



**THE DATASHEET OF  
SMA6F17A-M3/6A**





## Surface-Mount TRANSZORB® Transient Voltage Suppressors



Top View

Bottom View

SlimSMA (DO-221AC)



### FEATURES

- Very low profile - typical height of 0.95 mm
- Ideal for automated placement
- Uni-directional only
- Excellent clamping capability
- Peak pulse power:
  - 600 W (10/1000  $\mu$ s)
  - 4 kW (8/20  $\mu$ s)
- ESD capability: IEC 61000-4-2 level 4
  - 15 kV (air)
  - 8 kV (contact)
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



RoHS COMPLIANT HALOGEN FREE

### DESIGN SUPPORT TOOLS AVAILABLE



| PRIMARY CHARACTERISTICS       |                    |
|-------------------------------|--------------------|
| $V_{BR}$                      | 6.4 V to 159 V     |
| $V_{WM}$                      | 5.0 V to 130 V     |
| $P_{PPM}$ (10 x 1000 $\mu$ s) | 600 W              |
| $P_{PPM}$ (8 x 20 $\mu$ s)    | 4000 W             |
| $P_D$ at $T_M = 55$ °C        | 8 W                |
| $T_J$ max.                    | 175 °C             |
| Polarity                      | Uni-directional    |
| Package                       | SlimSMA (DO-221AC) |

### 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, and telecommunication.

### MECHANICAL DATA

**Case:** SlimSMA (DO-221AC)

Molding compound meets UL 94 V-0 flammability rating Base P/N-M3 - halogen-free, RoHS-compliant, and industrial grade

**Terminals:** matte tin plated leads, solderable per J-STD-002 and JESD22-B102

M3 suffix meets JESD 201 class 2 whisker test

**Polarity:** color band denotes cathode end

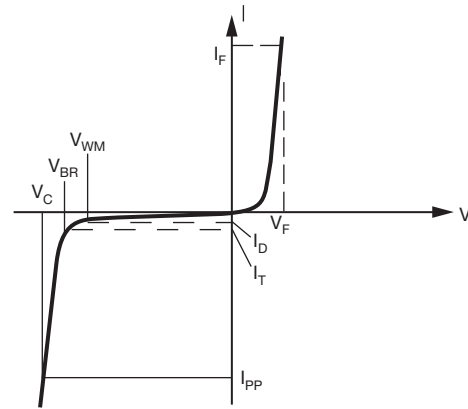
| MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted) |                                 |               |                |      |
|--|---------------------------------|---------------|----------------|------|
| PARAMETER  |                                 | SYMBOL        | VALUE          | UNIT |
| Peak pulse power dissipation                             | with a 10/1000 $\mu$ s waveform | $P_{PPM}$ (1) | 600            | W    |
|  | with a 8/20 $\mu$ s waveform    |               | 4000           |      |
| Peak pulse current                                       | with a 10/1000 $\mu$ s waveform | $I_{PPM}$ (1) | See next table | A    |
|  | with a 8/20 $\mu$ s waveform    |               |                |      |
| Power dissipation  | $T_M = 55$ °C                   | $P_D$ (2)     | 8              | W    |
|  | $T_A = 25$ °C                   | $P_D$ (3)     | 1.0            |      |
| Storage temperature range                                |                                 | $T_{STG}$     | - 65 to + 175  | °C   |
| Operating junction temperature range                     |                                 | $T_J$         | - 55 to + 175  |      |

### Notes

- (1) Non-repetitive current pulse, per fig. 3 and derated above  $T_A = 25$  °C per fig. 2.
- (2) Power dissipation mounted on infinite heatsink
- (3) Power dissipation mounted on FR4 PCB, 2 oz. standard footprint



| INDEX OF SYMBOLS |                                 |
|------------------|---------------------------------|
| SYMBOL           | PARAMETER                       |
| $V_{WM}$         | Stand-off voltage               |
| $V_{BR}$         | Breakdown voltage               |
| $V_C$            | Clamping voltage                |
| $I_D$            | Leakage current at $V_{WM}$     |
| $I_{PP}$         | Peak pulse current              |
| $\alpha T$       | Voltage temperature coefficient |
| $V_F$            | Forward voltage drop            |
| $R_D$            | Dynamic resistance              |



Zener Voltage Regulator

| ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted) |                     |   |      |     |                            |   |       |     |                       |      |          |                    |          |          |                |
|---|---------------------|---|------|-----|----------------------------|---|-------|-----|-----------------------|------|----------|--------------------|----------|----------|----------------|
| DEVICE TYPE   | DEVICE MARKING CODE | BREAKDOWN VOLTAGE $V_{BR}$ AT $I_T$ (1) |      |     | STAND-OFF VOLTAGE $V_{WM}$ | MAXIMUM REVERSE LEAKAGE $I_D$ AT $V_{WM}$ (3) |       |     | $V_C$ AT $I_{PP}$     |      |          | $R_D$ (2)          |          |          | $\alpha T$ (3) |
|   |                     | MIN.                                    | MAX. | mA  |                            | 25 °C   | 85 °C | V   | 10/1000 $\mu\text{s}$ |      |          | 8/20 $\mu\text{s}$ |          |          |                |
|   |                     |   |      |     |                            |   |       |     | MAX.                  | A    | $\Omega$ | MAX.               | A        | $\Omega$ |                |
|   |                     | V                                       |      |     |                            |   |       |     |                       | V    | V        | A                  | $\Omega$ | V        |                |
| SMA6F5.0A   | 6AE                 | 6.40                                    | 7.07 | 10  | 5                          | 150   | 375   | 5.0 | 9.2                   | 68.0 | 0.031    | 13.4               | 298      | 0.021    | 5.7            |
| SMA6F6.0A   | 6AG                 | 6.70                                    | 7.41 | 10  | 6                          | 600   | 1500  | 6.0 | 9.5                   | 63.2 | 0.033    | 13.7               | 290      | 0.022    | 5.9            |
| SMA6F6.5A   | 6AK                 | 7.20                                    | 7.96 | 10  | 6.5                        | 100   | 250   | 6.5 | 10.2                  | 58.8 | 0.038    | 14.5               | 276      | 0.024    | 6.1            |
| SMA6F7.5A   | 6AP                 | 8.33                                    | 9.21 | 1.0 | 7.5                        | 50  | 125   | 7.5 | 11.8                  | 50.8 | 0.051    | 17.0               | 235      | 0.033    | 6.5            |
| SMA6F8.0A   | 6AR                 | 8.89                                    | 9.83 | 1.0 | 8.0                        | 20  | 50    | 8.0 | 12.8                  | 46.9 | 0.063    | 18.2               | 220      | 0.038    | 7.0            |
| SMA6F8.5A   | 6AT                 | 9.4                                     | 10.4 | 1.0 | 8.5                        | 20  | 50    | 8.5 | 13.3                  | 45.1 | 0.064    | 18.7               | 205      | 0.040    | 7.3            |
| SMA6F10A  | 6AX                 | 11.1                                    | 12.3 | 1.0 | 10                         | 1.0   | 5.0   | 10  | 15.7                  | 38.2 | 0.089    | 19.6               | 184      | 0.040    | 7.8            |
| SMA6F11A  | 6AZ                 | 12.2                                    | 13.5 | 1.0 | 11                         | 1.0   | 5.0   | 11  | 17.2                  | 34.8 | 0.107    | 21.5               | 172      | 0.047    | 8.1            |
| SMA6F12A  | 6BE                 | 13.3                                    | 14.7 | 1.0 | 12                         | 0.2   | 1.0   | 12  | 18.8                  | 31.9 | 0.128    | 23.5               | 157      | 0.056    | 8.3            |
| SMA6F12AHD  | 6BF                 | 13.2                                    | 14.3 | 1.0 | 12                         | 0.2   | 1.0   | 12  | 18.5                  | 32.4 | 0.130    | 22.9               | 157      | 0.055    | 8.4            |
| SMA6F13A  | 6BG                 | 14.4                                    | 15.9 | 1.0 | 13                         | 0.2   | 1.0   | 13  | 20.4                  | 29.4 | 0.153    | 23.9               | 147      | 0.064    | 8.4            |
| SMA6F15A  | 6BM                 | 16.7                                    | 18.5 | 1.0 | 15                         | 0.2   | 1.0   | 15  | 23.6                  | 25.4 | 0.201    | 27.7               | 123      | 0.075    | 8.8            |
| SMA6F16A  | 6BP                 | 17.8                                    | 19.7 | 1.0 | 16                         | 0.2   | 1.0   | 16  | 25.2                  | 23.8 | 0.229    | 29.5               | 119      | 0.082    | 8.8            |
| SMA6F17A  | 6BR                 | 18.9                                    | 20.9 | 1.0 | 17                         | 0.2   | 1.0   | 17  | 26.7                  | 22.5 | 0.259    | 31.4               | 111      | 0.095    | 9.0            |
| SMA6F18A  | 6BT                 | 20.0                                    | 22.1 | 1.0 | 18                         | 0.2   | 1.0   | 18  | 28.3                  | 21.2 | 0.292    | 33.2               | 102      | 0.109    | 9.2            |
| SMA6F20A  | 6BV                 | 22.2                                    | 24.5 | 1.0 | 20                         | 0.2   | 1.0   | 20  | 31.4                  | 19.1 | 0.361    | 36.8               | 93       | 0.132    | 9.4            |
| SMA6F22A  | 6BX                 | 24.4                                    | 26.9 | 1.0 | 22                         | 0.2   | 1.0   | 22  | 35.5                  | 16.9 | 0.509    | 48.2               | 83.0     | 0.257    | 9.6            |
| SMA6F24A  | 6BZ                 | 26.7                                    | 29.5 | 1.0 | 24                         | 0.2   | 1.0   | 24  | 39.0                  | 15.4 | 0.617    | 50.0               | 80.0     | 0.256    | 9.6            |
| SMA6F26A  | 6CE                 | 28.9                                    | 31.9 | 1.0 | 26                         | 0.2   | 1.0   | 26  | 42.0                  | 14.3 | 0.706    | 53.3               | 75.0     | 0.285    | 9.7            |
| SMA6F28A  | 6CG                 | 31.1                                    | 34.4 | 1.0 | 28                         | 0.2   | 1.0   | 28  | 45.5                  | 13.2 | 0.841    | 58.8               | 68.0     | 0.359    | 9.8            |
| SMA6F30A  | 6CK                 | 33.3                                    | 36.8 | 1.0 | 30                         | 0.2   | 1.0   | 30  | 48.4                  | 12.4 | 0.935    | 64.5               | 62.0     | 0.447    | 9.9            |
| SMA6F33A  | 6CM                 | 36.7                                    | 40.6 | 1.0 | 33                         | 0.2   | 1.0   | 33  | 53.1                  | 11.3 | 1.11     | 70.2               | 57.0     | 0.519    | 10.0           |
| SMA6F36A  | 6CP                 | 40.0                                    | 44.2 | 1.0 | 36                         | 0.2   | 1.0   | 36  | 58.3                  | 10.3 | 1.37     | 76.9               | 52.0     | 0.629    | 10.0           |
| SMA6F40A  | 6CR                 | 44.4                                    | 49.1 | 1.0 | 40                         | 0.2   | 1.0   | 40  | 64.5                  | 9.3  | 1.66     | 83.3               | 48.0     | 0.713    | 10.1           |
| SMA6F43A  | 6CT                 | 47.8                                    | 52.8 | 1.0 | 43                         | 0.2   | 1.0   | 43  | 69.8                  | 8.6  | 1.98     | 89.9               | 44.5     | 0.834    | 10.1           |
| SMA6F45A  | 6CV                 | 50.0                                    | 55.3 | 1.0 | 45                         | 0.2   | 1.0   | 45  | 72.3                  | 8.3  | 2.05     | 93.9               | 42.6     | 0.906    | 10.2           |
| SMA6F48A  | 6CX                 | 53.3                                    | 58.9 | 1.0 | 48                         | 0.2   | 1.0   | 48  | 76.9                  | 7.8  | 2.31     | 100                | 40.0     | 1.03     | 10.3           |
| SMA6F51A  | 6CZ                 | 56.7                                    | 62.7 | 1.0 | 51                         | 0.2   | 1.0   | 51  | 82.2                  | 7.3  | 2.67     | 107                | 37.5     | 1.18     | 10.3           |
| SMA6F54A  | 6RE                 | 60.0                                    | 66.3 | 1.0 | 54                         | 0.2   | 1.0   | 54  | 87.0                  | 6.9  | 3.00     | 113                | 35.5     | 1.32     | 10.4           |
| SMA6F58A  | 6RG                 | 64.4                                    | 71.2 | 1.0 | 58                         | 0.2   | 1.0   | 58  | 93.8                  | 6.4  | 3.53     | 121                | 33.0     | 1.51     | 10.4           |



| <b>ELECTRICAL CHARACTERISTICS</b> ( $T_A = 25\text{ }^\circ\text{C}$ unless otherwise noted) |                     |  |      |               |                            |  |       |     |  |     |          |  |                      |          |                           |
|--|---------------------|--|------|---------------|----------------------------|--|-------|-----|--|-----|----------|--|----------------------|----------|---------------------------|
| DEVICE TYPE  | DEVICE MARKING CODE | BREAKDOWN VOLTAGE $V_{BR}$ AT $I_T$ <sup>(1)</sup> |      |               | STAND-OFF VOLTAGE $V_{WM}$ | MAXIMUM REVERSE LEAKAGE $I_D$ AT $V_{WM}$ <sup>(3)</sup> |       |     | $V_C$ AT $I_{PP}$ , $R_D$ <sup>(2)</sup> |     |          | $V_C$ AT $I_{PP}$ , $R_D$ <sup>(2)</sup> |                      |          | $\alpha T$ <sup>(3)</sup> |
|  |                     | MIN.   | MAX. | mA            |                            | 25 °C  | 85 °C | V   | 10/1000 $\mu\text{s}$                    |     |          | 8/20 $\mu\text{s}$                       |                      |          |                           |
|  |                     |  |      |               |                            |  |       |     | MAX.                                     | A   | $\Omega$ | MAX.                                     | A                    | $\Omega$ |                           |
|  |                     | V  |      | $\mu\text{A}$ |                            | V  | V     | A   | $\Omega$                                 | V   | A        | $\Omega$                                 | MAX.                 |          |                           |
|  |                     |  |      |               |                            |  |       |     |  |     |          |  | 10 <sup>-4</sup> /°C |          |                           |
| SMA6F60A   | 6RK                 | 66.7   | 73.7 | 1.0           | 60                         | 0.2  | 1.0   | 60  | 96.8                                     | 6.2 | 3.73     | 125                                      | 31.9                 | 1.61     | 10.5                      |
| SMA6F64A   | 6RM                 | 71.1   | 78.6 | 1.0           | 64                         | 0.2  | 1.0   | 64  | 103                                      | 5.8 | 4.21     | 134                                      | 29.9                 | 1.85     | 10.5                      |
| SMA6F70A   | 6RP                 | 77.8   | 86.0 | 1.0           | 70                         | 0.2  | 1.0   | 70  | 113                                      | 5.3 | 5.09     | 148                                      | 27.0                 | 2.30     | 10.5                      |
| SMA6F75A   | 6RR                 | 83.3   | 92.1 | 1.0           | 75                         | 0.2  | 1.0   | 75  | 120                                      | 5.0 | 5.58     | 156                                      | 25.6                 | 2.50     | 10.6                      |
| SMA6F78A   | 6RT                 | 86.7   | 95.8 | 1.0           | 78                         | 0.2  | 1.0   | 78  | 125                                      | 4.8 | 6.08     | 163                                      | 24.6                 | 2.73     | 10.6                      |
| SMA6F85A   | 6RV                 | 94.4   | 104  | 1.0           | 85                         | 0.2  | 1.0   | 85  | 136                                      | 4.4 | 7.27     | 178                                      | 22.5                 | 3.29     | 10.6                      |
| SMA6F90A   | 6RX                 | 100  | 111  | 1.0           | 90                         | 0.2  | 1.0   | 90  | 146                                      | 4.1 | 8.54     | 189                                      | 21.2                 | 3.68     | 10.7                      |
| SMA6F100A  | 6RZ                 | 111  | 123  | 1.0           | 100                        | 0.2  | 1.0   | 100 | 162                                      | 3.7 | 10.5     | 211                                      | 19.0                 | 4.63     | 10.7                      |
| SMA6F110A  | 6SE                 | 122  | 135  | 1.0           | 110                        | 0.2  | 1.0   | 110 | 177                                      | 3.4 | 12.4     | 230                                      | 17.4                 | 5.46     | 10.7                      |
| SMA6F120A  | 6VG                 | 133  | 147  | 1.0           | 120                        | 0.2  | 1.0   | 120 | 194                                      | 3.1 | 15.2     | 250                                      | 16.0                 | 6.44     | 10.7                      |
| SMA6F130A  | 6VK                 | 144  | 159  | 1.0           | 130                        | 0.2  | 1.0   | 130 | 207                                      | 2.9 | 16.6     | 267                                      | 15.0                 | 7.20     | 10.8                      |

**Notes**

- (1) Pulse test:  $t_p \leq 50\text{ ms}$
- (2) To calculate maximum clamping voltage at other surge currents, use following formula:  $V_{CL\text{ max.}} = R_D \times I_{PP} + V_{BR\text{ max.}}$
- (3) To calculate  $V_{BR}$  vs. junction temperature, use following formula:  $V_{BR}$  at  $T_J = V_{BR}$  at  $25\text{ }^\circ\text{C} \times (1 + \alpha T (T_J - 25))$

| <b>THERMAL CHARACTERISTICS</b> ( $T_A = 25\text{ }^\circ\text{C}$ unless otherwise noted) |                                |      |      |                    |
|---|--------------------------------|------|------|--------------------|
| PARAMETER   | SYMBOL                         | TYP. | MAX. | UNIT               |
| Typical thermal resistance  | $R_{\theta JA}$ <sup>(1)</sup> | 120  | 150  | $^\circ\text{C/W}$ |
|   | $R_{\theta JM}$ <sup>(2)</sup> | 12   | 15   |                    |

**Notes**

- (4) Thermal resistance junction-to-ambient to follow JEDEC<sup>®</sup> 51-2A, device mounted on FR4 PCB, 2 oz. standard footprint
- (5) Thermal resistance junction-to-mount to follow JEDEC<sup>®</sup> 51-14, using TDIM (transient dual interface test method)

| <b>IMMUNITY TO STATIC ELECTRICAL DISCHARGE TO THE FOLLOWING STANDARDS</b> |                                       |   |        |       |                  |
|---|---------------------------------------|---|--------|-------|------------------|
| $(T_A = 25\text{ }^\circ\text{C}$ unless otherwise noted)                 |                                       |   |        |       |                  |
| STANDARD  | TEST TYPE                             | TEST CONDITIONS                               | SYMBOL | CLASS | VALUE            |
| IEC 61000-4-2   | Human body model (contact mode)       | $C = 150\text{ pF}$ , $R = 330\text{ }\Omega$ | $V_C$  | 4     | $> 8\text{ kV}$  |
|   | Human body model (air discharge mode) |   |        |       | $> 15\text{ kV}$ |

| <b>ORDERING INFORMATION</b> (Example) |                 |                        |               |                                    |
|---------------------------------------|-----------------|------------------------|---------------|------------------------------------|
| PREFERRED P/N                         | UNIT WEIGHT (g) | PREFERRED PACKAGE CODE | BASE QUANTITY | DELIVERY MODE                      |
| SMA6F5.0A-M3/6A <sup>(1)</sup>        | 0.032           | 6A                     | 3500          | 7" diameter plastic tape and reel  |
| SMA6F5.0A-M3/6B <sup>(1)</sup>        | 0.032           | 6B                     | 14 000        | 13" diameter plastic tape and reel |
| SMA6F22A-M3/H <sup>(2)</sup>          | 0.032           | H                      | 3500          | 7" diameter plastic tape and reel  |
| SMA6F22A-M3/I <sup>(2)</sup>          | 0.032           | I                      | 14 000        | 13" diameter plastic tape and reel |

**Notes**

- (1) Package code "6A and 6B" apply for SMA6F5.0A thru SMA6F20A
- (2) Package code "H and I" apply for SMA6F22A thru SMA6F130A



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

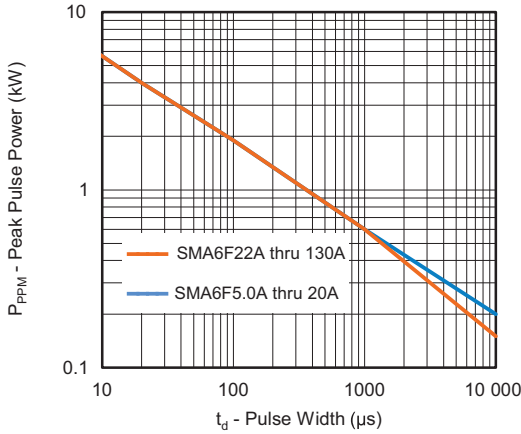


Fig. 1 - Peak Pulse Power Rating Curve

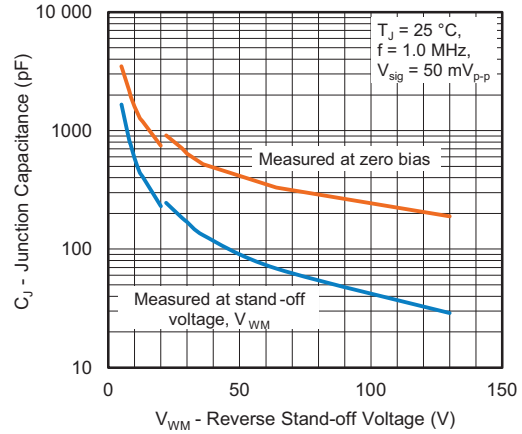


Fig. 4 - Typical Junction Capacitance

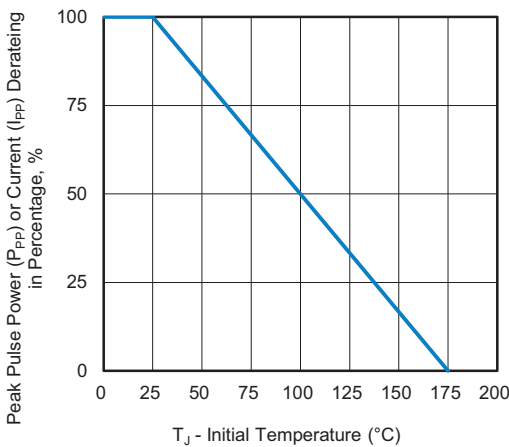


Fig. 2 - Pulse Power or Current vs. Initial Junction Temperature

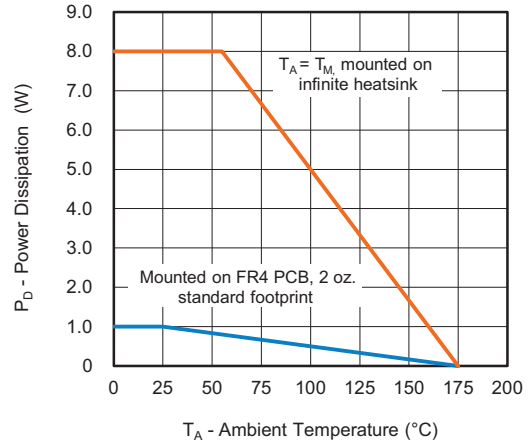


Fig. 5 - Power Dissipation Derating Curve

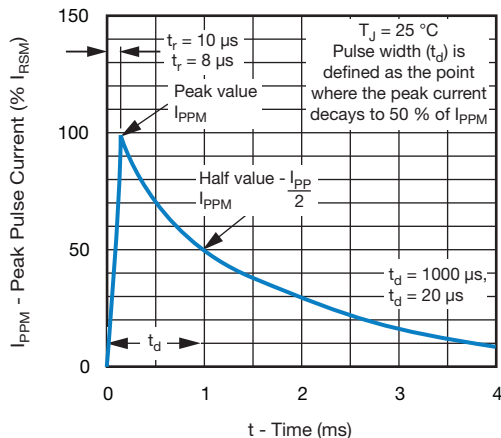


Fig. 3 - Pulse Waveform

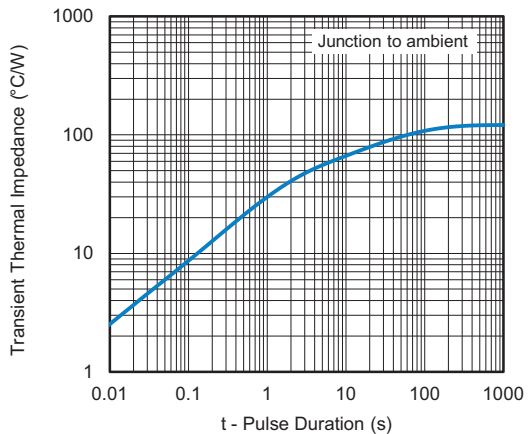


Fig. 6 - Typical Transient Thermal Impedance

**Notes**

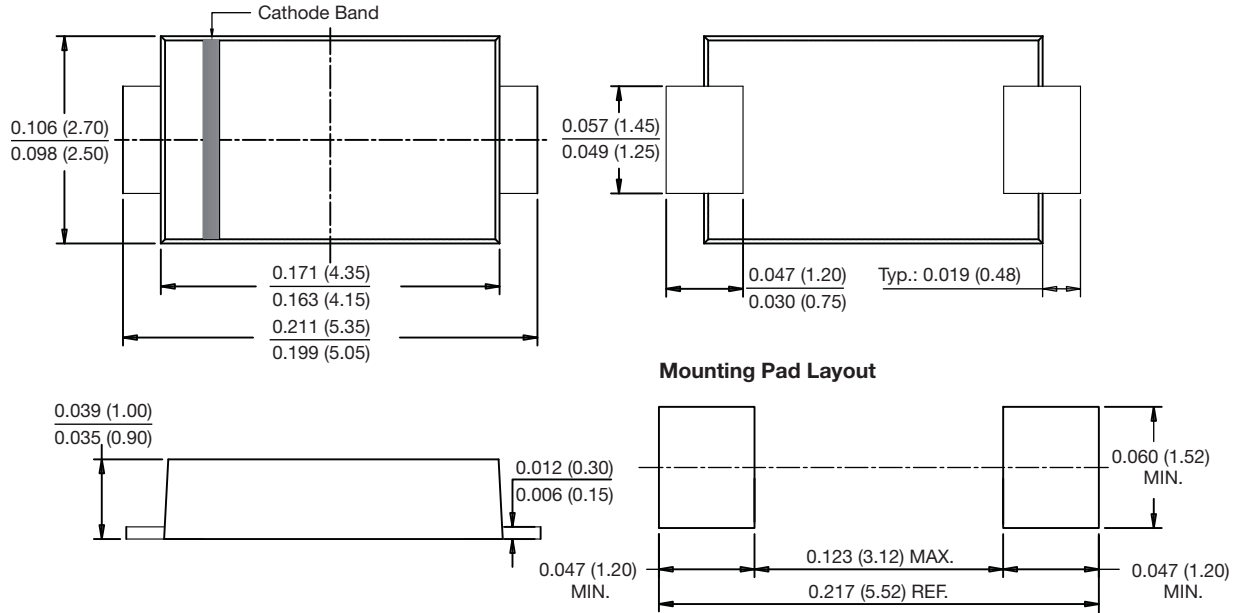
- Fig.1 - Power calculation is based on  $I_{PPM}$  times defined maximum clamping voltage by pulse width



- Fig.1 - 10 000  $\mu\text{s}$  P<sub>PPM</sub> is actual test for V<sub>WM</sub> ≤ 60 V types, over 60 V types 10 000  $\mu\text{s}$  P<sub>PPM</sub> is curve extensional value

### PACKAGE OUTLINE DIMENSIONS in inches (millimeters)

#### SlimSMA (DO-221AC)





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