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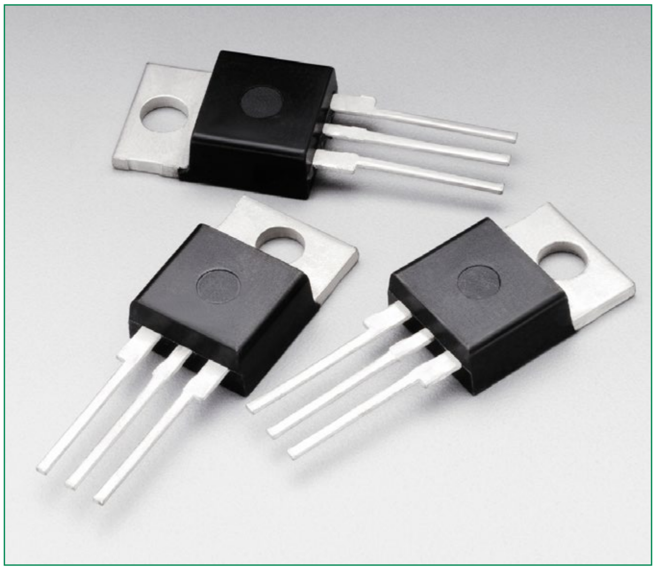
**Thyristors**
Surface Mount – 400V - 800V > MAC212A8, MAC212A10

# MAC212A8, MAC212A10



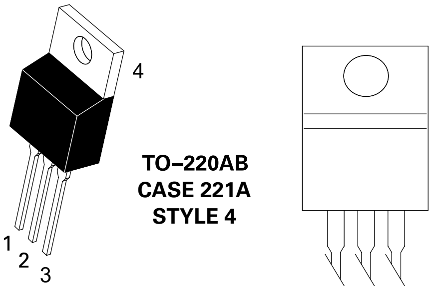
## Description

Designed primarily for full-wave AC control applications, such as light dimmers, motor controls, heating controls and power supplies; or wherever full–wave silicon gate controlled solid–state devices are needed. Triac type thyristors switch from a blocking to a conducting state for either polarity of applied main terminal voltage with positive or negative gate triggering.

## Features

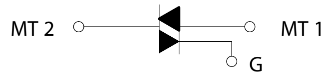
- Blocking Voltage to 800 Volts
- All Diffused and Glass Passivated Junctions for Greater Parameter Uniformity and Stability
- Small, Rugged, Thermowatt Construction for Low Thermal Resistance, High Heat Dissipation and Durability
- Gate Triggering Guaranteed in Four Modes (Quadrants)
- Pb–Free Packages are Available

## Pin Out



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

## Functional Diagram



## Additional Information

**Datasheet** | **Resources** | **Samples**

Revised: 07/25/19

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

| Rating | | Symbol | Value | Unit |
|---|---|---|---|---|
| Peak Repetitive Off–State Voltage (Note 1)<br>(– 40 to 125°C, Sine Wave, 50 to 60 Hz, Gate Open) | MAC212A8 | $V_{DRM}$,<br>$V_{RRM}$ | 600<br>800 | V |
| | MAC212A10 | | 800 | |
| On-State RMS Current (Full Cycle Sine Wave, 50 to 60 Hz, $T_C$ = +85°C) | | $I_{T\ (RMS)}$ | 12 | A |
| Peak Non-Repetitive Surge Current (One Full Cycle Sine Wave, 60 Hz, $T_c$ = +25°C) Preceded and followed by rated current | | $I_{TSM}$ | 100 | A |
| Circuit Fusing Considerations (t = 8.3 ms) | | $I^2t$ | 40 | A²sec |
| Peak Gate Power ($T_C$ = +85°C, Pulse Width = 10 µs) | | $P_{GM}$ | 20 | W |
| Average Gate Power (t = 8.3 ms, $T_C$ = +85°C) | | $P_{G\ (AV)}$ | 0.35 | W |
| Peak Gate Current ($T_C$ = +85°C, Pulse Width = 10 µs) | | $I_{GM}$ | 2.0 | A |
| Operating Junction Temperature Range | | $T_J$ | -40 to +125 | °C |
| Storage Temperature Range | | $T_{stg}$ | -40 to +150 | °C |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

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>$R_{\theta JA}$ | 2.0<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 ($T_J$ = 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 | $I_{DRM}$,<br>$I_{RRM}$ | - | - | 1.0 | mA |
| | $T_J$ = 125°C | | - | - | 2.0 | |

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

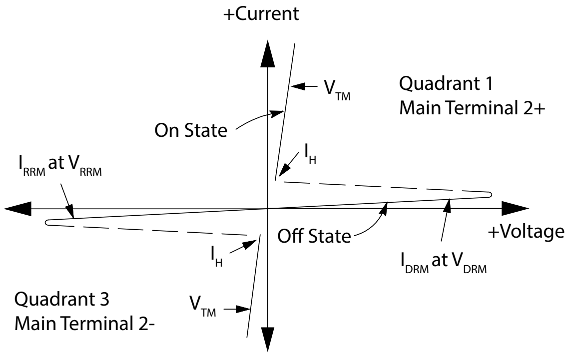
| Characteristic | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Peak On–State Voltage (TM = 14 A Peak; Pulse Width = 1 to 2 ms, Duty Cycle 2%) | | $V_{TM}$ | – | 1.3 | 1.75 | V |
| Gate Trigger Current (Continuous dc)<br>(Main Terminal Voltage = 12 Vdc, $R_L$ = 100 Ω) | MT2(+), G(+) | $I_{GT}$ | – | 12 | 50 | mA |
| | MT2(+), G(–) | | – | 12 | 50 | |
| | MT2(–), G(–) | | – | 20 | 50 | |
| | MT2(–), G(+) | | – | 35 | 75 | |
| Gate Trigger Voltage (Continuous dc)<br>(Main Terminal Voltage = 12 Vdc, $R_L$ = 100 Ω) | MT2(+), G(+) | $V_{GT}$ | – | 0.9 | 2.0 | V |
| | MT2(+), G(–) | | – | 0.9 | 2.0 | |
| | MT2(–), G(–) | | – | 1.1 | 2.0 | |
| | MT2(–), G(+) | | – | 1.4 | 2.5 | |
| Gate Non–Trigger Voltage (Continuous dc)<br>(Main Terminal Voltage = 12 Vdc, $R_L$ = 100 Ω) All Four Quadrants | | $V_{GD}$ | 0.02 | – | – | V |
| Holding Current (Main Terminal Voltage = 12 Vdc, Gate Open, Initiating Current = ± 200 mA) | | $I_H$ | – | 6.0 | 50 | mA |
| Turn-On Time (Rated $V_{DRM}$, $I_{TM}$ = 17 A)<br>($I_{GT}$ = 120 mA, Rise Time = 0.1 µs, Pulse Width = 2 µs) | | $t_{gt}$ | – | 1.5 | – | µs |

## Dynamic Characteristics

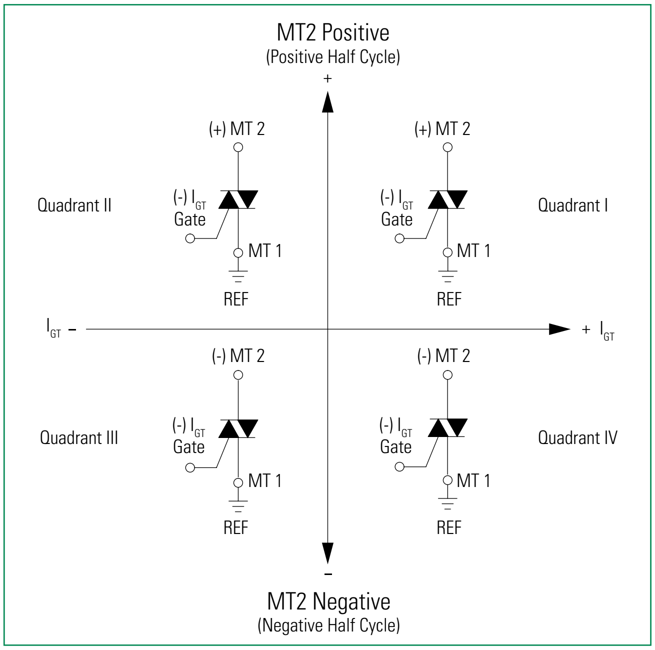
| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Critical Rate of Rise of Commutation Voltage<br>($V_D$ = Rated $V_{DRM}$, $I_{TM}$ = 11.3 A, Commutating di/dt = 6.1 A/ms, Gate Unenergized, $T_C$ = +85°C) | (di/dt)c | – | 5.0 | – | A/ms |
| Critical Rate of Rise of Off-State Voltage<br>($V_D$ = Rated $V_{DRM}$, Exponential Waveform, Gate Open, $T_C$ = +85°C) | dv/dt | – | 100 | – | 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

**Figure 1. Current Derating**

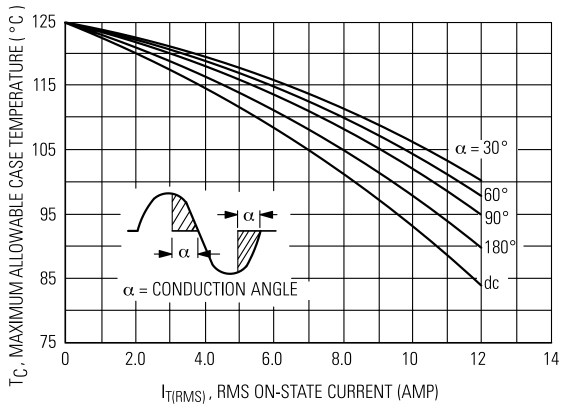


**Figure 2. Power Dissipation**

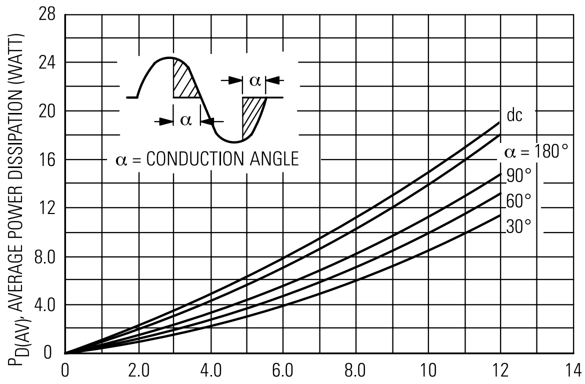


**Figure 3. Maximum On–State Characteristics**

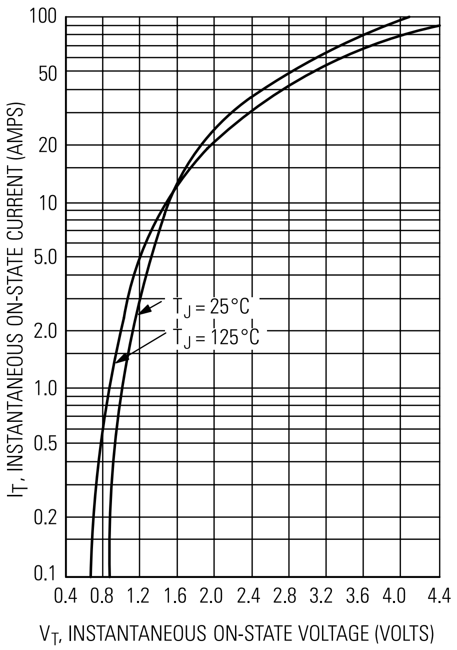


**Figure 4. Maximum Non–Repetitive Surge Current**

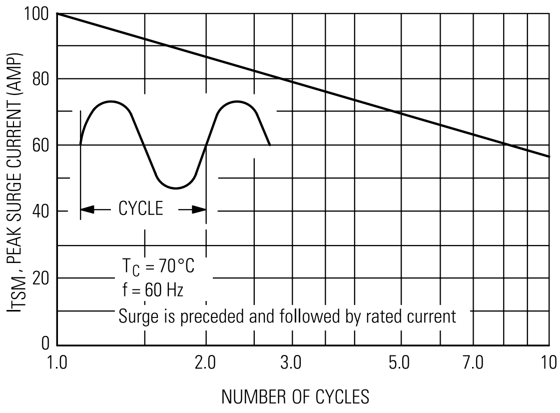
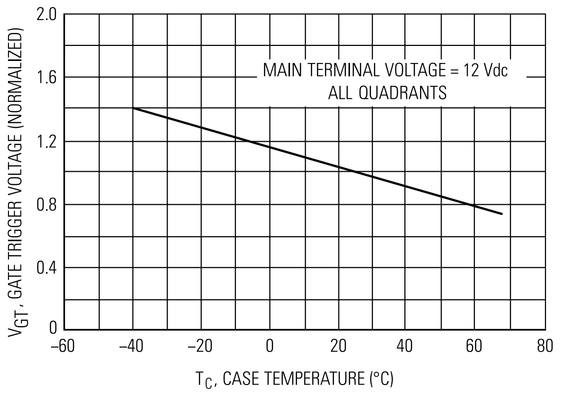
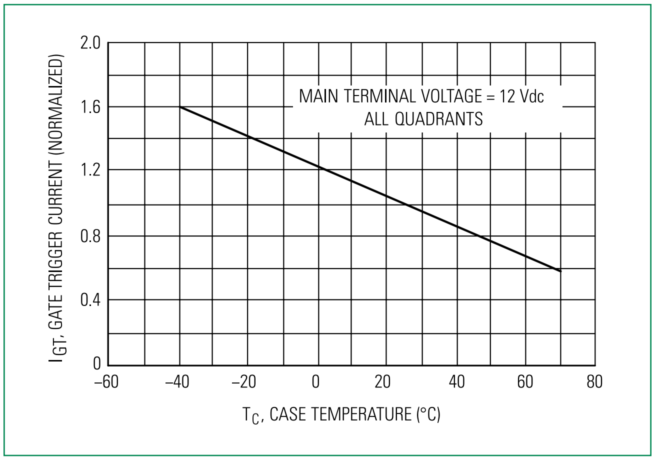


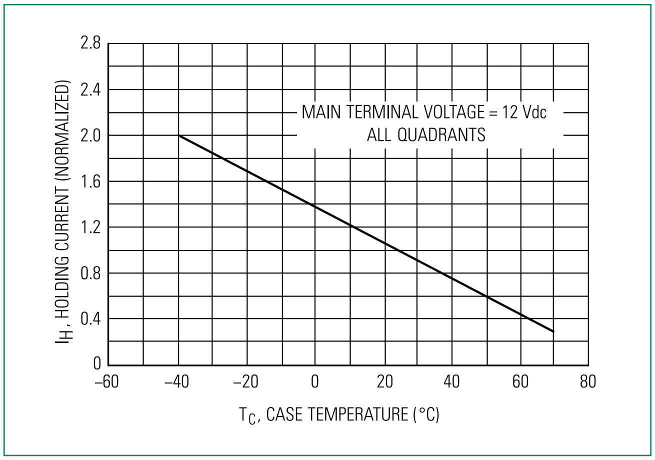
**Figure 5. Typical Gate Trigger Voltage**



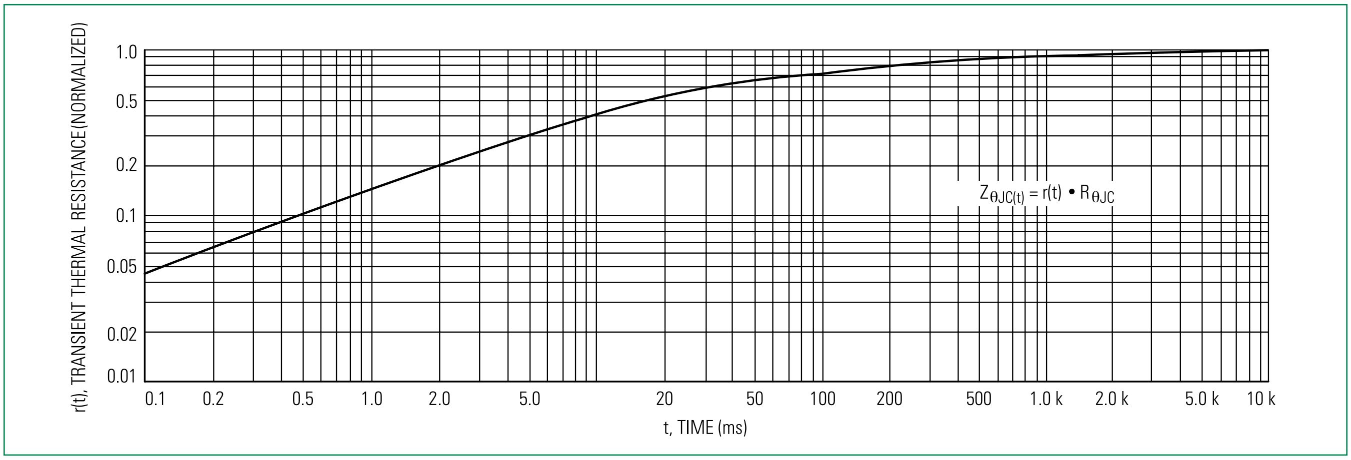
## Figure 6. Typical Gate Trigger Current



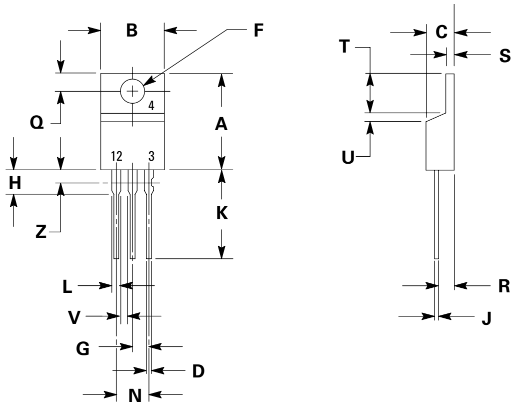
## Figure 7. Typical Holding Current



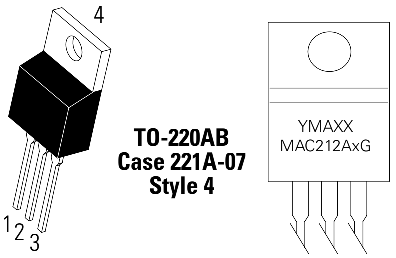
## Figure 8. Thermal Response



## Dimensions



## Part Marking System



**TO-220AB**
**Case 221A-07**
**Style 4**

x =8 or 10
Y =Year
M =Month
A =Assembly Site
XX =Lot Serial Code
G =Pb-Free Package

| 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.

| Pin Assignment | |
|---|---|
| 1 | Cathode |
| 2 | Anode |
| 3 | Gate |
| 4 | Anode |

## Ordering Information

| Device | Package | Shipping |
|---|---|---|
| MAC212A8 | TO-220AB | 500 Units/ Box |
| MAC212A8G | TO-220AB (Pb-Free) | |
| MAC212A10 | TO-220AB | |
| MAC212A10G | TO-220AB (Pb-Free) | |

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