Preferred Device

# 24 and 40 Watt Peak Power Zener Transient Voltage Suppressors

## SOT-23 Dual Common Anode Zeners for ESD Protection

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

- Pb–Free Packages are Available
- SOT-23 Package Allows Either Two Separate Unidirectional Configurations or a Single Bidirectional Configuration
- Working Peak Reverse Voltage Range 3 V to 26 V
- Standard Zener Breakdown Voltage Range 5.6 V to 33 V
- Peak Power 24 or 40 Watts @ 1.0 ms (Unidirectional), per Figure 5 Waveform
- ESD Rating of Class N (exceeding 16 kV) per the Human Body Model
- Maximum Clamping Voltage @ Peak Pulse Current
- Low Leakage < 5.0 μA
- Flammability Rating UL 94 V-O

### **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

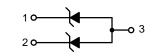
Package designed for optimal automated board assembly Small package size for high density applications Available in 8 mm Tape and Reel

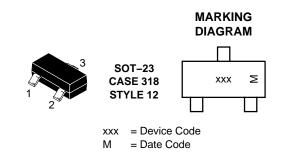
Use the Device Number to order the 7 inch/3,000 unit reel. Replace the "T1" with "T3" in the Device Number to order the 13 inch/10,000 unit reel.



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### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section 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.

**Preferred** devices are recommended choices for future use and best overall value.

#### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	P <sub>pk</sub>	24 40	Watts
Total Power Dissipation on FR–5 Board (Note 2) @ T <sub>A</sub> = 25°C Derate above 25°C	PD	225 1.8	mW mW/°C
Thermal Resistance Junction-to-Ambient	$R_{\thetaJA}$	556	°C/W
Total Power Dissipation on Alumina Substrate (Note 3) @ T <sub>A</sub> = 25°C Derate above 25°C	PD	300 2.4	mW mW/°C
Thermal Resistance Junction-to-Ambient	$R_{\thetaJA}$	417	°C/W
Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	– 55 to +150	°C
Lead Solder Temperature – Maximum (10 Second Duration)	TL	260	°C

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. Non-repetitive current pulse per Figure 5 and derate above  $T_A = 25^{\circ}C$  per Figure 6.

2.  $FR-5 = 1.0 \times 0.75 \times 0.62$  in.

3. Alumina = 0.4 x 0.3 x 0.024 in, 99.5% alumina.

\*Other voltages may be available upon request.

#### ORDERING INFORMATION

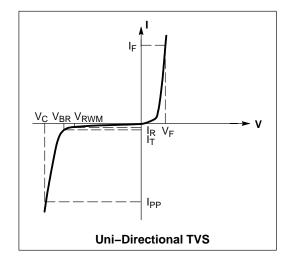
Device	Package	Shipping <sup>†</sup>		
MMBZ5V6ALT1	SOT-23	3000 Tape & Reel		
MMBZ5V6ALT1G	SOT-23 (Pb-Free)	3000 Tape & Reel		
MMBZ5V6ALT3	SOT-23	10,000 Tape & Reel		
MMBZ5V6ALT3G	SOT-23 (Pb-Free)	10,000 Tape & Reel		
MMBZ6VxALT1	SOT-23	3000 Tape & Reel		
MMBZ6VxALT1G	SOT-23 (Pb-Free)	3000 Tape & Reel		
MMBZ6VxALT3	SOT-23	10,000 Tape & Reel		
MMBZ6VxALT3G	SOT-23 (Pb-Free)	10,000 Tape & Reel		
MMBZ9V1ALT1	SOT-23	3000 Tape & Reel		
MMBZ9V1ALT1G	SOT-23 (Pb-Free)	3000 Tape & Reel		
MMBZ9V1ALT3	SOT-23	10,000 Tape & Reel		
MMBZ9V1ALT13G	SOT-23 (Pb-Free)	10,000 Tape & Reel		
MMBZxxVALT1	SOT-23	3000 Tape & Reel		
MMBZxxVALT1G	SOT-23 (Pb-Free)	3000 Tape & Reel		
MMBZxxVALT3	SOT-23	10,000 Tape & Reel		
MMBZxxVALT3G	SOT-23 (Pb-Free)	10,000 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.

### **ELECTRICAL CHARACTERISTICS**

 $(T_A = 25^{\circ}C \text{ unless otherwise noted})$ UNIDIRECTIONAL (Circuit tied to Pins 1 and 3 or 2 and 3)

Symbol	Parameter
I <sub>PP</sub>	Maximum Reverse Peak Pulse Current
V <sub>C</sub>	Clamping Voltage @ I <sub>PP</sub>
V <sub>RWM</sub>	Working Peak Reverse Voltage
I <sub>R</sub>	Maximum Reverse Leakage Current @ V <sub>RWM</sub>
V <sub>BR</sub>	Breakdown Voltage @ I <sub>T</sub>
Ι <sub>Τ</sub>	Test Current
$\Theta V_{BR}$	Maximum Temperature Coefficient of $V_{BR}$
١ <sub>F</sub>	Forward Current
V <sub>F</sub>	Forward Voltage @ I <sub>F</sub>
Z <sub>ZT</sub>	Maximum Zener Impedance @ I <sub>ZT</sub>
I <sub>ZK</sub>	Reverse Current
Z <sub>ZK</sub>	Maximum Zener Impedance @ I <sub>ZK</sub>



ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted) UNIDIRECTIONAL (Circuit tied to Pins 1 and 3 or Pins 2 and 3)

 $(V_F = 0.9 V Max @ I_F = 10 mA)$ 

**24 WATTS** 

				Breakdown Voltage				ax Zene ance (N		-	<b>₽ I</b> ₽₽ :e 6)		
	Device	V <sub>RWM</sub>	I <sub>R</sub> @ V <sub>RWM</sub>	VB	R (Note 4)	(V)	@ <b>կ</b>	Z <sub>ZT</sub> @ І <sub>ZT</sub>	Z <sub>ZK</sub> (	@ ե <sub>к</sub>	v <sub>c</sub>	I <sub>PP</sub>	ΘV <sub>BR</sub>
Device	Marking	Volts	μΑ	Min	Nom	Max	mA	Ω	Ω	mA	v	Α	mV/°C
MMBZ5V6AL	5A6	3.0	5.0	5.32	5.6	5.88	20	11	1600	0.25	8.0	3.0	1.26
MMBZ6V2AL	6A2	3.0	0.5	5.89	6.2	6.51	1.0	-	-	-	8.7	2.76	2.80
MMBZ6V8AL	6A8	4.5	0.5	6.46	6.8	7.14	1.0	-	-	-	9.6	2.5	3.4
MMBZ9V1AL	9A1	6.0	0.3	8.65	9.1	9.56	1.0	-	-	-	14	1.7	7.5
MMBZ10VAL	10A	6.5	0.3	9.50	10	10.5	1.0	-	-	-	14.2	1.7	7.5

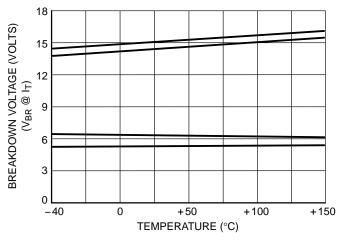
 $(V_F = 0.9 V Max @ I_F = 10 mA)$ 

### **40 WATTS**

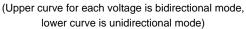
			I <sub>R</sub> @	Breakdown Voltage			V <sub>C</sub> @ I <sub>PP</sub>					
	Device	V <sub>RWM</sub>	V <sub>RWM</sub>	VB	V <sub>BR</sub> (Note 4) (V)		V <sub>BR</sub> (Note 4) (V)		@ <b>ተ</b>	Vc	I <sub>PP</sub>	ΘV <sub>BR</sub>
Device	Marking	Volts	nA	Min	Nom	Max	mA	V	Α	mV/°C		
MMBZ12VAL	12A	8.5	200	11.40	12	12.60	1.0	17	2.35	7.5		
MMBZ15VAL	15A	12	50	14.25	15	15.75	1.0	21	1.9	12.3		
MMBZ18VAL	18A	14.5	50	17.10	18	18.90	1.0	25	1.6	15.3		
MMBZ20VAL	20A	17	50	19.00	20	21.00	1.0	28	1.4	17.2		
MMBZ27VAL	27A	22	50	25.65	27	28.35	1.0	40	1.0	24.3		
MMBZ33VAL	33A	26	50	31.35	33	34.65	1.0	46	0.87	30.4		

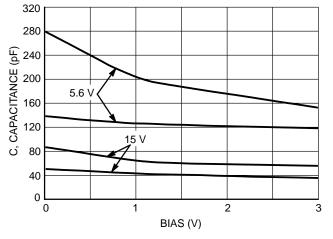
4. V<sub>BR</sub> measured at pulse test current I<sub>T</sub> at an ambient temperature of 25°C.
5. Z<sub>ZT</sub> and Z<sub>ZK</sub> are measured by dividing the AC voltage drop across the device by the AC current applied. The specified limits are for I<sub>Z(AC)</sub> = 0.1 I<sub>Z(DC)</sub>, with the AC frequency = 1.0 kHz.
6. Surge current waveform per Figure 5 and derate per Figure 6

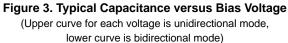
### **TYPICAL CHARACTERISTICS**











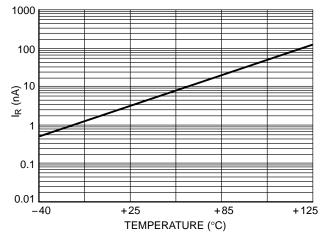


Figure 2. Typical Leakage Current versus Temperature

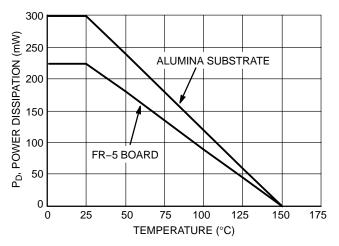
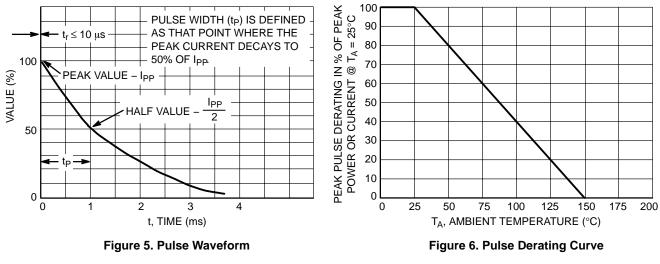
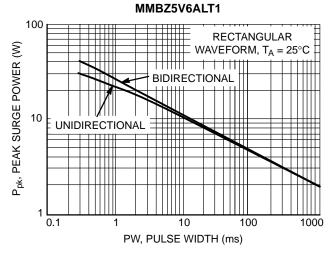


Figure 4. Steady State Power Derating Curve

### **TYPICAL CHARACTERISTICS**

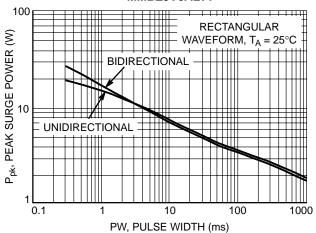




#### Figure 7. Maximum Non-repetitive Surge Power, P<sub>pk</sub> versus PW

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

MMBZ5V6ALT1



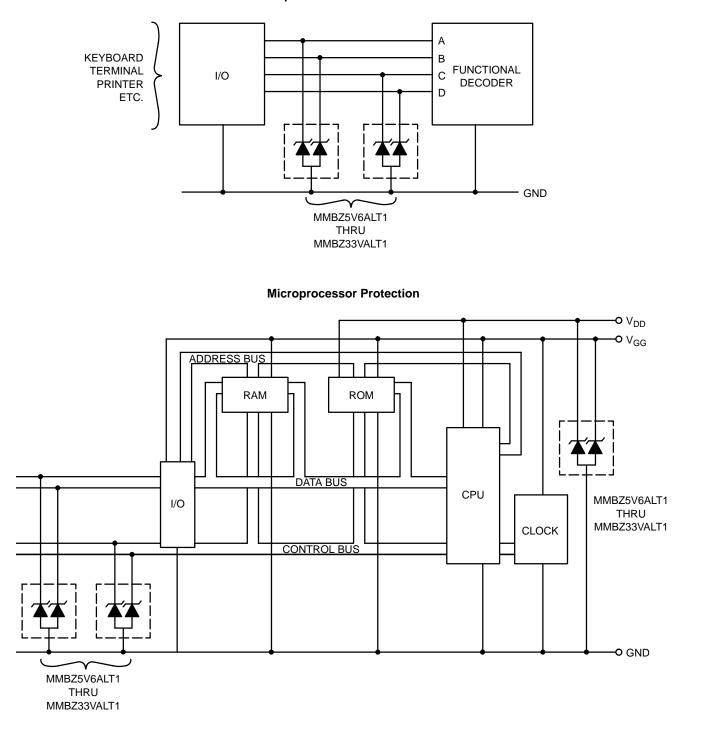
#### Figure 8. Maximum Non-repetitive Surge Power, P<sub>pk</sub>(NOM) versus PW

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.

### TYPICAL COMMON ANODE APPLICATIONS

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

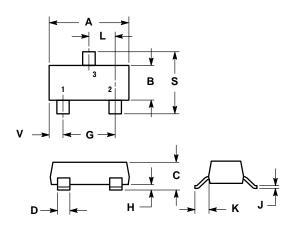
when board space is at a premium. Two simplified examples of TVS applications are illustrated below.



#### **Computer Interface Protection**

### PACKAGE DIMENSIONS

SOT-23 (TO-236) CASE 318-09 **ISSUE AH** 



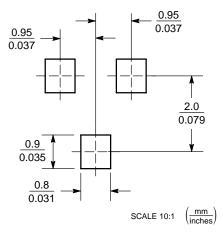
- NOTES: 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982. 2. CONTROLLING DIMENSION: INCH. 3. MAXIUMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS, MINIMUM LEAD THICKNESS, MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
  4. 318-01, -02, AND -06 OBSOLETE, NEW STANDARD 318-09.

	INC	HES	MILLIN	IETERS	
DIM	MIN	MIN MAX		MAX	
Α	0.1102	0.1197	2.80	3.04	
в	0.0472	0.0551	1.20	1.40	
С	0.0385	0.0498	0.99	1.26	
D	0.0140	0.0200	0.36	0.50	
G	0.0670	0.0826	1.70	2.10	
н	0.0040	0.0098	0.10	0.25	
J	0.0034	0.0070	0.085	0.177	
к	0.0180	0.0236	0.45	0.60	
L	0.0350	0.0401	0.89	1.02	
S	0.0830	0.0984	2.10	2.50	
V	0.0177	0.0236	0.45	0.60	

STYLE 12: PIN 1. CATHODE 2. CATHODE

3. ANODE

#### **SOLDERING FOOTPRINT\***



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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