

## Surface Mount Transient Voltage Suppressor Diodes

### Uni-directional



### Bi-directional



### Features

- For surface mounted applications
- Low-profile package
- Ideal for automated placement
- Available in Unidirectional and Bidirectional
- 400 W peak pulse power capability with a 10/1000  $\mu$ s waveform
- Low incremental surge resistance, excellent clamping capability
- Very fast response time
- High temperature soldering guaranteed: 260 °C/10 s at terminals
- Meets MSL level 1
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

### Typical Applications

Use in sensitive electronics protection against voltage transients induced by inductive load switching and lighting on ICs, MOSFET, signal lines of sensor units for consumer, computer, industrial, telecommunication.

### Mechanical Data

- **Package:** DO-214AC (SMA)  
Molding compound meets UL 94 V-0 flammability rating, RoHS-compliant, halogen-free
- **Terminals:** Tin plated leads, solderable per J-STD-002 and JESD22-B102
- **Polarity:** For uni-directional types the band denotes cathode end, no marking on bi-directional types

### ■Maximum Ratings ( $T_a=25^\circ\text{C}$ Unless otherwise specified)

| PARAMETER  | SYMBOL         | UNIT             | Max            |
|--|----------------|------------------|----------------|
| Peak power dissipation, with a 10/1000us waveform (1) (2) (Fig.1)                | $P_{PPM}$      | W                | 400            |
| Peak pulse current, with a 10/1000us waveform (1)                                | $I_{PPM}$      | A                | See Next Table |
| Power dissipation, on infinite heat sink at $T_L=75^\circ\text{C}$               | $P_D$          | W                | 1.0            |
| Peak forward surge current, 8.3 ms single half sine-wave unidirectional only (2) | $I_{FSM}$      | A                | 40             |
| Operating junction and storage temperature range                                 | $T_J, T_{STG}$ | $^\circ\text{C}$ | -55 to +150    |

### ■Electrical Characteristics ( $T_a=25^\circ\text{C}$ Unless otherwise specified)

| PARAMETER  | SYMBOL | UNIT | VALUE   |
|--|--------|------|---------|
| Maximum instantaneous forward voltage @ at 25A for unidirectional only (3) | $V_F$  | V    | 3.5/5.0 |
| Maximum instantaneous forward voltage @ at 1A for unidirectional only      | $V_F$  | V    | 1.5     |



# SMAJ SERIES

## ■ Thermal Characteristics (T<sub>A</sub>=25°C Unless otherwise specified)

| PARAMETER                   | SYMBOL           | UNIT | Conditions          | VALUE |
|-----------------------------|------------------|------|---------------------|-------|
| Thermal resistance(Typical) | R <sub>θJL</sub> | °C/W | junction to lead    | 30    |
|                             | R <sub>θJA</sub> | °C/W | junction to ambient | 120   |

Notes:

- (1) Non-repetitive current pulse, per Fig. 3 and derated above T<sub>A</sub> = 25°C per Fig.2.
- (2) Mounted on 0.2 x 0.2" (5.0 x 5.0 mm) copper pads to each terminal
- (3) V<sub>F</sub><3.5V for devices of V<sub>BR</sub><200V and V<sub>F</sub><5.0V for devices of V<sub>BR</sub>>201V

## ■ Electrical Characteristics (T<sub>A</sub>=25°C Unless otherwise specified)

| Part Number (Uni) | Part Number (Bi) | Breakdown Voltage V <sub>BR</sub> @I <sub>T</sub> |         |                                    | Maximum Reverse Leakage I <sub>R</sub> <sup>(6)</sup> @ V <sub>RWM</sub> (μA) | Working Peak Reverse Voltage V <sub>RWM</sub> (V) | Maximum Reverse Surge Current I <sub>PP</sub> <sup>(5)</sup> (A) | Maximum Clamping Voltage V <sub>c</sub> @ I <sub>PP</sub> (V) |
|-------------------|------------------|---|---------|------------------------------------|---|---|--|---|
|                   |                  | Min(V)  | Max (V) | I <sub>T</sub> <sup>(4)</sup> (mA) |   |   |  |   |
| SMAJ5.0           | SMAJ5.0C         | 6.40  | 7.30    | 10                                 | 800   | 5.0   | 41.67  | 9.6   |
| SMAJ5.0A          | SMAJ5.0CA        | 6.40  | 7.07    | 10                                 | 800   | 5.0   | 43.38  | 9.2   |
| SMAJ6.0           | SMAJ6.0C         | 6.67  | 8.15    | 10                                 | 800   | 6.0   | 35.09  | 11.4  |
| SMAJ6.0A          | SMAJ6.0CA        | 6.67  | 7.37    | 10                                 | 800   | 6.0   | 38.83  | 10.3  |
| SMAJ6.5           | SMAJ6.5C         | 7.22  | 8.82    | 10                                 | 500   | 6.5   | 32.52  | 12.3  |
| SMAJ6.5A          | SMAJ6.5CA        | 7.22  | 7.98    | 10                                 | 500   | 6.5   | 35.71  | 11.2  |
| SMAJ7.0           | SMAJ7.0C         | 7.78  | 9.51    | 10                                 | 200   | 7.0   | 30.08  | 13.3  |
| SMAJ7.0A          | SMAJ7.0CA        | 7.78  | 8.60    | 10                                 | 200   | 7.0   | 33.33  | 12.0  |
| SMAJ7.5           | SMAJ7.5C         | 8.33  | 10.20   | 1                                  | 100   | 7.5   | 27.97  | 14.3  |
| SMAJ7.5A          | SMAJ7.5CA        | 8.33  | 9.21    | 1                                  | 100   | 7.5   | 31.01  | 12.9  |
| SMAJ8.0           | SMAJ8.0C         | 8.89  | 10.90   | 1                                  | 50  | 8.0   | 26.67  | 15.0  |
| SMAJ8.0A          | SMAJ8.0CA        | 8.89  | 9.83    | 1                                  | 50  | 8.0   | 29.41  | 13.6  |
| SMAJ8.5           | SMAJ8.5C         | 9.44  | 11.50   | 1                                  | 10  | 8.5   | 25.16  | 15.9  |
| SMAJ8.5A          | SMAJ8.5CA        | 9.44  | 10.40   | 1                                  | 10  | 8.5   | 27.78  | 14.4  |
| SMAJ9.0           | SMAJ9.0C         | 10.00   | 12.20   | 1                                  | 5   | 9.0   | 23.67  | 16.9  |
| SMAJ9.0A          | SMAJ9.0CA        | 10.00   | 11.10   | 1                                  | 5   | 9.0   | 25.97  | 15.4  |
| SMAJ10            | SMAJ10C          | 11.10   | 13.60   | 1                                  | 5   | 10.0  | 21.28  | 18.8  |
| SMAJ10A           | SMAJ10CA         | 11.10   | 12.30   | 1                                  | 5   | 10.0  | 23.53  | 17.0  |
| SMAJ11            | SMAJ11C          | 12.20   | 14.90   | 1                                  | 5   | 11.0  | 19.90  | 20.1  |
| SMAJ11A           | SMAJ11CA         | 12.20   | 13.50   | 1                                  | 5   | 11.0  | 21.98  | 18.2  |
| SMAJ12            | SMAJ12C          | 13.30   | 16.30   | 1                                  | 5   | 12.0  | 18.18  | 22.0  |
| SMAJ12A           | SMAJ12CA         | 13.30   | 14.70   | 1                                  | 5   | 12.0  | 20.10  | 19.9  |
| SMAJ13            | SMAJ13C          | 14.40   | 17.60   | 1                                  | 5   | 13.0  | 16.81  | 23.8  |
| SMAJ13A           | SMAJ13CA         | 14.40   | 15.90   | 1                                  | 5   | 13.0  | 18.60  | 21.5  |
| SMAJ14            | SMAJ14C          | 15.60   | 19.10   | 1                                  | 5   | 14.0  | 15.50  | 25.8  |
| SMAJ14A           | SMAJ14CA         | 15.60   | 17.20   | 1                                  | 5   | 14.0  | 17.24  | 23.2  |
| SMAJ15            | SMAJ15C          | 16.70   | 20.40   | 1                                  | 5   | 15.0  | 14.87  | 26.9  |
| SMAJ15A           | SMAJ15CA         | 16.70   | 18.50   | 1                                  | 5   | 15.0  | 16.39  | 24.4  |



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## ■Electrical Characteristics (T<sub>a</sub>=25°C Unless otherwise specified)

| Part Number<br>(Uni) | Part Number<br>(Bi) | Breakdown Voltage V <sub>BR</sub> @I <sub>T</sub> |         |                                    | Maximum<br>Reverse Leakage<br>I <sub>R</sub> <sup>(6)</sup> @ V <sub>RWM</sub><br>(μA) | Working Peak<br>Reverse Voltage<br>V <sub>RWM</sub> (V) | Maximum<br>Reverse Surge<br>Current I <sub>PP</sub> <sup>(5)</sup><br>(A) | Maximum<br>Clamping<br>Voltage V <sub>c</sub><br>@ I <sub>PP</sub><br>(V) |
|----------------------|---------------------|---|---------|------------------------------------|--|---|---|---|
|                      |                     | Min(V)  | Max (V) | I <sub>T</sub> <sup>(4)</sup> (mA) |  |   |   |   |
| SMAJ16               | SMAJ16C             | 17.80   | 21.80   | 1                                  | 5  | 16.0  | 13.89   | 28.8  |
| SMAJ16A              | SMAJ16CA            | 17.80   | 19.70   | 1                                  | 5  | 16.0  | 15.40   | 26.0  |
| SMAJ17               | SMAJ17C             | 18.90   | 23.10   | 1                                  | 5  | 17.0  | 13.11   | 30.5  |
| SMAJ17A              | SMAJ17CA            | 18.90   | 20.90   | 1                                  | 5  | 17.0  | 14.49   | 27.6  |
| SMAJ18               | SMAJ18C             | 20.00   | 24.40   | 1                                  | 5  | 18.0  | 12.42   | 32.2  |
| SMAJ18A              | SMAJ18CA            | 20.00   | 22.10   | 1                                  | 5  | 18.0  | 13.70   | 29.2  |
| SMAJ19               | SMAJ19C             | 21.10   | 25.70   | 1                                  | 5  | 19.0  | 11.76   | 34.0  |
| SMAJ19A              | SMAJ19CA            | 21.10   | 23.30   | 1                                  | 5  | 19.0  | 13.00   | 30.8  |
| SMAJ20               | SMAJ20C             | 22.20   | 27.10   | 1                                  | 5  | 20.0  | 11.17   | 35.8  |
| SMAJ20A              | SMAJ20CA            | 22.20   | 24.50   | 1                                  | 5  | 20.0  | 12.35   | 32.4  |
| SMAJ22               | SMAJ22C             | 24.40   | 29.80   | 1                                  | 5  | 22.0  | 10.15   | 39.4  |
| SMAJ22A              | SMAJ22CA            | 24.40   | 26.90   | 1                                  | 5  | 22.0  | 11.27   | 35.5  |
| SMAJ24               | SMAJ24C             | 26.70   | 32.60   | 1                                  | 5  | 24.0  | 9.30  | 43.0  |
| SMAJ24A              | SMAJ24CA            | 26.70   | 29.50   | 1                                  | 5  | 24.0  | 10.28   | 38.9  |
| SMAJ26               | SMAJ26C             | 28.90   | 35.30   | 1                                  | 5  | 26.0  | 8.58  | 46.6  |
| SMAJ26A              | SMAJ26CA            | 28.90   | 31.90   | 1                                  | 5  | 26.0  | 9.50  | 42.1  |
| SMAJ28               | SMAJ28C             | 31.10   | 38.00   | 1                                  | 5  | 28.0  | 8.00  | 50.0  |
| SMAJ28A              | SMAJ28CA            | 31.10   | 34.40   | 1                                  | 5  | 28.0  | 8.81  | 45.4  |
| SMAJ30               | SMAJ30C             | 33.30   | 40.70   | 1                                  | 5  | 30.0  | 7.48  | 53.5  |
| SMAJ30A              | SMAJ30CA            | 33.30   | 36.80   | 1                                  | 5  | 30.0  | 8.26  | 48.4  |
| SMAJ33               | SMAJ33C             | 36.70   | 44.90   | 1                                  | 5  | 33.0  | 6.78  | 59.0  |
| SMAJ33A              | SMAJ33CA            | 36.70   | 40.60   | 1                                  | 5  | 33.0  | 7.50  | 53.3  |
| SMAJ36               | SMAJ36C             | 40.00   | 48.90   | 1                                  | 5  | 36.0  | 6.22  | 64.3  |
| SMAJ36A              | SMAJ36CA            | 40.00   | 44.20   | 1                                  | 5  | 36.0  | 6.88  | 58.1  |
| SMAJ40               | SMAJ40C             | 44.40   | 54.30   | 1                                  | 5  | 40.0  | 5.60  | 71.4  |
| SMAJ40A              | SMAJ40CA            | 44.40   | 49.10   | 1                                  | 5  | 40.0  | 6.20  | 64.5  |
| SMAJ43               | SMAJ43C             | 47.80   | 58.40   | 1                                  | 5  | 43.0  | 5.22  | 76.7  |
| SMAJ43A              | SMAJ43CA            | 47.80   | 52.80   | 1                                  | 5  | 43.0  | 5.76  | 69.4  |
| SMAJ45               | SMAJ45C             | 50.00   | 61.10   | 1                                  | 5  | 45.0  | 4.98  | 80.3  |
| SMAJ45A              | SMAJ45CA            | 50.00   | 55.30   | 1                                  | 5  | 45.0  | 5.50  | 72.7  |
| SMAJ48               | SMAJ48C             | 53.30   | 65.10   | 1                                  | 5  | 48.0  | 4.68  | 85.5  |
| SMAJ48A              | SMAJ48CA            | 53.30   | 58.90   | 1                                  | 5  | 48.0  | 5.17  | 77.4  |
| SMAJ51               | SMAJ51C             | 56.70   | 69.30   | 1                                  | 5  | 51.0  | 4.39  | 91.1  |
| SMAJ51A              | SMAJ51CA            | 56.70   | 62.70   | 1                                  | 5  | 51.0  | 4.85  | 82.4  |
| SMAJ54               | SMAJ54C             | 60.00   | 73.30   | 1                                  | 5  | 54.0  | 4.15  | 96.3  |
| SMAJ54A              | SMAJ54CA            | 60.00   | 66.30   | 1                                  | 5  | 54.0  | 4.59  | 87.1  |
| SMAJ58               | SMAJ58C             | 64.40   | 78.70   | 1                                  | 5  | 58.0  | 3.88  | 103.0   |
| SMAJ58A              | SMAJ58CA            | 64.40   | 71.20   | 1                                  | 5  | 58.0  | 4.27  | 93.6  |
| SMAJ60               | SMAJ60C             | 66.70   | 81.50   | 1                                  | 5  | 60.0  | 3.74  | 107.0   |
| SMAJ60A              | SMAJ60CA            | 66.70   | 73.70   | 1                                  | 5  | 60.0  | 4.13  | 96.8  |



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## ■Electrical Characteristics (T<sub>a</sub>=25°C Unless otherwise specified)

| Part Number(Uni) | Part Number(Bi) | Breakdown Voltage V <sub>BR</sub> @I <sub>T</sub> |         |                                    | Maximum Reverse Leakage I <sub>R</sub> <sup>(6)</sup> @ V <sub>RWM</sub> (μA) | Working Peak Reverse Voltage V <sub>RWM</sub> (V) | Maximum Reverse Surge Current I <sub>PP</sub> <sup>(5)</sup> (A) | Maximum Clamping Voltage V <sub>c</sub> @ I <sub>PP</sub> (V) |
|------------------|-----------------|---|---------|------------------------------------|---|---|--|---|
|                  |                 | Min(V)  | Max (V) | I <sub>T</sub> <sup>(4)</sup> (mA) |   |   |  |   |
| SMAJ64           | SMAJ64C         | 71.10   | 86.90   | 1                                  | 5   | 64.0  | 3.51   | 114.0   |
| SMAJ64A          | SMAJ64CA        | 71.10   | 78.60   | 1                                  | 5   | 64.0  | 3.88   | 103.0   |
| SMAJ70           | SMAJ70C         | 77.80   | 95.10   | 1                                  | 5   | 70.0  | 3.20   | 125.0   |
| SMAJ70A          | SMAJ70CA        | 77.80   | 86.00   | 1                                  | 5   | 70.0  | 3.54   | 113.0   |
| SMAJ75           | SMAJ75C         | 83.30   | 102.00  | 1                                  | 5   | 75.0  | 2.99   | 134.0   |
| SMAJ75A          | SMAJ75CA        | 83.30   | 92.10   | 1                                  | 5   | 75.0  | 3.31   | 121.0   |
| SMAJ78           | SMAJ78C         | 86.70   | 106.00  | 1                                  | 5   | 78.0  | 2.88   | 139.0   |
| SMAJ78A          | SMAJ78CA        | 86.70   | 95.80   | 1                                  | 5   | 78.0  | 3.17   | 126.0   |
| SMAJ80           | SMAJ80C         | 88.90   | 108.80  | 1                                  | 5   | 80.0  | 2.79   | 143.2   |
| SMAJ80A          | SMAJ80CA        | 88.80   | 97.60   | 1                                  | 5   | 80.0  | 3.09   | 129.0   |
| SMAJ85           | SMAJ85C         | 94.40   | 115.00  | 1                                  | 5   | 85.0  | 2.65   | 151.0   |
| SMAJ85A          | SMAJ85CA        | 94.40   | 104.00  | 1                                  | 5   | 85.0  | 2.92   | 137.0   |
| SMAJ90           | SMAJ90C         | 100.00  | 122.00  | 1                                  | 5   | 90.0  | 2.50   | 160.0   |
| SMAJ90A          | SMAJ90CA        | 100.00  | 111.00  | 1                                  | 5   | 90.0  | 2.74   | 146.0   |
| SMAJ100          | SMAJ100C        | 111.00  | 136.00  | 1                                  | 5   | 100.0   | 2.23   | 179.0   |
| SMAJ100A         | SMAJ100CA       | 111.00  | 123.00  | 1                                  | 5   | 100.0   | 2.47   | 162.0   |
| SMAJ110          | SMAJ110C        | 122.00  | 149.00  | 1                                  | 5   | 110.0   | 2.04   | 196.0   |
| SMAJ110A         | SMAJ110CA       | 122.00  | 135.00  | 1                                  | 5   | 110.0   | 2.26   | 177.0   |
| SMAJ120          | SMAJ120C        | 133.00  | 163.00  | 1                                  | 5   | 120.0   | 1.87   | 214.0   |
| SMAJ120A         | SMAJ120CA       | 133.00  | 147.00  | 1                                  | 5   | 120.0   | 2.07   | 193.0   |
| SMAJ130          | SMAJ130C        | 144.00  | 176.00  | 1                                  | 5   | 130.0   | 1.73   | 231.0   |
| SMAJ130A         | SMAJ130CA       | 144.00  | 159.00  | 1                                  | 5   | 130.0   | 1.91   | 209.0   |
| SMAJ140          | SMAJ140C        | 155.00  | 190.00  | 1                                  | 5   | 140.0   | 1.60   | 250.6   |
| SMAJ140A         | SMAJ140CA       | 155.00  | 171.00  | 1                                  | 5   | 140.0   | 1.76   | 226.8   |
| SMAJ150          | SMAJ150C        | 167.00  | 204.00  | 1                                  | 5   | 150.0   | 1.49   | 268.0   |
| SMAJ150A         | SMAJ150CA       | 167.00  | 185.00  | 1                                  | 5   | 150.0   | 1.65   | 243.0   |
| SMAJ160          | SMAJ160C        | 178.00  | 218.00  | 1                                  | 5   | 160.0   | 1.39   | 287.0   |
| SMAJ160A         | SMAJ160CA       | 178.00  | 197.00  | 1                                  | 5   | 160.0   | 1.54   | 259.0   |
| SMAJ170          | SMAJ170C        | 189.00  | 231.00  | 1                                  | 5   | 170.0   | 1.32   | 304.0   |
| SMAJ170A         | SMAJ170CA       | 189.00  | 209.00  | 1                                  | 5   | 170.0   | 1.45   | 275.0   |
| SMAJ180          | SMAJ180C        | 200.00  | 244.00  | 1                                  | 5   | 180.0   | 1.24   | 322.2   |
| SMAJ180A         | SMAJ180CA       | 200.00  | 220.00  | 1                                  | 5   | 180.0   | 1.37   | 291.6   |
| SMAJ190          | SMAJ190C        | 211.00  | 258.00  | 1                                  | 5   | 190.0   | 1.18   | 340.1   |
| SMAJ190A         | SMAJ190CA       | 211.00  | 232.00  | 1                                  | 5   | 190.0   | 1.30   | 307.8   |
| SMAJ200A         | SMAJ200CA       | 224.00  | 247.00  | 1                                  | 1   | 200.0   | 1.23   | 324.0   |
| SMAJ220A         | SMAJ220CA       | 246.00  | 272.00  | 1                                  | 1   | 220.0   | 1.12   | 356.0   |
| SMAJ250A         | SMAJ250CA       | 279.00  | 309.00  | 1                                  | 1   | 250.0   | 0.99   | 405.0   |
| SMAJ300A         | SMAJ300CA       | 335.00  | 371.00  | 1                                  | 1   | 300.0   | 0.82   | 486.0   |
| SMAJ350A         | SMAJ350CA       | 391.00  | 432.00  | 1                                  | 1   | 350.0   | 0.71   | 567.0   |
| SMAJ400A         | SMAJ400CA       | 447.00  | 494.00  | 1                                  | 1   | 400.0   | 0.62   | 648.0   |
| SMAJ440A         | SMAJ440CA       | 492.00  | 543.00  | 1                                  | 1   | 440.0   | 0.56   | 713.0   |



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## Notes:

- (4) Pulse test:  $t_p \leq 50\text{ms}$
- (5) Surge current waveform per Fig. 3 and derated per Fig.2.
- (6) For bi-directional types having  $V_{RWM}$  of 10 V and less, the  $I_R$  limit is doubled.

## ■ Characteristics (Typical)

FIG1: Peak Pulse Power Rating Curve

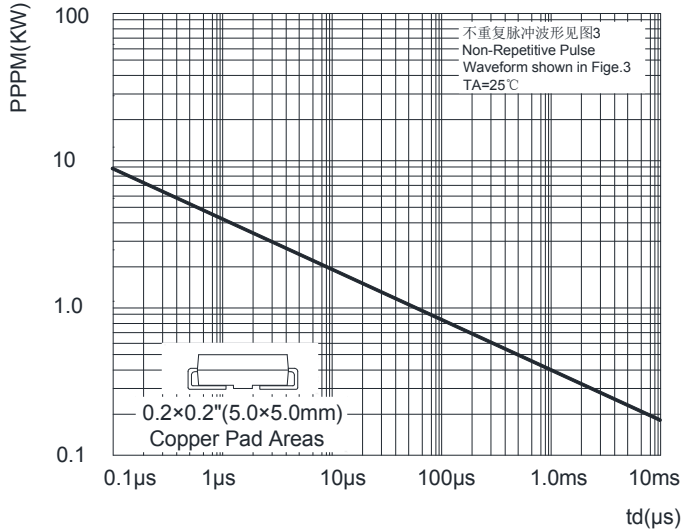


FIG2: Pulse Power or Current vs. Initial Junction Temperature

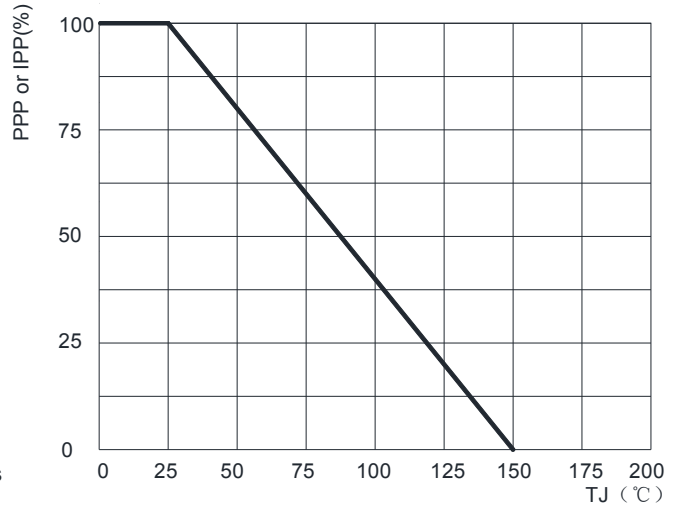


FIG3: Pulse Waveform

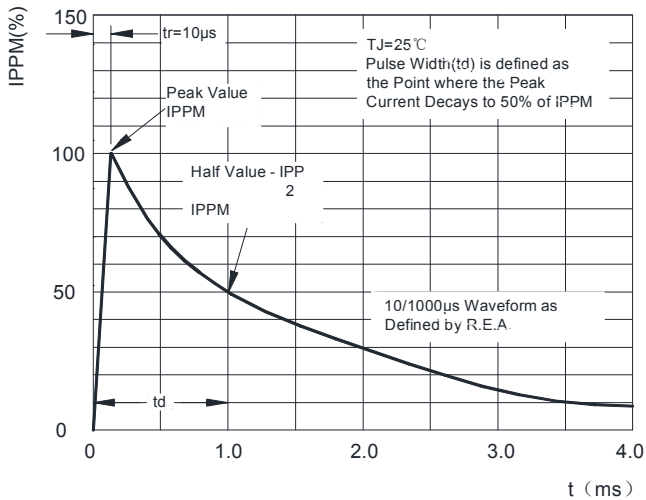


FIG4: Typical Transient Thermal Impedance

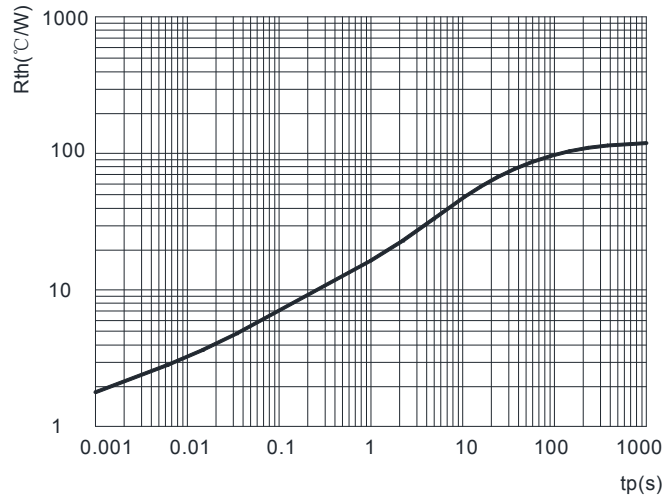
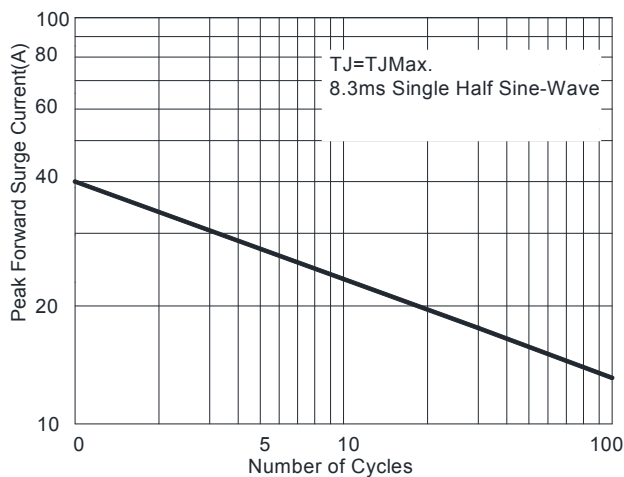


FIG5: Maximum Non-Repetitive Surge Current



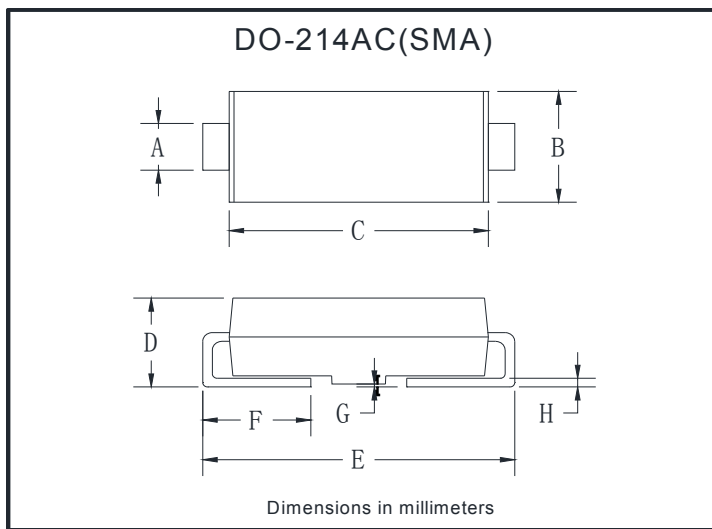


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## Ordering Information (Example)

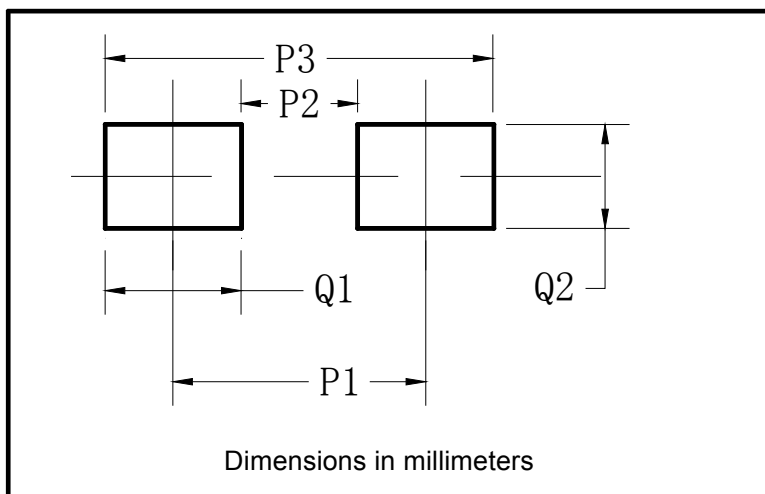
| PREFERRED P/N | PACKAGE CODE | UNIT WEIGHT(g)    | MINIMUM PACKAGE(pcs) | INNER BOX QUANTITY(pcs) | OUTER CARTON QUANTITY(pcs) | DELIVERY MODE |
|---------------|--------------|-------------------|----------------------|-------------------------|----------------------------|---------------|
| SMAJ SERIES   | F1           | Approximate 0.059 | 5000                 | 10000                   | 80000                      | 13" reel      |
| SMAJ SERIES   | F2           | Approximate 0.059 | 7500                 | 15000                   | 120000                     | 13" reel      |
| SMAJ SERIES   | F3           | Approximate 0.059 | 7500                 | 15000                   | 60000                      | 13" reel      |
| SMAJ SERIES   | F4           | Approximate 0.059 | 1800                 | 7200                    | 57600                      | 7" reel       |
| SMAJ SERIES   | F5           | Approximate 0.059 | 2000                 | 8000                    | 64000                      | 7" reel       |
| SMAJ SERIES   | F6           | Approximate 0.059 | 5000                 | 10000                   | 100000                     | 13" reel      |

## Outline Dimensions



| DO-214AC(SMA) |      |      |
|---------------|------|------|
| Dim           | Min  | Max  |
| A             | 1.25 | 1.58 |
| B             | 2.40 | 2.83 |
| C             | 4.25 | 4.75 |
| D             | 1.90 | 2.30 |
| E             | 4.93 | 5.28 |
| F             | 0.76 | 1.41 |
| G             | 0.08 | 0.20 |
| H             | 0.15 | 0.31 |

## Suggested Pad Layout



| DO-214AC(SMA) |             |
|---------------|-------------|
| Dim           | Millimeters |
| P1            | 4.00        |
| P2            | 1.50        |
| P3            | 6.50        |
| Q1            | 2.50        |
| Q2            | 1.70        |



## SMAJ SERIES

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