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.
THE VISHAY ADVANTAGE
AEC準拠
高耐圧性能
長寿命
高電力密度
カスタム対応

充電器
バッテリーマネージメント
コンバーター、ブースター

主要部品
## RESISTORS
### TNPW e3 Series
High-Stability Thin Film Chip Resistors
**Features**
- Low temperature coefficient and tight tolerances: $\pm 0.1\%$, $\pm 10$ ppm/K
- Excellent overall stability in harsh environmental conditions
- AEC-Q200 qualified, automotive grade
- Case sizes: 0402 to 1210

### LPS1100
High-Power Thick Film Resistor
**Features**
- High power for small size: up to 1100 W at 25 °C
- Low weight: 83 g
- Non-inductive down to 1 µH
- High pulse capability up to 1000 J short pulse

### PAT - Automotive Qualified
Tantalum Nitride Chip Resistor
Precision Thin Film Chip Resistor
**Features**
- Moisture-resistant tantalum nitride thin film chip resistor
- Wide resistance range: from 10 Ω to 3 MΩ; tolerance down to 0.1 %
- 0.05 % stability at 2000 h, 70 °C
- AEC-Q200 qualified

### MKT1820
Automotive Grade DC MKT Film Capacitor
**Features**
- AEC-Q200 qualified, automotive grade
- Maximum application temperature: 125 °C
- Maximum operating temperature for limited time: 150 °C
- Capacitance range: 1000 pF up to 15 µF

### 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
### 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

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## TRANSFORMERS
### Power Planar Transformer 1800 W
Full-Bridge Topology
**Features**
- High efficiency $\geq 99\%$
- Excellent thermal conductivity $\Delta < 45$ °C
- Leakage inductance $1 < \mu H < 9$
- High insulation $> 3000$ V<sub>dc</sub>

## RECTIFIERS
### AU1PK
Low-Profile, Surface-Mount Ultrafast Avalanche Rectifiers
**Features**
- Very low profile: typical height of 1.0 mm
- Glass-passivated chip junction
- Ultrafast recovery times for high frequency
- Meets MSL level 1 per J-STD-020; LF maximum peak of 260 °C

## MODULES
### X Map
Up to 450 A, 600 V and 1200 V Trench IGBT Module
**Features**
- $T_{j,\text{max}} = 175$ °C
- Customization of circuit topology, IGBT/MOSFET speed available
- Short circuit capability
- Symmetrical construction for even and low stray inductance

## THE VISHAY ADVANTAGE
AEC满足
高耐压オペレーション
長寿命
高電力密度
カスタマイズ
### RESISTORS

**WSBS8518**
Power Metal Strip® Battery Shunt Resistor

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

**RESISTORS**

**PAT Automotive Qualified Tantalum Nitride Chip Resistor**
Precision Thin Film Chip Resistor

**Features**
- Moisture-resistant tantalum nitride thin film chip resistor
- Wide resistance range: from 10 Ω to 3 MΩ; tolerance down to 0.1 %
- 0.05 % stability at 2000 h, 70 °C
- AEC-Q200 qualified

**RESISTORS**

**MCW 0406 AT Professional and Precision**
Wide Terminal Thin Film Chip Resistors

**Features**
- Rated dissipation up to 300 mW
- Superior temperature cycling robustness
- Operating temperature range: up to 175 °C for 1000 h
- AEC-Q200 qualified

**RESISTORS**

**DZTO**
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

**RESISTORS**

**WSH2818**
SMD, Power Metal Strip® Resistor

**Features**
- 5 W current sensing resistor in 2818 package size
- Features a very low 1 mΩ to 100 mΩ resistance range
- Standard tolerance of 1.0 % with 0.5% available
- High-temperature performance up to +170 °C

**RESISTORS**

**MMKP383**
AC and Pulse Double Metalized MKP Capacitor

**Features**
- Low contact resistance
- Low loss dielectric
- Small dimensions for high density packaging
- 7.5 mm to 37.5 mm lead pitch

**CAPACITORS**

**BFC23386**
Line Bypass Y2 Film Capacitor

**Features**
- Safe end of life: open circuit
- Rated capacitance from 1 nF to 0.47 µF
- Rated AC voltage of 300 V
- Operating temperature up to 110 °C

**CAPACITORS**

**IHLP-6767GZ-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

**INDUCTORS**

**SMxS24A**
Surface-Mount PAR® TVS

**Features**
- Junction passivation optimized design passivated anisotropic rectifier technology
- \( T_r = 175 °C \) capability; suitable for high-reliability and automotive requirements
- Available in unidirectional polarity only
- Low leakage current, low forward voltage drop, and high surge capability
### RESISTORS

**D2TO35**  
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

**WSRx**  
SMD, Power Metal Strip® Resistor  
**Features**  
- 2 W, 3 W, and 5 W versions of current sensing resistor in 4527 package size  
- Features a very low 1 mΩ to 1 Ω resistance range  
- Standard tolerance of 1.0 % with 0.5 % available  
- High-temperature performance up to +275 °C

**ACAS 0606 AT, ACAS 0612 AT - Precision**  
Precision Thin Film Chip Resistor Arrays  
**Features**  
- TCR tracking down to 10 ppm/K (± 5 ppm/K)  
- Tolerance matching down to 0.1 % (± 0.05 %)  
- AEC-Q200 qualified  
- Resistance ratio up to 1:20

### 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)

**F1772-2 310 V-X2**  
Automotive Grade RFI X2 MKT Capacitor  
**Features**  
- High stability grade for continuous across-the-line X2 applications  
- High reliability for continuous in series with the mains operation  
- AC voltage: 310 V  
- Operating temperature up to 110 °C

### RESISTORS, NON-LINEAR

**NTCALUG02**  
Low Thermal Gradient Lug NTC Thermistor  
**Features**  
- Thermal gradient: < 0.05 K/K  
- AEC-Q200 qualified  
- Shielded construction  
- Handles high transient current spikes without saturation  
- Ultra-low buzz noise due to composite construction

**HFA50PA60CPBF**  
HEXFRED® Ultrafast Soft Recovery Diode  
**Features**  
- Ultrafast and ultraslow recovery  
- Very low I_F and Q_r  
- RoHS-compliant  
- Designed and qualified according to JEDEC-JESD47

### INDUCTORS

**IHLP-5050FD-5A**  
Low-Profile, High-Current IHLP® Inductor  
**Features**  
- AEC-Q200 qualified  
- Shielded construction  
- Handles high transient current spikes without saturation  
- Ultra-low buzz noise due to composite construction

**IHLP-5050FD-5A**  
Low-Profi le, High-Current IHLP® Inductor  
**Features**  
- AEC-Q200 qualified  
- Shielded construction  
- Handles high transient current spikes without saturation  
- Ultra-low buzz noise due to composite construction

### DIODES

**5KASMC**  
5000 W Surface-Mount PAR® TVS  
**Features**  
- Junction passivation optimized design passivated anisotropic rectifier technology  
- TJ = 185 °C capability; suitable for high-reliability and automotive requirements  
- Available in unidirectional polarity only  
- 5000 W peak pulse power capability with 10/1000 μs waveform

### MODULES

**X Map IGBT Module**  
Up to 450 A, 600 V and 1200 V Trench IGBT Module  
**Features**  
- TJ,max = 175 °C  
- Customization of circuit topology, IGBT/MOSFET speed available  
- Short circuit capability  
- Symmetrical construction for even and low stray inductance

**MTP**  
Up to 100 A, 600 V and 1200 V IGBT/MOSFET Module  
**Features**  
- 3500 V RMS insulation voltage, circuit to external pin  
- Customization of circuit topology, IGBT/MOSFET speed available  
- Very low stray inductance design for high-speed operation  
- Press-fit connection pins available soon

### RECTIFIERS

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Up to 100 A, 600 V and 1200 V IGBT/MOSFET Module  
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