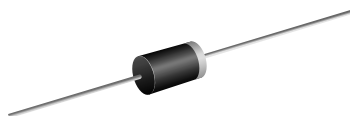


## TRANSZORB® Transient Voltage Suppressors



DO-204AL (DO-41)

### PRIMARY CHARACTERISTICS

|                                  |                |
|----------------------------------|----------------|
| $V_{BR}$ 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         |

### DEVICES FOR BI-DIRECTION APPLICATIONS

For bi-direction use C or CA suffix (e.g. P4KE440CA).  
Electrical characteristics apply in both directions.

### FEATURES

- Glass passivated chip junction
- Available in uni-directional and bi-directional
- 400 W peak pulse power capability with a 10/1000  $\mu$ s waveform, repetitive rate (duty cycle): 0.01 %
- Excellent clamping capability
- Very fast response time
- Low incremental surge resistance
- Solder dip 260 °C, 40 s
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



**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:** DO-204AL, 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, high reliability/automotive grade (AEC Q101 qualified)

**Terminals:** Matte tin plated leads, solderable per J-STD-002 and JESD22-B102

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

**Note:** P4KE250 ~ P4KE540A and P4KE250C ~ P4KE440CA 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         | LIMIT          | UNIT |
|----------------------------------------------------------------------------------------------|----------------|----------------|------|
| Peak power dissipation with a 10/1000 $\mu$ s waveform <sup>(1)</sup> (Fig. 1)               | $P_{PPM}$      | 400            | W    |
| Peak pulse current with a 10/1000 $\mu$ s waveform <sup>(1)</sup>                            | $I_{PPM}$      | 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 <sup>(2)</sup> | $I_{FSM}$      | 40             | A    |
| Maximum instantaneous forward voltage at 25 A for uni-directional only <sup>(3)</sup>        | $V_F$          | 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 P4KE220(A) and below;  $V_F = 5.0$  V for P4KE250(A) and above

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

| DEVICE TYPE | BREAKDOWN VOLTAGE<br>$V_{BR}$ AT $I_T^{(1)}$<br>(V) |      | TEST<br>CURRENT<br>$I_T$ (mA) | STAND-<br>OFF<br>VOLTAGE<br>$V_{WM}$ (V) | MAXIMUM<br>REVERSE<br>LEAKAGE<br>AT $V_{WM}$<br>$I_D^{(3)}$ ( $\mu\text{A}$ ) | MAXIMUM<br>PEAK<br>PULSE<br>CURRENT<br>$I_{PPM}^{(2)}$ (A) | MAXIMUM<br>CLAMPING<br>VOLTAGE<br>AT $I_{PPM}$<br>$V_C$ (V) | MAXIMUM<br>TEMPERATURE<br>COEFFICIENT<br>OF $V_{BR}$<br>(%/°C) |
|-------------|-----------------------------------------------------|------|-------------------------------|------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------------------------------------------|----------------------------------------------------------------|
|             | MIN.                                                | MAX. |                               |                                          |                                                                               |                                                            |                                                             |                                                                |
| P4KE6.8     | 6.12                                                | 7.48 | 10                            | 5.50                                     | 1000                                                                          | 37.0                                                       | 10.8                                                        | 0.057                                                          |
| P4KE6.8A    | 6.45                                                | 7.14 | 10                            | 5.80                                     | 1000                                                                          | 38.1                                                       | 10.5                                                        | 0.057                                                          |
| P4KE7.5     | 6.75                                                | 8.25 | 10                            | 6.05                                     | 500                                                                           | 34.2                                                       | 11.7                                                        | 0.061                                                          |
| P4KE7.5A    | 7.13                                                | 7.88 | 10                            | 6.40                                     | 500                                                                           | 35.4                                                       | 11.3                                                        | 0.061                                                          |
| P4KE8.2     | 7.38                                                | 9.02 | 10                            | 6.63                                     | 200                                                                           | 32.0                                                       | 12.5                                                        | 0.065                                                          |
| P4KE8.2A    | 7.79                                                | 8.61 | 10                            | 7.02                                     | 200                                                                           | 33.1                                                       | 12.1                                                        | 0.06                                                           |
| P4KE9.1     | 8.19                                                | 10.0 | 1.0                           | 7.37                                     | 50                                                                            | 29.0                                                       | 13.8                                                        | 0.068                                                          |
| P4KE9.1A    | 8.65                                                | 9.55 | 1.0                           | 7.78                                     | 50                                                                            | 29.9                                                       | 13.4                                                        | 0.068                                                          |
| P4KE10      | 9.00                                                | 11.0 | 1.0                           | 8.10                                     | 10                                                                            | 26.7                                                       | 15.0                                                        | 0.073                                                          |
| P4KE10A     | 9.50                                                | 10.5 | 1.0                           | 8.55                                     | 10                                                                            | 27.6                                                       | 14.5                                                        | 0.073                                                          |
| P4KE11      | 9.90                                                | 12.1 | 1.0                           | 8.92                                     | 5.0                                                                           | 24.7                                                       | 16.2                                                        | 0.075                                                          |
| P4KE11A     | 10.5                                                | 11.6 | 1.0                           | 9.40                                     | 5.0                                                                           | 25.6                                                       | 15.6                                                        | 0.075                                                          |
| P4KE12      | 10.8                                                | 13.2 | 1.0                           | 9.72                                     | 1.0                                                                           | 23.1                                                       | 17.3                                                        | 0.076                                                          |
| P4KE12A     | 11.4                                                | 12.6 | 1.0                           | 10.2                                     | 1.0                                                                           | 24.0                                                       | 16.7                                                        | 0.078                                                          |
| P4KE13      | 11.7                                                | 14.3 | 1.0                           | 10.5                                     | 1.0                                                                           | 21.1                                                       | 19.0                                                        | 0.081                                                          |
| P4KE13A     | 12.4                                                | 13.7 | 1.0                           | 11.1                                     | 1.0                                                                           | 22.0                                                       | 18.2                                                        | 0.081                                                          |
| P4KE15      | 13.5                                                | 16.5 | 1.0                           | 12.1                                     | 1.0                                                                           | 18.2                                                       | 22.0                                                        | 0.084                                                          |
| P4KE15A     | 14.3                                                | 15.8 | 1.0                           | 12.8                                     | 1.0                                                                           | 18.9                                                       | 21.2                                                        | 0.084                                                          |
| P4KE16      | 14.4                                                | 17.6 | 1.0                           | 12.9                                     | 1.0                                                                           | 17.0                                                       | 23.5                                                        | 0.086                                                          |
| P4KE16A     | 15.2                                                | 16.8 | 1.0                           | 13.6                                     | 1.0                                                                           | 17.8                                                       | 22.5                                                        | 0.086                                                          |
| P4KE18      | 16.2                                                | 19.8 | 1.0                           | 14.5                                     | 1.0                                                                           | 15.1                                                       | 26.5                                                        | 0.088                                                          |
| P4KE18A     | 17.1                                                | 18.9 | 1.0                           | 15.3                                     | 1.0                                                                           | 15.9                                                       | 25.2                                                        | 0.088                                                          |
| P4KE20      | 18.0                                                | 22.0 | 1.0                           | 16.2                                     | 1.0                                                                           | 13.7                                                       | 29.1                                                        | 0.090                                                          |
| P4KE20A     | 19.0                                                | 21.0 | 1.0                           | 17.1                                     | 1.0                                                                           | 14.4                                                       | 27.7                                                        | 0.090                                                          |
| P4KE22      | 19.8                                                | 24.2 | 1.0                           | 17.8                                     | 1.0                                                                           | 12.5                                                       | 31.9                                                        | 0.092                                                          |
| P4KE22A     | 20.9                                                | 23.1 | 1.0                           | 18.8                                     | 1.0                                                                           | 13.1                                                       | 30.6                                                        | 0.092                                                          |
| P4KE24      | 21.6                                                | 26.4 | 1.0                           | 19.4                                     | 1.0                                                                           | 11.5                                                       | 34.7                                                        | 0.094                                                          |
| P4KE24A     | 22.8                                                | 25.2 | 1.0                           | 20.5                                     | 1.0                                                                           | 12.0                                                       | 33.2                                                        | 0.094                                                          |
| P4KE27      | 24.3                                                | 29.7 | 1.0                           | 21.8                                     | 1.0                                                                           | 10.2                                                       | 39.1                                                        | 0.096                                                          |
| P4KE27A     | 25.7                                                | 28.4 | 1.0                           | 23.1                                     | 1.0                                                                           | 10.7                                                       | 37.5                                                        | 0.096                                                          |
| P4KE30      | 27.0                                                | 33.0 | 1.0                           | 24.3                                     | 1.0                                                                           | 9.2                                                        | 43.5                                                        | 0.097                                                          |
| P4KE30A     | 28.5                                                | 31.5 | 1.0                           | 25.6                                     | 1.0                                                                           | 9.7                                                        | 41.4                                                        | 0.097                                                          |
| P4KE33      | 29.7                                                | 36.3 | 1.0                           | 26.8                                     | 1.0                                                                           | 8.4                                                        | 47.7                                                        | 0.098                                                          |
| P4KE33A     | 31.4                                                | 34.7 | 1.0                           | 28.2                                     | 1.0                                                                           | 8.8                                                        | 45.7                                                        | 0.098                                                          |
| P4KE36      | 32.4                                                | 39.6 | 1.0                           | 29.1                                     | 1.0                                                                           | 7.7                                                        | 52.0                                                        | 0.099                                                          |
| P4KE36A     | 34.2                                                | 37.8 | 1.0                           | 30.8                                     | 1.0                                                                           | 8.0                                                        | 49.9                                                        | 0.099                                                          |
| P4KE39      | 35.1                                                | 42.9 | 1.0                           | 31.6                                     | 1.0                                                                           | 7.1                                                        | 56.4                                                        | 0.100                                                          |
| P4KE39A     | 37.1                                                | 41.0 | 1.0                           | 33.3                                     | 1.0                                                                           | 7.4                                                        | 53.9                                                        | 0.100                                                          |
| P4KE43      | 38.7                                                | 47.3 | 1.0                           | 34.8                                     | 1.0                                                                           | 6.5                                                        | 61.9                                                        | 0.101                                                          |
| P4KE43A     | 40.9                                                | 45.2 | 1.0                           | 36.8                                     | 1.0                                                                           | 6.7                                                        | 59.3                                                        | 0.101                                                          |
| P4KE47      | 42.3                                                | 51.7 | 1.0                           | 38.1                                     | 1.0                                                                           | 5.9                                                        | 67.8                                                        | 0.101                                                          |
| P4KE47A     | 44.7                                                | 49.4 | 1.0                           | 40.2                                     | 1.0                                                                           | 6.2                                                        | 64.8                                                        | 0.101                                                          |
| P4KE51      | 45.9                                                | 56.1 | 1.0                           | 41.3                                     | 1.0                                                                           | 5.4                                                        | 73.5                                                        | 0.102                                                          |
| P4KE51A     | 48.5                                                | 53.6 | 1.0                           | 43.6                                     | 1.0                                                                           | 5.7                                                        | 70.1                                                        | 0.102                                                          |
| P4KE56      | 50.4                                                | 61.6 | 1.0                           | 45.4                                     | 1.0                                                                           | 5.0                                                        | 80.5                                                        | 0.103                                                          |
| P4KE56A     | 53.2                                                | 58.8 | 1.0                           | 47.8                                     | 1.0                                                                           | 5.2                                                        | 77.0                                                        | 0.103                                                          |
| P4KE62      | 55.8                                                | 68.2 | 1.0                           | 50.2                                     | 1.0                                                                           | 4.5                                                        | 89.0                                                        | 0.104                                                          |
| P4KE62A     | 58.9                                                | 65.1 | 1.0                           | 53.0                                     | 1.0                                                                           | 4.7                                                        | 85.0                                                        | 0.104                                                          |
| P4KE68      | 61.2                                                | 74.8 | 1.0                           | 55.1                                     | 1.0                                                                           | 4.1                                                        | 98.0                                                        | 0.104                                                          |
| P4KE68A     | 64.6                                                | 71.4 | 1.0                           | 58.1                                     | 1.0                                                                           | 4.3                                                        | 92.0                                                        | 0.104                                                          |
| P4KE75      | 67.5                                                | 82.5 | 1.0                           | 60.7                                     | 1.0                                                                           | 3.7                                                        | 108                                                         | 0.105                                                          |
| P4KE75A     | 71.3                                                | 78.8 | 1.0                           | 64.1                                     | 1.0                                                                           | 3.9                                                        | 103                                                         | 0.105                                                          |

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25\text{ }^{\circ}\text{C}$  unless otherwise noted)

| DEVICE TYPE | BREAKDOWN VOLTAGE<br>$V_{BR}$ AT $I_T^{(1)}$<br>(V) |      | TEST<br>CURRENT<br>$I_T$ (mA) | STAND-<br>OFF<br>VOLTAGE<br>$V_{WM}$ (V) | MAXIMUM<br>REVERSE<br>LEAKAGE<br>AT $V_{WM}$<br>$I_D^{(3)}$ ( $\mu\text{A}$ ) | MAXIMUM<br>PEAK<br>PULSE<br>CURRENT<br>$I_{PPM}^{(2)}$ (A) | MAXIMUM<br>CLAMPING<br>VOLTAGE<br>AT $I_{PPM}$<br>$V_C$ (V) | MAXIMUM<br>TEMPERATURE<br>COEFFICIENT<br>OF $V_{BR}$<br>(%/°C) |
|-------------|-----------------------------------------------------|------|-------------------------------|------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------------------------------------------|----------------------------------------------------------------|
|             | MIN.                                                | MAX. |                               |                                          |                                                                               |                                                            |                                                             |                                                                |
| P4KE82      | 73.8                                                | 90.2 | 1.0                           | 66.4                                     | 1.0                                                                           | 3.4                                                        | 118                                                         | 0.105                                                          |
| P4KE82A     | 77.9                                                | 86.1 | 1.0                           | 70.1                                     | 1.0                                                                           | 3.5                                                        | 113                                                         | 0.105                                                          |
| P4KE91      | 81.9                                                | 100  | 1.0                           | 73.7                                     | 1.0                                                                           | 3.1                                                        | 131                                                         | 0.106                                                          |
| P4KE91A     | 86.5                                                | 95.5 | 1.0                           | 77.8                                     | 1.0                                                                           | 3.2                                                        | 125                                                         | 0.106                                                          |
| P4KE100     | 90.0                                                | 110  | 1.0                           | 81.0                                     | 1.0                                                                           | 2.8                                                        | 144                                                         | 0.106                                                          |
| P4KE100A    | 95.0                                                | 105  | 1.0                           | 85.5                                     | 1.0                                                                           | 2.9                                                        | 137                                                         | 0.106                                                          |
| P4KE110     | 99.0                                                | 121  | 1.0                           | 89.2                                     | 1.0                                                                           | 2.5                                                        | 158                                                         | 0.107                                                          |
| P4KE110A    | 105                                                 | 116  | 1.0                           | 94.0                                     | 1.0                                                                           | 2.6                                                        | 152                                                         | 0.107                                                          |
| P4KE120     | 108                                                 | 132  | 1.0                           | 97.2                                     | 1.0                                                                           | 2.3                                                        | 173                                                         | 0.107                                                          |
| P4KE120A    | 114                                                 | 126  | 1.0                           | 102                                      | 1.0                                                                           | 2.4                                                        | 165                                                         | 0.107                                                          |
| P4KE130     | 117                                                 | 143  | 1.0                           | 105                                      | 1.0                                                                           | 2.1                                                        | 187                                                         | 0.107                                                          |
| P4KE130A    | 124                                                 | 137  | 1.0                           | 111                                      | 1.0                                                                           | 2.2                                                        | 179                                                         | 0.107                                                          |
| P4KE150     | 135                                                 | 165  | 1.0                           | 121                                      | 1.0                                                                           | 1.9                                                        | 215                                                         | 0.108                                                          |
| P4KE150A    | 143                                                 | 158  | 1.0                           | 128                                      | 1.0                                                                           | 1.9                                                        | 207                                                         | 0.108                                                          |
| P4KE160     | 144                                                 | 176  | 1.0                           | 130                                      | 1.0                                                                           | 1.7                                                        | 230                                                         | 0.108                                                          |
| P4KE160A    | 152                                                 | 168  | 1.0                           | 136                                      | 1.0                                                                           | 1.8                                                        | 219                                                         | 0.108                                                          |
| P4KE170     | 153                                                 | 187  | 1.0                           | 138                                      | 1.0                                                                           | 1.6                                                        | 244                                                         | 0.108                                                          |
| P4KE170A    | 162                                                 | 179  | 1.0                           | 145                                      | 1.0                                                                           | 1.7                                                        | 234                                                         | 0.108                                                          |
| P4KE180     | 162                                                 | 198  | 1.0                           | 146                                      | 1.0                                                                           | 1.6                                                        | 258                                                         | 0.108                                                          |
| P4KE180A    | 171                                                 | 189  | 1.0                           | 154                                      | 1.0                                                                           | 1.6                                                        | 246                                                         | 0.108                                                          |
| P4KE200     | 180                                                 | 220  | 1.0                           | 162                                      | 1.0                                                                           | 1.4                                                        | 287                                                         | 0.108                                                          |
| P4KE200A    | 190                                                 | 210  | 1.0                           | 171                                      | 1.0                                                                           | 1.5                                                        | 274                                                         | 0.108                                                          |
| P4KE220     | 198                                                 | 242  | 1.0                           | 175                                      | 1.0                                                                           | 1.2                                                        | 344                                                         | 0.108                                                          |
| P4KE220A    | 209                                                 | 231  | 1.0                           | 185                                      | 1.0                                                                           | 1.2                                                        | 328                                                         | 0.108                                                          |
| P4KE250     | 225                                                 | 275  | 1.0                           | 202                                      | 1.0                                                                           | 1.1                                                        | 360                                                         | 0.110                                                          |
| P4KE250A    | 237                                                 | 263  | 1.0                           | 214                                      | 1.0                                                                           | 1.2                                                        | 344                                                         | 0.110                                                          |
| P4KE300     | 270                                                 | 330  | 1.0                           | 243                                      | 1.0                                                                           | 0.93                                                       | 430                                                         | 0.110                                                          |
| P4KE300A    | 285                                                 | 315  | 1.0                           | 256                                      | 1.0                                                                           | 1.0                                                        | 414                                                         | 0.110                                                          |
| P4KE350     | 315                                                 | 385  | 1.0                           | 284                                      | 1.0                                                                           | 0.79                                                       | 504                                                         | 0.110                                                          |
| P4KE350A    | 333                                                 | 368  | 1.0                           | 300                                      | 1.0                                                                           | 0.83                                                       | 482                                                         | 0.110                                                          |
| P4KE400     | 360                                                 | 440  | 1.0                           | 324                                      | 1.0                                                                           | 0.70                                                       | 574                                                         | 0.110                                                          |
| P4KE400A    | 380                                                 | 420  | 1.0                           | 342                                      | 1.0                                                                           | 0.73                                                       | 548                                                         | 0.110                                                          |
| P4KE440     | 396                                                 | 484  | 1.0                           | 356                                      | 1.0                                                                           | 0.63                                                       | 631                                                         | 0.110                                                          |
| P4KE440A    | 418                                                 | 462  | 1.0                           | 376                                      | 1.0                                                                           | 0.66                                                       | 602                                                         | 0.110                                                          |
| P4KE480     | 432                                                 | 528  | 1.0                           | 389                                      | 1.0                                                                           | 0.58                                                       | 686                                                         | 0.110                                                          |
| P4KE480A    | 456                                                 | 504  | 1.0                           | 408                                      | 1.0                                                                           | 0.61                                                       | 658                                                         | 0.110                                                          |
| P4KE510     | 459                                                 | 561  | 1.0                           | 413                                      | 1.0                                                                           | 0.55                                                       | 729                                                         | 0.110                                                          |
| P4KE510A    | 485                                                 | 535  | 1.0                           | 434                                      | 1.0                                                                           | 0.57                                                       | 698                                                         | 0.110                                                          |
| P4KE540     | 486                                                 | 594  | 1.0                           | 437                                      | 1.0                                                                           | 0.52                                                       | 772                                                         | 0.110                                                          |
| P4KE540A    | 513                                                 | 567  | 1.0                           | 459                                      | 1.0                                                                           | 0.54                                                       | 740                                                         | 0.110                                                          |

**Notes:**

- (1) Pulse test:  $t_p \leq 50\text{ ms}$
- (2) Surge current waveform per Fig. 3 and derated per Fig. 2
- (3) For bi-directional types having  $V_{WM}$  of 10 V and less, the  $I_D$  limit is doubled
- (4) All terms and symbols are consistent with ANSI/IEEE C62.35

**THERMAL CHARACTERISTICS** ( $T_A = 25\text{ }^{\circ}\text{C}$  unless otherwise noted)

| PARAMETER                                                                  | SYMBOL          | LIMIT | UNIT                 |
|----------------------------------------------------------------------------|-----------------|-------|----------------------|
| Typical thermal resistance, junction to lead                               | $R_{\theta JL}$ | 66    | $^{\circ}\text{C/W}$ |
| Typical thermal resistance, junction to ambient, $L_{Lead} = 10\text{ mm}$ | $R_{\theta JA}$ | 100   | $^{\circ}\text{C/W}$ |

### ORDERING INFORMATION (Example)

| PREFERRED P/N                 | 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 <sup>(1)</sup> | 0.350           | 54                     | 5500          | 13" diameter paper tape and reel |

#### Note:

(1) Automotive grade AEC Q101 qualified

### RATINGS AND CHARACTERISTICS CURVES

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

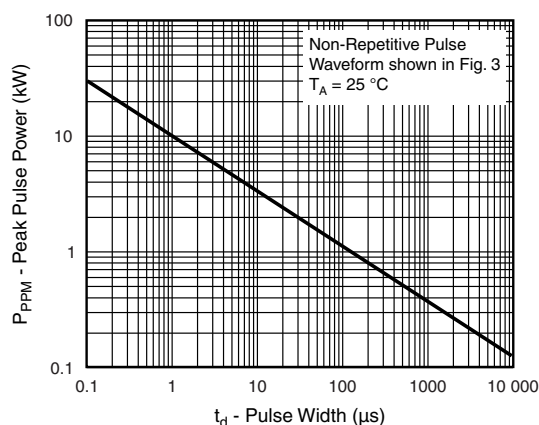


Figure 1. Peak Pulse Power Rating Curve

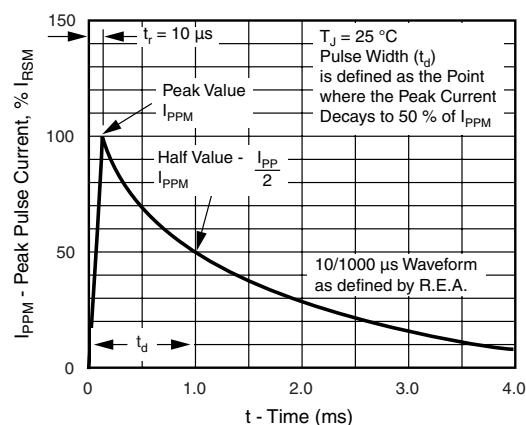


Figure 3. Pulse Waveform

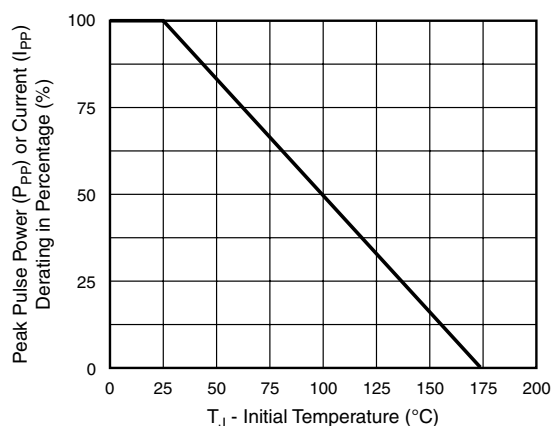


Figure 2. Pulse Power or Current vs. Initial Junction Temperature

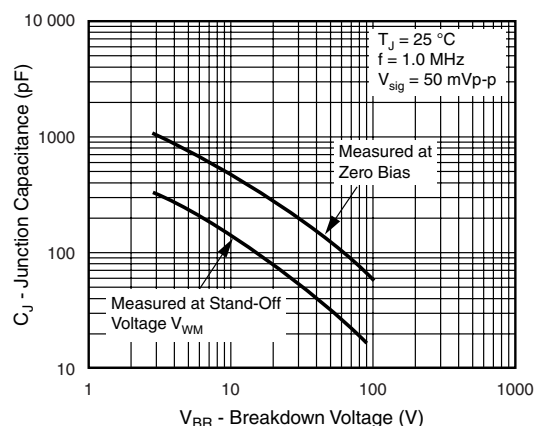


Figure 4. Typical Junction Capacitance Uni-Directional

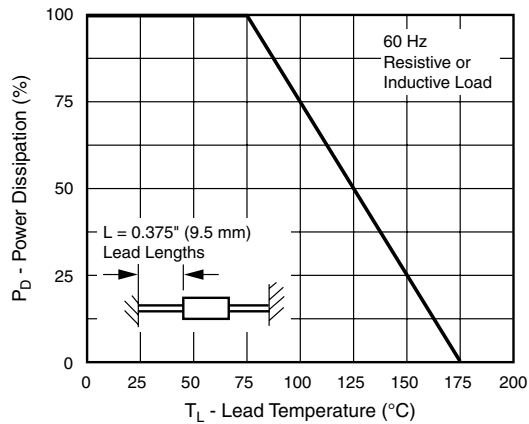


Figure 5. Power Derating Curve

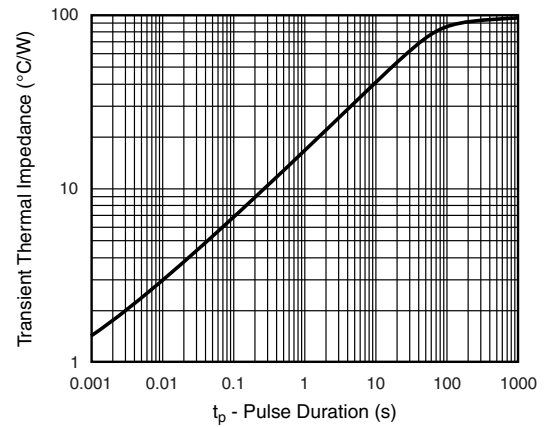


Figure 7. Typical Transient Thermal Impedance

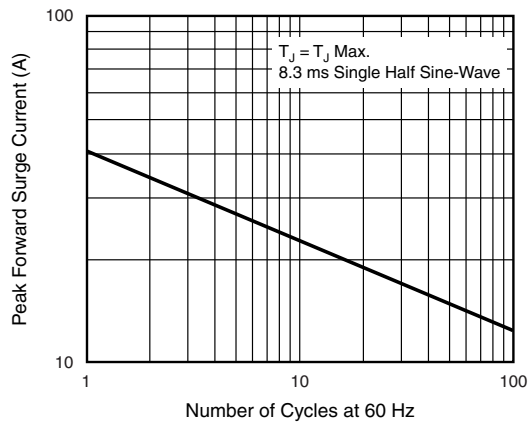
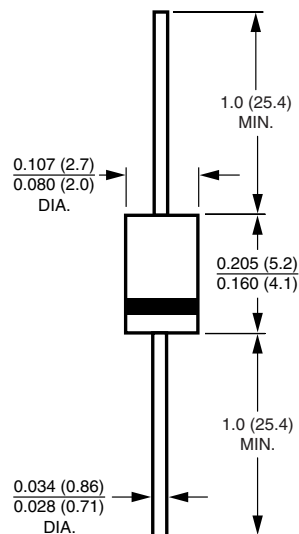


Figure 6. Max. Non-Repetitive Forward Surge Current  
Uni-Directional Only

### PACKAGE OUTLINE DIMENSIONS in inches (millimeters)

#### DO-204AL (DO-41)





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