

# MAC8SDG, MAC8SMG, MAC8SNG

## 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.

### Features

- Sensitive Gate Allows Triggering by Microcontrollers and other Logic Circuits
- Uniform Gate Trigger Currents in Three Quadrants; Q1, Q2, and Q3
- High Immunity to  $dv/dt$  – 25 V/ $\mu$ s Minimum at 110°C
- High Commutating  $di/dt$  – 8.0 A/ms Minimum at 110°C
- Maximum Values of  $I_{GT}$ ,  $V_{GT}$  and  $I_H$  Specified for Ease of Design
- On-State Current Rating of 8 Amperes RMS at 70°C
- High Surge Current Capability – 70 Amperes
- Blocking Voltage to 800 Volts
- Rugged, Economical TO-220 Package
- These Devices are Pb-Free and are RoHS Compliant\*

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

Rating	Symbol	Value	Unit
Peak Repetitive Off-State Voltage (Note 1) (T <sub>J</sub> = -40 to 110°C, Sine Wave, 50 to 60 Hz, Gate Open) MAC8SD MAC8SM MAC8SN	V <sub>DRM</sub> , V <sub>RRM</sub>	400 600 800	V
On-State RMS Current (Full Cycle Sine Wave, 60 Hz, T <sub>C</sub> = 70°C)	I <sub>T(RMS)</sub>	8.0	A
Peak Non-Repetitive Surge Current (One Full Cycle Sine Wave, 60 Hz, T <sub>J</sub> = 110°C)	I <sub>TSM</sub>	70	A
Circuit Fusing Consideration (t = 8.3 ms)	I <sup>2</sup> t	20	A <sup>2</sup> sec
Peak Gate Power (Pulse Width $\leq$ 1.0 $\mu$ s, T <sub>C</sub> = 70°C)	P <sub>GM</sub>	16	W
Average Gate Power (t = 8.3 ms, T <sub>C</sub> = 70°C)	P <sub>G(AV)</sub>	0.35	W
Operating Junction Temperature Range	T <sub>J</sub>	-40 to +110	°C
Storage Temperature Range	T <sub>stg</sub>	-40 to +150	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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.

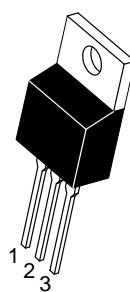
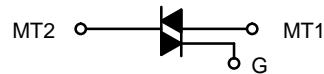
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



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### TRIACS 8 AMPERES RMS 400 thru 800 VOLTS



MARKING  
DIAGRAM  
TO-220  
CASE 221A  
STYLE 4

x = D, M, or N  
A = Assembly Location  
Y = Year  
WW = Work Week  
G = Pb-Free Package

PIN ASSIGNMENT	
1	Main Terminal 1
2	Main Terminal 2
3	Gate
4	Main Terminal 2

### ORDERING INFORMATION

Device	Package	Shipping
MAC8SDG	TO-220 (Pb-Free)	50 Units / Rail
MAC8SMG	TO-220 (Pb-Free)	50 Units / Rail
MAC8SNG	TO-220 (Pb-Free)	50 Units / Rail

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## THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case Junction-to-Ambient	$R_{\theta JC}$ $R_{\theta JA}$	2.2 62.5	°C/W
Maximum Lead Temperature for Soldering Purposes 1/8" from Case for 10 Seconds	$T_L$	260	°C

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise noted; Electricals apply in both directions)

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Peak Repetitive Blocking Current ( $V_D = \text{Rated } V_{\text{DRM}}, V_{\text{RRM}}$ ; Gate Open) $T_J = 25^\circ\text{C}$ $T_J = 110^\circ\text{C}$	$I_{\text{DRM}}$ , $I_{\text{RRM}}$	— —	— —	0.01 2.0	mA
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### ON CHARACTERISTICS

Peak On-State Voltage (Note) ( $I_{\text{TM}} = \pm 11\text{A}$ )	$V_{\text{TM}}$	—	—	1.85	V
Gate Trigger Current (Continuous dc) ( $V_D = 12\text{ V}, R_L = 100\ \Omega$ ) MT2(+), G(+) MT2(+), G(-) MT2(-), G(-)	$I_{\text{GT}}$	— — —	2.0 3.0 3.0	5.0 5.0 5.0	mA
Holding Current ( $V_D = 12\text{V}$ , Gate Open, Initiating Current = $\pm 150\text{mA}$ )	$I_H$	—	3.0	10	mA
Latching Current ( $V_D = 24\text{V}$ , $I_G = 5\text{mA}$ ) MT2(+), G(+) MT2(-), G(-) MT2(+), G(-)	$I_L$	— — —	5.0 10 5.0	15 20 15	mA
Gate Trigger Voltage (Continuous dc) ( $V_D = 12\text{ V}, R_L = 100\ \Omega$ ) MT2(+), G(+) MT2(+), G(-) MT2(-), G(-)	$V_{\text{GT}}$	0.45 0.45 0.45	0.62 0.60 0.65	1.5 1.5 1.5	V

### DYNAMIC CHARACTERISTICS

Rate of Change of Commutating Current $V_D = 400\text{ V}$ , $I_{\text{TM}} = 3.5\text{ A}$ , Commutating $dv/dt = 10\text{ V } \mu\text{sec}$ , Gate Open, $T_J = 110^\circ\text{C}$ , $f = 500\text{ Hz}$ , Snubber: $C_S = 0.01\ \mu\text{F}$ , $R_S = 15\ \Omega$ , (See Figure 16)	$di/dt_{(C)}$	8.0	10	—	A/ms
Critical Rate of Rise of Off-State Voltage ( $V_D = \text{Rate } V_{\text{DRM}}$ , Exponential Waveform, $R_{\text{GK}} = 510\ \Omega$ , $T_J = 110^\circ\text{C}$ )	$dv/dt$	25	75	—	V/ $\mu\text{s}$

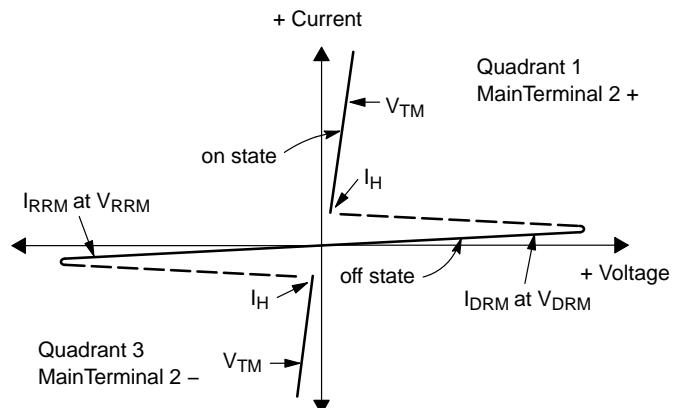
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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

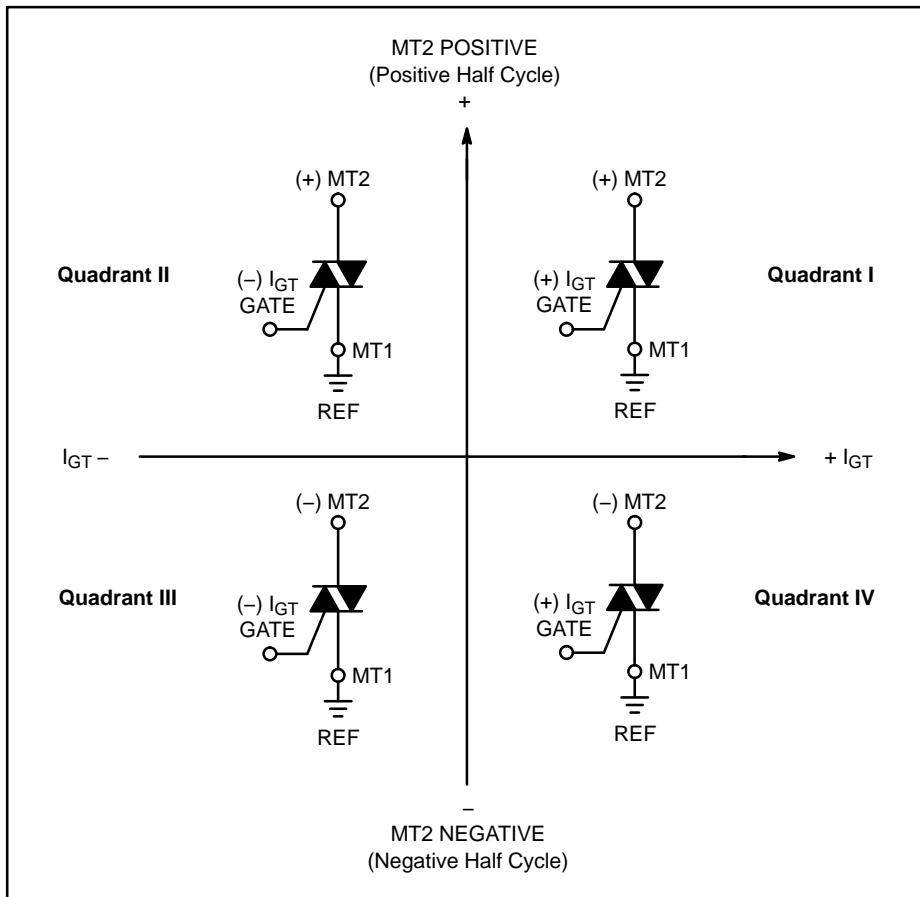
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## Voltage Current Characteristic of Triacs (Bidirectional Device)

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.

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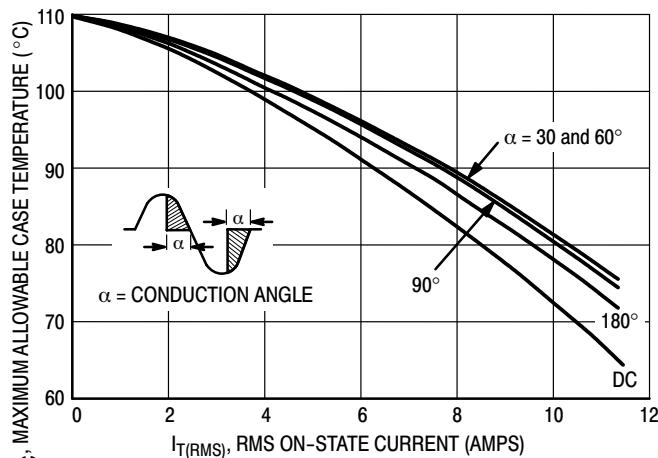


Figure 1. RMS Current Derating

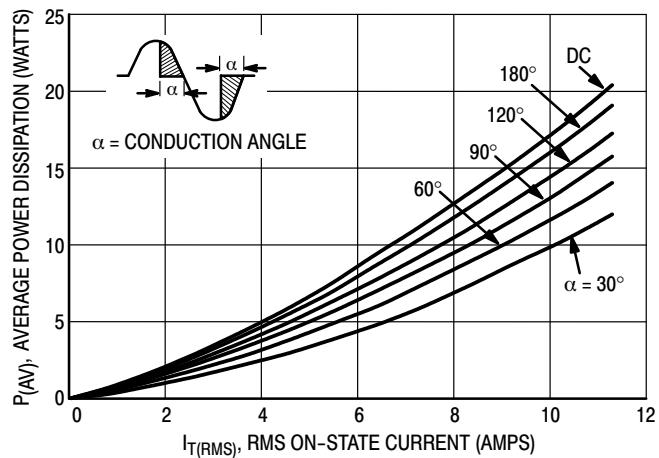


Figure 2. Maximum On-State Power Dissipation

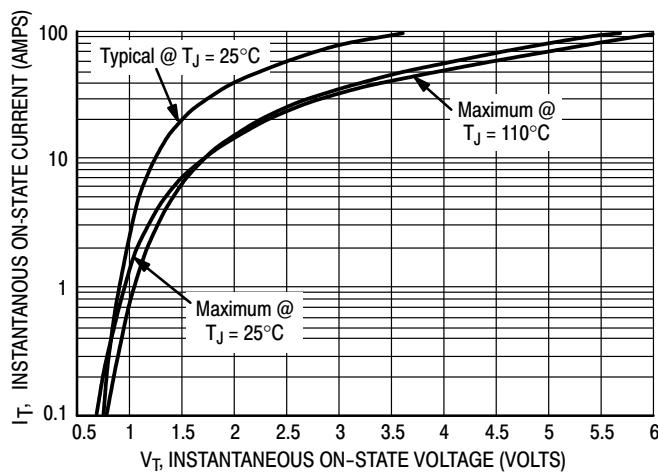


Figure 3. On-State Characteristics

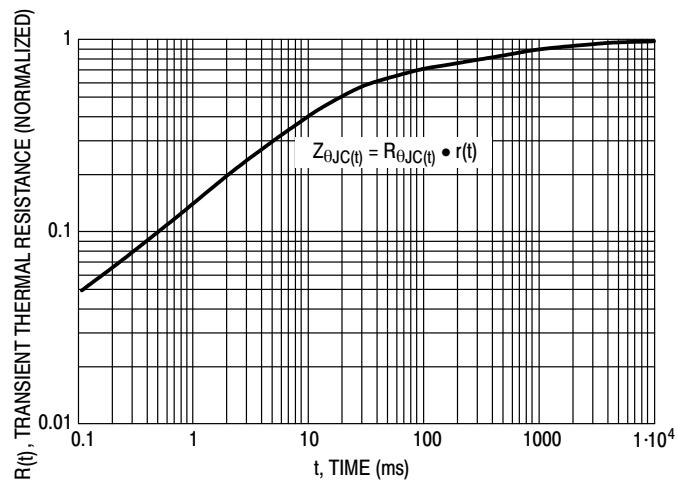


Figure 4. Transient Thermal Response

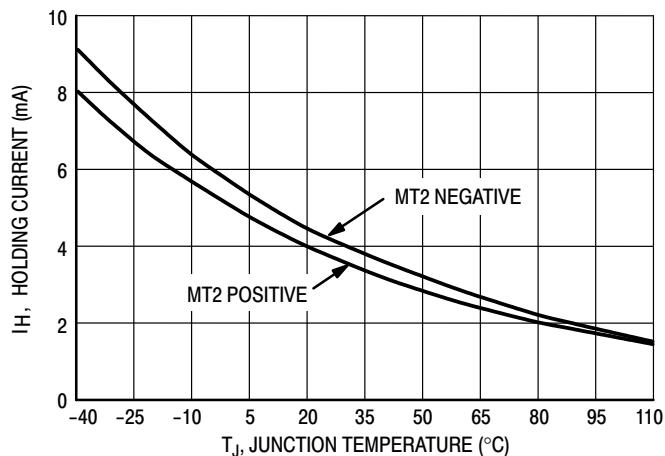


Figure 5. Typical Holding Current Versus Junction Temperature

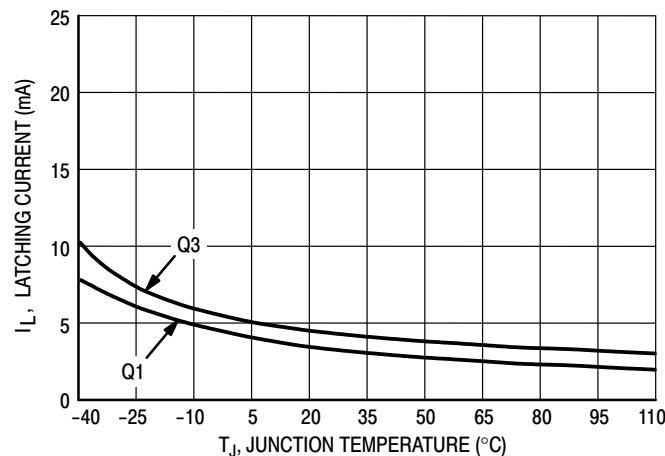


Figure 6. Typical Latching Current Versus Junction Temperature

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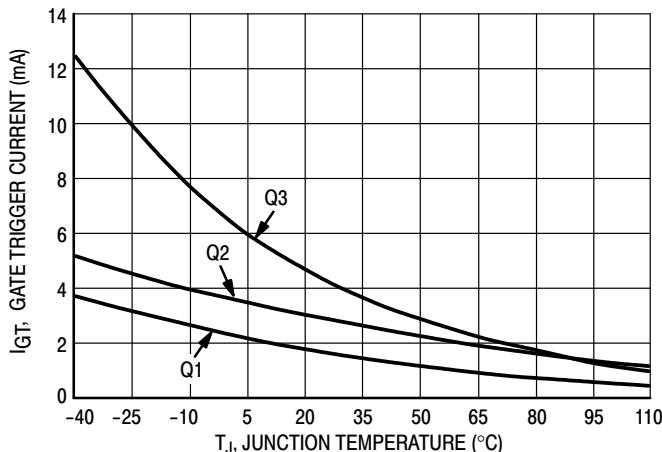


Figure 7. Typical Gate Trigger Current Versus Junction Temperature

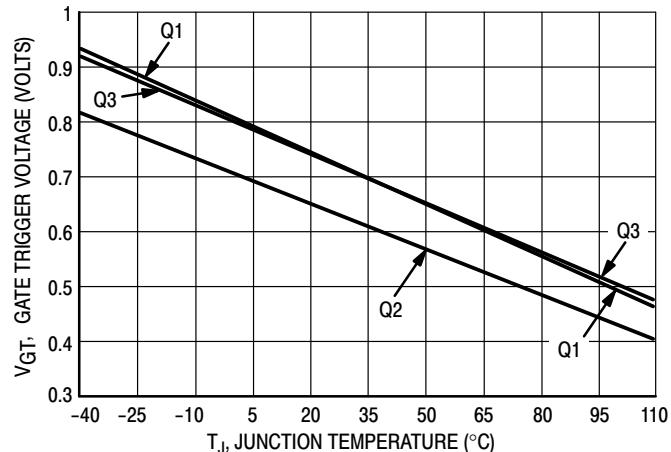


Figure 8. Typical Gate Trigger Voltage Versus Junction Temperature

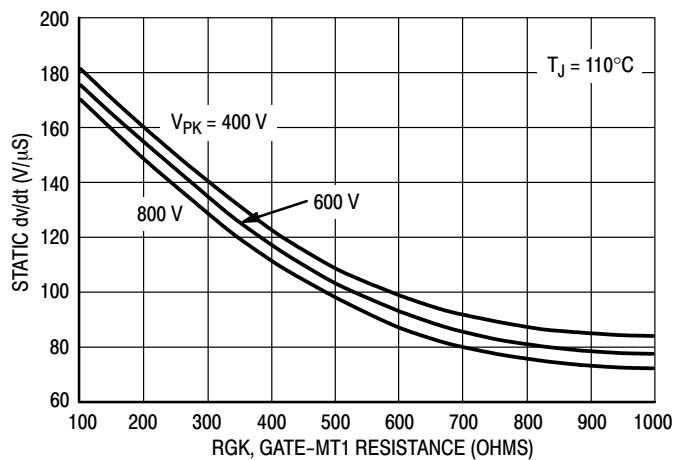


Figure 9. Typical Exponential Static dv/dt Versus Gate-MT1 Resistance, MT2(+)

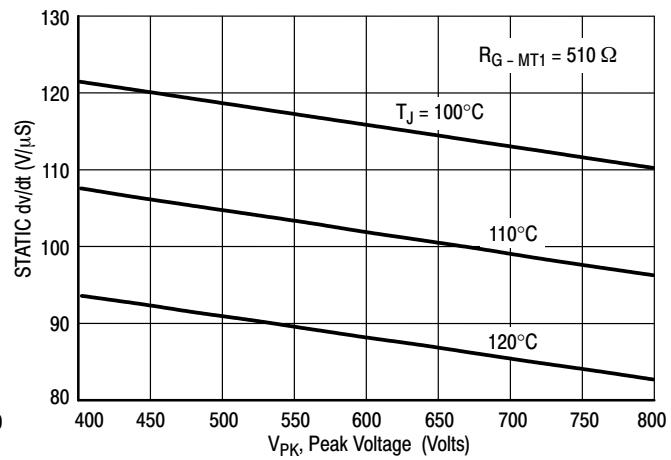


Figure 10. Typical Exponential Static dv/dt Versus Peak Voltage, MT2(+)

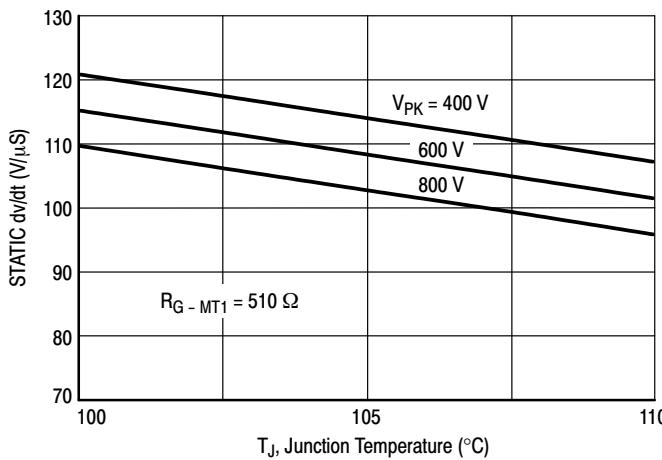


Figure 11. Typical Exponential Static dv/dt Versus Junction Temperature, MT2(+)

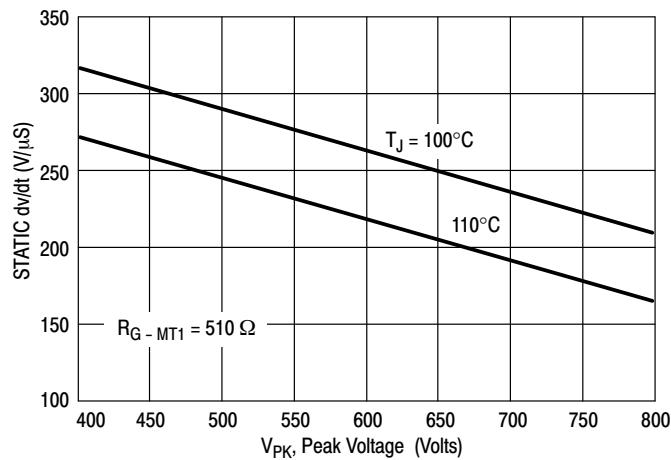


Figure 12. Typical Exponential Static dv/dt Versus Peak Voltage, MT2(-)

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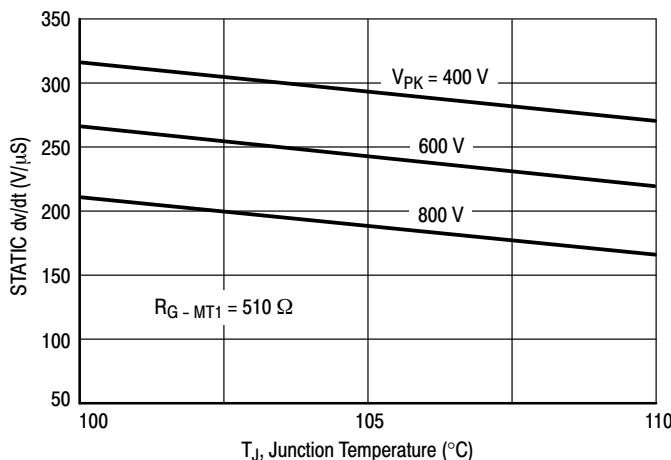


Figure 13. Typical Exponential Static  $dv/dt$  Versus Junction Temperature, MT2(-)

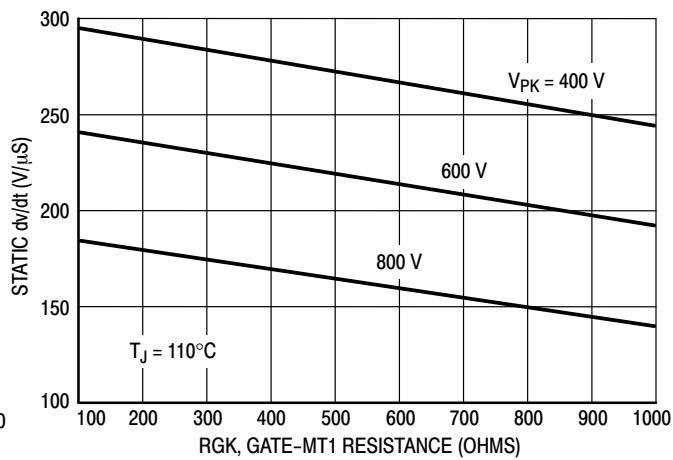


Figure 14. Typical Exponential Static  $dv/dt$  Versus Gate-MT1 Resistance, MT2(-)

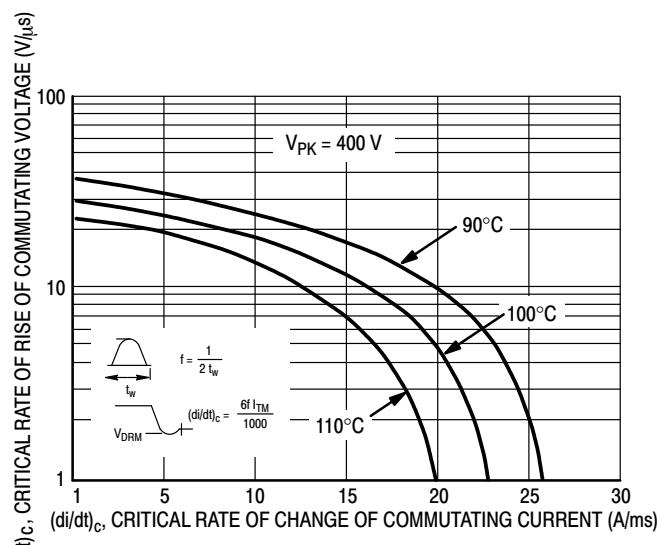
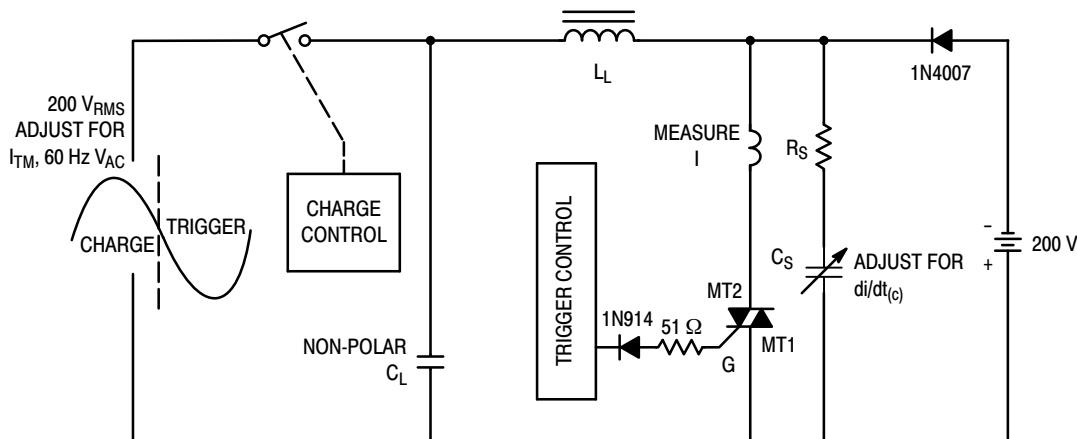


Figure 15. Critical Rate of Rise of Commutating Voltage



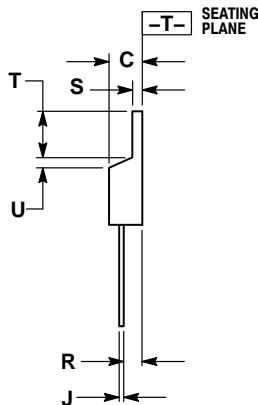
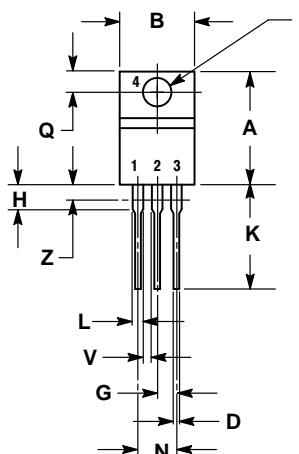
Note: Component values are for verification of rated  $(di/dt)_c$ . See AN1048 for additional information.

Figure 16. Simplified Test Circuit to Measure the Critical Rate of Rise of Commutating Current  $(di/dt)_c$

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## PACKAGE DIMENSIONS

TO-220  
CASE 221A-09  
ISSUE AH



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	0.415	9.66	10.53
C	0.160	0.190	4.07	4.83
D	0.025	0.038	0.64	0.96
F	0.142	0.161	3.61	4.09
G	0.095	0.105	2.42	2.66
H	0.110	0.161	2.80	4.10
J	0.014	0.024	0.36	0.61
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

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