



# Surface-Mount TRANSZORB® Transient Voltage Suppressors


**SMA (DO-214AC)**


## LINKS TO ADDITIONAL RESOURCES



| PRIMARY CHARACTERISTICS  |                               |
|--------------------------|-------------------------------|
| $V_{BR}$ uni-directional | 6.40 V to 231 V               |
| $V_{BR}$ bi-directional  | 6.40 V to 231 V               |
| $V_{WM}$                 | 5.0 V to 188 V                |
| $P_{PPM}$                | 400 W, 300 W                  |
| $P_D$                    | 3.3 W                         |
| $I_{FSM}$                | 40 A                          |
| $T_J$ max.               | 150 °C                        |
| Polarity                 | Unidirectional, bidirectional |
| Package                  | SMA (DO-214AC)                |

## DEVICES FOR BIDIRECTION APPLICATIONS

For bidirectional use CA suffix (e.g. SMAJ10CA). 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, automotive, 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 (1)(2) (fig. 1)    | $P_{PPM}$      | 400            | W    |
| Peak pulse current with a waveform (1)  | $I_{PPM}$      | See next table | A    |
| Power dissipation on infinite heatsink at $T_A = 50\text{ °C}$                  | $P_D$          | 3.3            | W    |
| Peak forward surge current 8.3 ms single half sine-wave unidirectional only (2) | $I_{FSM}$      | 40             | A    |
| Operating junction and storage temperature range                                | $T_J, T_{STG}$ | -55 to +150    | °C   |

### Notes

- Non-repetitive current pulse, per fig. 3 and derated above  $T_A = 25\text{ °C}$  per fig. 2. Rating is 300 W above 78 V
- 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
- 400 W peak pulse power capability with a 10/1000  $\mu$ s waveform, repetitive rate (duty cycle): 0.01 % (300 W above 78 V)
- 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 P/NHM3
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



## MECHANICAL DATA

**Case:** SMA (DO-214AC)

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  | DEVICE MARKING CODE |    | BREAKDOWN VOLTAGE V <sub>BR</sub> AT I <sub>T</sub> (1) (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> (μA) (3) | MAXIMUM PEAK PULSE SURGE CURRENT I <sub>PPM</sub> (A) (2) | MAXIMUM CLAMPING VOLTAGE AT I <sub>PPM</sub> V <sub>C</sub> (V) | MAXIMUM TEMPERATURE COEFFICIENT OF V <sub>BR</sub> (%/°C) |
|  | UNI                 | BI | MIN.  | MAX. |                                  |                                       |  |   |   |   |
| (+)SMAJ5.0A (5)  | AE                  | WE | 6.40  | 7.07 | 10                               | 5.0                                   | 800  | 43.5  | 9.2   | 0.057   |
| (+)SMAJ6.0A  | AG                  | WG | 6.67  | 7.37 | 10                               | 6.0                                   | 800  | 38.8  | 10.3  | 0.059   |
| (+)SMAJ6.5A  | AK                  | WK | 7.22  | 7.98 | 10                               | 6.5                                   | 500  | 35.7  | 11.2  | 0.061   |
| (+)SMAJ7.0A  | AM                  | WM | 7.78  | 8.60 | 10                               | 7.0                                   | 200  | 33.3  | 12.0  | 0.065   |
| (+)SMAJ7.5A  | AP                  | WP | 8.33  | 9.21 | 1.0                              | 7.5                                   | 100  | 31.0  | 12.9  | 0.067   |
| (+)SMAJ8.0A  | AR                  | WR | 8.89  | 9.83 | 1.0                              | 8.0                                   | 50   | 29.4  | 13.6  | 0.069   |
| (+)SMAJ8.5A  | AT                  | WT | 9.44  | 10.4 | 1.0                              | 8.5                                   | 10   | 27.8  | 14.4  | 0.073   |
| (+)SMAJ9.0A  | AV                  | WV | 10.0  | 11.1 | 1.0                              | 9.0                                   | 5.0  | 26.0  | 15.4  | 0.074   |
| (+)SMAJ10A   | AX                  | WX | 11.1  | 12.3 | 1.0                              | 10                                    | 1.0  | 23.5  | 17.0  | 0.078   |
| (+)SMAJ11A   | AZ                  | WZ | 12.2  | 13.5 | 1.0                              | 11                                    | 1.0  | 22.0  | 18.2  | 0.080   |
| (+)SMAJ12A   | BE                  | XE | 13.3  | 14.7 | 1.0                              | 12                                    | 1.0  | 20.1  | 19.9  | 0.083   |
| (+)SMAJ13A   | BG                  | XG | 14.4  | 15.9 | 1.0                              | 13                                    | 1.0  | 18.6  | 21.5  | 0.084   |
| (+)SMAJ14A   | BK                  | XK | 15.6  | 17.2 | 1.0                              | 14                                    | 1.0  | 17.2  | 23.2  | 0.087   |
| (+)SMAJ15A   | BM                  | XM | 16.7  | 18.5 | 1.0                              | 15                                    | 1.0  | 16.4  | 24.4  | 0.088   |
| (+)SMAJ16A   | BP                  | XP | 17.8  | 19.7 | 1.0                              | 16                                    | 1.0  | 15.4  | 26.0  | 0.089   |
| (+)SMAJ17A   | BR                  | XR | 18.9  | 20.9 | 1.0                              | 17                                    | 1.0  | 14.5  | 27.6  | 0.090   |
| (+)SMAJ18A   | BT                  | XT | 20.0  | 22.1 | 1.0                              | 18                                    | 1.0  | 13.7  | 29.2  | 0.092   |
| (+)SMAJ20A   | BV                  | XV | 22.2  | 24.5 | 1.0                              | 20                                    | 1.0  | 12.3  | 32.4  | 0.094   |
| (+)SMAJ22A   | BX                  | XX | 24.4  | 26.9 | 1.0                              | 22                                    | 1.0  | 11.3  | 35.5  | 0.096   |
| (+)SMAJ24A   | BZ                  | XZ | 26.7  | 29.5 | 1.0                              | 24                                    | 1.0  | 10.3  | 38.9  | 0.096   |
| (+)SMAJ26A   | CE                  | YE | 28.9  | 31.9 | 1.0                              | 26                                    | 1.0  | 9.5   | 42.1  | 0.097   |
| (+)SMAJ28A   | CG                  | YG | 31.1  | 34.4 | 1.0                              | 28                                    | 1.0  | 8.8   | 45.4  | 0.098   |
| (+)SMAJ30A   | CK                  | YK | 33.3  | 36.8 | 1.0                              | 30                                    | 1.0  | 8.3   | 48.4  | 0.099   |
| (+)SMAJ33A   | CM                  | YM | 36.7  | 40.6 | 1.0                              | 33                                    | 1.0  | 7.5   | 53.3  | 0.100   |
| (+)SMAJ36A   | CP                  | YP | 40.0  | 44.2 | 1.0                              | 36                                    | 1.0  | 6.9   | 58.1  | 0.100   |
| (+)SMAJ40A   | CR                  | YR | 44.4  | 49.1 | 1.0                              | 40                                    | 1.0  | 6.2   | 64.5  | 0.101   |
| (+)SMAJ43A   | CT                  | YT | 47.8  | 52.8 | 1.0                              | 43                                    | 1.0  | 5.8   | 69.4  | 0.102   |
| (+)SMAJ45A   | CV                  | YV | 50.0  | 55.3 | 1.0                              | 45                                    | 1.0  | 5.5   | 72.7  | 0.102   |
| (+)SMAJ48A   | CX                  | YX | 53.3  | 58.9 | 1.0                              | 48                                    | 1.0  | 5.2   | 77.4  | 0.103   |
| (+)SMAJ51A   | CZ                  | YZ | 56.7  | 62.7 | 1.0                              | 51                                    | 1.0  | 4.9   | 82.4  | 0.104   |
| (+)SMAJ54A   | RE                  | ZE | 60.0  | 66.3 | 1.0                              | 54                                    | 1.0  | 4.6   | 87.1  | 0.104   |
| (+)SMAJ58A   | RG                  | ZG | 64.4  | 71.2 | 1.0                              | 58                                    | 1.0  | 4.3   | 93.6  | 0.104   |
| (+)SMAJ60A   | RK                  | ZK | 66.7  | 73.7 | 1.0                              | 60                                    | 1.0  | 4.1   | 96.8  | 0.105   |
| (+)SMAJ64A   | RM                  | ZM | 71.1  | 78.6 | 1.0                              | 64                                    | 1.0  | 3.9   | 103   | 0.105   |
| (+)SMAJ70A   | RP                  | ZP | 77.8  | 86.0 | 1.0                              | 70                                    | 1.0  | 3.5   | 113   | 0.105   |
| (+)SMAJ75A   | RR                  | ZR | 83.3  | 92.1 | 1.0                              | 75                                    | 1.0  | 3.3   | 121   | 0.106   |
| (+)SMAJ78A   | RT                  | ZT | 86.7  | 95.8 | 1.0                              | 78                                    | 1.0  | 3.2   | 126   | 0.106   |
| (+)SMAJ85A   | RV                  | ZV | 94.4  | 104  | 1.0                              | 85                                    | 1.0  | 2.2   | 137   | 0.106   |
| (+)SMAJ90A   | RX                  | ZX | 100   | 111  | 1.0                              | 90                                    | 1.0  | 2.1   | 146   | 0.106   |
| (+)SMAJ100A  | RZ                  | ZZ | 111   | 123  | 1.0                              | 100                                   | 1.0  | 1.9   | 162   | 0.107   |
| (+)SMAJ110A  | SE                  | VE | 122   | 135  | 1.0                              | 110                                   | 1.0  | 1.7   | 177   | 0.107   |
| (+)SMAJ120A  | VG                  | VG | 133   | 147  | 1.0                              | 120                                   | 1.0  | 1.6   | 193   | 0.108   |
| (+)SMAJ130A  | VK                  | VK | 144   | 159  | 1.0                              | 130                                   | 1.0  | 1.4   | 209   | 0.108   |
| (+)SMAJ150A  | VM                  | VM | 167   | 185  | 1.0                              | 150                                   | 1.0  | 1.2   | 243   | 0.108   |
| (+)SMAJ160A  | SP                  | VP | 178   | 197  | 1.0                              | 160                                   | 1.0  | 1.2   | 259   | 0.108   |
| (+)SMAJ170A  | SR                  | VR | 189   | 209  | 1.0                              | 170                                   | 1.0  | 1.09  | 275   | 0.108   |
| (+)SMAJ188A  | SS                  | VS | 209   | 231  | 1.0                              | 188                                   | 1.0  | 0.91  | 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 bi-directional SMAJ5.0CA, the maximum V<sub>BR</sub> is 7.25 V
- (6) V<sub>F</sub> = 3.5 V at I<sub>F</sub> = 25 A (unidirectional only)
- (+) Underwriters Laboratory Recognition for the classification of protectors (QVGG2) under the UL standard for safety 497B and file number E136766 for both unidirectional and bidirectional device



| <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>                            | $R_{\theta JA}$ | 120   | $^\circ\text{C/W}$ |
| Typical thermal resistance, junction to lead  | $R_{\theta JL}$ | 30    | $^\circ\text{C/W}$ |

**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                      |
| SMAJ5.0A-E3/61                        | 0.064           | 61                     | 1800          | 7" diameter plastic tape and reel  |
| SMAJ5.0A-M3/61                        |                 |                        |               |                                    |
| SMAJ5.0A-E3/5A                        | 0.064           | 5A                     | 7500          | 13" diameter plastic tape and reel |
| SMAJ5.0A-M3/5A                        |                 |                        |               |                                    |
| SMAJ5.0AHE3_A/H <sup>(1)</sup>        | 0.064           | H                      | 1800          | 7" diameter plastic tape and reel  |
| SMAJ5.0AHM3_A/H <sup>(1)</sup>        |                 |                        |               |                                    |
| SMAJ5.0AHE3_A/I <sup>(1)</sup>        | 0.064           | I                      | 7500          | 13" diameter plastic tape and reel |
| SMAJ5.0AHM3_A/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 Forward Surge Current Unidirectional Only



## PACKAGE OUTLINE DIMENSIONS in inches (millimeters)

### SMA (DO-214AC)



### Mounting Pad Layout





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