

# Z0103MN, Z0107MN, Z0109MN

## Sensitive Gate Triac Series

### Silicon Bidirectional Thyristors

Designed for use in solid state relays, MPU interface, TTL logic and other light industrial or consumer applications. Supplied in surface mount package for use in automated manufacturing.

#### Features

- Sensitive Gate Trigger Current in Four Trigger Modes
- Blocking Voltage to 600 V
- Glass Passivated Surface for Reliability and Uniformity
- Surface Mount Package
- 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 (Note 1)<br>(Sine Wave, 50 to 60 Hz, Gate Open,<br>$T_J = -40$ to $+125^\circ\text{C}$ ) | $V_{\text{DRM}}$ ,<br>$V_{\text{RRM}}$ | 600                | V                    |
| On-State Current RMS ( $T_C = 80^\circ\text{C}$ )<br>(Full Sine Wave 50 to 60 Hz)                                          | $I_{\text{T(RMS)}}$                    | 1.0                | A                    |
| Peak Non-repetitive Surge Current (One Full<br>Cycle Sine Wave, 60 Hz, $T_C = 25^\circ\text{C}$ )                          | $I_{\text{TSM}}$                       | 8.0                | A                    |
| Circuit Fusing Considerations<br>(Pulse Width = 8.3 ms)                                                                    | $I^2t$                                 | 0.4                | $\text{A}^2\text{s}$ |
| Average Gate Power ( $T_C = 80^\circ\text{C}$ , $t \leq 8.3$ ms)                                                           | $P_{\text{G(AV)}}$                     | 1.0                | W                    |
| Peak Gate Current ( $t \leq 20$ $\mu\text{s}$ , $T_J = +125^\circ\text{C}$ )                                               | $I_{\text{GM}}$                        | 1.0                | A                    |
| Operating Junction Temperature Range                                                                                       | $T_J$                                  | $-40$ to<br>$+125$ | $^\circ\text{C}$     |
| Storage Temperature Range                                                                                                  | $T_{\text{stg}}$                       | $-40$ to<br>$+150$ | $^\circ\text{C}$     |

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.

#### THERMAL CHARACTERISTICS

| Characteristic                                                            | Symbol                | Max | Unit               |
|---------------------------------------------------------------------------|-----------------------|-----|--------------------|
| Thermal Resistance, Junction-to-Ambient PCB<br>Mounted per Figure 1       | $R_{\theta\text{JA}}$ | 156 | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction-to-Tab Measured on MT2 Tab Adjacent to Epoxy | $R_{\theta\text{JT}}$ | 25  | $^\circ\text{C/W}$ |
| Maximum Device Temperature for<br>Soldering Purposes for 10 Secs Maximum  | $T_L$                 | 260 | $^\circ\text{C}$   |



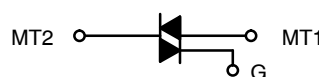
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<http://onsemi.com>

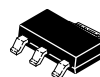
### TRIAC

#### 1.0 AMPERE RMS

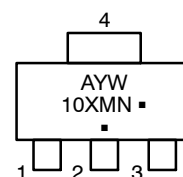
#### 600 VOLTS



#### MARKING DIAGRAM



SOT-223  
CASE 318E  
STYLE 11



A = Assembly Location  
Y = Year  
W = Work Week  
10XMN = Device Code  
x = 3, 7, 9  
▪ = Pb-Free Package  
(Note: Microdot may be in either location)

#### PIN ASSIGNMENT

|   | PIN ASSIGNMENT  |
|---|-----------------|
| 1 | Main Terminal 1 |
| 2 | Main Terminal 2 |
| 3 | Gate            |
| 4 | Main Terminal 2 |

#### ORDERING INFORMATION

| Device     | Package              | Shipping†        |
|------------|----------------------|------------------|
| Z0103MNT1G | SOT-223<br>(Pb-Free) | 1000/Tape & Reel |
| Z0107MNT1G | SOT-223<br>(Pb-Free) | 1000/Tape & Reel |
| Z0109MNT1G | SOT-223<br>(Pb-Free) | 1000/Tape & Reel |

†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.

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## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted; Electricals apply in both directions)

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

### OFF CHARACTERISTICS

|                                                                                                              |                                                  |                                     |        |        |            |          |
|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------|-------------------------------------|--------|--------|------------|----------|
| Peak Repetitive Blocking Current<br>(V <sub>D</sub> = Rated V <sub>DRM</sub> , V <sub>RRM</sub> ; Gate Open) | T <sub>J</sub> = 25°C<br>T <sub>J</sub> = +125°C | I <sub>DRM</sub> , I <sub>RRM</sub> | –<br>– | –<br>– | 5.0<br>500 | μA<br>μA |
|--------------------------------------------------------------------------------------------------------------|--------------------------------------------------|-------------------------------------|--------|--------|------------|----------|

### ON CHARACTERISTICS

|                                                                                                                                                                                           |                                 |                 |                              |                  |                          |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-----------------|------------------------------|------------------|--------------------------|----|
| Peak On-State Voltage<br>(I <sub>TM</sub> = ± 1.4 A Peak; Pulse Width ≤ 2.0 ms, Duty Cycle ≤ 2.0%)                                                                                        |                                 | V <sub>TM</sub> | –                            | –                | 1.56                     | V  |
| Gate Trigger Current (Continuous dc)<br>(V <sub>D</sub> = 12 Vdc, R <sub>L</sub> = 30 Ohms)<br>MT2(+), G(+)<br>MT2(+), G(–)<br>MT2(–), G(–)<br>MT2(–), G(+)                               | Z0103MN                         | I <sub>GT</sub> | 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 |
| Gate Trigger Current (Continuous dc)<br>(V <sub>D</sub> = 12 Vdc, R <sub>L</sub> = 30 Ohms)<br>MT2(+), G(+)<br>MT2(+), G(–)<br>MT2(–), G(–)<br>MT2(–), G(+)                               | Z0107MN                         | I <sub>GT</sub> | 0.15<br>0.15<br>0.15<br>0.25 | –<br>–<br>–<br>– | 5.0<br>5.0<br>5.0<br>7.0 | mA |
| Gate Trigger Current (Continuous dc)<br>(V <sub>D</sub> = 12 Vdc, R <sub>L</sub> = 30 Ohms)<br>MT2(+), G(+)<br>MT2(+), G(–)<br>MT2(–), G(–)<br>MT2(–), G(+)                               | Z0109MN                         | I <sub>GT</sub> | 0.15<br>0.15<br>0.15<br>0.25 | –<br>–<br>–<br>– | 10<br>10<br>10<br>10     | mA |
| Latching Current (V <sub>D</sub> = 12 V, I <sub>G</sub> = 1.2 x I <sub>GT</sub> )<br>MT2(+), G(+) All Types<br>MT2(+), G(–) All Types<br>MT2(–), G(–) All Types<br>MT2(–), G(+) All Types | Z0103MN                         | I <sub>L</sub>  | –<br>–<br>–<br>–             | –<br>–<br>–<br>– | 7.0<br>15<br>7.0<br>7.0  | mA |
| Latching Current (V <sub>D</sub> = 12 V, I <sub>G</sub> = 1.2 x I <sub>GT</sub> )<br>MT2(+), G(+) All Types<br>MT2(+), G(–) All Types<br>MT2(–), G(–) All Types<br>MT2(–), G(+) All Types | Z0107MN                         | I <sub>L</sub>  | –<br>–<br>–<br>–             | –<br>–<br>–<br>– | 10<br>20<br>10<br>10     | mA |
| Latching Current (V <sub>D</sub> = 12 V, I <sub>G</sub> = 1.2 x I <sub>GT</sub> )<br>MT2(+), G(+) All Types<br>MT2(+), G(–) All Types<br>MT2(–), G(–) All Types<br>MT2(–), G(+) All Types | Z0109MN                         | I <sub>L</sub>  | –<br>–<br>–<br>–             | –<br>–<br>–<br>– | 15<br>25<br>15<br>15     | mA |
| Gate Trigger Voltage (Continuous dc) (V <sub>D</sub> = 12 Vdc, R <sub>L</sub> = 30 Ohms)                                                                                                  |                                 | V <sub>GT</sub> | –                            | –                | 1.3                      | V  |
| Gate Non-Trigger Voltage (V <sub>D</sub> = 12 V, R <sub>L</sub> = 30 Ohms, T <sub>J</sub> = 125°C)<br>All Four Quadrants                                                                  |                                 | V <sub>GD</sub> | 0.2                          | –                | –                        | V  |
| Holding Current<br>(V <sub>D</sub> = 12 Vdc, Initiating Current = 50 mA, Gate Open)                                                                                                       | (Z0103MA)<br>(Z0107MA, Z0109MA) | I <sub>H</sub>  | –<br>–                       | –<br>–           | 7.0<br>10                | mA |

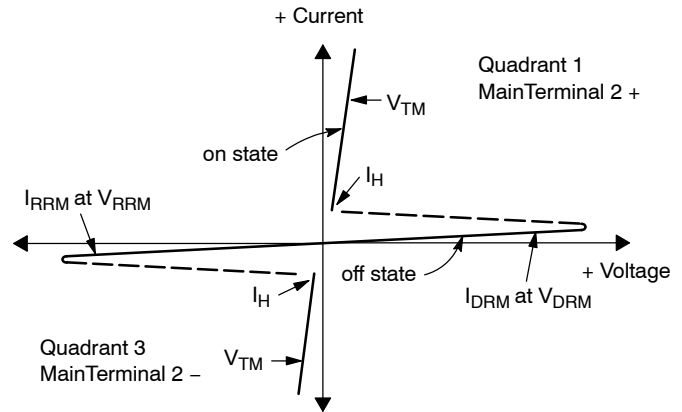
### DYNAMIC CHARACTERISTICS

|                                                                                                                                                                                           |          |                |                |             |      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------------|----------------|-------------|------|
| Rate of Change of Commutating Current<br>(V <sub>D</sub> = 400 V, I <sub>TM</sub> = 0.84 A, Commutating dv/dt = 1.5 V/μs, Gate Open,<br>T <sub>J</sub> = 110°C, f = 250 Hz, with Snubber) | di/dt(c) | 1.6            | –              | –           | A/ms |
| Critical Rate of Rise of Off-State Voltage (V <sub>D</sub> = 67% Rated V <sub>DRM</sub> , Exponential<br>Waveform, Gate Open, T <sub>J</sub> = 110°C)                                     | dv/dt    | 10<br>20<br>50 | 30<br>60<br>75 | –<br>–<br>– | V/μs |
| Repetitive Critical Rate of Rise of On-State Current, T <sub>J</sub> = 125°C<br>Pulse Width = 20 μs, IPKmax = 15 A, diG/dt = 1 A/μs, f = 60 Hz                                            | di/dt    | –              | –              | 20          | A/μs |

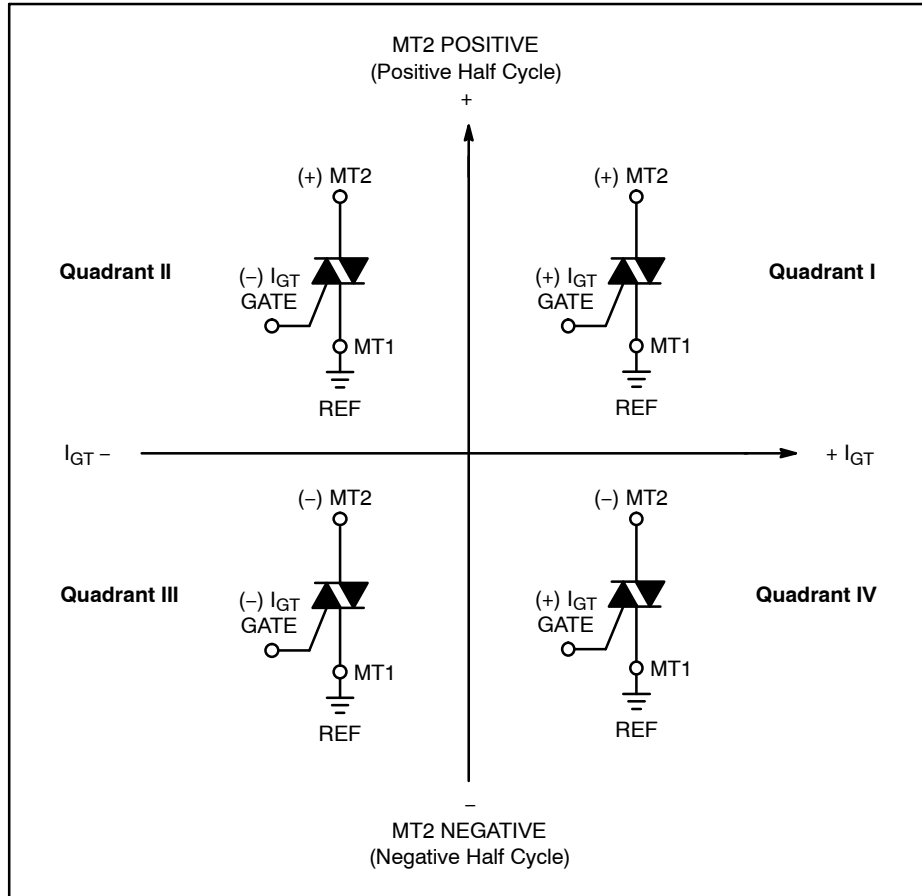
# Z0103MN, Z0107MN, Z0109MN

## 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                           |



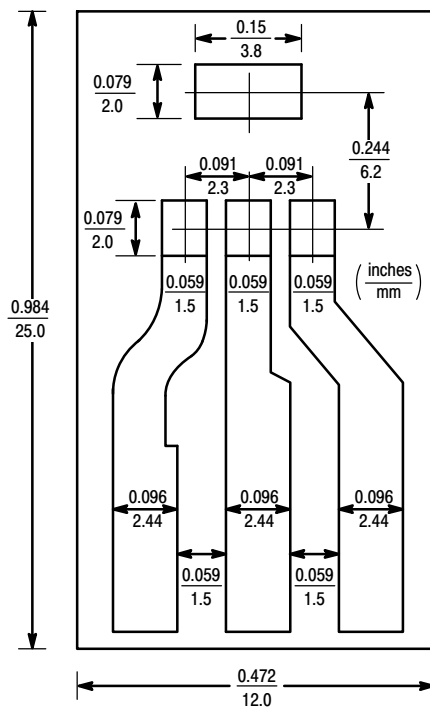
### Quadrant Definitions for a Triac



All polarities are referenced to MT1.

With in-phase signals (using standard AC lines) quadrants I and III are used.

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BOARD MOUNTED VERTICALLY IN CINCH 8840 EDGE CONNECTOR.  
BOARD THICKNESS = 65 MIL, FOIL THICKNESS = 2.5 MIL  
MATERIAL: G10 FIBERGLASS BASE EPOXY

Figure 1. PCB for Thermal Impedance and Power Testing of SOT-223

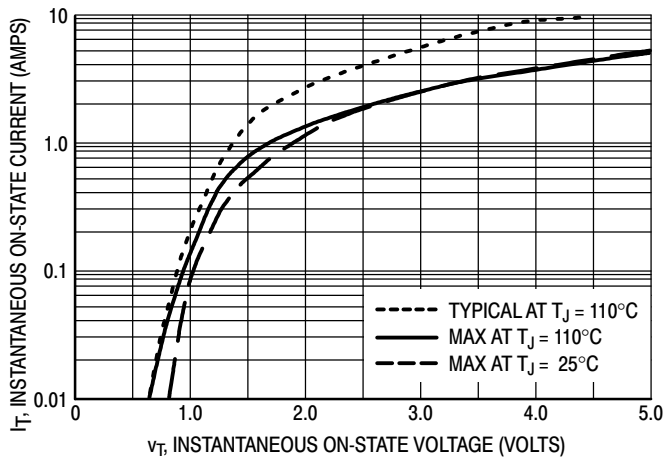


Figure 2. On-State Characteristics

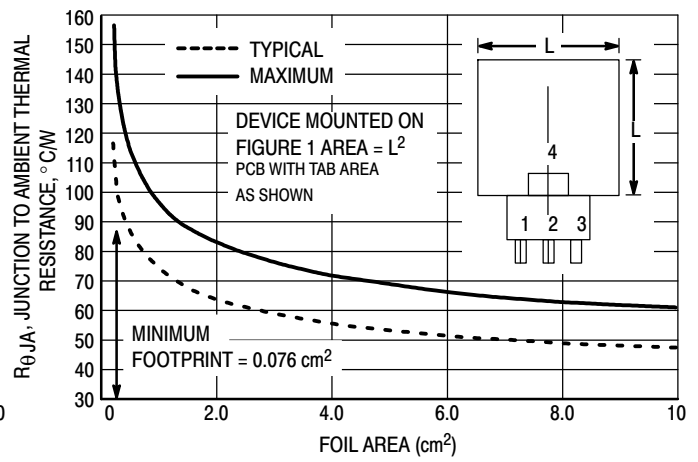


Figure 3. Junction to Ambient Thermal Resistance versus Copper Tab Area

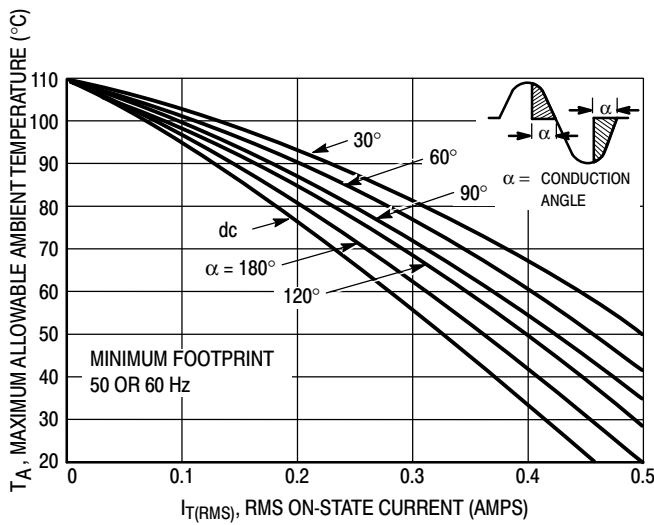


Figure 4. Current Derating, Minimum Pad Size  
Reference: Ambient Temperature

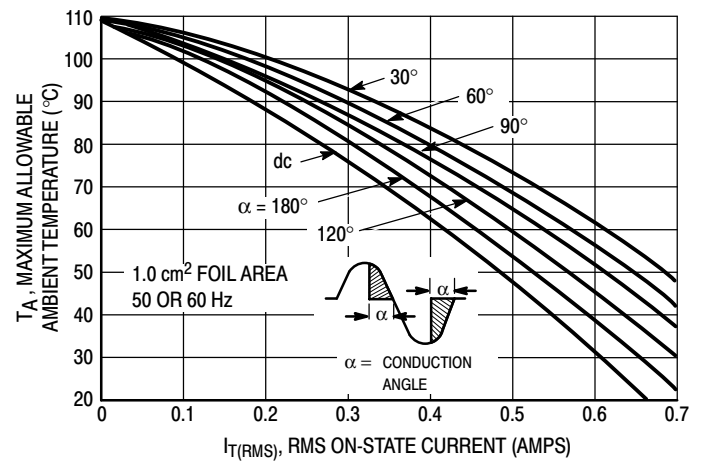


Figure 5. Current Derating, 1.0 cm Square Pad  
Reference: Ambient Temperature

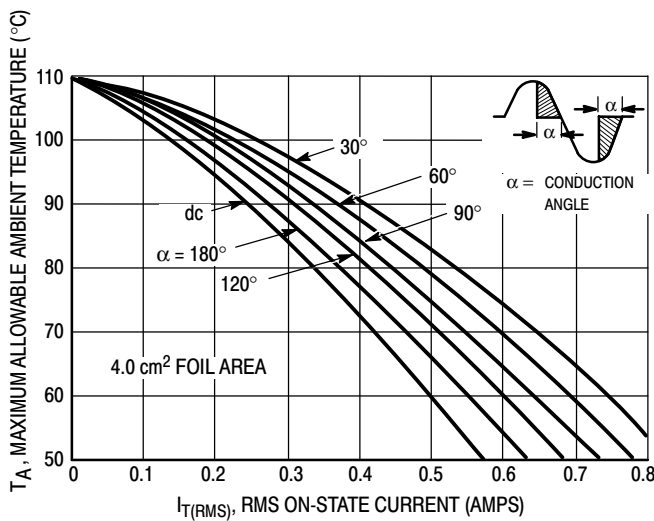


Figure 6. Current Derating, 2.0 cm Square Pad  
Reference: Ambient Temperature

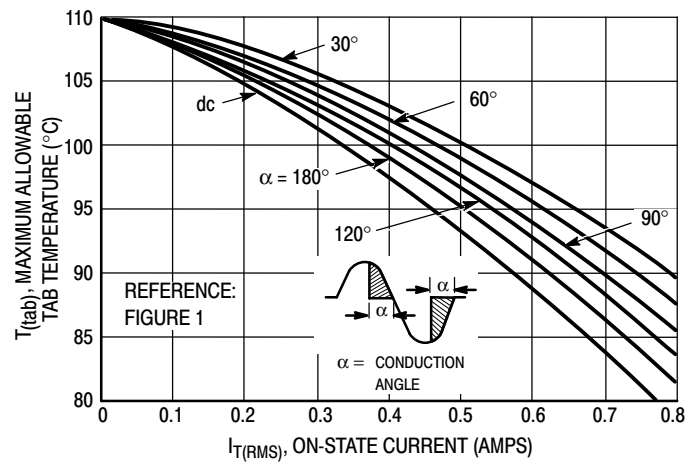


Figure 7. Current Derating  
Reference: MT2 Tab

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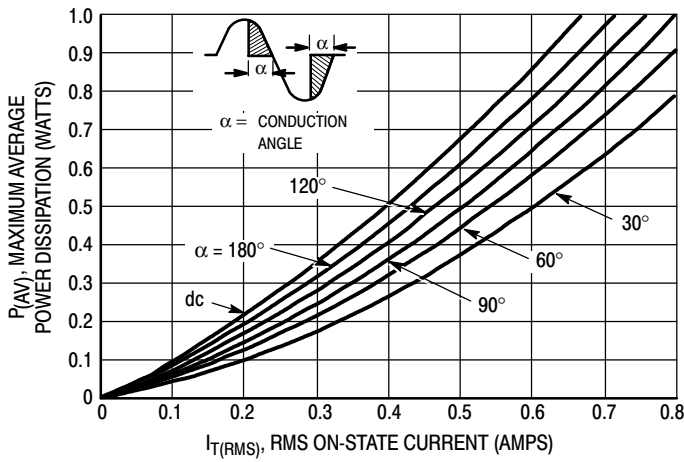


Figure 8. Power Dissipation

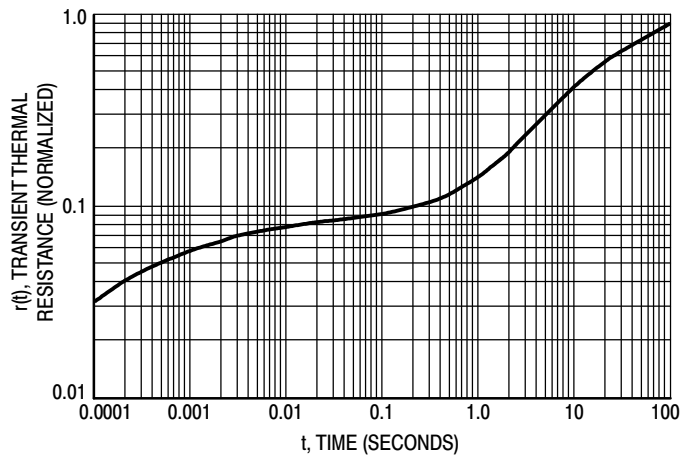
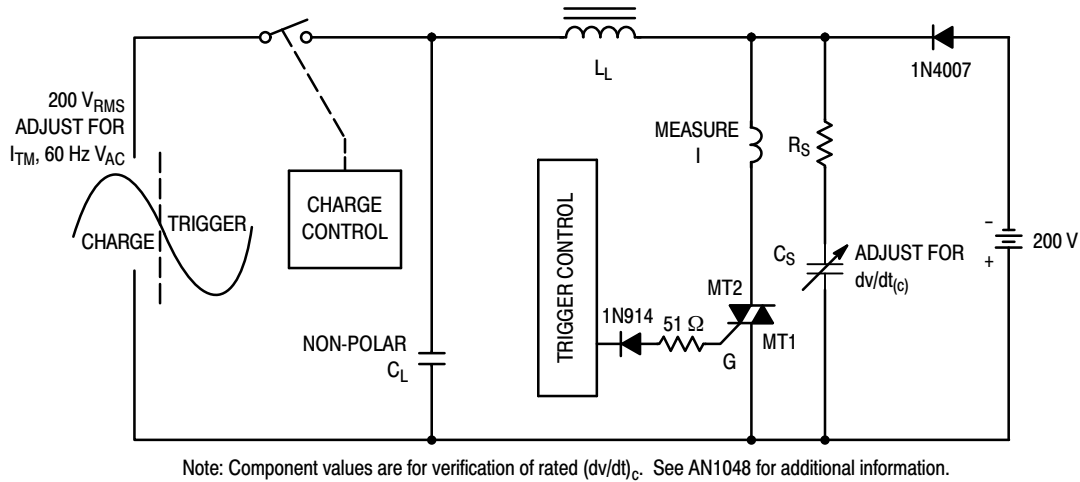


Figure 9. Thermal Response, Device Mounted on Figure 1 Printed Circuit Board



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

Figure 10. Simplified Test Circuit to Measure the Critical Rate of Rise of Commutating Voltage  $(dv/dt)_c$

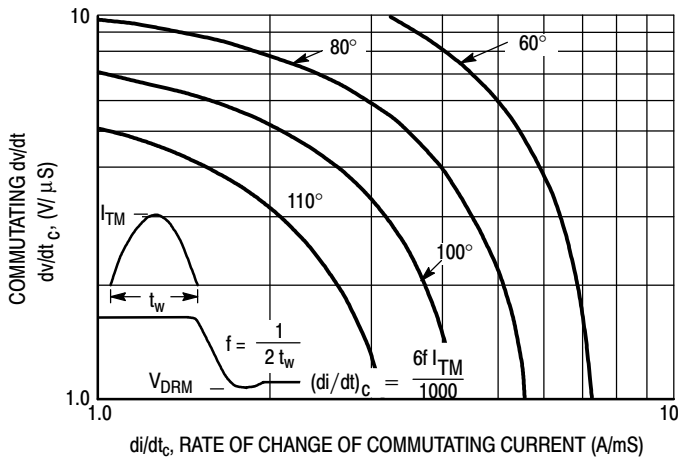


Figure 11. Typical Commutating  $dv/dt$  versus Current Crossing Rate and Junction Temperature

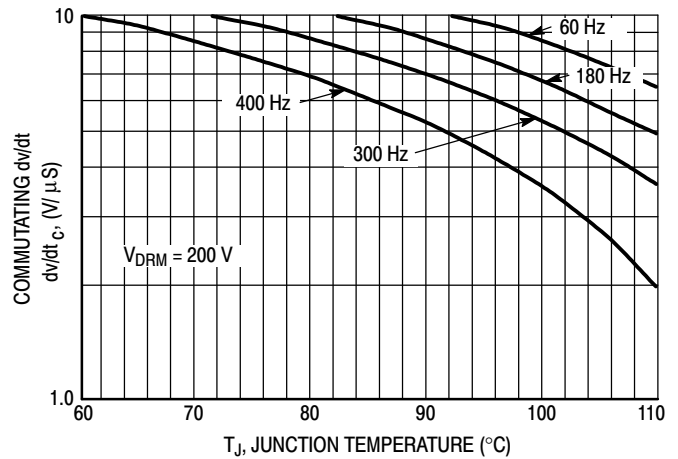


Figure 12. Typical Commutating  $dv/dt$  versus Junction Temperature at 0.8 Amps RMS

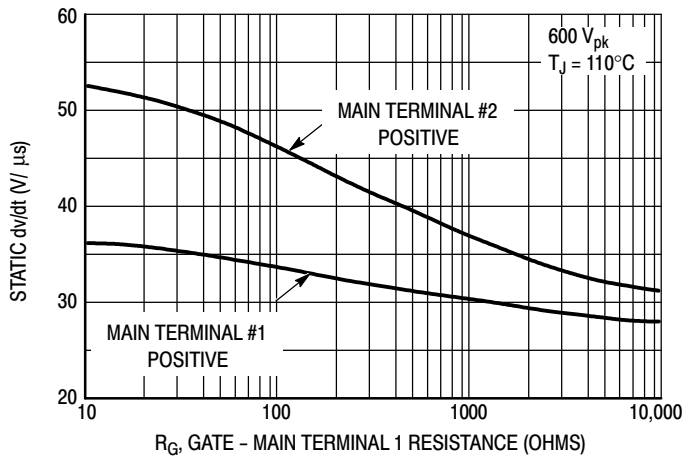


Figure 13. Exponential Static  $dv/dt$  versus Gate - Main Terminal 1 Resistance

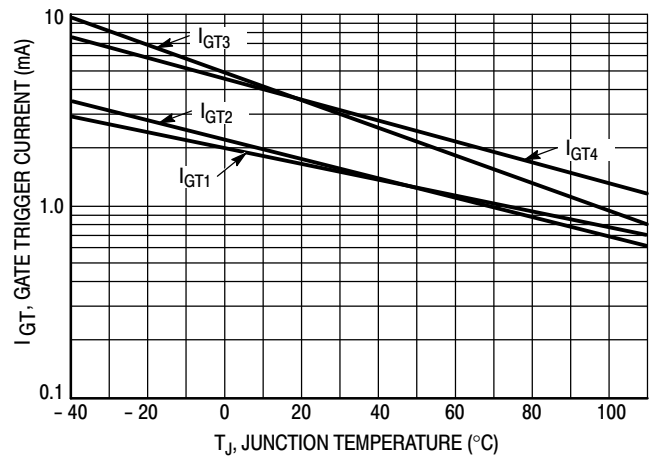


Figure 14. Typical Gate Trigger Current Variation

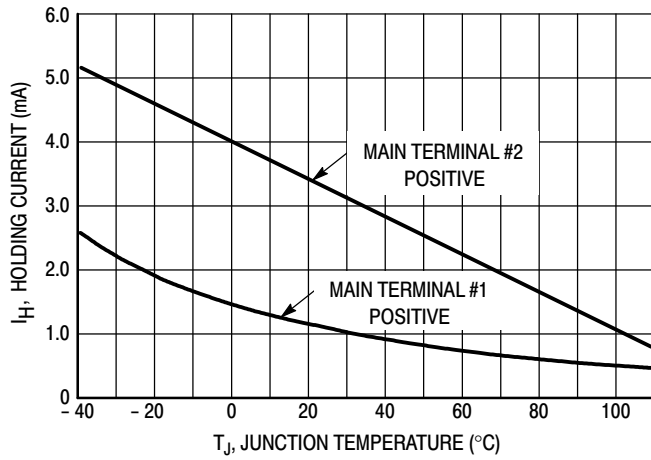


Figure 15. Typical Holding Current Variation

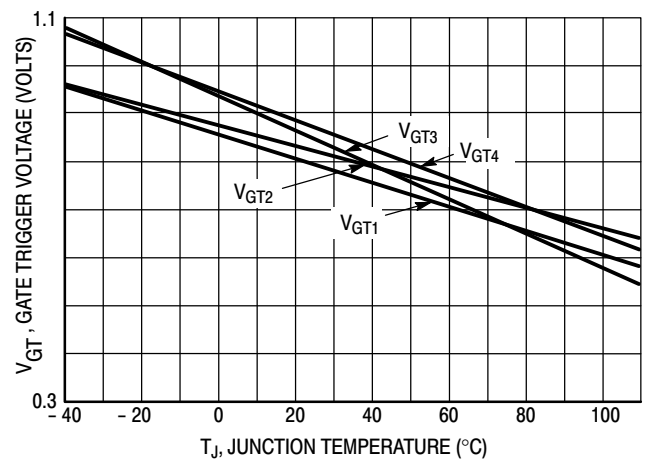
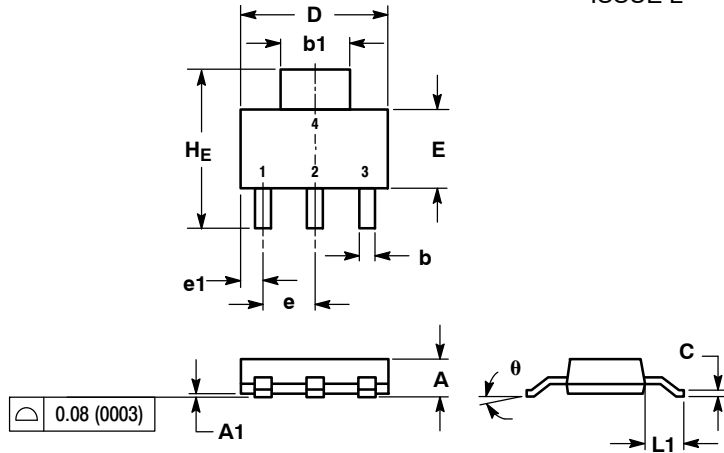


Figure 16. Gate Trigger Voltage Variation

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## PACKAGE DIMENSIONS

SOT-223 (TO-261)  
CASE 318E-04  
ISSUE L

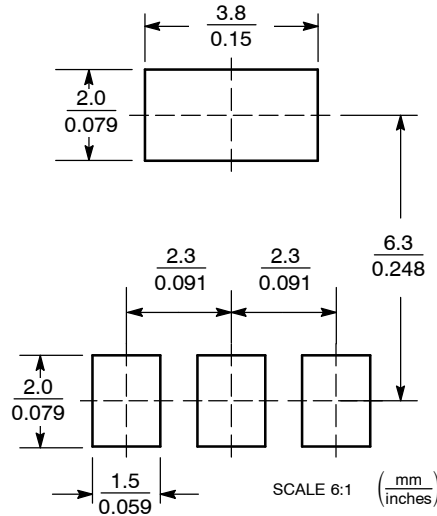


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.

| DIM            | MILLIMETERS |      |      | INCHES |       |       |
|----------------|-------------|------|------|--------|-------|-------|
|                | MIN         | NOM  | MAX  | MIN    | NOM   | MAX   |
| A              | 1.50        | 1.63 | 1.75 | 0.060  | 0.064 | 0.068 |
| A1             | 0.02        | 0.06 | 0.10 | 0.001  | 0.002 | 0.004 |
| b              | 0.60        | 0.75 | 0.89 | 0.024  | 0.030 | 0.035 |
| b1             | 2.90        | 3.06 | 3.20 | 0.115  | 0.121 | 0.126 |
| c              | 0.24        | 0.29 | 0.35 | 0.009  | 0.012 | 0.014 |
| D              | 6.30        | 6.50 | 6.70 | 0.249  | 0.256 | 0.263 |
| E              | 3.30        | 3.50 | 3.70 | 0.130  | 0.138 | 0.145 |
| e              | 2.20        | 2.30 | 2.40 | 0.087  | 0.091 | 0.094 |
| e1             | 0.85        | 0.94 | 1.05 | 0.033  | 0.037 | 0.041 |
| L1             | 1.50        | 1.75 | 2.00 | 0.060  | 0.069 | 0.078 |
| H <sub>E</sub> | 6.70        | 7.00 | 7.30 | 0.264  | 0.276 | 0.287 |
| θ              | 0°          | —    | 10°  | 0°     | —     | 10°   |

STYLE 11:  
PIN 1. MT 1  
2. MT 2  
3. GATE  
4. MT 2

## 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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