

## DESCRIPTION

This SMBJ5.0-170A or SMBG5.0-170A series of surface mount 600 W Transient Voltage Suppressors (TVSs) protects a variety of voltage-sensitive components from destruction or degradation. It is available in J-bend design (SMBJ) with the DO-214AA package for greater PC board mounting density or in a Gull-wing design (SMBG) in the DO-215AA for visible solder connections. It is also available in both unidirectional and bidirectional configurations with a C or CA suffix part number as well as RoHS Compliant with an e3 suffix. Their response time is virtually instantaneous. As a result, they can be used for protection from ESD or EFT per IEC61000-4-2 and IEC61000-4-4, or for inductive switching environments and induced RF protection. They can also protect from secondary lightning effects per IEC61000-4-5 and class levels defined herein. Microsemi also offers numerous other TVS products to meet higher and lower power demands and special applications.

**IMPORTANT:** For the most current data, consult MICROSEMI's website: <http://www.microsemi.com>

## APPEARANCE



**NOTE:** All SMB series are equivalent to prior SMS package identifications.

## FEATURES

- Available in both unidirectional and bidirectional construction (add C or CA suffix for bidirectional)
- Selections for 5.0 to 170 volts standoff voltages ( $V_{WM}$ )
- Optional 100% **screening for avionics grade** is available by adding MA prefix to part number for 100% temperature cycle -55°C to +125°C (10X) as well as surge (3X) and 24 hours HTRB with post test  $V_Z$  &  $I_R$  (in operating direction for unidirectional or both directions for bidirectional)
- Options for screening in accordance with MIL-PRF-19500 for JANTX are available by adding MX prefix to the part number.
- Axial-lead equivalent packages for thru-hole mounting available as P6KE6.8 to P6KE200CA (consult factory for other surface mount options)
- Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B
- RoHS compliant devices available by adding an "e3" suffix

## APPLICATIONS / BENEFITS

- Economical surface mount design in both J-bend or Gull-wing terminations
- Protects sensitive components such as IC's, CMOS, Bipolar, BiCMOS, ECL, DTL, T<sup>2</sup>L, etc.
- Protection from switching transients & induced RF
- Compliant to IEC61000-4-2 and IEC61000-4-4 for ESD and EFT protection respectively
- Secondary lightning protection per IEC61000-4-5 with 42 Ohms source impedance:
  - Class 1: SMB 5.0 to SMB 120A or CA
  - Class 2: SMB 5.0 to SMB 60A or CA
  - Class 3: SMB 5.0 to SMB 30A or CA
  - Class 4: SMB 5.0 to SMB 15A or CA
- Secondary lightning protection per IEC61000-4-5 with 12 Ohms source impedance:
  - Class 1: SMB 5.0 to SMB 36A or CA
  - Class 2: SMB 5.0 to SMB 18A or CA

## MAXIMUM RATINGS

- Peak Pulse Power dissipation at 25°C: 600 watts at 10/1000  $\mu$ s (also see Fig 1,2, and 3).
- Impulse repetition rate (duty factor): 0.01%
- $t_{clamping}$  (0 volts to  $V_{(BR)}$  min.): < 100 ps theoretical for unidirectional and < 5 ns for bidirectional
- Operating and Storage temperature: -65°C to +150°C
- Thermal resistance: 25°C/W junction to lead, or 90°C/W junction to ambient when mounted on FR4 PC board (1oz Cu) with recommended footprint (see last page)
- Steady-State Power dissipation: 5 watts at  $T_L = 25^\circ\text{C}$ , or 1.38 watts at  $T_A = 25^\circ\text{C}$  when mounted on FR4 PC board with recommended footprint
- Forward Surge at 25°C: 100 Amps peak impulse of 8.3 ms half-sine wave (unidirectional only)
- Solder temperatures: 260°C for 10 s (maximum)

## MECHANICAL AND PACKAGING

- CASE: Void-free transfer molded thermosetting epoxy body meeting UL94V-0
- TERMINALS: Gull-wing or C-bend (modified J-bend) tin-lead or RoHS compliant annealed matte-tin plating solderable per MIL-STD-750, method 2026
- POLARITY: Cathode indicated by band. No marking on bi-directional devices
- MARKING: Part number without standard prefix (e.g. 5.0, 5.0A, 5.0CA, 5.0Ae3, 36, MX36A, 36CAe3, etc.)
- TAPE & REEL option: Standard per EIA-481-1-A with 12 mm tape, 750 per 7 inch reel or 2500 per 13 inch reel (add "TR" suffix to part number)
- WEIGHT: 0.1 grams
- See package dimension on last page

**ELECTRICAL CHARACTERISTICS @ 25°C**

| MICROSEMI PART NUMBER |                        | REVERSE STAND-OFF VOLTAGE<br>V <sub>WM</sub> | BREAKDOWN VOLTAGE<br>V <sub>(BR)</sub> @ I <sub>(BR)</sub><br>Volts |      | MAXIMUM CLAMPING VOLTAGE<br>@ I <sub>PP</sub> | PEAK PULSE CURRENT<br>(See Fig. 2)<br>I <sub>PP</sub> | MAXIMUM STANDBY CURRENT<br>@ V <sub>WM</sub><br>I <sub>D</sub><br>μA |
|-----------------------|------------------------|----------------------------------------------|---------------------------------------------------------------------|------|-----------------------------------------------|-------------------------------------------------------|----------------------------------------------------------------------|
| GULL-WING LEAD        | MODIFIED “J” BEND LEAD |                                              | MIN.                                                                | MAX. |                                               |                                                       |                                                                      |
| SMBG5.0               | SMBJ5.0                | 5.0                                          | 6.40 – 7.30                                                         | 10   | 9.6                                           | 62.5                                                  | 800                                                                  |
| SMBG5.0A              | SMBJ5.0A               | 5.0                                          | 6.40 – 7.00                                                         | 10   | 9.2                                           | 65.2                                                  | 800                                                                  |
| SMBG6.0               | SMBJ6.0                | 6.0                                          | 6.67 – 8.15                                                         | 10   | 11.4                                          | 52.6                                                  | 800                                                                  |
| SMBG6.0A              | SMBJ6.0A               | 6.0                                          | 6.67 – 7.37                                                         | 10   | 10.3                                          | 58.3                                                  | 800                                                                  |
| SMBG6.5               | SMBJ6.5                | 6.5                                          | 7.22 – 8.82                                                         | 10   | 12.3                                          | 48.7                                                  | 500                                                                  |
| SMBG6.5A              | SMBJ6.5A               | 6.5                                          | 7.22 – 7.98                                                         | 10   | 11.2                                          | 53.6                                                  | 500                                                                  |
| SMBG7.0               | SMBJ7.0                | 7.0                                          | 7.78 – 9.51                                                         | 10   | 13.3                                          | 45.1                                                  | 200                                                                  |
| SMBG7.0A              | SMBJ7.0A               | 7.0                                          | 7.78 – 8.60                                                         | 10   | 12.0                                          | 50.0                                                  | 200                                                                  |
| SMBG7.5               | SMBJ7.5                | 7.5                                          | 8.33 – 10.2                                                         | 1    | 14.3                                          | 42.0                                                  | 100                                                                  |
| SMBG7.5A              | SMBJ7.5A               | 7.5                                          | 8.33 – 9.21                                                         | 1    | 12.9                                          | 46.5                                                  | 100                                                                  |
| SMBG8.0               | SMBJ8.0                | 8.0                                          | 8.89 – 10.9                                                         | 1    | 15.0                                          | 40.0                                                  | 50                                                                   |
| SMBG8.0A              | SMBJ8.0A               | 8.0                                          | 8.89 – 9.83                                                         | 1    | 13.6                                          | 44.1                                                  | 50                                                                   |
| SMBG8.5               | SMBJ8.5                | 8.5                                          | 9.44 – 11.5                                                         | 1    | 15.9                                          | 37.7                                                  | 10                                                                   |
| SMBG8.5A              | SMBJ8.5A               | 8.5                                          | 9.44 – 10.4                                                         | 1    | 14.4                                          | 41.7                                                  | 10                                                                   |
| SMBG9.0               | SMBJ9.0                | 9.0                                          | 10.0 – 12.2                                                         | 1    | 16.9                                          | 35.5                                                  | 5                                                                    |
| SMBG9.0A              | SMBJ9.0A               | 9.0                                          | 10.0 – 11.1                                                         | 1    | 15.4                                          | 39.0                                                  | 5                                                                    |
| SMBG10                | SMBJ10                 | 10                                           | 11.1 – 13.6                                                         | 1    | 18.8                                          | 31.9                                                  | 5                                                                    |
| SMBG10A               | SMBJ10A                | 10                                           | 11.1 – 12.3                                                         | 1    | 17.0                                          | 35.3                                                  | 5                                                                    |
| SMBG11                | SMBJ11                 | 11                                           | 12.2 – 14.9                                                         | 1    | 20.1                                          | 29.9                                                  | 5                                                                    |
| SMBG11A               | SMBJ11A                | 11                                           | 12.2 – 13.5                                                         | 1    | 18.2                                          | 33.0                                                  | 5                                                                    |
| SMBG12                | SMBJ12                 | 12                                           | 13.3 – 16.3                                                         | 1    | 22.0                                          | 27.3                                                  | 5                                                                    |
| SMBG12A               | SMBJ12A                | 12                                           | 13.3 – 14.7                                                         | 1    | 19.9                                          | 30.2                                                  | 5                                                                    |
| SMBG13                | SMBJ13                 | 13                                           | 14.4 – 17.6                                                         | 1    | 23.8                                          | 25.2                                                  | 1                                                                    |
| SMBG13A               | SMBJ13A                | 13                                           | 14.4 – 15.9                                                         | 1    | 21.5                                          | 27.9                                                  | 1                                                                    |
| SMBG14                | SMBJ14                 | 14                                           | 15.6 – 19.1                                                         | 1    | 25.8                                          | 23.3                                                  | 1                                                                    |
| SMBG14A               | SMBJ14A                | 14                                           | 15.6 – 17.2                                                         | 1    | 23.2                                          | 25.8                                                  | 1                                                                    |
| SMBG15                | SMBJ15                 | 15                                           | 16.7 – 20.4                                                         | 1    | 26.9                                          | 22.3                                                  | 1                                                                    |
| SMBG15A               | SMBJ15A                | 15                                           | 16.7 – 18.5                                                         | 1    | 24.4                                          | 24.0                                                  | 1                                                                    |
| SMBG16                | SMBJ16                 | 16                                           | 17.8 – 21.8                                                         | 1    | 28.8                                          | 20.8                                                  | 1                                                                    |
| SMBG16A               | SMBJ16A                | 16                                           | 17.8 – 19.7                                                         | 1    | 26.0                                          | 23.1                                                  | 1                                                                    |
| SMBG17                | SMBJ17                 | 17                                           | 18.9 – 23.1                                                         | 1    | 30.5                                          | 19.7                                                  | 1                                                                    |
| SMBG17A               | SMBJ17A                | 17                                           | 18.9 – 20.9                                                         | 1    | 27.6                                          | 21.7                                                  | 1                                                                    |
| SMBG18                | SMBJ18                 | 18                                           | 20.0 – 24.4                                                         | 1    | 32.2                                          | 18.6                                                  | 1                                                                    |
| SMBG18A               | SMBJ18A                | 18                                           | 20.0 – 22.1                                                         | 1    | 29.2                                          | 20.5                                                  | 1                                                                    |
| SMBG20                | SMBJ20                 | 20                                           | 22.2 – 27.1                                                         | 1    | 35.8                                          | 16.7                                                  | 1                                                                    |
| SMBG20A               | SMBJ20A                | 20                                           | 22.2 – 24.5                                                         | 1    | 32.4                                          | 18.5                                                  | 1                                                                    |
| SMBG22                | SMBJ22                 | 22                                           | 24.4 – 29.8                                                         | 1    | 39.4                                          | 15.2                                                  | 1                                                                    |
| SMBG22A               | SMBJ22A                | 22                                           | 24.4 – 26.9                                                         | 1    | 35.5                                          | 16.9                                                  | 1                                                                    |
| SMBG24                | SMBJ24                 | 24                                           | 26.7 – 32.6                                                         | 1    | 43.0                                          | 14.0                                                  | 1                                                                    |
| SMBG24A               | SMBJ24A                | 24                                           | 26.7 – 29.5                                                         | 1    | 38.9                                          | 15.4                                                  | 1                                                                    |
| SMBG26                | SMBJ26                 | 26                                           | 28.9 – 35.3                                                         | 1    | 46.6                                          | 12.4                                                  | 1                                                                    |
| SMBG26A               | SMBJ26A                | 26                                           | 28.9 – 31.9                                                         | 1    | 42.1                                          | 14.2                                                  | 1                                                                    |
| SMBG28                | SMBJ28                 | 28                                           | 31.1 – 38.0                                                         | 1    | 50.0                                          | 12.0                                                  | 1                                                                    |
| SMBG28A               | SMBJ28A                | 28                                           | 31.1 – 34.4                                                         | 1    | 45.4                                          | 13.2                                                  | 1                                                                    |
| SMBG30                | SMBJ30                 | 30                                           | 33.3 – 40.7                                                         | 1    | 53.5                                          | 11.2                                                  | 1                                                                    |
| SMBG30A               | SMBJ30A                | 30                                           | 33.3 – 36.8                                                         | 1    | 48.4                                          | 12.4                                                  | 1                                                                    |
| SMBG33                | SMBJ33                 | 33                                           | 36.7 – 44.9                                                         | 1    | 59.0                                          | 10.2                                                  | 1                                                                    |
| SMBG33A               | SMBJ33A                | 33                                           | 36.7 – 40.6                                                         | 1    | 53.3                                          | 11.3                                                  | 1                                                                    |
| SMBG36                | SMBJ36                 | 36                                           | 40.0 – 48.9                                                         | 1    | 64.3                                          | 9.3                                                   | 1                                                                    |
| SMBG36A               | SMBJ36A                | 36                                           | 40.0 – 44.2                                                         | 1    | 58.1                                          | 10.3                                                  | 1                                                                    |
| SMBG40                | SMBJ40                 | 40                                           | 44.4 – 54.3                                                         | 1    | 71.4                                          | 8.4                                                   | 1                                                                    |
| SMBG40A               | SMBJ40A                | 40                                           | 44.4 – 49.1                                                         | 1    | 64.5                                          | 9.3                                                   | 1                                                                    |
| SMBG43                | SMBJ43                 | 43                                           | 47.8 – 58.4                                                         | 1    | 76.7                                          | 7.8                                                   | 1                                                                    |
| SMBG43A               | SMBJ43A                | 43                                           | 47.8 – 52.8                                                         | 1    | 69.4                                          | 8.6                                                   | 1                                                                    |
| SMBG45                | SMBJ45                 | 45                                           | 50.0 – 61.1                                                         | 1    | 80.3                                          | 7.5                                                   | 1                                                                    |
| SMBG45A               | SMBJ45A                | 45                                           | 50.0 – 55.3                                                         | 1    | 72.7                                          | 8.3                                                   | 1                                                                    |

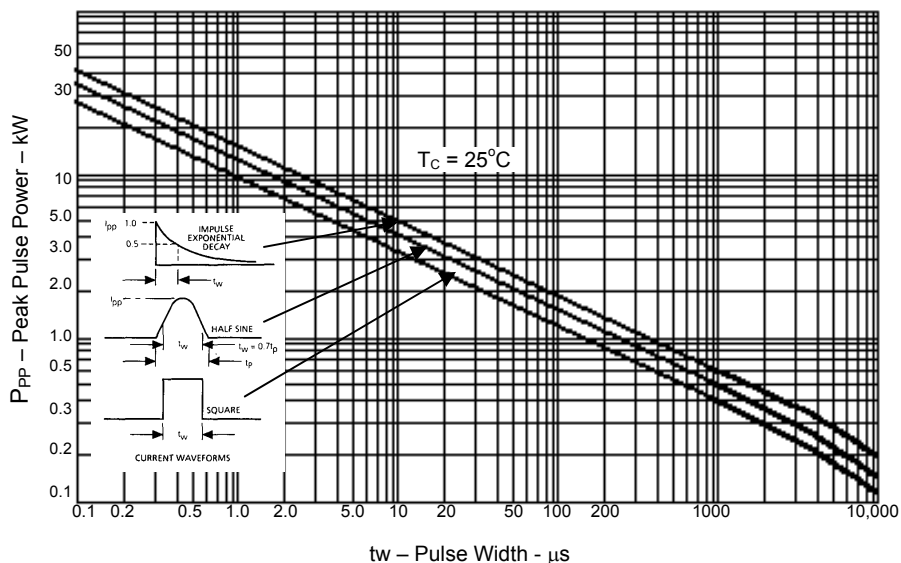
| MICROSEMI PART NUMBER |                        | REVERSE STAND-OFF VOLTAGE<br>$V_{WM}$ | BREAKDOWN VOLTAGE<br>$V_{(BR)}$ @ $I_{(BR)}$<br>Volts |      | MAXIMUM CLAMPING VOLTAGE<br>@ $I_{PP}$ | PEAK PULSE CURRENT<br>(See Fig. 2)<br>$I_{PP}$ | MAXIMUM STANDBY CURRENT<br>@ $V_{WM}$<br>$I_D$<br>$\mu A$ |
|-----------------------|------------------------|---------------------------------------|-------------------------------------------------------|------|----------------------------------------|------------------------------------------------|-----------------------------------------------------------|
| GULL-WING LEAD        | MODIFIED "J" BEND LEAD |                                       | MIN.                                                  | MAX. |                                        |                                                |                                                           |
| SMBG48                | SMBJ48                 | 48                                    | 53.3 – 65.1                                           | 1    | 85.5                                   | 7.0                                            | 1                                                         |
| SMBG48A               | SMBJ48A                | 48                                    | 53.3 – 58.9                                           | 1    | 77.4                                   | 7.7                                            | 1                                                         |
| SMBG51                | SMBJ51                 | 51                                    | 56.7 – 69.3                                           | 1    | 91.1                                   | 6.6                                            | 1                                                         |
| SMBG51A               | SMBJ51A                | 51                                    | 56.7 – 62.7                                           | 1    | 82.4                                   | 7.3                                            | 1                                                         |
| SMBG54                | SMBJ54                 | 54                                    | 60.0 – 73.3                                           | 1    | 96.3                                   | 6.2                                            | 1                                                         |
| SMBG54A               | SMBJ54A                | 54                                    | 60.0 – 66.3                                           | 1    | 87.1                                   | 6.9                                            | 1                                                         |
| SMBG58                | SMBJ58                 | 58                                    | 64.4 – 78.7                                           | 1    | 103                                    | 5.8                                            | 1                                                         |
| SMBG58A               | SMBJ58A                | 58                                    | 64.4 – 71.2                                           | 1    | 93.6                                   | 6.4                                            | 1                                                         |
| SMBG60                | SMBJ60                 | 60                                    | 66.7 – 81.5                                           | 1    | 107                                    | 5.6                                            | 1                                                         |
| SMBG60A               | SMBJ60A                | 60                                    | 66.7 – 73.7                                           | 1    | 96.8                                   | 6.2                                            | 1                                                         |
| SMBG64                | SMBJ64                 | 64                                    | 71.1 – 86.9                                           | 1    | 114                                    | 5.3                                            | 1                                                         |
| SMBG64A               | SMBJ64A                | 64                                    | 71.1 – 78.6                                           | 1    | 103                                    | 5.8                                            | 1                                                         |
| SMBG70                | SMBJ70                 | 70                                    | 77.8 – 95.1                                           | 1    | 125                                    | 4.8                                            | 1                                                         |
| SMBG70A               | SMBJ70A                | 70                                    | 77.8 – 86.0                                           | 1    | 113                                    | 5.3                                            | 1                                                         |
| SMBG75                | SMBJ75                 | 75                                    | 83.3 – 102                                            | 1    | 134                                    | 4.5                                            | 1                                                         |
| SMBG75A               | SMBJ75A                | 75                                    | 83.3 – 92.1                                           | 1    | 121                                    | 4.9                                            | 1                                                         |
| SMBG78                | SMBJ78                 | 78                                    | 86.7 – 106                                            | 1    | 139                                    | 4.3                                            | 1                                                         |
| SMBG78A               | SMBJ78A                | 78                                    | 86.7 – 95.8                                           | 1    | 126                                    | 4.7                                            | 1                                                         |
| SMBG85                | SMBJ85                 | 85                                    | 94.4 – 115                                            | 1    | 151                                    | 3.9                                            | 1                                                         |
| SMBG85A               | SMBJ85A                | 85                                    | 94.4 – 104                                            | 1    | 137                                    | 4.4                                            | 1                                                         |
| SMBG90                | SMBJ90                 | 90                                    | 100 – 122                                             | 1    | 160                                    | 3.8                                            | 1                                                         |
| SMBG90A               | SMBJ90A                | 90                                    | 100 – 111                                             | 1    | 146                                    | 4.1                                            | 1                                                         |
| SMBG100               | SMBJ100                | 100                                   | 111 – 136                                             | 1    | 179                                    | 3.4                                            | 1                                                         |
| SMBG100A              | SMBJ100A               | 100                                   | 111 – 123                                             | 1    | 162                                    | 3.7                                            | 1                                                         |
| SMBG110               | SMBJ110                | 110                                   | 122 – 149                                             | 1    | 196                                    | 3.0                                            | 1                                                         |
| SMBG110A              | SMBJ110A               | 110                                   | 122 – 135                                             | 1    | 177                                    | 3.4                                            | 1                                                         |
| SMBG120               | SMBJ120                | 120                                   | 133 – 163                                             | 1    | 214                                    | 2.8                                            | 1                                                         |
| SMBG120A              | SMBJ120A               | 120                                   | 133 – 147                                             | 1    | 193                                    | 3.1                                            | 1                                                         |
| SMBG130               | SMBJ130                | 130                                   | 144 – 176                                             | 1    | 231                                    | 2.6                                            | 1                                                         |
| SMBG130A              | SMBJ130A               | 130                                   | 144 – 159                                             | 1    | 209                                    | 2.9                                            | 1                                                         |
| SMBG150               | SMBJ150                | 150                                   | 167 – 204                                             | 1    | 268                                    | 2.2                                            | 1                                                         |
| SMBG150A              | SMBJ150A               | 150                                   | 167 – 185                                             | 1    | 243                                    | 2.5                                            | 1                                                         |
| SMBG160               | SMBJ160                | 160                                   | 178 – 218                                             | 1    | 287                                    | 2.1                                            | 1                                                         |
| SMBG160A              | SMBJ160A               | 160                                   | 178 – 197                                             | 1    | 259                                    | 2.3                                            | 1                                                         |
| SMBG170               | SMBJ170                | 170                                   | 189 – 231                                             | 1    | 304                                    | 2.0                                            | 1                                                         |
| SMBG170A              | SMBJ170A               | 170                                   | 189 – 209                                             | 1    | 275                                    | 2.2                                            | 1                                                         |

- For Bidirectional device types indicate a C or CA suffix after the part number. (i.e.: SMBG170CA or SMBJ170C). Bidirectional capacitance is half that shown in figure 4 at zero volts.
- Microsemi Corp's SMB series (600 W) surface mountable packages are designed specifically for transient voltage suppression. The wide leads assure a large surface contact for good heat dissipation, and a low resistance path for surge current flow to ground. These high speed transient voltage suppressors can be used to effectively protect sensitive components such as integrated circuits and MOS devices.

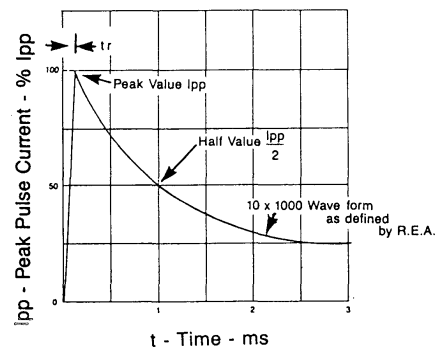
#### SYMBOLS & DEFINITIONS

| Symbol     | Definition                      | Symbol     | Definition                       |
|------------|---------------------------------|------------|----------------------------------|
| $V_{WM}$   | Working Peak (Standoff) Voltage | $I_{PP}$   | Peak Pulse Current               |
| $P_{PP}$   | Peak Pulse Power                | $V_C$      | Clamping Voltage                 |
| $V_{(BR)}$ | Breakdown Voltage               | $I_{(BR)}$ | Breakdown Current for $V_{(BR)}$ |
| $I_D$      | Standby Current                 |            |                                  |

## GRAPHS

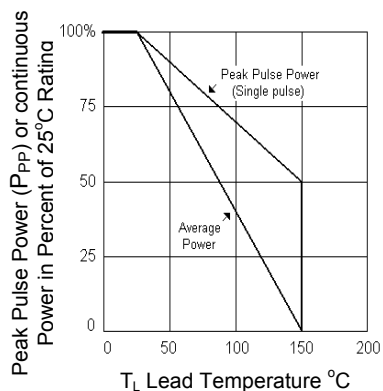


**FIGURE 1**  
Peak Pulse Power vs. Pulse Time

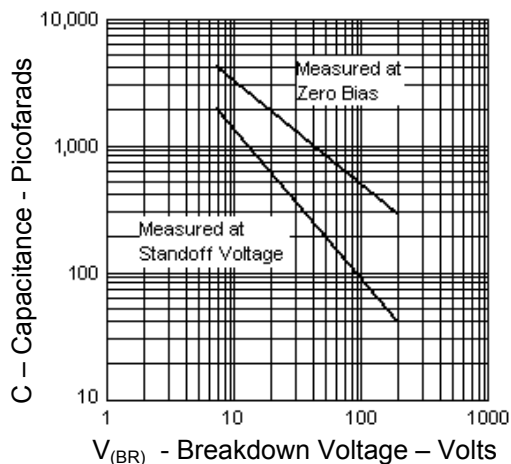


Test waveform parameters:  $t_r = 10 \mu\text{s}$ ,  $t_w = 1000 \mu\text{s}$

**FIGURE 2**  
Pulse Waveform for Exponential Surge

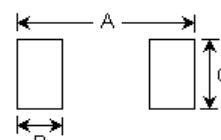


**FIGURE 3 - Derating Curve**



**FIGURE 4**  
Typical Capacitance vs Breakdown Voltage

## PAD LAYOUT



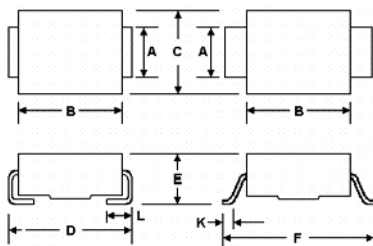
**SMBJ**

|   | INCHES | mm   |
|---|--------|------|
| A | .260   | 6.60 |
| B | .085   | 2.16 |
| C | .110   | 2.79 |

**SMBG**

|   | INCHES | mm   |
|---|--------|------|
| A | 0.320  | 8.13 |
| B | 0.085  | 2.16 |
| C | 0.110  | 2.79 |

## PACKAGE DIMENSIONS



|                           | A    | B    | C    | D    | E    | F    | K    | L     |
|---------------------------|------|------|------|------|------|------|------|-------|
| MIN                       | .077 | .160 | .130 | .205 | .077 | .235 | .015 | .030  |
| MAX                       | .083 | .180 | .155 | .220 | .104 | .255 | .030 | .060  |
| DIMENSIONS IN MILLIMETERS |      |      |      |      |      |      |      |       |
| MIN                       | 1.96 | 4.06 | 3.30 | 5.21 | 1.95 | 5.97 | .381 | .760  |
| MAX                       | 2.10 | 4.57 | 3.94 | 5.59 | 2.65 | 6.48 | .762 | 1.520 |