

## Transient Voltage Suppressors (TVS) Data Sheet

### Features

- For surface mounted applications in order to optimize board space
- Low profile package
- Glass passivated junction
- Low inductance
- Excellent clamping capability
- 400W peak pulse power capability at 10/1000μs waveform, repetition rate (duty cycle): 0.01%
- Fast response time
- Typical  $I_R$  less than 1μA above 10V
- High Temperature soldering: 260°C/10 seconds at terminals
- Plastic package has underwriters laboratory flammability 94V-0
- Meets MSL level 1, per J-STD-020
- Safety certification: UL: E244458
- AEC-Q101 qualified (SMAJ11~SMAJ440)



### Mechanical Data

- Case: JEDEC DO-214AC. 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: 0.07g

### Applications

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

### Maximum Ratings and Characteristics

Ratings at 25°C ambient temperature unless otherwise specified.

| Rating  | Symbol          | Value       | Units |
|---|-----------------|-------------|-------|
| Peak pulse power dissipation at 10/1000μs waveform (Note1, Note2, Fig.1)  | $P_{PPM}$       | Minimum 400 | Watts |
| Peak pulse current of at 10/1000μs waveform (Note 1, Fig.3)   | $I_{PPM}$       | See Table   | Amps  |
| Steady state power dissipation at $T_A=50^\circ\text{C}$ (Fig.5)  | $P_{M(AV)}$     | 3.3         | Watts |
| Peak forward surge current, 8.3ms single half sine-wave superimposed on rated load, (JEDEC Method) (Note3, Fig.6) | $I_{FSM}$       | 40          | Amps  |
| Operating junction and Storage Temperature Range.   | $T_J, T_{STG}$  | -65 to +150 | °C    |
| Typical thermal resistance junction to lead   | $R_{\theta JL}$ | 30          | °C/W  |
| Typical thermal resistance junction to ambient  | $R_{\theta JA}$ | 120         | °C/W  |

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

2. Mounted on 5.0mm×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 (SMA/DO-214AC)**

|  | Symbol | Millimeters |       | Inches |       |
|--|--------|-------------|-------|--------|-------|
|  |        | Min.        | Max.  | Min.   | Max.  |
|  | L      | 3.99        | 4.50  | 0.157  | 0.177 |
|  | D      | 2.54        | 2.79  | 0.100  | 0.110 |
|  | D1     | 1.25        | 1.65  | 0.049  | 0.065 |
|  | T      | 4.93        | 5.28  | 0.194  | 0.208 |
|  | T1     | 0.76        | 1.52  | 0.030  | 0.060 |
|  | d      | -           | 0.203 | -      | 0.008 |
|  | H      | 2.00        | 2.50  | 0.079  | 0.098 |
|  | H1     | 1.98        | 2.29  | 0.078  | 0.090 |

**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)               |
| SMAJ5.0A       | SMAJ5.0CA     | AE                  | WE | 5.0                       | 6.40~7.00                         | 10                  | 9.2                                       | 43.5                | 800                               |
| SMAJ6.0A       | SMAJ6.0CA     | AG                  | WG | 6.0                       | 6.67~7.37                         | 10                  | 10.3                                      | 38.8                | 800                               |
| SMAJ6.5A       | SMAJ6.5CA     | AK                  | WK | 6.5                       | 7.22~7.98                         | 10                  | 11.2                                      | 35.7                | 500                               |
| SMAJ7.0A       | SMAJ7.0CA     | AM                  | WM | 7.0                       | 7.78~8.60                         | 10                  | 12.0                                      | 33.3                | 200                               |
| SMAJ7.5A       | SMAJ7.5CA     | AP                  | WP | 7.5                       | 8.33~9.21                         | 1                   | 12.9                                      | 31.0                | 100                               |
| SMAJ8.0A       | SMAJ8.0CA     | AR                  | WR | 8.0                       | 8.89~9.83                         | 1                   | 13.6                                      | 29.4                | 50                                |
| SMAJ8.5A       | SMAJ8.5CA     | AT                  | WT | 8.5                       | 9.44~10.40                        | 1                   | 14.4                                      | 27.8                | 20                                |
| SMAJ9.0A       | SMAJ9.0CA     | AV                  | WV | 9.0                       | 10.00~11.10                       | 1                   | 15.4                                      | 26.0                | 10                                |
| SMAJ10A        | SMAJ10CA      | AX                  | WX | 10.0                      | 11.10~12.30                       | 1                   | 17.0                                      | 23.5                | 5                                 |
| SMAJ11A        | SMAJ11CA      | AZ                  | WZ | 11.0                      | 12.20~13.50                       | 1                   | 18.2                                      | 22.0                | 1                                 |
| SMAJ12A        | SMAJ12CA      | BE                  | XE | 12.0                      | 13.30~14.70                       | 1                   | 19.9                                      | 20.1                | 1                                 |
| SMAJ13A        | SMAJ13CA      | BG                  | XG | 13.0                      | 14.40~15.90                       | 1                   | 21.5                                      | 18.6                | 1                                 |
| SMAJ14A        | SMAJ14CA      | BK                  | XK | 14.0                      | 15.60~17.20                       | 1                   | 23.2                                      | 17.2                | 1                                 |
| SMAJ15A        | SMAJ15CA      | BM                  | XM | 15.0                      | 16.70~18.50                       | 1                   | 24.4                                      | 16.4                | 1                                 |
| SMAJ16A        | SMAJ16CA      | BP                  | XP | 16.0                      | 17.80~19.70                       | 1                   | 26.0                                      | 15.4                | 1                                 |
| SMAJ17A        | SMAJ17CA      | BR                  | XR | 17.0                      | 18.90~20.90                       | 1                   | 27.6                                      | 14.5                | 1                                 |
| SMAJ18A        | SMAJ18CA      | BT                  | XT | 18.0                      | 20.00~22.10                       | 1                   | 29.2                                      | 13.7                | 1                                 |
| SMAJ20A        | SMAJ20CA      | BV                  | XV | 20.0                      | 22.20~24.50                       | 1                   | 32.4                                      | 12.3                | 1                                 |
| SMAJ22A        | SMAJ22CA      | BX                  | XX | 22.0                      | 24.40~26.90                       | 1                   | 35.5                                      | 11.3                | 1                                 |
| SMAJ24A        | SMAJ24CA      | BZ                  | XZ | 24.0                      | 26.70~29.50                       | 1                   | 38.9                                      | 10.3                | 1                                 |

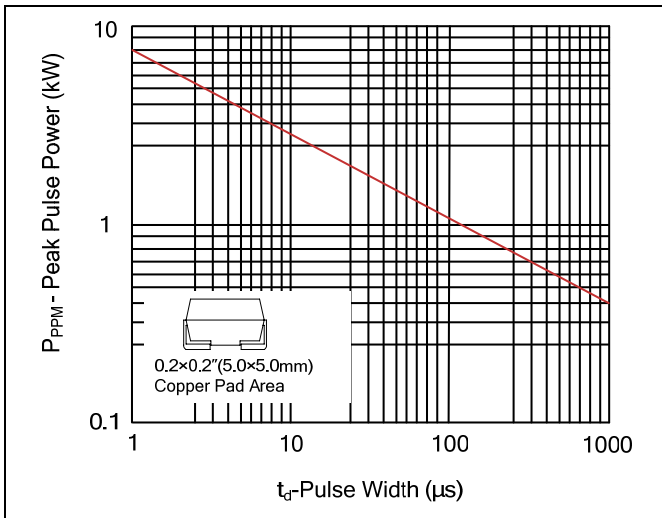
**Electrical Characteristics ( $T_A=25^{\circ}\text{C}$ )**

| 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 | $V_{RWM}(V)$              | $V_{BR}(V)$               | $I_T(mA)$    | $V_C(V)$                            | $I_{PP}(A)$        | $I_R(\mu A)$                |
| SMAJ26A        | SMAJ26CA      | CE                  | YE | 26.0                      | 28.90~31.90               | 1            | 42.1                                | 9.5                | 1                           |
| SMAJ28A        | SMAJ28CA      | CG                  | YG | 28.0                      | 31.10~34.40               | 1            | 45.4                                | 8.8                | 1                           |
| SMAJ30A        | SMAJ30CA      | CK                  | YK | 30.0                      | 33.30~36.80               | 1            | 48.4                                | 8.3                | 1                           |
| SMAJ33A        | SMAJ33CA      | CM                  | YM | 33.0                      | 36.70~40.60               | 1            | 53.3                                | 7.5                | 1                           |
| SMAJ36A        | SMAJ36CA      | CP                  | YP | 36.0                      | 40.00~44.20               | 1            | 58.1                                | 6.9                | 1                           |
| SMAJ40A        | SMAJ40CA      | CR                  | YR | 40.0                      | 44.40~49.10               | 1            | 64.5                                | 6.2                | 1                           |
| SMAJ43A        | SMAJ43CA      | CT                  | YT | 43.0                      | 47.80~52.80               | 1            | 69.4                                | 5.8                | 1                           |
| SMAJ45A        | SMAJ45CA      | CV                  | YV | 45.0                      | 50.00~55.30               | 1            | 72.7                                | 5.5                | 1                           |
| SMAJ48A        | SMAJ48CA      | CX                  | YX | 48.0                      | 53.30~58.90               | 1            | 77.4                                | 5.2                | 1                           |
| SMAJ51A        | SMAJ51CA      | CZ                  | YZ | 51.0                      | 56.70~62.70               | 1            | 82.4                                | 4.9                | 1                           |
| SMAJ54A        | SMAJ54CA      | RE                  | ZE | 54.0                      | 60.00~66.30               | 1            | 87.1                                | 4.6                | 1                           |
| SMAJ58A        | SMAJ58CA      | RG                  | ZG | 58.0                      | 64.40~71.20               | 1            | 93.6                                | 4.3                | 1                           |
| SMAJ60A        | SMAJ60CA      | RK                  | ZK | 60.0                      | 66.70~73.70               | 1            | 96.8                                | 4.1                | 1                           |
| SMAJ64A        | SMAJ64CA      | RM                  | ZM | 64.0                      | 71.10~78.60               | 1            | 103.0                               | 3.9                | 1                           |
| SMAJ70A        | SMAJ70CA      | RP                  | ZP | 70.0                      | 77.80~86.00               | 1            | 113.0                               | 3.5                | 1                           |
| SMAJ75A        | SMAJ75CA      | RR                  | ZR | 75.0                      | 83.30~92.10               | 1            | 121.0                               | 3.3                | 1                           |
| SMAJ78A        | SMAJ78CA      | RT                  | ZT | 78.0                      | 86.70~95.80               | 1            | 126.0                               | 3.2                | 1                           |
| SMAJ85A        | SMAJ85CA      | RV                  | ZV | 85.0                      | 94.40~104.00              | 1            | 137.0                               | 2.9                | 1                           |
| SMAJ90A        | SMAJ90CA      | RX                  | ZX | 90.0                      | 100.00~111.00             | 1            | 146.0                               | 2.7                | 1                           |
| SMAJ100A       | SMAJ100CA     | RZ                  | ZZ | 100.0                     | 111.00~123.00             | 1            | 162.0                               | 2.5                | 1                           |
| SMAJ110A       | SMAJ110CA     | SE                  | VE | 110.0                     | 122.00~135.00             | 1            | 177.0                               | 2.3                | 1                           |
| SMAJ120A       | SMAJ120CA     | SG                  | VG | 120.0                     | 133.00~147.00             | 1            | 193.0                               | 2.1                | 1                           |
| SMAJ130A       | SMAJ130CA     | SK                  | VK | 130.0                     | 144.00~159.00             | 1            | 209.0                               | 1.9                | 1                           |
| SMAJ150A       | SMAJ150CA     | SM                  | VM | 150.0                     | 167.00~185.00             | 1            | 243.0                               | 1.6                | 1                           |
| SMAJ160A       | SMAJ160CA     | SP                  | VP | 160.0                     | 178.00~197.00             | 1            | 259.0                               | 1.5                | 1                           |
| SMAJ170A       | SMAJ170CA     | SR                  | VR | 170.0                     | 189.00~209.00             | 1            | 275.0                               | 1.5                | 1                           |
| SMAJ180A       | SMAJ180CA     | ST                  | VT | 180.0                     | 201.00~222.00             | 1            | 292.0                               | 1.4                | 1                           |
| SMAJ190A       | SMAJ190CA     | SU                  | YU | 190.0                     | 211.00~233.00             | 1            | 308.0                               | 1.3                | 1                           |
| SMAJ200A       | SMAJ200CA     | SV                  | VV | 200.0                     | 224.00~247.00             | 1            | 324.0                               | 1.2                | 1                           |
| SMAJ210A       | SMAJ210CA     | SW                  | YW | 210.0                     | 237.00~263.00             | 1            | 340.0                               | 1.2                | 1                           |
| SMAJ220A       | SMAJ220CA     | GE                  | VX | 220.0                     | 246.00~272.00             | 1            | 356.0                               | 1.1                | 1                           |
| SMAJ250A       | SMAJ250CA     | SZ                  | VZ | 250.0                     | 279.00~309.00             | 1            | 405.0                               | 1.0                | 1                           |
| SMAJ300A       | SMAJ300CA     | TE                  | UE | 300.0                     | 335.00~371.00             | 1            | 486.0                               | 0.8                | 1                           |
| SMAJ350A       | SMAJ350CA     | TG                  | UG | 350.0                     | 391.00~432.00             | 1            | 567.0                               | 0.7                | 1                           |
| SMAJ400A       | SMAJ400CA     | TK                  | UK | 400.0                     | 447.00~494.00             | 1            | 648.0                               | 0.6                | 1                           |
| SMAJ440A       | SMAJ440CA     | TM                  | UM | 440.0                     | 492.00~543.00             | 1            | 713.0                               | 0.6                | 1                           |

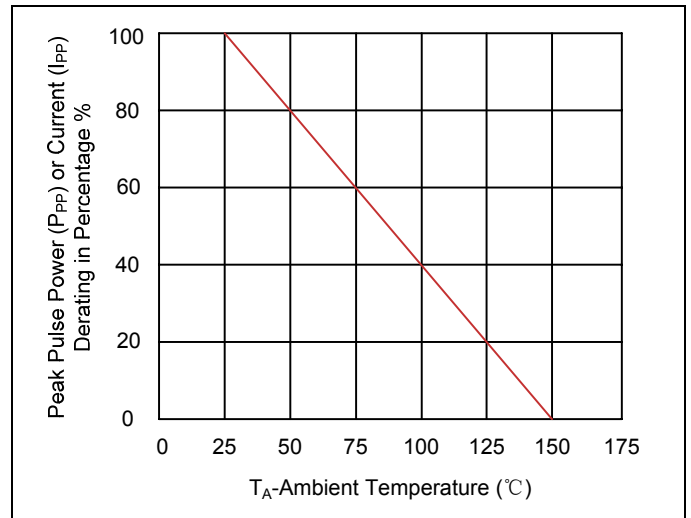
Notes: For bidirectional type having  $V_{RWM}$  of 10V and less, the  $I_R$  limit is double.

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

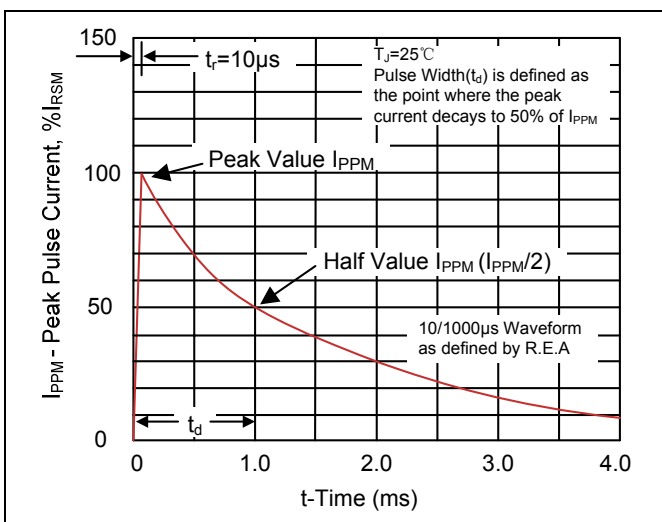
**Figure 1. Peak Pulse Power Rating Curve**



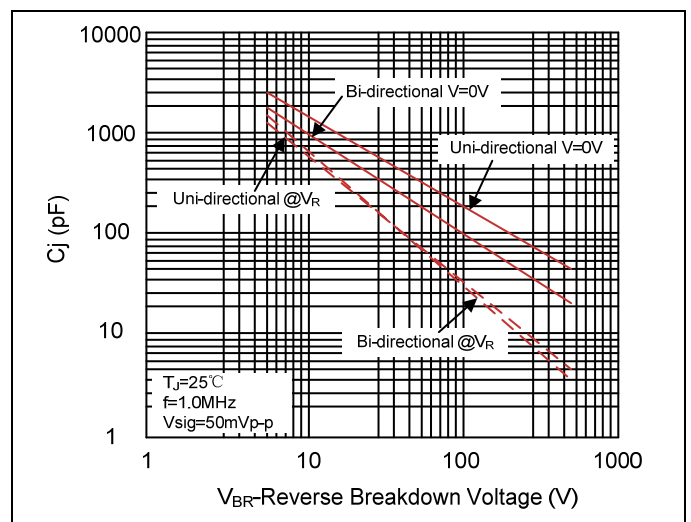
**Figure 2. Pulse Derating Curve**



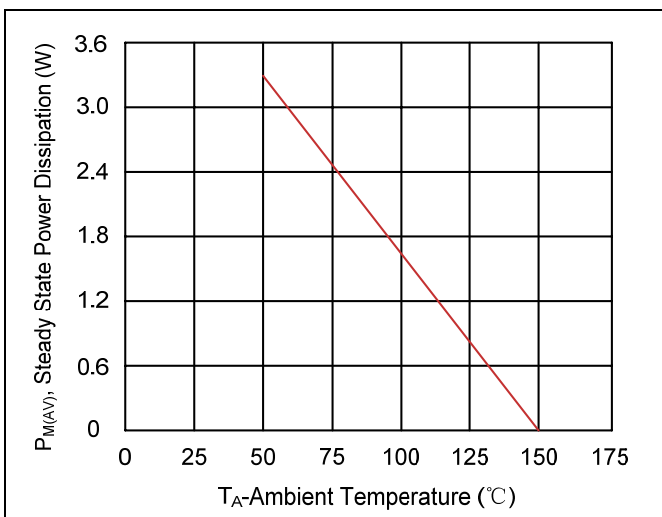
**Figure 3. Pulse Waveform**



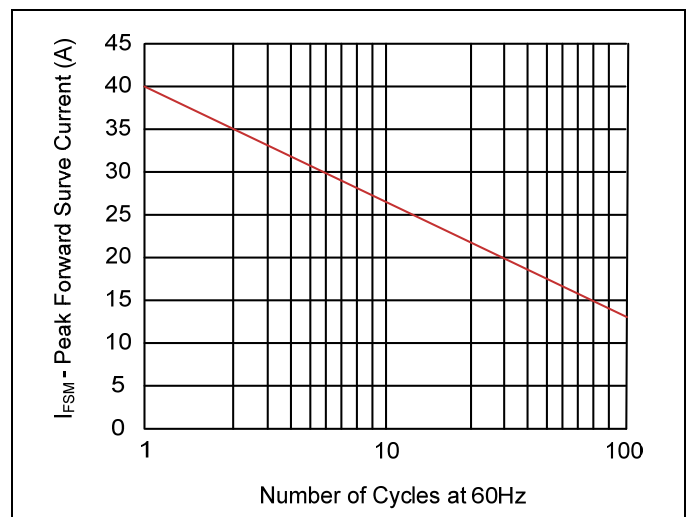
**Figure 4. Typical Junction Capacitance**



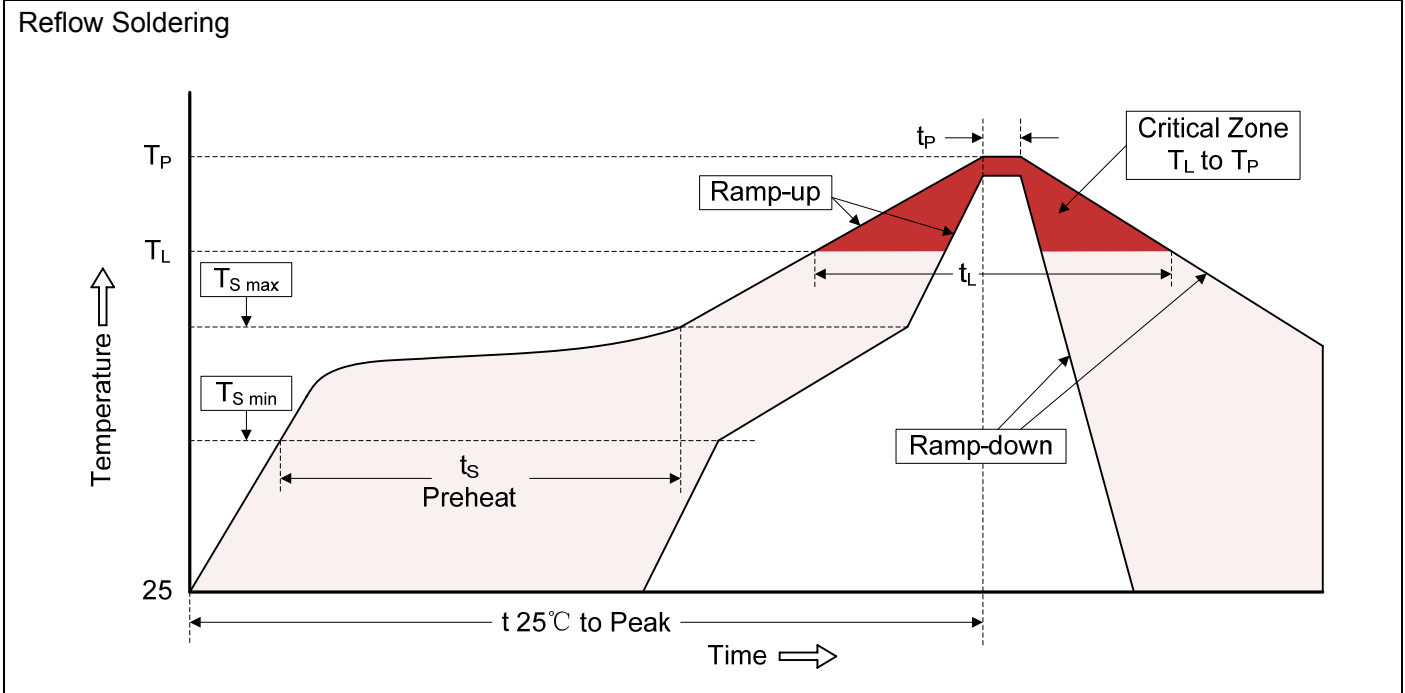
**Figure 5. Steady State Power Dissipation Derating Curve**



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



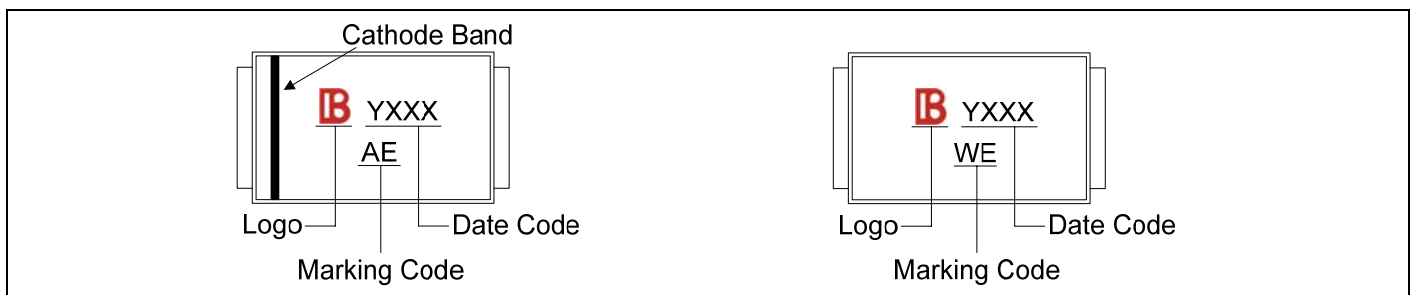
**Recommended Soldering Conditions**

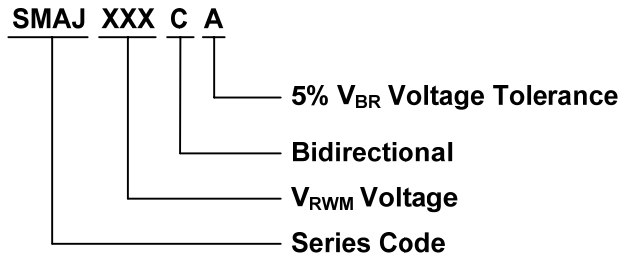


**Recommended Conditions**

| 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                | 4.00±0.10      |
|          | P2                | 2.00±0.10      |
|          | D0                | Φ1.5±0.10      |
|          | D1                | Φ1.5±0.10      |
|          | E                 | 1.75±0.10      |
|          | F                 | 5.50±0.05      |
|          | A0                | 2.79±0.10      |
|          | B0                | 5.33±0.10      |
|          | K0                | 2.55±0.15      |
|          | T                 | 0.25±0.05      |
|          | 7" Reel           | D2             |
|          | D3                | Φ50.0Min.      |
|          | D4                | Φ13.0±0.5      |
|          | W1                | 16.0±2.0       |
|          | Quantity: 1000PCS |                |
| 13" Reel | D5                | Φ330.0±2.0     |
|          | D6                | Φ13.5±0.5      |
|          | H                 | 2.5±1.0        |
|          | W2                | 16.0±2.0       |
|          | Quantity: 5000PCS |                |

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