



**THE DATASHEET OF
SZ1SMB17AT3G**



SZ1SMB Series

Surface Mount



Description

The SZ1SMB series is designed to protect voltage sensitive components from high voltage, high energy transients. They have excellent clamping and high surge capability, as well as fast response time. The SZ1SMB series is supplied in the Littelfuse exclusive, cost-effective, highly reliable package and is ideally suited for use in communication systems, automotive, numerical controls, process controls, medical equipment, business machines, power supplies and many other industrial and consumer applications.

Features & Benefits

- Zener Transient Overvoltage Suppressors
- Working Peak Reverse Voltage Range – 5.0 V to 170 V for uni-directional, and 10 V to 75 V for bi-directional
- Standard Avalanche Breakdown Voltage Range –6.4 V to 209 V for uni-directional, 11.1 V to 92.07 V for bi-directional
- Peak Power – 600 W @ 1.0 ms
- ESD Rating of Class 3 (> 16 kV) per Human Body Model
- Maximum Clamp Voltage @ Peak Pulse Current
- Low Leakage < 5.0 μ A Above 10 V
- Intended for UL 497B Type Protection
- Response Time is Typically < 1.0 ns
- Pb-free means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-609A.01)
- SZ Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable

Additional Information



Resources



Accessories



Samples

Agency Approvals

| Agency | Agency File Number |
|--------|--------------------|
| | E128662 |

Maximum Ratings and Thermal Characteristics

| Parameter | Symbol | Value | Unit |
|---|--------------------|-------------|----------------------------|
| Peak Power Dissipation (Note 1) @ $T_L = 25^\circ\text{C}$, Pulse Width = 1 ms | P_{PK} | 600 | W |
| DC Power Dissipation @ $T_L = 75^\circ\text{C}$ | P_D | 3.0 | W |
| Measured Zero Lead Length ^(Note 2) | $R_{\theta JL}$ | 40 | $\text{mW}/^\circ\text{C}$ |
| Derate Above 75°C | $R_{\theta JA}$ | 25 | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance from Junction-to-Lead | | | |
| DC Power Dissipation ^(Note 3) @ $T_A = 25^\circ\text{C}$ | P_D | 0.55 | W |
| Derate Above 25°C | $R_{\theta JA}$ | 4.4 | $\text{mW}/^\circ\text{C}$ |
| Thermal Resistance from Junction-to-Ambient | $R_{\theta JA}$ | 226 | $^\circ\text{C}/\text{W}$ |
| Forward Surge Current (Note 4) @ $T_A = 25^\circ\text{C}$ | I_{FSM} | 100 | A |
| Operating and Storage Temperature Range | T_J T_{stg} | -65 to +150 | $^\circ\text{C}$ |

Stresses exceeding those listed in the Maximum Ratings table may damage the component. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

- 10/1000 μ s, non-repetitive.
- 1" square copper pad, FR-4 board.
- FR-4 board, using Littelfuse minimum recommended footprint
- 1/2 sine wave (or equivalent square wave), PW = 8.3 ms, duty cycle = 4 pulses per minute maximum - For Unidirectional only.

Functional Diagram



SZ1SMB Series

Surface Mount

I-V Curve Characteristics

($T_A = 25^\circ\text{C}$ unless otherwise noted, $V_F = 3.5\text{ V Max. @ } I_F \text{ (Note 5) } = 30\text{ A}$) **For Uni-directional**



| Symbol | Parameter |
|-----------|---|
| I_{PP} | Maximum Reverse Peak Pulse Current |
| V_C | Clamping Voltage @ I_{PP} |
| V_{RWM} | Working Peak Reverse Voltage |
| I_R | Maximum Reverse Leakage Current @ V_{RWM} |
| V_{BR} | Breakdown Voltage @ I_T |
| I_T | Breakdown Current |
| V_F | Forward Voltage @ I_F |
| I_F | Forward Current |

5. 1/2 sine wave (or equivalent square wave), PW = 8.3 ms, non-repetitive duty cycle.

I-V Curve Characteristics

($T_A = 25^\circ\text{C}$ unless otherwise noted) **For Bi-directional**



| Symbol | Parameter |
|-----------|---|
| I_{PP} | Maximum Reverse Peak Pulse Current |
| V_C | Clamping Voltage @ I_{PP} |
| V_{RWM} | Working Peak Reverse Voltage |
| I_R | Maximum Reverse Leakage Current @ V_{RWM} |
| V_{BR} | Breakdown Voltage @ I_T |
| I_T | On-State Current |

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Electrical Characteristics - For Uni-directional

| Device | Device Marking | V_{RWM} (Note 5) | I_R @ V_{RWM} | Breakdown Voltage | | | | V_C @ I_{PP} (Note 8) | | Capacitance (Typical) ^(Note 9) |
|---------------|----------------|-----------------------|----------------------|-------------------------------|--------|--------|---------|------------------------------|----------|--|
| | | | | V_{BR} @ I_T (V) (Note 7) | | | @ I_T | V_C | I_{PP} | |
| | | | | Min | Nom | Max | | | | |
| SZ1SMB5.0AT3G | KE | 5.0 | 800 | 6.40 | 6.70 | 7.00 | 10 | 9.2 | 65.2 | 2700 |
| SZ1SMB6.0AT3G | KG | 6.0 | 800 | 6.67 | 7.02 | 7.37 | 10 | 10.3 | 58.3 | 2300 |
| SZ1SMB6.5AT3G | KK | 6.5 | 500 | 7.22 | 7.60 | 7.98 | 10 | 11.2 | 53.6 | 2140 |
| SZ1SMB7.0AT3G | KM | 7.0 | 500 | 7.78 | 8.19 | 8.60 | 10 | 12.0 | 50.0 | 2005 |
| SZ1SMB7.5AT3G | KP | 7.5 | 100 | 8.33 | 8.77 | 9.21 | 1.0 | 12.9 | 46.5 | 1890 |
| SZ1SMB8.0AT3G | KR | 8.0 | 50 | 8.89 | 9.36 | 9.83 | 1.0 | 13.6 | 44.1 | 1780 |
| SZ1SMB8.5AT3G | KT | 8.5 | 10 | 9.44 | 9.92 | 10.40 | 1.0 | 14.4 | 41.7 | 1690 |
| SZ1SMB9.0AT3G | KV | 9.0 | 5.0 | 10.00 | 10.55 | 11.10 | 1.0 | 15.4 | 39.0 | 1605 |
| SZ1SMB10AT3G | KX | 10 | 5.0 | 11.10 | 11.70 | 12.30 | 1.0 | 17.0 | 35.3 | 1460 |
| SZ1SMB11AT3G | KZ | 11 | 5.0 | 12.20 | 12.85 | 13.50 | 1.0 | 18.2 | 33.0 | 1345 |
| SZ1SMB12AT3G | LE | 12 | 5.0 | 13.30 | 14.00 | 14.70 | 1.0 | 19.9 | 30.2 | 1245 |
| SZ1SMB13AT3G | LG | 13 | 5.0 | 14.40 | 15.15 | 15.90 | 1.0 | 21.5 | 27.9 | 1160 |
| SZ1SMB14AT3G | LK | 14 | 5.0 | 15.60 | 16.40 | 17.20 | 1.0 | 23.2 | 25.8 | 1085 |
| SZ1SMB15AT3G | LM | 15 | 5.0 | 16.70 | 17.60 | 18.50 | 1.0 | 24.4 | 24.0 | 1020 |
| SZ1SMB16AT3G | LP | 16 | 5.0 | 17.80 | 18.75 | 19.70 | 1.0 | 26.0 | 23.1 | 965 |
| SZ1SMB17AT3G | LR | 17 | 5.0 | 18.90 | 19.90 | 20.90 | 1.0 | 27.6 | 21.7 | 915 |
| SZ1SMB18AT3G | LT | 18 | 5.0 | 20.00 | 21.05 | 22.10 | 1.0 | 29.2 | 20.5 | 870 |
| SZ1SMB20AT3G | LV | 20 | 5.0 | 22.20 | 23.35 | 24.50 | 1.0 | 32.4 | 18.5 | 790 |
| SZ1SMB22AT3G | LX | 22 | 5.0 | 24.40 | 25.65 | 26.90 | 1.0 | 35.5 | 16.9 | 730 |
| SZ1SMB24AT3G | LZ | 24 | 5.0 | 26.70 | 28.10 | 29.50 | 1.0 | 38.9 | 15.4 | 675 |
| SZ1SMB26AT3G | ME | 26 | 5.0 | 28.90 | 30.40 | 31.90 | 1.0 | 42.1 | 14.2 | 630 |
| SZ1SMB28AT3G | MG | 28 | 5.0 | 31.10 | 32.75 | 34.40 | 1.0 | 45.4 | 13.2 | 590 |
| SZ1SMB30AT3G | MK | 30 | 5.0 | 33.30 | 35.05 | 36.80 | 1.0 | 48.4 | 12.4 | 555 |
| SZ1SMB33AT3G | MM | 33 | 5.0 | 36.70 | 38.65 | 40.60 | 1.0 | 53.3 | 11.3 | 510 |
| SZ1SMB36AT3G | MP | 36 | 5.0 | 40.00 | 42.10 | 44.20 | 1.0 | 58.1 | 10.3 | 470 |
| SZ1SMB40AT3G | MR | 40 | 5.0 | 44.40 | 46.75 | 49.10 | 1.0 | 64.5 | 9.3 | 430 |
| SZ1SMB43AT3G | MT | 43 | 5.0 | 47.80 | 50.30 | 52.80 | 1.0 | 69.4 | 8.6 | 400 |
| SZ1SMB45AT3G | MV | 45 | 5.0 | 50.00 | 52.65 | 55.30 | 1.0 | 72.7 | 8.3 | 385 |
| SZ1SMB48AT3G | MX | 48 | 5.0 | 53.30 | 56.10 | 58.90 | 1.0 | 77.4 | 7.7 | 365 |
| SZ1SMB51AT3G | MZ | 51 | 5.0 | 56.70 | 59.70 | 62.70 | 1.0 | 82.4 | 7.3 | 345 |
| SZ1SMB54AT3G | NE | 54 | 5.0 | 60.00 | 63.15 | 66.30 | 1.0 | 87.1 | 6.9 | 330 |
| SZ1SMB58AT3G | NG | 58 | 5.0 | 64.40 | 67.80 | 71.20 | 1.0 | 93.6 | 6.4 | 310 |
| SZ1SMB60AT3G | NK | 60 | 5.0 | 66.70 | 70.20 | 73.70 | 1.0 | 96.8 | 6.2 | 300 |
| SZ1SMB64AT3G | NM | 64 | 5.0 | 71.10 | 74.85 | 78.60 | 1.0 | 103 | 5.8 | 280 |
| SZ1SMB70AT3G | NP | 70 | 5.0 | 77.80 | 81.90 | 86.00 | 1.0 | 113 | 5.3 | 260 |
| SZ1SMB75AT3G | NR | 75 | 5.0 | 83.30 | 87.70 | 92.10 | 1.0 | 121 | 4.9 | 245 |
| SZ1SMB85AT3G | NV | 85 | 55.0 | 94.40 | 99.20 | 104.00 | 1.0 | 137 | 4.4 | 220 |
| SZ1SMB90AT3G | NX | 90 | 5.0 | 100.00 | 105.50 | 111.00 | 1.0 | 146 | 4.1 | 210 |
| SZ1SMB100AT3G | NZ | 100 | 5.0 | 111.00 | 117.00 | 123.00 | 1.0 | 162 | 3.7 | 190 |
| SZ1SMB110AT3G | PE | 110 | 5.0 | 122.00 | 128.50 | 135.00 | 1.0 | 177 | 3.4 | 175 |
| SZ1SMB120AT3G | PG | 120 | 5.0 | 133.00 | 140.00 | 147.00 | 1.0 | 193 | 3.1 | 160 |
| SZ1SMB130AT3G | PK | 130 | 5.0 | 144.00 | 151.50 | 159.00 | 1.0 | 209 | 2.9 | 150 |
| SZ1SMB150AT3G | PM | 150 | 5.0 | 167.00 | 176.00 | 185.00 | 1.0 | 243 | 2.5 | 135 |
| SZ1SMB160AT3G | PP | 160 | 5.0 | 178.00 | 187.50 | 197.00 | 1.0 | 259 | 2.3 | 125 |
| SZ1SMB170AT3G | PR | 170 | 5.0 | 189.00 | 199.00 | 209.00 | 1.0 | 275 | 2.2 | 120 |

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Electrical Characteristics - For Bi-directional

| Device | Device Marking | V_{RWM} (Note 6) | $I_R @$ V_{RWM} | Breakdown Voltage | | | | $V_C @ I_{PP}$ (Note 8) | |
|---------------|----------------|-----------------------|----------------------|-----------------------------|-------|-------|---------|----------------------------|----------|
| | | | | $V_{BR} @ I_T$ (V) (Note 7) | | | @ I_T | V_C | I_{PP} |
| | | | | MIN | NOM | MAX | mA | Volts | Amps |
| SZ1SMB10CAT3G | KXC | 10 | 5.0 | 11.1 | 11.69 | 12.27 | 1.0 | 17.0 | 35.3 |
| SZ1SMB11CAT3G | KZC | 11 | 5.0 | 12.2 | 12.84 | 13.5 | 1.0 | 18.2 | 33.0 |
| SZ1SMB12CAT3G | LEC | 12 | 5.0 | 13.3 | 14.00 | 14.7 | 1.0 | 19.9 | 30.2 |
| SZ1SMB13CAT3G | LGC | 13 | 5.0 | 14.4 | 15.16 | 15.9 | 1.0 | 21.5 | 27.9 |
| SZ1SMB14CAT3G | LKC | 14 | 5.0 | 15.6 | 16.42 | 17.2 | 1.0 | 23.2 | 25.8 |
| SZ1SMB15CAT3G | LMC | 15 | 5.0 | 16.7 | 17.58 | 18.5 | 1.0 | 24.4 | 24.0 |
| SZ1SMB16CAT3G | LPC | 16 | 5.0 | 17.8 | 18.74 | 19.7 | 1.0 | 26.0 | 23.1 |
| SZ1SMB17CAT3G | LRC | 17 | 5.0 | 18.9 | 19.90 | 20.9 | 1.0 | 27.6 | 21.7 |
| SZ1SMB18CAT3G | LTC | 18 | 5.0 | 20.0 | 21.06 | 22.1 | 1.0 | 29.2 | 20.5 |
| SZ1SMB20CAT3G | LVC | 20 | 5.0 | 22.2 | 23.37 | 24.5 | 1.0 | 32.4 | 18.5 |
| SZ1SMB22CAT3G | LXC | 22 | 5.0 | 24.4 | 25.69 | 27.0 | 1.0 | 35.5 | 16.9 |
| SZ1SMB24CAT3G | LZC | 24 | 5.0 | 26.7 | 28.11 | 29.5 | 1.0 | 38.9 | 15.4 |
| SZ1SMB26CAT3G | MEC | 26 | 5.0 | 28.9 | 30.42 | 31.9 | 1.0 | 42.1 | 14.2 |
| SZ1SMB28CAT3G | MGC | 28 | 5.0 | 31.1 | 32.74 | 34.4 | 1.0 | 45.4 | 13.2 |
| SZ1SMB30CAT3G | MKC | 30 | 5.0 | 33.3 | 35.06 | 36.8 | 1.0 | 48.4 | 12.4 |
| SZ1SMB33CAT3G | MMC | 33 | 5.0 | 36.7 | 38.63 | 40.6 | 1.0 | 53.3 | 11.3 |
| SZ1SMB36CAT3G | MPC | 36 | 5.0 | 40.0 | 42.11 | 44.2 | 1.0 | 58.1 | 10.3 |
| SZ1SMB40CAT3G | MRC | 40 | 5.0 | 44.4 | 46.74 | 49.1 | 1.0 | 64.5 | 9.3 |
| SZ1SMB43CAT3G | MTC | 43 | 5.0 | 47.8 | 50.32 | 52.8 | 1.0 | 69.4 | 8.6 |
| SZ1SMB45CAT3G | MVC | 45 | 5.0 | 50.0 | 52.63 | 55.3 | 1.0 | 72.2 | 8.3 |
| SZ1SMB48CAT3G | MXC | 48 | 5.0 | 53.3 | 56.11 | 58.9 | 1.0 | 77.4 | 7.7 |
| SZ1SMB51CAT3G | MZC | 51 | 5.0 | 56.7 | 59.69 | 62.7 | 1.0 | 82.4 | 7.3 |
| SZ1SMB54CAT3G | NEC | 54 | 5.0 | 60.0 | 63.16 | 66.32 | 1.0 | 87.1 | 6.9 |
| SZ1SMB58CAT3G | NGC | 58 | 5.0 | 64.4 | 67.79 | 71.18 | 1.0 | 93.6 | 6.4 |
| SZ1SMB60CAT3G | NKC | 60 | 5.0 | 66.7 | 70.21 | 73.72 | 1.0 | 96.8 | 6.2 |
| SZ1SMB64CAT3G | NMC | 64 | 5.0 | 71.1 | 74.84 | 78.58 | 1.0 | 103 | 5.8 |
| SZ1SMB75CAT3G | NRC | 75 | 5.0 | 83.3 | 91.65 | 92.07 | 1.0 | 121 | 4.9 |

6. A transient suppressor is normally selected according to the working peak reverse voltage (V_{RWM}), which should be equal to or greater than the DC or continuous peak operating voltage level.

7. V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C.

8. Surge current waveform per Figure 1 and derate per Figure 3 of the General Data - 600 Watt at the beginning of this group.

9. Bias Voltage = 0 V, F = 1 MHz, $T_J = 25^\circ\text{C}$

SZ1SMB Series

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Ratings and Characteristic Curves

Figure 1.
Pulse Rating Curve



Figure 2.
Pulse Waveform



Figure 3.
Surge Derating Curve



Figure 4.
Typical Junction Capacitance vs. Bias Voltage



Figure 5.
Typical Junction Capacitance vs. Bias Voltage



Figure 6.
Typical Protection Circuit



SZ1SMB Series

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Soldering Parameters

| | | |
|--|------------------------------------|-------------------------|
| Reflow Condition | | Lead-free assembly |
| Pre Heat | - Temperature Min ($T_{s(min)}$) | 150°C |
| | - Temperature Max ($T_{s(max)}$) | 200°C |
| | - Time (min to max) (t_s) | 60 – 120 secs |
| Average ramp up rate (Liquidus Temp (T_L) to peak) | | 3°C/second max |
| $T_{s(max)}$ to T_L - Ramp-up Rate | | 3°C/second max |
| Reflow | - Temperature (T_L) (Liquidus) | 217°C |
| | - Time (min to max) (t_L) | 60 – 150 seconds |
| Peak Temperature (T_p) | | 260 ^{+0/-5} °C |
| Time within 5°C of actual peak Temperature (t_p) | | 30 seconds max |
| Ramp-down Rate | | 6°C/second max |
| Time 25°C to peak Temperature (T_p) | | 8 minutes max. |
| Do not exceed | | 260°C |



Physical Specifications

| | |
|-----------------|---|
| Weight | 0.00326 ounce, 0.1015 grams |
| Case | JEDEC DO214AA. Void-Free, Transfer-Molded, Thermosetting Plastic Epoxy Meets UL 94V-0 |
| Polarity | Color band denotes cathode for unidirectional components. |
| Terminal | Matte Tin-plated leads, Solderable per, JESD22-B102 |

Environmental Specifications

| | |
|----------------------------|--------------------------|
| High Temp. Storage | JESD22-A103 |
| HTRB | JESD22-A108 |
| Temperature Cycling | JESD22-A104 |
| MSL | JEDEC-J-STD-020, Level 1 |
| H3TRB | JESD22-A101 |
| RSH | JESD22-A111 |

Dimensions



| Dim | Inches | | | Millimeters | | |
|-----------|-----------|-------|-------|-------------|------|------|
| | Min | Nom | Max | Min | Nom | Max |
| A | 0.077 | 0.091 | 0.097 | 1.95 | 2.30 | 2.47 |
| A1 | 0.002 | 0.004 | 0.008 | 0.05 | 0.10 | 0.20 |
| b | 0.077 | 0.080 | 0.087 | 1.96 | 2.03 | 2.20 |
| c | 0.006 | 0.009 | 0.012 | 0.15 | 0.23 | 0.31 |
| D | 0.130 | 0.140 | 0.156 | 3.30 | 3.56 | 3.95 |
| E | 0.160 | 0.170 | 0.181 | 4.06 | 4.32 | 4.60 |
| HE | 0.205 | 0.214 | 0.220 | 5.21 | 5.44 | 5.60 |
| L | 0.030 | 0.040 | 0.063 | 0.76 | 1.02 | 1.60 |
| L1 | 0.020 REF | | | 0.51 REF | | |

Soldering Footprint



Ordering Information

| Device | Package | Shipping |
|---------------|---------------|--------------------|
| SZ1SMBxxAT3G | SMB (Pb-Free) | 2,500 /Tape & Reel |
| SZ1SMBxxCAT3G | SMB (Pb-Free) | 2,500 /Tape & Reel |

SZ1SMB Series

Surface Mount

Part Marking System



XXXX =Device Code (max four digits)
Y =Year
M =Month
A =Assembly Location
WW =Lot Code

Part Numbering System



Tape and Reel Specification



Cathode mark for uni-directional components



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