

# MAC16CD, MAC16CM, MAC16CN

Preferred Device

## Triacs

### Silicon Bidirectional Thyristors

Designed primarily for full wave ac control applications, such as motor controls, heating controls or dimmers; or wherever full-wave, silicon gate-controlled devices are needed.

- High Commutating di/dt and High Immunity to dv/dt @ 125°C
- Minimizes Snubber Networks for Protection
- Blocking Voltage to 800 Volts
- On-State Current Rating of 16 Amperes RMS
- High Surge Current Capability — 150 Amperes
- Industry Standard TO-220AB Package for Ease of Design
- Glass Passivated Junctions for Reliability and Uniformity
- Operational in Three Quadrants, Q1, Q2, and Q3
- Device Marking: Logo, Device Type, e.g., MAC16CD, Date Code

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

| Rating  | Symbol                                 | Value             | Unit                   |
|---|--|-------------------|------------------------|
| Peak Repetitive Off-State Voltage <sup>(1)</sup><br><br>( $T_J = -40$ to $125^\circ\text{C}$ )<br>MAC16CD<br>MAC16CM<br>MAC16CN | $V_{\text{DRM}}$ ,<br>$V_{\text{RRM}}$ | 400<br>600<br>800 | Volts                  |
| On-State RMS Current<br>(Full Cycle Sine Wave 50 to 60 Hz;<br>$T_C = 80^\circ\text{C}$ )  | $I_{\text{T(RMS)}}$                    | 16                | A                      |
| Peak Non-Repetitive Surge Current<br>(One Full Cycle, 60 Hz, $T_J = 125^\circ\text{C}$ )  | $I_{\text{TSM}}$                       | 150               | A                      |
| Circuit Fusing Consideration<br>( $t = 8.33$ ms)  | $I^2t$                                 | 93                | $\text{A}^2\text{sec}$ |
| Peak Gate Power<br>(Pulse Width $\leq 1.0$ $\mu\text{s}$ , $T_C = 80^\circ\text{C}$ )   | $P_{\text{GM}}$                        | 20                | Watts                  |
| Average Gate Power<br>( $t = 8.3$ ms, $T_C = 80^\circ\text{C}$ )  | $P_{\text{G(AV)}}$                     | 0.5               | Watts                  |
| Operating Junction Temperature Range  | $T_J$                                  | $-40$ to $+125$   | $^\circ\text{C}$       |
| Storage Temperature Range   | $T_{\text{stg}}$                       | $-40$ to $+150$   | $^\circ\text{C}$       |

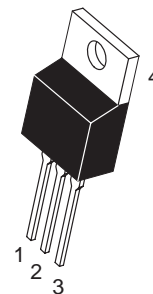
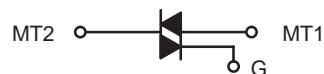
(1)  $V_{\text{DRM}}$  and  $V_{\text{RRM}}$  for all types can be applied on a continuous basis. Blocking voltages shall not be tested with a constant current source such that the voltage ratings of the devices are exceeded.



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**TRIACS**  
**16 AMPERES RMS**  
**400 thru 800 VOLTS**



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

#### PIN ASSIGNMENT

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

#### ORDERING INFORMATION

| Device  | Package | Shipping      |
|---------|---------|---------------|
| MAC16CD | TO220AB | 50 Units/Rail |
| MAC16CM | TO220AB | 50 Units/Rail |
| MAC16CN | TO220AB | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

# MAC16CD, MAC16CM, MAC16CN

## THERMAL CHARACTERISTICS

| Characteristic  | Symbol                             | Value       | Unit                 |
|---|------------------------------------|-------------|----------------------|
| Thermal Resistance<br>— Junction to Case<br>— Junction to Ambient             | $R_{\theta JC}$<br>$R_{\theta JA}$ | 2.2<br>62.5 | $^{\circ}\text{C/W}$ |
| 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>( $V_D = \text{Rated } V_{DRM}, V_{RRM}$ Gate Open) | $I_{DRM}, I_{RRM}$ | —<br>— | —<br>— | 0.01<br>2.0 | mA |
| $T_J = 25^{\circ}\text{C}$<br>$T_J = 125^{\circ}\text{C}$                               |                    |        |        |             |    |

## ON CHARACTERISTICS

|  |          |                   |                   |                   |    |
|--|----------|-------------------|-------------------|-------------------|----|
| Peak On-State Voltage <sup>(1)</sup><br>( $I_{TM} = \pm 21$ A Peak)  | $V_{TM}$ | —                 | 1.2               | 1.6               | V  |
| Gate Trigger Current (Continuous dc)<br>( $V_D = 12$ V, $R_L = 100$ $\Omega$ )<br>MT2(+), G(+)<br>MT2(+), G(–)<br>MT2(–), G(–) | $I_{GT}$ | 8.0<br>8.0<br>8.0 | 12<br>16<br>20    | 35<br>35<br>35    | mA |
| Holding Current<br>( $V_D = 12$ V, Gate Open, Initiating Current = $\pm 150$ mA)   | $I_H$    | —                 | 20                | 50                | mA |
| Latching Current ( $V_D = 12$ V, $I_G = 35$ mA)<br>MT2(+), G(+)<br>MT2(+), G(–)<br>MT2(–), G(–)                                | $I_L$    | —<br>—<br>—       | 25<br>40<br>24    | 50<br>80<br>50    | mA |
| Gate Trigger Voltage (Continuous dc)<br>( $V_D = 12$ V, $R_L = 100$ $\Omega$ )<br>MT2(+), G(+)<br>MT2(+), G(–)<br>MT2(–), G(–) | $V_{GT}$ | 0.5<br>0.5<br>0.5 | .75<br>.72<br>.82 | 1.5<br>1.5<br>1.5 | V  |

## DYNAMIC CHARACTERISTICS

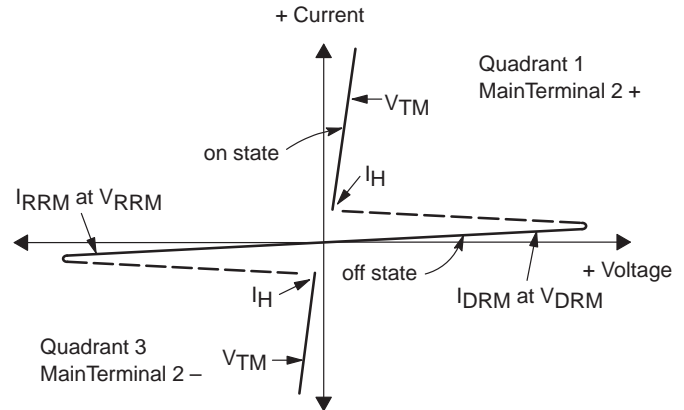
|   |             |     |   |    |                  |
|---|-------------|-----|---|----|------------------|
| Rate of Change of Commutating Current<br>( $V_D = 400$ V, $I_{TM} = 6.0$ A, Commutating $dv/dt = 24$ V/ $\mu\text{s}$ , Gate Open,<br>$T_J = 125^{\circ}\text{C}$ , $f = 250$ Hz, $C_L = 10$ $\mu\text{F}$ , $L_L = 40$ mH, with Snubber) | $(di/dt)_C$ | 15  | — | —  | A/ms             |
| Critical Rate of Rise of Off-State Voltage<br>( $V_D = \text{Rated } V_{DRM}$ , Exponential Waveform,<br>Gate Open, $T_J = 125^{\circ}\text{C}$ )   | $dv/dt$     | 600 | — | —  | V/ $\mu\text{s}$ |
| Repetitive Critical Rate of Rise of On-State Current<br>IPK = 50 A; PW = 40 $\mu\text{sec}$ ; $di_G/dt = 200$ mA/ $\mu\text{sec}$ ; $f = 60$ Hz   | $di/dt$     | —   | — | 10 | A/ $\mu\text{s}$ |

(1) Pulse Test: Pulse Width  $\leq 2.0$  ms, Duty Cycle  $\leq 2\%$ .

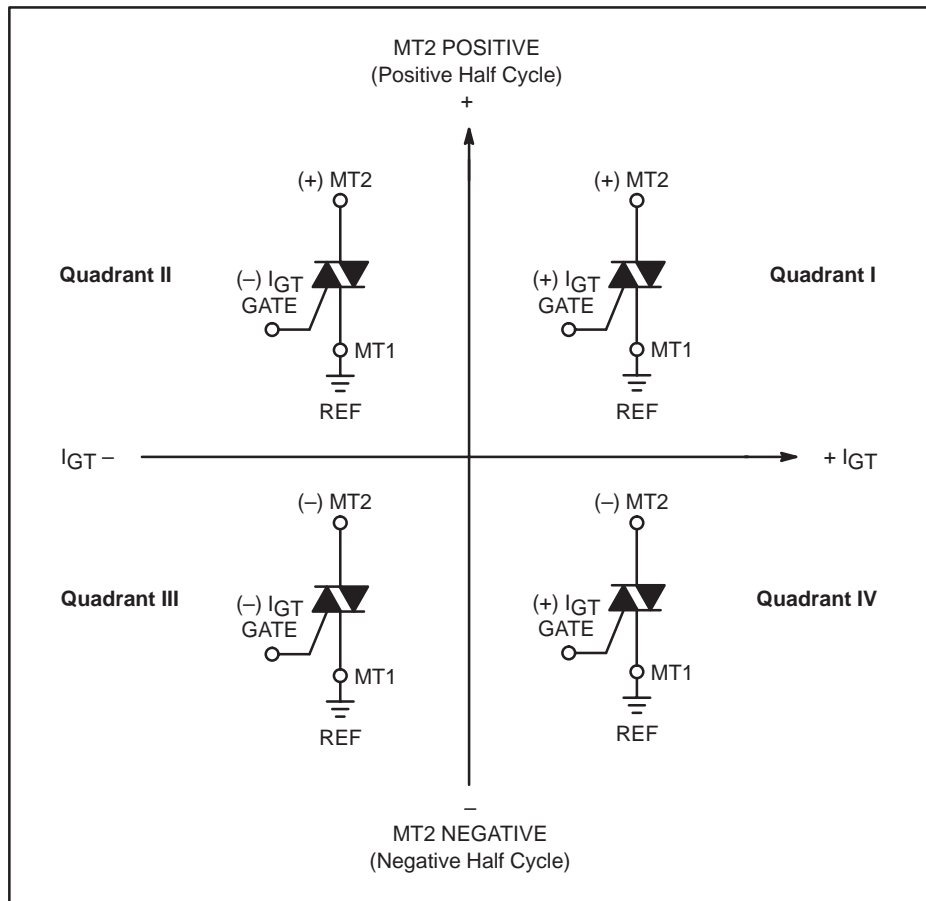
# MAC16CD, MAC16CM, MAC16CN

## 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                           |

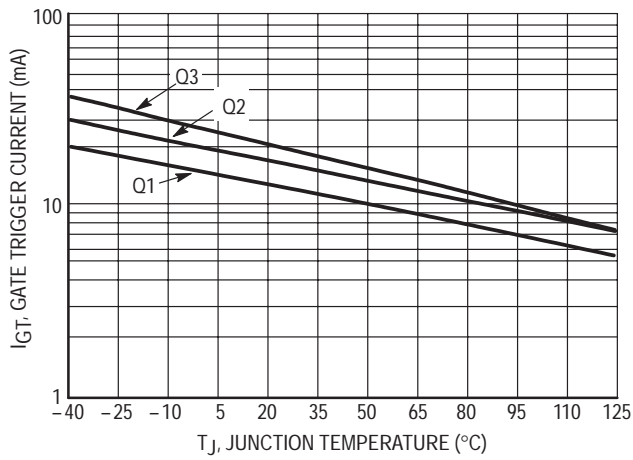


## Quadrant Definitions for a Triac

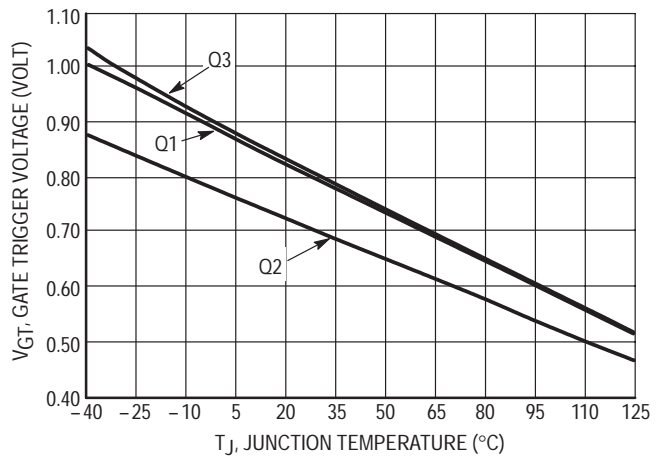


All polarities are referenced to MT1.  
With in-phase signals (using standard AC lines) quadrants I and III are used.

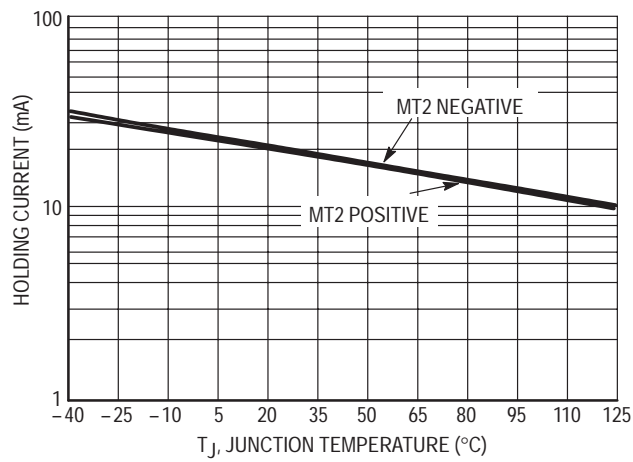
## MAC16CD, MAC16CM, MAC16CN



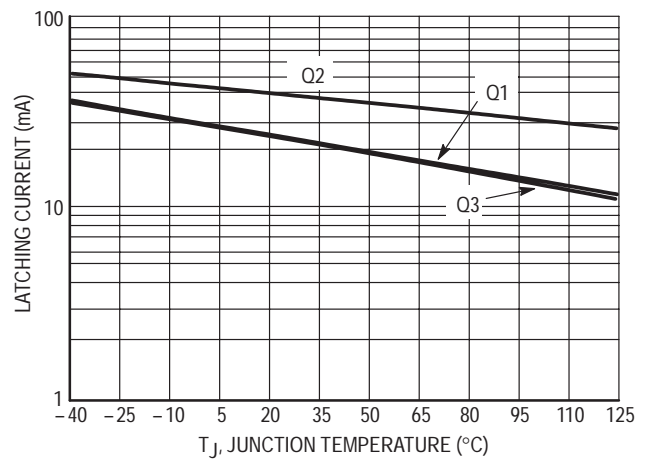
**Figure 1. Typical Gate Trigger Current versus Junction Temperature**



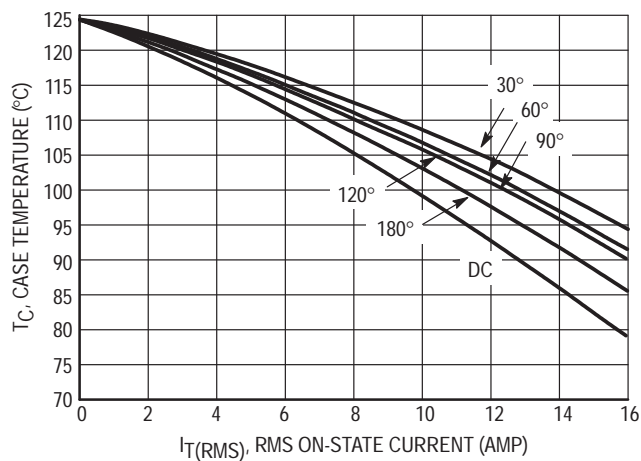
**Figure 2. Typical Gate Trigger Voltage versus Junction Temperature**



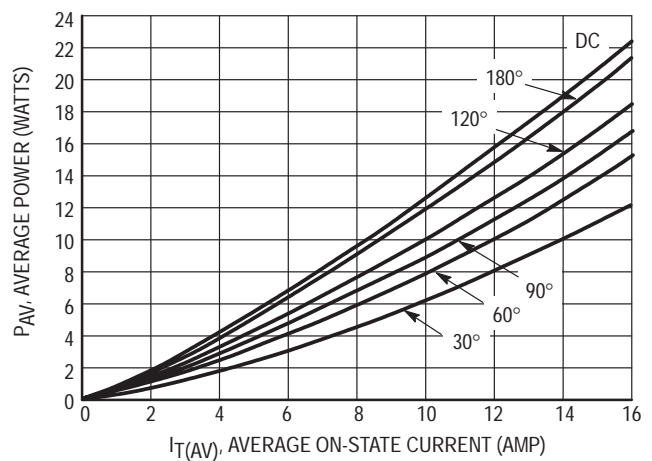
**Figure 3. Typical Holding Current versus Junction Temperature**



**Figure 4. Typical Latching Current versus Junction Temperature**

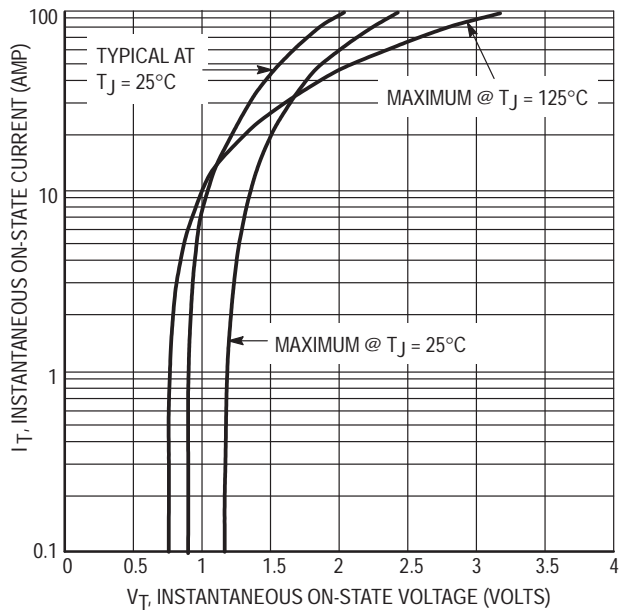


**Figure 5. Typical RMS Current Derating**

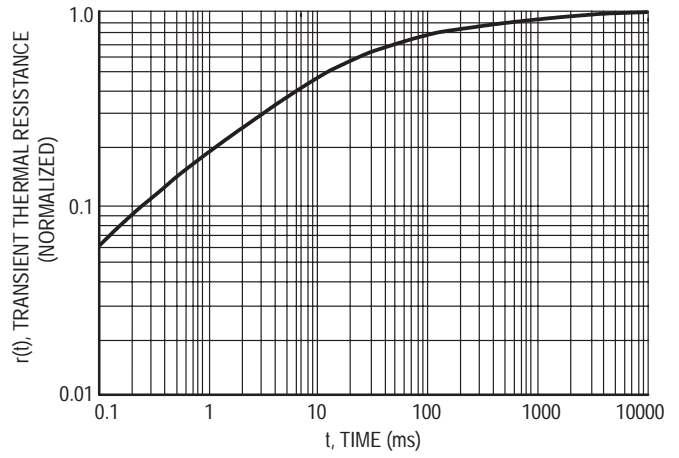


**Figure 6. On-State Power Dissipation**

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**Figure 7. On-State Characteristics**

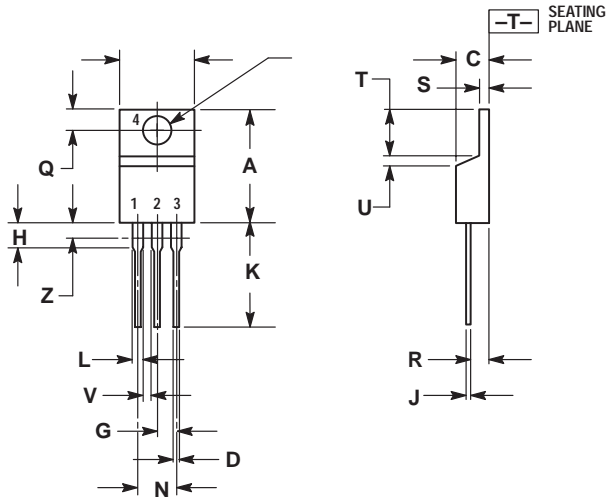


**Figure 8. Typical Thermal Response**

# MAC16CD, MAC16CM, MAC16CN

## PACKAGE DIMENSIONS

TO-220AB  
CASE 221A-09  
ISSUE Z



- 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   | 0.018  | 0.025 | 0.46        | 0.64  |
| 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
  - PIN 2. MAIN TERMINAL 2
  - PIN 3. GATE
  - PIN 4. MAIN TERMINAL 2

## **Notes**

# MAC16CD, MAC16CM, MAC16CN

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