

# Z0103MA

## Sensitive Gate Triacs Series

### Silicon Bidirectional Thyristors

Designed for use in solid state relays, MPU interface, TTL logic and any other light industrial or consumer application. Supplied in an inexpensive TO-92 package which is readily adaptable for use in automatic insertion equipment.

#### Features

- One-Piece, Injection-Molded Package
- Blocking Voltage to 600 V
- Sensitive Gate Triggering in Four Trigger Modes (Quadrants) for all possible Combinations of Trigger Sources, and especially for Circuits that Source Gate Drives
- All Diffused and Glassivated Junctions for Maximum Uniformity of Parameters and Reliability
- Improved Noise Immunity (dv/dt Minimum of 10 V/ $\mu$ sec at 110°C)
- Commutating di/dt of 1.6 A/msec at 110°C
- High Surge Current of 8 A
- These are Pb-Free Devices

#### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

| Rating  | Symbol                               | Value       | Unit             |
|---|--------------------------------------|-------------|------------------|
| Peak Repetitive Off-State Voltage<br>( $T_J = -40$ to $+125^\circ\text{C}$ ) <sup>(1)</sup><br>Sine Wave 50 to 60 Hz, Gate Open | $V_{\text{DRM}}$<br>$V_{\text{RRM}}$ | 600         | V                |
| On-State RMS Current<br>Full Cycle Sine Wave 50 to 60 Hz<br>( $T_C = 50^\circ\text{C}$ )  | $I_{\text{T(RMS)}}$                  | 1.0         | A                |
| Peak Non-Repetitive Surge Current<br>One Full Cycle, Sine Wave 60 Hz<br>( $T_C = 110^\circ\text{C}$ )                           | $I_{\text{TSM}}$                     | 8.0         | A                |
| Circuit Fusing Considerations ( $t = 8.3$ ms)   | $I^2t$                               | 0.35        | A <sup>2</sup> s |
| Average Gate Power ( $T_C = 80^\circ\text{C}$ , $t \leq 8.3$ ms)  | $P_{\text{G(AV)}}$                   | 1.0         | W                |
| Peak Gate Current ( $t \leq 20$ $\mu$ s, $T_J = +125^\circ\text{C}$ )   | $I_{\text{GM}}$                      | 1.0         | A                |
| Operating Junction Temperature Range  | $T_J$                                | -40 to +125 | $^\circ\text{C}$ |
| Storage Temperature Range   | $T_{\text{stg}}$                     | -40 to +150 | $^\circ\text{C}$ |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1.  $V_{\text{DRM}}$  and  $V_{\text{RRM}}$  for all types can be applied on a continuous basis. Blocking voltages shall not be tested with a constant current source such that the voltage ratings of the devices are exceeded.

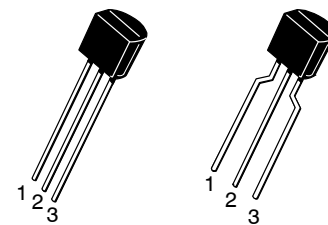
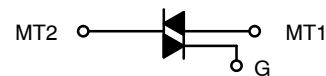


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#### TRIACS

**1.0 AMPERE RMS  
600 VOLTS**

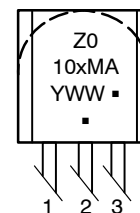


STRAIGHT LEAD  
BULK PACK

BENT LEAD  
TAPE & REEL  
AMMO PACK

**TO-92 (TO-226AA)  
CASE 029  
STYLE 12**

#### MARKING DIAGRAM



x = 3,7,9  
Y = Year  
WW = Work Week  
▪ = Pb-Free Package  
(\*Note: Microdot may be in either location)

#### PIN ASSIGNMENT

|   |                 |
|---|-----------------|
| 1 | Main Terminal 1 |
| 2 | Gate            |
| 3 | Main Terminal 2 |

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

# Z0103MA

## THERMAL CHARACTERISTICS

| Characteristic   | Symbol          | Max | Unit                 |
|--|-----------------|-----|----------------------|
| Thermal Resistance, Junction-to-Case                           | $R_{\theta JC}$ | 50  | $^{\circ}\text{C/W}$ |
| Thermal Resistance, Junction-to-Ambient                        | $R_{\theta JA}$ | 160 | $^{\circ}\text{C/W}$ |
| Maximum Lead Temperature for Soldering Purposes for 10 Seconds | $T_L$           | 260 | $^{\circ}\text{C}$   |

## ELECTRICAL CHARACTERISTICS ( $T_C = 25^{\circ}\text{C}$ unless otherwise noted; Electricals apply in both directions)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|   |  |                    |        |        |            |               |
|---|--|--------------------|--------|--------|------------|---------------|
| Peak Repetitive Blocking Current<br>( $V_D = \text{Rated } V_{DRM}, V_{RRM}; \text{ Gate Open}$ ) | $T_J = 25^{\circ}\text{C}$<br>$T_J = +125^{\circ}\text{C}$ | $I_{DRM}, I_{RRM}$ | –<br>– | –<br>– | 5.0<br>500 | $\mu\text{A}$ |
|---|--|--------------------|--------|--------|------------|---------------|

### ON CHARACTERISTICS

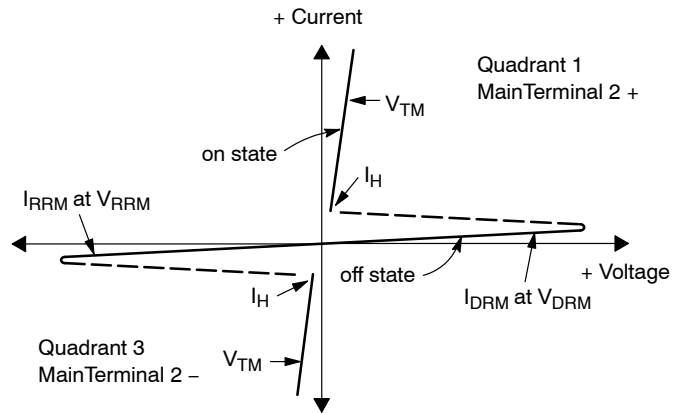
|   |          |                              |                  |                          |    |
|---|----------|------------------------------|------------------|--------------------------|----|
| Peak On-State Voltage<br>( $I_{TM} = \pm 1.4 \text{ A Peak}; \text{ Pulse Width} \leq 2.0 \text{ ms}, \text{ Duty Cycle} \leq 2.0\%$ )  | $V_{TM}$ | –                            | –                | 1.56                     | V  |
| Gate Trigger Current (Continuous dc)<br>( $V_D = 12 \text{ Vdc}, R_L = 30 \Omega$ )<br>MT2(+), G(+)<br>MT2(+), G(–)<br>MT2(–), G(–)<br>MT2(–), G(+)   | $I_{GT}$ | 0.15<br>0.15<br>0.15<br>0.25 | –<br>–<br>–<br>– | 3.0<br>3.0<br>3.0<br>5.0 | mA |
| Latching Current ( $V_D = 12 \text{ V}, I_G = 1.2 \times I_{GT}$ )<br>MT2(+), G(+) All Types<br>MT2(+), G(–) All Types<br>MT2(–), G(–) All Types<br>MT2(–), G(+) All Types                  | $I_L$    | –<br>–<br>–<br>–             | –<br>–<br>–<br>– | 7.0<br>15<br>7.0<br>7.0  | mA |
| Gate Trigger Voltage (Continuous dc)<br>( $V_D = 12 \text{ Vdc}, R_L = 30 \Omega$ )<br>MT2(+), G(+) All Types<br>MT2(+), G(–) All Types<br>MT2(–), G(–) All Types<br>MT2(–), G(+) All Types | $V_{GT}$ | –<br>–<br>–<br>–             | –<br>–<br>–<br>– | 1.3<br>1.3<br>1.3<br>1.3 | V  |
| Gate Non-Trigger Voltage<br>( $V_D = 12 \text{ V}, R_L = 30 \Omega, T_J = 125^{\circ}\text{C}$ )<br>All Four Quadrants  | $V_{GD}$ | 0.2                          | –                | 1.3                      | V  |
| Holding Current<br>( $V_D = 12 \text{ Vdc}, \text{ Initiating Current} = 50 \text{ mA}, \text{ Gate Open}$ )  | $I_H$    | –                            | –                | 7.0                      | mA |

### DYNAMIC CHARACTERISTICS

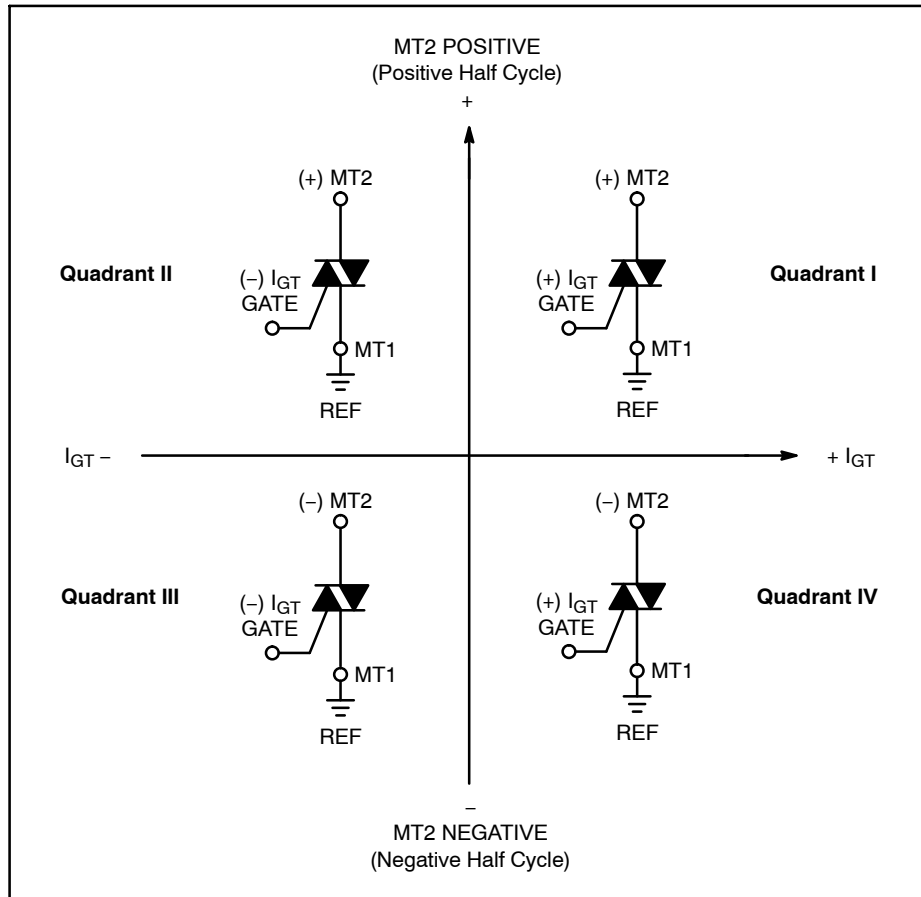
|   |            |     |    |    |                  |
|---|------------|-----|----|----|------------------|
| Rate of Change of Commutating Current<br>( $V_D = 400 \text{ V}, I_{TM} = 0.84 \text{ A}, \text{ Commutating } dv/dt = 1.5 \text{ V}/\mu\text{s}, \text{ Gate Open}, T_J = 110^{\circ}\text{C}, f = 250 \text{ Hz}, \text{ with Snubber}$ ) | $di/dt(c)$ | 1.6 | –  | –  | A/ms             |
| Critical Rate of Rise of Off-State Voltage ( $V_D = 67\% \text{ Rated } V_{DRM}, \text{ Exponential Waveform}, \text{ Gate Open}, T_J = 110^{\circ}\text{C}$ )  | $dv/dt$    | 10  | 30 | –  | V/ $\mu\text{s}$ |
| Repetitive Critical Rate of Rise of On-State Current, $T_J = 125^{\circ}\text{C}$<br>Pulse Width = 20 $\mu\text{s}$ , $IPK_{max} = 15 \text{ A}, diG/dt = 1 \text{ A}/\mu\text{s}, f = 60 \text{ Hz}$                                       | $di/dt$    | –   | –  | 20 | A/ $\mu\text{s}$ |

**Voltage Current Characteristic of Triacs  
(Bidirectional Device)**

| Symbol    | Parameter                                 |
|-----------|---|
| $V_{DRM}$ | Peak Repetitive Forward Off State Voltage |
| $I_{DRM}$ | Peak Forward Blocking Current             |
| $V_{RRM}$ | Peak Repetitive Reverse Off State Voltage |
| $I_{RRM}$ | Peak Reverse Blocking Current             |
| $V_{TM}$  | Maximum On State Voltage                  |
| $I_H$     | Holding Current                           |



**Quadrant Definitions for a Triac**



All polarities are referenced to MT1.  
With in-phase signals (using standard AC lines) quadrants I and III are used.

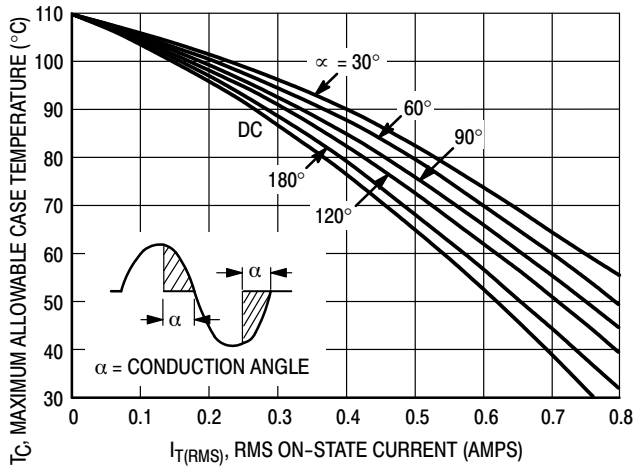


Figure 1. RMS Current Derating

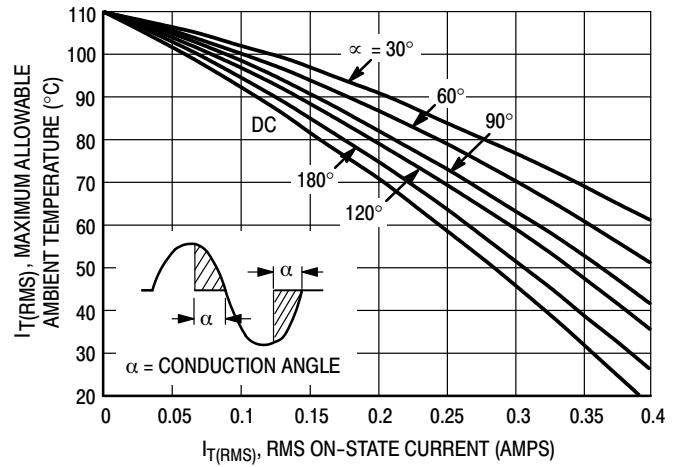


Figure 2. RMS Current Derating

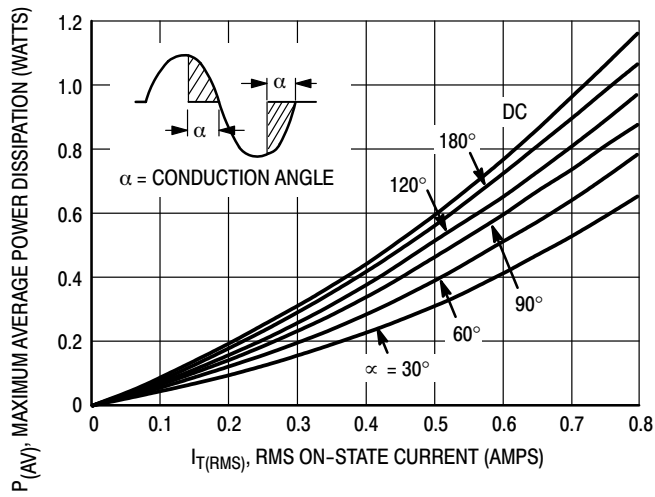


Figure 3. Power Dissipation

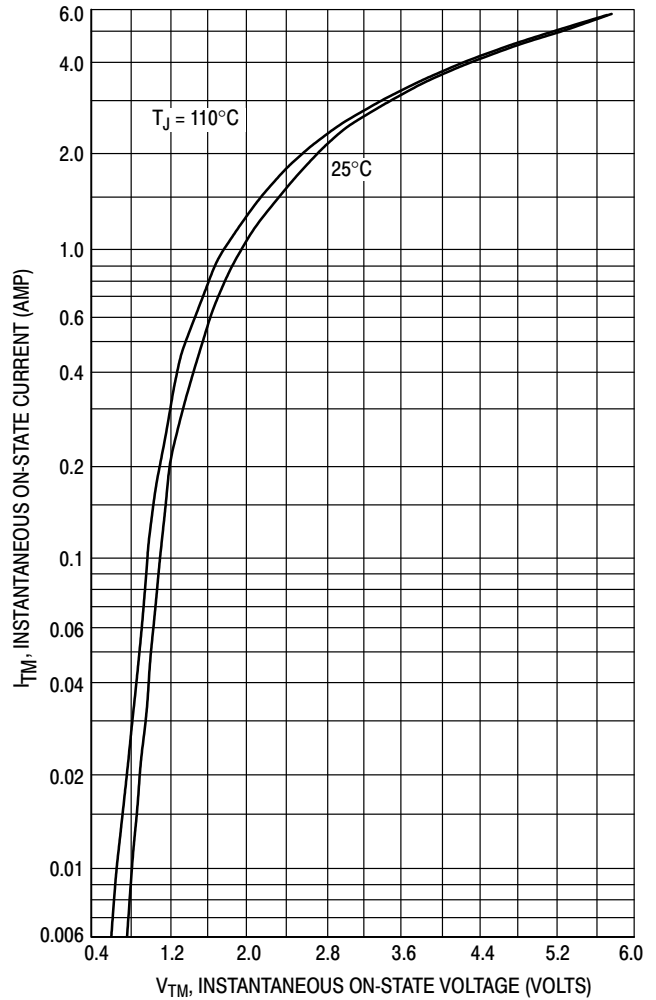


Figure 4. On-State Characteristics

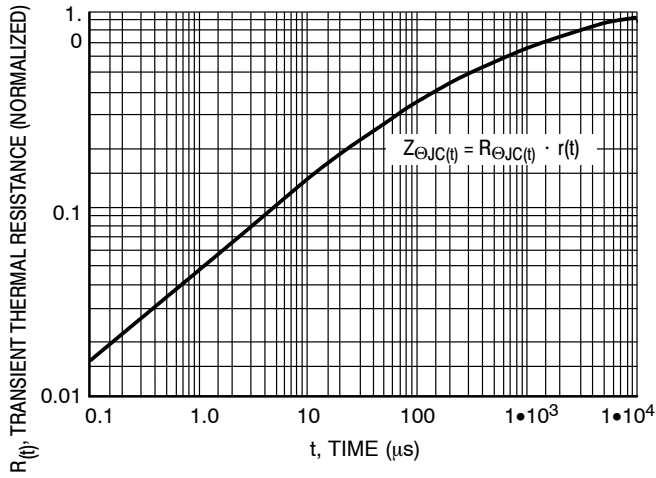


Figure 5. Transient Thermal Response

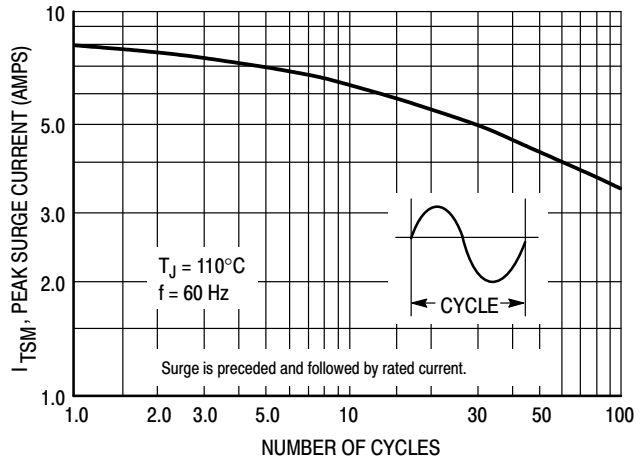


Figure 6. Maximum Allowable Surge Current

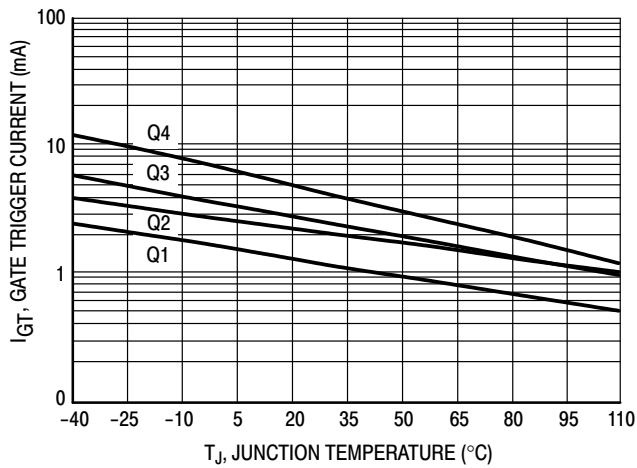


Figure 7. Typical Gate Trigger Current versus Junction Temperature

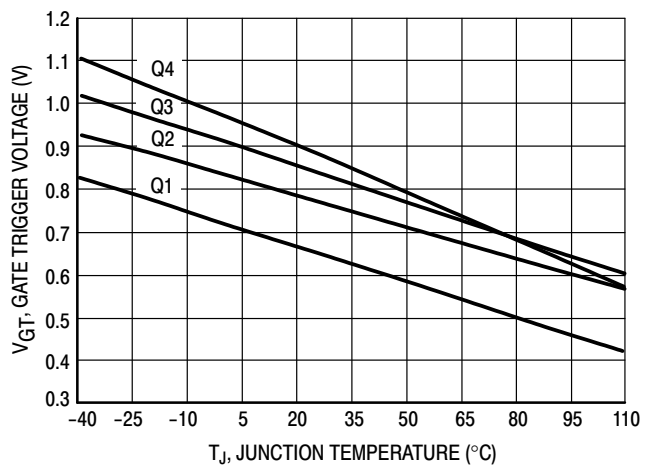


Figure 8. Typical Gate Trigger Voltage versus Junction Temperature

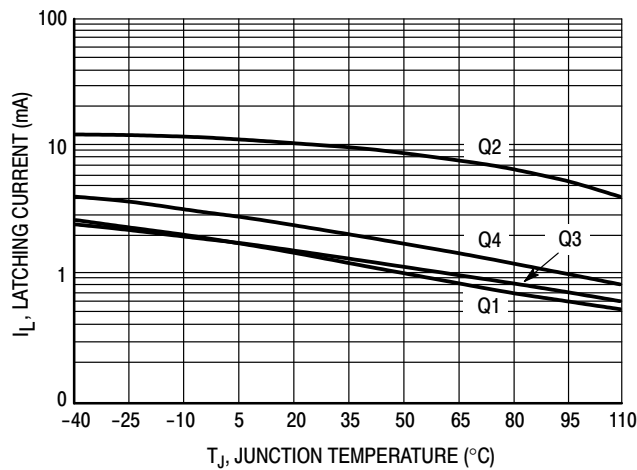


Figure 9. Typical Latching Current versus Junction Temperature

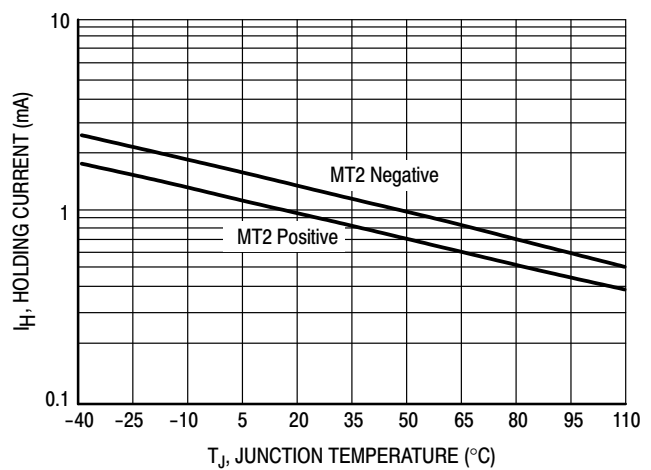
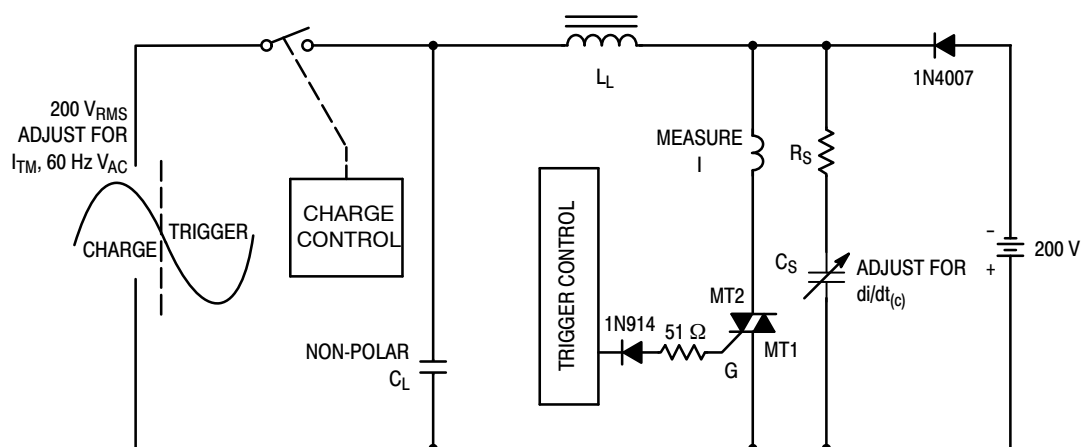


Figure 10. Typical Holding Current versus Junction Temperature

## Z0103MA



Note: Component values are for verification of rated  $(di/dt)_c$ . See AN1048 for additional information.

**Figure 11. Simplified Test Circuit to Measure the Critical Rate of Rise of Commutating Current  $(di/dt)_c$**

### ORDERING & SHIPPING INFORMATION: Packaging Options, Device Suffix

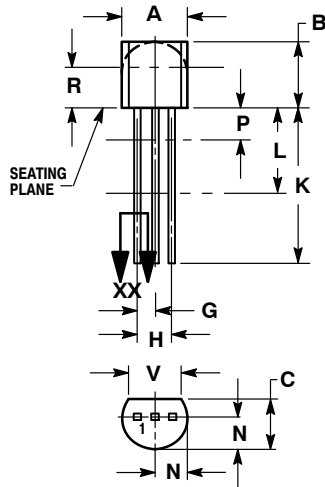
| U.S.         | Europe Equivalent | Shipping <sup>†</sup>                 | Description of TO-92 Tape Orientation                 |
|--------------|-------------------|---------------------------------------|---|
|              | Z0103MARL1G       | Radial Tape and Reel (2K/Reel)        | Flat side of TO-92 and adhesive tape visible          |
| Z0103MAG     |                   | Bulk in Box (5K/Box)                  | N/A, Bulk   |
| Z0103MARLRPG |                   | Radial Tape and Fan Fold Box (2K/Box) | Round side of TO-92 and adhesive tape visible         |
| Z0103MARLRFG |                   | Radial Tape and Fan Fold Box (2K/Box) | Round side of TO-92 and adhesive tape on reverse side |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

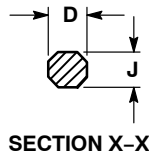
# Z0103MA

## PACKAGE DIMENSIONS

### TO-92 (TO-226AA) CASE 029-11 ISSUE AM



STRAIGHT LEAD  
BULK PACK

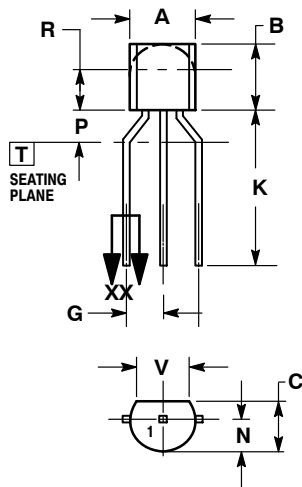


SECTION X-X

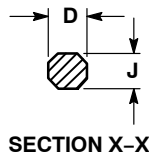
#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.175  | 0.205 | 4.45        | 5.20  |
| B   | 0.170  | 0.210 | 4.32        | 5.33  |
| C   | 0.125  | 0.165 | 3.18        | 4.19  |
| D   | 0.016  | 0.021 | 0.407       | 0.533 |
| G   | 0.045  | 0.055 | 1.15        | 1.39  |
| H   | 0.095  | 0.105 | 2.42        | 2.66  |
| J   | 0.015  | 0.020 | 0.39        | 0.50  |
| K   | 0.500  | ---   | 12.70       | ---   |
| L   | 0.250  | ---   | 6.35        | ---   |
| N   | 0.080  | 0.105 | 2.04        | 2.66  |
| P   | ---    | 0.100 | ---         | 2.54  |
| R   | 0.115  | ---   | 2.93        | ---   |
| V   | 0.135  | ---   | 3.43        | ---   |



BENT LEAD  
TAPE & REEL  
AMMO PACK



SECTION X-X


#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 4.45        | 5.20 |
| B   | 4.32        | 5.33 |
| C   | 3.18        | 4.19 |
| D   | 0.40        | 0.54 |
| G   | 2.40        | 2.80 |
| J   | 0.39        | 0.50 |
| K   | 12.70       | ---  |
| N   | 2.04        | 2.66 |
| P   | 1.50        | 4.00 |
| R   | 2.93        | ---  |
| V   | 3.43        | ---  |

#### STYLE 12:

- PIN 1. MAIN TERMINAL 1
- GATE
- MAIN TERMINAL 2

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