

# MAC228A Series

## Sensitive Gate Triacs

### Silicon Bidirectional Thyristors

Designed primarily for industrial and consumer applications for full-wave control of AC loads such as appliance controls, heater controls, motor controls, and other power switching applications.

#### Features

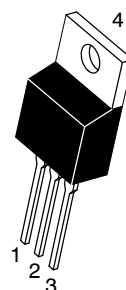
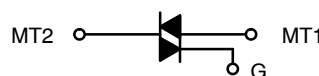
- Sensitive Gate Triggering in 3 Modes for AC Triggering on Sinking Current Sources
- Four Mode Triggering for Drive Circuits that Source Current
- All Diffused and Glass-Passivated Junctions for Parameter Uniformity and Stability
- Small, Rugged, Thermowatt Construction for Low Thermal Resistance and High Heat Dissipation
- Center Gate Geometry for Uniform Current Spreading
- These Devices are Pb-Free and are RoHS Compliant\*



**ON Semiconductor®**

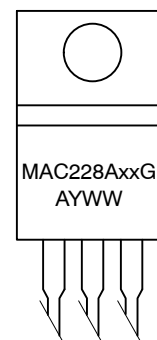
<http://onsemi.com>

**TRIACS**  
**8 AMPERES RMS**  
**200 – 800 VOLTS**



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

#### MARKING DIAGRAM



xx = 4, 6, 8, or 10  
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.

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

## MAC228A Series

### MAXIMUM RATINGS (T<sub>J</sub> = 25°C unless otherwise noted)

| Characteristic                                                                                                   | Symbol                                 | Value                    | Unit             |
|------------------------------------------------------------------------------------------------------------------|----------------------------------------|--------------------------|------------------|
| Peak Repetitive Off-State Voltage (Note 1)<br>(T <sub>J</sub> = -40 to 110°C, Sine Wave, 50 to 60 Hz, Gate Open) | V <sub>DRM</sub> ,<br>V <sub>RRM</sub> | 200<br>400<br>600<br>800 | V                |
| On-State RMS Current, (T <sub>C</sub> = 80°C) – Full Cycle Sine Wave 50 to 60 Hz                                 | I <sub>T(RMS)</sub>                    | 8.0                      | A                |
| Peak Non-Repetitive Surge Current<br>(One Full Cycle Sine Wave, 60 Hz, T <sub>J</sub> = 110°C)                   | I <sub>TSM</sub>                       | 80                       | A                |
| Circuit Fusing Considerations, (t = 8.3 ms)                                                                      | I <sup>2</sup> t                       | 26                       | A <sup>2</sup> s |
| Peak Gate Current, (t ≤ 2 μs, T <sub>C</sub> = 80°C)                                                             | I <sub>GM</sub>                        | ± 2.0                    | A                |
| Peak Gate Voltage, (t ≤ 2 μs, T <sub>C</sub> = 80°C)                                                             | V <sub>GM</sub>                        | ± 10                     | V                |
| Peak Gate Power, (t ≤ 2 μs, T <sub>C</sub> = 80°C)                                                               | P <sub>GM</sub>                        | 20                       | W                |
| Average Gate Power, (t ≤ 8.3 ms, T <sub>C</sub> = 80°C)                                                          | P <sub>G(AV)</sub>                     | 0.5                      | W                |
| Operating Junction Temperature Range                                                                             | T <sub>J</sub>                         | -40 to 110               | °C               |
| Storage Temperature Range                                                                                        | T <sub>stg</sub>                       | -40 to 150               | °C               |
| Mounting Torque                                                                                                  | –                                      | 8.0                      | in lb            |

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<sub>DRM</sub> and V<sub>RRM</sub> 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.

### THERMAL CHARACTERISTICS

| Characteristic                                                                | Symbol           | Value | Unit |
|-------------------------------------------------------------------------------|------------------|-------|------|
| Thermal Resistance – Junction-to-Case                                         | R <sub>θJC</sub> | 2.0   | °C/W |
| Thermal Resistance – Junction-to-Ambient                                      | R <sub>θJA</sub> | 62.5  | °C/W |
| Maximum Lead Temperature for Soldering Purposes 1/8" from Case for 10 Seconds | T <sub>L</sub>   | 260   | °C   |

### ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted; Electricals apply in both directions)

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

#### OFF CHARACTERISTICS

|                                                                                                                                  |                                        |   |   |     |    |
|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|---|---|-----|----|
| Peak Repetitive Blocking Current, (V <sub>D</sub> = Rated V <sub>DRM</sub> , V <sub>RRM</sub> ; Gate Open) T <sub>J</sub> = 25°C | I <sub>DRM</sub> ,<br>I <sub>RRM</sub> | – | – | 10  | μA |
| T <sub>J</sub> = 110°C                                                                                                           |                                        | – | – | 2.0 | mA |

#### ON CHARACTERISTICS

|                                                                                                                                                   |                 |     |     |            |    |
|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----|-----|------------|----|
| Peak On-State Voltage, (I <sub>TM</sub> = ± 11 A Peak, Pulse Width ≤ 2 ms, Duty Cycle ≤ 2%)                                                       | V <sub>TM</sub> | –   | –   | 1.8        | V  |
| Gate Trigger Current (Continuous DC), (V <sub>D</sub> = 12 V, R <sub>L</sub> = 100 Ω)<br>MT2(+), G(+); MT2(+), G(-); MT2(-), G(-)<br>MT2(-), G(+) | I <sub>GT</sub> | –   | –   | 5.0<br>10  | mA |
| Gate Trigger Voltage (Continuous DC), (V <sub>D</sub> = 12 V, R <sub>L</sub> = 100 Ω)<br>MT2(+), G(+); MT2(+), G(-); MT2(-), G(-)<br>MT2(-), G(+) | V <sub>GT</sub> | –   | –   | 2.0<br>2.5 | V  |
| Gate Non-Trigger Voltage (Continuous DC), (V <sub>D</sub> = 12 V, T <sub>C</sub> = 110°C, R <sub>L</sub> = 100 Ω)<br>All Four Quadrants           | V <sub>GD</sub> | 0.2 | –   | –          | V  |
| Holding Current, (V <sub>D</sub> = 12 Vdc, Initiating Current = ± 200 mA, Gate Open)                                                              | I <sub>H</sub>  | –   | –   | 15         | mA |
| Gate-Controlled Turn-On Time, (V <sub>D</sub> = Rated V <sub>DRM</sub> , I <sub>TM</sub> = 16 A Peak, I <sub>G</sub> = 30 mA)                     | t <sub>gt</sub> | –   | 1.5 | –          | μs |

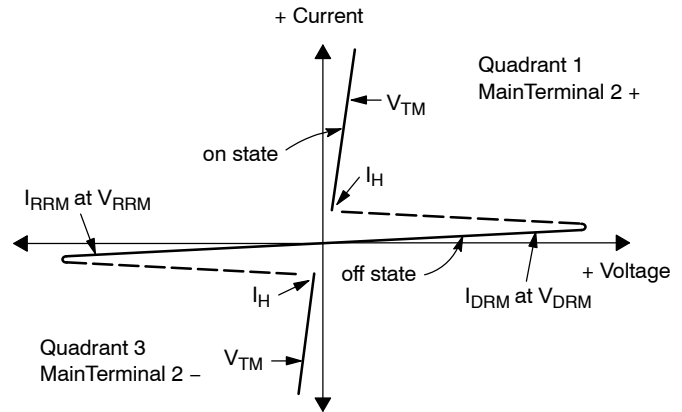
#### DYNAMIC CHARACTERISTICS

|                                                                                                                                                                                              |          |   |     |   |      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---|-----|---|------|
| Critical Rate of Rise of Off-State Voltage,<br>(V <sub>D</sub> = Rated V <sub>DRM</sub> , Exponential Waveform, T <sub>C</sub> = 110°C)                                                      | dv/dt    | – | 25  | – | V/μs |
| Critical Rate of Rise of Commutation Voltage, (V <sub>D</sub> = Rated V <sub>DRM</sub> , I <sub>TM</sub> = 11.3 A,<br>Commutating di/dt = 4.1 A/ms, Gate Unenergized, T <sub>C</sub> = 80°C) | dv/dt(c) | – | 5.0 | – | V/μs |

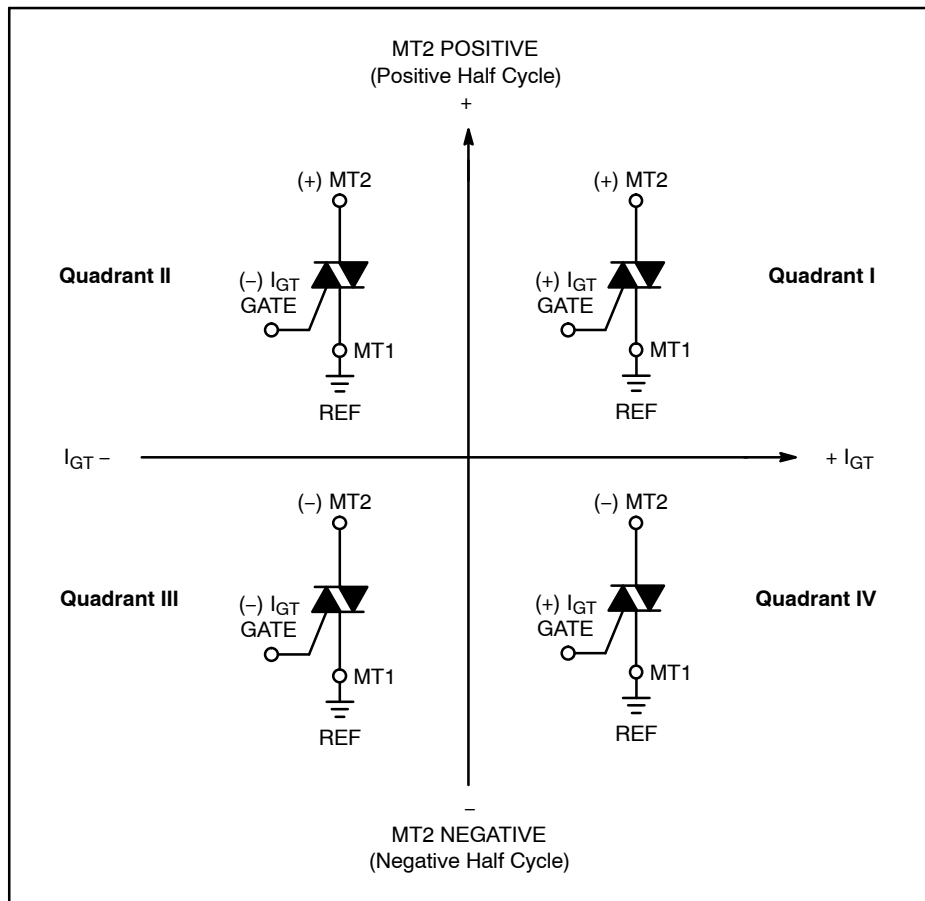
## MAC228A Series

### 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.

## MAC228A Series

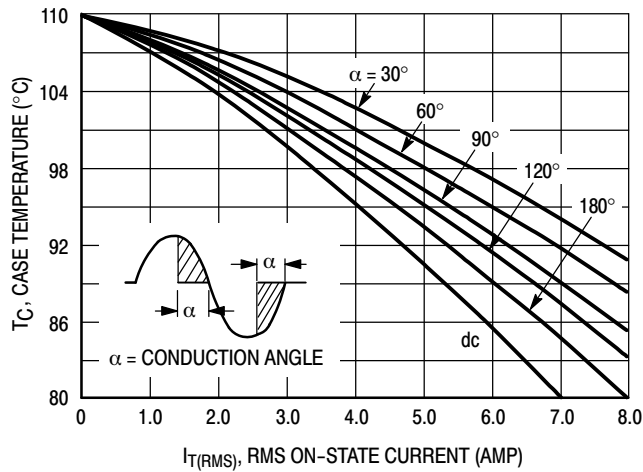


Figure 1. RMS Current Derating

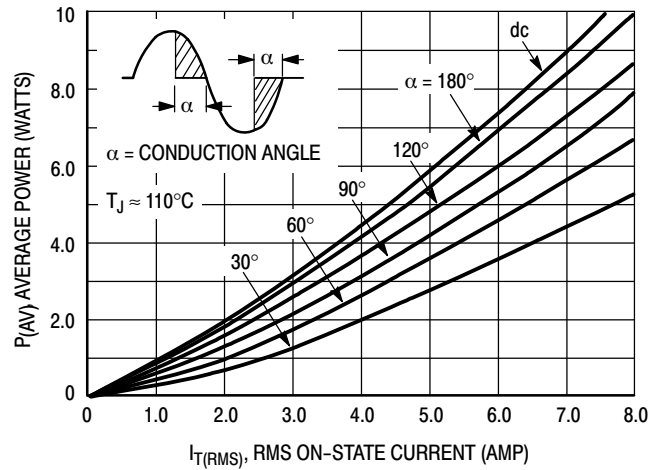


Figure 2. On-State Power Dissipation

### ORDERING INFORMATION

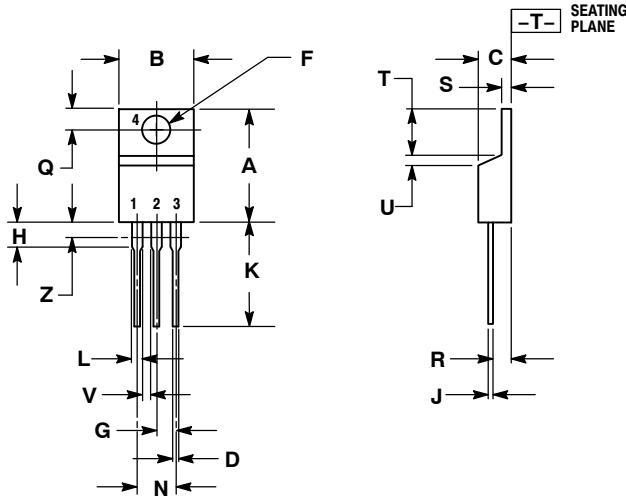
| Device     | Package             | Shipping <sup>†</sup> |
|------------|---------------------|-----------------------|
| MAC228A4   | TO-220              | 500 Units / Bulk      |
| MAC228A4G  | TO-220<br>(Pb-Free) | 500 Units / Bulk      |
| MAC228A6   | TO-220              | 500 Units / Bulk      |
| MAC228A6G  | TO-220<br>(Pb-Free) | 500 Units / Bulk      |
| MAC228A6T  | TO-220              | 50 Units / Rail       |
| MAC228A6TG | TO-220<br>(Pb-Free) | 50 Units / Rail       |
| MAC228A8   | TO-220              | 500 Units / Bulk      |
| MAC228A8G  | TO-220<br>(Pb-Free) | 500 Units / Bulk      |
| MAC228A8T  | TO-220              | 50 Units / Rail       |
| MAC228A8TG | TO-220<br>(Pb-Free) | 50 Units / Rail       |
| MAC228A10  | TO-220              | 500 Units / Bulk      |
| MAC228A10G | TO-220<br>(Pb-Free) | 500 Units / Bulk      |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# MAC228A Series

## PACKAGE DIMENSIONS

TO-220  
CASE 221A-09  
ISSUE AG



### 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  | 0.036 | 0.64        | 0.91  |
| F   | 0.142  | 0.161 | 3.61        | 4.09  |
| G   | 0.095  | 0.105 | 2.42        | 2.66  |
| H   | 0.110  | 0.161 | 2.80        | 4.10  |
| J   | 0.014  | 0.025 | 0.36        | 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  
2: MAIN TERMINAL 2  
3: GATE  
4: MAIN TERMINAL 2

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