



## Surface Mount TRANSZORB® Transient Voltage Suppressors


**SMBG (DO-215AA)**

**LINKS TO ADDITIONAL RESOURCES**


| PRIMARY CHARACTERISTICS         |                               |
|---------------------------------|-------------------------------|
| $V_{WM}$                        | 5.0 V to 188 V                |
| $V_{BR}$ (unidirectional)       | 6.4 V to 231 V                |
| $V_{BR}$ (bidirectional)        | 6.4 V to 231 V                |
| $P_{PPM}$                       | 600 W                         |
| $I_{FSM}$ (unidirectional only) | 100 A                         |
| $T_J$ max.                      | 150 °C                        |
| Polarity                        | Unidirectional, bidirectional |
| Package                         | SMBG (DO-215AA)               |

**DEVICES FOR BIDIRECTION APPLICATIONS**

For bidirectional devices use 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 unidirectional and bidirectional
- 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-020, LF maximum peak of 260 °C
- AEC-Q101 qualified
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


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

Molding compound meets UL 94 V-0 flammability rating

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

Base P/N-M3 - halogen-free, RoHS compliant, and industrial grade

Base P/NHE3 - RoHS compliant, AEC-Q101 qualified

Base P/NHM3 - halogen-free, RoHS compliant, and AEC-Q101 qualified

**Terminals:** matte tin plated leads, solderable per J-STD-002 and JESD 22-B102

E3, M3, HE3, and HM3 suffix meets JESD 201 class 2 whisker test

**Polarity:** for unidirectional types the band denotes cathode end, no marking on bidirectional 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 unidirectional only <sup>(2)</sup> | $I_{FSM}$      | 100            | A    |
| Operating junction and storage temperature range   | $T_J, T_{STG}$ | -55 to +150    | °C   |

**Notes**

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

<sup>(2)</sup> Mounted on 0.2" x 0.2" (5.0 mm x 5.0 mm) copper pads to each terminal



| 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> <sup>(1)</sup><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) <sup>(3)</sup> | MAXIMUM<br>PEAK PULSE<br>SURGE<br>CURRENT<br>I <sub>PPM</sub> (A) <sup>(2)</sup> | MAXIMUM<br>CLAMPING<br>VOLTAGE AT<br>I <sub>PPM</sub><br>V <sub>C</sub> (V) |
|  | UNI                    | BI | MIN.  | MAX. |   |  |   |  |   |
| (+)SMBG5.0A <sup>(6)</sup>   | KE                     | KE | 6.40  | 7.07 | 10  | 5.0  | 800   | 65.2   | 9.2   |
| (+)SMBG6.0A  | KG                     | KG | 6.67  | 7.37 | 10  | 6.0  | 800   | 58.3   | 10.3  |
| (+)SMBG6.5A  | KK                     | AK | 7.22  | 7.98 | 10  | 6.5  | 500   | 53.6   | 11.2  |
| (+)SMBG7.0A  | KM                     | KM | 7.78  | 8.60 | 10  | 7.0  | 200   | 50.0   | 12.0  |
| (+)SMBG7.5A  | KP                     | AP | 8.33  | 9.21 | 1.0                                       | 7.5  | 100   | 46.5   | 12.9  |
| (+)SMBG8.0A  | KR                     | AR | 8.89  | 9.83 | 1.0                                       | 8.0  | 50  | 44.1   | 13.6  |
| (+)SMBG8.5A  | KT                     | AT | 9.44  | 10.4 | 1.0                                       | 8.5  | 20  | 41.7   | 14.4  |
| (+)SMBG9.0A  | KV                     | AV | 10.0  | 11.1 | 1.0                                       | 9.0  | 10  | 39.0   | 15.4  |
| (+)SMBG10A   | KX                     | AX | 11.1  | 12.3 | 1.0                                       | 10   | 5.0   | 35.3   | 17.0  |
| (+)SMBG11A   | KZ                     | KZ | 12.2  | 13.5 | 1.0                                       | 11   | 5.0   | 33.0   | 18.2  |
| (+)SMBG12A   | LE                     | BE | 13.3  | 14.7 | 1.0                                       | 12   | 5.0   | 30.2   | 19.9  |
| (+)SMBG13A   | LG                     | LG | 14.4  | 15.9 | 1.0                                       | 13   | 1.0   | 27.9   | 21.5  |
| (+)SMBG14A   | LK                     | BK | 15.6  | 17.2 | 1.0                                       | 14   | 1.0   | 25.9   | 23.2  |
| (+)SMBG15A   | LM                     | BM | 16.7  | 18.5 | 1.0                                       | 15   | 1.0   | 24.6   | 24.4  |
| (+)SMBG16A   | LP                     | LM | 17.8  | 19.7 | 1.0                                       | 16   | 1.0   | 23.1   | 26.0  |
| (+)SMBG17A   | LR                     | LR | 18.9  | 20.9 | 1.0                                       | 17   | 1.0   | 21.7   | 27.6  |
| (+)SMBG18A   | LT                     | BT | 20.0  | 22.1 | 1.0                                       | 18   | 1.0   | 20.5   | 29.2  |
| (+)SMBG20A   | LV                     | LV | 22.2  | 24.5 | 1.0                                       | 20   | 1.0   | 18.5   | 32.4  |
| (+)SMBG22A   | LX                     | BX | 24.4  | 26.9 | 1.0                                       | 22   | 1.0   | 16.9   | 35.5  |
| (+)SMBG24A   | LZ                     | BZ | 26.7  | 29.5 | 1.0                                       | 24   | 1.0   | 15.4   | 38.9  |
| (+)SMBG26A   | ME                     | CE | 28.9  | 31.9 | 1.0                                       | 26   | 1.0   | 14.3   | 42.1  |
| (+)SMBG28A   | MG                     | MG | 31.1  | 34.4 | 1.0                                       | 28   | 1.0   | 13.2   | 45.4  |
| (+)SMBG30A   | MK                     | CK | 33.3  | 36.8 | 1.0                                       | 30   | 1.0   | 12.4   | 48.4  |
| (+)SMBG33A   | MM                     | CM | 36.7  | 40.6 | 1.0                                       | 33   | 1.0   | 11.3   | 53.3  |
| (+)SMBG36A   | MP                     | CP | 40.0  | 44.2 | 1.0                                       | 36   | 1.0   | 10.3   | 58.1  |
| (+)SMBG40A   | MR                     | CR | 44.4  | 49.1 | 1.0                                       | 40   | 1.0   | 9.3  | 64.5  |
| (+)SMBG43A   | MT                     | CT | 47.8  | 52.8 | 1.0                                       | 43   | 1.0   | 8.6  | 69.4  |
| (+)SMBG45A   | MV                     | MV | 50.0  | 55.3 | 1.0                                       | 45   | 1.0   | 8.3  | 72.7  |
| (+)SMBG48A   | MX                     | MX | 53.3  | 58.9 | 1.0                                       | 48   | 1.0   | 7.8  | 77.4  |
| (+)SMBG51A   | MZ                     | MZ | 56.7  | 62.7 | 1.0                                       | 51   | 1.0   | 7.3  | 82.4  |
| (+)SMBG54A   | NE                     | NE | 60.0  | 66.3 | 1.0                                       | 54   | 1.0   | 6.9  | 87.1  |
| (+)SMBG58A   | NG                     | NG | 64.4  | 71.2 | 1.0                                       | 58   | 1.0   | 6.4  | 93.6  |
| (+)SMBG60A   | NK                     | NK | 66.7  | 73.7 | 1.0                                       | 60   | 1.0   | 6.2  | 96.8  |
| (+)SMBG64A   | NM                     | NM | 71.1  | 78.6 | 1.0                                       | 64   | 1.0   | 5.8  | 103   |
| (+)SMBG70A   | NP                     | NP | 77.8  | 86.0 | 1.0                                       | 70   | 1.0   | 5.3  | 113   |
| (+)SMBG75A   | NR                     | NR | 83.3  | 92.1 | 1.0                                       | 75   | 1.0   | 5.0  | 121   |
| (+)SMBG78A   | NT                     | NT | 86.7  | 95.8 | 1.0                                       | 78   | 1.0   | 4.8  | 126   |
| (+)SMBG85A   | NV                     | NV | 94.4  | 104  | 1.0                                       | 85   | 1.0   | 4.4  | 137   |
| (+)SMBG90A   | NX                     | NX | 100   | 111  | 1.0                                       | 90   | 1.0   | 4.1  | 146   |
| (+)SMBG100A  | NZ                     | NZ | 111   | 123  | 1.0                                       | 100  | 1.0   | 3.7  | 162   |
| (+)SMBG110A  | PE                     | PE | 122   | 135  | 1.0                                       | 110  | 1.0   | 3.4  | 177   |
| (+)SMBG120A  | PG                     | PG | 133   | 147  | 1.0                                       | 120  | 1.0   | 3.1  | 193   |
| (+)SMBG130A  | PK                     | PK | 144   | 159  | 1.0                                       | 130  | 1.0   | 2.9  | 209   |
| (+)SMBG150A  | PM                     | PM | 167   | 185  | 1.0                                       | 150  | 1.0   | 2.5  | 243   |
| (+)SMBG160A  | PP                     | PP | 178   | 197  | 1.0                                       | 160  | 1.0   | 2.3  | 259   |
| (+)SMBG170A  | PR                     | PR | 189   | 209  | 1.0                                       | 170  | 1.0   | 2.2  | 275   |
| 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 bidirectional 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 bidirectional SMBG5.0CA, 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 (unidirectional only)
- (+) Underwriters laboratory recognition for the classification of protectors (QVGQ2) under the UL standard for safety 497B and file number E136766 for both unidirectional and bidirectional devices

| <b>THERMAL CHARACTERISTICS</b> ( $T_A = 25\text{ }^\circ\text{C}$ 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    |                    |

**Note**

<sup>(1)</sup> Mounted on minimum recommended pad layout

| <b>ORDERING INFORMATION</b> (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-M3/52                        | 0.096           | 52                     | 750           | 7" diameter plastic tape and reel  |
| SMBG5.0A-E3/5B                        | 0.096           | 5B                     | 3200          | 13" diameter plastic tape and reel |
| SMBG5.0A-M3/5B                        | 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  |
| SMBG5.0AHM3/52 <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 |
| SMBG5.0AHM3/5B <sup>(1)</sup>         | 0.096           | 5B                     | 3200          | 13" diameter plastic tape and reel |

**Note**

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

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


Fig. 1 - Peak Pulse Power Rating Curve



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



Fig. 3 - Pulse Waveform



Fig. 5 - Typical Transient Thermal Impedance



Fig. 4 - Typical Junction Capacitance



Fig. 6 - Maximum Non-Repetitive Peak Forward Surge Current



## PACKAGE OUTLINE DIMENSIONS in inches (millimeters)

### SMBG (DO-215AA)



### Mounting Pad Layout





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