SOLUTIONS FOR
POWER MANAGEMENT

FUSES AND OVERCURRENT PROTECTION DEVICES FOR POWER ELECTRONICS AND BATTERY-RELATED APPLICATIONS

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SAFE AND RELIABLE PROTECTION IN TWO DISTINCT PRODUCT CATEGORY OFFERINGS

Mersen offers a broad and comprehensive line of protective devices for the protection of power electronics and DC applications. This brochure provides the reader a product line overview, classified into two distinct categories:

CHAPTER 1: SEMICONDUCTOR PROTECTION FUSES

PAGE 3

Semiconductor Protection Fuses are used to protect sensitive loads against overcurrent conditions in power electronic equipment.

STANDARD POWER CONVERTER PROTECTION

FUNCTION

- Protection of power modules in converter / inverter / rectifier

PRODUCT FAMILIES

- Square Body Fuses. p.7
- North American Style Round Body. p.8
- IEC Cylindrical Body p.9
- NH DIN and BS88 Fuses. . . . . .p.10 & 11
- Miniature Fuses. p.12

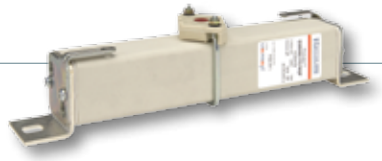
RAILWAY AND TRACTION CONVERTER PROTECTION

FUNCTION

- For installation in heavy or light rail applications
- For protection of main electrical feed and the power conversion

PRODUCT FAMILIES

- DC high performance Square & Round Body Power Fuses p.13
- Cylindrical Auxiliary DC Fuses. p.16



APPLICATION-ENGINEERED CONVERTER PROTECTION

FUNCTION

- Protection of highly demanding and specific applications

PRODUCT FAMILIES

- Low Inductance Square Body p.14
- High Performance Square Body p.15

CHAPTER 2: OVERCURRENT PROTECTION DEVICES FOR BATTERY APPLICATIONS

PAGE 18

Overcurrent Protective Devices (OCPD) are specifically designed to safely clear both high and low DC fault currents for today's demanding DC systems in EV/HEV and Electrical Energy Storage applications.

DC FUSES FOR E-MOBILITY

FUNCTION

- Fuses specifically designed for protection of DC battery related applications such as Electric Vehicles (EV) and Energy Storage (EES) facilities

PRODUCT FAMILIES

- M-*fuse* for Battery Module Protection. p.20
- EVpack-*fuse* for Battery Disconnect Unit (BDU) and Maintenance Safety Disconnect (MSD) p.21

HYBRID OVERCURRENT PROTECTIVE DEVICES

FUNCTION

- Hybrid DC protection and management for battery powered systems such as Electric Vehicles (EV) and Energy Storage (EES) facilities

PRODUCT FAMILIES

- Xp & Xs series p.22

SEMICONDUCTOR PROTECTION FUSES THAT MEET EVERY MAJOR STANDARD

Standards may change from country to country, but the need for safe, reliable electrical protection for semiconductor applications is the same the world over. That's why Mersen offers the best protection solutions on the market today and the widest range of semiconductor protection fuses that meets every major International Standard.

SEMICONDUCTOR PROTECTION FUSES ARE DIFFERENT THAN REGULAR STANDARD FUSES

Semiconductor protection fuses are used to protect against overcurrent conditions in power electronic equipment. They are specifically designed to reduce the I^2t, peak let-through current and arc voltages during a fault condition. There is hardly an electric powered product that exists today that does not rely on semiconductor technology to some degree. That means extending electrical protection to IGBTs, Silicon Carbide (SiC), GaN, thyristors, triacs, diodes, and a host of other solid-state components, and providing a wide range of voltage requirements, unique mounting configurations, and special protection characteristics. Semiconductor Protection Fuses differ vastly from standard fuses in performance and purpose, as indicated in the table below.

	Overcurrent Protection	Standards	Safety Standards	Ratings	Type of Protection	Purpose
Semiconductor and Special Purpose Fuses	Power Semiconductor	IEC or UL recognized component	Internationally harmonized (UL/IEC/CSA/CCC)	Non-Standard	Ultra-fast and low-energy	Sensitive component and topology protection
Standard Fuses	Cable/overload protection	IEC or UL listed component	Local-specific	Defined by Standards	Short circuit and overload	Provides general protection to power sources and AC loads

Semiconductor Protection Fuses from Mersen are designed to :

- Limit the thermal energy (I^2t) let-through
- Interrupt very high potential fault currents in extremely short times
- Limit the let-thru current in case of a fault
- Ride through normal transient overload conditions
- Withstand heavy duty cycling capabilities

SEMICONDUCTOR PROTECTION FUSE SOLUTIONS

Mersen supports OEM designers and equipment-maintenance personnel with a comprehensive line of semiconductor protection fuses. Product lines, such as Protistor® PSC Square Body ceramic semiconductor fuses, have been developed to meet worldwide standards and also match every market with complete lines of North American style round semiconductor fuses, IEC Cylindrical, NH DIN German and British BS88 Standards fuses.

TYPICAL APPLICATIONS

- Protection of Power inverters, converters and rectifiers, AC and DC drives
- DC common bus
- Reduced voltage motor starters
- UPS systems
- Protection of Capacitor banks
- Switchboard and control panels
- DC grids

Mersen dedicated solutions are used in various markets around the globe. We work closely with our customers to better understand their application needs and to help improve their productivity.

Renewable Energies | Power Electronics | Battery DC Protection | Transportation | Process Industries | Solar

TYPICAL MARKETS AND APPLICATIONS**

SEMICONDUCTOR PROTECTION FUSES PRODUCT LINE

TYPICAL MARKETS AND APPLICATIONS**	Square Body	North American Style Round Body	IEC Cylindrical Body	NH DIN and British Standard Square Body	British BS88 Standard Cylindrical Body	Miniature	DC high performance Square & Round Body Power Fuses	Low Inductance Square Body	High Performance Square Body	Cylindrical Auxiliaries AC & DC	DC Over-current Protection
Rectifiers	●	●	●	●	●	●		●	●	●	
Inverters	●	●	●	●	●	●		●		●	
Low and Medium Voltage Drives	●	●	●	●	●			●		●	
UPS and Power Supplies	●	●	●	●	●	●					
High Power Gen., Conversion, and Transmission							●	●	●	●	
Semiconductors (IGBT, Diodes, Thyristors)	●	●				●		●	●	●	
Battery - DC Applications							●				●

SEMICONDUCTOR PROTECTION FUSES PRODUCT LINE – TECHNICAL OVERVIEW

Product Line	Square Body	North American Round Body	Standard Cylindrical Body	NH DIN and British Standard Square Body	British Standard BS88 Cylindrical Body	Miniature	DC high performance Square & Round Body Power Fuses	Low Inductance Square Body	High Performance Square Body	Cylindrical Auxiliary DC Fuse	DC Over-current Protection	Special Application
												
Operating Class/Range	aR, gR	Partial Range	aR, gR	aR, gR. gS	aR, gR	Fast Acting, Time Lag	aR, gR	aR	aR	aR, gR	aR, DC	aR, gR
Voltage Range (AC/DC)	690-1300VAC/ 600-1100VDC*	150-1500VAC/ DC*	Up to 1000VAC/ 700VDC*	690VAC	Up to 690VAC	125V to 1000V	750VDC to 4200VDC	Up to 12,500VAC/ 10,000VDC	700VAC to 3800VAC	440 - 4000VDC	Up to 1000VDC (L/<1.5rms)	Subsea immersed converters, rotating converters
Current Ratings	2 - 5000A	1-6000A	1-250A	Up to 1000A	Up to 1050A	0.04 to 30A	6-1600A	Consult Mersen	400 to 10,000A	0.8 - 160A	5-600A	
Interrupting Rating	Up to 200kA	Up to 200kA	Up to 200kA	200kA AC only	Up to 200kA	Consult Mersen	Consult Mersen	Up to 80kA	Up to 230kA	-	Up to 20kA	
Protection For**	Rectifiers, inverters, AC drives, UPS systems	Motor drives, UPS, heavy traction and electro-chemical rectifiers, heavy-duty power supplies, AC Drives	Small inverters, UPS systems, Motor Drives capacitor discharge, high dI/dt disconnec-tion	Inverters, AC drives, UPS systems	Inverters, AC drives, UPS systems	Monitoring, controllers, very low power converter, metering devices	Light rail (metro / tram): 600/ 750VDC; Suburban lines: 1,5kVDC; Suburban lines: 3kVDC Railway 15 / 25 KVAC	Voltage Commutated Inverters (UPS and Drives) High voltage drives or softstarters	LV&MV high power drives (large rectifiers) Substation High power UPS systems	Auxiliary circuits, Monitoring controller, Very low power converter	Electric Vehicles and Battery-related applications	
Page	7	8	9	10	11	12	13	14	15	16	20, 21	

*Varies by rating – Consult Mersen for more details ** Typical Application – Consult Mersen for further application examples

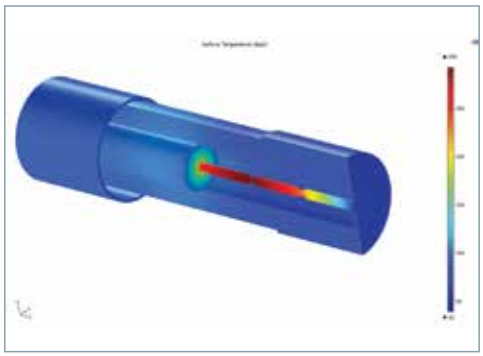
APPLICATION ENGINEERING SUPPORT

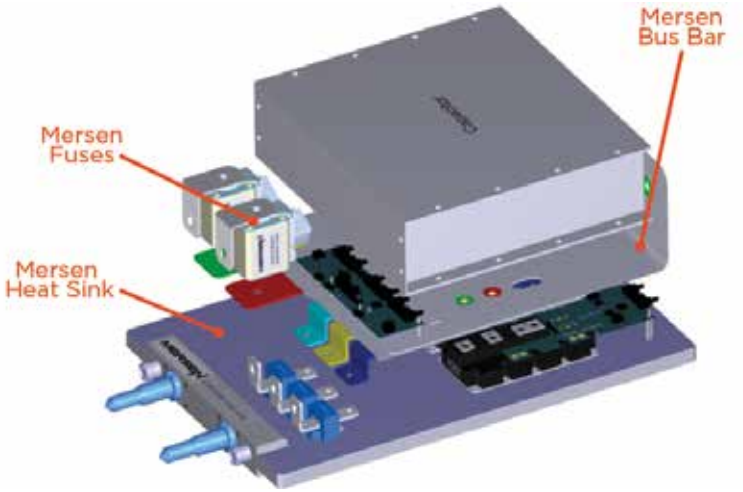
Mersen application engineering teams are available to assist our customers with the correct selection of semiconductor protection fuses for their applications. Visit ep.mersen.com for more information.

MERSEN HIGH-POWER FUSE TEST LABS

Mersen offers our customers global test capabilities for testing products in North America (Newburyport, Massachusetts) and in Europe (Saint Bonnet de Mure, France). Our labs can conduct fuse performance testing in AC and DC applications under UL/CSA or IEC standards guidelines. We utilize state-of-the-art instruments and software to provide accurate run-testing services and in-depth analysis. For more information on our test capabilities, please contact Mersen.

The labs also play a critical role in custom-fuse development, enabling us to test prototypes quickly and efficiently to keep pace with your development schedule. These labs play a crucial and fundamental role in our quality control program for Mersen's electrical protection products.

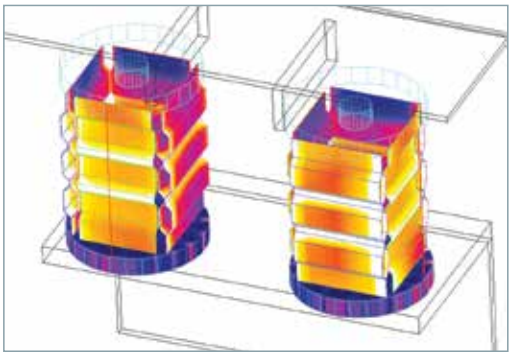




SOLUTIONS FOR POWER MANAGEMENT: TURN TO MERSEN TO BE YOUR DESIGN PARTNER

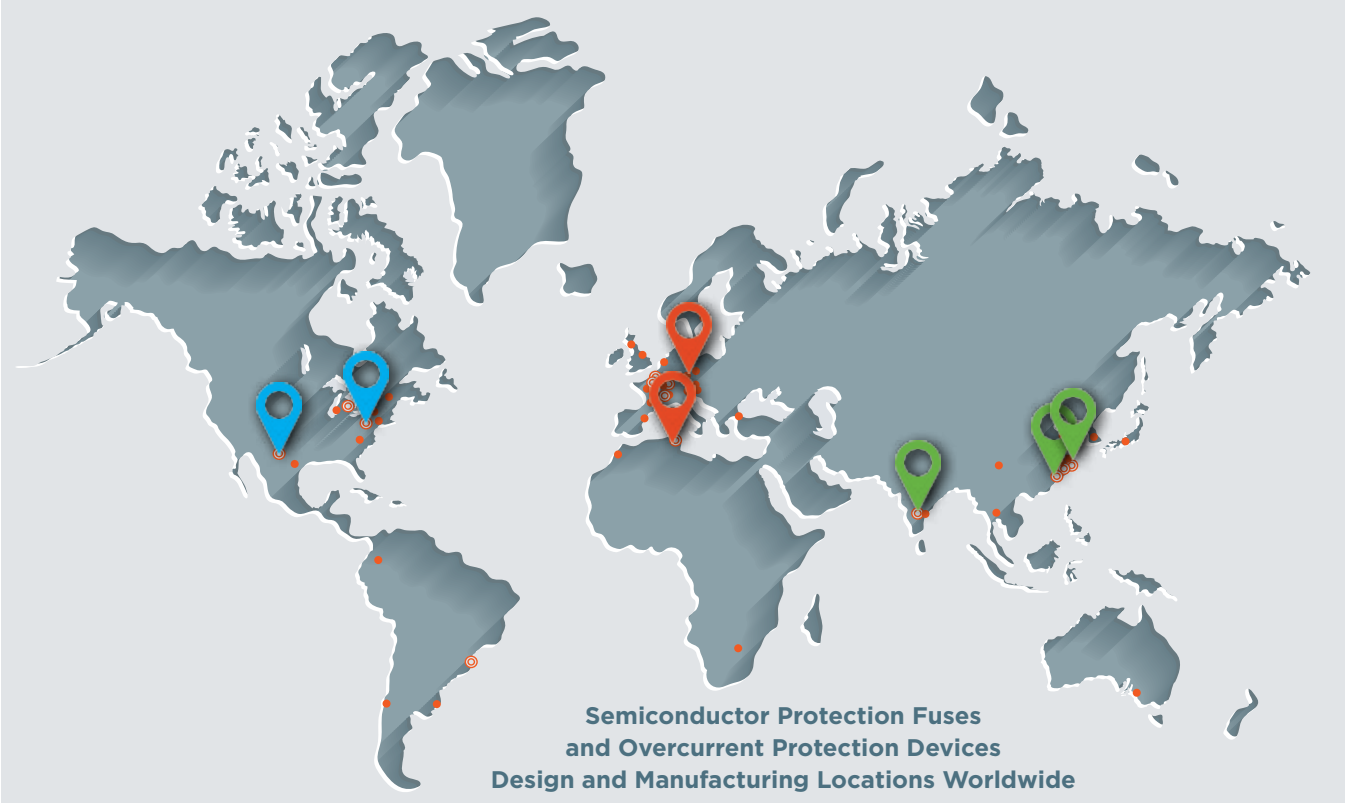
Combine Mersen square body semiconductor fuses with Mersen's cooling solutions and laminated bus bar offerings for an optimized system solution to support your power electronics designs. As a design partner with extensive application and product expertise, Mersen is able to maximize system performance, lower total costs, and reduce time to market. Our dedicated power electronics team is available to customize a solution for you. In addition, custom solutions are available for your semiconductor protection needs.

To reduce design time and to optimize performance specifications, Mersen engineering teams can provide state of the art simulations for fuses, heat sinks, and bus bars. Simulations can greatly improve prototype design considerations and reduce manufacturing lead times.



A GLOBAL REPUTATION FOR QUALITY

Mersen's reputation for outstanding technical expertise, product quality, and engineered safety is the result of over a century of design and manufacturing knowledge, coupled with state-of the-art equipment in various ISO-9001 and ISO-14001 registered facilities around the world.



Semiconductor Protection Fuses and Overcurrent Protection Devices Design and Manufacturing Locations Worldwide

Newburyport, MA, USA
Design and Test
ISO9001 & ISO14001

Saint-Bonnet, France
Design, Test & Manufacturing
ISO9001 & ISO14001
IRIS & ISO 17025

Shanghai, China
Wenzhou, China
Manufacturing
ISO9001 & ISO14001

Juarez, Mexico
Manufacturing
ISO9001 & ISO14001

Tunis, Tunisia
Manufacturing
ISO9001 & ISO14001, OHSAS 18001

Bangalore, India
Manufacturing
ISO9001 & ISO14001

PROTISTOR® SQUARE BODY FUSES

Mersen Protistor ® square body fuses provide maximum flexibility in equipment design and ultimate protection for today's power conversion equipment. These square body fuses are available in eight different body sizes, each size having more than seven worldwide acceptable mounting styles. The different mounting styles and body sizes along with a broad range of ampere ratings allow greatest flexibility in equipment design.

Mersen Protistor® square body fuses have been engineered to provide state-of-the-art protection for semiconductor devices. They have die-cut elements embedded in solidified sand, which helps control arcing characteristics for low I^2t and high interrupting rating. All contact surfaces are silver plated and all hardware is non-magnetic. Many square body fuses are equipped with a trip-indicator. This trip indicator can operate a field-mountable micro-switch which is easily mounted directly onto the fuse.

Highlights:
- Extremely fast-acting
- Current-limiting
- Very low I^2t
- Worldwide acceptability
- Superior cycling ability

Applications:
- Rectifiers
- Inverters
- AC drives
- UPS systems

Approvals:
- UL recognized file E76491
- CSA certified
- IEC 60269-4 certified
- CCC approved

PROTISTOR - SQUARE BODY FUSE RATINGS

Size/Series	Operating Class/Range	Ampere Rating I_n (A)	Rated Voltage (V) IEC/UL		Maximum Interrupting Rating IR		Mounting
			AC	DC	AC	DC	
30 31 32 33 2x31 2x32	aR	50-2500** 2X up to 5000	690/700VAC*	600VDC*	200kA*	100kA*	Flush-end, PressPack
30 31 32 33							Blade
70 71 72 73 2x72 2x73	aR	50-1800** 2X up to 3600	1250/1300VAC	750VDC-1100VDC*			Flush-end, PressPack
70 71 72 73							Blade
70 71 72 73	gR	50-1000	690VAC	600VDC*	150kA		Flush-end, Blade

* May vary by rating – Consult Mersen technical support

** May vary by mounting

Fuse holders available – Contact Mersen for more information

AMP TRAP® NORTH AMERICAN STYLE ROUND BODY FUSES

The Amp-Trap Round Body Semiconductor Protection fuses were designed for the protection of semiconductor devices. This product line encompasses a wide variety of voltage ratings and performance, making it ideal for protecting a wide variety of power electronic applications.

Highlights:

- Fast acting
- Current limiting
- Low I^2t
- Indicator options available
- Various mounting types

Applications:

- AC drives, inverters
- Heavy traction and electrochemical rectifiers
- Heavy duty power supplies
- UPS

Approvals:

- UL recognized file E76491, E60314
- CSA certified

AMP-TRAP NORTH AMERICAN ROUND BODY FUSES RATINGS

Size/Series: Amp-Trap®	Operating Class/ Range	Ampere Rating* I_n (A)	Rated Voltage Vn (V) (IEC)	Interrupting Rating - Tested		Mounting
				AC	DC	
A15QS	Partial Range	20 - 6000	150VAC/DC	100kA	50kA	Hockey Puck, Bolt-in Blades
A30QS		1 - 6000	300VAC/DC	200kA	100kA	Ferrule, Hockey Puck, Bolt-in Blades
A50QS		35 - 1200	500VAC/DC	200kA	87kA	Bolt-in Blades
A50P		10 - 1200	500VAC/450VDC	100kA	79kA	Ferrule, Bolt-in Blades
A60X		1 - 3000	600VAC	200kA	n/a	Ferrule, Hockey Puck, Bolt-in Blades
A70QS		35 - 800	700VAC/DC	200kA	100kA	Bolt-in Blades
A70P		10 - 2000	700VAC/650VDC	100kA	100kA	Ferrule, Hockey Puck, Bolt-in Blades
A70Q		35 - 600	700VAC/650VDC	200kA	100kA	Bolt-in Blades
A100P		15 - 2000	1000VAC/750VDC	100kA	100kA	Ferrule, Bolt-in Blades
A120X		½ - 30	1200VAC/1000VDC	100kA	100kA	Ferrule
A150X		1 - 1000	1500VAC/VDC	100kA	100kA	Ferrule, Bolt-in Blades

*For other ratings, consult Mersen technical support

Fuse holders available – Contact Mersen for more information

STANDARD CYLINDRICAL BODY FUSES

Mersen's Standard Cylindrical fuses provide an extremely high interrupting ratings offering power semiconductor applications the ultimate in electrical protection. The Protistor IEC semiconductor fuses offer is comprised of 2 different classes of protection:

- The gR range is a fast acting fuse with full-range protection. It protects high short-circuit currents and small overload currents.
- The aR range is a high performance, ultra-fast acting fuse for superior short-circuit protection only.

Highlights:

- Extremely fast acting
- Current limiting
- Extremely low I^2t
- High breaking capacity
- Excellent cycling capability
- Modular fuse holder

Applications:

- Small inverters
- UPS systems
- Motor drives
- Capacitor discharge, high dI/dt disconnection

Approvals:

- UL recognized file E76491, E60314
- CSA certified
- IEC 60269-4 certified
- CCC approved

PROTISTOR - IEC CYLINDRICAL FUSE-LINKS RATINGS

Size/Series	Operating Class/Range	Ampere Rating I_n (A)	Rated Voltage (V) IEC/UL		Maximum Interrupting Rating IR		Mounting
			AC	DC	AC	DC	
10X38 mm	gR	1-32	690/700VAC*	Consult Mersen technical support*	200kA	consult us*	Ferrule
14X51 mm		1-63					
22X58 mm		12-135					
27X60 mm		8-110	800VAC		90kA @ 800V 175kA @ 700V		
14X51 mm	aR	6-63	690/700VAC*		200kA		
22X58 mm		25-135					
27x60 mm		63-250					
27x60 mm		25-170	1000VAC		100kA		

* May vary by rating – Consult Mersen technical support

AMP TRAP - CYLINDRICAL FUSE RATINGS

Series	Size	Operating Class/Range	Ampere Rating I_n (A)	Rated Voltage (V) IEC/UL		Maximum Interrupting Rating IR		Mounting
				AC	DC	AC	DC	
A15QS	1-1/2" x 13/32" - 10X38 mm	partial	1-30	150VAC	150VDC	100kA	50kA	Ferrule
A60Q	1-1/2" x 13/32" - 10X38 mm	partial	5-40	600VAC	600VDC	200kA	100kA	
A70QS	2"x9/16" - 14x51 mm	partial	6-50	690VAC	700VDC	200kA	100kA	
	2-1/4"x13/16" - 22x58 mm	partial	10-100					

Fuse holders available – Contact Mersen for more information

PROTISTOR® - NH DIN AND BRITISH STANDARD BS88 SQUARE BODY FUSES

Mersen's DIN and BS88 Square Body Fuses offer an extremely high interrupting rating, providing the ultimate electrical protection for power semiconductor applications.

Highlights:

- Compact fast acting
- Current limiting
- High breaking capacity
- Low I^2t

Applications:

- Inverters
- AC drives
- UPS systems

Approvals:

- UL recognized file E76491
- CSA certified
- IEC 60269-4 certified
- CCC approved
- VDE 636-23

PROTISTOR - NH DIN AND BS88 SQUARE BODY FUSE RATINGS

Size/Series	Operating Class/ Range	Ampere Rating I_n (A)	Rated Voltage (V) IEC/UL AC	Maximum Interrupting Rating IR AC	Mounting
000	gR	20-125	690VAC*	200kA*	BS88 blade w/wo trip indicator
000	aR	75-400			BS88 blade w/wo trip indicator
000, 00	aR	80-400			DIN80/110 blade w/wo trip indicator
000, 00, 0, 1, 2, 3	aR	16-1000	690/700VAC*		plain blade
000, 00, 1, 2, 3	gS	16-630			plain blade

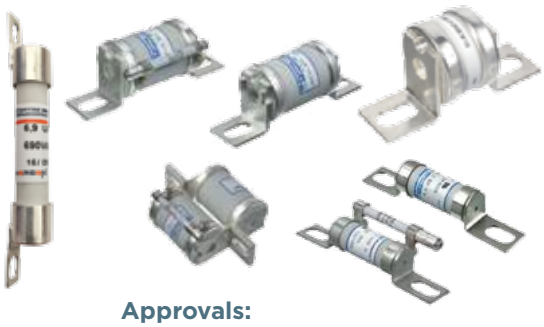
* May vary by rating – Consult Mersen technical support

For DC applications, consult Mersen technical support

Fuse holders available – Contact Mersen for more information

PROTISTOR® - BRITISH STANDARD BS88 CYLINDRICAL BODY FUSES

Mersen's Protistor Fuse line offers an extremely high interrupting rating, affording power semiconductor applications the ultimate in circuit protection while meeting the British Standard BS88 in a round fuse format.



Highlights:

- Compact fast acting
- Current limiting
- High breaking capacity
- Low I^2t

Applications:

- Inverters
- AC drives
- UPS systems

Approvals:

- IEC 60269-4 certified
- UL Recognized File: E76491
- VDE 636-23

PROTISTOR - BS88 CYLINDRICAL BODY FUSES RATINGS

Size/Series	Operating Class/ Range	Ampere Rating I_n (A)	Rated Voltage (VAC) IEC/UL	Maximum Interrupting Rating IR	Mounting
10X28 mm	aR/gR	5-32	250VAC*	100kA*	BS88 blade
17X27 mm	aR/gR	7-180			BS88 blade w/wo trip indicator
36X27 mm 2X36X27 mm	aR/gR	50-1050			BS88 blade w/wo trip indicator
10X51 mm	aR	5-20	690VAC*	200kA*	BS88 blade
17X49 mm 2X17X49 mm	aR	16-160			BS88 blade w/wo trip indicator
17X49 mm	gR	80-400			BS88 blade w/wo trip indicator
36X55 mm 2X36X55 mm	aR	75-800			BS88 blade w/wo trip indicator

* May vary by rating – Consult Mersen technical support

For DC applications, consult Mersen technical support

Fuse holders available – Contact Mersen for more information

PROTISTOR® - MINIATURE BODY FUSES

Mersen miniature fuse offers provide protection for electronic and low power equipment in AC networks. Mersen miniature fuse-links were developed to provide a very high breaking capacity for electronic converters. These fuse-links are ready to be installed directly on Printed Circuit Boards or with the use of clips for easy maintenance.

Highlights:

- Extremely current limiting
- High breaking capacity
- Worldwide acceptability

Applications:

- Monitoring controllers
- Very low power converter
- Metering devices

Approvals:

- UL recognized E76491
- UL recognized E90660
- IEC 127-2 Standard Sheet 1

PROTISTOR - MINIATURE BODY FUSES RATINGS

Size/Series	Operating Class/Range	Ampere Rating I_n (A)	Rated Voltage (VAC) IEC/UL	Mounting
5X20 mm	Fast acting/FA	14-20A	125VAC	axial leads ferrule
		0,04-13A	250VAC	
		0,04-4A	400VAC	
		0,63A	500VAC	
6X32 mm		25-30A	125VAC	
		0,04-20A	250VAC	
		0,04-20A	400VAC	
		2 6,3A	440VAC	
		0,04-16A	500VAC	
		0,1-2A	690VAC	
6X46 mm	Fast acting/FA	0,1-1,3A	1000VAC	
5X20 mm	Time Lag/SA	14-16A	125VAC	
		0,04-13A	250VAC	
		0,04-3,2A	400VAC	
6X32 mm		25-30A	125VAC	
		0,04-20A	250VAC	
		0,04-10A	400VAC	
		0,1-10A	500VAC	
		1,6A	600VAC	

Fuse holders available – Contact Mersen for more information

PROTISTOR® - DC HIGH PERFORMANCE SQUARE & ROUND POWER FUSES

Mersen DC high performance power fuses were developed to provide superior protection for railway power circuits. These fuse-links are typically operated at more elevated temperatures than other fuse types. They have lower I^2t to minimize damage to components in case of short circuits, and have lower watts loss and longer life.

PROTISTOR - DC HIGH PERFORMANCE SQUARE & ROUND BODY POWER FUSE RATINGS

Size/Series	Operating Class/ Range	Ampere Rating* I_n (A)	Rated Voltage (VDC) IEC/UL DC	Maximum Interrupting Rating IR DC	Mounting	Form
120	gR	50-160	900VDC* 750VDC**	Consult Mersen technical support	Flush-end or blade	Square
121		200-250				
122		250-500				
123		500-800				
2X122		500-1000			Flush-end	
2X123		1000-1600				
70	aR	20-125	1200VDC*		L-bracket	
72		160-420				
2X72		500-840				
120	aR	20-215	2000VDC*		L-bracket	
122		160-400				
2X122		500-800				
300	gR	6-125			L-bracket or blade	
302		100-280				
2X302		200-560			L-bracket	
300	aR	20-180	2400VDC*		L-bracket	
302		160-400				
2X302		400-800				
600	gR	6-125	4000VDC*		L-bracket or blade	
602		100-180			L-bracket	
2X602		200-560				
600	aR	10-150	4200VDC*			
602		200-375				
2X602		400-750				
Diam. 90mm	gR	400-600	1900VDC* 1500VDC**	60kA	Flush-end	Round
Diam. 146mm	gR	850-1000				

* Consult Mersen technical support

** Nominal line voltage (railway)

Fuse holders available – Contact Mersen for more information

Highlights:

- Extremely Fast Acting
- Current Limiting
- Very Low I^2t
- Worldwide Acceptability
- Superior Cycling Ability

Applications:

- Light rail (metro/tram): 600/ 750VDC
- Suburban lines: 1,5kVDC
- Suburban lines: 3kVDC
- Railway 15 / 25 KVAC

Approvals:

- UL recognized file E76491
- CSA certified
- IEC 60269-4 certified
- CCC approved (consult Mersen)

PROTISTOR® - LOW INDUCTANCE SQUARE BODY POWER FUSES

Mersen is a unique player in protection against capacitor discharge and high di/dt faults. Our extensive knowledge base was acquired from our direct partnerships with key customers that resulted in the development of Square Body. This experience has given us the ability to create a dynamic product that has the capability to disconnect within tens of microseconds to prevent collateral damage from a fault condition.

Highlights:

- Extremely fast acting
- Extremely current limiting
- Very low I^2t
- Worldwide acceptability
- Superior cycling ability

Applications:

- Voltage commutated inverters (UPS and drives)
- High voltage drives or softstarters

Approvals:

- Consult Mersen Technical Support

PROTISTOR - LOW INDUCTANCE SQUARE BODY FUSE RATINGS

Size/Series	Operating Class/Range	Ampere Rating I_n (A)	Rated Voltage (V) IEC/UL		Maximum Interrupting Rating		Mounting
			AC	DC**	AC	DC	
2X15X27 single body	aR	up to 325A	5000VAC*	5000VDC**	*	*	L-brackets terminals
2X15X27 multiples bodies		*		*	*	*	
2X15X27 single body		up to 250A	7200VAC*	7200VDC**	*	*	
2X15X27 multiples bodies		*		*	*	*	
2X15X27 single body		up to 170A	10000VAC*	10000VDC**	*	*	
2X15X27 multiples bodies		*		*	*	*	
2X15X27 single body		up to 135A	12500VAC*	*	*	*	
2X15X27 multiples bodies		*		*	*	*	

* Consult Mersen technical support

** DC (VSI) Voltage Source Inverter

Fuse holders available – contact Mersen for more information

PROTISTOR® - HIGH PERFORMANCE SQUARE BODY POWER FUSES

Mersen provides state-of-the-art protection for large, high-power applications of power generation, transmission, and conversion of electrical energy. Mersen High Performance Square Body fuses are fully customizable to fit our customer's requirements. Our expertise in fast acting technology has led to the development of an optimized protection solution with the lowest I^2t and the highest breaking current capacity while keeping the best cycling capability. The High Performance Square Body fuses have pure silver fuse elements embedded in solidified sand. All contact surfaces are plated and all hardware is non magnetic. All fuses come standard with a blown fuse indicator. This indicator can operate a microswitch which is easily mounted directly onto the fuse in service.

Highlights:

- Extremely Fast Acting
- Current Limiting
- Very Low I^2t
- Worldwide Acceptability
- Superior Cycling Ability

Applications:

- LV & MV high power drives
- Large rectifiers
- Substation
- High power UPS systems

Approvals:

- UL recognized file E76491
- CSA certified
- IEC 60269-4 certified
- CCC approved (consult Mersen)

PROTISTOR - HIGH PERFORMANCE SQUARE BODY FUSES RATINGS

Size/Series	Operating Class/ Range	Ampere Rating I_n (A)	Rated Voltage Vn (V) IEC/UL	Maximum Interrupting Rating IR AC	Mounting
44	aR	1250-6200	750VAC*	230kA tested* 350kA estimated*	Flush-end, PressPack
2X44		2400-10000	700VAC*		Plates, PressPack
73		800-2400	1250VAC*		Flush-end, Plates, Blades
2X73		1800-4200	1150VAC*		Plates, Omega bar
83, 84		630-4200	1500VAC*		Flush-end, Plates, Blades, PressPack
2X83, 2X84		900-8400	1450VAC*		Plates, PressPack
93, 94		525-3600	1800VAC*		Flush-end, Plates, Blades, PressPack
2X93, 2X94		1050-7200	1800VAC*		Plates, PressPack
123,124		630-2900	2500VAC*		Flush-end, Plates
2X123, 2X124		800-4100	2500VAC*		Plates, PressPack
173,174		400-1500	3800VAC*	150kA tested* 300kA estimated*	Plates, PressPack
2X173, 2X174		800-3100	3600VAC*		Plates

*may vary by rating – Consult Mersen technical support

Fuse holders available – Contact Mersen for more information

PROTISTOR® - CYLINDRICAL AUXILIARY DC FUSE

Mersen DC high performance power fuses were developed to provide superior protection for railway power and auxiliary circuits. They have lower I^2t to minimize damage to components in case of short circuits, and have lower watts loss and longer life.

Highlights:

- Extremely fast acting
- Current limiting
- Very Low I^2t
- Worldwide acceptability
- Superior cycling ability

Applications:

- Protection of rectifiers, inverters, AC drives, Traction Auxiliary Circuits
- UPS Systems, reduced voltage motor starters, and other equipment in globally accepted applications

Approvals:

- UL Recognized file E76491
- Consult Mersen Technical Support

PROTISTOR - CYLINDRICAL AUXILIARY DC FUSE RATINGS

Size/Series	Operating Class/ Range	Ampere Rating I_n (A)	Rated Voltage (VDC) IEC/UL DC	Maximum Interrupting Rating IR DC	Mounting
14X51 mm	gL	2-50	440VDC	100kA	Ferrule
22X58 mm		50-100			
27X60 mm		125-160			
27X60 mm	gR	0,8-110	660VDC	50kA	
20X127 mm	gR	6-63	1000VDC	100kA	
		0,8-25	1500VDC	30kA	
20X190 mm	gR	6-32	1500VDC	60kA	
36X127 mm	gR	20-100	1000VDC	100kA	
36X190 mm	gR	40-100	1500VDC	up to 100kA	
36X250 mm	gR	0,8-40	2000VDC	30kA	
36X400 mm	gR	0,8-20	4000VDC	30kA	

Fuse holders available – Contact Mersen for more information

SEMICONDUCTOR FUSE TECHNOLOGY

Semiconductor fuses are used to protect against catastrophic semiconductor failure. Because of their ability to operate quickly during high fault current, semiconductor fuses help to significantly limit short circuit current to downstream components. Each different technology type of semiconductor fuse is defined by the fuse size, shape, and the type of termination:

- Cylindrical fuses can have bladed or non-bladed electrical contacts. Ferrule style fuses have caps crimped or affixed to the body. The body construction material is either made of ceramic or GMG (Glass Melamine Glass).
- Square body fuses have terminals that are screwed to the body. The body material is made of ceramic.

REGIONAL STANDARDS

Semiconductor fuses are covered by regulatory standards. The mechanical connections represented by the standards shown in this brochure follow these regional practices. Here are general descriptions of these regional practices:

- US - North American: Ferrule type, round body, or square body fuses with closed slot blades or end contacts with UNC tapped holes.
- FR - IEC Europe: Ferrule type and square body fuses with open slot blades or end contacts with metric tapped holes.
- DIN - German: Round body and square body fuses with brackets and wedge shaped contacts according to DIN43620 and DIN 43653 standards.
- BS - British: Round body and square body fuses with brackets according to BS88-4 standards.
- SP - Special Purpose: Fuses with mounting arrangements determined by application needs.

MANAGING OPERATION & FAULT CLEARING OF DEMANDING DC APPLICATIONS

With the continuous growth of demands for DC battery-related applications such as Electric Vehicles and Energy Storage facilities, comes the need for better operation management and fault clearing of such loads. Mersen offers a wide range of DC overcurrent protection (OCP) solutions based upon incumbent proven technology (DC fuse) enhanced by two new disruptive hybrid devices. These three product families are designed to safely clear both high and low DC fault currents for today's demanding DC systems in EV/HEV and Electrical Energy Storage applications.

OVERCURRENT PROTECTION DEVICES FOR BATTERY AND DC APPLICATIONS

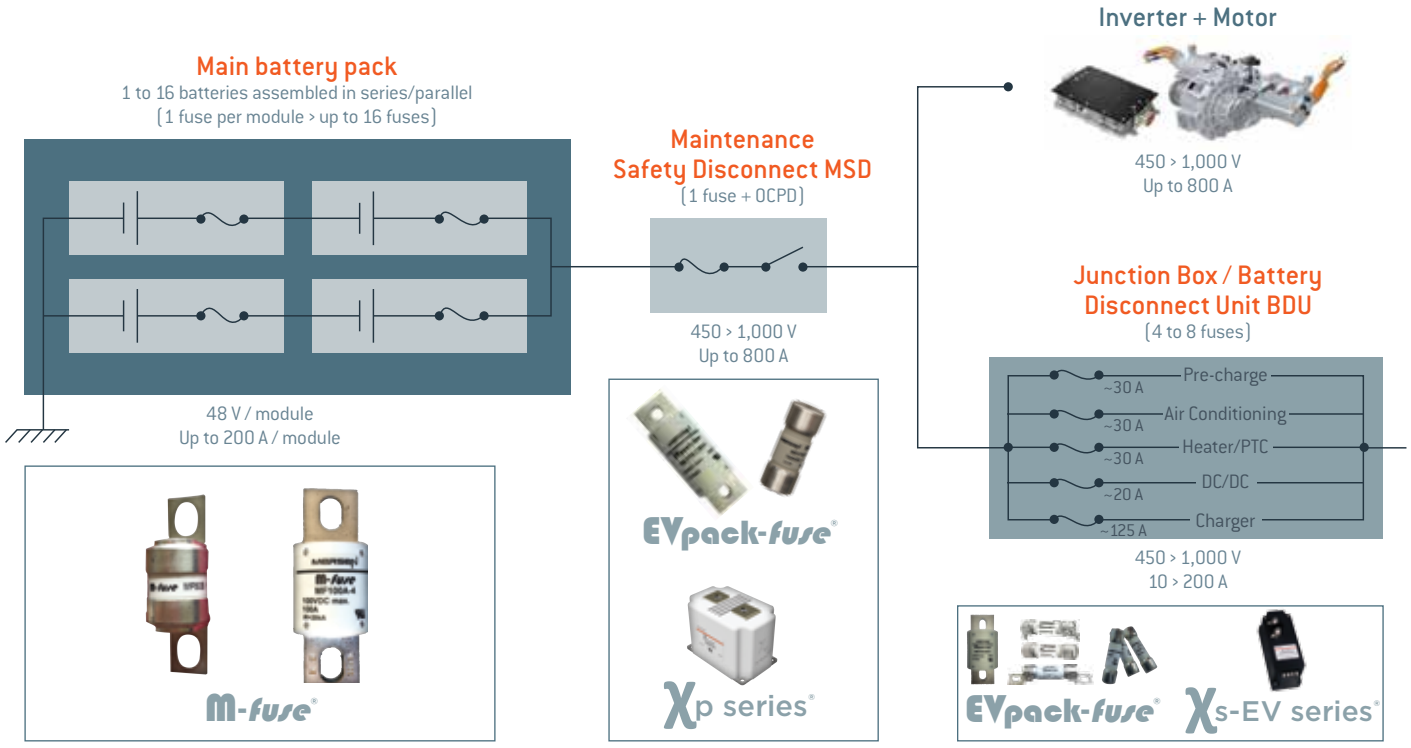
Mersen DC-rated OCPD devices have been specifically developed to :

- Clear both high and low DC fault current
- Limit or eliminate the impact of severe duty cycles in DC switching applications
- Decrease power losses during normal operation to improve system efficiency
- Offer a reliable and robust alternative to DC relays, DC contactors, DC switches

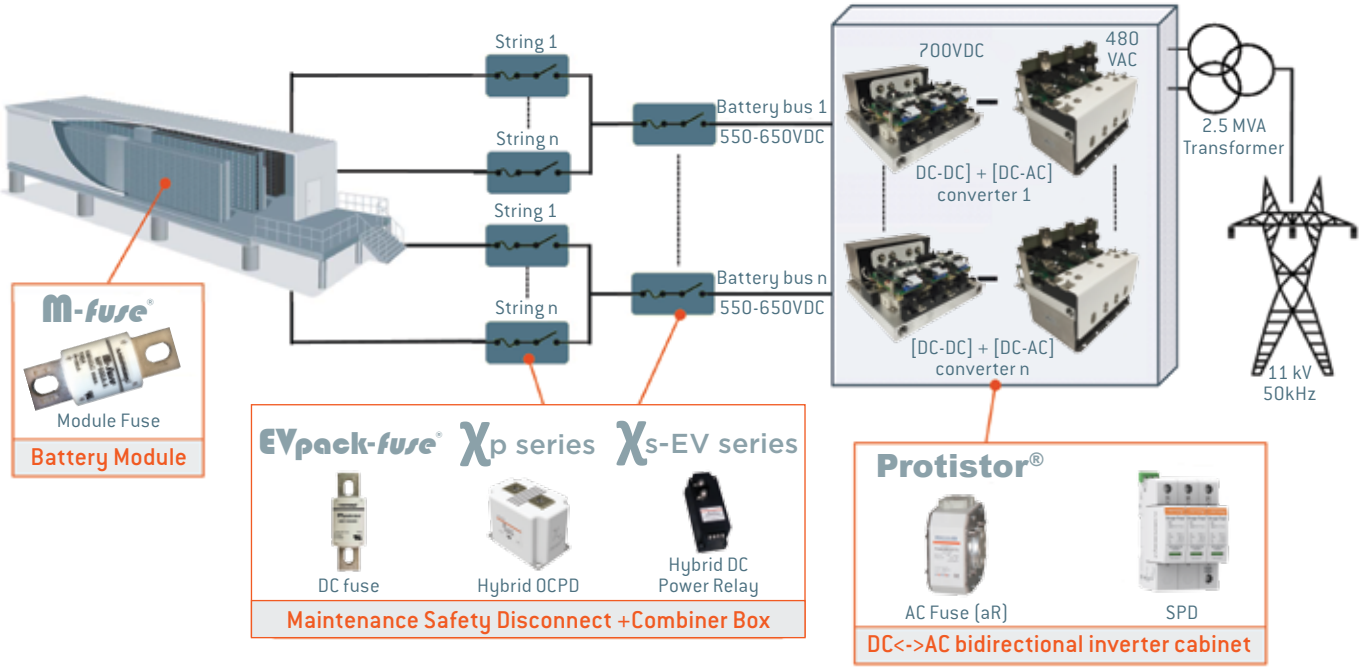
Mersen OCPD devices come in two variants: DC-Fuse and Hybrid Technology:

	MONOLITHIC TECHNOLOGY	HYBRID TECHNOLOGY	
Product range	EVpack-fuse® M-fuse®	Xp series	Xs-EV series
Core technology	**DC-Fuse**	**Pyro + clearing elements**	**Semiconductor + Switch**
Value proposition	Ultra fast-acting fuses (for large fault currents) Proven technology DC-specific design	Fast-acting operation < 1ms Innovative and cost effective solutions Close-to-zero conduction loss Operates for small or large fault current Fully configurable Very compact size High cycling performances High inrush current capabilities	Fast-acting protection Close-to-zero conduction loss Fully configurable Resettable Arc-less
Visuals			

EXAMPLE OF PRODUCT FIT IN EV/HEV APPLICATIONS:



EXAMPLE OF PRODUCT FIT IN ELECTRICAL ENERGY STORAGE APPLICATIONS:



M-FUSE MF 100VDC BATTERY MODULE FUSES

M-fuse line-up belongs to the new DC Overcurrent protection (O.C.P.) range developed by Mersen to address specific needs in EV/HEV and Battery Electrical Storage Systems. M-fuse provides the ultimate protection of the battery modules, offering reliable clearing of DC fault currents.

It has been specifically engineered and tested to provide DC-applications best-in-class protection performance: Up to 100VDC, Current rating (In) = 50 to 200A, Interrupting Rating (IR) = 20kA, L/R ≤1.5ms, Minimum Breaking Capacity (MBC) < 1kA.

Features and Benefits:

- Designed for DC applications
- Low watt losses
- High cycling performance
- Full coverage of battery module voltage and current
- Ultra compact size
- Current Ratings (In): 50 to 200A
- Interrupting Rating: 20kA @ 100VDC, L/R <1.5ms

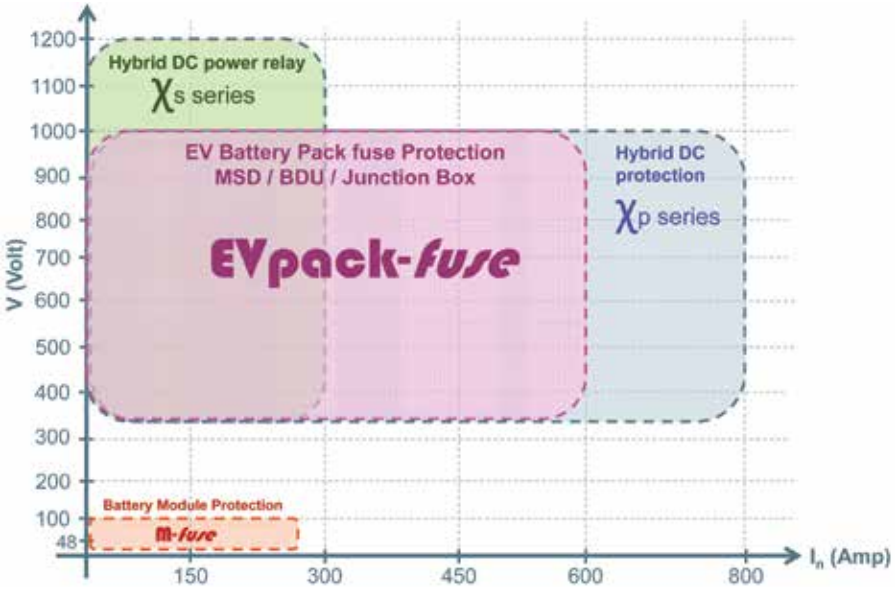
Applications:

- Battery modules protection
- EV/HEV
- Electrical Energy Storage
- Supercapacitor module protection

Standards:

- UL recognized, CE, RoHS
- Power Cycling & Vibrations: JASO D622
- IATF - ISO/TS 16949 Quality management undergoing certification

Typical usage of m-fuse in Mersen DC Protection Family



PROTISTOR® - HIGH PERFORMANCE SQUARE BODY FUSES RATINGS AND APPLICATION DATA

Series	Ampere Rating I_n (A)	Rated Voltage Vn (V) (IEC)	Maximum Interrupting Rating		Mounting
			AC	DC	
M-fuse MF 100VDC	50 – 200	100VDC	-	20kA	Bolt-In
	50 - 180				

EVpack-FUSE BATTERY PACK FUSES

EVpack-fuse line-up belongs to the new DC Overcurrent protection (O.C.P.) range developed by Mersen to address specific needs in EV/ HEV and Battery Electrical Storage Systems. EVpack-fuse provides the ultimate protection of the battery pack offering reliable clearing of DC fault currents. It has been specifically engineered and tested to provide DC applications best-in-class protection performance: Up to 1,000VDC, Current rating (In)= 5 to 600A, Interrupting Rating (IR) = 20kA, L/R ≤1ms, Minimum Breaking Capacity (MBC) < 3kA for a perfect matching with DC contactor.

Features and Benefits:

- Designed for DC applications
- Low watt losses
- High cycling performance
- Full coverage of battery module voltage and current
- Ultra compact size

Applications:

- EV/HEV
- Electrical Energy Storage
- Battery pack protection
- Battery Disconnect Unit (BDU)
- Battery Junction Box for auxiliaries
- Battery charger
- Supercapacitor pack protection
- Backup protection for DC relay / disconnector / switch
- Maintenance Safety Disconnect (MSD)

Standards:

- UL recognized, CE, RoHS
- Power Cycling & Vibrations: JASO D622
- IATF - ISO/TS 16949 Quality management undergoing certification

EVpack-FUSE BATTERY PACK FUSES

	Size	Series	Ampere Rating I_n (A)	Rated Voltage Vn (V)	Interrupting Rating DC
	MEV55C Ferrule Fuse	EVpack-fuse MEV55	5 - 50	550VDC	20kA
	MEV55C -S Surface Mount Fuse				
	MEV55C -P PC Board Mount				
	MEV70V -S Surface Mount Fuse	EVpack-fuse MEV70	35 - 175	700VDC	
	MEV70A Round Body Fuse		50 - 600		
	MEV100C Ferrule Fuse	EVpack-fuse MEV100	8 - 30	1000VDC	
	MEV100C -S Surface Mount				
	MEV100A Round Body Fuse		50 - 300		
	MEV100J Round Body Fuse		350 - 600		

Fuse holders available – contact Mersen for more info.

Xp SERIES: HYBRID DC FAULT CLEARING DEVICE

Xp features a high cycling performance DC protection device that can clear both high and low-fault current at 1,000 VDC in less than 1 ms, providing maximum flexibility in equipment design and ultimate protection. They have been engineered to provide protection for DC applications: Battery Energy Storage, EV/HEV, Smart-grid, PV installations, etc. The Xp system is composed of a fast acting pyro element, controlled by a gate current, plus a parallel clearing element. This protection meets custom requirements of very fast operating time and very high overload current.

Features and Benefits:

- DC application focused design
- Extremely low watt losses (~20W / 400A)
- Excellent cycling performance
- Ultra-fast acting (300 µs)
- Small footprint
- Large inrush current: 15 In for 100 ms
- Self-triggered and/or external triggering
- Tunable Time-Current curve and Minimum Breaking Capacity (MBC) value

Applications:

- EV/HEV
- Battery Energy Storage
- PV installations (1,500VDC in development)
- Supercapacitors bank
- DC General Purposes
- Remote Power Switch Contactor

Standards:

- IATF - ISO/TS 16949 Quality management undergoing certification

Xs-EV SERIES: HYBRID DC POWER RELAY

Xs-EV features a DC power relay that can repetitively clear up to 2kA at 1,000 VDC. Xs-EV has been engineered to provide high DC switching performances versus conventional mechanical DC power relay, switch and contactor. This power relay is a hybrid technology with the capability of switching both high voltage and high current designed specially for electrical vehicle applications.

Features and Benefits:

- Designed for DC applications
- Bidirectional
- Arc-less
- Reduced footprint & mass
- Low conduction losses
- Repeatable current make/break capability for resistive & inductive loads at full rated voltage and current
- Enhanced cycling performances
- Built-in turn ON fault detection

Applications:

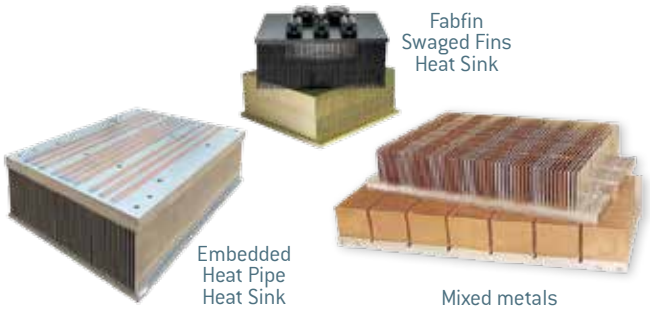
- EV/HEV
- Battery Energy Storage
- DC Grid, Smart-Grid, Off-Grid
- Battery Disconnect Units BDU
- Battery Junction Box
- Power switch, power contactor

HIGH-PERFORMANCE COOLING SOLUTIONS FOR POWER ELECTRONICS

Mersen integrates its extensive cooling expertise and patented heat sink technology into power electronics applications to make them more efficient, reliable, and profitable. Our unique knowledge of air, phase change, and liquid cooled heat sinks enables Mersen to help customers find the right customized thermal protection solution for their unique applications.

AIR COOLING SOLUTIONS

Mersen's air cooled Fabfin® heat sink stands out from ordinary extruded heat sinks because of its higher fins, giving it excellent performances. Using a swaging process means a variety of its higher fins and increased height-to-space ratio types of fins can be used.

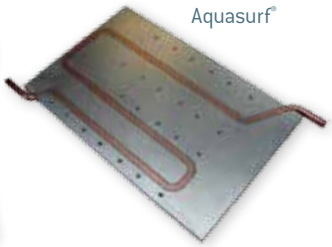


HEAT PIPES FOR INSTANTANEOUS COOLING ACTION

The high heat losses from press-pack or IGBT power devices can easily be conveyed outward via heat pipe cooling units. A heat pipe is a device that uses "phase change" to efficiently conduct large amounts of heat between two solid surfaces.

LIQUID COOLING SOLUTIONS

Power electronics components (SiC, IGBTs, thyristors) need a cooling solution that is both effective and reliable, especially when installed in a confined space. To ensure maximum reliability, Mersen has mastered vacuum brazing technology for liquid cooled solutions to achieve guaranteed water tightness with no seams, robustness, corrosion free, and excellent thermal performance.



LAMINATED BUS BAR SOLUTIONS

Laminated bus bar is an engineered component consisting of layers of fabricated copper separated by thin dielectric materials, laminated into a unified structure.

Why choose laminated bus bar?

Bus bars reduce system costs, improve reliability, increase capacitance, and eliminate wiring errors. They also lower inductance and lower impedance. Plus, the physical structure of bus bars offers unique features in mechanical design. For example, complete power distribution subsystems can also act as structural members of a total system. Multilayer bus bars offer a structural integrity that wiring methods just can't match.

Mersen
Expertise, our source of energy

MERSEN IS A GLOBAL EXPERT IN ELECTRICAL POWER AND ADVANCED MATERIALS

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