

## Transient Voltage Suppressors (TVS) Data Sheet

### Features

- For surface mounted applications in order to optimize board space
- Low profile package
- Built-in strain relief
- Glass passivated junction
- Low inductance
- Excellent clamping capability
- 1000W peak pulse power capability at 10/1000 $\mu$ s waveform, repetition rate (duty cycle): 0.01%
- Fast response time
- Typical  $I_R$  less than 1 $\mu$ A above 12V
- High Temperature soldering: 260 $^{\circ}$ C/10 seconds at terminals
- Plastic package has underwriters laboratory flammability 94V-0
- Meets MSL level 1, per J-STD-020



### Mechanical Data

- Case: JEDEC DO-214AA. Molded plastic over glass passivated junction
- Terminal: Solder plated, solderable per MIL-STD-750, Method 2026
- Polarity: Color band denotes cathode except bi-directional models
- Standard Packaging: 12mm tape (EIA STD RS-481)
- Weight: 0.10g

### Applications

- I/O interface
- AC/DC power supply
- Low frequency signal transmission line (RS232, RS485, etc.)

### Maximum Ratings and Characteristics

Ratings at 25 $^{\circ}$ C ambient temperature unless otherwise specified.

| Rating  | Symbol          | Value        | Units          |
|---|-----------------|--------------|----------------|
| Peak pulse power dissipation at 10/1000 $\mu$ s waveform (Note1, Note2, Fig.1)                                    | $P_{PPM}$       | Minimum 1000 | Watts          |
| Peak pulse current of at 10/1000 $\mu$ s waveform (Note 1, Fig.3)   | $I_{PPM}$       | See Table    | Amps           |
| Steady state power dissipation at $T_A=50^{\circ}$ C (Fig.5)  | $P_{M(AV)}$     | 5.0          | Watts          |
| Peak forward surge current, 8.3ms single half sine-wave superimposed on rated load, (JEDEC Method) (Note3, Fig.6) | $I_{FSM}$       | 100          | Amps           |
| Operating junction and Storage Temperature Range.   | $T_J, T_{STG}$  | -65 to +150  | $^{\circ}$ C   |
| Typical thermal resistance junction to lead   | $R_{\theta JL}$ | 20           | $^{\circ}$ C/W |
| Typical thermal resistance junction to ambient  | $R_{\theta JA}$ | 100          | $^{\circ}$ C/W |

Notes: 1. Non-repetitive current pulse, per Fig.3 and derated above  $T_A=25^{\circ}$ C per Fig.2.

2. Mounted on 5.0mm $\times$ 5.0mm (0.03mm thick) copper pads to each terminal.

3. 8.3ms single half sine-wave, or equivalent square wave, duty cycle=4 pulses per minutes maximum.

**Dimensions (SMB/DO-214AA)**

|  | Symbol | Millimeters |       | Inches |       |
|--|--------|-------------|-------|--------|-------|
|  |        | Min.        | Max.  | Min.   | Max.  |
|  | L      | 4.06        | 4.57  | 0.160  | 0.180 |
|  | D      | 3.30        | 3.94  | 0.130  | 0.155 |
|  | D1     | 1.95        | 2.20  | 0.077  | 0.086 |
|  | T      | 5.21        | 5.59  | 0.205  | 0.220 |
|  | T1     | 0.76        | 1.52  | 0.030  | 0.060 |
|  | d      | -           | 0.203 | -      | 0.008 |
|  | H      | 2.15        | 2.65  | 0.085  | 0.104 |
|  | H1     | 2.13        | 2.47  | 0.084  | 0.097 |

**Electrical Characteristics (T<sub>A</sub>=25°C)**

| Part Number    |               | Device Marking Code |      | Reverse Stand-Off Voltage | Breakdown Voltage @I <sub>T</sub> | Test Current        | Maximum Clamping Voltage @I <sub>PP</sub> | Peak Pulse Current  | Reverse Leakage @V <sub>RWM</sub> |
|----------------|---------------|---------------------|------|---------------------------|-----------------------------------|---------------------|---|---------------------|-----------------------------------|
| Unidirectional | Bidirectional | UNI                 | BI   | V <sub>RWM</sub> (V)      | V <sub>BR</sub> (V)               | I <sub>T</sub> (mA) | V <sub>C</sub> (V)                        | I <sub>PP</sub> (A) | I <sub>R</sub> (μA)               |
| 1.0SMB6.8A     | 1.0SMB6.8CA   | 6K8A                | 6K8C | 5.80                      | 6.45~7.14                         | 10                  | 10.5                                      | 96.8                | 1000                              |
| 1.0SMB7.5A     | 1.0SMB7.5CA   | 7K5A                | 7K5C | 6.40                      | 7.13~7.88                         | 10                  | 11.3                                      | 90.0                | 500                               |
| 1.0SMB8.2A     | 1.0SMB8.2CA   | 8K2A                | 8K2C | 7.02                      | 7.79~8.61                         | 10                  | 12.1                                      | 84.0                | 200                               |
| 1.0SMB9.1A     | 1.0SMB9.1CA   | 9K1A                | 9K1C | 7.78                      | 8.65~9.55                         | 1                   | 13.4                                      | 75.8                | 50                                |
| 1.0SMB10A      | 1.0SMB10CA    | K10A                | K10C | 8.55                      | 9.50~10.50                        | 1                   | 14.5                                      | 70.2                | 10                                |
| 1.0SMB11A      | 1.0SMB11CA    | K11A                | K11C | 9.40                      | 10.50~11.60                       | 1                   | 15.6                                      | 65.2                | 5                                 |
| 1.0SMB12A      | 1.0SMB12CA    | K12A                | K12C | 10.20                     | 11.40~12.60                       | 1                   | 16.7                                      | 60.8                | 5                                 |
| 1.0SMB13A      | 1.0SMB13CA    | K13A                | K13C | 11.10                     | 12.40~13.70                       | 1                   | 18.2                                      | 55.8                | 1                                 |
| 1.0SMB15A      | 1.0SMB15CA    | K15A                | K15C | 12.80                     | 14.30~15.80                       | 1                   | 21.2                                      | 48.0                | 1                                 |
| 1.0SMB16A      | 1.0SMB16CA    | K16A                | K16C | 13.60                     | 15.20~16.80                       | 1                   | 22.5                                      | 45.2                | 1                                 |
| 1.0SMB18A      | 1.0SMB18CA    | K18A                | K18C | 15.30                     | 17.10~18.90                       | 1                   | 25.5                                      | 40.3                | 1                                 |
| 1.0SMB20A      | 1.0SMB20CA    | K20A                | K20C | 17.10                     | 19.00~21.00                       | 1                   | 27.7                                      | 36.7                | 1                                 |
| 1.0SMB22A      | 1.0SMB22CA    | K22A                | K22C | 18.80                     | 20.90~23.10                       | 1                   | 30.6                                      | 33.2                | 1                                 |
| 1.0SMB24A      | 1.0SMB24CA    | K24A                | K24C | 20.50                     | 22.80~25.20                       | 1                   | 33.2                                      | 30.7                | 1                                 |

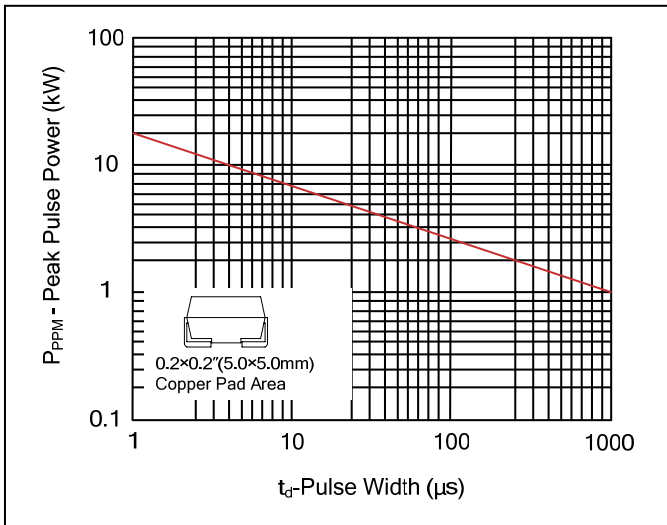
**Electrical Characteristics ( $T_A=25^{\circ}\text{C}$ )**

| Part Number    |               | Device Marking Code |      | Reverse Stand-Off Voltage | Breakdown Voltage @ $I_T$ | Test Current | Maximum Clamping Voltage @ $I_{PP}$ | Peak Pulse Current | Reverse Leakage @ $V_{RWM}$ |
|----------------|---------------|---------------------|------|---------------------------|---------------------------|--------------|-------------------------------------|--------------------|-----------------------------|
| Unidirectional | Bidirectional | UNI                 | BI   | $V_{RWM}(V)$              | $V_{BR}(V)$               | $I_T(mA)$    | $V_C(V)$                            | $I_{PP}(A)$        | $I_R(\mu A)$                |
| 1.0SMB27A      | 1.0SMB27CA    | K27A                | K27C | 23.10                     | 25.70~28.40               | 1            | 37.5                                | 27.2               | 1                           |
| 1.0SMB30A      | 1.0SMB30CA    | K30A                | K30C | 25.60                     | 28.50~31.50               | 1            | 41.4                                | 24.5               | 1                           |
| 1.0SMB33A      | 1.0SMB33CA    | K33A                | K33C | 28.20                     | 31.40~34.70               | 1            | 45.7                                | 22.2               | 1                           |
| 1.0SMB36A      | 1.0SMB36CA    | K36A                | K36C | 30.80                     | 34.20~37.80               | 1            | 49.9                                | 20.3               | 1                           |
| 1.0SMB39A      | 1.0SMB39CA    | K39A                | K39C | 33.30                     | 37.10~41.00               | 1            | 53.9                                | 18.8               | 1                           |
| 1.0SMB43A      | 1.0SMB43CA    | K43A                | K43C | 36.80                     | 40.90~45.20               | 1            | 59.3                                | 17.2               | 1                           |
| 1.0SMB47A      | 1.0SMB47CA    | K47A                | K47C | 40.20                     | 44.70~49.40               | 1            | 64.8                                | 15.7               | 1                           |
| 1.0SMB51A      | 1.0SMB51CA    | K51A                | K51C | 43.60                     | 48.50~53.60               | 1            | 70.1                                | 14.5               | 1                           |
| 1.0SMB56A      | 1.0SMB56CA    | K56A                | K56C | 47.80                     | 53.20~58.80               | 1            | 77.0                                | 13.2               | 1                           |
| 1.0SMB62A      | 1.0SMB62CA    | K62A                | K62C | 53.00                     | 58.90~65.10               | 1            | 85.0                                | 12.0               | 1                           |
| 1.0SMB68A      | 1.0SMB68CA    | K68A                | K68C | 58.10                     | 64.60~71.40               | 1            | 92.0                                | 11.0               | 1                           |

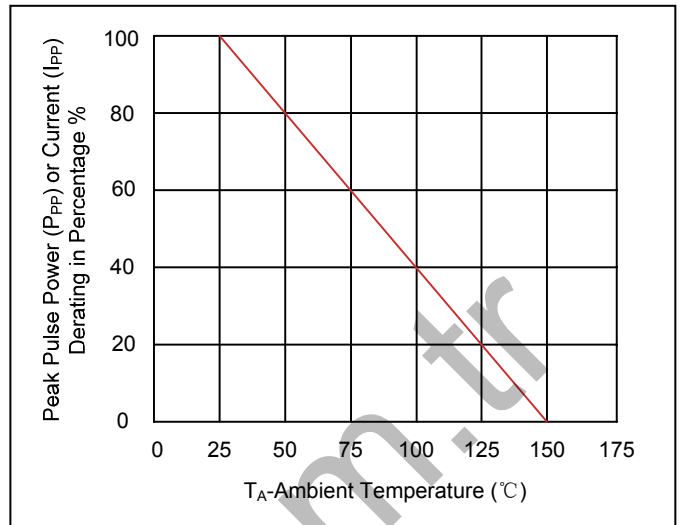
Notes: For bidirectional type having  $V_{RWM}$  of 12V and less, the  $I_R$  limit is double.

**Ratings and Characteristic Curves ( $T_A=25^\circ\text{C}$  unless otherwise noted)**

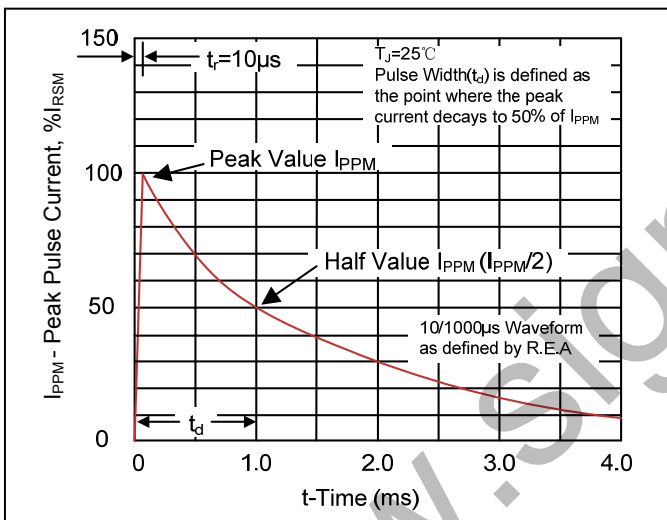
**Figure 1. Peak Pulse Power Rating Curve**



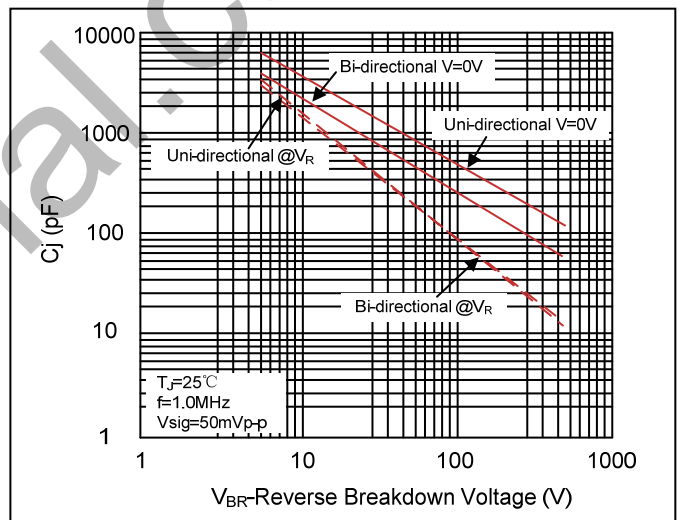
**Figure 2. Pulse Derating Curve**



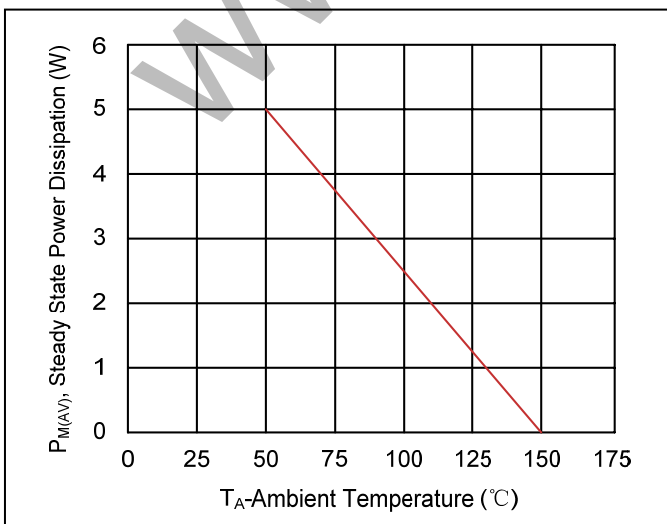
**Figure 3. Pulse Waveform**



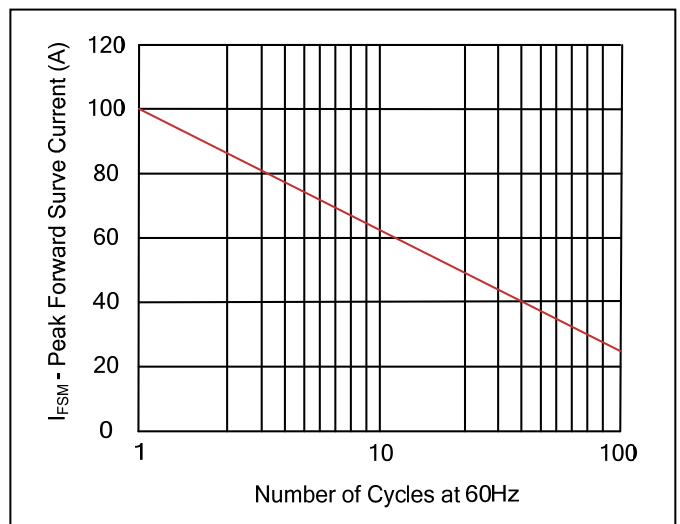
**Figure 4. Typical Junction Capacitance**



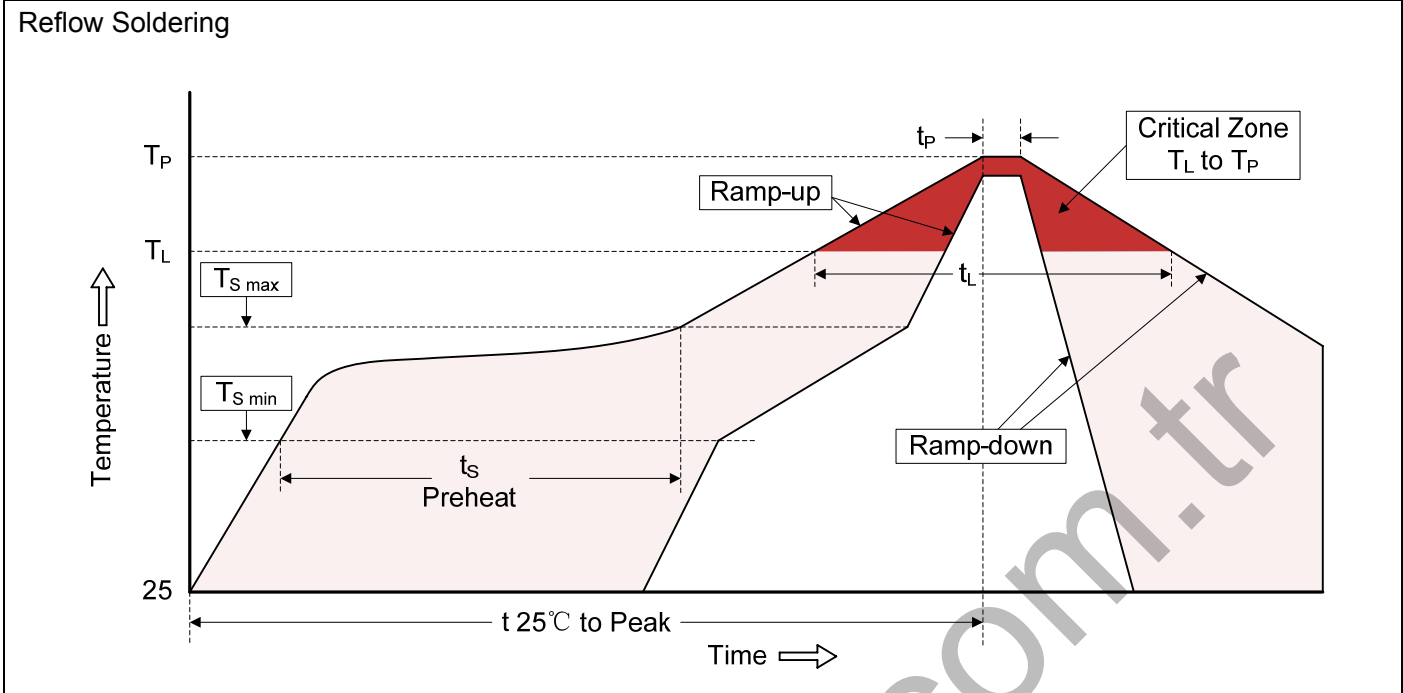
**Figure 5. Steady State Power Dissipation Derating Curve**



**Figure 6. Maximum Non-Repetitive Forward Surge Current Uni-Directional Only**



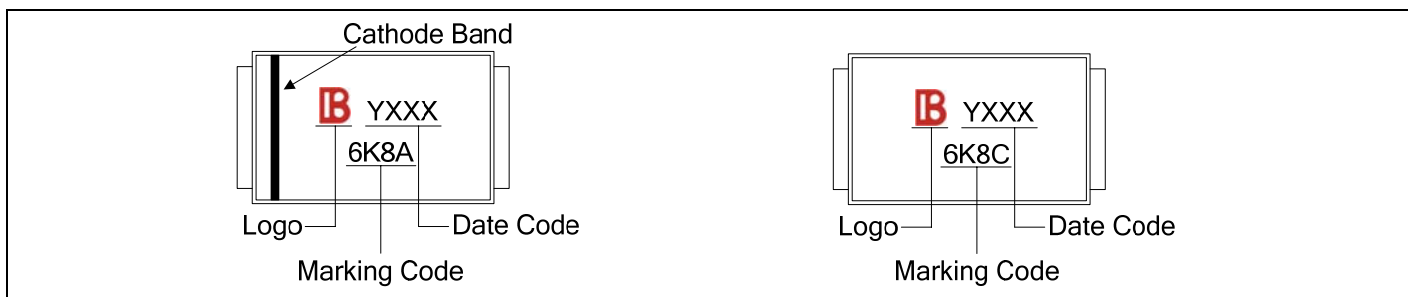
**Recommended Soldering Conditions**

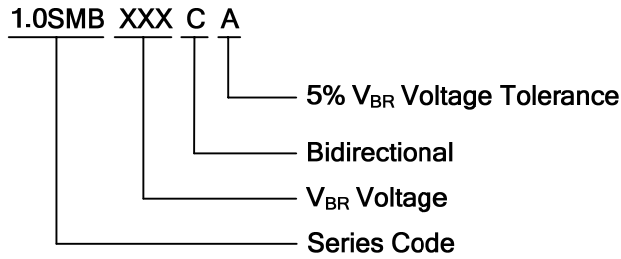


**Recommended Conditions**

| Profile Feature   | Pb-Free Assembly                 |
|---|----------------------------------|
| Average ramp-up rate ( $T_L$ to $T_P$ )   | 3°C/second max.                  |
| Preheat<br>-Temperature Min ( $T_{S\ min}$ )<br>-Temperature Max ( $T_{S\ max}$ )<br>-Time (min to max) ( $t_s$ ) | 150°C<br>200°C<br>60-180 seconds |
| $T_{S\ max}$ to $T_L$<br>-Ramp-up Rate  | 3°C/second max.                  |
| Time maintained above:<br>-Temperature ( $T_L$ )<br>-Time ( $t_L$ )   | 217°C<br>60-150 seconds          |
| Peak Temperature ( $T_P$ )  | 260°C                            |
| Time within 5°C of actual Peak Temperature ( $t_P$ )  | 20-40 seconds                    |
| Ramp-down Rate  | 6°C/second max.                  |
| Time 25°C to Peak Temperature   | 8 minutes max.                   |

**Marking Code**





**Packaging**

| Tape             | Symbol            | Dimension (mm) |
|------------------|-------------------|----------------|
|                  | W                 | 12.00±0.20     |
|                  | P0                | 4.00±0.10      |
|                  | P1                | 8.00±0.10      |
|                  | P2                | 2.00±0.10      |
|                  | D0                | Φ1.55±0.10     |
|                  | D1                | Φ1.5±0.10      |
|                  | E                 | 1.75±0.10      |
|                  | F                 | 5.50±0.10      |
|                  | A0                | 3.86±0.15      |
|                  | B0                | 5.65±0.10      |
|                  | K0                | 2.75±0.15      |
|                  | T                 | 0.25±0.05      |
|                  | D2                | Φ178.0±2.0     |
|                  | D3                | Φ50.0Min.      |
| D4               | Φ13.0±0.5         |                |
| W1               | 16.0±2.0          |                |
| Quantity: 500PCS |                   |                |
|                  | D5                | Φ330.0±2.0     |
|                  | D6                | Φ13.5±0.5      |
|                  | H                 | 2.5±1.0        |
|                  | W2                | 16.0±2.0       |
|                  | Quantity: 3000PCS |                |