

# Circuit Protection Products Overview

# TE Circuit Protection

TE's circuit protection products are a part of your everyday life. From your cell phone battery to your car's steering wheel, we are helping to make your world safer and your electronics more reliable. To date, billions of TE circuit protection devices are being used to help protect a wide range of electronic products in the computer, battery and portable electronics, consumer, automotive, industrial, home appliance and HVAC, and telecommunication markets.

- **Products manufactured:**

overcurrent, overtemperature, overvoltage, and hybrid circuit protection devices

- **Products sold under trademarks:**

2Pro, microSMD, miniSMD, nanoSMD, PolySwitch, PolyZen

- **Industries/markets served:**

Telecom & Networking, Computer & Multimedia, Battery & Portable Electronics, Medical, Lighting, Industrial, Automotive, Appliance & HVAC

The history of our circuit protection innovation began in 1980 when the use of a Polymeric Positive Temperature Coefficient (PPTC) device as a variable resistor in circuit protection applications was first commercialized by Raychem.

With its circuit protection products, TE is recognized as a leader in operational excellence, customer service and product innovation. A dedicated direct engineering sales force, global manufacturing and design centers, and local engineering support help us to think, manage, and share globally, yet, act locally to meet customer needs.

TE's circuit protection products are in compliance with globally recognized ISO9000/TS16949 standards.



### BUSINESS CENTERS

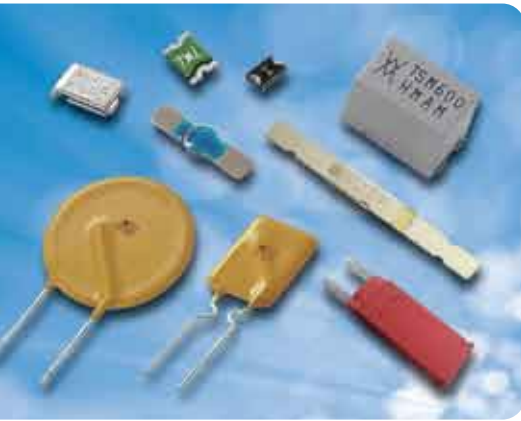
- A** Shanghai, China
- B** Munich, Germany
- C** Bangalore, India
- D** Tokyo, Japan
- E** Seoul, Korea
- F** Menlo Park, CA, USA

### FACTORIES

- 1** Kunshan, China
- 2** Shanghai, China
- 3** Tsukuba, Japan
- 4** Menlo Park, CA, USA

### R & D CENTERS

- a** Shanghai, China
- b** Paris, France
- c** Tsukuba, Japan
- d** Menlo Park, CA, USA



## POLYSWITCH RESETTABLE DEVICES



PolySwitch devices are used to help protect against damage caused by harmful overcurrent surges and overtemperature faults. Like traditional fuses, these devices limit the flow of dangerously high current during fault conditions. The PolySwitch device, however, resets after the fault is cleared and power to the circuit is removed, thereby helping to reduce warranty, service and repair costs.

### BENEFITS

- Reduced warranty and service costs
- Increased reliability
- Shock and vibration resistant
- Wide variety of application

### FEATURES

- RoHS compliant
- Remotely resettable
- Testable
- Solid state
- Variety of form factors
- Low-resistance devices available

### APPLICATIONS

#### Automotive

- Actuators and medium motors
- Trace protection
- Harness/junction box protection
- Powered outputs
- Electronic control modules
- Telematics/Infotainment

#### Battery Protection

- Lithium cells and battery packs
- Rechargeable battery packs
- Chargers

#### Computers and Peripherals

- DDC.2 computer video ports
- Hard disk drives/storage devices
- IEEE 1394 ports
- Mouse and keyboard ports
- USB (Universal Serial Bus) ports
- PC (PCMCIA) cards and sockets
- SCSI

#### Consumer

- Loudspeakers
- Satellite video receivers

#### Industrial/Appliance

- MOSFET device protection
- Motors, fans, and blowers
- POS equipment
- Process and industrial controls
- Security and fire alarm systems
- Test and measurement equipment
- Transformers
- Power supplies

#### Telecommunications & Networking

- Central office equipment
- Customer premise equipment
- Primary protection: MDF modules, Network Interface Devices (NIDs)
- xDSL modems and ISDN equipment
- WAN, LAN, T1/E1 equipment
- Cable power passing taps
- UL 60950, Telcordia GR-1089, GR-974 compliant equipment
- Equipment compliant with ITU-T K.20, K.21, K.45 resistibility recommendations
- Distributed power supplies

# Overcurrent Circuit Protection



## BENEFITS

- Glass ceramic monolithic structure provides stability in application cycling
- High-current rating in a small package allows more efficient use in system space
- Strong arc suppression in overcurrent conditions

## HIGH-CURRENT-RATED CHIP FUSES



The monolithic multilayer design helps to provide some of the highest current ratings available in the 1206 size and enhances high temperature performance in a wide range of circuit protection designs. The devices' small size, high reliability and strong arc suppression characteristics make them suitable for overcurrent protection of power supplies, servers, communications equipment, voltage regulator modules, and other high current, small size applications.

## FEATURES

- Lead free materials and RoHS compliant
- Halogen free (refers to: Br $\leq$  900ppm, Cl $\leq$  900ppm, Br+Cl $\leq$  1500ppm)
- Monolithic multilayer design
- High-temperature performance
- -55°C to +125°C operating temperature range

## APPLICATIONS

- Communications equipment
- Voltage regulator modules
- Automotive electronics
- Power supplies
- Servers



## BENEFITS

- Time-delayed design prevents nuisance openings in pulsed and high inrush current applications
- Small size with high-current ratings
- Strong arc suppression characteristics

## SLOW-BLOW CHIP FUSES



Available in industry standard 1206 and 0603 chip sizes, TE's slow-blow chip fuses help provide overcurrent protection on systems that experience large and frequent current surges as part of their normal operation. The slow-blow chip fuse's monolithic, multilayer design helps provide some of the highest current ratings available in the 1206 and 0603 footprints and enhances high-temperature performance in a wide range of circuit protection designs. The devices' small size, high reliability and strong arc suppression characteristics make them suitable for overcurrent protection of power supplies, capacitor filter banks, LCD (Liquid Crystal Display) backlight inverters, electric motors and portable electronics.

## FEATURES

- Lead free materials and RoHS compliant
- Halogen free (refers to: Br $\leq$  900ppm, Cl $\leq$  900ppm, Br+Cl $\leq$  1500ppm)
- Monolithic multilayer design
- High-temperature performance
- -55°C to +125°C operating temperature range

## APPLICATIONS

- Small motors systems
- Portable electronics
- Input power ports
- Power over Ethernet (PoE)
- Test equipment
- POL converter protection
- Computer drives
- Automotive electronics
- Displays
- Printers



## FAST-ACTING CHIP FUSES

 RoHS compliant

Fast-acting chip fuses help protect equipment from damage caused by overcurrent conditions when relatively fast clear times are required in DC power applications. The fuses' monolithic, multilayer design provides some of the highest current ratings on the market and the smallest footprint. Available in industry standard 0402, 0603 and 1206 chip sizes, they also reduce fuse aging, improve product reliability and resilience, and enhance high-temperature performance in a wide range of circuit protection designs.

### BENEFITS

- Small size with high-current ratings
- Excellent temperature stability
- High reliability and resilience
- Strong arc suppression characteristics

### FEATURES

- RoHS compliant
- Halogen free (refers to: Br $\leq$  900ppm, Cl $\leq$  900ppm, Br+Cl $\leq$  1500ppm)
- Monolithic, multilayer design
- High-temperature performance
- -55°C to +125°C operating temperature range

### APPLICATIONS

- Laptops
- DVD players
- Scanners
- Digital cameras
- Portable electronics
- Automotive electronics
- Cell phones
- Game systems
- Printers
- LCD monitors



## TELECOM FUSES

 RoHS compliant

The FT600 fuse assists telecommunications equipment manufacturers in complying with North American overcurrent protection requirements, including Telcordia GR-1089, TIA-968-A (formerly FCC Part 68), and UL60950 3rd edition.

### FEATURES

- RoHS compliant
- Low profile and small footprint
- The lightning-robust surface-mount fuse offers overcurrent protection in case of power fault events
- Enables the design of equipment complying with applicable telecom specifications including UL60950, TIA-968-A, and Telcordia GR-1089
- Low resistance

### BENEFITS

- High density placement in multi-port system designs
- Improved temperature rise performance over other similar surface-mount fuse devices under sneak current testing
- The FT600 fuse, in conjunction with a thyristor surge suppression device, assists designers to meet regulatory standards without additional series components

### APPLICATIONS

- ADSL, ADSL2, ADSL2plus, SHDSL, VDSL linecards and modems
- TI/EI systems
- Twisted-pair telecom ports requiring Telcordia GR-1089, UL60950 and FCC Part TIA-968-A compliance



## PULSE TOLERANT CHIP FUSES

**NEW**

RoHS compliant

Pulse tolerant chip fuses have high inrush current withstand capability and provide overcurrent protection on DC power systems. A silver fusing element and monolithic multilayer design provide strong arc suppression characteristics. These RoHS-compliant surface-mount devices facilitate the development of more reliable, high performance consumer electronics such as laptops, multimedia devices, cell phones, and other portable electronics.

### FEATURES

- Lead free materials and RoHS compliant
- Halogen free (refers to: Br ≤ 900ppm, Cl ≤ 900ppm, Br+Cl ≤ 1500ppm)
- Monolithic, multilayer design
- High-temperature performance
- -55°C to +125°C operating temperature range

### APPLICATIONS

- Laptops
- Digital cameras
- Cell phones
- Printer
- DVD players
- Portable electronics
- Game systems
- LCD monitors
- Scanners

### BENEFITS

- High inrush current withstanding capability
- Ceramic Monolithic structure
- Silver fusing element and silver termination with nickel and tin plating
- Excellent temperature stability
- Strong arc suppression characteristics



## 2410 VERY FAST ACTING FUSE

**NEW**

RoHS compliant

The 2410 (6125) fuse is a wire-in-air SMD fuse which is very suitable for secondary level over current protection applications. These lead-free surface mount devices offer reliability and, due to their design, are not subject to having an end cap dislodged. A straight wire element in air provides consistent fusing and cutting characteristics.

### FEATURES

- Halogen free, RoHS compliant and 100% lead-free
- Copper or copper alloy composite fuse link
- Fiberglass-reinforced epoxy fuse body
- Wide range of current rating
- -55°C to +125°C operating temperature range (with derating)

### APPLICATIONS

- Industrial equipment
- LCD/PDP TV
- Backlight inverter
- Power supply
- Telecom system
- Networking
- Game systems
- White goods
- Automotive

### BENEFITS

- Very fast acting at 200% overload current level
- Good inrush current withstanding capability
- High reliability and resilience
- Strong arc suppression characteristics



## 0603 VERY FAST ACTING CHIP FUSES



Very fast-acting chip fuses help provide overcurrent protection on systems using DC power sources up to 63V<sub>DC</sub>. The fuse's monolithic, multilayer design provides the highest hold current in the smallest footprint, reduces diffusion-related aging, improves product reliability and resilience, and enhances high-temperature performance in a wide range of circuit designs.

### BENEFITS

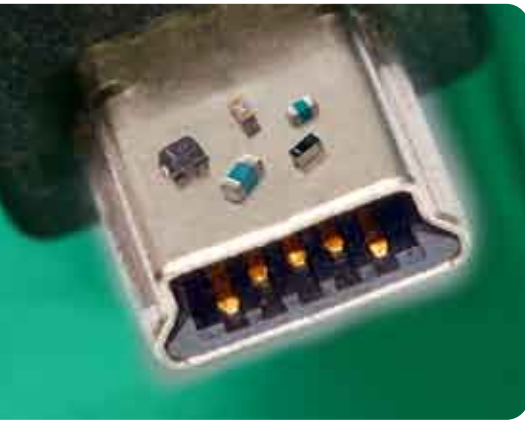
- Very fast acting at 200% and 300% overloads
- Excellent inrush current withstanding capability at high overloads
- Thin body for space limiting applications
- Glass ceramic monolithic structure
- Silver fusing element and silver termination with nickel and tin plating
- RoHS compliant and lead-free materials
- Symmetrical design with marking on both sides (optional)

### FEATURES

- Lead free materials and RoHS compliant
- Halogen free (refers to: Br $\leq$  900ppm, Cl $\leq$  900ppm, Br+Cl $\leq$  1500ppm)
- Monolithic, multilayer design
- High-temperature performance
- -55°C to +125°C operating temperature range

### APPLICATIONS

- Laptops
- Digital cameras
- Cell phones
- Printers
- DVD players
- Portable electronics
- Game systems
- LCD monitors
- Scanners



## SILICON ESD PROTECTION DEVICES



Silicon ESD (SESD) devices help protect electronic circuits against damage from electrostatic discharge (ESD) events. The 0201-sized SESD device's miniature footprint - measuring 0.6mm x 0.3mm x 0.3mm - is approximately 70 percent smaller than prior-generation devices, offering designers flexibility in space-constrained applications. Also included in the product line is the SESD0402S-005-054 device, an ultra-low capacitance SOD-923 (0402-size package) uni-directional device with 0.5pF typical capacitance. This device offers a 10kV contact discharge rating per IEC61000-4-2, level 4 and can be used with digital applications such as USB and HDMI.

### BENEFITS

- Small size SESD protection diodes for high speed signals
- ESD protection in space-constrained portable electronics and mobile handsets
- Helps protect electronic circuits against damage from ESD
- Assists equipment to pass IEC61000-4-2, level 4 testing

### FEATURES

- RoHS compliant
- Halogen free (refers to: Br $\leq$  900ppm, Cl $\leq$  900ppm, Br+Cl $\leq$  1500ppm)
- Low-leakage current - 1.0 $\mu$ A (max)
- Low-breakdown voltage < 5.8V
- Capable of withstanding numerous ESD strikes
- Low capacitance and insertion loss
- SOD-923 case epoxy material meets UL 94 V-0
- SESD0402S devices meet MSL-1 requirements

### APPLICATIONS

- Mobile phones and portable electronics
- High-speed data lines (low capacitance 0201 and 0402)
- Low-voltage antenna ports (bi-directional 0201)
- USB 2.0/3.0, HDMI 1.3/1.4, and DisplayPort standards
- Applications requiring high ESD performance in a small package



## BENEFITS

- ESD protection for high frequency applications (HDMI 1.3)
- Smaller form factor for board space savings
- Helps protect sensitive electronic circuits against damage caused by electrostatic discharge (ESD) events
- Assists equipment to pass IEC 61000-4-2, level 4 testing

## PESD PROTECTION DEVICES



Electrostatic Discharge Protection Devices (PESD) provide low capacitance and performance against IEC61000-4-2 testing, especially after multiple hits (up to 1000). The devices offer a lower trigger voltage and a lower clamping voltage than typical polymer ESD devices, resulting in improved protection of sensitive electronic components.

## FEATURES

- RoHS compliant
- Halogen free (refers to: Br $\leq$  900ppm, Cl $\leq$  900ppm, Br+Cl $\leq$  1500ppm)
- 0.25 pF (typical) capacitance
- Low-leakage current
- Low-clamping voltage
- Fast response time (< 1ns)
- Capable of withstanding numerous ESD strikes
- Compatible with standard reflow installation procedures
- Thick film technology
- Bi-directional protection

## APPLICATIONS

- HDMI 1.3 interfaces
- Printer ports
- LCD & plasma TV
- Cellular phones
- Antennas
- Portable video players
- Portable devices (PDA, DSC, Bluetooth compliant)
- Satellite radios
- USB 2.0 and IEEE 1394 interfaces
- DVI
- GPS systems



## BENEFITS

- Helps provide overvoltage fault protection against damage caused by high energy surges
- Suitable for use in sensitive equipment due to impulse sparkover response
- Suitable for high-frequency applications
- Highly reliable performance

## GAS DISCHARGE TUBES



Gas Discharge Tubes (GDT) are placed in front of, and in parallel with, sensitive telecom equipment such as power lines, communication lines, signal lines and data transmission lines to help protect them from damage caused by transient surge voltages that may result from lightning strikes and equipment switching operations. New surface-mount devices are now available for automated manufacturing applications.

## FEATURES

- RoHS compliant
- Halogen free (refers to: Br $\leq$  900ppm, Cl $\leq$  900ppm, Br+Cl $\leq$  1500ppm)
- Wide range of voltages (75V-600V)
- Wide range of form factors (3mm, 5mm, 6mm, 7mm, 8mm diameter devices)
- Low capacitance and insertion loss
- Crowbar device with low arc voltage
- High accuracy spark-over voltages for high precision designs
- Devices tested per ITU K.12 recommendations
- Various lead configurations and surface-mount options
- Optional fail-short mechanism
- Non-radioactive materials

## APPLICATIONS

- Telecommunications
  - MDF modules, xDSL equipment, RF systems, antennae, base stations
- Industrial and Consumer Electronics
  - Power supplies, surge protectors, alarm systems, irrigation systems



## REFLOWABLE THERMAL PROTECTION (RTP) DEVICES



 RoHS compliant

The TE Reflowable Thermal Protection (RTP) device is a low resistance, robust surface mountable thermal protector. It has a set open temperature and can be installed using reliable, lead-free, Surface Mount Device (SMD) assembly and reflow processes. To simplify installation, improve reliability, and optimize thermal coupling with the PCB, the RTP device is surface mountable. No special SMD installation is required. Instead, after installation, the RTP device utilizes a one time electronic arming process to become thermally sensitive. Before the arming procedure, the device can go through installation temperatures up to 260°C without going open. After arming, the device will open when the critical junction exceeds the open temperature. Arming can occur during test, or in the field.

### BENEFITS

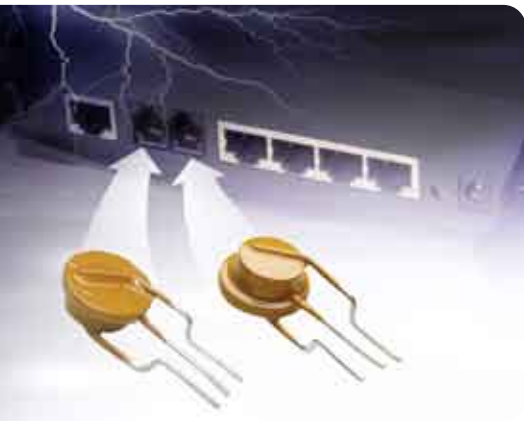
- Helps prevent failed components from smoking, and or de-soldering in case of a thermal event
- Allows use of standard surface-mount production methods with no special assembly costs
- Low power dissipation and voltage drop
- Supports DC electronic circuits
- Suitable for rugged environment applications (automotive and industrial)
- Green design

### FEATURES

- Opens at temperature below critical thermal threshold
- Compatible with up to 3 Pb-free solder reflow processes with peak temperatures up to 260°C
- Low series resistance
- DC interrupt voltage capable
- Robust design for harsh environment tested per stringent qualification specification
- RoHS compliant, lead and halogen free

### APPLICATIONS

- Helps provide protection against thermal runaway for powerFETs and other components if failure occurs in applications such as automotive HVAC, ABS, power steering, DC/DC converters, PTC heaters, IT servers, telecom power, converters, etc.
- Other DC thermal protection



## BENEFITS

- Single device helps reduce component count and footprint
- Helps reduce warranty returns
- Helps equipment comply with surge tests per: TIA-968-A, IEC 60950, ITU-T K.20/K.21
- Helps simplify UL 60950 testing
- Helps equipment comply with UL 60950

## 2PRO DEVICES



The 2Pro devices feature integrated overcurrent and overvoltage circuit protection technology designed to help prevent damage to telephony communications equipment. The device's small footprint, resettable functionality and coordinated protection capabilities allow for use in a wide range of telephony and VoIP (Voice over Internet Protocol) equipment applications.

## FEATURES

- RoHS compliant
- Halogen free (refers to: Br $\leq$  900ppm, Cl $\leq$  900ppm, Br+Cl $\leq$  1500ppm)
- Single overcurrent, overvoltage and ESD protection device
- Resettable overcurrent protection
- UL 497A listed protector (#E258475)

## APPLICATIONS

- Cordless telephones
- VoIP gateways
- Fax machines
- Data modems
- Set-top boxes
- Security systems
- MDF modules
- Analog and ISDN linecards



## BENEFITS

- Helps shield downstream electronics from overvoltage and reverse bias
- Trip events shut out overvoltage and reverse bias sources
- Analog nature of trip events minimizes upstream inductive spikes
- Helps reduce design costs with single component placement and minimal heat sinking requirements

## POLYZEN DEVICES



PolyZen devices are polymer enhanced precision Zener diode micro-assemblies. They offer resettable protection against damage caused by multi-watt fault events that require no special heat sinking. The relatively flat voltage vs current response of the PolyZen device helps clamp the output voltage, even when input voltage and source currents vary.

## FEATURES

- RoHS compliant
- Overvoltage transient suppression
- Hold currents up to 2.3A
- Time delayed, overvoltage trip
- Time delayed, reverse bias trip
- Power handling on the order of 30 watts
- Integrated device construction

## APPLICATIONS

- Portable media players
- Global positioning systems
- Hard disk drive 5V & 12V bus
- Solid State Drives (SSD) 5V bus
- Automotive peripheral input power
- DC power port protection
- Industrial handheld POS



## METAL HYBRID PPTC (MHP) DEVICES



The Metal Hybrid PPTC (MHP) device helps provide resettable overcurrent protection while also utilizing the low resistance of the PPTC device to help prevent arcing in the bimetal protector at higher currents.

### BENEFITS

- Fills market need for battery protection devices rated above 30A and 36VDC
- Provides resettable overcurrent and short circuit protection in Li-ion battery packs
- Helps protect Li-ion cells from damage due to abnormal high currents that could cause heat damage and lead to premature cell end of life and potential field returns
- Arc suppression: Current shunts to the PPTC due to its low resistance helping to suppress arcing all while helping protect the contacts from damage or welding shut
- Double make/double break contact design allows for a high current rating in a smaller device package

### FEATURES

- 30A hold current
- Rated at 36VDC, 100A max.
- Low device resistance (< 2mOhm) compared to other breaker devices
- Able to withstand heavy vibration and impact
- Device allows easy mounting between 18650 cells

### APPLICATIONS

- Li-ion battery packs for high-rate-discharge applications
  - Cordless power tools
  - E-bikes
  - Back-up power supplies (UPS)
- Motor protection

	Overcurrent Circuit Protection							Overvoltage Circuit Protection			Overtemperature Protection		Hybrid Protection		
	PolySwitch Devices	Chip Fuses					2410 Very Fast Acting Fuses	Telcom Fuses	GDT	ESD	SESD	RTP Devices	MHP Devices	2Pro Devices	PolyZen Devices
		Pulse Tolerant	0603 Very Fast Acting	Fast Acting	High Current Rated	Slow Blow									

## APPLIANCES

Buttons									X	X				
Compressors	X													
Displays	X	X	X	X		X	X		X	X				
Motors	X													
Power supplies	X	X	X	X			X		X		X		X	X
Transformers	X										X		X	
TRIACs	X										X			

## AUTOMOTIVE

ABS systems	X	X		X		X	X				X	X		
Antennae	X								X	X				
Cigarette lighter accessories	X	X	X	X		X								X
Connectors	X													
Displays	X	X	X	X		X	X		X	X				
Electronic control units	X	X	X	X		X	X		X	X	X	X		
HVAC and climate control	X										X	X		X
Infotainment and navigation systems	X	X	X	X		X	X		X	X	X			X
Motors	X											X		
Wire harness	X													

## BATTERIES

Li-ion	X	X		X	X	X			X	X	X	X		
Ni-Cd	X	X		X		X			X	X		X		
Ni-MH	X	X		X		X			X	X		X		

## BUSINESS AND RETAIL EQUIPMENT

Antennae									X					
Audio Input / Output	X	X	X	X		X	X		X	X				
Batteries	X	X				X					X			
Buttons	X													
Displays	X	X	X	X		X	X		X	X				
Motherboard components	X	X	X	X		X	X				X			
Ports	X	X	X	X		X	X		X	X				
HDDS	X	X	X	X		X	X		X	X				X
Power Input	X	X	X	X		X	X				X			X

	PolySwitch Devices	Overcurrent Circuit Protection						Overvoltage Circuit Protection			Overtemperature Protection	Hybrid Protection				
		Chip Fuses						2410 Very Fast Acting Fuses	Telcom Fuses	GDT	ESD	SESD	RTP Devices	MHP Devices	2Pro Devices	PolyZen Devices
		Pulse Tolerant	0603 Very Fast Acting	Fast Acting	High Current Rated	Slow Blow										

## COMMUNICATIONS

Antennae									X	X					
Audio Input / Output	X								X	X	X				
Batteries	X	X				X						X			
Buttons	X	X	X	X		X				X	X				
Displays	X	X	X	X		X				X	X				
Fans	X	X	X	X		X									
HDDs	X	X	X	X		X				X	X				X
Homeplug	X	X	X	X		X			X						
HPNA	X	X	X	X		X			X	X	X				
Low-speed test ports	X	X	X	X		X			X	X	X			X	
MoCA	X	X	X	X		X			X	X	X				
Motherboard components	X	X	X	X		X	X					X			
Networking over powerline	X	X	X	X		X	X	X	X	X	X				
Ports	X	X	X	X		X	X		X	X	X			X	
Power input	X	X	X	X		X	X		X					X	X
Power over Ethernet	X	X		X		X			X	X	X			X	

## ENERGY AND SOLAR

Batteries	X	X		X	X	X	X			X	X	X	X	X	
Charge controllers	X	X	X	X	X	X	X		X	X	X	X		X	
Combiner boxes	X	X			X	X	X		X						
Inverters	X	X			X	X	X		X	X	X	X	X		
Junction boxes					X		X			X	X				
Disconnect Boxes	X	X			X	X	X		X	X	X				

## HOME ENTERTAINMENT

Audio Input / Output	X								X						X
Batteries	X	X		X		X	X			X	X		X		
Buttons										X	X				
Displays	X	X	X	X	X	X	X			X	X				
HDDS	X	X	X	X	X	X				X	X				X
Motors	X														
PCB components	X											X			
Ports	X								X	X	X				
Power Input	X	X	X	X	X	X	X		X			X		X	X

	Overcurrent Circuit Protection						Overvoltage Circuit Protection			Overtemperature Protection		Hybrid Protection		
	PolySwitch Devices	Chip Fuses					2410 Very Fast Acting Fuses	Telcom Fuses	GDT	ESD	SESD	RTP Devices	MHP Devices	2Pro Devices
		Pulse Tolerant	0603 Very Fast Acting	Fast Acting	High Current Rated	Slow Blow								

## INDUSTRIAL

Buttons	X								X	X				
Compressors	X				X							X		
Displays	X	X	X	X		X	X							
Electromagnetic loads	X													
Motors	X													
Power Input	X	X	X	X		X	X				X		X	
Transformers	X										X			
UPS Backup	X				X						X	X		

## LIGHTING

CFL electronic ballasts	X						X						X	
LED ballasts	X	X	X	X			X				X		X	
LED controllers	X	X	X	X	X	X	X				X		X	X
LED drivers	X	X	X	X	X	X	X						X	X
PN junction											X			
Power input	X	X	X	X		X	X						X	X
Power supplies	X	X	X	X		X	X				X		X	X
TRIACs	X										X			

## MOBILE DEVICES

Antennae									X					
Audio Input / Output	X	X	X	X		X	X		X	X				
Batteries	X	X				X					X			
Buttons	X	X	X	X		X	X		X	X				
Displays	X	X	X	X		X	X		X	X				
LEDs	X	X	X	X		X	X		X	X				
Ports	X	X	X	X		X	X		X	X				
Power Input	X	X	X	X		X	X							X

## PERSONAL COMPUTERS

Antennae	X								X					
Audio Input / Output	X	X	X	X		X	X		X	X				
Batteries	X	X		X	X	X	X		X	X	X			
Buttons									X	X				
Displays	X	X	X	X		X	X		X	X				
Motherboard components	X	X	X	X	X	X	X		X	X	X			
Ports	X								X	X				
Power Input	X	X	X	X	X	X	X							X

## FOR MORE INFORMATION

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[www.te.com/japan/bu/circuitprotection/](http://www.te.com/japan/bu/circuitprotection/) (Japanese)

#### Brazil

Tel : 55-11-2103-6090  
Fax : 55-11-2103-6216

#### UK / Eire / Benelux / Israel / South Africa / Nordic / Baltic / Others

Tel : 49-89-6089485  
Fax : 49-89-6089394

#### Germany / Austria / Switzerland / Eastern Europe / Russia

Tel : 49-89-6089584  
Fax : 49-89-6089394

#### France / Italy / Iberia / Greece / Turkey

Tel : 33-1-34208455  
Fax : 33-1-34208479

#### Japan

Tel : 81-44-900-5110  
Fax : 81-44-900-5140

#### Korea

Tel : 82-2-3415-4654  
Fax : 82-2-3486-1786

#### Taiwan

Tel : 886-2-8768-2788 x 211  
Fax : 886-2-8768-1277

#### China, Hong Kong

Tel : 852-2738-8181  
Fax : 852-2735-1185

#### China, Beijing

Tel : 86-10-6569-3488 x 16526  
Fax : 86-10-6569-3206

#### China, Shanghai

Tel : 86-21-6106-7379  
Fax : 86-21-6485-3255

#### China, Shenzhen / Guangzhou

Tel : 86-755-2515-4797  
Fax : 86-755-2598-0419

#### Singapore / Indonesia

Tel : 65-6590-5089  
Fax : 65-6481-9377

#### Thailand / Malaysia / Vietnam

Tel : 6-04-217-8112  
Fax : 6-04-229-8177

#### Australia / Philippines

Tel : 63-2-988-9465  
Fax : 63-2-848-0205

#### India

Tel : 91-80-4161-3745  
Mobile : 91-99-0248-8886

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RCPO103E 06/2011

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