



Automotive Electrical/Electronic (E/E) Architecture

Bourns® Automotive Component Zonal Control Brochure



BOURNS®

Introduction

Electrical/Electronic (E/E) architecture is a defining feature of future vehicles. Emphasizing the centralization and modularity of vehicle subsystems, it is often associated with the concept of “zonal control.”

Unlike the older domain-based control—where each subsystem is individually managed by its own Electronic Control Unit (ECU)—zonal control groups neighboring devices under a local ECU, which then reports to a central computer. Zonal control reduces the number of wires running throughout a vehicle and consolidates the data processing of individual ECUs into a more powerful and efficient computer. E/E architecture paves the way for innovations such as self-driving, software-operated vehicles, and the electrification of cars to fully be adopted in modern EVs.

A key advancement in E/E architecture is the unification of power and data connections for in-vehicle sensors, cameras, and infotainment systems. Power over Dataline (PoDL) addresses this need by combining electrical power with Single-Pair Ethernet (SPE), allowing for 1 Gbps under the 1000BASE-T1 protocol while carrying up to 50 W of power.

Starting from the Power Sourcing Equipment (PSE) side, the power source (i.e., the car battery) is stepped up from 12 V to a higher 24 V or 48 V using a boost converter. Increasing the voltage decreases the current ($P = IV$), allowing for higher resistance wires ($I = V/R$), which can be achieved with thinner wires. Using lower-gauge wires significantly reduces vehicle weight and cost.

Once the voltage is stepped up, both the voltage and SPE Gigabit Ethernet are combined using a Coupling Decoupling Network (CDN). A CDN works by filtering out the DC from the data lines while blocking high-frequency interference from the power lines. This is done using series capacitors for the data line and series inductor chokes for the power line. The result from the PSE is a data line with increased DC voltage amplitude.

After reaching the Powered Device (PD) size, the SPE cable is separated back into data and power lines using a CDN. The data line is subsequently connected to an Ethernet PHY, which feeds into the local zonal ECU. A buck converter steps down the power line back to 12 V. From here, devices are connected to the ECU and the buck converter. For higher power devices, instead of being connected to the buck converter, they are connected to a separate power supply typically sourced from either the main battery pack or the auxiliary 12 V battery.

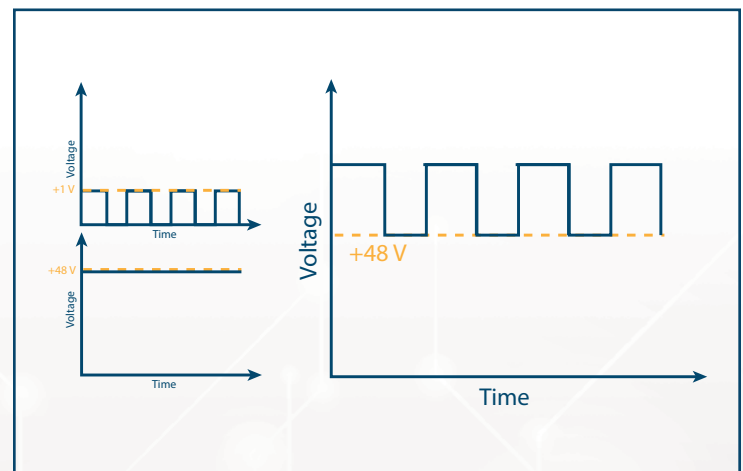
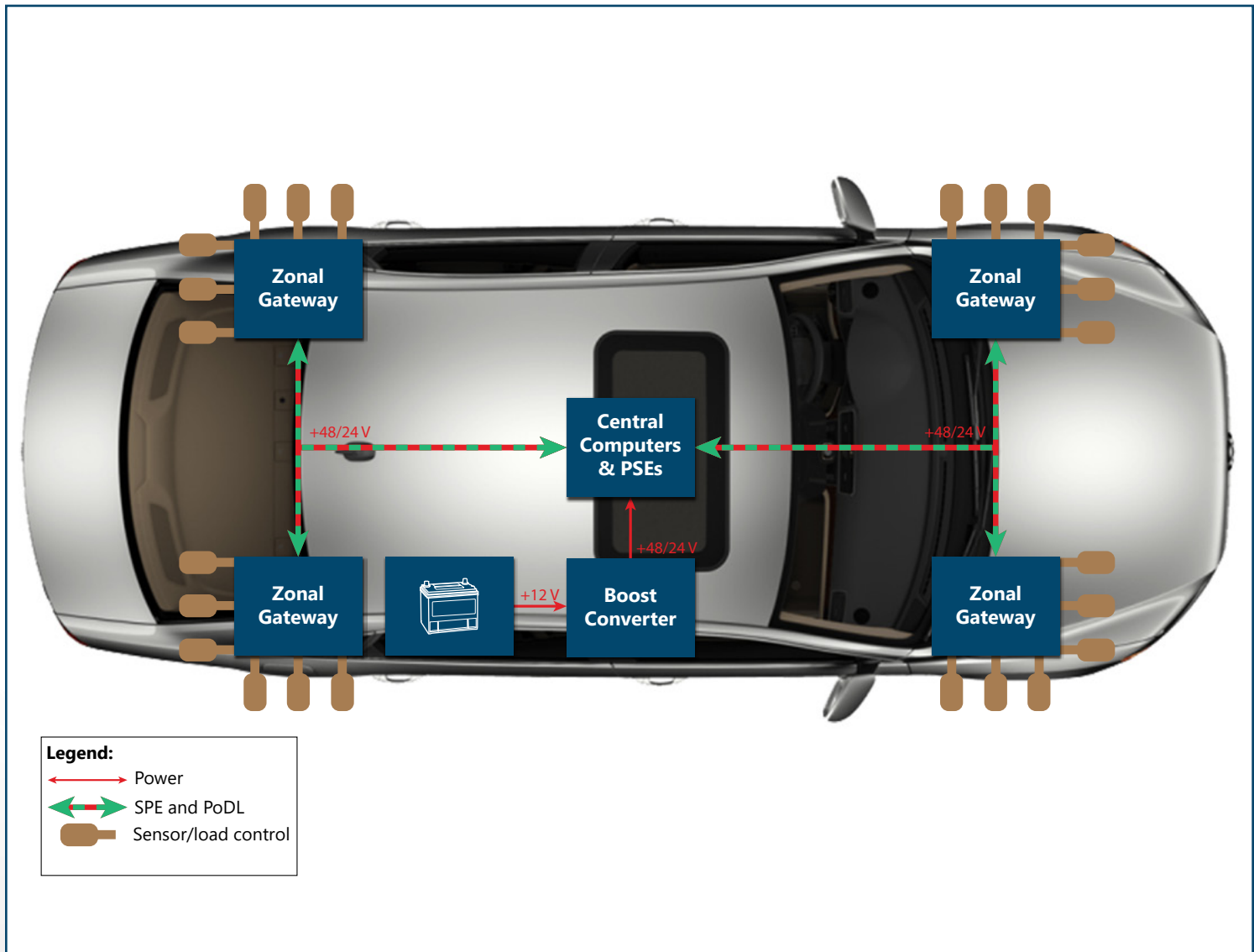


Diagram Example of Zonal Gateway Architectures



Bourns® Product Offerings*

- Resistors
- Current Sense Resistors
- Multifuse® Polymer PTC Resettable Fuses
- SinglFuse™ SMD Fuses
- TBU® High-Speed Protectors (HSPs)
- ChipGuard® ESD Suppressors
- TVS Diodes and Arrays
- Multilayer Varistors
- Gas Discharge Tubes
- Trimpot® Trimming Potentiometers



AUTOMOTIVE
GRADE

*Meets Bourns internal AEC-Q200 equivalent test plan.

PoDL and SPE Protection

Overvoltage and overcurrent events can cause fatal damage to zonal control architectures that utilize PoDL and SPE designs. Bourns has components which ensure overvoltage, overcurrent, precision voltage and current monitoring by offering designers multiple technologies compliant to automotive standards.

Bourns® Automotive qualified MLVs, TVS diodes, and Gas Discharge Tubes (GDTs) offer overvoltage protection for sensitive data line communication and power components with standard packaging and with high surge/ESD capabilities.

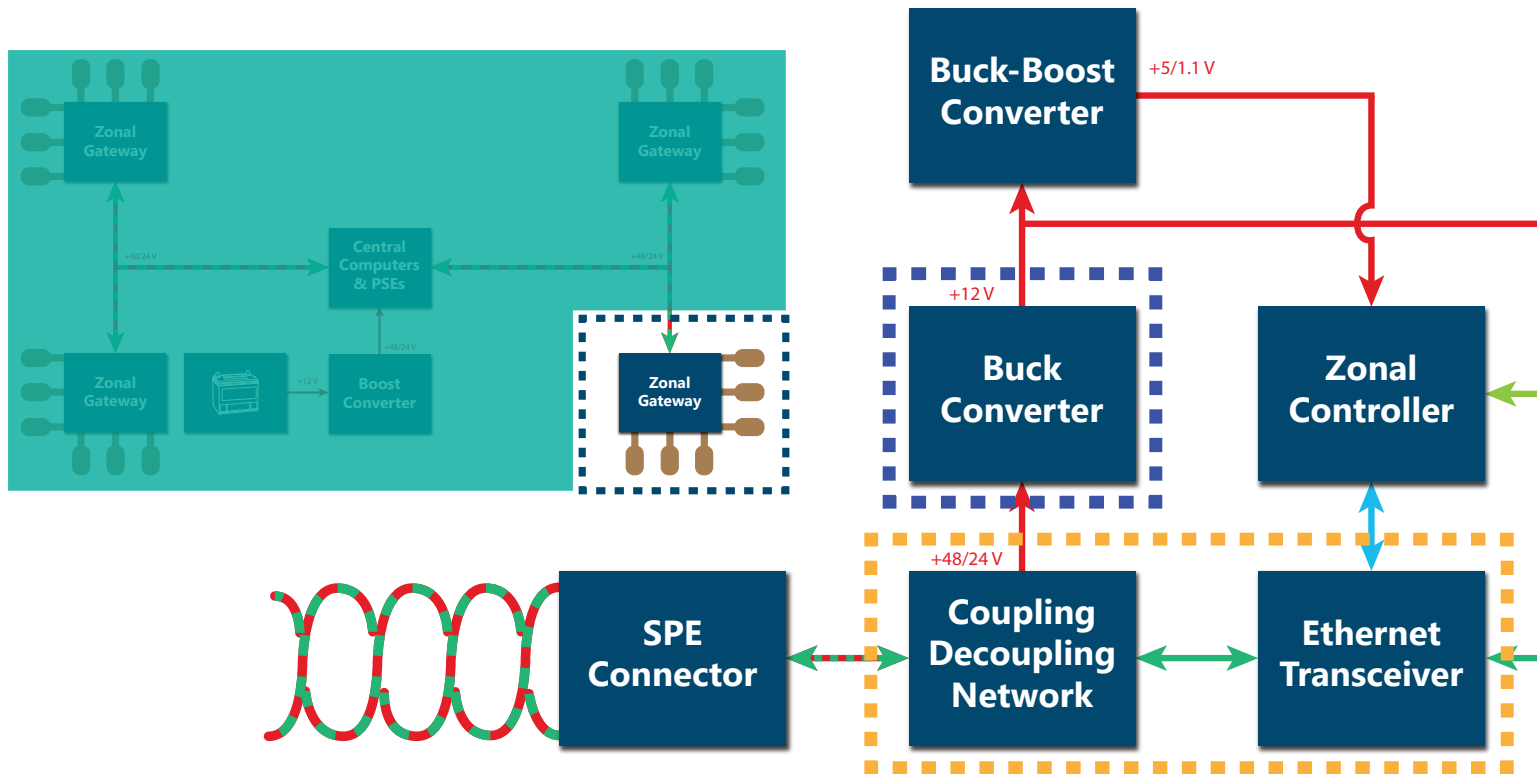
Bourns® Multifuse® Polymer PTC resettable fuses, traditional fuses, and TBU® High-Speed Protectors (HSPs) automotive-qualified products are designed for ruggedizing subsystems against overcurrent events. These components include various packaging styles while incorporating robust overcurrent protection for high operating temperature conditions.

Bourns® line of automotive grade resistors, shunts, and Trimpot® trimming potentiometers enhances current and voltage monitoring to support accurate and precise control. These devices offer low Temperature Coefficients of Resistance (TCRs) and tight tolerances to ensure measurements are precise.

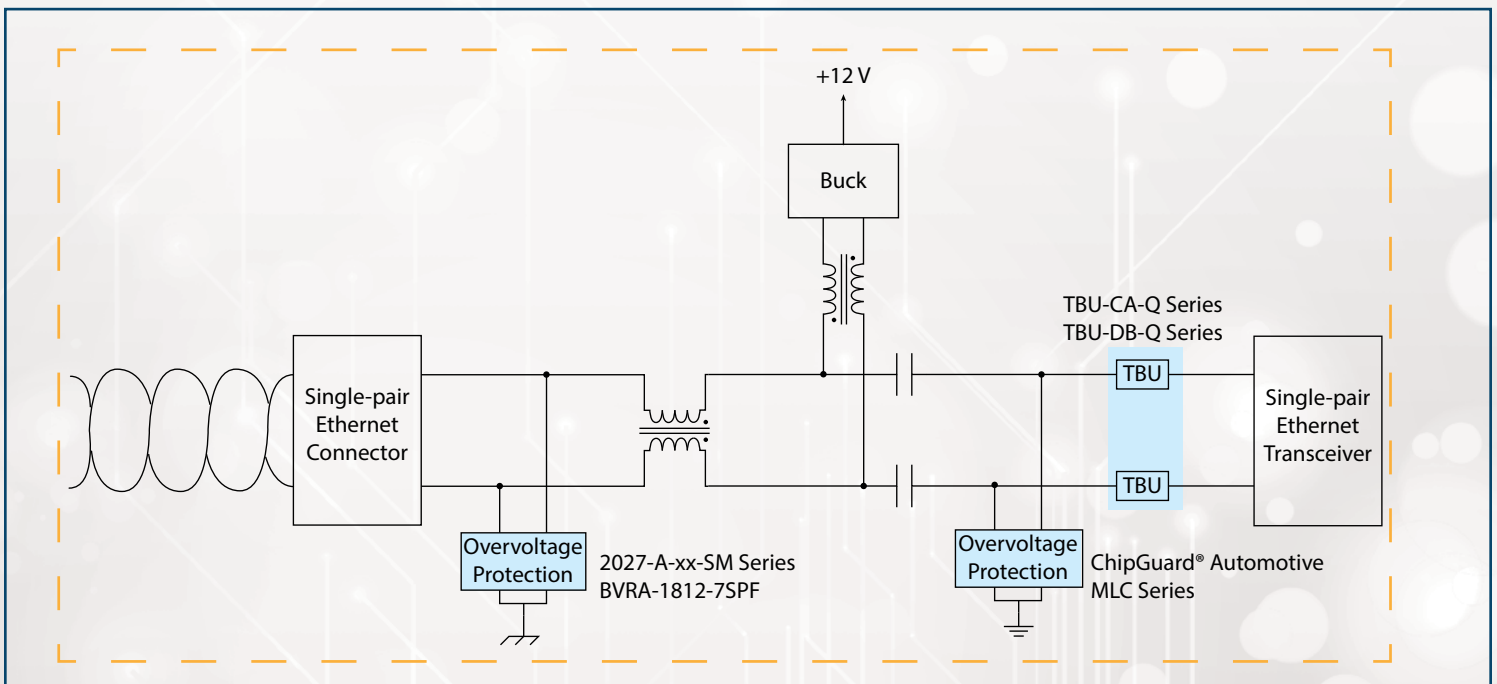
Bourns offers a wide range of high-quality, automotive grade components that protect every stage of device connectivity, with or without PoDL. From delicate data signals to HVDC systems, Bourns circuit protection solutions help safeguard devices in demanding automotive applications. Where zonal architecture is implemented, Bourns comprehensive selection of protection, current sensing, and precision components ensure critical subsystems remain powered, protected, and connected.

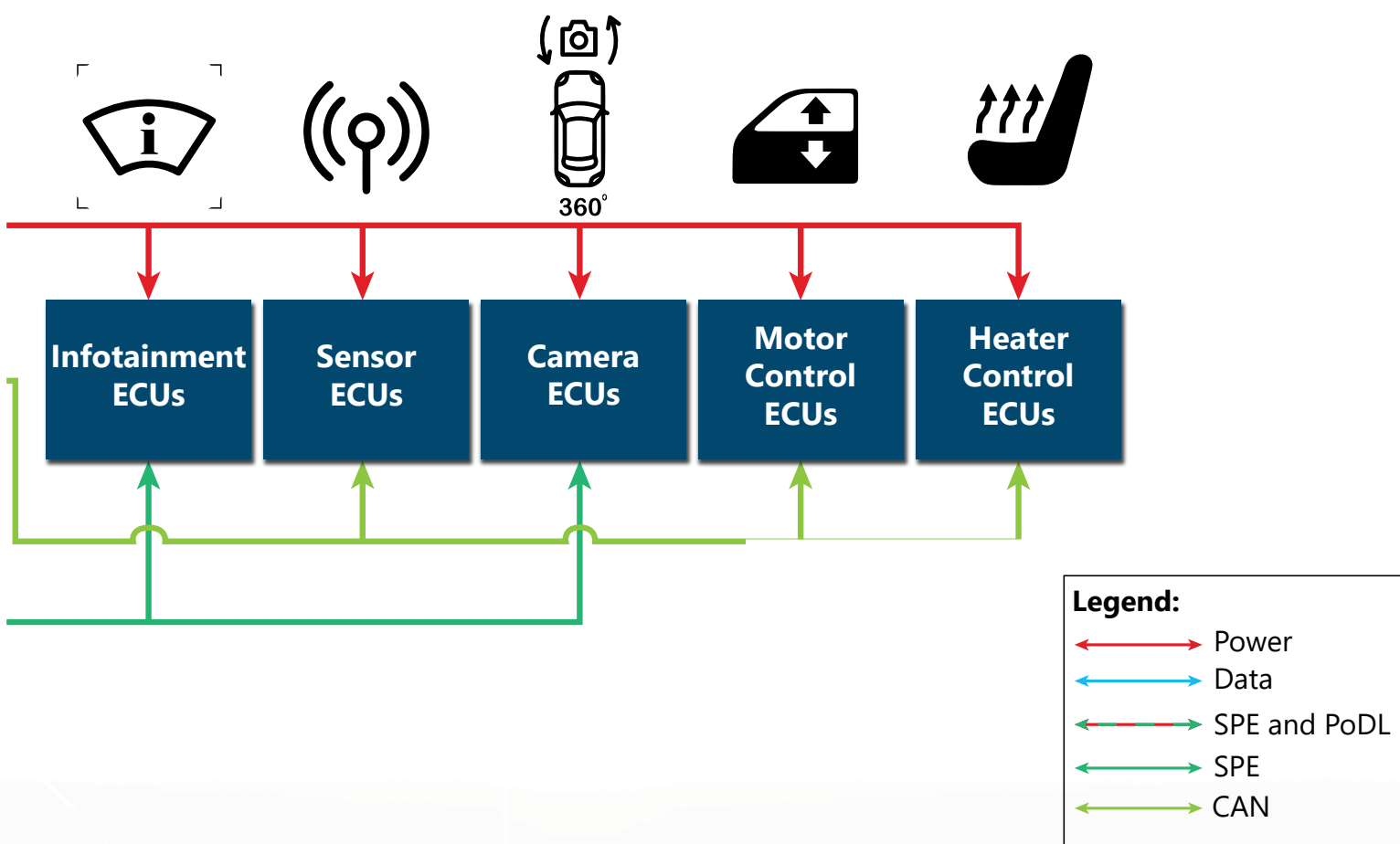


Diagram Example of Electrical/Electronic Architectures

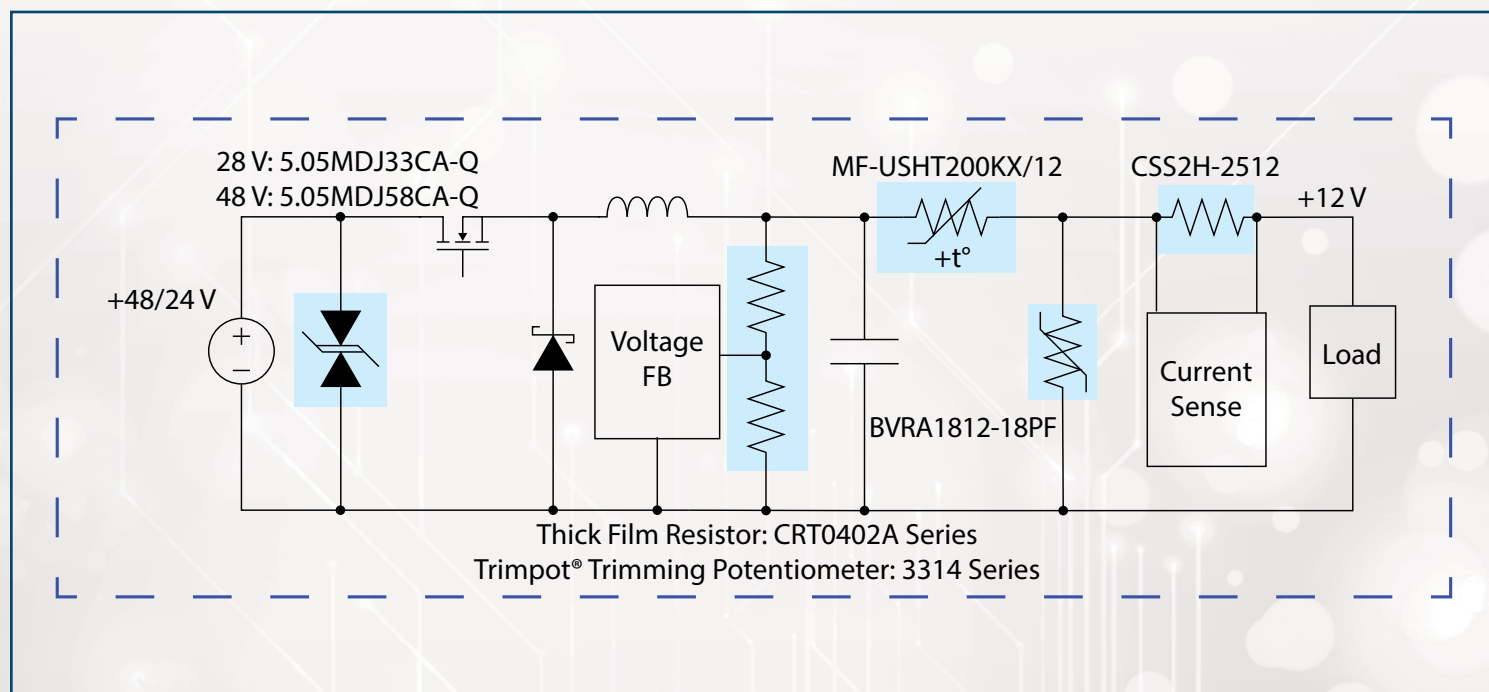


CDN with Featured Protection Devices





Buck Converter with Featured Devices





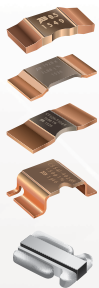
Resistors

Model	Tolerances	Temperature Coefficient (ppm/°C)	Power (W)	Resistance Range (Ω)	AEC-Q200 Compliant	PPAP Documentation	IATF 16949 Factory
CFN-A	1 %, 5 %	±50, ±100	0.2 – 1	5 m – 40 m	Yes	Level 3	Yes
CHP-A	1 %, 5 %	±100, ±200	0.33 – 3	10 – 1 M	Yes	Level 3	Yes
CHP0603-Q	1 %, 5 %	±100, ±200	0.3	10 – 1 M	Yes	Level 3	Yes
CHP0805-Q	1 %, 5 %	±100, ±200	0.5	10 – 1 M	Yes	Level 3	Yes
CHP1206-Q	1 %, 5 %	±100, ±200	0.75	10 – 1 M	Yes	Level 3	Yes
CHV-A	1 %, 5 %	±100, ±200	0.1 – 1	100 m – 100 M	Yes	Level 3	Yes
CMP-A	1 %, 5 %	±100, ±200	0.25 – 1.5	10 – 1 M	Yes	Level 3	Yes
CMP0603-Q	1 %, 5 %	±100, ±200	0.25	10 – 1 M	Yes	Level 3	Yes
CMP0805-Q	1 %, 5 %	±100, ±200	0.5	10 – 1 M	Yes	Level 3	Yes
CMP1206-Q	1 %, 5 %	±100, ±200	0.75	10 – 1 M	Yes	Level 3	Yes
CMP2010-Q	1 %, 5 %	±100, ±200	1	10 – 1 M	Yes	Level 3	Yes
CMP2512-Q	1 %, 5 %	±100, ±200	1.5	10 – 1 M	Yes	Level 3	Yes
CR0201A-AS	1 %, 5 %	±100, ±200, -200+600	0.05	1 – 10 M	Yes	Level 3	Yes
CR0402A-AS	1 %, 5 %	±100, ±200, -200+500	0.063	1 – 20 M	Yes	Level 3	Yes
CR0603A-AS	1 %, 5 %	±100, ±200, ±400	0.1	1 – 20 M	Yes	Level 3	Yes
CR0805A-AS	1 %, 5 %	±100, ±200, ±400	0.125	1 – 20 M	Yes	Level 3	Yes
CR1206A-AS	1 %, 5 %	±100, ±200, ±400	0.25	1 – 20 M	Yes	Level 3	Yes
CR1210A-AS	1 %, 5 %	±100, ±200, ±400	0.33	1 – 20 M	Yes	Level 3	Yes
CR2010A-AS	1 %, 5 %	±100, ±200, ±400	0.5	1 – 20 M	Yes	Level 3	Yes
CR2512A-AS	1 %, 5 %	±100, ±200, ±400	1	1 – 20 M	Yes	Level 3	Yes
CRA2512	1 %, 5 %	±50	3	10 m – 100 m	Yes	Level 3	Yes
CRE2512	1 %	±50	2, 3	1 m – 9 m	Yes	Level 3	Yes
CRF0805	1 %, 5 %	±50	0.5	0.001 – 0.025	Yes	Level 3	Yes
CRF0805-J	5 %	±3800	0.5	≤ 0.2 m	Yes	Level 3	Yes
CRF1206	1 %, 5 %	±50	1	0.001 – 0.050	Yes	Level 3	Yes
CRF1206-J	5 %	±3800	1	≤ 0.2 m	Yes	Level 3	Yes
CRF2010-J	5 %	±3800	1.5	≤ 0.2 m	Yes	Level 3	Yes
CRF2512	1 %, 5 %	±50	1, 2	1 m – 50 m	Yes	Level 3	Yes
CRF2512-J	5 %	±3800	2	≤ 0.2 m	Yes	Level 3	Yes
CRG2512	1 %, 5 %	±50	1, 2	110 m – 680 m	Yes	Level 3	Yes
CRK0612	1 %, 5 %	±100	1	1 m – 10 m	Yes	Level 3	Yes
CRK0815	1 %, 5 %	±100	1	1 m – 30 m	Yes	Level 3	Yes



Resistors

Model	Tolerances	Temperature Coefficient (ppm/°C)	Power (W)	Resistance Range (Ω)	AEC-Q200 Compliant	PPAP Documentation	IATF 16949 Factory
CRM0603A	0.5 %, 1 %, 5 %	±100, ±200	0.125	50 m – 1 M	Yes	Level 3	Yes
CRM0805A	0.5 %, 1 %, 5 %	±100, ±200	0.25	50 m – 1 M	Yes	Level 3	Yes
CRM1206A	0.5 %, 1 %, 5 %	±100, ±200	0.5	50 m – 1 M	Yes	Level 3	Yes
CRM1210A	0.5 %, 1 %, 5 %	±100, ±200	0.5	50 m – 1 M	Yes	Level 3	Yes
CRM2010A	0.5 %, 1 %, 5 %	±100, ±200	1	50 m – 1 M	Yes	Level 3	Yes
CRM2512A	0.5 %, 1 %, 5 %	±100, ±200	2	50 m – 1 M	Yes	Level 3	Yes
CRM1206-Q	0.5 %, 1 %, 5 %	±100, ±200	0.5	10 – 1 M	Yes	Level 3	Yes
CRM2010-Q	0.5 %, 1 %, 5 %	±100, ±200	1	10 – 1 M	Yes	Level 3	Yes
CRM2512-Q	0.5 %, 1 %, 5 %	±100, ±200	2	10 – 1 M	Yes	Level 3	Yes
CRS0603A	1 %, 5 %	±100, ±200	0.125	1 – 1 M	Yes	Level 3	Yes
CRS0805A	1 %, 5 %	±100, ±200	0.25	1 – 1 M	Yes	Level 3	Yes
CRS1206A	1 %, 5 %	±100, ±200	0.5	1 – 1 M	Yes	Level 3	Yes
CRS1210A	1 %, 5 %	±100, ±200	0.5	1 – 1 M	Yes	Level 3	Yes
CRS2010A	1 %, 5 %	±100, ±200	1	1 – 1 M	Yes	Level 3	Yes
CRS2512A	1 %, 5 %	±100, ±200	2	1 – 1 M	Yes	Level 3	Yes
CRS1206-Q	1 %, 5 %	±100, ±200	0.5	10 – 1 M	Yes	Level 3	Yes
CRS2010-Q	1 %, 5 %	±100, ±200	1	10 – 1 M	Yes	Level 3	Yes
CRS2512-Q	1 %, 5 %	±100, ±200	2	10 – 1 M	Yes	Level 3	Yes
CRT0402A	0.1 %, 0.25 %, 0.5 %, 1 %	±10, ±15, ±25, ±50	0.063	10 – 100 K	Yes	Level 3	Yes
CRT0603A	0.1 %, 0.25 %, 0.5 %, 1 %	±10, ±15, ±25, ±50	0.1	10 – 511 K	Yes	Level 3	Yes
CRT0805A	0.1 %, 0.25 %, 0.5 %, 1 %	±10, ±15, ±25, ±50	0.125	10 – 800 K	Yes	Level 3	Yes
CRT1206A	0.1 %, 0.25 %, 0.5 %, 1 %	±10, ±15, ±25, ±50	0.25	10 – 1 M	Yes	Level 3	Yes
CRT1206A	0.1 %, 0.25 %, 0.5 %, 1 %	±10, ±15, ±25, ±50	0.25	10 – 1 M	Yes	Level 3	Yes



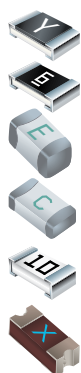
Current Sense Resistors

Model	Tolerances	Temperature Coefficient (ppm/°C)	Power (W)	Resistance Range (Ω)	AEC-Q200 Compliant	PPAP Documentation	IATF 16949 Factory
CSS2H-2512	1 %, 5 %	±50	1.5 – 6	0.3 m – 5 m	Yes	Level 3	Yes
CSS2H-3920	1 %, 5 %	±50	2 – 12	0.2 m – 5 m	Yes	Level 3	Yes
CSS2H-5930	1 %, 5 %	±50	4 – 15	0.2 m – 3 m	Yes	Level 3	Yes
CSS4J-4026	1 %, 5 %	±50	3 – 5	0.2 m – 5 m	Yes	Level 3	Yes
CST0612	1 %	±100, ±200	1	0.5 m – 5 m	Yes	Level 3	Yes



MultiFuse® Polymer PTC Resettable Fuses

Model	Size (EIA, mm)	Hold Current (A)	Max. Operating Voltage (V)	Max. Operating Current (A)	AEC-Q200 Compliant	PPAP Documentation	IATF 16949 Factory
MF-LSMF	2920, 7555	1.85 – 3.0	6 – 33	20 – 40	Yes	Level 3	Yes
MF-MSMF	1812, 4532	0.1 – 2.6	6 – 60	10 – 100	Yes	Level 3	Yes
MF-MSHT	1812	0.20 – 1.75	9 – 42	40	Yes	Level 3	Yes
MF-NSHT	1206, 3216	0.10 – 0.75	12 – 30	20 – 40	Yes	Level 3	Yes
MF-NSMF	1206, 3216	0.12 – 2.0	6 – 30	10 – 100	Yes	Level 3	Yes
MF-PSHT	0805, 2012	0.05 – 0.50	12 – 16	40	Yes	Level 3	Yes
MF-SMHT	3425, 8763 / 2920, 7555	1.36 – 3.0	16	100	Yes	Level 3	Yes
MF-USHT	1210, 3225	0.10 – 2.0	9 – 30	20 – 40	Yes	Level 3	Yes
MF-USMF	1210, 3225	0.05 – 0.50	6 – 30	10 – 40	Yes	Level 3	Yes



SinglFuse™ SMD Fuses

Model	Size (EIA, mm)	Rated Current (A)	Rated Voltage (V)	Operating Temperature (°C)	AEC-Q200 Compliant	PPAP Documentation	IATF 16949 Factory
SF-0603HIA-M	0603, 1608	1 – 5	32	-55 – +125	Yes	Level 3	Yes
SF-0603SA-M	0603, 1608	0.5 – 8	24 – 65	-55 – +150	Yes	Level 3	Yes
SF-0603SPA-R	0603, 1608	1 – 8	63	-55 – +150	Yes	Level 3	Yes
SF-1206HHA-R	1206, 3216	8 – 30	50	-55 – +125	Yes	Level 3	Yes
SF-1206HIA-M	1206, 3216	0.5 – 6	24 – 65	-55 – +150	Yes	Level 3	Yes
SF-1206SA-M	1206, 3216	0.5 – 5	65	-55 – +150	Yes	Level 3	Yes
SF-1206SA-R	1206, 3216	10 – 20	32	-55 – +150	Yes	Level 3	Yes
SF-1206SA-W	1206, 3216	1.5 – 15	32 – 110	-55 – +125	Yes	Level 3	Yes
SF-2410FA-W	2410, 6125	1 – 10	125 – 250	-55 – +125	Yes	Level 3	Yes
SF-2410FPA-W	2410, 6125	12 – 20	65	-55 – +125	Yes	Level 3	Yes



TBU® High-Speed Protectors (HSPs)

Model	Size (EIA, mm)	V _{imp}	V _{rms}	AEC-Q101 Compliant	PPAP Documentation	IATF 16949 Factory
TBU-CA-Q	6.5 mm x 4 mm	250 – 850	100 – 425	Yes	Level 3	Yes
TBU-DB-Q	6.5 mm x 5.5 mm	550	100	Yes	Level 3	Yes



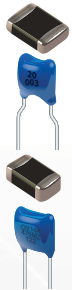
ChipGuard® ESD Suppressors

Model	Size (EIA, mm)	V _{rms}	AEC-Q101 Compliant	PPAP Documentation	IATF 16949 Factory
CGA0805MLA	0805	14 – 20	Yes	Level 3	Yes
CGAMLCL	0402, 0603	–	Yes	Level 3	Yes



Transient Voltage Suppressor (TVS) Diodes

Model	Package	Size (mm)	P _{pp} (W)		V _{RWM} (V)	AEC-Q101 Compliant	PPAP Documentation	IATF 16949 Factory
			8/20 μs	10/1000 μs				
5.0SMDJ-Q	DO-214AB (SMC)	7.9 x 5.9		5000	5 - 170	Yes	Level 3	Yes
15KPA-SD-Q	DO-218	15.5 x 10.0		15000	16 - 66	Yes	Level 3	Yes
CDS0D323-TxxS-Q	SOD-3D	Various		500	5 - 18	Yes	Level 3	Yes
CDS0D323-T12C-DSLQ	SOD-323	2.5 x 1.3	350		12	Yes	Level 3	Yes
CDS0D323-T24C-DSLQ	SOD-323	2.5 x 1.3	350		24	Yes	Level 3	Yes
CDS0T23-T03-Q ~ T15C-Q	SOT-23	2.9 x 2.3	500		3.3/8/ 15	Yes	Level 3	Yes
CDS0T23-T24CAN-Q	SOT-23	2.9 x 2.3	200		24	Yes	Level 3	Yes
SM8S-Q	DO-218	15.5 x 10.0		6000	16 - 43	Yes	Level 3	Yes
SM8SF-Q	DFN	10.5 x 8.1		7000	24 - 36	Yes	Level 3	Yes
SMA6J-Q	DO-214AC (SMA)	5.1 x 2.3		600	5 - 130	Yes	Level 3	Yes
SMAJ-Q / P4SMA-Q	DO-214AC (SMA)	5.1 x 2.3		400	5 - 220	Yes	Level 3	Yes
SMBJ-Q / P6SMB-Q	DO-214AA (SMB)	5.4 x 3.6		600	5 - 220 / 5.8 - 214	Yes	Level 3	Yes
SMCJ-Q / 1.5SMC-Q	DO-214AB (SMC)	7.9 x 5.9		1500	5 - 120 / 5.8 - 111	Yes	Level 3	Yes
SMLJ-Q	DO-214AB (SMC)	7.9 x 5.9		3000	12 - 58	Yes	Level 3	Yes
SMF4L-Q	SOD-123F	3.70 x 1.65		600	12 - 58	Yes	Level 3	Yes



Varistors

Model	Size (EIA, mm)	Peak Single Pulse Current 8/20 μs (A)	Operating Temperature (°C)	AEC-Q200 Compliant	PPAP Documentation	IATF 16949 Factory
AVHT-SMD	0805, 1206, 1812, 2220, 3225	200 - 2000	-55 - +150	Yes	Level 3	Yes
AV-TH	602, 802, 902, 1103	400 - 2000	-55 - +125	Yes	Level 3	Yes
AV-SMD	0805, 1206, 1812, 2220, 3225	200 - 2000	-55 - +125	Yes	Level 3	Yes
BVRA	0402, 0603, 0805, 1206, 1210, 1812	10 ~ 220	-40 - +125	Yes	Level 3	Yes
OV	9, 12	800, 1200	-55 - +125	Yes	Level 3	Yes



Gas Discharge Tubes (GDTs)

Model	Dimensions (Diameter x Length mm)	Capacitance (pF)	DC Breakdown Voltage Range (V)	Nominal 8/20 μs Impulse Discharge Current (kA) 10	Max 10x350 μs Impulse Current (kA) 1 Application	AEC-Q200 Compliant
2027-A-xx-SM	7.92 x 6.42	<1	75 - 600	10	25	Yes



Trimpot® Trimming Potentiometers

Model	Rotational Life	Temperature Coefficient, (ppm/°C)	Power Rating (W)	Resistance Range (Ω)	CRV/ENR	AEC-Q200 Compliant
3313	100 cycles	±100 - ±150	0.125	10 - 2 M	3 % or 3 Ω (whichever is greater)	Yes
3314	100 cycles	±100	0.25	10 - 2 M	3 % or 3 Ω (whichever is greater)	Yes

Worldwide Sales & Representative Offices



Country/Region	Phone	Email
Americas:	+1-951-781-5500	americus@bourns.com
Brazil:	+55 11 5505 0601	americus@bourns.com
China:	+86 21 64821250	asiacus@bourns.com
Europe, Middle East, Africa:	+36 88 885 877	eurocus@bourns.com
Japan:	+81 49 269 3204	asiacus@bourns.com
Korea:	+82 70 4036 7730	asiacus@bourns.com
Singapore:	+65 6348 7227	asiacus@bourns.com
Taiwan:	+886 2 25624117	asiacus@bourns.com
Other Asia-Pacific Countries:	+886 2 25624117	asiacus@bourns.com

Technical Assistance Region	Phone	Email
Asia-Pacific:	+886 2 25624117	techweb@bourns.com
Europe, Middle East, Africa:	+36 88 885 877	eurotech@bourns.com
Americas:	+1-951-781-5500	techweb@bourns.com

BOURNS®

www.bourns.com

Bourns® products are available through an extensive network of manufacturer's representatives, agents and distributors. To obtain technical applications assistance, a quotation, or to place an order, contact a Bourns representative in your area.

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.

COPYRIGHT© 2025, BOURNS, INC. • LITHO IN U.S.A. • MIMEO • 7/25 • e/K2534

"Bourns", "ChipGuard", "Multifuse", "TBU" and "Trimpot" are registered trademarks of Bourns, Inc. in the U.S. and other countries. "SinglFuse" is a trademark of Bourns, Inc. in the U.S. and other countries.