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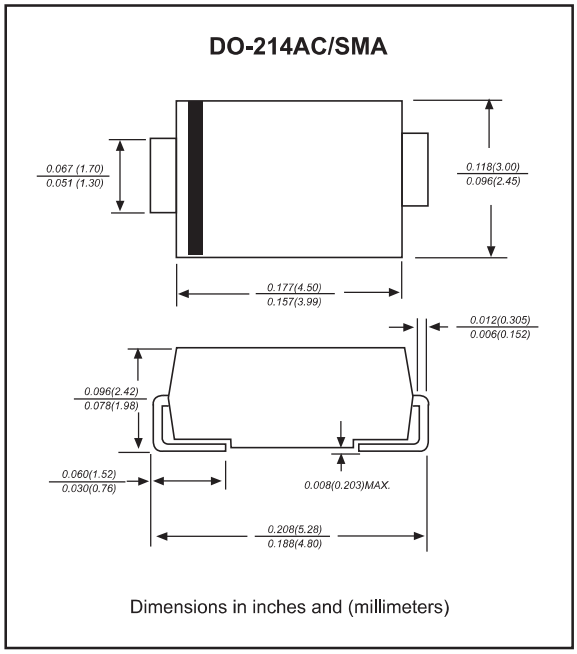
# SMAJ Series

**400W Surface Mount Transient Voltage Suppressors- 5.0V- 440V**

## Features

- 400W peak pulse power capability with a 10/1000 μs waveform, repetition rate (duty cycle): 0.01%.
- Low profile surface mounted application in order to optimize board space.
- Excellent clamping capability.
- Low incremental surge resistance.
- Fast response time from 0V to VBR, typically less than 1 ps for uni-directional & 5 ns for bi-directional types.
- Glass passivated chip junction.
- Lead-free parts meet RoHS requirments.
- Compliant to Halogen-free

## Package outline




Dimensions in inches and (millimeters)

## Mechanical data

- Epoxy:UL94-V0 rated flame retardant
- Case : Molded plastic, DO-214AC / SMA
- Terminals : Solder plated, solderable per MIL-STD-750, Method 2026
- Polarity : Indicated by cathode band
- Mounting Position : Any

## Maximum ratings (AT $T_A$=25°C unless otherwise noted)

| PARAMETER | CONDITIONS | Symbol | Value | UNIT |
|---|---|---|---|---|
| Peak Power Dissipation | with a 10/1000 μs waveform, Note 1, 2 & Fig. 1 | $P_{PPM}$ | 400 | W |
| Peak Pulse current | with a 10/1000 μs waveform | $I_{PPM}$ | See Table 1 | A |
| Steady State Power Dissipation | at $T_L$=75°C, Note 2 | $P_{M(AV)}$ | 1.0 | W |
| Peak Forward Surge Current | 8.3ms Single Half Sine-Wave, Note 3 | $I_{FSM}$ | 40 | A |
| Maximum Instantaneours Forward Voltage | at 25A For Uni-Directional Types Only, Note 4 | $V_F$ | 3.5/6.5 | V |
| Operating temperature range | | $T_J$ | -55 ~ +150 | °C |
| Storage temperature range | | $T_{STG}$ | -55 ~ +150 | °C |

Note 1. Non-repetitive current pulse, per Fig. 3 and derated above $T_A$=25 °C per Fig. 2
2. Mounted on copper pad area of 0.2"x0.2" (5.0x5.0 mm) per Fig 5
3. Measured on 8.3 ms single half sine-wave or equivalent square wave, duty cycle=4 pulses per minute maximum
4. $V_F$ < 3.5V for $V_{BR}$ < 200V and $V_F$< 6.5V for $V_{BR}$ >201V.

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## Electrical characteristics (at $T_A$=25°C unless otherwise noted)

| Part No. (Uni) | Part No. (Bi) | Reverse Stand-off Voltage | Breakdown Voltage @$I_T$ | | Test Current | Maximum Clamping Voltage @$I_{PP}$ | | Maximum Reverse Leakage Current | Marking Code | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_{RWM}$ | $V_{BR\ Min}$ | $V_{BR\ Max}$ | $I_T$ | $V_C$ | $I_{PP}$ | $I_R$@$V_{RWM}$ | | |
| | | Volts | Volts | Volts | mA | Volts | A | μA | UNI | BI |
| SMAJ5.0A | SMAJ5.0CA | 5.0 | 6.40 | 7.00 | 10 | 9.2 | 43.5 | 800 | AE | WE |
| SMAJ6.0A | SMAJ6.0CA | 6.0 | 6.67 | 7.37 | 10 | 10.3 | 38.0 | 800 | AG | WG |
| SMAJ6.5A | SMAJ6.5CA | 6.5 | 7.22 | 7.98 | 10 | 11.2 | 35.7 | 500 | AK | WK |
| SMAJ7.0A | SMAJ7.0CA | 7.0 | 7.78 | 8.60 | 10 | 12.0 | 33.3 | 200 | AM | WM |
| SMAJ7.5A | SMAJ7.5CA | 7.5 | 8.33 | 9.21 | 1.0 | 12.9 | 31.0 | 100 | AP | WP |
| SMAJ8.0A | SMAJ8.0CA | 8.0 | 8.89 | 9.83 | 1.0 | 13.6 | 29.4 | 50 | AR | WR |
| SMAJ8.5A | SMAJ8.5CA | 8.5 | 9.44 | 10.4 | 1.0 | 14.4 | 27.7 | 20 | AT | WT |
| SMAJ9.0A | SMAJ9.0CA | 9.0 | 10.0 | 11.1 | 1.0 | 15.4 | 26.0 | 10 | AV | WV |
| SMAJ10A | SMAJ10CA | 10 | 11.1 | 12.3 | 1.0 | 17.0 | 23.5 | 5 | AX | WX |
| SMAJ11A | SMAJ11CA | 11 | 12.2 | 13.5 | 1.0 | 18.2 | 22.0 | 5 | AZ | WZ |
| SMAJ12A | SMAJ12CA | 12 | 13.3 | 14.7 | 1.0 | 19.9 | 20.1 | 5 | BE | XE |
| SMAJ13A | SMAJ13CA | 13 | 14.4 | 15.9 | 1.0 | 21.5 | 18.6 | 5 | BG | XG |
| SMAJ14A | SMAJ14CA | 14 | 15.6 | 17.2 | 1.0 | 23.2 | 17.2 | 5 | BK | XK |
| SMAJ15A | SMAJ15CA | 15 | 16.7 | 18.5 | 1.0 | 24.4 | 16.4 | 5 | BM | XM |
| SMAJ16A | SMAJ16CA | 16 | 17.8 | 19.7 | 1.0 | 26.0 | 15.4 | 5 | BP | XP |
| SMAJ17A | SMAJ17CA | 17 | 18.9 | 20.9 | 1.0 | 27.6 | 14.5 | 5 | BR | XR |
| SMAJ18A | SMAJ18CA | 18 | 20.0 | 22.1 | 1.0 | 29.2 | 13.7 | 5 | BT | XT |
| SMAJ20A | SMAJ20CA | 20 | 22.2 | 24.5 | 1.0 | 32.4 | 12.3 | 5 | BV | XV |
| SMAJ22A | SMAJ22CA | 22 | 24.4 | 26.9 | 1.0 | 35.5 | 11.2 | 5 | BX | XX |
| SMAJ24A | SMAJ24CA | 24 | 26.7 | 29.5 | 1.0 | 38.9 | 10.3 | 5 | BZ | XZ |
| SMAJ26A | SMAJ26CA | 26 | 28.9 | 31.9 | 1.0 | 42.1 | 9.5 | 5 | CE | YE |
| SMAJ28A | SMAJ28CA | 28 | 31.1 | 34.4 | 1.0 | 45.4 | 8.8 | 5 | CG | YG |
| SMAJ30A | SMAJ30CA | 30 | 33.3 | 36.8 | 1.0 | 48.4 | 8.3 | 5 | CK | YK |
| SMAJ33A | SMAJ33CA | 33 | 36.7 | 40.6 | 1.0 | 53.3 | 7.5 | 5 | CM | YM |
| SMAJ36A | SMAJ36CA | 36 | 40.0 | 44.2 | 1.0 | 58.1 | 6.9 | 5 | CP | YP |
| SMAJ40A | SMAJ40CA | 40 | 44.4 | 49.1 | 1.0 | 64.5 | 6.2 | 5 | CR | YR |
| SMAJ43A | SMAJ43CA | 43 | 47.8 | 52.8 | 1.0 | 69.4 | 5.8 | 5 | CT | YT |
| SMAJ45A | SMAJ45CA | 45 | 50.0 | 55.3 | 1.0 | 72.7 | 5.5 | 5 | CV | YV |
| SMAJ48A | SMAJ48CA | 48 | 53.3 | 58.9 | 1.0 | 77.4 | 5.2 | 5 | CX | YX |
| SMAJ51A | SMAJ51CA | 51 | 56.7 | 62.7 | 1.0 | 82.4 | 4.9 | 5 | CZ | YZ |
| SMAJ54A | SMAJ54CA | 54 | 60.0 | 66.3 | 1.0 | 87.1 | 4.6 | 5 | RE | ZE |
| SMAJ58A | SMAJ58CA | 58 | 64.4 | 71.2 | 1.0 | 93.6 | 4.3 | 5 | RG | ZG |
| SMAJ60A | SMAJ60CA | 60 | 66.7 | 73.7 | 1.0 | 96.8 | 4.1 | 5 | RK | ZK |
| SMAJ64A | SMAJ64CA | 64 | 71.1 | 78.6 | 1.0 | 103.0 | 3.9 | 5 | RM | ZM |
| SMAJ70A | SMAJ70CA | 70 | 77.8 | 86.0 | 1.0 | 113.0 | 3.5 | 5 | RP | ZP |
| SMAJ75A | SMAJ75CA | 75 | 83.3 | 92.1 | 1.0 | 121.0 | 3.3 | 5 | RR | ZR |
| SMAJ78A | SMAJ78CA | 78 | 86.7 | 95.8 | 1.0 | 126.0 | 3.2 | 5 | RT | ZT |
| SMAJ85A | SMAJ85CA | 85 | 94.4 | 104 | 1.0 | 137.0 | 2.9 | 5 | RV | ZV |

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| Part No. (Uni) | Part No. (Bi) | Reverse Stand-off Voltage | Breakdown Voltage @$I_T$ | | Test Current | Maximum Clamping Voltage @$I_{PP}$ | | Maximum Reverse Leakage Current | Marking Code | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_{RWM}$ | $V_{BR\ Min}$ | $V_{BR\ Max}$ | $I_T$ | $V_C$ | $I_{PP}$ | $I_R$@$V_{RWM}$ | | |
| | | Volts | Volts | Volts | mA | Volts | A | μA | UNI | BI |
| SMAJ90A | SMAJ90CA | 90 | 100 | 111 | 1.0 | 146.0 | 2.7 | 5 | RX | ZX |
| SMAJ100A | SMAJ100CA | 100 | 111 | 123 | 1.0 | 162.0 | 2.5 | 5 | RZ | ZZ |
| SMAJ110A | SMAJ110CA | 110 | 122 | 135 | 1.0 | 177.0 | 2.3 | 5 | SE | VE |
| SMAJ120A | SMAJ120CA | 120 | 133 | 147 | 1.0 | 193.0 | 2.1 | 5 | SG | VG |
| SMAJ130A | SMAJ130CA | 130 | 144 | 159 | 1.0 | 209.0 | 1.9 | 5 | SK | VK |
| SMAJ150A | SMAJ150CA | 150 | 167 | 185 | 1.0 | 243.0 | 1.6 | 5 | SM | VM |
| SMAJ160A | SMAJ160CA | 160 | 178 | 197 | 1.0 | 259.0 | 1.5 | 5 | SP | VP |
| SMAJ170A | SMAJ170CA | 170 | 189 | 209 | 1.0 | 275.0 | 1.5 | 5 | SR | VR |
| SMAJ180A | SMAJ180CA | 180 | 201 | 222 | 1.0 | 292.0 | 1.4 | 5 | ST | VT |
| SMAJ200A | SMAJ200CA | 200 | 224 | 247 | 1.0 | 324.0 | 1.2 | 5 | SV | VV |
| SMAJ220A | SMAJ220CA | 220 | 246 | 272 | 1.0 | 356.0 | 1.1 | 5 | SX | VX |
| SMAJ250A | SMAJ250CA | 250 | 279 | 309 | 1.0 | 405.0 | 1.0 | 5 | SZ | VZ |
| SMAJ300A | SMAJ300CA | 300 | 335 | 371 | 1.0 | 486.0 | 0.8 | 5 | TE | UE |
| SMAJ350A | SMAJ350CA | 350 | 391 | 432 | 1.0 | 567.0 | 0.7 | 5 | TG | UG |
| SMAJ400A | SMAJ400CA | 400 | 447 | 494 | 1.0 | 648.0 | 0.6 | 5 | TK | UK |
| SMAJ440A | SMAJ440CA | 440 | 492 | 543 | 1.0 | 713.0 | 0.6 | 5 | TM | UM |

Note 1. $V_{BR}$ measured after $I_T$ applied for 300us, $I_T$=square wave pulse or equivalent
2. Surge current waveform per Fig. 3 and derated per Fig. 2
3. For bi-directional types having $V_{RWM}$ of 10 volts and less, the $I_R$ limit is doubled
4. Suffix 'C' denotes bi-directional devices. Suffix 'A' denotes 5% tolerance devices, no suffix denotes 10% tolerance devices.

Fig. a - Transients of several thousand volts can be clamped to a safe level by the TVS

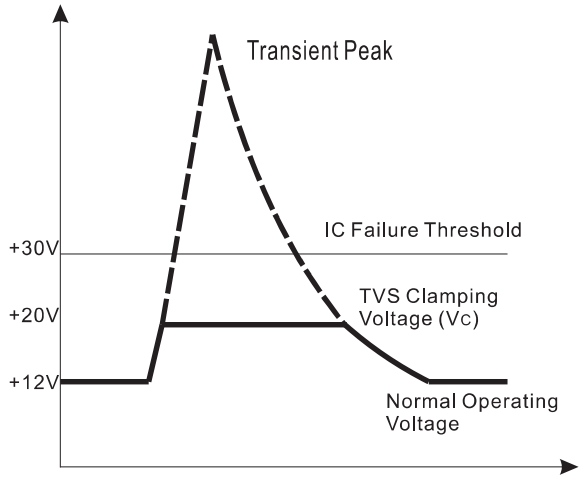
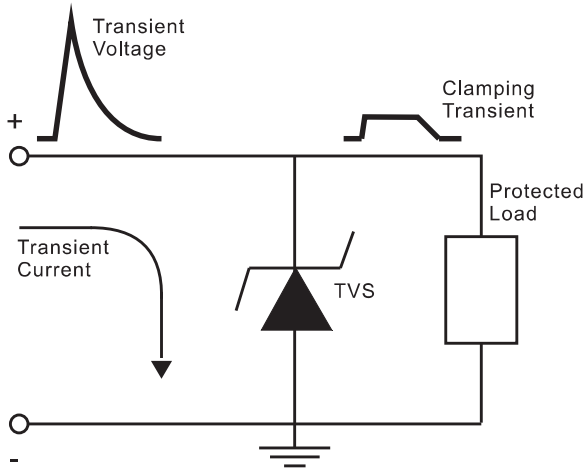



Fig. b - Transient current is divered to ground thru TVS; the voltage seen by the protected load is limited to the clamping voltage level



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## Rating and characteristic curves

Fig.1 - Pealk Pulse Power Rating Curve

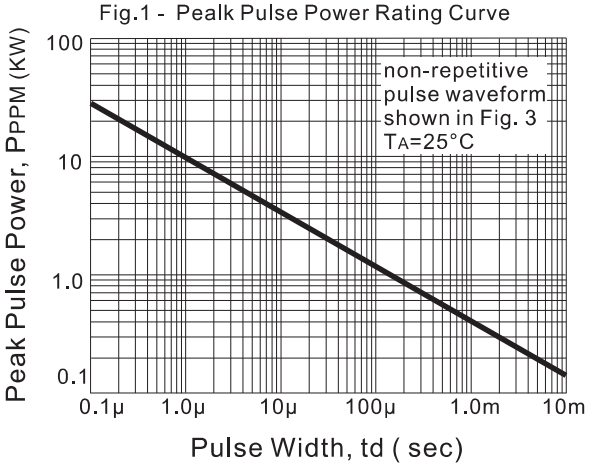



Fig.2 - Pulse Derating Curve

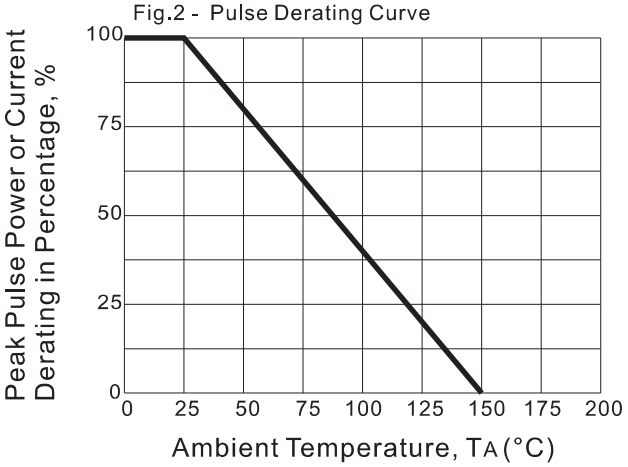



Fig.3 - Pulse Waveform

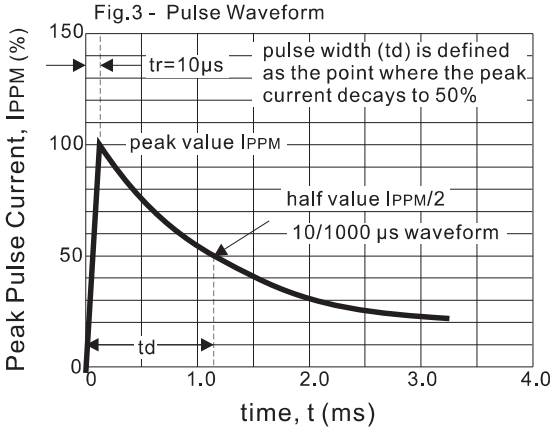



Fig.4 - Typical Junction Capacitance

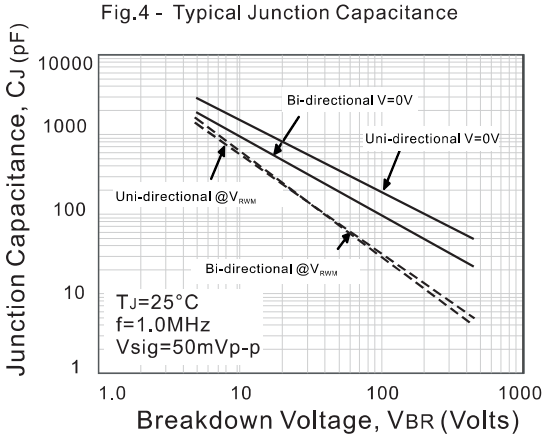



Fig.5 - Steady State Power Derating Curve

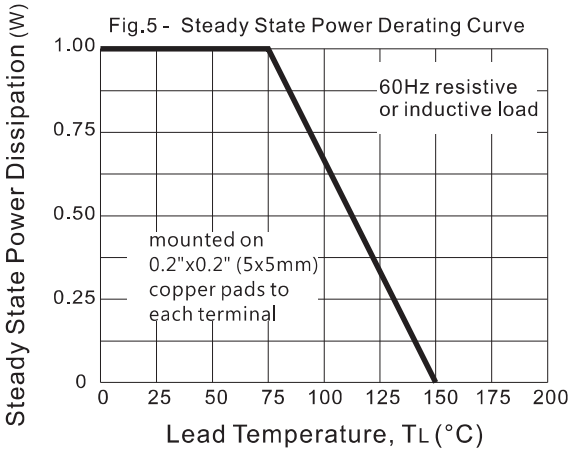
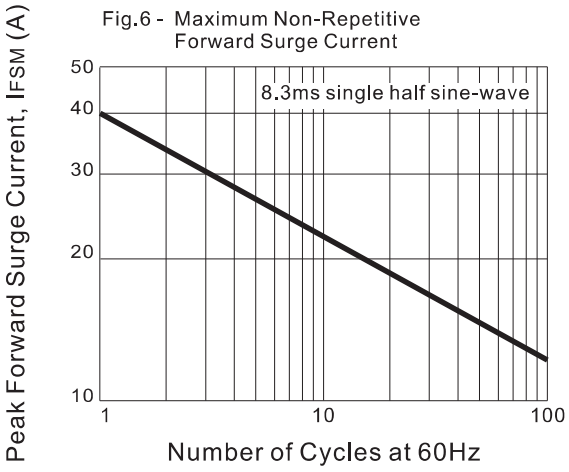


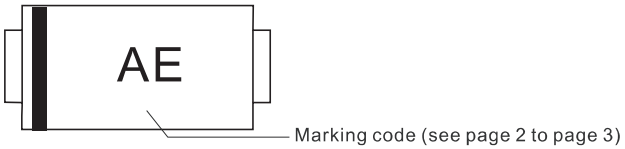
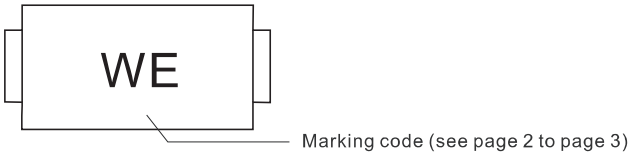

Fig.6 - Maximum Non-Repetitive Forward Surge Current



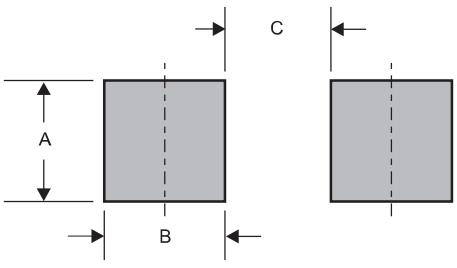
## Pinning information

| Pin | Simplified outline | Symbol |
|---|---|---|
| Uni-Directional<br>Pin1 cathode<br>Pin2 anode |  |  |
| Bi-Directional |  |  |

## Marking

| Type number | Example |
|---|---|
| Uni-Directional |  |
| Bi-Directional |  |

## Suggested solder pad layout

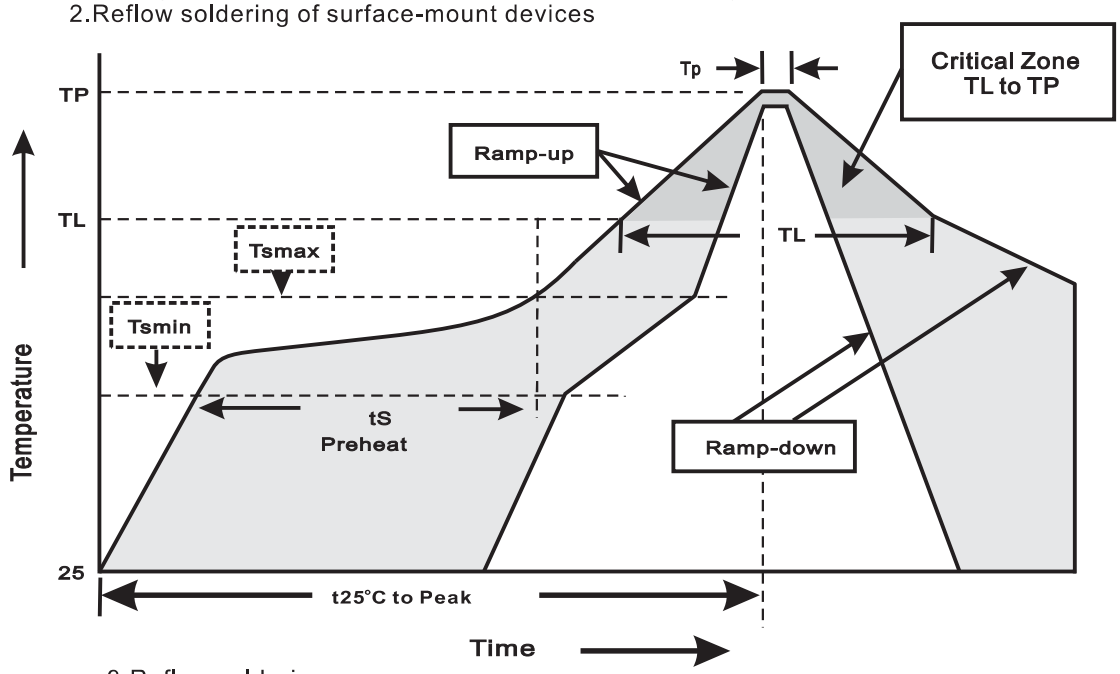



Dimensions in inches and (millimeters)

| PACKAGE | A | B | C |
|---|---|---|---|
| SMA | 0.063 (1.60) | 0.059 (1.50) | 0.110 (2.80) |

## Suggested thermal profiles for soldering processes

1.Storage environment: Temperature=5°C~40°C Humidity=55%±25%
2.Reflow soldering of surface-mount devices




3.Reflow soldering

| Profile Feature | Soldering Condition |
|---|---|
| Average ramp-up rate($T_L$ to $T_P$) | <3°C/sec |
| Preheat<br>-Temperature Min(Tsmin)<br>-Temperature Max(Tsmax)<br>-Time(min to max)($t_s$) | <br>150°C<br>200°C<br>60~120sec |
| Tsmax to $T_L$<br>-Ramp-upRate | <br><3°C/sec |
| Time maintained above:<br>-Temperature($T_L$)<br>-Time($t_L$) | <br>217°C<br>60~260sec |
| Peak Temperature($T_P$) | 255°C-0/+5°C |
| Time within 5°C of actual Peak Temperature($t_P$) | 10~30sec |
| Ramp-down Rate | <6°C/sec |
| Time 25°C to Peak Temperature | <6minutes |

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