Table of Contents

This catalog showcases the products we have developed specifically for the telecommunications industry. It also provides application information to give you a better understanding of the variety of circuit protection technologies available to meet your needs.

For more information about other Littelfuse products, contact your local Littelfuse representative or visit the Littelfuse web site at:

www.littelfuse.com

Introduction
Telecom System Protection

As the only manufacturer of resettable PTCs, sub-miniature and surface mount fuses, traditional fuses, and overvoltage devices, Littelfuse provides protection solutions to any telecom overcurrent and overvoltage circuit protection application.

Overcurrent Protection

The circuit designer has a choice of technologies when faced with the task of providing overcurrent protection. Traditional current limiting fuses and Polymer based PTC (Positive Temperature Coefficient) devices represent the most common and reliable choices of circuit protection. Understanding the differences in these two devices can be the best method in determining the proper protective device for the application.

A fuse is a device that reacts to excessive currents (overloads and short circuits) by melting its internal link. This stops the flow of current. The fuse must be replaced after operating but, because of its design, it is guaranteed to react instantly to excessive currents, minimizing damage to a circuit. It also has no moving parts and is not subject to mechanical fatigue like a circuit breaker.

A PTC is a resettable overload device that reacts to excessive currents by increasing its resistance, minimizing the flow of current. Unlike fuses, PTCs can be reset to their low resistance state by removing power and allowing them to cool down. Because of their resettability, PTCs are being used in more and more telecom applications where fuse replacement is impractical.

The following Littelfuse products have been developed for protecting telecom applications:

Tele-GARD™ Fuses

Littelfuse TLS, TLN, and L17T Series Tele-GARD telecom fuses were developed specifically for the protection of 170 VDC, 100,000 A.I.R. telecom circuits. All Tele-GARD fuses are safe, reliable, high performance devices that are engineered to provide current limiting protection to the cables and equipment found within a power distribution system.

Alarm Indicating Fuse

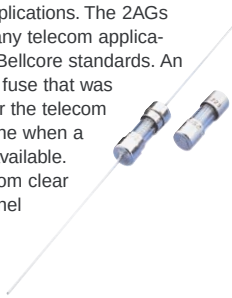
Our 481 Series alarm indicating fuses are used in telecommunications and control panel applications from 60 VDC and up to 20A. They feature a color coded flag that immediately identifies when a fuse has opened. The colors conform to telecom standards for easy determination of the amperage. Clear plastic lenses are available for additional safety.

Telecom Nano²® Fuse

This fuse meets UL and Bellcore standards for protection from lightning and power cross. It's small size makes it ideal for many applications such as desktop modems, telephones, answering machines, and other slim profile products. This fuse is rated for 250V applications and is designed to meet UL1459/1950 3rd edition, Bellcore CR-1089-CORE, and FCC 47 Part 68 Surge Specifications.

2AG Slo-Blo® Fuse

The 229 and 230 Series 2AG Slo-Blo fuses are offered in cartridge and axial leaded forms for a variety of applications. The 2AGs are currently used in many telecom applications and meet UL and Bellcore standards. An indicating version of the fuse that was developed specifically for the telecom industry to help determine when a fuse has blown is also available. The fuse's body turns from clear to brown to help personnel quickly identify when it needs replacement.



PTC Devices

Littelfuse's 1812L, 3425, 30R, and 60R Series resettable fuses are available in radial and surface mount configurations for a variety of telecom applications up to 60V. The devices protect sensitive circuits by using Polymer technology to virtually stop the flow of current when damaging current levels appear. Once the levels return to normal and the devices cool down, they return to their normal state and allow current to pass through.

Introduction
Telecom System Protection

Overvoltage Protection

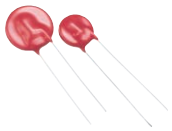
As with overcurrent protection, today's designers have numerous options available to protect their products from the damaging effects of overvoltage events. The threats can come from several sources including lightning strikes (both direct and induced) and electrostatic discharge (ESD). While the energy and source for these transients are completely different, their effects are the same; if provisions are not taken to guard against them, they can destroy electronic equipment.

Littelfuse offers a complete line of overvoltage suppression products to safeguard electronic equipment. The technologies include metal oxide varistors (MOVs), silicon SCR diode arrays, thyristors and voltage variable polymer devices. These devices will either clamp the transient to a tolerable level or crowbar the transient to ground.

Metal Oxide Varistors (MOVs)

These devices employ a semiconducting polycrystalline ceramic structure that clamps a transient to some safe level during a fault. The device is normally in a high impedance state, but switches to a low impedance state during a transient. Littelfuse offers devices in a variety of package options, from a '0603' chip package (capable of being used in portable devices) to large industrial packages (which can be bolted to the framework of large machines). The options also include radial leaded disc packages from 7 to 20mm.

The energy handling capability of these devices range from 100mJ in a surface mount chip package to over 1000 J in a large industrial package. Operating voltages are available from 3 to 1000V, depending upon package.



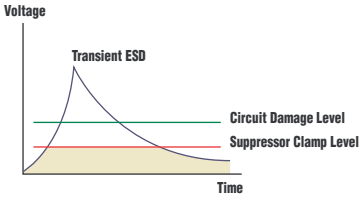
Thyristors/Surgectors

These devices employ silicon technology in various packages to crowbar the effects of induced lightning strikes in telecommunications devices. Littelfuse offers both leaded and surface mount versions in both unidirectional and bidirectional versions. These devices are traditionally used after the overcurrent protector on the front-end of the circuit and use of these parts allow the designer to meet the requirements of several current telecommunications standards.

ESD Protection

Data transmission lines are extremely susceptible to Electrostatic Discharge (ESD) events. ESD events can reach peak voltages of 25KV and currents of 100A in less than one nanosecond, causing tremendous damage to electronic devices that use microprocessors and other sensitive electronic circuitry. For this reason, ESD suppressors are used to temporarily shunt the flow of current to ground so that it does not enter the electronic circuitry.

TYPICAL ESD EVENT

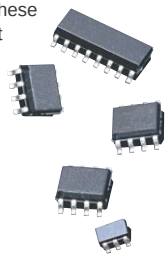


Voltage Rise Time vs.
Suppressor Clamp Level

One of the drivers for ESD protection globally are the requirements outlined in the IEC 61000-4-2 specification, which outlines specific immunity levels for devices shipping into member communities. The Littelfuse portfolio has options available to allow transparent protection for data rates up to 3000Mbit/sec. The capacitance levels available range from 60 pico farads to 55 femto farads.

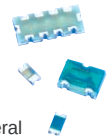
SP720 Diode Arrays

These devices are used primarily to protect data lines from the adverse effects of ESD. Littelfuse offers devices in both leaded and surface mounts packages with line provisions to protect from 4 to 14 lines. These devices will divert the transient to either power rail once the threshold voltage is exceeded. The typical energy handling capability of these devices is in the milli-joule range.



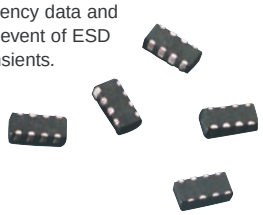
PulseGuard™

Littelfuse's PGB series PulseGuard ESD suppressors use Polymer composite voltage varying material to provide protection. Under normal circuit operating conditions, the ESD suppressor remains in a high resistance state that is transparent to the circuit. However, when an ESD transient develops, the suppressor's resistance drops sharply, shunting the ESD current away from the circuit. After the energy is dissipated, the suppressor automatically returns to its normal high resistance state. These devices are available in both single and multi-line surface mount packages, as well as array inserts to mate with several industry standard connector options.



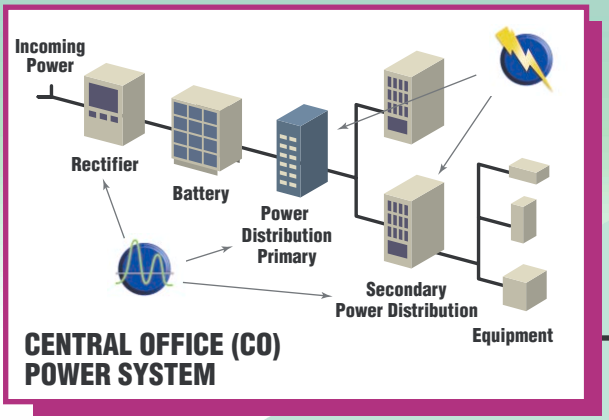
Multilayer Varistors

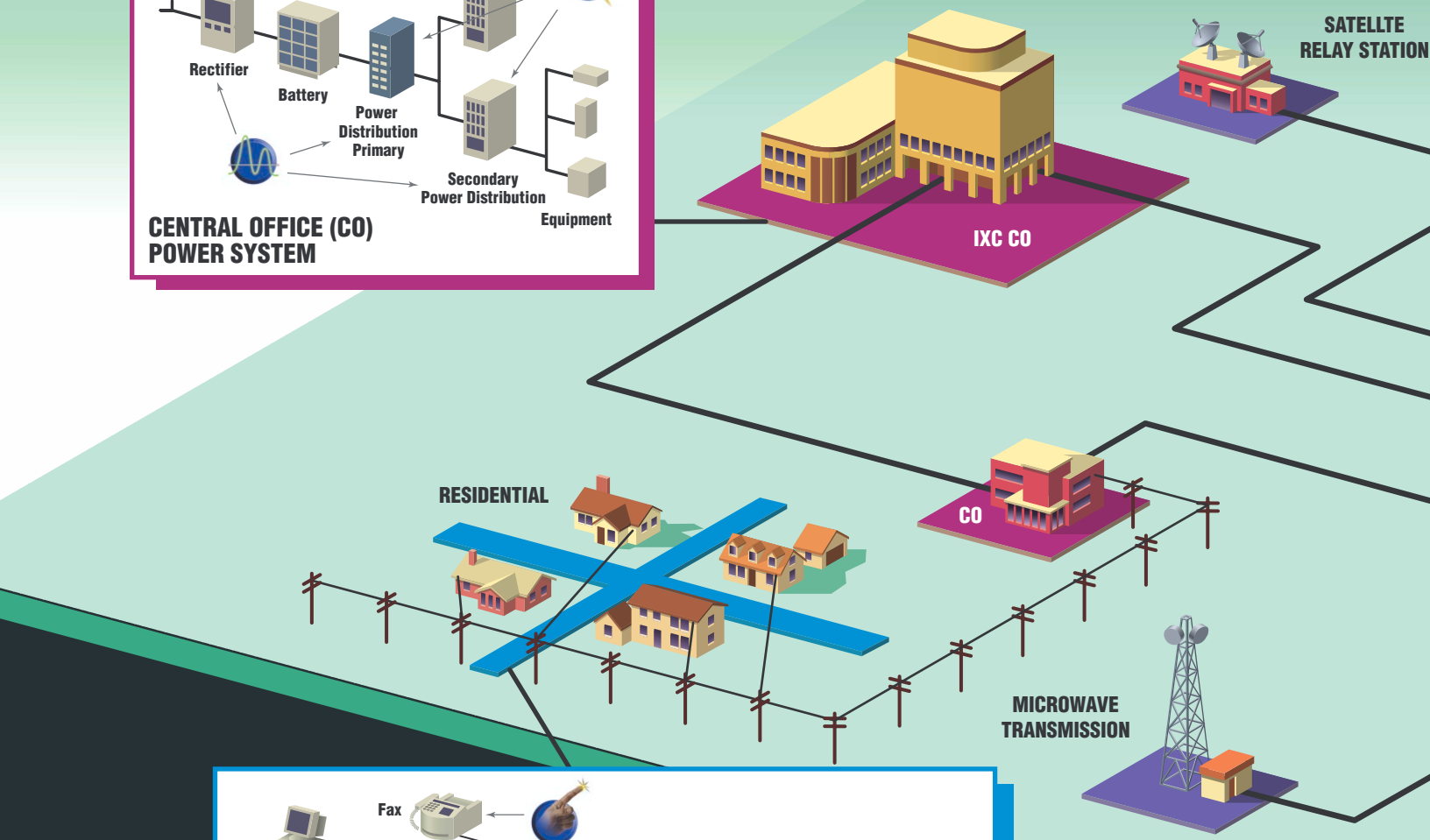
Littelfuse's multilayer varistors are ideal for the protection of board level power supply lines and low frequency data and control lines in the event of ESD or high-energy transients.

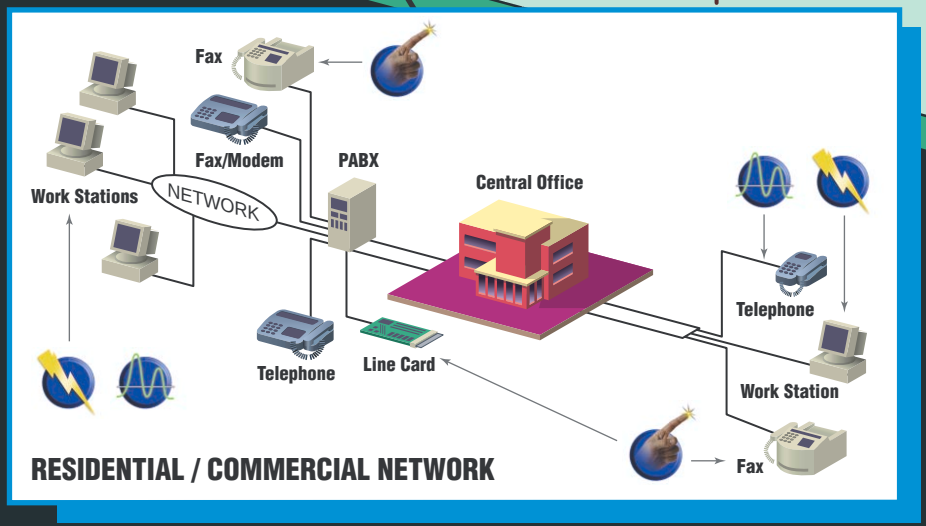


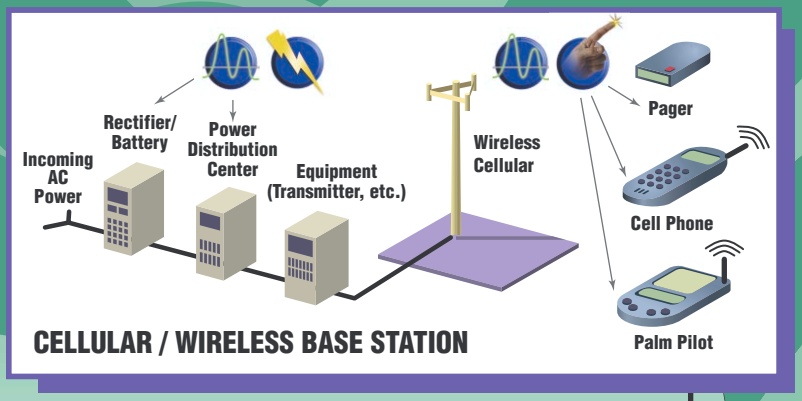
Fuse Applications

As a leading manufacturer of overcurrent, overvoltage, and ESD protection devices, Littelfuse understands the importance of circuit protection in communications systems. Whether you're protecting phones, faxes, modems, PBX's, or power distribution systems, Littelfuse has a product specifically designed for your application.









RESIDENTIAL

WIRELESS CELLULAR

MTSO CO

ILEC CO

WIRELESS CELLULAR BASE STATION

REMOTE SITE / NODE

REMOTE SITE / NODE

COMMERCIAL

ESD

Overcurrent

Overvoltage

GLOSSARY

CLEC (Competitive Local Exchange Carrier) A competitor to local telephone companies that has been granted permission to offer local telephone service. CLECs compete with independent and Bell telephone companies.

CO (Central Office) The location that contains equipment to route calls to and from customers. It also connects customers to Internet Service Providers and long distance carriers.

LEC (Local Exchange Carrier) Any company authorized by the state public utility commission to sell local telephone service.

MTSO (Mobile Telephone Switching Office) This location contains all the equipment required for mobile wireless communications.

PBX (Private Branch Exchange) A private telephone switching system, usually located on a customer's premises, that provides intra-premises exchange telephone service, as well as access to the public exchange network and/or private facilities.

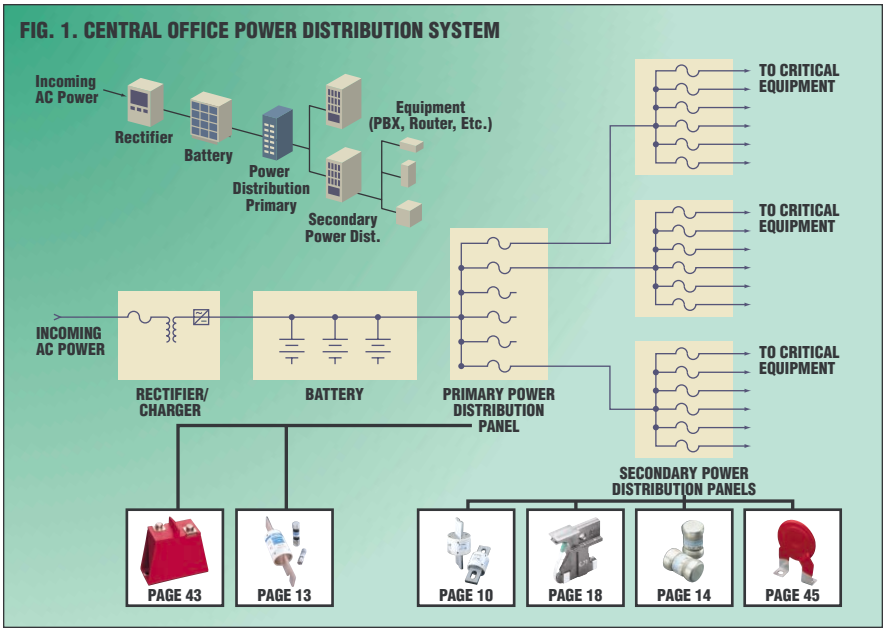
RBOC (Regional Bell Operating Company) Regional Bell Operating Companies that were formed after the breakup of AT&T in 1984. Examples include: US West, Bell South, Bell Atlantic, and SBC.

Wireless Base Station A remote location next to a cellular tower that contains communication equipment to support wireless calls.

Power Distribution Protection

Central Office Protection

In order to provide uninterrupted service, telecommunications circuits utilize DC power and rely on UPS and batteries to provide immediate backup in the event of an outage. Littelfuse's Tele-GARD™ series fuses have been specifically designed for DC applications to protect these systems.



The diagram in Figure 1 illustrates a typical power distribution system found within most telephone Central Offices (COs). Smaller systems utilizing similar equipment are also found in wireless/cellular base stations, remote sites, and cellular mobile telephone switching offices (MTSOs).

Selecting Overcurrent Protection

Fuses are commonly used in the primary and secondary power distribution circuits to protect the equipment and cables, as well as the equipment operators against the damage caused by a fault. Although other forms of circuit protection are available, only current limiting fuses can react quickly enough to interrupt a fault and minimize the damaging effects. This helps ensure the reliability and continued operation of the system.

Short circuit currents can reach as high as 40,000 or 50,000A during the first 1/2 cycle (0.008 seconds) of a fault (see Figure 2).

If not limited, the tremendous amount of energy can bend buss bars, destroy bracing structures, crack insulators, and damage components. Littelfuse's current limiting Tele-GARD fuses are designed to open and clear a short circuit in less than 1/2 cycle, greatly reducing the amount of damaging energy that is let through. Non-current limiting circuit breakers often require 2 to 3 cycles or more to open the circuit, permitting a huge amount of destructive short circuit energy through before opening the circuit (see Figure 3).

FIG. 2. FUSE LET-THRU CURRENT

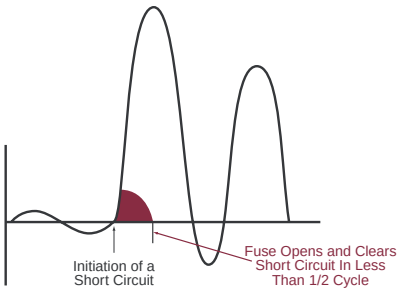
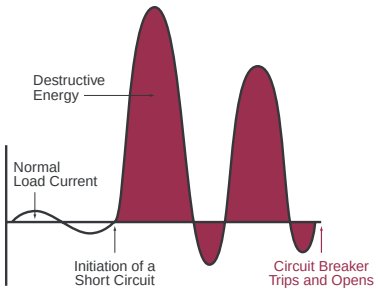


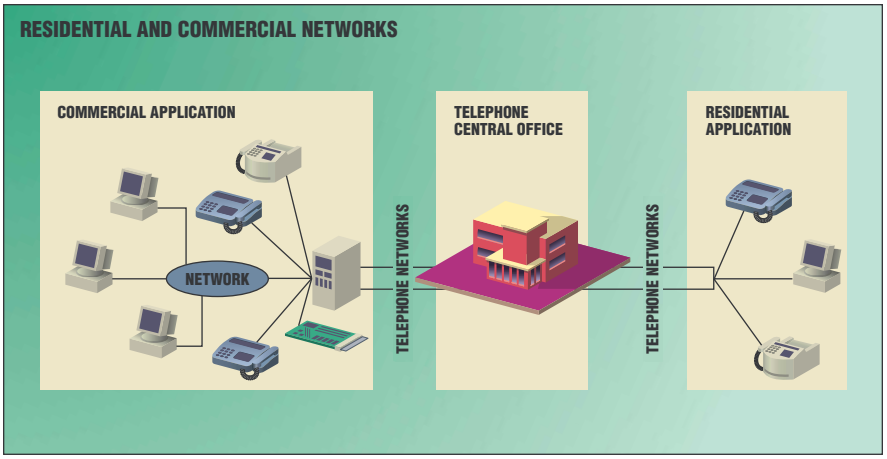
FIG. 3. CIRCUIT BREAKER LET-THRU CURRENT



Power Distribution Protection

Residential and Commercial Protection

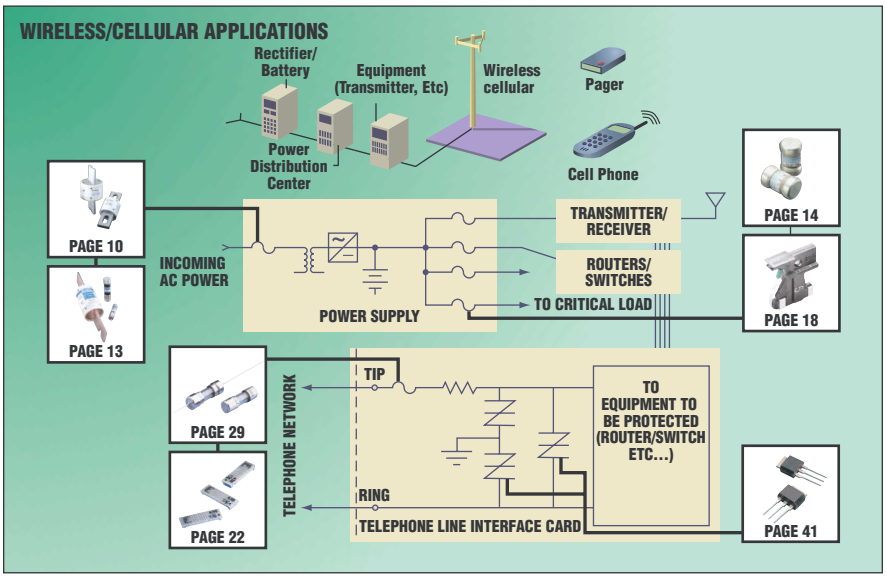
75% of all residential and commercial field equipment failures are caused by electrical overstress. Unexpected acts of nature such as lightning, ESD discharge, and powercross cause millions of dollars a year in damage to sensitive systems. For this reason, overvoltage, overcurrent, and ESD protection are used in most all of the components that are connected to a telecommunications system to ensure their reliability and continued operation.



Wireless/Cellular Protection

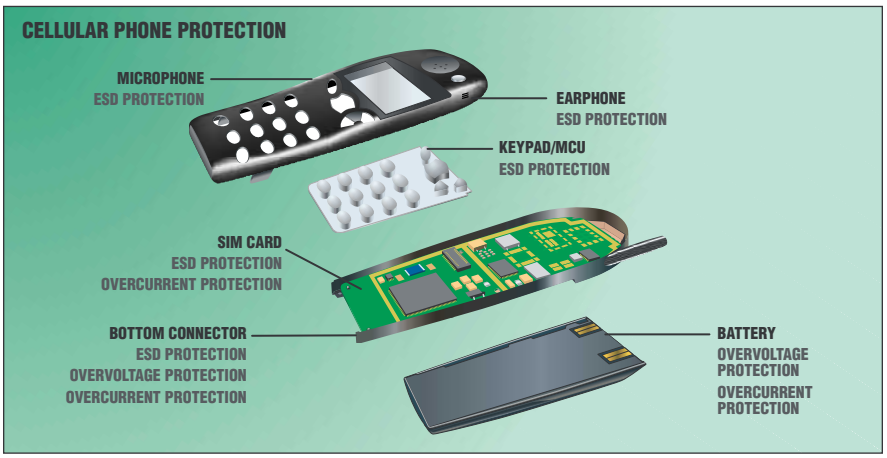
Base Station

Wireless and cellular base stations are critical pieces of the telecommunications infrastructure but are often located in remote, difficult to reach areas. This equipment must provide reliable and uninterrupted service with minimal upkeep. For this reason, multiple forms of overcurrent, overvoltage and ESD protection are used.



Portable Devices

Handheld cellular and wireless phones are particularly susceptible to power disturbances and ESD charges. Their batteries, LCD displays, bottom connectors and microphones are all critical components that require some form of circuit protection to remain in operation. As the world's leading supplier of overvoltage, overcurrent and ESD protection, Littelfuse understands this better then anyone else and has developed a complete array of protective devices for these applications.



Introduction
Summary of Telecom Standards

NEBS

NEBS (Network Equipment Building Systems) are guidelines developed by Bell Laboratories in the 1970s to assist equipment manufacturers in designing products that were compatible with the telecom environment. NEBS requirements include specifications for the physical and electrical requirements of telecom equipment to ensure their safety, compatibility, and reliability. The two documents that define NEBS requirements are GR-63-CORE for the physical requirements and GR-1089-CORE for the electrical safety and electromagnetic requirements.

UL 1459/1950

UL 1459 contains safety standards for telecommunications equipment. This includes answering machines, telephones, and private branch exchanges (PBXs) but does not include computer equipment.

Revised in 1990, the primary purpose of 1459 was to provide protection to users and service personnel from fire and shock hazards. 1459 also focuses on protecting against the hazards associated with the voltages normally present on the telephone network (48V when the receiver is lifted from the cradle, and 90 to 150VAC to ring the phone).

Test procedures require that telecommunications equipment being tested will be wrapped with a cheesecloth indicator and connected to a power source through a 1.6A time delay fuse. Several tests are conducted that simulate overvoltage, overcurrent, and power cross conditions. The device being tested must not present the risk of fire and no charring or ignition of the cheesecloth is allowed.

The purpose of the fuse or other protective device is to safely interrupt the fault before the cheesecloth is ignited. The fuse must also limit the amount of damaging energy that is passed along in the circuit.

UL 1950 3rd Edition “Safety of Information Technology Equipment” is a standard applicable to mains-powered or battery-powered information technology, electrical business and associated equipment. The device must have a rated voltage not exceeding 600V and designed to be installed in accordance with the NEC, Canadian Electric Code, and the Standards for the Protection of Electronic Equipment. It is also applicable to products connected directly to a telecommunications network to ensure the safety of the operating personnel.

UL 1950 incorporates all of the tests for UL 1459 with the exception that the fuse can be 2 amps instead of 1459’s 1.6A fuse. As of 4/1/00, all new equipment must be UL Listed to UL 1950.

FCC 47 Part 68

Part 68 “Connection of Terminal Equipment to the Telephone Network” provides protection to telephone networks from “harms caused by the connection of terminal equipment and wiring thereto” by establishing minimum allowable withstand ratings for fuses and overvoltage devices.

The most pertinent section relating to telecom fuses is Subpart D — Conditions for Registration. The focus of this subpart is environmental simulation. It contains four tests covering: vibration, temperature and humidity, shock, and surges. The temperature and humidity testing is a cyclical test varying the relative humidity (RH) and temperature for three 30 minute intervals. The surge testing consists of both metallic and longitudinal modes representing line-to-line and line-to-ground respectively. For compliance, the fuse must not open during any of these tests.

Telcordia GR-1089-CORE

Telcordia GR-1089-CORE “Electromagnetic Compatibility and Electrical Safety — Generic Criteria for Network Telecommunications Equipment” is a standard that defines the criteria for the safe and reliable operation of telecom network equipment. It is intended to help avoid equipment damage by defining withstand requirements for AC power cross, lightning, ESD, and power induction. There are several levels of tests for ensuring protection from lightning surges and AC power faults but in all cases, the device must not cause a fire or safety hazard.

There are several levels of protection in GR-1089-CORE standard but the fuse selection is determined by the type of equipment requiring protection as well as the level of protection that is needed.

First-Level Lightning Surge

The fuse will not be damaged and will continue to operate after applying the surges. A typical test surge is 1000V, 100A 10/1000µs for 50 repetitions. The testing is performed in the longitudinal mode.

Second-Level Lightning Surge

The fuse should not become a fire, fragmentation, or electrical safety hazard as a result of the application of lightning surge. The fuse is expected to open safely. Cheesecloth is used to determine if the fuse is a fire hazard. This test surge is 5000V, 500A 10/1000µs for two repetitions.

Intra-Building Lightning Surge

This test is similar to the First-Level Lightning Surge. The fuse is required to continue operation after a maximum surge of 1500V, 100A, 2/10µs for two repetitions.

First-Level AC Fault

The fuse should not be damaged and should continue to operate after the test under a wide range of short circuit conditions. This test is to determine if the circuit is immune to low level induced currents. The maximum condition that it would have to withstand is 600V, 1A for 60 (sixty) one-second pulses with the primary protector removed.

Second-Level AC Fault

The fuse will not become a fire, fragmentation, or electrical safety hazard after the Second-Level tests. The maximum condition that the circuit would have to withstand is a primary contact test at 600V, 60A for 5 seconds.

ESD Immunity Tests

This test consists of 10 (ten) discharges of each polarity at 4KV and 15KV for a total of 40 (forty) discharges. The fuse must not open during any of these tests.

power distribution

PROTECTION PRODUCTS

Littelfuse®

Telecommunications Power Fuse
L17T Series

Specifically designed for short circuit protection of telecommunications circuits, Littelfuse L17T Series fuses provide reliable protection of sensitive DC power distribution systems. Constructed with silver-plated elements for low I^2t and peak let-through, these advanced fuses virtually eliminate equipment damage due to surges and spikes. The L17T Series fuse's unique element geometry also provides cooler running temperatures, helping to minimize heat within enclosures.

Features

- 170 VDC rating
- Very fast-acting
- 70 to 1200 amperes
- Low I^2t
- Extremely current limiting
- Low operating temperature

Specifications

Voltage Rating:
170 VDC

Interrupting Rating:
100,000 amperes (UL Recognized)

Ampere Range:
70 to 1200 amperes

Recommended Fuse Blocks:
LTFD 6001 Series
LTFD 1200 Series

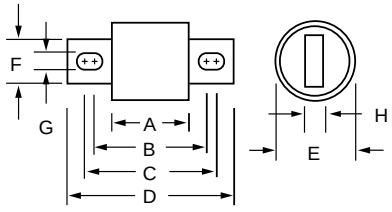


Fig. 3

Dimensions

Ampere Rating	Dimensions in Inches (mm) A	B	C	D	E	F	G	H
70 – 250	1-5/32 (29.4)	1-7/8 (47.6)	2-3/16 (55.6)	2-21/32 (67.5)	1 (25.4)	7/8 (22.2)	5/16 (7.9)	3/16 (4.8)
300 – 800	1-1/4 (31.8)	1-15/16 (49.2)	2-9/16 (65.1)	3-1/2 (88.9)	1-1/2 (38.1)	1 (25.4)	13/32 (10.3)	1/4 (6.35)
1000 – 1200	1-11/32 (34.0)	—	—	4-1/16 (103.12)	—	1-1/2 (38.1)	—	1/4 (6.35)

Ordering Information & Cross-Reference

Catalog Number	Ampere Rating	Competitor A Part Number	Competitor B Part Number
L17T 70	70	TPL-BA	TGL-BA
L17T 80	80	TPL-BB	TGL-BB
L17T 100	100	TPL-BD	TGL-BD
L17T 125	125	TPL-BE	TGL-BE
L17T 150	150	TPL-BF	TGL-BF
L17T 200	200	TPL-BH	TGL-BH
L17T 225	225	TPL-BK	TGL-BK
L17T 250	250	TPL-BL	TGL-BL
L17T 300	300	TPL-CN	TGL-CN
L17T 400	400	TPL-CR	TGL-CR
L17T 500	500	TPL-CV	TGL-CV
L17T 600	600	TPL-CZ	TGL-CZ
L17T 800	800	—	TGL-CZH
L17T 1000	1000	—	—
L17T 1200	1200	—	—

Replaces Competitor's TPL and TGL Series

Telecommunications Disconnect Switch
LTFD 6001 Series — 0 to 800 Amp

Littelfuse's compact LTFD 6001 Series holders are designed for use as a combination fuseholder and disconnect switch for telecommunications equipment. The rugged unit utilizes a pull-out fuse carrier to safely disconnect power and provide easy fuse replacement.

Features

- 145 VDC, 70 to 600 amperes
- 60 VDC, 800 amperes

Specifications

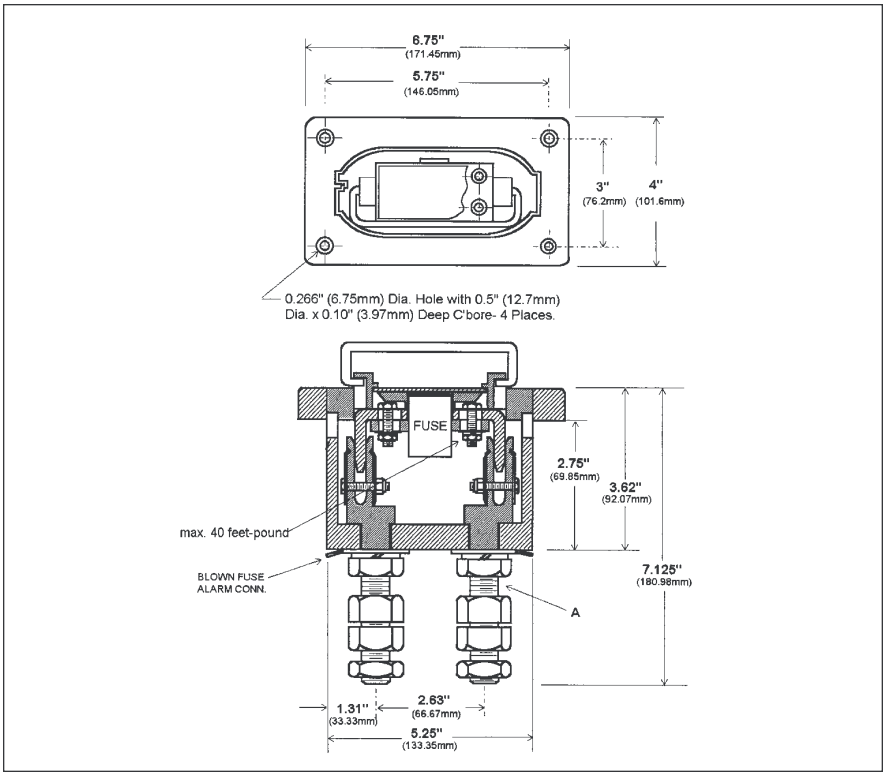
Voltage Rating:
70 to 600 amperes @ 145 VDC
800 amperes @ 60 VDC

Ampere Range:
70 to 800 amperes

Approvals:
UL Recognized (E122674)

Recommended Fuses:
Littelfuse L17T Series fuses

Dimensions



Ordering Information

Catalog Number	Stud Size (A)	Amperes	Contact Nut Max. Torque
LTFD6001-00	3/4 – 16 x 3.5 in.	70 – 600	100 feet-pound
LTFD6001-01	7/8 – 14 x 3.5 in.	70 – 800	120 feet-pound

Replaces Competitor's 15100 Series
System number examples: LTFD6001ZX00, LTFD6001ZX01

Telecom Disconnect Switch
LTFD 1200 Series — 900 to 1200 Amp

Littelfuse's new 1200 ampere LTFD 1200-01 fuseholders are designed for high power applications where space and costs are major concerns. This compact fuseholder is designed specifically for 900 to 1200A applications and can replace two conventional 600A holders. An optional integrated alarm fuse circuit provides visual and remote notification of a blown fuse. The innovative pull-out design provides a positive connection and eliminates the need for tools to replace blown fuses.

Features

- Compact
- Vented for cool running operation
- Quick fuse replacement
- Optional integrated alarm signaling circuit

Recommended Fuses

- Littelfuse L17T Series fuses
- Littelfuse 481 Series Alarm fuses

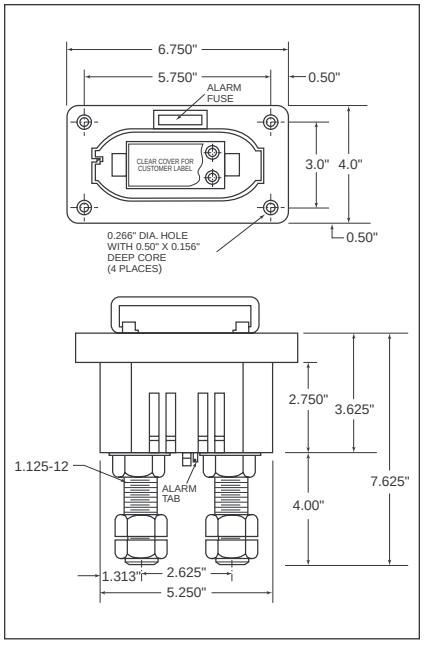
Specifications

Voltage Rating:
60 VDC

Ampere Range:
900 to 1200 amperes

Approvals:
UL Recognized (File No. E122674)

Dimensions



Ordering Information

Catalog Number
LTFD 1200-01

Telecommunications Power Fuse
TLN Series

The TLN Series fuses are specifically designed for the protection of telecommunications DC power distribution circuits.

Features

- 170 VDC
- Fast-acting and current limiting
- 1 to 600 amperes

Specifications

Voltage Rating:
170 VDC

Interrupting Rating:
100,000 amperes

Ampere Range:
1 to 600 amperes

Approvals:
UL Recognized

Dimensions

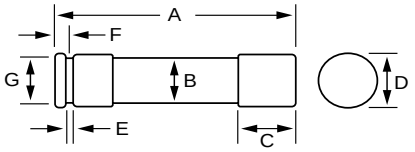


FIG. 1

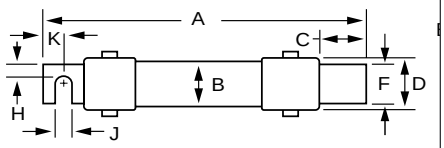


FIG. 2

Ampere Rating	Dimensions in Inches (mm) A	B	C	D	E	F	G	H	J	K
Figure 1										
1 – 30	2 (50.8)	1/2 (12.7)	1/2 (12.7)	9/16 (14.3)	5/64 (2.0)	5/32 (4.0)	3/8 (9.5)	—	—	—
35 – 60	3 (76.2)	3/4 (19.1)	5/8 (15.9)	13/16 (20.6)	3/32 (2.4)	3/16 (4.8)	5/8 (15.9)	—	—	—
Figure 2										
70 – 100	5-7/8 (149.2)	1 (25.4)	1-1/16 (27.0)	1-1/16 (27.0)	1/8 (3.2)	3/4 (19.1)	1-1/4 (31.6)	1/4 (6.4)	9/32 (7.1)	1/2 (12.7)
110 – 200	7-1/8 (181.0)	1-1/2 (38.1)	1-15/32 (37.3)	1-19/32 (40.5)	3/16 (4.8)	1-1/8 (28.6)	1-27/32 (46.8)	7/16 (11.1)	9/32 (7.1)	11/16 (17.5)
225 – 400	8-5/8 (219.1)	2 (50.8)	1-15/16 (49.2)	2-3/32 (53.2)	1/4 (6.4)	1-5/8 (41.3)	2-11/32 (59.5)	5/8 (15.9)	13/32 (10.3)	15/16 (23.8)
450 – 600	10-3/8 (263.5)	2-1/2 (63.5)	2-3/8 (60.3)	2-19/32 (65.9)	1/4 (6.4)	2 (50.8)	2-27/32 (72.2)	3/4 (19.1)	17/32 (13.5)	1-1/8 (28.6)

Ordering Information

Catalog Number	Amperage	Catalog Number	Amperage	Catalog Number	Amperage	Catalog Number	Amperage
TLN 1	1	TLN 30	30	TLN 90	90	TLN 250	250
TLN 3	3	TLN 35	35	TLN 100	100	TLN 300	300
TLN 5	5	TLN 40	40	TLN 110	110	TLN 350	350
TLN 6	6	TLN 45	45	TLN 125	125	TLN 400	400
TLN 10	10	TLN 50	50	TLN 150	150	TLN 450	450
TLN 15	15	TLN 60	60	TLN 175	175	TLN 500	500
TLN 20	20	TLN 70	70	TLN 200	200	TLN 600	600
TLN 25	25	TLN 80	80	TLN 225	225		

Replaces Competitor's TPN and TGN Series

Telecommunications Power Fuse
TLS Series

Littelfuse's TLS Series fuses are designed specifically for the protection of telecommunications equipment. TLS fuses have been engineered to operate up to 170 VDC to provide current limiting short circuit protection for cables and components found in the DC power distribution circuits of telecommunications systems. The TLS' compact design provides superior protection and high power density in an extremely compact package.

Features

- 170 VDC
- Current limiting
- 1 to 70 amperes

Specifications

Voltage Rating:
170 VDC

Interrupting Rating:
100,000 amperes DC

Ampere Range:
1 to 100 amperes

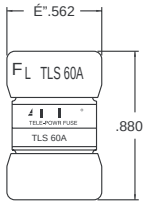
Approvals:
UL Recognized

Construction:
Caps: Silver-plated brass
Body: Glass melamine

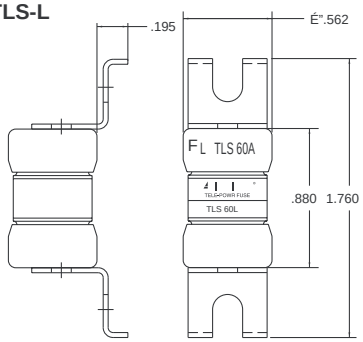
Recommended Fuseholders:
LTFD101 Series disconnect switches

Dimensions

TLS



TLS-L



Note: Contact factory for additional terminations.

Ordering Information

Catalog Number	Catalog Number Leaded Version	Ampere Rating
TLS001	TLS001L	1
TLS003	TLS003L	3
TLS005	TLS005L	5
TLS006	TLS006L	6
TLS010	TLS010L	10
TLS015	TLS015L	15
TLS020	TLS020L	20
TLS025	TLS025L	25
TLS030	TLS030L	30
TLS035	TLS035L	35
TLS040	TLS040L	40
TLS050	TLS050L	50
TLS060	TLS060L	60
TLS070	TLS070L	70
TLS080	—	80
TLS090	—	90
TLS0100	—	100

Replaces Competitor's TPS and TGS Series

Telecom Disconnect Switch
LTFD 101 Series

Littelfuse's compact LTFD 101 fuseholders for TLS fuses are designed for quick installation into telecom equipment panels. Their modular design fits into spaces originally designed for circuit breakers and they can be front panel mounted or rear mounted using bullet connectors. The innovative new pull-out design eliminates the need for tools to replace fuses and includes an alarm signaling circuit to identify the blown fuse.

Features

- Extremely compact
- Quick mounting
- Replaces circuit breakers
- Includes alarm signaling circuit

Specifications

Voltage Rating:
80 VDC

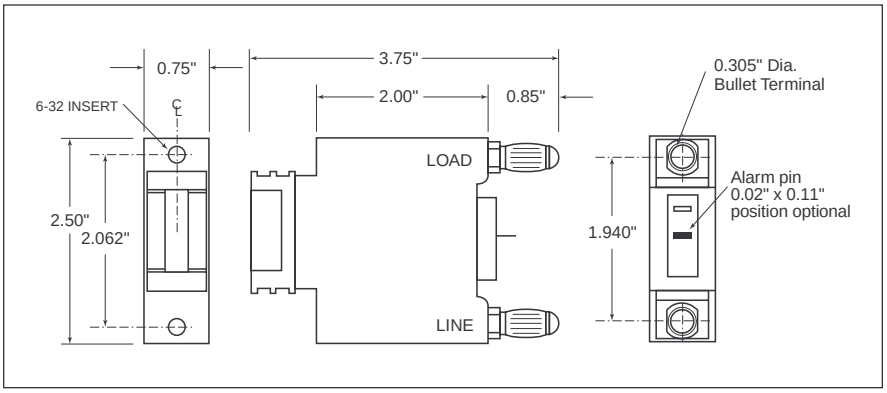
Ampere Range:
1 to 100 amperes

Approvals:
UL Recognized (File No. E122874)

Recommended Fuses

- Littelfuse TLS Series fuses
- Littelfuse 481 Series Alarm fuses

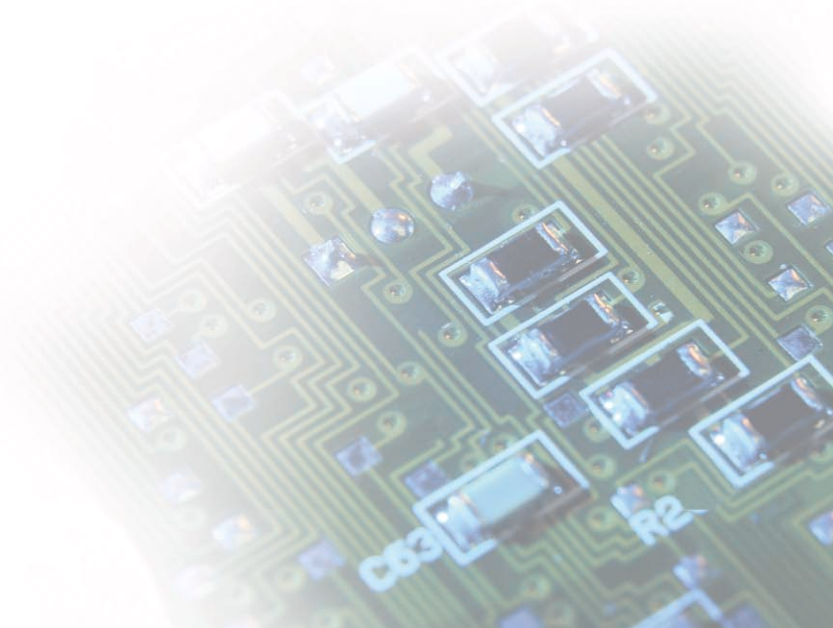
Dimensions



Ordering Information

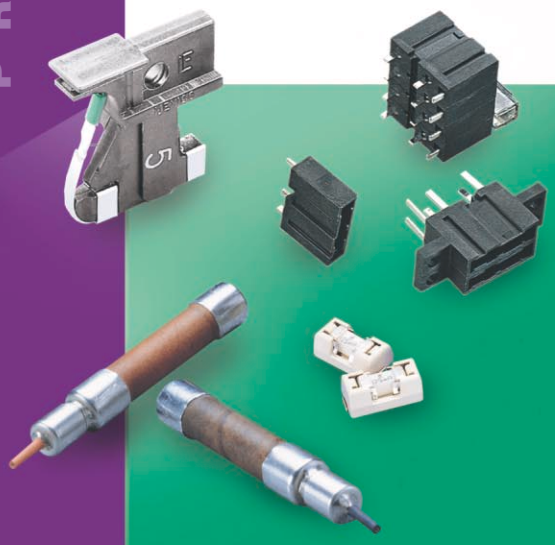
Catalog Number
LTFD 101

Notes:



electronic overcurrent

PROTECTION PRODUCTS



Littelfuse®

Alarm Indicating Fuse
481 Series

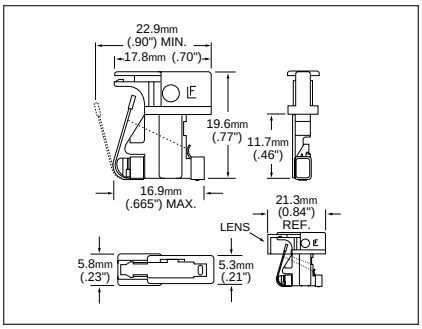
Features

- Ideal for telecommunications and control panel circuits
- Eliminates down time by immediately pinpointing the blown (open) circuit when triggering LED or audio alarm, when placed in mating holder (482 Series)
- Clear plastic lens option available for additional safety

Electrical Characteristics

% of Ampere Rating	Opening Time Minimum / Maximum
100	10 min. / —
150	— / 5 min.

Dimensions



Specifications

Approvals:

UL Recognized (E71611)
CSA Certified (LR29862)

Interrupting Ratings:

450 amperes @ 60 VDC
300 amperes @ 125 VAC (up to 20A)
300 amperes @ 125 VDC (up to 15A)
200 amperes @ 125 VDC (up to 20A)

Construction:

Body:	Polyphenylene sulfide (UL 940V0)
Terminations:	Beryllium copper/ tin plated
Optional Lens:	Nylon

Packaging:

Available in five (5) packs or boxes of one hundred (100). When ordering a five (5) pack, please add the letter 'V' after the catalog number. When ordering a one hundred (100) piece box, add an 'H'. To order the part with a protective lens, add the letters 'XL' after the package code.

Ordering Information

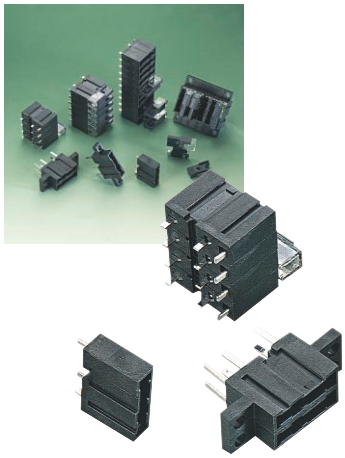
Catalog Number	Ampere Rating	Flag Color Code
0481.180	18/100	Yellow
0481.200	1/5	Red/Black
0481.250	1/4	Violet
0481.375	3/8	Grey/White
0481.500	1/2	Red
0481.650	65/100	Black
0481.750	3/4	Brown
0481 001	1	Grey
0481 1.33	1-1/3	White
0481 01.5	1-1/3	Yellow/White
0481 002	2	Orange

Contact Littelfuse for nominal cold resistance and melting I^2t

Catalog Number	Ampere Rating	Flag Color Code
0481 02.5	2-1/2	Orange/White
0481 003	3	Blue
0481 03.5	3-1/2	Blue/White
0481 004	4	Brown/White
0481 005	5	Green
0481 07.5	7-1/2	Black/White
0481 010	10	Red/White
0481 012	12	Green/Yellow
0481 015	15	Red/Blue
0481 020	20	Green/White
0481 000	Dummy	—

Replaces Competitor's GMT and AX Series

Alarm Indicating Fuseholder
482 Series



The flexible fuseholder design allows for either panel mounting or direct soldering to a PCB (printed circuit board). Both styles can be supplied in a single pole or ganged units up to 20 poles.

Features

- Gangable up to 20 poles
- 20 amps @ 125 VAC/VDC

Specifications

Approvals:

UL Recognized (E14721)
CSA Certified (LR7316)

Electrical:

Rated @ 20 amperes for any voltage up to 125 VAC, 125 VDC

Molded Bodies:

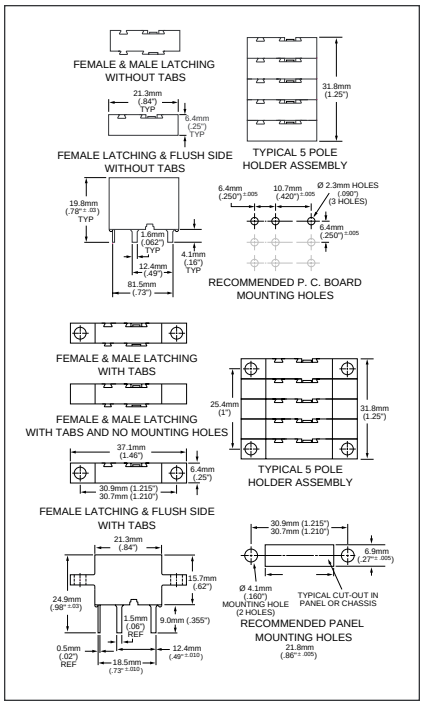
Thermoplastic or black phenolic (UL 94V-0) rating

Terminals:

Alarm Terminal:
Brass, tin-plated, wire wrap type or PCB wave soldering

Fuse Terminal:
Beryllium-copper, tin-plated

Dimensions



Ordering Information

Catalog Number PCB Mount	Catalog Number Panel Mount	Type	Amperes
04820001ZXB	04820001ZXP	1 pole	15
04820002ZXB	04820002ZXP	2 pole	15
04820003ZXB	04820003ZXP	3 pole	15
04820004ZXB	04820004ZXP	4 pole	15
04820005ZXB	04820005ZXP	5 pole	15
04820006ZXB	04820006ZXP	6 pole	15
04820007ZXB	04820007ZXP	7 pole	15
04820008ZXB	04820008ZXP	8 pole	15
04820009ZXB	04820009ZXP	9 pole	15
04820010ZXB	04820010ZXP	10 pole	15
04820011ZXB	04820011ZXP	11 pole	15
04820012ZXB	04820012ZXP	12 pole	15
04820013ZXB	04820013ZXP	13 pole	15
04820014ZXB	04820014ZXP	14 pole	15
04820015ZXB	04820015ZXP	15 pole	15
04820016ZXB	04820016ZXP	16 pole	15
04820017ZXB	04820017ZXP	17 pole	15
04820018ZXB	04820018ZXP	18 pole	15
04820019ZXB	04820019ZXP	19 pole	15
04820020ZXB	04820020ZXP	20 pole	15
N/A	04822001ZXPF	1 pole	20
Add On Poles			
04820AD1HXB	—	PCB mount	
—	0482HAD1HXP	Panel mount with mounting holes	15
—	04820AD1HXP	Panel mount without mounting holes	15

Replaces Competitor's HLS, HLT, PCT and HAX Series

Alarm Indicating Fuse
70 Series

The 70 Series alarm indicating fuses are designed for use in telecommunications equipment. A color-coded tip provides visual identification of the ampere rating and the fuse status.

Features

- Color coded tip
- Rated 125 VAC, 300 VDC

Specifications

Approvals:
UL Recognized

Interrupting Ratings:
1000 amperes @ 125 VAC
1000 amperes @ 300 VDC

Ordering Information

10 Minute Rating	Catalog Number	System Number	Color Code
100mA	70P	70P00000Z	Grey/White
150mA	70R	70R00000Z	Red/White
180mA	70E	70E00000Z	Yellow
200mA	70X	70X00000Z	Black
250mA	70F	70F00000Z	Violet
250mA	70K	70K00000Z	Violet/White
350mA	70S	70S00000Z	Gray
500mA	70G	70G00000Z	Red
750mA	70H	70H00000Z	Brown
1.33A	70A	70A00000Z	White
2A	70B	70B00000Z	Orange
3A	70C	70C00000Z	Blue
3.5A	70J	70J00000Z	Black/White
5A	70D	70D00000Z	Green/Black
8A	70M	70M00000Z	Tan/White
10A	70N	70N00000Z	Yellow/Purple

Telecom Surface Mount Fuse
NANO²® 461 Series

Features

- Surface mount overcurrent protection from lightning and power cross
- Meets UL1459/1950 power cross requirements stand alone
- Ideal for use in telecommunications equipment including modems, fax machines, desktop phones, answering machines and line cards
- Complies with Bellcore GR-1089-CORE and FCC 47 Part 68 surge specifications

Specifications

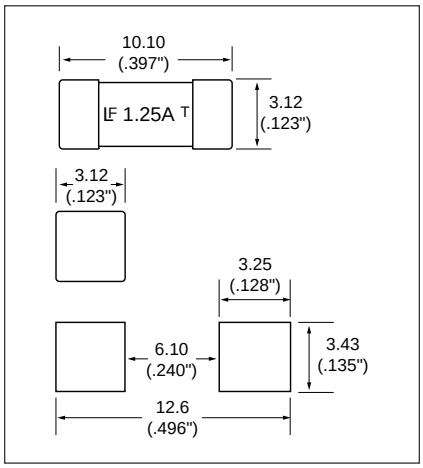
Approvals:
UL Recognized, CSA Certified

Short Circuit Capabilities (UL 1459/UL 1950 3rd ed.)
40 amperes @ 600 VAC
7 amperes @ 600 VAC
2.2 amperes @ 600 VAC

Interrupting Ratings:
50 amperes @ 250 VAC

Materials:
Body: Ceramic
Terminators: Silver-plated brass caps

Dimensions



Electrical Specifications

% of Ampere Rating	Opening Time Minimum / Maximum
100	4 hrs. / —
250	1 sec. /120 sec.

Overvoltage/AC Power Fault (Power Cross) Requirements:

The most severe tests are listed, Telecom Nano² will pass lower level test as well.

Standard/ Test	Source Voltage (VAC)	Surge Current (A)	Duration	Rating for Compliance Stand Alone[2]
GR-1089	1000	5	0.5 sec.	1.25A
GR-1089	600	60[1]	5 sec.	1.25A
UL 1950 3rd Edition	600	40	1.5 sec.	0.5, 1.25A
GR-1089	600	7	5 sec.	0.5, 1.25A
UL 1950 3rd Edition GR-1809	100-600	2.2	30 min.	0.5, 1.25A
UL 1950 3rd Edition GR-1809	277	25	15 min.	0.5, 1.25A
UL 1950 3rd Edition	120	25	30 min.	0.5, 1.25A

[1]The 1.25 rating is designed to enable equipment compliance with GR-1089. Application testing is strongly recommended as actual application and compliance testing will produce random closing angle surge conditions. Actual circuit resistance may enhance equipment performance under surge conditions.

[2]See UL 1950 for test procedures for fuses and testing at 135%.

Environmental/Lightning Surge Requirements

Standard/ Test	Source Voltage (Vpk)	Duration/ Wave Form (µSec.)	Surge Current (A)	Repetitions (Each Polarity)	Rating for Compliance Stand Alone[3]
GR-1089 1st Level	600	10 x 1000	100	25	1.25A
	1000	10 x 360	100	25	1.25A
	1000	10 x 1000	100	25	1.25A
	2500	2 x 10	500	10	1.25A
	1000	10 x 360	25	5	0.5, 1.25A
GR-1089 2nd Level	5000	2 x 10	500	1	1.25A
FCC 47 Part 68 Type A Metallic	800	10 x 560	100	1	1.25A
FCC 47 Part 68 Type A Longitudinal	1500	10 x 160	200	1	1.25A
FCC 47 Part 68 Type B Metallic	1000	voltage 9 x 720 current 5 x 320	25	1	0.5, 1.25A
FCC 47 Part 68 Type B Longitudinal	1500	voltage 9 x 720 current 5 x 320	37.5	1	0.5, 1.25A

[3]Additional series resistance used in conjunction with the fuse may allow compliance by fuse ratings not listed.

Ordering Information

Catalog Number	Ampere Rating	Voltage Rating	Nominal Resistance (Cold Ω)	Nominal Melting I²t (A² Sec.)
0461 .500	1/2	250	.56	.84
0461 1.25	1-1/4	250	.110	16.5[4]

[4] I²t is calculated at 10 msec or less. I²t at 10 times rated current has a typical value of 22 A²sec (1.25A).

SMTelecom® Fuse
436 Series

Features

- Surface mount overcurrent protection from lightning and power cross
- Meets UL 1459/1950 power cross requirements stand alone
- Ideal for use in telecommunications equipment including modems, fax machines, desktop phones, answering machines, and line cards
- UL recognized, with a 250V operating voltage
- Top side marking allows visual verification of ampere rating
- Complies with Bellcore GR-1089-CORE and FCC 47 Part 68 voltage specifications

Specifications

Short Circuit Capabilities
(UL 1459/UL 1950 3rd ed.)
40 amperes @ 600 VAC
7 amperes @ 600 VAC
2.2 amperes @ 600 VAC

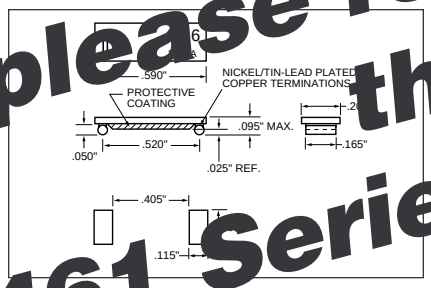
Interrupting Ratings:
10,000 amperes @ 125 V
100 amperes @ 250 V

Approvals:
UL Recognized (UL E14330)
CSA Certified (LR 29862)

Materials:
Body: Multilayer substrate
Terminations: Copper/nickel/tin-lead (95/5)

For new design, please reference the 461 Series/Page 21

Dimensions



Electrical Characteristics

% of Ampere Rating	Operating Time Minimum / Maximum
100	4 hrs. / —
250	5 sec. / 30 sec.

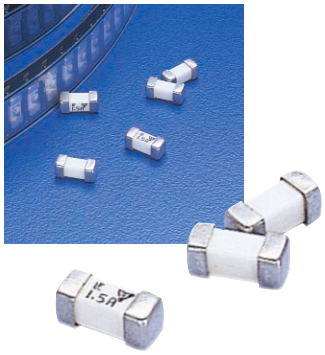
Performance Characteristics

Catalog Number	FCC 47 Part 68 Longitudinal Surge 10x160µSec. (1500V)		FCC 47 Part 68 Metallic Surge 10x560µSec. (800V)		Bellcore GR-1089-CORE First Level Lightning 10x1000µSec. (1000V)	Bellcore GR-1089-CORE First Level Lightning 2x10µSec. (2500V)
Repetitions:	*50*	*2*	*50*	*2*	*50*	*20*
0436.750	82A	88A	29A	32A	22A	225A
0436 001	102A	117A	44A	48A	37A	350A
0436 1.25	120A	135A	87A	95A	56A	425A
0436 01.5	175A	200A	100A	115A	80A	500A
0436 01.6	200A	200A	134A	156A	100A	500A

Ordering Information

Catalog Number	Ampere Rating	Voltage Rating	Nominal Resistance (Cold Ω)	Nominal Melting I²t (A² Sec.)
0436.750	3/4	250	0.850	1.143
0436 001	1	250	0.475	2.606
0436 1.25	1-1/4	250	0.305	3.658
0436 01.5	1-1/2	250	0.210	5.921
0436 01.6	1-6/10	250	0.165	13.500

Subminiature Surface Mount Fuse
NANO²® SMF Slo-Blo® Series



The very small NANO² Fuse with time delay performance characteristics. The unique time delay feature of this fuse design helps solve the problem of nuisance "opening" by accommodating inrush currents that normally cause a fast-acting fuse to open.

Specifications

Interrupting Ratings:

50 amperes @ 125 VAC
50 amperes @ 125 VDC
300 amperes @ 32 VDC

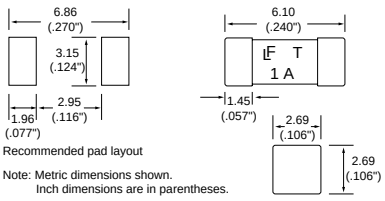
Approvals:

UL Recognized (UL E10480)
CSA Certified (LR29862)

Materials:

Body: Ceramic
Terminations: Tin-lead alloy or silver plated brass caps

Dimensions



Recommended pad layout

Note: Metric dimensions shown.
Inch dimensions are in parentheses.

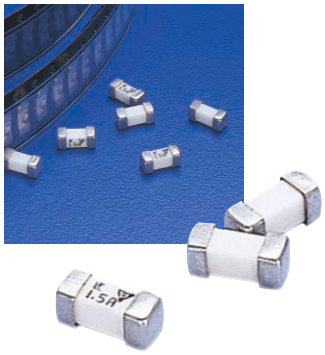
Electrical Characteristics

% of Ampere Rating	Opening Time Minimum / Maximum
100	4 hrs. / —
200	1 sec. / 60 sec.
300	0.2 sec. / 3 sec.
800	0.02 sec. / 0.1 sec.

Ordering Information

Catalog Number (Tin-Lead Plated)	Catalog Number (Silver-Plated)	Ampere Rating	Voltage Rating	Nominal Resistance (Cold Ω)	Nominal Melting I²t (A² Sec.)
R452.375	0454.375	3/8	125	1.20	0.101
R452.500	0454.500	1/2	125	0.700	0.240
R452.750	0454.750	3/4	125	0.360	0.904
R452 001	0454 001	1	125	0.225	1.98
R452 01.5	0454 01.5	1-1/2	125	0.0930	3.65
R452 002	0454 002	2	125	0.0625	8.20
R452 02.5	0454 02.5	2-1/2	125	0.0450	15.0
R452 003	0454 003	3	125	0.0340	20.16
R452 03.5	0454 03.5	3-1/2	125	0.0224	26.53
R452 004	0454 004	4	125	0.0186	34.40
R452 005	0454 005	5	125	0.0136	53.72

Subminiature Surface Mount Fuse
NANO²® SMF Very Fast-Acting Series



The very small NANO² Fuse with very fast-acting performance characteristics.

Specifications

Interrupting Ratings:

1/16 – 8A
- 50 amperes @ 125 VAC/VDC
- 300 amperes @ 32 VDC

10A
- 35 amperes @ 125 VAC
- 50 amperes @ 125 VDC
- 300 amperes @ 32 VDC

12A – 15A
- 50 amperes @ 65 VAC/VDC
- 300 amperes @ 24 VDC

Approvals:
- UL Recognized (UL E10480)
- CSA Certified (LR29862)
- MITI Approved (1 to 5 ampere)

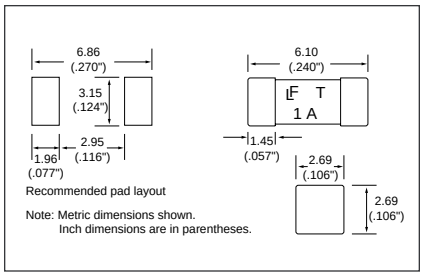
Materials:

Body:	Ceramic
Terminations:	Tin-lead alloy or silver plated brass caps

Electrical Characteristics

% of Ampere Rating	Amp Rating	Opening Time Minimum / Maximum
100	1/16 – 15	4 hrs. / —
200	1/16 – 10	— / 5 sec.
200	12 – 15	— / 20 sec.

Dimensions



Ordering Information

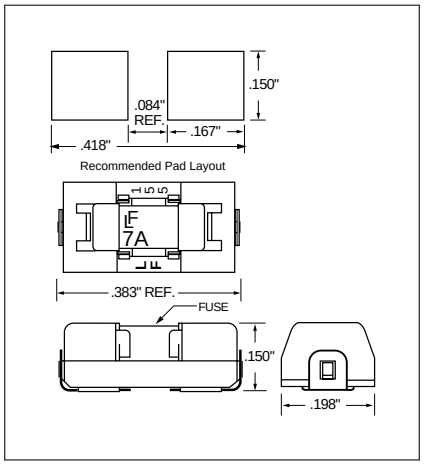
Catalog Number (Tin-Lead Plated)	Catalog Number (Silver-Plated)	Ampere Rating	Voltage Rating	Nominal Resistance (Cold Ω)	Nominal Melting I²t (A² Sec.)
—	R451.062	0.062	125	5.50	0.00019
—	R451.080	0.080	125	4.05	0.00033
—	R451.100	0.100	125	3.10	0.00138
—	R451.125	0.125	125	1.70	0.00286
R451.160	0453.160	0.160	125	1.80	0.00306
R451.200	0453.200	0.200	125	1.40	0.00652
R451.250	0453.250	0.250	125	1.05	0.01126
R451.315	0.453.315	0.315	125	0.78	0.0231
R451.375	0453.375	0.375	125	0.610	0.0425
R451.400	0453.400	0.400	125	0.560	0.0484
R451.500	0453.500	0.500	125	0.420	0.0795
R451.630	0453.630	0.630	125	0.305	0.143
R451.750	0453.750	0.750	125	0.245	0.185
R451.800	0453.800	0.800	125	0.212	0.271
R451 001	0453 001	1.0	125	0.153	0.459
R451 1.25	0453 1.25	1.25	125	0.0780	0.664
R451 01.5	0453 01.5	1.5	125	0.0630	0.853
R451 01.6	0453 01.6	1.6	125	0.0580	1.060
R451 002	0453 002	2.0	125	0.0367	0.530
R451 02.5	0453 02.5	2.5	125	0.0286	1.029
R451 003	0453 003	3.0	125	0.0227	1.650
R451 3.15	0453 3.15	3.15	125	0.0215	1.920
R451 03.5	0453 03.5	3.5	125	0.0200	2.469
R451 004	0453 004	4	125	0.0160	3.152
R451 005	0453 005	5	125	0.0125	5.566
R451 06.3	0453 06.3	6.3	125	0.0096	9.17
R451 007	0453 007	7	125	0.0090	10.32
R451 008	0453 008	8	125	0.0077	20.23
R451 010	0453 010	10	125	0.0056	26.46
R451 012	0453 012	12	65	0.0049	47.97
R451 015	0453 015	15	65	0.0037	97.82

NANO² Surface Mount Fuse
SMF OMNI-BLOK® Fuse Block Molded Base Type

The SMF Omni-Blok Fuseholder permits quick and easy replacement of NANO² SMF surface mount fuses. The fuse block and pre-installed fuse combination can be placed on the PC board in one efficient manufacturing operation. Fuse replacement is accomplished without exposing the PC board to the detrimental effects of solder heat.

Approvals:
UL Recognized
CSA Certified

Dimensions



Ordering Information

With Very Fast-Acting Fuse Installed			With Slo-Blo® Fuse Installed		
Catalog Number	Ampere Rating	Fuse Furnished[1]	Catalog Number	Ampere Rating	Fuse Furnished[2]
154.062	1/16	0453.062	154.375T	3/8	0454.375
154.125	1/8	0453.125	154.500T	1/2	0454.500
154.250	1/4	0453.250	154.750T	3/4	0454.750
154.375	3/8	0453.375	154 001T	1	0454 001
154.500	1/2	0453.500	154 01.5T	1-1/2	0454 01.5
154.750	3/4	0453.750	154 002T	2	0454 002
154 001	1	0453 001	154 02.5T	2-1/2	0454 02.5
154 01.5	1.5	0453 01.5	154 003T	3	0454 003
154 002	2	0453 002	154 03.5T	3-1/2	0454 03.5
154 02.5	2.5	0453 02.5	154 004T	4	0454 004
154 003	3	0453 003	154 005T	5	0454 005
154 03.5	3.5	0453 03.5	—	—	—
154 004	4	0453 004	—	—	—
154 005	5	0453 005	—	—	—
154 007	7	0453 007	—	—	—

[1] 454 Series Fuse has silver plated end caps, installed to accommodate solder reflow process. Use either 451 or 453 Series for replacement purposes.

[2] 454 Series Fuse has silver plated end caps, installed to accommodate solder reflow process. Use either 452 or 454 Series for replacement purposes.

Thin-Film Surface Mount Fuse
SlimLine 0603 Very Fast-Acting Type 434 Series

Features

- The SlimLine 0603 is an extremely small, low profile design (0603 chip size) utilizing thin-film technology to achieve precise control of electrical characteristics
- The lower height profile produces a flat surface for improved performance in pick-and-place operations and an alternate solution for height critical applications
- Mounting pad and electrical specification are identical to the popular 431 Series specifications

Specifications

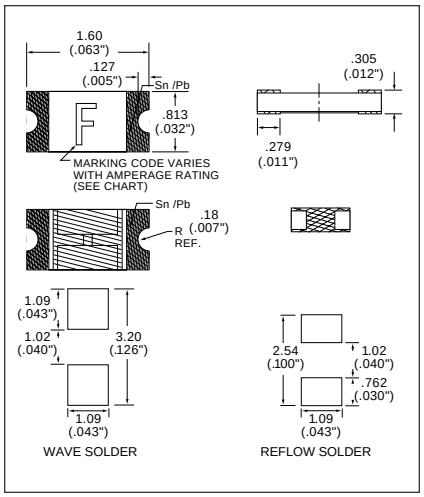
Interrupting Ratings:

.25 to 1A 50A @ 32 VAC/VDC
1.25 to 5A 35A @ 32 VAC/VDC

Approvals:

UL Recognized (UL E10480)
CSA Certified (LR29862)

Dimensions



Electrical Characteristics

% of Ampere Rating	Opening Time Minimum / Maximum
100	4 hrs. / —
200	— / 5 sec.
300	— / 0.2 sec.

Ordering Information

Catalog Number	Ampere Rating	Marking Code	Voltage Rating	Nominal Resistance (Cold Ω)	Nominal Melting I²t (A² Sec.)
0434.250	1/4	D	32	0.375	0.0030
0434.375	3/8	E	32	0.265	0.0053
0434.500	1/2	F	32	0.193	0.0087
0434.750	3/4	G	32	0.114	0.0171
0434 001	1	H	32	0.072	0.0210
0434 1.25	1-1/4	J	32	0.054	0.0320
0434 01.5	1-1/2	K	32	0.048	0.0526
0434 1.75	1-3/4	L	32	0.039	0.0661
0434 002	2	N	32	0.036	0.104
0434 02.5	2-1/2	O	32	0.028	0.175
0434 003	3	P	32	0.023	0.198
0434 03.5	3-1/2	R	32	0.019	0.265
0434 004	4	S	32	0.017	0.352
0434 005	5	T	32	0.013	1.297

Thin-Film Surface Mount Fuse
1206 SMF Very Fast-Acting Type 429/433 Series

Features

- The 1206 SMF is an extremely small, low profile design (1206 chip size) utilizing thin-film technology to achieve precise control of electrical characteristics
- New one-piece element/termination design assures extra reliability by eliminating the need for soldering, welding or other joining operations in the manufacture of the fuse
- Semi-rigid substrate eliminates the potential for thermal shock fractures and decreases the risk of mechanical damage during pick-and-place operations

Specifications

Interrupting Ratings:

0.125 to 3A 50A @ rated voltage AC/DC
4 to 7A 35A @ rated voltage AC/DC

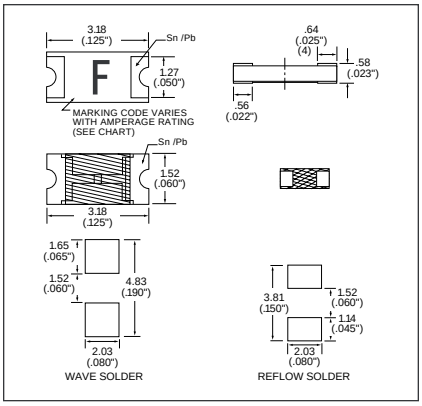
Approvals:

UL Recognized (UL E10480)
CSA Certified (LR29862)

Materials:

Body:	Epoxy substrate
Terminations:	Copper/nickel/ tin-lead (95/5)
Cover Coat:	Conformal coating

Dimensions (433 Series)



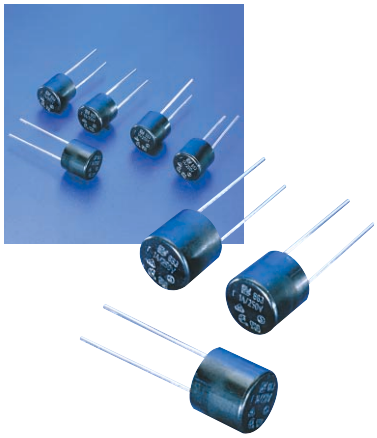
Electrical Characteristics

% of Ampere Rating	Opening Time Minimum / Maximum
100	4 hrs. / —
200	— / 5 sec.
300	— / 0.2 sec.

Ordering Information

Catalog Number	Ampere Rating	Marking Code	Voltage Rating	Nominal Resistance (Cold Ω)	Melting I²t (A² Sec.)
0433.125	.125	B	125	3.45	0.00040
0433.200	.200	C	125	0.938	0.00055
0433.250	.250	D	125	0.625	0.0010
0433.375	.375	E	125	0.375	0.0028
0433.500	.50	F	63	0.2405	0.0060
0433.600	.60	.6	63	0.2100	0.0131
0433.750	.75	G	63	0.1370	0.0170
0433.800	.80	.8	63	0.1225	0.0305
0433 001	1	H	63	0.09950	0.0350
0433 1.25	1.25	J	63	0.07475	0.0650
0433 01.5	1.5	K	63	0.06250	0.125
0433 1.75	1.75	L	63	0.05000	0.150
0433 002.	2	N	63	0.03975	0.230
0433 02.5	2.5	O	32	0.03065	0.50
0433 003	3	P	32	0.02625	0.70
429 004	4	FS	24	0.01926	1.18
429 005	5	FT	24	0.01375	2.12
429 007	7	FU	24	0.00925	4.90

Subminiature Radial Lead and Cartridge Fuses
LT-5™ Series



Features

Fast-Acting 662 Series,
Time Lag 663 Series and
Time Lag Extended Breaking 664 Series

- Fuses available in three different performance options/series
- Provide similar performance to conventional glass fuses, while occupying 70% less space
- Available in various lead configurations to be used in through-hole applications or with the available fuseholder. Parts also available on Tape & Reel.

Specifications

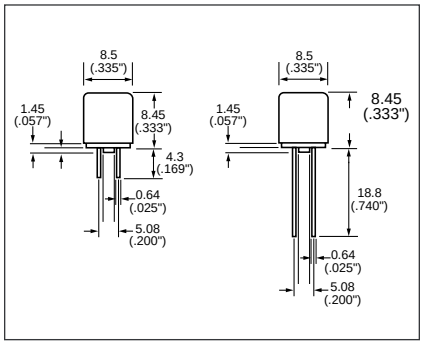
Interrupting Ratings:
(662 Series; 663 Series) 35A @ 250 VAC
(664 Series) 100A @ 250 VAC

Approvals:
(662 Series)
IEC 60127-3/1: Semko and VDE approved 50mA through 3.15A
(663 Series; 664 Series)
IEC 60127-3/1: Semko and VDE approved through 4A
UL Recognized/CSA Certified

Electrical Characteristics

% of Ampere Rating	662 Series Opening Time Minimum / Maximum	663 Series Opening Time Minimum / Maximum	664 Series Opening Time Minimum / Maximum
210	— / 30 min.	— / 2 min.	— / 2 min.
275	0.010 sec. / 3 sec.	.4 sec. / 10 sec.	.4 sec. / 10 sec.
400	0.003 sec. / 0.030 sec.	.15 sec. / 3 sec.	.1 sec. / 3 sec.
1000	— / 0.020 sec.	.02 sec. / .15 sec.	.02 sec. / .15 sec.

Dimensions

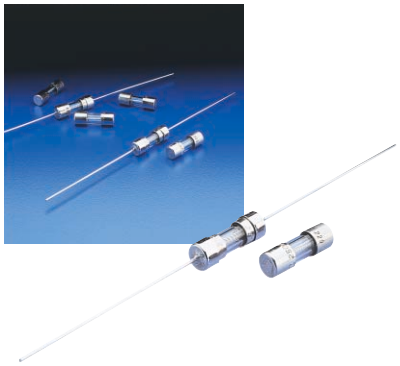


Ordering Information

Ampere Rating	662 Series Catalog Number	662 Series Nominal Melting I²t (A² Sec.)	663 Series Catalog Number	663 Series Nominal Melting I²t (A² Sec.)	664 Series Catalog Number	664 Series Nominal Melting I²t (A² Sec.)
.050	0662.050	0.004	0663.050	0.03	—	—
.063	0662.063	0.001	0663.063	0.05	—	—
.080	0662.080	0.001	0663.080	0.07	—	—
.100	0662.100	0.002	0663.100	0.08	—	—
.125	0662.125	0.006	0663.125	0.12	—	—
.160	0662.160	0.014	0663.160	0.24	—	—
.200	0662.200	0.024	0663.200	0.35	—	—
.250	0662.250	0.058	0663.250	0.6	—	—
.315	0662.315	0.104	0663.315	0.8	—	—
.400	0662.400	0.044	0663.400	1.1	—	—
.500	0662.500	0.090	0663.500	2.5	—	—
.630	0662.630	0.150	0663.630	4	—	—
.800	0662.800	0.220	0663.800	8	0664.800	2.2
1.00	0662 001	0.330	0663 001	12	0664 001	4.4
1.25	0662 1.25	0.680	0663 1.25	15	0064 1.25	6.3
1.60	0662 01.6	0.940	0663 01.6	30	0664 01.6	10
2.00	0662 002	1.330	0663 002	34	0664 002	16
2.50	0662 02.5	1.940	0663 02.5	55	0664 02.5	32
3.15	0662 3.15	5.400	0663 3.15	76	0664 3.15	57
4.00	0662 004	7.900	0663 004	80	0664 004	77
5.00	0662 005	11.190	0663 005	230	0664 005	155
6.30	—	—	0663 06.3	360	0664 06.3	262

Note: All fuses listed are rated @ 250 VAC

Subminiature Glass Body Axial Lead and Cartridge Fuses
2AG Slo-Blo® Surge Withstand Series



2AG Surge Withstand Fuses combine conventional overcurrent protection with the ability to withstand high current, short duration pulses. These fuses comply with the short circuit requirements of UL 1459 for telephone equipment. Insulating sleeve option available.

Features

- These fuses will withstand 50 repetitions of a double exponential impulse wave having peak currents (Ip) and peak voltages as listed
- Fuses rated .250 to 1.25A comply with the short circuit requirements of UL 1459/1950 3rd Edition (2.2, 7 & 40A @600 VAC)
- Leaded fuses are board washable
- Provide the same performance characteristics as 3AG Fuses, while occupying 1/3 the space

Specifications

Interrupting Ratings:

1/4 to 1-1/4A	10,000A @ 125 VAC
1/4 to 1A	35A @ 250 VAC
1-1/4A	100A @ 250 VAC

Short Circuit:

UL 1459 / UL 1950 3rd Edt.:

40A,	600 VAC
7A,	600 VAC
2.2A,	600 VAC

Approvals:

UL Recognized (E10480)
CSA Certified (LR29862)

Construction:

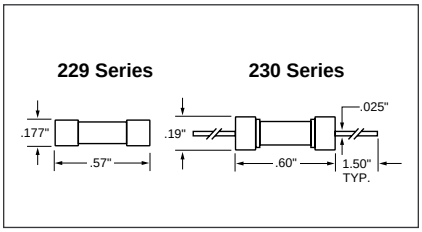
Caps: Nickel-plated brass
Body: Glass
Insulating sleeve option available

Peak Withstand Current

Ampere Rating	10 x 160 microsec. 1500V	10 x 560 microsec. 800V	10 x 1000 microsec. 1000V
1/4	23.0A	16.6A	12.4A
35/100	34.0A	25.8A	19.3A
3/8	40.0A	25.4A	19.0A
1/2	60.0A	37.7A	28.2A
6/10	71.0A	47.2A	35.3A
3/4	91.0A	65.5A	49.0A
8/10	104.0A	68.9A	51.6A
1	130.0A	88.6A	66.3A
1-1/4*	162.0A	118.1A	100.0A

*** 500A peak, 2500V, 2x10 microseconds, 20 repetitions**

Dimensions

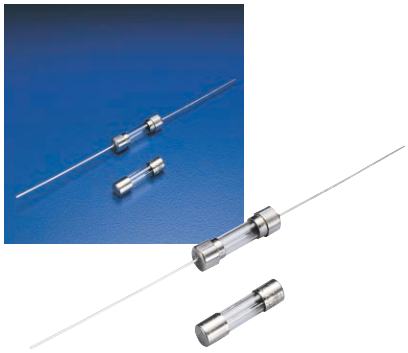


Ordering Information

Catalog Number (Cartridge)	Catalog Number (Axial Lead)	Ampere Rating	Voltage Rating	Nominal Resistance (Cold Ω)	Nominal Melting I²t (A² Sec.)
229.250	230.250	1/4	250	2.410	0.216
229.350	230.350	35/100	250	1.300	0.490
229.375	230.375	3/8	250	1.160	0.580
229.500	230.500	1/2	250	0.688	1.16
229.600	230.600	6/10	250	0.477	1.75
229.750	230.750	3/4	250	0.340	2.95
229.800	230.800	8/10	250	0.304	3.45
229 001	230 001	1	250	0.210	5.64
229 1.25	230 1.25	1-1/4	250	0.145	9.80

Note: LF Logo, series number, amperage rating, voltage rating, and UL and CSA logos are stamped on fuse caps. For more Slo-Blo ratings, see the Electronic Designers Guide, EC101-G.

IEC Standard Axial Lead and Cartridge Fuses
5 x 20mm Series



Features

5 x 20mm Fast-Acting Fuses 216 and 217 Series, and Time Lag Fuses 218 Series:

- Designed to IEC standards for global use
- Meets the IEC 60127-2, Sheet 1 and 2 specification for fast-acting fuses, Sheet 3 specifications for time lag fuses
- Available in cartridge and axial lead form
- Available in ratings of 0.032 to 10A

Specifications

Interrupting Ratings:

(216 Series) 1500A

(217/218 Series) 35A or 10 x rated current, whichever is greater

Approvals:

(216/217/218 Series)

IEC 60127-2/127-2

Semko approved through 6.3A

VDE approved .05 to 6.3A

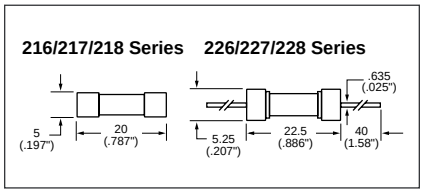
BSI approved 1A to 6.3A

UL Recognized/CSA Certified

Electrical Characteristics

	% of Ampere Rating	216/226 Series Opening Time Minimum / Maximum	217/227 Series Opening Time Minimum / Maximum	218/228 Series Opening Time Minimum / Maximum
.032 – .100A	150	60 min. / —	60 min. / —	60 min. / —
	210	— / 30 min.	— / 30 min.	— / 2 min.
	275	0.01 sec. / 2 sec.	0.01 sec. / 5 sec.	0.2 sec. / 10 sec.
	400	0.003 sec. / 0.3 sec.	0.003 sec. / 0.1 sec.	0.04 sec. / 3 sec.
	1000	— / 0.02 sec.	— / 0.02 sec.	0.01 sec. / 0.3 sec.
.125 – 6.3A	150	60 min. / —	60 min. / —	60 min. / —
	210	— / 30 min.	— / 30 min.	— / 2 min.
	275	0.01 sec. / 3 sec.	0.05 sec. / 2 sec.	0.6 sec. / 10 sec.
	400	0.003 sec. / 0.3 sec.	0.01 sec. / 0.3 sec.	0.15 sec. / 3 sec.
	1000	— / 0.02 sec.	— / 0.02 sec.	0.01 sec. / 0.3 sec.

Dimensions

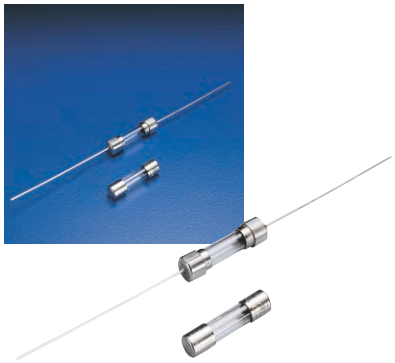


Ordering Information

Ampere Rating	216/226 Series (Fast-Acting) Catalog Number	216/226 Series (Fast-Acting) Nominal Melting I²t (A² Sec.)	217/227 Series (Fast-Acting) Catalog Number	217/227 Series (Fast-Acting) Nominal Melting I²t (A² Sec.)	218/228 Series (Time Lag) Catalog Number	218/228 Series (Time Lag) Nominal Melting I²t (A² Sec.)
0.032	—	—	217.032	0.000048	218.032	0.00305
0.040	—	—	217.040	0.000074	218.040	0.0055
0.050	216.050	0.00019	217.050	0.00020	218.050	0.0071
0.063	216.063	0.00055	217.063	0.00057	218.063	0.012
0.080	216.080	0.00086	217.080	0.00085	218.080	0.0265
0.100	216.100	0.0033	217.100	0.0034	218.100	0.0495
0.125	216.125	0.0056	217.125	0.0049	218.125	0.150
0.160	216.160	0.0018	217.160	0.011	218.160	0.225
0.200	216.200	0.0045	217.200	0.025	218.200	0.350
0.250	216.250	0.0092	217.250	0.043	218.250	0.555
0.315	216.315	0.015	217.315	0.110	218.315	1.14
0.400	216.400	0.028	217.400	0.130	218.400	1.35
0.500	216.500	0.045	217.500	0.225	218.500	2.90
0.630	216.630	0.097	217.630	0.420	218.630	4.80
0.800	216.800	0.18	217.800	0.870	218.800	1.99
1	216 001	0.19	217 001	1.07	218 001	3.33
1.25	216 1.25	0.49	217 1.25	2.29	218 1.25	5.80
1.6	216 01.6	1.04	217 01.6	4.74	218 01.6	10.61
2	216 002	1.92	217 002	5.88	218 002	14.80
2.5	216 02.5	2.77	217 02.5	9.72	218 02.5	23.85
3.15	216 3.15	7.85	217 3.15	18.2	218 3.15	39.20
4	216 004	15.4	217 004	30.0	218 004	70.95
5	216 005	28.2	217 005	43.9	218 005	114.0
6.3	216 06.3	57.9	217 06.3	64.2	218 06.3	204.0
8	216 008	66.1	217 008	203.5	218 008	350.5
10	216 010	158.5	217 010	223.5	218 010	583.0
15	—	—	—	—	218 015	1441.0

Note: For axial leads in 216, 217, and 218 Series, change catalog numbers from 216 to 226, 217 to 227, and 218 to 228. All fuses listed are rated @ 250 VAC.

UL/CSA Standard Axial Lead and Cartridge Fuses
5 x 20mm Series



Features

5 x 20mm Medium-Acting Fuses 233 Series, Fast-Acting 235 Series, and Time Lag Fuses 239 Series:

- Designed to UL/CSA/ANCE 248 standard
- Available in cartridge and axial lead format
- Available in ratings of 0.200 to 5A

Specifications

Approvals:

(233 Series)
MITI approved

(235 Series)
MITI approved from 1A to 5A

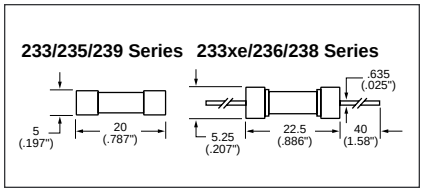
(239 Series)
MITI approved from 1A to 5A
Patented

UL Recognized/CSA Certified

Electrical Characteristics

	% of Ampere Rating	233/233xe Series Opening Time Minimum / Maximum	235/236 Series Opening Time Minimum / Maximum	238/239 Series Opening Time Minimum / Maximum
1 to 3.5A	110	4 hrs. / —	4 hrs. / —	4 hrs. / —
	135	— / 1 hr.	— / 1 hr.	— / 1 hr.
	200	— / 3 sec.	— / 1 sec.	5 sec. / —
4 to 6.3A	110	1 hr. / —	4 hrs. / —	4 hrs. / —
	135	— / 1 hr.	— / 1 hr.	— / 1 hr.
	200	— / 3 sec.	— / 1 sec.	5 sec. / —

Dimensions



Ordering Information

Ampere Rating	233/233xe Series (Medium-Acting) Catalog Number	Nominal Melting I²t (A² Sec.)	235/236 Series (Fast-Acting) Catalog Number	Nominal Melting I²t (A² Sec.)	238/239 Series (Time Lag) Catalog Number	Nominal Melting I²t (A² Sec.)
0.100	—	—	235.100	0.00160	—	—
0.125	—	—	235.125	0.00280	—	—
0.200	—	—	235.200	0.00890	239.200	0.170
0.250	—	—	235.250	0.0170	239.250	0.3508
0.300	—	—	235.300	0.0330	239.300	0.630
0.400	—	—	235.400	0.0600	239.400	1.53
0.500	—	—	235.500	0.0710	239.500	2.04
0.600	—	—	235.600	0.115	239.600	2.48
0.700	—	—	235.700	0.160	239.700	4.23
0.750	—	—	—	—	239.750	5.57
0.800	—	—	235.800	0.260	239.800	7.77
1	0233 001	2.03	235 001	0.480	239 001	11.60
1.25	0233 1.25	3.48	235 1.25	1.12	239 1.25	20.05
1.6	0233 0.16	6.31	235 01.6	2.08	239 01.6	31.25
2	0233 002	10.2	235 002	2.72	239 002	51.95
2.5	0233 02.5	17.5	235 02.5	5.59	239 02.5	81.85
3	0233 003	27.0	235 003	8.62	239 003	133.0
3.15	0233 3.15	30.6	—	—	239 3.15	131.5
3.5	0233 03.5	37.3	—	—	239 004	278.0
4	0233 004	53.0	235 004	17.60	239 005	311.0
5	0233 005	92.4	235 005	28.15	—	—
6	0233 006	135	235 006	48.60	—	—
6.3	0233 06.3	156	—	—	—	—

Note: For axial leads in 233 Series, add packaging suffix XE. For radial leads in 233 Series, add packaging suffix XW. For tape and reel option in 233 Series, contact Littlefuse. For axial leads in 235 Series, change catalog number from 235 to 236.

For axial leads in 239 Series, change catalog number from 239 to 238. All fuses listed are rated @ 250 VAC

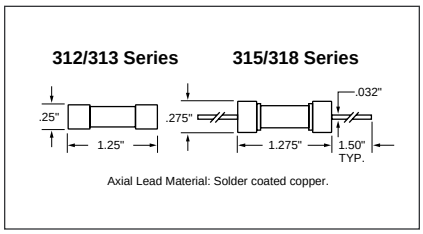
Glass Body Axial Lead and Cartridge Fuses
3AG Fast-Acting Series

312/318 Series Fast-Acting Fuses, 313/315 Series Slo-Blo Fuses. 3AG fuses satisfy a broad range of application requirements and are a standard for cost-effective and reliable circuit protection.

Electrical Characteristics

% of Ampere Rating	Ampere Rating	313/315 Slo-Blo Opening Time Min / Max	312/318 Fast-Acting Opening Time Min / Max
110%	1/32 - 35	4 hrs. / —	4 hrs. / —
135%	1/32 - 35	— / 1 hr.	— / 1 hr.
200%	1/32 - 10	5 sec. / —	— / 5 sec.
	12 - 30	5 sec. / —	— / 10 sec.
	35	5 sec. / —	— / 20 sec.

Dimensions



Axial Lead Material: Solder coated copper.

Specifications

Approvals:

(312/318 Series)

1/100 to 10A: Listed to UL 248-14

12 to 30A: Listed to UL 275

CSA approved

(313/315 Series)

0 to 8A: UL Listed

MITA approved from 1A to 5A (313)

CSA approved

Ordering Information

	313/315 Slo-Blo			312/318 Fast-Acting		
Ampere Rating	Catalog Number	Nominal Melting I^2t (A^2 Sec.)	Voltage Rating	Catalog Number	Nominal Melting I^2t (A^2 Sec.)	Voltage Rating
1/100	313.010	0.000121	250	—	—	250
1/32	313.031	0.00303	250	312.031	0.00003	250
1/25	313.040	0.00630	250	—	—	250
1/16	313.062	0.0210	250	312.062	0.000249	250
1/10	313.100	0.0850	250	313.100	0.00102	250
1/8	313.125	0.152	250	312.125	0.00289	250
3/20	313.150	0.270	250	312.150	0.0055	250
7/40	313.175	0.177	250	312.175	0.0096	250
3/16	313.187	0.230	250	312.187	0.0128	250
1/5	313.200	0.270	250	312.200	0.0165	250
1/4	313.250	0.385	250	312.250	0.0355	250
3/10	313.300	0.730	250	312.300	0.0689	250
3/8	313.375	1.23	250	312.375	0.185	250
2/5	313.400	1.35	250	—	—	250
1/2	313.500	2.55	250	312.500	0.483	250
3/5	313.600	4.00	250	312.600	0.880	250
7/10	313.700	5.90	250	—	—	250
3/4	313.750	7.16	250	312.750	1.84	250
4/5	313.800	8.00	250	—	—	250
1	313001	14.0	250	312001	0.760	250
1-1/5	31301.2	21.5	250	—	—	250
1-1/4	3131.25	24.0	250	3121.25	1.45	250
1-1/2	31301.5	38.0	250	31201.5	2.35	250
1-3/5	31301.6	49.6	250	31201.6	2.80	250
1-3/4	—	—	250	3121.75	3.60	250
1-4/5	31301.8	58.0	250	31201.8	3.85	250
2	313002	77.0	250	312002	5.20	250
2-1/4	3132.25	121.0	250	3122.25	7.20	250
2-1/2	31302.5	130.0	250	31202.5	9.54	250
2-4/5	31302.8	170.0	250	—	—	250
3	313003	200.0	250	312003	14	250
3-1/5	31303.2	209.0	250	—	—	250
4	313004	76.1	250	312004	28.5	250
5	313005	140.0	250	312005	50.0	250
6	—	—	250	312006	81.1	250
6-1/4	3136.25	242.0	250	—	—	250
6-3/10	3136.30	242.0	250	—	—	250
7	313007	347.0	250	312007	118.0	250
8	313008	445.0	250	312008	166.0	250
10	313010	760.0	32	312010	298.0	250
12	313012	1200.0	32	312012	—	32
15	313015	1870.0	32	312015	—	32
20	313020	9560.0	32	312020	—	32
25	313025	16500.0	32	312025	—	32
30	313030	26900.0	32	312030	—	32
35	—	—	—	312035	—	32

Note: For axial leads in the 313 Series, change catalog number from 313 to 315.
For axial leads in the 312 Series, change catalog number from 312 to 318.

UL/CSA Standard Axial Lead and Cartridge Fuses
3AB Series

Features

3AB Fast-Acting Type 314 Series, Very Fast-Acting Type 322 Series, and Slo-Blo Type 326 Series:

- For protection of silicon controlled rectifiers and similar solid-state devices (322 Series)
- Voltage rating for 314 Series is UL listed through 15A @ 250 VAC/125 DC
- Ideal application where high current loads are expected
- Ceramic body construction permits higher interrupting ratings and voltage ratings

Specifications

Approvals:

CSA Certified (LR29862)

(314 Series)
UL Recognized from 20A to 30A,
20A @ 250 VAC/125 VDC,
25A–30A @125 VAC/VDC,
MITI approved from 10A to 15A (E10480)

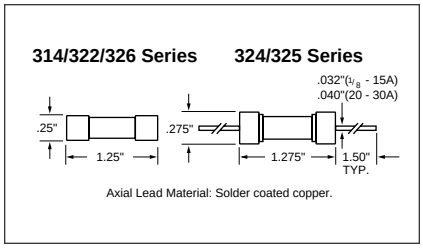
(322 Series)
UL recognized from 1A to 10A @ 250 VAC/65 VDC, 12A to 30A @ 65 VAC/VDC

(326 Series)
UL listed from 1/4A to 10A

Electrical Characteristics

% of Ampere Rating	314 Series .125 to 12A Mini. / Maxi.	314 Series 15 to 30A Mini. / Maxi.	322 Series 1 to 10A Mini. / Maxi.	322 Series 12 to 30A Mini. / Maxi.	326 Series .01 to 3.2A Mini. / Maxi.	326 Series 4 to 30A Mini. / Maxi.
100	4 hrs. / —	4 hrs. / —	4 hrs. / —	4 hrs. / —	4 hrs. / —	4 hrs. / —
110	4 hrs. / —	4 hrs. / —	—	—	4 hrs. / —	4 hrs. / —
135	— / 1 hr.	— / 1 hr.	—	—	— / 1 hr.	— / 1 hr.
200	— / 15 sec.	— / 30 sec.	—	—	5 sec. / 30 sec.	5 sec. / 60 sec.
250	—	—	— / .2 sec.	— / 1 sec.	—	—

Dimensions



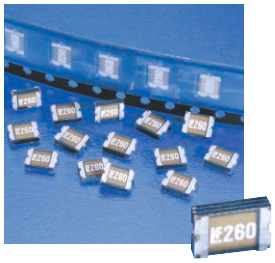
Axial Lead Material: Solder coated copper.

Ordering Information

Ampere Rating	314/324 Series Catalog Number	314/324 Series Nominal Melting I²t (A² Sec.)	322 Series Catalog Number	322 Series Nominal Melting I²t (A² Sec.)	326/325 Series Catalog Number	326/325 Series Nominal Melting I²t (A² Sec.)
1/100	—	—	—	—	326.010	0.00148
1/32	—	—	—	—	326.031	0.0110
1/16	—	—	—	—	326.062	0.0276
1/10	—	—	—	—	326.100	0.0870
1/8	314.125	0.00149	—	—	326.125	0.100
15/100	—	—	—	—	326.150	0.143
0.175	—	—	—	—	326.175	0.220
3/16	—	—	—	—	326.187	0.230
2/10	—	—	—	—	326.200	0.213
1/4	314.250	0.0140	—	—	326.250	0.432
3/10	—	—	—	—	326.300	0.690
3/8	314.375	0.050	—	—	326.375	1.20
4/10	—	—	—	—	326.400	1.33
1/2	314.500	0.115	—	—	326.500	2.50
6/10	—	—	—	—	326.600	3.90
7/10	—	—	—	—	326.700	6.42
3/4	314.750	0.466	—	—	326.750	7.00
8/10	—	—	—	—	326.800	8.20
1	314 001	0.690	322 001	—	326 001	16.3
1-2/10	—	—	—	—	326 01.2	22.0
1-1/4	—	—	322 1.25	—	326 1.25	24.0
1-1/2	—	—	—	—	326 01.5	40.1
1-6/10	—	—	—	—	326 01.6	45.0
2	314 002	11.0	322 002	—	326 002	80.0
2-1/2	—	—	—	—	326 02.5	136.0
2-8/10	—	—	—	—	326 02.8	170.0
3	314 003	14.6	322 003	—	326 003	200.0
3-2/10	—	—	—	—	326 03.2	214.0
4	314 004	10.4	322 004	—	326 004	9.71
5	314 005	26.0	322 005	—	326 005	25.0
6	314 006	45.0	322 006	—	—	—
6-1/4	—	—	—	—	326 6.25	60.4
7	314 007	71.0	322 007	—	326 007	47.3
8	314 008	105.0	322 008	—	326 008	67.1
9	—	—	322 009	—	—	—
10	314 010	206.0	322 010	—	326 010	137.0
12	314 012	570.0	322 012	—	326 012	129.0
15	314 015	292.0	322 015	—	326 015	245.0
20	314 020	631.0	322 020	—	326 020	575.0
25	314 025	1450.0	322 025	—	326 025	1030.0
30	314 030	2490.0	322 030	—	326 030	1690.0

Note: For axial leads in 314 and 326 Series, change catalog numbers from 314 to 324 and 326 to 325. All fuses are rated @ 250 VAC

Surface Mount Resettable PTCs
1812L Series



Features

- Utilize a unique polymer-based, positive temperature coefficient (PTC) material to protect electrical circuits against overcurrent conditions
- Provide surface mount overcurrent protection in a compact package
- Ideal for computer applications including: hard disc drives, USB ports, PC cards and printers

Specifications

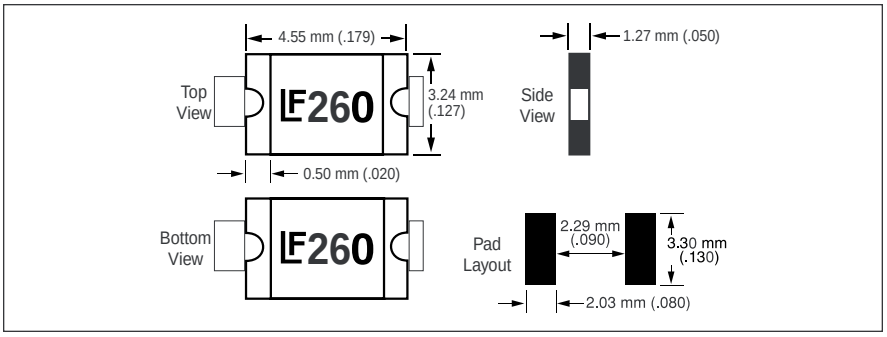
Approvals:

UL Recognized (UL E183209)
CSA Certified (LR108832)
TUV B 98 12 30766006

Materials:

Terminations: Tin-lead plated copper

Dimensions



Ordering Information

Part Number	I_{hold} (A)	I_{trip} (A)	V_{max} (Vdc)	I_{max} (A)	P_d max (W)	Maximum Time to Trip Current (A)	Maximum Time to Trip Time (Sec)	Resistance R_{IL} (Ω)	Resistance R_{AT} (Ω)	Dimension A
1812L050	0.50	1.00	15.0	40	0.8	8.0	0.15	0.100	1.000	0.50 (.020)
1812L075	0.75	1.50	13.2	40	0.8	8.0	0.20	0.075	0.420	0.50 (.020)
1812L110	1.10	2.20	6.0	40	0.8	8.0	0.30	0.040	0.226	0.50 (.020)
1812L125	1.25	2.50	6.0	40	0.8	8.0	0.25	0.045	0.184	0.40 (.016)
1812L150	1.50	3.00	6.0	40	0.8	8.0	0.30	0.040	0.137	0.40 (.016)
1812L200	2.00	4.00	6.0	40	0.8	8.0	2.50	0.180	0.070	0.40 (.016)
1812L260	2.60	5.20	6.0	40	0.8	8.0	2.50	0.010	0.050	0.40 (.016)

I_{hold} — Hold current: maximum current device will sustain for four hours without tripping in 20°C still air
I_{trip} — Trip current: minimum current device will trip in 20°C still air
V_{max} — Maximum voltage device can withstand without damage at rated current (I_{max})
I_{max} — Maximum fault current device can withstand without damage at rated voltage (V_{max})
$P_{d\ max}$ — Power dissipated from device when in the tripped state at 20°C still air
R_{IL} — Minimum resistance of device in initial (unsoldered) state
R_{AT} — Maximum resistance of device at 20°C measured one hour after tripping or reflow soldering of 260°C

CAUTION: Operation beyond the specified ratings may result in damage and possible arcing and flame.

Surface Mount Resettable PTCs
3425L Series

In normal operation, the 3425L Series PTC has many conductive paths and a very low resistance. In an overcurrent condition, the temperature of the polymer material rises. This dramatically reduces the conductive paths resulting in an immediate rise in resistance. In this condition, the device provides circuit protection by significantly limiting the flow of current. However, once the cause of the initial overcurrent condition is eliminated, the 3425L Series PTC cools down and resets to a low resistance value permitting the normal current flow to resume.

Features

- The 3425L Series is surface mountable
- Utilizes a unique polymer-based, positive temperature coefficient (PTC) material to protect electrical circuits against overcurrent conditions

Specifications

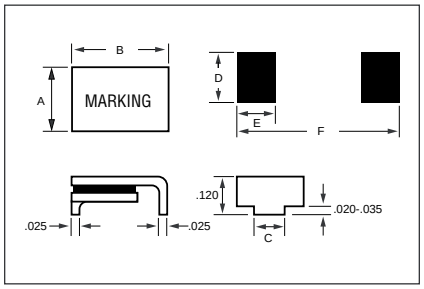
Approvals:

UL Recognized (UL E183209)
CSA Certified (LR108832)

Materials:

Terminations: Tin-plated brass to MIL-T-10727B

Dimensions



Series	A	B	C	D	E	F
3425L	.264 max.	.374 max.	.145	.180	.090	.420

Dimensions are in inches

Ordering Information

Part Number	I_{hold} (A)	I_{trip} (A)	V_{max} (Vdc)	I_{max} (A)	P_d max (W)	Maximum Time to Trip: Current (A)	Maximum Time to Trip: Time (Sec)	Resistance: R_{IL} (Ω)	Resistance: R_{AT} (Ω)
3425L150	1.50	3.0	15	40	1.9	8.0	5.0	0.060	0.25
3425L200	2.00	4.0	15	40	1.9	8.0	12.0	0.050	0.15
3425L250	2.50	5.0	15	40	1.9	8.0	25.0	0.035	0.10
3425L300	3.00	6.0	15	40	1.9	8.0	32.0	0.020	0.06

I_{hold} — Hold current: maximum current device will sustain for four hours without tripping in 20°C still air
I_{trip} — Trip current: minimum current device will trip in 20°C still air
V_{max} — Maximum voltage device can withstand without damage at rated current (I_{max})
I_{max} — Maximum fault current device can withstand without damage at rated voltage (V_{max})
$P_{d\,max}$ — Power dissipated from device when in the tripped state at 20°C still air
R_{IL} — Minimum resistance of device in initial (unsoldered) state
R_{AT} — Maximum resistance of device at 20°C measured one hour after tripping or reflow soldering of 260°C

CAUTION: Operation beyond the specified ratings may result in damage and possible arcing and flame.

Radial Leaded Resettable PTCs
60R Series

In normal operation, the 60R Series PTC has many conductive paths and a very low resistance. In an overcurrent condition, the temperature of the polymer material rises. This dramatically reduces the conductive paths resulting in an immediate rise in resistance. In this condition, the device provides circuit protection by significantly limiting the flow of current. However, once the cause of the initial overcurrent condition is eliminated, the 60R Series PTC cools down and resets to a low resistance value permitting the normal current flow to resume.

Features

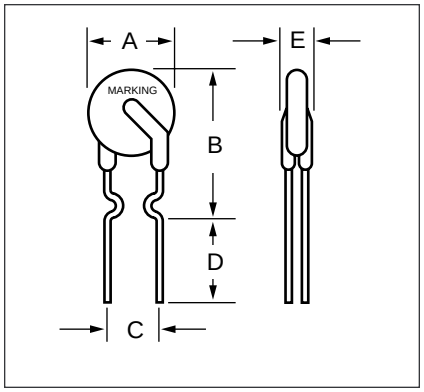
- Utilizes a unique polymer-based, positive temperature coefficient (PTC) material to protect electrical circuits against overcurrent conditions
- The 60R Series is a 60V radial leaded device with a 40A short circuit rating

Specifications

Approvals:

UL Recognized (UL E183209)
CSA Certified (LR108832)

Dimensions



Ordering Information

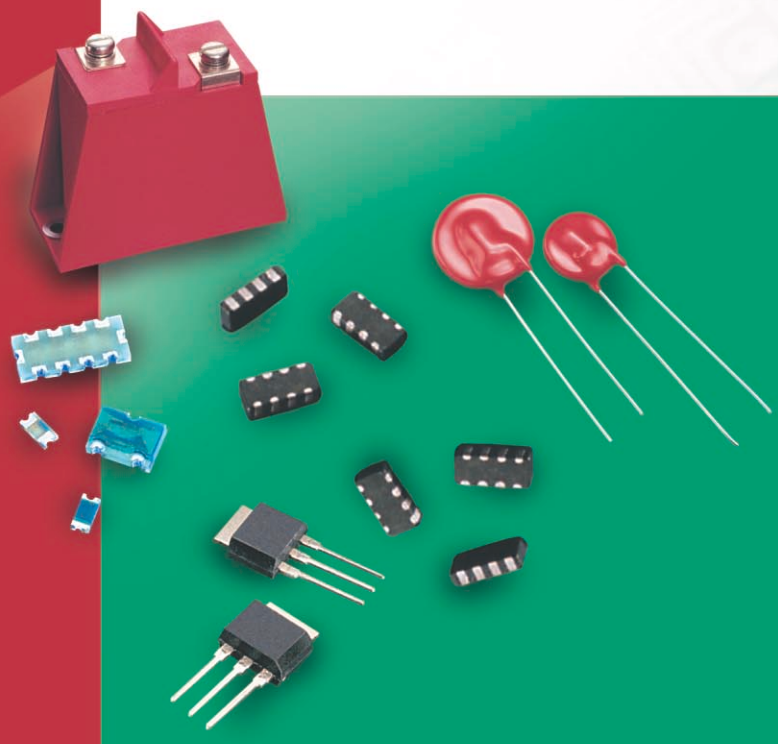
Part Number	I_{hold} (A)	I_{trip} (A)	V_{max} (Vdc)	I_{max} (A)	P_d max (W)	Maximum Time to Trip: Current (A)	Maximum Time to Trip: Time (Sec)	Resistance: R_{IL} (Ω)	Resistance: R_{AT} (Ω)
60R010	0.10	0.20	60	40	0.38	0.50	4.0	2.50	7.50
60R017	0.17	0.34	60	40	0.48	0.85	3.0	3.30	8.00
60R020	0.20	0.40	60	40	0.41	1.00	2.2	1.83	4.40
60R025	0.25	0.50	60	40	0.45	1.25	2.5	1.25	3.00
60R030	0.30	0.60	60	40	0.49	1.50	3.0	0.88	2.10
60R040	0.40	0.80	60	40	0.56	2.00	3.8	0.55	1.29
60R050	0.50	1.00	60	40	0.77	2.50	4.0	0.50	1.17
60R065	0.65	1.30	60	40	0.88	3.25	5.3	0.31	0.72
60R075	0.75	1.50	60	40	0.92	3.75	6.3	0.25	0.60
60R090	0.90	1.80	60	40	0.99	4.50	7.2	0.20	0.47
60R110	1.10	2.20	60	40	1.50	5.50	8.2	0.15	0.38
60R135	1.35	2.70	60	40	1.70	6.75	9.6	0.12	0.30
60R160	1.60	3.20	60	40	1.90	8.00	11.4	0.09	0.22
60R185	1.85	3.70	60	40	2.10	9.25	12.6	0.08	0.19
60R250	2.50	5.00	60	40	2.50	12.50	15.6	0.05	0.13
60R300	3.00	6.00	60	40	2.80	15.00	19.8	0.04	0.10
60R375	3.75	7.50	60	40	3.20	18.75	24.0	0.03	0.08

I_{hold} — Hold current: maximum current device will sustain for four hours without tripping in 20°C still air
I_{trip} — Trip current: minimum current device will trip in 20°C still air
V_{max} — Maximum voltage device can withstand without damage at rated current (I_{max})
I_{max} — Maximum fault current device can withstand without damage at rated voltage (V_{max})
$P_{d\,max}$ — Power dissipated from device when in the tripped state at 20°C still air
R_{IL} — Minimum resistance of device in initial (unsoldered) state
R_{AT} — Maximum resistance of device at 20°C measured one hour after tripping or reflow soldering of 260°C

CAUTION: Operation beyond the specified ratings may result in damage and possible arcing and flame.

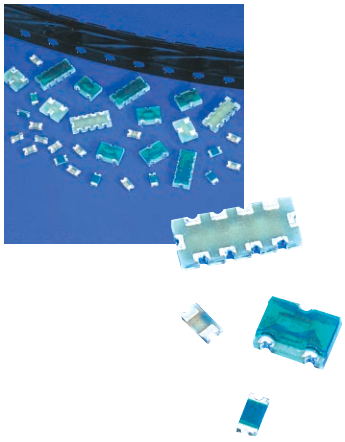
overvoltage/suppression

PROTECTION PRODUCTS



Littelfuse®

Surface Mount ESD Suppressors
PulseGuard® Series



PulseGuard ESD suppressors provide protection for electronic devices against the threat of electrostatic discharge (ESD). Employing a voltage-variable material to switch between high resistance and low resistance states, PulseGuard suppressors shunt ESD transients away from sensitive circuitry. They are ideal for use on high-speed data and signal communication lines that link the IC or ASIC to the outside of the electronic equipment. PulseGuard suppressors are designed to increase the reliability of electronic equipment as well as allowing compliance with ESD test specifications (IEC 61000-4-2, MIL-STD-883).

Electrical Characteristics

- Capacitance <0.055pF @ 1 MHz
- Leakage Current <1.0µA @ 5 VDC
- Trigger Voltage 1,000V
- Clamping Voltage 150V, typical
- Rated Voltage 24 VDC (max)
- Peak Current 45A, at 15 kV

Specifications

Body Material:
Glass epoxy

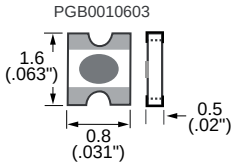
Terminations:
Tin-lead

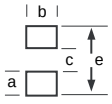
Voltage Variable Material:
Littelfuse polymeric formula

Dimensions

Reference Dimensions **Recommended Pad Layout**

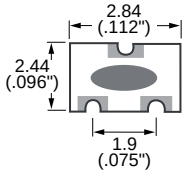
PGB0010603

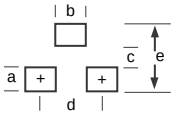




Dimensions (in.)	Reflow	Wave
a	1.27 (.050″)	1.27 (.050″)
b	0.76 (.030″)	0.76 (.030″)
c	0.51 (.020″)	0.76 (.030″)
d	N/A	N/A
e	3.05 (.120″)	3.30 (.130″)

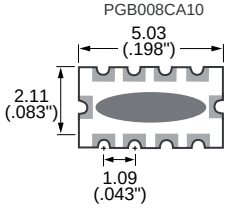
PGB002ST23

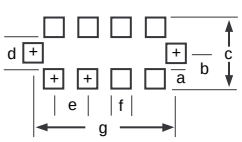




Dimensions (in.)	Reflow	Wave
a	1.27 (.050″)	1.27 (.050″)
b	0.89 (.035″)	0.89 (.035″)
c	1.02 (.040″)	1.27 (.050″)
d	2.03 (.080″)	2.29 (.090″)
e	3.56 (.140″)	3.81 (.150″)

PGB008CA10





Dimensions (in.)	Reflow	Wave
a	0.64 (.025″)	0.91 (.036″)
b	1.27 (.050″)	1.52 (.060″)
c	2.57 (.101″)	3.02 (.119″)
d	1.30 (.051″)	1.19 (.047″)
e	1.09 (.043″)	1.09 (.043″)
f	0.76 (.030″)	0.76 (.030″)
g	4.85 (.191″)	5.03 (.198″)

Ordering Information

Consult Littelfuse website or Littelfuse Electronic Designer's Guide for more information.

Multilayer Surface Mount Transient Voltage Surge Suppressors
ML, MLE, MLN Series

The multilayer varistor family of Transient Voltage Surge Suppression devices is based on the Littelfuse Multilayer fabrication technology. These components are designed to suppress a variety of transient events, including those specified by the IEC or other standards used for Electromagnetic Compliance (EMC). Multilayer varistor's are typically applied to protect integrated circuits and other components at the circuit board level.

The wide operating voltage and energy range make them suitable for numerous applications on power supply, control and signal lines.

Multilayer varistors are manufactured from semiconducting ceramics providing bidirectional voltage clamping and are supplied in leadless, surface mount form, compatible with modern reflow and wave soldering procedures.

Specifications

Continuous:

Steady State Applied Voltage:

DC Voltage Range ($V_{M(DC)}$)
3.5 to 120V

AC Voltage Range ($V_{M(AC)RMS}$)
2.5 to 104V

Transient:

Non-Repetitive Surge Current,
8/20µs Waveform, (I_{TM}) 30 to 250A

Non-Repetitive Surge Energy,
10/1000µs Waveform, (W_{TM}) 0.1 to 1.2J

Features

- Multilayer ceramic construction technology
- -55°C to 125°C operating temperature range
- Wide operating voltage range $V_{M(DC)}$ = 3.5V to 120
- Standard low capacitance types available
- Rated for energy (10 x 100)
- Rated for surge current (8 x 20)
- Inherent bidirectional clamping
- No plastic or epoxy packaging assures better than UL 94V-0 flammability rating

Applications

- Suppression of inductive switching or other transient events such as EFT and surge voltage at the circuit board level
- ESD protection for components sensitive to IEC 61000-4-2, MIL-STD-883C Method 3015.7, and other industry specifications (see also the MLE or MLN series)
- Provides on-board transient voltage protection for ICs and transistors
- Used to help achieve electromagnetic compliance of end products
- Replace larger surface mount TVS zeners in many applications

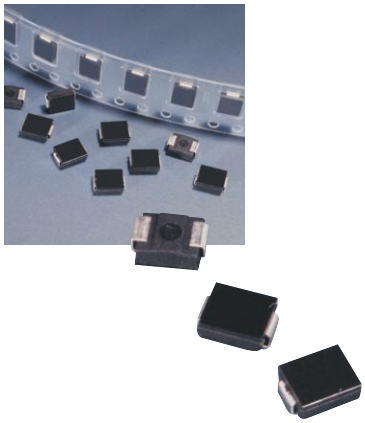
Packaging

0402, 0603, 0805, 1206, 1210, 1812, 2220, size options

Ordering Information

Refer to Suppression Guide for more information.

Surgector™ Transient Voltage Suppressors
SGT Surface Mount Series



Surgectors are designed to suppress lightning and other transients that are induced on the telecommunications system as described in various international safety and compatibility standards. These devices can help provide the secondary protection for telecommunications equipment such as telephones, modems, line cards and other devices subject to damage from transient overvoltage. Surgectors can be an integral part of a Telephone Line Protector Unit, meeting AC Power Cross criteria when used in association with properly selected resistors/PTC/ fuse combinations.

Littelfuse Surface Mount Surgectors are manufactured using a silicon thyristor technology, offering bidirectional voltage clamping for transients of either polarity from a single chip.

The Surgector devices described are manufactured with the DO-214AA low profile case style and are second source equivalent parts to industry "SIDAC" types. Surface Mount Surgectors are supplied in embossed carrier tape on 330mm (13 in.) reels.

Applications

- Secondary protectors for telephones, fax machines, modems, line cards, SLIC and TLPU modules
- Alarm systems
- CATV lines
- Remote sensors
- Power supplies

Features

- UL recognized component listed to UL 497B, file E135010
- Rated for telecom industry transient surge levels:
  - Telcordia GR-1089-CORE
  - ITU CCITT K.20/.21
  - FCC Part 68
- Low profile package, compatible with PCMCIA cards, UL-94V-0 listed
- Offered in the most common V_{DRM} voltage types
- Low on-state voltage
- Cross to common industry types
- High minimum holding content

Specifications

Continuous Reverse Voltage, V_{DRM}
58V – 300V

Transient Peak Surge Current, I_{PP}
8 x 20µs, 200A (B Types), 250A (C Types)
10 x 160µs, 150A (B Types), 200A (C Types)
10 x 560µs, 100A (B Types), 150A (C Types)
10 x 1000µs, 50A (B Types), 100A (C Types)

Critical Rate of Rise of Voltage, dv/dt
2000V/µs

Temperature Range (T_A)
-40°C to 85°C

Thermal Resistance (Typical, Note 1) (Θ_{SA})
J Bend Package C Types, 85° C/W
J Bend Package B Types, 90° C/W

Max Storage Temperature Range
-65°C to 150°C

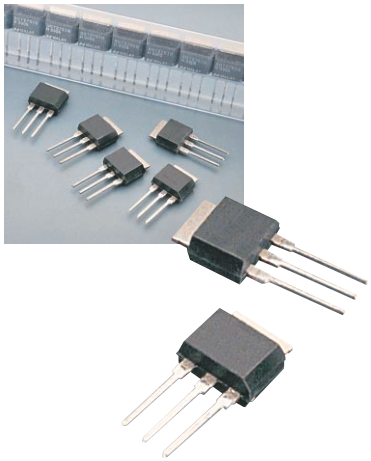
Max Junction Temperature (Plastic Package)
150°C

Max Lead Temperature (Soldering 5s)
300°C

Ordering Information

Refer to Suppression Guide for more information.

Surgector™ Transient Voltage Suppressors
SGT (TO-202) Series



Features

Bidirectional Surge Suppressors: (SGT 23B13, SGT 27B13, SGT 27B27)

- Constructed with a thyristor whose gate contains a special diffused section which acts as a zener diode
- Zener diode section permits anode voltage turn on of the structure
- Packaging: Modified TO-202

Unidirectional Surge Suppressors: (SGT 03U13, SGT 06U13, SGT 23U13)

- Offers unidirectional clamping action
- Designed to protect telecommunications equipment, data links, and other sensitive electrical circuits from damage by transients, lightning strikes, load changes, and power line crosses
- Packaging: Modified TO-202

Gate Controlled Unidirectional Surge Suppressors: (SGT 27S10, SGT 27S23)

- Fast turn-on, high holding current thyristors
- Provides excellent voltage limiting, even on very fast rise time transients, when coupled with a user supplied voltage level detector
- High holding current allows for return to a high impedance off state after a transient
- Packaging: Modified TO-202

Specifications

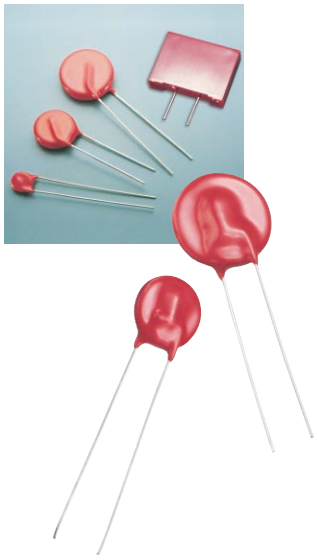
Part #	Off-State Current (max) @25°C	Off-State Current (max) @85°C	Reverse Current @25°C	Reverse Current @85°C	Clamping Voltage (min/max)	Breakover Voltage	Holding Current	On-State Voltage	Main Terminal Capacitance
Bidirectional									
SGT 27B27	200nA	100µA	—	—	270V/325V	345V	270mA	2V	80pF
SGT 23B13	200nA	100µA	—	—	230V/270V	240V	130mA	2V	50pF
SGT 27B13	200nA	100µA	—	—	270V/325V	345V	130mA	2V	50pF
Unidirectional									
SGT 03U13	50nA	10µA	1mA	10mA	33V/ —	50V	130mA	2V	90pF
SGT 06U13	50nA	10µA	1mA	10mA	60V/ —	85V	130mA	2V	90pF
SGT 23U13	50nA	10µA	1mA	10mA	230V/ —	275V	130mA	2V	90pF
Gate Controlled Unidirectional									
SGT 27S10	100nA	50µA	—	—	—	285V	100mA	2V	90pF
SGT 27S23	100nA	50µA	—	—	—	285V	230mA	2V	90pF

Ordering Information

SGT 10 S 10

- 10 — Off-state voltage rating divided by 10
- S — Type of Surgector (U = Unidirectional B = Bidirectional S = SCR)
- 10 — Holding current in mA divided by 10

Transient Voltage Suppression — Radial Metal Oxide Varistor (MOV) Components
ZA, RA, LA, UltraMOV, C-III and TMOV Series



The radial leaded Metal Oxide Varistor (MOV) components listed below are intended for a comprehensive range of applications and transient voltage suppression products. The product series vary in size and package style in order to meet specific performance as well as manufacturing needs of the user. The table below forms a selection guide matrix for the designer by illustrating the various device's working voltage transient energy and peak current ratings range. Additional product information can be found in the Littelfuse SP101 catalog.

Applications

- Cellular/cordless phones
- Modems
- Secondary phone protectors
- Data line connectors
- Repeaters
- Line cards
- COE
- T1/E1/ISDN
- Hand-held/portable devices
- I/O port and interfaces
- UPS
- AC panels
- AC power taps
- TVSS devices
- Power meters
- Power supplies
- Consumer electronics
- Distribution panels

Specifications

	Radial Leaded MOVs				
Series Name	ZA	RA	LA	C-III	UltraMOV
Technology Type	Zinc Oxide	Zinc Oxide	Zinc Oxide	Zinc Oxide	Zinc Oxide
Operating AC Voltage Range	4 – 460	4 – 275	130 – 1000	130 – 320	130 – 625
Operating DC Voltage Range	5.5 – 615	5.5 – 369	175 – 1200	—	170 – 825
Peak Current Range (A)*	50 – 6,500	150 – 6,500	1,200 – 6,500	6,000 – 9,000	1,750 – 10,000
Peak Energy Range (J)	0.1 – 52	0.4 – 140	11 – 360	45 – 220	12.5 – 400
Temperature Range (°C)	-55 – +85	-55 – +125	-55 – +85	-55 – +85	-55 – +85
Lines Protected	1	1	1	1	1
Mount/Form Factor	Radial Leaded	Packaged	Radial Leaded	Radial Leaded	Radial Leaded
Disc Size (MOV)	5, 7, 10 14, 20mm	8, 16, 22mm	7, 10, 14 20mm	14, 20mm	7, 10, 14 20mm
Agency Approvals	UL, VDE	UL, CSA & VDE	UL, CSA & VDE	UL, CSA & VDE	UL, CSA

*Not an applicable parameter for Crowbar devices.

Ordering Information

Refer to Suppression Guide for more information.

Transient Voltage Suppression — Packaged High Energy (MOV's)
DA/DB and BA/BB Series

The BA and BB Series transient surge suppressors are heavy-duty industrial metal oxide varistors (MOV's) designed to provide surge protection for power supplies and power distribution centers used in the telecommunications industry. These UL recognized varistors have similar package construction but differ in size and rating. The BA models are rated from 130V to 880$V_{M(AC)}$. The BB models are rated from 1100V to 2800$V_{M(AC)}$.

The DA Series devices feature rigid terminals to insure secure wire contacts. Both the DA and DB Series feature improved creep and strike distance capability to minimize breakdown along the package surface design that provides complete electrical isolation of the disc subassembly.

Features

- UL Recognized as "Transient Voltage Surge Suppressors" to Std. 1449, second edition (BA Types)
- Rigid terminals for secure wire contact
- Case design provides complete electrical isolation of disc assembly
- Wide operating voltage range
- Very high energy absorption capability
- No derating up to 85°C ambient

Applications

- A/C power distribution
- Power generation
- Industrial controllers

Specifications

	BA Series	BB Series	DA/DB Series
Continuous:			
Steady State Applied Voltage:			
AC Voltage Range ($V_{M(AC)RMS}$)	130V to 880V	1100V to 2800V	130V to 750V
DC Voltage Range ($V_{M(DC)}$)	175V to 1150V	1400V to 3500V	175V to 970V
Transient:			
Peak Pulse Current (I_{TM}) for 8/20uS Current Wave	50,000A to 70,000A	70,000A	30,000 to 40,000A
Single Pulse Energy Range for 2ms Current Square Wave (W_{TM})	450J to 3200J	3800J to 10,000J	270J to 1050J
Operating Ambient Temp. Range (TA)	-55°C to 85°C	-55°C to 85°C	-55°C to 85°C
Storage Temp. Range (T_{STG})	-55°C to 125°C	-55°C to 125°C	-55°C to 125°C

Ordering Information

Refer to Suppression Guide for more information.

Transient Voltage Suppression — Industrial High Energy Metal Oxide Disc Varistors
NA34, CA50 and CA60 Series

This family of High Energy Metal Oxide Disc Varistors are intended for applications requiring heavy-duty industrial transient suppression provided by a device with unique electrical contact or packaging methods. The electrode finish of these devices is solderable and can also be used with pressure contacts. Discs of the same size can be stacked.

The CA series of industrial disc varistors are available in three diameters, 32mm, 40mm, and 60mm with disc thickness ranging from 1.8mm to 32mm. They are available in a wide voltage range from 130V to 2800V.

The NA series is a square 34mm device for voltage applications ranging from 130V to 750V.

Features

- Provided in disc form for unique packaging by the customer
- Designed for pressure contacts and/or disc stacking
- Solderable electrode finish options
- Wide operating voltage range: $V_{M(AC)RMS}$: 130V to 750V
- Very high energy absorption capability: W_{TM} = 200J to 10,000J
- High peak pulse current capability: I_{TM} — 20,000A to 70,000A
- No derating up to 85°C ambient

Applications

- AC/DC power distribution
- Meter protection
- Surge arresters
- High energy surge protection devices (SPD)
- DIN rail mounted SPD

Specifications

	CA Series	NA Series
Continuous:		
Steady State Applied Voltage:		
AC Voltage Range ($V_{M(AC)RMS}$)	130V to 2800V	130V to 750V
DC Voltage Range ($V_{M(DC)}$)	175V to 3500V	175V to 970V
Transient:		
Peak Pulse Current (I_{TM}) for 8/20uS Current Wave	20,000A to 70,000A	40,000A
Single Pulse Energy Range for 2ms Current Square Wave (W_{TM})	200J to 10,000J	270J to 1050J
Operating Ambient Temp. Range (TA)	-55°C to 85°C	-55°C to 85°C
Storage Temp. Range (T_{STG})	-55°C to 125°C	-55°C to 125°C

Ordering Information

Refer to Suppression Guide for more information.

Transient Voltage Suppression — Leaded High Energy MOV's
HA, HB34 and HC Series

This family of Leaded High Energy Metal Oxide Varistors (MOV's) are intended for a comprehensive range of heavy-duty industrial transient suppression applications. They are designed to provide secondary surge protection in power distribution panels, power supplies, and industrial service entrance equipment used by the telecommunications industry.

The devices comprise 32mm and 40mm circular MOV discs and 34mm square MOV forms.

The HA32 and HA40 Series utilize the 32mm and 40mm circular MOV discs and provide rigid terminals for screw mounting. These devices are also available in a clipped lead version, HC32 and HC40, for through hole board placement. The HB34 Series utilizes a 34mm square MOV and, with similar performance to the HA40 Series, offers a low profile solution in a crimped leaded configuration for through hole board placement.

Features

- UL Recognized and CSA certified as "Transient Voltage Surge Suppressors"
- Wide operating voltage range: $V_{M(AC)RMS}$: 130V to 750V
- High energy absorption capability: W_{TM} = 200J to 1050J
- High peak pulse current capability: I_{TM} — 25,000A to 40,000A
- Rigid terminals for secure mounting
- No derating up to 85°C ambient

Applications

- Power supplies
- UPS
- A/C power distribution
- Meter protection
- Industrial controllers
- Data centers
- High energy surge protection devices (SPD)
- DIN rail mounted SPD

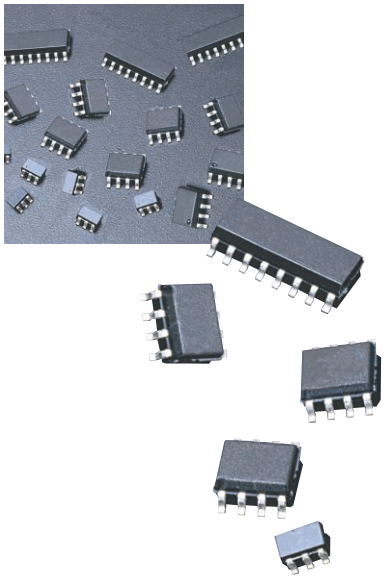
Specifications

	HA Series	HB Series
Continuous:		
Steady State Applied Voltage:		
AC Voltage Range ($V_{M(AC)RMS}$)	130V to 750V	130V to 750V
DC Voltage Range ($V_{M(DC)}$)	175V to 970V	175V to 970V
Transient:		
Peak Pulse Current (I_{TM}) for 8/20uS Current Wave	25,000A to 40,000A	30,000A to 40,000A
Single Pulse Energy Range for 2ms Current Square Wave (W_{TM})	200J to 1050J	270J to 1050J
Operating Ambient Temp. Range (TA)	-55°C to 85°C	-55°C to 85°C
Storage Temp. Range (T_{STG})	-55°C to 125°C	-55°C to 125°C

Ordering Information

Refer to Suppression Guide for more information.

Transient Voltage Suppression
SP72X Series SCR/Diode Arrays



The SP72X family of diode arrays are designed to withstand extreme ESD conditions and provide multiple lines of transient voltage suppression (TVS) protection. The SP series protects data, signal and control lines by diverting transients away from sensitive components.

The SP720 has two protection SCR/diode structures per input and a total of 14 available inputs can be used to protect up to 14 external signal or bus lines.

The SP721 and SP723 have two protection SCR/diode structures per input and there are a total of six inputs that can be used to protect up to six external signal or bus lines.

The SP724 is comprised of bipolar SCR/diode structures to protect up to four independent lines by clamping transients of either polarity to the power supply rails. The SP724 offers very low leakage and low input capacitance.

Features

- Wide selection of array sizes
- High energy rating
- Low profile surface mount packages
- Low capacitance and leakage

Specifications

Capacitance:
3.0 to 5.0 pf; 1 to 2 pf measured

Leakage Current:
1.0 to 2.0 nA @ 25°C

Operating Voltage:
1.0 to 30 VDC

ESD rated to IEC 1000-4-2 (level 4)

Specifications

				MIL-STD 3015.7		IEC 1000-4-2			EIAJ IC121
Part #	Inputs	Package	Styles	Modified HBM	Standard HBM	HBM Air	HBM Direct Discharge	HBM Direct Discharge Two Parallel Inputs	Machine Model
SP720	14	16 Ld	PDIP, SOIC	15kV	6kV	15kV	4kV	8kV	1kV
SP721	6	8 Ld	PDIP, SOIC	15kV	6kV	15kV	4kV	8kV	1kV
SP723	6	8 Ld	PDIP, SOIC	15kV	10kV	15kV	8kV	—	2kV
SP724	4	6 Ld	SOT-23, 6-Pin	8kV (1)	2kV	15kV	8kV	—	2kV

Ordering Information

Refer to Suppression Guide for more information.

Glossary

CLEC (Competitive Local Exchange Carrier) A competitor to local telephone companies that has been granted permission to offer local telephone service. CLECs compete with independent and Bell telephone companies.

CO (Central Office) The location that contains equipment to route calls to and from customers. It also connects customers to Internet Service Providers and long distance carriers.

CPE (Customer Premise Equipment) Telephone systems, modems and terminals installed at customer sites.

ESD (Electrostatic Discharge) The rapid transfer of electrostatic charge between objects.

ESD Suppressors Protective devices connected in parallel to the load that shunt damaging voltages to ground.

ILEC (Incumbent Local Exchange Carrier) Bell and independent telephone companies, established before the Telecommunications act of 1996, that sell local telephone service.

IXC (Interexchange Carrier) Carriers that provide long distance service between CLECs.

LEC (Local Exchange Carrier) Any company authorized by the state public utility commission to sell local telephone service.

MOV (Metal Oxide Varistor) A component that is used to protect circuits by suppressing or diverting transients.

MTSO (Mobile Telephone Switching Office) This location contains all the equipment required for mobile wireless communications.

PBX (Private Branch Exchange) A private telephone switching system, usually located on a customer's premises, that provides intra-premises exchange telephone service, as well as access to the public exchange network and/or private facilities.

POP (Point of Presence) The point where a long distance company's equipment is connected to the local telephone company's central office.

POTS (Plain Old Telephone Service) Analog telephone lines connected to most residential and small business users from their nearest local telephone company.

PSTN (Public Switched Telephone Network) The network of transmission and switching systems, signaling processors, and associated operations support systems (OSS) that is shared by the public. Sometimes referred to as PTN, PSN, PN (Public Telephone Network, Public Switched Network, Public Network.)

PTC Device (Positive Temperature Coefficient) A protective device with electrical characteristics that change with the device's temperature. PTC protective devices temporarily limit current by dramatically increasing in resistance when subjected to overcurrents.

RBOC (Regional Bell Operating Company) Regional Bell Operating Companies that were formed after the breakup of AT&T in 1984. Examples include: US West, Bell South, Bell Atlantic, and SBC.

Router A device with routing intelligence that connects local and remote networks together.

SLIC (Subscriber Line Interface Card) An interface card that connects a telephone network to a piece of equipment (phone, fax, modem, etc).

Surgector A device intended to suppress lightning and other transients. (Also known as thyristors)

T1 A North American and Japanese standard for communicating at 1.54 million bits per second.

Transient A short duration spike in voltage.

Wireless Base Station A remote location next to a cellular tower that contains communication equipment to support wireless calls.

Selection Chart

ESD

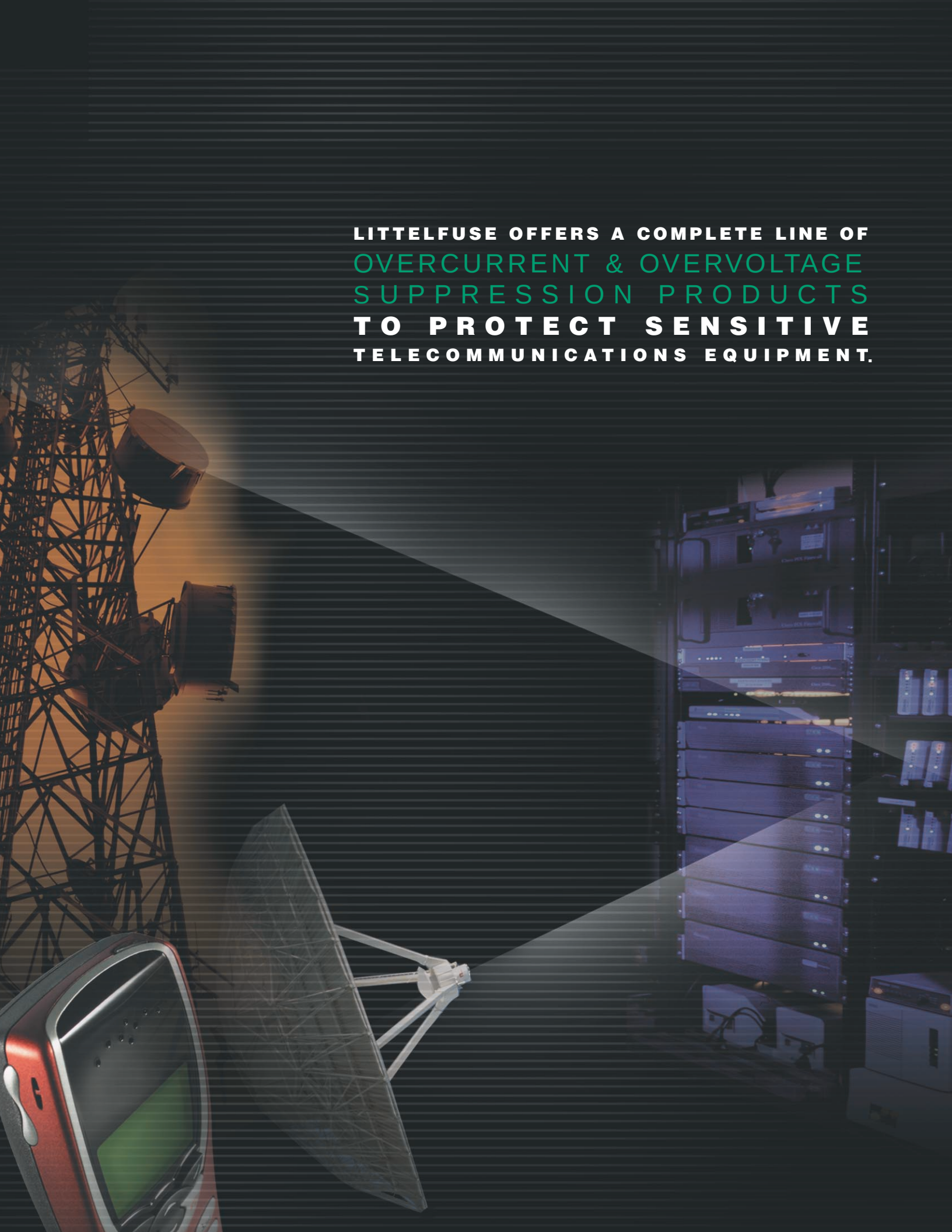
Overcurrent

Overvoltage

Application	Protection	Littelfuse Product	Page
Central Office Power Panels	Provides protection of DC power supplies used to power telephone networks. Must meet Bellcore GR-1089-CORE specifications.	Tele-GARD™ Fuse (L17T Series) Tele-GARD Fuse (TLN Series) Tele-GARD Fuse (TLS Series) Alarm Indication Fuse (481 Series) Alarm Fuseholder (482 Series) Metal-Oxide Varistors (LA, HA, Ultramov Series)	10 13 14 18 19 42, 45
Network Modems Analog, xDSL, ISDN, T1	Must meet UL 1950 3rd Edition/UL 1459 and FCC 46 Part 68 specifications.	*SMT*elecom® Fuse (436 Series) 2AG Slo-Blo® Fuse (230 Series) Surgector™ (SGT Series)	22 29 40
Desktop/PC-card Modems	Must meet UL 1950 3rd Edition and FCC 47 Part 68 specifications.	*SMT*elecom Fuse (436 Series) 2AG Slo-Blo Fuse (230 Series) NANO²® Slo-Blo Fuse (452 Series) 1206 SMF Slo-Blo (430 Series) Surgector (SGT Series)	22 29 23 27 40
Fax Machines/Business Machines	Must meet UL 1950 3rd Edition/UL 1459 and FCC 47 Part 68 specifications.	*SMT*elecom Fuse (436 Series) 2AG Slo-Blo Fuse (230 Series) Surgector (SGT Series) PulseGuard® ESD Suppressor (PGB Series) Multi-layer Varistors (MLE, MLN Series)	22 29 40 38 39
Desktop Telephones	Must meet UL 1950 3rd Edition/UL 1459 and FCC 47 Part 68 specifications.	*SMT*elecom Fuse (436 Series) 2AG Slo-Blo Fuse (230 Series) Surgector (SGT Series)	22 29 40
Answering Machines	Must meet UL 1950 3rd Edition/UL 1459 and FCC 47 Part 68 specifications.	*SMT*elecom Fuse (436 Series) 2AG Slo-Blo Fuse (230 Series) Surgector (SGT Series)	22 29 40
Line Cards and PBXs	Must meet UL 1950 3rd Edition/UL 1459, FCC 47 Part 68 and Bellcore GR-1089-CORE specifications.	*SMT*elecom Fuse (436 Series) 2AG Slo-Blo Fuse (230 Series) Surgector (SGT Series)	22 29 40
Cellular Phones and Wireless Modems	Used for filtering and protection against electro-static discharge (ESD).	PulseGuard ESD Suppressor (PGB Series) Multi-layer Varistors (MLE, MLN Series)	38 39
	Used for overcurrent protection of displays and batteries.	1812L PTC (1812 Series) 1206 SMF Fuse (429 Series) 1206 SMF Slo-Blo (430 Series) 0603 SMF Fuse (431 Series)	34 27 27 26
Telecom/Internet Gateways	Telecom side must meet UL 1950 3rd Edition/UL 1458 and Bellcore GR-1089-CORE specifications.	*SMT*elecom Fuse (436 Series) 2AG Slo-Blo Fuse (230 Series) Surgector (SGT Series)	22 29 40
	The data side is traditionally ethernet.	PulseGuard ESD Suppressor (PGB Series)	38

Telecom CIRCUIT PROTECTION

Littelfuse®



LITTELFUSE OFFERS A COMPLETE LINE OF
OVERCURRENT & OVERVOLTAGE
SUPPRESSION PRODUCTS
TO PROTECT SENSITIVE
TELECOMMUNICATIONS EQUIPMENT.

telecommunications

PRODUCT CATALOG

Telecom CIRCUIT PROTECTION

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telecommunications
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