



Vishay Intertechnology, Inc.



# *Automotive*



# GEARED TOWARDS AUTOMOTIVE





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*Key components for*  
**ENGINE VEHICLE CONTROL UNIT - 12 V / 24 V**



**Engine Cooling (BLDC)**



**Exhaust Emission Control System**



**THE VISHAY ADVANTAGE**

- AEC Qualifications
- High-Temperature Performance
- High Reliability
- Low Profile
- Long Life
- High Vibration Handling

## Engine Cooling (BLDC)



### ALUMINUM CAPACITORS

**SMD Aluminum Capacitors, High Temperature Up to 150 °C, Low ESR**



#### [260 CLA-V](#)

- High ripple current up to 1400 mA at 150 °C, capacitance up to 3300  $\mu$ F
- Useful life up to 2000 h at 150 °C, high vibration capability

### MOSFETs

**N-Channel MOSFETs in 8 mm x 8 mm PowerPAK<sup>®</sup>, 40 V, 160 A, 1.2 m $\Omega$**

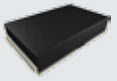


#### [SQJQ100EL](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Ultra-low  $R_{DS(on)}$ , thermally enhanced PowerPAK<sup>®</sup> 8x8L replaces D<sup>2</sup>PAK in less than half of the area

### RESISTORS

**Power Metal Strip<sup>®</sup> SMD Resistors, High Power (7 W), Low Value (Down to 0.001  $\Omega$ )**



#### [WSHM2818](#)

- Very high power rating of 7 W in small 2818 package
- Very low resistance values, 0.001  $\Omega$  to 0.10  $\Omega$ , with tolerance of 1 %

### NON-LINEAR RESISTORS

**SMD Glass-Protected NTC Thermistors**



#### [NTCS...e3](#)

- Standard series, AEC-Q200 compliant
- Glass-protected with soft terminations

### INDUCTORS

**Low-Profile, High-Current IHLP<sup>®</sup> Inductors**



#### [IHLP-6767GZ-5A](#)

- Lowest DCR/ $\mu$ H in this package size
- High temperature up to 155 °C, shielded construction

### CERAMIC CAPACITORS

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NPO), X7R, and X8R**



#### [VJ...31X RoHS Automotive MLCCs](#)

- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

### MOSFETs

**N-Channel MOSFETs in 8 mm x 8 mm PowerPAK<sup>®</sup>, 40 V, 200 A, 1.7 m $\Omega$**



#### [SQJQ402E](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Low  $R_{DS(on)}$ , logic level MOSFET, PowerPak<sup>®</sup> 8x8L replaces D<sup>2</sup>PAK in less than half of the area

### CERAMIC CAPACITORS

**High Operating Temperature, Automotive Grade Leaded MLCC Capacitors**



#### [HOTcap<sup>®</sup> K...H, A...R, K...R](#)

- High-reliability MLCC insert with wet build process
- High operating temperature (up to 175 °C for K...H and up to 160 °C for A...R and K...R), rated voltages: 50 V, 100 V, 200 V



# Exhaust Emission Control System



MOSFETs  
**N-Channel MOSFETs as Known Good Die (KGD) Rated at 60 V, 71 mΩ** 


[SQC462BKGD](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Efficient KGD packaging allows high power density and reduced parasitics

MOSFETs  
**P-Channel MOSFETs as Known Good Die (KGD) Rated at -60 V, 14 mΩ** 


[SQC461KGD](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Efficient KGD packaging allows high power density and reduced parasitics

RECTIFIERS  
**Schottky Diode Chips, 15 V to 150 V, Up to 3 A** 


[SC036H100S6B](#)

- Wafers in box, sawn on film, Al or Ag top metal

DIODES  
**Surface Mount PAR® TVS, 11 V to 48 V Breakdown Voltage** 

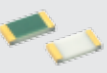
[SM8S10](#)

- AEC-Q101 qualified and high power up to 6600 W (10 x 1000 μs)
- Meet ISO7637-2 surge specification (varied by test conditions)

RESISTORS  
**Power Metal Strip® SMD Resistors, High Temperature (275 °C), High Power (1 W)** 

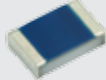
[WSLT2010...18](#)

- High temperature for harsh environments, resistance values down to 0.01 Ω
- Power Metal Strip® construction offers high reliability in critical applications

RESISTORS  
**Precision High-Temperature (215 °C) Thin Film Resistors, Low TCR with ± 5 ppm/°C** 

[PLTT0603](#)

- Gold terminations, Special Passivation Method (SPM)

NON-LINEAR RESISTORS  
**Platinum SMD Flat Chip Temperature Sensors** 


[PTS AT Series](#)

- Standard characteristics according to IEC 60751
- Short reaction times down to 2 s (in air)

NON-LINEAR RESISTORS  
**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NPO), X7R, and X8R** 

[VJ...31X RoHS Automotive MLCCs](#)

- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

CERAMIC CAPACITORS  
**High Operating Temperature, Automotive Grade Leaded MLCC Capacitors** 

[HOTcap® K...H, A...R, K...R](#)

- High-reliability MLCC insert with wet build process
- High operating temperature (up to 175 °C for K...H and up to 160 °C for A...R and K...R), rated voltages: 50 V, 100 V, 200 V


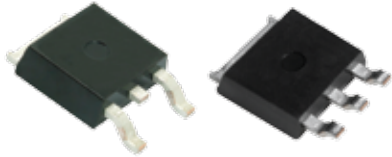

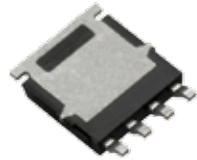





# Spotlight on SQ Rugged Series of Automotive MOSFETs

## Dedicated Automotive Process Flow Reduces Defects

The Vishay Siliconix SQ series of AEC-Q101-qualified power MOSFETs is produced using a special process that is optimized for automotive excellence. Featuring n-channel and p-channel TrenchFET® technologies with low on-resistance, our automotive power MOSFETs are rated for a maximum junction temperature of 175 °C.

Packages include the traditional D<sup>2</sup>PAK (TO-263), DPAK (TO-252), SO-8, TSOP-6, SOT-23, SC-70, and innovative space saving PowerPAK® packages in sizes ranging from large (8 mm x 8 mm) to small (2 mm x 2 mm). The PowerPAK® 8x8L, at 8 mm x 8 mm, offers on-resistance down to 1.2 mΩ and high-current capability in less than half the size of the D<sup>2</sup>PAK, offering a significant reduction in board space. The PowerPAK® SO-8L, at 5 mm x 6 mm, offers on-resistance down to 3 mΩ in less than half the size of a DPAK and thermal resistance as low as 1.5 °C/W. It also comes in dual symmetric and asymmetric configurations, allowing high-side and low-side MOSFETs to be optimized for applications. The PowerPAK® 1212-8, at 3 mm x 3 mm, delivers on-resistance and current capability similar to the SO-8 in one-third the size. It is also available in dual configuration and with wettable flanks for AOI. Even smaller, the PowerPAK® SC-70, at 2 mm x 2 mm, offers low on-resistance and current capability similar to that of the larger sized TSOP-6 and SOT-23. In addition, Vishay offers Known Good Die (KGD) packaging, where die are singulated, tested, and packaged in tape and reel, which provides high quality and reliable performance.

For details on these and other MOSFETs for automotive applications, visit <http://www.vishay.com/mosfets/automotive-mosfets/>

D <sup>2</sup> PAK	DPAK / Reverse DPAK	PowerPAK® 8x8L	PowerPAK® SO-8L	SO-8
				
15.88 x 10.41 x 4.83	10.41 x 6.73 x 2.38	8.0 x 8.0 x 1.9	6.15 x 5.13 x 1.14	5.0 x 6.2 x 1.75
PowerPAK® 1212	TSOP-6	SOT-23	SC-70	PowerPAK® SC-70
				
3.3 x 3.3 x 1.2	3.1 x 2.98 x 1.1	3.04 x 2.64 x 1.12	2.2 x 2.4 x 1.1	2.15 x 2.15 x 0.8

Length x Width x Height (mm)

# Key components for POWERTRAIN - INJECTION CONTROL AND FUEL PUMP



**Direct Injection Control**



**Piezo Injection Control**



**Fuel Pump Control (BLDC)**




## **THE VISHAY ADVANTAGE**

- AEC Qualifications
- High-Temperature Performance
- High Reliability
- Low Profile
- Long Life
- High-Voltage SMD Components




# Direct Injection Control




ALUMINUM CAPACITORS  
**SMD Aluminum Capacitors, High Temperature Up to 150 °C, Low ESR**  
  
[260 CLA-V](#)


- High ripple current up to 1400 mA at 150 °C, capacitance up to 3300 µF
- Useful life up to 2000 h at 150 °C, high vibration capability

RECTIFIERS  
**200 V, 2 x 3 A Fred Pt® Hyperfast Rectifiers**  
  
[VS-6CSH02HM3](#)

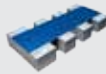
- Hyperfast recovery time,  $t_{rr} = 27$  ns, reduced  $Q_{rr}$ , and soft recovery
- Low forward voltage drop and low leakage current

RESISTORS  
**Power Metal Strip® SMD Resistors, Wide Terminal, 1 mΩ to 3 mΩ, 1 W**  
  
[WSL0612](#)

- Low EMF, high temperature up to 170 °C

MOSFETs  
**N-Channel MOSFETs in 5 mm x 6 mm PowerPAK® SO-8L Rated at 80 V, 7 mΩ**  
  
[SQJA80EP](#)


- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Ultra-low  $R_{DS(on)}$ , thermally enhanced PowerPAK® 8x8L replaces D<sup>2</sup>PAK in less than half of the area

RESISTORS  
**Precision Thin Film Chip Resistor Arrays, Superior Moisture Resistivity**  
  
[ACAS0612 AT Precision](#)


- Resistance ratio up to 1:20, superior tracking stability over lifetime
- Relative TCR to  $\pm 5$  ppm/K (tracking), AEC-Q200 qualified, sulfur-resistant

RECTIFIERS  
**200 V, 2 x 3 A Fred Pt® Hyperfast Rectifiers**  
  
[VS-8DKH02](#)

- Dual 5x6 (FlatPAK™) package
- $T_j = 175$  °C

INDUCTORS  
**Low-Profile, High-Current IHLP® Inductors**  
  
[IHLP-5050FD-5A](#)

- Excellent high-temperature performance and noise filtering

NON-LINEAR RESISTORS  
**SMD Glass-Protected NTC Thermistors**  
  
[NTCS...e3](#)


- Standard series, AEC-Q200 compliant
- Glass-protected with soft terminations

MOSFETs  
**Dual N-Channel MOSFETs in 5 mm x 6 mm PowerPAK® SO-8L Rated at 60 V, 12 mΩ**  
  
[SQJB60EP](#)


- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Dual configuration in thermally enhanced PowerPAK® SO-8L saves board space

DIODES  
**Surface-Mount PAR® TVS, 600 W, 6.8 V to 51 V**  
  
[TA6Fxx](#)

- Very low-profile DO-221AC (SlimSMA™) package - typical height of 0.95 mm
- $T_j = 185$  °C

CERAMIC CAPACITORS  
**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NPO), X7R, and X8R**  
  
[VJ...31X RoHS Automotive MLCCs](#)

- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

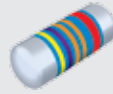
MOSFETs  
**Dual N-Channel MOSFETs in 5 mm x 6 mm PowerPAK® SO-8L Rated at 40 V, 9.66 mΩ**  
  
[SQJB42EP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Dual configuration in thermally enhanced PowerPAK® SO-8L saves board space

# Piezo Injection Control


**RESISTORS**

**Professional High-Temperature Mini-MELF Resistors**



[MMA 0204 HT](#)

- Operating temperature up to 175°C, power handling of 500 mW
- AEC-Q200 qualified, high overall stability  $|\Delta R/R| \leq 0.1\%$ , intrinsically sulfur-resistant

**MOSFETs**

**N-Channel MOSFETs in DPAK Package Rated at 300 V, 10 A, 330 mΩ**



[SQD10N30-330H](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Up to 300 V operation in DPAK package

**RECTIFIERS**

**600 V, 2 A FRED Pt® Ultrafast Rectifiers**



[VS-2EFU06HM3](#)

- SMF (DO-219AB) package, operating temperature up to 175 °C
- Pulse current up to 30 A (6 ms)

**RESISTORS**

**Power Metal Strip® SMD Resistors, 0.5 mΩ to 500 mΩ, 1 W**



[WSL2512](#)

- 2512 package size, also available in 2816 with 2 W

**INDUCTORS**

**High-Isolation Flyback Transformers in Press-Fit and SMD Versions**



[Customized Transformers](#)

- Customized solutions up to kW ranges

**INDUCTORS**

**Low-Profile, High-Current IHLP® Inductors**



[IHLP-5050FD-5A](#)

- Excellent high-temperature performance and noise filtering

**NON-LINEAR RESISTORS**

**SMD Glass-Protected NTC Thermistors**



[NTCS...e3](#)

- Standard series, AEC-Q200 compliant
- Glass-protected with soft terminations

**INDUCTORS**

**Low-Profile, High-Current IHLP® Inductors**



[IHLP-2525CZ-5A](#)

- Excellent high-temperature performance for DC/DC converter input and output filters

**CERAMIC CAPACITORS**

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NPO), X7R, and X8R**



[VJ...31X RoHS Automotive MLCCs](#)

- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

**DIODES**

**Unidirectional and Bidirectional Power SMD TVS Diodes, SMA Package, Up to 400 W**



[SMAJxx](#)

- DO-214AC (SMA) package, high-voltage clamping
- 6.4 V to 231 V

**ALUMINUM CAPACITORS**

**Radial Miniature, High-Voltage, Up to 450 V with CR Up to 220 μF**



[152RMH](#)

- High voltage applications, 105 °C long life
- Miniaturized, ultra-high CV product per unit volume

**MOSFETs**

**N-Channel MOSFETs in 5 mm x 6 mm PowerPAK®, 100 V, 32 A, 11 mΩ**



[SQJ402EP](#)


- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- 100 V MOSFETs for use in low-side flyback converters

# Fuel Pump Control (BLDC)



ALUMINUM CAPACITORS

**SMD Aluminum Capacitors, High Temperature Up to 150 °C, Low ESR**



[260 CLA-V](#)

- High ripple current up to 1400 mA at 150 °C, capacitance up to 3300  $\mu$ F
- Useful life up to 2000 h at 150 °C, high vibration capability

MOSFETs

**N-Channel MOSFETs in 5 mm x 6 mm PowerPAK® SO-8L Rated at 40 V, 3.2 m $\Omega$**




[SQJ444EP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Logic level  $V_{th}$ , low  $R_{DS(on)}$ , thermally enhanced PowerPAK® SO-8L replaces DPAK in less than half of the area

MOSFETs

**N-Channel MOSFETs in 5 mm x 6 mm PowerPAK® SO-8L Rated at 40 V, 3.0 m $\Omega$**



[SQJA46EP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Thermally enhanced PowerPAK® SO-8L replaces DPAK in less than half of the area

RESISTORS

**Power Metal Strip® SMD Resistors, Very High Power (3 W), Low Value (to 0.0005  $\Omega$ )**



[WSLP2512](#)

- Very high power rating of 3 W in 2512 package
- Extremely low resistance values from 0.0005  $\Omega$  to 0.01  $\Omega$  and tolerance of 1 %

RECTIFIERS

**1 A, 200 V FRED Pt® Hyperfast Rectifiers**



[VS-1EFH02HM3](#)

- Hyperfast recovery time,  $t_{rr} = 25$  ns, reduced  $Q_{rr}$ , and soft recovery
- DO-219AB (SMF) package, high  $T_j$  of 175 °C

RESISTORS

**Power Metal Strip® SMD Resistors, Wide Terminal, 1 m $\Omega$  to 6 m $\Omega$ , 6 W**




[WSL1020](#)

- TCR < 20 ppm/K, high-temperature performance up to 170 °C

MOSFETs

**Dual N-Channel MOSFETs in 8 mm x 8 mm PowerPAK®, 40 V, 100 A, 3.4 m $\Omega$**




[SQJQ904E](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- High power density dual PowerPAK® 8x8L offers significant reduction in PCB area

NON-LINEAR RESISTORS

**SMD Glass-Protected NTC Thermistors**



[NTCS...e3](#)

- Standard series, AEC-Q200 compliant
- Glass-protected with soft terminations

INDUCTORS

**Power SMD IHLP® Storage Inductors, E-Field Shielded, Inductance of 0.22  $\mu$ H to 22  $\mu$ H**



[IHLE-4040DD-5A](#)

- Shielded housing provides excellent protection against EMI (B and E fields)
- Optimized for high frequency

CERAMIC CAPACITORS

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, COG (NPO), X7R, and X8R**




[VJ...31X RoHS Automotive MLCCs](#)

- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

CERAMIC CAPACITORS

**High Operating Temperature, Automotive Grade Leaded MLCC Capacitors**



[HOTcap® K...H, A...R, K...R](#)

- High-reliability MLCC insert with wet build process
- High operating temperature (up to 175 °C for K...H and up to 160 °C for A...R and K...R), rated voltages: 50 V, 100 V, 200 V



# Key components for CHASSIS CONTROL



**Electric Power  
Steering (BLDC  
Motor Drive)**



**Transmission  
ECU, Double  
Clutch BLDC**



## **THE VISHAY ADVANTAGE**

- AEC Qualifications
- High Power Density
- High Pulse Current Capabilities
- Low Profile
- Long Life
- Small Size




# Electric Power Steering (BLDC Motor Drive)



**ALUMINUM CAPACITORS**

**SMD Aluminum Capacitors, High Temperature Up to 150 °C, Low ESR**




[260 CLA-V](#)

- High ripple current up to 1400 mA at 150 °C, capacitance up to 3300 µF
- Useful life up to 2000 h at 150 °C, high vibration capability

**RESISTORS**

**Thin Film Resistors, 4.7 Ω to 3.01 MΩ, 0402 to 1210 Case Sizes, 50 V to 200 V**




[TNPW e3](#)

- Excellent stability  $|\Delta R/R| \leq 0.05\%$  after 1000 h at 70 °C, 0402 to 1210 case sizes

**MOSFETs**

**N-Channel MOSFETs in 8 mm x 8 mm PowerPAK®, 40 V, 160 A, 1.2 mΩ**




[SQJQ100EL](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Ultra-low  $R_{DS(on)}$ , thermally enhanced PowerPAK® 8x8L replaces D<sup>2</sup>PAK in less than half of the area

**MOSFETs**

**N-Channel MOSFETs as Known Good Die (KGD) Rated at 40 V, 0.72 mΩ**



[SQC200N04-0m72KGD](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Efficient KGD packaging allows high power density and reduced parasitics

**RESISTORS**

**Precision Thin Film Chip Resistor Arrays, Superior Moisture Resistivity**

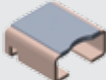


[ACAS0612 AT Precision](#)

- Resistance ratio up to 1:20, superior tracking stability over lifetime
- Relative TCR to  $\pm 5$  ppm/K (tracking), AEC-Q200 qualified, sulfur-resistant

**RESISTORS**

**Power Metal Strip® SMD Resistors, 4-Terminal, Low Value (Down to 0.0001 Ω)**




[WSK1216](#)

- High power rating of 3 W to 5 W with TCR = 20 ppm/K
- Very low resistance values, 0.0001 Ω to 0.004 Ω, with tolerance of 1%

**OPTOELECTRONICS**

**3-Channel SMD Transmissive Sensors for "Turn and Push" Optical Encoding**




[TCUT1630X01](#)

- Wide operating temperature range of -40 °C to +110 °C, 3 output channels
- Sensing of motion, speed, and direction; third channel for trigger signal

**NON-LINEAR RESISTORS**

**SMD Glass-Protected NTC Thermistors**




[NTCS...e3](#)

- Standard series, AEC-Q200 compliant
- Glass-protected with soft terminations

**INDUCTORS**

**Shielded SMD Low-Profile, High-Current IHLP® Inductors, EMI Filters, 155 °C, Low DCR**




[IHLP-6767GZ-5A](#)

- Very high-current and high-temperature operation for filters

**RESISTORS**

**Power Metal Strip® SMD Resistors**



[WSLP2726](#)

- Very high power (7 W)
- Resistance = 0.3 mΩ to 4 mΩ

**INDUCTORS**

**Shielded EMI Filters Up to 190 A I<sub>DCR</sub>, 2.2 µH, Ultra-Low DCR (0.22 mΩ)**



[IHXL-2000VZ-5A](#)

- Very high-current and high-temperature operation for filters and energy storage

**CERAMIC CAPACITORS**

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NPO), X7R, and X8R**




[VJ...31X RoHS Automotive MLCCs](#)

- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

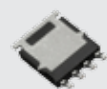


# Transmission ECU, Double Clutch BLDC




MOSFETs  
**N-Channel MOSFETs as Known Good Die (KGD) Rated at 40 V, 0.72 mΩ**  
  
[SQC200N04-0m72KGD](#)  

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Efficient KGD packaging allows high power density and reduced parasitics

MOSFETs  
**N-Channel MOSFETs in 5 mm x 6 mm PowerPAK® SO-8L Rated at 40 V, 3.0 mΩ**  
  
[SQJA46EP](#)  


- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Thermally enhanced PowerPAK® SO-8L replaces DPAK in less than half of the area

MOSFETs  
**Dual N-Channel MOSFETs in 8 mm x 8 mm PowerPAK®, 40 V, 100 A, 3.4 mΩ**  
  
[SQJQ904E](#)  

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- High power density dual PowerPAK® 8x8L offers significant reduction in PCB area

CERAMIC CAPACITORS  
**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NPO), X7R, and X8R**  
  
[VJ...31X RoHS Automotive MLCCs](#)  

- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

RECTIFIERS  
**High Current Density Surface-Mount Schottky Barrier Rectifiers**  
  
[SS3P4L](#)  

- AEC-Q101 qualified
- Very low profile - typical height of 1.0 mm

INDUCTORS  
**Coupled Inductors for SEPIC Converter**  
  
[IHCL-3232DZ-5A](#)  


- High-temperature operation up to 155 °C
- Frequency range up to 5.0 MHz

DIODES  
**600 W, 6.8 V to 51 V SMD PAR® TVS Diodes**  
  
[TA6Fxx](#)  


- T<sub>J</sub> = 185 °C
- Very low profile - typical height of 0.95 mm

RESISTORS  
**Power Metal Strip® SMD Resistors, Wide Terminal, 1 mΩ to 30 mΩ, 2 W**  
  
[WSLP2010](#)  


- Very high power to footprint size ratio (2 W in 2010)
- Construction is impervious to high-sulfur environments

RESISTORS  
**SMD Thick Film Resistors, High Stability**  
  
[RCA0603](#)  

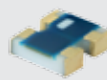
- TCR = 50 to 200 ppm/K
- Sulfur-resistant

NON-LINEAR RESISTORS  
**SMD Glass-Protected NTC Thermistors**  
  
[NTCS...e3](#)  

- Standard series, AEC-Q200 compliant
- Glass-protected with soft terminations

INDUCTORS  
**Low-Profile, High-Current IHLP® Inductors**  
  
[IHLP-2525CZ-5A](#)  

- Excellent high-temperature performance for DC/DC converter input and output filters

RESISTORS  
**Precision Gold Terminated Thin Film Chip Resistor Arrays for Conductive Gluing**  
  
[ACAS 0606 ATAU Precision](#)  

- Glueable gold terminations, resistance ratio up to 1:20, tolerance ± 0.05 %
- AEC-Q200 qualified, extreme sulfur resistance, superior tracking stability



# Spotlight on Power Metal Strip® Resistors

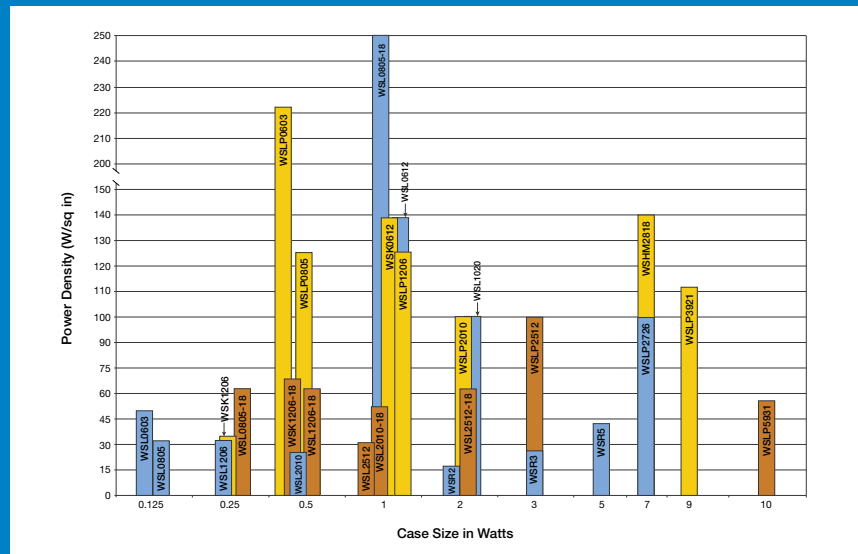
## Combining Low TCR (< 30 ppm/°C), Low Ohmic Values Down to 0.2 mΩ, Tight Tolerance, and High-Temperature Capabilities

Vishay's Power Metal Strip® current sensing resistors combine superior performance in high-temperature applications with a wide range of package sizes and a choice of resistance values from 0.0002 Ω to 1 Ω. These patented, state-of-the-art products deliver overload capabilities equivalent to wirewound devices and temperature coefficients as low as 30 ppm/°C.

Current sensing Power Metal Strip resistors allow control circuitry to monitor the level of current in a circuit by translating current into a voltage that can be monitored easily. The devices work by resisting the current flow in a circuit to a calibrated level, thus allowing a voltage drop to be detected and monitored by control circuitry. The low resistance values of Power Metal Strip resistors allow this function to be carried out with exceptional efficiency.

### High Power Density (up to 222 W/in<sup>2</sup>, 34.4 W/cm<sup>2</sup>)

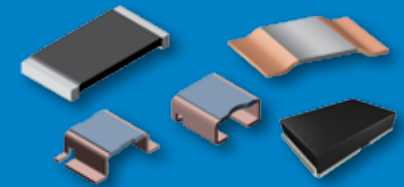
Vishay's Power Metal Strip resistors have evolved to "High Power" WSL...-18, WSLP, WSR3, WSR5, and WSHM2818 type resistors. Specially selected materials and processing permit these components to attain high power ratings of up to 10 W. The WSL...-18, WSLP, WSR3, WSR5, and WSHM2818 resistors offer a high power-to-package-size ratio while maintaining superior electrical characteristics. These high power ratings enable designers to use smaller PCBs, which in turn increases manufacturing speed and reduces raw material costs.



### Very High-Power, Surface-Mount Power Metal Strip Current Sensing Resistors

#### FEATURES

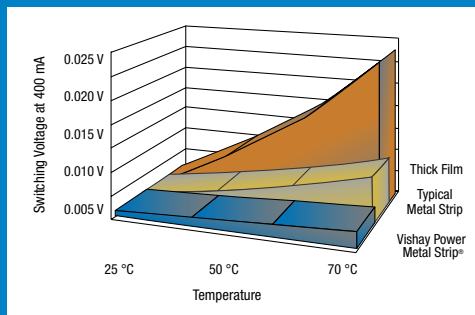
- High power in small case sizes: up to 10 W
- Very low resistance values: 0.0002 Ω to 1.0 Ω
- Tight resistance tolerance: down to ± 0.1 %



### Low Temperature Coefficient of Resistance (TCR) (Down to 30 ppm/°C)

The low TCR of Vishay Power Metal Strip resistors minimizes the resistance change caused by self-heating and high-temperature environments.

This chart shows the voltage of a 30 ppm/°C Vishay Power Metal Strip resistor compared to typical 100 ppm/°C metal strip and 700 ppm/°C thick film chip resistors.



## Key components for BODY ELECTRONICS



**Comfort, Door,  
Window Controls**



**Infotainment,  
Navigation, Audio**



**Interior  
LED Lighting**



### **THE VISHAY ADVANTAGE**

- AEC Qualifications
- High Power Density
- Low Profile
- Durability
- Customization



# Comfort, Door, Window Controls



**MOSFETs**

**N-Channel MOSFETs in 5 mm x 6 mm PowerPAK®, 40 V, 58 A, 6.3m Ω**




[SQJ868EP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Thermally enhanced PowerPAK SO-8L replaces DPAK in less than half of the area

**RESISTORS**

**Thick Film Surface-Mount Chip Resistors, Wraparound, Extremely Low Value**




[RCWE](#)

- Low resistance values from 0.01 Ω to 0.99 Ω and tolerance of 1 %
- Thick film construction with 2x power capacity

**INDUCTORS**

**Low-Profile, High-Current IHLP® Inductors**




[IHLP-4040DZ-5A](#)

- Excellent high-current performance for noise filters
- High-temperature operation up to 155 °C

**OPTOELECTRONICS**

**SMD Silicon PIN Photodiodes with Large Active Area for High Photo Currents**




[VEMD5110X01](#)

- QFN package with wettable flanks, reduced noise sensitivity
- Wide operating temperature range of -40 ° to +110 °C, wide viewing angle of ± 65°

**RECTIFIERS**

**Surface-Mount Schottky Barrier Rectifiers**




[MSS1P4](#)

- Very low profile - typical height of 0.65 mm
- AEC-Q101 qualified

**OPTOELECTRONICS**

**Ambient Light PIN Photodiode Sensors**



[TEMD6200FX01](#)

- SMD 0805 package, low profile of 0.85 mm, wide viewing angle of ± 60 °
- Spectral sensitivity close to human eye, high signal output linearity

**TANTALUM CAPACITORS**

**Solid Tantalum Chip Capacitors, High CV Leadframeless Molded, Automotive Grade**




[TP3 / TP8](#)

- TP3 - AEC-Q200 qualified; low ESR; A, B, C, D and E cases
- TP8 - AEC-Q200 qualified

**OPTOELECTRONICS**

**850 nm SMD Infrared Emitters**




[VSMY1850ITX01](#)

- SMD 0805 package, low profile of 0.85 mm, high radiant intensity of 10 mW/sr
- Wide operating temperature range of -40 ° to +105 °C, wide viewing angle of ± 60°

**DIODES**

**SMD Power ESD Diodes, Up to ± 30 kV, I<sub>FSM</sub> = 50 A**




[SMFxx](#)

- SMF package: 3.5 mm x 1.9 mm
- Breakdown voltage = 6.4 V to 64.4 V

**OPTOELECTRONICS**

**Silicon PIN Photodiode with Excellent Output Linearity Characteristics**




[VEMD6160X01](#)

- SMD 1206 package, daylight blocking filter, wide viewing angle of ±70°
- Low capacitance of 4.6pF, ideal for noisy environments and small signal detection

**ALUMINUM CAPACITORS**

**Aluminum Capacitors, Increased Vibration Resistance**




[246 CTI-V](#)

- High temperature, low impedance, high vibration capability
- High ripple current, long useful life

**CERAMIC CAPACITORS**

**High Operating Temperature, Automotive Grade Leaded MLCC Capacitors**



[HOTcap® K...H, A...R, K...R](#)

- High-reliability MLCC insert with wet build process
- High operating temperature (up to 175 °C for K...H and up to 160 °C for A...R and K...R), rated voltages: 50 V, 100 V, 200 V





# Infotainment, Navigation, Audio



**MOSFETs**

**Dual N-Channel MOSFETs in 5 mm x 6 mm PowerPAK®, 40 V, 11 mΩ / 22 mΩ**




[SQJ942EP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Optimized for high-frequency DC/DC applications, lower switching losses

**OPTOELECTRONICS**

**890 nm SMD Infrared Emitters**



[VSMF970011X01](#)

- Low-profile PLCC<sup>2</sup> package, wavelength matched to sensitivity of proximity sensor
- External emitter to enable gesture function of proximity sensor

**INDUCTORS**

**IHLP® High-Temperature (155 °C) Parts in Double Inductor Package**




[IHLD-4032KB-5A](#)

- Optimal design provides high quality sound and low distortion
- Low coupling for minimal cross-talk between inductors

**RESISTORS**

**Thick Film Surface-Mount Chip Resistors, Wraparound, Extremely Low Value**




[RCWE0603](#)

- Low resistance values from 0.01 Ω to 0.99 Ω and tolerance of 1 %
- Thick film construction with 2x power capacity

**OPTOELECTRONICS**

**Integrated Proximity and Ambient Light Sensors with I<sup>2</sup>C Interface**




[VCNL4020X01](#)

- Low-profile QFN SMD package, 16 bit resolution, proximity distance up to 200 mm
- Suitable for extended detection range, gesture function with external emitters

**MOSFETs**

**Dual N-Channel MOSFETs in 5 mm x 6 mm PowerPAK®, 12 V, 2.7 mΩ / 7.4 mΩ**




[SQJ202EP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Low-voltage, high-frequency synchronous buck applications, lower switching losses

**RECTIFIERS**

**Surface-Mount Schottky Barrier Rectifiers**




[MSS1P4](#)

- Very low profile - typical height of 0.65 mm
- AEC-Q101 qualified

**INDUCTORS**

**Low-Profile, High-Current IHLP® Inductors**



[IHLP-2525CZ-5A](#)

- Excellent high-temperature performance for DC/DC converter input and output filters

**RESISTORS**

**Precision Thin Film Resistor Arrays, Superior Moisture Resistivity, TCR ± 0.05**



[ACAS 0606 AT](#)

- Arbitrary resistance ratio up to 1:20, superior tracking stability over lifetime
- Relative TCR down to ± 5 ppm/K (tracking), AEC-Q200 qualified

**TANTALUM CAPACITORS**

**Solid Tantalum Chip Capacitors, High CV Leadframeless Molded, Automotive Grade**



[TP8](#)

- Smallest AEC-Q200 qualified tantalum capacitors with case sizes as small as 0603

**CERAMIC CAPACITORS**

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NPO), X7R, and X8R**



[VJ...31X RoHS Automotive MLCCs](#)

- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

**INDUCTORS**

**High-Curent SMD Inductors with E-Field Shielding and 155 °C Operating Temperature**



[IHLE-3232DD-5A](#)

- Excellent EMI protection, double-shielded




# Interior LED Lighting



RESISTORS

**Pulse-Proof, High-Power Thick Film Chip Resistors**




[CRCW-HP e3](#)

- Excellent pulse load capability
- Enhanced power rating

MOSFETs

**P-Channel MOSFETs in 3 mm x 3 mm PowerPAK® 1212, -60 V, -16 A, 65 mΩ**



[SQ7415AENW](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- High power density PowerPAK® 1212 with wettable flanks for AOI

RECTIFIERS

**Surface-Mount Schottky Barrier Rectifiers**




[MSS1P6](#)

- Low-profile MicroSMP package for low-voltage, high-frequency inverters; DC/DC converters; and polarity protection applications

MOSFETs

**N-Channel MOSFETs in 3 mm x 3 mm PowerPAK® 1212, 60 V, 18 A, 23 mΩ**

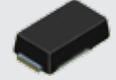


[SQ7414AENW](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- High power density PowerPAK® 1212 with wettable flanks for AOI

RECTIFIERS

**100 V, 2 A High-Voltage Schottky Diodes, T<sub>j</sub> = 175 °C**



[SS2PH10](#)

- SMP(DO-220AA) package, 3.7 mm x 2.18 mm

RESISTORS

**Power Metal Strip® SMD Resistors, Wide Terminal, 1 mΩ to 3 mΩ, 1 W**

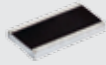


[WSL0612](#)

- Low EMF, high temperature up to 170 °C

RESISTORS

**Thick Film Surface-Mount Chip Resistors, Wraparound, Extremely Low Values**




[RCWE0603](#)

- Low resistance values from 0.01 Ω to 0.99 Ω and tolerance of 1 %
- Thick film construction with 2x power capacity

NON-LINEAR RESISTORS

**SMD Glass-Protected NTC Thermistors**




[NTCS...e3](#)

- Standard series, AEC-Q200 compliant
- Glass-protected with soft terminations

INDUCTORS

**Low-Profile, High-Current IHLP® Inductors**



[IHLP-1616BZ-A1](#)

- Shielded construction, lowest DCR/μH in this package size
- Excellent DC/DC energy storage up to 5 MHz

TANTALUM CAPACITORS

**Solid Tantalum Molded Chip Capacitors, Automotive Grade**



[TP3](#)

- AEC-Q200 qualified, low ESR
- A, B, C, D, and E cases



# Key components for ACTIVE SAFETY



**Enhanced Electrical Braking (EEB)**




**Electronic Stability Program (ESP)  
Vehicle Stability Control (VSC)**



**Electrical Parking Brake (EPB)  
Integrated Parking Brake (IPB)**



**Advanced Driver Assistance System (ADAS)**

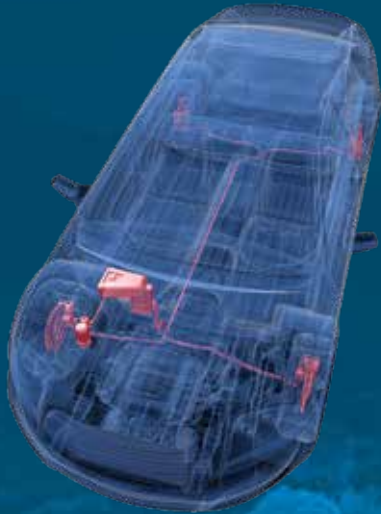


**THE VISHAY ADVANTAGE**  
AEC Qualifications  
High-Temperature Performance  
Low Profile  
High Reliability  
Long Life






# Enhanced Electrical Braking (EEB)



**RESISTORS**

**Thin Film Resistors, 4.7 Ω to 3.01 MΩ, 0402 to 1210 Case Sizes, 50 V to 200 V**




[TNPW e3](#)

- Excellent stability  $|\Delta R/R| \leq 0.05\%$  after 1000 h at 70 °C, 0402 to 1210 case sizes

**MOSFETs**

**N-Channel MOSFETs in 8 mm x 8 mm PowerPAK®, 40 V, 160 A, 1.2 mΩ**

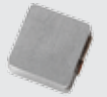


[SQJQ100EL](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Ultra-low  $R_{DS(on)}$ , thermally enhanced PowerPAK® 8x8L replaces D<sup>2</sup>PAK in less than half of the area

**INDUCTORS**

**Power SMD IHLP® Storage Inductors, 0.22 μH to 22μH**

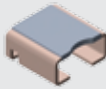


[IHLP5050FD-5A](#)

- Soft saturation, high rated current, temperature up to 155 °C

**RESISTORS**

**Power Metal Strip® SMD Resistors, 4-Terminal, Low Value (Down to 0.0001 Ω)**



[WSK1216](#)

- High power rating of 3 W to 5 W with TCR of 20 ppm/K
- Very low resistance values, 0.0001 Ω to 0.004 Ω, with tolerance of 1 %

**NON-LINEAR RESISTORS**

**SMD Glass-Protected NTC Thermistors**




[NTCS...e3](#)

- Standard series, AEC-Q200 compliant
- Glass-protected with soft terminations

**INDUCTORS**

**SMD Low-Profile, High-Current IHLP® Inductors, 0.22 μH to 33 μH**




[IHLP-3232DZ-5A](#)

- High-temperature (up to +155 °C), high-current shielded inductors

**INDUCTORS**

**Low-Profile, High-Current IHLP® Inductors**



[IHLP-4040DZ-5A](#)

- Excellent high-current performance for noise filters
- High-temperature operation up to 155 °C

**CERAMIC CAPACITORS**

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NPO), X7R, and X8R**




[VJ...31X RoHS Automotive MLCCs](#)

- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

**ALUMINUM CAPACITORS**

**SMD Aluminum Capacitors, High Temperature Up to 150 °C, Low ESR**




[260 CLA-V](#)

- High ripple current up to 1400 mA at 150 °C, capacitance up to 3300 μF
- Useful life up to 2000 h at 150 °C, high vibration capability

**MOSFETs**

**N-channel MOSFET in Reverse DPAK Rated at 40 V, 3.8 mΩ**



[SQR50N04-3m8 GE3](#)

- AEC-Q101 Qualified, 100 % UIS & RG tested with up to 175 °C operation
- Reverse DPAK package allows excellent heat transfer and is good for high current application such as park brake



# Electronic Stability Program (ESP) Vehicle Stability Control (VSC)

### ALUMINUM CAPACITORS

**SMD Aluminum Capacitors, High Temperature Up to 150 °C, Low ESR**



[260 CLA-V](#)

- High ripple current up to 1400 mA at 150 °C, capacitance up to 3300 µF
- Useful life up to 2000 h at 150 °C, high vibration capability

### RESISTORS

**SMD Thick Film Resistors, High Stability, Sulfur-Resistant**



[RCA0603](#)

- TCR = 50 ppm/K to 200 ppm/K

### MOSFETs

**N-Channel MOSFETs in 8 mm x 8 mm PowerPAK®, 40 V, 160 A, 1.2 mΩ**



[SQJQ100EL](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Ultra-low  $R_{DS(on)}$ , thermally enhanced PowerPAK® 8x8L replaces D<sup>2</sup>PAK in less than half of the area

### MOSFETs

**Dual N-Channel MOSFETs in 8 mm x 8 mm PowerPAK®, 40 V, 100 A, 3.9 mΩ**

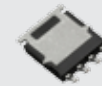


[SQJQ900E](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- High power density dual PowerPAK® 8x8L offers significant reduction in PCB area

### MOSFETs

**N-Channel MOSFETs in 5 mm x 6 mm PowerPAK® SO-8L Rated at 40 V, 3.0 mΩ**



[SQJA46EP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Thermally enhanced PowerPAK® SO-8L replaces DPAK in less than half of the area

### INDUCTORS

**Low-Profile, High-Current IHLP® Inductors**

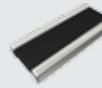


[IHLP-2525CZ-5A](#)

- Excellent high-temperature performance for DC/DC converter input and output filters

### RESISTORS

**Power Metal Strip® SMD Resistors, Wide Terminal, 1 mΩ to 3 mΩ, 1 W**



[WSL0612](#)

- Low EMF, high temperature up to 170 °C

### RECTIFIERS

**1A, 200 V FRED Pt® Hyperfast Rectifiers**



[VS-1EFH02HM3](#)

- Hyperfast recovery time,  $t_{rr}$  = 25 ns, reduced  $Q_{rr}$ , and soft recovery
- DO-219AB (SMF) package, high  $T_j$  of 175 °C

### INDUCTORS

**Low-Profile, High-Current IHLP® Inductors**



[IHLP-4040DZ-5A](#)

- Excellent high-current performance for noise filters
- High-temperature operation up to 155 °C

### CERAMIC CAPACITORS

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NPO), X7R, and X8R**



[VJ...31X RoHS Automotive MLCCs](#)

- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

### TANTALUM CAPACITORS

**Solid Tantalum Surface-Mount Chip Capacitors, Molded Case, Automotive Grade**




[TH3 / TH4](#)

- High-temperature molded tantalum capacitors, HI-TMP®, TH4 = up to 175 °C, TH3 = up to 150 °C




# Electrical Parking Brake (EPB) Integrated Parking Brake (IPB)




**ALUMINUM CAPACITORS**  
**SMD Aluminum Capacitors, High Temperature Up to 150 °C, Low ESR**  
  
[260 CLA-V](#)

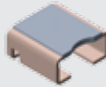
- High ripple current up to 1400 mA at 150 °C, capacitance up to 3300 µF
- Useful life up to 2000 h at 150 °C, high vibration capability

**MOSFETs**  
**Dual N-Channel MOSFETs in 8 mm x 8 mm PowerPAK®, 40 V, 100 A, 3.9 mΩ**  
  
[SQJQ900E](#)

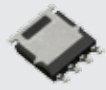
- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- High power density dual PowerPAK® 8x8L offers significant reduction in PCB area

**INDUCTORS**  
**Shielded EMI Filter Up to 190 A I<sub>DCR</sub>, 2.2µH, Ultra-Low DCR (0.22 mΩ)**  
  
[IHXL-2000VZ-5A](#)

- Very high-current and high-temperature operation for filters and energy storage

**RESISTORS**  
**Power Metal Strip® SMD Resistors, 4-Terminal, Low Value (Down to 0.0001 Ω)**  
  
[WSK1216](#)

- High power rating of 3 W to 5 W with TCR of 20 ppm/K
- Very low resistance values, 0.0001 Ω to 0.004 Ω, with tolerance of 1 %

**MOSFETs**  
**N-Channel MOSFETs in 5 mm x 6 mm PowerPAK® SO-8L Rated at 40 V, 3.0 mΩ**  
  
[SQJA46EP](#)


- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Thermally enhanced PowerPAK® SO-8L replaces DPAK in less than half of the area

**CERAMIC CAPACITORS**  
**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NPO), X7R, and X8R**  
  
[VJ...31X RoHS Automotive MLCCs](#)


- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

**MOSFETs**  
**N-Channel MOSFETs in 8 mm x 8 mm PowerPAK®, 40 V, 160 A, 1.2 mΩ**  
  
[SQJQ100EL](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Ultra-low R<sub>DS(on)</sub>, thermally enhanced PowerPAK® 8x8L replaces D<sup>2</sup>PAK in less than half of the area

**INDUCTORS**  
**Low-Profile, High-Current IHLP® Inductors**  
  
[IHLP-6767GZ-5A](#)

- Lowest DCR/µH in this package size
- High temperature up to 155 °C, shielded construction

**TANTALUM CAPACITORS**  
**Solid Tantalum Surface-Mount Chip Capacitors, Molded Case, Automotive Grade**  
  
[TH3 / TH4](#)

- High-temperature molded tantalum capacitors, HI-TMP®, TH4 = up to 175 °C, TH3 = up to 150 °C






# Advanced Driver Assistance System (ADAS)



**MOSFETs**

**Dual N-Channel MOSFETs in 5 mm x 6 mm PowerPAK®, 40 V, 11 mΩ / 22 mΩ**




[SQJ942EP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Optimized for high-frequency DC/DC applications, lower switching losses

**INDUCTORS**

**Low-Profile, High-Current IHLP® Inductors**




[IHLP-1616BZ-A1](#)

- Shielded construction, lowest DCR/μH in this package size
- Excellent DC/DC energy storage up to 5 MHz

**DIODES**

**SMD Power ESD Diodes, Up to ± 30 kV, I<sub>FSM</sub> = 50 A**




[SMFxx](#)

- SMF package: 3.5 mm x 1.9 mm
- Breakdown voltage = 6.4 V to 64.4 V

**OPTOELECTRONICS**

**Integrated Proximity and Ambient Light Sensors with I<sup>2</sup>C Interface**




[VCNL4020X01](#)

- Low-profile QFN SMD package, 16 bit resolution, proximity distance up to 200 mm
- Suitable for extended detection range, gesture function with external emitters

**MOSFETs**

**Dual N-Channel MOSFETs in 5 mm x 6 mm PowerPAK®, 12 V, 2.7 mΩ / 7.4 mΩ**




[SQJ202EP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Low-voltage, high-frequency synchronous buck applications, lower switching losses

**RECTIFIERS**

**Surface-Mount Schottky Barrier Rectifiers**




[MSS1P4](#)

- Very low profile - typical height of 0.65 mm
- AEC-Q101 qualified

**INDUCTORS**

**Low-Profile, High-Current IHLP® Inductors**



[IHLP-2525CZ-5A](#)

- Excellent high-temperature performance for DC/DC converter input and output filters

**RESISTORS**

**Precision Thin Film Resistor Arrays, Superior Moisture Resistivity, TCR ± 0.05**



[ACAS 0606 AT](#)

- Arbitrary resistance ratio up to 1:20, superior tracking stability over lifetime
- Relative TCR down to ± 5 ppm/K (tracking), AEC-Q200 qualified

**TANTALUM CAPACITORS**

**Solid Tantalum Chip Capacitors, High CV Leadframeless Molded, Automotive Grade**



[TP8](#)

- Smallest AEC-Q200 qualified tantalum capacitors with case sizes as small as 0603

**CERAMIC CAPACITORS**

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NPO), X7R, and X8R**



[VJ...31X RoHS Automotive MLCCs](#)

- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

**INDUCTORS**

**High-Curent SMD Inductors with E-Field Shielding and 155 °C Operating Temperature**




[IHLE-3232DD-5A](#)

- Excellent EMI protection, double-shielded

**MOSFETs**

**Dual N-Channel MOSFET in Small 2 mm x 2 mm SC-70 Package Rated at 20 V, 28 mΩ**



[SQ1912AEEH-T1 GE3](#)

- AEC-Q101 Qualified, 100 % UIS & RG tested with up to 175 °C operation
- Compact part for use in sync buck power supply for camera system

# Spotlight on the IHLP<sup>®</sup> Inductor Loss Calculator Tool

Vishay's new IHLP Loss Calculator is a free tool that assists designers in selecting the correct IHLP inductor based on the operating conditions of their circuit. This tool will simulate the losses in the inductor, including core and both AC and DC copper losses. The temperature rise and final component temperature will also be predicted based on the estimated losses. This tool will allow designers to compare several different inductors, both in size and value, to assist in the selection process. The calculator can be used for buck, boost and buck/boost style converters.

The calculator has ten inputs: input voltage, output voltage, switch (FET) voltage drop, diode (or sync FET) voltage drop, output current, frequency, ambient temperature and inductance. The calculator will do the rest based on these inputs. Inductance can be selected by using the "radio" buttons on the left hand side.

Please note: all designs should be verified in circuit as this tool is for simulation only.

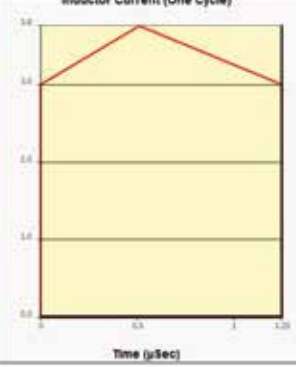

Access the loss calculator tool at: [www.vishay.com/inductors/calculator-home-list/](http://www.vishay.com/inductors/calculator-home-list/)

Access the user guide at: [www.vishay.com/doc?49421](http://www.vishay.com/doc?49421)

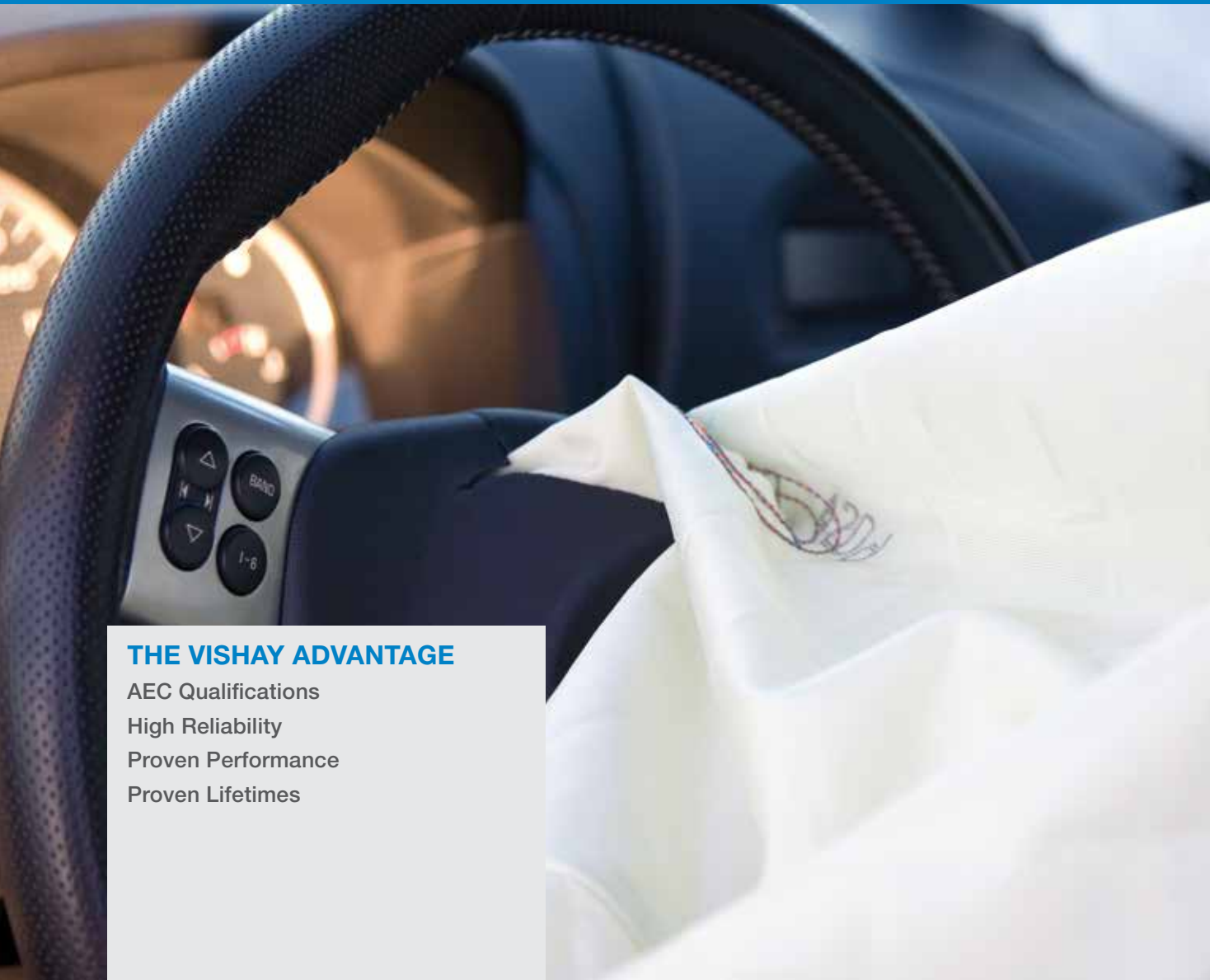
## Important Design Criteria

IHLP inductors have a recommended maximum component temperature of 125 °C. Subtracting the ambient temperature will give us the maximum allowed temperature rise for the part. If this number should exceed 40 °C it is recommended that 40 °C be used for the allowed temperature rise. The recommended range for the ripple current is 30 % to 50 % of inductor current. This is based on a trade-off of inductor size and cost versus output capacitor size and cost. The maximum peak current should be kept below the last value of the selected inductor, although it can be exceeded with caution due to the soft saturation characteristics of the powdered iron core material. The calculators are based on operation in the continuous conduction mode only. Information determined in the discontinuous conduction mode should be considered suspect and in need of verification by the user.

**IHLP<sup>®</sup> INDUCTOR LOSS CALCULATOR TOOL**

Choose Calculator Type		IHLP-1616AB-01 Boost $\mu$ H Ind. Loss Calculator				Ratings	
Boost						Inductance	1 $\mu$ H
Choose Available Series						25° C DC Res	0.043 Ohms
IHLP-1616AB-01						I <sub>sat</sub>	8.5 Amps
						I <sub>Heat</sub>	4 Amps
Select Inductance:		Inputs: Enter data into yellow fields				Outputs	
0.047 $\mu$ H <input type="radio"/>		Frequency =	800000 Hz	ET <sub>DC</sub>	0.76 V- $\mu$ sec	Inductor Current (One Cycle)	
0.10 $\mu$ H <input type="radio"/>		Output Current =	2 Amps	F <sub>(eff)</sub>	506349.5 Hertz		
0.22 $\mu$ H <input type="radio"/>		Ambient Temp =	25 °C	Res	0.061936 Ohms		
0.47 $\mu$ H <input type="radio"/>		Volts In =	1.5 Volts	I <sub>sat</sub>	3.77 Amps		
1 $\mu$ H <input checked="" type="radio"/>		Volts Out =	2.5 Volts	I <sub>sat</sub>	3.01 Amps		
		V <sub>sat</sub> =	0.025 Volts	I <sub>peak</sub>	0.76 Amps		
		V <sub>D</sub> =	0.025 Volts	Duty	0.41		
		I <sub>avg</sub> =	3.4 Amps	P <sub>core</sub>	0.012 Watts		
		ET <sub>rise</sub> =	0.27 V- $\mu$ sec	P <sub>DC</sub>	0.597 Watts		
		B <sub>sat</sub> =	260 G	P <sub>AC</sub>	0.014 Watts		
		A	0.175 Inch 4.13 mm	P <sub>tot</sub>	0.623 Watts		
		B	0.160 Inch 4.13 mm	Temp Coeff	48.1 °C/W		
		C	0.047 Inch 1.13 mm	Temp Rise	30.0 °C		
				Comp Temp	55.0 °C		
Reference Cost	0.9	Compared to IHLP-2528CZ-01				Notes May Be Added Here:	
		Warning Messages:				<input type="text"/>	

# Key components for PASSIVE SAFETY



**Airbag Control Systems**



**Restraint System Power Supplies**



**Pedestrian Protection Systems**



## **THE VISHAY ADVANTAGE**

- AEC Qualifications
- High Reliability
- Proven Performance
- Proven Lifetimes



# Airbag Control Systems


**RESISTORS**

**Thin Film Resistors, 4.7 Ω to 3.01 MΩ, 0402 to 1210 Case Sizes, 50 V to 200 V**


[TNPW e3](#)

- Excellent stability  $|\Delta R/R| \leq 0.05\%$  after 1000 h at 70 °C, 0402 to 1210 case sizes

**RESISTORS**

**Massive Electro-Pyrotechnic Initiator Chip Resistors**


[MEPIC](#)

- Low firing energy down to 1.5 mJ, fast firing time down to 250 μs
- Standard 0805 SMD case, alternative to bridge wire technology

**MOSFETs**

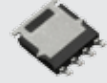
**Dual N- and P-Channel MOSFETs in 5 mm x 6 mm PowerPAK® SO-8L, 40/-40 V, 11/30 mΩ**


[SQJ500AEP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Package saves board space

**MOSFETs**

**N-Channel MOSFETs in 5 mm x 6 mm PowerPAK®, 40 V, 58 A, 6.3m Ω**


[SQJ868EP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Thermally enhanced PowerPAK SO-8L replaces DPAK in less than half of the area

**RECTIFIERS**

**High Current Density Surface-Mount Schottky Barrier Rectifiers**


[SS3P4L](#)

- AEC-Q101 qualified
- Very low profile - typical height of 1.0 mm

**INDUCTORS**

**Low-Profile, High-Current IHLP® Inductors**


[IHLP-4040DZ-5A](#)

- Excellent high-current performance for noise filters
- High-temperature operation up to 155 °C

**DIODES**

**High-Power TVS, Up to 6.6 kW, Standoff with 24 V, 700 A Peak Current**


[SM8S24AT](#)

- PAR® TVS in DO-218AC package for automotive load dump protection applications

**TANTALUM CAPACITORS**

**Solid Tantalum Chip Capacitors, High CV Leadframeless Molded, Automotive Grade**


[TP8](#)

- Smallest AEC-Q200 qualified tantalum capacitors with case sizes as small as 0603

**ALUMINUM CAPACITORS**

**Aluminum Capacitors, Increased Vibration Resistance**


[246CTI-V](#)

- High temperature, low impedance, high vibration capability
- High ripple current, long useful life

**CERAMIC CAPACITORS**

**High Operating Temperature, Automotive Grade Leaded MLCC Capacitors**


[HOTcap® K...H, A...R, K...R](#)

- High-reliability MLCC insert with wet build process
- High operating temperature (up to 175 °C for K...H and up to 160 °C for A...R and K...R), rated voltages: 50 V, 100 V, 200 V

**TANTALUM CAPACITORS**

**Solid Tantalum Surface-Mount Chip Capacitors, Tantamount® Molded Case, Automotive Grade**


[TH3](#)

- High-temperature molded tantalum capacitors, HI-TMP®, up to 150 °C



# Restraint System Power Supplies



**RESISTORS**

**Thick Film Resistors, Pulse-Proof, Excellent Stability**




[CRCW-IF e3](#)

- High pulse performance up to 10 kW
- Stability  $|\Delta R/R| \leq 1\%$  after 1000 h at 70 °C

**ALUMINUM CAPACITORS**

**Aluminum Capacitors, Increased Vibration Resistance**

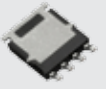


[246CTI-V](#)

- High temperature, low impedance, high vibration capability
- High ripple current, long useful life

**MOSFETs**

**P-Channel MOSFETs in 5 mm x 6 mm PowerPAK® SO-8L, -60 V, 52 A, 18 mΩ**



[SQJ459EP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Thermally enhanced package replaces DPAK in less than half the area

**RECTIFIERS**

**Ultrafast Rectifiers, 200 V, 1.2 A**

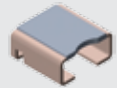


[ES07D](#)

- AEC-Q101 qualified low-profile DO-219AB (SMF) package for surface-mount applications

**RESISTORS**

**Power Metal Strip® SMD Resistors, 4-Terminal, Low Values (Down to 0.0001 Ω)**




[WSK1216](#)

- High power rating of 3 W to 5 W with TCR = 20 ppm/K
- Very low resistance values, 0.0001 Ω to 0.004 Ω, with tolerance of 1 %

**INDUCTORS**

**Low-Profile, High-Current IHLP® Inductors**

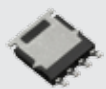


[IHLP-5050FD-5A](#)

- Excellent high-temperature performance and noise filtering

**MOSFETs**

**N-Channel MOSFETs in 5 mm x 6 mm PowerPAK® SO-8L Rated at 40 V, 3.0 mΩ**



[SQJA46EP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Thermally enhanced PowerPAK® SO-8L replaces DPAK in less than half of the area

**CERAMIC CAPACITORS**

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NPO), X7R, and X8R**




[VJ...31X RoHS Automotive MLCCs](#)

- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

**DIODES**

**Surface-Mount PAR® TVS**




[TPSMA](#)

- AEC-Q101 qualified,  $T_j = 185\text{ °C}$  capability, suitable for automotive applications
- 400 W peak pulse power capability with 10/1000 μs waveform

**CERAMIC CAPACITORS**

**High Operating Temperature, Automotive Grade Leaded MLCC Capacitors**



[HOTcap® K...H, A...R, K...R](#)

- High-reliability MLCC insert with wet build process
- High operating temperature (up to 175 °C for K...H and up to 160 °C for A...R and K...R), rated voltages: 50 V, 100 V, 200 V




# Pedestrian Protection Systems



**RESISTORS**

**Thin Film Resistors, 4.7 Ω to 3.01 MΩ, 0402 to 1210 Case Sizes, 50 V to 200 V**



[TNPW e3](#)

- Excellent stability  $|\Delta R/R| \leq 0.05\%$  after 1000 h at 70 °C, 0402 to 1210 case sizes

**MOSFETs**

**Dual N-Channel MOSFETs in 5 mm x 6 mm PowerPAK®, 12 V, 2.7 mΩ / 7.4 mΩ**




[SQJ202EP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Low-voltage, high-frequency synchronous buck applications, lower switching losses

**INDUCTORS**

**Low-Profile, High-Current IHLP® Inductors**



[IHLP-2525CZ-5A](#)

- Excellent high-temperature performance for DC/DC converter input and output filters

**INDUCTORS**

**Low-Profile, High-Current Inductors with E-Field Shield**




[IHLE-2525CD-5A](#)

- High temperature operation up to 155 °C
- Integrated e-field shield eliminates need for separate shielding

**MOSFETs**

**Dual N-Channel MOSFETs in 5 mm x 6 mm PowerPAK®, 40 V, 11 mΩ / 22 mΩ**




[SQJ942EP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Optimized for high-frequency DC/DC applications, lower switching losses

**RECTIFIERS**

**Surface-Mount Schottky Barrier Rectifiers**




[MSS1P4](#)

- Very low profile - typical height of 0.65 mm
- AEC-Q101 qualified

**RECTIFIERS**

**Schottky Diodes, 30 V, 8 A,  $I_{FSM} = 150$  A**




[SS8P3LHM3](#)

- Low-profile TO-277A (SMPC) package for use in low-voltage, high-frequency inverters; DC/DC converters; and polarity protection applications

**MOSFETs**

**Dual N-Channel MOSFETs in 5 mm x 6 mm PowerPAK®, 12 V, 2.7 mΩ / 7.4 mΩ**




[SQJ202EP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Low-voltage, high-frequency synchronous buck applications, lower switching losses

**INDUCTORS**

**Low-Profile, High-Current IHLP® Inductors**




[IHLP-4040DZ-5A](#)

- Excellent high-current performance for noise filters
- High-temperature operation up to 155 °C

**INDUCTORS**

**Low-Profile, High-Current IHLP® Inductors**



[IHLP-1616BZ-A1](#)

- Shielded construction, lowest DCR/μH in this package size
- Excellent DC/DC energy storage up to 5 MHz

**CERAMIC CAPACITORS**

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NPO), X7R, and X8R**




[VJ...31X RoHS Automotive MLCCs](#)

- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

**DIODES**

**Trench Schottky Rectifiers in SMPC (TO-277A), High Pulse Current up to 220 A, 150 V**



[V15P15HM3](#)

- Low-profile TO-277A (SMPC) package for use in low-voltage, high-frequency inverters; DC/DC converters; and polarity protection applications



## Key components for EXTERIOR LIGHTING



### THE VISHAY ADVANTAGE

- Automotive Qualified
- High-SFR Components
- EMI-Improved Components
- High-Temperature-Approved Passive Components ( $\geq 155\text{ }^{\circ}\text{C}$ )

**LED Headlight Units**



**Daytime Lighting**



**LED Fog Lighting**



**Rear and Signal LED Lights**






# LED Headlight Units



**MOSFETs**

**Dual N-Channel MOSFETs in 5 mm x 6 mm PowerPAK® SO-8L, 60 V, 12 mΩ**



[SQJB60EP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Dual configuration in thermally enhanced PowerPAK® SO-8L saves board space

**INDUCTORS**

**Low Profile, High Current Inductors with E-Field Shield**




[IHLE-3232DD-5A](#)

- High temperature operation up to 155 °C
- Integrated e-field shield eliminates need for separate shielding

**DIODES**

**Surface-Mount TRANSZORB® TVS**



[P6SMB36CA](#)

- AEC-Q101 qualified
- 600 W peak pulse power capability with 10/1000 μs waveform

**RESISTORS**

**Professional Thin Film MELF Resistors**




[MMB 0207](#)

- Unrivalled surge handling capability, ultimate stability over lifetime
- AEC-Q200 qualified, approved according to EN 140401-803, intrinsically sulfur-resistant, Green product

**RESISTORS**

**Power Metal Strip® SMD Resistors, Very High Power (to 3 W), Extremely Low Resistance (to 0.0005 Ω)**




[WSLP](#)

- Very high power rating, to 3 W
- Extremely low resistance values from 0.0005 Ω to 0.1 Ω and tolerance of 1 %

**NON-LINEAR RESISTORS**

**SMD Glass-Protected NTC Thermistors**




[NTCS...e3](#)

- Standard series, AEC-Q200 compliant
- Glass-protected with soft terminations

**RECTIFIERS**

**High Current Density, Surface-Mount Trench MOS Barrier Schottky Rectifiers**

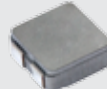


[V8P10HM3](#)

- Ultra-low  $V_F = 0.466$  V at  $I_F = 4$  A
- Very low profile - typical height of 1.1 mm

**INDUCTORS**

**Low-Profile, High-Current Coupled Inductor**




[IHCL-4040DZ-5A](#)

- High-temperature operation up to 155 °C
- Shielded construction

**INDUCTORS**

**Low-Profile, High-Current IHLP® Inductors**




[IHLP-5050EZ-5A](#)

- High saturation current
- High-temperature operation up to 155 °C

**INDUCTORS**

**Low-Profile, High-Current IHLP® Inductors**



[IHLP-4040DZ-5A](#)

- Excellent high-current performance for noise filters
- High-temperature operation up to 155 °C

**CERAMIC CAPACITORS**

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NPO), X7R, and X8R**




[VJ...31X RoHS Automotive MLCCs](#)

- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

**TANTALUM CAPACITORS**

**Solid Tantalum Surface-Mount Chip Capacitors, Tantamount® Molded Case, Automotive Grade**



[TH3](#)

- High-temperature molded tantalum capacitors, HI-TMP®, up to 150 °C




# Daytime Lighting



**RESISTORS**

**Pulse-Proof, High-Power Thick Film Chip Resistors**




[CRCW-HP e3](#)

- Excellent pulse load capability
- Enhanced power rating

**MOSFETs**

**Dual N-Channel MOSFETs in 5 mm x 6 mm PowerPAK SO-8L, 40 V, 33 mΩ**



[SQJ946EP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Optimized for high-frequency DC/DC applications, lower switching losses

**MOSFETs**

**N-Channel MOSFETs in 3 mm x 3 mm PowerPAK® 1212 with Wettable Flanks, 80 V, 25 mΩ**



[SQSA80ENW](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- For higher currents

**MOSFETs**

**N-Channel MOSFETs in Small 3 mm x 3 mm SOT-23, 100 V, 1.6 A, 300 mΩ**




[SQ2398ES](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- 100 V MOSFETs for switching low currents in small packages

**RECTIFIERS**

**High Current Density, Surface-Mount Trench MOS Barrier Schottky Rectifier**




[V8P10HM3](#)

- Ultra-low  $V_F = 0.466$  V at  $I_F = 4$  A
- Very low profile - typical height of 1.1 mm

**RECTIFIERS**

**High-Voltage Schottky Diode, 100 V, 2 A,  $T_j = 175$  °C**




[SS2PH10](#)

- Very low profile - typical height of 1.0 mm
- Low forward voltage drop, low power losses

**DIODES**

**High Power Density Surface-Mount PAR® TVS**




[TPSMP](#)

- AEC-Q101 qualified,  $T_j = 185$  °C capability, suitable for automotive applications
- Very low profile - typical height of 1.0 mm

**RESISTORS**

**Thick Film Surface-Mount Chip Resistors, Wraparound, Extremely Low Value**



[RCWE](#)

- Low resistance values from 0.01 Ω to 0.976 Ω and tolerance of 1 %
- Thick film construction with 2x power capacity

**RESISTORS**

**Professional Thin Film MELF Resistors**




[MMB 0207](#)

- Unrivaled surge handling capability, ultimate stability over lifetime
- AEC-Q200 qualified, approved according to EN 140401-803, intrinsically sulfur-resistant, Green product

**OPTOELECTRONICS**

**SMD PLCC-2 Plus 0.5 W White LEDs**




[VLMW51Q2R3](#)

- Luminous intensity up to 51 lm in compact 3.5 x 3.5 x 1.2 mm surface-mount package
- White color coordinates of 0.33 (X) and 0.33 (Y) with 120° viewing angle

**NON-LINEAR RESISTORS**

**SMD Glass-Protected NTC Thermistors**



[NTCS...e3](#)

- Standard series, AEC-Q200 compliant
- Glass-protected with soft terminations

**CERAMIC CAPACITORS**

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NPO), X7R, and X8R**



[VJ...31X RoHS Automotive MLCCs](#)


- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding






# LED Fog Lighting




**RESISTORS**  
**Pulse-Proof, High-Power Thick Film Chip Resistors**  
  
[CRCW-HP e3](#)  


- Excellent pulse load capability
- Enhanced power rating

**MOSFETs**  
**Dual N-Channel MOSFETs in 5 mm x 6 mm PowerPAK®, 40 V, 11 mΩ / 22 mΩ**  
  
[SQJ942EP](#)  

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Optimized for high-frequency DC/DC applications, lower switching losses

**RECTIFIERS**  
**2 A, 40 V Schottky Diodes**  
  
[SS2P4](#)  


- Low-profile DO-220AA (SMP) package for low-voltage, high-frequency DC/DC converters; switching power supplies; free-wheeling diodes; and polarity protection

**RECTIFIERS**  
**45 V, 3 A Trench Schottky Diodes, Ultra-Low V<sub>F</sub>**  
  
[V3PAL45](#)  


- Low-profile DO-221BC (SMPA) package for low-voltage, high-frequency DC/DC converters; switching power supplies; freewheeling diodes; and polarity protection

**RESISTORS**  
**Professional Thin Film MELF Resistors**  
  
[MMB 0207](#)  


- Unrivaled surge handling capability, ultimate stability over lifetime
- AEC-Q200 qualified, approved according to EN 140401-803, intrinsically sulfur-resistant, Green product

**RESISTORS**  
**Thick Film Surface Mount Chip Resistors, Wraparound, Extremely Low Values**  
  
[RCWE](#)  


- Low resistance values from 0.01 Ω to 0.976 Ω and tolerance of 1 %
- Thick film construction with 2x power capacity

**DIODES**  
**Surface-Mount PAR® TVS**  
  
[TPSMA](#)  

- 400 W peak pulse power capability with a 10/1000 μs waveform

**NON-LINEAR RESISTORS**  
**SMD Glass-Protected NTC Thermistors**  
  
[NTCS...e3](#)  

- Standard series, AEC-Q200 compliant
- Glass-protected with soft terminations

**INDUCTORS**  
**Low-Profile, High-Current IHLP® Inductors**  
  
[IHLP-2525CZ-5A](#)  

- Excellent high-temperature performance for DC/DC converter input and output filters

**CERAMIC CAPACITORS**  
**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, COG (NPO), X7R, and X8R**  
  
[VJ...31X RoHS Automotive MLCCs](#)  

- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

**INDUCTORS**  
**Low-Profile, High-Current IHLP® Inductors**  
  
[IHLP-2020CZ-5A](#)  

- Compact size and high current, low saturation for noise filtering
- Up to 155 °C continuous operation



# Rear and Signal LED Lights



**RESISTORS**  
**Pulse-Proof, High-Power Thick Film Chip Resistors**  
  
[CRCW-HP e3](#)  

- Excellent pulse load capability
- Enhanced power rating

**RESISTORS**  
**Professional Thin Film MELF Resistors**  
  
[MMB 0207](#)  


- Unrivaled surge handling capability, ultimate stability over lifetime
- AEC-Q200 qualified, approved according to EN 140401-803, intrinsically sulfur-resistant, Green product

**MOSFETs**  
**N-Channel MOSFETs in 3 mm x 3 mm PowerPAK® 1212 with Wettable Flanks Rated at 40 V, 9 mΩ**  
  
[SQS484ENW](#)  


- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation

**RECTIFIERS**  
**Surface-Mount Schottky Barrier Rectifiers**  
  
[MSS1P6HM3](#)  

- Low-profile MicroSMP package for low-voltage, high-frequency inverters; DC/DC converters; and polarity protection applications
- AEC-Q101 qualified

**INDUCTORS**  
**Low-Profile, High-Current IHLP® Inductors**  
  
[IHLP-1616BZ-A1](#)  


- Shielded construction, lowest DCR/μH in this package size
- Excellent DC/DC energy storage up to 5 MHz

**RESISTORS**  
**Thick Film Surface Mount Chip Resistors, Wraparound, Extremely Low Value**  
  
[RCWE](#)  


- Low resistance values from 0.01 Ω to 0.976 Ω and tolerance of 1 %
- Thick film construction with 2x power capacity

**RESISTORS**  
**Power Metal Strip® SMD Resistors, Wide Terminal, 1 mΩ to 3 mΩ, 1 W**  
  
[WSL0612](#)  


- Low EMF, high temperature up to 170 °C

**OPTOELECTRONICS**  
**SMD High-Power, 1 W Visible LEDs (Red, Amber, and Yellow)**  
  
[VLMR71AAAC](#)  

- Compact, high-power SMD package: 6 x 6 x 1.5 mm
- Wide viewing angle of 120°

**NON-LINEAR RESISTORS**  
**SMD Glass-Protected NTC Thermistors**  
  
[NTCS...e3](#)  

- Standard series, AEC-Q200 compliant
- Glass-protected with soft terminations

**CERAMIC CAPACITORS**  
**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NPO), X7R, and X8R**  
  
[VJ...31X RoHS Automotive MLCCs](#)  

- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

**INDUCTORS**  
**Low-Profile, High-Current IHLP® Inductors**  
  
[IHLP-2020CZ-5A](#)  

- Compact size and high current, low saturation for noise filtering
- Up to 155 °C continuous operation

# Spotlight on Automotive Qualified Tantalum Capacitors



**TP8 MICROTAN® Low-Profile, High-CV Leadframeless Capacitors**



**TH4 High-Temperature Molded Tantalum Chip Capacitors**

For space-constrained designs, the TP8 series offers capacitance values up to 100  $\mu\text{F}$  and case sizes down to 0805 and 0603. The table below summarizes the advantages of the MICROTAN series over conventional molded tantalum devices.

## TP8 Next Generation Tantalum Chip Capacitors

### ADVANTAGES

Industry's best volumetric efficiency	→	Reduced size, higher ratings
No lead frames	→	Improved reliability, reduced ESR, reduced cost
L-shape termination design	→	Superior mechanical and electrical contact, visual inspection of solder joints
Tantalum technology	→	Unlike MLCC, no piezoelectric noise
RoHS-compliant and halogen-free	→	Environmentally friendly

## Select Application Examples for Tantalum Capacitors

### POWER MANAGEMENT AND CONVERSION

Tantalum capacitor options include devices in a broad variety of case sizes and with the high temperature ratings required by the automotive environment. They provide effective filtering in switchmode power supplies and deliver exceptionally stable, high-capacitance performance over a long life and in high-temperature (under-the-hood) environments.

### ENERGY STORAGE

Today's automotive circuitry requires stability under various loads and peak power requirements. Vishay tantalum capacitors provide a low-cost bulk energy storage solution for power bus hold-up applications.

### COUPLING

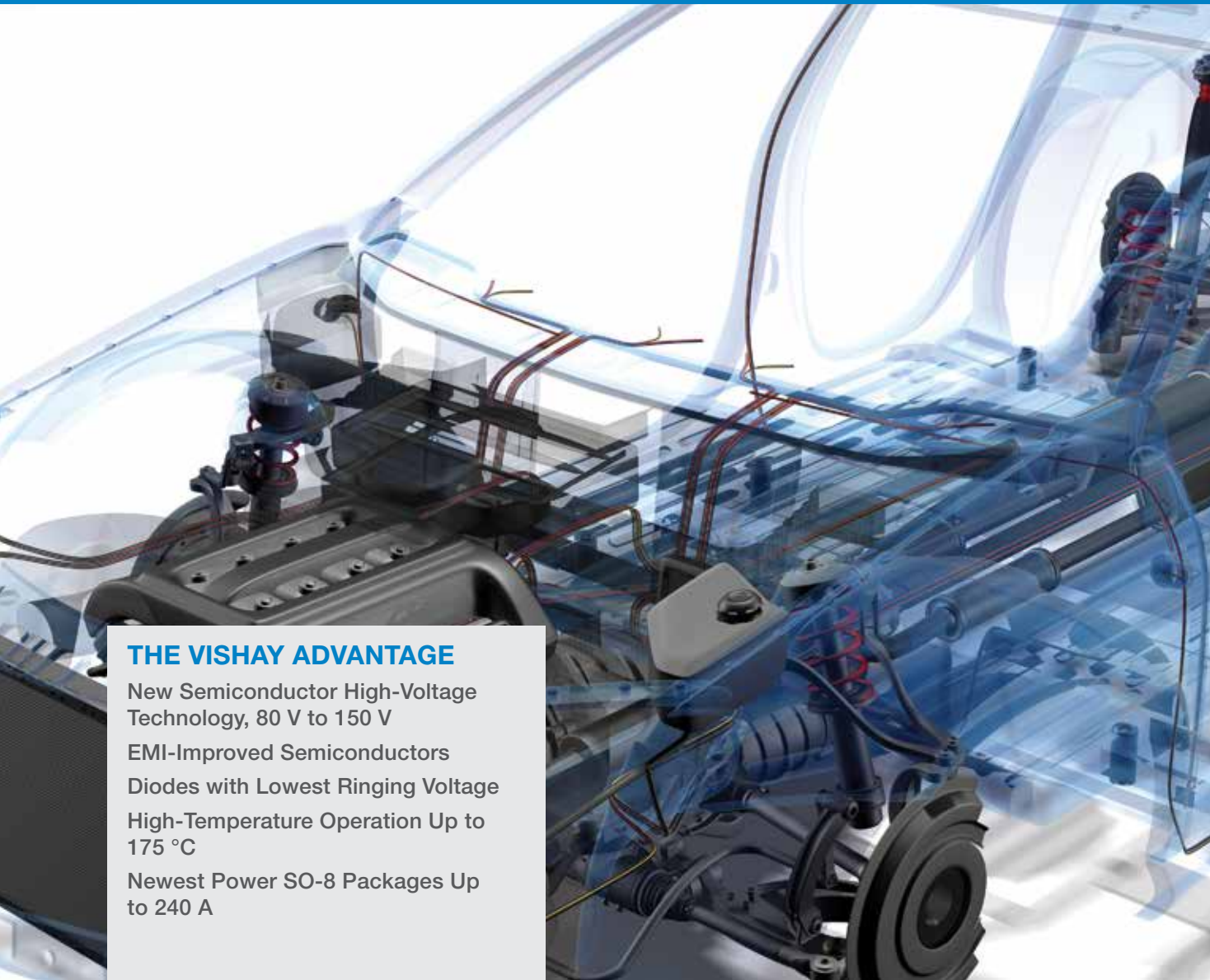
Automotive analog circuitry, including audio, sensor, and telematics applications, requires a coupling capacitor to connect two circuits so that only the AC signal passes from the first circuit to the next. The capacitor, often called a blocking capacitor, blocks the DC signal, isolating the DC bias of the two coupled circuits. Vishay tantalum capacitors offer the requisite capacitance, DC leakage current, and stability over temperature and time for automotive analog coupling.

## Capabilities Overview

Series	TP3	TP8	TH3	TH4
Type	Low-ESR molded SMD	MICROTAN® Leadframeless SMD	High-Temperature (+150 °C) SMD	High-Temperature (+175 °C) SMD
Capacitance Range	0.1 $\mu\text{F}$ to 470 $\mu\text{F}$	1 $\mu\text{F}$ to 100 $\mu\text{F}$	0.33 $\mu\text{F}$ to 220 $\mu\text{F}$	10 $\mu\text{F}$ to 47 $\mu\text{F}$
Voltage Range	4 V to 50 V	6.3 V to 40 V	6.3 V to 50 V	6.3 V to 35 V
Capacitance Tolerance	$\pm 10\%$ , $\pm 20\%$	$\pm 20\%$ , $\pm 10\%$	$\pm 10\%$ , $\pm 20\%$	$\pm 10\%$ , $\pm 20\%$
Case Codes	A, B, C, D, E	M, W, R, P, A, N, T, B	A, B, C, D, E	B, C, D



## Key components for 48 V<sub>DC</sub> BOARDNET



**Integrated Starter  
Generators  
(48 V<sub>DC</sub>)**



**DC/DC  
Converters,  
Bidirectional  
(48 V<sub>DC</sub>)**



**HVAC  
(E-Compressor  
for 48 V<sub>DC</sub>)**



### THE VISHAY ADVANTAGE

New Semiconductor High-Voltage  
Technology, 80 V to 150 V

EMI-Improved Semiconductors  
Diodes with Lowest Ringing Voltage  
High-Temperature Operation Up to  
175 °C

Newest Power SO-8 Packages Up  
to 240 A



# Integrated Starter Generators (48 V<sub>DC</sub>)



**MOSFETs**

**N-Channel MOSFETs in 5 mm x 6 mm PowerPAK® SO-8L Rated at 80 V, 7 mΩ**




[SQJA80EP](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Ultra-low R<sub>DS(on)</sub>, thermally enhanced PowerPAK® 8x8L replaces D<sup>2</sup>PAK in less than half of the area

**NON-LINEAR RESISTORS**

**SMD Glass-Protected NTC Thermistors**

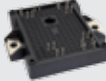


[NTCS...e3](#)

- Standard series, AEC-Q200 compliant
- Glass-protected with soft terminations

**MODULES**

**MOSFET H Bridges or B6 Bridges Based on Customer Specifications**




[EMIPAK 1B/2B Customized](#)

- 80 V to 100 V MOSFET power modules

**CERAMIC CAPACITORS**

**High Operating Temperature, Automotive Grade Leaded MLCC Capacitors**




[HOTcap® K...H, A...R, K...R](#)

- High-reliability MLCC insert with wet build process
- High operating temperature (up to 175 °C for K...H and up to 160 °C for A...R and K...R), rated voltages: 50 V, 100 V, 200 V

**MOSFETs**

**N-Channel MOSFETs as Known Good Die, 100 V, 3.6 mΩ**




[SQC260N10 3m6KDG](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Efficient KGD packaging allows high power density and reduced parasitics

**INDUCTORS**

**EMI Filters with Flat Copper Wire, SMD or Leaded Up to 260 A**



[Customized EMI Filters](#)

- Customized solutions for 48 V applications, low DCR, high current

**FILM CAPACITORS**

**DC-Link Polyester Film Capacitors, Operating Temperature Up to 150 °C, High Ripple Current**



[MKT1820S](#)

- Low voltage DC-link capacitors with high-temperature capabilities
- Customized solutions for 48 V applications

**RESISTORS**

**Power Metal Strip® Meter Shunt Resistor, Very Low Value (Down to 100 μΩ)**



[WSMS2908](#)

- Extremely low resistance values: 100 μΩ to 1000 μΩ
- 3 W power capability with sensing terminals to mount on PCB

**CERAMIC CAPACITORS**

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NPO), X7R, and X8R**




[VJ...31X RoHS Automotive MLCCs](#)

- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

**RECTIFIERS**

**TVS Clamping Diodes, Up to 1.5 kW**



[1.5 SMC Series](#)

- DO-214AB (SMCJ) package to protect ICs, MOSFETs, and signal lines of sensor units against voltage transients induced by inductive load switching and lightning



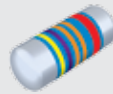


# DC/DC Converters, Bidirectional (48 V<sub>DC</sub>)



RESISTORS

**Professional High-Temperature Mini-MELF Resistors**

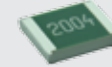


[MMA 0204 HT](#)

- Operating temperature up to 175 °C, power handling of 500 mW, high surge capability
- AEC-Q200 qualified, high overall stability  $|\Delta R/R| \leq 0.1 \%$ , intrinsically sulfur-resistant

RESISTORS

**Thin Film Resistors, 4.7 Ω to 3.01 MΩ, 0402 to 1210 Case Sizes, 50 V to 200 V**



[TNPW e3](#)

- Excellent stability  $|\Delta R/R| \leq 0.05 \%$  after 1000 h at 70 °C, 0402 to 1210 case sizes

INDUCTORS

**Low-Profile, High-Current IHLP® Inductors**



[IHLP-8787MZ-5A](#)

- Highest current composite inductor available
- High temperature operation up to 155 °C, shielded construction

MOSFETs

**N-Channel MOSFETs in 8 mm x 8 mm PowerPAK® 8x8L, 80 V, 150 A, 2.7 mΩ**



[SQJQ480E](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Ultra-low R<sub>DS(on)</sub>, thermally enhanced package reduces board area

MOSFETs

**N-Channel MOSFETs in 8 mm x 8 mm PowerPAK®, 40 V, 160 A, 1.2 mΩ**

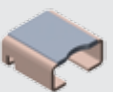


[SQJQ100EL](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Ultra-low R<sub>DS(on)</sub>, thermally enhanced PowerPAK® 8x8L replaces D<sup>2</sup>PAK in less than half of the area

RESISTORS

**Power Metal Strip® SMD Resistors, 4-Terminal, Low Values (Down to 0.0001 Ω)**



[WSK1216](#)

- High power rating of 3 W to 5 W with TCR = 20 ppm/K
- Very low resistance values, 0.0001 Ω to 0.004 Ω, with tolerance of 1 %

INDUCTORS

**Shielded SMD Low-Profile, High-Current IHLP® Inductors, EMI Filter, 155 °C, Low DCR**



[IHLP-6767GZ-5A](#)

- Very high-current and high-temperature operation for filters

INDUCTORS

**Coupled Inductors for SEPIC Converter**



[IHCL-3232DZ-5A](#)

- High-temperature operation up to 155 °C
- Frequency range up to 5.0 MHz

INDUCTORS

**EMI Filters with Flat Copper Wire as SMD or Ledged, Up to 260 A**



[Customized EMI Filters](#)

- Customized solutions for 48 V applications, low DCR, high current

FILM CAPACITORS

**DC-Link Polyester Film Capacitors, Operating Temperature Up to 150 °C, High Ripple Current**



[MKT1820S](#)

- Low voltage DC-link capacitors with high-temperature capabilities
- Customized solutions for 48 V applications

FILM CAPACITORS

**SMD Aluminum Capacitors, High Temperature Up to 150 °C, Low ESR**



[260 CLA-V](#)

- High ripple current up to 1400 mA at 150 °C, capacitance up to 3300 μF
- Useful life up to 2000 h at 150 °C, high vibration capability

CERAMIC CAPACITORS

**X1/Y2 AC Line Rated Ceramic Disc Capacitors for Automotive Applications**



[AY2](#)

- AEC-Q200 qualified, X1/Y2 safety rating according to IEC 60384-14, 3rd edition
- Proven to withstand 3000 temperature cycles from -55 °C to +125 °C





# HVAC (E-Compressor for 48 V<sub>DC</sub>)



### CERAMIC CAPACITORS

**High Operating Temperature, Automotive Grade Leaded MLCC Capacitors**



[HOTcap® K...H, A...R, K...R](#)

- High-reliability MLCC insert with wet build process
- High operating temperature (up to 175 °C for K...H and up to 160 °C for A...R and K...R), rated voltages: 50 V, 100 V, 200 V

### NON-LINEAR RESISTORS

**SMD Glass-Protected NTC Thermistors**



[NTCS...e3](#)

- Standard series, AEC-Q200 compliant
- Glass-protected with soft terminations

### CAPACITORS MLCC

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NPO), X7R, and X8R**



[VJ...31X RoHS Automotive MLCCs](#)

- RoHS and Green compliant parts available
- AgPd termination available for epoxy bonding

### CERAMIC CAPACITORS

**High Operating Temperature, Automotive Grade Leaded MLCC Capacitors**



[HOTcap® K...H, A...R, K...R](#)

- High-reliability MLCC insert with wet build process
- High operating temperature (up to 175 °C for K...H and up to 160 °C for A...R and K...R), rated voltages: 50 V, 100 V, 200 V

### MOSFETs

**N-Channel MOSFETs in 8 mm x 8 mm PowerPAK® 8x8L, 80 V, 150 A, 2.7 mΩ**



[SQJQ480E](#)

- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Ultra-low R<sub>DS(on)</sub>, thermally enhanced package reduces board area

### INDUCTORS

**Low Profile, High Current IHLP® Inductors**



[IHLP-8787MZ-5A](#)

- Highest current composite inductor available
- High temperature operation up to 155 °C, shielded construction

### FILM CAPACITORS

**DC-Link Polyester Film Capacitors, Operating Temperature Up to 150 °C, High Ripple Current**

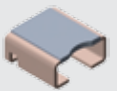


[MKT1820](#)

- Automotive general purpose capacitors with high temperature capabilities
- Capacitance up to 560 μF

### RESISTORS

**Power Metal Strip® SMD Resistors, 4-Terminal; Low Value (Down to 0.0001 Ω)**



[WSK1216](#)

- High power rating of 3 W to 5 W with TCR = 20 ppm/K
- Very low resistance values, 0.0001 Ω to 0.004 Ω, with tolerance of 1 %

### INDUCTORS

**Shielded EMI Filters Up to 190 A I<sub>DCR</sub>, 2.2μH, Ultra-Low DCR (0.22 mΩ)**



[IHL-2000VZ-5A](#)

- Very high-current and high-temperature operation for filters and energy storage

### ALUMINUM CAPACITORS

**SMD Aluminum Capacitors, High Temperature Up to 150 °C, Low ESR**



[260 CLA-V](#)

- High ripple current up to 1400 mA at 150 °C, capacitance up to 3300 μF
- Useful life up to 2000 h at 150 °C, high vibration capability

## Key components for FULL HYBRID VEHICLES (HEVs)



**Electrical Motor  
Drives (DC/AC)**



### **THE VISHAY ADVANTAGE**

- AEC Qualifications
- High-Temperature Performance
- High Reliability
- New High-Voltage Passive Components in SMD Packages
- High-Voltage Semiconductors
- Transient-Voltage Capabilities




# Electrical Motor Drives (DC/AC)



**CERAMIC CAPACITORS**

**High Operating Temperature, Automotive Grade Leaded MLCC Capacitors**




[HOTcap® K...H, A...R, K...R](#)

- High-reliability MLCC insert with wet build process
- High operating temperature (up to 175 °C for K...H and up to 160 °C for A...R and K...R), rated voltages: 50 V, 100 V, 200 V

**RESISTORS**

**Surface-Mount Molded Dividers, High-Voltage**




[CDMx](#)

- High voltage up to 3000 V, sulfur-resistant
- Automotive compliant terminations, wide range of resistance values and ratios

*\*Preliminary*

**MODULES**

**Trench FS IGBT Modules**




[VS-GC30C065TB](#)

- Optimized for use with FRED Pt® Gen 4 ultrafast diodes
- Low collector-to-emitter voltages, extremely low conduction losses

**RESISTORS**

**High-Voltage Thin Film Flat Chip Resistors, Up to 1 kV Operating Voltage, Range = 121 kΩ to 3.01 MΩ**




[TNPV1210 e3](#)

- 0.1 %, 0.5 %, and 1 % tolerances
- Excellent stability  $|\Delta R/R| \leq 0.05$  % after 1000 h at 70 °C

**NON-LINEAR RESISTORS**

**NTC Thermistors, Low Thermal Gradient Lug Sensors**




[NTCALUG02A](#)

- Low thermal gradient surface temperature sensors
- High insulation voltage

**FILM CAPACITORS**

**High-Performance DC-Link Capacitors for Automotive Traction Applications (EV/HEV)**




[MKP1849](#)

- High voltage, high capacitance, high ripple current
- Customized upon request

**RECTIFIERS**

**600 V, 30 A Hyperfast Rectifiers**




[VS-ETH3006SHM3](#)

- TO-263AB (D<sup>2</sup>PAK) power package optimized for fast battery charging systems and main inverter applications up to 20 kW

**INDUCTORS**

**EMI Filters with Flat Copper Wire as SMD or Leaded Up to 260 A**




[Customized EMI Filters](#)

- Customized solutions for 48 V applications, low DCR, high current

**FILM CAPACITORS**

**Metallized Polypropylene DC-Link Film Capacitors, 450 V<sub>DC</sub> to 1200 V<sub>DC</sub>**



[MKP1848](#)

- OBC and HEV inverter DC link
- High ripple current, capacitance up to 400 μF



## Key components for FULL ELECTRIC VEHICLES (FEVs)



**Electric Motor  
Drives (DC/AC)**



**Battery  
Management  
and DC/DC**



**On-Board  
Chargers**



### **THE VISHAY ADVANTAGE**

- AEC Qualifications
- High-Temperature Performance
- High Reliability
- New High-Voltage Passive Components in SMD Packages
- High-Voltage Semiconductors
- Transient-Voltage Capabilities



# Electric Motor Drives (DC/AC)



### CERAMIC CAPACITORS

**High Operating Temperature, Automotive Grade Leaded MLCC Capacitors**



[HOTcap® K...H, A...R, K...R](#)

- High-reliability MLCC insert with wet build process
- High operating temperature (up to 175 °C for K...H and up to 160 °C for A...R and K...R), rated voltages: 50 V, 100 V, 200 V

### NON-LINEAR RESISTORS

**NTC Thermistors, Low Thermal Gradient Lug Sensors**



[NTCALUG02A](#)

- Low thermal gradient surface temperature sensor
- High insulation voltage

### MODULES

**Trench FS IGBT Modules**



[VS-GC30C065TB](#)

- Optimized for use with FRED Pt® Gen 4 ultrafast diodes
- Low collector-to-emitter voltages, extremely low conduction losses

### RESISTORS

**Surface-Mount Molded Dividers, High-Voltage**



[CDMx](#)

- High voltage up to 3000 V, sulfur-resistant
- Automotive compliant terminations, wide range of resistance values and ratios

\*Preliminary

### INDUCTORS

**EMI Filters with Flat Copper Wire as SMD or Leaded Up to 260 A**



[Customized EMI Filters](#)

- Customized solutions for 48 V applications, low DCR, high current

### RESISTORS

**Wirebondable Gate Resistors for IGBT Applications**



[IGBR](#)

- Back-contact resistors for single wirebond assembly with power ratings up to 4 W
- Available case sizes from 0202 to 2010

### FILM CAPACITORS

**Metallized Polypropylene DC-Link Film Capacitors, 450 V<sub>DC</sub> to 1000 V<sub>DC</sub>**



[MKP1848S](#)

- OBC and HEV inverter DC link
- High ripple current and high capacitance up to 100 µF

### FILM CAPACITORS

**High Performance DC-Link Capacitors for Automotive Traction Applications (EV/HEV)**



[MKP1849](#)

- High voltage, high capacitance, high ripple current

### RECTIFIERS

**600 V, 30 A Hyperfast Rectifiers**



[VS-ETH3006SHM3](#)


- TO-263AB (D<sup>2</sup>PAK) power package optimized for fast battery charging systems and main inverter applications up to 20 kW

# Battery Management and DC/DC




**CERAMIC CAPACITORS**  
**X1/Y2 AC Line Rated Ceramic Disc Capacitors for Automotive Applications**  
  
[AY2](#)  

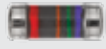
- AEC-Q200 qualified, X1/Y2 safety rating according to IEC 60384-14, 3rd edition
- Proven to withstand 3000 temperature cycles from -55 °C to +125 °C

**RESISTORS**  
**Long-Side Termination Thick Film Resistors, 250 mW to 2 W in 0406 to 1225 sizes, 1 Ω - 1 mΩ**  
  
[RCL e3](#)  

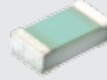
- Operating temperature up to 155 °C , TCR = 100 ppm/K to 200 ppm/K

**MOSFETs**  
**Dual N-Channel MOSFETs in 5 mm x 6 mm PowerPAK SO-8L, 40 V, 33 mΩ**  
  
[SQJ946EP](#)  


- AEC-Q101 qualified, 100 % UIS and RG tested with up to 175 °C operation
- Optimized for high-frequency DC/DC applications, lower switching losses

**RESISTORS**  
**High Pulse Load Carbon Film MELF Resistors, Pulse Handling Up to 3 kW, ESD Up to 16 kV**  
  
[CMB 0207](#)  


- 1.0 W rated dissipation in MELF 0207 package
- Resistance from 2.2 Ω to 1.5 MΩ

**RESISTORS**  
**Thin Film Chip Resistors, Resistance = 1 Ω to 10 mΩ, TCR = 25 ppm/K to 50 ppm/K**  
  
[MCT 0603 AT](#)  


- Tolerance = 0.5 % to 1 %
- Power rating 125 mW

**RESISTORS**  
**SMD Power Resistors, 35 W, 10 mΩ to 550 KΩ, Non-Inductive**  
  
[D2TO35](#)  


- TO-263 package, TCR = 150 ppm/K
- AEC-Q200 qualified

**DIODES**  
**400 W PAR® TVS Diodes, Voltage = 6.8 V to 43 V, T<sub>j</sub> = 185 °C**  
  
[TPSMA6.8](#)  


- DO-214AC (SMA) package to protect ICs, MOSFETs, and signal lines of sensor units against voltage transients induced by inductive load switching and lightning

**RESISTORS**  
**Power Metal Strip® Battery Shunt Resistors, Very Low Values (100 μΩ, 125 μΩ, and 250 μΩ)**  
  
[WSBS8518](#)  

- High power to resistor size ratio
- Low thermal EMF, < 3 μV / °C, for accurate current sensing

**NON-LINEAR RESISTORS**  
**NTC Thermistors, Mini Lug Sensors**  
  
[NTCALUG03](#)  

- Robust surface temperature sensors
- AEC-Q200 compliant, UL recognized

**DIODES**  
**500 mW Zener diodes in < 0.6 mm low-profile MicroSMF package**  
  
[PLZ Series Zener Diode](#)  

- Excellent stability for voltage stabilization and reference voltage generation
- AEC-Q101 qualified versions available





# On-Board Chargers




CERAMIC CAPACITORS  
**X1/Y2 AC Line Rated Ceramic Disc Capacitors for Automotive Applications**  
[AY2](#)  

- AEC-Q200 qualified, X1/Y2 safety rating according to IEC 60384-14, 3rd edition
- Proven to withstand 3000 temperature cycles from -55 °C to +125 °C



RESISTORS  
**Power Resistors, 100 W, 15 mΩ to 1 MΩ, Non-Inductive**  
[LTO100](#)  

- TO-247 package, TCR = 150 ppm/K
- AEC-Q200 qualified




RESISTORS  
**Wirebondable Gate Resistor for IGBT Applications**  
[IGBR](#)  

- Back-contact resistors for single wirebond assembly with power rating up to 4 W
- Available case sizes from 0202 to 2010




INDUCTORS  
**High Isolation as Press-Fit or SMD Version Flyback Transformers**  
[Customized Transformers](#)  

- Customized solutions up to kW ranges




RESISTORS  
**High Pulse Load Carbon Film MELF Resistors, Pulse Handling Up to 3 kW, ESD Up to 16 kV**  
[CMB 0207](#)  

- 1.0 W rated dissipation in MELF 0207 package
- Resistance from 2.2 Ω to 1.5 MΩ




RECTIFIERS  
**15 A, 1200 V FRED Pt® Hyperfast Rectifiers**  
[VS-15ETU12HN3](#)  

- AEC-Q101 qualified, hyperfast and soft recovery time with reduced  $Q_{rr}$  in TO-220AC package
- 175 °C maximum operating temperature




NON-LINEAR RESISTORS  
**NTCALUG, Custom Capabilities NTC LUG Ring Tongue**  
[NTCALUG](#)  

- Minimum breakdown voltages: 500 V<sub>AC</sub> Up to 3000 V<sub>AC</sub>




MODULES  
**Press-Fit Semiconductor Power Modules for IGBT or MOSFET Drives**  
[EMIPAK-1B / 2B](#)  

- 600 V to 650 V, or lower voltages upon customer request



RESISTORS  
**SMD Power Resistors, 35 W, 10 mΩ to 550 kΩ, Non-Inductive**  
[D2TO35](#)  


- TO-263 package, TCR = 150 ppm/K
- AEC-Q200 qualified



RESISTORS  
**Surface-Mount Molded Dividers, High-Voltage**  
[CDMx](#)  

- High voltage up to 3000 V, sulfur-resistant
- Automotive compliant terminations, wide range of resistance values and ratios

*\*Preliminary*




INDUCTORS  
**1 kW to 3 kW Standard Power Planar Transformers and Custom Power Planar Inductors**  
[Planar Series](#)  

- Planar and flat wire designs available for improved efficiency



FILM CAPACITORS  
**Interference Suppression Film Capacitors, MKP Radial Potted Type**  
[MKP339](#)  

- RFI X2 capacitor for standard across-the-line applications
- Automotive grade, AEC-Q200 compliant



# Spotlight on MELF Resistors

## The World's Most Reliable and Predictable High-Performance Film Resistors



For more than 25 years, Vishay's MELF resistors have successfully met the demanding requirements of the automotive industry. They offer superior SMD resistor performance in terms of accuracy, stability, reliability, and pulse load capability. The cylindrical construction of MELF devices provides an optimal power rating and pulse load capability relative to the mounting space. Continuous development has led to improved long-term stability and moisture resistance, and enables high-temperature operation to +175 °C.

### KEY PERFORMANCE BENEFITS:

- Predictable behavior of components
- Zero-defect philosophy
- Ideal for harsh operating environments
- Long-term stability
- Moisture resistance
- Operating voltage up to 1 kV for MM\_HV series
- Temperature cycling (up to 2000 cycles) in lead (Pb)-free assembly processes
- Insulation voltage up to 500 V

### APPROVALS

- EN 140401-803
- AEC-Q200

All products are completely lead (Pb)-free and comply with the Global Automotive Declarable Substances List (GADSL), which includes full compliance with the RoHS directive.

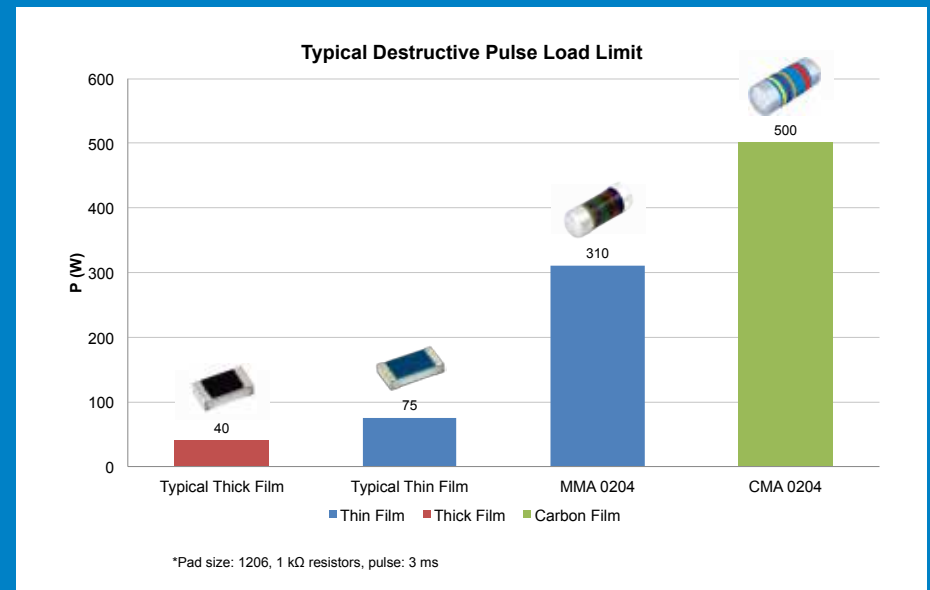
### TEMPERATURE COEFFICIENT, TOLERANCE, AND STABILITY

Resistor temperature coefficients down to  $\pm 5$  ppm/K are available, as well as tolerances down  $\pm 0.02$  %. Long-term stability results in a superior maximum resistance change ( $\Delta R/R$ ) of  $< \pm 0.05$  % after 8000 h operation for high-precision MELF resistors.

### PULSE LOAD CAPABILITY

Another aspect of MELF resistors is their reliability when exposed to various overload conditions. The metal film technology, together with the cylindrical construction of the MELF devices, provides an advantage compared to standard thick and thin film chip resistors in regard to pulse load capability. MELF resistors are also available in advanced carbon film technology, offering up to 6 kV ESD capability on the 1206 pad size, or 10 kV surge handling on the 2512 pad size. As shown in the diagram below, thick film flat chip resistors fail at much lower pulse loads than thin film flat chips, and both types are outperformed by thin film and carbon film MELF resistors.

For technical questions, contact: [melf@vishay.com](mailto:melf@vishay.com)









Vishay Intertechnology, Inc.



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