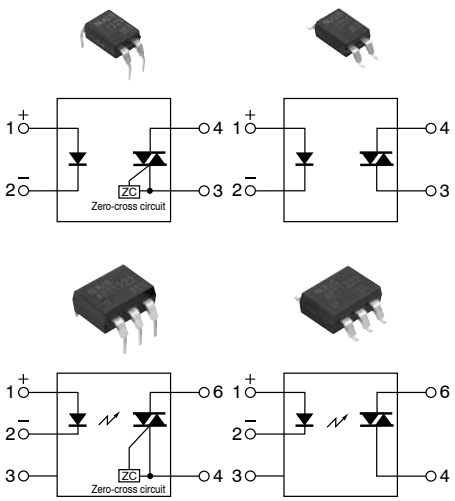
Trigger LED current: 10 mA (APT1211S)



Panasonic
ideas for life

Phototriac Coupler Wide Terminal Type (IEC compliant reinforced insulation)

Phototriac Coupler (APT12○○W)



FEATURES

1. Distance between input and output terminals is 10.16 mm .400 inch. (IEC335 standard of min. 8 mm .315 inch maintained.)
2. Only ours handles both 100 and 200 V AC loads
This relay handles both voltages in a single product it is not necessary for users that use both types to manage separate part numbers.
3. I/O isolation resistance of 5,000 V AC realized!
4. Two types available: Zero-cross type and Non zero-cross type
5. Two package design available: DIP type and SMD type
6. Pin No. 5 is completely molded for high resistance against extraneous noise.

TYPICAL APPLICATIONS

1. Triac driver for SSRs
2. Heater control for copiers and other products
3. Industrial equipment such as NC machines, chip mounters, Robotics and so on
4. Control of heated-water motors and flush valve for personal hygiene systems
5. AC fan-motor controls of air conditioner

TYPES

Type	Output rating*		Type	Package size	Part No.				Packing quantity	
	Repetitive peak OFF-state voltage	ON-state RMS current			Through hole terminal	Surface-mount terminal				
					Tube packing style		Tape and reel packing style		Tube	Tape and reel
AC type	600 V	100 mA	Zero-cross	DIP4pin	APT1211W	APT1211WA	APT1211WAY (Picked from the 1/4-pin side)	APT1211WAW (Picked from the 2/3-pin side)	[DIP4pin] 1 tube contains 100 pcs. 1 batch contains 1,000 pcs. [DIP6pin] 1 tube contains 50 pcs. 1 batch contains 500 pcs.	[DIP4pin] [DIP6pin] 1,000 pcs.
			Non zero-cross		APT1221W	APT1221WA	APT1221WAY (Picked from the 1/4-pin side)	APT1221WAW (Picked from the 2/3-pin side)		
			Zero-cross	DIP6pin	APT1212W	APT1212WA	APT1212WAY (Picked from the 1/6-pin side)	APT1212WAW (Picked from the 3/4-pin side)		
			Non zero-cross		APT1222W	APT1222WA	APT1222WAY (Picked from the 1/6-pin side)	APT1222WAW (Picked from the 3/4-pin side)		

Note: For space reasons the initial letters “APT” of the product number for the DIP 4-pin type, the letter “WA”, which indicates the SMD terminal shape for the DIP 4-pin and 6-pin types, and the package type indications “Y” and “W” have been omitted from the product label. (Example: The label for product number APT1221WAY is 1221.)
* Repetitive peak OFF-state voltage and surge on current express the peak AC.

RATING

1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	APT1211W(A)	APT1221W(A)	APT1212W(A)	APT1222W(A)	Remarks
Input	LED forward current	I_F	50 mA				
	LED reverse voltage	V_R	6 V				
	Peak forward current	I_{FP}	1 A				f = 100 Hz, Duty Ratio = 0.1%
Output	Repetitive peak OFF-state voltage	V_{DRM}	600 V				
	ON-state RMS current*	$I_{T(RMS)}$	0.1 A				AC
	Non-repetitive surge current	I_{TSM}	1.2 A				In one cycle at 60Hz
Total power dissipation		P_T	500 mW				
I/O isolation voltage		V_{iso}	5,000 V AC				
Temperature limits	Operating	T_{opr}	–40°C to +100°C –40°F to +212°F				Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +125°C –40°F to +257°F				

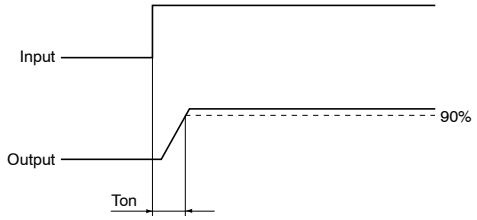
* Do not exceed 50 mA of ON state RMS current in case of following load voltage condition.
APT1211W, APT1221W: more than 100 V AC; APT1212W, APT1222W: more than 120 V AC

Phototriac Coupler (APT12❍❍W)

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

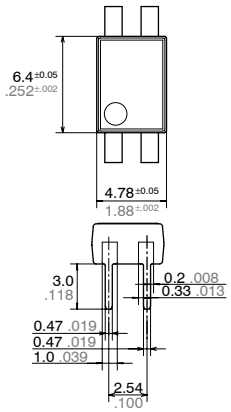
Item			Symbol	APT1211W, APT1212W	APT1221W, APT1222W	Condition
Input	LED dropout voltage	Typical	V_F	1.18 V		I_F = 10 mA
		Maximum		1.3 V		
	LED reverse current	Typical	I_R	—		V_R = 6 V
		Maximum		10 μA		
Output	Peak OFF-state current	Typical	I_{DRM}	—		I_F = 0 mA V_{DRM} = 600 V
		Maximum		1 μA		
	Peak On-state voltage	Typical	V_{TM}	1.3 V		I_F = 10 mA I_{TM} = 0.05 A
		Maximum		2.5 V		
	Holding current	Typical	I_H	0.3 mA		
		Maximum		3.5 mA		
	Critical rate of rise of OFF-state voltage	Minimum	dv/dt	500 V/μs		V_{DRM} = 600 V ×1/ M2
Transfer characteristics	Trigger LED current*	Maximum	I_{FT}	10 mA		V_D = 6 V R_L = 100 Ω
	Zero-cross voltage**	Maximum	V_{ZC}	50 V	—	I_F = 10 mA
	Turn on time***	Maximum	T_{ON}	100 μs		I_F = 20 mA V_D = 6 V R_L = 100 Ω
	I/O capacitance	Maximum	C_{iso}	1.5 pF		f = 1 MHz V_B = 0
	I/O resistance	Minimum	R_{iso}	50 GΩ		500 V DC

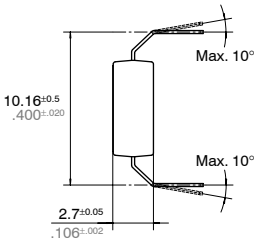
*Recommended LED current I_F = 20mA
**Applicable part numbers: APT1211W and APT1212W.
***Turn on time



DIMENSIONS

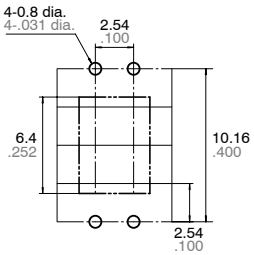
mm inch



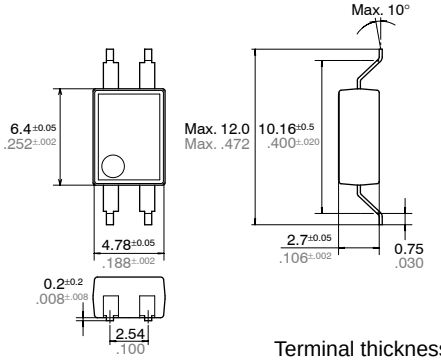


Terminal thickness: 0.25 .010
General tolerance: ±0.1 ±.004

PC board pattern
(BOTTOM VIEW)

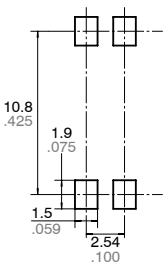


Tolerance: ±0.1 ±.004



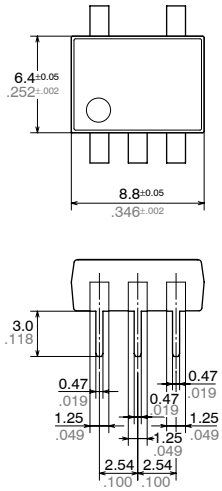
Terminal thickness: 0.25 .010
General tolerance: ±0.1 ±.004

Recommended mounting pad
(TOP VIEW)



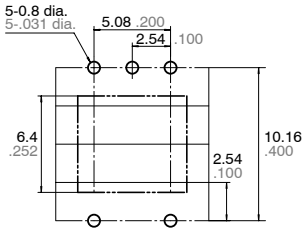
Tolerance: ±0.1 ±.004

mm inch

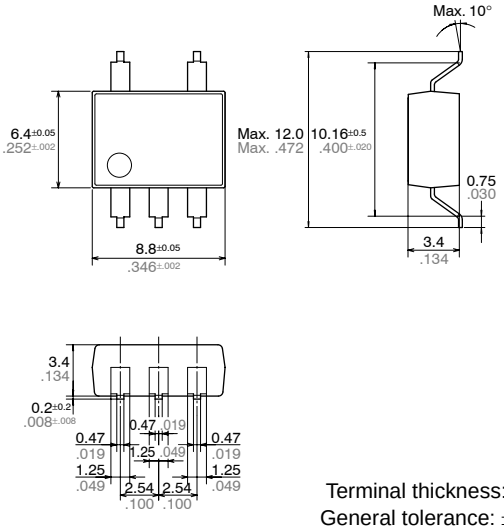


Terminal thickness: 0.25 .010
General tolerance: ±0.1 ±.004

PC board pattern
(BOTTOM VIEW)

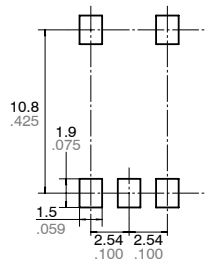


Tolerance: ±0.1 ±.004



Terminal thickness: 0.25 .010
General tolerance: ±0.1 ±.004

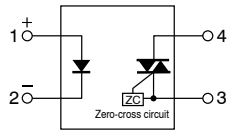
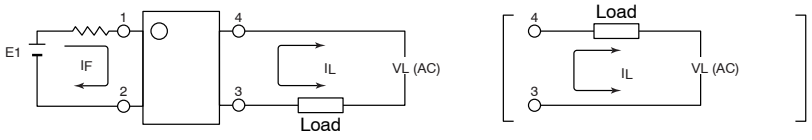
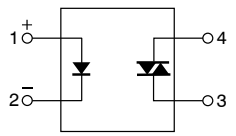
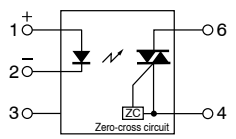
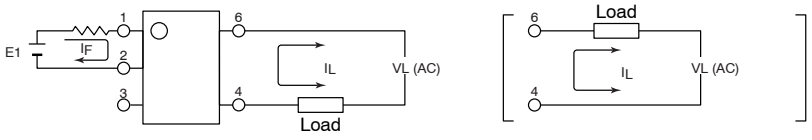
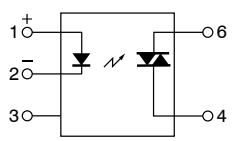
Recommended mounting pad
(TOP VIEW)



Tolerance: ±0.1 ±.004

SCHEMATIC AND WIRING DIAGRAMS

Notes: E_1: Power source at input side; I_F: Trigger LED forward current; V_L: Load voltage; I_L: Load current;

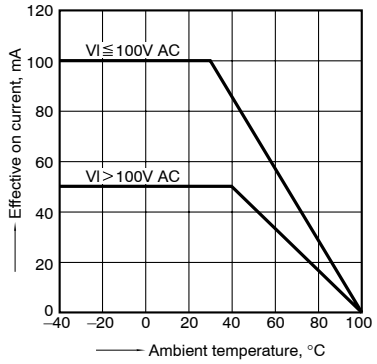
Schematic	Output configuration	Load	Wiring diagram
	1a	AC	
			
			
			

REFERENCE DATA

1. Effective on current vs. Ambient temperature characteristics

Allowable ambient temperature: –40°C to +100°C
–40°F to +212°F

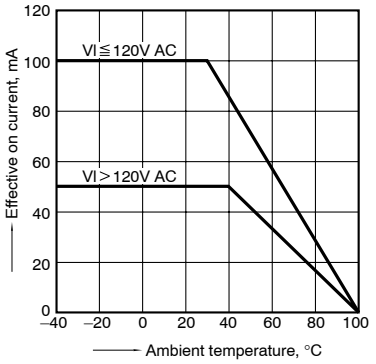
Tested sample: APT1211W, APT1221W



2. Effective on current vs. Ambient temperature characteristics

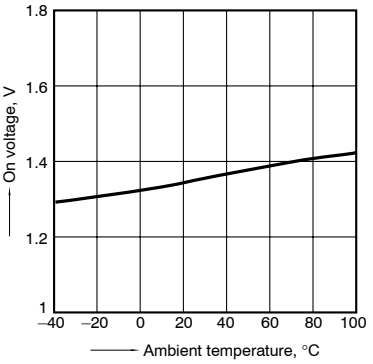
Allowable ambient temperature: –40°C to +100°C
–40°F to +212°F

Tested sample: APT1212W, APT1222W



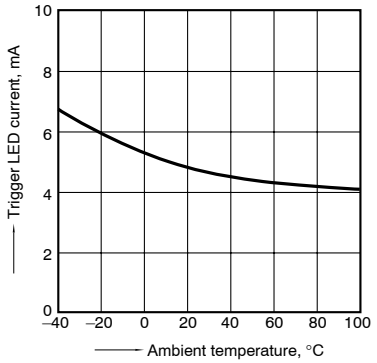
3. On voltage vs. Ambient temperature characteristics

Trigger LED current: 10 mA
ON current: 50 mA AC



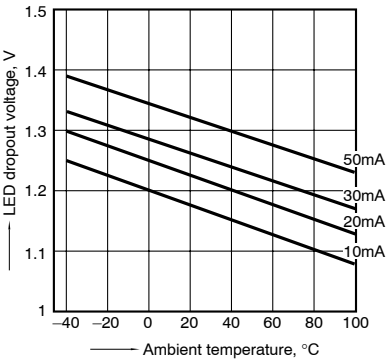
4. Trigger LED current vs. Ambient temperature characteristics

Load voltage: 6 V DC; Load resistance: 100Ω



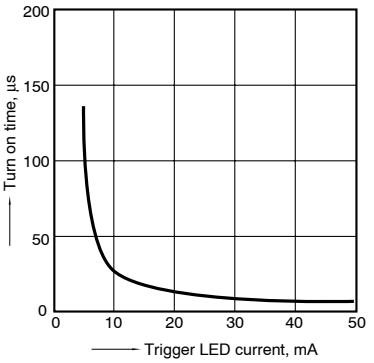
5. LED dropout voltage vs. Ambient temperature characteristics

LED current: 10 to 50 mA



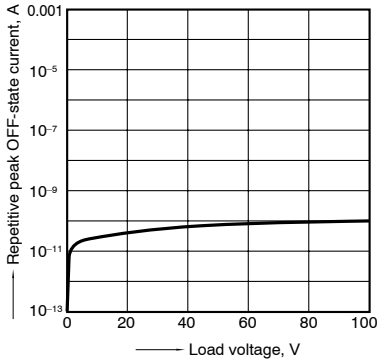
6. Turn on time vs. Trigger LED current characteristics

Load voltage: 6 V DC; Load resistance: 100Ω

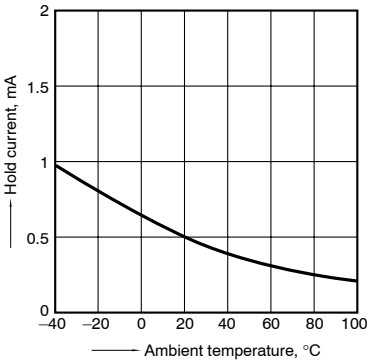


7. Repetitive peak OFF-state current vs. Load voltage characteristics

LED current: 0 mA; Ambient temperature: 25°C 77°F

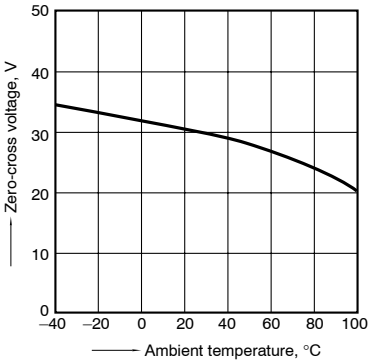


8. Hold current vs. Ambient temperature characteristics



9. Zero-cross voltage vs. Ambient temperature characteristics

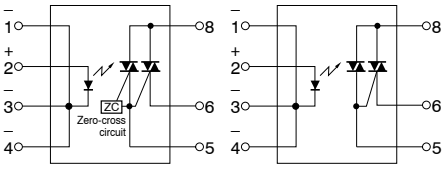
Trigger LED current: 10 mA (APT1211W, APT1212W)



Panasonic
ideas for life

AQ-H SOLID STATE RELAY

AQ-H RELAYS

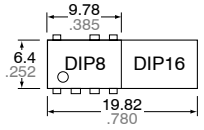



FEATURES

1. Compact DIP type SSR that's ideal for AC load control

2. Supports 0.3 A, 0.6 A, 0.9 A and 1.2 A ON-state RMS currents.

3. The 1.2 A type saves space with a DIP 8-pin package. (Competitor only provides a 16-pin type.)



4. Only ours handles both 100 and 200 V AC loads

This relay handles both voltages in a single product. It is not necessary for users that use both types to manage separate part numbers.

5. High dielectric strength: 5,000 V AC (between input and output)

6. Two types available: Zero-cross type and Non-zero-cross type

TYPICAL APPLICATIONS

1. Home appliances (air conditioners, microwave ovens, washing machines, personal hygiene systems, refrigerators, fan heaters, inductive heating cooker, and water heaters, etc.)

2. Industrial equipment market.

TYPES

Type	Output rating*		Type	Part No.				Packing quantity	
				Through hole terminal	Surface-mount terminal				
	Repetitive peak OFF-state voltage	ON-state RMS current		Tube packing style		Tape and reel packing style		Tube	Tape and reel
						Picked from the 1/2/3/4-pin side	Picked from the 5/6/8-pin side		
AC type	600 V	0.3 A	Zero-cross	AQH0213	AQH0213A	AQH0213AX	AQH0213AZ	1 tube contains 40 pcs. 1 batch contains 400 pcs.	1,000 pcs.
		0.6 A		AQH1213	AQH1213A	AQH1213AX	AQH1213AZ		
		0.9 A		AQH2213	AQH2213A	AQH2213AX	AQH2213AZ		
		1.2 A		AQH3213	AQH3213A	AQH3213AX	AQH3213AZ		
		0.3 A	Non zero-cross	AQH0223	AQH0223A	AQH0223AX	AQH0223AZ		
		0.6 A		AQH1223	AQH1223A	AQH1223AX	AQH1223AZ		
		0.9 A		AQH2223	AQH2223A	AQH2223AX	AQH2223AZ		
		1.2 A		AQH3223	AQH3223A	AQH3223AX	AQH3223AZ		

*Indicate the repetitive peak OFF-state voltage and ON-state RMS current: peak AC.
Note: For space reasons, the SMD terminal shape indicator "A" and the package type indicator "X" and "Z" are omitted from the seal.

RATING

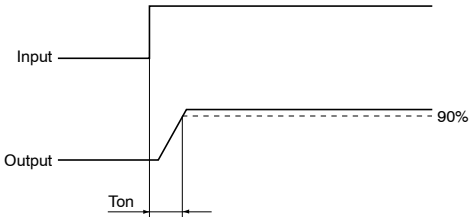
1. Absolute maximum ratings (Ambient temperature: 25°C 77°F)

Item		Symbol	AQH0213	AQH0223	AQH1213	AQH1223	AQH2213	AQH2223	AQH3213	AQH3223	Remarks
Input	LED forward current	I_F	50 mA								
	LED reverse voltage	V_R	6 V								
	Peak forward current	I_{FP}	1 A								f = 100 Hz, Duty Ratio = 0.1%
Output	Repetitive peak OFF-state voltage	V_{DRM}	600 V								
	ON-state RMS current	$I_{T(RMS)}$	0.3 A		0.6 A		0.9 A		1.2 A		
	Non-repetitive surge current	I_{TSM}	3 A		6 A		9 A		12 A		60Hz, 1 cycle
I/O isolation voltage		V_{iso}	5,000 V AC								
Temperature limits	Operating	T_{opr}	–30°C to +85°C –22°F to +185°F								Non-condensing at low temperatures
	Storage	T_{stg}	–40°C to +125°C –40°F to +257°F								

2. Electrical characteristics (Ambient temperature: 25°C 77°F)

Item			Symbol	AQH0213	AQH1213	AQH2213	AQH3213	AQH0223	AQH1223	AQH2223	AQH3223	Condition
Input	LED dropout voltage	Typical	V_F	1.18 V								I_F = 10 mA
		Maximum		1.3 V								
	LED reverse current	Typical	I_R	—								V_R = 6 V
		Maximum		10 μA								
Output	Peak OFF-state current	Typical	I_{DRM}	—								I_F = 0 mA V_{DRM} = 600 V
		Maximum		100 μA								
	Peak ON-state voltage	Typical	V_{TM}	—								I_F = 10 mA I_{TM} = Max.
		Maximum		2.5 V								
	Holding current	Typical	I_H	—								
		Maximum		25 mA								
	Critical rate of rise of OFF-state voltage	Minimum	dv/dt	200 V/μs								V_{DRM} = 600 V ×1/M2
Transfer characteristics	Trigger LED current*	Maximum	I_{FT}	10 mA								V_D = 6 V R_L = 100 Ω
	Zero-cross voltage**	Maximum	V_{ZC}	50 V				—				I_F = 10 mA
	Turn on time***	Maximum	T_{ON}	100 μs								I_F = 20 mA V_D = 6 V R_L = 100 Ω
	I/O isolation resistance	Minimum	R_{iso}	50 GΩ								500 V DC

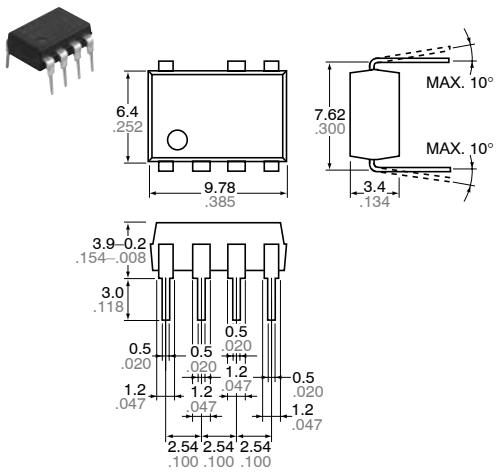
Notes: *Recommended LED current I_F: 20 mA
**Applicable part No.: AQH0213, AQH1213, AQH2213 and AQH3213.
***Turn on time



DIMENSIONS

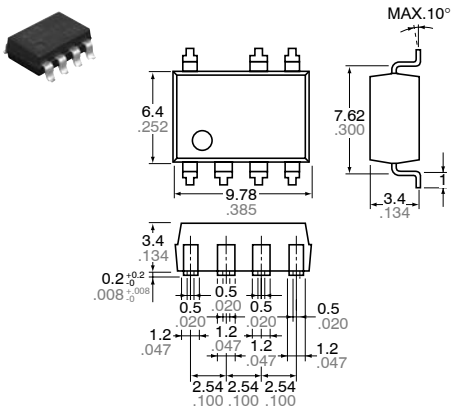
mm inch

Through hole terminal type



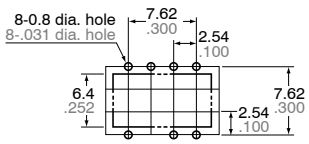
Terminal thickness: 0.25 .010
General tolerance: ±0.1 ±.004

Surface mount terminal type



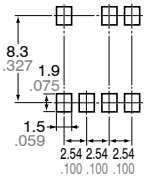
Terminal thickness: 0.25 .010
General tolerance: ±0.1 ±.004

PC board pattern
(BOTTOM VIEW)



Tolerance: ±0.1 ±.004

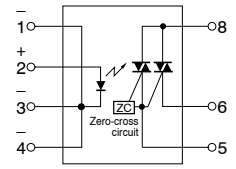
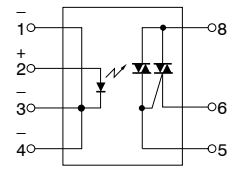
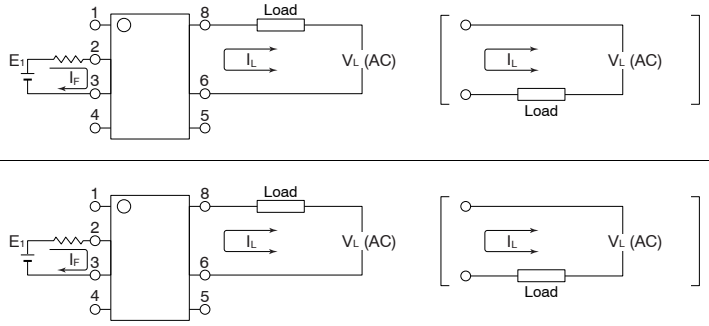
Recommended mounting pad
(TOP VIEW)



Tolerance: ±0.1 ±.004

SCHEMATIC AND WIRING DIAGRAMS

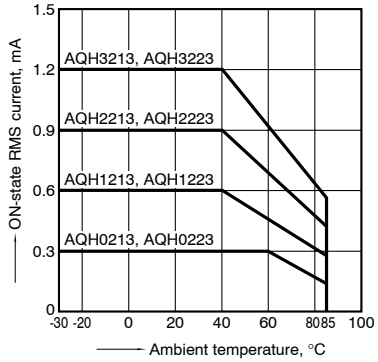
Notes: E_1: Power source at input side; I_F: Trigger LED forward current; V_L: Load voltage; I_L: Load current;

Schematic	Output configuration	Load	Wiring diagram
 	1a	AC	

REFERENCE DATA

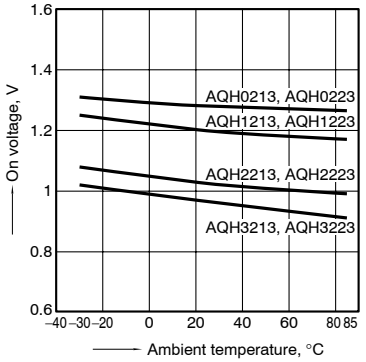
1. ON-state RMS current vs. Ambient temperature characteristics

Allowable ambient temperature:
–30°C to +85°C –22°F to +185°F



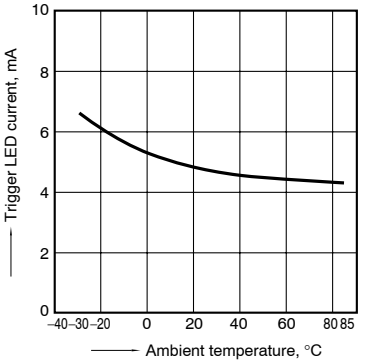
2. On voltage vs. Ambient temperature characteristics

LED current: 10 mA; ON current: Max.
Measured portion: between terminals 6 and 8



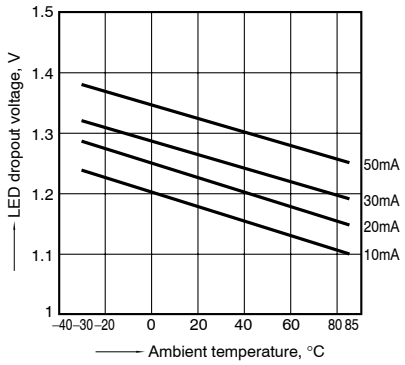
3. Trigger LED current vs. Ambient temperature characteristics

Load voltage: 6 V DC;
Load resistance: 100Ω



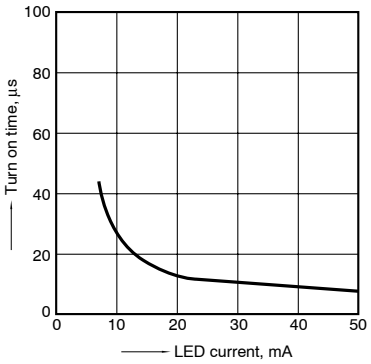
4. LED dropout voltage vs. Ambient temperature characteristics

LED current: 10 to 50 mA



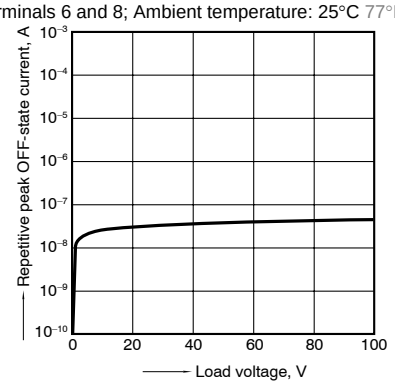
5. Turn on time vs. LED current characteristics

Load voltage: 6 V DC; Load resistance: 100Ω
Measured portion: between terminals 6 and 8

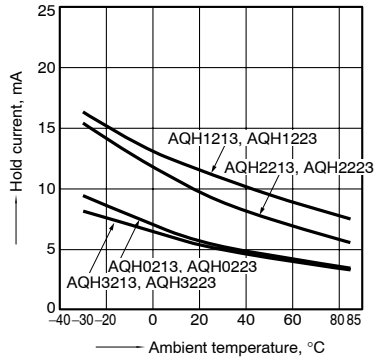


6. Repetitive peak OFF-state current vs. Load voltage characteristics

LED current: 0 mA; Measured portion: between terminals 6 and 8; Ambient temperature: 25°C 77°F

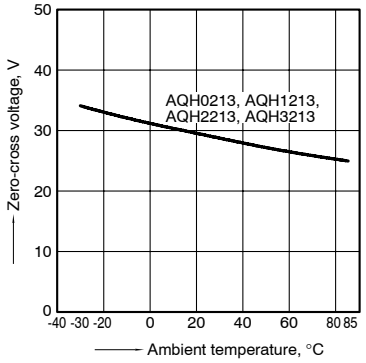


7. Hold current vs. Ambient temperature characteristics



8. Zero-cross voltage vs. Ambient temperature characteristics

LED current: 10 mA

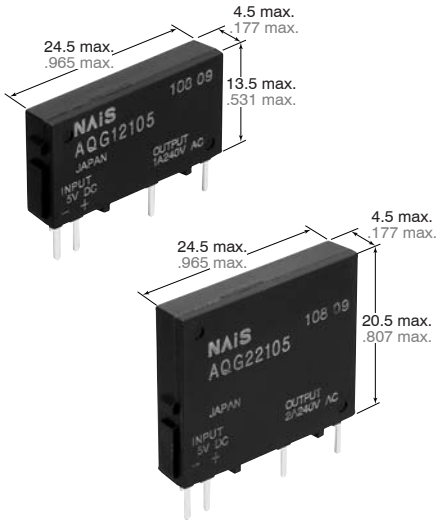


For Cautions for Use, see page 268.

Panasonic
ideas for life

AQ-G SOLID STATE RELAY

AQ-G RELAYS



mm inch

FEATURES

1. Space saving, Slim size with a maximum thickness of 4.5 mm.
Mounting space has been reduced to 30% (compared to conventional SSR's) while meeting high density PC board mounting requirements.

2. 1A and 2A load types available

3. Zero-cross type and Non zero-cross type available

4. High dielectric strength of 3,000V AC
(between input and output)

5. Snubber circuit integrated
The snubber circuit is integrated to prevent malfunction caused by the rapid rise of voltage on the output side, such as inductive load and current.

TYPES

Type	Load current	Load voltage	Input voltage	Part No.
Zero-cross	1A	75 to 264 V AC	5 V DC	AQG12105
			12 V DC	AQG12112
			24 V DC	AQG12124
	2A	75 to 264 V AC	5 V DC	AQG22105
			12 V DC	AQG22112
			24 V DC	AQG22124
Non zero-cross	1A	75 to 264 V AC	5 V DC	AQG12205
			12 V DC	AQG12212
			24 V DC	AQG12224
	2A	75 to 264 V AC	5 V DC	AQG22205
			12 V DC	AQG22212
			24 V DC	AQG22224

TYPICAL APPLICATIONS

- **Manufacturing equipment**
  - NC machines
  - Injection molders
  - Robots
- **Air conditioners**
- **Computers**

ORDERING INFORMATION

Ex. AQG | 1 | 2 | 1 | 0 | 5

Load current	Load voltage	Type	Input voltage
1: 1 A 2: 2 A	2: 75 to 264 V AC	1: Zero-cross (3,000 V) 2: Non zero-cross (3,000 V)	05: 5 V DC 12: 12 V DC 24: 24 V DC

(Note) Standard packing: Carton 20 pcs., Case 500 pcs.

SPECIFICATIONS

1. Ratings (at 20°C 68°F, Input voltage ripple: 1% or less)

1) Zero-cross type

Item	Type	Part No.						Remarks
		AQG12105	AQG12112	AQG12124	AQG22105	AQG22112	AQG22124	
Input side	Input voltage	4 to 6 V DC	9.6 to 14.4 V DC	19.2 to 28.8 V DC	4 to 6 V DC	9.6 to 14.4 V DC	19.2 to 28.8 V DC	
	Input impedance	Approx. 0.3k Ω	Approx. 0.8k Ω	Approx. 1.6k Ω	Approx. 0.3k Ω	Approx. 0.8k Ω	Approx. 1.6k Ω	
	Drop-out voltage, min.	1 V						
	Reverse voltage	3 V						
Load side	Max. load current	1 A AC			2 A AC			
	Load voltage	75 to 264 V AC						
	Frequency	45 to 65 Hz						
	Non-repetitive surge current	8 A			30 A			In one cycle at 60 Hz
	Max. “OFF-state” leakage current	1.5 mA (applied 200 V)						
	Max. “ON-state” voltage drop	1.6 V						at Max. carrying current
	Min. load current	20 mA						

2) Non zero-cross type

Item	Type	Part No.						Remarks
		AQG12205	AQG12212	AQG12224	AQG22205	AQG22212	AQG22224	
Input side	Input voltage	4 to 6 V DC	9.6 to 14.4 V DC	19.2 to 28.8 V DC	4 to 6 V DC	9.6 to 14.4 V DC	19.2 to 28.8 V DC	
	Input impedance	Approx. 0.3k Ω	Approx. 0.8k Ω	Approx. 1.6k Ω	Approx. 0.3k Ω	Approx. 0.8k Ω	Approx. 1.6k Ω	
	Drop-out voltage, min.	1 V						
	Reverse voltage	3 V						
Load side	Max. load current	1 A AC			2 A AC			
	Load voltage	75 to 264 V AC						
	Frequency	45 to 65 Hz						
	Non-repetitive surge current	8 A			30 A			In one cycle at 60 Hz
	Max. “OFF-state” leakage current	1.5 mA (applied 200 V)						
	Max. “ON-state” voltage drop	1.6 V						at Max. carrying current
	Min. load current	20 mA						

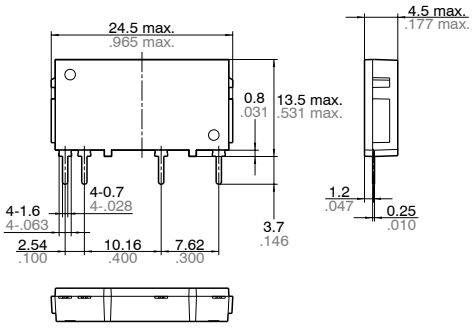
2. Characteristics (at 20°C 68°F, Input voltage ripple: 1% or less)

Item	Zero-cross type	Non zero-cross type	Remarks
Operate time max.	(1/2 cycle of voltage sine wave) + 1 ms	1 ms	
Release time, max.	(1/2 cycle of voltage sine wave) + 1 ms		
Insulation resistance, min.	10^9 Ω between input and output		Using 500 V DC megger
Breakdown voltage	3,000 Vrms between input and output		Initial for 1 min.
Vibration resistance	10 to 55 Hz double amplitude of 0.75 mm		X, Y, Z axes
Shock resistance	1,000 m/s^2		X, Y, Z axes
Ambient temperature	–30°C to +80°C –22°F to +176°F		Non-condensing at low temperatures
Storage temperature	–30°C to +100°C –22°F to +212°F		
Operational method	Zero-cross (Turn-ON and Turn-OFF)	Random turn ON, zero-cross turn OFF	

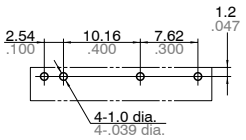
DIMENSIONS

mm inch

1. 1A type

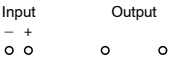


PC board pattern (Bottom view)



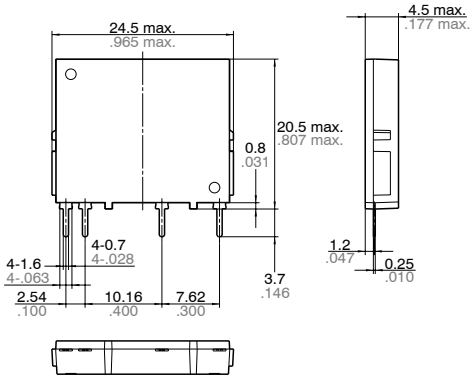
Tolerance: ±0.1 ±.004

Schematic
AC type

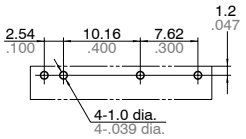


General tolerance: ±0.2 ±.008

2. 2A type

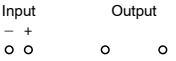


PC board pattern (Bottom view)



Tolerance: ±0.1 ±.004

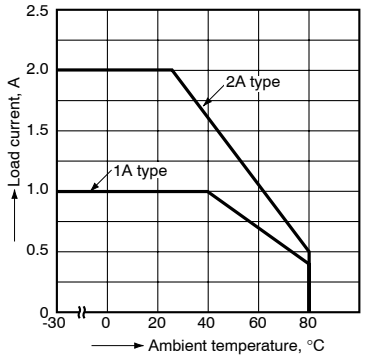
Schematic
AC type



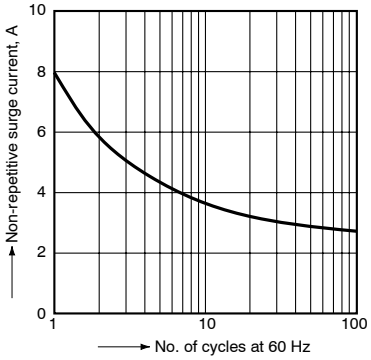
General tolerance: ±0.2 ±.008

REFERENCE DATA

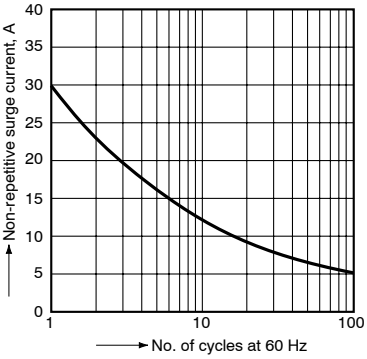
1. Load current vs. ambient temperature



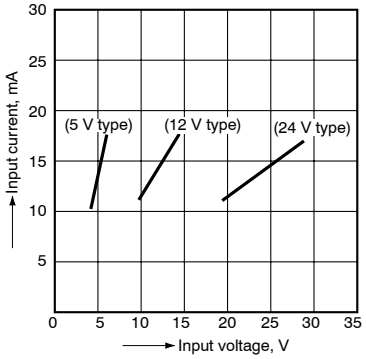
2.-(1) Non-repetitive surge current vs. carrying time (1A type)



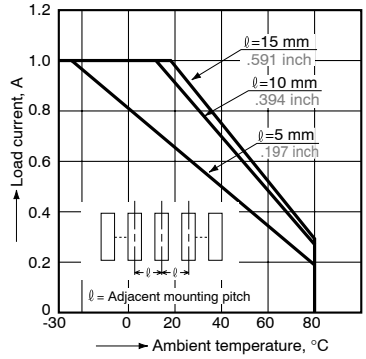
2.-(2) Non-repetitive surge current vs. carrying time (2A type)



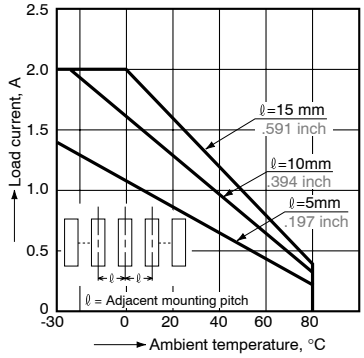
3. Input current vs. input voltage characteristics



4.-(1) Load current vs. ambient temperature characteristics for adjacent mounting (1A type)



4.-(2) Load current vs. ambient temperature characteristics for adjacent mounting (2A type)

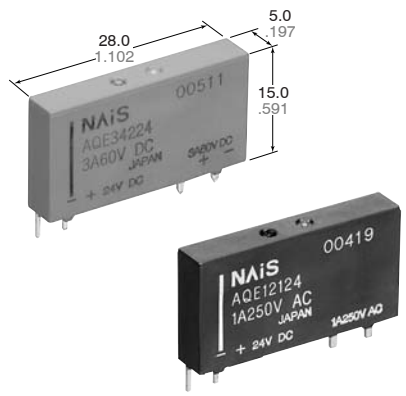


For Cautions for Use, see page 269.

Panasonic
ideas for life

AQ-E SOLID STATE RELAY

AQ-E RELAYS



mm inch

FEATURES

1. Conforms to European safety standards (VDE0110)
dielectric distance between input and output
• Creepage distance: Min. 3.0 mm
• Clearances distance: Min. 2.5 mm

2. The small-sized slim type
28 mm (L)×5 mm (W)×15 mm
1.063 inch (L)×.197 inch (W)×.591 inch
permits high density mounting to PC board

3. High dielectric strength: 2,500V AC
(between input and output)

4. Two load types available:
DC output type (3A)
AC output type (1A)

5. Zero-cross type are available (AC type)
The zero-cross type generates minimal noise

6. Snubber circuit integrated (AC type)
The snubber circuit is integrated to prevent malfunction caused by the rapid rise of voltage on the output side, such as inductive load and current.

TYPES

Type	Load voltage	Input voltage	Part No.
AC output	75 to 250 V AC	5 V DC	AQE12105
		12 V DC	AQE12112
		24 V DC	AQE12124
DC output	3 to 60 V DC	5 V DC	AQE34205
		12 V DC	AQE34212
		24 V DC	AQE34224

TYPICAL APPLICATIONS

- **Interface relays for programmable controllers**
- **Industrial equipment**
- **Timers and counters**
- **Air conditioners**

ORDERING INFORMATION

Ex. AQE [1] [2] [1] [0] [5]

Load current	Load voltage	Type	Input voltage
1: 1 A 3: 3 A	2: 75 to 250 V AC 4: 3 to 60 V DC	1: AC output (Zero-cross) 2: DC output	05: 5 V DC 12: 12 V DC 24: 24 V DC

(Note) Standard packing: Carton 20 pcs., Case 1,000 pcs.

SPECIFICATIONS

Ratings (at 20°C 68°F, Input voltage ripple: 1% or less)

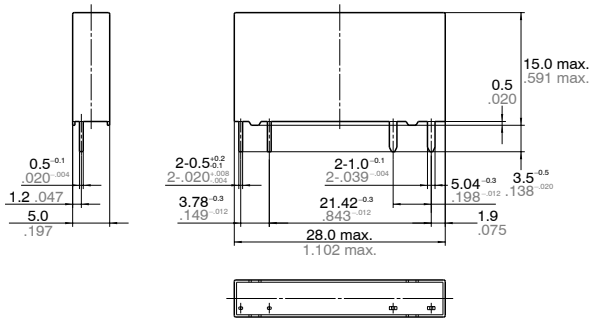
Item	Type	AC output			DC output			Remarks
	Part No.	AQE12105	AQE12112	AQE12124	AQE34205	AQE34212	AQE34224	
Input side	Input voltage	4 to 6 V DC	9.6 to 14.4 V DC	21.6 to 26.4 V DC	4 to 6 V DC	9.6 to 14.4 V DC	21.6 to 26.4 V DC	
	Input impedance	Approx. 0.5k Ω	Approx. 1.3k Ω	Approx. 3k Ω	Approx. 0.5k Ω	Approx. 1.3k Ω	Approx. 3k Ω	
	Drop-out voltage, min.	0.5 V DC	1.2 V DC	2.4 V DC	0.5 V DC	1.2 V DC	2.4 V DC	
	Reverse voltage	3 V						
Load side	Max. load current	1 A AC			3 A DC			
	Load voltage	75 to 250 V AC			3 to 60 V DC			
	Frequency	45 to 65 Hz			—			
	Non-repetitive surge current	20 A			15 A			AC: In one cycle at 60 Hz DC: 10 ms
	Max. “OFF-state” leakage current	1.5 mA (applied 200 V)			10μA			
	Max. “ON-state” voltage drop	1.6 V			0.3 V			at Max. carrying current
	Min. load curent	20 mA			1 mA			
	OFF state dV/dt	50 V/μs			—			
	Max. operating speed	—			0.5cps.			at rated operating voltage, rated load voltage and current

Characteristics (at 20°C 68°F, Input voltage ripple: 1% or less)

Item		AC output	DC output	Remarks
Operate time max.		(1/2 cycle of voltage sine wave) + 1 ms	2 ms	
Release time, max.		(1/2 cycle of voltage sine wave) + 1 ms	0.4 ms	
Insulation resistance, min.		10^9 Ω between input and output		Using 500 V DC megger
Breakdown voltage		2,500 Vrms between input and output		Initial for 1 min.
Vibration resistance	Functional	10 to 55 Hz double amplitude of 1.5 mm		1 hour for X, Y, Z axes
	Destructive	10 to 55 Hz double amplitude of 1.5 mm		10 min. for X, Y, Z axes
Shock resistance	Functional	Min. 490 m/s² {50 G}		5 times each for X, Y, Z axes
	Destructive	Min. 490 m/s² {50 G}		4 times each for X, Y, Z axes
Ambient temperature		–30°C to +80°C –22°F to +176°F		
Storage temperature		–30°C to +100°C –22°F to +212°F		
Operational method		Zero-cross (Turn-ON and Turn-OFF)	—	

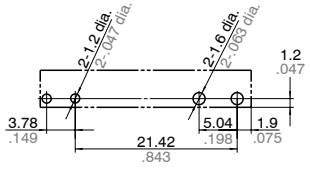
DIMENSIONS

mm inch



General tolerance: ±0.5 ±.020

Mounting hole location (Bottom view)



Tolerance: ±0.1 ±.004

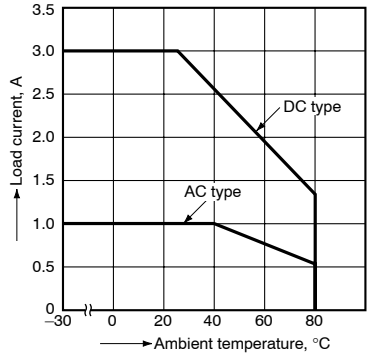
Schematic

AC type

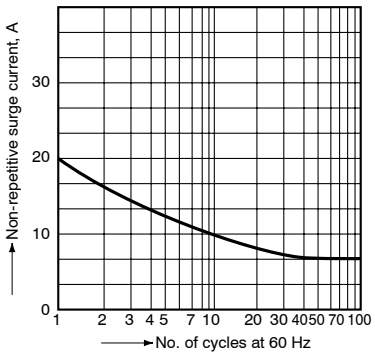
DC type

REFERENCE DATA

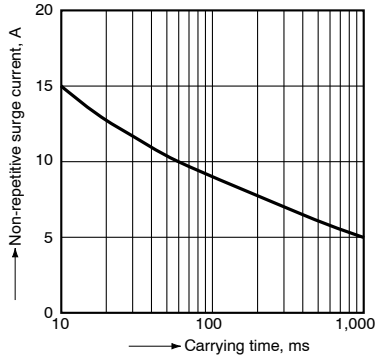
1. Load current vs. ambient temperature



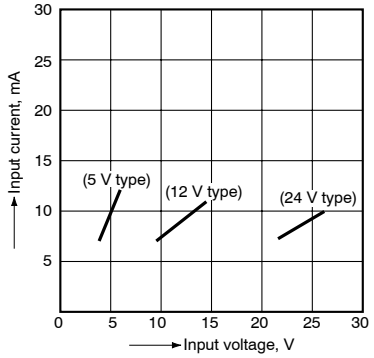
2.-(1) Non-repetitive surge current vs. carrying time (AC output)



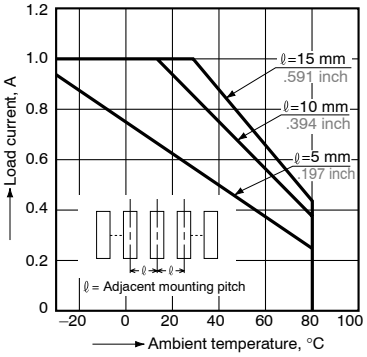
2.-(2) Non-repetitive surge current vs. carrying time (DC output)



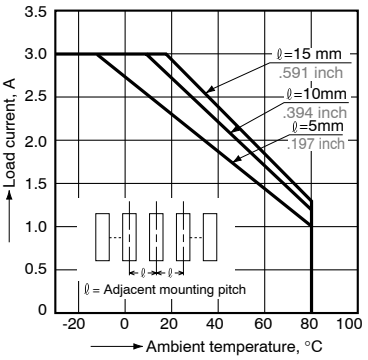
3. Input current vs. input voltage characteristics



4.-(1) Load current vs. ambient temperature characteristics for adjacent mounting (AC output)



4.-(2) Load current vs. ambient temperature characteristics for adjacent mounting (DC output)



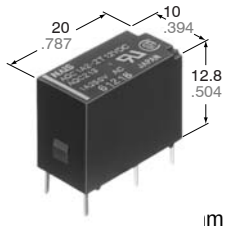
For Cautions for Use, see page 269.

Please contact us about TÜV certified products.

Panasonic
ideas for life

AQ-C SOLID STATE RELAY

AQ-C RELAYS



mm inch

FEATURES

- **Compact DIL type: 20 mm (length) × 10 mm (width) × 12.8 mm (height) (.787×.394×.504 inch)**
- **Excellent in noise resistance**
- **Snubber circuit integrated**
- **High dielectric strength: 2,500 V between input and output**
- **Reverse polarity type available**

TYPES

1. Input module

Type	Output voltage	Input voltage	Part No.
AC input	4 to 32 V DC	80 to 250 V AC	AQCD3-IM 100/240 V AC
DC input	4 to 32 V DC	3 to 32 V DC	AQCD3-IM 4/24 V DC

2. Output module

Type	Load voltage	Input voltage	Part No.
AC output Zero-cross	75 to 125 V AC	5 V DC	AQC1A1 - ZT5 V DC
		12 V DC	AQC1A1 - ZT12 V DC
		24 V DC	AQC1A1 - ZT24 V DC
	75 to 250 V AC	5 V DC	AQC1A2 - ZT5 V DC
		12 V DC	AQC1A2 - ZT12 V DC
		24 V DC	AQC1A2 - ZT24 V DC
AC output Non Zero-cross	75 to 125 V AC	5 V DC	AQC1A1 - T 5 V DC
		12 V DC	AQC1A1 - T 12 V DC
		24 V DC	AQC1A1 - T 24 V DC
	75 to 250 V AC	5 V DC	AQC1A2 - T 5 V DC
		12 V DC	AQC1A2 - T 12 V DC
		24 V DC	AQC1A2 - T 24 V DC
DC output	3 to 60 V DC	5 V DC	AQC1AD1- 5 V DC
		12 V DC	AQC1AD1- 12 V DC
		24 V DC	AQC1AD1- 24 V DC

ORDERING INFORMATION

AQC [1A] [D1] — [ZT] [5VDC] — [R]

Load current	Load voltage	Type	Input voltage	Input polarity
Nil: Input module 1A: Output module	1: 75 to 125 V AC (Output module) 2: 75 to 250 V AC (Output module) D1: 3 to 60 V DC (Output module) D3: 4 to 32 V DC (Input module)	Nil: DC output IM: Input module T: AC output Non Zero-cross ZT: AC output Zero-cross	Output module: 5, 12, 24 V DC Input module: 4/24 V DC, 100/240 V AC	Nil: Standard polarity R: Reverse polarity (Only for output module)

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

SPECIFICATIONS

Rating [at 20°C 68°F; Input voltage ripple (output module) and output voltage ripple (input module): max. 1%]

1. Input module

Item	Type	AC input AQCD3-M 100/240 V AC	DC input AQCD3-IM 4/24 V DC	Remarks
Input side	Input voltage	80 to 250 V AC	3 to 32 V DC	
	Input current	Max. 5 mA	Max. 5 mA	
	Pick-up voltage	Max. 80 V AC	Max. 3 V DC	
	Drop-out voltage	Min. 10 V AC	Min. 1 V DC	
Output side	Load voltage	4 to 32 V DC	4 to 32 V DC	
	Load current	0.1 to 25 mA	0.1 to 25 mA	
	Max. “OFF-state” leakage current	Max. 5μA	Max. 5μA	When 32 V DC applied
	Max. “ON-state” voltage drop	Max. 1.6 V	Max. 1.6 V	at max. carrying current

2. Output module

(1) AC output type

Item \ Type		AQC1A1-ZT5VDC / AQC1A1-T5VDC	AQC1A1-ZT12VDC / AQC1A1-T12VDC	AQC1A1-ZT24VDC / AQC1A1-T24VDC	AQC1A2-ZT5VDC / AQC1A2-T5VDC	AQC1A2-ZT12VDC / AQC1A2-T12VDC	AQC1A2-ZT24VDC / AQC1A2-T24VDC	Remarks
Input side	Input voltage	(5 V type) 4 to 6 V DC	(12 V type) 9.6 to 14.4 V DC	(24 V type) 21.6 to 26.4 V DC	(5 V type) 4 to 6 V DC	(12 V type) 9.6 to 14.4 V DC	(24 V type) 21.6 to 26.4 V DC	See “Data 3”.
	Input impedance (Approx.)	0.3 k Ω	0.8 k Ω	1.8 k Ω	0.3 k Ω	0.8 k Ω	1.8 k Ω	
	Drop-out voltage, min	0.5 V	1.2 V	2.4 V	0.5 V	1.2 V	2.4 V	
Load side	Max. load current	1 A						See “Data 1”. Ta = Min. 40°C
	Load voltage	75 to 125 V AC			75 to 250 V AC			
	Non-repetitive surge current	20 A						See “Data 2”. In one cycle at 60 Hz
	Max. “OFF-state” leakage current	0.6 m A (When 100 V AC applied)			1.1 m A (When 200 V AC applied)			at 60 Hz
	Max. “ON-state” voltage drop	1.6 A						at max. carrying current
	Min. load current	10 mA			20 mA			

(2) DC output type

Item \ Type		AQC1AD1-5VDC	AQC1AD1-12VDC	AQC1AD1-24VDC	Remarks
Input side	Input voltage	(5 V type) 4 to 6 V DC	(12 V type) 9.6 to 14.4 V DC	(24 V type) 21.6 to 26.4 V DC	See “Data 3”.
	Input impedance (Approx.)	430 Ω	1.2 k Ω	2.8 k Ω	
	Drop-out voltage, min	0.8 V			
Load side	Max. load current	1 A			See “Data 1”. Ta = Min. 40°C
	Load voltage	3 to 60 V DC			
	Non-repetitive surge current	1.5 A			See “Data 2”. at 1s
	Max. “OFF-state” leakage current	0.1 m A (When 60 V DC applied)			
	Max. “ON-state” voltage drop	1.6 V			at max. carrying current
	Min. load current	1 mA			

Characteristics [at 20°C 68°F; Input voltage ripple (output module) and output voltage ripple (input module): max. 1%]

Input module

Item \ Type		AC Input	DC Input	Remarks
Operate time, max.		20 ms	0.5 ms	Input voltage: 24 V DC or 100V AC Output voltage: 24 V DC Output current: 25mA
Release time, max		20 ms	0.5 ms	
Insulation resistance, min.		10^9 Ω between input and output		at 500 V DC
Breakdown voltage		2,500 Vrms between input and output		For 1 minute
Vibration resistance	Functional	10 to 55Hz double amplitude of 3 mm		10 minutes for X,Y, Z, axis
	Destructive	10 to 55Hz double amplitude of 3 mm		1 hour for X,Y, Z, axis
Shock resistance	Functional	Min. 980 m/s² {100 G}		4 time each for X,Y,Z axis
	Destructive	Min. 980 m/s² {100 G}		5 time each for X,Y,Z axis
Ambient temperature		–30°C to +80°C –22°F to +176°F		
Storage temperature		–30°C to +100°C –22°F to +212°F		

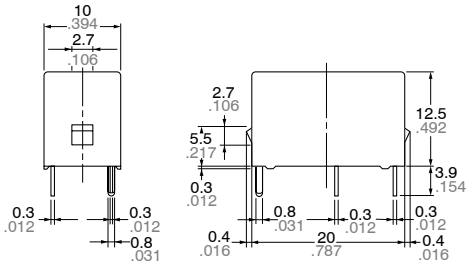
Output module

Item \ Type		AC output		DC output	Conditions
		Non zero-cross	Zero-cross		
Operate time, max.		1 ms	(1/2 cycle of voltage sine wave)+1ms	0.5 ms	
Release time, max.		(1/2 cycle of voltage sine wave)+1ms		1 ms	
Insulation resistance, min.		10^9Ω between input and output			at 500 V DC
Breakdown voltage		2,500 Vrms between input and output			For 1 minute
Vibration resistance	Functional	10 to 55Hz double amplitude of 3 mm			10 minutes for X,Y, Z, axis
	Destructive	10 to 55Hz double amplitude of 3 mm			1 hour for X,Y, Z, axis
Shock resistance	Functional	Min. 980 m/s² {100 G}			4 time each for X,Y,Z axis
	Destructive	Min. 980 m/s² {100 G}			5 time each for X,Y,Z axis
Ambient temperature		–30°C to +80°C –22°F to +176°F			
Storage temperature		–30°C to +100°C –22°F to +212°F			
Operational method		Random Turn-ON, Zero-cross Turn-OFF	Zero-cross (Turn-ON and Turn-OFF)	—	

DIMENSIONS

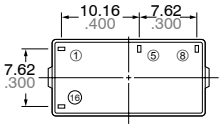
mm inch

1. Input module (AC, DC)



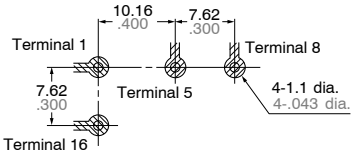
AC input
⑤ Output: DC-□
⑧ Output: DC+
⑯ Input: AC
① Input: AC
Case color: Yellow

DC input
⑤ Output: DC-
⑧ Output: DC+
⑯ Input: DC+
① Input: DC-
Case color: White



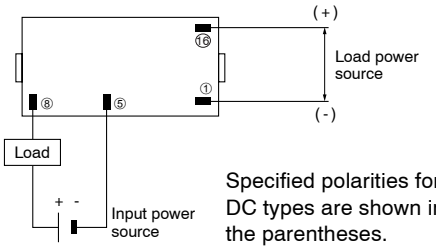
General tolerance: ±0.5 ±.020

PC board pattern (Copper-side view)



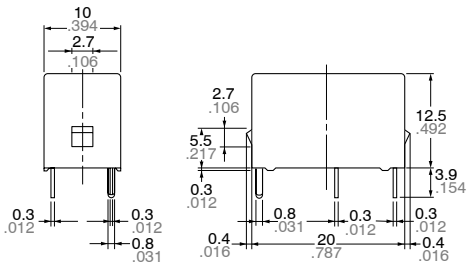
Tolerance: ±0.1 ±.004

Schematic



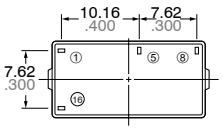
Specified polarities for DC types are shown in the parentheses.

2. Output module (AC, DC)



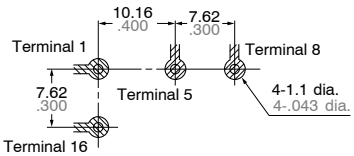
AC output
⑤ Output: AC
⑧ Output: AC
⑯ Input: DC+
① Input: DC-
Case color: Black

DC output
⑤ Output: DC-
⑧ Output: DC+
⑯ Input: DC+
① Input: DC-
Case color: Red



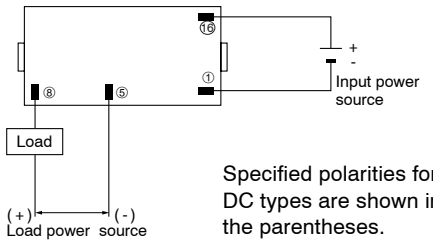
General tolerance: ±0.5 ±.020

PC board pattern (Copper-side view)



Tolerance: ±0.1 ±.004

Schematic



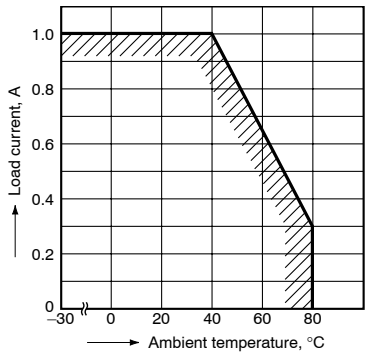
Specified polarities for DC types are shown in the parentheses.

ACCESSORY

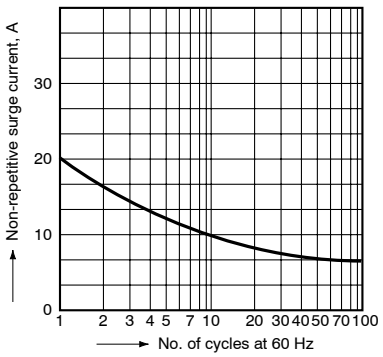
PCIA-PS

REFERENCE DATA

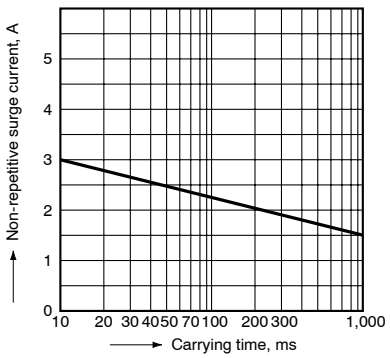
1. Load current vs. ambient temperature



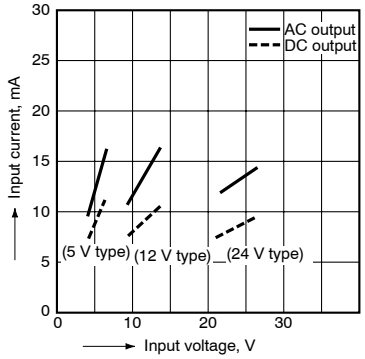
2.-(1) Non-repetitive surge current vs. carrying time (AC output)



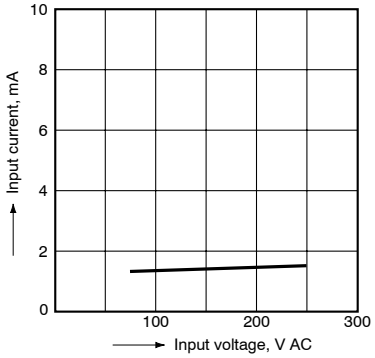
2.-(2) Non-repetitive surge current vs. carrying time (DC output)



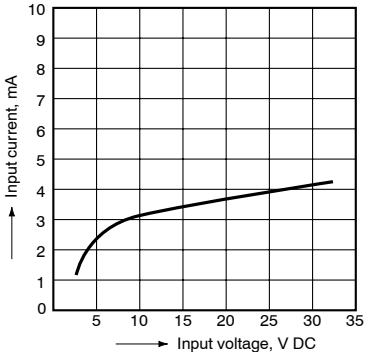
3. Input current vs. input voltage characteristics (AC/DC output)



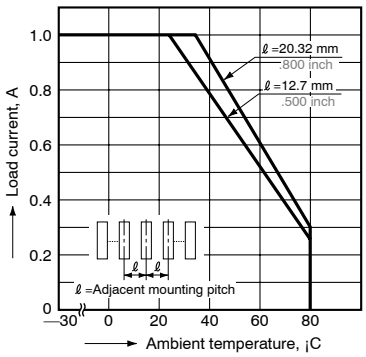
4.-(1) Input current vs. input voltage characteristics (AC input)
Tested sample: AQCD3-IM100/240 V AC, 5 pcs.



4.-(2) Input current vs. input voltage characteristics (DC input)
Tested sample: AQCD3-IM4/24 V DC

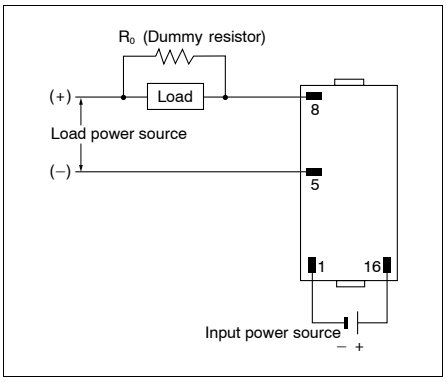


5. Load current vs. ambient temperature characteristics for adjacent mounting

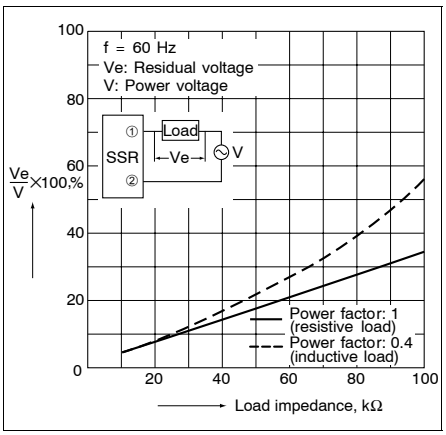


NOTE

When used for the load less than rated
In the case of the load current less than rated, malfunction may result from the residual voltage across the both ends of the load even if the solid state relay is turned off.
Use a dummy resistor as a countermeasure.
The total of the current through the resistor and the load current must exceed the min. rated load current.



In case the dummy resistor is not used, keep in mind that the residual voltage becomes as follows:
Example:
For the inductive load by the 5 mA load current and the 200 V AC load voltage, the load impedance becomes 40 kW and Ve/V = 16% is estimated from the below graph.
Accordingly, the 32 V voltage remains across the both ends of the load when the solid state relay is turned off.
• Characteristics of residual voltage vs. load impedance



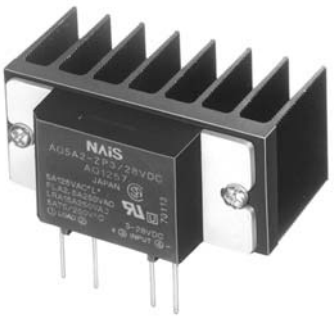
For Cautions for Use, see page 269.

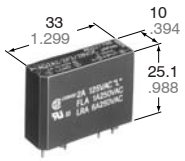
Please contact us about TÜV certified products.

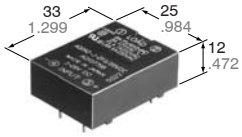
Panasonic
ideas for life

AQ1 SOLID STATE RELAY

AQ1 RELAYS







mm inch

FEATURES

- **Strong against high inrush current and long life**
- **Strong against high inrush current and long life**
  Optical isolation: 5 ×10⁷ operations
- **No chattering or bouncing and no arc generation**
- **Both slim and flat package available**
- **SIL (single in line) terminal layout**
- **Zero-voltage turn-ON and Zero-current turn-OFF for eliminating surge and reducing inrush currents and EMI**

TYPICAL APPLICATIONS

- Traffic signal control
- Terminal equipment of data processing
- Computer peripherals
- NC machines
- Automatic ticket punchers

TYPES

1. AQ1 Solid State Relays

Load	Isolation	Zero-cross function	Type	Input voltage	Load current Load voltage	Part No.
AC	Optically coupled isolation	Zero-cross	2 A (Vertical)	3 to 28 V DC	2 A, 75 to 250 V AC	AQ2A2-ZP3/28VDC
			2 A (flat)	3 to 28 V DC	2 A, 75 to 250 V AC	AQ2A2-J-ZP3/28VDC
			5 A	3 to 28 V DC	5 A, 75 to 250 V AC (3 A without heat sink)	AQ5A2-ZP3/28VDC
DC	Optically coupled isolation	–	1 A	3 to 28 V DC	1 A, 10 to 200 V DC	AQ1AD2-3/28VDC
			2 A	3 to 28 V DC	2 A, 3 to 60 V DC	AQ2AD1-3/28VDC

2. Heat sink for AQ1 solid state relay (for 5 A types): AQ-HS-5A

ORDERING INFORMATION

AQ [2A] [2] [J] [ZP] [3/28 VDC]

Load current	Load voltage	Shape	Type	Input voltage
1 A 2 A 5 A	2: 75 to 250 V AC D1: 3 to 60 V DC D2: 10 to 200 V DC	Nil: Vertical type J: Flat type	Nil:DC output ZP: AC output (Zero-cross)	3/28 V DC: 3 to 28 V DC

SPECIFICATIONS

Rating (at 20°C 68°F, Ripple factor: less than 1%)

1. AC output type

		Zero-cross		Remarks
		2 A	5 A	
Input side	Input voltage	3 to 28 V DC		
	Input impedance	Approx. 1.6 k Ω (3 to 28 V DC)		
	Drop-out voltage, min.	0.8 V		
Load side	Max. load current	2 A	5 A*	at ambient temperature 40°C 104°F
	Load voltage	75 to 250 V AC		
	Non-repetitive surge current	80 A	100 A	See “REFERENCE DATA 2-(1), (2)” In one cycle at 60 Hz
	Max. “OFF-state” leakage current	5 mA		at 200 V AC 60 Hz
	Max. “ON-state” voltage drop	1.6 V		at Max. carrying current
	Min. load current	50 mA		

*5 A with heat sink 3 A without heat sink see “REFERENCE DATA 1-(2)”

2. DC output type

		1 A type	2 A type	Remarks
Input side	Input voltage	3 to 28 V DC		
	Input impedance	Approx. 1.6 k Ω		
	Drop-out voltage, min.	0.8 V		
Load side	Max. load current	1 A	2 A	at ambient temperature 40°C 104°F
	Load voltage	10 to 200 V DC	3 to 60 V DC	
	Non-repetitive surge current	5 A (1 s)		
	Max. “OFF-state” leakage current	1 mA		at 200 V AC 60 Hz
	Max. “ON-state” voltage drop	2.3 V	1.6 V	at Max. carrying current
	Min. load current	5 mA		

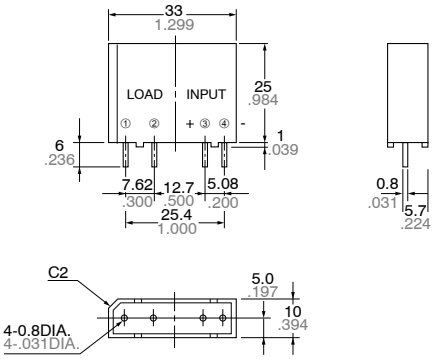
Characteristics (at 20°C 68°F, Ripple factor: less than 1%)

		AC output		DC output	Remarks
		Zero-cross			
		2 A	5 A		
Operate time, Max.		(1/2 cycle of voltage sine wave) + 1 ms		0.5 ms	
Release time, Max.		(1/2 cycle of voltage sine wave) + 1 ms		2 ms	
Insulation resistance, Min.		100 M Ω for input, output and case		100 M Ω for input, output	at 500 V DC
Breakdown voltage		3,000 Vrms between input and output	3,000 Vrms between input and output 1,500 Vrms among input, output and case	3,000 Vrms between input-output	
Vibration resistance	Destructive	117.6 m/s² {12G}, 10 to 55 Hz at double amplitude of 2 mm			1 hour for X, Y, Z axis
	Functional	117.6 m/s² {12G}, 10 to 55 Hz at double amplitude of 2 mm			10 minutes for X, Y, Z axis
Shock resistance	Destructive	Min. 980 m/s² {100 G}		Min. 980 m/s² {100 G}	5 times each for X, Y, Z axis
	Functional	Min. 980 m/s² {100 G}		Min. 980 m/s² {100 G}	4 times each for X, Y, Z axis
Ambient temperature		–30°C to +80°C –22°F to +176°F			
Storage temperature		–30°C to +100°C –22°F to +212°F			
Operational method		Zero-cross (Turn-ON and Turn-OFF)		—	

DIMENSIONS

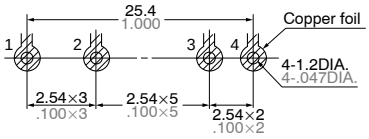
mm inch

AC output, 2A type (vertical)

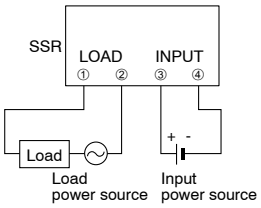


General tolerance: ±0.5 ±.020

Mounting hole location
(Copper-side view)

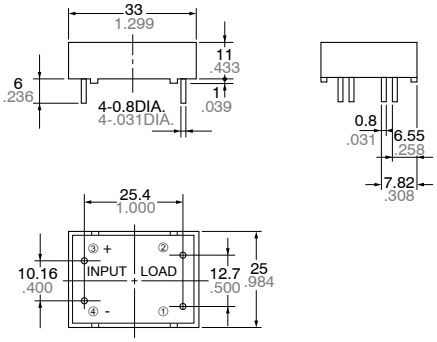


Schematic



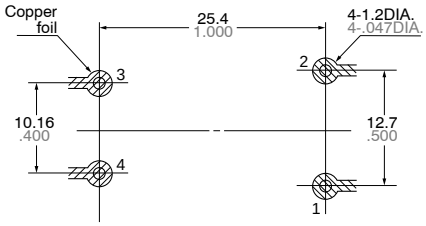
Tolerance: ±0.1 ±.004

AC output, 2A type (Flat)

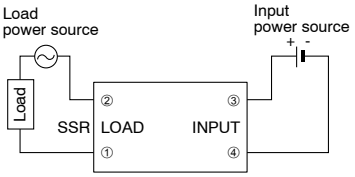


General tolerance: ±0.5 ±.020

Mounting hole location
(Copper-side view)

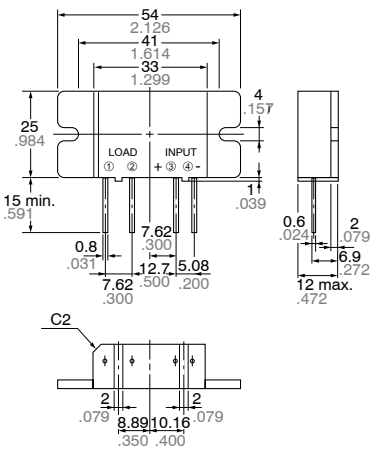


Schematic



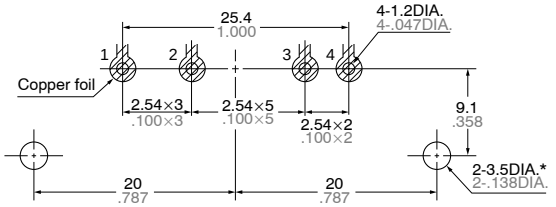
Tolerance: ±0.1 ±.004

AC output, 5A type



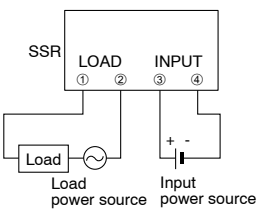
General tolerance: ±0.5 ±.020

Mounting hole location (Copper-side view)



* There 2 holes are not necessary when not using heat sink (AQ-HS-5A)

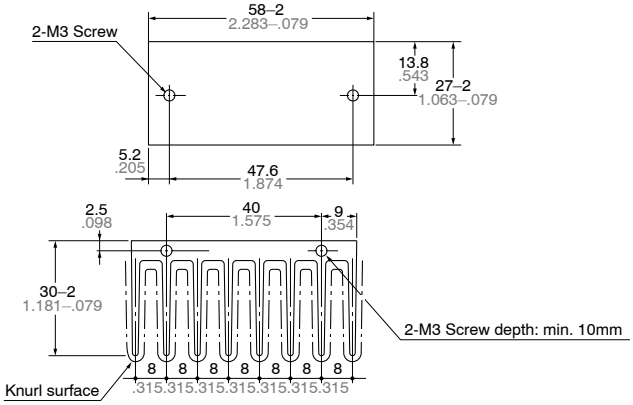
Schematic



Tolerance: ±0.1 ±.004

Heat sink (for AC output, 5A type)
AQ-HS-5A

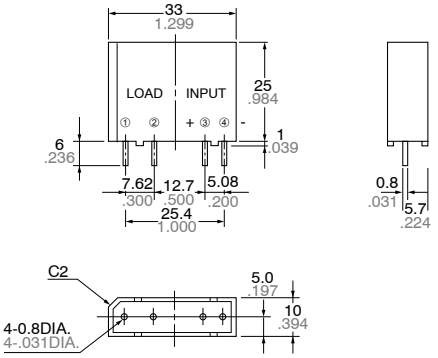
mm inch



When using heat sink, please refer to “Thermal Design (Page 25)”

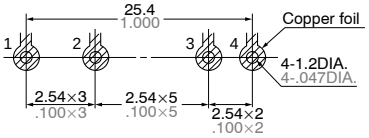
General tolerance: ±0.5 ±.020

DC output, 1A, 2A types

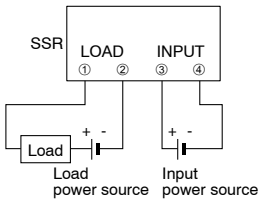


General tolerance: ±0.5 ±.020

Mounting hole location (Copper-side view)



Schematic

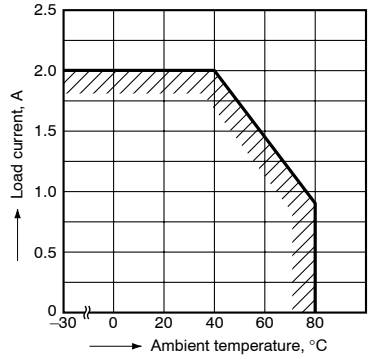


Tolerance: ±0.1 ±.004

REFERENCE DATA

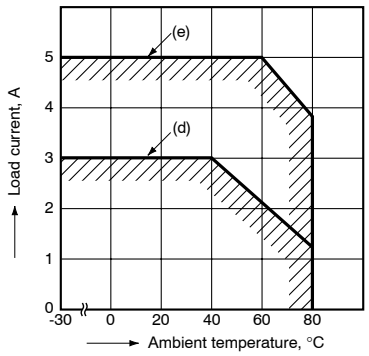
1. Load current vs. ambient temperature

(1) AC output zero-cross type (2 A type)



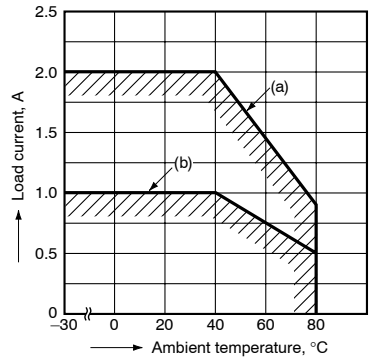
Allowable ambient temperature:
–30°C to +80°C –22°F to +176°F

(2) AC output zero-cross type (5 A type)



d. External heat sink is not used.
e. In the case of mounting on heat sink (AQ-HS-5A) or 66 × 66 × 2.0 thick aluminum plate. The AQ-HS-5A heat sink is mounted on the printed circuit board. The load current is improved compared with the unmounted condition as indicated in the diagram above. When the 5 A type heat sink (AQ-HS-5A) or a heat sink is not use, in order to provide good cooling conditions, the back surface plate should be exposed.

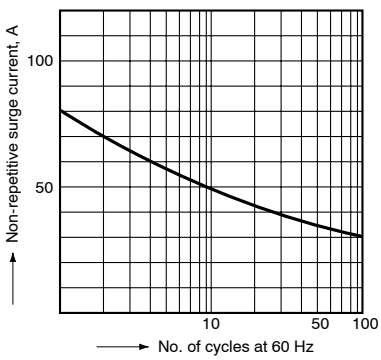
(3) DC type (1 A, 2 A type)



a. DC type (2 A type)
Allowable temperature range:
–30°C to +80°C –22°F to +176°F
b. DC type (1 A type)
Allowable temperature range:
–30°C to +80°C –22°F to +176°F

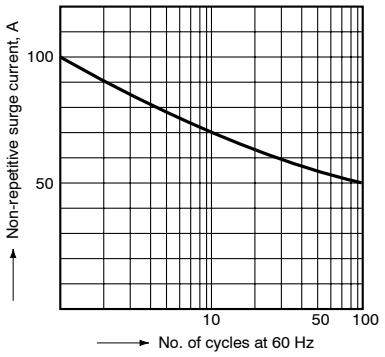
2. Non-repetitive surge current vs. carrying time

(1) AC output zero-crossing type (2 A type)

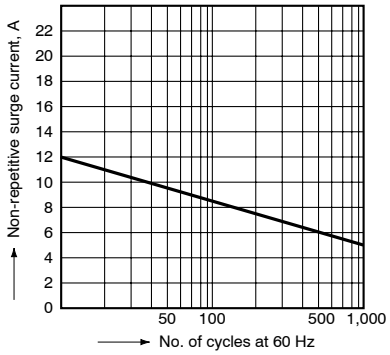


2. Non-repetitive surge current vs. carrying time

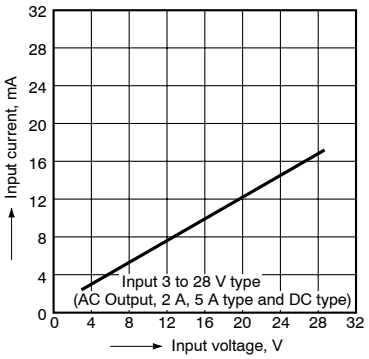
(2) AC output zero-cross type (5 A type)



(3) DC output type



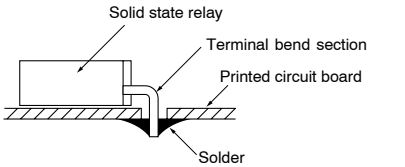
3. Input current vs. input voltage characteristics



NOTE

1. When using bent output terminals

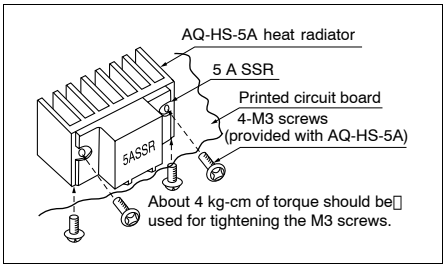
To avoid applying mechanical stress on the main unit and molded section of the solid state relay, radio pliers should be used to grasp the terminals between the point of bending and the molded case when making the bends.



2. When a heat sink is mounted on the 5 A type

The heat sink (AQ-HS-5A) or a heat sink which can make good contact should be used.

If a heat sink is used in which the contact condition is bad, a heat conducting compound should be used to improve the heat radiation. (A silicon compound is a typical example.) The compound should be coated on the heat sink and the AQ1.

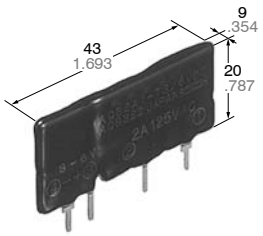


For Cautions for Use, see page 269.

Panasonic
ideas for life

AQ-B SOLID STATE RELAY

AQ-B RELAYS



FEATURES

- **Two types available: Non zero-cross type and Zero-cross type**
  Non zero-cross type permits phase control and Zero-cross type suppresses occurrence of noise.
- **Slim type**
  The small-sized slim type (43 mm long × 9 mm wide × 24 mm high) (1.693×.354×.945 inch) permits high density mounting to PC board.
- **High dielectric strength: 1,500 V AC (between input and output)**
  4,000 V AC (between input and output)

TYPICAL APPLICATIONS

- Copying equipment
- NC machines, sequencers, robots
- Air conditioners

TYPES

Type	Load voltage	Input voltage	Standard type (1,500 V AC) Part No.	Reinforced type (4,000 V AC) Part No.
Zero-cross 1 A	75 to 125 V AC	3 to 6 V DC	AQB1A1-ZT3/6VDC	—
		7 to 14 V DC	AQB1A1-ZT7/14VDC	—
		10 to 18 V DC	AQB1A1-ZT10/18VDC	—
		18 to 30 V DC	AQB1A1-ZT18/30VDC	—
	75 to 250 V AC	3 to 6 V DC	AQB1A2-ZT3/6VDC	AQB1A2-ZV3/6VDC
		7 to 14 V DC	AQB1A2-ZT7/14VDC	AQB1A2-ZV7/14VDC
		10 to 18 V DC	AQB1A2-ZT10/18VDC	AQB1A2-ZV10/18VDC
		18 to 30 V DC	AQB1A2-ZT18/30VDC	AQB1A2-ZV18/30VDC
Zero-cross 2 A	75 to 125 V AC	3 to 6 V DC	AQB2A1-ZT3/6VDC	—
		7 to 14 V DC	AQB2A1-ZT7/14VDC	—
		10 to 18 V DC	AQB2A1-ZT10/18VDC	—
		18 to 30 V DC	AQB2A1-ZT18/30VDC	—
	75 to 250 V AC	3 to 6 V DC	AQB2A2-ZT3/6VDC	AQB2A2-ZV3/6VDC
		7 to 14 V DC	AQB2A2-ZT7/14VDC	AQB2A2-ZV7/14VDC
		10 to 18 V DC	AQB2A2-ZT10/18VDC	AQB2A2-ZV10/18VDC
		18 to 30 V DC	AQB2A2-ZT18/30VDC	AQB2A2-ZV18/30VDC
Non zero-cross 1 A	75 to 125 V AC	3 to 6 V DC	AQB1A1-T3/6VDC	—
		7 to 14 V DC	AQB1A1-T7/14VDC	—
		10 to 18 V DC	AQB1A1-T10/18VDC	—
		18 to 30 V DC	AQB1A1-T18/30VDC	—
	75 to 250 V AC	3 to 6 V DC	AQB1A2-T3/6VDC	AQB1A2-V3/6VDC
		7 to 14 V DC	AQB1A2-T7/14VDC	AQB1A2-V7/14VDC
		10 to 18 V DC	AQB1A2-T10/18VDC	AQB1A2-V10/18VDC
		18 to 30 V DC	AQB1A2-T18/30VDC	AQB1A2-V18/30VDC
Non zero-cross 2 A	75 to 125 V AC	3 to 6 V DC	AQB2A1-T3/6VDC	—
		7 to 14 V DC	AQB2A1-T7/14VDC	—
		10 to 18 V DC	AQB2A1-T10/18VDC	—
		18 to 30 V DC	AQB2A1-T18/30VDC	—
	75 to 250 V AC	3 to 6 V DC	AQB2A2-T3/6VDC	AQB2A2-V3/6VDC
		7 to 14 V DC	AQB2A2-T7/14VDC	AQB2A2-V7/14VDC
		10 to 18 V DC	AQB2A2-T10/18VDC	AQB2A2-V10/18VDC
		18 to 30 V DC	AQB2A2-T18/30VDC	AQB2A2-V18/30VDC

ORDERING INFORMATION

Ex. AQB [1A] [1] —— [ZT] [3/6VDC]

Load current	Load voltage	Type	Input voltage
1A 2A	1: 75 to 125 V AC 2: 75 to 250 V AC	ZT: Zero-cross type: 1,500 V ZV: Zero-cross type: 4,000 V T: Non zero-cross type: 1,500 V V: Non zero-cross type: 4,000 V	3/6, 7/14, 10/18, 18/30 V DC

SPECIFICATIONS

Ratings (at 20°C 68°F, Input voltage ripple: 1% or less)

1. Zero-cross type

1 A type

Item	Part No.	AQB1A1-ZT 3/6VDC	AQB1A1-ZT 7/14VDC	AQB1A1-ZT 10/18VDC	AQB1A1-ZT 18/30VDC	AQB1A2-ZT 3/6VDC AQB1A2-ZV 3/6VDC	AQB1A2-ZT 7/14VDC AQB1A2-ZV 7/14VDC	AQB1A2-ZT 10/18VDC AQB1A2-ZV 10/18VDC	AQB1A2-ZT 18/30VDC AQB1A2-ZV 18/30VDC	Remarks
Input side	Input voltage	3 to 6 V DC	7 to 14 V DC	10 to 18 V DC	18 to 30 V DC	3 to 6 V DC	7 to 14 V DC	10 to 18 V DC	18 to 30 V DC	
	Input impedance	Approx. 0.18 kΩ	Approx. 0.75 kΩ	Approx. 1.2 kΩ	Approx. 2.15 kΩ	Approx. 0.18 kΩ	Approx. 0.75 kΩ	Approx. 1.2 kΩ	Approx. 2.15 kΩ	
	Drop-out voltage, min.	1 V								
Load side	Max. load current	1 A								See “DATA 1”
	Load voltage	75 to 125 V AC				75 to 250 V AC				
	Frequency	45 to 65 Hz								
	Repetitive peak voltage, max.	400 V				600 V				
	Non-repetitive surge current	10A								In one cycle at 60 Hz
	“OFF-state” leakage current	0.6 mA/100 V applied				1.1 mA/200 V applied				at 60 Hz
	Max. “ON-state” voltage drop	1.6 V								at max. carrying current
	Min. load current	10 mA				20 mA				
	OFF state dV/dt	100 V/μs								

2 A type

Item	Part No.	AQB2A1-ZT 3/6VDC	AQB2A1-ZT 7/14VDC	AQB2A1-ZT 10/18VDC	AQB2A1-ZT 18/30VDC	AQB2A2-ZT 3/6VDC AQB2A2-ZV 3/6VDC	AQB2A2-ZT 7/14VDC AQB2A2-ZV 7/14VDC	AQB2A2-ZT 10/18VDC AQB2A2-ZV 10/18VDC	AQB2A2-ZT 18/30VDC AQB2A2-ZV 18/30VDC	Remarks
Input side	Input voltage	3 to 6 V DC	7 to 14 V DC	10 to 18 V DC	18 to 30 V DC	3 to 6 V DC	7 to 14 V DC	10 to 18 V DC	18 to 30 V DC	
	Input impedance	Approx. 0.18 kΩ	Approx. 0.75 kΩ	Approx. 1.2 kΩ	Approx. 2.15 kΩ	Approx. 0.18 kΩ	Approx. 0.75 kΩ	Approx. 1.2 kΩ	Approx. 2.15 kΩ	
	Drop-out voltage, min.	1 V								
Load side	Max. load current	2 A								See “DATA 1”
	Load voltage	75 to 125 V AC				75 to 250 V AC				
	Frequency	45 to 65 Hz								
	Repetitive peak voltage, max.	400 V				600 V				
	Non-repetitive surge current	20A								In one cycle at 60 Hz
	“OFF-state” leakage current	0.6 mA/100 V applied				1.1 mA/200 V applied				at 60 Hz
	Max. “ON-state” voltage drop	1.6 V								at max. carrying current
	Min. load current	10 mA				20 mA				
	OFF state dV/dt	100 V/μs								

2. Non zero-cross type

1 A type

Item \ Part No.		AQB1A1-T 3/6VDC	AQB1A1-T 7/14VDC	AQB1A1-T 10/18VDC	AQB1A1-T 18/30VDC	AQB1A2-T 3/6VDC AQB1A2-V 3/6VDC	AQB1A2-T 7/14VDC AQB1A2-V 7/14VDC	AQB1A2-T 10/18VDC AQB1A2-V 10/18VDC	AQB1A2-T 18/30VDC AQB1A2-V 18/30VDC	Remarks
Input side	Input voltage	3 to 6 V DC	7 to 14 V DC	10 to 18 V DC	18 to 30 V DC	3 to 6 V DC	7 to 14 V DC	10 to 18 V DC	18 to 30 V DC	
	Input impedance	Approx. 0.18 kΩ	Approx. 0.75 kΩ	Approx. 1.2 kΩ	Approx. 2.15 kΩ	Approx. 0.18 kΩ	Approx. 0.75 kΩ	Approx. 1.2 kΩ	Approx. 2.15 kΩ	
	Drop-out voltage, min.	1 V								
Load side	Max.load current	1 A								See “DATA 1”
	Load voltage	75 to 125 V AC				75 to 250 V AC				
	Frequency	45 to 65 Hz								
	Repetitive peak voltage, max.	400 V				600 V				
	Non-repetitive surge current	10A								In one cycle at 60 Hz
	“OFF-state” leakage current	0.6 mA/100 V applied				1.1 mA/200 V applied				at 60 Hz
	Max. “ON-state” voltage drop	1.6 V								at max. carrying current
	Min. load current	10 mA				20 mA				
	OFF state dV/dt	100 V/μs								

2 A type

Item \ Part No.		AQB2A1-T 3/6VDC	AQB2A1-T 7/14VDC	AQB2A1-T 10/18VDC	AQB2A1-T 18/30VDC	AQB2A2-T 3/6VDC AQB2A2-V 3/6VDC	AQB2A2-T 7/14VDC AQB2A2-V 7/14VDC	AQB2A2-T 10/18VDC AQB2A2-V 10/18VDC	AQB2A2-T 18/30VDC AQB2A2-V 18/30VDC	Remarks
Input side	Input voltage	3 to 6 V DC	7 to 14 V DC	10 to 18 V DC	18 to 30 V DC	3 to 6 V DC	7 to 14 V DC	10 to 18 V DC	18 to 30 V DC	
	Input impedance	Approx. 0.18 kΩ	Approx. 0.75 kΩ	Approx. 1.2 kΩ	Approx. 2.15 kΩ	Approx. 0.18 kΩ	Approx. 0.75 kΩ	Approx. 1.2 kΩ	Approx. 2.15 kΩ	
	Drop-out voltage, min.	1 V								
Load side	Max.load current	2 A								See “DATA 1”
	Load voltage	75 to 125 V AC				75 to 250 V AC				
	Frequency	45 to 65 Hz								
	Repetitive peak voltage, max.	400 V				600 V				
	Non-repetitive surge current	20A								In one cycle at 60 Hz
	“OFF-state” leakage current	0.6 mA/100 V applied				1.1 mA/200 V applied				at 60 Hz
	Max. “ON-state” voltage drop	1.6 V								at max. carrying current
	Min. load current	10 mA				20 mA				
	OFF state dV/dt	100 V/μs								

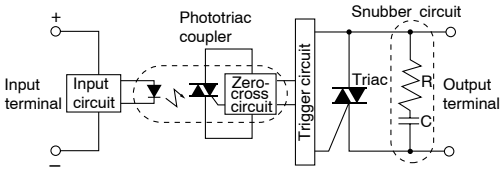
Characteristics (at 20°C 68°F, Input voltage ripple: less than 1%)

Item		Zero-cross type		Non zero-cross type		Remarks
		Standard type	Reinforced type	Standard type	Reinforced type	
Operate time, max.		(1/2 cycle of voltage sine wave) +1 ms		0.5 ms		
Release time, max.		(1/2 cycle of voltage sine wave) +1 ms				
Insulation resistance, min.		10^9 Ω between input and output				
Breakdown voltage		1,500 V AC between input and output	4,000 V AC between input and output	1,500 V AC between input and output	4,000 V AC between input and output	For 1 minute
Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3 mm				10 minutes for X, Y, Z axes
	Destructive	10 to 55 Hz at double amplitude of 3 mm				1 hour for X, Y, Z axes
Shock resistance	Functional	Min. 980 m/s² {100 G}				4 times for X, Y, Z axes
	Destructive	Min. 980 m/s² {100 G}				5 times for X, Y, Z axes
Ambient temperature		–20°C to +80°C –4°F to +176°F				
Storage temperature		–25°C to +85°C –13°F to +185°F				
Operational method		Zero-cross Turn-ON Zero-cross Turn-OFF		Random Turn-ON Zero-cross Turn-OFF		

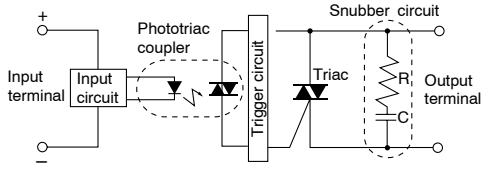
OPERATING PRINCIPLE

Internal circuit

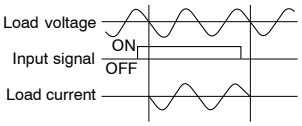
Zero-cross type

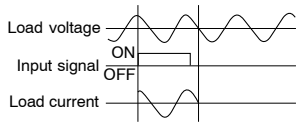


Non zero-cross type



Wave form of input and output (Resistive load)

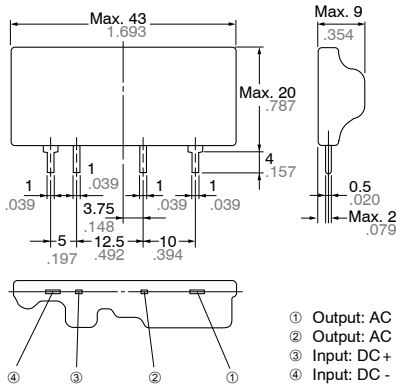




DIMENSIONS

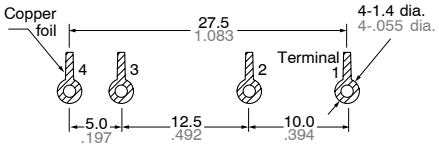
mm inch

(Common for zero-cross and Non zero-cross type)

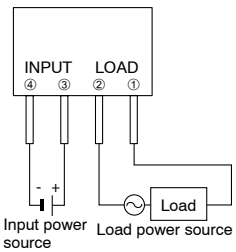


General tolerance: ±0.5 ±.020

PC board pattern (BOTTOM VIEW)

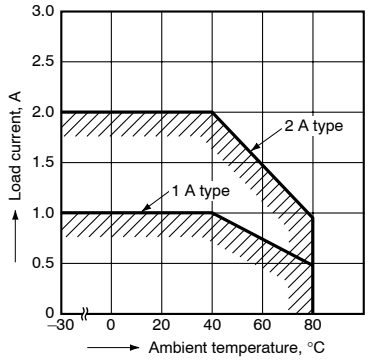


Terminal connection diagram

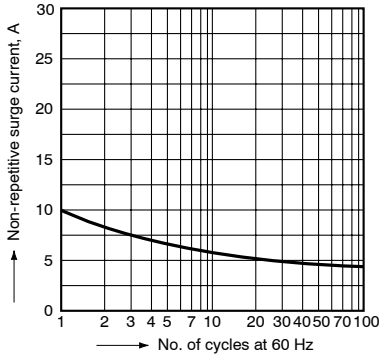


REFERENCE DATA

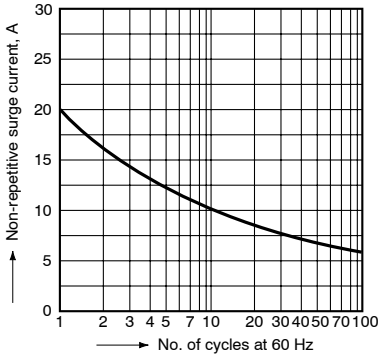
1. Load current vs. ambient temperature



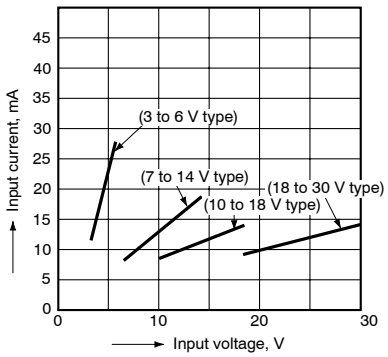
2-1. Non-repetitive surge current vs. carrying time (1 A type)



2-2. Non-repetitive surge current vs. carrying time (2 A type)

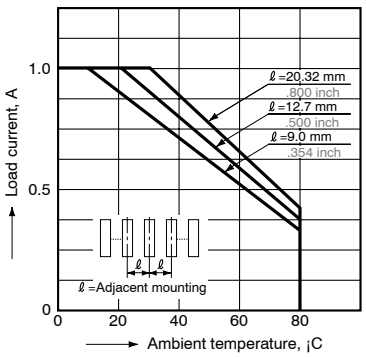


3. Input current vs. input voltage

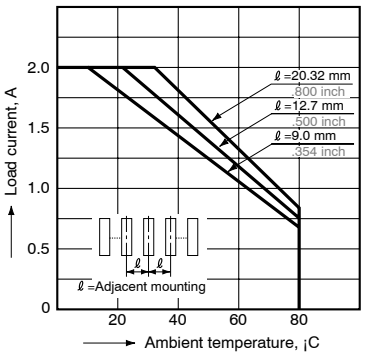


4. Load current vs. ambient temperature for adjacent mounting

1 A type

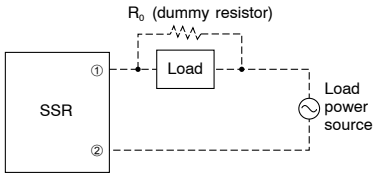


2 A type



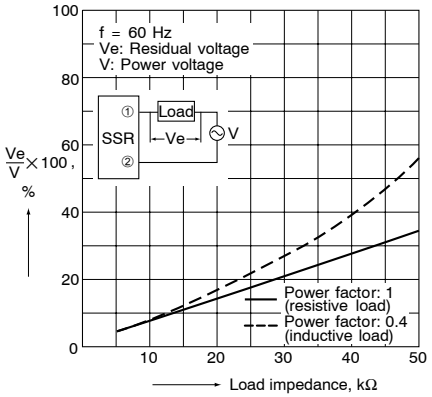
NOTE

When used for the load less than rated
In case of the load current less than rated, malfunction may result from the residual voltage across the both ends of the load even if the solid state relay is turned off.
Use a dummy resistor as a countermeasure.
The total of the current through the resistor and the load current must exceed the min. rated load current.



In case the dummy resistor is not used, keep in mind that the residual voltage becomes as follows:
Example:
For the inductive load by the 5 mA load current and the 200 V AC load voltage, the load impedance becomes 40 k Ω and Ve/V = 16% is estimated from the right above graph. Accordingly, the 32 V voltage remains across the both ends of the load when the solid state relay is turned off.

• Characteristics of residual voltage vs. load impedance



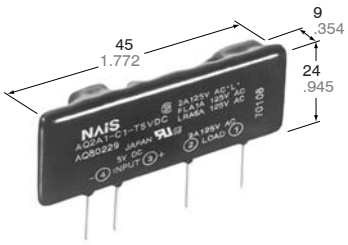
For Cautions for Use, see page 269.

Please contact us about TÜV certified products.

Panasonic
ideas for life

SOLID STATE RELAY

AQ8 RELAYS



mm inch

FEATURES

1. So slim with 9 mm .354 inch thickness
The thin type (45 mm long × 24 mm high × 9 mm wide) (1.772×.945×.354 inch) permits high density mounting.

2. Excellent in noise resistance
Since the input and output are insulated by the photo TRIAC coupler, the noise on the output side is not fed back to the input side.

3. Snubber circuit integrated
The snubber circuit is integrated to prevent malfunction caused by the rapid rise of the voltage on the output side, such as inductive load and noise.

4. Zero-cross and nonzero-cross types are available.
The zero-cross type generates minimal noise by suppressing occurrence of radio frequency interference (RFI) and electromagnetic interference (EMI).
The nonzero-cross type features a short operation time which permits phase control.

5. High dielectric strength: 3,000 V AC (between input and output)

6. Two kinds of terminals distance are available. (5.08 mm and 7.62 mm) (.200 and .300 inch)

7. High reliability, long life and maintenance-free

TYPICAL APPLICATIONS

Most suitable as drivers for small size AC motors, solenoids, solenoid valves and so on.
1. Copying equipment
2. Air conditioners
3. Industrial equipment such as NC machines, sequencers, robots and so on

TYPES

1. Zero-cross type

Input terminals distance	Max. load current	Load voltage	Input voltage	Part No.
5.08 mm .200 inch type	2 A	75 to 125 V AC	5 V DC	AQ2A1-C1-ZT5VDC
			12 V DC	AQ2A1-C1-ZT12VDC
			24 V DC	AQ2A1-C1-ZT24VDC
		75 to 250 V AC	5 V DC	AQ2A2-C1-ZT5VDC
			12 V DC	AQ2A2-C1-ZT12VDC
			24 V DC	AQ2A2-C1-ZT24VDC
	3 A	75 to 125 V AC	5 V DC	AQ3A1-C1-ZT5VDC
			12 V DC	AQ3A1-C1-ZT12VDC
			24 V DC	AQ3A1-C1-ZT24VDC
		75 to 250 V AC	5 V DC	AQ3A2-C1-ZT5VDC
			12 V DC	AQ3A2-C1-ZT12VDC
			24 V DC	AQ3A2-C1-ZT24VDC
7.62 mm .300 inch type	2 A	75 to 125 V AC	5 V DC	AQ2A1-C2-ZT5VDC
			12 V DC	AQ2A1-C2-ZT12VDC
			24 V DC	AQ2A1-C2-ZT24VDC
		75 to 250 V AC	5 V DC	AQ2A2-C2-ZT5VDC
			12 V DC	AQ2A2-C2-ZT12VDC
			24 V DC	AQ2A2-C2-ZT24VDC
	3 A	75 to 125 V AC	5 V DC	AQ3A1-C2-ZT5VDC
			12 V DC	AQ3A1-C2-ZT12VDC
			24 V DC	AQ3A1-C2-ZT24VDC
		75 to 250 V AC	5 V DC	AQ3A2-C2-ZT5VDC
			12 V DC	AQ3A2-C2-ZT12VDC
			24 V DC	AQ3A2-C2-ZT24VDC

2. Nonzero-cross type

Input terminals distance	Max. load current	Load voltage	Input voltage	Part No.
5.08 mm .200 inch type	2 A	75 to 125 V AC	5 V DC	AQ2A1-C1-T5VDC
			12 V DC	AQ2A1-C1-T12VDC
			24 V DC	AQ2A1-C1-T24VDC
		75 to 250 V AC	5 V DC	AQ2A2-C1-T5VDC
			12 V DC	AQ2A2-C1-T12VDC
			24 V DC	AQ2A2-C1-T24VDC
	3 A	75 to 125 V AC	5 V DC	AQ3A1-C1-T5VDC
			12 V DC	AQ3A1-C1-T12VDC
			24 V DC	AQ3A1-C1-T24VDC
		75 to 250 V AC	5 V DC	AQ3A2-C1-T5VDC
			12 V DC	AQ3A2-C1-T12VDC
			24 V DC	AQ3A2-C1-T24VDC
7.62 mm .300 inch type	2 A	75 to 125 V AC	5 V DC	AQ2A1-C2-T5VDC
			12 V DC	AQ2A1-C2-T12VDC
			24 V DC	AQ2A1-C2-T24VDC
		75 to 250 V AC	5 V DC	AQ2A2-C2-T5VDC
			12 V DC	AQ2A2-C2-T12VDC
			24 V DC	AQ2A2-C2-T24VDC
	3 A	75 to 125 V AC	5 V DC	AQ3A1-C2-T5VDC
			12 V DC	AQ3A1-C2-T12VDC
			24 V DC	AQ3A1-C2-T24VDC
		75 to 250 V AC	5 V DC	AQ3A2-C2-T5VDC
			12 V DC	AQ3A2-C2-T12VDC
			24 V DC	AQ3A2-C2-T24VDC

Remark: Standard packing Carton: 20 pcs.; Case: 200 pcs.

RATINGS

1. Rating (Ambient temperature: 20°C, 68°F; Voltage ripple on the input side: 1% or less)

1) Zero-cross type

• 2 A type

Item	Part No.	AQ2A1-C1-ZT5VDC AQ2A1-C2-ZT5VDC	AQ2A1-C1-ZT12VDC AQ2A1-C2-ZT12VDC	AQ2A1-C1-ZT24VDC AQ2A1-C2-ZT24VDC	AQ2A2-C1-ZT5VDC AQ2A2-C2-ZT5VDC	AQ2A2-C1-ZT12VDC AQ2A2-C2-ZT12VDC	AQ2A2-C1-ZT24VDC AQ2A2-C2-ZT24VDC	Remarks
Input side	Control voltage	5 V DC (4 to 6V)	12 V DC (9.6 to 14.4V)	24 V DC (21.6 to 26.4V)	5 V DC (4 to 6V)	12 V DC (9.6 to 14.4V)	24 V DC (21.6 to 26.4V)	The parenthesized values represent the allowable voltage ranges
	Input impedance	Approx. 0.18 k Ω	Approx. 0.55 k Ω	Approx. 1.4 k Ω	Approx. 0.18 k Ω	Approx. 0.55 k Ω	Approx. 1.4 k Ω	
	Drop-out voltage	min. 0.5 V	min. 1.2 V	min. 2.4 V	min. 0.5 V	min. 1.2 V	min. 2.4 V	
Load side	Max. load current	2 A*1						At ambient temperature of 30°C or less
	Load voltage	75 to 125 V AC			75 to 250 V AC			
	Frequency	45 to 65 Hz						
	Repetitive peak OFF voltage	400 V			600 V			
	Non-repetitive surge current	30 A*2						In one cycle at 60 Hz
	Max. “OFF-state” leakage current	2.5 mA/100 V applied			5 mA/200 V applied			
	Max. “ON-state” voltage drop	1.6 V						at max. carrying current
	Min. load current	25 mA*3			50 mA*3			
	OFF state dV/dt	50 V/μs						At ambient temperature of 80°C

• 3 A type

Item	Part No.	AQ3A1-C1-ZT5VDC AQ3A1-C2-ZT5VDC	AQ3A1-C1-ZT12VDC AQ3A1-C2-ZT12VDC	AQ3A1-C1-ZT24VDC AQ3A1-C2-ZT24VDC	AQ3A2-C1-ZT5VDC AQ3A2-C2-ZT5VDC	AQ3A2-C1-ZT12VDC AQ3A2-C2-ZT12VDC	AQ3A2-C1-ZT24VDC AQ3A2-C2-ZT24VDC	Remarks
Input side	Control voltage	5 V DC (4 to 6V)	12 V DC (9.6 to 14.4V)	24 V DC (21.6 to 26.4V)	5 V DC (4 to 6V)	12 V DC (9.6 to 14.4V)	24 V DC (21.6 to 26.4V)	The parenthesized values represent the allowable voltage ranges
	Input impedance	Approx. 0.18 k Ω	Approx. 0.55 k Ω	Approx. 1.4 k Ω	Approx. 0.18 k Ω	Approx. 0.55 k Ω	Approx. 1.4 k Ω	
	Drop-out voltage	min. 0.5 V	min. 1.2 V	min. 2.4 V	min. 0.5 V	min. 1.2 V	min. 2.4 V	
Load side	Max. load current	3 A*1						At ambient temperature of 30°C or less
	Load voltage	75 to 125 V AC			75 to 250 V AC			
	Frequency	45 to 65 Hz						
	Repetitive peak OFF voltage	400 V			600 V			
	Non-repetitive surge current	80 A*2						In one cycle at 60 Hz
	Max. “OFF-state” leakage current	2.5 mA/100 V applied			5 mA/200 V applied			
	Max. “ON-state” voltage drop	1.6 V						at max. carrying current
	Min. load current	25 mA*3			50 mA*3			
	OFF state dV/dt	50 V/μs						At ambient temperature of 80°C

Notes: *1) Refer REFERENCE DATA 1, characteristics of load current vs. ambient temperature.

*2) Refer to REFERENCE DATA 2, characteristics of non-repetitive surge current vs. carrying time.

*3) When the load current is less than the min. load current, refer to “NOTE” on page 311.

2) Non zero-cross type

• 2 A type

Item	Part No.	AQ2A1-C1-T5VDC AQ2A1-C2-T5VDC	AQ2A1-C1-T12VDC AQ2A1-C2-T12VDC	AQ2A1-C1-T24VDC AQ2A1-C2-T24VDC	AQ2A2-C1-T5VDC AQ2A2-C2-T5VDC	AQ2A2-C1-T12VDC AQ2A2-C2-T12VDC	AQ2A2-C1-T24VDC AQ2A2-C2-T24VDC	Remarks
Input side	Control voltage	5 V DC (4 to 6V)	12 V DC (9.6 to 14.4V)	24 V DC (21.6 to 26.4V)	5 V DC (4 to 6V)	12 V DC (9.6 to 14.4V)	24 V DC (21.6 to 26.4V)	The parenthesized values represent the allowable voltage ranges
	Input impedance	Approx. 0.3 k Ω	Approx. 0.8 k Ω	Approx. 1.8 k Ω	Approx. 0.3 k Ω	Approx. 0.8 k Ω	Approx. 1.8 k Ω	
	Drop-out voltage	min. 0.5 V	min. 1.2 V	min. 2.4 V	min. 0.5 V	min. 1.2 V	min. 2.4 V	
Load side	Max. load current	2 A*1						At ambient temperature of 30°C or less
	Load voltage	75 to 125 V AC			75 to 250 V AC			
	Frequency	45 to 65 Hz						
	Repetitive peak OFF voltage	400 V			600 V			
	Non-repetitive surge current	30 A*2						In one cycle at 60 Hz
	Max. “OFF-state” leakage current	2.5 mA/100 V applied			5 mA/200 V applied			
	Max. “ON-state” voltage drop	1.6 V						at max. carrying current
	Min. load current	25 mA*3			50 mA*3			
	OFF state dV/dt	50 V/μs						At ambient temperature of 80°C

• 3 A type

Item	Part No.	AQ3A1-C1-T5VDC AQ3A1-C2-T5VDC	AQ3A1-C1-T12VDC AQ3A1-C2-T12VDC	AQ3A1-C1-T24VDC AQ3A1-C2-T24VDC	AQ3A2-C1-T5VDC AQ3A2-C2-T5VDC	AQ3A2-C1-T12VDC AQ3A2-C2-T12VDC	AQ3A2-C1-T24VDC AQ3A2-C2-T24VDC	Remarks
Input side	Control voltage	5 V DC (4 to 6V)	12 V DC (9.6 to 14.4V)	24 V DC (21.6 to 26.4V)	5 V DC (4 to 6V)	12 V DC (9.6 to 14.4V)	24 V DC (21.6 to 26.4V)	The parenthesized values represent the allowable voltage ranges
	Input impedance	Approx. 0.3 k Ω	Approx. 0.8 k Ω	Approx. 1.8 k Ω	Approx. 0.3 k Ω	Approx. 0.8 k Ω	Approx. 1.8 k Ω	
	Drop-out voltage	min. 0.5 V	min. 1.2 V	min. 2.4 V	min. 0.5 V	min. 1.2 V	min. 2.4 V	
Load side	Max. load current	3 A*1						At ambient temperature of 30°C or less
	Load voltage	75 to 125 V AC			75 to 250 V AC			
	Frequency	45 to 65 Hz						
	Repetitive peak OFF voltage	400 V			600 V			
	Non-repetitive surge current	80 A*2						In one cycle at 60 Hz
	Max. “OFF-state” leakage current	2.5 mA/100 V applied			5 mA/200 V applied			
	Max. “ON-state” voltage drop	1.6 V						at max. carrying current
	Min. load current	25 mA*3			50 mA*3			
	OFF state dV/dt	50 V/μs						At ambient temperature of 80°C

Notes: *1) Refer REFERENCE DATA 1, characteristics of load current vs. ambient temperature.

*2) Refer to REFERENCE DATA 2, characteristics of non-repetitive surge current vs. carrying time.

*3) When the load current is less than the min. load current, refer to “NOTE” on page 311.

2. Characteristics (Amdient temperature: 20°C 68°F; Input voltage ripple: 1% or less)

Item \ Type		Zero-cross type	Non-zero-cross type	Remarks
Operate time, max.		1/2 cycle of voltage sine wave + 1 ms	1 ms	
Release time, max.		1/2 cycle of voltage sine wave + 1 ms		
Insulation resistance, min.		$10^9\Omega$ between input and output		at 500 V DC
Breakdown voltage		3,000 V AC between input and output		For 1 minute
Vibration resistance	Functional	10 to 55 Hz at double amplitude of 3 mm		10 min. for X, Y, Z axis
	Destructive	10 to 55 Hz at double amplitude of 3 mm		1 hour for X, Y, Z axis
Shock resistance	Functional	Min. 980 m/s² {100 G}		4 times each for X, Y, Z axis
	Destructive	Min. 980 m/s² {100 G}		5 times each for X, Y, Z axis
Ambient temperature		–30°C to +80°C –22°F to +176°F		
Storage temperature		–30°C to +100°C –22°F to +212°F		
Operational method		Zero-cross (Turn ON and Turn OFF)	Random turn ON, zero-cross turn OFF	

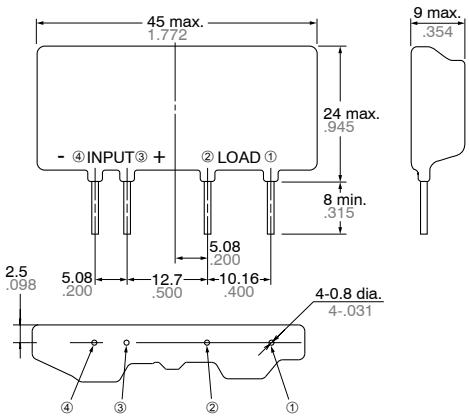
DIMENSIONS

mm inch

(Common for zero-cross and nonzero-cross types)

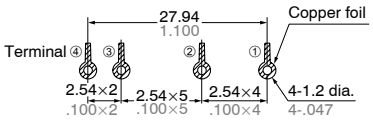
1. Input terminals distance 5.08 mm .200 inch

1) 2 A type



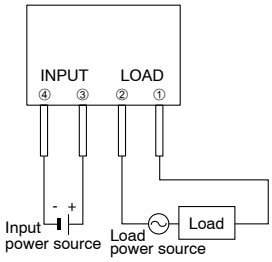
General tolerance: ±0.5 ±.020

Mounting hole location (Bottom view)

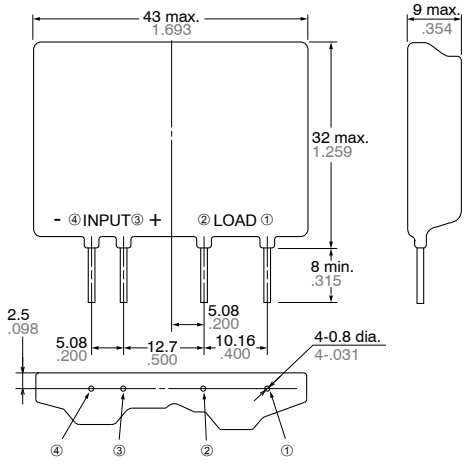


Tolerance: ±0.1 ±.004

Schematic

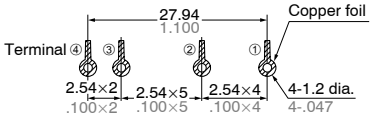


2) 3 A type



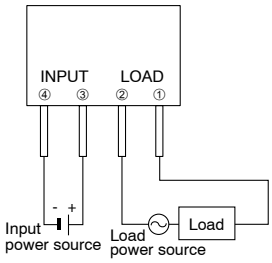
General tolerance: ±0.5 ±.020

Mounting hole location (Bottom view)



Tolerance: ±0.1 ±.004

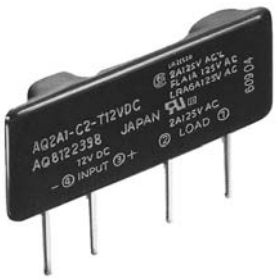
Schematic

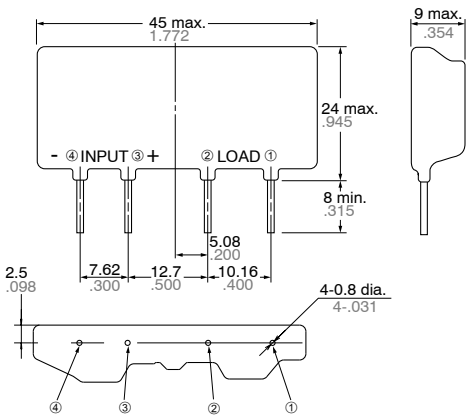


2. Input terminals distance 7.62 mm .300 inch

mm inch

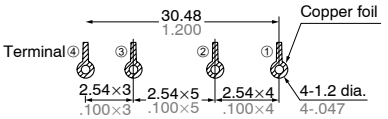
1) 2A type





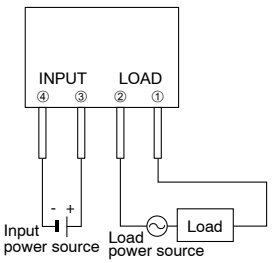
General tolerance: ±0.5 ±.020

Mounting hole location (Bottom view)



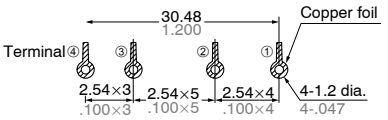
Tolerance: ±0.1 ±.004

Schematic



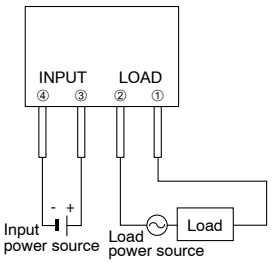
2) 3A type

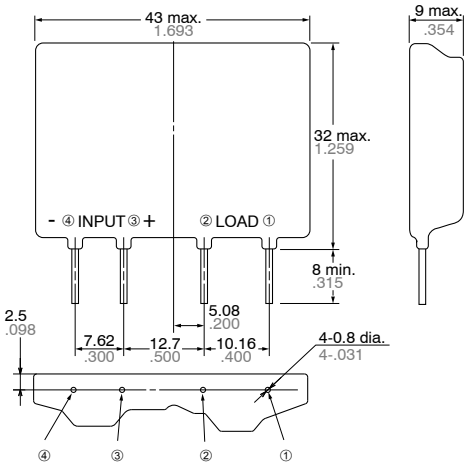
Mounting hole location (Bottom view)



Tolerance: ±0.1 ±.004

Schematic



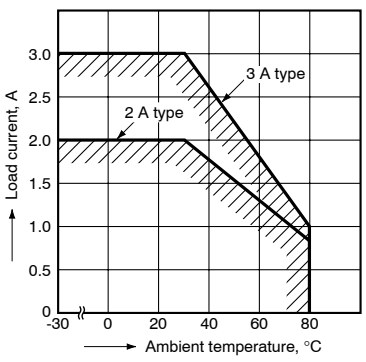


General tolerance: ±0.5 ±.020

REFERENCE DATA

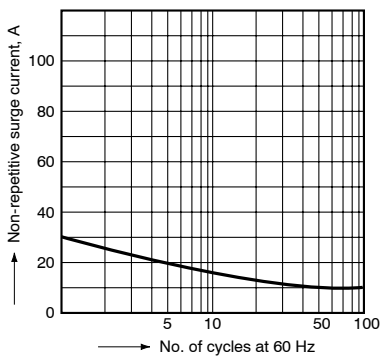
1. Characteristics of load current vs. ambient temperature

Conditions: Natural cooling

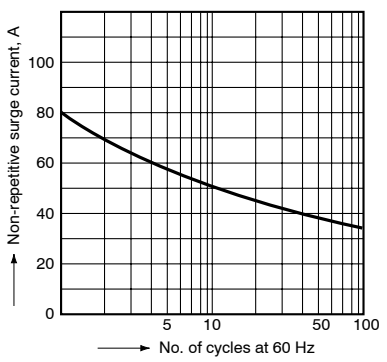


2. Characteristics of non-repetitive surge current vs. carrying time

(2 A type)

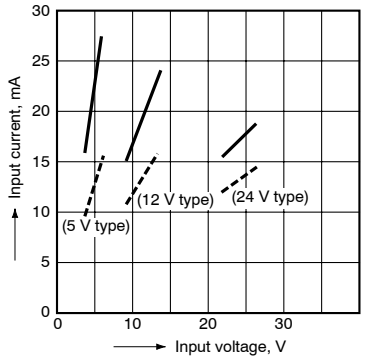


(3 A type)



3. Characteristics of input current vs. input voltage

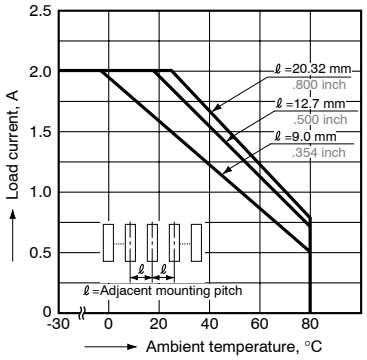
—zero-cross type ---Nonzero-cross type



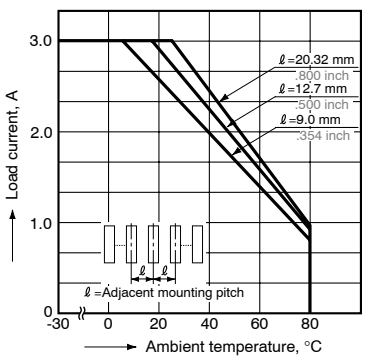
4. Characteristics of load current vs. ambient temperature for adjacent mounting

Conditions: Natural cooling

(2 A type)



(3 A type)



Approved standards list

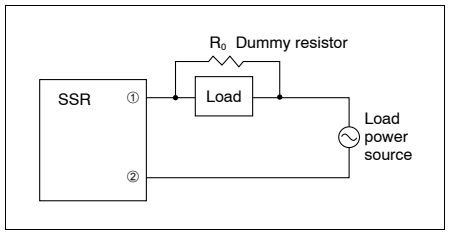
Product name	File No.	Qualified ratings
AQ8	UL E95895	2A type: 2 A 125, 250 V AC 2 A 125 V AC (Tungsten) FLA 1 A, LRA 6 A 125, 250 V AC 3A type: 3 A 125, 250 V AC 3 A 125 V AC (Tungsten) FLA 1.5 A, LRA 9 A 125, 250 V AC
	CSA LR26550	

NOTE

1. When used for the load less than rated

In case of the load current less than rated, malfunction may result from the residual voltage across the both ends of the load even if the solid state relay is turned off. Use a dummy resistor as a countermeasure.

The total of the current through the resistor and the load current must exceed the min. rated load current.

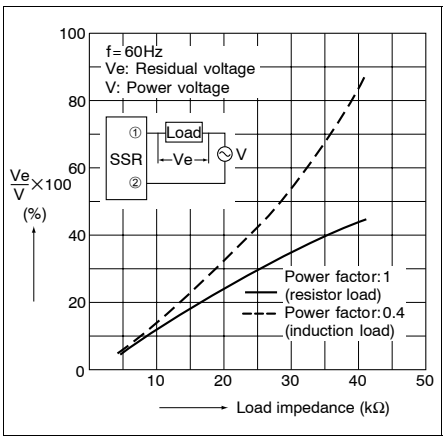


In case the dummy resistor is not used, keep in mind that the residual voltage becomes as follows:

Example:

For the inductive load by the 20 mA load current and the 200 V AC load voltage, the load impedance becomes 10 k Ω and Ve/V = 14% is estimated from the right above graph. Accordingly, the 28 V voltage remains across the both ends of the load when the solid state relay is turned off.

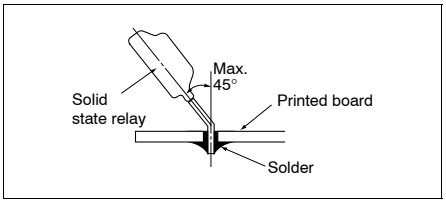
• Characteristics of residual voltage vs. load impedance



2. Solder the terminals within 5 seconds at 260°C 500°F.

3. when the terminal is bent

Care shall be taken neither to apply mechanical stresses to the mold area of the solid state relay nor to bend the terminal 45 degrees or more.

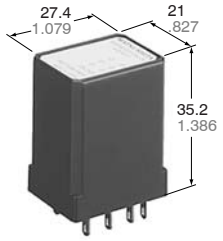


For Cautions for Use, see page 269.

Panasonic
ideas for life

AQ-F SOLID STATE RELAY

AQ-F RELAYS



mm inch

FEATURES

- **Suitable for high-capacity and high-frequency switching**
- **Same size, same terminal arrangement as HC relay**
  Sockets for HC relays are applicable
- **Two load types available: DC output type (2 A, 3 A)**
  AC output type (2 A, 3 A)
- **Wide range of input voltage: 3 V to 28 V**

TYPICAL APPLICATIONS

Drive for small-sized motor, heater, solenoid and electromagnetic valves.

- NC machine
- Printing machine
- Machine tool
- Robot for industrial use
- Wrapping and packing machine

TYPES

Type		Part No.
AC output	Zero-cross 2 A	AQF2A2-ZT3/28VDC
	Zero-cross 3 A	AQF3A2-ZT3/28VDC
DC output	2 A	AQF2AD1-3/28VDC
	3 A	AQF3AD1-3/28VDC

SPECIFICATIONS

Ratings (at 20°C 68°F, Input voltage ripple: 1% or less)

Item \ Type		AC output		DC output		Remarks
		AQF2A2-ZT3/28VDC	AQF3A2-ZT3/28VDC	AQF2AD1-3/28VDC	AQF3AD1-3/28VDC	
Input side	Input voltage	3 to 28 V DC				
	Input impedance	Approx. 1.6 k Ω (3 to 28 V DC)				
	Drop-out voltage, min.	0.8 V DC				
Load side	Max. load current	2 A	3 A	2 A	3 A	See “REFERENCE DATA 1” on the following page
	Load voltage	75 to 250 V AC		3 to 60 V DC		
	Non-repetitive surge current	80 A		5 A	6 A	AC: In one cycle at 60 Hz DC: 1 s
	Max. “OFF-state” leakage current	5 mA		1 mA		AC: at 60 Hz 200 V DC: at 60 V
	Max. “ON-state” voltage drop	1.6 V				at max. carrying current
	Min. load current	50 mA		5 mA		

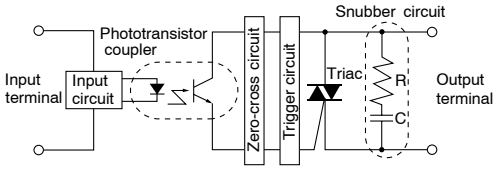
Characteristics (at 20°C 68°F, Input voltage ripple: 1% or less)

Item \ Type		AC output		DC output		Remarks
		AQF2A2-ZT3/28 VDC	AQF3A2-ZT3/28 VDC	AQF2AD1-3/28 VDC	AQF3AD1-3/28 VDC	
Operate time max.		(1/2 cycle of voltage sine wave) + 1 ms		0.5 ms		
Release time, max.		(1/2 cycle of voltage sine wave) + 1 ms		2 ms		
Insulation resistance, min.		100 M Ω between input and output				Initial at 500 V DC
Breakdown voltage		2,000 Vrms between input and output				Initial for 1 min.
Vibration resistance	Functional	10 to 55 Hz double amplitude of 3 mm				10 min. for X, Y, Z axes
	Destructive	10 to 55 Hz double amplitude of 3 mm				1 hour for X, Y, Z axes
Shock resistance	Functional	Min. 980 m/s² {100 G}				4 times each for X, Y, Z axes
	Destructive	Min. 980 m/s² {100 G}				5 times each for X, Y, Z axes
Ambient temperature		–30°C to +80°C –22°F to +176°F				
Storage temperature		–30°C to +100°C –22°F to +212°F				
Operational method		Zero-cross (Turn-ON and Turn-OFF)		—		

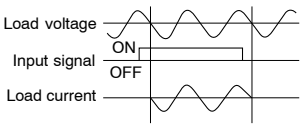
OPERATING PRINCIPLE

Internal circuit

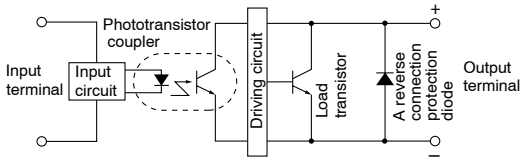
AC output type

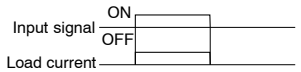


Waveform of input and output (Resistive load)



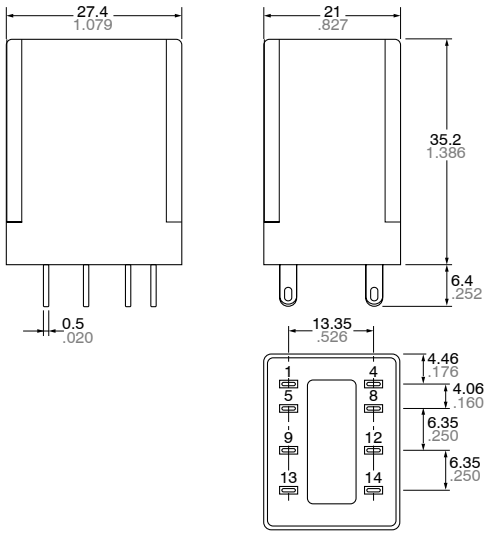
DC output type



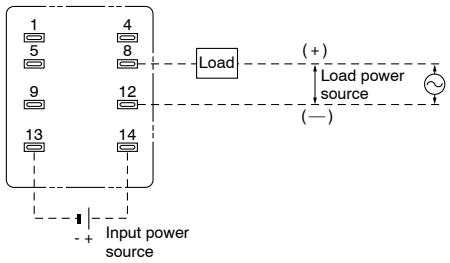


DIMENSIONS

mm inch



Terminal connection diagram (Bottom view)



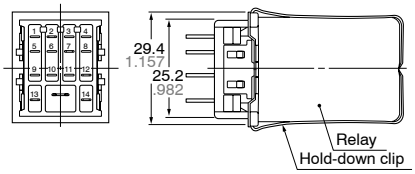
AQ-F SOLID STATE RELAY ACCESSORIES

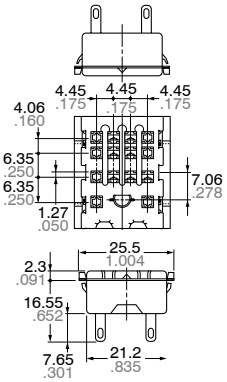
Socket of HC relay is available for AQ-F solid state relay.

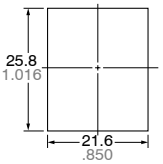
1. Socket for plug-in type

HC2 socket

HC2-SS-K







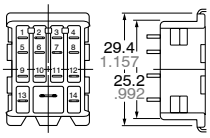
Note: HC3-SS-K and HC4-SS-K can be also used.

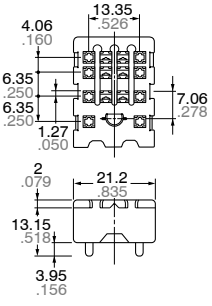
Tolerance: ±0.1 ±.004

2. Socket for PC board

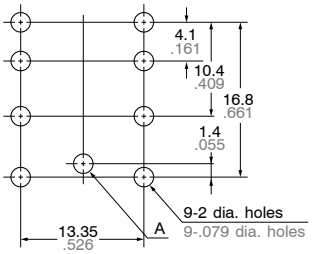
HC2 socket for PC board

HC2-PS-K





PC board pattern (Bottom view)



Note: HC3-PS-K and HC4-PS-K can be also used.

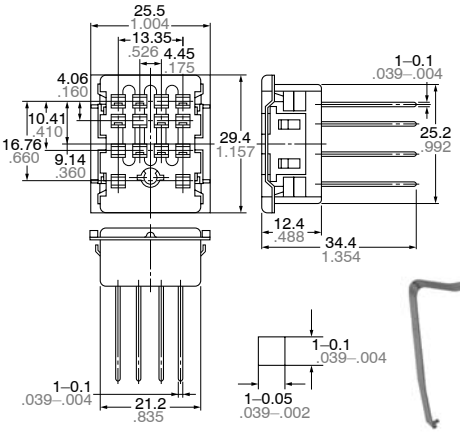
Tolerance: ±0.1 ±.004

3. Wrapping socket

mm inch

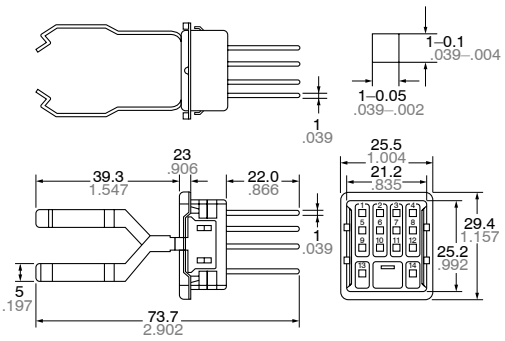
Standard wrapping socket

HC2-WS-K



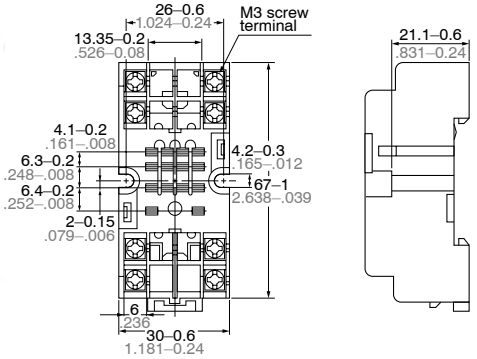
Wrapping socket with lock spring

HC2-WS-L

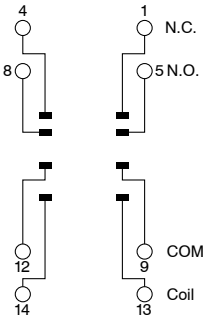


4. DIN rail mounting socket

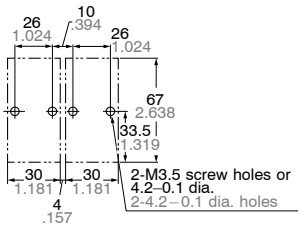
HC2-SFD-K



Schematic

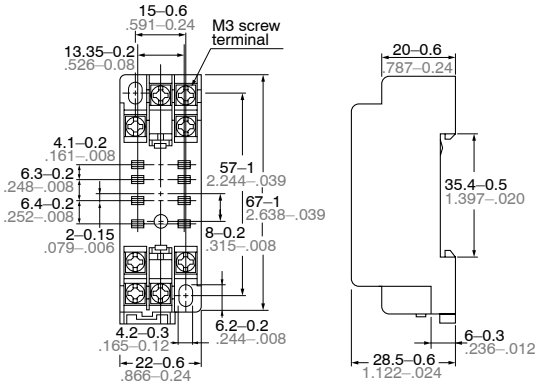


Mounting dimension (Bottom view)

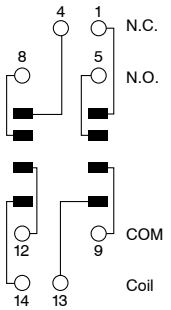


5. DIN socket for HC2-slim type

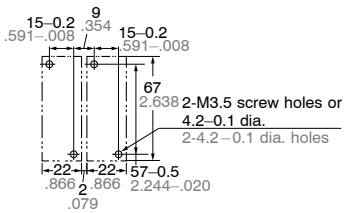
HC2-SFD-S



Schematic

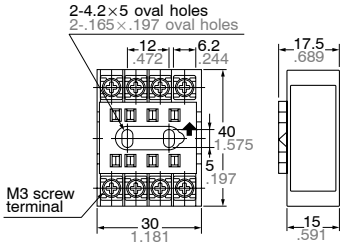


Mounting dimension (Bottom view)

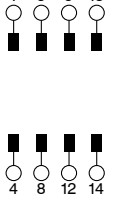


6. General socket

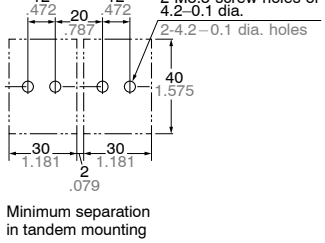
HC2-SF-K



Schematic

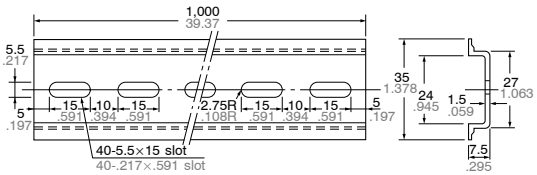


Mounting dimension (Bottom view)



Mounting rail

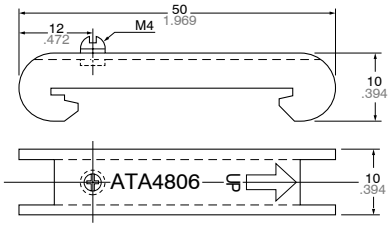
AT8-DLA1



Fastening plate

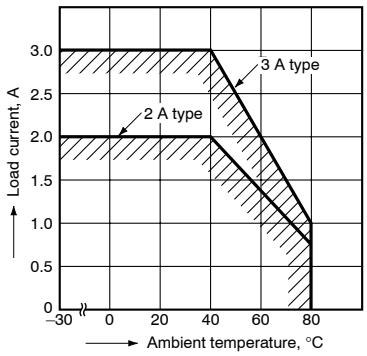
mm inch

ATA4806

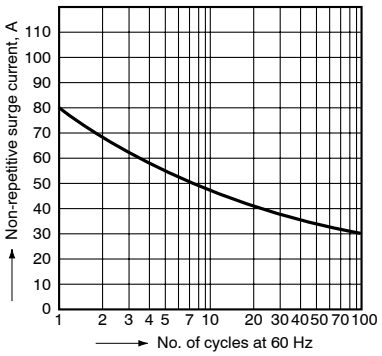


REFERENCE DATA

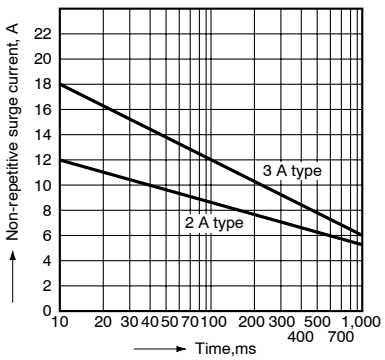
1. Load current vs. ambient temperature



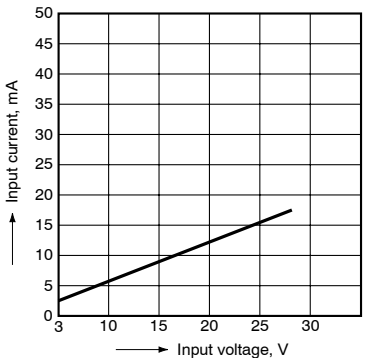
2-(1). Non-repetitive surge current vs. carrying time (AC output type)



2-(2). Non-repetitive surge current vs. carrying time (DC output type)



3. Input current vs. input voltage



For Cautions for Use, see page 269.

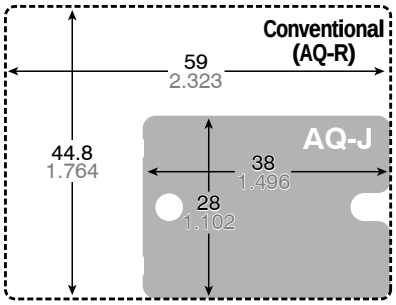
C-UL Pending TÜV Pending

Panasonic
ideas for life

AQ-J SOLID STATE RELAY

AQ-J RELAYS

• Footprint comparison (Unit: mm inch)



FEATURES

1. Ultra-compact size
Space saved with footprint 40% that of previous.

2. Built-in varistor
Superior external noise absorption.

3. Three types available from 10 A to 25 A.

4. Reverse input connection prevention function.

5. Uses #110 type input and #250 type output terminals.

6. Environmentally friendly
Supports RoHS Directive (2002/95/EC)

TYPICAL APPLICATIONS

1. Kitchen appliances
2. Vending machine
3. Injection molding machine
4. Amusement machine

TYPES

Type	Load current	Load voltage	Input voltage	Part No.
Zero-cross	10A	75V to 264V AC	4 to 6V DC	AQJ112V
			10 to 18V DC	AQJ119V
			18 to 28V DC	AQJ116V
	15A		4 to 6V DC	AQJ212V
			10 to 18V DC	AQJ219V
			18 to 28V DC	AQJ216V
	25A		4 to 6V DC	AQJ412V
			10 to 18V DC	AQJ419V
			18 to 28V DC	AQJ416V

ORDERING INFORMATION

Ex. AQJ □ □ □ □

Load current/voltage	Terminal	Input voltage	Built-in varistor
1: 10 A 75 to 264 V AC 2: 15 A 75 to 264 V AC 4: 25 A 75 to 264 V AC	1: Plug-in terminal, Zero-cross	2: 4 to 6 V DC 6: 18 to 28 V DC 9: 10 to 18 V DC	V: Built-in varistor

Note: Standard packing: Carton 10 pcs., Case: 200 pcs.

SPECIFICATIONS

1. Ratings (at 20°C 68°F, input ripple: 1% or less)
1) Input side

Item \ Type	AQJ112V AQJ212V AQJ412V	AQJ119V AQJ219V AQJ419V	AQJ116V AQJ216V AQJ416V
Rated voltage	5V DC	12V DC	24V DC
Input voltage	4 to 6V DC	10 to 18V DC	18 to 28V DC
Input impedance	Approx. 260Ω	Approx. 800Ω	Approx. 1.6kΩ
Drop-out voltage	Min. 1V DC		

2) Output side

Item \ Type	AQJ112V AQJ119V AQJ116V	AQJ212V AQJ219V AQJ216V	AQJ412V AQJ419V AQJ416V
Max. load current	10A	15A	25A
Load voltage	75 to 264V AC		
Frequency	45Hz to 65Hz		
Non-repetitive surge current	100A	150A	250A
Max. “OFF-state” leakage current	Max. 5mA		
Max. “ON-state” voltage drop	Max. 1.6V		
Min. load current*	50mA		

* See CAUTIONS FOR USE “2. When used for the load less than rated” on page 269.

2. Characteristics (at 20°C 68°F, input ripple: 1% or less)

Type	Characteristics	Remarks
Operate time, max.	(1/2 cycle of voltage sine wave) + 1ms	
Release time, max.	(1/2 cycle of voltage sine wave) + 1ms	
Insulation resistance, min.	100MΩ between input to output to case	Using 500 V DC megger
Breakdown voltage	3,000 Vrms between input and output	for 1min.
	2,500 Vrms between input, output and case	
Vibration resistance	10 to 55 Hz double amplitude of 1.5mm	X, Y, Z axes
Shock resistance	Min. 980m/s^2	X, Y, Z axes
Ambient temperature	–30 to +80°C –22 to +176°F	Non-condensing at low temperatures
Storage temperature	–30 to +100°C –22 to +212°F	Recommended: Temperature: 5 to 30°C 41 to 86°F Humidity: Max. 60% RH Atmosphere: Should be free of sulfurous acid and other toxic gasses, and relatively free from dust.
Operational method	Zero-cross (Turn ON and Turn OFF)	

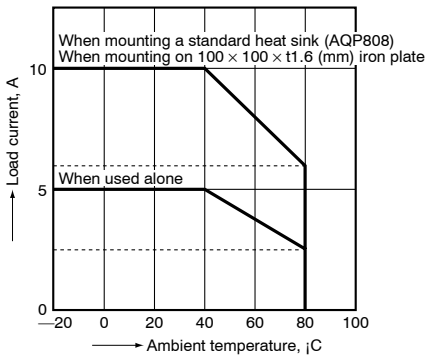
REFERENCE DATA

1. Load current vs. ambient temperature

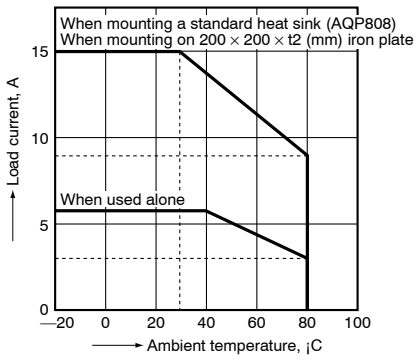
Use load current within range specified in the figure below

Tested condition:
1) If attached to a heat sink, use a heat conductive compound (Ex. Toshiba sillicone YG6111 or TSK5303) of similar coating to improve cooling
2) Without external heat sink
If the mounting surface is not metallic and a heat sink is not used, expose the bottom surface and plate surface to improve heat dissipation.

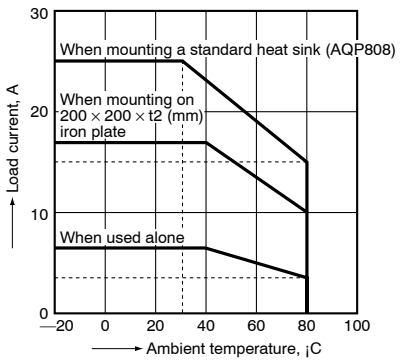
(1) 10A type



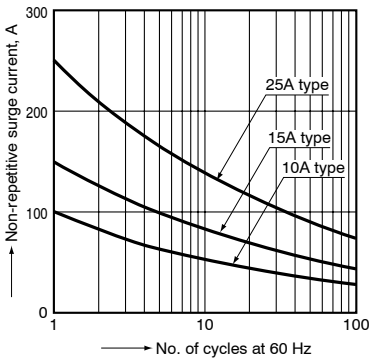
(2) 15A type



(3) 25A type

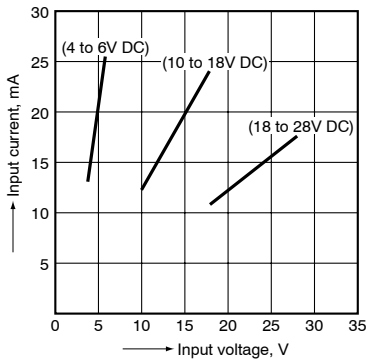


2. Non-repetitive surge current vs. carrying time



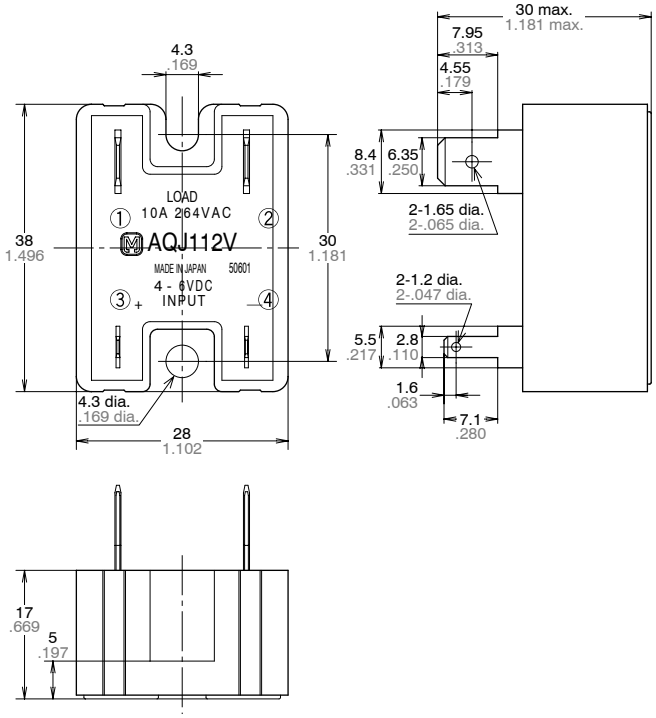
3. Input current vs. input voltage characteristics

(10A, 15A and 25A common)

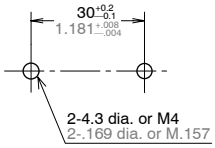


DIMENSIONS

mm inch



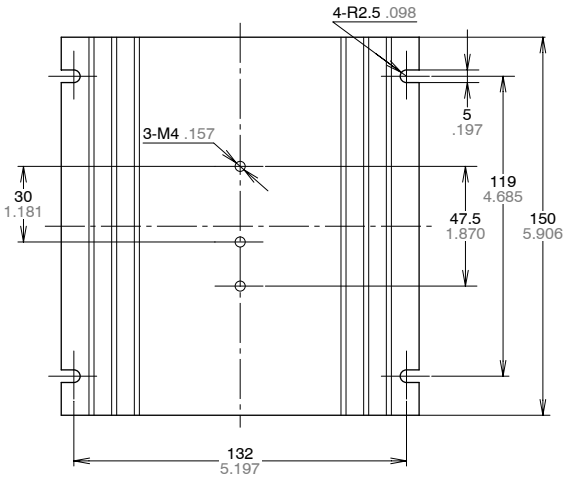
Mounting dimensions

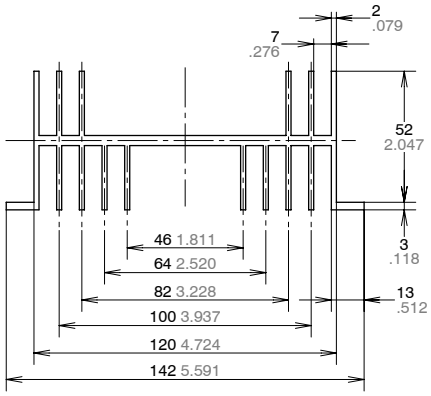


ACCESSORIES

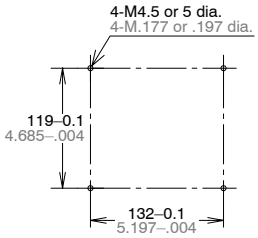
Heat sink

AQP-HS-J25A





Mounting dimensions



General tolerance: ±0.5 ±.020

For Cautions for Use, see page 269.

Panasonic
ideas for life

AQ-N SOLID STATE RELAY

AQ-N RELAYS

FEATURES

- Five types available from 10 A to 40 A.
- Built-in varistor
- Includes operation LED (red)
- Dielectric voltage of 4,000 V
- 4 to 32 V DC input voltage.
- Zero-cross and Non zero-cross types are available.

TYPICAL APPLICATIONS

- Molding machine (heater control)
- Temperature controlled bath (heater control)
- Printing machines (heater control)
- Wrapping snd packing machine (heater control)
- Machine tools (Motor control)

TYPES

1. Standard type

Type	Load current	Load voltage	Part No.
Zero-cross type	10A	75 to 250V AC	AQN111
	15A		AQN211
	20A		AQN311
	25A		AQN411
	40A		AQN611
Non zero-cross type	10A	75 to 250V AC	AQN121
	15A		AQN221
	20A		AQN321
	25A		AQN421
	40A		AQN621

2. With LED indication type

Type	Load current	Load voltage	Part No.
Zero-cross type	10A	75 to 250V AC	AQN111L
	15A		AQN211L
	20A		AQN311L
	25A		AQN411L
	40A		AQN611L
Non zero-cross type	10A	75 to 250V AC	AQN121L
	15A		AQN221L
	20A		AQN321L
	25A		AQN421L
	40A		AQN621L

3. With varistor type

Type	Load current	Load voltage	Part No.
Zero-cross type	10A	75 to 250V AC	AQN111V
	15A		AQN211V
	20A		AQN311V
	25A		AQN411V
	40A		AQN611V
Non zero-cross type	10A	75 to 250V AC	AQN121V
	15A		AQN221V
	20A		AQN321V
	25A		AQN421V
	40A		AQN621V

4. With varistor and LED indication type

Type	Load current	Load voltage	Part No.
Zero-cross type	10A	75 to 250V AC	AQN111VL
	15A		AQN211VL
	20A		AQN311VL
	25A		AQN411VL
	40A		AQN611VL
Non zero-cross type	10A	75 to 250V AC	AQN121VL
	15A		AQN221VL
	20A		AQN321VL
	25A		AQN421VL
	40A		AQN621VL

5. Accessories

Type	Part No.	Standard packing
Terminal cover	AQP-NPC	Carton: 2 pcs.; Case: 100 pcs.

ORDERING INFORMATION

Ex. AQN [1] [1] [1] [ ] [ ]

Load current	Load voltage	Input voltage	Type
1: 10 A 2: 15 A 3: 20 A 4: 25 A 6: 40 A	1: 75 to 250 V AC (Zero-cross) 2: 75 to 250 V AC (Non zero-cross)	1: 4 to 32 V DC	Nil: None V: Built-in varistor L: With LED indication VL: Built-in varistor and with LED indication

RATINGS

1. Ratings (at 20°C 68°F, Input ripple: 1% or less)

1) Zero-cross type

Item	Type	10A	15A	20A	25A	40A	Remarks
	Part No.	AQN111 AQN111L AQN111V AQN111VL	AQN211 AQN211L AQN211V AQN211VL	AQN311 AQN311L AQN311V AQN311VL	AQN411 AQN411L AQN411V AQN411VL	AQN611 AQN611L AQN611V AQN611VL	
Input side	Input voltage	4 to 32V					See REFERENCE DATA 3
	Input current	Max. 20mA					See REFERENCE DATA 3
	Drop-out voltage	Min. 1V					
Output side	Max. load current	10A	15A	20A	25A	40A	See REFERENCE DATA 1
	Load voltage	75V to 250V					
	Frequency	45Hz to 65Hz					
	Non-repetitive surge current	100A	150A	200A	250A	400A	In one cycle at 60Hz, See REFERENCE DATA 2
	Max. “OFF-state” leakage current	Max. 10mA					at 60Hz
	Max. “ON-state” voltage drop	Min. 1.6V					at Max. carrying current
	Min. load current	100mA					See CAUTIONS FOR USE (Using be below the specified load)

2) Non zero-cross type

Item	Type	10A	15A	20A	25A	40A	Remarks
	Part No.	AQN121 AQN121L AQN121V AQN121VL	AQN221 AQN221L AQN221V AQN221VL	AQN321 AQN321L AQN321V AQN321VL	AQN421 AQN421L AQN421V AQN421VL	AQN621 AQN621L AQN621V AQN621VL	
Input side	Input voltage	4 to 32V					See REFERENCE DATA 3
	Input current	Max. 20mA					See REFERENCE DATA 3
	Drop-out voltage	Min. 1V					
Output side	Max. load current	10A	15A	20A	25A	40A	See REFERENCE DATA 1
	Load voltage	75V to 250V					
	Frequency	45Hz to 65Hz					
	Non-repetitive surge current	100A	150A	200A	250A	400A	In one cycle at 60Hz, See REFERENCE DATA 2
	Max. “OFF-state” leakage current	Max. 10mA					at 60Hz
	Max. “ON-state” voltage drop	Min. 1.6V					at Max. carrying current
	Min. load current	100mA					See CAUTIONS FOR USE (Using below the specified load)

2. Characteristics (at 20°C 68°F, Input ripple: 1% or less)

1) Zero-cross type

Type	10A	15A	20A	25A	40A	Remarks
Part No.	AQN111 AQN111L AQN111V AQN111VL	AQN211 AQN211L AQN211V AQN211VL	AQN311 AQN311L AQN311V AQN311VL	AQN411 AQN411L AQN411V AQN411VL	AQN611 AQN611L AQN611V AQN611VL	
Operate time, max.	(1/2 cycle of voltage sine wave) + 1ms					
Release time, max.	(1/2 cycle of voltage sine wave) + 1ms					
Insulation resistance, min.	100MΩ between input and output					Using 500 V DC megger
Breakdown voltage	4,000 Vrms between input and output 2,500 Vrms among input, output and case					for 1min.
Vibration resistance (Functional)	10 to 55Hz double amplitude of 1.5mm					X, Y, Z axes
Shock resistance (Functional)	Min. 980 m/s²					X, Y, Z axes
Ambient temperature	–20°C to +80°C –4°F to +176°F					Non-condensing at low temperatures
Storage temperature	–25°C to +85°C –13°F to +185°F					
Operational method	Zero-cross (Turn-ON and Turn-OFF)					

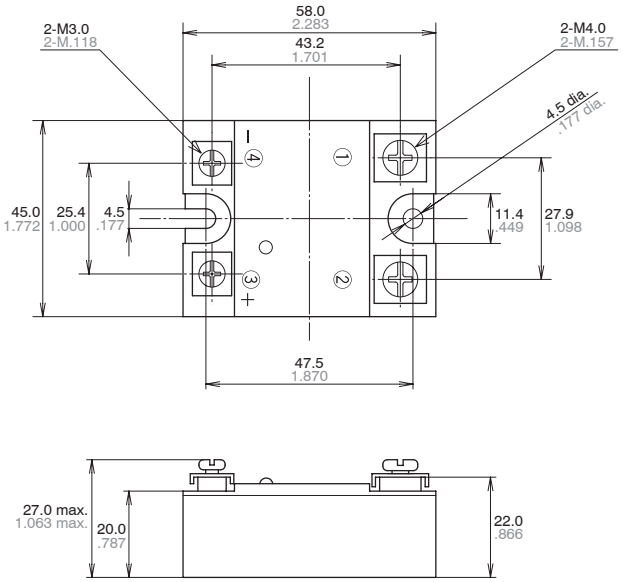
2) Non zero-cross type

Type	10A	15A	20A	25A	40A	Remarks
Part No.	AQN121 AQN121L AQN121V AQN121VL	AQN221 AQN221L AQN221V AQN221VL	AQN321 AQN321L AQN321V AQN321VL	AQN421 AQN421L AQN421V AQN421VL	AQN621 AQN621L AQN621V AQN621VL	
Operate time, max.	1ms					
Release time, max.	(1/2 cycle of voltage sine wave) + 1ms					
Insulation resistance, min.	100MΩ between input and output					Using 500 V DC megger
Breakdown voltage	4,000 Vrms between input and output 2,500 Vrms among input, output and case					for 1min.
Vibration resistance (Functional)	10 to 55Hz double amplitude of 1.5mm					X, Y, Z axes
Shock resistance (Functional)	Min. 980 m/s²					X, Y, Z axes
Ambient temperature	–20°C to +80°C –4°F to +176°F					Non-condensing at low temperatures
Storage temperature	–25°C to +85°C –13°F to +185°F					
Operational method	Random (Turn-ON), Zero-cross (Turn-OFF)					

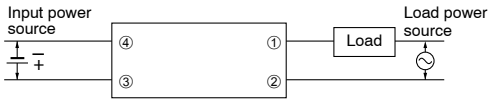
DIMENSIONS

mm inch

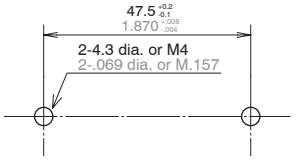
* The right figure is the with LED indication type.
  The standard type has the same dimensions.



Schematic



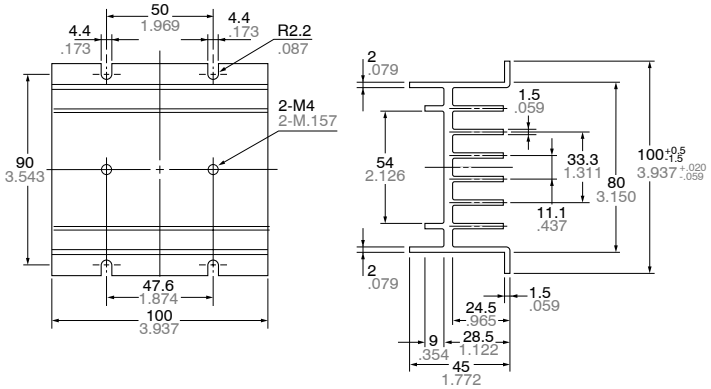
Mounting dimensions



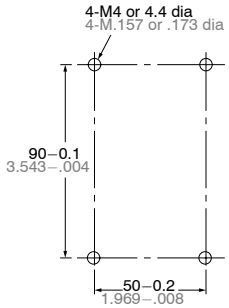
ACCESSORIES

Heat sink (For 10A, 15A, 20A)

AQP-HS-20A



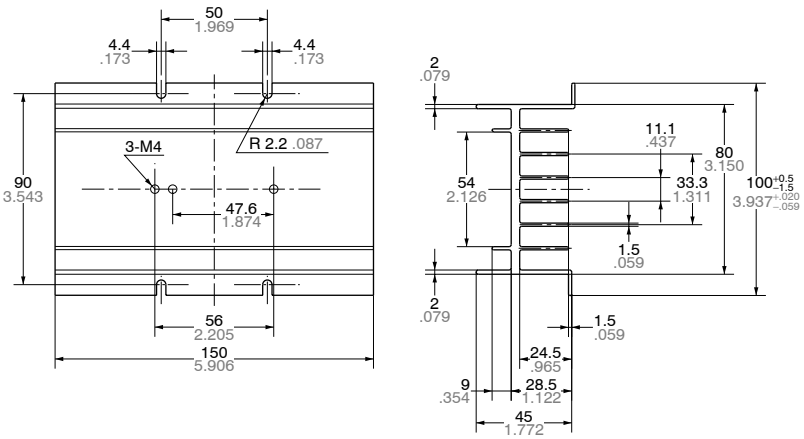
Mounting dimensions



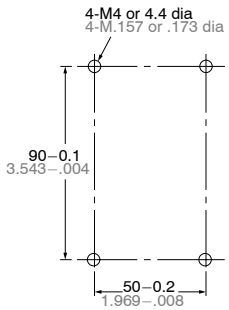
General tolerance: ±0.5 ±.020

Heat sink (For 25A)

AQP-HS-30/40A



Mounting dimensions

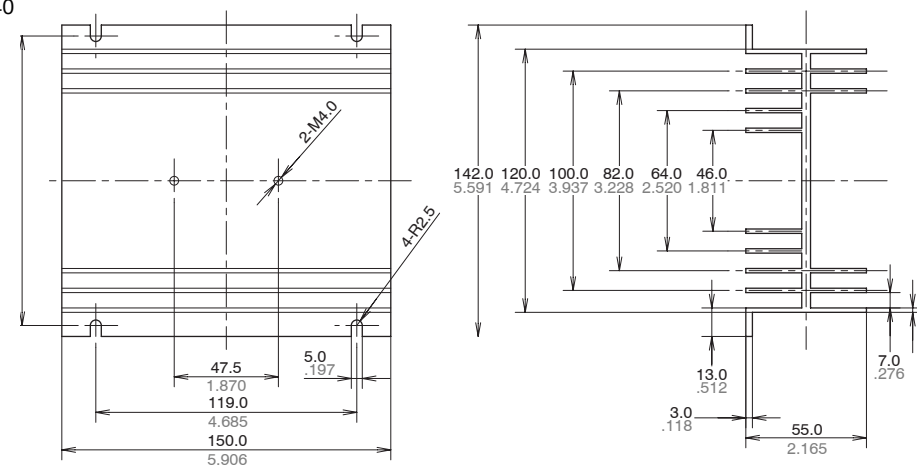


General tolerance: ±0.5 ±.020

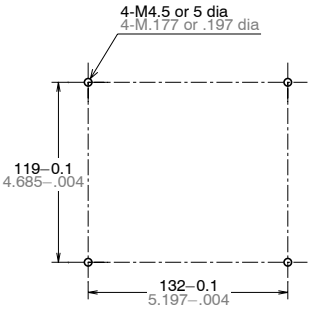
Heat sink (For 40A)

mm inch

AQP-HS-N40

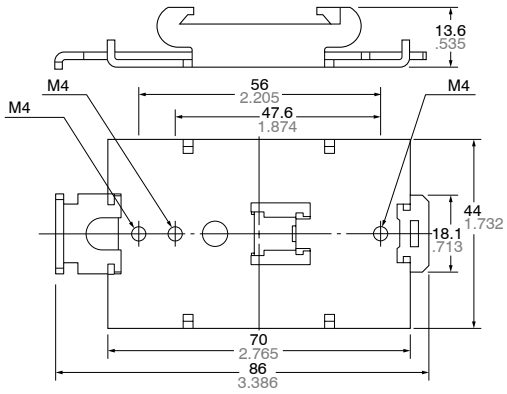


Mounting dimensions



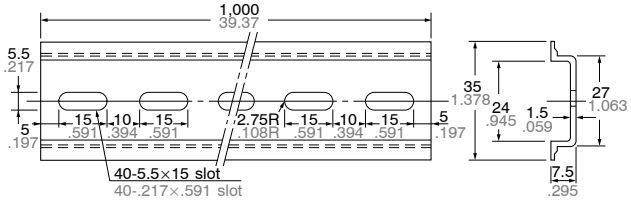
DIN rail mounting plate

AQP-DP



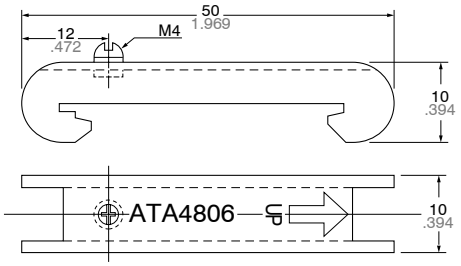
Mounting rail

AT8-DLA1

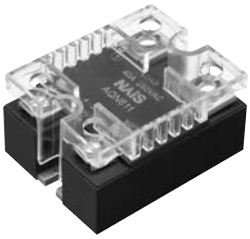


Fastening plate

ATA4806

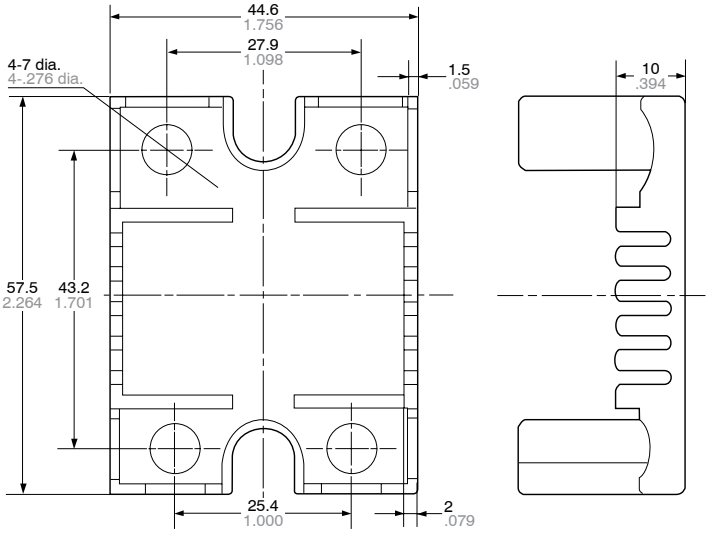


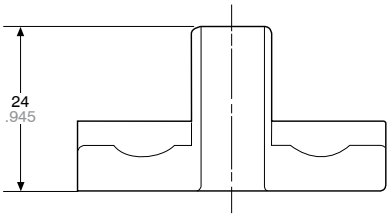
Terminal cover



AQP-NPC

mm inch





REFERENCE DATA

1. Load current vs. ambient temperature

Use load current within range specified in the figure below.

Tested condition

(1) With external heat sink

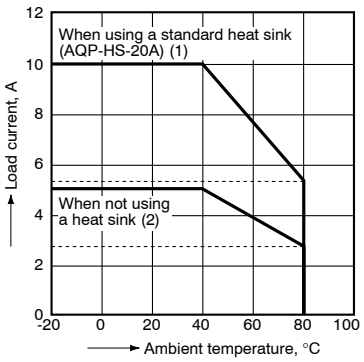
1) (a) 10A, 15A, 20A type
Shown with standard heat sink (AQP-HS-20A)
(b) Shown with 25A type standard heat sink (AQP-HS-30/40A)
(c) Shown with 40A type standard heat sink (AQP-HS-N40)

2) If attached to a heat sink, use a heat conductive compound (Ex. Toshiba silicone YG6111 or TSK5303) of similar coating to improve cooling.

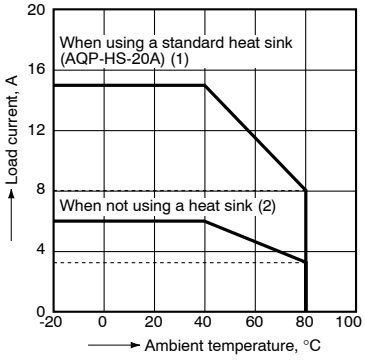
(2) Without external heat sink

If the mounting surface is not metallic and a heat sink is not used, expose the bottom surface and plate surface to improve heat dissipation.

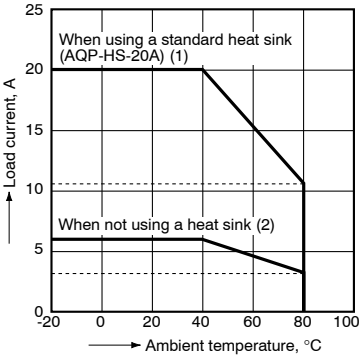
(1) 10 A type



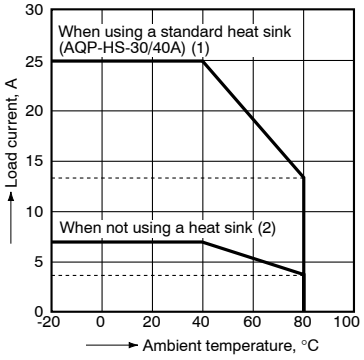
(2) 15 A type



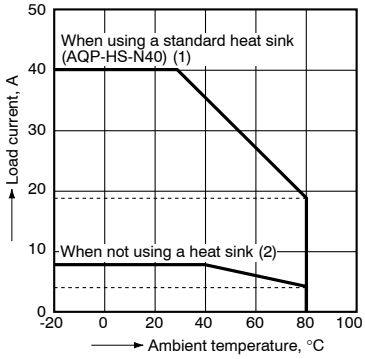
(3) 20 A type



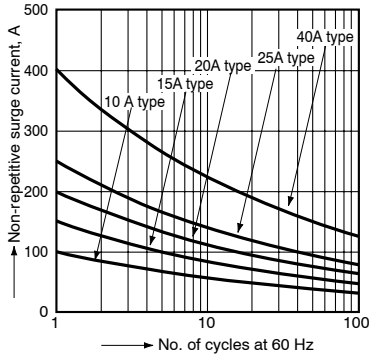
(4) 25 A type



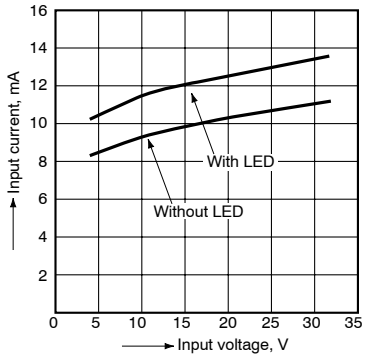
(5) 40 A type



2. Non-repetitive surge current vs. carrying time



3. Input current vs. input voltage
10A, 15A, 20A, 25A, 40A common



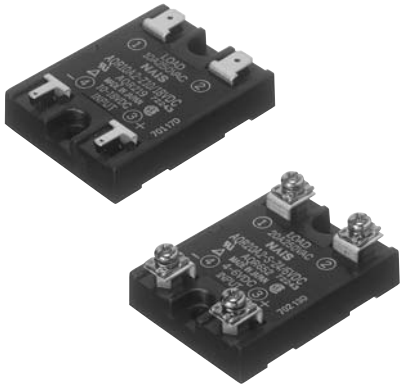
For Cautions for Use, see page 269.

(10A, 15A, 20A type) (30A, 40A type)

Panasonic
ideas for life

AQ-R SOLID STATE RELAY

AQ-R RELAYS



FEATURES

1. Two types of terminal shape: Plug-in terminal and Screw terminal (30 A, 40 A is screw terminal types only)

2. Flat type of SSR possible by aluminium printed circuit board

3. High dielectric strength of 1,500 V between input and output. 4,000 V available for 10A, 15A, 20A devices.

4. Heat sink and DIN mounting rail and terminal cover are available as accessories

APPLICATIONS

1. Molding machine (heater control)
2. Temperature controlled bath (heater control)
3. Printing machine (heater control)
4. Machine tool (motor control)

TYPES

1. Plug-in terminal type

Type	Load voltage	Input voltage	Standard (1,500V AC) Part No.	Reinforced (4,000V AC) Part No.
Zero-cross 10 A	75 to 125V AC	4 to 6V DC	AQR10A1-Z4/6VDC	—
		10 to 18V DC	AQR10A1-Z10/18VDC	—
		18 to 28V DC	AQR10A1-Z18/28VDC	—
	75 to 250V AC	4 to 6V DC	AQR10A2-Z4/6VDC	AQR10A2-ZV4/6VDC
		10 to 18V DC	AQR10A2-Z10/18VDC	AQR10A2-ZV10/18VDC
		18 to 28V DC	AQR10A2-Z18/28VDC	AQR10A2-ZV18/28VDC
Zero-cross 15 A	75 to 125 V AC	4 to 6V DC	AQR15A1-Z4/6VDC	—
		10 to 18V DC	AQR15A1-Z10/18VDC	—
		18 to 28V DC	AQR15A1-Z18/28VDC	—
	75 to 250 V AC	4 to 6V DC	AQR15A2-Z4/6VDC	AQR15A2-ZV4/6VDC
		10 to 18V DC	AQR15A2-Z10/18VDC	AQR15A2-ZV10/18VDC
		18 to 28V DC	AQR15A2-Z18/28VDC	AQR15A2-ZV18/28VDC
Zero-cross 20 A	75 to 125 V AC	4 to 6V DC	AQR20A1-Z4/6VDC	—
		10 to 18V DC	AQR20A1-Z10/18VDC	—
		18 to 28V DC	AQR20A1-Z18/28VDC	—
	75 to 250 V AC	4 to 6V DC	AQR20A2-Z4/6VDC	AQR20A2-ZV4/6VDC
		10 to 18V DC	AQR20A2-Z10/18VDC	AQR20A2-ZV10/18VDC
		18 to 28V DC	AQR20A2-Z18/28VDC	AQR20A2-ZV18/28VDC

2. Screw-terminal type

Type	Load voltage	Input voltage	Standard (1,500V AC) Part No.	Reinforced (4,000V AC) Part No.
Zero-cross 10 A	75 to 125 V AC	4 to 6V DC	AQR10A1-S-Z4/6VDC	—
		10 to 18V DC	AQR10A1-S-Z10/18VDC	—
		18 to 28V DC	AQR10A1-S-Z18/28VDC	—
	75 to 250 V AC	4 to 6V DC	AQR10A2-S-Z4/6VDC	AQR10A2-S-ZV4/6VDC
		10 to 18V DC	AQR10A2-S-Z10/18VDC	AQR10A2-S-ZV10/18VDC
		18 to 28V DC	AQR10A2-S-Z18/28VDC	AQR10A2-S-ZV18/28VDC
Zero-cross 15 A	75 to 125 V AC	4 to 6V DC	AQR15A1-S-Z4/6VDC	—
		10 to 18V DC	AQR15A1-S-Z10/18VDC	—
		18 to 28V DC	AQR15A1-S-Z18/28VDC	—
	75 to 250 V AC	4 to 6V DC	AQR15A2-S-Z4/6VDC	AQR15A2-S-ZV4/6VDC
		10 to 18V DC	AQR15A2-S-Z10/18VDC	AQR15A2-S-ZV10/18VDC
		18 to 28V DC	AQR15A2-S-Z18/28VDC	AQR15A2-S-ZV18/28VDC
Zero-cross 20 A	75 to 125 V AC	4 to 6V DC	AQR20A1-S-Z4/6VDC	—
		10 to 18V DC	AQR20A1-S-Z10/18VDC	—
		18 to 28V DC	AQR20A1-S-Z18/28VDC	—
	75 to 250 V AC	4 to 6V DC	AQR20A2-S-Z4/6VDC	AQR20A2-S-ZV4/6VDC
		10 to 18V DC	AQR20A2-S-Z10/18VDC	AQR20A2-S-ZV10/18VDC
		18 to 28V DC	AQR20A2-S-Z18/28VDC	AQR20A2-S-ZV18/28VDC
Zero-cross 30 A	75 to 250 V AC	4 to 6V DC	AQR30A2-S-Z4/6VDC	—
		10 to 18V DC	AQR30A2-S-Z10/18VDC	—
		18 to 28V DC	AQR30A2-S-Z18/28VDC	—
Zero-cross 40 A	75 to 250 V AC	4 to 6V DC	AQR40A2-S-Z4/6VDC	—
		10 to 18V DC	AQR40A2-S-Z10/18VDC	—
		18 to 28V DC	AQR40A2-S-Z18/28VDC	—

ORDERING INFORMATION

Ex. AQR | 10A | 1 | S | Z | 4/6VDC

Load current	Load voltage	Terminal shape	Type	Input voltage
10 A, 15 A, 20 A, 30 A, 40 A	1: 75 to 125 V AC 2: 75 to 250 V AC	Nil: Plug-in terminal S: Screw terminal	Z: Zero-cross type (1,500 V) ZV: Zero-cross type (4,000 V)	4/6, 10/18, 18/28 V DC

Note: Standard packing: Carton 10 pcs., Case: 100 pcs.

SPECIFICATIONS

1. Ratings (at 20°C 68°F, Input ripple: 1% or less)

1) 10 A type

Items	Part No.	AQR10A1-Z4/ 6VDC	AQR10A1-Z10/ 18VDC	AQR10A1-Z18/ 28VDC	AQR10A2-Z4/ 6VDC AQR10A2-ZV4/ 6VDC	AQR10A2-Z10/ 18VDC AQR10A2-ZV10/ 18VDC	AQR10A2-Z18/ 28VDC AQR10A2-ZV18/ 28VDC	Remarks
		AQR10A1-S-Z4/ 6VDC	AQR10A1-S-Z10/ 18VDC	AQR10A1-S-Z18/ 28VDC	AQR10A2-S-Z4/ 6VDC AQR10A2-S-ZV4/ 6VDC	AQR10A2-S-Z10/ 18VDC AQR10A2-S-ZV10/18VDC	AQR10A2-S-Z18/ 28VDC AQR10A2-S-ZV18/28VDC	
Input side	Input voltage	4 to 6V DC	10 to 18V DC	18 to 28V DC	4 to 6V DC	10 to 18V DC	18 to 28V DC	
	Input impedance	Approx. 0.26 kΩ	Approx. 0.86 kΩ	Approx. 1.36 kΩ	Approx. 0.26 kΩ	Approx. 0.86 kΩ	Approx. 1.36 kΩ	
	Drop-out voltage, min.	1 V						
Load side	Max. load current	10 A						See "REFERENCE DATA 1"
	Load voltage	75 to 125 V AC			75 to 250 V AC			
	Frequency	45 to 65 Hz						
	Repetitive peak voltage	400 V			600 V			
	Non-repetitive surge current	100 A						In one cycle at 60 Hz
	Max. "OFF-state" leakage current	2.5 mA (when 100 V AC applied)			5 mA (when 200 V AC applied)			at 60 Hz
	Max. "ON-state" voltage drop	1.6 V						at max. carrying current
	Min. load current	100 mA						
	OFF-state dV/dt	100 V/μs						

2) 15 A type

Items	Part No.	AQR15A1-Z4/ 6VDC	AQR15A1-Z10/ 18VDC	AQR15A1-Z18/ 28VDC	AQR15A2-Z4/ 6VDC AQR15A2-ZV4/ 6VDC	AQR15A2-Z10/ 18VDC AQR15A2-ZV10/ 18VDC	AQR15A2-Z18/ 28VDC AQR15A2-ZV18/ 28VDC	Remarks
		AQR15A1-S-Z4/ 6VDC	AQR15A1-S-Z10/ 18VDC	AQR15A1-S-Z18/ 28VDC	AQR15A2-S-Z4/ 6VDC AQR15A2-S-ZV4/ 6VDC	AQR15A2-S-Z10/ 18VDC AQR15A2-S-ZV10/18VDC	AQR15A2-S-Z18/ 28VDC AQR15A2-S-ZV18/28VDC	
Input side	Input voltage	4 to 6V DC	10 to 18V DC	18 to 28V DC	4 to 6V DC	10 to 18V DC	18 to 28V DC	
	Input impedance	Approx. 0.26 kΩ	Approx. 0.86 kΩ	Approx. 1.36 kΩ	Approx. 0.26 kΩ	Approx. 0.86 kΩ	Approx. 1.36 kΩ	
	Drop-out voltage, min.	1 V						
Load side	Max. load current	15 A						See "REFERENCE DATA 1"
	Load voltage	75 to 125 V AC			75 to 250 V AC			
	Frequency	45 to 65 Hz						
	Repetitive peak voltage	400 V			600 V			
	Non-repetitive surge current	150 A						In one cycle at 60 Hz
	Max. "OFF-state" leakage current	2.5 mA (when 100 V AC applied)			5 mA (when 200 V AC applied)			at 60 Hz
	Max. "ON-state" voltage drop	1.6 V						at max. carrying current
	Min. load current	100 mA						
	OFF-state dV/dt	100 V/μs						

3) 20 A type

Items		Part No.	AQR20A1-Z4/ 6VDC	AQR20A1-Z10/ 18VDC	AQR20A1-Z18/ 28VDC	AQR20A2-Z4/ 6VDC AQR20A2-ZV4/ 6VDC	AQR20A2-Z10/ 18VDC AQR20A2-ZV10/ 18VDC	AQR20A2-Z18/ 28VDC AQR20A2-ZV18/ 28VDC	Remarks
			AQR20A1-S-Z4/ 6VDC	AQR20A1-S-Z10/ 18VDC	AQR20A1-S-Z18/ 28VDC	AQR20A2-S-Z4/ 6VDC AQR20A2-S-ZV4/ 6VDC	AQR20A2-S-Z10/ 18VDC AQR20A2-S-ZV10/18VDC	AQR20A2-S-Z18/ 28VDC AQR20A2-S-ZV18/28VDC	
Input side	Input voltage		4 to 6V DC	10 to 18V DC	18 to 28V DC	4 to 6V DC	10 to 18V DC	18 to 28V DC	
	Input impedance		Approx. 0.26 k Ω	Approx. 0.86 k Ω	Approx. 1.36 k Ω	Approx. 0.26 k Ω	Approx. 0.86 k Ω	Approx. 1.36 k Ω	
	Drop-out voltage, min.		1 V						
Load side	Max. load current		20 A						See “REFERENCE DATA 1”
	Load voltage		75 to 125 V AC			75 to 250 V AC			
	Frequency		45 to 65 Hz						
	Repetitive peak voltage		400 V			600 V			
	Non-repetitive surge current		200 A						In one cycle at 60 Hz
	Max. “OFF-state” leakage current		2.5 mA (when 100 V AC applied)			5 mA (when 200 V AC applied)			at 60 Hz
	Max. “ON-state” voltage drop		1.6 V						at max. carrying current
	Min. load current		100 mA						
	OFF-state dV/dt		100 V/μs						

4) 30 A type and 40 A type

Items		Part No.	AQR30A2-S-Z4/ 6VDC	AQR30A2-S-Z10/ 18VDC	AQR30A2-S-Z18/ 28VDC	AQR40A2-S-Z4/ 6VDC	AQR40A2-S-Z10/ 18VDC	AQR40A2-S-Z18/ 28VDC	Remarks
Input side	Input voltage		4 to 6V DC	10 to 18V DC	18 to 28V DC	4 to 6V DC	10 to 18V DC	18 to 28V DC	
	Input impedance		Approx. 0.26 k Ω	Approx. 0.86 k Ω	Approx. 1.36 k Ω	Approx. 0.26 k Ω	Approx. 0.86 k Ω	Approx. 1.36 k Ω	
	Drop-out voltage, min.		1 V						
Load side	Max. load current		30 A			40 A			See “REFERENCE DATA 1”
	Load voltage		75 to 250 V AC						
	Frequency		45 to 65 Hz						
	Non-repetitive surge current		300 A			400 A			In one cycle at 60 Hz
	Max. “OFF-state” leakage current		5 mA (when 200 V AC applied)						at 60 Hz
	Max. “ON-state” voltage drop		1.6 V						at max. carrying current
	Min. load current		120 mA						

2. Characteristics (at 20°C 68°F, Input ripple: 1% or less)

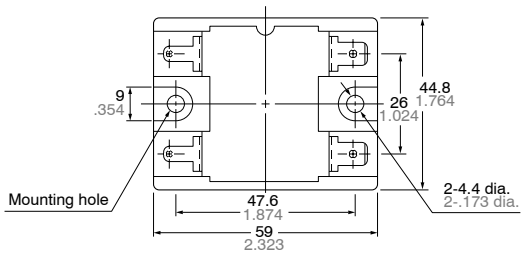
Item	Type	Zero-cross type		Remarks
		Standard type	Reinforced type	
Operate time, max.		(1/2 cycle of voltage sine wave) + 1 ms		
Release time, max.		(1/2 cycle of voltage sine wave) + 1 ms		
Insulation resistance, min., Initial		100 M Ω between input, output and case		by 500V DC megger
Breakdown voltage		1,500 V AC between input, output and case	4,000 V AC between input, output and case	For 1 min.
Vibration resistance	Functional	10 to 55 Hz at double amplitude of 2 mm*		1 hour for X, Y, Z axes
	Destructive	10 to 55 Hz at double amplitude of 2 mm*		10 minutes for X, Y, Z axes
Shock resistance	Functional	Min. 980 m/s² {100 G}		5 time each for X, Y, Z axes
	Destructive	Min. 980 m/s² {100 G}		4 time each for X, Y, Z axes
Ambient temperature		–20°C to +80°C –4°F to +176°F		
Storage temperature		–25°C to +85°C –13°F to +185°F		
Operational method		Zero-cross (Turn-ON and Turn-OFF)		

Note: * 30 A and 40 A type is 10 to 55 Hz at double amplitude of 1.5 mm.

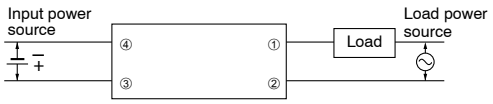
DIMENSIONS

mm inch

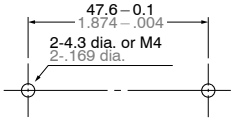
1. Plug-in terminal

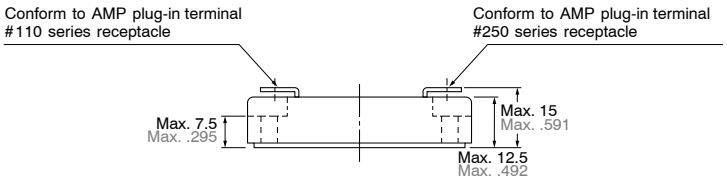


Schematic

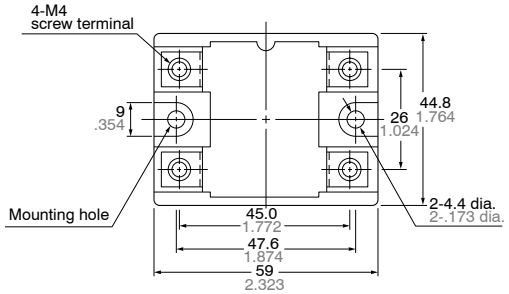


Mounting dimensions
(Bottom view)

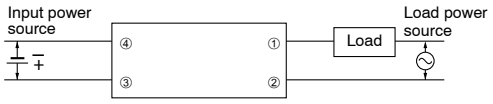




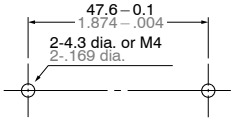
2. Screw terminal

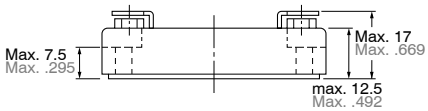


Schematic



Mounting dimensions
(Bottom view)

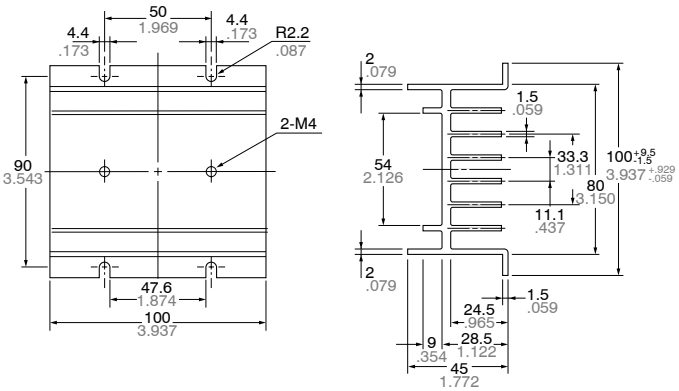




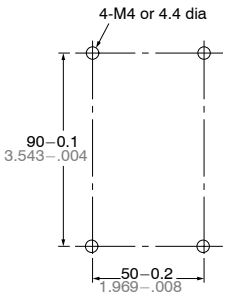
ACCESSORIES

Heat sink (For 10 A, 15A and 20 A)

AQP-HS-20A



Mounting dimensions
(Bottom view)

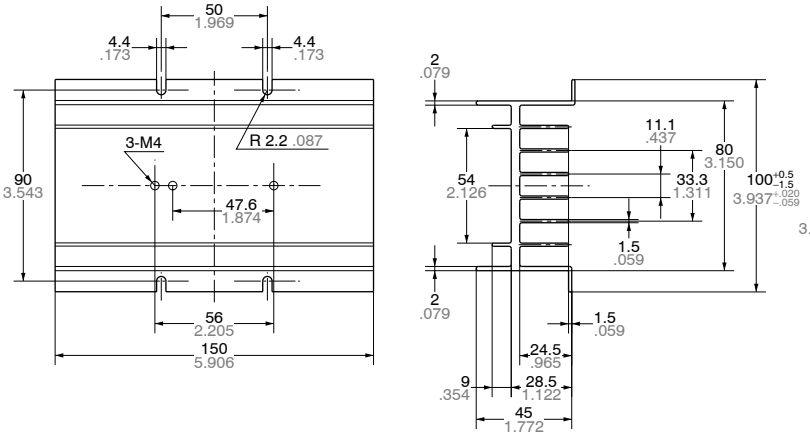


General tolerance: ±0.5 ±.020

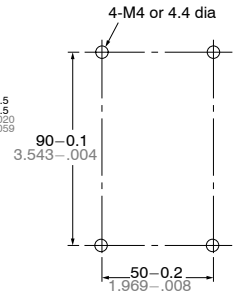
Heat sink (For 30 A, 40 A)

mm inch

AQP-HS-30/40A

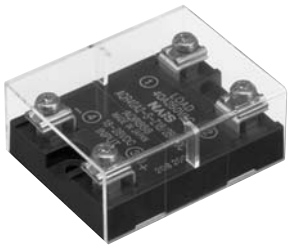


Mounting dimensions
(Bottom view)

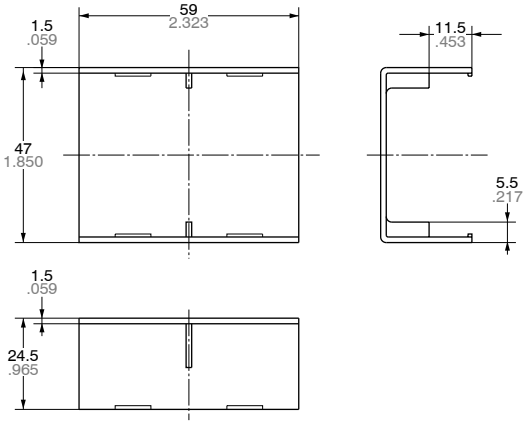


General tolerance: ±0.5 ±.020

With terminal cover



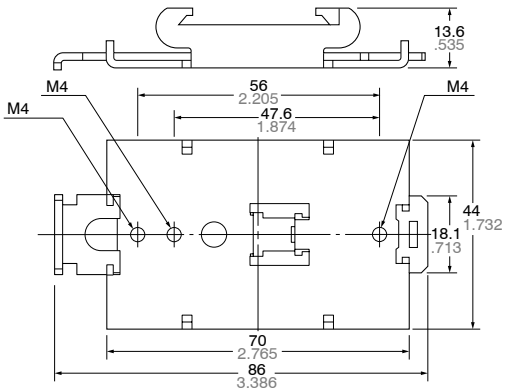
AQP-PC



General tolerance: ±0.5 ±.020

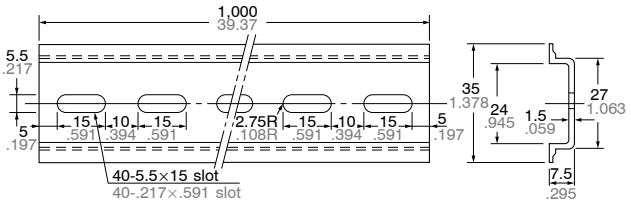
DIN rail mounting plate

AQP-DP



Mounting rail

AT8-DLA1

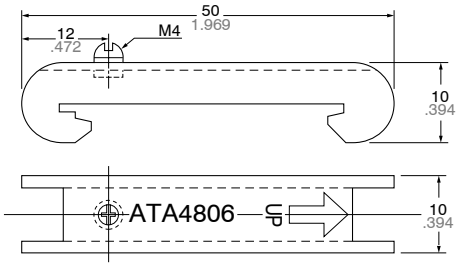


General tolerance: ±0.5 ±.020

Fastening plate

mm inch

ATA4806



REFERENCE DATA

1. Load current vs. ambient temperature

Use load current within range specified in the figure below.

Tested condition:

(1) With external heat sink

1) (a) 10 A, 15A, 20 A type

• A heat sink; optional heat sink (AQP801) or a 150×150×3.2 mm aluminum sheet (painted black)

(b) 30 A, 40 A type

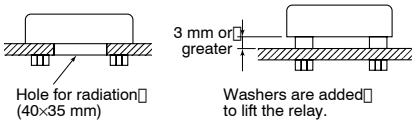
Shown with standard heat sink (AQP804)

2) If attached to a heat sink, use a heat-conductive compound or similar coating to improve cooling.

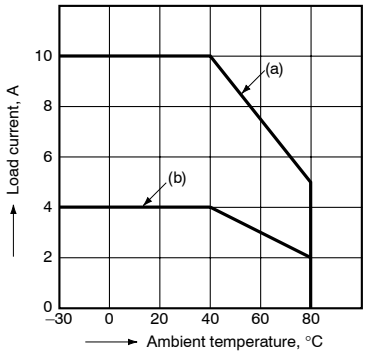
(2) Without external heat sink

If the mounting surface is not metallic and a heat sink is not used, expose the bottom surface and plate surface to improve heat dissipation.

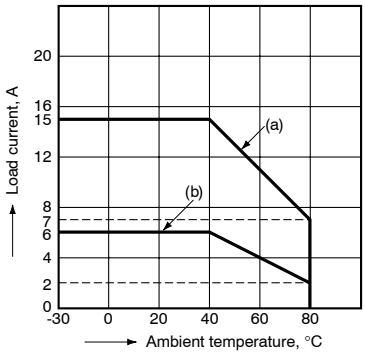
The graphs show the characteristics when the relay is mounted as shown in the right figure.



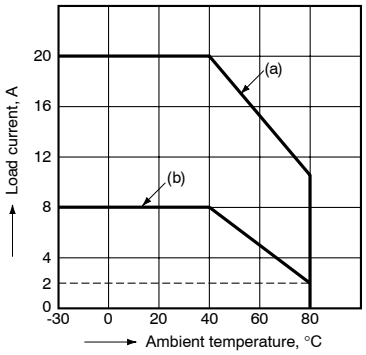
(1) 10 A type



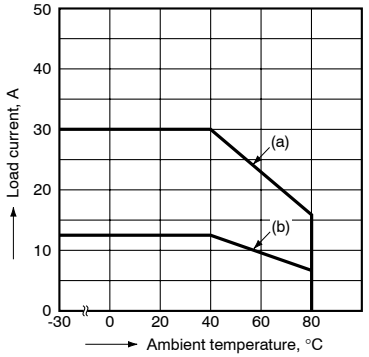
(2) 15 A type



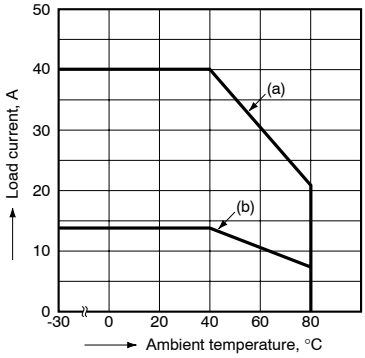
(3) 20 A type



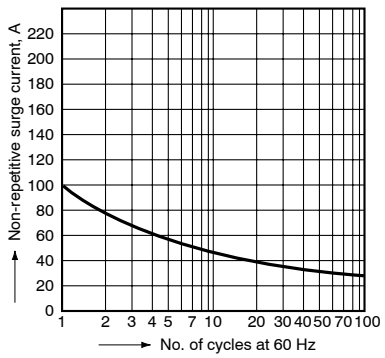
(4) 30 A type



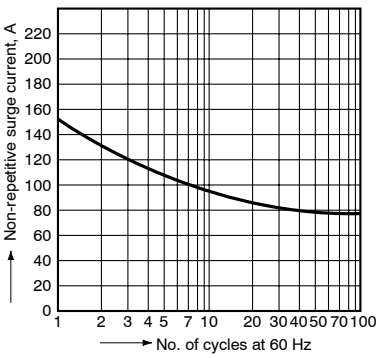
(5) 40 A type



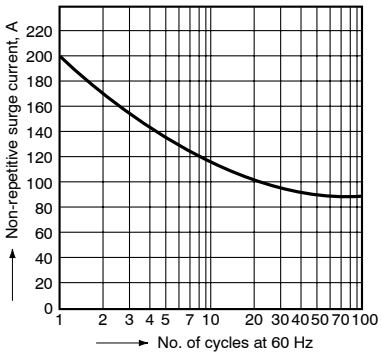
2-1. Non-repetitive surge current vs. carrying time (10 A type)



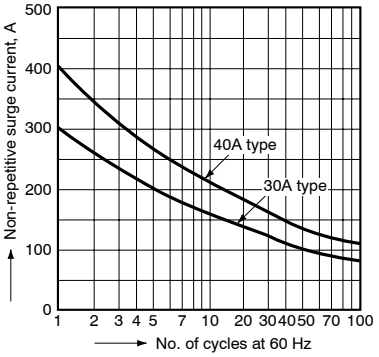
2-2. Non-repetitive surge current vs. carrying time (15 A type)



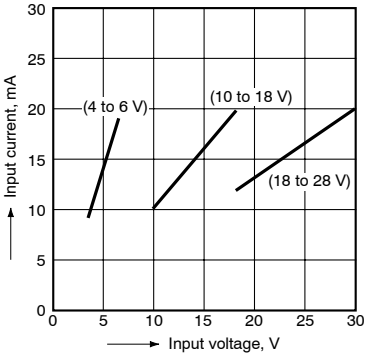
2-3. Non-repetitive surge current vs. carrying time (20 A type)



2-4. Non-repetitive surge current vs. carrying time (30 A, 40 A type)



3. Input current vs. input voltage (10 A, 15 A, 20 A, 30 A, 40 A common)



For Cautions for Use, see page 269.

(Breakdown voltage 2,500V) (Breakdown voltage 4,000V)

Panasonic
ideas for life

AQ-K SOLID STATE RELAY

AQ-K RELAYS

FEATURES

1. Combined with heat sink for slim profile
Helps to save space on control panel

2. Dielectric voltage of 2,500V or 4,000V

3. Both screw-on installation or one-touch DIN-rail installation available

4. Includes operation LED (red)

5. Built-in varistor

APPLICATIONS

1. Molding machine (heater control)
2. Temperature controlled bath (heater control)
3. Printing machine (heater control)
4. Machine tool (motor control)

TYPES

Type	Load current	Load voltage	Breakdown voltage	Part No.
Zero-cross	15 A	75 to 250 V AC	2,500 V AC	AQK1211
			4,000 V AC	AQK1231
	25 A	75 to 250 V AC	2,500 V AC	AQK2211
			4,000 V AC	AQK2231

ORDERING INFORMATION

Ex. AQK □ □ □ □

Load current	Load voltage	Type	Input voltage
1: 15 A 2: 25 A	2: 75 to 250 V AC	1: Zero-cross type (2,500 V) 3: Zero-cross type (4,000 V)	1: 4.5 to 30 V DC

Note: Standard packing: Carton 10 pcs., Case: 60 pcs.

SPECIFICATIONS

1. Ratings (at 20°C 68°F, Input ripple: 1% or less)
1) 10 A type

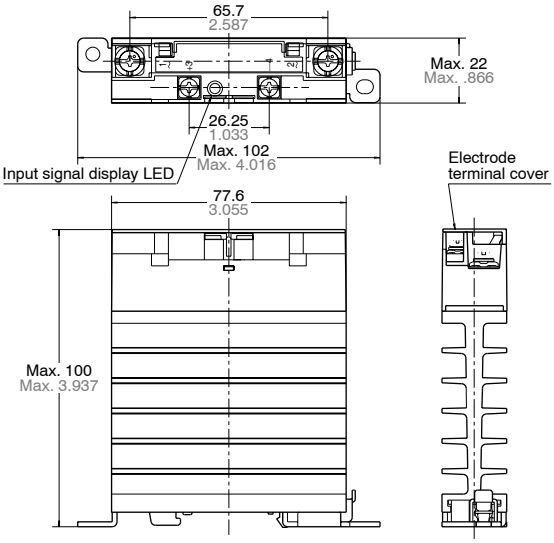
Items	Type	AQK1211	AQK1231	AQK2211	AQK2231	Remarks
Input side	Input voltage	4.5 to 30 V DC				
	Input current, max.	10 mA				
	Drop-out voltage, min.	1 V				
Load side	Max. load current	15 A		25 A		See “REFERENCE DATA 1”
	Load voltage	75 to 250 V AC				
	Frequency	45 to 65 Hz				
	Non-repetitive surge current	150 A		250 A		In one cycle at 60 Hz
	Max. “OFF-state” leakage current	9 mA (when 200 V applied)				at 60 Hz
	Max. “ON-state” voltage drop	1.6 V				at max. carrying current
	Min. load current	100 mA				

2. Characteristics (at 20°C 68°F, Input ripple: 1% or less)

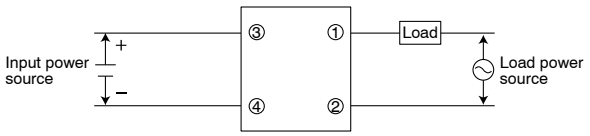
Part No.	AQK1211	AQK1231	AQK2211	AQK2231	Remarks
Operate time, max.	(1/2 cycle of voltage sine wave) + 1 ms				
Release time, max.	(1/2 cycle of voltage sine wave) + 1 ms				
Breakdown voltage	2,500 V AC	4,000 V AC	2,500 V AC	4,000 V AC	
Ambient temperature	–30°C to +80°C –22°F to +176°F				Non-condensing at low temperatures
Insulation resistance, min., Initial	100 M Ω between input, output and case				by 500V DC megger
Vibration resistance	10 to 55 Hz at double amplitude of 0.75 mm				For 1 min.
Shock resistance	Min. 294 m/s^2				
Storage temperature	–35°C to +100°C –31°F to +212°F				
Operational method	Zero-cross (Turn-ON and Turn-OFF)				

DIMENSIONS

mm inch

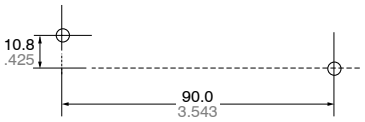


Schematic



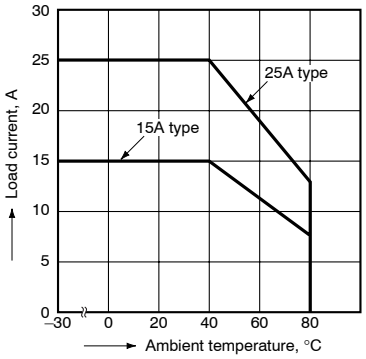
Mounting dimensions (Bottom view)

35-mm DIN rail installation, or 2-4.6/M4 dia. Screws

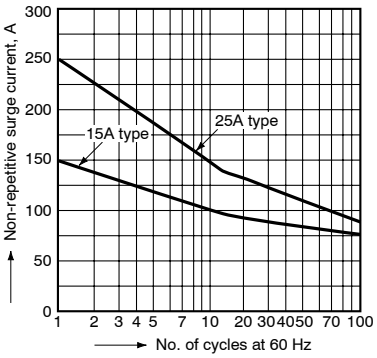


REFERENCE DATA

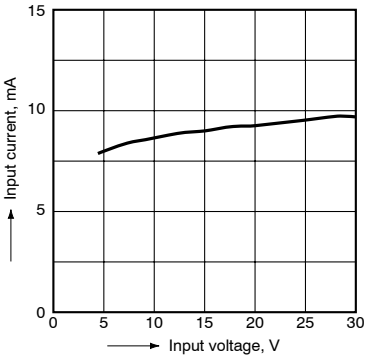
1. Load current vs. ambient temperature characteristics



2. Non-repetitive surge current vs. carrying time (15 A, 25 A type)

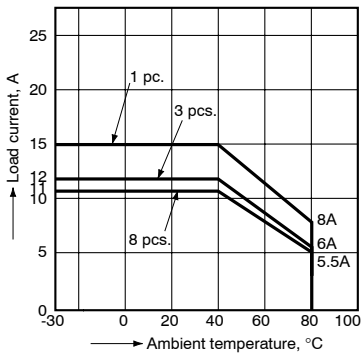


3. Input current vs. input voltage characteristics



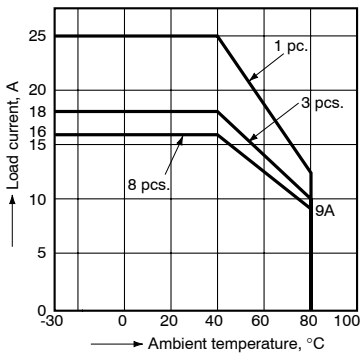
4-(1) Load current when contact mounted vs. ambient temperature characteristics

Tested sample: AQK1211, AQK1231



4-(2) Load current when contact mounted vs. ambient temperature characteristics

Tested sample: AQK2211, AQK2231

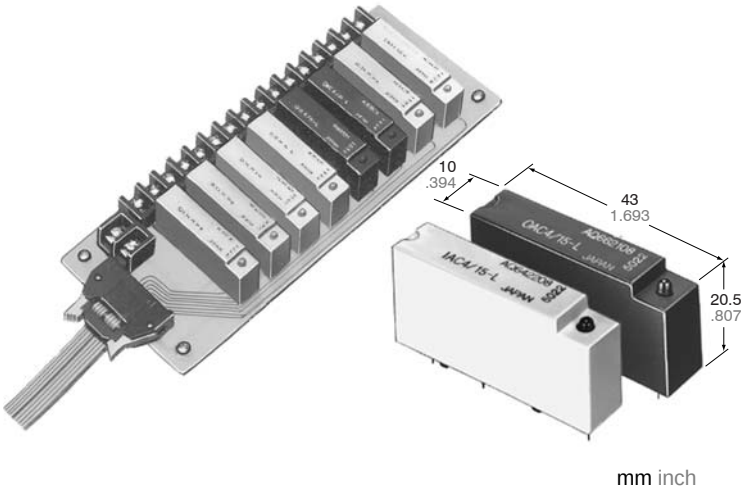


For Cautions for Use, see page 269.

Panasonic
ideas for life

INPUT/OUTPUT RELAYS FOR INTERFACE BETWEEN THE CPU AND THE LOAD

I/O-RELAYS



mm inch

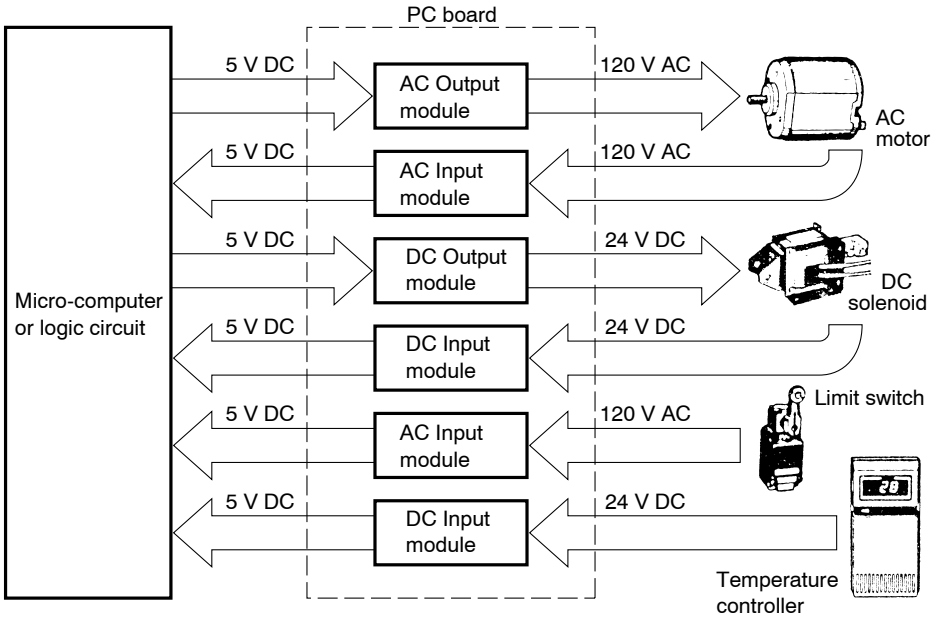
FEATURES

- **Input and output modules for interfacing between CPU and external input devices or loads**
  - **IAC: AC input (yellow)**
  - **OAC: AC output (black)**
  - **IDC: DC input (white)**
  - **ODC: DC output (red)**
- **Excellent transient noise immunity**
- **Breakdown voltage: 4,000 V between input and output**
- **Zero-cross switching for reducing EMI**
- **LED operation indication types available**

TYPICAL APPLICATIONS

1. Optimum for minicomputer and microcomputer use, and for feed back control process control systems.
Robot, NC machine, Automatic Assembling machine.
2. Programmable controllers controls for motors, solenoids and solenoid valves.

EXAMPLE OF I/O SYSTEM CONSTRUCTION



Recently, the microcomputer shown in the left has come into use, with a rapid increase in the use of feedback control for process controllers. As an input/output interface relay, it represents a fast responding interface with long life, noiseless, PC board mounting facility, making circuit design and manufacture simple, and providing amplification of maintenance with space saving. Our company's I/O relays have been grouped for use with either AC or DC devices as AC output type, AC input type, DC output type, and DC input. In addition, the I/O use relay is modularized identically, responding to the various load types for PC board mounting. Because combinations can be freely used, circuit design has been greatly facilitated. Accordingly, the above diagram of interface PC board mounting is a practical construction which can be used.

ORDERING INFORMATION

I	AC	4/15	A	L

Input or Output	AC or DC	Logic supply or control voltage	Input or Output Voltage			Operation indication
				Input	Output	
I: Input module O: Output module	AC: AC input or AC output DC: DC input or DC output	3/15: 3 to 15 V DC 4/15: 4 to 15 V DC 10/32: 10 to 32 V DC	Nil	80 to 140 V AC 3 to 32 C DC	75 to 125 V AC 3 to 60 V DC	Nil: No operation indication L: Operation indication
			A	160 to 280 V AC	75 to 250 V AC 10 to 200 V DC	

(Note) Standard packing: Carton: 20 pcs.; Case: 200 pcs.

TYPES

Input modules

Type	Logic supply voltage	Input voltage	Part No.	
			No LED	With LED
AC	4 to 15 V DC	80 to 140 V AC	IAC4/15	IAC4/15-L
		160 to 280 V AC	IAC4/15-A	IAC4/15-AL
	10 to 32 V DC	80 to 140 V AC	IAC10/32	IAC10/32-L
		160 to 280 V AC	IAC 10/32-A	IAC10/32-AL
DC	4 to 15 V DC	3 to 32 V DC	IDC4/15	IDC4/15-L
	10 to 32 V DC	3 to 32 V DC	IDC10/32	IDC10/32-L

Output modules

Type	Logic supply voltage	Output voltage	Part No.	
			No LED	With LED
AC	3 to 15 V DC or 4 to 15 V DC	75 to 125 V AC	OAC3/15	OAC4/15-L
		75 to 250 V AC	OAC3/15-A	OAC4/15-AL
	10 to 32 V DC	75 to 125 V AC	OAC10/32	OAC10/32-L
		75 to 250 V AC	OAC10/32-A	OAC10/32-AL
DC	3 to 15 V DC or 4 to 15 V DC	3 to 60 V DC	ODC3/15	ODC4/15-L
		10 to 200 V DC	ODC3/15-A	ODC4/15-AL
	10 to 32 V DC	3 to 60 V DC	ODC10/32	ODC10/32-L
		10 to 200 V DC	ODC10/32-A	ODC10/32-AL

SPECIFICATIONS

Rating (at 20°C 68°F, Voltage ripple of logic side: less than 1%)

1. Input module

		IAC 4/15	IAC 4/15-L	IAC 10/32	IAC 10/32-L	IAC 4/15-A	IAC 4/15-AL	IAC 10/32-A	IAC 10/32-AL	IDC 4/15	IDC 4/15-L	IDC 10/32	IDC 10/32-L
Input side	Input voltage	80 to 140 V AC				160 to 280 V AC				3 to 32 V DC			
	Input current, Max.	5 mA (100 V)				5 mA (200 V)				20 mA (32 V)			
	Operate voltage, Max.	80 V AC				160 V AC				3 V			
	Release voltage Min.	10 V AC				20 V AC				0.8 V			
Logic side	Logic supply voltage	4 to 15 V		10 to 32 V		4 to 15 V		10 to 32 V		4 to 15 V		10 to 32 V	
	Logic supply current, Max.	15 mA								15 mA			
	Breakdown voltage	30 V								30 V			
	Output current, Max.	25 mA								25 mA			
	Max. “OFF-side” leakage current	100 μA								100 μA			
	Max. “ON-side” voltage drop	0.4 V								0.4 V			

2. Output module

		OAC 3/15	OAC 4/15-L	OAC 10/32	OAC 10/32-L	OAC 3/15-A	OAC 4/15-AL	OAC 10/32-A	OAC 10/32-AL	ODC 3/15	ODC 4/15-L	ODC 10/32	ODC 10/32-L	ODC 3/15-A	ODC 4/15-AL	ODC 10/32-A	ODC 10/32-AL
Logic side	Logic voltage range	3 to 15 V	4 to 15 V	10 to 32 V		3 to 15 V	4 to 15 V	10 to 32 V		3 to 15 V	4 to 15 V	10 to 32 V		3 to 15 V	4 to 15 V	10 to 32 V	
	Input Impedance (Approx.)	1.6 kΩ	1.7 kΩ	6 kΩ	5 kΩ	1.6 kΩ	1.7 kΩ	6 kΩ	5 kΩ	1.6 kΩ	1.7 kΩ	6 kΩ	5 kΩ	1.6 kΩ	1.7 kΩ	6 kΩ	5 kΩ
	Drop-out voltage, Min.	0.8V								0.8V							
Output side	Max. load current	2 A (Ambient temperature: Max. 30°C)								2 A (Ambient temperature: Max. 40°C)				1 A (Ambient temperature: Max. 40°C)			
	Output voltage	75 to 125 V AC				75 to 250 V AC				3 to 60 V DC				10 to 200 V DC			
	Non-repetitive surge current	30 A (in one cycle at 60 Hz)								5 A (for 1 s)							
	Max. “OFF-state” leakage current	5 mA (100 V)				5 mA (200 V)				1 mA (60 V)				1 mA (200 V)			
	Max. “ON-state” voltage current	1.6 V								1.6 V				2.3 V			
	Min. load current	50 mA								5 mA							

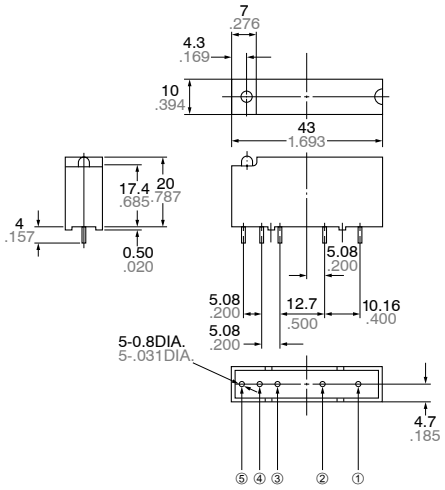
Characteristics (at 20°C 68°F, Voltage ripple of logic side: less than 1%)

		Input modules		Output modules	
		IAC	IDC	OAC	ODC
Operate time, max.		20 ms	5 ms	(1/2 cycle of voltage sine wave)+1 ms	0.5 ms
Release time, max.		20 ms	5 ms	(1/2 cycle of voltage sine wave)+1 ms	2 ms
Insulation resistance		10^9 Ω between input and output (at 500 V DC)			
Breakdown voltage		4,000 V AC between input and output			
Vibration resistance	Functional	117.6 m/s² {12G}, 10 to 55 Hz at double amplitude of 2 mm (10 minutes for X, Y, Z axis)			
	Destructive	117.6 m/s² {12G}, 10 to 55 Hz at double amplitude of 2 mm (1hour for X, Y, Z axis)			
Shock resistance	Functional	Min. 980 m/s² {100G} (4 times each for X, Y, Z axis)			
	Destructive	Min. 980 m/s² {100G}(5 times each for X, Y, Z axis)			
Ambient temperature		–30°C to +80°C –22°F to +176°F		–30°C to +80°C –22°F to +176°F	
Storage temperature		–30°C to +100°C –22°F to +212°F		–30°C to +100°C –22°F to +212°F	
Operational method		–		Zero-cross (Turn-ON and Turn-OFF)	–

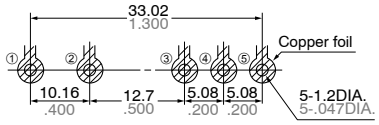
DIMENSIONS

mm inch

Input module (IAC, IDC)

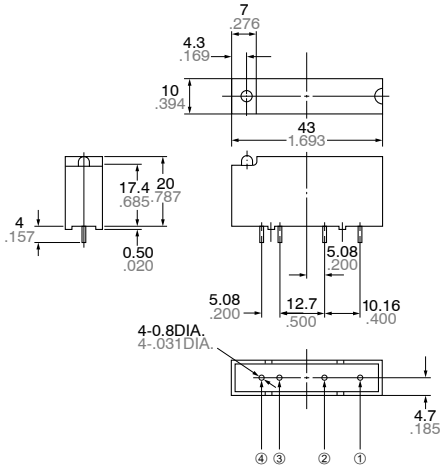


PC board pattern (Copper-side view)

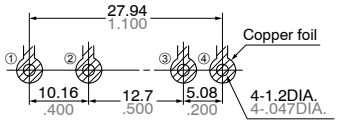


	IAC	IDC
①	Input: AC	Input: DC +
②	Input: AC	Input: DC –
③	Vcc	Vcc
④	Logic output	Logic output
⑤	Grounding	Grounding
Body color	Yellow	White

Output modules (OAC, ODC)



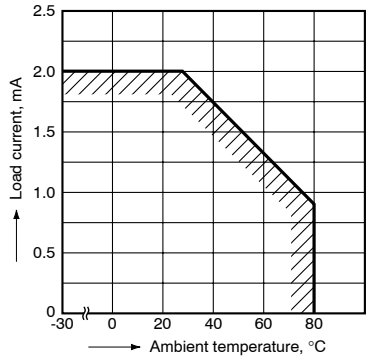
PC board pattern (Copper-side view)



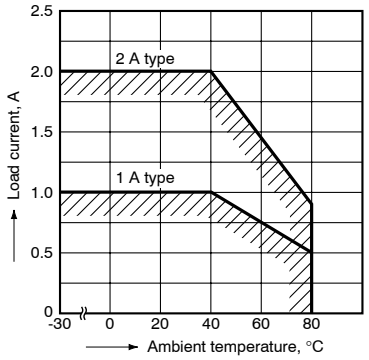
	OAC	ODC
①	Output: AC	Output: DC +
②	Output: AC	Output: DC –
③	Input: DC+	Input: DC+
④	Input: DC-	Input: DC-
Body color	Black	Red

REFERENCE DATA

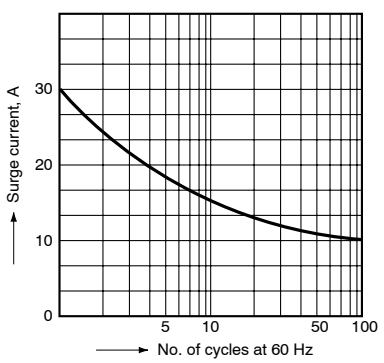
1-1. Load current vs. ambient temperature (OAC)



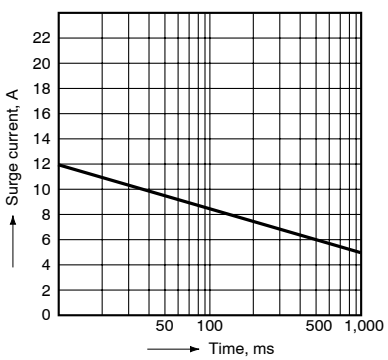
1-2. Load current vs. ambient temperature (ODC)



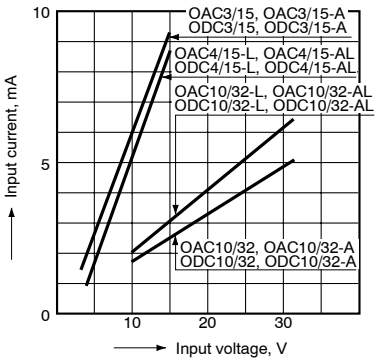
2-1. Surge current vs. time (OAC)



2-2. Surge current vs. time (IDC)

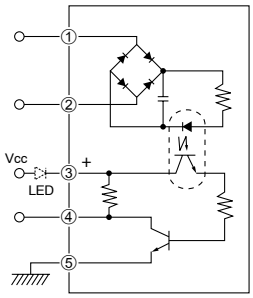


3. Input current vs. input voltage (OAC, ODC)

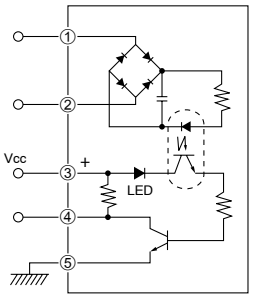


BLOCK DIAGRAM

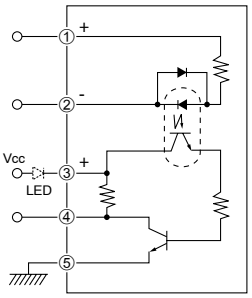
IAC without LED



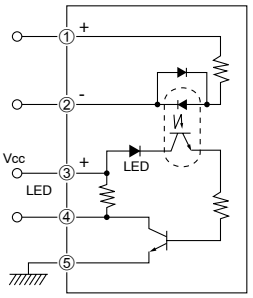
IAC with LED



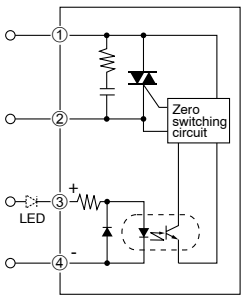
IDC without LED



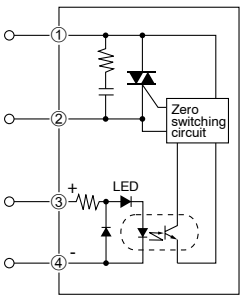
IDC with LED



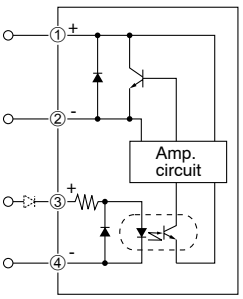
OAC without LED



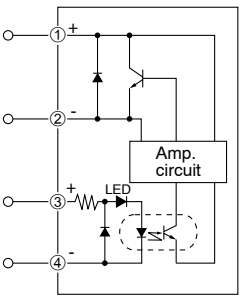
OAC with LED



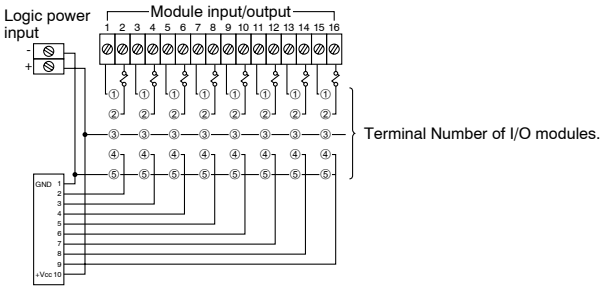
ODC without LED



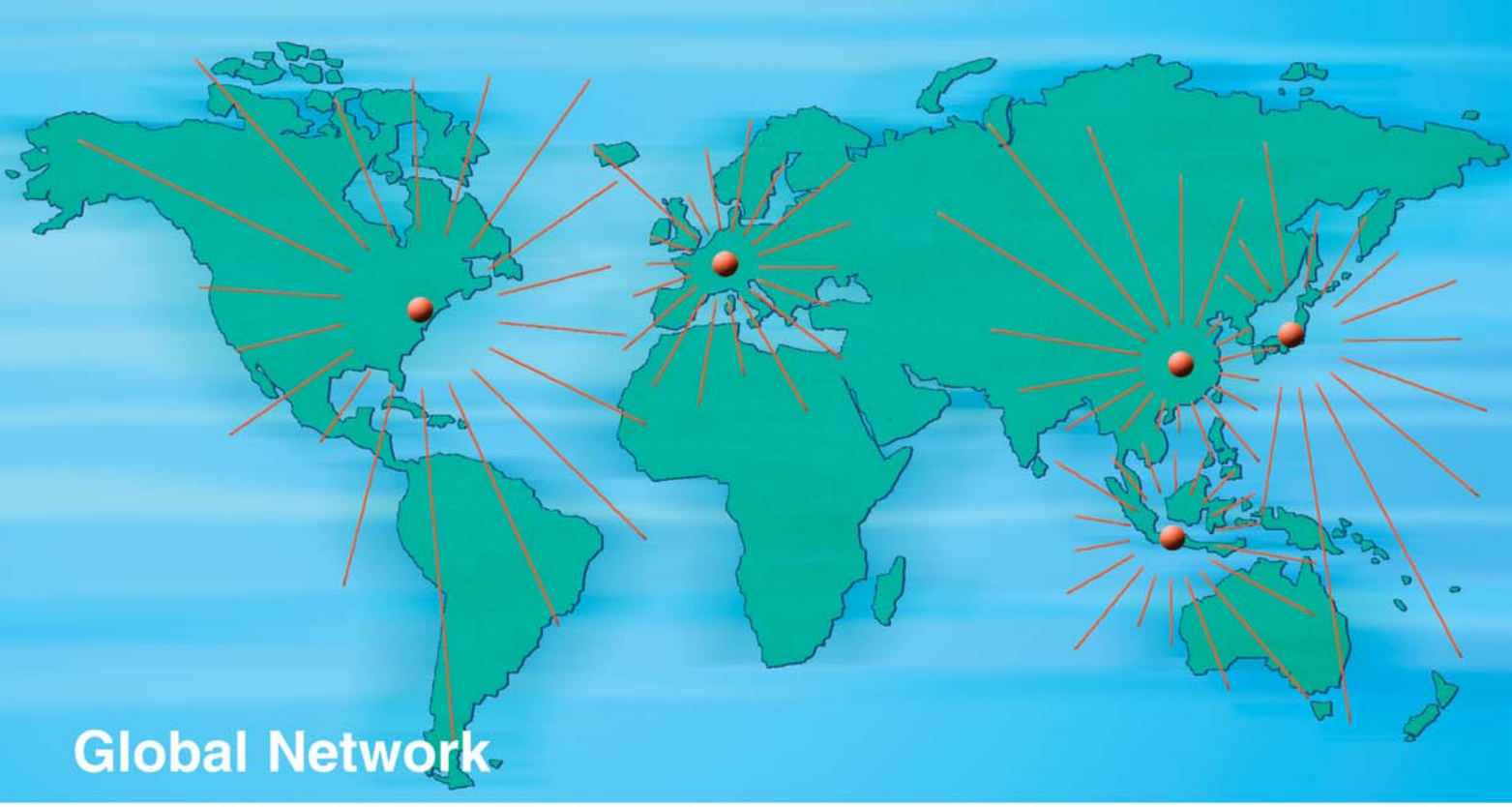
ODC with LED



Wiring method
(8 input/output example)
Wiring can be used commonly for input modules and output modules. Therefore, wiring becomes simple.



For Cautions for Use, see page 269.



North America | Europe | Asia Pacific | China | Japan

Panasonic Electric Works

Please contact our European Sales Companies in:

Europe

▸ Headquarters	Panasonic Electric Works Europe AG	Rudolf-Diesel-Ring 2, 83607 Holzkirchen, Tel. (08024) 648-0, Fax (08024) 648-111, www.panasonic-electric-works.com
▸ Austria	Panasonic Electric Works Austria GmbH	Josef Madersperger Str. 2, 2362 Biedermannsdorf, Tel. (02236) 26846, Fax (02236) 46133, www.panasonic-electric-works.at
	PEW Electronic Materials Europe GmbH	Industriehafenstraße 9, 4470 Enns, Tel. (07223) 883, Fax (07223) 88333, www.panasonic-electronic-materials.com
▸ Benelux	Panasonic Electric Works Sales Western Europe B.V.	De Rijn 4, (Postbus 211), 5684 PJ Best, (5680 AE Best), Netherlands, Tel. (0499) 372727, Fax (0499) 372185, www.panasonic-electric-works.nl
▸ Czech Republic	Panasonic Electric Works Czech s.r.o.	Prumyslová 1, CZ-34815 Planá, Tel. (0374) 799990, Fax (0374) 799999, www.panasonic-electric-works.cz
▸ France	Panasonic Electric Works Sales Western Europe B.V.	French Branch Office, B.P. 44, F-91371 Verrières le Buisson CEDEX, Tél. 01 60135757, Fax 01 60135758, www.panasonic-electric-works.fr
	PEW Electronic Materials France S.A.R.L.	26 Allée du Clos des Charmes, 77090 Collegien, Tél. 01 64622919, Fax 01 64622809, www. panasonic-electronic-materials.com
▸ Germany	Panasonic Electric Works Deutschland GmbH	Rudolf-Diesel-Ring 2, 83607 Holzkirchen, Tel. (08024) 648-0, Fax (08024) 648-555, www.panasonic-electric-works.de
▸ Ireland	Panasonic Electric Works UK Ltd.	Dublin, Tel. (01) 4600969, Fax (01) 4601131, www.panasonic-electric-works.co.uk
▸ Italy	Panasonic Electric Works Italia s.r.l.	Via del Commercio 3-5 (Z.I. Ferlina), 37012 Bussolengo (VR), Tel. (045) 6752711, Fax (045) 6700444, www.panasonic-electric-works.it
	PEW Building Materials Europe s.r.l.	Viale Elvezia 18, 20154 Milano (MI), Tel. (02) 33604525, Fax (02) 33605053, www.panasonic-building-materials.com
▸ Nordic Countries	Panasonic Electric Works Nordic AB	Sjöängsvägen 10, 19272 Sollentuna, Sweden, Tel. (08) 59476680, Fax (08) 59476690, www.panasonic-electric-works.se
	PEW Fire & Security Technology Europe AB	Citadellsvägen 23, 21118 Malmö, Tel. (040) 6977000, Fax (040) 6977099, www.panasonic-fire-security.com
▸ Portugal	Panasonic Electric Works España S.A.	Portuguese Branch Office, Avda Adelino Amaro da Costa 728 R/C J, 2750-277 Cascais, Tel. (21) 4812520, Fax (21) 4812529
▸ Spain	Panasonic Electric Works España S.A.	Barajas Park, San Severo 20, 28042 Madrid, Tel. (91) 3293875, Fax (91) 3292976, www.panasonic-electric-works.es
▸ Switzerland	Panasonic Electric Works Schweiz AG	Grundstrasse 8, 6343 Rotkreuz, Tel. (041) 7997050, Fax (041) 7997055, www.panasonic-electric-works.ch
▸ United Kingdom	Panasonic Electric Works UK Ltd.	Sunrise Parkway, Linford Wood, Milton Keynes, MK14 6LF, Tel. (01908) 231555, Fax (01908) 231599, www.panasonic-electric-works.co.uk

Panasonic®

1153 eu en 05/05