

## DESCRIPTION:

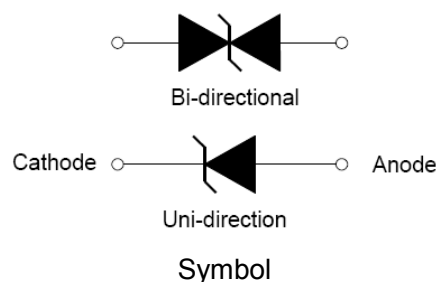
TVS diodes can be used in a wide range of applications which like consumer electronic products, automotive industries, munitions, telecommunications, aerospace industries, and intelligent control systems.

## FEATURES:

- ✧ Glass passivated or planar junction
- ✧ Excellent clamping capability
- ✧ Repetition rate (duty cycle): 0.01%
- ✧ Typical  $I_R$  less than  $1\mu A$  above 10V.
- ✧ Low profile package and low inductance
- ✧ 400W Peak Pulse power capability at  $10 \times 1000\mu s$  waveform.
- ✧ Fast response time: typically less than 1.0ps from 0V to  $V_{BR}$  min.
- ✧ High temperature soldering:  $260^\circ C/10s$  at terminals.
- ✧ Plastic package has Underwriters Laboratory Flammability 94V-0.
- ✧ For surface mounted applications in order to optimize board space
- ✧ AEC-Q101 qualified.



SMA



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

| Parameter                                                       | Symbol      | Value       | Unit       |
|-----------------------------------------------------------------|-------------|-------------|------------|
| Storage temperature range                                       | $T_{stg}$   | -55 to +125 | $^\circ C$ |
| Operating junction temperature range                            | $T_j$       | -55 to +125 | $^\circ C$ |
| Steady state power dissipation at $T_L=75^\circ C$              | $P_{M(AV)}$ | 3.3         | W          |
| Peak pulse power dissipation on 10/1000 $\mu s$ waveform        | $P_{PP}$    | 400         | W          |
| Maximum Instantaneous Forward Voltage at 30A for Unidirectional | $V_F$       | 5.0         | V          |

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub>=25°C)

| Part Number |             | V <sub>R</sub> | I <sub>R</sub> @<br>V <sub>R</sub> | V <sub>BR</sub> @I <sub>T</sub> |        | I <sub>T</sub> | V <sub>C</sub> @I <sub>PP</sub> | I <sub>PP</sub> <sup>①</sup> |
|-------------|-------------|----------------|------------------------------------|---------------------------------|--------|----------------|---------------------------------|------------------------------|
| Uni-Polar   | Bi-Polar    | V              | μA                                 | min(V)                          | max(V) | mA             | max(V)                          | A                            |
| S-SMAJ5.0A  | S-SMAJ5.0CA | 5.0            | 100                                | 6.40                            | 7.00   | 10             | 9.2                             | 43.5                         |
| S-SMAJ6.0A  | S-SMAJ6.0CA | 6.0            | 100                                | 6.67                            | 7.37   | 10             | 10.3                            | 38.8                         |
| S-SMAJ6.5A  | S-SMAJ6.5CA | 6.5            | 50                                 | 7.22                            | 7.98   | 10             | 11.2                            | 35.7                         |
| S-SMAJ7.0A  | S-SMAJ7.0CA | 7.0            | 50                                 | 7.78                            | 8.60   | 10             | 12.0                            | 33.3                         |
| S-SMAJ7.5A  | S-SMAJ7.5CA | 7.5            | 50                                 | 8.33                            | 9.21   | 1              | 12.9                            | 31.0                         |
| S-SMAJ8.0A  | S-SMAJ8.0CA | 8.0            | 20                                 | 8.89                            | 9.83   | 1              | 13.6                            | 29.4                         |
| S-SMAJ8.5A  | S-SMAJ8.5CA | 8.5            | 10                                 | 9.44                            | 10.40  | 1              | 14.4                            | 27.8                         |
| S-SMAJ9.0A  | S-SMAJ9.0CA | 9.0            | 5                                  | 10.00                           | 11.10  | 1              | 15.4                            | 26.0                         |
| S-SMAJ10A   | S-SMAJ10CA  | 10.0           | 2                                  | 11.10                           | 12.30  | 1              | 17.0                            | 23.5                         |
| S-SMAJ11A   | S-SMAJ11CA  | 11.0           | 1                                  | 12.20                           | 13.50  | 1              | 18.2                            | 22.0                         |
| S-SMAJ12A   | S-SMAJ12CA  | 12.0           | 1                                  | 13.30                           | 14.70  | 1              | 19.9                            | 20.1                         |
| S-SMAJ13A   | S-SMAJ13CA  | 13.0           | 1                                  | 14.40                           | 15.90  | 1              | 21.5                            | 18.6                         |
| S-SMAJ14A   | S-SMAJ14CA  | 14.0           | 1                                  | 15.60                           | 17.20  | 1              | 23.2                            | 17.3                         |
| S-SMAJ15A   | S-SMAJ15CA  | 15.0           | 1                                  | 16.70                           | 18.50  | 1              | 24.4                            | 16.4                         |
| S-SMAJ16A   | S-SMAJ16CA  | 16.0           | 1                                  | 17.80                           | 19.70  | 1              | 26.0                            | 15.4                         |
| S-SMAJ17A   | S-SMAJ17CA  | 17.0           | 1                                  | 18.90                           | 20.90  | 1              | 27.6                            | 14.5                         |
| S-SMAJ18A   | S-SMAJ18CA  | 18.0           | 1                                  | 20.00                           | 22.10  | 1              | 29.2                            | 13.7                         |
| S-SMAJ20A   | S-SMAJ20CA  | 20.0           | 1                                  | 22.20                           | 24.50  | 1              | 32.4                            | 12.4                         |
| S-SMAJ22A   | S-SMAJ22CA  | 22.0           | 1                                  | 24.40                           | 26.90  | 1              | 35.5                            | 11.3                         |
| S-SMAJ24A   | S-SMAJ24CA  | 24.0           | 1                                  | 26.70                           | 29.50  | 1              | 38.9                            | 10.3                         |
| S-SMAJ26A   | S-SMAJ26CA  | 26.0           | 1                                  | 28.90                           | 31.90  | 1              | 42.1                            | 9.5                          |
| S-SMAJ28A   | S-SMAJ28CA  | 28.0           | 1                                  | 31.10                           | 34.40  | 1              | 45.4                            | 8.8                          |
| S-SMAJ30A   | S-SMAJ30CA  | 30.0           | 1                                  | 33.30                           | 36.80  | 1              | 48.4                            | 8.3                          |
| S-SMAJ33A   | S-SMAJ33CA  | 33.0           | 1                                  | 36.70                           | 40.60  | 1              | 53.3                            | 7.5                          |
| S-SMAJ36A   | S-SMAJ36CA  | 36.0           | 1                                  | 40.00                           | 44.20  | 1              | 58.1                            | 6.9                          |
| S-SMAJ40A   | S-SMAJ40CA  | 40.0           | 1                                  | 44.40                           | 49.10  | 1              | 64.5                            | 6.2                          |
| S-SMAJ43A   | S-SMAJ43CA  | 43.0           | 1                                  | 47.80                           | 52.80  | 1              | 69.4                            | 5.8                          |
| S-SMAJ45A   | S-SMAJ45CA  | 45.0           | 1                                  | 50.00                           | 55.30  | 1              | 72.7                            | 5.5                          |
| S-SMAJ48A   | S-SMAJ48CA  | 48.0           | 1                                  | 53.30                           | 58.90  | 1              | 77.4                            | 5.2                          |
| S-SMAJ51A   | S-SMAJ51CA  | 51.0           | 1                                  | 56.70                           | 62.70  | 1              | 82.4                            | 4.9                          |

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

| Part Number |             | $V_R$ | $I_R@V_R$     | $V_{BR}@I_T$ |        | $I_T$ | $V_C@I_{PP}$ | $I_{PP}^{①}$ |
|-------------|-------------|-------|---------------|--------------|--------|-------|--------------|--------------|
| Uni-Polar   | Bi-Polar    | V     | $\mu\text{A}$ | min(V)       | max(V) | mA    | max(V)       | A            |
| S-SMAJ54A   | S-SMAJ54CA  | 54.0  | 1             | 60.00        | 66.30  | 1     | 87.1         | 4.6          |
| S-SMAJ58A   | S-SMAJ58CA  | 58.0  | 1             | 64.40        | 71.20  | 1     | 93.6         | 4.3          |
| S-SMAJ60A   | S-SMAJ60CA  | 60.0  | 1             | 66.70        | 73.70  | 1     | 96.8         | 4.1          |
| S-SMAJ64A   | S-SMAJ64CA  | 64.0  | 1             | 71.10        | 78.60  | 1     | 103.0        | 3.9          |
| S-SMAJ70A   | S-SMAJ70CA  | 70.0  | 1             | 77.80        | 86.00  | 1     | 113.0        | 3.6          |
| S-SMAJ75A   | S-SMAJ75CA  | 75.0  | 1             | 83.30        | 92.10  | 1     | 121.0        | 3.3          |
| S-SMAJ78A   | S-SMAJ78CA  | 78.0  | 1             | 86.70        | 95.80  | 1     | 126.0        | 3.2          |
| S-SMAJ85A   | S-SMAJ85CA  | 85.0  | 1             | 94.40        | 104.0  | 1     | 137.0        | 2.9          |
| S-SMAJ90A   | S-SMAJ90CA  | 90.0  | 1             | 100.0        | 111.0  | 1     | 146.0        | 2.8          |
| S-SMAJ100A  | S-SMAJ100CA | 100.0 | 1             | 111.0        | 123.0  | 1     | 162.0        | 2.5          |
| S-SMAJ110A  | S-SMAJ110CA | 110.0 | 1             | 122.0        | 135.0  | 1     | 177.0        | 2.3          |
| S-SMAJ120A  | S-SMAJ120CA | 120.0 | 1             | 133.0        | 147.0  | 1     | 193.0        | 2.1          |
| S-SMAJ130A  | S-SMAJ130CA | 130.0 | 1             | 144.0        | 159.0  | 1     | 209.0        | 1.9          |
| S-SMAJ150A  | S-SMAJ150CA | 150.0 | 1             | 167.0        | 185.0  | 1     | 243.0        | 1.7          |
| S-SMAJ160A  | S-SMAJ160CA | 160.0 | 1             | 178.0        | 197.0  | 1     | 259.0        | 1.6          |
| S-SMAJ170A  | S-SMAJ170CA | 170.0 | 1             | 189.0        | 209.0  | 1     | 275.0        | 1.5          |
| S-SMAJ180A  | S-SMAJ180CA | 180.0 | 1             | 201.0        | 222.0  | 1     | 292.0        | 1.4          |
| S-SMAJ200A  | S-SMAJ200CA | 200.0 | 1             | 224.0        | 247.0  | 1     | 324.0        | 1.3          |
| S-SMAJ220A  | S-SMAJ220CA | 220.0 | 1             | 246.0        | 272.0  | 1     | 356.0        | 1.1          |
| S-SMAJ250A  | S-SMAJ250CA | 250.0 | 1             | 279.0        | 309.0  | 1     | 405.0        | 1.0          |
| S-SMAJ300A  | S-SMAJ300CA | 300.0 | 1             | 335.0        | 371.0  | 1     | 486.0        | 0.8          |
| S-SMAJ350A  | S-SMAJ350CA | 350.0 | 1             | 391.0        | 432.0  | 1     | 567.0        | 0.7          |
| S-SMAJ400A  | S-SMAJ400CA | 400.0 | 1             | 447.0        | 494.0  | 1     | 648.0        | 0.6          |
| S-SMAJ440A  | S-SMAJ440CA | 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  $I_{PP}$

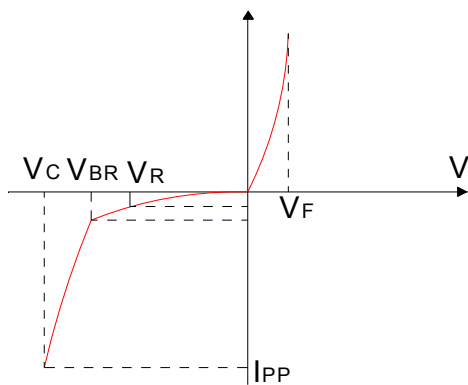
$I_R$ : Reverse Leakage Current

## ORDERING INFORMATION

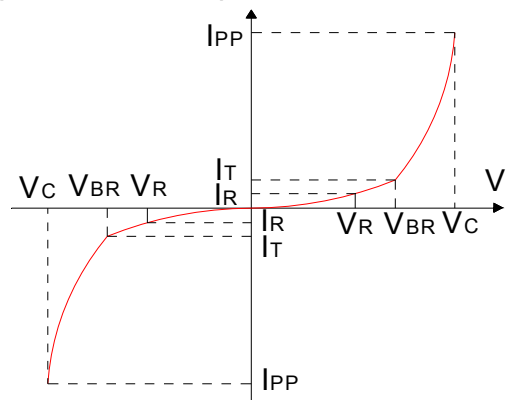
|                 |               |                   |                               |
|-----------------|---------------|-------------------|-------------------------------|
| <b>S-SMAJ</b>   | <b>xx</b>     | <b>C</b>          | <b>A</b>                      |
| 400W SMA Series | $V_R$ Voltage | C: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

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

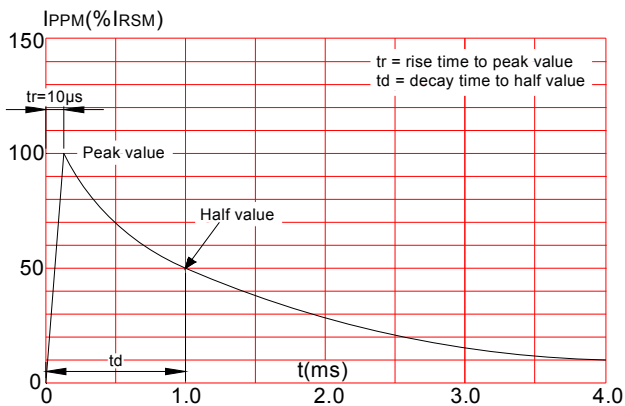
**FIG.1:V- I curve characteristics (Uni-directional)**



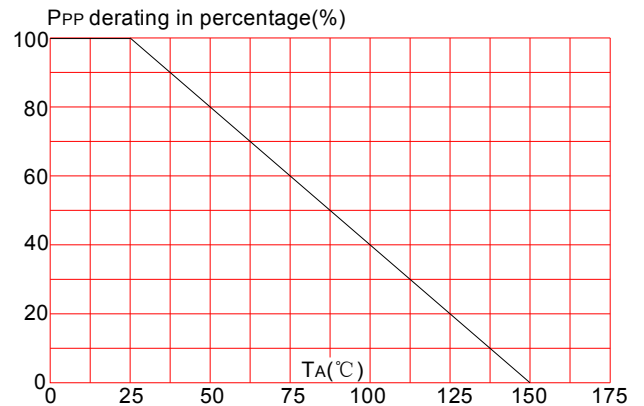
**FIG.2:V- I curve characteristics (Bi-directional)**



**FIG.3: Pulse waveform**

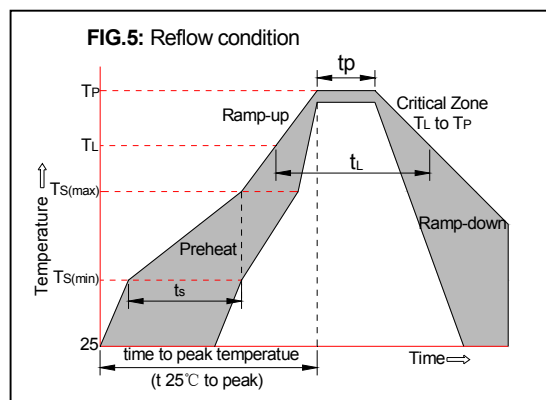


**FIG.4: Pulse derating curve**

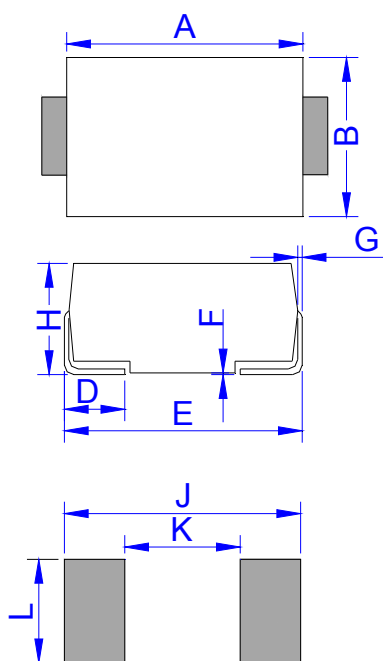


## SOLDERING PARAMETERS

| Reflow Condition                                        |                                   | Pb-Free assembly<br>(see FIG.5) |
|---------------------------------------------------------|-----------------------------------|---------------------------------|
| 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 (Liquid us Temp ( $T_L$ ) to peak) |                                   | 3°C/sec. Max                    |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                    |                                   | 3°C/sec. Max                    |
| Reflow                                                  | -Temperature( $T_L$ )(Liquid us)  | +217°C                          |
|                                                         | -Temperature( $t_L$ )             | 60-150 secs.                    |
| 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                          |



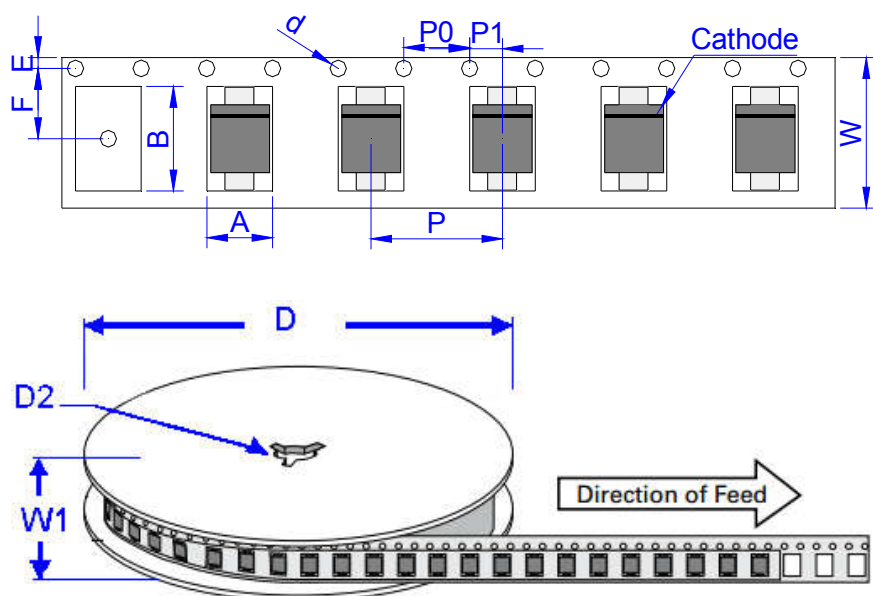
## PACKAGE MECHANICAL DATA



DO-214AC (SMA)

| Ref. | Dimensions  |       |        |       |
|------|-------------|-------|--------|-------|
|      | Millimeters |       | Inches |       |
|      | Min.        | Max.  | Min.   | Max.  |
| A    | 4.00        | 4.65  | 0.157  | 0.183 |
| B    | 2.30        | 2.90  | 0.091  | 0.114 |
| C    | 1.35        | 1.65  | 0.053  | 0.065 |
| D    | 0.76        | 1.52  | 0.030  | 0.060 |
| E    | 4.70        | 5.28  | 0.185  | 0.208 |
| F    | 0.051       | 0.203 | 0.002  | 0.008 |
| G    | 0.15        | 0.31  | 0.006  | 0.012 |
| H    | 1.90        | 2.41  | 0.075  | 0.095 |
| J    | 6.50        |       | 0.256  |       |
| K    |             | 2.30  |        | 0.090 |
| L    | 1.70        |       | 0.067  |       |

## TAPE AND REEL SPECIFICATION-SMA



| Ref. | Dimensions  |               |
|------|-------------|---------------|
|      | Millimeters | Inches        |
| A    | 2.79 ± 0.3  | 0.110 ± 0.012 |
| B    | 5.33 ± 0.3  | 0.210 ± 0.012 |
| d    | 1.5 ± 0.1   | 0.059 ± 0.004 |
| D    | 330.0       | 13.0          |
| D2   | 13 ± 1      | 0.512 ± 0.039 |
| E    | 1.5 ± 0.2   | 0.059 ± 0.008 |
| F    | 5.65 ± 0.2  | 0.222 ± 0.008 |
| P    | 4.0 ± 0.2   | 0.157 ± 0.008 |
| P0   | 4.0 ± 0.2   | 0.157 ± 0.008 |
| P1   | 2.0 ± 0.2   | 0.079 ± 0.008 |
| W    | 12.0 ± 0.2  | 0.472 ± 0.008 |
| W1   | 16.8 ± 2.0  | 0.661 ± 0.079 |

| OUTLINE | REEL (PCS) | PER CARTON (PCS) | REEL DIAMETERS (mm) |
|---------|------------|------------------|---------------------|
| TAPING  | 5,000      | 80,000           | 330                 |