



## SMAJ Series 400W Transient Voltage Suppressor

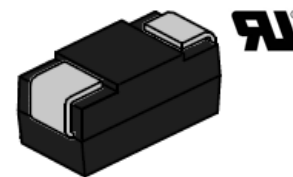
Rev.4.3

### DESCRIPTION:

TVS diodes can be used in a wide range of applications which like consumer electronic products, automotive industries, munitions, telecommunications, aerospace industries, and intelligent control systems.

### FEATURES:

- ✧ Low profile package.
- ✧ Low inductance.
- ✧ Excellent clamping capability.
- ✧ 400W peak pulse power capability at 10/1000μs waveform.
- ✧ Typical  $I_R$  less than 1μA above 10V.
- ✧ Fast response time: typically less than 1.0ps from 0V to  $V_{BR}$  min.
- ✧ High temperature to reflow soldering: 260°C/40s at terminals.
- ✧ Plastic package has underwriters laboratory flammability 94V-0.
- ✧ Meets MSL level 1, per J-STD-020, LF maximum peak of 260°C.
- ✧ Terminal: solder plated, solderable per J-STD-002.
- ✧ For surface mounted applications in order to optimize board space.
- ✧ UL 497B item recognized. (File No.:E480698).



SMA



Bi-directional



Uni-directional

Symbol

### ABSOLUTE MAXIMUM RATINGS ( $T_A=25^\circ\text{C}$ , RH=45%-75%, unless otherwise noted)

| Parameter                                                       | Symbol          | Value       | Unit               |
|-----------------------------------------------------------------|-----------------|-------------|--------------------|
| Operating junction and storage temperature range                | $T_J/T_{STG}$   | -55 to +150 | $^\circ\text{C}$   |
| Peak pulse power dissipation at 10/1000μs waveform              | $P_{PP}$        | 400         | W                  |
| Steady state power dissipation at $T_L=75^\circ\text{C}$        | $P_{M(AV)}$     | 3.3         | W                  |
| Maximum instantaneous forward voltage at 25A for unidirectional | $V_F$           | 5.0         | V                  |
| Peak forward surge current, 8.3ms single half sine wave(Note 1) | $I_{FSM}$       | 60          | A                  |
| Typical thermal resistance junction to lead                     | $R_{\theta JL}$ | 30          | $^\circ\text{C/W}$ |
| Typical thermal resistance junction to ambient                  | $R_{\theta JA}$ | 120         | $^\circ\text{C/W}$ |

### Notes:

1. Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional device only, duty cycle=4 per minute maximum

## MARKING



TE: Device Marking Code  
2009: In ninth week, 2020

ELECTRICAL CHARACTERISTICS ( $T_A=25^{\circ}\text{C}$ )

| Part Number |           | Marking |    | $V_R$ | $I_R@V_R$     | $V_{BR}@I_T$ |        | $I_T$ | $V_C@I_{PP}$ | $I_{PP}^{①}$ |
|-------------|-----------|---------|----|-------|---------------|--------------|--------|-------|--------------|--------------|
| Uni-Polar   | Bi-Polar  | Uni     | Bi | V     | $\mu\text{A}$ | min(V)       | max(V) | mA    | max(V)       | A            |
| SMAJ5.0A    | SMAJ5.0CA | HE      | TE | 5.0   | 120           | 6.40         | 7.00   | 10    | 9.2          | 43.5         |
| SMAJ6.0A    | SMAJ6.0CA | HG      | TG | 6.0   | 120           | 6.67         | 7.37   | 10    | 10.3         | 38.8         |
| SMAJ6.5A    | SMAJ6.5CA | HK      | TK | 6.5   | 80            | 7.22         | 7.98   | 10    | 11.2         | 35.7         |
| SMAJ7.0A    | SMAJ7.0CA | HM      | TM | 7.0   | 50            | 7.78         | 8.60   | 10    | 12.0         | 33.3         |
| SMAJ7.5A    | SMAJ7.5CA | HP      | TP | 7.5   | 50            | 8.33         | 9.21   | 1     | 12.9         | 31.0         |
| SMAJ8.0A    | SMAJ8.0CA | HR      | TR | 8.0   | 20            | 8.89         | 9.83   | 1     | 13.6         | 29.4         |
| SMAJ8.5A    | SMAJ8.5CA | HT      | TT | 8.5   | 10            | 9.44         | 10.40  | 1     | 14.4         | 27.8         |
| SMAJ9.0A    | SMAJ9.0CA | HV      | TV | 9.0   | 5             | 10.00        | 11.10  | 1     | 15.4         | 26.0         |
| SMAJ10A     | SMAJ10CA  | HX      | TX | 10.0  | 2             | 11.10        | 12.30  | 1     | 17.0         | 23.5         |
| SMAJ11A     | SMAJ11CA  | HZ      | TZ | 11.0  | 1             | 12.20        | 13.50  | 1     | 18.2         | 22.0         |
| SMAJ12A     | SMAJ12CA  | IE      | UE | 12.0  | 1             | 13.30        | 14.70  | 1     | 19.9         | 20.1         |
| SMAJ13A     | SMAJ13CA  | IG      | UG | 13.0  | 1             | 14.40        | 15.90  | 1     | 21.5         | 18.6         |
| SMAJ14A     | SMAJ14CA  | IK      | UK | 14.0  | 1             | 15.60        | 17.20  | 1     | 23.2         | 17.3         |
| SMAJ15A     | SMAJ15CA  | IM      | UM | 15.0  | 1             | 16.70        | 18.50  | 1     | 24.4         | 16.4         |
| SMAJ16A     | SMAJ16CA  | IP      | UP | 16.0  | 1             | 17.80        | 19.70  | 1     | 26.0         | 15.4         |
| SMAJ17A     | SMAJ17CA  | IR      | UR | 17.0  | 1             | 18.90        | 20.90  | 1     | 27.6         | 14.5         |
| SMAJ18A     | SMAJ18CA  | IT      | UT | 18.0  | 1             | 20.00        | 22.10  | 1     | 29.2         | 13.7         |
| SMAJ20A     | SMAJ20CA  | IV      | UV | 20.0  | 1             | 22.20        | 24.50  | 1     | 32.4         | 12.4         |
| SMAJ22A     | SMAJ22CA  | IX      | UX | 22.0  | 1             | 24.40        | 26.90  | 1     | 35.5         | 11.3         |
| SMAJ24A     | SMAJ24CA  | IZ      | UZ | 24.0  | 1             | 26.70        | 29.50  | 1     | 38.9         | 10.3         |
| SMAJ26A     | SMAJ26CA  | JE      | VE | 26.0  | 1             | 28.90        | 31.90  | 1     | 42.1         | 9.5          |
| SMAJ28A     | SMAJ28CA  | JG      | VG | 28.0  | 1             | 31.10        | 34.40  | 1     | 45.4         | 8.8          |
| SMAJ30A     | SMAJ30CA  | JK      | VK | 30.0  | 1             | 33.30        | 36.80  | 1     | 48.4         | 8.3          |

**ELECTRICAL CHARACTERISTICS** ( $T_A=25^{\circ}\text{C}$ , continued)

| Part Number |           | Marking |    | $V_R$ | $I_R@V_R$     | $V_{BR}@I_T$ |        | $I_T$ | $V_C@I_{PP}$ | $I_{PP}^{①}$ |
|-------------|-----------|---------|----|-------|---------------|--------------|--------|-------|--------------|--------------|
| Uni-polar   | Bi-polar  | Uni     | Bi | V     | $\mu\text{A}$ | min(V)       | max(V) | mA    | V            | A            |
| SMAJ33A     | SMAJ33CA  | JM      | VM | 33.0  | 1             | 36.70        | 40.60  | 1     | 53.3         | 7.5          |
| SMAJ36A     | SMAJ36CA  | JP      | VP | 36.0  | 1             | 40.00        | 44.20  | 1     | 58.1         | 6.9          |
| SMAJ40A     | SMAJ40CA  | JR      | VR | 40.0  | 1             | 44.40        | 49.10  | 1     | 64.5         | 6.2          |
| SMAJ43A     | SMAJ43CA  | JT      | VT | 43.0  | 1             | 47.80        | 52.80  | 1     | 69.4         | 5.8          |
| SMAJ45A     | SMAJ45CA  | JV      | VV | 45.0  | 1             | 50.00        | 55.30  | 1     | 72.7         | 5.5          |
| SMAJ48A     | SMAJ48CA  | JX      | VX | 48.0  | 1             | 53.30        | 58.90  | 1     | 77.4         | 5.2          |
| SMAJ51A     | SMAJ51CA  | JZ      | VZ | 51.0  | 1             | 56.70        | 62.70  | 1     | 82.4         | 4.9          |
| SMAJ54A     | SMAJ54CA  | RE      | WE | 54.0  | 1             | 60.00        | 66.30  | 1     | 87.1         | 4.6          |
| SMAJ58A     | SMAJ58CA  | RG      | WG | 58.0  | 1             | 64.40        | 71.20  | 1     | 93.6         | 4.3          |
| SMAJ60A     | SMAJ60CA  | RK      | WK | 60.0  | 1             | 66.70        | 73.70  | 1     | 96.8         | 4.1          |
| SMAJ64A     | SMAJ64CA  | RM      | WM | 64.0  | 1             | 71.10        | 78.60  | 1     | 103.0        | 3.9          |
| SMAJ70A     | SMAJ70CA  | RP      | WP | 70.0  | 1             | 77.80        | 86.00  | 1     | 113.0        | 3.6          |
| SMAJ75A     | SMAJ75CA  | RR      | WR | 75.0  | 1             | 83.30        | 92.10  | 1     | 121.0        | 3.3          |
| SMAJ78A     | SMAJ78CA  | RT      | WT | 78.0  | 1             | 86.70        | 95.80  | 1     | 126.0        | 3.2          |
| SMAJ85A     | SMAJ85CA  | RV      | WV | 85.0  | 1             | 94.40        | 104.0  | 1     | 137.0        | 2.9          |
| SMAJ90A     | SMAJ90CA  | RX      | WX | 90.0  | 1             | 100.0        | 111.0  | 1     | 146.0        | 2.8          |
| SMAJ100A    | SMAJ100CA | RZ      | WZ | 100.0 | 1             | 111.0        | 123.0  | 1     | 162.0        | 2.5          |
| SMAJ110A    | SMAJ110CA | SE      | XE | 110.0 | 1             | 122.0        | 135.0  | 1     | 177.0        | 2.3          |
| SMAJ120A    | SMAJ120CA | SG      | XG | 120.0 | 1             | 133.0        | 147.0  | 1     | 193.0        | 2.1          |
| SMAJ130A    | SMAJ130CA | SK      | XK | 130.0 | 1             | 144.0        | 159.0  | 1     | 209.0        | 1.9          |
| SMAJ150A    | SMAJ150CA | SM      | XM | 150.0 | 1             | 167.0        | 185.0  | 1     | 243.0        | 1.7          |
| SMAJ160A    | SMAJ160CA | SP      | XP | 160.0 | 1             | 178.0        | 197.0  | 1     | 259.0        | 1.6          |
| SMAJ170A    | SMAJ170CA | SR      | XR | 170.0 | 1             | 189.0        | 209.0  | 1     | 275.0        | 1.5          |
| SMAJ180A    | SMAJ180CA | ST      | XT | 180.0 | 1             | 201.0        | 222.0  | 1     | 292.0        | 1.4          |
| SMAJ200A    | SMAJ200CA | SX      | XX | 200.0 | 1             | 224.0        | 247.0  | 1     | 324.0        | 1.3          |
| SMAJ220A    | SMAJ220CA | ZE      | YE | 220.0 | 1             | 246.0        | 272.0  | 1     | 356.0        | 1.1          |
| SMAJ250A    | SMAJ250CA | ZG      | YG | 250.0 | 1             | 279.0        | 309.0  | 1     | 405.0        | 1.0          |

**ELECTRICAL CHARACTERISTICS** ( $T_A=25^{\circ}\text{C}$ , continued)

| Part Number |           | Marking |    | $V_R$ | $I_R@V_R$     | $V_{BR}@I_T$ |        | $I_T$ | $V_C@I_{PP}$ | $I_{PP}^{①}$ |
|-------------|-----------|---------|----|-------|---------------|--------------|--------|-------|--------------|--------------|
| Uni-polar   | Bi-polar  | Uni     | Bi | V     | $\mu\text{A}$ | min(V)       | max(V) | mA    | V            | A            |
| SMAJ300A    | SMAJ300CA | ZK      | YK | 300.0 | 1             | 335.0        | 371.0  | 1     | 486.0        | 0.8          |
| SMAJ350A    | SMAJ350CA | ZM      | YM | 350.0 | 1             | 391.0        | 432.0  | 1     | 567.0        | 0.7          |
| SMAJ400A    | SMAJ400CA | ZP      | YP | 400.0 | 1             | 447.0        | 494.0  | 1     | 648.0        | 0.6          |
| SMAJ440A    | SMAJ440CA | ZR      | YR | 440.0 | 1             | 492.0        | 543.0  | 1     | 713.0        | 0.6          |

① Surge waveform: 10/1000 $\mu\text{s}$

$V_R$ : Stand-off voltage -- Maximum voltage that can be applied

$V_{BR}$ : Breakdown voltage

$V_C$ : Clamping voltage -- Peak voltage measured across the suppressor at a specified  $I_{PP}$

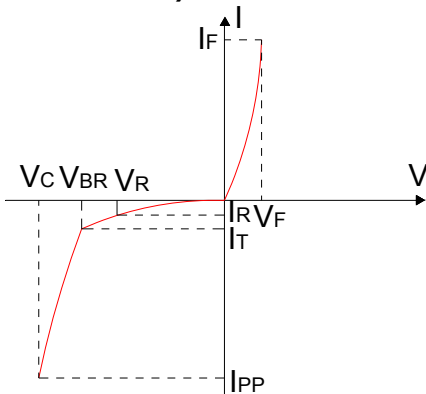
$I_R$ : Reverse leakage current

**ORDERING INFORMATION**

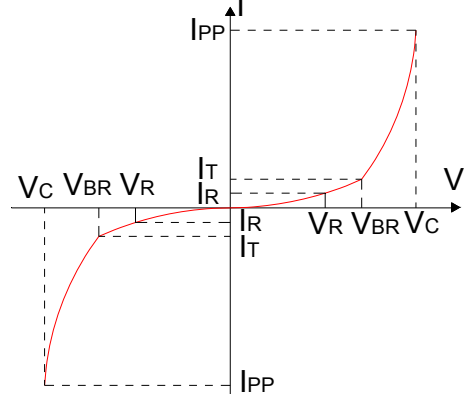
|                 |               |                  |                               |
|-----------------|---------------|------------------|-------------------------------|
| <b>SMAJ</b>     | <b>xx</b>     | <b>C</b>         | <b>A</b>                      |
| 400W SMA Series | $V_R$ Voltage | C:Bi-directional | 5% $V_{BR}$ voltage tolerance |

**RATINGS AND V-I CHARACTERISTICS CURVES** ( $T_A=25^{\circ}\text{C}$ , unless otherwise noted)

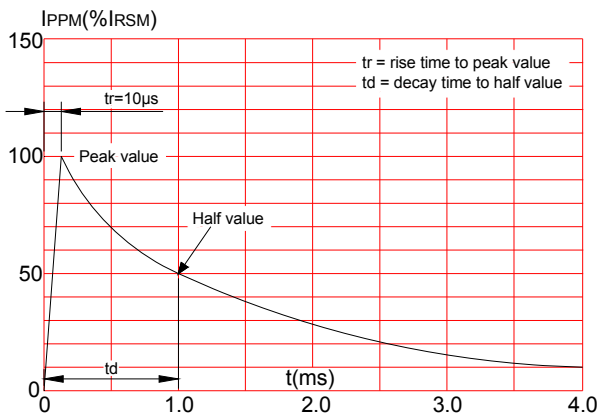
**FIG.1:V- I curve characteristics (Uni-directional)**



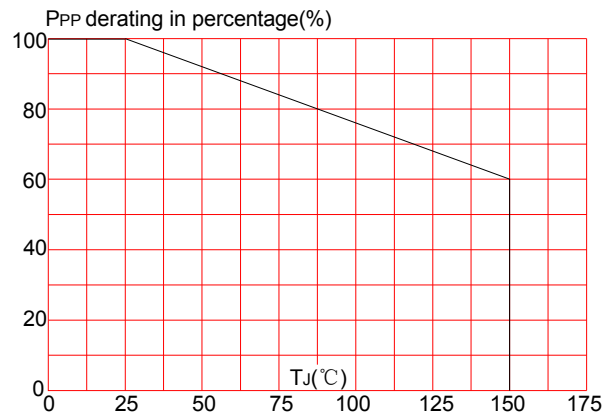
**FIG.2:V- I curve characteristics (Bi-directional)**



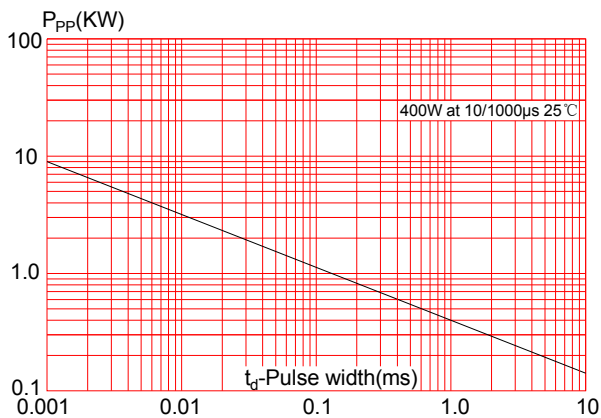
**FIG.3: Pulse waveform**



**FIG.4: Pulse derating curve**

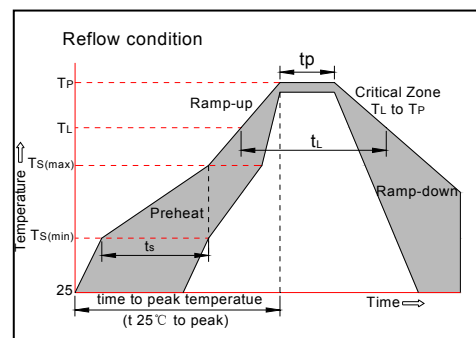


**FIG.5: Peak pulse power dissipation vs. pulse width**

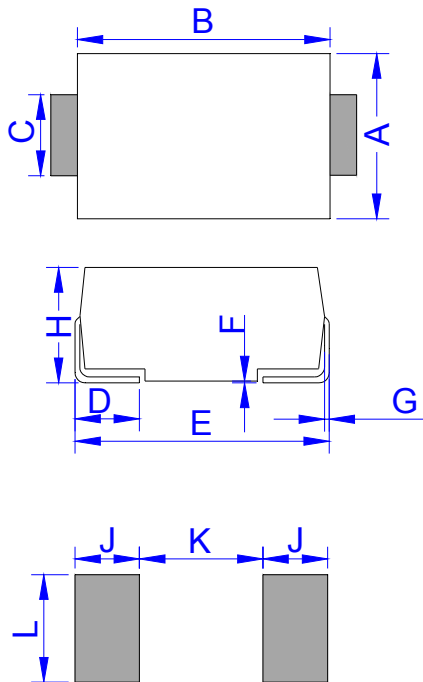


## SOLDERING PARAMETERS

| Reflow Condition                                        |                                   | Pb-Free assembly<br>(see figure at right) |
|---------------------------------------------------------|-----------------------------------|-------------------------------------------|
| Pre Heat                                                | -Temperature Min ( $T_{s(min)}$ ) | +150 $^{\circ}C$                          |
|                                                         | -Temperature Max( $T_{s(max)}$ )  | +200 $^{\circ}C$                          |
|                                                         | -Time (Min to Max) ( $t_s$ )      | 60-180 secs.                              |
| Average ramp up rate (Liquidus Temp ( $T_L$ )to peak)   |                                   | 3 $^{\circ}C/sec.$ Max                    |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                    |                                   | 3 $^{\circ}C/sec.$ Max                    |
| Reflow                                                  | -Temperature( $T_L$ )(Liquidus)   | +217 $^{\circ}C$                          |
|                                                         | -Temperature( $t_L$ )             | 60-150 secs.                              |
| Peak Temp ( $T_p$ )                                     |                                   | +260(+0/-5) $^{\circ}C$                   |
| Time within 5 $^{\circ}C$ of actual Peak Temp ( $t_p$ ) |                                   | 20-40secs.                                |
| Ramp-down Rate                                          |                                   | 6 $^{\circ}C/sec.$ Max                    |
| Time 25 $^{\circ}C$ to Peak Temp ( $T_p$ )              |                                   | 8 min. Max                                |
| Do not exceed                                           |                                   | +260 $^{\circ}C$                          |



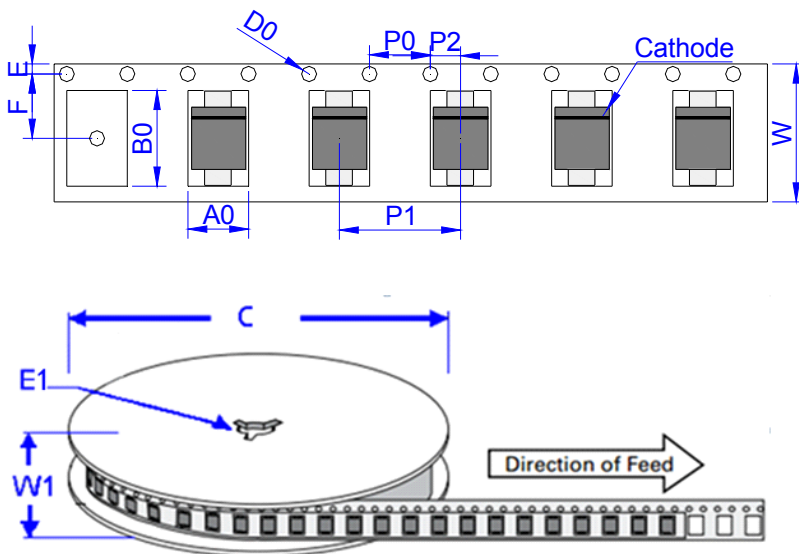
## PACKAGE MECHANICAL DATA



DO-214AC (SMA)

| Ref. | Dimensions  |       |        |       |
|------|-------------|-------|--------|-------|
|      | Millimeters |       | Inches |       |
|      | Min.        | Max.  | Min.   | Max.  |
| A    | 2.60        | 3.00  | 0.102  | 0.118 |
| B    | 4.15        | 4.65  | 0.163  | 0.183 |
| C    | 1.25        | 1.65  | 0.049  | 0.065 |
| D    | 0.95        | 1.52  | 0.037  | 0.060 |
| E    | 4.90        | 5.30  | 0.193  | 0.209 |
| F    | 0.051       | 0.203 | 0.002  | 0.008 |
| G    | 0.15        | 0.31  | 0.006  | 0.012 |
| H    | 2.00        | 2.44  | 0.079  | 0.096 |
| J    | 2.00        |       | 0.079  |       |
| K    |             | 2.30  |        | 0.091 |
| L    | 1.80        |       | 0.071  |       |

## TAPE AND REEL SPECIFICATION-SMA



| Ref. | Dimensions  |               |
|------|-------------|---------------|
|      | Millimeters | Inches        |
| A0   | 2.79 ± 0.3  | 0.110 ± 0.012 |
| B0   | 5.33 ± 0.3  | 0.210 ± 0.012 |
| C    | 330.0       | 13.0          |
| D0   | 1.55 ± 0.1  | 0.061 ± 0.004 |
| E    | 1.75 ± 0.2  | 0.069 ± 0.008 |
| E1   | 13.3 ± 0.3  | 0.524 ± 0.012 |
| F    | 5.5 ± 0.2   | 0.217 ± 0.008 |
| P0   | 4.00 ± 0.2  | 0.157 ± 0.008 |
| P1   | 4.00 ± 0.2  | 0.157 ± 0.008 |
| P2   | 2.00 ± 0.2  | 0.079 ± 0.008 |
| W    | 12.0 ± 0.2  | 0.472 ± 0.008 |
| W1   | 15.7 ± 2.0  | 0.618 ± 0.079 |

| PART No.   | UNIT WEIGHT<br>(g/PCS) typ. | REEL<br>(PCS) | PER CARTON<br>(PCS) | DESCRIPTION       |
|------------|-----------------------------|---------------|---------------------|-------------------|
| SMAJxxA/CA | 0.067                       | 5,000         | 80,000              | 13 inch reel pack |

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