



**THE DATASHEET OF  
SMAJ5.0CHE3/5A**





## Surface Mount TRANSZORB® Transient Voltage Suppressors



DO-214AC (SMA)

| PRIMARY CHARACTERISTICS |                |
|-------------------------|----------------|
| $V_{WM}$                | 5.0 V to 188 V |
| $P_{PPM}$               | 400 W, 300 W   |
| $I_{FSM}$               | 40 A           |
| $T_J \text{ max.}$      | 150 °C         |

### DEVICES FOR BI-DIRECTION APPLICATIONS

For bi-directional use C or CA suffix (e.g. SMAJ10C, SMAJ10CA).

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
- 400 W peak pulse power capability with a 10/1000  $\mu\text{s}$  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
- Solder dip 260 °C, 40 s
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



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-214AC (SMA)

Molding compound meets UL 94 V-0 flammability rating

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

Base P/NHE3 - RoHS compliant, high reliability/automotive grade (AEC Q101 qualified)

**Terminals:** Matte tin plated leads, solderable per J-STD-002 and JESD22-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 ( $T_A = 25\text{ °C}$ unless otherwise noted)                                |                |                |      |
|---|----------------|----------------|------|
| PARAMETER   | SYMBOL         | VALUE          | UNIT |
| Peak pulse power dissipation with a 10/1000 $\mu\text{s}$ waveform <sup>(1)(2)</sup> (Fig. 1) | $P_{PPM}$      | 400            | W    |
| Peak pulse current with a 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>   | $I_{FSM}$      | 40             | 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. Rating is 300 W above 78 V

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

| ELECTRICAL CHARACTERISTICS ( $T_A = 25\text{ }^\circ\text{C}$ unless otherwise noted) |                     |    |  |      |                         |                                |  |   |   |
|---|---------------------|----|--|------|-------------------------|--------------------------------|--|---|---|
| DEVICE TYPE   | DEVICE MARKING CODE |    | BREAKDOWN VOLTAGE $V_{BR}$ AT $I_T$ <sup>(1)</sup> (V) |      | TEST CURRENT $I_T$ (mA) | STAND-OFF VOLTAGE $V_{WM}$ (V) | MAXIMUM REVERSE LEAKAGE AT $V_{WM}$ $I_D$ ( $\mu\text{A}$ ) <sup>(3)</sup> | MAXIMUM PEAK PULSE SURGE CURRENT $I_{PPM}$ (A) <sup>(2)</sup> | MAXIMUM CLAMPING VOLTAGE AT $I_{PPM}$ $V_C$ (V) |
|   | UNI                 | BI | MIN.   | MAX. |                         |                                |  |   |   |
| SMAJ5.0   | AD                  | WD | 6.40   | 7.82 | 10                      | 5.0                            | 800  | 41.7  | 9.6   |
| SMAJ5.0A <sup>(5)</sup>   | AE                  | WE | 6.40   | 7.07 | 10                      | 5.0                            | 800  | 43.5  | 9.2   |
| SMAJ6.0   | AF                  | WF | 6.67   | 8.15 | 10                      | 6.0                            | 800  | 35.1  | 11.4  |
| SMAJ6.0A  | AG                  | WG | 6.67   | 7.37 | 10                      | 6.0                            | 800  | 38.8  | 10.3  |
| SMAJ6.5   | AH                  | WH | 7.22   | 8.82 | 10                      | 6.5                            | 500  | 32.5  | 12.3  |
| SMAJ6.5A  | AK                  | WK | 7.22   | 7.98 | 10                      | 6.5                            | 500  | 35.7  | 11.2  |
| SMAJ7.0   | AL                  | WL | 7.78   | 9.51 | 10                      | 7.0                            | 200  | 30.1  | 13.3  |
| SMAJ7.0A  | AM                  | WM | 7.78   | 8.60 | 10                      | 7.0                            | 200  | 33.3  | 12.0  |
| SMAJ7.5   | AN                  | WN | 8.33   | 10.2 | 1.0                     | 7.5                            | 100  | 28.0  | 14.3  |
| SMAJ7.5A  | AP                  | WP | 8.33   | 9.21 | 1.0                     | 7.5                            | 100  | 31.0  | 12.9  |
| SMAJ8.0   | AQ                  | WQ | 8.89   | 10.9 | 1.0                     | 8.0                            | 50   | 26.7  | 15.0  |
| SMAJ8.0A  | AR                  | WR | 8.89   | 9.83 | 1.0                     | 8.0                            | 50   | 29.4  | 13.6  |
| SMAJ8.5   | AS                  | WS | 9.44   | 11.5 | 1.0                     | 8.5                            | 10   | 25.2  | 15.9  |
| SMAJ8.5A  | AT                  | WT | 9.44   | 10.4 | 1.0                     | 8.5                            | 10   | 27.8  | 14.4  |
| SMAJ9.0   | AU                  | WU | 10.0   | 12.2 | 1.0                     | 9.0                            | 5.0  | 23.7  | 16.9  |
| SMAJ9.0A  | AV                  | WV | 10.0   | 11.1 | 1.0                     | 9.0                            | 5.0  | 26.0  | 15.4  |
| SMAJ10  | AW                  | WW | 11.1   | 13.6 | 1.0                     | 10                             | 1.0  | 21.3  | 18.8  |
| SMAJ10A   | AX                  | WX | 11.1   | 12.3 | 1.0                     | 10                             | 1.0  | 23.5  | 17.0  |
| SMAJ11  | AY                  | WY | 12.2   | 14.9 | 1.0                     | 11                             | 1.0  | 19.9  | 20.1  |
| SMAJ11A   | AZ                  | WZ | 12.2   | 13.5 | 1.0                     | 11                             | 1.0  | 22.0  | 18.2  |
| SMAJ12  | BD                  | XD | 13.3   | 16.3 | 1.0                     | 12                             | 1.0  | 18.2  | 22.0  |
| SMAJ12A   | BE                  | XE | 13.3   | 14.7 | 1.0                     | 12                             | 1.0  | 20.1  | 19.9  |
| SMAJ13  | BF                  | XF | 14.4   | 17.6 | 1.0                     | 13                             | 1.0  | 16.8  | 23.8  |
| SMAJ13A   | BG                  | XG | 14.4   | 15.9 | 1.0                     | 13                             | 1.0  | 18.6  | 21.5  |
| SMAJ14  | BH                  | XH | 15.6   | 19.1 | 1.0                     | 14                             | 1.0  | 15.5  | 25.8  |
| SMAJ14A   | BK                  | XK | 15.6   | 17.2 | 1.0                     | 14                             | 1.0  | 17.2  | 23.2  |
| SMAJ15  | BL                  | XL | 16.7   | 20.4 | 1.0                     | 15                             | 1.0  | 14.9  | 26.9  |
| SMAJ15A   | BM                  | XM | 16.7   | 18.5 | 1.0                     | 15                             | 1.0  | 16.4  | 24.4  |
| SMAJ16  | BN                  | XN | 17.8   | 21.8 | 1.0                     | 16                             | 1.0  | 13.9  | 28.8  |
| SMAJ16A   | BP                  | XP | 17.8   | 19.7 | 1.0                     | 16                             | 1.0  | 15.4  | 26.0  |
| SMAJ17  | BQ                  | XQ | 18.9   | 23.1 | 1.0                     | 17                             | 1.0  | 13.1  | 30.5  |
| SMAJ17A   | BR                  | XR | 18.9   | 20.9 | 1.0                     | 17                             | 1.0  | 14.5  | 27.6  |
| SMAJ18  | BS                  | XS | 20.0   | 24.4 | 1.0                     | 18                             | 1.0  | 12.4  | 32.2  |
| SMAJ18A   | BT                  | XT | 20.0   | 22.1 | 1.0                     | 18                             | 1.0  | 13.7  | 29.2  |
| SMAJ20  | BU                  | XU | 22.2   | 27.1 | 1.0                     | 20                             | 1.0  | 11.2  | 35.8  |
| SMAJ20A   | BV                  | XV | 22.2   | 24.5 | 1.0                     | 20                             | 1.0  | 12.3  | 32.4  |
| SMAJ22  | BW                  | XW | 24.4   | 29.8 | 1.0                     | 22                             | 1.0  | 10.2  | 39.4  |
| SMAJ22A   | BX                  | XX | 24.4   | 26.9 | 1.0                     | 22                             | 1.0  | 11.3  | 35.5  |
| SMAJ24  | BY                  | XY | 26.7   | 32.6 | 1.0                     | 24                             | 1.0  | 9.3   | 43.0  |
| SMAJ24A   | BZ                  | XZ | 26.7   | 29.5 | 1.0                     | 24                             | 1.0  | 10.3  | 38.9  |
| SMAJ26  | CD                  | YD | 28.9   | 35.3 | 1.0                     | 26                             | 1.0  | 8.6   | 46.6  |
| SMAJ26A   | CE                  | YE | 28.9   | 31.9 | 1.0                     | 26                             | 1.0  | 9.5   | 42.1  |
| SMAJ28  | CF                  | YF | 31.1   | 38.0 | 1.0                     | 28                             | 1.0  | 8.0   | 50.0  |
| SMAJ28A   | CG                  | YG | 31.1   | 34.4 | 1.0                     | 28                             | 1.0  | 8.8   | 45.4  |
| SMAJ30  | CH                  | YH | 33.3   | 40.7 | 1.0                     | 30                             | 1.0  | 7.5   | 53.5  |
| SMAJ30A   | CK                  | YK | 33.3   | 36.8 | 1.0                     | 30                             | 1.0  | 8.3   | 48.4  |
| SMAJ33  | CL                  | YL | 36.7   | 44.9 | 1.0                     | 33                             | 1.0  | 6.8   | 59.0  |
| SMAJ33A   | CM                  | YM | 36.7   | 40.6 | 1.0                     | 33                             | 1.0  | 7.5   | 53.3  |
| SMAJ36  | CN                  | YN | 40.0   | 48.9 | 1.0                     | 36                             | 1.0  | 6.2   | 64.3  |
| SMAJ36A   | CP                  | YP | 40.0   | 44.2 | 1.0                     | 36                             | 1.0  | 6.9   | 58.1  |
| SMAJ40  | CQ                  | YQ | 44.4   | 54.3 | 1.0                     | 40                             | 1.0  | 5.6   | 71.4  |



| <b>ELECTRICAL CHARACTERISTICS</b> ( $T_A = 25\text{ }^\circ\text{C}$ unless otherwise noted) |                     |  |  |      |                         |                                |  |   |   |
|--|---------------------|--|--|------|-------------------------|--------------------------------|--|---|---|
| DEVICE TYPE  | DEVICE MARKING CODE |  | BREAKDOWN VOLTAGE $V_{BR}$ AT $I_T$ <sup>(1)</sup> (V) |      | TEST CURRENT $I_T$ (mA) | STAND-OFF VOLTAGE $V_{WM}$ (V) | MAXIMUM REVERSE LEAKAGE AT $V_{WM}$ $I_D$ ( $\mu\text{A}$ ) <sup>(3)</sup> | MAXIMUM PEAK PULSE SURGE CURRENT $I_{PPM}$ (A) <sup>(2)</sup> | MAXIMUM CLAMPING VOLTAGE AT $I_{PPM}$ $V_C$ (V) |
|  | UNI                 | BI   | MIN.   | MAX. |                         |                                |  |   |   |
| SMAJ40A  | CR                  | YR   | 44.4   | 49.1 | 1.0                     | 40                             | 1.0  | 6.2   | 64.5  |
| SMAJ43   | CS                  | YS   | 47.8   | 58.4 | 1.0                     | 43                             | 1.0  | 5.2   | 76.7  |
| SMAJ43A  | CT                  | YT   | 47.8   | 52.8 | 1.0                     | 43                             | 1.0  | 5.8   | 69.4  |
| SMAJ45   | CU                  | YU   | 50.0   | 61.1 | 1.0                     | 45                             | 1.0  | 5.0   | 80.3  |
| SMAJ45A  | CV                  | YV   | 50.0   | 55.3 | 1.0                     | 45                             | 1.0  | 5.5   | 72.7  |
| SMAJ48   | CW                  | YW   | 53.3   | 65.1 | 1.0                     | 48                             | 1.0  | 4.7   | 85.5  |
| SMAJ48A  | CX                  | YX   | 53.3   | 58.9 | 1.0                     | 48                             | 1.0  | 5.2   | 77.4  |
| SMAJ51   | CY                  | YY   | 56.7   | 69.3 | 1.0                     | 51                             | 1.0  | 4.4   | 91.1  |
| SMAJ51A  | CZ                  | YZ   | 56.7   | 62.7 | 1.0                     | 51                             | 1.0  | 4.9   | 82.4  |
| SMAJ54   | RD                  | ZD   | 60.0   | 73.3 | 1.0                     | 54                             | 1.0  | 4.2   | 96.3  |
| SMAJ54A  | RE                  | ZE   | 60.0   | 66.3 | 1.0                     | 54                             | 1.0  | 4.6   | 87.1  |
| SMAJ58   | RF                  | ZF   | 64.4   | 78.7 | 1.0                     | 58                             | 1.0  | 3.9   | 103   |
| SMAJ58A  | RG                  | ZG   | 64.4   | 71.2 | 1.0                     | 58                             | 1.0  | 4.3   | 93.6  |
| SMAJ60   | RH                  | ZH   | 66.7   | 81.5 | 1.0                     | 60                             | 1.0  | 3.7   | 107   |
| SMAJ60A  | RK                  | ZK   | 66.7   | 73.7 | 1.0                     | 60                             | 1.0  | 4.1   | 96.8  |
| SMAJ64   | RL                  | ZL   | 71.1   | 86.9 | 1.0                     | 64                             | 1.0  | 3.5   | 114   |
| SMAJ64A  | RM                  | ZM   | 71.1   | 78.6 | 1.0                     | 64                             | 1.0  | 3.9   | 103   |
| SMAJ70   | RN                  | ZN   | 77.8   | 95.1 | 1.0                     | 70                             | 1.0  | 3.2   | 125   |
| SMAJ70A  | RP                  | ZP   | 77.8   | 86.0 | 1.0                     | 70                             | 1.0  | 3.5   | 113   |
| SMAJ75   | RQ                  | ZQ   | 83.3   | 102  | 1.0                     | 75                             | 1.0  | 3.0   | 134   |
| SMAJ75A  | RR                  | ZR   | 83.3   | 92.1 | 1.0                     | 75                             | 1.0  | 3.3   | 121   |
| SMAJ78   | RS                  | ZS   | 86.7   | 106  | 1.0                     | 78                             | 1.0  | 2.9   | 139   |
| SMAJ78A  | RT                  | ZT   | 86.7   | 95.8 | 1.0                     | 78                             | 1.0  | 3.2   | 126   |
| SMAJ85   | RU                  | ZU   | 94.4   | 115  | 1.0                     | 85                             | 1.0  | 2.0   | 151   |
| SMAJ85A  | RV                  | ZV   | 94.4   | 104  | 1.0                     | 85                             | 1.0  | 2.2   | 137   |
| SMAJ90   | RW                  | ZW   | 100  | 122  | 1.0                     | 90                             | 1.0  | 1.9   | 160   |
| SMAJ90A  | RX                  | ZX   | 100  | 111  | 1.0                     | 90                             | 1.0  | 2.1   | 146   |
| SMAJ100  | RY                  | ZY   | 111  | 136  | 1.0                     | 100                            | 1.0  | 1.7   | 179   |
| SMAJ100A   | RZ                  | <td>111</td> <td>123</td> <td>1.0</td> <td>100</td> <td>1.0</td> <td>1.9</td> <td>162</td> | 111  | 123  | 1.0                     | 100                            | 1.0  | 1.9   | 162   |
| SMAJ110  | VD                  | VD   | 122  | 149  | 1.0                     | 110                            | 1.0  | 1.5   | 196   |
| SMAJ110A   | SE                  | VE   | 122  | 135  | 1.0                     | 110                            | 1.0  | 1.7   | 177   |
| SMAJ120  | SF                  | VF   | 133  | 163  | 1.0                     | 120                            | 1.0  | 1.4   | 214   |
| SMAJ120A   | VG                  | VG   | 133  | 147  | 1.0                     | 120                            | 1.0  | 1.6   | 193   |
| SMAJ130  | SH                  | VH   | 144  | 176  | 1.0                     | 130                            | 1.0  | 1.3   | 231   |
| SMAJ130A   | VK                  | VK   | 144  | 159  | 1.0                     | 130                            | 1.0  | 1.4   | 209   |
| SMAJ150  | SL                  | VL   | 167  | 204  | 1.0                     | 150                            | 1.0  | 1.1   | 268   |
| SMAJ150A   | VM                  | VM   | 167  | 185  | 1.0                     | 150                            | 1.0  | 1.2   | 243   |
| SMAJ160  | SN                  | VN   | 178  | 218  | 1.0                     | 160                            | 1.0  | 1.0   | 287   |
| SMAJ160A   | SP                  | VP   | 178  | 197  | 1.0                     | 160                            | 1.0  | 1.2   | 259   |
| SMAJ170  | SQ                  | VQ   | 189  | 231  | 1.0                     | 170                            | 1.0  | 0.99  | 304   |
| SMAJ170A   | SR                  | VR   | 189  | 209  | 1.0                     | 170                            | 1.0  | 1.09  | 275   |
| SMAJ188  | ST                  | VT   | 209  | 255  | 1.0                     | 188                            | 1.0  | 0.90  | 344   |
| SMAJ188A   | SS                  | VS   | 209  | 231  | 1.0                     | 188                            | 1.0  | 0.91  | 328   |

**Notes:**

- (1) Pulse test:  $t_p \leq 50\text{ ms}$
- (2) Surge current waveform per Fig. 3 and derate per Fig. 2
- (3) For bi-directional types having  $V_{WM}$  of 10 V and less, the  $I_D$  limit is doubled
- (4) All terms and symbols are consistent with ANSI/IEEE C62.35
- (5) For the bi-directional SMAJ5.0CA, the maximum  $V_{BR}$  is 7.25 V
- (6)  $V_F = 3.5\text{ V}$  at  $I_F = 25\text{ A}$  (uni-directional only)

### THERMAL CHARACTERISTICS ( $T_A = 25\text{ }^\circ\text{C}$ 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:**

(1) Mounted on minimum recommended pad layout

### ORDERING INFORMATION (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-E3/5A                | 0.064           | 5A                     | 7500          | 13" diameter plastic tape and reel |
| SMAJ5.0AHE3/61 <sup>(1)</sup> | 0.064           | 61                     | 1800          | 7" diameter plastic tape and reel  |
| SMAJ5.0AHE3/5A <sup>(1)</sup> | 0.064           | 5A                     | 7500          | 13" diameter plastic tape and reel |

**Note:**

(1) Automotive grade AEC Q101 qualified

### RATINGS AND CHARACTERISTICS CURVES

( $T_A = 25\text{ }^\circ\text{C}$  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-Repetitive Forward Surge Current Uni-Directional Only

## PACKAGE OUTLINE DIMENSIONS in inches (millimeters)

### DO-214AC (SMA)



### Mounting Pad Layout





## Disclaimer

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