

## TRANSZORB® Transient Voltage Suppressors


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

| PRIMARY CHARACTERISTICS          |                                 |
|----------------------------------|---------------------------------|
| $V_{WM}$                         | 5.8 V to 376 V                  |
| $V_{BR}$ (uni-directional)       | 6.45 V to 462 V                 |
| $V_{BR}$ (bi-directional)        | 6.45 V to 462 V                 |
| $P_{PPM}$                        | 400 W                           |
| $P_D$                            | 1.5 W                           |
| $I_{FSM}$ (uni-directional only) | 40 A                            |
| $T_J$ max.                       | 175 °C                          |
| Polarity                         | Uni-directional, bi-directional |
| Package                          | DO-204AL (DO-41)                |

### DEVICES FOR BI-DIRECTION APPLICATIONS

For bi-directional types, use B suffix (e.g. BZW04P-6V4B).

Electrical characteristics apply in both directions.

### FEATURES

- Glass passivated chip junction
- Available in uni-directional and bi-directional
- 400 W peak pulse power capability with a 10/1000  $\mu$ s waveform, repetitive rate (duty cycle): 0.01 %
- Excellent clamping capability
- Very fast response time
- Low incremental surge resistance
- Solder dip 275 °C max. 10 s, per JESD 22-B106
- AEC-Q101 qualified
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

### TYPICAL APPLICATIONS

Use in sensitive electronics protection against voltage transients induced by inductive load switching and lighting on ICs, MOSFET, signal lines of sensor units for consumer, computer, industrial, and telecommunication.

### MECHANICAL DATA

**Case:** DO-204AL, molded epoxy over passivated chip

Molding compound meets UL 94 V-0 flammability rating

Base P/N-E3 - RoHS-compliant, commercial grade

Base P/NHE3 - RoHS-compliant, 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) to BZW04-376(B) for commercial grade only

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

| MAXIMUM RATINGS AND THERMAL CHARACTERISTICS ( $T_A = 25\text{ °C}$ 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 $T_L = 75\text{ °C}$ (fig. 5)                      | $P_D$          | 1.5            | W    |
| Peak forward surge current, 8.3 ms single half sine-wave uni-directional only <sup>(2)</sup> | $I_{FSM}$      | 40             | A    |
| Maximum instantaneous forward voltage at 25 A for uni-directional only <sup>(3)</sup>        | $V_F$          | 3.5/5.0        | V    |
| Operating junction and storage temperature range   | $T_J, T_{STG}$ | -55 to +175    | °C   |

#### Notes

<sup>(1)</sup> Non-repetitive current pulse, per fig. 3 and derated above  $T_A = 25\text{ °C}$  per fig. 2

<sup>(2)</sup> Measured on 8.3 ms single half sine-wave or equivalent square wave, duty cycle = 4 pulses per minute maximum

<sup>(3)</sup>  $V_F = 3.5\text{ V}$  for BZW04P(-)188 and below;  $V_F = 5.0\text{ V}$  for BZW04P(-)213 and above



| <b>ELECTRICAL CHARACTERISTICS</b> ( $T_A = 25\text{ }^\circ\text{C}$ unless otherwise noted) |  |      |                         |                                |  |   |   |  |
|--|--|------|-------------------------|--------------------------------|--|---|---|--|
| PART NUMBER  | BREAKDOWN VOLTAGE $V_{BR}$ AT $I_T$ <sup>(1)</sup> (V) |      | TEST CURRENT $I_T$ (mA) | STAND-OFF VOLTAGE $V_{WM}$ (V) | MAXIMUM REVERSE LEAKAGE AT $V_{WM}$ $I_D$ <sup>(4)</sup> ( $\mu\text{A}$ ) | MAXIMUM PEAK PULSE CURRENT $I_{PPM}$ <sup>(2)</sup> (A) | MAXIMUM CLAMPING VOLTAGE AT $I_{PPM}$ $V_C$ (V) | MAXIMUM TEMPERATURE COEFFICIENT OF $V_{BR}$ (%/ $^\circ\text{C}$ ) |
|  | MIN.   | MAX. |                         |                                |  |   |   |  |
| <b>UNI-DIRECTIONAL TYPES</b>   |  |      |                         |                                |  |   |   |  |
| BZW04-5V8  | 6.45   | 7.14 | 10.0                    | 5.80                           | 1000   | 38.0  | 10.5  | 0.057  |
| BZW04-6V4  | 7.13   | 7.88 | 10.0                    | 6.40                           | 500  | 35.4  | 11.3  | 0.061  |
| BZW04-7V0  | 7.79   | 8.61 | 10.0                    | 7.02                           | 200  | 33.0  | 12.1  | 0.065  |
| BZW04-7V8  | 8.65   | 9.55 | 1.0                     | 7.78                           | 50   | 30.0  | 13.4  | 0.073  |
| BZW04-8V5  | 9.50   | 10.5 | 1.0                     | 8.55                           | 10   | 27.6  | 14.5  | 0.075  |
| BZW04-9V4  | 10.5   | 11.6 | 1.0                     | 9.4                            | 5.0  | 25.7  | 15.6  | 0.075  |
| BZW04-10   | 11.4   | 12.6 | 1.0                     | 10.2                           | 1.0  | 24.0  | 16.7  | 0.078  |
| BZW04-11   | 12.4   | 13.7 | 1.0                     | 11.1                           | 1.0  | 22.0  | 18.2  | 0.081  |
| BZW04-13   | 14.3   | 15.8 | 1.0                     | 12.8                           | 1.0  | 19.0  | 21.2  | 0.084  |
| BZW04-14   | 15.2   | 16.8 | 1.0                     | 13.6                           | 1.0  | 17.8  | 22.5  | 0.086  |
| BZW04-15   | 17.1   | 18.9 | 1.0                     | 15.3                           | 1.0  | 16.0  | 25.2  | 0.088  |
| BZW04-17   | 19.0   | 21.0 | 1.0                     | 17.1                           | 1.0  | 14.5  | 27.7  | 0.090  |
| BZW04-19   | 20.9   | 23.1 | 1.0                     | 18.8                           | 1.0  | 13.0  | 30.6  | 0.092  |
| BZW04-20   | 22.8   | 25.2 | 1.0                     | 20.5                           | 1.0  | 12.0  | 33.2  | 0.094  |
| BZW04-23   | 25.7   | 28.4 | 1.0                     | 23.1                           | 1.0  | 10.7  | 37.5  | 0.096  |
| BZW04-26   | 28.5   | 31.5 | 1.0                     | 25.6                           | 1.0  | 9.6   | 41.5  | 0.097  |
| BZW04-28   | 31.4   | 34.7 | 1.0                     | 28.2                           | 1.0  | 8.8   | 45.7  | 0.098  |
| BZW04-31   | 34.2   | 37.8 | 1.0                     | 30.8                           | 1.0  | 8.0   | 49.9  | 0.099  |
| BZW04-33   | 37.1   | 41.0 | 1.0                     | 33.3                           | 1.0  | 7.4   | 53.9  | 0.100  |
| BZW04-37   | 40.9   | 45.2 | 1.0                     | 36.8                           | 1.0  | 6.7   | 59.3  | 0.101  |
| BZW04-40   | 44.7   | 49.4 | 1.0                     | 40.2                           | 1.0  | 6.2   | 64.8  | 0.101  |
| BZW04-44   | 48.5   | 53.6 | 1.0                     | 43.6                           | 1.0  | 5.7   | 70.1  | 0.102  |
| BZW04-48   | 53.2   | 58.8 | 1.0                     | 47.8                           | 1.0  | 5.2   | 77.0  | 0.103  |
| BZW04-53   | 58.9   | 65.1 | 1.0                     | 53.0                           | 1.0  | 4.7   | 85.0  | 0.104  |
| BZW04-58   | 64.6   | 71.4 | 1.0                     | 58.1                           | 1.0  | 4.3   | 92.0  | 0.104  |
| BZW04-64   | 71.3   | 78.8 | 1.0                     | 64.1                           | 1.0  | 3.9   | 103   | 0.105  |
| BZW04-70   | 77.9   | 86.1 | 1.0                     | 70.1                           | 1.0  | 3.5   | 113   | 0.105  |
| BZW04-78   | 86.5   | 95.5 | 1.0                     | 78.0                           | 1.0  | 3.2   | 125   | 0.105  |
| BZW04-85   | 95.0   | 105  | 1.0                     | 85.5                           | 1.0  | 2.9   | 137   | 0.106  |
| BZW04-94   | 105  | 116  | 1.0                     | 94.0                           | 1.0  | 2.6   | 152   | 0.107  |
| BZW04-102  | 114  | 126  | 1.0                     | 102                            | 1.0  | 2.4   | 165   | 0.107  |
| BZW04-110  | 124  | 137  | 1.0                     | 111                            | 1.0  | 2.2   | 179   | 0.107  |
| BZW04-128  | 143  | 158  | 1.0                     | 128                            | 1.0  | 2.0   | 207   | 0.108  |
| BZW04-136  | 152  | 168  | 1.0                     | 136                            | 1.0  | 1.8   | 219   | 0.108  |
| BZW04-145  | 161  | 179  | 1.0                     | 145                            | 1.0  | 1.7   | 234   | 0.108  |
| BZW04-154  | 171  | 189  | 1.0                     | 154                            | 1.0  | 1.6   | 246   | 0.108  |
| BZW04-171  | 190  | 210  | 1.0                     | 171                            | 1.0  | 1.5   | 274   | 0.108  |
| BZW04-188  | 209  | 231  | 1.0                     | 188                            | 1.0  | 1.4   | 301   | 0.108  |
| BZW04-213  | 237  | 263  | 1.0                     | 213                            | 1.0  | 1.2   | 344   | 0.110  |
| BZW04-239  | 266  | 294  | 1.0                     | 239                            | 1.0  | 1.1   | 384   | 0.110  |
| BZW04-256  | 285  | 315  | 1.0                     | 256                            | 1.0  | 1.0   | 414   | 0.110  |
| BZW04-273  | 304  | 336  | 1.0                     | 273                            | 1.0  | 0.90  | 438   | 0.110  |
| BZW04-299  | 332  | 368  | 1.0                     | 299                            | 1.0  | 0.80  | 482   | 0.110  |
| BZW04-342  | 380  | 420  | 1.0                     | 342                            | 1.0  | 0.75  | 548   | 0.110  |
| BZW04-376  | 418  | 462  | 1.0                     | 376                            | 1.0  | 0.67  | 603   | 0.110  |



| ELECTRICAL CHARACTERISTICS (T <sub>A</sub> = 25 °C unless otherwise noted) |  |      |                                  |                                       |   |  |   |   |
|--|--|------|----------------------------------|---------------------------------------|---|--|---|---|
| PART NUMBER  | BREAKDOWN VOLTAGE V <sub>BR</sub> AT I <sub>T</sub> <sup>(1)</sup> (V) |      | TEST CURRENT I <sub>T</sub> (mA) | STAND-OFF VOLTAGE V <sub>WM</sub> (V) | MAXIMUM REVERSE LEAKAGE AT V <sub>WM</sub> I <sub>D</sub> <sup>(4)</sup> (µA) | MAXIMUM PEAK PULSE CURRENT I <sub>PPM</sub> <sup>(2)</sup> (A) | MAXIMUM CLAMPING VOLTAGE AT I <sub>PPM</sub> V <sub>C</sub> (V) | MAXIMUM TEMPERATURE COEFFICIENT OF V <sub>BR</sub> (%/°C) |
|  | MIN.   | MAX. |                                  |                                       |   |  |   |   |
| <b>BI-DIRECTIONAL TYPES</b>  |  |      |                                  |                                       |   |  |   |   |
| BZW04-5V8B   | 6.45   | 7.14 | 10.0                             | 5.80                                  | 1000  | 38.0   | 10.5  | 0.057   |
| BZW04-6V4B   | 7.13   | 7.88 | 10.0                             | 6.40                                  | 500   | 35.4   | 11.3  | 0.061   |
| BZW04-7V0B   | 7.79   | 8.61 | 10.0                             | 7.02                                  | 200   | 33.0   | 12.1  | 0.065   |
| BZW04-7V8B   | 8.65   | 9.55 | 1.0                              | 7.78                                  | 50  | 30.0   | 13.4  | 0.073   |
| BZW04-8V5B   | 9.50   | 10.5 | 1.0                              | 8.55                                  | 10  | 27.6   | 14.5  | 0.075   |
| BZW04-9V4B   | 10.5   | 11.6 | 1.0                              | 9.4                                   | 5.0   | 25.7   | 15.6  | 0.075   |
| BZW04-10B  | 11.4   | 12.6 | 1.0                              | 10.2                                  | 1.0   | 24.0   | 16.7  | 0.078   |
| BZW04-11B  | 12.4   | 13.7 | 1.0                              | 11.1                                  | 1.0   | 22.0   | 18.2  | 0.081   |
| BZW04-13B  | 14.3   | 15.8 | 1.0                              | 12.8                                  | 1.0   | 19.0   | 21.2  | 0.084   |
| BZW04-14B  | 15.2   | 16.8 | 1.0                              | 13.6                                  | 1.0   | 17.8   | 22.5  | 0.086   |
| BZW04-15B  | 17.1   | 18.9 | 1.0                              | 15.3                                  | 1.0   | 16.0   | 25.2  | 0.088   |
| BZW04-17B  | 19.0   | 21.0 | 1.0                              | 17.1                                  | 1.0   | 14.5   | 27.7  | 0.090   |
| BZW04-19B  | 20.9   | 23.1 | 1.0                              | 18.8                                  | 1.0   | 13.0   | 30.6  | 0.092   |
| BZW04-20B  | 22.8   | 25.2 | 1.0                              | 20.5                                  | 1.0   | 12.0   | 33.2  | 0.094   |
| BZW04-23B  | 25.7   | 28.4 | 1.0                              | 23.1                                  | 1.0   | 10.7   | 37.5  | 0.096   |
| BZW04-26B  | 28.5   | 31.5 | 1.0                              | 25.6                                  | 1.0   | 9.6  | 41.5  | 0.097   |
| BZW04-28B  | 31.4   | 34.7 | 1.0                              | 28.2                                  | 1.0   | 8.8  | 45.7  | 0.098   |
| BZW04-31B  | 34.2   | 37.8 | 1.0                              | 30.8                                  | 1.0   | 8.0  | 49.9  | 0.099   |
| BZW04-33B  | 37.1   | 41.0 | 1.0                              | 33.3                                  | 1.0   | 7.4  | 53.9  | 0.100   |
| BZW04-37B  | 40.9   | 45.2 | 1.0                              | 36.8                                  | 1.0   | 6.7  | 59.3  | 0.101   |
| BZW04-40B  | 44.7   | 49.4 | 1.0                              | 40.2                                  | 1.0   | 6.2  | 64.8  | 0.101   |
| BZW04-44B  | 48.5   | 53.6 | 1.0                              | 43.6                                  | 1.0   | 5.7  | 70.1  | 0.102   |
| BZW04-48B  | 53.2   | 58.8 | 1.0                              | 47.8                                  | 1.0   | 5.2  | 77.0  | 0.103   |
| BZW04-53B  | 58.9   | 65.1 | 1.0                              | 53.0                                  | 1.0   | 4.7  | 85.0  | 0.104   |
| BZW04-58B  | 64.6   | 71.4 | 1.0                              | 58.1                                  | 1.0   | 4.3  | 92.0  | 0.104   |
| BZW04-64B  | 71.3   | 78.8 | 1.0                              | 64.1                                  | 1.0   | 3.9  | 103   | 0.105   |
| BZW04-70B  | 77.9   | 86.1 | 1.0                              | 70.1                                  | 1.0   | 3.5  | 113   | 0.105   |
| BZW04-78B  | 86.5   | 95.5 | 1.0                              | 78.0                                  | 1.0   | 3.2  | 125   | 0.105   |
| BZW04-85B  | 95.0   | 105  | 1.0                              | 85.5                                  | 1.0   | 2.9  | 137   | 0.106   |
| BZW04-94B  | 105  | 116  | 1.0                              | 94.0                                  | 1.0   | 2.6  | 152   | 0.107   |
| BZW04-102B   | 114  | 126  | 1.0                              | 102                                   | 1.0   | 2.4  | 165   | 0.107   |
| BZW04-110B   | 124  | 137  | 1.0                              | 111                                   | 1.0   | 2.2  | 179   | 0.107   |
| BZW04-128B   | 143  | 158  | 1.0                              | 128                                   | 1.0   | 2.0  | 207   | 0.108   |
| BZW04-136B   | 152  | 168  | 1.0                              | 136                                   | 1.0   | 1.8  | 219   | 0.108   |
| BZW04-145B   | 161  | 179  | 1.0                              | 145                                   | 1.0   | 1.7  | 234   | 0.108   |
| BZW04-154B   | 171  | 189  | 1.0                              | 154                                   | 1.0   | 1.6  | 246   | 0.108   |
| BZW04-171B   | 190  | 210  | 1.0                              | 171                                   | 1.0   | 1.5  | 274   | 0.108   |
| BZW04-188B   | 209  | 231  | 1.0                              | 188                                   | 1.0   | 1.4  | 301   | 0.108   |
| BZW04-213B   | 237  | 263  | 1.0                              | 213                                   | 1.0   | 1.2  | 344   | 0.110   |
| BZW04-239B   | 266  | 294  | 1.0                              | 239                                   | 1.0   | 1.1  | 384   | 0.110   |
| BZW04-256B   | 285  | 315  | 1.0                              | 256                                   | 1.0   | 1.0  | 414   | 0.110   |
| BZW04-273B   | 304  | 336  | 1.0                              | 273                                   | 1.0   | 0.90   | 438   | 0.110   |
| BZW04-299B   | 332  | 368  | 1.0                              | 299                                   | 1.0   | 0.80   | 482   | 0.110   |
| BZW04-342B   | 380  | 420  | 1.0                              | 342                                   | 1.0   | 0.75   | 548   | 0.110   |
| BZW04-376B   | 418  | 462  | 1.0                              | 376                                   | 1.0   | 0.67   | 603   | 0.110   |

Notes

- (1) Pulse test: t<sub>p</sub> ≥ 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<sub>WM</sub> of 10 V and less, the I<sub>D</sub> limit is doubled



| ORDERING INFORMATION (Example) |                 |                        |               |                                  |
|--------------------------------|-----------------|------------------------|---------------|----------------------------------|
| PREFERRED P/N                  | UNIT WEIGHT (g) | PREFERRED PACKAGE CODE | BASE QUANTITY | DELIVERY MODE                    |
| BZW0410-E3/54                  | 0.350           | 54                     | 550           | 13" diameter paper tape and reel |
| BZW0410HE3/54 <sup>(1)</sup>   | 0.350           | 54                     | 550           | 13" diameter paper tape and reel |

Note

<sup>(1)</sup> AEC Q101 qualified

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

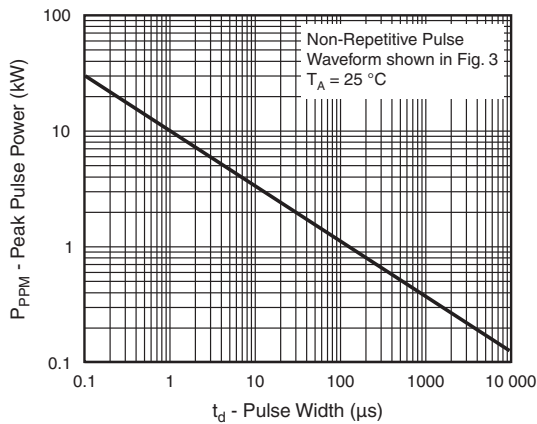


Fig. 1 - Peak Pulse Power Rating Curve

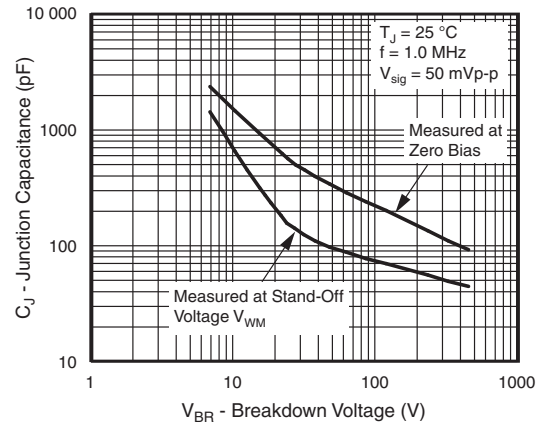


Fig. 4 - Typical Junction Capacitance

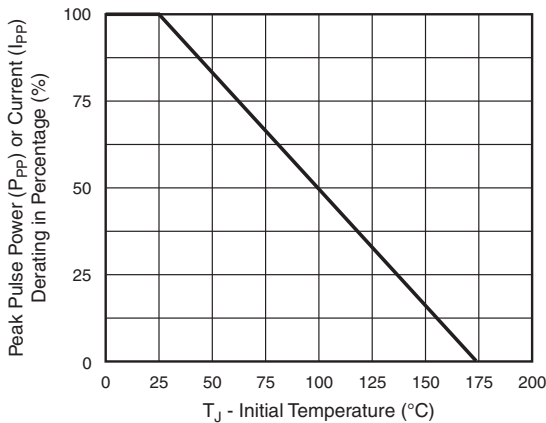


Fig. 2 - Pulse Power or Current vs. Initial Junction Temperature

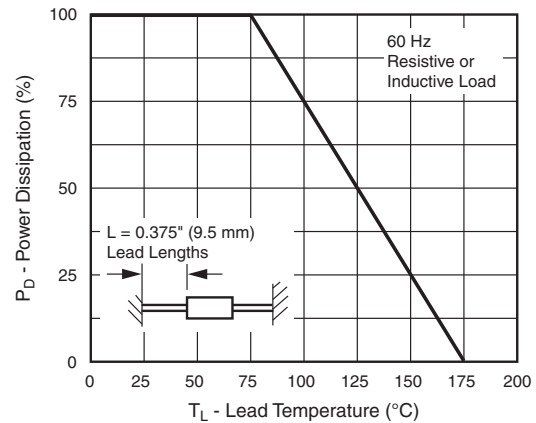


Fig. 5 - Power Derating Curve

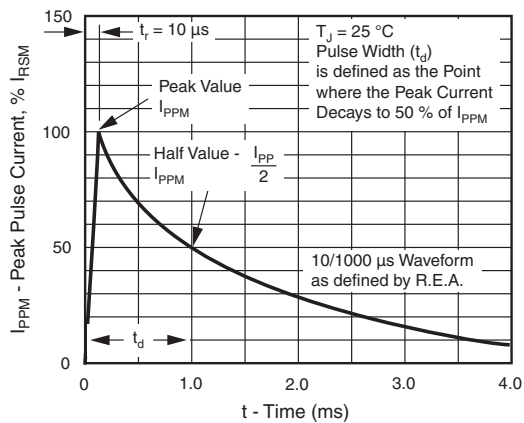


Fig. 3 - Pulse Waveform

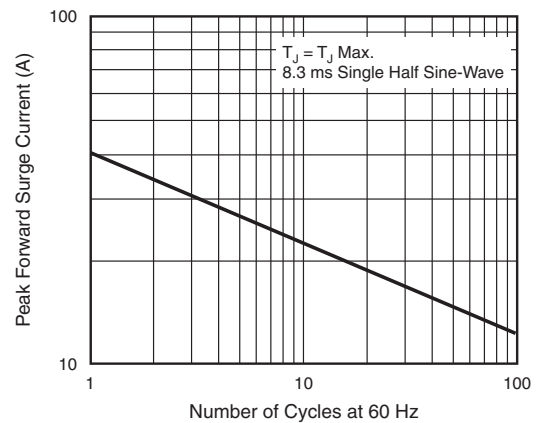
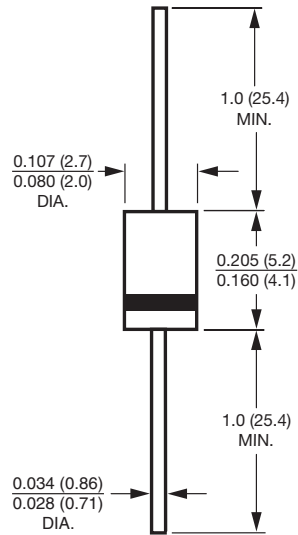


Fig. 6 - Max. Non-Repetitive Forward Surge Current Uni-Directional Only



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

DO-204AL (DO-41)





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