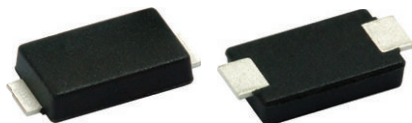


# Surface Mount TRANSZORB® Transient Voltage Suppressors

**SlimSMA™**


Top View

Bottom View

**DO-221AC**

## PRIMARY CHARACTERISTICS

|                                   |                      |
|-----------------------------------|----------------------|
| $V_{BR}$                          | 6.4 V to 24.5 V      |
| $V_{WM}$                          | 5.0 V to 20 V        |
| $P_{PPM}$ (10 x 1000 $\mu$ s)     | 600 W                |
| $P_{PPM}$ (8 x 20 $\mu$ s)        | 4000 W               |
| $P_D$ at $T_M = 55^\circ\text{C}$ | 6 W                  |
| $T_J$ max.                        | 175 $^\circ\text{C}$ |
| Polarity                          | Uni-directional      |
| Package                           | DO-221AC (SlimSMA)   |

## 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.

## 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  $^\circ\text{C}$
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

## MECHANICAL DATA

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

Molding compound meets UL 94 V-0 flammability rating  
Base P/N-M3 - halogen-free, RoHS-compliant, and commercial 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 ( $T_A = 25^\circ\text{C}$ , 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                    | $T_M = 55^\circ\text{C}$        | $P_D^{(2)}$     | 6              | W                |
|                                      | $T_A = 25^\circ\text{C}$        | $P_D^{(3)}$     | 1.0            |                  |
| Storage temperature range            |                                 | $T_{STG}$       | -65 to +175    | $^\circ\text{C}$ |
| Operating junction temperature range |                                 | $T_J$           | -55 to +175    |                  |

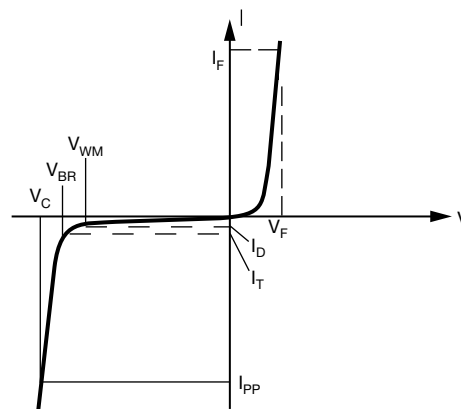
### Notes

- (1) Non-repetitive current pulse, per fig. 3 and derated above  $T_A = 25^\circ\text{C}$  per fig. 2.
- (2) Power dissipation mounted on infinite heatsink
- (3) Power dissipation mounted on minimum recommended pad layout



## 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<br>TYPE | DEVICE<br>MARKING<br>CODE | BREAKDOWN<br>VOLTAGE<br>V <sub>BR</sub> AT I <sub>T</sub> <sup>(1)</sup> |      |    | STAND-OFF<br>VOLTAGE<br>V <sub>WM</sub> | MAXIMUM<br>REVERSE<br>LEAKAGE<br>I <sub>D</sub> AT V <sub>WM</sub> <sup>(3)</sup> |       |     | V <sub>C</sub> AT I <sub>PP</sub> |      | R <sub>D</sub> <sup>(2)</sup> | V <sub>C</sub> AT I <sub>PP</sub> |     | R <sub>D</sub> <sup>(2)</sup> | αT <sup>(3)</sup> |
|----------------|---------------------------|--------------------------------------------------------------------------|------|----|-----------------------------------------|-----------------------------------------------------------------------------------|-------|-----|-----------------------------------|------|-------------------------------|-----------------------------------|-----|-------------------------------|-------------------|
|                |                           | MIN.                                                                     | MAX. |    |                                         | 25 °C                                                                             | 85 °C |     | 10/1000 μs                        |      |                               | 8/20 μs                           |     |                               |                   |
|                |                           |                                                                          |      |    |                                         |                                                                                   |       |     | MAX.                              |      |                               | MAX.                              |     |                               |                   |
|                |                           | V                                                                        | mA   | V  |                                         | μA                                                                                | V     | μA  | V                                 | V    | A                             | Ω                                 | V   | A                             |                   |
| 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  | 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  | 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  | 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  | 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  | 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  | 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  | 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  | 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  | 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  | 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  | 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  | 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  | 20                                      | 0.2                                                                               | 1.0   | 20  | 31.4                              | 19.1 | 0.361                         | 36.8                              | 93  | 0.132                         | 9.4               |

## Notes

(1) Pulse test:  $t_p \leq 50$  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:  $V_{BR} \text{ at } T_J = V_{BR} \text{ at } 25^\circ\text{C} \times (1 + \alpha T \times (T_J - 25))$ THERMAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

| PARAMETER                                       | SYMBOL                         | VALUE | UNIT               |
|-------------------------------------------------|--------------------------------|-------|--------------------|
| Typical thermal resistance, junction to ambient | $R_{\theta JA}$ <sup>(1)</sup> | 150   | $^\circ\text{C/W}$ |
| Typical thermal resistance, junction to mount   | $R_{\theta JM}$ <sup>(2)</sup> | 20    | $^\circ\text{C/W}$ |

## Notes

(1) Mounted on minimum recommended pad layout

(2) Mounted on infinite heatsink

**IMMUNITY TO STATIC ELECTRICAL DISCHARGE TO THE FOLLOWING STANDARDS**

( $T_A = 25\text{ }^{\circ}\text{C}$  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 kV  |
|               | Human body model (air discharge mode) |                                               |        |       | > 15 kV |

**ORDERING INFORMATION (Example)**

| PREFERRED P/N   | UNIT WEIGHT (g) | PREFERRED PACKAGE CODE | BASE QUANTITY | DELIVERY MODE                      |
|-----------------|-----------------|------------------------|---------------|------------------------------------|
| SMA6F5.0A-M3/6A | 0.032           | 6A                     | 3500          | 7" diameter plastic tape and reel  |
| SMA6F5.0A-M3/6B | 0.032           | 6B                     | 14 000        | 13" diameter plastic tape and reel |

**RATINGS AND CHARACTERISTICS CURVES**

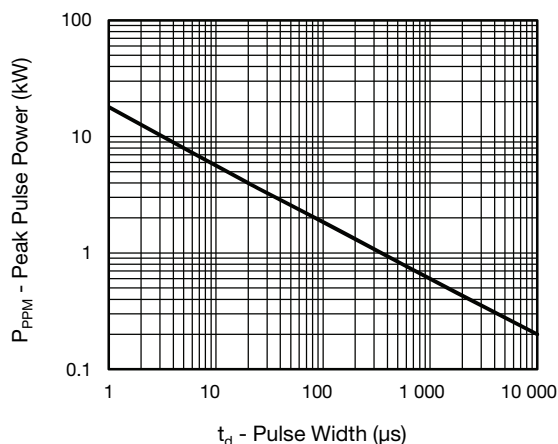
( $T_A = 25\text{ }^{\circ}\text{C}$  unless otherwise noted)


Fig. 1 - Peak Pulse Power Rating Curve

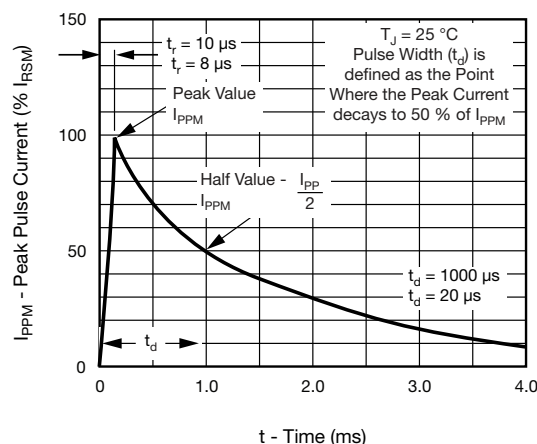


Fig. 3 - Pulse Waveform

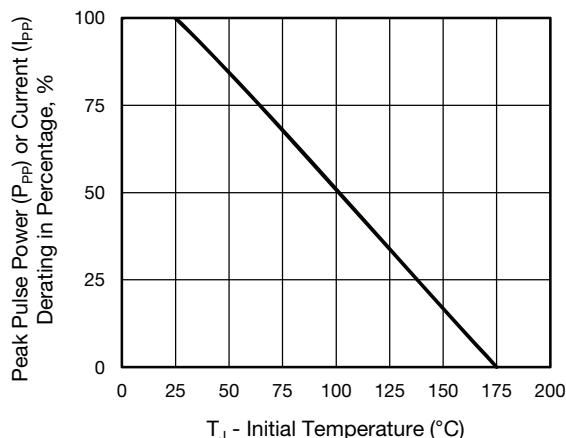


Fig. 2 - Pulse Power or Current vs. Initial Junction Temperature

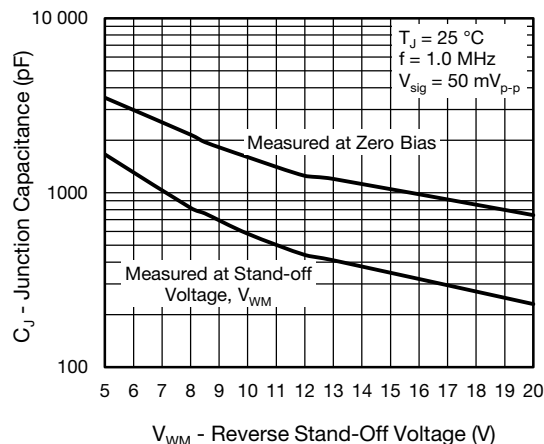


Fig. 4 - Typical Junction Capacitance

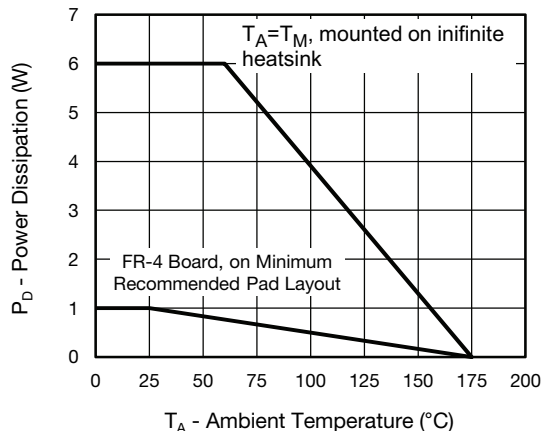


Fig. 5 - Power Dissipation Derating Curve

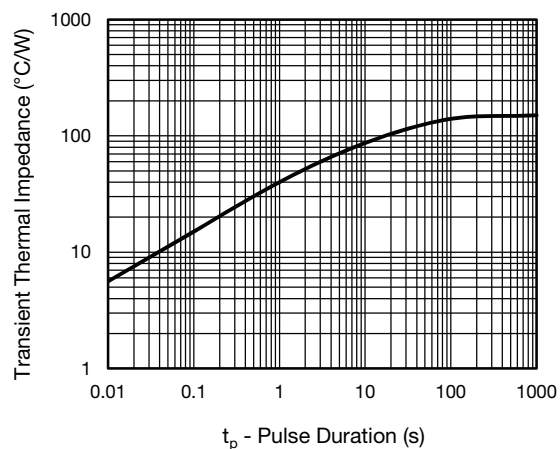
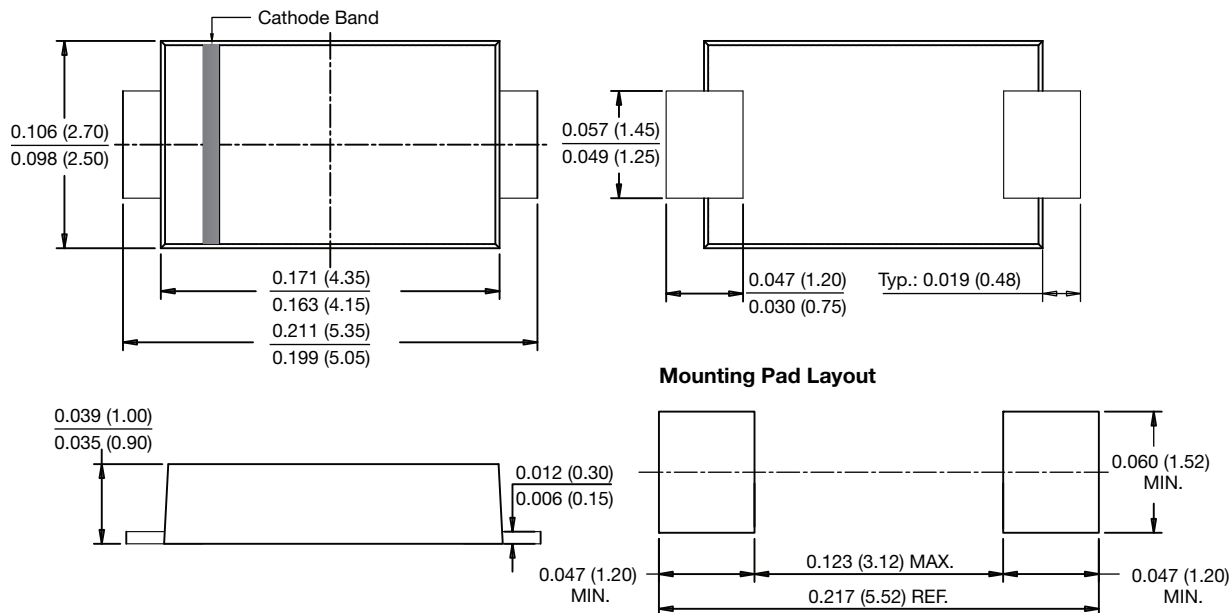


Fig. 6 - Typical Transient Thermal Impedance

**PACKAGE OUTLINE DIMENSIONS** in inches (millimeters)

**DO-221AC (SlimSMA)**




## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

## Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**