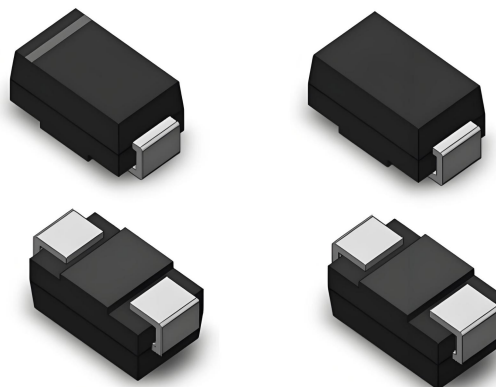


## Description

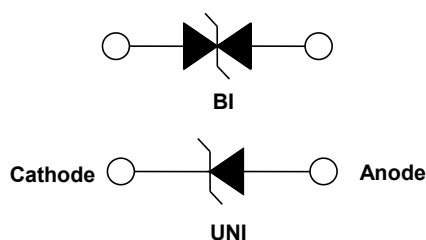
The SMAJ series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

## Features

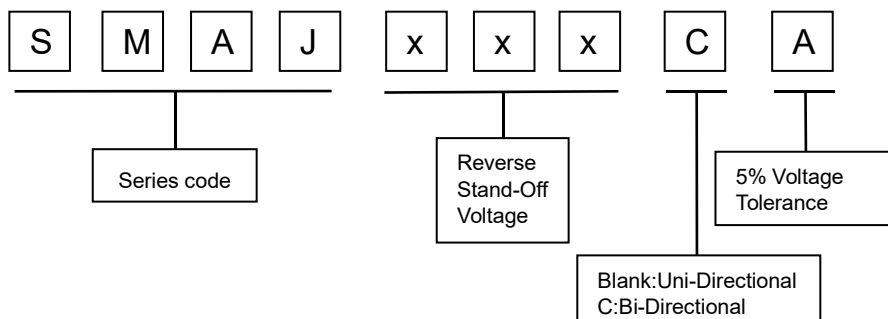
- Fast response time
- Low incremental surge resistance
- Matte tin lead-free Plated
- Halogen free and RoHS compliant
- Typical IR less than 1 $\mu$ A above 10V
- Meet MSL level1, per J-STD-020
- Compatible with industrial standard package DO-214AC
- For surface mounted applications to optimize board space
- 400W peak pulse power capability with at 10/1000 $\mu$ s waveform, repetition rate (duty cycle): 0.01%
- High temperature soldering: 260°C/10 seconds at terminals



## Electrical symbol



## Part Number Code



## Mechanical Characteristics

| Rating                                                                                                       | Symbol    | Value      | Units            |
|--------------------------------------------------------------------------------------------------------------|-----------|------------|------------------|
| Peak Pulse Power Dissipation at $T_A=25^\circ\text{C}$ by 10/1000 $\mu$ s Waveform (Fig.2)(Note 1), (Note 2) | $P_{PP}$  | 400        | W                |
| Power Dissipation on Infinite Heat Sink at $T_L=75^\circ\text{C}$ (Fig.6)                                    | $P_D$     | 3.0        | W                |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3)                                             | $I_{FSM}$ | 40         | A                |
| Operating Temperature Range                                                                                  | $T_J$     | -55 to 150 | $^\circ\text{C}$ |
| Storage Temperature Range                                                                                    | $T_{STG}$ | -55 to 150 | $^\circ\text{C}$ |

Notes:

1. Non-repetitive current pulse, per Fig.4 and derated above  $T_A=25^\circ\text{C}$  per Fig. 3.
2. Mounted on 5.0x5.0mm copper pad to each terminal.
3. Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional device only.

## Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

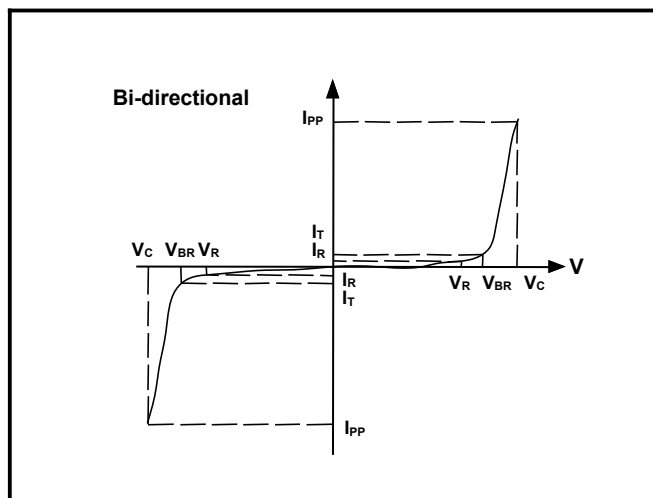
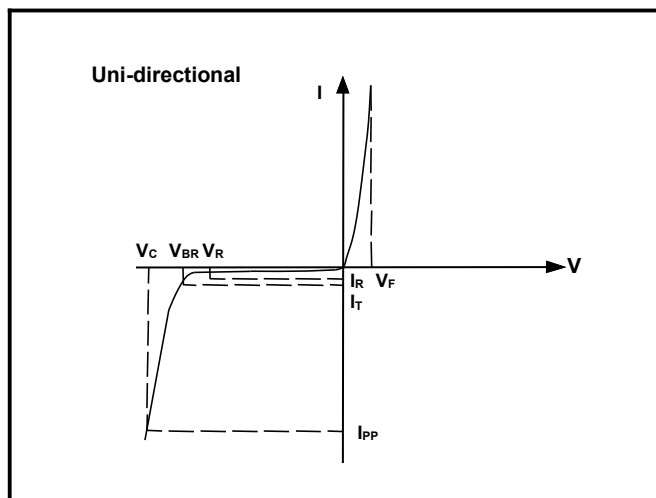
| Type Number |           | Marking |    | Reverse Stand-Off Voltage | Breakdown Voltage               |       | Test Current   | Max. Clamping Voltage 10/1000μs | Max. Peak Pulse Current 10/1000μs | Reverse Leakage                |
|-------------|-----------|---------|----|---------------------------|---------------------------------|-------|----------------|---------------------------------|-----------------------------------|--------------------------------|
|             |           |         |    | V <sub>RWM</sub>          | V <sub>BR</sub> @I <sub>T</sub> |       | I <sub>T</sub> | V <sub>C@I<sub>PP</sub></sub>   | I <sub>PP</sub>                   | I <sub>R@V<sub>RWM</sub></sub> |
|             |           |         |    |                           | Min                             | Max   |                |                                 |                                   |                                |
| UNI         | BI        | UNI     | BI | V                         | V                               | V     | mA             | V                               | A                                 | μA                             |
| SMAJ5.0A    | SMAJ5.0CA | HE      | TE | 5.0                       | 6.40                            | 7.00  | 10             | 9.2                             | 43.5                              | 800                            |
| SMAJ6.0A    | SMAJ6.0CA | HG      | TG | 6.0                       | 6.67                            | 7.37  | 10             | 10.3                            | 38.8                              | 800                            |
| SMAJ6.5A    | SMAJ6.5CA | HK      | TK | 6.5                       | 7.22                            | 7.98  | 10             | 11.2                            | 35.7                              | 500                            |
| SMAJ7.0A    | SMAJ7.0CA | HM      | TM | 7.0                       | 7.78                            | 8.60  | 10             | 12.0                            | 33.3                              | 200                            |
| SMAJ7.5A    | SMAJ7.5CA | HP      | TP | 7.5                       | 8.33                            | 9.21  | 1              | 12.9                            | 31.0                              | 100                            |
| SMAJ8.0A    | SMAJ8.0CA | HR      | TR | 8.0                       | 8.89                            | 9.83  | 1              | 13.6                            | 29.4                              | 50                             |
| SMAJ8.5A    | SMAJ8.5CA | HT      | TT | 8.5                       | 9.44                            | 10.40 | 1              | 14.4                            | 27.8                              | 10                             |
| SMAJ9.0A    | SMAJ9.0CA | HV      | TV | 9.0                       | 10.00                           | 11.10 | 1              | 15.4                            | 26.0                              | 5                              |
| SMAJ10A     | SMAJ10CA  | HX      | TX | 10.0                      | 11.10                           | 12.30 | 1              | 17.0                            | 23.5                              | 5                              |
| SMAJ11A     | SMAJ11CA  | HZ      | TZ | 11.0                      | 12.20                           | 13.50 | 1              | 18.2                            | 22.0                              | 1                              |
| SMAJ12A     | SMAJ12CA  | IE      | UE | 12.0                      | 13.30                           | 14.70 | 1              | 19.9                            | 20.1                              | 1                              |
| SMAJ13A     | SMAJ13CA  | IG      | UG | 13.0                      | 14.40                           | 15.90 | 1              | 21.5                            | 18.6                              | 1                              |
| SMAJ14A     | SMAJ14CA  | IK      | UK | 14.0                      | 15.60                           | 17.20 | 1              | 23.2                            | 17.2                              | 1                              |
| SMAJ15A     | SMAJ15CA  | IM      | UM | 15.0                      | 16.70                           | 18.50 | 1              | 24.4                            | 16.4                              | 1                              |
| SMAJ16A     | SMAJ16CA  | IP      | UP | 16.0                      | 17.80                           | 19.70 | 1              | 26.0                            | 15.4                              | 1                              |
| SMAJ17A     | SMAJ17CA  | IR      | UR | 17.0                      | 18.90                           | 20.90 | 1              | 27.6                            | 14.5                              | 1                              |
| SMAJ18A     | SMAJ18CA  | IT      | UT | 18.0                      | 20.00                           | 22.10 | 1              | 29.2                            | 13.7                              | 1                              |
| SMAJ20A     | SMAJ20CA  | IV      | UV | 20.0                      | 22.20                           | 24.50 | 1              | 32.4                            | 12.3                              | 1                              |
| SMAJ22A     | SMAJ22CA  | IX      | UX | 22.0                      | 24.40                           | 26.90 | 1              | 35.5                            | 11.3                              | 1                              |
| SMAJ24A     | SMAJ24CA  | IZ      | UZ | 24.0                      | 26.70                           | 29.50 | 1              | 38.9                            | 10.3                              | 1                              |
| SMAJ26A     | SMAJ26CA  | JE      | VE | 26.0                      | 28.90                           | 31.90 | 1              | 42.1                            | 9.5                               | 1                              |
| SMAJ28A     | SMAJ28CA  | JG      | VG | 28.0                      | 31.10                           | 34.40 | 1              | 45.4                            | 8.8                               | 1                              |
| SMAJ30A     | SMAJ30CA  | JK      | VK | 30.0                      | 33.30                           | 36.80 | 1              | 48.4                            | 8.3                               | 1                              |
| SMAJ33A     | SMAJ33CA  | JM      | VM | 33.0                      | 36.70                           | 40.60 | 1              | 53.3                            | 7.5                               | 1                              |
| SMAJ36A     | SMAJ36CA  | JP      | VP | 36.0                      | 40.00                           | 44.20 | 1              | 58.1                            | 6.9                               | 1                              |
| SMAJ40A     | SMAJ40CA  | JR      | VR | 40.0                      | 44.40                           | 49.10 | 1              | 64.5                            | 6.2                               | 1                              |
| SMAJ43A     | SMAJ43CA  | JT      | VT | 43.0                      | 47.80                           | 52.80 | 1              | 69.4                            | 5.8                               | 1                              |
| SMAJ45A     | SMAJ45CA  | JV      | VV | 45.0                      | 50.00                           | 55.30 | 1              | 72.7                            | 5.5                               | 1                              |
| SMAJ48A     | SMAJ48CA  | JX      | VX | 48.0                      | 53.30                           | 58.90 | 1              | 77.4                            | 5.2                               | 1                              |
| SMAJ51A     | SMAJ51CA  | JZ      | VZ | 51.0                      | 56.70                           | 62.70 | 1              | 82.4                            | 4.9                               | 1                              |

## Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Type Number |           | Marking |    | Reverse<br>Stand-Off<br>Voltage | Breakdown<br>Voltage            |        | Test<br>Current | Max.<br>Clamping<br>Voltage<br>10/1000µs | Max.<br>Peak Pulse<br>Current<br>10/1000µs | Reverse<br>Leakage             |
|-------------|-----------|---------|----|---------------------------------|---------------------------------|--------|-----------------|------------------------------------------|--------------------------------------------|--------------------------------|
|             |           |         |    | V <sub>RWM</sub>                | V <sub>BR</sub> @I <sub>T</sub> |        | I <sub>T</sub>  | V <sub>C@I<sub>PP</sub></sub>            | I <sub>PP</sub>                            | I <sub>R@V<sub>RWM</sub></sub> |
|             |           |         |    |                                 | Min                             | Max    |                 |                                          |                                            |                                |
| UNI         | BI        | UNI     | BI | V                               | V                               | V      | mA              | V                                        | A                                          | µA                             |
| SMAJ54A     | SMAJ54CA  | RE      | WE | 54.0                            | 60.00                           | 66.30  | 1               | 87.1                                     | 4.6                                        | 1                              |
| SMAJ58A     | SMAJ58CA  | RG      | WG | 58.0                            | 64.40                           | 71.20  | 1               | 93.6                                     | 4.3                                        | 1                              |
| SMAJ60A     | SMAJ60CA  | RK      | WK | 60.0                            | 66.70                           | 73.70  | 1               | 96.8                                     | 4.1                                        | 1                              |
| SMAJ64A     | SMAJ64CA  | RM      | WM | 64.0                            | 71.10                           | 78.60  | 1               | 103.0                                    | 3.9                                        | 1                              |
| SMAJ70A     | SMAJ70CA  | RP      | WP | 70.0                            | 77.80                           | 86.00  | 1               | 113.0                                    | 3.5                                        | 1                              |
| SMAJ75A     | SMAJ75CA  | RR      | WR | 75.0                            | 83.30                           | 92.10  | 1               | 121.0                                    | 3.3                                        | 1                              |
| SMAJ78A     | SMAJ78CA  | RT      | WT | 78.0                            | 86.70                           | 95.80  | 1               | 126.0                                    | 3.2                                        | 1                              |
| SMAJ85A     | SMAJ85CA  | RV      | WV | 85.0                            | 94.40                           | 104.00 | 1               | 137.0                                    | 2.9                                        | 1                              |
| SMAJ90A     | SMAJ90CA  | RX      | WX | 90.0                            | 100.0                           | 111.00 | 1               | 146.0                                    | 2.7                                        | 1                              |
| SMAJ100A    | SMAJ100CA | RZ      | WZ | 100.0                           | 111.0                           | 123.00 | 1               | 162.0                                    | 2.5                                        | 1                              |
| SMAJ110A    | SMAJ110CA | SE      | XE | 110.0                           | 122.0                           | 135.00 | 1               | 177.0                                    | 2.3                                        | 1                              |
| SMAJ120A    | SMAJ120CA | SG      | XG | 120.0                           | 133.0                           | 147.00 | 1               | 193.0                                    | 2.1                                        | 1                              |
| SMAJ130A    | SMAJ130CA | SK      | XK | 130.0                           | 144.0                           | 159.00 | 1               | 209.0                                    | 1.9                                        | 1                              |
| SMAJ150A    | SMAJ150CA | SM      | XM | 150.0                           | 167.0                           | 185.00 | 1               | 243.0                                    | 1.6                                        | 1                              |
| SMAJ160A    | SMAJ160CA | SP      | XP | 160.0                           | 178.0                           | 197.00 | 1               | 259.0                                    | 1.5                                        | 1                              |
| SMAJ170A    | SMAJ170CA | SR      | XR | 170.0                           | 189.0                           | 209.00 | 1               | 275.0                                    | 1.5                                        | 1                              |
| SMAJ180A    | SMAJ180CA | ST      | XT | 180.0                           | 201.0                           | 222.00 | 1               | 292.0                                    | 1.4                                        | 1                              |
| SMAJ190A    | SMAJ190CA | SV      | XV | 190.0                           | 209.0                           | 233.00 | 1               | 306.0                                    | 1.3                                        | 1                              |
| SMAJ200A    | SMAJ200CA | SX      | XX | 200.0                           | 224.0                           | 247.00 | 1               | 324.0                                    | 1.2                                        | 1                              |
| SMAJ210A    | SMAJ210CA | SZ      | XZ | 210.0                           | 231.0                           | 258.00 | 1               | 340.0                                    | 1.1                                        | 1                              |
| SMAJ220A    | SMAJ220CA | ZE      | YE | 220.0                           | 246.0                           | 272.00 | 1               | 356.0                                    | 1.1                                        | 1                              |
| SMAJ250A    | SMAJ250CA | ZG      | YG | 250.0                           | 279.0                           | 309.0  | 1               | 405.0                                    | 1.0                                        | 1                              |
| SMAJ300A    | SMAJ300CA | ZK      | YK | 300.0                           | 335.0                           | 371.0  | 1               | 486.0                                    | 0.8                                        | 1                              |
| SMAJ350A    | SMAJ350CA | ZM      | YM | 350.0                           | 391.0                           | 432.0  | 1               | 567.0                                    | 0.7                                        | 1                              |
| SMAJ400A    | SMAJ400CA | ZP      | YP | 400.0                           | 447.0                           | 494.0  | 1               | 648.0                                    | 0.6                                        | 1                              |
| SMAJ440A    | SMAJ440CA | ZR      | YR | 440.0                           | 492.0                           | 543.0  | 1               | 713.0                                    | 0.6                                        | 1                              |

Notes: For bidirectional type having V<sub>R</sub> of 10V and less, the I<sub>R</sub> limit is double.

## I-V Curve Characteristics



$P_{PPM}$  Peak Pulse Power Dissipation -- Max power dissipation

$V_R$  Stand-off Voltage -- Maximum voltage that can be applied to the TVS without operation

$V_{BR}$  Breakdown Voltage -- Maximum voltage that flows though the TVS at a specified test current ( $I_T$ )

$V_C$  Clamping Voltage -- Peak voltage measured across the TVS at a specified  $I_{ppm}$  (peak impulse current)

$I_R$  Reverse Leakage Current -- Current measured at  $V_R$

$V_F$  Forward Voltage Drop for Uni-directional

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

Figure 1 - TVS Transients Clamping Waveform

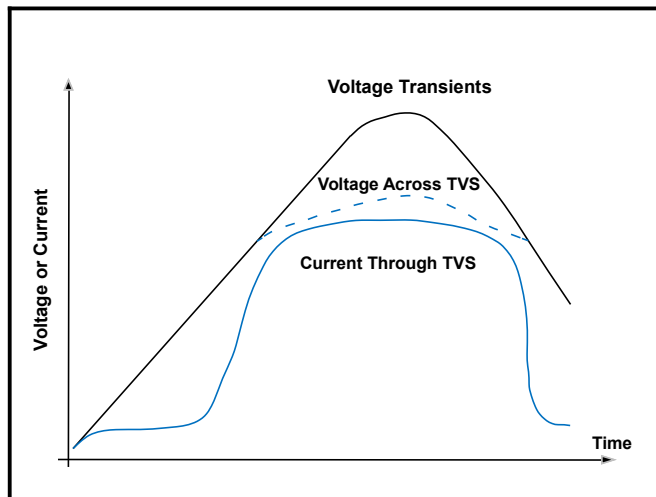
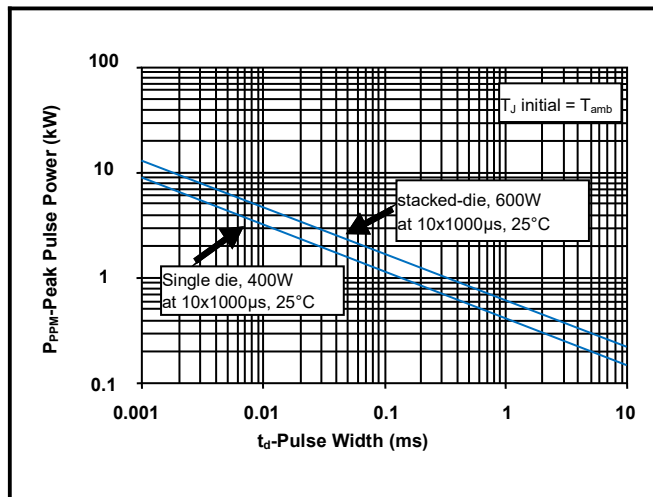


Figure 2 - Peak Pulse Power Rating Curve



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

Figure 3 - Pulse Derating Curve

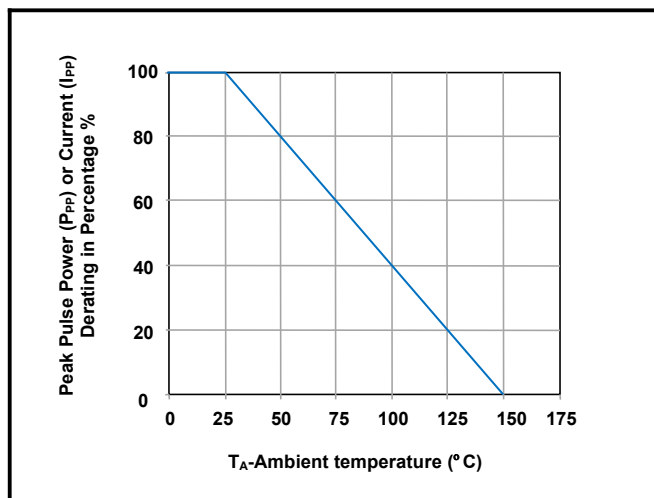


Figure 4 - Pulse Waveform

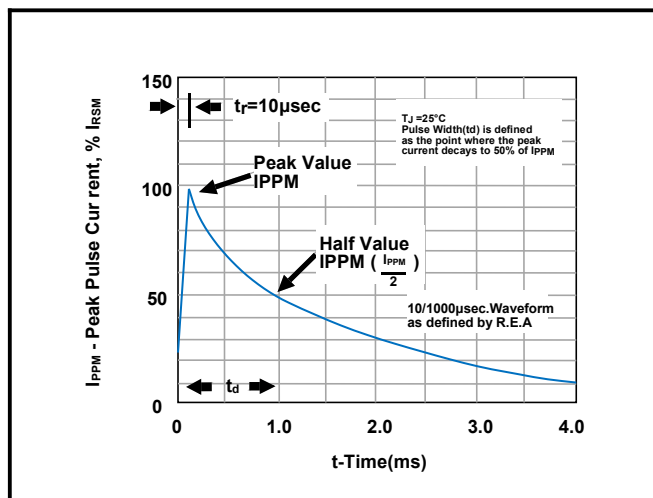


Figure 5 - Typical Junction Capacitance

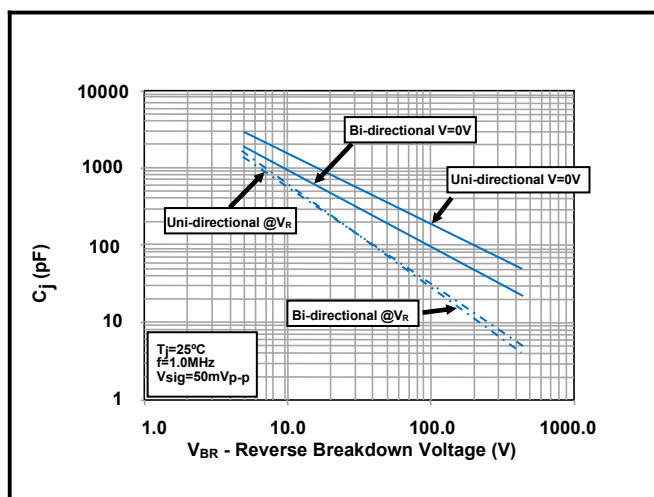


Figure 6 - Steady State Power Derating Curve

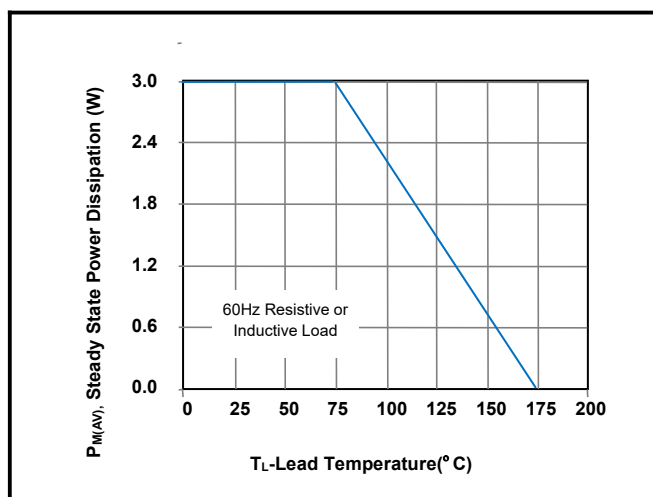
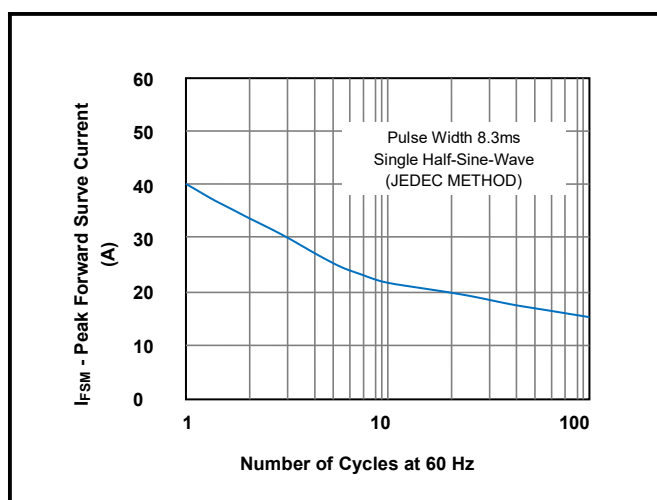
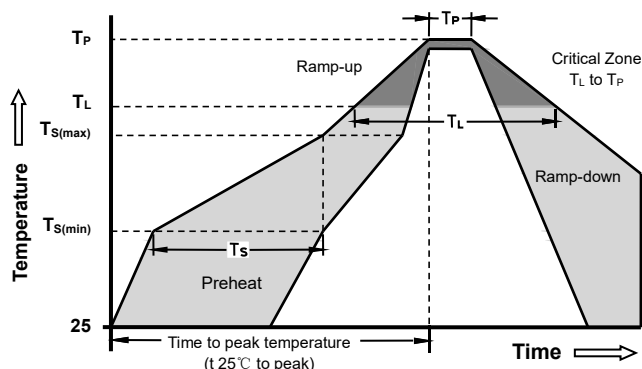
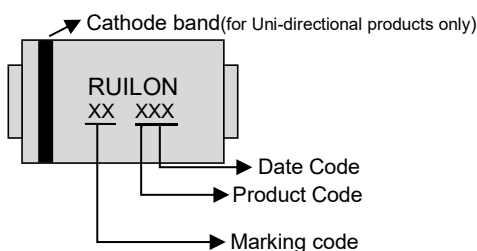
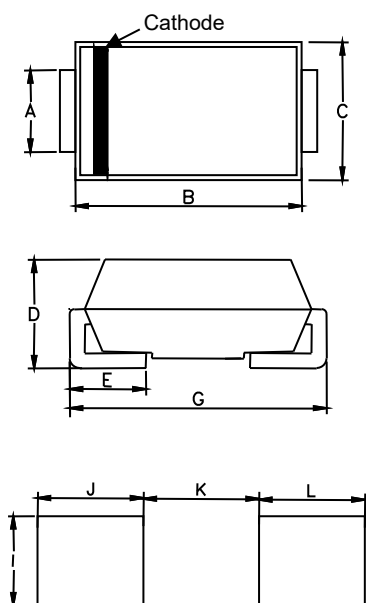


Figure 7 - Maximum Non-Repetitive Surge Current



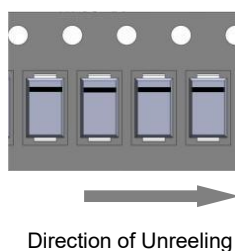
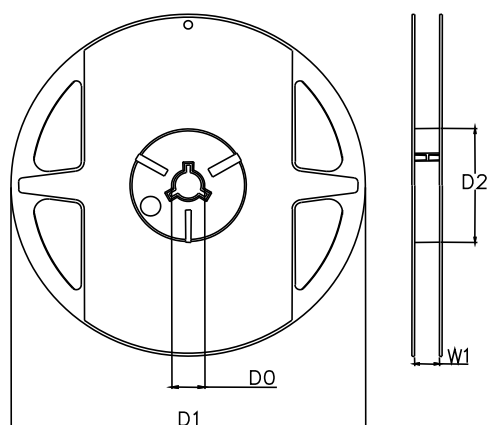
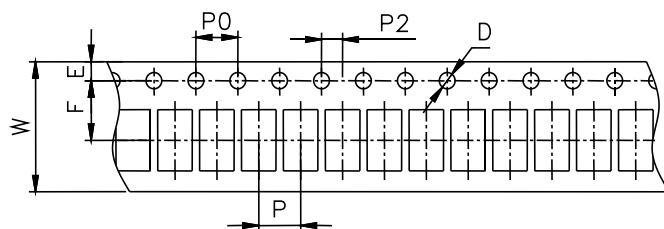
**Soldering Parameters - Reflow Soldering (Surface Mount Devices)**


| Reflow Condition                                     |                                   | Pb - Free assembly |
|------------------------------------------------------|-----------------------------------|--------------------|
| Pre Heat                                             | -Temperature Min ( $T_{s(min)}$ ) | 150°C              |
|                                                      | -Temperature Max ( $T_{s(max)}$ ) | 200°C              |
|                                                      | - Time (min to max) ( $t_s$ )     | 60 -180 Seconds    |
| Average ramp up rate ( Liquids Temp $T_L$ ) to peak  |                                   | 3°C/second max     |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                 |                                   | 3°C/second max     |
| Reflow                                               | - Temperature ( $T_L$ ) (Liquids) | 217°C              |
|                                                      | - Time (min to max) ( $t_s$ )     | 60 -150 Seconds    |
| Peak Temperature ( $T_P$ )                           |                                   | 260 +0/-5°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 ( $T_P$ )              |                                   | 8 minutes Max      |
| Do not exceed                                        |                                   | 260°C              |

**Part Marking System**

**Dimensions**


| DIM | Millimeters |       | Inches |       |
|-----|-------------|-------|--------|-------|
|     | Min         | Max   | Min    | Max   |
| A   | 1.25        | 1.80  | 0.049  | 0.071 |
| B   | 3.99        | 4.60  | 0.157  | 0.181 |
| C   | 2.50        | 2.80  | 0.100  | 0.110 |
| D   | 1.90        | 2.45  | 0.075  | 0.096 |
| E   | 0.76        | 1.52  | 0.030  | 0.060 |
| G   | 4.80        | 5.30  | 0.189  | 0.209 |
| I   | 1.800       | -     | 0.070  | -     |
| J   | 2.100       | -     | 0.082  | -     |
| K   | -           | 2.300 | -      | 0.090 |
| L   | 2.100       | -     | 0.082  | -     |

## Taping and Reel Specifications



| Symbol    | Millimeters  | Inches             |
|-----------|--------------|--------------------|
| <b>W</b>  | 12±0.3       | 0.472±0.012        |
| <b>P</b>  | 4±0.1        | 0.157±0.004        |
| <b>F</b>  | 5.5±0.1      | 0.217±0.004        |
| <b>E</b>  | 1.75±0.1     | 0.069±0.004        |
| <b>D</b>  | 1.5+0.1/-0.0 | 0.059+0.004/-0.0   |
| <b>P0</b> | 4±0.1        | 0.157±0.004        |
| <b>P2</b> | 2±0.1        | 0.079±0.004        |
| <b>D0</b> | 16.7±0.15    | 0.657±0.006        |
| <b>D1</b> | 330.2±2      | 13.0±0.079         |
| <b>D2</b> | 59.6+1/-2    | 2.346+0.039/-0.079 |
| <b>W1</b> | 12.64±0.4    | 0.498±0.016        |

| Part Number | Component package | Quantity | Packaging option       | Packaging specification |
|-------------|-------------------|----------|------------------------|-------------------------|
| SMAJXXXA/CA | DO-214AC(SMA)     | 5000     | Tape&Reel-12mm/13"tape | EIA STD RS-481          |