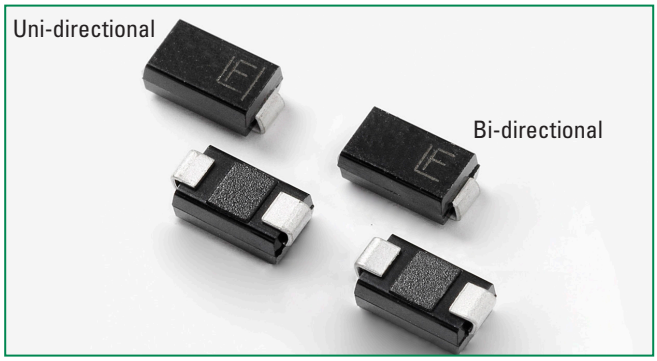
# SMAJ-HRA Series
## Surface Mount - 400W




## Agency Approvals

| Agency | Agency File/Certificate Number |
|---|---|
| | E230531 |

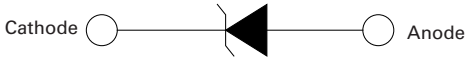
## Maximum Ratings & Thermal Characteristics
($T_A$=25°C unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Peak Pulse Power Dissipation ($I_{PP}$ x $V_C$) by 10/1000µs Waveform (Fig.2) (Note 1), (Note 2) | $P_{PPM}$ | 400 | W |
| Power Dissipation on Infinite Heat Sink at $T_L$=50°C | $P_D$ | 3.3 | W |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3) | $I_{FSM}$ | 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 | $R_{\theta JL}$ | 30 | °C/W |
| Typical Thermal Resistance Junction to Ambient | $R_{\theta JA}$ | 120 | °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 copper pad area of 0.31x0.31" (8.0 x 8.0mm) to each terminal.
3. Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional component only

## Functional Diagram


Bi-directional



Uni-directional

## Description

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

## Features

- Excellent clamping capability
- Typical $I_R \leq 1\mu A$ for $V_R > 10V$
- 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
- ESD protection of data lines in accordance with IEC 61000-4-2, 30kV(Air), 30kV (Contact)
- EFT protection of data lines in accordance with IEC 61000-4-4
- Built-in strain relief
- 400W Peak pulse power capability at 10/1000µs waveform, repetition rate (duty cycle): 0.01%
- Fast response time: typically less than 1.0ps from 0 Volts to $V_{BR}$ min
- Glass passivated junction
- Low inductance
- High temperature to 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%) Coefficient, typical value
- UL Recognized epoxy meeting flammability rating V-0
- Meet MSL level1, per J-STD-020, LF 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.

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# SMAJ-HRA Series
## Surface Mount - 400W

### Electrical Characteristics

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | UNI | BI | | MIN | MAX | | | | | |
| SMAJ6.0A-HRA | SMAJ6.0CA-HRA | AGH | WGH | 6.0 | 6.67 | 7.37 | 10 | 10.3 | 38.8 | 800 | X |
| SMAJ9.0A-HRA | SMAJ9.0CA-HRA | AVH | WVH | 9.0 | 10.00 | 11.10 | 1 | 15.4 | 26.0 | 10 | X |
| SMAJ10A-HRA | SMAJ10CA-HRA | AXH | WXH | 10.0 | 11.10 | 12.30 | 1 | 17.0 | 23.5 | 5 | X |
| SMAJ11A-HRA | SMAJ11CA-HRA | AZH | WZH | 11.0 | 12.20 | 13.50 | 1 | 18.2 | 22.0 | 1 | X |
| SMAJ12A-HRA | SMAJ12CA-HRA | BEH | XEH | 12.0 | 13.30 | 14.70 | 1 | 19.9 | 20.1 | 1 | X |
| SMAJ13A-HRA | SMAJ13CA-HRA | BGH | XGH | 13.0 | 14.40 | 15.90 | 1 | 21.5 | 18.6 | 1 | X |
| SMAJ14A-HRA | SMAJ14CA-HRA | BKH | XKH | 14.0 | 15.60 | 17.20 | 1 | 23.2 | 17.2 | 1 | X |
| SMAJ15A-HRA | SMAJ15CA-HRA | BMH | XMH | 15.0 | 16.70 | 18.50 | 1 | 24.4 | 16.4 | 1 | X |
| SMAJ16A-HRA | SMAJ16CA-HRA | BPH | XPH | 16.0 | 17.80 | 19.70 | 1 | 26.0 | 15.4 | 1 | X |
| SMAJ17A-HRA | SMAJ17CA-HRA | BRH | XRH | 17.0 | 18.90 | 20.90 | 1 | 27.6 | 14.5 | 1 | X |
| SMAJ18A-HRA | SMAJ18CA-HRA | BTH | XTH | 18.0 | 20.00 | 22.10 | 1 | 29.2 | 13.7 | 1 | X |
| SMAJ20A-HRA | SMAJ20CA-HRA | BVH | XVH | 20.0 | 22.20 | 24.50 | 1 | 32.4 | 12.3 | 1 | X |
| SMAJ26A-HRA | SMAJ26CA-HRA | CEH | YEH | 26.0 | 28.90 | 31.90 | 1 | 42.1 | 9.5 | 1 | X |
| SMAJ33A-HRA | SMAJ33CA-HRA | CMH | YMH | 33.0 | 36.70 | 40.60 | 1 | 53.3 | 7.5 | 1 | X |
| SMAJ36A-HRA | SMAJ36CA-HRA | CPH | YPH | 36.0 | 40.00 | 44.20 | 1 | 58.1 | 6.9 | 1 | X |
| SMAJ45A-HRA | SMAJ45CA-HRA | CVH | YVH | 45.0 | 50.00 | 55.30 | 1 | 72.7 | 5.5 | 1 | X |

Note:

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



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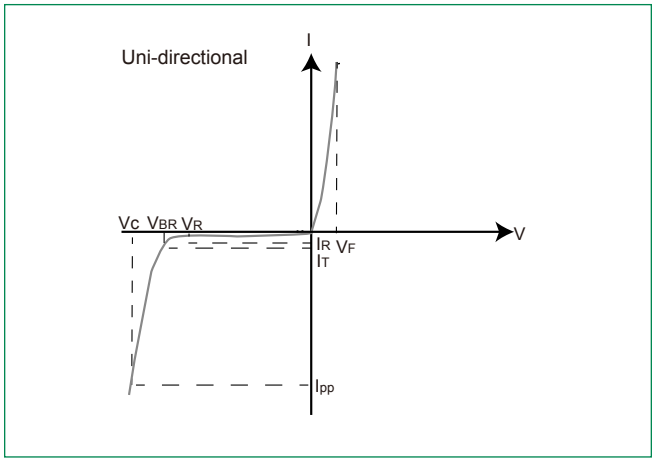
# SMAJ-HRA Series
## Surface Mount - 400W

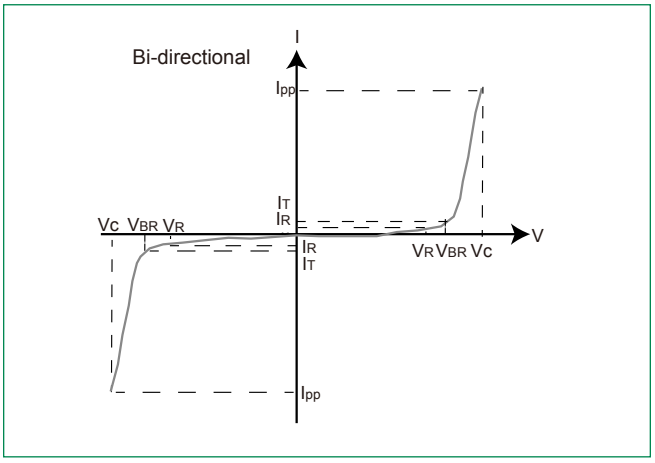
### Screen Process

| | |
|---|---|
| **100% Vision Inspection** | MIL-STD-750 method 2074 |
| **100% High Temperature Storage Life (168hrs,175°C)** | MIL-STD-750 method 1031 |
| **100% X-RAY inspection** | MIL-STD-750 method 2076 |
| **100% Temperature Cycle Test (-55 to150°C, 20 cycles, dwell time 15 min)** | MIL-STD-750 method 1051 |
| **100% Reflow (2X)** | JEDEC J-STD-020 |
| **100% Surge Test (2x)** | MIL-STD-750 method 4066 |
| **100% HTRB 150°C Bias=$V_R$ (80% breakdown voltage, 96hrs, and each direction 96hrs for Bi-directional products)** | MIL–STD–750 method 1038 |
| **Final Electrical Test (100% 3 sigma limit, 100% dynamic test and PAT limit)** | MIL-STD-750 method 4016.4021.4011 |

Note: Up-screen program can be specified by customer's request by contacting Littelfuse customer service

### I-V Curve Characteristics



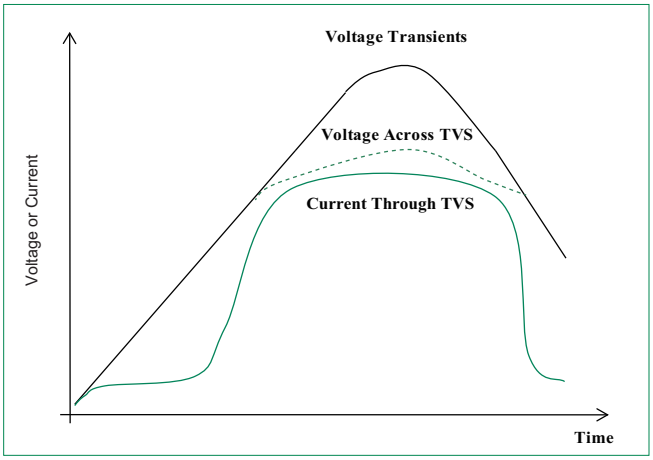

**$P_{PPM}$ Peak Pulse Power Dissipation** -- ($I_{PP}$ x $V_C$) Max power dissipation
**$V_R$ Stand-off Voltage** -- Maximum voltage that can be applied to the TVS without operation
**$V_{BR}$ Breakdown Voltage** -- Maximum voltage that flows though the TVS at a specified test current ($I_T$)
**$V_C$ Clamping Voltage** -- Peak voltage measured across the TVS at a specified Ippm (peak impulse current)
**$I_R$ Reverse Leakage Current** -- Current measured at $V_R$
**$V_F$ Forward Voltage Drop for Uni-directional**

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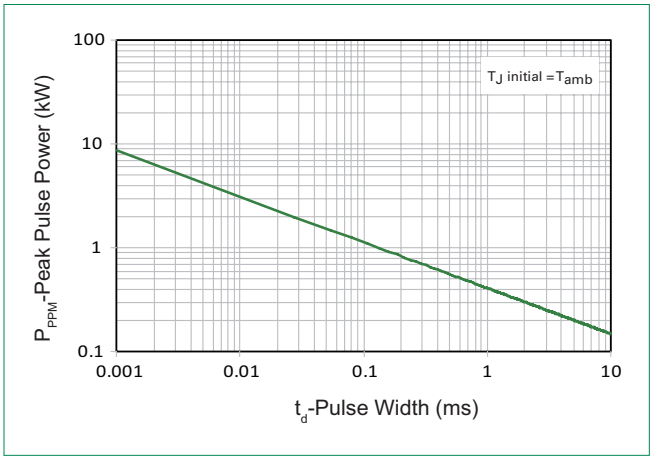
# SMAJ-HRA Series
## Surface Mount - 400W

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

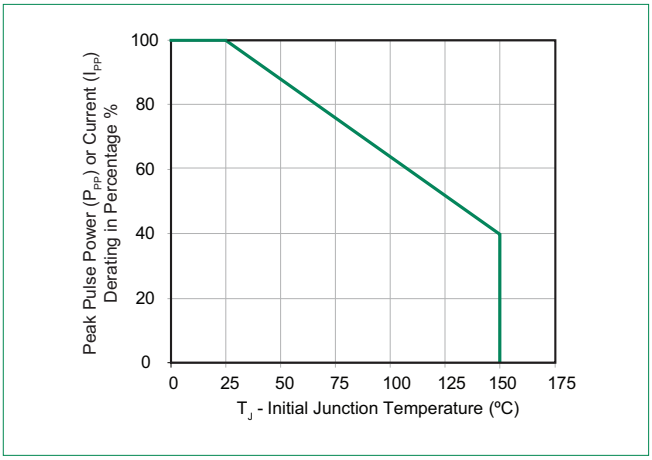
### Figure 1 - TVS Transients Clamping Waveform



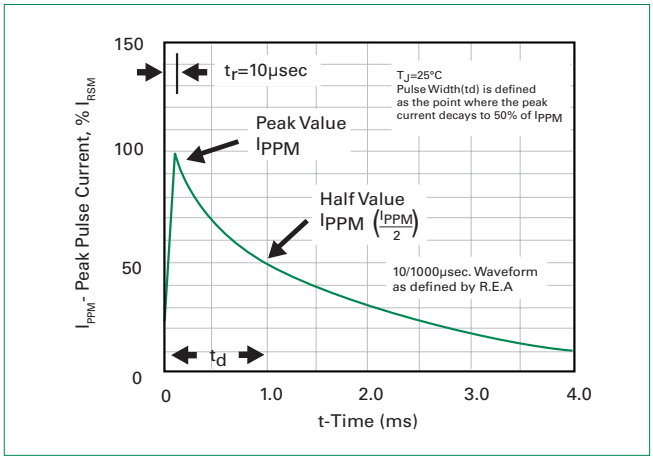

### Figure 2 - PPeak Pulse Power Rating Curve



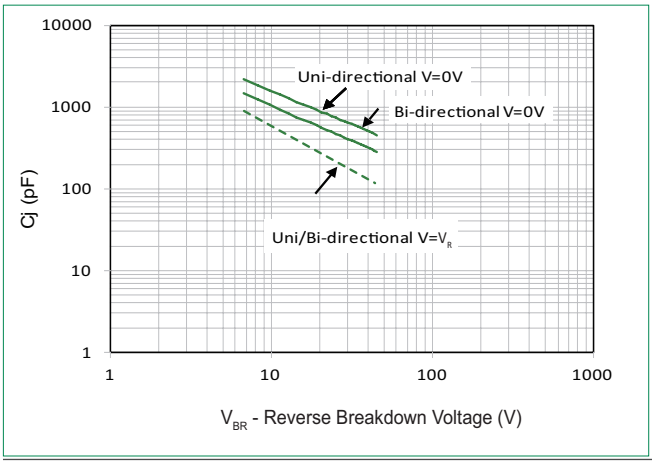

### Figure 3 - Peak Pulse Power Derating Curve



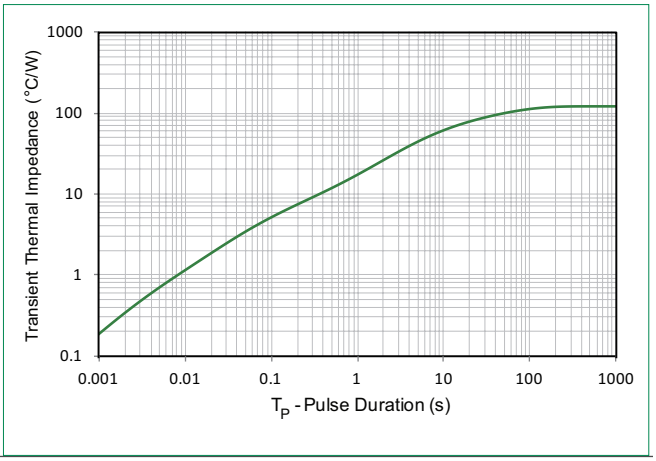

### Figure 4 - Pulse Waveform




### Figure 5 - Typical Junction Capacitance



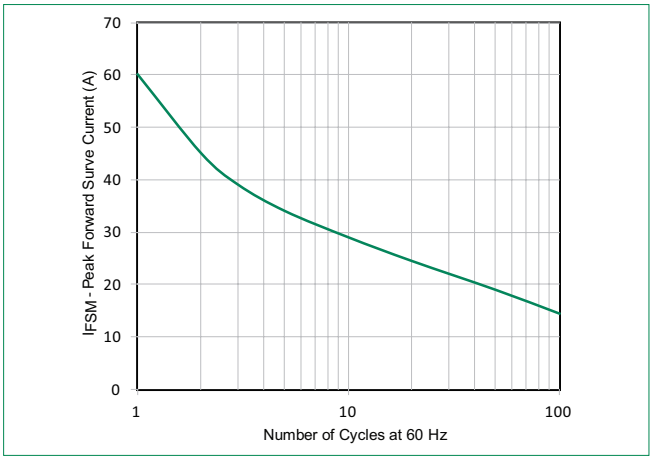

### Figure 6 - Typical Transient Thermal Impedance



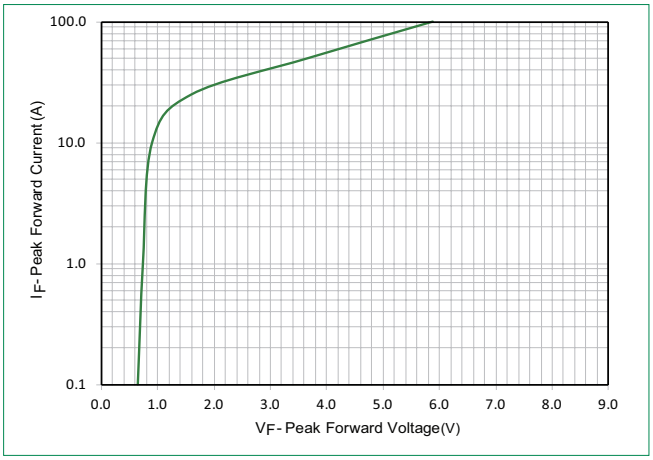

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# SMAJ-HRA Series
## Surface Mount - 400W

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

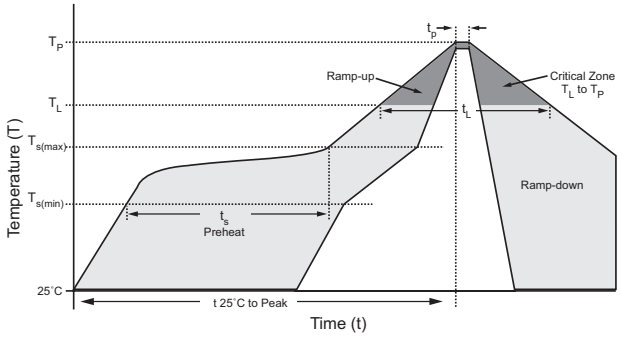



### Figure 8 - Peak Forward Voltage Drop vs Peak Forward Current (Typical Values)




### 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 – 120 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 ($t_p$)** | | 30 seconds |
| **Ramp-down Rate** | | 6°C/second max |
| **Time 25°C to peak Temperature ($T_P$)** | | 8 minutes max. |
| **Do not exceed** | | 260°C |



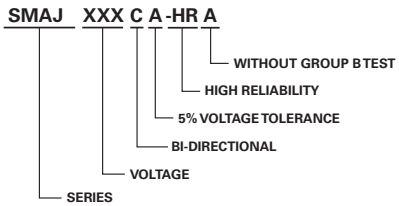

### Physical Specifications

| | |
|---|---|
| **Weight** | 0.002 ounce, 0.061 gram |
| **Case** | JEDEC DO-214AC Molded Plastic over glass passivated junction |
| **Polarity** | Color band denotes cathode except bidirectional |
| **Terminal** | Matte Tin-plated leads. Solderable per JESD22-B102 |

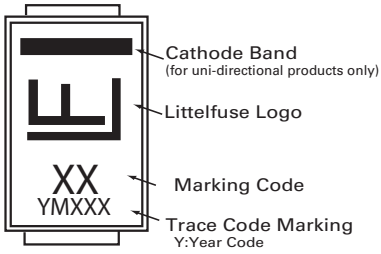
### Environmental Specifications

| | |
|---|---|
| **High Temp. Storage** | JESD22-A103 |
| **HTRB** | JESD22-A108 |
| **Temperature Cycling** | JESD22-A104 |
| **MSL** | JEDEC-J-STD-020, Level 1 |
| **H3TRB** | JESD22-A101 |
| **RSH** | JESD22–A111 |

### Part Numbering System




### Part Marking System

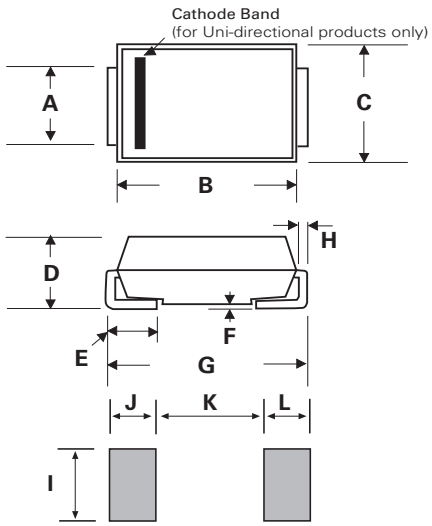



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# SMAJ-HRA Series
## Surface Mount - 400W

## Dimensions

**DO-214AC (SMA)**

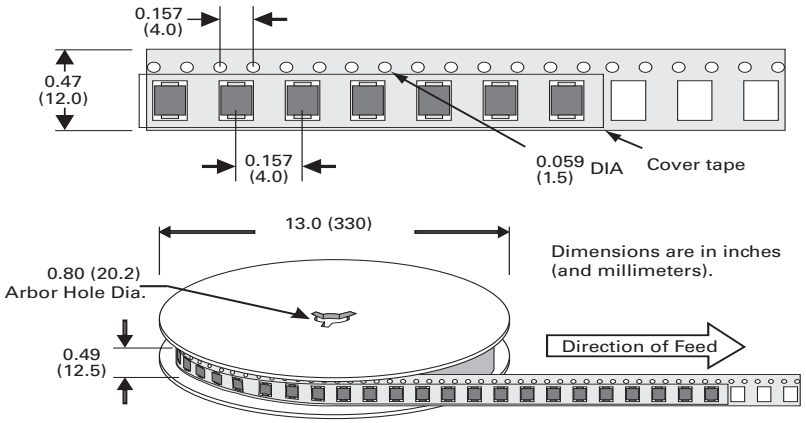


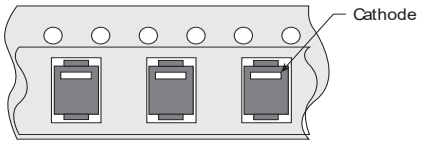

| Dimensions | Inches | | Millimeters | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.049 | 0.065 | 1.250 | 1.650 |
| B | 0.157 | 0.181 | 3.990 | 4.600 |
| C | 0.095 | 0.110 | 2.400 | 2.790 |
| D | 0.075 | 0.090 | 1.900 | 2.290 |
| E | 0.030 | 0.060 | 0.780 | 1.520 |
| F | - | 0.008 | - | 0.203 |
| G | 0.189 | 0.208 | 4.800 | 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 | - |

## Packaging

| Part number | Component Package | Quantity | Packaging Option | Packaging Specification |
|---|---|---|---|---|
| SMAJ-xxxXX-HRA | DO-214AC | 5000 | Tape & Reel - 12mm tape/13" reel | EIA STD RS-481 |

## Tape and Reel Specification




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