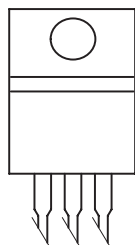
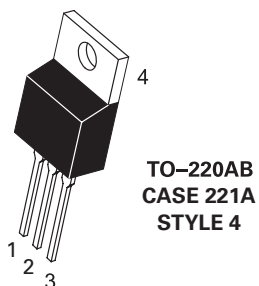


MAC12HCDG, MAC12HCMG, MAC12HCNG



Pin Out



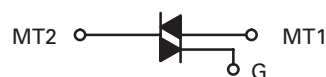
Description

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.

Features

- Uniform Gate Trigger Currents in Three Quadrants, Q1, Q2, and Q3
- 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 12 Amperes RMS at 80°C
- High Surge Current Capability – 100 Amperes
- Industry Standard TO-220AB Package for Ease of Design
- Glass Passivated Junctions for Reliability and Uniformity
- These Devices are Pb-Free and are RoHS Compliant

Functional Diagram



Additional Information



Datasheet



Resources



Samples

Maximum Ratings ($T_J = 25^\circ\text{C}$ unless otherwise noted)

| Rating | Symbol | Value | Unit |
|--|--|-------------------|--------------------|
| Peak Repetitive Off-State Voltage (Note 1) (Gate Open, Sine Wave 50 to 60 Hz, $T_J = 25^\circ$ to 100°C) | V_{DRM}^* V_{RRM} | 400 600 800 | V |
| On-State RMS Current (Full Cycle Sine Wave, 60 Hz, $T_C = 80^\circ\text{C}$) | $I_{\text{T (RMS)}}$ | 12 | A |
| Peak Non-Repetitive Surge Current (One Full Cycle Sine Wave, 60 Hz, $T_J = 125^\circ\text{C}$) | I_{TSM} | 100 | A |
| Circuit Fusing Consideration ($t = 8.3$ ms) | I^2t | 41 | A ² sec |
| Peak Gate Power (Pulse Width ≤ 1.0 μs , $T_t = 80^\circ\text{C}$) | P_{GM} | 16 | W |
| Average Gate Power ($t = 8.3$ ms, $T_C = 80^\circ\text{C}$) | $P_{\text{G (AV)}}$ | 0.35 | W |
| Operating Junction Temperature Range | T_J | -40 to +125 | $^\circ\text{C}$ |
| Storage Temperature Range | T_{stg} | -40 to +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_{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) | R_{8JC} | 2.2 | $^\circ\text{C/W}$ |
| Junction-to-Ambient | R_{8JA} | 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 - OFF ($T_J = 25^\circ\text{C}$ unless otherwise noted ; Electricals apply in both directions)

| Characteristic | | Symbol | Min | Typ | Max | Unit |
|--|---------------------------|-----------|-----|-----|------|------|
| Peak Repetitive Blocking Current ($V_D = V_{DRM} = V_{RRM}$; Gate Open) | $T_J = 25^\circ\text{C}$ | I_{DRM} | - | - | 0.01 | mA |
| | $T_J = 125^\circ\text{C}$ | I_{RRM} | - | - | 2.0 | |

Electrical Characteristics - ON ($T_J = 25^\circ\text{C}$ unless otherwise noted; Electricals apply in both directions)

| Characteristic | | Symbol | Min | Typ | Max | Unit |
|---|--------------|----------|-----|-----|-----|------|
| Peak On-State Voltage (Note 2) ($I_{TM} = \pm 11\text{ A}$) | | V_{TM} | - | 1.2 | 1.6 | V |
| Gate Trigger Current (Continuous dc) ($V_D = 12\text{ V}$, $R_L = 100\ \Omega$) | MT2(+), G(+) | I_{GT} | 5.0 | - | 50 | mA |
| | MT2(+), G(-) | | 5.0 | - | 50 | |
| | MT2(-), G(-) | | 5.0 | - | 50 | |
| Holding Current ($V_D = 12\text{ V}$, Gate Open, Initiating Current = $\pm 150\text{ mA}$) | | I_H | - | 20 | 60 | mA |
| Latching Current ($V_D = 24\text{ V}$, $I_G = 50\text{ mA}$) | MT2(+), G(+) | I_L | - | - | 60 | mA |
| | MT2(+), G(-) | | - | - | 80 | |
| | MT2(-), G(-) | | - | - | 60 | |
| Gate Trigger Voltage ($V_D = 12\text{ V}$, $R_L = 100\ \Omega$) | MT2(+), G(+) | V_{GT} | 0.5 | - | 1.5 | V |
| | MT2(+), G(-) | | 0.5 | - | 1.5 | |
| | MT2(-), G(-) | | 0.5 | - | 1.5 | |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

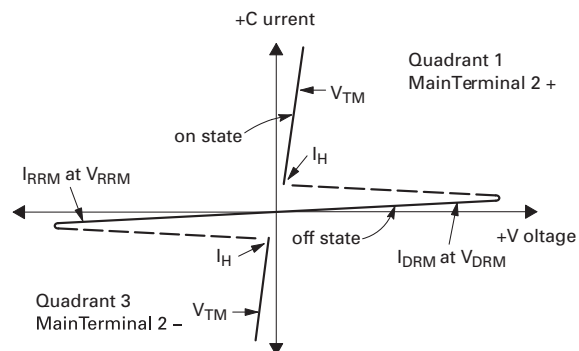
2. Indicates Pulse Test: Pulse Width $\leq 2.0\text{ ms}$, Duty Cycle $\leq 2\%$.

Dynamic Characteristics

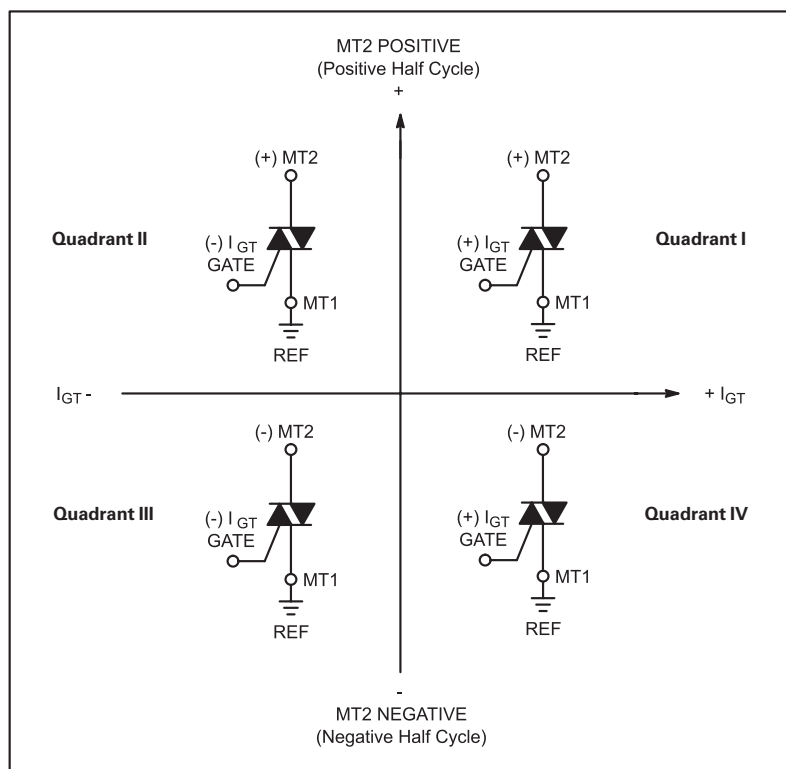
| Characteristic | Symbol | Min | Typ | Max | Unit |
|--|---------|-----|-----|-----|------------------|
| Rate of Change of Commutating Current See Figure 10. ($V_D = 400\text{ V}$, $I_{TM} = 4.4\text{ A}$, Commutating $dv/dt = 18\text{ V}/\mu\text{s}$, Gate Open, $T_J = 125^\circ\text{C}$, $f = 250\text{ Hz}$, No Snubber) $C_L = 10\ \mu\text{F}$ $L_L = 40\text{ mH}$ | dV/dt | 15 | - | - | A/ms |
| Critical Rate of Rise of Off-State Voltage ($V_D = \text{Rated } V_{DRM}$, Exponential Waveform, Gate Open, $T_J = 125^\circ\text{C}$) | dV/dt | 600 | - | - | V/ μs |
| Repetitive Critical Rate of Rise of On-State Current IPK = 50 A; PW = 40 μsec ; $diG/dt = 200\text{ mA}/\mu\text{sec}$; $f = 60\text{ Hz}$ | di/dt | - | - | 10 | A/ 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. Typical Gate Trigger Current vs Junction Temperature

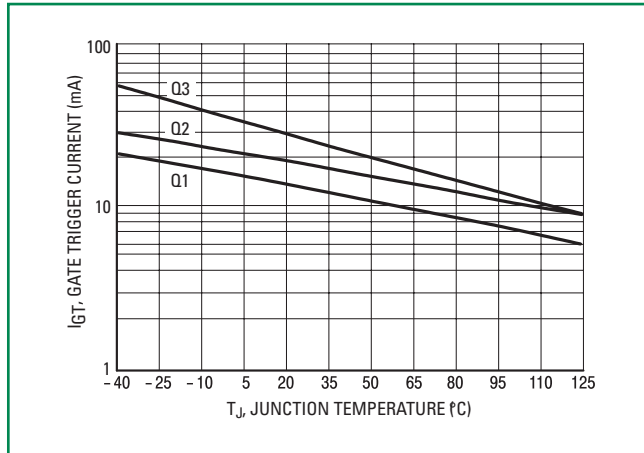


Figure 2. Typical Gate Trigger Voltage vs Junction Temperature

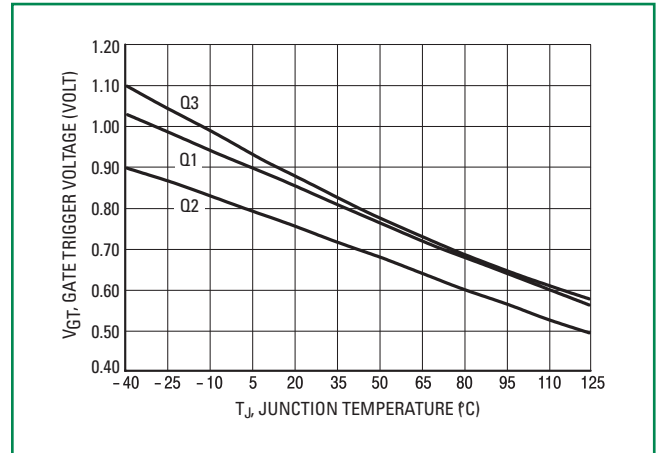


Figure 3. Typical Holding Current vs Junction Temperature

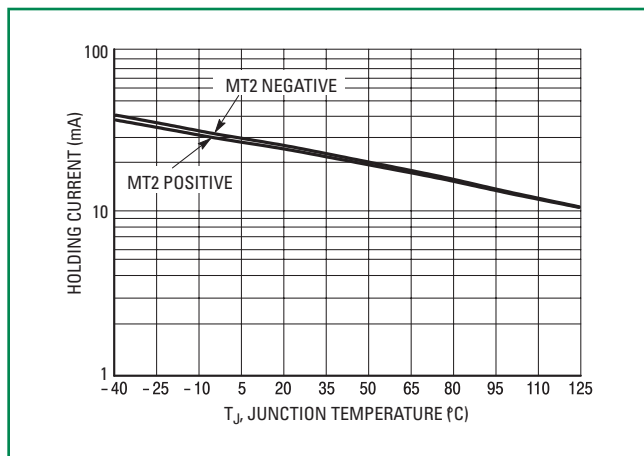


Figure 4. Typical Latching Current vs Junction Temperature

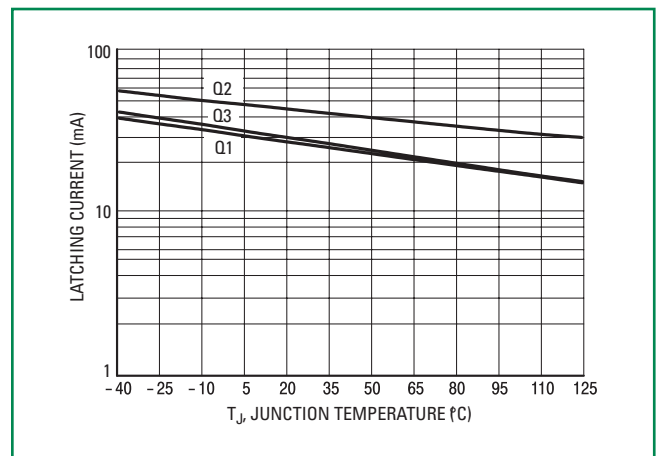


Figure 5. Typical RMS Current Derating

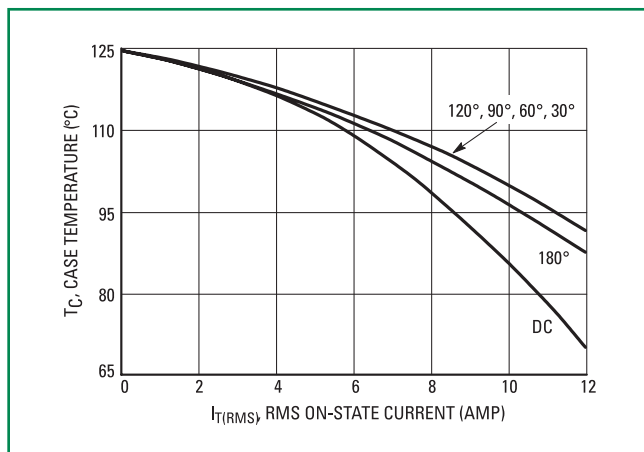


Figure 6. On-State Power Dissipation

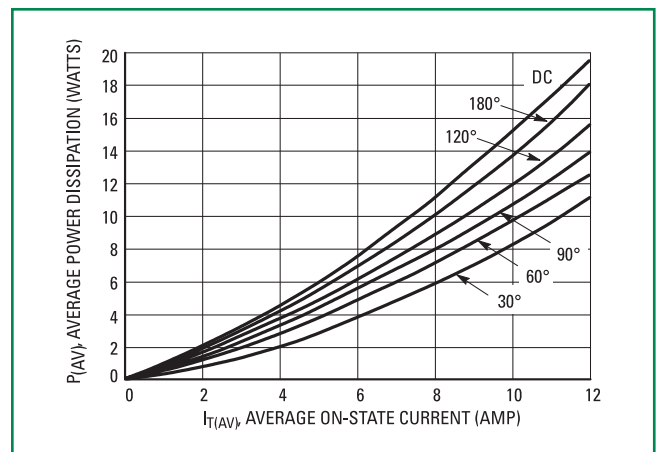


Figure 7. Typical On-State Characteristics

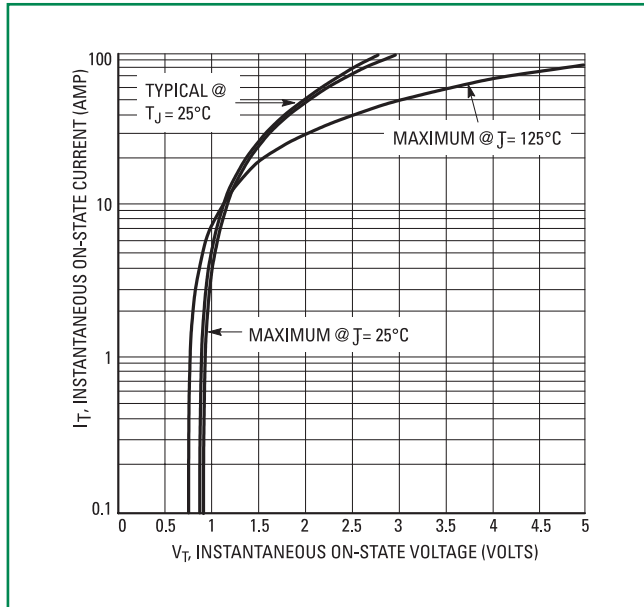
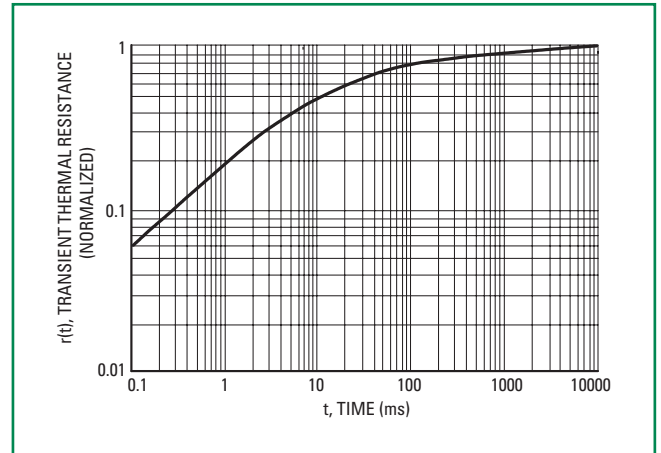
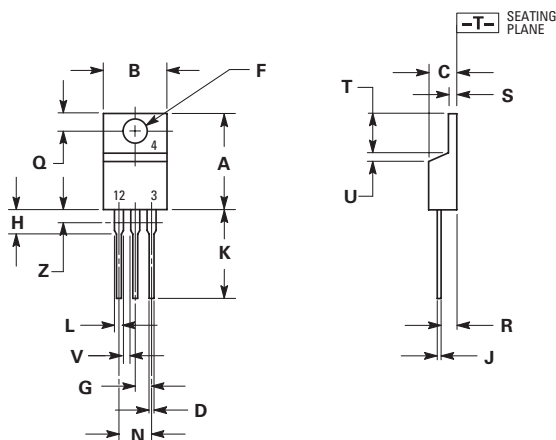


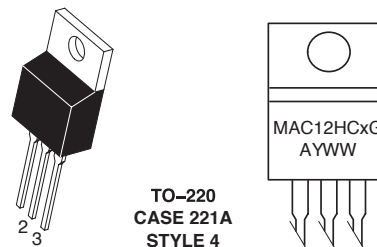
Figure 8. Typical Thermal Response



Dimensions



Part Marking System



TO-220
CASE 221A
STYLE 4

x= D, M, or N
A= Assembly Location (Optional)*
Y= Year
WW = Work Week
G = Pb-Free Package

* The Assembly Location code (A) is optional. In cases where the Assembly Location is stamped on the package the assembly code may be blank.

| 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 |

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

Ordering Information

| Device | Package | Shipping |
|-----------|---------------------|-----------------|
| MAC12HCDG | TO-220 (Pb-Free) | 50 Units / Rail |
| MAC12HCMG | | |
| MAC12HCNG | | |

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