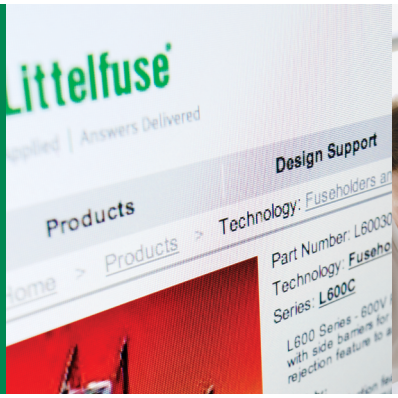
Littelfuse®

Expertise Applied | Answers Delivered

CIRCUIT
PROTECTION
SOLUTIONS



Electronics Circuit Protection Product Selection Guide

A guide to selecting Littelfuse circuit protection components for electronic applications.

Broadest and Deepest Portfolio of Product Backed by Unparalleled Circuit Protection Expertise

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.

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WHY CHOOSE CIRCUIT PROTECTION

Circuit protection devices interrupt overcurrent events and divert overvoltage transients. They increase safety and enable end products to survive harsh electrical conditions.

Most electrical and electronic equipment require circuit protection devices. In many cases they must be installed to comply with safety and performance standards before the end products can be sold or used.

Beyond this, strategically-selected protection devices will:

- Improve end-product uptime, sustainability and reliability
- Assure low warranty return, repair and replacement costs
- Minimize fire and shock risks and larger damage potential
- Minimize operating dangers and potential liabilities

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 make compromises.

Testing Support

Littelfuse can help assure 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 ESD/EFT/lightning surge conditions.

Application Knowledge

For over 85 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 products, application knowledge and technical support are available around the globe. We offer a network of regional customer support offices and hundreds of independent authorized distributor contacts to assist you. Visit www.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.

FOR FURTHER GUIDANCE

Littelfuse product representatives will work with you to find circuit protection technologies that will meet your requirements.

To address your requirements or questions in detail, please contact a representative near you (Littelfuse.com/contact-us).

For reference diagrams, technical articles, and other application guidance materials to assist in your design processes, please visit Littelfuse.com/designsupport

For detailed selection of Littelfuse circuit protection technologies and their common applications, please visit Littelfuse.com/products

For a library of detailed application guides, please visit Littelfuse.com/technical-resources/application-designs

To download the most current edition of this brochure and our product catalogs, please visit Littelfuse.com/catalogs

Littelfuse 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 stop current flow, which helps to identify faults; Wide range of options	Ultimate protection for sensitive/ expensive/critical components	Low thru Very High	Not applicable	Series impedance measured in nH	Very Extensive Range of Options
PTCs	Resettable; No device replacement after most common overcurrent events	Where overcurrent events may occur often, and continuous uptime desired	Low thru 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 and EFT suppression in smaller and portable electronics	Low thru Medium	Moderate	High	Miniature Surface Mount
Metal-Oxide Varistor (MOVs)	Capable of withstanding very high energy transients; Wide range of options	Appliance, industrial and very high energy suppression applications	Medium thru 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 thru 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 Array SPA® Diodes	Low capacitance / low clamping voltage; Compact size	ESD suppression; Low distortion; Ideal for I/O interfaces and digital & analog signal lines	Low thru Medium	Very Fast	Low	Extensive range of surface mount options
TVS Diodes	Fast response to fast transients; Wide range of options	Semiconductor protection; telecom I/O interfaces, electronics, industrial equipment	Medium thru High	Fast	High	Axial Leaded, Radial Leaded, Surface Mount
SIDACtor® Protection Thyristors	Specifically designed to serve stringent telecom/ networking standards	Telecom / Datacom and networking applications	Medium thru High	Very Fast	Low	Extensive range of surface mount and thru-hole options
Switching Technologies:						
Power Thyristors	Solid state switches that switch to low "on" state and control the flow of current	Home appliances, power tools, outdoor equipment	Not applicable	Not applicable	Not applicable	Extensive range of surface mount and thru-hole options

1. 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 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. (Pages 4-6).

2. Positive Temperature Coefficient Devices (PTCs) — Provide resettable overcurrent protection for a wide range of applications (Page 7).

3. Varistors — 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/EFT transients in computers and handheld devices as well as industrial and automotive applications (Page 8).

4. Gas Discharge Tubes (GDTs) — Available in small footprint leaded and surface mount configurations, Littelfuse GDTs respond fast to transient overvoltage events, reducing the risk of equipment damage (Page 9).

5. PulseGuard® ESD Suppressors — Available in various surface mount form factors to protect high-speed digital lines without causing signal distortion (Page 9).

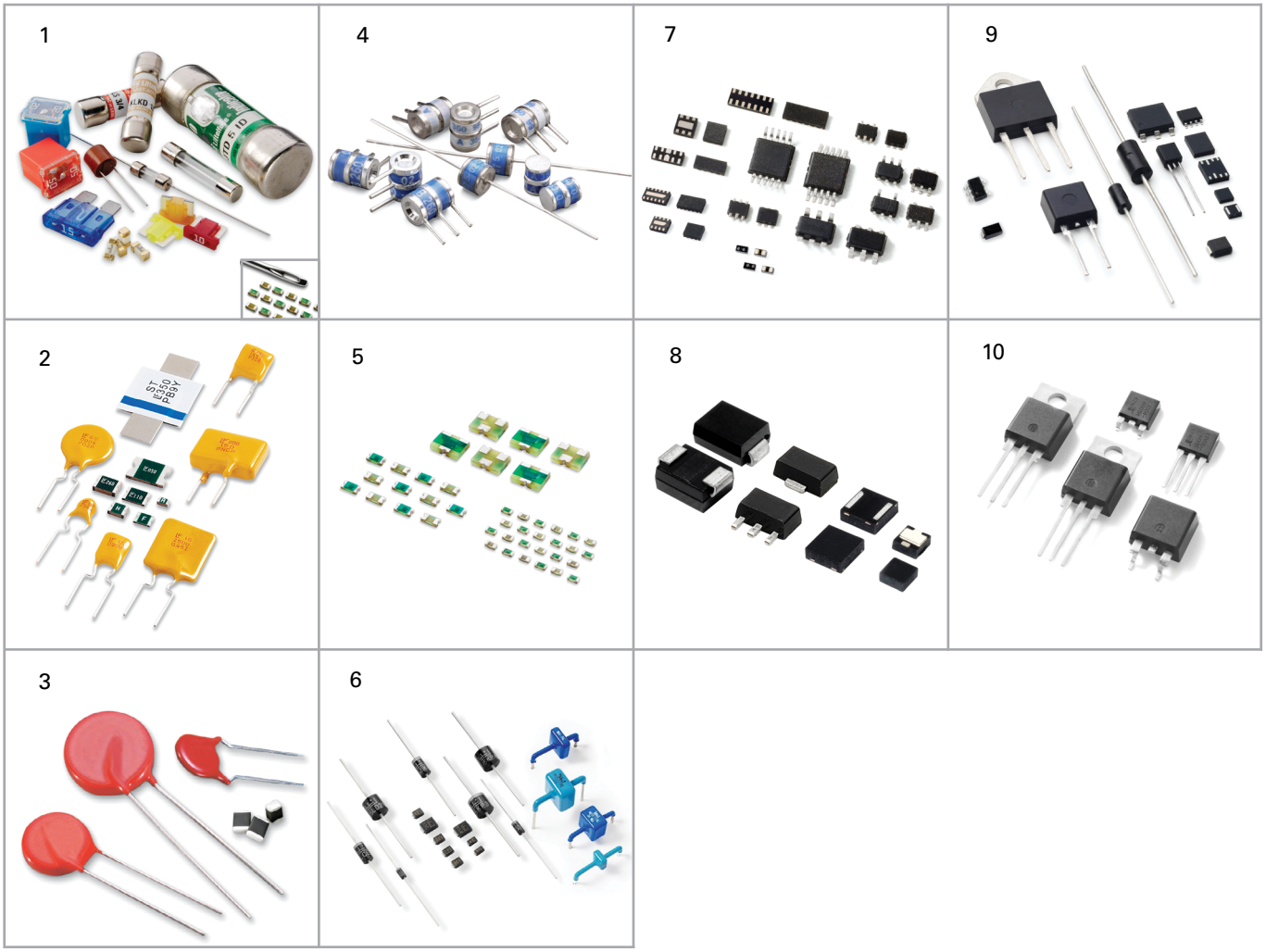
6. TVS Diodes — Suppress overvoltage transients such as Electrical Fast Transients (EFT), inductive load switching and lightning in a wide variety of applications in the computer, industrial, telecom and automotive markets (Pages 10–11).

7. TVS Diode Array – SPA® Diodes — Designed specifically to protect analog and digital signal lines from electrostatic discharge (ESD) and other overvoltage transients such as EFT and Lightning (Page 12).

8. PLED Bypass Protectors — Specialty silicon devices that enable LED lighting strings to continue to function if any single LED fails as an open circuit, and also offer ESD and reverse power protection (Page 13).

9. SIDACtor® Protection Thyristors — Complete line of protection thyristor products specifically designed to suppress overvoltage transients in a broad range of telecom and datacom applications (Pages 14–15).

10. Switching Thyristors — Solid-state switches used to control the flow of electrical current in applications, capable of withstanding rated blocking/off-state voltage until triggered to the on-state (Pages 16–17).



Product Specifications and Selection Guide

FUSE PRODUCTS

Fuses provide protection by completely stopping the flow of energy to sensitive circuits. If current exceeds the fuse's operating range, the metal wire or strip melts safely within an enclosure. Littelfuse offers the most extensive range of fuses available, and for easy replacement of cartridge fuses Littelfuse offers a wide selection of fuseholders including panel mount, in-line, and surface and thru-hole circuit board mount devices.
See page 6 for fuseholder selection.

Surface Mount:

		Series Name[1]	View Datasheet	Order Samples	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] UL	UR	CSA	PSE	UMF	Halogen Free	RoHS Compliant	Lead Free
Ceramic Chip		437	•	•	1206		•		0.25 - 8	125 / 63 / 32	50	-55°C to +150°C		•				•	•	•
		438	•	•	0603		•		0.25 - 6	32 / 24	50			•				•	•	•
		440	•	•	1206		•		1.75 - 8	32	50			•	•			•	•	•
		441	•	•	0603		•		2 - 6	32	50			•	•			•	•	•
		469	•	•	1206	•			1 - 8	24 / 32	24 - 63			•	•			•	•	•
		501	•	•	1206		•		10, 12, 15, 20	32	150			•				•	•	•
Thin Film		466	•	•	1206			•	0.125 - 5	125 / 63 / 32	50	-55°C to +90°C		•	•			•	•	
		429	•	•	1206			•	7	24	35			•	•				•	•
		468	•	•	1206	•			0.5 - 3	63 / 32	35 - 50			•	•			•	•	•
		467	•	•	0603			•	0.25 - 5	32	35 - 50			•	•			•	•	•
		494	•	•	0603	•			0.25 - 5	32	35 - 50			•	•			•	•	•
		435	•	•	0402			•	0.25 - 5	32	35			•	•			•	•	•
Nano²® Fuse		448	•	•	2410			•	0.062 - 15	125 / 65	35 - 50	-55°C to +125°C		•	•	•			•	•
		449	•	•	2410	•			0.375 - 5	125	50			•	•	•			•	•
		451 / 453	•		2410			•	0.062 - 15	125 / 65	35 - 50		•	•	•	•		•	•	
		452 / 454	•		2410	•			0.375 - 12	125 / 72	50			•	•	•		•	•	
		456	•	•	4012			•	20, 25, 30, 40	125	100			•				•	•	
		458	•	•	1206		•		1.0 - 10	75 / 63	50			•				•	•	
		443	•	•	4012	•			0.5 - 5	250	50			•				•	•	
		464	•	•	4818		•		0.5 - 6.3	250	100					•	•	•	•	
		465	•	•	4818	•			1 - 6.3	250	100					•	•	•	•	
		462	•	•	4118	•			0.500 - 5	350	100	-40°C to +80°C		•			•		•	
		485	•	•	4818		•		0.500 - 3.15	600	100	-55°C to +125°C		•				•	•	
Telelink® Fuse		461	•	•	4012				0.5 - 2.0	600	60	-55°C to +125°C		•	•			•	•	
		461E			4012				1.25	600	60			•				•	•	
OMNI-BLOK® Fuseholder		154	•	•	*			•	0.062 - 10.0	125	35 - 50	-55°C to +125°C		•				•	•	
		154T			*	•			0.375 - 5	125	50			•				•	•	
Fuse and Clip Assemblies		157			*			•	0.062 - 10	125	35 - 50	-55°C to +125°C		•				•	•	
		157T			*	•			0.375 - 5	125	50			•				•	•	
		159	•	•	*				0.5 - 2	600	60			•				•	•	
		160			*	•			0.5 - 5	250	50			•				•	•	
PICO® SMF Fuse		459	•	•	*			•	0.062 - 5	125	50 - 300	-55°C to +125°C		•	•					
		460	•	•	*	•			0.5 - 5	125	50			•	•					
Flat Pak		202	•	•	*		•		0.062 - 5	250	50	-55°C to +125°C		•	•					
		203	•	•	*	•			0.25 - 5	250	50			•	•					
EBF		446	•	•	*		•		2.0 - 10.0	350	100	-40°C to +125°C		•	•					
		447	•	•	*		•		2.0 - 10.0	350	100			•	•					

(1) Detailed information about most product series listed here can be found on our web site.
(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 www.littelfuse.com and in our data sheets for detailed information by part number.
* Please refer to data sheet for detailed specifications.

Radial Leaded / Socket:

		Series Name[1]	View Datasheet	Order Samples	Time Lag	Medium Acting	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]														RoHS Compliant	Lead Free
													Americas					Europe					Asia					
													UL	UR	CSA	OPL	UMF	CE	VDE	TUV	BSI	Semko	PSE	K	CCC	CQC		
Micro™ Fuse / TR3 Fuse		262/268	•	••				•	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	125	50	-55°C to +70°C	•		•			•									•	•
TR5® Fuse		370	•	•			•		0.4 - 6.3	250	35 - 50			•				•	•			•	•		•		•	•
		372	•	•	•				0.4 - 6.3	250	35 - 50			•				•	•			•	•	•	•	•	•	•
		373	•	•			•		0.5 - 10	250	50	-40°C to +85°C	•		•			•									•	•
		374	•	•	•				0.5 - 10	250	50		•		•			•									•	•
		382	•	•	•				1 - 10	250	100			•				•	•			•	•	•	•	•	•	•
		383	•	•	•				1 - 10	300	50 - 100			•				•	•				•				•	•
TE5		369	•	•	•				1 - 6.3	300	50			•				•					•				•	•
		385	•	•	•				0.35 - 1.5	125	50			•				•									•	•
		391	•	•			•		0.125 - 4	65	50			•				•									•	•
		392	•	•	•				0.8 - 6.3	250	25 - 63			•				•	•			•	•	•		•	•	•
		395	•	•			•		0.05 - 6.3	125	100	-40°C to +85°C	•					•					•				•	
		396	•	•	•				0.05 - 6.3	125	100		•					•					•				•	•
		397	•	•	•				0.35 - 1.5	125	50		•					•									•	•
		398	•	•		•			0.125 - 4	65	50			•				•									•	•
		399	•	•	•				0.125 - 4	65	50			•				•									•	•
		400	•	•	•				0.5 - 6.3	250	130			•				•	•				•				•	•
		804	•	•	•				0.8 - 6.3	250	150	-40°C to +125°C					•	•	•				•	•		•	•	•
		808	•	•			•		2 - 5	250	100	-40°C to +85°C		•				•									•	•
TE7		807	•	•	•				0.8 - 6.3	300	100	-40°C to +125°C	•	•	•			•					•	•			•	•

Axial Leaded / Cartridge:

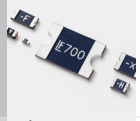
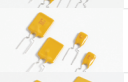
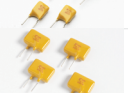
		Series Name[1]	View Datasheet	Order Samples	Time Lag	Medium Acting	Fast Acting	Very Fast Acting	Device Range[3] (Operating Current Options in Amps)	Max. Voltage Rating[3] (Volts)	Interrupting Rating at Max Voltage Rating[3] (Amps)	Operating Temperature Range	Agency Approvals[3]														RoHS Compliant	Lead Free
													Americas					Europe					Asia					
													UL	UR	CSA	OPL	UMF	CE	VDE	TUV	BSI	Semko	PSE	K	CCC	CQC		
PICO® Fuse / PICO® II Fuse Axial		251	•	•				•	0.062 - 15	125	300DC / 50AC			•	•			•		•			•				•	
		253	•	•				•	0.062 - 15	125	300DC / 50AC					•		•		•			•				•	
		275	•	•				•	20 - 30	32	300DC / 50AC			•	•												•	
		263	•	•				•	0.062 - 5	250	50			•	•			•					•				•	
		471	•	•	•				0.5 - 5	125	50	-55°C to +125°C		•	•			•					•				•	
		472	•	•	•				0.5 - 5	125	50			•				•									•	
		473	•	•	•				0.375 - 7	125	50			•	•			•					•				•	
		265/266/267	•	•••				•	0.062 - 15	125	300DC / 50AC			•	•	•		•									•	
3.6x10 mm		874	•	•				•	0.1 - 10	250	50		•					•									•	•
		875	•	•	•				0.1 - 10	250	50		•					•									•	•
		876	•	•				•	0.125 - 5	250	35 - 50			•				•	•								•	•
		877	•	•	•				2 - 6.3	250	35 - 63			•				•	•								•	•
4.5x14.5 mm (2AG)		208	•	•			•		0.125 - 10	350	100			•		•		•					•				•	•
		209	•	•	•				0.25 - 7	350	100			•		•		•					•				•	•
		220	•	•	Special Fuse				0.3 - 7	250 / 300 / 350	35 - 100	-55°C to +125°C	•	•	•			•					•				•	•
		2205	•	•	•				0.25 - 2.5	250	35			•	•			•									•	•
		224/225	•	••			•		0.375 - 10	250 / 125	35 - 500		•	•	•			•					•				•	•
		229/230	•	••	•				0.25 - 7	250 / 125	35 - 400		•	•	•			•					•				•	•
5x20 mm		217	•	•			•		0.032 - 15	250	35 - 150			•	•			•	•		•	•	•	•	•		•	•
		218	•	•	•				0.032 - 16	250	35 - 100			•	•			•	•		•	•	•	•	•		•	•
		213	•	•	•				0.2 - 6.3	250	35 - 63			•	•			•	•		•	•	•		•		•	•
		219XA	•	•	•				0.04 - 6.3	250	150			•	•			•	•		•	•	•		•		•	•
		216	•	•			•		0.05 - 16	250	750 - 1500			•	•			•	•		•	•	•	•	•		•	•
		215	•	•	•				0.125 - 20	250	400 / 1500			•	•			•	•		•	•	•	•	•		•	•
		232	•	•		•			1 - 10	250 / 125	300 / 10,000	-55°C to +125°C						•					•	•			•	•
		235	•	•			•		0.1 - 7	250 / 125	35 - 10,000		•			•		•					•	•			•	•
		233	•	•		•			1 - 10	125	10,000		•			•		•					•	•			•	•
		234	•	•		•			1 - 10	250	100 - 200		•			•		•					•	•			•	•
		239	•	•	•				0.08 - 7	250 / 125	35 - 10,000		•			•		•					•	•			•	•
		285	•	•	•				0.125 - 20	250	400 - 1500							•					•				•	•
		477	•	•	•				0.5 - 16	400DC / 500AC	100 - 1500			•	•			•				•	•				•	•
		977	•	•	•				0.5 - 16	450DC / 500AC	200 / 100							•				•	•				•	•
6.3x32 mm (3AG/3AB)		312/318	•	••			•		0.062 - 35	250 / 32	35 - 300		•	•	•			•					•	•			•	•
		313/315	•	••	•				0.01 - 30	250 / 125 / 32	35 - 300		•	•	•			•					•	•			•	•
		314/324	•	••			•		0.375 - 40	250	35 - 1000		•	•	•			•					•	•			•	•
		322	•	•				•	12 - 30	65	200 - 1000			•				•					•				•	
		332	•	•				•	1- 10	250	100 / 200			•	•			•					•				•	•
		325/326	•	••	•				0.01 - 30	250	100 - 600	-55°C to +125°C	•	•	•			•					•	•			•	•
		505	•	•			•		10 - 30	450 / 500	20,000 - 50,000			•	•			•									•	•
		506	•	•			•		15 - 20	600DC	10,000			•	•			•									•	•
		508	•	•	1000VAC / DC High Voltage Fuse				0.315 - 1	1000	10,000			•	•			•									•	•

FUSEHOLDER SELECTION GUIDE

Circuit Connection Method		Wire	Wire Connector Terminals	TH= Thru-Hole SM= Surface Mount CT= Wire Connector Terminal QC= Quick Connect					
Fuseholder Type		In- Line Fuseholders	Panel Mount Fuse Enclosures	Circuit Board Mount Fuse Enclosures		Fuse Blocks		Fuse Clips	
Fuse Type	Fuse Series								
4.5x14.5 mm (2AG)	208 / 209 225 / 229	150274 150300 150307 150308	3452 series Int. Shocksafe			CT	254 011 - 008	TH	111501
			345 series Int. Shocksafe (old)			TH	254 101, 254 121	SM	111505
			245001 Solder QC			TH	254 131	TH	111506
			245002 Nema QC			QC	254 201 - 208	TH	111510
			286377 Fip Top					TH	111512
5x20 mm	213 / 215 216 / 217 218 / 219XA 232 / 233 234 / 235 239 / 285 377 / 477 617 / 618	150274 150300 150307 150308 150315 150316 150317 150318 150319 PTF0080M FH503	345 Shocksafe	TH	345121 Shocksafe	TH	354252	TH	100 / 111 Series
			3455 Int. Shocksafe	TH	4450718 / 595 / 596	TH	445073	TH	04450001 / 00300210
			286677 Flip Top	TH	598 / 652	TH	520 002, 520 101	TH	5200001
			800 / 801 / 802 / 821 Series	TH	810 / 811 / 813 / 814	QC	520 003, 520 005	TH	52000001009
			823 Series Snap-in	TH	830 / 831 / 834	CT	520 004	TH	52100001009
			824 / 824 - 20 / 850 / 851 / 860 series	TH	852 / 853 / 862	TH	646 / 649 / 656	TH	51900001009
			870 Series Medical Grade	TH	PTF045 / PTF050	CT	647	TH	51800001009
			820/ 820-20 Series Mini Shocksafe			SM	658	TH	523 Series
			601			CT	PTF010 / PTF020	TH	445 Series
			445					TH	NY61AP
			PTF030 / PTF035 / PTF040			TH	PTF015 / PTF065	TH	OCT136
			PTF055 / PTF070			TH	PTF075 / PTF077	TH	FC51
						TH	PTF078		
			FH02A				FB55 / FB58		
6.3x32 mm (3AB/3AG)	312 313 314 322 326 332 373 505 506 508 605	155 Series 150322 445 PTF080 LH61A800 FH602 / FH604	3453 Series Int. Shocksafe	TH	345101 Shocksafe	CT	354 Series	CT	101001 / 101002
			345 Series Int. Shocksafe (old)	TH	810 Series	QC	35406	CT	101003 / 102064
			342 Series Traditionalf	TH	811 Series	QC	35408	CT	121001 / 121002
			342006 Watertight	TH	813 Series	QC	35409	CT	121003 / 121004
				TH	814 Series	CT	356 Series	TH	102071
			344 Series Snap / Panel Mount	TH	862 Series	CT	359 Series	TH	102076 / 102078
			348 Series Snap Mount			QC	OMN002	TH	102079 / 102080
			340 Series RF Shielded / Watertight			QC	OMN004	TH	122083 / 122087
			346877 Flip Top			QC	OMN006	TH	122088 / 122093
			342021 (FHN26W) Water Tight			QC	FB65 / FB66	TH	122090 / 100058
			342024 (FHN26G2) Drip Proof					TH	51800001009
			342025 (FHN20G) Drip Proof					CT	101010
			800 Series Shocksafe					TH	102074
			801 / 802 / 803-01 Series					TH	10207101009
									030201
			860 Series						0CT136
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	571 0000 000				
				TH	559 / 560 / 562 Series				
				SM	564 Series				
				TH	576 Series				
				TH	556 / 557				
Micro™ Fuse / TR3	262 / 268 269 / 272 273 / 274 278 / 279		282001 Front mt. Neoprene	TH	281005 Vertical Silver				
			282007 Front mt. Conductive	TH	281007 Horizontal Silver				
			282002 Rear mt. Neoprene	TH	281008 Vertical Tin				
			282008 Rear mt. Conductive	TH	281010 Horizontal Tin				
			280004 32V indicating						

PTC PRODUCTS

PTCs (positive temperature coefficient) increase resistance as temperature increases. They are designed to prevent unsafe levels of current while allowing constant safe current levels, and their resistance will "reset" automatically when the current and temperature returns to a safe level. PTCs are typically used in applications where automatic reset is desired.

Series Name[1]		View Datasheet	Order Samples	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			
Surface Mount:														
LoRho PTC (Low Resistance)		•	•	0402	0.1 - 0.5A	6 / 12 V	50 A	-40°C to 85°C	•	•	•	•	•	•
				0603	0.5 - 2.0A									
				0805	0.75 - 3.0A									
				1206	0.75 - 4.5A									
				1812	1.9 - 3.7A									
				2920	7.0A									
0603L		•	•	0603 (1608)	0.04 - 0.5A	6 - 15 V	40 A		•	•	•	•	•	•
0805L		•	•	0805 (2012)	0.10 - 1.10 A	6 - 15 V	100 / 40 A		•	•	•	•	•	•
1206L		•	•	1206 (3216)	0.10 - 2.0A	6 - 30 V	100 A		•	•	•	•	•	•
1210L		•	•	1210 (3225)	0.05 - 2.0A	6 - 30 V	10 / 100 A		•	•	•	•	•	•
1812L		•	•	1812 (4532)	0.1 - 3.0A	6 - 60 V	10 / 20 / 100 A		•	•	•	•	•	•
2016L		•	•	2016 (5041)	0.30 - 2.00 A	6 - 60 V	20 / 40 A		•	•	•	•	•	•
2920L		•	•	2920 (7351)	0.30 - 3.00 A	6 - 60 V	10 / 40 A		•	•	•	•	•	•
250S		•	•	see data sheet	0.13 A	60 V	3 A				•	•	•	•
Radial Leaded:														
USBR		•	•	see data sheet	0.75 - 2.50 A	6 / 16 V	40 A	-40°C to 85°C	•	•	•		•	•
16R		•	•		2.50 - 14.00 A	16 V	100 A		•	•	•		•	•
30R		•	•		0.90 - 9.00 A	30 V	40 A		•	•	•		•	•
60R		•	•		0.10 - 3.75 A	60 V	40 A		•	•	•		•	•
72R		•	•		0.20 - 3.75 A	72 V	40 A		•	•	•		•	•
250R		•	•		0.08 - 0.18 A	250 V	3 / 10 A		•	•	•		•	•
600R		•	•		0.15 - 0.16 A	600 V	3 A		•	•	•		•	•
Battery Strap:														
SL (Low Resistance)		•	•	see data sheet	1.9 - 3.7 A	6 V	50 A	-40°C to 85°C	•	•	•	•	•	•

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

VARISTOR PRODUCTS

Shorthand for "Variable Resistors," Varistors possess characteristics that divert transient currents away from sensitive components. Littelfuse offers two types: Miniature surface mount Multi-Layer Varistors (MLVs) for small electronics applications and Metal Oxide Varistors (MOV) for higher energy applications.

Series Name[1]		View Datasheet	Order Samples	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: UR	CSA	VDE	CECC	QPL	RoHS	Lead Free	Halogen Free
Surface Mount MLV / MOV:																				
MHS		•	•	Multi-Layer Zinc Oxide (MLV)	9 - 42	30 - 135	300		-55 to +125°C	1	Surface Mount	Not Applicable						•		
MLE		•	•		18	18	22 - 28											•		
ML		•	•		2.7 - 107	5.5 - 120	4 - 500	0.02 - 2.5										•		
AUML		•	•			18												•		
MLN		•	•		18	5.5 - 18	30	0.05 - 0.10		4								•		
CH		•	•	Zinc Oxide (MOV)	14 - 275	18 - 369	100 - 250	1.0 - 8.0		1			•					•		
SM7		•	•		115 - 510	369 - 675	1200	23 - 40	-55 to +85°C				•					•	•	•
SM20		•	•		20 - 320	26	6500	165					•					•	•	•
Radial Leaded MOV:																				
UltraMOV™ Varistor		•	•	Zinc Oxide	130 - 625	170 - 825	1750 -10000	12.5 - 720	-55 to +85°C	1	Radial Leaded	7, 10, 14 20mm	•	•	•	•		•	•	•
UltraMOV™ 25S Varistor		•	•		115 - 750	150 - 970	22000	230 - 890				25mm	•	•	•	•		•	•	•
C-III		•	•		130 - 660		3500 - 9000	40 - 530				10, 14, 20mm	•	•	•			•	•	•
LA		•	•		130 - 1000	175 - 1200	1200 - 6500	11 - 360				7, 10, 14 20mm	•	•	•	•		•	•	•
ZA		•	•		4 - 460	5.5 - 615	50 - 6500	0.1 - 52				5, 7, 10, 14, 20mm	•		•	•		•	•	•
Industrial High Energy Terminal MOV:																				
BA/BB		•	•	Zinc Oxide	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				40mm	•					•	•	
HA		•	•		130 - 750	175 - 970	25000 40000	200 - 1050			Industrial Packaged Radial Leads	32, 40mm	•	•				•	•	•
HB34, HG34, HF34		•			130 - 750	175 - 970	40000	270 - 1050				34mm	•	•				•	•	•
DHB34		•	•		250 - 2800	330 - 3500	20000 70000	330 - 10000				34mm	•	•				•	•	•
CA		•	•		250 - 2800	330 - 3500	20000 70000	330 - 10000			Bare Disc	60mm						•		
Specialty Application MOV:																				
MA		•	•	Zinc Oxide	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	100 - 6500	0.4 - 160	-55 to +125°C		Inline Radial Leads	Not Applicable	•	•				•	•	
High Reliability		•			130 - 510	4 - 675	100 - 6500	0.4 - 190	-55 to +85°C		(Varies)	(Varies)					•			
Thermally Protected MOV:																				
SMOV™ 25S Varistor		•	•	Zinc Oxide	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		Industrial Packaged Radial Leads	34mm	•					•	•	
TMOV® 25S Varistor		•	•		115 - 750	150 - 970	20000	170 - 670	-55 to +85°C		Radial Leaded	25mm	•		•	•		•	•	
TMOV® 34S Varistor		•	•		115 - 750	150 - 970	40000	235 - 1050	-55 to +85°C		Industrial Packaged Radial Leads	34mm	•		•	•		•	•	
TMOV® Varistor / iTMOV® Varistor		•	•		115 - 750	150 - 970	6000 - 10000	35 - 480	-55 to +85°C		Radial Leaded	14, 20mm	•	•	•	•		•	•	

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

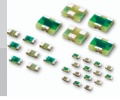
GDT PRODUCTS

GDTs (gas discharge tube) 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. Littelfuse devices offer a small footprint and are available in leaded and surface mount configurations, with high surge handling capability. Their fast response to transient over-voltage events, and ability to dissipate large amounts of energy, translates into reduced risk of equipment damage. The amount of energy they can dissipate makes them a good choice for lightning surge protection, particularly for telecom equipment located in outdoor structures.

Series Name[1]		View Datasheet	Order Samples	DC Breakover Voltage Range (Nom V_{BO})	Max AC Surge Rating	Peak Pulse Current (8/20µs)	Max Capacitance	Operating Temperature Range	# Terminals	Mounting Options: Mini Tube	Surface	Axial Lead	Radial Lead	Cartridge Clip	RoHS Compliant	Lead Free
High Voltage GDTs:																
AC		•	•	285 - 600	NA	5000A	1.5pF	-40°C to +90°C	2			•			•	
CG3		•	•	1000 - 7500		5000A	1.5pF		2			•			•	
Low to Medium Surge GDTs:																
CG5		•	•	90 - 600	5A	5000A	1.5pF		2	•	•	•			•	
SL0902A		•	•	90 - 600	5A	5000A	1.5pF		2	•	•				•	•
SL1002A		•	•	75 - 600	5A	5000A	1.2pF	-40°C to +90°C	2	•	•				•	•
SL1003A		•	•	90 - 500	10A*	10,000A	1.2pF		3	•	•		•		•	•
SL1011A		•	•	75 - 600	5A	5000A	1.5pF		2		•	•			•	•
Medium to High Surge GDTs:																
SG (1812 Size)		•	•	75 - 420	500 - 750		1.0pF				•				•	•
SL1122A		•	•	90 - 260	10A*	10000A*	100-270pF		3				•		•	
SL1021A		•	•	90 - 600	10A*	10000A*	1.5pF		3		•		•		•	•
SL1024A		•	•	90 - 600	10A*	10000A*	1.5pF		3		•		•		•	•
PMT8		•	•	90 - 400	10A*	20000A*	1.5pF	-40°C to +90°C	3		•		•		•	•
SL1011B		•	•	75 - 350	10A	10000A	1.5pF		2		•	•			•	•
SL1411A		•	•	75 - 600	10A	10000A	1.5pF		2		•	•			•	•
PMT3		•	•	90 - 500	20A*	20000A*	1.5pF		3		•		•		•	
CG/CG2		•	•	75 - 1000	20A	20000A	1.5pF		2	•	•	•			•	
Very High Surge GDTs:																
SL1021B		•	•	90 - 600	10A*	20000A*	1.5pF		3		•		•		•	•
SL1024B		•	•	90 - 600	10A*	20000A*	1.5pF	-40°C to +90°C	3		•		•		•	•
SL1026		•	•	275 - 700	10A*	20000A*			2					•	•	•

(1) Detailed information about most product series listed here can be found on our web site.
* Total current through center (ground) terminal

PULSEGUARD® ESD SUPPRESSORS

Series Name		View Datasheet	Order Samples	Surface Mount	Through-Hole	Technology Type	Working Voltage	Array Package (No. of Lines)	Single Line Package	Typical Device Capacitance	Leakage Current	Rated Immunity to IEC 61000-4-2 level 4	Also Rated for EFT or Lightning	Bidirectional (transients of either polarity)	Performs Low Pass Filtering
PulseGuard® ESD Suppressors:															
PGB1		•	•	•		Voltage Variable Material	0–24VDC	SOT23 (2)	0402, 0603	0.04–0.12pF	<1nA	•		•	
PGB2		•	•	•		Voltage Variable Material	0–12VDC	NA	0402, 0201	0.07pF	<1nA	•		•	

TVS DIODES

TVS Diodes are used to protect semiconductor components from high-voltage transients. Their p-n junctions have a larger cross-sectional area than those of a normal diode, allowing them to conduct large currents to ground without sustaining damage. Littelfuse supplies TVS Diodes with peak power ratings from 200W to 30kW, and reverse standoff voltages from 5V to 512V.

Series Name	Photo	View Datasheet	Order Samples	Package Type	Reverse Standoff Voltage (V_R)	Peak Pulse Power Range† (P_{PP})	Peak Pulse Current (I_{PP} 8/20µs)	Operating Temperature	Halogen-Free	RoHS Compliant	UR Recognized
Surface Mount-Standard Application (200–5000W):											
SMF		•	•	SOD-123	5.0 - 54	200W		-85° to +302° F (-65° to +150° C)	•	•	*
SMAJ		•	•	DO-214AC	5.0 - 440	400W			•	•	•
P4SMA		•	•	DO-214AC	5.8 - 495	400W			•	•	•
SMA6J		•	•	DO-214AC	5.0 - 12	600W			•	•	•
SMA6L		•	•	DO-221AC	5.0 - 85	600W			•	•	*
SACB		•	•	DO-214AA	5.0 - 50	500W			•	•	•
SMBJ		•		DO-214AA	5.0 - 440	600W			•	•	•
P6SMB		•	•	DO-214AA	5.8 - 495	600W			•	•	•
1KSMB		•	•	DO-214AA	5.8 - 136	1000W			•	•	•
SMCJ		•	•	DO-214AB	5.0 - 440	1500W			•	•	•
1.5SMC		•		DO-214AB	5.8 - 495	1500W			•	•	•
SMDJ		•		DO-214AB	5.0 - 170	3000W			•	•	•
5.0SMDJ		•	•	DO-214AB	12 - 170	5000W			•	•	•
Axial Leaded-Standard Application (400–5000W):											
P4KE		•	•	DO-41	5.8 - 495	400W		-85° to +302° F (-65° to +150° C)	•	•	•
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			•	•	•
3KP		•	•	P600	5.0 - 220	3000W			•	•	•
5KP		•	•	P600	5.0 - 250	5000W			•	•	•
Axial Leaded-High Power:											
15KPA		•	•	P600	17 - 280	15000W		-85° to +302° F (-65° to +150° C)	•	•	•
20KPA		•	•	P600	20 - 300	20000W			•	•	•
30KPA		•	•	P600	28 - 288	30000W			•	•	•
AK1		•	•	Radial Lead	76		1000A	-67° to +347° F (-55° to +150° C)	•	•	•
AK3		•	•	Radial Lead	15 - 430		3000A		•	•	•
AK6		•	•	Radial Lead	30 - 430		6000A		•	•	•
AK10		•	•	Radial Lead	30 - 430		10000A		•	•	•
AK15		•	•	Radial Lead	58 - 76		15000A	-67° to +257° F (-55° to +125° C)	•	•	•

Remark: "*" UR approval is pending.

TVS DIODES (continued)

Series Name	Photo	View Datasheet	Order Samples	Package Type	Reverse Standoff Voltage (V_R)	Peak Pulse Power Range† (P_{PP})	Peak Pulse Current (I_{PP} 8/20µs)	Operating Temperature	Halogen-Free	RoHS Compliant	UR Recognized	AEC-Q101 Compliant
Automotive Application:												
TPSMA6L		•	•	DO-221AC	10 - 60	600W		-85° to +302° F (-65° to +150° C)	•	•	*	•

Remark: "*" UR approval is pending.

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Learn about the key selection criteria and tradeoffs among protection technologies for USB 3.0 devices. Recently updated!

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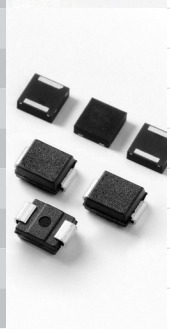
TVS DIODE ARRAY – SPA® DIODES

TVS Diode Arrays are designed to protect analog and digital signal lines from electrostatic discharge (ESD), Electrical Fast Transients (EFT), and lightning-induced surge currents. Offering low dynamic resistance for improved clamping performance, TVS Diode Arrays are offered in a wide range of industry standard discrete and multi-channel SMD packages. Features of this portfolio include capacitance as low as 0.4 pF and enhanced ESD capability up to ±30kV (contact discharge).

Series Name	Photo	View Datasheet	Order Samples	Package Type	Working Voltage	Capacitance	Number of Channels	ESD Rating (Contact Discharge, IEC61000-4-2)	Clamping Voltage (t_p=8/20µs)	Maximum Surge Rating (t_p=8/20µs)	Lead Free/ Green	RoHS Compliant
General Purpose ESD Protection (SCR Diode Array):												
SP720		•	•	PDIP SOIC	2-30V	3pF	14	4kV	2V @ 1A	3A	•	•
SP721		•	•		2-30V	3pF	6	4kV	2V @ 1A	3A	•	•
SP723		•	•		2-30V	5pF	6	8kV	2V @ 2A	7A	•	•
SP724		•	•	SOT23	2-20V	3pF	4	8kV	2V @ 1A	3A	•	•
SP725		•	•	SOIC	2-30V	5pF	4	8kV	2V @ 2A	14A	•	•
General Purpose ESD Protection (TVS Discretes and Arrays):												
SP05		•	•	SC70 SOT23 SOT143 MSOP	5.5V	30pF	2 / 3 / 4 / 5 / 6	30kV	N/A	N/A	•	•
SP1001		•	•	SC70 SOT553 SOT563 SOT963	5.5V	8pF	2 / 4 / 5	15kV	8.0V @ 1A	2A	•	•
SP1002		•	•	SC70	6.0V	5pF	1 / 2	8kV	9.2V @ 1A	2A	•	•
SP1003		•	•	0402 (SOD723) 0402 (SOD882)	5.0V	30pF	1	30kV	12.0V @ 7A	7A	•	•
SP1004		•	•	SOT953	6.0V	5pF	4	8kV	10V @ 1A	1A	•	•
SP1005		•	•	0201 (Flipchip) 0402 (SOD882)	6.0V	30pF	1	30kV	9.3V @ 1A	10A	•	•
SP1006		•	•	0201 (µDFN-2)	6.0V	25pF	1	30kV	8.3V @ 1A	5A	•	•
SP1007		•	•	0201 (Flipchip) 0402 (SOD882)	6.0V	3.5pF	1	8kV	11.2V @ 1A	2A	•	•
SP1008				0201 (Flipchip)	6.0V	6pF	1	15kV	10.7V @ 1A	2.5A	•	•
SP1011		•	•	µDFN-6	6.0V	7pF	4	15kV	8.7V @ 1A	2A	•	•
Low Capacitance ESD Protection:												
SP3001		•	•	SC70	6.0V	0.65pF	4	8kV	9.5V @ 1A	2.5A	•	•
SP3002		•	•	SC70 SOT23 µDFN-6	6.0V	0.85pF	4	12kV	9.5V @ 1A	4.5A	•	•
SP0504S				SOT23								
SP3003		•	•	µDFN-6 SC70 SOT5x3 MSOP10	6.0V	0.65pF	2 / 4 / 8	8kV	10.0V @ 1A	2.5A	•	•
SP3004		•	•	SOT563	6.0V	0.85pF	4	12kV	10.0V @ 1A	4A	•	•
SP3010		•	•	µDFN-10	6.0V	0.45pF	4	8kV	10.8V @ 1A	3A	•	•
SP3011		•	•	µDFN-14	6.0V	0.40pF	6	8kV	11.0V @ 1A	3A	•	•
SP3012		•	•	µDFN-10 µDFN-14	5.0V	0.50pF	4 / 6	12kV	6.6V @ 1A	4A	•	•
SP3021				0402 (SOD882)	5.0V	0.50pF	1	8kV	13.1V @ 1A	2A	•	•
SP3030				0402 (SOD882)	5.0V	0.50pF	1	20kV	9.2V @ 1A	3A	•	•
SP3031				0402 (SOD882)	5.0V	0.80pF	1	10kV	6.9V @ 1A	5A	•	•
SP0524P				µDFN-10	5.0V	0.50pF	4	12kV	6.6V @ 1A	4A	•	•
Lightning Surge Protection:												
SRV05-4				SOT23	6.0V	2.4pF	4	20kV	11.5V @ 5A	10A	•	•
SP03-3.3		•	•	SOIC	3.3V	16pF	2	30kV	15V @ 100A	150A	•	•
SP03-6		•	•	SOIC	6.0V	16pF	2	30kV	20V @ 100A	150A	•	•
LC03-3.3				SOIC	3.3V	9.0pF	2	30kV	17V @ 100A	150A	•	•
SP2502L				SOIC	3.3V	5.0pF	2	30kV	20V @ 75A	75A	•	•
SLVU2.8				SOT23	2.8V	2.0pF	1	30kV	13.9V @ 24A	40A	•	•
SLVU2.8-4		•	•	SOIC	2.8V	2.0pF	4	30kV	13.9V @ 24A	40A	•	•
SR70		•	•	SOT143	70V	2.0pF	2	30kV	12V @ 30A	40A	•	•
SP4060		•	•	MSOP	2.5V	4.4pF	8	30kV	8.0V @ 10A	20A	•	•
SP2504N				µDFN-10	2.5V	3.5pF	4	30kV	6.3V @ 5A	20A	•	•
SP3304N				µDFN-10	3.3V	3.5pF	4	30kV	7V @ 5A	20A	•	•

PLED LIGHT-EMITTING DIODE (LED) PROTECTORS

Littelfuse PLED devices provide added reliability to LED lighting strings. Designed to minimize the impact of losing an entire LED string due to a single LED failure, PLED devices provide a switching function that will bypass LEDs that go open circuit, and allow current to flow to the remaining LEDs in the string. PLED devices also offer LED protection against electrostatic discharge (ESD) and accidental reverse power connection (PLED5 devices only). Designed to serve the needs of high brightness outdoor LED lighting applications (advertising and traffic signs, roadway/pathway/runway lighting, aircraft and emergency lighting, etc), PLED devices help assure reliability and lower maintenance costs.

Part Number	Photo	View Datasheet	Order Samples	Powermite	QFN 3x3	DO-214	V_{BR} breakdown Volts Min	V_{BR} breakdown Volts Max	I_H mAmps	I_S mAmps Max	$I_T@V_T$ Amps Max	V_T and I_T Volts Max	Critical rate of rise dV/dt Volts Max
PLED6M		•	•	•			5.5	7.5	12	70	0.35	1.2	N/A
PLED6Q12		•	•		•		6	16	5	100	1.0	1.2	250V/µs
PLED6S		•	•			•							
PLED9Q12		•	•		•		9	18					
PLED9S		•	•			•							
PLED13Q12		•	•		•		13	26					
PLED13S		•	•			•							
PLED18Q12		•	•		•		18	33					
PLED18S		•	•			•							

Part Number	Photo	View Datasheet	Order Samples	QFN 2x2	SOT 89	V_{AK} Input Voltage Volts Max	V_{TO} Turn-On Voltage Volts Min	V_{TO} Turn-On Voltage Volts Typ	V_{TO} Turn-On Voltage Volts Max	I_S Switching Current mAmps Max	V_{OS} On-State Voltage Volts Min	V_{OSR} Reverse On-State Voltage Volts Max	I_S On-State Current mAmps Max	I_{OSR} Reverse On-State Current mAmps Max	V_{ESD} ESD WIthstand Voltage (IEC61000-4-2) kV Contact	V_{ESD} ESD WIthstand Voltage (IEC61000-4-2) kV Air
PLED5Q12		•	•	•		40	4.65	4.9	5.15	20	1.3@ I_{AK}=350mA	1.4@ I_{AK}=350mA	500	500	±8	±15
PLED5HT		•	•		•	38					1.8@ I_{AK}=700mA	1.8@ I_{AK}=700mA	700	700	±8	±15

SIDACtor® PROTECTION THYRISTORS

SIDACtor® Protection Thyristors are designed to suppress overvoltage transients in telecom and datacom equipment, and are able to divert currents as high as 5000A to ground within nanoseconds of reaching their breakover voltage. Littelfuse offers a wide range of configurations including DO-214AA, DO214AC, COMPAK (3-Pin DO-214), SOT23-5, QFN, MS-012 and modified MS-013 surface mount, TO-92, TO-218, DO-15, modified TO-220, and TO-220 through-hole package options designed to handle medium to high energy transients.

Series Name	Photo	View Datasheet	Order Samples	Package Type	Type	Standoff (working) Voltage (V_{DRM})	Switching Voltage (V_S)	Peak Pulse Rating: 2/10µs	Peak Pulse Rating: 10/1000µs	Peak Pulse Rating: 8/20µs	RoHS Compliant	UR Recognized
Broadband Optimized Protection:												
MC Series		•		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 Series		•		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 Series		•		3x3 QFN	A	6 - 320	25 - 400	150A	45A	150A	•	•
					B			250A	80A	250A		
				3.3x3.3 QFN	C			500A	100A	400A		
MC Multiport Series		•		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			
SDP Series		•	•	3x3 QFN	F	8 - 24	15 - 35			50A	•	•
		•		SOT23 - 5	B	58 - 320	77 - 400	250A	80A	250A	•	•
SDP Biased Series		•		5x6 QFN	C	6 - 320	25 - 400	500A	100A	400A	•	•
SEP Biased Series		•		5x6 QFN	C	6 - 75	25 - 98	500A	100A	400A	•	•
P0080T023G5		•		SOT 23 - 5	G	8	15	45A	18A	50A	•	•
Subscriber Line Interface Circuit (SLIC) Protection:												
Fixed Voltage Series		•	•	DO-214AA	A	58 - 160	77 - 200	150A	45A	150A	•	•
					C			500A	100A	400A		
Fixed Voltage Twin SLIC Series		•	•	Modified DO-214AA	A	58 - 160	77 - 200	150A	45A	150A	•	•
Fixed Voltage Q2L Series		•	•	QFN 3.3x3.3	C	58 - 160	77 - 200	500A	100A	400A	•	•
Fixed Voltage Single Port Series		•	•	MS-012	F	58 - 95	77 - 130	120A	30A	100A	•	•
Fixed Voltage Enhanced Single Series		•	•	MS-012	F	58 - 160	77 - 200	120A	30A	100A	•	•
Fixed Voltage Multiport Series		•	•	MS-013	A	58 - 160	77 - 200	150A	45A	150A	•	•
					C			500A	100A	400A		
Battrax® Protectors Positive/Negative		•	•	Modified DO-214AA	A	These devices track their reference voltages. Please refer to data sheets in SIDACtor® Protection Thyristor catalog or www.littelfuse.com for detailed information.		150A	45A	150A	•	•
					C			500A	100A	400A		
Battrax® Protectors Single Port Negative		•	•	MS-013	C			500A	100A	400A	•	•
Battrax® Protectors Single Port Positive/Negative		•	•	MS-013	C			500A	100A	400A	•	•
Battrax® Protectors Dual Port Negative		•	•	MS-013	C			500A	100A	400A	•	•

SIDACtor® PROTECTION THYRISTORS (continued)

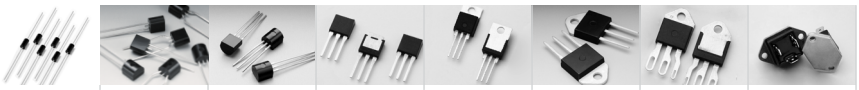
Series Name	Photo	View Datasheet	Order Samples	Package Type	Type	Standoff (working) Voltage (V_{DRM})	Switching Voltage (V_S)	Peak Pulse Rating: 2/10µs	Peak Pulse Rating: 10/1000µs	Peak Pulse Rating: 8/20µs	RoHS Compliant	UR Recognized
Line Circuit Access Switch (LCAS) Protection:												
Asymmetrical Multiport Series		•	•	MS-013	A	These products have asymmetric trigger voltages. See data sheet.		150A	45A	150A	•	•
					C			500A	100A	400A		
Custom LCAS Discrete Series		•	•	DO-214AA	A	100 - 230	130 - 290	150A	45A	150A	•	•
					B			250A	80A	250A		
					C			500A	100A	400A		
Baseband Protection (Voice-DS1):												
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 Series		•	•	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 Series		•		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 Series		•	•	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 Series		•	•	DO-15	A	50 - 245	84 - 370		50A	100A	•	•
T10B Series		•	•	DO-201	B	80 - 275	120 - 360		100A	250A	•	•
High Exposure Surge Protection:												
Primary Protection Series		•	•	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 Series		•	•	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	•	•
5kA Series		•	•	TO-218	E	140 - 180	180 - 260			5000A	•	•
High Surge Current Series				DO-214AA	D	6 - 320	25 - 400	1000A	200A	800A	•	•

SWITCHING THYRISTORS

Switching Thyristors are solid state switches that are normally open circuits (very high impedance), capable of withstanding rated blocking/off-state voltage until triggered to on state. Used for circuit control applications, Littelfuse offers Triac, QUADRAC® Semiconductors, SCRs, Rectifiers plus Alternistor Triacs for best commutating and noise immunity. Offered in various and other configurations for a wide range of currents blocking/off-state voltages, packages, and triggering.

Through-Hole Packages:

Other:



DO-15 | TO-92-2L | TO-92-3L | TO-251 | TO-220 | TO-218 | TO-218X | TO3 Fastpak

Surface Mount Packages:

SOT-89 | SOT-223 | Compak | DO-214AA | TO-252 | TO-263

$I_{T(RMS)}$	V_{DRM}/V_{RRM}	$I_{GT\ (Q1)}$	Series								Through-Hole							Surface Mount			
			Sensitive	View Datasheet	Order Samples	Standard	View Datasheet	Order Samples	Alternistor	View Datasheet	Order Samples	TO-92	TO-251	TO-220 Isl	TO-220 Non-Isl	TO-218 Isl	TO-218X Isl	TO-3	Compak	SOT-223	TO-252	TO-263
Triac:																						
0.8A	400-600V	3-25mA	LxX8Ex LxXx	•	•	QxX8Ex QxXx	•	•				•							•			
0.8A		3-5mA	LX8	•	•							•								•		
1.0A		3-25mA	Lx01Ex,LxNx	•	•	Qx01Ex,QxNx	•	•				•							•			
1.0A	400-800V	3-10mA	L01	•	•							•								•		
4A	400-1000V	3-25mA	Lxx04xx	•	•	Qxx04xx	•	•					•	•	•						•	
6A		5-50mA	Lxx06xx	•	•	Qxx06xx	•	•	Qxx06xHx	•	•		•	•	•						•	•
8A		5-50mA	Lxx08xx	•	•	Qxx08xx	•	•	Qxx08xHx	•	•		•	•	•						•	•
10A		25-50mA				Qxx10xx	•	•	Qxx10xHx	•	•			•	•							•
12A		10-50mA							Qxx12xHx	•	•			•	•							•
15A & 16A		10-80mA				Qxx15xx	•	•	Qxx16xHx	•	•			•	•							•
25A		50-80mA				Qxx25xx	•	•	Qxx25xHx	•	•			•	•	•	•	•				•
25A	600V	50mA							HQ6025xH5	•	•			•	•	•						•
30A & 35A	400-800V	50mA				Qxx35xx	•	•	Qxx35xHx	•	•			•	•			•				•
40A	400-1000V	50-100mA							Qxx40xx	•	•					•	•					
QUADRAC® Semiconductors:																						
	400-600V	4-15A				QxxxxLT			QxxxxLTH					•								

SWITCHING THYRISTORS (continued)

$I_{T(RMS)}$	V_{DRM}/V_{RRM}	$I_{GT (Q1)}$	Series						Through-Hole								Surface Mount				
			Sensitive	View Datasheet	Order Samples	Standard	View Datasheet	Order Samples	TO-92	TO-251	TO-220 Isl	TO-220 Non-Isl	TO-218AC Isl	TO-218AC Non-Isl	TO-218X Isl	TO-218X Non-Isl	Compak	SOT-89	SOT-223	TO-252	TO-263
SCR:																					
0.8A	400-600V	12 - 500µA	EC103xx SxSx	•	•				•								•				
0.8A	400-800V	5 - 200µA	SxX8xSx	•	•				•									•	•		
1A	400-600V	10mA				Sx01E SxN1	•	•	•								•				
1.5A		200µA	TCR22-x	•	•				•												
1.5A		200µA	Sx02xS	•	•				•										•		
4A		50- 500µA	Sxx04xSx	•	•					•										•	
6A		0.2-15mA	Sxx06xSx	•	•	Sxx06x	•	•		•	•	•								•	
8A		0.2-15mA	Sxx08xSx	•	•	Sxx08x	•	•		•	•	•								•	
10A		0.2-15mA	Sxx10xSx	•	•	Sxx10x	•	•		•	•	•								•	
12A		20mA				Sxx12x	•	•		•		•								•	
15A & 16A	400-1000V	30mA				Sxx15x Sxx16x	•	•			•	•									•
20A & 25A		30-35mA				Sxx20x Sxx25x	•	•			•	•									•
35A		40mA				Sxx35x	•	•					•		•						
40A		40mA				Sxx40x	•	•				•									•
55A		40mA				Sxx55x	•	•				•		•		•					•
65A		50mA				Sxx65x	•	•					•		•						
70A		50mA				Sxx70x	•	•								•					

Series									Through Hole	Surface Mount	Switching V_{BO}	I_H	I_{TSM}	static dv/dt	di/dt	T_J
Standard	View Datasheet	Order Samples	High Energy	View Datasheet	Order Samples	Multipulse	View Datasheet	Order Samples								
SIDAC:																
Kxxxzy	•	•							DO-15,TO-92	DO-214AA	79-330V	150mA	20A	1500V/µs	150A/µs	-40 to +125 °C
			Kxxx0yH	•	•				DO-15,TO-92	DO-214AA	190-280V	150mA	20A		150A/µs	-40 to +125 °C
			K2xx0GHU	•	•				DO-15		190-260V	60mA			220A/µs	-40 to +125 °C
						Kxxx1G	•	•	DO-15		200-380V	120mA			150A/µs	-40 to +125 °C

Series	View Datasheet	Order Samples	Through Hole	$I_{F(RMS)}$ RMS forward current	$I_{F(AV)}$ Average forward current	I_{FSM} Peak non-repetitive surge current		I^2t I^2t Value for fusing	T_{stg} Storage temperature range	T_J
Rectifiers:										
Dxx15L	•		TO-220 Isl.	15 - 25A	9.5 to15.9A	single half cycle; f = 50Hz; TJ (initial) = 25°C 188 - 300A	single half cycle; f = 60Hz; TJ (initial) = 25°C 225 - 350A	210 - 508 A^2s	-40 to +150 °C	-40 to +125 °C
Dxx20L	•	•								
Dxx25L	•									

Common Circuit Threats and Protection Solutions

Threat or Circuit Action What is the threat or circuit action that may damage sensitive electronics?	Typical Applications 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 PTCs
Lightning	Any electronic or electrical equipment with connections to the outside environment	Fast response, proper switching threshold, surge current rating	SIDACtor® Protection Thyristors, Varistors (MOVs), TVS Diodes, Gas Discharge Tubes (GDTs)
Electrostatic Discharge (ESD)	Any electronic equipment with a human interface	Fast response, high peak voltage rating	PulseGuard® ESD Suppressors, TVS Diode Array – SPA® Diodes, 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 Array – SPA® Diodes
Inductive Load Switching and Commutative Spikes	Large motors, pumps, compressors, relays and AC distribution	High energy rating	Varistors (MOVs and MLVs), GDTs, TVS Diodes
Data and Communication Line Voltage Transients	Ethernet, xDSL, data bus, telecom, etc.	Fast response, low load capacitance	TVS Diode Array – SPA® Diodes, 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 possible fire, electrocution or explosion. Sources 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 positive temperature coefficient (PTC) 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.

PTCs offer the ability to re-set for withstanding most minor, common and recurring overcurrent events. They will allow safe levels of current to pass continuously, and during major overcurrent events, 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 Array – SPA® Diodes 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. Littelfuse Metal Oxide Varistor (MOV), TVS Diodes and GDT products are typically used to protect against these events. Look to Littelfuse SIDACtor® Protection Thyristors and TVS Diode Array – SPA® Diode products for Telecom/Datacom requirements (see page 22).

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.

Application Solutions by Circuit Type and Related Threat

CONSUMER ELECTRONIC PRODUCT APPLICATIONS

Computers—Server, Notebook, Ultrabook, Desktop
Handheld Portables—Smart Phone, Tablet, eReader, PND/GPS, MP3/PMP, Digital Camera/Camcorder
Consumer A/V Equipment—LCD/LED TV, set top box, DVD player
Peripherals—Scanner, Printer, Monitor, Disk Drive

Circuit Type	Function or Threat	Standards	Littelfuse Product Series	
Medium/Low-Speed Data Interfaces: USB 1.1, Ethernet, RS-232, RS-485, Keypads, Audio, Analog Video	ESD, EMI, EFT	IEC61000-4-2 IEC61000-4-4	TVS Diode Array SPA® Diodes	SP05x, SP10xx, SP40xx, LC03, SP72x, SP03-xx, SLVU2.8, SLVU2.8-4
			Varistor (MLV)	MLA, MLE, MLN, MHS
			SIDACtor® Protection Thyristors	PxxxxSA/SB/SC, PxxxxQ12/Q22
			TVS Diodes	SMF, SMAJ, SMA6L, SMBJ, SMCJ, SMDJ
	Overcurrent		PTCs	0603L, 0805L, 1206L, 1210L, 1812L, 2920L
High-Speed Data Interfaces: USB 2.0/3.0, HDMI, eSATA, DisplayPort, DVI, IEEE 1394, RF Antenna	ESD, EMI, EFT	IEC61000-4-2, IEC61000-4-4	PulseGuard® ESD Supressor	PGB1, PGB2 - 0201, 0402, 0603
			TVS Diode Array SPA® Diodes	SP30xx, SP40xx, SP0524P, SP0504S
	Overcurrent		LoRho PTCs	SL SMT Series 0402L, 0603L, 0805L, 1206L, 1210L, 1812L
Power Inputs: 120/240 VAC	Lightning	IEC61000-4-5	TVS Diode	SMF, SMAJ, SMA6L, SMBJ, SMCJ, SMDJ, P4KE, P6KE, 1.5KE
			Varistor (MOV)	LA, UltraMOV™, C-III, TMOV® varistors
	Overcurrent		Fuse	SMD: Nano²®, Fuse, PICO® SMD fuses Leaded: 2AG, 3AB/3AG, 5x20, 3.6x10, TR5®/TE5 fuses
Power Inputs: Blade DC input, Low voltage DC, Li-ion Battery	Lightning / ESD	IEC61000-4-2, IEC61000-4-5	TVS Diode	SMF, SMAJ, SMA6L, SMBJ, SMCJ, SMDJ, P4KE, P6KE, 1.5KE
			Varistor (MLV)	ML, MLE
			Varistor (MOV)	ZA
	Overcurrent		Fuse	SMD - Thin Film, Ceramic, Chip, Nano²®, (1206 size), 501 (20A), 456 (40A) fuses
			LoRho PTC	SL SMT Series 0402L, 0603L, 0805L, 1206L, 1210L, 1812L

POWER MAINS / AC LINE PROTECTION*

Circuit Type	Function or Threat	Littelfuse Product Series	
Type 1 (Power before the panel)			
Surge Protective Devices (SPD) (Primary building entrance, electric meters)	Lightning	Varistor (MOV)	SMOV™, TMOV®, UltraMOV™, LA, C-III, HA, HB34, HF34, HG34 varistors
Type 2 (Permanently connected devices after the panel)			
Uninterruptible Power Supply (commercial/industrial) **Surge Protective Devices (SPD)** (building level equipment, load-center panels, datacenters) **Power Inverters**	Lightning, Switching Transients	Varistor (MOV)	SMOV™, TMOV®, UltraMOV™, LA, C-III, HA, HB34, HF34, HG34 varistors
		TVS Diode	5KP, 15KPA, 20KPA, 30KPA, AK1, AK3, AK6, AK10, AK15
		GDT	AC120, AC240
	Power Fault / Short Circuit and other themal events	Fuse	POWR-GARD® Midget fuses LVSP series (MOV protection)
Type 3 (Plug-in equipment after the panel)			
Uninterruptible Power Supply (consumer/residential) **External Power Supplies** (chargers, peripheral devices, etc) **Consumer Electronics** **AC Appliances** **AC Power Strips** **Switch Mode Power Supplies**	Lightning, Switching Transients	Varistor (MOV)	TMOV®, UltraMOV™, LA, C-III, HA, HB34, HF34, HG34 varistors
		TVS Diode	5KP, 15KPA, 20KPA, 30KPA, AK1, AK3, AK6, AK10, AK15
		GDT	CG3 4.0
	Power Fault / Short Circuit and other themal events	Fuse	Thru Hole: TR5® / TE5, 2AG, 3AG, 5x20, 3.6x10, PICO® fuses Surface Mount: Nano²®, PICO® SMD fuses

LIGHTING SYSTEMS

Circuit Type	Function or Threat	Littelfuse Product Series	
LED Lighting Systems	Improved LED String Reliability	PLED devices	PLEDxx
	Power Supply (Lightning, Inductive Load Switching)	Varistor (MOV)	TMOV®, UltraMOV™, CH, LA, C-III varistors
		TVS Diode	SMBJ, P4KE, P6KE, 1.5KE, 5KP, 15KPA, 30KPA, AK1, AK3, AK6, AK10, AK15
	Power Fault / Short Circuit and other themal events	Fuse	Thru Hole: TR5® / TE5, 2AG, 3AG, 5x20, 3.6x10, PICO® fuses Surface Mount: Ceramic Chip, Nano²®, PICO® SMD (High Voltage) 477 series, 505 series, 808 series, 485 series fuses
Light Dimmers	Phase Control	Thyrsitor	Triacs / Alternistor Triacs: Q6010Lx, Q6016Lx, Q6025Lx QUADRAC® semiconductors: Q6010LT, Q6015LT
	Overcurrent (Europe)	Fuse	3.6x10
Electronic Fluorescent Lighting Ballasts	Lightning	Varistor (MOV)	LA
	Overcurrent	Fuse	383 TR series / 369 TR5® series, 446 / 447 EBF fuse
Compact Fluorescent Lamps (CFL)	Overcurrent	Fuse	3.6x10
Metal Halide Lighting	Lamp Ignition	Thyristor	Multipulse Sidac: K2401G
High Pressure Sodium Lighting	Lamp Ignition	Thyristor	Sidac: K1200G

ELECTRIC MOTORS*

Circuit Type	Function or Threat	Littelfuse Product Series	
Universal / DC Motors (intermittant use)	Speed Control	Thyristor	Triac: Q6016LH4 SCR: S6025L Rectifier: D6025L
AC Induction Motors (continuous use)	Speed Control	Thyristor	Triac: Q6012LH4
	Thyristor Overvoltage Protection	Varistor (MOV)	LA, SM20
		TVS Diode	SMBJ, P4KE, P6KE, 1.5KE

* Littelfuse offers protection solutions to serve a wide range of electric motors, controllers and power systems. Please consult with your Littelfuse products representative for detailed discussion about your requirements. For higher power and industrial applications, please refer to our POWR-GARD® division product catalogs (www.littelfuse.com/catalogs).

TELECOM/DATACOM

Circuit	Threat	Standards	Littelfuse Product Series	
Medium/Low-Speed Data Interfaces: USB 1.1, RS-232, RS-485, Keypads, Audio, Analog Video	ESD, EMI, EFT	IEC61000-4-2, IEC61000-4-4	TVS Diode Array SPA® Diodes	SP05x, SP10xx, SP40xx, SP72x, SP03-xx, SLVU2.8, SLVU2.8-4
			Varistor (MLV)	ML, MLE, MLN, MHS
			TVS Diodes	SMF, SMAJ, SMA6L, SMBJ, SMCJ, SMDJ
	Overcurrent		PTCs	0805L, 1206L, 1210L, 1812L
High-Speed Data Interfaces: USB 2.0/3.0, HDMI, eSATA, DisplayPort, DVI, IEEE 1394, RF Antenna	ESD, EMI, EFT	IEC61000-4-2, IEC61000-4-4	PulseGuard® ESD Suppressor	PGB1, PGB2 - 0201, 0402, 0603
			TVS Diode Array SPA® Diodes	SP30xx, SP40xx, SP0524P, SP0504S
	Overcurrent		PTCs	0805L, 1206L, 1210L, 1812L
	Overvoltage	IEC61000-4-5, GR-1089, ITU-7 K.12	GDTs	SG, SL0902A
SLICs (Subscriber Line Interface Circuits): CO sites, Remote Cabinets/Terminals, VoIP systems, FXS ports	Lightning	GR-1089, TIA-968-A/B, ITU K.20/.21/.45, UL/EN/IEC 60950-1, UL 497B, IEC 61000-4-5, YD/T-993	SIDACtor® Protection Thyristors	Pxxx1 Fixed Voltage SLIC Protectors Bxxxx Battrax® Programmable SLIC Protectors
	Power Fault		Fuses	TeleLink® 461
			PTCs	600R150
Low-Speed Circuits: Voice, Fax, Modem, FXO / DAA	Lightning	GR-1089, TIA-968-A/B, ITU K.20/.21/.45, UL/EN/IEC 60950-1, UL 497B, IEC 61000-4-5, YD/T-993	SIDACtor® Protection Thyristors	Pxxxx SIDACtor® Protectors SDP series low profile SIDACtor® Protectors
			GDTs	SL0902A, SL1002A, SL1003A, SL1011A, SL1024A
	Power Fault		Fuses	TeleLink® 461 fuse
			PTCs	600R150
Medium-Speed Circuits: T1/E1/J1/DS1, T3/E3/DS3	Lightning	GR-1089, TIA-968-A/B, ITU K.20/.21/.45, UL/EN/IEC 60950-1,UL 497B, IEC 61000-4-5, YD/T-993	SIDACtor® Protection Thyristors	PxxxxxxMCL SIDACtor® Protectors Pxxx2xxMCL TwinChip™ Protectors PxxxxQxx QFN SIDACtor® Protectors, SDP, SEP series low profile SIDACtor® Protectors, SDP023T
			TVS Diode Array SPA® Diodes	SRV05-4, SP4060, SP2504N, SP3304N, SP2502L, LC03, SP03-xx
			GDTs	SL0902A, SL1002A, SL1003A, SL1011A, SL1024A
	Power Fault		Fuses	TeleLink® 461 / 461E fuses
			PTCs	600R150, 250S, 250R
Ethernet: 10/100/1000BaseT	Lightning	GR-1089, TIA-968-A/B, ITU K.20/.21/.45, UL/EN/IEC 60950-1, UL 497B, YD/T-993, IEEE 802.3, IEC61000-4-5	SIDACtor® Protection Thyristors	SDP, SEP series low profile SIDACtor® Protectors
			GDTs	SL0902A, SL1002A, SL1003A, SL1011A, SL1024A
			TVS Diode Array SPA® Diodes	SP30xx, SP40xx, LC03, SLVU2.8, SLVU2.8-4, SRV05-4, SP2504N, SP3304N, SP2502L, SP03A-3.3
	Power Fault		Fuses	TeleLink® 461 fuse
			PTCs	600R150, 250S, 250R
	ESD	IEC 61000-4-2	TVS Diode Array SPA® Diodes	SP30xx, SP0524P, SP0504S
xDSL: ADSL, ADSL2, HDSL, VDSL, VDSL2	Lightning	GR-1089, TIA-968-A/B, ITU K.20/.21/.45, IEC 61000-4-5, YD/T-993, IEEE 802.3	SIDACtor® Protection Thyristors	SDP SIDACtor® Protectors, SDP023T
			TVS Diode Array SPA® Diodes	SR70
Primary Protection	Lightning and Power Fault	UL497 GR-974 UL/EN/IEC 60950-1	GDT	SL0902A, SL1002A, SL1003A, SL1011A, SL1024A, SL1411A, SL1021A, SL1122A
Power Inputs: 120/240 VAC, up to 120 VDC, ATCA	Lightning		TVS Diode	P4KE, P6KE, 1.5KE, AK1, AK3, AK6, AK10, AK15
			Varistor (MOV)	CH, ZA, UltraMOV™ varistors
	Fault Current		Fuse	Midget Series (SFE, KIK, KLKD, BLS, BLN, FLQ, FLM, FLA, KLQ) Fast Acting: 435, 431/434, 429/433, 271, 446, 445, 451/453, 456, 459 Slo-Blo® fuses: 430, 452 / 454, 461, PICO® II fuses

AUTOMOTIVE ELECTRONICS*

Engine/Body/Chassis Controllers — Anti-lock brake / steering / air bag / seat belt / collision control and other safety systems and sensors, lighting / signalling controls, instrument cluster, engine / emission controllers, window / wipers controls, door lock / security controls, seating sensors and controllers

Multimedia/Information Systems — In-dash stereo / GPS / climate control electronics, portable GPS, portable CD/DVD/media players, audio / video / data / power docks and inputs

Circuit Type	Function or Threat	Standards	Littelfuse Product Series	
High-Speed Interfaces: USB 2.0, IEEE 1394	ESD	IEC61000-4-2	PulseGuard® ESD Suppressor	PGB1, PGB2 - 0201, 0402, 0603
			TVS Diode Array SPA® Diodes	SP30xx, SP0524P, SP0504S
Medium/Low-Speed Interfaces: USB 1.1, CAN	ESD, EMI	IEC61000-4-2	TVS Diode Array SPA® Diodes	SP05x, SP72x, SP10xx
			Varistor (MLV)	ML, MLE, MLN, MHS
Power Inputs: Up to 42 VDC	Fault Currents	RoHS; ISO 7637; GM 9105; Various UL, CSA, IEC, MITI	Fuse	Blade / Terminal Fuse Series: 257, 297, 298, 299, 495, 498 (see automotive products catalogs)
	Load Dump and Inductive Switching	—	Varistor (MLV)	AUML, MLA, MLE, MHS
			TVS Diode (AEC-Q101)	TPSMA6L
			Varistor (MOV)	CH, ZA

* Littelfuse offers a wide range of solutions designed to serve the requirements of automotive, truck, and off-road vehicle applications. Please refer to our automotive products catalogs (www.littelfuse.com/catalogs) and your Littelfuse products representative for detailed discussion about your requirements.

WHITE GOODS / APPLIANCES

Circuit Type	Function or Threat	Littelfuse Product Series	
AC Induction Motor	On / Off / Speed Control	Switching Thyristor	Alternistor Triac
AC Shaded Pole Motor Fan	On / Off / Speed Control	Switching Thyristor	EV Series Triac
AC Solenoid Valve / Lock	On / Off	Switching Thyristor	EV Series Triac
	Spike Suppression	Varistor (MOV)	LA
Brushless DC Motor Drive	DC Supply Protection	TVS Diode	1.5KE / 1.5SMC
Display / Touchscreen	ESD Protection	Varistor (MLV)	ML
Gas Ignitor	Free-Running Oscillator	Switching Thyristor	K2xxxyH Series SIDAC
	Micro-controller Fired	Switching Thyristor	EC Series SCR
Heating Element	On / Off / Variable	Switching Thyristor	HQ Series High Temp Triac
Incandescent Bulb	On / Off / Dim	Switching Thyristor	L-Series Triac
LED Indicator / Light	ESD Protection	Varistor (MLV)	ML
MicroController I/O	ESD Protection	Varistor (MLV)	ML
Sensor	ESD Protection	Varistor (MLV)	ML
Switch-Mode Power Supply	AC Input Overcurrent	Fuse	Cartridge 215, 218, 877, PICO® II, TR / TE 392, 382 fuses
	Input Overvoltage	Varistor (MOV)	LA
	Output Overcurrent	Fuse	477, 977, 505 HV DC Cartridge, TE 808 HV DC, 485 Nano²® fuses
	Output Overvoltage	TVS Diode	1.5KE / 1.5SMC
Touch Keypad	ESD Protection	Varistor (MLV)	ML
		TVS Diode Array – SPA® Diodes	SP10xx
Triac Control	Overvoltage Protection	TVS Diode	1.5KE / 1.5SMC
		Varistor (MOV)	LA
Wax Motor Latch / Lock	On / Off	Switching Thyristor	EV Series Triac

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littelfuse.com
circuitprotection@littelfuse.com

EC102Nv0115