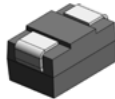


# SMAJE

## 400 W Transient voltage suppressor



### Product features

- Low profile SMA package
- Excellent clamping capability
- 400 W peak pulse power capability at 10/1000  $\mu$ s waveform
- Typical  $I_R$  less than 1  $\mu$ A above 10 V
- Fast response time: typically less than 1.0 ps from 0 V to  $V_{BR}$  minimum
- High temperature reflow soldering: +260 °C /40 s at terminal
- Plastic package meets UL 94 V-0 flammability rating
- Meets moisture sensitivity level (MSL) level 1
- Terminal: Solder plated leads, solderable per J-STD-002
- For surface mounted applications in order to optimize board space
- UL 497B recognized.  
File No. : E198449 Guide QVGQ2

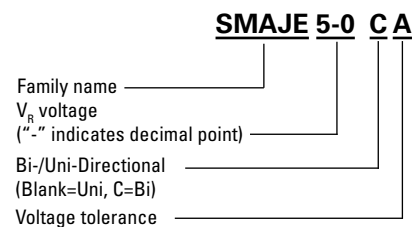
### Applications

- Consumer electronics
- Telecommunications
- Computing and servers
- Appliances
- Industrial automation
- Mobile and wearables

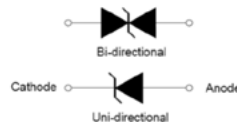
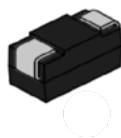
### Environmental compliance and general specifications



### Ordering part number



### PIN configuration



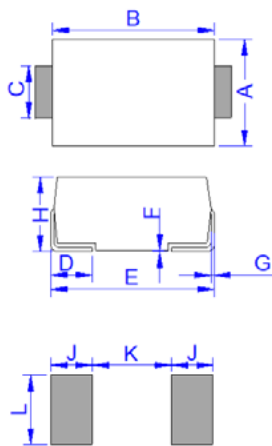
### Absolute maximum ratings

(+25 °C, RH=45%-75%, unless otherwise noted)

| Parameter   | Symbol          | Value       | Unit |
|---|-----------------|-------------|------|
| Storage operating junction temperature range                          | $T_{STG}/T_J$   | -55 to +150 | °C   |
| Steady state power dissipation at $T_L = +75$ °C                      | $P_{M(AV)}$     | 3.3         | W    |
| Peak pulse power dissipation on 10/1000 $\mu$ s waveform              | $P_{PP}$        | 400         | W    |
| Maximum instantaneous forward voltage at 100 A for unidirectional     | $V_F$           | 5.0         | V    |
| Peak forward surge current, 8.3 ms single half sine wave <sup>1</sup> | $I_{FSM}$       | 60          | A    |
| Typical thermal resistance junction to lead                           | $R_{\theta JL}$ | 30          | °C/W |
| Typical thermal resistance junction to ambient                        | $R_{\theta JA}$ | 120         | °C/W |

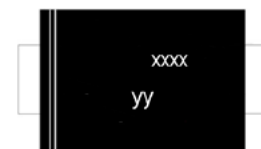
1. Measured on 8.3 ms single half sine wave or equivalent square wave for unidirectional device only, duty cycle = 4 per minute maximum

### Mechanical parameters, pad layout- mm



| Dimension | Millimeters |         | Inches  |         |
|-----------|-------------|---------|---------|---------|
|           | Minimum     | Maximum | Minimum | Maximum |
| A         | 2.60        | 3.00    | 0.102   | 0.118   |
| B         | 4.15        | 4.65    | 0.163   | 0.183   |
| C         | 1.25        | 1.65    | 0.049   | 0.065   |
| D         | 0.95        | 1.52    | 0.037   | 0.060   |
| E         | 4.90        | 5.30    | 0.193   | 0.209   |
| F         | 0.051       | 0.203   | 0.002   | 0.008   |
| G         | 0.15        | 0.31    | 0.006   | 0.012   |
| H         | 2.00        | 2.44    | 0.079   | 0.096   |
| J         | 2.00        |         | 0.079   |         |
| K         |             | 2.30    |         | 0.091   |
| L         | 1.80        |         | 0.071   |         |

### Part marking



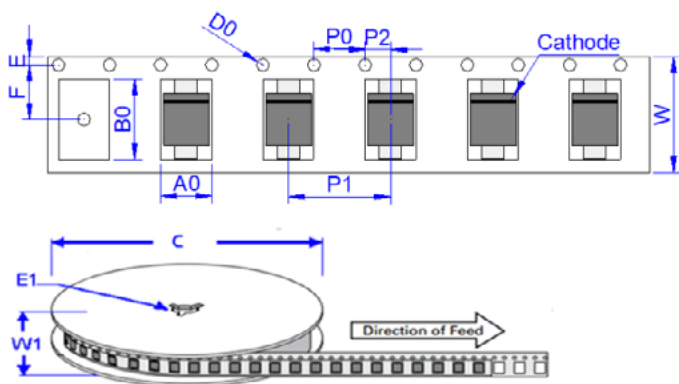
Cathode band (Uni-polar only)

Part marking: xxxx = Date code  
yy- Refer to marking designator listed in Electrical Characteristics table

### Packaging information (mm)

Drawing not to scale.

Supplied in tape and reel packaging, 5,000 parts per 13" diameter reel (EIA-481 compliant)



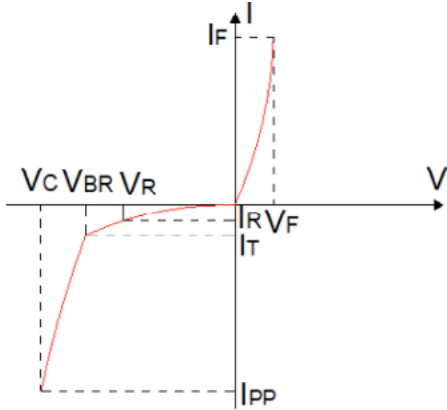
| Dimension | Millimeters | Inches        |
|-----------|-------------|---------------|
| A0        | 2.79 ± 0.3  | 0.110 ± 0.012 |
| B0        | 5.33 ± 0.3  | 0.210 ± 0.012 |
| C         | 330.0       | 13.0          |
| D0        | 1.55 ± 0.1  | 0.061 ± 0.004 |
| E         | 1.75 ± 0.2  | 0.069 ± 0.008 |
| E1        | 13.3 ± 0.3  | 0.524 ± 0.012 |
| F         | 5.50 ± 0.2  | 0.217 ± 0.008 |
| P0        | 4.00 ± 0.2  | 0.157 ± 0.008 |
| P1        | 4.00 ± 0.2  | 0.157 ± 0.008 |
| P2        | 2.00 ± 0.2  | 0.079 ± 0.008 |
| W         | 12.0 ± 0.2  | 0.472 ± 0.008 |
| W1        | 15.7 ± 2.0  | 0.618 ± 0.079 |

Electrical characteristics (+25 °C)

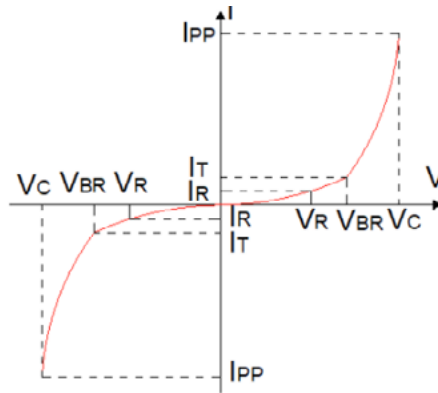
| Part number | Marking    |          | $V_R$<br>(V) | $I_R @ V_R$<br>( $\mu$ A) | $V_{BR} @ I_T$<br>min (V) | max (V) | $I_T$<br>(mA) | $V_C @ I_{PP}$<br>max (V) | $I_{PP}$<br>(A) |      |
|-------------|------------|----------|--------------|---------------------------|---------------------------|---------|---------------|---------------------------|-----------------|------|
|             | Uni-polar  | Bi-polar |              |                           |                           |         |               |                           |                 | Uni  |
| SMAJE5-0A   | SMAJE5-0CA | HE       | TE           | 5                         | 120                       | 6.4     | 7             | 10                        | 9.2             | 43.5 |
| SMAJE6-0A   | SMAJE6-0CA | HG       | TG           | 6                         | 120                       | 6.67    | 7.37          | 10                        | 10.3            | 38.8 |
| SMAJE6-5A   | SMAJE6-5CA | HK       | TK           | 6.5                       | 80                        | 7.22    | 7.98          | 10                        | 11.2            | 35.7 |
| SMAJE7-0A   | SMAJE7-0CA | HM       | TM           | 7                         | 50                        | 7.78    | 8.6           | 10                        | 12              | 33.3 |
| SMAJE7-5A   | SMAJE7-5CA | HP       | TP           | 7.5                       | 50                        | 8.33    | 9.21          | 1                         | 12.9            | 31   |
| SMAJE8-0A   | SMAJE8-0CA | HR       | TR           | 8                         | 20                        | 8.89    | 9.83          | 1                         | 13.6            | 29.4 |
| SMAJE8-5A   | SMAJE8-5CA | HT       | TT           | 8.5                       | 10                        | 9.44    | 10.4          | 1                         | 14.4            | 27.8 |
| SMAJE9-0A   | SMAJE9-0CA | HV       | TV           | 9                         | 5                         | 10      | 11.1          | 1                         | 15.4            | 26   |
| SMAJE10A    | SMAJE10CA  | HX       | TX           | 10                        | 2                         | 11.1    | 12.3          | 1                         | 17              | 23.5 |
| SMAJE11A    | SMAJE11CA  | HZ       | TZ           | 11                        | 1                         | 12.2    | 13.5          | 1                         | 18.2            | 22   |
| SMAJE12A    | SMAJE12CA  | IE       | UE           | 12                        | 1                         | 13.3    | 14.7          | 1                         | 19.9            | 20.1 |
| SMAJE13A    | SMAJE13CA  | IG       | UG           | 13                        | 1                         | 14.4    | 15.9          | 1                         | 21.5            | 18.6 |
| SMAJE14A    | SMAJE14CA  | IK       | UK           | 14                        | 1                         | 15.6    | 17.2          | 1                         | 23.2            | 17.3 |
| SMAJE15A    | SMAJE15CA  | IM       | UM           | 15                        | 1                         | 16.7    | 18.5          | 1                         | 24.4            | 16.4 |
| SMAJE16A    | SMAJE16CA  | IP       | UP           | 16                        | 1                         | 17.8    | 19.7          | 1                         | 26              | 15.4 |
| SMAJE17A    | SMAJE17CA  | IR       | UR           | 17                        | 1                         | 18.9    | 20.9          | 1                         | 27.6            | 14.5 |
| SMAJE18A    | SMAJE18CA  | IT       | UT           | 18                        | 1                         | 20      | 22.1          | 1                         | 29.2            | 13.7 |
| SMAJE20A    | SMAJE20CA  | IV       | UV           | 20                        | 1                         | 22.2    | 24.5          | 1                         | 32.4            | 12.4 |
| SMAJE22A    | SMAJE22CA  | IX       | UX           | 22                        | 1                         | 24.4    | 26.9          | 1                         | 35.5            | 11.3 |
| SMAJE24A    | SMAJE24CA  | IZ       | UZ           | 24                        | 1                         | 26.7    | 29.5          | 1                         | 38.9            | 10.3 |
| SMAJE26A    | SMAJE26CA  | JE       | VE           | 26                        | 1                         | 28.9    | 31.9          | 1                         | 42.1            | 9.5  |
| SMAJE28A    | SMAJE28CA  | JG       | VG           | 28                        | 1                         | 31.1    | 34.4          | 1                         | 45.4            | 8.8  |
| SMAJE30A    | SMAJE30CA  | JK       | VK           | 30                        | 1                         | 33.3    | 36.8          | 1                         | 48.4            | 8.3  |
| SMAJE33A    | SMAJE33CA  | JM       | VM           | 33                        | 1                         | 36.7    | 40.6          | 1                         | 53.3            | 7.5  |
| SMAJE36A    | SMAJE36CA  | JP       | VP           | 36                        | 1                         | 40      | 44.2          | 1                         | 58.1            | 6.9  |
| SMAJE40A    | SMAJE40CA  | JR       | VR           | 40                        | 1                         | 44.4    | 49.1          | 1                         | 64.5            | 6.2  |
| SMAJE43A    | SMAJE43CA  | JT       | VT           | 43                        | 1                         | 47.8    | 52.8          | 1                         | 69.4            | 5.8  |
| SMAJE45A    | SMAJE45CA  | JV       | VV           | 45                        | 1                         | 50      | 55.3          | 1                         | 72.7            | 5.5  |
| SMAJE48A    | SMAJE48CA  | JX       | VX           | 48                        | 1                         | 53.3    | 58.9          | 1                         | 77.4            | 5.2  |
| SMAJE51A    | SMAJE51CA  | JZ       | VZ           | 51                        | 1                         | 56.7    | 62.7          | 1                         | 82.4            | 4.9  |
| SMAJE54A    | SMAJE54CA  | RE       | WE           | 54                        | 1                         | 60      | 66.3          | 1                         | 87.1            | 4.6  |
| SMAJE58A    | SMAJE58CA  | RG       | WG           | 58                        | 1                         | 64.4    | 71.2          | 1                         | 93.6            | 4.3  |
| SMAJE60A    | SMAJE60CA  | RK       | WK           | 60                        | 1                         | 66.7    | 73.7          | 1                         | 96.8            | 4.1  |
| SMAJE64A    | SMAJE64CA  | RM       | WM           | 64                        | 1                         | 71.1    | 78.6          | 1                         | 103             | 3.9  |
| SMAJE70A    | SMAJE70CA  | RP       | WP           | 70                        | 1                         | 77.8    | 86            | 1                         | 113             | 3.6  |
| SMAJE75A    | SMAJE75CA  | RR       | WR           | 75                        | 1                         | 83.3    | 92.1          | 1                         | 121             | 3.3  |
| SMAJE78A    | SMAJE78CA  | RT       | WT           | 78                        | 1                         | 86.7    | 95.8          | 1                         | 126             | 3.2  |
| SMAJE85A    | SMAJE85CA  | RV       | VV           | 85                        | 1                         | 94.4    | 104           | 1                         | 137             | 2.9  |
| SMAJE90A    | SMAJE90CA  | RX       | WX           | 90                        | 1                         | 100     | 111           | 1                         | 146             | 2.8  |
| SMAJE100A   | SMAJE100CA | RZ       | WZ           | 100                       | 1                         | 111     | 123           | 1                         | 162             | 2.5  |
| SMAJE110A   | SMAJE110CA | SE       | XE           | 110                       | 1                         | 122     | 135           | 1                         | 177             | 2.3  |
| SMAJE120A   | SMAJE120CA | SG       | XG           | 120                       | 1                         | 133     | 147           | 1                         | 193             | 2.1  |
| SMAJE130A   | SMAJE130CA | SK       | XK           | 130                       | 1                         | 144     | 159           | 1                         | 209             | 1.9  |
| SMAJE150A   | SMAJE150CA | SM       | XM           | 150                       | 1                         | 167     | 185           | 1                         | 243             | 1.7  |
| SMAJE160A   | SMAJE160CA | SP       | XP           | 160                       | 1                         | 178     | 197           | 1                         | 259             | 1.6  |
| SMAJE170A   | SMAJE170CA | SR       | XR           | 170                       | 1                         | 189     | 209           | 1                         | 275             | 1.5  |
| SMAJE180A   | SMAJE180CA | ST       | XT           | 180                       | 1                         | 201     | 222           | 1                         | 292             | 1.4  |
| SMAJE200A   | SMAJE200CA | SX       | XX           | 200                       | 1                         | 224     | 247           | 1                         | 324             | 1.3  |
| SMAJE220A   | SMAJE220CA | ZE       | YE           | 220                       | 1                         | 246     | 272           | 1                         | 356             | 1.1  |
| SMAJE250A   | SMAJE250CA | ZG       | YG           | 250                       | 1                         | 279     | 309           | 1                         | 405             | 1    |
| SMAJE300A   | SMAJE300CA | ZK       | YK           | 300                       | 1                         | 335     | 371           | 1                         | 486             | 0.8  |
| SMAJE350A   | SMAJE350CA | ZM       | YM           | 350                       | 1                         | 391     | 432           | 1                         | 567             | 0.7  |
| SMAJE400A   | SMAJE400CA | ZP       | YP           | 400                       | 1                         | 447     | 494           | 1                         | 648             | 0.6  |
| SMAJE440A   | SMAJE440CA | ZR       | YR           | 440                       | 1                         | 492     | 543           | 1                         | 713             | 0.6  |

**Ratings and V-I characteristic curves** (+25 °C unless otherwise noted)

**V- I curve characteristics (Uni-directional)**



**V- I curve characteristics (Bi-directional)**



Surge waveform: 10/1000  $\mu$ s

$V_R$ : Stand-off voltage – Maximum voltage that can be applied

$V_{BR}$ : Breakdown voltage

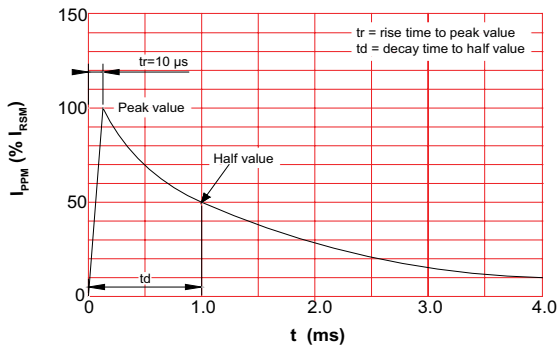
$V_C$ : Clamping voltage – Peak voltage measured across the suppressor at a specified  $I_{PP}$

$I_R$ : Reverse leakage current

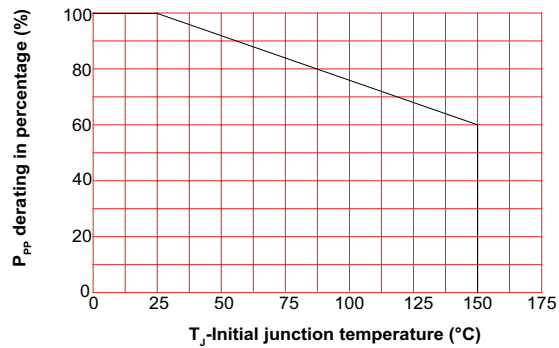
$I_T$ : Test current

$V_F$ : Forward voltage drop for Uni-directional TVS diode

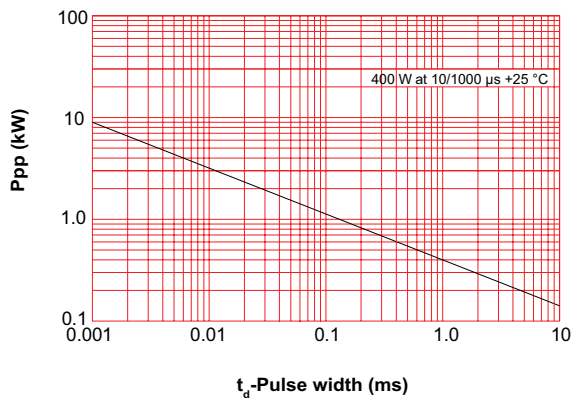
**Pulse waveform**



**Pulse derating curve**



**Peak pulse power dissipation vs. pulse width**



Solder reflow profile

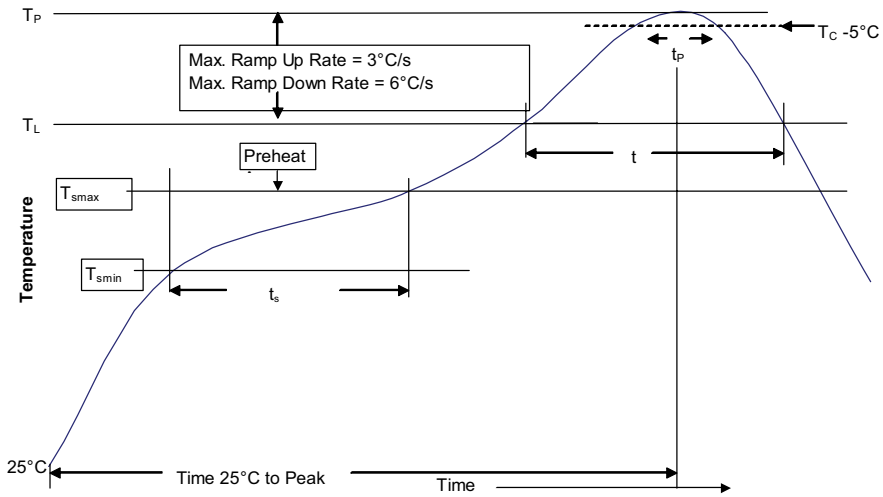


Table 1 - Standard SnPb solder ( $T_C$ )

| Package thickness | Volume $\text{mm}^3$ <350 | Volume $\text{mm}^3$ $\geq$ 350 |
|-------------------|---------------------------|---------------------------------|
| <2.5 mm           | 235 °C                    | 220 °C                          |
| $\geq$ 2.5 mm     | 220 °C                    | 220 °C                          |

Table 2 - Lead (Pb) free solder ( $T_C$ )

| Package thickness | Volume $\text{mm}^3$ <350 | Volume $\text{mm}^3$ 350 - 2000 | Volume $\text{mm}^3$ >2000 |
|-------------------|---------------------------|---------------------------------|----------------------------|
| <1.6 mm           | 260 °C                    | 260 °C                          | 260 °C                     |
| 1.6 – 2.5 mm      | 260 °C                    | 250 °C                          | 245 °C                     |
| >2.5 mm           | 250 °C                    | 245 °C                          | 245 °C                     |

Reference J-STD-020

| Profile feature   | Standard SnPb solder   | Lead (Pb) free solder  |
|---|--|--|
| Preheat and soak  | <ul style="list-style-type: none"> <li>Temperature min. (<math>T_{smin}</math>)</li> <li>Temperature max. (<math>T_{smax}</math>)</li> <li>Time (<math>T_{smin}</math> to <math>T_{smax}</math>) (<math>t_s</math>)</li> </ul> | <ul style="list-style-type: none"> <li>100 °C</li> <li>150 °C</li> <li>60-120 seconds</li> </ul> |
| Ramp up rate $T_L$ to $T_p$   | 3 °C/ second max.  | 3 °C/ second max.  |
| Liquidous temperature ( $T_L$ )<br>Time ( $t_L$ ) maintained above $T_L$          | <ul style="list-style-type: none"> <li>183 °C</li> <li>60-150 seconds</li> </ul>   | <ul style="list-style-type: none"> <li>217 °C</li> <li>60-150 seconds</li> </ul>                 |
| Peak package body temperature ( $T_p$ )*  | Table 1  | Table 2  |
| Time ( $t_p$ )* within 5 °C of the specified classification temperature ( $T_C$ ) | 20 seconds*  | 40 seconds*  |
| Ramp-down rate ( $T_p$ to $T_L$ )   | 6 °C/ second max.  | 6 °C/ second max.  |
| Time 25 °C to peak temperature  | 6 minutes max.   | 8 minutes max.   |

\* Tolerance for peak profile temperature ( $T_p$ ) is defined as a supplier minimum and a user maximum.

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Printed in USA  
Publication No. 11213 BU-MC20191  
November 2020

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