Copper Flex Products .......................................................................................................................................... R-2 to R-4
Printer Circuit and Electromechanical Assemblies ........................................................................................... R-5 to R-6
Switch Products ............................................................................................................................................... R-7 to R-11
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.

<table>
<thead>
<tr>
<th>Product</th>
<th>Features</th>
<th>Flex Construction</th>
<th>Standard Interconnects</th>
</tr>
</thead>
</table>
| **High-Speed Rigid Flex** | • Surface mount on both sides  
 • Stronger barrels  
 • 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  
 • Large number of interconnect options  
 • 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  
 • Controlled impedance  
 • Improves airflow within the system | Multi-layer        | VHDM, VHDM-HSD™, MZP™, PCI Express, SATA, SAS, MFB™, Omnigrid™ |
| **High-Density Flex** | • Typically 2 or more layers  
 • Tight line and space widths  
 • Reduces weight  
 • Better thermal characteristics than standard rigid board constructions | Double-sided 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  
 • Reduces assembly time  
 • Excellent thermal management | Single-sided 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  
 • Reduces package size  
 • At least one ZIF end connection | Single-sided 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

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

*SEARAY is a trademark of Samtec, Inc.*

## Copper Flex Products

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

<table>
<thead>
<tr>
<th>Product</th>
<th>Features and Benefits</th>
</tr>
</thead>
</table>
| **Backplane/Midplane Assemblies** | • Signal integrity modeling  
• Full turnkey services  
• Support all Molex and industry-standard backplane connector systems (Impact™, I-Trac™, GbX®, VHDM®, VHDM-HSD™, Milli-Z™, Serial ATA, SCSI, etc.)  
• Mechanical and electrical design, development, test support and in-house test engineering development capabilities  
• 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  
• Global manufacturing, material sourcing, tooling and testing capabilities  
• Clean sheet mechanical and electrical design, development and test support, including modeling and empirical testing  
• Mechanical packaging expertise to modify I/O to meet specialized form factor requirements |
| **Interconnect Cards** | • Signal and/or power cards available  
• Press-fit, through hole and SMT options available  
• Cost effective solution by integrating Molex connector technology and manufacturing  
• Specialize in boards with high connector content  
• 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  
• Designed with 4 compact slots to allow either 10 full-height (10 total) slots or 4 compact and 8 full-height slots (12 total).  
• Connector interface with backplane (launch geometry) has been carefully designed to minimize reflections for 10 Gbps performance.  
• FRU ROM (Field Replaceable Unit Read Only Memory) on the backplane communicates with MCH all of the important characteristics  
• Design is easily scalable and flexible to minimize customization and time-to-market, to meet customer applications and requirements. |

GbX, VHDM and VHDM-HSD are trademarks or registered trademarks of Amphenol Corporation.

# Printed Circuit and Electromechanical Assemblies

<table>
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<tr>
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</table>
| **MicroTCA Chassis**          | • Small chassis 438.00 W by 177.00 H by 260.00mm D (17.24 by 6.96 by 10.23") is a convenient size for use on the desktop or lab bench.  
• 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.  
• Air input from all 4 sides, exhaust from 3 sides and the top enables full cooling functionality in the very small 4 U height.  
• Extra port allows a JTAG switch module for system level testing  
• 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.  
• Field Replaceable Unit Read Only Memory (FRU ROM) on the backplane communicates to the MCH all of the important backplane characteristics. |
| **Repeater**                  | • Automotive solutions  
• Fully custom solutions for I/O Hubs  
• Supporting the major I/O interconnects (USB, 1394, etc.)  
• Mechanical and electrical design                                                                                                                                          |
| **Industry Standard Cards**  | • Expertise in industry standard platforms such as DVI, IEEE 1394, USB, SFF and other serial interface technologies  
• Standard card offerings such as ADD2 DVI card as well as stacked SFP assemblies for standard ATCA applications  
• 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  
• Global manufacturing and material sourcing capabilities  
• Mechanical and electrical design, development, test support and prototype capabilities                                                                 |

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www.molex.com/product/pcbassembly.html
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 final tooling.

Display Attachment

Automated LED Bonding

100% Electrical Testing

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

www.molex.com/product/switch/switch.html
Advanced Quality Planning Sheet for
Membrane Switches

Company: ____________________________ Date: ____________________________
Address: ____________________________ Contact: ____________________________
City/State: ____________________________ Phone: ____________________________
Estimated annual usage: ____________________________ Type of control panel: __________ Membrane __________ Hybrid
Price objective: ____________________________ Components __________ Conductor Rubber

Graphic Sheet Matrix
No. of colors: ____________________________ Material: ____________________________ Thickness: ____________________________
Texture: ______ Matte __________ Gloss __________ Selective
Embossing: ______ Rail __________ Pillow __________ Height
Display windows: ______ LCD __________ LED __________ Vacuum

POTENTIAL CHEMICAL EXPOSURE:

Electrical Specifications
Contact resistance (at termination): ____________________________ Operating current: ____________________________
Max. Operating voltage: ____________________________ 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: ____________________________ Contact force: ____________________________
Termination at tail: ____________________________ Tactile feedback: ____________________________
Optional components required:
  ______ Backlighting ______ LEDs ______ Conductive rubber ______ Backer ______ Molded housing ______ LCD
Dimensional Tolerances required:
  Overall size: +/- ____________________________ 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
**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: 12.00mm (.472”) Force: 40g
- 12.00mm (.472”) Force: 240g
- 9.00mm (.354”) Force: 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”)

**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 1038, 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.