

## Transient Voltage Suppressors (TVS) Data Sheet

### Features

- Glass passivated junction
- Low zener impedance
- Excellent clamping capability
- 400W 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 13V.
- Plastic package has underwriters laboratory flammability 94V-0
- Meets MSL level 1, per J-STD-020.

### Mechanical Data

- Case: JEDEC DO-214AC Moulded plastic
- Terminal:solderplated, solderable per MIL-STD-750, Method 2026
- Polarity: Color band denotes cathode except bi-directional models
- Mounting Position: Any

### 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, Fig.1)                                    | $P_{PPM}$       | Minimum 400 | 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 $T_L=75^{\circ}$ C (Fig.4)                                               | $P_{M(AV)}$     | 3.3         | Watts          |
| Peak forward surge current, 8.3ms single half sine-wave superimposed on rated load, (JEDEC Method) (Note2) | $I_{FSM}$       | 40          | Amps           |
| Operating junction and Storage Temperature Range.                                                          | $T_J, T_{STG}$  | -55 to +150 | $^{\circ}$ C   |
| Typical thermal resistance junction to lead                                                                | $R_{\theta JL}$ | 30          | $^{\circ}$ C/W |
| Typical thermal resistance junction to ambient                                                             | $R_{\theta JA}$ | 120         | $^{\circ}$ C/W |

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

2. 8.3ms single half sine-wave, or equivalent square wave, duty cycle=4 pulses per minutes maximum.

## Dimensions (DO-214AC/SMA)

| Symbol | Millimeters |      | Inches |       |
|--------|-------------|------|--------|-------|
|        | Min.        | Max. | Min.   | Max.  |
| L      | 3.90        | 4.50 | 0.154  | 0.177 |
| D      | 2.40        | 2.80 | 0.094  | 0.110 |
| D1     | 1.30        | 1.70 | 0.051  | 0.067 |
| T      | 4.80        | 5.30 | 0.189  | 0.208 |
| T1     | 0.76        | 1.52 | 0.030  | 0.060 |
| d      | 0.10        | 0.20 | 0.003  | 0.008 |
| H      | 2.00        | 2.50 | 0.078  | 0.098 |

## 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                       | 6.4~7.0                           | 10                  | 9.2                                       | 43.5                | 800                               |
| SMAJ6.0A       | SMAJ6.0CA     | AG                  | WG | 6.0                       | 6.7~7.4                           | 10                  | 10.3                                      | 38.8                | 800                               |
| SMAJ6.5A       | SMAJ6.5CA     | AK                  | WK | 6.5                       | 7.2~8.0                           | 10                  | 11.2                                      | 35.7                | 500                               |
| SMAJ7.0A       | SMAJ7.0CA     | AM                  | WM | 7.0                       | 7.8~8.6                           | 10                  | 12.0                                      | 33.3                | 200                               |
| SMAJ7.5A       | SMAJ7.5CA     | AP                  | WP | 7.5                       | 8.3~9.2                           | 1                   | 12.9                                      | 31.0                | 100                               |
| SMAJ8.0A       | SMAJ8.0CA     | AR                  | WR | 8.0                       | 8.9~9.8                           | 1                   | 13.6                                      | 29.4                | 50                                |
| SMAJ8.5A       | SMAJ8.5CA     | AT                  | WT | 8.5                       | 9.4~10.4                          | 1                   | 14.4                                      | 27.8                | 10                                |
| SMAJ9.0A       | SMAJ9.0CA     | AV                  | WV | 9.0                       | 10.0~11.0                         | 1                   | 15.4                                      | 26.0                | 5                                 |
| SMAJ10A        | SMAJ10CA      | AX                  | WX | 10.0                      | 11.1~12.3                         | 1                   | 17.0                                      | 23.5                | 5                                 |
| SMAJ11A        | SMAJ11CA      | AZ                  | WZ | 11.0                      | 12.2~13.5                         | 1                   | 18.2                                      | 22.0                | 1                                 |
| SMAJ12A        | SMAJ12CA      | BE                  | XE | 12.0                      | 13.3~14.7                         | 1                   | 19.9                                      | 20.1                | 1                                 |
| SMAJ13A        | SMAJ13CA      | BG                  | XG | 13.0                      | 14.4~15.9                         | 1                   | 21.5                                      | 18.6                | 1                                 |
| SMAJ14A        | SMAJ14CA      | BK                  | XK | 14.0                      | 15.6~17.2                         | 1                   | 23.2                                      | 17.2                | 1                                 |
| SMAJ15A        | SMAJ15CA      | BM                  | XM | 15.0                      | 16.7~18.5                         | 1                   | 24.4                                      | 16.4                | 1                                 |
| SMAJ16A        | SMAJ16CA      | BP                  | XP | 16.0                      | 17.8~19.7                         | 1                   | 26.0                                      | 15.4                | 1                                 |
| SMAJ17A        | SMAJ17CA      | BR                  | XR | 17.0                      | 18.9~20.9                         | 1                   | 27.6                                      | 14.5                | 1                                 |
| SMAJ18A        | SMAJ18CA      | BT                  | XT | 18.0                      | 20.0~22.1                         | 1                   | 29.2                                      | 13.7                | 1                                 |
| SMAJ19A        | SMAJ19CA      | BW                  | XW | 19.0                      | 21.1~23.3                         | 1                   | 30.8                                      | 13.0                | 1                                 |
| SMAJ20A        | SMAJ20CA      | BV                  | XV | 20.0                      | 22.2~24.5                         | 1                   | 32.4                                      | 12.4                | 1                                 |
| SMAJ22A        | SMAJ22CA      | BX                  | XX | 22.0                      | 24.4~26.9                         | 1                   | 35.5                                      | 11.3                | 1                                 |
| SMAJ24A        | SMAJ24CA      | BZ                  | XZ | 24.0                      | 26.7~29.5                         | 1                   | 38.9                                      | 10.3                | 1                                 |
| SMAJ26A        | SMAJ26CA      | CE                  | YE | 26.0                      | 28.9~31.9                         | 1                   | 42.1                                      | 9.5                 | 1                                 |

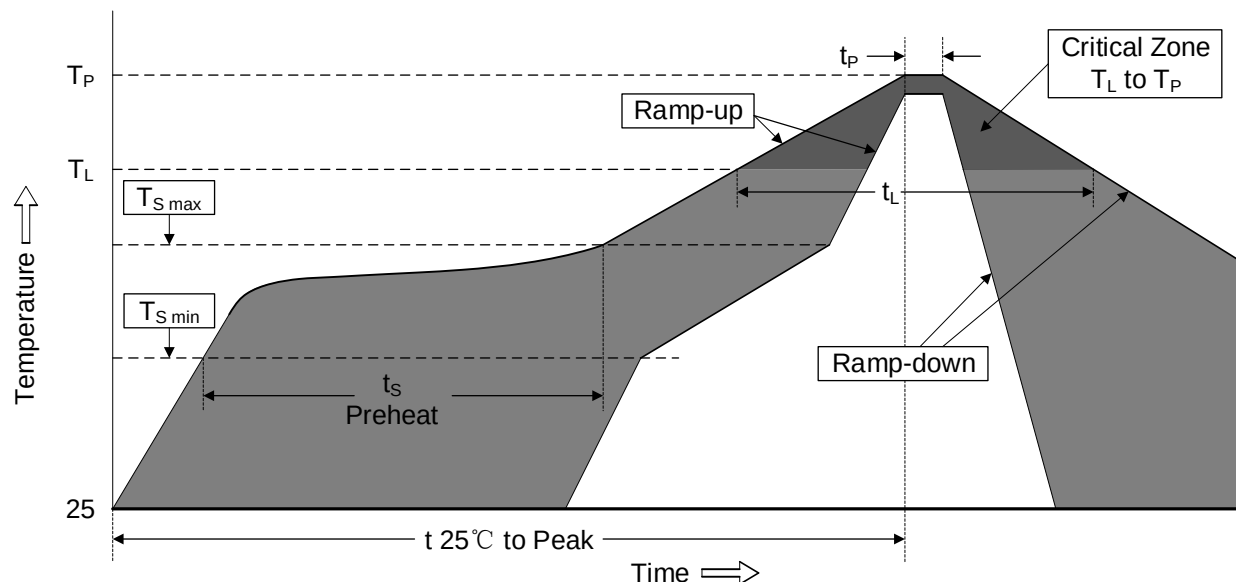
Electrical Characteristics ( $T_A=25^{\circ}\text{C}$ )

| 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 | $V_{RWM}(V)$              | $V_{BR}(V)$               | $I_T(mA)$    | $V_C(V)$                            | $I_{PP}(A)$        | $I_R(\mu A)$                |
| SMAJ28A        | SMAJ28CA      | CG                  | YG | 28.0                      | 31.1~34.4                 | 1            | 45.4                                | 8.8                | 1                           |
| SMAJ30A        | SMAJ30CA      | CK                  | YK | 30.0                      | 33.3~36.8                 | 1            | 48.4                                | 8.3                | 1                           |
| SMAJ33A        | SMAJ33CA      | CM                  | YM | 33.0                      | 36.7~40.6                 | 1            | 53.3                                | 7.5                | 1                           |
| SMAJ36A        | SMAJ36CA      | CP                  | YP | 36.0                      | 40.0~44.2                 | 1            | 58.1                                | 6.9                | 1                           |
| SMAJ40A        | SMAJ40CA      | CR                  | YR | 40.0                      | 44.4~49.1                 | 1            | 64.5                                | 6.2                | 1                           |
| SMAJ43A        | SMAJ43CA      | CT                  | YT | 43.0                      | 47.8~52.8                 | 1            | 69.4                                | 5.8                | 1                           |
| SMAJ45A        | SMAJ45CA      | CV                  | YV | 45.0                      | 50.0~55.3                 | 1            | 72.7                                | 5.5                | 1                           |
| SMAJ48A        | SMAJ48CA      | CX                  | YX | 48.0                      | 53.3~58.9                 | 1            | 77.4                                | 5.2                | 1                           |
| SMAJ51A        | SMAJ51CA      | CZ                  | YZ | 51.0                      | 56.7~62.7                 | 1            | 82.4                                | 4.9                | 1                           |
| SMAJ54A        | SMAJ54CA      | RE                  | ZE | 54.0                      | 60.0~66.3                 | 1            | 87.1                                | 4.6                | 1                           |
| SMAJ58A        | SMAJ58CA      | RG                  | ZG | 58.0                      | 64.4~71.2                 | 1            | 93.6                                | 4.3                | 1                           |
| SMAJ60A        | SMAJ60CA      | RK                  | ZK | 60.0                      | 66.7~73.7                 | 1            | 96.8                                | 4.1                | 1                           |
| SMAJ64A        | SMAJ64CA      | RM                  | ZM | 64.0                      | 71.1~78.6                 | 1            | 103.0                               | 3.9                | 1                           |
| SMAJ70A        | SMAJ70CA      | RP                  | ZP | 70.0                      | 77.8~86.0                 | 1            | 113.0                               | 3.5                | 1                           |
| SMAJ75A        | SMAJ75CA      | RR                  | ZR | 75.0                      | 83.3~92.1                 | 1            | 121.0                               | 3.3                | 1                           |
| SMAJ78A        | SMAJ78CA      | RT                  | ZT | 78.0                      | 86.7~95.8                 | 1            | 126.0                               | 3.2                | 1                           |
| SMAJ80A        | SMAJ80CA      | RW                  | ZW | 80.0                      | 88.8~97.6                 | 1            | 129.6                               | 3.1                | 1                           |
| SMAJ85A        | SMAJ85CA      | RV                  | ZV | 85.0                      | 94.4~104                  | 1            | 137.0                               | 2.9                | 1                           |
| SMAJ90A        | SMAJ90CA      | RX                  | ZX | 90.0                      | 100~111                   | 1            | 146.0                               | 2.7                | 1                           |
| SMAJ100A       | SMAJ100CA     | RZ                  | ZZ | 100.0                     | 111~123                   | 1            | 162.0                               | 2.5                | 1                           |
| SMAJ110A       | SMAJ110CA     | SE                  | VE | 110.0                     | 122~135                   | 1            | 177.0                               | 2.3                | 1                           |
| SMAJ120A       | SMAJ120CA     | SG                  | VG | 120.0                     | 133~147                   | 1            | 193.0                               | 2.1                | 1                           |
| SMAJ130A       | SMAJ130CA     | SK                  | VK | 130.0                     | 144~159                   | 1            | 209.0                               | 1.9                | 1                           |
| SMAJ140A       | SMAJ140CA     | SW                  | VW | 140.0                     | 155~171                   | 1            | 227.0                               | 1.8                | 1                           |
| SMAJ150A       | SMAJ150CA     | SM                  | VM | 150.0                     | 167~185                   | 1            | 243.0                               | 1.7                | 1                           |
| SMAJ160A       | SMAJ160CA     | SP                  | VP | 160.0                     | 178~197                   | 1            | 259.0                               | 1.6                | 1                           |
| SMAJ170A       | SMAJ170CA     | SR                  | VR | 170.0                     | 189~209                   | 1            | 275.0                               | 1.5                | 1                           |
| SMAJ180A       | SMAJ180CA     | ST                  | VT | 180.0                     | 200~220                   | 1            | 291.0                               | 1.4                | 1                           |
| SMAJ190A       | SMAJ190CA     | SU                  | VU | 190.0                     | 211~232                   | 1            | 308.0                               | 1.3                | 1                           |
| SMAJ200A       | SMAJ200CA     | SV                  | VV | 200.0                     | 224~247                   | 1            | 324.0                               | 1.2                | 1                           |
| SMAJ220A       | SMAJ220CA     | SX                  | VX | 220.0                     | 246~272                   | 1            | 356.0                               | 1.1                | 1                           |
| SMAJ250A       | SMAJ250CA     | SZ                  | VZ | 250.0                     | 279~309                   | 1            | 405.0                               | 1.0                | 1                           |
| SMAJ300A       | SMAJ300CA     | TE                  | UE | 300.0                     | 335~371                   | 1            | 486.0                               | 0.8                | 1                           |
| SMAJ350A       | SMAJ350CA     | TG                  | UG | 350.0                     | 391~432                   | 1            | 567.0                               | 0.7                | 1                           |
| SMAJ400A       | SMAJ400CA     | TK                  | UK | 400.0                     | 447~494                   | 1            | 648.0                               | 0.6                | 1                           |
| SMAJ440A       | SMAJ440CA     | TM                  | UM | 440.0                     | 492~543                   | 1            | 713.0                               | 0.6                | 1                           |

Notes: For bidirectional type having VRWM of 10V and less, the IR limit is double.

## Recommended Soldering Conditions

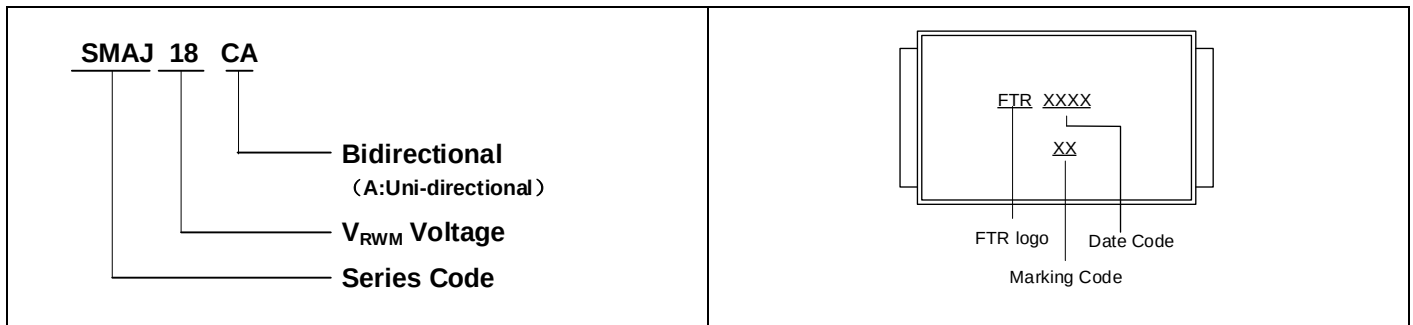
### Reflow Soldering



### Recommended Conditions

| Profile Feature                                                                                                                                                                                       | Pb-Free Assembly                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Average ramp-up rate ( $T_L$ to $T_P$ )                                                                                                                                                               | 3°C/second max.                  |
| Preheat <ul style="list-style-type: none"> <li>-Temperature Min (<math>T_{S\min}</math>)</li> <li>-Temperature Max (<math>T_{S\max}</math>)</li> <li>-Time (min to max) (<math>t_s</math>)</li> </ul> | 150°C<br>200°C<br>60-180 seconds |
| $T_{S\max}$ to $T_L$ <ul style="list-style-type: none"> <li>-Ramp-up Rate</li> </ul>                                                                                                                  | 3°C/second max.                  |
| Time maintained above: <ul style="list-style-type: none"> <li>-Temperature (<math>T_L</math>)</li> <li>-Time (<math>t_L</math>)</li> </ul>                                                            | 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.                   |

## Partnumber code



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

Figure 1. Peak Pulse Power Rating Curve

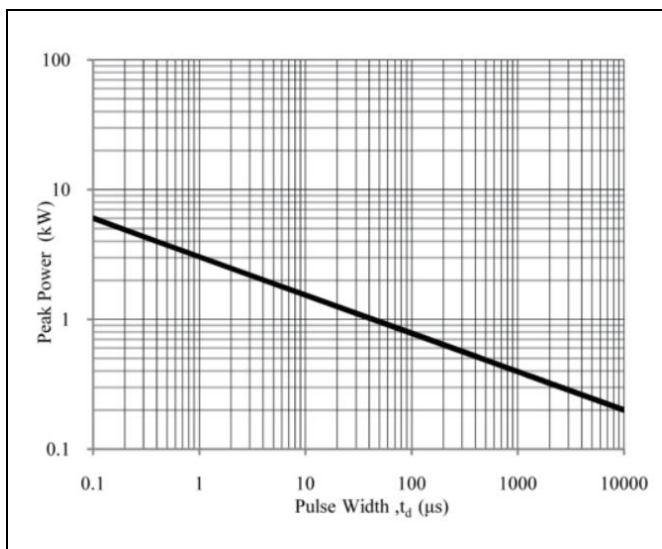


Figure 2. Pulse Derating Curve

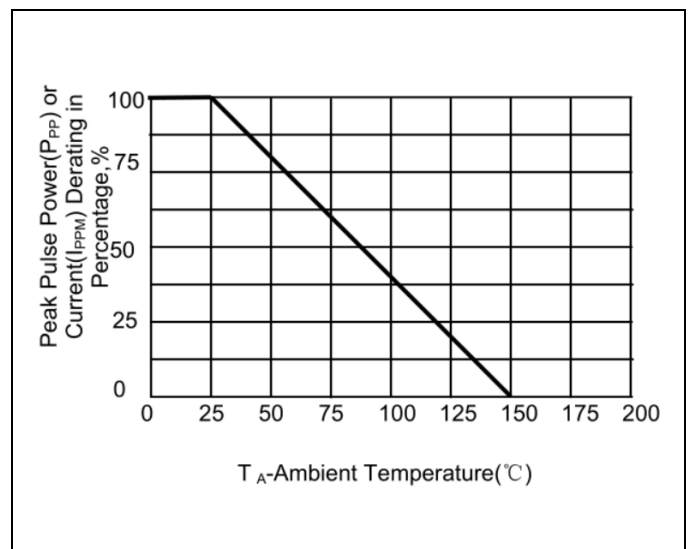


Figure 3. Pulse Waveform

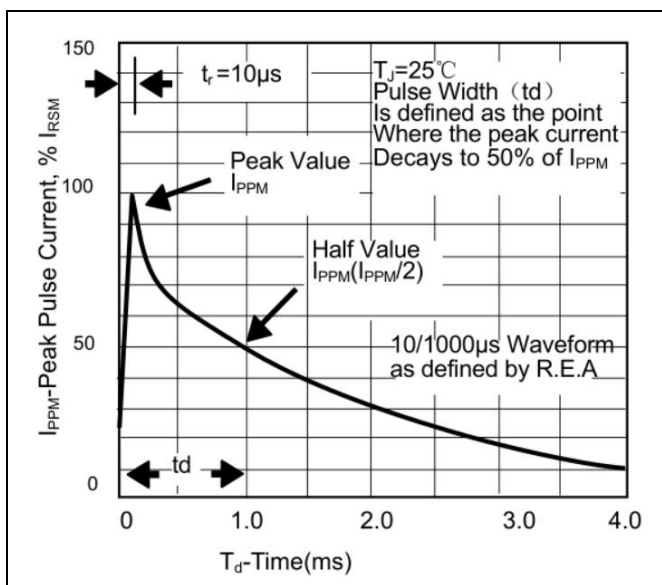
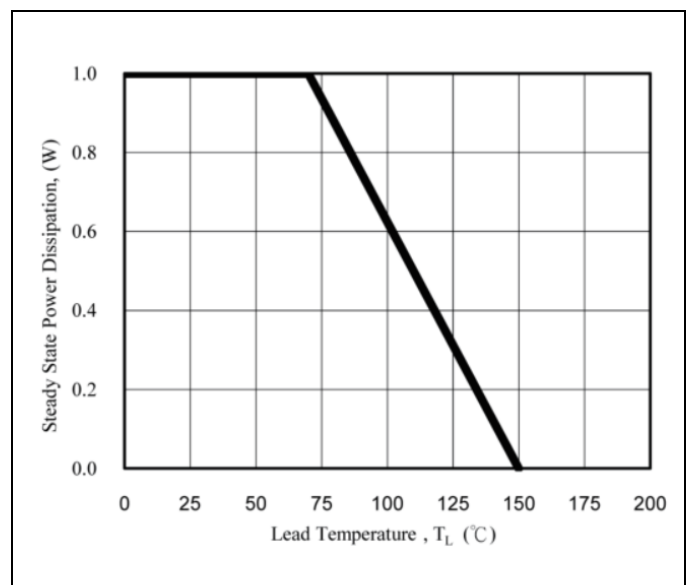
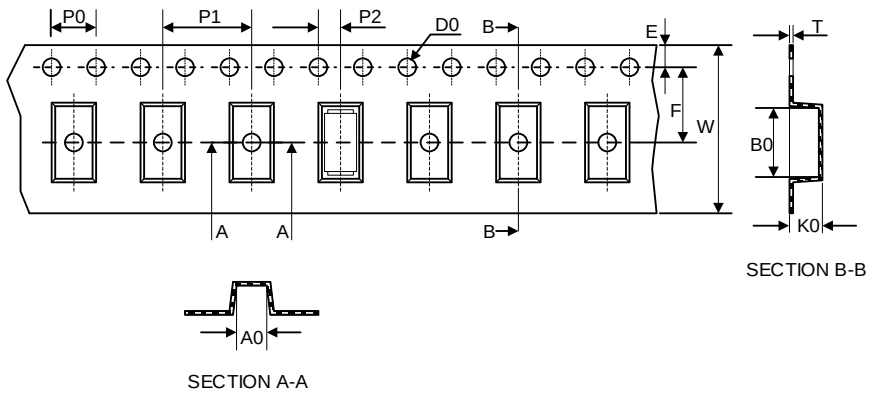
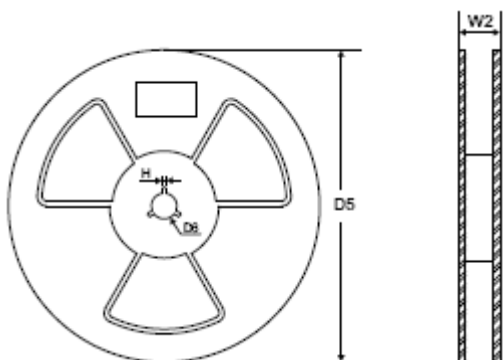


Figure 4. Steady State Power Dissipation Derating Curve



## Packaging

| Tape                                                                                |  | Symbol            | Dimension (mm) |
|-------------------------------------------------------------------------------------|--|-------------------|----------------|
|    |  | W                 | 12.00±0.10     |
|                                                                                     |  | P0                | 4.00±0.10      |
|                                                                                     |  | P1                | 4.00±0.10      |
|                                                                                     |  | P2                | 2.00±0.10      |
|                                                                                     |  | D0                | Φ1.55±0.10     |
|                                                                                     |  | E                 | 1.75±0.10      |
|                                                                                     |  | F                 | 5.50±0.10      |
|                                                                                     |  | A0                | 2.80±0.1       |
|                                                                                     |  | B0                | 5.30±0.1       |
|                                                                                     |  | K0                | 2.36±0.1       |
|                                                                                     |  | T                 | 0.25±0.1       |
| Reel                                                                                |  | D5                | Φ330.0±2.0     |
|  |  | D6                | Φ12.0±0.5      |
|                                                                                     |  | W2                | 14.0±2.0       |
|                                                                                     |  | Quantity: 5000PCS |                |