

# BTB16-600BW3G, BTB16-800BW3G



**ON Semiconductor®**

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## Triacs Silicon Bidirectional Thyristors

Designed for high performance full-wave ac control applications where high noise immunity and high commutating di/dt are required.

### Features

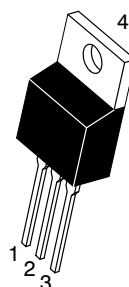
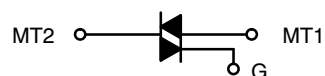
- Blocking Voltage to 800 V
- On-State Current Rating of 16 A RMS at 25°C
- Uniform Gate Trigger Currents in Three Quadrants
- High Immunity to dV/dt - 1500 V/μs minimum at 125°C
- Minimizes Snubber Networks for Protection
- Industry Standard TO-220AB Package
- High Commutating dI/dt - 7.5 A/ms minimum at 125°C
- These are Pb-Free Devices

### MAXIMUM RATINGS (T<sub>J</sub> = 25°C unless otherwise noted)

| Rating  | Symbol                                 | Value                                      | Unit               |
|---|--|--|--------------------|
| Peak Repetitive Off-State Voltage (Note 1)<br>(T <sub>J</sub> = -40 to 125°C, Sine Wave,<br>50 to 60 Hz, Gate Open)<br>BTB16-600BW3G<br>BTB16-800BW3G | V <sub>DRM</sub> ,<br>V <sub>RRM</sub> | 600<br>800                                 | V                  |
| On-State RMS Current<br>(Full Cycle Sine Wave, 60 Hz, T <sub>C</sub> = 80°C)  | I <sub>T(RMS)</sub>                    | 16   | A                  |
| Peak Non-Repetitive Surge Current<br>(One Full Cycle Sine Wave, 60 Hz,<br>T <sub>C</sub> = 25°C)  | I <sub>TSM</sub>                       | 170  | A                  |
| Circuit Fusing Consideration (t = 10 ms)  | I <sup>2</sup> t                       | 144  | A <sup>2</sup> sec |
| Non-Repetitive Surge Peak Off-State<br>Voltage (T <sub>J</sub> = 25°C, t = 10ms)  | V <sub>DSM</sub> /<br>V <sub>RSM</sub> | V <sub>DSM</sub> /V <sub>RSM</sub><br>+100 | V                  |
| Peak Gate Current (T <sub>J</sub> = 125°C, t = 20ms)  | I <sub>GM</sub>                        | 4.0  | A                  |
| Peak Gate Power<br>(Pulse Width ≤ 1.0 μs, T <sub>C</sub> = 80°C)  | P <sub>GM</sub>                        | 20   | W                  |
| Average Gate Power (T <sub>J</sub> = 125°C)   | P <sub>G(AV)</sub>                     | 1.0  | W                  |
| Operating Junction Temperature Range  | T <sub>J</sub>                         | -40 to +125                                | °C                 |
| Storage Temperature Range   | T <sub>stg</sub>                       | -40 to +150                                | °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<sub>DRM</sub> and V<sub>RRM</sub> 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.



**TO-220AB  
CASE 221A  
STYLE 4**

- x = 6 or 8
- A = Assembly Location
- Y = Year
- WW = Work Week
- G = Pb-Free Package

### MARKING DIAGRAM



### PIN ASSIGNMENT

| Pin | Assignment      |
|-----|-----------------|
| 1   | Main Terminal 1 |
| 2   | Main Terminal 2 |
| 3   | Gate            |
| 4   | Main Terminal 2 |

### ORDERING INFORMATION

| Device        | Package               | Shipping        |
|---------------|-----------------------|-----------------|
| BTB16-600BW3G | TO-220AB<br>(Pb-Free) | 50 Units / Rail |
| BTB16-800BW3G | TO-220AB<br>(Pb-Free) | 50 Units / Rail |

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# BTB16-600BW3G, BTB16-800BW3G

## THERMAL CHARACTERISTICS

| Characteristic  | Symbol          | Value | Unit                 |
|---|-----------------|-------|----------------------|
| Thermal Resistance, Junction-to-Case  | $R_{\theta JC}$ | 2.1   | $^{\circ}\text{C/W}$ |
| Junction-to-Ambient   | $R_{\theta JA}$ | 60    |                      |
| Maximum Lead Temperature for Soldering Purposes 1/8" from Case for 10 seconds | $T_L$           | 260   | $^{\circ}\text{C}$   |

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

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

### OFF CHARACTERISTICS

|   |                         |   |   |              |                             |
|---|-------------------------|---|---|--------------|-----------------------------|
| Peak Repetitive Blocking Current<br>( $V_D = \text{Rated } V_{DRM}, V_{RRM}; \text{ Gate Open}$ ) | $I_{DRM}/$<br>$I_{RRM}$ | - | - | 0.005<br>2.0 | mA                          |
|   |                         |   |   |              | $T_J = 25^{\circ}\text{C}$  |
|   |                         |   |   |              | $T_J = 125^{\circ}\text{C}$ |

### ON CHARACTERISTICS

|   |          |     |   |      |    |
|---|----------|-----|---|------|----|
| Peak On-State Voltage (Note 2)<br>( $I_{TM} = \pm 22.5 \text{ A Peak}$ )  | $V_{TM}$ | -   | - | 1.55 | V  |
| Gate Trigger Current (Continuous dc) ( $V_D = 12 \text{ V}, R_L = 30 \Omega$ )                                  | $I_{GT}$ | 2.5 | - | 50   | mA |
| MT2(+), G(+)  |          | 2.5 | - | 50   |    |
| MT2(+), G(-)  |          | 2.5 | - | 50   |    |
| MT2(-), G(-)  |          |     |   |      |    |
| Holding Current<br>( $V_D = 12 \text{ V}, \text{ Gate Open}, \text{ Initiating Current} = \pm 150 \text{ mA}$ ) | $I_H$    | -   | - | 60   | mA |
| Latching Current ( $V_D = 24 \text{ V}, I_G = 50 \text{ mA}$ )  | $I_L$    | -   | - | 70   | mA |
| MT2(+), G(+)  |          | -   | - | 90   |    |
| MT2(+), G(-)  |          | -   | - | 70   |    |
| MT2(-), G(-)  |          |     |   |      |    |
| Gate Trigger Voltage ( $V_D = 12 \text{ V}, R_L = 30 \Omega$ )  | $V_{GT}$ | 0.5 | - | 1.7  | V  |
| MT2(+), G(+)  |          | 0.5 | - | 1.1  |    |
| MT2(+), G(-)  |          | 0.5 | - | 1.1  |    |
| MT2(-), G(-)  |          |     |   |      |    |
| Gate Non-Trigger Voltage ( $T_J = 125^{\circ}\text{C}$ )  | $V_{GD}$ | 0.2 | - | -    | V  |
| MT2(+), G(+)  |          | 0.2 | - | -    |    |
| MT2(+), G(-)  |          | 0.2 | - | -    |    |
| MT2(-), G(-)  |          |     |   |      |    |

### DYNAMIC CHARACTERISTICS

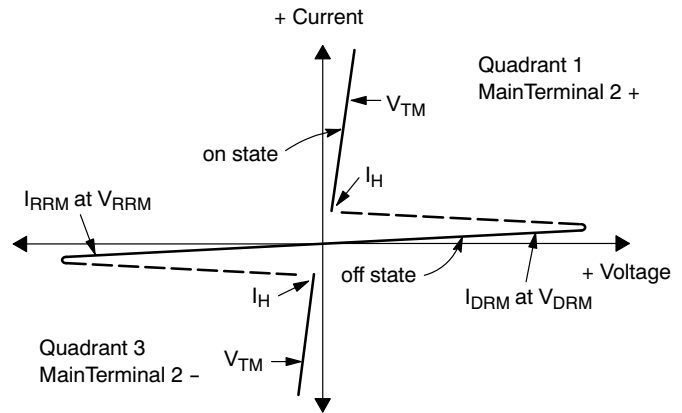
|   |             |      |   |    |                  |
|---|-------------|------|---|----|------------------|
| Rate of Change of Commutating Current, See Figure 10.<br>(Gate Open, $T_J = 125^{\circ}\text{C}$ , No Snubber)                                  | $(di/dt)_c$ | 7.5  | - | -  | A/ms             |
| Critical Rate of Rise of On-State Current<br>( $T_J = 125^{\circ}\text{C}, f = 120 \text{ Hz}, I_G = 2 \times I_{GT}, tr \leq 100 \text{ ns}$ ) | $di/dt$     | -    | - | 50 | A/ $\mu\text{s}$ |
| Critical Rate of Rise of Off-State Voltage<br>( $V_D = 0.66 \times V_{DRM}$ , Exponential Waveform, Gate Open, $T_J = 125^{\circ}\text{C}$ )    | $dV/dt$     | 1500 | - | -  | V/ $\mu\text{s}$ |

2. Indicates Pulse Test: Pulse Width  $\leq 2.0 \text{ ms}$ , Duty Cycle  $\leq 2\%$ .

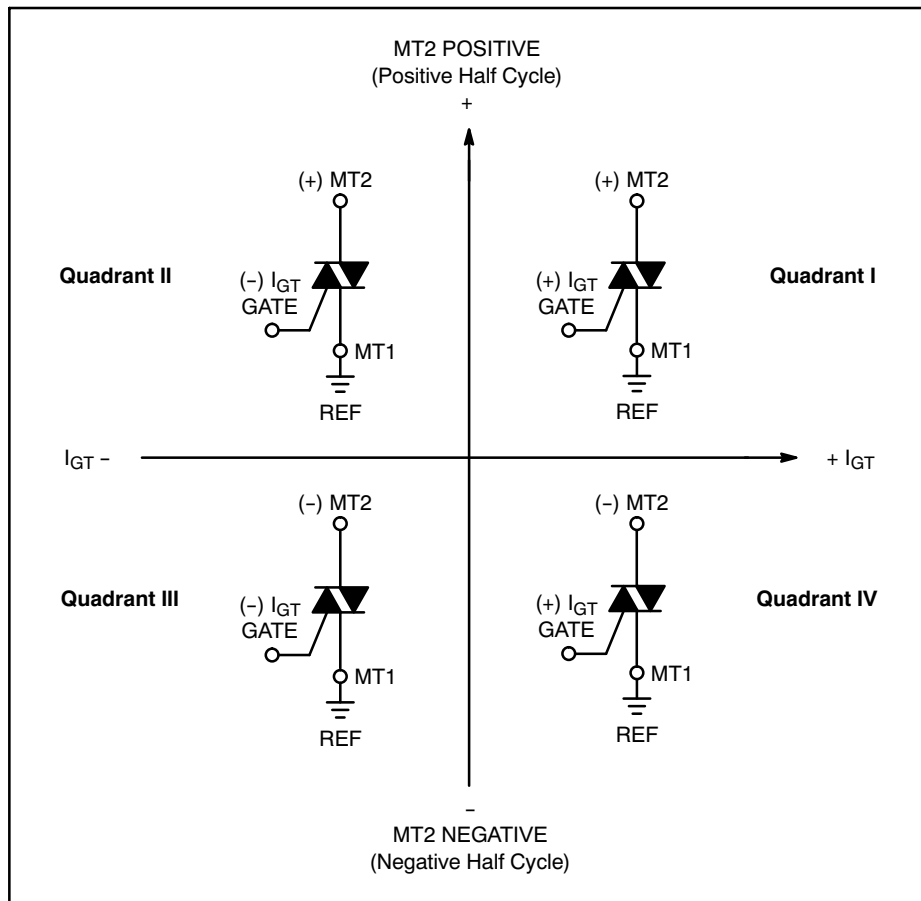
# BTB16-600BW3G, BTB16-800BW3G

## 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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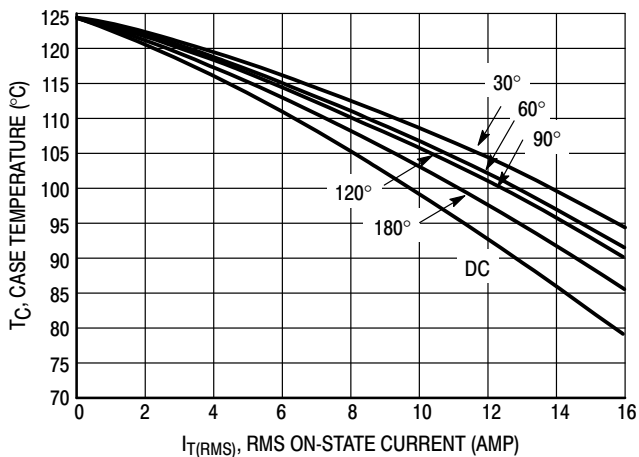


Figure 1. Typical RMS Current Derating

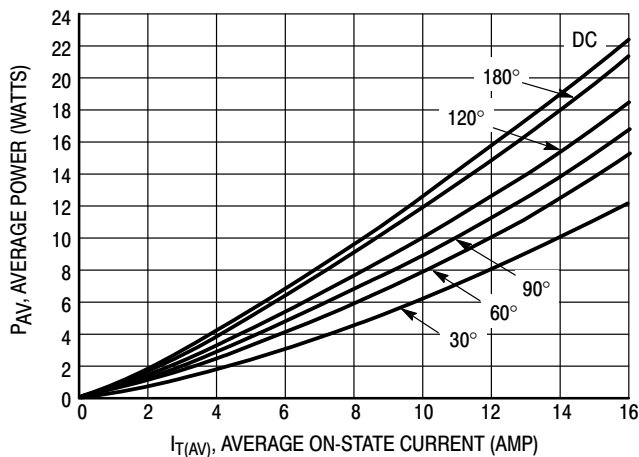


Figure 2. On-State Power Dissipation

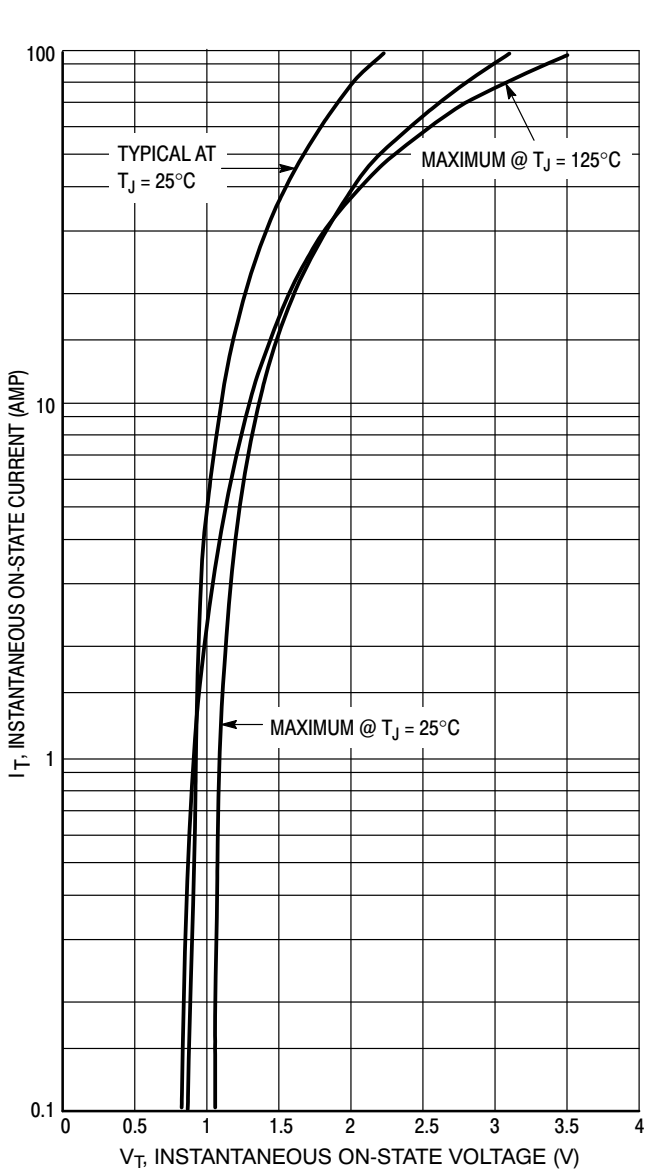


Figure 3. On-State Characteristics

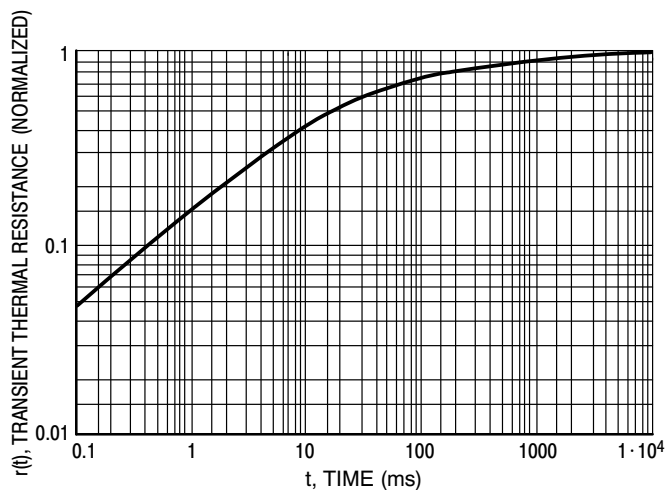


Figure 4. Thermal Response

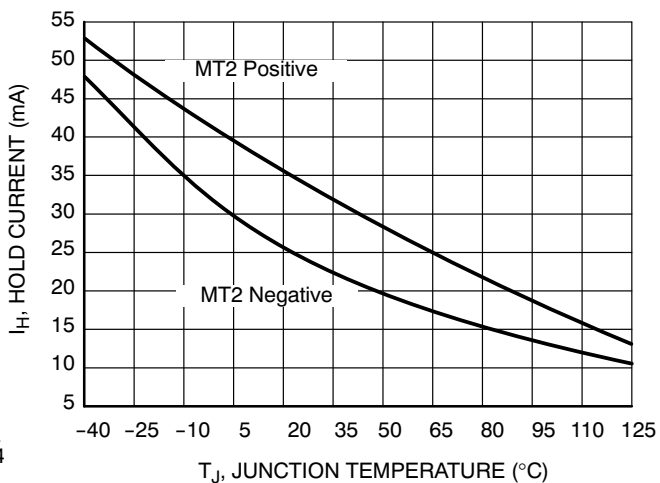


Figure 5. Typical Hold Current Variation

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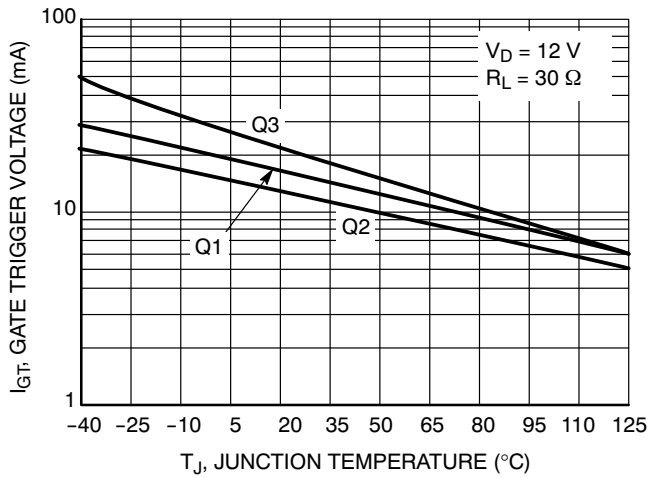


Figure 6. Typical Gate Trigger Current Variation

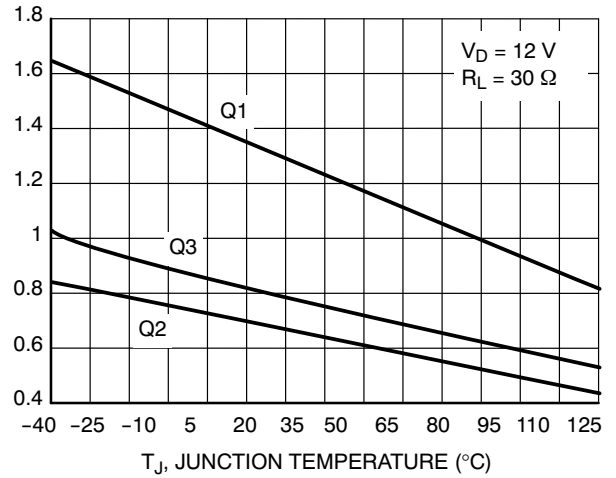


Figure 7. Typical Gate Trigger Voltage Variation

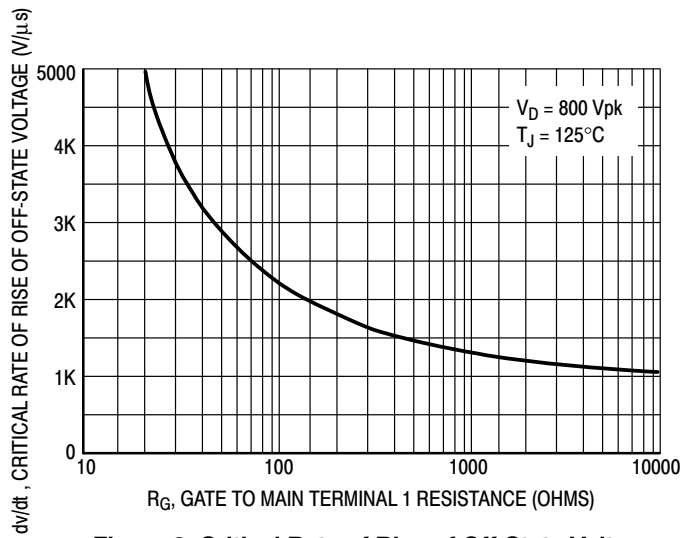
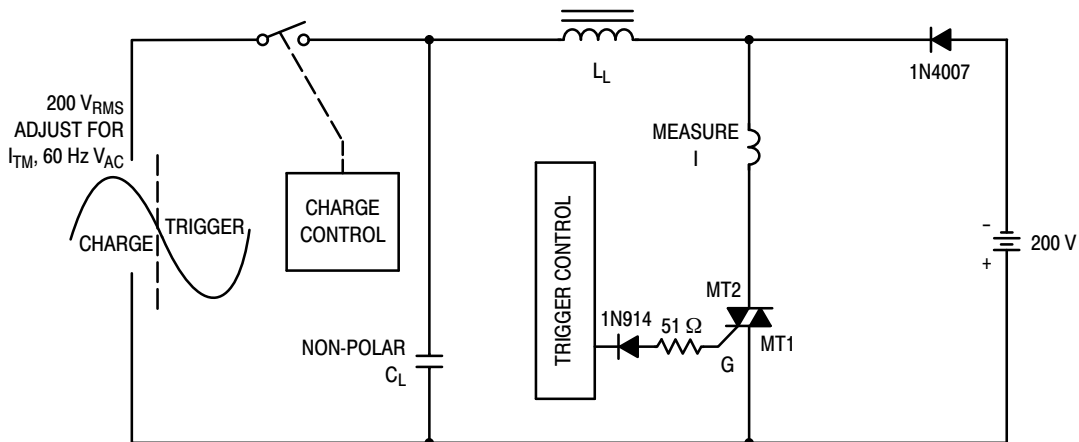


Figure 8. Critical Rate of Rise of Off-State Voltage (Exponential Waveform)



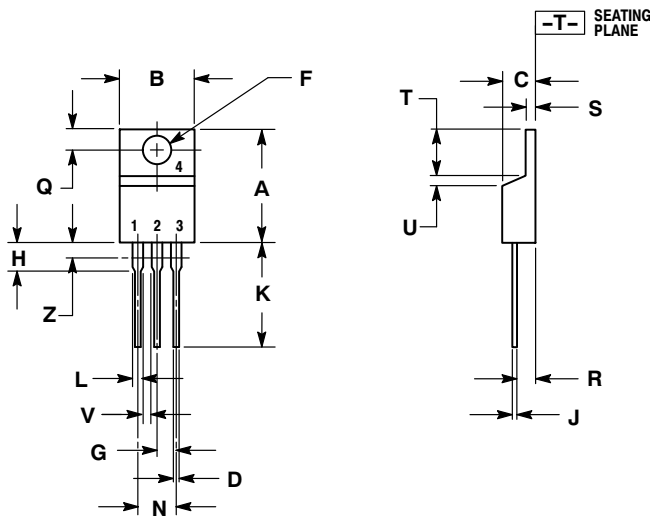
Note: Component values are for verification of rated  $(di/dt)_c$ . See AN1048 for additional information.

Figure 9. Simplified Test Circuit to Measure the Critical Rate of Rise of Commutating Current  $(di/dt)_c$

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## PACKAGE DIMENSIONS

TO-220  
CASE 221A-07  
ISSUE AA



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.570  | 0.620 | 14.48       | 15.75 |
| B   | 0.380  | 0.405 | 9.66        | 10.28 |
| C   | 0.160  | 0.190 | 4.07        | 4.82  |
| D   | 0.025  | 0.035 | 0.64        | 0.88  |
| F   | 0.142  | 0.147 | 3.61        | 3.73  |
| G   | 0.095  | 0.105 | 2.42        | 2.66  |
| H   | 0.110  | 0.155 | 2.80        | 3.93  |
| J   | 0.014  | 0.022 | 0.36        | 0.55  |
| K   | 0.500  | 0.562 | 12.70       | 14.27 |
| L   | 0.045  | 0.060 | 1.15        | 1.52  |
| N   | 0.190  | 0.210 | 4.83        | 5.33  |
| Q   | 0.100  | 0.120 | 2.54        | 3.04  |
| R   | 0.080  | 0.110 | 2.04        | 2.79  |
| S   | 0.045  | 0.055 | 1.15        | 1.39  |
| T   | 0.235  | 0.255 | 5.97        | 6.47  |
| U   | 0.000  | 0.050 | 0.00        | 1.27  |
| V   | 0.045  | ---   | 1.15        | ---   |
| Z   | ---    | 0.080 | ---         | 2.04  |

STYLE 4:

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

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