

MAC224A Series

Preferred Device

Triacs

Silicon Bidirectional Thyristors

Designed primarily for full-wave ac control applications such as lighting systems, heater controls, motor controls and power supplies.

- Blocking Voltage to 800 Volts
- All Diffused and Glass-Passivated Junctions for Parameter Uniformity and Stability
- Gate Triggering Guaranteed in Four Modes
- High Current and Surge Ratings
- Device Marking: Logo, Device Type, e.g., MAC224A4, Date Code

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

| Rating | Symbol | Value | Unit |
|--|--|------------|----------------------|
| Peak Repetitive Off-State Voltage ⁽¹⁾ ($T_J = -40$ to 125°C , Sine Wave 50 to 60 Hz, Gate Open) | V_{DRM} , V_{RRM} | | Volts |
| MAC224A4 | | 200 | |
| MAC224A6 | | 400 | |
| MAC224A8 | | 600 | |
| MAC224A10 | | 800 | |
| On-State RMS Current ($T_C = 75^\circ\text{C}$) ⁽²⁾ (Full Cycle Sine Wave 50 to 60 Hz) | $I_{\text{T(RMS)}}$ | 40 | A |
| Peak Non-repetitive Surge Current (One Full Cycle, 60 Hz, $T_J = 125^\circ\text{C}$) | I_{TSM} | 350 | A |
| Circuit Fusing Considerations ($t = 8.3$ ms) | I^2t | 500 | A^2s |
| Peak Gate Current (Pulse Width ≤ 2.0 μsec ; $T_C = 75^\circ\text{C}$) | I_{GM} | ± 2.0 | A |
| Peak Gate Voltage (Pulse Width ≤ 2.0 μsec ; $T_C = 75^\circ\text{C}$) | V_{GM} | ± 10 | Volts |
| Peak Gate Power (Pulse Width ≤ 2.0 μsec ; $T_C = 75^\circ\text{C}$) | P_{GM} | 20 | Watts |
| Average Gate Power ($T_C = 75^\circ\text{C}$, $t = 8.3$ ms) | $P_{\text{G(AV)}}$ | 0.5 | Watts |
| Operating Junction Temperature Range | T_J | -40 to 125 | $^\circ\text{C}$ |
| Storage Temperature Range | T_{stg} | -40 to 150 | $^\circ\text{C}$ |
| Mounting Torque | — | 8.0 | in. lb. |

(1) V_{DRM} , V_{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.

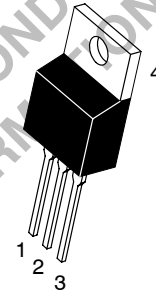
(2) This device is rated for use in applications subject to high surge conditions. Care must be taken to insure proper heat sinking when the device is to be used at high sustained currents. (See Figure 1 for maximum case temperatures.)



ON Semiconductor

<http://onsemi.com>

TRIACS
40 AMPERES RMS
200 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 |
|-----------|---------|----------|
| MAC224A4 | TO220AB | 500/Box |
| MAC224A6 | TO220AB | 500/Box |
| MAC224A8 | TO220AB | 500/Box |
| MAC224A10 | TO220AB | 500/Box |

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

MAC224A Series

Thermal Characteristics

| Characteristic | Symbol | Value | Unit |
|---|-----------------|-------|---------------|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 1.0 | $^{\circ}C/W$ |
| — Junction to Ambient | $R_{\theta JA}$ | 60 | |
| Maximum Lead Temperature for Soldering Purposes 1/8" from Case for 10 Seconds | T_L | 260 | $^{\circ}C$ |

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

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

OFF CHARACTERISTICS

| | | | | | |
|---|--------------------------|---|---|-----|---------|
| Peak Repetitive Blocking Current (Rated V_{DRM} , V_{RRM} ; Gate Open) | I_{DRM} , I_{RRM} | — | — | 10 | μA |
| $T_J = 25^{\circ}C$ | | — | — | 2.0 | mA |
| $T_J = 125^{\circ}C$ | | — | — | | |

ON CHARACTERISTICS

| | | | | | |
|---|----------|-----|-----|------|---------|
| Peak On-State Voltage ($I_{TM} = \pm 56 A$ Peak, Pulse Width $\leq 2 ms$, Duty Cycle $\leq 2\%$) | V_{TM} | — | 1.4 | 1.85 | Volts |
| Gate Trigger Current (Continuous dc) ($V_D = 12 V$, $R_L = 100 \Omega$) MT2(+), G(+); MT2(+), G(-); MT2(+), G(-) MT2(-), G(+) | I_{GT} | — | 25 | 50 | mA |
| | | — | 40 | 75 | |
| Gate Trigger Voltage (Continuous dc) ($V_D = 12 V$, $R_L = 100 \Omega$) MT2(+), G(+); MT2(-), G(-); MT(+), G(-) MT2(-), G(+) | V_{GT} | — | 1.1 | 2.0 | Volts |
| | | — | 1.3 | 2.5 | |
| Gate Non-Trigger Voltage ($V_D = 12 V$, $T_J = 125^{\circ}C$, $R_L = 100 \Omega$) All Quadrants | V_{GD} | 0.2 | — | — | Volts |
| Holding Current ($V_D = 12 Vdc$, Gate Open, Initiating Current = $\pm 200 mA$) | I_H | — | 30 | 75 | mA |
| Gate Controlled Turn-On Time ($V_D = \text{Rated } V_{DRM}$, $I_{TM} = 56 A$ Peak, $I_G = 200 mA$) | t_{gt} | — | 1.5 | — | μs |

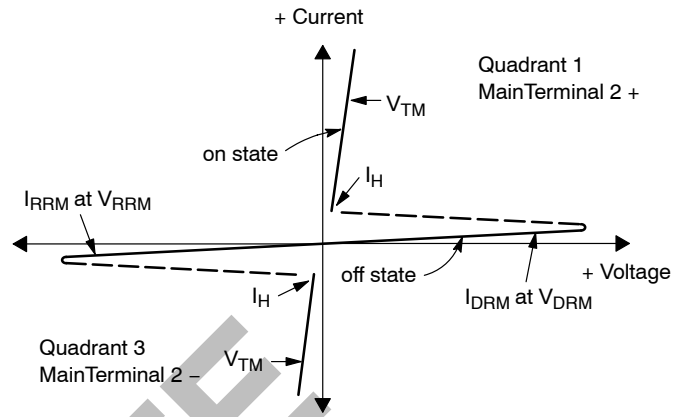
DYNAMIC CHARACTERISTICS

| | | | | | |
|--|------------|---|-----|---|-----------|
| Critical Rate of Rise of Off-State Voltage ($V_D = \text{Rated } V_{DRM}$, Exponential Waveform, $T_C = 125^{\circ}C$) | dv/dt | — | 50 | — | $V/\mu s$ |
| Critical Rate of Rise of Commutation Voltage ($V_D = \text{Rated } V_{DRM}$, $I_{TM} = 56 A$ Peak, Commutating $di/dt = 20.2 A/ms$, Gate Unenergized, $T_C = 75^{\circ}C$) | $dv/dt(c)$ | — | 5.0 | — | $V/\mu s$ |

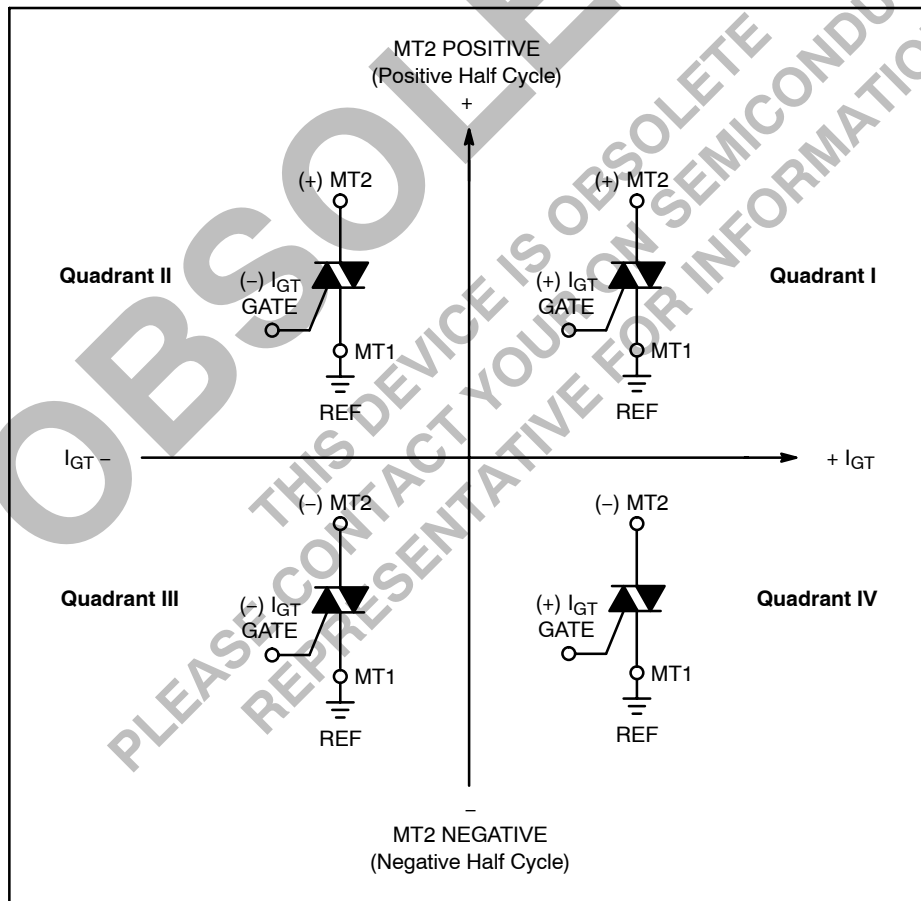
MAC224A Series

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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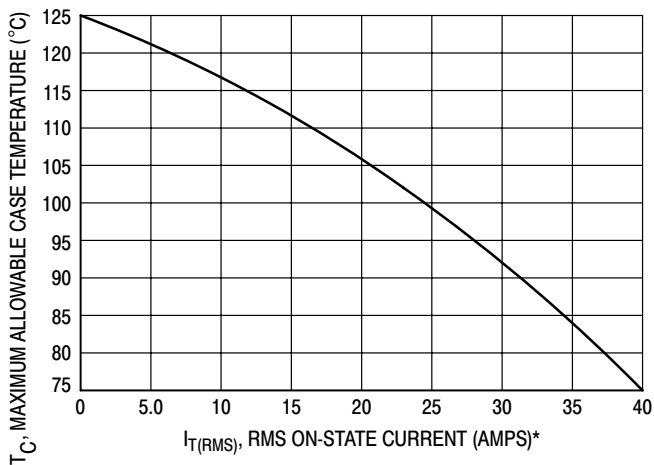


Figure 1. RMS Current Derating

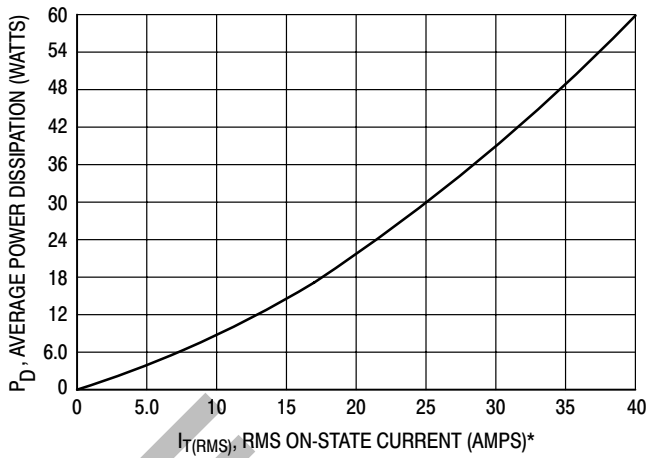


Figure 2. On-State Power Dissipation

*This device is rated for use in applications subject to high surge conditions. Care must be taken to insure proper heat sinking when the device is to be used at high sustained currents.

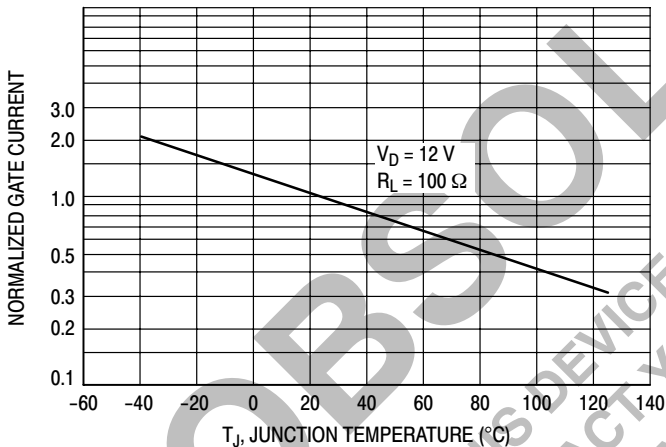


Figure 3. Typical Gate Trigger Current

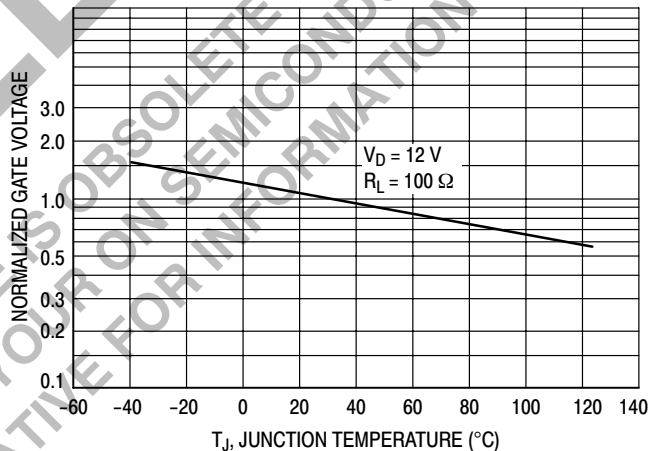


Figure 4. Typical Gate Trigger Voltage

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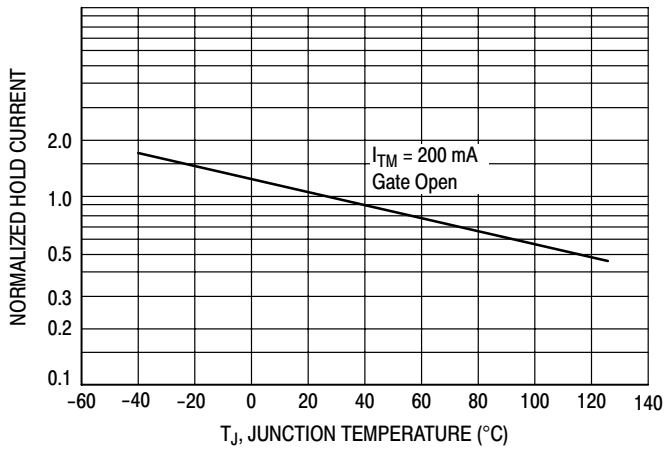


Figure 5. Typical Holding Current

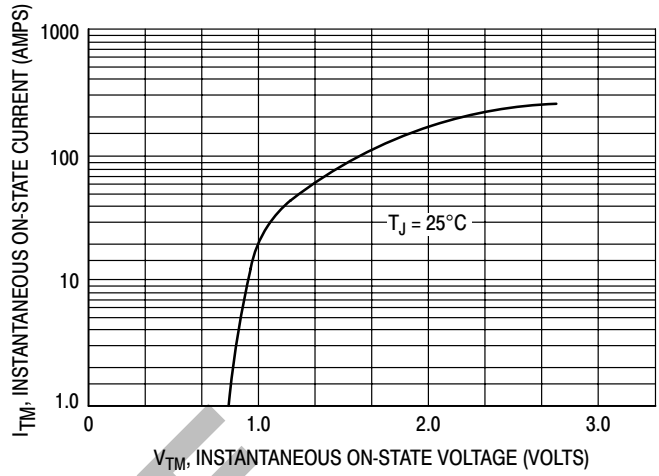


Figure 6. Typical On-State Characteristics

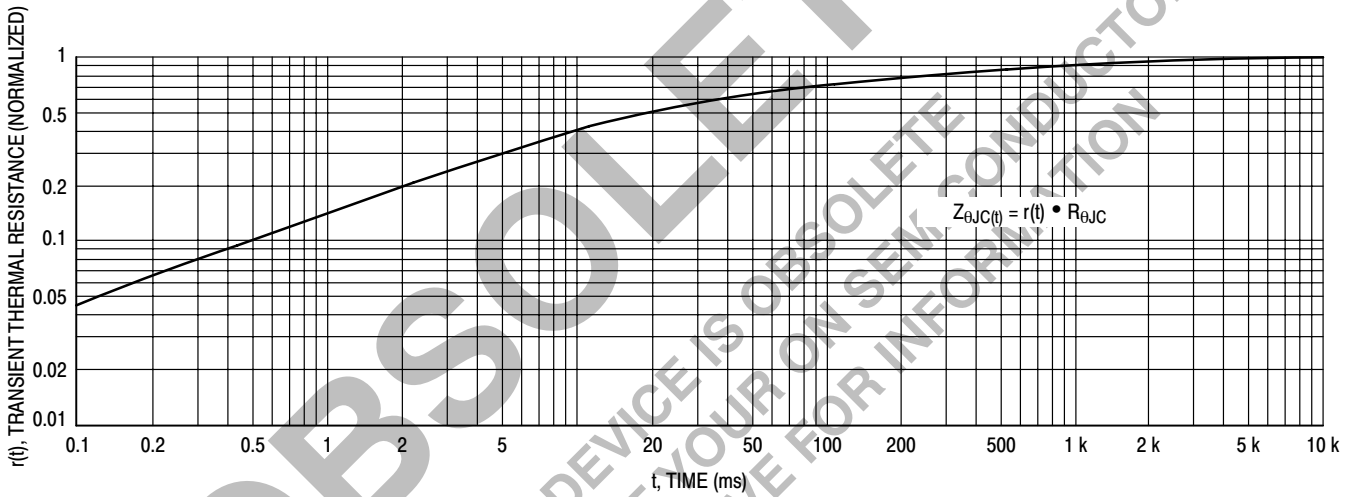
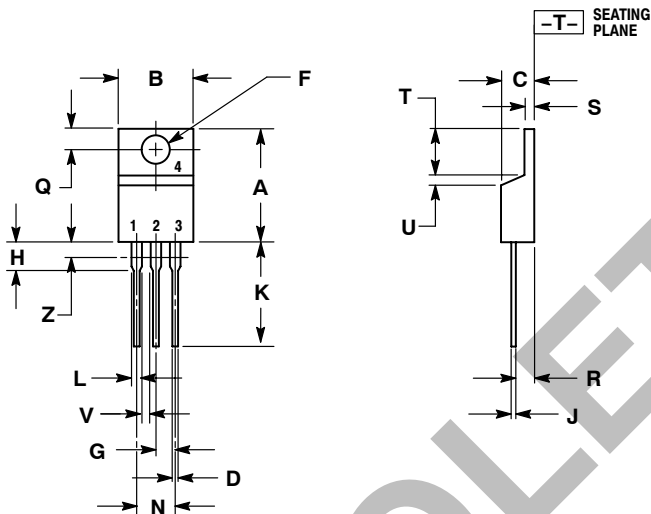


Figure 7. Thermal Response

MAC224A Series

PACKAGE DIMENSIONS

TO-220AB
CASE 221A-07
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 | 0.014 | 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 | --- |

STYLE 4:

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

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