

# MAC12SM, MAC12SN

Preferred Device

## Sensitive Gate Triacs

### Silicon Bidirectional Thyristors

Designed 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 Allows Triggering by Microcontrollers and other Logic Circuits
- Blocking Voltage to 800 Volts
- On-State Current Rating of 12 Amperes RMS at 70°C
- High Surge Current Capability - 90 Amperes
- Rugged, Economical TO220AB Package
- Glass Passivated Junctions for Reliability and Uniformity
- Maximum Values of  $I_{GT}$ ,  $V_{GT}$  and  $I_H$  Specified for Ease of Design
- High Commutating  $di/dt$  - 8.0 A/ms Minimum at 110°C
- Immunity to  $dV/dt$  - 15 V/ $\mu$ sec Minimum at 110°C
- Operational in Three Quadrants: Q1, Q2, and Q3
- Device Marking: Logo, Device Type, e.g., MAC12SM, Date Code

#### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Peak Repetitive Off-State Voltage (Note 1) ( $T_J = -40$ to $110^\circ\text{C}$ , Sine Wave, 50 to 60 Hz, Gate Open)	$V_{DRM}$ , $V_{RRM}$	600 800	V
On-State RMS Current (All Conduction Angles; $T_C = 70^\circ\text{C}$ )	$I_{T(RMS)}$	12	A
Peak Non-Repetitive Surge Current (One Full Cycle Sine Wave, 60 Hz, $T_J = 110^\circ\text{C}$ )	$I_{TSM}$	90	A
Circuit Fusing Consideration ( $t = 8.33$ ms)	$I^2t$	33	A <sup>2</sup> sec
Peak Gate Power (Pulse Width = 1.0 $\mu$ sec, $T_C = 70^\circ\text{C}$ )	$P_{GM}$	16	W
Average Gate Power ( $t = 8.3$ msec, $T_C = 70^\circ\text{C}$ )	$P_{G(AV)}$	0.35	W
Operating Junction Temperature Range	$T_J$	- 40 to 110	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	- 40 to 150	$^\circ\text{C}$

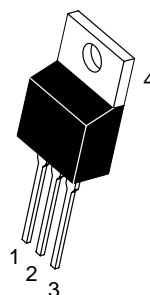
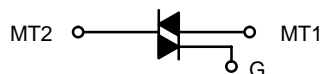
1. ( $V_{DRM}$  and  $V_{RRM}$  for all types can be applied on a continuous basis. Blocking voltages shall not be tested with a constant current source such that the voltage ratings of the devices are exceeded.



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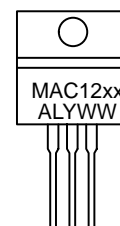
<http://onsemi.com>

**TRIACS**  
**12 AMPERES RMS**  
**600 thru 800 VOLTS**



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

#### MARKING DIAGRAM



xx = Specific Device Code  
A = Assembly Location  
L = Wafer Lot  
Y = Year  
WW = Work Week

#### PIN ASSIGNMENT

1	Main Terminal 1
2	Main Terminal 2
3	Gate
4	Main Terminal 2

#### ORDERING INFORMATION

Device	Package	Shipping
MAC12SM	TO220AB	50 Units/Rail
MAC12SN	TO220AB	50 Units/Rail

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

# MAC12SM, MAC12SN

## THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance - Junction to Case - Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	2.2 62.5	$^{\circ}C/W$
Maximum Lead Temperature for Soldering Purposes 1/8" from Case for 10 Seconds	$T_L$	260	$^{\circ}C$

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^{\circ}C$ unless otherwise noted; Electricals apply in both directions)

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Peak Repetitive Blocking Current ( $V_D = \text{Rated } V_{DRM}, V_{RRM}; \text{ Gate Open}$ )	$I_{DRM},$ $I_{RRM}$	- -	- -	0.01 2.0	mA
					$T_J = 25^{\circ}C$ $T_J = 110^{\circ}C$

### ON CHARACTERISTICS

Peak On-State Voltage <sup>(1)</sup> ( $I_{TM} = \pm 17 \text{ A}$ )	$V_{TM}$	-	-	1.85	V
Gate Trigger Current (Continuous dc) ( $V_D = 12 \text{ V}, R_L = 100 \Omega$ ) MT2(+), G(+) MT2(+), G(-) MT2(-), G(-)	$I_{GT}$	- - -	1.5 2.5 2.7	5.0 5.0 5.0	mA
Holding Current ( $V_D = 12 \text{ V}, \text{ Gate Open}, \text{ Initiating Current} = \pm 200 \text{ mA}$ )	$I_H$	-	2.5	10	mA
Latching Current ( $V_D = 12 \text{ V}, I_G = 5 \text{ mA}$ ) MT2(+), G(+) MT2(+), G(-) MT2(-), G(-)	$I_L$	- - -	3.0 5.0 3.0	15 20 15	mA
Gate Trigger Voltage (Continuous dc) ( $V_D = 12 \text{ V}, R_L = 100 \Omega$ ) MT2(+), G(+) MT2(+), G(-) MT2(-), G(-)	$V_{GT}$	0.45 0.45 0.45	0.68 0.62 0.67	1.5 1.5 1.5	V

### DYNAMIC CHARACTERISTICS

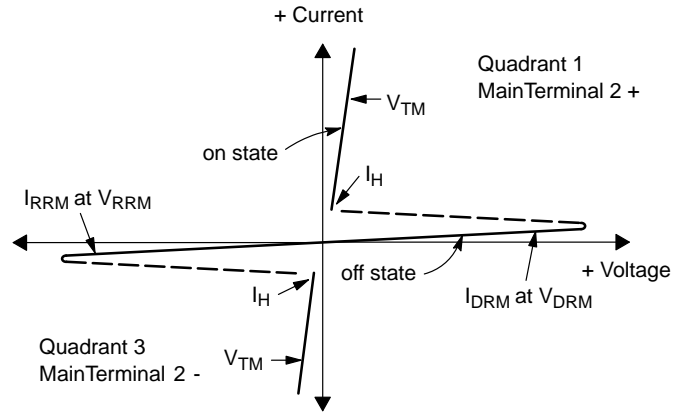
Critical Rate of Change of Commutating Current ( $V_D = 400 \text{ V}, I_{TM} = 3.5 \text{ A}, \text{ Commutating } dV/dt = 10 \text{ V}/\mu\text{s}, \text{ Gate Open},$ $T_J = 110^{\circ}C, f = 500 \text{ Hz}, \text{ Snubber: } C_s = 0.01 \mu\text{f}, R_s = 15 \Omega$ )	$(di/dt)_c$	8.0	10	-	A/ms
Critical Rate of Rise of Off-State Voltage ( $V_D = 67\% V_{DRM}, \text{ Exponential Waveform}, R_{GK} = 1 \text{ K}\Omega,$ $T_J = 110^{\circ}C$ )	$dV/dt$	15	40	-	V/ $\mu\text{s}$
Repetitive Critical Rate of Rise of On-State Current IPK = 50 A; PW = 40 $\mu\text{sec}$ ; $di/dt = 1 \text{ A}/\mu\text{sec}$ ; $I_{gt} = 100 \text{ mA}$ ; f = 60 Hz	$di/dt$	-	-	10	A/ $\mu\text{s}$

2. Pulse Test: Pulse Width  $\leq 2.0 \text{ ms}$ , Duty Cycle  $\leq 2\%$ .

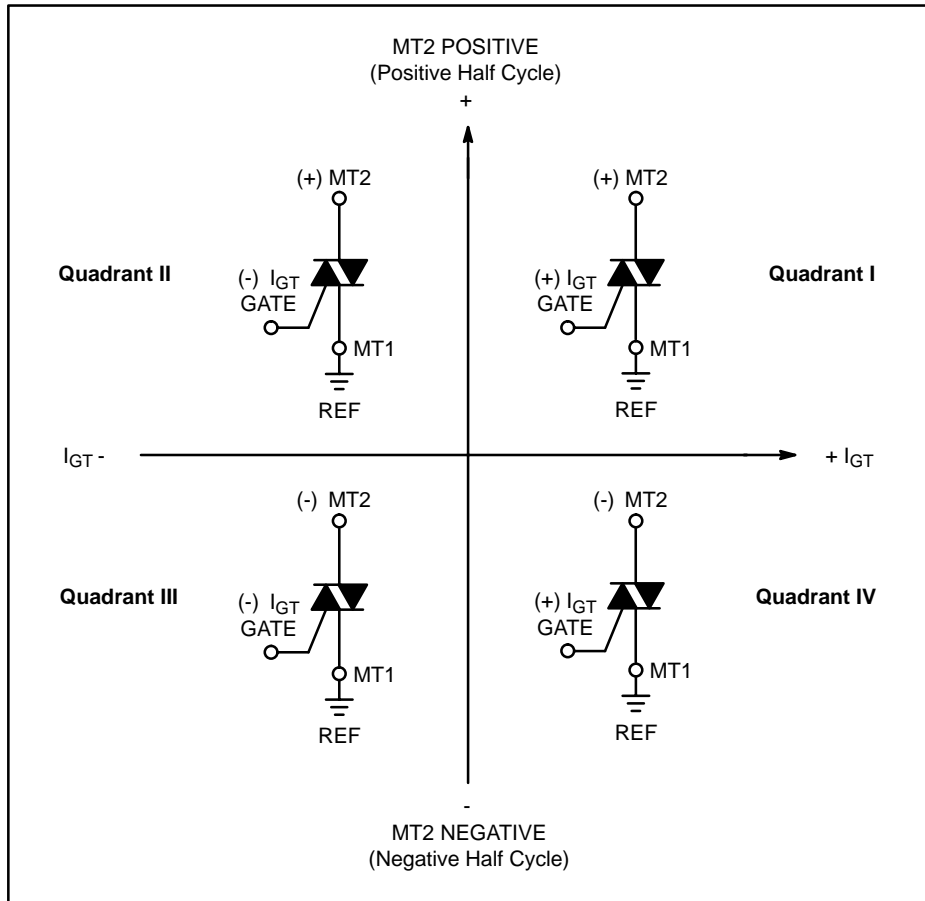
# MAC12SM, MAC12SN

## 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

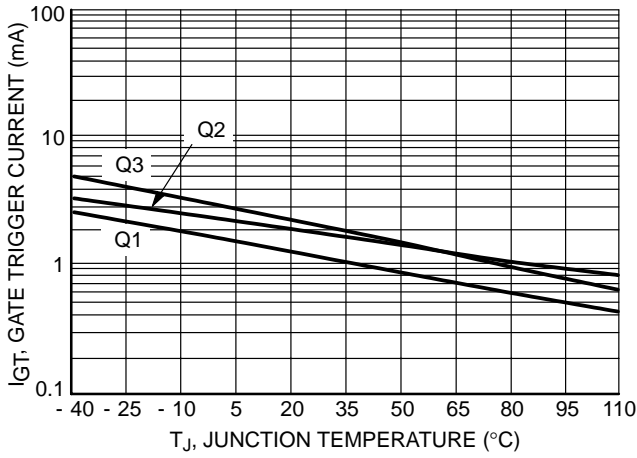


### Quadrant Definitions for a Triac

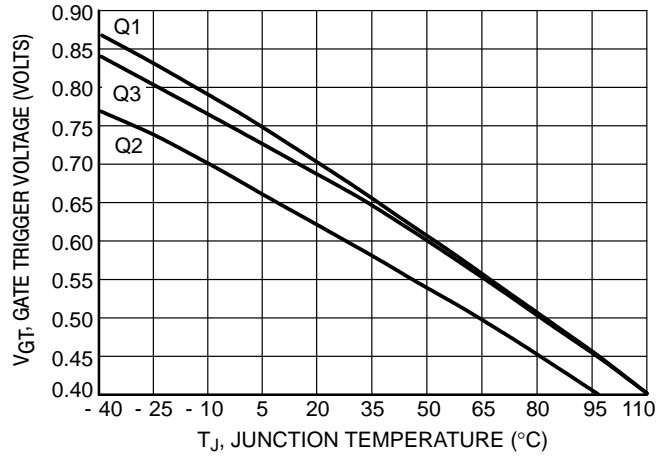


All polarities are referenced to MT1.  
 With in-phase signals (using standard AC lines) quadrants I and III are used.

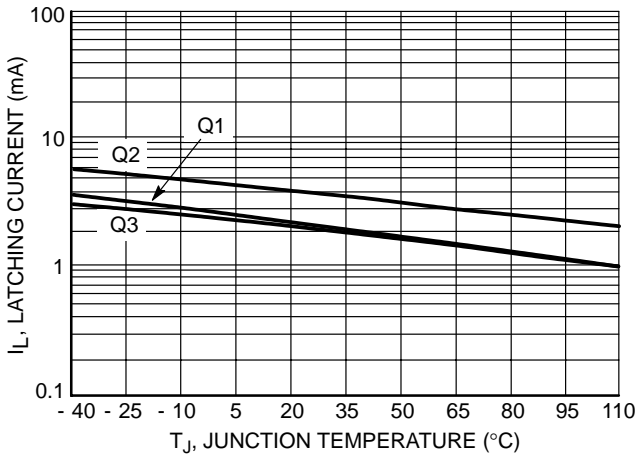
# MAC12SM, MAC12SN



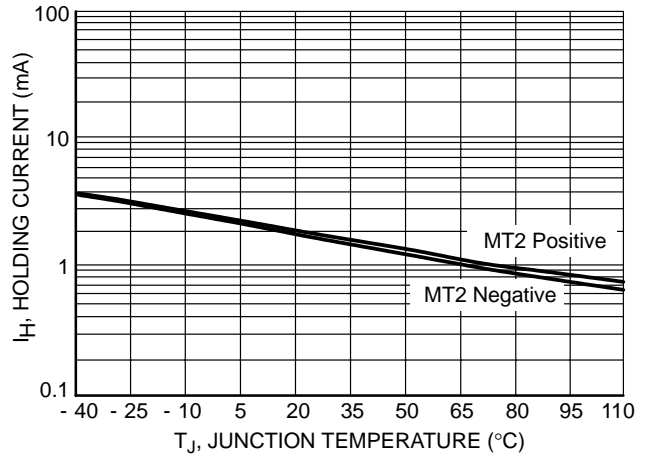
**Figure 1. Typical Gate Trigger Current versus Junction Temperature**



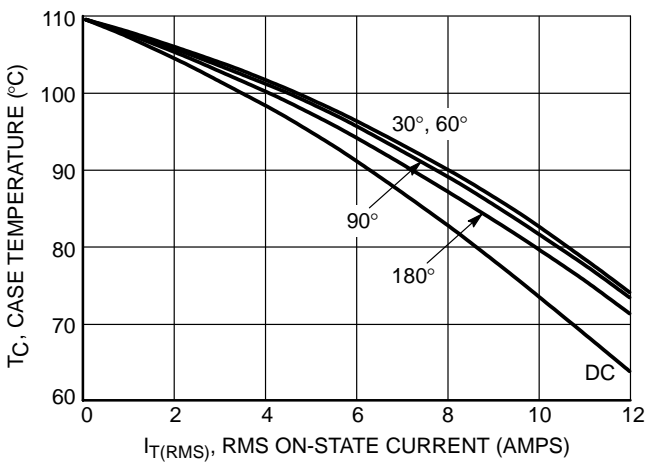
**Figure 2. Typical Gate Trigger Voltage versus Junction Temperature**



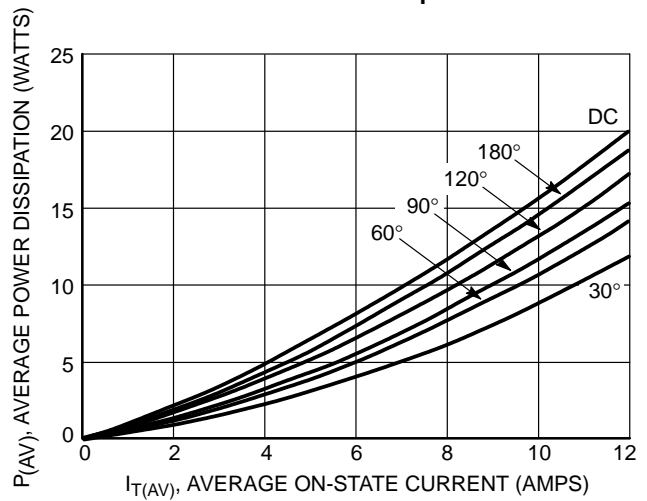
**Figure 3. Typical Latching Current versus Junction Temperature**



**Figure 4. Typical Holding Current versus Junction Temperature**



**Figure 5. Typical RMS Current Derating**



**Figure 6. On-State Power Dissipation**

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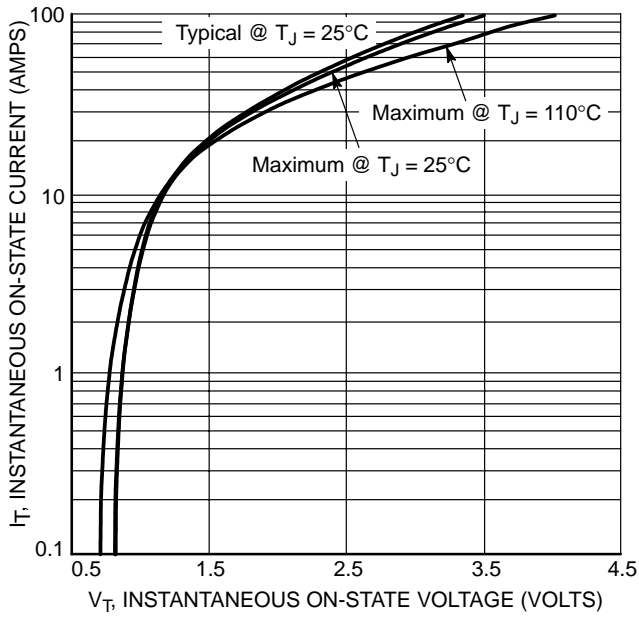


Figure 7. Typical On-State Characteristics

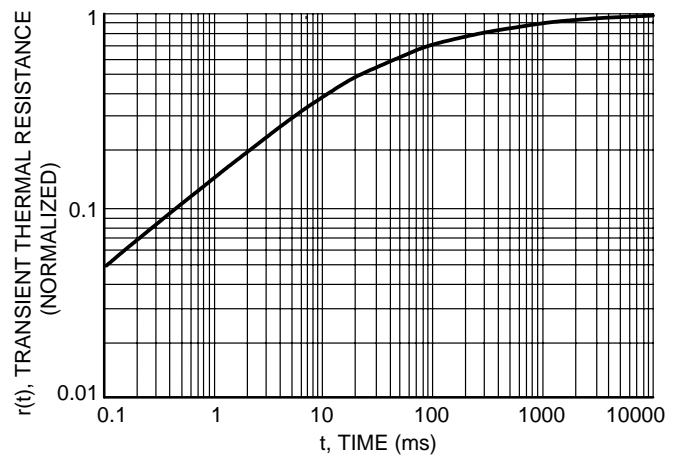
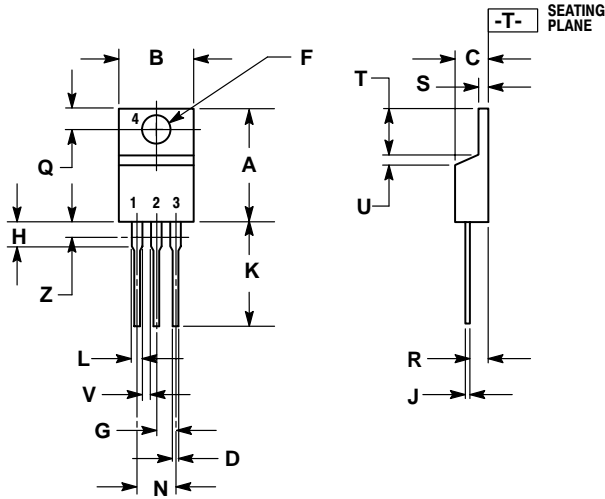


Figure 8. Typical Thermal Response

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## PACKAGE DIMENSIONS

TO-220AB  
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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