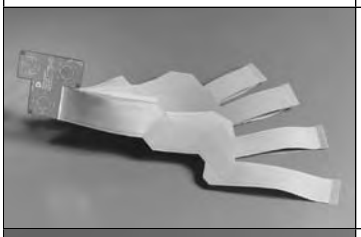
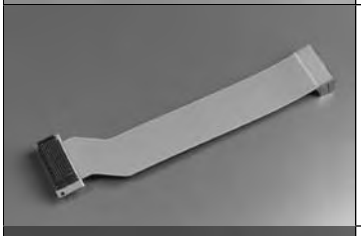
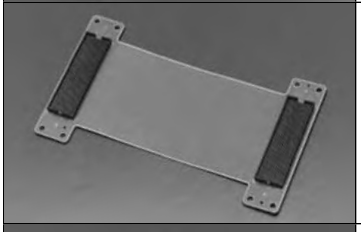
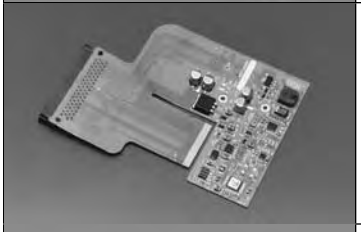
Visit www.molex.com to access more part numbers and product information, download sales drawings, product specifications, 3D models, place sample requests, and more.

# Copper Flex Products

Molex Flexible Printed Circuit Technology is the answer to your most challenging interconnect applications. We are your total solution for Flexible Printed Circuitry because we design and manufacture both the flex and the connectors. A Flexible Printed Circuit (FPC or Flex) is an ultra-reliable technology. An FPC can be the best solution for creating products which are complex, small, lightweight or have harsh environmental conditions. Flex can be designed to meet a wide range of temperature and environmental extremes.

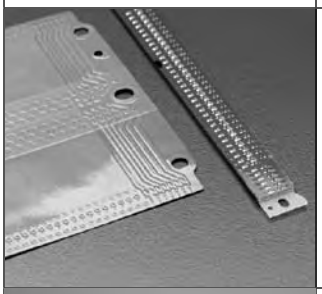
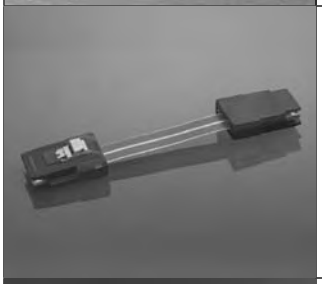
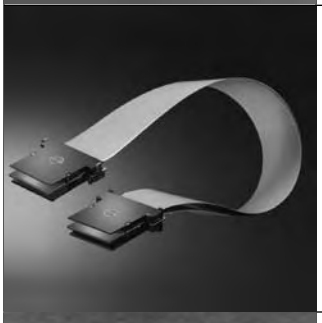
This custom solution has a variety of applications. An FPC can replace a traditional printed circuit board. Flex circuits are excellent for designs with high-density circuitry, and are more suited for dynamic applications such as hinge and drawer applications.

Most commonly, flex acts as an interconnect device. Flex circuits make electronic interconnection both simpler and more reliable. FPC interconnects are often used in applications where high signal speed, heat, flexibility or space savings are issues.

| | Product | Features | Flex Construction | Standard Interconnects |
|---|---|---|---|---|
|  | ***High-Speed Rigid Flex*** | • Surface mount on both sides<br>• Stronger barrels<br>• Press-fit connector capability | Rigid flex | Plateau HS Mezz™, SlimStack™, 0.50mm (.020") stacking systems, VHDM® |
|  | ***High-Speed Flex Assemblies*** | • Typically 3 or more layers<br>• Large number of interconnect options<br>• High conductive routing area | Multi-layer | Plateau HS Mezz, SlimStack, 0.50mm (.020") stacking systems, VHDM, C-Grid®, Milli-Grid™, EBBI™ |
|  | ***Flex Backplanes*** | • High signal frequency<br>• Controlled impedance<br>• Improves airflow within the system | Multi-layer<br>Rigid flex | VHDM, VHDM-HSD™, MZP™, PCI Express, SATA, SAS, MFB™, Omnigrid® |
|  | ***High-Density Flex*** | • Typically 2 or more layers<br>• Tight line and space widths<br>• Reduces weight<br>• Better thermal characteristics than standard rigid board constructions | Double-sided<br>Multi-layer | C-Grid, Milli-Grid, SlimStack, 1.00 to .030mm (.039 to .012") board-to-board systems |
|  | ***Flex Interconnect Assemblies*** | • Virtually unlimited variety of interconnect options<br>• Reduces assembly time<br>• Excellent thermal management | Single sided<br>Single-sided, dual access<br>Double-sided<br>Multi-layer | C-Grid, Milli-Grid, SlimStack, 1.00 to .030mm (.039 to .012") board-to-board systems, MicroCross™ DVI, RJ-11, RJ-45, Mini-Fit®, Micro-Fit 3.0™, EBBI™, CradleCon™, LFH™, HDMI, USB |
|  | ***Flex Jumpers*** | • Eliminates wire harnesses<br>• Reduces package size<br>• At least one ZIF end connection | Single-sided<br>Single-sided, dual access<br>Double-sided | 1.27 to 0.30mm (.050 to .020") ZIF systems |

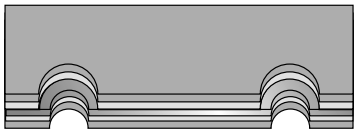
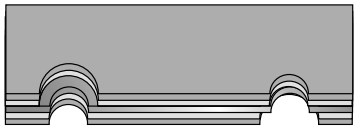
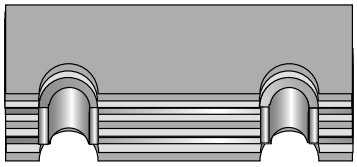
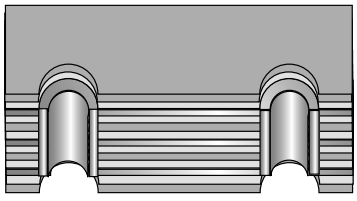
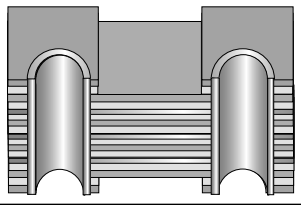
VHDM and VHDM-HSD are trademarks or registered trademarks of Amphenol Corporation

# Copper Flex

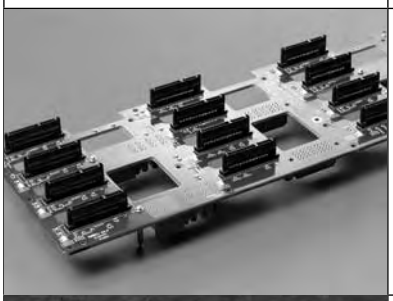
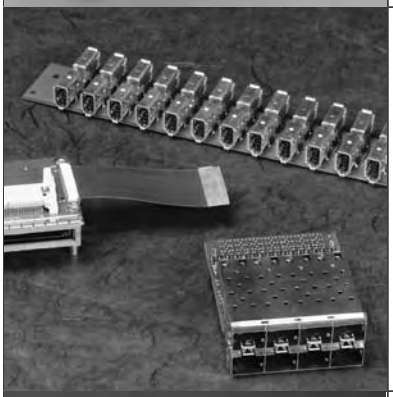
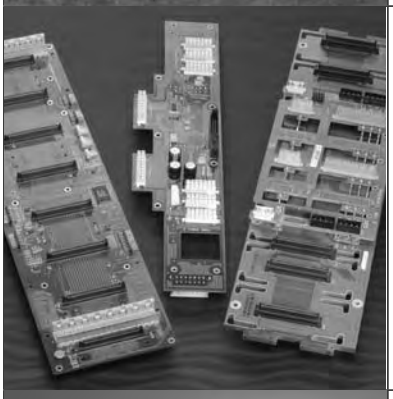
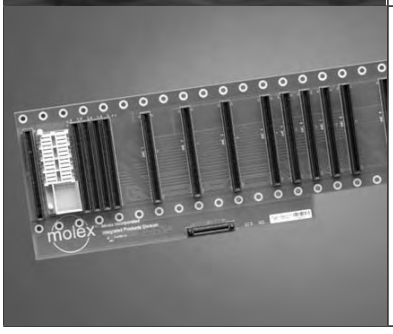
| | Product | Features and Benefits | Applications |
|---|---|---|---|
|  | ***FlexBeam™*** | • Low-profile design provides optimum electrical performance<br>• Pin-matrix configuration on 1.00 and 0.80mm (.039 and .031") centers provides high signal density<br>• Wiping contact ensures high reliability<br>• Available in single beam, 0.80mm (.031") pitch configurations, to provide high-density and reliability; available in dual-beam, 1.00mm (.039") pitch configurations, to provide contact redundancy in high-reliability applications<br>• Flex cable lengths of 4 to 28 inches for design flexibility | • Telecommunication<br>• Server<br>• Mass storage<br>• Medical imaging<br>• Automatic test equipment (ATE)<br>• Military command and control centers |
|  | ***iPass™ Flex Cable Assemblies*** | • iPass flex assemblies are compatible with the iPass connector, providing all the advantages of the high-density iPass connector system<br>• Data rates capable of 6.25 Gbps and higher to support current and future SAS and SATA signal speeds<br>• Mass terminated for a reliable and consistent flex circuit-to-PCB assembly termination<br>• Excellent for wrap-around termination applications on external ports | • Telecommunication<br>• Computers/storage<br>• Medical imaging and controller<br>• Industrial controller<br>• Consumer gaming |
|  | ***Rigid Flex*** | • Provides an integrated packaging solution that eliminates separate board, cables and connectors<br>• Ideal for high-speed applications because there are no geometry changes to cause impedance discontinuities<br>• Reliable—the one piece design eliminates failure points in the board-to-board interconnect.<br>• Light weight, which makes it excellent for portable devices<br>• Occupies three dimensions, enabling the Copper Flex to be bent around packaging and even over itself to fit in to a much smaller device enclosure | • Telecommunication: Switches, hand held units, base stations<br>• Computer: Servers and storage<br>• Military/Aero: Communications, guidance systems and weapon systems<br>• Medical: Hand held and mobile devices, imaging<br>• Automatic test equipment |
|  | ***SEARAY* Copper Flex Jumpers*** | • Off-the-shelf design which provides a proven product for immediate use with little or no development cost for the end user<br>• High-performance design that supports the most aggressive digital transmission needs up to 10 Gbps<br>• High-density flex jumper and connector design which provides packaging advantages, including high-pin counts, multiple stack heights and clean-signal routing<br>• Mass solder process that provides high reliability that cables do not offer and the flexibility that rigid boards do not provide. | • High and Mid-Range Computers: Servers<br>• Medical: Scanning equipment, data acquisition and imaging equipment<br>• Military: Radar and topographical equipment, control centers and CPUs<br>• Networking and Telecommunications: Network routers and switches, mobile base stations |
|  | ***EXTreme PowerEdge™ Flex*** | • Replaces traditional cable harnesses for improved airflow and cable routing management<br>• For power applications from 25.0 to 100.0A with side band signal options<br>• Large conductor surface provides good heat dissipation<br>• Low inductance in power systems allows for clean power transfer in system, and helps to minimize losses in the power delivery system.<br>• Positive latching for secure mating. | • Telecommunication: Switches and base stations<br>• Industrial: System controls<br>• Military: Communications, systems controls, data acquisition<br>• Medical: Imaging, systems controls<br>• Computer/Storage: Server, mass storage, point of sale<br>• Test Equipment: Automatic Test Equipment (ATE) |
|  | ***SlimStack™ Flex Assemblies*** | • 0.50 to 0.635mm (.020 to .025") contact pitch provides high-density signals in a low-cost connector system<br>• High signal frequency for impedance control to 100 ohms differential with up to 4.25 Gpbs performance<br>• Low profile to accommodate small spaces<br>• Latching system available upon request (contact Product Manager) for additional mating assurance | • Telecommunication: Hubs, routers and base stations (Cisco, Motorola and Alcatel)<br>• Computer: Storage, servers and notebooks<br>• Test Equipment: Scopes, data acquisition systems<br>• Medical: Controls and monitoring systems<br>• Industrial: Controls and monitoring systems |

*SEARAY is a trademark of Samtec, Inc.

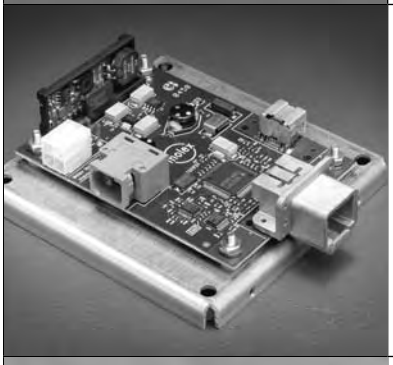
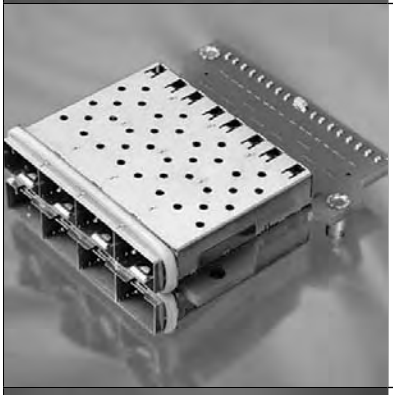
# Copper Flex Products

| | Flex Construction | Description | Applications |
|---|---|---|---|
|  | ***Single-Sided*** | One conductive layer | • Jumpers (board-to-board interconnect)<br>• Print head cables<br>• Wire harness replacements<br>• Power control modulators<br>• Low-cost jumpers |
|  | ***S2—Single-Sided, Dual Access*** | One conductive layer, access from both sides | • Jumpers (board-to-board interconnect)<br>• Disk drives<br>• Consumer electronics<br>• Automotive controls and sensors |
|  | ***Double-Sided*** | Two conductive layers | • Digital displays for consumer and hand-held items<br>• Industrial electronic controls<br>• LED panels for military and medical devices<br>• Digital cameras |
|  | ***Multi-Layer*** | More than 2 conductive layers | • Servers and high-end computers<br>• Laptop computers<br>• Computer storage<br>• Telecom base stations, hubs and routers<br>• Mobile phones |
|  | ***Rigid Flex*** | Combination of traditional PCB and Flex created into 1 continuous piece | • Military electronics<br>• Flex applications requiring SMT components on both sides<br>• Flex applications that need press-fit connectors<br>• Mobile medical equipment<br>• High-temperature and harsh environment applications |

# Printed Circuit and Electromechanical Assemblies

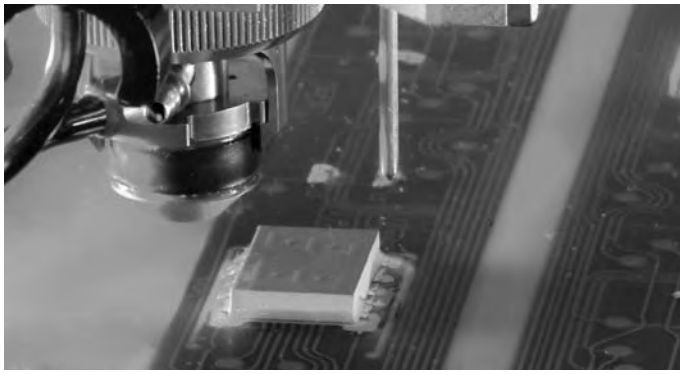
| | Product | Features and Benefits |
|---|---|---|
|  | ***Backplane/Midplane Assemblies*** | • Signal integrity modeling<br>• Full turnkey services<br>• Support all Molex and industry-standard backplane connector systems (Impact™, I-Trac™, GbX®, VHDM®, VHDM-HSD™, Milli-Z™, Serial ATA, SCSI, etc.)<br>• Mechanical and electrical design, development, test support and in-house test engineering development capabilities<br>• Global assembly capabilities |
|  | ***Custom Printed Circuit Board Assemblies*** | • Experts in interconnect PCB assembly solutions: I/O cards, mezzanine cards and hybrid passive and active interconnect cards<br>• Global manufacturing, material sourcing, tooling and testing capabilities<br>• Clean sheet mechanical and electrical design, development and test support, including modeling and empirical testing<br>• Mechanical packaging expertise to modify I/O to meet specialized form factor requirements |
|  | ***Interconnect Cards*** | • Signal and/or power cards available<br>• Press-fit, through hole and SMT options available<br>• Cost effective solution by integrating Molex connector technology and manufacturing<br>• Specialize in boards with high connector content<br>• Currently serving customers worldwide, reliably and competitively |
|  | ***MicroTCA Backplane*** | • Connectors for 2 power supplies and 2 MCHs facilitates testing of hand-off features when one power supply or MCH fails<br>• Designed with 4 compact slots to allow either 10 full-height (10 total) slots or 4 compact and 8 full-height slots (12 total).<br>• Connector interface with backplane (launch geometry) has been carefully designed to minimize reflections for 10 Gbps performance.<br>• FRU ROM (Field Replaceable Unit Read Only Memory) on the backplane communicates with MCH all of the important characteristics<br>• Design is easily scalable and flexible to minimize customization and time-to-market, to meet customer applications and requirements. |

# Printed Circuit and Electromechanical Assemblies

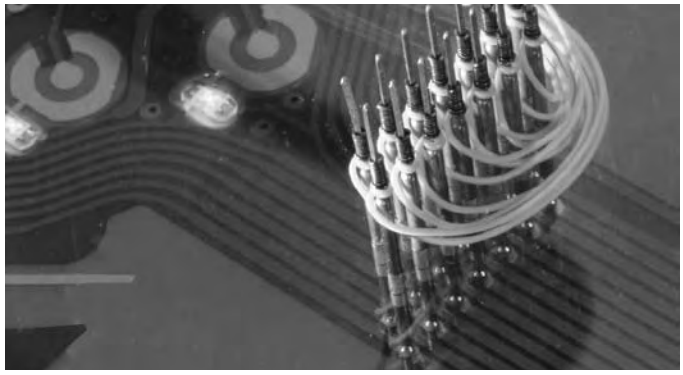
| | Product | Features and Benefits |
|---|---|---|
|  | ***MicroTCA Chassis*** | • Small chassis 438.00 W by 177.00 H by 260.00mm D (17.244 by 6.968 by 10.236") is a convenient size for use on the desktop or lab bench.<br>• Power supply on the rear converts 100 or 220V AC to 48V DC that is wired to the front; a short cable plugs in to the MicroTCA power module which can easily be placed on the desk or workbench without special 48V power feed.<br>• Air input from all 4 sides, exhaust from 3 sides and the top enables full cooling functionality in the very small 4 U height.<br>• Extra port allows a JTAG switch module for system level testing<br>• Molex 10 Gbps backplane installed allows direct comparison of the Molex solution against any other backplane solution in a similar card edge by functionally evaluating the systems and comparing results, especially when higher speeds are required.<br>• Field Replaceable Unit Read Only Memory (FRU ROM) on the backplane communicates to the MCH all of the important backplane characteristics. |
|  | ***Repeater*** | • Automotive solutions<br>• Fully custom solutions for I/O Hubs<br>• Supporting the major I/O interconnects (USB, 1394, etc.)<br>• Mechanical and electrical design |
|  | ***Industry Standard Cards*** | • Expertise in industry standard platforms such as DVI, IEEE 1394, USB, SFF and other serial interface technologies<br>• Standard card offerings such as ADD2 DVI card as well as stacked SFP assemblies for standard ATCA applications<br>• Offer kits that include backplane assemblies and harness assemblies for one integrated solution for your high-speed signal requirements |
|  | ***Rack and Accessories*** | • Integrates Molex technologies: cables, connectors, flex, switches, PCB assemblies and thermal products<br>• Global manufacturing and material sourcing capabilities<br>• Mechanical and electrical design, development, test support and prototype capabilities |

# Switch Technology

Molex is a global leader in interconnect solutions, as well as a manufacturer of custom user-interfaces, membrane switches and flex circuits.
Our manufacturing capabilities are strategically placed in the United States, Mexico and China, and include automated processes such as screen-printing, surface-mount component bonding, die cutting and tactile element (snap dome) placement. Secondary processes include final assembly, 100% electrical inspection/testing and packaging.
A full-service prototype lab is present in each location to produce designs and qualify products prior to fi nal tooling.

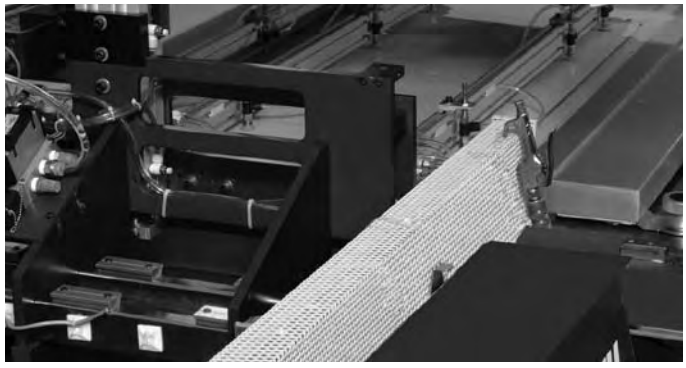


Display Attachment



100% Electrical Testing

Automated LED Bonding



Automated Screen Printing

Automated Dome Placement


Laser Cutting

# Products

Our custom keypad solutions, designed and supported throughout both North America and Asia, include technologies such as membrane switches and switches with embedded LEDs. Additionally, Molex offers flat panel products with 7 segment displays, PCB-substrate front panel keypads (both passive and active designs), dome arrays (polyester and metal dome) and silicone rubber keypad assemblies. With regionally-located sales and application engineers that specialize in assisting our customers with their specific designs and solutions, Molex has earned its position as the global leader of user interface keypads.

## Membrane Switches (Tactile and Non-tactile)

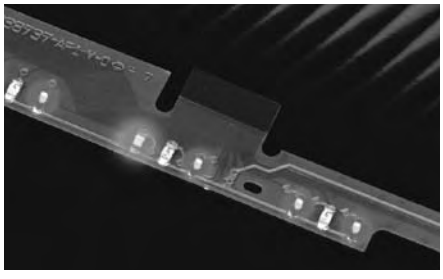
- High-reliability Molex domes
- Unlimited non-tactile contact configurations
- Automated global circuit printing
- 3D membrane switches enhanced with rubber keypads
- Disposable medical circuits

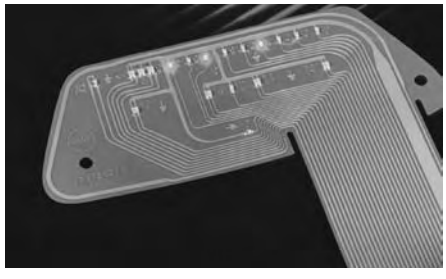
## Membrane Switches With Embedded LEDs and Indication

- SMT LEDs for backlighting
- Embossed windows provide enhanced viewing angle
- Fully automated component bonding (resistors, caps, ICs)

## LED/Display Flex Assemblies

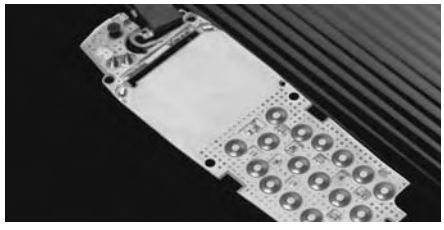
- Multiple circuit substrate options
- Unlimited optoelectronic options:
  - 7 segment displays
  - LEDs
  - Diodes/Photodiodes
  - Emitters/Detectors/Sensors
- Allow for flexible mounting configurations





## Dome Arrays

- Low-cost contact systems
- Easy peel 'n stick application
- Easy to integrate to PCBs
- Allow for custom contact configurations
- Metal dome or embossed contact systems

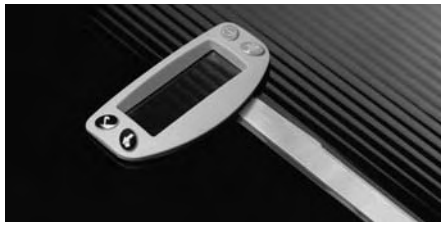



## Control Panel/Value Add Options

- Capacitive switching with backlighting (membrane and PCB)
- Unlimited integration (housings, backers, electronics)
- Reduced supply base and BOM
- Designed for manufacturability
- Cost effective design


## Rubber Keypad Assemblies

- Enhance design aesthetics
- Increase switch travel and tactile feedback
- Provide discrete key appearance with multiple surface finishes
- Patented Molex rocker switch options
- Hard keycap options/in-mold decorating
- Multiple backlighting options







molex

www.molex.com/product/switch/switch.html

# Advanced Quality Planning Sheet for Membrane Switches

Company: _____ Date: _____
Address: _____ Contact: _____
City/State: _____ Phone: _____ Type of control panel:
Estimated annual usage: _____ _____ Membrane _____ Hybrid
Price objective: _____ _____ Bonded _____ Tactile
Components Membrane
_____ Conductive Rubber

## Graphic Sheet Matrix

No. of colors: _____ Material: _____ Thickness: _____
Texture: _____ Matte Embossing: _____ Rail Display windows: _____ LCD
_____ Gloss _____ Pillow _____ LED
_____ Selective _____ Height _____ Vacuum
POTENTIAL CHEMICAL EXPOSURE: _____

## Electrical Specifications

Contact resistance (at termination): _____ Max.
Operating voltage: _____ Operating current: _____
Shielding requirements: _____ ESD _____ RFI _____ EMI
Switch circuitry: _____ Matrix _____ SPST/COM _____ Other
Max. contact bounce: _____

## Mechanical Specifications

Life requirements: _____ Cycles Panel size: _____ x _____
Mounting method: _____ Flex tail length: _____
Critical dimensions: _____
Termination at tail: _____ Contact force: _____
Optional components required: Tactile feedback: _____
_____ Backlighting _____ LEDs Dimensional tolerances required:
_____ Conductive rubber _____ Backer Overall size: +/- _____
_____ Molded housing _____ LCD Registration: +/- _____

## Environmental Specifications

Storage Temperature: _____ min. to _____ max. Humidity: _____
Operating Temperature: _____ min. to _____ max. Altitude: _____
User environment: _____

## Product Qualification

Environment test: _____
Qualification process: _____

**Molex Switch Products**
**2222 Wellington Court**
**Lisle, IL 60532**
**Fax: 630-396-6338**
**switch@molex.com**

***Molex recommends photocopying this form instead of removing page from catalog.***

# Capacitive Sensing

**What is capacitive sensing?**
A robust technology that uses capacitance to detect the presence of a human finger or any other conducting object. There are no moving parts that can wear out or detract from the reliability of the product.

**How does it work?**
A custom circuit sensor, either on a printed circuit board, polyimide or polyester circuit, creates a capacitive field. When a finger or conductive object enters the field, the product recognizes a change in capacitance.

## *Features and Benefits*

### *Elegant Design*
- Unique backlighting solutions
- Seamless overlays allow for easy cleaning
- Feather light actuation
- Unlimited cosmetic options including colors, texture and backlighting

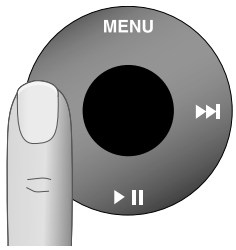
### *Robust and Durable*
- No moving parts to wear out
- Can sense through the protection of glass or thick plastic overlays
- Resistant to harsh chemical exposure
- Can be sealed and protected from environmental effects
- Resistant to contaminants on overlays
- Resistant to the effects of EMI
- Senses through gloves

### *Design Flexibility*
- Circuit can be constructed using polyester, polyimide, or PCB
- Communication using many options including I2C, SPI and UART or user defined
- Unlimited cosmetic options
- Can incorporate LEDs for discrete backlighting
- Can be mounted to curved surface
- Wide variety of overlay options: glass, polycarbonate, polyester, leather, wood or acrylic. Virtually any non-conduction material
- Shape and size of buttons can be tailored to your specifications
- Can incorporate tactile elements
- Can function when wet
- Can compensate for environmental and physical sensor variations
- Keypads can be sealed

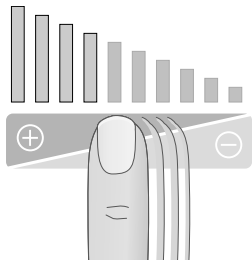
## *Physical*
Circuit Substrate Options: Rigid FR4, flexible polyimide and flexible polyester
Overlay Options: Glass, polycarbonate, polyester, leather, wood or acrylic

## *Environmental*
Parameters may vary depending on specific switch configuration and application requirements
Supply Voltage: 3 to 5.25V DC
Supply Current: 3.0 to 4.0mA (not including driving any LEDs)
Storage Temperature: -40 to +125˚C
Humidity: Up to 90% RH non-condensing per MIL-STD 202F
Thermal Shock: Per MIL-STD 202F, 1 cycle of -40˚ C for 30 minutes, then +65˚ C for 30 minutes

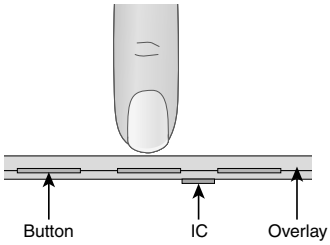
## *Applications*
- Appliances: cooking, dish washer, microwave and refrigeration
- Medical Equipment: Diagnostic equipment, operating room equipment
- Fitness Equipment: Treadmill, cycle and stair equipment
- Gaming: Video gaming and slot machines
- Vending Machines: Dispensing equipment
- Commercial: Elevators, fuel pumps and weigh scale
- Automotive: Entertainment and navigation systems, door switches and locks
- Point of Sale Terminal: Restaurant, retail, automated banking machines (ABM), kiosks
- Home Automation/Security: HVAC—A/C control
- Industrial: Human Machine Interface (HMI), robotics



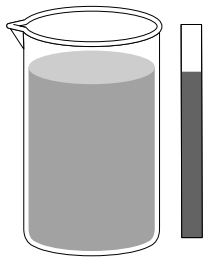

**Rotary Sliders**



**Linear Sliders**




**Discrete Switch Buttons**



**Position Measurement and Proximity Sensing**

# Tech Sheet

### *Physical*

Substrate:
*Polyester (PET)*—Clear, translucent or white, 0.13 or 0.18mm (.005 or .007") thick
*Polyimide*—Various thicknesses available, 0.03mm (.001") standard
Conductive Ink Resistivity:
*Silver Ink*—20 milliohms/sq/mil max.
*Carbon Ink*—150 milliohms/sq/mil max.

### *Component Attachment*

Silver Epoxy: Isotropic adhesive, used for attaching SMT devices
Z-Axis Epoxy: Anisotropic adhesive
Lead-Free Solder: For RoHS applications
Component Types: LEDs, Resistors, Capacitors, Diodes, Phototransistors, 7-Segment Displays
Minimum Package Size: 0603 (on PET only)

### *Membrane Switch Options*

Tactile Dome Selection*:

| Size | Force |
|---|---|
| 12.00mm (.472") | 405g |
| 12.00mm (.472") | 240g |
| 9.00mm (.354") | 250g |

### *Print Capabilities*

Sheet and roll-to-roll printing available globally
Maximum Sheet Size: 60.96 by 91.44cm (24.00 by 36.00")

### *Trace Pitch Capabilities*

Lines: 0.51mm (.020")—PET
Spaces: 0.51mm (.020")—PET
Circuit Construction:
Screened Crossover Circuit: Two insulated conductors on same side
Printed Through Hole: Double-sided circuits with as many as 4 conductive layers
Print Registration Tolerances: ± 0.38mm (.015") print pass to print pass

### *Die-Cut Capabilities*

Circuit

| Die-Cut Type | Die-Cut to Print Tolerance |
|---|---|
| Hard Tool | ± 0.13mm (.005") |
| Steel Rule Die | ± 0.38mm (.015") |
| Steel Rule Die-Cut Tolerances | |
| Overall Size: | ± 0.38mm (.015") |
| Hole Diameter: | ± 0.25mm (.010") |
| Hole Location: | ± 0.38mm (.015") |
| All Cutouts: | ± 0.38mm (.015") |

### *Electrical*

Circuit Resistance: 100 ohms max., may vary depending on circuit configuration
Durability: Tactile—1 million operations
Non-Tactile—5 million operations
Contact Bounce: 5 milliseconds typical
Insulation Resistance: 100 Megohms initial between adjacent traces

### *Environmental*

These parameters may vary depending on specific switch configuration and application requirements.
Storage Temperature: -40 to +70˚ C typical (+85˚ C construction available)
Humidity: Up to 90% RH non-condensing, per MIL-STD 202F, Method 103B, Condition A*
Thermal Aging: 96 hours at +70˚ C, then 96 hours at -40˚ C
Thermal Shock: Per MIL-STD 202F, Method 107D. 5 cycles of -40˚ C for 30 minutes, then +70˚ C for 30 minutes
Silver Migration: 3 cycles of 4 hours in +45˚ C at 85% RH, then cooled to +25˚ C for 4 hours with 5V DC applied

*After test, parts must meet electrical characteristics as specified above.