



# MAC9DG, MAC9MG, MAC9NG



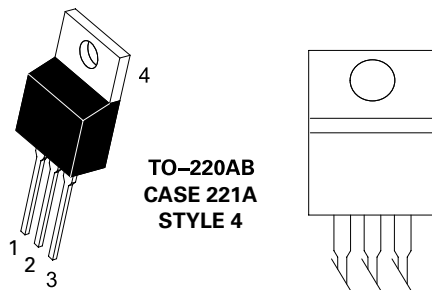
## Description

Designed primarily for full-wave ac control applications, such as motor controls, heating controls and power supplies; or wherever half-wave silicon gate-controlled, solid-state devices are needed.

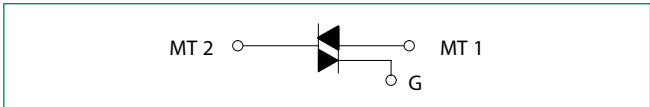
## Features

- Blocking Voltage to 800 Volts
- On-State Current Rating of 8.0 Amperes RMS at 100°C
- Uniform Gate Trigger Currents in Three Quadrants
- High Immunity to  $dv/dt$  – 500 V/ $\mu$ s minimum at 125°C
- Minimizes Snubber Networks for Protection
- Industry Standard TO-220 Package
- High Commutating  $di/dt$  – 6.5 A/ms minimum at 125°C
- These Devices are Pb-Free and are RoHS Compliant

## Pin Out



## Functional Diagram



## Additional Information



**Datasheet**



**Resources**



**Samples**

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

Rating		Symbol	Value	Unit
Peak Repetitive Off-State Voltage (Note 1) (Gate Open, Sine Wave 50 to 60 Hz, $T_J = -25^\circ$ to $100^\circ\text{C}$ )	MAC9SD MAC9M MAC9N	$V_{DRM}^*$ $V_{RRM}$	400 600 800	V
On-State RMS Current (Full Cycle Sine Wave, 60 Hz, $T_C = 100^\circ\text{C}$ )		$I_{T(RMS)}$	8.0	A
Peak Non-Repetitive Surge Current (One Full Cycle Sine Wave, 60 Hz, $T_C = 125^\circ\text{C}$ )		$I_{TSM}$	80	A
Circuit Fusing Consideration ( $t = 8.3$ ms)		$I^2t$	26	A <sup>2</sup> sec
Peak Gate Power (Pulse Width $\leq 1.0$ $\mu\text{s}$ , $T_C = 80^\circ\text{C}$ )		$P_{GM}$	16	W
Average Gate Power ( $t = 8.3$ ms, $T_C = 80^\circ\text{C}$ )		$P_{G(AV)}$	0.35	W
Operating Junction Temperature Range		$T_J$	-40 to +125	$^\circ\text{C}$
Storage Temperature Range		$T_{stg}$	-40 to +125	$^\circ\text{C}$

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.  $V_{DRM}^*$  and  $V_{RRM}$  for all types can be applied on a continuous basis. Ratings apply for zero or negative gate voltage; however, positive gate voltage shall not be applied concurrent with negative potential on the anode. Blocking voltages shall not be tested with a constant current source such that the voltage ratings of the devices are exceeded.

### Thermal Characteristics

Rating		Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (AC) Junction-to-Ambient		$R_{\theta JC}$ $R_{\theta JA}$	2.2 62.5	$^\circ\text{C}/\text{W}$
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds		$T_L$	260	$^\circ\text{C}$

### Electrical Characteristics - OFF ( $T_J = 25^\circ\text{C}$ unless otherwise noted ; Electricals apply in both directions)

Characteristic		Symbol	Min	Typ	Max	Unit
Peak Repetitive Blocking Current ( $V_D = V_{DRM} = V_{RRM}^*$ ; Gate Open)	$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$	$I_{DRM}^*$ $I_{RRM}$	- -	- -	0.01 2.0	mA

### Electrical Characteristics - ON ( $T_J = 25^\circ\text{C}$ unless otherwise noted; Electricals apply in both directions)

Characteristic		Symbol	Min	Typ	Max	Unit
Peak On-State Voltage (Note 2) ( $I_{TM} = \pm 11$ A)		$V_{TM}$	-	1.2	1.6	V
Gate Trigger Current (Continuous dc) ( $V_D = 12$ V, $R_L = 100$ $\Omega$ )	MT2(+), G(+) MT2(+), G(-) MT2(-), G(-)	$I_{GT}$	10 10 10	16 18 22	50 50 5.0	mA
Holding Current ( $V_D = 12$ V, Gate Open, Initiating Current = $\pm 150$ mA)		$I_H$	-	30	50	mA
Latching Current ( $V_D = 24$ V, $I_G = 50$ mA)	MT2(+), G(+) MT2(+), G(-) MT2(-), G(-)	$I_L$	- - -	20 30 20	50 80 50	mA
Gate Trigger Voltage ( $V_D = 12$ V, $R_L = 100$ $\Omega$ )	MT2(+), G(+) MT2(+), G(-) MT2(-), G(-)	$V_{GT}$	0.5 0.5 0.5	0.69 0.77 0.72	1.5 1.5 1.5	V
Gate Non-Trigger Voltage ( $V_D = 12$ V, $R_L = 100$ $\Omega$ , $T_J = 125^\circ\text{C}$ )	MT2(+), G(+) MT2(+), G(-) MT2(-), G(-)	$V_{GD}$	0.2 0.2 0.2	- - -	- - -	V

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

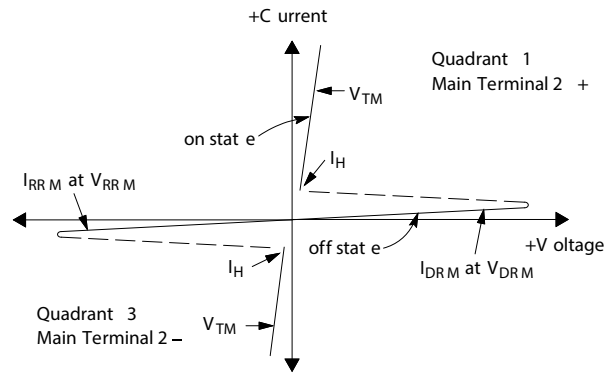
2. Indicates Pulse Test: Pulse Width  $\leq 2.0$  ms, Duty Cycle  $\leq 2\%$ .

**Dynamic Characteristics**

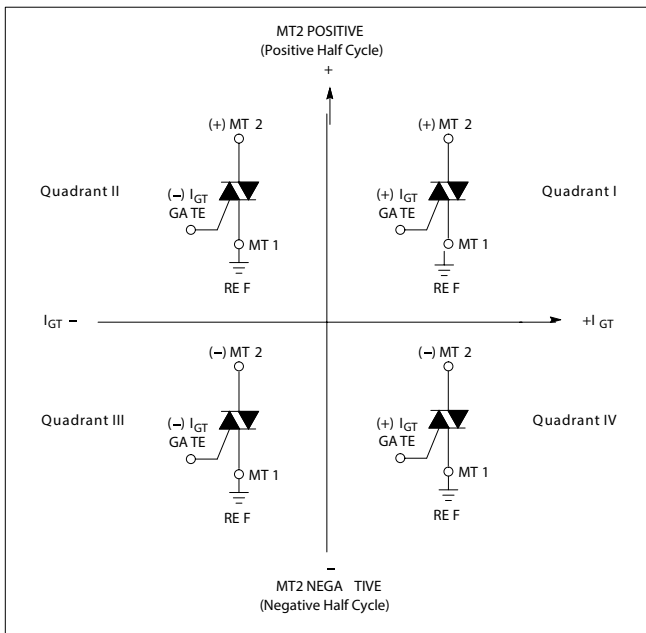
Characteristic	Symbol	Min	Typ	Max	Unit
Rate of Change of Commutating Current See Figure 10. 400 V, $I_{TM} = 4.4$ A, Commutating $dv/dt = 18$ V/ $\mu$ s, Gate Open, $T_J = 125^\circ$ C, $f = 250$ Hz, No Snubber) $C_L = 10$ $\mu$ F $L_L = 40$ mH	$dV/dt$	6.5	10	-	A/ms
Critical Rate of Rise of Off-State Voltage ( $V_D = \text{Rated } V_{DRM}$ , Exponential Waveform, $R_{GK} = 510$ $\Omega$ , $T_J = 125^\circ$ C)	$dV/dt$	500	75	-	V/ $\mu$ s

**Voltage Current Characteristic of SCR**

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

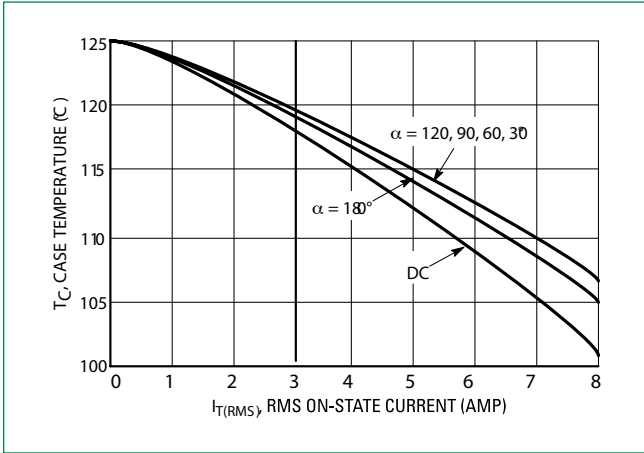


**Quadrant Definitions for a Triac**

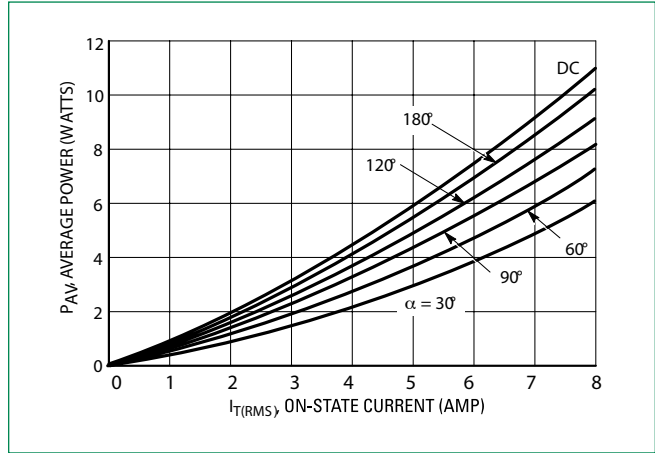


All polarities are referenced to MT1.  
With in-phase signals (using standard AC lines) quadrants I and III are used

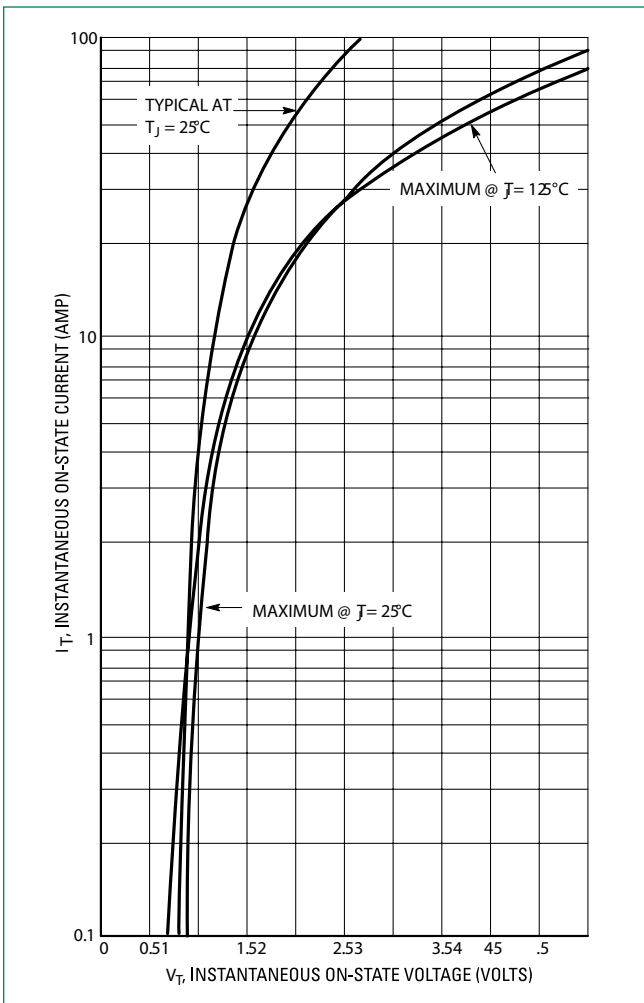
**Figure 1. RMS Current Derating**



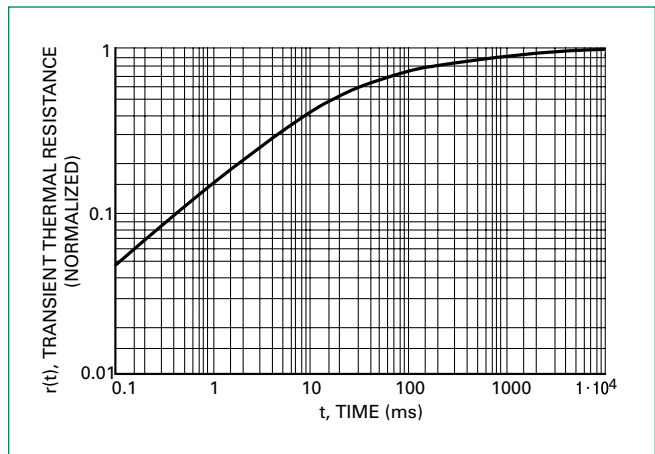
**Figure 2. On-State Power Dissipation**



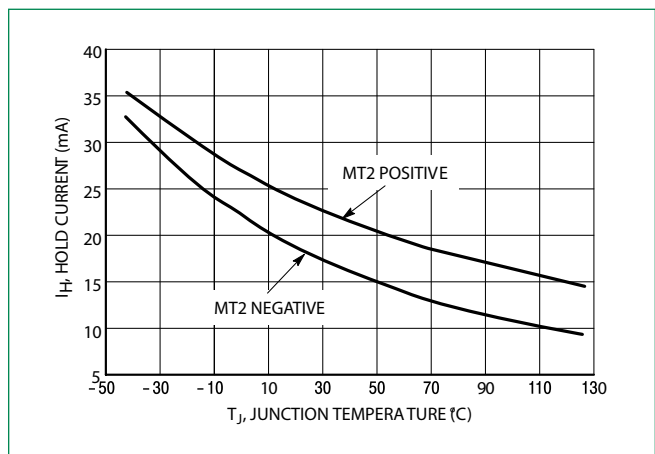
**Figure 3. On-State Characteristics**



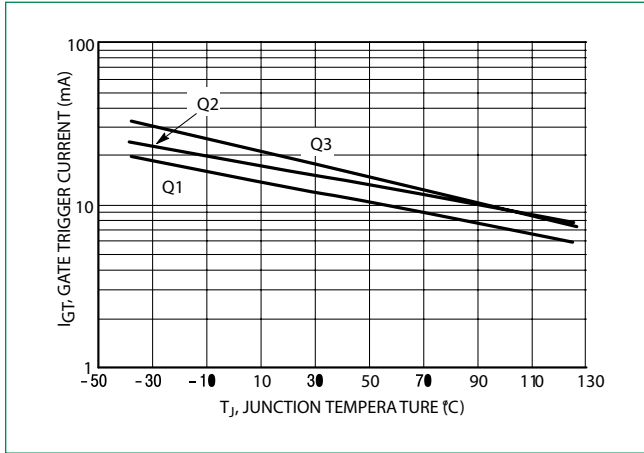
**Figure 4. Thermal Response**



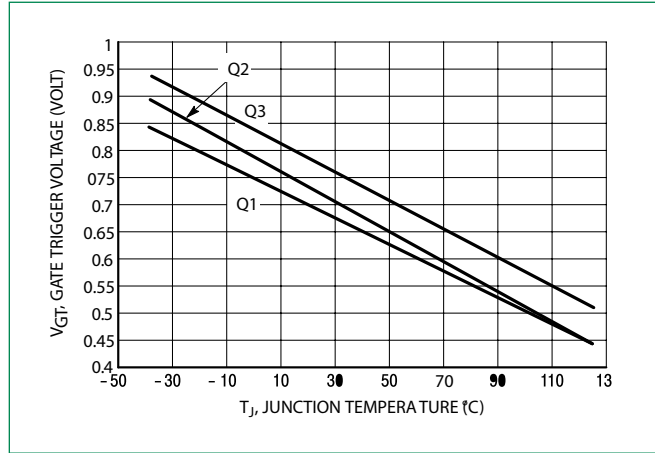
**Figure 5. Hold Current Variation**



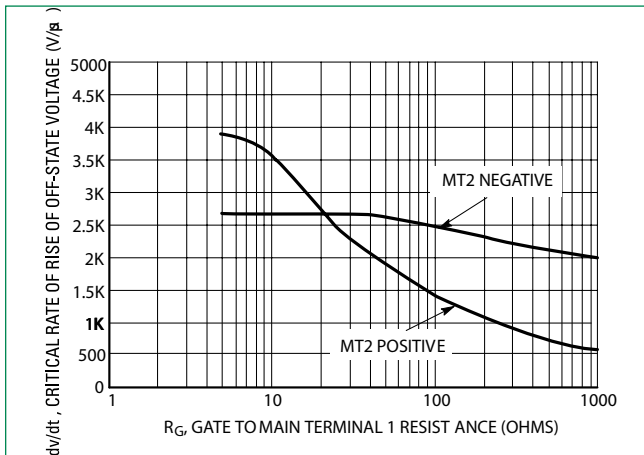
**Figure 6. Gate Trigger Current Variation**



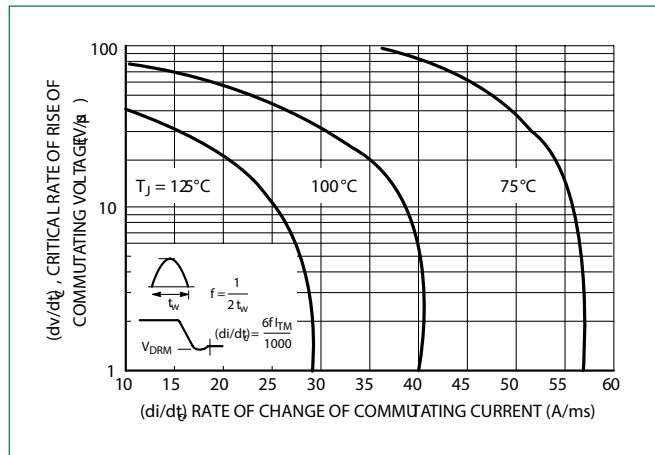
**Figure 7. Gate Trigger Voltage Variation**



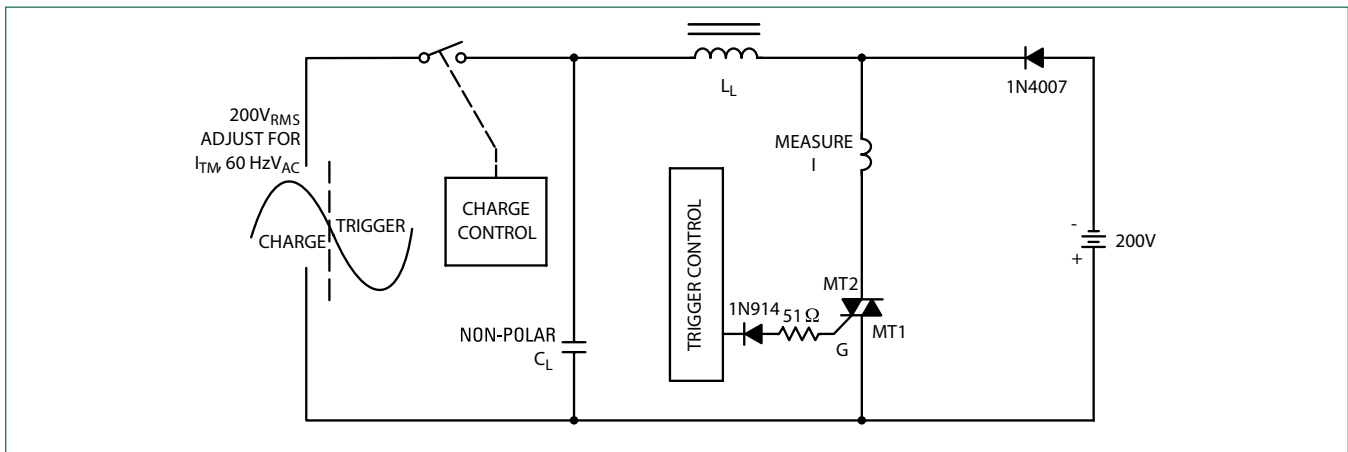
**Figure 8. Critical Rate of Rise of Off-State Voltage (Exponential)**



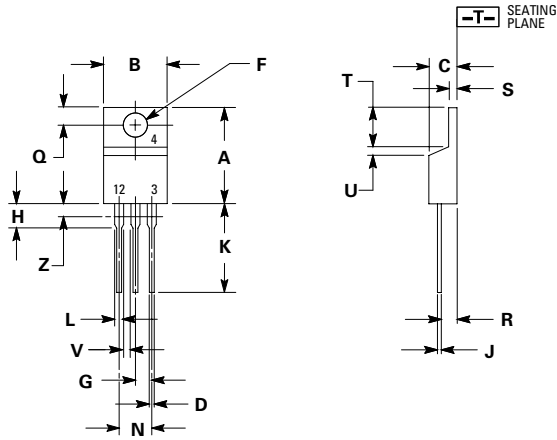
**Figure 9. Critical Rate of Rise of Commutating Voltage**



**Figure 10. Simplified Test Circuit to Measure the Critical Rate of Rise of Commutating Current (di/dt)**



**Dimensions**

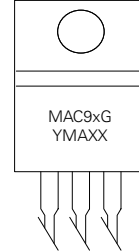


**Part Marking System**



**TO-220AB  
CASE 221A  
STYLE 12**

x =D, M, or N  
Y =Year  
M =Month  
A =Assembly Site  
XX =Lot Serial Code  
G =Pb-Free Package



Dim	Inches		Millimeters	
	Min	Max	Min	Max
A	0.590	0.620	14.99	15.75
B	0.380	0.420	9.65	10.67
C	0.178	0.188	4.52	4.78
D	0.025	0.035	0.64	0.89
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.41	2.67
H	0.110	0.130	2.79	3.30
J	0.018	0.024	0.46	0.61
K	0.540	0.575	13.72	14.61
L	0.060	0.075	1.52	1.91
N	0.195	0.205	4.95	5.21
Q	0.105	0.115	2.67	2.92
R	0.085	0.095	2.16	2.41
S	0.045	0.060	1.14	1.52
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

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.

Pin Assignment	
1	Main Terminal 1
2	Main Terminal 2
3	Gate
4	No Connection

**Ordering Information**

Device	Package	Shipping
MAC9DG	TO-220AB (Pb-Free)	500 Units / Rail
MAC9MG		
MAC9NG		

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