

# 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

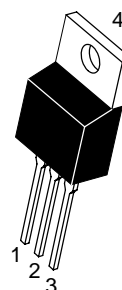
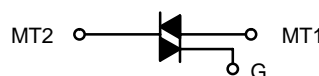
- Sensitive Gate Triggering in 3 Modes for AC Triggering on Sinking Current Sources
- Four Mode Triggering for Drive Circuits that Source Current
- All Diffused and Glass-Passivated Junctions for Parameter Uniformity and Stability
- Small, Rugged, Thermowatt Construction for Low Thermal Resistance and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



**ON Semiconductor®**

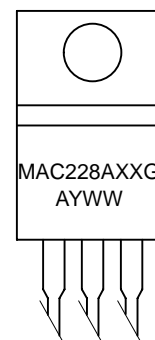
<http://onsemi.com>

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



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

#### MARKING DIAGRAM



XX	= 4, 6, 8, or 10
A	= Assembly Location
Y	= Year
WW	= Work Week
G	= Pb-Free Package

#### ORDERING INFORMATION

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

**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

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
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#### 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> , 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) 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

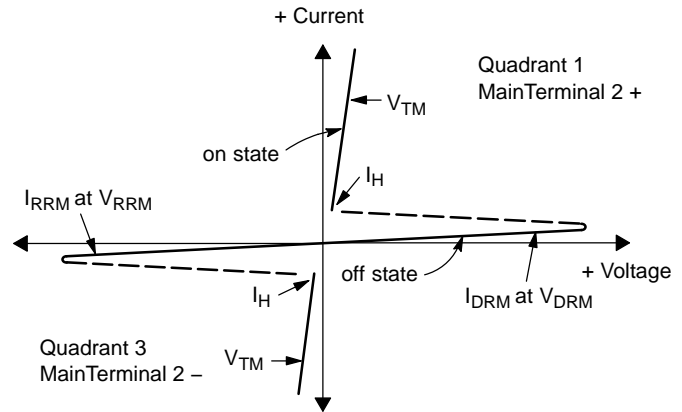
#### DYNAMIC CHARACTERISTICS

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

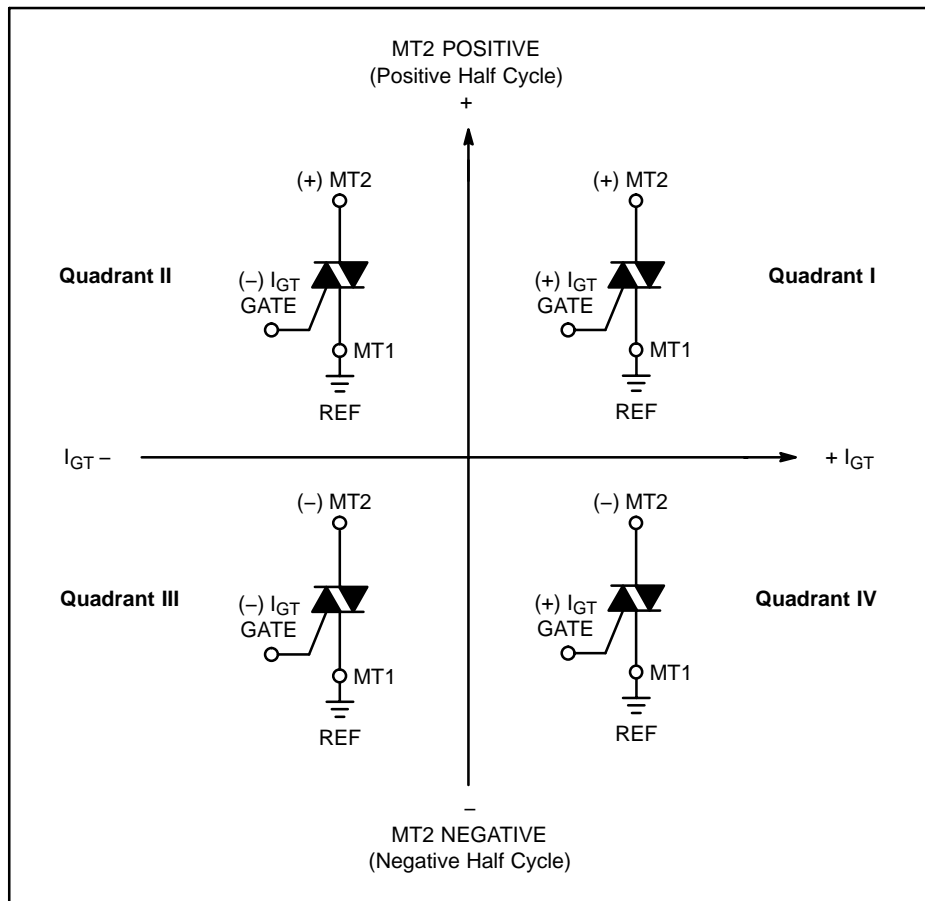
## MAC228A Series

### 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

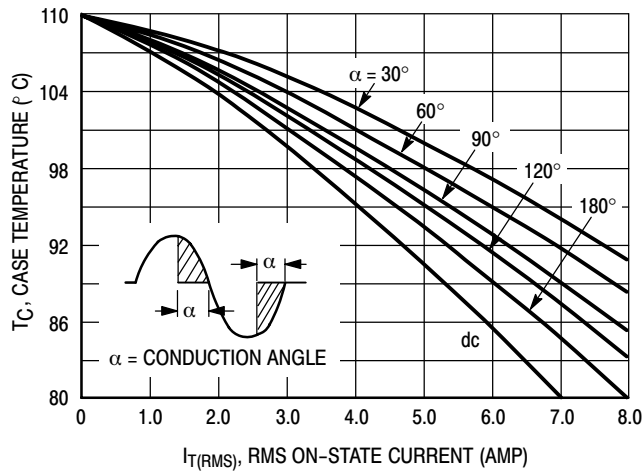


Figure 1. RMS Current Derating

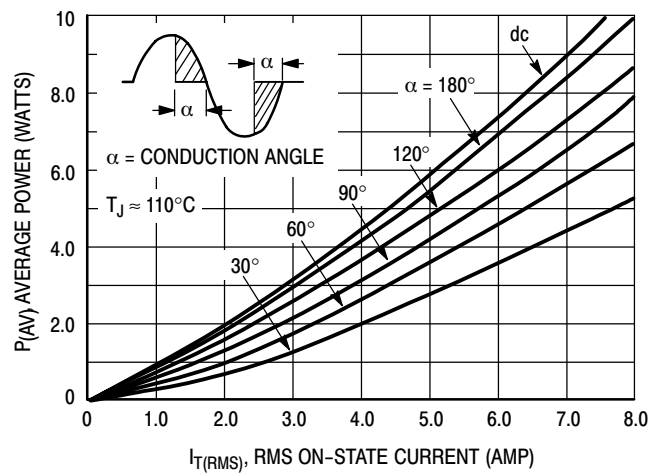


Figure 2. On-State Power Dissipation

### ORDERING INFORMATION

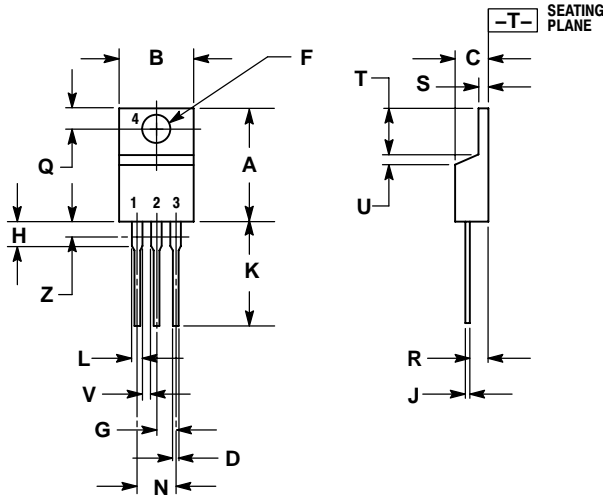
Device	Package	Shipping <sup>†</sup>
MAC228A4	TO-220	50 Units / Rail
MAC228A4G	TO-220 (Pb-Free)	50 Units / Rail
MAC228A6	TO-220	50 Units / Rail
MAC228A6G	TO-220 (Pb-Free)	50 Units / Rail
MAC228A6T	TO-220	50 Units / Rail
MAC228A6TG	TO-220 (Pb-Free)	50 Units / Rail
MAC228A8	TO-220	50 Units / Rail
MAC228A8G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

<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  
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

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