

TRANSZORB® Transient Voltage Suppressors


DO-15 (DO-204AC)

**RoHS
COMPLIANT**

FEATURES

- Glass passivated chip junction
- Available in unidirectional and bidirectional
- 600 W peak pulse power capability with a 10/1000 μ s waveform, repetitive rate (duty cycle): 0.01 %
- Excellent clamping capability
- Very fast response time
- Low incremental surge resistance
- Solder dip 275 °C max. 10 s, per JESD 22-B106
- AEC-Q101 qualified
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

TYPICAL APPLICATIONS

Use in sensitive electronics protection against voltage transients induced by inductive load switching and lighting on ICs, MOSFET, signal lines of sensor units for consumer, computer, industrial, automotive, and telecommunication.

MECHANICAL DATA

Case: DO-15 (DO-204AC)

Molded epoxy over passivated chip

Molding compound meets UL 94 V-0 flammability rating

Base P/N-E3 - RoHS compliant, commercial grade

Base P/NHE3 - RoHS compliant, AEC-Q101 qualified

Terminals: matte tin plated leads, solderable per J-STD-002 and JESD 22-B102

E3 suffix meets JESD 201 class 1A whisker test, HE3 suffix meets JESD 201 class 2 whisker test

Note

- P6KE250A to P6KE540A and P6KE250CA to P6KE440CA for commercial grade only

Polarity: for unidirectional types the color band denotes cathode end, no marking on bidirectional types

PRIMARY CHARACTERISTICS

| | |
|---------------------------------|-------------------------------|
| V_{WM} | 5.8 V to 459 V |
| V_{BR} unidirectional | 6.8 V to 540 V |
| V_{BR} bidirectional | 6.8 V to 440 V |
| P_{PPM} | 600 W |
| P_D | 5.0 W |
| I_{FSM} (unidirectional only) | 100 A |
| T_J max. | 175 °C |
| Polarity | Unidirectional, bidirectional |
| Package | DO-15 (DO-204AC) |

DEVICES FOR BIDIRECTION APPLICATIONS

For bidirectional types, use CA suffix (e.g. P6KE440CA).

Electrical characteristics apply in both directions.

MAXIMUM RATINGS ($T_A = 25$ °C unless otherwise noted)

| PARAMETER | SYMBOL | VALUE | UNIT |
|--|----------------|----------------|------|
| Peak pulse power dissipation with a 10/1000 μ s waveform ⁽¹⁾ (fig. 1) | P_{PPM} | 600 | W |
| Peak pulse current with a 10/1000 μ s waveform ⁽¹⁾ | I_{PPM} | See next table | A |
| Power dissipation on infinite heatsink at $T_L = 75$ °C (fig. 5) | P_D | 5.0 | W |
| Peak forward surge current 8.3 ms single half sine-wave ⁽²⁾ | I_{FSM} | 100 | A |
| Maximum instantaneous forward voltage at 50 A for unidirectional only ⁽³⁾ | V_F | 3.5/5.0 | V |
| Operating junction and storage temperature range | T_J, T_{STG} | -55 to +175 | °C |

Notes

⁽¹⁾ Non-repetitive current pulse, per fig. 3 and derated above $T_A = 25$ °C per fig. 2

⁽²⁾ Measured on 8.3 ms single half sine-wave or equivalent square wave, duty cycle = 4 pulses per minute maximum

⁽³⁾ $V_F = 3.5$ V for P6KE220A and below; $V_F = 5.0$ V for P6KE250A and above



| ELECTRICAL CHARACTERISTICS (T _A = 25 °C unless otherwise noted) | | | | | | | | |
|--|--|------|----------------------------------|---------------------------------------|---|--|---|---|
| DEVICE TYPE | BREAKDOWN VOLTAGE V _{BR} AT I _T ⁽¹⁾ (V) | | TEST CURRENT I _T (mA) | STAND-OFF VOLTAGE V _{WM} (V) | MAXIMUM REVERSE LEAKAGE AT V _{WM} ⁽³⁾ I _D (μA) | MAXIMUM PEAK PULSE CURRENT I _{PPM} ⁽²⁾ (A) | MAXIMUM CLAMPING VOLTAGE AT I _{PPM} V _C (V) | MAXIMUM TEMPERATURE COEFFICIENT AT V _{BR} (%/°C) |
| | MIN. | MAX. | | | | | | |
| (+)P6KE6.8A | 6.45 | 7.14 | 10 | 5.80 | 1000 | 57.1 | 10.5 | 0.057 |
| (+)P6KE7.5A | 7.13 | 7.88 | 10 | 6.40 | 500 | 53.1 | 11.3 | 0.061 |
| (+)P6KE8.2A | 7.79 | 8.61 | 10 | 7.02 | 200 | 49.6 | 12.1 | 0.065 |
| (+)P6KE9.1A | 8.65 | 9.55 | 1.0 | 7.78 | 50 | 44.8 | 13.4 | 0.068 |
| (+)P6KE10A | 9.50 | 10.5 | 1.0 | 8.55 | 10 | 41.4 | 14.5 | 0.073 |
| (+)P6KE11A | 10.5 | 11.6 | 1.0 | 9.40 | 5.0 | 38.5 | 15.6 | 0.075 |
| (+)P6KE12A | 11.4 | 12.6 | 1.0 | 10.2 | 5.0 | 35.9 | 16.7 | 0.078 |
| (+)P6KE13A | 12.4 | 13.7 | 1.0 | 11.1 | 5.0 | 33.0 | 18.2 | 0.081 |
| (+)P6KE15A | 14.3 | 15.8 | 1.0 | 12.8 | 1.0 | 28.3 | 21.2 | 0.084 |
| (+)P6KE16A | 15.2 | 16.8 | 1.0 | 13.6 | 1.0 | 26.7 | 22.5 | 0.086 |
| (+)P6KE18A | 17.1 | 18.9 | 1.0 | 15.3 | 1.0 | 23.8 | 25.2 | 0.088 |
| (+)P6KE20A | 19.0 | 21.0 | 1.0 | 17.1 | 1.0 | 21.7 | 27.7 | 0.090 |
| (+)P6KE22A | 20.9 | 23.1 | 1.0 | 18.8 | 1.0 | 19.6 | 30.6 | 0.092 |
| (+)P6KE24A | 22.8 | 25.2 | 1.0 | 20.5 | 1.0 | 18.1 | 33.2 | 0.094 |
| (+)P6KE27A | 25.7 | 28.4 | 1.0 | 23.1 | 1.0 | 16.0 | 37.5 | 0.096 |
| (+)P6KE30A | 28.5 | 31.5 | 1.0 | 25.6 | 1.0 | 14.5 | 41.4 | 0.097 |
| (+)P6KE33A | 31.4 | 34.7 | 1.0 | 28.2 | 1.0 | 13.1 | 45.7 | 0.098 |
| (+)P6KE36A | 34.2 | 37.8 | 1.0 | 30.8 | 1.0 | 12.0 | 49.9 | 0.099 |
| (+)P6KE39A | 37.1 | 41.0 | 1.0 | 33.3 | 1.0 | 11.1 | 53.9 | 0.100 |
| (+)P6KE43A | 40.9 | 45.2 | 1.0 | 36.8 | 1.0 | 10.1 | 59.3 | 0.101 |
| (+)P6KE47A | 44.7 | 49.4 | 1.0 | 40.2 | 1.0 | 9.3 | 64.8 | 0.101 |
| (+)P6KE51A | 48.5 | 53.6 | 1.0 | 43.6 | 1.0 | 8.6 | 70.1 | 0.102 |
| (+)P6KE56A | 53.2 | 58.8 | 1.0 | 47.8 | 1.0 | 7.8 | 77.0 | 0.103 |
| (+)P6KE62A | 58.9 | 65.1 | 1.0 | 53.0 | 1.0 | 7.1 | 85.0 | 0.104 |
| (+)P6KE68A | 64.6 | 71.4 | 1.0 | 58.1 | 1.0 | 6.5 | 92.0 | 0.104 |
| (+)P6KE75A | 71.3 | 78.8 | 1.0 | 64.1 | 1.0 | 5.8 | 103 | 0.105 |
| (+)P6KE82A | 77.9 | 86.1 | 1.0 | 70.1 | 1.0 | 5.3 | 113 | 0.105 |
| (+)P6KE91A | 86.5 | 95.5 | 1.0 | 77.8 | 1.0 | 4.8 | 125 | 0.106 |
| (+)P6KE100A | 95.0 | 105 | 1.0 | 85.5 | 1.0 | 4.4 | 137 | 0.106 |
| (+)P6KE110A | 105 | 116 | 1.0 | 94.0 | 1.0 | 3.9 | 152 | 0.107 |
| (+)P6KE120A | 114 | 126 | 1.0 | 102 | 1.0 | 3.6 | 165 | 0.107 |
| (+)P6KE130A | 124 | 137 | 1.0 | 111 | 1.0 | 3.4 | 179 | 0.107 |
| (+)P6KE150A | 143 | 158 | 1.0 | 128 | 1.0 | 2.9 | 207 | 0.108 |
| (+)P6KE160A | 152 | 168 | 1.0 | 136 | 1.0 | 2.7 | 219 | 0.108 |
| (+)P6KE170A | 162 | 179 | 1.0 | 145 | 1.0 | 2.6 | 234 | 0.108 |
| (+)P6KE180A | 171 | 189 | 1.0 | 154 | 1.0 | 2.4 | 246 | 0.108 |
| (+)P6KE200A | 190 | 210 | 1.0 | 171 | 1.0 | 2.2 | 274 | 0.108 |
| (+)P6KE220A | 209 | 231 | 1.0 | 185 | 1.0 | 1.8 | 328 | 0.108 |
| (+)P6KE250A | 237 | 263 | 1.0 | 214 | 1.0 | 1.7 | 344 | 0.110 |
| (+)P6KE300A | 285 | 315 | 1.0 | 256 | 1.0 | 1.4 | 414 | 0.110 |
| (+)P6KE350A | 333 | 368 | 1.0 | 300 | 1.0 | 1.2 | 482 | 0.110 |
| (+)P6KE400A | 380 | 420 | 1.0 | 342 | 1.0 | 1.1 | 548 | 0.110 |
| (+)P6KE440A | 418 | 462 | 1.0 | 376 | 1.0 | 1.00 | 602 | 0.110 |
| P6KE480A | 456 | 504 | 1.0 | 408 | 1.0 | 0.91 | 658 | 0.110 |
| P6KE510A | 485 | 535 | 1.0 | 434 | 1.0 | 0.86 | 698 | 0.110 |
| P6KE540A | 513 | 567 | 1.0 | 459 | 1.0 | 0.81 | 740 | 0.110 |

Notes

- (1) Pulse test: t_p ≤ 50 ms
- (2) Surge current waveform per fig. 3 and derate per fig. 2
- (3) For bidirectional types with V_{WM} of 10 V and less the I_D limit is doubled
- (4) All terms and symbols are consistent with ANSI/IEEE CA62.35
- (5) Underwriters laboratory recognition for the classification of protectors (QVGG2) under the UL standard for safety 497B and file number E136766 for both unidirectional and bidirectional devices



| THERMAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$ unless otherwise noted) | | | |
|--|-----------------|-------|---------------------------|
| PARAMETER | SYMBOL | VALUE | UNIT |
| Typical thermal resistance, junction to lead | $R_{\theta JL}$ | 20 | $^\circ\text{C}/\text{W}$ |
| Typical thermal resistance, junction to ambient | $R_{\theta JA}$ | 75 | |

| ORDERING INFORMATION (Example) | | | | |
|--------------------------------|-----------------|------------------------|---------------|----------------------------------|
| PREFERRED PIN | UNIT WEIGHT (g) | PREFERRED PACKAGE CODE | BASE QUANTITY | DELIVERY MODE |
| P6KE6.8A-E3/54 | 0.432 | 54 | 4000 | 13" diameter paper tape and reel |
| P6KE6.8AHE3/54 (1) | 0.432 | 54 | 4000 | 13" diameter paper tape and reel |

Note

(1) AEC-Q101 qualified

RATINGS AND CHARACTERISTICS CURVES ($T_A = 25\text{ }^\circ\text{C}$ unless otherwise noted)

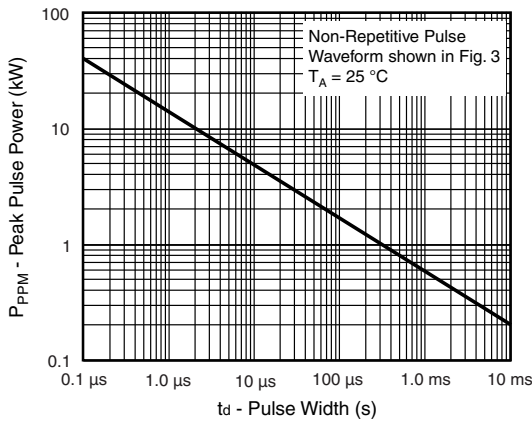


Fig. 1 - Peak Pulse Power Rating Curve

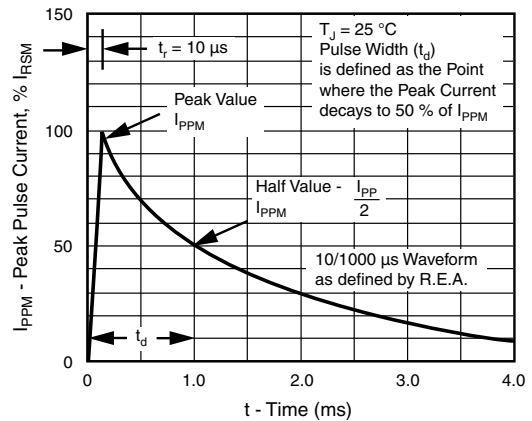


Fig. 3 - Pulse Waveform

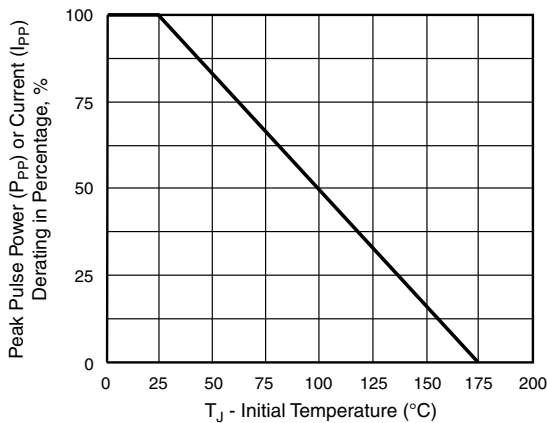


Fig. 2 - Pulse Power or Current vs. Initial Junction Temperature

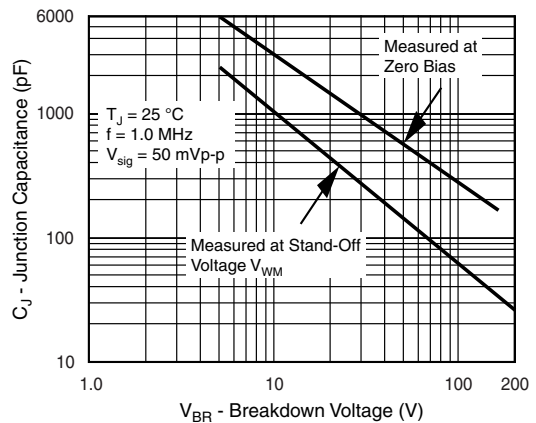


Fig. 4 - Typical Junction Capacitance Unidirectional

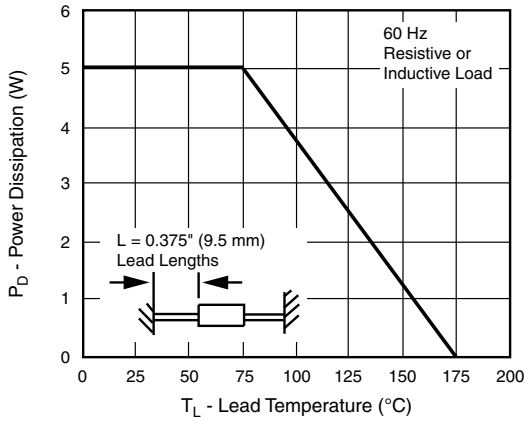


Fig. 5 - Power Derating Curve

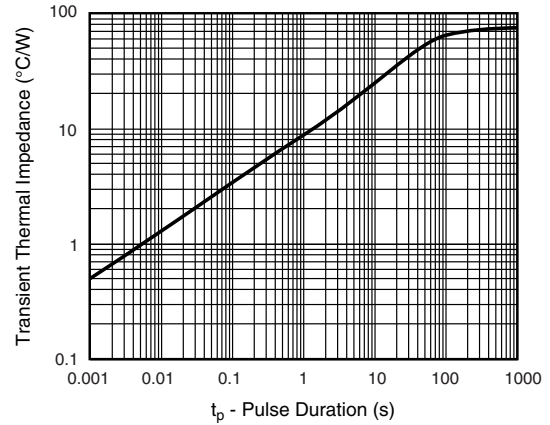


Fig. 7 - Typical Transient Thermal Impedance

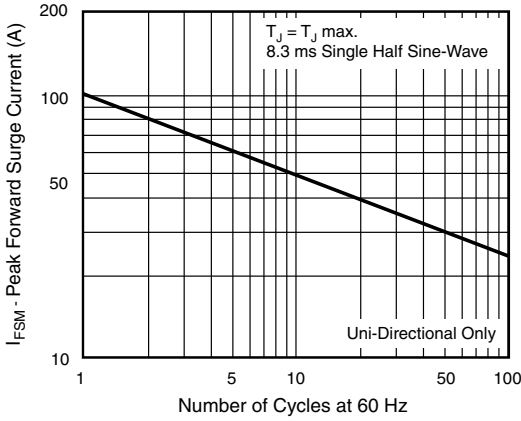


Fig. 6 - Maximum Non-Repetitive Forward Surge Current



PACKAGE OUTLINE DIMENSIONS in inches (millimeters)

DO-15 (DO-204AC)



Note

- Dimensions of mold length and diameter do not include mold flash and gate burr, mold flash shall not exceed 0.015 inch per side. These dimensions are measured at the outermost extreme of the plastic body

APPLICATION NOTES

- This P6KE TVS series is a low cost commercial product for use in applications where large voltage transients can permanently damage voltage-sensitive components.
- The P6KE series device types are designed in a small package size where power and space is a consideration. They are characterized by their high surge capability, extremely fast response time, and low impedance, (R_{on}). Because of the unpredictable nature of transients, and the variation of the impedance with respect to these transients, impedance, per se, is not specified as a parametric value. However, a minimum voltage at low current conditions (V_c) and a maximum clamping voltage (V_c) at a maximum peak pulse current is specified.
- In some instances, the thermal effect (see V_c Clamping Voltage) may be responsible for 50 % to 70 % of the observed voltage differential when subjected to high current pulses for several duty cycles, thus making a maximum impedance specification insignificant.
- In case of a severe current overload or abnormal transient beyond the maximum ratings, the Transient Voltage Suppressor will initially fail 'short' thus tripping the system's circuit breaker or fuse while protecting the entire circuit. Curves depicting clamping voltage vs. various current pulses are available from the factory. Extended power curves vs. pulse time are also available.



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