

# MMBZ5221ELT1 Series

Preferred Device

## Zener Voltage Regulators

### 225 mW SOT-23 Surface Mount

This series of Zener diodes is offered in the convenient, surface mount plastic SOT-23 package. These devices are designed to provide voltage regulation with minimum space requirement. They are well suited for applications such as cellular phones, hand held portables, and high density PC boards.

#### Features

- 225 mW Rating on FR-4 or FR-5 Board
- Zener Voltage Range – 2.4 V to 91 V
- Package Designed for Optimal Automated Board Assembly
- Small Package Size for High Density Applications
- ESD Rating of Class 3 (>16 kV) per Human Body Model
- Peak Power – 225 W (8 x 20  $\mu$ s)
- Pb-Free Packages are Available

#### 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

**POLARITY:** Cathode indicated by polarity band

**FLAMMABILITY RATING:** UL 94 V-0

#### MAXIMUM RATINGS

| Rating                                                                                                                   | Symbol          | Max            | Unit                       |
|--------------------------------------------------------------------------------------------------------------------------|-----------------|----------------|----------------------------|
| Peak Power Dissipation @ 20 $\mu$ s (Note 1)<br>@ $T_L \leq 25^\circ\text{C}$                                            | $P_{pk}$        | 225            | W                          |
| Total Power Dissipation on FR-5 Board,<br>(Note 2) @ $T_A = 25^\circ\text{C}$<br>Derated above $25^\circ\text{C}$        | $P_D$           | 225<br>1.8     | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient                                                                                  | $R_{\theta JA}$ | 556            | $^\circ\text{C/W}$         |
| Total Power Dissipation on Alumina<br>Substrate, (Note 3) @ $T_A = 25^\circ\text{C}$<br>Derated above $25^\circ\text{C}$ | $P_D$           | 300<br>2.4     | mW<br>mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient                                                                                  | $R_{\theta JA}$ | 417            | $^\circ\text{C/W}$         |
| Junction and Storage Temperature Range                                                                                   | $T_J, T_{stg}$  | -65 to<br>+150 | $^\circ\text{C}$           |

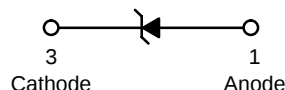
Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur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

1. Nonrepetitive current pulse per Figure 9.
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.

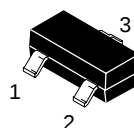


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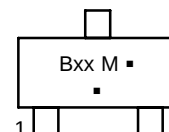
<http://onsemi.com>



#### MARKING DIAGRAM



SOT-23  
CASE 318  
STYLE 8



Bxx = Device Code  
xx = (Refer to page 2)  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation may vary depending upon manufacturing location.

#### ORDERING INFORMATION

| Device        | Package             | Shipping <sup>†</sup> |
|---------------|---------------------|-----------------------|
| MMBZ52xxELT1  | SOT-23              | 3000/Tape & Reel      |
| MMBZ52xxELT1G | SOT-23<br>(Pb-Free) | 3000/Tape & Reel      |
| MMBZ52xxELT3  | SOT-23              | 10000/Tape & Reel     |
| MMBZ52xxELT3G | SOT-23<br>(Pb-Free) | 10000/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.

#### DEVICE MARKING INFORMATION

See specific marking information in the device marking column of the Electrical Characteristics table on page 2 of this data sheet.

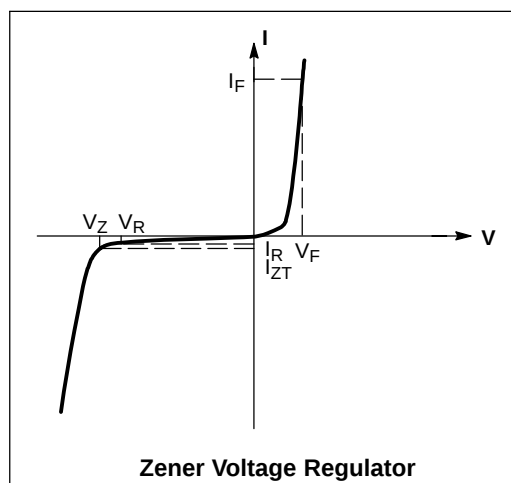
Devices listed in **bold, italic** are ON Semiconductor **Preferred** devices. **Preferred** devices are recommended choices for future use and best overall value.

## MMBZ5221ELT1 Series

### ELECTRICAL CHARACTERISTICS

(Pinout: 1-Anode, 2-No Connection, 3-Cathode) ( $T_A = 25^\circ\text{C}$  unless otherwise noted,  $V_F = 0.95\text{ V Max. @ } I_F = 10\text{ mA}$ )

| Symbol   | Parameter                          |
|----------|------------------------------------|
| $V_Z$    | Reverse Zener Voltage @ $I_{ZT}$   |
| $I_{ZT}$ | Reverse Current                    |
| $Z_{ZT}$ | Maximum Zener Impedance @ $I_{ZT}$ |
| $I_{ZK}$ | Reverse Current                    |
| $Z_{ZK}$ | Maximum Zener Impedance @ $I_{ZK}$ |
| $I_R$    | Reverse Leakage Current @ $V_R$    |
| $V_R$    | Reverse Voltage                    |
| $I_F$    | Forward Current                    |
| $V_F$    | Forward Voltage @ $I_F$            |



### ELECTRICAL CHARACTERISTICS (Pinout: 1-Anode, 2-NC, 3-Cathode) ( $V_F = 0.9\text{ V Max @ } I_F = 10\text{ mA}$ for all types.)

| Device                   | Device Marking | Zener Voltage (Note 4) |            |              |            | Zener Impedance     |                     |             | Leakage Current |            |
|--------------------------|----------------|------------------------|------------|--------------|------------|---------------------|---------------------|-------------|-----------------|------------|
|                          |                | $V_Z$ (V)              |            |              | @ $I_{ZT}$ | $Z_{ZT}$ @ $I_{ZT}$ | $Z_{ZK}$ @ $I_{ZK}$ |             | $I_R$ @ $V_R$   |            |
|                          |                | Min                    | Nom        | Max          |            |                     | $\Omega$            | $\Omega$    | $\mu\text{A}$   | V          |
| MMBZ5221ELT1/T3, G       | BE2            | 2.28                   | 2.4        | 2.52         | 20         | 30                  | 1200                | 0.25        | 100             | 1          |
| MMBZ5226ELT1/T3, G       | BE7            | 3.13                   | 3.3        | 3.47         | 20         | 28                  | 1600                | 0.25        | 25              | 1          |
| MMBZ5228ELT1/T3, G       | BE9            | 3.70                   | 3.9        | 4.10         | 20         | 23                  | 1900                | 0.25        | 10              | 1          |
| MMBZ5229ELT1/T3, G       | BF1            | 4.08                   | 4.3        | 4.52         | 20         | 22                  | 2000                | 0.25        | 5               | 1          |
| MMBZ5230ELT1/T3, G       | BF2            | 4.46                   | 4.7        | 4.94         | 20         | 19                  | 1900                | 0.25        | 5               | 2          |
| <b>MMBZ5231ELT1/T3,G</b> | <b>BF3</b>     | <b>4.84</b>            | <b>5.1</b> | <b>5.36</b>  | <b>20</b>  | <b>17</b>           | <b>1600</b>         | <b>0.25</b> | <b>5</b>        | <b>2</b>   |
| <b>MMBZ5232ELT1/T3,G</b> | <b>BF4</b>     | <b>5.32</b>            | <b>5.6</b> | <b>5.88</b>  | <b>20</b>  | <b>11</b>           | <b>1600</b>         | <b>0.25</b> | <b>5</b>        | <b>3</b>   |
| <b>MMBZ5234ELT1/T3,G</b> | <b>BF6</b>     | <b>5.89</b>            | <b>6.2</b> | <b>6.51</b>  | <b>20</b>  | <b>7</b>            | <b>1000</b>         | <b>0.25</b> | <b>5</b>        | <b>4</b>   |
| <b>MMBZ5235ELT1/T3,G</b> | <b>BF7</b>     | <b>6.46</b>            | <b>6.8</b> | <b>7.14</b>  | <b>20</b>  | <b>5</b>            | <b>750</b>          | <b>0.25</b> | <b>3</b>        | <b>5</b>   |
| MMBZ5236ELT1/T3, G       | BF8            | 7.12                   | 7.5        | 7.88         | 20         | 6                   | 500                 | 0.25        | 3               | 6          |
| MMBZ5237ELT1/T3, G       | BF9            | 7.79                   | 8.2        | 8.61         | 20         | 8                   | 500                 | 0.25        | 3               | 6.5        |
| MMBZ5239ELT1/T3, G       | BG2            | 8.65                   | 9.1        | 9.55         | 20         | 10                  | 600                 | 0.25        | 3               | 7          |
| <b>MMBZ5240ELT1/T3,G</b> | <b>BG3</b>     | <b>9.50</b>            | <b>10</b>  | <b>10.50</b> | <b>20</b>  | <b>17</b>           | <b>600</b>          | <b>0.25</b> | <b>3</b>        | <b>8</b>   |
| <b>MMBZ5242ELT1/T3,G</b> | <b>BG5</b>     | <b>11.40</b>           | <b>12</b>  | <b>12.60</b> | <b>20</b>  | <b>30</b>           | <b>600</b>          | <b>0.25</b> | <b>1</b>        | <b>9.1</b> |
| MMBZ5243ELT1/T3, G       | BG6            | 12.35                  | 13         | 13.65        | 9.5        | 13                  | 600                 | 0.25        | 0.5             | 9.9        |
| MMBZ5244ELT1/T3, G       | BG7            | 13.30                  | 14         | 14.70        | 9          | 15                  | 600                 | 0.25        | 0.1             | 10         |
| <b>MMBZ5245ELT1/T3,G</b> | <b>BG8</b>     | <b>14.25</b>           | <b>15</b>  | <b>15.75</b> | <b>8.5</b> | <b>16</b>           | <b>600</b>          | <b>0.25</b> | <b>0.1</b>      | <b>11</b>  |
| MMBZ5246ELT1, G†         | BG9            | 15.20                  | 16         | 16.80        | 7.8        | 17                  | 600                 | 0.25        | 0.1             | 12         |
| <b>MMBZ5248ELT1/T3,G</b> | <b>BH2</b>     | <b>17.10</b>           | <b>18</b>  | <b>18.90</b> | <b>7</b>   | <b>21</b>           | <b>600</b>          | <b>0.25</b> | <b>0.1</b>      | <b>14</b>  |
| <b>MMBZ5250ELT1/T3,G</b> | <b>BH4</b>     | <b>19.00</b>           | <b>20</b>  | <b>21.00</b> | <b>6.2</b> | <b>25</b>           | <b>600</b>          | <b>0.25</b> | <b>0.1</b>      | <b>15</b>  |

4. Zener voltage is measured with a pulse test current  $I_Z$  at an ambient temperature of  $25^\circ\text{C}$ .

\*The "G" suffix indicates Pb-Free package available.

†MMBZ5246EL, MMBZ5252EL, and MMBZ5265EL Not Available in 10,000/Tape & Reel.

## MMBZ5221ELT1 Series

**ELECTRICAL CHARACTERISTICS** (continued) (Pinout: 1-Anode, 2-NC, 3-Cathode) ( $V_F = 0.9\text{ V Max @ }I_F = 10\text{ mA}$  for all types.)

| Device*                  | Device Marking | Zener Voltage (Note 5) |           |              |            | Zener Impedance     |                     |             | Leakage Current |           |
|--------------------------|----------------|------------------------|-----------|--------------|------------|---------------------|---------------------|-------------|-----------------|-----------|
|                          |                | $V_Z$ (V)              |           |              | @ $I_{ZT}$ | $Z_{ZT}$ @ $I_{ZT}$ | $Z_{ZK}$ @ $I_{ZK}$ |             | $I_R$ @ $V_R$   |           |
|                          |                | Min                    | Nom       | Max          | mA         | $\Omega$            | $\Omega$            | mA          | $\mu\text{A}$   | V         |
| MMBZ5252ELT1, G†         | BH6            | 22.80                  | 24        | 25.20        | 5.2        | 33                  | 600                 | 0.25        | 0.1             | 18        |
| MMBZ5253ELT1/T3          | BH7            | 23.75                  | 25        | 26.25        | 5          | 35                  | 600                 | 0.25        | 0.1             | 19        |
| <b>MMBZ5254ELT1/T3,G</b> | <b>BH8</b>     | <b>25.65</b>           | <b>27</b> | <b>28.35</b> | <b>4.6</b> | <b>41</b>           | <b>600</b>          | <b>0.25</b> | <b>0.1</b>      | <b>21</b> |
| MMBZ5255ELT1/T3, G       | BH9            | 26.60                  | 28        | 29.40        | 4.5        | 44                  | 600                 | 0.25        | 0.1             | 21        |
| MMBZ5256ELT1/T3, G       | BJ1            | 28.50                  | 30        | 31.50        | 4.2        | 49                  | 600                 | 0.25        | 0.1             | 23        |
| <b>MMBZ5257ELT1/T3,G</b> | <b>BJ2</b>     | <b>31.35</b>           | <b>33</b> | <b>34.65</b> | <b>3.8</b> | <b>58</b>           | <b>700</b>          | <b>0.25</b> | <b>0.1</b>      | <b>25</b> |
| MMBZ5258ELT1/T3, G       | BJ3            | 34.20                  | 36        | 37.80        | 3.4        | 70                  | 700                 | 0.25        | 0.1             | 27        |
| MMBZ5262ELT1/T3, G       | BJ7            | 48.45                  | 51        | 53.55        | 2.5        | 125                 | 1100                | 0.25        | 0.1             | 37        |
| MMBZ5263ELT1/T3, G       | BJ8            | 53.20                  | 56        | 58.80        | 2.2        | 150                 | 1300                | 0.25        | 0.1             | 43        |
| MMBZ5265ELT1, G†         | BK1            | 58.90                  | 62        | 65.10        | 2          | 185                 | 1400                | 0.25        | 0.1             | 47        |

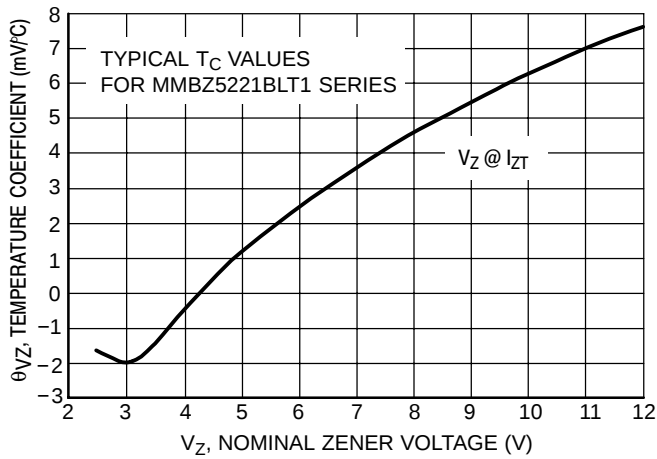
5. Zener voltage is measured with a pulse test current  $I_Z$  at an ambient temperature of 25°C.

\*The "G" suffix indicates Pb-Free package available.

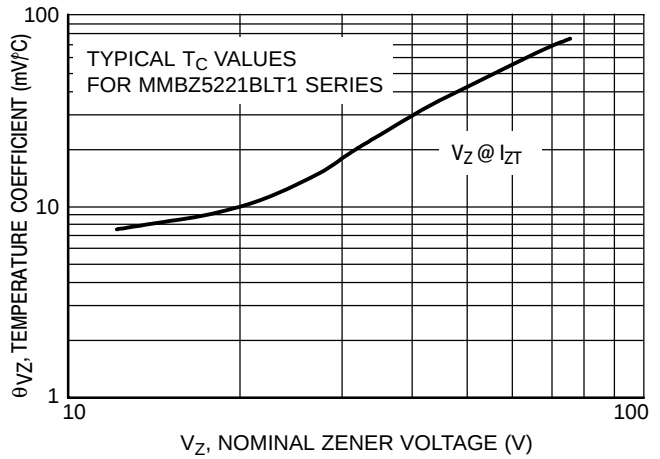
†MMBZ5246EL, MMBZ5252EL, and MMBZ5265EL Not Available in 10,000/Tape & Reel.

# MMBZ5221ELT1 Series

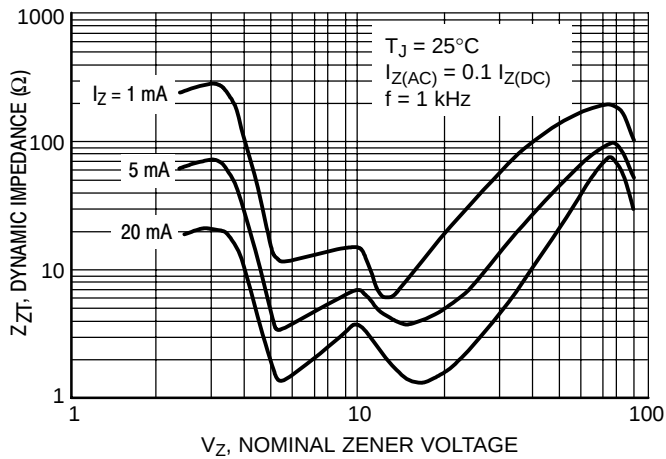
## TYPICAL CHARACTERISTICS



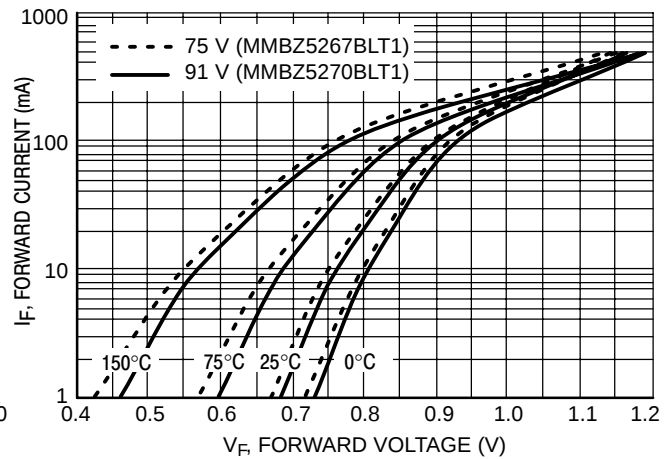
**Figure 1. Temperature Coefficients**  
(Temperature Range -55°C to +150°C)



**Figure 2. Temperature Coefficients**  
(Temperature Range -55°C to +150°C)



**Figure 3. Effect of Zener Voltage on**  
**Zener Impedance**



**Figure 4. Typical Forward Voltage**

# MMBZ5221ELT1 Series

## TYPICAL CHARACTERISTICS

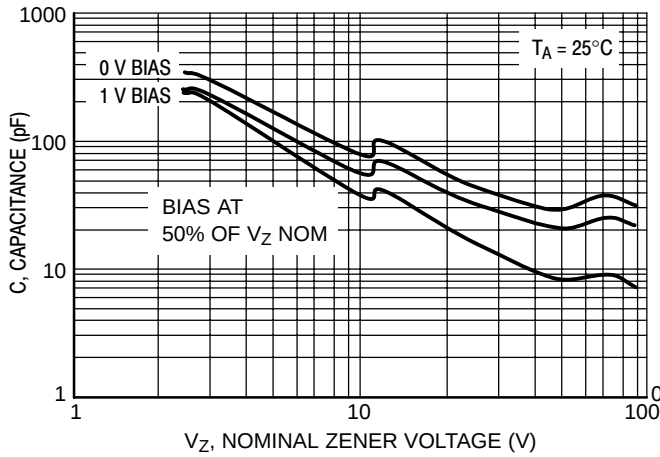


Figure 5. Typical Capacitance

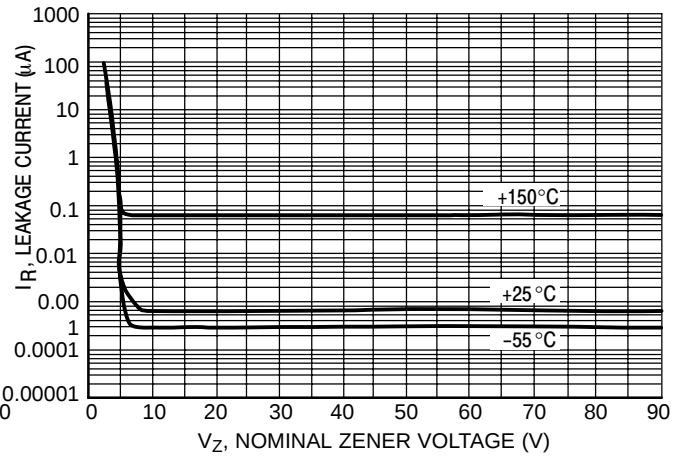


Figure 6. Typical Leakage Current

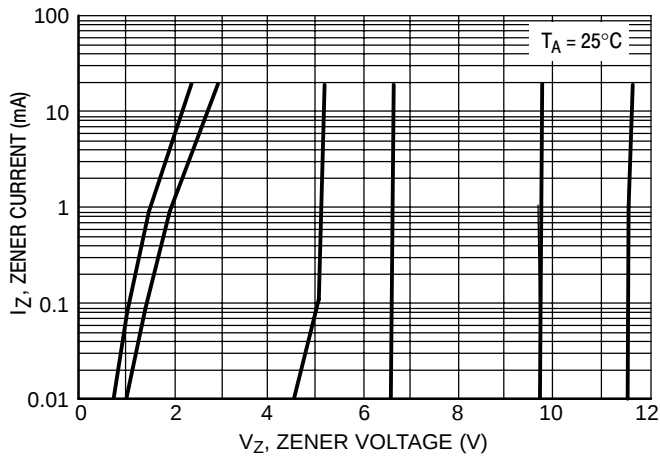


Figure 7. Zener Voltage versus Zener Current ( $V_Z$  Up to 12 V)

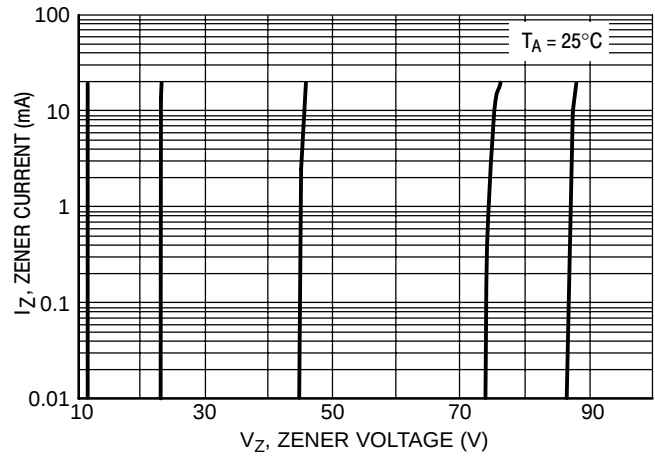


Figure 8. Zener Voltage versus Zener Current (12 V to 91 V)

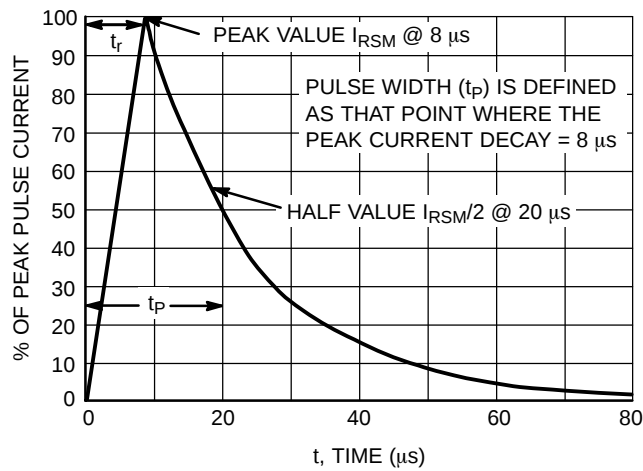
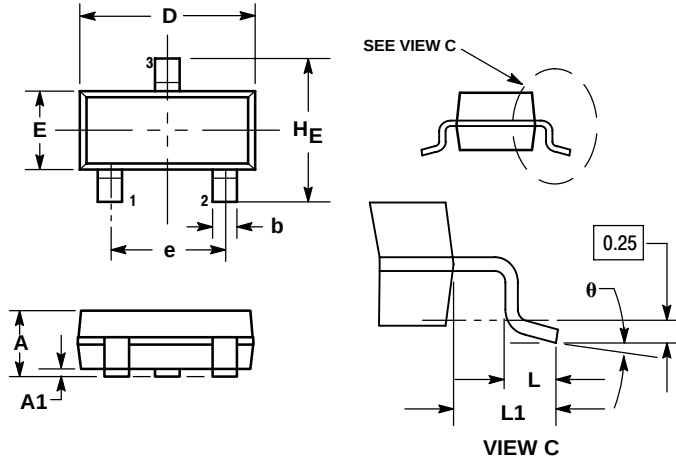


Figure 9.  $8 \times 20 \mu\text{s}$  Pulse Waveform

# MMBZ5221ELT1 Series

## PACKAGE DIMENSIONS

SOT-23  
TO-236AB  
CASE 318-08  
ISSUE AM



### NOTES:

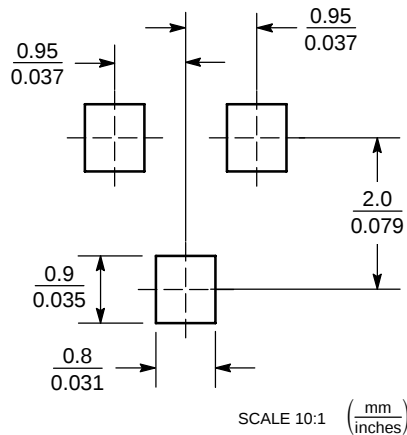
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318-01 THRU -07 AND -09 OBSOLETE, NEW STANDARD 318-08.

| DIM | MILLIMETERS |      |      | INCHES |       |       |
|-----|-------------|------|------|--------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN    | NOM   | MAX   |
| A   | 0.89        | 1.00 | 1.11 | 0.035  | 0.040 | 0.044 |
| A1  | 0.01        | 0.06 | 0.10 | 0.001  | 0.002 | 0.004 |
| b   | 0.37        | 0.44 | 0.50 | 0.015  | 0.018 | 0.020 |
| c   | 0.09        | 0.13 | 0.18 | 0.003  | 0.005 | 0.007 |
| 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 | 0.081 |
| L   | 0.10        | 0.20 | 0.30 | 0.004  | 0.008 | 0.012 |
| L1  | 0.35        | 0.54 | 0.69 | 0.014  | 0.021 | 0.029 |
| H_E | 2.10        | 2.40 | 2.64 | 0.083  | 0.094 | 0.104 |

### STYLE 8:

- PIN 1. ANODE
- NO CONNECTION
- CATHODE

## 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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