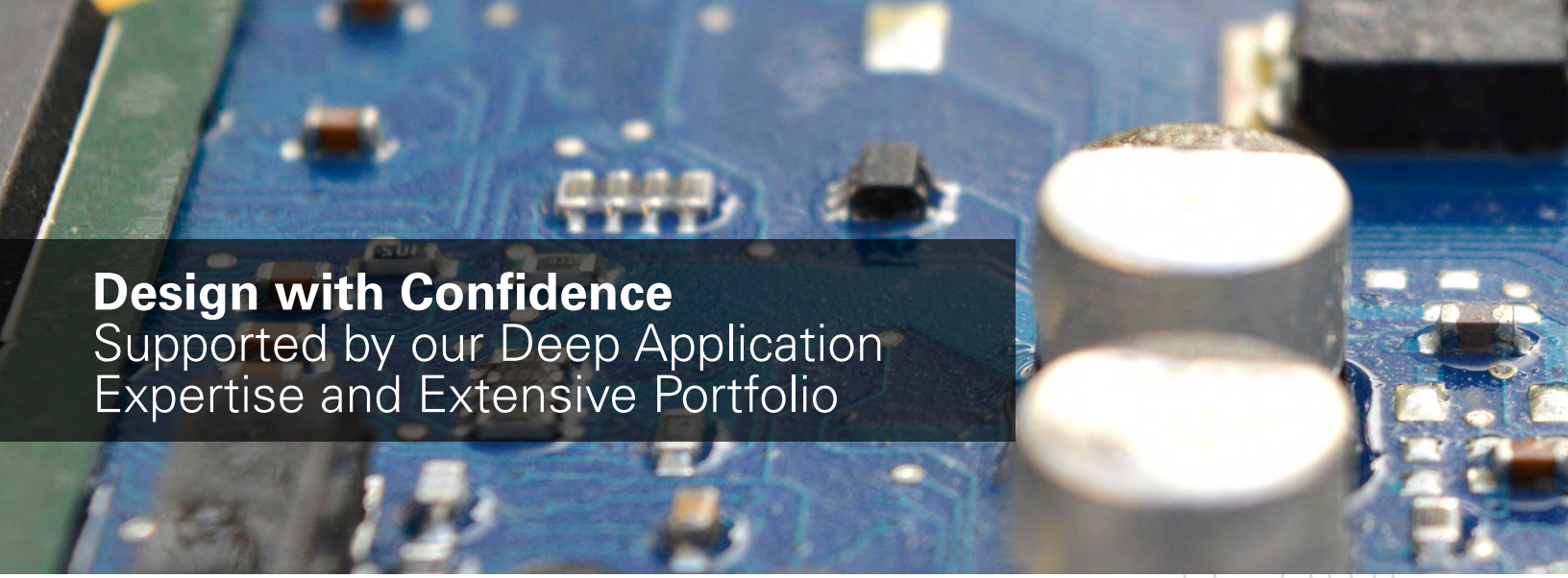
Littelfuse®

Expertise Applied | Answers Delivered

Circuit Protection Products

Selection Guide

A guide to selecting the right protection components for your applications

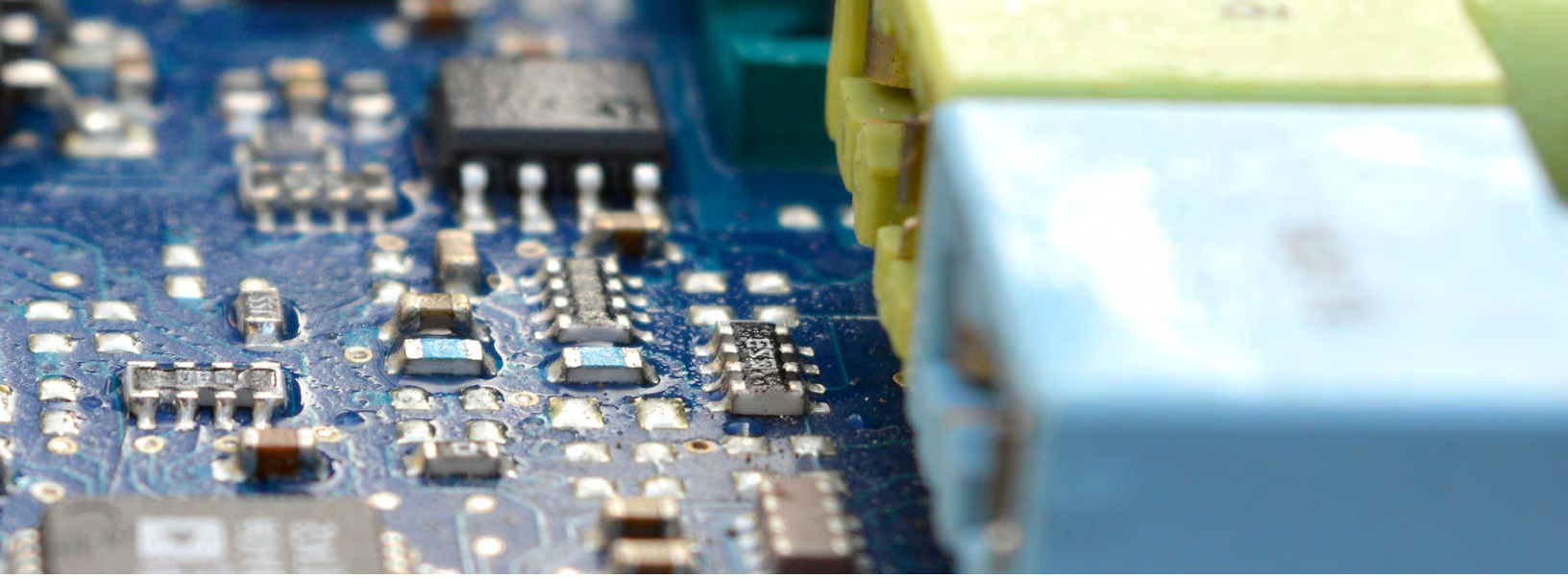


Design with Confidence
Supported by our Deep Application Expertise and Extensive Portfolio

About this guide

This guide provides a summary of key circuit protection consideration factors, descriptions of the technologies Littelfuse offers, and product selection tables. It is designed to help you quickly find a protection solution appropriate to your application.

Specifications, descriptions, and illustrative material in this literature are as accurate as known at the time of publication, but are subject to changes without notice. Visit **Littelfuse.com** for more information.



Littelfuse: Everywhere, Every Day

Founded in 1927, Littelfuse has become the world's most respected circuit protection brand, with well-established and growing platforms in power control and sensing technologies. Today, we are a global company, offering a diverse and extensive product portfolio—fuses, semiconductors, polymers, ceramics, relays, sensors, and more—serving the electronics, automotive, and industrial markets. Each is manufactured to exacting quality standards and backed by an unwavering commitment to technical support and customer service.

Our history of innovation, combined with our customer-first culture, drives us to collaborate with you to develop safer, more reliable products that are energy efficient and compliant with global regulations. We will partner with you to solve complex problems wherever electrical energy is used, bringing design, engineering, and technical expertise to deliver business results.

Why Choose Littelfuse

Littelfuse is the global leader in circuit protection solutions. We are the only company to offer all of the pertinent circuit protection technologies, with products that can be used in virtually everything that uses electrical energy. Complementing our wide portfolio of circuit protection products is a global network of design and technical support expertise. We offer decades of design experience to help you address application challenges and achieve regulatory compliance.

Your Single Source

Littelfuse offers an extensive circuit protection product line. We design forward-thinking, application-specific solutions to provide assurance that your most demanding requirements will be met. Our goal is to provide the most complete range of options so that you will not have to compromise.

Testing Support

Littelfuse can help ensure that your products will withstand most common threats repeatedly and will fail safely under extreme circumstances. We can serve as an independent source to provide assistance as you design by offering lab testing capabilities for customer applications. This testing includes industry-specific required power fault and Electrostatic Discharge (ESD) / Electrically Fast Transients (EFT) / lightning surge conditions.

Application Knowledge

For over 90 years, Littelfuse has maintained a focus on circuit protection, and we will continue to adapt as technologies evolve. Engineers and circuit designers around the world have come to rely on Littelfuse products and application knowledge to support their designs.

Global Support

Littelfuse stays close to customers. With manufacturing, lab, and design facilities located around the globe, application knowledge and technical support are locally available. Also, we offer a network of regional customer support offices and hundreds of independent authorized distributor contacts to assist you. Visit Littelfuse.com/contact-us to find local support near you.

Standards Compliance Expertise

Most Littelfuse products comply with a wide range of applicable industry and government guidelines as well as our own rigorous quality and reliability criteria. We continually look forward and adapt to changing requirements so that our products will comply with industry-specific national and international standards, such as CCC, CSA, IEC, IEEE, ISO, ITU, Meti, RoHs, Telcordia, TIA, and many more.

Operational Excellence

With our global manufacturing footprint, Littelfuse is firmly committed to manufacturing quality products at a competitive price. We build quality into our products and services, striving for zero defects in everything we do, thereby reducing cost and increasing your total satisfaction. We strive to exceed your expectations every day.

Quality Assurance

Our global manufacturing facilities abide by strict quality assurance requirements and hold the following quality management system registrations:

- ISO 9001
- ISO14001
- IATF 16949

Circuit **Protection** Technologies

Technology	Key Features and Protection Characteristics	When / Where Typically Used	Surge Energy Rating Range	Typical Voltage Clamping Speeds	Typical Capacitance/ Insertion Loss	Mounting/Size/ Packaging Options
Overcurrent Protection Technologies						
Fuses	Completely stops current flow, which helps to identify faults; Wide range of options	Ultimate protection for sensitive/ expensive/critical components	Low through Very High	Not applicable	Series impedance measured in nH	Very Extensive Range of Options
PPTC Devices	Resettable; No device replacement needed after most common overcurrent events	Where overcurrent events may occur often, and continuous uptime desired	Low through High	Not applicable	Series resistance measured in ohms	Surface Mount, Radial Leaded, Axial Strap
Overvoltage Suppression Technologies						
Multi-Layer Varistors (MLVs)	Compact and capable of handling significant surges for their size	ESD(1) and EFT(2) suppression in smaller and portable electronics	Low through Medium	Moderate	High	Miniature Surface Mount
Metal-Oxide Varistors (MOVs)	Capable of withstanding very high energy transients; Wide range of options	Appliance, industrial, and very high energy suppression applications	Medium through Very High	Moderate	High	Radial Leaded, Industrial Terminal
GDTs	Switches that turn to on state and shunt overvoltage to ground using a contained inert gas as an insulator	Protection of telecom equipment from lightning surges	Medium through High	Fast	Low	Surface Mount, Axial Leaded, 2/3 Lead Radial
PulseGuard® ESD Suppressors	Extremely low capacitance; Fast response time; Compact size	ESD suppression; Ultra-fast reaction; Low signal distortion	Low	Moderate	Low	Miniature Surface Mount
PLED LED Protectors	Shunt function bypasses open LEDs; ESD and reverse power protection	High brightness outdoor LED lighting applications	Low	Very Fast	Medium	Miniature Surface Mount
TVS Diode Arrays	Low capacitance/ low clamping voltage; Compact size	ESD suppression; Low distortion; Ideal for I/O interfaces and digital and analog signal lines	Low through Medium	Very Fast	Low	Extensive range of surface mount options
TVS Diodes	Fast response to fast transients; Wide range of options: No wear out mechanism	Semiconductor protection; Telecom I/O interfaces, electronics, industrial equipment, and automotive electronics	Medium through High	Fast	Medium	Axial Leaded, Radial Leaded, Surface Mount
SIDACtor® Protection Thyristors	Designed to comply with stringent telecom/datacom networking and industrial AC power surge protection standards; No wear out mechanism, precise trigger voltage, and very low Vt	Telecom/datacom and networking applications, industrial equipment	Medium through High	Very Fast	Medium - Low	Extensive range of surface mount and through-hole options

(1) ESD – Electrostatic Discharge
(2) EFT – Electrical Fast Transient

Fuses and Holders

Fuses – Full range including surface mount, axial, glass or ceramic, thin-film or Nano²® style, fast-acting or Slo-Blo® fuse.

Clips – Used in applications that require a fuse to be easily mounted to a Printed Circuit Board (PCB), but real estate is scarce. Clips are also ideal for high-current applications, allowing for better heat management of the fuse. They are the most economical solution.

Blocks – An alternative solution to clips but with easier placement on the PC board during manufacturing. In some instances, blocks may provide insulation to the side ears of the clips. In addition to being through-hole, blocks can also be screwed or riveted in place.

Holders – The ideal solutions for those applications that require the cartridge fuse to be protected, providing a shock-safe environment. Panel-mount holders allow for easy replacement of the fuse from outside of the appliance, perfect for applications that require replacing the fuse without opening the appliance enclosure.

PolySwitch® PPTC Devices

PolySwitch Polymeric Positive Temperature Coefficient (PPTC) devices 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 PPTC device, however, resets after the fault is cleared and power to the circuit is removed, thereby helping to reduce warranty, service and repair costs. PolySwitch PPTC devices are typically used in consumer electronics, automotive, industrial, home appliance, HVAC, and telecommunications applications.

TVS Diodes

The Transient Voltage Suppressor diode (TVS Diode) is a protection diode designed to protect electronic circuits from very fast and often damaging voltage transients, such as lightning and Electrostatic Discharge (ESD). TVS Diodes are silicon avalanche devices typically chosen for their fast response time (low clamping voltage), lower capacitance, and low leakage current. TVS Diodes are ideal for applications in computer, industrial, telecom, and automotive markets.

TVS Diode Arrays

TVS Diode Arrays are designed to protect electronics against transients and overvoltage threats, such as Electrically Fast Transients (EFT) and Electrostatic Discharge (ESD). Because of their lower capacitance and low leakage current, they offer an ideal protection solution for I/O interfaces and digital and analog signal lines, in computer and consumer portable electronics markets.

PulseGuard® ESD Suppressors

PulseGuard suppressors use polymer composite materials to suppress fast-rising ESD transients while adding virtually no capacitance to the circuit. PulseGuard suppressors are best suited for low-voltage, high-speed applications such as protection for high-speed protocols like USB 2.0, IEEE1394, HDMI, and Digital Visual Interface (DVI), where low capacitance is important.

Varistors

Varistors are available in multiple forms, from Metal Oxide Varistors (MOVs) and Thermally Protected MOV (TMOV® varistors) that suppress lightning transient voltages to Multi-Layer Varistors (MLVs) designed for applications requiring protection from various ESD and EFT transients. They are often used in computers and handheld devices as well as in industrial and automotive applications.

Gas Discharge Tubes

Gas Discharge Tubes (GDTs) dissipate voltage transients through a contained plasma gas. They have high insulation resistance plus low capacitance and leakage to ensure minimal effect on normal operation of equipment. GDT's fast response to transient over-voltage events, and ability to dissipate large amounts of energy, translate into reduced risk of equipment damage. The amount of energy dispersed by GDTs makes them a good choice for lightning surge protection, particularly for telecom equipment located in outdoor structures.

PLED Bypass Protectors

PLED Bypass Protectors are specialty silicon devices that enable LED lighting strings to continue to function if any single LED fails as an open circuit, and they also offer ESD and reverse power protection. PLED are often incorporated into the circuit designs of high-power LEDs in applications such as roadway lights and outdoor LED advertising display signs.

SIDACtor® Protection Thyristors

SIDACtor components use a patented ion implant technology that ensures effective protection within nanoseconds, up to 5000 A surge current ratings. SIDACtors are designed to suppress overvoltage transient surge in the telecom/datacom applications, and they are also used to protect industrial AC/DC powering terminals.

Fuses

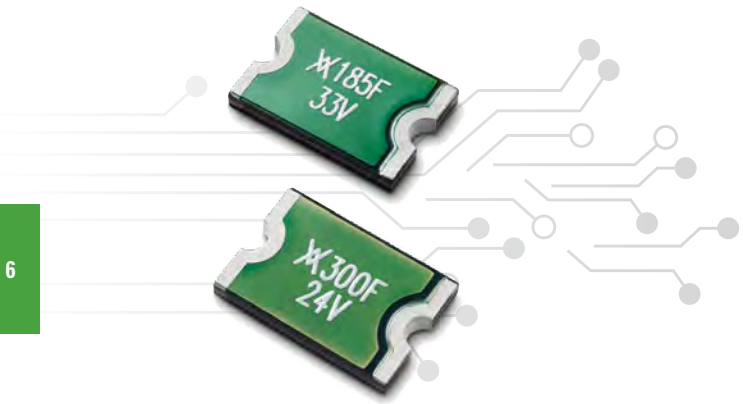
Fuses have been referred to as "one time" devices, in that the fuse will provide protection from the overload by opening only once and then need to be replaced. The heart of a typical fuse is a length of wire that is heated to its melting point by the excessive current. The circuit current flow decreases to zero as the wire melts open.

Benefits

- It is the most cost-effective form of protection
- Operation of a fuse is simple, and no complexity is involved
- A fuse's inverse time current characteristic allows it to be used for overload protection

Applications

- Fuses completely stop current in fault condition; this may be more desired if safety or avoidance of downstream circuit equipment is a premium concern
- Fuses are also helpful for diagnostic purposes, aiding equipment designers and users in tracing the origin of the overcurrent faults



PolySwitch® PPTC Devices

PolySwitch Polymer Positive Temperature Coefficient (PPTC) devices offer a resettable overcurrent protection alternative, thereby reducing warranty, service, and repair costs. PPTCs increase resistance as temperature increases due to increased flow. The components are designed to limit unsafe currents while allowing constant safe current levels. Resistance will "reset" automatically when the fault is removed and temperature returns to safe levels. The ability of the PPTCs to reset themselves after exposure to a fault current makes them ideal within circuits that are not easily accessible. PPTCs are typically used as circuit protection in applications where sensitive components are at constant risk of damage from overcurrent conditions. The components are also ideal for situations where frequent overcurrent conditions occur or constant uptime is required.

Benefits

- Improved system reliability
- Lower warranty cost and service
- Reduced system downtime
- Lower voltage drop
- Ruggedness prevents breakage during manufacturing and shipment
- Shock & vibration resistance eliminates need for calibration

Applications

- Port protection on personal computers (USB, firewire, keyboard/mouse, and serial ports)
- Peripherals (hard drives, video cards, and hubs)
- Cell phones
- Battery packs
- Industrial controls
- Lighting ballast
- Motor controls

The four most commonly used technologies for overvoltage protection are as follows:

- **SIDACtor® Devices**
- **Gas Discharge Tubes (GDTs)**
- **Metal Oxide Varistors (MOVs)**
- **TVS Diodes**

All four technologies are connected in parallel with the circuit being protected, and all exhibit a high off-state impedance when biased with a voltage less than their respective blocking voltages.

SIDACtor® Protection Thyristors

A SIDACtor device is a PNPN device that can be thought of as a thyristor device without a gate. Upon exceeding its peak off-state voltage (VDRM), a SIDACtor device will clamp a transient voltage to within the device's switching voltage (VS) rating. Then, once the current flowing through the SIDACtor device exceeds its switching current, the device will crowbar and simulate a short-circuit condition. When the current flowing through the SIDACtor device is less than the device's holding current (IH), the SIDACtor device will reset and return to its high off-state impedance.

Benefits

Advantages of the SIDACtor device include its fast response time, stable electrical characteristics, long term reliability, and low capacitance. Also, because the SIDACtor device is a crowbar device, it cannot be damaged by voltage.

Restrictions

Because the SIDACtor device is a crowbar device, it cannot be used directly across the AC line; it must be placed behind a load. Failing to do so will result in exceeding the SIDACtor device's maximum on-state current rating, which may cause the device to enter a permanent short-circuit condition.

Applications

Although found in other applications, SIDACtor devices are primarily used as the principle overvoltage protector in telecommunications and data communications circuits.

Gas Discharge Tubes

Gas Discharge Tubes (GDTs) are either glass or ceramic packages filled with an inert gas and capped on each end with an electrode. When a transient voltage exceeds the DC breakdown rating of the device, the voltage differential causes the electrodes of the gas tube to fire, resulting in an arc, which in turn ionizes the gas within the tube and provides a low impedance path for the transient to follow. Once the transient drops below the DC holdover voltage and current, the gas tube returns to its off state.

Benefits

Gas Discharge Tubes have high surge current and low capacitance ratings. Current ratings can be as high as 20 kA, and capacitance ratings can be as low as 1 pF with a zero-volt bias.

Applications

Gas Discharge Tubes are typically used for primary protection due to their high surge rating. However, their low interference for high-frequency components make them a candidate for high-speed data links.

Metal Oxide Varistors

Metal Oxide Varistors (MOVs) are two-leaded, through-hole components typically shaped in the form of discs. Manufactured from sintered oxides and schematically equivalent to two back-to-back PN junctions, MOVs shunt transients by decreasing their resistance as voltage is applied.

Benefits

Since MOVs' surge capabilities are determined by their physical dimensions, high surge current ratings are available. Also, because MOVs are clamping devices, they can be used as transient protectors in secondary AC power line applications.

Applications

Although MOVs' are restricted from use in many telecom applications (other than disposable equipment), they are useful in AC applications where a clamping device is required and tight voltage tolerances are not.

TVS Diodes

Transient Voltage Suppressor (TVS) diodes are clamping voltage suppressors that are constructed with back-to-back PN junctions. During conduction, TVS diodes create a low impedance path by varying their resistance as voltage is applied across their terminals. Once the voltage is removed, the diode will turn off and return to its high off-state impedance.

Benefits

Because TVS diodes are solid-state devices, they do not fatigue nor do their electrical parameters change as long as they are operated within their specified limits. TVS diodes effectively clamp fast-rising transients and are well suited for low-voltage applications that do not require large amounts of energy to be shunted.

Applications

Due to their low power ratings, TVS diodes are not used as primary interface protectors, but they can be used as secondary protectors that are embedded within a circuit.

Overshoot Levels Versus dv/dt

Figure 1.1 below shows a peak voltage comparison between SIDACtor® devices, Gas Discharge Tubes (GDT), Metal-Oxide Varistors (MOVs), and TVS diodes, all with a nominal stand-off voltage rating of 230 V. The X axis represents the dv/dt (rise in voltage with respect to time) applied to each protector, and the Y axis represents the maximum voltage drop across each protector.

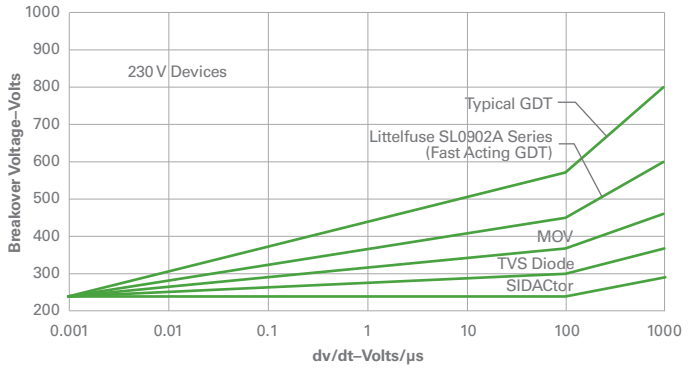
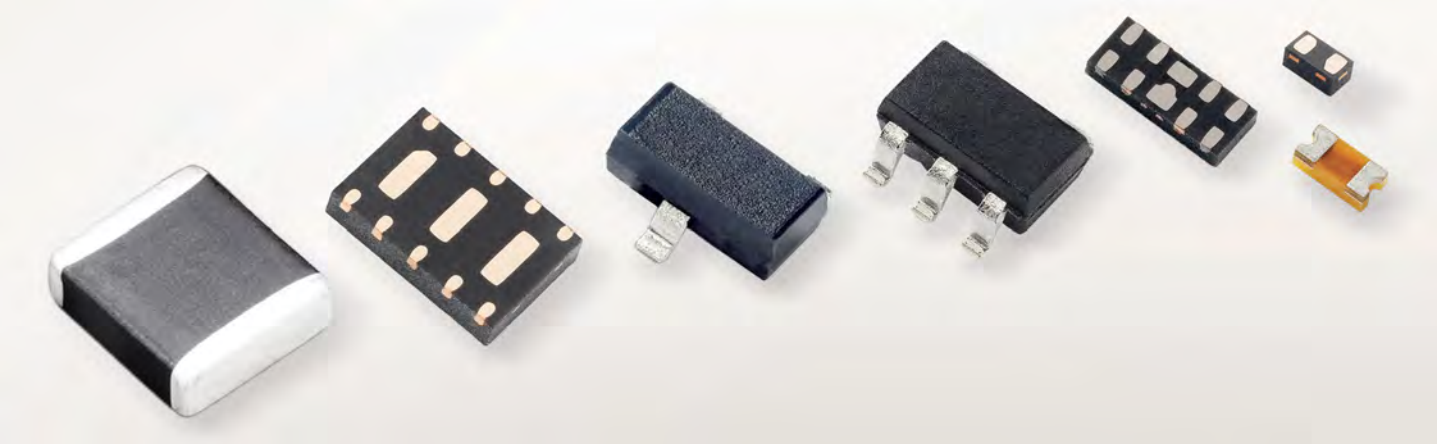


Figure 1.1 Overshoot Levels versus dv/dt



MLV

A Multi-Layer Varistor (MLV) is a voltage suppression device that filters and clamps transients in an electrical circuit. It is a compact, surface-mountable chip that is voltage dependent, nonlinear, and bidirectional. MLVs are chosen when:

- Surge currents or energy beyond Electrostatic Discharge (ESD) is expected in the application—Electrical Fast Transient (EFT), lightning
- Added capacitance is desirable for Electromagnetic Interference (EMI) filtering (3pF – 6000pF)
- Power supply line or low-to-medium speed data and signal lines are to be protected
- The operating voltage is above silicon or PulseGuard® ESD suppressor ratings

Benefits

- Leadless chip makes it compact in size
- Robust construction makes it ideally suitable to endure the thermal stresses encountered during soldering, assembling, and manufacturing
- Low cost

Applications

MLVs are connected near the I/O port to clamp the ESD or surge event with a Surface Mount Device (SMD) package and wide capacitance range to as low as 3pF. MLVs are widely used in audio, control, and dataline communication such as USB2.0.

TVS Diode Arrays

TVS Diode Arrays are designed to protect electronics from very fast and often damaging voltage transients, such as lightning and electrostatic discharge (ESD). They offer a high level of protection (up to 30kV per IEC 61000-4-2) with very low capacitance, leakage current, and clamp voltage for more robust applications.

Designers choose TVS Diode Arrays when:

- The device being protected requires the lowest possible clamp voltage, low capacitance (0.1pF – 400pF), and low leakage (0.01µA – 10µA)
- Board space is at a premium and space-savings multi-line protection is needed
- Transients other than ESD, such as EFT or lightning, must also be considered

Benefits

- Low capacitance
- Low clamping voltage and leakage current
- Small package size offers space savings and also enables mounting close to input ports for optimal protection

Applications

TVS diode arrays offer an ideal protection solution for I/O interfaces and digital and analog signal lines, such as USB and HDMI, in computer and consumer portable electronics markets. Typical applications include:

- Parallel port (LPT) printer scanner
- Computer inputs and peripheral devices, such as PDA, PMP, cell phone, digital camera, and game controller ports
- Digital video recorder, hard disk drive, video editing system, scanner, desktop, and laptop

PulseGuard® ESD Suppressors

PulseGuard® ESD Suppressors offer extremely low capacitance, which makes them ideal for use in high-speed data circuits (IEEE 1394, USB 2.0, HDMI, DVI, etc.). Available in single-line and multi-line packages, they provide ESD protection while ensuring that signal integrity is maintained. Designers choose Pulse-Guard over other ESD solutions when:

- The application tolerates very little added capacitance, (high-speed data lines or RF circuits)
- ESD is the only transient threat
- Protection is required on data, signal, and control lines (not power supply lines)

Benefits

- Ultra-low capacitance
- Low leakage current
- Fast response time
- Withstands multiple ESD strikes

Applications

- HDTV hardware
- Laptop/desktop computer
- Network hardware
- Computer peripherals
- Digital camera
- External storage
- Set-top box
- Antenna

Applications

For more than 90 years, Littelfuse has been the leader in circuit protection, and we continue to develop new solutions as customer applications evolve. We offer a broad portfolio of protection technologies for a wide range of applications.

We offer a broad portfolio of ***protection technologies.***

Overcurrent Protection

Application Matrix

Overcurrent Protection												
Vertical Markets	**Applications**	**Cartridge Fuses**	**Pico Fuses**	**TR/TE/Micro Fuses**	**Nano Fuses**	**Thin Film Chip Fuses**	**Industrial Fuses**	**Automotive Fuses**	**Radial Leaded Resettable PPTCs**	**Battery Strap Resettable PPTCs**	**Surface Mount Resettable PPTCs**	**Telecom Fuses**
Datacenter and Cloud	Servers: Computing	•	-	•	•	•	-	-	•	-	•	•
	Switches	-	•	•	•	•	-	-	•	-	•	•
	Routers	-	•	•	•	•	-	-	•	-	•	•
	Mobile Network: 4G/5G Indoor	-	-	-	-	-	-	-	-	-	-	-
	Mobile Network: 4G/5G Outdoor	•	•	•	•	•	-	-	•	-	•	•
Consumer Electronics	TVs and Displays	•	•	•	•	•	-	-	•	•	•	-
	Speakers & A/V Equipment	•	•	•	•	•	-	-	•	-	•	-
	Printers & Scanners	•	•	•	•	•	-	-	•	-	•	-
	Desktop Computers	-	•	•	•	•	-	-	•	-	•	-
	Power Supplies	•	•	•	•	•	-	-	•	-	•	-
Appliances	Major Appliances	•	-	•	•	•	-	-	•	-	•	-
	Small Appliances	•	•	•	•	•	-	-	•	-	•	-
	Battery Powered	•	-	•	•	•	-	-	•	•	•	-
	Robotic Appliances	•	-	•	•	•	-	-	•	•	•	-
	Power Tools	•	-	•	•	•	-	•	-	-	•	-
Building Automation	GFCI/AFCI & USB Receptacles	•	•	•	•	•	-	-	•	•	•	-
	Environmental & Building Control	-	-	•	•	•	-	-	-		•	-
	Security & Access Control	•	•	•	•	•	-	-	•	•	•	-
	HVAC & Elevator Drives	•	-	-	•	-	-	-	•	-	-	-
	Smart Meters	•	-	•	-	•	-	-	•	•	•	-
Industrial	UPS	•	•	•	•	•	•	-	•	-	•	-
	Lighting	•	•	•	•	•	-	-	•	•	•	-
	Robotics	•	•	•	•	•	•	-	•	-	•	-
	Motor Control	•	•	•	•	•	•	•	•	•	•	-
Renewable Energy	Solar PV	•	-	•	•	•	•	-	•	-	•	-
	Large Inverters	•	-	•	•	•	•	-	•	-	•	-
	Micro Inverters	•	-	•	•	•	-	-	•	-	•	-
	Energy Management	•	-	•	•	•	•	-	•	-	•	-
Transportation/ Automotive	E-Mobility (Onboard Charger, BMS)	•	-	•	•	•	•	•	•	-	•	-
	Connectivity & Autonomous Driving	•	-	•	•	•	•	•	•	-	•	-
	Engine and Ignition Systems	-	-	-	-	-	-	-	-	-	-	-
	E-Motorcycle (EV 2-3 Wheelers)	•	-	•	•	•	-	-	•	-	•	-
Mobile and Wearables	Gaming Controllers	-	-	-	•	•	-	-	-	-	•	-
	Smart Watches	-	-	-	•	•	-	-	-	-	•	-
	Smart Phones	-	-	-	•	•	-	-	-	-	•	-
	Chargers	•	•	•	•	•	-	-	•	-	•	-
	Notebooks		•	•	•	•	-	-	•	•	•	-
EV-Infrastructure	AC Charging	•	-	-	-	-	•	-	-	-	•	-
	DC Charging	•	-	-	-	-	•	-	•	-	•	-
	Wireless Charging	•	-	-	-	-	•	-	•	-	•	-

Overvoltage Protection

Application Matrix

Overvoltage Protection									
Vertical Markets	**Applications**	**MLVs**	**MOVs and TMOVs**	**GDTs**	**ESD Suppressors**	**PLED LED Protectors**	**TVS Diode Arrays**	**TVS Diodes**	**SIDACtors**
Datacenter & Cloud	Servers -Computing	•	•	•	•	-	•	•	•
	Switches	•	•	•	•	-	•	•	•
	Routers	•	•	•	•	-	•	•	•
	Mobile Network: 4G/5G Indoor	-	-	-	-	-	•	•	•
	Mobile Network: 4G/5G Outdoor	•	•	•	•	-	•	•	•
Consumer Electronics	TVs and Displays	•	•	-	•	-	•	•	•
	Speakers & A/V Equipment	•	•	-	•	-	•	•	-
	Printers & Scanners	•	•	-	•	-	•	•	•
	Desktop Computers	•	•	-	•	-	•	•	•
	Power Supplies	•	•	-	•	-	•	•	•
Appliances	Major Appliances	•	•	-	•	-	•	•	•
	Small Appliances	•	•	-	•	-	•	•	•
	Battery Powered	•	-	-	•	-	•	•	-
	Robotic Appliances	•	•	-	•	-	•	•	•
	Power Tools	-	•	-	•	-	•	•	•
Building Automation	GFCI/AFCI & USB Receptacles	•	•	•	•	-	•	•	•
	Environmental & Building Control	•	•	-	•	-	•	•	•
	Security & Access Control	•	•	•	•	-	•	•	•
	HVAC & Elevator Drives		•	-	-	-	-	•	•
	Smart Meters	•	•	-	•	-	•	•	•
Industrial	UPS	•	•	•	•	•	-	•	-
	Lighting	•	•	•	•	-	•	•	•
	Robotics	•	•	•	•	-	•	•	•
	Motor Control	•	•	•	•	-	•	•	•
Renewable Energy	Solar PV	•	•	•	•	-	•	•	•
	Large Inverters	•	•	•	•	-	•	•	•
	Micro Inverters	•	•	•	•	-	•	•	•
	Energy Management	•	•	•	•	-	•	•	
Transportation/ Automotive	E-Mobility (Onboard Charger, BMS)	•	•	•	•	•	•	•	•
	Connectivity & Autonomous Driving	•	•	•	•	•	•	•	•
	Engine and Ignition systems	-	-	-	-	-	-	•	-
	E-Motorcycle (EV 2-3 Wheelers)	•	•	-	•	•	•	•	-
Mobile and Wearables	Gaming Controllers	•	•	-	-	-	•	•	-
	Smart Watches	•	•	-	-	-	•	•	-
	Smart Phones	•	•	-	-	-	•	•	-
	Chargers	•	•	-	-	-	•	•	-
	Notebooks	•	•	-	-	-	•	•	-
EV- Infrastructure	AC Charging	-	•	•	•	-	•	•	-
	DC Charging	-	•	•	•	-	•	•	-
	Wireless Charging	-	•	•	•	-	•	•	-

Design smarter by identifying key ***threats*** *and* ***solutions*** *at the onset of new development.*

Common **Circuit Threats** and Protection Solutions

Type of Electrical Fault or Transient What is the threat or circuit action that may damage sensitive electronics?	**Systems or Modules Affected** What are the typical end products that require protection from this damage?	**Principal Protection Criteria** What are the characteristics required of the circuit protection technology?	**Littelfuse Protection Technologies** Which circuit protection technologies best serve these types of situations?
Overcurrent / Ground Faults	Systems that are grounded and/or in near proximity to AC power lines	Proper interrupting rating, current carrying capability and voltage rating	Fuses and/or PPTCs
Lightning	Any electronic or electrical equipment with connections to the outside environment	Fast response, proper switching threshold, and surge current rating	SIDACtor® Protection Thyristors, Varistors (MOVs), TVS Diodes, TVS Diode Arrays, Gas Discharge Tubes (GDTs)
Electrostatic Discharge (ESD)	Any electronic equipment with a human interface	Fast response, and high peak voltage rating	PulseGuard® ESD Suppressors, TVS Diode Arrays, Multi-Layer Varistors (MLVs) PLED Bypass Protectors
Electrical Fast Transients (EFT)	Any system that has inductive loads	Fast rise time and recovery for repetitive pulses	TVS Diodes, Varistors (MLVs and MOVs), TVS Diode Arrays
Inductive Load Switching and Commutative Spikes	Large motors, pumps, compressors, relays, and AC distribution	High energy rating	Varistors (MOVs and MLVs), GDTs, TVS Diodes, TVS Diode Arrays
Data and Communication Line Voltage Transients	Ethernet, xDSL, data bus, telecom, etc.	Fast response and low load capacitance	TVS Diodes, TVS Diode Arrays, SIDACtor® Protection Thyristors
Current Switching / Diversion	Wide range of electrical and electronic circuits	Proper blocking voltage and current carrying capacity	Switching Thyristors, PLED Bypass Protectors

Overcurrent Events

Excessive current events can lead to catastrophic failures in electronic circuits. These failures can result in safety hazards such as fire, shock, or explosion. Common types of overcurrent threats include:

Overload

Overloads occur when more current is allowed to flow through a circuit path than it was designed to carry. This excess current can generate and accumulate heat and result in complete circuit destruction and possibly fire, electrocution, or explosion. Causes of overload can include:

- Construction hazards cutting across power mains
- Equipment failure in the power grid
- Environmental hazards on the power grid
- Short spikes of energy within the circuit as a result of turning equipment on or off

Short Circuit

Short circuits occur when one conducting path comes in contact with another conducting path or with ground, such as may occur due to a loose wire, insulation breakdown, or contact with water. These conditions can increase the likelihood of arcs, shock, or fire hazards.

The principal forms of protection against overcurrent conditions include fuses and resettable polymeric positive temperature coefficient (PPTC) thermistors.

Their function is to limit current to acceptable levels and prevent catastrophic events, and during acceptable conditions act dormant with a minimal amount of resistance to the circuit.

Fuses will completely stop the flow of current when opened, which may be desired with sensitive, expensive, or critical applications.

PPTCs offer the ability to reset for withstanding most minor, common, and recurring overcurrent events. They will allow safe levels of current to pass continuously, and during major overcurrent events, they increase in resistance as they heat to restrict the flow of current. When the overcurrent event ends, the device resets to its normal operating state.

Voltage Transient Events

Voltage transients are short-duration surges or spikes. Unsuppressed, they may damage circuits and components and result in complete system failure. Below are descriptions of common types of voltage transients, and technologies to reduce their effects:

Electrostatic Discharge (ESD)

Damage from ESD is generally caused by the transfer of static electrical charge from a body to an electronic circuit. It may result in faulty circuit operation, latent defects, and even catastrophic failure of sensitive components. ESD suppressors must have very fast response times and handle high peak voltages and currents for short durations. Littelfuse offers a range of PulseGuard® ESD suppressors, Multi-Layer Varistors (MLVs), and TVS Diode Arrays that are designed to suppress these types of events.

Inductive Load Switching

Switching of inductive loads, such as those that occur with transformers, generators, motors, and relays, can create transients up to hundreds of volts and amps, and can last as long as 400 milliseconds, affecting both AC and DC circuits. For these applications, commonly used suppressor devices include Metal Oxide Varistors (MOVs), Gas Discharge Tubes (GDTs), and Transient Voltage Suppression (TVS) Diodes.

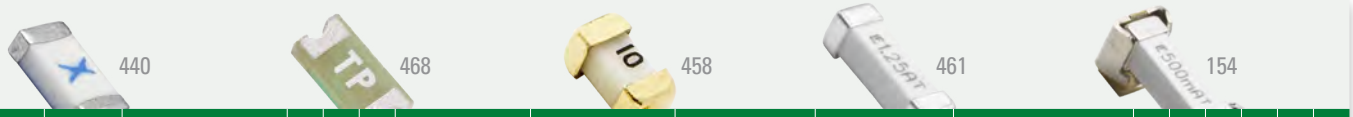
Lightning Induced Transient

Most transients induced by nearby lightning strikes result in an electromagnetic disturbance on electrical and communication lines connected to electronic equipment. Devices that protect against these transients must have a fast response time and must be able to dissipate a large amount of energy. Metal Oxide Varistors (MOV), TVS Diodes, and GDTs are typically used to protect against these events. Look to Littelfuse SIDACtor® Protection Thyristors and TVS Diode Arrays for telecom/datacom requirements.

Automotive Load Dump

Load dump refers to what happens to the supply voltage in a vehicle when a load is removed. If a load is removed rapidly (such as when the battery is disconnected while the engine is running), the voltage may spike before stabilizing and damage electronic components. In a typical 12V circuit, load dump can rise as high as 120V and take 400 ms to decay—more than enough to cause serious damage. Littelfuse offers a wide range of TVS Diode and Multi-Layer Varistor (MLV) products designed to protect against these types of events.

Surface Mount Fuses



Surface Mount Type	Series Name[1]	Size[2]	Time Lag	Fast Acting	Very Fast Acting	Device Range[3] (Operating Current Options in Amps)	Max. Voltage Rating[3] (Volts)	Interrupting Rating at Max. Voltage Rating[3] (Amps)	Operating Temperature Range	Agency Approvals[3]					Halogen Free	RoHS Compliant	Lead Free	TUV	VDE	CQC
										UL	UR	CSA	PSE	UMF						
Ceramic Chip	437	1206	-	•	-	0.25 - 8	125/63/32	50	-55°C to +150°C	-	•	•	-	-	•	•	•	-	-	-
	438	0603	-	•	-	0.25 - 6	32/24/63	50	-55°C to +150°C	-	•		-	-	•	•	•	-	-	-
	440	1206	-	•	-	0.25 - 8	32/125/63/50	50	-55°C to +150°C	-	•	•	-	-	•	•	•	-	-	-
	441	0603	-	•	-	2 - 6	32	50	-55°C to +150°C	-	•	•	-	-	•	•	•	-	-	-
	469	1206	•	-	-	2 - 8	24/32/63	60	-55°C to +150°C	-	•	•	-	-	•	•	•	-	-	-
	501	1206	-	•	-	10, 12, 15, 20	32	150	-55°C to +150°C	-	•	•	-	-	•	•	•	-	-	-
Thin Film	466	1206	-	-	•	0.125 - 5	125/63/32	50	-55°C to +90°C	-	•	•	-	-	•	•	•	-	-	-
	429	1206	-	-	•	7	24	35	-55°C to +90°C	-	•	•	-	-	•	•	•	-	-	-
	468	1206	•	-	-	0.5 - 3	63/32	35 - 50	-55°C to +90°C	-	•	•	-	-	•	•	•	-	-	-
	467	0603	-	-	•	0.25 - 5	32	35 - 50	-55°C to +90°C	-	•	•	-	-	•	•	•	-	-	-
	494	0603	-	•	-	0.25 - 5	32	35 - 50	-55°C to +90°C	-	•	•	-	-	•	•	•	-	-	-
	435	0402	-	-	•	0.25 - 5	32	35	-55°C to +90°C	-	•	•	-	-	•	•	•	-	-	-
Nano²® Fuse	448	2410	-	-	•	0.062 - 15	125/85	35 - 50	-55°C to +125°C	-	•	•	•	-	•	•	•	-	-	-
	449	2410	•	-	-	0.375 - 5	125	50	-55°C to +125°C	-	•	•	•	-	•	•	•	-	-	-
	451 / 453	2410	-	-	•	0.062 - 20	125/65	35 - 50	-55°C to +125°C	•	•	•	•	-	•	•	-	-	-	-
	452 / 454	2410	•	-	-	0.375 - 12	125/75	50	-55°C to +125°C	-	•	•	•	-	•	•	-	-	-	-
	456	4012	-	-	•	20, 25, 30, 40	125/72	100 - 180	-55°C to +125°C	-	•	•	•	-	•	•	-	•	-	-
	458	1206	-	•	-	1.0 - 10	75/63	50	-55°C to +125°C	-	•	-	-	-	•	•	-	-	-	-
	443	4012	•	-	-	0.5 - 5	250	50	-55°C to +125°C	-	•	-	•		•	•	-	•	-	-
	464	4818	-	•	-	0.5 - 6.3	250	100	-55°C to +125°C	-	-	-	•	•	•	•	-	-	-	-
	465	4818	•	-	-	1 - 6.3	250	100	-55°C to +125°C	-	-	-	•	•	•	•	-	-	-	-
	462	4118	•	-	-	0.500 - 5	250	100 - 150	-40°C to +85°C	•	•	-	•	•	•	•	-	-	•	•
	476	2410	-	•	-	1 - 15	250 VAC up to 5 A 125 VAC for 6.3-15 A	100 @ 250 VAC 100 @ 125 VAC	-55°C to +125°C	-	•	•	•	-	•	•	-	-	-	-
	485	4818	-	•	-	1 - 3.15	600	100	-55°C to +125°C	-	•	•	-	-	•	•	-	-	-	-
	881	12.5 x 10 mm	-	•	-	60 - 100	75	1500 @ 75 VDC	-55°C to +100°C	-	•	•	-	-	•	•	•	-	-	-
	885	10.86 x 4.78 mm	•	-	-	1 - 5	500	100 @ 500 VDC 1500 @ 350 VDC	-40°C to +105°C	-	•	•	-	-	•	•	•	•	-	-
Telelink® Fuse	461	4012	-	-	-	0.5 - 2.0	600	60	-55°C to +125°C	-	•	•	-	-	•	•	-	-	-	-
	461E	4012	-	-	-	1.25	600	60	-55°C to +125°C	-	•	-	-	-	•	•	-	-	-	-
OMNI-BLOK® Fuseholder	154	3820	-	-	•	0.062 - 10.0	125	35 - 50	-55°C to +125°C	-	•	-	•	-	•	•	-	-	-	-
	154T	3820	•	-	-	0.375 - 7	125	50	-55°C to +125°C	-	•	-	•	-	•	•	-	-	-	-
Fuse and Clip Assemblies	157	2615	-	-	•	0.062 - 10	125	35 - 50	-55°C to +125°C	-	•	-	-	-	•	•	-	-	-	-
	157T	2615	•	-	-	0.375 - 5	125	50	-55°C to +125°C	-	•	-	-	-	•	•	-	-	-	-
	159	4319	-	-	-	0.5 - 2	600	60	-55°C to +125°C	-	•	-	-	-	•	•	-	-	-	-
	160	4319	•	-	-	0.5 - 5	250	50	-55°C to +125°C	-	•	-	-	-	•	•	-	-	-	-
PICO® SMF Fuse	459	7.24 x 4.32 mm	-	-	•	0.062 - 5	125	50 - 300	-55°C to +125°C	-	•	•	-	-	-	-	-	-	-	-
	460	7.24 x 4.32 mm	•	-	-	0.5 - 5	125	50	-55°C to +125°C	-	•	•	-	-	-	-	-	-	-	-

(1) Detailed information about product series listed here can be found on our website.
(2) Size for these surface mount items refers to common industry length and width dimensions of the device surface area. Example: 0402 = .04" x .02"
(3) In some cases for these categories, the ratings, agency approvals, and specifications vary by part number and are presented here as ranges representing the whole series. Please refer to product data on Littelfuse.com and in our data sheets for detailed information by part number.

Surface Mount Fuses (continued)


202


203


446


459

Surface Mount Type	Series Name[1]	Size (mm)	Time Lag	Fast Acting	Very Fast Acting	Device Range[2] (Operating Current Options in Amps)	Max. Voltage Rating[2] (Volts)	Interrupting Rating at Max. Voltage Rating[2] (Amps)	Operating Temperature Range	Agency Approvals[2]					Halogen Free	RoHS Compliant	Lead Free	TUV	VDE	CQC
										UL	UR	CSA	PSE	UMF						
Flat Pak	202	13.00 x 6.35 x 7.62	-	•	-	0.062 - 5	250	50	-55°C to +125°C	-	•	•	-	-	-	-	-	-	-	-
	203	13.00 x 6.35 x 7.62	•	-	-	0.25 - 5	250	50		-	•	•	-	-	-	-	-	-	-	-
EBF	446	10.92 x 4.06 x 14.35	-	•	-	2.0 - 10.0	350	100	-40°C to +125°C	-	•	•	-	-	-	-	-	-	-	-
	447	10.92 x 4.06 x 14.35	-	•	-	2.0 - 10.0	350	100		-	•	•	-	-	-	-	-	-	-	-

Radial Leaded/Socket Fuses


370


303


804

Surface Mount Type	Series Name[1]	Size (mm)	Time Lag	Fast Acting	Very Fast Acting	Device Range[2] (Operating Current Options in Amps)	Max. Voltage Rating[2] (Volts)	Interrupting Rating at Max. Voltage Rating[2] (Amps)	Operating Temperature Range	Agency Approvals[2]					Halogen Free	RoHS Compliant	Lead Free	TUV	VDE	CQC
										UL	UR	CSA	PSE	UMF						
Micro™ Fuse / TR3 Fuse	262/268	6 x 8	-	-	-	0.002 - 5	125	10,000	-55°C to +125°C	-	•	•	-	-	-	-	-	-	-	-
	269		-	-	-	0.002 - 5	125	10,000	-55°C to +125°C	-	•	•	-	-	-	-	-	-	-	-
	272/278		-	-	-	0.002 - 5	125	10,000	-55°C to +125°C	-	•	•	-	-	-	-	-	-	-	-
	273/279		-	-	-	0.002 - 5	125	10,000	-55°C to +85°C	-	•	•	-	-	-	-	-	-	-	-
	274		-	-	-	0.002 - 5	125	10,000	-55°C to +85°C	-	-	-	-	-	-	-	-	-	-	-
	303		-	-	•	0.5 - 5.0 to 0.05 - 5.0	125	50	-55°C to +70°C	•	-	•	-	-	-	•	•	-	-	-
TR5® Fuse	370	8.5 x 8	-	-	•	0.4 - 6.3 to 0.04 - 6.3	250	35 - 63	-40°C to +85°C	-	•	-	•	-	•	•	•	-	•	-
	372		•	-	-	0.04 - 6.3	250	35 - 50	-40°C to +85°C	-	•	-	•	-	•	•	•	-	•	•
	373		-	-	•	0.05 - 10	250	50	-40°C to +85°C	•	-	•	-	-	•	•	•	-	-	-
	374		•	-	-	0.05 - 10	250	50	-40°C to +85°C	•	-	•	-	-	•	•	•	-	-	-
	382		•	-	-	1 - 10	250	100	-40°C to +85°C	-	•	-	•	-	•	•	•	-	•	•
	383		•	-	-	1 - 10	300	50 - 100	-40°C to +85°C	-	•	-	•	-	•	•	•	-	•	-
TE5	369	8.5 x 8	•	-	-	0.8 - 6.3	300	50	-40°C to +85°C	-	•	-	•	-	•	•	•	-	-	-
	385		•	-	-	0.35 - 1.5	125	50	-40°C to +85°C	-	•	-	-	-	-	•	•	-	-	-
	391		-	-	•	0.125 - 4	65	50	-40°C to +85°C	-	•	-	-	-	-	•	•	-	-	-
	392		•	-	-	0.280 - 6.3	250	25 - 63	-40°C to +85°C	-	•	-	•	-	•	•	•	-	•	•
	395		-	-	•	0.05 - 6.3	125	100	-40°C to +85°C	•	-	-	•	-	•	•	-	-	-	-
	396		•	-	-	0.05 - 6.3	125	100	-40°C to +85°C	•	-	-	•	-	•	•	•	-	-	-
	397		•	-	-	0.35 - 1.5	125	50	-40°C to +85°C	•	-	-	-	-	-	•	•	-	-	-
	398		-	•	-	0.125 - 4	65	50	-40°C to +85°C	-	•	-	-	-	•	•	•	-	-	-
	399		•	-	-	0.125 - 4	65	50	-40°C to +85°C	-	•	-	-	-	•	•	•	-	-	-
	400		•	-	-	0.5 - 6.3	250	130	-40°C to +85°C	-	•	-	•	-	•	•	•	-	•	-
	808	8.9 x 8.9	-	-	•	2 - 5	250	100	-40°C to +85°C	-	•	-	-	-	-	•	•	-	-	-
TE7	804	12.4 x 9.2 x 6.4	•	-	-	0.8 - 6.3	250	150	-40°C to +125°C	-	-	-	•	•	-	•	•	-	•	•
	807	12.4 x 9.2 x 6.4	•	-	-		300	100	-40°C to +125°C	•	•	•	•	-	-	•	•	-	-	-

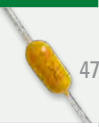
(1) Detailed information about product series listed here can be found on our website.
(2) In some cases for these categories, the ratings, agency approvals, and specifications vary by part number and are presented here as ranges representing the whole series.

How is the Surface Mount Fuse Used Here?

881 Series High-Current SMD Fuse

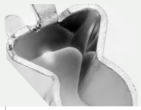
Provides a single-fuse solution for applications up to 75 Vdc. Current ratings from 60 A to 100 A, eliminates the need to parallel multiple lower-rated fuses or over-spec industrial-type fuses. Applications included blade servers, server chassis, backplane boards, and line cards.

Axial Leaded/Cartridge Fuses

Surface Mount Type	Series Name[1]	Time Lag	Medium Acting	Fast Acting	Very Fast Acting	Device Range[2] (Operating Current Options in Amps)	Max. Voltage Rating[2] (Volts)	Interrupting Rating at Max Voltage Rating[2] (Amps)	Operating Temperature Range	Agency Approvals[2]															RoHS Compliant	Lead Free	Halogen Free
										Americas					Europe						Asia						
										UL	UR	CSA	QPL	UMF	CE	VDE	TUV	BSI	Semko	PSE	K	CCC	CQC			
		 251				 473		 215		 325					 606											
PICO® Fuse / PICO® II Fuse Axial	251	-	-	-	•	0.062 - 15	125	300DC / 50AC	-55°C to +125°C	-	•	•	-	-	•	-	•	-	-	•	-	-	-	•	-	•
	253	-	-	-	•	0.062 - 15	125	300DC / 50AC	-55°C to +125°C	-	-	-	•	-	•	-	•	-	-	•	-	-	-	•	-	-
	275	-	-	-	•	20 - 30	32	300DC / 100AC	-55°C to +125°C	-	•	•	-	-	-	-	-	-	-	-	-	-	-	•	-	-
	263	-	-	-	•	0.062 - 5	250	50	-55°C to +125°C	-	•	•	-	-	•	-	-	-	-	•	-	-	-	•	-	•
	471	•	-	-	-	0.5 - 5	125	50	-55°C to +125°C	-	•	•	-	-	•	-	-	-	-	•	-	-	-	•	-	•
	472	•	-	-	-	0.5 - 5	125	50	-55°C to +125°C	-	•	-	-	-	•	-	-	-	-	-	-	-	-	•	-	•
	473	•	-	-	-	0.375 - 7	125	50	-55°C to +125°C	-	•	•	-	-	•	-	-	-	-	•	-	-	-	•	-	•
	265/266/267	-	-	-	•	0.062 - 15	125	300DC / 50AC	-55°C to +125°C	-	•	•	•	-	•	-	-	-	-	-	-	-	-	•	-	-
3.6 x 10mm	874	-	-	-	•	0.1 - 10	250	50	-55°C to +125°C	•	-	-	-	-	•	-	-	-	-	-	-	-	-	•	•	-
	875	•	-	-	-	0.1 - 10	250	50	-55°C to +125°C	•	-	-	-	-	•	-	-	-	-	-	-	-	-	•	•	-
	876	-	-	-	•	0.125 - 5	250	35 - 50	-55°C to +125°C	-	•	-	-	-	•	•	-	-	-	-	-	-	-	•	•	-
	877	•	-	-	-	0.375 - 10	250	35 - 63	-55°C to +125°C	-	•	-	-	-	•	•	-	-	-	-	-	-	-	•	•	-
4.5 x 14.5mm (2AG)	208	-	-	•	-	0.125 - 10	350	100	-55°C to +125°C	-	•	-	•	-	•	-	-	-	-	•	-	-	-	•	•	-
	209	•	-	-	-	0.25 - 7	350	100	-55°C to +125°C	-	•	-	•	-	•	-	-	-	-	•	-	-	-	•	•	-
	220	Special Fuse				0.3 - 7	250 / 300 / 350	35 - 100	-55°C to +125°C	•	•	•	-	-	•	-	-	-	-	•	-	-	-	•	•	-
	2205	•	-	-	-	0.25 - 2.5	250	35	-55°C to +125°C	-	•	•	-	-	•	-	-	-	-	-	-	-	-	•	•	-
	224/225	-	-	•	-	0.375 - 10	250 / 125	35 - 500	-55°C to +125°C	•	•	•	-	-	•	-	-	-	-	•	-	-	-	•	•	-
	229/230	•	-	-	-	0.25 - 7	250 / 125	35 - 400	-55°C to +125°C	•	•	•	-	-	•	-	-	-	-	•	-	-	-	•	•	-
5 x 20mm	217	-	-	•	-	0.032 - 15	250	35 - 150	-55°C to +125°C	-	•	•	-	-	•	•	-	•	•	•	•	•	-	•	•	-
	218	•	-	-	-	0.032 - 16	250	35 - 100	-55°C to +125°C	-	•	•	-	-	•	•	-	•	•	•	•	•	-	•	•	-
	213	•	-	-	-	0.2 - 6.3	250	35 - 63	-55°C to +125°C	-	•	•	-	-	•	•	-	•	•	•	-	•	-	•	•	-
	219XA	•	-	-	-	0.04 - 6.3	250	150	-55°C to +125°C	-	•	•	-	-	•	•	-	•	•	•	-	•	-	•	•	-
	216	-	-	•	-	0.05 - 16	250	750 - 1500	-55°C to +125°C	-	•	•	-	-	•	•	-	•	•	•	•	•	-	•	•	-
	215	•	-	-	-	0.125 - 20	250	400 / 1500	-55°C to +125°C	-	•	•	-	-	•	•	-	•	•	•	•	•	-	•	•	-
	232	-	•	-	-	1 - 10	250 / 125	300 / 10,000	-55°C to +125°C	-	-	-	-	-	•	-	-	-	-	•	•	-	-	•	•	-
	235	-	-	•	-	0.1 - 7	250 / 125	35 - 10,000	-55°C to +125°C	•	-	•	-	-	•	-	-	-	-	•	•	-	-	•	•	-
	233	-	•	-	-	1 - 10	125	10,000	-55°C to +125°C	•	-	•	-	-	•	-	-	-	-	•	•	-	-	•	•	-
	234	-	•	-	-	1 - 10	250	100 - 200	-55°C to +125°C	•	-	•	-	-	•	-	-	-	-	•	•	-	-	•	•	-
	239	•	-	-	-	0.08 - 7	250 / 125	35 - 10,000	-55°C to +125°C	•	-	•	-	-	•	-	-	-	-	•	•	-	-	•	•	-
	285	•	-	-	-	0.125 - 20	250	400 - 1500	-55°C to +125°C	-	-	-	-	-	•	-	-	-	-	•	-	-	-	•	•	-
	477	•	-	-	-	0.5 - 16	400DC / 500AC	100 - 1500	-55°C to +125°C	-	•	•	-	-	•	-	-	-	•	•	-	-	-	•	•	-
	487	-	-	•	-	8 - 20	420	200	-55°C to +125°C	•	-	-	-	-	-	-	•	-	-	-	-	-	-	•	•	-
	835	•	-	-	-	5 - 8	250	1500	-55°C to +125°C	•	-	-	-	-	-	-	•	-	-	•	•	•	•	•	•	-
	977	•	-	-	-	0.5 - 16	450DC / 500AC	200 / 100	-55°C to +125°C	-	-	-	-	-	•	-	-	-	•	•	-	-	-	•	•	-
6.3 x 32mm (3AG/3AB)	312/318	-	-	•	-	0.062 - 35	250 / 32	35 - 300	-55°C to +125°C	•	•	•	-	-	•	-	-	-	-	•	•	-	-	•	•	-
	313/315	•	-	-	-	0.01 - 30	250 / 125 / 32	35 - 300	-55°C to +125°C	•	•	•	-	-	•	-	-	-	-	•	•	-	-	•	•	-
	314/324	-	-	•	-	0.375 - 40	250	35 - 1000	-55°C to +125°C	•	•	•	-	-	•	-	-	-	-	•	•	-	-	•	•	-
	322	-	-	-	•	12 - 30	65	200 - 1000	-55°C to +125°C	-	•	-	-	-	•	-	-	-	-	•	-	-	-	•	-	-
	328	-	-	-	-	21	100VDC / 300VAC	200 / 200	-55°C to +125°C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	332	-	-	-	•	1- 10	250	100 / 200	-55°C to +125°C	-	•	•	-	-	•	-	-	-	-	•	-	-	-	•	•	-
	325/326	•	-	-	-	0.01 - 30	250	100 - 600	-55°C to +125°C	•	•	•	-	-	•	-	-	-	-	•	•	-	-	•	•	-
	504	-	-	-	-	20 - 30	420VDC / 500VAC / 250 VAC	400 / 200 / 1500	-55°C to +125°C	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	505	-	-	•	-	10 - 30	450 / 500	20,000 - 50,000	-55°C to +125°C	-	•	•	-	-	•	-	-	-	-	-	-	-	-	•	•	-
	506	-	-	•	-	15 - 20	600DC	10,000	-55°C to +125°C	-	•	•	-	-	•	-	-	-	-	-	-	-	-	•	•	-
	507	-	-	-	-	1 - 8	650VDC	150	-55°C to +125°C	-	•	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	508	-	-	-	-	0.315 - 1	1000	10,000	-55°C to +125°C	-	•	•	-	-	•	-	-	-	-	-	-	-	-	•	•	-
	514	-	-	•	-	1.6 - 12.5	500	5000	-55°C to +125°C	•	-	-	-	-	•	-	-	-	-	-	-	-	-	•	•	•
10 x 32mm	606	-	-	-	-	40 - 63	500	2000	-55°C to +125°C	•	-	-	-	-	-	-	-	-	-	-	-	-	-	•	•	•
6 x 25mm	688	-	-	-	-	5 - 40	70	1500 - 2500	-55°C to +125°C	•	-	-	-	-	-	-	•	-	-	-	-	-	-	•	•	-

(1) Detailed information about product series listed here can be found on our website.
(2) In some cases for these categories, the ratings, agency approvals, and specifications vary by part number and are presented here as ranges representing the whole series.

Fuse Holders

Fuseholder Type		In-Line Fuseholders	Panel Mount Fuse Enclosures	Circuit Board Mount Fuse Enclosures		Fuse Blocks		Fuse Clips	
Circuit Connection Method		Wire	Wire Connector Terminals	TH= Through-Hole SM= Surface Mount		CT= Wire Connector Terminal		QC= Quick Connect	
Fuse Type	Fuse Series[1]								
4.5×14.5 mm (2AG)	208 / 209 225 / 229	150274 150300 150307	3452 Series Int. Shocksafe 345 Series Int. Shocksafe (old) 245001 Solder QC 245002 NEMA QC 286377 Flip Top	—		CT TH TH QC	254 011 - 008 254 101, 254 121 254 131 254 201 - 208	TH SM TH TH TH TH TH TH TH TH	111501 111505 111506 111510 111512 52100001009 51900001009 51800001009 523 Series 445 Series
5×20 mm	213 / 215 216 / 217 218 / 219XA 232 / 233 234 / 235 239 / 285 377 / 477 617 / 618	150274 150300 150307 150315 150316 150317 150318 150319 PTF0080M FH503	345 Shocksafe 3455 Int. Shocksafe 286677 Flip Top 800 / 801 / 802 / 821 Series 823 Series Snap-in 824 / 824 - 20 / 850 / 851 / 860 Series 870 Series Medical Grade 820/ 820-20 Series Mini Shocksafe PTF030 / PTF035 / PTF040 PTF055 / PTF070	TH TH TH TH TH	345121 High Voltage Series 810 / 811 / 813 / 814 830 / 831 / 834 852 / 853 / 862 PTF045 / PTF050	TH TH QC CT TH CT SM TH TH TH	445073 520 002, 520 101 520 003, 520 005 520 004 646 / 649 / 656 647 658 PTF015 / PTF065 PTF075 / PTF077 PTF078 FB55 / FB58	TH TH TH TH TH TH	100 / 111 Series 04450001 / 00300210 5200001 52000001009 NY61AP FC51
6.3×32 mm (3AB/3AG)	312 313 314 322 326 332 373 505 506 508 605	155 Series 150312 150322 150603 445004 445005 PTF080 FH602 / FH604 150603	3453 Series Int. Shocksafe 345 High Voltage Series 342 Series Traditional 342006 Watertight 344 Series Snap / Panel Mount 348 Series Snap Mount 340 Series RF Shielded / Watertight 346877 Flip Top 342021 (FHN26W) Watertight 342024 (FHN26G2) Drip Proof 342025 (FHN20G) Drip Proof 800 Series Shocksafe 803-01 Series 860 Series	TH TH TH TH TH TH	345101 High Voltage Series 810 Series 811 Series 813 Series 814 Series 862 Series	CT QC QC QC QC QC CT CT QC QC QC QC	354 Series 35406 Series 35407 Series 35408 Series 35409 Series 354701 Series 356 Series 359 Series OMN002 OMN004 OMN006 FB65 / FB66	CT CT CT CT TH TH TH TH TH CT TH TH	101001 / 101002 101003 / 102064 121001 / 121002 121003 / 121004 102071 102076 / 102078 102079 / 102080 122083 / 122087 122088 / 122093 122090 / 100058 51800001009 101010 102074 10207101009
TE5/TR5® Fuse	303 / 369 370 / 372 373 / 374 382 / 383 385 / 392 395 / 396 397 / 398 400 / 662 663 / 664 665 / 804 807 / 808		570 Series	TH TH SM TH TH	571 Series 559 / 560 / 562 Series 564 Series 576 Series 556 / 557 Series				
Micro™ Fuse / TR3	262 / 268 269 / 272 273 / 274 278 / 279		282001 Front Mount Neoprene 282007 Front Mount Conductive 282002 Rear Mount Neoprene 282008 Rear Mount Conductive 280004 32V Indicating	TH TH TH TH	281005 Vertical Silver 281007 Horizontal Silver 281008 Vertical Tin 281010 Horizontal Tin				

(1) Detailed information about product series listed here can be found on our website.

Surface Mount PPTC Devices

PolySwitch®/POLY-FUSE® Standard SMD


FemtoSMD


MicroSMD


1206L


1812L


2920L

Series Name[1]	Size[2]	Hold Current (I_{HOLD})	Max Voltage (V_{MAX})	Max Fault current (I_{MAX})	Operating Temperature Range	Agency Approvals			Halogen Free	RoHS	Lead Free
						cUR	UR	TUV			
femtoSMDC	0603	0.05 - 0.35	15	40	-40°C to 85°C	•	•	•	•	•	•
picoSMDC	0805	0.1 - 1.1	15	100	-40°C to 85°C	•	•	•	•	•	•
nanoSMDC	1206	0.1 - 2.0	60	100	-40°C to 85°C	•	•	•	•	•	•
microSMD	1210	0.05 - 2.0	30	100	-40°C to 85°C	•	•	•	•	•	•
miniSMDC	1812	0.1 - 3.0	60	100	-40°C to 85°C	•	•	•	•	•	•
midSMD	2018	0.3 - 2.0	60	40	-40°C to 85°C	•	•	•	•	•	•
SMDC	2920	0.3 - 3.1	60	50	-40°C to 85°C	•	•	•	•	•	•
SMD	2920	0.3 - 3.0	60	50	-40°C to 85°C	•	•	•	•	•	•
SMD2	3425	1.5 - 2.5	33	70	-40°C to 85°C	•	•	•	•	•	•
LoRho PTC (Low Resistance)	0402	0.1 - 0.5	6	40	-40°C to 85°C	•	•	•	•	•	•
	0603	0.5 - 1.75	6	50	-40°C to 85°C	•	•	•	•	•	•
	0805	0.75 - 3.0	6	50	-40°C to 85°C	•	•	•	•	•	•
	1206	0.75 - 4.5	12	50	-40°C to 85°C	•	•	•	•	•	•
	1210	1.75 - 4.5	6	50	-40°C to 85°C	•	•	•	•	•	•
	1812	1.9 - 3.7	6	50	-40°C to 85°C	•	•	•	•	•	•
	2920	7.0	6	50	-40°C to 85°C	•	•	•	•	•	•
0603L	0603	0.04 - 0.5	24	40	-40°C to 85°C	•	•	•	•	•	•
0805L	0805	0.05 - 1.1	30	100	-40°C to 85°C	•	•	•	•	•	•
1206L	1206	0.05 - 2.0	60	100	-40°C to 85°C	•	•	•	•	•	•
1210L	1210	0.05 - 2.0	30	100	-40°C to 85°C	•	•	•	•	•	•
1812L	1812	0.1 - 3.0	60	100	-40°C to 85°C	•	•	•	•	•	•
2016L	2016	0.3 - 5.0	60	100	-40°C to 85°C	•	•	•	•	•	•
2920L	2920	0.3 - 7.0	60	50	-40°C to 85°C	•	•	•	•	•	•
250S	3729	0.13	250 / 60	3	-40°C to 85°C	•	-	•	•	•	•

PolySwitch® Automotive SMD


FemtoASMD


PicoASMD


ASMDC


NanoASMDCH

Series Name[1]	Size[2]	Hold Current (I_{HOLD})	Max Voltage (V_{MAX})	Max Fault current (I_{MAX})	Operating Temperature Range	Agency Approvals			Halogen Free	RoHS	Lead Free
						cUR	UR	TUV			
femtoASMDC	0603	0.05 - 0.1	15	10	-40°C to 85°C	-	-	-	•	•	•
picoASMDC	0805	0.1 - 0.12	15	20	-40°C to 85°C	-	-	-	•	•	•
picoASMDCH	0805	0.1	16	40	-40°C to 125°C	-	-	-	•	•	•
nanoASMDC	1206	0.1 - 0.5	60	100	-40°C to 85°C	-	-	-	•	•	•
nanoASMDCH	1206	0.16 - 0.5	30	50	-40°C to 125°C	-	-	-	•	•	•
microASMD	1210	0.05 - 0.5	30	40	-40°C to 85°C	-	-	-	•	•	•
miniASMDC	1812	0.1 - 2.6	60	100	-40°C to 85°C	-	-	-	•	•	•
ASMDC	2920	0.3 - 3.0	60	40	-40°C to 85°C	-	-	-	•	•	•
AHS	2018-3425	0.8 - 3.0	16	70	-40°C to 125°C	-	-	-	•	•	•
ASMD	2920-3425	0.23 - 1.97	60	40	-40°C to 85°C	-	-	-	•	•	•

(1) Detailed information about most product series listed here can be found on our website.
(2) Size for these surface mount items refers to common industry length and width dimensions of the device surface area. Example: 0402 = .04" x .02"

Surface Mount PPTC Devices (Continued)

PolySwitch® Oil Resistant SMD

NanoSMDCH

MicroSMDCH

SMDCH

Series Name[1]	Size[2]	Hold Current (I_{HOLD})	Max Voltage (V_{MAX})	Max Fault current (I_{MAX})	Operating Temperature Range	Agency Approvals			Halogen Free	RoHS	Lead Free
						cUR	UR	TUV			
NANOSMDCH	1206	0.1 - 0.75	30	10	-40°C to 125°C	-	•	-	•	•	•
MICROSMDCH	1210	0.1 - 0.5	30	10	-40°C to 125°C	-	-	-	•	•	•
SMDCH	2920	0.5 - 2.0	24	20	-40°C to 125°C	-	•	-	•	•	•

Radial Leaded PPTC Devices

PolySwitch®/POLY-FUSE® Standard R-Line


RUEF


RXEF


RUSBF


RGEF

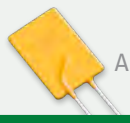

RHEF

Series Name[1]	Size (mm)	Hold Current (I_{HOLD})	Max Voltage (V_{MAX})	Max Fault current (I_{MAX})	Operating Temperature Range	Agency Approvals			Halogen Free	RoHS	Lead Free
						cUR	UR	TUV			
RUEF	7.4 x 12.2 to 24.1 x 29.0	0.90 - 9.0	30	100 / 70	-40°C to 85°C	•	•	•	•	•	•
RKEF	7.1 x 11.43 to 24.1 x 29.0	0.50 - 5.0	60	40	-40°C to 85°C	•	•	•	•	•	•
RXEF	8.0 x 8.3 to 27.2 x 31.8	0.05 - 0.17 / 0.20 - 3.75	60 / 72	40	-40°C to 85°C	•	•	•	•	•	•
RUSBF	6.9 x 11.4 to 11.4 x 18.3	0.90 - 2.5 / 0.75 - 1.55	16 / 6	40	-40°C to 85°C	•	•	•	•	•	•
RGEF	7.1 x 11.0 to 23.5 x 27.9	2.5 - 14.0	16	100	-40°C to 85°C	•	•	•	•	•	•
RHEF	6.9 x 10.8 to 23.5 x 28.7	0.50 - 1.0 / 2.0 - 15.0	30 / 16	40 / 100	-40°C to 125°C	•	•	•	•	•	•
USBR	6.9 x 11.4 to 11.4 x 18.3	0.75 - 2.50	6 / 16	40	-40°C to 85°C	•	•	•	•	•	•
16R	7.1 x 11.0 to 23.5 x 27.9	2.50 - 14.00	16	100	-40°C to 85°C	•	•	•	•	•	•
30R	7.4 x 12.2 to 24.1 x 31.6	0.90 - 9.00	30	40	-40°C to 85°C	•	•	•	•	•	•
60R	7.4 x 11.7 to 26.3 x 31.1	0.10 - 3.75	60	40	-40°C to 85°C	•	•	•	•	•	•
72R	7.4 x 11.7 to 26.3 x 31.1	0.20 - 3.75	72	40	-40°C to 85°C	•	•	•	•	•	•
250R	5.8 x 9.9 to 9.5 x 12	0.08 - 0.18	250	3 / 10	-40°C to 85°C	•	•	•	•	•	•
600R	9.0 x 12.5 to 16.0 x 12.6	0.15 - 0.16	600	3	-40°C to 85°C	•	•	•	•	•	•

PolySwitch® Automotive R-Line


AGRF


AHEF


AHRF

Series Name[1]	Size (mm)	Hold Current (I_{HOLD})	Max Voltage (V_{MAX})	Max Fault current (I_{MAX})	Operating Temperature Range	Agency Approvals			Halogen Free	RoHS	Lead Free
						cUR	UR	TUV			
AGRF	8.9 x 14.1 to 23.5 x 28.7	4.0 - 14.0	16	100	-40°C to 85°C	-	-	-	•	•	•
AHRF	6.9 x 10.8 to 23.5 x 28.7	0.5 - 1.0 / 2.0 - 15.0	30 / 16	40 / 100	-40°C to 125°C	-	-	-	•	•	•
AHEF	6.9 x 10.8 to 23.5 x 27.9	0.5 - 10.0	32	100	-40°C to 125°C	-	-	-	•	•	•

(1) Detailed information about most product series listed here can be found on our website.
(2) Size for these surface mount items refers to common industry length and width dimensions of the device surface area. Example: 0402 = .04" x .02"

Radial Leaded PPTC Devices (Continued)

PolySwitch® Line Voltage


LVB


LVR

Series Name[1]	Size (mm)	Hold Current (I_{HOLD})	Max Voltage (V_{MAX})	Max Fault current (I_{MAX})	Operating Temperature Range	Agency Approvals			Halogen Free	RoHS	Lead Free
						cUR	UR	TUV			
LVR	6.9 x 9.9 to 24.9 x 34.8	0.05 - 2.0	240	1 - 20	-20°C to 85°C	•	•	•	-	•	•
LVB	25.2 x 27.2	1.25	240	12.5	-40°C to 85°C	-	•	-	-	•	•

Battery PPTC Devices

PolySwitch® Straps


VLR


VLP


VTP


LR4


SRP

Series Name[1]	Size (mm)	Hold Current (I_{HOLD})	Max Voltage (V_{MAX})	Max Fault Current (I_{MAX})	Operating Temperature Range	Agency Approvals			Halogen Free	RoHS	Lead Free
						cUR	UR	TUV			
VLR	23.2 X 3.9 to 23.1 x 5.3	1.70 - 2.30	12	100	-40°C to 85°C	•	•	•	•	•	•
VLP	11.8 x 4.6 to 23.1 x 5.3	1.20 - 2.70	16	60	-40°C to 85°C	•	•	•	•	•	•
VTP	25.6 x 2.9 to 23.1 x 5.3	1.10 - 2.10	16	100	-40°C to 85°C	•	•	•	•	•	•
LR4	22.1 x 5.5 to 66.5 x 10.0	1.90 - 13.0	15/20	100	-40°C to 85°C	•	•	•	•	•	•
SRP	22.1 x 5.2 to 32.4 x 13.6	1.20 - 4.20	15/30	100	-40°C to 85°C	•	•	•	•	•	•

PolySwitch® LowRho Straps


MXP


MGP


RSD

Series Name[1]	Size (mm)	Hold Current (I_{HOLD})	Max Voltage (V_{MAX})	Max Fault Current (I_{MAX})	Operating Temperature Range	Agency Approvals			Halogen Free	RoHS	Lead Free
						cUR	UR	TUV			
MXP/MGP (Low Resistance)	10.0 x 2.6 to 16.5 x 3.26	1.80 - 5.0	6	50	-40°C to 85°C	-	•	•	•	•	•
RSD	10.3 x 2.95	3.1 - 4.2	6	50	-40°C to 85°C	-	•	-	•	•	•

How is the PPTC Used Here?

ASMD & miniASMD Surface Mount Resettable PPTCs

Resettable PPTC overcurrent protection helps prevent system breakdowns and enhances safety. Surface-mounted automotive PPTCs safeguard a wide range of functions such as powered antennas, CANbus, touchscreens, USB ports, HDMI ports, and I/O lines.

Battery PPTC Devices (Continued)

POLY-FUSE® LoRho SMD

Series Name[1]	Size[2]	Hold Current (I_{HOLD})	Max Voltage (V_{MAX})	Max Fault Current (I_{MAX})	Operating Temperature Range	Agency Approvals			Halogen Free	RoHS	Lead Free
						cUR	UR	TUV			
LoRho	0402	0.1 - 0.5	6	40	-40°C to 85°C	•	•	•	•	•	•
	0603	0.5 - 1.75	6	50	-40°C to 85°C	•	•	•	•	•	•
	0805	0.75 - 3.0	6	50	-40°C to 85°C	•	•	•	•	•	•
	1206	0.75 - 4.5	12	50	-40°C to 85°C	•	•	•	•	•	•
	1210	1.75 - 4.5	6	50	-40°C to 85°C	•	•	•	•	•	•
	1812	1.9 - 3.7	6	50	-40°C to 85°C	•	•	•	•	•	•
	2920	7.0	6	50	-40°C to 85°C	•	•	•	•	•	•

Battery Mini-Breakers (Thermal Cutoff Devices)

Battery Mini-Breakers (Thermal Cutoff Devices)

Series Name[1]	Size (mm)	Operation Temperature	Reset Temperature	Hold Current @25°C (I_{HOLD})	Contact Rating	Max Breaking Current	Operating Temperature Range	Agency Approvals			Halogen Free	RoHS	Lead Free
								cUR	UR	CB			
MHP-TAM6	5.80 x 3.80 x 1.15$_{MAX}$	72-90°C	≥40°C	6A	DC 9V/12A, 6000 Cycles	DC 5V/40A, 100 Cycles	-30 to 100°C	•	•	•	•	•	•
MHP-TAM15	5.80 x 3.80 x 1.15$_{MAX}$	72-90°C	≥40°C	15A	DC 9V/25A, 6000 Cycles	DC 5V/80A, 100 Cycles	-30 to 100°C	•	•	•	•	•	•
MHP-TAT18	5.80 x 3.80 x 1.15$_{MAX}$	72-90°C	≥40°C	18A	DC 9V/30A, 6000 Cycles	DC 5V/80A, 100 Cycles	-30 to 100°C	•	•	•	•	•	•
MHP-TAC6	4.75 x 2.80 x 0.85$_{MAX}$	72-90°C	≥40°C	6A	DC 12V/12A, 6000 Cycles	DC 5V/40A, 100 Cycles	-30 to 100°C	•	•	•	•	•	•
MHP-TAC15	4.75 x 2.80 x 0.85$_{MAX}$	72-90°C	≥40°C	15A	DC 12V/25A, 6000 Cycles	DC 5V/80A, 100 Cycles	-30 to 100°C	•	•	•	•	•	•

(1) Detailed information about most product series listed here can be found on our website.
(2) Size for these surface mount items refers to common industry length and width dimensions of the device surface area. Example: 0402 = .04" x .02"

How is the Mini-Breaker Used Here?

MHP-TA Metal Hybrid PPTC Devices

Mini-breakers provide resettable overtemperature and overcurrent protection in high-capacity Li-ion polymer and prismatic cells. They are capable of handling the high battery-discharge currents in notebook PCs, gaming PCs, ultra-books, tablets, smartphones, and other small portable electronic devices.

Telecom PPTC Devices

PolySwitch® Surface Mount & Chips


TCF250


TSV250


TSM250


TS600


TSM600

Series Name[1]	Size (mm)	Hold Current (I_{HOLD})	Max Voltage (V_{MAX})	Max Fault current (I_{MAX})	Operating Temperature Range	Agency Approvals			Halogen Free	RoHS	Lead Free
						cUR	UR	TUV			
TCF250	4.9 x 4.9 x 2.3 to 7.1 x 7.1 x 1.6	0.09 - 0.18	250	3	-40°C to 85°C	-	•	-	•	•	•
TSL250	7.9 x 5.3	0.08 - 0.13	250	3	-40°C to 85°C	•	•	•	•	•	•
TS250	9.4 x 7.4	0.13	250	3	-40°C to 85°C	•	•	•	•	•	•
TSM250	8.9 x 8.6	0.13	250	3	-40°C to 85°C	-	•	-	•	•	•
TSV250	6.1 x 6.9	0.13	250	3	-40°C to 85°C	•	•	•	•	•	•
TS600	19.4 x 8.3	0.17 - 0.4	600	3	-40°C to 85°C	•	•	-	•	•	•
TSM600	17.6 x 11.2	0.25 - 0.4	600	3	-40°C to 85°C	•	•	-	•	•	•

PolySwitch® Radial Leaded


TRF250


TRF600

Series Name[1]	Size (mm)	Hold Current (I_{HOLD})	Max Voltage (V_{MAX})	Max Fault current (I_{MAX})	Operating Temperature Range	Agency Approvals			Halogen Free	RoHS	Lead Free
						cUR	UR	TUV			
TRF250	4.8 x 9.3 to 9.0 x 12.0	0.055 - 0.184	250	3	-40°C to 85°C	•	•	•	•	•	•
TRF600	9.0 x 12.5 to 16.0 x 12.6	0.15 - 0.4	600	3	-40°C to 85°C	•	•	•	•	•	•
TR600	13.5 x 12.6	0.15	600	3	-40°C to 85°C	-	-	-	•	•	•

(1) Detailed information about most product series listed here can be found on our website.

How is the Varistor Used Here?

TMOV20RP460EL2T7
Thermally Protected Varistor

The aging and degradation of conventional MOVs can lead to catastrophic failure, smoke, and fire. In contrast, this TMOV enhances safety and extends smart meter reliability.

Varistors

Surface Mount MLV / MOV


MHS


MLA


MLN


CH


SM7

Series Name[1]	Technology Type	Operating AC Voltage Range	Operating DC Voltage Range	Peak Current Range[2] (A)	Peak Energy Range (J)	Operating Temperature Range	Lines Protected	Mount/ Form Factor	Disc Size	Agency Approvals					RoHS	Lead Free	Halogen Free
										UR	cURus	VDE	CECC	QPL			
MHS	Multi-Layer Zinc Oxide (MLV)	-	9 - 42	-	-	-55 to +125°C	1	Surface Mount	Not Applicable	-	-	-	-	-	•	•	•
MLE		-	18	-	-	-55 to +125°C	1			-	-	-	-	-	•	•	•
MLA		2.5 - 107	3.5 - 120	4 - 1000	0.02 - 4.5	-55 to +125°C	1			-	-	-	-	-	•	•	•
MLA AUTO		2.5 - 107	3.5 - 120	4 - 1000	0.02 - 4.5	-55 to +125°C	1			-	-	-	-	-	•	•	•
AUML		-	18 - 68	-	-	-55 to +125°C	1			-	-	-	-	-	•	•	•
MLN		18	5.5 - 18	30	0.05 - 0.10	-55 to +125°C	4			-	-	-	-	-	•	•	•
CH	Metal Oxide Varistor (MOV)	14 - 275	18 - 369	100 - 250	1.0 - 8.0	-55 to +125°C	1			•	-	-	-	-	•	•	•
SM7		115 - 510	369 - 675	1200	23 - 40	-55 to +85°C	1			•	-	-	-	-	•	•	•
SM20		20 - 320	26 - 420	6500	165	-55 to +85°C	1			•	-	-	-	-	•	•	•

Radial Leaded MOV


UltraMOV


UltraMOV25S

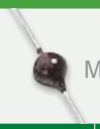

C-III


ZA


HMOV

Series Name[1]	Technology Type	Operating AC Voltage Range	Operating DC Voltage Range	Peak Current Range[2] (A)	Peak Energy Range (J)	Operating Temperature Range	Lines Protected	Mount/ Form Factor	Disc Size	Agency Approvals					RoHS	Lead Free	Halogen Free
										UR	cURus	VDE	CECC	QPL			
UltraMOV™ Varistor	Metal Oxide Varistor	130 - 625	170 - 825	1750 -10000	12.5 - 400	-55 to +85°C	1	Radial Leaded	7, 10, 14, 20mm	-	•	•	•	-	•	•	•
UltraMOV™ 25S Varistor		115 - 750	150 - 970	22000	230 - 890	-55 to +85°C	1		25mm	-	•	•	-	-	•	•	•
C-III		130 - 1000	-	3500 - 1000	40 - 530	-55 to +85°C	1		10, 14, 20mm	-	•	•	•	-	•	•	•
LA		130 - 1000	175 - 1200	1200 - 6500	11 - 360	-55 to +85°C	1		7, 10, 14, 20mm	-	•	•	•	-	•	•	•
ZA		4 - 460	5.5 - 615	50 - 6500	0.1 - 52	-55 to +85°C	1		5, 7, 10, 14, 20mm	-	•	•	•	-	•	•	•
LV UltraMOV		11-95	14-125	500-10000	0.8-150	-55 to +85°C epoxy coated ; -55 to +125°C phenolic coated	1		5, 7, 10, 14, 20mm	-	•	-	-	-	•	•	•
AUMOV		14-625	16-825	400-10000	1-490		1		5, 7, 10, 14, 20mm	•	-	-	-	-	•	•	•
HMOV		11-625	14-825	1500-10000	4.2-900	-55 to +125°C	1		10, 14, 20mm	-	•	-	•	-	•	•	•

Specialty Application MOV


MA


RA


High Reliability

Series Name[1]	Technology Type	Operating AC Voltage Range	Operating DC Voltage Range	Peak Current Range[2] (A)	Peak Energy Range (J)	Operating Temperature Range	Lines Protected	Mount/ Form Factor	Disc Size	Agency Approvals					RoHS	Lead Free	Halogen Free
										UR	cURus	VDE	CECC	QPL			
MA	Metal Oxide Varistor	9 - 264	13 - 365	40 - 100	0.06 - 1.7	-55 to +85°C	1	Axial Leaded	Not Applicable	-	-	-	-	-	•	•	•
RA		4 - 275	5.5 - 369	150 - 6500	0.4 - 160	-55 to +125°C	1	Inline Radial Leads	Not Applicable	-	•	-	-	-	•	•	-
High Reliability		130 - 510	4 - 675	100 - 6500	0.4 - 190	-55 to +85°C	1	(Varies)	(Varies)	-	-	-	-	•	-	-	-

Varistors (Continued)

Industrial High-Energy Terminal MOV


BA/BB


DA/DB


HA


HB34


CA

Series Name[1]	Technology Type	Operating AC Voltage Range	Operating DC Voltage Range	Peak Current Range[2] (A)	Peak Energy Range (J)	Operating Temperature Range	Lines Protected	Mount/ Form Factor	Disc Size	Agency Approvals					RoHS	Lead Free	Halogen Free
										UR	cURus	VDE	CECC	QPL			
BA/BB	Metal Oxide Varistor	130 - 2800	175 - 3500	50000 70000	450 - 10000	-55 to +85°C	1	Screw / Clip Terminals	60mm	•	-	-	-	-	•	-	-
DA/DB		130 - 750	175 - 970	40000	270 - 1050	-55 to +85°C	1		40mm	•	-	-	-	-	•	•	-
HA		110 - 750	148 - 970	25000 40000	160 - 1050	-55 to +85°C	1	Industrial Packaged Radial Leads	32, 40mm	-	•	-	-	-	•	•	•
HB34, HG34, HF34		110 - 750	148 - 970	40000	220 - 1050	-55 to +85°C	1		34mm	-	•	-	-	-	•	•	•
DHB34		110 - 750	148 - 970	40000	220 - 10000	-55 to +85°C	1		34mm	-	•	-	-	-	•	•	•
CA		250 - 2800	330 - 3500	50000 70000	880 - 10000	-55 to +85°C	1	Bare Disc	60mm	-	-	-	-	-	•	-	•

Thermally Protected MOV


SMOV25S


SMOV34S


TMOV25S


TMOV34S


iTMOV

Series Name[1]	Technology Type	Operating AC Voltage Range	Operating DC Voltage Range	Peak Current Range[2] (A)	Peak Energy Range (J)	Operating Temperature Range	Lines Protected	Mount/ Form Factor	Disc Size	Agency Approvals					RoHS	Lead Free	Halogen Free
										UR	cURus	VDE	CECC	QPL			
SMOV™ 25S Varistor	Metal Oxide Varistor	115 - 750	150 - 970	20000	170 - 670	-45 to +75°C	1	Industrial Packaged Radial Leads	25mm	•	-	-	-	-	•	•	-
SMOV™ 34S Varistor		115 - 750	150 - 970	40000	280 - 1200	-45 to +75°C	1		34mm	•	-	-	-	-	•	•	-
TMOV® 25S Varistor		115 - 750	150 - 970	20000	170 - 670	-55 to +85°C	1	Radial Leaded	25mm	-	•	•	•	-	•	•	•
TMOV® 34S Varistor		115 - 750	150 - 970	40000	280 - 1200	-55 to +85°C	1	Industrial Packaged Radial Leads	34mm	-	•	•	•	-	•	•	•
TMOV® Varistor / iTMOV® Varistor		115 - 750	150 - 970	6000 - 10000	35 - 480	-55 to +85°C	1	Radial Leaded	14, 20mm	-	•	•	•	-	•	•	•

(1) Detailed information about product series listed here can be found on our website.
(2) Not an applicable parameter for Crowbar devices

Gas Discharge Tubes

High-Voltage GDTs


AC


CG3

CG4

Series Name[1]	DC Sparkover Voltage @ 100V/s ±20% Tolerance (V)	Max AC Surge (A)	Max Impulse Discharge Current 8x20us, 10 hits (KA)	Max Capacitance (pF)	Operation Temperature	Agency Approvals			Halogen Free	RoHS	Lead Free
						cUR	UR	TUV			
CG3/AC	285~7500	NA	5	1.5	-40°C to +90°C	•	•	-	-	•	•
CG4	800~3000	3	3	0.8	-40°C to +90°C	•	•	-	-	•	•
GTCX28-XXXM-R20	75~350	20	20	1.5	-40°C to +90°C	-	•	-	-	•	•

Gas Discharge Tubes (Continued)

Low- to Medium-Surge GDTs


CG5


SH


SL1002A

Series Name[1]	DC Sparkover Voltage @ 100V/s ±20% Tolerance (V)	Max AC Surge (A)	Max Impulse Discharge Current 8x20us, 10 hits (KA)	Max Capacitance (pF)	Operation Temperature	Agency Approvals			Halogen Free	RoHS	Lead Free
						cUR	UR	TUV			
CG5/SL0902A	90~600	5	5	1.5	-40°C to +90°C	•	•	-	-	•	•
CG6	75~600	3	3	0.3	-40°C to +90°C	•	•	-	-	•	•
CG7	75~470	1	1	0.3	-40°C to +90°C	•	•	-	-	•	•
SH	75~600	5	5	0.7	-40°C to +90°C	•	•	-	-	•	•
SL1002A	75~600	5	5	1.2	-40°C to +90°C	•	•	-	-	•	•
SL1003A	90~500	10	10	1.5	-40°C to +90°C	•	•	-	-	•	•
SL1011A	75~600	5	5	1.5	-40°C to +90°C	•	•	-	-	•	•
SL1010A	75~470	NA	5~10	1.5	-40°C to +90°C	•	•	-	-	•	•
GTCX25-XXXM-R02	75~600	2.5	2.5	1	-40°C to +90°C	-	•	-	-	•	•
GTCX25-XXXM-R05	75~230	5	5	1	-40°C to +90°C	-	•	-	-	•	•
GTCX26-XXXM-R05	75~600	5	5	1	-40°C to +90°C	-	•	-	-	•	•
GTCX28-XXXM-R05	75~600	5	5	1	-40°C to +90°C	-	•	-	-	•	•
GTCX35-XXXM-R05	75~600	5	5	1	-40°C to +90°C	-	•	-	-	•	•
GTCX36-XXXM-R05	75~600	5	5	1	-40°C to +90°C	-	•	-	-	•	•

Medium- to High-Surge GDTs


CG/CG2


SG


SE

Series Name[1]	DC Sparkover Voltage @ 100V/s ±20% Tolerance (V)	Max AC Surge (A)	Max Impulse Discharge Current 8x20us, 10 hits (KA)	Max Capacitance (pF)	Operation Temperature	Agency Approvals			Halogen Free	RoHS	Lead Free
						cUR	UR	TUV			
CG/CG2	75~1000	20	20 (10 for 800 & 1000V)	1.5	-40°C to +90°C	•	•	-	-	•	•
SG	75~600	2.5	1~2	1	-40°C to +90°C	•	•	-	-	•	•
SE	75~600	NA	0.5	0.5	-40°C to +90°C	•	•	-	-	•	•
SL1021A	90~600	10	10	1.5	-40°C to +90°C	-	-	-	-	-	-
SL1411A	75~600	10	10	1.5	-40°C to +90°C	•	•	-	-	•	•
SL1122A	90~260	10	5	1	-40°C to +90°C	•	•	-	-	•	•
GTCX23-XXXM-R01	75~400	NA	1	0.5	-40°C to +90°C	•	•	-	-	•	•
GTCX28-XXXM-R10	75~600	10	10	1	-40°C to +90°C	•	•	-	-	•	•
GTCX38-XXXM-R10	75~600	10	10	1	-40°C to +90°C	-	•	-	-	•	•
GTCX36-XXXM-R10	75~600	10	10	1	-40°C to +90°C	-	•	-	-	•	•
GTCX37-XXXM-R10	75~600	10	10	1	-40°C to +90°C	-	•	-	-	•	•

(1) Detailed information about product series listed here can be found on our website.

Gas Discharge Tubes (Continued)

Very-High-Surge GDTs


SL1021B


SL1026


GTCA28

Series Name[1]	DC Sparkover Voltage @ 100V/s ±20% Tolerance (V)	Max AC Surge (A)	Max Impulse Discharge Current 8x20us, 10 hits (KA)	Max Capacitance (pF)	Operation Temperature	Agency Approvals			Halogen Free	RoHS	Lead Free
						cUR	UR	TUV			
SL1021B	75~500	10	20	1.5	-40°C to +90°C	•	•	-	-	•	•
SL1026	275~700	10	20	NA	-40°C to +90°C	-	-	-	-	•	•
GTCA28-XXXM-R03	800~4000	5	3 (5 for 800V)	1	-40°C to +90°C	-	•	-	-	•	•

PulseGuard® ESD Suppressors

PulseGuard® ESD Suppressors


PGB1


PGB2


XGD


AXGD


PESD0603

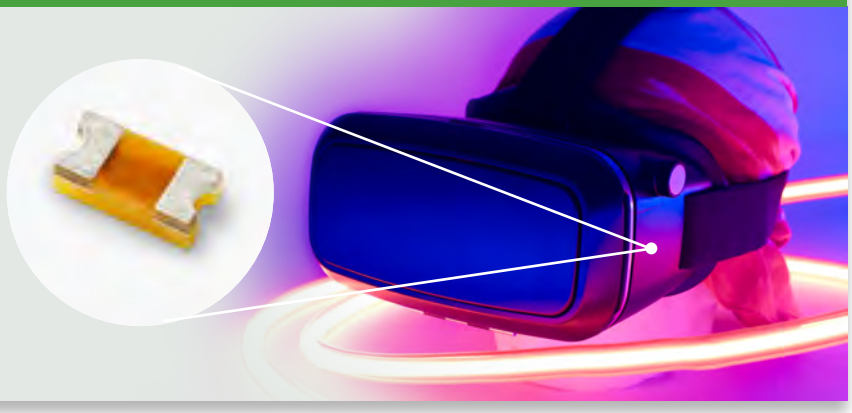
Series Name[1]	Surface Mount	Through Hole	Working Voltage (V)	Array Package (No. of lines)	Single Line Package	Typical Capacitance (pF)	Typical Leakage Current	Rated Immunity to IEC 61000-4-2 level 4	Bidirectional (transients of either polarity)	Halogen Free	RoHS	Lead Free
PGB1	•	-	0~24	SOT23 (2)	0402 0603	0.04-0.12	<1nA	•	•	-	•	•
PGB2	•	-	0~12	NA	0402	0.07	<1nA	•	•	•	•	•
XGD	•	-	0~32	-	0402 0603	0.04-0.09	<1nA	•	•	•	•	•
AXGD	•	-	0~32	-	0402 0603	0.04-0.09	<1nA	•	•	•	•	•
PESD0402	•	-	0~24	-	0402	0.25	< 0.01μA	•	•	•	•	•
PESD0603	•	-	0~24	-	0603	0.25	< 0.01μA	•	•	•	•	•
PESD1206	•	-	0~24	-	1206	0.25	< 0.01μA	•	•	•	•	•

(1) Detailed information about product series listed here can be found on our website.

How is the ESD Device Used Here?

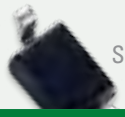
AXGD10402KR ESD Suppressor

This ESD suppressor provides reliable protection for USB ports, data communication ports, HDMI ports, audio interfaces, on-screen display interfaces, push button switches, and LVDS.



TVS Diode Arrays

General Purpose ESD Protection


SOD323


SOT23-3


uDFN-2

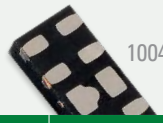

SOD882


SOD523

Series Name[1]	Package Type	Breakdown Voltage (V)	Capacitance (pF)	Channel	ESD Contact (V)	Clamping Voltage (tp = 8/20µs)	Max. Surge Rating (tp = 8/20µs) (A)	RoHS	AEC-Q101 Qualified
SD	SOD323	6-40	50-350	1	±30	8.5-52V	5-30	•	•
SD-C	SOD323	6-40	30-200	1	±30	10-50V	5-30	•	•
SM	SOT23-3	6-40	50-400	2	±30	9.8-52V	5-24	•	•
SP1003	SOD723 / SOD882	7	35	1	±30	12.0V	7	•	•
SP1005	SOD882 / 0201 Flipchip	7	35	1	±30	10V	8-10	•	•
SP1006	uDFN-2	7	30	1	±30	8.3V	5	•	•
SP1026	µDFN-2 (0201)	7.8	15	1	±30	12.0V	5.0	•	•
SP1103C	uDFN-2	3.8	130	1	±30	9.0V@80A	80.0	•	•
SP11xx	uDFN-2	6.0-26.7	130-630	1	±30	9.8-45V	20-80	•	•
SP1124T	uDFN-2	26.7	130	1	±30	29.0V@1A	20.0	•	•
SP1233	SOD882	4.2	35	1	±30	6.1V@1A	20	•	•
SP1305	SOT23-3	7	30	2	±30	8.6V	5	•	•
SP1326	SOD523	7.8	15	1	±30	12V@1A	4	•	•
SP3019	SOT23-6	8.2	0.3	4	+22/-10	10.5V@1A	2.5	•	•
SP712	SOT23-3L	9	75	2	±30	17V	20	•	•
SP720 Lead-Free/Green	SOIC-16 / PDIP-16	-	3	14	±4	-	3	•	-
SP721 Lead-Free/Green	SOIC-8 / PDIP-8	-	3	6	±4	-	3	•	-
SP723 Lead-Free/Green	SOIC-8 / PDIP-8	-	5	6	±8	-	7	•	-
SP724 Lead-Free/Green	SOT23-6	-	3	4	±8	-	3	•	-
SP725	MSOP-10L/ SOIC-8	-	5	-	±8	-	9	•	-
SPHV	SOD882	13.3-40	25-60	1	±15-±30	19-52 @ 1A	2-8.0	•	•
SPHV-C	SOD882	13.3-40	13-30	1	±15-±30	19-52 @ 1A	2-8.0	•	•

Ultra-Low Capacitance


0402 DFN


1004 DFN


uDFN-2


SOD882

Series Name[1]	Package Type	Breakdown Voltage (V)	Capacitance (pF)	Channel	ESD Contact (V)	Clamping Voltage (tp = 8/20µs)	Max. Surge Rating (tp = 8/20µs) (A)	RoHS	AEC-Q101 Qualified
Enhanced ESD Discrete TVS	0201 DFN / 0402 DFN	8.8-9.6	0.15-0.3	1	±22	13-14V@2.5A	2.5	•	•
Ultra-Low Capacitance Discrete TVS	0201 DFN / 0402 DFN	9-9.8	0.1-0.2	1	±20	9.2-10V@2.0A	2.0	•	•
Enhanced ESD Diode Arrays	0402 DFN array	8	0.3	2	±22	13V@2.2A	2.2	•	•
Ultra-Low Capacitance Diode Arrays	0402 DFN array / 1004 DFN	9	0.2	2	±20	9.2V@2.0A	2.0	•	•
SP3213	uDFN-2	7.5	0.09	1	±12	12V	2	•	•
SP3522	SOD882 / 0201 DFN	9.2	0.15	1	±22	14.5V@2.5A	2.5	•	•
SP3530	SOD882 / 0201 DFN	8.2	0.3	1	±22	11.8V@2.5A	2.5	•	•

How Is the TVS Diode Array Used Here?

SP3522, SP3530 Series, SP1005-01ETG / SP1003-01ETG / AQ3400-02UTG, AQHVxx-01LTG/ AQHVxx-01LTG-C Diode Arrays

High-speed data lines require robust ESD protection that does not interfere with the signal. Littelfuse TVS Diode Arrays offer low clamping and low leakage, with certain models (SP3522, SP3530 Series and AQ3400-02UTG) featuring low capacitance.

TVS Diode Arrays (continued)

Lightning Surge Protection


uDFN-10


SOD323


MSOP-10


uDFN-12


SOT143

Series Name[1]	Package Type	Breakdown Voltage (V)	Capacitance (pF)	Channel	ESD Contact (V)	Clamping Voltage (tp = 8/20µs)	Max. Surge Rating (tp = 8/20µs) (A)	RoHS	AEC-Q101 Qualified
SP2525NUTG	uDFN-10L	7	1.7	4	±30	9V@30A	30	•	-
SP2555NUTG	uDFN-10	4	2.5	4	±30	17V@40A	40	•	•
SP3374NUTG	uDFN-10	5.07	3.5	4	±30	5.5A	40	•	•
SP3384NUTG	uDFN-10	6.5	0.5	4	±30	4A	15	•	•
SP3025	SOT23-6L	7	1.7	4	±30	9V@30A	30	•	-
SP4020	SOD323	3.5	2.5	1	±30	6.6V @ 1A	30	•	•
SP4021	SOD323	6.3	2.5	1	±30	9.3V @ 1A	25	•	•
SP4022	SOD323	13.3	2	1	±30	19.0V@1A	15	•	•
SP4023	SOD323	16	2	1	±30	23.0V@1A	12	•	•
SP4024	SOD323	26	2	1	±30	34.0V@1A	7	•	•
SP4044	MSOP-10	4.3	1.5	4	±30	5.2V@1A	24	•	•
SP4045	MSOP-10	4.3	1.5	4	±30	6.0V@1A	24	•	•
SP4050	uDFN12	4.3	4.4	12	±30	13.2V@20A	20	•	-
SP4208	SOD323	9.5	3	1	±30	11.5V@1A	30	•	•
SR05	SOT143	6	10	2	±30	9.8V @ 1A	25	•	-
SR70	SOT143-4	0.7	3	2	±30	1.4V @ 1A	40	•	-

Low-Capacitance ESD Protection


SOD882


uDFN-6


uDFN-10


uDFN-14


SOT23-6

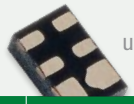
Series Name[1]	Package Type	Breakdown Voltage (V)	Capacitance (pF)	Channel	ESD Contact (V)	Clamping Voltage (tp = 8/20µs)	Max. Surge Rating (tp = 8/20µs) (A)	RoHS	AEC-Q101 Qualified
SP1255P	uDFN-6	4.5	0.6	3	30	6.6V@1A	4	•	•
SP3022	SOD882	6	0.5	1	±20	12.0V@1A	3.0	•	•
SP3030	SOD882	6	0.6	1	±20	9.2V @ 1A	3	•	•
SP3400	uDFN-6	6.5	0.5	2	±25	6.6V@1A	10	•	•
SP3401	uDFN-6	6.5	0.8	2	±18	4V	10	•	•
SP3420	uDFN-10	6.5	0.32	4	±12	2.7V	6	•	•
SP3422	5FC-uDFN	6.7	0.2	4	+20/-10	13.5V@1A	2.0	•	•
SP4010	SOT23-6L	12.5	0.48	2	±30	27.5V	23	•	-
SP8008	uDFN-14	6	0.3	8	+30/-23	12.45V@4A	4.0	•	•
SRV05-04HTG-D	SOT23-6	6	1	4	±30	11.7V	10	•	•
SM24CANB	SOT23-3	26.7	40	2	±30	34.0V@1A	10.0	•	•

TVS Diode Arrays (continued)

Automotive Qualified


SOD323


SOD523


uDFN-6L


SOT23-3


0201 DFN

Series Name[1]	Package Type	Breakdown Voltage (V)	Capacitance (pF)	Channel	ESD Contact (V)	Clamping Voltage (tp = 8/20µs)	Max. Surge Rating (tp = 8/20µs) (A)	RoHS	AEC-Q101 Qualified
AQxx-01FTG/AQxx-01LTG	SOD323/SOD523	6-40	5-30	1	±30	9.8-34V @ 1A	7-30	•	•
AQxxC-01FTG/AQxxC-01LTG	SOD323/SOD523	6-40	5-30	1	±30	10.0-36V @ 1A	7-30	•	•
AQ1003-01ETG/AQ1003-01LTG	SOD882/SOD523	7.8	30	1	±30	11.4V@6A/ 12.0V@7A	7.0	•	•
AQ1005	SOD882	8.5	30	1	±30	9.3V@1A/10V@2A/ 15.6V@10A	8.0	•	•
AQ3041	SOD882	7.8	0.3	1	±20	9.2V@1A	3.0	•	•
AQ3045	SOD882	7.8	0.35	1	±30	12V@1A	3.0	•	•
AQ3118	SOD882	20	0.75	1	±10	31.0V@1A/34.0V@2A	2.0	•	•
AQ3130	SOD882	30	0.3	1	±10	39.0V@1A/42.0V@2A	2.0	•	•
AQ3400	uDFN-6L	7.8	3	2	±30	9.2V@1A	2.0	•	•
AQ24CANA	SOT23-3L	28	15	2	±27	34V@1A	5.0	•	•
SM24CANB	SOT23-3	26.7	30	2	±30	34.0V@1A	10.0	•	•
AQ24CANFD	SOT23-3	28	11.5	2	±21	33V@1A	3.0	•	•
AQ2555NUTG	uDFN-10	4	2.5	4	±30	17V@40A	45.0	•	•
SESD Ultra-Low Capacitance Discrete TVS	0201 DFN / 0402 DFN	9-9.8	0.1-0.2	1	±20	9.2-10.0V@2A	2.0	-	•
SESD Enhanced ESD Discrete TVS	0201 DFN / 0402 DFN	8.8-9.6	0.15-0.3	1	±22	13-14V@2.5A	2.5	•	•
SESD Ultra-Low Capacitance Diode Arrays	0402 DFN Array / 0802 DFN Array / 1004 DFN Array / 1103 DFN Array	9	0.2	2/4/6	±20	10.0V@2.2A	2.0	-	•
SESD Enhanced ESD Diode Arrays	0402 DFN Array / 1004 DFN Array	8	0.3	2 /4	±22	13V	2.2-2.5	•	•

(1) Detailed information about product series listed here can be found on our website.

TVS Diodes

Surface Mount High Power


SMDJ


SMTAK3


LTKAK3

Series Name[1]	Package Type	Reverse Standoff Voltage (VR)	Peak Pulse Power Range (PPP 10/1000µs)	Peak Pulse Current (IPP 8x20µs)	Operating Temperature	Halogen Free	RoHS	UL Recognized
SMDJ	DO-214AB	5.0-440	3000W	21.5A-1630.5A (max)	-65°C - 150°C	•	•	•
4.0SMDJ	DO-214AB	24	4000W	650A (max)	-65°C - 150°C	•	•	•
5.0SMDJ	DO-214AB	12-170	5000W	136.5A-1890A (max)	-65°C - 150°C	•	•	•
5.0SMDJxxS	DO-214AB	6.0-58	5000W	267.5A-2669.7A (max)	-65°C - 150°C	•	•	•
8.0SMDJ	DO-214AB	12-110	8000W	293.8A-2613.7A (max)	-65°C - 150°C	•	•	•
SMTAK3	SMTAK	15-76	-	3KA	-55°C - 125°C	•	•	•
**LTKAK1	SMTO-218	380	-	1KA	-55°C - 125°C	•	•	•
**LTKAK2	SMTO-218	150-170	-	2KA	-55°C - 125°C	•	•	•
LTKAK3	SMTO-218	66	-	3KA	-55°C - 125°C	•	•	•
LTKAK6	SMTO-218	58-76	-	6KA	-55°C - 125°C	•	•	•
LTKAK10	SMTO-218	58-86	-	10KA	-55°C - 125°C	•	•	•

TVS Diodes (continued)

Surface-Mount Standard Application (200W-3000W)


SMF4L


SMAJ


SMA6L


SMBJ


SMCJ

Series Name[1]	Package Type	Reverse Standoff Voltage (VR)	Peak Pulse Power Range (PPP 10/1000µs)	Peak Pulse Current (IPP 8x20µs)	Operating Temperature	Halogen Free	RoHS Compliant	UL Recognized
SMF4L	SOD-123FL	5.0-250	400W	-	-55°C - 150°C	•	•	•
SMF3.3	SOD-123FL	3.3	200W	-	-55°C - 150°C	•	•	•
SMF	SOD-123	5.0-250	200W	-	-65°C - 150°C	•	•	•
SMAJ	DO-214AC	5.0-440	400W	-	-65°C - 150°C	•	•	•
SMAJ-E	DO-214AC	300-850	400W	-	-65°C - 150°C	•	•	*
P4SMA	DO-214AC	5.8-468	400W	-	-65°C - 150°C	•	•	•
P4SMA-E	DO-214AC	300-850	400W	-	-65°C - 150°C	•	•	*
SMA6J	DO-214AC	5.0-130	600W	-	-65°C - 150°C	•	•	•
SMA6L	DO-221AC	5.0-250	600W	-	-65°C - 150°C	•	•	•
SACB	DO-214AA	5.0-50	500W	-	-65°C - 150°C	•	•	•
SMBJ	DO-214AA	5.0-440	600W	-	-65°C - 150°C	•	•	•
SMBJ-E	DO-214AA	300-850	600W	-	-65°C - 150°C	•	•	*
P6SMB	DO-214AA	5.8-512	600W	-	-65°C - 150°C	•	•	•
P6SMB-E	DO-214AA	300-850	600W	-	-65°C - 150°C	•	•	*
1KSMB	DO-214AA	5.8-153	1000W	-	-65°C - 150°C	•	•	•
1.5SMB	DO214-AA	17.1-85.5	1500W	-	-65°C - 150°C	•	•	•
SMCJ	DO-214AB	5.0-440	1500W	-	-65°C - 150°C	•	•	•
1.5SMC	DO-214AB	5.8-512	1500W	-	-65°C - 150°C	•	•	•
3.0SMC	DO-214AB	20-33	-	365-570A	-65°C - 150°C	•	•	*

*UR approval is pending

Axial-Leaded Standard Application (400W-1500W)


P4KE


P6KE


1.5KE

Series Name[1]	Package Type	Reverse Standoff Voltage (VR)	Peak Pulse Power Range (PPP 10/1000µs)	Peak Pulse Current (IPP 8x20µs)	Operating Temperature	Halogen Free	RoHS Compliant	UL Recognized
P4KE	DO-41	5.8-468	400W	-	-	•	•	•
SA	DO-15	5.0-180	500W	-	-	•	•	•
SAC	DO-15	5.0-50	500W	-	-	•	•	•
P6KE	DO-15	5.8-512	600W	-	-	•	•	•
1.5KE	DO-201	5.8-512	1500W	-	-	•	•	•
LCE	DO-201	6.5-90	1500W	-	-	•	•	•

How is the TVS Diode Used Here?

8.0SMDJ or AK-Y High-Power TVS Diode

Outdoor and industrial communications systems applications require robust circuit protection, especially at DC output. The 8.0SMDJ TVS Diode protects against surges up to 8kW and features a compact surface-mount package (DO-214AB). If needed, AK-Y TVS Diodes provide even higher levels of surge protection.

TVS Diodes (continued)

Axial Leaded High Power


15KPA


AK15


AK1-Y


AK6-Y


AK20-Y

Series Name[1]	Package Type	Reverse Standoff Voltage (VR)	Peak Pulse Power Range (PPP 10/1000µs)	Peak Pulse Current (IPP 8x20µs)	Operating Temperature	Halogen Free	RoHS Compliant	UL Recognized
15KPA	P600	17-280	15000W	-	-55°C - +175°C	•	•	•
20KPA	P600	20-300	20000W	-	-55°C - +175°C	•	•	•
30KPA	P600	28-360	30000W	-	-55°C - +175°C	•	•	•
AK1	Axial Lead	76-430	-	1000A	-55°C - +125°C	•	•	•
AK3	Axial Lead	15-430	-	3000A	-55°C - +125°C	•	•	•
AK6	Axial Lead	30-430	-	6000A	-55°C - +125°C	•	•	•
AK10	Axial Lead	15-530	-	10000A	-55°C - +125°C	•	•	•
AK15	Axial Lead	58-190	-	15000A	-55°C - +125°C	•	•	•
AK1-Y	Axial Lead	76-430	-	1000A	-55°C - +125°C	•	•	•
AK3-Y	Axial Lead	15-430	-	3000A	-55°C - +125°C	•	•	•
AK6-Y	Axial Lead	30-430	-	6000A	-55°C - +125°C	•	•	•
AK10-Y	Axial Lead	15-530	-	10000A	-55°C - +125°C	•	•	•
AK15-Y	Axial Lead	58-190	-	15000A	-55°C - +125°C	•	•	•
AK20-Y	Axial Lead	16-76	-	20000A	-55°C - +125°C	•	•	*
5KP	P600	5.0-350	5000W	-	-55°C - +125°C	•	•	•

*UR approval is pending

High-Reliablity Axial Lead


15KPA-HR


30KPA-HR

Series Name[1]	Package Type	Reverse Standoff Voltage (VR)	Peak Pulse Power Range (PPP 10/1000µs)	Peak Pulse Current (IPP 8x20µs)	Operating Temperature	Halogen Free	RoHS Compliant	UL Recognized
5KPA-HR/5KPA-HRA	P600	5.0-220	5000W	-	-55 to 175°C	•	•	-
15KPA-HR/15KPA-HRA	P600	17-280	15kW	-	-55 to 175°C	•	•	•
30KPA-HR/30KPA-HRA	P600	28-345	30kW	-	-55 to 175°C	•	•	•
TLP/TLPA	P600	10-40	5000W	-	-55 to 175°C	•	•	-

High-Reliablity Surface Mount


SMBJ-HR


SMCG-HR


SMCJ-HR

Series Name[1]	Package Type	Reverse Standoff Voltage (VR)	Peak Pulse Power Range (PPP 10/1000µs)	Peak Pulse Current (IPP 8x20µs)	Operating Temperature	Halogen Free	RoHS Compliant	UL Recognized
SMBJ-HR/SMBJ-HRA	D0-214AA	5.0-170	600W	-	-65 to 150°C	•	•	-
**SMBLCE-HR/HRA	D0-214AA	6.5-70	600W	-	-65 to 150°C	•	•	-
SMCG-HR/SMCG-HRA	D0-215AB	5.0-120	1500W	-	-65 to 150°C	•	•	•
SMCJ-HR/SMCJ-HRA	D0-214AB	5.0-170	1500W	-	-65 to 150°C	•	•	•
SMDJ-HR/SMDJ-HRA	D0-214AB	5.0-150	3000W	-	-65 to 150°C	•	•	•

(1) Detailed information about product series listed here can be found on our website.
** Series are still under development. Please contact the local Littelfuse sales for more details.

Automotive TVS Diodes

Automotive Axial Lead


SLD


TP1.5KE

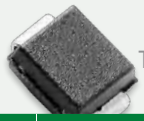

TP6KE

Series Name[1]	Package Type	Reverse Standoff Voltage (VR)	Peak Pulse Power Range (PPP 10/1000µs)	Operating Temperature	Halogen Free	RoHS Compliant	UL Recognized AEC-Q101 Compliant	AEC-Q101 Compliant
SLD	P600	11-60	2200W	-55 to 175°C	•	•	•	•
TP1.5KE	DO-201	10.20-40.20	1500W	-55 to 150°C	•	•	•	•
TP5KP	P600	11-60	5000W	-55 to 150°C	•	•	•	•
TP6KE	DO-204AC	11.10-77.80	600W	-55 to 175°C	•	•	•	•

Automotive Surface Mount


SLD8S


SZ1SMA


TPSMB

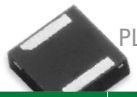

TPSMC


TPSMF-4L

Series Name[1]	Package Type	Reverse Standoff Voltage (VR)	Peak Pulse Power Range (PPP 10/1000µs)	Operating Temperature	Halogen Free	RoHS Compliant	UL Recognized AEC-Q101 Compliant	AEC-Q101 Compliant
SLD8S	SMTO-263	14-57	2200W	-55 to 175°C	•	•	•	•
SZ1.5SMC	DO-214AB	5.8-77.8	1500W	-65 to +150°C	•	•	•	•
SZ1SMA	DO-214AC	5.0-78	400W	-65 to +150°C	•	•	-	•
SZ1SMB	DO-214AA	5.0-170	600W	-65 to +150°C	•	•	•	•
SZ1SMC	DO-214AB	5.0-78	1500W	-65 to +150°C	•	•	•	•
SZP6SMB	DO-214AA	5.8-171	600W	-65 to +150°C	•	•	•	•
SZSMF	SOD–123FL	5-58	200W	-55 to 150˚C	•	•	-	•
TPSMA6L	DO-221AC	5.0-85	600W	-65 to +150°C	•	•	•	•
TPSMB	DO-214AA	6.40-553.00	600W	-65 to +150°C	•	•	•	•
TPSMB-VR	DO-214AA	6.5-440.0	600W	-65 to +150°C	•	•	•	•
TPSMC	DO-214AB	10.20-77.80	1500W	-65 to +150°C	•	•	•	•
TPSMC-VR	DO-214AB	11.0-85.0	1500W	-65 to +150°C	•	•	•	•
TPSMD	DO-214AB	10.0-85.0	1500W	-65 to +150°C	•	•	•	•
TPSMF4L	SOD-123FL	5.0-85	400W	-55 to 150˚C	•	•	•	•

PLED Bypass Protectors

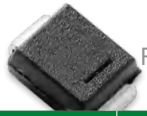
PLED Bypass Protectors


PLED


PLEDxUx


PLEDxN


PLED Ultra Low

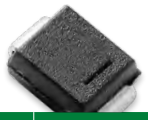

PLEDxUSxA

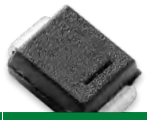
Series Name[1]	QFN3X3	DO-214	SOD-123	VBR breakdown Volts	IH mAmps	IS mAmps Max	IT@VT Amps Max	VT and IT Volts Max
PLED	•	•	-	6 - 18	5	100	1	1.2
PLEDxUx	•	•	-	6 - 35	30	50	1	1.2
PLEDxN	-	-	•	6	12	70	1	1.2
PLED Ultra Low	-	•	-	64 - 480	21	800	1	2
PLEDxUSxA	-	•	-	6 - 9	5	100	1	1.2

(1) Detailed information about product series listed here can be found on our website.

PLED Bypass Protectors (continued)

PLED Bypass Protectors


PLEDxS-A


PLEDxUx-A

Series Name[1]	QFN3X3	DO-214	SOD-123	VDRM Volts	VS Volts	IH mAmps	IS mAmps Max	IT@VT Amps Max	VT and IT Volts Max
PLEDxS-A	-	•	-	6 - 18	27-55	5	100	1	1.2
PLEDxUx-A	-	•	-	6 - 35	27-83	30	50	1	1.2

SIDACtor® Protection Thyristors

Broadband-Optimized Protection


TO-92


3x3QFN


DO-15


SOT23-6L

Series Name[1]	Package Type	Surge Rating	Standoff (working) Voltage (VDRM)	Switching Voltage (VS)	Peak Pulse Rating			RoHS Compliant	UL Recognized
					2/10µs	10/1000µs	8/20µs		
MC	DO-214AA	A	6 - 25	25 - 40	150A	45A	150A	•	•
		C	6 - 320	25 - 400	500A	100A	400A		
	TO-92	C	6 - 320	25 - 400	500A	100A	400A		
	Modified TO-220	A	Pin 1-2, 3-2: 6-275 Pin 1-3: 12-550	Pin 1-2, 3-2: 25-350 Pin 1-3: 50-700	150A	45A	150A		
		C			500A	100A	500A		
Balanced MC	Modified TO-220	C	Pin 1-2, 3-2, 1-3: 130-420	Pin 1-2, 3-2, 1-3: 180-600	500A	100A	400A	•	•
Q2L	3x3 QFN	A	6 - 320	25 - 400	150A	45A	150A	•	•
		B			250A	80A	250A		
	3.3x3.3 QFN	C			500A	100A	400A		
MC Multiport	MS-013	C	6 - 320	25 - 400	500A	100A	400A	•	•
TwinChip™ Protectors	DO-214AA	A	220 - 640	300 - 800	150A	45A	150A	•	•
		B			250A	80A	250A		
	DO-15	A	220 - 320	300 - 400	-	50A	-		
		B			-	80A	-		
SDP0240T023G6RP	SOT23-6L	G	19	20	-	-	30A	•	•
SDP	3x3 QFN	F	8 - 24	15 - 35	-	-	50A	•	•
	SOT23 - 5	B	58 - 320	77 - 400	250A	80A	250A	•	•
DSLP	SOT23-6L	G	8 - 36	18 - 48	-	-	35A	•	•
SDP Biased	5x6 QFN	C	6 - 320	25 - 400	500A	100A	400A	•	•
SEP Biased	5x6 QFN	C	6 - 75	25 - 98	500A	100A	400A	•	•
P0080T023G5	SOT 23 - 5	G	8	15	45A	18A	50A	•	•
PxxxxS4xLRP	SOD-123FL	B	6	25	150A	50A	150A	•	-
Pxxx0SxL-A	SOD-123FL	B	6	25	150A	50A	150A	•	-
Pxxx0SxLHL	SOD-123FL	B	6	25	150A	50A	150A	•	-

(1) Detailed information about product series listed here can be found on our website.

SIDACtor® Protection Thyristors (continued)

Subscriber Line Interface Circuit (SLIC) Protection


Modified DO-214AA


MS-012


QFN3.3x3.3


DO-214AA


MS-013

Series Name[1]	Package Type	Surge Rating	Standoff (working) Voltage (VDRM)	Switching Voltage (VS)	Peak Pulse Rating			RoHS Compliant	UL Recognized
					2/10µs	10/1000µs	8/20µs		
Fixed Voltage	DO-214AA	A	58 - 160	77 - 200	150A	45A	150A	•	•
		C			500A	100A	400A		
Fixed Voltage Twin SLIC	Modified DO-214AA	A	58 - 160	77 - 200	150A	45A	150A	•	•
Fixed Voltage Q2L	QFN 3.3x3.3	C	58 - 160	77 - 200	500A	100A	400A	•	•
Fixed Voltage Single Port	MS-012	F	58 - 95	77 - 130	120A	30A	100A	•	•
Fixed Voltage Enhanced Single	MS-012	F	58 - 160	77 - 200	120A	30A	100A	•	•
Fixed Voltage Multiport	MS-013	A	58 - 160	77 - 200	150A	45A	150A	•	•
		C			500A	100A	400A		
Battrax® Protectors Positive/Negative	Modified DO-214AA	A	Programmable up to -200 V to 110 V	Programmable up to -210 V to 120 V	150A	45A	150A	•	•
		C			500A	100A	400A		
Battrax® Protectors Single Port Negative	MS-013	C	Programmable up to -200 V to 0 V	Programmable up to -210 V to -10 V	500A	100A	400A	•	•
Battrax® Protectors Single Port Positive/Negative	MS-013	C	Programmable up to -200 V to 110 V	Programmable up to -210 V to 120 V	500A	100A	400A	•	•
Battrax® Protectors Dual Port Negative	MS-013	C	Programmable up to -200 V to 0 V	Programmable up to -210 V to -10 V	500A	100A	400A	•	•

Line Circuit Access Switch (LCAS) Protection


MS-013


DO-214AA

Series Name[1]	Package Type	Surge Rating	Standoff (working) Voltage (VDRM)	Switching Voltage (VS)	Peak Pulse Rating:			RoHS Compliant	UL Recognized
					2/10µs	10/1000µs	8/20µs		
Asymmetrical Multiport	MS-013	A	These products have asymmetric trigger voltages. See data sheet.		150A	45A	150A	•	•
		C			500A	100A	400A		
Custom LCAS Discrete	DO-214AA	A	100 - 230	130 - 290	150A	45A	150A	•	•
		B			250A	80A	250A		
		C			500A	100A	400A		

How is the SIDACtor® Device Used Here?

PxxxxS4xLRP Series SIDACtor® Protection Thyristor

Overvoltage transients can damage sensitive telecommunications equipment, including Composite Video Blanking Sync (CVBS) signal lines and ports.

The new component with 100A 5/310µs surge peak current capability and a low junction capacitance rating offers robust protection from these transients.

SIDACtor® Protection Thyristors (continued)

Broadband Protection (Voice-DS1)


DO-214AA


DO214AC (SMA)


TO-92


DO-15


Modified TO-220

Series Name[1]	Package Type	Surge Rating	Standoff (working) Voltage (VDRM)	Switching Voltage (VS)	Peak Pulse Rating:			RoHS Compliant	UL Recognized
					2/10µs	10/1000µs	8/20µs		
SIDACtor® Protection Thyristors	DO-214AA	A	6 - 320	25 - 400	150A	45A	150A	•	•
		B			250A	80A	250A		
		C			500A	100A	400A		
	DO-214AC (SMA)	A	6 - 320	25 - 400	150A	50A	150A	•	•
	TO-92	A	6 - 320	25 - 400	150A	45A	150A	•	•
		B			250A	80A	250A		
		C			500A	100A	400A		
	DO-15	A	90 - 320	130 - 400	-	45A	-	•	•
		B			-	80A	-		
	Modified TO-220	A	Pins 1-2,3-2: 25-275 Pins 1-3: 50-550	Pins 1-2,3-2: 40-350 Pins 1-3: 80-700	150A	45A	150A	•	•
		B			250A	80A	250A		
		C			400A	100A	400A		
SIDACtor® Protection Thyristors Multiport	MS-013	A	Pins 1-2,3-2,4-5,6-5: 6-320 Pins 1-3,4-6: 12-640	Pins 1-2,3-2,4-5,6-5: 25-400 Pins 1-3,4-6: 50-800	150A	45A	150A	•	•
		C			500A	100A	400A	•	•
SIDACtor® Protection Thyristors Balanced	MS-013	C	130 - 420	180 - 600	500A	100A	400A	•	•
	Modified TO-220	A	Pins 1-2, 3-2: 130-420 Pins 1-3: 130-420	Pins 1-2, 3-2: 180-600 Pins 1-3: 180-600	150A	45A	150A	•	•
		B			250A	80A	250A		
		C			400A	100A	400A		
SIDACtor® Protection Thyristors Balanced Multiport	MS-013	A	130 - 420	180 - 600	150A	45A	150A	•	•
		B			250A	80A	250A		
		C			500A	100A	400A		
		Asym. A6	Pins 1-2,2-3,4-5,5-6: 170-400 Pins 4-6,1-3: 50-270	Pins 1-2,2-3,4-5,5-6: 250-550 Pins 4-6,1-3: 80-340	150A	45A	150A		
		Asym. B6			250A	80A	250A		
		Asym. C6			500A	100A	400A		
T10A	DO-15	A	50 - 245	84 - 370	-	50A	100A	•	•
T10B	DO-201	B	80 - 275	120 - 360	-	100A	250A	•	•

High-Exposure Surge Protection


Modified TO-220


TO-262M


TO-218


DO-214AA

Series Name[1]	Package Type	Surge Rating	Standoff (working) Voltage (VDRM)	Switching Voltage (VS)	Peak Pulse Rating:			RoHS Compliant	UL Recognized
					2/10µs	10/1000µs	8/20µs		
Primary Protection	Modified TO-220	C	Pins 1-2,3-2: 25-275 Pins 1-3: 50-550	Pins 1-2,3-2: 40-350 Pins 1-3: 80-700	500A	100A	400A	•	•
Primary Protection Balanced	Modified TO-220	C	Pins 1-2, 3-2: 130-420 Pins 1-3: 130-420	Pins 1-2, 3-2: 180-600 Pins 1-3: 180-600	500A	100A	400A	•	•
3kA (Pxxx0FNL)	TO-262M	N	58 - 350	77 - 430	-	-	3000A	•	•
5kA	TO-218	E	140 - 450	180 - 600	-	1100A	5000A	•	•
High Surge Current	DO-214AA	D	6 - 320	25 - 400	1000A	200A	800A	•	•

(1) Detailed information about product series listed here can be found on our website.

Protect. Control. Sense.

Littelfuse offers leading technologies in circuit protection, power control, and sensing. We continue to expand our broad and diverse portfolio of products into adjacent markets, including Power Semiconductors, heavy-duty Switches, Magnetic, Optical, Electromechanical, and Temperature Sensors as well as other products that provide safe control and distribution of electrical power.

In addition to the circuit protection products found in this selection guide, we offer a wide variety of product technologies.

Power Semiconductors
- Bipolar Devices
- IGBTs
- MOSFETs
- Switching Thyristors
- Silicon Carbide Technology
- Power Semiconductors and ICs
- Discrete and Module Solutions
- Bare Die Devices
- Power Control
- TRIAC Thyristors
- Fully Engineered Subsystems

Integrated Circuits and Solid-State Relays
- High-Voltage ICs
- Solid-State Relays
- Gate Drivers

Magnetic Sensing
- Reed Switches
- Reed Sensors
- Reed Relays
- Hall Effect Sensors
- Magnetic Actuators

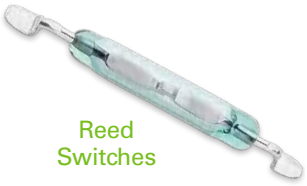
Temperature Sensing
- Thermistors
- RTDs
- Digital Temperature Indicators

Global Footprint

At Littelfuse, our mission is to develop innovative circuit protection, power control, and sensing solutions that meet our customers' unique needs. This customer-focused philosophy has helped us become the top circuit protection brand in the world.

Our industry-leading product portfolio includes reliable circuit protection, power control, and sensing products that are designed for a variety of markets and applications. We have assembled unparalleled expertise and developed a global footprint that puts our facilities close to our customers and target markets. As our global manufacturing and R&D teams objectively recommend the best circuit protection, power control, or sensing solution for each customer application, they form partnerships that will lead to the development of the next generation of advanced products.

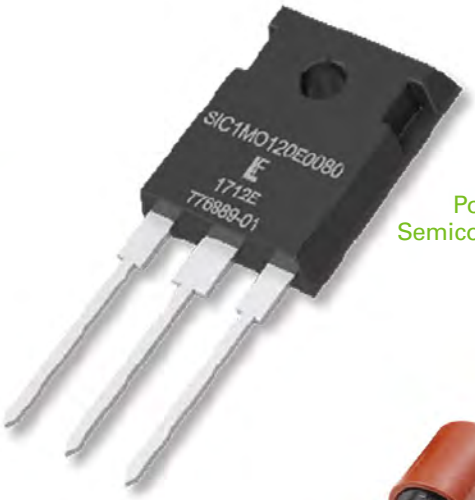
Littelfuse provides:
- Application Expertise
- Global Support
- Operational Excellence
- Technology Innovation
- Collaboration
- Customer Focus



Reed Switches

Thermistors

Gas Discharge Tubes



Power Semiconductors

Metal Oxide Varistors

Radial Leaded Fuses

Multi-Layer Varistors

Additional Resources

Sensing Products Selection Guide
This guide provides an overview of magnetic and temperature sensing technologies, key consideration factors, descriptions of technologies Littelfuse offers, and product selection tables to help you quickly find the sensing solution appropriate for your application.

Scan or click to download

Power Semiconductor Catalog
This catalog represents the powerful combination of IXYS: A Littelfuse Technology. It offers a comprehensive portfolio of advanced power semiconductor technologies, including silicon and wide bandgap solutions in discrete and module packages.

Scan or click to download

Protection Relays and Controls Catalog
This catalog includes a comprehensive line of motor and pump protection relays, arc-flash relays, ground fault relays, feeder protection, pump controllers, time delay relays, flashers and tower lighting, and more to minimize electrical safety hazards, limit equipment damage, improve productivity, and safeguard personnel from injury due to electrical faults.

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Visit Technical Resources at Littelfuse.com

Technical information is only a click away. The Littelfuse Technical Resources page contains datasheets, product manuals, white papers, application guides, demos, on-line design tools, and more.

An Extension of Your Team

Littelfuse engineers are a phone call away to help identify potential issues and provide product recommendations to solve problems.

Japan Technical Support: 03-6435-0750
Asia Technical Support: +86 512 67613189
North America Technical Support: (800) 999-9445
South America Technical Support: +55 11 2844-4395
Europe Technical Support: +49 421 82 87 3 147

Application and Field Support
Our experienced product and application engineers work step by step with customers from design to installation to determine the best solution. Contact us today:
Littelfuse.com/contactus.aspx

PolySwitch® Resettable PPTC Devices


TVS Diode Arrays


TVS Diodes


Fuse Holders


PLED LED Protectors


PulseGuard® ESD Suppressors


Fuse Blocks


SIDACtor® Protection Thyristors


Switching Thyristors


Surface Mount Fuses


Fuses

Global Lab Capabilities

You need to be certain that your products live up to the highest standards for performance, reliability, safety, and regulatory compliance. Working with Littelfuse, you have access to dedicated application engineers who partner with you to provide expert design consultation, perform comprehensive tests simulating the harshest environments, and confidentially evaluate the results in consultation with you.

TESTING CAPABILITIES

Environmental

- Autoclave
- Dust
- H3TRB
- HAST
- High- & Low-Temperature Storage
- High-Temperature Loading
- Ingress Protection (IP)
- HTGB
- HTRB
- Temperature & Humidity
- Temperature Cycling
- Thermal Shock
- Salt Fog

Physical-Mechanical Characteristics

- Acceleration
- Die Shear
- Leak Detection
- Mechanical Shock
- Resistance to Soldering Heat (Dip, Reflow, Wave)
- Resistance to Solvents
- Solderability
- Terminal Strength (Push, Pull, Bend)
- Vibration
- Wetting Balance
- Wire Pull

Electrical

- BCI
- Capacitance
- EFT
- ESD
- Impedance
- Insulation Resistance
- I-V
- Life
- Lightning Surge
- Overload
- Parametric Tests
- Power-Cross
- Power Cycling
- Ring Wave
- R-T
- S-Parameter Measurements (Insertion Loss, Isolation, Reflection)
- Short Circuit
- Step Current
- Surface Resistivity
- Surge
- TDR (Eye Diagram)
- Telecom
- Thermal Cut-Off
- Time-to-Trip
- TLP
- Transient
- Trip Cycle
- Trip Endurance
- Voltage Drop

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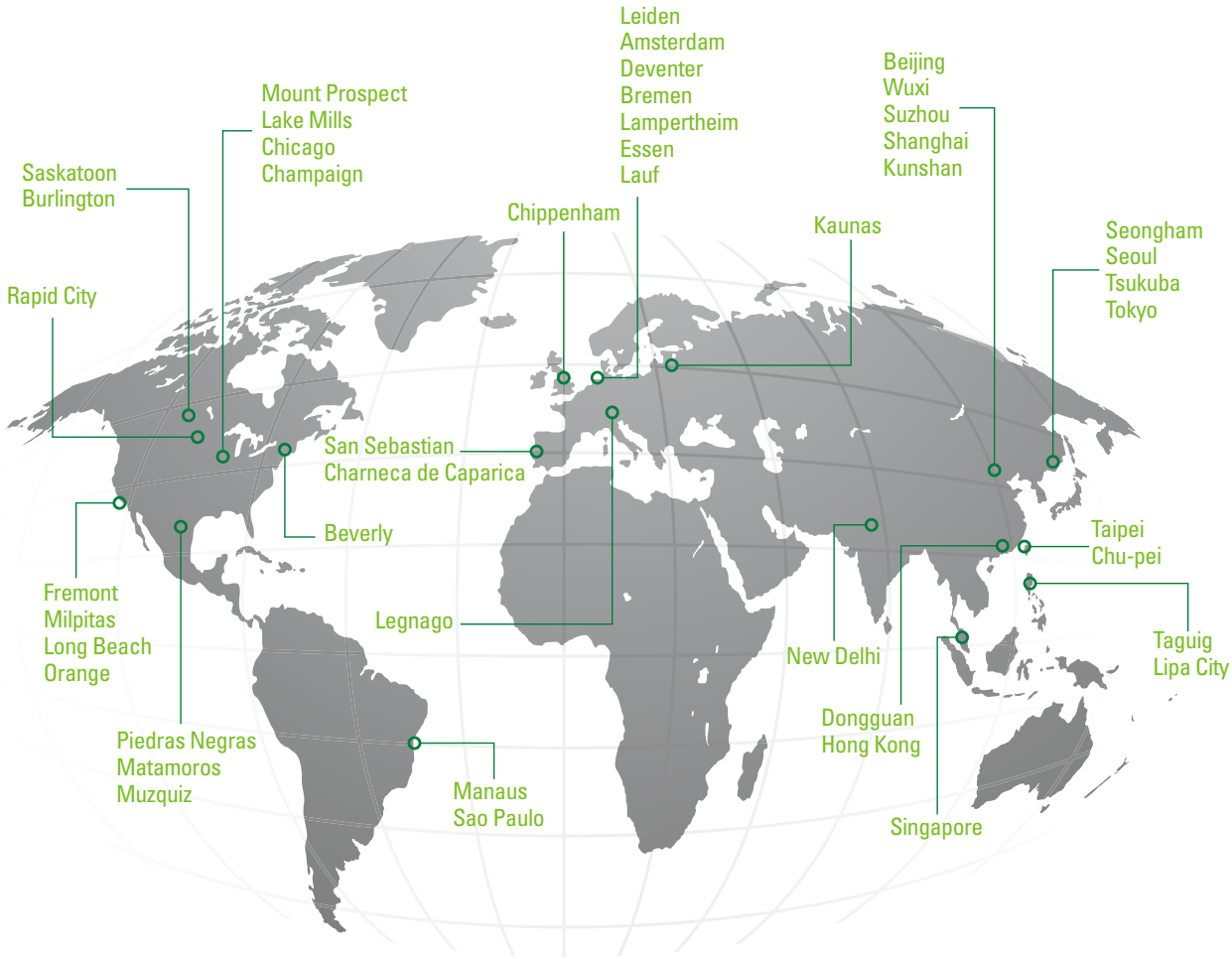
LOCAL RESOURCES FOR A **GLOBAL** MARKET



Littelfuse products are certified to many standards around the world. To check certifications on specific products, please refer to the product datasheet on Littelfuse.com.

Littelfuse®

Expertise Applied | Answers Delivered

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