

# DIGITRON SEMICONDUCTORS

## MAC97,(A),(B) SERIES

## SILICON BIDIRECTIONAL THYRISTORS

Available Non-RoHS (standard) or RoHS compliant (add PBF suffix).

Available as "HR" (high reliability) screened per MIL-PRF-19500, JANTX level. Add "HR" suffix to base part number.

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
<b>Peak repetitive off-state voltage<sup>(1)</sup></b> ( $T_J = -40$ to $+110^\circ\text{C}$ , $\frac{1}{2}$ sine wave 50 to 60Hz, gate open) MAC97-1, MAC97A-1, MAC97B-1 MAC97-2, MAC97A-2, MAC97B-2 MAC97-3, MAC97A-3, MAC97B-3 MAC97-4, MAC97A-4, MAC97B-4 MAC97-5, MAC97A-5, MAC97B-5 MAC97-6, MAC97A-6, MAC97B-6 MAC97-7, MAC97A-7, MAC97B-7 MAC97-8, MAC97A-8, MAC97B-8	$V_{\text{DRM}}$	30 60 100 200 300 400 500 600	Volts
<b>RMS on-state current</b> (full sine wave, 50 to 60Hz, $T_C = 50^\circ\text{C}$ )	$I_{\text{T(RMS)}}$	0.6	Amps
<b>Peak non-repetitive surge current</b> (1 cycle, 60 Hz, $T_C = 110^\circ\text{C}$ )	$I_{\text{TSM}}$	8.0	Amps
<b>Circuit fusing considerations</b> ( $T_J = -40$ to $+110^\circ\text{C}$ , $t = 8.3\text{ms}$ )	$I^2t$	0.26	$\text{A}^2\text{s}$
<b>Peak gate voltage</b> ( $t \leq 2.0\mu\text{s}$ )	$V_{\text{GM}}$	5.0	Volts
<b>Peak gate power</b> ( $t \leq 2.0\mu\text{s}$ )	$P_{\text{GM}}$	5.0	Watts
<b>Average gate power</b> ( $T_C = 80^\circ\text{C}$ , $t = 8.3\text{ms}$ )	$P_{\text{G(AV)}}$	0.1	Watts
<b>Peak gate current</b> ( $t \leq 2.0\mu\text{s}$ )	$I_{\text{GM}}$	1.0	Amps
<b>Operating junction temperature range</b>	$T_J$	-40 to +110	$^\circ\text{C}$
<b>Storage temperature range</b>	$T_{\text{stg}}$	-40 to +150	$^\circ\text{C}$

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

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Maximum	Unit
<b>Thermal resistance, junction to case</b>	$R_{\theta\text{JC}}$	75	$^\circ\text{C}/\text{W}$
<b>Thermal resistance, junction to ambient</b>	$R_{\theta\text{JA}}$	200	$^\circ\text{C}/\text{W}$

### 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
<b>Peak blocking current<sup>(2)</sup></b> (Rated $V_{\text{DRM}}$ @ $T_J = 110^\circ\text{C}$ )	$I_{\text{DRM}}$	-	-	0.1	mA
<b>Peak on-state voltage</b> (either direction) ( $I_{\text{TM}} = 0.85\text{A}$ peak, pulse width $\leq 2$ ms, duty cycle $\leq 2\%$ )	$V_{\text{TM}}$	-	-	1.9	Volts
<b>Gate trigger voltage</b> (continuous dc) ( $V_D = 12\text{V}$ , $R_L = 100\Omega$ ) MT2(+),G(+) MT2(+),G(-) MT2(-),G(-) MT2(-),G(+) ( $V_D = \text{Rated } V_{\text{DRM}}$ , $R_L = 10\text{k}\Omega$ , $T_J = 110^\circ\text{C}$ ) MT2(+),G(+); MT2(+),G(-); MT2(-),G(-) MT2(-),G(+)	$V_{\text{GT}}$	- - - - 0.1 0.1	- - - - - -	2.0 2.0 2.0 2.5	Volts
<b>Holding current</b> (either direction) ( $V_D = 12\text{V}$ , gate open, $I_T = 200\text{mA}$ )	$I_H$	-	-	10	mA

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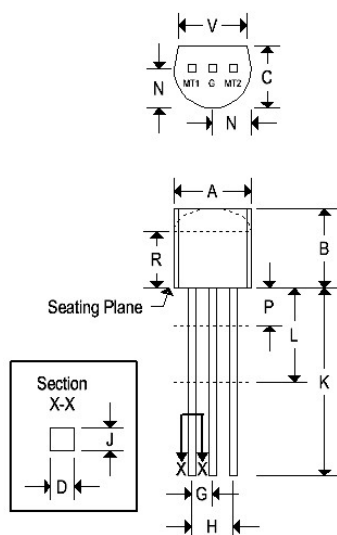
Characteristic	Symbol	Min	Typ.	Max	Unit
<b>Gate controlled turn on time</b> ( $V_D = \text{rated } V_{DRM}, I_{TM} = 1.0A \text{ peak}, I_G = 25mA$ )	$t_{gt}$	-	2.0	-	$\mu s$
<b>Critical rate of rise of commutation voltage</b> ( $V_D = \text{Rated } V_{DRM}, I_{TM} = 0.84\mu A \text{ peak}, \text{commutating } di/dt = 0.32A/ms, \text{ gate unenergized}, T_C = 50^\circ C$ )	$dv/dt(c)$	-	5	-	$V/\mu s$
<b>Critical rate of rise of off-state voltage</b> ( $V_D = \text{Rated } V_{DRM}, \text{ exponential waveform}, T_C = 110^\circ C$ )	$dv/dt$	-	25	-	$V/\mu s$

Note 2: Ratings apply for open gate conditions. Thyristor devices shall not be tested with a constant current source for blocking voltage such that the voltage applied exceeds the rated blocking voltage.

Quadrant and polarity	MAC SERIES			Unit
	97	97A	97B	
<b>I</b> MT2(+), G(+)	10	5.0	3.0	mA
<b>II</b> MT2(+), G(-)	10	5.0	3.0	mA
<b>III</b> MT2(-), G(-)	10	5.0	3.0	mA
<b>IV</b> MT2(-), G(+)	10	7.0	5.0	mA

## MECHANICAL CHARACTERISTIC

Case	TO-92
Marking	Body painted, alpha-numeric
Pin out	See below



	TO-92			
	Inches		Millimeters	
	Min	Max	Min	Max
A	0.175	0.205	4.450	5.200
B	0.170	0.210	4.320	5.330
C	0.125	0.165	3.180	4.190
D	0.016	0.022	0.410	0.550
F	0.016	0.019	0.410	0.480
G	0.045	0.055	1.150	1.390
H	0.095	0.105	2.420	2.660
J	0.015	0.020	0.390	0.500
K	0.500	-	12.700	-
L	0.250	-	6.350	-
N	0.080	0.105	2.040	2.660
P	-	0.100	-	2.540
R	0.115	-	2.930	-
V	0.135	-	3.430	-

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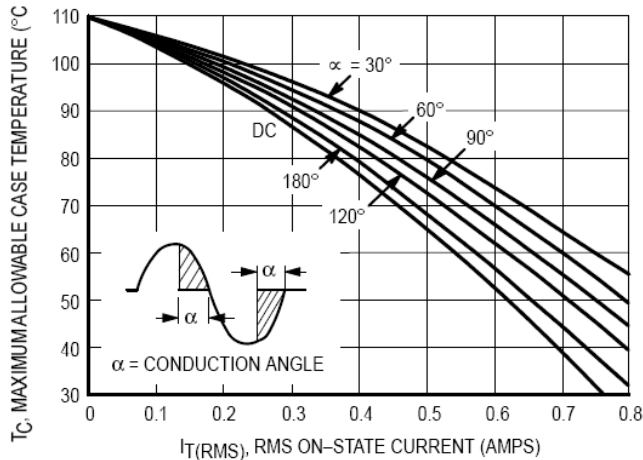


Figure 1. RMS Current Derating

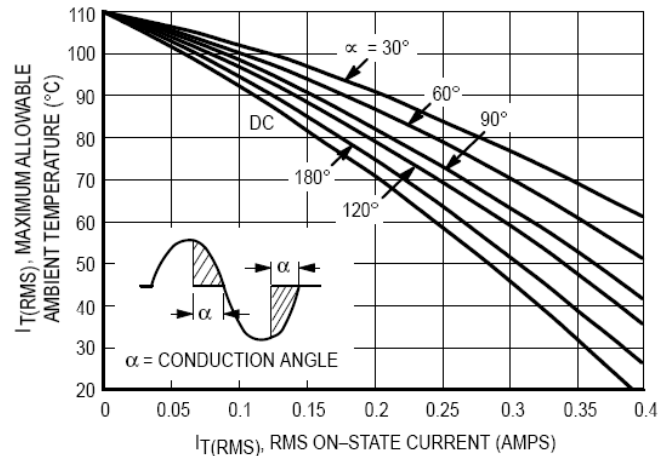


Figure 2. RMS Current Derating

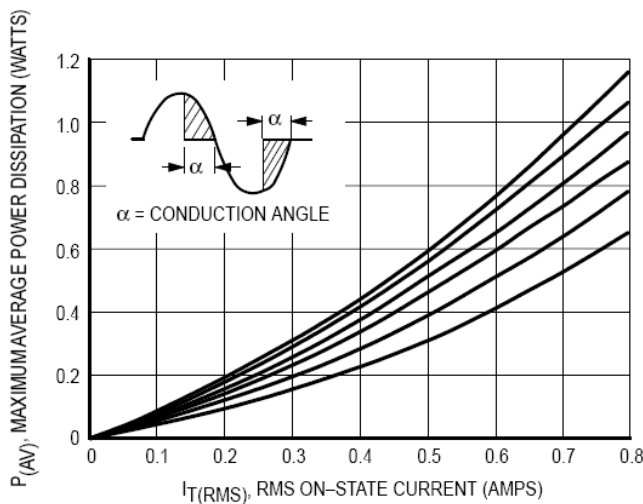


Figure 3. Power Dissipation

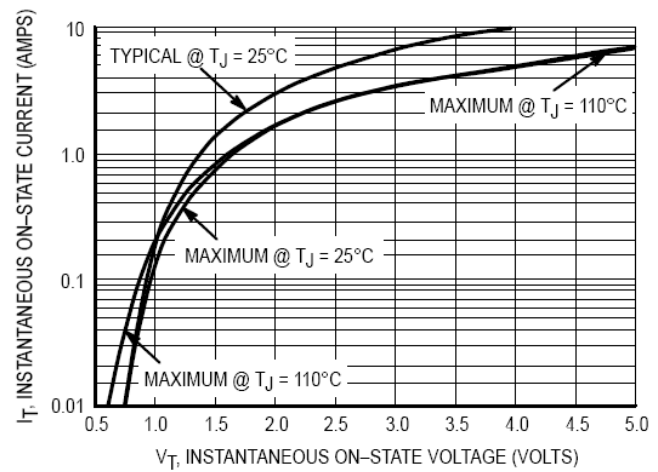


Figure 4. On-State Characteristics

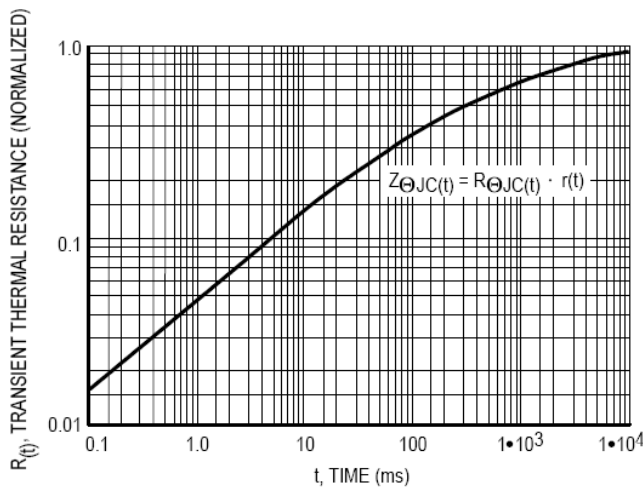


Figure 5. Transient Thermal Response

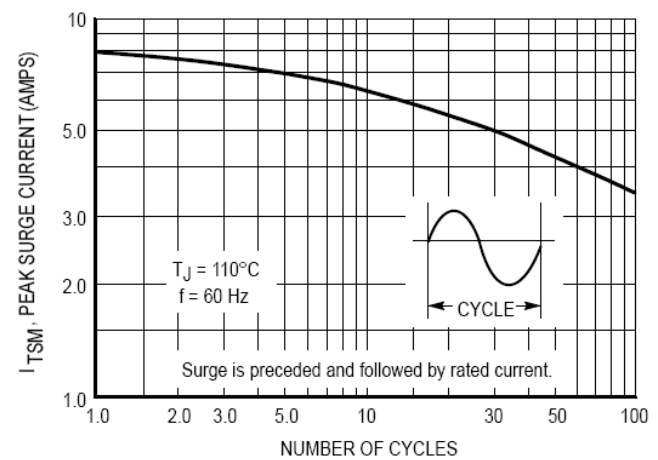
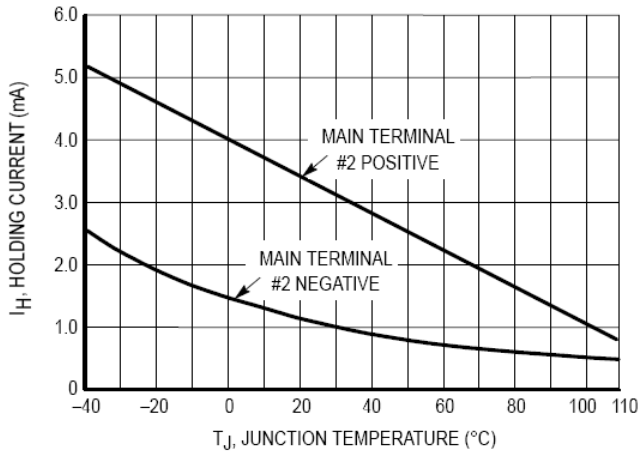


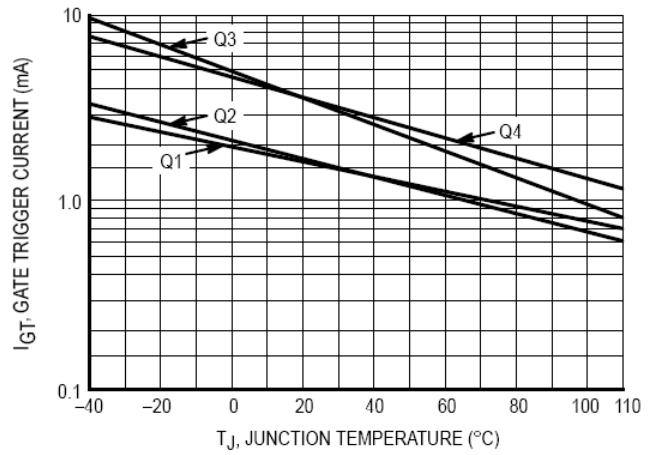
Figure 6. Maximum Allowable Surge Current

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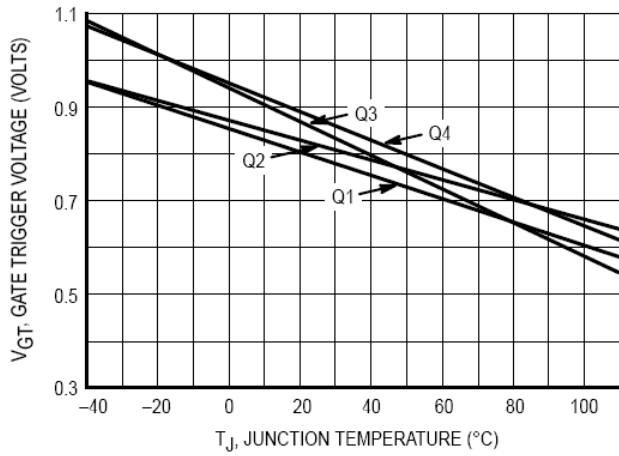
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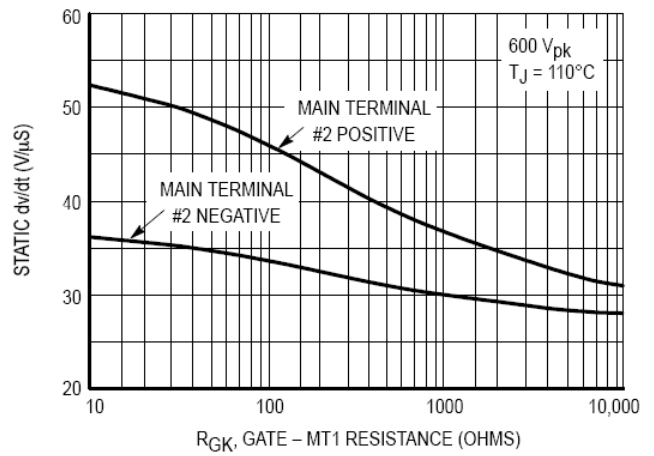
**Figure 7. Typical Holding Current Variation**



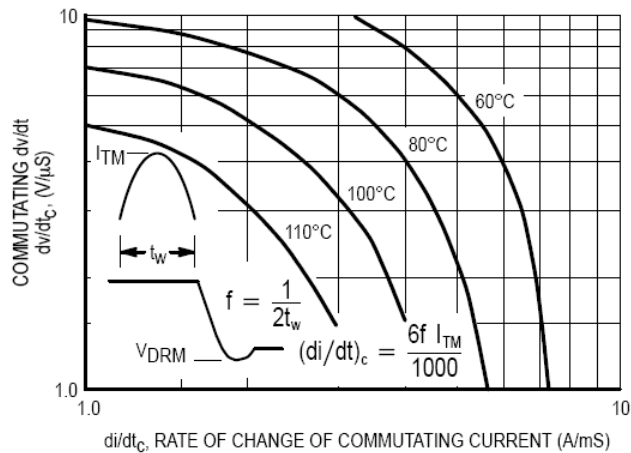
**Figure 8. Typical Gate Trigger Current Variation**



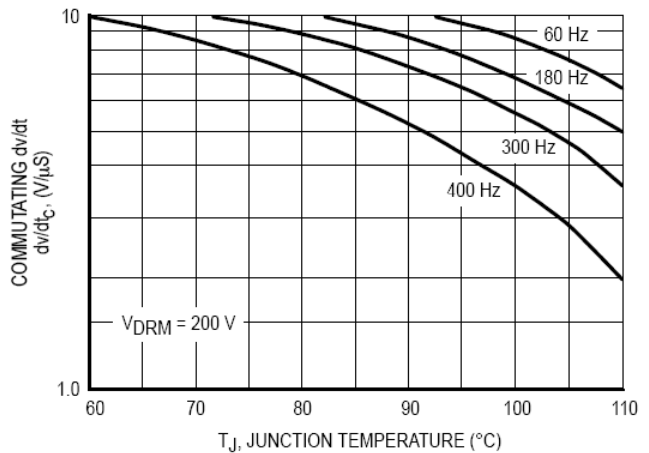
**Figure 9. Gate Trigger Voltage Variation**



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



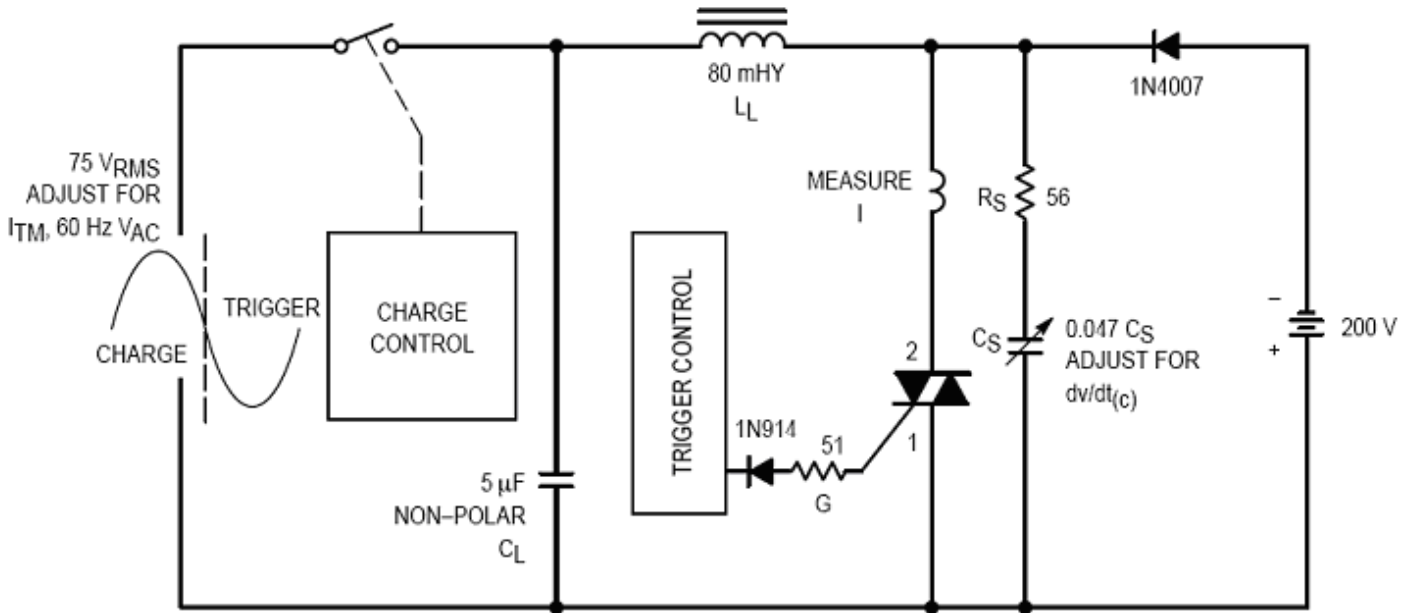
**Figure 11. Typical Commutating dv/dt versus Current Crossing Rate and Junction Temperature**



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

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NOTE: Component values are for verification of rated (dv/dt)<sub>C</sub>.

**Figure 13. Simplified Q<sub>1</sub> (dv/dt)<sub>C</sub> Test Circuit**