



## Features

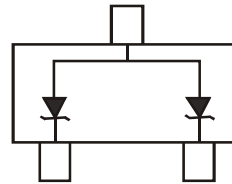
- Dual TVS in Common Anode Configuration
- 24W/40W Peak Power Dissipation Rating @ 1.0ms (Unidirectional)
- 225mW Power Dissipation
- Ideally Suited for Automated Insertion
- Low Leakage
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

## Mechanical Data

- Case: SOT23
- Case Material: Molded Plastic "Green" Molding Compound. UL Flammability Classification 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Solderable per MIL-STD-202, Method 208 (e3)
- Polarity: See Diagram
- Lead Free Plating (Matte Tin Finish Annealed over Alloy 42 Leadframe).
- ESD Rating Exceeding 16kV per the Human Body Model (Note 9)
- Marking Information: See Below
- Ordering Information: See Below
- Weight: 0.008 grams (Approximate)



Top View



Device Schematic

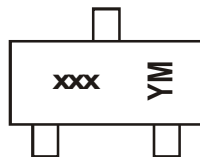
## Ordering Information (Note 5)

Part Number	Qualification	Case	Packaging
(Type Number)-7*-F	Commercial	SOT23	3,000/Tape & Reel
(Type Number)Q-7*-F (Note 4)	Automotive	SOT23	3,000/Tape & Reel
MMBZ27VALQ-13-F (Note 4)	Automotive	SOT23	10,000/Tape & Reel

\* Example: 5.6V type = MMBZ5V6AL-7-F.

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  2. See <http://www.diodes.com> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
  3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
  4. Automotive products are AEC-Q101 qualified and are PPAP capable. Automotive, AEC-Q101 and standard products are electrically and thermally the same, except where specified. For more information, please refer to <https://www.diodes.com/quality/product-compliance-definitions/>.
  5. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

## Marking Information



xxx = Product type marking code,  
See Electrical Characteristics Table, Pages 2  
YM = Date Code Marking  
Y = Year (ex: F = 2018)  
M = Month (ex: 9 = September)

### Date Code Key

Year	2006	2007	2008	2009	.....	2018	2019	2020	2021	2022	2023	2024	2025
Code	T	U	V	W	.....	F	G	H	I	J	K	L	M

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Code	1	2	3	4	5	6	7	8	9	O	N	D

**Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Peak Power Dissipation: MMBZ5V6AL - MMBZ10VAL (Note 7)	P <sub>PK</sub>	24	W
Peak Power Dissipation: MMBZ15VAL - MMBZ33VAL (Note 7)	P <sub>PK</sub>	40	W

**Thermal Characteristics**

Characteristic	Symbol	Value	Unit
Power Dissipation (Note 6)	P <sub>D</sub>	225	mW
Thermal Resistance, Junction to Ambient Air (Note 6)	R <sub>θJA</sub>	556	°C/W
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-65 to +150	°C

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

**24 Watt (V<sub>F</sub> = 0.9V max @ I<sub>F</sub> = 10mA)**

Type Number	Marking Code	V <sub>RWM</sub>	Max Reverse Current, I <sub>R</sub> @ V <sub>RWM</sub> (Note 8)	Breakdown Voltage			@ I <sub>T</sub>	Max. Clamping Voltage, V <sub>C</sub> @ I <sub>PP</sub> (Note 7)		Typical Temperature Coefficient of Reverse Voltage T <sub>C</sub> (mV/°C)
				V <sub>BR</sub> (Note 8) (V)				V <sub>C</sub>	I <sub>PP</sub>	
				Volts	µA	Min		Nom	Max	
MMBZ5V6AL	K9A	3	5.0	5.32	5.6	5.88	20	8.0	3.0	1.8

**24 Watt (V<sub>F</sub> = 0.9V max @ I<sub>F</sub> = 10mA)**

Type Number	Marking Code	V <sub>RWM</sub>	Max Reverse Current, I <sub>R</sub> @ V <sub>RWM</sub> (Note 8)	Breakdown Voltage			@ I <sub>T</sub>	Max. Clamping Voltage, V <sub>C</sub> @ I <sub>PP</sub> (Note 7)		Typical Temperature Coefficient of Reverse Voltage T <sub>C</sub> (%/°C)
				V <sub>BR</sub> (Note 8) (V)				V <sub>C</sub>	I <sub>PP</sub>	
				Volts	µA	Min		Nom	Max	
MMBZ6V2AL	K9B	3.0	0.5	5.89	6.2	6.51	1.0	8.7	2.76	+0.04
MMBZ6V8AL	K9C	4.5	0.5	6.46	6.8	7.14	1.0	9.6	2.5	+0.045
MMBZ9V1AL	K9D	6.0	0.3	8.65	9.1	9.56	1.0	14	1.7	+0.065
MMBZ10VAL	K9E	6.5	0.3	9.50	10	10.5	1.0	14.2	1.7	+0.065

**40 Watt (V<sub>F</sub> = 0.9V max @ I<sub>F</sub> = 10mA)**

Type Number	Marking Code	V <sub>RWM</sub>	Max. Reverse Current, I <sub>R</sub> @ V <sub>RWM</sub> (Note 8)	Breakdown Voltage			@ I <sub>T</sub>	Max. Clamping Voltage, V <sub>C</sub> @ I <sub>PP</sub> (Note 7)		Typical Temperature Coefficient of Reverse Voltage T <sub>C</sub> (%/°C)
				V <sub>BR</sub> (Note 8) (V)				V <sub>C</sub>	I <sub>PP</sub>	
				Volts	nA	Min		Nom	Max	
MMBZ15VAL	K9K	12	50	14.25	15	15.75	1.0	21	1.9	+0.080
MMBZ18VAL	K9L	14.5	50	17.10	18	18.90	1.0	25	1.6	+0.090
MMBZ20VAL	K9N	17	50	19.00	20	21.00	1.0	28	1.4	+0.090
MMBZ27VAL	K9Q	22	50	25.65	27	28.35	1.0	40	1.0	+0.090
MMBZ33VAL	K9T	26	50	31.35	33	34.65	1.0	46	0.87	+0.090

Notes: 6. Device mounted on FR-4 PCB pad layout (2oz copper) as shown on Diodes website at <http://www.diodes.com/package-outlines.html>.

7. Non-repetitive current pulse per Figure 2 and derate above T<sub>A</sub> = +25°C per Figure 2.

8. Short duration pulse test used to minimize self-heating effect.

9. MMBZ5V6AL and MMBZ15VAL exceed 16kV ESD rating, all other voltages exceed 8kV ESD rating.

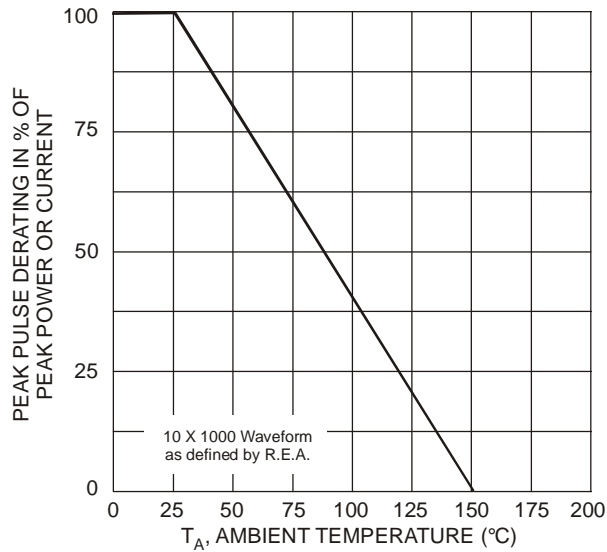


Fig. 1 Pulse Derating Curve

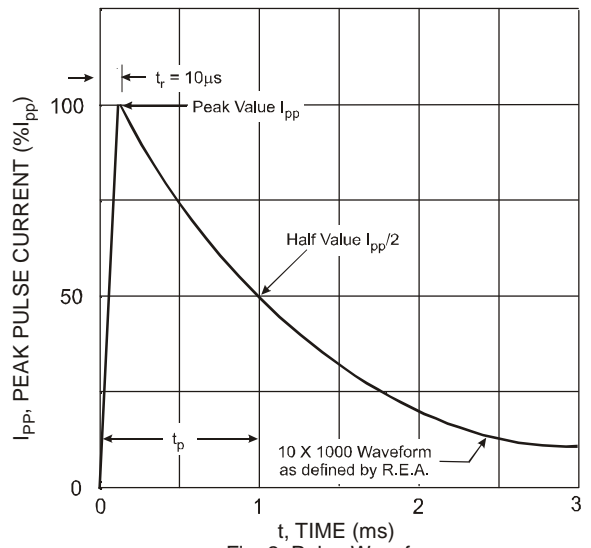


Fig. 2 Pulse Waveform

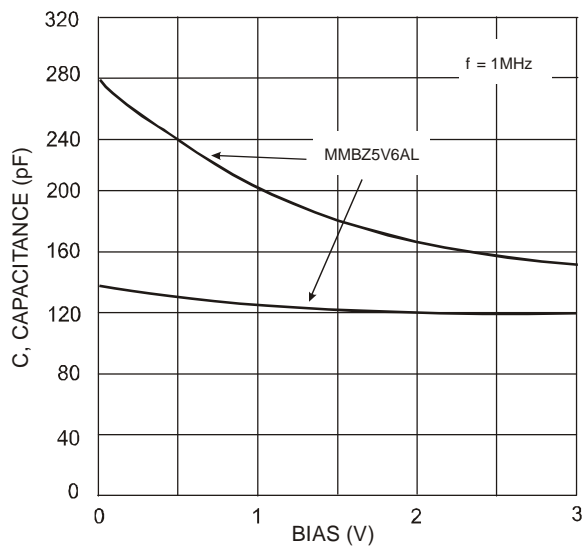


Fig. 3 Typical Capacitance vs. Bias Voltage  
(Lower curve is Bidirectional mode,  
Upper curve is Unidirectional mode)

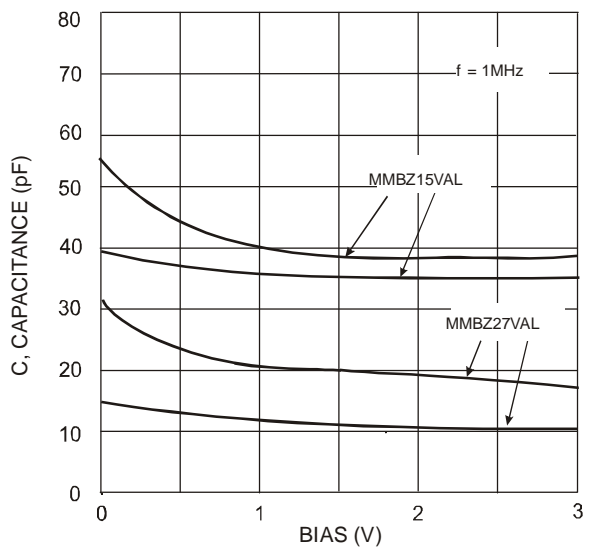


Fig. 4 Typical Capacitance vs. Bias Voltage  
(Lower curve is Bidirectional mode,  
Upper curve is Unidirectional mode)

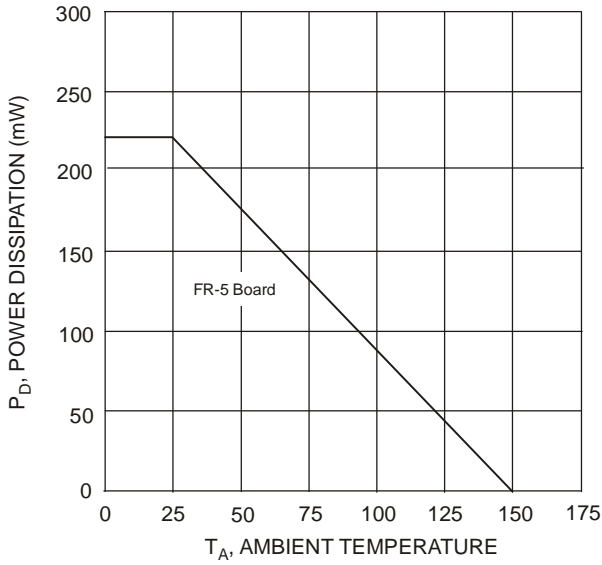


Fig. 5 Steady State Power Derating Curve

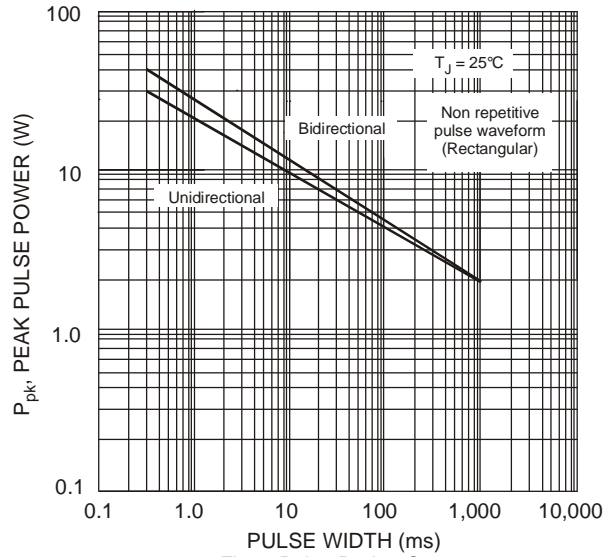


Fig. 6 Pulse Rating Curve,  $P_{pk}$  (W) vs. Pulse Width (ms)

Power is defined as  $P_{pk} = V_C \times I_{pp}$

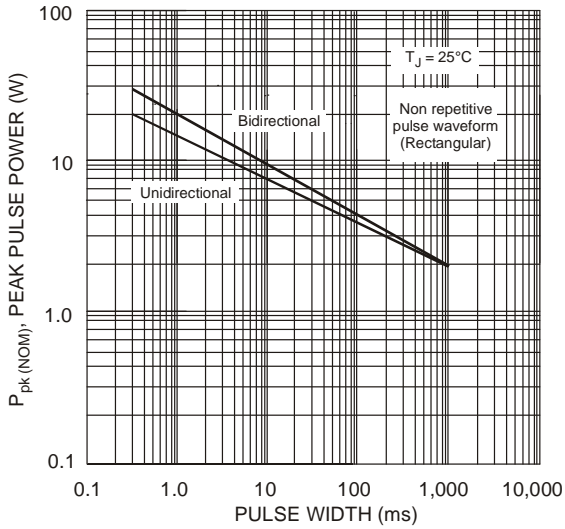


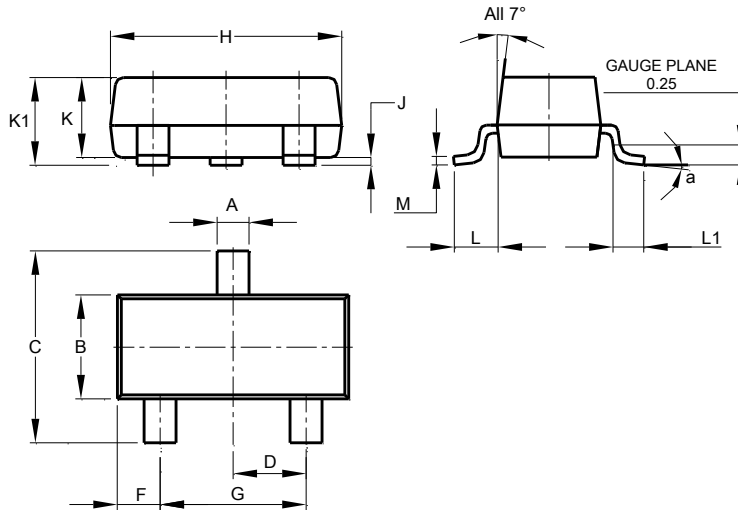
Fig. 7 Pulse Rating Curve,  $P_{pk(NOM)}$  (W) vs. Pulse Width (ms)

Power is defined as  $P_{pk(NOM)} = V_{BR(NOM)} \times I_{pp}$   
 where  $V_{BR(NOM)}$  is the nominal reverse breakdown voltage measured at the low test current used for voltage classification

## Package Outline Dimensions

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**SOT23**

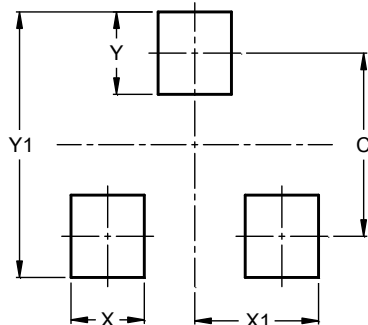


SOT23			
Dim	Min	Max	Typ
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	0°	8°	--
All Dimensions in mm			

## Suggested Pad Layout

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

**SOT23**



Dimensions	Value (in mm)
C	2.0
X	0.8
X1	1.35
Y	0.9
Y1	2.9

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