



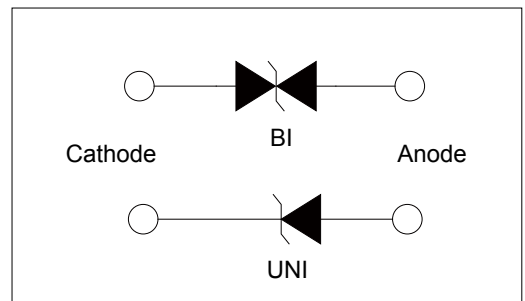
Transient Voltage Suppressors

SMAJ Series

Transient Voltage Suppressors - SMAJ Series

Features

- Fast response time
- Low incremental surge resistance
- Matte tin lead-free Plated
- Halogen free and RoHS compliant
- Typical I_R less than $1\mu A$ above 10V
- Compatible with industrial standard package DO-214AC
- For surface mounted applications to optimize board space
- 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)
- 400W peak pulsepower capability at 10/1000 μs waveform, repetition rate (duty cycle): 0.01%
- High temperature soldering : 260°C/ 40 seconds at terminals



Description

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

Mechanical Characteristics

| Rating | Symbol | Value | Units |
|--|----------------|----------------|-------|
| Peak Pulse Power Dissipation at $T_A=25^\circ C$ by 10/1000 μs Waveform (Fig.2)(Note 1), (Note 2) | P_{PPM} | 400 | Watts |
| Power Dissipation on Infinite Heat Sink at $T_A=50^\circ C$ | P_D | 3.3 | Watts |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3) | I_{FSM} | 40 | Amps |
| Maximum Instantaneous Forward Voltage at 25A for Unidirectional Only (Note 4) | V_F | 3.5/6.5 | V |
| Operating junction and Storage Temperature Range. | T_J, T_{STG} | -55°C to 150°C | °C |
| Typical Thermal Resistance Junction to Lead | R_{uJL} | 30 | °C/W |
| Typical Thermal Resistance Junction to Ambient | R_{uJA} | 120 | °C/W |

Notes:

1. Non-repetitive current pulse, per Fig.4 and derated above $T_A=25^\circ C$ per Fig. 3.
2. Mounted on 5.0x5.0mm copper pad to each terminal.
3. Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional device only.
4. $V_F < 3.5V$ for $V_{BR} \leq 200V$ and $V_F < 6.5V$ for $V_{BR} \geq 201V$

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Electrical Characteristics

| Type Number | | Device Marking Code | | Reverse Stand-Off Voltage | Breakdown Voltage@I _T | | Test Current | Maximum Clamping Voltage@I _{PP} | Peak Pulse Current | Reverse Leakage @V _{RWM} |
|-------------|-----------|---------------------|----|---------------------------|----------------------------------|-------------------------|---------------------|--|---------------------|-----------------------------------|
| UNI | BI | UNI | BI | V _{RWM} (V) | V _{BR MIN} (V) | V _{BR MAX} (V) | I _T (mA) | VC(V) | I _{PP} (A) | I _R (μA) |
| SMAJ5.0A | SMAJ5.0CA | HE | TE | 5.0 | 6.40 | 7.25 | 10 | 9.2 | 43.5 | 800 |
| SMAJ6.0A | SMAJ6.0CA | HG | TG | 6.0 | 6.67 | 7.67 | 10 | 10.3 | 38.8 | 800 |
| SMAJ6.5A | SMAJ6.5CA | HK | TK | 6.5 | 7.22 | 8.30 | 10 | 11.2 | 35.7 | 500 |
| SMAJ7.0A | SMAJ7.0CA | HM | TM | 7.0 | 7.78 | 8.95 | 10 | 12.0 | 33.3 | 200 |
| SMAJ7.5A | SMAJ7.5CA | HP | TP | 7.5 | 8.33 | 9.58 | 1 | 12.9 | 31.0 | 100 |
| SMAJ8.0A | SMAJ8.0CA | HR | TR | 8.0 | 8.89 | 10.23 | 1 | 13.6 | 29.4 | 50 |
| SMAJ8.5A | SMAJ8.5CA | HT | TT | 8.5 | 9.44 | 10.82 | 1 | 14.4 | 27.7 | 20 |
| SMAJ9.0A | SMAJ9.0CA | HV | TV | 9.0 | 10.00 | 11.50 | 1 | 15.4 | 26.0 | 10 |
| SMAJ10A | SMAJ10CA | HX | TX | 10.0 | 11.10 | 12.80 | 1 | 17.0 | 23.5 | 5 |
| SMAJ11A | SMAJ11CA | HZ | TZ | 11.0 | 12.20 | 14.00 | 1 | 18.2 | 22.0 | 1 |
| SMAJ12A | SMAJ12CA | IE | UE | 12.0 | 13.30 | 15.30 | 1 | 19.9 | 20.1 | 1 |
| SMAJ13A | SMAJ13CA | IG | UG | 13.0 | 14.40 | 16.50 | 1 | 21.5 | 18.6 | 1 |
| SMAJ14A | SMAJ14CA | IK | UK | 14.0 | 15.60 | 17.90 | 1 | 23.2 | 17.2 | 1 |
| SMAJ15A | SMAJ15CA | IM | UM | 15.0 | 16.70 | 19.20 | 1 | 24.4 | 16.4 | 1 |
| SMAJ16A | SMAJ16CA | IP | UP | 16.0 | 17.80 | 20.50 | 1 | 26.0 | 15.3 | 1 |
| SMAJ17A | SMAJ17CA | IR | UR | 17.0 | 18.90 | 21.70 | 1 | 27.6 | 14.5 | 1 |
| SMAJ18A | SMAJ18CA | IT | UT | 18.0 | 20.00 | 23.30 | 1 | 29.2 | 13.7 | 1 |
| SMAJ20A | SMAJ20CA | IV | UV | 20.0 | 22.20 | 25.50 | 1 | 32.4 | 12.3 | 1 |
| SMAJ22A | SMAJ22CA | IX | UX | 22.0 | 24.40 | 28.00 | 1 | 35.5 | 11.2 | 1 |
| SMAJ24A | SMAJ24CA | IZ | UZ | 24.0 | 26.70 | 30.70 | 1 | 38.9 | 10.3 | 1 |
| SMAJ26A | SMAJ26CA | JE | VE | 26.0 | 28.90 | 33.20 | 1 | 42.1 | 9.5 | 1 |
| SMAJ28A | SMAJ28CA | JG | VG | 28.0 | 31.10 | 35.80 | 1 | 45.4 | 8.8 | 1 |
| SMAJ30A | SMAJ30CA | JK | VK | 30.0 | 33.30 | 38.30 | 1 | 48.4 | 8.3 | 1 |
| SMAJ33A | SMAJ33CA | JM | VM | 33.0 | 36.70 | 42.20 | 1 | 53.3 | 7.5 | 1 |
| SMAJ36A | SMAJ36CA | JP | VP | 36.0 | 40.00 | 46.00 | 1 | 58.1 | 6.9 | 1 |
| SMAJ40A | SMAJ40CA | JR | VR | 40.0 | 44.40 | 51.10 | 1 | 64.5 | 6.2 | 1 |
| SMAJ43A | SMAJ43CA | JT | VT | 43.0 | 47.80 | 54.90 | 1 | 69.4 | 5.7 | 1 |
| SMAJ45A | SMAJ45CA | JV | VV | 45.0 | 50.00 | 57.50 | 1 | 72.7 | 5.5 | 1 |
| SMAJ48A | SMAJ48CA | JX | VX | 48.0 | 53.30 | 61.30 | 1 | 77.4 | 5.2 | 1 |
| SMAJ51A | SMAJ51CA | JZ | VZ | 51.0 | 56.70 | 65.20 | 1 | 82.4 | 4.9 | 1 |
| SMAJ54A | SMAJ54CA | RE | WE | 54.0 | 60.00 | 69.00 | 1 | 87.1 | 4.6 | 1 |
| SMAJ58A | SMAJ58CA | RG | WG | 58.0 | 64.40 | 74.10 | 1 | 93.6 | 4.3 | 1 |
| SMAJ60A | SMAJ60CA | RK | WK | 60.0 | 66.70 | 76.70 | 1 | 96.8 | 4.1 | 1 |
| SMAJ64A | SMAJ64CA | RM | WM | 64.0 | 71.10 | 81.80 | 1 | 103.0 | 3.9 | 1 |
| SMAJ70A | SMAJ70CA | RP | WP | 70.0 | 77.80 | 89.50 | 1 | 113.0 | 3.5 | 1 |
| SMAJ75A | SMAJ75CA | RR | WR | 75.0 | 83.30 | 95.80 | 1 | 121.0 | 3.3 | 1 |
| SMAJ78A | SMAJ78CA | RT | WT | 78.0 | 86.70 | 99.70 | 1 | 126.0 | 3.2 | 1 |
| SMAJ85A | SMAJ85CA | RV | WV | 85.0 | 94.40 | 108.20 | 1 | 137.0 | 2.9 | 1 |
| SMAJ90A | SMAJ90CA | RX | WX | 90.0 | 100.0 | 115.50 | 1 | 146.0 | 2.7 | 1 |
| SMAJ100A | SMAJ100CA | RZ | WZ | 100.0 | 111.0 | 128.0 | 1 | 162.0 | 2.5 | 1 |
| SMAJ110A | SMAJ110CA | SE | XE | 110.0 | 122.0 | 140.5 | 1 | 177.0 | 2.3 | 1 |
| SMAJ120A | SMAJ120CA | SG | XG | 120.0 | 133.0 | 153.0 | 1 | 193.0 | 2.0 | 1 |
| SMAJ130A | SMAJ130CA | SK | XK | 130.0 | 144.0 | 165.5 | 1 | 209.0 | 1.9 | 1 |
| SMAJ150A | SMAJ150CA | SM | XM | 150.0 | 167.0 | 192.6 | 1 | 243.0 | 1.6 | 1 |
| SMAJ160A | SMAJ160CA | SP | XP | 160.0 | 178.0 | 205.0 | 1 | 259.0 | 1.5 | 1 |
| SMAJ170A | SMAJ170CA | SR | XR | 170.0 | 189.0 | 217.5 | 1 | 275.0 | 1.4 | 1 |
| SMAJ180A | SMAJ180CA | ST | XT | 180.0 | 198.0 | 230.4 | 1 | 292.0 | 1.3 | 1 |
| SMAJ190A | SMAJ190CA | SV | XV | 190.0 | 209.0 | 243.2 | 1 | 308.0 | 1.3 | 1 |
| SMAJ200A | SMAJ200CA | SX | XX | 200.0 | 220.0 | 256.0 | 1 | 324.0 | 1.2 | 1 |
| SMAJ210A | SMAJ210CA | SZ | XZ | 210.0 | 231.0 | 268.8 | 1 | 340.0 | 1.2 | 1 |
| SMAJ220A | SMAJ220CA | ZE | YE | 220.0 | 242.0 | 281.6 | 1 | 356.0 | 1.1 | 1 |

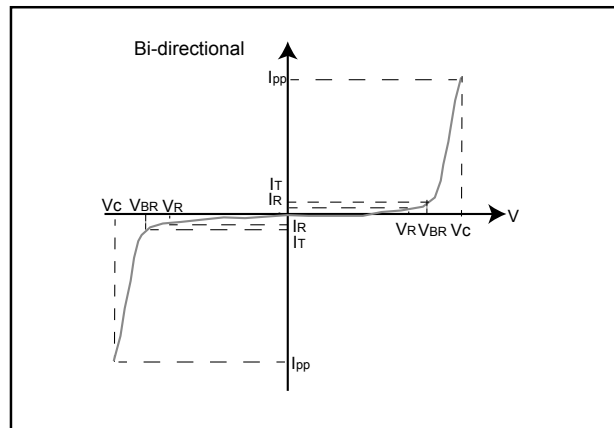
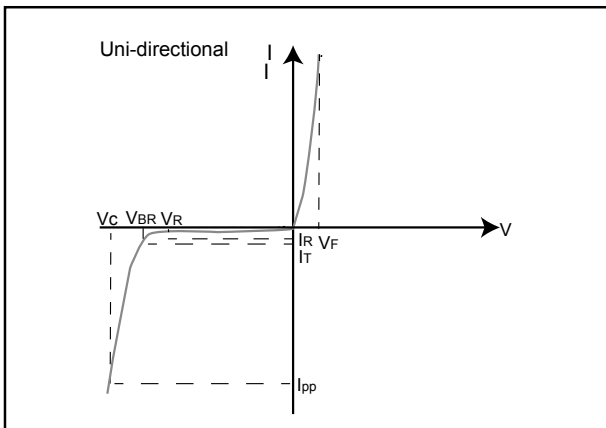
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Electrical Characteristics

| Type Number | | Device Marking Code | | Reverse Stand-Off Voltage | Breakdown Voltage@I _T | | Test Current | Maximum Clamping Voltage@I _{PP} | Peak Pulse Current | Reverse Leakage @V _{RWM} |
|-------------|-----------|---------------------|----|---------------------------|----------------------------------|--------------------------|---------------------|--|---------------------|-----------------------------------|
| UNI | BI | UNI | BI | V _{RWM} (V) | V _{BR MIN.} (V) | V _{BR MAX.} (V) | I _T (mA) | V _C (V) | I _{PP} (A) | I _R (μA) |
| SMAJ250A | SMAJ250CA | ZG | YG | 250.0 | 279.0 | 309.0 | 1 | 405.0 | 1.0 | 1 |
| SMAJ300A | SMAJ300CA | ZK | YK | 300.0 | 335.0 | 371.0 | 1 | 486.0 | 0.8 | 1 |
| SMAJ350A | SMAJ350CA | ZM | YM | 350.0 | 391.0 | 432.0 | 1 | 567.0 | 0.7 | 1 |
| SMAJ400A | SMAJ400CA | ZP | YP | 400.0 | 447.0 | 494.0 | 1 | 648.0 | 0.6 | 1 |
| SMAJ440A | SMAJ440CA | ZR | YR | 440.0 | 492.0 | 543.0 | 1 | 713.0 | 0.6 | 1 |

Notes: For bidirectional type having V_R of 10V and less, the I_R limit is double.

I-V Curve Characteristics



PPPM Peak Pulse Power Dissipation -- Max power dissipation

VR Stand-off Voltage -- Maximum voltage that can be applied to the TVS without operation

VBR Breakdown Voltage -- Maximum voltage that flows through the TVS at a specified test current (I_T)

Vc Clamping Voltage -- Peak voltage measured across the TVS at a specified I_{ppm} (peak impulse current)

IR Reverse Leakage Current -- Current measured at V_R

VF Forward Voltage Drop for Uni-directional

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

Figure 1 - TVS Transients Clamping Waveform

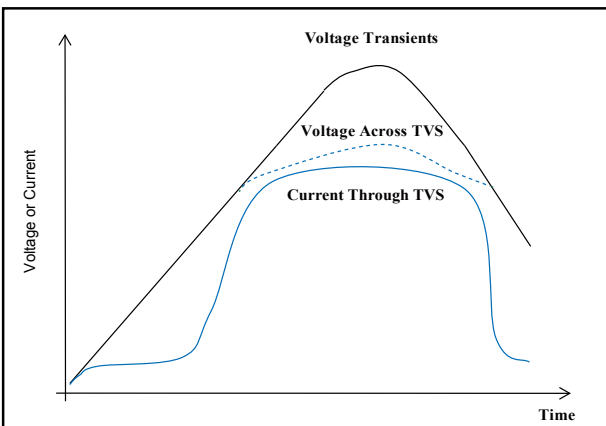
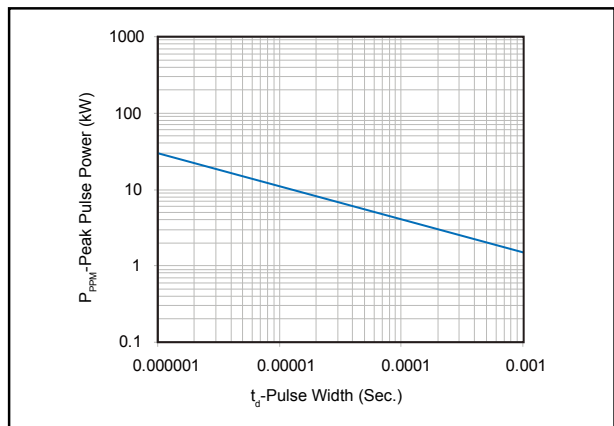


Figure 2 - Peak Pulse Power Rating



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

Figure 3 - Pulse Derating Curve

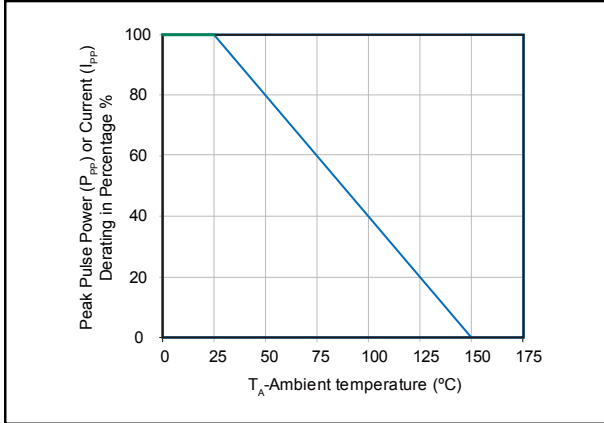


Figure 4 - Pulse Waveform

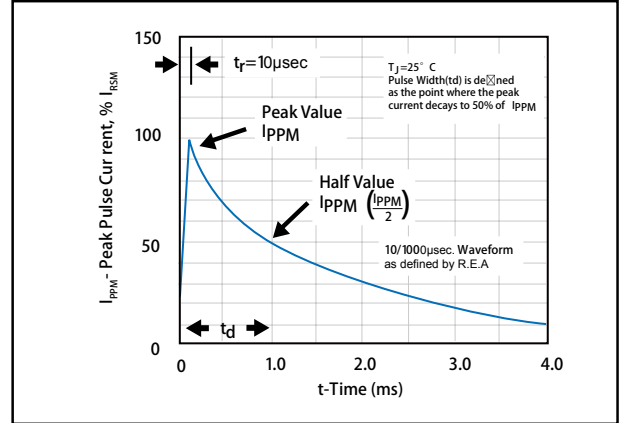


Figure 5 - Typical Junction Capacitance

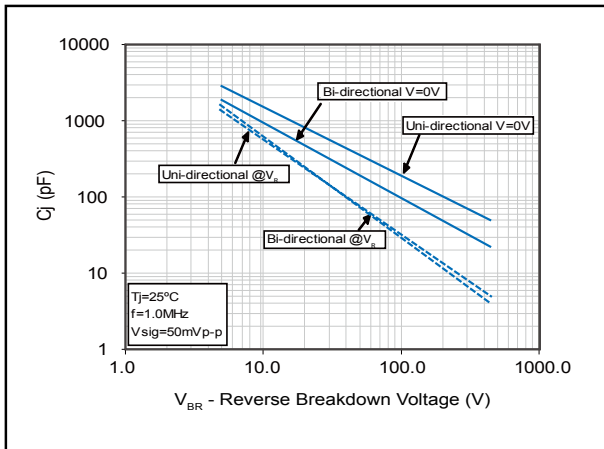


Figure 6 - Steady State Power Dissipation Derating Curve

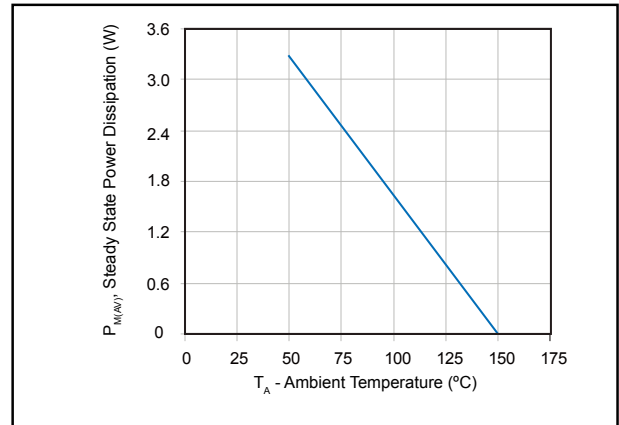
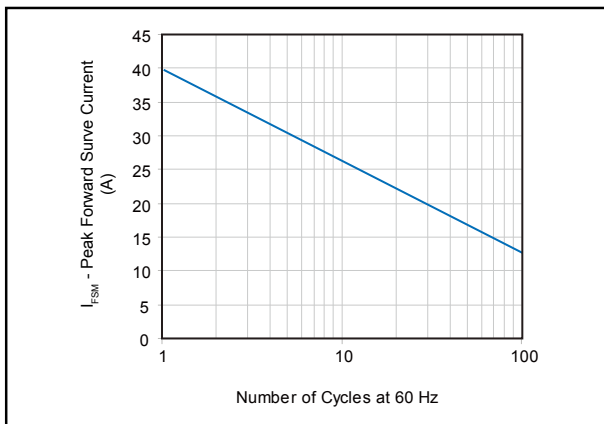


Figure 7 - Maximum Non-Repetitive Forward Surge Current Uni-Directional Only



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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_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 | | 280°C |

Physical Specifications

| | |
|-----------|---|
| Weight | 0.002 ounce, 0.061 gram |
| Case | JEDEC DO-214AC Molded Plastic over |
| Polarity | glass passivated junction |
| Terminals | Matte Tin axial leads, solderable per JESD22-B102D. |



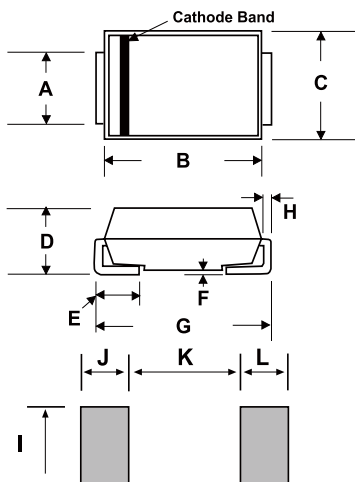
Environmental Specifications

| | |
|--------------------|--------------|
| Temperature Cycle | JESD22-A104 |
| Pressure Cooker | JESD 22-A102 |
| High Temp. Storage | JESD22-A103 |
| HTRB | JESD22-A108 |
| Thermal Shock | JESD22-A106 |

Flow/Wave Soldering

| | |
|--------------------|------------|
| Peak Temperature : | 265°C |
| Dipping Time : | 10 seconds |
| Soldering : | 1 time |

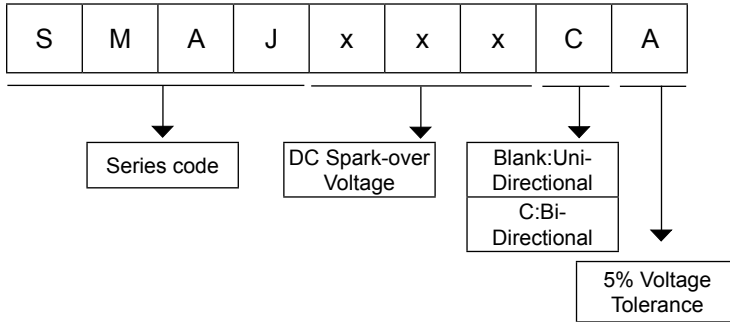
Dimensions DO-214AC/SMA



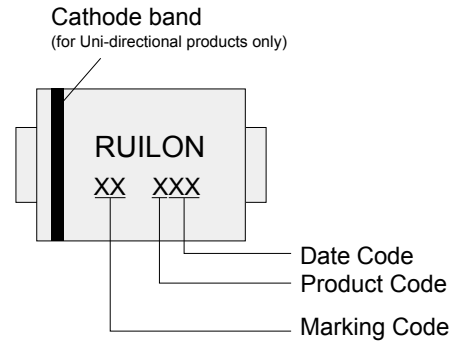
| DIM | Inches | | Millimeters | |
|-----|--------|-------|-------------|-------|
| | Min | Max | Min | Max |
| A | 0.049 | 0.065 | 1.250 | 1.650 |
| B | 0.157 | 0.177 | 3.990 | 4.500 |
| C | 0.100 | 0.110 | 2.540 | 2.790 |
| D | 0.078 | 0.090 | 1.980 | 2.290 |
| E | 0.030 | 0.060 | 0.780 | 1.520 |
| F | - | 0.008 | - | 0.203 |
| G | 0.194 | 0.208 | 4.930 | 5.280 |
| H | 0.006 | 0.012 | 0.152 | 0.305 |
| I | 0.070 | - | 1.800 | - |
| J | 0.082 | - | 2.100 | - |
| K | - | 0.090 | - | 2.300 |
| L | 0.082 | - | 2.100 | - |

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Product Name



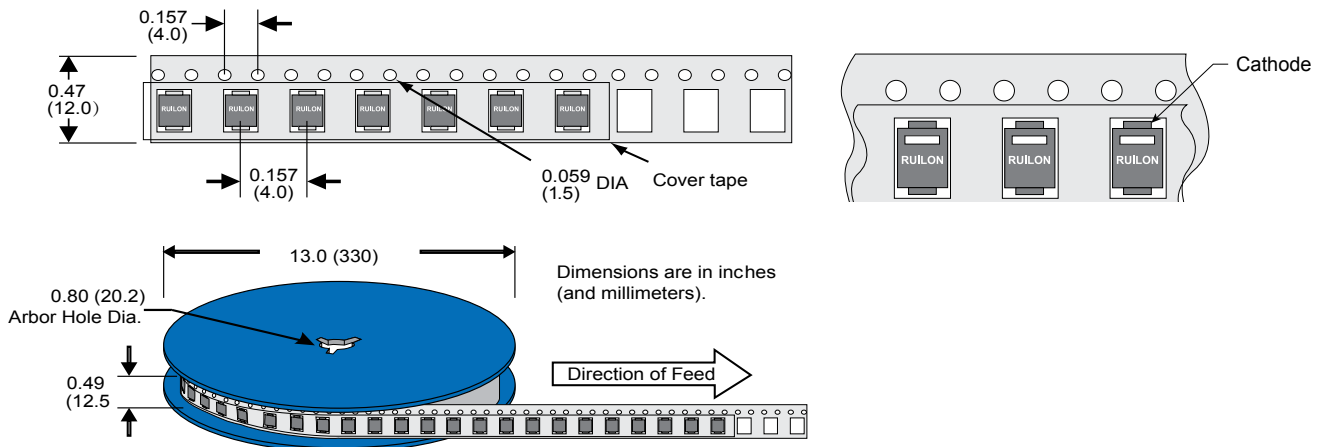
Part Marking System



Packaging

| Part Number | Component Package | Quantity | Packaging Option | Packaging Specification |
|-------------|-------------------|----------|------------------|-------------------------|
| SMAJxxxXX | DO-214AC | 2000 | Tape & Reel | EIA RS-481 |

Tape and Reel Specification



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