

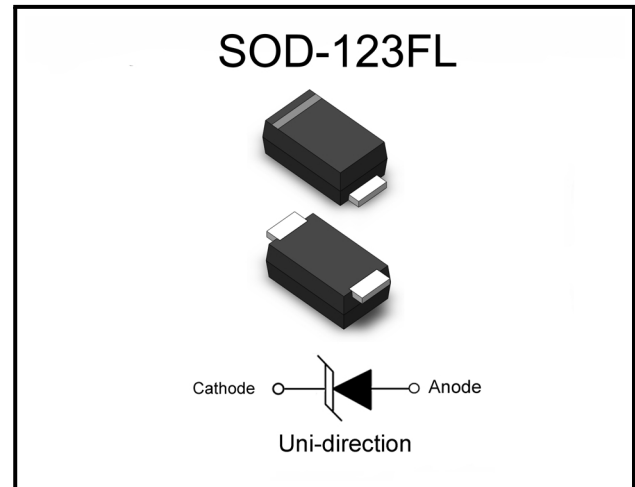
# BNPTVS Series

Transient Voltage Suppressor

## Features

- Excellent clamping capability
- Low leakage current
- Low capacitance
- High surge capability
- Glass passivated chip
- Epoxy resin package
- Built-in strain relief
- Will not fatigue
- RoHS Compliant
- Fast response time:  
typically less than 1.0ps from 0 Volts to  $V_{BR}$  min

## Package



## Mechanical Characteristics

- Package: SOD-123FL plastic package
- Lead Finish: Matte Tin
- Case Material: Epoxy Molding Compound
- UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020

## Applications

- Cellular phones
- Portable devices
- Business machines
- Power supplies
- Consumer applications

## Making Code



## Summary of Packing Options

| Package   | Packing Description | Packing Quantity | Industry Standard |
|-----------|---------------------|------------------|-------------------|
| SOD-123FL | Tape/Reel, 7" reel  | 3000             | EIA-481-1         |
|           | Tape/Reel, 13" reel | 10000            | EIA-481-1         |

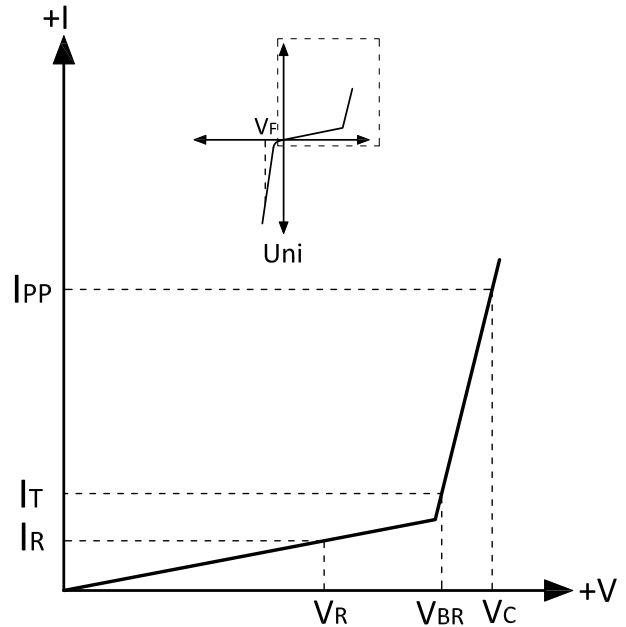


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## Electrical Parameters

| Parameter | Definition                                                                                          |
|-----------|-----------------------------------------------------------------------------------------------------|
| $C_J$     | Junction Capacitance - typical capacitance measured with 0V or $V_R$ bias                           |
| $I_{PP}$  | Peak Pulse Current - maximum rated peak impulse current                                             |
| $V_C$     | Clamping Voltage - Peak voltage measured across the suppressor at a specified $I_{ppm}$             |
| $V_{BR}$  | Breakdown Voltage - Maximum voltage that flows though the TVS at a specified test current ( $I_T$ ) |
| $I_R$     | Leakage Current - maximum peak off-state current measured at $V_R$                                  |
| $V_R$     | Peak Off-state Voltage - maximum voltage that can be applied while maintaining off state            |



## Absolute Maximum Ratings ( $T_A=+25^{\circ}\text{C}$ , unless otherwise noted)

| Parameter                                             | Symbol          | Value      | Units                |
|-------------------------------------------------------|-----------------|------------|----------------------|
| Peak Pulse Power Dissipation(Note1,2)                 | $P_{PPM}$       | 400        | W                    |
| Steady State Power Dissipation (Note3)                | $P_D$           | 3.3        | W                    |
| Peak Forward Surge Current (Note4)                    | $I_{FSM}$       | 40         | A                    |
| Maximum Instantaneous Forward Voltage at 100A (Note5) | $V_{FM}$        | 3.5/6.5    | V                    |
| Typical Thermal Resistance Junction to Lead           | $R_{\theta JL}$ | 100        | $^{\circ}\text{C/W}$ |
| Typical Thermal Resistance Junction to Ambient        | $R_{\theta JA}$ | 220        | $^{\circ}\text{C/W}$ |
| Operating Junction Temperature Range                  | $T_J$           | -55 to 150 | $^{\circ}\text{C}$   |
| Storage Temperature Range                             | $T_{STG}$       | -55 to 150 | $^{\circ}\text{C}$   |

Notes:

- (1) Non-repetitive current pulse , 10/1000us Waveform.
- (2) Mounted on copper pad area of 3×3mm to each terminal.
- (3) Infinite Heat Sink at  $T_A = 50^{\circ}\text{C}$
- (4) Measured on 8.3ms single half sine wave or equivalent square wave, duty cycle=4 perminute maximum.
- (5) For UnidirectionalOnly.



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

| Part Number   | Marking Code | Reverse Stand-Off Voltage $V_R$ | Breakdown Voltage $V_{BR}@ I_T$ |         | Test Current $I_T$ | Maximum Clamping Voltage $V_C@ I_{pp}$ | Maximum Peak Pulse Current $I_{pp}$ | Maximum Reverse Leakage $I_R@ V_R$ |
|---------------|--------------|---------------------------------|---------------------------------|---------|--------------------|----------------------------------------|-------------------------------------|------------------------------------|
| (Uni)         | (Uni)        | (V)                             | Min.(V)                         | Max.(V) | (mA)               | (V)                                    | (A)                                 | ( $\mu\text{A}$ )                  |
| BNPTVS5V0S1UR | 5.0A         | 5                               | 6.4                             | 7       | 10                 | 9.2                                    | 43.5                                | 400                                |
| BNPTVS6V0S1UR | 6.0A         | 6                               | 6.67                            | 7.37    | 10                 | 10.3                                   | 38.8                                | 400                                |
| BNPTVS6V5S1UR | 6.5A         | 6.5                             | 7.22                            | 7.98    | 10                 | 11.2                                   | 35.7                                | 250                                |
| BNPTVS7V0S1UR | 7.0A         | 7                               | 7.78                            | 8.6     | 10                 | 12                                     | 33.3                                | 100                                |
| BNPTVS7V5S1UR | 7.5A         | 7.5                             | 8.33                            | 9.21    | 1                  | 12.9                                   | 31                                  | 50                                 |
| BNPTVS8V0S1UR | 8.0A         | 8.0                             | 8.89                            | 9.83    | 1                  | 13.6                                   | 29.4                                | 25                                 |
| BNPTVS8V5S1UR | 8.5A         | 8.5                             | 9.44                            | 10.4    | 1                  | 14.4                                   | 27.8                                | 10                                 |
| BNPTVS9V0S1UR | 9.0A         | 9.0                             | 10                              | 11.1    | 1                  | 15.4                                   | 26                                  | 5                                  |
| BNPTVS10VS1UR | 10A          | 10                              | 11.1                            | 12.3    | 1                  | 17                                     | 23.5                                | 2.5                                |
| BNPTVS11VS1UR | 11A          | 11                              | 12.2                            | 13.5    | 1                  | 18.2                                   | 22                                  | 2.5                                |
| BNPTVS12VS1UR | 12A          | 12                              | 13.3                            | 14.7    | 1                  | 19.9                                   | 20.1                                | 2.5                                |
| BNPTVS13VS1UR | 13A          | 13                              | 14.4                            | 15.9    | 1                  | 21.5                                   | 18.6                                | 1                                  |
| BNPTVS14VS1UR | 14A          | 14                              | 15.6                            | 17.2    | 1                  | 23.2                                   | 17.2                                | 1                                  |
| BNPTVS15VS1UR | 15A          | 15                              | 16.7                            | 18.5    | 1                  | 24.4                                   | 16.4                                | 1                                  |
| BNPTVS16VS1UR | 16A          | 16                              | 17.8                            | 19.7    | 1                  | 26                                     | 15.4                                | 1                                  |
| BNPTVS17VS1UR | 17A          | 17                              | 18.9                            | 20.9    | 1                  | 27.6                                   | 14.5                                | 1                                  |
| BNPTVS18VS1UR | 18A          | 18                              | 20                              | 22.1    | 1                  | 29.2                                   | 13.7                                | 1                                  |
| BNPTVS20VS1UR | 20A          | 20                              | 22.2                            | 24.5    | 1                  | 32.4                                   | 12.3                                | 1                                  |
| BNPTVS22VS1UR | 22A          | 22                              | 24.4                            | 26.9    | 1                  | 35.5                                   | 11.3                                | 1                                  |
| BNPTVS24VS1UR | 24A          | 24                              | 26.7                            | 29.5    | 1                  | 38.9                                   | 10.3                                | 1                                  |
| BNPTVS26VS1UR | 26A          | 26                              | 28.9                            | 31.9    | 1                  | 42.1                                   | 9.5                                 | 1                                  |
| BNPTVS28VS1UR | 28A          | 28                              | 31.1                            | 34.4    | 1                  | 45.4                                   | 8.8                                 | 1                                  |
| BNPTVS30VS1UR | 30A          | 30                              | 33.3                            | 36.8    | 1                  | 48.4                                   | 8.3                                 | 1                                  |
| BNPTVS33VS1UR | 33A          | 33                              | 36.7                            | 40.6    | 1                  | 53.3                                   | 7.5                                 | 1                                  |
| BNPTVS36VS1UR | 36A          | 36                              | 40                              | 44.2    | 1                  | 58.1                                   | 6.9                                 | 1                                  |
| BNPTVS40VS1UR | 40A          | 40                              | 44.4                            | 49.1    | 1                  | 64.5                                   | 6.2                                 | 1                                  |
| BNPTVS43VS1UR | 43A          | 43                              | 47.8                            | 52.8    | 1                  | 69.4                                   | 5.8                                 | 1                                  |
| BNPTVS45VS1UR | 45A          | 45                              | 50                              | 55.3    | 1                  | 72.7                                   | 5.5                                 | 1                                  |
| BNPTVS48VS1UR | 48A          | 48                              | 53.33                           | 58.9    | 1                  | 77.4                                   | 5.2                                 | 1                                  |
| BNPTVS51VS1UR | 51A          | 51                              | 56.7                            | 62.7    | 1                  | 82.4                                   | 4.9                                 | 1                                  |
| BNPTVS54VS1UR | 54A          | 54                              | 60                              | 66.3    | 1                  | 87.1                                   | 4.6                                 | 1                                  |
| BNPTVS58VS1UR | 58A          | 58                              | 64.4                            | 71.2    | 1                  | 93.6                                   | 4.3                                 | 1                                  |
| BNPTVS60VS1UR | 60A          | 60                              | 66.7                            | 73.7    | 1                  | 96.8                                   | 4.1                                 | 1                                  |



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| Part Number    | Marking Code | Reverse Stand-Off Voltage<br>$V_R$ | Breakdown Voltage<br>$V_{BR}@ I_T$ |         | Test Current<br>$I_T$ | Maximum Clamping Voltage<br>$V_C@ I_{pp}$ | Maximum Peak Pulse Current<br>$I_{pp}$ | Maximum Reverse Leakage<br>$I_R@ V_R$ |
|----------------|--------------|------------------------------------|------------------------------------|---------|-----------------------|-------------------------------------------|----------------------------------------|---------------------------------------|
|                |              |                                    | Min.(V)                            | Max.(V) |                       |                                           |                                        |                                       |
| (Uni)          | (Uni)        | (V)                                |                                    |         | (mA)                  | (V)                                       | (A)                                    | (uA)                                  |
| BNPTVS64VS1UR  | 64A          | 64                                 | 71.1                               | 78.6    | 1                     | 103                                       | 3.9                                    | 1                                     |
| BNPTVS70VS1UR  | 70A          | 70                                 | 78.8                               | 86      | 1                     | 113                                       | 3.5                                    | 1                                     |
| BNPTVS75VS1UR  | 75A          | 75                                 | 83.3                               | 92.1    | 1                     | 121                                       | 3.3                                    | 1                                     |
| BNPTVS78VS1UR  | 78A          | 78                                 | 86.7                               | 95.8    | 1                     | 126                                       | 3.2                                    | 1                                     |
| BNPTVS85VS1UR  | 85A          | 85                                 | 94.4                               | 104     | 1                     | 137                                       | 2.9                                    | 1                                     |
| BNPTVS90VS1UR  | 90A          | 90                                 | 100                                | 111     | 1                     | 146                                       | 2.7                                    | 1                                     |
| BNPTVS100VS1UR | 100A         | 100                                | 111                                | 123     | 1                     | 162                                       | 2.5                                    | 1                                     |
| BNPTVS110VS1UR | 110A         | 110                                | 122                                | 135     | 1                     | 177                                       | 2.3                                    | 1                                     |
| BNPTVS120VS1UR | 120A         | 120                                | 133                                | 147     | 1                     | 193                                       | 2.1                                    | 1                                     |
| BNPTVS130VS1UR | 130A         | 130                                | 144                                | 159     | 1                     | 209                                       | 1.9                                    | 1                                     |
| BNPTVS150VS1UR | 150A         | 150                                | 167                                | 185     | 1                     | 243                                       | 1.6                                    | 1                                     |
| BNPTVS160VS1UR | 160A         | 160                                | 178                                | 197     | 1                     | 259                                       | 1.5                                    | 1                                     |
| BNPTVS170VS1UR | 170A         | 170                                | 189                                | 209     | 1                     | 275                                       | 1.5                                    | 1                                     |



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

Figure 1: Peak Pulse Power Rating

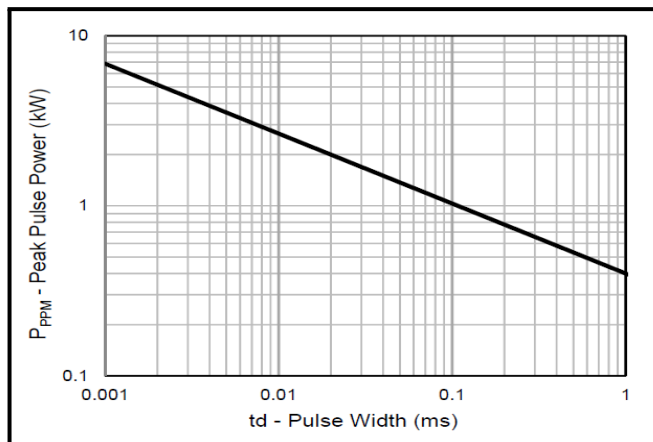


Figure 2: Pulse Derating Curve

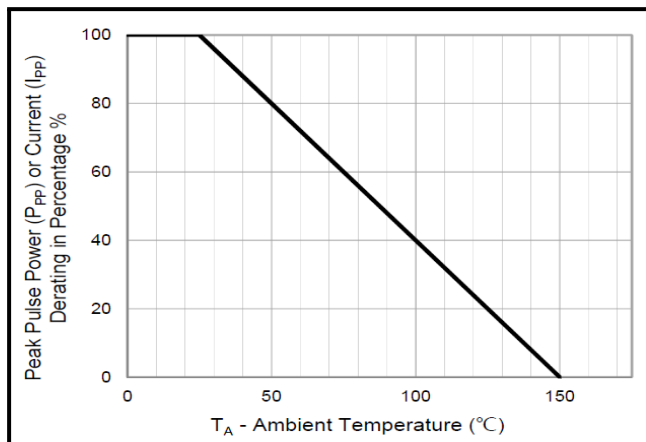


Figure 3: Pulse Waveform

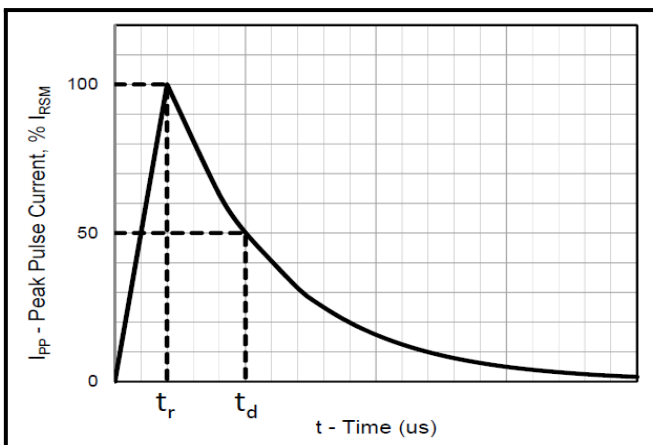


Figure 4 : Typical Junction Capacitance

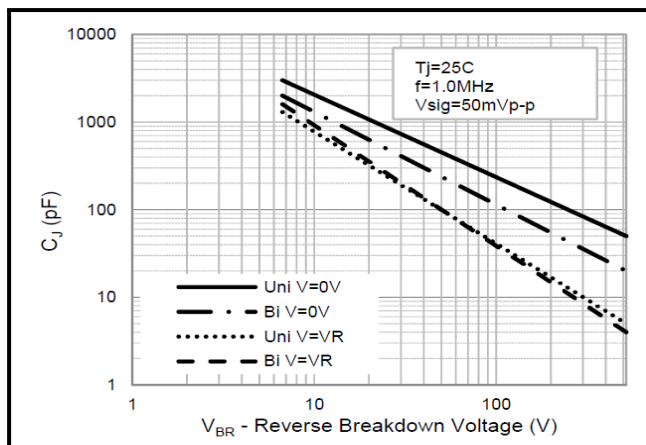


Figure 5: Steady State Power Dissipation Derating

Curve

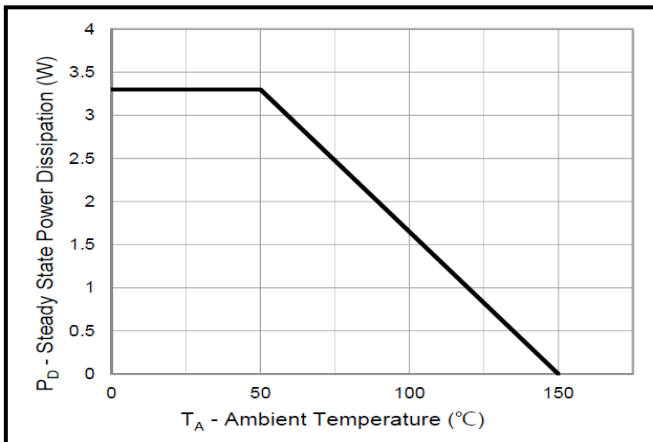
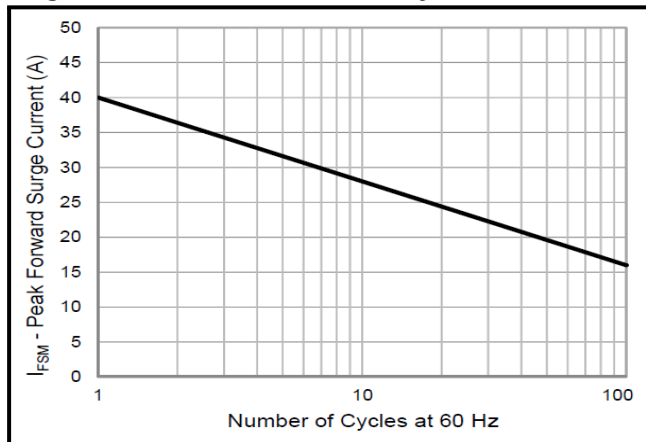


Figure 6 : Maximum Non-Repetitive Peak Forward

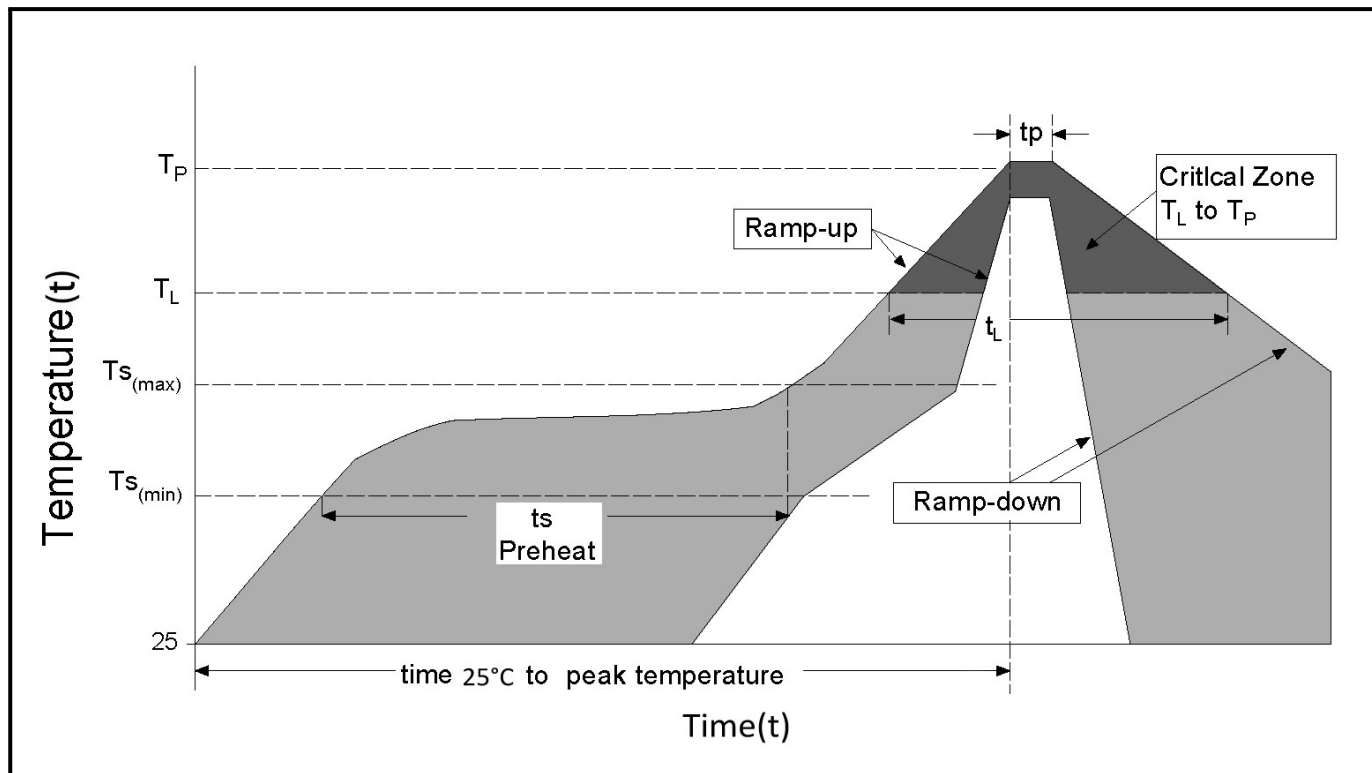
Surge Current Uni-Directional Only



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## Soldering Parameters



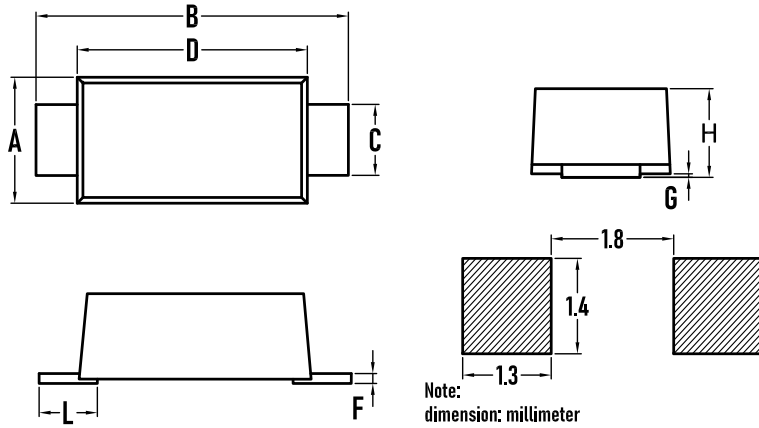
| Reflow Condition                                       |                                    | Lead-free assembly      |
|--------------------------------------------------------|------------------------------------|-------------------------|
| Pre Heat                                               | - Temperature Min ( $T_{S(min)}$ ) | 150°C                   |
|                                                        | - Temperature Max ( $T_{S(max)}$ ) | 200°C                   |
|                                                        | - Time (min to max) ( $t_s$ )      | 60 - 180 secs           |
| Average ramp up rate (Liquidus Temp ( $T_L$ ) to peak) |                                    | 3°C/second max          |
| $T_{S(max)}$ to $T_L$ - Ramp-up Rate                   |                                    | 3°C/second max          |
| Reflow                                                 | - Temperature ( $T_L$ ) (Liquidus) | 217°C                   |
|                                                        | - Time ( $t_L$ )                   | 60 -150 secs            |
| Peak Temperature ( $T_P$ )                             |                                    | 260 <sup>+0/-5</sup> °C |
| Time within 5°C of actual peak Temperature ( $t_p$ )   |                                    | 20 - 40 secs            |
| Ramp-down Rate                                         |                                    | 6°C/second max          |
| Time 25°C to peak Temperature (t)                      |                                    | 8 minutes Max.          |
| Do not exceed                                          |                                    | 260°C                   |



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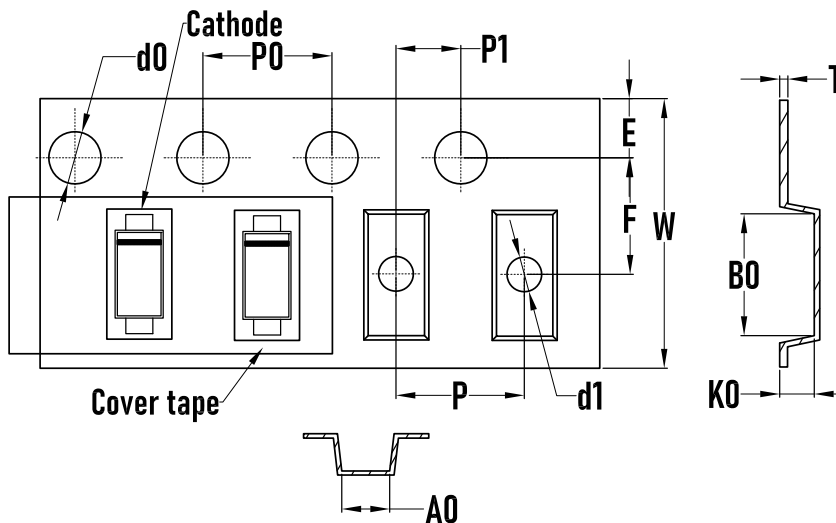
Transient Voltage Suppressor

## Package Mechanical Data - SOD-123FL



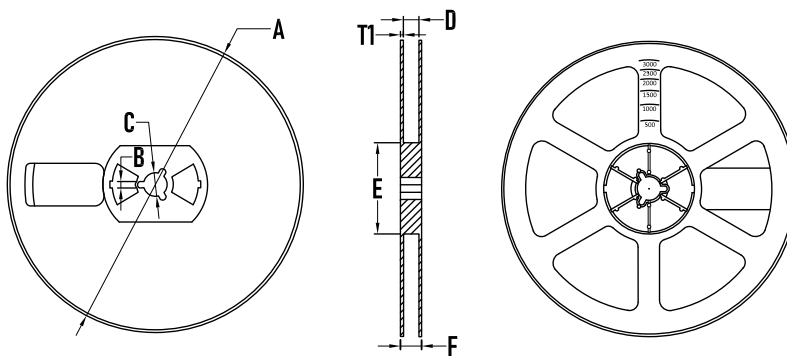
| SYMBOL | MILLIMETER |      |      |
|--------|------------|------|------|
|        | MIN.       | Typ. | MAX. |
| A      | 1.50       | 1.75 | 2.00 |
| B      | 3.40       | 3.65 | 3.90 |
| C      | 0.70       | 0.95 | 1.20 |
| D      | 2.50       | 2.70 | 2.90 |
| F      | 0.05       | 0.15 | 0.26 |
| G      | 0.00       | —    | 0.10 |
| H      | 0.95       | 1.15 | 1.35 |
| L      | 0.35       | 0.63 | 0.90 |

## Packaging Tape - SOD-123FL



| SYMBOL | MILLIMETER |
|--------|------------|
| A0     | 2.10±0.1   |
| B0     | 4.0 ±0.1   |
| d0     | 1.5±0.1    |
| d1     | 1.0±0.1    |
| E      | 1.75±0.1   |
| F      | 3.50±0.1   |
| K0     | 1.25±0.1   |
| P      | 4.00±0.1   |
| P0     | 4.00±0.1   |
| P1     | 2.00±0.1   |
| W      | 8.00±0.1   |
| T      | 0.2±0.02   |

## Packaging Reel



| SYMBOL   | MILLIMETER |
|----------|------------|
| A        | 177.8±0.2  |
| B        | 2.7±0.2    |
| C        | 13.5±0.2   |
| D        | 9.6±0.3    |
| E        | 54.5±0.2   |
| F        | 12.3±0.3   |
| T1       | 1.0±0.2    |
| Quantity | 3000PCS    |

