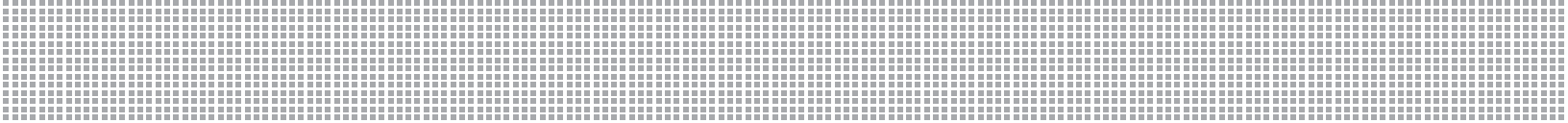




Expertise Applied | Answers Delivered



CIRCUIT  
PROTECTION  
SOLUTIONS FOR  
AUTOMOTIVE  
APPLICATIONS



# Automotive

**Passenger Car Solutions**



**Our offering of automotive circuit protection solutions encompasses a wide range of applications:**

- Powertrain** Engine Management  
Transmission Control  
Cooling Fan  
Water Pump
- Safety** ABS  
EPAS  
Air Bag  
Chassis Control
- Comfort** Window Lift  
Sun Roof  
Door Lock  
Power Seat  
HVAC
- Infotainment** Dashboard  
Navigation  
In-Car Entertainment
- Fuse Box** Wire Harness
- Power Supply** Generator
- Lighting** HID Headlight  
Headlight Leveling  
Directional Lighting



# portfolio of Littelfuse automotive technologies, products & services

Passenger Automobiles | Aftermarket

## SERVICES

### Product Technologies Plus Application Design Evaluation Services

Littelfuse is the world leader in circuit protection. We offer an extensive selection of circuit protection technologies for Automotive applications. Littelfuse circuit protection expert staff can assist you in designing circuit protection for your most demanding applications. Solutions for over-current applications as well as over-voltage applications are available from Littelfuse.



## CIRCUIT PROTECTION TECHNOLOGIES (1-8)

### 1. Fuses/Footprint Reduction

MICRO2™, MICRO3™ fuses

### 2. Medium Current Cartridge Fuses

MCASE+™ cartridge fuses; considerably smaller than JCASE® and Low Profile JCASE® fuses

### 3. Discrete High Current Fuses

High Current Bolt Down fuses and fuse arrays

### 4. ZCase Masterfuse

Smallest high current distribution product in the industry

### 5. Masterfuse

High current distribution array

### 6. ZCase Single MEGA

Minimal Footprint Bolt Down fuse

### 7. High Voltage Fuses

Low-current fuses for Electric and Hybrid Electric Vehicles

### 8. Battery Cable Protection

CABLE PRO® protectors for mounting directly inline as part of a high power cable assembly



Blade Fuses	1
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Specialty Products	48
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## Helping to make the World a Cleaner Place to Live

### Littelfuse and the Environment

As members of the global community, we at Littelfuse have always strived to understand the impact of what we do, and of what we create, on the world around us. Because of this, our concern for the environment has always been an integral and fundamental part of our business. We continually work to balance our business objectives with the need to protect and improve the local and global environment.

### Our Strategy for the Design of Eco-friendly Products

Littelfuse has established a focused program committed to developing high-performance eco-friendly products along with a comprehensive set of processing/reliability data and technical process expertise. This includes processes for eliminating, detecting and documenting the presence of hazardous materials such as

- Lead
- Cadmium
- Hexavalent Chromium
- Mercury
- Brominated flame-retardants (PBBs and PBDEs)

The Littelfuse strategy for eco-friendly products is specifically designed to help support our worldwide customers in their transition to Lead-Free processing.



All products considered to be lead-free are marked with this symbol.

Littelfuse defines lead-free as products which contain less than 1000ppm (0.1%) Lead, measured by weight of the entire product.



All RoHS compliant products are marked with this symbol.

Littelfuse follows the requirement set by the European Union for all RoHS compliant products. The European Union Directive 2002/95/EC RoHS restricts the use of Lead, Mercury, Hexavalent Chromium, Cadmium and Brominated flame-retardants (PBBs and PBDEs)

Visit [www.littelfuse.com/lead-free](http://www.littelfuse.com/lead-free) for further information.

# Blade Fuses

MICRO2™ Blade Fuse 32V	2
MICRO3™ Blade Fuse 32V	3
Low Profile MINI® Fuses Rated 58V	4
MINI® Blade Fuse Rated 32V	5
MINI® Blade Fuse Rated 58V	6
ATOF® Blade Fuse Rated 32V	7
MAXI® Blade Fuse Rated 32V	8
MAXI® Blade Fuse Rated 58V	9





MICRO2™ Blade Fuses



MICRO2™ Sn (Tin plated) Blade Fuses

## MICRO2™ Blade Fuses Rated 32V

The MICRO2™ Fuse is the new standard for vehicle circuit protection. Its sub-miniature design 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 MICRO2™ Fuse of recommended choice for protection.

Black amperage stamps are used on the 20A & 25A / light colored housings to improve contrast for vision system inspection.

### Specifications

	MICRO2 (Silver Plated)	MICRO2 Sn (Tin Plated)
Voltage Rating:	32 VDC	32 VDC
Interrupting Ratings:	1000A @ 32 VDC	1000A @ 32 VDC
*Component Level Temperature Range:	-40°C to +125°C	-40°C to +105°C
**System Level Temperature Range:	-40°C to +105°C	-40°C to +85°C
<i>105°C and 85°C are typical system level temperature requirements.</i>		
Terminals:	Ag plated zinc alloy	Sn plated zinc alloy
Housing Material:	PA66	PA66
Conforms to:	SAE 2741 and ISO 8820-3 in reference to electrical, mechanical and environmental performance requirements	

### RoHS

### Ordering Information

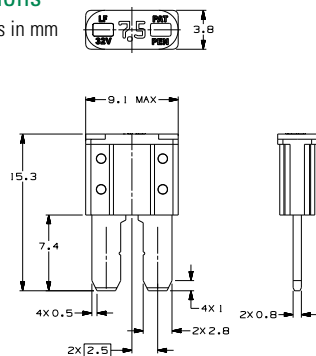
Part Number	Package Size
0327xxx.YX2S	4000
0327xxx.UXS	500
0327xxx.LXS	50
MICRO2 Sn Fuse	
0327xxx.YX2T	4000

### Time-Current Characteristics

Part Number	Package Size	% of Rating	Opening Time Min / Max
0327xxx.YX2S	4000	110	100 h / -
0327xxx.UXS	500	135	0.75 sec / 120 sec
0327xxx.LXS	50	160	0.30 sec / 50 sec
MICRO2 Sn Fuse		200	0.15 sec / 5 sec
0327xxx.YX2T	4000	350	0.04 sec / 0.50 sec
		600	0.02 sec / 0.100 sec

### Dimensions

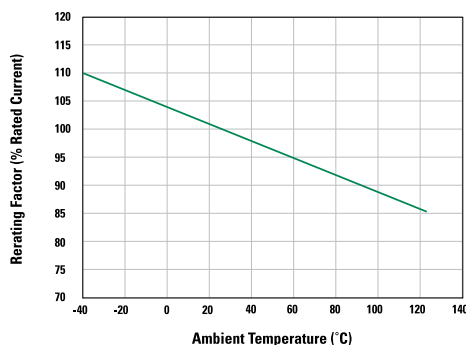
Dimensions in mm



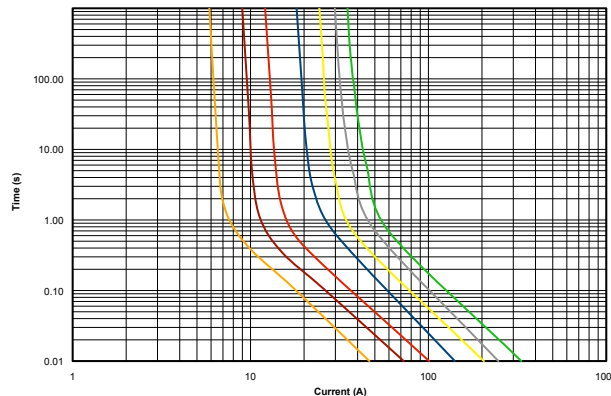
### Ratings

Part Number	Current Rating (A)	Housing Material Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I²t (A²s)
0327005_	5	Brown	116	17.4	17
032707.5_	7.5	Dark Brown	106	10.8	47
0327010_	10	Red	102	7.7	89
0327015_	15	Blue	94	4.9	189
0327020_	20	Yellow	91	3.5	397
0327025_	25	Light Grey	90	2.6	585
0327030_	30	Green	88	2.1	1028

### Temperature Derating Curve



### Time-Current Characteristic Curves



**\*Component Level Temperature** = the maximum ambient temperature that a single fuse will survive. This does not factor-in the heat from a populated fuse box, but does include the heat from the current load with the proper derating. **\*\*System Level Temperature** represents the ambient temperature of the fuse box at a location within the vehicle. The temperature within a populated fuse box (in a given location) will be higher. The limiting factor is the plating. Sn-plating's temperature limit is ≈130°C, and Ag-plating allows up to 150°C at the terminal interface.



## MICRO3™ Blade Fuses Rated 32V

The MICRO3™ Fuse has 3 terminals and 2 fuse elements with a common center terminal. Its sub-miniature design 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 MICRO3™ Fuse of recommended choice for protection.

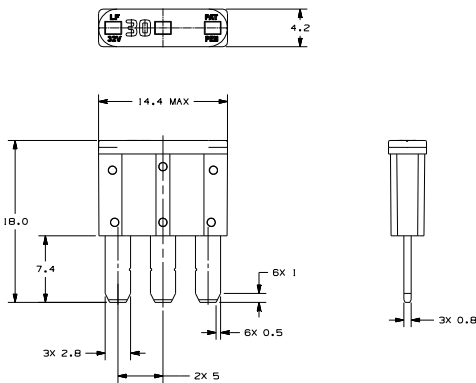
### Specifications

Voltage Rating:	32 VDC
Interrupting Ratings:	1000A @ 32 VDC
*Component Level Temperature Range:	-40°C to +125°C
**System Level Temperature Range:	-40°C to +105°C
<i>105°C is a typical system level temperature requirement.</i>	
Terminals:	Ag plated zinc alloy
Housing Material:	PA66
Conforms to:	SAE 2741 and ISO 8820-3 in reference to electrical, mechanical and environmental performance requirements

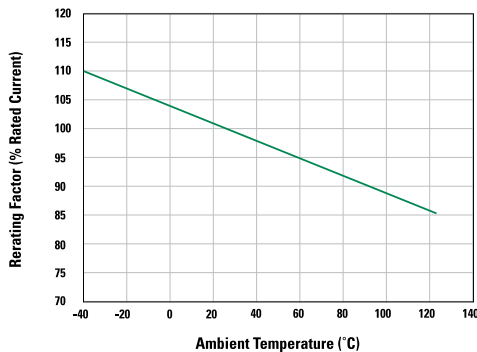
### RoHS

### Dimensions

Dimensions in mm



### Temperature Derating Curve



**\*Component Level Temperature** = the maximum ambient temperature that a single fuse will survive. This does not factor-in the heat from a populated fuse box, but does include the heat from the current load with the proper derating.  
**\*\*System Level Temperature** represents the ambient temperature of the fuse box at a location within the vehicle. The temperature within a populated fuse box (in a given location) will be higher. The limiting factor is the plating. Sn-plating's temperature limit is ≈130°C, and Ag-plating allows up to 150°C at the terminal interface.

### Ordering Information

Part Number	Package Size
0337xxx.PX2S	2000
0337xxx.LXS	50

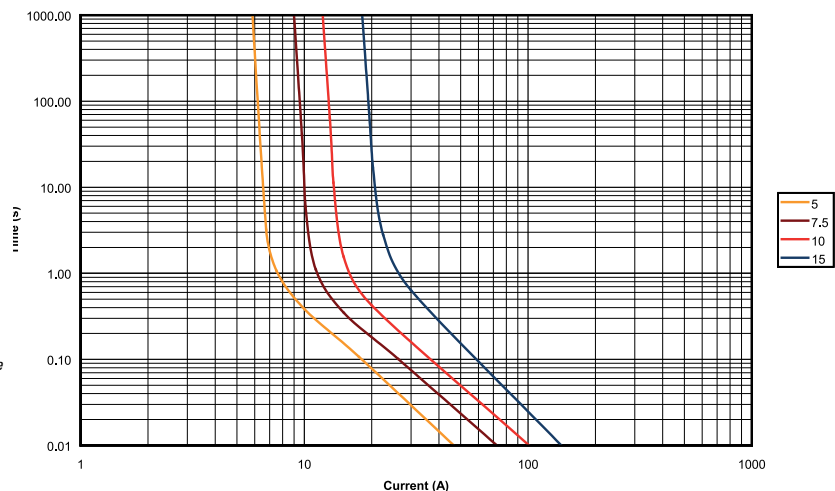
### Time-Current Characteristics

% of Rating	Opening Time (Min / Max)
110	100 h / –
135	0.75 sec / 120 sec
160	0.30 sec / 50 sec
200	0.15 sec / 5 sec
350	0.04 sec / 0.50 sec
600	0.02 sec / 0.100 sec

### Ratings

Part Number	Current Rating (A)	Housing Material Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I²t (A²s)
0337005_	5	Brown	116	17.4	17
033707.5_	7.5	Red	106	10.8	47
0337010_	10	Blue	102	7.8	89
0337015_	15	Orange	94	4.9	189

### Time-Current Characteristic Curves



## Low Profile MINI® Blade Fuses Rated 58V

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.

### Specifications

Voltage Rating: 58 VDC  
 Interrupting Rating: 1000A @ 58 VDC  
 \*Component Level Temperature Range: -40°C to +125°C  
 \*\*System Level Temperature Range: -40°C to +105°C  
*105°C is a typical system level temperature requirement.*  
 Terminals: Ag plated zinc  
 Housing Material: PA66  
 Complies with: ISO 8820-9



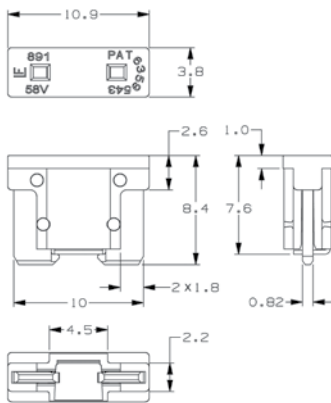
Low Profile MINI®  
Blade Fuses



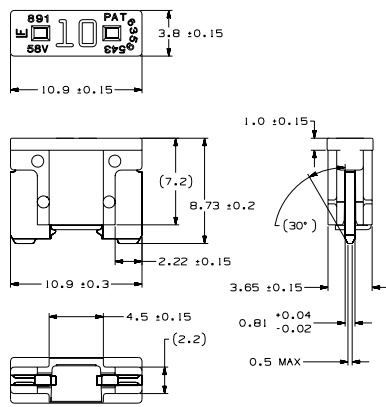
Low Profile MINI® 10.9mm  
Blade Fuses

### Dimensions

Dimensions in mm



### Low Profile MINI® 10.9mm



### Ordering Information

Part Number	Package Size	Plating
0891xxx.NXS	5000	Ag
0891xxx.U	500	Ag
0891xxx.H	100	Ag
<b>Low Profile MINI® 10.9mm Fuse</b>		
0891xxx.NXWS	5000	Ag

### Time-Current Characteristics

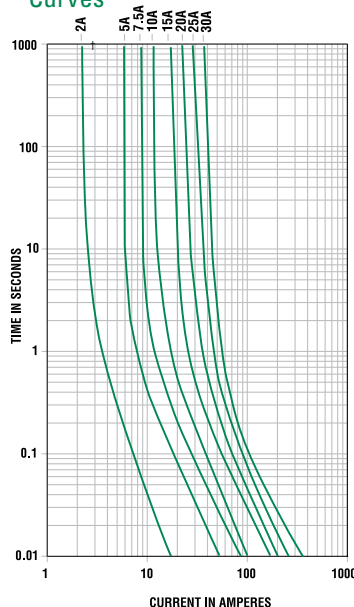
% of Rating	Opening Time Min / Max (s)
110	360,000 s / -
135	0.750 s / 120 s
200	0.150 s / 5 s
350	0.080 s / 0.250 s
600	0.030 s / 0.100 s

### Ratings

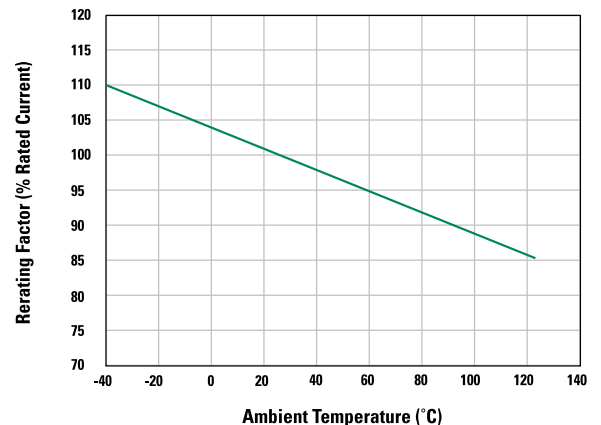
Part Number	Current Rating (A)	Housing Material Color	Cold Resistance (mΩ)	I²t (A²s)
0891002_†	2		54.2	3
0891005_	5		17.21	22
089107.5_	7.5		10.65	53
0891010_	10		7.59	102
0891015_	15		4.70	198
0891020_	20		3.35	420
0891025_	25		2.56	613
0891030_	30		2.06	1110

† Only offered for the 10.0mm series.

### Time-Current Characteristic Curves



### Temperature Derating Curve



\***Component Level Temperature** – the maximum ambient temperature that a single fuse will survive. This does not factor-in the heat from a populated fuse box, but does include the heat from the current load with the proper derating. \*\***System Level Temperature** represents the ambient temperature of the fuse box at a location within the vehicle. The temperature within a populated fuse box (in a given location) will be higher. The limiting factor is the plating. Sn-plating's temperature limit is -130°C, and Ag-plating allows up to 150°C at the terminal interface.

Littelfuse products are not designed for, and shall not be used for, any purpose (including, without limitation, automotive, military, aerospace, medical, life-saving, life-sustaining or nuclear facility applications, devices intended for surgical implant into the body, or any other application in which the failure or lack of desired operation of the product may result in personal injury, death, or property damage) other than those expressly set forth in applicable Littelfuse product documentation. Warranties granted by Littelfuse shall be deemed void for products used for any purpose not expressly set forth in applicable Littelfuse documentation. Littelfuse shall not be liable for any claims or damages arising out of products used in applications not expressly intended by Littelfuse as set forth in applicable Littelfuse documentation. The sale and use of Littelfuse products is subject to Littelfuse Terms and Conditions of Sale, unless otherwise agreed by Littelfuse.



## MINI® Blade Fuses Rated 32V

The MINI® Fuse is the standard for vehicle circuit protection. Its miniature design 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 of recommended choice for protection.

### Specification

	MINI (Silver Plated)	MINI Sn (Tin Plated)
Interrupting Rating:	1000A @ 32 VDC	1000A @ 32 VDC
Voltage Rating:	32 VDC	32 VDC
*Component Level Temperature Range:	-40°C to +125°C	-40°C to +105°C
**System Level Temperature Range:	-40°C to +105°C	-40°C to +85°C
<i>105°C and 85°C are typical system level temperature requirements.</i>		
Terminals:	Ag plated zinc alloy	Sn plated zinc alloy
Housing Material:	PA66	PA66
Complies with:	SAE J2077, ISO 8820-3, UL 248 Special Purpose Fuses	SAE J2077, ISO 8820-3 not UL recognized



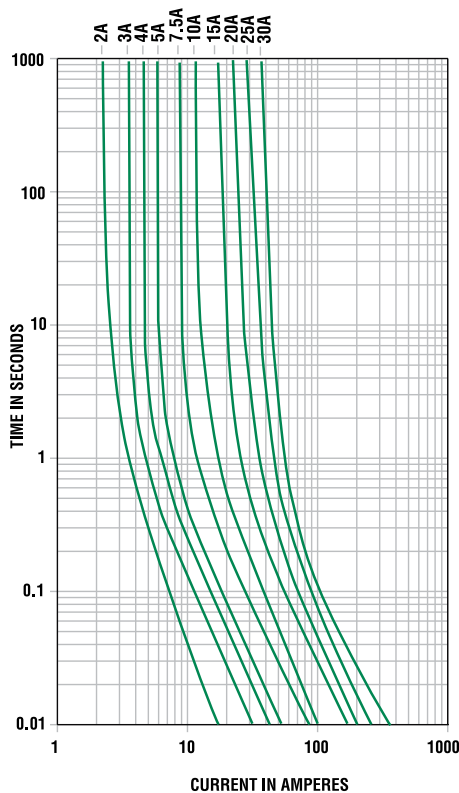
### Ordering Information

Part Number	Package Size
0297xxx.WXNV	3000
0297xxx.U	500
0297xxx.H	100
0297xxx.L	50
MINI® Sn Fuse	
0297xxx.WXT	3000

### Time-Current Characteristics

% of Rating	Opening Time Min / Max (s)
110	360,000 s / –
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

### Time-Current Characteristic Curves



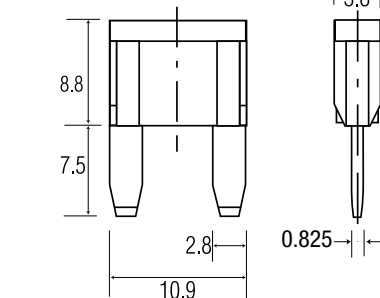
**\*Component Level Temperature** = the maximum ambient temperature that a single fuse will survive. This does not factor-in the heat from a populated fuse box, but does include the heat from the current load with the proper rerating. **\*\*System Level Temperature** represents the ambient temperature of the fuse box at a location within the vehicle. The temperature within a populated fuse box (in a given location) will be higher. The limiting factor is the plating. Sn-plating's temperature limit is ~130°C, and Ag-plating allows up to 150°C at the terminal interface.

### Ratings

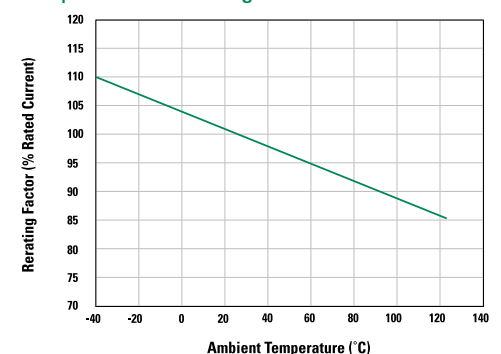
Part Number	Current Rating (A)	Housing Material Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I <sup>2</sup> t (A <sup>2</sup> s)
0297002_	2	Grey	171	55.60	2.8
0297003_	3	Purple	153	33.75	9.4
0297004_	4	Pink	121	23.48	17
0297005_	5	Orange	129	17.75	25
029707.5_	7.5	Brown	135	10.85	68
0297010_	10	Red	108	7.42	93
0297015_	15	Blue	98	4.58	270
0297020_	20	Yellow	96	3.21	380
0297025_	25	Light Orange	86	2.36	625
0297030_	30	Green	87	1.85	1130

### Dimensions

Dimensions in mm



### Temperature Rerating Curve



## MINI® Blade Fuses Rated 58V

MINI® style fuse for use in 42V Systems. Same Time-Current characteristic as the 32V MINI® fuse. Fits into standard MINI® fuse sockets. Has a rejection feature to prevent fuses with lower voltage rating from being wrongfully inserted into the circuit. Current rating 2A - 30A @58 VDC max.

### Specifications

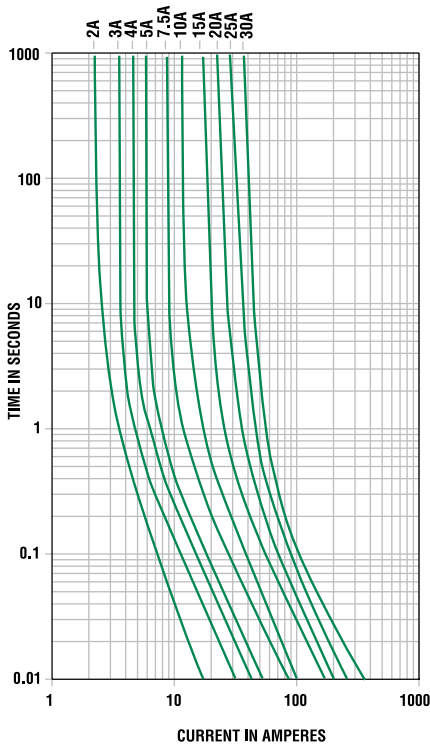
Interrupting Rating: 1000A @ 58 VDC  
 Voltage Rating: 58 VDC  
 \*Component Level Temperature Range: -40°C to +125°C  
 \*\*System Level Temperature Range: -40°C to +105°C  
*105°C is a typical system level temperature requirement.*

Terminals: Ag plated zinc alloy  
 Housing Materials: PA66  
 Complies with: SAE J2077, SAE 2576  
 ISO 8820  
 UL 248 Special Purpose Fuses



MINI® Blade Fuses

### Time-Current Characteristic Curves



**\*Component Level Temperature** = the maximum ambient temperature that a single fuse will survive. This does not factor-in the heat from a populated fuse box, but does include the heat from the current load with the proper rerating. **\*\*System Level Temperature** represents the ambient temperature of the fuse box at a location within the vehicle. The temperature within a populated fuse box (in a given location) will be higher. The limiting factor is the plating. Sn-plating's temperature limit is ~130°C, and Ag-plating allows up to 150°C at the terminal interface.

### Ordering Information

Part Number	Package Size
0997xxx.WXN	3000

### Time-Current Characteristics

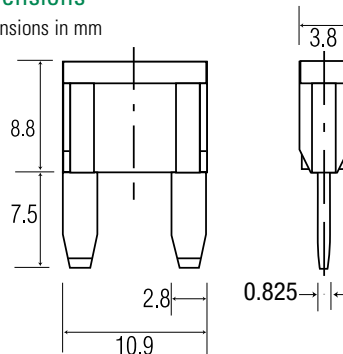
% of Rating	Opening Time Min / Max (s)
110	360,000 s / -
135	0.75 s / 600 s
200	0.15 s / 5 s
350	0.080 s / 0.500 s
600	0.030 s / 0.100 s

### Ratings

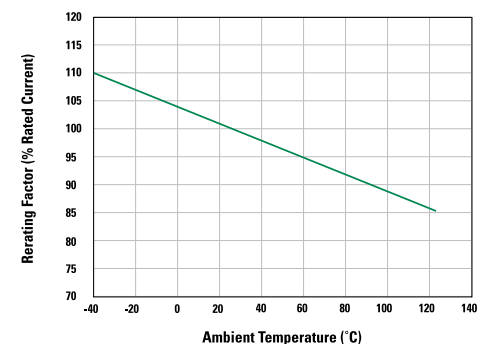
Part Number	Current Rating (A)	Housing Material Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I <sup>2</sup> t (A <sup>2</sup> s)
0997002_	2	Grey	171	55.60	2.8
0997003_	3	Purple	153	33.75	9.4
0997004_	4	Pink	121	23.48	17
0997005_	5	Brown	129	17.75	25
099707.5_	7.5	Dark Brown	135	10.85	68
0997010_	10	Red	108	7.42	93
0997015_	15	Blue	98	4.58	270
0997020_	20	Yellow	96	3.21	380
0997025_	25	Orange	86	2.36	625
0997030_	30	Green	87	1.85	1130

### Dimensions

Dimensions in mm



### Temperature Rerating Curve



Littelfuse products are not designed for, and shall not be used for, any purpose (including, without limitation, automotive, military, aerospace, medical, life-saving, life-sustaining or nuclear facility applications, devices intended for surgical implant into the body, or any other application in which the failure or lack of desired operation of the product may result in personal injury, death, or property damage) other than those expressly set forth in applicable Littelfuse product documentation. Warranties granted by Littelfuse shall be deemed void for products used for any purpose not expressly set forth in applicable Littelfuse documentation. Littelfuse shall not be liable for any claims or damages arising out of products used in applications not expressly intended by Littelfuse as set forth in applicable Littelfuse documentation. The sale and use of Littelfuse products is subject to Littelfuse Terms and Conditions of Sale, unless otherwise agreed by Littelfuse.

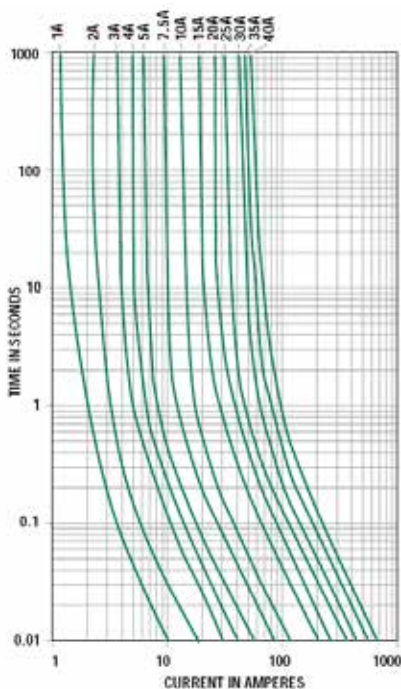


ATOF® Blade Fuses

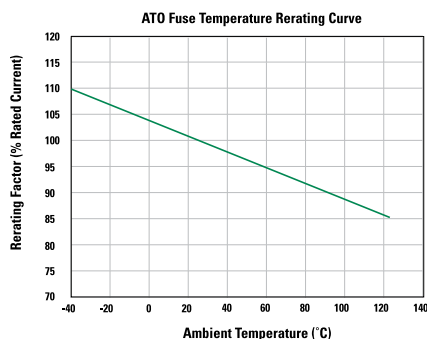


ATO® Ag (Silver plated) Blade Fuses

## Time-Current Characteristic Curves



## Temperature Derating Curve



## ATOF® Blade Fuses Rated 32V

Developed by Littelfuse for the automotive industry, the ATOF® fuse has become the original equipment circuit protection standard for foreign and domestic automobiles and trucks. Readily identifiable and easily replaced, this fuse can be specified for a variety of low voltage electronic applications.

### Specification

	ATOF® (Tin Plated)	ATO Ag (Silver Plated)
Voltage Rating:	32 VDC	32 VDC
Interrupting Rating:	1000A @ 32 VDC	1000A @ 32 VDC
*Component Level Temperature Range:	-40°C to +105°C	-40°C to +125°C
**System Level Temperature Range:	-40°C to +85°C	-40°C to +105°C
	<i>105°C and 85°C are typical system level temperature requirements.</i>	
Terminals:	Sn plated zinc alloy	Ag plated zinc alloy
Housing Material:	PA66	PA66
Complies with:	SAE J1284, ISO 8820-3	SAE J1284, ISO 8820-3
UL Listed:	File AU1410	File AU1410
CSA Certified:	File No. 29862	File No. 29862



### Ordering Information

Part Number	Package Size
0287xxx.PXCN	2000
0287xxx.U	500
0287xxx.H	100
0287xxx.L	50
<b>ATO® Ag Fuse</b>	
0287xxx.PXS	2000

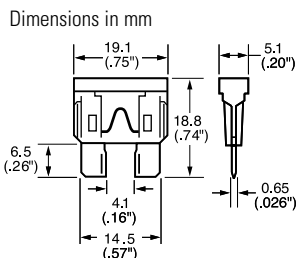
### Time-Current Characteristics

% of Rating	Current Rating	Opening Time Min / Max (s)
100	35A & 40A	360,000 s / -
110	1A-30A	360,000 s / -
135	1A & 2A 3A-40A	350 ms / 600 s 0.750 s / 600 s
160	1A-40A	250 ms / 50 s
200	1A & 2A 3A-40A	100 ms / 5.0 s 0.150 s / 5.0 s
350	1A & 2A 3A-40A	20 ms / 500 ms 80 ms / 500 ms
600	1A-30A 35A & 40A	- / 100 ms - / 150 ms

### Ratings

Part Number	Current Rating (A)	Housing Material Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I <sup>2</sup> t (A <sup>2</sup> s)
0287001_	1	Black	176	123	0.4
0287002_	2	Grey	141	53.5	1.4
0287003_	3	Purple	137	31.1	7.4
0287004_	4	Pink	136	22.8	14
0287005_	5	Brown	128	17.85	26
028707.5_	7.5	Dark Brown	116	10.91	60
0287010_	10	Red	109	7.70	115
0287015_	15	Blue	102	4.80	340
0287020_	20	Yellow	98	3.38	520
0287025_	25	Light Orange	92	2.52	1080
0287030_	30	Green	84	1.97	1510
0287035_	35	Dark Green	87	1.61	2280
0287040_	40	Orange	96	1.44	3310

### Dimensions



**\*Component Level Temperature** = the maximum ambient temperature that a single fuse will survive. This does not factor-in the heat from a populated fuse box, but does include the heat from the current load with the proper derating. **\*\*System Level Temperature** represents the ambient temperature of the fuse box at a location within the vehicle. The temperature within a populated fuse box (in a given location) will be higher. The limiting factor is the plating. Sn-plating's temperature limit is =130°C, and Ag-plating allows up to 150°C at the terminal interface.

## MAXI Blade Fuses Rated 32V

The MAXI® fuse uses “Diffusion Pill Technology” to provide predictable time delay characteristics and low heat dissipation.

### Specification

	MAXI (Silver Plated)	MAXI Sn (Tin Plated)
Voltage Rating:	32 VDC/32 VDC	
Interrupting Ratings:	1000A @ 32 VDC	1000A @ 32 VDC
*Component Level Temperature Range:	-40°C to +125°C	-40°C to +105°C
**System Level Temperature Range:	-40°C to +105°C	-40°C to +85°C
	<i>105°C and 85°C are typical system level temperature requirements.</i>	
Terminals:	Ag plated zinc alloy	Sn plated zinc alloy
Housing Material:	PA66 PA66	
Complies with:	SAE J 1888, SAE 2576, ISO 8820-3:2002(E)	SAE J 1888, SAE 2576, ISO 8820-3:2002(E)



### Ordering Information

Part Number	Package Size
0299xxx.ZXNV	1200
0299xxx.L	50
0299xxx.TXN	10
<b>MAXI Sn Fuse</b>	
0299xxx.ZXT	1200

### Time-Current Characteristics

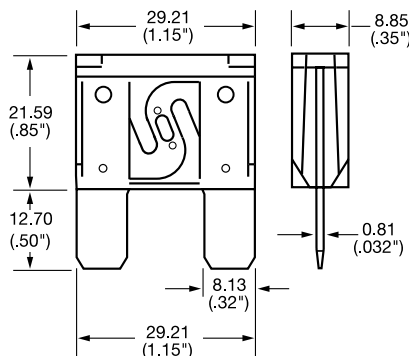
% of Rating	Opening Time Min / Max (s)
100	360,000 s / –
135	60 s / 1,800 s
200	2 s / 60 s
350	0.20 s / 7 s
600	0.040 s / 1 s

### Ratings

Part Number	Current Rating (A)	Housing Material Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I <sup>2</sup> t (A <sup>2</sup> s)
0299020_	20	Yellow	76	3.10	1100
0299025_	25	Grey	75	2.39	2087
0299030_	30	Green	77	1.95	4070
0299035_	35	Brown	75	1.71	6032
0299040_	40	Orange	75	1.42	8450
0299050_	50	Red	73	1.10	11300
0299060_	60	Blue	77	0.89	15300
0299070_	70	Tan	61	0.64	21200
0299080_	80	Light Orange	62	0.54	43600

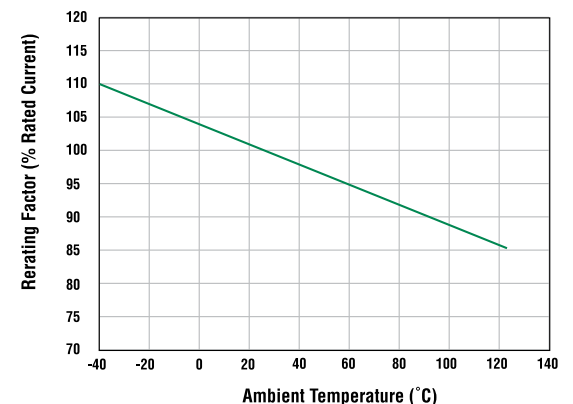
### Dimensions

Dimensions in mm



### Temperature Derating Curve

MAXI Fuse Temperature Derating Curve

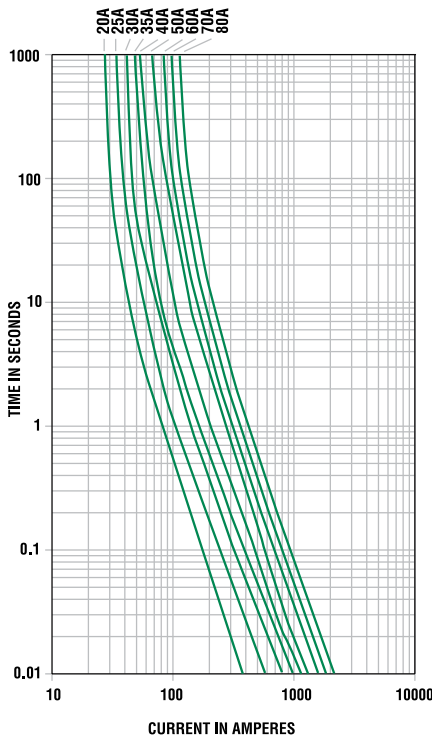


MAXI Blade Fuses



MAXI Sn Fuse (tin plated)

### Time-Current Characteristic Curves



**\*Component Level Temperature** = the maximum ambient temperature that a single fuse will survive. This does not factor in the heat from a populated fuse box, but does include the heat from the current load with the proper derating. **\*\*System Level Temperature** represents the ambient temperature of the fuse box at a location within the vehicle. The temperature within a populated fuse box (in a given location) will be higher. The limiting factor is the plating. Sn-plating's temperature limit is ~130°C, and Ag-plating allows up to 150°C at the terminal interface.



MAXI Blade Fuses

## MAXI Blade Fuses Rated 58V

The MAXI® style fuse for use in 42V Systems. Same Time-Current characteristic as the 32V MAXI fuse using "Diffusion Pill Technology" to provide predictable time delay characteristics and low heat dissipation. Fits into standard MAXI® fuse sockets. Has a rejection feature to prevent fuses with lower voltage rating from being wrongfully inserted into the circuit. Current rating 20A - 80A @58 VDC max.

### Specifications

Voltage Rating:	58 VDC
Interrupting Ratings:	1000A @ 58 VDC
*Component Level Temperature Range:	-40°C to +125°C
**System Level Temperature Range:	-40°C to +105°C
<i>105°C is a typical system level temperature requirement.</i>	
Terminals:	Ag plated zinc alloy
Housing Material:	PA66
Complies with:	SAE J 1888, SAE 2576 ISO 8820-3:2002(E)



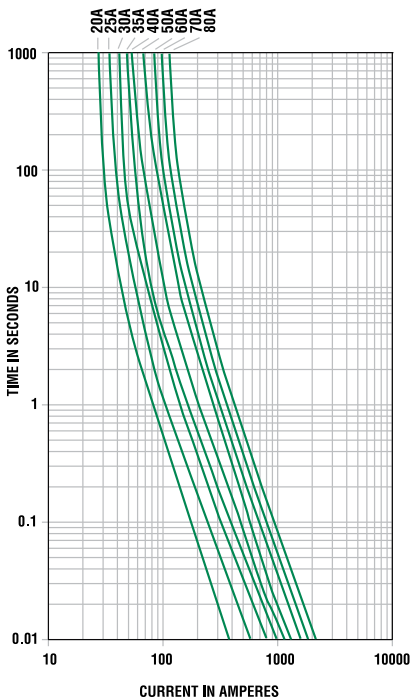
### Ordering Information

Part Number	Package Size
0999xxx.ZXN	1200

### Time-Current Characteristics

% of Rating	Opening Time Min / Max (s)
100	360,000 s / -
135	60 s / 1,800 s
200	2 s / 60 s
350	0.20 s / 7 s
600	0.040 s / 1 s

### Time-Current Characteristic Curves



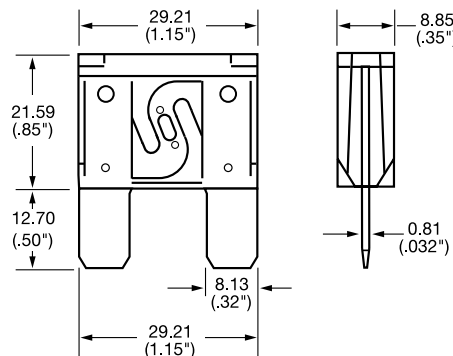
**\*Component Level Temperature** = the maximum ambient temperature that a single fuse will survive. This does not factor-in the heat from a populated fuse box, but does include the heat from the current load with the proper rerating.  
**\*\*System Level Temperature** represents the ambient temperature of the fuse box at a location within the vehicle. The temperature within a populated fuse box (in a given location) will be higher. The limiting factor is the plating. Sn-plating's temperature limit is ~130°C, and Ag-plating allows up to 150°C at the terminal interface.

### Ratings

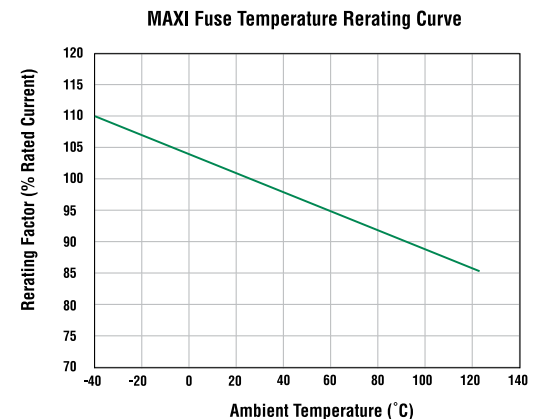
Part Number	Current Rating (A)	Housing Material Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I <sup>2</sup> t (A <sup>2</sup> s)
0999020_	20	Yellow	76	3.10	1100
0999025_	25	Grey	75	2.39	2087
0999030_	30	Green	77	1.95	4070
0999035_	35	Brown	75	1.71	6032
0999040_	40	Orange	75	1.42	8450
0999050_	50	Red	73	1.10	11300
0999060_	60	Blue	77	0.89	15300
0999070_	70	Tan	61	0.64	21200
0999080_	80	Light Orange	62	0.54	43600

### Dimensions

Dimensions in mm



### Temperature Rerating Curve



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# Cartridge Fuses

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JCASE® Fuse Rated 32V	15





MCASE+™ Cartridge Fuses

## MCASE+™ Cartridge Fuses Rated 32V

The Unslotted MCASE+™ Fuse is a cartridge style fuse up to 40A with female terminals for 2.8 mm male terminals. The Slotted MCASE+™ Fuse is available in amperages up to 60A and can mate with larger male terminals (e.g., 6.3mm) or even mount directly to onto a busbar. It has a miniaturized footprint for optimal usage of space. It is a time delayed fuse and can handle inrush currents.

### Specifications

Voltage Rating:	32 VDC
Interrupting Ratings:	1000A @ 32 VDC
Operating Temperature Range:	-40°C to +125°C
Housing Material:	PPA-GF33
Cover Material:	PA66
Fuse Insertion Force:	50N (11.2lb) Typical
Extraction Force:	4N Min. (0.9 lb).   24.5N Max. (5.5 lb)
Conforms to:	SAE 2741 and ISO 8820-4 in reference to electrical, mechanical and environmental performance requirements

### Ordering Information

Part Number	Package Size
0695xxx.PXPS Slotted	2000
0695xxx.PXP Unslotted	2000

### Time-Current Characteristics

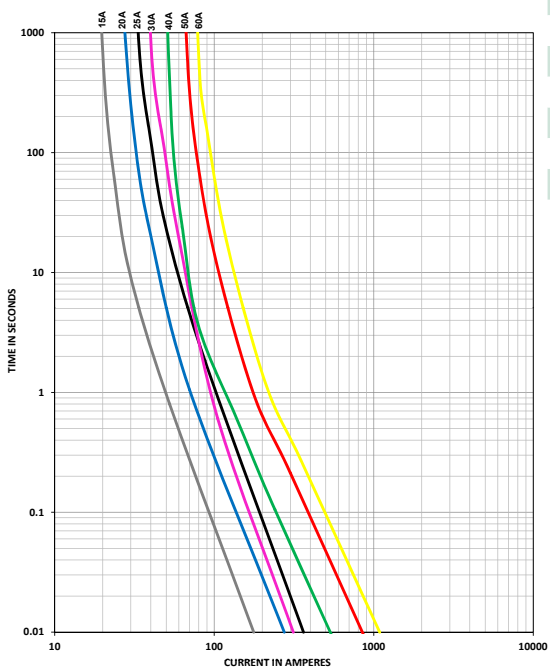
% of Rating	Opening Time Min / Max
110	100hrs / –
135	60s / 1800s
200	2s / 60s
350	0.2s / 7s
600	0.04s / 1s

### Ratings

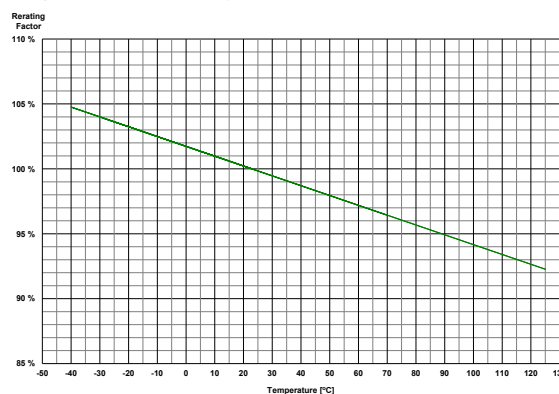
Part Number	Type	Current Rating* (A)	Housing Material Color	Max. Voltage Drop (mV)	Cold Resistance (mΩ)	I <sup>2</sup> t (A <sup>2</sup> s)
0695015.PXP	Unslotted	15	Grey	125	5.1	310
0695020.PXP	Unslotted	20	Blue	125	3.4	750
0695025.PXP	Unslotted	25	Orange	125	2.5	1300
0695030.PXP	Unslotted	30	Pink	120	1.8	970
0695040.PXP	Unslotted	40	Green	120	1	1550
0695015.PXPS	Slotted	15	Grey	125	5.1	310
0695020.PXPS	Slotted	20	Blue	125	3.4	750
0695025.PXPS	Slotted	25	Orange	125	2.5	1300
0695030.PXPS	Slotted	30	Pink	120	1.8	970
0695040.PXPS	Slotted	40	Green	120	1.1	1550
0695050.PXPS	Slotted	50	Red	120	0.8	4000
0695060.PXPS	Slotted	60	Yellow	120	0.6	8500

\* The performance of the male terminal is critical to ensuring the fuse will function as designed. The current-carrying capability of the mating terminal must be verified to ensure proper system operation.

### Time-Current Characteristic Curves



### Temperature Derating Curve



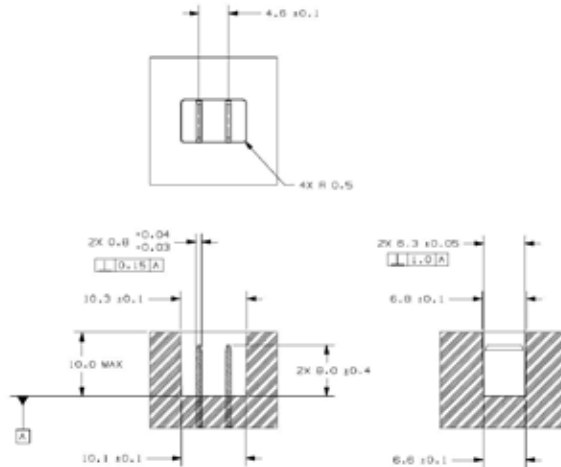
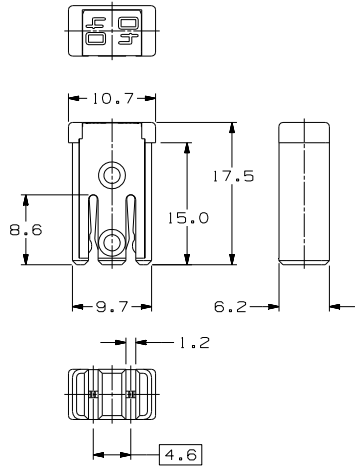
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## MCASE+™ Cartridge Fuses Rated 32V

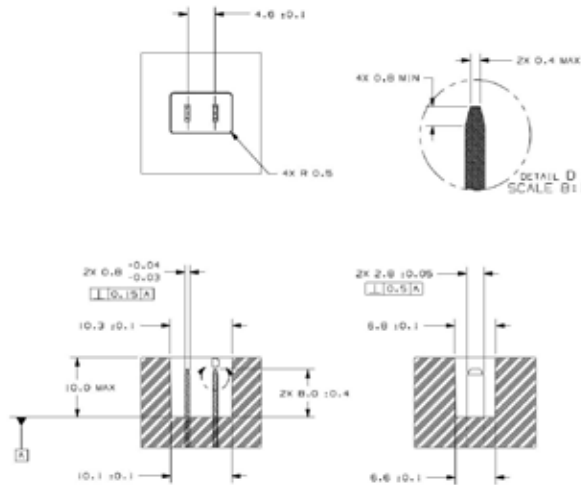
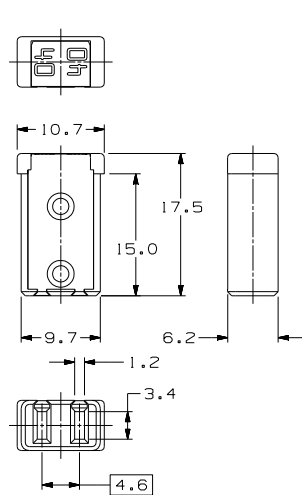
### Dimensions

Dimensions in mm

#### Slotted



#### Unslotted







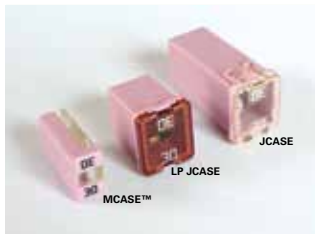
MCASE™ Cartridge Fuses

## MCASE™ Cartridge Fuses Rated 32V

The MCASE™ is a cartridge style fuse with female terminals for 2.8 mm male terminals. It has a miniaturized footprint for optimal usage of space. It is a time delayed fuse and can handle in rush currents.

### Specifications

Voltage Rating:	32 VDC
Interrupting Ratings:	1000A @ 32 VDC
Operating Temperature Range:	-40°C to +125°C
Housing Material:	PPA-GF33
Cover Material:	PA66
Insertion Force:	50N (11.2lbf) Typical
Extraction Force:	4N Min. (0.9 lb.)   24.5N Max. (5.5 lb)
Conforms to:	SAE 2741 and ISO 8820-4 in reference to electrical, mechanical and environmental performance requirements



### Ordering Information

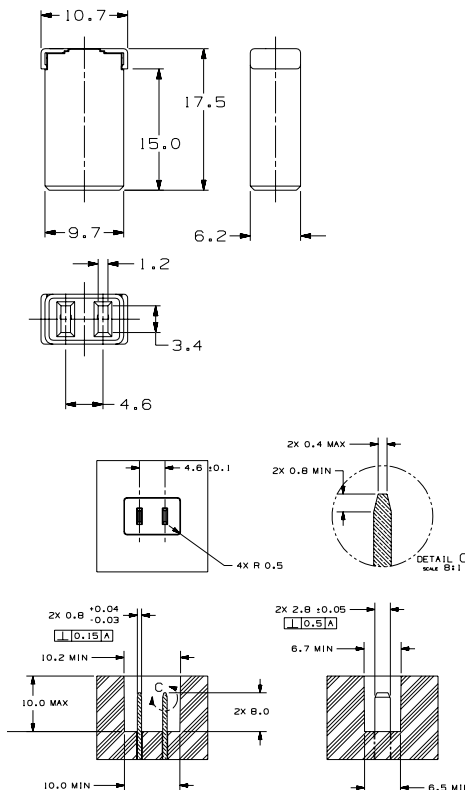
Part Number	Package Size
0695xxx.PX4	2000
0695xxx.U	500
0695xxx.L	50

### Time-Current Characteristics

% of Rating	Opening Time Min / Max (s)
110	100 hrs / -
135	60 s / 1800 s
200	2 s / 60 s
350	0.2 s / 7 s
600	0.04 s / 1 s

### Dimensions

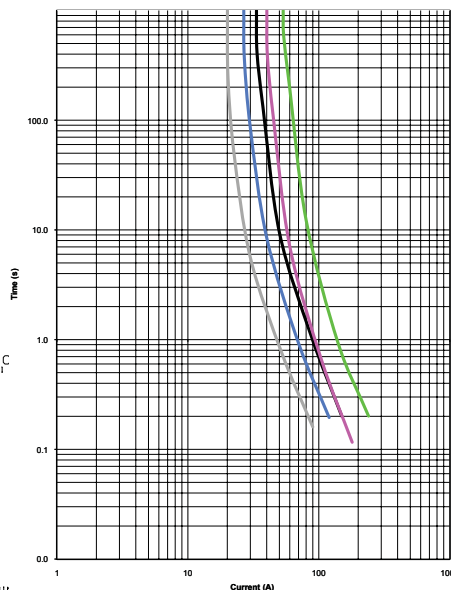
Dimensions in mm



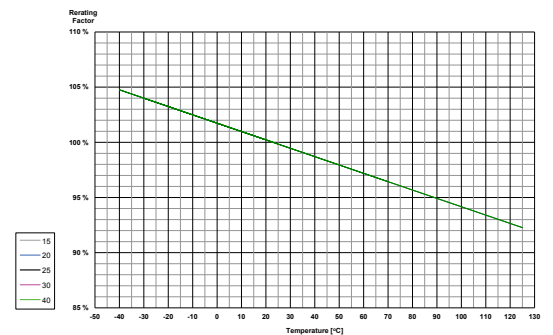
### Ratings

Part Number	Current Rating (A)	Housing Material Color	Max. Voltage Drop (mV)	Cold Resistance (mΩ)	I <sup>2</sup> t (A <sup>2</sup> s)
0695015_	15	Grey	125	4.9	160
0695020_	20	Blue	125	3.5	530
0695025_	25	Orange	125	2.3	1140
0695030_	30	Pink	120	1.8	970
0695040_	40	Green	120	1.3	2950

### Time-Current Characteristic Curves



### Temperature Derating Curve



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Low Profile JCASE®  
Cartridge Fuses

## Low Profile JCASE® Cartridge Fuses Rated 58V

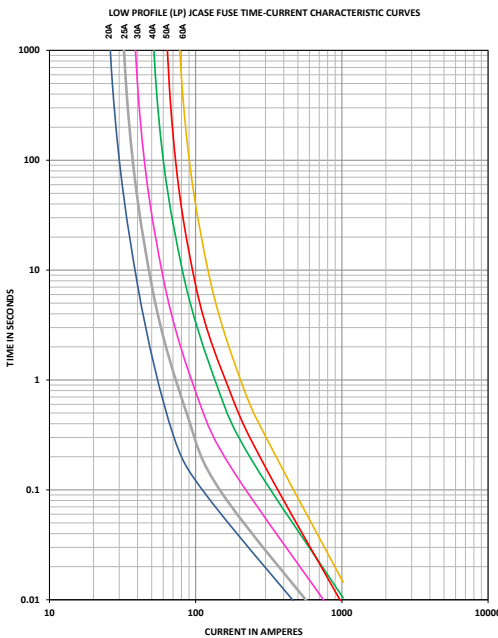
The Low Profile JCASE® fuse has similar performance characteristics as the standard JCASE® fuse. The lower overall height reduction allows for more space and weight savings and also allows for a shorter male blade terminal, saving additional weight and material savings in fuse box designs.

### Specifications

Voltage Rating:	58 VDC
Interrupting Rating:	1000A @ 58 VDC
Operating Temperature Range:	-40°C to + 125°C
Housing Material:	PPA-GF13
Cover Material:	PA66
Insertion Force:	53N Max. (12 lb.)
Extraction Force:	9N Min (2 lb.)
Conforms to:	SAE 2741 and ISO 8820-4 except for the life test – LF specification is 100-hours at 100% of rated current

**RoHS**

### Time-Current Characteristic Curves



### Ordering Information

Part Number	Package Size
0895xxx.Z	2000
0895xxx.U	500
0895xxx.T	10

### Time-Current Characteristics

% of Rating	Opening Time Min / Max (s)
100	360,000 s / -
135	60 s / 1800 s
200	4 s / 60 s
350	0.200 s / 7 s
600	0.040 s / 1 s

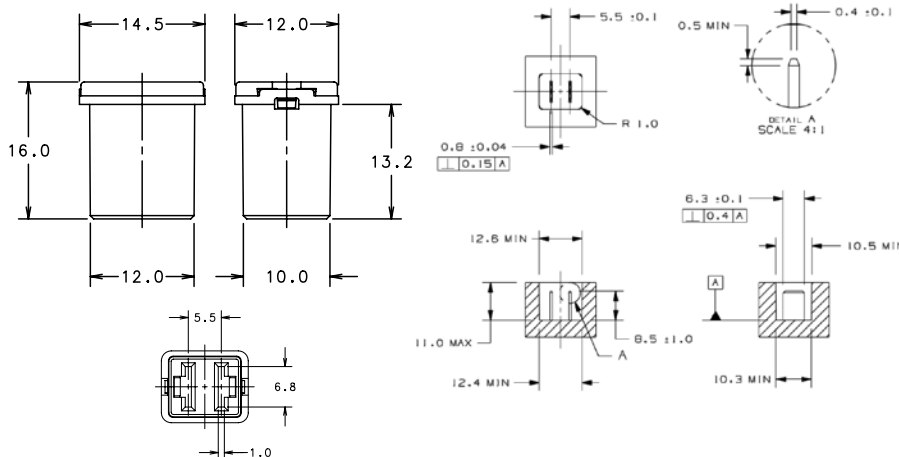
### Ratings

Part Number	Current Rating (A)	Housing Material Color	Max. Voltage Drop (mV)	Cold Resistance (mΩ)	I²t (A²s)
0895020_	20	Blue	125	4.48	400
0895025_	25	White	125	3.39	680
0895030_	30	Pink	125	2.68	1780
0895040_	40	Green	125	1.89	5470
0895050_	50	Red	125	1.08	4880
0895060_	60	Yellow	125	0.83	9600

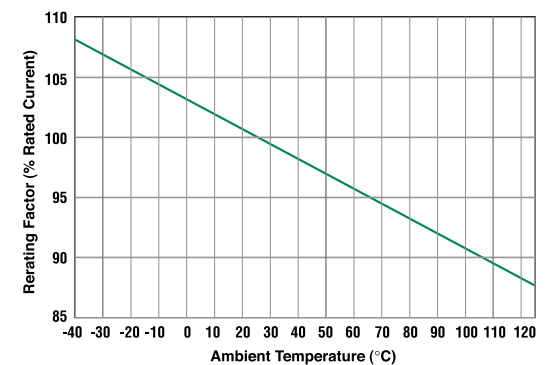
Corresponding holder see Section "Fuse Holders."

### Dimensions

Dimensions in mm



### Temperature Derating Curve



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JCASE®  
Cartridge Fuses

## JCASE® Cartridge Fuses Rated 32V

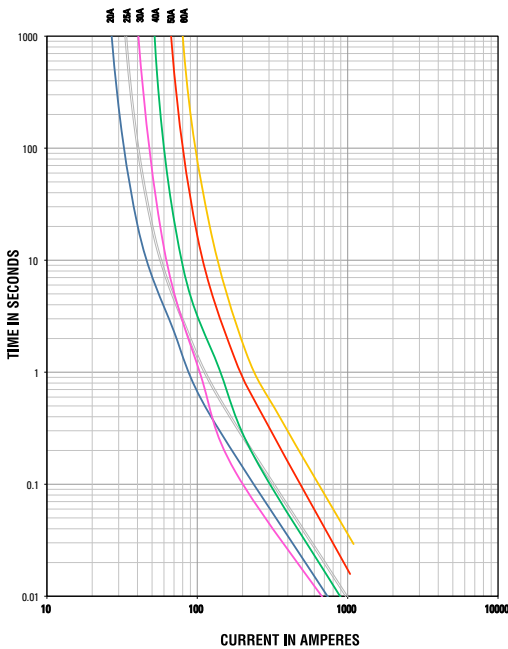
The JCASE® is a cartridge style fuse with female terminal design. JCASE® provides both increased time delay and low voltage drop to protect high current circuits. JCASE® has the ability to handle inrush currents.

### Specifications

Voltage Rating:	32 VDC
Interrupting Rating:	1000A @ 32 VDC
Operating Temperature Range:	-40°C to + 125°C
Housing Material:	PA-GF13HS
Housing Material (60A):	PA-GF13
Cover Material:	PC
Insertion Force:	53N max. (12 lb.)
Extraction Force:	9N min. (2 lb.)
Complies with:	SAE 2741, ISO 8820-4



### Time-Current Characteristic Curves



### Ordering Information

Part Number	Package Size	% of Rating	Opening Time Min / Max (s)
0495xxx.ZXA	2200	110	360,000 s / -
0495xxx.UXA	500	135	60 s / 1800 s
0495xxx.TXA	10	200	4 s / 60 s
		350	0.200 s / 7 s
		600	0.040 s / 1 s

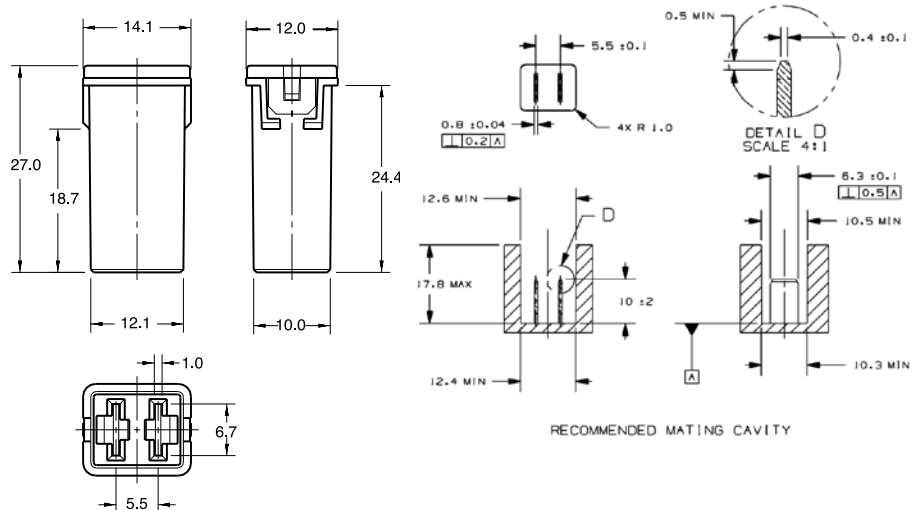
### Time-Current Characteristics

### Ratings

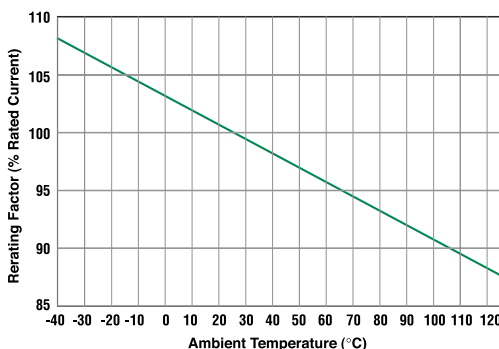
Part Number	Current Rating (A)	Housing Material Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I <sup>2</sup> t (A <sup>2</sup> s)
0495020_	20	Blue	106	4.29	1750
0495025_	25	White	101	3.28	3220
0495030_	30	Pink	91	2.12	1480
0495040_	40	Green	87	1.30	3650
0495050_	50	Red	88	0.99	8750
0495060_	60	Yellow	87	0.76	19500

### Dimensions

Dimensions in mm



### Temperature Rerating Curve



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# High Current Fuses

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MEGA® Fuse Rated 32V	22
MEGA® Low Temperature Fuse Rated 32V	24
UL Recognized Mega® Fuse Rated 32V	25
MIDI® Style Bolt-down Fuse Rated 32V	26
BF1 Fuse Rated 32V	28
BF1 Fuse Rated 58V	30
BF2 Fuse Rated 32V	31
BF2 Fuse Rated 58V	32
CF Fuse Rated 58V	33
Fuse Strips	34





ZCASE Masterfuses

## ZCASE Masterfuse

The ZCASE Masterfuse product is the smallest high current distribution product in the industry. It utilizes the Z-Axis effectively to create a compact design which takes one third the footprint of a traditional solution. This package allows the user to replace multiple discrete fuses in a power distribution box with a single component, thus eliminating additional bolts, bus bars and interconnects. The output bolt is integrated into the fuse creating a reliable interface to the mating terminal due to its high torque withstandability. Keying features are available on each bolt position to ensure the correct mating ring terminal is used during assembly. The solution can also be connectorized to mate to high current terminals. This compact design enables the integration of the high current distribution into the main junction box due to its small footprint. This eliminates the need for a separate fuse box for high current distribution. By reducing the number of components required, overall system costs are reduced.

The ZCASE Masterfuse product is available as a standard design with customized fuse ratings. The modular manufacturing approach enables a wide range of configurations within a product family. In addition, the form factor can be fully customized for specific applications to further optimize the system. Contact Littelfuse to review your application needs.

### Features and Benefits:

**Miniaturization:** Compact design enables a 2/3 footprint reduction when compared to a traditional solution.

**Integration:** Enables the integration of the prefuse function into the main junction box due to its small footprint.

### Specifications

Mating Terminal Options:	M10, M8, M6, M5 bolt-down connections or female terminals
Operating Temperature Range:	-40°C to 125°C
Housing Material:	PPA-GF33HS
Fuse Ratings Available:	30-500A
Voltage Rating:	32Vdc
Materials:	Copper terminals (silver or tin plating options available)
Complies with:	ISO 8820-5

**RoHS**

### Ordering Information

Part Number	Description	Package Size
05980015Z-CN	MFUSE ZCASE 32V 2-Way 125A - 200A	200
05980016Z-CN	MFUSE ZCASE 32V 2-Way 125A - 125A	200
05980017Z-CN	MFUSE ZCASE 32V 2-Way 275A - 200A	200
05980019Z	MFUSE ZCASE 32V 1-MEGA + 4-MIDI	100
05980020Z	MFUSE ZCASE 32V 2-MEGA + 2-MIDI	50

## MASTERFUSE

The MASTERFUSE product is a configurable fuse solution combining several different fuse types (i.e. MEGA and MIDI) and ratings in one compact package. This fuse package allows the user to replace multiple discrete fuses in a power distribution box with a single component, thus eliminating additional bolts, bus bars, and interconnects that are currently used. By reducing the number of connections required, overall system reliability is increased while cost is decreased.

Each MASTERFUSE is customized to the user's application creating an optimized circuit protection package. Contact Littelfuse to review your application needs.

### Features and Benefits:

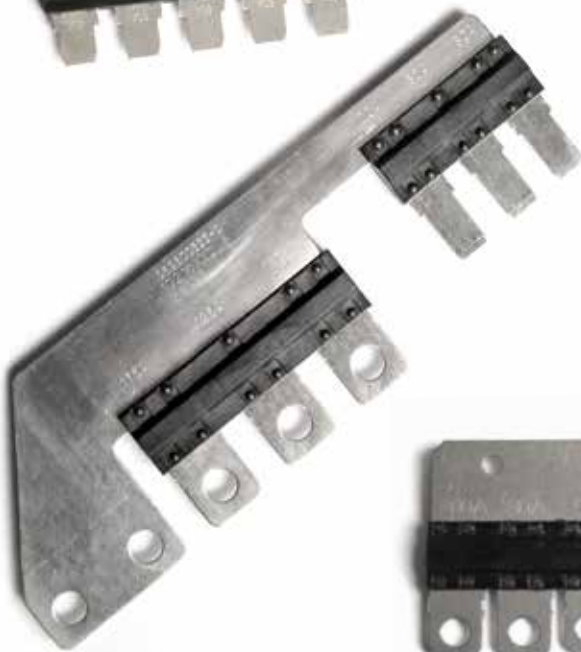
- Increased Reliability:** due to reduced number of terminal interfaces
- System Cost Savings:** Material savings due to reduced number of components required. Assembly cost savings due to reduced number of operations required for installation.
- Fuse Array Customization:** Ability to mix different fuse types (i.e. MEGA, MIDI, etc.) in one compact package
- Termination Options:** Ability to mate to female terminals to enable "bolt-less" design
- Marking:** Custom marking options available

### Specifications

- Mating Terminal Options: M10, M8, M6, M5 bolt-down connections or female terminals
  - Operating Temperature Range: -40°C to 125°C
  - Housing Material: PPA-GF33HS
  - Fuse Ratings Available: 30A-250A Full Range  
300A-600A Short Circuit
  - Voltage Rating: 32Vdc
  - Materials: Copper terminals (silver or tin plating options available)
  - Complies with: ISO 8820-5
- Note: Short circuit protected fuses have a limited continuous current.



Masterfuses





ZCASE Single Mega/Starter Fuse

## ZCASE Single MEGA/Starter Fuse

The Single ZCASE is a Minimal Footprint Bolt Down Fuse with a wide rating range up to 600A in the same packaging size. The Time Current characteristic is similar to the well known MEGA Design and can be used as full wire protection until 250A. Higher ratings are mostly used for typically Starter Fuse applications as a protector fuse. The fuse design is optimized for a one bolt connection M6 (40A - 250A) or M8 (300A - 600A) and can be used directly on a battery post or busbar connection. Littelfuse is offering a complete solution for the necessary stud and different busbar connections including some battery clamps.

### Specifications

Operating temperature:	-40 to 125°C
Housing Material:	PPA-GF33HS
Insulating Tube:	Out of ceramic
Terminal:	Tin plated Copper
Voltage Rating:	32V DC
Interrupting Rating:	2000A @ 32V VDC
Mounting Torque M6:	9.8Nm±1.4Nm
Mounting Torque M8:	14Nm±2Nm

### Ordering Information

Part Number	Package Size
3298XXX.ZXSTA	480
3298XXX.Z	480
3298XXX.H	100

### Time-Current Characteristics

% of Rating	Opening Time Min / Max (s)		
	40A - 250A	300A - 500A	600A
50	- / -	14,400 / -	14,400 / -
100	14,400 / -	- / -	- / -
135	120 / 1800	- / -	- / -
200	1 / 15	1 / 40	1 / 40
350	0.300 / 5	0.300 / 5	0.300 / 5
500	- / -	- / -	0.100 / 1
600	0.100 / 1	0.100 / 1	- / -

### Ratings

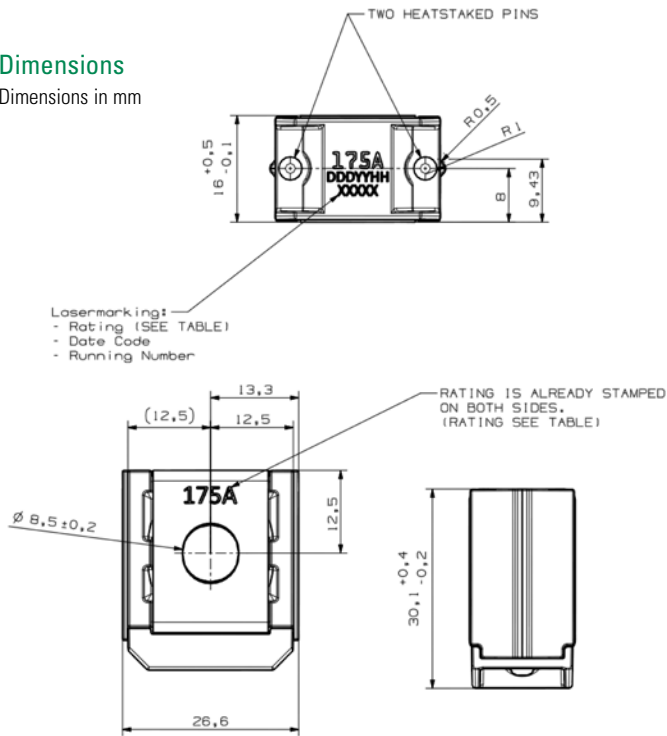
Part number	Current Rating (A)	Wire size (mm <sup>2</sup> )	Max. Voltage Drop (mV)	Average Cold Resistance (mΩ)	I <sup>2</sup> t (A <sup>2</sup> s)
3298040_	40	4	110	1.53	5000
3298060_	60	6	110	0.98	18000
3298080_	80	10	110	0.715	15500
3298100_	100	16	110	0.57	31000
3298125_	125	16	110	0.39	45000
3298150_	150	25	110	0.32	75000
3298175_	175	25	110	0.26	140000
3298200_	200	35	110	0.231	235000
3298225_	225	35	110	0.175	95000
3298250_	250	50	110	0.167	160000
3298300.ZXSTA	300	35	70	0.128	310000
3298350.ZXSTA	350	35	70	0.103	570000
3298400.ZXSTA	400	50	70	0.084	870000
3298500.ZXSTA	500	50	70	0.065	1550000
3298600.ZXSTA	600	50	70	0.049	3000000
3298900_	SHUNT	50	-	-	-

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## ZCASE Single Mega/Starter Fuse

### Dimensions

Dimensions in mm



### Assembly Components (sold separately)

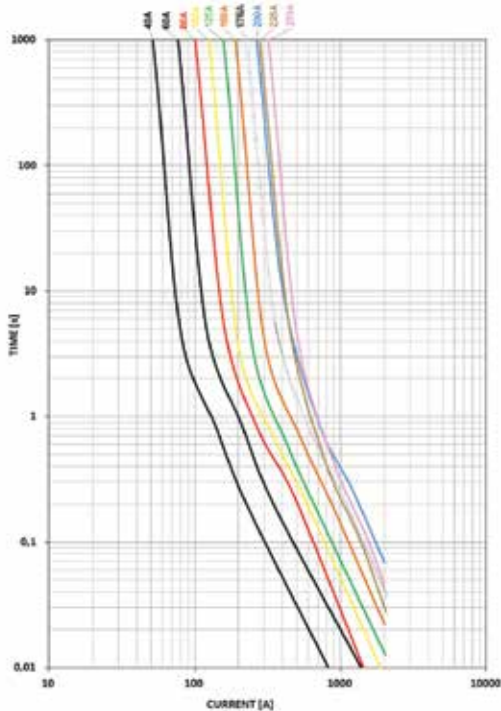
Part No.	Description
882-853	3-Way Bus Bar with M8 Insulating Bolts Assembly*
882-854	2-Way Bus Bar with M8 Insulating Bolts Assembly* *M8 Nuts not included
876-199	Battery Terminal Mount
32980001ZXM8	M8 Insulating Bolt



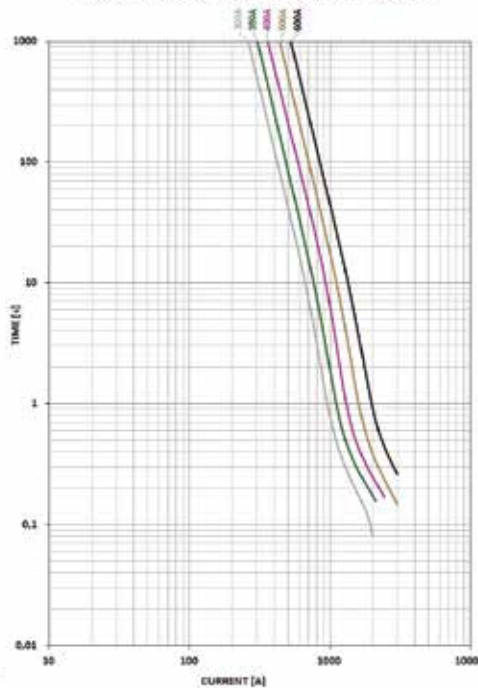
Please contact your Littelfuse representative for application support and information on mating hardware.

## Time-Current Characteristic Curves

Reference Time-Current Characteristic Curves (Recorded@23°)



Reference Time-Current Characteristic Curves (Recorded@23°)



All ZCASE Starters T/C curves were performed on the left or right side of the metal bar as shown in pictures above. A 50mm<sup>2</sup> Cu wire was mounted at the mid hole (M8) of the metal bar as current feed.

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MEGA® 70V HP Fuse

## MEGA® High Performance Fuse Rated 70V

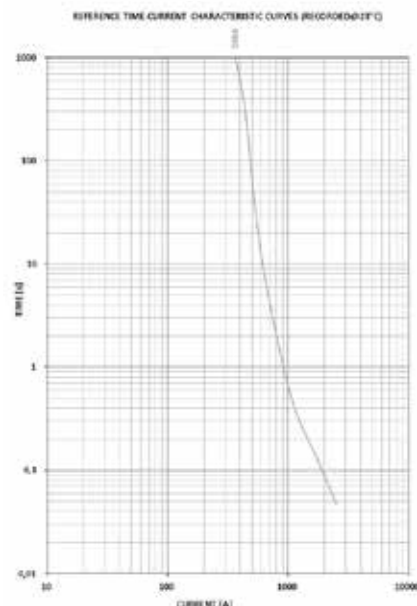
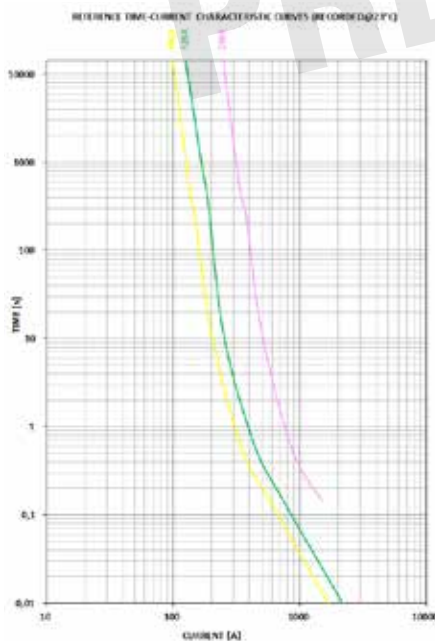
The MEGA® 70V High Performance (HP) Fuse is designed for high current circuit protection up to 500A with "Diffusion Pill Technology." The MEGA 70V HP features 1MΩ Open State Resistance after fuse opening to guarantee safe interruption at any voltage up to 70V. The MEGA® 70V HP Fuse is ideal for battery and alternator protection application and other heavy gauge cables requiring ultra-high current protection.

### Specifications

Interrupting Rating:	2500A @ 70 VDC
Voltage Rating:	70 VDC
Operating Temperature Range:	-40°C to +125°C
Housing Material:	PPA-GF33
Terminals:	ETP Copper (Tin plated)
Mounting Torque:	20Nm+/-1Nm
Open State Resistance (after fuse opening)	>1MΩ
Reference to:	ISO 20934 - Type SF51 (draft), LV 230



### Time-Current Characteristic Curves

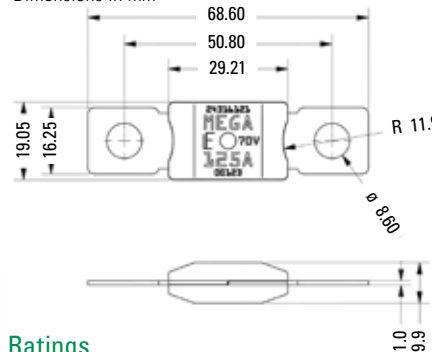


### Ordering Information

Part Number	Package Size	Rating	Bolt Size	Bolt Hole Qty
0998xxx.U-2M8	---	60 - 500	M8	2
0998xxx.U-1M8	---	60 - 500	M8	1
0998xxx.U-2M6	---	60 - 500	M6	2
0998xxx.U-1M6	---	60 - 500	M6	1
0998xxx.U-NH	---	60 - 500	N/A	0

### Dimensions

Dimensions in mm



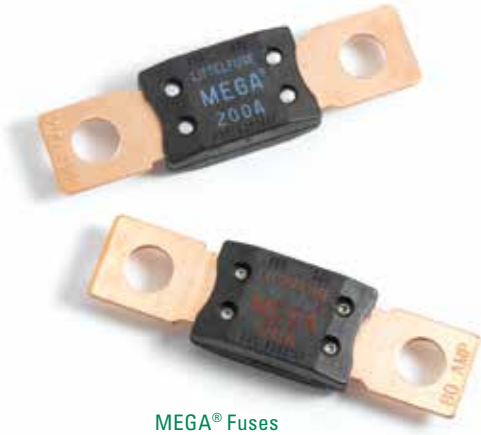
### Time-Current Characteristics

Rating (A)	% of Rating	Opening Time Min (s)	Opening Time Max (s)
300-500	75	14400	--
60-250	100	14400	--
300-500	135	--	--
60-250		120	1800
300-500	150	--	--
60-250		20	450
300-500	200	1	15
60-250		1	15
300-500	350	0.5	5
60-250		0.3	5
300-500	600	--	--
60-250		0.1	1

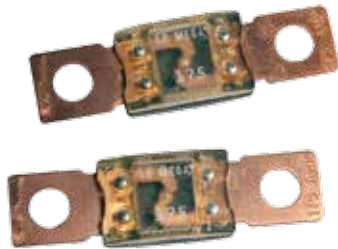
### Ratings

Part Number	Current Rating (A)	Rated Voltage (V)	Voltage Drop (mV) max.	Wire (mm <sup>2</sup> )	I <sup>2</sup> t (A <sup>2</sup> s)
0998060_	60	70	110	6	25000
0998080_	80	70	110	10	46000
0998100_	100	70	110	10	23000
0998125_	125	70	110	16	43000
0998150_	150	70	110	25	72000
0998175_	175	70	110	25	112000
0998200_	200	70	110	35	193000
0998225_	225	70	110	35	250000
0998250_	250	70	110	50	240000
0998300_	300	70	80	50	300000
0998350_	350	70	80	50	590000
0998400_	400	70	80	70	950000
0998450_	450	70	80	70	1250000
0998500_	500	70	80	70	1750000

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MEGA® Fuses



MEGA® Clear Top Housing Fuse

## MEGA® and MEGA® Clear Top Fuse Rated 32V

The MEGA® Fuse is designed for high current circuit protection up to 500A 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.

### Specifications

Interrupting Rating:	2000A @ 32 VDC
Voltage Rating:	32 VDC
Operating Temperature Range:	-40°C to + 125°C
Housing Material:	PPA-GF33HS
Clear Top Housing Material:	PES (top) PPA-GF33HS (bottom)
Terminals:	Copper (Silver plated copper available) M6 or M8 bolts available
Mounting Torque:	8-14 Nm M6 12-18 Nm M8
Complies with:	ISO 8820-5



### Ordering Information

Part Number	Rating	Package Size	Plating	Bolt Size	Bolt Hole Qty
0298xxx.ZXEH	80 - 250	500	None	M8	2
0298xxx.ZXH	300 - 500	500	None	M8	2
0298xxx.UX1M8	80 - 500	500	None	M8	1
0298xxx.ZXB	40 - 250	500	Ag	M8	2
0298xxx.ZXA	80 - 500	500	None	M6	2
0298xxx.UXT	40 - 250	500	None	M8	2

### MEGA Clear Top Housing Material Fuse

### Time-Current Characteristics

% of Rating	Opening Time Min / Max (s)	
	40-250	300-500
75	- / -	14,400 s / -
100	14,400 s / -	- / -
135	120 s / 1800 s	- / -
200	1 s / 15 s	1 s / 15 s
350	0.300 s / 5 s	0.500 s / 5 s
600	0.100 s / 1 s	0.100 s / 1 s

### Ratings

Part Number	Current Rating (A)	Font Color*	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I <sup>2</sup> t (A <sup>2</sup> s)
0298040._1	40	-	132	2.510	8700
0298060._1	60	-	119	1.504	21000
0298080._	80	Red	87	0.720	21500
0298100._	100	Yellow	87	0.562	31100
0298125._	125	Green	80	0.423	57800
0298150._	150	Orange	92	0.352	100000
0298175._	175	White	86	0.294	168000
0298200._	200	Blue	83	0.257	204000
0298225._	225	Brown	82	0.222	257000
0298250._	250	Pink	82	0.201	389000
0298300._2	300	Grey	74 **	0.167	315000
0298350._2	350	Dark Green	68 **	0.138	500000
0298400._2	400	Purple	64 **	0.126	610000
0298450._2	450	Yellow	60 **	0.112	1050000
0298500._2	500	Brown	58 **	0.092	2050000

Note 1: Not mentioned in ISO standards Note 2: Short Circuit Protector only

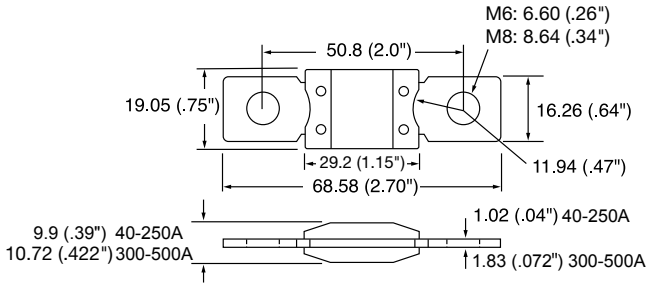
\* 0298xxx.ZXB has white font color on all ratings.

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

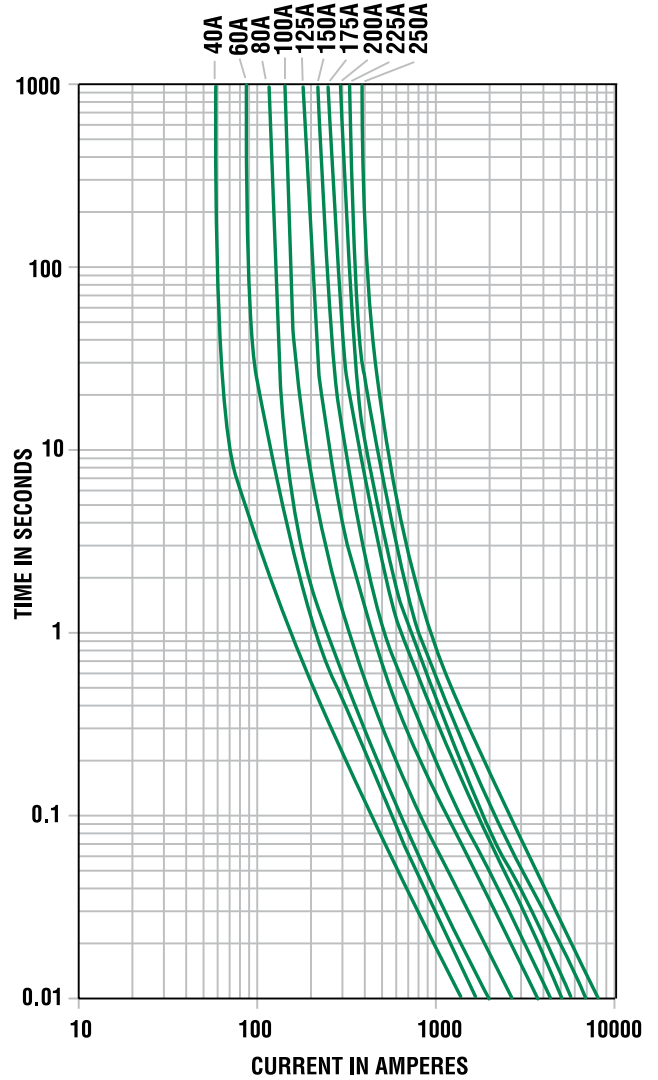
## MEGA® Fuse Rated 32V

### Dimensions

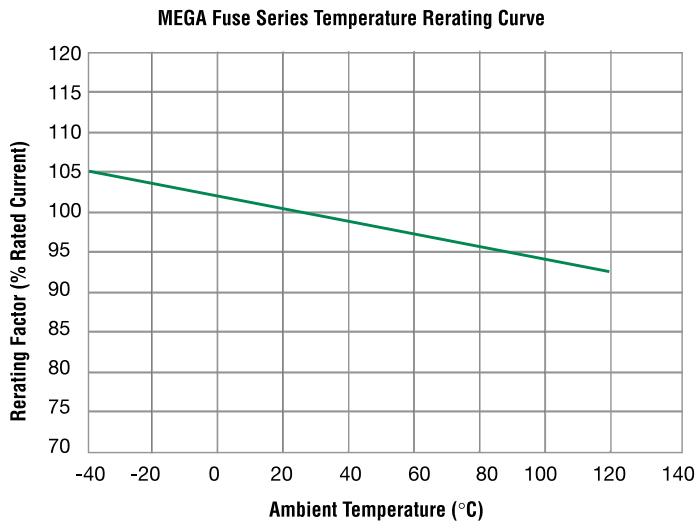
Dimensions in mm



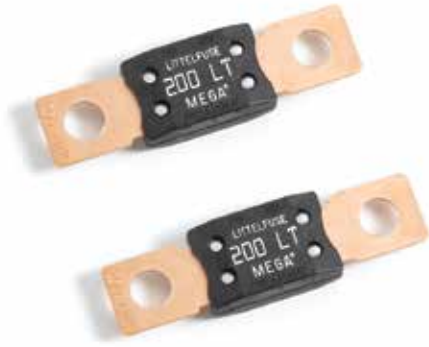
### Time-Current Characteristic Curves



### Temperature Rerating Curve



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MEGA® Low Temperature Fuses

## MEGA® Low Temperature Fuse Rated 32V

The MEGA® Fuse is designed for high current circuit protection up to 275A 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.

### Specifications

Interrupting Rating:	2000A @ 32 VDC
Voltage Rating:	32 VDC
Operating Temperature Range:	-40°C to + 125°C
Housing Material:	PPA-GF33HS
Terminals:	Copper (Silver plated copper available) M8 bolts
Mounting Torque:	12-18 Nm M8

### RoHS

### Ordering Information

Part Number	Rating	Package Size	Plating	Bolt Hole Qty
0298125.ZXBLT	125	500	Ag	2
0298xxx.ZXEH-LT	150-275	500	None	2
0298xxx.UX1M8LT	150-275	500	None	1

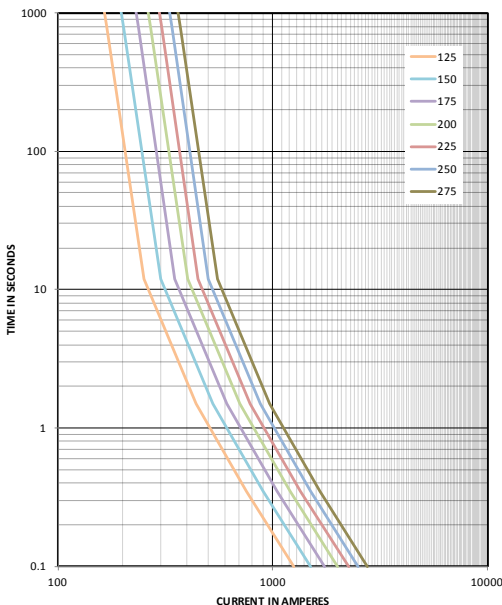
### Time-Current Characteristics

% of Rating	Opening Time Min / Max (s)	
	125	150-275
100	4 hrs / –	4 hrs / –
135	120 s / 1800 s	120 s / 1800 s
200	1 s / 50 s	1 s / 150 s
350	0.300 s / 5 s	0.300 s / 5 s
600	0.100 s / 1 s	0.100 s / 1 s

### Ratings

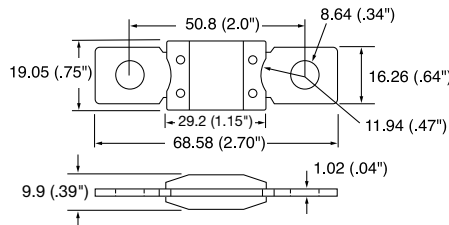
Part Number	Current Rating (A)	Font Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I <sup>2</sup> t (A <sup>2</sup> s)
0298125.ZXBLT	125	□	67	0.330	57000 A
0298150.ZXEH-LT	150	□	62	0.258	59000 A
0298175.ZXEH-LT	175	□	65	0.232	123000 A
0298200.ZXEH-LT	200	□	61	0.214	140000 A
0298225.ZXEH-LT	225	□	57	0.177	317000 A
0298250.ZXEH-LT	250	□	54	0.144	637000 A
0298275.ZXEH-LT	275	□	53	0.122	800000 A

### Time-Current Characteristic Curves

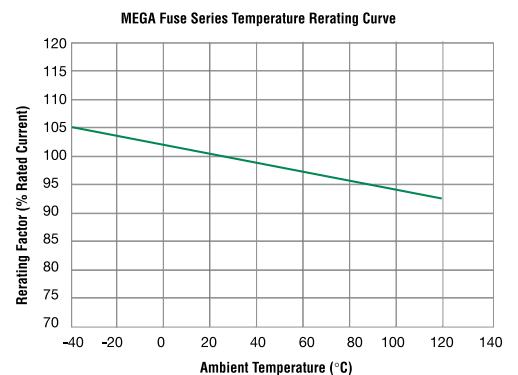


### Dimensions

Dimensions in mm



### Temperature Rerating Curve



Last figure of article no. = packaging code

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UL Recognized MEGA® Fuses

## UL Recognized MEGA® Fuses Rated 32V

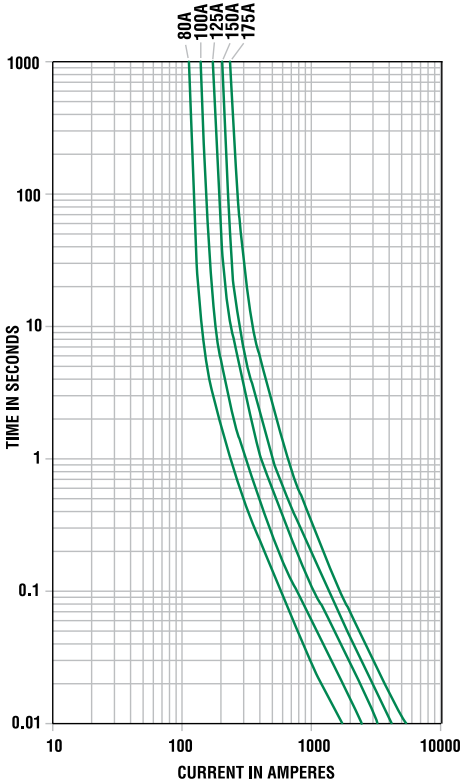
The MEGA® Fuse is designed for high current circuit protection with “Diffusion Pill Technology.” The MEGA® Fuse also provides time delay characteristics. Designed and patented by Littelfuse, the MEGA® Fuse is ideal for battery and alternator protection application and other heavy gauge cables requiring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

### Specifications

Interrupting Rating:	2000A @ 32 VDC
Voltage Rating:	32 VDC
Operating Temperature Range:	-40°C to + 125°C
Housing Material:	PPA-GF30FR
Terminals:	Copper
	M8 bolts holes
Mounting Torque:	12-18 Nm M8
Complies with:	ISO 8820-5 ,UL 248 Special Purpose Fuses



### Time-Current Characteristic Curves



### Ordering Information

Part Number	Package Size
0298xxx.ZXEH-UL	500

### Time-Current Characteristics

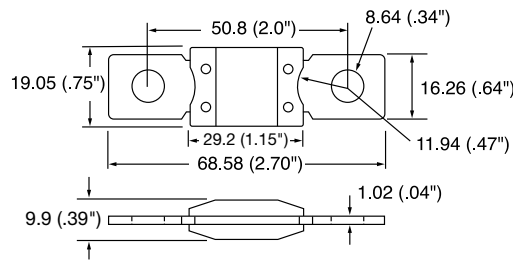
% of Rating	Opening Time Min / Max (s)
	80A-175A
75	- / -
100	14,400 s / -
135	120 s / 1800 s
200	1 s / 15 s
350	0.300 s / 5 s
500	- / -
600	0.100 s / 1 s

### Ratings

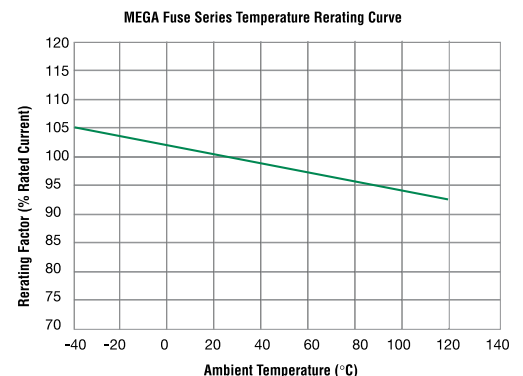
Part Number	Current Rating (A)	Font Color	Typ. Voltage Drop (mV)	I <sup>2</sup> t (A <sup>2</sup> s)
0298080.ZXEH-UL	80	Red	87	21500
0298100.ZXEH-UL	100	Yellow	87	31100
0298125.ZXEH-UL	125	Green	80	57800
0298150.ZXEH-UL	150	Orange	92	100000
0298175.ZXEH-UL	175	White	62	168000

### Dimensions

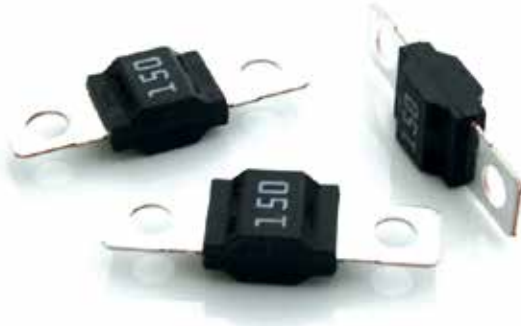
Dimensions in mm



### Temperature Derating Curve



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MIDI® Fuses

## MIDI®, Clear MIDI®, and One Hole MIDI® Style Bolt-down Fuse Rated 32V

This MIDI® style fuse offers a bolt-on space saving fuse for high current wiring protection and provides time delay characteristics with “Diffusion Pill Technology”. The MIDI® was designed and patented by Littelfuse.

### Specifications

Interrupting Rating:	1000A @ 32 VDC
Voltage Rating:	32 VDC
Operating Temperature Range:	-40°C to + 125°C
Black Housing Material:	PA-GF25FR
Clear Housing Material:	PA-6/66
Terminal:	Tin plated Copper
Mounting Torque M5:	4.5 Nm +/- 1Nm
Mounting Torque M6:	6.0 Nm +/- 1Nm
Complies with:	ISO 8820-5:2003, UL 248 Special Purpose Fuses



Clear MIDI® Fuses  
(transparent nylon composite cover)

One Hole MIDI® Fuses

### Time-Current Characteristics

% of Rating	Opening Time Min / Max (s)	
	23-125A	150-200A
75	- / -	360,000 s / -
100	360,000 s / -	- / -
110	14,400 s / -	- / -
150	90 s / 3,600 s	- / -
200	3 s / 100 s	1 s / 15 s
300	0.3 s / 3 s	- / -
350	- / -	0.3 s / 5 s
500	0.1 s / 1 s	0.1 s / 1 s

### Ordering Information

Part Number	Package Size	Housing Color	Bolt Size	Bolt Hole Qty	Mfg Location
0498xxx.M	1000	Black	M5	2	Mexico
0498xxx.M-CN	1000	Black	M5	2	China
0498xxx.H	100	Black	M5	2	Mexico
0498xxx.MXM6	1000	Black	M6	2	Mexico
0498xxx.MXM6-CN	1000	Black	M6	2	China
0498xxx.MX1M5	1000	Black	M5	1	Mexico
0498xxx.MX1M5-CN	1000	Black	M5	1	China
0498xxx.MX1M6	1000	Black	M6	1	China
0498xxx.MX1M6-CN	1000	Black	M6	1	China
0498xxx.MXT	1000	Clear	M5	2	Mexico
0498xxx.MXT-CN	1000	Clear	M5	2	China
0498xxx.MXTM6	1000	Clear	M6	2	Mexico
0498xxx.MXTM6-CN	1000	Clear	M6	2	China

\* Materials manufactured in Asia are produced to the same specifications as materials manufactured in North America, and meets the same test requirements. Multiple production locations are for capacity expansion only.

### Ratings

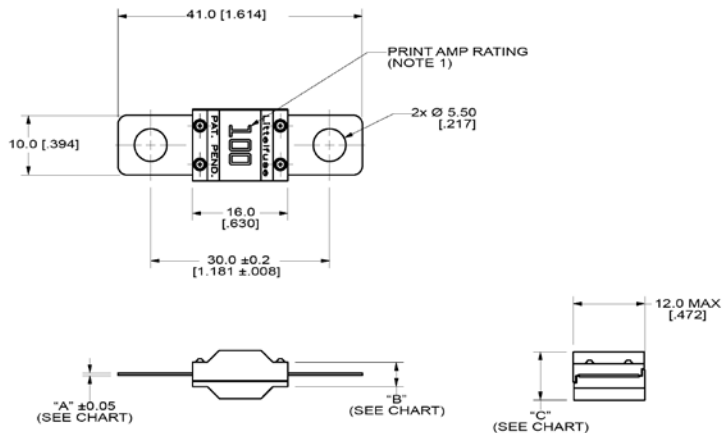
Part Number	Current Rating (A)	Font Color	Typ. Voltage Drop max. (mV)	Cold Resistance (mΩ)	I <sup>2</sup> t (A <sup>2</sup> s)
0498023_2	23	White	90	3.43	1,800
0498030_2	30	Orange	65	2.06	4,200
0498040_	40	Green	65	1.398	10,000
0498050_	50	Red	65	1.025	13,000
0498060_	60	Yellow	68	0.865	21,700
0498070_	70	Brown	70	0.72	24,000
0498080_	80	White	58	0.541	24,600
0498100_	100	Blue	60	0.457	51,300
0498125_2	125	Pink	71	0.394	73,200
0498150_1,2	150	Grey	77	0.323	81,900
0498175_1,2	175	Dark Grey	77	0.285	100,000
0498200_1,2	200	Purple	77	0.261	125,000

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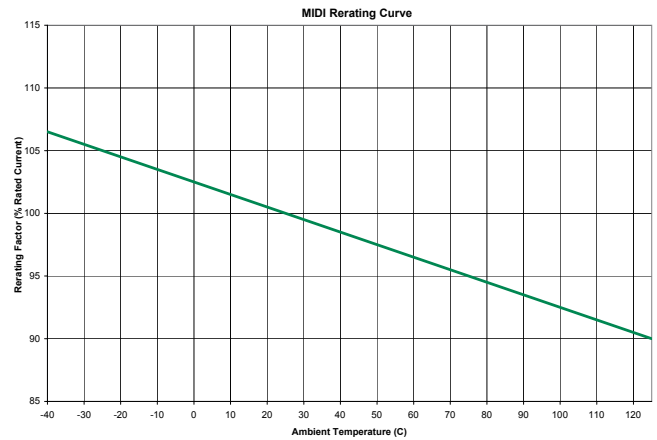
## MIDI®, Clear MIDI®, and One Hole MIDI® Style Bolt-down Fuse Rated 32V

### Dimensions

Dimensions in mm

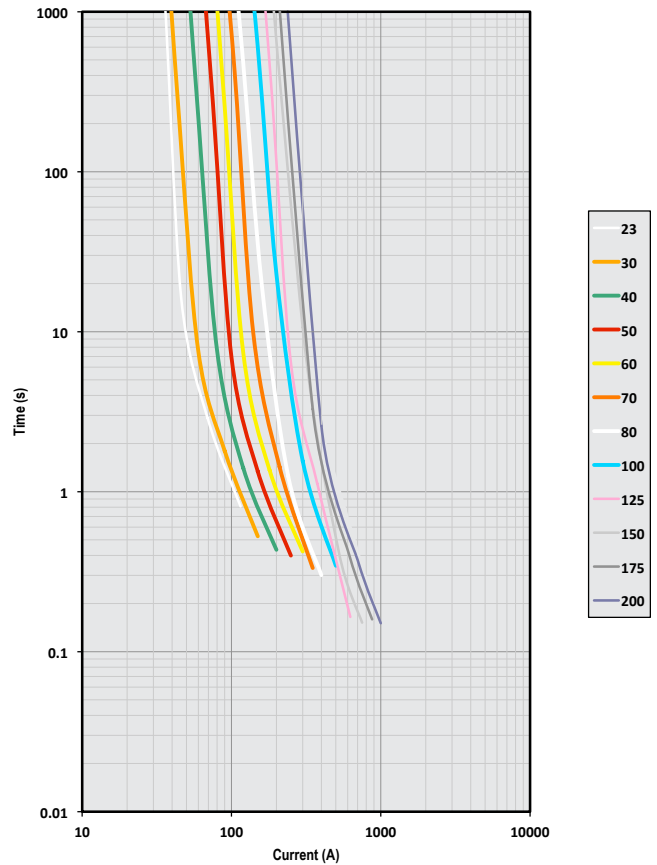


### Temperature Derating Curve

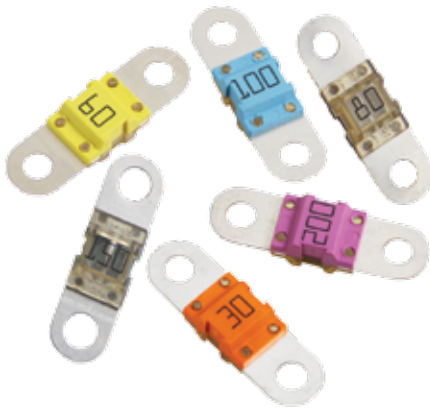


Part Number	"A" mm (inch)	"B" mm (inch)	"C" mm (inch)
0498023_	0.41 (0.016)	4.0 (0.157)	8.0 (0.315)
0498030_	0.41 (0.016)	4.0 (0.157)	8.0 (0.315)
0498040_	0.41 (0.016)	4.0 (0.157)	8.0 (0.315)
0498050_	0.41 (0.016)	4.0 (0.157)	8.0 (0.315)
0498060_	0.41 (0.016)	4.0 (0.157)	8.0 (0.315)
0498070_	0.41 (0.016)	4.0 (0.157)	8.0 (0.315)
0498080_	0.41 (0.016)	4.0 (0.157)	8.0 (0.315)
0498100_	0.63 (0.025)	4.3 (0.169)	8.3 (0.327)
0498125_	0.63 (0.025)	4.3 (0.169)	8.3 (0.327)
0498150_	0.63 (0.025)	4.3 (0.169)	8.3 (0.327)
0498175_	0.63 (0.025)	4.3 (0.169)	8.3 (0.327)
0498200_	0.63 (0.025)	4.3 (0.169)	8.3 (0.327)

### Time-Current Characteristic Curves



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BF1 Fuses



One Hole BF1 Fuses

## BF1 and One-Hole BF1 Fuse Rated 32V

This BF1 fuse is rated at 32V and offers a bolt-on fuse for high current wiring protection. Current rating 23A - 200A; with transparent housing material for easy detection of blown fuses. One-Hole BF1 fuses have a current rating 60-125A.

### Specifications

Operating Temperature:	-40 to 125 degrees C
Housing Material:	PET-GF30
Clear Housing Material:	PES
Terminals:	Copper alloy, gal. Sn 2 x M5 or M6 bolts, distance 30 mm
Mounting Torque M5:	4.5 Nm +/- 1Nm
Mounting Torque M6:	6.0 Nm +/- 1Nm
Interrupting Rating:	23A & 30A: 1000A @32 VDC 40A - 150A: 2000A @32 VDC 200A: 1500A @32 VDC
Complies with:	ISO 8820-5, UL 248 Special Purpose Fuses



### Ordering Information

Part Number	Package Size	Bolt Size	Bolt Hole Qty	Rated
153.5631.xxx2	1000	M5	2	30A-200A
153.5631.xxx1	10	M5	2	30A-200A
153.7010.xxx2	1000	M6	2	30A-150A
153.7000.xxx2	500	M6	2	200A
153.0010.xxx2	1000	M6	1	60A-125A
153.0020.xxx2	500	--	0	30A-200A

### Time-Current Characteristics

% of Rating	Opening Time Min / Max (s)	
	23-150A Fuses	200A Short Circuit Protectors
75	- / -	360,000 s / -
100	360,000 s / -	- / -
110	14,400 s / -	- / -
150	90 s / 3,600 s	- / -
200	3 s / 100 s	1 s / 15 s
300	0.300 s / 3 s	- / -
350	- / -	0.300 s / 5 s
500	0.100 s / 1 s	- / -
600	- / -	0.100 s / 1 s

### Ratings

Part Number		Current Rating (A)	Housing Material Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I <sup>2</sup> t (A <sup>2</sup> s)
M5	M6					
153.5631.523_1,2	-	23	Yellow	105	3.50	1,400
153.5631.530_	153.7010.530_	30	Orange	105	2.70	5,100
153.5631.540_	153.7010.540_	40	Green	90	1.56	6,800
153.5631.550_	153.7010.550_	50	Red	80	1.03	6,900
153.5631.560_	153.7010.560_	60	Yellow	75	0.75	16,200
153.5631.570_	153.7010.570_	70	Brown	70	0.64	22,000
153.5631.580_	153.7010.580_	80	White	70	0.55	25,600
153.5631.610_	153.7010.610_	100	Blue	70	0.44	42,500
153.5631.612_	153.7010.612_	125	Pink	70	0.34	62,500
153.5631.615_1	153.7010.615_1	150	Grey	70	0.29	83,400
153.5631.620_3	153.7000.620_3	200	Purple	70	0.24	126,000

Corresponding holder see Section "Fuse Holders."

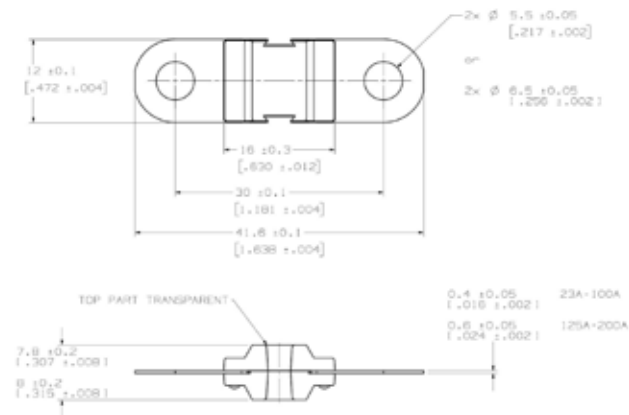
Note 1: not mentioned in ISO standard Note 2: Not UL rated Note 3: Short Circuit Protector only Note 4: For 1-Hole and No-Hole values, refer to 2-Hole version values



## BF1 and One-Hole BF1 Fuse Rated 32V

### Dimensions

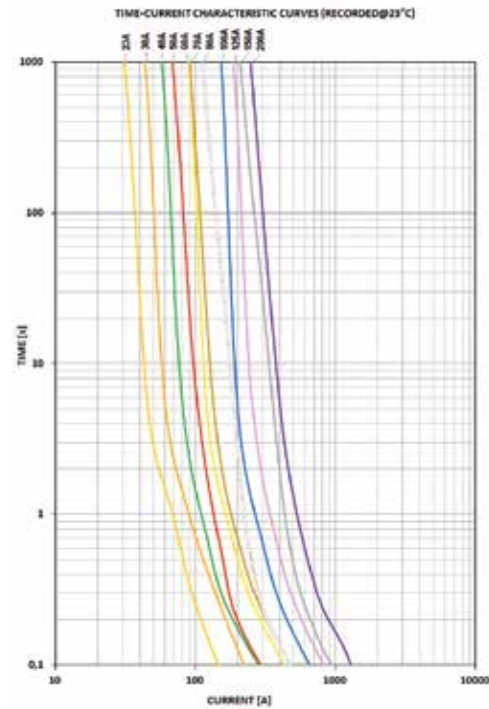
Dimensions in mm



### Derating

Individual derating curves by rating can be ordered through your Littelfuse contact person.

### Pre-Arcing Time-Limits



23 A - 150 A: FI = 1.25 (max. operating current:  $0.8 \times I_{rat}$  at 23°C)

200 A: FI = 2.00 (max. operating current:  $0.5 \times I_{rat}$  at 23°C)



## BF1 Fuses Rated 58V

This BF1 fuse is rated at 58V and offers a bolt-on fuse for high current wiring protection. Current rating 30A - 200A; with transparent housing material for easy detection of blown fuses.

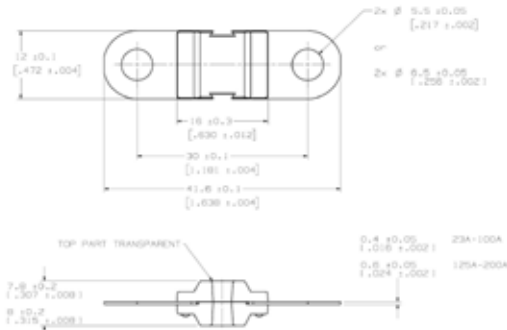
### Specifications

Operating temperature: -40 to 125 degrees C  
 Housing Material: PET-GF30  
 Clear Housing Material: PES  
 Terminals: Copper alloy, gal. Sn  
 2 x M5 or M6 bolts, distance 30 mm  
 Mounting Torque M5: 4.5 Nm +/- 1Nm  
 Mounting Torque M6: 6.0 Nm +/- 1Nm  
 Interrupting Rating: 1000A @ 58 VDC  
 Complies with: ISO 8820-5, UL 248 Special Purpose Fuses



### Dimensions

Dimensions in mm



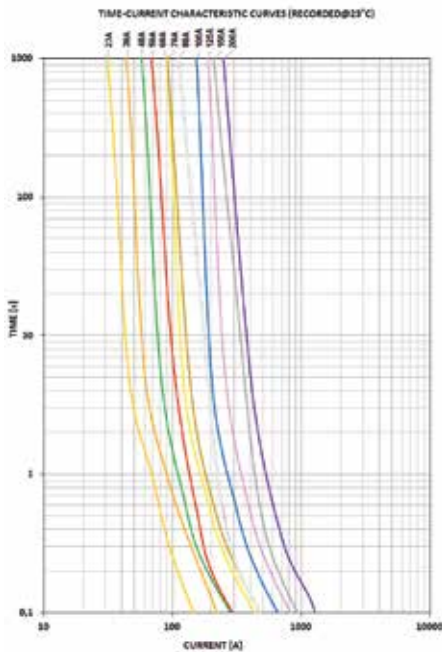
### Ordering Information

Part Number	Package Size	Bolt Size	Bolt Hole Qty
142.5631.xxx2	500	M5	2
142.7010.xxx2	500	M6	2
142.7020.xxx2	500	N/A	0

### Time-Current Characteristics

% of Rating	Opening Time Min / Max (s)	
	30-150A Fuses	200A Short Circuit Protectors
75	- / -	360,000 s / -
100	360,000 s / -	- / -
110	14,400 s / -	- / -
150	90 s / 3,600 s	- / -
200	3 s / 100 s	1 s / 15 s
300	0.300 s / 3 s	- / -
350	- / -	0.300 s / 5 s
500	0.100 s / 1 s	- / -
600	- / -	0.100 s / 1 s

### Pre-Arcing Time-Limits



30 A - 150 A: FI = 1.25  
 (max. operating current: 0.8 x I<sub>rat</sub> at 23°C)  
 200 A: FI = 2.00  
 (max. operating current: 0.5 x I<sub>rat</sub> at 23°C)

### Ratings

Part Number M5	Part Number M6	Current Rating (A)	Housing Material Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I <sub>t</sub> (A <sup>2</sup> s)
142.5631.5302 <sup>1</sup>	142.70xx.5302 <sup>1</sup>	30	Orange	105	2.70	5,100
142.5631.5402	142.70xx.5402	40	Green	90	1.56	6,800
142.5631.5502	142.70xx.5502	50	Red	80	1.03	6,900
142.5631.5602	142.70xx.5602	60	Yellow	75	0.75	16,200
142.5631.5702	142.70xx.5702	70	Brown	70	0.64	22,000
142.5631.5802	142.70xx.5802	80	White	70	0.55	25,600
142.5631.6102	142.70xx.6102	100	Blue	70	0.44	42,500
142.5631.6122	142.70xx.6122	125	Pink	70	0.34	62,500
142.5631.6152	142.70xx.6152	150	Grey	70	0.29	83,400
142.5631.6202 <sup>2</sup>	142.70xx.6202	200	Purple	70	0.24	126,000

Note 1: Not UL rated Note 2: Short Circuit Protector only

### Derating

Individual derating curves by rating can be ordered through your Littelfuse contact person.



BF2 Fuses

## BF2 Fuses Rated 32V

This BF2 fuse is rated at 32V and offers a bolt-on fuse for high current wiring protection. Current rating 100A - 500A; with transparent housing material for easy detection of blown fuses.

### Specifications

Housing Material:	PET-GF30
Clear Housing Material:	PES
Terminal:	Copper alloy, gal. Sn 2 x M8 bolts, Distance 51 mm
Mounting Torque:	12.0 Nm +/- 1Nm
Breaking Capacity:	100 A - 300 A: 2.000 A, 32V, DC 400 A - 500 A: 1.500 A, 32V, DC
Complies with:	ISO 8820-5, UL 248 Special Purpose Fuses



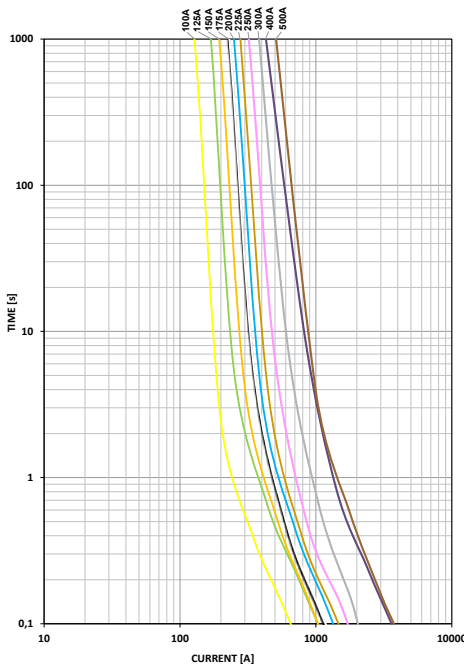
### Ordering Information

Part Number	Package Size
<b>Standard M8 Holes</b>	
153.5395.xxxx	200
<b>M6 Holes</b>	
153.7011.xxxx	200

### Time Current Characteristics

% of Rating	Opening Time Min / Max (s)	
	100A - 250A	300A - 500A
75	- / -	4 h / -
100	4 h / -	- / -
135	120 s / 1,800 s	- / -
200	1 s / 15 s	1 s / 15 s
350	0.300 s / 5 s	0.500 s / 5 s
600	0.100 s / 1 s	0.100 s / 1 s

### Time-Current Characteristic Curves



100A-300A:  $F_t=1,25$  (max. operating current:  $0,8 \times I_{rat}$  at 23°C)  
400A-500A:  $F_t=2,00$  (max. operating current:  $0,5 \times I_{rat}$  at 23°C)

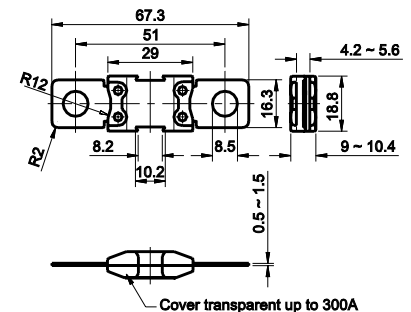
### Ratings

Part Number M8 Holes	Part Number M6 Holes	Current Rating (A)	Housing Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I <sup>2</sup> t (A <sup>2</sup> s)
153.5395.610_	153.7011.610_	100	Yellow	110	0.70	46,800
153.5395.612_	153.7011.612_	125	Green	110	0.52	118,100
153.5395.615_	153.7011.615_	150	Orange	110	0.42	113,400
153.5395.617_	153.7011.617_	175	White	110	0.36	154,400
153.5395.620_	153.7011.620_	200	Blue	110	0.34	288,000
153.5395.622_	153.7011.622_	225	Brown	110	0.29	236,000
153.5395.625_	153.7011.625_	250	Pink	110	0.25	292,500
153.5395.630_*	153.7011.630_*	300	Grey	110	0.21	486,000
153.5395.640_*	153.7011.640_*	400	Purple	110	0.13	964,000
153.5395.650_*	153.7011.650_*	500	Brown	110	0.12	1,449,000

Last figure of article no. = packaging code  
Corresponding holder see Section "Fuse Holders."  
\* Parts with asterisk are short circuit protectors only.

### Dimensions

Dimensions in mm





BF2 Fuses

## BF2 Fuses Rated 58V

This BF2 fuse is rated at 58V and offers a bolt-on fuse for high current wiring protection. Current rating 100A - 300A; with transparent housing material for easy detection of blown fuses.

### Specifications

Housing Material:	PET-GF30
Clear Housing Material:	PES
Terminal:	Copper alloy, gal. Sn 2 x M8 bolts, Distance 51 mm
Mounting Torque:	12.0 Nm +/- 1Nm
Breaking Capacity:	1000A, 58V DC
Complies with:	ISO 8820-5, UL 248 Special Purpose Fuses



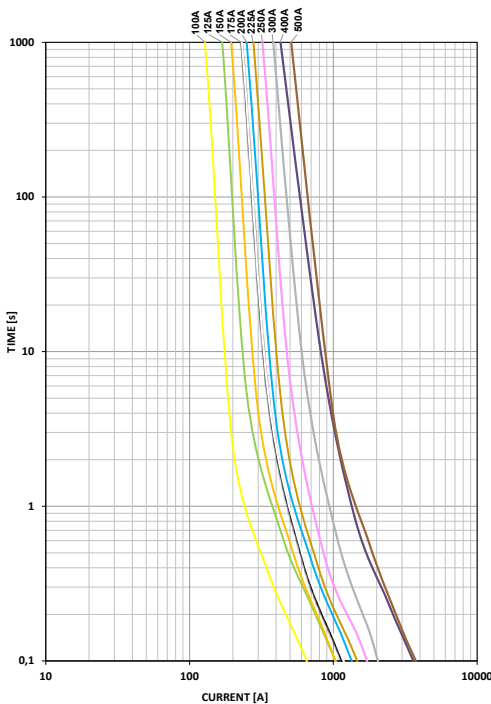
### Ordering Information

Part Number	Package Size
142.5395.xxxx	200

### Time Current Characteristics

% of Rating	Opening Time Min / Max (s)	
	100A - 250A	300A
75	- / -	- / -
100	4 h / -	4 h / -
135	120 s / 1,800 s	- / -
200	1 s / 15 s	1 s / 15 s
350	0.300 s / 5 s	0.500 s / 5 s
600	0.100 s / 1 s	0.100 s / 1 s

### Time-Current Characteristic Curves



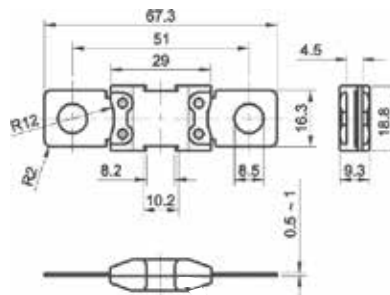
100A-300A:  $F_t=1,25$  (max. operating current:  $0,8 \times I_{rat}$  at 23°C)  
 400A-500A:  $F_t=2,00$  (max. operating current:  $0,5 \times I_{rat}$  at 23°C)

### Ratings

Part Number	Current Rating (A)	Housing Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I <sup>2</sup> t (A <sup>2</sup> s)
142.5395.6102	100	Yellow	110	0.70	46,800
142.5395.6122	125	Green	110	0.52	118,100
142.5395.6152	150	Orange	110	0.42	113,400
142.5395.6172	175	White	110	0.36	154,400
142.5395.6202	200	Blue	110	0.34	288,000
142.5395.6222	225	Brown	110	0.29	236,000
142.5395.6252	250	Pink	110	0.25	292,500
142.5395.6302 <sup>1</sup>	300	Grey	110	0.21	486,000

### Dimensions

Dimensions in mm



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CF Fuses

## CF Fuses Rated 58V

Main Fuse for mounting with battery clamp on the battery pole. Voltage rating 58 VDC, Current rating 50A - 300A. With transparent cover material for visual inspection of melting element.

### Specifications

Insulating Body Material:	Ceramic
Cover Material:	PES
	Visible melting-element
Interrupting Rating:	2,000A @58 VDC
Complies with:	ISO 8820-6, DIN 72581-5, UL 248 Special Purpose Fuses
cULus Recognized:	File No. E211637



### Ordering Information

Part Number	Package Size
155.0892.xxx1	100

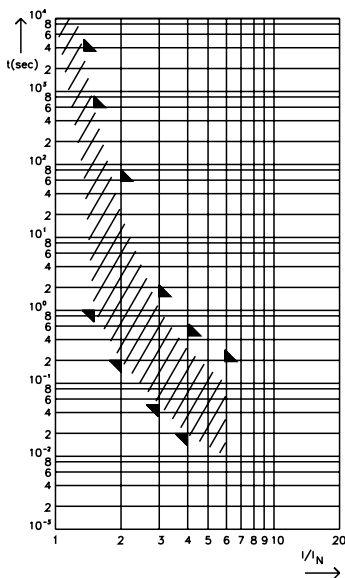
### Time-Current Characteristics

% of Rating	Opening Time Min / Max (s)
100	360,000 s / -
135	- / 3,600 s
150	1 s / 600 s
200	0.200 s / 60 s
300	0.050 s / 1.5 s
400	0.020 s / 0.50 s
600	- / 0.20 s

### Ratings

Part Number	Current Rating (A)	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I <sup>2</sup> t (A <sup>2</sup> s)
155.0892.5501	50	100	1.20	1,900
155.0892.5751	75	90	0.60	12,000
155.0892.6101	100	80	0.60	14,000
155.0892.6121	125	75	0.45	51,000
155.0892.6151	150	70	0.35	63,800
155.0892.6171	175	70	0.25	120,000
155.0892.6201	200	65	0.25	172,800
155.0892.6251	250	70	0.20	330,000
155.0892.6301	300	70	0.15	372,000

### Pre-Arcing Time-Limits

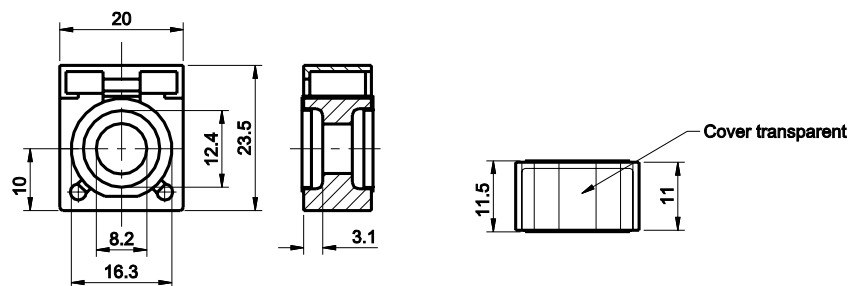


FI = 1.25 (max. operating current:  
0.8 x I<sub>rat</sub> at 23°C)

Insert CF8-Fuse links only in conjunction with the insulating nuts, see Section "Fuse Holders."  
Corresponding battery clamp see Section "Fuse Holders."

### Dimensions

Dimensions in mm





## Fuse Strips with Housing Rated 36V - SPECIAL PURPOSE FUSES (NOT INTENDED FOR AUTOMOTIVE or TRUCK APPLICATIONS)

Housed fuse strips with window for visual inspection of melting element. Current rating 30A - 150A, 36 VDC. 90° fork type lugs.

### Specifications

Voltage Rating:	36 VDC
Interrupt Ratings:	up to 375A
Operating Temperature Range:	-40° to 125°C
Insulating Body:	Out of ceramic
Metal Parts:	Zinc-alloy
Complies with:	DIN 72581/2



### Ordering Information

Part Number	Package Size
156.5611.xxx1	50

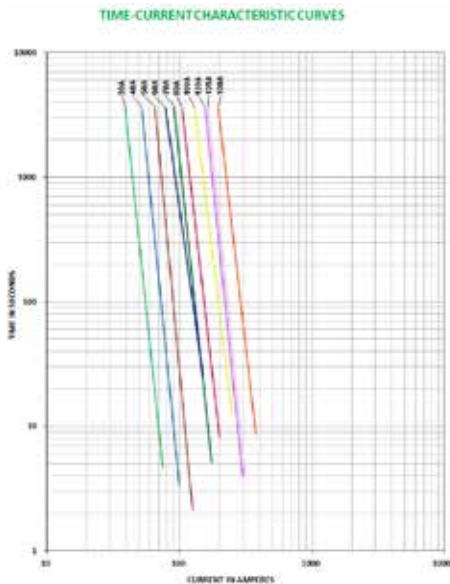
### Time-Current Characteristics

% of Rating	Opening Time Min / Max (s)
130	3,600 s / -
250	- / 60 s

### Ratings

Part Number	Current Rating (A)*	Typ. Voltage Drop (mV)	Material Thickness "S" (mm)
156.5611.5301	30	70	0.25
156.5611.5401	40	70	0.20
156.5611.5501	50	70	0.25
156.5611.5601	60	70	0.40
156.5611.5701	70	70	0.45
156.5611.5801	80	70	0.50
156.5611.6101	100	70	0.70
156.5611.6111	120	70	0.70
156.5611.6121	125	70	0.70
156.5611.6151	150	70	1.00

### Pre-Arcing Time-Limits



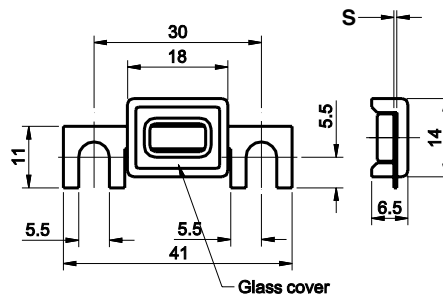
FI = 1.00 (max. operating current : 1.0 x I<sub>rat</sub> at 23°C)

Corresponding holder see Section "Fuse Holders."

\*Metal parts in compliance with DIN 72581/2. Fuses with housings not mentioned in the standards.

### Dimensions

Dimensions in mm





## Fuse Strips Rated 48V - SPECIAL PURPOSE FUSES (NOT INTENDED FOR AUTOMOTIVE OR TRUCK APPLICATIONS)

Non-housed fuse strips for battery powered fuses rated at 48VDC. 90° and straight fork type lugs.

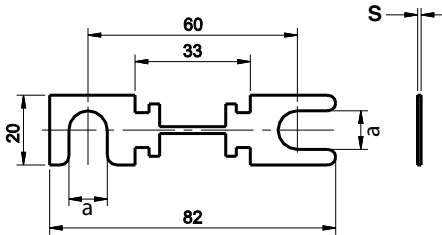
### Specifications

Voltage Rating:	48 VDC
Interrupt Ratings:	up to 3000A
Operating Temperature Range:	-40° to 125°C
Metal Parts:	35 A - 80 A: Zinc-alloy 100A - 500 A: Copper Cu, gal. Sn
Complies with:	DIN 43560-1

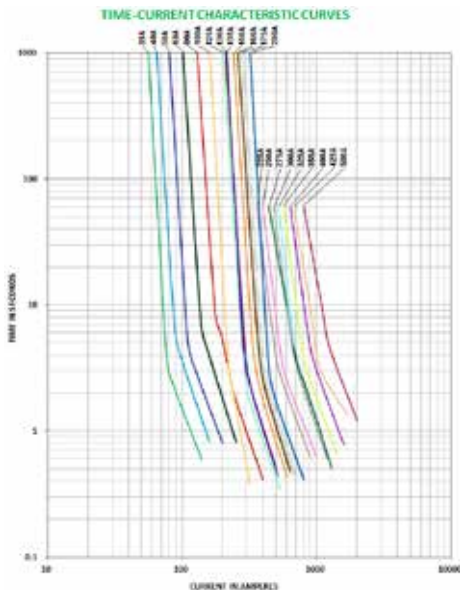


### Dimensions

Dimensions in mm



### Pre-Arcing Time-Limits



FI = 1.00 (max. operating current:  $1.0 \times I_{rat}$  at 23°C)

### Ordering Information

Part Number	Package Size
157.5700.xxx1	50
157.5916.xxx1	50

### Time-Current Characteristics

% of Rating	Opening Time Min / Max (s)	
	35-200	225 - 500
150	3,600 s / -	- / -
160	- / -	60 s / -
220	- / 60 s	
250	0.8 s / 10 s	
400	0.20 / 2 s	

### Ratings

Part Number		Current Rating (A)	Typ. Voltage Drop (mV)	Breaking Capacity (VDC/A)	Material Thickness "S" (mm)
a = 11 mm	a = 9 mm*				
157.5700.5351	157.5916.5351	35	125	48/210	0.6
157.5700.5401	-	40	125	48/240	0.6
157.5700.5501	157.5916.5501	50	125	48/300	0.6
157.5700.5631	157.5916.5631	63	125	48/378	0.6
157.5700.5801	157.5916.5801	80	125	48/480	0.6
157.5700.6101	157.5916.6101	100	125	48/600	0.5
157.5700.6121	157.5916.6121	125	125	48/750	0.8
157.5700.6131	157.5916.6131	130	125	48/780	0.8
157.5700.6141	-	135	125	48/810	0.8
157.5700.6151	-	150	125	48/900	0.8
157.5700.6161	157.5916.6161	160	125	48/960	1.0
157.5700.6171	-	175	125	48/1050	1.0
157.5700.6201	157.5916.6201	200	125	48/1200	0.8
157.5700.6231	-	225	125	48/1350	0.5
157.5700.6251	157.5916.6251	250	125	48/1500	0.5
157.5700.6271	-	275	125	48/1650	0.8
157.5700.6301	-	300	125	48/1800	0.8
157.5700.6331	-	325	125	48/1950	0.8
157.5700.6351	-	355	125	48/2130	0.8
157.5700.6401	-	400	125	48/2400	0.8
157.5700.6421	-	425	125	48/2550	1.0
157.5700.6501	-	500	125	48/3000	1.0

Corresponding holders = 177.5701.0001 and 177.5702.0001."

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## Fuse Strips with Housing Rated 48V - SPECIAL PURPOSE FUSES (NOT INTENDED FOR AUTOMOTIVE OR TRUCK APPLICATIONS)

Housed fuse strips for battery-powered vehicles. Current rating 35A - 500A, 48 VDC. 90° and straight fork type lugs. With window for visual inspection of melting element.

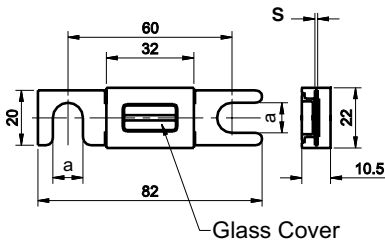
### Specifications

Voltage Rating:	48 VDC
Interrupt Ratings:	up to 3000A
Operating Temperature Range:	-40° to 125°C
Metal Parts:	35A - 80A: Zinc-alloy 100A - 500A: Copper Cu, gal. Sn
Complies with:	UL 248 Special Purpose Fuses
cULus Recognized:	File No. E211637

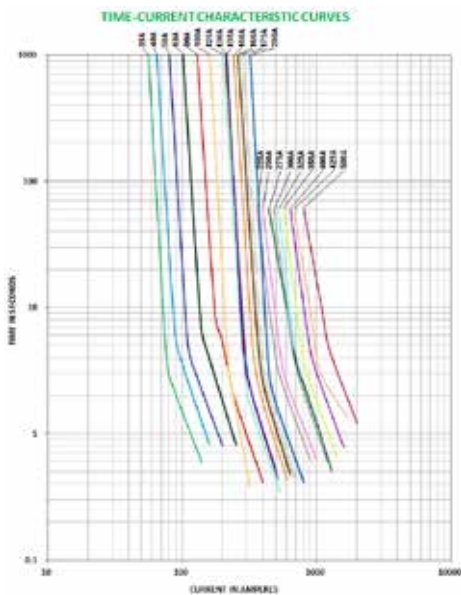


### Dimensions

Dimensions in mm



### Pre-Arcing Time-Limits



FI = 1.00 (max. operating current:  $1.0 \times I_{rat}$  at 23°C)

### Ordering Information

Part Number	Package Size
157.5701.xxx1	50
157.5917.xxx1	50

### Time-Current Characteristics

% of Rating	Opening Time Min / Max (s)	
	35-200	225 - 500
150	3,600 s / -	- / -
160	- / -	60 s / -
220	- / 60 s	
250	0.8 s / 10 s	
400	0.20 / 2 s	

### Ratings

Part Number		Current Rating (A)	Typ. Voltage Drop (mV)	Breaking Capacity (VDC/A)	Material Thickness "S" (mm)
a = 11 mm	a = 9 mm*				
157.5701.5351	157.5917.5351	35	125	48/210	0.6
157.5701.5401	-	40	125	48/240	0.6
157.5701.5501	157.5917.5501	50	125	48/300	0.6
157.5701.5631	157.5917.5631	63	125	48/378	0.6
157.5701.5801	157.5917.5801	80	125	48/480	0.6
157.5701.6101	157.5917.6101	100	125	48/600	0.5
157.5701.6121	157.5917.6121	125	125	48/750	0.8
157.5701.6131	-	130	125	48/780	0.8
157.5701.6141	-	135	125	48/810	0.8
157.5701.6151	157.5917.6151	150	125	48/900	0.8
157.5701.6161	157.5917.6161	160	125	48/960	1.0
157.5701.6171	157.5917.6171	175	125	48/1050	1.0
157.5701.6201	157.5917.6201	200	125	48/1200	0.8
157.5701.6231	157.5917.6231	225	125	48/1350	0.5
157.5701.6251	157.5917.6251	250	125	48/1500	0.5
157.5701.6271	157.5917.6281	275	125	48/1650	0.8
157.5701.6301	-	300	125	48/1800	0.8
157.5701.6331	157.5917.6331	325	125	48/1950	0.8
157.5701.6351	157.5917.6351	355	125	48/2130	0.8
157.5701.6401	-	400	125	48/2400	0.8
157.5701.6421	157.5917.6421	425	125	48/2550	1.0
157.5701.6501	157.5917.6501	500	125	48/3000	1.0

Corresponding holder see Section "Fuse Holders."

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## HSB Fuses Rated 32V

Non-housed fuse strips for rated voltage up to 32 VDC. Current rating 30 A - 175 A. Ring type lugs.

### Specifications

Voltage Rating:	32 VDC
Interrupt Ratings:	1000A
Operating Temperature Range:	-40° to 125°C
Material:	Zinc-alloy
Connections:	Zinc-alloy 2 x M6 bolts, distance 30 mm
Torque:	4 Nm +/- 1 Nm

**RoHS**

### Ordering Information

Part Number	Package Size
156.5677.xxx1	100
156.5677.xxx2	10000

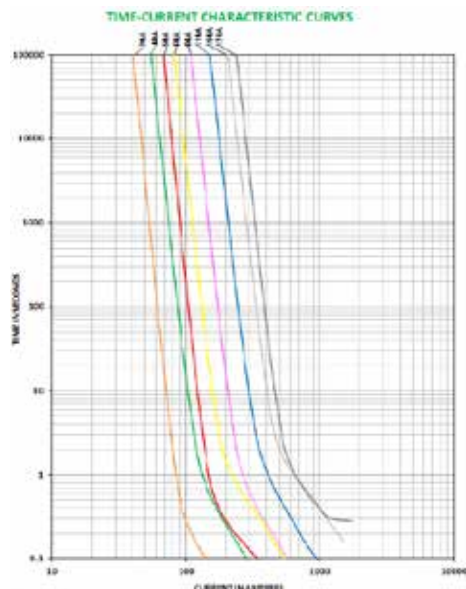
### Time-Current Characteristics

% of Rating	Opening Time Min / Max (s)
100	∞ / -
125	360,000 s / -
300	0.100 s / 10 s
600	0.020 s / 1 s
1000	0.010 s / 0.300 s

### Ratings

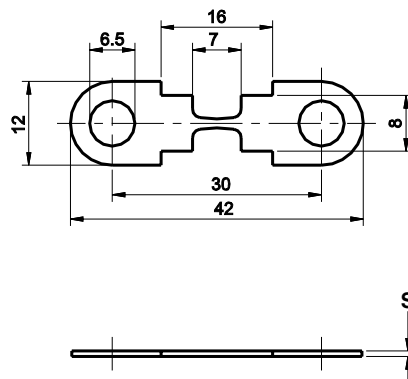
Part Number	Current Rating (A)	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I <sup>2</sup> t (A <sup>2</sup> s)	Material Thickness "S" (mm)
156.5677.530_	30	44	1.33	3800	0.4
156.5677.540_	40	40	0.89	11200	0.4
156.5677.550_	50	44	0.72	21300	0.4
156.5677.560_	60	38	0.58	41400	0.4
156.5677.580_	80	40	0.43	44800	0.8
156.5677.611_	110	40	0.31	139000	0.8
156.5677.615_	150	52	0.23	465000	0.8
156.5677.617_	175	46	0.22	560000	0.8

### Pre-Arcing Time-Limits



### Dimensions

Dimensions in mm



FI = 1.00 (max. operating current:  
1.0 x I<sub>rat</sub> at 23°C)

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## Fuse Strips with Rated 36V - SPECIAL PURPOSE FUSES (NOT INTENDED FOR AUTOMOTIVE OR TRUCK APPLICATIONS)

Non-housed fuse strips for Diesel vehicles. Current rating 25A - 150A, 36 VDC. 90° fork type lugs.

### Specifications

Voltage Rating:	36 VDC
Interrupt Ratings	up to 625A
Operating Temperature Range:	-40° to 125°C
Material:	Zinc-alloy
Complies with:	DIN 72581/2

**RoHS**

### Ordering Information

Part Number	Package Size	% of Rating	Opening Time Min / Max (s)
156.5610.xxx1	100	130	3,600 s / -
156.5610.xxx2	2000	250	- / 60 s

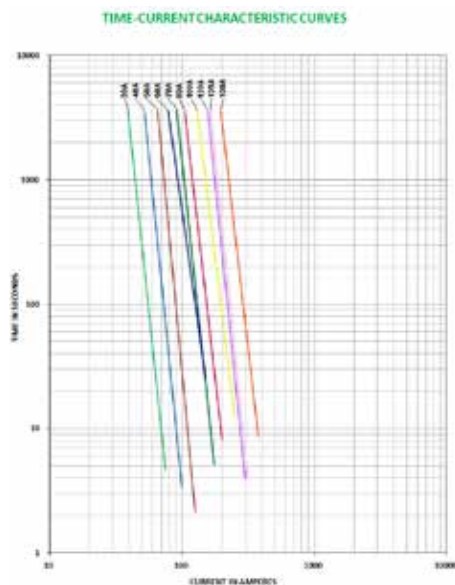
### Time-Current Characteristics

### Ratings

Part Number	Current Rating (A)	Typ. Voltage Drop (mV)	Material Thickness "S" (mm)
156.5610.525_	25*	70	0.20
156.5610.530_	30	70	0.25
156.5610.540_	40*	70	0.20
156.5610.550_	50	70	0.25
156.5610.560_	60*	70	0.40
156.5610.570_	70*	70	0.45
156.5610.580_	80	70	0.50
156.5610.610_	100	70	0.70
156.5610.611_	120*	70	0.70
156.5610.612_	125*	70	0.70
156.5610.615_	150*	70	1.00
156.5610.625_	250*	70	2.00

\*Not mentioned in the standards  
Corresponding holder see Section "Fuse Holders."

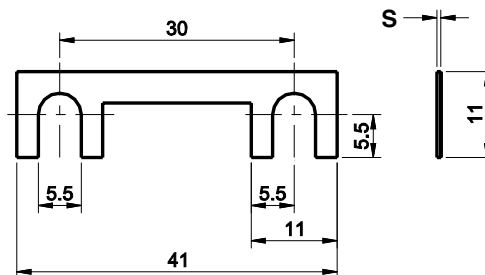
### Pre-arcing Time-limits



FI = 1.00 (max. operating current: 1.0 x I<sub>rat</sub> at 23°C)

### Dimensions

Dimensions in mm



# Cable/PAL Fuses

BF-Inline Fuses Rated 32V	40
CABLEPRO® Cable Protector Fuses Rated 32V	41
PAL Fuses	42





## BF-Inline Fuse Rated 32V

Inline fuse to protect specific cable cross-sections and insulations; Cross-section 10mm<sup>2</sup> to 35mm<sup>2</sup>. For rated voltage up to 32 VDC.

Assembly notes: The wire integrated fuse has to be insulated by using a self-adhesive shrinking tube. The wire has to be fixed on both sides of the fuse to minimize the wire forces. Recommended shrinking tube: DERAY(R)-IAKT 4:1, 24mm

### Specifications

Voltage Rating:	32 VDC
Housing Material:	PETGF30
Insulating Housing Material:	PAGF30
Terminals:	Crimp, Copper alloy, tinned
Interrupting Rating:	2000A @32VDC

### Ordering Information

Part Number	Package Size
153.0000	300

### Time-Current Characteristics 100A-190A

% of Rating	Opening Time Min / Max (s)	
100	360,000 s	—
150	90 s	1800 s
200	3 s	240 s
300	0.3 s	60 s
500	0.1 s	10 s

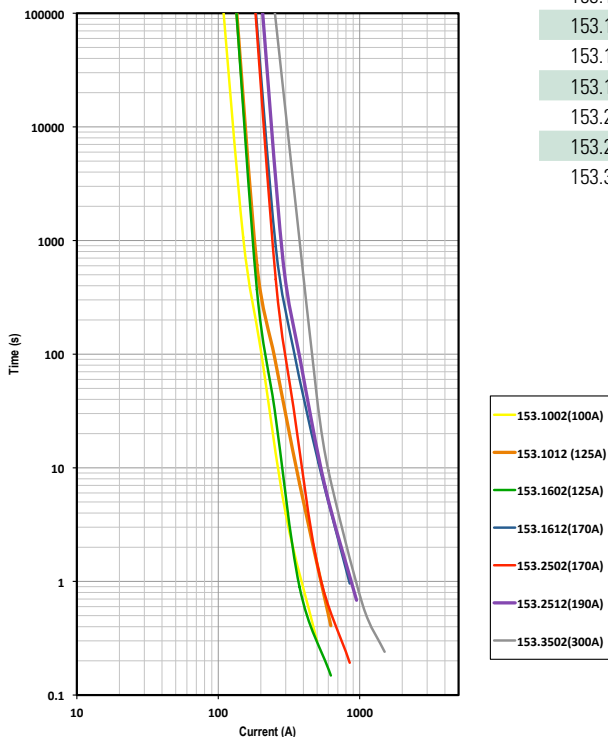
### Time-Current Characteristics 300A

% of Rating	Opening Time Min / Max (s)	
75	360,000 s	—
165	10 s	100 s
200	1 s	15 s
350	0.3 s	5 s
500	0.1 s	1 s

### Ratings

Part Number	Current Rating (A)	Wire Size/Type/Marking	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I <sup>2</sup> t (A <sup>2</sup> s)
153.1002	100	10mm <sup>2</sup> /FLY/P	60	0.42	27,000
153.1012	125	10mm <sup>2</sup> /FL2G/S	70	0.32	87,500
153.1602	125	16mm <sup>2</sup> /FLY/P	75	0.41	29,600
153.1612	170	16mm <sup>2</sup> /FL2G/S	60	0.22	248,000
153.2502	170	25mm <sup>2</sup> /FLY/P	70	0.29	78,500
153.2512	190	25mm <sup>2</sup> /FL2G/S	52	0.22	248,000
153.3502	300	35mm <sup>2</sup> /FLY/P	70	0.20	373,000

### Time-Current Characteristics Curve



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## CABLEPRO® Cable Protector Fuses Rated 32V

Available in AWG and metric cables

The CABLEPRO® fuse is designed to replace conventional wire fusible links in high current automotive applications. The slim package of the CABLEPRO® and the predictable and reliable performance characteristics (similar to MEGA® fuse) make this far superior over wire fusible links. Interrupting rating 2000A @ 32 VDC. CablePro is not a sealed product. To seal it a shrink tube should be used.

### Specifications

Voltage Rating:	32V
Interrupting rating:	2000A @ 32 VDC
Housing Material:	PPAGF33HS
Operating Temperature Range:	-40°C to +125°C
Cable Types Available:	SAE J1127 SXT, SAE J1128 TXL, ISO 6722: Type FL2G
Operating Temperature Range:	-40°C to +150°C - Optional for 150A, 175A and 200A ratings
Cable Type:	Thin wall irradiated XLPE (SAE 4GA)

Available with UL recognized in 60, 100, 150 & 200 at 32V  
(UL not available with the thin wall irradiated XLPE SAE 4GA cable)

**RoHS**



### 293 Series

Auto Link PAL 293 Series Fuse  
Amps (A): 20, 30, 40, 50, 60, 70, 80, 100



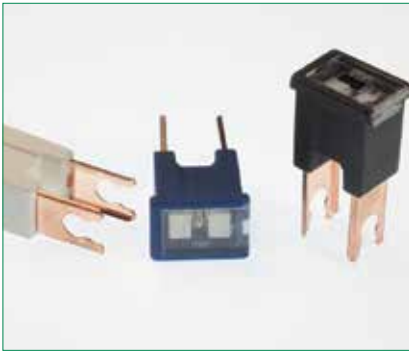
### 2935 Series

Auto Link PAL 2935 Series Fuse  
Amps (A): 25, 30, 45, 65, 75



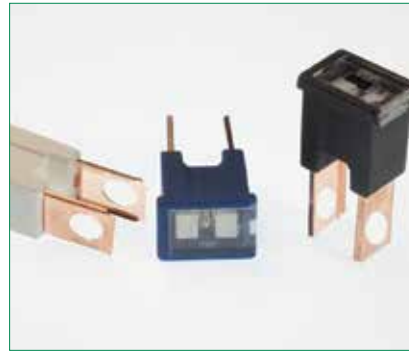
### 2938 Series

Auto Link PAL 2938 Series Fuse  
Amps (A): 20, 30, 40, 50, 60, 70, 80



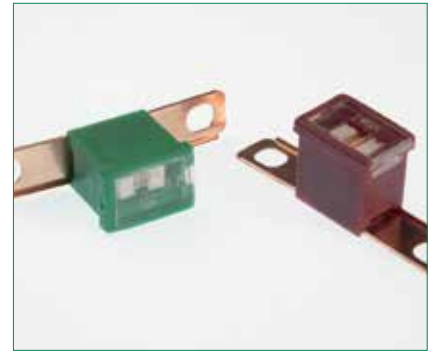
### 294 Series

Auto Link PAL 294 Series Fuse  
Amps (A): 30, 40, 50, 60, 70, 80, 100, 120



### 294C Series

Auto Link PAL 294C Series Fuse  
Amps (A): 20, 30, 40, 50, 60, 70, 80, 100, 120



### 295 Series

Auto Link PAL 295 Series Fuse  
Amps (A): 20, 30, 40, 50, 60, 70, 80, 100, 120, 140



### 283B Series

Auto Link PAL 283B Series Fuse  
Amps (A): 20, 30, 40, 50, 60, 70, 80, 100, 120, 140



### 283 Series

Auto Link PAL 283 Series Fuse  
Amps (A): 20, 30, 40, 50, 60, 70, 80, 100, 120, 140

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# High Voltage Fuses

LC High Voltage Fuse	44
LC High Voltage 50A Fuse	46





Low Current HEV Fuses



OHEV040.ZXBD

## Low Current HEV Fuse

The LC HEV fuse is designed for protection of high-voltage accessory circuits in electric and hybrid electric vehicles.

### Specifications

Voltage Rating (10A, 15A, 20A, 30A):	450 VDC
Voltage Rating (40A):	425 VDC
Note: The OHEV040.ZXBD is rated at 450 VDC	
Interrupting Rating (10A, 15A, 20A, 30A):	10kA @ 450 VDC
Interrupting Rating (40A):	10kA @ 425 VDC
Operating Temperature Range:	-40°C to +125°C

### Ordering Information

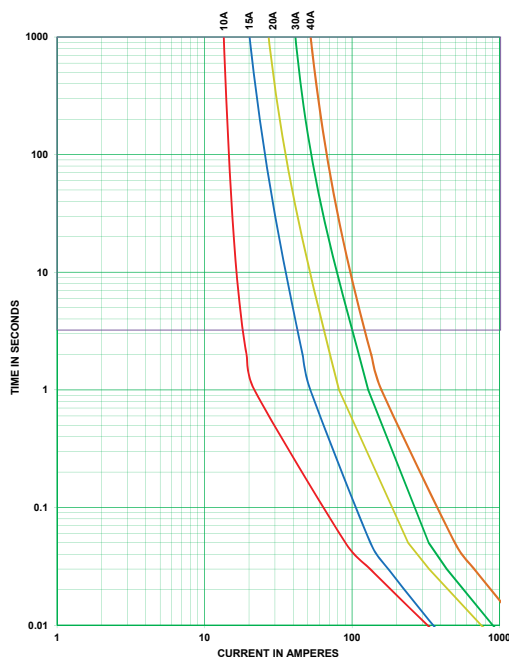
Part Number	Termination	Package Size	% of Rating	Time-Current Characteristics		
				Opening Time Min / Max (s) 10A	Opening Time Min / Max (s) 15A, 20A, 30A	Opening Time Min / Max (s) 40A
OHEVxxx.ZXC	Cartridge	240	100	100 hrs / -	100 hrs / -	100 hrs / -
OHEVxxx.ZXISO	Bolt Down (ISO)	240	110	4 hrs / -	4 hrs / -	-
OHEVxxx.ZXPY	Blade	240	135	100 / 3600	150 / 3600	150 / 3600
OHEVxxx.ZXBD	Bolt Down (Axial)	240	150	10 / 1000	10 / 1000	10 / 1000
OHEVxxx.ZXPCB	PCB Mount	240	200	0.5 / 100	0.5 / 100	0.5 / 100
OHEVxxx.ZXPCBL	PCB Mount (Long)	240	300	0.1 / 15	0.1 / 15	0.1 / 15
			500	0.05 / 1	0.05 / 1	0.05 / 1

### Ratings

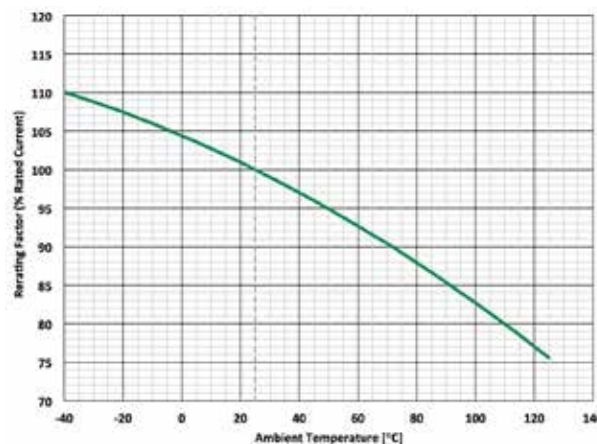
Part Number	Current Rating (A)	Color Code	Typical Voltage Drop at 70% I <sub>R</sub> (mV)	Maximum Voltage Drop Spec at 100% IR (mV)	Typical Cold Resistance (mΩ)	Minimum Melting I <sup>2</sup> t (A <sup>2</sup> s)
OHEV010.xxx	10	Red	114	300	12.8	255
OHEV015.xxx	15	Blue	96	200	7.9	133
OHEV020.xxx	20	Yellow	79	200	5.0	268
OHEV030.xxx	30	Green	67	200	2.7	993
OHEV040.xxx	40	Orange	69	200	2.0	1495

(Average Initial Measurements)

### Time-Current Characteristic Curves



### Temperature Derating Curve



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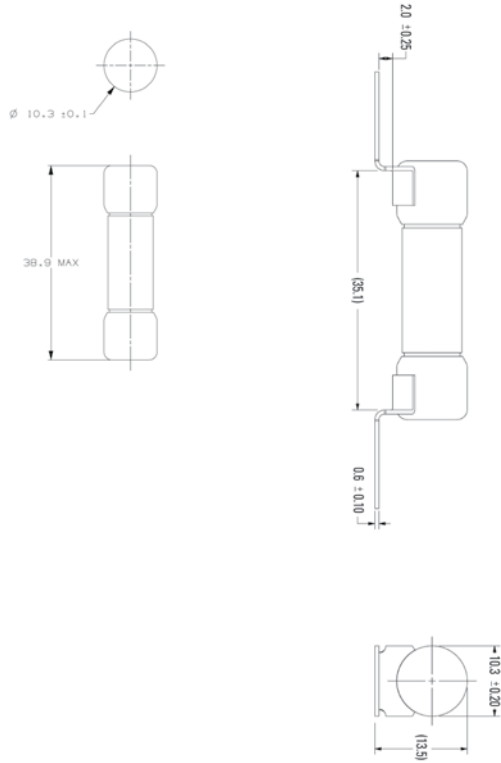


## Low Current HEV Fuse

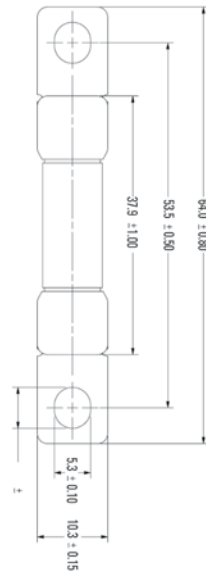
### Dimensions

Dimensions in mm

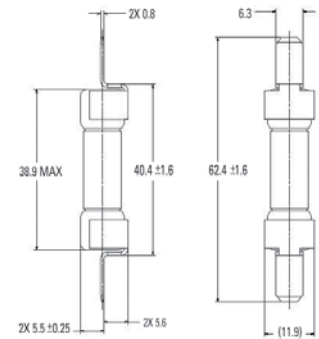
ZXC Cartridge



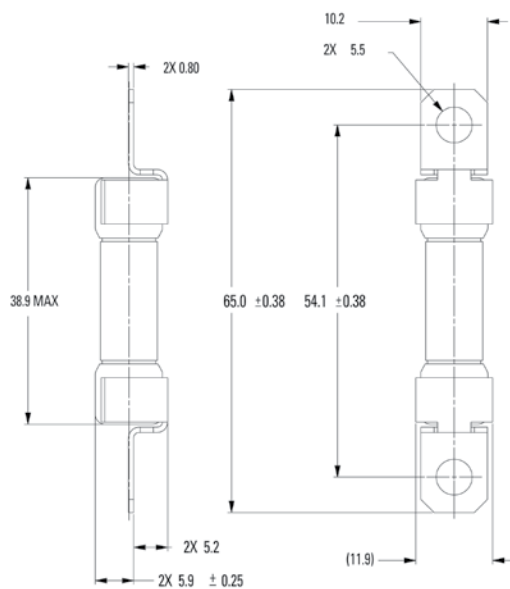
ZXISO Bolt Down (ISO)



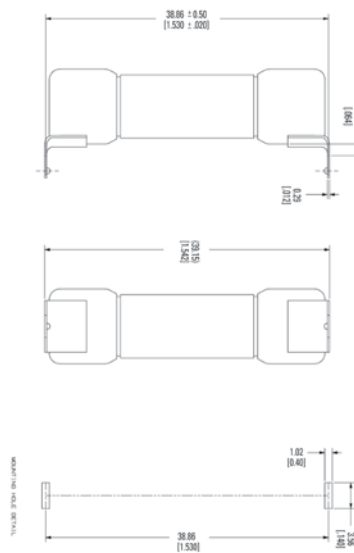
ZXPY Blade



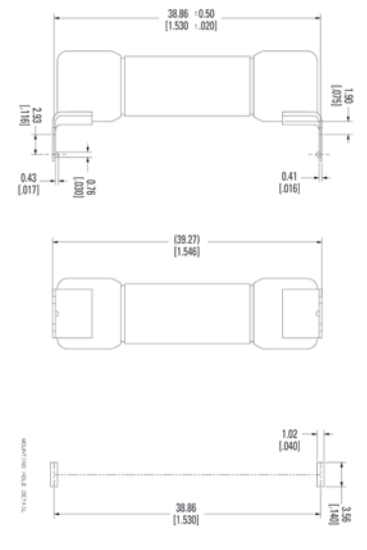
ZXBD Bolt Down (Axial)



ZXPCB PCB Mount



ZXPCBL PCB Mount (Long)



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Low Current  
High Voltage 50A Fuses

## Low Current High Voltage 50A Fuse

The LC HEV fuse is designed for protection of high-voltage accessory circuits in electric and hybrid electric vehicles.

### Specifications

Voltage Rating (50A): 275 VAC  
 Interrupting Rating (50A): 10,000A @ 275 VAC  
 Operating Temperature Range: -40°C to +125°C

### Ordering Information

Part Number	Termination	Package Size
OHEVxxx.ZXC2	Cartridge	240
OHEVxxx.ZXIS02	Bolt Down (ISO)	240
OHEVxxx.ZXP2Y	Blade	240
OHEVxxx.ZXPCB2	PCB Mount	240
OHEVxxx.ZXPCBL2	PCB Mount (Long)	240
OHEVxxx.ZXBD2	Bolt Down (Axial)	240

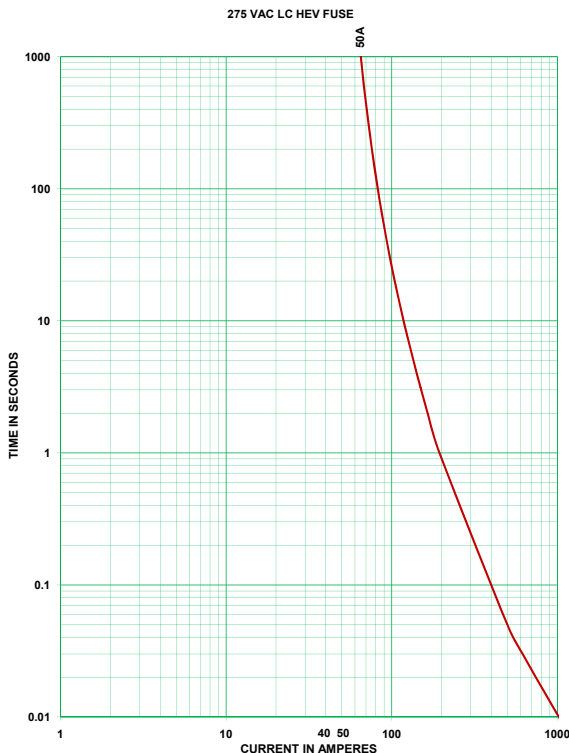
### Time-Current Characteristics

% of Rating	Opening Time Min / Max (s)
100	100 hrs / -
110	4 hrs / -
135	-
150	-
200	0.5 / 100
300	0.1 / 15
500	0.05 / 1

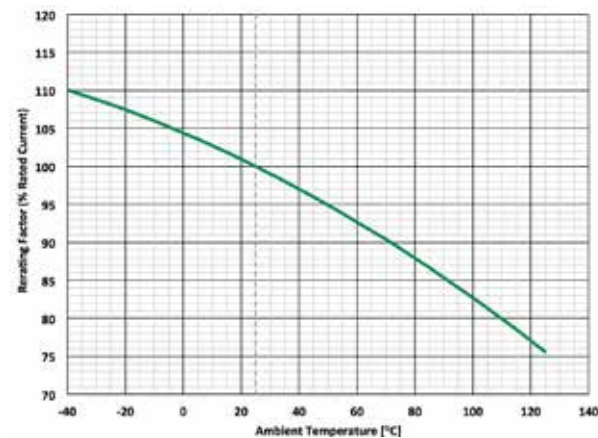
### Ratings

Part Number	Current Rating (A)	Voltage Rating (VAC)	Color Code	Typical Voltage Drop at 70% I <sub>R</sub> (mV)	Maximum Voltage Drop Spec at 100% I <sub>R</sub> (mV)	Typical Cold Resistance (mΩ)	Minimum Melting I <sup>2</sup> t (A <sup>2</sup> s)
OHEV050.XXX	50	275	White	57	200	1.2	1495

### Time-Current Characteristic Curves



### Temperature Derating Curve



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# Specialty Products

Shunts

49



## SHUNTS

### ATO® Shunt



Operating Temp.: -40°C to +125°C  
 Maximum Continuous Load Rating: 35A\*  
 Housing Material: Thermoplastic (UL 94V0 Rated)  
 Terminal Material: Brass Tin Plated

### MINI® Shunt



Operating Temp.: -40°C to +125°C  
 Maximum Continuous Load Rating: 20A\*  
 Housing Material: Thermoplastic (UL 94V0 Rated)  
 Terminal Material: Zinc Silver Plated

### MICRO2® Shunt



Operating Temp.: -40°C to +125°C  
 Maximum Continuous Load Rating: 20A\*  
 Housing Material: PA66  
 Terminal Material: Ag plated zinc alloy

### MICRO3® Shunt



Operating Temp.: -40°C to +125°C  
 Maximum Continuous Load Rating: 15A\*  
 Housing Material: PA66  
 Terminal Material: Ag plated zinc alloy

### JCASE® Shunt



Operating Temp.: -40°C to +125°C  
 Maximum Continuous Load Rating: 50A\*  
 Housing Material: PA66  
 Terminal Material: Copper

### MCASE+® Shunt



Operating Temp.: -40°C to +125°C  
 Maximum Continuous Load Rating Unslotted: 30A\*  
 Maximum Continuous Load Rating Slotted: 50A\*  
 Housing Material: PPA (33% / 35% GF)  
 Terminal Material: Copper

Part Number	Type	Max Continuous Load Rating* (A)	Housing Material	Terminal Material	Part Quantity
02400094P	ATO	35	Thermoplastic (UL 94V0)	Brass Tin Plated	2000
0297900.WXNV	MINI	20	Thermoplastic (UL 94V0)	Zinc Silver Plated	3000
0327900.YX2S	MICRO2	20	PA66	Zinc Silver Plated	4000
0337900.PX2S	MICRO3	15	PA66	Zinc Silver Plated	2000
0495900_	JCASE	50	PA66	Copper	Z=2200 pcs/X=1 pc
0695900.PXP	MCASE+ Unslotted	30	PPA (33%/35% GF)	Copper	2000
0695900.PXPS	MCASE+ Slotted	50	PPA (33%/35% GF)	Copper	2000

\*Rating varies based on mating terminal performance

## 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®, JCASE®, and MIDI® Fuses, and 2000A @ 32 volts DC for the MEGA® 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 9 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 50 seconds.

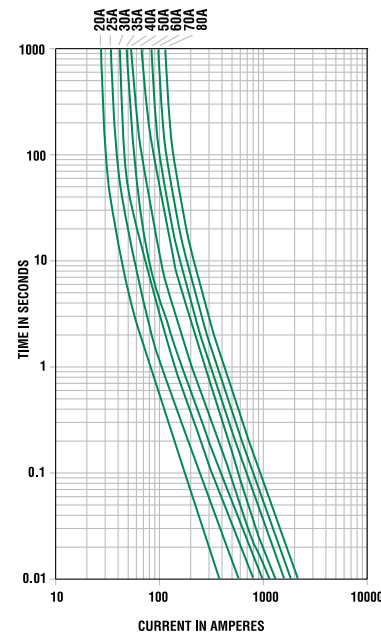


Figure 1: Average Melting-Current Curve for the MAXI Fuse Series (20-60A)

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

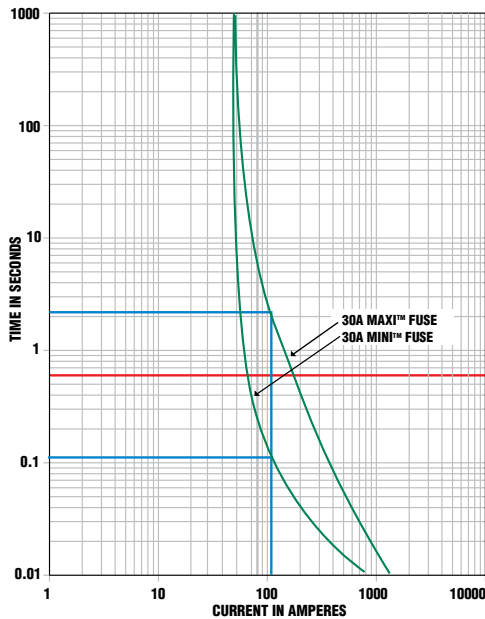


Figure 2: Average Melting-Current Curve Comparing 30A MINI Fuse to 30A MAXI Fuse

## 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 & 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:

$$\begin{aligned} \text{Ideal fuse rating} &= \frac{\text{Normal operating current}}{\text{Temp rerating factor} \times 0.75} \\ &= \frac{15\text{A}}{0.88 \times 0.75} \\ &= 22.73\text{A} \end{aligned}$$

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

## E. Transient Overcurrent Considerations

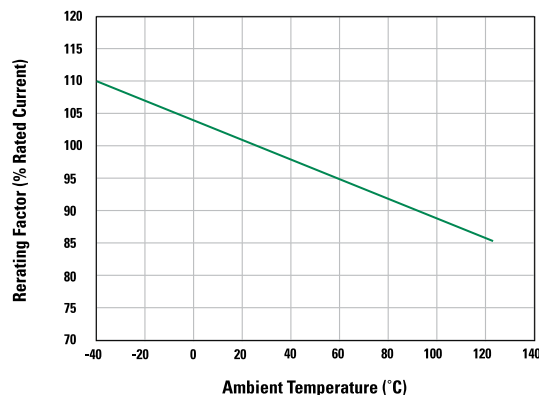


Figure 3: MINI Auto Fuse 297 Series Temperature Rerating Curve

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

## 1. I<sup>2</sup>t

I<sup>2</sup>t 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<sup>2</sup>t. The units for I<sup>2</sup>t are expressed in ampere-squared-seconds [A<sup>2</sup>s].

**Melting I<sup>2</sup>t:** the thermal energy required to melt a specific fuse element.

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

**Total Clearing I<sup>2</sup>t:** the thermal energy through the fuse from overcurrent inception until current is completely interrupted. Total clearing I<sup>2</sup>t = (melting I<sup>2</sup>t) + (arcing I<sup>2</sup>t).

I<sup>2</sup>t has two important applications to fuse selection. The first is pulse cycle withstand capability and the second is selective coordination.

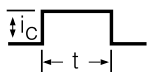
## 2. Pulse Cycle Withstand Capability

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<sup>2</sup>t value that can be withstood by the fuse without opening, assuming that there is sufficient cool down time between pulses.

### WAVESHAPES      FUNCTION AND VALUE

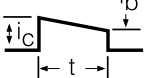
Square



$$i = k$$

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

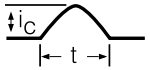
Trapezoidal



$$i = i_c \pm kt$$

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

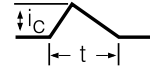
Sine



$$i = i_c \sin t$$

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

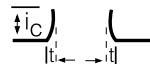
Triangular



$$i = \pm kt$$

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

Second order power



$$i = kt^2$$

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

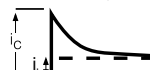
Natural decay to zero



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

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

Natural decay to non-zero value



$$I^2t = i_b^2 t - 2\tau i_b (i_c - i_b) (e^{-t/\tau} - 1) - \tau/2 (i_c - i_b)^2 (e^{-2t/\tau} - 1)$$

Figure 4: Evaluating the I<sup>2</sup>t of a Variety of Current Wave Shapes

Figure 4 shows how I<sup>2</sup>t 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, application testing is recommended to establish the ability of the fuse design to withstand the pulse condition.

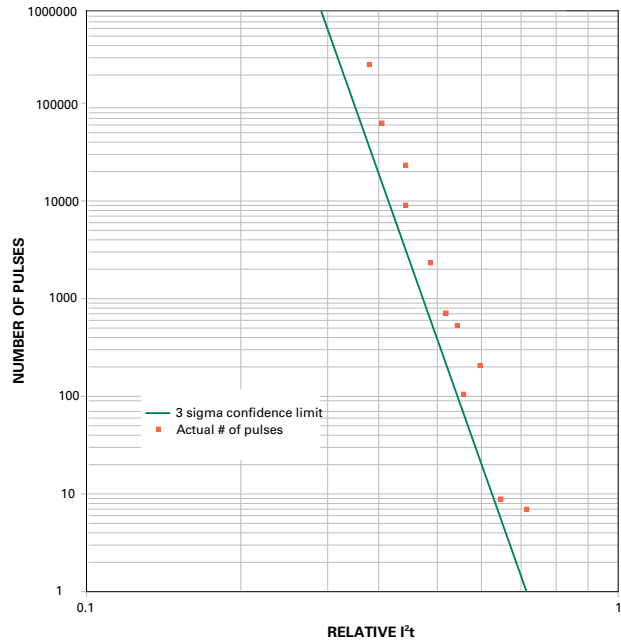


Figure 5: Pulse Cycle Withstand Capability for Blade Fuses

## 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<sup>2</sup>t of the supply side fuse (fuse #2) must be greater than the total clearing I<sup>2</sup>t of the load side fuse (fuse #1). This condition results in the load side fuse opening before the supply side fuse begins to melt. Minimum melting and total clearing I<sup>2</sup>t data are given in this catalog.

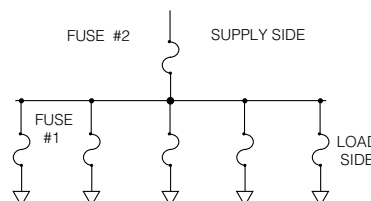


Figure 6: Selective Coordination for Fuses in Series



## 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 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  $V_{1-3}$ .

Type	Maximum Recommended Voltage Drop Per Terminal [MV] (between points 1-3 or 2-4)
ATO® FUSE	30
MINI® FUSE	30
MAXI® FUSE	30
MEGA® FUSE	15

Table 1: Maximum Recommended Voltage Drop per Terminal

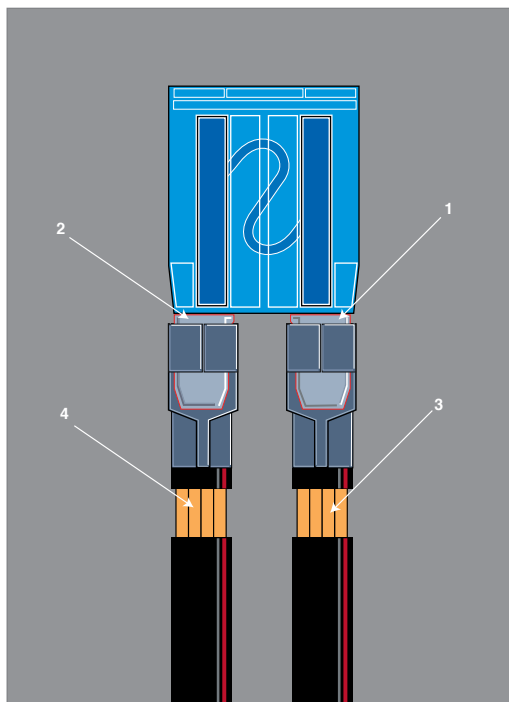


Figure 7: Measurement Locations along the Fuse/Terminal/Cable System Used to Determine the Voltage Drop across the Terminal

## V. 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.

## VI. 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>	Gage 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.





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As the world's #1 brand in circuit protection Littelfuse offers the broadest and deepest portfolio of circuit protection products and a global network of technical support, backed by more than 85 years of application design expertise. For all of your circuit protection needs visit our Technical Resources center at [www.littelfuse.com/technical-resources](http://www.littelfuse.com/technical-resources)

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Littelfuse is the world leader in circuit protection. We offer an extensive selection of circuit protection technologies for Automotive applications. Littelfuse circuit protection expert staff can assist you in designing circuit protection for your most demanding applications. Solutions for over-current applications as well as over-voltage applications are available from Littelfuse.

**Low Current Distribution (LCD)** MICRO2, MICRO3, LP MINI, MINI, ATOF, MAXI, MCASE, LP JCASE, JCASE

**High Current Distribution (HCD)** ZCASE MASTERFUSE, MASTERFUSE, ZCASE MEGA, MIDI, BF1, MEGA, CF

**High Voltage Fuses (HEV)** OHEV

**Battery Cable Protection (BCP)** CABLE PRO and BF-Inline products for mounting directly inline as part of a high-power cable assembly

For more information, please contact your authorized Littelfuse product representative or visit our website at [www.littelfuse.com](http://www.littelfuse.com)