

# Surface Mount Transient Voltage Suppressor

## Stand-Off Voltage - 5.0 to 440 Volts

## 400 Watt Peak Pulse Power

### Features

- For surface mounted applications in order to optimize board space
- Low profile package
- Built-in strain relief
- Glass passivated junction
- Low inductance
- Excellent clamping capability
- Repetition Rate (duty cycle):0.01%
- Fast response time: typically less than 1.0ps from 0 Volts to V(BR) for unidirectional types
- Typical IR less than 1 $\mu$ A above 10V
- High Temperature soldering: 260°C/10 seconds at terminals
- Plastic package has Underwriters Laboratory Flammability 94V-O
- Pb-free plated
- AEC-Q101



### Mechanical Data

- **Case:** JEDEC DO-214AC. Molded plastic over glass passivated junction
- **Terminals:** Solderable per MIL-STD-750, Method 2026
- **Polarity:** Color band denoted positive end (cathode) except Bidirectional
- **Standard Packaging:** 12mm tape (EIA STD RS-481)

### Devices For Bipolar Application

- For Bidirectional use C or CA Suffix for types SMAJ5.0 thru types SMAJ170 (e.g. SMAJ5.0C, SMAJ170CA)
- Electrical characteristics apply in both directions

### Maximum Ratings And Characteristics

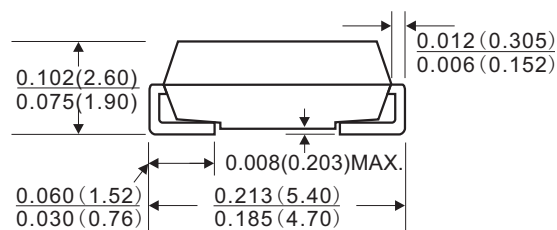
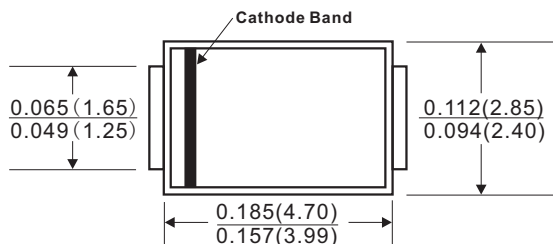
Ratings at 25°C ambient temperature unless otherwise specified.

| RATING                                                                                                        | SYMBOL                            | VALUE          | UNITS |
|---------------------------------------------------------------------------------------------------------------|-----------------------------------|----------------|-------|
| Peak Pulse Power Dissipation on 10/1000 $\mu$ s waveform (Note 1,2, FIG.1)                                    | P <sub>PPM</sub>                  | 400            | Watts |
| Peak Pulse Current of on 10/1000 $\mu$ s waveform (Note 1, FIG.3)                                             | I <sub>PPM</sub>                  | SEE<br>TABLE 1 | Amps  |
| Peak Forward Surge Current, 8.3ms Single Half Sine-Wave Superimposed on Rated Load, (JEDEC Method) (Note 2,3) | I <sub>FSM</sub>                  | 40             | Amps  |
| Operating junction and Storage Temperature Range                                                              | T <sub>J</sub> , T <sub>STG</sub> | -55 to<br>+150 | °C    |

#### Notes :

1. Non-repetitive current pulse, per Fig. 3 and derated above T<sub>A</sub> = 25°C per Fig. 2.
2. Mounted on 5.0mm x 5.0mm (0.03mm thick) Copper Pads to each terminal
3. 8.3ms single half sine-wave, or equivalent square wave, Duty cycle = 4 pulses per minutes maximum.

## Dimensions (DO-214AC)

**DO-214AC(SMA J-Bend)**


Dimensions in inches and (millimeters)

## Electrical Characteristics

**TABLE1**

\*\*Stand for commonly used models

| SMAJ Part Number |             | Device Marking Code |    | Reverse Stand-Off Voltage | Breakdown Voltage @IT | Breakdown Voltage @IT | Test Current | Maximum Clamping Voltage @Ipp | Peak Pulse Current | Reverse Leakage @VRWM |
|------------------|-------------|---------------------|----|---------------------------|-----------------------|-----------------------|--------------|-------------------------------|--------------------|-----------------------|
| UNI-Polar        | BI-Polar    | UNI                 | BI | VRWM(V)                   | VBR(V)Min.            | VBR(V)Max.            | IT(mA)       | Vc(V)                         | Ipp(A)             | IR(μA)                |
| SMAJ5.0A         | SMAJ5.0CA   | AE                  | WE | 5.0                       | 6.40                  | 7.00                  | 10           | 9.2                           | 43.5               | 500                   |
| * SMAJ6.0A       | * SMAJ6.0CA | AG                  | WG | 6.0                       | 6.67                  | 7.37                  | 10           | 10.3                          | 38.8               | 500                   |
| SMAJ6.5A         | SMAJ6.5CA   | AK                  | WK | 6.5                       | 7.22                  | 7.98                  | 10           | 11.2                          | 35.7               | 300                   |
| SMAJ7.0A         | SMAJ7.0CA   | AM                  | WM | 7.0                       | 7.78                  | 8.60                  | 10           | 12.0                          | 33.3               | 200                   |
| SMAJ7.5A         | SMAJ7.5CA   | AP                  | WP | 7.5                       | 8.33                  | 9.21                  | 1            | 12.9                          | 31.0               | 100                   |
| * SMAJ8.0A       | * SMAJ8.0CA | AR                  | WR | 8.0                       | 8.89                  | 9.83                  | 1            | 13.6                          | 29.4               | 50                    |
| SMAJ8.5A         | SMAJ8.5CA   | AT                  | WT | 8.5                       | 9.44                  | 10.40                 | 1            | 14.4                          | 27.8               | 20                    |
| SMAJ9.0A         | SMAJ9.0CA   | AV                  | WV | 9.0                       | 10.00                 | 11.10                 | 1            | 15.4                          | 26.0               | 10                    |
| SMAJ10A          | SMAJ10CA    | AX                  | WX | 10.0                      | 11.10                 | 12.30                 | 1            | 17.0                          | 23.5               | 5                     |
| SMAJ11A          | SMAJ11CA    | AZ                  | WZ | 11.0                      | 12.20                 | 13.50                 | 1            | 18.2                          | 22.0               | 1                     |
| SMAJ12A          | * SMAJ12CA  | BE                  | XE | 12.0                      | 13.30                 | 14.70                 | 1            | 19.9                          | 20.1               | 1                     |
| SMAJ13A          | SMAJ13CA    | BG                  | XG | 13.0                      | 14.40                 | 15.90                 | 1            | 21.5                          | 18.6               | 1                     |
| SMAJ14A          | SMAJ14CA    | BK                  | XK | 14.0                      | 15.60                 | 17.20                 | 1            | 23.2                          | 17.2               | 1                     |
| SMAJ15A          | * SMAJ15CA  | BM                  | XM | 15.0                      | 16.70                 | 18.50                 | 1            | 24.4                          | 16.4               | 1                     |
| SMAJ16A          | SMAJ16CA    | BP                  | XP | 16.0                      | 17.80                 | 19.70                 | 1            | 26.0                          | 15.4               | 1                     |
| SMAJ17A          | SMAJ17CA    | BR                  | XR | 17.0                      | 18.90                 | 20.90                 | 1            | 27.6                          | 14.5               | 1                     |
| SMAJ18A          | * SMAJ18CA  | BT                  | XT | 18.0                      | 20.00                 | 22.10                 | 1            | 29.2                          | 13.7               | 1                     |
| SMAJ20A          | SMAJ20CA    | BV                  | XV | 20.0                      | 22.20                 | 24.50                 | 1            | 32.4                          | 12.3               | 1                     |
| SMAJ22A          | SMAJ22CA    | BX                  | XY | 22.0                      | 24.40                 | 26.90                 | 1            | 35.5                          | 11.3               | 1                     |
| SMAJ24A          | SMAJ24CA    | BZ                  | XZ | 24.0                      | 26.70                 | 29.50                 | 1            | 38.9                          | 10.3               | 1                     |
| SMAJ26A          | SMAJ26CA    | CE                  | YE | 26.0                      | 28.90                 | 31.90                 | 1            | 42.1                          | 9.5                | 1                     |
| SMAJ28A          | SMAJ28CA    | CG                  | YG | 28.0                      | 31.10                 | 34.40                 | 1            | 45.4                          | 8.8                | 1                     |

**Notes :**

- 1.For bidirectional type having VRWM of 10 volts and less, the IR limit is double
- 2.For parts with A , the VBR is ± 5%

## Electrical Characteristics

**TABLE 1**

\*\*\*Stand for commonly used models

| SMAJ Part Number |             | Device Marking Code |    | Reverse Stand-Off Voltage | Breakdown Voltage @I <sub>T</sub> | Breakdown Voltage @I <sub>T</sub> | Test Current        | Maximum Clamping Voltage @I <sub>pp</sub> | Peak Pulse Current  | Reverse Leakage @V <sub>RWM</sub> |
|------------------|-------------|---------------------|----|---------------------------|-----------------------------------|-----------------------------------|---------------------|-------------------------------------------|---------------------|-----------------------------------|
| UNI-Polar        | BI-Polar    | UNI                 | BI | V <sub>RWM</sub> (V)      | V <sub>BR</sub> (V)Min.           | V <sub>BR</sub> (V)Max.           | I <sub>T</sub> (mA) | V <sub>C</sub> (V)                        | I <sub>pp</sub> (A) | I <sub>R</sub> (μA)               |
| SMAJ30A          | * SMAJ30CA  | CK                  | YK | 30.0                      | 33.30                             | 36.80                             | 1                   | 48.4                                      | 8.3                 | 1                                 |
| SMAJ33A          | SMAJ33CA    | CM                  | YM | 33.0                      | 36.70                             | 40.60                             | 1                   | 53.3                                      | 7.5                 | 1                                 |
| SMAJ36A          | SMAJ36CA    | CP                  | YP | 36.0                      | 40.00                             | 44.20                             | 1                   | 58.1                                      | 6.9                 | 1                                 |
| SMAJ40A          | * SMAJ40CA  | CR                  | YR | 40.0                      | 44.40                             | 49.10                             | 1                   | 64.5                                      | 6.2                 | 1                                 |
| SMAJ43A          | * SMAJ43CA  | CT                  | YT | 43.0                      | 47.80                             | 52.80                             | 1                   | 69.4                                      | 5.8                 | 1                                 |
| SMAJ45A          | SMAJ45CA    | CV                  | YV | 45.0                      | 50.00                             | 55.30                             | 1                   | 72.7                                      | 5.5                 | 1                                 |
| SMAJ48A          | SMAJ48CA    | CX                  | YX | 48.0                      | 53.30                             | 58.90                             | 1                   | 77.4                                      | 5.2                 | 1                                 |
| SMAJ51A          | SMAJ51CA    | CZ                  | YZ | 51.0                      | 56.70                             | 62.70                             | 1                   | 82.4                                      | 4.9                 | 1                                 |
| SMAJ54A          | SMAJ54CA    | RE                  | ZE | 54.0                      | 60.00                             | 66.30                             | 1                   | 87.1                                      | 4.6                 | 1                                 |
| SMAJ58A          | SMAJ58CA    | RG                  | ZG | 58.0                      | 64.40                             | 71.20                             | 1                   | 93.6                                      | 4.3                 | 1                                 |
| SMAJ60A          | SMAJ60CA    | RK                  | ZK | 60.0                      | 66.70                             | 73.70                             | 1                   | 96.8                                      | 4.1                 | 1                                 |
| SMAJ64A          | SMAJ64CA    | RM                  | ZM | 64.0                      | 71.10                             | 78.60                             | 1                   | 103.0                                     | 3.9                 | 1                                 |
| SMAJ70A          | SMAJ70CA    | RP                  | ZP | 70.0                      | 77.80                             | 86.00                             | 1                   | 113.0                                     | 3.5                 | 1                                 |
| SMAJ75A          | SMAJ75CA    | RR                  | ZR | 75.0                      | 83.30                             | 92.10                             | 1                   | 121.0                                     | 3.3                 | 1                                 |
| SMAJ78A          | SMAJ78CA    | RT                  | ZT | 78.0                      | 86.70                             | 95.80                             | 1                   | 126.0                                     | 3.2                 | 1                                 |
| SMAJ85A          | SMAJ85CA    | RV                  | ZV | 85.0                      | 94.40                             | 104.00                            | 1                   | 137.0                                     | 2.9                 | 1                                 |
| SMAJ90A          | SMAJ90CA    | RX                  | ZX | 90.0                      | 100.00                            | 111.00                            | 1                   | 146.0                                     | 2.7                 | 1                                 |
| SMAJ100A         | SMAJ100CA   | RZ                  | ZZ | 100.0                     | 111.00                            | 123.00                            | 1                   | 162.0                                     | 2.5                 | 1                                 |
| SMAJ110A         | SMAJ110CA   | SE                  | VE | 110.0                     | 122.00                            | 135.00                            | 1                   | 177.0                                     | 2.3                 | 1                                 |
| SMAJ120A         | SMAJ120CA   | SG                  | VG | 120.0                     | 133.00                            | 147.00                            | 1                   | 193.0                                     | 2.1                 | 1                                 |
| SMAJ130A         | SMAJ130CA   | SK                  | VK | 130.0                     | 144.00                            | 159.00                            | 1                   | 209.0                                     | 1.9                 | 1                                 |
| SMAJ150A         | SMAJ150CA   | SM                  | VM | 150.0                     | 167.00                            | 185.00                            | 1                   | 243.0                                     | 1.6                 | 1                                 |
| SMAJ160A         | SMAJ160CA   | SP                  | VP | 160.0                     | 178.00                            | 197.00                            | 1                   | 259.0                                     | 1.5                 | 1                                 |
| SMAJ170A         | SMAJ170CA   | SR                  | VR | 170.0                     | 189.00                            | 209.00                            | 1                   | 275.0                                     | 1.5                 | 1                                 |
| SMAJ180A         | SMAJ180CA   | ST                  | VT | 180.0                     | 201.00                            | 222.00                            | 1                   | 292.0                                     | 1.4                 | 1                                 |
| SMAJ200A         | SMAJ200CA   | SV                  | VV | 200.0                     | 224.00                            | 247.00                            | 1                   | 324.0                                     | 1.2                 | 1                                 |
| SMAJ220A         | SMAJ220CA   | SX                  | VX | 220.0                     | 246.00                            | 272.00                            | 1                   | 356.0                                     | 1.1                 | 1                                 |
| SMAJ250A         | SMAJ250CA   | SZ                  | VZ | 250.0                     | 279.00                            | 309.00                            | 1                   | 405.0                                     | 1.0                 | 1                                 |
| SMAJ300A         | SMAJ300CA   | TE                  | UE | 300.0                     | 335.00                            | 371.00                            | 1                   | 486.0                                     | 0.8                 | 1                                 |
| SMAJ350A         | SMAJ350CA   | TG                  | UG | 350.0                     | 391.00                            | 432.00                            | 1                   | 567.0                                     | 0.7                 | 1                                 |
| SMAJ400A         | * SMAJ400CA | TK                  | UK | 400.0                     | 447.00                            | 494.00                            | 1                   | 648.0                                     | 0.6                 | 1                                 |
| SMAJ440A         | * SMAJ440CA | TM                  | UM | 440.0                     | 492.00                            | 543.00                            | 1                   | 713.0                                     | 0.6                 | 1                                 |

### Notes :

1. For bidirectional type having V<sub>RWM</sub> of 10 volts and less, the I<sub>R</sub> limit is double
2. For parts with A, the V<sub>BR</sub> is ± 5%

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

Fig.1 Peak Pulse Power Rating

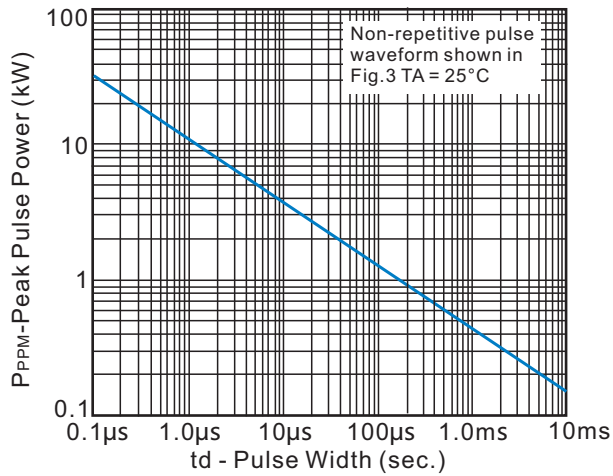


Fig.2 Pulse Derating Curve

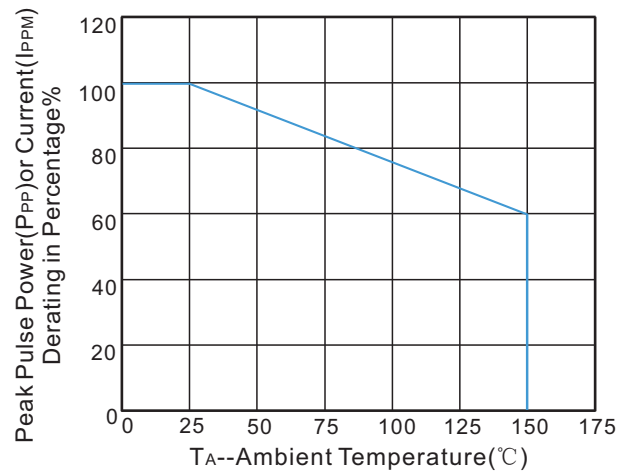


Fig.3 Pulse Waveform

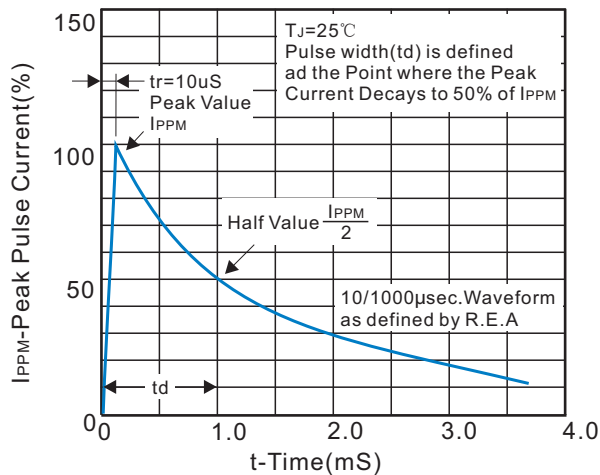


Fig.4 Typical Junction Capacitance

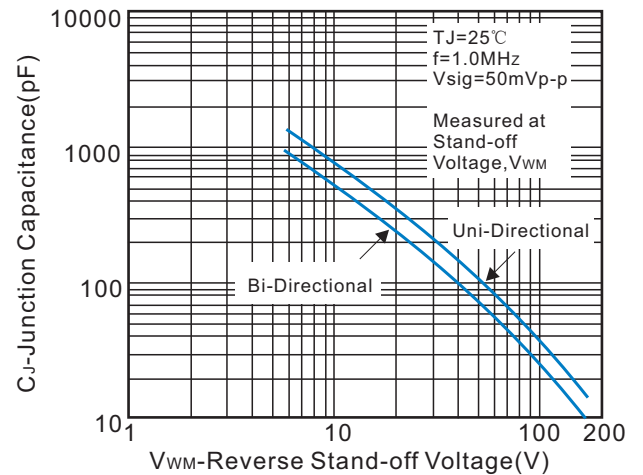


Fig.5 Typ. Transient Thermal Impedance

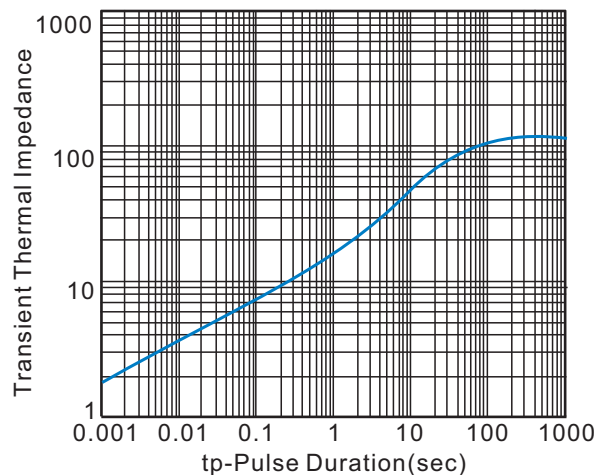
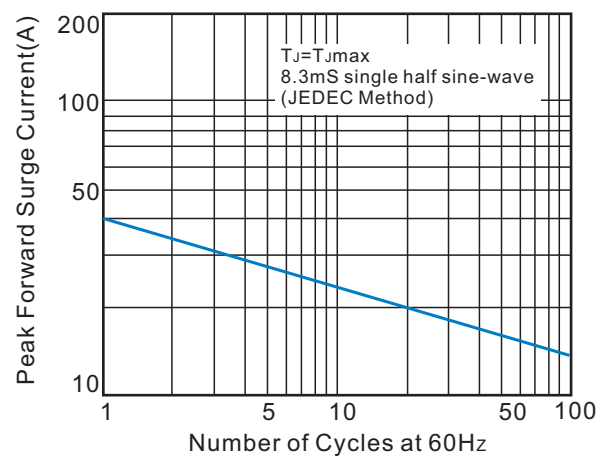


Fig.6 Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only

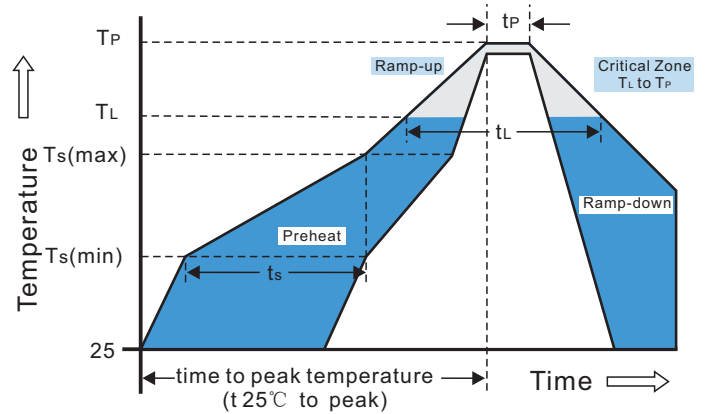


## Recommended Soldering Conditions

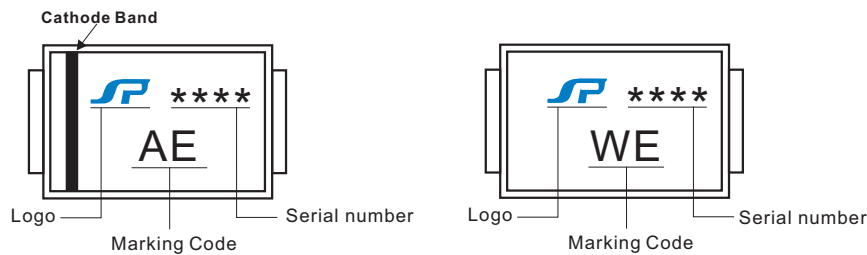
### Recommended Conditions

| Reflow Condition                                         |                                  | Pb-Free assembly<br>(see Fig.1) |
|----------------------------------------------------------|----------------------------------|---------------------------------|
| Pre Heat                                                 | -Temperature Min( $T_{s(min)}$ ) | +150°C                          |
|                                                          | -Temperature Max( $T_{s(max)}$ ) | +200°C                          |
|                                                          | -Time(Min to Max)( $t_s$ )       | 60-180secs                      |
| Average ramp up rate<br>(Liquidus Temp( $T_L$ ) to peak) |                                  | 3°C/sec.Max.                    |
| $T_{s(max)}$ to $T_L$ -Ramp-up Rate                      |                                  | 3°C/sec.Max.                    |
| Reflow                                                   | -Temperature( $T_L$ )(Liquidus)  | +217°C                          |
|                                                          | -Temperature( $t_L$ )            | 60-150secs                      |
| Peak Temp( $T_P$ )                                       |                                  | +260(+0/-5)°C                   |
| Time within 5°C of actual Peak Temp( $t_P$ )             |                                  | 30 secs.Max.                    |
| Ramp-down Rate                                           |                                  | 6°C/sec.Max.                    |
| Time 25°C to Peak Temp( $T_P$ )                          |                                  | 8 min.Max.                      |
| Do not exceed                                            |                                  | +260°C                          |

### Reflow Soldering



## Marking Code



## Tape And Reel Specification

| Symbol  | Ea Per Reel | REEL DIA<br>(mm) | Industry Standard |
|---------|-------------|------------------|-------------------|
| SMAJ*** | 1000/5000   | 178/330          | EIA RS-481        |

