

## 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

## MECHANICAL DATA

**Case:** DO-204AL, molded epoxy over passivated chip  
Molding compound meets UL 94 V-0 flammability rating

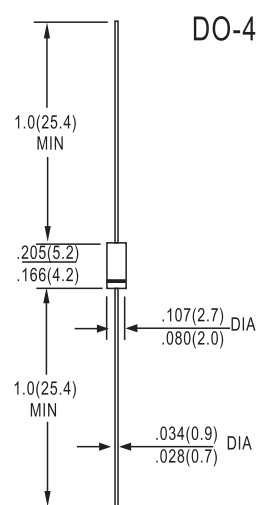
Base P/N-E3 - RoHS compliant, commercial grade  
Base P/NHE3 - RoHS compliant, high reliability/  
automotive grade (AEC Q101 qualified)

**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:** BZW04-213(B) ~ BZW04-376(B) for commercial grade only

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



Dimensions in inches and (millimeters)

## MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

| <b>MAXIMUM RATINGS AND THERMAL CHARACTERISTICS</b> ( $T_A = 25\text{ }^{\circ}\text{C}$ unless otherwise noted) |                |                |                    |
|-----------------------------------------------------------------------------------------------------------------|----------------|----------------|--------------------|
| PARAMETER                                                                                                       | SYMBOL         | LIMIT          | UNIT               |
| Peak pulse 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 $T_L = 75\text{ }^{\circ}\text{C}$ (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  | $^{\circ}\text{C}$ |

### Notes:

(1) Non-repetitive current pulse, per Fig. 3 and derated above  $T_A = 25\text{ }^{\circ}\text{C}$  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)  $V_F = 3.5\text{ V}$  for BZW04P(-)188 and below;  $V_F = 5.0\text{ V}$  for BZW04P(-)213 and above



### ELECTRICAL CHARACTERISTICS

$T_j = 25^\circ\text{C}$  unless otherwise specified.

| <b>ELECTRICAL CHARACTERISTICS</b> ( $T_A = 25^\circ\text{C}$ unless otherwise noted) |            |                                                  |      |                            |                                   |                                                                      |                                                   |                                                    |                                                                     |
|--------------------------------------------------------------------------------------|------------|--------------------------------------------------|------|----------------------------|-----------------------------------|----------------------------------------------------------------------|---------------------------------------------------|----------------------------------------------------|---------------------------------------------------------------------|
| PART NUMBER                                                                          |            | BREAKDOWN VOLTAGE<br>$V_{BR}$ AT $I_T^{(1)}$ (V) |      | TEST CURRENT<br>$I_T$ (mA) | STAND-OFF VOLTAGE<br>$V_{WM}$ (V) | MAXIMUM REVERSE LEAKAGE AT $V_{WM}$<br>$I_D^{(4)}$ ( $\mu\text{A}$ ) | MAXIMUM PEAK PULSE CURRENT AT $I_{PPM}^{(2)}$ (A) | MAXIMUM CLAMPING VOLTAGE AT $I_{PPM}$<br>$V_C$ (V) | MAXIMUM TEMPERATURE COEFFICIENT OF<br>$V_{BR}$ ( $^\circ\text{C}$ ) |
|                                                                                      |            | MIN.                                             | MAX. |                            |                                   |                                                                      |                                                   |                                                    |                                                                     |
| BZW04P5V8                                                                            | BZW04P5V8B | 6.45                                             | 7.48 | 10.0                       | 5.80                              | 1000                                                                 | 38.0                                              | 10.5                                               | 0.057                                                               |
| BZW04-5V8                                                                            | BZW04-5V8B | 6.45                                             | 7.14 | 10.0                       | 5.80                              | 1000                                                                 | 38.0                                              | 10.5                                               | 0.057                                                               |
| BZW04P6V4                                                                            | BZW04P6V4B | 7.13                                             | 8.25 | 10.0                       | 6.40                              | 500                                                                  | 35.4                                              | 11.3                                               | 0.061                                                               |
| BZW04-6V4                                                                            | BZW04-6V4B | 7.13                                             | 7.88 | 10.0                       | 6.40                              | 500                                                                  | 35.4                                              | 11.3                                               | 0.061                                                               |
| BZW04P7V0                                                                            | BZW04P7V0B | 7.79                                             | 9.02 | 10.0                       | 7.02                              | 200                                                                  | 33.0                                              | 12.1                                               | 0.065                                                               |
| BZW04-7V0                                                                            | BZW04-7V0B | 7.79                                             | 8.61 | 10.0                       | 7.02                              | 200                                                                  | 33.0                                              | 12.1                                               | 0.065                                                               |
| BZW04P7V8                                                                            | BZW04P7V8B | 8.65                                             | 10.0 | 1.0                        | 7.78                              | 50                                                                   | 30.0                                              | 13.4                                               | 0.068                                                               |
| BZW04-7V8                                                                            | BZW04-7V8B | 8.65                                             | 9.55 | 1.0                        | 7.78                              | 50                                                                   | 30.0                                              | 13.4                                               | 0.073                                                               |
| BZW04P8V5                                                                            | BZW04P8V5B | 9.50                                             | 11.0 | 1.0                        | 8.55                              | 10                                                                   | 27.6                                              | 14.5                                               | 0.07                                                                |
| BZW04-8V5                                                                            | BZW04-8V5B | 9.50                                             | 10.5 | 1.0                        | 8.55                              | 10                                                                   | 27.6                                              | 14.5                                               | 0.075                                                               |
| BZW04P9V4                                                                            | BZW04P9V4B | 10.5                                             | 12.1 | 1.0                        | 9.4                               | 5.0                                                                  | 25.7                                              | 15.6                                               | 0.075                                                               |
| BZW04-9V4                                                                            | BZW04-9V4B | 10.5                                             | 11.6 | 1.0                        | 9.4                               | 5.0                                                                  | 25.7                                              | 15.6                                               | 0.075                                                               |
| BZW0P10                                                                              | BZW0P10B   | 11.4                                             | 13.2 | 1.0                        | 10.2                              | 5.0                                                                  | 24.0                                              | 16.7                                               | 0.078                                                               |
| BZW04-10                                                                             | BZW04-10B  | 11.4                                             | 12.6 | 1.0                        | 10.2                              | 5.0                                                                  | 24.0                                              | 16.7                                               | 0.078                                                               |
| BZW04P11                                                                             | BZW04P11B  | 12.4                                             | 14.3 | 1.0                        | 11.1                              | 5.0                                                                  | 22.0                                              | 18.2                                               | 0.081                                                               |
| BZW04-11                                                                             | BZW04-11B  | 12.4                                             | 13.7 | 1.0                        | 11.1                              | 5.0                                                                  | 22.0                                              | 18.2                                               | 0.081                                                               |
| BZW04P13                                                                             | BZW04P13B  | 14.3                                             | 16.5 | 1.0                        | 12.8                              | 5.0                                                                  | 19.0                                              | 21.2                                               | 0.084                                                               |
| BZW04-13                                                                             | BZW04-13B  | 14.3                                             | 15.8 | 1.0                        | 12.8                              | 5.0                                                                  | 19.0                                              | 21.2                                               | 0.084                                                               |
| BZW04P14                                                                             | BZW04P14B  | 15.2                                             | 17.6 | 1.0                        | 13.6                              | 1.0                                                                  | 17.8                                              | 22.5                                               | 0.086                                                               |
| BZW04-14                                                                             | BZW04-14B  | 15.2                                             | 16.8 | 1.0                        | 13.6                              | 1.0                                                                  | 17.8                                              | 22.5                                               | 0.086                                                               |
| BZW04P15                                                                             | BZW04P15B  | 17.1                                             | 19.8 | 1.0                        | 15.3                              | 1.0                                                                  | 16.0                                              | 25.2                                               | 0.088                                                               |
| BZW04-15                                                                             | BZW04-15B  | 17.1                                             | 18.9 | 1.0                        | 15.3                              | 1.0                                                                  | 16.0                                              | 25.2                                               | 0.088                                                               |
| BZW04P17                                                                             | BZW04P17B  | 19.0                                             | 22.0 | 1.0                        | 17.1                              | 1.0                                                                  | 14.5                                              | 27.7                                               | 0.090                                                               |
| BZW04-17                                                                             | BZW04-17B  | 19.0                                             | 21.0 | 1.0                        | 17.1                              | 1.0                                                                  | 14.5                                              | 27.7                                               | 0.090                                                               |
| BZW04P19                                                                             | BZW04P19B  | 20.9                                             | 24.2 | 1.0                        | 18.8                              | 1.0                                                                  | 13.0                                              | 30.6                                               | 0.092                                                               |
| BZW04-19                                                                             | BZW04-19B  | 20.9                                             | 23.1 | 1.0                        | 18.8                              | 1.0                                                                  | 13.0                                              | 30.6                                               | 0.092                                                               |
| BZW04P20                                                                             | BZW04P20B  | 22.8                                             | 26.4 | 1.0                        | 20.5                              | 1.0                                                                  | 12.0                                              | 33.2                                               | 0.094                                                               |
| BZW04-20                                                                             | BZW04-20B  | 22.8                                             | 25.2 | 1.0                        | 20.5                              | 1.0                                                                  | 12.0                                              | 33.2                                               | 0.094                                                               |
| BZW04P23                                                                             | BZW04P23B  | 25.7                                             | 29.7 | 1.0                        | 23.1                              | 1.0                                                                  | 10.7                                              | 37.5                                               | 0.096                                                               |
| BZW04-23                                                                             | BZW04-23B  | 25.7                                             | 28.4 | 1.0                        | 23.1                              | 1.0                                                                  | 10.7                                              | 37.5                                               | 0.096                                                               |
| BZW04P26                                                                             | BZW04P26B  | 28.5                                             | 33.0 | 1.0                        | 25.6                              | 1.0                                                                  | 9.6                                               | 41.5                                               | 0.097                                                               |
| BZW04-26                                                                             | BZW04-26B  | 28.5                                             | 31.5 | 1.0                        | 25.6                              | 1.0                                                                  | 9.6                                               | 41.5                                               | 0.097                                                               |
| BZW04P28                                                                             | BZW04P28B  | 31.4                                             | 36.3 | 1.0                        | 28.2                              | 1.0                                                                  | 8.8                                               | 45.7                                               | 0.098                                                               |
| BZW04-28                                                                             | BZW04-28B  | 31.4                                             | 34.7 | 1.0                        | 28.2                              | 1.0                                                                  | 8.8                                               | 45.7                                               | 0.098                                                               |
| BZW04P31                                                                             | BZW04P31B  | 34.2                                             | 39.6 | 1.0                        | 30.8                              | 1.0                                                                  | 8.0                                               | 49.9                                               | 0.099                                                               |
| BZW04-31                                                                             | BZW04-31B  | 34.2                                             | 37.8 | 1.0                        | 30.8                              | 1.0                                                                  | 8.0                                               | 49.9                                               | 0.099                                                               |
| BZW04P33                                                                             | BZW04P33B  | 37.1                                             | 42.9 | 1.0                        | 33.3                              | 1.0                                                                  | 7.4                                               | 53.9                                               | 0.100                                                               |
| BZW04-33                                                                             | BZW04-33B  | 37.1                                             | 41.0 | 1.0                        | 33.3                              | 1.0                                                                  | 7.4                                               | 53.9                                               | 0.100                                                               |
| BZW04P37                                                                             | BZW04P37B  | 40.9                                             | 47.3 | 1.0                        | 36.8                              | 1.0                                                                  | 6.7                                               | 59.3                                               | 0.101                                                               |
| BZW04-37                                                                             | BZW04-37B  | 40.9                                             | 45.2 | 1.0                        | 36.8                              | 1.0                                                                  | 6.7                                               | 59.3                                               | 0.101                                                               |
| BZW04P40                                                                             | BZW04P40B  | 44.7                                             | 51.7 | 1.0                        | 40.2                              | 1.0                                                                  | 6.2                                               | 64.8                                               | 0.101                                                               |
| BZW04-40                                                                             | BZW04-40B  | 44.7                                             | 49.4 | 1.0                        | 40.2                              | 1.0                                                                  | 6.2                                               | 64.8                                               | 0.101                                                               |
| BZW04P44                                                                             | BZW04P44B  | 48.5                                             | 56.1 | 1.0                        | 43.6                              | 1.0                                                                  | 5.7                                               | 70.1                                               | 0.102                                                               |
| BZW04-44                                                                             | BZW04-44B  | 48.5                                             | 53.6 | 1.0                        | 43.6                              | 1.0                                                                  | 5.7                                               | 70.1                                               | 0.102                                                               |
| BZW04P48                                                                             | BZW04P48B  | 53.2                                             | 61.6 | 1.0                        | 47.8                              | 1.0                                                                  | 5.2                                               | 77.0                                               | 0.103                                                               |
| BZW04-48                                                                             | BZW04-48B  | 53.2                                             | 58.8 | 1.0                        | 47.8                              | 1.0                                                                  | 5.2                                               | 77.0                                               | 0.103                                                               |
| BZW04P53                                                                             | BZW04P53B  | 58.9                                             | 68.2 | 1.0                        | 53.0                              | 1.0                                                                  | 4.7                                               | 85.0                                               | 0.104                                                               |
| BZW04-53                                                                             | BZW04-53B  | 58.9                                             | 65.1 | 1.0                        | 53.0                              | 1.0                                                                  | 4.7                                               | 85.0                                               | 0.104                                                               |
| BZW04P58                                                                             | BZW04P58B  | 64.6                                             | 74.8 | 1.0                        | 58.1                              | 1.0                                                                  | 4.3                                               | 92.0                                               | 0.104                                                               |
| BZW04-58                                                                             | BZW04-58B  | 64.6                                             | 71.4 | 1.0                        | 58.1                              | 1.0                                                                  | 4.3                                               | 92.0                                               | 0.104                                                               |
| BZW04P64                                                                             | BZW04P64B  | 71.3                                             | 82.5 | 1.0                        | 64.1                              | 1.0                                                                  | 3.9                                               | 103                                                | 0.105                                                               |
| BZW04-64                                                                             | BZW04P64B  | 71.3                                             | 78.8 | 1.0                        | 64.1                              | 1.0                                                                  | 3.9                                               | 103                                                | 0.105                                                               |

**TAYCHIPST****Transient Voltage Suppressors****BZW04P-5V8 THRU BZW04-376**

5.8V-376V 40A

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

| PART NUMBER |            | BREAKDOWN VOLTAGE<br>$V_{BR}$ AT $I_T^{(1)}$<br>(V) |      | TEST CURRENT<br>$I_T$ (mA) | STAND-OFF VOLTAGE<br>$V_{WM}$ (V) | MAXIMUM REVERSE LEAKAGE AT $V_{WM}$<br>$I_D^{(4)}$ ( $\mu\text{A}$ ) | MAXIMUM PEAK PULSE CURRENT<br>$I_{PPM}^{(2)}$ (A) | MAXIMUM CLAMPING VOLTAGE AT $I_{PPM}$<br>$V_C$ (V) | MAXIMUM TEMPERATURE COEFFICIENT OF<br>$V_{BR}$ ( $\%/^\circ\text{C}$ ) |
|-------------|------------|-----------------------------------------------------|------|----------------------------|-----------------------------------|----------------------------------------------------------------------|---------------------------------------------------|----------------------------------------------------|------------------------------------------------------------------------|
|             |            | MIN.                                                | MAX. |                            |                                   |                                                                      |                                                   |                                                    |                                                                        |
| BZW04P70    | BZW04P70B  | 77.9                                                | 90.2 | 1.0                        | 70.1                              | 1.0                                                                  | 3.5                                               | 113                                                | 0.105                                                                  |
| BZW04-70    | BZW04-70B  | 77.9                                                | 86.1 | 1.0                        | 70.1                              | 1.0                                                                  | 3.5                                               | 113                                                | 0.105                                                                  |
| BZW04P78    | BZW04P78B  | 86.5                                                | 100  | 1.0                        | 78.0                              | 1.0                                                                  | 3.2                                               | 125                                                | 0.105                                                                  |
| BZW04-78    | BZW04-78B  | 86.5                                                | 95.5 | 1.0                        | 78.0                              | 1.0                                                                  | 3.2                                               | 125                                                | 0.105                                                                  |
| BZW04P85    | BZW04P85B  | 95.0                                                | 110  | 1.0                        | 85.5                              | 1.0                                                                  | 2.9                                               | 137                                                | 0.106                                                                  |
| BZW04-85    | BZW04-85B  | 95.0                                                | 105  | 1.0                        | 85.5                              | 1.0                                                                  | 2.9                                               | 137                                                | 0.106                                                                  |
| BZW04P94    | BZW04P94B  | 105                                                 | 121  | 1.0                        | 94.0                              | 1.0                                                                  | 2.6                                               | 152                                                | 0.107                                                                  |
| BZW04-94    | BZW04-94B  | 105                                                 | 116  | 1.0                        | 94.0                              | 1.0                                                                  | 2.6                                               | 152                                                | 0.107                                                                  |
| BZW04P102   | BZW04P102B | 114                                                 | 132  | 1.0                        | 102                               | 1.0                                                                  | 2.4                                               | 165                                                | 0.107                                                                  |
| BZW04-102   | BZW04-102B | 114                                                 | 126  | 1.0                        | 102                               | 1.0                                                                  | 2.4                                               | 165                                                | 0.107                                                                  |
| BZW04P110   | BZW04P110B | 124                                                 | 143  | 1.0                        | 111                               | 1.0                                                                  | 2.2                                               | 179                                                | 0.107                                                                  |
| BZW04-110   | BZW04-110B | 124                                                 | 137  | 1.0                        | 111                               | 1.0                                                                  | 2.2                                               | 179                                                | 0.107                                                                  |
| BZW04P128   | BZW04P128B | 143                                                 | 165  | 1.0                        | 128                               | 1.0                                                                  | 2.0                                               | 207                                                | 0.108                                                                  |
| BZW04-128   | BZW04-128B | 143                                                 | 158  | 1.0                        | 128                               | 1.0                                                                  | 2.0                                               | 207                                                | 0.108                                                                  |
| BZW04P136   | BZW04P136B | 152                                                 | 176  | 1.0                        | 136                               | 1.0                                                                  | 1.8                                               | 219                                                | 0.108                                                                  |
| BZW04-136   | BZW04-136B | 152                                                 | 168  | 1.0                        | 136                               | 1.0                                                                  | 1.8                                               | 219                                                | 0.108                                                                  |
| BZW04P145   | BZW04P145B | 161                                                 | 187  | 1.0                        | 145                               | 1.0                                                                  | 1.7                                               | 234                                                | 0.108                                                                  |
| BZW04-145   | BZW04-145B | 161                                                 | 179  | 1.0                        | 145                               | 1.0                                                                  | 1.7                                               | 234                                                | 0.108                                                                  |
| BZW04P154   | BZW04P154B | 171                                                 | 198  | 1.0                        | 154                               | 1.0                                                                  | 1.6                                               | 246                                                | 0.108                                                                  |
| BZW04-154   | BZW04-154B | 171                                                 | 189  | 1.0                        | 154                               | 1.0                                                                  | 1.6                                               | 246                                                | 0.108                                                                  |
| BZW04P171   | BZW04P171B | 190                                                 | 220  | 1.0                        | 171                               | 1.0                                                                  | 1.5                                               | 274                                                | 0.108                                                                  |
| BZW04-171   | BZW04-171B | 190                                                 | 210  | 1.0                        | 171                               | 1.0                                                                  | 1.5                                               | 274                                                | 0.108                                                                  |
| BZW04P188   | BZW04P188B | 209                                                 | 242  | 1.0                        | 188                               | 1.0                                                                  | 1.4                                               | 301                                                | 0.108                                                                  |
| BZW04-188   | BZW04-188B | 209                                                 | 231  | 1.0                        | 188                               | 1.0                                                                  | 1.4                                               | 301                                                | 0.108                                                                  |
| BZW04P213   | BZW04P213B | 237                                                 | 275  | 1.0                        | 213                               | 1.0                                                                  | 1.2                                               | 344                                                | 0.110                                                                  |
| BZW04-213   | BZW04-213B | 237                                                 | 263  | 1.0                        | 213                               | 1.0                                                                  | 1.2                                               | 344                                                | 0.110                                                                  |
| BZW04P239   | BZW04P239B | 266                                                 | 308  | 1.0                        | 239                               | 1.0                                                                  | 1.1                                               | 384                                                | 0.110                                                                  |
| BZW04-239   | BZW04-239B | 266                                                 | 294  | 1.0                        | 239                               | 1.0                                                                  | 1.1                                               | 384                                                | 0.110                                                                  |
| BZW04P256   | BZW04P256B | 285                                                 | 330  | 1.0                        | 256                               | 1.0                                                                  | 1.0                                               | 414                                                | 0.110                                                                  |
| BZW04-256   | BZW04-256B | 285                                                 | 315  | 1.0                        | 256                               | 1.0                                                                  | 1.0                                               | 414                                                | 0.110                                                                  |
| BZW04P273   | BZW04P273B | 304                                                 | 352  | 1.0                        | 273                               | 1.0                                                                  | 0.90                                              | 438                                                | 0.110                                                                  |
| BZW04-273   | BZW04-273B | 304                                                 | 336  | 1.0                        | 273                               | 1.0                                                                  | 0.90                                              | 438                                                | 0.110                                                                  |
| BZW04P299   | BZW04P299B | 332                                                 | 385  | 1.0                        | 299                               | 1.0                                                                  | 0.80                                              | 482                                                | 0.110                                                                  |
| BZW04-299   | BZW04-299B | 332                                                 | 368  | 1.0                        | 299                               | 1.0                                                                  | 0.80                                              | 482                                                | 0.110                                                                  |
| BZW04P342   | BZW04P342B | 380                                                 | 440  | 1.0                        | 342                               | 1.0                                                                  | 0.75                                              | 548                                                | 0.110                                                                  |
| BZW04-342   | BZW04-342B | 380                                                 | 420  | 1.0                        | 342                               | 1.0                                                                  | 0.75                                              | 548                                                | 0.110                                                                  |
| BZW04P376   | BZW04P376B | 418                                                 | 484  | 1.0                        | 376                               | 1.0                                                                  | 0.67                                              | 603                                                | 0.110                                                                  |
| BZW04-376   | BZW04-376B | 418                                                 | 462  | 1.0                        | 376                               | 1.0                                                                  | 0.67                                              | 603                                                | 0.110                                                                  |

**Notes:**

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



**TAYCHIPST**

**Transient Voltage Suppressors**

**BZW04P-5V8 THRU BZW04-376**

**5.8V-376V 40A**

**RATINGS AND CHARACTERISTIC CURVES**

**BYW04P-5V8 THRU BZW04-376**

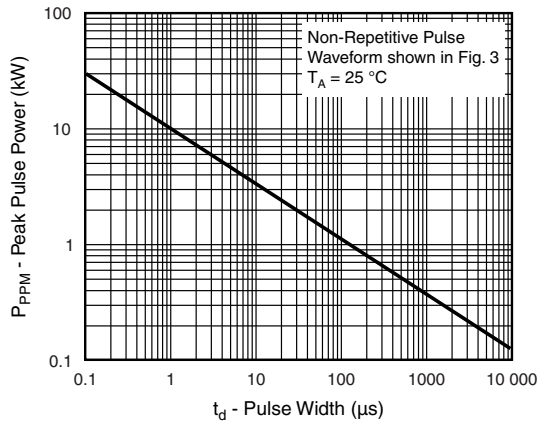


Figure 1. Peak Pulse Power Rating Curve

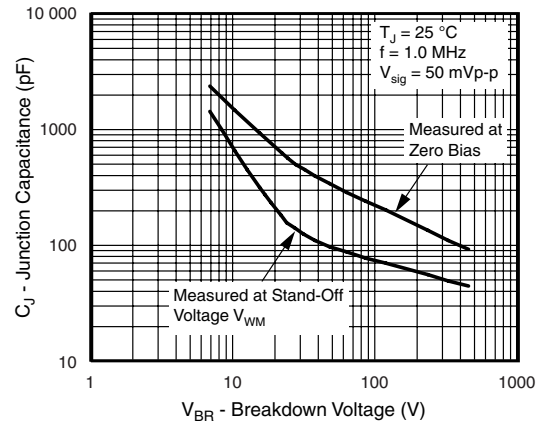


Figure 4. Typical Junction Capacitance

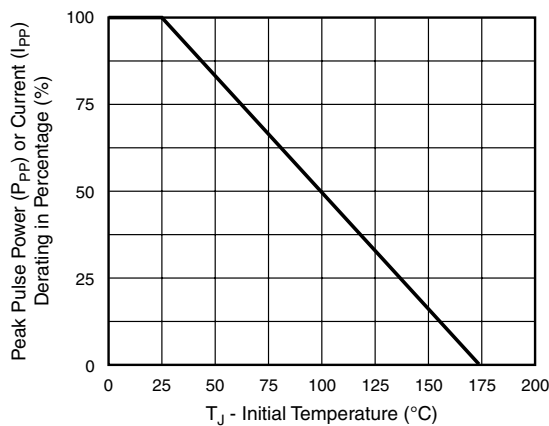


Figure 2. Pulse Power or Current vs. Initial Junction Temperature

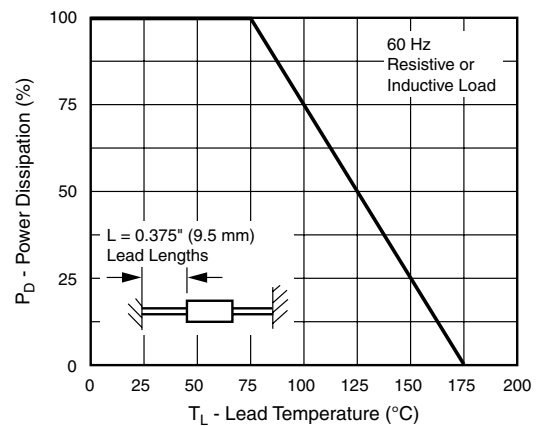


Figure 5. Power Derating Curve

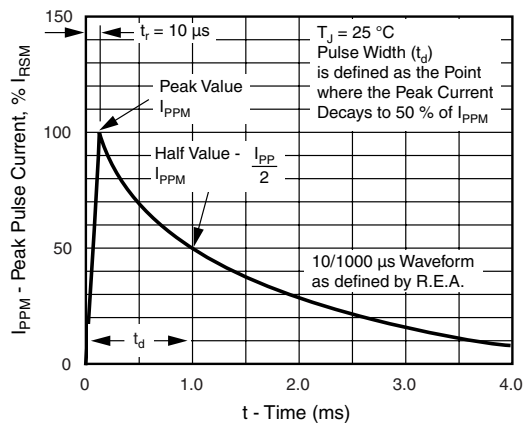


Figure 3. Pulse Waveform

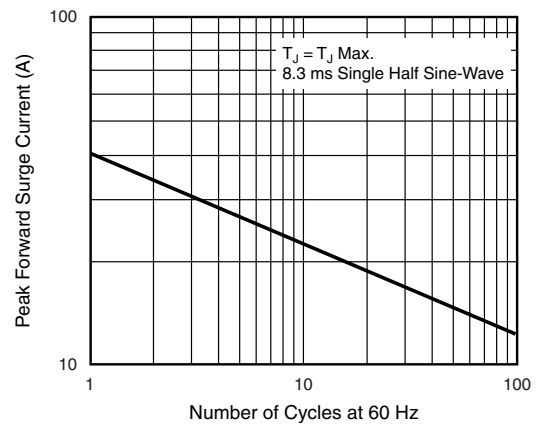


Figure 6. Max. Non-Repetitive Forward Surge Current  
Uni-Directional Only