

# MAC223A6FP, MAC223A8FP, MAC223A10FP

Preferred Device




**ON Semiconductor**

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
## Triacs

### Silicon Bidirectional Thyristors

Designed primarily for full-wave ac control applications, such as lighting systems, heater controls, motor controls and power supplies; or wherever full-wave silicon-gate-controlled devices are needed.


- Off-State Voltages to 800 Volts
- All Diffused and Glass Passivated Junctions for Parameter Uniformity and Stability
- Small, Rugged Thermowatt Construction for Thermal Resistance and High Heat Dissipation
- Gate Triggering Guaranteed in Four Modes
-  Indicates UL Registered — File #E69369
- Device Marking: Logo, Device Type, e.g., MAC223A6FP, Date Code

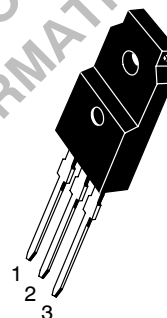
#### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Peak Repetitive Off-State Voltage <sup>(1)</sup> ( $T_J = -40$ to $+125^\circ\text{C}$ , Sine Wave 50 to 60 Hz, Gate Open)	$V_{DRM}$ , $V_{RRM}$		Volts
	MAC223A6FP	400	
	MAC223A8FP	600	
	MAC223A10FP	800	
On-State RMS Current ( $T_C = +80^\circ\text{C}$ ) <sup>(2)</sup> Full Cycle Sine Wave 50 to 60 Hz	$I_{T(RMS)}$	25	Amps
Peak Non-repetitive Surge Current (One Full Cycle, 60 Hz, $T_C = 80^\circ\text{C}$ ) Preceded and followed by rated current	$I_{TSM}$	250	Amps
Circuit Fusing ( $t = 8.3$ ms)	$I^2t$	260	$\text{A}^2\text{s}$
Peak Gate Power ( $t \leq 2$ $\mu\text{sec}$ ; $T_C = +80^\circ\text{C}$ )	$P_{GM}$	20	Watts
Average Gate Power ( $t = 8.3$ ms; $T_C = +80^\circ\text{C}$ )	$P_{G(AV)}$	0.5	Watt
Peak Gate Current ( $t \leq 2$ $\mu\text{sec}$ ; $T_C = +80^\circ\text{C}$ )	$I_{GM}$	2.0	Amps
Peak Gate Voltage ( $t \leq 2$ $\mu\text{sec}$ ; $T_C = +80^\circ\text{C}$ )	$V_{GM}$	$\pm 10$	Volts
RMS Isolation Voltage ( $T_A = 25^\circ\text{C}$ , Relative Humidity $\leq 20\%$ ) 	$V_{(ISO)}$	1500	Volts
Operating Junction Temperature	$T_J$	-40 to +125	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-40 to +150	$^\circ\text{C}$
Mounting Torque	—	8.0	in. lb.

(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.

(2) The case temperature reference point for all  $T_C$  measurements is a point on the center lead of the package as close as possible to the plastic body.

**ISOLATED TRIAC **  
**25 AMPERES RMS**  
**400 thru 800 VOLTS**



**ISOLATED TO-220 Full Pack**  
**CASE 221C**  
**STYLE 3**

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

#### ORDERING INFORMATION

Device	Package	Shipping
MAC223A6FP	ISOLATED TO220FP	500/Box
MAC223A8FP	ISOLATED TO220FP	500/Box
MAC223A10FP	ISOLATED TO220FP	500/Box

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

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## THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.2	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Case to Sink	$R_{\theta CS}$	2.2	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	60	$^{\circ}\text{C}/\text{W}$
Maximum Lead Temperature for Soldering Purposes 1/8" from Case for 10 Seconds	$T_L$	260	$^{\circ}\text{C}$

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

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Peak Repetitive Blocking Current ( $V_D = \text{Rated } V_{DRM}, V_{RRM}; \text{ Gate Open}$ )	$T_J = 25^{\circ}\text{C}$	$I_{DRM}$	—	—	10	$\mu\text{A}$
	$T_J = 125^{\circ}\text{C}$	$I_{RRM}$	—	—	2.0	$\text{mA}$

### ON CHARACTERISTICS

Peak On-State Voltage ( $I_{TM} = \pm 35 \text{ A Peak, Pulse Width} \leq 2 \text{ ms; Duty Cycle} \leq 2\%$ )	$V_{TM}$	—	1.4	1.85	Volts
Gate Trigger Current (Continuous dc) ( $V_D = 12 \text{ V, } R_L = 100 \Omega$ ) MT2(+), G(+); MT2(-), G(-); MT2(+), G(-) MT2(-), G(+)	$I_{GT}$	—	20	50	$\text{mA}$
		—	30	75	
Gate Trigger Voltage (Continuous dc) ( $V_D = 12 \text{ V, } R_L = 100 \Omega$ ) MT2(+), G(+); MT2(-), G(-); MT2(+), G(-) MT2(-), G(+)	$V_{GT}$	—	1.1	2.0	Volts
		—	1.3	2.5	
Gate Non-trigger Voltage ( $V_D = 12 \text{ V, } T_J = 125^{\circ}\text{C, } R_L = 100 \Omega$ ) All Quadrants	$V_{GD}$	0.2	0.4	—	Volts
Holding Current ( $V_D = 12 \text{ Vdc, Gate Open, Initiating Current} = \pm 200 \text{ mA}$ )	$I_H$	—	10	50	$\text{mA}$
Gate Controlled Turn-On Time ( $V_D = \text{Rated } V_{DRM}, I_{TM} = 35 \text{ A Peak, } I_G = 200 \text{ mA}$ )	$t_{gt}$	—	1.5	—	$\mu\text{s}$

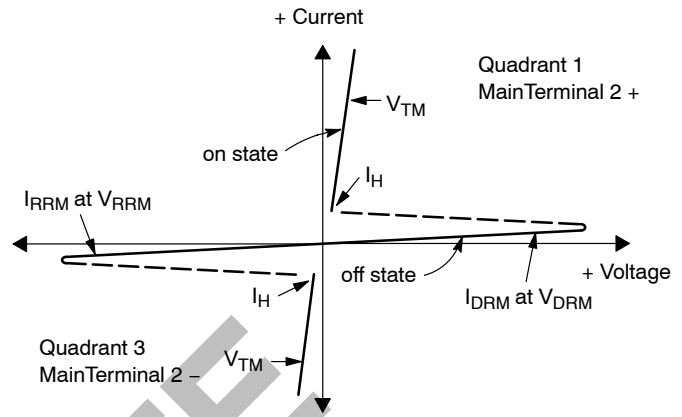
### DYNAMIC CHARACTERISTICS

Critical Rate of Rise of Off-State Voltage ( $V_D = \text{Rated } V_{DRM}, \text{ Exponential Waveform, } T_C = 125^{\circ}\text{C}$ )	$dv/dt$	—	40	—	$\text{V}/\mu\text{s}$
Critical Rate of Rise of Commutation Voltage ( $V_D = \text{Rated } V_{DRM}, I_{TM} = 35 \text{ A Peak, Commutating } di/dt = 12.6 \text{ A/ms, Gate Unenergized, } T_C = 80^{\circ}\text{C}$ )	$dv/dt(c)$	—	5.0	—	$\text{V}/\mu\text{s}$

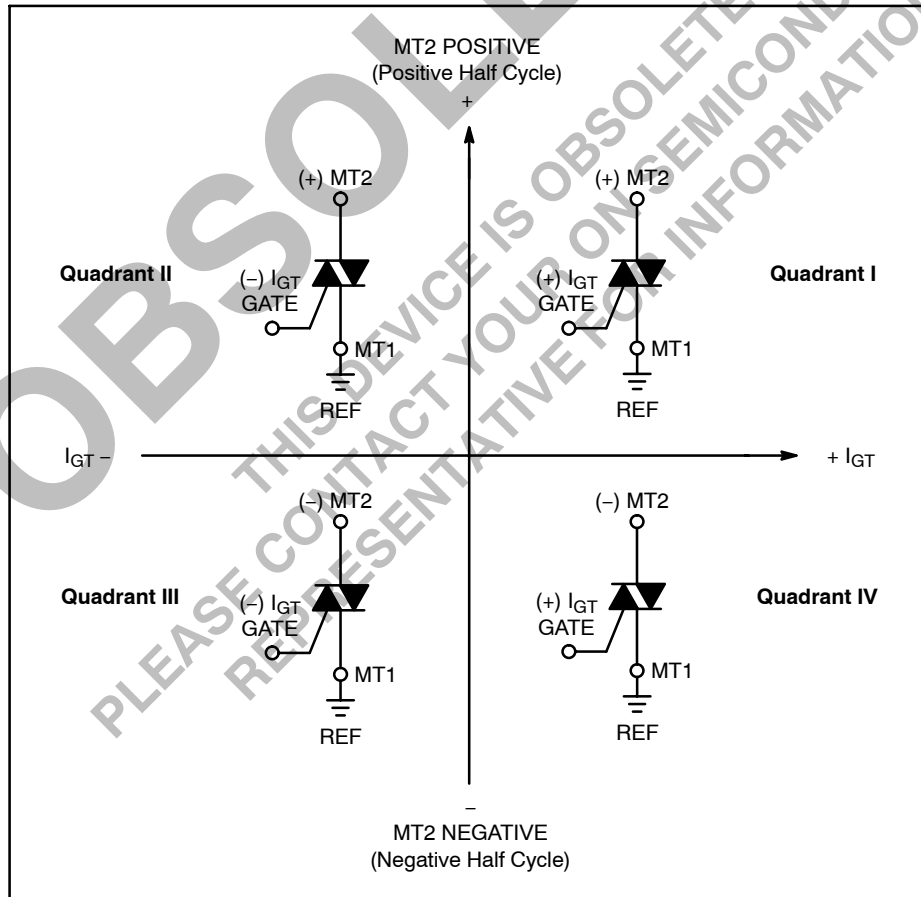
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## Voltage Current Characteristic of Triacs (Bidirectional Device)

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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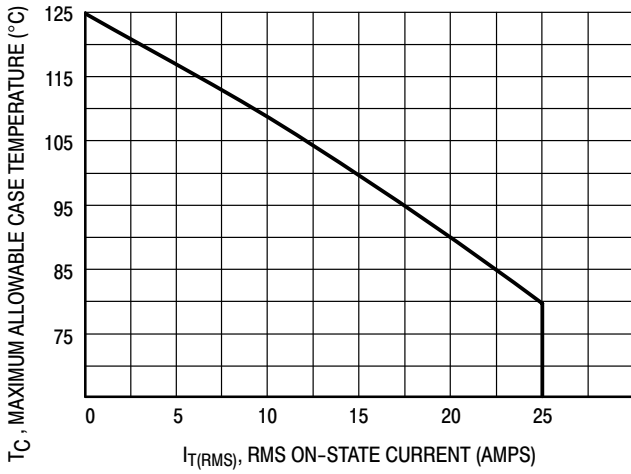


Figure 1. RMS Current Derating

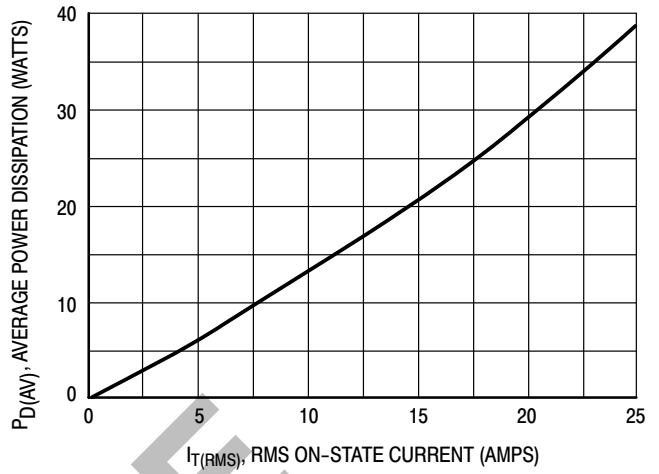


Figure 2. On-State Power Dissipation

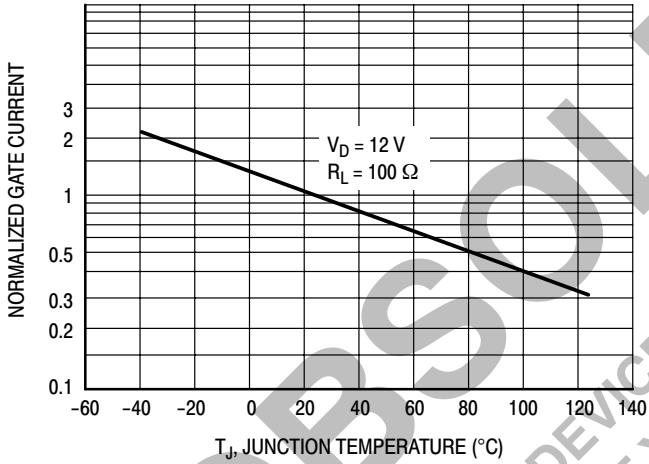


Figure 3. Typical Gate Trigger Current

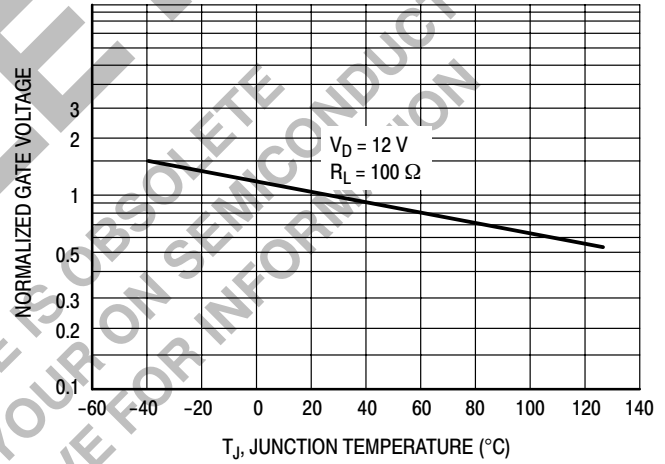


Figure 4. Typical Gate Trigger Voltage

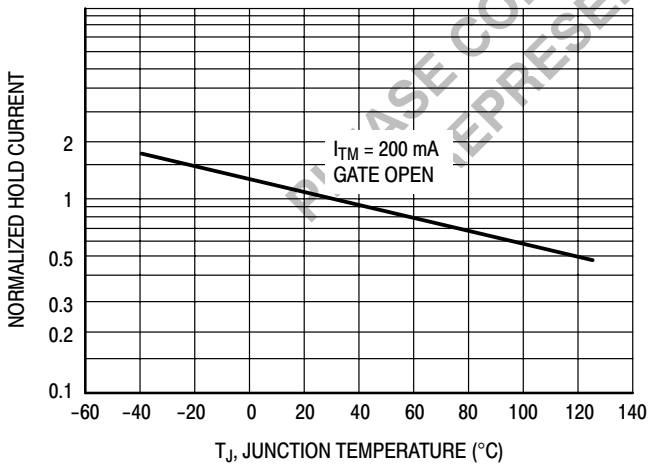


Figure 5. Typical Hold Current

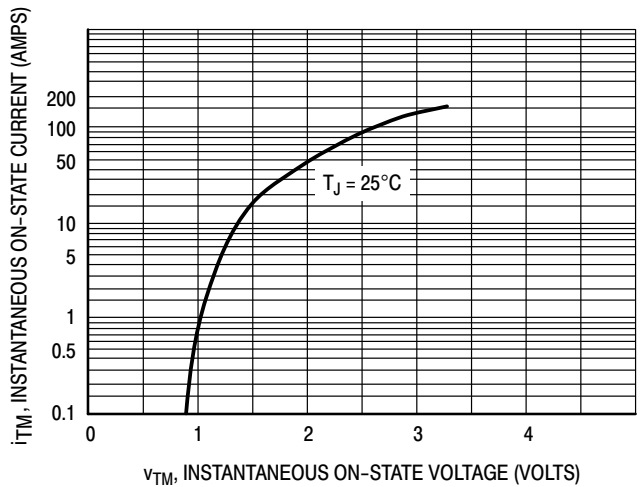
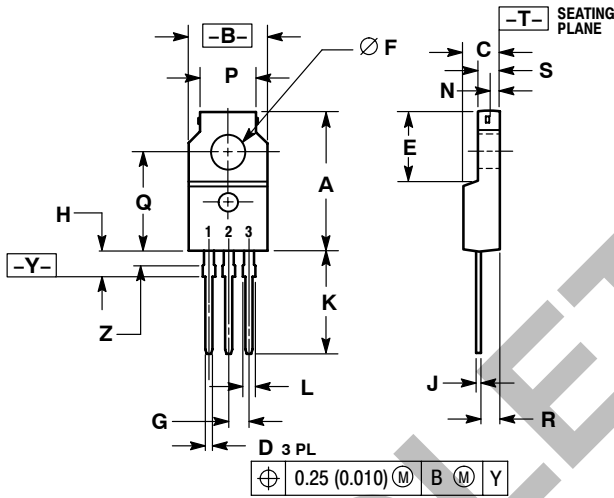


Figure 6. Typical On-State Characteristics

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## PACKAGE DIMENSIONS

### ISOLATED TO-220 Full Pack CASE 221C-02 ISSUE C



**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. LEAD DIMENSIONS UNCONTROLLED WITHIN DIMENSION Z.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.680	0.700	17.28	17.78
B	0.388	0.408	9.86	10.36
C	0.175	0.195	4.45	4.95
D	0.025	0.040	0.64	1.01
E	0.340	0.355	8.64	9.01
F	0.140	0.150	3.56	3.81
G	0.100 BSC		2.54 BSC	
H	0.110	0.155	2.80	3.93
J	0.018	0.028	0.46	0.71
K	0.500	0.550	12.70	13.97
L	0.045	0.070	1.15	1.77
N	0.049	---	1.25	---
P	0.270	0.290	6.86	7.36
Q	0.480	0.500	12.20	12.70
R	0.090	0.120	2.29	3.04
S	0.105	0.115	2.67	2.92
Z	0.070	0.090	1.78	2.28

**STYLE 3:**

- PIN 1: MT 1
- 2: MT 2
- 3: GATE

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