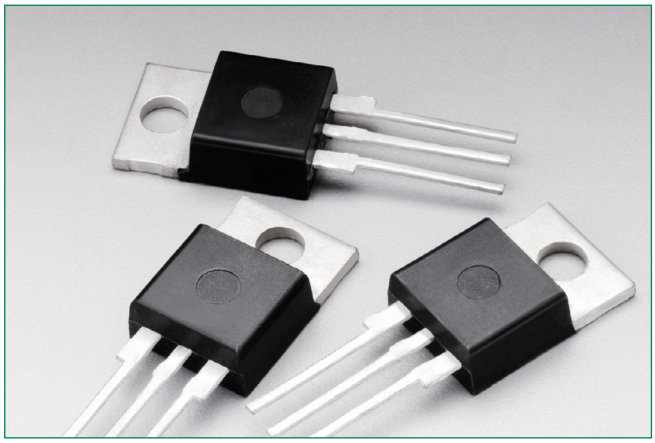
# MAC8DG, MAC8MG, MAC8NG

## Surface Mount – 400V -800V



## Description

Designed for high performance full–wave ac control applications where high noise immunity and high commutating di/dt are required. The MAC8xG series is designed for high performance full-wave AC control applications where high noise immunity and high commutating di/dt are required.

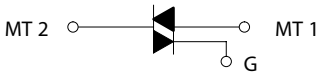
## Features

- Blocking Voltage to 800 Volts
- On–State Current Rating of 8.0 Amperes RMS at 100°C
- Uniform Gate Trigger Currents in Three Quadrants
- High Immunity to dv/dt – 250 V/µs minimum at 125°C
- Minimizes Snubber Networks for Protection
- Industry Standard TO–220 Package
- High Commutating di/dt – 6.5 A/ms minimum at 125°C
- These Devices are Pb–Free and are RoHS Compliant

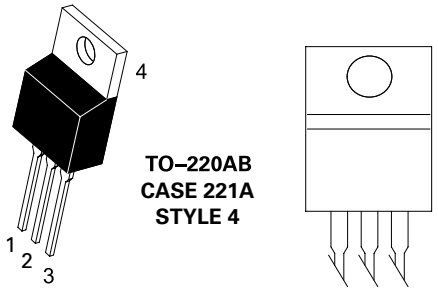
## Additional Information

Resources | Accessories | Samples

## Functional Diagram




## Pin Out




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

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# MAC8DG, MAC8MG, MAC8NG

Surface Mount – 400V -800V

## Maximum Ratings (TJ = 25°C unless otherwise noted)

| Rating | | Symbol | Value | Unit |
|---|---|---|---|---|
| Peak Repetitive Off-State Voltage (Note 1)<br>(Gate Open, Sine Wave 50 to 60 Hz, $T_J$ = -40° to 125°C) | MAC8DG<br>MAC8MG<br>MAC8NG | $V_{DRM}$, $V_{RRM}$ | 400<br>600<br>800 | V |
| On-State RMS Current (Full Cycle Sine Wave, 60 Hz, $T_C$ = 100°C) | | $I_{T\ (RMS)}$ | 8.0 | A |
| Peak Non-Repetitive Surge Current<br>(One Full Cycle Sine Wave, 60 Hz, $T_C$= 125°C) | | $I_{TSM}$ | 80 | A |
| Circuit Fusing Consideration (t = 8.3 ms) | | $I^2t$ | 26 | $A^2$sec |
| Peak Gate Power (Pulse Width ≤ 1.0 µs, $T_C$ = 80°C) | | $P_{GM}$ | 16 | W |
| Average Gate Power (t=8.3ms, $T_J$ = 80°C) | | $P_{G(AV)}$ | 0.35 | W |
| Operating Junction Temperature Range | | $T_J$ | -40 to +125 | °C |
| Storage Temperature Range | | $T_{stg}$ | -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. $V_{DRM}$ and $V_{RRM}$ for all types can be applied on a continuous basis. Ratings apply for zero or negative gate voltage; however, positive gate voltage shall not be applied concurrent with negative potential on the anode. Blocking voltages shall not be tested with a constant current source such that the voltage ratings of the devices are exceeded.

## Thermal Characteristics

| Rating | | Symbol | Value | Unit |
|---|---|---|---|---|
| Thermal Resistance, | Junction–to–Case (AC)<br>Junction–to–Ambient | $R_{\theta JC}$<br>$R_{\theta JA}$ | 2.2<br>62.5 | °C/W |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds | | $T_L$ | 260 | °C |

## Electrical Characteristics - OFF (TJ = 25°C unless otherwise noted ; Electricals apply in both directions)

| Characteristic | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Peak Repetitive Blocking Current<br>($V_D = V_{DRM} = V_{RRM}$; Gate Open) | $T_J$ = 25°C | $I_{DRM}$, $I_{RRM}$ | - | - | 0.01 | mA |
| | $T_J$ = 125°C | | - | - | 2.0 | |

## Electrical Characteristics - ON (TJ = 25°C unless otherwise noted; Electricals apply in both directions)

| Characteristic | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Peak On–State Voltage (Note 4) ($I_{TM}$ = ±6.0 A) | | $V_{TM}$ | – | 1.3 | 1.6 | V |
| Gate Trigger Current<br>(Continuous dc)<br>($V_D$ = 12 V, $R_L$ = 100 Ω) | MT2(+), G(+) | $I_{GT}$ | 5.0 | 13 | 35.0 | mA |
| | MT2(+), G(–) | | 5.0 | 16 | 35.0 | |
| | MT2(–), G(–) | | 5.0 | 18 | 35.0 | |
| Holding Current ($V_D$ = 12 V, Gate Open, Initiating Current = ±150 mA)) | | $I_H$ | – | 20 | 40 | mA |
| Latching Current<br>($V_D$ = 24 V, $I_G$ = 35 mA) | MT2(+), G(+) | $I_L$ | _ | 20 | 50 | mA |
| | MT2(+), G(–) | | _ | 30 | 80 | |
| | MT2(–), G(–) | | _ | 20 | 50 | |
| Gate Trigger Voltage<br>($V_D$ = 12 V, $R_L$ = 100 Ω) | MT2(+), G(+) | $V_{GT}$ | 0.5 | 0.69 | 1.5 | V |
| | MT2(+), G(–) | | 0.5 | 0.77 | 1.5 | |
| | MT2(–), G(–) | | 0.5 | 0.72 | 1.5 | |
| Gate Non–Trigger Voltage<br>($T_J$ = 125°C)<br>($V_D$ = 12 V, $R_L$ = 100 Ω) | MT2(+), G(+) | $V_{GD}$ | 0.2 | – | – | V |
| | MT2(+), G(–) | | 0.2 | – | – | |
| | MT2(–), G(–) | | 0.2 | – | – | |

**2.** Indicates Pulse Test: Pulse Width ≤ 2.0 ms, Duty Cycle ≤ 2%.





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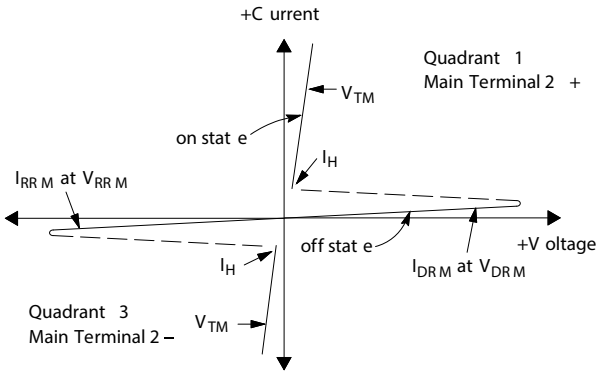
## Dynamic Characteristics

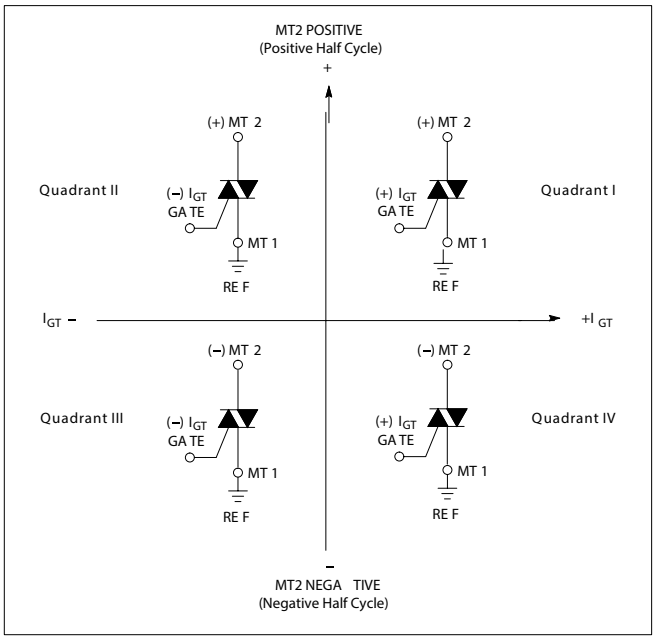
| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Rate of Change of Commutating Current See Figure 10.($V_D$ = 400 V, $I_{TM}$ = 4.4 A, Commutating dv/dt = 18 V/µs,Gate Open, $T_J$ = 125°C, f = 250 Hz, No Snubber) $C_L$ = 10 µF $L_L$ = 40 mH | (dv/dt)c | 6.5 | – | – | A/ms |
| Critical Rate of Rise of Off-State Voltage ($V_D$ = Rated $V_{DRM}$, Exponential Waveform, Gate Open, $T_J$ = 125°C) | dV/dt | 250 | – | – | V/µs |

## Voltage Current Characteristic of SCR

| 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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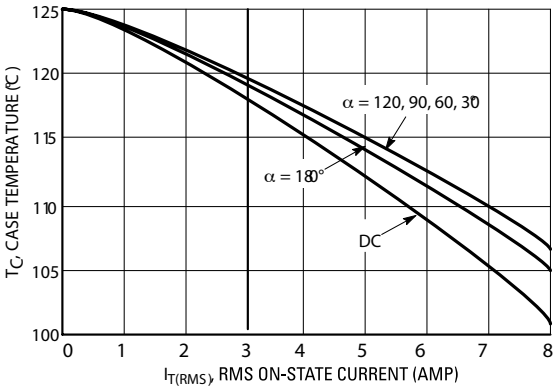
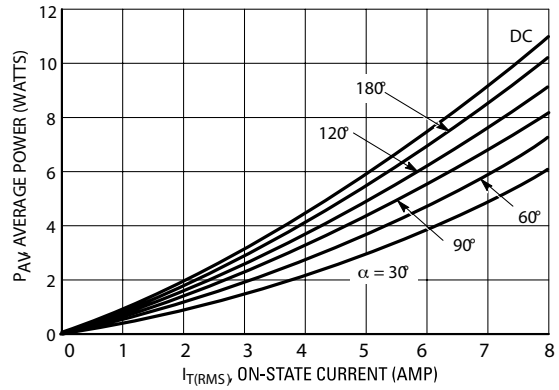
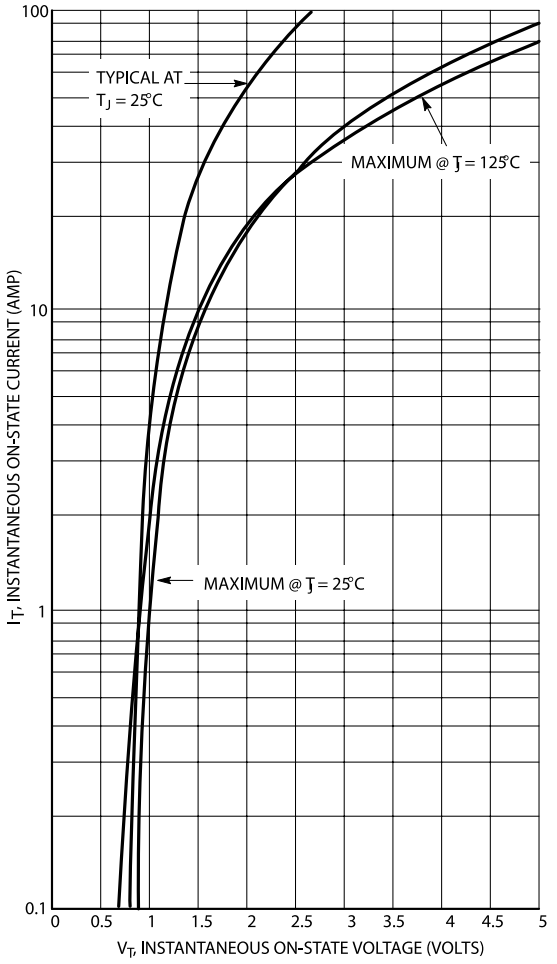
### Figure 1. RMS Current Derating



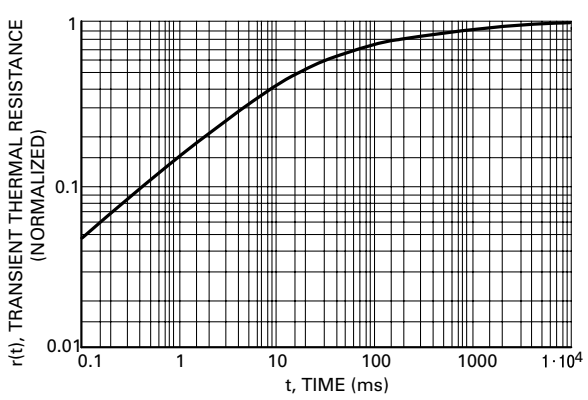

### Figure 2. On-State Power Dissipation



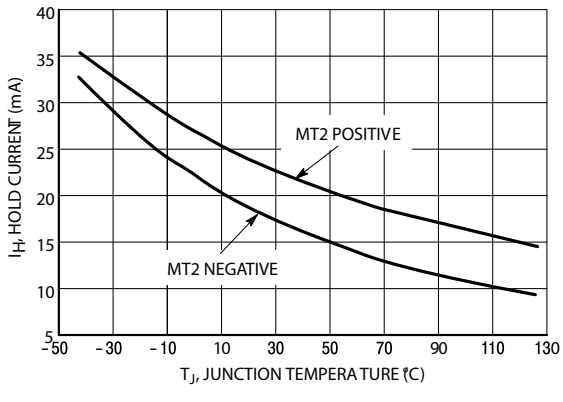

### Figure 3. On–State Characteristics




### Figure 4. Thermal Response




### Figure 5. Hold Current Variation







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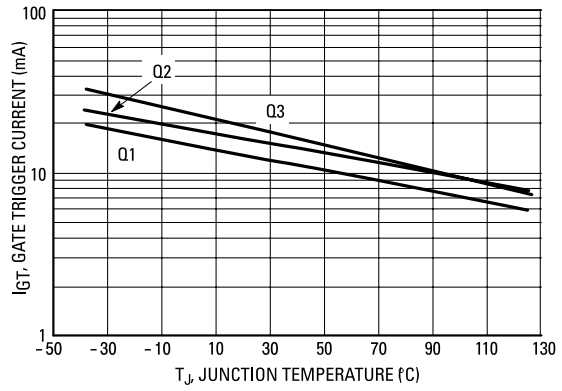
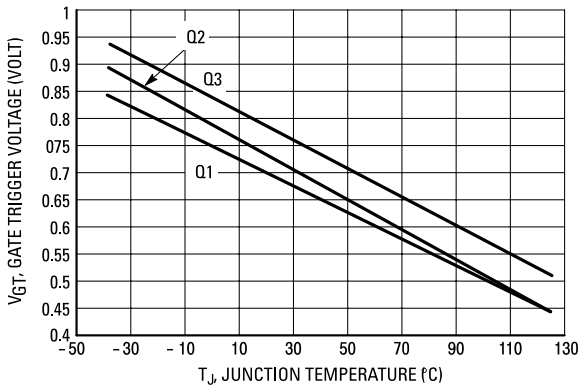
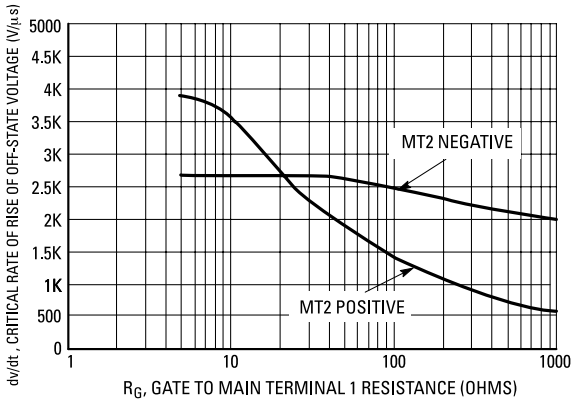
### Figure 6. Gate Trigger Current Variation



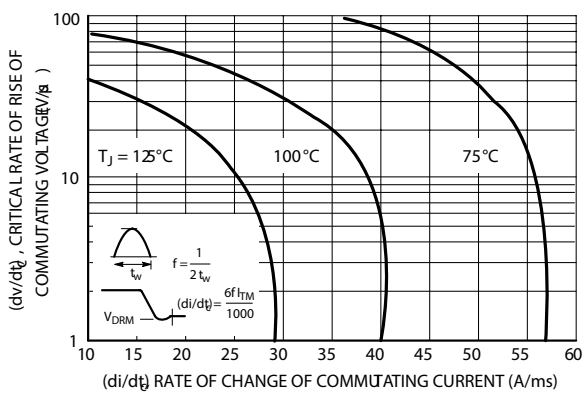

### Figure 7. Gate Trigger Voltage Variation



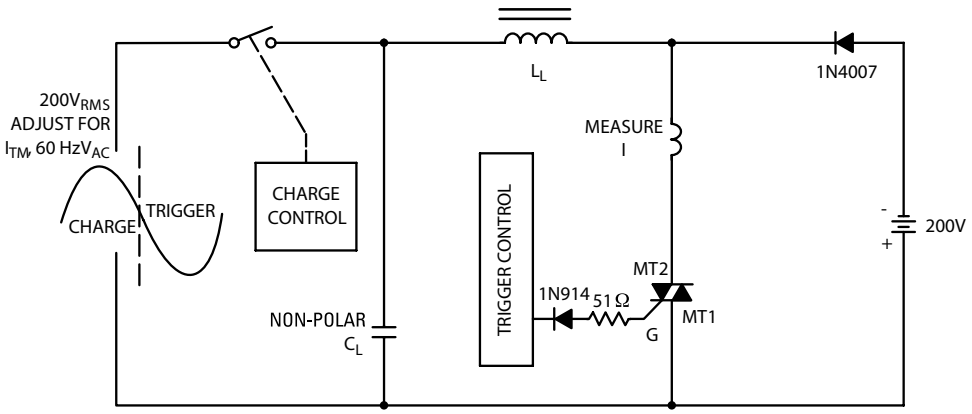

### Figure 8. Critical Rate of Rise of Off-State Voltage (Exponential)




### Figure 9. Critical Rate of Rise of Commutating Voltage




### Figure 10. Simplified Test Circuit to Measure the Critical Rate of Rise of Commutating Current (di/dt)

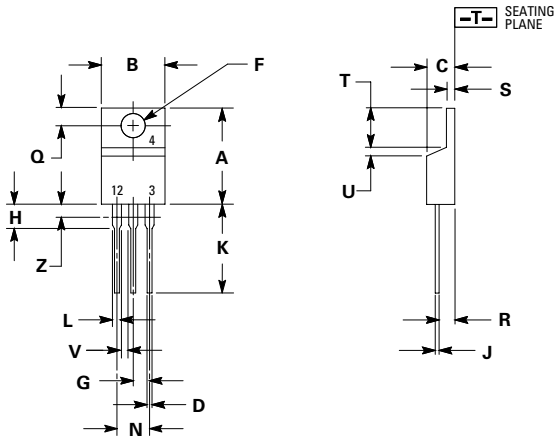



**Note:** Component values are for verification of rated $(di/dt)_c$. See AN1048 for additional information

# MAC8DG, MAC8MG, MAC8NG

## Surface Mount – 400V -800V

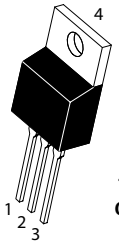
## Dimensions



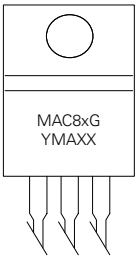

| Dim | Inches | | Millimeters | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.590 | 0.620 | 14.99 | 15.75 |
| B | 0.380 | 0.420 | 9.65 | 10.67 |
| C | 0.178 | 0.188 | 4.52 | 4.78 |
| D | 0.025 | 0.035 | 0.64 | 0.89 |
| F | 0.142 | 0.147 | 3.61 | 3.73 |
| G | 0.095 | 0.105 | 2.41 | 2.67 |
| H | 0.110 | 0.130 | 2.79 | 3.30 |
| J | 0.018 | 0.024 | 0.46 | 0.61 |
| K | 0.540 | 0.575 | 13.72 | 14.61 |
| L | 0.060 | 0.075 | 1.52 | 1.91 |
| N | 0.195 | 0.205 | 4.95 | 5.21 |
| Q | 0.105 | 0.115 | 2.67 | 2.92 |
| R | 0.085 | 0.095 | 2.16 | 2.41 |
| S | 0.045 | 0.060 | 1.14 | 1.52 |
| 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 |

**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.

## Part Marking System




**TO–220AB**
**CASE 221A**
**STYLE 12**




x =D, M, or N
Y =Year
M =Month
A =Assembly Site
XX =Lot Serial Code
G =Pb-Free Package

| Pin Assignment | |
|---|---|
| 1 | Main Terminal 1 |
| 2 | Main Terminal 2 |
| 3 | Gate |
| 4 | No Connection |

## Ordering Information

| Device | Package | Shipping |
|---|---|---|
| MAC8DG | TO-220AB (Pb-Free) | 1000 Units / Box |
| MAC8MG | | |
| MAC8NG | | |



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