



**THE DATASHEET OF  
SMBG16HE3/52**



## Surface Mount TRANSZORB® Transient Voltage Suppressors



DO-215AA (SMBG)

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

### DEVICES FOR BI-DIRECTION APPLICATIONS

For bi-directional 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 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-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)


**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, automotive, and telecommunication.

### MECHANICAL DATA

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

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 JESD 22-B102

E3 suffix meets JESD 201 class 1A whisker test, HE3 suffix meets JESD 201 class 2 whisker test

**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

<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>(5)</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 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/SMBJ5.8CA, 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 (QVGQ2) under the UL standard for safety 497B and file number E136766 for both uni-directional and bi-directional 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   | °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-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**
<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. 3 - Pulse Waveform



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



Fig. 4 - Typical Junction Capacitance



Fig. 5 - Typical Transient Thermal Impedance



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

## PACKAGE OUTLINE DIMENSIONS in inches (millimeters)

### DO-215AA (SMBG)



### Mounting Pad Layout





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