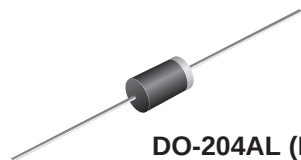




## TRANSZORB® Transient Voltage Suppressors



DO-204AL (DO-41 Plastic)

$V_{(BR)}$  Unidirectional 6.8 to 540V  
 $V_{(BR)}$  Bidirectional 6.8 to 440V  
Peak Pulse Power 400W

## Features

- Plastic package has Underwriters Laboratory Flammability Classification 94V-0
- Glass passivated junction
- 400W peak pulse power capability on 10/1000 $\mu$ s waveform, repetition rate (duty cycle): 0.01%
- Excellent clamping capability
- Low incremental surge resistance
- Very fast response time

## Mechanical Data

**Case:** JEDEC DO-204AL molded plastic body over passivated junction

**Terminals:** Axial leads, solderable per MIL-STD-750, Method 2026

High temperature soldering guaranteed: 265°C/10 seconds, 0.375" (9.5mm) lead length, 5lbs. (2.3 kg) tension

**Polarity:** For unidirectional types the color band denotes the cathode, which is positive with respect to the anode under normal TVS operation

**Mounting Position:** Any **Weight:** 0.012oz., 0.3g

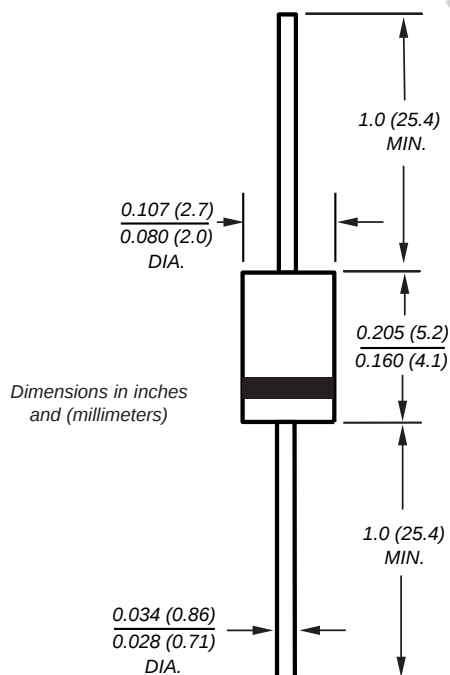
**Packaging Codes – Options (Antistatic):**

51 – 1K per Bulk box, 10K/carton

54 – 5.5K per 13" paper Reel

(52mm horiz. tape), 16.5K/carton

73 – 3K per horiz. tape & Ammo box, 30K/carton



\*Voltages above 440V available Q3-2002

## Devices for Bidirectional Applications

For bi-directional, use C or CA suffix for types P4KE6.8 thru types P4KE440 (e.g. P4KE6.8C, P4KE440CA). Electrical characteristics apply in both directions.

Maximum Ratings and Characteristics (T<sub>A</sub> = 25°C unless otherwise noted)

| Parameter                                                                                           | Symbol                            | Limit          | Unit |
|-----------------------------------------------------------------------------------------------------|-----------------------------------|----------------|------|
| Peak power dissipation with a 10/1000 $\mu$ s waveform <sup>(1)</sup> (Fig. 1)                      | PPPM                              | 400            | W    |
| Peak pulse current with a 10/1000 $\mu$ s waveform <sup>(1)</sup>                                   | IPPM                              | See Next Table | A    |
| Steady state power dissipation at T <sub>L</sub> = 75°C, lead lengths 0.375" (9.5mm) <sup>(2)</sup> | P <sub>M(AV)</sub>                | 1.0            | W    |
| Peak forward surge current, 8.3ms single half sine-wave unidirectional only <sup>(3)</sup>          | I <sub>FSM</sub>                  | 40             | A    |
| Maximum instantaneous forward voltage at 25A for unidirectional only <sup>(4)</sup>                 | V <sub>F</sub>                    | 3.5/5.0        | V    |
| Typical thermal resistance junction-to-lead                                                         | R <sub>θJL</sub>                  | 60             | °C/W |
| Typ. thermal resistance junction-to-ambient, L <sub>Lead</sub> = 10mm                               | R <sub>θJA</sub>                  | 100            | °C/W |
| Operating junction and storage temperature range                                                    | T <sub>J</sub> , T <sub>STG</sub> | -55 to +175    | °C   |

**Notes:** (1) Non-repetitive current pulse, per Fig.3 and derated above T<sub>A</sub> = 25°C per Fig. 2

(2) Mounted on copper pad area of 1.6 x 1.6" (40 x 40mm) per Fig. 5

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

(4) V<sub>F</sub> = 3.5V for P4KE220(A) & below; V<sub>F</sub> = 5.0V for P4KE250(A) & above

# P4KE Series

Vishay Semiconductors  
formerly General Semiconductor



## Electrical Characteristics

Ratings at 25°C ambient temperature unless otherwise specified.

| Device Type | Breakdown Voltage<br>$V_{BR}$ at $I_T^{(1)}$<br>(V) |      | Test<br>Current<br>$I_T$<br>(mA) | Stand-off<br>Voltage<br>$V_{WM}$<br>(V) | Maximum<br>Reverse<br>Leakage<br>at $V_{WM}$<br>$I_{D^{(3)}}$<br>( $\mu$ A) | Maximum<br>Peak Pulse<br>Current<br>$I_{PPM}^{(2)}$<br>(A) | Maximum<br>Clamping<br>Voltage at<br>$I_{PPM}$<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                                                            |

**Electrical Characteristics (Con't.)** Ratings at 25°C ambient temperature unless otherwise specified.

| Device Type | Breakdown Voltage<br>$V_{BR}$ at $I_T^{(1)}$<br>(V) |      | Test<br>Current<br>$I_T$<br>(mA) | Stand-off<br>Voltage<br>$V_{WM}$<br>(V) | Maximum<br>Reverse<br>Leakage<br>at $V_{WM}$<br>$I_D^{(3)}$<br>( $\mu$ A) | Maximum<br>Peak Pulse<br>Current<br>$I_{PPM}^{(2)}$<br>(A) | Maximum<br>Clamping<br>Voltage at<br>$I_{PPM}$<br>$V_C$ (V) | Maximum<br>Temperature<br>Coefficient<br>of $V_{BR}$<br>(% / °C) |
|-------------|-----------------------------------------------------|------|----------------------------------|-----------------------------------------|---------------------------------------------------------------------------|------------------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------------------|
|             | MIN                                                 | MAX  |                                  |                                         |                                                                           |                                                            |                                                             |                                                                  |
| 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                                                            |
| 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:  $t_p \leq 50$ ms

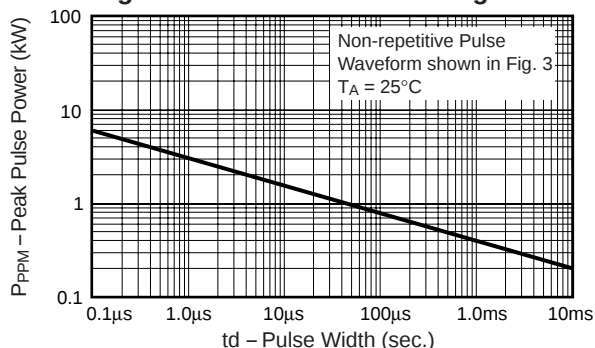
(2) Surge current waveform per Fig. 3 and derated per Fig. 2

(3) For bidirectional types having  $V_{WM}$  of 10 volts and less, the  $I_D$  limit is doubled

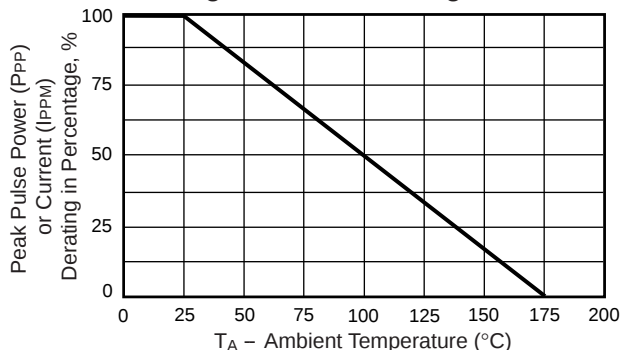
(4) All terms and symbols are consistent with ANSI/IEEE C62.35

## Ratings and Characteristic Curves ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

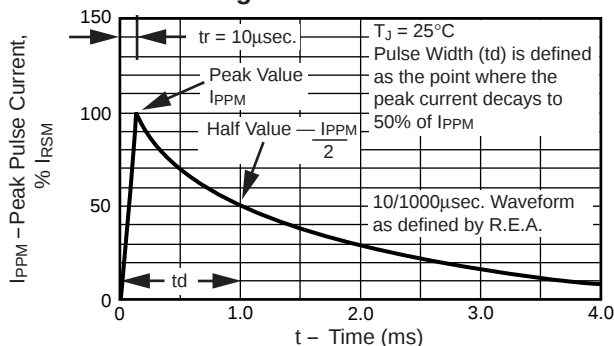
**Fig. 1 – Peak Pulse Power Rating Curve**



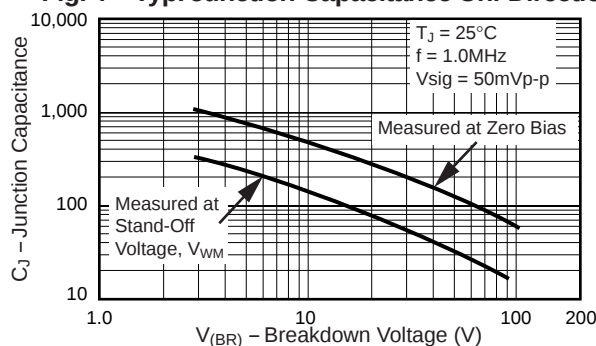
**Fig. 2 – Pulse Derating Curve**



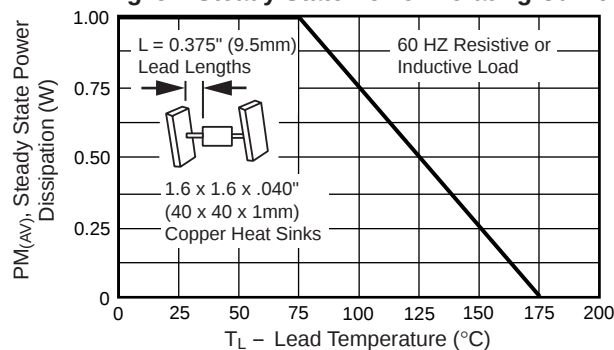
**Fig. 3 – Pulse Waveform**



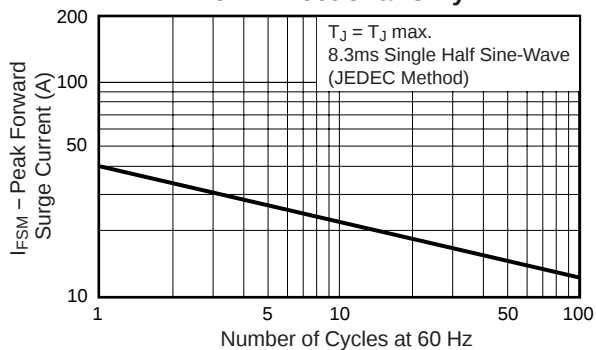
**Fig. 4 – Typ. Junction Capacitance Uni-Directional**



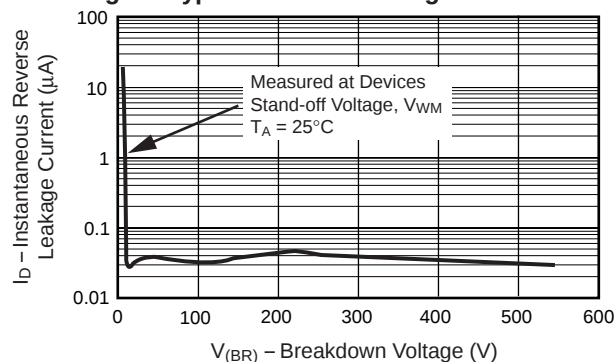
**Fig. 5 – Steady State Power Derating Curve**



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



**Fig. 7 – Typical Reverse Leakage Characteristics**



**Fig. 8 – Typ. Transient Thermal Impedance**

