# MMBZxxxALT1G Series, SZMMBZxxxALT1G Series

# Zener Diodes, 24 and 40 Watt Peak Power

## SOT−23 Dual Common Anode Zeners

These dual monolithic silicon Zener diodes are designed for applications requiring transient overvoltage protection capability. They are intended for use in voltage and ESD sensitive equipment such as computers, printers, business machines, communication systems, medical equipment and other applications. Their dual junction common anode design protects two separate lines using only one package. These devices are ideal for situations where board space is at a premium.

### Features

- SOT−23 Package Allows Either Two Separate Unidirectional Configurations or a Single Bidirectional Configuration
- Standard Zener Breakdown Voltage Range − 5.6 V to 47 V
- Peak Power − 24 or 40 W @ 1.0 ms (Unidirectional), per Figure 6 Waveform
- ESD Rating:
  - − Class 3B (> 16 kV) per the Human Body Model
  - − Class C (> 400 V) per the Machine Model
- ESD Rating of IEC61000−4−2 Level 4, ±30 kV Contact Discharge
- Maximum Clamping Voltage @ Peak Pulse Current
- Low Leakage < 5.0 μA
- Flammability Rating UL 94 V−0
- SZ Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free and are RoHS Compliant

### Mechanical Characteristics

**CASE:** Void-free, transfer-molded, thermosetting plastic case
**FINISH:** Corrosion resistant finish, easily solderable
**MAXIMUM CASE TEMPERATURE FOR SOLDERING PURPOSES:**
260°C for 10 Seconds
Package designed for optimal automated board assembly
Small package size for high density applications
Available in 8 mm Tape and Reel

Use the Device Number to order the 7 inch/3,000 unit reel.
Replace the “T1” with “T3” in the Device Number to order the 13 inch/10,000 unit reel.

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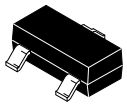
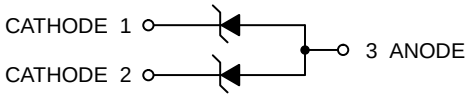
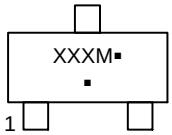


**SOT−23**
**CASE 318**
**STYLE 12**




**MARKING DIAGRAM**




XXX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

(Note: Microdot may be in either location)

**ORDERING INFORMATION**

See detailed ordering and shipping information on page 2 of this data sheet.

**DEVICE MARKING INFORMATION**

See specific marking information in the device marking column of the table on page 3 of this data sheet.

## MAXIMUM RATINGS

| Rating | | Symbol | Value | Unit |
|---|---|---|---|---|
| Peak Power Dissipation @ 1.0 ms (Note 1)<br>@ $T_L \le 25°C$ | MMBZ5V6ALT1G thru MMBZ9V1ALT1G<br>MMBZ12VALT1G thru MMBZ47VALT1G | $P_{pk}$ | 24<br>40 | W |
| Total Power Dissipation on FR−5 Board (Note 2)<br>@ $T_A = 25°C$<br>Derate above 25°C | | $P_D$ | <br>225<br>1.8 | <br>mW<br>mW/°C |
| Thermal Resistance Junction−to−Ambient | | $R_{\theta JA}$ | 556 | °C/W |
| Total Power Dissipation on Alumina Substrate (Note 3)<br>@ $T_A = 25°C$<br>Derate above 25°C | | $P_D$ | <br>300<br>2.4 | <br>mW<br>mW/°C |
| Thermal Resistance Junction−to−Ambient | | $R_{\theta JA}$ | 417 | °C/W |
| Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | − 55 to +150 | °C |
| Lead Solder Temperature − Maximum (10 Second Duration) | | $T_L$ | 260 | °C |

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

1. Non−repetitive current pulse per Figure 6 and derate above $T_A = 25°C$ per Figure 7.
2. FR−5 = 1.0 x 0.75 x 0.62 in.
3. Alumina = 0.4 x 0.3 x 0.024 in, 99.5% alumina.

*Other voltages may be available upon request.

## ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| MMBZ5V6ALT1G | SOT−23<br>(Pb−Free) | 3,000 / Tape & Reel |
| SZMMBZ5V6ALT1G* | SOT−23<br>(Pb−Free) | 3,000 / Tape & Reel |
| MMBZ5V6ALT3G | SOT−23<br>(Pb−Free) | 10,000 / Tape & Reel |
| MMBZ6VxALT1G | SOT−23<br>(Pb−Free) | 3,000 / Tape & Reel |
| SZMMBZ6VxALT1G* | SOT−23<br>(Pb−Free) | 3,000 / Tape & Reel |
| MMBZ6VxALT3G | SOT−23<br>(Pb−Free) | 10,000 / Tape & Reel |
| MMBZ9V1ALT1G | SOT−23<br>(Pb−Free) | 3,000 / Tape & Reel |
| MMBZ9V1ALT13G | SOT−23<br>(Pb−Free) | 10,000 / Tape & Reel |
| MMBZxxVALT1G | SOT−23<br>(Pb−Free) | 3,000 / Tape & Reel |
| SZMMBZxxVALT1G* | SOT−23<br>(Pb−Free) | 3,000 / Tape & Reel |
| MMBZxxVALT3G | SOT−23<br>(Pb−Free) | 10,000 / Tape & Reel |
| SZMMBZxxVALT3G* | SOT−23<br>(Pb−Free) | 10,000 / Tape & Reel |
| SZMMBZxxVTALT1G* | SOT−23<br>(Pb−Free) | 3,000 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

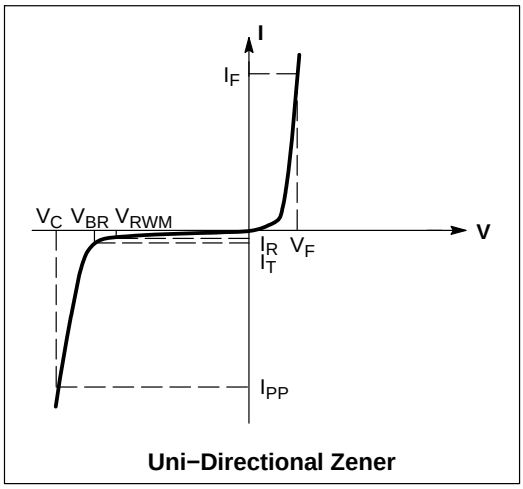
*SZ Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable

## ELECTRICAL CHARACTERISTICS

($T_A$ = 25°C unless otherwise noted)

**UNIDIRECTIONAL** (Circuit tied to Pins 1 and 3 or 2 and 3)

| 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 @ $I_T$ |
| $I_T$ | Test Current |
| $\Theta V_{BR}$ | Maximum Temperature Coefficient of $V_{BR}$ |
| $I_F$ | Forward Current |
| $V_F$ | Forward Voltage @ $I_F$ |
| $Z_{ZT}$ | Maximum Zener Impedance @ $I_{ZT}$ |
| $I_{ZK}$ | Reverse Current |
| $Z_{ZK}$ | Maximum Zener Impedance @ $I_{ZK}$ |



Uni−Directional Zener

## ELECTRICAL CHARACTERISTICS ($T_A$ = 25°C unless otherwise noted)

**UNIDIRECTIONAL** (Circuit tied to Pins 1 and 3 or Pins 2 and 3)

($V_F$ = 0.9 V Max @ $I_F$ = 10 mA) (5% Tolerance) **24 WATTS**

| Device* | Device Marking | $V_{RWM}$ | $I_R$ @ $V_{RWM}$ | Breakdown Voltage $V_{BR}$ (Note 4) (V) | | | @ $I_T$ | Max Zener Impedance (Note 5) $Z_{ZT}$ @ $I_{ZT}$ | $Z_{ZK}$ @ $I_{ZK}$ | | $V_C$ @ $I_{PP}$ (Note 6) $V_C$ | $I_{PP}$ | $\Theta V_{BR}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Volts | μA | Min | Nom | Max | mA | Ω | Ω | mA | V | A | mV/°C |
| MMBZ5V6ALT1G/T3G | 5A6 | 3.0 | 5.0 | 5.32 | 5.6 | 5.88 | 20 | 11 | 1600 | 0.25 | 8.0 | 3.0 | 1.26 |
| MMBZ6V2ALT1G | 6A2 | 3.0 | 0.5 | 5.89 | 6.2 | 6.51 | 1.0 | – | – | – | 8.7 | 2.76 | 2.80 |
| MMBZ6V8ALT1G | 6A8 | 4.5 | 0.5 | 6.46 | 6.8 | 7.14 | 1.0 | – | – | – | 9.6 | 2.5 | 3.4 |
| MMBZ9V1ALT1G | 9A1 | 6.0 | 0.3 | 8.65 | 9.1 | 9.56 | 1.0 | – | – | – | 14 | 1.7 | 7.5 |

($V_F$ = 0.9 V Max @ $I_F$ = 10 mA) (5% Tolerance) **40 WATTS**

| Device* | Device Marking | $V_{RWM}$ | $I_R$ @ $V_{RWM}$ | Breakdown Voltage $V_{BR}$ (Note 4) (V) | | | @ $I_T$ | $V_C$ @ $I_{PP}$ (Note 6) $V_C$ | $I_{PP}$ | $\Theta V_{BR}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Volts | nA | Min | Nom | Max | mA | V | A | mV/°C |
| MMBZ12VALT1G | 12A | 8.5 | 200 | 11.40 | 12 | 12.60 | 1.0 | 17 | 2.35 | 7.5 |
| MMBZ15VALT1G | 15A | 12 | 50 | 14.25 | 15 | 15.75 | 1.0 | 21 | 1.9 | 12.3 |
| MMBZ16VALT1G | 16A | 13 | 50 | 15.20 | 16 | 16.80 | 1.0 | 23 | 1.7 | 13.8 |
| MMBZ18VALT1G | 18A | 14.5 | 50 | 17.10 | 18 | 18.90 | 1.0 | 25 | 1.6 | 15.3 |
| MMBZ20VALT1G | 20A | 17 | 50 | 19.00 | 20 | 21.00 | 1.0 | 28 | 1.4 | 17.2 |
| MMBZ27VALT1G/T3G | 27A | 22 | 50 | 25.65 | 27 | 28.35 | 1.0 | 40 | 1.0 | 24.3 |
| MMBZ33VALT1G | 33A | 26 | 50 | 31.35 | 33 | 34.65 | 1.0 | 46 | 0.87 | 30.4 |
| MMBZ47VALT1G | 47A | 38 | 50 | 44.65 | 47 | 49.35 | 1.0 | 54 | 0.74 | 43.1 |

($V_F$ = 0.9 V Max @ $I_F$ = 10 mA) (2% Tolerance) **40 WATTS**

| Device* | Device Marking | $V_{RWM}$ | $I_R$ @ $V_{RWM}$ | Breakdown Voltage $V_{BR}$ (Note 4) (V) | | | @ $I_T$ | $V_C$ @ $I_{PP}$ (Note 6) $V_C$ | $I_{PP}$ | $\Theta V_{BR}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Volts | nA | Min | Nom | Max | mA | V | A | mV/°C |
| MMBZ16VTALT1G | 16T | 13 | 50 | 15.68 | 16 | 16.32 | 1.0 | 23 | 1.7 | 13.8 |
| MMBZ47VTALT1G | 47T | 38 | 50 | 46.06 | 47 | 47.94 | 1.0 | 54 | 0.74 | 43.1 |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. $V_{BR}$ measured at pulse test current $I_T$ at an ambient temperature of 25°C.
5. $Z_{ZT}$ and $Z_{ZK}$ are measured by dividing the AC voltage drop across the device by the AC current applied. The specified limits are for $I_{Z(AC)}$ = 0.1 $I_{Z(DC)}$, with the AC frequency = 1.0 kHz.
6. Surge current waveform per Figure 6 and derate per Figure 7

* Include SZ-prefix devices where applicable.

## TYPICAL CHARACTERISTICS

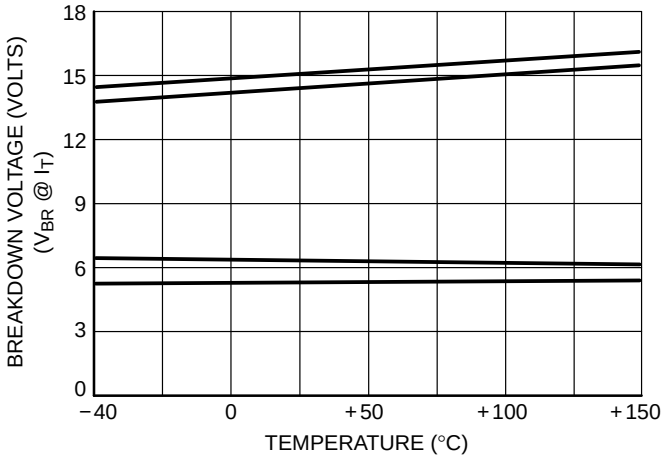



**Figure 1. Typical Breakdown Voltage versus Temperature**
(Upper curve for each voltage is bidirectional mode, lower curve is unidirectional mode)

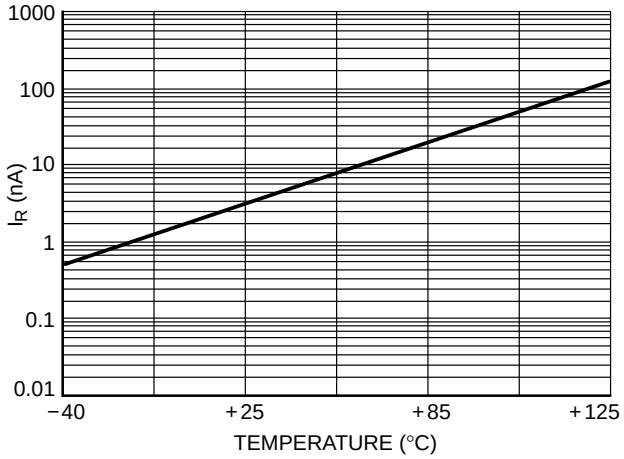



**Figure 2. Typical Leakage Current versus Temperature**

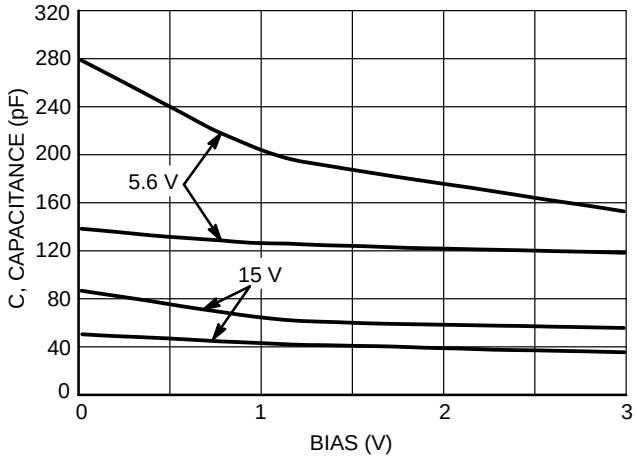



**Figure 3. Typical Capacitance versus Bias Voltage**
(Upper curve for each voltage is unidirectional mode, lower curve is bidirectional mode)

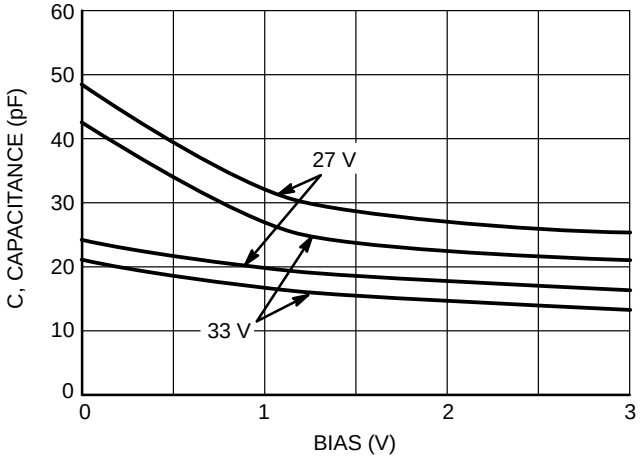



**Figure 4. Typical Capacitance versus Bias Voltage**
(Upper curve for each voltage is unidirectional mode, lower curve is bidirectional mode)

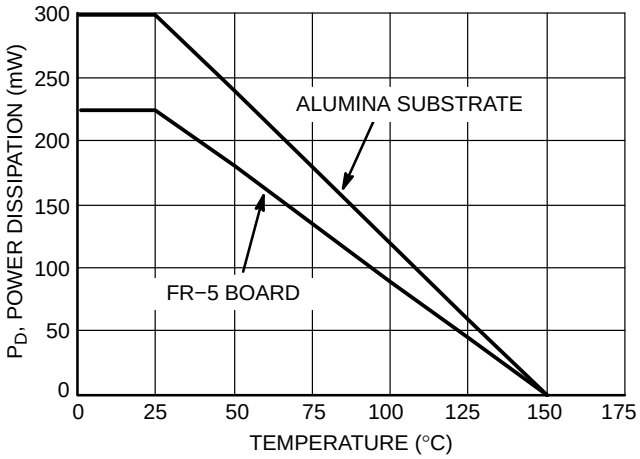



**Figure 5. Steady State Power Derating Curve**

## TYPICAL CHARACTERISTICS

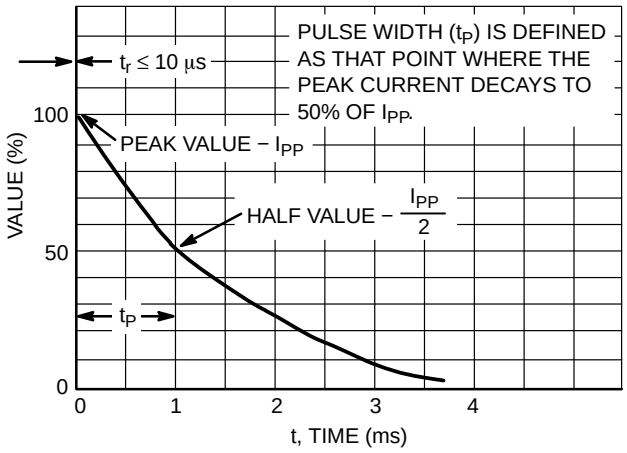



**Figure 6. Pulse Waveform**

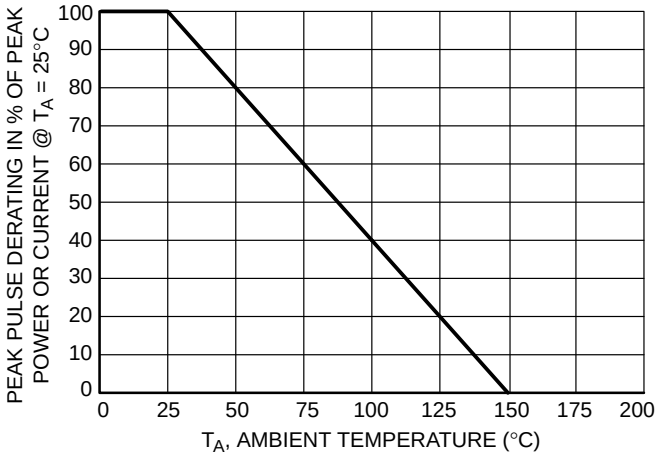



**Figure 7. Pulse Derating Curve**

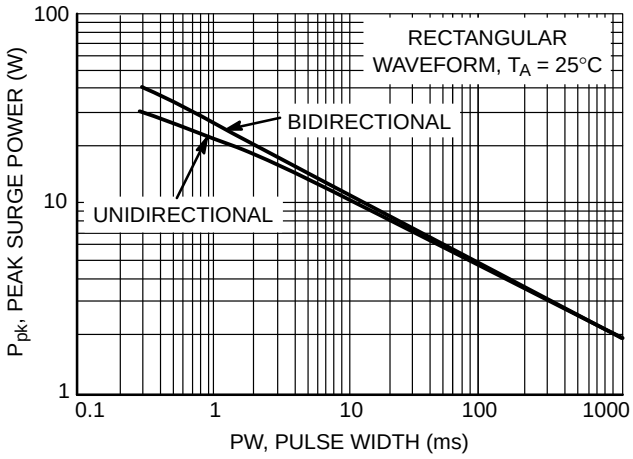



**Figure 8. Maximum Non−repetitive Surge Power, $P_{pk}$ versus PW**

Power is defined as $V_{RSM}$ x $I_Z$(pk) where $V_{RSM}$ is the clamping voltage at $I_Z$(pk).

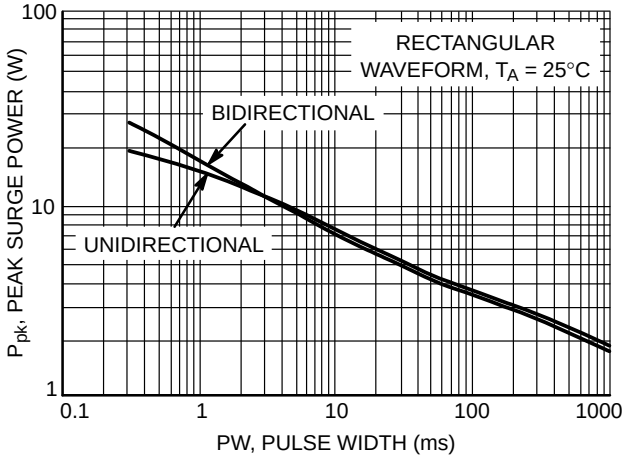


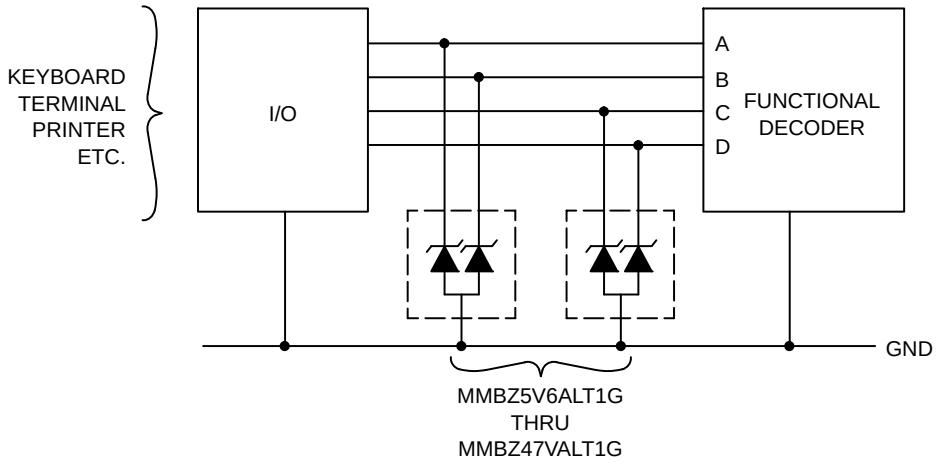

**Figure 9. Maximum Non−repetitive Surge Power, $P_{pk}$(NOM) versus PW**

Power is defined as $V_Z$(NOM) x $I_Z$(pk) where $V_Z$(NOM) is the nominal Zener voltage measured at the low test current used for voltage classification.

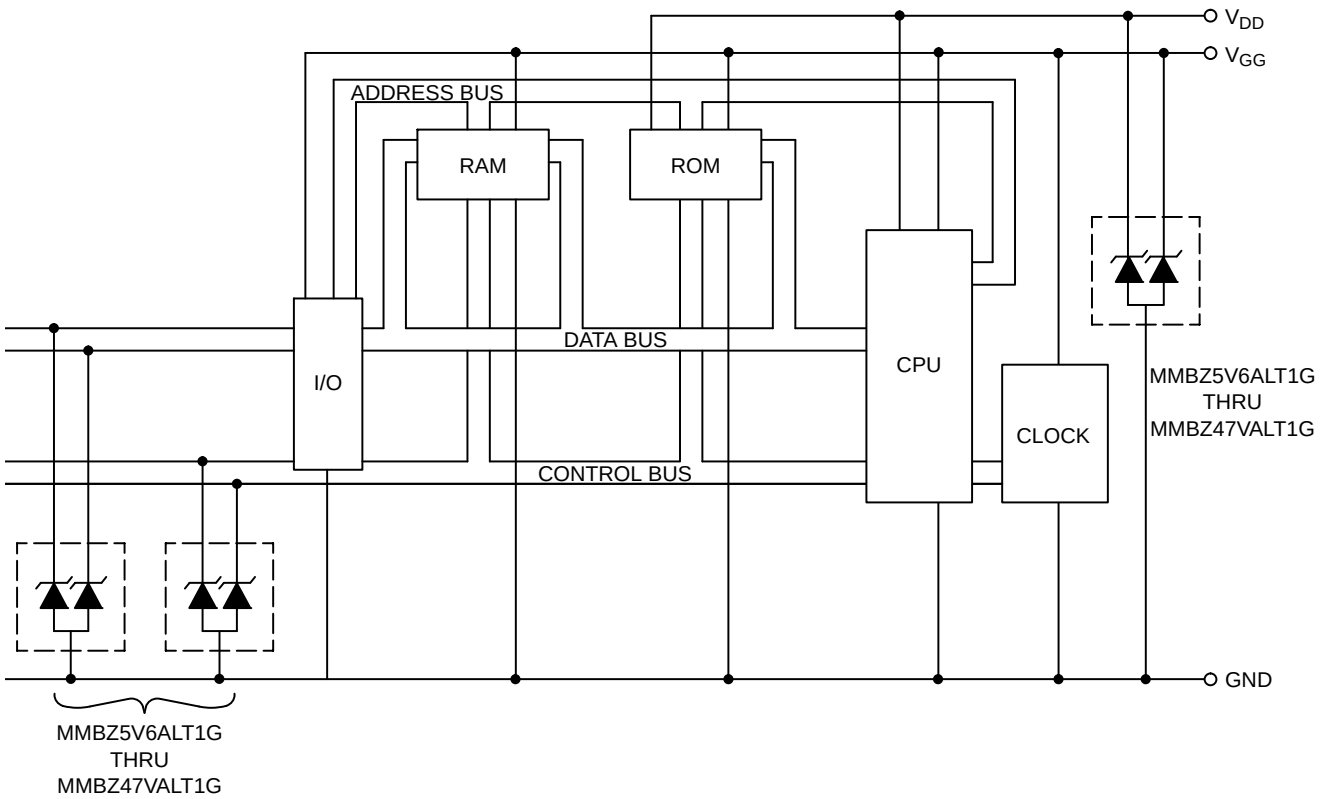
## TYPICAL COMMON ANODE APPLICATIONS

A dual junction common anode design in a SOT−23 package protects two separate lines using only one package. This adds flexibility and creativity to PCB design especially when board space is at a premium. Two simplified examples of ESD applications are illustrated below.

**Computer Interface Protection**




**Microprocessor Protection**



# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

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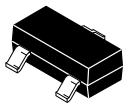
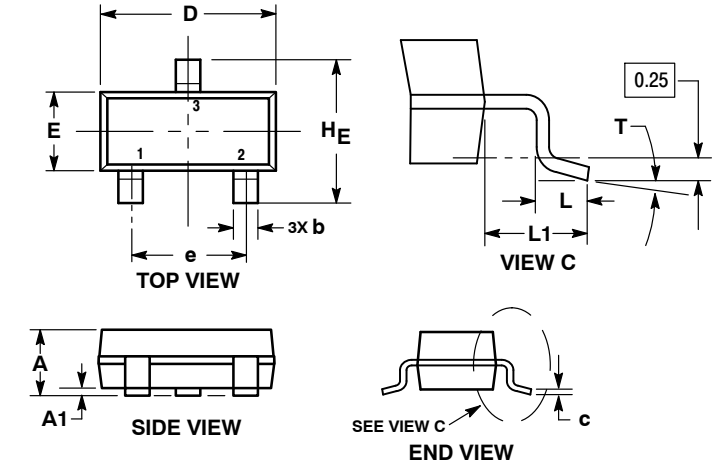


**SOT−23 (TO−236)**
CASE 318−08
ISSUE AS

DATE 30 JAN 2018

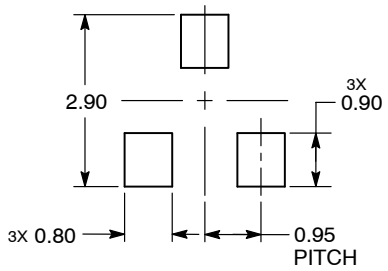
SCALE 4:1




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

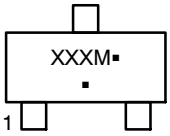
| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.89 | 1.00 | 1.11 | 0.035 | 0.039 | 0.044 |
| A1 | 0.01 | 0.06 | 0.10 | 0.000 | 0.002 | 0.004 |
| b | 0.37 | 0.44 | 0.50 | 0.015 | 0.017 | 0.020 |
| c | 0.08 | 0.14 | 0.20 | 0.003 | 0.006 | 0.008 |
| D | 2.80 | 2.90 | 3.04 | 0.110 | 0.114 | 0.120 |
| E | 1.20 | 1.30 | 1.40 | 0.047 | 0.051 | 0.055 |
| e | 1.78 | 1.90 | 2.04 | 0.070 | 0.075 | 0.080 |
| L | 0.30 | 0.43 | 0.55 | 0.012 | 0.017 | 0.022 |
| L1 | 0.35 | 0.54 | 0.69 | 0.014 | 0.021 | 0.027 |
| $H_E$ | 2.10 | 2.40 | 2.64 | 0.083 | 0.094 | 0.104 |
| T | 0° | −−− | 10° | 0° | −−− | 10° |

### RECOMMENDED SOLDERING FOOTPRINT




DIMENSIONS: MILLIMETERS

### GENERIC MARKING DIAGRAM*




XXX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present.

STYLE 1 THRU 5:
CANCELLED

STYLE 6:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

STYLE 7:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

STYLE 8:
PIN 1. ANODE
2. NO CONNECTION
3. CATHODE

STYLE 9:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 10:
PIN 1. DRAIN
2. SOURCE
3. GATE

STYLE 11:
PIN 1. ANODE
2. CATHODE
3. CATHODE−ANODE

STYLE 12:
PIN 1. CATHODE
2. CATHODE
3. ANODE

STYLE 13:
PIN 1. SOURCE
2. DRAIN
3. GATE

STYLE 14:
PIN 1. CATHODE
2. GATE
3. ANODE

STYLE 15:
PIN 1. GATE
2. CATHODE
3. ANODE

STYLE 16:
PIN 1. ANODE
2. CATHODE
3. CATHODE

STYLE 17:
PIN 1. NO CONNECTION
2. ANODE
3. CATHODE

STYLE 18:
PIN 1. NO CONNECTION
2. CATHODE
3. ANODE

STYLE 19:
PIN 1. CATHODE
2. ANODE
3. CATHODE−ANODE

STYLE 20:
PIN 1. CATHODE
2. ANODE
3. GATE

STYLE 21:
PIN 1. GATE
2. SOURCE
3. DRAIN

STYLE 22:
PIN 1. RETURN
2. OUTPUT
3. INPUT

STYLE 23:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 24:
PIN 1. GATE
2. DRAIN
3. SOURCE

STYLE 25:
PIN 1. ANODE
2. CATHODE
3. GATE

STYLE 26:
PIN 1. CATHODE
2. ANODE
3. NO CONNECTION

STYLE 27:
PIN 1. CATHODE
2. CATHODE
3. CATHODE

STYLE 28:
PIN 1. ANODE
2. ANODE
3. ANODE

| DOCUMENT NUMBER: | 98ASB42226B | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red. |
|---|---|---|
| DESCRIPTION: | SOT−23 (TO−236) | PAGE 1 OF 1 |

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MMBZ12VALT1 MMBZ12VALT1G MMBZ15VALT1 MMBZ15VALT1G MMBZ15VALT3 MMBZ15VALT3G MMBZ18VALT1 MMBZ18VALT1G MMBZ20VALT1 MMBZ20VALT1G MMBZ20VALT3 MMBZ20VALT3G MMBZ27VALT1 MMBZ27VALT1G MMBZ33VALT1 MMBZ33VALT1G MMBZ33VALT3 MMBZ33VALT3G MMBZ5V6ALT1 MMBZ5V6ALT1G MMBZ5V6ALT3 MMBZ5V6ALT3G MMBZ6V2ALT1 MMBZ6V2ALT1G MMBZ6V2ALT3 MMBZ6V2ALT3G MMBZ6V8ALT1 MMBZ6V8ALT1G MMBZ6V8ALT3 MMBZ9V1ALT1 MMBZ9V1ALT1G MMBZ9V1ALT3 MMBZ9V1ALT3G SZMMBZ12VALT1G SZMMBZ18VALT1G SZMMBZ18VALT3G SZMMBZ5V6ALT1G SZMMBZ20VALT3G SZMMBZ33VALT3G SZMMBZ27VALT1G SZMMBZ20VALT1G SZMMBZ15VALT1G SZMMBZ33VALT1G MMBZ27VALT3G SZMMBZ6V2ALT1G SZMMBZ6V8ALT3G SZMMBZ15VALT3G SZMMBZ6V8ALT1G SZMMBZ27VALT3G MMBZ16VALT1G SZMMBZ4252T3G SMMBZ33VALT3G SMMBZ33VALT1G SZMMBZ4252T1G SZMMBZ16VTALT1G SZMMBZ47VTALT1G SZMMBZ47VALT1G MMBZ47VALT1G MMBZ47VTALT1G SZMMBZ9V1ALT3G MMBZ16VTALT1G SZMMBZ16VALT1G S2ZMMBZ18VALT1G S1ZMMBZ12VALT1G S1ZMMBZ27VALT3G