

# Silicon Bidirectional Triode Thyristors

... designed for use in solid state relays, MPU interface, TTL logic and any other light industrial or consumer application. Supplied in an inexpensive TO-92 package which is readily adaptable for use in automatic insertion equipment.

- One-Piece, Injection-Molded Unibloc Package
- Sensitive Gate Triggering in Four Trigger Modes for all possible Combinations of Trigger Sources, and Especially for Circuits that Source Gate Drives
- All Diffused and Glassivated Junctions for Maximum Uniformity of Parameters and Reliability

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

Rating	Symbol	Value	Unit
Peak Repetitive Off-State Voltage (Gate Open, T <sub>J</sub> = -40 to +110°C)(1) 1/2 Sine Wave 50 to 60 Hz, Gate Open MAC97-4, MAC97A4 MAC97-6, MAC97A6 MAC97-8, MAC97A8	V <sub>DRM</sub>	200 400 600	Volts
On-State RMS Current Full Cycle Sine Wave 50 to 60 Hz (T <sub>C</sub> = +50°C)	I <sub>T(RMS)</sub>	0.8	Amp
Peak Non-repetitive Surge Current (One Full Cycle, 60 Hz, T <sub>A</sub> = 110°C)	I <sub>TSM</sub>	8.0	Amps
Circuit Fusing Considerations T <sub>J</sub> = -40 to +110°C (t = 8.3 ms)	I <sup>2</sup> t	0.26	A <sup>2</sup> s
Peak Gate Voltage (t ≤ 2.0 μs)	V <sub>GM</sub>	5.0	Volts
Peak Gate Power (t ≤ 2.0 μs)	P <sub>GM</sub>	5.0	Watts
Average Gate Power (T <sub>C</sub> = 80°C, t ≤ 8.3 ms)	P <sub>G(AV)</sub>	0.1	Watt
Peak Gate Current (t ≤ 2.0 μs)	I <sub>GM</sub>	1.0	Amp
Operating Junction Temperature Range	T <sub>J</sub>	-40 to +110	°C
Storage Temperature Range	T <sub>stg</sub>	-40 to +150	°C

## THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	75	°C/W
Thermal Resistance, Junction to Ambient	R <sub>θJA</sub>	200	°C/W

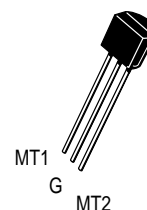
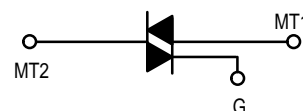
(1) V<sub>DRM</sub> for all types can be applied on a continuous basis. Blocking voltages shall not be tested with a constant current source such that the voltage ratings of the devices are exceeded.

## MAC97,A IMPROVED SERIES

(Device Date Code  
9625 and Up)

Motorola preferred devices

TRIACs  
0.8 AMPERE RMS  
200 — 600 VOLTS



CASE 29-04  
TO-226AA, STYLE 12  
(TO-92)

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

## MAC97,A IMPROVED SERIES

### ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ , and Either Polarity of MT2 to MT1 Voltage unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Peak Blocking Current <sup>(1)</sup> ( $V_D = \text{Rated } V_{DRM}$ , $T_J = 110^\circ\text{C}$ , Gate Open)	$I_{RRM}$	—	—	0.1	mA
Peak On-State Voltage (Either Direction) ( $I_{TM} = 1.1 \text{ A Peak}$ ; Pulse Width $\leq 2.0 \text{ ms}$ , Duty Cycle $\leq 2.0\%$ )	$V_{TM}$	—	—	1.65	Volts
Gate Trigger Current (Continuous dc) ( $V_D = 12 \text{ Vdc}$ , $R_L = 100 \text{ Ohms}$ ) MT2(+), G(+) MT2(+), G(-) MT2(-), G(-) MT2(-), G(+) MAC97  MT2(+), G(+) MT2(+), G(-) MT2(-), G(-) MT2(-), G(+) MAC97A	$I_{GT}$	— — — —	— — — —	10 10 10 10  5.0 5.0 5.0 7.0	mA
Gate Trigger Voltage, (Continuous dc) ( $V_D = 12 \text{ Vdc}$ , $R_L = 100 \text{ Ohms}$ ) MT2(+), G(+) MT2(+), G(-) MT2(-), G(-) MT2(-), G(+) ( $V_D = \text{Rated } V_{DRM}$ , $R_L = 10 \text{ k Ohms}$ , $T_J = 110^\circ\text{C}$ ) MT2(+), G(+); MT2(-), G(-); MT2(+), G(-) MT2(-), G(+) All Types	$V_{GT}$	— — — — 0.1 0.1	— — — — — —	2.0 2.0 2.0 2.5 — —	Volts
Holding Current ( $V_D = 12 \text{ Vdc}$ , $I_{TM} = 200 \text{ mA}$ , Gate Open)	$I_H$	—	—	5.0	mA
Gate Controlled Turn-On Time ( $V_D = \text{Rated } V_{DRM}$ , $I_{TM} = 1.0 \text{ A pk}$ , $I_G = 25 \text{ mA}$ )	$t_{gt}$	—	2.0	—	$\mu\text{s}$
Critical Rate-of-Rise of Commutation Voltage ( $f = 250 \text{ Hz}$ , $I_{TM} = 1.0 \text{ A}$ , Commutating $di/dt = 1.5 \text{ A/mS}$ , On-State Current Duration = 2.0 mS, $V_{DRM} = 200 \text{ V}$ , Gate Unenergized, $T_C = 110^\circ\text{C}$ , Gate Source Resistance = 150 $\Omega$ , See Figure 13)	$dv/dt_C$	1.5	—	—	$\text{V}/\mu\text{s}$
Critical Rate-of-Rise of Off State Voltage ( $V_{pk} = \text{Rated } V_{DRM}$ , $T_C = 110^\circ\text{C}$ , Gate Open, Exponential Method)	$dv/dt$	10	—	—	$\text{V}/\mu\text{s}$

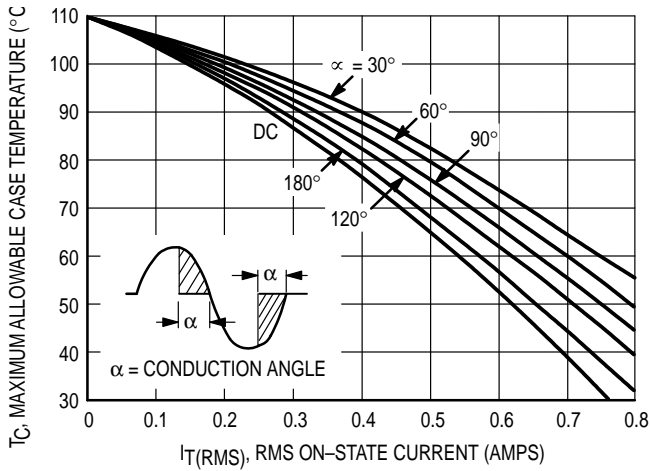


Figure 1. RMS Current Derating

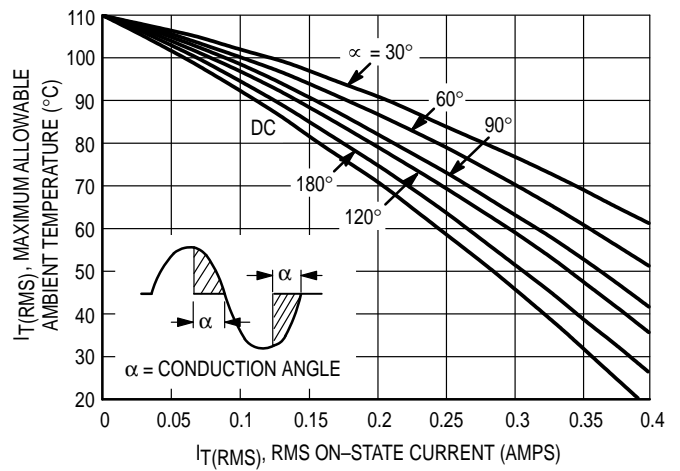


Figure 2. RMS Current Derating

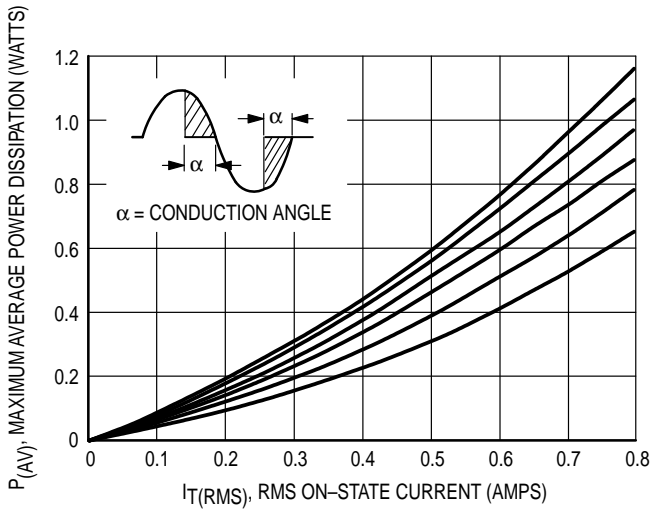


Figure 3. Power Dissipation

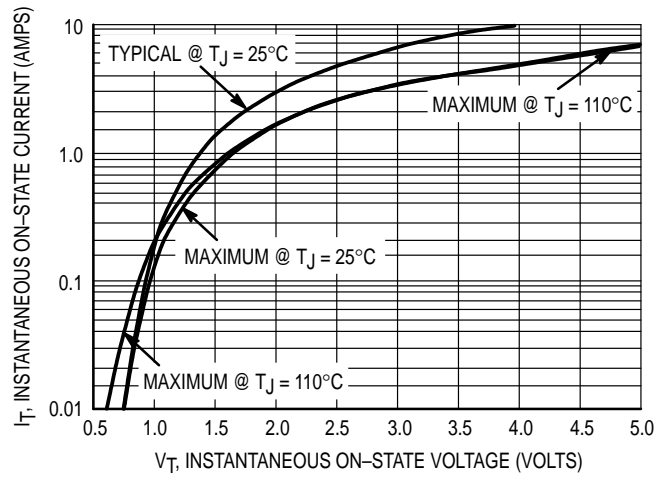


Figure 4. On-State Characteristics

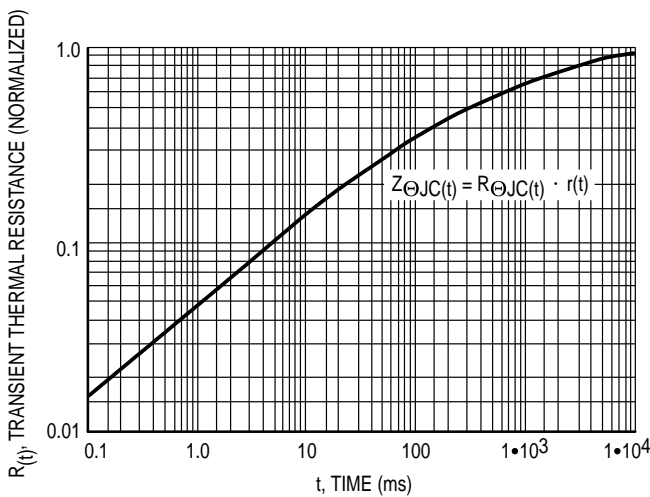


Figure 5. Transient Thermal Response

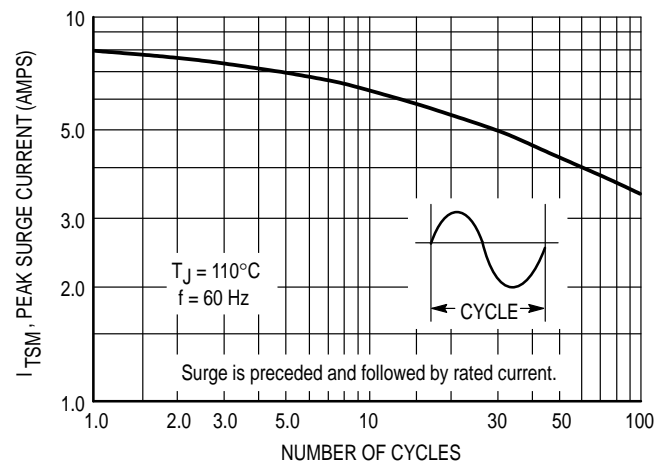


Figure 6. Maximum Allowable Surge Current

# MAC97,A IMPROVED SERIES

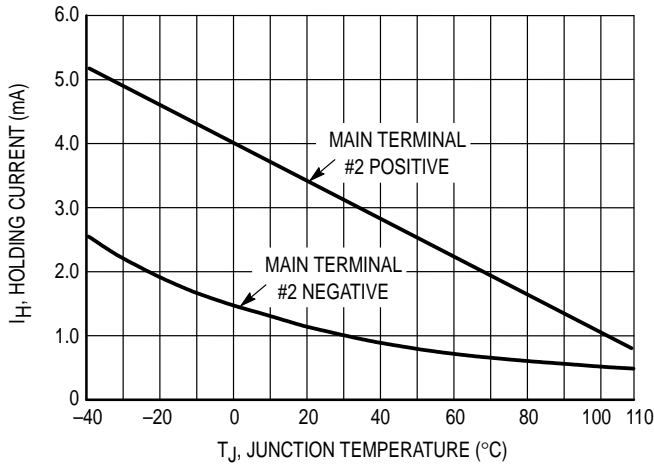


Figure 7. Typical Holding Current Variation

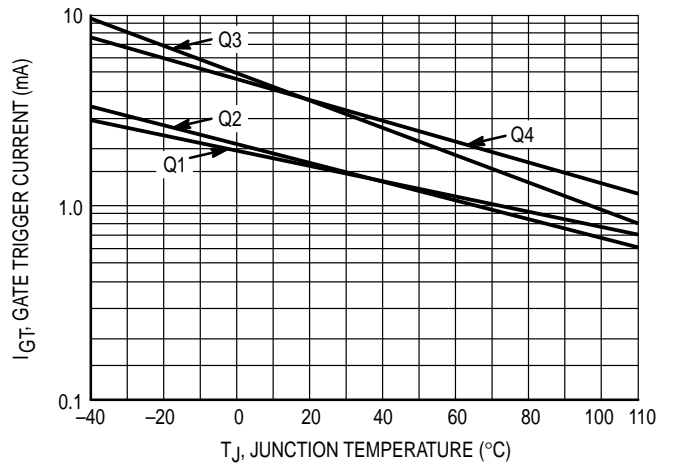


Figure 8. Typical Gate Trigger Current Variation

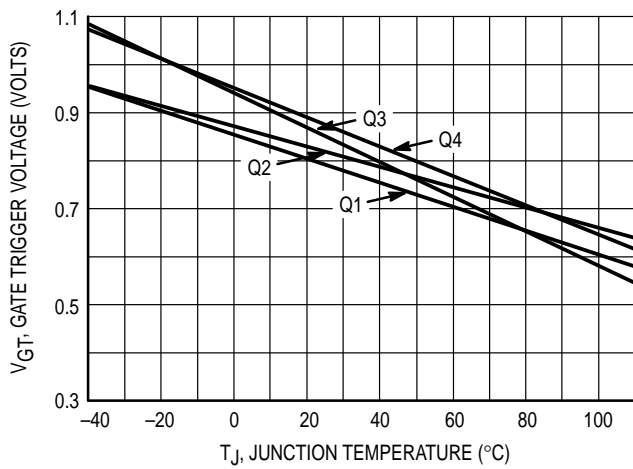


Figure 9. Gate Trigger Voltage Variation

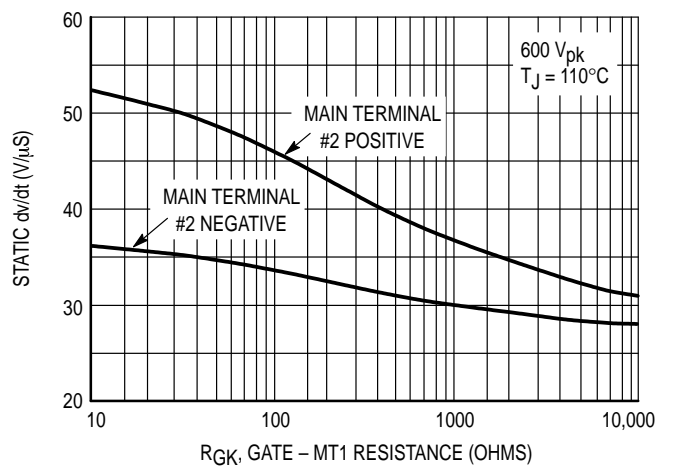


Figure 10. Exponential Static dv/dt versus Gate - MT1 Resistance

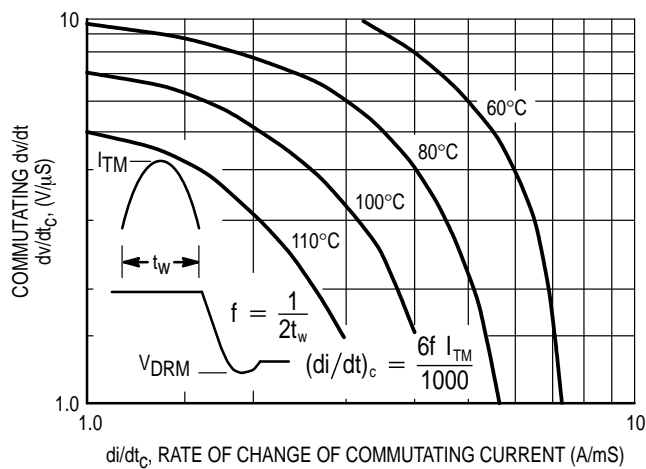


Figure 11. Typical Commutating dv/dt versus Current Crossing Rate and Junction Temperature

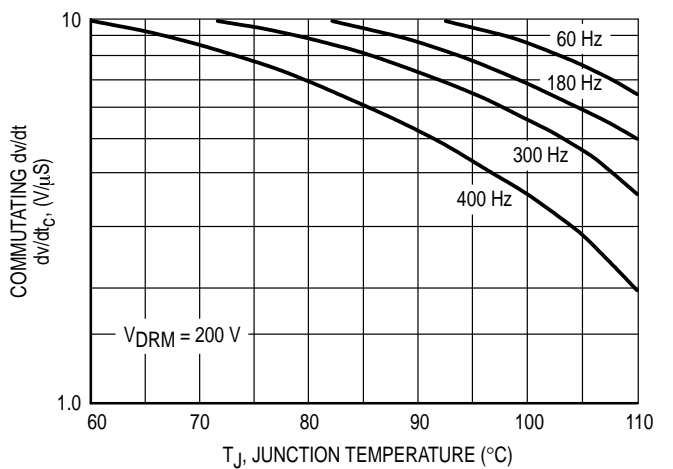
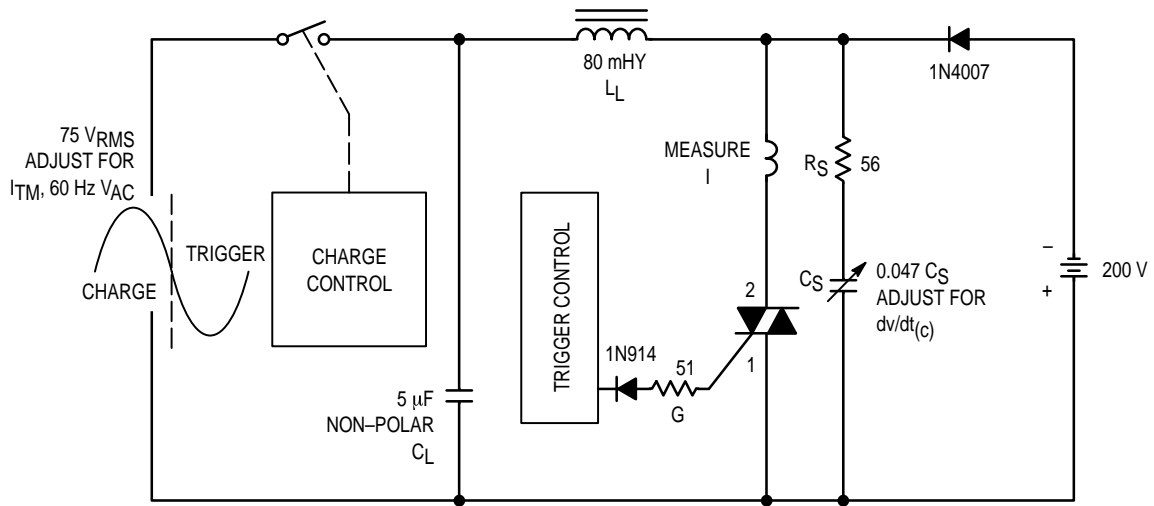


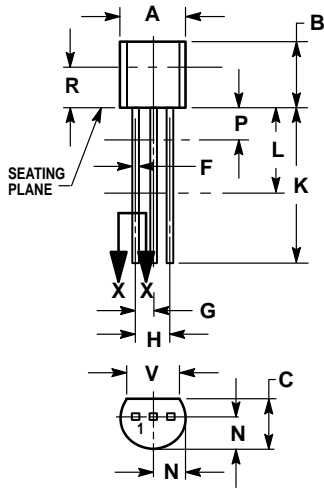
Figure 12. Typical Commutating dv/dt versus Junction Temperature at 0.8 Amps RMS



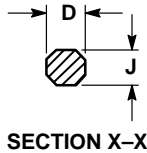
NOTE: Component values are for verification of rated  $(dv/dt)_C$ . See AN1048 for additional information.

Figure 13. Simplified  $Q_1$   $(dv/dt)_C$  Test Circuit

**PACKAGE DIMENSIONS**



STYLE 12:  
 PIN 1. MAIN TERMINAL 1  
 2. GATE  
 3. MAIN TERMINAL 2



**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. DIMENSION F APPLIES BETWEEN P AND L. DIMENSION D AND J APPLY BETWEEN L AND K. MINIMUM LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.022	0.41	0.55
F	0.016	0.019	0.41	0.48
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500	—	12.70	—
L	0.250	—	6.35	—
N	0.080	0.105	2.04	2.66
P	—	0.100	—	2.54
R	0.115	—	2.93	—
V	0.135	—	3.43	—

**CASE 29-04  
 (TO-226AA)  
 (TO-92)**

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