



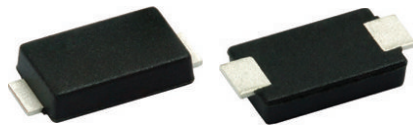
THE DATASHEET OF SMA6F12AHD-M3/6B





Surface-Mount TRANSZORB® Transient Voltage Suppressors

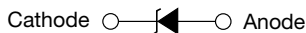
eSMP® Series



Top View

Bottom View

SlimSMA (DO-221AC)



FEATURES

- Very low profile - typical height of 0.95 mm
- Ideal for automated placement
- Unidirectional only
- Excellent clamping capability
- Peak pulse power:
 - 600 W (10/1000 μ s)
 - 4 kW (8/20 μ 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



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 μ s) | 600 W |
| P_{PPM} (8 x 20 μ s) | 4000 W |
| P_D at $T_M = 55$ °C | 8 W |
| T_J max. | 175 °C |
| Polarity | Unidirectional |
| 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

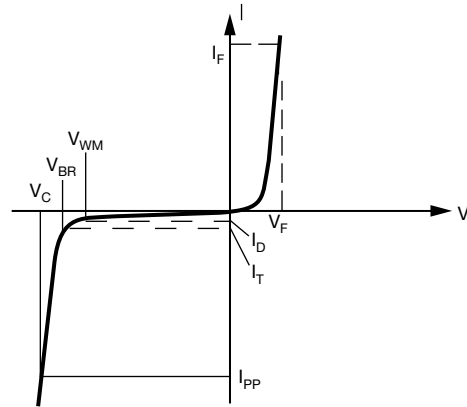
| MAXIMUM RATINGS ($T_A = 25$ °C, unless otherwise noted) | | | | |
|--|---------------------------------|--------------------------|----------------|------|
| PARAMETER | | SYMBOL | VALUE | UNIT |
| Peak pulse power dissipation | with a 10/1000 μ s waveform | P_{PPM} ⁽¹⁾ | 600 | W |
| | with a 8/20 μ s waveform | | 4000 | |
| Peak pulse current | with a 10/1000 μ s waveform | I_{PPM} ⁽¹⁾ | See next table | A |
| | with a 8/20 μ 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 |
| αT | Voltage temperature coefficient |
| V_F | Forward voltage drop |
| R_D | Dynamic resistance |



Zener Voltage Regulator

| ELECTRICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$ 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) | | | αT (9) |
| | | MIN. | MAX. | mA | | 25 °C | 85 °C | V | 10/1000 μ s | | | 8/20 μ s | | | |
| | | | | | V | | | | A | Ω | MAX. V | A | Ω | MAX. V | |
| | | | | | | | | μ 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 | 1.0 | 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 |



| ELECTRICAL CHARACTERISTICS (T _A = 25 °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⁾ | | | V _C AT I _{PP} R _D ⁽²⁾ | | | αT ⁽³⁾ |
| | | MIN. | MAX. | mA | V | 25 °C | 85 °C | V | 10/1000 μs | | | 8/20 μs | | | |
| | | V | | | | μA | | | MAX. V | A | Ω | MAX. V | A | Ω | |
| 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 ≤ 50 ms
- (2) To calculate maximum clamping voltage at other surge currents, use following formula: V_{CL} max. = R_D x I_{PP} + V_{BR} max.
- (3) To calculate V_{BR} vs. junction temperature, use following formula: V_{BR} at T_J = V_{BR} at 25 °C x (1 + αT x (T_J - 25))

| THERMAL CHARACTERISTICS (T _A = 25 °C unless otherwise noted) | | | | |
|---|---------------------------------|------|------|------|
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
| Typical thermal resistance | R _{θJA} ⁽¹⁾ | 120 | 150 | °C/W |
| | R _{θJM} ⁽²⁾ | 12 | 15 | |

Notes

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

| IMMUNITY TO STATIC ELECTRICAL DISCHARGE TO THE FOLLOWING STANDARDS (T _A = 25 °C unless otherwise noted) | | | | | |
|--|---------------------------------------|-----------------------|----------------|-------|---------|
| STANDARD | TEST TYPE | TEST CONDITIONS | SYMBOL | CLASS | VALUE |
| IEC 61000-4-2 | Human body model (contact mode) | C = 150 pF, R = 330 Ω | 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 ⁽¹⁾ | 0.032 | 6A | 3500 | 7" diameter plastic tape and reel |
| SMA6F5.0A-M3/6B ⁽¹⁾ | 0.032 | 6B | 14 000 | 13" diameter plastic tape and reel |
| SMA6F22A-M3/H ⁽²⁾ | 0.032 | H | 3500 | 7" diameter plastic tape and reel |
| SMA6F22A-M3/I ⁽²⁾ | 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)

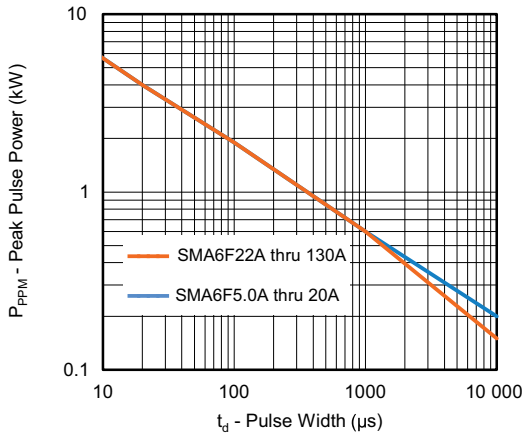


Fig. 1 - Peak Pulse Power Rating Curve

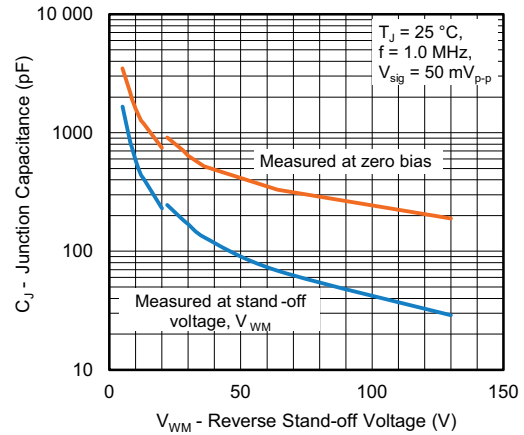


Fig. 4 - Typical Junction Capacitance

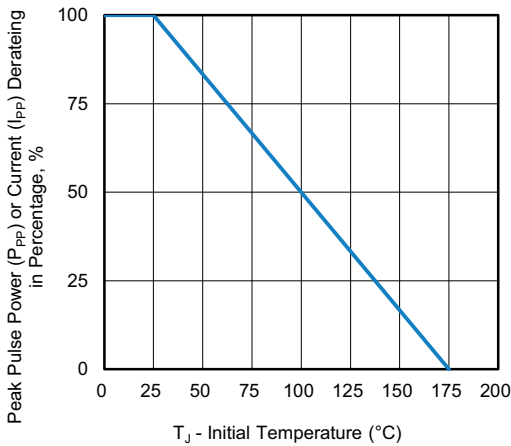


Fig. 2 - Pulse Power or Current vs. Initial Junction Temperature

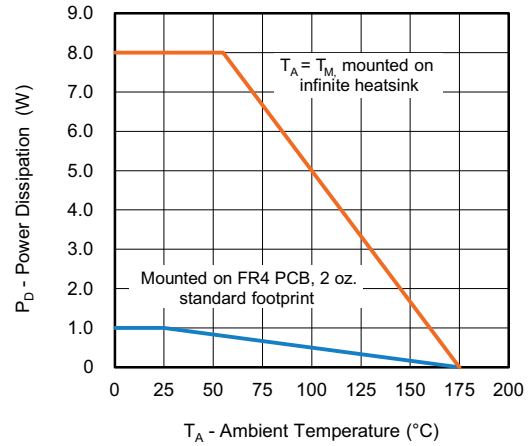


Fig. 5 - Power Dissipation Derating Curve

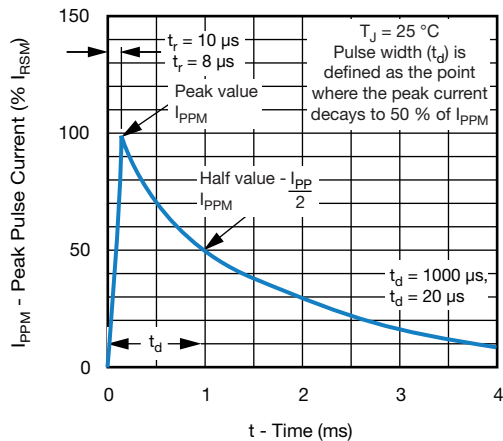


Fig. 3 - Pulse Waveform

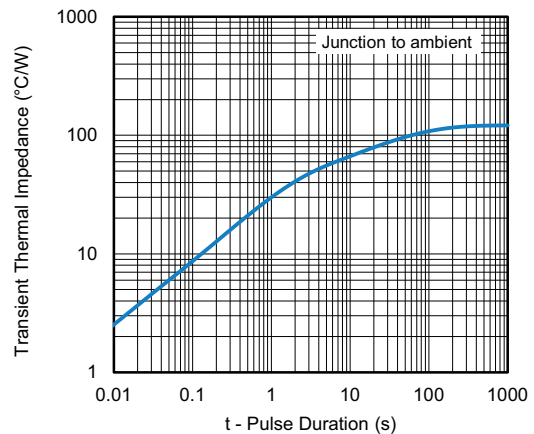


Fig. 6 - Typical Transient Thermal Impedance

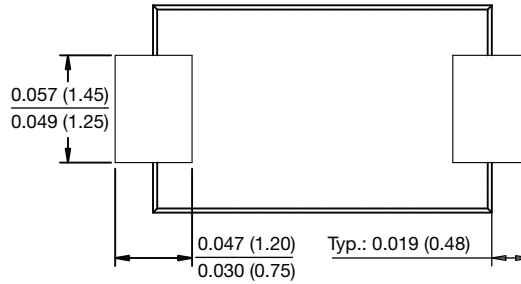
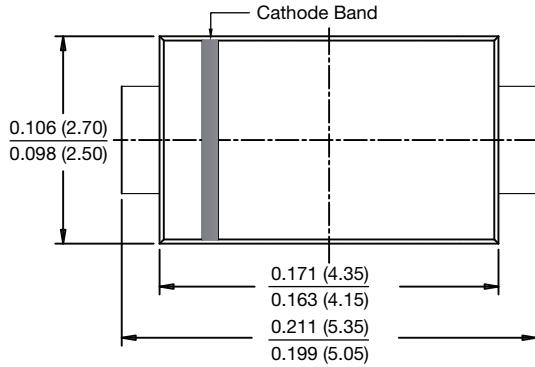
Notes

- Fig. 1 - Power calculation is based on I_{PPM} times defined maximum clamping voltage by pulse width
- Fig. 1 - 10 000 μs P_{PPM} is actual test for $V_{WM} \leq 60\text{ V}$ types, over 60 V types 10 000 μs P_{PPM} is curve extensional value

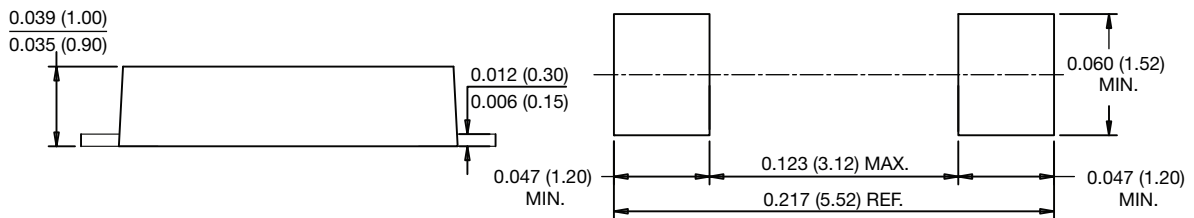


PACKAGE OUTLINE DIMENSIONS in inches (millimeters)

SlimSMA (DO-221AC)



Mounting Pad Layout





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