



**Surface Mount Transient Voltage Suppressors**  
**Peak Pulse Power 200W Working Voltage 5.0 to 190V**

# SMF5.0A thru SMF190CA

## Features

- Glass passivated chip
- Uni and Bidirectional unit
- Excellent clamping capability
- 200W peak pulse power capability with a 10/1000µs waveform, repetition rate (duty cycle) : 0.01%
- Very-fast response time
- Low leakage
- RoHS compliant

## Mechanical Data

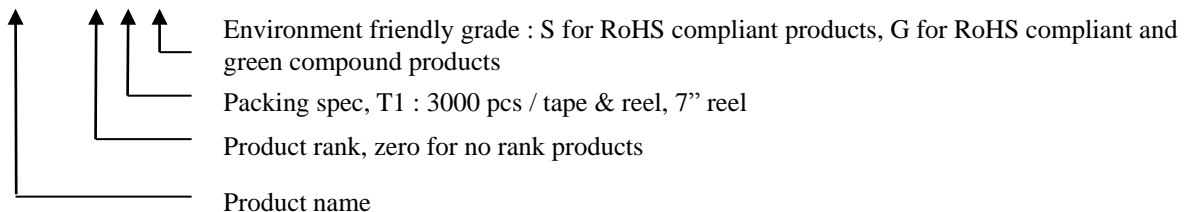
- Case : Molded plastic
- Terminals: Pure tin plated, solderable per MIL-STD-750 method 2026
- Polarity: For uni-directional types, the band denotes the cathode, which is positive with respect to the anode under normal TVS operation
- Mounting position : Any
- Epoxy: UL 94V-0 rate flame retardant

## Devices for bidirectional applications

For bi-directional devices, use suffix CA (e.g. SMF10CA). Electrical characteristics apply in both directions.

## Ordering Information

| Device            | Package                                                | Shipping               |
|-------------------|--------------------------------------------------------|------------------------|
| SMFXXX(C)A-0-T1-G | SMF<br>(Pb-free lead plating and halogen-free package) | 3000 pcs / tape & reel |





**Maximum Ratings and Characteristics**( $T_A=25^{\circ}\text{C}$ , unless otherwise noted)

| Parameter                                                                             | Symbol                           | Value          | Unit               |
|---------------------------------------------------------------------------------------|----------------------------------|----------------|--------------------|
| Peak pulse power dissipation with a 10/1000 $\mu\text{s}$ waveform (Note 1)           | PPP                              | 200            | W                  |
| Peak pulse power dissipation with a 8/20 $\mu\text{s}$ waveform (Note 1)              | PPP                              | 1000           | W                  |
| Peak pulse current with a 10/1000 $\mu\text{s}$ waveform (Note 1)                     | IPP                              | See next table | A                  |
| Peak forward surge current, 8.3ms single half sine wave uni-directional only (Note 2) | IFSM                             | 20             | A                  |
| Typical thermal resistance, junction to ambient air (Note 3)                          | R <sub>thJA</sub>                | 200            | K/W                |
| Typical thermal resistance, junction to Lead (Note 3)                                 | R <sub>thJL</sub>                | 100            | K/W                |
| Power dissipation on infinite heatsink at $T_L=75^{\circ}\text{C}$                    | P <sub>D</sub>                   | 0.4            | W                  |
| Maximum instantaneous forward voltage at 25A for unidirectional only                  | V <sub>F</sub>                   | 3.5            | V                  |
| Operating junction and storage temperature range                                      | T <sub>J</sub> ;T <sub>STG</sub> | -55 ~ +150     | $^{\circ}\text{C}$ |

Notes:

1. Non-repetitive current pulse, per Fig. 5 and derated above  $T_A=25^{\circ}\text{C}$  per Fig. 1.
2. Mounted on 8.3ms single half sine-wave or equivalent square wave, duty cycle=4 pulses per minute maximum.
3. Mounted on PCB with 10mm x 10 mm x 2mm Cu pads to each terminal.

**Electrical Characteristics** Ratings at  $25^{\circ}\text{C}$  ambient temperature, unless otherwise noted.

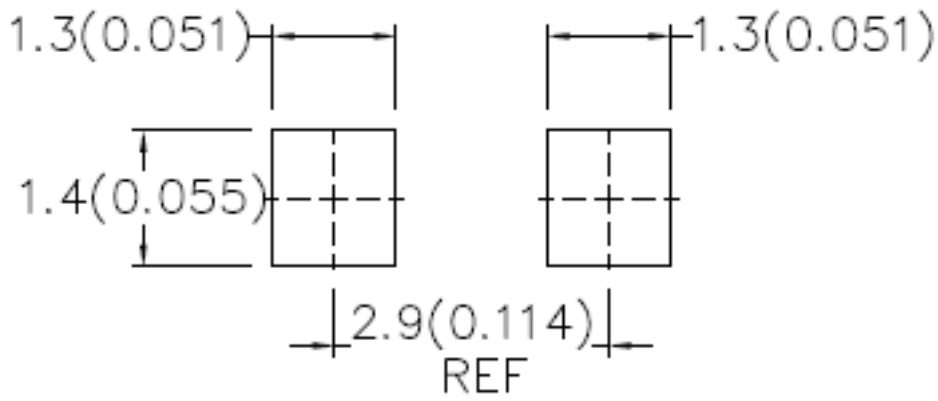
| Part Number (UNI) | Part Number (BI) | Device Marking Code |    | Breakdown Voltage $V_{(BR)}$ @ $I_T$ |         |            | Maximum reverse leakage $I_R$ @ $V_{RWM}$ ( $\mu\text{A}$ ) | Working Peak reverse voltage $V_{RWM}$ (V) | Maximum reverse surge Current $I_{PP}$ (A) | Maximum clamping voltage $V_C$ @ $I_{PP}$ (V) |
|-------------------|------------------|---------------------|----|--------------------------------------|---------|------------|-------------------------------------------------------------|--------------------------------------------|--------------------------------------------|-----------------------------------------------|
|                   |                  | UNI                 | BI | Min (V)                              | Max (V) | $I_T$ (mA) |                                                             |                                            |                                            |                                               |
| SMF5.0A           | SMF5.0CA         | FE                  | KE | 6.40                                 | 7.00    | 10         | 400                                                         | 5.0                                        | 21.74                                      | 9.2                                           |
| SMF6.0A           | SMF6.0CA         | FG                  | KG | 6.67                                 | 7.37    | 10         | 400                                                         | 6.0                                        | 19.42                                      | 10.3                                          |
| SMF6.5A           | SMF6.5CA         | FK                  | KK | 7.22                                 | 7.98    | 10         | 250                                                         | 6.5                                        | 17.86                                      | 11.2                                          |
| SMF7.0A           | SMF7.0CA         | FM                  | KM | 7.78                                 | 8.60    | 10         | 100                                                         | 7.0                                        | 16.67                                      | 12.0                                          |
| SMF7.5A           | SMF7.5CA         | FP                  | KP | 8.33                                 | 9.21    | 1          | 50                                                          | 7.5                                        | 15.50                                      | 12.9                                          |
| SMF8.0A           | SMF8.0CA         | FR                  | KR | 8.89                                 | 9.83    | 1          | 25                                                          | 8.0                                        | 14.71                                      | 13.6                                          |
| SMF8.5A           | SMF8.5K          | FT                  | KT | 9.44                                 | 10.40   | 1          | 10                                                          | 8.5                                        | 13.89                                      | 14.4                                          |
| SMF9.0A           | SMF9.0CA         | FV                  | KV | 10.00                                | 11.10   | 1          | 5                                                           | 9.0                                        | 12.99                                      | 15.4                                          |
| SMF10A            | SMF10CA          | FX                  | KX | 11.10                                | 12.30   | 1          | 2.5                                                         | 10.0                                       | 11.76                                      | 17.0                                          |
| SMF11A            | SMF11CA          | FZ                  | KZ | 12.20                                | 13.50   | 1          | 2.5                                                         | 11.0                                       | 10.99                                      | 18.2                                          |
| SMF12A            | SMF12CA          | HE                  | LE | 13.30                                | 14.70   | 1          | 2.5                                                         | 12.0                                       | 10.05                                      | 19.9                                          |
| SMF13A            | SMF13CA          | HG                  | LG | 14.40                                | 15.90   | 1          | 1                                                           | 13.0                                       | 9.30                                       | 21.5                                          |
| SMF14A            | SMF14CA          | HK                  | LK | 15.60                                | 17.20   | 1          | 1                                                           | 14.0                                       | 8.62                                       | 23.2                                          |
| SMF15A            | SMF15CA          | HM                  | LM | 16.70                                | 18.50   | 1          | 1                                                           | 15.0                                       | 8.20                                       | 24.4                                          |
| SMF16A            | SMF16CA          | HP                  | LP | 17.80                                | 19.70   | 1          | 1                                                           | 16.0                                       | 7.69                                       | 26.0                                          |
| SMF17A            | SMF17CA          | HR                  | LR | 18.90                                | 20.90   | 1          | 1                                                           | 17.0                                       | 7.25                                       | 27.6                                          |
| SMF18A            | SMF18CA          | HT                  | LT | 20.00                                | 22.10   | 1          | 1                                                           | 18.0                                       | 6.85                                       | 29.2                                          |
| SMF19A            | SMF19CA          | HB                  | LB | 21.10                                | 23.30   | 1          | 1                                                           | 19.0                                       | 6.54                                       | 30.6                                          |
| SMF20A            | SMF20CA          | HV                  | LV | 22.20                                | 24.50   | 1          | 1                                                           | 20.0                                       | 6.17                                       | 32.4                                          |
| SMF22A            | SMF22CA          | HX                  | LX | 24.40                                | 26.90   | 1          | 1                                                           | 22.0                                       | 5.63                                       | 35.5                                          |
| SMF24A            | SMF24CA          | HZ                  | LZ | 26.70                                | 29.50   | 1          | 1                                                           | 24.0                                       | 5.14                                       | 38.9                                          |



| Part Number<br>(UNI) | Part Number<br>(BI) | Device<br>Marking<br>Code |    | Breakdown Voltage<br>$V_{(BR)}$ @ $I_T$ |            |               | Maximum<br>reverse<br>leakage $I_R$<br>@ $V_{RWM}$<br>( $\mu A$ ) | Working<br>Peak<br>reverse<br>voltage<br>$V_{RWM}$<br>(V) | Maximum<br>reverse<br>surge<br>Current<br>$I_{PP}$<br>(A) | Maximum<br>clamping<br>voltage $V_C$<br>@ $I_{PP}$<br>(V) |
|----------------------|---------------------|---------------------------|----|-----------------------------------------|------------|---------------|-------------------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------|
|                      |                     | UNI                       | BI | Min<br>(V)                              | Max<br>(V) | $I_T$<br>(mA) |                                                                   |                                                           |                                                           |                                                           |
| SMF26A               | SMF26CA             | JE                        | ME | 28.90                                   | 31.90      | 1             | 1                                                                 | 26.0                                                      | 4.75                                                      | 42.1                                                      |
| SMF28A               | SMF28CA             | JG                        | MG | 31.10                                   | 34.40      | 1             | 1                                                                 | 28.0                                                      | 4.41                                                      | 45.4                                                      |
| SMF30A               | SMF30CA             | JK                        | MK | 33.30                                   | 36.80      | 1             | 1                                                                 | 30.0                                                      | 4.13                                                      | 48.4                                                      |
| SMF33A               | SMF33CA             | JM                        | MM | 36.70                                   | 40.60      | 1             | 1                                                                 | 33.0                                                      | 3.75                                                      | 53.3                                                      |
| SMF36A               | SMF36CA             | JP                        | MP | 40.00                                   | 44.20      | 1             | 1                                                                 | 36.0                                                      | 3.44                                                      | 58.1                                                      |
| SMF40A               | SMF40CA             | JR                        | MR | 44.40                                   | 49.10      | 1             | 1                                                                 | 40.0                                                      | 3.10                                                      | 64.5                                                      |
| SMF43A               | SMF43CA             | JT                        | MT | 47.80                                   | 52.80      | 1             | 1                                                                 | 43.0                                                      | 2.88                                                      | 69.4                                                      |
| SMF45A               | SMF45CA             | JV                        | MV | 50.00                                   | 55.30      | 1             | 1                                                                 | 45.0                                                      | 2.75                                                      | 72.7                                                      |
| SMF48A               | SMF48CA             | JX                        | MX | 53.30                                   | 58.90      | 1             | 1                                                                 | 48.0                                                      | 2.58                                                      | 77.4                                                      |
| SMF51A               | SMF51CA             | JZ                        | MZ | 56.70                                   | 62.70      | 1             | 1                                                                 | 51.0                                                      | 2.43                                                      | 82.4                                                      |
| SMF54A               | SMF54CA             | XE                        | NE | 60.00                                   | 66.30      | 1             | 1                                                                 | 54.0                                                      | 2.30                                                      | 87.1                                                      |
| SMF58A               | SMF58CA             | XG                        | NG | 64.40                                   | 71.20      | 1             | 1                                                                 | 58.0                                                      | 2.14                                                      | 93.6                                                      |
| SMF60A               | SMF60CA             | XK                        | NK | 66.70                                   | 73.70      | 1             | 1                                                                 | 60.0                                                      | 2.07                                                      | 96.8                                                      |
| SMF64A               | SMF64CA             | XM                        | NM | 71.10                                   | 78.60      | 1             | 1                                                                 | 64.0                                                      | 1.94                                                      | 103.0                                                     |
| SMF70A               | SMF70CA             | XP                        | NP | 77.80                                   | 86.00      | 1             | 1                                                                 | 70.0                                                      | 1.77                                                      | 113.0                                                     |
| SMF75A               | SMF75CA             | XR                        | NR | 83.30                                   | 92.10      | 1             | 1                                                                 | 75.0                                                      | 1.65                                                      | 121.0                                                     |
| SMF78A               | SMF78CA             | XT                        | NT | 86.70                                   | 95.80      | 1             | 1                                                                 | 78.0                                                      | 1.59                                                      | 126.0                                                     |
| SMF80A               | SMF80CA             | XB                        | NB | 88.80                                   | 97.60      | 1             | 1                                                                 | 80.0                                                      | 1.55                                                      | 129.0                                                     |
| SMF85A               | SMF85CA             | XV                        | NV | 94.40                                   | 104.00     | 1             | 1                                                                 | 85.0                                                      | 1.46                                                      | 137.0                                                     |
| SMF90A               | SMF90CA             | XX                        | NX | 100.00                                  | 111.00     | 1             | 1                                                                 | 90.0                                                      | 1.37                                                      | 146.0                                                     |
| SMF100A              | SMF100CA            | XZ                        | NZ | 111.00                                  | 123.00     | 1             | 1                                                                 | 100.0                                                     | 1.23                                                      | 162.0                                                     |
| SMF110A              | SMF110CA            | TE                        | PE | 122.00                                  | 135.00     | 1             | 1                                                                 | 110.0                                                     | 1.13                                                      | 177.0                                                     |
| SMF120A              | SMF120CA            | TG                        | PG | 133.00                                  | 147.00     | 1             | 1                                                                 | 120.0                                                     | 1.04                                                      | 193.0                                                     |
| SMF130A              | SMF130CA            | TK                        | PK | 144.00                                  | 159.00     | 1             | 1                                                                 | 130.0                                                     | 0.96                                                      | 209.0                                                     |
| SMF140A              | SMF140CA            | TB                        | PB | 155.00                                  | 171.00     | 1             | 1                                                                 | 140.0                                                     | 0.89                                                      | 224.0                                                     |
| SMF150A              | SMF150CA            | TM                        | PM | 167.00                                  | 185.00     | 1             | 1                                                                 | 150.0                                                     | 0.82                                                      | 243.0                                                     |
| SMF160A              | SMF160CA            | TP                        | PP | 178.00                                  | 197.00     | 1             | 1                                                                 | 160.0                                                     | 0.77                                                      | 259.0                                                     |
| SMF170A              | SMF170CA            | TR                        | PR | 189.00                                  | 209.00     | 1             | 1                                                                 | 170.0                                                     | 0.73                                                      | 275.0                                                     |
| SMF180A              | SMF180CA            | TT                        | PT | 200.00                                  | 220.00     | 1             | 1                                                                 | 180.0                                                     | 0.69                                                      | 292.0                                                     |
| SMF190A              | SMF190CA            | TV                        | PV | 211.00                                  | 232.00     | 1             | 1                                                                 | 190.0                                                     | 0.69                                                      | 308.0                                                     |

- Note: 1.Suffix 'A' denotes 5% tolerance device.  
 2.Add suffix 'C' or 'CA' after part number to specify Bi-directional devices.  
 3.For bidirectional types having  $V_R$  of 10 volts and less, the  $I_R$  limit is doubled.

**Recommended Footprint**



Mounting Pad Layout

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

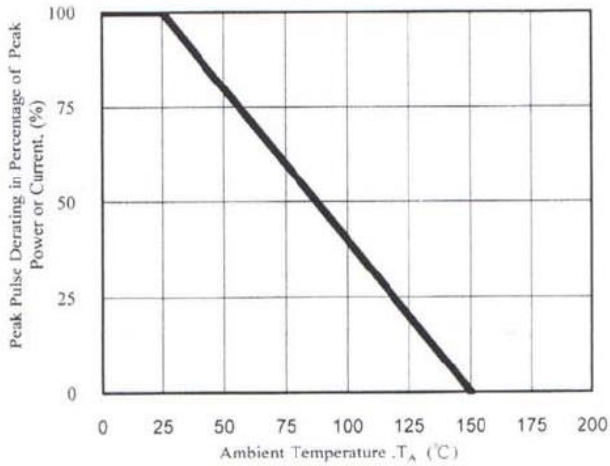


Fig. 1 - Pulse Derating Curve

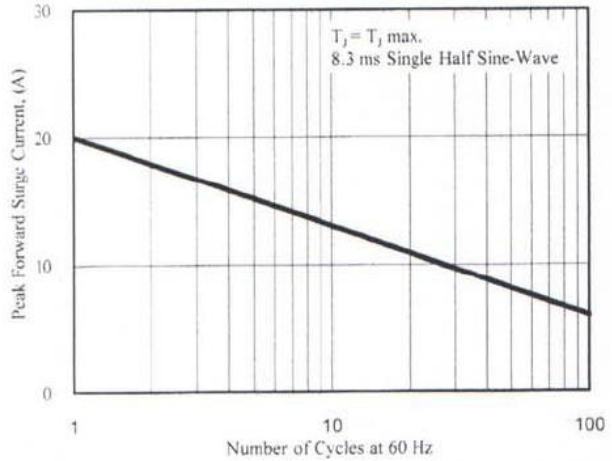


Fig. 2 - Maximum Non-Repetitive Surge Current

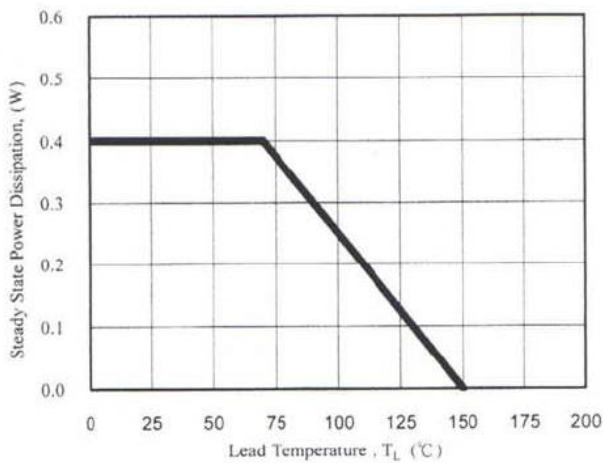


Fig. 3 - Steady State Power Derating Curve

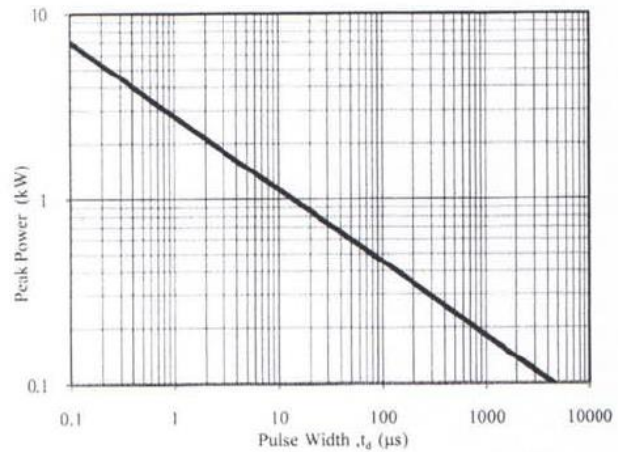


Fig. 4 - Peak Pulse Power Rating Curve

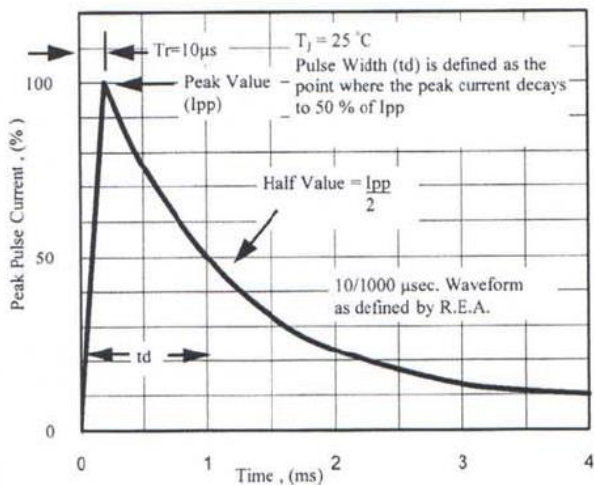


Fig. 5 - Pulse Waveform

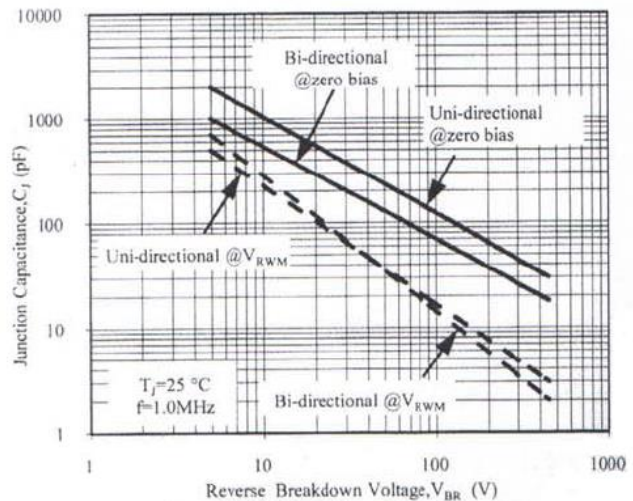
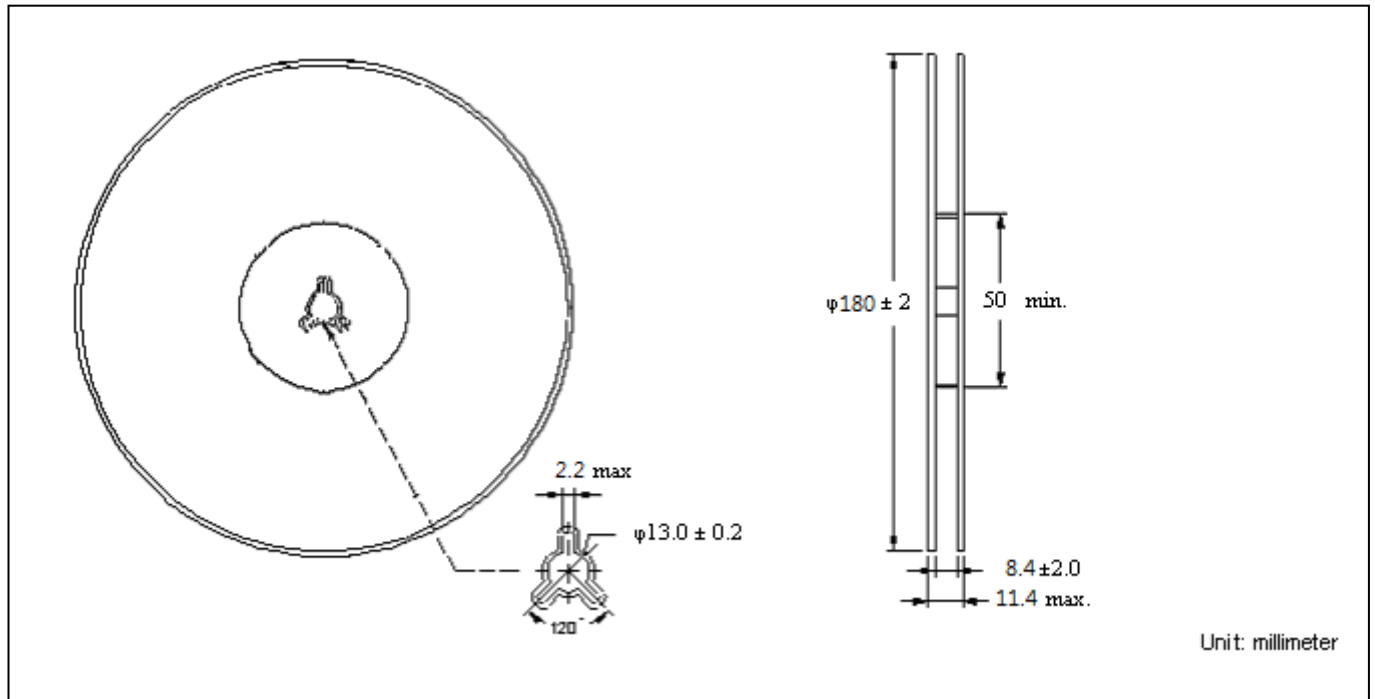
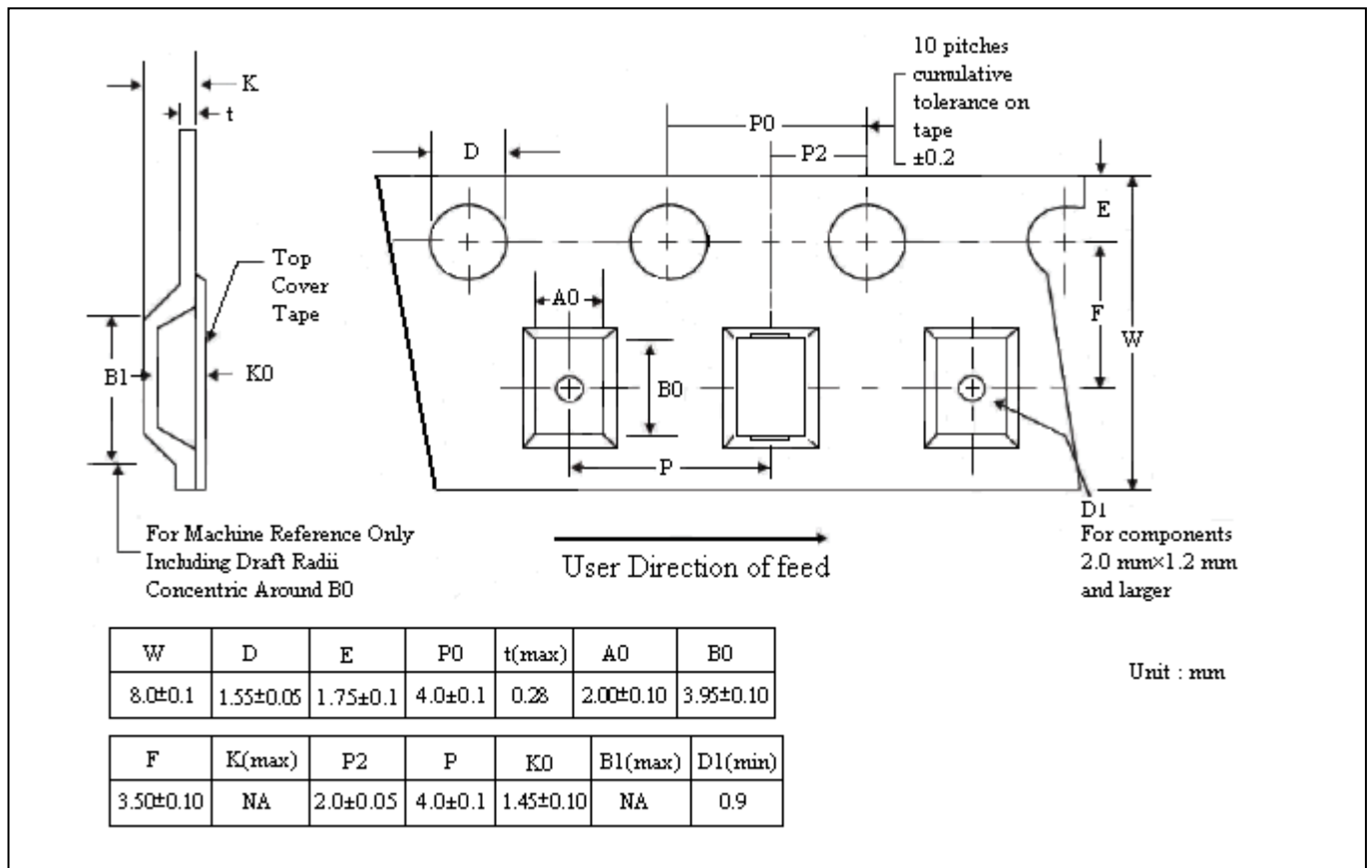


Fig. 6 - Typical Junction Capacitance

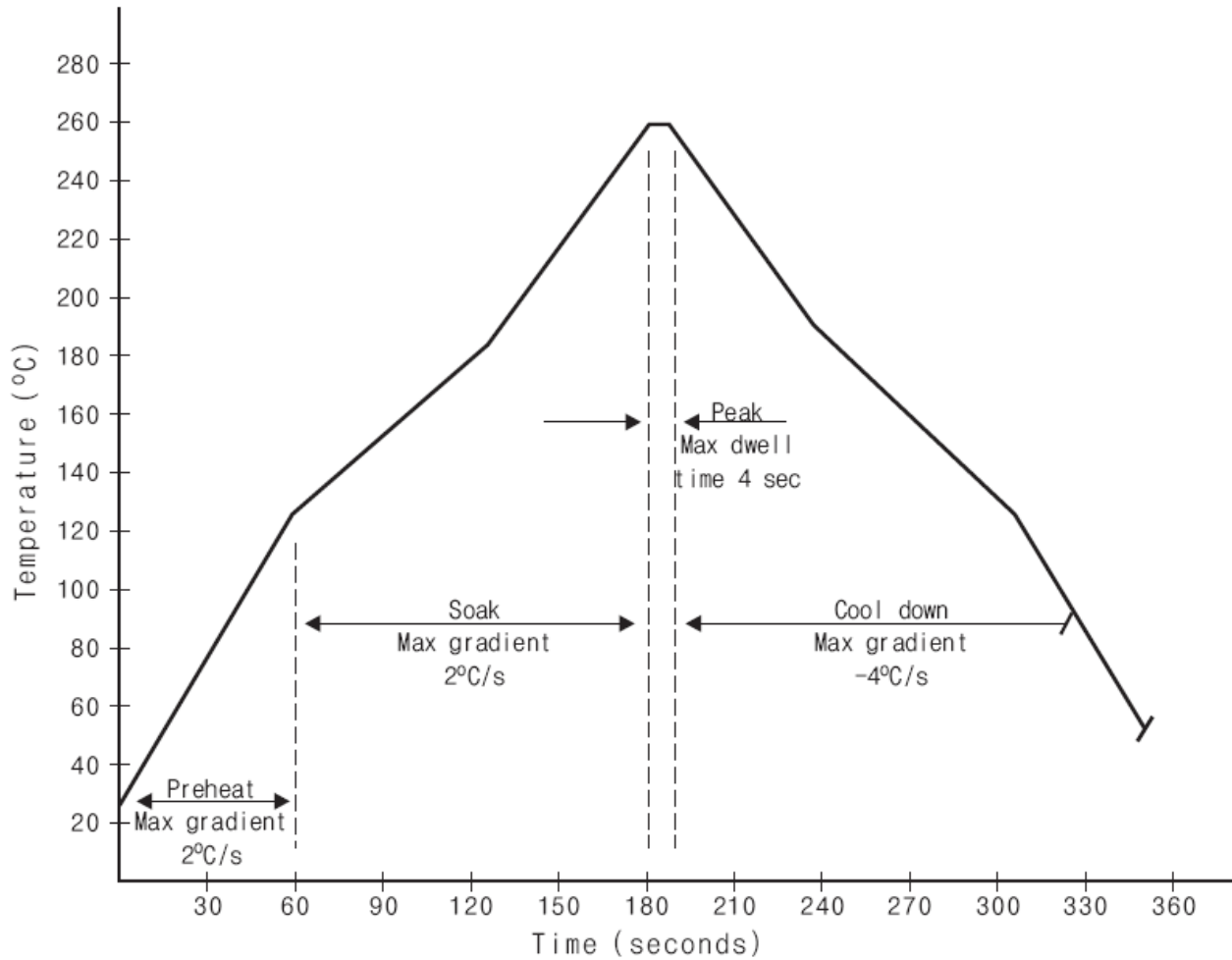
**Reel Dimension**



**Carrier Tape Dimension**



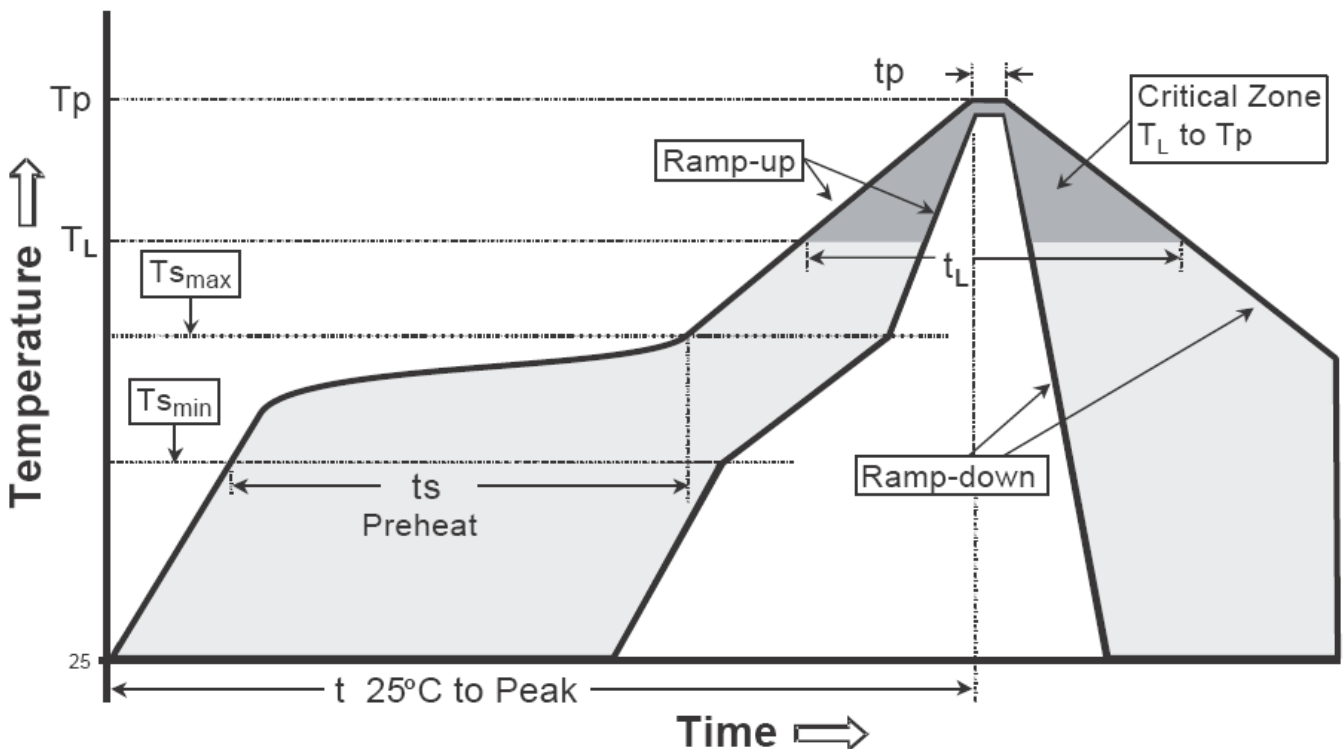
### Recommended Wave Soldering Profile





**Recommended wave soldering condition**

|                 |                  |                 |
|-----------------|------------------|-----------------|
| Product         | Peak Temperature | Soldering Time  |
| Pb-free devices | 260 +0/-5 °C     | 5 +1/-1 seconds |

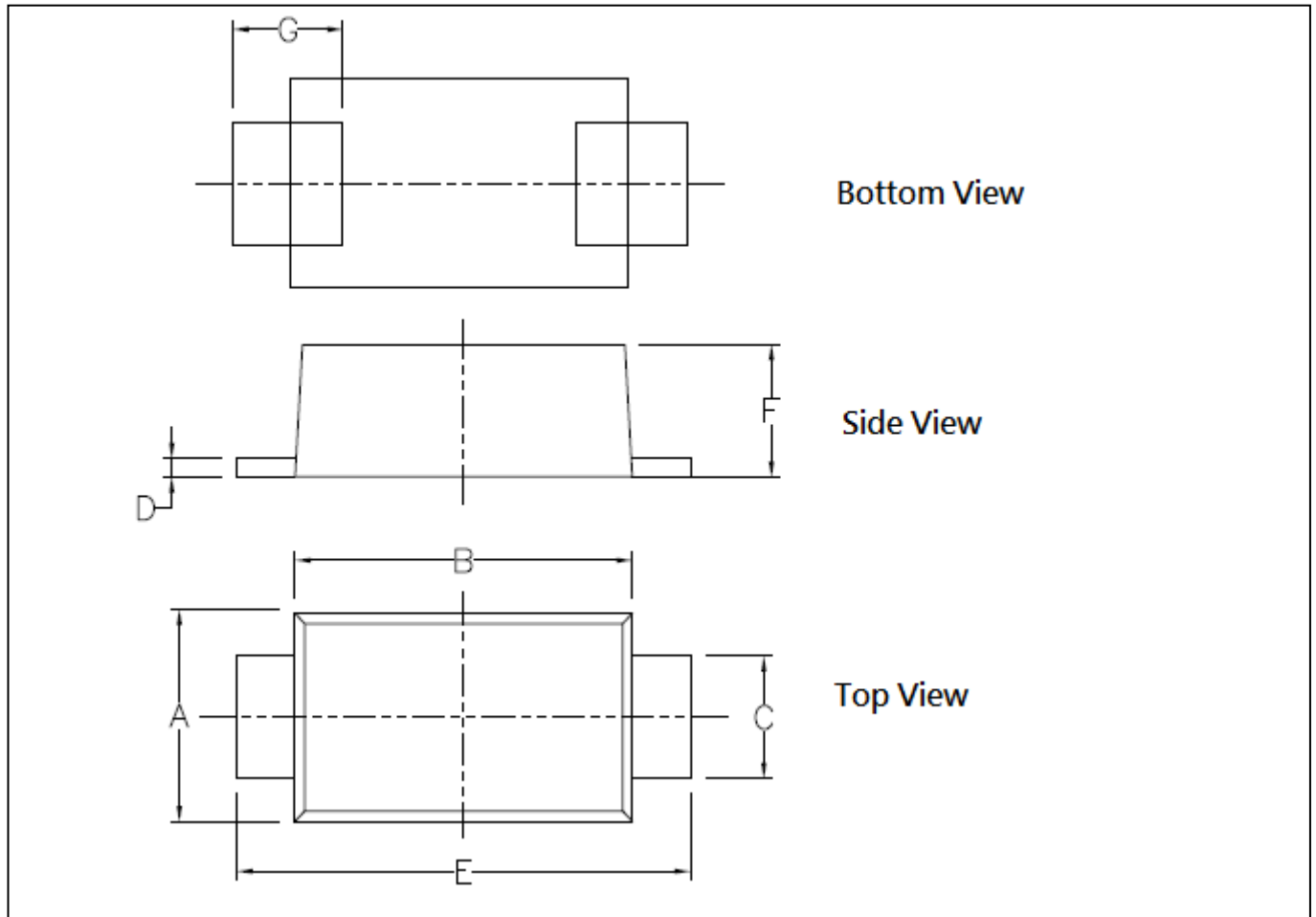
**Recommended temperature profile for IR reflow**


| Profile feature                                             | Sn-Pb eutectic Assembly | Pb-free Assembly |
|-------------------------------------------------------------|-------------------------|------------------|
| Average ramp-up rate (T <sub>smax</sub> to T <sub>p</sub> ) | 3°C/second max.         | 3°C/second max.  |
| Preheat                                                     |                         |                  |
| -Temperature Min(T <sub>s min</sub> )                       | 100°C                   | 150°C            |
| -Temperature Max(T <sub>s max</sub> )                       | 150°C                   | 200°C            |
| -Time(t <sub>s min</sub> to t <sub>s max</sub> )            | 60-120 seconds          | 60-180 seconds   |
| Time maintained above:                                      |                         |                  |
| -Temperature (T <sub>L</sub> )                              | 183°C                   | 217°C            |
| - Time (t <sub>L</sub> )                                    | 60-150 seconds          | 60-150 seconds   |
| Peak Temperature(T <sub>P</sub> )                           | 240 +0/-5 °C            | 260 +0/-5 °C     |
| Time within 5°C of actual peak temperature(tp)              | 10-30 seconds           | 20-40 seconds    |
| Ramp down rate                                              | 6°C/second max.         | 6°C/second max.  |
| Time 25 °C to peak temperature                              | 6 minutes max.          | 8 minutes max.   |

Note : All temperatures refer to topside of the package, measured on the package body surface.



**SMF Dimension**



| DIM | Millimeters |      | Inches |       | DIM | Millimeters |      | Inches |       |
|-----|-------------|------|--------|-------|-----|-------------|------|--------|-------|
|     | Min.        | Max. | Min.   | Max.  |     | Min.        | Max. | Min.   | Max.  |
| A   | 1.60        | 1.90 | 0.063  | 0.075 | E   | 3.50        | 3.90 | 0.138  | 0.154 |
| B   | 2.60        | 2.90 | 0.102  | 0.114 | F   | 0.95        | 1.30 | 0.037  | 0.051 |
| C   | 0.70        | 1.20 | 0.028  | 0.047 | G   | 0.35        | 0.85 | 0.014  | 0.033 |
| D   | 0.05        | 0.25 | 0.002  | 0.010 | H   |             |      |        |       |

Notes : 1.Controlling dimension : millimeters.  
 2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.  
 3.If there is any question with packing specification or packing method, please contact your local CYStek sales office.

**Material :**

- Lead : Pure tin plated.
- Mold Compound : Epoxy resin family, flammability solid burning class:UL94V-0.

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