# MAC228A Series

Preferred Device

# 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.

- 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
- Device Marking: Logo, Device Type, e.g., MAC228A4, Date Code

**MAXIMUM RATINGS** ($T_J$ = 25°C unless otherwise noted)

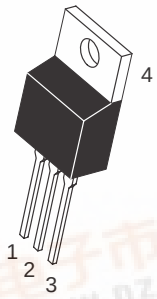
| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Off–State Voltage(1) ($T_J$ = –40 to 110°C, Sine Wave, 50 to 60 Hz, Gate Open) MAC228A4 / MAC228A6 / MAC228A8 / MAC228A10 | $V_{DRM}$, $V_{RRM}$ | 200 / 400 / 600 / 800 | Volts |
| On-State RMS Current ($T_C$ = 80°C) Full Cycle Sine Wave 50 to 60 Hz | $I_{T(RMS)}$ | 8.0 | Amps |
| Peak Non–Repetitive Surge Current (One Full Cycle Sine Wave, 60 Hz, $T_J$ = 110°C) | $I_{TSM}$ | 80 | Amps |
| Circuit Fusing Considerations (t = 8.3 ms) | $I^2t$ | 26 | $A^2s$ |
| Peak Gate Current ($t \le 2\ \mu s$, $T_C$ = 80°C) | $I_{GM}$ | ±2.0 | Amps |
| Peak Gate Voltage ($t \le 2\ \mu s$, $T_C$ = 80°C) | $V_{GM}$ | ±10 | Volts |
| Peak Gate Power ($t \le 2\ \mu s$, $T_C$ = 80°C) | $P_{GM}$ | 20 | Watts |
| Average Gate Power ($t \le 8.3$ ms, $T_C$ = 80°C) | $P_{G(AV)}$ | 0.5 | Watt |
| Operating Junction Temperature Range | $T_J$ | –40 to 110 | °C |
| Storage Temperature Range | $T_{stg}$ | –40 to 150 | °C |
| Mounting Torque | — | 8.0 | in. lb. |

(1) $V_{DRM}$ and $V_{RRM}$ 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.

ON Semiconductor

http://onsemi.com

**TRIACS**
**8 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 |
|---|---|---|
| MAC228A4 | TO220AB | 500/Box |
| MAC228A6 | TO220AB | 500/Box |
| MAC228A8 | TO220AB | 500/Box |
| MAC228A10 | TO220AB | 500/Box |

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





Publication Order Number:

## THERMAL CHARACTERISTICS

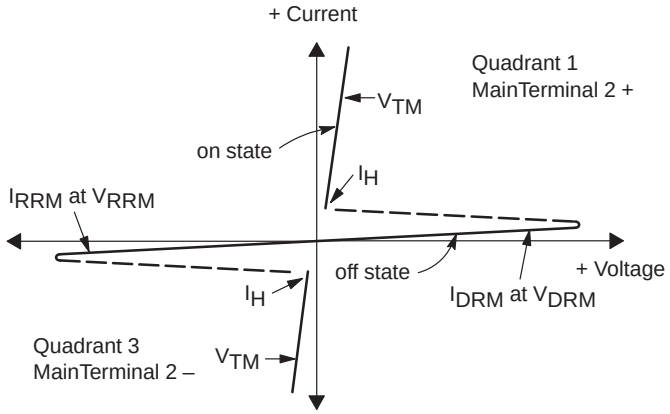
| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case<br>— Junction to Ambient | $R_{\theta JC}$<br>$R_{\theta JA}$ | 2.0<br>62.5 | °C/W |
| Maximum Lead Temperature for Soldering Purposes 1/8″ from Case for 10 Seconds | $T_L$ | 260 | °C |

## ELECTRICAL CHARACTERISTICS ($T_C$ = 25°C unless otherwise noted; Electricals apply in both directions)

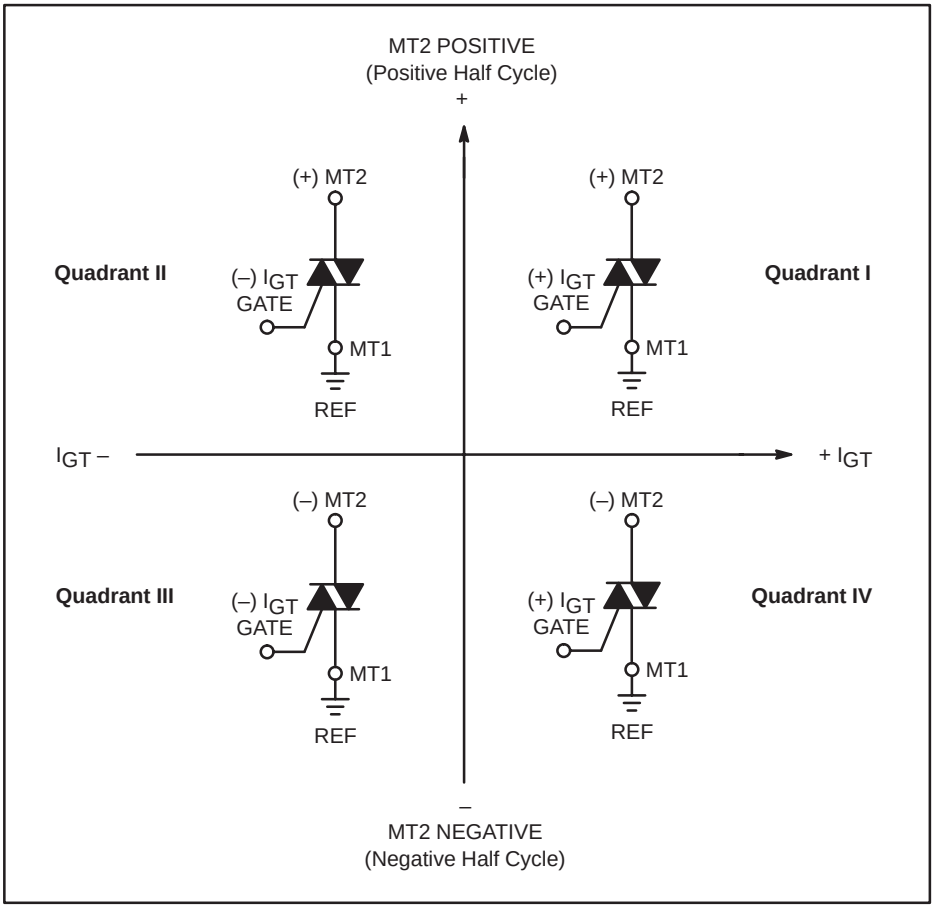
| Characteristic | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Peak Repetitive Blocking Current<br>($V_D$ = Rated $V_{DRM}$, $V_{RRM}$; Gate Open) | $T_J$ = 25°C<br>$T_J$ = 110°C | $I_{DRM}$, $I_{RRM}$ | —<br>— | —<br>— | 10<br>2.0 | μA<br>mA |
| **ON CHARACTERISTICS** | | | | | | |
| Peak On-State Voltage<br>($I_{TM}$ = ±11 A Peak, Pulse Width ≤ 2 ms, Duty Cycle ≤ 2%) | | $V_{TM}$ | — | — | 1.8 | Volts |
| Gate Trigger Current (Continuous dc)<br>($V_D$ = 12 V, $R_L$ = 100 Ω)<br>MT2(+), G(+); MT2(+), G(–); MT2(–), G(–)<br>MT2(–), G(+) | | $I_{GT}$ | <br><br>—<br>— | <br><br>—<br>— | <br><br>5.0<br>10 | mA |
| Gate Trigger Voltage (Continuous dc)<br>($V_D$ = 12 V, $R_L$ = 100 Ω)<br>MT2(+), G(+); MT2(+), G(–); MT2(–), G(–)<br>MT2(–), G(+) | | $V_{GT}$ | <br><br>—<br>— | <br><br>—<br>— | <br><br>2.0<br>2.5 | Volts |
| Gate Non–Trigger Voltage (Continuous dc)<br>($V_D$ = 12 V, $T_C$ = 110°C, $R_L$ = 100 Ω)<br>All Four Quadrants | | $V_{GD}$ | 0.2 | — | — | Volts |
| Holding Current<br>($V_D$ = 12 Vdc, Initiating Current = ±200 mA, Gate Open) | | $I_H$ | — | — | 15 | mA |
| Gate–Controlled Turn–On Time<br>($V_D$ = Rated $V_{DRM}$, $I_{TM}$ = 16 A Peak, $I_G$ = 30 mA) | | $t_{gt}$ | — | 1.5 | — | μs |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Critical Rate of Rise of Off-State Voltage<br>($V_D$ = Rated $V_{DRM}$, Exponential Waveform, $T_C$ = 110°C) | | dv/dt | — | 25 | — | V/μs |
| Critical Rate of Rise of Commutation Voltage<br>($V_D$ = Rated $V_{DRM}$, $I_{TM}$ = 11.3 A,<br>Commutating di/dt = 4.1 A/ms, Gate Unenergized, $T_C$ = 80°C) | | dv/dt(c) | — | 5.0 | — | V/μs |

## 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.

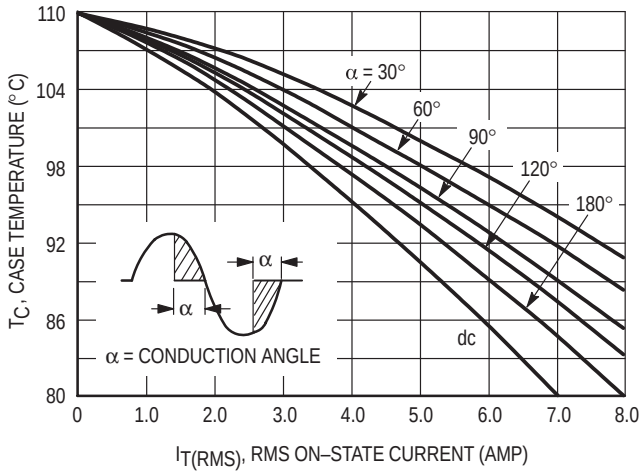



**Figure 1. RMS Current Derating**

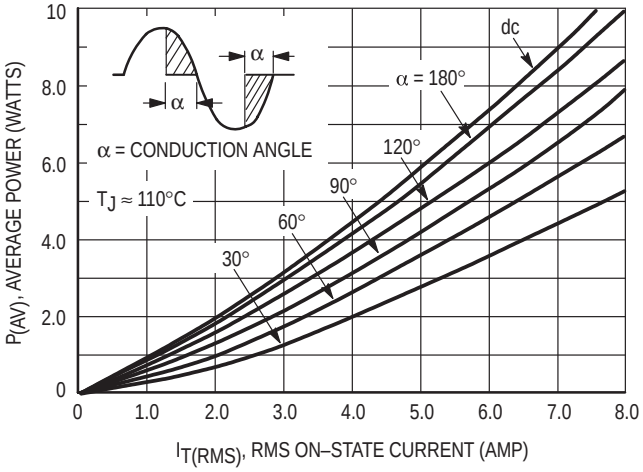
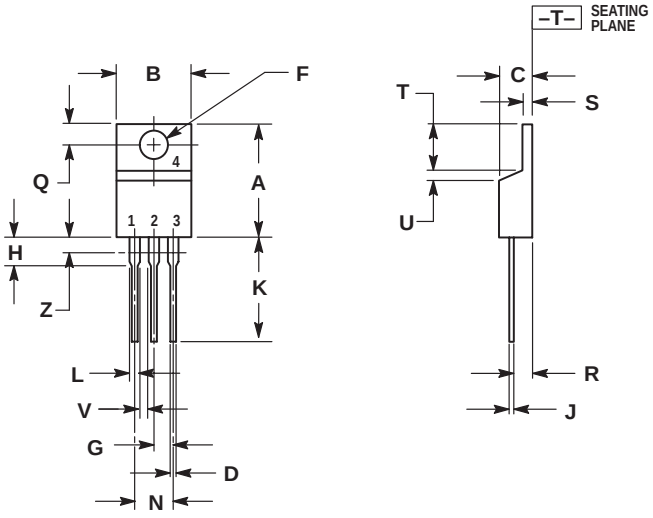



**Figure 2. On–State Power Dissipation**

## 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.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | 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 |

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

# Notes

# Notes

## PUBLICATION ORDERING INFORMATION

**NORTH AMERICA Literature Fulfillment**:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
**Phone**: 303–675–2175 or 800–344–3860 Toll Free USA/Canada
**Fax**: 303–675–2176 or 800–344–3867 Toll Free USA/Canada
**Email**: ONlit@hibbertco.com
Fax Response Line: 303–675–2167 or 800–344–3810 Toll Free USA/Canada

**N. American Technical Support**: 800–282–9855 Toll Free USA/Canada

**EUROPE:** LDC for ON Semiconductor – European Support
**German Phone**: (+1) 303–308–7140 (M–F 1:00pm to 5:00pm Munich Time)
**Email**: ONlit–german@hibbertco.com
**French Phone**: (+1) 303–308–7141 (M–F 1:00pm to 5:00pm Toulouse Time)
**Email**: ONlit–french@hibbertco.com
**English Phone**: (+1) 303–308–7142 (M–F 12:00pm to 5:00pm UK Time)
**Email**: ONlit@hibbertco.com

**EUROPEAN TOLL–FREE ACCESS*: 00–800–4422–3781**
*Available from Germany, France, Italy, England, Ireland

**CENTRAL/SOUTH AMERICA:**
**Spanish Phone**: 303–308–7143 (Mon–Fri 8:00am to 5:00pm MST)
**Email**: ONlit–spanish@hibbertco.com

**ASIA/PACIFIC**: LDC for ON Semiconductor – Asia Support
**Phone**: 303–675–2121 (Tue–Fri 9:00am to 1:00pm, Hong Kong Time)
Toll Free from Hong Kong & Singapore:
**001–800–4422–3781**
**Email**: ONlit–asia@hibbertco.com

**JAPAN**: ON Semiconductor, Japan Customer Focus Center
4–32–1 Nishi–Gotanda, Shinagawa–ku, Tokyo, Japan 141–8549
**Phone**: 81–3–5740–2745
**Email**: r14525@onsemi.com

**ON Semiconductor Website**: http://onsemi.com

For additional information, please contact your local
Sales Representative.