

# SMBJE

## 600 W Transient voltage suppressor



### Product features

- Low profile SMB package
- Excellent clamping capability
- 600 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 QVGO2

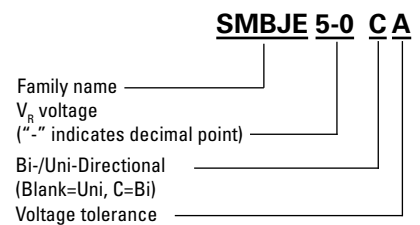
### Applications

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

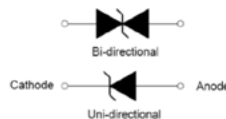
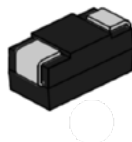
### Environmental compliance and general specifications



### Ordering part number



### PIN configuration



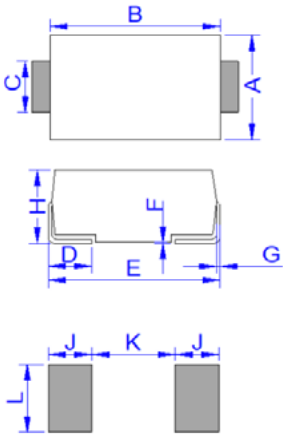
**Absolute maximum ratings**

(+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                      | $P_{M(AV)}$     | 5.0         | W    |
| Peak pulse power dissipation on 10/1000 $\mu$ s waveform              | $P_{PP}$        | 600         | 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> | $I_{FSM}$       | 100         | A    |
| Typical thermal resistance junction to lead                           | $R_{\theta JL}$ | 20          | °C/W |
| Typical thermal resistance junction to ambient                        | $R_{\theta JA}$ | 100         | °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         | 3.30        | 3.94    | 0.130   | 0.155   |
| B         | 4.30        | 4.80    | 0.169   | 0.189   |
| C         | 1.90        | 2.20    | 0.075   | 0.087   |
| D         | 0.95        | 1.52    | 0.037   | 0.060   |
| E         | 5.20        | 5.60    | 0.205   | 0.220   |
| F         | 0.051       | 0.203   | 0.002   | 0.008   |
| G         | 0.15        | 0.31    | 0.006   | 0.012   |
| H         | 2.10        | 2.40    | 0.083   | 0.094   |
| J         | 2.20        |         | 0.087   |         |
| K         |             | 2.60    |         | 0.102   |
| L         | 2.30        |         | 0.091   |         |

**Part marking**



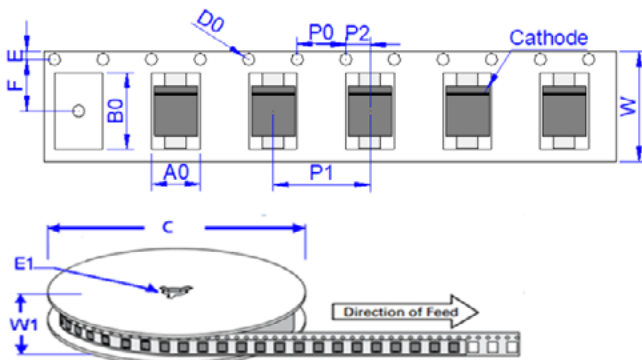
Cathode band (Uni-polar only)

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, 3,000 parts per 13" diameter reel (EIA-481 compliant)



| Dimension | Millimeters | Inches         |
|-----------|-------------|----------------|
| A0        | 3.76 ± 0.3  | 0.148 ± 0.012  |
| B0        | 5.69 ± 0.3  | 0.224 ± 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        | 8.00 ± 0.2  | 0.3145 ± 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  |

SMBJE  
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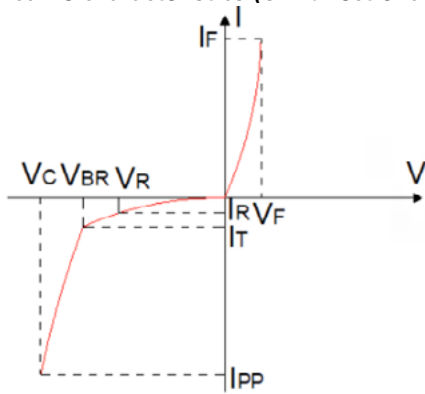
Technical Data 11214  
Effective November 2020

Electrical characteristics (+25 °C)

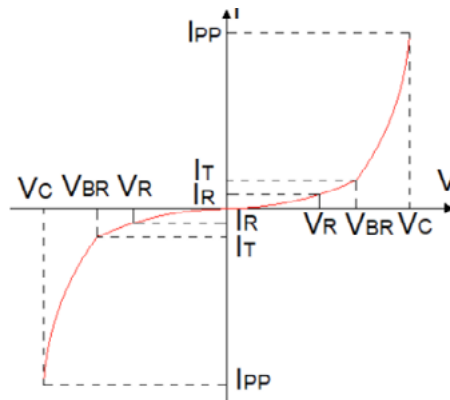
| Part number | Marking    |          | $V_R$<br>(V) | $I_R @ V_R$<br>( $\mu$ A) | $V_{BR} @ I_T$<br>min (V) | max (V) | $I_T$<br>(mA) | $V_C @ I_{PP}$<br>max (V) | $I_{PP}$<br>(A) |      |
|-------------|------------|----------|--------------|---------------------------|---------------------------|---------|---------------|---------------------------|-----------------|------|
|             | Uni-polar  | Bi-polar |              |                           |                           |         |               |                           |                 | Uni  |
| SMBJE5-0A   | SMBJE5-0CA | KE       | AE           | 5                         | 120                       | 6.4     | 7             | 10                        | 9.2             | 65.2 |
| SMBJE6-0A   | SMBJE6-0CA | KG       | AG           | 6                         | 120                       | 6.67    | 7.37          | 10                        | 10.3            | 58.3 |
| SMBJE6-5A   | SMBJE6-5CA | KK       | AK           | 6.5                       | 120                       | 7.22    | 7.98          | 10                        | 11.2            | 53.6 |
| SMBJE7-0A   | SMBJE7-0CA | KM       | AM           | 7                         | 50                        | 7.78    | 8.6           | 10                        | 12              | 50   |
| SMBJE7-5A   | SMBJE7-5CA | KP       | AP           | 7.5                       | 50                        | 8.33    | 9.21          | 1                         | 12.9            | 46.5 |
| SMBJE8-0A   | SMBJE8-0CA | KR       | AR           | 8                         | 20                        | 8.89    | 9.83          | 1                         | 13.6            | 44.1 |
| SMBJE8-5A   | SMBJE8-5CA | KT       | AT           | 8.5                       | 10                        | 9.44    | 10.4          | 1                         | 14.4            | 41.7 |
| SMBJE9-0A   | SMBJE9-0CA | KV       | AV           | 9                         | 5                         | 10      | 11.1          | 1                         | 15.4            | 39   |
| SMBJE10A    | SMBJE10CA  | KX       | AX           | 10                        | 2                         | 11.1    | 12.3          | 1                         | 17              | 35.3 |
| SMBJE11A    | SMBJE11CA  | KZ       | AZ           | 11                        | 1                         | 12.2    | 13.5          | 1                         | 18.2            | 33   |
| SMBJE12A    | SMBJE12CA  | LE       | BE           | 12                        | 1                         | 13.3    | 14.7          | 1                         | 19.9            | 30.2 |
| SMBJE13A    | SMBJE13CA  | LG       | BG           | 13                        | 1                         | 14.4    | 15.9          | 1                         | 21.5            | 27.9 |
| SMBJE14A    | SMBJE14CA  | LK       | BK           | 14                        | 1                         | 15.6    | 17.2          | 1                         | 23.2            | 25.9 |
| SMBJE15A    | SMBJE15CA  | LM       | BM           | 15                        | 1                         | 16.7    | 18.5          | 1                         | 24.4            | 24.6 |
| SMBJE16A    | SMBJE16CA  | LP       | BP           | 16                        | 1                         | 17.8    | 19.7          | 1                         | 26              | 23.1 |
| SMBJE17A    | SMBJE17CA  | LR       | BR           | 17                        | 1                         | 18.9    | 20.9          | 1                         | 27.6            | 21.8 |
| SMBJE18A    | SMBJE18CA  | LT       | BT           | 18                        | 1                         | 20      | 22.1          | 1                         | 29.2            | 20.6 |
| SMBJE20A    | SMBJE20CA  | LV       | BV           | 20                        | 1                         | 22.2    | 24.5          | 1                         | 32.4            | 18.6 |
| SMBJE22A    | SMBJE22CA  | LX       | BX           | 22                        | 1                         | 24.4    | 26.9          | 1                         | 35.5            | 16.9 |
| SMBJE24A    | SMBJE24CA  | LZ       | BZ           | 24                        | 1                         | 26.7    | 29.5          | 1                         | 38.9            | 15.4 |
| SMBJE26A    | SMBJE26CA  | ME       | CE           | 26                        | 1                         | 28.9    | 31.9          | 1                         | 42.1            | 14.3 |
| SMBJE28A    | SMBJE28CA  | MG       | CG           | 28                        | 1                         | 31.1    | 34.4          | 1                         | 45.4            | 13.2 |
| SMBJE30A    | SMBJE30CA  | MK       | CK           | 30                        | 1                         | 33.3    | 36.8          | 1                         | 48.4            | 12.4 |
| SMBJE33A    | SMBJE33CA  | MM       | CM           | 33                        | 1                         | 36.7    | 40.6          | 1                         | 53.3            | 11.3 |
| SMBJE36A    | SMBJE36CA  | MP       | CP           | 36                        | 1                         | 40      | 44.2          | 1                         | 58.1            | 10.4 |
| SMBJE40A    | SMBJE40CA  | MR       | CR           | 40                        | 1                         | 44.4    | 49.1          | 1                         | 64.5            | 9.3  |
| SMBJE43A    | SMBJE43CA  | MT       | CT           | 43                        | 1                         | 47.8    | 52.8          | 1                         | 69.4            | 8.7  |
| SMBJE45A    | SMBJE45CA  | MV       | CV           | 45                        | 1                         | 50      | 55.3          | 1                         | 72.7            | 8.3  |
| SMBJE48A    | SMBJE48CA  | MX       | CX           | 48                        | 1                         | 53.3    | 58.9          | 1                         | 77.4            | 7.8  |
| SMBJE51A    | SMBJE51CA  | MZ       | CZ           | 51                        | 1                         | 56.7    | 62.7          | 1                         | 82.4            | 7.3  |
| SMBJE54A    | SMBJE54CA  | NE       | DE           | 54                        | 1                         | 60      | 66.3          | 1                         | 87.1            | 6.9  |
| SMBJE58A    | SMBJE58CA  | NG       | DG           | 58                        | 1                         | 64.4    | 71.2          | 1                         | 93.6            | 6.4  |
| SMBJE60A    | SMBJE60CA  | NK       | DK           | 60                        | 1                         | 66.7    | 73.7          | 1                         | 96.8            | 6.2  |
| SMBJE64A    | SMBJE64CA  | NM       | DM           | 64                        | 1                         | 71.1    | 78.6          | 1                         | 103             | 5.8  |
| SMBJE70A    | SMBJE70CA  | NP       | DP           | 70                        | 1                         | 77.8    | 86            | 1                         | 113             | 5.3  |
| SMBJE75A    | SMBJE75CA  | NR       | DR           | 75                        | 1                         | 83.3    | 92.1          | 1                         | 121             | 5    |
| SMBJE78A    | SMBJE78CA  | NT       | DT           | 78                        | 1                         | 86.7    | 95.8          | 1                         | 126             | 4.8  |
| SMBJE85A    | SMBJE85CA  | NV       | DV           | 85                        | 1                         | 94.4    | 104           | 1                         | 137             | 4.4  |
| SMBJE90A    | SMBJE90CA  | NX       | DX           | 90                        | 1                         | 100     | 111           | 1                         | 146             | 4.1  |
| SMBJE100A   | SMBJE100CA | NZ       | DZ           | 100                       | 1                         | 111     | 123           | 1                         | 162             | 3.7  |
| SMBJE110A   | SMBJE110CA | PE       | EE           | 110                       | 1                         | 122     | 135           | 1                         | 177             | 3.4  |
| SMBJE120A   | SMBJE120CA | PG       | EG           | 120                       | 1                         | 133     | 147           | 1                         | 193             | 3.1  |
| SMBJE130A   | SMBJE130CA | PK       | EK           | 130                       | 1                         | 144     | 159           | 1                         | 209             | 2.9  |
| SMBJE150A   | SMBJE150CA | PM       | EM           | 150                       | 1                         | 167     | 185           | 1                         | 243             | 2.5  |
| SMBJE160A   | SMBJE160CA | PP       | EP           | 160                       | 1                         | 178     | 197           | 1                         | 259             | 2.3  |
| SMBJE170A   | SMBJE170CA | PR       | ER           | 170                       | 1                         | 189     | 209           | 1                         | 275             | 2.2  |
| SMBJE180A   | SMBJE180CA | PT       | ET           | 180                       | 1                         | 201     | 222           | 1                         | 292             | 2.1  |
| SMBJE190A   | SMBJE190CA | PV       | EV           | 190                       | 1                         | 211     | 234           | 1                         | 307             | 2    |
| SMBJE200A   | SMBJE200CA | PX       | EX           | 200                       | 1                         | 224     | 247           | 1                         | 324             | 1.9  |
| SMBJE210A   | SMBJE210CA | PZ       | EZ           | 210                       | 1                         | 233     | 258           | 1                         | 337             | 1.8  |
| SMBJE220A   | SMBJE220CA | QE       | FE           | 220                       | 1                         | 246     | 272           | 1                         | 356             | 1.7  |
| SMBJE250A   | SMBJE250CA | QG       | FG           | 250                       | 1                         | 279     | 309           | 1                         | 405             | 1.5  |
| SMBJE300A   | SMBJE300CA | QK       | FK           | 300                       | 1                         | 335     | 371           | 1                         | 486             | 1.3  |
| SMBJE350A   | SMBJE350CA | QM       | FM           | 350                       | 1                         | 391     | 432           | 1                         | 567             | 1.1  |
| SMBJE400A   | SMBJE400CA | QP       | FP           | 400                       | 1                         | 447     | 494           | 1                         | 648             | 0.9  |
| SMBJE440A   | SMBJE440CA | QR       | FR           | 440                       | 1                         | 492     | 543           | 1                         | 713             | 0.8  |

**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

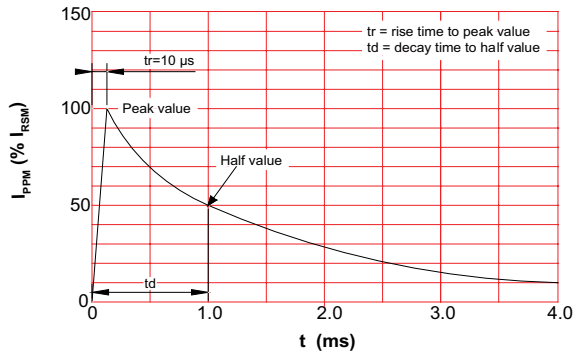
$V_C$ : Clamping voltage – Peak voltage measured across the suppressor at a specified  $I_{PP}$

$I_R$ : Reverse leakage current

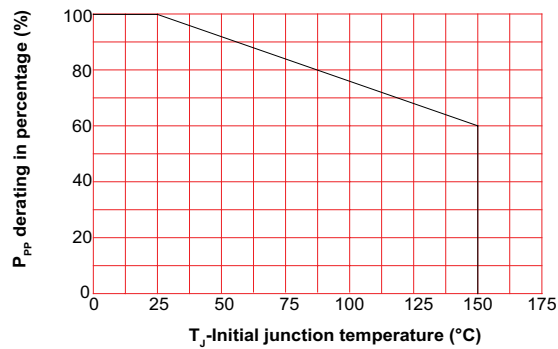
$I_T$ : Test current

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

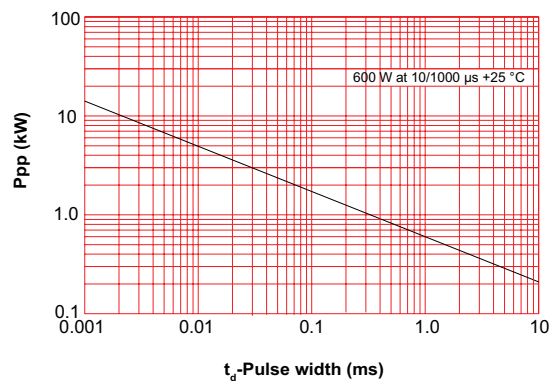
**Pulse waveform**



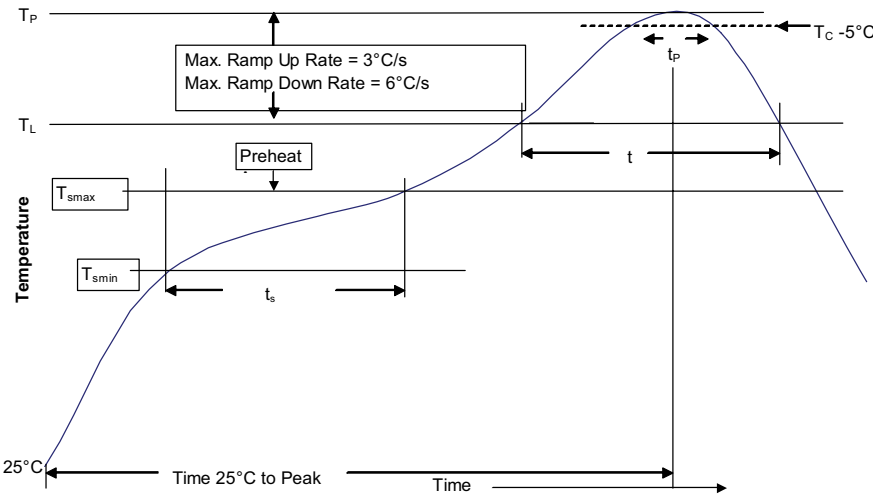
**Pulse derating curve**



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



**Solder reflow profile**



**Table 1 - Standard SnPb solder ( $T_C$ )**

| Package thickness | Volume mm <sup>3</sup> <350 | Volume mm <sup>3</sup> ≥350 |
|-------------------|-----------------------------|-----------------------------|
| <2.5 mm           | 235 °C                      | 220 °C                      |
| ≥2.5 mm           | 220 °C                      | 220 °C                      |

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

| Package thickness | Volume mm <sup>3</sup> <350 | Volume mm <sup>3</sup> 350 - 2000 | Volume mm <sup>3</sup> >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 ( $T_L$ )   | 183 °C   | 217 °C   |
| Time ( $t_L$ ) maintained above $T_L$   | 60-150 seconds   | 60-150 seconds   |
| 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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