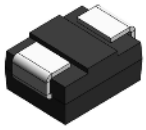
# SMBJE

## Automotive grade 600 W Transient voltage suppressor



### Applications

- Automotive chassis and safety systems
- Advanced driver assistance systems (ADAS)
- Communication and infotainment systems
- Network systems and body electronics
- Power Train controls
- xEV and battery systems

### Product features

- Automotive grade (AEC-Q101 qualified)
- Low profile SMB package
- Excellent clamping capability
- High reliability application
- 600 W peak pulse power capability at 10/1000 µs waveform
- Typical $I_R$ less than 1 µA above 9 V
- Fast response time: typically less than 1.0 ps from 0 V to $V_{BR}$ minimum
- Plastic package meets UL 94 V-0 flammability rating
- Meets moisture sensitivity level (MSL) level 1
- Terminal: tin plated, solderable per J-STD-002
- UL 497B recognized.
  File No. : E198449 Guide QVGQ2

### Environmental compliance and general specifications

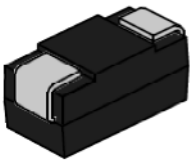
- AEC-Q101 qualified

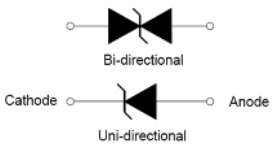
### Ordering part number

**SMBJE 5-0 C A H**

- Family name
- $V_R$ voltage ("-" indicates decimal point)
- Bi-/Uni-Directional (Blank=Uni, C=Bi)
- Voltage tolerance
- High reliability application

### PIN configuration






Powering Business Worldwide

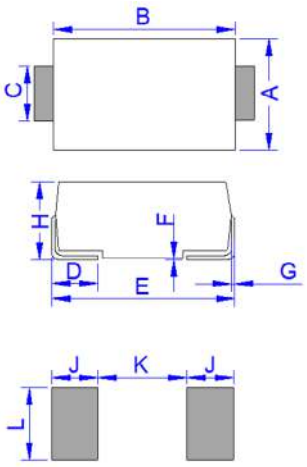
## Absolute maximum ratings

(+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 | W |
| Peak pulse power dissipation on 10/1000 µs waveform | $P_{PP}$ | 600 | W |
| Maximum instantaneous forward voltage at 100 A for unidirectional | $V_F$ | 5 | V |
| Peak forward surge current, 8.3 ms single half sine wave[1] | $I_{FSM}$ | 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/inches




| | Millimeters | | Inches | |
|---|---|---|---|---|
| **Dimension** | **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 | 2.00 | - | 0.087 | - |
| K | - | 2.60 | - | 0.102 |
| L | 2.30 | - | 0.091 | - |

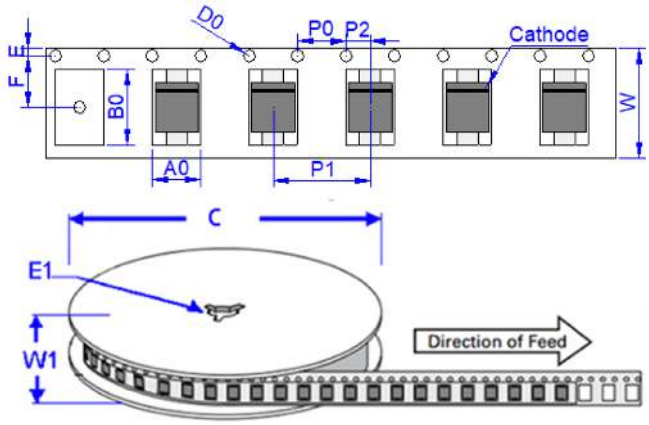
### Part marking


Cathode band (uni-polar only)
Part marking:
xxxx = Date code
yy- Refer to marking designator listed in Electrical characteristics table

## Packaging information - mm/inches

Drawing not to scale.

Supplied in tape and reel packaging, 3,000 parts per 13" diameter reel (EIA-481 compliant)



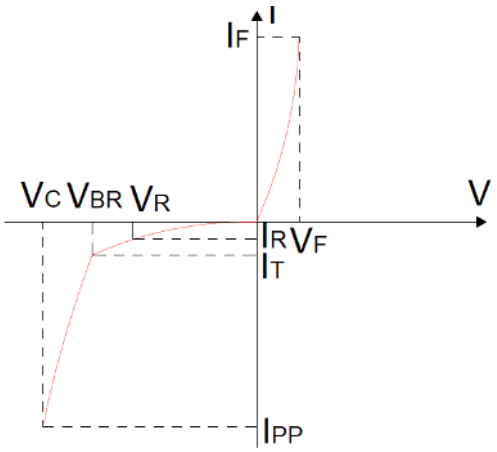

| Dimensions | Millimeters | Inches |
|---|---|---|
| A0 | 3.76 ± 0.3 | 0.148 ± 0.012 |
| B0 | 5.69 ± 0.3 | 0.224 ± 0.012 |
| C | 330.0 | 13.0 |
| D0 | 1.55 ± 0.1 | 0.061 ± 0.004 |
| E | 1.75 ± 0.2 | 0.069 ± 0.008 |
| E1 | 13.3 ± 0.3 | 0.524 ± 0.012 |
| F | 5.50 ± 0.2 | 0.217 ± 0.008 |
| P0 | 4.00 ± 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 |

**Electrical specifications (+25 °C)** * = not UL497B recognized

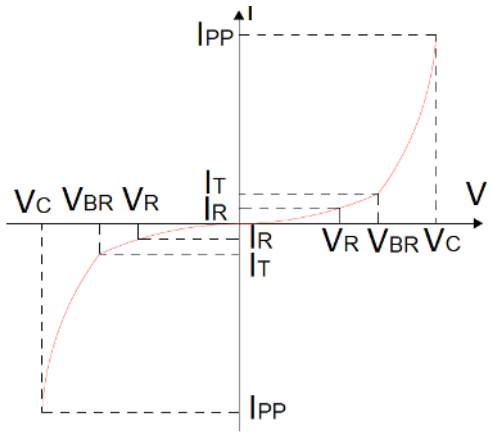
| Part number | | Marking | | $V_R$ | $I_R$ @ $V_R$ | $V_{BR}$ @ $I_T$ | | $I_T$ | $V_C$ @ $I_{PP}$ | $I_{PP}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| **Uni-polar** | **Bi-polar** | **Uni** | **Bi** | **(V)** | **(µA)** | **min (V)** | **max (V)** | **(mA)** | **max (V)** | **(A)** |
| SMBJE5-0AH | SMBJE5-0CAH | KE | AE | 5 | 120 | 6.4 | 7 | 10 | 9.2 | 65.2 |
| SMBJE6-0AH | SMBJE6-0CAH | KG | AG | 6 | 120 | 6.67 | 7.37 | 10 | 10.3 | 58.3 |
| SMBJE6-5AH | SMBJE6-5CAH | KK | AK | 6.5 | 120 | 7.22 | 7.98 | 10 | 11.2 | 53.6 |
| SMBJE7-0AH | SMBJE7-0CAH | KM | AM | 7 | 50 | 7.78 | 8.6 | 10 | 12 | 50 |
| SMBJE7-5AH | SMBJE7-5CAH | KP | AP | 7.5 | 50 | 8.33 | 9.21 | 1 | 12.9 | 46.5 |
| SMBJE8-0AH | SMBJE8-0CAH | KR | AR | 8 | 20 | 8.89 | 9.83 | 1 | 13.6 | 44.1 |
| SMBJE8-5AH | SMBJE8-5CAH | KT | AT | 8.5 | 10 | 9.44 | 10.4 | 1 | 14.4 | 41.7 |
| SMBJE9-0AH | SMBJE9-0CAH | KV | AV | 9 | 5 | 10 | 11.1 | 1 | 15.4 | 39 |
| SMBJE11AH | SMBJE11CAH | KZ | AZ | 11 | 1 | 12.2 | 13.5 | 1 | 18.2 | 33 |
| SMBJE12AH | SMBJE12CAH | LE | BE | 12 | 1 | 13.3 | 14.7 | 1 | 19.9 | 30.2 |
| SMBJE13AH | SMBJE13CAH | LG | BG | 13 | 1 | 14.4 | 15.9 | 1 | 21.5 | 27.9 |
| SMBJE14AH | SMBJE14CAH | LK | BK | 14 | 1 | 15.6 | 17.2 | 1 | 23.2 | 25.9 |
| SMBJE15AH | SMBJE15CAH | LM | BM | 15 | 1 | 16.7 | 18.5 | 1 | 24.4 | 24.6 |
| SMBJE16AH | SMBJE16CAH | LP | BP | 16 | 1 | 17.8 | 19.7 | 1 | 26 | 23.1 |
| SMBJE17AH | SMBJE17CAH | LR | BR | 17 | 1 | 18.9 | 20.9 | 1 | 27.6 | 21.8 |
| SMBJE18AH | SMBJE18CAH | LT | BT | 18 | 1 | 20 | 22.1 | 1 | 29.2 | 20.6 |
| SMBJE20AH | SMBJE20CAH | LV | BV | 20 | 1 | 22.2 | 24.5 | 1 | 32.4 | 18.6 |
| SMBJE22AH | SMBJE22CAH | LX | BX | 22 | 1 | 24.4 | 26.9 | 1 | 35.5 | 16.9 |
| SMBJE24AH | SMBJE24CAH | LZ | BZ | 24 | 1 | 26.7 | 29.5 | 1 | 38.9 | 15.4 |
| SMBJE26AH | SMBJE26CAH | ME | CE | 26 | 1 | 28.9 | 31.9 | 1 | 42.1 | 14.3 |
| SMBJE28AH | SMBJE28CAH | MG | CG | 28 | 1 | 31.1 | 34.4 | 1 | 45.4 | 13.2 |
| SMBJE30AH | SMBJE30CAH | MK | CK | 30 | 1 | 33.3 | 36.8 | 1 | 48.4 | 12.4 |
| SMBJE33AH | SMBJE33CAH | MM | CM | 33 | 1 | 36.7 | 40.6 | 1 | 53.3 | 11.3 |
| SMBJE36AH | SMBJE36CAH | MP | CP | 36 | 1 | 40 | 44.2 | 1 | 58.1 | 10.4 |
| SMBJE40AH | SMBJE40CAH | MR | CR | 40 | 1 | 44.4 | 49.1 | 1 | 64.5 | 9.3 |
| SMBJE43AH | SMBJE43CAH | MT | CT | 43 | 1 | 47.8 | 52.8 | 1 | 69.4 | 8.7 |
| SMBJE45AH | SMBJE45CAH | MV | CV | 45 | 1 | 50 | 55.3 | 1 | 72.7 | 8.3 |
| SMBJE48AH | SMBJE48CAH | MX | CX | 48 | 1 | 53.3 | 58.9 | 1 | 77.4 | 7.8 |
| SMBJE51AH | SMBJE51CAH | MZ | CZ | 51 | 1 | 56.7 | 62.7 | 1 | 82.4 | 7.3 |
| SMBJE54AH | SMBJE54CAH | NE | DE | 54 | 1 | 60 | 66.3 | 1 | 87.1 | 6.9 |
| SMBJE58AH | SMBJE58CAH | NG | DG | 58 | 1 | 64.4 | 71.2 | 1 | 93.6 | 6.4 |
| SMBJE60AH | SMBJE60CAH | NK | DK | 60 | 1 | 66.7 | 73.7 | 1 | 96.8 | 6.2 |
| SMBJE64AH | SMBJE64CAH | NM | DM | 64 | 1 | 71.1 | 78.6 | 1 | 103 | 5.8 |
| SMBJE70AH | SMBJE70CAH | NP | DP | 70 | 1 | 77.8 | 86 | 1 | 113 | 5.3 |
| SMBJE75AH | SMBJE75CAH | NR | DR | 75 | 1 | 83.3 | 92.1 | 1 | 121 | 5 |
| SMBJE78AH | SMBJE78CAH | NT | DT | 78 | 1 | 86.7 | 95.8 | 1 | 126 | 4.8 |
| SMBJE85AH | SMBJE85CAH | NV | DV | 85 | 1 | 94.4 | 104 | 1 | 137 | 4.4 |
| SMBJE90AH | SMBJE90CAH | NX | DX | 90 | 1 | 100 | 111 | 1 | 146 | 4.1 |
| SMBJE100AH | SMBJE100CAH | NZ | DZ | 100 | 1 | 111 | 123 | 1 | 162 | 3.7 |
| SMBJE110AH | SMBJE110CAH | PE | EE | 110 | 1 | 122 | 135 | 1 | 177 | 3.4 |
| SMBJE120AH | SMBJE120CAH | PG | EG | 120 | 1 | 133 | 147 | 1 | 193 | 3.1 |
| SMBJE130AH | SMBJE130CAH | PK | EK | 130 | 1 | 144 | 159 | 1 | 209 | 2.9 |
| SMBJE150AH | SMBJE150CAH | PM | EM | 150 | 1 | 167 | 185 | 1 | 243 | 2.5 |
| SMBJE160AH | SMBJE160CAH | PP | EP | 160 | 1 | 178 | 197 | 1 | 259 | 2.3 |
| SMBJE170AH | SMBJE170CAH | PR | ER | 170 | 1 | 189 | 209 | 1 | 275 | 2.2 |
| SMBJE180AH | SMBJE180CAH | PT | ET | 180 | 1 | 201 | 222 | 1 | 292 | 2.1 |
| SMBJE190AH | SMBJE190CAH | PV | EV | 190 | 1 | 211 | 234 | 1 | 307 | 2 |
| SMBJE200AH | SMBJE200CAH | PX | EX | 200 | 1 | 224 | 247 | 1 | 324 | 1.9 |
| SMBJE210AH | SMBJE210CAH | PZ | EZ | 210 | 1 | 233 | 258 | 1 | 337 | 1.8 |
| SMBJE220AH | SMBJE220CAH | QE | FE | 220 | 1 | 246 | 272 | 1 | 356 | 1.7 |
| SMBJE250AH | SMBJE250CAH | QG | FG | 250 | 1 | 279 | 309 | 1 | 405 | 1.5 |
| SMBJE300AH | SMBJE300CAH | QK | FK | 300 | 1 | 335 | 371 | 1 | 486 | 1.3 |
| SMBJE350AH | SMBJE350CAH | QM | FM | 350 | 1 | 391 | 432 | 1 | 567 | 1.1 |
| SMBJE400AH | SMBJE400CAH | QP | FP | 400 | 1 | 447 | 494 | 1 | 648 | 0.9 |
| SMBJE440AH | SMBJE440CAH | QR | FR | 440 | 1 | 492 | 543 | 1 | 713 | 0.8 |
| SMBJE460AH* | SMBJE460CAH* | QT | FT | 460 | 1 | 510 | 560 | 1 | 735 | 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 µs

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

$V_{BR}$: Breakdown voltage

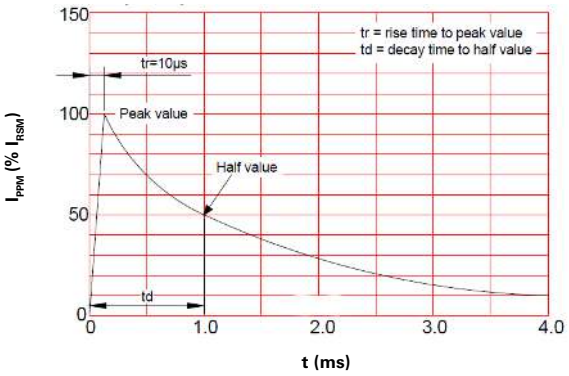
$V_C$: Clamping voltage – Peak voltage measured across the suppressor at a specified $I_{PP}$

$I_R$: Reverse leakage current

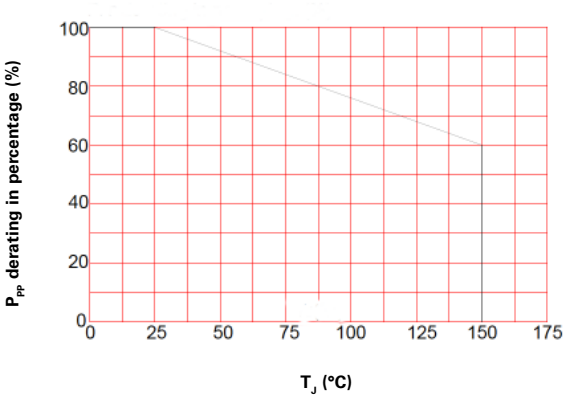
$I_T$: Test current

$V_F$: Forward voltage drop for Uni-directional

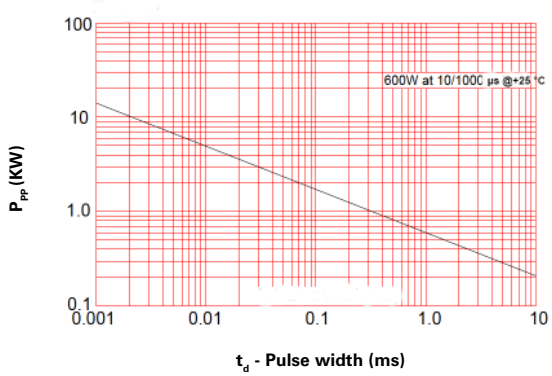
### Pulse waveform




### Pulse derating curve




### Peak pulse power dissipation curve



## Solder reflow profile

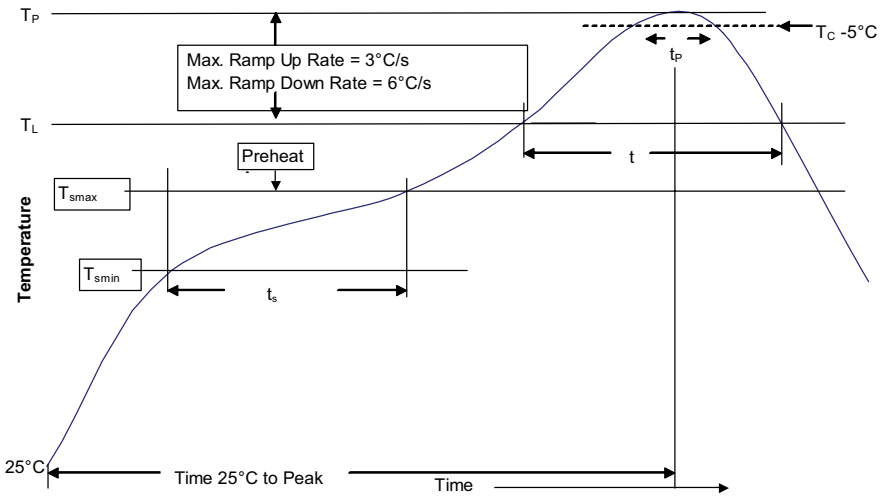



**Table 1 - Standard SnPb solder ($T_C$)**

| Package thickness | Volume mm3 <350 | Volume mm3 ≥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 $mm^3$ <350 | Volume $mm^3$ 350 - 2000 | Volume $mm^3$ >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 | • Temperature min. ($T_{smin}$) | 100 °C | 150 °C |
| | • Temperature max. ($T_{smax}$) | 150 °C | 200 °C |
| | • Time ($T_{smin}$ to $T_{smax}$) ($t_S$) | 60-120 seconds | 60 - 180 seconds |
| 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 $T_L$ | | 183 °C<br>60-150 seconds | 217 °C<br>60-150 seconds |
| Peak package body temperature ($T_P$)* | | Table 1 | Table 2 (+0, -5 °C) |
| 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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