Littelfuse®

Expertise Applied | Answers Delivered



CIRCUIT PROTECTION SOLUTIONS FOR AUTOMOTIVE APPLICATIONS





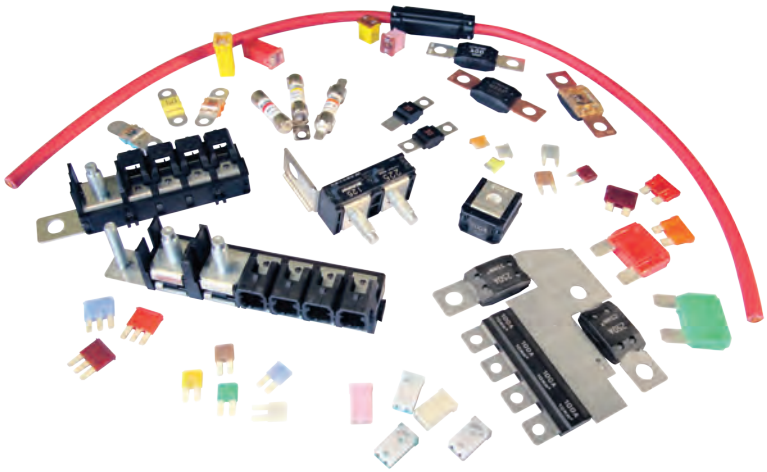
Automotive

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

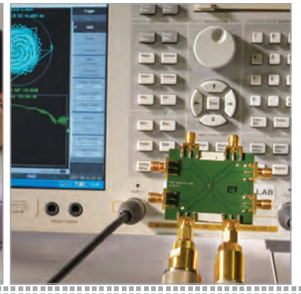
SERVICES

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

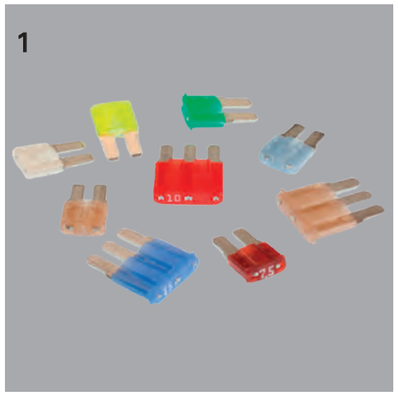
4. ZCase Masterfuse
Smallest high current distribution product in the industry

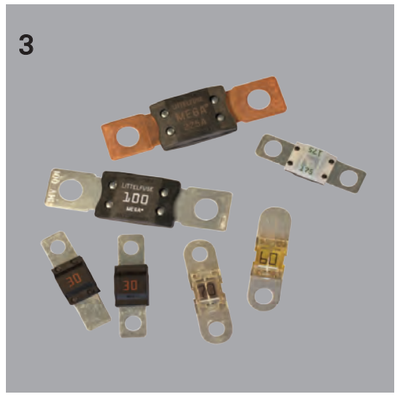
5. Masterfuse
High current distribution array

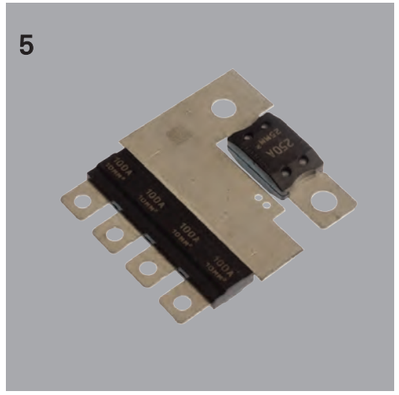
6. ZCase Single MEGA
Minimal Footprint Bolt Down fuse

7. High Voltage Fuses
Low-current fuses for Electric and Hybrid Electric Vehicles

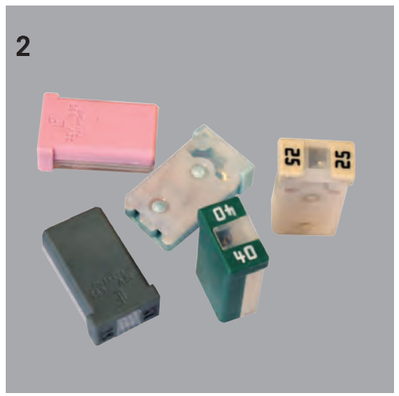
8. Battery Cable Protection
CABLE PRO® protectors for mounting directly inline as part of a high power cable assembly











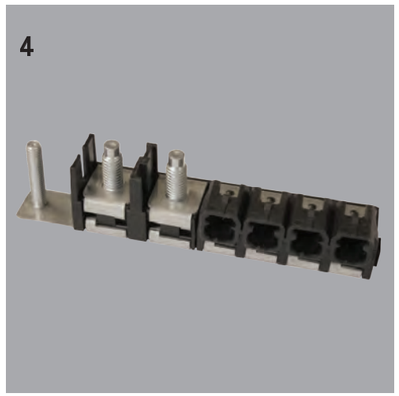






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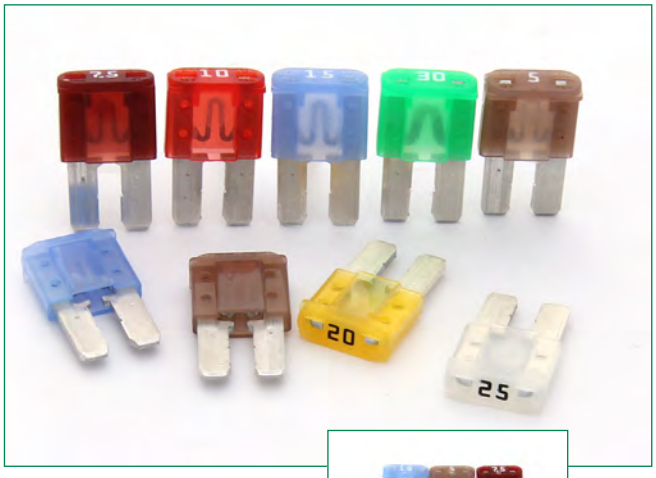
Blade Fuses



MICRO2™ Blade Fuse 32V	2
MICRO3™ Blade Fuse 32V	4
Low Profile MINI® Fuses Rated 58V	6
MINI® Blade Fuse Rated 32V	8
MINI® Blade Fuse Rated 58V	10
ATOF® Blade Fuse Rated 32V	12
MAXI® Blade Fuse Rated 32V	14
MAXI® Blade Fuse Rated 58V	16
Copper Blade Fuses	18

MICRO2™ BLADE FUSE 32V

RoHS



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



Also available: MICRO2 Sn Fuse (tin plated)

Specifications

Voltage Rating:	32 VDC
Interrupting Ratings:	1000A @ 32 VDC
Operating Temperature Range:	-40°C to +125°C
Terminals:	Ag plated zinc alloy
Housing Material:	PA66

Ordering Information

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

Description

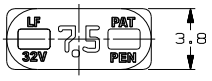
The MICRO2™ Fuse is the new standard for vehicle circuit protection. Its sub-miniature design meets the need for more circuits to be protected while utilizing less space and its ability to cope with high temperatures in adverse environments makes the MICRO2™ Fuse of recommended choice for protection.

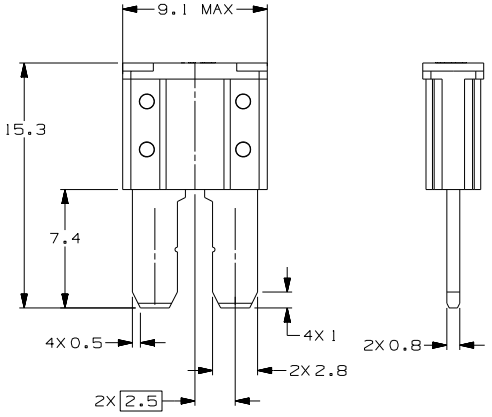
Time-Current Characteristics

% 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

Dimensions

Dimensions in mm





Ratings

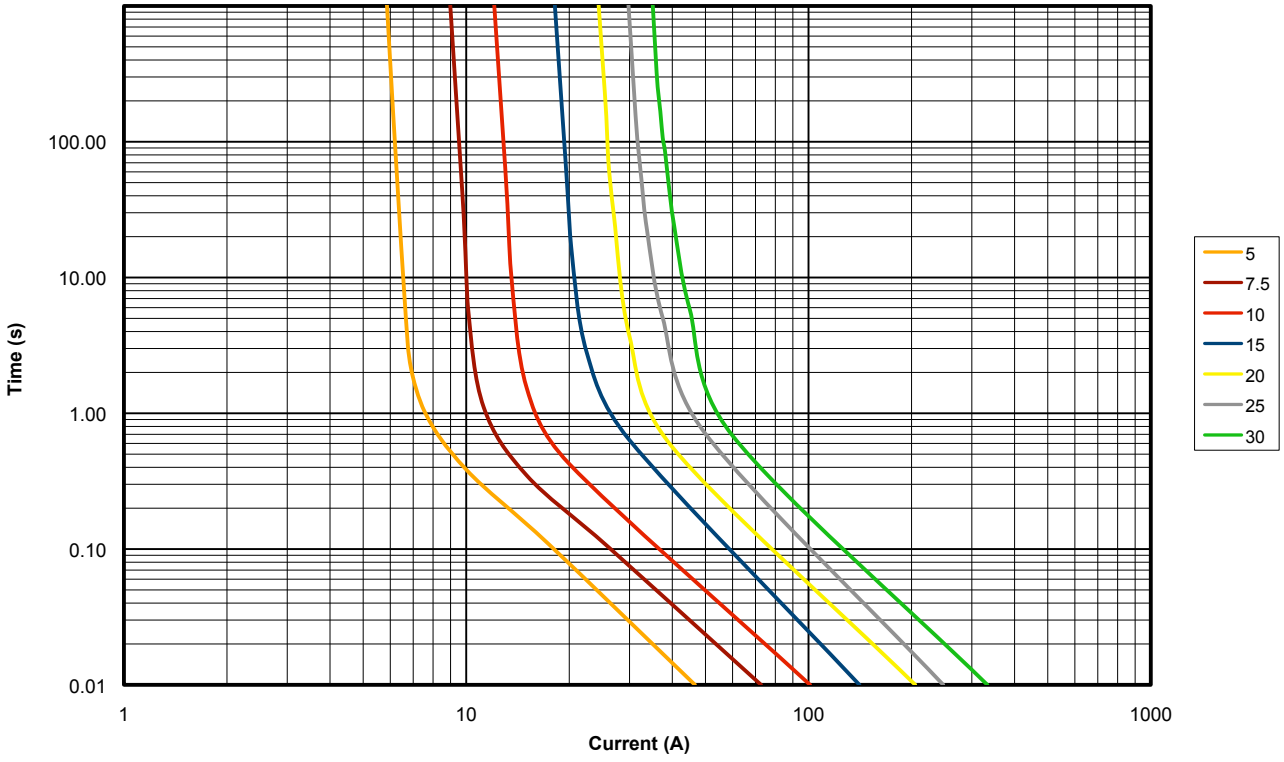
Part Number	Current Rating (A)	Housing Material Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I^2t (A^2s)
0327005._	5		116	17.4	17
032707.5_	7.5		106	10.8	47
0327010._	10		102	7.7	89
0327015._	15		94	4.9	189
0327020._	20		91	3.5	397
0327025._	25		90	2.6	585
0327030._	30		88	2.1	1028

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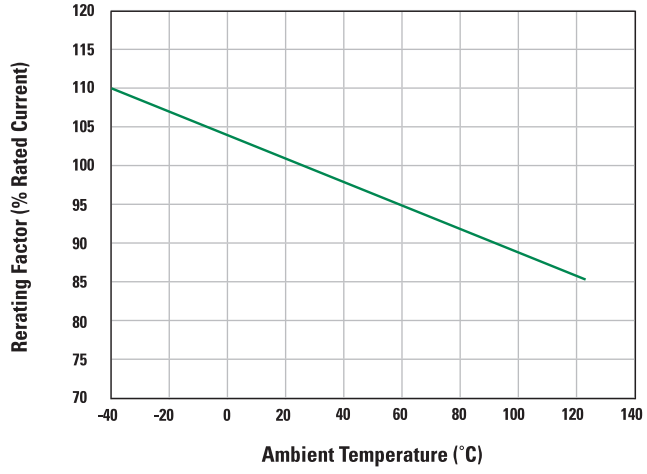
MICRO2™ BLADE FUSE 32V

RoHS

Time-Current Characteristic Curves

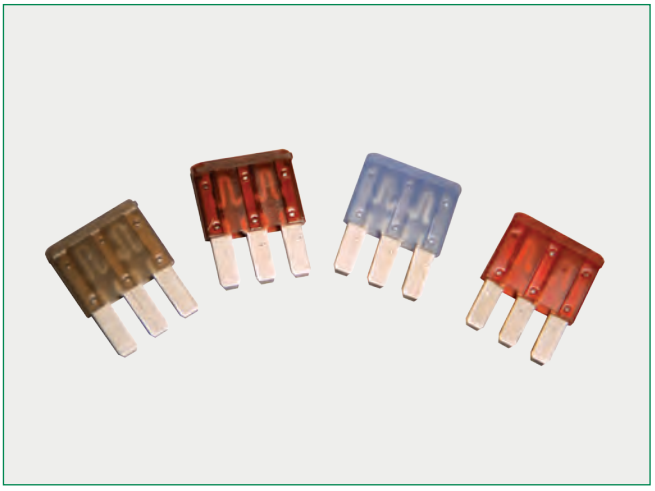


Temperature Rerating Curve



MICRO3™ BLADE FUSE 32V

RoHS



Description

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

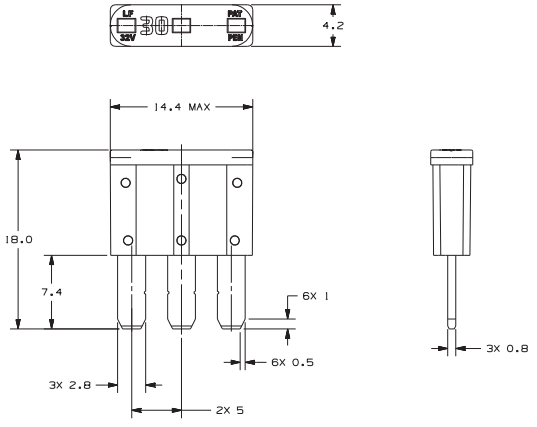
Voltage Rating:	32 VDC
Interrupting Ratings:	1000A @ 32 VDC
Operating Temperature Range:	-40˚C to +125˚C
Terminals:	Ag plated zinc alloy
Housing Material:	PA66

Ordering Information

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

Dimensions

Dimensions in mm



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

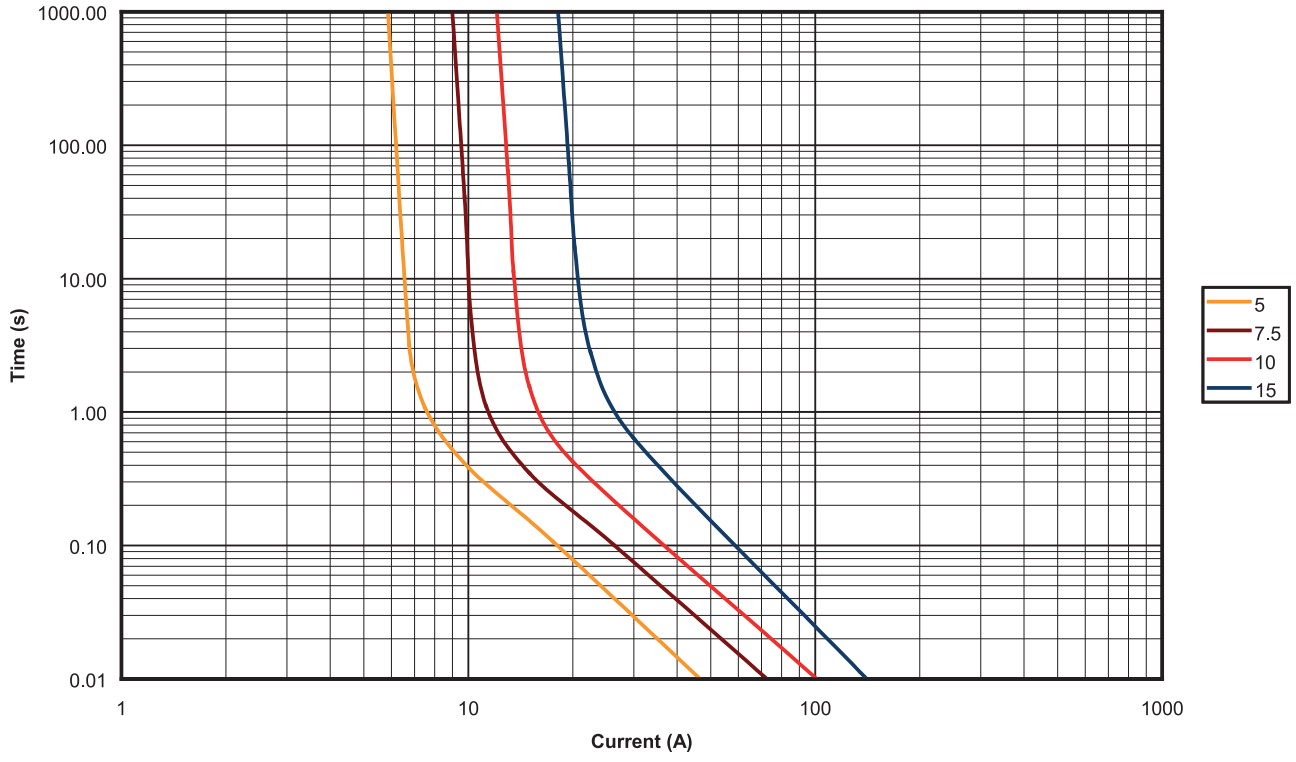
Part Number	Current Rating (A)	Housing Material Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I^2t (A^2s)
0337005._	5		116	17.4	17
033707.5_	7.5		106	10.8	47
0337010._	10		102	7.8	89
0337015._	15		94	4.9	189

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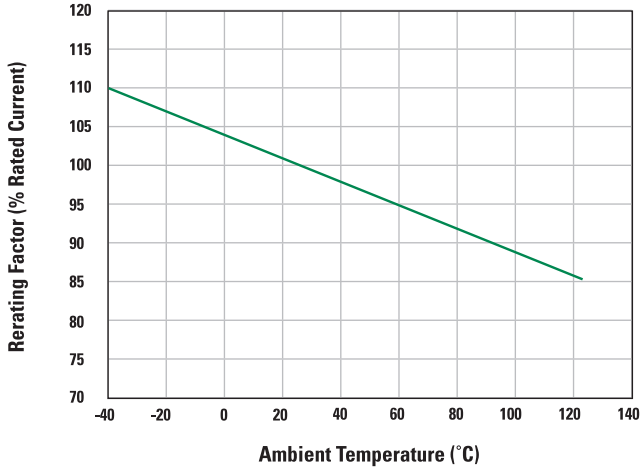
MICRO3™ BLADE FUSE 32V

RoHS

Time-Current Characteristic Curves



Temperature Rerating Curve



LOW PROFILE MINI® 10.0MM FUSES RATED 58V

RoHS





Also available:

Low Profile MINI® 10.9mm

Specifications

Voltage Rating:	58 VDC
Interrupting Rating:	1000A @ 58 VDC
Operating Temperature Range:	-40°C to +125°C
Terminals:	Ag plated zinc
Housing Material:	PA66

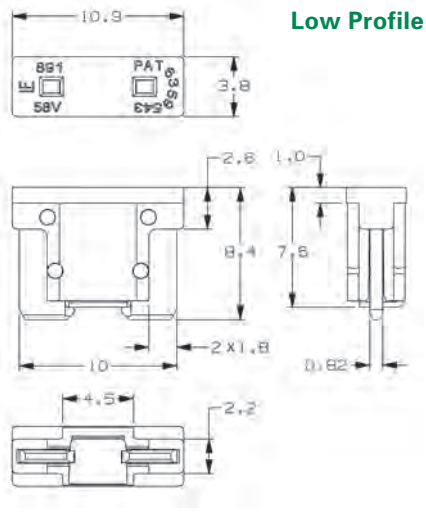
Ordering Information

Part Number	Package Size	Plating
Low Profile MINI® 10.0mm		
0891xxx.NXS	5000	Ag
0891xxx.U	500	Ag
0891xxx.H	100	Ag
Low Profile MINI® 10.9mm		
0891xxx.NXWS	5000	Ag

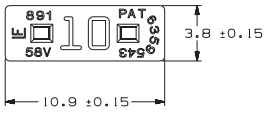
Dimensions

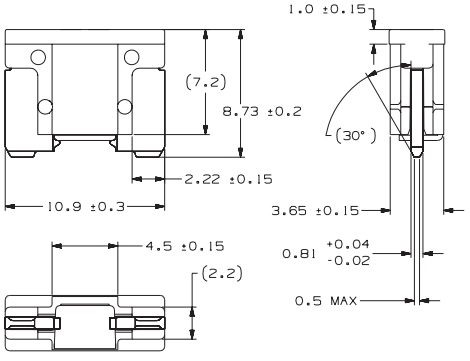
Dimensions in mm

Low Profile MINI®



Low Profile MINI® 10.9mm





Description

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.

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

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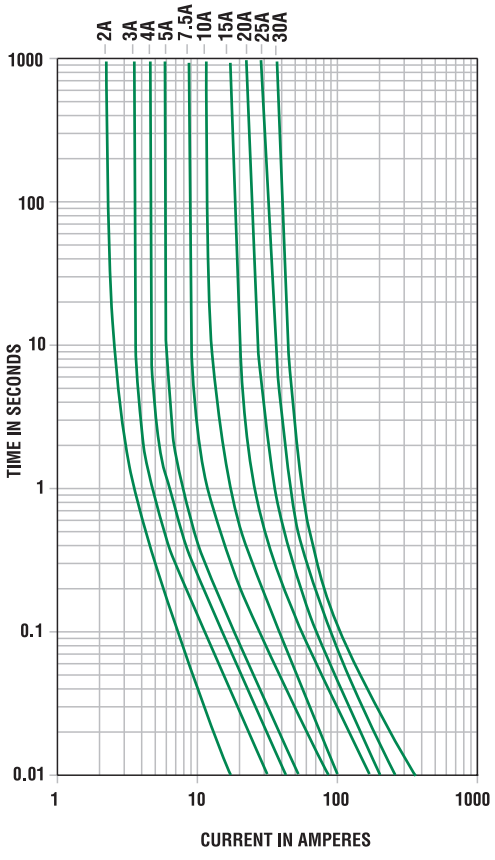
LOW PROFILE MINI® 10.0MM FUSES RATED 58V

RoHS

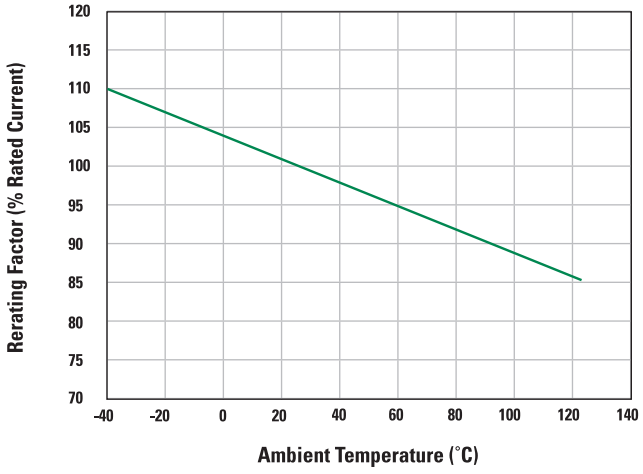
Ratings

Part Number	Current Rating (A)	Housing Material Color	Cold Resistance (mΩ)	I²t (A²s)
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

Time-Current Characteristic Curves



Temperature Rerating Curve



MINI® BLADE FUSE RATED 32V



Also available:

MINI® Sn Fuse (tin plated)

Specifications

Interrupting Rating:	1000A @ 32 VDC
Voltage Rating:	32 VDC
Operating Temperature Range:	-40°C to +125°C (Sn=-40°C to +105°C)
Terminals:	Ag plated zinc alloy
Housing Material:	PA66
Complies with:	Meets SAE J2077 ISO 8820-3 UL 248 Special Purpose Fuses (Sn Fuse not UL recognized)

Ordering Information

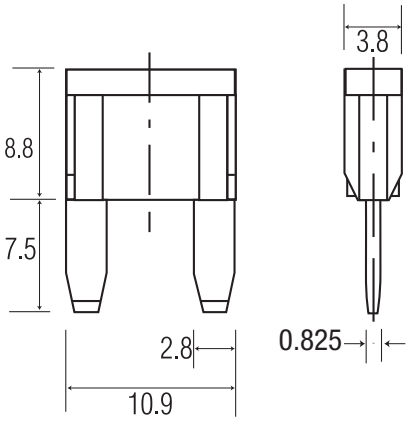
Part Number	Package Size
0297xxx.WXNV	3000
0297xxx.U	500
0297xxx.H	100
0297xxx.L	50
MINI® Sn Fuse	
0297xxx.WXT	3000

Description

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.

Dimensions

Dimensions in mm



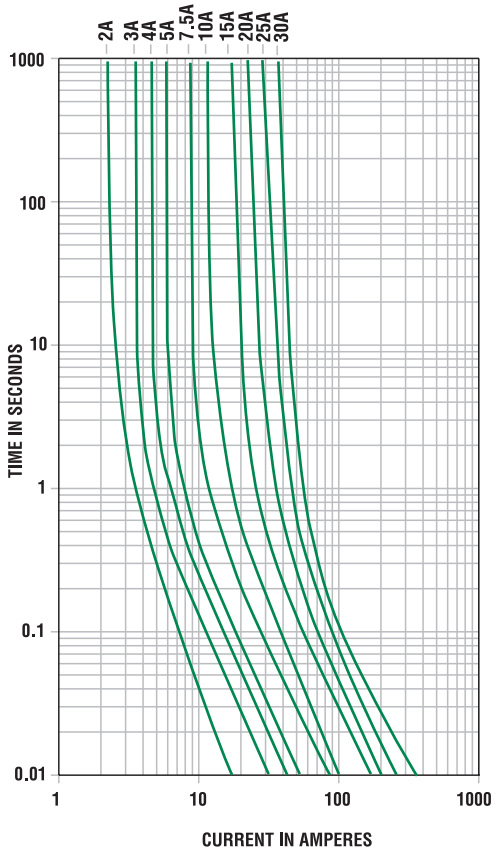
Time-Current Characteristics

% 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

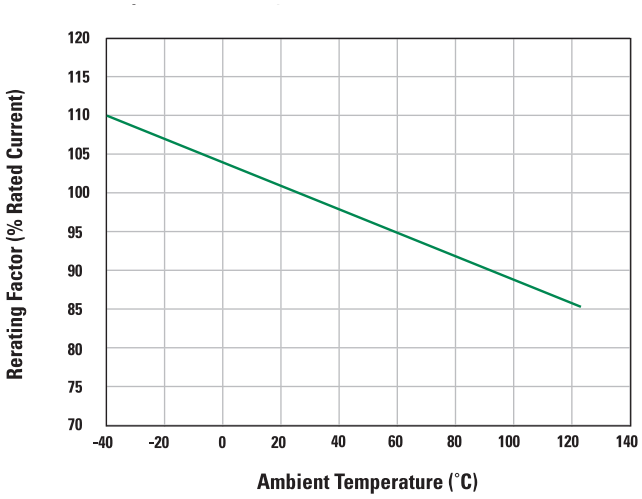
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MINI® BLADE FUSE RATED 32V

Time-Current Characteristic Curves



Temperature Rerating Curve



Ratings

Part Number	Current Rating (A)	Housing Material Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I²t (A²s)
0297002._	2		171	55.60	2.8
0297003._	3		153	33.75	9.4
0297004._	4		121	23.48	17
0297005._	5		129	17.75	25
029707.5_	7.5		135	10.85	68
0297010._	10		108	7.42	93
0297015._	15		98	4.58	270
0297020._	20		96	3.21	380
0297025._	25		86	2.36	625
0297030._	30		87	1.85	1130

MINI® BLADE FUSE RATED 58V

RoHS



Specifications

Interrupting Rating:	1000A @ 58 VDC
Voltage Rating:	58 VDC
Operating Temperature Range:	-40°C to +125°C
Terminals:	Ag plated zinc alloy
Housing Materials:	PA66
Complies with:	Meets SAE J2077 ISO 8820 UL 248 Special Purpose Fuses

Ordering Information

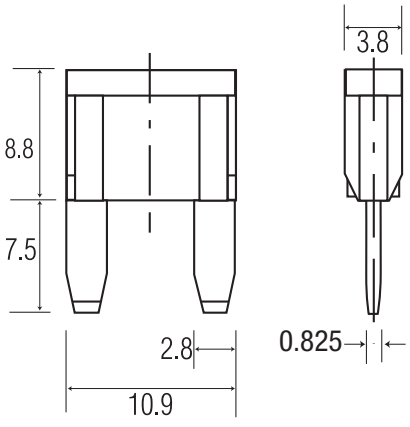
Part Number	Package Size
0997xxx.WXN	3000

Description

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.

Dimensions

Dimensions in mm



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

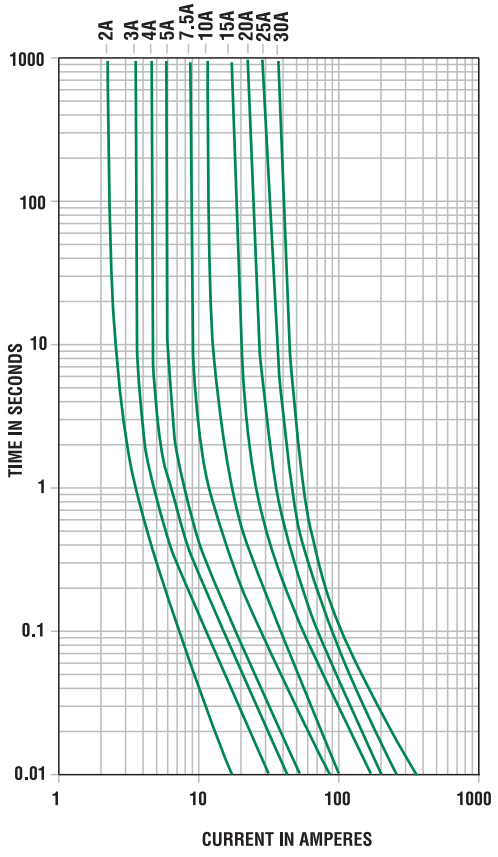
Part Number	Current Rating (A)	Housing Material Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I²t (A²s)
0997002_	2		171	55.60	2.8
0997003_	3		153	33.75	9.4
0997004_	4		121	23.48	17
0997005_	5		129	17.75	25
099707.5_	7.5		135	10.85	68
0997010_	10		108	7.42	93
0997015_	15		98	4.58	270
0997020_	20		96	3.21	380
0997025_	25		86	2.36	625
0997030_	30		87	1.85	1130

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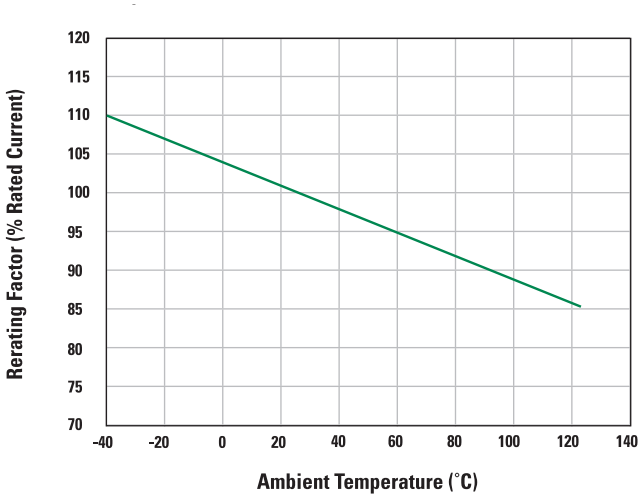
MINI® BLADE FUSE RATED 58V

RoHS

Time-Current Characteristic Curves



Temperature Rerating Curve



ATOF® BLADE FUSE RATED 32V



Also available:

ATO® Ag Fuse (silver plated)

Specifications

Voltage Rating:	32 VDC
Interrupting Rating:	1000A @ 32 VDC
Operating Temperature Range:	-40˚C to +105˚C (Ag=-40˚C to +125˚C)
Terminals:	Sn plated zinc alloy
Housing Material:	PA66
Complies with:	ISO 8820-3
UL Listed:	File AU1410
CSA Certified:	File No. 29862

Ordering Information

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

Description

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.

Ratings

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

Corresponding holder see Section “Fuse Holders.”

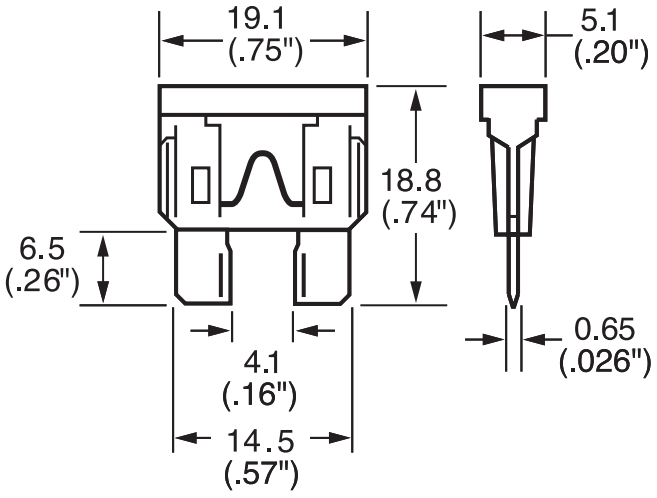
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ATOF® BLADE FUSE RATED 32V

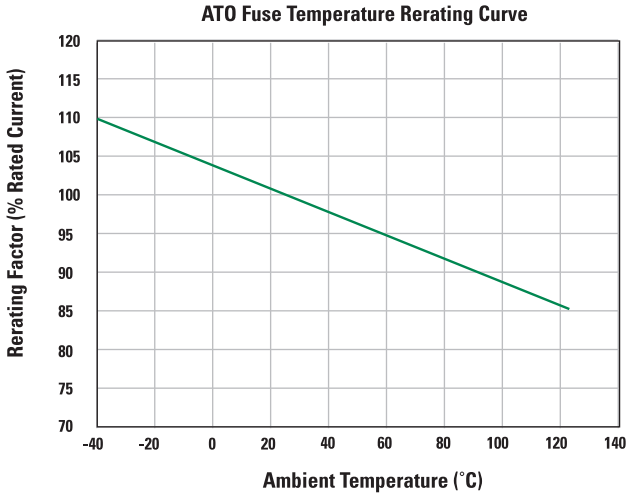
UL RoHS

Dimensions

Dimensions in mm



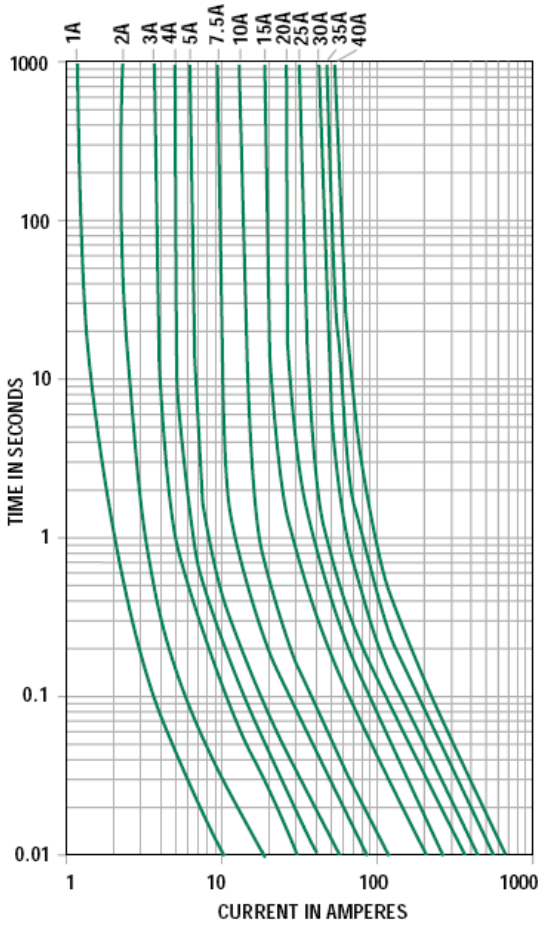
Temperature Rerating Curve



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

Time-Current Characteristic Curves



MAXI® BLADE FUSE RATED 32V





Also available:

MAXI Sn Fuse (tin plated)

Specifications

Voltage Rating:	32 VDC
Interrupting Ratings:	1000A @ 32 VDC
Operating Temperature Range:	-40°C to +125°C (Sn=-40°C to +105°C)
Terminals:	Ag plated zinc alloy
Housing Material:	PA66
Complies with:	SAE J 1888 ISO 8820-3:2002(E) (Sn Fuse not UL recognized)

Ordering Information

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

Description

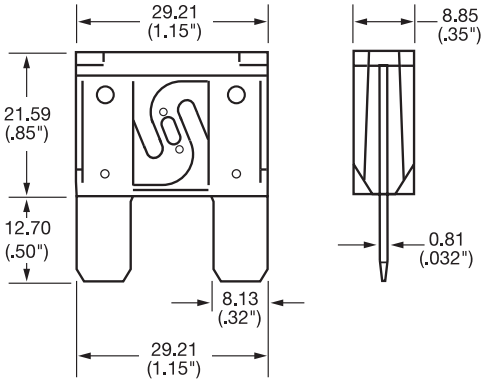
The MAXI® fuse uses "Diffusion Pill Technology" to provide predictable time delay characteristics and low heat dissipation.

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

Dimensions

Dimensions in mm



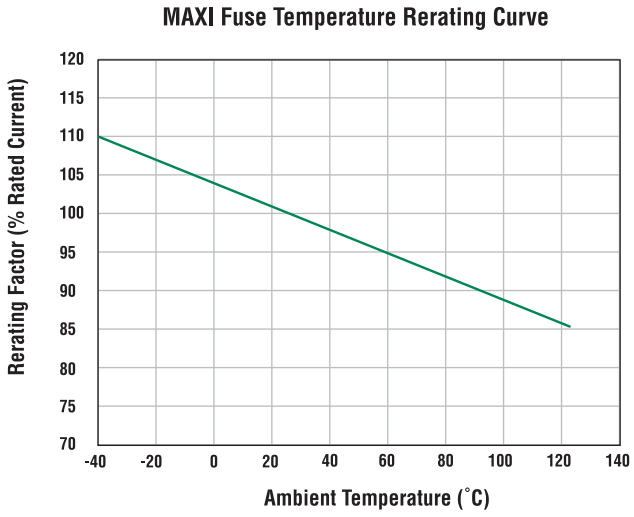
Corresponding holder see Section "Fuse Holders."

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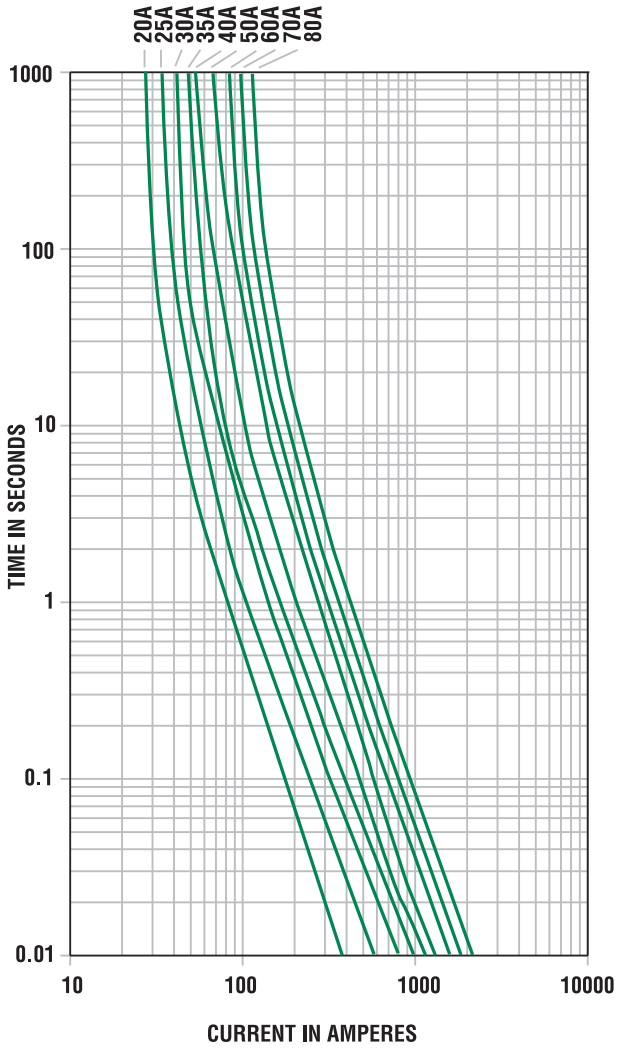
MAXI® BLADE FUSE RATED 32V

RoHS

Temperature Rerating Curve



Time-Current Characteristic Curves



Ratings

Part Number	Current Rating (A)	Housing Material Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I²t (A²s)
0299020._	20		76	3.10	1100
0299025._	25		75	2.39	2087
0299030._	30		77	1.95	4070
0299035._	35		75	1.71	6032
0299040._	40		75	1.42	8450
0299050._	50		73	1.10	11300
0299060._	60		77	0.89	15300
0299070._	70		61	0.64	21200
0299080._	80		62	0.54	43600

MAXI® BLADE FUSE RATED 58V

RoHS



Specifications

Voltage Rating:	58 VDC
Interrupting Ratings:	1000A @ 58 VDC
Operating Temperature Range:	-40˚C to +125˚C
Terminals:	Ag plated zinc alloy
Housing Material:	PA66
Complies with:	SAE J 1888 ISO 8820-3:2002(E)

Ordering Information

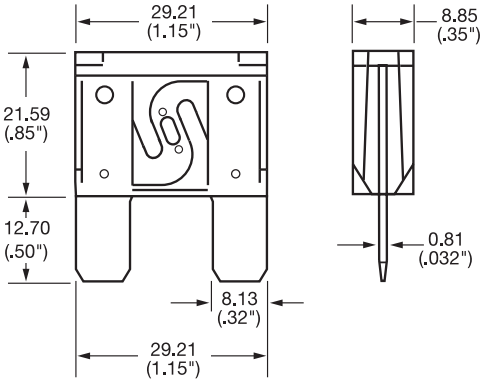
Part Number	Package Size
0999xxx.ZXN	1200

Description

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.

Dimensions

Dimensions in mm



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)	I²t (A²s)
0999020._	20		76	3.10	1100
0999025._	25		75	2.39	2087
0999030._	30		77	1.95	4070
0999035._	35		75	1.71	6032
0999040._	40		75	1.42	8450
0999050._	50		73	1.10	11300
0999060._	60		77	0.89	15300
0999070._	70		61	0.64	21200
0999080._	80		62	0.54	43600

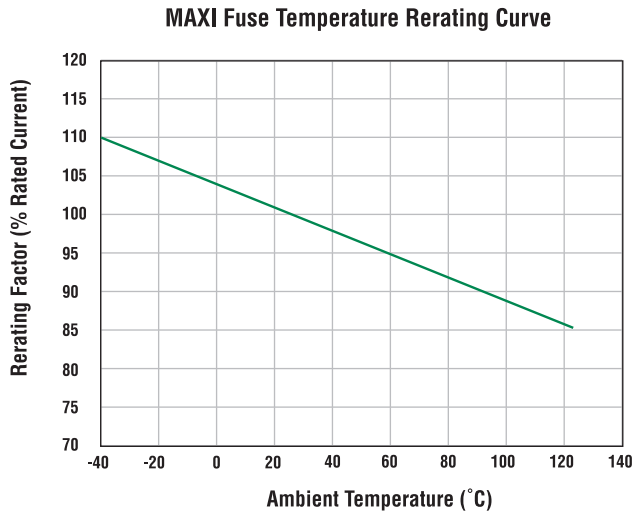
Corresponding holder see Section "Fuse Holders."

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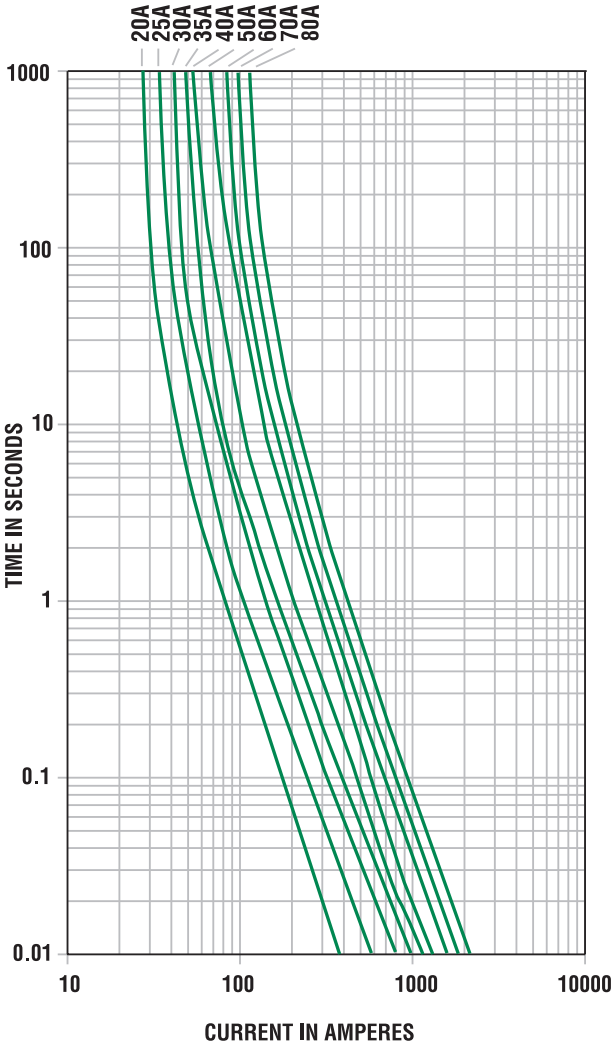
MAXI® BLADE FUSE RATED 58V

RoHS

Temperature Rerating Curve



Time-Current Characteristic Curves



COPPER BLADE FUSES



FK1 32V

FK1 32V MINI® style Fast-Acting Automotive Copper Blade Fuse

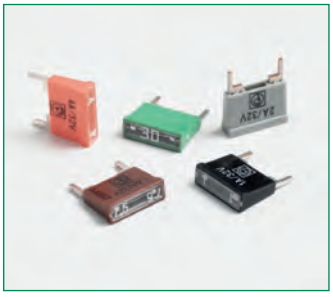
Amps (A):1- 2, 3, 4, 5, 7.5, 10, 15, 20, 25, 30



FUN

MINI® 125V Automotive Copper Blade Fuse

Amps (A): 3, 4, 5, 7.5, 10, 15



FP1

MINI® 32V Fast - Acting Automotive Blade Fuse for P.C. Mounting

Amps (A): 1-2, 3, 4, 5, 7.5, 10, 15, 20, 25, 30



FKS

ATO® 32V Fast-Acting Automotive Copper Blade Fuse

Amps (A): 1-4, 5, 7.5, 10, 15, 20, 25, 30, 35, 40



TAC

ATO® 58V Fast-Acting Automotive Copper Blade Fuse

Amps (A): 1-3, 4, 5, 7.5, 10, 15, 20, 25, 30, 40



FKS 80V

ATO® 80V Automotive Copper Blade Fuse

Amps (A): 3, 4, 5, 7.5, 10, 15, 20, 25, 30



TF

ATO® 90V Automotive Copper Blade Fuse

Amps (A): 4, 8, 10, 15



FK3

MAXI® Slo-Blo® 32V Automotive Copper Blade Fuse

Amps (A): 15, 20, 25, 30, 35, 40, 50, 60, 70, 80



TOE

MAXI® style 58V Slo-Blo® Automotive Copper Blade Fuse

Amps (A): 20, 30, 40, 50, 60, 70



FK3 80V

MAXI™ 80V Automotive Copper Blade Fuse

Amps (A): 20, 30, 40, 50

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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.

RoHS

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 for further information.

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Cartridge Fuses



MCASE™ Cartridge Fuses Rated 32V	20
MCASE+ Cartridge Fuses Rated 32V	22
Low Profile JCASE® Fuse Rated 58V	24
JCASE® Fuse Rated 32V	26

MCASE™ CARTRIDGE FUSES RATED 32V

RoHS



Specifications

Voltage Rating:	32 VDC
Interrupting Ratings:	1000A @ 32 VDC
Operating Temperature Range:	-40˚C to +125˚C
Insertion Force:	44.1N Max. (9.9 lb.) Single Terminal
Extraction Force:	4N Min. (0.9 lb). I 24.5N Max. (5.5 lb)

Ordering Information

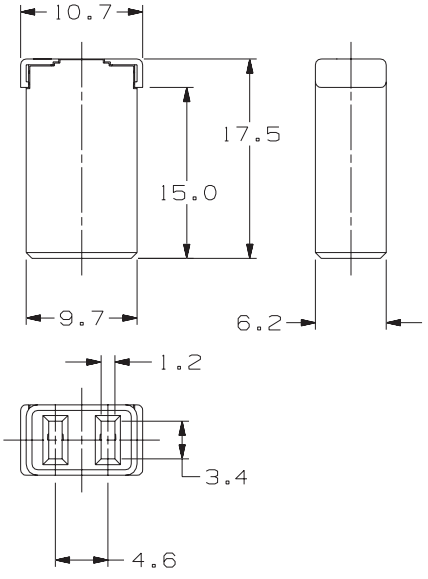
Part Number	Package Size
0695xxx.PX4	2000
0695xxx.L	50

Description

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 inrush currents.

Dimensions

Dimensions in mm



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

Ratings

Part Number	Current Rating (A)	Housing Material Color	I^2t (A^2s)
0695015._	15		160
0695020._	20		530
0695025._	25		1140
0695030._	30		970
0695040._	40		2950

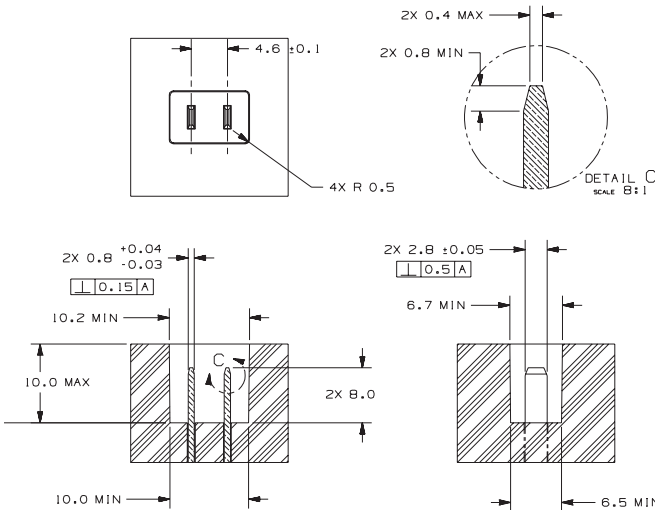
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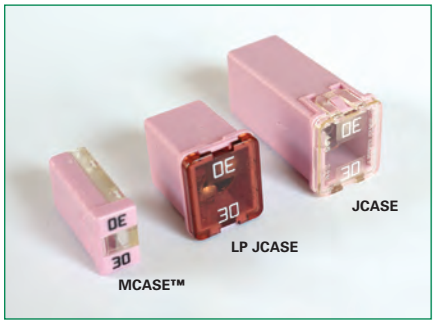
MCASE™ CARTRIDGE FUSES RATED 32V

RoHS

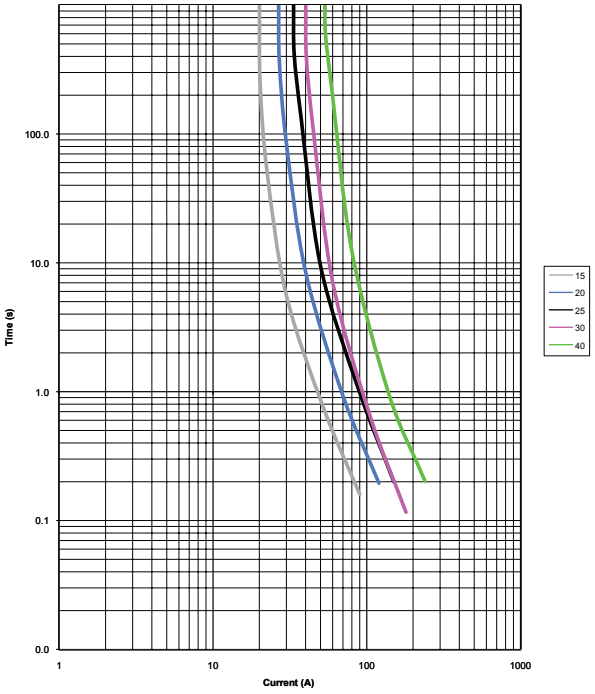
Dimensions

Dimensions in mm

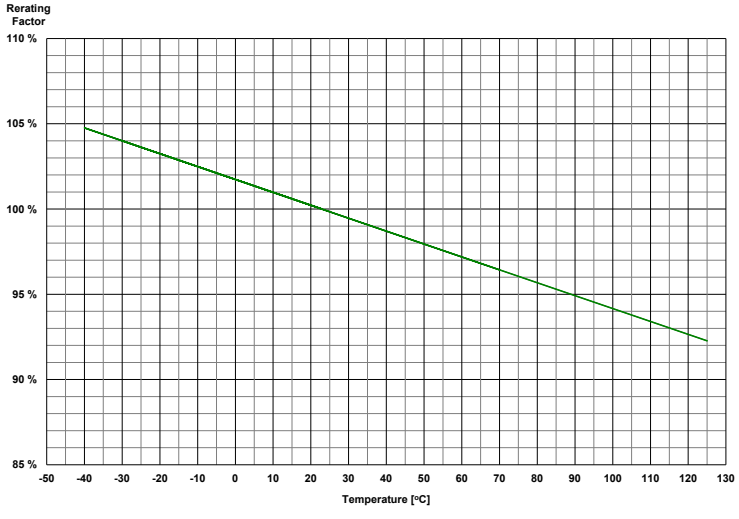




Time-Current Characteristics Curve

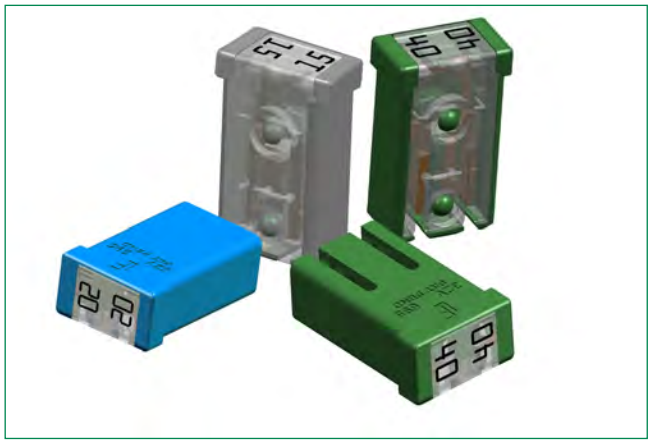


Temperature Rerating Curve



MCASE+™ CARTRIDGE FUSES RATED 32V

RoHS



Specifications

Voltage Rating:	32 VDC
Interrupting Ratings:	1000A @ 32 VDC
Operating Temperature Range:	-40˚C to +125˚C
Fuse Insertion Force:	50N (11.2lbf) Typical
Extraction Force:	4N Min. (0.9 lb). I 24.5N Max. (5.5 lb)

Ordering Information

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

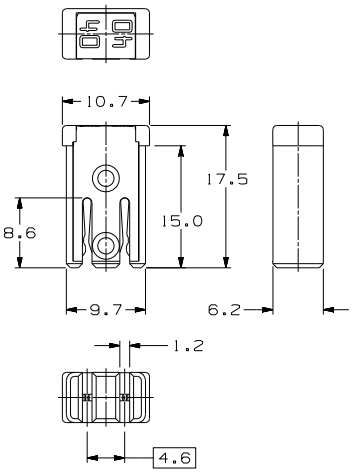
Description

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.

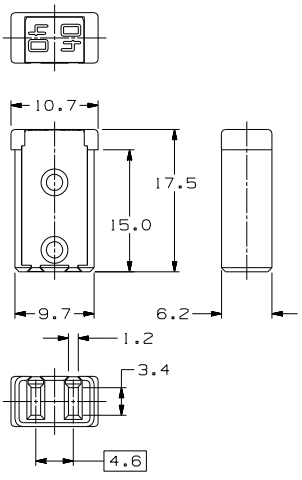
Dimensions

Dimensions in mm

Slotted



Unslotted



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	I^2t (A^2s)
0695015.PXP	Unslotted	15		310
0695020.PXP	Unslotted	20		750
0695025.PXP	Unslotted	25		1300
0695030.PXP	Unslotted	30		970
0695040.PXP	Unslotted	40		1550
0695015.PXPS	Slotted	15		310
0695020.PXPS	Slotted	20		750
0695025.PXPS	Slotted	25		1300
0695030.PXPS	Slotted	30		970
0695040.PXPS	Slotted	40		1550
0695050.PXPS	Slotted	50		4000
0695060.PXPS	Slotted	60		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.**

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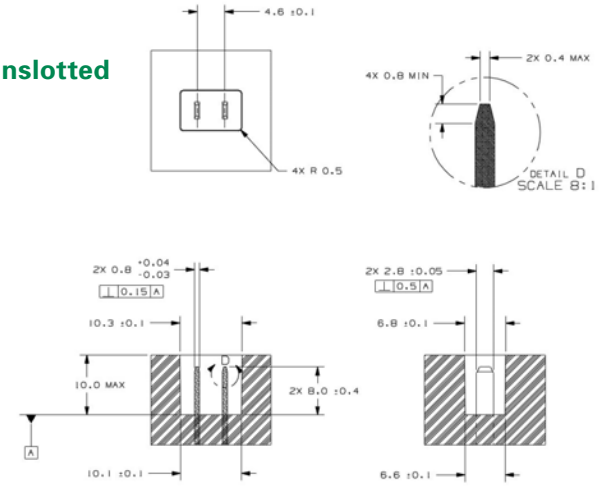
MCASE+™ CARTRIDGE FUSES RATED 32V

RoHS

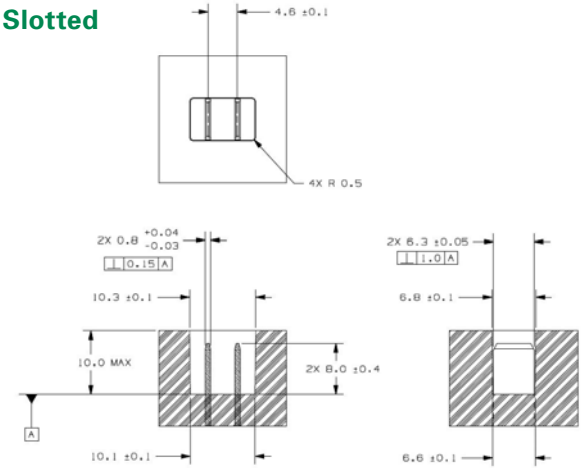
Recommended Cavities

Dimensions in mm

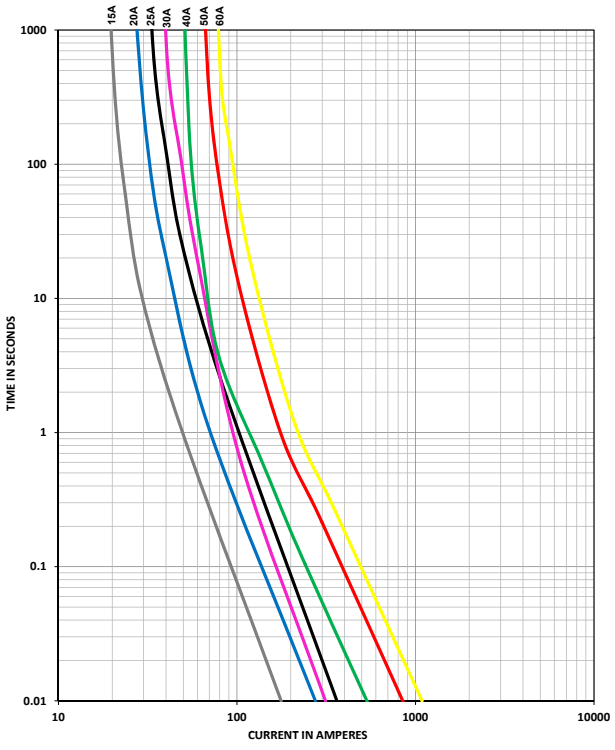
Unslotted



Slotted



Time-Current Characteristics Curve



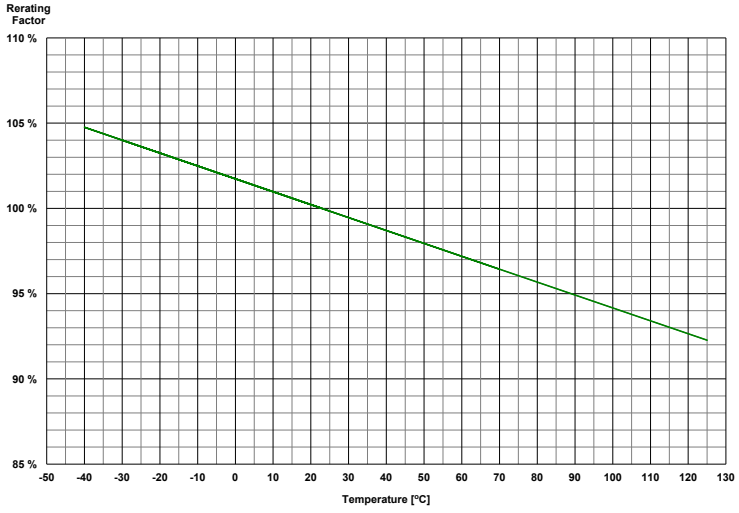


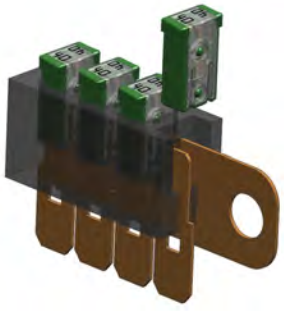
JCASE® Fuse

LP JCASE® Fuse

MCASE+™ Fuse

Temperature Rerating Curve





LOW PROFILE JCASE® FUSES RATED 58V

RoHS



Specifications

Voltage Rating:	58 VDC
Interrupting Rating:	1000A @ 58 VDC
Operating Temperature Range:	-40°C to + 125°C
Insertion Force:	53N Max. (12 lb.)
Extraction Force:	9N Min (2 lb.)

Ordering Information

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

Description

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.

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	Cold Resistance (mΩ)	I^2t (A^2s)
0895020_	20		4.48	400
0895025_	25		3.39	680
0895030_	30		2.68	1780
0895040_	40		1.89	5470
0895050_	50		1.08	4880
0895060_	60		0.83	9600

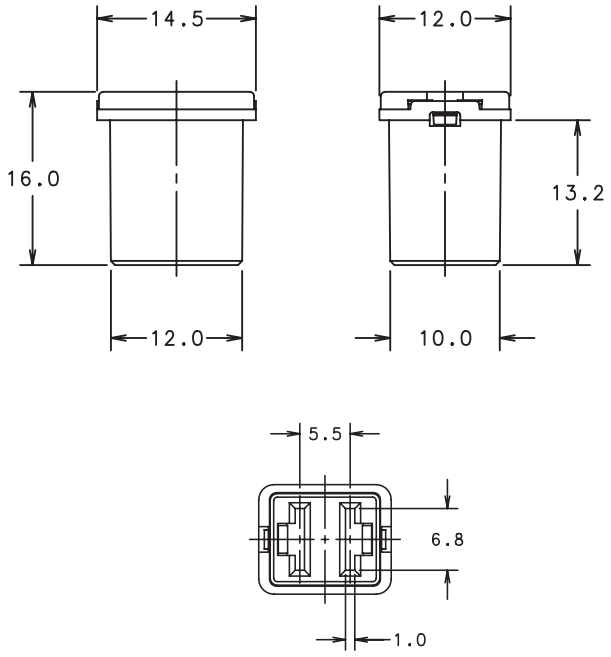
Corresponding holder see Section "Fuse Holders."

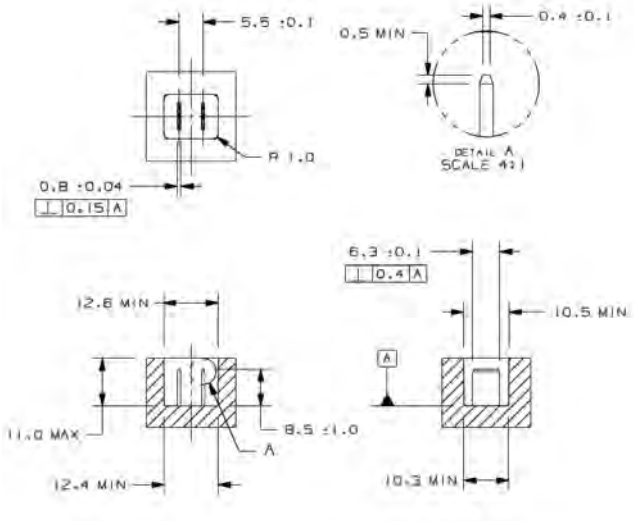
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LOW PROFILE JCASE® FUSES RATED 58V

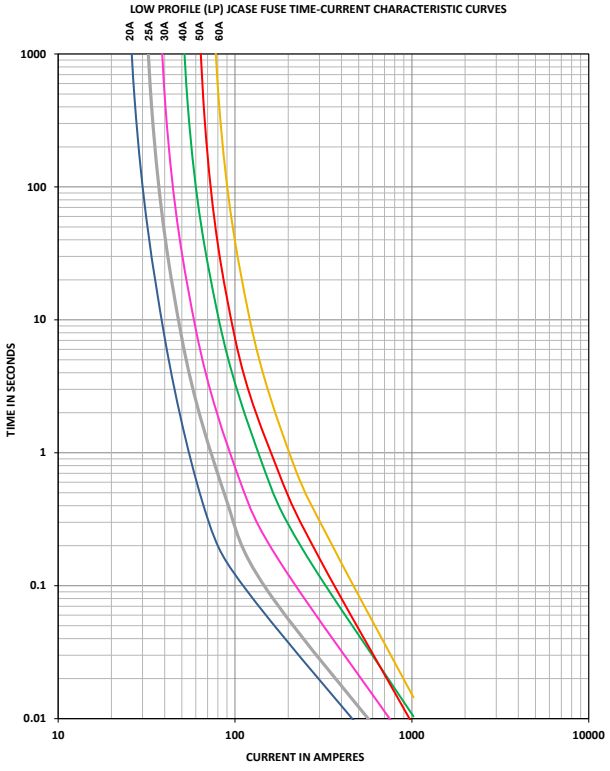
Dimensions

Dimensions in mm

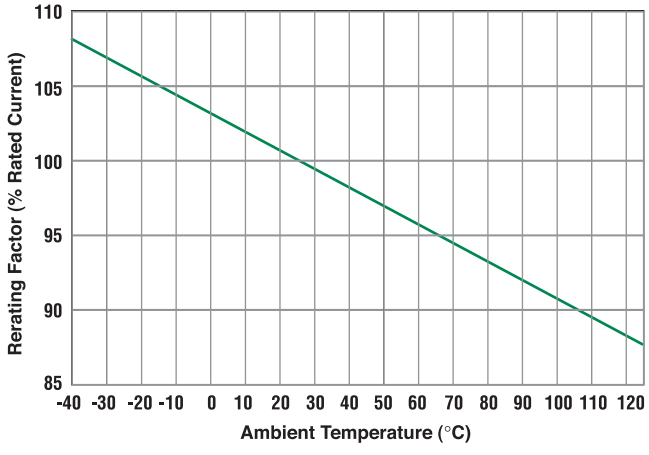




Time-Current Characteristics Curve



Temperature Rerating Curve



JCASE® CARTRIDGE FUSE RATED 32V



Specifications

Voltage Rating:	32 VDC
Interrupting Rating:	1000A @ 32 VDC
Operating Temperature Range:	-40°C to + 125°C
Insertion Force:	53N max. (12 lb.)
Extraction Force:	9N min. (2 lb.)

Ordering Information

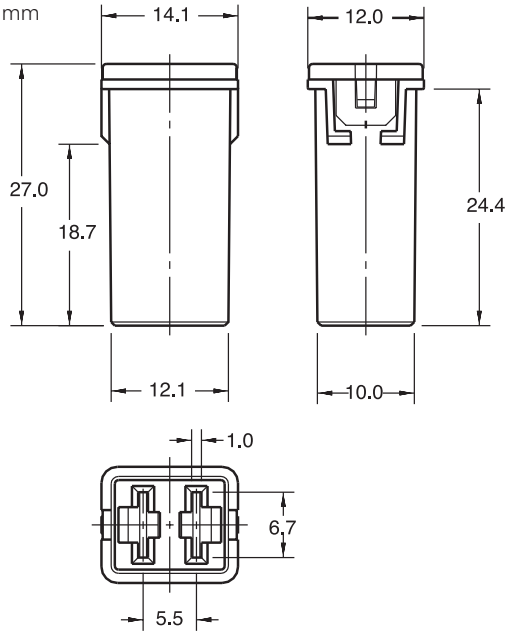
Part Number	Package Size
0495xxx.TXA	10
0495xxx.UXA	500
0495xxx.ZXA	2200

Description

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.

Dimensions

Dimensions in mm



Time-Current Characteristics

% of Rating	Opening Time Min / Max (s)
110	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

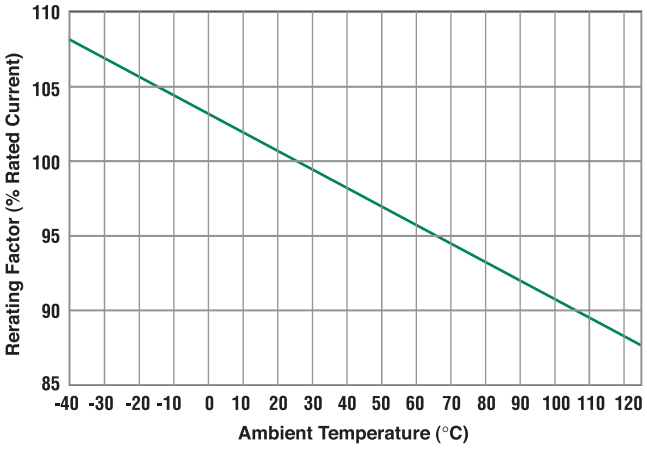
Part Number	Current Rating (A)	Housing Material Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I^2t (A^2s)
0495020_	20		106	4.29	1750
0495025_	25		101	3.28	3220
0495030_	30		91	2.12	1480
0495040_	40		87	1.30	3650
0495050_	50		88	0.99	8750
0495060_	60		87	0.76	19500

Corresponding holder see Section "Fuse Holders."

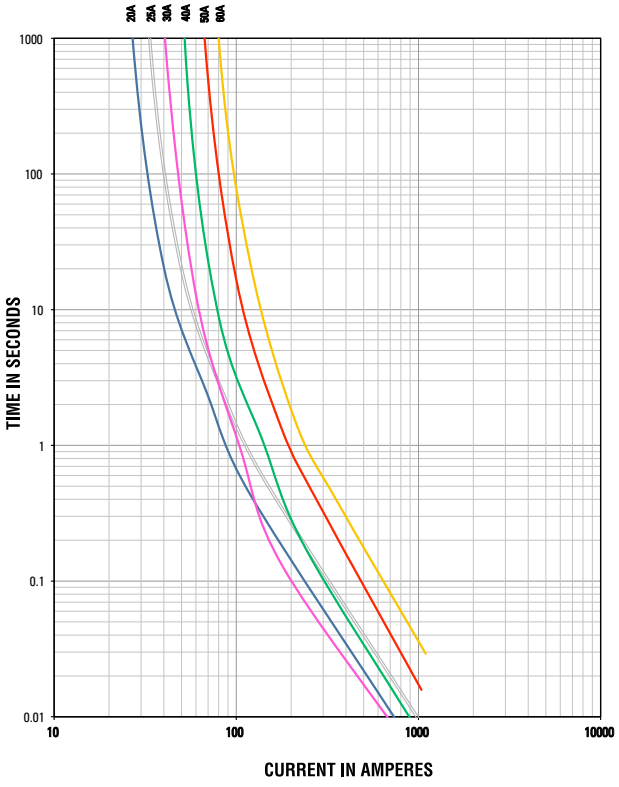
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JCASE® CARTRIDGE FUSE RATED 32V

Temperature Rerating Curve

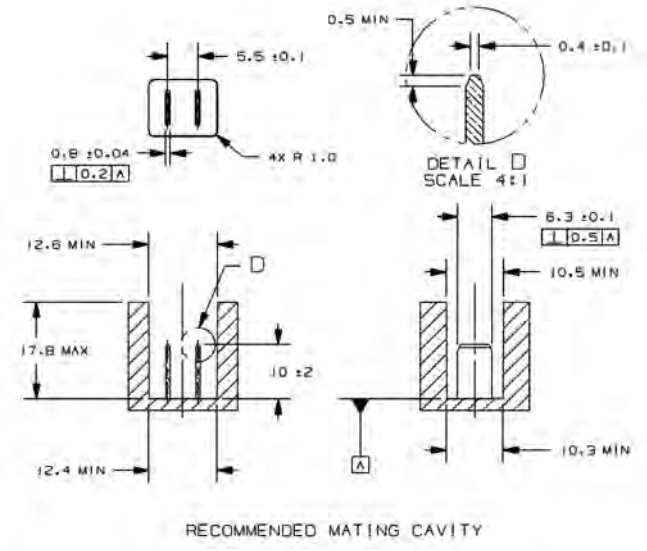


Time-Current Characteristic Curves



Dimensions

Dimensions in mm



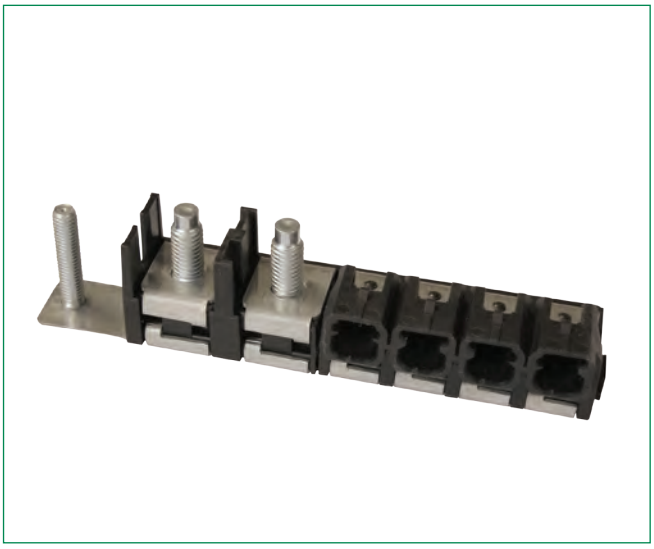
High Current Fuses



ZCase Masterfuse	29
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ZCASE MASTERFUSE

RoHS



Specifications

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

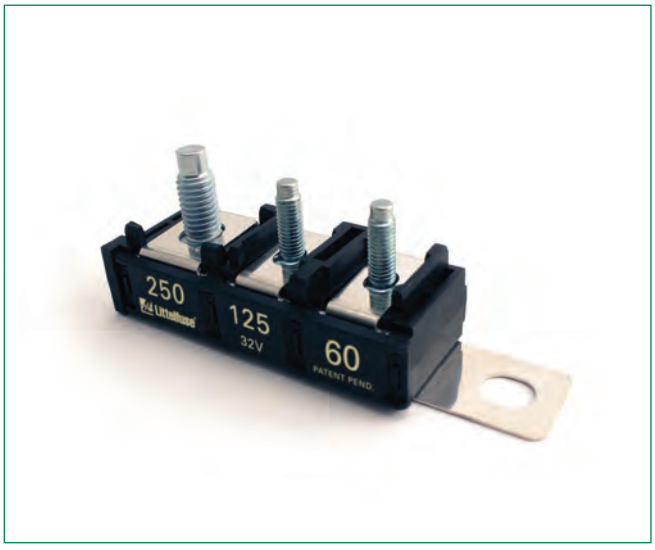
Features and Benefits

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

Description

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 withstandablity. 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.

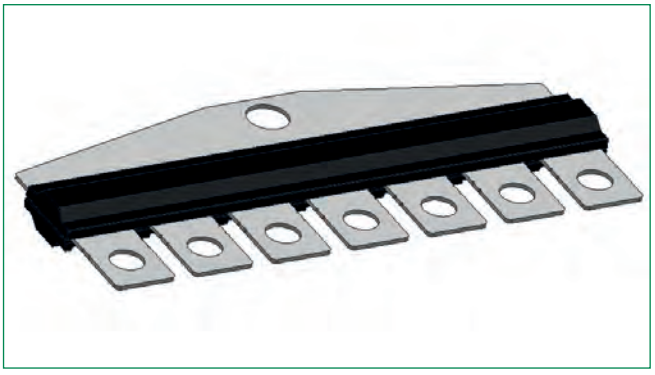
The ZCase Masterfuse product is available as a standard design with customized fuse ratings. The modular manufacturing approach enables a wide range of configurations within a product family. In addition, the form factor can be fully customized for specific applications to further optimize the system.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



MASTERFUSE

RoHS





Specifications

Mating Terminal Options:	M10, M8, M6, M5 bolt-down connections or female terminals
Operating Temperature Range:	-40°C to 125°C
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 continious current.

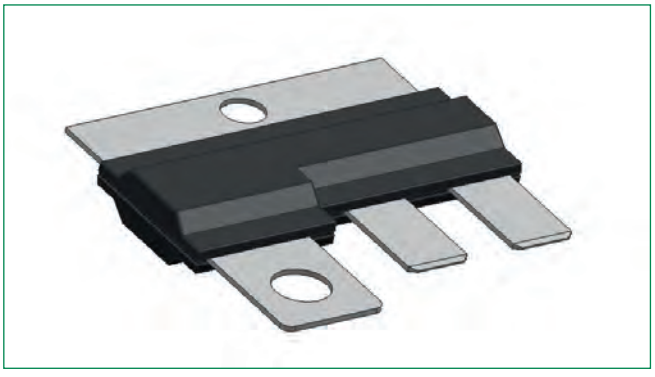
Features and Benefits

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

Description

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.



ZCASE SINGLE MEGA/STARTER



Specifications

Cover/Base Material:	PPA (33% GF)
Insulating Tube:	Out of ceramic
Terminal:	Tin plated Copper
Voltage Rating:	32V DC
Interrupting Rating:	2000A @ 32V VDC
Operating temperature:	-40 to 125°C
Mounting Torque M6:	9.8Nm±1.4Nm
Mounting Torque M8:	14Nm±2Nm

Ordering Information

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

Description

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 used as full wire protection until 250A. Higher ratings mostly used for typically Starter Fuse application as a protector fuse. The fuse design is optimized for a one bolt connection M6 (40A - 250A) or M8 (300A - 600A) and can 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.

Time-Current Characteristics

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

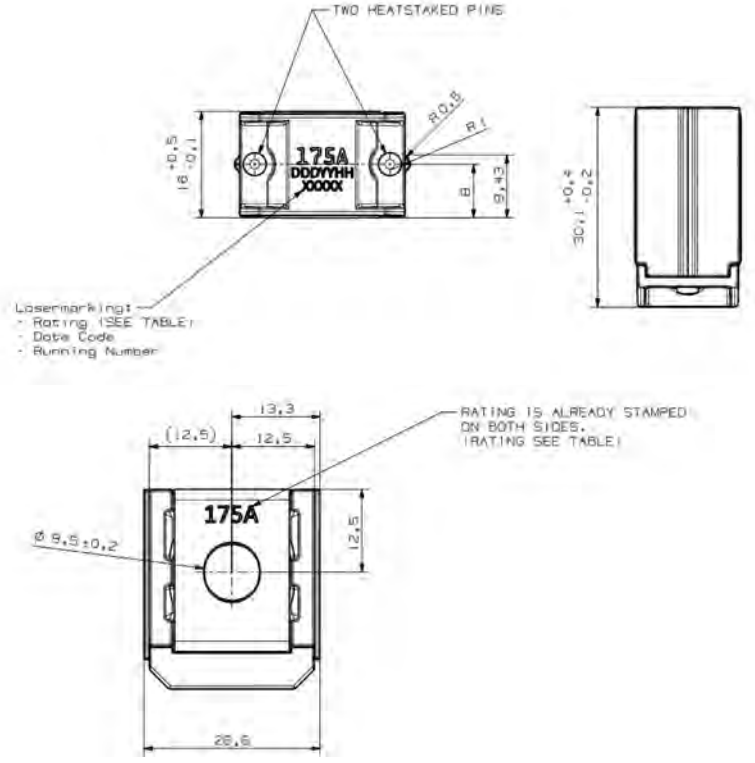
Ratings

Part number	Current Rating (A)	Wire size (mm^2)	Max. Voltage Drop (mV)	Average Cold Resistance (mΩ)	I^2t (A^2s)
3298040.Z	40	4	110	1.53	5000
3298060.Z	60	6	110	0.98	18000
3298080.Z	80	10	110	0.715	15500
3298100.Z	100	16	110	0.57	31000
3298125.Z	125	16	110	0.39	45000
3298150.Z	150	25	110	0.32	75000
3298175.Z	175	25	110	0.26	140000
3298200.Z	200	35	110	0.231	235000
3298225.Z	225	35	110	0.175	95000
3298250.Z	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.Z	SHUNT	50	-	-	-

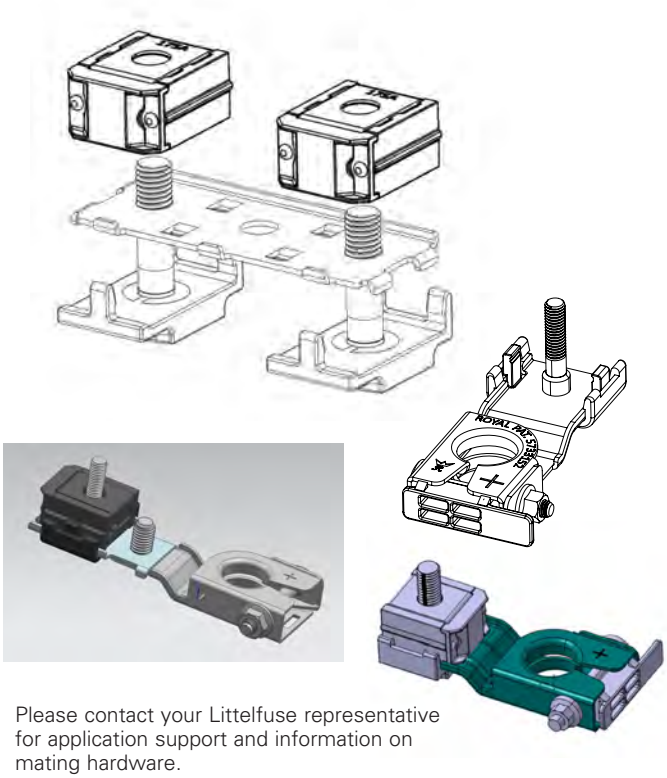
ZCASE SINGLE MEGA/STARTER

Dimensions

Dimensions in mm

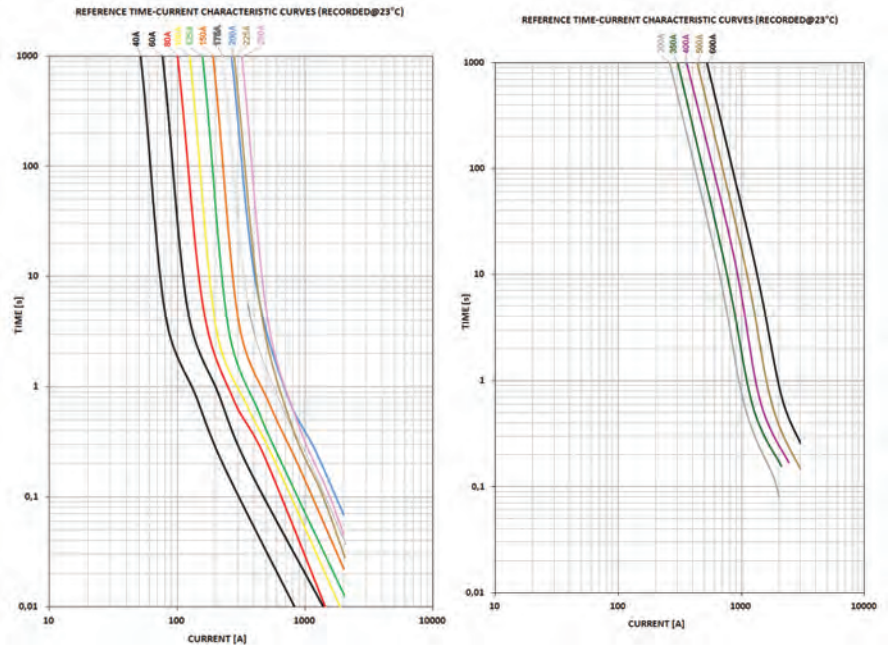


Examples of Single ZCASE Applications



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

Time-Current Characteristic Curves



All ZCase Starters T/C curves were performed on the left or right side of the metal bar as shown in pictures above. A 50mm² Cu wire was mounted at the mid hole (M8) of the metal bar as current feed.

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MEGA® FUSE RATED 32V

RoHS



Also available:

MEGA Clear Top Housing Fuse



Clear Housing Material:
Polyethersulfone (top)
PPA (33%/35% GF) (bottom)

Specifications

Interrupting Rating:	2000A @ 32 VDC
Voltage Rating:	32 VDC
Operating Temperature Range:	-40˚C to + 125˚C
Housing Material:	PPA (33%/35% GF)
Terminals:	Copper (Silver plated copper available) M6 or M8 bolts available
Mounting Torque:	8-14 Nm M6 12-18 Nm M8
Ref. To:	ISO 8820-5

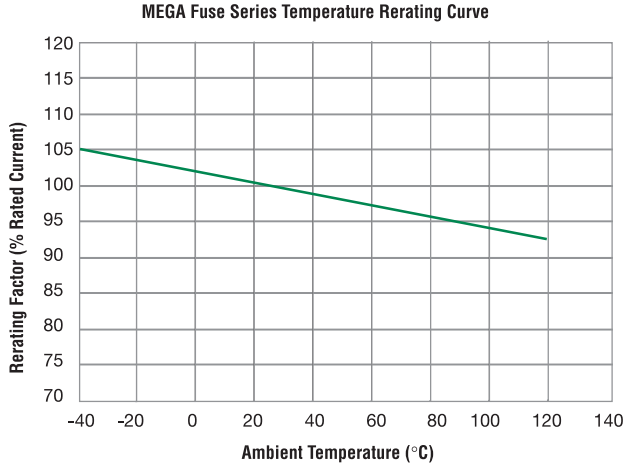
Ordering Information

Part Number	Package Size	Plating	Bolt Size	Rating
0298xxx.ZXH	500	none	M8	300 - 500
0298xxx.ZXEH	500	none	M8	80 - 250
0298xxx.ZXB	500	Ag	M8	40 - 250
0298xxx.ZXA	500	none	M6	80 - 500
MEGA Clear Top Housing Material Fuse				
0298xxx.UXT	500	none	M8	40 - 250

Description

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.

Temperature Rerating Curve



Time-Current Characteristics

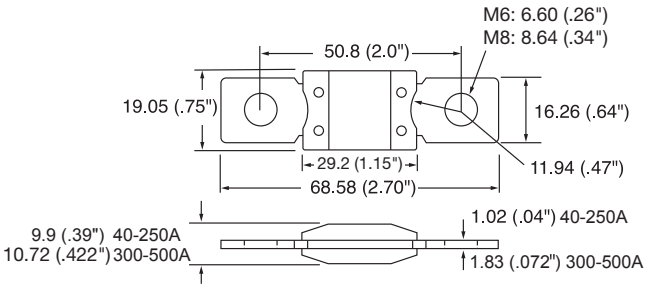
% of Rating	Opening Time Min / Max (s)	
	40-250	300-500
75	– / –	14,400 s / –
100	14,400 s / –	– / –
135	120 s / 1800 s	– / –
200	1 s / 15 s	1 s / 15 s
350	0.300 s / 5 s	0.500 s / 5 s
600	0.100 s / 1 s	0.100 s / 1 s

MEGA® FUSE RATED 32V

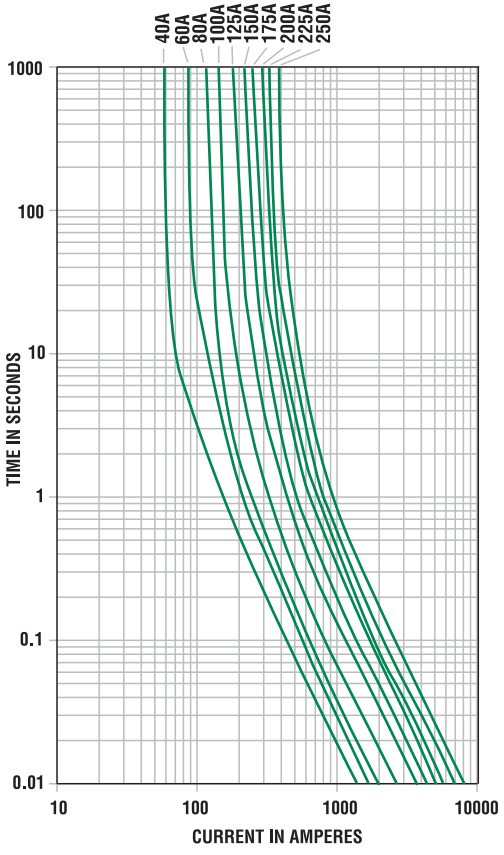
RoHS

Dimensions

Dimensions in mm



Time-Current Characteristic Curves



Ratings

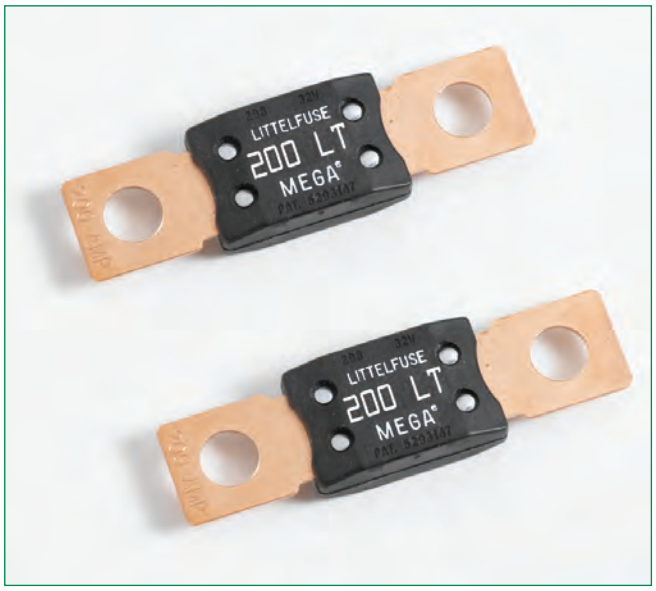
Part Number	Current Rating (A)	Font Color*	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I²t (A²s)
0298040._[1]	40	–	132	2.510	8700
0298060._[1]	60	–	119	1.504	21000
0298080._	80		87	0.720	21500
0298100._	100		87	0.562	31100
0298125._	125		80	0.423	57800
0298150._	150		92	0.352	100000
0298175._	175		86	0.294	168000
0298200._	200		83	0.257	204000
0298225._	225		82	0.222	257000
0298250._	250		82	0.201	389000
0298300._[2]	300		74 **	0.167	315000
0298350._[2]	350		68 **	0.138	500000
0298400._[2]	400		64 **	0.126	610000
0298450._[2]	450		60 **	0.112	1050000
0298500._[2]	500		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.

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MEGA® LOW TEMPERATURE FUSE RATED 32V

RoHS



Specifications

Interrupting Rating:	2000A @ 32 VDC
Voltage Rating:	32 VDC
Operating Temperature Range:	-40˚C to + 125˚C
Housing Material:	PPA (33%/35% GF)
Terminals:	Copper (Silver plated copper available) M8 bolts
Mounting Torque:	12-18 Nm M8

Ordering Information

Part Number	Package Size	Plating	Rating
0298125.ZXBLT	500	Ag	125
0298xxx.ZXEH-LT	500	none	150 - 275

Description

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.

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^2t (A^2s)
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

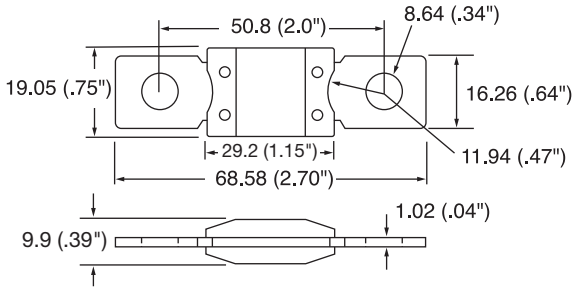
Last figure of article no. = packaging code
Corresponding holder see Section "Fuse Holders.

MEGA® LOW TEMPERATURE FUSE RATED 32V

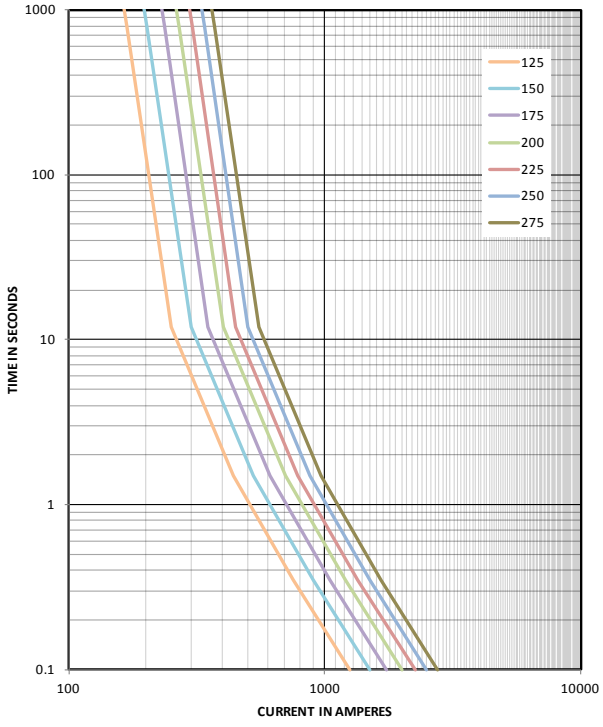
RoHS

Dimensions

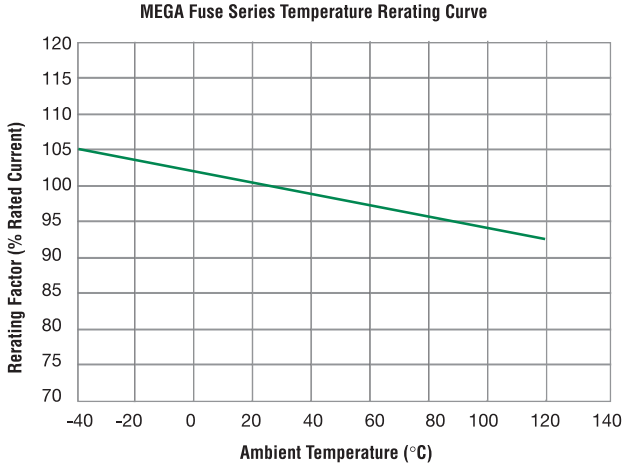
Dimensions in mm



Time-Current Characteristic Curves

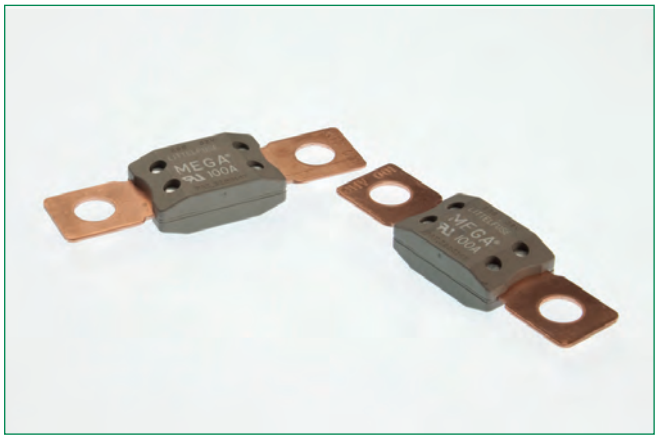


Temperature Rerating Curve



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UL RECOGNIZED MEGA® FUSE RATED 32V



Specifications

Interrupting Rating:	2000A @ 32 VDC
Voltage Rating:	32 VDC
Operating Temperature Range:	-40˚C to + 125˚C
Housing Material:	PA66
Terminals:	Copper M8 bolts holes
Mounting Torque:	12-18 Nm M8
Complies with:	ISO 8820-5 UL 248 Special Purpose Fuses

Description

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.

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

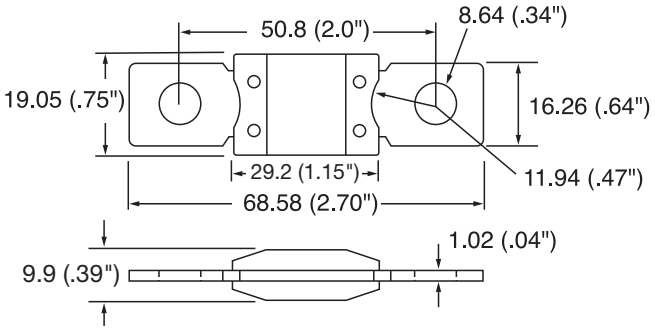
Part Number	Current Rating (A)	Font Color	Typ. Voltage Drop (mV)	I^2t (A^2s)
0298080.ZXEH-UL	80		87	21500
0298100.ZXEH-UL	100		87	31100
0298125.ZXEH-UL	125		80	57800
0298150.ZXEH-UL	150		92	100000
0298175.ZXEH-UL	175		62	168000

UL RECOGNIZED MEGA® FUSE RATED 32V

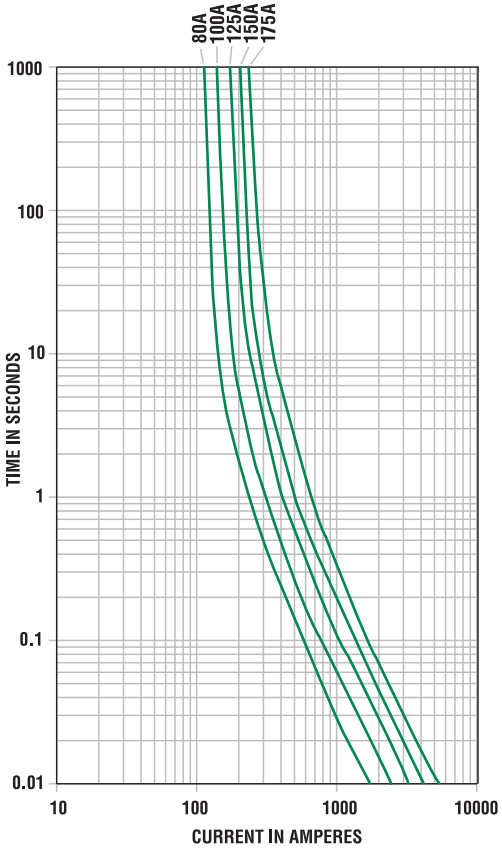
RoHS

Dimensions

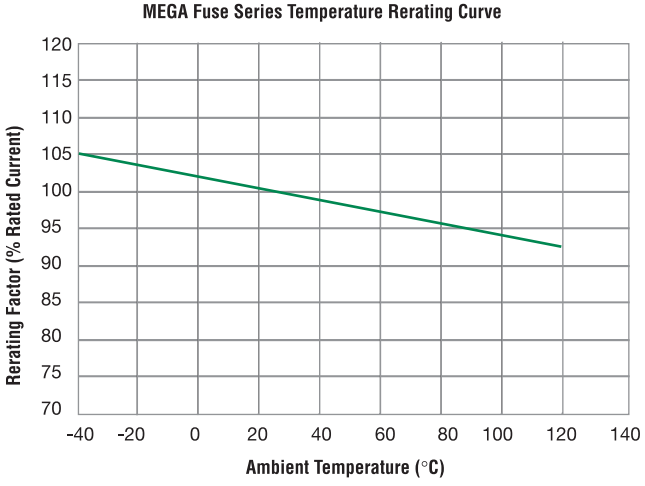
Dimensions in mm



Time-Current Characteristic Curves



Temperature Rerating Curve

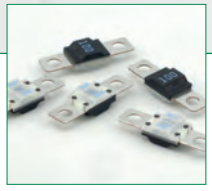


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MIDI® STYLE BOLT-DOWN FUSE RATED 32V



Also available:
Clear MIDI® version &
MIDI® one hole version





(transparent nylon composite cover / *not UL recognized)

Specifications

Interrupting Rating:	1000A @ 32 VDC
Voltage Rating:	32 VDC
Operating Temperature Range:	-40˚C to + 125˚C
Housing Material:	Heat Resistant 94-V0 Thermoplastic
Terminal:	Tin plated Copper
Mounting Torque M5:	4.5 Nm +/- 1Nm
Mounting Torque M6:	5.5-6.5 Nm +/- 1Nm
Complies with:	ISO 8820-5
	UL 248 Special Purpose Fuses

Ordering Information

Part Number	Package Size	Mfg Location
M5 Version		
0498xxx.H	100	North America
0498xxx.M*	1000	North America
0498.xxx.M-CN*	1000	Asia
M6 Version		
0498xxx.MXM6*	1000	North America
0498.xxx.MXM6-CN*	1000	Asia
Clear MIDI® Version		
0498xxx.SXT	20	North America
0498xxx.MXT	1000	North America
One Hole Version		
0498xxx.MX1M5*	1000	North America
0498xxx.MX1M5-CN*	1000	Asia

***** 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 expanison only.

Description

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.

Ratings

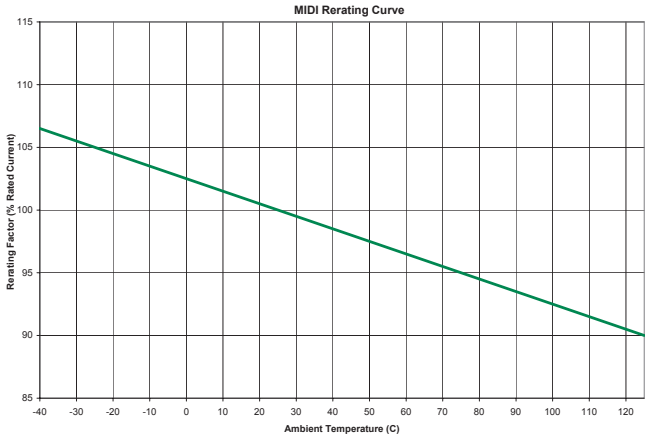
Part Number	Current Rating (A)	Housing Material Color	Typ. Voltage Drop Littelfuse max. (mV)	Cold Resistance (mΩ)	I^2t (A^2s)
0498023._[2]	23		90	3.43	1,800
0498030._[2]	30		65	2.06	4,200
0498040._	40		65	1.398	10,000
0498050._	50		65	1.025	13,000
0498060._	60		68	0.865	21,700
0498070._	70		70	0.72	24,000
0498080._	80		58	0.541	24,600
0498100._	100		60	0.457	51,300
0498125._[2]	125		71	0.394	73,200
0498150._[1,2]	150		77	0.323	81,900
0498175._[1,2]	175		77	0.285	100,000
0498200._[1,2]	200		77	0.261	125,000

Note 1: Short circuit protector only Note 2: not UL recognized

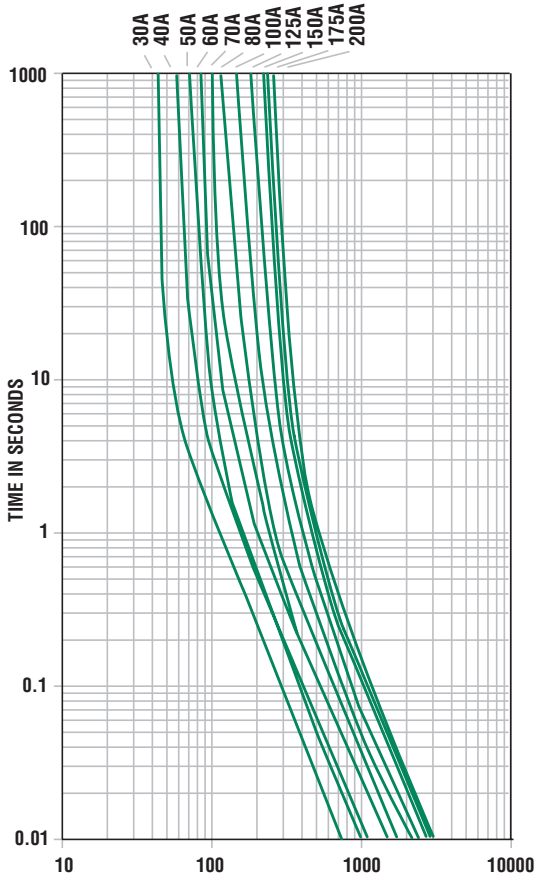
MIDI® STYLE BOLT-DOWN FUSE RATED 32V

RoHS

Temperature Rerating Curve

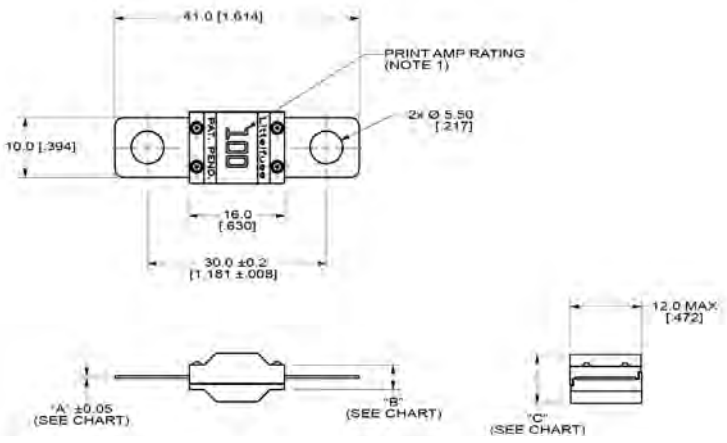


Time-Current Characteristic Curves



Dimensions

Dimensions in mm



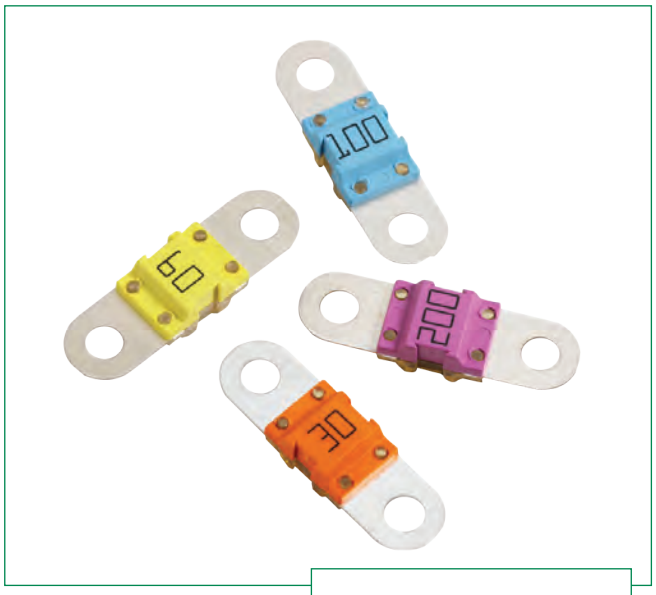
Part Number	"A" mm (inch)	"B" mm (inch)	"C" mm (inch)
0498030._	0.41 (0.016)	4.0 (0.157)	8.0 (0.315)
0498040._	0.41 (0.016)	4.0 (0.157)	8.0 (0.315)
0498050._	0.41 (0.016)	4.0 (0.157)	8.0 (0.315)
0498060._	0.41 (0.016)	4.0 (0.157)	8.0 (0.315)
0498070._	0.41 (0.016)	4.0 (0.157)	8.0 (0.315)
0498080._	0.41 (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 Characteristics

% of Rating	Opening Time Min / Max (s)	
	30-125A	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
300 350	0.3 s / 3 s – / –	– / – 0.3 s / 5 s
500	0.1 s / 1 s	0.1 s / 1 s

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BF1 FUSE RATED 32V



Also available:
BF1 one hole version
60A-125A



Specifications

Housing Material:	Heat Resistant 94-V0 Thermoplastic Visible melting element
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
Operating Temperature:	-40 to 125 degrees C

Ordering Information

Mounting Torque	Part Number	Package Size
M5	153.5631.xxx2	1000
M5	153.5631.xxx1	10
M6	153.7010.xxx2	1000
M6	153.7000.xxx2	500
BF1 one hole version		
M6	153.0010.xxx2	1000

Description

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.

Time-Current Characteristics

% of Rating	Opening Time Min / Max (s)	
	23-150A Fuses	150-200A 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

BF1 FUSE RATED 32V

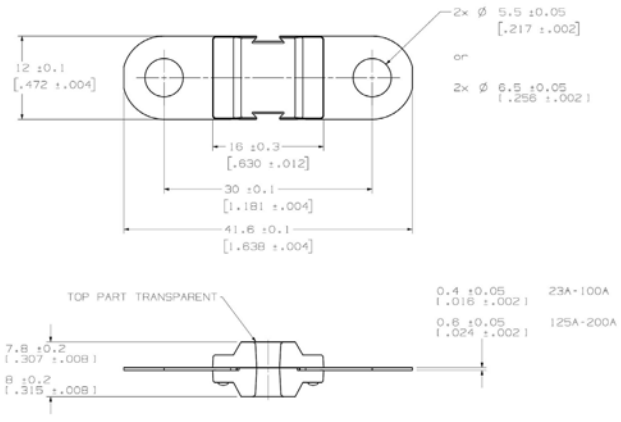
Ratings

Part Number		Current Rating (A)	Housing Material Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I²t (A²s)
M5	M6					
153.5631.523_[1,2]	-	23		105	3.50	1,400
153.5631.530_	153.7010.530_	30		105	2.70	5,100
153.5631.540_	153.7010.540_	40		90	1.56	6,800
153.5631.550_	153.7010.550_	50		80	1.03	6,900
153.5631.560_	153.7010.560_	60		75	0.75	16,200
153.5631.570_	153.7010.570_	70		70	0.64	22,000
153.5631.580_	153.7010.580_	80		70	0.55	25,600
153.5631.610_	153.7010.610_	100		70	0.44	42,500
153.5631.612_	153.7010.612_	125		70	0.34	62,500
153.5631.615_[1]	153.7010.615_[1]	150		70	0.29	83,400
-	153.7000.615_[3]	150		70	0.33	98,000
153.5631.620__[3]	153.7000.620__[3]	200		70	0.24	126,000

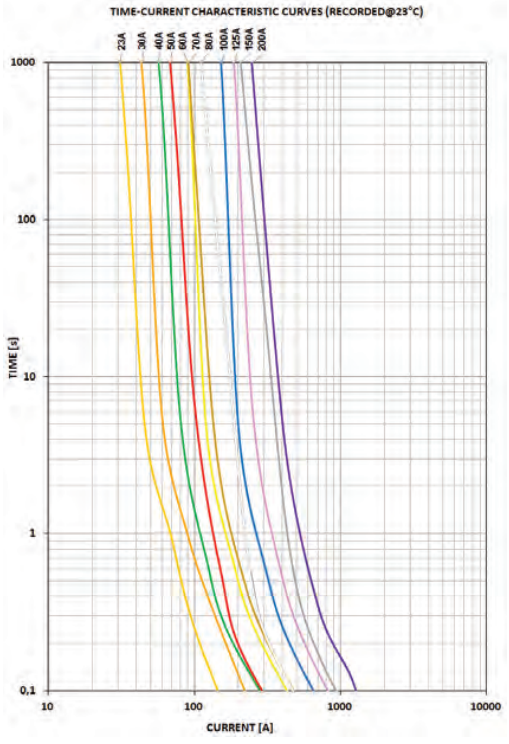
Corresponding holder see Section "Fuse Holders."
Note 1: not mentioned in ISO standard Note 2: Not UL rated Note 3: Short Circuit Protector only

Dimensions

Dimensions in mm



Pre-Arcing Time-Limits



Derating

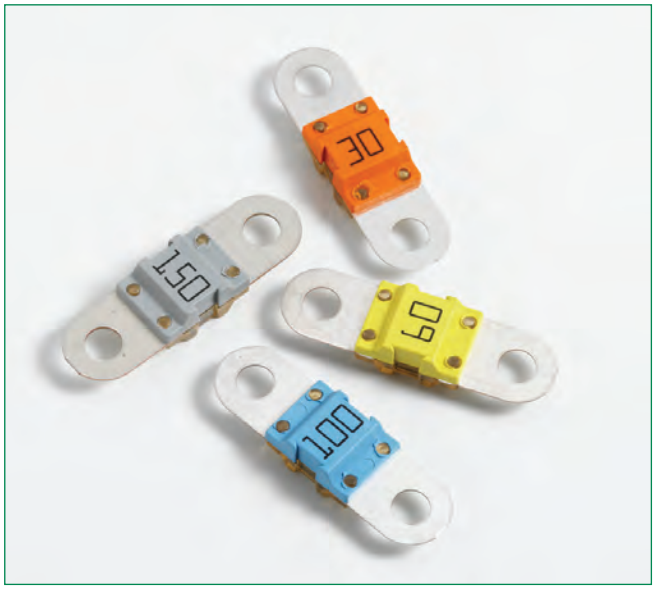
Individual derating curves by rating can be ordered through your Littelfuse contact person.

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

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

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BF1 FUSE RATED 58V



Description

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

Housing Material:	Heat Resistant 94-V0 Thermoplastic Visible melting element
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
Operating temperature:	-40 to 125 degrees C

Ordering Information

Part Number	Package Size
142.5631.xxx2	500

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

Ratings

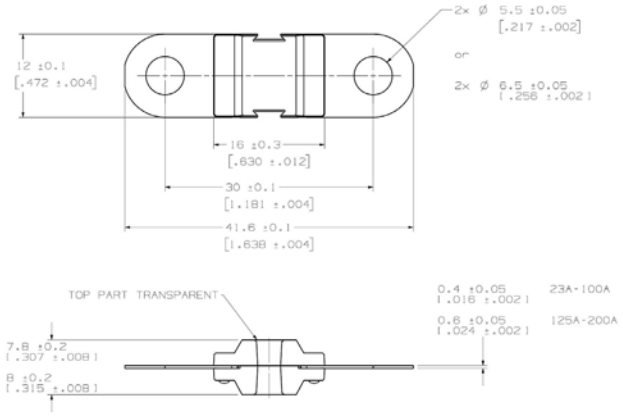
Part Number M5	Part Number M6	Current Rating (A)	Housing Material Color	Typ. Voltage Drop (mV)	Cold Resistance (mΩ)	I^2t (A^2s)
142.5631.5302[1]	142.7010.5302[1]	30		105	2.70	5,100
142.5631.5402	142.7010.5402	40		90	1.56	6,800
142.5631.5502	142.7010.5502	50		80	1.03	6,900
142.5631.5602	142.7010.5602	60		75	0.75	16,200
142.5631.5702	142.7010.5702	70		70	0.64	22,000
142.5631.5802	142.7010.5802	80		70	0.55	25,600
142.5631.6102	142.7010.6102	100		70	0.44	42,500
142.5631.6122	142.7010.6122	125		70	0.34	62,500
142.5631.6152	142.7010.6152	150		70	0.29	83,400
142.5631.6202[2]	142.7010.6202[2]	200		70	0.24	126,000

Corresponding holder see Section "Fuse Holders."
Note 1: Not UL rated Note 2: Short Circuit Protector only

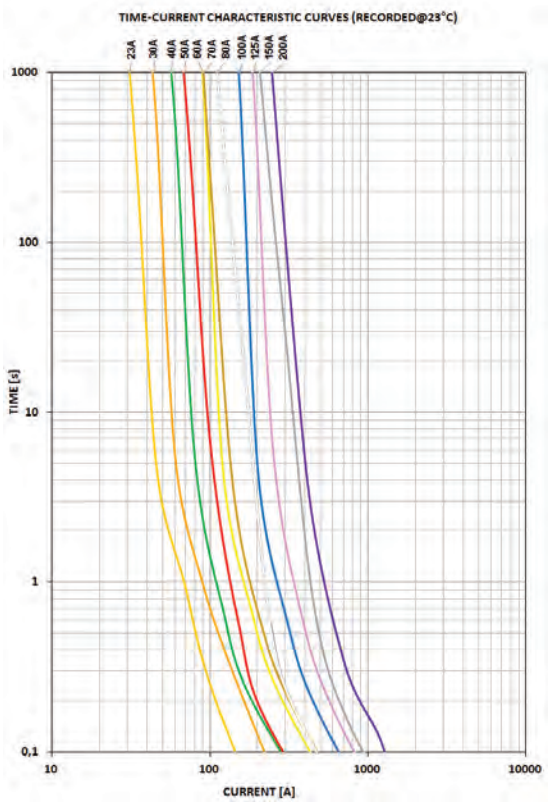
BF1 FUSE RATED 58V

Dimensions

Dimensions in mm



Pre-Arcing Time-Limits



30 A - 150 A: FI = 1.25 (max. operating current: 0.8 x I_{rat} at 23°C)
200 A: FI = 2.00 (max.operating current: 0.5 x I_{rat} at 23°C)

Derating

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

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BF2 FUSE RATED 32V



Specifications

Housing Material:	Heat Resistant 94-V0 Thermoplastic Visible melting element
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

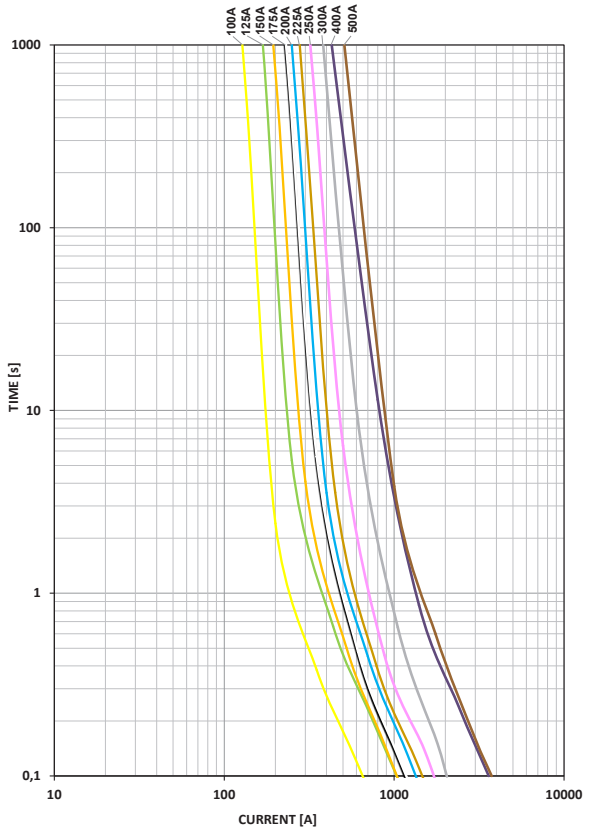
Ordering Information

Part Number	Package Size
153.5395.xxxx	200

Description

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.

Time-Current Characteristic Curves



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

BF2 FUSE RATED 58V



Specifications

Housing Material:	Heat Resistant 94-V0 Thermoplastic Visible melting element
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

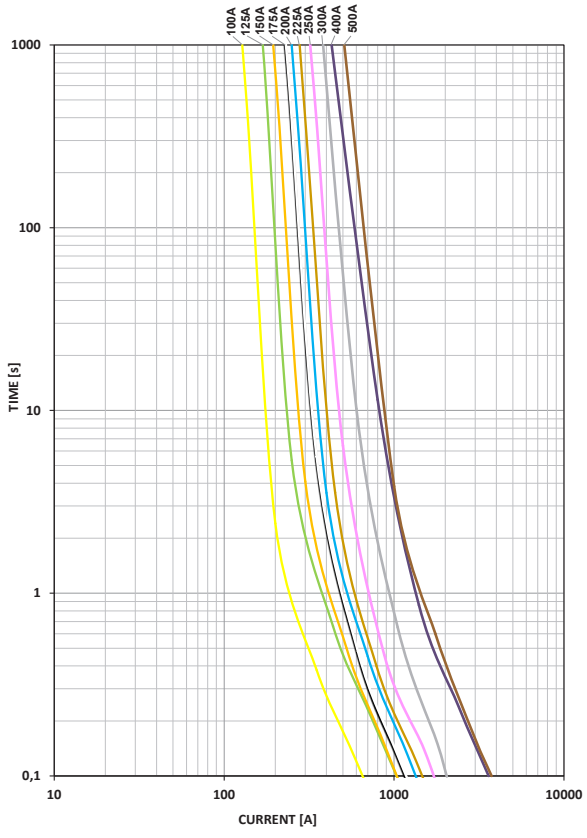
Ordering Information

Part Number	Package Size
142.5395.xxx2	200

Description

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.

Time-Current Characteristic Curves



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

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CF FUSE RATED 58V

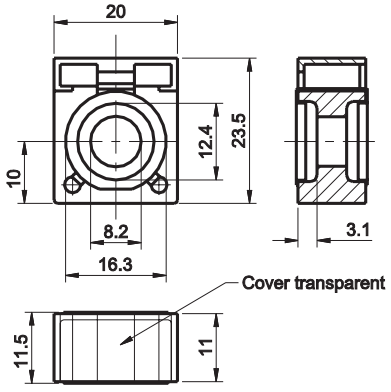


Description

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.

Dimensions

Dimensions in mm



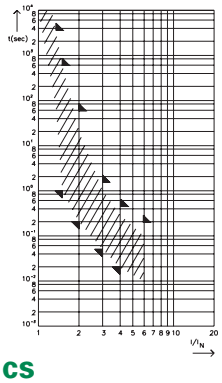
Specifications

Insulating Body Material:	Out of ceramic
Cover Material:	Out of thermoplast (UL 94-V0, heat resistant) 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

Pre-Arcing Time-Limits



FI = 1.25 (max. operating current: 0.8 x Irat at 23°C)

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^2t (A^2s)
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

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

FUSE STRIPS

RoHS



Fuse Strips

Fuse Strips for Diesel Vehicles Rated 36V

Amps (A): 25, 30, 40, 50, 60-70, 80, 100, 120-125, 150, 250



Fuse Strips with Housing

Fuse Strips with Housing Rated 80V

Amps (A): 30, 40, 50, 60, 70, 80, 100, 120, 125, 150



Fuse Strips for BPV

Fuse Strips for Battery-Powered Vehicles Rated 80V

Amps (A): 35-50, 63, 80, 100, 125, 130, 135, 150, 160, 175-500



157.5701

Fuse strips with housing for battery-powered vehicles rated 80V

Amps (A): 35-50, 63, 80, 100, 125, 130, 135, 150, 160, 175-500



HSB

HSB Fuse Rated 32V

Amps (A): 30, 40, 50, 60, 80, 110, 150, 175

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PAL & Cable Fuses



Auto Link PAL Fuses	**50**
CABLEPRO® Cable Protector Fuses Rated 32V	**51**
BF-Inline Fuses Rated 32V	**51**

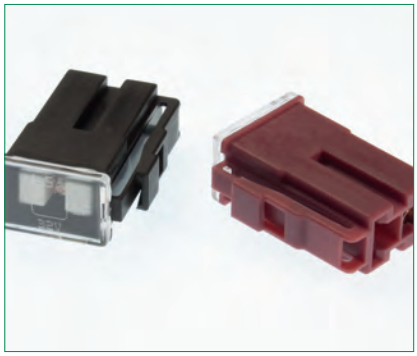
AUTO LINK PAL FUSES



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

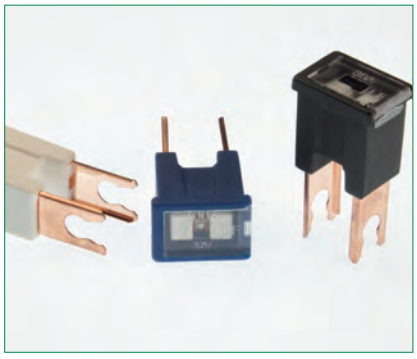
Amps (A): 25, 30, 45, 65, 75



2938 Series

Auto Link PAL 2938 Series Fuse

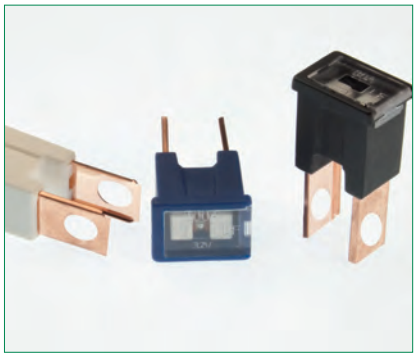
Amps (A): 20, 30, 40, 50, 60, 70, 80



294 Series

Auto Link PAL 294 Series Fuse

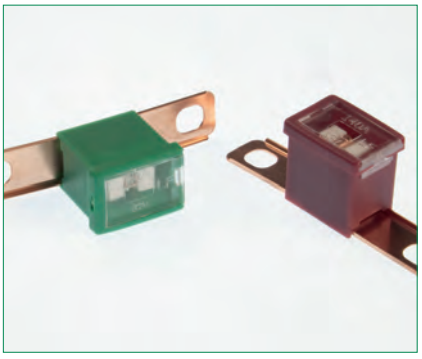
Amps (A): 30, 40, 50, 60, 70, 80, 100, 120



294C Series

Auto Link PAL 294C Series Fuse

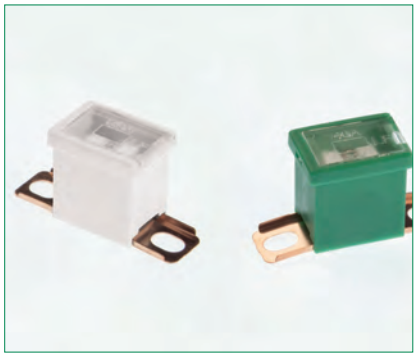
Amps (A): 20, 30, 40, 50, 60, 70, 80, 100, 120



295 Series

Auto Link PAL 295 Series Fuse

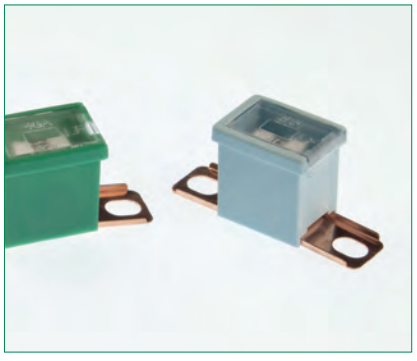
Amps (A): 20, 30, 40, 50, 60, 70, 80, 100, 120, 140



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

CABLEPRO® CABLE PROTECTOR FUSES RATED 32V

Available in AWG and metric cables

RoHS



Specifications

Voltage Rating:	32V
Interrupting rating:	2000A @ 32 VDC
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)

Description

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.

BF-INLINE FUSE RATED 32V



Specifications

Voltage Rating:	32 VDC
Housing Material:	Heat Resistant Thermoplastic
Terminals:	Crimp, Copper alloy, tinned
Interrupting Rating:	2000A @32VDC

Description

Inline fuse to protect specific cable cross-sections and insulations; Cross-section 10mm² to 35mm². 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

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High Voltage Fuses



LC High Voltage Fuse	**53**
LC High Voltage 50A Fuse	**55**

LOW CURRENT HEV FUSE

RoHS



Description

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

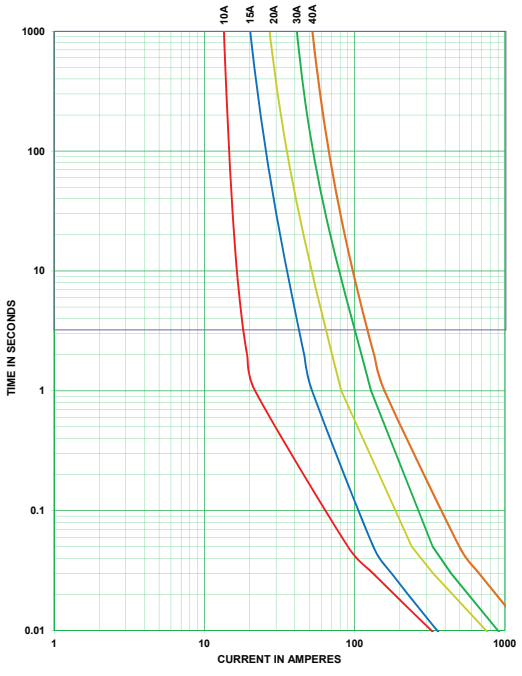
Specifications

Voltage Rating (10A, 15A, 20A, 30A):	450 VDC
Voltage Rating (40A):	425 VDC
Note: The 0HEV040.ZXBD is rated at 450 VDC	
Interrupting Rating (10A, 15A, 20A, 30A):	10kA @ 450 VDC
Interrupting Rating (40A):	10kA @ 425 VDC
Operating Temperature Range:	-40ºC to +125ºC

Ordering Information

Part Number	Termination	Package Size
0HEVxxx.ZXC	Cartridge	240
0HEVxxx.ZXISO	Bolt Down (ISO)	240
0HEVxxx.ZXPY	Blade	240
0HEVxxx.ZXBD	Bolt Down (Axial)	240
0HEVxxx.ZXPCB	PCB Mount	240
0HEVxxx.ZXPCBL	PCB Mount (Long)	240

Time-Current Characteristic Curves



Time-Current Characteristics

% of Rating	Opening Time Min / Max (s) 10A	Opening Time Min / Max (s) 15A, 20A, 30A	Opening Time Min / Max (s) 40A
100	100 hrs / -	100 hrs / -	100 hrs / -
110	4 hrs / -	4 hrs / -	-
135	100 / 3600	150 / 3600	150 / 3600
150	10 / 1000	10 / 1000	10 / 1000
200	0.5 / 100	0.5 / 100	0.5 / 100
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_R (mV)	Maximum Voltage Drop Spec at 100% IR (mV)	Typical Cold Resistance (mΩ)	Minimum Melting I^2t (A^2s)
0HEV010.xxx	10		114	300	12.8	255
0HEV015.xxx	15		96	200	7.9	133
0HEV020.xxx	20		79	200	5.0	268
0HEV030.xxx	30		67	200	2.7	993
0HEV040.xxx	40		69	200	2.0	1495

(Average Initial Measurements)

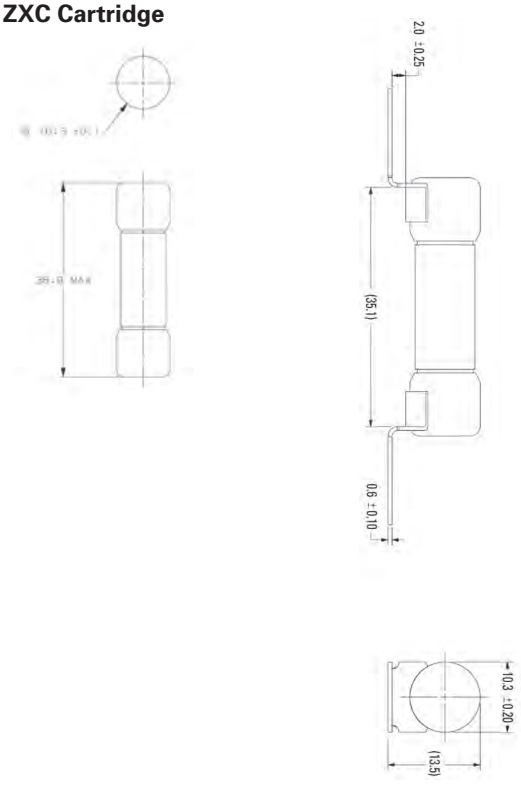
LOW CURRENT HEV FUSE

RoHS

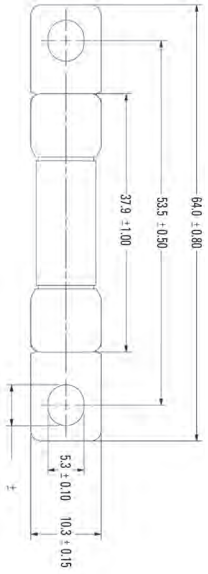
Dimensions

Dimensions in mm

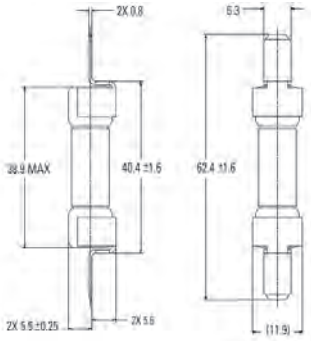
ZXC Cartridge



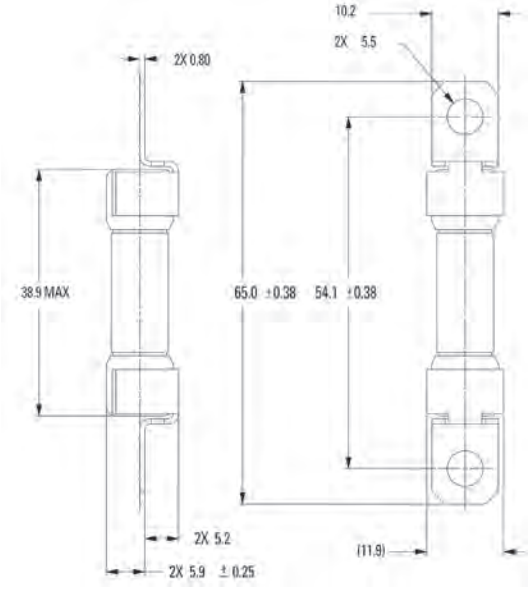
ZXISO Bolt Down (ISO)



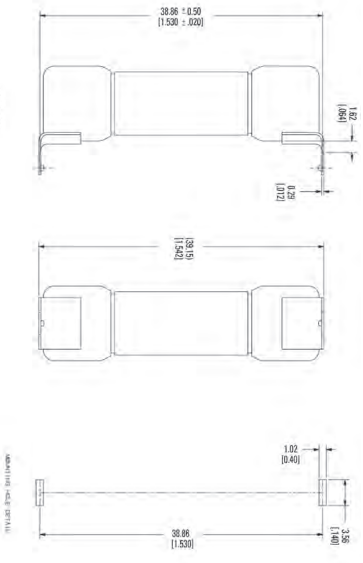
ZXPY Blade



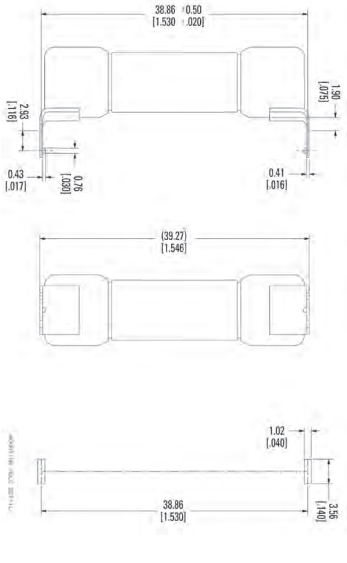
ZXBD Bolt Down (Axial)



ZXPCB PCB Mount



ZXPCBL PCB Mount (Long)



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LC HIGH VOLTAGE 50A FUSE

RoHS



Specifications

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

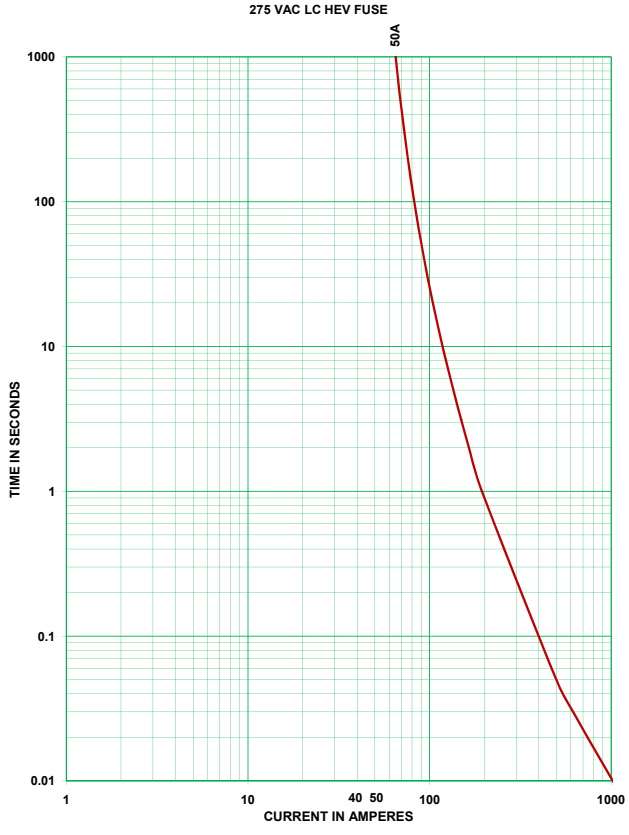
Ordering Information

Part Number	Termination	Package Size
0HEVxxx.ZXISO2	Bolt Down (ISO)	240
0HEVxxx.ZXP2Y	Blade	240
0HEVxxx.ZXPCB2	PCB Mount	240
0HEVxxx.ZXPCBL2	PCB Mount (Long)	240
0HEVxxx.ZXBD2	Bolt Down (Axial)	240

Description

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

Time-Current Characteristic Curves



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_R (mV)	Maximum Voltage Drop Spec at 100% I_R (mV)	Typical Cold Resistance (mΩ)	Minimum Melting I^2t (A^2s)
0HEV050.XXX	50A	275		57	200	1.2	1495

(Average Initial Measurements)

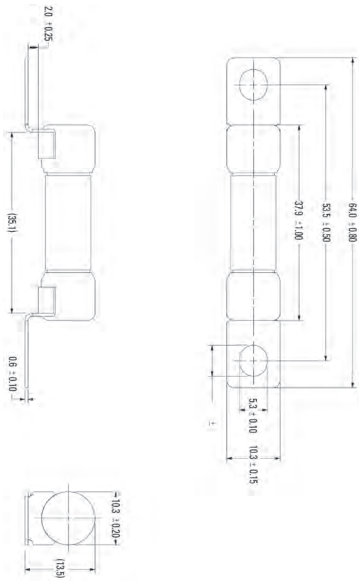
LC HIGH VOLTAGE 50A FUSE

RoHS

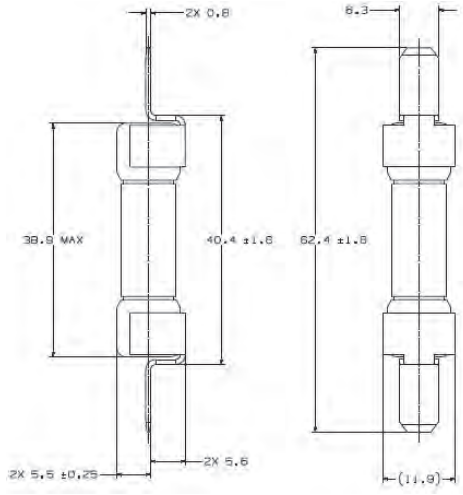
Dimensions

Dimensions in mm

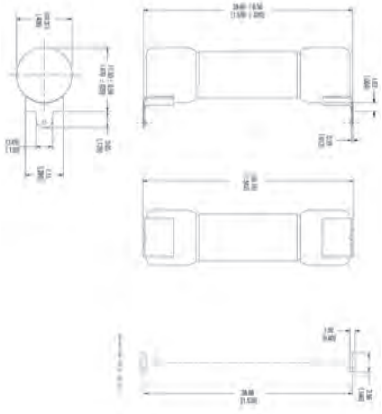
ZXISO2 Bolt Down (ISO)



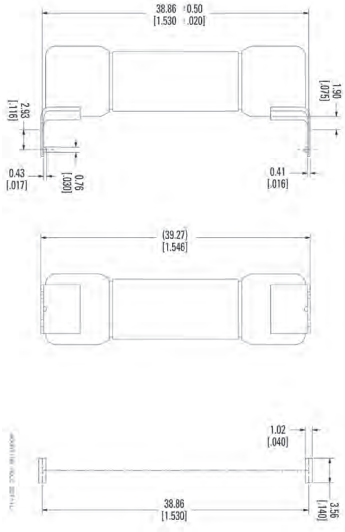
ZXP2Y Blade



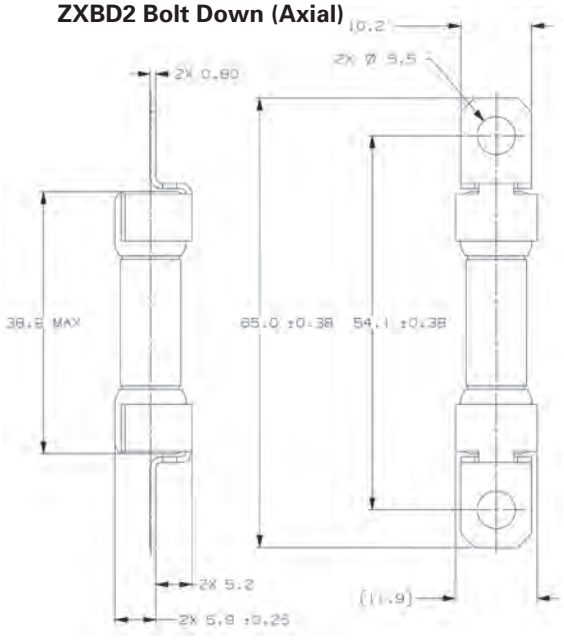
ZXPCB2 PCB Mount



ZXPCBL PCB Mount (Long)



ZXBD2 Bolt Down (Axial)



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Specialty Products



Shunts 58

Fuseholders 60

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

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
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**

INLINE AND PCB FUSE HOLDERS



FHM

Splashproof Inline Fuseholder for MINI® Style

Amps (A): 20, 30



FHA

Inline Fuseholder for ATO® Style

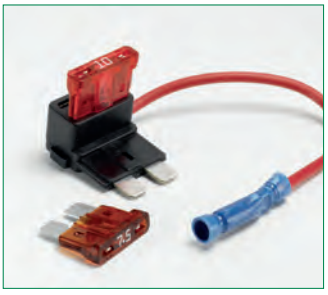
Amps (A): 20, 30, 3, 4, 5, 10, 25, 7.5



FHAC

Splashproof Inline Fuseholder for ATO® Style

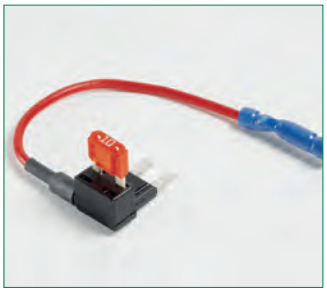
Amps (A): 20, 30



0FHA0200

ATO® Add-A-Circuit®

Amps (A): 10.4



0FHM0200

MINI® Add-A-Circuit®

Amps (A): 10.4



FHJ

Inline Fuseholder for JCASE® Style

Amps (A): 40, 60



MAH

Inline Fuseholder for MAXI® Style



0152

Fuseholder for MAXI® Style



FHMaS

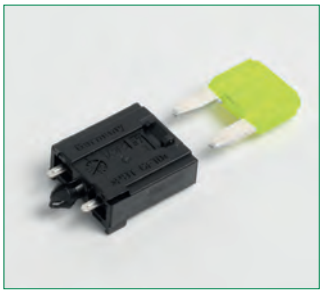
Splashproof Fuseholder MAXI® Style



153

PCB Mount Fuseholder for MINI® Style Blade Fuse

Amps (A): 15, 20



178

PCB Mount Fuseholder for MINI® Style Blade Series 125V



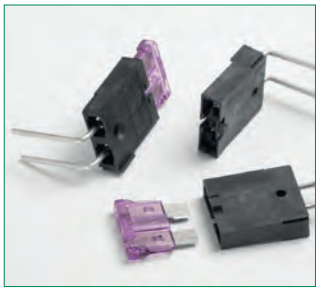
178 FLR

FLR PCB Mount Fuseholder for ATO® Style Blade Fuse 80V



178 FLR

FLR PCB Mount Fuseholder for ATO® Style Blade Fuse 58V



FKH Fuseholder 80V with 90° connection

FKH Fuseholder with 90° Connection for ATO® Style Blade Fuse Rated 80V

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STACKABLE AND PANEL MOUNT FUSE HOLDERS



Stackable Panel Mount ATO

Stackable Panel Mont fuse Holder with Wire Leads for ATO Style

Amps (A): 20, 3, 4, 5, 10, 15, 7.5, 25, 30



ATO Panel Mount Holder Components



SNAP Mount Fuse Holder

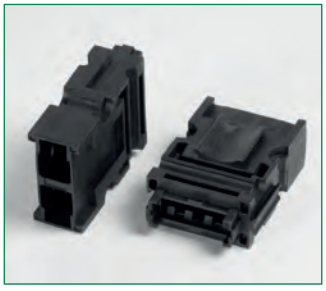


Stackable Panel Mount Fuse Holder



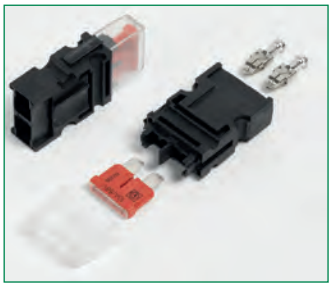
868

Panel-Mount Stackable Components



FH2 Stackable Block Fuse Holder

ATO® style 80V Fuseholder



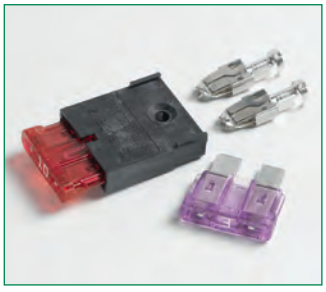
FH2 Stackable Block Fuse Holder

ATO® style 58V Fuseholder



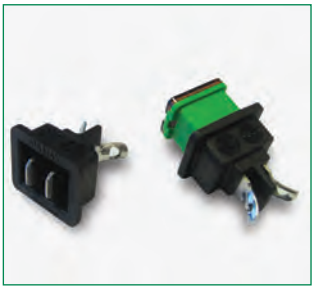
FKH Stackable Fuse Holder

ATO® style 58V Fuseholder



FKH Stackable Fuse Holder

ATO® style 80V Fuseholder

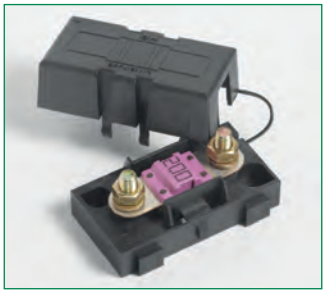


Low Profile JCASE Holder

Panel Mount Fuseholder for Low Profile JCASE® Series

Amps (A): 40

BOLT-DOWN FUSE HOLDERS & ASSEMBLIES



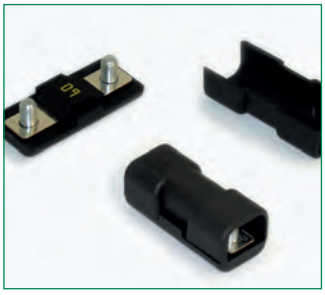
498

Fuseholder for MIDI/BF1 Style



MIDI BF1 Fuseholder

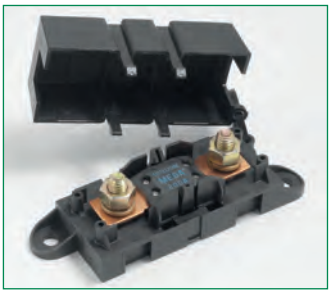
MIDI/BF1 2 & 3-Way Fuesholder



498

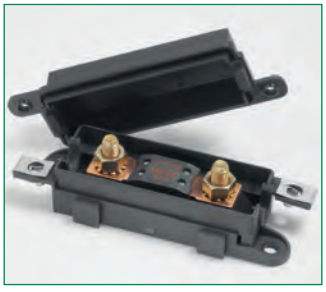
Inline Fuseholder for MIDI® Style

Amps (A): 200



Bolt Down Mega

Bolt Down Fuseholder for MEGA Style



298

Splashproof Fuseholder for MEGA® Style Bolt-Down Fuse

Amps (A): 250



MEGA-Flex Holder

MEGA™-Flex Holder for MEGA® Fuses

Amps (A): 500



Strips 80V

Fuse Base for Fuse Strips 80V for Single



Double Strips 80V

Fuse Base for Fuse Strips 80V for Double

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I. Introduction

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

II. Types of Overcurrents

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

A. Overloads

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

B. Short Circuits

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

III. Fuse Selection Parameters

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

A. Voltage Rating

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

B. Interrupting Rating

The interrupting rating (also known as breaking capacity or short circuit rating) is the maximum current, as stated by the manufacturer, which the fuse can safely interrupt at rated voltage. During a fault or short circuit condition, a fuse may receive an instantaneous current many times greater than its normal operating current. Safe operation requires that the fuse remain intact (no body rupture) and clear the circuit. The interrupting rating is 1000A @ 32 volts DC for the MINI®, MAXI®, ATO®, 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.

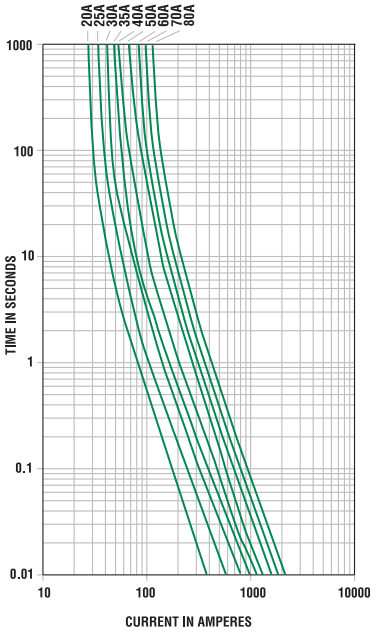


Figure 1: Average Melting-Current Curve for the MAXI Fuse Series (20-60A)

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.

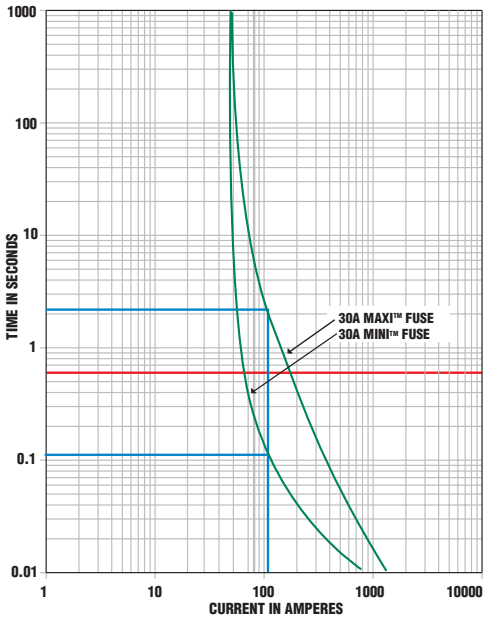


Figure 2: Average Melting-Current Curve Comparing 30A MINI Fuse to 30A MAXI Fuse

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:

$$\text{Ideal fuse rating} = \frac{\text{Normal operating current}}{\text{Temp rerating factor} \times 0.75}$$

$$= \frac{15\text{A}}{0.88 \times 0.75}$$

$$= 22.73\text{A}$$

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

E. Transient Overcurrent Considerations

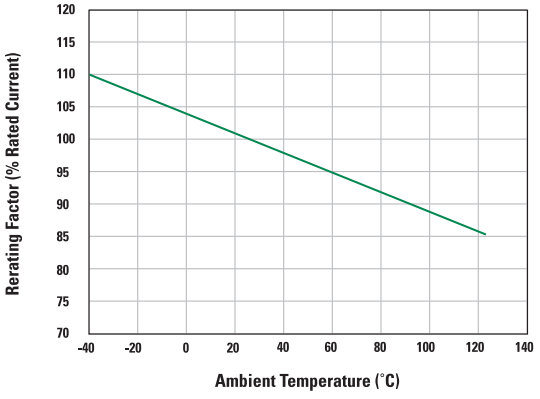


Figure 3: MINI Auto Fuse 297 Series Temperature Rerating Curve

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

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1. I^2t

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

Melting I2t: the thermal energy required to melt a specific fuse element.

Arcing I2t: the thermal energy passed by a fuse during the arcing time. The magnitude of arcing I^2t is a function of the available voltage and stored energy in the circuit.

Total Clearing I2t: the thermal energy through the fuse from overcurrent inception until current is completely interrupted. Total clearing I^2t = (melting I^2t) + (arcing I^2t).

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

2. Pulse Cycle Withstand Capability

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

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

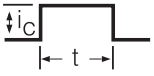
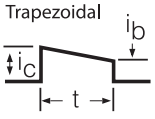
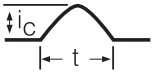
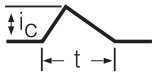
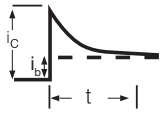
WAVESHAPE	FUNCTION AND VALUE
Square 	$i = k$ $I^2t = i_c^2t$
Trapezoidal 	$i = i_C \pm kt$ $I^2t = (1/3)(i_c^2+i_bi_c+i_b^2)t$
Sine 	$i = i_C \sin t$ $I^2t = (1/2)i_c^2t$
Triangular 	$i = \pm kt$ $I^2t = (1/3)i_c^2t$
Second order power 	$i = kt^2$ $I^2t = (1/5)i_c^2t$
Natural decay to zero 	$i = i_Ce^{-t/\tau}$ $I^2t = (1/2)i_c^2\tau$
Natural decay to non-zero value 	$I^2t = i_b^2t - 2\tau i_b(i_c-i_b)(e^{-t/\tau}-1)-\tau/2(i_c-i_b)^2(e^{-2t/\tau}-1)$

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

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

Figure 5 is a graph of the pulse cycle withstand capability of blade fuses. Because electrical pulse conditions can vary considerably from one application to another, application testing is recommended to establish the ability of the fuse design to withstand the pulse condition.

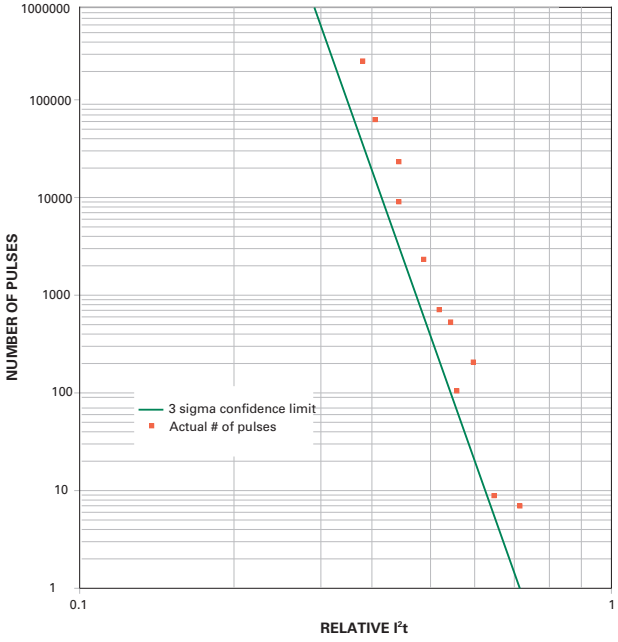


Figure 5: Pulse Cycle Withstand Capability for Blade Fuses

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

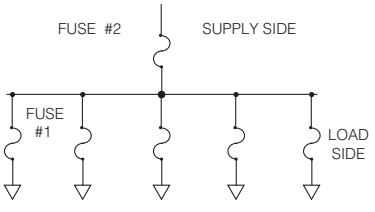


Figure 6: Selective Coordination for Fuses in Series

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

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

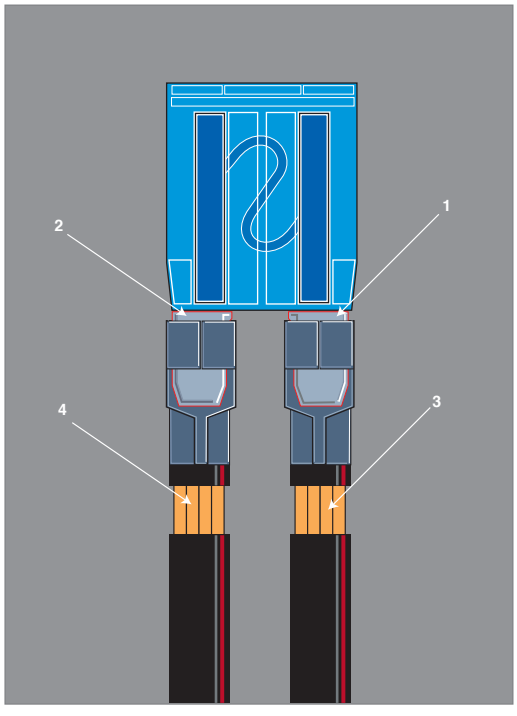


Figure 7: Measurement Locations along the Fuse/Terminal/Cable System Used to Determaine the Voltage Drop across the Terminal

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
mm²	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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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

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FORM NO. AA101

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