

# MAC15SD, MAC15SM, MAC15SN

Preferred Device

## 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.

- Sensitive Gate allows Triggering by Microcontrollers and other Logic Circuits
- 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 15 A RMS at 70°C
- High Surge Current Capability - 120 A
- Blocking Voltage to 800 V
- Rugged, Economical TO220AB Package
- Uniform Gate Trigger Currents in Three Quadrants, Q1, Q2, and Q3
- Device Marking: Logo, Device Type, e.g., MAC15SD, Date Code

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

Rating	Symbol	Value	Unit
Peak Repetitive Off-State Voltage (Note 1) ( $T_J = -40$ to $110^\circ\text{C}$ , Sine Wave, 50 to 60 Hz, Gate Open)	$V_{DRM}$ , $V_{RRM}$	400 600 800	V
On-State RMS Current (Full Cycle Sine Wave, 60Hz, $T_J = 70^\circ\text{C}$ )	$I_{T(RMS)}$	15	A
Peak Non-repetitive Surge Current (One Full Cycle Sine Wave, 60 Hz, $T_J = 110^\circ\text{C}$ )	$I_{TSM}$	120	A
Circuit Fusing Consideration ( $t = 8.3$ ms)	$I^2t$	60	$\text{A}^2\text{s}$
Peak Gate Power (Pulse Width $\leq 1.0$ $\mu$ s, $T_C = 70^\circ\text{C}$ )	$P_{GM}$	20	W
Average Gate Power ( $t = 8.3$ ms, $T_C = 70^\circ\text{C}$ )	$P_{G(AV)}$	0.5	W
Operating Junction Temperature Range	$T_J$	- 40 to +110	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	- 40 to +150	$^\circ\text{C}$

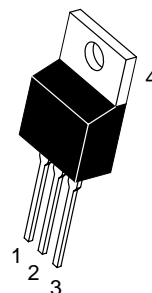
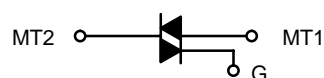
1.  $V_{DRM}$  and  $V_{RRM}$  for all types can be applied on a continuous basis. Blocking voltages shall not be tested with a constant current source such that the voltage ratings of the devices are exceeded.



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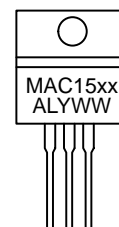
<http://onsemi.com>

**TRIACS**  
**15 AMPERES RMS**  
**400 thru 800 VOLTS**



**TO-220AB**  
**CASE 221A**  
Style 4

#### MARKING DIAGRAM



xx = Specific Device Code  
A = Assembly Location  
L = Wafer Lot  
Y = Year  
WW = Work Week

#### PIN ASSIGNMENT

1	Main Terminal 1
2	Main Terminal 2
3	Gate
4	Main Terminal 2

#### ORDERING INFORMATION

Device	Package	Shipping
MAC15SD	TO220AB	50 Units/Rail
MAC15SM	TO220AB	50 Units/Rail
MAC15SN	TO220AB	50 Units/Rail

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

# MAC15SD, MAC15SM, MAC15SN

## THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance - Junction to Case - Junction to Ambient	$R_{\theta JC}$ $R_{\theta JA}$	2.0 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
	$T_J = 25^{\circ}C$ $T_J = 110^{\circ}C$				

### ON CHARACTERISTICS

Peak On-State Voltage <sup>(1)</sup> ( $I_{TM} = \pm 21A$ )	$V_{TM}$	-	-	1.8	V
Gate Trigger Current (Continuous dc) ( $V_D = 12 V, R_L = 100\Omega$ ) MT2(+), G(+) MT2(+), G(-) MT2(-), G(-)	$I_{GT}$	- - -	2.0 3.0 3.0	5.0 5.0 5.0	mA
Hold Current ( $V_D = 12 V, \text{ Gate Open, Initiating Current} = \pm 150mA$ )	$I_H$	-	3.0	10	mA
Latching Current ( $V_D = 24V, I_G = 5mA$ ) MT2(+), G(+) MT2(+), G(-) MT2(-), G(-)	$I_L$	- - -	5.0 10 5.0	15 20 15	mA
Gate Trigger Voltage (Continuous dc) ( $V_D = 12 V, R_L = 100\Omega$ ) MT2(+), G(+) MT2(+), G(-) MT2(-), G(-)	$V_{GT}$	0.45 0.45 0.45	0.62 0.60 0.65	1.5 1.5 1.5	V

### DYNAMIC CHARACTERISTICS

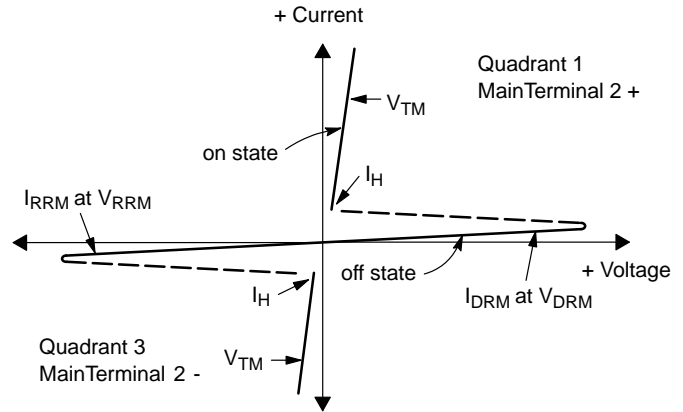
Rate of Change of Commutating Current ( $V_D = 400V, I_{TM} = 3.5A, \text{ Commutating } dv/dt = 10V\mu\text{sec},$ Gate Open, $T_J = 110^{\circ}C, f = 500Hz, \text{ Snubber: } C_S = 0.01 \mu F, R_S = 15\Omega,$ see Figure 15.)	$(di/dt)_c$	8.0	10	-	A/ms
Critical Rate of Rise of Off-State Voltage ( $V_D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

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

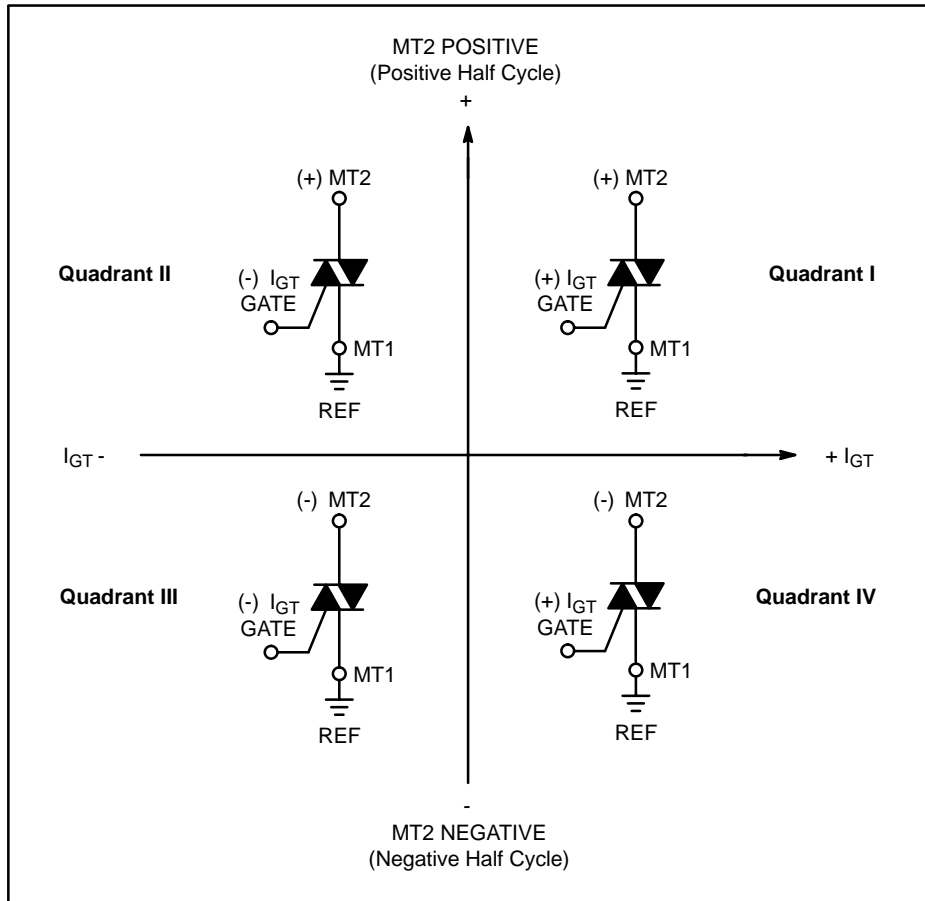
# MAC15SD, MAC15SM, MAC15SN

## 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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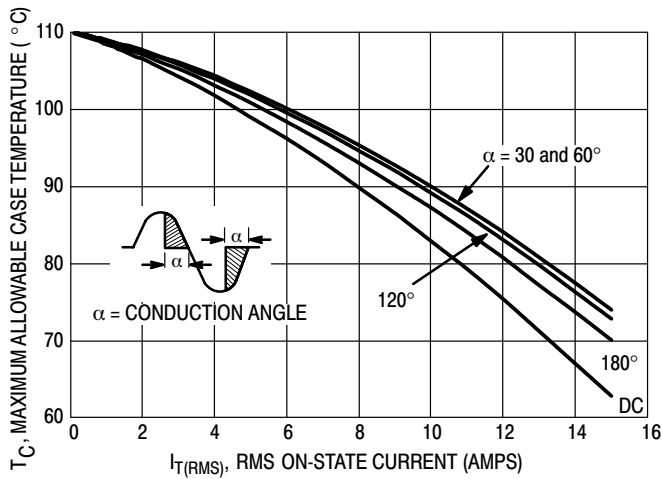


Figure 1. RMS Current Derating

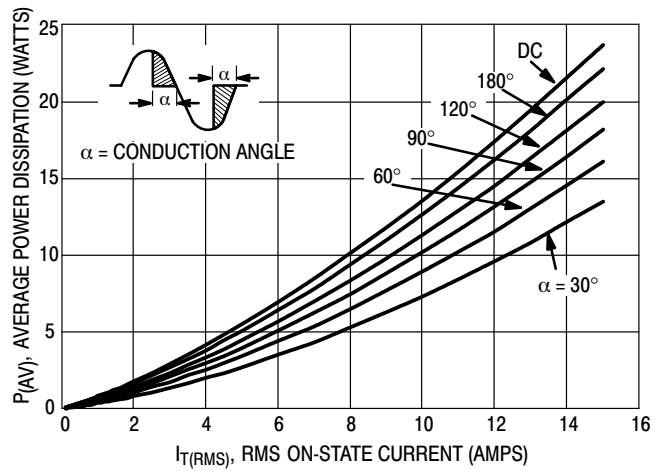


Figure 2. Maximum On-State Power Dissipation

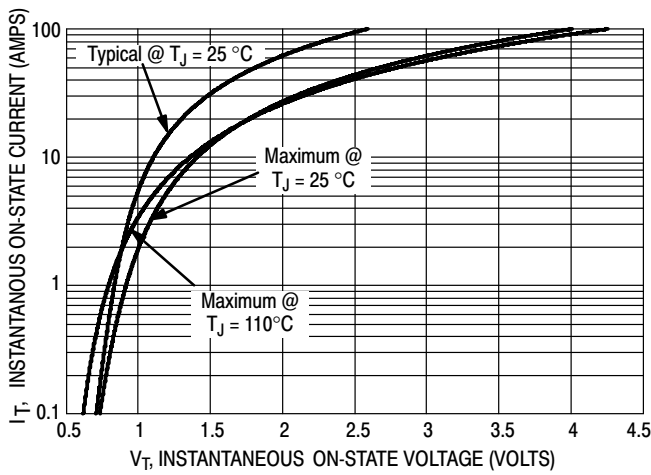


Figure 3. On-State Characteristics

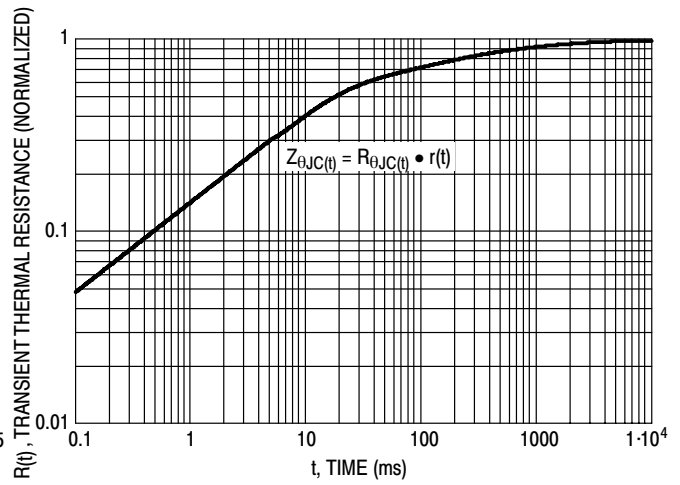


Figure 4. Transient Thermal Response

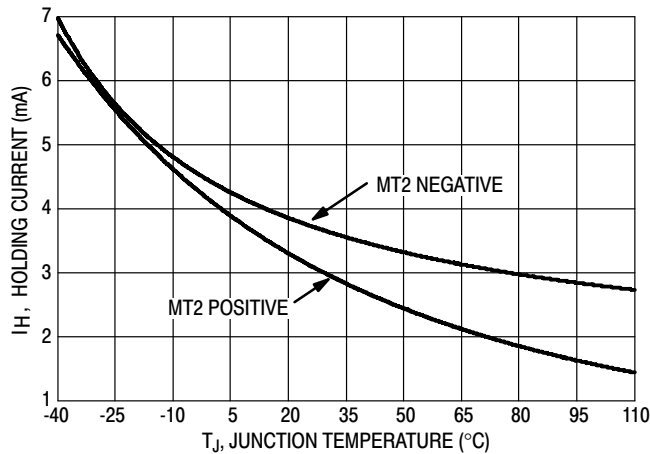


Figure 5. Typical Holding Current Versus Junction Temperature

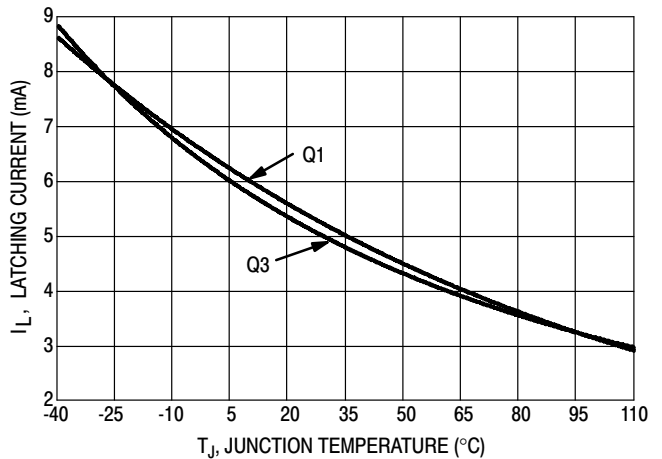
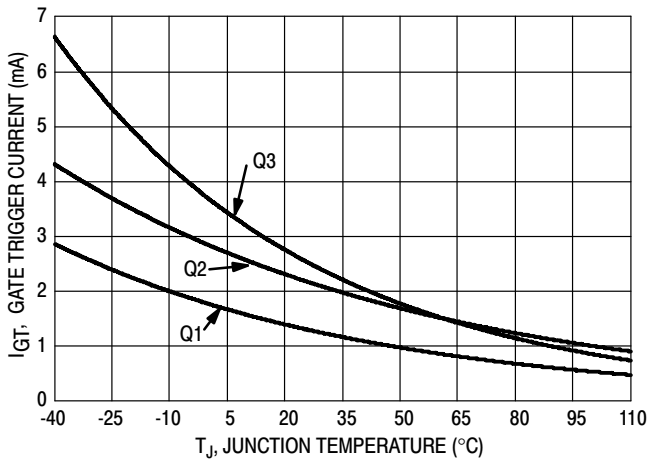
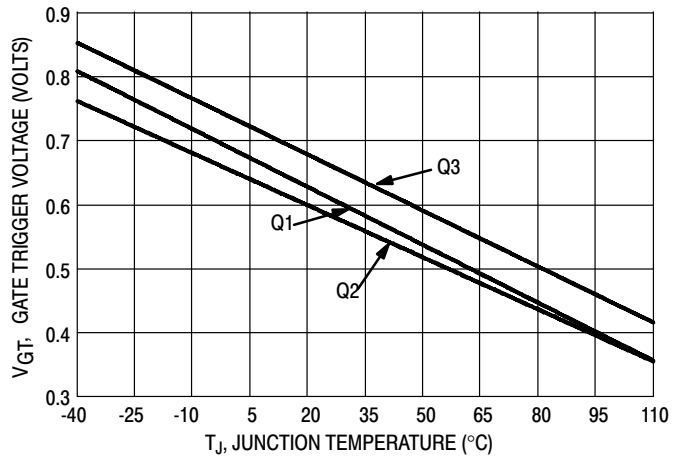


Figure 6. Typical Latching Current Versus Junction Temperature

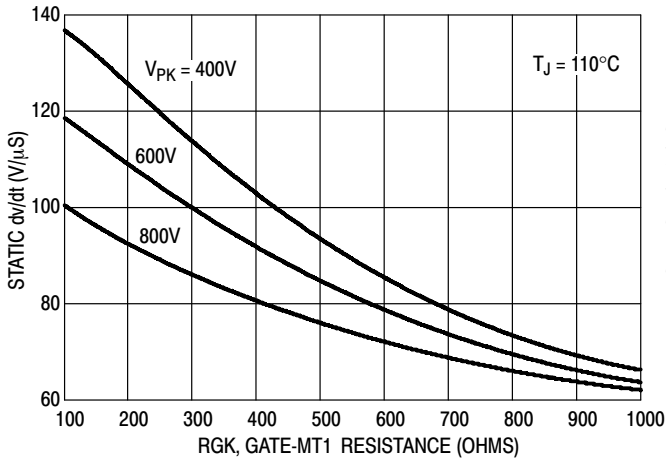
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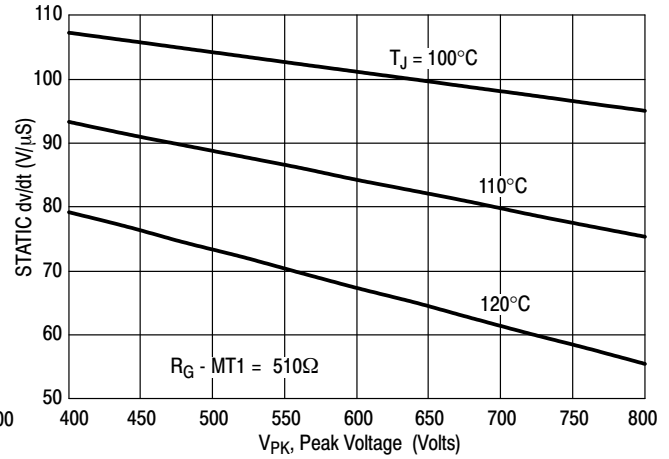
**Figure 7. Typical Gate Trigger Current Versus Junction Temperature**



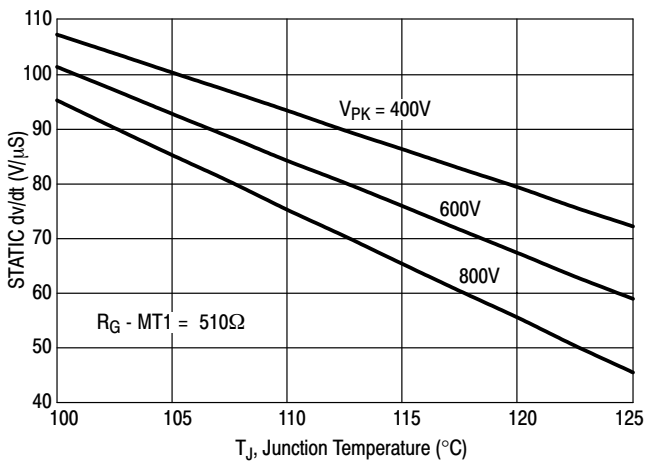
**Figure 8. Typical Gate Trigger Voltage Versus Junction Temperature**



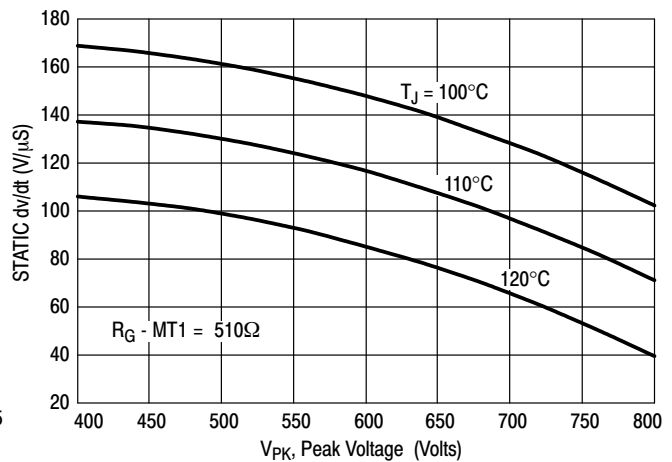
**Figure 9. Typical Exponential Static dv/dt Versus Gate-MT1 Resistance, MT2(+)**



**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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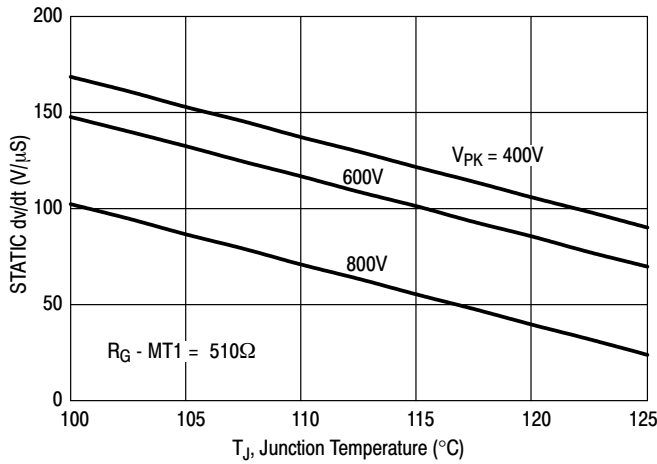


Figure 13. Typical Exponential Static dv/dt Versus Junction Temperature, MT2(-)

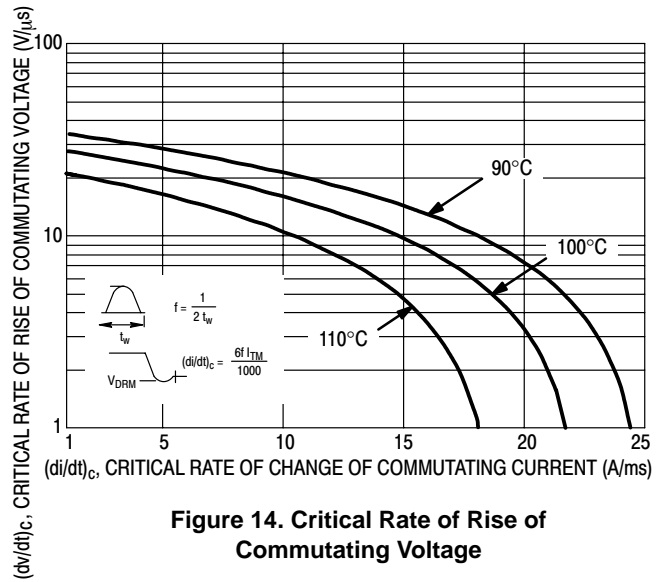


Figure 14. Critical Rate of Rise of Commutating Voltage

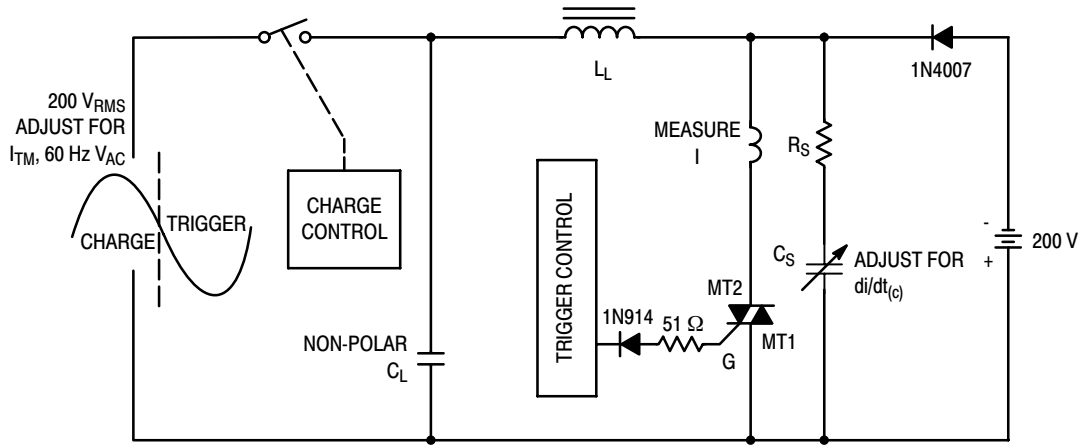


Figure 15. Simplified Test Circuit to Measure the Critical Rate of Rise of Commutating Current (di/dt)<sub>c</sub>

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## PACKAGE DIMENSIONS

TO-220AB  
CASE 221A-09  
ISSUE AA



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

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