

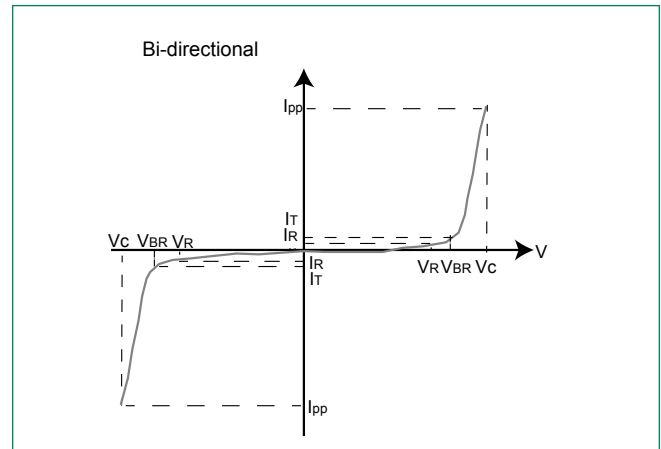
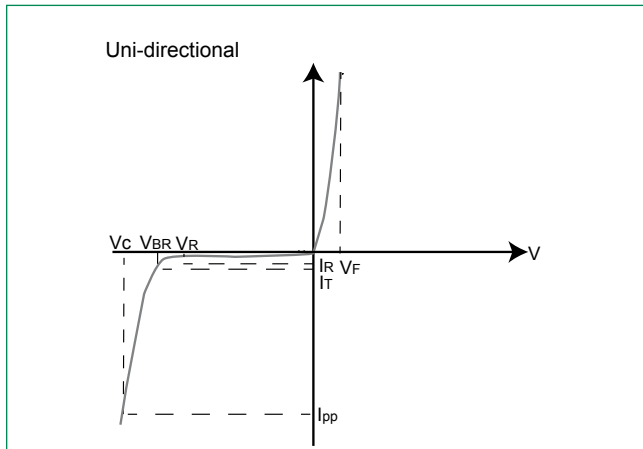
### Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Part Number |          | Marking Code |    | Breakdown Voltage VBR<br>(Volts) @ IT |        | Test Current IT<br>(mA) | Reverse Stand<br>off Voltage<br>VR (V) | Maximum Re-<br>verse Leakage<br>@ VR IR (μA) | Maximum Peak<br>Pulse Current<br>Ipp (A)<br>10*1000us | Maximum<br>Clamping<br>Voltage @Ipp<br>VC (V)<br>10*1000us | Agency Approval<br> |    |
|-------------|----------|--------------|----|---------------------------------------|--------|-------------------------|----------------------------------------|----------------------------------------------|-------------------------------------------------------|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----|
| Uni         | Bi       | Uni          | Bi | MIN                                   | MAX    |                         |                                        |                                              |                                                       |                                                            | Uni                                                                                                    | Bi |
| SMF5.0A     | SMF5.0CA | AE           | HE | 6.40                                  | 7.00   | 10                      | 5.0                                    | 400                                          | 21.7                                                  | 9.2                                                        | X                                                                                                      | -  |
| SMF6.0A     | SMF6.0CA | AG           | HG | 6.67                                  | 7.37   | 10                      | 6.0                                    | 400                                          | 19.4                                                  | 10.3                                                       | X                                                                                                      | -  |
| SMF6.5A     | SMF6.5CA | AK           | HK | 7.22                                  | 7.98   | 10                      | 6.5                                    | 250                                          | 17.9                                                  | 11.2                                                       | X                                                                                                      | -  |
| SMF7.0A     | SMF7.0CA | AM           | HM | 7.78                                  | 8.60   | 10                      | 7.0                                    | 100                                          | 16.7                                                  | 12.0                                                       | X                                                                                                      | -  |
| SMF7.5A     | SMF7.5CA | AP           | HP | 8.33                                  | 9.21   | 1                       | 7.5                                    | 50                                           | 15.5                                                  | 12.9                                                       | X                                                                                                      | -  |
| SMF8.0A     | SMF8.0CA | AR           | HR | 8.89                                  | 9.83   | 1                       | 8.0                                    | 25                                           | 14.7                                                  | 13.6                                                       | X                                                                                                      | -  |
| SMF8.5A     | SMF8.5CA | AT           | HT | 9.44                                  | 10.40  | 1                       | 8.5                                    | 10                                           | 13.9                                                  | 14.4                                                       | X                                                                                                      | -  |
| SMF9.0A     | SMF9.0CA | AV           | HV | 10.00                                 | 11.10  | 1                       | 9.0                                    | 5                                            | 13.0                                                  | 15.4                                                       | X                                                                                                      | -  |
| SMF10A      | SMF10CA  | AX           | HX | 11.10                                 | 12.30  | 1                       | 10                                     | 2.5                                          | 11.8                                                  | 17.0                                                       | X                                                                                                      | -  |
| SMF11A      | SMF11CA  | AZ           | HZ | 12.20                                 | 13.50  | 1                       | 11                                     | 2.5                                          | 11.0                                                  | 18.2                                                       | X                                                                                                      | -  |
| SMF12A      | SMF12CA  | BE           | IE | 13.30                                 | 14.70  | 1                       | 12                                     | 2.5                                          | 10.1                                                  | 19.9                                                       | X                                                                                                      | -  |
| SMF13A      | SMF13CA  | BG           | IG | 14.40                                 | 15.90  | 1                       | 13                                     | 1.0                                          | 9.3                                                   | 21.5                                                       | X                                                                                                      | -  |
| SMF14A      | SMF14CA  | BK           | IK | 15.60                                 | 17.20  | 1                       | 14                                     | 1.0                                          | 8.6                                                   | 23.2                                                       | X                                                                                                      | -  |
| SMF15A      | SMF15CA  | BM           | IM | 16.70                                 | 18.50  | 1                       | 15                                     | 1.0                                          | 8.2                                                   | 24.4                                                       | X                                                                                                      | -  |
| SMF16A      | SMF16CA  | BP           | IP | 17.80                                 | 19.70  | 1                       | 16                                     | 1.0                                          | 7.7                                                   | 26.0                                                       | X                                                                                                      | -  |
| SMF17A      | SMF17CA  | BR           | IR | 18.90                                 | 20.90  | 1                       | 17                                     | 1.0                                          | 7.2                                                   | 27.6                                                       | X                                                                                                      | -  |
| SMF18A      | SMF18CA  | BT           | IT | 20.0 0                                | 22.10  | 1                       | 18                                     | 1.0                                          | 6.8                                                   | 29.2                                                       | X                                                                                                      | -  |
| SMF20A      | SMF20CA  | BV           | IV | 22.20                                 | 24.50  | 1                       | 20                                     | 1.0                                          | 6.2                                                   | 32.4                                                       | X                                                                                                      | -  |
| SMF22A      | SMF22CA  | BX           | IX | 24.40                                 | 26.90  | 1                       | 22                                     | 1.0                                          | 5.6                                                   | 35.5                                                       | X                                                                                                      | -  |
| SMF24A      | SMF24CA  | BZ           | IZ | 26.70                                 | 29.50  | 1                       | 24                                     | 1.0                                          | 5.1                                                   | 38.9                                                       | X                                                                                                      | -  |
| SMF26A      | SMF26CA  | CE           | JE | 28.90                                 | 31.90  | 1                       | 26                                     | 1.0                                          | 4.8                                                   | 42.1                                                       | X                                                                                                      | -  |
| SMF28A      | SMF28CA  | CG           | JG | 31.10                                 | 34.40  | 1                       | 28                                     | 1.0                                          | 4.4                                                   | 45.4                                                       | X                                                                                                      | -  |
| SMF30A      | SMF30CA  | CK           | JK | 33.30                                 | 36.80  | 1                       | 30                                     | 1.0                                          | 4.1                                                   | 48.4                                                       | X                                                                                                      | -  |
| SMF33A      | SMF33CA  | CM           | JM | 36.70                                 | 40.60  | 1                       | 33                                     | 1.0                                          | 3.8                                                   | 53.3                                                       | X                                                                                                      | -  |
| SMF36A      | SMF36CA  | CP           | JP | 40.00                                 | 44.20  | 1                       | 36                                     | 1.0                                          | 3.4                                                   | 58.1                                                       | X                                                                                                      | -  |
| SMF40A      | SMF40CA  | CR           | JR | 44.40                                 | 49.10  | 1                       | 40                                     | 1.0                                          | 3.1                                                   | 64.5                                                       | X                                                                                                      | -  |
| SMF43A      | SMF43CA  | CT           | JT | 47.80                                 | 52.80  | 1                       | 43                                     | 1.0                                          | 2.9                                                   | 69.4                                                       | X                                                                                                      | -  |
| SMF45A      | SMF45CA  | CV           | JV | 50.00                                 | 55.30  | 1                       | 45                                     | 1.0                                          | 2.8                                                   | 72.7                                                       | X                                                                                                      | -  |
| SMF48A      | SMF48CA  | CX           | JX | 53.30                                 | 58.90  | 1                       | 48                                     | 1.0                                          | 2.6                                                   | 77.4                                                       | X                                                                                                      | -  |
| SMF51A      | SMF51CA  | CZ           | JZ | 56.70                                 | 62.70  | 1                       | 51                                     | 1.0                                          | 2.4                                                   | 82.4                                                       | X                                                                                                      | -  |
| SMF54A      | SMF54CA  | DE           | KE | 60.00                                 | 66.30  | 1                       | 54                                     | 1.0                                          | 2.3                                                   | 87.1                                                       | X                                                                                                      | -  |
| SMF58A      | SMF58CA  | RG           | KG | 64.40                                 | 71.20  | 1                       | 58                                     | 1.0                                          | 2.1                                                   | 93.6                                                       | -                                                                                                      | -  |
| SMF60A      | SMF60CA  | RK           | KK | 66.70                                 | 73.70  | 1                       | 60                                     | 1.0                                          | 2.1                                                   | 96.8                                                       | -                                                                                                      | -  |
| SMF64A      | SMF64CA  | RM           | KM | 71.10                                 | 78.60  | 1                       | 64                                     | 1.0                                          | 1.9                                                   | 103.0                                                      | -                                                                                                      | -  |
| SMF70A      | SMF70CA  | RP           | KP | 77.80                                 | 86.00  | 1                       | 70                                     | 1.0                                          | 1.7                                                   | 113.0                                                      | -                                                                                                      | -  |
| SMF75A      | SMF75CA  | RR           | KR | 83.30                                 | 92.10  | 1                       | 75                                     | 1.0                                          | 1.6                                                   | 121.0                                                      | -                                                                                                      | -  |
| SMF78A      | SMF78CA  | RT           | KT | 86.70                                 | 95.80  | 1                       | 78                                     | 1.0                                          | 1.6                                                   | 126.0                                                      | -                                                                                                      | -  |
| SMF85A      | SMF85CA  | RV           | KV | 94.40                                 | 104.00 | 1                       | 85                                     | 1.0                                          | 1.5                                                   | 137.0                                                      | -                                                                                                      | -  |
| SMF90A      | SMF90CA  | RW           | KX | 100.00                                | 111.00 | 1                       | 90                                     | 1.0                                          | 1.2                                                   | 146.0                                                      | -                                                                                                      | -  |
| SMF100A     | SMF100CA | RX           | KZ | 111.00                                | 123.00 | 1                       | 100                                    | 1.0                                          | 1.1                                                   | 162.0                                                      | -                                                                                                      | -  |
| SMF110A     | SMF110CA | SE           | LE | 122.00                                | 135.00 | 1                       | 110                                    | 1.0                                          | 1.1                                                   | 177.0                                                      | -                                                                                                      | -  |
| SMF120A     | SMF120CA | SG           | LG | 133.00                                | 147.00 | 1                       | 120                                    | 1.0                                          | 1.0                                                   | 193.0                                                      | -                                                                                                      | -  |
| SMF130A     | SMF130CA | SK           | LK | 144.00                                | 159.00 | 1                       | 130                                    | 1.0                                          | 1.0                                                   | 209.0                                                      | -                                                                                                      | -  |
| SMF150A     | SMF150CA | SM           | LM | 167.00                                | 185.00 | 1                       | 150                                    | 1.0                                          | 0.8                                                   | 243.0                                                      | -                                                                                                      | -  |
| SMF160A     | SMF160CA | SP           | LP | 178.00                                | 197.00 | 1                       | 160                                    | 1.0                                          | 0.8                                                   | 259.0                                                      | -                                                                                                      | -  |
| SMF170A     | SMF170CA | SR           | LR | 189.00                                | 209.00 | 1                       | 170                                    | 1.0                                          | 0.7                                                   | 275.0                                                      | -                                                                                                      | -  |
| SMF180A     | SMF180CA | ST           | LT | 201.00                                | 222.00 | 1                       | 180                                    | 1.0                                          | 0.7                                                   | 292.0                                                      | -                                                                                                      | -  |
| SMF188A     | SMF188CA | SV           | LV | 209.00                                | 231.00 | 1                       | 188                                    | 1.0                                          | 0.7                                                   | 304.0                                                      | -                                                                                                      | -  |
| SMF200A     | SMF200CA | SX           | LX | 224.00                                | 247.00 | 1                       | 200                                    | 1.0                                          | 0.6                                                   | 324.0                                                      | -                                                                                                      | -  |
| SMF220A     | SMF220CA | SZ           | LZ | 246.00                                | 272.00 | 1                       | 220                                    | 1.0                                          | 0.6                                                   | 356.0                                                      | -                                                                                                      | -  |
| SMF250A     | SMF250CA | TE           | ME | 279.00                                | 309.00 | 1                       | 250                                    | 1.0                                          | 0.5                                                   | 405.0                                                      | -                                                                                                      | -  |

#### -Notes:

1. V<sub>BR</sub> measured after I<sub>T</sub> applied for 300μs, I<sub>T</sub> = square wave pulse or equivalent.
2. Surge current waveform per 10/1000μs exponential wave and derated per Fig.2.
3. All terms and symbols are consistent with ANSI/IEEE C62.35.
4. For bidirectional type having VR of 10 volts and less, the IR limit is double.

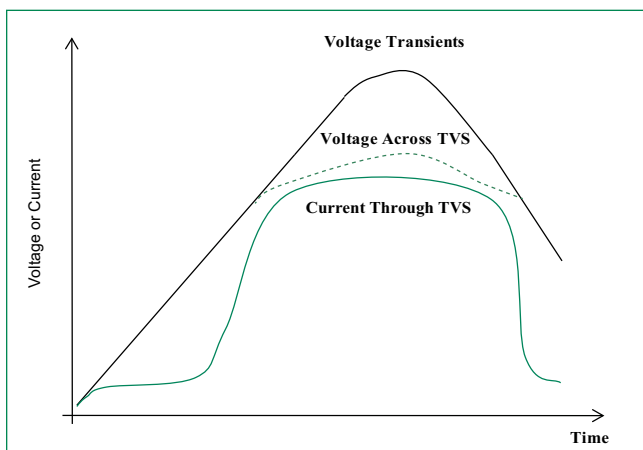
## I-V Curve Characteristics



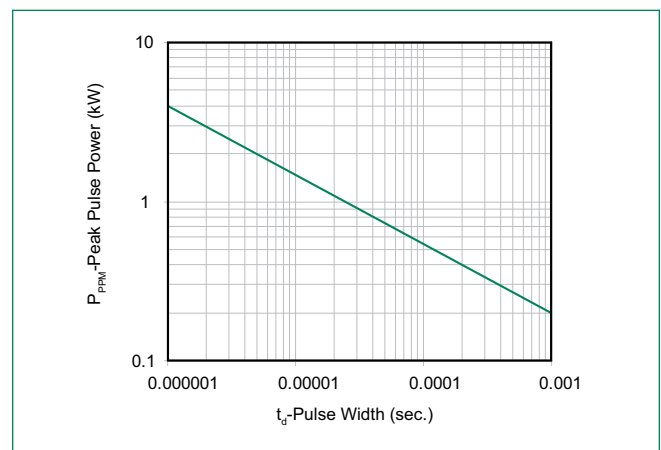
- $P_{PPM}$  Peak Pulse Power Dissipation** – Max power dissipation  
 **$V_R$  Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation  
 **$V_{BR}$  Breakdown Voltage** – Maximum voltage that flows through the TVS at a specified test current ( $I_T$ )  
 **$V_C$  Clamping 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**

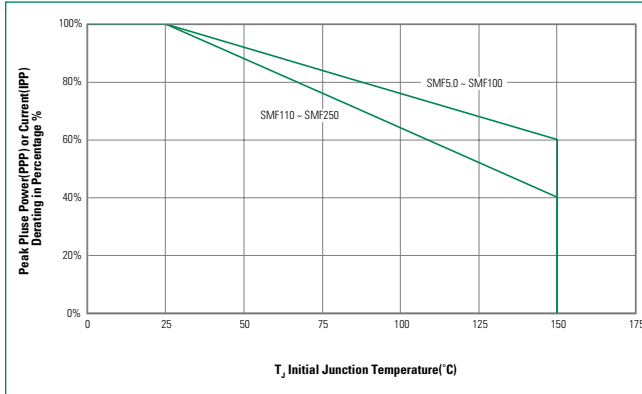


**Figure 2 - Peak Pulse Power Rating Curve**

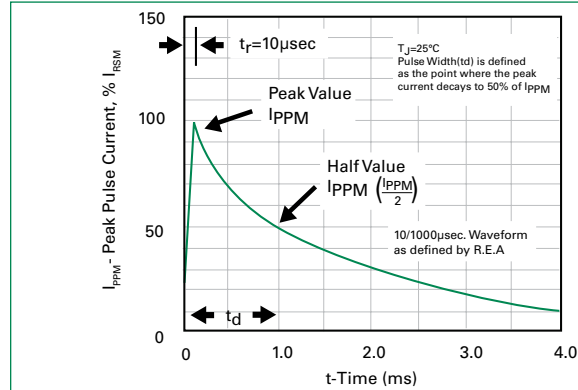


**Ratings and Characteristic Curves** ( $T_A=25^\circ\text{C}$  unless otherwise noted) (Continued)

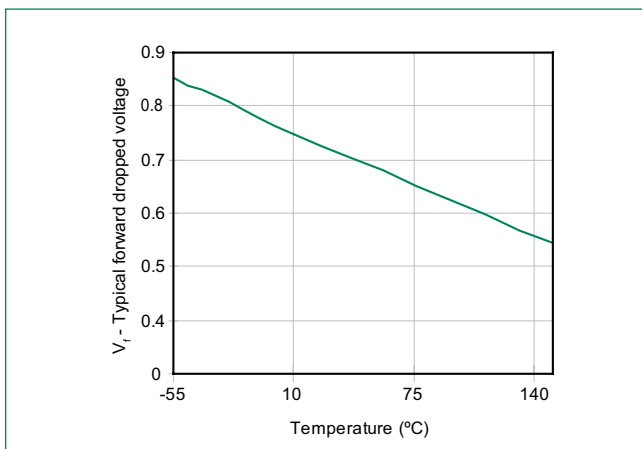
**Figure 3 - Peak Pulse Power Derating Curve**



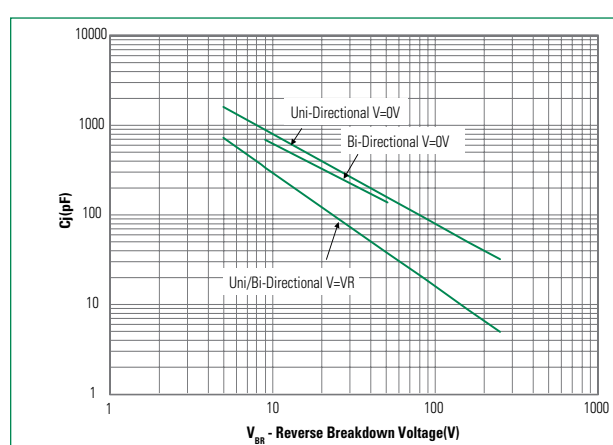
**Figure 4 - Pulse Waveform - 10/1000 $\mu\text{s}$**



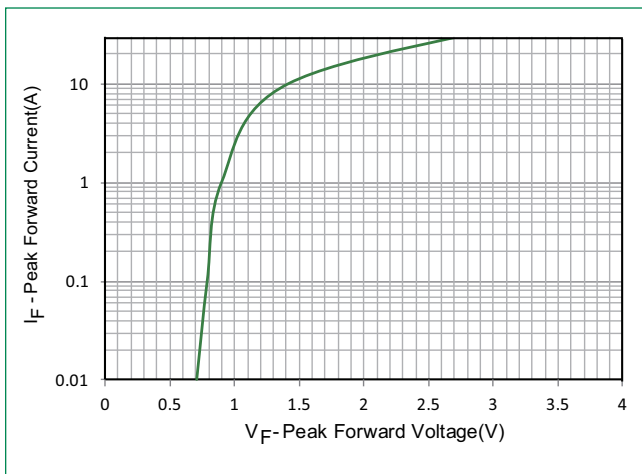
**Figure 5 - Forward Voltage**



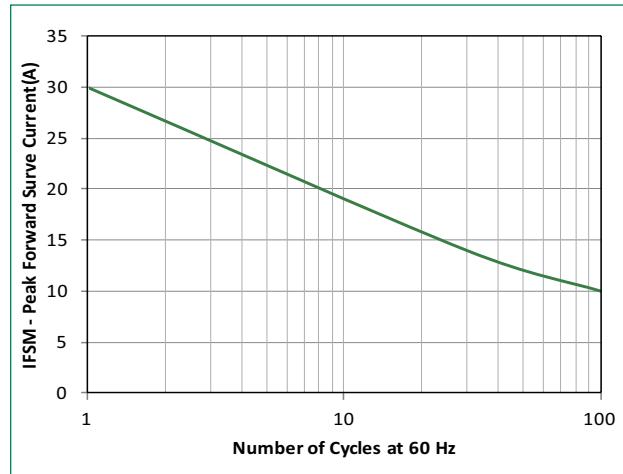
**Figure 6 - Typical Junction Capacitance**



**Figure 7 - Peak Forward Voltage Drop vs. Peak Forward Current**

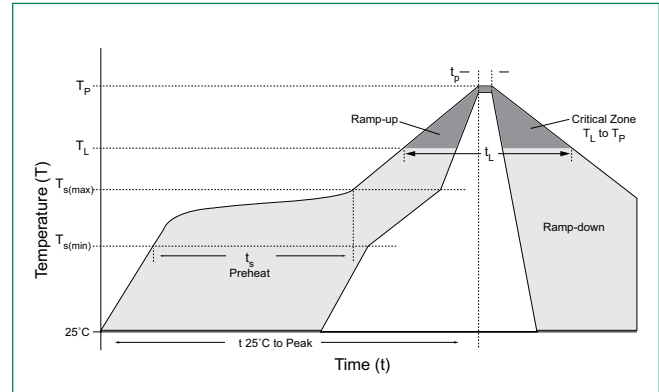


**Figure 8 - Maximum Non-Repetitive Forward Surge Current Uni-Directional Only**



### Soldering Parameters

|                                                                       |                                    |                         |
|-----------------------------------------------------------------------|------------------------------------|-------------------------|
| <b>Reflow Condition</b>                                               |                                    | Lead-free assembly      |
| <b>Pre Heat</b>                                                       | - Temperature Min ( $T_{s(min)}$ ) | 150°C                   |
|                                                                       | - Temperature Max ( $T_{s(max)}$ ) | 200°C                   |
|                                                                       | - Time (min to max) ( $t_s$ )      | 60 – 120 secs           |
| <b>Average ramp up rate (Liquidus Temp (<math>T_L</math>) to peak</b> |                                    | 3°C/second max          |
| <b><math>T_{s(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>     |                                    | 3°C/second max          |
| <b>Reflow</b>                                                         | - Temperature ( $T_L$ ) (Liquidus) | 217°C                   |
|                                                                       | - Time (min to max) ( $t_L$ )      | 60 – 150 seconds        |
| <b>Peak Temperature (<math>T_p</math>)</b>                            |                                    | 260 <sup>+0/-5</sup> °C |
| <b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>  |                                    | 30 Seconds Max          |
| <b>Ramp-down Rate</b>                                                 |                                    | 6°C/second Max          |
| <b>Time 25°C to peak Temperature (<math>T_p</math>)</b>               |                                    | 8 minutes Max.          |
| <b>Do not exceed</b>                                                  |                                    | 260°C                   |



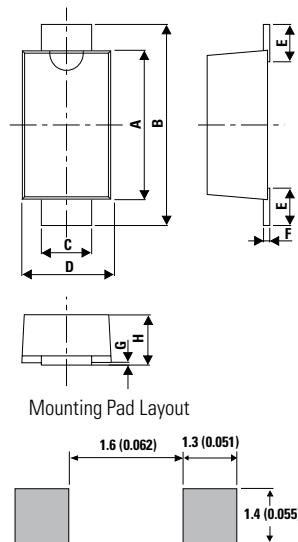
### Physical Specifications

|                 |                                                    |
|-----------------|----------------------------------------------------|
| <b>Case</b>     | SOD-123FL plastic over glass passivated junction   |
| <b>Polarity</b> | Color band denotes cathode except bipolar          |
| <b>Terminal</b> | Matte tin-plated leads, solderable per JESD22-B102 |

### Environmental Specifications

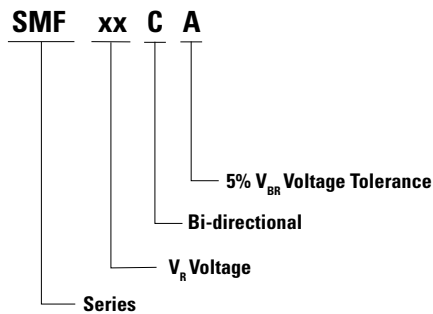
|                            |                          |
|----------------------------|--------------------------|
| <b>High Temp. Storage</b>  | JESD22-A103              |
| <b>HTRB</b>                | JESD22-A108              |
| <b>Temperature Cycling</b> | JESD22-A104              |
| <b>MSL</b>                 | JEDEC-J-STD-020, Level 1 |
| <b>H3TRB</b>               | JESD22-A101              |
| <b>RSH</b>                 | JESD22-A111              |

### Dimensions - SOD-123FL Package

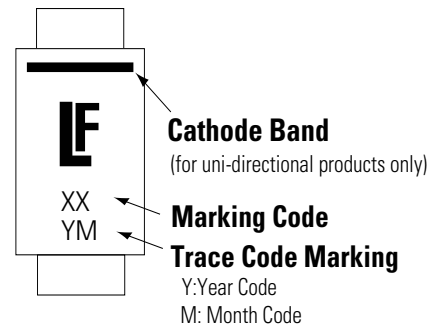


| Dimensions |                   | Millimeters |      | Inches |        |
|------------|-------------------|-------------|------|--------|--------|
|            |                   | Min         | Max  | Min    | Max    |
| A          | SMF5.0A~SMF100A   | 2.50        | 2.90 | 0.0984 | 0.1142 |
|            | SMF110A~SMF250A   | 2.90        | 3.10 | 0.1142 | 0.1220 |
|            | SMF5.0CA~SMF250CA |             |      |        |        |
| B          |                   | 3.40        | 3.90 | 0.1339 | 0.1535 |
| C          |                   | 0.70        | 1.20 | 0.0275 | 0.0472 |
| D          |                   | 1.50        | 2.00 | 0.0591 | 0.0787 |
| E          |                   | 0.35        | 0.90 | 0.0138 | 0.0354 |
| F          |                   | 0.05        | 0.26 | 0.0020 | 0.0102 |
| G          |                   | 0.00        | 0.10 | 0.000  | 0.0039 |
| H          | SMF5.0A~SMF100A   | 0.95        | 1.10 | 0.0374 | 0.0433 |
|            | SMF110A~SMF250A   | 0.90        | 1.08 | 0.0354 | 0.0425 |
|            | SMF5.0CA~SMF250CA |             |      |        |        |

### Part Numbering System



### Part Marking System



### Packaging Options

| Part number | Component Package | Quantity | Packaging Option                | Packaging Specification |
|-------------|-------------------|----------|---------------------------------|-------------------------|
| SMFXXX      | SOD-123FL         | 3000     | Tape & Reel – 8mm tape/7" reel  | EIA RS-481              |
| SMFXXX-T13  | SOD-123FL         | 10000    | Tape & Reel – 8mm tape/13" reel | EIA RS-481              |

### Tape and Reel Specification

