

PROTECTION DEVICES



Innovative Products for Intelligent Applications

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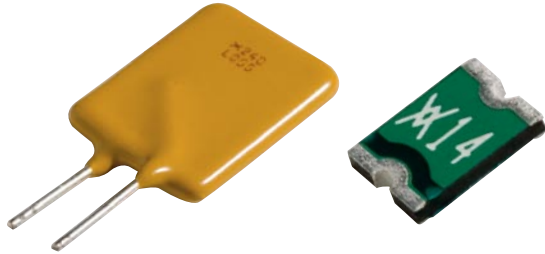


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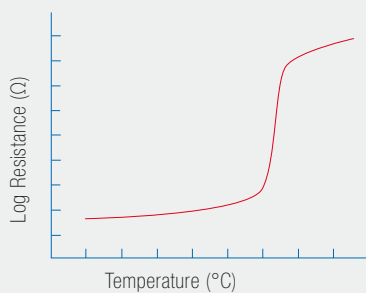


POLYSWITCH® DEVICES



„PolySwitch“ circuit protectors are conductive polymer PTC (PPTC) devices. When submitted to an electrical overload or short-circuit these devices will switch from a low resistance state to a very high resistance. PolySwitch circuit protection devices are commonly called ‚resettable devices‘ to distinguish them from traditional fuses that work only once and then have to be replaced - an expensive and inconvenient proposition. It's an excellent alternative device to ceramic PTCs, bimetallic switches and fuses. These components are RoHS compliant and lead-free solderable.

Characteristics of PolySwitch

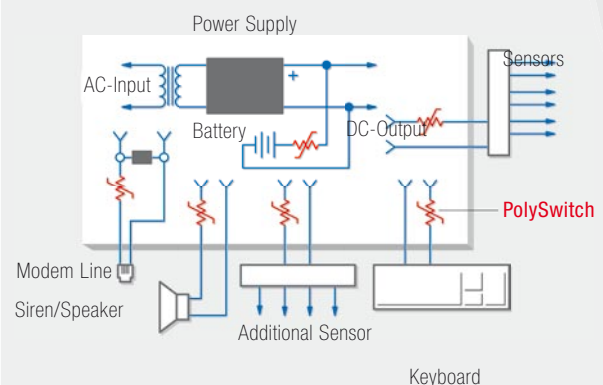


Applications

- » automotive: motors, climate controls, window opener
- » consumer electronics: multimedia, motherboards, USB hubs and ports
- » satellite receivers
- » power supplies und transformers
- » battery packs
- » telecommunication: modems, alarm systems, powered Ethernet, VoIP

	MODEL	FORM FACTOR	HOLD CURRENT (A)	VOLTAGE (V), max.
femtoSMD	SMD 0603	0.05 ... 0.16	15 ... 9	
picoSMD	SMD 0805	0.10 ... 1	15 ... 6	
nanoSMD	SMD 1206	0.12 ... 2	48 ... 6	
microSMD	SMD 1210	0.05 ... 2	30 ... 6	
miniSMD	SMD 1812	0.10 ... 3	60 ... 6	
midSMD	SMD 2018	0.30 ... 2	60 ... 6	
SMD	SMD 2920	0.30 ... 3	60 ... 6	
SMD2	SMD 3425	1.50 ... 2.5	33 ... 15	
RGEF	disk, radial leaded	2.50 ... 14	16	
RHEF	disk, radial leaded	0.50 ... 15	30 ... 16	
RUEF	disk, radial leaded	0.90 ... 9	30	
RKEF	disk, radial leaded	0.05 ... 5	60	
RXEF	disk, radial leaded	0.05 ... 3.75	72	
LVR	disk, radial leaded	0.05 ... 2	240	

Application: Short-circuit/inverse-polarity protection



VARISTORS (MOV/MLV)

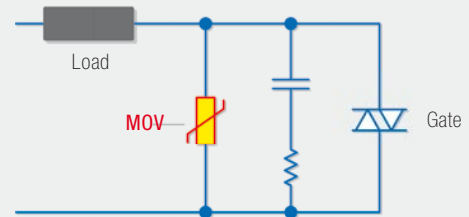


Metal Oxide Varistors are a cost effective solution to protect a circuit against over voltage transients. Due to their soft I/V derating and high surge capability they are perfectly suited in applications with a wide protection level and high energy like power supplies and power line applications.

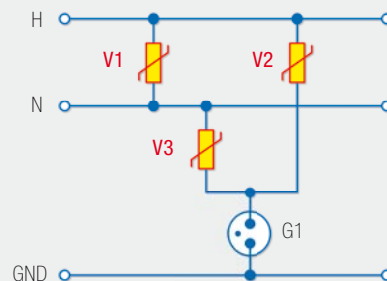
Multi Layer Varistors are in general SMD parts and designed for a lower voltage range. Due to their construction they can handle high impulse currents in a small volume. With a response time of about 0.5 ns and low capacity they are ideal for the protection of high speed data lines.

MODEL	FORM FACTOR	DC WORKING VOLTAGE (V)	PEAK CURRENT (A) (8/20µs)
SFI0402ML	SMD 0402	5.5 ... 18	20
SFI0603ML	SMD 0603	5.5 ... 38	30
SFI0805ML	SMD 0805	5.5 ... 45	80 ... 100
SFI1206ML	SMD 1206	5.5 ... 85	100 ... 200
SFI1210ML	SMD 1210	18 ... 85	250 ... 400
SFI1812ML	SMD 1812	18 ... 45	500 ... 800
SFI2220ML	SMD 2220	18 ... 38	1000 ... 1200
SFI08CH	SMD 3225	45 ... 385	250 ... 500
ACPA05D	disk, ø 5 mm	18 ... 680	100 ... 400
ACPA07D/H	disk, ø 7 mm	18 ... 680	250 ... 1750
ACPA10D/H	disk, ø 10 mm	18 ... 1100	500 ... 3500
ACPA14D/H	disk, ø 14 mm	18 ... 1100	1000 ... 6000
ACPA20D/H	disk, ø 20 mm	18 ... 1800	2000 ... 10000
ACPA25D/H	disk, ø 25 mm	27 ... 1100	3000 ... 15000
ACPA32D	disk, ø 32 mm	200 ... 1100	25000
ACPA40D	disk, ø 40 mm	200 ... 1100	40000
ACPA53D	disk, ø 53 mm	200 ... 1100	70000

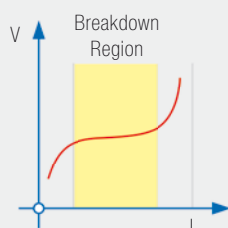
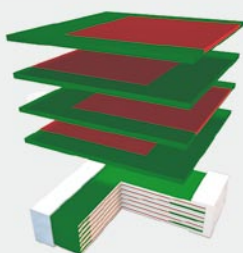
Application MOV – TRIAC-protection



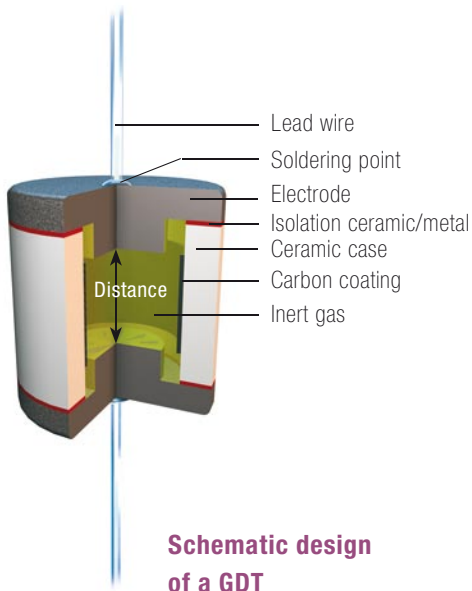
Application MOV – power line protection



MLV – schematic design / characteristics

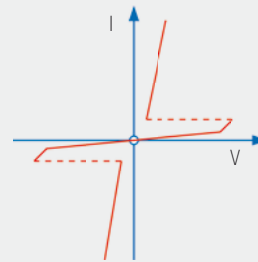


GAS DISCHARGE TUBES (GDT)

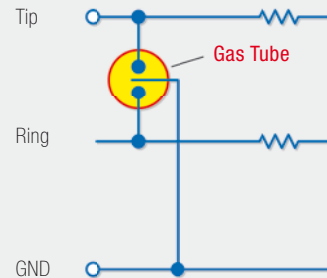


A **Gas Tube Arrester (GTA)** is a surge absorber featuring low capacitance and high surge absorption energy. It consists of a sealed tube in which inert gas is injected and electrodes which are set at fixed intervals. The simple structure and the dimensional accuracy offer high reliability and stable characteristics.

Characteristics



Application: Telecommunication



MODEL	NUMBER OF ELECTRODES	DIAMETER (mm)	DC BREAKDOWN VOLTAGE (V)	PEAK CURRENT (kA), (8/20 μ s)
GTCs23	2	3	75 ... 400	1
GTCx25	2	65	75 ... 600	2.5
GTCx26	2	6	75 ... 600	5
GTCx28	2	8	75 ... 600	5 ... 20
GTCx35	3	5	75 ... 600	5
GTCx36	3	6	75 ... 600	5 ... 10
GTCx37	3	7	75 ... 600	10
GTCx38	3	8	75 ... 600	10
SFI4532G	2	SMD	75 ... 600	2

Other sizes and characteristics on request!

POLYZEN DEVICES



PolyZen devices are polymer protected precision Zener diode micro-assemblies. An advanced feature of the PolyZen micro-assembly is that its Zener and follow-on electronics are additionally protected by a resistively non-linear, polymer PTC (positive temperature coefficient) layer. They offer resettable protection against multi-watt fault events that requires no special heat sinking.

Benefits

- » helps to shield downstream electronics from overvoltage and reverse bias
- » trip events shut out overvoltage and reverse bias sources
- » analog nature of trip events minimize upstream inductive spikes
- » helps to reduce design costs with single component placement and minimal heat sinking requirements
- » integrated device construction
- » RoHS compliant

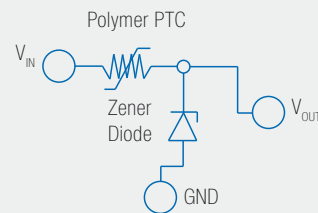
Applications

- » DC power port protection for systems using barrel jacks for power input
- » DC power port protection in portable electronics
- » internal overvoltage and transient suppression

Features

- » overvoltage transient suppression
- » stable V_z vs. fault current
- » time delayed, overvoltage trip
- » time delayed, reverse bias trip
- » power handling up to 100 W
- » integrated device construction

Internal circuit



MODEL	CLAMPING VOLTAGE (V)	HOLD CURRENT@ 20°C (A)	MAX WORKING VOLTAGE (V)	MAX DIODE CURRENT (A)
ZEN056V130A24LS	5.6	1.30	24	+10 / -40
ZEN065V130A24LS	6.5	1.30	24	+6 / -40
ZEN098V130A24LS	9.8	1.30	24	+3.5 / -40
ZEN132V130A24LS	13.4	1.30	24	+2 / -40
ZEN164V130A24LS	16.4	1.30	24	+1.25 / -40
ZEN056V230A16LS	5.6	2.30	16	+5 / -40
ZEN065V230A16LS	6.5	2.30	16	+3.5 / -40
ZEN132V230A16LS	13.4	2.30	16	+2 / -40
ZEN056V075A48LS	5.6	0.75	48	+10 / -40
ZEN132V075A48LM	13.4	0.75	48	+2 / -40
ZEN056V115A24LS	5.6	1.15	24	+10 / -40
ZEN056V130A24GS	5.6	1.30	24	+6 / -40
ZEN059V130A24LS	5.9	1.30	24	+6 / -40

TVS-DIODES / - ARRAYS



TVS – and steering diodes are silicon based protection devices. Due to their very short response time and exact limitation of the voltage they are well appropriated for the protection of semiconductor devices. These low capacitance devices also permit the protection of high speed data lines like Ethernet.

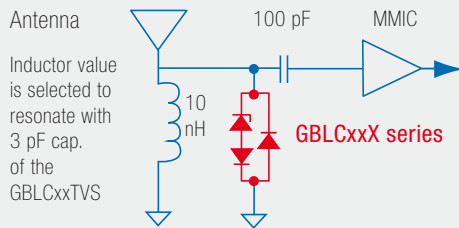
APPLICATIONS

TYPICAL INTERFACES

SUGGESTED PARTS

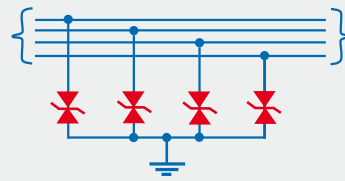
Computer Systems Set-Top Boxes Mobile Devices Telecom & Datacom Equipment Base Station Aviation / Military Automobile Test & Measurement Medical Industrial Controls Homeland Security Point of Sale	USB2.0 / USB1.1	PLR0502, PLR0504, GBLC05, USB208
	FireWire (IEEE1394)	GBLCxxC, PLC497
	10/100/1000BaseT Ethernet	GBLCxxC, SLVDA2,8LC, SLVU2,8-4, GBLCxxCI, SMDAxxLC, ET724
	Video	GBLCxxC, MSMF05LC, VSMF05LC, VSMF05LCC, USB004, USB208, ET721, ET724
	Audio	PSOTxxC series, USB004, ULC04 series
	Modem, ADSL	PP-SM series, USB004, USB208
	Serial Port (RS-232, RS-422)	PSOTxxC series, SMFxxC series, PSM712, SM8LC series
	Parallel Port (IEEE1284)	SM16LC series, PMMAD series, U040 series
	Battery/Charge Connector	PSD series, PLW series
	XDSL	GBLC series, PP-SM series, USB004
	Keyboard	RSB6,8S, MSMF05LC, VSMF05LC, ESDx-DFN
	Memory Card	EM6D, MSMF05C, ULC04 series
	Edge Connector	MSMF05C, SFC05-4, VSMF05LC, ET724, USB04xx series
	AC/DC Power	15KPA series, 30KPA series
Sensors	PD10862, PSOTxxC series, SMFxxC series, ET724, USB208	

Application: Antenna protection

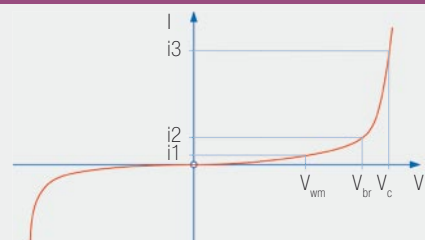


Application: Set-top box data line

Protection using Low-Cap bidirectional TVS Array **ESDA05C-4** 15 pF



Characteristic



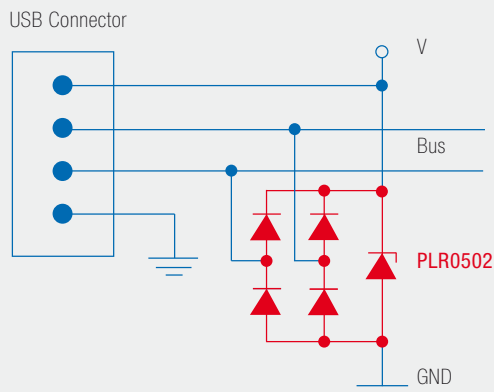
STEERING DIODES / TVS COMBOS



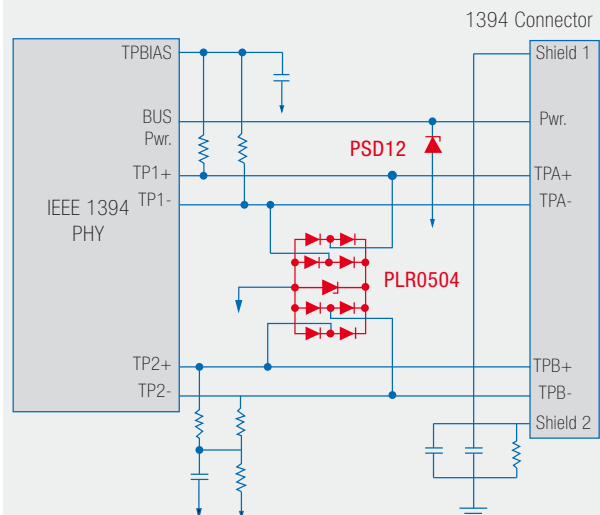
Steering diodes/TVS combos are designed to protect high speed serial interface applications, which require a very low capacitance loading. The embedded TVS functions to protect the VCC bus, the steering diodes steer the ESD event to either VCC or GND. Other applications include PCiX ports, USB2.0 ports, IEEE-1394 serial ATA, DVI/HDMI ports, digital recorders, DVD-RV drives and test- and communication equipment.

APPLICATIONS	TYPICAL INTERFACES	SUGGESTED PARTS
Computer Systems	USB2.0 / USB1.1	PLR series, PSR05, SRV04-5, SR2.8
Set Top Boxes	FireWire (IEEE1394), DVI	PLR series
Mobile Devices	Modem	PLC03-3.3
Telecom & Datacom	Sensor / Detector	SVR05-4, PSR05
Test & Measurement	HDMI	PLR series, TVUMSOP04AD0
Medical	10/100 BaseT Ethernet	PLC03-3.3, PLC03-6, SVR05-4
Homeland Security	1000 BaseT Ethernet	PSRDA-4 series, PSRDA-6 series, PLC01-6, PLC03-3.3, PLC03-6, SRV05-5
Point of Sale	T1/E1, T3/E3	PLC01-6, PLC03-3.3, PLC03-6
	LCD Display	ESD4-DFN, EM8Q-100

Application: USB-Interface



Application: IEEE-1394 Interface



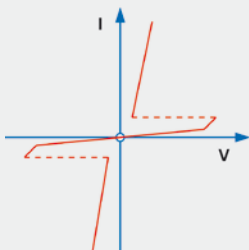
POLYMER ESD PROTECTION DEVICES / THYRISTORS



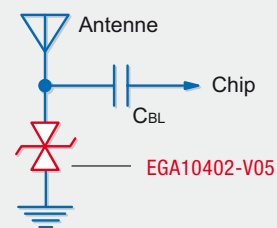
Thyristors are crowbar devices and are based on silicon or polymer material. Due to their crowbar characteristic they are able to handle high surge current at higher trigger voltage. The special polymer thyristors have a capacitance of 0,2 pF and are designed for ESD-protection of RF-applications.

MODEL	REPETITIVE PEAK OFF-STATE VOLTAGE (V)	TRIGGER VOLTAGE (V)	I_{PP} (A) @ 10x100µs	PACKAGES	CAPACITANCE (pF) @ 0 V
PPxxxxSA	58 ... 300	77 ... 400	50	SMB	30 ... 60
PPxxxxSB	25 ... 300	40 ... 400	80	SMB	30 ... 110
PPxxxxSC	58 ... 300	77 ... 400	100	SMB	60 ... 120
PESD0402-140	14	250		SMD 0402	0.25
PESD0603-240	24	215		SMD 0603	0.25
PESD1206Q-240	24	250		SMD 1206	0.25
EGA10402V05	5	150		SMD 0402	0.2
EGA10402V12	12	300		SMD 0402	0.2
EGA10603V05	5	150		SMD 0603	0.2
EGA10603V12	12	150		SMD 0603	0.2
EGA10603V24	24	300		SMD 0603	0.2
EGA41206V12	12	150		SMD 1206	0.2

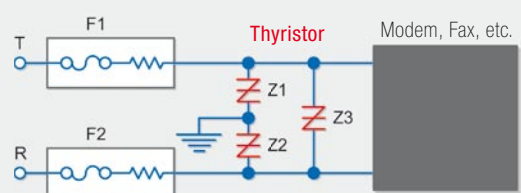
Characteristics



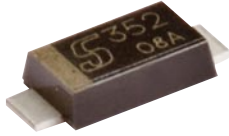
Application: Antenna-input



Application: Analog communication devices



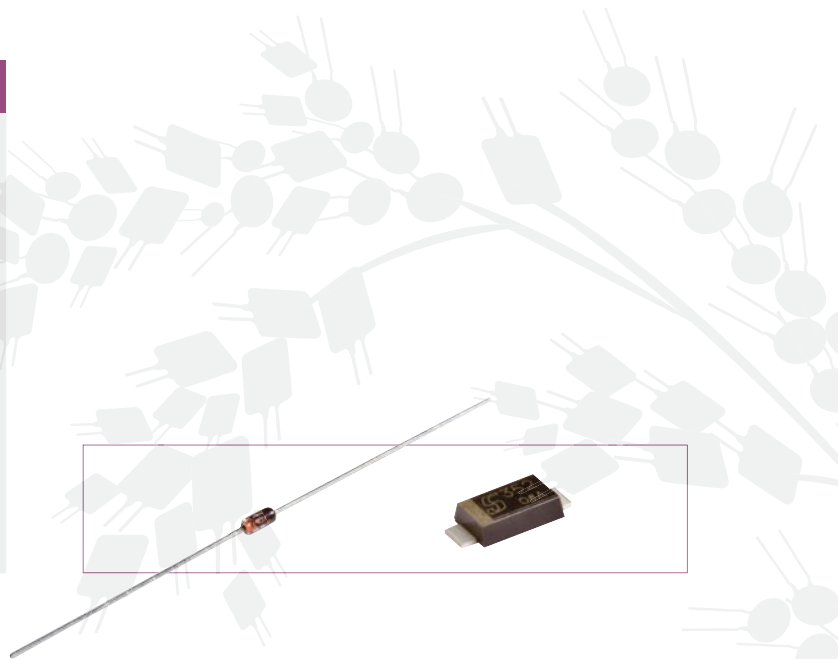
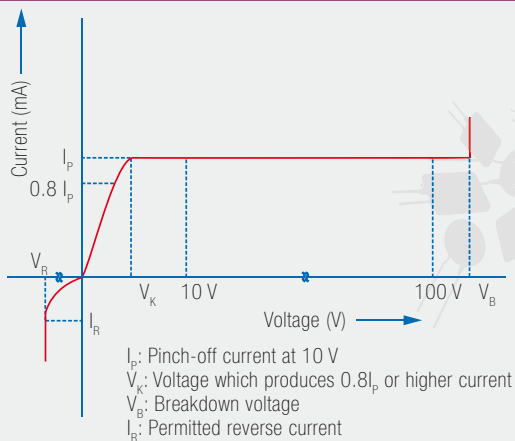
CURRENT REGULATIVE DIODES (CRD)



A **CRD** is a diode which supplies constant current to an electric circuit, even when power supply voltage fluctuations or load impedance fluctuations occur. CRD are used for current stabilization and limitation.

MODEL: SMD CHIP	MODEL: AXIAL LEADED	RATING VOLTAGE, max. (V)	PINCH-OFF CURRENT I_p (mA)
S-101	E-101	100	0.05 ... 0.21
S-301	E-301	100	0.20 ... 0.42
S-501	E-501	100	0.40 ... 0.63
S-701	E-701	100	0.60 ... 0.92
S-102	E-102	100	0.88 ... 1.32
S-152	E-152	100	1.28 ... 1.72
S-202	E-202	100	1.68 ... 2.32
S-272	E-272	100	2.28 ... 3.10
S-352	E-352	100	3.00 ... 4.10
S-452	E-452	100	3.90 ... 5.10
S-562	E-562	100	5.00 ... 6.50
S-822	E-822	50 / 30	6.56 ... 9.84
S-103	E-103	50 / 30	8.00 ... 12.0
S-123	E-123	50 / 30	9.60 ... 14.4
S-153	E-153	50 / 25	12.00 ... 18.0
S-183	E-183	40 / 25	16.00 ... 20.0

Basic characteristic



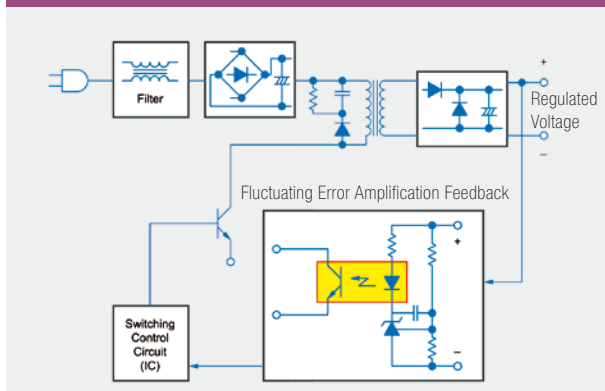
PHOTOCOUPLER / - TRIACS



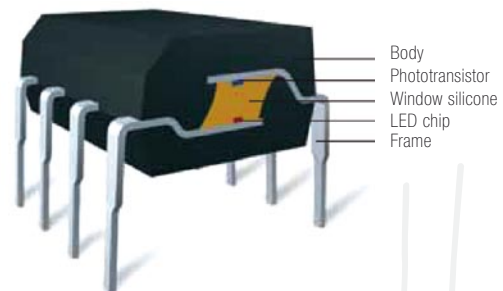
A **photocopler /-triac** optically links, via a transparent isolating material, an infrared LED and a photodetector within one housing. Usually this detector is a phototransistor or a photodiode with some additional amplifiers. These devices are used for galvanic separation and protection of the inputs of micro-controllers. The couplers are approved according to the most important safety approvals like VDE or UL.

MODEL	OUTPUT TYPE	PACKAGE	INPUT CURRENT (mA)	$V_{CE0} N_{DRM}$ (V)	V_{ISO} (V)
K / EL	Transistor	SMD, DIP	10 ... 50	30 ... 350	2500 ... 5000
KPC / EL	Transistor	SOP	50	35 ... 300	3750
KPS / EL3H	Transistor	SSOP	50	40 ... 300	3750
KMOC	Triac	SMD, DIP	50	400 ... 800	5000
KTLP	Triac	SOP	50	400 ... 800	2500 ... 5000
4N / H11	Darlington	DIP	60	35 ... 55	5000
KPC6N / 6N	High Speed	SMD, DIP, SOP			2500 ... 3750

Application: Switch mode power supply



Schematic design of a photocopler



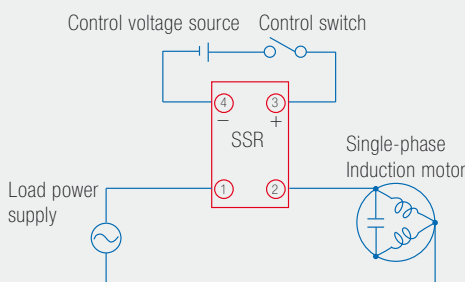
SOLID STATE RELAYS (SSR)



A **Solid State Relay (SSR)** with MOSFET or triac output is a device with a function similar to a mechanical relay, but purely on semiconductor-, non-mechanical basis. An infrared-LED is coupled optically to a Power MOSFET or triac within one housing. Most of the SSR with triac are available with zero-crossing circuit. This internal circuit leads to the on- or off-switching of the triac only when the applied alternating voltage is near the zero-value. There are MOSFET SSRs available with switching behaviour: normal open and normal closed.

MODEL	OUTPUT	PINS	TYPE	LOAD VOLTAGE (V)	LOAD CURRENT (mA)	ON RESISTANCE (Ω)	ISOLATION VOLTAGE (Vrms)
KAQY2	MOSFET	4	Normal Open	60 ... 600	120 ... 400	0.83 ... 40	1500 ... 5000
KAQV2	MOSFET	6	Normal Open	60 ... 600	120 ... 400	0.83 ... 40	1500 ... 5000
KAQW2	MOSFET	8	Normal Open	60 ... 600	120 ... 400	0.83 ... 40	1500 ... 5000
KAQY4	MOSFET	4	Normal Close	60 ... 400	130 ... 200	2.50 ... 25	1500 ... 5000
KAQV4	MOSFET	6	Normal Close	60 ... 400	130 ... 200	2.50 ... 25	1500 ... 5000
KAQW4	MOSFET	8	Normal Close	60 ... 400	130 ... 200	2.50 ... 25	1500 ... 5000
KAQW6	MOSFET	8	Normal Open + Normal Close	60	35 ... 300	2.50 ... 25	1500 ... 5000
KSA	TRIAC	4	AC Input / AC Output	250 ... 480	10 ... 40 A		4000
KSD	TRIAC	4	DC Input / AC Output	250 ... 480	3 ... 40 A		4000
EPR2	MOSFET	4	Normal Open / Normal Close	20 ... 600	50 ... 2000		3500
EPR3	MOSFET	6	Normal Open / Normal Close	20 ... 600	50 ... 2000		3750
EPR4	MOSFET	8	Normal Open / Normal Close	20 ... 600	50 ... 2000		3750
ESR2	TRIAC	4	DC Input / AC/DC Output	24 ... 380	3000 ... 7000		2500 ... 4000
ESR3	TRIAC	4	DC Input / AC/DC Output	24 ... 240	2000 ... 4000		2500 ... 4000
ESR4	TRIAC	4	DC Input / AC/DC Output	0 ... 265	1000 ... 4000		2500 ... 3750
ESR5	TRIAC	4	DC Input / AC/DC Output	120 ... 480	10 ... 40 A		3500

Application: Single-phase induction motor control



FUSES AND HOLDERS



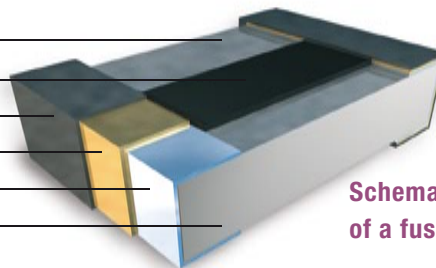
Miniature fuses, subminiature fuses, pico fuses, SMD (Chip) fuses and car fuses are self-acting break appliances for the protection of electrical devices against unsuitable current loads. The current will be interrupted by melting of the fuse wire.

Miniature fuses are available in very quick-acting (FF), quick-acting (F), medium time-lag (M), time-lag (T) and super time-lag (TT) characteristics.

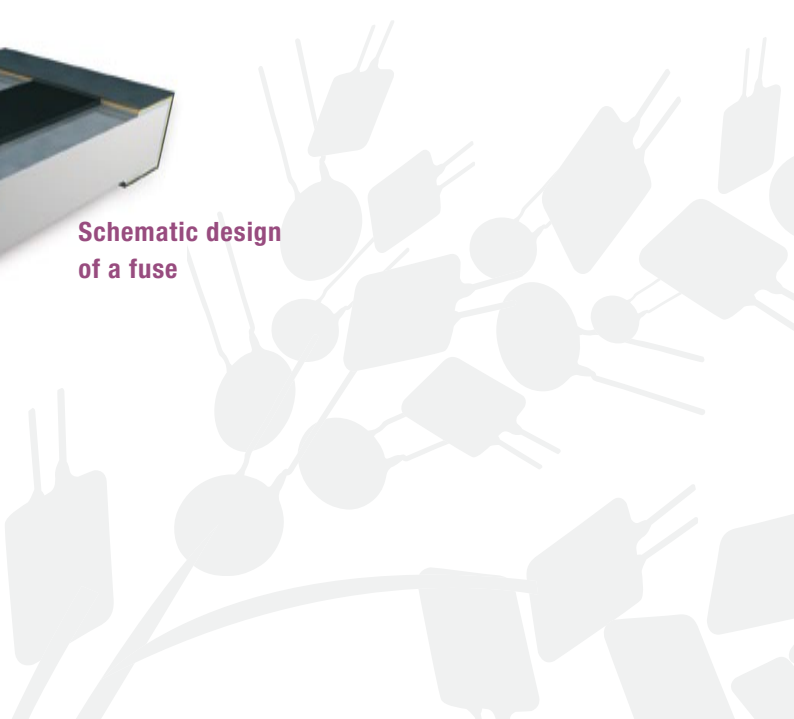
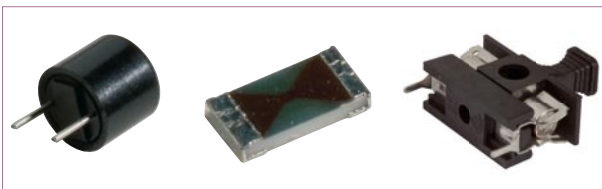
	MODEL	SIZE	RATED CURRENT (A)	RATED VOLTAGE (V)	BREAKING CAPACITY (A)	CHARACTERISTICS
SMD	0402		0.500 ... 4	24		FF
SMD	0603		0.500 ... 6	32		FF, T
SMD	0805		0.500 ... 4	32		FF
SMD	1206		0.500 ... 8	24 ... 63		FF, T
Tube, glass/ceramic	∅ 5 mm × 15 mm		0.100 ... 7	250	35 ... 400	F, T
Tube, glass/ceramic	∅ 5 mm × 20 mm		0.032 ... 20	250	35 ... 1500	FF, F, M, T, TT
Tube, glass/ceramic	∅ 5 mm × 25 mm		0.032 ... 16	250	50 ... 1500	F, M
Tube, glass/ceramic	∅ 6.3 mm × 32 mm		0.032 ... 25	250 ... 500	35 ... 10000	FF, F, M, T
Subminiature	∅ 8.35 mm × 7.7 mm		0.080 ... 6.3	250	35	F, T
Subminiature	8.35 mm × 4.0 mm × 7.7 mm		0.080 ... 6.3	250	35	T
Pico	different sizes		0.063 ... 15	125 ... 250	35 ... 300	F, T

Other sizes and characteristics on request!

- Protective overglaze
- Element
- Tin plating
- Nickel barrier
- Silver metalization
- Ceramic substrate



Schematic design of a fuse



THERMAL CUTOFFS (TCO)



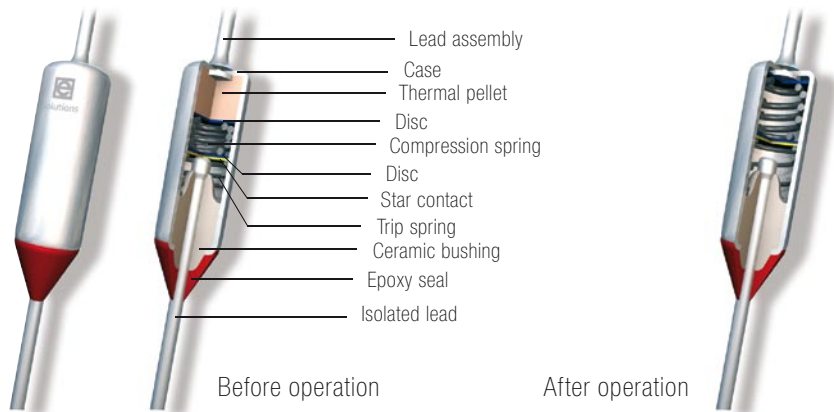
Thermal cutoffs also known as thermal fuses, thermal links, or TCO are widely used to prevent damage from overheating in electrical products.

The active component of a thermal cutoff is a fusible alloy surrounded by a special resin. Under normal operating temperatures the fusible alloy joins the two lead wires within the body of the cutoff. When the preset temperature of the cutoff is reached, the fusible alloy melts and with the aid of the special resin, a complete cutoff is ensured.

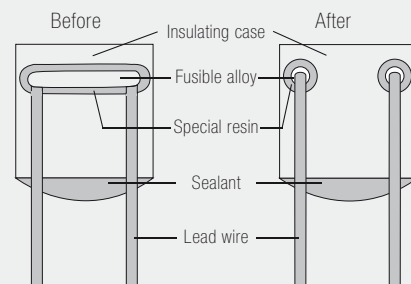
Or simply: Thermal Cutoffs provide non-resetting protection against overheating by interrupting an electric circuit when the operating temperature exceeds the rated temperature.

MODEL	RATED CURRENT (A)	RATED VOLTAGE (V)	RATED FUNCTIONING TEMPERATURE (°C)
Axial leaded	5 ... 25	250	70 ... 240
Radial leaded	1 ... 5	250	65 ... 187

Schematic design of a thermal cutoff



Construction of radial type



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