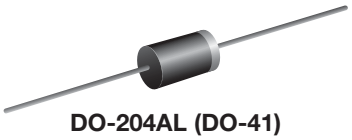
# TRANSZORB® Transient Voltage Suppressors



DO-204AL (DO-41)

## FEATURES

- Glass passivated chip junction
- Available in uni-directional and bi-directional
- 400 W peak pulse power capability with a 10/1000 µs 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

RoHS COMPLIANT

| PRIMARY CHARACTERISTICS | |
|---|---|
| $V_{WM}$ | 5.8 V to 459 V |
| $V_{BR}$ uni-directional | 6.8 V to 540 V |
| $V_{BR}$ bi-directional | 6.8 V to 440 V |
| $P_{PPM}$ | 400 W |
| $P_D$ | 1.5 W |
| $I_{FSM}$ (uni-directional only) | 40 A |
| $T_J$ max. | 175 °C |
| Polarity | Uni-directional, bi-directional |
| Package | DO-204AL (DO-41) |

## 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-204AL, molded epoxy body 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**

- P4KE250CA to P4KE540A and P4KE250A to P4KE440CA for commercial grade only

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

## DEVICES FOR BI-DIRECTION APPLICATIONS

For bi-directional types, use CA suffix (e.g. P4KE440CA). Electrical characteristics apply in both directions.

| MAXIMUM RATINGS ($T_A$ = 25 °C unless otherwise noted) | | | |
|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **LIMIT** | **UNIT** |
| Peak pulse power dissipation with a 10/1000 µs waveform (1) (fig.1) | $P_{PPM}$ | 400 | W |
| Peak pulse current with a 10/1000 µs waveform (1) | $I_{PPM}$ | See next table | A |
| Power dissipation on infinite heatsink at $T_L$ = 75 °C (fig. 5) | $P_D$ | 1.5 | W |
| Peak forward surge current 8.3 ms single half-sine wave uni-directional only (2) | $I_{FSM}$ | 40 | A |
| Maximum instantaneous forward voltage at 25 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) 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 P4KE220A and below; $V_F$ = 5.0 V for P4KE250A and above



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**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 $V_{WM}$ $I_D$ (3) (µA) | MAXIMUM PEAK PULSE CURRENT $I_{PPM}$ (2) (A) | MAXIMUM CLAMPING VOLTAGE AT $I_{PPM}$ $V_C$ (V) | MAXIMUM TEMPERATURE COEFFICENT AT $V_{BR}$ (%/°C) |
|---|---|---|---|---|---|---|---|---|
| | MIN. | MAX. | | | | | | |
| P4KE6.8A | 6.45 | 7.14 | 10 | 5.80 | 1000 | 38.1 | 10.5 | 0.057 |
| P4KE7.5A | 7.13 | 7.88 | 10 | 6.40 | 500 | 35.4 | 11.3 | 0.061 |
| P4KE8.2A | 7.79 | 8.61 | 10 | 7.02 | 200 | 33.1 | 12.1 | 0.060 |
| P4KE9.1A | 8.65 | 9.55 | 1.0 | 7.78 | 50 | 29.9 | 13.4 | 0.068 |
| P4KE10A | 9.5 | 10.5 | 1.0 | 8.55 | 10 | 27.6 | 14.5 | 0.073 |
| P4KE11A | 10.5 | 11.6 | 1.0 | 9.40 | 5.0 | 25.6 | 15.6 | 0.075 |
| P4KE12A | 11.4 | 12.6 | 1.0 | 10.2 | 1.0 | 24.0 | 16.7 | 0.078 |
| P4KE13A | 12.4 | 13.7 | 1.0 | 11.1 | 1.0 | 22.0 | 18.2 | 0.081 |
| P4KE15A | 14.3 | 15.8 | 1.0 | 12.8 | 1.0 | 18.9 | 21.2 | 0.084 |
| P4KE16A | 15.2 | 16.8 | 1.0 | 13.6 | 1.0 | 17.8 | 22.5 | 0.086 |
| P4KE18A | 17.1 | 18.9 | 1.0 | 15.3 | 1.0 | 15.9 | 25.2 | 0.088 |
| P4KE20A | 19.0 | 21.0 | 1.0 | 17.1 | 1.0 | 14.4 | 27.7 | 0.090 |
| P4KE22A | 20.9 | 23.1 | 1.0 | 18.8 | 1.0 | 13.1 | 30.6 | 0.092 |
| P4KE24A | 22.8 | 25.2 | 1.0 | 20.5 | 1.0 | 12.0 | 33.2 | 0.094 |
| P4KE27A | 25.7 | 28.4 | 1.0 | 23.1 | 1.0 | 10.7 | 37.5 | 0.096 |
| P4KE30A | 28.5 | 31.5 | 1.0 | 25.6 | 1.0 | 9.7 | 41.4 | 0.097 |
| P4KE33A | 31.4 | 34.7 | 1.0 | 28.2 | 1.0 | 8.8 | 45.7 | 0.098 |
| P4KE36A | 34.2 | 37.8 | 1.0 | 30.8 | 1.0 | 8.0 | 49.9 | 0.099 |
| P4KE39A | 37.1 | 41.0 | 1.0 | 33.3 | 1.0 | 7.4 | 53.9 | 0.100 |
| P4KE43A | 40.9 | 45.2 | 1.0 | 36.8 | 1.0 | 6.7 | 59.3 | 0.101 |
| P4KE47A | 44.7 | 49.4 | 1.0 | 40.2 | 1.0 | 6.2 | 64.8 | 0.101 |
| P4KE51A | 48.5 | 53.6 | 1.0 | 43.6 | 1.0 | 5.7 | 70.1 | 0.102 |
| P4KE56A | 53.2 | 58.8 | 1.0 | 47.8 | 1.0 | 5.2 | 77.0 | 0.103 |
| P4KE62A | 58.9 | 65.1 | 1.0 | 53.0 | 1.0 | 4.7 | 85.0 | 0.104 |
| P4KE68A | 64.6 | 71.4 | 1.0 | 58.1 | 1.0 | 4.3 | 92.0 | 0.104 |
| P4KE75A | 71.3 | 78.8 | 1.0 | 64.1 | 1.0 | 3.9 | 103 | 0.105 |
| P4KE82A | 77.9 | 86.1 | 1.0 | 70.1 | 1.0 | 3.5 | 113 | 0.105 |
| P4KE91A | 86.5 | 95.5 | 1.0 | 77.8 | 1.0 | 3.2 | 125 | 0.106 |
| P4KE100A | 95.0 | 105 | 1.0 | 85.5 | 1.0 | 2.9 | 137 | 0.106 |
| P4KE110A | 105 | 116 | 1.0 | 94.0 | 1.0 | 2.6 | 152 | 0.107 |
| P4KE120A | 114 | 126 | 1.0 | 102 | 1.0 | 2.4 | 165 | 0.107 |
| P4KE130A | 124 | 137 | 1.0 | 111 | 1.0 | 2.2 | 179 | 0.107 |
| P4KE150A | 143 | 158 | 1.0 | 128 | 1.0 | 1.9 | 207 | 0.108 |
| P4KE160A | 152 | 168 | 1.0 | 136 | 1.0 | 1.8 | 219 | 0.108 |
| P4KE170A | 162 | 179 | 1.0 | 145 | 1.0 | 1.7 | 234 | 0.108 |
| P4KE180A | 171 | 189 | 1.0 | 154 | 1.0 | 1.6 | 246 | 0.108 |
| P4KE200A | 190 | 210 | 1.0 | 171 | 1.0 | 1.5 | 274 | 0.108 |
| P4KE220A | 209 | 231 | 1.0 | 185 | 1.0 | 1.2 | 328 | 0.108 |
| P4KE250A | 237 | 263 | 1.0 | 214 | 1.0 | 1.2 | 344 | 0.110 |
| P4KE300A | 285 | 315 | 1.0 | 256 | 1.0 | 1.00 | 414 | 0.110 |
| P4KE350A | 333 | 368 | 1.0 | 300 | 1.0 | 0.83 | 482 | 0.110 |
| P4KE400A | 380 | 420 | 1.0 | 342 | 1.0 | 0.73 | 548 | 0.110 |
| P4KE440A | 418 | 462 | 1.0 | 376 | 1.0 | 0.66 | 602 | 0.110 |
| P4KE480A | 456 | 504 | 1.0 | 408 | 1.0 | 0.61 | 658 | 0.110 |
| P4KE510A | 485 | 535 | 1.0 | 434 | 1.0 | 0.57 | 698 | 0.110 |
| P4KE540A | 513 | 567 | 1.0 | 459 | 1.0 | 0.54 | 740 | 0.110 |

**Notes**

(1) Pulse test: $t_p \leq$ 50 ms

(2) Surge current waveform per fig. 3 and derate per fig. 2

(3) For bi-directional types with $V_{WM}$ of 10 V and less the $I_D$ limit is doubled

(4) All terms and symbols are consistent with ANSI/EEE CA62.35



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| THERMAL CHARACTERISTICS ($T_A$ = 25 °C unless otherwise noted) | | | |
|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **VALUE** | **UNIT** |
| Typical thermal resistance, junction to lead | $R_{\theta JL}$ | 66 | °C/ W |
| Typical thermal resistance, junction to ambient $L_{Lead}$ = 10 mm | $R_{\theta JA}$ | 100 | |

| ORDERING INFORMATION (Example) | | | | |
|---|---|---|---|---|
| **PREFERRED PIN** | **UNIT WEIGHT (g)** | **PREFERRED PACKAGE CODE** | **BASE QUANTITY** | **DELIVERY MODE** |
| P4KE6.8A-E3/54 | 0.350 | 54 | 5500 | 13" diameter paper tape and reel |
| P4KE6.8AHE3/54 (1) | 0.350 | 54 | 5500 | 13" diameter paper tape and reel |

**Note**

(1) AEC-Q101 qualified

## RATINGS AND CHARACTERISTICS CURVES ($T_A$ = 25 °C unless otherwise noted)

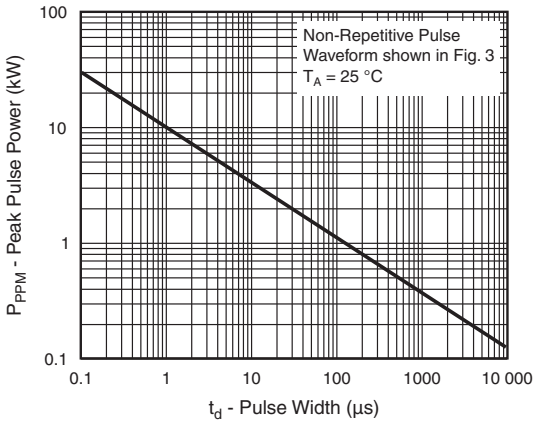


Fig. 1 - Peak Pulse Power Rating Curve

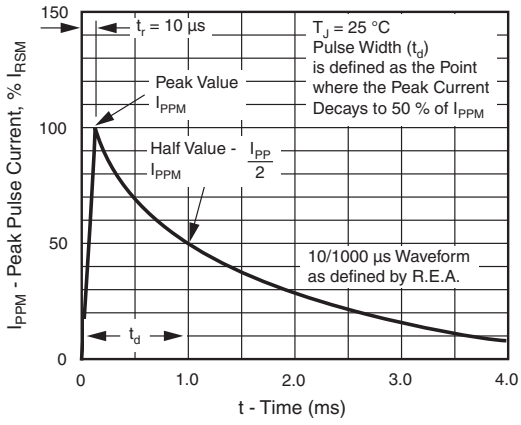


Fig. 3 - Pulse Waveform

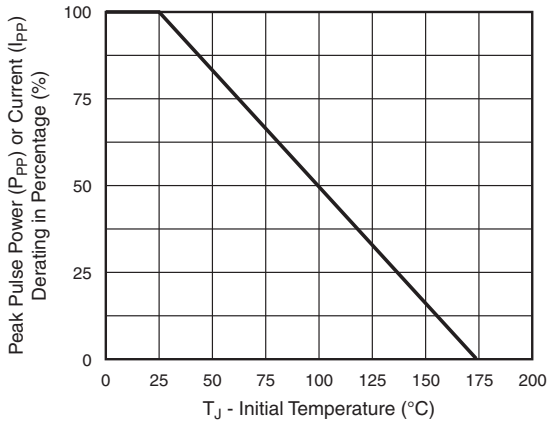


Fig. 2 - Pulse Power or Current vs. Initial Junction Temperature

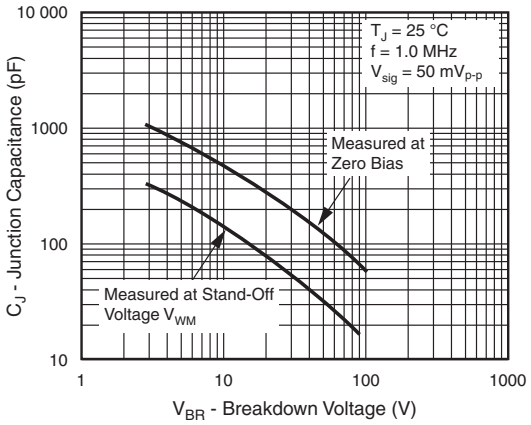


Fig. 4 - Typical Junction Capacitance Uni-Directional



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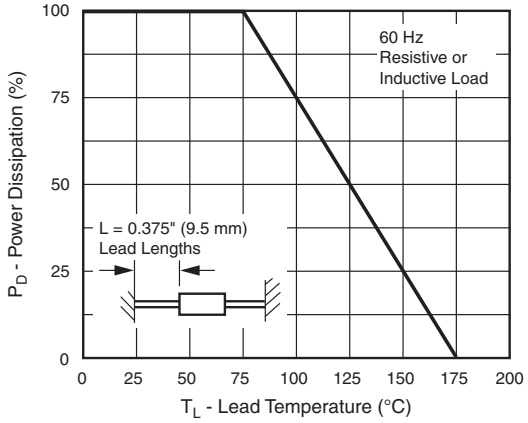



Fig. 5 - Power Derating Curve

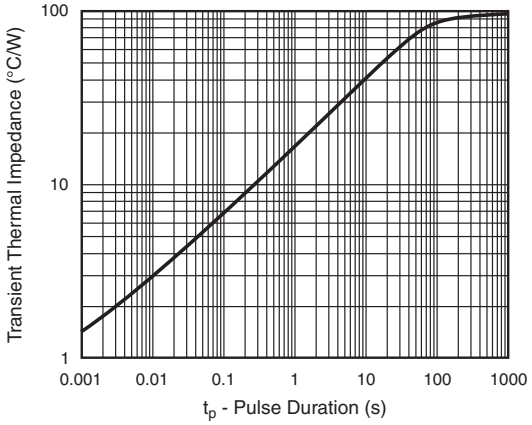



Fig. 7 - Typical Transient Thermal Impedance

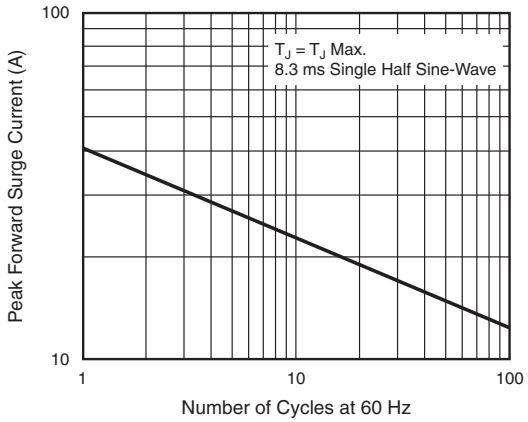
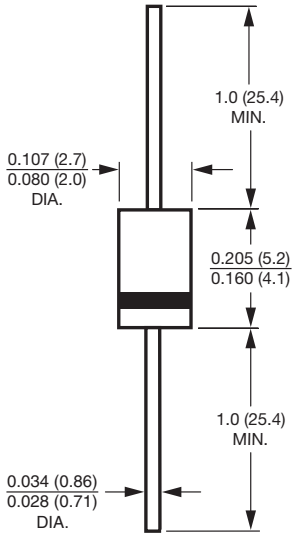



Fig. 6 - Maximum Non-Repetitive Forward Surge Current
Uni-Directional Only

## **PACKAGE OUTLINE DIMENSIONS** in inches (millimeters)

**DO-204AL (DO-41)**





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