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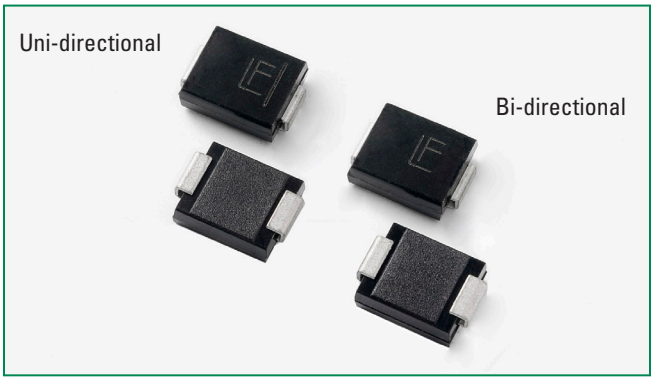
# Transient Voltage Suppression Diodes
Surface Mount – 1500W > 1.5SMC series

## 1.5SMC Series




## Agency Approvals

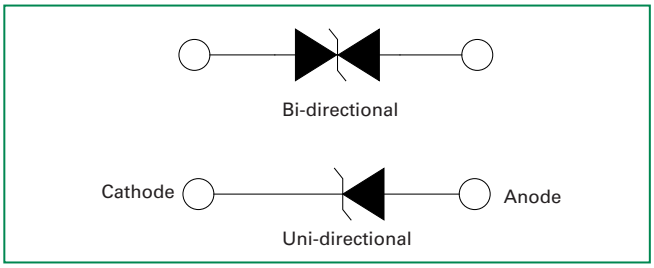
| AGENCY | AGENCY FILE NUMBER |
|---|---|
| ®RU | E230531 |

## Maximum Ratings and Thermal Characteristics ($T_A$=25°C unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Peak Pulse Power Dissipation at $T_A$=25°C by 10/1000µs Waveform (Fig.2)(Note 1), (Note 2) | $P_{PPM}$ | 1500 | W |
| Power Dissipation on Infinite Heat Sink at $T_A$=50°C | $P_{M(AV)}$ | 6.5 | W |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3) | $I_{FSM}$ | 200 | A |
| Maximum Instantaneous Forward Voltage at 100A for Unidirectional Only (Note 4) | $V_F$ | 3.5/5.0 | V |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{STG}$ | -55 to 150 | °C |
| Typical Thermal Resistance Junction to Lead | $R_{uJL}$ | 15 | °C/W |
| Typical Thermal Resistance Junction to Ambient | $R_{uJA}$ | 75 | °C/W |

**Notes:**
1. Non-repetitive current pulse , per Fig. 4 and derated above $T_A$ = 25°C per Fig. 3.
2. Mounted on copper pad area of 0.31x0.31" (8.0 × 8.0mm) to each terminal.
3. Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional device only, duty cycle=4 per minute maximum.
4. $V_F$<3.5V for $V_{BR}$≤ 200V and $V_F$<5.0V for $V_{BR}$≥ 201V.

## Functional Diagram




## Description

The 1.5SMC series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

## Features

- For surface mounted applications to optimize board space
- Low profile package.
- Typical failure mode is short from over-specified voltage or current
- Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
- IEC-61000-4-2 ESD 15kV(Air), 8kV (Contact)
- ESD protection of data lines in accordance with IEC 61000-4-2 (IEC801-2)
- EFT protection of data lines in accordance with IEC 61000-4-4 (IEC801-4)
- Built-in strain relief
- $V_{BR}$ @$T_J$= $V_{BR}$@25°C × (1+αT x ($T_J$ - 25))
  (αT: Temperature Coefficient)
- Glass passivated chip junction
- 1500W peak pulse power capability at 10/1000µs waveform, repetition rate (duty cycles):0.01 %
- Fast response time: typically less than 1.0ps from 0V to BV min
- Excellent clamping capability
- Low incremental surge resistance
- Typical $I_R$ less than 1µA above 13V
- High temperature soldering guaranteed: 260°C/40 seconds at terminals
- Plastic package has underwriters laboratory flammability 94V-O
- Meet MSL level1, per J-STD-020, LF maximum peak of 260°C
- Matte tin lead–free plated
- Halogen free and RoHS compliant

## Applications

TVS devices are ideal for the protection of I/O Interfaces, $V_{CC}$ bus and other vulnerable circuits used in Telecom, Computer, Industrial and Consumer electronic applications.

## Additional Information

**Datasheet** | **Resources** | **Samples**

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

| Part Number (Uni) | Part Number (Bi) | Marking | | Reverse Stand off Voltage $V_R$ (Volts) | Breakdown Voltage $V_{BR}$ (Volts) @ $I_T$ | | Test Current $I_T$ (mA) | Maximum Clamping Voltage $V_C$ @ $I_{pp}$ (V) | Maximum Peak Pulse Current $I_{pp}$ (A) | Maximum Reverse Leakage $I_R$ @ $V_R$ (µA) | Agency Approval ®RU |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | UNI | BI | | MIN | MAX | | | | | |
| 1.5SMC6.8A | 1.5SMC6.8CA | 6V8A | 6V8C | 5.80 | 6.45 | 7.14 | 10 | 10.5 | 144.8 | 1000 | X |
| 1.5SMC7.5A | 1.5SMC7.5CA | 7V5A | 7V5C | 6.40 | 7.13 | 7.88 | 10 | 11.3 | 134.5 | 500 | X |
| 1.5SMC8.2A | 1.5SMC8.2CA | 8V2A | 8V2C | 7.02 | 7.79 | 8.61 | 10 | 12.1 | 125.6 | 200 | X |
| 1.5SMC9.1A | 1.5SMC9.1CA | 9V1A | 9V1C | 7.78 | 8.65 | 9.50 | 1 | 13.4 | 113.4 | 50 | X |
| 1.5SMC10A | 1.5SMC10CA | 10A | 10C | 8.55 | 9.50 | 10.50 | 1 | 14.5 | 104.8 | 10 | X |
| 1.5SMC11A | 1.5SMC11CA | 11A | 11C | 9.40 | 10.50 | 11.60 | 1 | 15.6 | 97.4 | 5 | X |
| 1.5SMC12A | 1.5SMC12CA | 12A | 12C | 10.20 | 11.40 | 12.60 | 1 | 16.7 | 91.0 | 5 | X |
| 1.5SMC13A | 1.5SMC13CA | 13A | 13C | 11.10 | 12.40 | 13.70 | 1 | 18.2 | 83.5 | 1 | X |
| 1.5SMC15A | 1.5SMC15CA | 15A | 15C | 12.80 | 14.30 | 15.80 | 1 | 21.2 | 71.7 | 1 | X |
| 1.5SMC16A | 1.5SMC16CA | 16A | 16C | 13.60 | 15.20 | 16.80 | 1 | 22.5 | 67.6 | 1 | X |
| 1.5SMC18A | 1.5SMC18CA | 18A | 18C | 15.30 | 17.10 | 18.90 | 1 | 25.2 | 60.3 | 1 | X |
| 1.5SMC20A | 1.5SMC20CA | 20A | 20C | 17.10 | 19.00 | 21.00 | 1 | 27.7 | 54.9 | 1 | X |
| 1.5SMC22A | 1.5SMC22CA | 22A | 22C | 18.80 | 20.90 | 23.10 | 1 | 30.6 | 49.7 | 1 | X |
| 1.5SMC24A | 1.5SMC24CA | 24A | 24C | 20.50 | 22.80 | 25.20 | 1 | 33.2 | 45.8 | 1 | X |
| 1.5SMC27A | 1.5SMC27CA | 27A | 27C | 23.10 | 25.70 | 28.40 | 1 | 37.5 | 40.5 | 1 | X |
| 1.5SMC30A | 1.5SMC30CA | 30A | 30C | 25.60 | 28.50 | 31.50 | 1 | 41.4 | 36.7 | 1 | X |
| 1.5SMC33A | 1.5SMC33CA | 33A | 33C | 28.20 | 31.40 | 34.70 | 1 | 45.7 | 33.3 | 1 | X |
| 1.5SMC36A | 1.5SMC36CA | 36A | 36C | 30.80 | 34.20 | 37.80 | 1 | 49.9 | 30.5 | 1 | X |
| 1.5SMC39A | 1.5SMC39CA | 39A | 39C | 33.30 | 37.10 | 41.00 | 1 | 53.9 | 28.2 | 1 | X |
| 1.5SMC43A | 1.5SMC43CA | 43A | 43C | 36.80 | 40.90 | 45.20 | 1 | 59.3 | 25.6 | 1 | X |
| 1.5SMC47A | 1.5SMC47CA | 47A | 47C | 40.20 | 44.70 | 49.40 | 1 | 64.8 | 23.5 | 1 | X |
| 1.5SMC51A | 1.5SMC51CA | 51A | 51C | 43.60 | 48.50 | 53.60 | 1 | 70.1 | 21.7 | 1 | X |
| 1.5SMC56A | 1.5SMC56CA | 56A | 56C | 47.80 | 53.20 | 58.80 | 1 | 77.0 | 19.7 | 1 | X |
| 1.5SMC62A | 1.5SMC62CA | 62A | 62C | 53.00 | 58.90 | 65.10 | 1 | 85.0 | 17.9 | 1 | X |
| 1.5SMC68A | 1.5SMC68CA | 68A | 68C | 58.10 | 64.60 | 71.40 | 1 | 92.0 | 16.5 | 1 | X |
| 1.5SMC75A | 1.5SMC75CA | 75A | 75C | 64.10 | 71.30 | 78.80 | 1 | 103.0 | 14.8 | 1 | X |
| 1.5SMC82A | 1.5SMC82CA | 82A | 82C | 70.10 | 77.90 | 86.10 | 1 | 113.0 | 13.5 | 1 | X |
| 1.5SMC91A | 1.5SMC91CA | 91A | 91C | 77.80 | 86.50 | 95.50 | 1 | 125.0 | 12.2 | 1 | X |
| 1.5SMC100A | 1.5SMC100CA | 100A | 100C | 85.50 | 95.00 | 105.00 | 1 | 137.0 | 11.1 | 1 | X |
| 1.5SMC110A | 1.5SMC110CA | 110A | 110C | 94.00 | 105.00 | 116.00 | 1 | 152.0 | 10.0 | 1 | X |
| 1.5SMC120A | 1.5SMC120CA | 120A | 120C | 102.00 | 114.00 | 126.00 | 1 | 165.0 | 9.2 | 1 | X |
| 1.5SMC130A | 1.5SMC130CA | 130A | 130C | 111.00 | 124.00 | 137.00 | 1 | 179.0 | 8.5 | 1 | X |
| 1.5SMC150A | 1.5SMC150CA | 150A | 150C | 128.00 | 143.00 | 158.00 | 1 | 207.0 | 7.3 | 1 | X |
| 1.5SMC160A | 1.5SMC160CA | 160A | 160C | 136.00 | 152.00 | 168.00 | 1 | 219.0 | 6.9 | 1 | X |
| 1.5SMC170A | 1.5SMC170CA | 170A | 170C | 145.00 | 162.00 | 179.00 | 1 | 234.0 | 6.5 | 1 | X |
| 1.5SMC180A | 1.5SMC180CA | 180A | 180C | 154.00 | 171.00 | 189.00 | 1 | 246.0 | 6.2 | 1 | X |
| 1.5SMC200A | 1.5SMC200CA | 200A | 200C | 171.00 | 190.00 | 210.00 | 1 | 274.0 | 5.5 | 1 | X |
| 1.5SMC220A | 1.5SMC220CA | 220A | 220C | 185.00 | 209.00 | 231.00 | 1 | 328.0 | 4.6 | 1 | X |
| 1.5SMC250A | 1.5SMC250CA | 250A | 250C | 214.00 | 237.00 | 263.00 | 1 | 344.0 | 4.4 | 1 | X |
| 1.5SMC300A | 1.5SMC300CA | 300A | 300C | 256.00 | 285.00 | 315.00 | 1 | 414.0 | 3.7 | 1 | X |
| 1.5SMC350A | 1.5SMC350CA | 350A | 350C | 300.00 | 332.00 | 368.00 | 1 | 482.0 | 3.2 | 1 | X |
| 1.5SMC400A | 1.5SMC400CA | 400A | 400C | 342.00 | 380.00 | 420.00 | 1 | 548.0 | 2.8 | 1 | X |
| 1.5SMC440A | 1.5SMC440CA | 440A | 440C | 376.00 | 418.00 | 462.00 | 1 | 602.0 | 2.5 | 1 | X |
| 1.5SMC480A | 1.5SMC480CA | 480A | 480C | 408.00 | 456.00 | 504.00 | 1 | 658.0 | 2.3 | 1 | X |
| 1.5SMC510A | 1.5SMC510CA | 510A | 510C | 434.00 | 485.00 | 535.00 | 1 | 698.0 | 2.1 | 1 | X |
| 1.5SMC530A | 1.5SMC530CA | 530A | 530C | 477.00 | 503.50 | 556.50 | 1 | 725.0 | 2.1 | 1 | X |
| 1.5SMC540A | 1.5SMC540CA | 540A | 540C | 486.00 | 513.00 | 567.00 | 1 | 740.0 | 2.0 | 1 | X |
| 1.5SMC550A | 1.5SMC550CA | 550A | 550C | 495.00 | 522.50 | 577.50 | 1 | 760.0 | 2.0 | 1 | X |

For bidirectional type having $V_R$ of 10 volts and less, the $I_R$ limit is double.

For parts without A , the $V_{BR}$ is ± 10% and Vc is 5% higher than with A parts.

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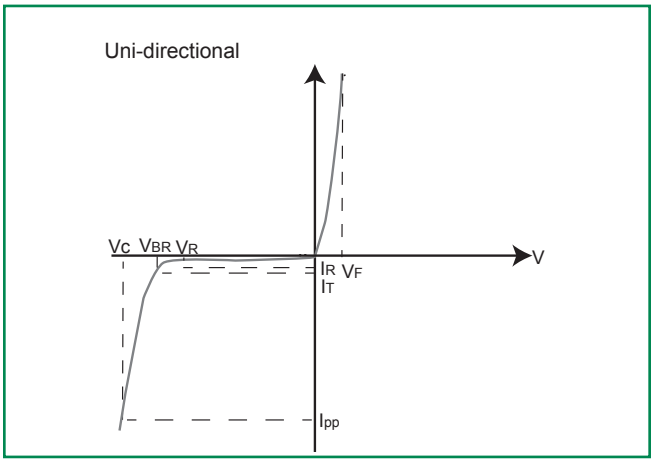
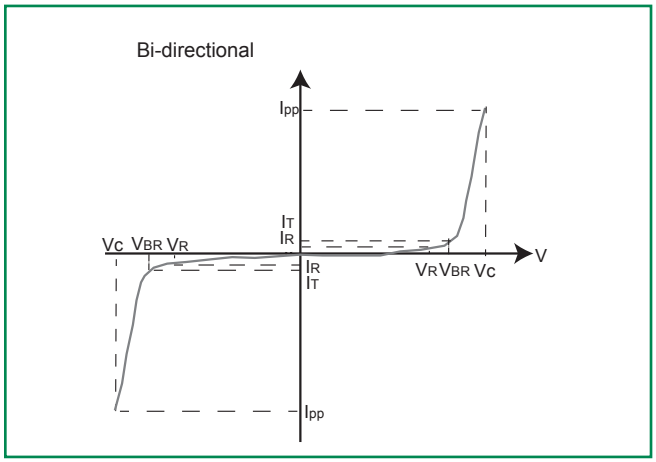
## I-V Curve Characteristics

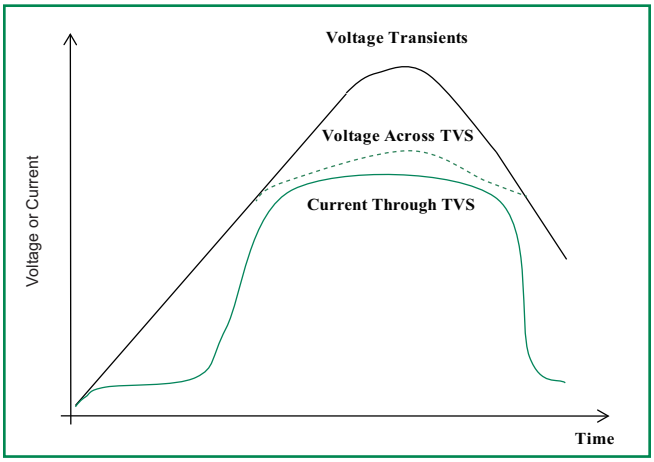


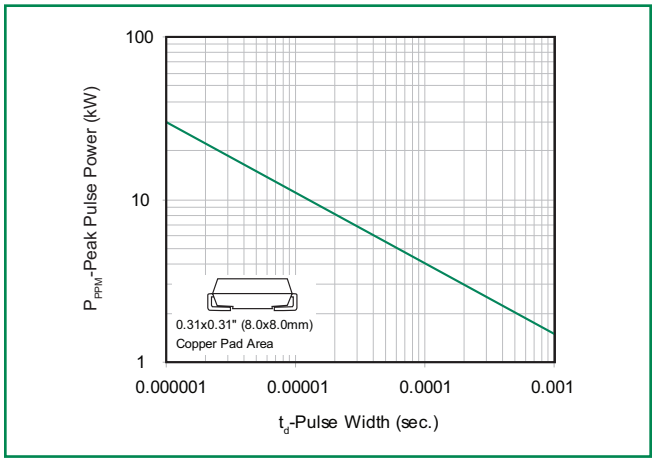

**$P_{PPM}$ Peak Pulse Power Dissipation** – Max power dissipation
**$V_R$ Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation
**$V_{BR}$ Breakdown Voltage** – Maximum voltage that flows though the TVS at a specified test current ($I_T$)
**$V_C$ Clamping Voltage** –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

### Figure 1 - TVS Transients Clamping Waveform




### Figure 2 - Peak Pulse Power Rating

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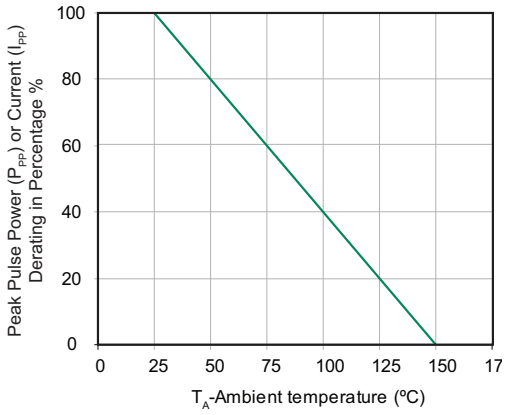
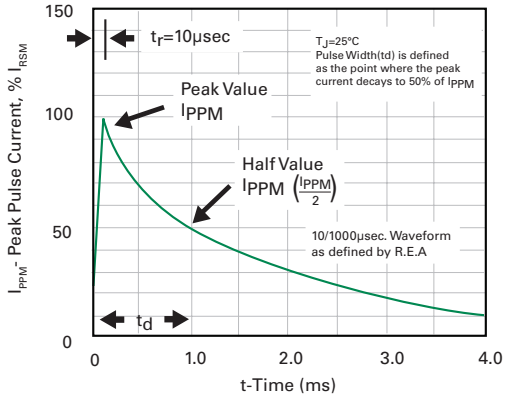
## Ratings and Characteristic Curves ($T_A$=25°C unless otherwise noted) (Continued)

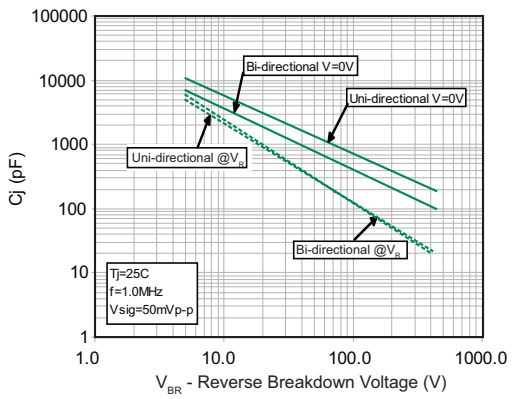
### Figure 3 - Pulse Derating Curve



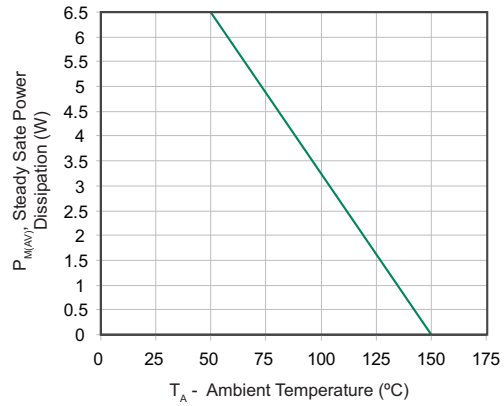

### Figure 4 - Pulse Waveform



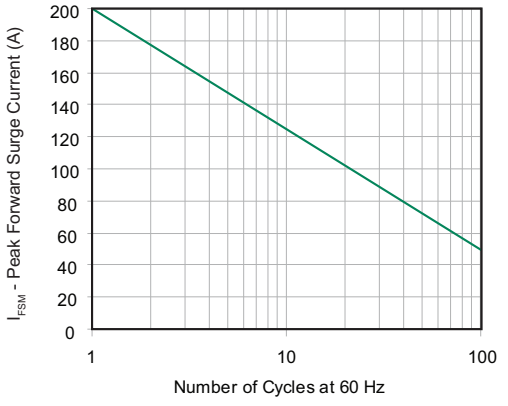

### Figure 5 - Typical Junction Capacitance




### Figure 6 - Steady State Power Dissipation Derating Curve




### Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only

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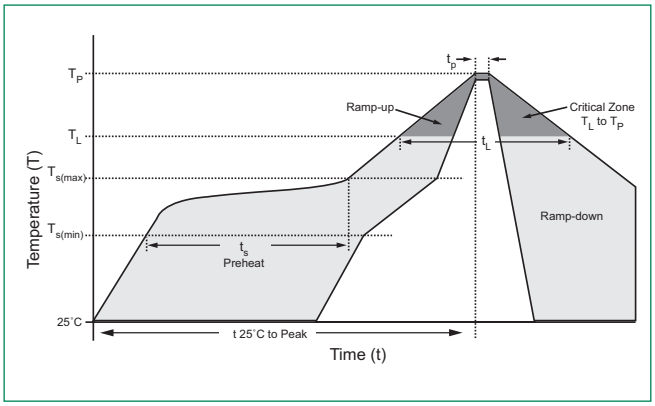
## Surface Mount – 1500W > 1.5SMC series

## 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 (min to max) ($t_s$) | 60 – 150 seconds |
| Peak Temperature ($T_P$) | | $260^{+0/-5}$ °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 | | 280°C |




## Physical Specifications

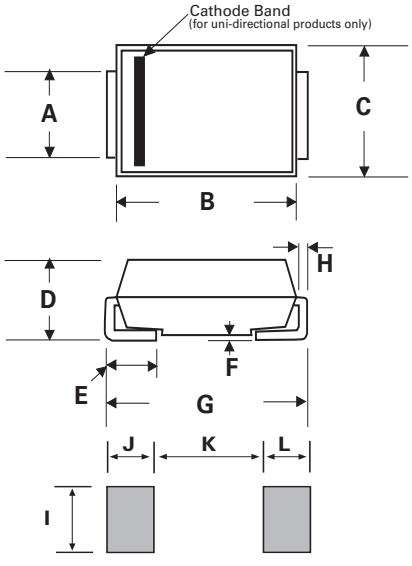
| | |
|---|---|
| **Weight** | 0.007 ounce, 0.21 grams |
| **Case** | JEDEC DO214AB. Molded plastic body over glass passivated junction |
| **Polarity** | Color band denotes positive end (cathode) except Bidirectional. |
| **Terminal** | Matte Tin-plated leads, Solderable per JESD22-B102 |

## Environmental Specifications

| | |
|---|---|
| **High Temp. Storage** | JESD22-A103 |
| **HTRB** | JESD22-A108 |
| **Temperature Cycling** | JESD22-A104 |
| **MSL** | JEDEC-J-STD-020, Level 1 |
| **H3TRB** | JESD22-A101 |
| **RSH** | JESD22-B106 |

## Dimensions

**DO-214AB (SMC J-Bend)**




| Dimensions | Inches | | Millimeters | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.114 | 0.126 | 2.900 | 3.200 |
| B | 0.260 | 0.280 | 6.600 | 7.110 |
| C | 0.220 | 0.245 | 5.590 | 6.220 |
| D | 0.079 | 0.103 | 2.060 | 2.620 |
| E | 0.030 | 0.060 | 0.760 | 1.520 |
| F | - | 0.008 | - | 0.203 |
| G | 0.305 | 0.320 | 7.750 | 8.130 |
| H | 0.006 | 0.012 | 0.152 | 0.305 |
| I | 0.129 | - | 3.300 | - |
| J | 0.094 | - | 2.400 | - |
| K | - | 0.165 | - | 4.200 |
| L | 0.094 | - | 2.400 | - |

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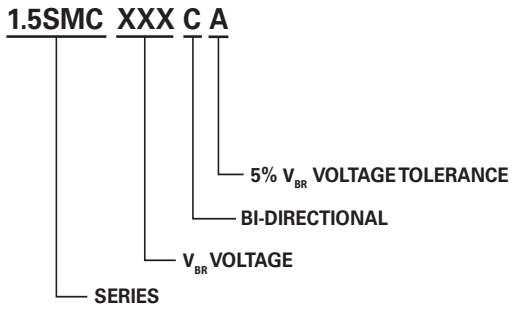
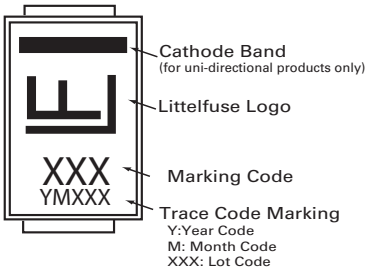
## Part Numbering System



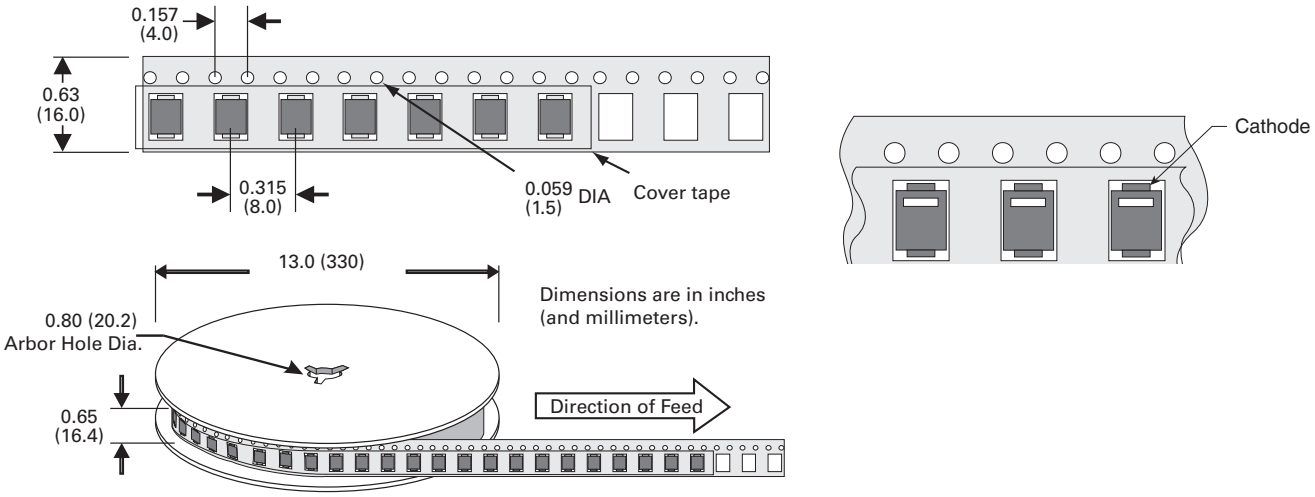

## Part Marking System




## Packaging

| Part number | Component Package | Quantity | Packaging Option | Packaging Specification |
|---|---|---|---|---|
| 1.5SMCxxxXX | DO-214AB | 3000 | Tape & Reel – 16mm/13" tape | EIA STD RS-481 |

## Tape and Reel Specification

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