

# 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

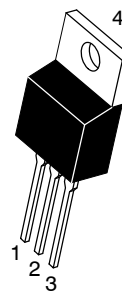
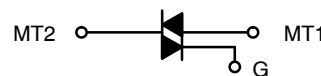
- Sensitive Gate Triggering in 3 Modes for AC Triggering on Sinking Current Sources
- Four Mode Triggering for Drive Circuits that Source Current
- All Diffused and Glass-Passivated Junctions for Parameter Uniformity and Stability
- Small, Rugged, Thermowatt Construction for Low Thermal Resistance and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



**ON Semiconductor®**

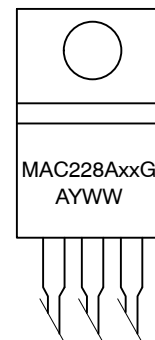
<http://onsemi.com>

**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) (T <sub>J</sub> = -40 to 110°C, Sine Wave, 50 to 60 Hz, Gate Open)	V <sub>DRM</sub> , V <sub>RRM</sub>	200 400 600 800	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 (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.

- 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> ,	-	-	10	μA
T <sub>J</sub> = 110°C	I <sub>RRM</sub>	-	-	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) MT2(+), G(+); MT2(+), G(-); MT2(-), G(-) MT2(-), G(+)	I <sub>GT</sub>	-	-	5.0 10	mA
Gate Trigger Voltage (Continuous DC), (V <sub>D</sub> = 12 V, R <sub>L</sub> = 100 Ω) MT2(+), G(+); MT2(+), G(-); MT2(-), G(-) MT2(-), G(+)	V <sub>GT</sub>	-	-	2.0 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) 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

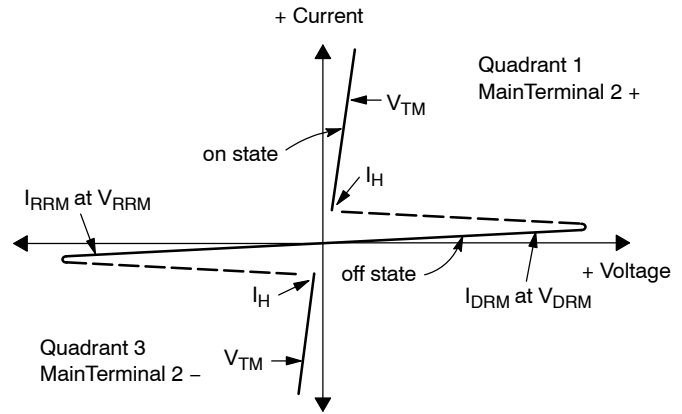
#### DYNAMIC CHARACTERISTICS

Critical Rate of Rise of Off-State Voltage, (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, Commutating di/dt = 4.1 A/ms, Gate Unenergized, T <sub>C</sub> = 80°C)	dv/dt(c)	-	5.0	-	V/μs

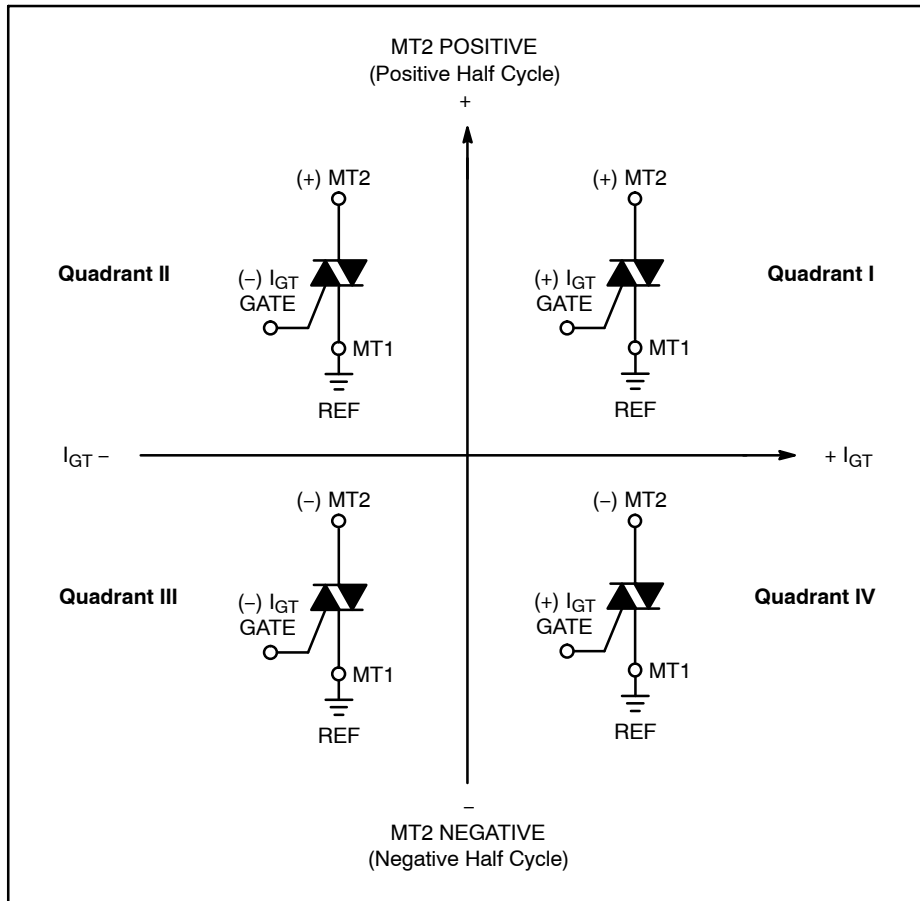
# MAC228A Series

## 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



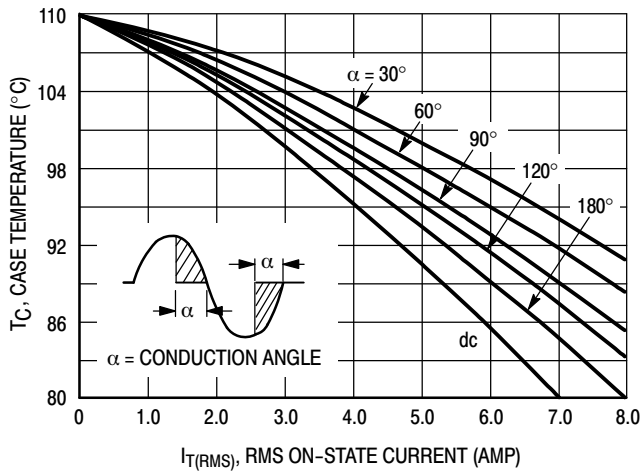
### Quadrant Definitions for a Triac



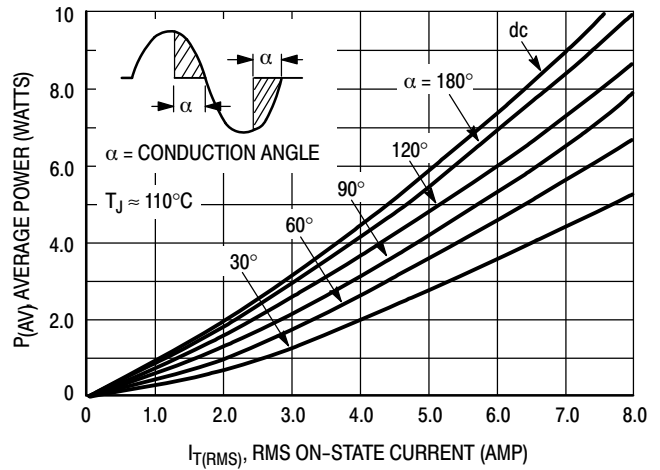
All polarities are referenced to MT1.

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

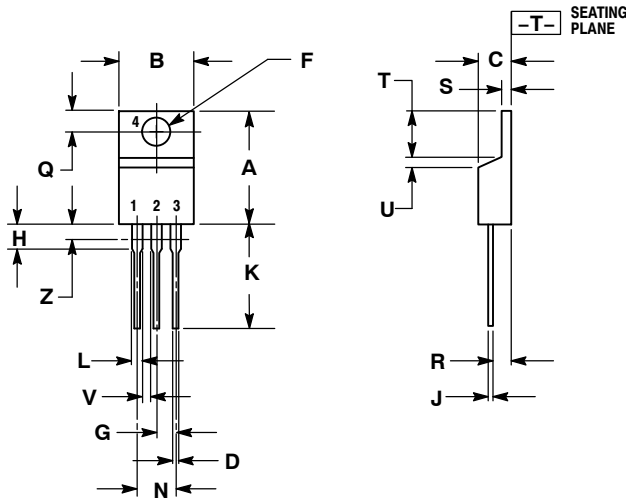
Device	Package	Shipping <sup>†</sup>
MAC228A4	TO-220	500 Units / Bulk
MAC228A4G	TO-220 (Pb-Free)	500 Units / Bulk
MAC228A6	TO-220	500 Units / Bulk
MAC228A6G	TO-220 (Pb-Free)	500 Units / Bulk
MAC228A6T	TO-220	50 Units / Rail
MAC228A6TG	TO-220 (Pb-Free)	50 Units / Rail
MAC228A8	TO-220	500 Units / Bulk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

**ON Semiconductor** and **ON** are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of SCILLC's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

### PUBLICATION ORDERING INFORMATION

**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:** [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative