



**THE DATASHEET OF  
SMBJ13-E3/5B**



# Surface-Mount TRANSZORB® Transient Voltage Suppressors


**SMB (DO-214AA)**


## LINKS TO ADDITIONAL RESOURCES



| PRIMARY CHARACTERISTICS         |                               |
|---------------------------------|-------------------------------|
| $V_{BR}$ (bidirectional)        | 6.4 V to 231 V                |
| $V_{BR}$ (unidirectional)       | 6.4 V to 231 V                |
| $V_{WM}$                        | 5.0 V to 188 V                |
| $P_{PPM}$                       | 600 W                         |
| $P_D$                           | 5.0 W                         |
| $I_{FSM}$ (unidirectional only) | 100 A                         |
| $T_J$ max.                      | 150 °C                        |
| Polarity                        | Unidirectional, bidirectional |
| Package                         | SMB (DO-214AA)                |

## DEVICES FOR BIDIRECTION APPLICATIONS

For bidirectional devices use CA suffix (e.g. SMBJ10CA). Electrical characteristics apply in both directions.

## 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.

| MAXIMUM RATINGS ( $T_A = 25\text{ °C}$ 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    |
| Power dissipation on infinite heatsink at $T_A = 50\text{ °C}$                             | $P_D$          | 5.0            | W    |
| 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

- (1) Non-repetitive current pulse, per fig. 3 and derated above  $T_A = 25\text{ °C}$  per fig. 2  
 (2) Mounted on 0.2" x 0.2" (5.0 mm x 5.0 mm) copper pads to each terminal

## 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 available  
 - Automotive ordering code: base P/NHE3 or base P/NHM3
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



## MECHANICAL DATA

**Case:** SMB (DO-214AA)

Molding compound meets UL 94 V-0 flammability rating

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

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

Base P/NHE3\_X - RoHS-compliant and AEC-Q101 qualified

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

("\_X" denotes revision code e.g. A, B, ...)

**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



| ELECTRICAL CHARACTERISTICS (T <sub>A</sub> = 25 °C unless otherwise noted) |                           |    |                                                                                 |      |                                           |                                                |                                                                                           |                                                                                     |                                                                             |                                                                       |
|----------------------------------------------------------------------------|---------------------------|----|---------------------------------------------------------------------------------|------|-------------------------------------------|------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------|
| DEVICE TYPE<br>MODIFIED<br>"J" BEND<br>LEAD                                | DEVICE<br>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<br>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) | MAXIMUM<br>TEMPERATURE<br>COEFFICIENT<br>OF V <sub>BR</sub><br>(%/°C) |
|                                                                            | UNI                       | BI | MIN.                                                                            | MAX. |                                           |                                                |                                                                                           |                                                                                     |                                                                             |                                                                       |
| (+)SMBJ5.0A <sup>(5)</sup>                                                 | KE                        | KE | 6.40                                                                            | 7.07 | 10                                        | 5.0                                            | 800                                                                                       | 65.2                                                                                | 9.2                                                                         | 0.057                                                                 |
| (+)SMBJ6.0A                                                                | KG                        | KG | 6.67                                                                            | 7.37 | 10                                        | 6.0                                            | 800                                                                                       | 58.3                                                                                | 10.3                                                                        | 0.059                                                                 |
| (+)SMBJ6.5A                                                                | KK                        | AK | 7.22                                                                            | 7.98 | 10                                        | 6.5                                            | 500                                                                                       | 53.6                                                                                | 11.2                                                                        | 0.061                                                                 |
| (+)SMBJ7.0A                                                                | KM                        | KM | 7.78                                                                            | 8.60 | 10                                        | 7.0                                            | 200                                                                                       | 50.0                                                                                | 12.0                                                                        | 0.065                                                                 |
| (+)SMBJ7.5A                                                                | KP                        | AP | 8.33                                                                            | 9.21 | 1.0                                       | 7.5                                            | 100                                                                                       | 46.5                                                                                | 12.9                                                                        | 0.067                                                                 |
| (+)SMBJ8.0A                                                                | KR                        | AR | 8.89                                                                            | 9.83 | 1.0                                       | 8.0                                            | 50                                                                                        | 44.1                                                                                | 13.6                                                                        | 0.069                                                                 |
| (+)SMBJ8.5A                                                                | KT                        | AT | 9.44                                                                            | 10.4 | 1.0                                       | 8.5                                            | 20                                                                                        | 41.7                                                                                | 14.4                                                                        | 0.073                                                                 |
| (+)SMBJ9.0A                                                                | KV                        | AV | 10.0                                                                            | 11.1 | 1.0                                       | 9.0                                            | 10                                                                                        | 39.0                                                                                | 15.4                                                                        | 0.074                                                                 |
| (+)SMBJ10A                                                                 | KX                        | AX | 11.1                                                                            | 12.3 | 1.0                                       | 10                                             | 5.0                                                                                       | 35.3                                                                                | 17.0                                                                        | 0.078                                                                 |
| (+)SMBJ11A                                                                 | KZ                        | KZ | 12.2                                                                            | 13.5 | 1.0                                       | 11                                             | 5.0                                                                                       | 33.0                                                                                | 18.2                                                                        | 0.080                                                                 |
| (+)SMBJ12A                                                                 | LE                        | BE | 13.3                                                                            | 14.7 | 1.0                                       | 12                                             | 5.0                                                                                       | 30.2                                                                                | 19.9                                                                        | 0.083                                                                 |
| (+)SMBJ13A                                                                 | LG                        | LG | 14.4                                                                            | 15.9 | 1.0                                       | 13                                             | 1.0                                                                                       | 27.9                                                                                | 21.5                                                                        | 0.084                                                                 |
| (+)SMBJ14A                                                                 | LK                        | BK | 15.6                                                                            | 17.2 | 1.0                                       | 14                                             | 1.0                                                                                       | 25.9                                                                                | 23.2                                                                        | 0.087                                                                 |
| (+)SMBJ15A                                                                 | LM                        | BM | 16.7                                                                            | 18.5 | 1.0                                       | 15                                             | 1.0                                                                                       | 24.6                                                                                | 24.4                                                                        | 0.088                                                                 |
| (+)SMBJ16A                                                                 | LP                        | LM | 17.8                                                                            | 19.7 | 1.0                                       | 16                                             | 1.0                                                                                       | 23.1                                                                                | 26.0                                                                        | 0.089                                                                 |
| (+)SMBJ17A                                                                 | LR                        | LR | 18.9                                                                            | 20.9 | 1.0                                       | 17                                             | 1.0                                                                                       | 21.7                                                                                | 27.6                                                                        | 0.090                                                                 |
| (+)SMBJ18A                                                                 | LT                        | BT | 20.0                                                                            | 22.1 | 1.0                                       | 18                                             | 1.0                                                                                       | 20.5                                                                                | 29.2                                                                        | 0.092                                                                 |
| (+)SMBJ20A                                                                 | LV                        | LV | 22.2                                                                            | 24.5 | 1.0                                       | 20                                             | 1.0                                                                                       | 18.5                                                                                | 32.4                                                                        | 0.094                                                                 |
| (+)SMBJ22A                                                                 | LX                        | BX | 24.4                                                                            | 26.9 | 1.0                                       | 22                                             | 1.0                                                                                       | 16.9                                                                                | 35.5                                                                        | 0.096                                                                 |
| (+)SMBJ24A                                                                 | LZ                        | BZ | 26.7                                                                            | 29.5 | 1.0                                       | 24                                             | 1.0                                                                                       | 15.4                                                                                | 38.9                                                                        | 0.096                                                                 |
| (+)SMBJ26A                                                                 | ME                        | CE | 28.9                                                                            | 31.9 | 1.0                                       | 26                                             | 1.0                                                                                       | 14.3                                                                                | 42.1                                                                        | 0.097                                                                 |
| (+)SMBJ28A                                                                 | MG                        | MG | 31.1                                                                            | 34.4 | 1.0                                       | 28                                             | 1.0                                                                                       | 13.2                                                                                | 45.4                                                                        | 0.098                                                                 |
| (+)SMBJ30A                                                                 | MK                        | CK | 33.3                                                                            | 36.8 | 1.0                                       | 30                                             | 1.0                                                                                       | 12.4                                                                                | 48.4                                                                        | 0.099                                                                 |
| (+)SMBJ33A                                                                 | MM                        | CM | 36.7                                                                            | 40.6 | 1.0                                       | 33                                             | 1.0                                                                                       | 11.3                                                                                | 53.3                                                                        | 0.100                                                                 |
| (+)SMBJ36A                                                                 | MP                        | CP | 40.0                                                                            | 44.2 | 1.0                                       | 36                                             | 1.0                                                                                       | 10.3                                                                                | 58.1                                                                        | 0.100                                                                 |
| (+)SMBJ40A                                                                 | MR                        | CR | 44.4                                                                            | 49.1 | 1.0                                       | 40                                             | 1.0                                                                                       | 9.3                                                                                 | 64.5                                                                        | 0.101                                                                 |
| (+)SMBJ43A                                                                 | MT                        | CT | 47.8                                                                            | 52.8 | 1.0                                       | 43                                             | 1.0                                                                                       | 8.6                                                                                 | 69.4                                                                        | 0.102                                                                 |
| (+)SMBJ45A                                                                 | MV                        | MV | 50.0                                                                            | 55.3 | 1.0                                       | 45                                             | 1.0                                                                                       | 8.3                                                                                 | 72.7                                                                        | 0.102                                                                 |
| (+)SMBJ48A                                                                 | MX                        | MX | 53.3                                                                            | 58.9 | 1.0                                       | 48                                             | 1.0                                                                                       | 7.8                                                                                 | 77.4                                                                        | 0.103                                                                 |
| (+)SMBJ51A                                                                 | MZ                        | MZ | 56.7                                                                            | 62.7 | 1.0                                       | 51                                             | 1.0                                                                                       | 7.3                                                                                 | 82.4                                                                        | 0.104                                                                 |
| (+)SMBJ54A                                                                 | NE                        | NE | 60.0                                                                            | 66.3 | 1.0                                       | 54                                             | 1.0                                                                                       | 6.9                                                                                 | 87.1                                                                        | 0.104                                                                 |
| (+)SMBJ58A                                                                 | NG                        | NG | 64.4                                                                            | 71.2 | 1.0                                       | 58                                             | 1.0                                                                                       | 6.4                                                                                 | 93.6                                                                        | 0.104                                                                 |
| (+)SMBJ60A                                                                 | NK                        | NK | 66.7                                                                            | 73.7 | 1.0                                       | 60                                             | 1.0                                                                                       | 6.2                                                                                 | 96.8                                                                        | 0.105                                                                 |
| (+)SMBJ64A                                                                 | NM                        | NM | 71.1                                                                            | 78.6 | 1.0                                       | 64                                             | 1.0                                                                                       | 5.8                                                                                 | 103                                                                         | 0.105                                                                 |
| (+)SMBJ70A                                                                 | NP                        | NP | 77.8                                                                            | 86.0 | 1.0                                       | 70                                             | 1.0                                                                                       | 5.3                                                                                 | 113                                                                         | 0.105                                                                 |
| (+)SMBJ75A                                                                 | NR                        | NR | 83.3                                                                            | 92.1 | 1.0                                       | 75                                             | 1.0                                                                                       | 5.0                                                                                 | 121                                                                         | 0.106                                                                 |
| (+)SMBJ78A                                                                 | NT                        | NT | 86.7                                                                            | 95.8 | 1.0                                       | 78                                             | 1.0                                                                                       | 4.8                                                                                 | 126                                                                         | 0.106                                                                 |
| (+)SMBJ85A                                                                 | NV                        | NV | 94.4                                                                            | 104  | 1.0                                       | 85                                             | 1.0                                                                                       | 4.4                                                                                 | 137                                                                         | 0.106                                                                 |
| (+)SMBJ90A                                                                 | NX                        | NX | 100                                                                             | 111  | 1.0                                       | 90                                             | 1.0                                                                                       | 4.1                                                                                 | 146                                                                         | 0.106                                                                 |
| (+)SMBJ100A                                                                | NZ                        | NZ | 111                                                                             | 123  | 1.0                                       | 100                                            | 1.0                                                                                       | 3.7                                                                                 | 162                                                                         | 0.107                                                                 |
| (+)SMBJ110A                                                                | PE                        | PE | 122                                                                             | 135  | 1.0                                       | 110                                            | 1.0                                                                                       | 3.4                                                                                 | 177                                                                         | 0.107                                                                 |
| (+)SMBJ120A                                                                | PG                        | PG | 133                                                                             | 147  | 1.0                                       | 120                                            | 1.0                                                                                       | 3.1                                                                                 | 193                                                                         | 0.108                                                                 |
| (+)SMBJ130A                                                                | PK                        | PK | 144                                                                             | 159  | 1.0                                       | 130                                            | 1.0                                                                                       | 2.9                                                                                 | 209                                                                         | 0.108                                                                 |
| (+)SMBJ150A                                                                | PM                        | PM | 167                                                                             | 185  | 1.0                                       | 150                                            | 1.0                                                                                       | 2.5                                                                                 | 243                                                                         | 0.108                                                                 |
| (+)SMBJ160A                                                                | PP                        | PP | 178                                                                             | 197  | 1.0                                       | 160                                            | 1.0                                                                                       | 2.3                                                                                 | 259                                                                         | 0.108                                                                 |
| (+)SMBJ170A                                                                | PR                        | PR | 189                                                                             | 209  | 1.0                                       | 170                                            | 1.0                                                                                       | 2.2                                                                                 | 275                                                                         | 0.108                                                                 |
| SMBJ188A                                                                   | PS                        | PS | 209                                                                             | 231  | 1.0                                       | 188                                            | 1.0                                                                                       | 2.0                                                                                 | 328                                                                         | 0.108                                                                 |

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 SMBJ5.0CA, the maximum V<sub>BR</sub> is 7.25 V
- (6) V<sub>F</sub> = 3.5 V max. 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 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                      |
| SMBJ5.0A-E3/52                        | 0.106           | 52                     | 750           | 7" diameter plastic tape and reel  |
| SMBJ5.0A-M3/52                        |                 |                        |               |                                    |
| SMBJ5.0A-E3/5B                        | 0.106           | 5B                     | 3200          | 13" diameter plastic tape and reel |
| SMBJ5.0A-M3/5B                        |                 |                        |               |                                    |
| SMBJ5.0AHE3_B/H <sup>(1)</sup>        | 0.106           | H                      | 750           | 7" diameter plastic tape and reel  |
| SMBJ5.0AHM3_B/H <sup>(1)</sup>        |                 |                        |               |                                    |
| SMBJ5.0AHE3_B/I <sup>(1)</sup>        | 0.106           | I                      | 3200          | 13" diameter plastic tape and reel |
| SMBJ5.0AHM3_B/I <sup>(1)</sup>        |                 |                        |               |                                    |

**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. 4 - Typical Junction Capacitance



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



Fig. 5 - Typical Transient Thermal Impedance



Fig. 3 - Pulse Waveform



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



### PACKAGE OUTLINE DIMENSIONS in inches (millimeters)

SMB (DO-214AA)



Mounting Pad Layout





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