

## 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
- 1500W peak pulse power capability at 10/1000μs waveform, repetition rate (duty cycle): 0.01%
- Fast response time
- Typical  $I_R$  less than 1μA above 12V
- 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



### Mechanical Data

- Case: JEDEC DO-214AB. 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: 16mm tape (EIA STD RS-481)
- Weight: 0.26g

### 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 1500 | 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)  | $P_{M(AV)}$     | 6.5          | Watts |
| Peak forward surge current, 8.3ms single half sine-wave superimposed on rated load, (JEDEC Method) (Note3, Fig.6) | $I_{FSM}$       | 200          | Amps  |
| Operating junction and Storage Temperature Range.   | $T_J, T_{STG}$  | -55 to +150  | °C    |
| Typical thermal resistance junction to lead   | $R_{\theta JL}$ | 15           | °C/W  |
| Typical thermal resistance junction to ambient  | $R_{\theta JA}$ | 75           | °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 8.0mm×8.0mm copper pads to each terminal.

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

**Dimensions (SMC/DO-214AB)**

| Symbol | Millimeters |       | Inches |       |
|--------|-------------|-------|--------|-------|
|        | Min.        | Max.  | Min.   | Max.  |
| L      | 6.60        | 7.11  | 0.260  | 0.280 |
| D      | 5.59        | 6.22  | 0.220  | 0.245 |
| D1     | 2.90        | 3.20  | 0.114  | 0.126 |
| T      | 7.75        | 8.13  | 0.305  | 0.320 |
| T1     | 0.76        | 1.52  | 0.030  | 0.060 |
| d      | -           | 0.203 | -      | 0.008 |
| H      | 2.20        | 2.80  | 0.087  | 0.110 |
| H1     | 2.06        | 2.62  | 0.079  | 0.103 |

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

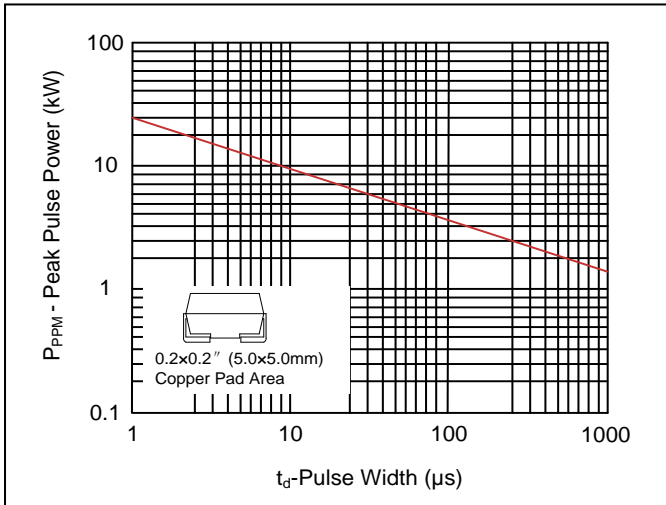
| Part Number    |               | Device Marking Code |      | Reverse Stand-Off Voltage | Breakdown Voltage @I <sub>T</sub> | Test Current        | Maximum Clamping Voltage @I <sub>PP</sub> | Peak Pulse Current  | Reverse Leakage @V <sub>RWM</sub> |
|----------------|---------------|---------------------|------|---------------------------|-----------------------------------|---------------------|---|---------------------|-----------------------------------|
| 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)               |
| 1.5SMC6.8A     | 1.5SMC6.8CA   | 6V8A                | 6V8C | 5.80                      | 6.45~7.14                         | 10                  | 10.5                                      | 144.8               | 1000                              |
| 1.5SMC7.5A     | 1.5SMC7.5CA   | 7V5A                | 7V5C | 6.40                      | 7.13~7.88                         | 10                  | 11.3                                      | 134.5               | 500                               |
| 1.5SMC8.2A     | 1.5SMC8.2CA   | 8V2A                | 8V2C | 7.02                      | 7.79~8.61                         | 10                  | 12.1                                      | 125.6               | 200                               |
| 1.5SMC9.1A     | 1.5SMC9.1CA   | 9V1A                | 9V1C | 7.78                      | 8.65~9.55                         | 1                   | 13.4                                      | 113.4               | 50                                |
| 1.5SMC10A      | 1.5SMC10CA    | 10A                 | 10C  | 8.55                      | 9.50~10.50                        | 1                   | 14.5                                      | 104.8               | 10                                |
| 1.5SMC11A      | 1.5SMC11CA    | 11A                 | 11C  | 9.40                      | 10.50~11.60                       | 1                   | 15.6                                      | 97.4                | 5                                 |
| 1.5SMC12A      | 1.5SMC12CA    | 12A                 | 12C  | 10.20                     | 11.40~12.60                       | 1                   | 16.7                                      | 91.0                | 5                                 |
| 1.5SMC13A      | 1.5SMC13CA    | 13A                 | 13C  | 11.10                     | 12.40~13.70                       | 1                   | 18.2                                      | 83.5                | 1                                 |
| 1.5SMC15A      | 1.5SMC15CA    | 15A                 | 15C  | 12.80                     | 14.30~15.80                       | 1                   | 21.2                                      | 71.7                | 1                                 |
| 1.5SMC16A      | 1.5SMC16CA    | 16A                 | 16C  | 13.60                     | 15.20~16.80                       | 1                   | 22.5                                      | 67.6                | 1                                 |
| 1.5SMC18A      | 1.5SMC18CA    | 18A                 | 18C  | 15.30                     | 17.10~18.90                       | 1                   | 25.2                                      | 60.3                | 1                                 |
| 1.5SMC20A      | 1.5SMC20CA    | 20A                 | 20C  | 17.10                     | 19.00~21.00                       | 1                   | 27.7                                      | 54.9                | 1                                 |
| 1.5SMC22A      | 1.5SMC22CA    | 22A                 | 22C  | 18.80                     | 20.90~23.10                       | 1                   | 30.6                                      | 49.7                | 1                                 |
| 1.5SMC24A      | 1.5SMC24CA    | 24A                 | 24C  | 20.50                     | 22.80~25.20                       | 1                   | 33.2                                      | 45.8                | 1                                 |
| 1.5SMC27A      | 1.5SMC27CA    | 27A                 | 27C  | 23.10                     | 25.70~28.40                       | 1                   | 37.5                                      | 40.5                | 1                                 |
| 1.5SMC30A      | 1.5SMC30CA    | 30A                 | 30C  | 25.60                     | 28.50~31.50                       | 1                   | 41.4                                      | 36.7                | 1                                 |
| 1.5SMC33A      | 1.5SMC33CA    | 33A                 | 33C  | 28.20                     | 31.40~34.70                       | 1                   | 45.7                                      | 33.3                | 1                                 |
| 1.5SMC36A      | 1.5SMC36CA    | 36A                 | 36C  | 30.80                     | 34.20~37.80                       | 1                   | 49.9                                      | 30.5                | 1                                 |
| 1.5SMC39A      | 1.5SMC39CA    | 39A                 | 39C  | 33.30                     | 37.10~41.00                       | 1                   | 53.9                                      | 28.2                | 1                                 |

| 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   | $V_{RWM}(V)$              | $V_{BR}(V)$               | $I_T(mA)$    | $V_C(V)$                            | $I_{PP}(A)$        | $I_R(\mu A)$                |
| 1.5SMC43A      | 1.5SMC43CA    | 43A                 | 43C  | 36.80                     | 40.90~45.20               | 1            | 59.3                                | 25.6               | 1                           |
| 1.5SMC47A      | 1.5SMC47CA    | 47A                 | 47C  | 40.20                     | 44.70~49.40               | 1            | 64.8                                | 23.5               | 1                           |
| 1.5SMC51A      | 1.5SMC51CA    | 51A                 | 51C  | 43.60                     | 48.50~53.60               | 1            | 70.1                                | 21.7               | 1                           |
| 1.5SMC56A      | 1.5SMC56CA    | 56A                 | 56C  | 47.80                     | 53.20~58.80               | 1            | 77.0                                | 19.7               | 1                           |
| 1.5SMC62A      | 1.5SMC62CA    | 62A                 | 62C  | 53.00                     | 58.90~65.10               | 1            | 85.0                                | 17.9               | 1                           |
| 1.5SMC68A      | 1.5SMC68CA    | 68A                 | 68C  | 58.10                     | 64.60~71.40               | 1            | 92.0                                | 16.5               | 1                           |
| 1.5SMC75A      | 1.5SMC75CA    | 75A                 | 75C  | 64.10                     | 71.30~78.80               | 1            | 103.0                               | 14.8               | 1                           |
| 1.5SMC82A      | 1.5SMC82CA    | 82A                 | 82C  | 70.10                     | 77.90~86.10               | 1            | 113.0                               | 13.5               | 1                           |
| 1.5SMC91A      | 1.5SMC91CA    | 91A                 | 91C  | 77.80                     | 86.50~95.50               | 1            | 125.0                               | 12.2               | 1                           |
| 1.5SMC100A     | 1.5SMC100CA   | 100A                | 100C | 85.50                     | 95.00~105.00              | 1            | 137.0                               | 11.1               | 1                           |
| 1.5SMC110A     | 1.5SMC110CA   | 110A                | 110C | 94.00                     | 105.00~116.00             | 1            | 152.0                               | 10.0               | 1                           |
| 1.5SMC120A     | 1.5SMC120CA   | 120A                | 120C | 102.00                    | 114.00~126.00             | 1            | 165.0                               | 9.2                | 1                           |
| 1.5SMC130A     | 1.5SMC130CA   | 130A                | 130C | 111.00                    | 124.00~137.00             | 1            | 179.0                               | 8.5                | 1                           |
| 1.5SMC150A     | 1.5SMC150CA   | 150A                | 150C | 128.00                    | 143.00~158.00             | 1            | 207.0                               | 7.3                | 1                           |
| 1.5SMC160A     | 1.5SMC160CA   | 160A                | 160C | 136.00                    | 152.00~168.00             | 1            | 219.0                               | 6.9                | 1                           |
| 1.5SMC170A     | 1.5SMC170CA   | 170A                | 170C | 145.00                    | 162.00~179.00             | 1            | 234.0                               | 6.5                | 1                           |
| 1.5SMC180A     | 1.5SMC180CA   | 180A                | 180C | 154.00                    | 171.00~189.00             | 1            | 246.0                               | 6.2                | 1                           |
| 1.5SMC200A     | 1.5SMC200CA   | 200A                | 200C | 171.00                    | 190.00~210.00             | 1            | 274.0                               | 5.5                | 1                           |
| 1.5SMC220A     | 1.5SMC220CA   | 220A                | 220C | 185.00                    | 209.00~231.00             | 1            | 328.0                               | 4.6                | 1                           |
| 1.5SMC250A     | 1.5SMC250CA   | 250A                | 250C | 214.00                    | 237.00~263.00             | 1            | 344.0                               | 4.4                | 1                           |
| 1.5SMC300A     | 1.5SMC300CA   | 300A                | 300C | 256.00                    | 285.00~315.00             | 1            | 414.0                               | 3.7                | 1                           |
| 1.5SMC350A     | 1.5SMC350CA   | 350A                | 350C | 300.00                    | 332.00~368.00             | 1            | 482.0                               | 3.2                | 1                           |
| 1.5SMC400A     | 1.5SMC400CA   | 400A                | 400C | 342.00                    | 380.00~420.00             | 1            | 548.0                               | 2.8                | 1                           |
| 1.5SMC440A     | 1.5SMC440CA   | 440A                | 440C | 376.00                    | 418.00~462.00             | 1            | 602.0                               | 2.5                | 1                           |
| 1.5SMC480A     | 1.5SMC480CA   | 480A                | 480C | 408.00                    | 456.00~504.00             | 1            | 658.0                               | 2.3                | 1                           |
| 1.5SMC510A     | 1.5SMC510CA   | 510A                | 510C | 434.00                    | 485.00~535.00             | 1            | 698.0                               | 2.1                | 1                           |
| 1.5SMC530A     | 1.5SMC530CA   | 530A                | 530C | 450.00                    | 503.50~556.50             | 1            | 725.0                               | 2.1                | 1                           |
| 1.5SMC540A     | 1.5SMC540CA   | 540A                | 540C | 459.00                    | 513.00~567.00             | 1            | 740.0                               | 2.0                | 1                           |
| 1.5SMC550A     | 1.5SMC550CA   | 550A                | 550C | 467.00                    | 522.50~577.50             | 1            | 760.0                               | 2.0                | 1                           |

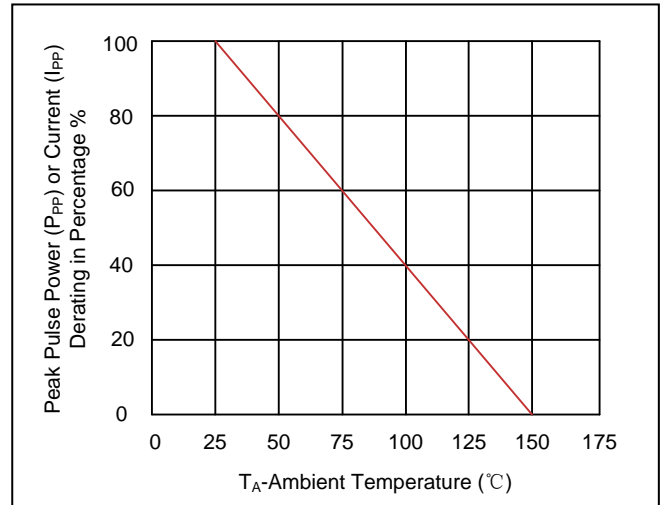
Notes: For bidirectional type having  $V_{RWM}$  of 10V and less, the  $I_R$  limit is double.

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

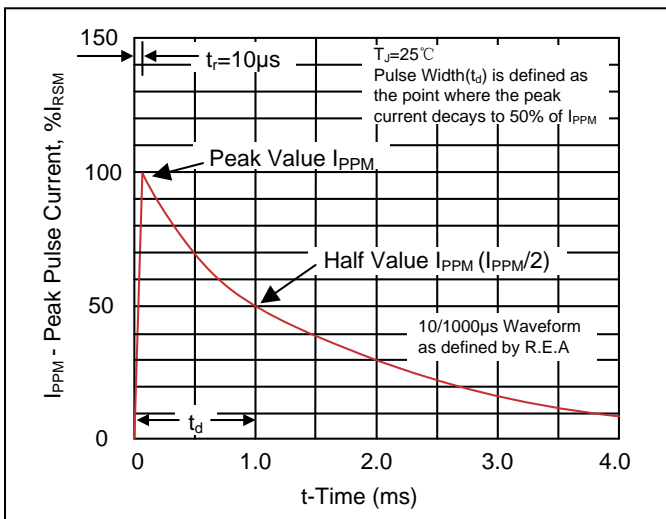
**Figure 1. Peak Pulse Power Rating Curve**



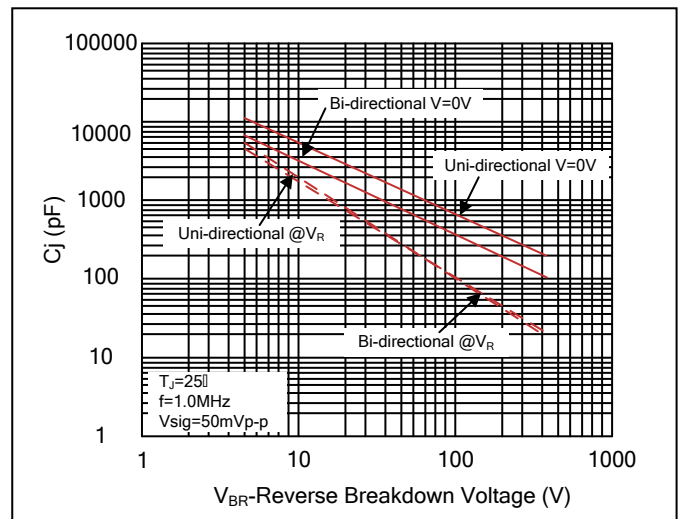
**Figure 2. Pulse Derating Curve**



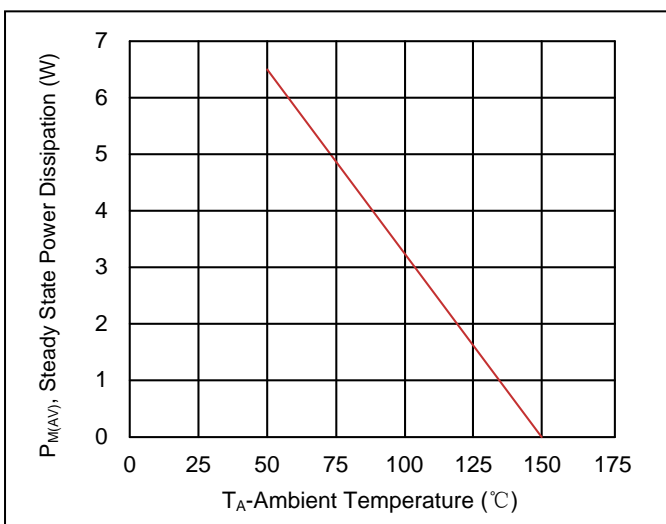
**Figure 3. Pulse Waveform**



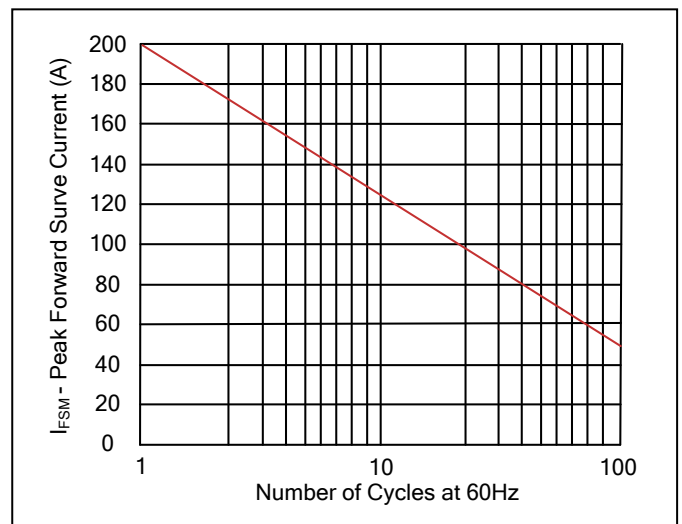
**Figure 4. Typical Junction Capacitance**



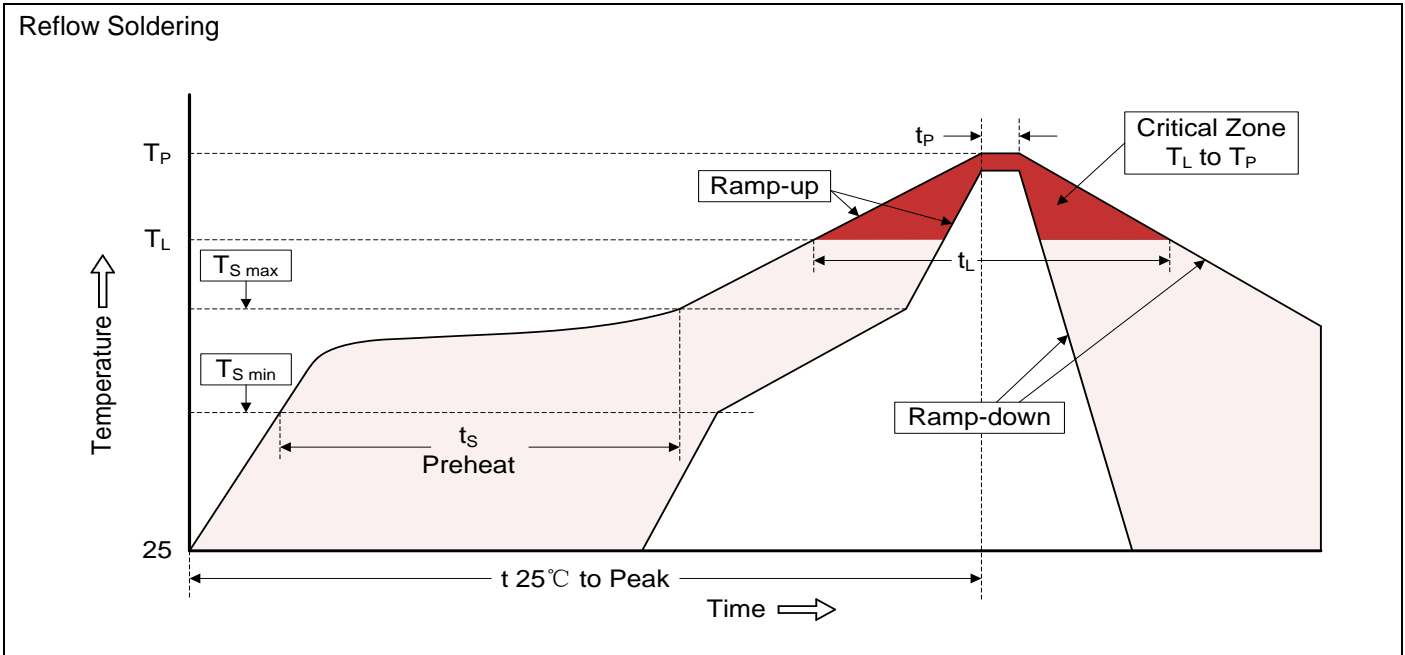
**Figure 5. Steady State Power Dissipation Derating Curve**



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



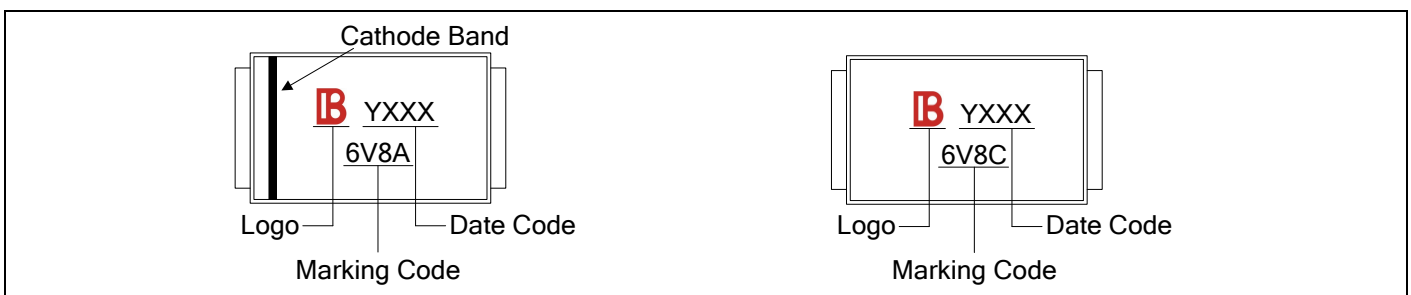
**Recommended Soldering Conditions**



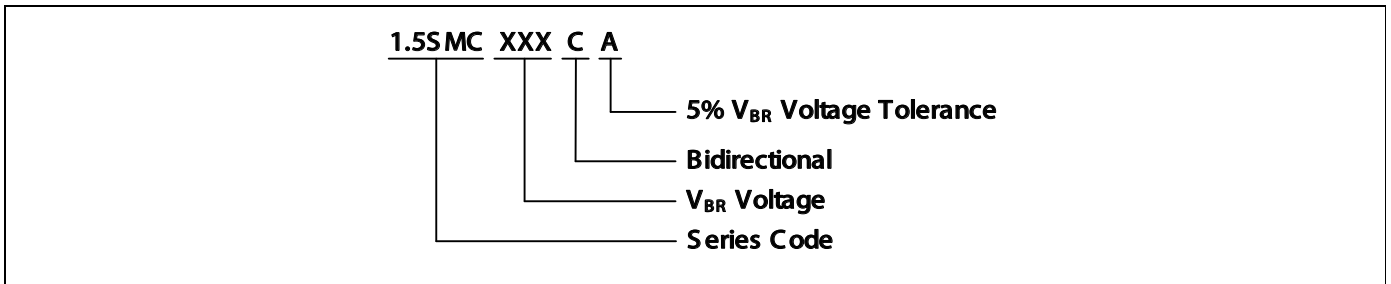
Recommended Conditions

| 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**



**Part Number Code**



**Ordering Code for Different Package**

7 inch reel package: Add suffix "/TR7" at the end of the part number, such as 1.5SMC47A/TR7

13 inch reel package: Add suffix "/TR13" at the end of the part number, such as 1.5SMC250CA/TR13

**Packaging**

| Tape             |           | Symbol            | Dimension (mm) |
|------------------|-----------|-------------------|----------------|
|                  |           | W                 | 16.00±0.20     |
|                  |           | P0                | 4.00±0.10      |
|                  |           | P1                | 8.00±0.10      |
|                  |           | P2                | 2.00±0.10      |
|                  |           | D0                | Φ1.5±0.10      |
|                  |           | D1                | Φ1.5±0.10      |
|                  |           | E                 | 1.75±0.10      |
|                  |           | F                 | 7.50±0.10      |
|                  |           | A0                | 6.27±0.15      |
|                  |           | B0                | 8.30±0.10      |
|                  |           | K0                | 3.15±0.15      |
|                  |           | T                 | 0.30±0.05      |
|                  |           | D2                | Φ178.0±2.0     |
|                  |           | D3                | Φ50.0Min.      |
| D4               | Φ13.0±0.5 |                   |                |
| W1               | 20.0±2.0  |                   |                |
| Quantity: 500PCS |           |                   |                |
| 7" Reel          |           | D5                | Φ330.0±2.0     |
|                  |           | D6                | Φ13.5±0.5      |
|                  |           | H                 | 2.5±1.0        |
|                  |           | W2                | 20.0±2.0       |
|                  |           | Quantity: 3000PCS |                |
| 13" Reel         |           |                   |                |
|                  |           |                   |                |
|                  |           |                   |                |
|                  |           |                   |                |
|                  |           |                   |                |

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