



Vishay Intertechnology, Inc.

Automotive Full Hybrid Vehicles





Automotive

Full Hybrid
Vehicles

Main Inverters	4
High-Voltage Bus Systems	5
Energy Recuperation	6

The Engineer's Toolbox highlights, by market application, some innovative components Vishay manufactures that help design engineers develop superior end products. We recognize that offering unique component solutions helps improve the performance of next-generation devices, overcome technical barriers, and create new markets.

More information on the Engineer's Toolbox, including product datasheet links, can be found at www.vishay.com/ref/et2. For inquiries, please contact your local sales representative.



Key components for FULL HYBRID VEHICLES



MAIN INVERTERS



**HIGH- VOLTAGE
BUS SYSTEMS**



ENERGY RECUPERATION

THE VISHAY ADVANTAGE
AEC Qualifications
High-Temperature Performance
High Reliability
High-Voltage Performance
Transient-Voltage Capabilities
and more...



MAIN INVERTERS

RESISTORS

LTO100

Power Thick Film Resistor

Features

- TO-247 package: compact and easy to mount
- 100 W at 25 °C case temperature, heatsink mounted
- RoHS-compliant
- AEC-Q200 qualification in process



INDUCTORS

IHTHxxxx

High-Current Through-Hole Inductor

Features

- High-temperature series
- Shielded construction
- Handles high transient current spikes without saturation
- Ultra-low buzz noise due to composite construction



RECTIFIERS

UGB12JTHE3

600 V 12 A Ultrafast Rectifier in TO-263AB

Features

- Glass-passivated chip technology
- Ultrafast recovery time
- Meets MSL level 1
- RoHS-compliant



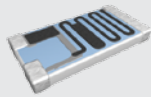
RESISTORS

CDHV

High-Voltage Thick Film Chip Divider

Features

- Working voltage of 3,000 V, in values from 20 MΩ to 50 GΩ, in a 2512-sized package
- Typical resistance ratios of 250:1, 500:1, etc.
- 3-sided wraparound terminations standard, with options including flip chip
- Termination materials available for soldering, epoxy, or wire bond applications



CAPACITORS

159 PUL-SI

105 °C Power Long-Life Snap-In

Features

- Long useful life: up to 5000 h at 105 °C with high ripple current
- Keyed polarity snap-in version available
- Special configurations for high vibration and automatic insertion available
- Sizes: 22 mm x 25 mm up to 35 mm x 60 mm; 200 V to 450 V



RESISTORS, NON-LINEAR

NTCALUG02

Low Thermal Gradient Lug NTC Thermistor

Features

- Thermal gradient: < 0.05 K/K
- AEC-Q200 qualified
- Low conducting nickel PEEK insulated leads AWG #30



MODULES

XL_Map Module

Main and/or Generator Inverter for Hybrid Electric Vehicle (Mild HEV up to 20 kW)

Features

- 650 V and 1200 V state-of-the-art Trench FS IGBT technology with FRED Pt® and HEXFRED® for antiparallel diode optimized for low EMI and improved efficiency
- Extended temperature range up to T_J max 175 °C
- Scalable power rating
- Automotive qualified



RESISTORS

VR25

High-Voltage Metal Glaze Resistor

Features

- 1600 V working voltage
- 7 kV pulse load capability
- AEC-Q200 qualified



CAPACITORS

HVArc Guard®

Surface Arc-Over Protection MLCCs

Features

- Voltage: up to 1000 V (NP0/C0G) and 2500 V (X7R)
- Case sizes: 0805 to 2225
- Capacitance: up to 8.2 nF (NP0/C0G) and 270 nF (X7R)
- Smaller body sizes and extended capacitance ranges compared to traditional solutions



MOSFETs

SQJ431EP

- 200 V P-Channel PowerPAK® SO-8L: 0.213 Ω, 12 A

Features

- AEC-Q101 qualified
- 5 mm x 6 mm; ideal for antenna filtering or where high voltage is needed with automotive ruggedness and reliability
- 175 °C maximum temperature



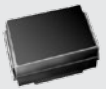
DIODES

TPSMC

1500 W Surface-Mount PAR® TVS

Features

- Junction passivation optimized design passivated anisotropic rectifier technology
- T_J = 185 °C capability; suitable for high-reliability and automotive requirements
- Available in unidirectional polarity only
- 1500 W peak pulse power capability with 10/1000 μs waveform





HIGH-VOLTAGE BUS SYSTEMS

RESISTORS

RCL

Long Side Termination Thick Film Resistor

Features

- Higher power dissipation due to wider terminals
- Better ability to withstand temperature cycle test
- AEC-Q200 qualified



CAPACITORS

VJ...31/VJ...34

AEC-Q200 Qualified Multilayer Ceramic Chip Capacitors

Features

- C0G (NP0), X7R, and X8R dielectric
- Case sizes: 0402 to 1812; voltages up to 3000 V_{DC}
- Reliable wet build process with robust NME design can withstand high ESD impulse
- Operating temperature up to + 175 °C (above + 125 °C derating)



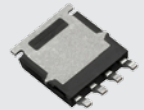
MOSFETS

SQJ402EP

Single, 100 V N-Channel Power MOSFET

Features

- AEC-Q101 qualified
- 5 mm x 6 mm thermally enhanced PowerPAK® SO-8L
- Maximum on-resistance down to 0.011 Ω
- 175 °C maximum temperature



RESISTORS

WSBS8518

Power Metal Strip® Battery Shunt Resistor

Features

- 36 W power capability in 8518 size package
- Extremely low resistance of 50 μΩ to 1000 μΩ
- Tolerance of 5.0 %
- Features very low thermal EMF design and all-welded construction



RESISTORS

D2T035

Power Thick Film Resistor

Features

- TO-263 standard package
- AEC-Q200 qualified
- RoHS-compliant/high temperature capability
- High-pulse capability up to 10 J short pulse



INDUCTORS

IHLP-5050FD-5A

Low-Profile, High-Current IHLP® Inductor

Features

- AEC-Q200 qualified
- High-temperature series: up to 155 °C
- Shielded construction
- Handles high transient current spikes without saturation



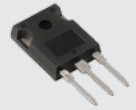
RECTIFIERS

HFA50PA60CPBF

HEXFRED® Ultrafast Soft Recovery Diode

Features

- Ultrafast and ultrasoft recovery
- Very low I_{RRM} and Q_{rr}
- RoHS-compliant
- Designed and qualified according to JEDEC-JESD47



RESISTORS

NOMCA

Molded Precision Resistor Network

Features

- Moisture-resistant tantalum nitride film
- Tight stability of 0.05 % at 1000 h, 125 °C
- Tight TCR tracking of 5 ppm/°C
- Ratio tolerance down to 0.05 %



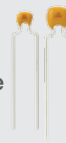
CAPACITORS

K...V Series

Radial Leaded MLCC for Automotive

Features

- Operating temperature from - 55 °C to + 160 °C
- Rated voltage of 50 V, 100 V, and 200 V
- Class 1 and Class 2 ceramic
- Radial leaded



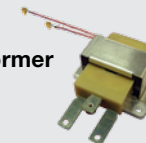
INDUCTORS

1800 W Power Planar Transformer

Full-Bridge Topology

Features

- High efficiency: ≥ 99 %
- Excellent thermal conductivity Δ < 45 °C
- Leakage inductance: 1 < μH < 9
- High insulation: > 3000 V_{DC}



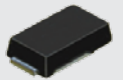
DIODES

TPSMP

400 W Low-Profile, Surface-Mount PAR® TVS

Features

- Junction passivation optimized design passivated anisotropic rectifier technology
- T_J = 185 °C capability; suitable for high-reliability and automotive requirements
- Very low profile: typical height of 1.0 mm
- Unidirectional only





ENERGY RECUPERATION

RESISTORS

MMB 0207

Professional and Precision MELF Resistors

Features

- AEC-Q200 qualified
- Advanced thin film technology
- Single pulse capability up to 3 kV or 1 kW
- Superior stability down to class 0.05
- Approved to EN 140401-803



CAPACITORS

VJ...31/VJ...34

AEC-Q200 Qualified Multilayer Ceramic Chip Capacitors

Features

- C0G (NP0), X7R, and X8R dielectric
- Case sizes: 0402 to 1812; voltages up to 3000 V_{DC}
- Reliable wet build process with robust NME design can withstand high ESD impulse
- Operating temperature up to + 175 °C (above + 125 °C derating)



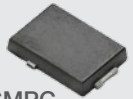
RECTIFIERS

UH6PJ

600 V 6 A Ultrafast Rectifier in SMPC

Features

- Oxide planar chip technology
- Ultrafast recovery time
- Very low profile: typical height of 1.1 mm
- RoHS-compliant
- Halogen-free



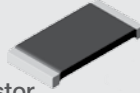
RESISTORS

WSLPxxxx

SMD, Power Metal Strip® Resistor

Features

- Extremely high power ratings: from 0.4 W to 1.0 W for SMD devices
- Available in many case sizes: 0603 to 5931
- Very low resistance value range: 0.3 mΩ to 50 mΩ
- Standard tolerance of 1.0 % with 0.5 % available



CAPACITORS

159 PUL-SI

105 °C Power Long-Life Snap-in

Features

- Long useful life: up to 5000 h at 105 °C with high ripple current
- Keyed polarity snap-in version available
- Special configurations for high vibration and automatic insertion available
- Sizes: 22 mm x 25 mm up to 35 mm x 60 mm; 200 V to 450 V



CAPACITORS

MKP1848S

Low Profile DC-Link Capacitor

Features

- Slim design – low profile
- High CV product: 2 μF to 100 μF; 500 V to 1000 V
- Long useful life: > 100 000 h at U_{NDC} and 70 °C
- High ripple current (up to 17.5 A)
- Low ESR (3.5 mΩ) and low ESL (< 1 nH per mm pitch)



MODULES

CPV362M4UPbF

IGBT SIP Module (Fast IGBT)

Features

- Fully isolated printed circuit board mount package
- Switching loss rating includes all “tail” losses
- HEXFRED® soft ultrafast diodes
- Optimized for high speeds over 5 kHz



RESISTORS

MPMA

SOT-23 Precision Matched Pair Divider

Features

- Moisture-resistant tantalum nitride film
- 1:1 to 100:1 divider ratio available
- Tight TCR tracking of 2 ppm/°C
- Ratio tolerance down to 0.05 %



CAPACITORS

K...V Series

Radial Leaded MLCCs for Automotive

Features

- Operating temperature from - 55 °C to + 160 °C
- Rated voltage of 50 V, 100 V, and 200 V
- Class 1 and class 2 ceramic
- Radial leaded



RESISTORS, NON-LINEAR

NTCLE203E3

2-Point Radial Leaded NTC Thermistor

Features

- High accuracy over a wide temperature range up to 150 °C
- High stability over a long life
- Exceptional thermal shock withstanding performance
- AEC-Q200 qualified



THE VISHAY ADVANTAGE

AEC Qualifications

High-Temperature Performance

High Reliability

High-Voltage Performance

Transient-Voltage Capabilities

and more...



Vishay Intertechnology, Inc.

BUILD VISHAY

into your **DESIGN**

