# SMAJ Series
## Surface Mount – 400W




## Additional Information

Resources | Accessories | Samples

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

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Peak Pulse Power Dissipation at TA=25° by 10/1000us Waveform(Fig.2)(Note 1), (Note 2) -Single Die Parts | $P_{PPM}$ | 400 | W |
| Peak Pulse Power Dissipation at TA=25° by 10/1000us Waveform(Fig.2)(Note 1), (Note 2)-Stacked Die Parts(Note 5) | $P_{PPM}$ | 600 | 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 (Note 4) | $V_F$ | 3.5/5.0 | 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 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. VF < 3.5V for single die parts and VF< 5.0V for stacked-die parts.
5. For stacked die component details, please refer to part numbers labeled by * in Electrical Characteristics.

## Description

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

## Features

- 400W Peak Pulse Power capability at 10/1000μs waveform, repetition rate (duty cycle): 0.01%
- Excellent clamping capability
- Typical IR less than 1μA when VBR min>12V
- Surface mount footprint for compact PCB layout
- 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 30kV(Air), 30kV (Contact)
- ESD protection of data lines in accordance with IEC 61000-4-2
- EFT protection of data lines in accordance with IEC 61000-4-4
- Built-in strain relief
- Fast response time: typically less than 1.0ps from 0 Volts to VBR min
- Glass passivated junction
- Low inductance
- High temperature to reflow soldering guaranteed: 260°C/30sec
- VBR @TJ= VBR@25°C x (1+αT x (TJ - 25)) (αT:Temperature Coefficient, typical value is 0.1%)
- Plastic package is flammability rated V-0 per UL-94.
- 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)

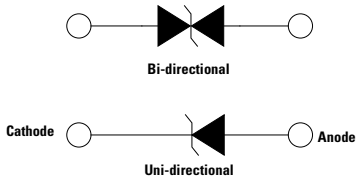
## Applications

TVS 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.

### Agency Approvals

| Agency | Agency File Number |
|---|---|
| | E230531 |

### Functional Diagram





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# SMAJ Series
## Surface Mount – 400W

### 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Uni. | Bi. | | Min. | Max. | | | | | |
| SMAJ5.0A | SMAJ5.0CA | AE | WE | 5.0 | 6.40 | 7.00 | 10 | 9.2 | 43.5 | 800 | X |
| SMAJ6.0A | SMAJ6.0CA | AG | WG | 6.0 | 6.67 | 7.37 | 10 | 10.3 | 38.8 | 800 | X |
| SMAJ6.5A | SMAJ6.5CA | AK | WK | 6.5 | 7.22 | 7.98 | 10 | 11.2 | 35.7 | 500 | X |
| SMAJ7.0A | SMAJ7.0CA | AM | WM | 7.0 | 7.78 | 8.60 | 10 | 12.0 | 33.3 | 200 | X |
| SMAJ7.5A | SMAJ7.5CA | AP | WP | 7.5 | 8.33 | 9.21 | 1 | 12.9 | 31.0 | 100 | X |
| SMAJ8.0A | SMAJ8.0CA | AR | WR | 8.0 | 8.89 | 9.83 | 1 | 13.6 | 29.4 | 50 | X |
| SMAJ8.5A | SMAJ8.5CA | AT | WT | 8.5 | 9.44 | 10.40 | 1 | 14.4 | 27.8 | 20 | X |
| SMAJ9.0A | SMAJ9.0CA | AV | WV | 9.0 | 10.00 | 11.10 | 1 | 15.4 | 26.0 | 10 | X |
| SMAJ10A | SMAJ10CA | AX | WX | 10.0 | 11.10 | 12.30 | 1 | 17.0 | 23.5 | 5 | X |
| SMAJ11A | SMAJ11CA | AZ | WZ | 11.0 | 12.20 | 13.50 | 1 | 18.2 | 22.0 | 1 | X |
| SMAJ12A | SMAJ12CA | BE | XE | 12.0 | 13.30 | 14.70 | 1 | 19.9 | 20.1 | 1 | X |
| SMAJ13A | SMAJ13CA | BG | XG | 13.0 | 14.40 | 15.90 | 1 | 21.5 | 18.6 | 1 | X |
| SMAJ14A | SMAJ14CA | BK | XK | 14.0 | 15.60 | 17.20 | 1 | 23.2 | 17.2 | 1 | X |
| SMAJ15A | SMAJ15CA | BM | XM | 15.0 | 16.70 | 18.50 | 1 | 24.4 | 16.4 | 1 | X |
| SMAJ16A | SMAJ16CA | BP | XP | 16.0 | 17.80 | 19.70 | 1 | 26.0 | 15.4 | 1 | X |
| SMAJ17A | SMAJ17CA | BR | XR | 17.0 | 18.90 | 20.90 | 1 | 27.6 | 14.5 | 1 | X |
| SMAJ18A | SMAJ18CA | BT | XT | 18.0 | 20.00 | 22.10 | 1 | 29.2 | 13.7 | 1 | X |
| SMAJ20A | SMAJ20CA | BV | XV | 20.0 | 22.20 | 24.50 | 1 | 32.4 | 12.3 | 1 | X |
| SMAJ22A | SMAJ22CA | BX | XX | 22.0 | 24.40 | 26.90 | 1 | 35.5 | 11.3 | 1 | X |
| SMAJ24A | SMAJ24CA | BZ | XZ | 24.0 | 26.70 | 29.50 | 1 | 38.9 | 10.3 | 1 | X |
| SMAJ26A | SMAJ26CA | CE | YE | 26.0 | 28.90 | 31.90 | 1 | 42.1 | 9.5 | 1 | X |
| SMAJ28A | SMAJ28CA | CG | YG | 28.0 | 31.10 | 34.40 | 1 | 45.4 | 8.8 | 1 | X |
| SMAJ30A | SMAJ30CA | CK | YK | 30.0 | 33.30 | 36.80 | 1 | 48.4 | 8.3 | 1 | X |
| SMAJ33A | SMAJ33CA | CM | YM | 33.0 | 36.70 | 40.60 | 1 | 53.3 | 7.5 | 1 | X |
| SMAJ36A | SMAJ36CA | CP | YP | 36.0 | 40.00 | 44.20 | 1 | 58.1 | 6.9 | 1 | X |
| SMAJ40A | SMAJ40CA | CR | YR | 40.0 | 44.40 | 49.10 | 1 | 64.5 | 6.2 | 1 | X |
| SMAJ43A | SMAJ43CA | CT | YT | 43.0 | 47.80 | 52.80 | 1 | 69.4 | 5.8 | 1 | X |
| SMAJ45A | SMAJ45CA | CV | YV | 45.0 | 50.00 | 55.30 | 1 | 72.7 | 5.5 | 1 | X |
| SMAJ48A | SMAJ48CA | CX | YX | 48.0 | 53.30 | 58.90 | 1 | 77.4 | 5.2 | 1 | X |
| SMAJ51A | SMAJ51CA | CZ | YZ | 51.0 | 56.70 | 62.70 | 1 | 82.4 | 4.9 | 1 | X |
| SMAJ54A | SMAJ54CA | RE | ZE | 54.0 | 60.00 | 66.30 | 1 | 87.1 | 4.6 | 1 | X |
| SMAJ58A | SMAJ58CA | RG | ZG | 58.0 | 64.40 | 71.20 | 1 | 93.6 | 4.3 | 1 | X |
| SMAJ60A | SMAJ60CA | RK | ZK | 60.0 | 66.70 | 73.70 | 1 | 96.8 | 4.1 | 1 | X |
| SMAJ64A | SMAJ64CA | RM | ZM | 64.0 | 71.10 | 78.60 | 1 | 103.0 | 3.9 | 1 | X |
| SMAJ70A | SMAJ70CA | RP | ZP | 70.0 | 77.80 | 86.00 | 1 | 113.0 | 3.5 | 1 | X |
| SMAJ75A | SMAJ75CA | RR | ZR | 75.0 | 83.30 | 92.10 | 1 | 121.0 | 3.3 | 1 | X |
| SMAJ78A | SMAJ78CA | RT | ZT | 78.0 | 86.70 | 95.80 | 1 | 126.0 | 3.2 | 1 | X |
| SMAJ85A | SMAJ85CA | RV | ZV | 85.0 | 94.40 | 104.00 | 1 | 137.0 | 2.9 | 1 | X |
| SMAJ90A | SMAJ90CA | RX | ZX | 90.0 | 100.00 | 111.00 | 1 | 146.0 | 2.7 | 1 | X |
| SMAJ100A | SMAJ100CA | RZ | ZZ | 100.0 | 111.00 | 123.00 | 1 | 162.0 | 2.5 | 1 | X |
| SMAJ110A | SMAJ110CA | SE | VE | 110.0 | 122.00 | 135.00 | 1 | 177.0 | 2.3 | 1 | X |
| SMAJ120A | SMAJ120CA | SG | VG | 120.0 | 133.00 | 147.00 | 1 | 193.0 | 2.1 | 1 | X |
| SMAJ130A | SMAJ130CA | SK | VK | 130.0 | 144.00 | 159.00 | 1 | 209.0 | 1.9 | 1 | X |
| SMAJ150A | SMAJ150CA | SM | VM | 150.0 | 167.00 | 185.00 | 1 | 243.0 | 1.6 | 1 | X |
| SMAJ160A | SMAJ160CA | SP | VP | 160.0 | 178.00 | 197.00 | 1 | 259.0 | 1.5 | 1 | X |
| SMAJ170A | SMAJ170CA | SR | VR | 170.0 | 189.00 | 209.00 | 1 | 275.0 | 1.5 | 1 | X |
| SMAJ180A | SMAJ180CA | ST | VT | 180.0 | 201.00 | 222.00 | 1 | 292.0 | 1.4 | 1 | X |
| SMAJ188A | SMAJ188CA | SB | VB | 188.0 | 209.00 | 231.00 | 1 | 304.0 | 1.4 | 1 | X |
| SMAJ200A | SMAJ200CA | SV | VV | 200.0 | 224.00 | 247.00 | 1 | 324.0 | 1.2 | 1 | X |
| SMAJ220A | - | SX | - | 220.0 | 246.00 | 272.00 | 1 | 356.0 | 1.1 | 1 | X |
| - | SMAJ220CA* | - | VX | 220.0 | 246.00 | 272.00 | 1 | 356.0 | 1.7 | 1 | X |
| SMAJ250A | - | SZ | - | 250.0 | 279.00 | 309.00 | 1 | 405.0 | 1.0 | 1 | X |
| - | SMAJ250CA* | - | VZ | 250.0 | 279.00 | 309.00 | 1 | 405.0 | 1.5 | 1 | X |
| SMAJ300A* | SMAJ300CA* | TE | UE | 300.0 | 335.00 | 371.00 | 1 | 486.0 | 1.3 | 1 | X |
| SMAJ350A* | SMAJ350CA* | TG | UG | 350.0 | 391.00 | 432.00 | 1 | 567.0 | 1.1 | 1 | X |
| SMAJ400A* | SMAJ400CA* | TK | UK | 400.0 | 447.00 | 494.00 | 1 | 648.0 | 1.0 | 1 | X |
| SMAJ440A* | SMAJ440CA* | TM | UM | 440.0 | 492.00 | 543.00 | 1 | 713.0 | 0.9 | 1 | X |

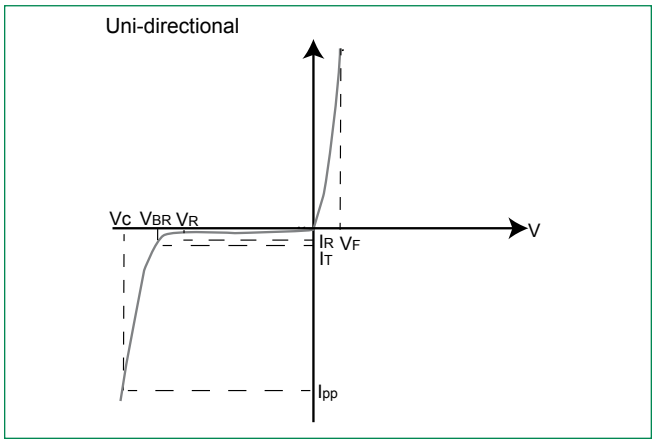
**Notes:**
For bidirectional type having $V_R$ of 10 volts and less, the $I_R$ limit is double.
For stack-die parts, use * to label the part number.

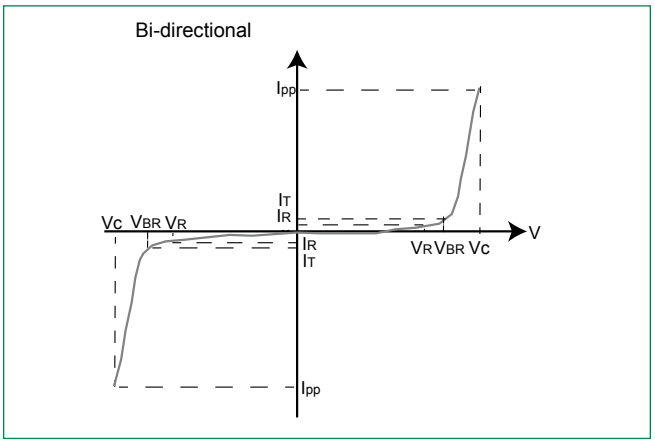


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## Surface Mount – 400W

### 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 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

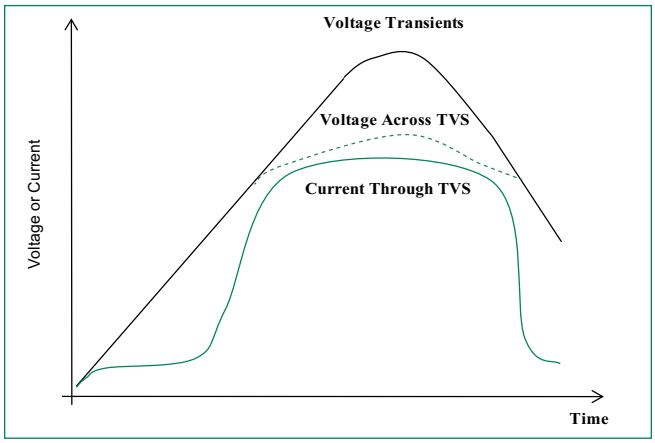
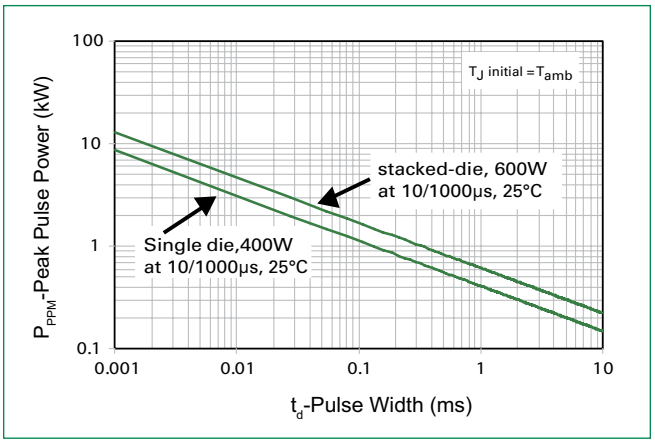



**Figure 2:**
Peak Pulse Power Rating Curve





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# SMAJ Series
## Surface Mount – 400W

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

**Figure 3:**
Peak Pulse Power Derating Curve

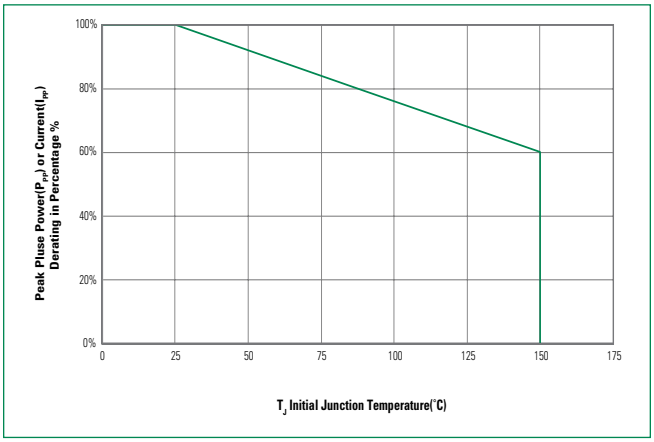



**Figure 4:**
Pulse Waveform

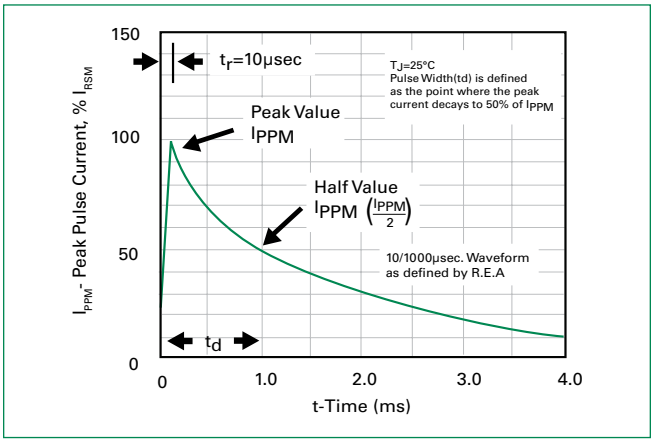



**Figure 5:**
Typical Junction Capacitance

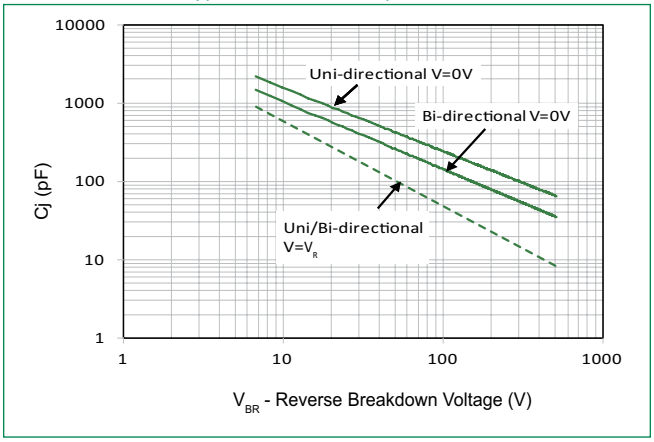



**Figure 6:**
Typical Transient Thermal Impedance

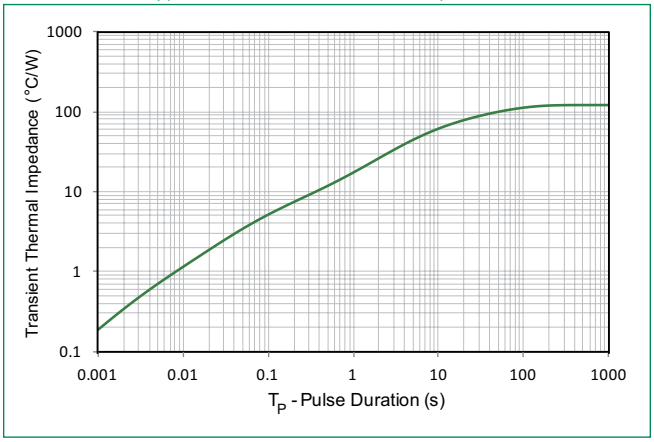



**Figure 7:**
Maximum Non-Repetitive Forward Surge Current
Uni-Directional Only

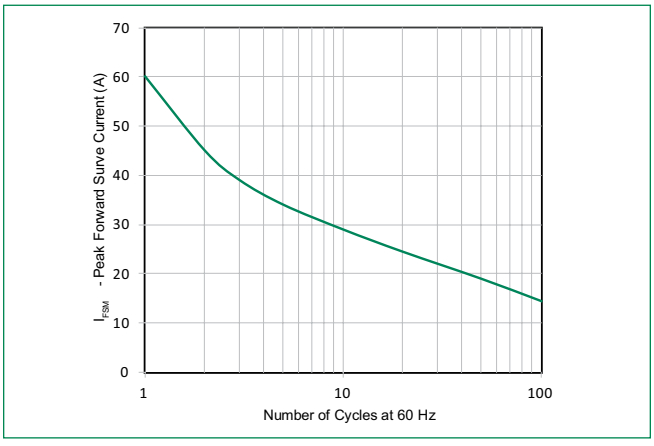
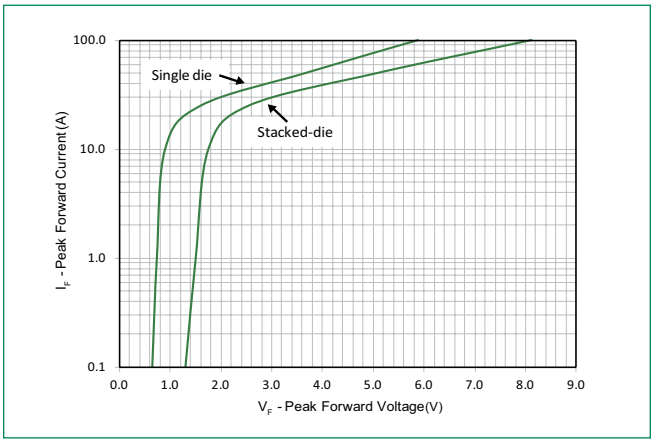



**Figure 8:**
Peak Forward Voltage Drop vs Peak Forward Current
(Typical Values)



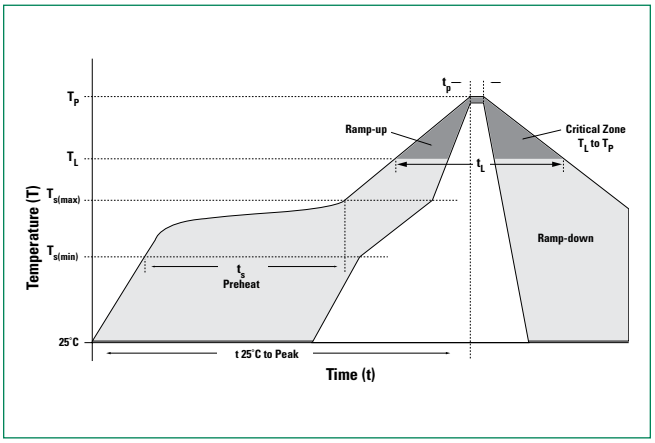


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# SMAJ Series
## Surface Mount – 400W

## 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) ($t_L$)** | 60 – 150 seconds |
| **Peak Temperature ($T_P$)** | | $260^{+0/-5}$ °C |
| **Time within 5°C of actual peak Temperature ($t_p$)** | | 30 seconds Max |
| **Ramp-down Rate** | | 6°C/second Max |
| **Time 25°C to peak Temperature ($T_P$)** | | 8 minutes Max. |
| **Do not exceed** | | 260°C |



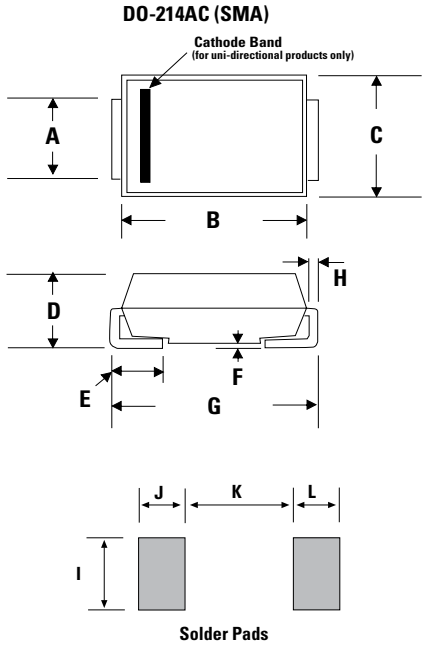

### Physical Specifications

| | |
|---|---|
| **Weight** | 0.002 ounce, 0.061 gram |
| **Case** | JEDEC DO-214AC Molded Plastic over glass passivated junction |
| **Polarity** | Color band denotes cathode except 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



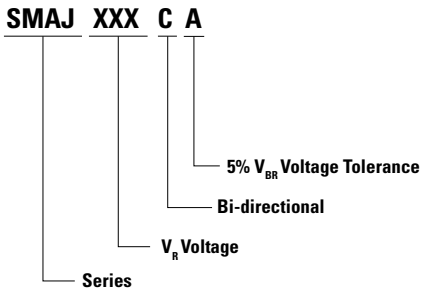

| Dimensions | Inches | | Millimeters | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| **A** | 0.049 | 0.065 | 1.250 | 1.650 |
| **B** | 0.157 | 0.181 | 3.990 | 4.600 |
| **C** | 0.095 | 0.110 | 2.400 | 2.790 |
| **D** | 0.075 | 0.090 | 1.900 | 2.290 |
| **E** | 0.030 | 0.060 | 0.780 | 1.520 |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



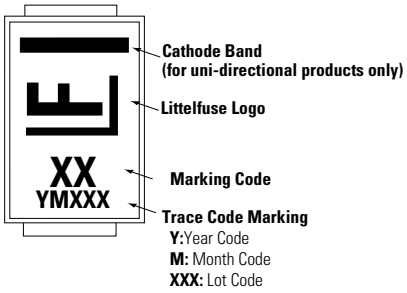
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# SMAJ Series
## Surface Mount – 400W

### Part Numbering System



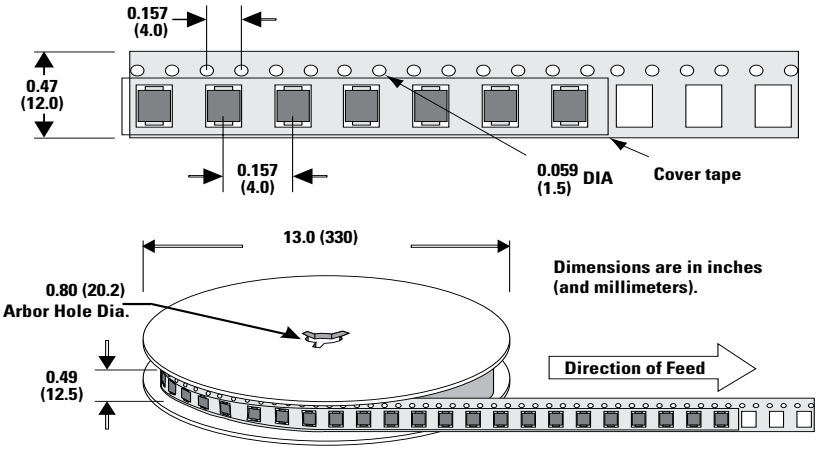

### Part Marking System

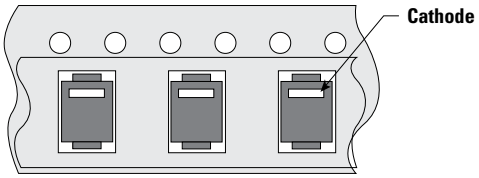



### Packaging

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

### Tape and Reel Specification




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