TAIWAN SEMICONDUCTOR

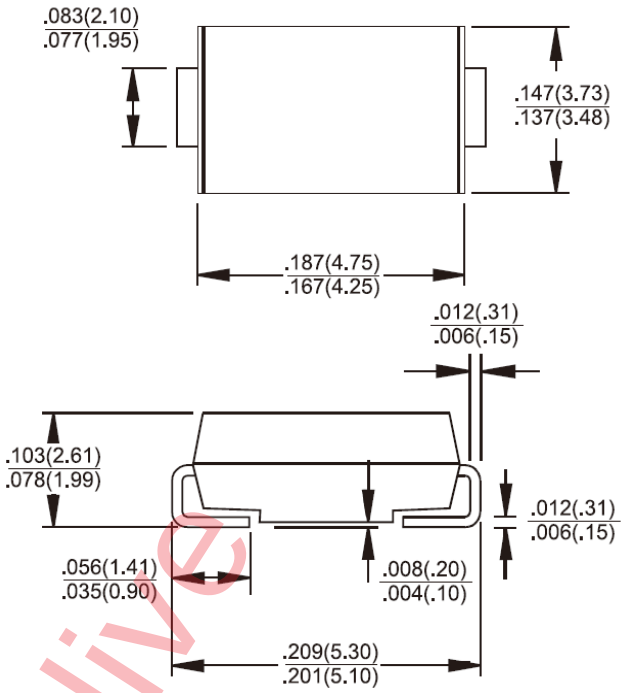
# SMBJ SERIES

600 Watts Suface Mount Transient Voltage Suppressor

**SMB/DO-214AA**

Pb RoHS COMPLIANCE






**Dimensions in inches and (millimeters)**

## Features

- For surface mounted application
- Low profile package
- Built-in strain relief
- Glass passivated junction
- Excellent clamping capability
- Fast response time: Typically less than 1.0ps from 0 volt to BV min
- Typical $I_R$ less than 1uA above 10V
- High temperature soldering guaranteed: 260℃ / 10 seconds at terminals
- Plastic material used carried Underwriters Laboratory Flammability Classification 94V-0
- 600 watts peak pulse power capability with a 10/1000 us waveform
- Green compound with suffix "G" on packing code & prefix "G" on datecode

## Mechanical Data

- Case: Molded plastic
- Terminals: Pure tin plated, lead free
- Polarity: Indicated by cathode band except bipolar
- Standard packaging: 12mm tape per EIA Std RS-481
- Weight: 0.093 gram

**Marking Diagram**




XX = Specific Device Code
G = Green Compound
Y = Year
M = Work Month

## Maximum Ratings and Electrical Characteristics

Rating at 25 ℃ ambient temperature unless otherwise specified.
Single phase, half wave, 60 Hz, resistive or inductive load.
For capacitive load, derate current by 20%

| Type Number | Symbol | Value | Unit |
|---|---|---|---|
| Peak Power Dissipation at $T_A$=25℃, Tp=1ms(Note 1) | $P_{PK}$ | 600 | Watts |
| Steady State Power Dissipation | $P_D$ | 3 | Watts |
| Peak Forward Surge Current, 8.3ms Single Half Sine-wave Superimposed on Rated Load (JEDEC method)(Note 2) - Unidirectional Only | $I_{FSM}$ | 100 | Amps |
| Maximum Instantaneous Forward Voltage at 50.0A for Unidirectional Only (Note 4) | $V_F$ | 3.5 / 5.0 | Volts |
| Typical Thermal Resistance | $R_{\theta JC}$<br>$R_{\theta JA}$ | 10<br>55 | ℃/W |
| Operating and Storage Temperature Range | $T_J$, $T_{STG}$ | -65 to +150 | ℃ |

Note 1: Non-repetitive Current Pulse Per Fig. 3 and Derated above $T_A$=25℃ Per Fig. 2

Note 2: Mounted on 10 x 10mm Copper Pads to Each Terminal

Note 3: $V_F$=3.5V on SMBJ5.0 thru SMBJ90 Devices and $V_F$=5.0V on SMBJ100 thru SMBJ170 Devices

Devices for Bipolar Applications

1. For Bidirectional Use C or CA Suffix for Types SMBJ5.0 through Types SMBJ170
2. Electrical Characterstics Apply in Both Directions

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# RATINGS AND CHARACTERISTIC CURVES (SMBJ SERIES)

FIG. 1 PEAK PULSE POWER RATING CURVE

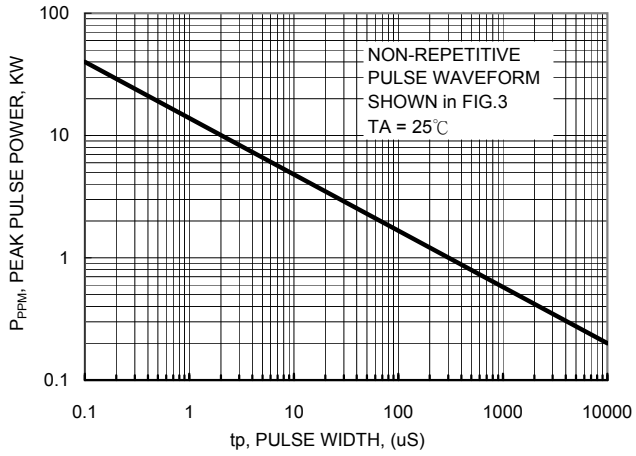



FIG.2 PULSE DERATING CURVE

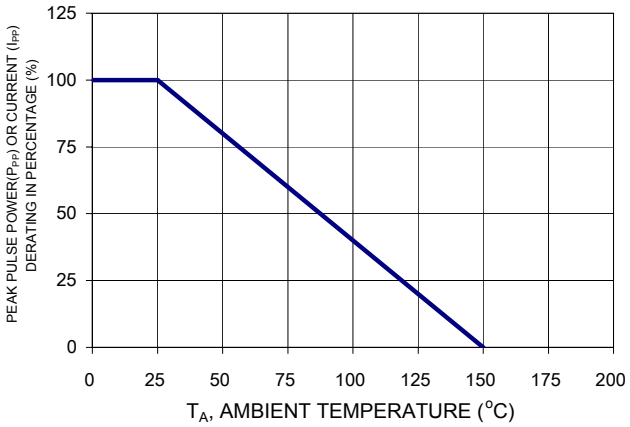



FIG. 3 CLAMPING POWER PULSE WAVEFORM

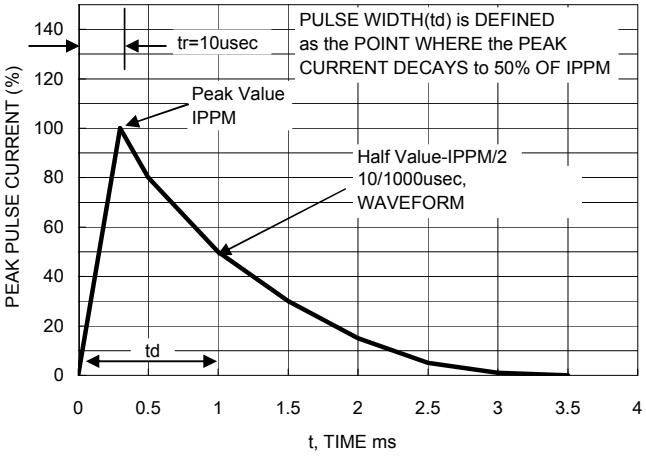



FIG. 4 MAXIMUM NON-REPETITIVE FORWARD SURGE CURRENT

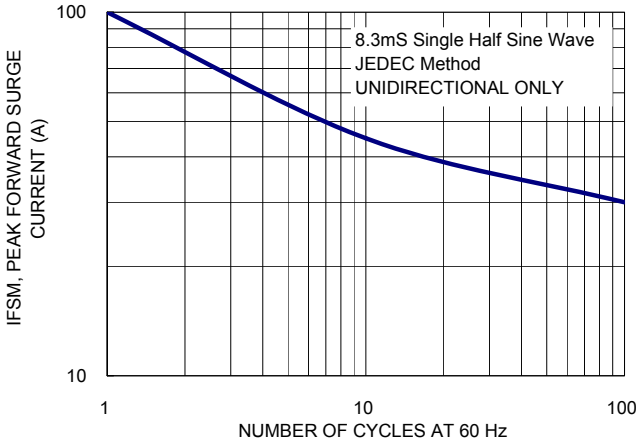
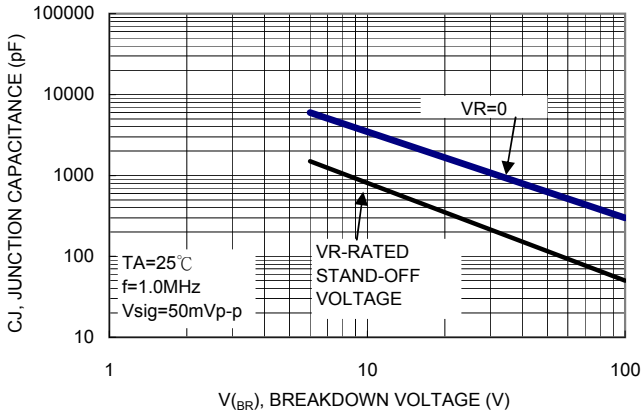



FIG. 5 TYPICAL JUNCTION CAPACITANCE



ELECTRICAL CHARACTERISTICS ($T_A$=25℃ unless otherwise noted)

| Device | Device Marking Code | Breakdown Voltage (Note 1) | | Test Current | Stand-Off Voltage | Maximum Reverse Leakage @ $V_{WM}$ | Maximum Peak Pulse Current | Maximum Clamping Voltage @ $I_{PPM}$ |
|---|---|---|---|---|---|---|---|---|
| | | $V_{BR}$ | | $I_T$ | $V_{WM}$ | $I_D$ | $I_{PPM}$ | Vc |
| | | V | | mA | V | uA | A | V |
| | | Min. | Max. | | | | (Note 2) | |
| SMBJ5.0 | KD | 6.40 | 7.30 | 10 | 5.0 | 800 | 65.0 | 9.6 |
| SMBJ5.0A | KE | 6.40 | 7.00 | 10 | 5.0 | 800 | 68.0 | 9.2 |
| SMBJ6.0 | KF | 6.67 | 8.15 | 10 | 6.0 | 800 | 55.0 | 11.4 |
| SMBJ6.0A | KG | 6.67 | 7.37 | 10 | 6.0 | 800 | 61.0 | 10.3 |
| SMBJ6.5 | KH | 7.22 | 8.82 | 10 | 6.5 | 500 | 51.0 | 12.3 |
| SMBJ6.5A | KK | 7.22 | 7.98 | 10 | 6.5 | 500 | 56.0 | 11.2 |
| SMBJ7.0 | KL | 7.78 | 9.51 | 10 | 7.0 | 200 | 47.0 | 13.3 |
| SMBJ7.0A | KM | 7.78 | 8.60 | 10 | 7.0 | 200 | 52.0 | 12.0 |
| SMBJ7.5 | KN | 8.33 | 10.3 | 1 | 7.5 | 100 | 44.0 | 14.3 |
| SMBJ7.5A | KP | 8.33 | 9.21 | 1 | 7.5 | 100 | 48.0 | 12.9 |
| SMBJ8.0 | KQ | 8.89 | 10.9 | 1 | 8.0 | 50 | 42.0 | 15.0 |
| SMBJ8.0A | KR | 8.89 | 9.83 | 1 | 8.0 | 50 | 46.0 | 13.6 |
| SMBJ8.5 | KS | 9.44 | 11.5 | 1 | 8.5 | 10 | 39.0 | 15.9 |
| SMBJ8.5A | KT | 9.44 | 10.4 | 1 | 8.5 | 10 | 43.0 | 14.4 |
| SMBJ9.0 | KU | 10.0 | 12.2 | 1 | 9.0 | 5 | 37.0 | 16.9 |
| SMBJ9.0A | KV | 10.0 | 11.1 | 1 | 9.0 | 5 | 40.0 | 15.4 |
| SMBJ10 | KW | 11.1 | 13.6 | 1 | 10 | 5 | 33.0 | 18.8 |
| SMBJ10A | KX | 11.1 | 12.3 | 1 | 10 | 5 | 37.0 | 17.0 |
| SMBJ11 | KY | 12.2 | 14.9 | 1 | 11 | 5 | 31.0 | 20.1 |
| SMBJ11A | KZ | 12.2 | 13.5 | 1 | 11 | 5 | 34.0 | 18.2 |
| SMBJ12 | LD | 13.3 | 16.3 | 1 | 12 | 5 | 28.0 | 22.0 |
| SMBJ12A | LE | 13.3 | 14.7 | 1 | 12 | 5 | 31.0 | 19.9 |
| SMBJ13 | LF | 14.4 | 17.6 | 1 | 13 | 5 | 26.0 | 23.8 |
| SMBJ13A | LG | 14.4 | 15.9 | 1 | 13 | 5 | 29.0 | 21.5 |
| SMBJ14 | LH | 15.6 | 19.1 | 1 | 14 | 5 | 24.4 | 25.8 |
| SMBJ14A | LK | 15.6 | 17.2 | 1 | 14 | 5 | 27.0 | 23.2 |
| SMBJ15 | LL | 16.7 | 20.4 | 1 | 15 | 5 | 23.1 | 26.9 |
| SMBJ15A | LM | 16.7 | 18.5 | 1 | 15 | 5 | 25.1 | 24.4 |
| SMBJ16 | LN | 17.8 | 21.8 | 1 | 16 | 5 | 21.8 | 28.8 |
| SMBJ16A | LP | 17.8 | 19.7 | 1 | 16 | 5 | 24.2 | 26.0 |
| SMBJ17 | LQ | 18.9 | 23.1 | 1 | 17 | 5 | 20.0 | 30.5 |
| SMBJ17A | LR | 18.9 | 20.9 | 1 | 17 | 5 | 22.8 | 27.6 |
| SMBJ18 | LS | 20.0 | 24.4 | 1 | 18 | 5 | 19.5 | 32.2 |
| SMBJ18A | LT | 20.0 | 22.1 | 1 | 18 | 5 | 21.5 | 29.2 |
| SMBJ20 | LU | 22.2 | 27.1 | 1 | 20 | 5 | 17.6 | 35.8 |
| SMBJ20A | LV | 22.2 | 24.5 | 1 | 20 | 5 | 19.4 | 32.4 |
| SMBJ22 | LW | 24.4 | 29.8 | 1 | 22 | 5 | 15.0 | 39.4 |
| SMBJ22A | LX | 24.4 | 26.9 | 1 | 22 | 5 | 17.7 | 35.5 |
| SMBJ24 | LY | 26.7 | 32.6 | 1 | 24 | 5 | 14.6 | 43.0 |
| SMBJ24A | LZ | 26.7 | 29.5 | 1 | 24 | 5 | 16.0 | 38.9 |
| SMBJ26 | MD | 28.9 | 35.3 | 1 | 26 | 5 | 13.5 | 46.6 |
| SMBJ26A | ME | 28.9 | 31.9 | 1 | 26 | 5 | 14.9 | 42.1 |
| SMBJ28 | MF | 31.1 | 38.0 | 1 | 28 | 5 | 12.6 | 50.0 |
| SMBJ28A | MG | 31.1 | 34.4 | 1 | 28 | 5 | 13.8 | 45.4 |
| SMBJ30 | MH | 33.3 | 40.7 | 1 | 30 | 5 | 11.7 | 53.5 |
| SMBJ30A | MK | 33.3 | 36.8 | 1 | 30 | 5 | 13.0 | 48.4 |
| SMBJ33 | ML | 36.7 | 44.9 | 1 | 33 | 5 | 10.6 | 59.0 |
| SMBJ33A | MM | 36.7 | 40.6 | 1 | 33 | 5 | 11.8 | 53.3 |
| SMBJ36 | MN | 40.0 | 48.9 | 1 | 36 | 5 | 9.8 | 64.3 |
| SMBJ36A | MP | 40.0 | 44.2 | 1 | 36 | 5 | 10.8 | 58.1 |
| SMBJ40 | MQ | 44.4 | 54.3 | 1 | 40 | 5 | 8.8 | 71.4 |
| SMBJ40A | MR | 44.4 | 49.1 | 1 | 40 | 5 | 9.7 | 64.5 |
| SMBJ43 | MS | 47.8 | 58.4 | 1 | 43 | 5 | 8.2 | 76.7 |
| SMBJ43A | MT | 47.8 | 52.8 | 1 | 43 | 5 | 9.0 | 69.4 |

ELECTRICAL CHARACTERISTICS ($T_A$=25℃ unless otherwise noted)

| Device | Device Marking Code | Breakdown Voltage (Note 1) | | Test Current | Stand-Off Voltage | Maximum Reverse Leakage @ $V_{WM}$ | Maximum Peak Pulse Current | Maximum Clamping Voltage @ $I_{PPM}$ |
|---|---|---|---|---|---|---|---|---|
| | | $V_{BR}$ | | $I_T$ | $V_{WM}$ | $I_D$ | $I_{PPM}$ | Vc |
| | | V | | mA | V | uA | A | V |
| | | Min. | Max. | | | | (Note 2) | |
| SMBJ45 | MU | 50.0 | 61.1 | 1 | 45 | 5 | 7.8 | 80.3 |
| SMBJ45A | MV | 50.0 | 55.3 | 1 | 45 | 5 | 8.6 | 72.7 |
| SMBJ48 | MW | 53.3 | 65.1 | 1 | 48 | 5 | 7.3 | 85.5 |
| SMBJ48A | MX | 53.3 | 58.9 | 1 | 48 | 5 | 8.1 | 77.4 |
| SMBJ51 | MY | 56.7 | 69.3 | 1 | 51 | 5 | 6.9 | 91.1 |
| SMBJ51A | MZ | 56.7 | 62.7 | 1 | 51 | 5 | 7.6 | 82.4 |
| SMBJ54 | ND | 60.0 | 73.3 | 1 | 54 | 5 | 6.5 | 96.3 |
| SMBJ54A | NE | 60.0 | 66.3 | 1 | 54 | 5 | 7.2 | 87.1 |
| SMBJ58 | NF | 64.4 | 78.7 | 1 | 58 | 5 | 6.1 | 103 |
| SMBJ58A | NG | 64.4 | 71.2 | 1 | 58 | 5 | 6.7 | 93.6 |
| SMBJ60 | NH | 66.7 | 81.5 | 1 | 60 | 5 | 5.8 | 107 |
| SMBJ60A | NK | 66.7 | 73.7 | 1 | 60 | 5 | 6.5 | 96.8 |
| SMBJ64 | NL | 71.1 | 86.9 | 1 | 64 | 5 | 5.5 | 114 |
| SMBJ64A | NM | 71.1 | 78.6 | 1 | 64 | 5 | 6.1 | 103 |
| SMBJ70 | NN | 77.8 | 95.1 | 1 | 70 | 5 | 5.0 | 125 |
| SMBJ70A | NP | 77.8 | 86 | 1 | 70 | 5 | 5.5 | 113 |
| SMBJ75 | NQ | 83.3 | 102 | 1 | 75 | 5 | 4.7 | 134 |
| SMBJ75A | NR | 83.3 | 92.1 | 1 | 75 | 5 | 5.2 | 121 |
| SMBJ78 | NS | 86.7 | 106 | 1 | 78 | 5 | 4.5 | 139 |
| SMBJ78A | NT | 86.7 | 95.8 | 1 | 78 | 5 | 5.0 | 126 |
| SMBJ85 | NU | 94.4 | 115 | 1 | 85 | 5 | 4.1 | 151 |
| SMBJ85A | NV | 94.4 | 104 | 1 | 85 | 5 | 4.6 | 137 |
| SMBJ90 | NW | 100 | 122 | 1 | 90 | 5 | 3.9 | 160 |
| SMBJ90A | NX | 100 | 111 | 1 | 90 | 5 | 4.3 | 146 |
| SMBJ100 | NY | 111 | 136 | 1 | 100 | 5 | 3.5 | 179 |
| SMBJ100A | NZ | 111 | 123 | 1 | 100 | 5 | 3.8 | 162 |
| SMBJ110 | PD | 122 | 149 | 1 | 110 | 5 | 3.2 | 196 |
| SMBJ110A | PE | 122 | 135 | 1 | 110 | 5 | 3.5 | 177 |
| SMBJ120 | PF | 133 | 163 | 1 | 120 | 5 | 2.9 | 214 |
| SMBJ120A | PG | 133 | 147 | 1 | 120 | 5 | 3.2 | 193 |
| SMBJ130 | PH | 144 | 176 | 1 | 130 | 5 | 2.7 | 231 |
| SMBJ130A | PK | 144 | 159 | 1 | 130 | 5 | 3.0 | 209 |
| SMBJ150 | PL | 167 | 204 | 1 | 150 | 5 | 2.3 | 266 |
| SMBJ150A | PM | 167 | 185 | 1 | 150 | 5 | 2.5 | 243 |
| SMBJ160 | PN | 178 | 218 | 1 | 160 | 5 | 2.2 | 287 |
| SMBJ160A | PP | 178 | 197 | 1 | 160 | 5 | 2.4 | 259 |
| SMBJ170 | PQ | 189 | 231 | 1 | 170 | 5 | 2.0 | 304 |
| SMBJ170A | PR | 189 | 209 | 1 | 170 | 5 | 2.2 | 275 |

Notes:

1. $V_{BR}$ measure after $I_T$ applied for 300us, $I_T$=square wave pulse or equivalent.
2. Surge current waveform per Figure. 3 and derate per Figure. 2
3. All terms and symbols are consistent with ANSI/IEEE C62.35.
4. For bidirectional use C or CA suffix for types SMBJ5.0 through SMBJ17(
5. For bipolar types having $V_{WM}$ of 10 volts(SMBJ8.0C) and under, the $I_D$ limit is doubled.

## TVS APPLICATION NOTES:

Transient Voltage Suppressors may be used at various points in a circuit to provide various degrees of protection. The following is a typical linear power supply with transient voltage suppressor units plaved at different points. All provide protection of the load.

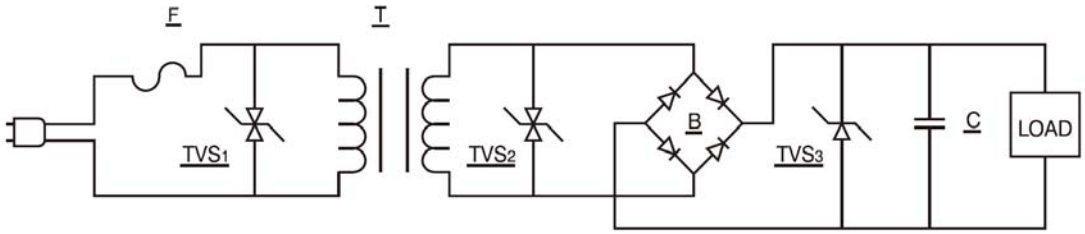



FIGURE 1

Transient Voltage Suppressor 1 provides maximum protection. However, the system will probably require replacement of the line fuse(F) since it provides a dominant portion of the series impedance when a surge is encountered.

Hower, we do not recommend to use the TVS diode here, unless we can know the electric circuit impedance and the magnitude of surge rushed into the circuit. Otherwise the TVS diode is easy to be destroyed by voltage surge.

Transient Voltage Suppressor 2 provides execllent protection of circuitry excluding the transformer(T). However, since the transformer is a large part of the series impedance, the chance of the line fuse opening during the surge condition is reduced.

Transient Voltage Suppressor 3 provides the load with complete protection. It uses a unidirectional Transient Voltage Suppressor, which is a cost advantage. The series impedance now includes the line fuse, transformer, and bridge rectifier(B) so failure of the line fuse is further reduced. If onlt Transient Voltage Suppressor 3 is in use, then the bridge rectifier is unprotected and would require a higher voltage and current rating to prevent failure by transients.

Any combination of this three, or any one of these applivations, will prevent damage to the load. This would require varying trade-offs in power supply protection versus maintenance(changing the time fuse).
An additional method is to utilize the Transient Voltage Suppressor units as a controlled avalanche bridge. This reduces the parts count and incorporated the protection within the bridge rectifier.

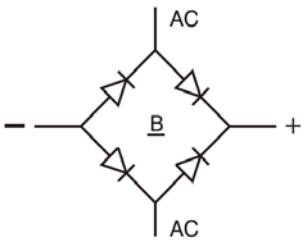



FIGURE 2

**RECOMMENDED PAD SIZES**

**The pad dimensions should be 0.010"(0.25mm) longer than the contact size, in the lead axis. This allows a solder filler to form, see figure below. Contact factort for soldering methods.**

