

TRANSZORB® Transient Voltage Suppressors



Case Style 1.5KE

| PRIMARY CHARACTERISTICS | |
|---|---------------------------------|
| V _{BR} uni-directional | 6.8 V to 540 V |
| V _{BR} bi-directional | 6.8 V to 440 V |
| V _{WM} uni-directional | 5.8 V to 459 V |
| V _{WM} bi-directional | 5.8 V to 376 V |
| P _{PPM} | 1500 W |
| P _D | 6.5 W |
| I _{FSM} (uni-directional only) | 200 A |
| T _J max. | 175 °C |
| Polarity | Uni-directional, bi-directional |
| Package | 1.5KE |

DEVICES FOR BI-DIRECTION APPLICATIONS

For bi-directional types, use CA suffix (e.g. 1.5KE440CA)
Electrical characteristics apply in both directions.

FEATURES

- Glass passivated chip junction
- Available in uni-directional and bi-directional
- 1500 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
- AEC-Q101 qualified
- Solder dip 275 °C max. 10 s, per JESD 22-B106
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

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: Molded epoxy body over passivated junction
Molding compound meets UL 94 V-0 flammability rating
Base P/N-E3 - RoHS compliant, commercial grade
Base P/NHE3_X - RoHS compliant, and AEC-Q101 qualified ("X" denotes revision code e.g. A, B, ...)

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

- 1.5KE250A to 1.5KE540A and 1.5KE250CA to 1.5KE440CA for commercial grade only

Polarity: For uni-directional types the color band denotes cathode end, no marking on bi-directional types

| 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} | 1500 | 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 | 6.5 | W |
| Peak forward surge current 8.3 ms single half sine-wave uni-directional only ⁽²⁾ | I _{FSM} | 200 | A |
| Maximum instantaneous forward voltage at 100 A for uni-directional 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 1.5KE220A and below; V_F = 5.0 V for 1.5KE250A and above



| ELECTRICAL CHARACTERISTICS (T _A = 25 °C unless otherwise noted) | | | | | | | | | |
|--|---|---|------|---|--|--|---|---|---|
| JEDEC® TYPE NUMBER | GENERAL SEMICONDUCTOR PART NUMBER | 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} I _D ⁽⁴⁾ (µA) | MAXIMUM PEAK PULSE CURRENT I _{PPM} ⁽²⁾ (A) | MAXIMUM CLAMPING VOLTAGE AT I _{PPM} V _C (V) | MAXIMUM TEMPERATURE COEFFICIENT OF V _{BR} (%/°C) |
| | | MIN. | MAX. | | | | | | |
| 1N6267A | (+) ⁽⁺⁾ 1.5KE6.8A | 6.45 | 7.14 | 10 | 5.80 | 1000 | 143 | 10.5 | 0.057 |
| 1N6268A | (+) ⁽⁺⁾ 1.5KE7.5A | 7.13 | 7.88 | 10 | 6.40 | 500 | 133 | 11.3 | 0.061 |
| 1N6269A | (+) ⁽⁺⁾ 1.5KE8.2A | 7.79 | 8.61 | 10 | 7.02 | 200 | 124 | 12.1 | 0.065 |
| 1N6270A | (+) ⁽⁺⁾ 1.5KE9.1A | 8.65 | 9.55 | 1.0 | 7.78 | 50 | 112 | 13.4 | 0.068 |
| 1N6271A | (+) ⁽⁺⁾ 1.5KE10A | 9.50 | 10.5 | 1.0 | 8.55 | 10 | 103 | 14.5 | 0.073 |
| 1N6272A | (+) ⁽⁺⁾ 1.5KE11A | 10.5 | 11.6 | 1.0 | 9.40 | 5.0 | 96.2 | 15.6 | 0.075 |
| 1N6273A | (+) ⁽⁺⁾ 1.5KE12A | 11.4 | 12.6 | 1.0 | 10.2 | 5.0 | 89.8 | 16.7 | 0.078 |
| 1N6274A | (+) ⁽⁺⁾ 1.5KE13A | 12.4 | 13.7 | 1.0 | 11.1 | 5.0 | 82.4 | 18.2 | 0.081 |
| 1N6275A | (+) ⁽⁺⁾ 1.5KE15A | 14.3 | 15.8 | 1.0 | 12.8 | 1.0 | 70.8 | 21.2 | 0.084 |
| 1N6276A | (+) ⁽⁺⁾ 1.5KE16A | 15.2 | 16.8 | 1.0 | 13.6 | 1.0 | 66.7 | 22.5 | 0.086 |
| 1N6277A | (+) ⁽⁺⁾ 1.5KE18A | 17.1 | 18.9 | 1.0 | 15.3 | 1.0 | 59.5 | 25.2 | 0.089 |
| 1N6278A | (+) ⁽⁺⁾ 1.5KE20A | 19.0 | 21.0 | 1.0 | 17.1 | 1.0 | 54.2 | 27.7 | 0.090 |
| 1N6279A | (+) ⁽⁺⁾ 1.5KE22A | 20.9 | 23.1 | 1.0 | 18.8 | 1.0 | 49.0 | 30.6 | 0.092 |
| 1N6280A | (+) ⁽⁺⁾ 1.5KE24A | 22.8 | 25.2 | 1.0 | 20.5 | 1.0 | 45.2 | 33.2 | 0.094 |
| 1N6281A | (+) ⁽⁺⁾ 1.5KE27A | 25.7 | 28.4 | 1.0 | 23.1 | 1.0 | 40.0 | 37.5 | 0.096 |
| 1N6282A | (+) ⁽⁺⁾ 1.5KE30A | 28.5 | 31.5 | 1.0 | 25.6 | 1.0 | 36.2 | 41.4 | 0.097 |
| 1N6283A | (+) ⁽⁺⁾ 1.5KE33A | 31.4 | 34.7 | 1.0 | 28.2 | 1.0 | 32.8 | 45.7 | 0.098 |
| 1N6284A | (+) ⁽⁺⁾ 1.5KE36A | 34.2 | 37.8 | 1.0 | 30.8 | 1.0 | 30.1 | 49.9 | 0.099 |
| 1N6285A | (+) ⁽⁺⁾ 1.5KE39A | 37.1 | 41.0 | 1.0 | 33.3 | 1.0 | 27.8 | 53.9 | 0.100 |
| 1N6286A | (+) ⁽⁺⁾ 1.5KE43A | 40.9 | 45.2 | 1.0 | 36.8 | 1.0 | 25.3 | 59.3 | 0.101 |
| 1N6287A | (+) ⁽⁺⁾ 1.5KE47A | 44.7 | 49.4 | 1.0 | 40.2 | 1.0 | 23.1 | 64.8 | 0.101 |
| 1N6288A | (+) ⁽⁺⁾ 1.5KE51A | 48.5 | 53.6 | 1.0 | 43.6 | 1.0 | 21.4 | 70.1 | 0.102 |
| 1N6289A | (+) ⁽⁺⁾ 1.5KE56A | 53.2 | 58.8 | 1.0 | 47.8 | 1.0 | 19.5 | 77.0 | 0.103 |
| 1N6290A | (+) ⁽⁺⁾ 1.5KE62A | 58.9 | 65.1 | 1.0 | 53.0 | 1.0 | 17.6 | 85.0 | 0.104 |
| 1N6291A | (+) ⁽⁺⁾ 1.5KE68A | 64.6 | 71.4 | 1.0 | 58.1 | 1.0 | 16.3 | 92.0 | 0.104 |
| 1N6292A | (+) ⁽⁺⁾ 1.5KE75A | 71.3 | 78.8 | 1.0 | 64.1 | 1.0 | 14.6 | 104 | 0.105 |
| 1N6293A | (+) ⁽⁺⁾ 1.5KE82A | 77.9 | 86.1 | 1.0 | 70.1 | 1.0 | 13.3 | 113 | 0.105 |
| 1N6294A | (+) ⁽⁺⁾ 1.5KE91A | 86.5 | 95.5 | 1.0 | 77.8 | 1.0 | 12.0 | 125 | 0.106 |
| 1N6295A | (+) ⁽⁺⁾ 1.5KE100A | 95.0 | 105 | 1.0 | 85.5 | 1.0 | 10.9 | 137 | 0.106 |
| 1N6296A | (+) ⁽⁺⁾ 1.5KE110A | 105 | 116 | 1.0 | 94.0 | 1.0 | 9.9 | 152 | 0.107 |
| 1N6297A | (+) ⁽⁺⁾ 1.5KE120A | 114 | 126 | 1.0 | 102 | 1.0 | 9.1 | 165 | 0.107 |
| 1N6298A | (+) ⁽⁺⁾ 1.5KE130A | 124 | 137 | 1.0 | 111 | 1.0 | 8.4 | 179 | 0.107 |
| 1N6299A | (+) ⁽⁺⁾ 1.5KE150A | 143 | 158 | 1.0 | 128 | 1.0 | 7.2 | 207 | 0.106 |
| 1N6300A | (+) ⁽⁺⁾ 1.5KE160A | 152 | 168 | 1.0 | 136 | 1.0 | 6.8 | 219 | 0.108 |
| 1N6301A | (+) ⁽⁺⁾ 1.5KE170A | 162 | 179 | 1.0 | 145 | 1.0 | 6.4 | 234 | 0.108 |
| 1N6302A | (+) ⁽⁺⁾ 1.5KE180A | 171 | 189 | 1.0 | 154 | 1.0 | 6.1 | 246 | 0.108 |
| 1N6303A | (+) ⁽⁺⁾ 1.5KE200A | 190 | 210 | 1.0 | 171 | 1.0 | 5.5 | 274 | 0.108 |
| - | (+) ⁽⁺⁾ 1.5KE220A | 209 | 231 | 1.0 | 185 | 1.0 | 4.6 | 328 | 0.108 |
| - | 1.5KE250A | 237 | 263 | 1.0 | 214 | 1.0 | 4.4 | 344 | 0.110 |
| - | 1.5KE300A | 285 | 315 | 1.0 | 256 | 1.0 | 3.6 | 414 | 0.110 |
| - | 1.5KE350A | 333 | 368 | 1.0 | 300 | 1.0 | 3.1 | 482 | 0.110 |
| - | 1.5KE400A | 380 | 420 | 1.0 | 342 | 1.0 | 2.7 | 548 | 0.110 |
| - | 1.5KE440A | 418 | 462 | 1.0 | 376 | 1.0 | 2.5 | 602 | 0.110 |
| - | 1.5KE480A | 456 | 504 | 1.0 | 408 | 1.0 | 2.28 | 658 | 0.110 |
| - | 1.5KE510A | 485 | 535 | 1.0 | 434 | 1.0 | 2.15 | 698 | 0.110 |
| - | 1.5KE540A | 513 | 567 | 1.0 | 459 | 1.0 | 2.03 | 740 | 0.110 |

Notes

- (1) Pulse test: t_p ≤ 50 ms
- (2) Surge current waveform per fig. 3 and derate per fig. 2
- (3) All terms and symbols are consistent with ANSI/IEEE CA62.35
- (4) For bi-directional types with V_R 10 V and less the I_D limit is doubled
- (+)⁽⁺⁾ Underwriters laboratory recognition for the classification of protectors (QVGQ2) under the UL standard for safety 497B and file number E136766 for both uni-directional and bi-directional devices



| THERMAL CHARACTERISTICS (T _A = 25 °C unless otherwise noted) | | | |
|---|------------------|-------|-------|
| PARAMETER | SYMBOL | VALUE | UNIT |
| Typical thermal resistance, junction to ambient | R _{θJA} | 75 | °C/ W |
| Typical thermal resistance, junction to lead | R _{θJL} | 15.4 | |

| ORDERING INFORMATION (Example) | | | | |
|------------------------------------|-----------------|------------------------|---------------|----------------------------------|
| PREFERRED PIN | UNIT WEIGHT (g) | PREFERRED PACKAGE CODE | BASE QUANTITY | DELIVERY MODE |
| 1.5KE6.8A-E3/54 | 0.968 | 54 | 1400 | 13" diameter paper tape and reel |
| 1.5KE6.8AHE3_A/C ⁽¹⁾⁽²⁾ | 0.968 | C | 1400 | 13" diameter paper tape and reel |

Notes

(1) AEC-Q101 qualified

(2) Applied for 1.5KE6.8AHE3_A to 1.5KE220AHE3_A, and 1.5KE6.8CAHE3_A to 1.5KE220CAHE3_A

RATINGS AND CHARACTERISTICS CURVES (T_A = 25 °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



Fig. 5 - Power Derating Curve

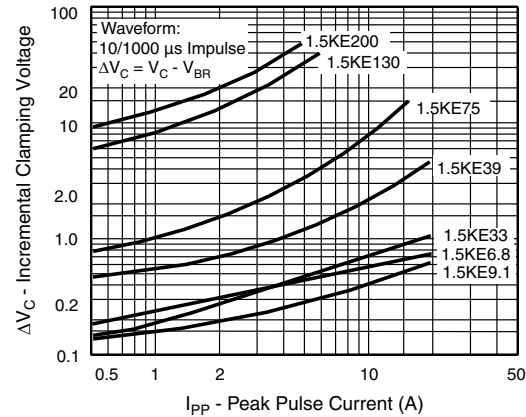


Fig. 8 - Incremental Clamping Voltage Curve (Uni-directional)



Fig. 6 - Maximum Non-Repetitive Forward Surge Current
Uni-Directional only

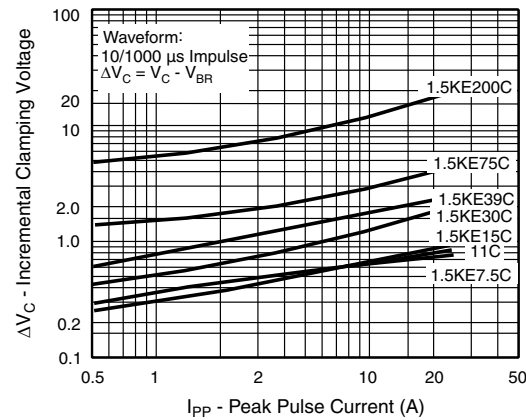


Fig. 9 - Incremental Clamping Voltage Curve (Bi-directional)

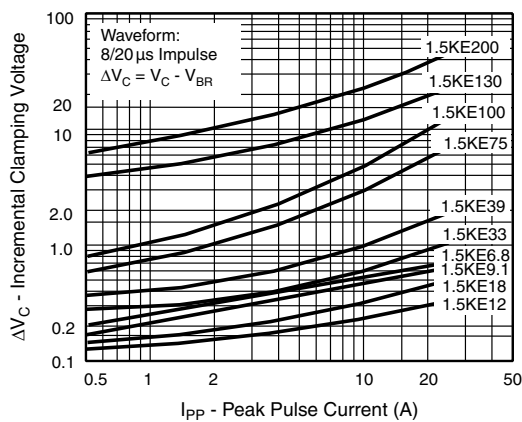


Fig. 7 - Incremental Clamping Voltage Curve (Uni-Directional)

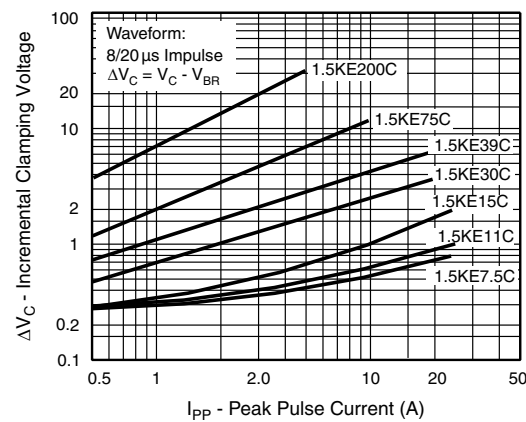


Fig. 10 - Incremental Clamping Voltage Curve (Bi-Directional)

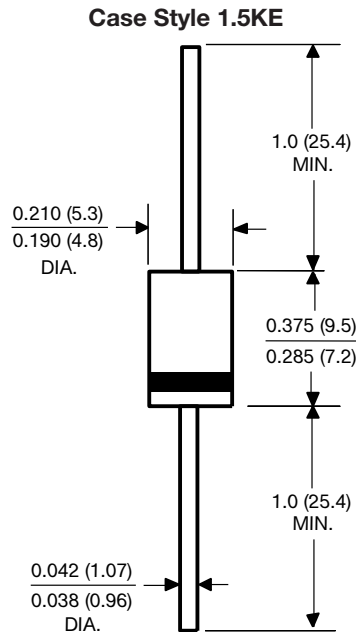


Fig. 11 - Instantaneous Forward Voltage Characteristics Curve



Fig. 12 - Typical Transient Thermal Impedance

PACKAGE OUTLINE DIMENSIONS in inches (millimeters)



APPLICATION NOTES

- This series of Silicon Transient Suppressors is used in applications where large voltage transients can permanently damage voltage-sensitive components.
- The TVS diode can be used in applications where induced lightning on rural or remote transmission lines presents a hazard to electronic circuitry (ref: R.E.A. specification P.E. 60).
- This Transient Voltage Suppressor diode has a pulse power rating of 1500 W for 1 ms. The response time of TVS diode clamping action is effectively instantaneous (1×10^{-9} s bi-directional); therefore, they can protect integrated circuits, MOS devices, hybrids, and other voltage sensitive semiconductors and components. TVS diodes can also be used in series or parallel to increase the peak power ratings.



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