



Vishay Intertechnology, Inc.

# *Automotive / Transportation*



One of the World's Largest Manufacturers of  
**Discrete Semiconductors and Passive Components**



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For inquiries, please contact your local sales representative.



# Key components for POWERTRAIN – 12 V / 24 V



**Engine Cooling**



**Exhaust Emission Control System**



**Heating, Ventilation, Air Conditioning (HVAC)**



## **THE VISHAY ADVANTAGE**

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



## Engine Cooling



### ALUMINUM CAPACITORS

**Advanced Temperature Range Up to 150 °C**

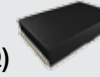


**160 CLA**

- High ripple current: up to 1.4 A at 150 °C / 100 kHz
- Useful life up to 2000 h at 150 °C

### RESISTORS

**Power Metal Strip® SMD Resistors, High Power (7 W) Low Value (Down to 0.001 Ω)**



**WSHM2818**

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

### 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

### CERAMIC CAPACITORS

**Radial Leaded Multilayer Ceramic Capacitors for Automotive Applications**



**K...V**

- High-reliability MLCC insert with wet build process
- High operating temperature up to 160 °C, rated voltages: 50 V, 100 V, and 200 V

### RECTIFIERS

**High Barrier Technology for Improved High-Temperature Performance**

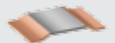


**MBRB25H45CT**

- Halogen-free according to IEC 61249-2-21 definition and AEC-Q101 qualified
- Low leakage current

### RESISTORS

**Power Metal Strip® SMD Resistors, Very High Power (to 9 W), Low Value (Down to 0.0002 Ω)**



**WSLP3921**

- High power rating of 5 W to 9 W in WSLP3921 package
- Very low resistance values, 0.0002 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

### CERAMIC CAPACITORS

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages C0G (NP0), X7R, and X8R**



**VJ...31/VJ...34 Automotive MLCC**

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

### NON-LINEAR RESISTORS

**NTC Thermistors, Radial Leaded, Accuracy Line**



**NTCLE203...**

- Accurate over a wide temperature range (tolerance on B-value down to 0.5 %)
- Low heat conductive wiring



# Exhaust Emission Control System



MOSFETs

**Automotive N-Channel 60 V (D-S) 175 °C MOSFET**



**SQJ858AEP**

- TrenchFET® Gen III technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  6.3 mΩ
- Thermally enhanced PowerPAK® SO-8L packaging

RESISTORS

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



**WSLT2010...18**

- High temp. for harsh environments; resistance values down to 0.01 Ω
- Power Metal Strip construction offers high reliability in critical applications

RECTIFIERS

**High Current Density Surface-Mount Schottky Rectifier**



**SS3P4**

- AEC-Q101 qualified
- Very low profile – typical height of 1.1 mm

RESISTORS

**Precision Automotive High Temperature (155 °C at Full Rated Power) Thin Film Chip Resistor**



**PATT**

- Wide resis. range of 1 Ω to 1 MΩ; tol. as low as ± 0.1% and 25 ppm/°C TCR
- Load-life stability of < 0.2 % at 155 °C and full rated power for 1000 hours

DIODES

**Surface-Mount PAR® Transient Voltage Suppressors for Automotive Load Dump Application**



**SM8S10**

- AEC-Q101 qualified
- Meets ISO7637-2 surge specification (varied by test condition)

NON-LINEAR RESISTORS

**NTC Thermistor for High-Temperature Applications**



**NTCV101...**

- Wide temperature range from -40 °C to +900 °C
- Small body diameter of maximum 2 mm

CERAMIC CAPACITORS

**AEC-Q200 Qualified Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R**



**VJ...31/VJ...34 Automotive MLCC**

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

NON-LINEAR RESISTORS

**Platinum SMD Flat Chip Temperature Sensor**






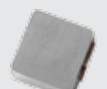


**PTS...AT**

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

View datasheets for these products  
[www.vishay.com/ref/et3au1b](http://www.vishay.com/ref/et3au1b)



# Heating, Ventilation, Air Conditioning (HVAC)

<p>RESISTORS</p> <p><b>Precision Thin Film Chip Resistor Array, Superior Moisture Resistivity</b></p>  <p><b>ACAS0606 AT</b></p> <ul style="list-style-type: none"> <li>Arbitrary resistance ratio up to 1:20, superior tracking stability over lifetime</li> <li>Relative TCR down to <math>\pm 5</math> ppm/K (tracking), AEC-Q200 qualified, sulfur resistant</li> </ul>	<p>MOSFETs</p> <p><b>Automotive N-Channel 40 V (D-S) 175 °C MOSFET</b></p>  <p><b>SQJ422EP</b></p> <ul style="list-style-type: none"> <li>TrenchFET® Gen III technology, AEC-Q101 qualified, maximum <math>R_{DS(on)}</math> 3.4 m<math>\Omega</math></li> <li>Thermally enhanced PowerPAK® SO-8L packaging</li> </ul>	<p>RESISTORS</p> <p><b>Power Metal Strip® SMD Resistors, Very High Power (to 9 W), Low Value (Down to 0.0002 <math>\Omega</math>)</b></p>  <p><b>WSLP3921</b></p> <ul style="list-style-type: none"> <li>High power rating of 5 W to 9 W in WSLP3921 package</li> <li>Very low resistance values, 0.0002 <math>\Omega</math> to 0.004 <math>\Omega</math>, with tolerance of 1 %</li> </ul>
<p>RECTIFIERS</p> <p><b>High Current Density Surface-Mount Trench MOS Barrier Schottky Rectifier</b></p>  <p><b>V15P45HM3</b></p> <ul style="list-style-type: none"> <li>Very low profile – typical height of 1.1 mm</li> <li>Trench MOS Schottky technology</li> </ul>	<p>FILM CAPACITORS</p> <p><b>DC Film Capacitors MKT Radial Potted Type</b></p>  <p><b>MKT370</b></p> <ul style="list-style-type: none"> <li>General purpose MKT pitch 5 mm / 7.5 mm and 10 mm</li> </ul>	<p>OPTOELECTRONICS</p> <p><b>Transmissive Sensor as Optical Potentiometer (Climate Control) with Phototransistor Output</b></p>  <p><b>TCUT1350X01</b></p> <ul style="list-style-type: none"> <li>Resolve direction and speed with dual channel transmissive (interrupter) sensor</li> <li>Wide operating temperature range from -40 °C to +125 °C</li> </ul>
<p>INDUCTORS</p> <p><b>Low-Profile, High-Current IHLP® Inductors</b></p>  <p><b>IHLP-5050FD-5A</b></p> <ul style="list-style-type: none"> <li>High current, low DCR, low saturation for excellent noise suppression</li> </ul>	<p>DIODES</p> <p><b>Surface-Mount PAR® Transient Voltage Suppressors for Automotive Load Dump Application</b></p>  <p><b>SMxS24A</b></p> <ul style="list-style-type: none"> <li>AEC-Q101 qualified</li> <li>Meets ISO7637-2 surge specification (varied by test condition)</li> </ul>	<p>CERAMIC CAPACITORS</p> <p><b>AEC-Q200 Qualified Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R</b></p>  <p><b>VJ...31/VJ...34 Automotive MLCC</b></p> <ul style="list-style-type: none"> <li>RoHS and GREEN compliant parts available</li> <li>AgPd termination available for epoxy bonding</li> </ul>
<p>FUSES</p> <p><b>High Current Thermal Fuse</b></p>  <p><b>HCTF235</b></p> <ul style="list-style-type: none"> <li>Functioning temperature: <math>\vartheta_F = (235 \pm 15) ^\circ\text{C}</math></li> <li>Current: <math>\leq 55</math> A</li> </ul>	<p>NON-LINEAR RESISTORS</p> <p><b>SMD, Glass Protected NTC Thermistors</b></p>  <p><b>NTCS...e3</b></p> <ul style="list-style-type: none"> <li>Standard series, AEC-Q200 compliant</li> <li>Glass protected with soft terminations</li> </ul>	<p>ALUMINUM CAPACITORS</p> <p><b>Aluminum Capacitors SMD (Chip), High Temperature, Low Impedance</b></p>  <p><b>146 CTI</b></p> <ul style="list-style-type: none"> <li>High temperature up to 125 °C, long life, low impedance, high ripple current</li> <li>Soldering according JEDEC-J-STD-020</li> </ul>

View datasheets for these products  
[www.vishay.com/ref/et3au1c](http://www.vishay.com/ref/et3au1c)



# Key components for POWERTRAIN – INJECTION CONTROL AND FUEL PUMP



**Direct Injector  
Control (Solenoid)**



**Piezo Injection  
Control**



**Fuel Pump  
Control**



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

## Direct Injector Control (Solenoid)


**ALUMINUM CAPACITORS**

**Advanced Temperature Range Up to 150 °C**

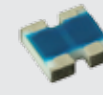


**160 CLA**

- High ripple current: up to 1.4 A at 150 °C / 100 kHz
- Useful life up to 2000 h at 150 °C

**RESISTORS**

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



**ACAS...AT**

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

**MOSFETs**

**Automotive Dual N-Channel 75 V (D-S) 175 °C MOSFET**



**SQJ986EP**

- Medium-voltage ThunderFET® technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  21 m $\Omega$
- Thermally enhanced PowerPAK® SO-8L packaging

**INDUCTORS**

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



**IHLP-2525CZ-5A**

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

**RECTIFIERS**

**Ultrafast Rectifier, 1 A FRED Pt®**



**1EFH02W**

- AEC-Q101 qualified, meets JESD 201 class 2 whisker test
- Ultrafast recovery time, reduced  $Q_{rr}$  and soft recovery with  $T_j$  maximum 175 °C

**RESISTORS**

**Power Metal Strip® SMD Resistors, Very High Power (0.5 W), Low Value (Down to 0.005  $\Omega$ )**



**WSLP0805**

- Very high power rating of 0.5 W in small 0805 package
- All-welded construction offers high pulse capacity

**MOSFETs**

**Automotive N-Channel 100 V (D-S) 175 °C MOSFET**



**SQJ488EP**

- 100 % UIS tested
- Thermally enhanced PowerPAK SO-8L packaging

**RECTIFIERS**

**Ultrafast Rectifier, 3 A FRED Pt®**



**3EJH02**

- Ultrafast recovery time, reduced  $Q_{rr}$  and soft recovery

**TANTALUM CAPACITORS**

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



**TP3**

- High-performance molded tantalum capacitor, AEC-Q200 qualified
- Applications: motor control, body electronics, dash board

## Piezo Injection Control


**RESISTORS**
**Professional High-Temperature MINI-MELF Resistor**

**MMA0204...HT**

- Operating temperature of 175 °C, power handling of 500 mW, high surge capability
- AEC-Q200 qualified, high overall stability < 0.1 %, sulfur resistant

**MOSFETs**
**Automotive N-Channel 300 V (D-S) 175 °C MOSFET**

**SQD10N30-330H**

- Classic TrenchFET® technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  330 m $\Omega$
- Popular DPAK packaging

**CERAMIC CAPACITORS**
**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R**

**VJ...31/VJ...34 Automotive MLCC**

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

**RECTIFIERS**
**Ultrafast Rectifier, 6 A FRED Pt®**

**6ESU06**

- AEC-Q101 qualified, meets JESD 201 class 2 whisker test
- Ultrafast recovery time, reduced  $Q_{rr}$  and soft recovery with  $T_j$  maximum 175 °C

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

**IHLP-2525CZ-5A**

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

**NON-LINEAR RESISTORS**
**SMD, Glass Protected NTC Thermistors**

**NTCS...e3**

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

**FILM CAPACITORS**
**DC Film Capacitors, MKT Radial Potted Type**

**MKT1820**

- Automotive general purpose MKT capacitor, with high-temperature capabilities
- Featuring capacitance up to 560  $\mu$ F

**RESISTORS**
**Power Metal Strip® SMD Resistors, Very High Power (to 9 W), Low Value (Down to 0.0002  $\Omega$ )**

**WSLP3921**

- Very low resistance values from 0.0002  $\Omega$  to 0.004  $\Omega$ , with tolerance of 1 %

**ALUMINUM CAPACITORS**
**Radial Miniature, High Voltage 250 V<sub>DC</sub> to 270 V<sub>DC</sub> with C<sub>R</sub> up to 220  $\mu$ F**

**152 RMH**

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

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

**IHLP-5050FD-5A**

- Excellent high-temperature performance and noise filtering

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

**RCWE**


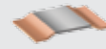
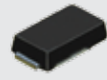
- Low resistance values from 0.01  $\Omega$  to 0.976  $\Omega$  and tolerance of 1 %
- Thick film construction with 2x power capacity

View datasheets for these products  
[www.vishay.com/ref/et3au2b](http://www.vishay.com/ref/et3au2b)



# Fuel Pump Control



<p>MOSFETs</p> <p><b>Automotive N-Channel 40 V (D-S) 175 °C MOSFET</b></p> <p><b>SQJ422EP</b></p> <ul style="list-style-type: none"> <li>• TrenchFET® Gen III technology, AEC-Q101 qualified, maximum <math>R_{DS(on)}</math> 3.4 mΩ</li> <li>• Thermally enhanced PowerPAK® SO-8L packaging</li> </ul> 	<p>CERAMIC CAPACITORS</p> <p><b>Radial Leaded Multilayer Ceramic Capacitors for Automotive Applications</b></p> <p><b>K...V</b></p> <ul style="list-style-type: none"> <li>• High-reliability MLCC insert with wet build process</li> <li>• High operating temp. up to 160 °C, rated voltages: 50 V, 100 V, and 200 V</li> </ul> 	<p>RECTIFIERS</p> <p><b>HEXFRED® Ultrafast Soft Recovery Diode, 30 A</b></p> <p><b>HFA30PB120PbF</b></p> <ul style="list-style-type: none"> <li>• Very low <math>I_{RRM}</math> and <math>Q_{rr}</math></li> <li>• Ultrafast and ultrasoft recovery</li> </ul> 
<p>RESISTORS</p> <p><b>Power Metal Strip® SMD Resistors, Very High Power (to 9 W), Low Value (Down to 0.0002 Ω)</b></p> <p><b>WSLP3921</b></p> <ul style="list-style-type: none"> <li>• High power rating of 5 W to 9 W in WSLP3921 package</li> <li>• Very low resistance values from 0.0002 Ω to 0.004 Ω, with tolerance of 1 %</li> </ul> 	<p>RECTIFIERS</p> <p><b>High Current Density Surface-Mount Schottky Rectifiers</b></p> <p><b>SS3P4HM3</b></p> <ul style="list-style-type: none"> <li>• AEC-Q101 qualified</li> <li>• Very low profile – typical height of 1.0 mm</li> </ul> 	<p>NON-LINEAR RESISTORS</p> <p><b>SMD 0603, Glass Protected NTC Thermistors</b></p> <p><b>NTCS0603E3...T</b></p> <ul style="list-style-type: none"> <li>• Standard series, AEC-Q200 compliant</li> <li>• Glass protected with soft terminations</li> </ul> 
<p>DIODES</p> <p><b>Surface-Mount PAR® Transient Voltage Suppressors</b></p> <p><b>SM8S24A</b></p> <ul style="list-style-type: none"> <li>• AEC-Q101 qualified</li> <li>• Meets ISO7637-2 surge specification (varied by test condition)</li> </ul> 	<p>CERAMIC CAPACITORS</p> <p><b>AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R</b></p> <p><b>VJ....31/VJ....34 Automotive MLCC</b></p> <ul style="list-style-type: none"> <li>• RoHS and GREEN compliant parts available</li> <li>• AgPd termination available for epoxy bonding</li> </ul> 	<p>RECTIFIERS</p> <p><b>Ultrafast Rectifier, 3 A FRED Pt®</b></p> <p><b>3EJH02</b></p> <ul style="list-style-type: none"> <li>• Ultrafast recovery time, reduced <math>Q_{rr}</math> and soft recovery</li> <li>• 175 °C maximum operating junction temperature and halogen-free</li> </ul> 
<p>INDUCTORS</p> <p><b>Low-Profile, High-Current IHLP® Inductors</b></p> <p><b>IHLP-4040DZ-5A</b></p> <ul style="list-style-type: none"> <li>• Excellent high-temperature performance and noise filtering</li> </ul> 	<p>RECTIFIERS</p> <p><b>Ultrafast Rectifier, 1 A FRED Pt®</b></p> <p><b>1EFH02W</b></p> <ul style="list-style-type: none"> <li>• AEC-Q101 qualified, meets JESD 201 class 2 whisker test</li> <li>• Ultrafast recovery time, reduced <math>Q_{rr}</math> and soft recovery with <math>T_j</math> maximum 175 °C</li> </ul> 	<p>RESISTORS</p> <p><b>Power Metal Strip® SMD Resistors, Very High Power (3 W), Low Value (to 0.0005 Ω)</b></p> <p><b>WSLP2512</b></p> <ul style="list-style-type: none"> <li>• Very high power rating of 3 W in 2512 package</li> <li>• Extremely low resistance values from 0.0005 Ω to 0.01 Ω and tolerance of 1 %</li> </ul> 

View datasheets for these products  
[www.vishay.com/ref/et3au2c](http://www.vishay.com/ref/et3au2c)

# Key components for CHASSIS CONTROL



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



**Brake and Active Safety Control**



**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)





**RESISTORS**  
**High-Stability Thin Film Flat Chip Resistors**   
**TNPW e3**  
 • Excellent overall stability, endurance < 0.05 %, resistance range from 10 Ω to 3 MΩ  
 • AEC-Q200 qualified, sulfur resistant, halogen-free


**MOSFETs**  
**Automotive N-Channel 40 V (D-S) 175 °C MOSFET**   
**SQM200N04-1m1L**  
 • TrenchFET® Gen III technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  1.1 mΩ  
 • 7-lead D<sup>2</sup>PAK packaging


**ALUMINUM CAPACITORS**  
**Advanced Temperature Range up to 150 °C**   
**160 CLA**  
 • High ripple current: up to 1.4 A at 150 °C / 100 kHz  
 • Useful life up to 2000 h at 150 °C


**RECTIFIERS**  
**High Current Density Surface-Mount Trench MOS Barrier Schottky Rectifier**   
**V15P45HM3**  
 • Trench MOS Schottky technology  
 • AEC-Q101 qualified

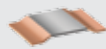
**NON-LINEAR RESISTORS**  
**SMD 0603, Glass Protected NTC Thermistors**   
**NTCS0603E3....T**  
 • Standard series, AEC-Q200 compliant  
 • Glass protected with soft terminations

**DIODES**  
**Surface-Mount PAR® Transient Voltage Suppressors**   
**SM8S24A**  
 • AEC-Q101 qualified  
 • Meets ISO7637-2 surge specification (varied by test condition)


**INDUCTORS**  
**Low-Profile, High-Current IHLP® Inductors**   
**IHLP-6767GZ-5A**  
 • Excellent high-current, low-saturation performance for noise filters  
*Customized high-current ferrite filters available*

**OPTOELECTRONICS**  
**Subminiature Dual-Channel Transmissive Optical Sensor with Phototransistor Outputs**   
**TCUT1350X01**  
 • Resolve direction and speed with dual-channel transmissive (interrupter) sensor  
 • Wide operating temperature range from -40 °C to +125 °C

**CERAMIC CAPACITORS**  
**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R**   
**VJ....31/VJ....34 Automotive MLCC**  
 • RoHS and GREEN compliant parts available  
 • AgPd termination available for epoxy bonding

**RESISTORS**  
**Power Metal Strip® SMD Resistors, Very High Power (to 9 W), Low Value (Down to 0.0002 Ω)**   
**WSLP3921**  
 • High power rating of 5 W to 9 W in WSLP3921 package  
 • Very low resistance values from 0.0002 Ω to 0.004 Ω, with tolerance of 1 %

**FILM CAPACITORS**  
**DC Film Capacitors, MKT Radial Potted Type**   
**MKT1820**  
 • Automotive general purpose MKT capacitor, with high-temperature capabilities  
 • Featuring capacitance up to 560 μF

**INDUCTORS**  
**Low-Profile, High-Current IHLP® Inductors**   
**IHLP-8787MZ-5A**  
 • Highest current composite inductor available  
 • High temperature up to 155 °C, shielded construction

View datasheets for these products [www.vishay.com/ref/et3au3a](http://www.vishay.com/ref/et3au3a)






# Brake and Active Safety Control



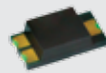
MOSFETs  
**Automotive N-Channel 40 V (D-S) 175 °C MOSFET**  
**SQJ422EP**  
 • TrenchFET® Gen III technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  3.4 mΩ  
 • Thermally enhanced PowerPAK® SO-8L packaging



ALUMINUM CAPACITORS  
**Advanced Temperature Range Up to 150 °C**  
**160 CLA**  
 • High ripple current: up to 1.4 A at 150 °C / 100 kHz  
 • Useful life up to 2000 h at 150 °C




OPTOELECTRONICS  
**Miniature PIN Photodiode with Widest Operating Temperature Range up to 110 °C**  
**VEMD6110X01**  
 • SMD photo-pin-diode in 1206 package with active chip area of 0.85 mm<sup>2</sup>  
 • Daylight blocking filter for infrared light sensing applications




RESISTORS  
**Professional Thin Film MELF Resistors**  
**MMA0204**  
 • Unrivalled surge handling capability, ultimate stability over lifetime  
 • AEC-Q200 qualified, approved acc. EN 140401-803, sulfur resistant, GREEN product




RESISTORS  
**Pulse-Proof, High-Power Thick Film Chip Resistors**  
**CRCW...HP e3**  
 • Excellent pulse load capability  
 • Enhanced power rating




DIODES  
**Surface-Mount PAR® Transient Voltage Suppressors**  
**SM8S24A**  
 • AEC-Q101 qualified  
 • Meets ISO7637-2 surge specification (varied by test condition)




INDUCTORS  
**Low-Profile, High-Current IHLP® Inductors**  
**IHLP-6767GZ-5A**  
 • Excellent high-current, low-saturation performance for noise filters and DC/DC converters



RESISTORS  
**Power Metal Strip® SMD Resistors, Very High Power (1 W), Low Value (to 0.001 Ω)**  
**WSLP1206**  
 • Very high power rating of 1 W in small 1206 package  
 • Power Metal Strip construction offers high reliability in critical applications



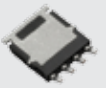
RECTIFIERS  
**Low-Voltage Trench MOS Barrier Schottky Rectifier**  
**V30DL45-M3**  
 • Very low profile – typical height of 1.7 mm  
 • AEC-Q101 qualified



NON-LINEAR RESISTORS  
**Platinum SMD Flat Chip Temperature Sensor**  
**PTS...AT**  
 • Standardized characteristics according to IEC 60751  
 • Short reaction times down to 2 s (in air)



MOSFETs  
**Automotive N-Channel 40 V (D-S) 175 °C MOSFET**  
**SQJ858AEP**  
 • TrenchFET® Gen III technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  6.3 mΩ  
 • Thermally enhanced PowerPAK® SO-8L packaging



TANTALUM CAPACITORS  
**Solid Tantalum Surface-Mount Chip Capacitors, TANTAMOUNT® Molded Case, Automotive Grade**  
**TH4**  
 • High-temperature molded tantalum capacitor, HI TMP® up to 175 °C  
 • Applications: filtering, decoupling, LDO-regulators, braking systems



View datasheets for these products [www.vishay.com/ref/et3au3b](http://www.vishay.com/ref/et3au3b)



# Transmission ECU, Double Clutch BLDC



**RESISTORS**

**Power Metal Strip® Resistors, High-Power, Surface-Mount, 4-Terminal**




**WSK0612**

- High power of 1 W in small 0612 package size with 4-terminal construction
- Power Metal Strip construction offers high reliability in critical applications

**OPTOELECTRONICS**

**Single-Channel Transmissive Optical Sensor with Phototransistor Output**




**TCPT1300X01**

- Position sensor for submillimeter encoding
- -40 °C to +105 °C operating temperature range

**NON-LINEAR RESISTORS**

**SMD 0805, Glass Protected NTC Thermistors**



**NTCS0805E3....T**

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

**MOSFETs**

**Automotive N-Channel 40 V (D-S) 175 °C MOSFET**




**SQJ412EP**

- Classic TrenchFET® technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  4.1 mΩ
- Thermally enhanced PowerPAK® SO-8L packaging

**INDUCTORS**

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




**IHLP-2525CZ-5A**

- High-temperature DC/DC converter performance with silver / epoxy bond compatibility

**DIODES**

**Surface-Mount PAR® Transient Voltage Suppressors for Automotive Load Dump Applications**



**SMxS24A**

- AEC-Q101 qualified
- Meets ISO7637-2 surge specification (varied by test condition)

**RESISTORS**

**Power Metal Strip SMD Resistors, Wide Terminal, Low Value (0.003 Ω to 0.006 Ω)**




**WSL1020**

- Reverse geometry allows for 2 W power rating in small 1020 size
- Construction offers high reliability in critical applications

**RECTIFIERS**

**Ultrafast Rectifier, 1 A FRED Pt®**



**1EFH02W**

- AEC-Q101 qualified, meets JESD 201 class 2 whisker test
- Ultrafast recovery time, reduced  $Q_{rr}$  and soft recovery with  $T_j$  maximum 175 °C

**TANTALUM CAPACITORS**

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




**TH4**

- High-temperature molded tantalum capacitor, HI TMP® up to 175 °C
- Applications: filtering, decoupling, LDO-regulators, braking systems

**MOSFETs**

**Automotive N-Channel 40 V (D-S) 175 °C MOSFET**




**SQJ422EP**

- TrenchFET® Gen III technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  3.4 mΩ
- Thermally enhanced PowerPAK® SO-8L packaging

**CERAMIC CAPACITORS**

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R**



**VJ....31/VJ....34 Automotive MLCC**

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

**MOSFETs**

**Automotive N-Channel 40 V Bare Die MOSFET**



**SQC200N04-1m7KGD**

- TrenchFET® Gen III technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  1.7 mΩ
- Supplied in bare die form in tape and reel

View datasheets for these products  
[www.vishay.com/ref/et3au3c](http://www.vishay.com/ref/et3au3c)

## 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**  
**Automotive N-Channel 40 V (D-S) 175 °C MOSFET**   
**SQJ858AEP**  
 • TrenchFET® Gen III technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  6.3 mΩ  
 • Thermally enhanced PowerPAK® SO-8L packaging


**RESISTORS**  
**Pulse-Proof, High-Power Thick Film Chip Resistors**   
**CRCW...HP e3**  
 • Excellent pulse load capability  
 • Enhanced power rating

**RECTIFIERS**  
**High Current Density Surface-Mount Schottky Barrier Rectifiers**   
**SS3P4L**  
 • AEC-Q101 qualified  
 • Very low profile – typical height of 1.0 mm


**RESISTORS**  
**Thick Film Surface-Mount Chip Resistors, Wraparound and 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

**DIODES**  
**Surface-Mount PAR® Transient Voltage Suppressors for Automotive Load Dump Applications**   
**SMxS24A**  
 • AEC-Q101 qualified  
 • Meets ISO7637-2 surge specification (varied by test condition)


**INDUCTORS**  
**Low-Profile, High-Current IHLP® Inductors**   
**IHLP-4040DZ-5A**  
 • Excellent high-current performance for noise filters


**OPTOELECTRONICS**  
**Subminiature Dual-Channel Transmissive Optical Sensor with Phototransistor Outputs**   
**TCUT1350X01**  
 • Resolve direction and speed with dual-channel transmissive (interrupter) sensor  
 • Wide operating temperature range from -40 °C to +125 °C

**TANTALUM CAPACITORS**  
**Solid Tantalum Chip Capacitors, High CV Leadframeless Molded, Automotive Grade**   
**TP8**  
 • Smallest AEC-Q200-qualified tantalum capacitor with case sizes as small as 0603  
 • Perfect for space-constrained designs

**MOSFETs**  
**Automotive Dual N-Channel 40 V (D-S) 175 °C MOSFET**   
**SQJ912AEP**  
 • TrenchFET® Gen III technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  9.3 mΩ  
 • Thermally enhanced PowerPAK® SO-8L packaging

**RESISTORS**  
**Precision Thin Film Chip Resistor Array, Superior Moisture Resistivity**   
**ACAS0606 AT**  
 • Arbitrary resistance ratio up to 1:20, superior tracking stability over lifetime  
 • Relative TCR down to ± 5 ppm/K (tracking), AEC-Q200 qualified, sulfur resistant

**OPTOELECTRONICS**  
**Ambient Light Sensor with High-Speed and High-Sensitivity PIN Photodiode Output**   
**TEMD6200FX01**  
 • Wavelength of peak sensitivity of 550 nm; similar to human eye sensitivity  
 • Excellent linearity over operating temperature range of -40 °C to +100 °C

**NON-LINEAR RESISTORS**  
**SMD 0603, Glass Protected NTC Thermistors**   
**NTCS6030E3...T**  
 • Standard series, AEC-Q200 compliant  
 • Glass protected with soft terminations

View datasheets for these products  
[www.vishay.com/ref/et3au4a](http://www.vishay.com/ref/et3au4a)



# Infotainment, Navigation, Audio



TANTALUM CAPACITORS

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




TP8

- Smallest AEC-Q200-qualified tantalum capacitor with case sizes as small as 0603
- Perfect for space-constrained designs

DIODES

**Surface-Mount PAR® Transient Voltage Suppressors for Automotive Load Dump Applications**




SMxS24A

- AEC-Q101 qualified
- Meets ISO7637-2 surge specification (varied by test condition)

RESISTORS

**Thick Film Surface-Mount Chip Resistors, Wraparound and 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

RECTIFIERS

**Surface-Mount Schottky Barrier Rectifiers**




MSS1P4

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

NON-LINEAR RESISTORS

**SMD 0603, Glass Protected NTC Thermistors**




NTCS6030E3...T

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

OPTOELECTRONICS

**Amber, Red, and Yellow LED in a PLCC-2 Plus Package with High Luminous Intensity**




VLMK51Z1AA

- Amber color has wavelength of 610 nm to 621 nm
- Compact package 3.5 mm x 3.5 mm x 1.2 mm

INDUCTORS

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



IHLP-4040DZ-5A

- High current, low DCR, low saturation for excellent noise suppression
- High temperature up to 155 °C, shielded construction

RESISTORS

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




ACAS0606 AT

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

MOSFETS

**Automotive Dual N-Channel 40 V (D-S) 175 °C MOSFETs**



SQJ942EP

- TrenchFET® Gen III technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  11 mΩ
- Thermally enhanced PowerPAK® SO-8L packaging

INDUCTORS

**Dual Inductor Using IHLP® High-Temperature (155 °C) Automotive Grade Part**




IHLD-4032KB-5A

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

ALUMINUM CAPACITORS

**Aluminum Capacitors SMD (Chip), High-Temperature, Low Impedance**

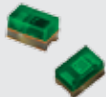


146 CTI

- High temperature up to 125 °C, long life, low impedance, high ripple current
- Soldering according to JEDEC-J-STD-020

OPTOELECTRONICS

**Ambient Light Sensor in Miniature 0805 Package with Phototransistor Output**



TEMT6200FX01


- Wavelength of peak sensitivity of 550 nm; similar to human eye sensitivity
- Excellent linearity over operating temperature range of -40 °C to +100 °C

View datasheets for these products  
[www.vishay.com/ref/et3au4b](http://www.vishay.com/ref/et3au4b)

# Interior LED Lighting




**DIODES**

**Surface-Mount PAR® Transient Voltage Suppressors** 

**TPSMB**

- AEC-Q101 qualified,  $T_j = 185\text{ }^\circ\text{C}$  capability suitable for automotive requirement
- 600 W peak pulse power capability with a 10/1000  $\mu\text{s}$  waveform

**CERAMIC CAPACITORS**

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R** 

**VJ...31/VJ...34 Automotive MLCC**

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


**MOSFETs**

**Automotive N-Channel 30 V (D-S) 175 °C MOSFET** 

**SQS482EN**

- Classic TrenchFET® technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  8.5 m $\Omega$
- Thermally enhanced PowerPAK® 1212-8 is 1/3 the size of an SO-8


**NON-LINEAR RESISTORS**

**SMD 0603, Glass Protected NTC Thermistors** 

**NTCS6030E3...T**

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


**RESISTORS**

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

**WSLP**

- Very high power rating to 3 W in WSLP0603 to WSLP2512 size packages
- Extremely low resistance values from 0.0005  $\Omega$  to 0.1  $\Omega$  and tolerance of 1 %


**RECTIFIERS**

**Surface-Mount Schottky Barrier Rectifiers** 

**MSS1P4**

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


**RESISTORS**

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

**CRCW...HP e3**

- Excellent pulse load capability
- Enhanced power rating


**MOSFETs**

**Automotive N-Channel 40 V (D-S) 175 °C MOSFET** 

**SQS840EN**

- Classic TrenchFET technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  16.6 m $\Omega$
- Thermally enhanced PowerPAK 1212-8 is 1/3 the size of an SO-8


**OPTOELECTRONICS**

**Little Star® 1 W Power SMD LED** 

**VLMK71ABAD**

- Red, amber, and yellow colors with luminous intensity up to 18 000 mcd
- Amber color has wavelength of 610 nm to 621 nm


**INDUCTORS**

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

**IHLP-2525CZ-5A**

- Compact size and high current, low saturation for noise filtering

**DIODES**

**Surface-Mount PAR® Transient Voltage Suppressors** 

**TPSMA**

- AEC-Q101 qualified,  $T_j = 185\text{ }^\circ\text{C}$  capability suitable for automotive requirement
- 400 W peak pulse power capability with a 10/1000  $\mu\text{s}$  waveform

**TANTALUM CAPACITORS**

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

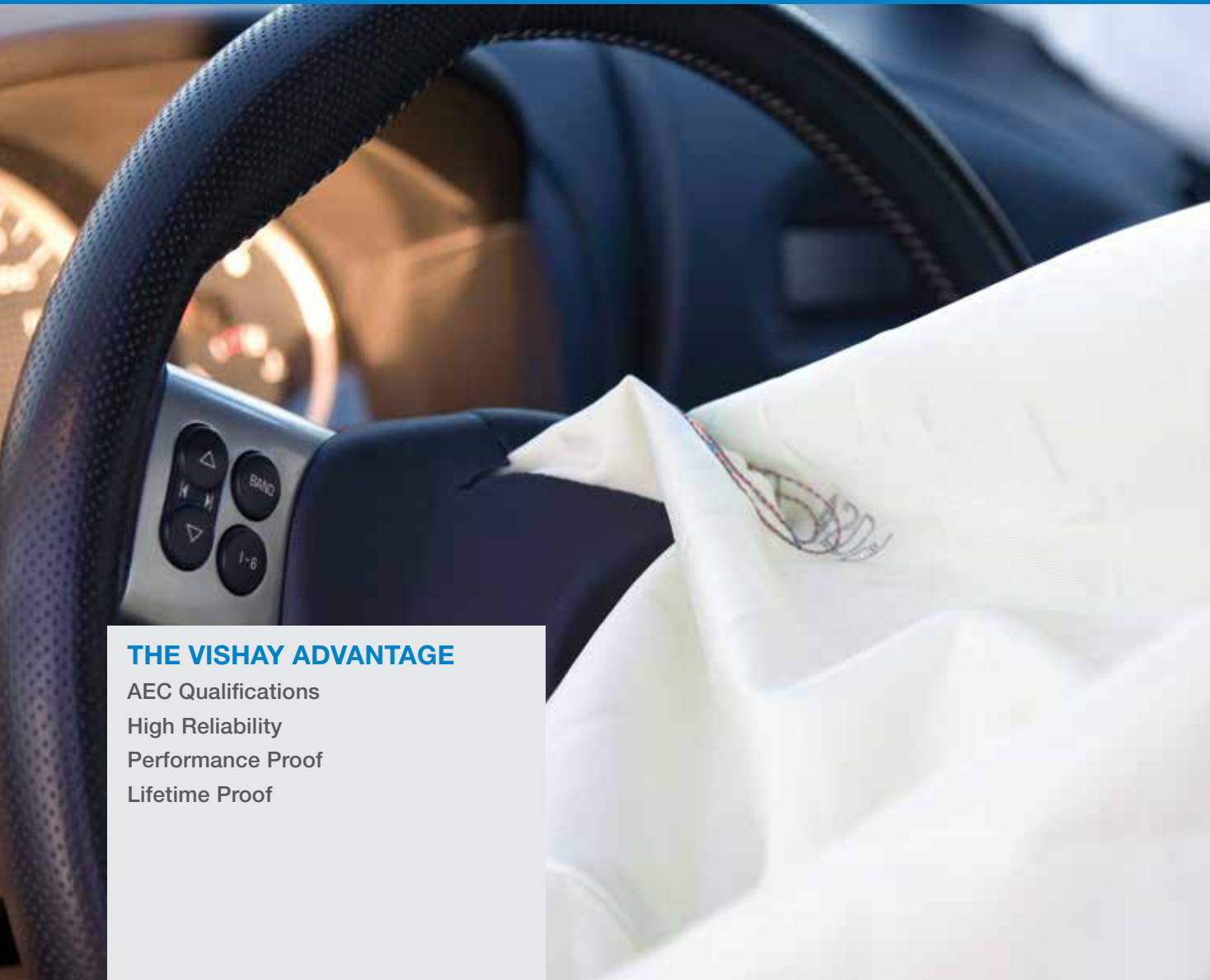
**TP8**

- Smallest AEC-Q200-qualified tantalum capacitor with case sizes as small as 0603
- Perfect for space-constrained designs

View datasheets for these products  
[www.vishay.com/ref/et3au4c](http://www.vishay.com/ref/et3au4c)



# Key components for PASSIVE SAFETY



**Airbag Control Systems**



**Restraint System Power Supplies**



**Pedestrian Protection Systems**



## **THE VISHAY ADVANTAGE**


- AEC Qualifications
- High Reliability
- Performance Proof
- Lifetime Proof



# Airbag Control Systems



RESISTORS

**Lead (Pb)-Bearing High-Stability Thin Film Chip Resistors** 

**TNPW**

- Excellent overall stability, endurance < 0.05 %, resistance range from 10 Ω to 3 MΩ
- SnPb plating with Pb content > 6 %, TCR down to 10 ppm/K, tol. down to 0.1 %


MOSFETs

**Automotive Dual N-Channel 40 V (D-S) 175 °C MOSFET** 

**SQ4284EY**

- Classic TrenchFET® technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  13.5 mΩ
- Popular SO-8 packaging


CERAMIC CAPACITORS

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R** 

**VJ...31/VJ...34 Automotive MLCC**

- 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


RESISTORS

**Professional Wide Terminal Thin Film Chip Resistors** 

**MCW 0406 AT**

- Power handling up to 300 mW, extreme thermocycling robustness up to 3000 cycles
- Avail. to 1 Ω, TCR to 25 ppm/K and 0.1 % tol., AEC-Q200 qualified, sulfur resistant

INDUCTORS

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

**IHLP-4040DZ-5A**

- High current, low DCR, and low saturation for excellent noise suppression

TANTALUM CAPACITORS

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

**TP3**

- High-performance molded tantalum capacitor, AEC-Q200 qualified
- Automotive applications such as motor control, body electronics, and dash board


RESISTORS

**Electro-Pyrotechnic Initiator Thin Film Chip Resistor** 

**EPIC**

- Low firing energy down to 50 μJ, fast firing time down to 50 μs
- Standard SMD case 0603, alternative to bridge wire technology

ALUMINUM CAPACITORS

**Aluminum Capacitors Radial, High-Temperature, Low Impedance** 

**146 RTI**

- High temperature up to 125 °C, long life, low impedance, high ripple current

RESISTORS

**Professional Thin Film MELF Resistors** 

**MMA0204**

- Unrivaled surge handling capability, ultimate stability over lifetime
- AEC-Q200 qualified, approved acc. EN 140401-803, sulfur resistant, GREEN product

RESISTORS

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

**WSLP**

- Very high power rating to 3 W in WSLP0603 to WSLP2512 size packages
- Extremely low resistance values from 0.0005 Ω to 0.1 Ω and tolerance of 1 %

RESISTORS

**Massive Electro-Pyrotechnic Initiator Chip Resistor** 

**MEPIC**


- Low firing energy down to 1.5 mJ, fast firing time down to 250 μs
- Standard SMD case 0805, alternative to bridge wire technology, AKLV16 qualification

View datasheets for these products [www.vishay.com/ref/et3au5a](http://www.vishay.com/ref/et3au5a)



# Restraint System Power Supplies


MOSFETs

**Automotive N-Channel 40 V (D-S) 175 °C MOSFET** 

**SQJ858AEP**

- TrenchFET® Gen III technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  6.3 mΩ
- Thermally enhanced PowerPAK® SO-8L packaging


RESISTORS

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

**CRCW...HP e3**

- Excellent pulse load capability
- Enhanced power rating


RECTIFIERS

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

**SS3P4L**

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


ALUMINUM CAPACITORS

**Aluminum Capacitors SMD (Chip), High-Temperature, Low Impedance** 

**146 CTI**

- High temperature up to 125 °C, long life, low impedance, high ripple current
- Soldering according to JEDEC-J-STD-020


MOSFETs

**Automotive N-Channel 40 V (D-S) 175 °C MOSFET** 

**SQJ422EP**

- TrenchFET Gen III technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  3.4 mΩ
- Thermally enhanced PowerPAK SO-8L packaging


INDUCTORS

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

**IHLP-4040DZ-5A**

- High current, low DCR, and low saturation for excellent noise suppression


RECTIFIERS

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

**SS5P4L**

- Meets MSL level 1, per J-STD-020
- Very low profile – typical height of 1.1 mm


RESISTORS

**Power Metal Strip® SMD Resistors, Wide Terminal, Low Value (0.003 Ω to 0.006 Ω)** 

**WSL1020**

- Reverse geometry allows for 2 W power rating in small 1020 size
- Power Metal Strip construction offers high reliability in critical applications

CERAMIC CAPACITORS

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R** 

**VJ...31/VJ...34 Automotive MLCC**

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

RESISTORS

**Professional Thin Film MELF Resistors** 

**MMA0204**

- Unrivaled surge handling capability, ultimate stability over lifetime
- AEC-Q200 qualified, approved acc. EN 140401-803, sulfur resistant, GREEN product

View datasheets for these products [www.vishay.com/ref/et3au5b](http://www.vishay.com/ref/et3au5b)





# Pedestrian Protection Systems



RESISTORS

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

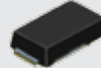


**WSLP**

- Very high power rating to 3 W in WSLP0603 to WSLP2512 size packages
- Extremely low resistance values from 0.0005 Ω to 0.1 Ω and tolerance of 1 %

RECTIFIERS

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



**SS2P3L**

- Meets MSL level 1 per J-STD-020, LF maximum
- AEC-Q101 qualified

RESISTORS

**Lead (Pb)-Bearing High-Stability Thin Film Chip Resistors**

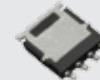


**TNPW**

- Excellent overall stability, endurance < 0.05 %, resistance range from 10 Ω to 3 MΩ
- SnPb plating with Pb content > 6 %, TCR down to 10 ppm/K, tol. down to 0.1 %

MOSFETs

**Automotive N-Channel 40 V (D-S) 175 °C MOSFET**



**SQJ422EP**

- TrenchFET® Gen III technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  3.4 mΩ
- Thermally enhanced PowerPAK® SO-8L packaging

ALUMINUM CAPACITORS

**Aluminum Capacitors SMD (Chip), High-Temperature, Low Impedance**



**146 CTI**

- High temperature up to 125 °C, long life, low impedance, high ripple current
- Soldering according JEDEC-J-STD-020

OPTOELECTRONICS

**High-Sensitivity PIN Photodiode in Leadless Low-Profile Package**



**VEMD5110X01**

- 0.8 mm height SMD photodiode featuring a chip with a 7.5 mm<sup>2</sup> sensitive area
- Daylight blocking filter matched with IR emitters operating at wavelengths of 870 nm or 950 nm

INDUCTORS

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



**IHLP-4040DZ-5A**

- High current, low DCR, and low saturation for excellent noise suppression

OPTOELECTRONICS

**High-Power SurfLight™ Emitter with 850 nm Peak Wavelength**



**VSMY7850X01**

- Wavelength matches CMOS-based camera systems for nighttime and low-visibility illumination
- 170 mW/sr intensity at 1 A forward current, 780 mW/sr at 5 A forward current

CERAMIC CAPACITORS

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R**



**VJ...31/VJ...34 Automotive MLCC**

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

View datasheets for these products  
[www.vishay.com/ref/et3au5c](http://www.vishay.com/ref/et3au5c)

## 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**



**Day Lighting**



**LED Fog Lighting**

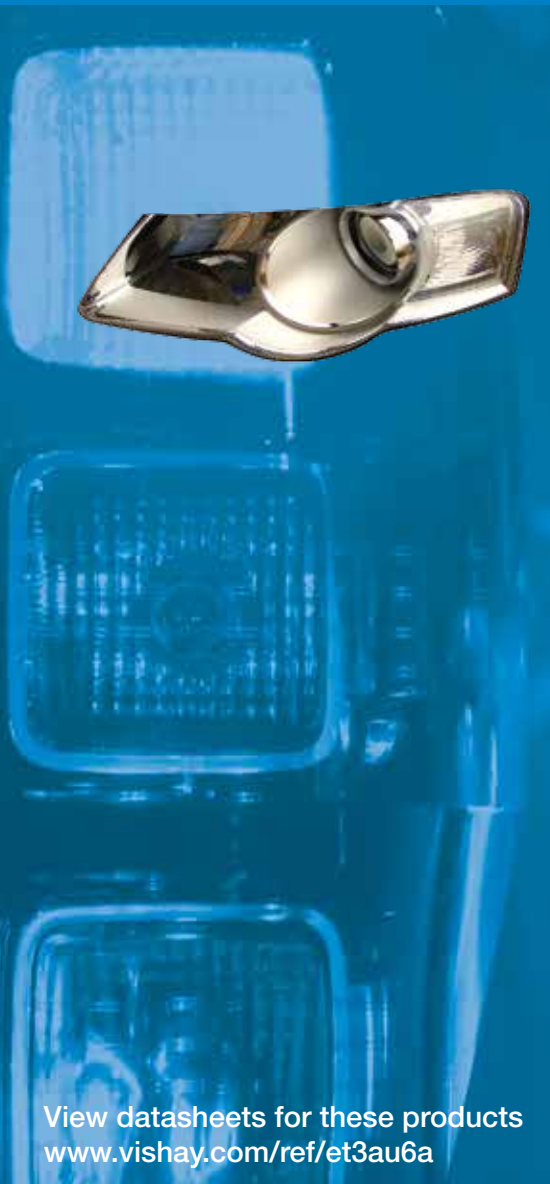



**Rear and Signal LED Lights**





# LED Headlight Units



<p>DIODES</p> <p><b>Surface-Mount TRANSZORB® Transient Voltage Suppressors</b></p> <p><b>P6SMB36CA</b></p> <ul style="list-style-type: none"> <li>• AEC-Q101 qualified</li> <li>• 600 W peak pulse power capability with a 10/1000 <math>\mu</math>s waveform</li> </ul> 	<p>RESISTORS</p> <p><b>Low-Ohmic, Wide-Terminal Thin Film Chip Resistors</b></p> <p><b>NCW0406 AT</b></p> <ul style="list-style-type: none"> <li>• Power handling up to 300 mW, extreme thermocycling robustness up to 3000 cycles</li> <li>• Available from 0.33 <math>\Omega</math> to 0.91 <math>\Omega</math> with TCR of 50 ppm/K and 1 % tolerance</li> </ul> 	<p>MOSFETs</p> <p><b>Automotive N-Channel 100 V (D-S) 175 °C MOSFET</b></p> <p><b>SQJ488EP</b></p> <ul style="list-style-type: none"> <li>• Medium-voltage ThunderFET® technology, AEC-Q101 qualified, maximum <math>R_{DS(on)}</math> 21 m<math>\Omega</math></li> <li>• Thermally enhanced PowerPAK® SO-8L packaging</li> </ul> 
<p>OPTOELECTRONICS</p> <p><b>Subminiature Dual-Channel Transmissive Optical Sensor with Phototransistor Outputs</b></p> <p><b>TCUT1350X01</b></p> <ul style="list-style-type: none"> <li>• Resolve direction and speed with dual-channel transmissive (interrupter) sensor</li> <li>• Wide operating temperature range from -40 °C to +125 °C</li> </ul> 	<p>RESISTORS</p> <p><b>Pulse-Proof, High-Power Thick Film Chip Resistors</b></p> <p><b>CRCW...HP e3</b></p> <ul style="list-style-type: none"> <li>• Excellent pulse load capability</li> <li>• Enhanced power rating</li> </ul> 	<p>RECTIFIERS</p> <p><b>High Current Density Surface-Mount Trench MOS Barrier Schottky Rectifier</b></p> <p><b>V8P10HM3</b></p> <ul style="list-style-type: none"> <li>• Trench MOS Schottky technology</li> <li>• AEC-Q101 qualified</li> </ul> 
<p>INDUCTORS</p> <p><b>Low-Profile, High-Current IHLP® Inductors</b></p> <p><b>IHLP-2525CZ-5A</b></p> <ul style="list-style-type: none"> <li>• Compact size and high current, low saturation for noise filtering</li> </ul> 	<p>MOSFETs</p> <p><b>Automotive N-Channel 100 V (D-S) 175 °C MOSFET</b></p> <p><b>SQJ402EP</b></p> <ul style="list-style-type: none"> <li>• Medium-voltage ThunderFET technology, AEC-Q101 qualified, maximum <math>R_{DS(on)}</math> 11 m<math>\Omega</math></li> <li>• Thermally enhanced PowerPAK SO-8L packaging</li> </ul> 	<p>RESISTORS</p> <p><b>Thick Film Surface-Mount Chip Resistors, Wraparound and Extremely Low Value</b></p> <p><b>RCWE</b></p> <ul style="list-style-type: none"> <li>• Low resistance values from 0.01 <math>\Omega</math> to 0.976 <math>\Omega</math> and tolerance of 1 %</li> <li>• Thick film construction with 2x power capacity</li> </ul> 
<p>RESISTORS</p> <p><b>Power Metal Strip® SMD Resistors, Very High Power (to 3 W), Low Value (to 0.0005 <math>\Omega</math>)</b></p> <p><b>WSLP</b></p> <ul style="list-style-type: none"> <li>• Very high power rating to 3 W in WSLP0603 to WSLP2512 size packages</li> <li>• Extremely low resistance values from 0.0005 <math>\Omega</math> to 0.1 <math>\Omega</math> and tolerance of 1 %</li> </ul> 	<p>INDUCTORS</p> <p><b>Low-Profile, High-Current IHLP Inductors</b></p> <p><b>IHLP-4040DZ-5A</b></p> <ul style="list-style-type: none"> <li>• High current, low DCR, low saturation for excellent noise suppression</li> </ul> 	<p>NON-LINEAR RESISTORS</p> <p><b>SMD Glass Protected NTC Thermistors</b></p> <p><b>NTCS...e3</b></p> <ul style="list-style-type: none"> <li>• Standard series, AEC-Q200 compliant</li> <li>• Glass protected with soft terminations</li> </ul> 

View datasheets for these products [www.vishay.com/ref/et3au6a](http://www.vishay.com/ref/et3au6a)





# Day Lighting



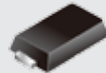
TANTALUM CAPACITORS

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

**TP3**

- High-performance molded tantalum capacitor, AEC-Q200 qualified
- Automotive applications: motor control, body electronics, dash board


RECTIFIERS

**Surface-Mount Schottky Barrier Rectifiers** 

**MSS2P3**

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

INDUCTORS

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

**IHLP-2525CZ-5A**

- Compact size and high current, low saturation for noise filtering


DIODES

**High Power Density Surface-Mount PAR® Transient Voltage Suppressors** 

**TPSMP**

- AEC-Q101 qualified,  $T_j = 185\text{ °C}$  capability suitable for automotive requirements
- Very low profile – typical height of 1.0 mm

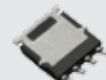
NON-LINEAR RESISTORS

**SMD Glass Protected NTC Thermistors** 

**NTCS...e3**

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


MOSFETS

**Automotive N-Channel 100 V (D-S) 175 °C MOSFET** 

**SQJ402EP**

- Medium-voltage ThunderFET® technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  11 mΩ
- Thermally enhanced PowerPAK® SO-8L packaging


RESISTORS

**Power Metal Strip® Resistors, Low Value (Down to 0.0005 Ω), Surface Mount** 

**WSL2010**

- Low TCR element (< 20 ppm) results in accurate current sensing in application
- Power Metal Strip construction offers high reliability in critical applications


OPTOELECTRONICS

**Little Star® 1 W Power SMD LED White** 

**VLMW712U2U3XV**

- Luminous intensity up to 113 lm in a compact 6.0 mm x 6.0 mm x 1.5 mm surface-mount package
- White color coordinates of 0.33 (X), 0.33 (Y) with a 120° viewing angle


RECTIFIERS

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

**SS2P4**

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


RESISTORS

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

**CRCW...HP e3**

- Excellent pulse load capability
- Enhanced power rating


MOSFETS

**Automotive N-Channel 100 V (D-S) 175 °C MOSFET** 

**SQJ488EP**

- Medium-voltage ThunderFET technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  21 mΩ
- Thermally enhanced PowerPAK SO-8L packaging

RESISTORS

**Thick Film Surface-Mount Chip Resistors, Wraparound and 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

View datasheets for these products [www.vishay.com/ref/et3au6b](http://www.vishay.com/ref/et3au6b)

# LED Fog Lighting



<p>RECTIFIERS</p> <p><b>Surface-Mount Schottky Barrier Rectifiers</b></p>  <p><b>MSS1P6HM3</b></p> <ul style="list-style-type: none"> <li>• Very low profile – typical height of 0.65 mm</li> <li>• AEC-Q101 qualified</li> </ul>	<p>INDUCTORS</p> <p><b>Low-Profile, High-Current IHLP® Inductors</b></p>  <p><b>IHLP-2020CZ-5A</b></p> <ul style="list-style-type: none"> <li>• Compact size and high current, low saturation for noise filtering</li> <li>• Up to 155 °C continuous operation</li> </ul>	<p>OPTOELECTRONICS</p> <p><b>Little Star® 1 W Power SMD LED White</b></p>  <p><b>VLMW712U2U3XV</b></p> <ul style="list-style-type: none"> <li>• Luminous intensity up to 113 lm in a compact 6.0 mm x 6.0 mm x 1.5 mm surface-mount package</li> <li>• White color coordinates of 0.33 (X), 0.33 (Y) with a 120° viewing angle</li> </ul>
<p>RESISTORS</p> <p><b>Thick Film Surface-Mount Chip Resistors, Wraparound and Extremely Low Value</b></p>  <p><b>RCWE</b></p> <ul style="list-style-type: none"> <li>• Low resistance values from 0.01 Ω to 0.976 Ω and tolerance of 1 %</li> <li>• Thick film construction with 2x power capacity</li> </ul>	<p>DIODES</p> <p><b>Surface-Mount PAR® Transient Voltage Suppressors</b></p>  <p><b>TPSMA</b></p> <ul style="list-style-type: none"> <li>• AEC-Q101 qualified, <math>T_j = 185\text{ °C}</math> capability suitable for automotive requirements</li> <li>• 400 W peak pulse power capability with a 10/1000 μs waveform</li> </ul>	<p>RESISTORS</p> <p><b>Pulse-Proof, High-Power Thick Film Chip Resistors</b></p>  <p><b>CRCW...HP e3</b></p> <ul style="list-style-type: none"> <li>• Excellent pulse load capability</li> <li>• Enhanced power rating</li> </ul>
<p>MOSFETs</p> <p><b>Automotive N-Channel 40 V (D-S) 175 °C MOSFET</b></p>  <p><b>SQJ858AEP</b></p> <ul style="list-style-type: none"> <li>• TrenchFET® Gen III technology, AEC-Q101 qualified, maximum <math>R_{DS(on)}</math> 6.3 mΩ</li> <li>• Thermally enhanced PowerPAK® SO-8L packaging</li> </ul>	<p>CERAMIC CAPACITORS</p> <p><b>AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R</b></p>  <p><b>VJ...31/VJ...34 Automotive MLCC</b></p> <ul style="list-style-type: none"> <li>• RoHS and GREEN compliant parts available</li> <li>• AgPd termination available for epoxy bonding</li> </ul>	<p>NON-LINEAR RESISTORS</p> <p><b>SMD Glass Protected NTC Thermistors</b></p>  <p><b>NTCS...e3</b></p> <ul style="list-style-type: none"> <li>• Standard series, AEC-Q200 compliant</li> <li>• Glass protected with soft terminations</li> </ul>
<p>RESISTORS</p> <p><b>Professional Thin Film MELF Resistors</b></p>  <p><b>MMB0207</b></p> <ul style="list-style-type: none"> <li>• Unrivaled surge handling capability, ultimate stability over lifetime</li> <li>• AEC-Q200 qualified, approved acc. EN 140401-803, sulfur resistant, GREEN product</li> </ul>	<p>INDUCTORS</p> <p><b>Low-Profile, High-Current IHLP Inductors</b></p>  <p><b>IHLP-1616BZ-5A</b></p> <ul style="list-style-type: none"> <li>• Very small size, high-current operation for DC/DC conversion and noise filtering</li> </ul>	

View datasheets for these products  
[www.vishay.com/ref/et3au6c](http://www.vishay.com/ref/et3au6c)




# Rear and Signal LED Lights



RESISTORS

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



**CRCW...HP e3**

- Excellent pulse load capability
- Enhanced power rating

MOSFETs

**Automotive N-Channel 40 V (D-S) 175 °C MOSFET**




**SQS484EN**

- Classic TrenchFET® technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  9 mΩ
- Thermally enhanced PowerPAK® 1212-8 is 1/3 the size of an SO-8

INDUCTORS

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

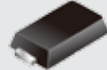


**IHLP-1212AB-5A**

- Extremely small size, high-current filter and energy storage

RECTIFIERS

**Surface-Mount Schottky Barrier Rectifiers**




**MSS1P6HM3**

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

NON-LINEAR RESISTORS

**SMD Glass Protected NTC Thermistors**



**NTCS...e3**

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

MOSFETs

**Automotive P-Channel 60 V (D-S) 175 °C MOSFET**




**SQ2309ES**

- Classic TrenchFET technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  335 mΩ
- Popular SOT-23 packaging

INDUCTORS

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



**IHCL-4040DZ-5A**

- Unique 2-coil design coupled inductor in a composite IHLP-style package
- Optimized for SEPIC circuits for high efficiency and compact size

DIODES

**High Power Density Surface-Mount PAR® Transient Voltage Suppressors**



**TPSMP**

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

RESISTORS

**Thick Film Surface-Mount Chip Resistors, Wraparound and 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

OPTOELECTRONICS

**PLCC-2 Plus, High Luminous Output White LED**




**VLMW51Q2R3**

- Luminous intensity up to 51.7 lm in a compact 3.5 mm x 3.5 mm x 1.2 mm surface-mount package
- White color coordinates of 0.33 (X), 0.33 (Y) with a 120° viewing angle

INDUCTORS

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




**IHLP-1616BZ-5A**

- Very small size, high-current operation for DC/DC conversion and noise filtering

MOSFETs

**Automotive P-Channel 40 V (D-S) 175 °C MOSFET**



**SQS401EN**

- Classic TrenchFET technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  29 mΩ
- Thermally enhanced PowerPAK 1212-8 is 1/3 the size of an SO-8

View datasheets for these products [www.vishay.com/ref/et3au6d](http://www.vishay.com/ref/et3au6d)





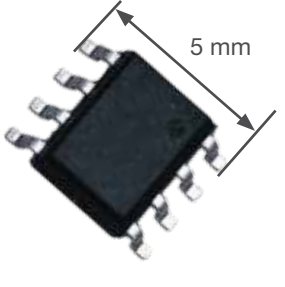
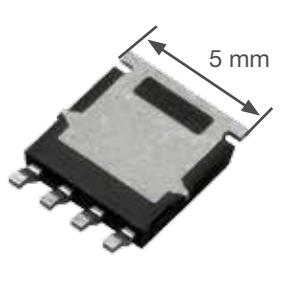
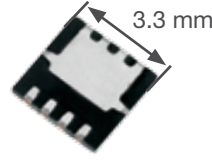
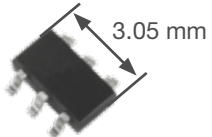
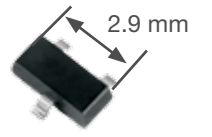
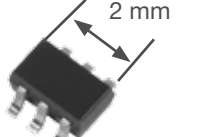

# Spotlight on SQ Rugged Series of Automotive MOSFETs

## 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.

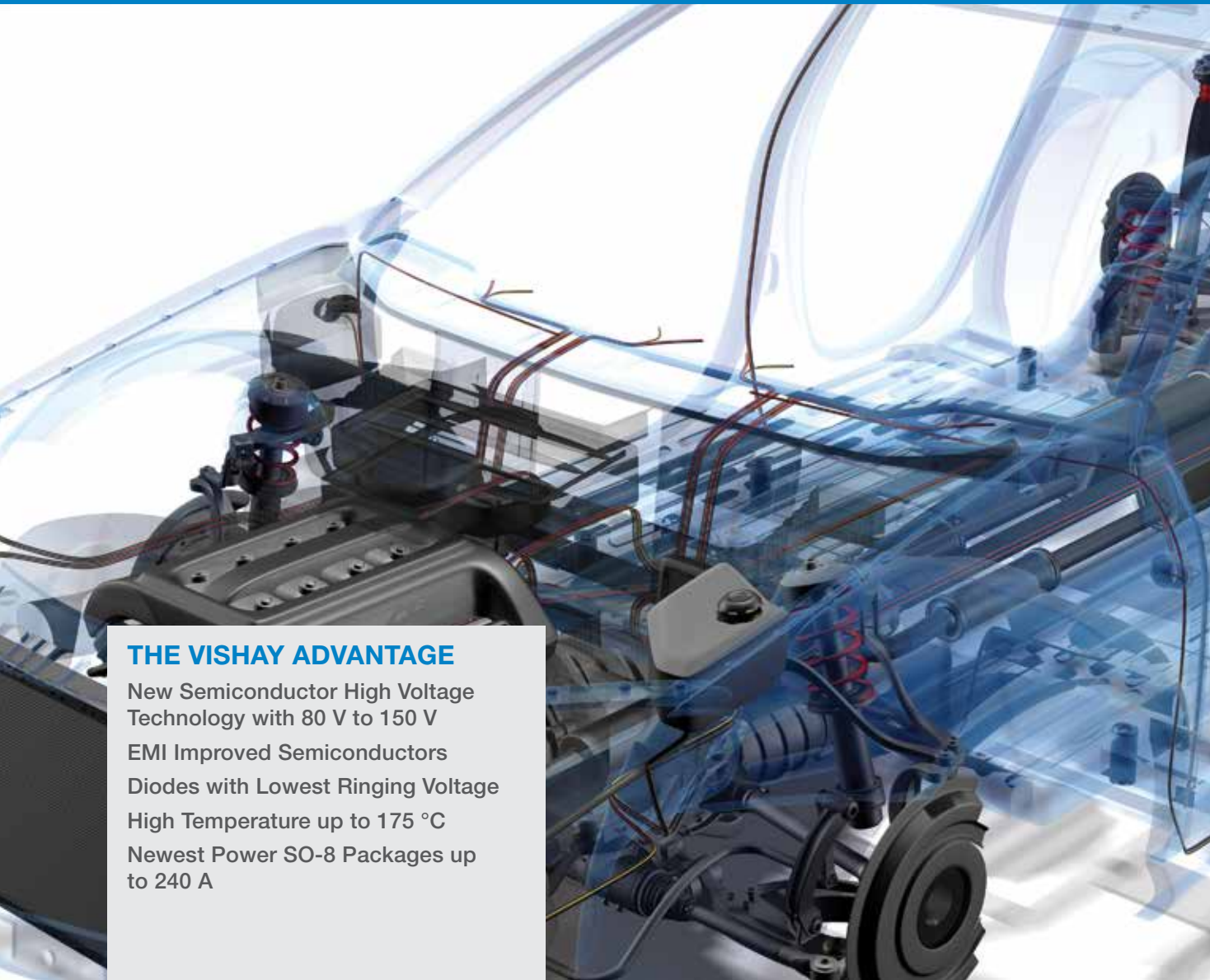
Packages include the TO-262, D<sup>2</sup>PAK (TO-263), and DPAK (TO-252), as well as several space-saving, small-outline options. For example, the PowerPAK® SO-8L, at 5.13 mm by 6.15 mm, is half the size of a DPAK but delivers the same on-resistance, and thermal resistance as low as 1.5 °C/W. Even smaller at 3.3 mm by 3.3 mm, the PowerPAK 1212-8 delivers on-resistance similar to the SO-8 in about 1/3 the size, with thermal resistance of 2.4 °C/W. The PowerPAK SO-8L Dual Asymmetric optimizes a high-side and a low-side MOSFET in one compact package while lowering low-side on-resistance over 30 % over conventional duals. The SQ series also includes devices in small packages such as the TSOP-6, SOT-23, and tiny 2 mm by 2 mm SC-70 and PowerPAK SC-70.

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

D <sup>2</sup> PAK*	DPAK and Reverse DPAK	SO-8	PowerPAK SO-8L	
				
PowerPAK 1212	TSOP-6	SOT-23	SC-70	PowerPAK SC-70
				

\* 7 lead also available

# 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>)**



**Steering (BLDC  
Motor Drive for  
48 V<sub>DC</sub>)**



## THE VISHAY ADVANTAGE

- New Semiconductor High Voltage Technology with 80 V to 150 V
- EMI Improved Semiconductors
- Diodes with Lowest Ringing Voltage
- High Temperature up to 175 °C
- Newest Power SO-8 Packages up to 240 A



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



RESISTORS

**Power Metal Strip® Meter Shunt Resistor, Very Low Value (Down to 0.0003 Ω)**



**WSMS2906**

- Extremely low resistance values: 300 μΩ to 660 μΩ
- 3 W power capability with sensing terminals to mount in PCB

MOSFETs

**Automotive Bare Die MOSFET Family, Available in Tape-and-Reel Format**



**SQC100N08-3m5**

- High-performance MOSFET technologies available in bare die
- Known good die processing with comprehensive testing

FILM CAPACITORS

**DC Film Capacitors, MKT Radial Potted Type**



**MKT1820S**

- Automotive general purpose MKT capacitor with high-temperature capabilities
- Featuring capacitance up to 560 μF

MODULES

**EMIPAK-1B / 2B PressFit Power Module**



**Custom EMIPAK-1B / 2B**

- UL approved file E78996
- Exposed Al<sub>2</sub>O<sub>3</sub> substrate with low thermal optimized for low internal inductance

NON-LINEAR RESISTORS

**2-Point Radial Leaded, Automotive-Grade NTC Thermistors**



**NTCLE...E3...SB**

- Automotive line
- Thermal cycling resistant, suitable for potting

INDUCTORS

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



**IHLP-8787MZ-5A**

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

RESISTORS

**Surface-Mount Molded Divider, High Precision**



**CDMP4527**

- High precision to ± 0.25 % with low TCR to 50 ppm/°C, sulfur resistant
- Automotive-compliant terminations with wide range of resistance values and ratios

INDUCTORS

**Custom Magnetics**



- High-current, high-temperature designs for boardnet and DC/DC conversion
- Current handling capability to several hundred amps

CERAMIC CAPACITORS

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R**



**VJ...31/VJ...34 Automotive MLCC**

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

RESISTORS

**Power Metal Strip Battery Shunt Resistor, Very Low Value (100 μΩ, 125 μΩ, and 250 μΩ)**



**WSBS8518**

- Extremely low resistance values: 50 μΩ to 1000 μΩ
- 36 W (850 A) power capability in an 8518 package

View datasheets for these products  
[www.vishay.com/ref/et3au7a](http://www.vishay.com/ref/et3au7a)





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



MOSFETs

**Automotive N-Channel 100 V (D-S) 175 °C MOSFET** 

**SQM120N10-3m8**

- Medium-voltage ThunderFET® technology, AEC-Q101 qualified, maximum R<sub>DS(on)</sub> 3.8 mΩ
- Popular D<sup>2</sup>PAK packaging

RESISTORS

**Professional Thin Film MELF Resistors** 

**MMA0204**

- Unrivaled surge handling capability, ultimate stability over lifetime
- AEC-Q200 qualified, approved acc. EN 140401-803, sulfur resistant, GREEN product

RESISTORS

**High-Stability Thin Film Flat Chip Resistors** 

**TNPW...e3**

- Excellent overall stability, endurance < 0.05 %, resistance range from 10 Ω to 3 MΩ
- AEC-Q200-qualified, sulfur resistant, halogen-free


RESISTORS

**Power Metal Strip® SMD Resistors, Very High Power (to 9 W), Low Value (Down to 0.0002 Ω)** 

**WSLP3921**

- High power rating of 5 W to 9 W in WSLP3921 package
- Very low resistance values from 0.0002 Ω to 0.004 Ω, with tolerance of 1 %


FILM CAPACITORS

**DC Film Capacitors MKT Radial Potted Type** 

**MKT1820S**

- Automotive general purpose MKT capacitor, with high-temperature capabilities
- Featuring capacitance up to 560 μF

INDUCTORS

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

**IHLP-6767GZ-5A**

- Very high-current, low-saturation inductor for DC/DC conversion and filtering
- High-temperature continuous operation at 155 °C


CERAMIC CAPACITORS

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R** 

**VJ....31/VJ....34 Automotive MLCC**

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

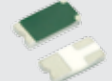
MODULES

**EMIPAK-1B / 2B PressFit Power Module** 

**Custom EMIPAK-1B / 2B**

- UL approved file E78996
- Exposed Al<sub>2</sub>O<sub>3</sub> substrate with low thermal optimized for low internal inductance

RESISTORS

**High-Voltage Thin Film Resistor Divider Network** 

**HVRD1206**

- High-precision thin film construction with 0.1 % tol. and 10 ppm/°C TCR track
- High-voltage divider with 120 V operating voltage, R1 = 3 KΩ to 9 KΩ and R2 = 1 MΩ


RESISTORS

**Surface-Mount Power Resistor Thick Film Technology** 

**D2TO**

- AEC-Q200-qualified D<sup>2</sup>PAK TO-263 standard package, 20 W and 35 W at 25 °C case temperature
- High-pulse capability up to 10 J for short pulse, high-temp. soldering, RoHS-comp.

INDUCTORS

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

**IHLP-8787MZ-5A**

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

RESISTORS

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

**WSLP2512**

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

View datasheets for these products [www.vishay.com/ref/et3au7b](http://www.vishay.com/ref/et3au7b)

# HVAC

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


**CERAMIC CAPACITORS**

**Axial Leaded Multilayer Ceramic Capacitors for Automotive Applications**


**A...V**

- High-reliability MLCC insert with wet build process
- High operating temp. up to 160 °C, rated voltages: 50 V, 100 V, and 200 V

**MOSFETs**

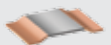
**Automotive N-Channel 100 V (D-S) 175 °C MOSFET**


**SQM100N10-10**

- Classic TrenchFET® technology, AEC-Q101 qualified, maximum R<sub>DS(on)</sub> 10.5 mΩ
- Popular D<sup>2</sup>PAK packaging

**RESISTORS**

**Power Metal Strip® SMD Resistors, Very High Power (to 9 W), Low Value (Down to 0.0002 Ω)**


**WSLP3921**

- High power rating of 5 W to 9 W in WSLP3921 package
- Very low resistance values from 0.0002 Ω to 0.004 Ω, with tolerance of 1 %

**INDUCTORS**

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


**IHLP-8787MZ-5A**

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

**CERAMIC CAPACITORS**

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R**


**VJ...31/VJ...34 Automotive MLCC**

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

**INDUCTORS**

**Custom Ferrite Filters and Transformers; High-Current PressFit Customized Topologies High Isolation Voltage**

- Many options available for low-loss, high-efficiency filtering

**NON-LINEAR RESISTORS**

**SMD Glass Protected NTC Thermistors**


**NTCS...e3**

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

**FILM CAPACITORS**

**DC Film Capacitors, MKT Radial Potted Type**


**MKT1820**

- Automotive general purpose MKT capacitor with high-temperature capabilities
- Featuring capacitance up to 560 μF


# Steering (BLDC Motor Drive for 48 V<sub>DC</sub>)



**DIODES**  
**Surface-Mount TRANSZORB<sup>®</sup> Transient Voltage Suppressors** 


**1.5SMC86A**

- 1500 W peak pulse power capability with a 10/1000  $\mu$ s waveform
- AEC-Q101 qualified

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


**IHLP-6767GZ-5A**

- High-current, high-temperature designs for boardnet and DC/DC conversion

**CERAMIC CAPACITORS**  
**Radial Leaded Multilayer Ceramic Capacitors for Automotive Applications** 


**K...V**

- High-reliability MLCC insert with wet build process
- High operating temp. up to 160 °C, rated voltages: 50 V, 100 V, and 200 V

**FILM CAPACITORS**  
**DC Film Capacitors, MKT Radial Potted Type** 


**MKT1820**

- Automotive general purpose MKT capacitor with high-temperature capabilities
- Featuring capacitance up to 560  $\mu$ F

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


**CRCW...HP e3**

- Excellent pulse load capability
- Enhanced power rating

**MOSFETs**  
**Automotive N-Channel 100 V (D-S) 175 °C MOSFET** 


**SCQ120N04-1m7KGD**

- Medium-voltage ThunderFET<sup>®</sup> technology, AEC-Q101 qualified, maximum R<sub>DS(on)</sub> 3.8 m $\Omega$
- Popular D<sup>2</sup>PAK packaging

**NON-LINEAR RESISTORS**  
**SMD Glass Protected NTC Thermistors** 


**NTCS...e3**

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

**RESISTORS**  
**Power Metal Strip<sup>®</sup> SMD Resistors, Very High Power (to 9 W), Low Value (Down to 0.0002  $\Omega$ )** 

**WSLP3921**

- High power rating of 5 W to 9 W in WSLP3921 package
- Very low resistance values from 0.0002  $\Omega$  to 0.004  $\Omega$ , with tolerance of 1 %

**OPTOELECTRONICS**  
**Subminiature Dual-Channel Transmissive Optical Sensor with Phototransistor Outputs** 


**TCUT1350X01**

- Resolve direction and speed with dual-channel transmissive (interrupter) sensor
- Wide operating temperature range from -40 °C to +125 °C

**TANTALUM CAPACITORS**  
**Solid Tantalum Surface-Mount Chip Capacitors, TANTAMOUNT<sup>®</sup> Molded Case, Automotive Grade** 


**TP3**

- High-performance molded tantalum capacitor, AEC-Q200-qualified
- Automotive applications: motor control, body electronics, dash board

**DIODES**  
**Small-Signal Zener Diodes** 

**BZX84B**

- ESD capability acc. to AEC-Q101
- The Zener voltages are graded according to the international E24 standard

**CERAMIC CAPACITORS**  
**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R** 

**VJ...31/VJ...34 Automotive MLCC**

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

View datasheets for these products  
[www.vishay.com/ref/et3au7d](http://www.vishay.com/ref/et3au7d)



# 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 related to the mounting space. Continuous development has led to improved long-term stability and moisture resistance, and allows high-temperature operation to +175 °C.

### KEY PERFORMANCE BENEFITS:

- Predictable behavior of components
- Zero-defect philosophy
- Harsh operating environments
- Long-term stability
- Moisture resistance
- Reliability
- Temperature cycling in lead (Pb)-free assembly processes
- Insulation voltage up to 500 V

### APPROVALS

- EN140401-803
- 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.

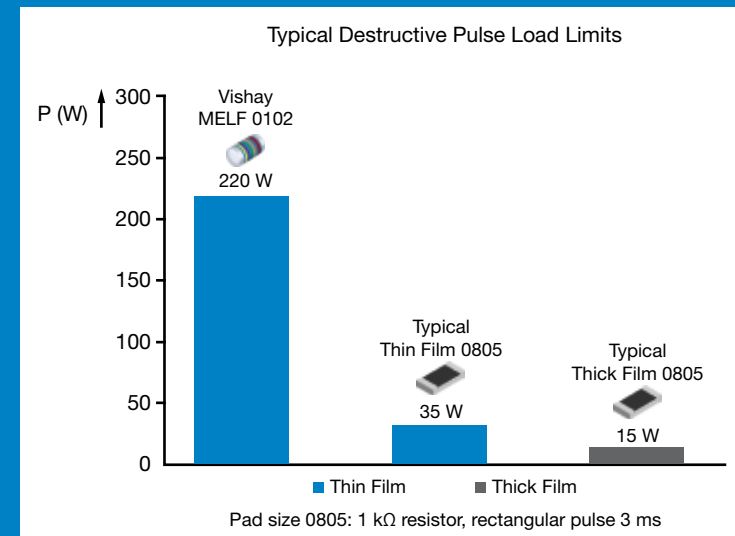
### TEMPERATURE COEFFICIENT, TOLERANCE, AND STABILITY

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 MELF resistors.

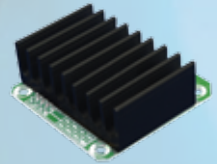
For technical questions, contact: [melf@vishay.com](mailto:melf@vishay.com)



## Key components for MICRO HYBRID – START / STOP (12 V)



**Generator and  
Alternator  
Power Modules**



**Generator and  
Alternator  
Control Modules**



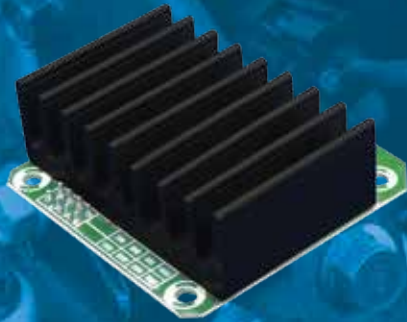
**Boardnet  
Stabilizer  
DC/DC  
Converters**



### **THE VISHAY ADVANTAGE**

- AEC Qualifications
- High-Temperature Performance
- Customized Storage Elements
- High Reliability
- High Power Density
- KGD Semiconductor Solutions

# Generator and Alternator Power Modules


**MOSFETs**

**Automotive Bare Die MOSFET Family Available in Tape-and-Reel Format**

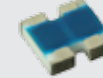


**SQC100N10-1-KGD**

- High-performance MOSFET technologies available in bare die
- Known good die processing with comprehensive testing

**RESISTORS**

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



**ACAS0606 AT**

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

**CERAMIC CAPACITORS**

**Radial Leaded Multilayer Ceramic Capacitors for Automotive Applications**



**K...V**

- High-reliability MLCC insert with wet build process
- High operating temp. up to 160 °C, rated voltages: 50 V, 100 V, and 200 V

**NON-LINEAR RESISTORS**

**SMD Glass Protected NTC Thermistors**



**NTCS...e3**

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

**FILM CAPACITORS**

**DC Film Capacitors, MKT Radial Potted Type**



**MKT1820S**

- Automotive general purpose MKT capacitor with high-temperature capabilities
- Featuring capacitance up to 560  $\mu$ F

**INDUCTORS**

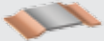
**Custom Magnetics**



- High-current, high-temperature designs for boardnet and DC/DC conversion
- Current handling capability to several hundred amps

**RESISTORS**

**Power Metal Strip® SMD Resistors, Very High Power (to 9 W), Low Value (Down to 0.0002  $\Omega$ )**

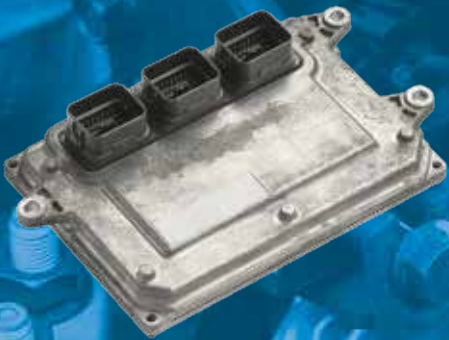


**WSLP3921**

- High power rating of 5 W to 9 W in WSLP3921 package
- Very low resistance values from 0.0002  $\Omega$  to 0.004  $\Omega$ , with tolerance of 1 %



# Generator and Alternator Control Modules


**CERAMIC CAPACITORS**

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R**



**VJ...31/VJ...34 Automotive MLCC**

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

**FILM CAPACITORS**

**Metallized Polypropylene Film Capacitors, DC-Link Capacitor**



**MKP1848**

- High-performance DC-Link capacitor with high RMS current capabilities
- Automotive Grade, AEC-Q200 compliant

**MOSFETs**

**Automotive Bare Die MOSFET Family Available in Tape-and-Reel Format**

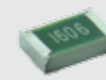


**SQC100N08-5m0KGD**

- High-performance MOSFET technologies available in bare die
- Known good die processing with comprehensive testing

**RESISTORS**

**High-Stability Thin Film Flat Chip Resistors**

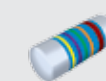


**TNPW...e3**

- Excellent overall stability, endurance < 0.05 %, resistance range from 10  $\Omega$  to 3 M $\Omega$
- AEC-Q200-qualified, sulfur resistant, halogen-free

**RESISTORS**

**Professional Thin Film MELF Resistors**



**MMB0207**

- Unrivaled surge handling capability, ultimate stability over lifetime
- AEC-Q200 qualified, approved acc. EN 140401-803, sulfur resistant, GREEN product

**RESISTORS**

**Power Metal Strip® Battery Shunt Resistor, Very Low Value (100  $\mu\Omega$ , 125  $\mu\Omega$ , and 250  $\mu\Omega$ )**



**WSBS8518**

- Extremely low resistance values: 50  $\mu\Omega$  to 1000  $\mu\Omega$
- 36 W (850 A) power capability in an 8518 package

**INDUCTORS**

**Custom Magnetics**



- High-current, compact size for high efficiency
- Litz wire and flat conductor designs available for best efficiency

**ALUMINUM CAPACITORS**

**Aluminum Capacitors SMD (Chip), High-Temperature, Low Impedance**



**146 CTI**

- High temperature up to 125 °C, long life, low impedance, high ripple current
- Soldering according JEDEC-J-STD-020

View datasheets for these products  
[www.vishay.com/ref/et3au8b](http://www.vishay.com/ref/et3au8b)



# Boardnet Stabilizer DC/DC Converters



RECTIFIERS

**Low-Voltage Trench MOS Barrier Schottky Rectifier**



**V20DL45HM3**

- Very low profile – typical height of 1.7 mm
- Trench MOS Schottky technology

INDUCTORS

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



**IHLP-6767GZ-5A**

- Excellent high-current, low-saturation performance for noise filters and DC/DC converters

DIODES

**Surface-Mount PAR® Transient Voltage Suppressors**



**SM8S24A**

- AEC-Q101 qualified
- Meets ISO7637-2 surge specification (varied by test condition)

RESISTORS

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



**WSLP2512**

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

MOSFETs

**Automotive N-Channel 40 V (D-S) 175 °C MOSFET**



**SQJ422EP**

- TrenchFET® Gen III technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  3.4 mΩ
- Thermally enhanced PowerPAK® SO-8L packaging

CERAMIC CAPACITORS

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R**



**VJ...31/VJ...34 Automotive MLCC**

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

RECTIFIERS

**Dual Low-Voltage Trench MOS Barrier Schottky Rectifier**



**V60D45C**

- Very low profile – typical height of 1.7 mm
- Trench MOS Schottky technology

FILM CAPACITORS

**DC Film Capacitors, MKT Radial Potted Type**

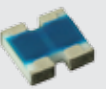


**MKT1820**

- Automotive general purpose MKT capacitor with high-temperature capabilities
- Featuring capacitance up to 560 μF

RESISTORS

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



**ACAS0606 AT**

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

NON-LINEAR RESISTORS

**SMD Glass Protected NTC Thermistors**



**NTCS...e3**

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

ALUMINUM CAPACITORS

**Advanced Temperature Range Up to 150 °C**



**160 CLA**

- High ripple current: up to 1.4 A at 150 °C / 100 kHz
- Useful life up to 2000 h at 150 °C

View datasheets for these products  
[www.vishay.com/ref/et3au8c](http://www.vishay.com/ref/et3au8c)



## Key components for FULL HYBRID VEHICLES (HEVs)



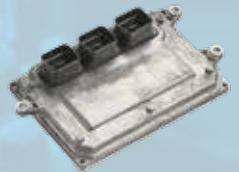
**Electrical Motor  
Drives (DC/AC)**



**DC/DC  
Bidirectional  
and Chargers**



**Energy  
Control Modules**



### **THE VISHAY ADVANTAGE**

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





# Electrical Motor Drives (DC/AC)



### CERAMIC CAPACITORS

**Radial Leaded Multilayer Ceramic Capacitors for Automotive Applications**



**K...V**

- High-reliability MLCC insert with wet build process
- High operating temp. up to 160 °C, rated voltages: 50 V, 100 V, and 200 V

### NON-LINEAR RESISTORS

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



**NTCALUG02A**

- Low thermal gradient surface temperature sensor
- High insulation voltage

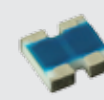
### INDUCTORS

**Custom Filter**

- Many options available for low-loss, high-efficiency filtering

### RESISTORS

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



**ACAS0612 AT**

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

### CERAMIC CAPACITORS

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R**



**VJ...31/VJ...34 Automotive MLCC**

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

### RESISTORS

**Power Metal Strip® SMD Resistors, Very High Power (to 9 W), Low Value (Down to 0.0002  $\Omega$ )**



**WSLP3921**

- High power rating of 5 W to 9 W in WSLP3921 package
- Very low resistance values from 0.0002  $\Omega$  to 0.004  $\Omega$ , with tolerance of 1 %

### FILM CAPACITORS

**Customized High-Voltage DC-Link Capacitor**



**MKP1849**

- High capacitance up to 6 mF
- Operating voltage up to 1200 V<sub>DC</sub>, operating temperature up to 105 °C

### FILM CAPACITORS

**Metallized Polypropylene Film Capacitors, DC-Link Capacitor**



**MKP1848**

- High-performance DC-link capacitor with high RMS current capabilities
- Automotive Grade, AEC-Q200 compliant

### RESISTORS

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

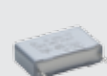


**CDMH4527**

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

### FILM CAPACITORS

**Interference Suppression Film Capacitor – Class Y2, Radial MKP 300 V<sub>AC</sub>**



**MKP338 6**

- RFI Y2 capacitor for bypass applications
- Automotive Grade with AEC-Q200 compliance

### FILM CAPACITORS

**DC Film Capacitors, MKT Radial Potted Type**



**MKT1820S**

- Automotive general purpose MKT capacitor with high-temperature capabilities
- Featuring capacitance up to 560  $\mu$ F

View datasheets for these products  
[www.vishay.com/ref/et3au9a](http://www.vishay.com/ref/et3au9a)

# DC/DC Bidirectional and Chargers



MOSFETs

**Automotive N-Channel 100 V (D-S) 175 °C MOSFET**

**SQJ402EP**

- Medium-voltage ThunderFET® technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  11 mΩ
- Thermally enhanced PowerPAK® SO-8L packaging




CERAMIC CAPACITORS

**Radial Leaded Multilayer Ceramic Capacitors for Automotive Applications**

**K...V**

- High-reliability MLCC insert with wet build process
- High operating temp. up to 160 °C, rated voltages: 50 V, 100 V, and 200 V




RESISTORS

**Wirebondable Gate Resistor for IGBT Applications**

**IGBR**

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



FILM CAPACITORS

**Metallized Polypropylene Film Capacitors, DC-Link Capacitor**

**MKP1848**

- High-performance DC-link capacitor with high RMS current capabilities
- Automotive Grade, AEC-Q200 compliant




ALUMINUM CAPACITORS

**Aluminum Capacitors SMD (Chip), High Temperature, Low Impedance**

**146 CTI**

- High temperature up to 125 °C, long life, low impedance, high ripple current
- Soldering according JEDEC-J-STD-020



RESISTORS

**Professional Thin Film Chip Resistors**

**MC...AT**

- Power rating improved by 60 %
- 175 °C maximum operating temperature




INDUCTORS

**2 kW to 5 kW Standard Power Planar Transformer and Custom Power Planar Inductor**

**PLA**

- Planar and flat wire designs available for improved efficiency
- Power supply topology: full-bridge; push-pull; half-bridge; forward



RESISTORS

**Professional Thin Film MELF Resistors**

**MMB0207**

- Unrivaled surge handling capability, ultimate stability over lifetime
- AEC-Q200 qualified, approved acc. EN 140401-803, sulfur resistant, GREEN product




NON-LINEAR RESISTORS

**NTC Thermistors, Radial Leaded, Accuracy Line**

**NTCLE203E3**

- Accuracy line
- Low-heat conductive wiring



FILM CAPACITORS

**Interference Suppression Film Capacitors, MKP Radial Potted Type**

**MKP339**

- RFI X2 capacitor for standard across-the-line applications
- Automotive Grade with AEC-Q200 compliance




RESISTORS

**Surface-Mount Molded Divider, High Precision**

**CDMP4527**

- High precision to ± 0.25 % with low TCR to 50 ppm/°C, sulfur resistant
- Automotive-compliant terminations with wide range of resistance values and ratios




CERAMIC CAPACITORS

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R**

**VJ...31/VJ...34 Automotive MLCC**

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



View datasheets for these products  
[www.vishay.com/ref/et3au9b](http://www.vishay.com/ref/et3au9b)



# Energy Control Modules



RESISTORS

**High-Power Resistor for Mounting onto a Heatsink, Thick Film Technology**



LPS 300

- High power 57 mm x 57 mm size up to 300 W at 25 °C on heatsink
- Non-inductive down to 1 μH, high pulse capability up to 1000 J for short pulse

FILM CAPACITORS

**Metallized Polypropylene Film Capacitors, DC-Link Capacitor**



MKP1848S

- Slim high-performance DC-Link for low building height applications

RESISTORS

**Surface-Mount Power Resistor, Thick Film Technology**



D2TO

- AEC-Q200-qualified D<sup>2</sup>PAK TO-263 standard package, 20 W and 35 W at 25 °C case temperature
- High-pulse capability up to 10 J for short pulse, high-temp. soldering, RoHS comp.

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**

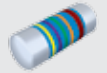


IHLP-5050FD-5A

- High-current, high-temperature designs for boardnet and DC/DC conversion

RESISTORS

**Professional Thin Film MELF Resistors**



MMB0207

- Unrivaled surge handling capability, ultimate stability over lifetime
- AEC-Q200 qualified, approved acc. EN 140401-803, sulfur resistant, GREEN product

RESISTORS

**Power Metal Strip<sup>®</sup> SMD Resistors, Very High Power (to 9 W), Low Value (Down to 0.0002 Ω)**



WSLP3921

- High power rating of 5 W to 9 W in WSLP3921 package
- Very low resistance values from 0.0002 Ω to 0.004 Ω, with tolerance of 1 %

CERAMIC CAPACITORS

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R**



VJ...31/VJ...34 Automotive MLCC

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

RESISTORS

**Matched Pair, Molded, Automotive, Thin Film, SOT-23, Resistor, Surface-Mount Network**



MPMA

- Multiple standard divider ratios available with TCR tracking down to 2 ppm/°C
- Excellent long-term ratio stability ± 0.03 % over 1000 h at 125 °C

View datasheets for these products  
[www.vishay.com/ref/et3au9c](http://www.vishay.com/ref/et3au9c)



## Key components for FULL ELECTRIC VEHICLES (FEVs)



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



**Battery  
Management  
and DC/DC**



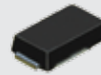
**On-Board  
Chargers**



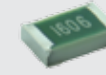
### **THE VISHAY ADVANTAGE**

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

## Electric Motor Drives (DC/AC)


**RECTIFIERS**
**Surface-Mount Ultrafast Avalanche Rectifiers**

**AU1PK**

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

**RESISTORS**
**High-Stability Thin Film Flat Chip Resistors**

**TNPW e3**

- Excellent overall stability, endurance < 0.05 %, resistance range from 10  $\Omega$  to 3 M $\Omega$
- AEC-Q200 qualified, sulfur resistant, halogen-free

**CERAMIC CAPACITORS**
**Radial Leaded Multilayer Ceramic Capacitors for Automotive Applications**

**K...V**

- High-reliability MLCC insert with wet build process
- High operating temp. up to 160  $^{\circ}\text{C}$ , rated voltages: 50 V, 100 V, and 200 V

**RESISTORS**
**Surface-Mount Molded Divider, High Voltage**

**CDMH4527**

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

**CERAMIC CAPACITORS**
**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R**

**VJ...31/VJ...34 Automotive MLCC**

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

**NON-LINEAR RESISTORS**
**NTC Thermistors, Low Thermal Gradient Lug Sensors**

**NTCALUG02A**

- Low thermal gradient surface temperature sensor
- High insulation voltage

**RESISTORS**
**Power Thick Film Resistor**

**LTO100**

- TO-247 package: 100 W at 25  $^{\circ}\text{C}$  case temperature and heatsink mounted
- Compliant to RoHS AEC-Q200

**INDUCTORS**
**Custom Magnetics**


- Many custom designs for low-loss, high-efficiency filtering and transformers

- Litz wire and flat conductor designs available for best efficiency

**FILM CAPACITORS**
**Metallized Polypropylene Film Capacitors, DC-Link Capacitor**

**MKP1848**

- High-performance DC-link capacitor with high RMS current capabilities
- Automotive Grade, AEC-Q200 compliant

**FILM CAPACITORS**
**Customized High-Voltage DC-Link Capacitor**

**MKP1849**

- High capacitance up to 6 mF, excellent V/I pulse performance
- Operating voltage up to 1200 V<sub>DC</sub>, operating temperature up to 105  $^{\circ}\text{C}$

**RESISTORS**
**Precision Automotive Thin Film Chip Resistors, AEC-Q200 Qualified, 2 kV ESD Rating**

**PAT**

- Moisture-resistant tantalum nitride film and added silicon nitride layer for ESD
- Wide resistance range from 2.5  $\Omega$  to 3 M $\Omega$  with tolerance down to  $\pm 0.1$  %


View datasheets for these products  
[www.vishay.com/ref/et3au10a](http://www.vishay.com/ref/et3au10a)

# Battery Management and DC/DC



CERAMIC CAPACITORS

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




**AY2**

- AEC-Q200 qualified, X1 / Y2 safety rating according to IEC 60384-14, 3rd edition
- Proven to withstand more than 2000 temp. cycles from -55 °C to +125 °C

DIODES

**Surface-Mount TRANSZORB® Transient Voltage Suppressors**




**1.5SMC86A**

- 1500 W peak pulse power capability with a 10/1000 µs waveform
- AEC-Q101 qualified

RESISTORS

**Surface-Mount Power Resistor Thick Film Technology**




**D2TO**

- AEC-Q200-qualified D<sup>2</sup>PAK TO-263 standard package, 20 W and 35 W at 25 °C case temperature
- High-pulse capability up to 10 J for short pulse, high-temp. soldering, RoHS comp.

NON-LINEAR RESISTORS

**SMD Glass Protected NTC Thermistors**



**NTCS...e3**

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

RESISTORS

**Professional Wide-Terminal Thin Film Chip Resistors**



**MCW 0406 AT**

- Power handling up to 300 mW, extreme thermocycling robustness up to 3000 cycles
- Avail. to 1 Ω, TCR to 25 ppm/K and 0.1 % tol., AEC-Q200 qualified, sulfur resistant

FILM CAPACITORS

**DC Film Capacitors, MKT Radial Potted Type**



**MKT1820**

- Automotive general purpose MKT capacitor with high-temperature capabilities
- Featuring capacitance up to 560 µF


INDUCTORS

**Custom Filters**

- Many options available for low-loss, high-efficiency filtering
- Litz wire and flat conductor designs available for best efficiency

ALUMINUM CAPACITORS

**Advanced Temperature Range Up to 150 °C**



**160 CLA**

- High ripple current: up to 1.4 A at 150 °C / 100 kHz
- Useful life up to 2000 h at 150 °C

TANTALUM CAPACITORS

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



**TH4**

- High-temperature molded tantalum capacitor, HI-TMP® up to 175 °C
- Applications: filtering, decoupling, LDO-regulators, braking systems

RESISTORS

**Power Metal Strip® Battery Shunt Resistor, Very Low Value (100 µΩ, 125 µΩ, and 250 µΩ)**



**WSBS8518**

- Extremely low resistance values: 50 µΩ to 1000 µΩ
- 36 W (850 A) power capability in an 8518 package

CERAMIC CAPACITORS

**Axial Leaded Multilayer Ceramic Capacitors for Automotive Applications**




**A...V**

- High-reliability MLCC insert with wet build process
- High operating temp. up to 160 °C, rated voltages: 50 V, 100 V, and 200 V

NON-LINEAR RESISTORS

**NTC Thermistors, Standard Lug Sensors**



**NTCALUG**

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

View datasheets for these products  
[www.vishay.com/ref/et3au10b](http://www.vishay.com/ref/et3au10b)






# On-Board Chargers




**DIODES**

**Surface-Mount TRANSZORB® Transient Voltage Suppressors** 

**1.5SMC540A**

- 1500 W peak pulse power capability with a 10/1000  $\mu$ s waveform
- AEC-Q101 qualified

**RESISTORS**

**Wirebondable Gate Resistor for IGBT Applications** 

**IGBR**

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

**CERAMIC CAPACITORS**

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R** 

**VJ...31/VJ...34 Automotive MLCC**

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

**RESISTORS**

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

**ACAS...AT**

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

**FILM CAPACITORS**

**Interference Suppression Film Capacitor, Class X2 MKT 310 V<sub>AC</sub>, High-Stability Grade** 

**F1772**

- RFI X2 film capacitors for continuous across-the-line and series impedance app.
- Withstanding 85 °C / 85 % RH for 1000 h at 240 V<sub>AC</sub>


**RESISTORS**

**Surface-Mount Power Resistor Thick Film Technology** 

**D2TO20**

- AEC-Q200-qualified D<sup>2</sup>PAK TO-263 standard package, 20 W and 35 W at 25 °C case temperature
- High-pulse capability up to 10 J for short pulse, high-temp. soldering, RoHS comp.


**CERAMIC CAPACITORS**

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

**AY2**

- AEC-Q200 qualified, X1 / Y2 safety rating according to IEC 60384-14, 3rd edition
- Proven to withstand more than 2000 temp. cycles from -55 °C to +125 °C


**RESISTORS**

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

**WSLP**

- Very high power rating to 3 W in WSLP0603 to WSLP2512 size packages
- Extremely low resistance values from 0.0005  $\Omega$  to 0.1  $\Omega$  and tolerance of 1 %


**INDUCTORS**

**2 kW to 5 kW Standard Power Planar Transformer and Custom Power Planar Inductor** 

**PLA**

- Planar and flat wire designs available for improved efficiency
- Power supply topology: full-bridge; push-pull; half-bridge; forward


**FILM CAPACITORS**

**Customized High-Voltage DC-Link Capacitor** 

**MKP1849**

- High capacitance up to 6 mF
- Operating voltage up to 1200 V<sub>DC</sub>, operating temperature up to 105 °C


**FILM CAPACITORS**

**Interference Suppression Film Capacitors, MKP Radial Potted Type** 

**MKP339**

- RFI X2 capacitor for standard across-the-line applications
- Automotive Grade with AEC-Q200 compliance

**NON-LINEAR RESISTORS**

**SMD Glass Protected NTC Thermistors** 

**NTCS...e3**

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

View datasheets for these products [www.vishay.com/ref/et3au10c](http://www.vishay.com/ref/et3au10c)

# Key components for OFF-ROAD EQUIPMENT



**Pedal Position Controls**



**Steering Controls**



**Panel Controls**



## **THE VISHAY ADVANTAGE**

- AEC Qualifications
- Robust Design
- High Reliability
- Durability
- Long Life
- and more...





# Pedal Position Controls



OPTOELECTRONICS

**Subminiature Dual-Channel Transmissive Optical Sensor with Deep Slot for Turn-and-Push Encoding**

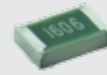


**TCUT1600X01**

- Resolve direction and speed with dual-channel transmissive (interrupter) sensor
- High slot height for turn-and-push sensing

RESISTORS

**High-Stability Thin Film Flat Chip Resistors**



**TNPW e3**

- Excellent overall stability, endurance < 0.05 %, resistance range from 10 Ω to 3 MΩ
- AEC-Q200 qualified, sulfur resistant, halogen-free

SENSORS

**Throttle Position Sensor in Hall Effect Technology, Hollow and D-Shaft Versions**

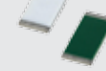


**981 HE**

- Accurate linearity down to ± 0.5 %, hollow and d-shaft versions available
- Spring-loaded types available, dedicated to applications in harsh environments

RESISTORS

**Precision Automotive Thin Film Chip Resistors, AEC-Q200 Qualified, 2 kV ESD Rating**

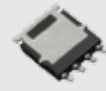


**PAT**

- Moisture-resistant tantalum nitride film and added silicon nitride layer for ESD
- Wide resistance range from 2.5 Ω to 3 MΩ with tolerance down to ± 0.1 %

MOSFETs

**Automotive P-Channel 60 V (D-S) 175 °C MOSFET**



**SQJ461EP-T1-GE3**

- TrenchFET® technology, AEC-Q101 qualified, maximum R<sub>DS(on)</sub> 16 mΩ
- Thermally enhanced PowerPAK® SO-8L packaging

RESISTORS

**Thick Film Surface-Mount Chip Resistors, Wraparound and 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

DIODES

**Surface-Mount PAR® Transient Voltage Suppressors**



**TPSMA**

- AEC-Q101 qualified, T<sub>J</sub> = 185 °C capability suitable for automotive requirements
- 400 W peak pulse power capability with a 10/1000 μs waveform

NON-LINEAR RESISTORS

**SMD 0603, Glass Protected NTC Thermistors**



**NTCS0603**

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

CERAMIC CAPACITORS

**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R**



**VJ...31/VJ...34 Automotive MLCC**

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

View datasheets for these products  
[www.vishay.com/ref/et3tr1a](http://www.vishay.com/ref/et3tr1a)





# Steering Controls




**RESISTORS**

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

**ACAS...AT**

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

**DIODES**

**Small-Signal Zener Diodes** 

**BZX84B6V8**

- ESD capability according to AEC-Q101
- The Zener voltages are graded according to the international E24 standard


**TANTALUM CAPACITORS**

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

**TP8**

- Smallest AEC-Q200-qualified tantalum capacitor with case sizes as small as 0603
- Perfect for space-constrained designs

**OPTOELECTRONICS**

**Subminiature Dual-Channel Transmissive Optical Sensor with Phototransistor Outputs** 

**TCUT1350X01**

- Resolve direction and speed with dual-channel transmissive (interrupter) sensor
- Wide operating temperature range from  $-40$  °C to  $+125$  °C


**RESISTORS**

**Molded, 50 mil Pitch, Dual-In-Line Thin Film Resistor Network, Precision Automotive** 

**NOMCA**

- Tantalum nitride resistive film for superior moisture protection
- Excellent long term ratio stability  $\pm 0.015$  % for 1000 h at  $125$  °C


**RECTIFIERS**

**Surface-Mount Glass Passivated Rectifier** 

**S1G**

- Glass passivated diode technology
- AEC-Q101 qualified


**SENSORS**

**Ten-Turns Servo or Bushing Mount Hall Effect Sensor in Size 09 (22.2 mm)** 

**34 THE**

- Accurate linearity:  $\pm 0.5$  %, long life: 50M cycles for servo, 10M for bushing
- All electrical angles available up to  $3600^\circ$ , dedicated to long-life applications


**ALUMINUM CAPACITORS**

**Advanced Temperature Range Up to  $150$  °C** 

**160 CLA**

- High ripple current: up to 1.4 A at  $150$  °C / 100 kHz
- Useful life up to 2000 h at  $150$  °C

**NON-LINEAR RESISTORS**

**NTC Thermistors, SMD 0402, 0603, 0805, and 1206 Chip** 

**NTHS...**

- Standard series
- Glass protected

**RESISTORS**

**Lead (Pb)-Bearing High-Stability Thin Film Chip Resistors** 

**TNPW**


- Excellent overall stability, endurance  $< 0.05$  %, resistance range from  $10 \Omega$  to  $3 M\Omega$
- SnPb plating with Pb content  $> 6$  %, TCR down to 10 ppm/K, tol. down to 0.1 %

View datasheets for these products  
[www.vishay.com/ref/et3tr1b](http://www.vishay.com/ref/et3tr1b)




# Panel Controls




RECTIFIERS  
**Surface-Mount Ultrafast Rectifier**  
  
**US1G**  

- High forward surge capability
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C

ALUMINUM CAPACITORS  
**Aluminum Capacitors SMD (Chip), High Temperature, Low Impedance**  
  
**146 CTI**  


- High temperature up to 125 °C, long life, low impedance, high ripple current
- Soldering according to JEDEC-J-STD-020

OPTOELECTRONICS  
**Standard SMD LED PLCC-2**  
  
**VLMW41R1T1**  


- Luminous intensity up to 355 mcd with typical color temperature of 5000 K
- White color coordinates of 0.345 (X), 0.352 (Y) with a 120° viewing angle

RESISTORS  
**Thin Film Mini-MELF Resistors**  
  
**SMM0204**  

- Unrivaled surge handling capability, ultimate stability over lifetime
- AEC-Q200 qualified, sulfur resistant, GREEN product

DIODES  
**Surface-Mount PAR® Transient Voltage Suppressors**  
  
**3KASMC24**  


- AEC-Q101 qualified, T<sub>j</sub> = 185 °C capability suitable for automotive requirement
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C

INDUCTORS  
**Low-Profile, High-Current IHLP® Inductors**  
  
**IHLP-1616AB**  


- Extremely small, high-current inductors for DC/DC conversion
- High-efficiency, high-frequency operation

DISPLAYS  
**High-Quality Displays Offer Excellent Human-to-Machine Interface Solutions**  
  
**LCD, OLED, Color TFT**  

- Selection of transfective LCD, sunlight-readable OLED, and high-brightness color TFT
- High-visibility displays for use in the transportation industry

RESISTORS  
**Long-Life Cermet Potentiometer**  
  
**P11L**  


- Long life 2M cycles 12.5 mm square single-turn panel control, versatile options
- Compliant to RoHS, tested according to CECC, value added and custom designs available

OPTOELECTRONICS  
**Subminiature Dual-Channel Transmissive Optical Sensor with Deep Slot for Turn-and-Push Encoding**  
  
**TCUT1600X01**  

- Resolve direction and speed with dual-channel transmissive (interrupter) sensor
- High slot height for turn-and-push sensing

CERAMIC CAPACITORS  
**AEC-Q200 Qualified, Broad Range of Sizes and Working Voltages, C0G (NP0), X7R, and X8R**  
  
**VJ...31/VJ...34 Automotive MLCC**  

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

RESISTORS  
**Fully Sealed Panel Potentiometer, Military and Professional Grades**  
  
**PE30**  

- Robust 2 W, 19.7 mm axial single-turn panel control
- Compliant to RoHS, tested according to CECC, value added and custom designs available

View datasheets for these products  
www.vishay.com/ref/et3tr1c



## Key components for AC AND HYBRID TRAINS



### THE VISHAY ADVANTAGE

- Robust Design
- High Reliability
- Durability
- Long Life
- Safety Approvals

**Main Inverters**



**Auxiliary Inverters**



**Auxiliary Rectifiers**



**Motor Blowers / Cooling Fans**








# Main Inverters



RESISTORS

**Very High Energy Absorption Wirewound Resistor (up to 16 KJ) and High Overloads**




**C52T**

- Overload up to  $10 \times P_n$  during 30 s
- Superior reliability

OPTOELECTRONICS

**2.5 A Output Current IGBT and MOSFET Driver**



**VO3120**

- 2.5 A peak output current in a DIP or SMD package
- 35 kV/ $\mu$ s common mode rejection and UL, cUL, and VDE certified


INDUCTORS

**Numerous Custom Designs for High-Efficiency Inductor and Transformer Applications**

- Current ratings up to 1000 A, switching frequency power levels from 1 W to 1 MW
- Amorphous, powder, and ferrite cores including low profile packaging

DIODES

**TRANSZORB® Transient Voltage Suppressors**




**5KP60A**

- AEC-Q101 qualified
- 5000 W peak pulse power capability with a 10/1000  $\mu$ s waveform

ESTA POWER CAPACITORS

**Capacitors for Power Electronics (PEC) – Rectangular**




**DCMKP Rectangular**

- Heavy duty
- Low self inductance

OPTOELECTRONICS

**High-Speed Optocoupler, Single and Dual, 10 MBd**



**VO2611**

- 25 kV/ $\mu$ s common mode rejection and VDE, BSI, UL, cUL certified
- Guaranteed AC and DC performance from -40 °C to +100 °C

RESISTORS

**Power Resistors for Mounting onto a Heatsink, Thick Film Technology**




**RTOP100V820RJB**

- ISOTOP case SOT-227, high power up to 200 W, wide ohmic value range 0.046  $\Omega$  to 1 M $\Omega$
- Non-inductive, easy mounting, low thermal radiation of the case

FILM CAPACITORS

**Metallized Polypropylene Film Capacitors, DC-Link Capacitor**



**MKP1848**

- High-performance DC-link capacitor with high RMS current capabilities
- Automotive Grade, AEC-Q200 compliant

RESISTORS

**Power Metal Strip® Resistors, Low Value (Down to 0.001  $\Omega$ ), Surface-Mount**



**WSR**

- High power ratings to 5 W in molded 4527 size package
- Molded package with compliant leads that give superior thermal shock resilience

RESISTORS

**High-Power Custom-Designed Power Resistors**



**CS61**

- Custom designs offering electrical and mechanical application-specific features
- Designed to meet heavy-duty requirements where space is at a premium

RESISTORS

**Vitreous Wirewound Resistors with Corrugated Ribbon**



**GBS / ZBS**

- High power rating up to 1000 W
- Complete vitreous coating for perfect humidity protection

RESISTORS

**Aluminum-Housed Compact Wirewound Resistor**



**VACR**

- High power rating up to 500 W
- Easy to mount due to rectangular design

View datasheets for these products [www.vishay.com/ref/et3tr2a](http://www.vishay.com/ref/et3tr2a)



# Auxiliary Inverters



RESISTORS

**Vitreous Wirewound Resistors with Corrugated Ribbon**

[GBS309603829JLX000](#)

- High power rating up to 1000 W
- Complete vitreous coating for perfect humidity protection



MODULES

**ADD-A-PAK Generation VII Power Modules, Standard Diodes, 80 A**

[VSKC71/12](#)

- UL approved file E78996
- Industrial standard package used in high-voltage regulated power supplies




ESTA POWER CAPACITORS

**Capacitors for Power Electronic (PEC) – Rectangular**

[ACMKP Rectangular](#)

- High RMS and impulse current rating
- High reliability




OPTOELECTRONICS

**High-Speed Optocoupler, Single and Dual, 10 MBd**

[VO2611](#)

- 25 kV/μs common mode rejection and VDE, BSI, UL, and cUL certified
- Guaranteed AC and DC performance from -40 °C to +100 °C




RESISTORS

**High Power Dissipation with Standards and Custom Terminals**

[RCEC500](#)

- Resistance range: 0.47 W to 1 MW
- Creeping distance up to 75 mm




RESISTORS

**Wirewound Resistors, Industrial Power, Tubular**

[RDSF](#)

- High-temperature silicone or vitreous enamel coatings
- Non-inductive options available




FILM CAPACITORS

**Metallized Polypropylene Film Capacitor, Radial Snubber Type**

[MKP386M](#)

- IGBT direct-mount snubber
- High peak current capabilities for demanding power electronics applications




OPTOELECTRONICS

**2.5 A Output Current IGBT and MOSFET Driver**

[VO3120](#)

- 2.5 A peak output current in a DIP or SMD package
- 35 kV/μs common mode rejection and UL, cUL, and VDE certified




RESISTORS

**MCRL Series, Metal Case Wirewound Resistors**

[MCR](#)

- High power-to-size ratio
- Heatsink-mountable for high power dissipation



RESISTORS

**Vitreous Wirewound Resistors with Lugs**

[GWS / ZWS](#)

- High power rating up to 500 W
- Available in adjustable = “E” or non-inductive design = “Ni”




ALUMINUM CAPACITORS

**Aluminum Capacitors, Power Ultra Long Life Snap-In**

[159 PUL-SI](#)

- Most popular series; long life snap-in, up to 500 V at 105 °C
- Custom-made parts based on the needs of your application are available on request




View datasheets for these products [www.vishay.com/ref/et3tr2b](http://www.vishay.com/ref/et3tr2b)



# Auxiliary Rectifiers




OPTOELECTRONICS

**Optocoupler, Phototransistor Output, High Reliability, 5300 V<sub>RMS</sub>** 

**VO617A-3X007T**

- Isolation test voltage of 5300 V<sub>RMS</sub> and VDE, UL, cUL, BSI, and FIMKO certified
- Operating temperature from -55 °C to +110 °C and 5 mA trigger current

RESISTORS

**Very High Power Water Cooled Resistor with Multiple Resistive Functions** 

**WCR**

- Power up to 2500 W at 60 °C water inlet temperature and 5 l/min
- Possible to have up to eight resistive functions on the same support

MODULES

**High-Power Module, Three-Phase Bridge, from 130 A to 160 A and up to 1600 V** 

**VS-130-160MT..KPbF**

- UL approved file E78996
- Package fully compatible with the industry-standard INT-A-PAK series


RESISTORS

**High-Power Thick Film Resistor with Low Partial Discharge** 

**RCEC 750**

- Partial discharge < 10 pC at 5000 V
- Rated dissipation 750 W at 75 °C

OPTOELECTRONICS

**2.5 A Output Current IGBT and MOSFET Driver** 

**VO3120**

- 2.5 A peak output current in a DIP or SMD package
- 35 kV/μs common mode rejection and UL, cUL, and VDE certified

RESISTORS

**Vitreous Wirewound Resistors with Corrugated Ribbon** 

**GBS Load Bank**

- High power rating up to 1000 W
- Customer-specific assembly of standard resistors

MODULES

**Full-Bridge IGBT MTP Module, 20 A, 1200 V for High-Frequency Applications** 

**VS-20MT120UFAPbF**

- UL E78996 approved
- Speed: 8 kHz to 60 kHz

RESISTORS

**Stainless Steel Power Resistor** 

**VSGR**

- High power capability up to 20 kW at 40 °C
- Operating temperature range: -25 °C to +250 °C

FILM CAPACITORS

**Metallized Polypropylene Film Capacitors, DC-Link Capacitor** 

**MKP1848**

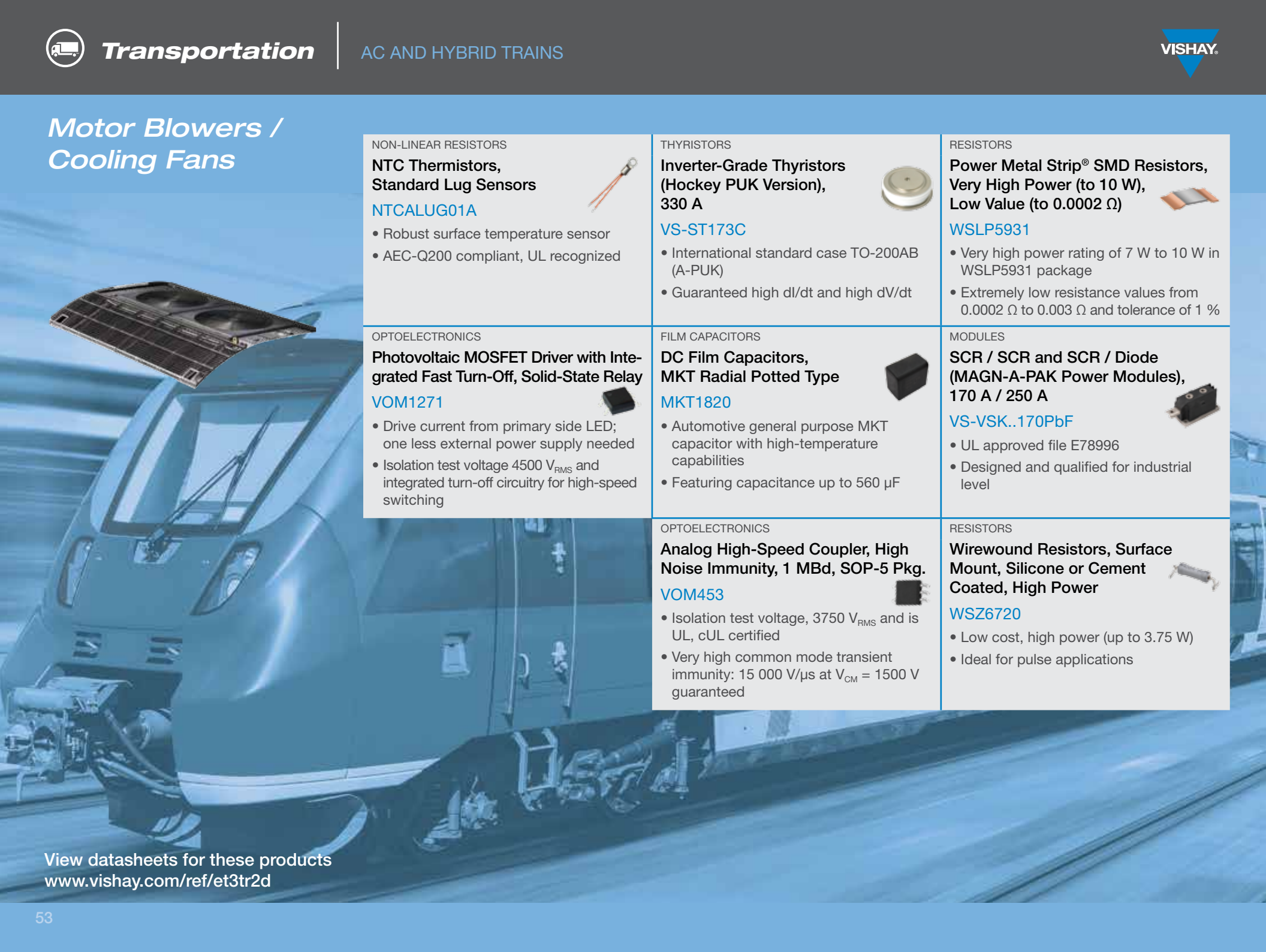
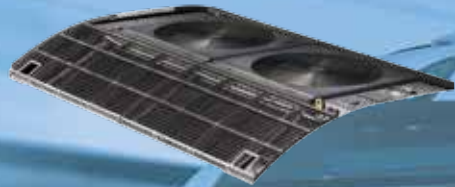
- High-performance DC-link capacitor with high RMS current capabilities
- Automotive Grade, AEC-Q200 compliant

View datasheets for these products [www.vishay.com/ref/et3tr2c](http://www.vishay.com/ref/et3tr2c)





# Motor Blowers / Cooling Fans



NON-LINEAR RESISTORS

**NTC Thermistors, Standard Lug Sensors**

**NTCALUG01A**

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



THYRISTORS

**Inverter-Grade Thyristors (Hockey PUK Version), 330 A**

**VS-ST173C**

- International standard case TO-200AB (A-PUK)
- Guaranteed high di/dt and high dv/dt

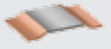


RESISTORS

**Power Metal Strip® SMD Resistors, Very High Power (to 10 W), Low Value (to 0.0002 Ω)**

**WSLP5931**

- Very high power rating of 7 W to 10 W in WSLP5931 package
- Extremely low resistance values from 0.0002 Ω to 0.003 Ω and tolerance of 1 %



OPTOELECTRONICS

**Photovoltaic MOSFET Driver with Integrated Fast Turn-Off, Solid-State Relay**

**VOM1271**

- Drive current from primary side LED; one less external power supply needed
- Isolation test voltage 4500 V<sub>RMS</sub> and integrated turn-off circuitry for high-speed switching



FILM CAPACITORS

**DC Film Capacitors, MKT Radial Potted Type**

**MKT1820**

- Automotive general purpose MKT capacitor with high-temperature capabilities
- Featuring capacitance up to 560 μF



MODULES

**SCR / SCR and SCR / Diode (MAGN-A-PAK Power Modules), 170 A / 250 A**

**VS-VSK..170PbF**

- UL approved file E78996
- Designed and qualified for industrial level



OPTOELECTRONICS

**Analog High-Speed Coupler, High Noise Immunity, 1 MBd, SOP-5 Pkg.**

**VOM453**

- Isolation test voltage, 3750 V<sub>RMS</sub> and is UL, cUL certified
- Very high common mode transient immunity: 15 000 V/μs at V<sub>CM</sub> = 1500 V guaranteed



RESISTORS

**Wirewound Resistors, Surface Mount, Silicone or Cement Coated, High Power**

**WSZ6720**

- Low cost, high power (up to 3.75 W)
- Ideal for pulse applications



View datasheets for these products  
[www.vishay.com/ref/et3tr2d](http://www.vishay.com/ref/et3tr2d)

## Spotlight on Vishay ESTA Power Capacitors for Transportation Applications

Vishay ESTA is the world's only manufacturer to offer a complete range of power capacitors. These cost-effective devices for harmonic control, energy savings, and voltage stabilization are highly reliable and environmentally safe, and can be used under the most rugged conditions.

Their efficient operation helps promote CO2 reduction as well as reducing losses in long-distance HVDC transmissions. The power capacitors are also used for RFI filters and voltage and frequency converters in traction and industrial drives.

Vishay ESTA capacitors are manufactured with the highest quality standards and come complete and ready to use for all applications.

### APPLICATIONS

- Static converters for:
  - Heavy-haul locomotives
  - Light local trains
  - Trolley busses
  - Trams / streetcars

### STANDARDS

- IEC 61071
- IEC 61881
- Customer specifications

### RANGES

- AC up to 24 kV per unit
- DC up to 125 kV and 15 kJ per unit
- Rectangular and tubular designs for casings

### BENEFITS

- All appropriate capacitor technologies available to ensure optimum suitability to specific applications
- Highest flexibility in mechanical designs, including designs for low quantities



For custom requirements complete your specification details at [www.vishay.com/doc?13018](http://www.vishay.com/doc?13018) and / or email [esta@vishay.com](mailto:esta@vishay.com).

Key components for  
**FORKLIFTS, LIFT TRUCKS**



**Main Inverters /  
Motor Drives**



**Battery Chargers /  
Monitoring  
Systems**



**Electronic  
Controls**



**THE VISHAY ADVANTAGE**

- High Reliability
- Durability
- Long Life
- Safety Approvals
- High Precision





# Main Inverters / Motor Drives



View datasheets for these products  
[www.vishay.com/ref/et3tr3a](http://www.vishay.com/ref/et3tr3a)

### RESISTORS

#### Thin Film Mini-MELF Resistors

**SMM0204**



- Unrivaled surge handling capability, ultimate stability over lifetime
- AEC-Q200 qualified, sulfur resistant, GREEN product

### MOSFETs

#### Automotive Bare Die MOSFET, Family Available in Tape-and-Reel Format

**SQM100N08-5m0KGD**



- High-performance MOSFET technologies available in bare die
- Known good die processing with comprehensive testing

### INDUCTORS

#### Numerous Custom Designs for High-Efficiency Inductor and Transformer Applications

- Current ratings up to 1000 A, switching frequency power levels from 1 W to 1 MW
- Amorphous, powder, and ferrite cores including low profile packaging

### DIODES

#### Surface-Mount TRANSZORB® Transient Voltage Suppressors

**SMBJ**



- AEC-Q101 qualified
- Peak pulse power: 600 W (10/1000  $\mu$ s)

### RESISTORS

#### Wirewound Resistors, Industrial Power, Tubular

**RBSF**



- High-temperature silicone or vitreous enamel coatings
- Designed to meet heavy-duty requirements where space is at a premium

### OPTOELECTRONICS

#### Widebody IGBT and MOSFET Driver with 10 mm Creepage and Clearance

**VOW3120**



- 10 mm min. external creepage distance, 8000 V max. transient isolation voltage
- 2.5 A minimum peak output current, 45 kV/ $\mu$ s common mode rejection

### NON-LINEAR RESISTORS

#### NTC Thermistors, Naked Chips

**NTCC100E4**



- High stability over long time
- Wire-bondable NTC die version available

### OPTOELECTRONICS

#### Widebody 1 MBd High-Speed Optocoupler with 10 mm Creepage and Clearance

**VOW2611**



- 8000 V max. transient isolation voltage
- Integrated faraday shield provides very high input-to-output noise isolation of 40 kV/ $\mu$ s

### ESTA POWER CAPACITORS

#### Capacitors for Power Electronics (PEC) – Cylindrical

**HDMKP**



- Low self inductance
- High current rating

### MOSFETs

#### Automotive N-Channel 40 V (D-S) 175 °C MOSFET

**SQM200n04-1m1L**



- TrenchFET® Gen III technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  1.1 m $\Omega$
- 7-leaded D<sup>2</sup>PAK packaging

### RESISTORS

#### Power Metal Strip® SMD Resistors, Very High Power (to 7 W), Low Value (to 0.0005 $\Omega$ )

**WSLP2726**



- High power rating of 5 W to 7 W in WSLP2726 package
- Very low resistance values from 0.0005  $\Omega$  to 0.002  $\Omega$  in 4-terminal package

### OPTOELECTRONICS

#### Widebody 1 MBd High-Speed Optocoupler with 10 mm Creepage and Clearance

**VOW136**



- 10 mm min. external creepage distance, 8000 V max. transient isolation voltage
- Integrated faraday shield provides very high input-to-output noise isolation



# Battery Chargers / Monitoring Systems



View datasheets for these products  
[www.vishay.com/ref/et3tr3b](http://www.vishay.com/ref/et3tr3b)

DIODES

**Surface-Mount TRANSZORB® Transient Voltage Suppressors**




**SMBJ150-E3/52**

- AEC-Q101 qualified
- Peak pulse power: 600 W (10/1000  $\mu$ s)

NON-LINEAR RESISTORS

**NTC Thermistors, Radial Leaded, Standard Precision**




**NTCLE100E3103HT1**

- Standard classic series
- Color band coded

MOSFETs

**Automotive N-Channel 100 V (D-S) 175 °C MOSFET**




**SQM120N10-3m8**

- Medium-voltage ThunderFET® technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  3.8 m $\Omega$
- Popular D<sup>2</sup>PAK packaging

OPTOELECTRONICS

**Optocoupler, Phototransistor Output, High Reliability, 5300 V<sub>RMS</sub>**



**VO617A-3X007T**

- Isolation test voltage of 5300 V<sub>RMS</sub> and VDE, UL, cUL, BSI, and FIMKO certified
- Operating temperature from -55 °C to +110 °C and 5 mA trigger current

RESISTORS

**High-Stability Thin Film Flat Chip Resistors**




**TNPW e3**

- Excellent overall stability, endurance < 0.05 %, resistance range from 10  $\Omega$  to 3 M $\Omega$
- AEC-Q200 qualified, sulfur resistant, halogen-free

OPTOELECTRONICS

**AC and DC Linear Optocoupler with VDE, UL, BSI, and FIMKO Certification**




**IL300**

- Feedback photodiode compensates for LED's time and temperature characteristics
- Isolation test voltage, 5300 V<sub>RMS</sub> in a DIP or SMD package

RESISTORS

**Power Metal Strip® Battery Shunt Resistor, Very Low Value (100  $\mu\Omega$ , 125  $\mu\Omega$ , and 250  $\mu\Omega$ )**




**WSBS8518**

- 36 W (850 A) power capability in an 8518 package
- Power Metal Strip all-welded construction for severe environments

RESISTORS

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



**WSLP**

- Very high power rating to 3 W in WSLP0603 to WSLP2512 size packages
- Extremely low resistance values from 0.0005  $\Omega$  to 0.1  $\Omega$  and tolerance of 1 %

MOSFETs

**E Series 600 V N-Channel Power MOSFET**




**SiHG22N60E**

- High-performance E Series high-voltage technology, maximum  $R_{DS(on)}$  180 m $\Omega$
- Popular TO-247 packaging, maximum continuous current of 21 A

INDUCTORS


**Numerous Custom Designs for High-Efficiency Inductor and Transformer Applications**



- Current ratings up to 1000 A, switching frequency power levels from 1 W to 1 MW
- Amorphous, powder, and ferrite cores including low profile packaging

DISPLAYS

**High-Quality Displays Offer Excellent Human-to-Machine Interface Solutions**



**LCD, Color TFT, OLED**

- Selection of transreflective LCD, sunlight-readable OLED and high-brightness color TFT
- High-visibility displays for use in the transportation industry

OPTOELECTRONICS

**Widebody 1 MBd High-Speed Optocoupler with 10 mm Creepage and Clearance**



**VOW2611**

- 8000 V max. transient isolation voltage
- Integrated faraday shield provides very high input-to-output noise isolation of 40 kV/ $\mu$ s



# Electronic Controls




TANTALUM CAPACITORS

**Solid Tantalum Chip Capacitors, 298D MICROTAN®, 298W Extended Range MICROTAN** 

**298D**

- High capacitance in small case sizes, including 0603 and 0402 footprint
- Perfect for space-constrained designs


RECTIFIERS

**Surface-Mount Ultrafast Plastic Rectifier** 

**MURS120-E3/53T**

- Glass passivated diode technology
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C

SENSORS

**Position Sensor, Non-Contacting** 

**A1260HE**

- Easy and fast mounting (2 ears) d-shaft design, output cable and connector
- Redundant laws for security, 8-turns electrical signal, steering applications


DIODES

**Small-Signal Schottky Diodes** 

**BAS281**

- AEC-Q101 qualified
- Integrated protection ring against static


SENSORS

**Single-Turn Bushing Mount Hall Effect Sensor in Size 09 (22.2 mm)** 

**351 HE**

- Accurate linearity: ± 0.5 %, all angles available up to 360°, no dead band
- Dedicated to applications in harsh environments, long life > than 10M cycles

INDUCTORS

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

**IHLP-5050**

- High-current, high-temperature inductor for filtering and DC/DC conversion

OPTOELECTRONICS

**Widebody 1 MBd High-Speed Optocoupler with 10 mm Creepage and Clearance** 

**VOW2611**

- 8000 V max. transient isolation voltage
- Integrated faraday shield provides very high input-to-output noise isolation of 40 kV/μs

DISPLAYS

**High-Quality Displays Offer Excellent Human-to-Machine Interface Solutions** 

**LCD, Color TFT, OLED**

- Selection of transfective LCD, sunlight-readable OLED, and high-brightness color TFT
- High-visibility displays for use in the transportation industry

RESISTORS

**Professional Thin Film MELF Resistors** 

**MMU 0102, MMA 0204, MMB 0207**

- Unrivaled surge-handling capability, ultimate stability over lifetime
- AEC-Q200 qualified, approved acc. EN 140401-803, sulfur resistant, GREEN product


MOSFETs

**Automotive N-Channel 75 V (D-S) 175 °C MOSFET** 

**SQJ486EP**

- Classic TrenchFET® technology, AEC-Q101 qualified, maximum R<sub>DS(on)</sub> 26 mΩ
- Thermally enhanced PowerPAK® SO-8L packaging


ALUMINUM CAPACITORS

**Aluminum Capacitors SMD (Chip), High Temperature, Low Impedance** 

**146 CTI**

- High temperature up to 125 °C, long life, low impedance, high ripple current
- Soldering according JEDEC-J-STD-020

OPTOELECTRONICS

**0.5 A Output Current IGBT and MOSFET Driver** 

**VO3150A**

- 0.5 A minimum peak output current in a DIP or SMD package
- 25 kV/μs minimum common mode rejection and is UL, cUL, and VDE certified

View datasheets for these products [www.vishay.com/ref/et3tr3c](http://www.vishay.com/ref/et3tr3c)



Key components for  
**HEAVY TRANSPORTATION**



**Cranes**



**Mining Trucks**



**Boats, Ships, Vessels**



**THE VISHAY ADVANTAGE**

- AEC Qualifications
- High Power Density
- High-Voltage Performance
- Inrush Current Capabilities
- Long Life
- High Reliability
- and more...




# Cranes



RECTIFIERS  
**Surface-Mount Glass Passivated Rectifier**  
  
**S1J**  

- Glass passivated diode technology
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C

ESTA POWER CAPACITORS  
**Capacitors for Power Electronics (PEC) – Rectangular**  
  
**DCMKP Rectangular**  


- Heavy duty
- Low self inductance

MOSFETs  
**Automotive N-Channel 100 V (D-S) 175 °C MOSFET**  
  
**SQD50N10-8m9L**  


- Medium-voltage ThunderFET® technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  8.9 mΩ
- Popular DPAK packaging

RESISTORS  
**Precision Thin Film Chip Resistor Array, Superior Moisture Resistivity**  
  
**ACAS...AT**  


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

OPTOELECTRONICS  
**Widebody IGBT and MOSFET Driver with 10 mm Creepage and Clearance**  
  
**VOW3120**  


- 10 mm min. external creepage distance, 8000 V max. transient isolation voltage
- 2.5 A minimum peak output current, 45 kV/μs common mode rejection

RESISTORS  
**High-Power, High-Current Grid Resistors, 1 kW and Larger**  
  
**GRE1**  


- High active mass with good thermal dissipation
- IP00, IP20, and IP23 rated enclosures available

SENSORS  
**Single-Turn Bushing Mount Hall Effect Sensor in Size 09 (22.2 mm)**  
  
**351 HE**  

- Accurate linearity: ± 0.5 %, all angles available up to 360°, no dead band
- Dedicated to applications in harsh environments, long life > than 10M cycles

INDUCTORS  
**Low-Profile, High-Current IHLP® Inductors**  
  
**IHLP-6767GZER470M11**  


- High-current, high-temperature inductor for filtering and DC/DC conversion

RESISTORS  
**High-Stability Thin Film Flat Chip Resistors**  
  
**TNPW e3**  


- Excellent overall stability, endurance < 0.05 %, resistance range from 10 Ω to 3 MΩ
- AEC-Q200 qualified, sulfur resistant, halogen-free

RESISTORS  
**Surface-Mount Power Resistor Thick Film Technology**  
  
**D2TO020**  

- AEC-Q200-qualified D<sup>2</sup>PAK TO-263 standard package, 20 W and 35 W at 25 °C case temperature
- High-pulse capability up to 10 J for short pulse, high-temp. soldering, RoHS comp.

NON-LINEAR CAPACITORS  
**SMD 0805, Glass Protected NTC Thermistors**  
  
**NTCS0805E3...**  

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

RESISTORS  
**Thick Film Surface-Mount Chip Resistors, Wraparound and 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

View datasheets for these products  
[www.vishay.com/ref/et3tr4a](http://www.vishay.com/ref/et3tr4a)



# Mining Trucks



RESISTORS

**Vitreous Wirewound Resistors with Corrugated Ribbon** 

**GBS**

- High power rating up to 1000 W
- Complete vitreous coating for perfect humidity protection


MOSFETs

**Automotive N-Channel 100 V (D-S) 175 °C MOSFET** 

**SQD50N10-8m9L**

- Medium-voltage ThunderFET® technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  8.9 mΩ
- Popular DPAK packaging


RESISTORS

**Integrated Braking Resistor with Fans** 

**Grid Box Braking Resistor**

- Power of 4.4 MW
- Dedicated for severe conditions (mining)


OPTOELECTRONICS

**Widebody 1 MBd High-Speed Optocoupler with 10 mm Creepage and Clearance** 

**VOW2611**

- 8000 V max. transient isolation voltage
- Integrated faraday shield provides very high input-to-output noise isolation of 40 kV/μs


RESISTORS

**Universal Mount Edgewound Power Wirewound Resistors** 

**EDGU**

- High current capability
- Enclosures and mounting frames available


INDUCTORS

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

**IHLP-6767GZER470M11**

- High-current, high-temperature inductor for filtering and DC/DC conversion


NON-LINEAR RESISTORS

**SMD 0805, Glass Protected NTC Thermistors** 

**NTCS0805E3...**

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

RECTIFIERS

**Surface-Mount Glass Passivated Rectifier** 

**S1J**

- Glass passivated diode technology
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C

SENSORS

**Position Sensor Tiller Head Control** 

**Auto xxxxHE**

- Redundant laws for safety, molded housing for perfectly fitting in applications
- Sealed sensor: IP67, integrated connector, hollow shaft actuated by flatted axis


RESISTORS

**Thick Film Surface-Mount Chip Resistors, Wraparound and 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


ESTA POWER CAPACITORS

**Capacitors for Power Electronic (PEC) - Rectangular** 

**ACMKP Rectangular**

- High RMS and impulse current rating
- High reliability

RESISTORS

**Vitreous Wirewound Resistors with Ferrules** 

**GWK**

- High power rating up to 260 W
- Complete vitreous coating for perfect humidity protection

View datasheets for these products [www.vishay.com/ref/et3tr4b](http://www.vishay.com/ref/et3tr4b)





### Boats, Ships, Vessels




**DIODES**

**Small-Signal Zener Diodes**

**MMBZ5235**

- AEC-Q101 qualified
- ESD capability according to AEC-Q101




**TRANSDUCERS**

**Precision Rotative Transducers, Conductive Plastic, Economic Series (ECO)**

**ECO78**

- Rudder position control for boats, phased for easier mounting in production
- Special electrical angle for a perfect fitting with customer application



**RECTIFIERS**

**Surface-Mount Ultrafast Plastic Rectifier**

**ES1B**

- Glass passivated diode technology
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C




**RESISTORS**

**Very High Power Water Cooled Resistor with Multiple Resistive Functions**

**WCR**

- Power up to 2500 W at 60 °C water inlet temperature and 5 l/min
- Possible to have up to eight resistive functions on the same support




**MOSFETs**

**Automotive P-Channel 30 V (D-S) 175 °C MOSFET**

**SQ4425EY**

- TrenchFET® technology, AEC-Q101 qualified, maximum  $R_{DS(on)}$  down to 12 mΩ
- Popular SO-8 packaging




**INDUCTORS**

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

**IHLP-2525CZ-5A**

- Compact size and high current, low saturation for noise filtering




**SENSORS**

**Throttle Position Sensor in Hall Effect Technology, Hollow and D-Shaft Versions**

**981 HE**

- Accurate linearity down to ± 0.5 %, hollow and d-shaft versions available
- Spring-loaded types available, dedicated to applications in harsh environments




**RESISTORS**

**Aluminum-Housed Compact Wirewound Resistor**

**VACR**

- High power rating up to 500 W
- Easy to mount due to rectangular design




**OPTOELECTRONICS**

**Photovoltaic MOSFET Driver with Integrated Fast Turn-Off, Solid-State Relay**

**VOM1271**

- Drive current from primary-side LED; one less external power supply needed
- Isolation test voltage 4500 V<sub>RMS</sub> and integrated turn-off circuitry for high-speed switching




**RESISTORS**

**Vitreous Wirewound Resistors**

**RW**

- High power rating up to 480 W
- Complete vitreous coating for perfect humidity




**DISPLAYS**

**High-Quality Displays Offer Excellent Human-to-Machine Interface Solutions**

**LCD, Color TFT, OLED**

- Selection of transfective LCD, sunlight-readable OLED, and high-brightness color TFT
- High-visibility displays for use in the transportation industry




**RESISTORS**

**Power Metal Strip® Resistors, Low Value (Down to 0.0005 Ω), Surface-Mount**

**WSL2512**

- Extremely low resistance values from 0.0005 Ω to 0.5 Ω and tolerance of 1 %
- High power of 1 W in 2512 size resistor



View datasheets for these products  
[www.vishay.com/ref/et3tr4c](http://www.vishay.com/ref/et3tr4c)

## Key components for TOLL SYSTEMS



**Toll Systems  
(Coin, Card, Cash)**



### **THE VISHAY ADVANTAGE**

- High Reliability
- Transient Immunity
- Good Performance in Harsh Environments
- Long Life
- and more ...



# Toll Systems (Coin, Card, Cash)



CERAMIC CAPACITORS

**AC Line Rated Disc Capacitors**  
Class X1, 760 V<sub>AC</sub>,  
Class Y1, 500 V<sub>AC</sub>



**VY1**

- X1 / Y1 safety rating according to IEC 60384-14, 3rd edition
- Highest reliability and lifetime, operating temperature: -40 °C to +125 °C

INDUCTORS

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



**IHLP-2525CZ-5A**

- Compact size and high current, low saturation for noise filtering

RESISTORS

**Professional Thin Film MELF Resistors**



**MMU 0102, MMA 0204, MMB 0207**

- Unrivaled surge-handling capability, ultimate stability over lifetime
- AEC-Q200 qualified, approved acc. EN 140401-803, sulfur resistant, GREEN product

DIODES

**Small-Signal Zener Diodes**



**MMBZ5235**

- AEC-Q101 qualified
- ESD capability according to AEC-Q101

RECTIFIERS

**Surface-Mount Glass Passivated Rectifier**



**S1J**

- Glass passivated diode technology
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C

DIODES

**Small-Signal Schottky Diodes**



**BAS281**

- AEC-Q101 qualified
- Integrated protection ring against static

TANTALUM CAPACITORS

**Solid Tantalum Chip Capacitors, 298D MICROTAN®, 298W Extended Range MICROTAN**



**298D**

- High capacitance in small case sizes, including 0603 and 0402 footprint
- Perfect for space-constrained designs

OPTOELECTRONICS

**High-Power SurfLight™ Emitter with 850 nm Peak Wavelength**



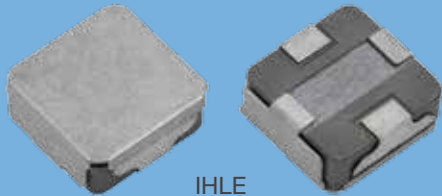
**VSMY7850X01**

- Wavelength matches CMOS-based camera systems for nighttime and low-visibility illumination
- 170 mW/sr intensity at 1 A forward current, 780 mW/sr at 5 A forward current

View datasheets for these products  
[www.vishay.com/ref/et3tr5a](http://www.vishay.com/ref/et3tr5a)



## Vishay Delivers Saturation Performance Advantages



IHLE



IHCL

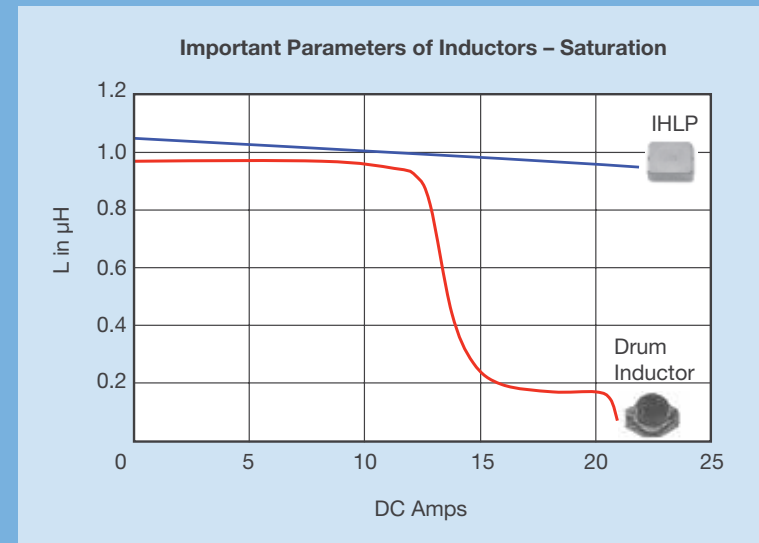

 IHL  
 IHLD

Taking the Vishay innovation of composite inductor technology to the next step, three new products, the IHLE, IHCL, and IHL open the door for more robust automotive applications.

The IHCL is an IHLP® with two highly coupled inductors in one standard SMD package. Primarily designed for SEPIC converters, the 94 % coupling of the two inductors provides more efficient operation with a reduced footprint and lower profile compared to other standard ferrite solutions. The low core loss, high temperature stability, and soft saturation inherent in IHLP technology provide superior performance at continuous operating temperatures of 155 °C. Available in three footprints, 3232, 4040, and 5050, with inductance range from 2.7  $\mu\text{H}$  to 33  $\mu\text{H}$  for each inductor, the IHCL coupled inductor can cover a wide range of SEPIC converter output currents for LED drives and other circuits that require a stable operating voltage regardless of the input voltage.

The IHL product also has two inductors in one package. However, these inductors are not coupled. The IHL is designed for Class D audio amplifiers and contains two IHLP inductor vertically mounted in a robust LCP housing, reducing the board space needed for two IHLP inductors by 50 %. Again, the temperature stability of the IHLP as a function of inductance and saturation provides a more stable output inductor for Class D amplifier circuits that can improve fidelity and total harmonic distortion. The IHL inductor is currently available in the IHL4032 and IHL3232 footprints in 10  $\mu\text{H}$ , 15  $\mu\text{H}$ , 22  $\mu\text{H}$  and 33  $\mu\text{H}$  values to cover the needs of most Class D amplifiers

While the IHLP is one of the best self-shielded inductors on the market due to the fact that its wire coil is completely surrounded by magnetic material with no discrete air gap to keep the magnetic flux inside the package, all inductors still emit EMI through an e-field which sometimes has to be shielded with an external metal shield. The IHLE inductor utilizes a standard IHLP but integrates an e-field shield that, when connected to ground, can attenuate the e-field emitted by the inductor by up to -20 dB at 1 cm. The IHLE can eliminate the need for a large, bulky, expensive shield by just shielding the high-current inductor. The IHLE is currently available in the 4040 footprint in any IHLP4040 standard value. Other sizes down to IHLE1616 are in the prototype stage. Use the IHLE in sensitive circuits where EMI is present due to switching noise in the inductor for a compact and cost-effective alternative to board-level shielding.



## Overview of Automotive Grade Products

Vishay has incorporated key automotive industry quality initiatives into an Automotive Grade Product line. The goal is zero defects. The requirements cover design, qualification, and manufacturing, and are used to continuously improve Vishay products and processes. Products fulfilling the Vishay Automotive Grade requirements, described below, earn our Automotive Grade stamp on their datasheets.

### DESIGN

- **Robust Design Policy:** New and modified products are designed using design rules, DFMEA, and lessons learned. The design rules ensure Automotive Grade Products are robust through manufacturing and assembly. Testing to failure confirms that design margins meet the demands of automotive use.
- **Safe Launch:** Vishay's Safe Launch Policy ensures everything from design through production roll-out happens according to plan. Process corner evaluation, yield analysis, process capability review, and reliability testing are all incorporated.

### QUALIFICATIONS

- **AEC-Q100-, AEC-Q101-, AEC-Q200-Qualified:** Automotive Grade Products are qualified to the latest AEC qualification standards and presented for approval using PPAP.

### MANUFACTURING

- **TS16949 Facility:** All Automotive Grade Products are produced in facilities certified to TS16949.
- **Maverick Lot Program:** The Maverick Lot Program employs Part Average Testing (PAT), Statistical Yield Limit (SYL), and Statistical Bin Limit (SBL) according to AEC-Q001 and AEC-Q002 to identify statistically different parts and lots.
- **Periodic Verification to AEC Requirements:** Product families are verified to AEC Stress Test Qualification standards every two years.

### CONTINUOUS IMPROVEMENT

- **Error Proofing:** Error proofing is performed during the entire process to identify and eliminate potential causes of defects.
- **Lessons Learned / Look Across:** All continual improvement actions are linked to lessons learned and look across programs to ensure improvement everywhere in the Company.



### DISCRETE SEMICONDUCTORS

- MOSFETs
- Optoelectronics

### PASSIVE COMPONENTS

- Capacitors
  - Aluminum
  - Tantalum
  - Ceramic
  - Film
- Resistors
  - Film
  - Wirewound
  - Power Metal Strip®
  - Thick Film Power
- Inductors
  - IHLP®
  - IHTH









Vishay Intertechnology, Inc.



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*SOLUTIONS*

