

## Surface Mount TRANSZORB® Transient Voltage Suppressors



DO-215AA (SMBG)

| PRIMARY CHARACTERISTICS          |                |
|----------------------------------|----------------|
| $V_{WM}$                         | 5.0 V to 188 V |
| $P_{PPM}$                        | 600 W          |
| $I_{FSM}$ (uni-directional only) | 100 A          |
| $T_J$ max.                       | 150 °C         |

### DEVICES FOR BI-DIRECTION APPLICATIONS

For bi-directional devices use C or CA suffix (e.g. SMBG10CA).

Electrical characteristics apply in both directions.

### FEATURES

- Low profile package
- Ideal for automated placement
- Glass passivated chip junction
- Available in uni-directional and bi-directional
- 600 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
- Meets MSL level 1, per J-STD-020C, LF max peak of 260 °C
- Solder dip 260 °C, 40 seconds
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



### TYPICAL APPLICATIONS

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

### MECHANICAL DATA

**Case:** DO-215AA (SMBG)

Epoxy meets UL 94V-0 flammability rating

**Terminals:** Matte tin plated leads, solderable per J-STD-002B and JESD22-B102D

E3 suffix for commercial grade, HE3 suffix for high reliability grade (AEC Q101 qualified)

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

| MAXIMUM RATINGS ( $T_A = 25$ °C unless otherwise noted)                                     |                |                |      |
|---|----------------|----------------|------|
| PARAMETER   | SYMBOL         | VALUE          | UNIT |
| Peak pulse power dissipation with a 10/1000 $\mu$ s waveform <sup>(1)(2)</sup> (Fig. 1)     | $P_{PPM}$      | 600            | W    |
| Peak pulse current with a 10/1000 $\mu$ s waveform <sup>(1)</sup>                           | $I_{PPM}$      | See next table | A    |
| Peak forward surge current 8.3 ms single half sine-wave uni-directional only <sup>(2)</sup> | $I_{FSM}$      | 100            | A    |
| Operating junction and storage temperature range  | $T_J, T_{STG}$ | - 55 to + 150  | °C   |

#### Notes:

(1) Non-repetitive current pulse, per Fig. 3 and derated above  $T_A = 25$  °C per Fig. 2

(2) Mounted on 0.2 x 0.2" (5.0 x 5.0 mm) copper pads to each terminal



| <b>ELECTRICAL CHARACTERISTICS</b> ( $T_A = 25\text{ }^\circ\text{C}$ unless otherwise noted) |                        |    |   |      |                                  |   |  |   |   |
|--|------------------------|----|---|------|----------------------------------|---|--|---|---|
| DEVICE TYPE<br>MODIFIED<br>GULL WING   | DEVICE MARKING<br>CODE |    | BREAKDOWN<br>VOLTAGE<br>$V_{BR}$ AT $I_T$ <sup>(1)</sup><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>$I_D$ ( $\mu\text{A}$ ) <sup>(3)</sup> | MAXIMUM<br>PEAK PULSE<br>SURGE<br>CURRENT<br>$I_{PPM}$ (A) <sup>(2)</sup> | MAXIMUM<br>CLAMPING<br>VOLTAGE AT<br>$I_{PPM}$<br>$V_C$ (V) |
|  | UNI                    | BI | MIN   | MAX  |                                  |   |  |   |   |
| (+)SMBG5.0   | KD                     | KD | 6.40  | 7.82 | 10                               | 5.0                                     | 800  | 62.5  | 9.6   |
| (+)SMBG5.0A <sup>(5)</sup>   | KE                     | KE | 6.40  | 7.07 | 10                               | 5.0                                     | 800  | 65.2  | 9.2   |
| (+)SMBG6.0   | KF                     | KF | 6.67  | 8.15 | 10                               | 6.0                                     | 800  | 52.6  | 11.4  |
| (+)SMBG6.0A  | KG                     | KG | 6.67  | 7.37 | 10                               | 6.0                                     | 800  | 58.3  | 10.3  |
| (+)SMBG6.5   | KH                     | AH | 7.22  | 8.82 | 10                               | 6.5                                     | 500  | 48.8  | 12.3  |
| (+)SMBG6.5A  | KK                     | AK | 7.22  | 7.98 | 10                               | 6.5                                     | 500  | 53.6  | 11.2  |
| (+)SMBG7.0   | KL                     | KL | 7.78  | 9.51 | 10                               | 7.0                                     | 200  | 45.1  | 13.3  |
| (+)SMBG7.0A  | KM                     | KM | 7.78  | 8.60 | 10                               | 7.0                                     | 200  | 50.0  | 12.0  |
| (+)SMBG7.5   | KN                     | AN | 8.33  | 10.2 | 1.0                              | 7.5                                     | 100  | 42.0  | 14.3  |
| (+)SMBG7.5A  | KP                     | AP | 8.33  | 9.21 | 1.0                              | 7.5                                     | 100  | 46.5  | 12.9  |
| (+)SMBG8.0   | KQ                     | AQ | 8.89  | 10.9 | 1.0                              | 8.0                                     | 50   | 40.0  | 15.0  |
| (+)SMBG8.0A  | KR                     | AR | 8.89  | 9.83 | 1.0                              | 8.0                                     | 50   | 44.1  | 13.6  |
| (+)SMBG8.5   | KS                     | AS | 9.44  | 11.5 | 1.0                              | 8.5                                     | 20   | 37.7  | 15.9  |
| (+)SMBG8.5A  | KT                     | AT | 9.44  | 10.4 | 1.0                              | 8.5                                     | 20   | 41.7  | 14.4  |
| (+)SMBG9.0   | KU                     | AU | 10.0  | 12.2 | 1.0                              | 9.0                                     | 10   | 35.5  | 16.9  |
| (+)SMBG9.0A  | KV                     | AV | 10.0  | 11.1 | 1.0                              | 9.0                                     | 10   | 39.0  | 15.4  |
| (+)SMBG10  | KW                     | AW | 11.1  | 13.6 | 1.0                              | 10                                      | 5.0  | 31.9  | 18.8  |
| (+)SMBG10A   | KX                     | AX | 11.1  | 12.3 | 1.0                              | 10                                      | 5.0  | 35.3  | 17.0  |
| (+)SMBG11  | KY                     | KY | 12.2  | 14.9 | 1.0                              | 11                                      | 5.0  | 29.9  | 20.1  |
| (+)SMBG11A   | KZ                     | KZ | 12.2  | 13.5 | 1.0                              | 11                                      | 5.0  | 33.0  | 18.2  |
| (+)SMBG12  | LD                     | BD | 13.3  | 16.3 | 1.0                              | 12                                      | 5.0  | 27.3  | 22.0  |
| (+)SMBG12A   | LE                     | BE | 13.3  | 14.7 | 1.0                              | 12                                      | 5.0  | 30.2  | 19.9  |
| (+)SMBG13  | LF                     | LF | 14.4  | 17.6 | 1.0                              | 13                                      | 1.0  | 25.2  | 23.8  |
| (+)SMBG13A   | LG                     | LG | 14.4  | 15.9 | 1.0                              | 13                                      | 1.0  | 27.9  | 21.5  |
| (+)SMBG14  | LH                     | BH | 15.6  | 19.1 | 1.0                              | 14                                      | 1.0  | 23.3  | 25.8  |
| (+)SMBG14A   | LK                     | BK | 15.6  | 17.2 | 1.0                              | 14                                      | 1.0  | 25.9  | 23.2  |
| (+)SMBG15  | LL                     | BL | 16.7  | 20.4 | 1.0                              | 15                                      | 1.0  | 22.3  | 26.9  |
| (+)SMBG15A   | LM                     | BM | 16.7  | 18.5 | 1.0                              | 15                                      | 1.0  | 24.6  | 24.4  |
| (+)SMBG16  | LN                     | LN | 17.8  | 21.8 | 1.0                              | 16                                      | 1.0  | 20.8  | 28.8  |
| (+)SMBG16A   | LP                     | LM | 17.8  | 19.7 | 1.0                              | 16                                      | 1.0  | 23.1  | 26.0  |
| (+)SMBG17  | LQ                     | LQ | 18.9  | 23.1 | 1.0                              | 17                                      | 1.0  | 19.7  | 30.5  |
| (+)SMBG17A   | LR                     | LR | 18.9  | 20.9 | 1.0                              | 17                                      | 1.0  | 21.7  | 27.6  |
| (+)SMBG18  | LS                     | BS | 20.0  | 24.4 | 1.0                              | 18                                      | 1.0  | 18.6  | 32.2  |
| (+)SMBG18A   | LT                     | BT | 20.0  | 22.1 | 1.0                              | 18                                      | 1.0  | 20.5  | 29.2  |
| (+)SMBG20  | LU                     | LU | 22.2  | 27.1 | 1.0                              | 20                                      | 1.0  | 16.8  | 35.8  |
| (+)SMBG20A   | LV                     | LV | 22.2  | 24.5 | 1.0                              | 20                                      | 1.0  | 18.5  | 32.4  |
| (+)SMBG22  | LW                     | BW | 24.4  | 29.8 | 1.0                              | 22                                      | 1.0  | 15.2  | 39.4  |
| (+)SMBG22A   | LX                     | BX | 24.4  | 26.9 | 1.0                              | 22                                      | 1.0  | 16.9  | 35.5  |
| (+)SMBG24  | LY                     | BY | 26.7  | 32.6 | 1.0                              | 24                                      | 1.0  | 14.0  | 43.0  |
| (+)SMBG24A   | LZ                     | BZ | 26.7  | 29.5 | 1.0                              | 24                                      | 1.0  | 15.4  | 38.9  |
| (+)SMBG26  | MD                     | CD | 28.9  | 35.3 | 1.0                              | 26                                      | 1.0  | 12.9  | 46.6  |
| (+)SMBG26A   | ME                     | CE | 28.9  | 31.9 | 1.0                              | 26                                      | 1.0  | 14.3  | 42.1  |
| (+)SMBG28  | MF                     | MF | 31.1  | 38.0 | 1.0                              | 28                                      | 1.0  | 12.0  | 50.0  |
| (+)SMBG28A   | MG                     | MG | 31.1  | 34.4 | 1.0                              | 28                                      | 1.0  | 13.2  | 45.4  |
| (+)SMBG30  | MH                     | CH | 33.3  | 40.7 | 1.0                              | 30                                      | 1.0  | 11.2  | 53.5  |
| (+)SMBG30A   | MK                     | CK | 33.3  | 36.8 | 1.0                              | 30                                      | 1.0  | 12.4  | 48.4  |
| (+)SMBG33  | ML                     | CL | 36.7  | 44.9 | 1.0                              | 33                                      | 1.0  | 10.2  | 59.0  |
| (+)SMBG33A   | MM                     | CM | 36.7  | 40.6 | 1.0                              | 33                                      | 1.0  | 11.3  | 53.3  |
| (+)SMBG36  | MN                     | CN | 40.0  | 48.9 | 1.0                              | 36                                      | 1.0  | 9.3   | 64.3  |
| (+)SMBG36A   | MP                     | CP | 40.0  | 44.2 | 1.0                              | 36                                      | 1.0  | 10.3  | 58.1  |
| (+)SMBG40  | MQ                     | CQ | 44.4  | 54.3 | 1.0                              | 40                                      | 1.0  | 8.4   | 71.4  |
| (+)SMBG40A   | MR                     | CR | 44.4  | 49.1 | 1.0                              | 40                                      | 1.0  | 9.3   | 64.5  |



| ELECTRICAL CHARACTERISTICS (T <sub>A</sub> = 25 °C unless otherwise noted) |                        |    |  |      |   |  |  |   |   |
|--|------------------------|----|--|------|---|--|--|---|---|
| DEVICE TYPE<br>MODIFIED<br>GULL WING                                       | DEVICE MARKING<br>CODE |    | BREAKDOWN<br>VOLTAGE<br>V <sub>BR</sub> AT I <sub>T</sub> (1)<br>(V) |      | TEST<br>CURRENT<br>I <sub>T</sub><br>(mA) | STAND-OFF<br>VOLTAGE<br>V <sub>WM</sub><br>(V) | MAXIMUM<br>REVERSE<br>LEAKAGE<br>AT V <sub>WM</sub><br>I <sub>D</sub> (μA) (3) | MAXIMUM<br>PEAK PULSE<br>SURGE<br>CURRENT<br>I <sub>PPM</sub> (A) (2) | MAXIMUM<br>CLAMPING<br>VOLTAGE AT<br>I <sub>PPM</sub><br>V <sub>C</sub> (V) |
|  | UNI                    | BI | MIN  | MAX  |   |  |  |   |   |
| (+)SMBG43  | MS                     | CS | 47.8   | 58.4 | 1.0                                       | 43   | 1.0  | 7.8   | 76.7  |
| (+)SMBG43A   | MT                     | CT | 47.8   | 52.8 | 1.0                                       | 43   | 1.0  | 8.6   | 69.4  |
| (+)SMBG45  | MU                     | MU | 50.0   | 61.1 | 1.0                                       | 45   | 1.0  | 7.5   | 80.3  |
| (+)SMBG45A   | MV                     | MV | 50.0   | 55.3 | 1.0                                       | 45   | 1.0  | 8.3   | 72.7  |
| (+)SMBG48  | MW                     | MW | 53.3   | 65.1 | 1.0                                       | 48   | 1.0  | 7.0   | 85.5  |
| (+)SMBG48A   | MX                     | MX | 53.3   | 58.9 | 1.0                                       | 48   | 1.0  | 7.8   | 77.4  |
| (+)SMBG51  | MY                     | MY | 56.7   | 69.3 | 1.0                                       | 51   | 1.0  | 6.6   | 91.1  |
| (+)SMBG51A   | MZ                     | MZ | 56.7   | 62.7 | 1.0                                       | 51   | 1.0  | 7.3   | 82.4  |
| (+)SMBG54  | ND                     | ND | 60.0   | 73.3 | 1.0                                       | 54   | 1.0  | 6.2   | 96.3  |
| (+)SMBG54A   | NE                     | NE | 60.0   | 66.3 | 1.0                                       | 54   | 1.0  | 6.9   | 87.1  |
| (+)SMBG58  | NF                     | NF | 64.4   | 78.7 | 1.0                                       | 58   | 1.0  | 5.8   | 103   |
| (+)SMBG58A   | NG                     | NG | 64.4   | 71.2 | 1.0                                       | 58   | 1.0  | 6.4   | 93.6  |
| (+)SMBG60  | NH                     | NH | 66.7   | 81.5 | 1.0                                       | 60   | 1.0  | 5.6   | 107   |
| (+)SMBG60A   | NK                     | NK | 66.7   | 73.7 | 1.0                                       | 60   | 1.0  | 6.2   | 96.8  |
| (+)SMBG64  | NL                     | NL | 71.1   | 86.9 | 1.0                                       | 64   | 1.0  | 5.3   | 114   |
| (+)SMBG64A   | NM                     | NM | 71.1   | 78.6 | 1.0                                       | 64   | 1.0  | 5.8   | 103   |
| (+)SMBG70  | NN                     | NN | 77.8   | 95.1 | 1.0                                       | 70   | 1.0  | 4.8   | 125   |
| (+)SMBG70A   | NP                     | NP | 77.8   | 86.0 | 1.0                                       | 70   | 1.0  | 5.3   | 113   |
| (+)SMBG75  | NQ                     | NQ | 83.3   | 102  | 1.0                                       | 75   | 1.0  | 4.5   | 134   |
| (+)SMBG75A   | NR                     | NR | 83.3   | 92.1 | 1.0                                       | 75   | 1.0  | 5.0   | 121   |
| (+)SMBG78  | NS                     | NS | 86.7   | 106  | 1.0                                       | 78   | 1.0  | 4.3   | 139   |
| (+)SMBG78A   | NT                     | NT | 86.7   | 95.8 | 1.0                                       | 78   | 1.0  | 4.8   | 126   |
| (+)SMBG85  | NU                     | NU | 94.4   | 115  | 1.0                                       | 85   | 1.0  | 4.0   | 151   |
| (+)SMBG85A   | NV                     | NV | 94.4   | 104  | 1.0                                       | 85   | 1.0  | 4.4   | 137   |
| (+)SMBG90  | NW                     | NW | 100  | 122  | 1.0                                       | 90   | 1.0  | 3.8   | 160   |
| (+)SMBG90A   | NX                     | NX | 100  | 111  | 1.0                                       | 90   | 1.0  | 4.1   | 146   |
| (+)SMBG100   | NY                     | NY | 111  | 136  | 1.0                                       | 100  | 1.0  | 3.4   | 179   |
| (+)SMBG100A  | NZ                     | NZ | 111  | 123  | 1.0                                       | 100  | 1.0  | 3.7   | 162   |
| (+)SMBG110   | PD                     | PD | 122  | 149  | 1.0                                       | 110  | 1.0  | 3.1   | 196   |
| (+)SMBG110A  | PE                     | PE | 122  | 135  | 1.0                                       | 110  | 1.0  | 3.4   | 177   |
| (+)SMBG120   | PF                     | PF | 133  | 163  | 1.0                                       | 120  | 1.0  | 2.8   | 214   |
| (+)SMBG120A  | PG                     | PG | 133  | 147  | 1.0                                       | 120  | 1.0  | 3.1   | 193   |
| (+)SMBG130   | PH                     | PH | 144  | 176  | 1.0                                       | 130  | 1.0  | 2.6   | 231   |
| (+)SMBG130A  | PK                     | PK | 144  | 159  | 1.0                                       | 130  | 1.0  | 2.9   | 209   |
| (+)SMBG150   | PL                     | PL | 167  | 204  | 1.0                                       | 150  | 1.0  | 2.2   | 268   |
| (+)SMBG150A  | PM                     | PM | 167  | 185  | 1.0                                       | 150  | 1.0  | 2.5   | 243   |
| (+)SMBG160   | PN                     | PN | 178  | 218  | 1.0                                       | 160  | 1.0  | 2.1   | 287   |
| (+)SMBG160A  | PP                     | PP | 178  | 197  | 1.0                                       | 160  | 1.0  | 2.3   | 259   |
| (+)SMBG170   | PQ                     | PQ | 189  | 231  | 1.0                                       | 170  | 1.0  | 2.0   | 304   |
| (+)SMBG170A  | PR                     | PR | 189  | 209  | 1.0                                       | 170  | 1.0  | 2.2   | 275   |
| SMBG188  | PT                     | PT | 209  | 255  | 1.0                                       | 188  | 1.0  | 1.7   | 344   |
| SMBG188A   | PS                     | PS | 209  | 231  | 1.0                                       | 188  | 1.0  | 2.0   | 328   |

**Notes:**

- (1) Pulse test: t<sub>p</sub> ≤ 50 ms
- (2) Surge current waveform per Fig. 3 and derate per Fig. 2
- (3) For bi-directional types having V<sub>WM</sub> of 10 V and less, the I<sub>D</sub> limit is doubled
- (4) All terms and symbols are consistent with ANSI/IEEE C62.35
- (5) For the bi-directional SMBG/SMBJ5.0CA, the maximum V<sub>BR</sub> is 7.25 V
- (6) V<sub>F</sub> = 3.5 V at I<sub>F</sub> = 50 A (uni-directional only)
- (+) Underwriters laboratory recognition for the classification of protectors (QVGG2) under the UL standard for safety 497B and file number E136766 for both uni-directional and bi-directional devices

| THERMAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted) |                 |       |                    |
|--|-----------------|-------|--------------------|
| PARAMETER  | SYMBOL          | VALUE | UNIT               |
| Typical thermal resistance, junction to ambient <sup>(1)</sup>             | $R_{\theta JA}$ | 100   | $^\circ\text{C/W}$ |
| Typical thermal resistance, junction to lead                               | $R_{\theta JL}$ | 20    | $^\circ\text{C/W}$ |

**Note:**

(1) Mounted on minimum recommended pad layout

| ORDERING INFORMATION (Example) |                 |                        |               |                                    |
|--------------------------------|-----------------|------------------------|---------------|------------------------------------|
| PREFERRED P/N                  | UNIT WEIGHT (g) | PREFERRED PACKAGE CODE | BASE QUANTITY | DELIVERY MODE                      |
| SMBG5.0A-E3/52                 | 0.096           | 52                     | 750           | 7" diameter plastic tape and reel  |
| SMBG5.0A-E3/5B                 | 0.096           | 5B                     | 3200          | 13" diameter plastic tape and reel |
| SMBG5.0AHE3/52 <sup>(1)</sup>  | 0.096           | 52                     | 750           | 7" diameter plastic tape and reel  |
| SMBG5.0AHE3/5B <sup>(1)</sup>  | 0.096           | 5B                     | 3200          | 13" diameter plastic tape and reel |

**Note:**

(1) Automotive grade AEC Q101 qualified

## RATINGS AND CHARACTERISTICS CURVES

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

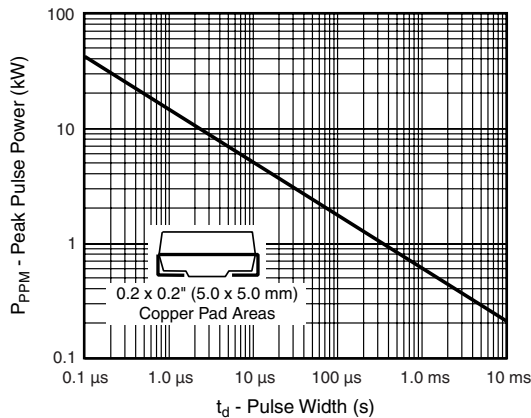


Figure 1. Peak Pulse Power Rating Curve

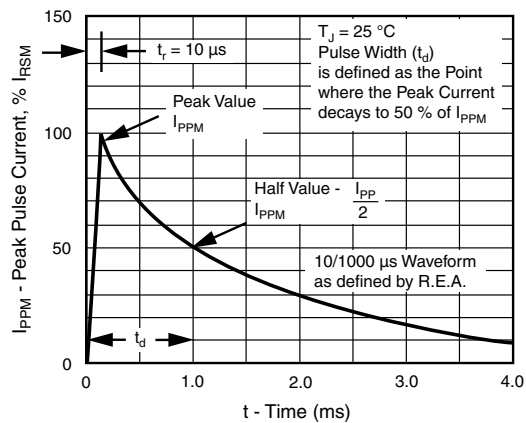


Figure 3. Pulse Waveform

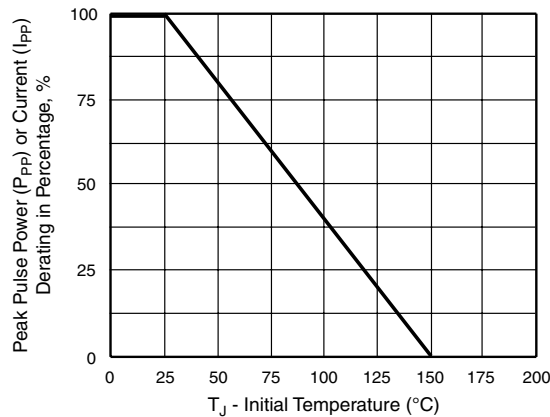


Figure 2. Pulse Power or Current vs. Initial Junction Temperature

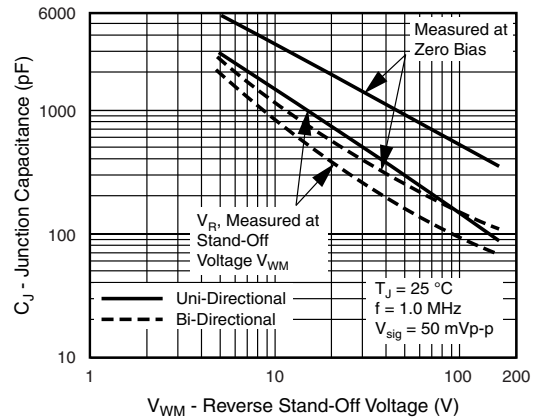


Figure 4. Typical Junction Capacitance

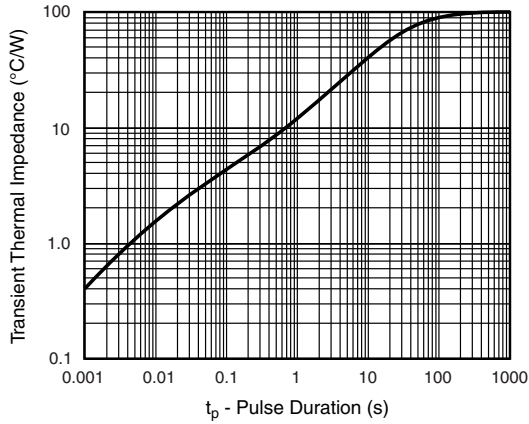


Figure 5. Typical Transient Thermal Impedance

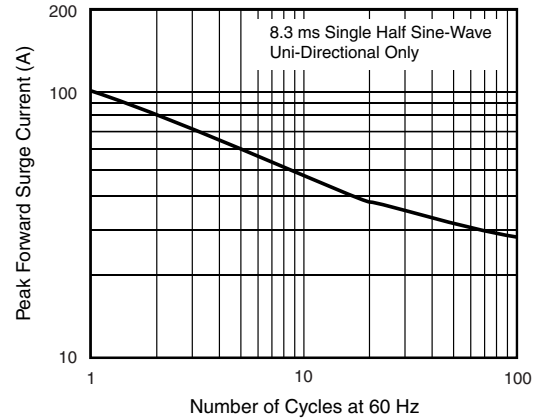
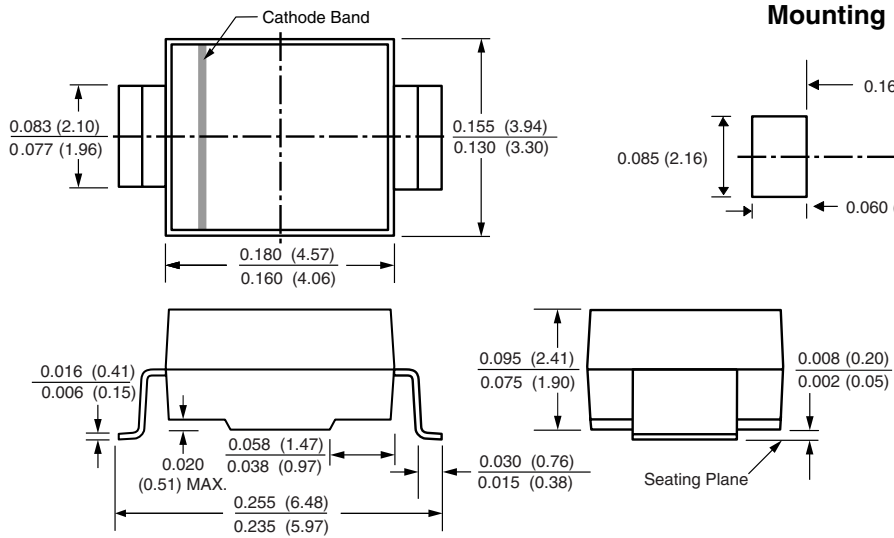


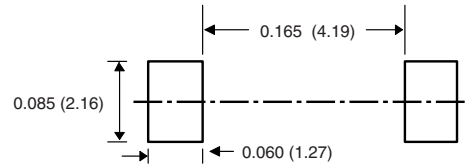
Figure 6. Maximum Non-Replicative Peak Forward Surge Current

## PACKAGE OUTLINE DIMENSIONS in inches (millimeters)

### DO-215AA (SMBG)



### Mounting Pad Layout





## Notice

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