

# 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.

#### Features

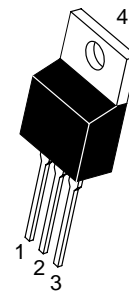
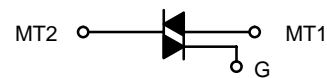
- Pb-Free Packages are Available
- Sensitive Gate Triggering in 3 Modes for AC Triggering on Sinking Current Sources
- Four Mode Triggering for Drive Circuits that Source Current
- All Diffused and Glass-Passivated Junctions for Parameter Uniformity and Stability
- Small, Rugged, Thermowatt Construction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



**ON Semiconductor®**

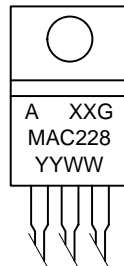
<http://onsemi.com>

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



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

#### MARKING DIAGRAM



X = 4, 6, 8, or 10  
YY = Year  
WW = Work Week  
G = Pb-Free

#### ORDERING INFORMATION

Device	Package	Shipping†
MAC228A4	TO-220	500 Units/Box
MAC228A6	TO-220	500 Units/Box
MAC228A8	TO-220	500 Units/Box
MAC228A8G	TO-220 (Pb-Free)	500 Units/Box
MAC228A10	TO-220	500 Units/Box
MAC228A10G	TO-220 (Pb-Free)	500 Units/Box

†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.

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

\*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

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

- 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)	I <sub>DRM</sub> , I <sub>RRM</sub>	-	-	10 2.0	μA 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

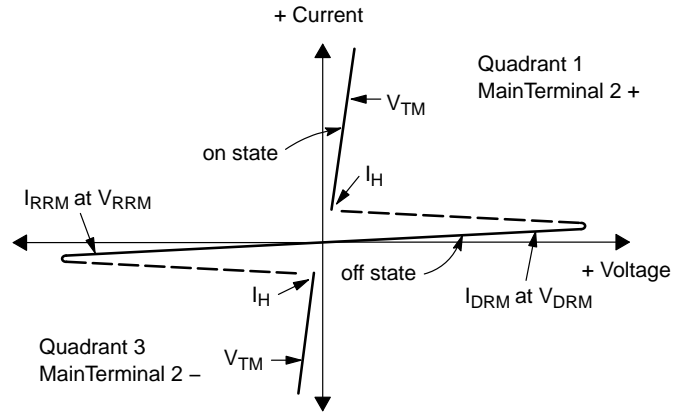
### DYNAMIC CHARACTERISTICS

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

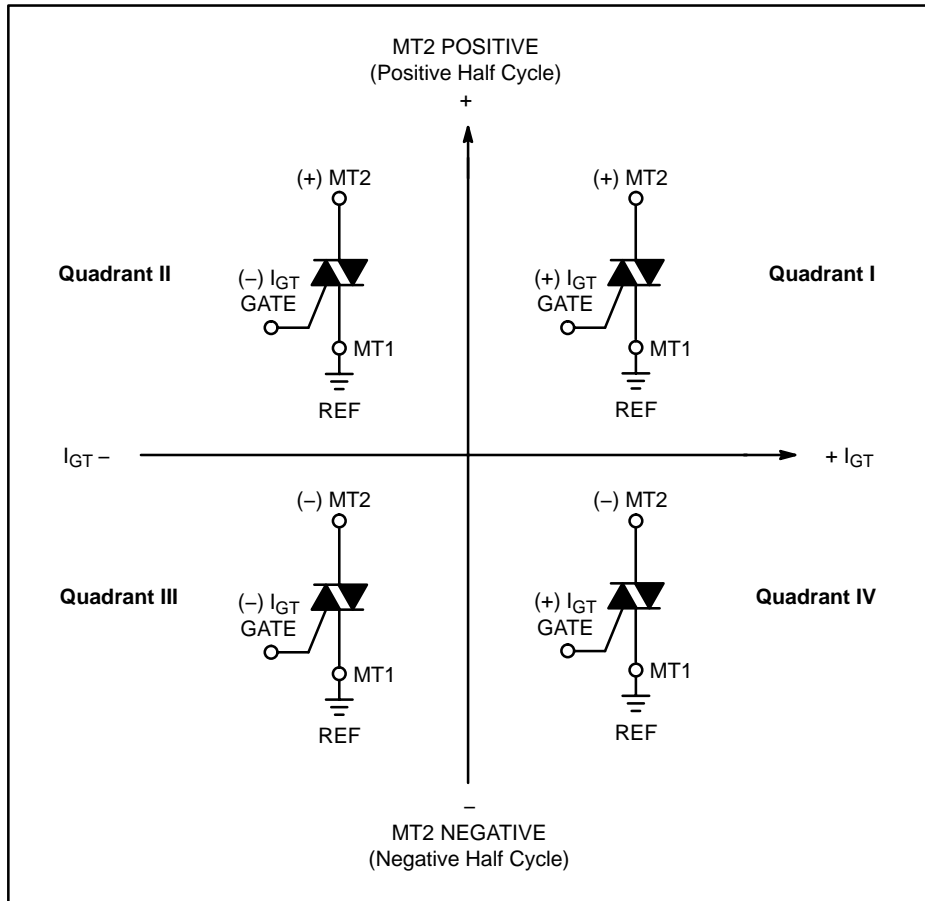
# MAC228A Series

## 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

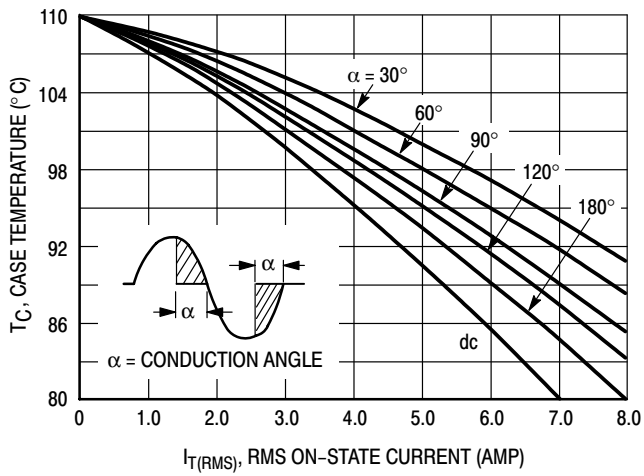


Figure 1. RMS Current Derating

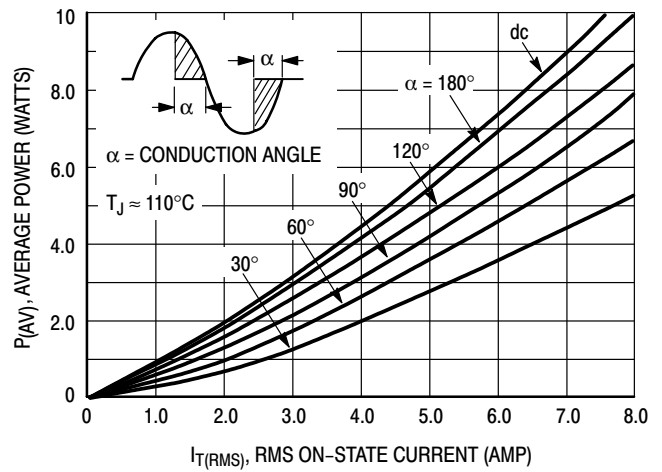
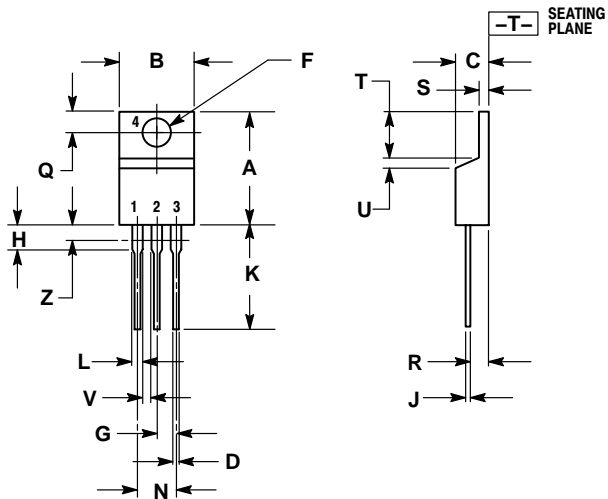


Figure 2. On-State Power Dissipation

# MAC228A Series

## PACKAGE DIMENSIONS

TO-220  
 PLASTIC  
 CASE 221A-09  
 ISSUE AA




- 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	0.018	0.025	0.46	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

# MAC228A Series

**ON Semiconductor** and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). 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 61312, Phoenix, Arizona 85082-1312 USA  
**Phone:** 480-829-7710 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 480-829-7709 or 800-344-3867 Toll Free USA/Canada  
**Email:** orderlit@onsemi.com

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

**Japan:** ON Semiconductor, Japan Customer Focus Center  
2-9-1 Kamimeguro, Meguro-ku, Tokyo, Japan 153-0051  
**Phone:** 81-3-5773-3850

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

**Order Literature:** <http://www.onsemi.com/litorder>

For additional information, please contact your  
local Sales Representative.