

# Zener Diodes, 24 and 40 Watt Peak Power

## SOT-23 Dual Common Anode Zeners



ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)

## MMBZHxxxALT1G Series, SZMMBZHxxxALT1G Series

These dual monolithic silicon Zener diodes are designed for applications requiring transient overvoltage ESD 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
  - IEC61000-4-2 Level 4, ±30 kV Contact Discharge
- Low Leakage < 5.0 µA
- Flammability Rating UL 94 V-0
- 175°C T<sub>J(MAX)</sub> – Rated for High Temperature, Mission Critical Applications
- 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

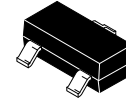
Small package size for high density applications

Available in 8 mm Tape and Reel

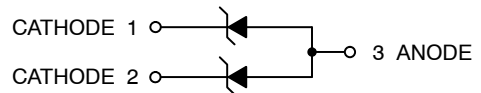
Use the Device Number to order the 7 inch/3,000 unit reel.

Replace the “T1” with “T3” in the Device Number to order the

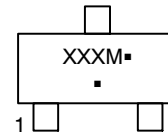
13 inch/10,000 unit reel.



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.

## MMBZHxxxALT1G Series, SZMMBZHxxxALT1G Series

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Power Dissipation @ 1.0 ms (Note 1) MMBZH5V6ALT1G thru MMBZH9V1ALT1G @ $T_L \leq 25^\circ\text{C}$ MMBZH12VALT1G thru MMBZH47VALT1G	$P_{pk}$	24 40	W
Total Power Dissipation on FR-5 Board (Note 2) @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	225 1.5	mW mW/ $^\circ\text{C}$
Thermal Resistance Junction-to-Ambient	$R_{\theta JA}$	540	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to +175	$^\circ\text{C}$
Lead Solder Temperature - Maximum (10 Second Duration)	$T_L$	260	$^\circ\text{C}$

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  $T_A = 25^\circ\text{C}$  per Figure 7.
2. FR-5 = 1.0 x 0.75 x 0.62 in.

### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
MMBZHxVxALT1G	SOT-23 (Pb-Free)	3,000 / Tape & Reel
SZMMBZHxVxALT1G*	SOT-23 (Pb-Free)	3,000 / Tape & Reel
MMBZHxVxALT3G	SOT-23 (Pb-Free)	10,000 / Tape & Reel
SZMMBZHxVxALT3G*	SOT-23 (Pb-Free)	10,000 / Tape & Reel
MMBZHxxVxALT1G	SOT-23 (Pb-Free)	3,000 / Tape & Reel
SZMMBZHxxVxALT1G*	SOT-23 (Pb-Free)	3,000 / Tape & Reel
MMBZHxxVxALT3G	SOT-23 (Pb-Free)	10,000 / Tape & Reel
SZMMBZHxxVxALT3G*	SOT-23 (Pb-Free)	10,000 / Tape & Reel

<sup>†</sup>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

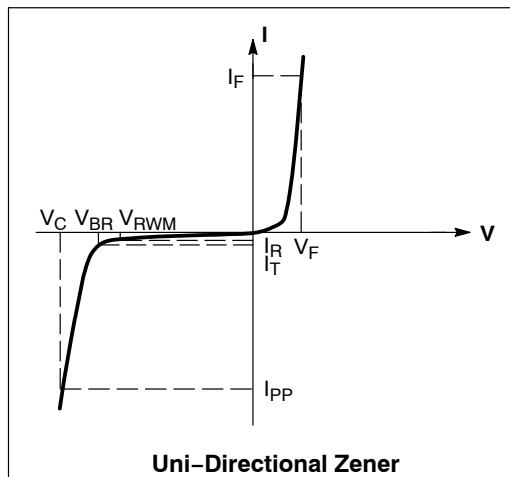
# MMBZHxxxALT1G Series, SZMMBZHxxxALT1G Series

## ELECTRICAL CHARACTERISTICS

( $T_A = 25^\circ\text{C}$  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 @ $I_{ZK}$



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

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

( $V_F = 0.9\text{ V Max @ } I_F = 10\text{ mA}$ ) (5% Tolerance)

**24 WATTS**

Device*	Device Marking	$V_{RWM}$ Volts	$I_R @ V_{RWM}$ $\mu\text{A}$	Breakdown Voltage				Max Zener Impedance (Note 4)			$V_C @ I_{PP}$ (Note 5)		$\Theta V_{BR}$ $\text{mV}/^\circ\text{C}$
				$V_{BR}$ (Note 3) (V)			@ $I_T$ mA	$Z_{ZT}$ @ $I_{ZT}$ $\Omega$	$Z_{ZK}$ @ $I_{ZK}$ $\Omega$	mA	$V_C$ V	$I_{PP}$ A	
				Min	Nom	Max							
MMBZH5V6ALT1G**	5A6	3.0	5.0	5.32	5.6	5.88	20	11	1600	0.25	8.0	3.0	1.26
MMBZH6V2ALT1G**	6A2	3.0	0.5	5.89	6.2	6.51	1.0	-	-	-	8.7	2.76	2.80
MMBZH6V8ALT1G**	6A8	4.5	0.5	6.46	6.8	7.14	1.0	-	-	-	9.6	2.5	3.4
MMBZH9V1ALT1G**	9A1	6.0	0.3	8.65	9.1	9.56	1.0	-	-	-	14	1.7	7.5

( $V_F = 0.9\text{ V Max @ } I_F = 10\text{ mA}$ ) (5% Tolerance)

**40 WATTS**

Device*	Device Marking	$V_{RWM}$ Volts	$I_R @ V_{RWM}$ nA	Breakdown Voltage				$V_C @ I_{PP}$ (Note 5)		$\Theta V_{BR}$ $\text{mV}/^\circ\text{C}$
				$V_{BR}$ (Note 3) (V)			@ $I_T$ mA	$V_C$ V	$I_{PP}$ A	
				Min	Nom	Max				
MMBZH12VALT1G**	12A	8.5	200	11.40	12	12.60	1.0	17	2.35	7.5
MMBZH15VALT1G**	15A	12	50	14.25	15	15.75	1.0	21	1.9	12.3
MMBZH16VALT1G**	16A	13	50	15.20	16	16.80	1.0	23	1.7	13.8
MMBZH18VALT1G	ACJ	14.5	50	17.10	18	18.90	1.0	25	1.6	15.3
MMBZH20VALT1G**	20A	17	50	19.00	20	21.00	1.0	28	1.4	17.2
MMBZH27VALT1G**	27A	22	50	25.65	27	28.35	1.0	40	1.0	24.3
MMBZH33VALT1G**	33A	26	50	31.35	33	34.65	1.0	46	0.87	30.4
MMBZH47VALT1G**	47A	38	50	44.65	47	49.35	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.

3.  $V_{BR}$  measured at pulse test current  $I_T$  at an ambient temperature of  $25^\circ\text{C}$ .

4.  $Z_{ZT}$  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.

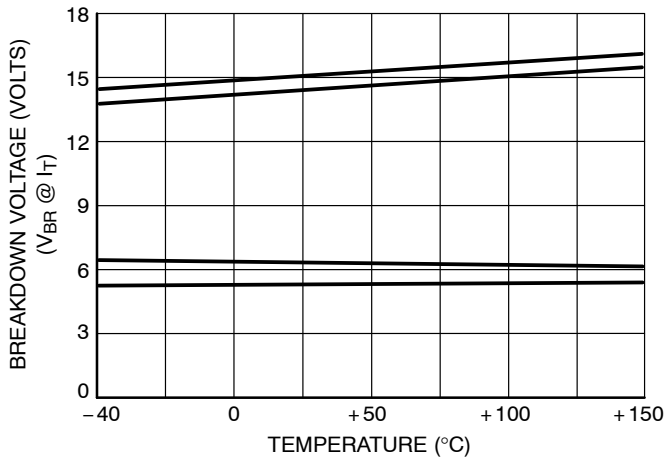
5. Surge current waveform per Figure 6 and derate per Figure 7

\* Includes SZ-prefix devices where applicable.

\*\*AEC-Q release available upon request.

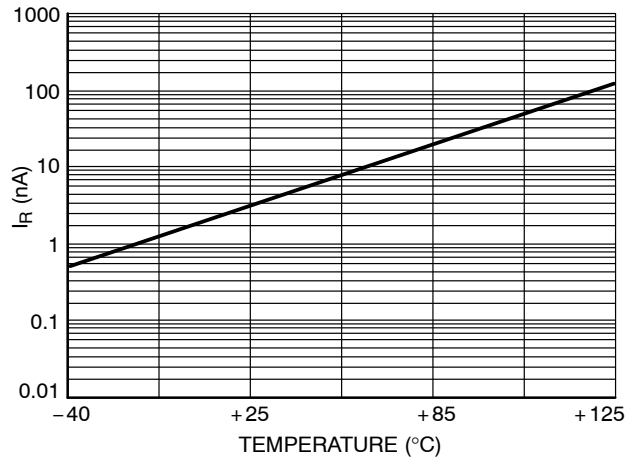
# MMBZHxxxALT1G Series, SZMMBZHxxxALT1G Series

## TYPICAL CHARACTERISTICS

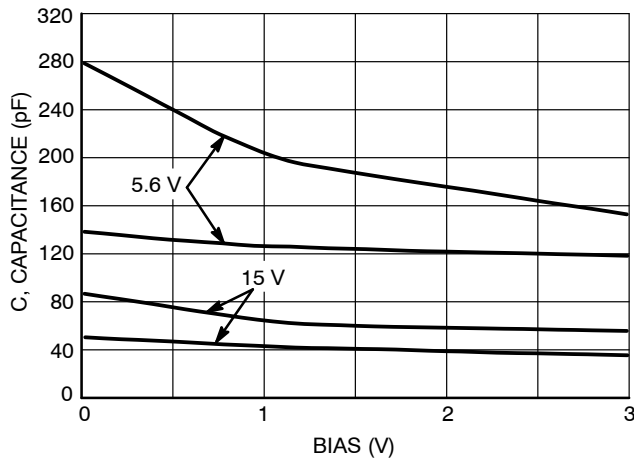


**Figure 1. Typical Breakdown Voltage versus Temperature**

(Upper curve for each voltage is bidirectional mode, lower curve is unidirectional mode)

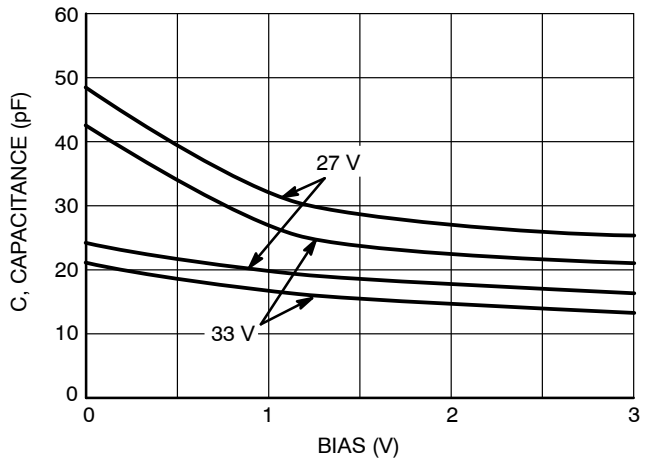


**Figure 2. Typical Leakage Current versus Temperature**



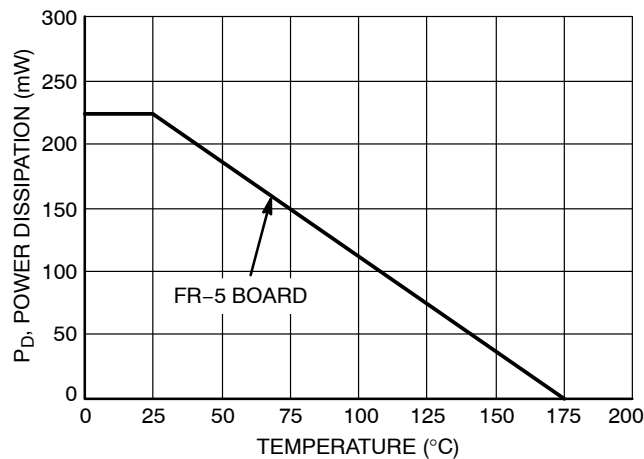
**Figure 3. Typical Capacitance versus Bias Voltage**

(Upper curve for each voltage is unidirectional mode, lower curve is bidirectional mode)



**Figure 4. Typical Capacitance versus Bias Voltage**

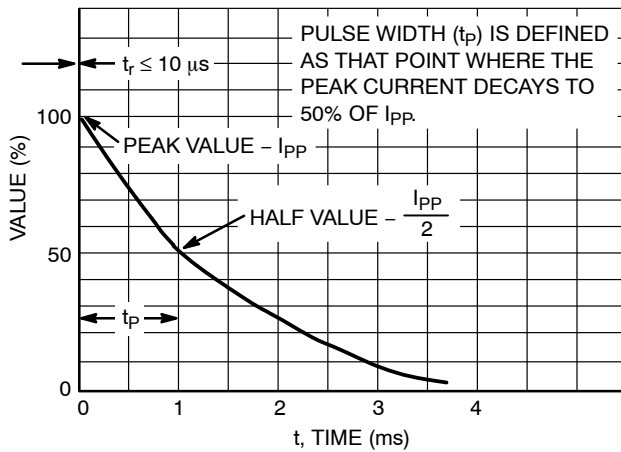
(Upper curve for each voltage is unidirectional mode, lower curve is bidirectional mode)



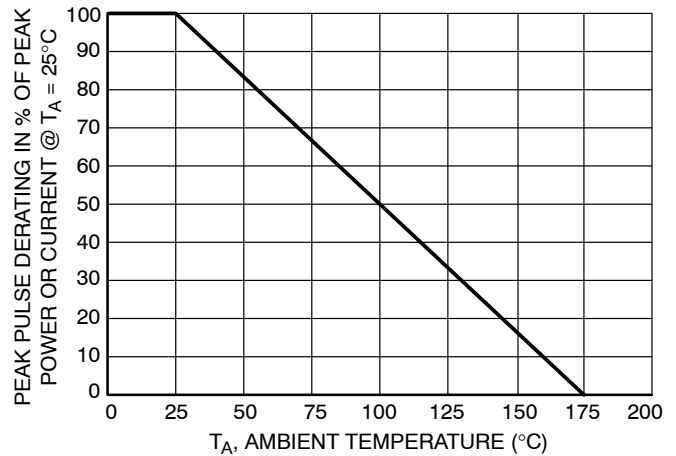
**Figure 5. Steady State Power Derating Curve**

# MMBZHxxxALT1G Series, SZMMBZHxxxALT1G Series

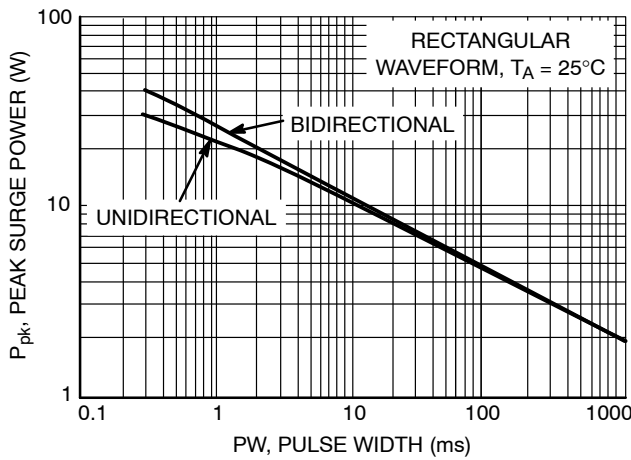
## TYPICAL CHARACTERISTICS



**Figure 6. Pulse Waveform**

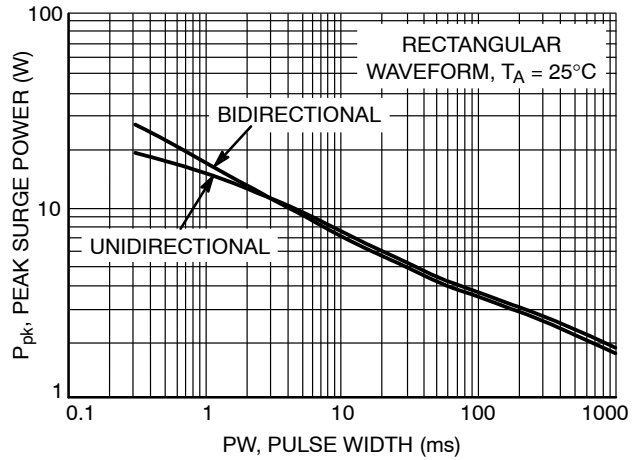


**Figure 7. Pulse Derating Curve**



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

Power is defined as  $V_{RSM} \times I_Z(pk)$  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  $V_Z(NOM) \times I_Z(pk)$  where  $V_Z(NOM)$  is the nominal Zener voltage measured at the low test current used for voltage classification.

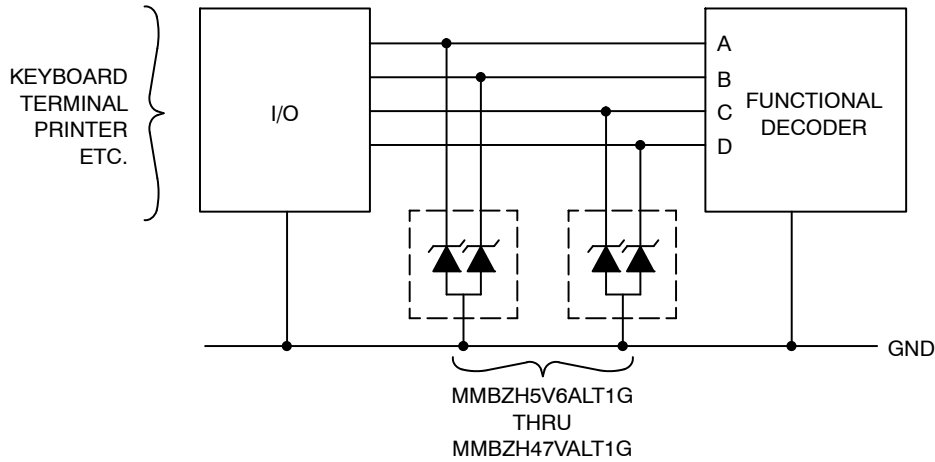
# MMBZHxxxALT1G Series, SZMMBZHxxxALT1G Series

## TYPICAL COMMON ANODE APPLICATIONS

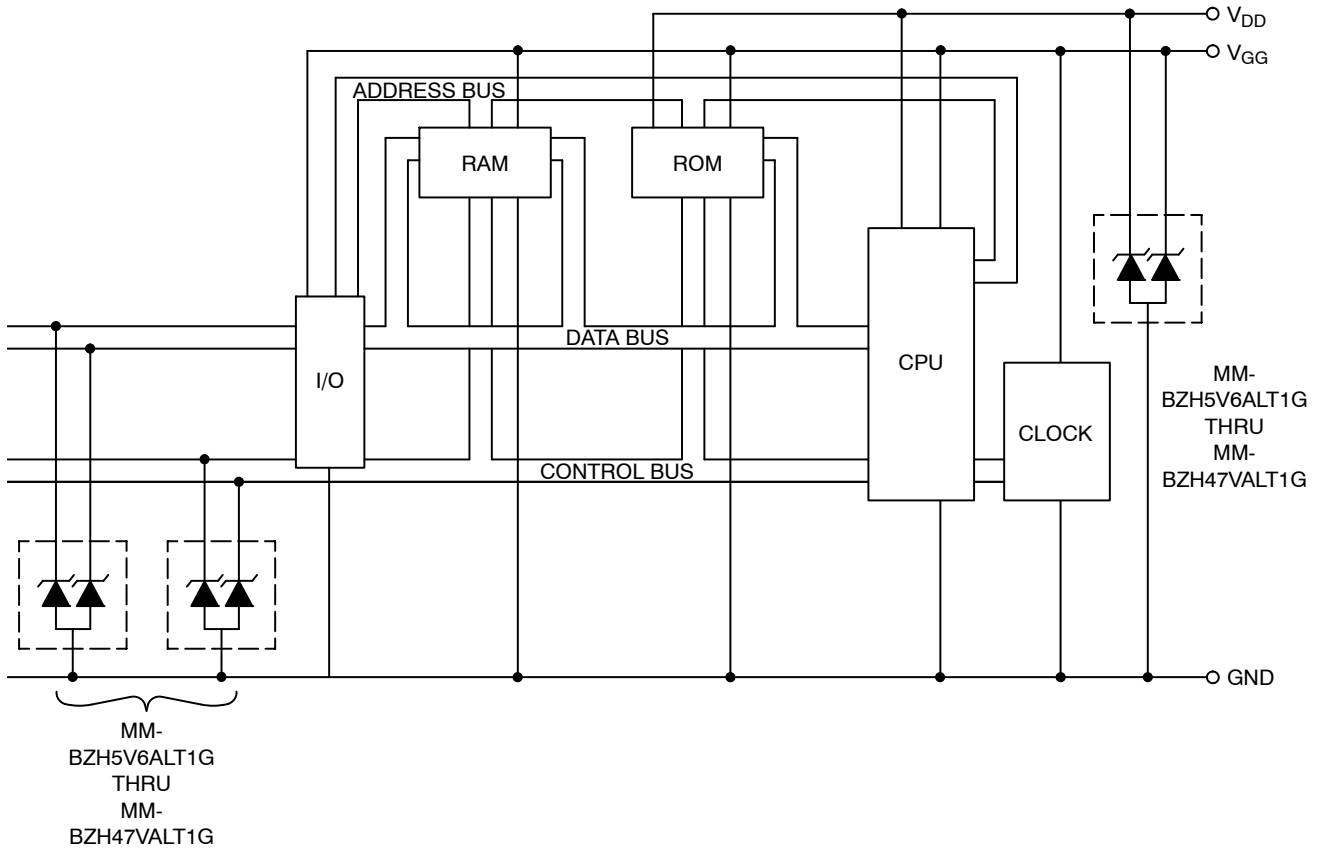
A dual junction common anode design in a SOT-23 package protects two separate lines using only one package. This adds flexibility and creativity to PCB design especially

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

ON Semiconductor®



### 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.

DIM	MILLIMETERS			INCHES		
	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
HE	2.10	2.40	2.64	0.083	0.094	0.104
T	0°	---	10°	0°	---	10°

### RECOMMENDED SOLDERING FOOTPRINT



### 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

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