

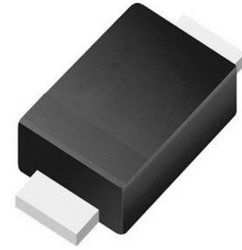
## SMF Series Datasheet

### Description

The SMF series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events. SMF package is 50% smaller in footprint when compare to SMA package and delivering one of the low height profiles (1.2mm) in the industry.

### Features

- IEC61000-4-2 ESD 15KV Air, 8KV contact compliance
- SOD-123FL surface mount package
- Protects one I/O line
- Peak power dissipation of 1000W under 8/20 $\mu$ s waveform
- Low leakage current
- Solid-state silicon avalanche technology
- RoHS compliant
- Solder reflow temperature: Pure Tin-Sn, 260~270 $^{\circ}$ C
- Flammability rating UL 94V-0
- Meets MSL level 1, per J-STD-020



### Applications

SMF devices are ideal for the protection of I/O interfaces, VCC bus and other vulnerable circuit used in cellular phones, portable devices, business machines, power supplies and other consumer applications.

### Maximum Ratings and Characteristics

Ratings at 25 $^{\circ}$ C ambient temperature unless otherwise specified.

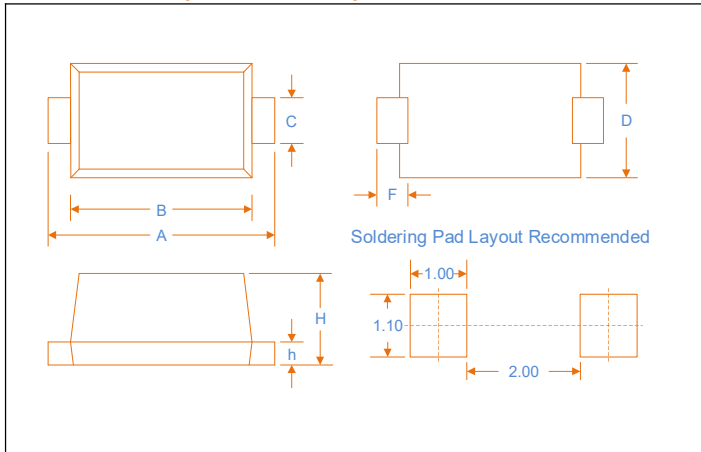
| Rating  | Symbol                             | Value        | Units          |
|---|------------------------------------|--------------|----------------|
| Peak pulse power dissipation at 10/1000 $\mu$ s waveform (Note1, Note2, Fig.1)                                    | P <sub>PPM</sub>                   | Minimum 200  | Watts          |
| Peak pulse power (tp=8/20 $\mu$ s waveform)   | P <sub>PPM</sub>                   | Minimum 1000 | Watts          |
| Peak pulse current of at 10/1000 $\mu$ s waveform (Note 1, Fig.3)   | I <sub>PPM</sub>                   | See Table    | Amps           |
| Steady state power dissipation at T <sub>L</sub> =75 $^{\circ}$ C (Fig.5)   | P <sub>M(AV)</sub>                 | 1.0          | Watts          |
| Maximum Instantaneous Forward Voltage at 12A for Unidirectional Only  | V <sub>F</sub>                     | 3.5          | V              |
| Peak forward surge current, 8.3ms single half sine-wave superimposed on rated load, (JEDEC Method) (Note3, Fig.6) | I <sub>FSM</sub>                   | 20           | Amps           |
| Operating junction and Storage Temperature Ranges.  | T <sub>J</sub> , T <sub>STG</sub>  | -55 to +150  | $^{\circ}$ C   |
| Typical thermal resistance junction to lead   | R <sub><math>\theta</math>JL</sub> | 100          | $^{\circ}$ C/W |
| Typical thermal resistance junction to ambient  | R <sub><math>\theta</math>JA</sub> | 220          | $^{\circ}$ C/W |

Notes: 1. Non-repetitive current pulse, per Fig.3 and Derating above T<sub>A</sub>=25 $^{\circ}$ C per Fig.2.

2. Each terminal is surface Mounted on the 5.0mm $\times$ 5.0mm (0.03mm thick) copper pads.

3. 8.3ms single half sine-wave or equivalent square wave, duty cycle=4 pulses per minutes maximum.

### Dimensions (SOD123FL)



| Dimensions | Inches    |       | Millimeters |      |
|------------|-----------|-------|-------------|------|
|            | Min.      | Max.  | Min.        | Max. |
| A          | 0.138     | 0.154 | 3.50        | 3.90 |
| B          | 0.102     | 0.118 | 2.60        | 3.00 |
| C          | 0.030     | 0.043 | 0.75        | 1.10 |
| D          | 0.063     | 0.079 | 1.60        | 2.00 |
| F          | 0.031Typ. |       | 0.80Typ.    |      |
| H          | 0.035     | 0.053 | 0.90        | 1.35 |
| h          | 0.005     | 0.009 | 0.12        | 0.22 |

### Electrical Characteristics (TA=25°C)

| Part Number |          | Device Marking Code |    | Reverse Stand-Off Voltage | Breakdown Voltage @I <sub>r</sub> |        | Test Current        | Maximum Clamping Voltage @I <sub>PP</sub> | Peak Pulse Current  | Reverse Leakage @V <sub>R</sub> |
|-------------|----------|---------------------|----|---------------------------|-----------------------------------|--------|---------------------|---|---------------------|---------------------------------|
| Uni         | Bi       | UNI                 | BI | V <sub>R</sub> (V)        | Min(V)                            | Max(V) | I <sub>r</sub> (mA) | V <sub>C</sub> (V)                        | I <sub>PP</sub> (A) | I <sub>R</sub> (μA)             |
| SMF5.0A     | SMF5.0CA | KE                  | AE | 5                         | 6.4                               | 7      | 10                  | 9.2                                       | 21.8                | 500                             |
| SMF6.0A     | SMF6.0CA | KG                  | AG | 6                         | 6.67                              | 7.37   | 10                  | 10.3                                      | 19.4                | 400                             |
| SMF6.5A     | SMF6.5CA | KK                  | AK | 6.5                       | 7.22                              | 7.98   | 10                  | 11.2                                      | 17.9                | 350                             |
| SMF7.0A     | SMF7.0CA | KM                  | AM | 7                         | 7.78                              | 8.6    | 10                  | 12.0                                      | 16.7                | 200                             |
| SMF7.5A     | SMF7.5CA | KP                  | AP | 7.5                       | 8.33                              | 9.21   | 1                   | 12.9                                      | 15.5                | 100                             |
| SMF8.0A     | SMF8.0CA | KR                  | AR | 8                         | 8.89                              | 9.83   | 1                   | 13.6                                      | 14.7                | 50                              |
| SMF8.5A     | SMF8.5CA | KT                  | AT | 8.5                       | 9.44                              | 10.4   | 1                   | 14.4                                      | 13.9                | 20                              |
| SMF9.0A     | SMF9.0CA | KV                  | AV | 9                         | 10                                | 11.1   | 1                   | 15.4                                      | 13.0                | 10                              |
| SMF10A      | SMF10CA  | KX                  | AX | 10                        | 11.1                              | 12.3   | 1                   | 17.0                                      | 11.8                | 5                               |
| SMF11A      | SMF11CA  | KZ                  | AZ | 11                        | 12.2                              | 13.5   | 1                   | 18.2                                      | 11.0                | 3                               |
| SMF12A      | SMF12CA  | LE                  | BE | 12                        | 13.3                              | 14.7   | 1                   | 19.9                                      | 10.1                | 1                               |
| SMF13A      | SMF13CA  | LG                  | BG | 13                        | 14.4                              | 15.9   | 1                   | 21.5                                      | 9.3                 | 1                               |
| SMF14A      | SMF14CA  | LK                  | BK | 14                        | 15.6                              | 17.2   | 1                   | 23.2                                      | 8.6                 | 1                               |
| SMF15A      | SMF15CA  | LM                  | BM | 15                        | 16.7                              | 18.5   | 1                   | 24.4                                      | 8.2                 | 1                               |
| SMF16A      | SMF16CA  | LP                  | BP | 16                        | 17.8                              | 19.7   | 1                   | 26.0                                      | 7.7                 | 1                               |
| SMF17A      | SMF17CA  | LR                  | BR | 17                        | 18.9                              | 20.9   | 1                   | 27.6                                      | 7.3                 | 1                               |
| SMF18A      | SMF18CA  | LT                  | BT | 18                        | 20                                | 22.1   | 1                   | 29.2                                      | 6.9                 | 1                               |
| SMF20A      | SMF20CA  | LV                  | BV | 20                        | 22.2                              | 24.5   | 1                   | 32.4                                      | 6.2                 | 1                               |
| SMF22A      | SMF22CA  | LX                  | BX | 22                        | 24.4                              | 26.9   | 1                   | 35.5                                      | 5.7                 | 1                               |
| SMF24A      | SMF24CA  | LZ                  | BZ | 24                        | 26.7                              | 29.5   | 1                   | 38.9                                      | 5.2                 | 1                               |
| SMF26A      | SMF26CA  | ME                  | CE | 26                        | 28.9                              | 31.9   | 1                   | 42.1                                      | 4.8                 | 1                               |
| SMF28A      | SMF28CA  | MG                  | CG | 28                        | 31.1                              | 34.4   | 1                   | 45.4                                      | 4.4                 | 1                               |
| SMF30A      | SMF30CA  | MK                  | CK | 30                        | 33.3                              | 36.8   | 1                   | 48.4                                      | 4.2                 | 1                               |
| SMF33A      | SMF33CA  | MM                  | CM | 33                        | 36.7                              | 40.6   | 1                   | 53.3                                      | 3.8                 | 1                               |

### Electrical Characteristics (TA=25°C)

| Part Number |          | Device Marking Code |    | Reverse Stand-Off Voltage | Breakdown Voltage @I <sub>T</sub> |        | Test Current        | Maximum Clamping Voltage @I <sub>PP</sub> | Peak Pulse Current  | Reverse Leakage @V <sub>R</sub> |
|-------------|----------|---------------------|----|---------------------------|-----------------------------------|--------|---------------------|---|---------------------|---------------------------------|
| Uni         | Bi       | UNI                 | BI | V <sub>R</sub> (V)        | Min(V)                            | Max(V) | I <sub>T</sub> (mA) | V <sub>C</sub> (V)                        | I <sub>PP</sub> (A) | I <sub>R</sub> (μA)             |
| SMF36A      | SMF36CA  | MP                  | CP | 36                        | 40                                | 44.2   | 1                   | 58.1                                      | 3.5                 | 1                               |
| SMF40A      | SMF40CA  | MR                  | CR | 40                        | 44.4                              | 49.1   | 1                   | 64.5                                      | 3.1                 | 1                               |
| SMF43A      | SMF43CA  | MT                  | CT | 43                        | 47.8                              | 52.8   | 1                   | 69.4                                      | 2.9                 | 1                               |
| SMF45A      | SMF45CA  | MV                  | CV | 45                        | 50                                | 55.3   | 1                   | 72.7                                      | 2.8                 | 1                               |
| SMF48A      | SMF48CA  | MX                  | CX | 48                        | 53.3                              | 58.9   | 1                   | 77.4                                      | 2.6                 | 1                               |
| SMF51A      | SMF51CA  | MZ                  | CZ | 51                        | 56.7                              | 62.7   | 1                   | 82.4                                      | 2.5                 | 1                               |
| SMF54A      | SMF54CA  | NE                  | DE | 54                        | 60                                | 66.3   | 1                   | 87.1                                      | 2.3                 | 1                               |
| SMF58A      | SMF58CA  | NG                  | DG | 58                        | 64.4                              | 71.2   | 1                   | 93.6                                      | 2.2                 | 1                               |
| SMF60A      | SMF60CA  | NK                  | DK | 60                        | 66.7                              | 73.7   | 1                   | 96.8                                      | 2.1                 | 1                               |
| SMF64A      | SMF64CA  | NM                  | DM | 64                        | 71.1                              | 78.6   | 1                   | 103.0                                     | 2.0                 | 1                               |
| SMF70A      | SMF70CA  | NP                  | DP | 70                        | 77.8                              | 86     | 1                   | 113.0                                     | 1.8                 | 1                               |
| SMF75A      | SMF75CA  | NR                  | DR | 75                        | 83.3                              | 92.1   | 1                   | 121.0                                     | 1.7                 | 1                               |
| SMF78A      | SMF78CA  | NT                  | DT | 78                        | 86.7                              | 95.8   | 1                   | 126.0                                     | 1.6                 | 1                               |
| SMF85A      | SMF85CA  | NV                  | DV | 85                        | 94.4                              | 104    | 1                   | 137.0                                     | 1.5                 | 1                               |
| SMF90A      | SMF90CA  | NX                  | DX | 90                        | 100                               | 111    | 1                   | 146.0                                     | 1.4                 | 1                               |
| SMF100A     | SMF100CA | NZ                  | DZ | 100                       | 111                               | 123    | 1                   | 162.0                                     | 1.3                 | 1                               |
| SMF110A     | SMF110CA | PE                  | EE | 110                       | 122                               | 135    | 1                   | 177.0                                     | 1.2                 | 1                               |
| SMF120A     | SMF120CA | PG                  | EG | 120                       | 133                               | 147    | 1                   | 193.0                                     | 1.1                 | 1                               |
| SMF130A     | SMF130CA | PK                  | EK | 130                       | 144                               | 159    | 1                   | 209.0                                     | 1.0                 | 1                               |
| SMF150A     | SMF150CA | PM                  | EM | 150                       | 167                               | 185    | 1                   | 243.0                                     | 0.8                 | 1                               |
| SMF160A     | SMF160CA | PP                  | EP | 160                       | 178                               | 197    | 1                   | 259.0                                     | 0.8                 | 1                               |
| SMF170A     | SMF170CA | PR                  | ER | 170                       | 189                               | 209    | 1                   | 275.0                                     | 0.8                 | 1                               |

**Ratings and Characteristic Curves (Ta=25°C unless otherwise noted)**

Figure 1. Peak Pulse Power Rating Curve

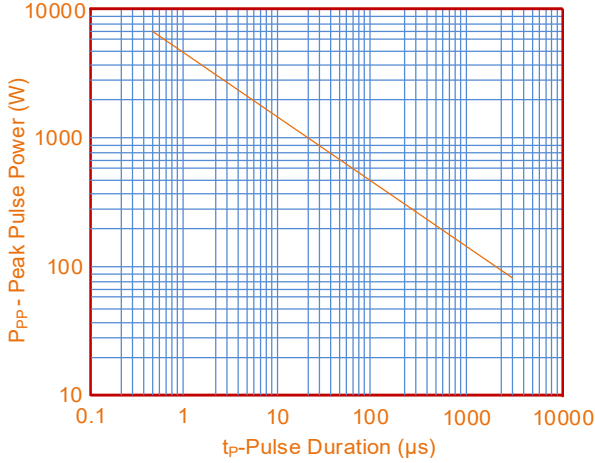


Figure 2. Pulse Derating Curve

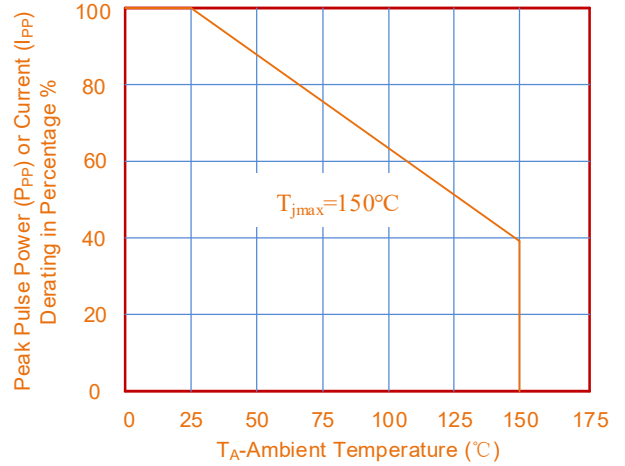


Figure 3. Pulse Waveform

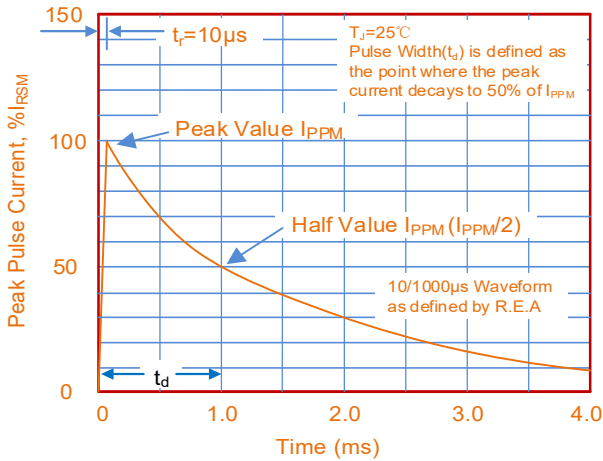


Figure 4. Typical Junction Capacitance

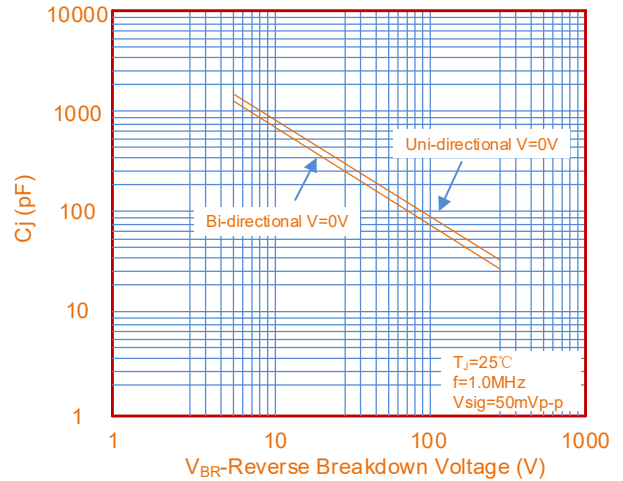


Figure 5. Steady State Power Dissipation Derating Curve

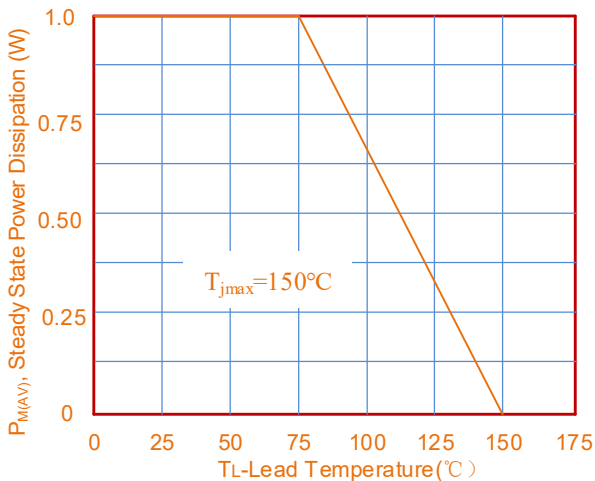
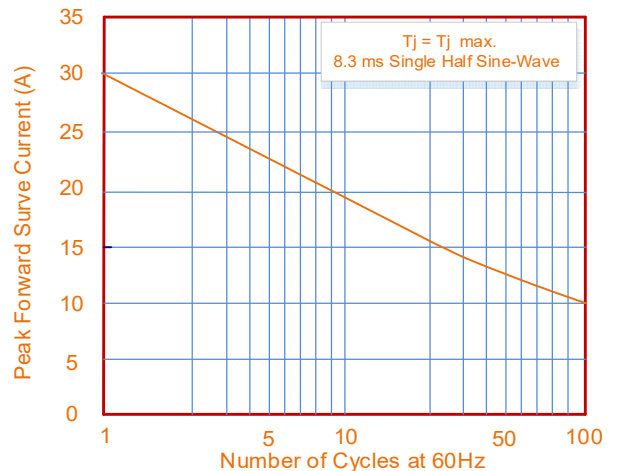
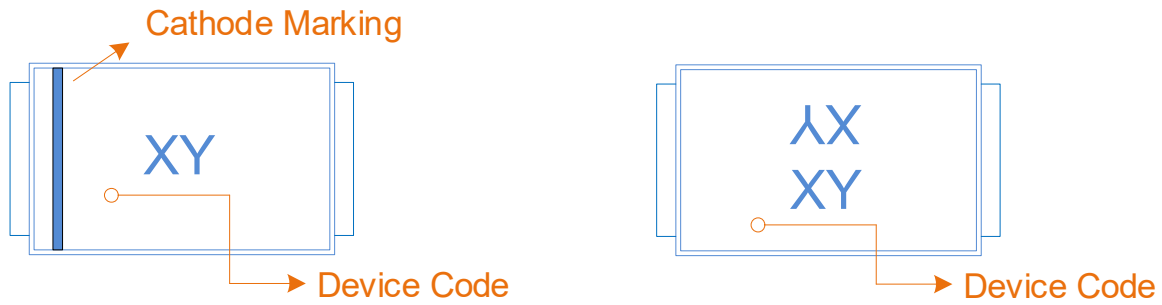


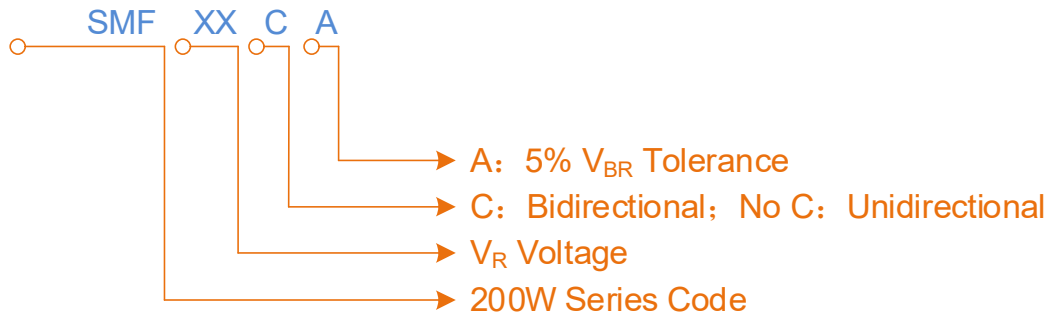
Figure 6. Maximum Non-Repetitive Forward Surge Current Uni-Directional Only



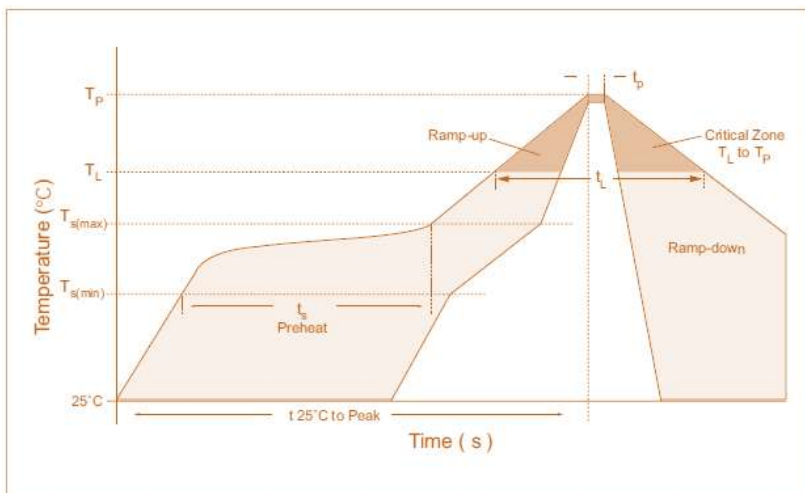
## Marking Code



## Part Number Code

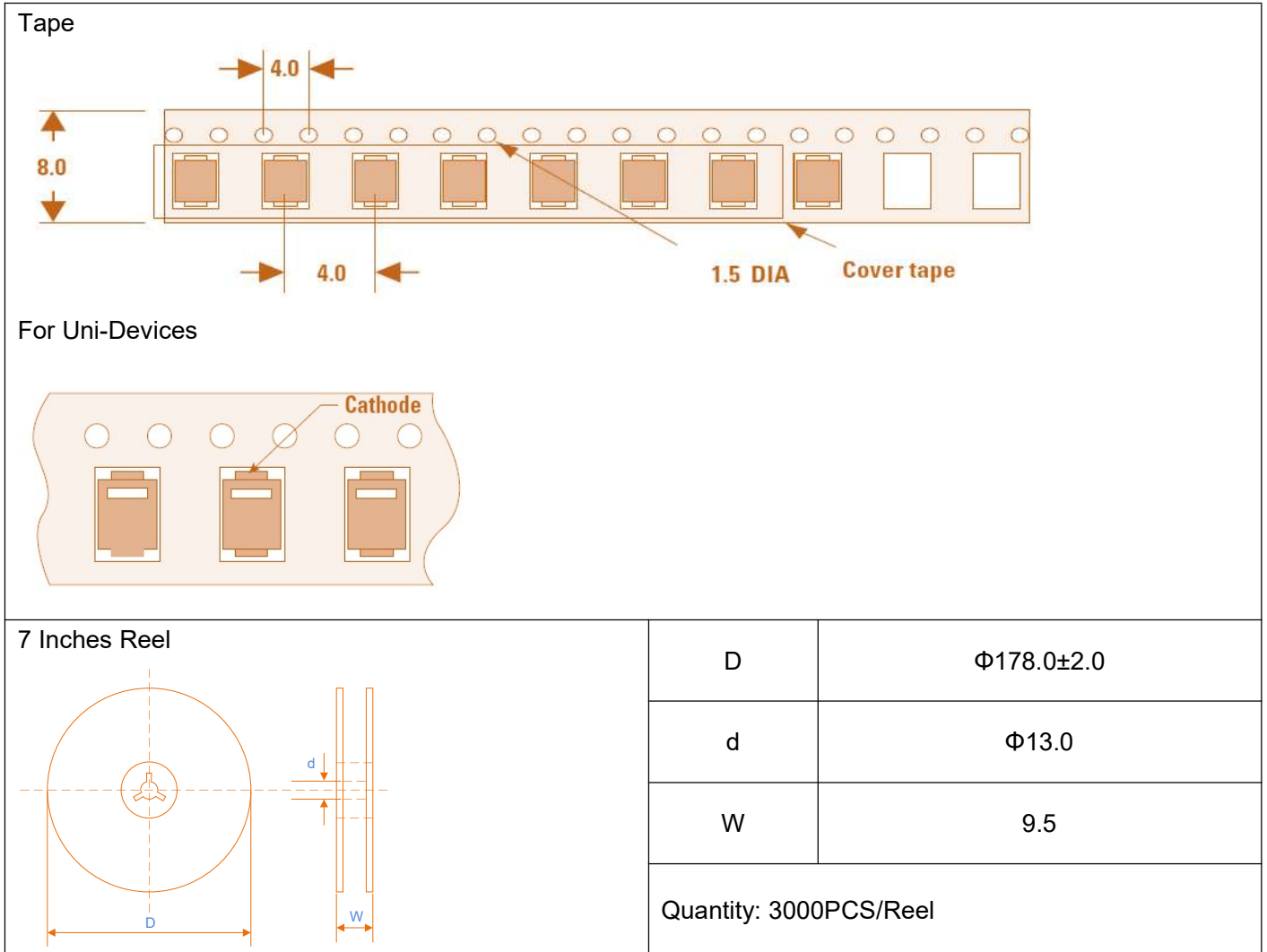


## Soldering Parameters



| Reflow Condition                                       |                                    | Lead-free Soldering |
|--|------------------------------------|---------------------|
| Pre Heat   | - Temperature Min ( $T_{s(min)}$ ) | 150°C               |
|  | - Temperature Max ( $T_{s(max)}$ ) | 200°C               |
|  | - Time (min to max) ( $t_s$ )      | 60 – 180 secs       |
| Average ramp up rate (Liquidus Temp ( $T_A$ ) to peak) |                                    | 3°C/second max      |
| $T_{s(max)}$ to $T_A$ - Ramp-up Rate                   |                                    | 3°C/second max      |
| Reflow   | - Temperature ( $T_A$ )            | 217°C               |
|  | - Time (min to max) ( $t_r$ )      | 60 – 150 seconds    |
| Peak Temperature ( $T_p$ )                             |                                    | 260°C               |
| Time within 5°C of actual peak Temperature ( $t_p$ )   |                                    | 20 – 40 seconds     |
| Ramp-down Rate   |                                    | 6°C/second max      |
| Time 25°C to peak Temperature ( $T_p$ )                |                                    | 8 minutes Max.      |
| Do not exceed Temperature                              |                                    | 260°C               |

## Packaging Specification



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