

## Features

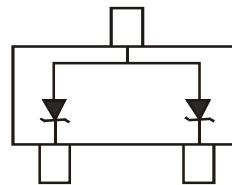
- Dual TVS in Common Anode Configuration
- 24W/40W Peak Power Dissipation Rating @ 1.0ms (Unidirectional)
- 225mW Power Dissipation
- Ideally Suited for Automated Insertion
- Low Leakage
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **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 <sup>(e3)</sup>
- Polarity: See Diagram
- Lead Free Plating (Matte Tin Finish annealed over Alloy 42 leadframe).
- ESD Rating Exceeding 16kV per the Human Body Model (Note 8)
- Marking Information: See Below
- Ordering Information: See Below
- Weight: 0.008 grams (approximate)



Top View



Device Schematic

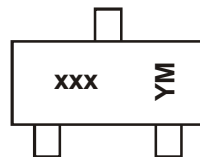
## Ordering Information (Note 4)

| Part Number         | Qualification | Case  | Packaging        |
|---------------------|---------------|-------|------------------|
| (Type Number)-7*-F  | Commercial    | SOT23 | 3000/Tape & Reel |
| (Type Number)Q-7*-F | Automotive    | SOT23 | 3000/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. For packaging details, go to our website at <http://www.diodes.com>.

## Marking Information



xxx = Product type marking code,  
See Electrical Characteristics Table, Pages 2  
YM = Date Code Marking  
Y = Year (ex: A = 2013)  
M = Month (ex: 9 = September)

### Date Code Key

| Year | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Code | T    | U    | V    | W    | X    | Y    | Z    | A    | B    | C    | D    | E    | F    |

| 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 6) | P <sub>pk</sub> | 24    | W    |
| Peak Power Dissipation MMBZ15VAL - MMBZ33VAL (Note 6) | P <sub>pk</sub> | 40    | W    |

**Thermal Characteristics**

| Characteristic                                       | Symbol                            | Value       | Unit |
|--|-----------------------------------|-------------|------|
| Power Dissipation (Note 5)                           | P <sub>D</sub>                    | 225         | mW   |
| Thermal Resistance, Junction to Ambient Air (Note 5) | 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 7) | Breakdown Voltage            |     |      | Max. Clamping Voltage, V <sub>C</sub> @ I <sub>PP</sub> (Note 6) |                | Typical Temperature Coefficient of Reverse Voltage TC (mV/°C) |                 |
|-------------|--------------|------------------|---|------------------------------|-----|------|--|----------------|---|-----------------|
|             |              |                  |   | V <sub>BR</sub> (Note 7) (V) |     |      | @ I <sub>T</sub>   | V <sub>C</sub> |   | I <sub>PP</sub> |
|             |              |                  |   | Volts                        | µA  | Min  | Nom  | Max            |   | mA              |
| 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 7) | Breakdown Voltage            |     |      | Max. Clamping Voltage, V <sub>C</sub> @ I <sub>PP</sub> (Note 6) |                | Typical Temperature Coefficient of Reverse Voltage TC (%/°C) |                 |
|-------------|--------------|------------------|---|------------------------------|-----|------|--|----------------|--|-----------------|
|             |              |                  |   | V <sub>BR</sub> (Note 7) (V) |     |      | @ I <sub>T</sub>   | V <sub>C</sub> |  | I <sub>PP</sub> |
|             |              |                  |   | Volts                        | µA  | Min  | Nom  | Max            |  | mA              |
| 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 7) | Breakdown Voltage            |    |       | Max. Clamping Voltage, V <sub>C</sub> @ I <sub>PP</sub> (Note 6) |                | Typical Temperature Coefficient of Reverse Voltage TC (%/°C) |                 |
|-------------|--------------|------------------|--|------------------------------|----|-------|--|----------------|--|-----------------|
|             |              |                  |  | V <sub>BR</sub> (Note 7) (V) |    |       | @ I <sub>T</sub>   | V <sub>C</sub> |  | I <sub>PP</sub> |
|             |              |                  |  | Volts                        | nA | Min   | Nom  | Max            |  | mA              |
| 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:
- Device mounted on FR-4 PCB pad layout (2oz copper) as shown on Diodes, Inc. suggested pad layout AP02001, which can be found on our website at <http://www.diodes.com>.
  - Non-repetitive current pulse per Figure 2 and derate above T<sub>A</sub> = +25°C per Figure 2.
  - Short duration pulse test used to minimize self-heating effect.
  - MMBZ5V6AL and MMBZ15VAL exceed 16kV ESD rating, all other voltages exceed 8kV ESD rating.

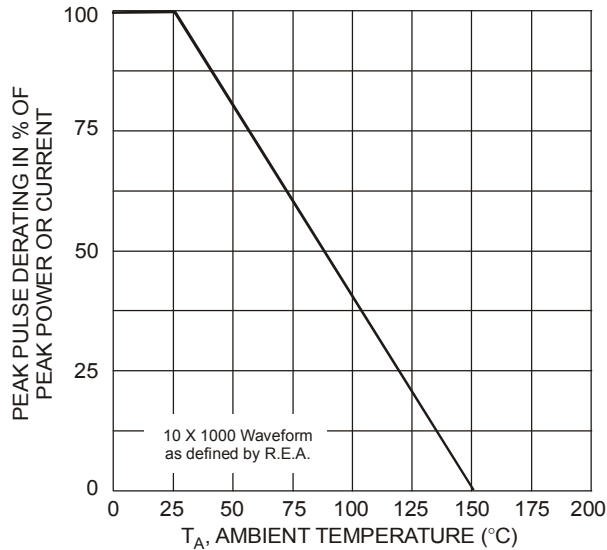


Fig. 1 Pulse Derating Curve

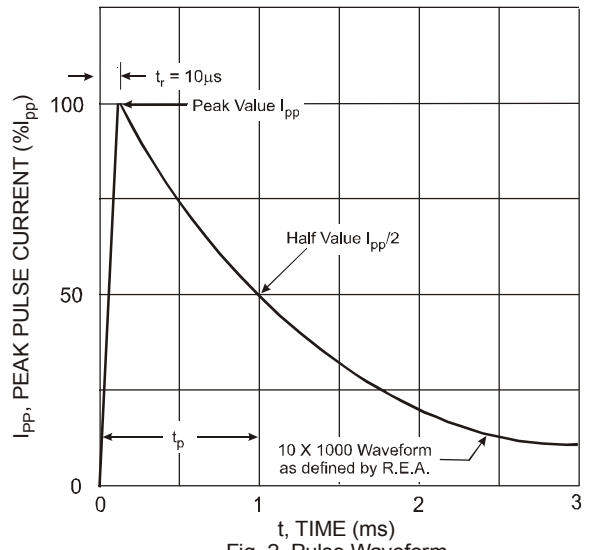


Fig. 2 Pulse Waveform

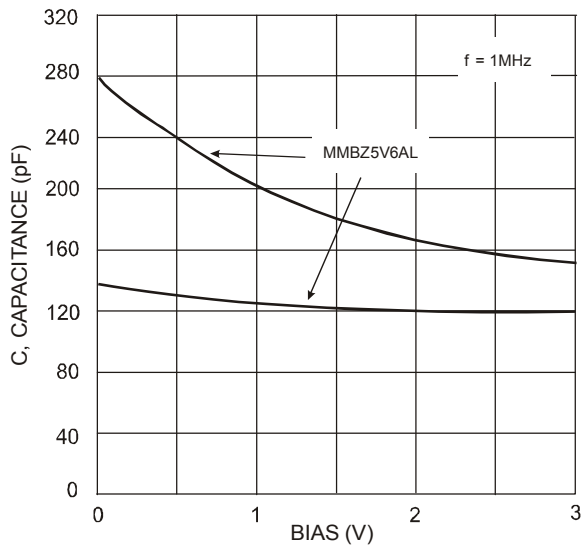


Fig. 3 Typical Capacitance vs. Bias Voltage  
(Lower curve is Bidirectional mode,  
Upper curve is Unidirectional mode)

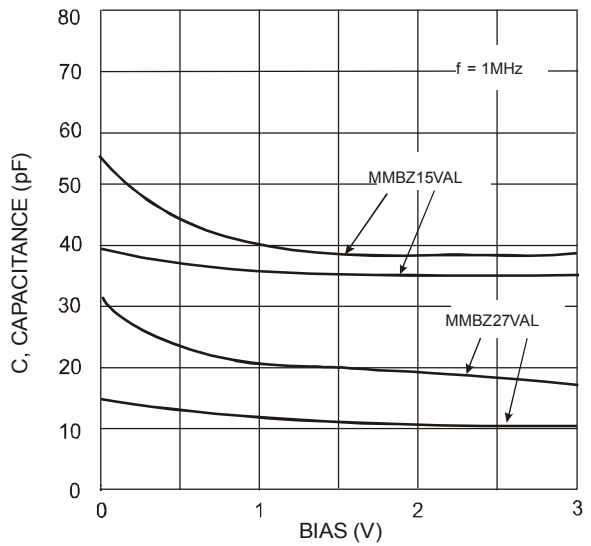


Fig. 4 Typical Capacitance vs. Bias Voltage  
(Lower curve is Bidirectional mode,  
Upper curve is Unidirectional mode)

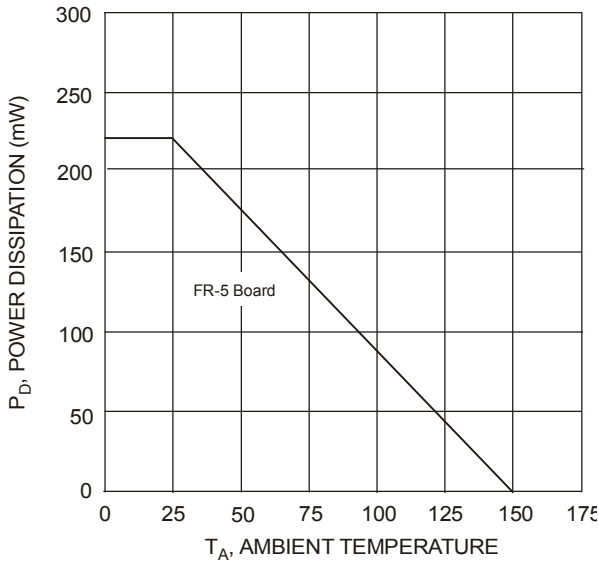


Fig. 5 Steady State Power Derating Curve

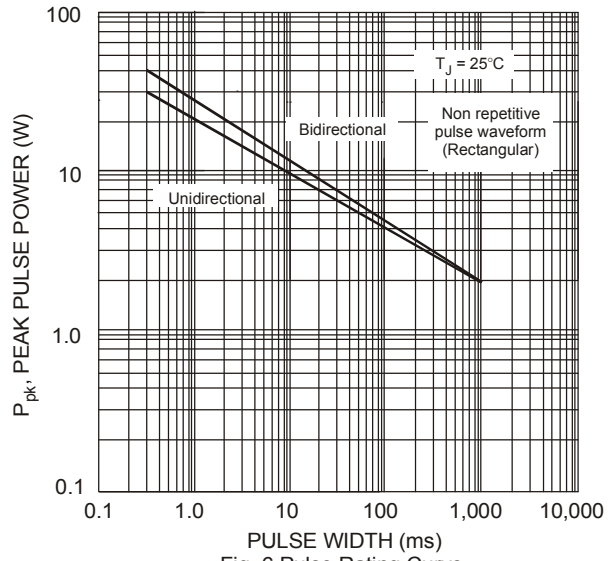


Fig. 6 Pulse Rating Curve,  $P_{pk}$  (W) vs. Pulse Width (ms)

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

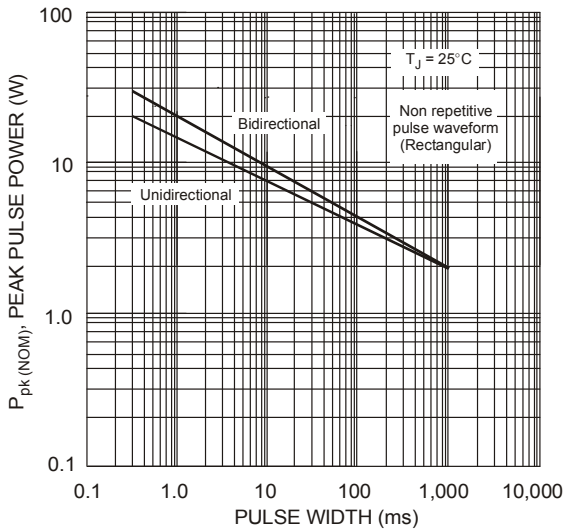
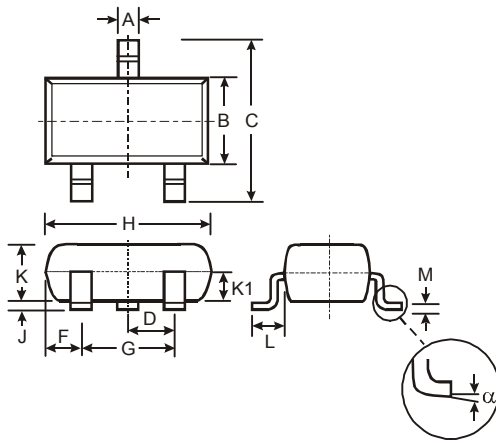


Fig. 7 Pulse Rating Curve,  $P_{pk(NOM)}$  (W) vs. Pulse Width (ms)

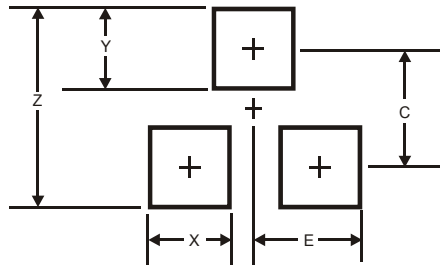
Power is defined as  $P_{pk(NOM)} = V_{BR(NOM)} \times I_{pp}$   
 where  $V_{BR(NOM)}$  is the nominal reverse breakdown voltage measured at the low test current used for voltage classification

**Package Outline Dimensions**



| 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                    | 0.903 | 1.10 | 1.00  |
| K1                   | -     | -    | 0.400 |
| L                    | 0.45  | 0.61 | 0.55  |
| M                    | 0.085 | 0.18 | 0.11  |
| α                    | 0°    | 8°   | -     |
| All Dimensions in mm |       |      |       |

**Suggested Pad Layout**



| Dimensions | Value (in mm) |
|------------|---------------|
| Z          | 2.9           |
| X          | 0.8           |
| Y          | 0.9           |
| C          | 2.0           |
| E          | 1.35          |

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