

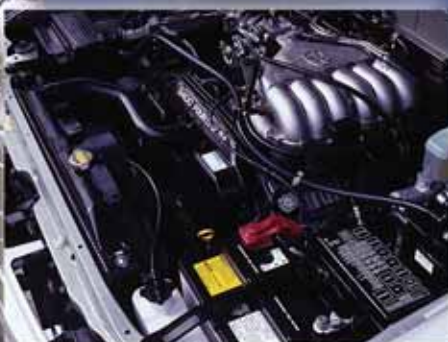
# AUTOMOTIVE OEM

## SUPPRESSION BLADE ELECTRONIC

VOLTAGE SUPPRESSION PRODUCTS

BLADE TERMINAL FUSES

ELECTRONIC FUSES & RESETTABLE DEVICES



**Littelfuse®**

# A Circuit Protection Leader

Littelfuse is committed to the automotive industry, and that commitment is the key to Littelfuse's leadership in automotive circuit protection. It promotes the growth of our technology, solidifies our partnerships with customers around the world, and strengthens our assurance of quality from product design and manufacturing to delivery and service.

## Technology

With leadership comes responsibility. It has become our job to forecast the future of automotive circuit protection, and we take that job very seriously. No other manufacturer has impacted the growth of circuit protection technology as much as Littelfuse. Littelfuse holds 170+ patents on circuit protection devices, more than all the other fuse manufacturers combined.

With an engineering team made up of the world's top circuit protection designers, an Advanced Materials Lab devoted solely to the exploration of new technologies, and a worldwide sales staff in close contact with automotive manufacturers around the globe, Littelfuse is driving the future of circuit protection. Whether it is alternative power sources, electronics applications, or unique accessories with special needs, Littelfuse is developing the solutions today for the challenges you will face tomorrow.

## Partnerships

Our commitment to the automotive industry is apparent in the way we view our customers - as partners. Littelfuse has strategic partnerships with every major automotive OEM, working with their designers to find out exactly what they need and provide them with timely, effective and safe solutions. Littelfuse's engineering staff is always ready to help you with "Quick Fixes" to your circuit protection dilemmas, producing specially designed products that meet your needs right now.

With sales, service and distribution centers in the United States, United Kingdom, The Netherlands, Brazil, Korea, Philippines, Mexico, Singapore, Hong Kong and Japan, and manufacturing facilities located throughout the world, Littelfuse is a global circuit protection provider. Our worldwide reach confirms our ability to partner with customers in every automotive market, as well as an international assembly of suppliers who demonstrate an ability and commitment to support the quality we promise to our customers.

## Quality

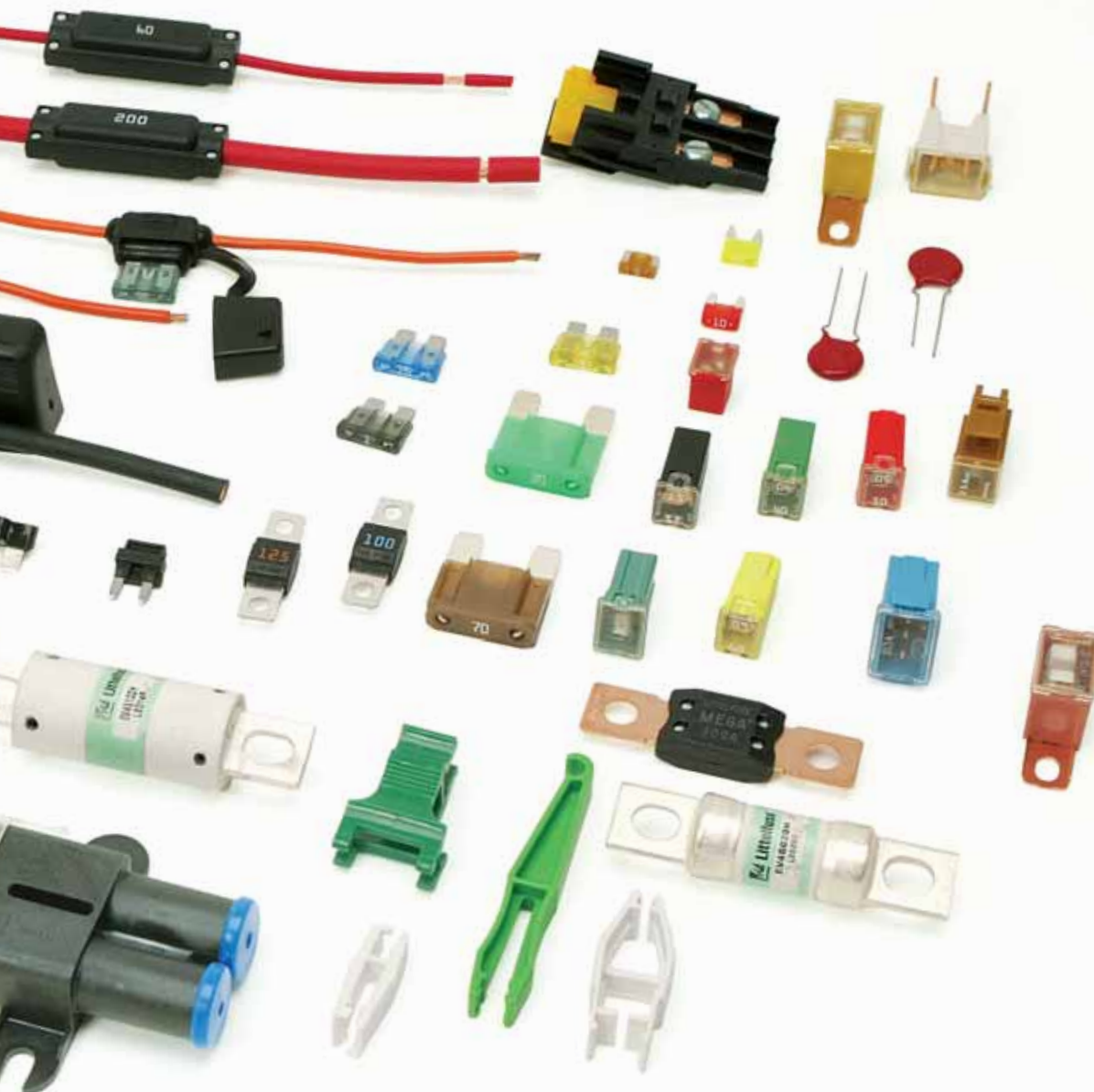
Quality is essential in circuit protection. It is not just a word. It is a factor that can impact the safety and economic viability of those using our products and their customers. Littelfuse is built on a tradition of quality and has earned a reputation for product reliability and exemplary service. We design our fuses to meet the highest expectations, test them to exceed all required standards, and work towards reduced cycle times, improved productivity and zero defects.

With our entire worldwide operations ISO 14001 certified, QS-9000 and TS16949 certification attained by all our facilities in North America and Europe, Littelfuse takes extra steps to ensure that we are ready to meet the challenges ahead. With the largest selection of circuit protection products available to the automotive industry, and a commitment to developing new technologies, sustaining mutually beneficial long-term partnerships, and continuously improving quality, Littelfuse is the circuit protection provider of choice for automotive OEMs around the world.

Visit our web site at [www.littelfuse.com](http://www.littelfuse.com)







## The Littelfuse Quality Policy

Littelfuse is committed to being sensitive to customer expectations and to providing quality products and services at a competitive price. In support of this commitment, Littelfuse will:

**Encourage** quality awareness and quality performance in all associates at all levels of the Company through management leadership;

**Promote** the participation of all associates in making individual contributions to the quality improvement process;

**Support** continuous quality improvement by providing our associates with the necessary training, tools, and information feedback to enable enhancement of the quality of our products and services;

**Develop** relationships with suppliers who consistently demonstrate their ability to fulfill quality, price and delivery objectives that are mutually beneficial; and,

**Build** quality into our products and services, striving for zero defects in everything we do, thereby reducing cost and increasing Total Customer Satisfaction.

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## I. Introduction

The purpose of this Fuseology section is to promote a better understanding of fuses and some of the more common application details. The fuses to be considered are current-sensitive devices which are designed as the intentional weak link in the electrical circuit. The function of a fuse is to provide discrete component or complete circuit protection by reliably melting under overcurrent conditions and thus safely interrupting the flow of current.

## II. Types of Overcurrents

An overcurrent is any current which exceeds the ampere rating of wiring, equipment or devices under conditions of use. The term "overcurrent" includes both overloads and short circuits.

### A. Overloads

An overload is an overcurrent which is confined to normal current paths. An overload occurs when the current exceeds the value for which the wires or equipment are rated. This can happen when too many devices are connected to the circuit, or when a device connected to the circuit malfunctions in a way that causes it to draw higher than normal current, usually in the range of one to six times normal current. Sustained overloads eventually overheat circuit components. Therefore, fuses must open circuits experiencing sustained overloads before damage occurs.

### B. Short Circuits

A short circuit is current out of its normal path. It occurs when accident or malfunction creates an unintended path for the electricity to flow from the battery or alternator to ground. This shorter, more direct path to ground bypasses the resistance normally offered by the wiring and devices connected to the circuit. With virtually no resistance left to impede current flow, the voltage forces higher and higher current to flow through the wires to the point of the short. Under such a condition, the current will quickly build to such a high level that the heat generated can cause insulation to burn and equipment to be damaged unless the circuit is opened through the use of a fuse.

## III. Fuse Selection Parameters

Since overcurrent protection is crucial to reliable electrical system operation and safety, fuse selection and application should be carefully considered. When selecting fuses, the following parameters should be evaluated:

### A. Voltage Rating

The voltage rating, as marked on a fuse, indicates the maximum voltage of the circuit for which the fuse is designed to operate safely in the event of an overcurrent. Therefore, the fuse's voltage rating must equal or exceed the available circuit voltage where the fuse will be installed. System voltage exceeding the fuse's rated voltage may result in fuse damage. The voltage rating is 32 volts DC for the MINI®, MAXI™, ATO®, MIDI®, MEGA® and CABLEPRO® Fuses.

### B. Interrupting Rating

The interrupting rating (also known as breaking capacity or short circuit rating) is the maximum current, as stated by the manufacturer, which the fuse can safely interrupt at rated voltage. During a fault or short circuit condition, a fuse may

receive an instantaneous current many times greater than its normal operating current. Safe operation requires that the fuse remain intact (no body rupture) and clear the circuit. The interrupting rating is 1000A @ 32 volts DC for the MINI, MAXI, ATO, and JCASE fuses, and 2000A @ 32 volts DC for the MEGA, MIDI, and CABLEPRO Fuses.

## C. Time-Current Characteristics

A fuse's time-current characteristics determine how fast it responds to different overcurrents. All fuses have inverse time-current characteristics, so opening time decreases as overcurrents increase. Time-current characteristics are presented graphically on standardized "log-log" paper. Figure 1 is a sample time-current curve for the MAXI Fuse series for fuses rated 20-60A. Current values increase from left to right, and time increases from bottom to top. The average melting time for any current can be determined from the curve. For example, from Figure 1 it can be determined that a 20A MAXI Fuse experiencing an overload of 100A will open in about 0.5 seconds. At 40A, the same 20A MAXI Fuse would open in about 15 seconds.

Time-current curves are also used to compare fuses of the same series but of different current ratings. Suppose it was desired to compare the opening times of 20A and 60A MAXI Fuses at an overload of 100A. From the curve in Figure 1, one can see that the 20A fuse opens in about 0.5 seconds at 100 amps, whereas the 60A fuse does not open until about 100 seconds.

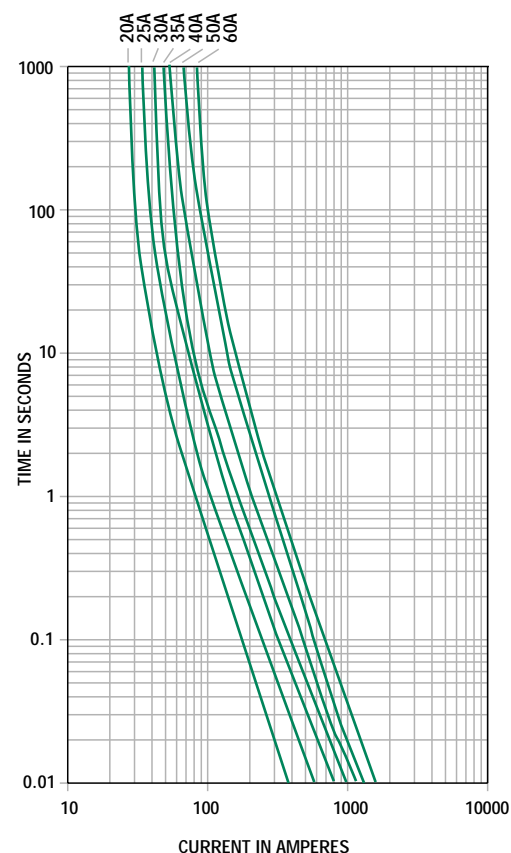
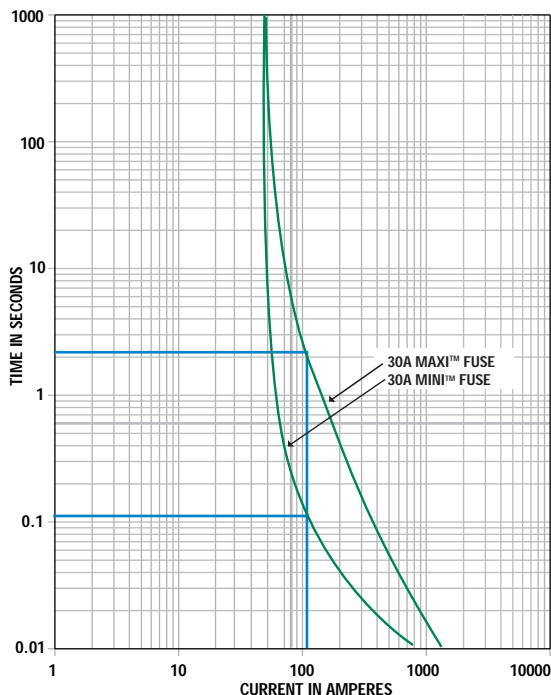


Figure 1: Average Melting-Current Curve for the MAXI Fuse Series (20-60A)

It is important to note that time-current curves give only *average* melting times and are presented as a design aid but are not considered as part of the fuse specifications.

The term used in fuse design that describes how rapidly a fuse responds to various overcurrents is the fuse's "characteristics." Automotive fuse characteristics are determined by the fuse's degree of time delay. Initial or start-up pulses are normal for many automotive applications and require fuses to have a time delay designed in to enable them to survive these pulses and still provide protection against prolonged overloads. Fuses such as the MINI® Fuse and ATO® Fuse have a moderate degree of time delay, whereas fuses like the MAXI™ Fuse and MEGA® Fuse have a high degree of time delay which enables them to handle high inrush currents like those caused by motor start-ups. Figure 2 compares sample time-current curves of a 30A MINI Fuse to a 30A MAXI Fuse. To see that the MAXI Fuse has more time delay than the MINI Fuse, compare their opening times at an overload of 100A. Despite the fact that the fuses are the same rating, the MINI Fuse opens in about 0.1 seconds while the MAXI Fuse opens in about 2.2 seconds.

When selecting a fuse, the start-up pulse should be defined



**Figure 2:** Average Melting-Current Curve Comparing 30A MINI Fuse to 30A MAXI Fuse

and then compared to the time-current curve for the fuse.

## D. Current Rating

The current rating is the maximum current which the fuse can continuously carry under specified conditions.

### 1. Normal Operating Current

The current rating of a fuse is typically derated 25% for

operation at 25°C to avoid nuisance blowing. For example, a fuse with a current rating of 10A is not usually recommended for operation at more than 7.5A in a 25°C ambient.

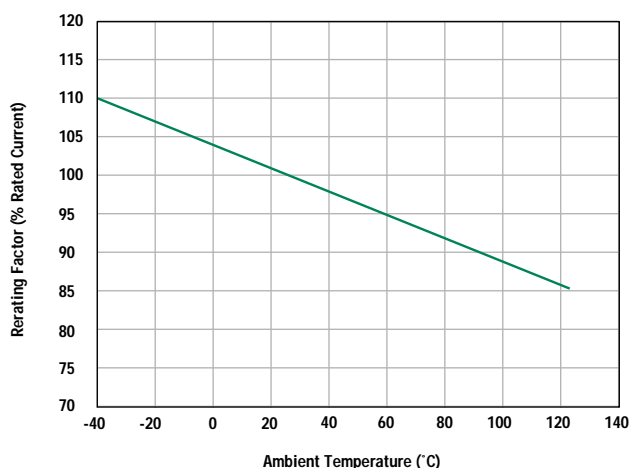
## 2. Rerating for Ambient Temperature

The current carrying capacity tests of fuses are performed at 25°C and will be affected by changes in ambient temperature. At higher ambient temperatures, a fuse will respond faster to a given overload. Conversely, at lower ambient temperatures, a fuse will respond slower to a given overload. In addition, the temperature of the fuse increases as the normal operating current approaches or exceeds the rating of the fuse.

A MINI Fuse operating at 25°C and 110% of rated current has a minimum life of 100 hours. However, if that same fuse were operated at a very high ambient temperature, rerating would be necessary. Figure 3 is a sample temperature rerating curve for the MINI Fuse. The following example shows how to use such a curve.

Suppose there is a normal operating current of 15 amperes in a particular circuit, and the ambient temperature will be 105°C instead of 25°C. Which MINI Fuse rating should be used? From Figure 3, the percent of rated current to be used at an ambient temperature of 105°C is 88%, so:

$$\begin{aligned} \text{Ideal fuse rating} &= \text{Normal operating current} \\ &\quad \div \text{Temperature factor} \times 0.75 \\ &= 15\text{A} \\ &\quad \div 0.88 \times 0.75 \end{aligned}$$



**Figure 3:** MINIFuse 297 Series Temperature Rerating Curve

$$= 22.73\text{A}$$

Therefore, a 25A or larger MINI Fuse should be used.

## E. Transient Overcurrent Considerations

Transient pulses of inrush current are commonplace in vehicle electrical systems. The transient overcurrent pulses affect the life of automotive fuses.

## 1. $I^2t$

$I^2t$  is an expression of the available thermal energy resulting from current flow. With regard to fuses, the term is usually expressed as melting, arcing, and total clearing  $I^2t$ . The units for  $I^2t$  are expressed in ampere-squared-seconds [ $A^2s$ ].

**Melting  $I^2t$ :** the thermal energy required to melt a specific fuse element.

**Arcing  $I^2t$ :** the thermal energy passed by a fuse during the arcing time. The magnitude of arcing  $I^2t$  is a function of the available voltage and stored energy in the circuit.

**Total Clearing  $I^2t$ :** the thermal energy through the fuse from overcurrent inception until current is completely interrupted. Total clearing  $I^2t = (\text{melting } I^2t) + (\text{arcing } I^2t)$ .

$I^2t$  has two important applications to fuse selection. The first is pulse cycle withstand capability and the second is selective coordination.

## 2. Pulse Cycle Withstand Capability

Electrical pulses produce thermal cycling and possible mechanical fatigue that could affect the life of the fuse.

For this reason, it is important to know the pulse cycle withstand capability of the fuse, which is defined as the number of pulses of a given  $I^2t$  value that can be withstood by the fuse without opening, assuming that there is sufficient cool down time between pulses.

Figure 4 shows how  $I^2t$  of the pulse can be calculated from the graph of the pulse current as a function of time.

Figure 5 is a graph of the pulse cycle withstand capability of blade fuses. Because electrical pulse conditions can vary considerably from one application to another,

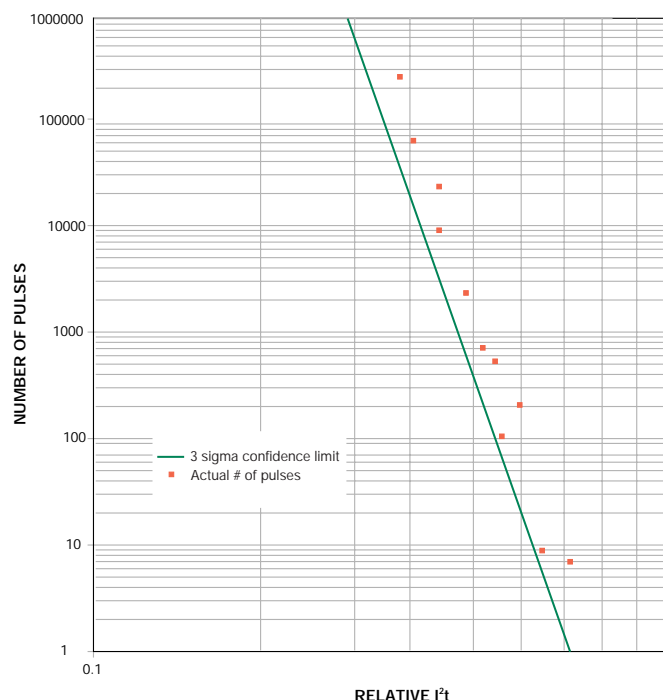


Figure 5: Pulse Cycle Withstand Capability for Blade Fuses

application testing is recommended to establish the ability of the fuse design to withstand the pulse condition.

## 3. Selective Coordination

In a selectively coordinated system, only the fuse immediately on the line side of an overcurrent opens. Upstream fuses remain closed and undamaged. All other equipment remains in service, which simplifies locating overloaded equipment or short circuits. In Figure 6, if a short circuit arises behind fuse #1, fuse #1 should open and fuse #2 should stay closed and undamaged. The condition necessary to assure this result is that the minimum melting  $I^2t$  of the supply side fuse (fuse #2) must be greater than the total clearing  $I^2t$  of the load side fuse (fuse #1). This condition results in

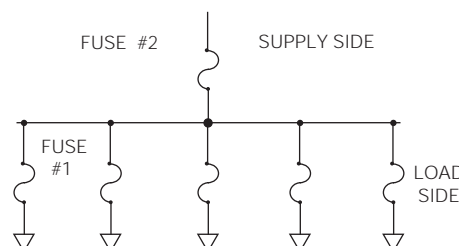
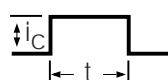


Figure 6: Selective Coordination for Fuses in Series

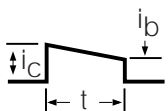
### WAVESHAPES

### FUNCTION AND VALUE



$$i = i_c$$

$$I^2t = i_c^2 t$$



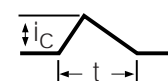
$$i = i_c \pm kt$$

$$I^2t = (1/3)(i_c^2 + i_b i_c + i_b^2)t$$



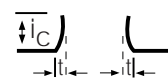
$$i = i_c \sin t$$

$$I^2t = (1/2)i_c^2 t$$



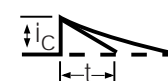
$$i = \pm kt$$

$$I^2t = (1/3)i_c^2 t$$



$$i = kt^2$$

$$I^2t = (1/5)i_c^2 t$$



$$i = i_c e^{-t/t}$$

$$I^2t = (1/2)i_c^2 t$$

Figure 4: Evaluating the  $I^2t$  of a Variety of Current Wave Shapes



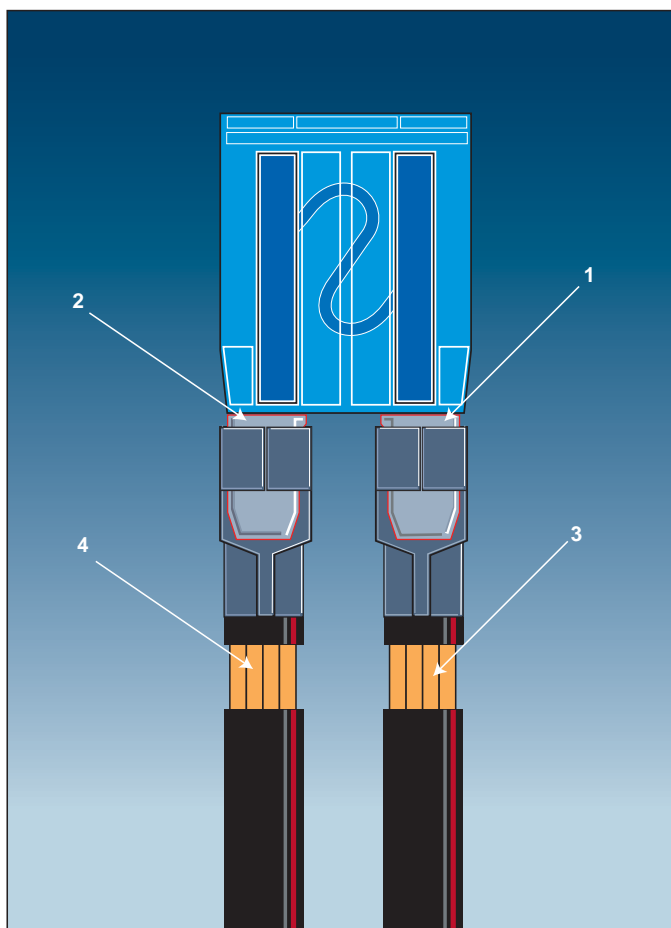
the load side fuse opening before the supply side fuse begins to melt. Minimum melting and total clearing  $I^2t$  data are given in this catalog.

## IV. Voltage Drop Across Terminals

A fuse is only as good as the system in which it is used. One aspect of the electrical system that has considerable effects on the performance of the fuse is the quality of the connection between the fuse and the cable it protects. High voltage drop across the fuse/terminal interface creates additional thermal loading, which in turn causes shifts in the time-current characteristics of the fuse. Table 1 below gives the maximum recommended voltage drop per terminal for automotive fuses. Figure 7 indicates the measurement locations used to determine the

TYPE	MAXIMUM RECOMMENDED VOLTAGE DROP PER TERMINAL [mV]
ATO® FUSE	30
MINI® FUSE	30
MAXI® FUSE	30
MEGA® FUSE	15

**Table 1:** Maximum Recommended Voltage Drop per Terminal



**Figure 7:** Measurement Locations along the Fuse/Terminal/Cable System Used to Determine the Voltage Drop across the Terminal

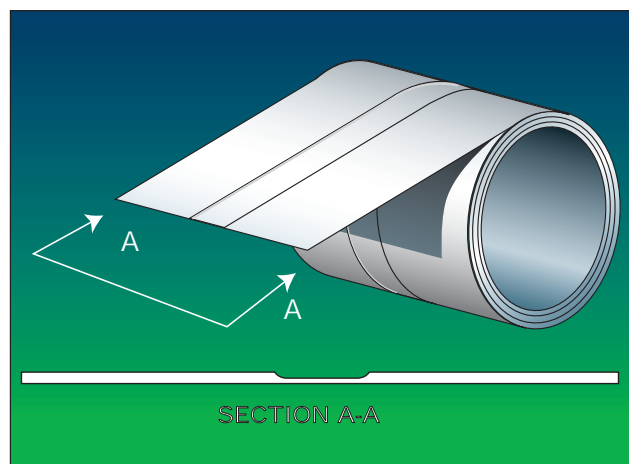
voltage drop across the terminal. The voltage drop across the left terminal would be  $V_{2-4}$  and the voltage drop across the right terminal would be  $V_{1-3}$ .

## V. Skiving Process

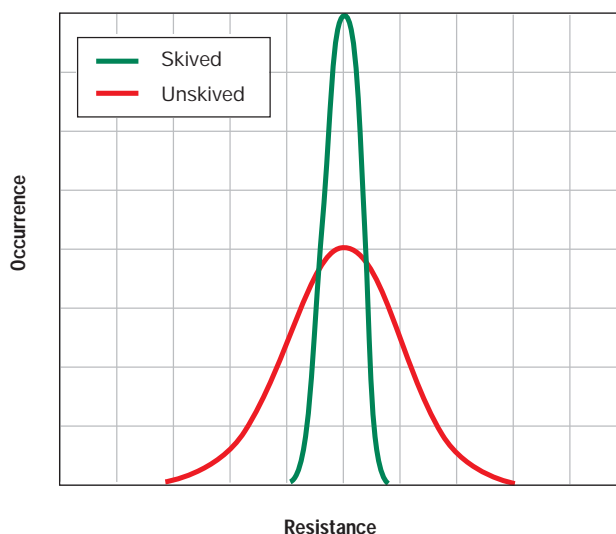
In order to provide predictable fuse opening characteristics, it is necessary to have tight fuse element resistance control during the manufacturing process.

The resistance of electrically conductive material is determined by the formula:  $R = \rho L / A$ , where  $\rho$  is the resistivity,  $L$  is the length of the material, and  $A$  is the area of material cross-section.  $A$  is determined by the thickness  $T$  and width  $W$  of cross-section area. The thickness  $T$  is the parameter to control and adjust with least variation compared with other parameters' adjustment in resistance control.

Littelfuse accurately controls the thickness and resistivity of the fuse element by using a skiving process in manufacturing. Skiving is the removal of a precise amount of material from a strip of that material. During fuse production, a coil of material is skived and the fuse element is stamped from the skived section. Figure 8 shows the coil of material and the skived section. The



**Figure 8:** Coil of Material with Skived Section



**Figure 9:** Resistance Spread - Skived vs. Unskived

skiving process ensures that each fuse is a calibrated device. Figure 9 is a graph of the resistance spread with skived vs. unskived showing the increased accuracy provided by skiving.

## VI. Diffusion

Diffusion Pill Technology is a mixing of molecules, atoms or crystals in the solid, liquid or gaseous state. Diffusion Pill Technology is often used in the design of fuses for automotive, electronic and industrial fuse applications.

“M-effect” is the method of diffusing one metal into another to form a new alloy with a lower melting point. Littelfuse uses the “M-effect” to produce three very desirable characteristics in fuse designs: lower melting temperature, time delay, and lower voltage drop.

By affixing a diffusion pill tin to the element, the melting temperature is decreased. This decrease in melting temperature reduces the fuse rating. In order to reestablish its original rating the fuse elements’ cross section needs to increase. An increase in cross section increases the blow time at higher overload condition. A higher degree of time delay enables a fuse to withstand higher current inrush pulses. This increase in cross section reduces the overall fuse resistance and voltage drop.

## VII. Match Wire Gauge to Fuse

In order to protect wiring under all overload and short circuit conditions, it is necessary to standardize the fuse and wire selection process.

Fuses have controlled opening characteristics, and each wire gauge has its respective current carrying capacity. Fuses need to be selected to always protect the wire insulation from damage.

In the selection of wire gauge at various ambient temperatures, it is important to consider the worst case or highest ambient temperature for the application. Wires derate to a much higher degree than fuses, because wire insulation temperature capability is affected much more severely.

## Maximum Recommended Continuous Current

Wire Size		Max. Continuous Current (A)				
		At 25°C		At 80°C		At 105°C
mm <sup>2</sup>	Gauge No.	GXL (1)	GPT (2)	GXL (1)	GPT (2)	GXL (1)
0.3		15	10	11	4	9
0.5	20	21	15	16	6	13
0.75		27	21	20	7	17
0.8	18	31	22	23	7	19
1	16	33	23	25	9	20
1.5		43	30	33	12	27
2	14	50	36	37	14	32
2.5		60	42	45	15	38
3	12	68	47	51	18	42
4		80	56	61	22	50
5	10	90	65	68	23	58
6		103	73	78	28	64
8	8	125	87	96	30	79
10		146	103	111	40	90
13	6	170	120	129	47	105
19	4	221	156	166	61	137

(1) = General purpose cross link polyethylene insulation wire with a maximum insulation temperature of 155°C.

(2) = General purpose thermoplastic insulation wire with a maximum insulation temperature of 90°C.

For further reference, there are specific application guides available. Please consult the nearest Littelfuse sales office if any additional application information is needed.

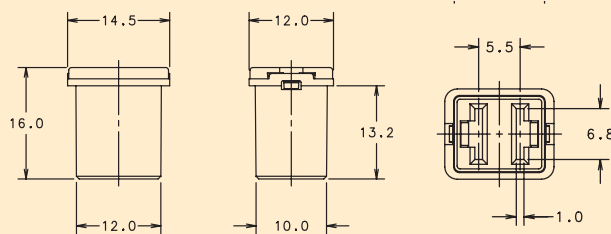




# Low Profile JCASE® Fuses



The Low Profile JCASE fuse has similar performance characteristics as the standard JCASE fuse. The lower overall height reduction allows for more space and weight savings and also allows for a shorter male blade terminal, saving additional weight and material savings in fuse box designs.



## LOW PROFILE JCASE FUSE TABLE

Part Number	Current Rating (A)	Housing Color
895020	20	Blue
895025	25	White
895030	30	Pink
895040	40	Green
895050	50	Red
895060	60	Yellow

## TIME-CURRENT CHARACTERISTICS

% of Rating	Opening Time	
	Minimum	Maximum
100	100 hrs	—
135	60 s	1800 s
200	4 s	60 s
350	0.2 s	7 s
600	0.04 s	1 s

Interrupting Rating: 1000A @ 58 VDC

Voltage Rating: 58 VDC

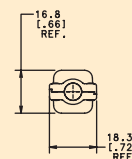
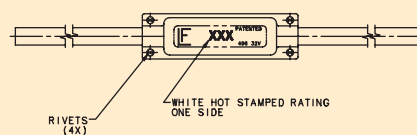
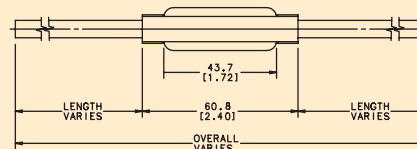
Ambient Temp: -40°C to + 125°C



# CABLEPRO® Cable Protector Fuses



The CablePro fuse is designed to replace conventional wire fusible links in high current automotive applications. The slim package of the CablePro fuse fits into tight locations and has predictable electrical opening characteristics similar to the Mega fuse. The predictable and reliable performance characteristics of the CablePro, makes this product a far superior method for protecting high current circuits over wire fusible links.



## CABLEPRO CABLE Table

Part Number	Current Rating (A)	Wire Size
496060	60	5mm <sup>2</sup> (10AWG)
496080	80	8mm <sup>2</sup> (8AWG)
496100	100	8mm <sup>2</sup> (8AWG)
496125	125	13mm <sup>2</sup> (6AWG)
496150	150	19mm <sup>2</sup> (4AWG)
496175	175	19mm <sup>2</sup> (4AWG)
496200	200	19mm <sup>2</sup> (4AWG)

## Time-Current Characteristics

% of Rating	Opening Time	
	Minimum	Maximum
100	100 hrs.	—
135	120 s	1800 s
200	10 s	300 s
350	1 s	15 s
600	0.3 s	5 s

### CABLE TYPE:

SAE J1127(4 & 6 AWG) & SAE J1128(8 and 10 AWG)

### INTERRUPTING RATINGS:

2000 amperes @ 32 VDC

### ENVIRONMENTAL SPECIFICATIONS:

Operating Temperature Range: -40°C to +125°C





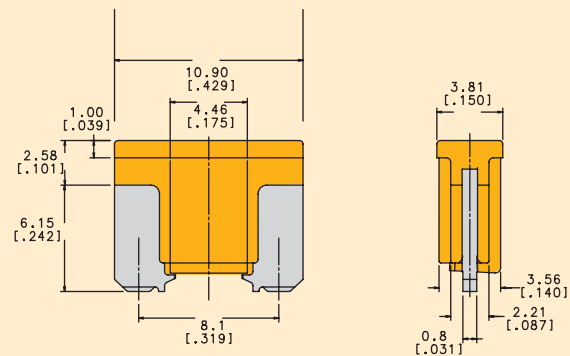
# Low Profile MINI® Fuses



The Low Profile Mini fuse has similar performance characteristics as the standard Mini fuse. The lower overall height allows for more space and weight savings. The Low Profile Mini fuse is designed to mate with tuning-fork terminals, which provides additional weight and material savings in fuse box designs by eliminating the need for female box terminals.

## MINI Fuse Table

Part Number	Current Rating (A)	Housing Color
897002	2	Gray
897003	3	Violet
897004	4	Pink
897005	5	Tan
89707.5	7.5	Brown
897010	10	Red
897015	15	Blue
897020	20	Yellow
897025	25	Clear
897030	30	Green



## Time-Current Characteristics

% of Rating	Opening Time	
	Minimum	Maximum
110	100 hrs.	—
135	0.75 s	1800 s
200	0.15 s	5 s
350	0.080 s	0.250 s
600	0.030 s	0.100 s

**Interrupting Rating:** 1000A @ 58 VDC

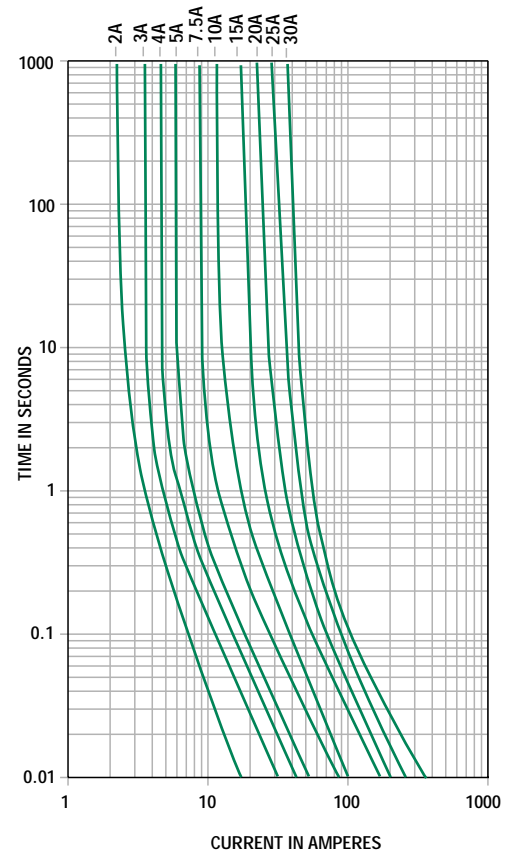
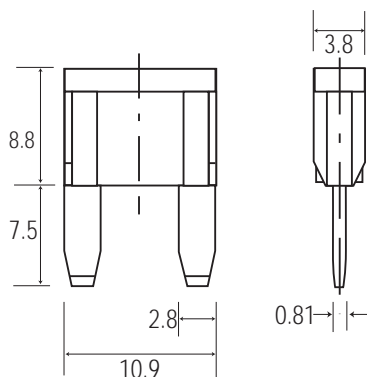
**Voltage Rating:** 58 VDC

**Ambient Temp:** -40°C to +125°C



# MINI® Blade Fuse

The MINI Fuse is quickly becoming the new standard for vehicle circuit protection throughout the world. Its miniature design, patented by Littelfuse, meets the need for more circuits to be protected while utilizing less space, and its ability to cope with high temperatures in adverse environments makes the MINI Fuse the recommended choice for protection.



**Time-Current Characteristics**

% of Rating	Opening Time	
	Minimum	Maximum
110	100 hrs.	—
135	0.75 s	600 s
200	0.15 s	5 s
350	0.080 s	0.500 s
600	0.030 s	0.100 s

## MINI Fuse Table

Meets SAE J2077

Part Number	Current Rating (A)	Housing Color	Typ. Voltage Drop at Rated Current (mV)
297002	2	Gray	171
297003	3	Violet	153
297004	4	Pink	121
297005	5	Tan	129
29707.5	7.5	Brown	135
297010	10	Red	108
297015	15	Blue	98
297020	20	Yellow	96
297025	25	Clear	86
297030	30	Green	87



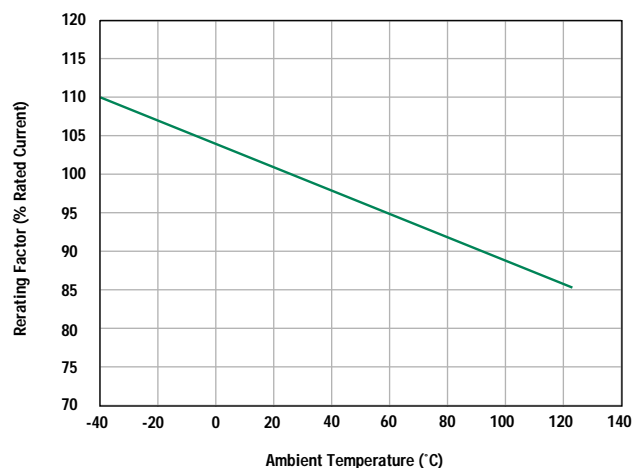
See page 32 for MINI Resistors, Diodes, and Shunts.

**Interrupting Rating:** 1000A @ 32 VDC

**Voltage Rating:** 32 VDC

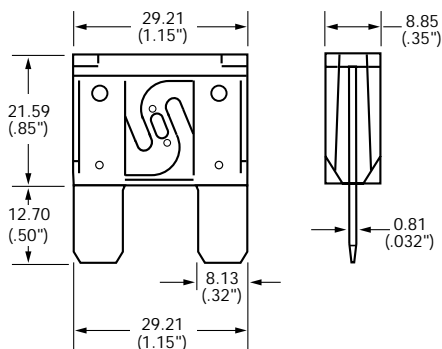
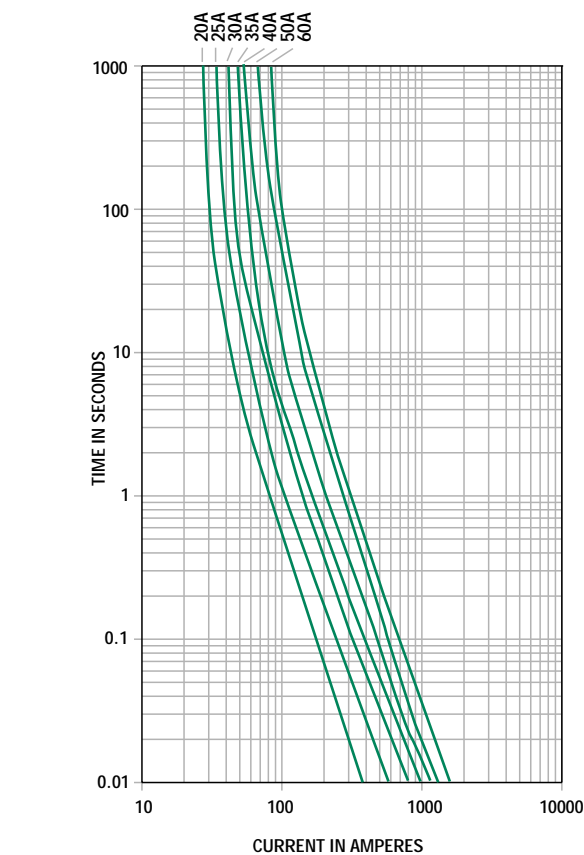
**Ambient Temp:** -40°C to +125°C

**MINI Fuse Temperature Rerating Curve**



# MAXI®Blade Fuse

With “Diffusion Pill Technology,” the MAXI Fuse provides excellent time delay characteristics and low heat dissipation. Designed and patented by Littelfuse, the MAXI Fuse is ideal for motor powered applications which have large inrush currents.



## Time-Current Characteristics

% of Rating	Opening Time Max/Min (s)							
	20A	25A	30A	35A	40A	50A	60A	80A
1800	1800	1800	1800	1800	1800	1800	1800	1800
135	60	60	60	60	60	60	60	60
200	20	30	30	40	40	50	60	60
350	4	6	6	8	8	10	15	4
600	2	4	4	5	5	6	7	2
	0.7	1	1	1.4	1.4	1.7	2	0.20
	1	1	1	1	1	1	1	1
	0.15	0.20	0.20	0.20	0.20	0.20	0.20	.1

Interrupting Rating: 1000A @ 32 VDC

Voltage Rating: 32 VDC

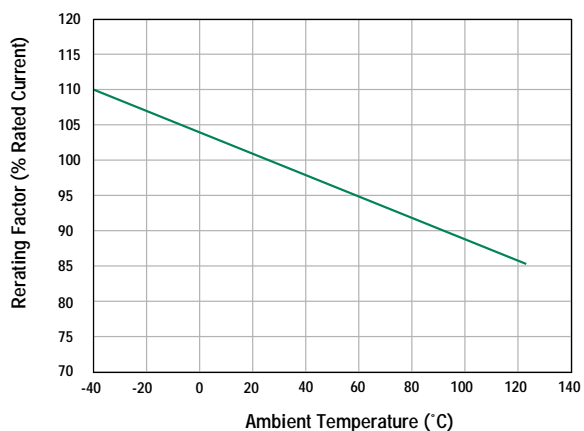
Ambient Temp.: -40°C to +125°C

## MAXI Fuse Table

Meets SAE J1888

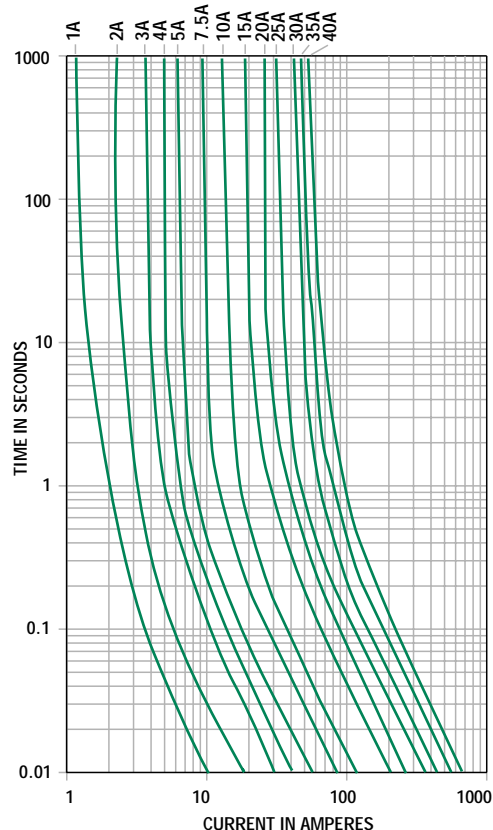
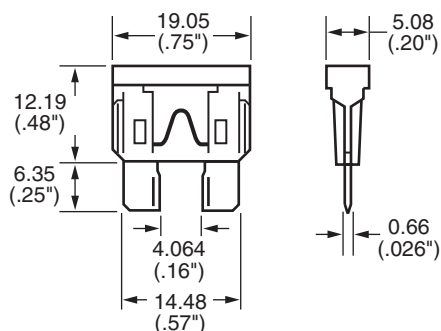
Part Number	Current Rating (A)	Housing Color	Typ. Voltage Drop at Rated Current (mV)
299020	20	Yellow	76
299025	25	Gray	75
299030	30	Green	77
299035	35	Brown	75
299040	40	Orange	75
299050	50	Red	73
299060	60	Blue	77
299070	70	Tan	61
299080	80	Clear	62

## MAXI Fuse Temperature Derating Curve



# ATO® Blade Fuse

The ATO Fuse was designed and patented by Littelfuse in 1976 and set the standard for automotive circuit protection. It features industry standard color coding to indicate amperage rating.



## ATO Fuse Table

Meets SAE J1284

Part Number	Current Rating (A)	Housing Color	Typ. Voltage Drop at Rated Current (mV)
257001	1	Black	176
257002	2	Gray	141
257003	3	Violet	137
257004	4	Pink	136
257005	5	Tan	128
25707.5	7.5	Brown	116
257010	10	Red	109
257015	15	Blue	102
257020	20	Yellow	98
257025	25	Clear	92
257030	30	Green	84
257035	35	Blue-Green	87
257040	40	Orange	96



See page 32 for ATO Resistors, Diodes, and Shunts.

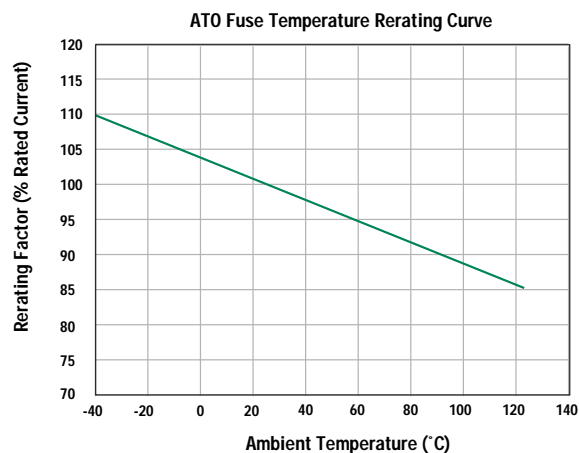
## Time-Current Characteristics

% of Rating	Current Rating	Opening Time	
		Minimum	Maximum
110	1-40A	100 hrs	—
135	1-2A	0.35 s	600 s
	3-40A	0.75 s	600 s
200	1-2A	0.10 s	5 s
	3-40A	0.15 s	5 s
350	1-2A	0.020 s	0.5 s
	3-40A	0.080 s	0.5 s
600	1-30A	—	.1 s
	35-40A	—	.15 s

Interrupting Rating: 1000A @ 32 VDC

Voltage Rating: 32 VDC

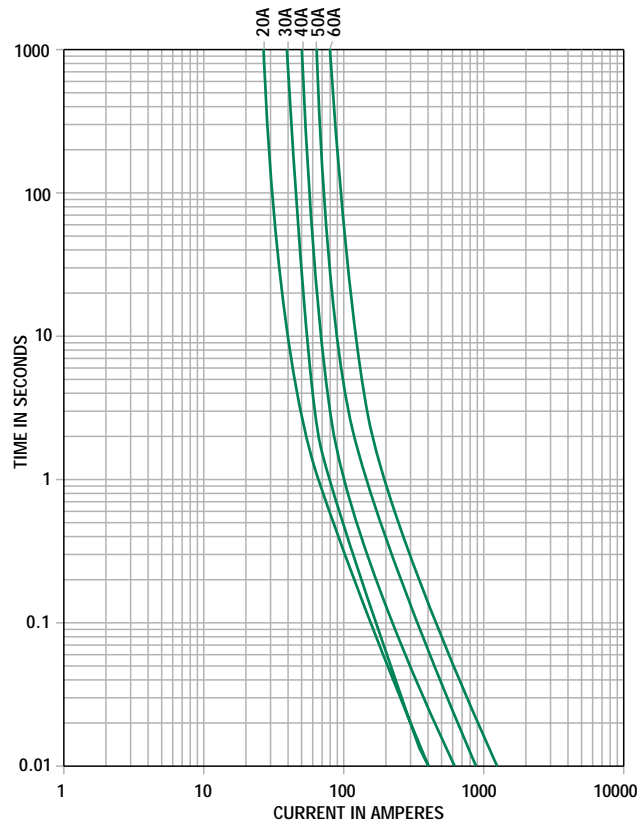
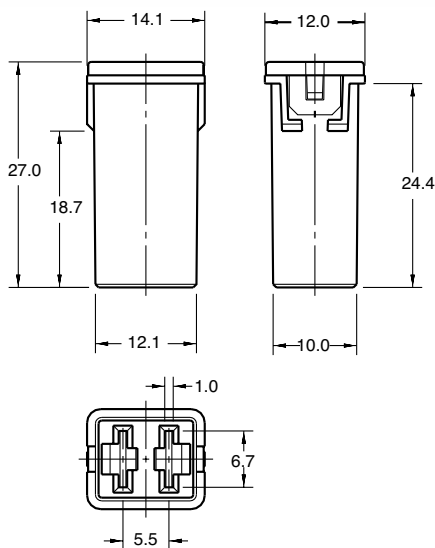
Ambient Temp.: -40°C to +105°C





# JCASE® Cartridge Fuse

The JCASE is a cartridge style fuse with female terminal design, providing both increased time delay and low voltage drop to protect high current circuits and handle inrush currents. The JCASE was designed and patented by Littelfuse.



## TIME-CURRENT CHARACTERISTICS

% of Rating	Opening Time	
	Minimum	Maximum
100	100 hrs	—
135	60 s	1800 s
200	4 s	60 s
350	0.2 s	7 s
600	0.04 s	1 s

**Interrupting Rating:** 1000A @ 32 VDC

**Voltage Rating:** 32 VDC

**Insertion Force:** 53N max. (12 lb.)

**Extraction Force:** 9N min. (2 lb.)

**Ambient Temp:** -40°C to +125°C

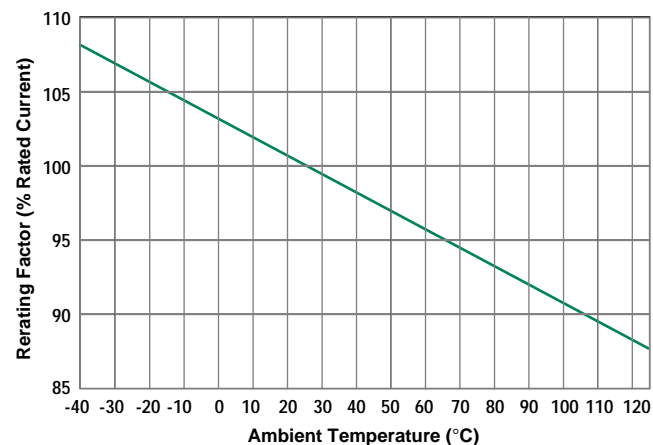
## JCASE CARTRIDGE FUSE TABLE

Part Number	Current Rating (A)	Housing Color	Typ. Voltage Drop at Rated Current (mV)
495020	20	Blue	106
495025	25	White	101
495030	30	Pink	91
495040	40	Green	87
495050	50	Red	88
495060	60	Yellow	87



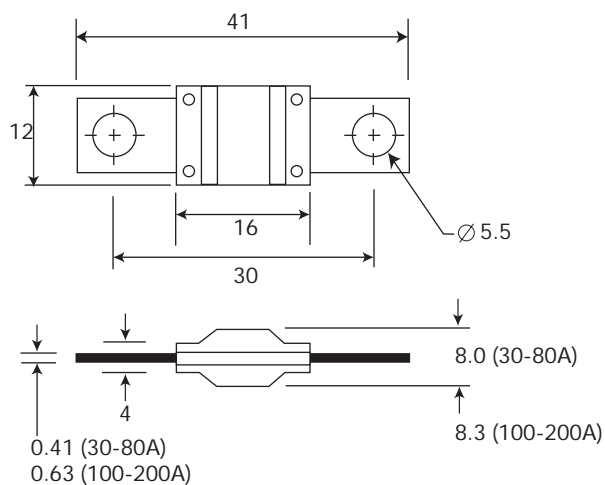
See page 32 for JCASE Shunt

JCASE Fuse Series Temperature Derating Curve



# MIDI® Fuse

The MIDI Fuse offers a bolt-on space saving fuse for high current wiring protection and provides time delay characteristics with "Diffusion Pill Technology". The MIDI Fuse was designed and patented by Littelfuse,

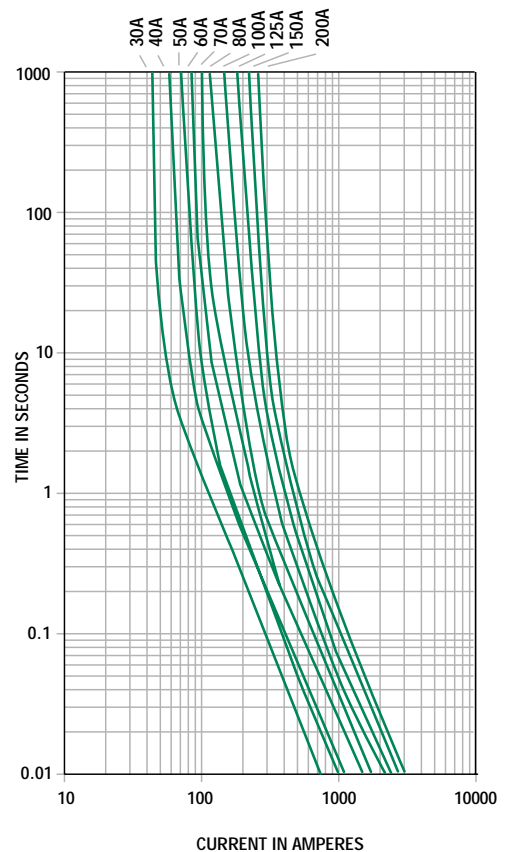


**MIDI Fuse Table**

Part Number	Current Rating (A)	Typ. Voltage Drop at Rated Current (mV)
498030	30	65
498040	40	65
498050	50	65
498060	60	68
498070	70	70
498080	80	58
498100	100	60
498125	125	71
498150*	150	77**
498200*	200	77**

\* Parts with asterik are short circuit protectors only.

\*\* Voltage drop measurements for short circuit protectors are at 75% of rated current.



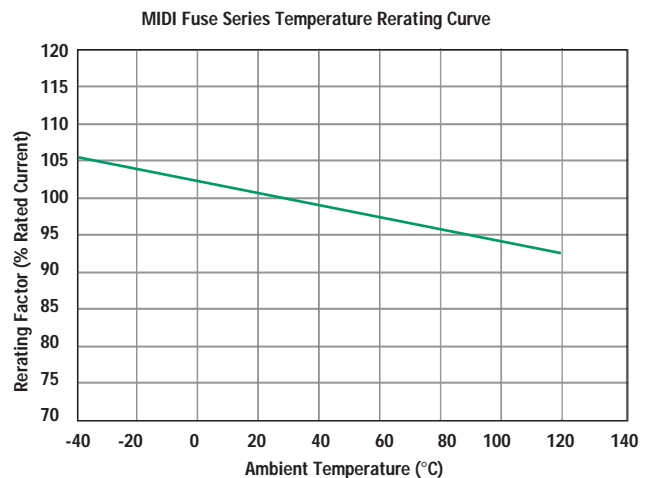
**TIME-CURRENT CHARACTERISTICS**

% of Rating	30-125		150-200	
	Min	Max	Min	Max
75	—	—	100 hrs	—
100	100 hrs	—	—	—
110	4 hrs	—	—	—
150	90 s	3600 s	—	—
200	5 s	100 s	1 s	15 s
300	0.5 s	3 s	.3 s	3 s
500	0.1 s	1 s	0.1 s	1 s

**Interrupting Rating:** 2,000A @ 32 VDC

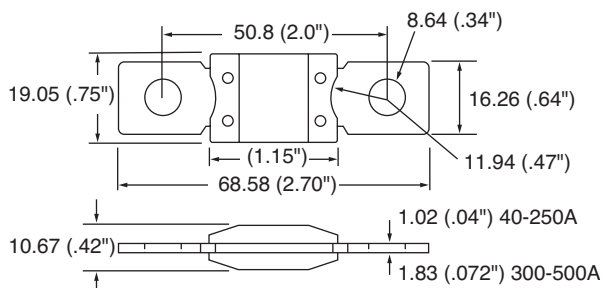
**Voltage Rating:** 32 VDC

**Ambient Temp.:** -40°C to +125°C



# MEGA® Fuse

The MEGA Fuse is designed for high current circuit protection up to 500 amperes with "Diffusion Pill Technology", the MEGA Fuse also provides time delay characteristics. Designed and patented by Littelfuse, the MEGA Fuse is ideal for battery and alternator protection application and other heavy gauge cables requiring ultra-high current protection.

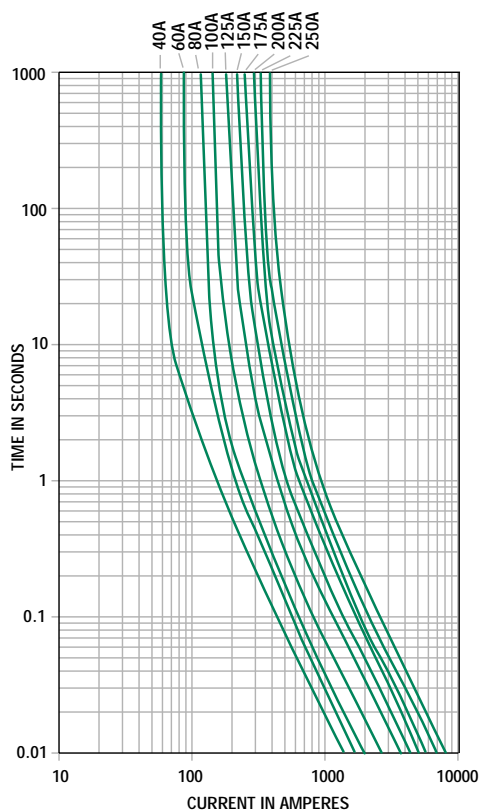


## MEGA FUSE TABLE

Part Number	Current Rating (A)	Typ. Voltage Drop at Rated Current (mV)
298040	40	132
298060	60	119
298080	80	87
298100	100	87
298125	125	80
298150	150	92
298175	175	86
298200	200	83
298225	225	82
298250	250	82
298300*	300	74**
298350*	350	68**
298400*	400	64**
298450*	450	60**
298500*	500	58**

\* Parts with asterik are short circuit protectors only.

\*\* Voltage Drop measurements for short circuit protectors are at 75% of rated current



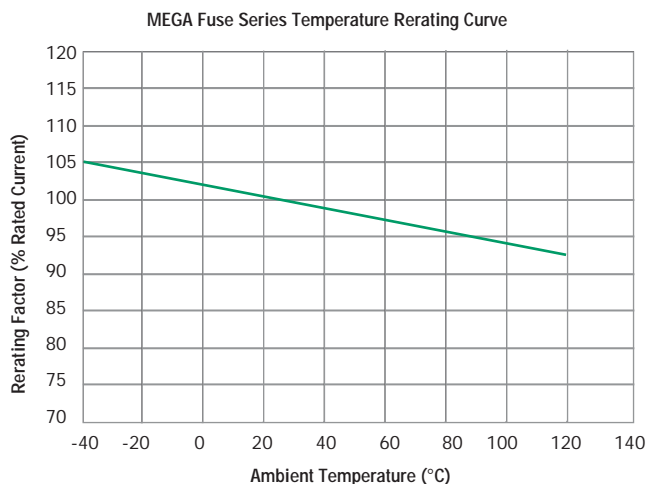
## TIME-CURRENT CHARACTERISTICS

% of Rating	40-250		300-500	
	Min	Max	Min	Max
75	—	—	4 hrs	—
100	4 hrs	—	—	—
135	120 s	1800 s	—	—
200	1 s	15 s	1 s	15 s
350	0.3 s	5 s	0.3 s	5 s
600	0.1 s	1 s	—	—

Interrupting Rating: 2000A @ 32 VDC

Voltage Rating: 32 VDC

Ambient Temp: -40°C to +125°C



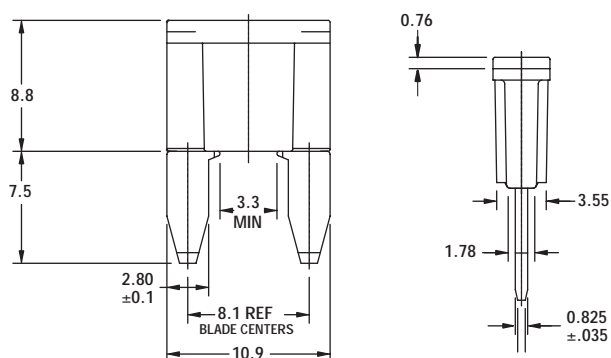


# MINI® 42 Fuse

The MINI 42 volt fuse rated at 58 volts DC was designed for use in 42-volt systems yet maintains the same performance characteristics and terminal footprint as the standard Mini fuse. Because there are severe dangers involved with using a fuse designed for a 12-volt system in a 42-volt system, the unique rejection feature prevents fuses with a lower voltage rating (i.e. Standard MINI fuse rated at 32 volts DC) from being inserted into the circuit. In order for the rejection feature to function as intended, fuse box designers need to follow the recommended mating cavity guidelines in this section.



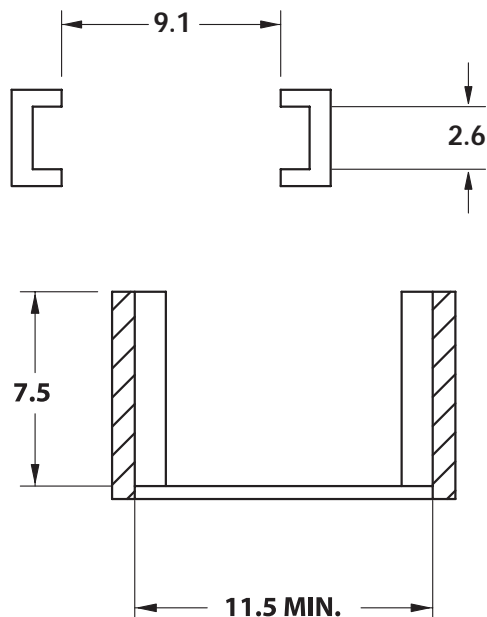
## DIMENSIONS (in mm)



## MINI42 FUSE TABLE

Part Number	Current Rating (A)	Housing Color	Typ. Voltage Drop at Rated Current (mV)
997002	2	Grey	171
997003	3	Violet	153
997004	4	Pink	121
997005	5	Tan	129
99707.5	7.5	Brown	135
997010	10	Red	108
997015	15	Blue	98
997020	20	Yellow	96
997025	25	Clear	86
997030	30	Green	87

## RECOMMENDED MATING CAVITY



## TIME-CURRENT CHARACTERISTICS

% of Rating	Opening Time	
	Minimum	Maximum
110	100 h	—
135	.75 s	600 s
200	.15 s	5 s
350	.080 s	.500 s
600	.030 s	.100 s

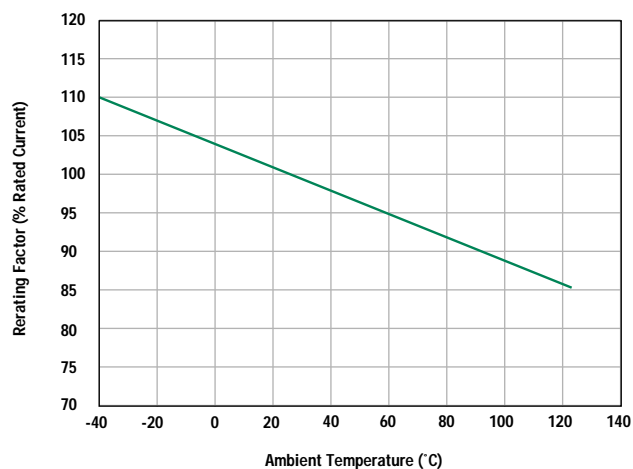
## INTERRUPTING RATINGS:

1000 amperes @ 58 VDC

## ENVIRONMENTAL SPECIFICATIONS:

Operating Temperature Range: -40°C to +125°C

MINI Fuse Temperature Derating Curve

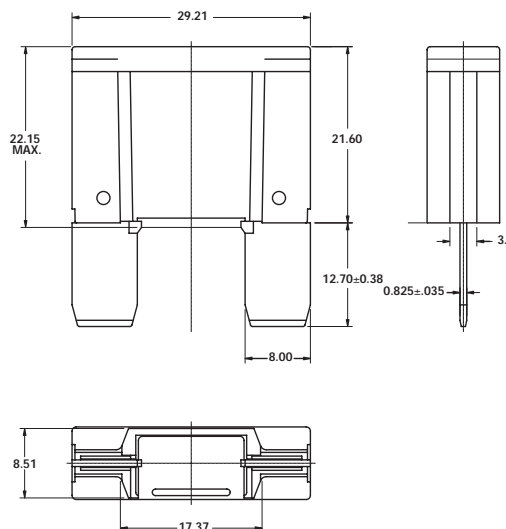


# MAXI® 42 Fuse

The MAXI 42 volt fuse rated at 58 volts DC was designed for use in 42-volt systems yet maintains the same performance characteristics and terminal footprint as the standard Maxi fuse. Because there are severe dangers involved with using a fuse designed for a 12-volt system in a 42-volt system, the unique rejection feature prevents fuses with a lower voltage rating (i.e. Standard Maxi fuse rated at 32 volts DC) from being inserted into the circuit. In order for the rejection feature to function as intended, fuse box designers need to follow the recommended mating cavity guidelines in this section.



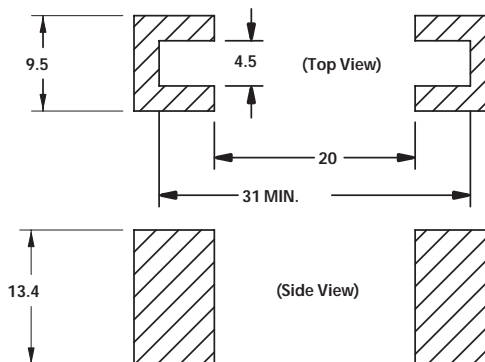
## DIMENSIONS (in mm)



## MAXI 42 FUSE TABLE

Part Number	Current Rating (A)	Housing Color	Typ. Voltage Drop at Rated Current (mV)
999020	20	Yellow	76
999025	25	Gray	75
999030	30	Green	77
999035	35	Brown	75
999040	40	Orange	75
999050	50	Red	70
999060	60	Blue	66
999070	70	Tan	61
999080	80	Clear	62

## RECOMMENDED MATING CAVITY



## Time-Current Characteristics

% of Rating	Opening Time Max/Min (s)								
	20A	25A	30A	35A	40A	50A	60A	70A	80A
135	1800	1800	1800	1800	1800	1800	1800	1800	1800
	60	60	60	60	60	60	60	60	60
200	20	30	30	40	40	50	60	60	60
	4	6	6	8	8	10	15	4	4
350	2	4	4	5	5	6	7	2	2
	0.7	1	1	1.4	1.4	1.7	2	0.20	0.20
600	1	1	1	1	1	1	1	1	1
	0.15	0.20	0.20	0.20	0.20	0.20	0.20	.1	.1

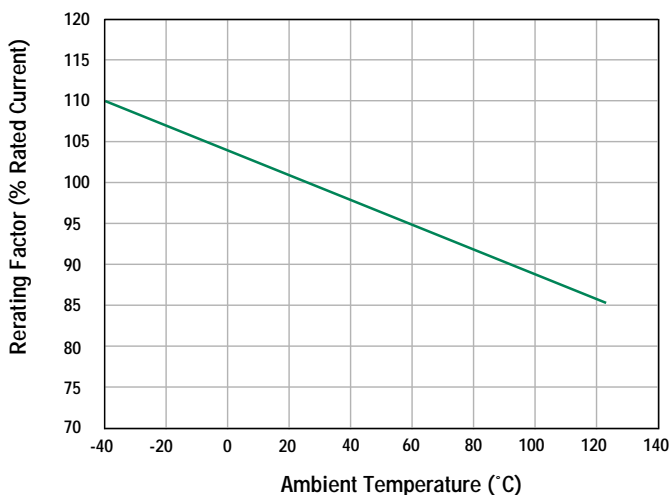
## INTERRUPTING RATINGS:

1000 amperes @ 58 VDC

## ENVIRONMENTAL SPECIFICATIONS:

Operating Temperature Range: -40°C to +125°C

## MAXI Fuse Temperature Derating Curve

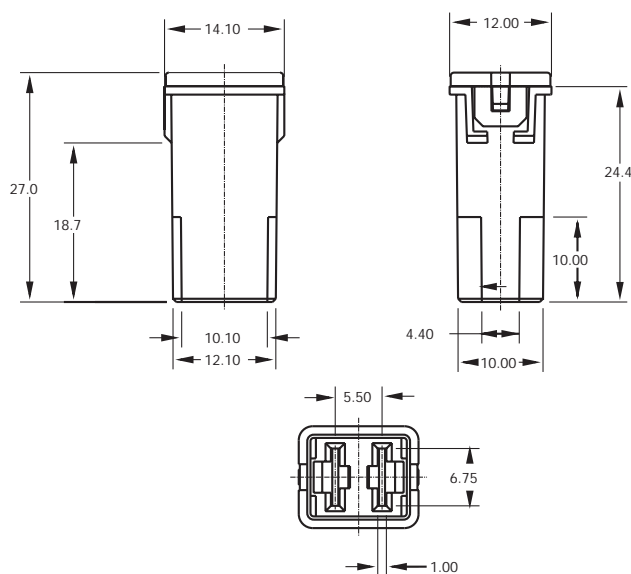


# JCASE® 42 Fuse

The JCASE 42 volt fuse rated at 58 volts DC was designed for use in 42-volt systems yet maintains the same performance characteristics and terminal footprint as the standard JCASE fuse. Because there are severe dangers involved with using a fuse designed for a 12-volt system in a 42-volt system, the unique rejection feature prevents fuses with a lower voltage rating (i.e. Standard JCASE fuse rated at 32 volts DC) from being inserted into the circuit. In order for the rejection feature to function as intended, fuse box designers need to follow the recommended mating cavity guidelines in this section.



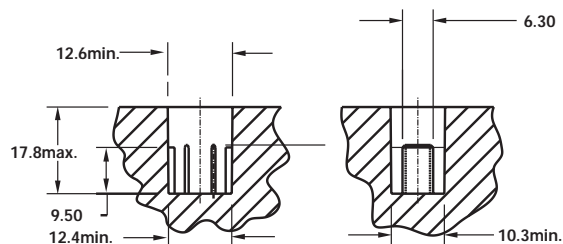
## DIMENSIONS (in mm)



## JCASE 42 FUSE TABLE

Part Number	Current Rating (A)	Housing Color	Typ. Voltage Drop at Rated Current (mV)
995020	20	Blue	106
995025	25	White	101
995030	30	Pink	91
995040	40	Green	87
995050	50	Red	88
995060	60	Yellow	87

## RECOMMENDED MATING CAVITY



## TIME CURRENT CHARACTERISTICS:

% of Rating	Opening Time	
	Min	Max
100	100 hrs	
135	60 s	1800 s
200	4.00 s	60.0 s
350	0.20 s	7.0 s
600	0.04 s	1.00 s

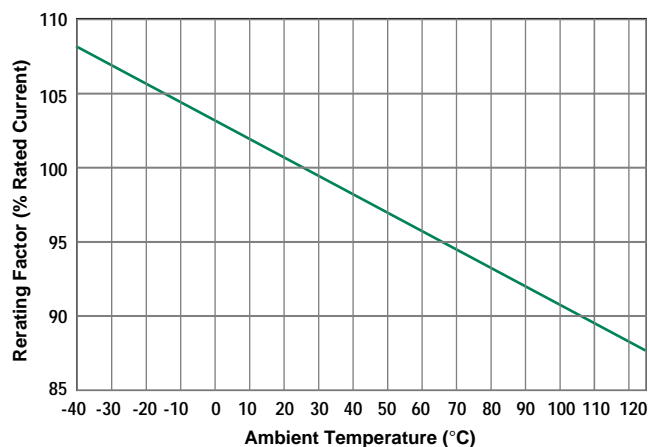
## INTERRUPTING RATINGS:

1000 amperes @ 58 VDC

## ENVIRONMENTAL SPECIFICATIONS:

Operating Temperature Range: -40°C to +125°C

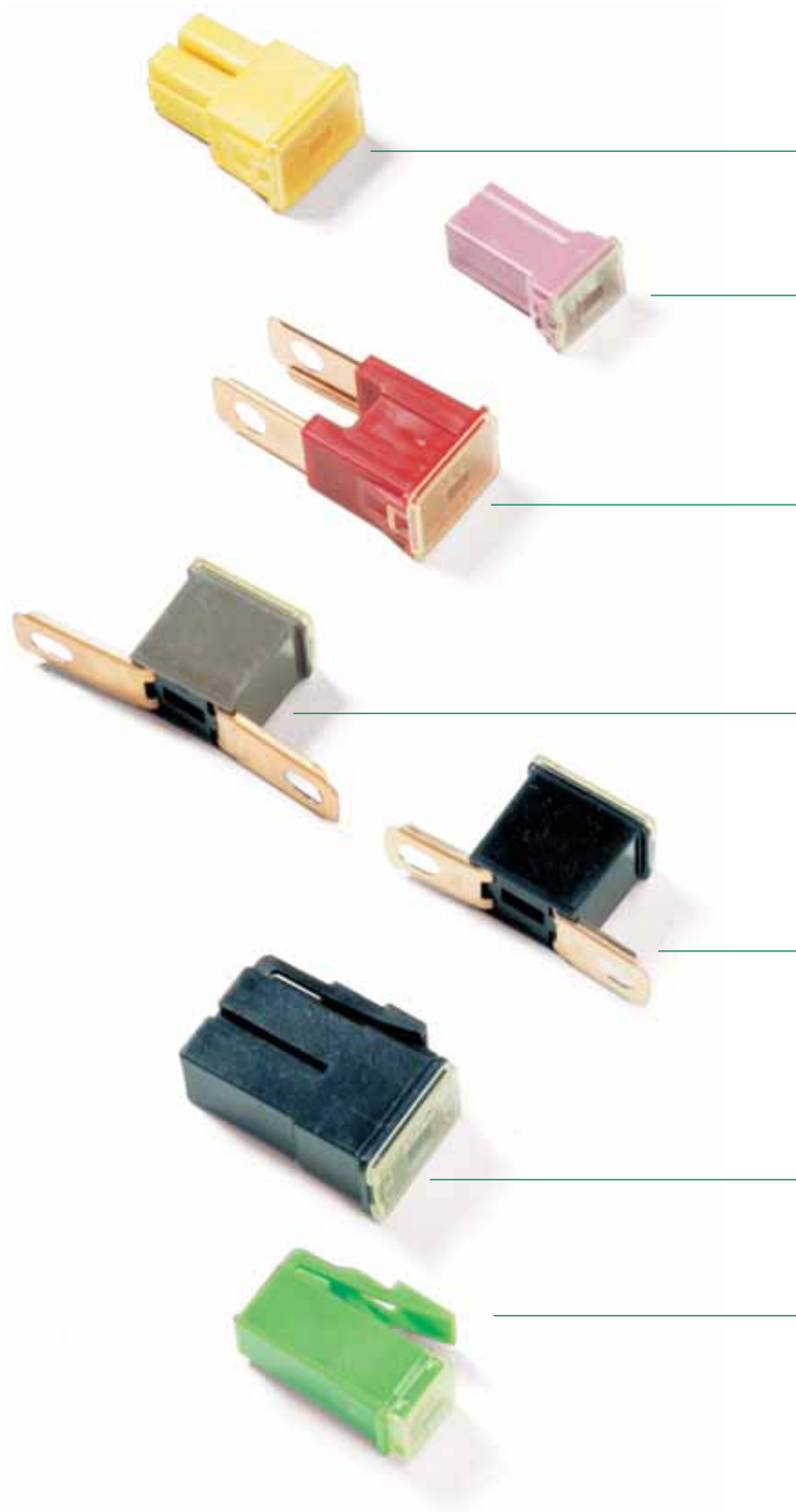
JCASE Fuse Series Temperature Derating Curve





# PAL™ Fuses

Commonly found on many Japanese OEM applications. PAL Fuses are available in current ratings up to 120 amperes, with either female or bolt-on terminals.



Part Number	Current Rating (A)	Housing Color
293020	20	Light Blue
293030	30	Pink
293040	40	Green
293050	50	Red
293060	60	Yellow
293830	30	Pink
293840	40	Green
294030	30	Pink
294040	40	Green
294050	50	Red
294060	60	Yellow
294070	70	Brown
294080	80	Black
294100	100	Blue
294120	120	White
295030	30	Pink
295040	40	Green
295050	50	Red
295060	60	Yellow
295070	70	Brown
295080	80	Black
295100	100	Blue
295120	120	White
283030	30	Pink
283040	40	Green
283050	50	Red
283060	60	Yellow
283070	70	Brown
283080	80	Black
283100	100	Blue
283120	120	White
(standard) 293545	45	Red
293565	65	Black
293575	75	Grey
293525	25	Brown
293530	30	Green

## EV Fuses

Littelfuse sets high standards of accuracy, consistent quality, reliability, and predictable performance for fuse design development. By using advanced metallurgical, polymer, and materials research, as well as mathematical modeling and computerized statistical analysis, Littelfuse engineers have developed a new EV fuse series designed to protect high voltage applications on electric vehicles such as air conditioning compressors, electric heaters and power steering, all of which are mechanically driven in a traditional vehicle design.

EV use is expected to grow in the near future due to environmental concerns and zero emission requirements. As EV development continues, the Littelfuse EV design team will design state-of-the-art EV fuses to protect all the new electrical applications in electric vehicles.

Littelfuse offers a variety of DC voltage fuses to meet EV applications (150-1000 VDC) as well as an array of fuseholders.

**Interrupting Rating:** 200,000 amperes

**Ampere Range:** 1 - 1,000 amperes

**Very Fast Acting:** EV fuses may be used wherever extremely fast-acting, current limiting fuses with no time delay are required.



EV49 Series



EV45 Series



KLKD Series



CCEV Series

L60030C-1CEV1  
Holder

EV45 Series

# Automotive Electronics

## Littelfuse Electronics Products

Littelfuse offers an extensive line of circuit protection products for automotive electronics applications. With the growing number of on-board electronics, automotive designers have more circuits to protect - accessories such as radios, cassette and CD players, cellular phones and global positioning system (GPS) products, as well as basic electronic functions such as power seats, power windows and climate control.

Littelfuse's broad selection of electronics devices address the changing needs of electronics applications. In addition to traditional glass and ceramic fuses, Littelfuse provides several low-profile surface mount designs which facilitate automated installation. To solve space limitations in electronics applications, Littelfuse offers 1206 and 0603 chip sizes produced with its breakthrough thin film processing techniques which enable precise control of electrical characteristics in compact packages. Littelfuse Slo-Blo® Fuses feature time delay to accommodate the inrush currents of electric motor control circuits, and very fast acting performance characteristics are also available.

For more detailed information, please contact your Littelfuse sales representative for a copy of the Littelfuse *Electronic Designer's Guide* which contains all the necessary specifications for Littelfuse electronics products or visit our website at [www.littelfuse.com](http://www.littelfuse.com).

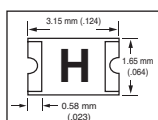
## Over Current Protection Products

### Resettable PTCs

#### 1206L Series

##### Surface Mount

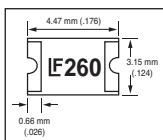
I <sub>hold</sub> (A)	V <sub>max</sub> (VDC)
0.20	15.0
0.25	15.0
0.35	6.0
0.50	6.0
0.75	6.0
1.10	6.0
1.50	6.0



#### 1812L Series

##### Surface Mount

I <sub>hold</sub> (A)	V <sub>max</sub> (VDC)
0.50	15.0
0.75	13.2
1.10	6.0
1.25	6.0
1.50	6.0
1.60	6.0
2.00	6.0
2.60	6.0



## 30R Series

### Radial Lead

V<sub>max</sub>  
30VDC

Ampere Range  
0.90 – 9.0A



## 60R Series

### Radial Lead

V<sub>max</sub>  
60VDC

Ampere Range  
0.10 – 3.75A



## Surface Mount Fuses

### SlimLine™ Lead-Free 1206

NEW

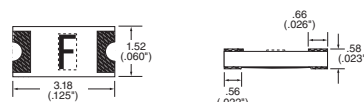
#### Very Fast-Acting Thin-Film Fuse 466 Series

VOLTAGE RANGE: 24-125V

AMPERE RANGE: 0.125 – 7.0A

INTERRUPTING 0.125 – .375A 50A @ 125VAC/VDC

RATINGS: 0.5 – 2A 50A @ 63VAC/VDC  
2.5 – 3A 50A @ 32VAC/VDC  
4 – 7A 35A @ 24VAC/VDC



### SlimLine™ 1206

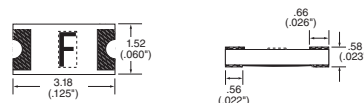
#### Very Fast-Acting Thin-Film Fuse 433 Series

VOLTAGE RANGE: 32 – 125V

AMPERE RANGE: 0.125 – 3.0A

INTERRUPTING 0.125 – .375A 50A @ 125VAC/VDC

RATINGS: 0.5 – 2A 50A @ 63VAC/VDC  
2.5 – 3A 50A @ 32VAC/VDC  
4 – 7A 35A @ 24VAC/VDC





# Automotive Electronics

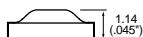
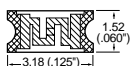
## Over Current Protection Products (Cont.)

### Surface Mount Fuses

#### 1206

##### Slo-Blo® Thin-Film Fuse 430 Series

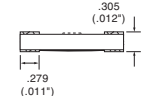
VOLTAGE RANGE: 32 – 63V  
 AMPERE RANGE: 0.5 – 3.0A  
 INTERRUPTING 0.5 – 1.5A 50A @ 63VAC/VDC  
 RATINGS: 2A 35A @ 63VAC/VDC  
 3A 50A @ 32VAC/VDC



#### SlimLine™ Lead-Free 0603

##### Very Fast-Acting Thin-Film Fuse 467 Series

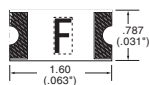
VOLTAGE RANGE: 32V  
 AMPERE RANGE: 0.25 – 5.0A  
 INTERRUPTING 0.25 – 1A 50A @ 32VAC/VDC  
 RATINGS: 1.25 – 5A 35A @ 32VAC/VDC



#### SlimLine™ 0603

##### Very Fast-Acting Thin-Film Fuse 434 Series

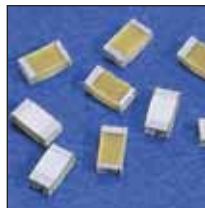
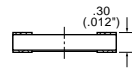
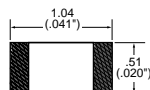
VOLTAGE RANGE: 32V  
 AMPERE RANGE: 0.25 – 5.0A  
 INTERRUPTING 0.25 – 1A 50A @ 32VAC/VDC  
 RATINGS: 1.25 – 5A 35A @ 32VAC/VDC



#### SlimLine™ Lead-Free 0402

##### Very Fast-Acting Thin-Film Fuse 435 Series

VOLTAGE RANGE: 24V  
 AMPERE RANGE: 0.25 – 2.0A  
 INTERRUPTING 035A @ 24 VDC  
 RATINGS:

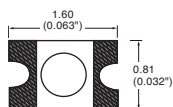


## Overvoltage Suppression Products

### PulseGuard® Polymeric ESD Suppressors-PGB Series

#### PGB1010603

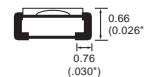
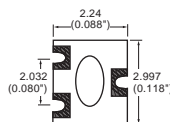
OPERATING VOLTAGE: 0-24VDC  
 PEAK CURRENT: 45A@15kV  
 CAPACITANCE: 0.05pF@1MHz  
 LEAKAGE CURRENT: <1.0nA  
 OFFSTATE  
 RESISTANCE: 10MΩ  
 CLAMPING: 150V,TYPICAL@8KV  
 LINES PROTECTED:



1-line

#### PGB102ST23

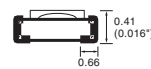
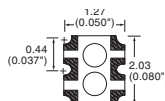
OPERATING VOLTAGE: 0-24VDC  
 PEAK CURRENT: 45A@15kV  
 CAPACITANCE: 0.05pF@1MHz  
 LEAKAGE CURRENT: <1.0nA  
 OFFSTATE  
 RESISTANCE: 10MΩ  
 CLAMPING: 150V,TYPICAL@8KV  
 LINES PROTECTED:



2-lines

#### PGB1040805

OPERATING VOLTAGE: 0-24VDC  
 PEAK CURRENT: 45A@15kV  
 CAPACITANCE: 0.05pF@1MHz  
 LEAKAGE CURRENT: <1.0nA  
 OFFSTATE  
 RESISTANCE: 10MΩ  
 CLAMPING: 150V,TYPICAL@8KV  
 LINES PROTECTED:



4-lines



# Automotive Electronics

## Overvoltage Suppression Products (Cont.)

### Metal Oxide Varistors (MOV's)

#### MA Series

**OPERATING VOLTAGE:** 4-264 VAC  
13-365 VDC  
**PEAK CURRENT:** 40-100A  
**PEAK ENERGY:** 0.06-1.7J  
**MOUNT/Form Factor:** Axial Leaded  
**DISC SIZE:** 3mm



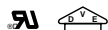
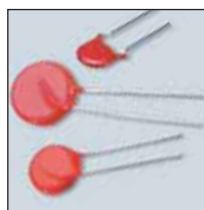
#### RA Series

**OPERATING VOLTAGE:** 4-275 VAC  
5.5-364 VDC  
**PEAK CURRENT:** 150-6,500A  
**PEAK ENERGY:** 0.4-140J  
**MOUNT/Form Factor:** Packaged  
**DISC SIZE:** 8, 6, 22mm



#### ZA Series

**OPERATING VOLTAGE:** 4-460 VAC  
5.5-615 VDC  
**PEAK CURRENT:** 50-6,500A  
**PEAK ENERGY:** 0.1-52J  
**MOUNT/Form Factor:** Radial Leaded  
**DISC SIZE:** 5, 7, 10, 14, 20mm



### MULTILAYER VARISTORS (MLV's)

#### MHS Series

**OPERATING VOLTAGE:** 0 – 42 VDC  
**PEAK CURRENT:** N/A  
**LEAKAGE CURRENT:**  $<5\mu A$   
**PEAK ENERGY:** N/A  
**LINES PROTECTED:** 1  
**CAPACITANCE:** 3, 12pF  
**PACKAGE SIZE:** 0402, 0603



#### ML Series

**OPERATING VOLTAGE:** 2.5-104 VAC  
3.5-120 VDC  
**PEAK CURRENT:** 30-250A  
**LEAKAGE CURRENT:**  $<5\mu A$   
**PEAK ENERGY:** 1-2.0J  
**LINES PROTECTED:** 1  
**CAPACITANCE:** 40-6000pF  
**PACKAGE SIZE:** 0402-1210



#### MLE Series

**OPERATING VOLTAGE:** 0-18 VDC  
**PEAK CURRENT:** 20A  
**LEAKAGE CURRENT:**  $<10\mu A$   
**PEAK ENERGY:** 0.5J  
**LINES PROTECTED:** 1  
**CAPACITANCE:** 40-1700pF  
**PACKAGE SIZE:** 0402-1206



#### MLN Series

**OPERATING VOLTAGE:** 5.5-18 VDC  
**PEAK CURRENT:** 20A  
**LEAKAGE CURRENT:**  $<2\mu A$   
**PEAK ENERGY:** 0.05J  
**LINES PROTECTED:** 4  
**CAPACITANCE:** 45-430pF  
**PACKAGE SIZE:** 1206



#### AUML Series

**OPERATING VOLTAGE:** 18 VDC  
**PEAK CURRENT:** N/A  
**LEAKAGE CURRENT:** N/A  
**PEAK ENERGY:** N/A  
**LINES PROTECTED:** 1  
**CAPACITANCE:** N/A  
**PACKAGE SIZE:** 1206-2220



#### CH Series

**OPERATING VOLTAGE:** 14-275 VAC  
18-369 VDC  
**PEAK CURRENT:** 250-500A  
**PEAK ENERGY:** 1-23J  
**MOUNT/Form Factor:** Surface Mount  
**DISC SIZE:** N/A



# Automotive Electronics

## Overvoltage Suppression Products (Cont.)

### Silicon Protection Arrays

#### SPO5X Series

##### TVS Avalanche Diode

**OPERATING VOLTAGE:** 0-5.5 VDC  
**LEAKAGE CURRENT:**  $<10\mu A$   
**LINES PROTECTED:** 2,3,4,5,6  
**CAPACITANCE:** 30pF  
**PACKAGE SIZE:** SC70, SOT23, SOT143,  
TSSOP-8, MSOP-8



#### SP72X Series

**OPERATING VOLTAGE:** 0-30VDC  
**LEAKAGE CURRENT:**  $<20\mu A$   
**LINES PROTECTED:** 4,6,14  
**CAPACITANCE:** 3-5pF  
**AGE SIZE:** DIP, SOIC, SOT23



#### SPUSB1 Series NEW

##### Upstream USB Port Terminator with ESD suppression and EMI Filtering

**OPERATING VOLTAGE:** 5.5 VDC  
**LEAKAGE CURRENT:**  $<1\mu A$   
**LINES PROTECTED:** 3  
**CAPACITANCE:** 47pF  
**AGE SIZE:** SC70-6

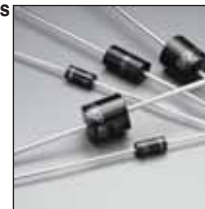


### TVS Diodes

#### Through-hole TVS Diode NEW

SA, P4KE, P6KE, 1.5KE, 5KP, 15KP, FSLD, SLD Series

**MAX OPERATING VOLTAGE:** 5.0 to 380.0  
**PEAK PULSE CURRENT:** N/A  
**FORM FACTOR:** Axial leaded  
**PEAK PULSE POWER** 400W to 5kW



#### Surface Mount TVS Diode NEW

P4SMA, SMAJ, 1.5SMC, SMCJ, SMBJ,  
P6SMBJ, 1KSMBJ Series

**MAX OPERATING VOLTAGE:** 5.0 to 188.0  
**PEAK PULSE CURRENT:** N/A  
**FORM FACTOR:** DO 214 AA  
**PEAK PULSE POWER** 600W to 1kW



### Gas Discharge Tubes

#### High Performance Gas Plasma TRIGGER NEW

##### XT Series

**PEAK PULSE CURRENT:** 400A  
**FORM FACTOR:** 2 terminal axial & SMT  
**NOM. DC BREAKOVER  
VOLTAGE** 600-1000



# Fuseholders

## Customized “Quick Fix” Solutions

For those times when additional circuit protection requirements are presented by unforeseen situations and the design is frozen, fuse block space is limited, or the vehicles are already on the road, Littelfuse can provide customized “Quick Fix” solutions, specially designed for your specific application when standard products cannot solve the problem individually.

Littelfuse has the expertise and resources to develop any solution you need, using fuses, fuseholders, terminals and other Littelfuse products creatively and effectively. We have the design, quality

testing, manufacturing and packaging capabilities to meet all the circuit protection challenges faced by OEMs. Our ability to respond to emergency situations with quick turnaround times and high production volumes is unrivaled in the industry, and all our custom products conform to the same rigid quality, performance and safety standards applied to Littelfuse’s stock products.

For more information on customized “Quick Fix” solutions, contact your Littelfuse representative.

MINI® Blade Fuse  
Splashproof In-Line Fuseholder  
The protective cover of the Splashproof Fuseholder permits use of MINI® Fuses in harsh environments.

**Specifications**  
**Body:** Black Alcryn Thermoplastic  
**Cover:** Black Alcryn Thermoplastic  
**Ambient Temp.:** -10°C to +80°C

Part Number	Description
FHM001	#14AWG (2.0mm²) stranded black wire with terminals rated for 20A
FHM002	#12AWG (3.0mm²) stranded orange wire with terminals rated for 30A



## MINI® Blade Fuse Printed Circuit Board Mount

Designed to hold the MINI® Fuse, the Printed Circuit Board Mount is an economical alternative for PCB circuit protection in a variety of applications.

**Specifications**  
**Terminals:** Copper Alloy/Tin plated  
**Body:** Black Thermoplastic (UL94V0)  
**Electrical:** Recognized under the Components Program of Underwriters Laboratories for 15A and certified by CSA for 10A (32V)  
**Ambient Temp.:** -40°C to +85°C  
**Mounting:** Intended for soldering directly to 0.062 (1.57mm) printed circuit board

Part Number	Description
153007	Horizontal Mount
153008	Vertical Mount Single Unit or Stackable Unit (RH)
153009	Vertical Mount Stackable Unit



# Fuseholders

## MAXI™ Fuse Splashproof Fuseholder

Ideal for high amperage MAXI™ Fuse applications where a protective cover is required for harsh under-the-hood environments.



### Specifications

**Terminals:** Copper Alloy/Tin Plated with integral stainless steel reinforcing spring

**Wire Seal:** Silicon Rubber

**Body:** Heat Stabilized Thermoplastic

**Cover:** Transparent Thermoplastic with integral silicon seal

**Rated:** 80A (Dependent on application - contact Littelfuse)

**Ambient Temp.:** -40°C to +105°C

### Maxi Fuse Splashproof Holder for 20-70 Amp

Quantity Required	Part Number	Description
1	1520007Z	Cover with Intergal seal
1	1520004Z	Body with Mounting Tabs (one tab is slotted)
	1520005Z	Body with Mounting Tabs
	1520006Z	Body without Mounting Tabs
2	868-095	Blue Wire Seal for 1.5-4mm <sup>2</sup> (14-12AWG) Wire
	868-096	Gray Wire Seal for 4-10mm <sup>2</sup> (10-8AWG) Wire
2	913-064	Single terminal 1.5-4mm <sup>2</sup> (14-12AWG) Wire
	913-064-001	Reeled terminals 1.5-4mm <sup>2</sup> (14-12AWG) Wire
	913-068	Single terminal 4-6mm <sup>2</sup> (10AWG) Wire
	913-068-001	Reeled terminals 4-6mm <sup>2</sup> (10AWG) Wire
	913-087	Single terminal 6-10mm <sup>2</sup> (8AWG) Wire
	913-087-001	Reeled terminals 6-10mm <sup>2</sup> (8AWG) Wire

### Maxi Fuse Splashproof Holder for 80 Amp

Quantity Required	Part Number	Description
1	1520007Z	Cover with Intergal seal
1	1520008Z	Body with Mounting Tabs, 80 Amp
	1520009Z	Body without Mounting Tabs, 80 Amp
2	868-096	Gray Wire Seal for 4-10mm <sup>2</sup> (10-8AWG) Wire
2	913-088	Single terminal 8mm <sup>2</sup> (8AWG) Wire
	913-088-001	Reeled terminals 8mm <sup>2</sup> (8AWG) Wire

\*It is recommended that cross linked polyethelene (GLX) insulated wire be used, as described in SAE J1128 (Type, FLY in DIN 76722) or equivalent.

# Fuseholders

## MAXI™ Fuse In-Line Fuseholder

The In-Line Fuseholder provides an efficient, simple installation method for MAXI™ Fuse applications.

### Specifications

**Terminal:** Copper Alloy

**Body:** Black Thermoplastic (UL94HB)

**Cover:** Translucent Thermoplastic

**Ambient Temp.:** -10°C to +80°C

Maximum number of fuseblocks tied together is two for all ratings, up to and including 50A.

Quantity Required	Part Number	Description
1	152001	Fuseholder-Rated at 60A
1	152900	Cover
2	913-653	Ring tongue terminal for 2.5-6mm <sup>2</sup> (12-10AWG) wire*
	913-654	Ring tongue terminal for 5-10mm <sup>2</sup> (10-8 AWG) wire*
2	913-550	M5 x 8 Screw per DIN 7985-4.8

\*It is recommended that cross linked polyethelene (GXL) insulated wire be used, as described in SAE J1128 (Type, FLY in DIN 76722) or equivalent.

## MAXI™ Fuse In-Line Fuseholder With Protective Cap

Supplied with two 6" leads -  
6 gauge wire for up to 60 amp  
MAXI™ Fuse applications,  
this In-Line Fuseholder also provides  
a protective cover for harsh under-the-hood  
environments. Mounting hole also permits  
easy bulkhead installation.

**Part Number:** MAH 1

## ATO® Blade Fuse Splashproof In-Line Fuseholder

The Splashproof Fuseholder provides a protective  
cover to permit the use of ATO® Fuses in harsh environments.

### Specifications

**Body:** Black Alcryn Thermoplastic

**Cover:** Black Alcryn Thermoplastic

**Ambient Temp.:** -10°C to +80°C

Part Number	Description
FHAC001	#16AWG (1.0mm <sup>2</sup> ) stranded black wire with terminals rated for 20A
FHAC002	#12AWG (3.0mm <sup>2</sup> ) stranded orange wire with terminals rated for 30A



# Fuseholders

## ATO® Blade Fuse In-Line Panel Mount Fuseholder

The In-Line Panel Mount Fuseholder provides an easy and quick mounting alternative when specifying ATO® Fuses.

### Specifications

**Body:** Black Heat Stabilized Thermoplastic (UL94V2)

**Terminals:** Brass, Tin Plated - Snap lock into body

**Ambient Temp.:** -40°C to +85°C

**Mounting:** Capable of snap mounting into panel from rear.  
Fuseholder interlocks for multiple mountings.

Part Number			
Unassembled	Assembled with 8" Wire Loop- No Fuse	Assembled with 8" Wire Loop- With Fuse	Fuse Amperage Rating
155320U	155300	155303A	3
Terminals for #14AWG (2.0mm <sup>2</sup> ) stranded wire marked "14"	#14AWG (2.0mm <sup>2</sup> ) Terminals rated to 20A	155304A	4
		155305A	5
		15537.5A	7.5
		155310A	10
		155315A	15
		155320A	20
155430U	155400	155425A	25
Terminals for #10AWG (5.0mm <sup>2</sup> ) stranded wire marked "10"	#10AWG (5.0mm <sup>2</sup> ) Terminals rated to 30A	155430A	30

## ATO® Blade Fuse In-Line Molded Fuseholder

The Molded Fuseholder is a versatile fuseholder for in-line applications.

### Specifications

**Body:** Black Thermoplastic

**Wire:** PVC

**Ambient Temp.:** -10°C to +80°C

Part Number	Description	Part Number	Description
FHA 001	20A Max-No fuse supplied	FHA 002	30A Max-No fuse supplied
FHA 003	With 3A fuse		
FHA 004	With 4A fuse	FHA 025	With 25A fuse
FHA 005	With 5A fuse		
FHA 07.5	With 7.5A fuse	FHA 030	With 30A fuse
FHA 010	With 10A fuse		
FHA 015	With 15A fuse		
FHA 020	With 20A fuse		
#16 AWG (1.0mm <sup>2</sup> ) Stranded Black Wire		#12 AWG (3.0mm <sup>2</sup> ) Stranded Orange Wire	

## ATO® Blade Fuse Terminal

The ATO® Blade Fuse Terminal is a tin plated terminal for ATO Fuse mounting on printed circuit boards.

### Specifications

**Terminal:** Brass/Tin Plated

• Suitable for current levels up to 15A

• First time fuse insertion force may approach 40lbs. (180N)

**Part Number:** 100057





# Fuseholders

## MEGA® Fuse Fuseholders

### Specifications

**Electrical:** Use with MEGA Fuses from 40 to 500 amps

**Part No.:** 2981000 Series Single holder

2982000 Series Dual holders

2983000 Series Triple holders

**Body:** Glass Filled thermoplastic

**Body Color:** Black

**Cover with Tether:** Glass Filled Thermoplastic

**Cover Color:** Black

**Ambient Temp.:** -40°C to +125°C

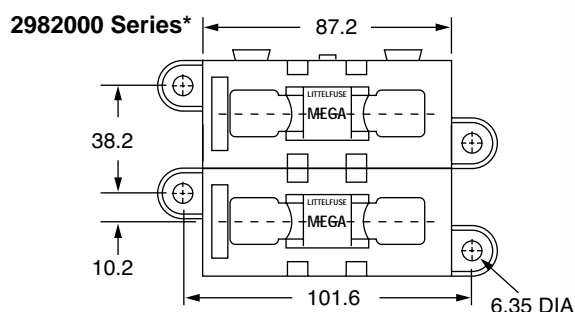
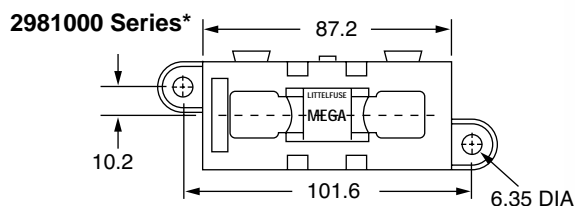
**Fuse Mounting:** M8 Threaded Stud and Hex Nuts or  
M6 Threaded Hex Nuts

**Cover Opening Positions:** - 6 total - location optional

**Side Stackable Feature**

**Holder Mounting Dimensions:** Optional

**Torque Requirements:** M8 Nut 12-18 Newton meters  
M6 Nut 8-14 Newton meters



## MIDI® Fuse Fuseholders

### Specifications

**Electrical:** Use with MIDI Fuses from 30 to 200 amps

**Part No.:** 498900 Series

**Body:** Glass Filled Thermoplastic

**Body Color:** Black

**Cover with Tether:** Glass Filled Thermoplastic

**Cover Color:** Black

**Ambient Temp.:** -40°C to +125°C

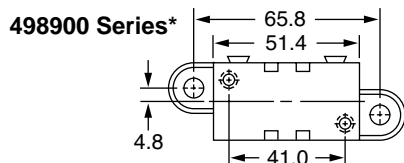
**Fuse Mounting:** M5 Threaded Stud and Hex Nuts

**Cover Opening Positions:** Location Optional - 6 total

**Side Stackable Feature**

**Holder Mounting Dimensions:** Available with or without mounting tabs

**Torque Requirements:** M5 Nut 4-5 Newton meters



\*Holder Part No. w/cover dependent on part locations/patterns.

# Special Products

## ATO™ Resistor

Part Number: 240100 Series



### Specifications

**Operating Temp.:** -20°C to +85°C

**Resistor Value:** Optional

**Power Rating:** 1/4 W Max

**Body Material:** Thermoplastic

**Term. Material:** C.R.S. (Ni/Zn Plated)

**Term. Retention:** 25 N

## ATO™ Diode

Part Number: 240103



### Specifications

**Operating Temp.:** -40°C to +85°C

**Diode Rating:** 1.0 A

**Max P.I.V.:** Optional

**Body Material:** Thermoplastic

**Term. Material:** C.R.S. (Ni/Zn Plated)

**Term. Retention:** 25 N

## MINI™ Resistor

Part Number: 240100 Series



### Specifications

**Operating Temp.:** -40°C to +85°C

**Resistor Value:** Optional

**Power Rating:** 1/4 Max

**Body Material:** Thermoplastic

**Term. Material:** C.R.S. (Ni/Zn Plated)

**Term. Retention:** 25 N

## MINI™ Diode

Part Number: 240113



### Specifications

**Operating Temp.:** -40°C to +85°C

**Diode Rating:** 1.0 A

**Max P.I.V.:** Optional

**Body Material:** Thermoplastic

**Term. Material:** C.R.S. (Ni/Zn Plated)

**Term. Retention:** 25 N

## ATO™ Shunt

Part Number: 240094



### Specifications

**Operating Temp.:** -40°C to +125°C

**Maximum Continuous Load Rating:** 35 A

**Body Material:** Thermoplastic (UL 94V0 Rated)

**Term. Material:** Brass Tin Plated

## MINI™ Shunt

Part Number: 297900



### Specifications

**Operating Temp.:** -40°C to +125°C

**Maximum Continuous Load Rating:** 20 A

**Body Material:** Thermoplastic (UL 94V0 Rated)

**Term. Material:** Zinc Silver Plated

## JCASE™ Shunt

Part Number: 495900



### Specifications

**Operating Temp.:** -40°C to +125°C

**Maximum Continuous Load Rating:** 50 A

**Body Material:** Nylon

**Term. Material:** Copper

# Fuse Pullers

Littelfuse offers a selection of fuse pullers for easy removal and replacement of ATO®, MINI®, and MAXI™ Blade Fuses.

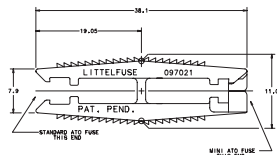
## ATO and MINI Fuse Puller

### Specifications

**Material:** Polyamide

**Color:** White

**Part Numbers:** 097021



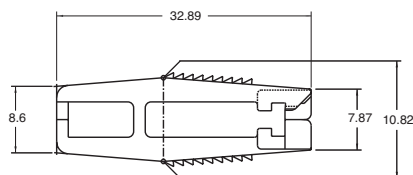
## MINI Fuse Puller

### Specifications

**Material:** Polyamide

**Color:** White

**Part Numbers:** 097024



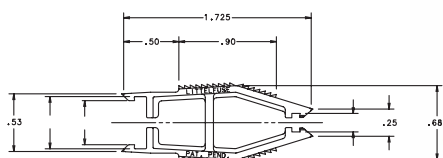
## JCASE and MINI Fuse Puller

### Specifications

**Material:** Polyamide

**Color:** White

**Part Numbers:** 097053



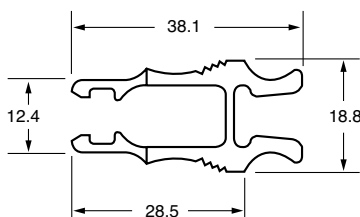
## MAXI Fuse Puller

### Specifications

**Material:** Polyamide

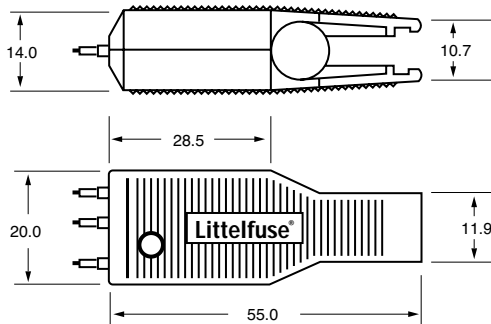
**Color:** Green or White

**Part Numbers:** 097026 Green  
097027 White



## Fuse Tester and Puller

The Tester/Puller conveniently and easily tests ATO® and MINI® Blade Fuses either in or out of the fuse block. Indicator light on tester glows bright green when fuse is good. Fuse puller end allows for easy fuse removal and replacement. 24V maximum.

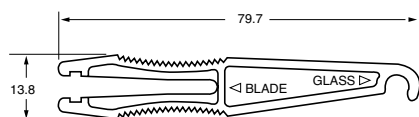


**Part Number:** 097019

## Tri-Puller™ Fuse Puller

Tri-Puller™ Fuse Puller allows for easy fuse removal and replacement of Glass Fuses, Ceramic Type Fuses, ATO® and MINI® Blade Fuses.

**Part Number:** 097023





# Catalogs & Support Materials

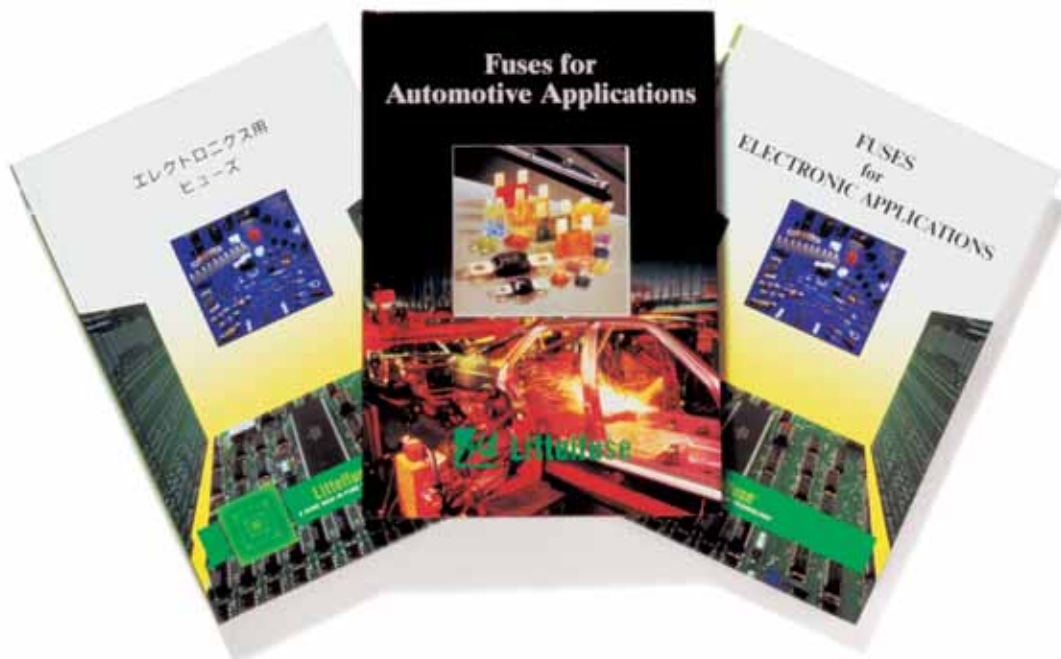
## Catalogs

Littelfuse, Inc. produces a vast array of products serving numerous markets including electronics, aftermarket and power fuses. Catalogs for Littelfuse products are available upon your request. Please contact your local sales representative for copies.



## Technical Support Books

Littelfuse, Inc. has published *Fuses for Automotive Applications* to share knowledge that we possess in a market with ever increasing demands for reliability and quality.



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## A History of Littelfuse Automotive Firsts

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For more than 75 years, Littelfuse has been the circuit protection manufacturer to achieve the automotive industry's most significant accomplishments, beginning in 1927 by inventing electronic circuit protection technology with the first small fast-acting protective fuse.

- 1930** - Automotive fuse introduced by Littelfuse
- 1950** - Littelfuse develops design of industry's first centralized under dash fuseblock
- 1976** - ATO® Blade Fuse revolutionizes automotive circuit protection
- 1986** - U.S. auto industry selects the MAXI™ Fuse to replace the commonly used high amp fusible wire and fusible links in under-the-hood electrical harnesses
- 1987** - Littelfuse expands high amp coverage with reliable new line of PAL™ Auto Links for complete Japanese coverage
- 1989** - MINI® Fuse introduced as compact version of ATO® Fuse to address the proliferation of circuits being added to new car designs
- 1991** - High amp protection MEGA® Fuse introduced as the first OE and Aftermarket fuse rated up to 250 amps
- 1993** - Littelfuse becomes the first circuit protection manufacturer to receive ISO 9000 certification
- 1994** - MIDI® compact bolt-down automotive fuse introduced for European high amp applications
- 1996** - Littelfuse is first circuit protection manufacturer to receive QS 9000 certification
- 1997** - JCASE® Fuse introduced as a high current, space saving, female terminated fuse
- 1997** - Littelfuse celebrates 70 years of quality circuit protection innovation
- 2001** - Cable Pro® Fuse introduced as an inline high current fuse to replace fusible links in underhood applications
- 2004** - Low Profile JCASE Fuse introduced as a compact version of the JCASE Fuse





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