IP&E News

3rd Quarter 2025

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Battery Management Systems

Battery Management Systems

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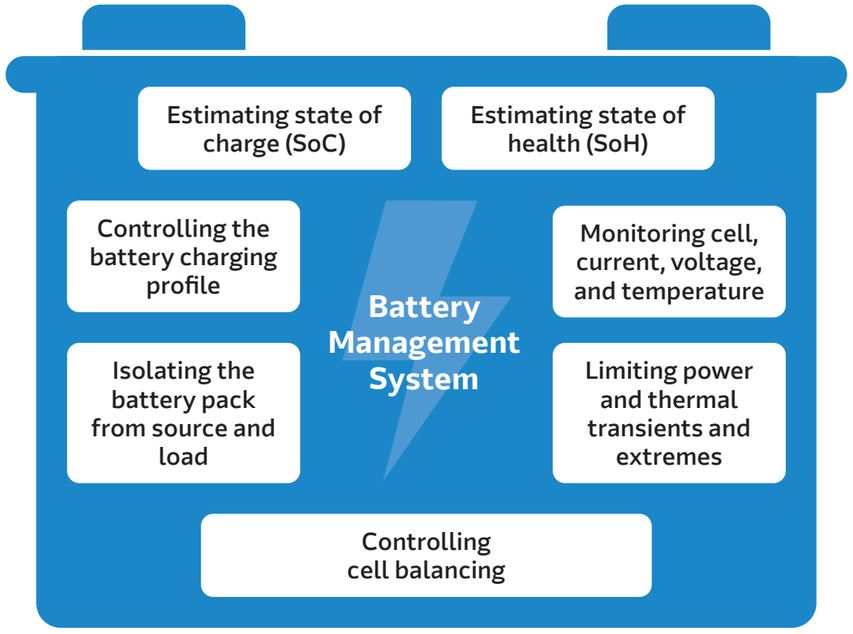
A Battery Management System (BMS) is not just a simple control unit. The BMS is essential for ensuring the operational integrity, efficiency, and longevity of battery packs. Its core safety functions mitigate risks of overcharging, overcurrent, and thermal runaway, thereby preventing severe failures with for example fires. Integrated health monitoring continuously measures voltage, current, and temperature across cells to detect degradation or faults early, supporting proactive maintenance and system reliability.

To make sure the battery pack works properly over time, there are cell balancing mechanisms that actively equalize charge across cells to prevent imbalance, optimize capacity usage, and extend cycle life. The overall efficiency is improved by regulating charge/discharge pathways to minimize losses and maintain optimal power delivery. The system has performance optimization algorithms that dynamically adapt to operating conditions, enhancing system consistency and responsiveness.



For surveillance applications, advanced communication interfaces (e.g., CAN, Modbus) are employed to support real-time data exchange between the BMS and the host controllers. These interfaces enable seamless system-level integration and continuous diagnostics, which are essential for operational reliability.

Additionally, environmental adaptability features allow the BMS to respond to variations in ambient temperature and humidity. This ensures stable and safe performance of the battery system under diverse and often harsh environmental conditions.

From a cost and system design perspective, a robust BMS reduces lifetime cost by minimizing downtime and extending service intervals. It supports scalable architecture that enables modular battery configurations, essential for large-format or customizable applications. Finally, compliance with regulatory standards (e.g., UL, IEC, ISO) ensures the battery system meets established safety and performance requirements, which is essential for certification and commercial deployment.

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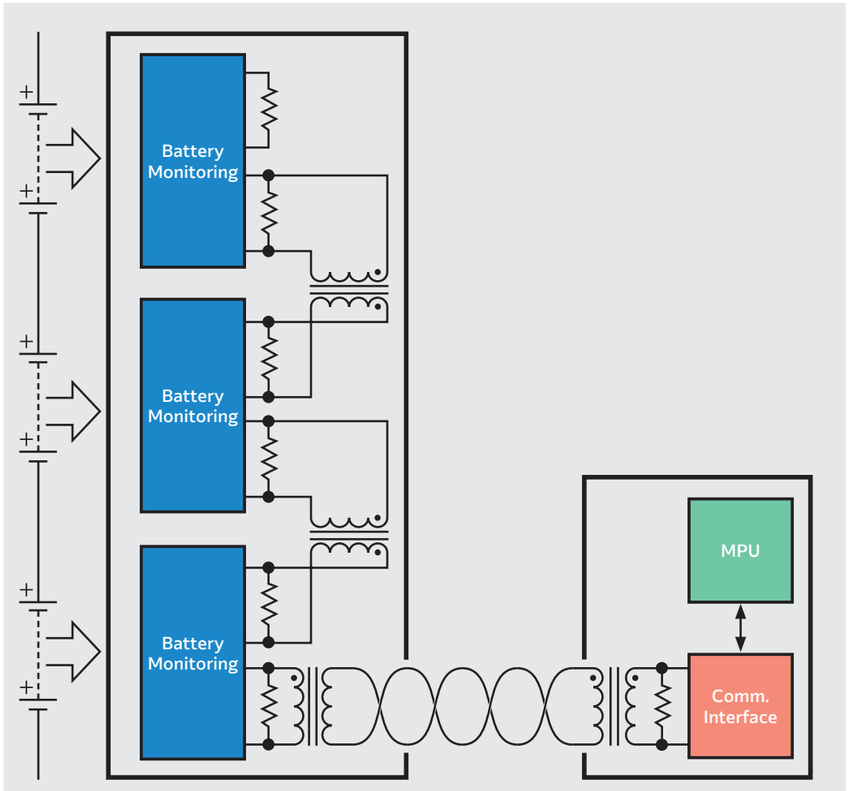
An essential part of BMS design is magnetic components, particularly isolation and signal transformers which enable safe, efficient, and reliable system performance across a wide range of conditions.

Why Magnetics matter in BMS?
Battery packs today operate at voltages ranging from 400 V to over 1500 V. These high-voltage environments demand galvanic isolation to separate low-voltage control electronics from high-voltage battery domains. Magnetic isolation components provide protection for microcontrollers and digital processors, breaking ground loops to reduce noise and errors, secure signal transmission across high-voltage domains, and reliable power delivery to isolated circuitry. This isolation is not just a design best practice. It is a mandatory safety feature guided by global regulatory standards like IEC, UL, and VDE.

BMS architecture often includes two key subsystems, the Cell Monitoring Controller (CMC), which monitors cell voltages and temperatures and performs active or passive balancing, and the Battery Module Controller (BMC), which gathers data from the CMCs and report battery health, state of charge, and more.

Transformers play multiple roles within these subsystems. Signal isolation transformers enable reliable data transmission using protocols like SPI or UART across isolated domains. Power isolation transformers are used in isolated flyback DC/DC converters to supply power to gate drivers, monitoring ICs, and communication interfaces. Pulse transformers deliver fast, isolated switching signals to IGBT or MOSFET gate drivers, which are essential for ensuring battery protection and control.



Design Considerations in BMS Magnetic Components
When selecting transformers for BMS, designers must involve a combination of electrical, mechanical, and environmental design parameters, such as:

- Peak Working Voltage
- Isolation voltage
- Volt-Microsecond (Volt-µs) Rating
- Turns ratio
- Insulation level (functional, basic, or reinforced)
- Creepage and clearance distances
- SMT or THT packages
- Safety standards
- Board space
- Environmental Parameters: Altitude, pollution degree, humidity, etc.

Interconnect
As always, the products don't work without connectors, and Battery Management Systems (BMS) is not different. They all rely on a wide range of electrical connectors to ensure safe and efficient operation. These connectors must fulfil various roles, high-power delivery, cell balancing function, data communication, and environmental monitoring.

High-voltage power connectors are used to transfer energy between the battery pack, load, and charging systems. They are designed to handle high currents and voltages, incorporating insulation, shielding, and locking mechanisms for safety.

Low-voltage signal connectors transmit data between the BMS, sensors, and control units. These connectors are compact, support high pin density, and provide EMI shielding for signal integrity.

Cell interconnects or busbar connectors electrically link individual battery cells in series or parallel configurations. They are designed for low resistance, high current capacity, and often include thermal compensation features. These can be custom-designed as flexible or rigid busbars or use press-fit and welded terminals. The more mature and stable design you have, there is a huge cost reduction to be made by standardizing the building practice around the cell interconnect, as connecting all cells can be complex.

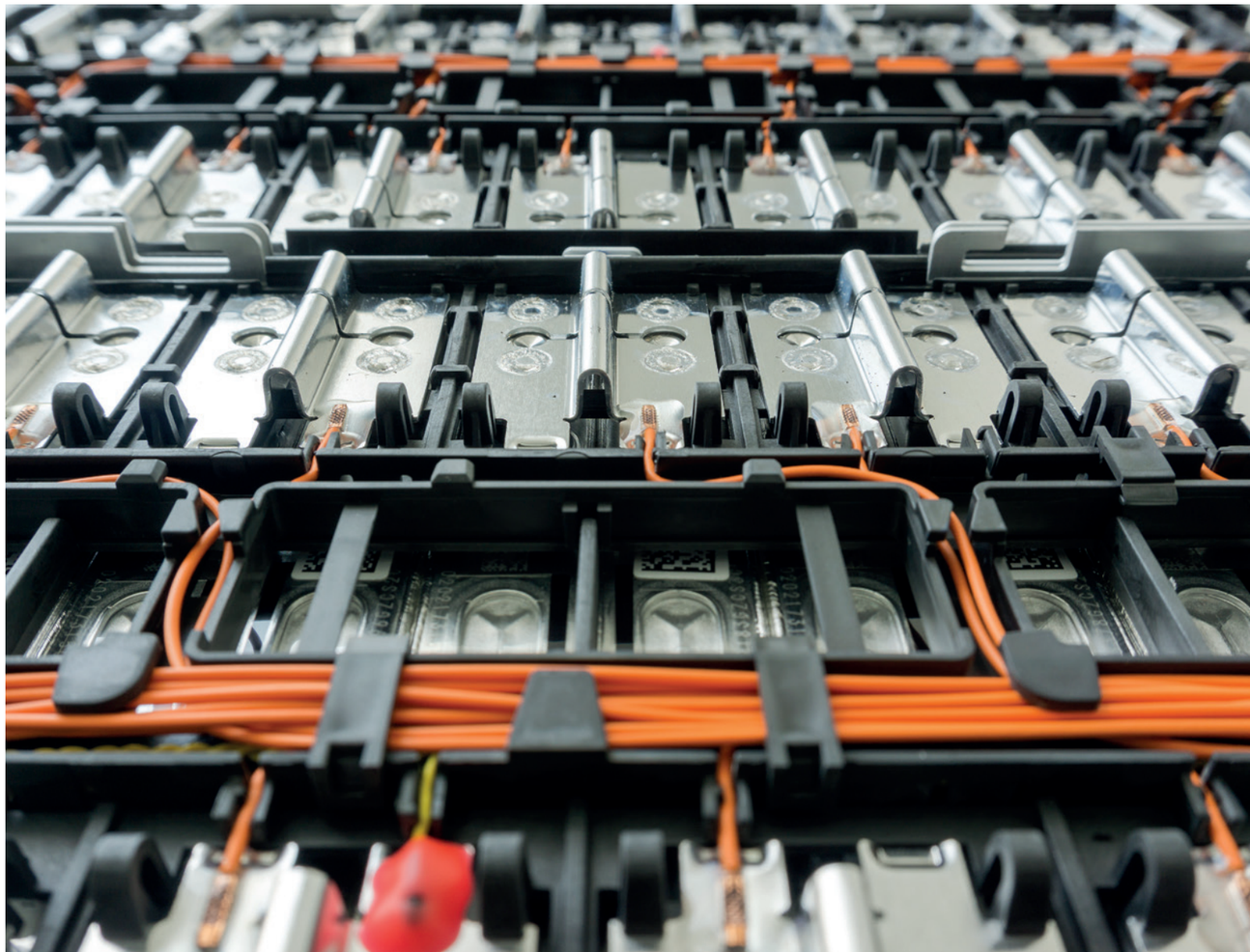
Temperature sensor connectors are used to connect NTC/PTC thermistors or other temperature sensors distributed throughout the battery pack. These connectors are small, reliable, and offer secure contact retention.

Communication connectors enable data exchange between the BMS and external systems over protocols like CAN, Modbus, or UART. These connectors offer EMI protection and protocol-specific support, for example, D-sub connectors for RS232/485 and M12 or RJ45 for Ethernet and Modbus.

Grounding connectors establish a safe ground path for system electronics and ensure electrical safety. These include ring terminals, ground lugs, and chassis-mounted ground screws, all designed for secure mechanical connection and corrosion resistance in the very often harsh environment it is operating in.

Finally, fuse and circuit breaker connectors integrate protective devices to guard against overcurrent and short-circuit events. These connectors must handle high currents securely and are often seen in blade fuse holders, MEGA/MIDI fuse connectors, and DIN rail-mounted breaker terminals.

In the design phase, it is very important to spend the time and evaluate different options to do the proper selection and integration of these connectors, as they are critical to ensuring the overall safety, functionality, and serviceability of the battery system.



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Robust Energy Storage Connectors for Systems

Engineered for BMS in EVs and industrial ESS, these connectors ensure high safety, low resistance, and long-term stability.

Scan QR-Code to find more information on arrow.com

As energy storage systems evolve in both automotive and industrial sectors, the need for safe, efficient, and high-performance connectivity is more critical than ever. Adam Tech's Energy Storage Connectors are purpose-built to meet the high standards required by advanced Battery Management Systems (BMS) in Electric Vehicles (EVs), Plug-in Hybrids (PHEVs), and Industrial Energy Storage Solutions.

High Safety and Environmental Compliance:
Crafted from PA66 material with UL 94V-0 flame-retardant properties, these connectors ensure fire resistance under extreme conditions. Paired connectors meet the IP67 waterproof rating, protecting systems from dust and moisture. All products are UL certified and fully RoHS and REACH compliant, reflecting our commitment to both safety and environmental responsibility.

Engineered to Eliminate Common Failures:
Many conventional connectors struggle with excessive temperature rise, poor fault tolerance, and high insertion force. Adam Tech's connectors overcome these issues through advanced design:

- Short Conduction Path (≤1.5 mm) reduces internal resistance and heat build-up.
- Spring Cage Technology allows tolerance for misalignment up to 0.25 mm, maintaining strong electrical contact even under vibration or slight offset.
- Downward Contact Terminals from railway-grade designs offer improved stability across temperature extremes.

Efficiency Through Design:
- Reduced Insertion Force enables smoother handling and over 10,000 mating cycles, improving both ease of use and product lifespan.
- Modular Compatibility with various wire gauges, busbars, studs, and threaded terminals allows seamless integration in diverse applications.
- Dust Caps and protective features extend durability and minimize system downtime.

Innovation with Patent Security:
- Protected by multiple patents – including utility and design – Adam Tech connectors ensure originality and legal peace of mind.
- These connectors are not cross-compatible with other brands, a deliberate design choice that guarantees system integrity and connector reliability.
- From electric mobility to grid-scale storage, Adam Tech's Energy Storage Connectors are the ideal choice for high-current, mission-critical environments.

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FlexLock™ Flex-to-Board/ Wire Connectors

FlexLock™ connectors offer compact, auto grade FPC-to-board and flex-to-wire solutions up to 2A

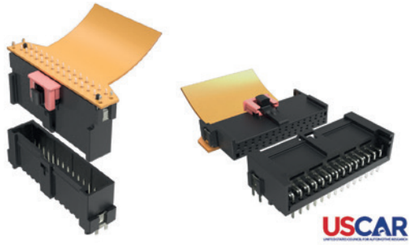
FlexLock™ FPC-to-Board and Flex-to-Wire connectors feature a compact, robust design tailored for the growing demands of automotive applications. Compliant with USCAR-T2V2 and LV214-S3 standards, these connectors support up to 2A per contact for higher power needs.

The FlexLock™ family offers multiple pitch options and configurations:

- 2.54 mm pitch: 10–36 positions (double row) and 4 positions (single row) in both vertical and horizontal TH formats
- 3.20 mm pitch: 10–26 positions (double row) in horizontal TH format
- 1.80 mm pitch: 10–40 positions (double row) in horizontal TH format
  - USCAR-T2V2, LV214-S3 compliant
  - Re-flow tin plated reduce mating force
  - Position from 10 to 36 (2.54 mm pitch, double row)
  - Position from 4 to 15 (2.54 mm pitch, single row)
  - Position from 10 to 26 (3.20 mm pitch, double row)
  - Position from 10 to 40 (1.8 mm pitch, double row)
  - Connector Position Assurance (CPA)

Features:
- Re-flow tin plating process for terminal
- Terminal Position Assurance (TPA)
- Current rating 2A with each contact
- Hold down
- Connector Positioning Assurance (CPA)

Benefits
- Low mating and un-mating force
- Ensures proper terminal insertion position and retention
- Meet higher power Amps performance
- Increases the board grip force
- Ensures that connectors are properly mated and locked together



Orderable Part Numbers at arrow.com
- 10158557-R302111LF
- 10161735-V302011LF

Scan QR-Code to find more information on arrow.com

Rugged Fuses for EV and eMobility

EV and HEV fuses designed to protect main battery pack, battery module, junction box/auxiliary circuits or charging stations

A leading manufacturer of circuit protection products for automotive, e-mobility, industrial, and commercial applications, Bel offers a breadth of products that can be customized to meet your specific needs. This includes SMD and radial PTC fuses, slow-blow and fast-acting surface mount fuses, and power fuses, many of which are designed to meet AEC-Q200. Our products are robust, reliable, and backed by shorter lead times. We are a dependable supplier with a long history of providing quality products and services.

EV/HEV fuse product range

- 150 ~ 1500 VDC rated voltages
- 5 ~ 800 A rated currents
- 10 ~ 60 kV interrupt voltages

With the growth of eMobility, fuses play an increasingly important role in protecting EVs from overcurrent. Overcurrent can occur in an EV for a number of reasons, such as a short circuit, a fault in the battery pack, or a problem with the charging system. If overcurrent is not prevented, it can damage or even destroy the EV's electrical system.

Fuses are used to protect electronic systems in the EV, such as the battery, motor, power distribution, charging system, and lighting, from overcurrent. They work by melting when they are subjected to an overcurrent. This opens the circuit and prevents further current flow.

Bel offers fuses that are specifically designed for electric vehicles to withstand the harsh environmental conditions of high temperatures, humidity, and thermal shock. These fuses have voltage ratings up to 1500 VDC and current ratings up to 800 A, making them suitable for a wide range of EV applications.

Orderable Part Numbers at arrow.com

- 0AKHBK400-BA
- 0AKHBK500-BA
- 0AKK-9800-BB
- 0AKK-K100-BB
- 0AKMB9800-BD
- 0AKNBK100-BB
- 0AKNBK200-BB
- 0AKRBK300-BB
- 0AKRBK350-BB
- 0AKRBK400-BB
- 0ALEB9500-PD
- 0ALLBK200-EA
- 0ALLBK250-EA
- 0ALLBK300-EA
- 0ALLBK315-EA

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PoE-Enabled ICMs for Data and Devices

High-performance PoE-enabled ICMs, delivering reliable power and data connectivity for smart infrastructure and industry.

As smart buildings and industrial environments become more connected, reliable Power over Ethernet (PoE) solutions are essential for streamlined operations and efficient network infrastructure. Bel's comprehensive lineup of PoE-enabled Integrated Connector Modules (ICMs) simplifies system design by combining power and data transmission into a single, cost-effective solution.

Bel's MagJack® ICMs are engineered for performance, supporting high-speed Ethernet while seamlessly delivering power to connected devices. Whether integrating IoT sensors, lighting systems, building management technology, or network infrastructure, Bel provides scalable, high-quality connectivity to meet the demands of modern applications.

Bel offers multiple PoE solutions, including standard and high-power ICMs to support a wide range of smart devices. From compact installations requiring 802.3 af low-power PoE for IoT applications to robust 802.3 bt high-power PoE++ solutions for industrial automation, Bel's products ensure reliable power delivery and data integrity.

Additionally, Bel's Power over Ethernet (PoE) jacks simplify infrastructure by reducing the need for separate power supplies, making installations more cost-effective and space efficient. With advanced designs that mitigate EMI, Bel's solutions enhance network stability while maintaining superior performance.

Key Features:

- Single-cable power and data transmission
- Support for multiple IEEE standards
- Flexible power delivery modes
- Enhanced EMI mitigation
- Scalable power levels ranging from 15.4 W to 90 W

Bel's PoE solutions ensure dependable connectivity and power efficiency across smart environments, helping businesses and industries build scalable, high-performance networks that support evolving infrastructure demands.

Orderable Part Numbers at arrow.com

- 0826-1X1T-GH-F
- 0826-1C4T-GH-F
- 0895-2C1R-GK
- G10-1GHT-056H
- G27-122T-066B

Scan QR-Code to find more information on arrow.com

The Electronics Behind Modern BMS Solutions

Eaton's BMS components enhance safety, efficiency, and performance in automotive and industrial sectors.

Scan QR-Code to find more information on arrow.com

As electrification reshapes the automotive and industrial sectors, Battery Management Systems (BMS) have emerged as critical enablers of safety, efficiency, and performance. While managing the energy flow in electric vehicles or stabilizing power in industrial automation, BMS platforms rely on a sophisticated array of electronic components to function reliably under demanding conditions. These components are designed to meet stringent safety standards, environmental conditions, and performance expectations across diverse use cases – from electric cars to robotic assembly lines.

In automotive systems, Eaton's AEC-Q qualified components are tailored for powertrain, chassis, and safety electronics. For industrial applications, Eaton's components support automation, motor control, and power conversion.

These product technologies collectively enhance the safety, efficiency and performance of BMS systems:

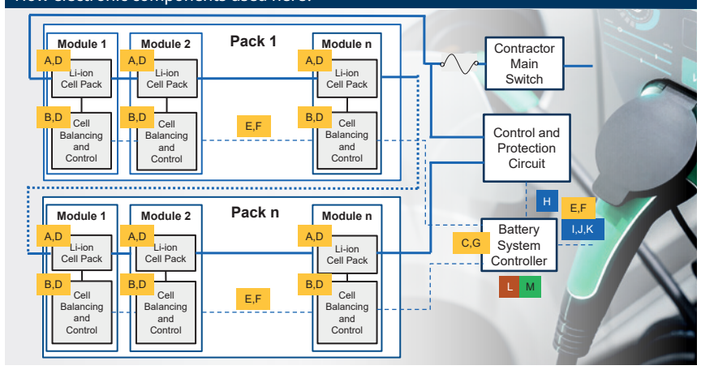
- **Bussmann® series fuses** provide precise overcurrent protection isolating faults without disabling the entire battery pack, which is essential for maintaining uptime and reducing repair costs. Eaton offers voltage ratings of up to 1000 V in compact packages.
- **Overvoltage protection,** including varistors and TVS diodes, is crucial for protecting BMS from voltage spikes and surges.
- **Supercapacitors** offer energy buffering during peak loads or power interruptions while **magnetics (inductors and transformers)** ensure stable voltage regulation.
- **NTC** (Negative Temperature Coefficient) and **PTC** (Positive Temperature Coefficient) thermistors are used for temperature sensing, which is critical for preventing overheating and ensuring optimal battery performance.
- **Current sense sensors** help in monitoring the current flow within the battery pack, enabling precise control and management of the energy flow.

Across both domains, Eaton emphasizes sustainability and compliance. Their components are RoHS-compliant, halogen-free, and built to withstand harsh environments. This makes them ideal for integration into systems where reliability and longevity are non-negotiable.

As industries converge on electrification, the line between automotive and industrial BMS technologies continues to blur. Eaton's versatile, high-performance components are helping engineers bridge that gap – delivering smarter, safer, and more resilient energy systems for the road and the factory floor alike.

		Product
Circuit Pro.-OC	A	SMT high current fuse
	B	SMT chip fuse
	C	SMD high voltage fuse
Circuit Pro.-OV	D	High power TVS diode | automotive rated
	E	Polymer ESD suppressor
	F	ESD TVS diode | automotive rated
	G	High power TVS diode | automotive rated
Magnetics	H	HV isolated transformer
	I	Low profile molded inductor, Semi-shielded inductor, Shielded inductor
	J	Ferrite chip bead
	K	Signal line CMC
Timing Devices	L	Quartz crystal resonator
Capac-itors	M	Hybrid polymer capacitor

How electronic components used here?



Orderable Part Numbers at arrow.com

- 3250HV
- 3250HVA
- SCF9550
- 2822HC
- AMX
- AMH
- EKM-10
- 1245HC100-RTR

High Precision High Voltage Divider

HVD P08 – Thin Film High Voltage Divider Network

KOA's HVD series is designed as a high precision high voltage divider network for operating voltages up to 1000 V. HVDs are always customized parts. Constructed using two metal thin film resistors inside a molded IC package, the device provides 0.1 % ratio tolerance and 10 ppm ratio TCR. The ratios of the internal R1 and R2 resistors are selectable between 1:10 and 1:1000. Customized resistor combinations of R1 and R2 are available as needed. With an initial TCR down to ±25 ppm and a tolerance as low as ±0.1 %, the HVD series from KOA is ideal for precision designs such as high-accuracy sensing or voltage detection circuits in automotive, industrial, and measuring applications. The HVD series also features excellent long-term stability, is AEC-Q200 tested, and is suitable for high reliability applications.

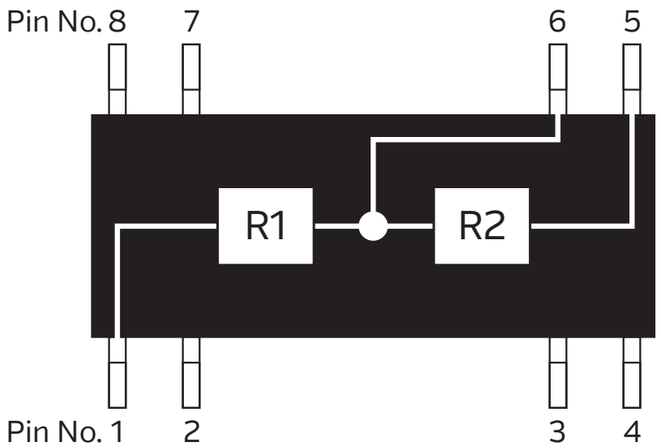
Features

- High precision high voltage divider
- Ultra precise due to low ratio tolerance and T.C.R.
- High reliability and long-term stability
- Available custom combinations of R1 & R2 and tolerance as needed
- Max. resistance value 51 MΩ
- Max. working voltage 1000 V
- Resistance ratio selectable between 1:10 to 1:1000
- Operating temperatures up to +155 °C
- AEC-Q200 tested
- EU-RoHS compliant

Scan QR-Code to find more information on arrow.com

Applications:

- High voltage divider for HEV/EV
- Battery module (voltage monitoring, battery management circuit)
- Inverter module (inverter circuit, DCDC converter)
- Voltage detection circuit of quick charger
- Charging control circuits
- Power supplies
- Motor control units
- High magnification of operational amplifier circuits



Technologies by Supplier	Connectors												Antennas, Batteries, Emech											Passives																								Power Supply			
	Sockets & Contacts	Board to Board	Wire to Board / Wire to Wire	FFC / FPC	Terminal Blocks & Acessories	I/O Connectors	Industrial Connectors	Fiber Optic	High Speed	RF Connectors	Cables	Cable Assemblies	Cable Management Accessories	Relays	Switches	Thermal Management	Batteries / Battery Packs	Antennas	Sensors	Test & Measurement	Enclosures	Soldering Tools / Accessories	Ceramic Capacitors	Silicon Capacitors	Tantalum Capacitors	Aluminum Capacitors	Film Capacitors	Super Capacitors	Fixed Resistors	Varistors	Non Linear / Variable Resistors	Fuses	Inductors / Chokes / Coils	Ferrites / Ferrite Beads / EMI Filter	EMC Power Filters	Planar Magnetics	Transformers	Thermistors	Timing Devices	Buzzer	RF Products	AC/DC	DC/DC	EMI Filter	LED Driver
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Advanced Thermal Solutions [9]																•																														
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Altran Magnetics														•																						•										
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Carling															•																														
Cherry CID															•				•																											
Chilisin (Now Pulse) [6]																		•																												
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Grayhill															•																															
Hahn																																														

* not in all EMEA countries [1] ABB, GE Critical Power, Lineage [2] Artesyn, Excelsys, Ultravolt [3] Acquired by Bel Inc. [4] 3Y Power Technology, Protek Power [5] now part of Advanced Energy
[6] Yageo company (Group) [7] Schaffner fully owned by TE [8] Former CUI Devices [9] QATS

EMEA Components – IP&E Linecard

Technologies by Supplier	Connectors												Antennas, Batteries, Emech											Passives																								Power Supply			
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Hammond																					•																										
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Mean Well																																												•	•	•
Metrofunk											•																																		
Metz *					•	•																																							
Micro-Mode	•	•		•	•	•		•	•	•	•	•																																	
Micronel *																			•																											
Molex	•	•	•	•	•	•	•	•	•	•	•	•								•	•																								
Moons																																													•
Murata																			•		•																								
Myrra																																													
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NuEnergy Storage Technologies																																													
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Pancon	•	•	•	•		•	•		•			•																																	
Panduit							•	•														•																							
Panstrong	•								•																																				
Phoenix Contact	•	•	•	•	•	•	•			•	•	•										•																							

* not in all EMEA countries [1] ABB, GE Critical Power, Lineage [2] Artesyn, Excelsys, Ultravolt [3] Acquired by Bel Inc. [4] 3Y Power Technology, Protek Power [5] now part of Advanced Energy
[6] Yageo company (Group) [7] Schaffner fully owned by TE [8] Former CUI Devices [9] QATS

Technologies by Supplier

	Connectors													Antennas, Batteries, Emech								Passives																		Power Supply			
	Sockets & Contacts	Board to Board	Wire to Board / Wire to Wire	FFC / FPC	Terminal Blocks & Acessories	I/O Connectors	Industrial Connectors	Fiber Optic	High Speed	RF Connectors	Cables	Cable Assemblies	Cable Management Accessories	Relays	Switches	Thermal Management	Batteries / Battery Packs	Antennas	Sensors	Test & Measurement	Enclosures	Soldering Tools / Accessories	Ceramic Capacitors	Silicon Capacitors	Tantalum Capacitors	Aluminum Capacitors	Film Capacitors	Super Capacitors	Fixed Resistors	Non Linear / Variable Resistors	Fuses	Varistors	Inductors / Chokes / Coils	Ferrites / Ferrite Beads / EMI Filter	EMC Power Filters	Planar Magnetics	Transformers	Thermistors	Timing Devices	Buzzer	RF Products	AC/DC	DC/DC	EMI Filter	LED Driver
PMEC																																•												
Powerbox																																									•	•		
Preci-Dip	•	•	•			•																																						
PTR Hartmann	•				•										•																													
PUI Audio																			•																					•				
Pulse [6]						•			•									•												•	•	•	•	•	•	•	•						
Qualcomm																																						•		•				
Radiall			•			•		•		•		•			•			•																										
Raffenday												•																																
Rafi *															•																													
Raltron										•		•						•	•																				•	•	•			
Recom																																									•	•		
Rennsteig Tools																						•																							
RF360 (Now Qualcomm)																																									•		•		
Same Sky Devices [8]			•		•	•	•					•		•		•			•																					•				
Samsung Electro-Mechanics																							•							•			•	•										
Samtec	•	•	•	•		•	•	•	•	•		•																																
Sanyo Denki																•																													
Sauro		•	•		•																																						
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Schurter											•				•																	•	•	•								•	
Seiko																	•																											
Sensata															•				•																									
Signal Transformer [3]																																					•							
SiTime																																						•						
SKS Kontakttechnik											•	•	•																															
SL Power [5]																																									•			•
SongChuan														•																														
Souriau *		•	•			•						•																															
Standex-Meder														•					•																				•		•			
Stewart Connector (Bel Stewart) [3]						•	•					•																																
Sumida				•							•	•																																
Sumitomo	•		•		•	•			•	•																																		
Susumu																															•	•												
Syfer Technology																							•											•										
Tadiran Batteries																	•																												
Taiyo Yuden																		•					•			•								•	•							•		
Taoglas										•	•	•						•																									•		
TDK														•				•	•				•		•	•	•					•	•	•		•	•	•						
TDK-Lambda *																																										•	•		
TE Connectivity	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			•	•				•							•	•			•	•						•			
TKR Spezialwerkzeuge																						•																							
Traco Power																																										•	•		
TRP Connector [3]			•			•																																						
TXC Corporation																																									•				
Varta Storage and Microbatteries																	•																												
Vicor																																										•	•		
Vishay																		•	•				•		•	•	•	•	•	•	•	•	•	•			•	•	•					
Vishay PG																														•														
Vitrohm																																												
W+P Products	•	•	•	•		•					•	•	•																															
Wago	•		•	•	•	•																																						
Weidmüller *					•		•	•																																				
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Wima																											•																	
Yageo																		•					•							•	•	•	•											
ZF Friedrichshafen														•					•																										
Zippy														•																													•	•	

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[6] Yageo company (Group) [7] Schaffner fully owned by TE [8] Former CUI Devices [9] QATS

Littelfuse
Expertise Applied | Answers Delivered

New high voltage SMD fuses from Littelfuse

Littelfuse Introduces Industry-First Nano² 415 SMD Fuse (1500 A @ 277 V) and AEC-Q200-Qualified 823A 1000 Vdc Automotive Fuse

The new 823A Series Fuse is an AEC-Q200-qualified, high-voltage-rated SMD fuse designed for modern automotive systems. It features a compact 5 x 20 mm footprint and delivers reliable overcurrent protection for 1000 VDC applications such as Battery Disconnect Units (BDU) and Battery Management Systems (BMS).

Key Differentiators:
- AEC-Q200 Qualified: Ensures automotive-grade reliability.
- 1000 VDC Rating: Ideal for high-voltage automotive circuits.
- Compact SMD Design: Space-saving 5 x 20 mm footprint.
- Wire-in-Air Construction: Offers high interrupting rating (100 A @ 1 kV DC), excellent thermal stability, and high I^2t.
- Wide Temp Range: Operates from -40 °C to 125 °C.

Benefits for Engineers:
- Enhanced Protection: Withstands inrush and surge currents.
- Space Optimization: Fits compact PCB layouts.
- High-Voltage Resilience: Robust protection against overcurrent.
- Application Flexibility: Ideal for primary circuit protection.

The 823A Series is essential for EVs and next-gen automotive electronics.

Scan QR-Code to find more information about the 823A Series on arrow.com

The new Nano²® 415 SMD Series Fuse is the first surface-mount fuse with a 1500 A interrupting rating at 277 V. It offers exceptional protection in compact designs, ideal for space-constrained, high-performance applications. Designed to buffer 250 V systems from voltage fluctuations, the 415 Series ensures robust fault current protection.

Key Features & Benefits:
- Industry-Leading Interrupting Rating: 1500 A @ 277 V for superior high-fault protection.
- True Voltage Buffering: Ideal for 250 V systems with unpredictable surges.
- High I^2t Rating: Enhanced surge and pulse withstand capability.
- Compact SMD Design: Enables automated assembly, reducing costs and replacing through-hole fuses.

The 415 Series is a drop-in SMD alternative to the Littelfuse 215 Cartridge Fuse, offering higher voltage rating and enabling fully automated manufacturing.

Orderable Part Series at arrow.com
- 823A Series
- 415 SMD Series

Scan QR-Code to find more information about the 415 SMD Series on arrow.com

Applications:

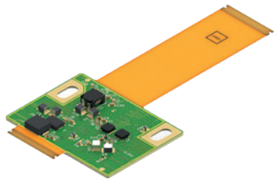
8283A is for Automotive applications including
- Battery Management Systems (BMS)
- Battery Disconnect Units (BDU)
- High-voltage DC-DC converters
- Automotive fuel cell cooling systems

415 SMD is for applications including
- Consumer electronics – Power adapters, chargers, and power supplies
- Industrial systems – Inverters, converters, and instrumentation
- Automotive – EV charging stations, home chargers, and lighting
- Appliances/White Goods – Washers, dryers, and refrigerators
- Home automation – Automated garage doors and smart home systems

molex

Lightweight, Flexible Circuitry from Molex

How Molex can support your design to balance performance, durability and weight in compact, high-performance applications



Molex's expertise in printed electronics enable tailored solutions that meet the specific needs of your design. Molex delivers innovative sensor solutions, combining lightweight, flexible circuitry, wireless connectivity, sensors, and thin-film batteries to support connected devices, wearables, and other compact applications across diverse industries. In this article, we highlight three of Molex's capabilities in this space: Human Machine Interface Solutions (HMI), Flexible Hybrid Electronics (FHE) and Flexible Printed Circuits (FPC).

Human Machine Interface (HMI) Solutions
Whether printed circuits or fully integrated solutions, Molex delivers customized designs to match your application requirements. Capabilities include membrane switches, capacitive touch sensors, PEDOT Touch Foils, rubber keypads, backlighting and LEDs, as well as digitally printed graphics and value-add assemblies. These solutions are engineered for durability and reliability through intuitive design in applications ranging from medical or home appliances to automotive and industrial equipment.

Flexible Hybrid Electronics (FHEs)
Flexible Hybrid Electronics (FHE) are ideal for low-power, low-signal applications where space is limited, such as automotive, home appliances, or MedTech. With FHE, you can create designs that bend or flex while benefiting from highly scalable printing and converting processes, including laser cutting, lamination, die cutting, and traces as narrow as 0.0127 mm. Molex's FHE solutions incorporate advanced printing, surface-mount technology (SMT) component attachment, and precision die cutting, making them an exceptional choice for innovative and compact product designs.

Flexible Printed Circuits (FPCs)
Flexible printed circuits (FPCs) play a crucial role in electronics packaging, offering exceptional capabilities in bending, routing, serviceability, and assembly to suit diverse needs. With expertise in impedance control, shape forming, power handling, and high circuit count routing, Molex helps ensure your design is optimized from the start of your design through to prototyping and production tailored to fit your global needs.

Find the range of Flat Flexible Cables available on arrow.com or contact your Arrow representative to learn more about Molex's capabilities.

Orderable Part Numbers at arrow.com
- 150201042

Scan QR-Code to find more information on arrow.com

EMEA COMPONENTS
IP&E News · 3rd Quarter 2025

OMRON

Omron G9KB-E: Switching for Future Energy

Omron's G9KB-E relay offers high-power switching, safety, and efficiency for ESS, EV charging, and V2X systems.

Scan QR-Code to find more information on arrow.com

To meet the latest trends in higher battery voltage and current in the energy solutions market, Omron has introduced the G9KB-E – a high-capacity model in the G9KB series. This new model supports up to 800 VDC and 100 A, while maintaining the same size and weight as the standard G9KB. It is particularly well-suited for 15 to 40 kW battery applications such as energy storage systems (ESS), EV chargers, and V2X.

Key Features:
- **High Power Handling:** Capable of switching 800 VDC / 50 A and 600 VDC / 100 A
- **Bidirectional Switching:** Non-polarized for no power loss with reverse current flow
- **Low Contact Resistance:** Initial value ≤5 mΩ, minimizing heat generation
- **Wide Contact Gap:** 3.6 mm or more for added safety
- **Low Coil Power Consumption:** Approximately 570 mW with 45 % holding voltage
- **Certified Standards:** Complies with UL60947-4-1 and EN61810-10 for energy storage systems
- **Carbon Footprint Verified:** ISO 14067 third-party certification available

Benefits:
- **Supports Next-Generation Energy Designs:** With increasing battery voltage and current demands for higher capacity systems, the G9KB-E is ideal for modern applications.
- **Fewer Components Needed:** Bidirectional switching eliminates the need for two separate unidirectional relays, reducing system complexity and cost in applications like ESS and V2X.
- **Improved Safety and Efficiency:** Unlike sealed relays filled with hydrogen gas, the G9KB-E is gas-free, making it safer and lighter. Its PCB-mountable design also enables automated manufacturing, replacing conventional screw-terminal relays.

The G9KB-E offers multiple advantages: higher system capacity, fewer switching devices, safer and lighter designs, and more efficient manufacturing processes. Upgrade your application today with the G9KB-E.

Orderable Part Numbers at arrow.com
- G9KB-1A-E DC24
- G9KB-1A-E DC12

Panasonic INDUSTRY

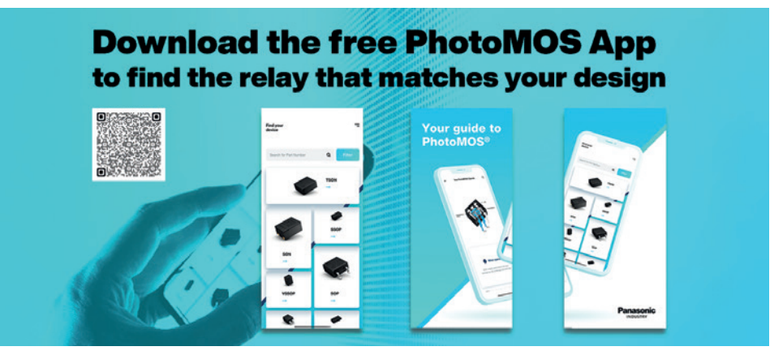
AQV258H5 – 1,500V DIP5 PhotoMOS® for BMS

Compact PhotoMOS® relay with 5kV I/O isolation, ideal for Battery Management System with low power loss and high reliability

Scan QR-Code to find more information on arrow.com

The AQV258H5 from Panasonic Industry is a high-voltage PhotoMOS® relay designed for use in energy management applications. Housed in a miniature DIP5 package offers a 1,500 V switching capability and provides 5 kV I/O isolation, making it a reliable choice for Battery Management Systems (BMS).
The increased clearance and creepage distances on the output side provide robust insulation performance, crucial for applications such as monitoring between high voltage (HV) & low voltage (LV) paths in battery systems to detect any leakage current. This makes AQV258H5 particularly effective for use in isolation monitoring, enhancing safety in energy storage, EV charging systems & various high voltage measurement and infrastructure control applications.

The AQV258H5 comes with 5 pins to achieve higher creepage and clearance requirements, but a 6-pin version is also available. Both versions are available with Through-Hole or Surface-Mount Terminals, offering flexibility for different board layouts and assembly processes.



PhotoMOS® relays like the AQV258H5 have an AMOSFET output, delivering high reliability and almost unlimited lifetime (if used according to the specifications). Their stable On-resistance over time and immunity to vibration make them a robust, long-lasting alternative to traditional electromechanical relays across a wide range of industrial applications.

In addition to their durability, PhotoMOS® relays offer superior system performance through high reliability and significantly lower power consumption compared to other switching technologies. These attributes are particularly valuable in applications where energy efficiency and long-term reliability are critical.

With its combination of high-voltage capability, compact package, and dependable performance, the AQV258H5 is well-suited for engineers developing next-generation energy systems and high-voltage monitoring solutions.

Key Features
- Load voltage: 1,500 V AC/DC
- Load current: 20 mA
- Increased creepage & clearance distance on output side
- Low control current
- Low leakage current
- Stable on-resistance over lifetime
- No switching noises
- Unlimited number of switching cycles
- DIP5 package

Orderable Part Numbers at arrow.com
- AQV258H5
- AQV258H5A
- AQV258H5AX
- AQV258H5AZ

PANDUIT™

High Voltage Clamp ideal for Battery Cables

High voltage cable clamps are important components in vehicle electrical systems above 25 VAC or 60 VDC.

Panduit's new high-voltage (HV) cable clamps make it safer and more flexible to install battery cables in electric vehicles.

High voltage cable clamps are important components in vehicle electrical systems above 25 VAC or 60 VDC. These systems have to comply with a number of safety requirements.

The safety of high voltage cables in vehicles depends on three factors: Electric shock, electromagnetic radiation and vibration. Panduit's high-voltage cable clamps are specifically designed to efficiently manage and secure high-voltage battery cable installations and are part of the vehicle's high-voltage electrical system as well as the charging infrastructure, enabling cables to be connected safely and reliably. Made from glass-fibre reinforced high temperature nylon for use from – 40 °C to 135 °C, the robust housings have compressible rubber inserts.

This protects the delicate outer insulation of the cables from damage - a common problem with other fixing methods. The HV clamps are designed to be connected in pairs. Integrated anti-rotation points prevent rotation or displacement, protecting the cables from excessive strain. The clamps are adjustable up to 4.5 mm, allowing them to be moved freely over the cable until they are positioned over the actual fixing point. In addition, Panduit's HV clamps provide a safe distance between cables, significantly reducing abrasion between adjacent cables and protecting connected quick disconnects from excessive stress. The HV clamps are available for cable diameters of 25 to 40 mm² (4 to 2 AWG), 50 to 70 mm² (1 to 2/0 AWG) and 85 to 120 mm² (3/0 to 4/0 AWG). In series production of wire harnesses, the HV clamp fits seamlessly into the assembly process and remains securely attached to the wire harness assembly until final assembly. This ensures that all components, including the HV clamps, remain together during the various production stages of the harness and can then be easily secured in their final position. The new HV clamps reduce overall assembly time and improve serviceability, as their push-in locking mechanism makes them easy to release without the need for tools.

Panduit's new HV clamps are specifically designed for high voltage cable management in heavy electric vehicles. With proper installation and maintenance, HV clamps reduce vehicle breakdowns, increase cable life and improve overall harness productivity.

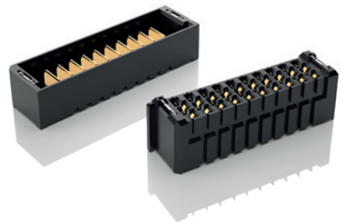
Orderable Part Numbers at Arrow
- HV15CC1-C376
- HV15CC2-C376
- HV19CC1-C370
- HV19CC2-C370
- HV23CC1-C378
- HV23CC2-C378

Scan QR-Code to find more information on arrow.com

Features:
- **Integrated anti-rotation points:** Ensure precise positioning and protect against abrasion and overloading.
- **User-friendly:** tool-free design allows easy installation, making the process convenient and accessible for all user.
- **Time-efficient:** quick and easy installation and maintenance, thanks to the push-in mechanism, saving you valuable time and effort.
- **Process reliability:** consistent spacing, prevent cable abrasion, and eliminate potential user errors, enhancing overall process reliability.

mPOWER® Ultra Micro Power Connector System

Samtec mPOWER® connectors deliver excellent power density for BMS applications, with many board stacking height options.



Whether in automotive applications or the latest energy storage systems, the competing requirements of increased power consumption and miniaturized electronics pose new challenges. These systems require clean and consistent power supplies, and reliable printed circuit board (PCB) connectors are vitally important. The use of PCBs in battery management systems means that power connectors must share space with more traditional signal connectors. Consequently, the domains of signal and power connectors are merging.

The mPOWER® (UMP) connector system is a compact family of high-power solutions for board-to-board power delivery. Designed to work alongside Samtec's existing range of high-speed mezzanine connectors, the mPOWER family is available in a variety of board stacking heights. At the heart of its design is a blade-type contact that offers a large mating surface area for increased current-carrying capacity. These blade contacts can deliver up to 18 Amps per circuit with a pitch of just 2 mm, resulting in a compact connector with high power density.

The UMP family is available with the same stacking heights as existing Samtec high-speed connectors, such as the ERM5/ERF5 and QSH/QTH series. This compatibility allows engineers to create a compact, high-density connector system that maximizes space efficiency on the board.

Features

- A single product family that includes board-to-board, cable-to-board and cable-to-cable solutions.
- Power blades provide current ratings of up to 18 Amps per circuit.
- Options ranging from 2 to 10 circuits deliver up to 180 Amps in a single, compact connector.
- PCB connectors are compatible with Samtec signal connectors, such as the Edge Rate® and Q Strip® families.
- Multiple stacking height options deliver a flexible power and signal combination for your board.
- Qualified under Samtec's Severe Environment Testing program.

Orderable Part Numbers at arrow.com

- UMPS-02-05.5-L-V-S-W-TR
- UMPS-04-05.5-L-V-S-W-TR
- UMPS-06-05.5-L-V-S-W-TR
- UMPT-02-01.5-L-V-S-W-TR

Scan QR-Code to find more information on arrow.com

Compact Fuses for BMS Protection

Explore SCHURTER's AEC-Q200 fuse portfolio for BMS: precise overcurrent & thermal protection in compact designs.

Battery Management Systems (BMS) require precise and reliable protection components to ensure safety and performance, especially in demanding industrial and automotive environments. SCHURTER offers a robust selection of compact, high-performance SMD fuses and thermal protection devices tailored to meet the rigorous requirements of modern BMS designs.

Featured Products:

UMT 250 – High Breaking Capacity SMT Fuse
A versatile fuse with a current range from 80 mA to 10 A and a high breaking capacity of 200 A @ 250 VAC (IEC). UL approved for 277 VAC and 250 VDC, it is ideal for use in intrinsically safe circuits thanks to its hermetic seal. The UMT 250 provides reliable protection in a compact footprint, handling pulse-shaped continuous currents with ease.

USN 1206 – Temperature-Sensitive SMD Fuse
Combining traditional fuse characteristics with ambient temperature sensitivity, rated voltage 32 VDC, rated current 12 A the USN 1206 is ideal for electronics with temperature-critical components. Made of ceramic glass-fiber reinforced material, it withstands inrush currents and provides protection for DC/AC secondary circuits and automotive electronics. It is also impervious to potting compound, meeting ATEx and IECEx standards.

RTS – Reflowable Thermal Switch
Developed for thermal protection of power semiconductors (MOSFETs, IGBTs, ICs), RTS provides galvanic separation inside its housing and is compatible with reflow soldering. With a footprint of only 6.6 x 8.8 mm, it handles currents up to 100 A at 60 VDC and meets AEC-Q200 and MIL-STD. Available with optional shunt or overcurrent protection.

USI 1206 – Ultra-Slow Blow Fuse for High Inrush Currents
Designed with a robust IEC characteristic and high melting I^2t-values rated voltage 32 VAC, 63 VDC, rated current 0.5 – 6.3 A, the USI 1206 is ideal for applications where inrush currents are a challenge. It is potting compound–resistant and tested according to AEC-Q200 specifications, making it a strong candidate for automotive-grade BMS applications.

UHP – High-Power SMD Fuse for 80 VDC
For high-current SELV (Safety Extra-Low Voltage) applications, the UHP offers a breaking capacity of up to 3000 A and fast tripping (≤ 15 s at 2x rated current). Its superior thermal behavior and power reduction performance make it perfect for protecting high-performance lithium-ion batteries in automotive, telecom, and industrial systems.
(https://youtu.be/JOfrluczsp8)

Orderable Part Numbers at arrow.com

- 3403.0155
- 3413.0512
- 3-104-513
- 3413.0213
- 3-139-122

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SSM SUSUMU
Thin Film Specialist and Innovator

MSR Series Metal Alloy Shunt

Susumu's MSR series metal alloy shunt consists of precision resistive alloy and is welded with vacuum electron beam in different inch size 1216, 2726 and 4026.

Applications

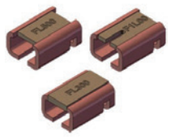
- Automotive electronics: HVAC, Oil Pump, EPS, Thermal System
- Power source devices, ACDC converters, DCDC converters, OBC system and BMS System
- Motors Current Sensing, inverters, PSU devices

Scan QR-Code to find more information on arrow.com

The MSRPM 1216 series is based on precision resistive alloy and welded with vacuum electron beam welding equipment to ensure its characteristics and reliability. This shunt can achieve a maximum target tolerance of ± 0.5 % after precision trimming. TCR of MSRPM 1216 series is ≤±100ppm/ °C within the operating temperature range from -55 °C to +170 °C and inductance is less than 3nH. MSRPM 1216 0.3 mΩ 10 W 182 A -55 °C~+170 °C ±100 ppm °C+20 °C~+170 °C successfully achieves the independent and controllable production, stable quality, and timely delivery relying on our self-developed raw materials, core equipment and core processes.

The MSRPF2726 and the MSRPF4026 series are based on precision resistive alloy and welded with vacuum electron beam welding equipment to ensure its characteristics and reliability. Precision machining and uniform welding provide a minimum tolerance of ±0.5 % without trimming.

TCR of MSRPF2726 series within the temperature range of +20 °C to +120 °C is ≤ ±75 ppm/ °C (1 mΩ~2 mΩ) and ±50 ppm/ °C (3 mΩ~5 mΩ). The "Trimming-free" technology avoids current loss and is free of hot spots. The thermoelectric power is extremely low and thermal fluctuations are minimized.

	Series	Resistance Value	Power (+70 °C)	Max. Operating Current	Operating Temperature	TCR ppm/°C+20°C Ref)	Thermal Resistance	Weight	Tolerance	PKG.
	MSRPM 1216	0.3 mΩ	10 W	182 A	-55 °C~+170 °C	± 100 (+20 °C~+170 °C)	7.8 °C/W	0.1 ± 0.05 g	± 0.5 %	Tape 3,000 pcs.
		0.5 mΩ	9 W	134 A	-55 °C~+170 °C	± 100 (+20 °C~+170 °C)	12.1 °C/W	0.1 ± 0.05 g	± 1.0 %	
		1.0 mΩ	7 W	83 A	-55 °C~+170 °C	± 100 (+20 °C~170 °C)	12.7 °C/W	0.07 ± 0.03 g	± 5.0 %	

	Series	Size inch. (mm)	Resistance Value	Power	Max. Current	Operating Temperature	TCR (20°CRsef)	Tolerance	Resistance	PKG.
	MSRPF 2726	2726 (6966)	1 mΩ	7 W	83 A	-55~170 °C	± 75 ppm/°C	± 0.5 % ± 1 % ± 5 %	8.6 °C/W	1,200 pcs.
			1.3 mΩ	7 W	73 A				10.0 °C/W	
			2 mΩ	6 W	54 A				17.6 °C/W	
			3 mΩ	5 W	40 A		± 50 ppm/°C		25.3 °C/W	
			4 mΩ	4 W	31 A				32.1 °C/W	
			5 mΩ	3 W	24 A				39.7 °C/W	

	Series	Size inch. (mm)	Resistance Value	Power	Max. Current	Operating Temperature	TCR (20°CRsef)	Tolerance	Resistance	PKG.
	MSRPF 4026	4026 (10166)	1 mΩ	7 W	83 A	-55°C ~ 170 °C	± 75 ppm/°C	± 0.5 % ± 1.0 % ± 5.0 %	8.6 °C/W	1,200 pcs.
			1.3 mΩ	7 W	73 A				10.0 °C/W	
			2 mΩ	6 W	54 A				17.6 °C/W	
			3 mΩ	5 W	40 A		± 50 ppm/°C		25.3 °C/W	
			4 mΩ	4 W	31 A				32.1 °C/W	
			5 mΩ	3 W	24 A				39.7 °C/W	

TDK

TDK – Carxield

A standardized EMI filter for automotive application

The first EMI filter to set standards: HV DC EMI filter for automotive drive inverters.

High frequency switching noise from inverters is a potential source of RF emissions.

Inverter noise on battery lines is also a major concern both for immunity and emissions:

- Inverter is producing electromagnetic interferences
- EMI filter shall reduce the interferences between inverter and battery

1000 V DC and 500 V DC with 200 to 400 A at +85 °C.

Product validation according to automotive requirements (based on AEC-Q200 and MBN LV 124).

Advantages

- **Cost-saving**
  - Reduced development time for the customer
  - Product validation already done
  - No custom-specific production line investment
- **Reliability**
  - Basic product design already running in production, Production process approved
- **Flexibility**
  - Available with or without copper bars. Customer can use already existing own busbars
- **Availability**
  - Product is in serial production now

Orderable Part Numbers at arrow.com

- B84252B0400A000

Scan QR-Code to find more information on arrow.com

TE Connectivity(TE) High Voltage DC Contactor

AUTHORIZED DISTRIBUTOR

Choose TE's high voltage DC contactors, offering: Safer & reliable, equipped with Superior Contacts and Designed for varied usage

Focus Applications:
- Battery energy storage system
- Photovoltaic inverters
- Super EV charger
- Megawatt charger

High Voltage DC Contactors ECP Series
ECP series high voltage contactors are designed for battery energy storage systems, photovoltaic inverters, and EV chargers. With the hydrogen gas filling and ceramic hermetically sealing technology, they can achieve excellent arc extinguishing, making them safer and reliable, applicable in 1500 VDC voltage system.

ECP 40B, 150B, 250B, 350B, 600B Series.

Key Benefits:
- Hermetically sealed with ceramic technology helping ensure high reliability
- Continuous current carrying capability up to 800 A
- High performance in electrical endurance with maximum breaking capacity up to 1500 VDC at 1000 A
- Supports bi-directional load
- Dual coil design with holding 5.0 W of power
- Equipped with auxiliary contact and smart monitoring for main contact status
- Complies with DC-1 utilization category in IEC60947-4

Focus Applications:
- Electric Forklifts
- EV charging
- DC converter
- Battery Test Equipment
- Power Distribution Unit

High Voltage DC Contactors ECK Series
The ECK series is designed for control in new energy applications. The ECK product line is an advanced and reliable solution for EV charging stations, solar inverters, battery energy storage systems, automated-guided vehicles (AGV) and e-Forklifts, they provide for bi-directional loads. With the hydrogen gas filling and ceramic hermetically sealing technology, they can achieve excellent arc extinguishing, making them safer and reliable. These contactors can be used in 1000 VDC system applications.

ECK 50B, 100B, 150, 150B, 200, 200B, 250, 250B Series.

Key Benefits:
- Hermetically sealed with ceramic technology
- Switching voltage up to 1000 VDC
- Equipped with optional auxiliary contact and smart monitoring for main contact status
- Complies with DC-1 utilization category
- Meets the system upgrade requirement
- High performance in electrical endurance making it suitable for high voltage applications
- Equipped with bi-directional contacts that supports bi-directional load
- CE approved, serving as a global solution for customer projects

Connect with high voltage DC contactor solutions from TE Connectivity, engineered for high-performance and reliability.

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EMEA COMPONENTS
IP&E News · 3rd Quarter 2025

Powering the Future of Battery Management & Energy Storage!

YAGEO GROUP PULSE

YAGEO Group is proud to unveil the new HM216xNL Series, our next generation of BMS isolation transformers

Applications (Renewable Energy):
- Solar/Wind
- Battery Management
- Energy Storage
- EV/PHEV

Scan QR-Code to find more information on arrow.com

Yageo Pulse Electronics Wired Communications PBU are proud to introduce the new HM216xNL series, the next generation of BMS transformers designed for energy storage and battery management systems with enhanced manufacturability and reliability.

This series features a new header design that ensures consistent quality and performance. Designed to meet IEC/UL 61558 standards, these transformers ensure safety and performance. They are AEC-Q200 qualified and PPAP level 3 compliant, guaranteeing the highest quality and reliability for automotive applications. The HM216xNL series is ideal for BMS in electric and hybrid vehicles, energy storage systems, and marine and aviation applications where separation from high-voltage battery stacks and circuits for battery management is critical.

This series meets creepage distance requirements for basic insulation, making it suitable for higher-level applications. They integrate seamlessly into existing systems due to the similar footprint of current Pulse legacy BMS products, without the need for additional investment or new layout designs.

Key Product Features
Safety compliance to IEC-62368/61558 for Basic Insulation up to 1000 V peak working voltage.
- 4300 Vdc Isolation across windings (15 years 1500 Vrms)
- Operating temperature: - 40 °C to + 125 °C
- 260 °C peak reflow soldering temperature
- Available with or without common mode choke
- Fully automated production process offers high reliability
- Qualified to AEC-Q200, in compliance with IATF16949
- HM2166/67/69NL Drop-in replacement for HM2106/2108NL

Orderable Part Numbers at arrow.com
- HM2162NL
- HM2166NL
- HM2167HL
- HM2168NL
- HM2169NL

Electrical Specifications @ 25 °C – Operating Temperature - 40 °C to + 125 °C

Part Number	Inductance (100 kHz, 10 0m Vrms)	Number of Channels	Choke fitted	Isolation breakdown (Pri:Sec)	Working Voltage	Insulation & Creepage (mm)	Winding Style	Qualified BMS Silicon
HM2162NL	150 uH min	Dual	YES	4300 Vdc / 60 sec	1600 VDC	Functional	ICT: 1CT	NXP, ADI, Infineon, Texas
HM2166NL	150 uH min	Single	NO	4300 Vdc / 60 sec	1000 VDC	Basic (>10)	1:1	NXP, ADI, Infineon, Texas
HM2167HL	150 uH min	Single	NO	3700 Vrms / 60 sec	1000 VDC	Basic (>10)	ICT: 1CT	NXP, ADI, Infineon, Texas
HM2168NL	150 uH min	Dual	NO	4300 Vdc / 60 sec	1500 VDC	Functional	1CT: 1CT	NXP, ADI, Infineon, Texas
HM2169NL	150 uH min	Single	YES	4300 Vdc / 60 sec	1000 VDC	Basic (>10)	1CT: 1CT	NXP, ADI, Infineon, Texas

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Five Years Out