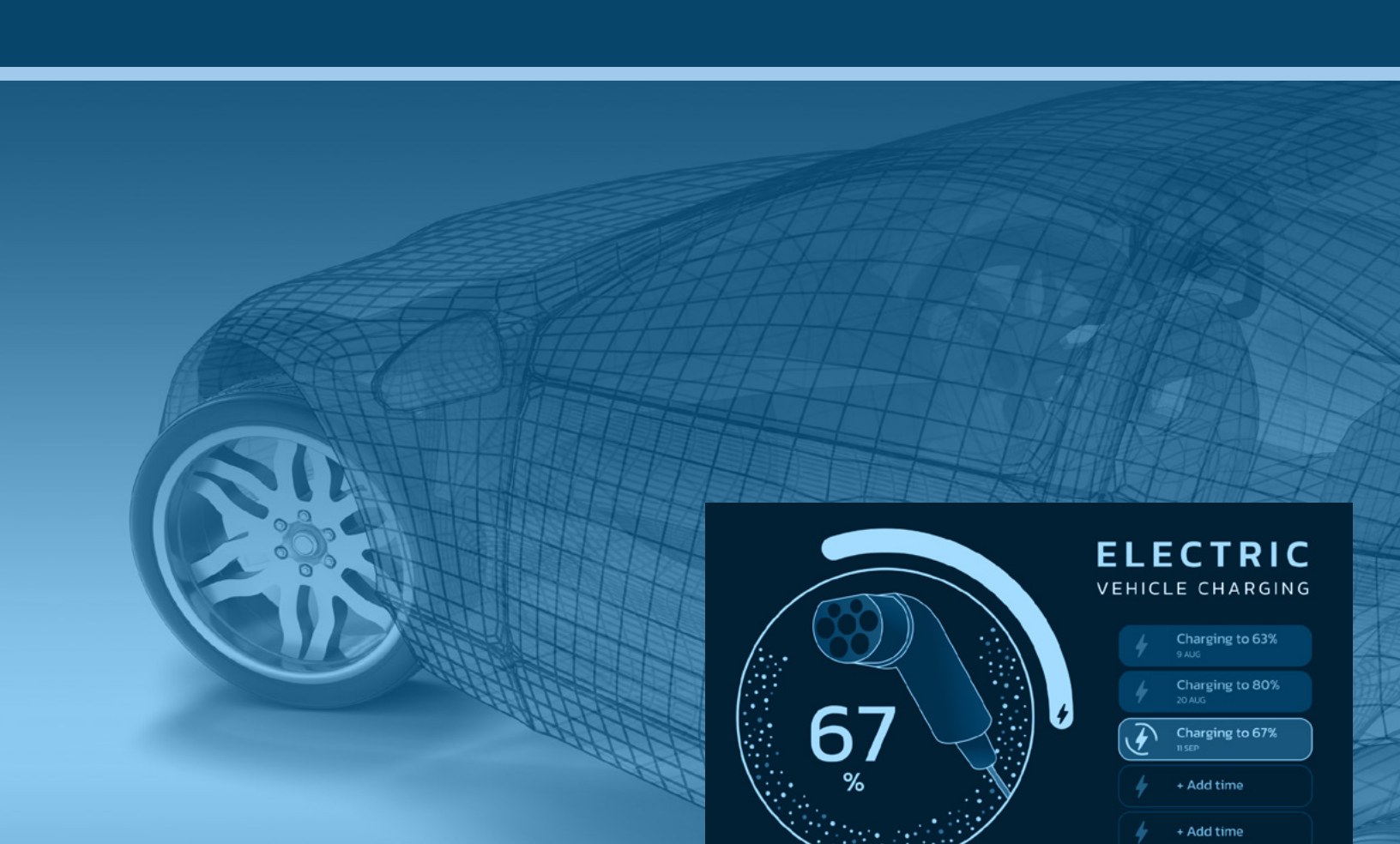




Automotive Electronic Components for Electric & Fuel Cell Powertrains



BOURNS®



Electric Powertrains

Electric Vehicles (EVs) utilize a complex multi-stage system to power the wheels of the vehicle. The electric powertrain operates by receiving high-voltage AC or DC power, then processing and isolating it for efficient charging of the main EV battery. To power the electric motors, the DC voltage is taken from the battery, inverted into a more efficient AC voltage, and finally, powers the electric motor. At each stage of the powertrain, overvoltage and overcurrent events can occur.

To protect this vital system, Bourns® automotive grade components are designed to safeguard the critical infrastructure of the EV. As EVs are becoming one of the solutions to long-term sustainability and innovation, Bourns remains a leading manufacturer of EV protection solutions





Automotive Grade Components

Bourns® products offer effective protection for the supporting devices in the electric powertrain. Bourns designs and manufactures its automotive grade components with high quality and precision to comply with AEC-Q standards. This brochure highlights components used in current sensing, communication busses, and DC-DC converter roles. However, these products are also versatile and can be used in many different automotive applications such as infotainment, comfort, sensors, and zonal control systems. The Bourns commitment to quality and reliability makes these products optimal solutions for protecting almost any automotive application.



Bourns® Product Offerings

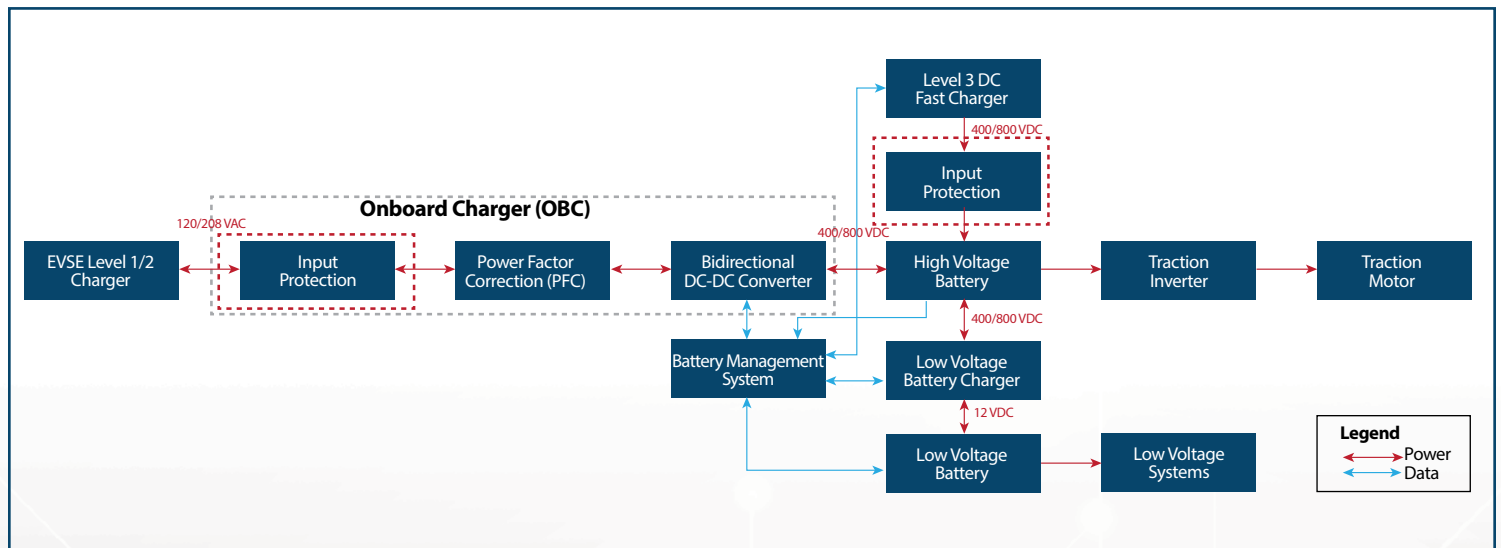
- Gas Discharge Tubes (GDTs)
- High Power Shunt Resistors
- Metal Element Chip Resistors
- Power Resistors
- TVS Diodes and Arrays
- Multilayer Varistors (MLVs)
- Multifuse® Polymer PTC Resettable Fuses
- SinglFuse™ SMD Fuses
- POWrFuse™ High-Power Fuses
- TBU® High-Speed Protectors (HSPs)
- Thick Film on Steel (TFOS)

Application Examples


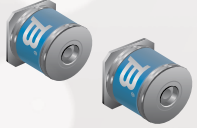
Input Protection

Whether charging via Level 1/2 AC or Level 3 DC, the initial connection from the charging station to the vehicle must be protected against both human-caused Electrostatic Discharge (ESD) and environmental

overvoltage and overcurrent events. Bourns® Fuses and GDTs offer the features to guard against such electrical dangers.



Bourns® Product Recommendations

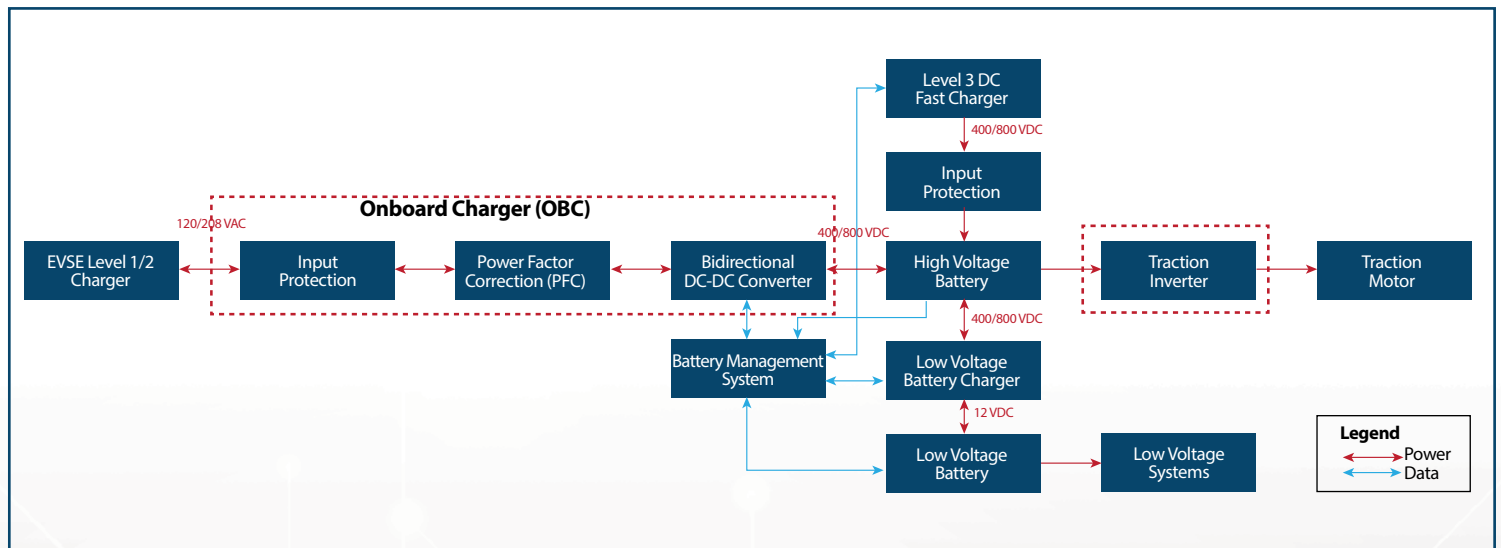
Product Image	Recommended Products	Description	Specifications and Features
	POWrFuse™ High-Power Fuses PF-K Series	Designed for overcurrent protection of electric and hybrid vehicle systems.	<ul style="list-style-type: none"> Rated voltage: 275V AC/500 VDC Rated currents: 15-50 A Interrupt rating: 10 kA ISO 8820-8 compliant Bolt-down and PCB mounting options
	Gas Discharge Tubes (GDTs) 2027-A-xx-SM	GDTs are used on front-end and data line protection designs. They absorb large amounts of energy.	<ul style="list-style-type: none"> DC Sparkover Voltage: 75-600 V @100 V/s Impulse Discharge Current: 25,000 A, 8/20 μs AEC-Q200 compliant and UL recognized Surface mount




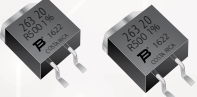
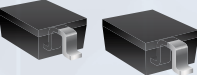
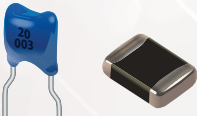
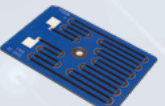
Onboard Chargers and Traction Inverters

Both the AC-DC converter and the DC-AC converter have sensitive sensors and data equipment that is susceptible to cross contamination from the high voltage line.

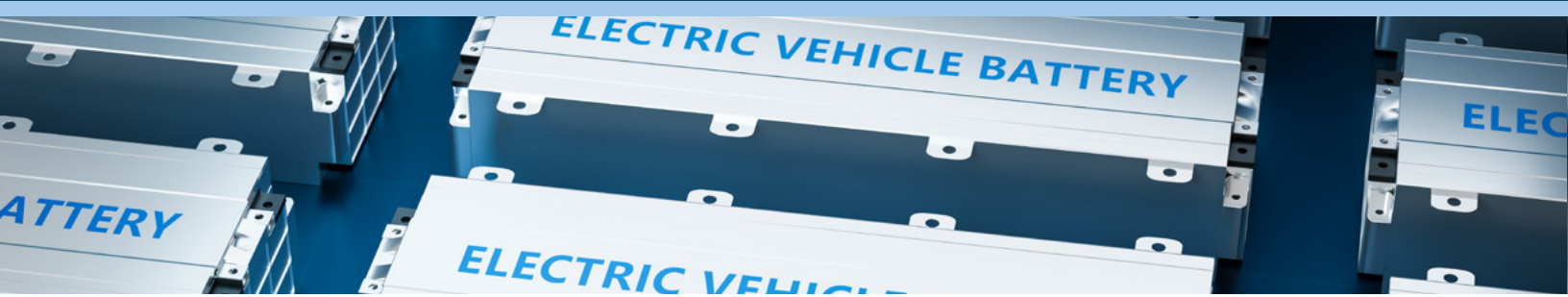
Bourns® automotive grade components are available to help ensure that the effects of such events can be minimized and reduced to a safe level.



Bourns® Product Recommendations

Product Image	Recommended Products	Description	Specifications and Features
	High Power Shunt Resistors CSM2F Series	Shunt resistors for monitoring high current in high power applications.	<ul style="list-style-type: none"> Resistance Range: 25-200 $\mu\Omega$ Power: 36-50 W AEC-Q200 compliant Sensing pins included in select models
	Power Resistor PWR Series	Power resistors manufactured using thick film on alumina ceramic technology, used in current measurement, snubber, bleeder and discharge circuits.	<ul style="list-style-type: none"> Resistance Range: 0.02 – 130 kΩ Tolerance: 1 %, 5 % Power: 20-35 W TO-220, DPAK, and D²PAK package options AEC-Q200 compliant
	TVS Diode CDSOD323-T12C-DSLQ Series	Gate inputs at switching elements such as IGBTs and MOSFETs are prone to transient overvoltage events. For protection of these inputs, TVS diodes clamp harmful transients to typical gate input voltage levels (12-20 V).	<ul style="list-style-type: none"> Multiple packages offer working peak reverse voltage in the <24 V range Multiple power ratings up to 15 kW Several industry standard SMD packages Low capacitance AEC-Q101 compliant
	Multilayer Varistors (MLVs) AV-SMD Series AV-HT-SMD Series AV-TH Series	Overvoltage protection for gate inputs at switching elements.	<ul style="list-style-type: none"> Rated Voltage: 14–170 VDC Surge Current Rating: 30–1200 A, 8/20 μs Temperature Range: -55 to +150 °C SMD and through-hole packaging SMD case sizes: 0603–2220 AEC-Q200 compliant
	Thick Film on Steel (TFOS) TFOS30-1-150T	Bourns® Thick Film on Steel offers high-power use in braking resistor applications. Available with standard solder pads or push-on terminal connections. Designed to be easily mountable to heat sinks.	<ul style="list-style-type: none"> Power Rating: 260 W Maximum Element Temperature: 365 °C Low profile thick film on steel Low inductance

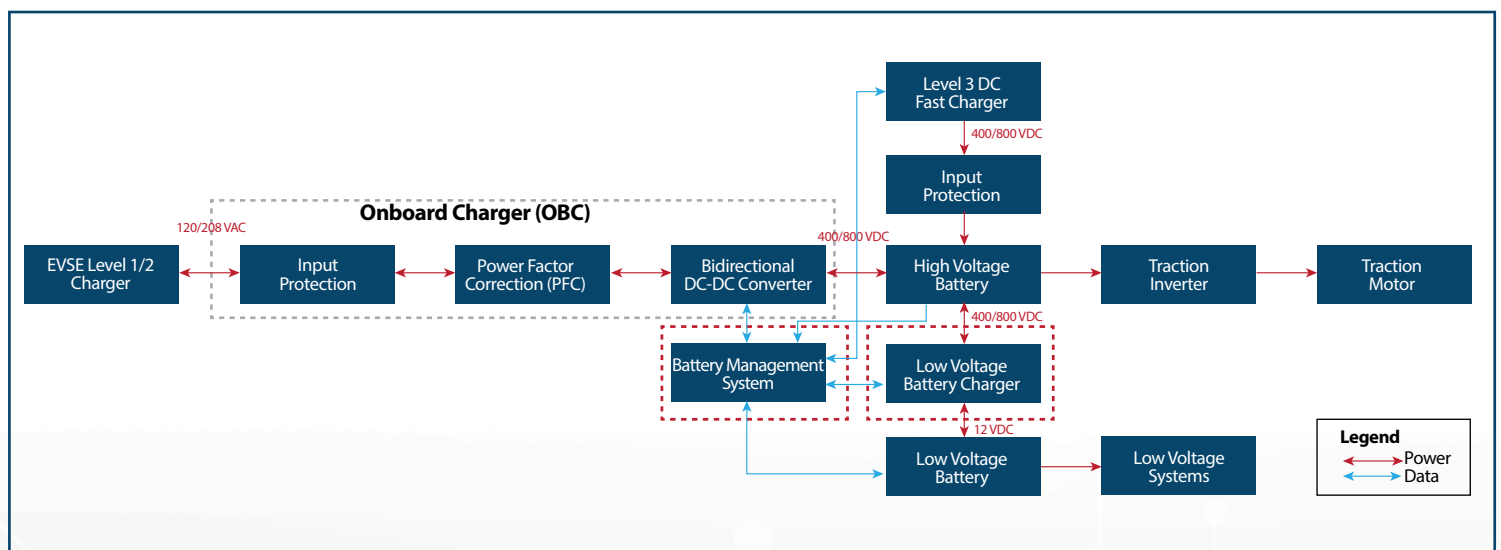
Application Examples





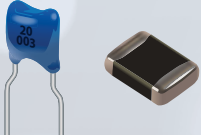

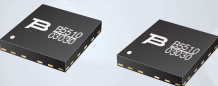
Battery Management Systems (BMS) and Low Voltage Chargers

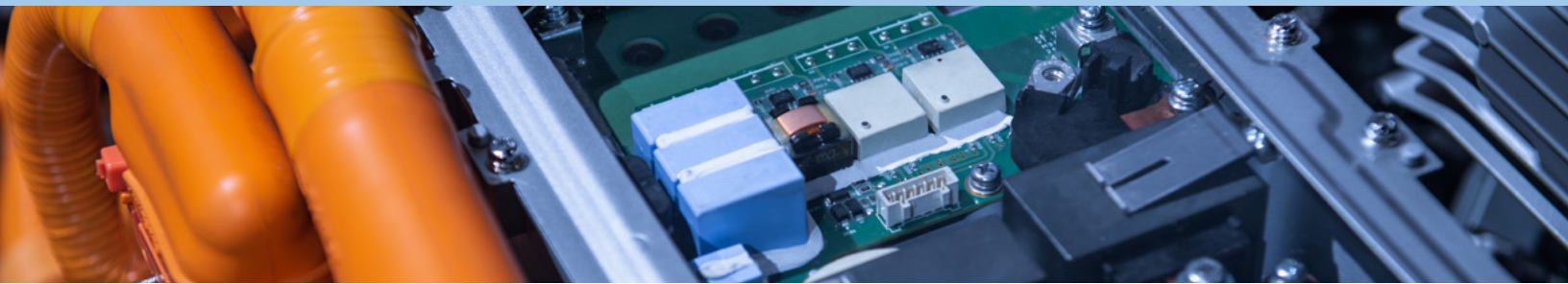
Within the BMS, low-voltage high-speed connections demand precision and speed to maintain battery performance and safety.

Bourns offers effective current sensing and data protection for this application.



Bourns® Product Recommendations

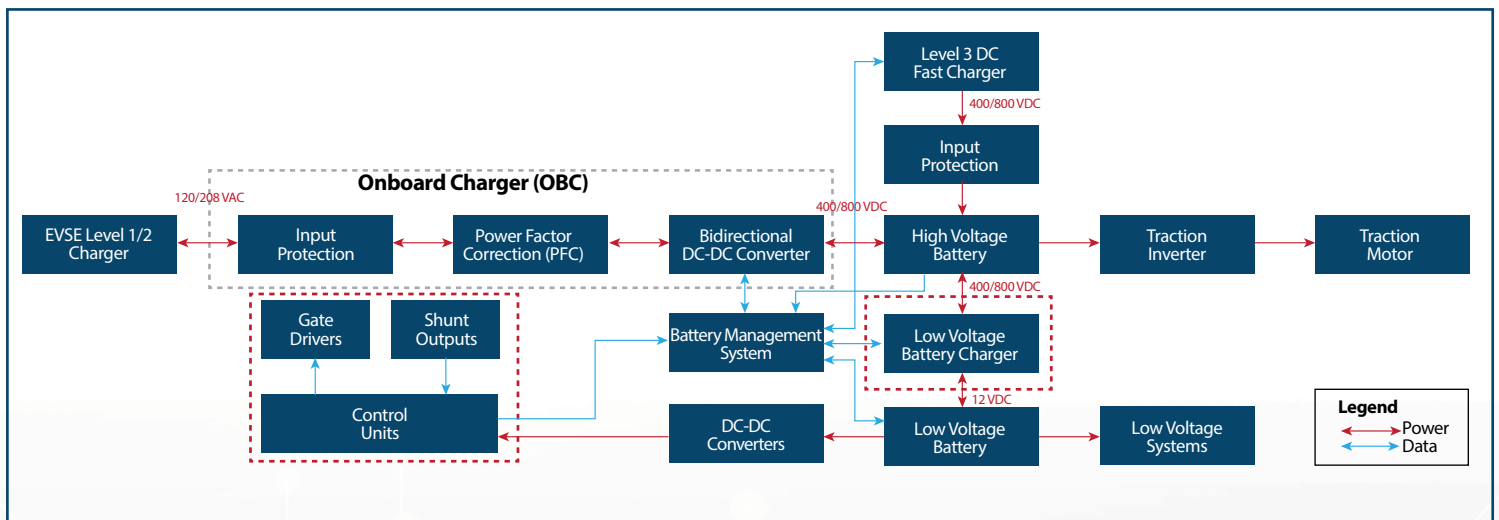
Product Image	Recommended Products	Description	Specifications and Features
	TVS Diodes SMAJ-Q Series SMLJ-Q Series	For precision overvoltage protection of low voltage DC busses. Can protect against residual surge energy and Electrostatic Discharge (ESD). Quick clamping action with several power options and voltages available.	<ul style="list-style-type: none"> Min. Breakdown Voltage: 6.4-550 V Power: 400-15000 W DO-214A and DO-214B SMD packages AEC-Q101 compliant
	High Power Shunt Resistors CSS Series CSM2F Series	Power resistor manufactured using thick film on alumina ceramic technology, used in current measurement, snubber, bleeder and discharge circuits.	<ul style="list-style-type: none"> Resistance Range: 0.02 – 130 kΩ Tolerance: 1 %, 5 % Power: 20-35 W TO-220, DPAK, and D²PAK package options AEC-Q200 compliant
	Multilayer Varistors (MLVs) AV-SMD Series AV-HT-SMD Series AV-TH Series	Several rated voltages and model sizes are available. MLVs can protect against overvoltage surges with WLD energy capabilities up to 12 J.	<ul style="list-style-type: none"> Rated Voltage: 14–70 VDC Surge Current Rating: 30–1200 A, 8/20 μs Load Dump Energy: 1–12 J SMD and through-hole packaging SMD case sizes: 0603–2220 AEC-Q200 compliant
	Multifuse® Polymer PTC Resettable Fuses AEC-Q200 Compliant Series	Resettable overcurrent protection. Good for low voltage and low current DC busses and inputs. SMD packaging available.	<ul style="list-style-type: none"> Maximum Voltage: 6-60 VDC Hold Current: 0.05-50 A Operating Temperature: -40 to +125 °C Multiple SMD packages available AEC-Q200 compliant
	TBU® High-Speed Protectors (HSPs) TBU-DB-Q Series	Bourns® TBU® High-Speed Protectors (HSPs) are low capacitance dual bidirectional high-speed protection components, designed to protect against faults caused by short circuits, overvoltage transients and faults in battery cells, up to rated limits.	<ul style="list-style-type: none"> Maximum Impulse Voltage: 550V Trigger Current Levels: 100 mA Trigger Time: 1 μs High-speed performance MOSFET semiconductor technology AEC-Q200 compliant




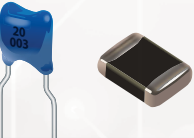



DC-DC Converters

The low voltage supporting devices of the powertrain often receive 48 V but operate on a lower voltage, such as 5 V. The conversion of the voltages requires protection from overvoltage and overcurrent events.

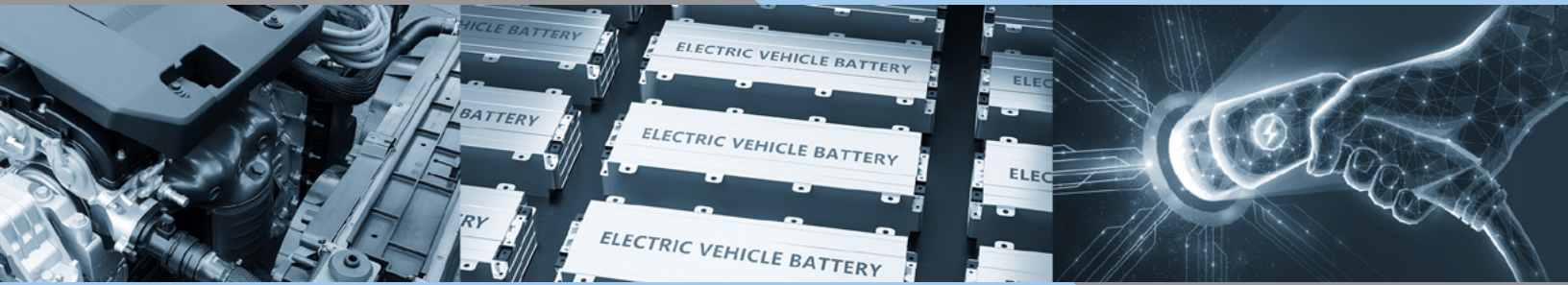
Bourns offers many automotive grade components that help ensure the reliability and safety of these devices.



Bourns® Product Recommendations

Product Image	Recommended Products	Description	Specifications and Features
	<p>TVS Diodes</p> <p>SMAJ-Q Series</p> <p>SMLJ-Q Series</p>	For precision overvoltage protection of low voltage DC buses. Can protect against residual surge energy and Electrostatic Discharge (ESD). Quick clamping action with several power options and voltages available.	<ul style="list-style-type: none"> • Min. Breakdown Voltage: 6.4-550 V • Power: 400-15000 W • DO-214A and DO-214B SMD packages • AEC-Q101 compliant
	<p>Multilayer Varistors (MLVs)</p> <p>AV-SMD Series</p> <p>AV-HT-SMD Series</p> <p>AV-TH Series</p>	Several rated voltages and model sizes are available. MLVs can protect against overvoltage surges with WLD energy capabilities up to 12 J.	<ul style="list-style-type: none"> • Rated Voltage: 14-70 VDC • Surge Current Rating: 30-1200 A, 8/20 μs • Load Dump Energy: 1-12 J • SMD and through-hole packaging • SMD case sizes: 0603-2220 • AEC-Q200 compliant
	<p>Metal Element Chip Resistors</p> <p>CFN-A Series</p> <p>CRF Series</p> <p>CRE Series</p> <p>CRG Series</p>	Precision SMD current sense resistors ideally suited for DC-DC converter circuits. SMD shunts provide tight tolerances with low temperature drift in a small footprint.	<ul style="list-style-type: none"> • Resistance Range: 1-100 mΩ • Tolerances: 1%, 5% • Power: 0.5-3 W • Low TCR and thermal EMF • SMD packaging • AEC-Q200 compliant
	<p>Multifuse® Polymer PTC Resettable Fuses</p> <p>AEC-Q200 Compliant Series</p>	Resettable overcurrent protection. Good for low voltage and low current DC buses and inputs. SMD packaging available.	<ul style="list-style-type: none"> • Maximum Voltage: 6-60 VDC • Hold Current: 0.05-50 A • Operating Temperature: -40 to +125 °C • Multiple SMD packages available • AEC-Q200 compliant
	<p>SinglFuse™ SMD Fuses -</p> <p>AEC-Q200-Equivalent Compliant Series</p>	SinglFuse™ SMD Fuses will act as overcurrent protection devices for critical components.	<ul style="list-style-type: none"> • Rated Voltage: 24-250 VDC • Rated Current: 0.5-30 A • Operating Temperature: -55 to +150 °C • Wire core, metal foil, and ceramic technologies • SMD packaging • AEC-Q200 compliant

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Specifications subject to change without notice. Actual performance in specific customer applications may differ due to the influence of other variables. Customers should verify actual device performance in their specific applications.

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