

# MAC9D, MAC9M, MAC9N

Preferred Device

## Triacs

### Silicon Bidirectional Thyristors

Designed for high performance full-wave ac control applications where high noise immunity and high commutating di/dt are required.

- 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/μs minimum at 125°C
- Minimizes Snubber Networks for Protection
- Industry Standard TO-220AB Package
- High Commutating di/dt — 6.5 A/ms minimum at 125°C
- Device Marking: Logo, Device Type, e.g., MAC9D, Date Code

#### MAXIMUM RATINGS (T<sub>J</sub> = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Peak Repetitive Off-State Voltage <sup>(1)</sup> (T <sub>J</sub> = -40 to 125°C, Sine Wave, 50 to 60 Hz, Gate Open)	V <sub>DRM</sub> , V <sub>RRM</sub>		Volts
	MAC9D	400	
	MAC9M	600	
	MAC9N	800	
On-State RMS Current (Full Cycle Sine Wave, 60 Hz, T <sub>C</sub> = 100°C)	I <sub>T(RMS)</sub>	8.0	Amps
Peak Non-Repetitive Surge Current (One Full Cycle Sine Wave, 60 Hz, T <sub>J</sub> = 125°C)	I <sub>TSM</sub>	80	Amps
Circuit Fusing Consideration (t = 8.3 ms)	I <sup>2</sup> t	26	A <sup>2</sup> sec
Peak Gate Power (Pulse Width ≤ 1.0 μs, T <sub>C</sub> = 80°C)	P <sub>GM</sub>	16	Watts
Average Gate Power (t = 8.3 ms, T <sub>C</sub> = 80°C)	P <sub>G(AV)</sub>	0.35	Watt
Operating Junction Temperature Range	T <sub>J</sub>	-40 to +125	°C
Storage Temperature Range	T <sub>stg</sub>	-40 to +150	°C

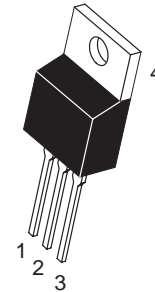
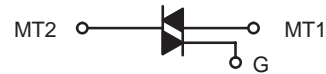
(1) V<sub>DRM</sub> and V<sub>RRM</sub> for all types can be applied on a continuous basis. Blocking voltages shall not be tested with a constant current source such that the voltage ratings of the devices are exceeded.



ON Semiconductor

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**TRIACS**  
**8 AMPERES RMS**  
**400 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
MAC9D	TO220AB	50 Units/Rail
MAC9M	TO220AB	50 Units/Rail
MAC9N	TO220AB	50 Units/Rail

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

# MAC9D, MAC9M, MAC9N

## 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

## ON CHARACTERISTICS

Peak On-State Voltage* ( $I_{TM} = \pm 11 \text{ A Peak}$ )	$V_{TM}$	—	1.2	1.6	Volts
Gate Trigger Current (Continuous dc) ( $V_D = 12 \text{ V}, R_L = 100 \Omega$ ) MT2(+), G(+) MT2(+), G(-) MT2(-), G(-)	$I_{GT}$	10 10 10	16 18 22	50 50 50	mA
Holding Current ( $V_D = 12 \text{ V}, \text{ Gate Open}, \text{ Initiating Current} = \pm 150 \text{ mA}$ )	$I_H$	—	30	50	mA
Latching Current ( $V_D = 24 \text{ V}, I_G = 50 \text{ mA}$ ) MT2(+), G(+); MT2(-), G(-) MT2(+), G(-)	$I_L$	— —	20 30	50 80	mA
Gate Trigger Voltage ( $V_D = 12 \text{ V}, R_L = 100 \Omega$ ) 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	Volts
Gate Non-Trigger Voltage ( $V_D = 12 \text{ V}, R_L = 100 \Omega, T_J = 125^{\circ}C$ ) MT2(+), G(+); MT2(+), G(-); MT2(-), G(-)	$V_{GD}$	0.2	—	—	Volts

## DYNAMIC CHARACTERISTICS

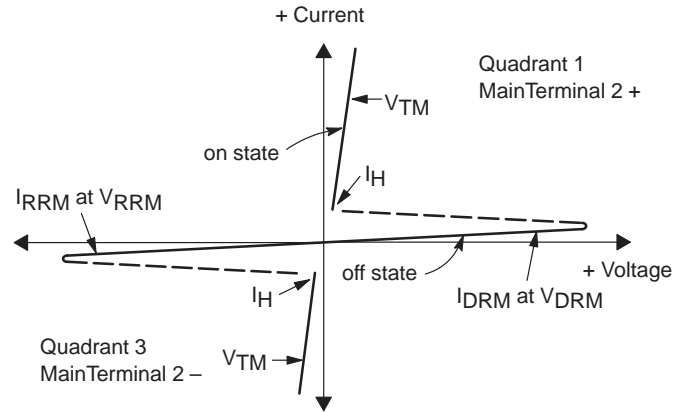
Rate of Change of Commutating Current; See Figure 10. ( $V_D = 400 \text{ V}, I_{TM} = 4.4 \text{ A}, \text{ Commutating } dv/dt = 18 \text{ V}/\mu\text{s},$ Gate Open, $T_J = 125^{\circ}C, f = 250 \text{ Hz}, \text{ No Snubber}$ ) $C_L = 10 \mu\text{F}$ $L_L = 40 \text{ mH}$	$(di/dt)_C$	6.5	—	—	A/ms
Critical Rate of Rise of Off-State Voltage ( $V_D = \text{Rated } V_{DRM}, \text{ Exponential Waveform},$ Gate Open, $T_J = 125^{\circ}C$ )	$dv/dt$	500	—	—	$V/\mu\text{s}$

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

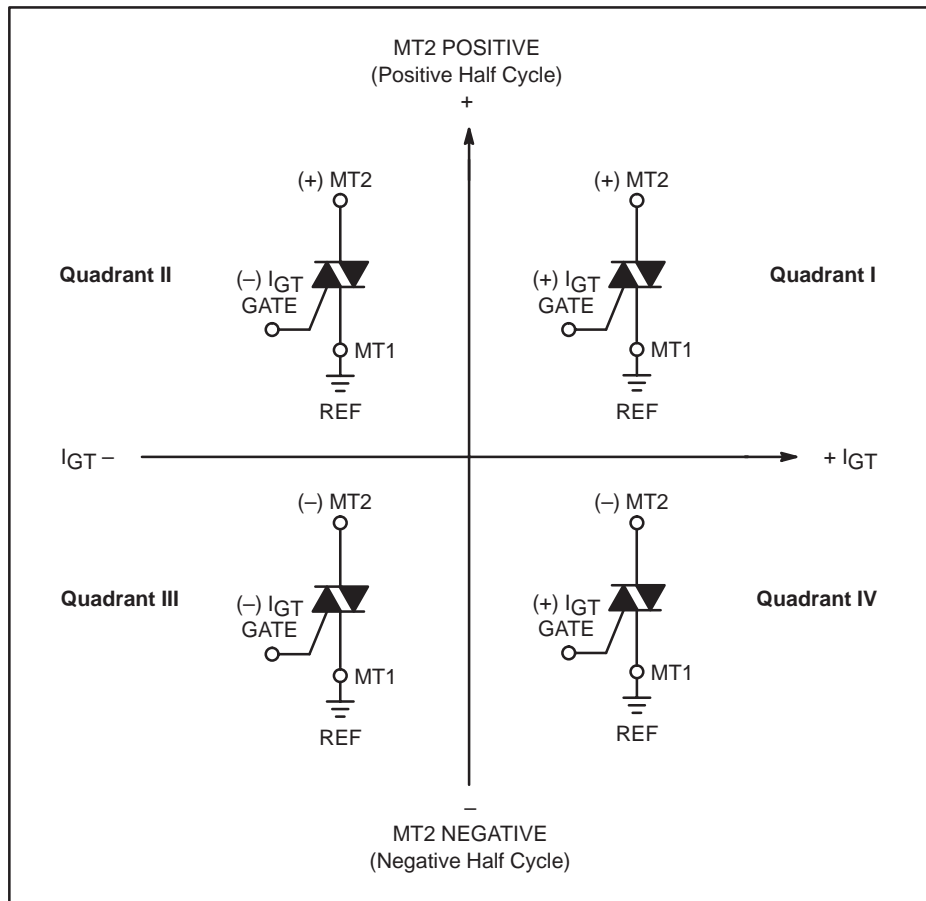
# MAC9D, MAC9M, MAC9N

## 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.

# MAC9D, MAC9M, MAC9N

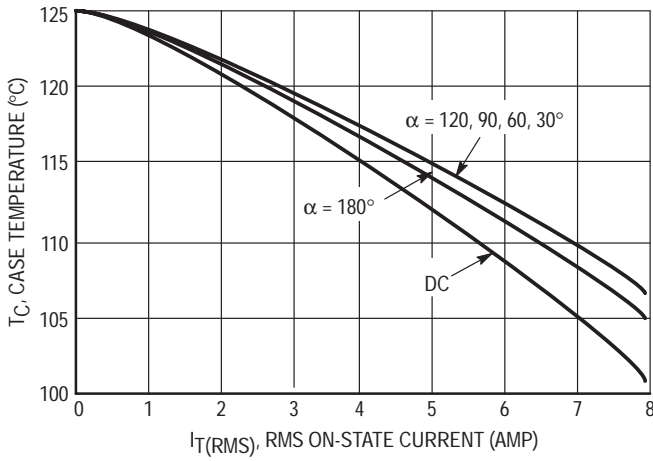


Figure 1. RMS Current Derating

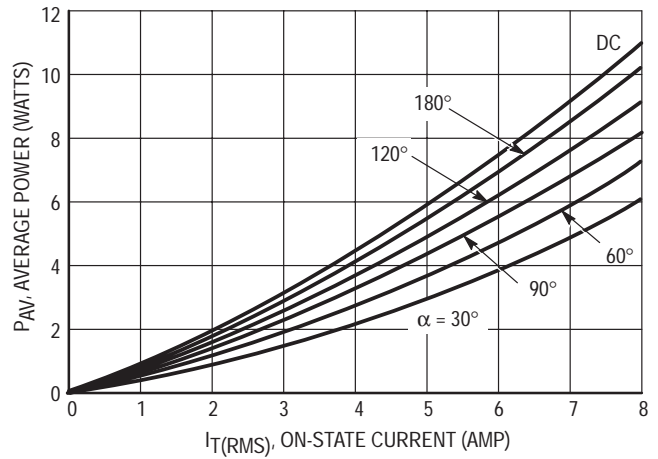


Figure 2. On-State Power Dissipation

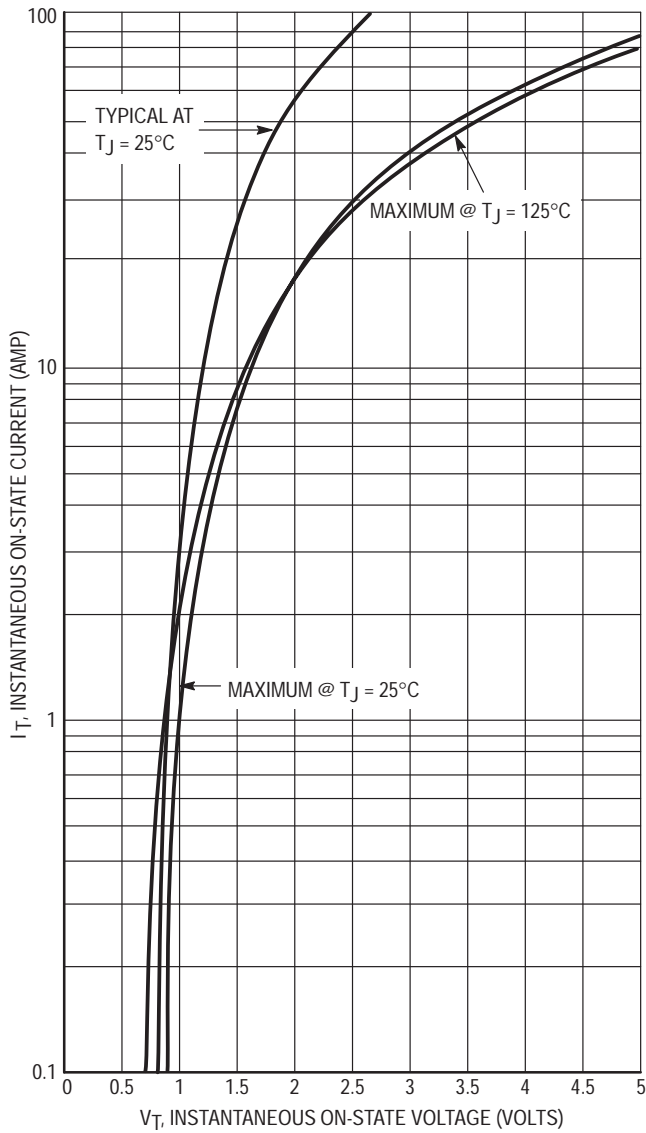


Figure 3. On-State Characteristics

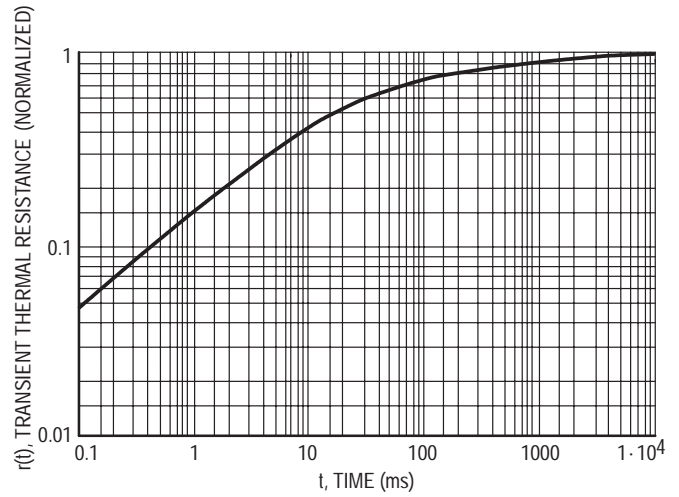


Figure 4. Thermal Response

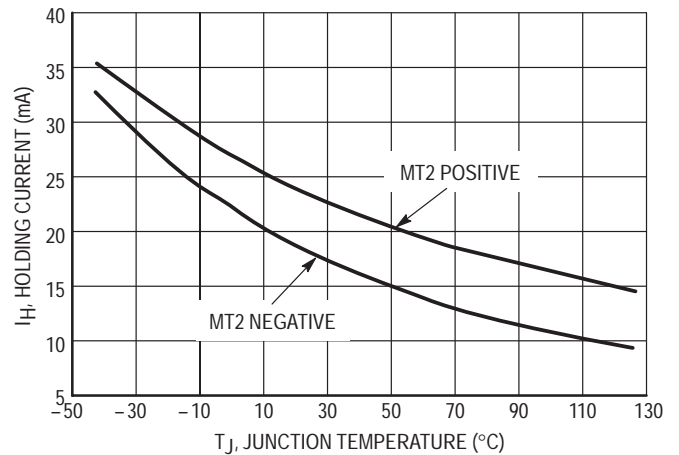


Figure 5. Holding Current Variation

# MAC9D, MAC9M, MAC9N

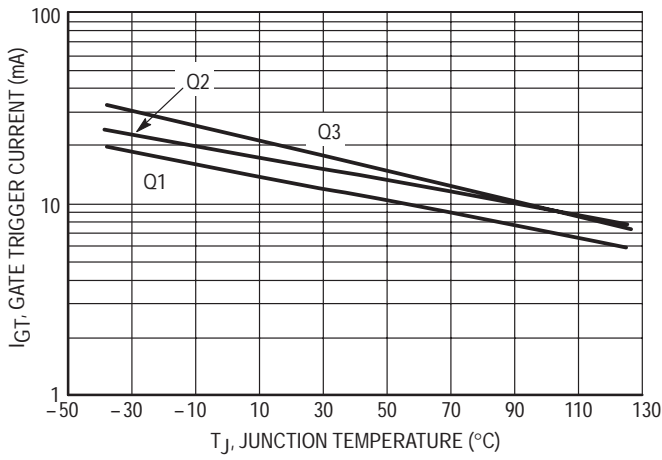


Figure 6. Gate Trigger Current Variation

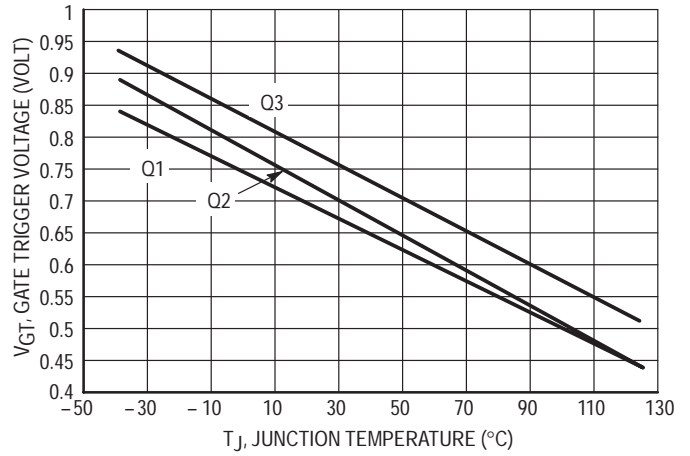


Figure 7. Gate Trigger Voltage Variation

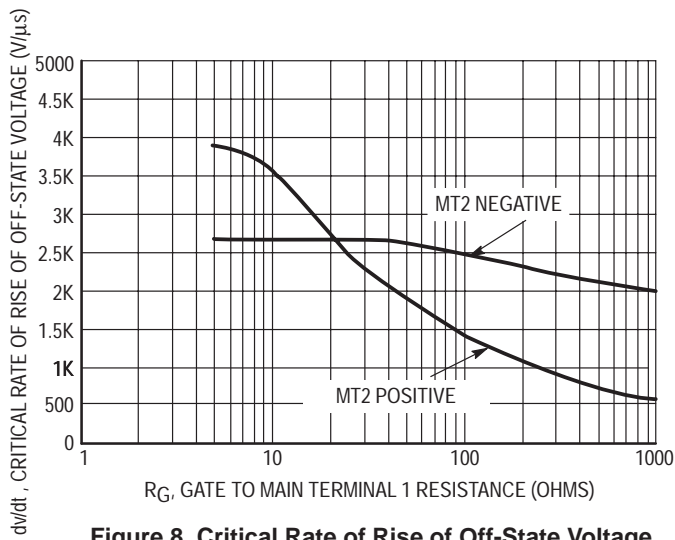


Figure 8. Critical Rate of Rise of Off-State Voltage (Exponential)

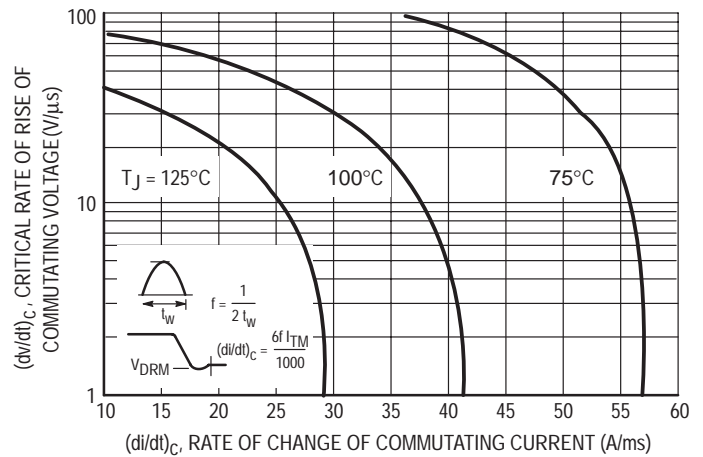
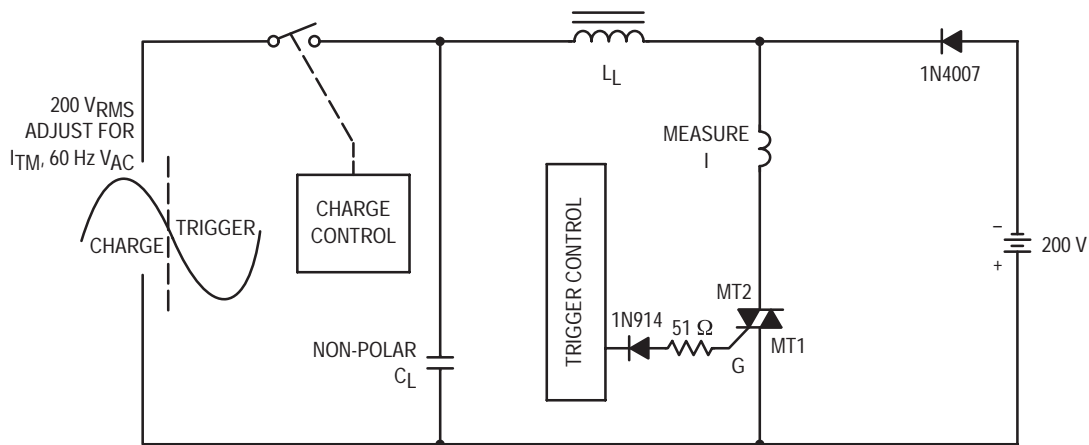


Figure 9. Critical Rate of Rise of Commutating Voltage



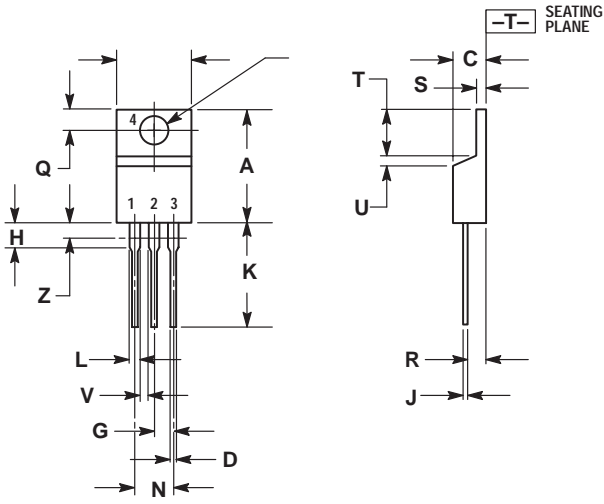
Note: Component values are for verification of rated  $(di/dt)_c$ . See AN1048 for additional information.

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

# MAC9D, MAC9M, MAC9N

## 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  
2. MAIN TERMINAL 2  
3. GATE  
4. MAIN TERMINAL 2

**Notes**

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