

# MAC4SM, MAC4SN

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
- High Immunity to  $dv/dt$  — 50 V/ $\mu s$  Minimum at 125°C
- Commutating  $di/dt$  — 3.0 A/ms Minimum at 125°C
- Minimum and Maximum Values of  $I_{GT}$ ,  $V_{GT}$  and  $I_H$  Specified for Ease of Design
- On-State Current Rating of 4 Amperes RMS at 100°C
- High Surge Current Capability — 40 Amperes
- Blocking Voltage to 800 Volts
- Rugged, Economical TO220AB Package
- Operational in Three Quadrants: Q1, Q2, and Q3
- Device Marking: Logo, Device Type, e.g., MAC4SM, Date Code

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

Rating	Symbol	Value	Unit
Peak Repetitive Off-State Voltage <sup>(1)</sup> ( $T_J = -40$ to $125^\circ C$ , Sine Wave, 50 to 60 Hz, Gate Open) MAC4SM MAC4SN	$V_{DRM}$ , $V_{RRM}$	600 800	Volts
On-State RMS Current (Full Cycle Sine Wave, 60 Hz, $T_C = 100^\circ C$ )	$I_T(RMS)$	4.0	Amps
Peak Non-Repetitive Surge Current (One Full Cycle, 60 Hz, $T_J = 125^\circ C$ )	$I_{TSM}$	40	Amps
Circuit Fusing Consideration ( $t = 8.33$ ms)	$I^2t$	6.6	A <sup>2</sup> sec
Peak Gate Power (Pulse Width $\leq 1.0$ $\mu s$ , $T_C = 100^\circ C$ )	$P_{GM}$	0.5	Watt
Average Gate Power ( $t = 8.3$ ms, $T_C = 100^\circ C$ )	$P_{G(AV)}$	0.1	Watt
Operating Junction Temperature Range	$T_J$	-40 to +125	°C
Storage Temperature Range	$T_{stg}$	-40 to +150	°C

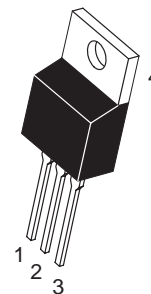
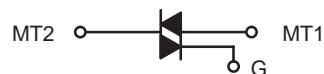
(1)  $V_{DRM}$  and  $V_{RRM}$  for all types can be applied on a continuous basis. Blocking voltages shall not be tested with a constant current source such that the voltage ratings of the devices are exceeded.



ON Semiconductor

<http://onsemi.com>

**TRIACS**  
**4 AMPERES RMS**  
**600 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
MAC4SM	TO220AB	50 Units/Rail
MAC4SN	TO220AB	50 Units/Rail

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

# MAC4SM, MAC4SN

## 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 ( $V_D = \text{Rated } V_{DRM}, V_{RRM}$ ; Gate Open)	$I_{DRM}, I_{RRM}$	— —	— —	0.01 2.0	mA
$T_J = 25^{\circ}C$ $T_J = 125^{\circ}C$					

### ON CHARACTERISTICS

Peak On-State Voltage <sup>(1)</sup> ( $I_{TM} = \pm 6.0 A$ )	$V_{TM}$	—	1.3	1.6	V
Gate Trigger Current (Continuous dc) ( $V_D = 12 V, R_L = 100 \Omega$ ) MT2(+), G(+) MT2(+), G(–) MT2(–), G(–)	$I_{GT}$	2.9 2.9 2.9	4.0 4.7 6.0	10 10 10	mA
Holding Current ( $V_D = 12 V$ , Gate Open, Initiating Current = $\pm 200 mA$ )	$I_H$	2.0	5.0	15	mA
Latching Current ( $V_D = 12 V, I_G = 10 mA$ ) MT2(+), G(+) MT2(+), G(–) MT2(–), G(–)	$I_L$	— — —	6.0 15 6.0	30 30 30	mA
Gate Trigger Voltage (Continuous dc) ( $V_D = 12 V, R_L = 100 \Omega$ ) MT2(+), G(+) MT2(+), G(–) MT2(–), G(–)	$V_{GT}$	0.5 0.5 0.5	0.7 .65 0.7	1.3 1.3 1.3	V

### DYNAMIC CHARACTERISTICS

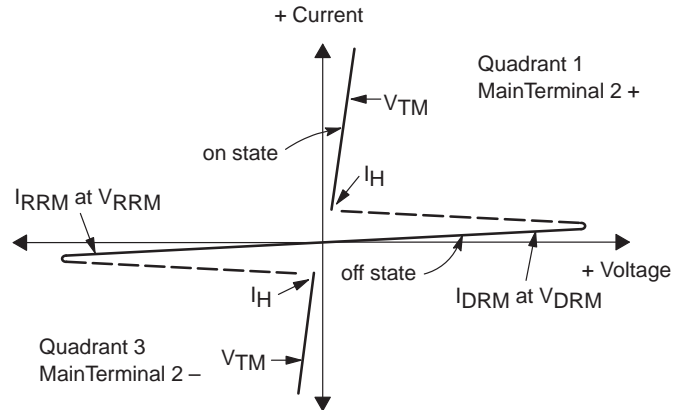
Rate of Change of Commutating Current ( $V_D = 400 V, I_{TM} = 3.5 A$ , Commutating $dv/dt = 10 V/\mu s$ , Gate Open, $T_J = 125^{\circ}C, f = 500 Hz, C_L = 5.0 \mu F, L_L = 20 mH$ , No Snubber)	$(di/dt)_C$	3.0	4.0	—	A/ms
Critical Rate of Rise of Off-State Voltage ( $V_D = 0.67 \times \text{Rated } V_{DRM}$ , Exponential Waveform, Gate Open, $T_J = 125^{\circ}C$ )	$dv/dt$	50	150	—	V/ $\mu s$
Repetitive Critical Rate of Rise of On-State Current IPK = 50 A; PW = 40 $\mu s$ ; $di_G/dt = 200 mA/\mu s$ ; $f = 60 Hz$	$di/dt$	—	—	10	A/ $\mu s$

(1) Pulse Test: Pulse Width  $\leq 2.0 ms$ , Duty Cycle  $\leq 2\%$ .

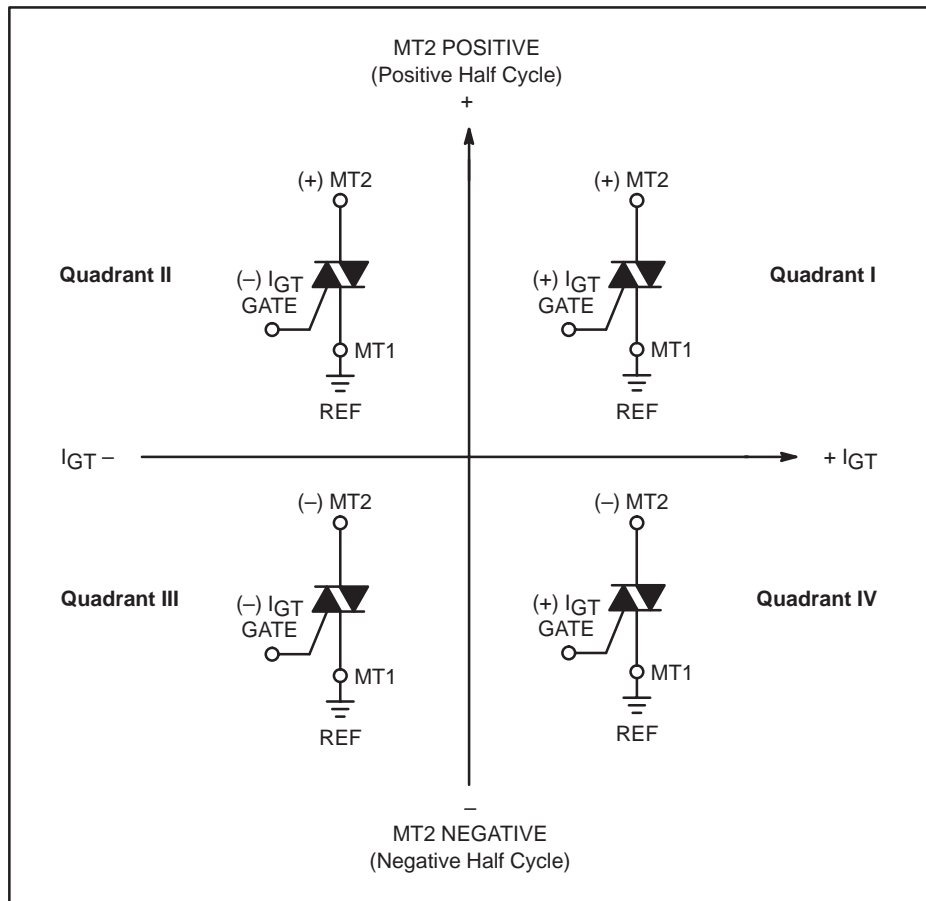
## MAC4SM, MAC4SN

### 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

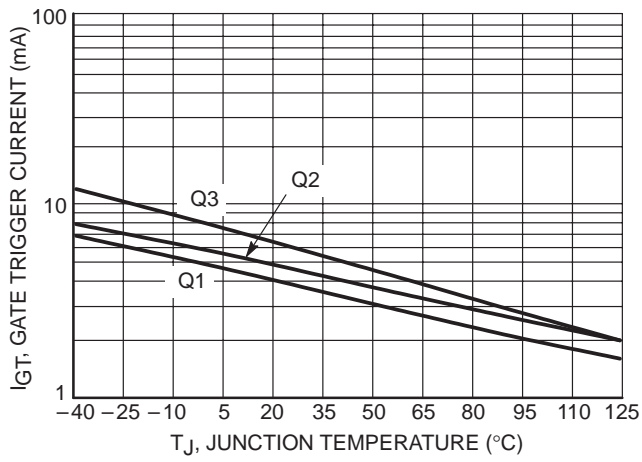


### Quadrant Definitions for a Triac

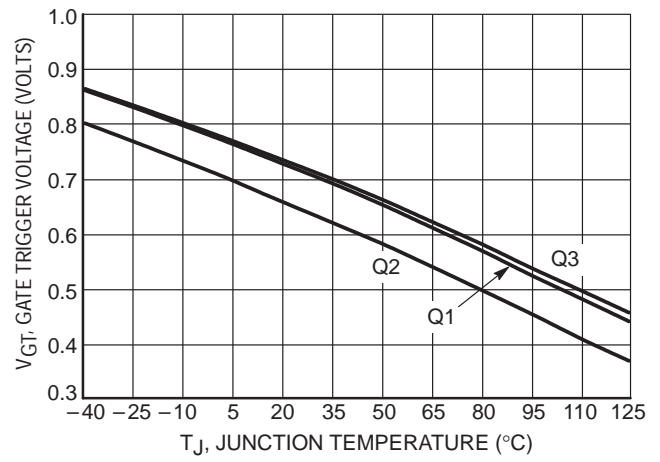


All polarities are referenced to MT1.  
With in-phase signals (using standard AC lines) quadrants I and III are used.

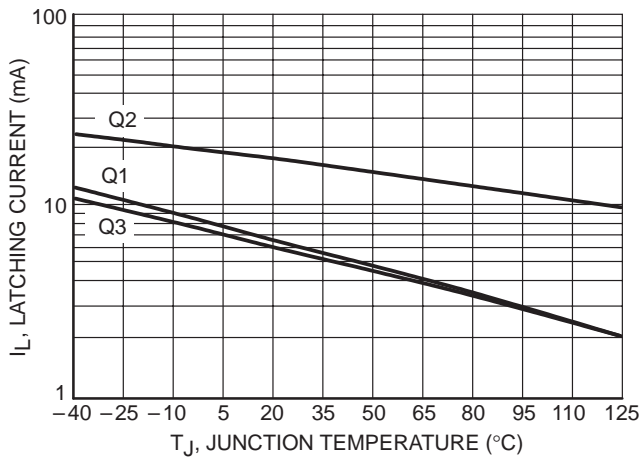
# MAC4SM, MAC4SN



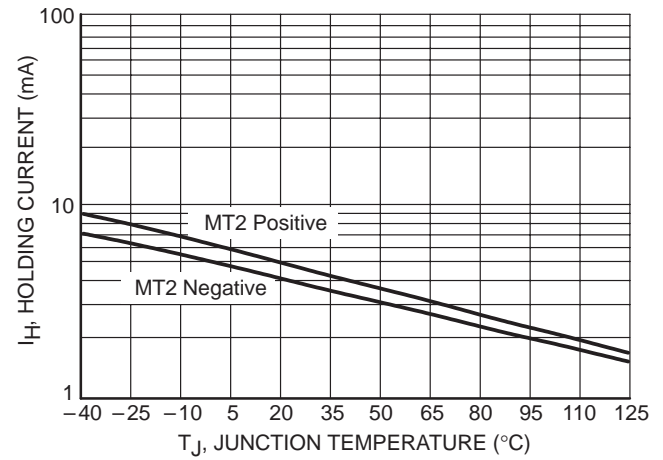
**Figure 1. Typical Gate Trigger Current versus Junction Temperature**



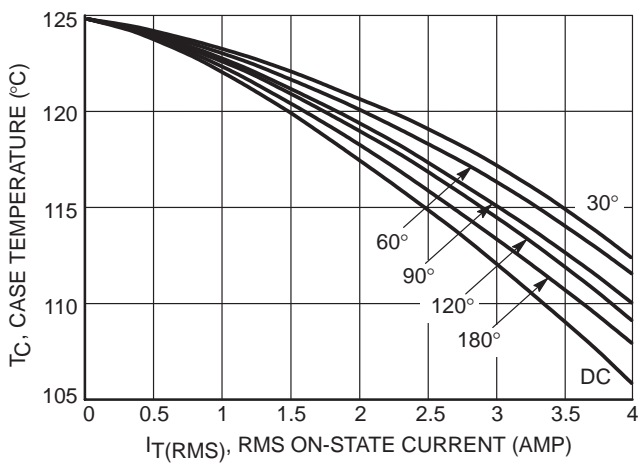
**Figure 2. Typical Gate Trigger Voltage versus Junction Temperature**



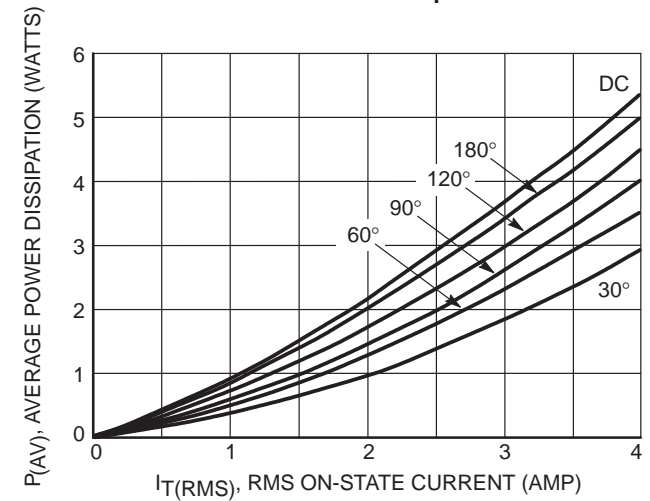
**Figure 3. Typical Latching Current versus Junction Temperature**



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

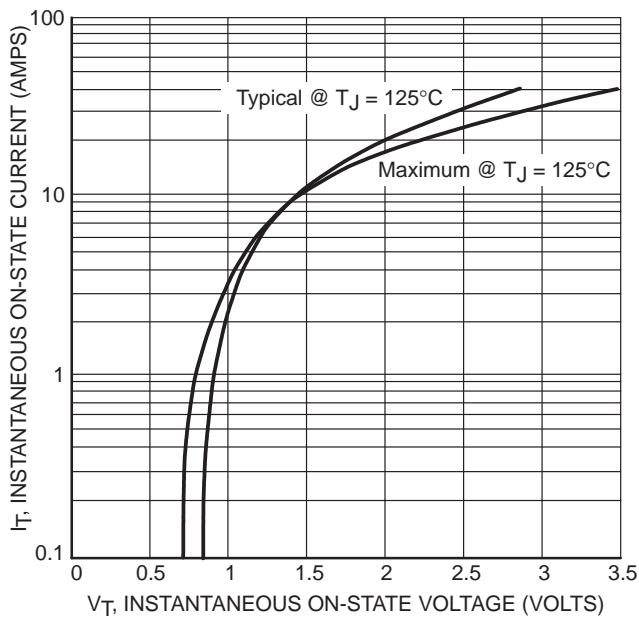


**Figure 5. Typical RMS Current Derating**

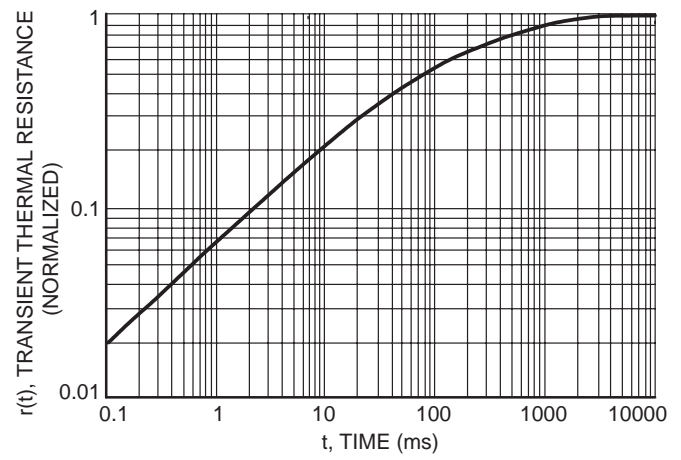


**Figure 6. On-State Power Dissipation**

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**Figure 7. Typical On-State Characteristics**

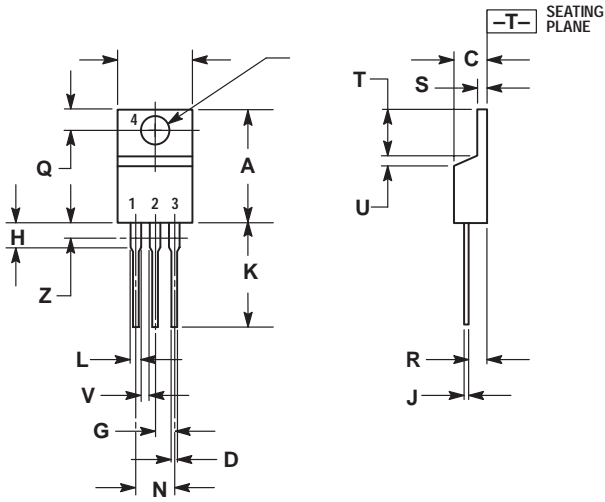


**Figure 8. Typical Thermal Response**

# MAC4SM, MAC4SN

## PACKAGE DIMENSIONS

### TO-220AB CASE 221A-09 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.

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
  - PIN 2. MAIN TERMINAL 2
  - PIN 3. GATE
  - PIN 4. MAIN TERMINAL 2

## Notes

# MAC4SM, MAC4SN

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