Littelfuse
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# SMA6L Series




## Agency Approvals

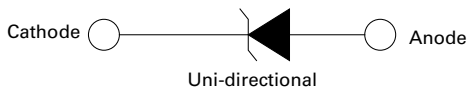
| AGENCY | AGENCY FILE NUMBER |
|---|---|
| | E230531 |

## 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 1,2,3) | $P_{PPM}$ | 600 | W |
| Power Dissipation on Infinite Heat Sink at $T_L$=50°C | $P_D$ | 3 | W |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 4) | $I_{FSM}$ | 60 | A |
| Maximum Instantaneous Forward Voltage at 25A for Unidirectional Only | $V_F$ | 3.5 | V |
| Operating Temperature Range | $T_J$ | -65 to 150 | °C |
| Storage Temperature Range | $T_{STG}$ | -65 to 175 | °C |
| Typical Thermal Resistance Junction to Lead | $R_{\theta JL}$ | 35 | °C/W |
| Typical Thermal Resistance Junction to Ambient | $R_{\theta JA}$ | 200 | °C/W |

**Notes:**
1. Non-repetitive current pulse, per Fig.4 and derated above $T_J$ (initial) =25°C per Fig. 3.
2. Mounted on 5.0x5.0mm copper pad to each terminal.
3. SMA6L150A~SMA6L250A Peak Pulse Power Dissipation by 10/1000µs Waveform (PPPM ) is 400W
4. Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional device only.

## Functional Diagram



Uni-directional

## Description

The SMA6L series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

The SMA6L low profile package has the same power performance as the SMB package but with lowest height profiles (1.1mm) in the industry.

## Features

- Same power as standard SMB devices (600 W)
- SMA low profile package: less than 1.1 mm
- Footprint compatibility with standard SMA and SMB products (easy to layout)
- Typical failure mode is a short circuit condition for current events exceeding component rating
- Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
- IEC 61000-4-2 ESD 30kV(Air), 30kV (Contact)
- EFT protection of data lines in accordance with IEC 61000-4-4
- Low inductance, excellent clamping capability
- Fast response time: typically less than 1.0ns from 0 Volts to $V_{BR}$ min
- Built-in strain relief
- Glass passivated junction
- Typical IR < 1µA when VBR min > 12 V
- High temperature reflow soldering guaranteed: 260°C/40sec
- $V_{BR}$ @ $T_J$= $V_{BR}$@25°C x (1+ $\alpha$ T x ($T_J$ - 25)) ($\alpha$ T:Temperature Coefficient, typical value is 0.1%)
- UL Recognized compound meeting flammability rating V-0
- Meet MSL level1, per J-STD-020, lead-frame maximun peak of 260°C
- Matte tin lead–free plated
- Halogen free and RoHS compliant
- Pb-free E3 means 2ND level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-609A.01)

## Applications

TVS components 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 Infomarion

Datasheet | Resources | Samples

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# Transient Voltage Suppression Diodes

## Surface Mount – 600W > SMA6L series

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

| Part Number (Uni) | Marking Code | 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 |
|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | MAX | | | | | |
| SMA6L5.0A | AE | 5.0 | 6.40 | 7.00 | 10 | 9.2 | 65.3 | 800 | x |
| SMA6L6.0A | AG | 6.0 | 6.67 | 7.37 | 10 | 10.3 | 58.3 | 800 | x |
| SMA6L6.5A | AK | 6.5 | 7.22 | 7.98 | 10 | 11.2 | 53.6 | 500 | x |
| SMA6L7.0A | AM | 7.0 | 7.78 | 8.60 | 10 | 12.0 | 50.0 | 200 | x |
| SMA6L7.5A | AP | 7.5 | 8.33 | 9.21 | 1 | 12.9 | 46.6 | 100 | x |
| SMA6L8.0A | AR | 8.0 | 8.89 | 9.83 | 1 | 13.6 | 44.2 | 50 | x |
| SMA6L8.5A | AT | 8.5 | 9.44 | 10.40 | 1 | 14.4 | 41.7 | 20 | x |
| SMA6L9.0A | AV | 9.0 | 10.00 | 11.10 | 1 | 15.4 | 39.0 | 10 | x |
| SMA6L10A | AX | 10.0 | 11.10 | 12.30 | 1 | 17.0 | 35.3 | 5 | x |
| SMA6L11A | AZ | 11.0 | 12.20 | 13.50 | 1 | 18.2 | 33.0 | 1 | x |
| SMA6L12A | BE | 12.0 | 13.30 | 14.70 | 1 | 19.9 | 30.2 | 1 | x |
| SMA6L13A | BG | 13.0 | 14.40 | 15.90 | 1 | 21.5 | 28.0 | 1 | x |
| SMA6L14A | BK | 14.0 | 15.60 | 17.20 | 1 | 23.2 | 25.9 | 1 | x |
| SMA6L15A | BM | 15.0 | 16.70 | 18.50 | 1 | 24.4 | 24.6 | 1 | x |
| SMA6L16A | BP | 16.0 | 17.80 | 19.70 | 1 | 26.0 | 23.1 | 1 | x |
| SMA6L17A | BR | 17.0 | 18.90 | 20.90 | 1 | 27.6 | 21.8 | 1 | x |
| SMA6L18A | BT | 18.0 | 20.00 | 22.10 | 1 | 29.2 | 20.6 | 1 | x |
| SMA6L20A | BV | 20.0 | 22.20 | 24.50 | 1 | 32.4 | 18.6 | 1 | x |
| SMA6L22A | BX | 22.0 | 24.40 | 26.90 | 1 | 35.5 | 16.9 | 1 | x |
| SMA6L24A | BZ | 24.0 | 26.70 | 29.50 | 1 | 38.9 | 15.5 | 1 | x |
| SMA6L26A | CE | 26.0 | 28.90 | 31.90 | 1 | 42.1 | 14.3 | 1 | x |
| SMA6L28A | CG | 28.0 | 31.10 | 34.40 | 1 | 45.4 | 13.3 | 1 | x |
| SMA6L30A | CK | 30.0 | 33.30 | 36.80 | 1 | 48.4 | 12.4 | 1 | x |
| SMA6L33A | CM | 33.0 | 36.70 | 40.60 | 1 | 53.3 | 11.3 | 1 | x |
| SMA6L36A | CP | 36.0 | 40.00 | 44.20 | 1 | 58.1 | 10.4 | 1 | x |
| SMA6L40A | CR | 40.0 | 44.40 | 49.10 | 1 | 64.5 | 9.3 | 1 | x |
| SMA6L43A | CT | 43.0 | 47.80 | 52.80 | 1 | 69.4 | 8.7 | 1 | x |
| SMA6L45A | CV | 45.0 | 50.00 | 55.30 | 1 | 72.7 | 8.3 | 1 | x |
| SMA6L48A | CX | 48.0 | 53.30 | 58.90 | 1 | 77.4 | 7.8 | 1 | x |
| SMA6L51A | CZ | 51.0 | 56.70 | 62.70 | 1 | 82.4 | 7.3 | 1 | x |
| SMA6L54A | RE | 54.0 | 60.00 | 66.30 | 1 | 87.1 | 6.9 | 1 | x |
| SMA6L58A | RG | 58.0 | 64.40 | 71.20 | 1 | 93.6 | 6.5 | 1 | x |
| SMA6L60A | RK | 60.0 | 66.70 | 73.70 | 1 | 96.8 | 6.2 | 1 | x |
| SMA6L64A | RM | 64.0 | 71.10 | 78.60 | 1 | 103.0 | 5.9 | 1 | x |
| SMA6L70A | RP | 70.0 | 77.80 | 86.00 | 1 | 113.0 | 5.3 | 1 | x |
| SMA6L75A | RR | 75.0 | 83.30 | 92.10 | 1 | 121.0 | 5.0 | 1 | x |
| SMA6L78A | RT | 78.0 | 86.70 | 95.80 | 1 | 126.0 | 4.8 | 1 | x |
| SMA6L85A | RV | 85.0 | 94.40 | 104.00 | 1 | 137.0 | 4.4 | 1 | x |
| SMA6L90A | RX | 90.0 | 100.0 | 111.00 | 1 | 146.0 | 4.2 | 1 | x |
| SMA6L100A | RZ | 100.0 | 111.0 | 123.00 | 1 | 162.0 | 3.7 | 1 | x |
| SMA6L 110A | SE | 110.0 | 122.0 | 135.00 | 1 | 177.0 | 3.4 | 1 | x |
| SMA6L120A | SG | 120.0 | 133.0 | 147.00 | 1 | 193.0 | 3.2 | 1 | x |
| SMA6L 130A | SK | 130.0 | 144.0 | 159.00 | 1 | 209.0 | 2.9 | 1 | x |
| SMA6L150A | SM | 150.0 | 167.0 | 185.00 | 1 | 243.0 | 1.65 | 1 | x |
| SMA6L160A | SP | 160.0 | 178.0 | 197.00 | 1 | 259.0 | L55 | 1 | x |
| SMA6L170A | SR | 170.0 | 189.0 | 209.00 | 1 | 275.0 | 1.50 | 1 | x |
| SMA6L180A | ST | 180.0 | 201.0 | 222.00 | 1 | 292.0 | 1.40 | 1 | x |
| SMA6L185A | SU | 185.0 | 209.0 | 231.00 | 1 | 303.0 | 1.40 | 1 | x |
| SMA6L200A | SV | 200.0 | 224.0 | 247.00 | 1 | 324.0 | 1.25 | 1 | x |
| SMA6L215A | SW | 215.0 | 237.0 | 263.00 | 1 | 344.0 | 1.17 | 1 | x |
| SMA6L220A | SX | 220.0 | 246.0 | 272.00 | 1 | 356.0 | 1.13 | 1 | x |
| SMA6L250A | SZ | 250.0 | 279.0 | 309.00 | 1 | 405.0 | 0.95 | 1 | x |

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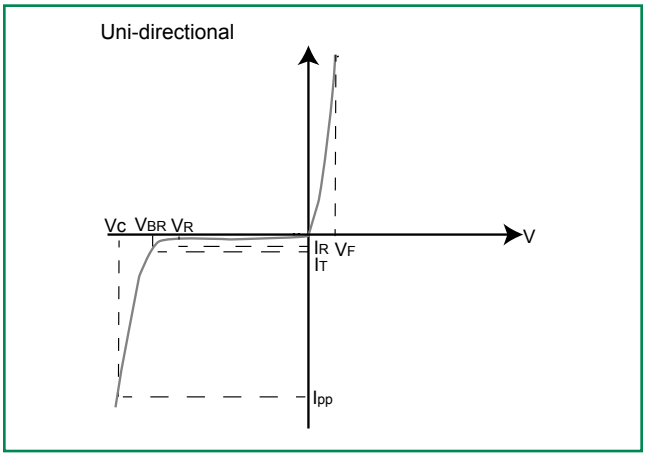
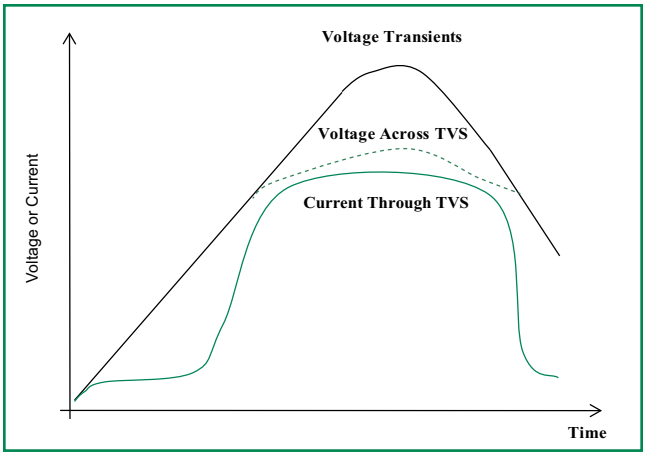
## I-V Curve Characteristics



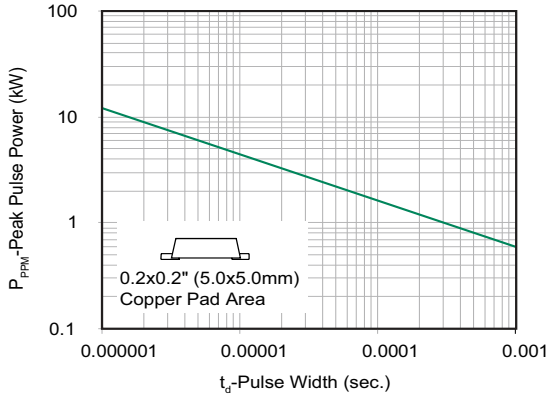

**$P_{PPM}$ Peak Pulse Power Dissipation** – Max power dissipation
**$V_R$ Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation
**$V_{BR}$ Breakdown Voltage** – Maximum voltage that flows though the TVS at a specified test current ($I_T$)
**$V_C$ Clamping Voltage** – Peak voltage measured across the TVS at a specified $I^{PPM}$ (peak impulse current @ 10/1000)
**$I_R$ 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 Curve

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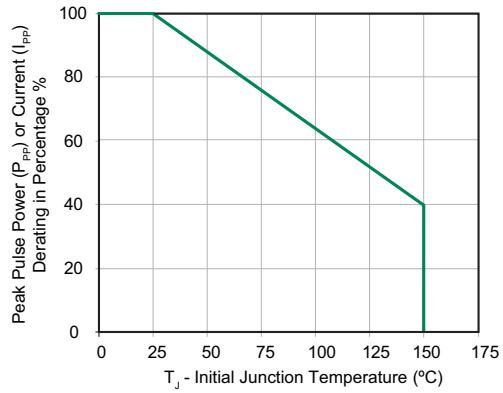
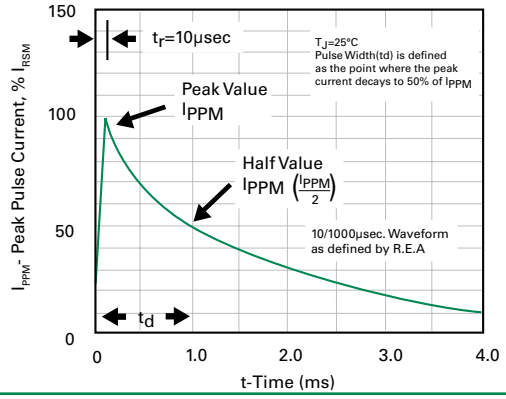
## Ratings and Characteristic Curves ($T_A$=25°C unless otherwise noted) (Continued)

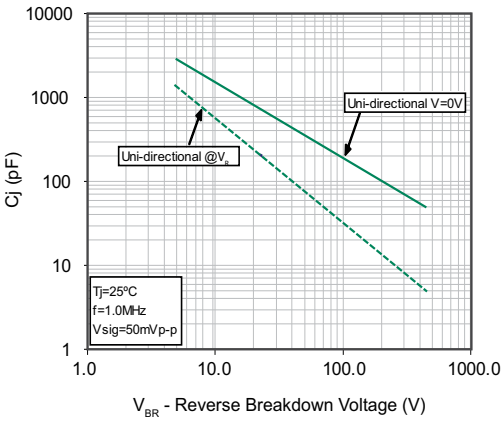
### Figure 3 - Peak Pulse Power Derating Curve



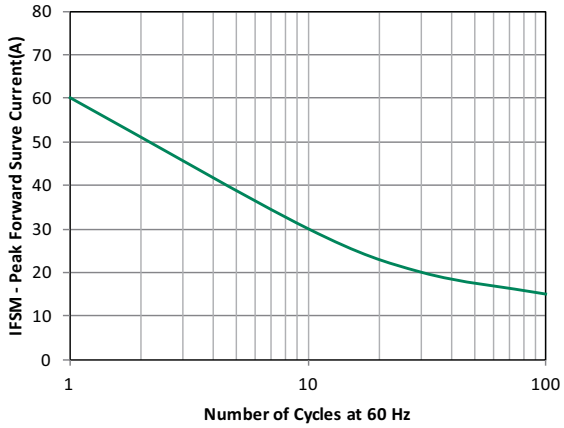

### Figure 4 - Pulse Waveform



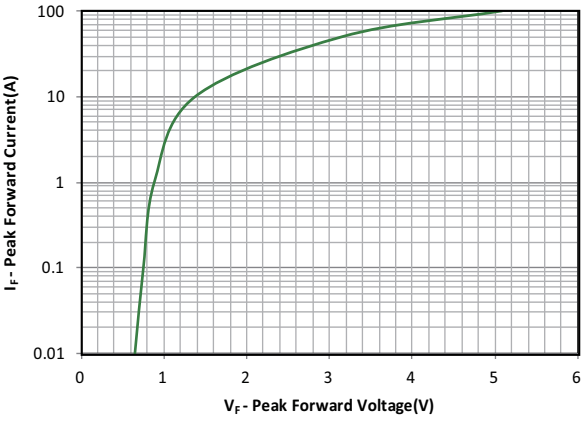

### Figure 5 - Typical Junction Capacitance




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




### Figure 7 - Peak Forward Voltage Drop vs Peak Forward Current (typical values)

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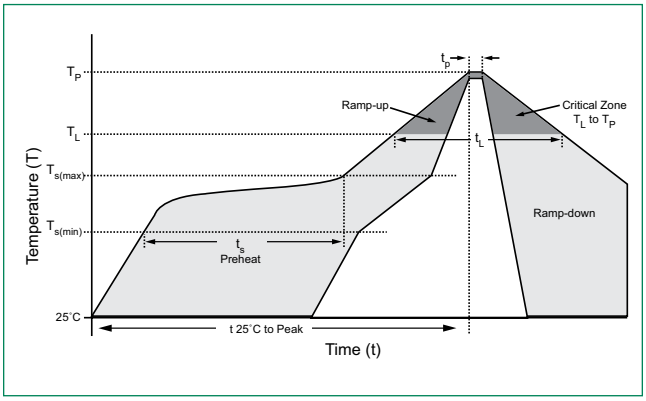
## Soldering Parameters

| 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 ($T_A$) to peak | | 3°C/second max |
| $T_{S(max)}$ to $T_A$ - Ramp-up Rate | | 3°C/second max |
| Reflow | -Temperature ($T_A$) (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 | | 260°C |



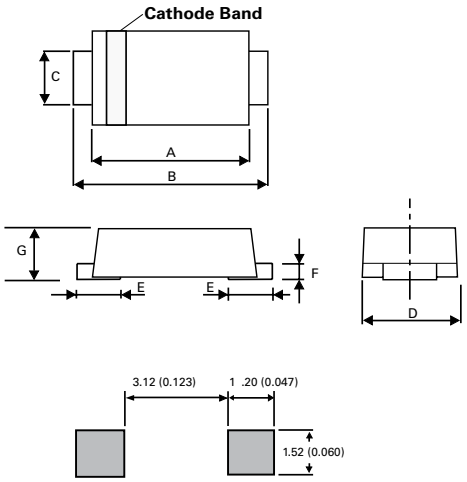

## Physical Specifications

| | |
|---|---|
| **Weight** | 0.002 ounce, 0.032 gram |
| **Case** | JEDEC DO-221AC Molded Plastic over glass passivated junction |
| **Polarity** | Color band denotes cathode except Bipolar |
| **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-A111 |

## Dimensions




**Mounting Pad Layout**

| Dimensions | Inches | | Millimeters | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.156 | 0.181 | 3.950 | 4.600 |
| B | 0.189 | 0.220 | 4.800 | 5.600 |
| C | 0.049 | 0.069 | 1.250 | 1.750 |
| D | 0.088 | 0.116 | 2.250 | 2.950 |
| E | 0.030 | 0.059 | 0.750 | 1.500 |
| F | 0.005 | 0.010 | 0.125 | 0.250 |
| G | 0.035 | 0.043 | 0.900 | 1.100 |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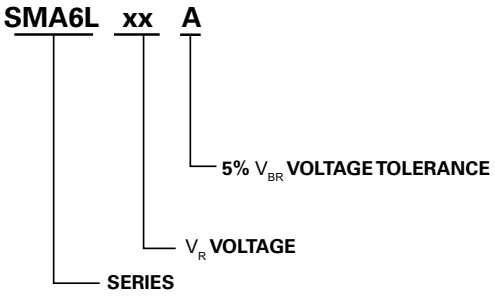
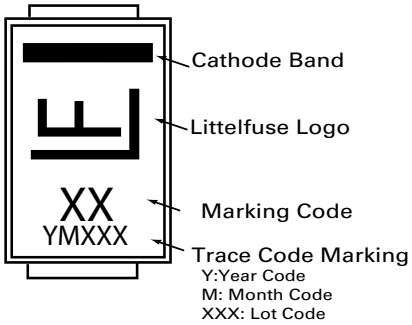
# Transient Voltage Suppression Diodes

## Surface Mount – 600W > SMA6L series

## Part Numbering System



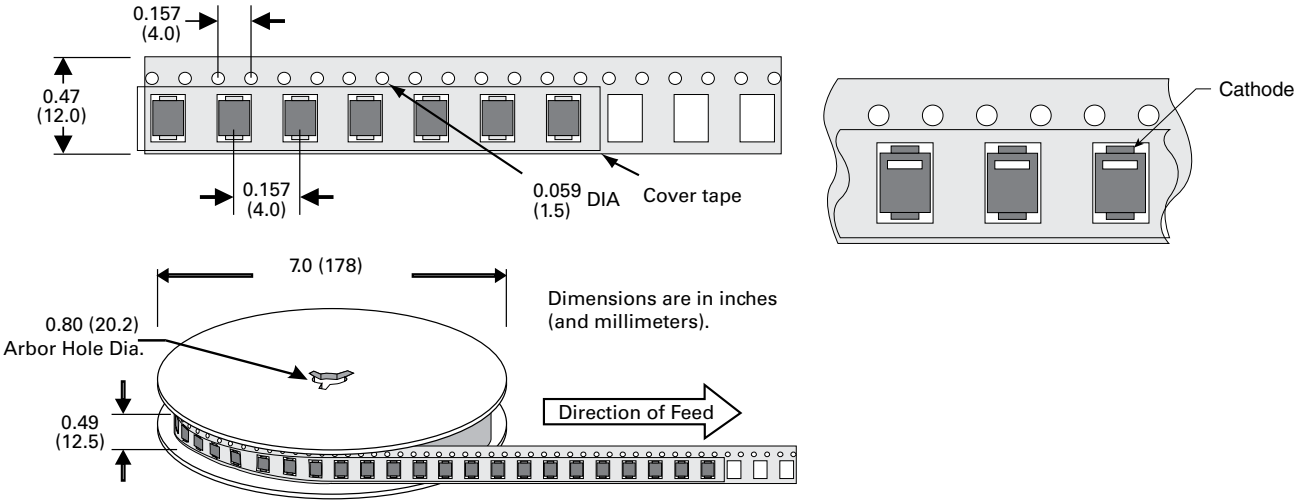

## Part Marking System




## Packaging

| Part number | Component Package | Quantity | Packaging Option | Packaging Specification |
|---|---|---|---|---|
| SMA6LxxA | DO-221AC | 3000 | Tape & Reel – 12mm/7" tape | EIA RS-481 |

## Tape and Reel Specification

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