



MAC12SM, MAC12SN



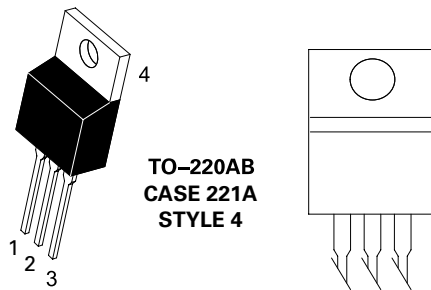
Description

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.

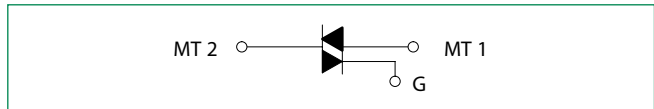
Features

- Uniform Gate Trigger Currents in Three Quadrants, Q1, Q2, and Q3
- High Commutating di/dt and High Immunity to dv/dt @ 125°C
- Minimizes Snubber Networks for Protection
- Blocking Voltage to 800 Volts
- On-State Current Rating of 12 Amperes RMS at 80°C
- High Surge Current Capability – 100 Amperes
- Industry Standard TO-220AB Package for Ease of Design
- Glass Passivated Junctions for Reliability and Uniformity
- These Devices are Pb-Free and are RoHS Compliant

Pin Out



Functional Diagram



Additional Information



Datasheet



Resources



Samples

Maximum Ratings ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Rating		Symbol	Value	Unit
Peak Repetitive Off-State Voltage (Note 1) (Gate Open, Sine Wave 50 to 60 Hz, $T_J = -25^\circ\text{C}$ to 100°C)	MAC12HCDG MAC12HCMG	V_{DRM} V_{RRM}	400 600	V
On-State RMS Current (Full Cycle Sine Wave, 60 Hz, $T_C = 70^\circ\text{C}$)		$I_T (RMS)$	12	A
Peak Non-Repetitive Surge Current (One Full Cycle Sine Wave, 60 Hz, $T_C = 125^\circ\text{C}$)		I_{TSM}	90	A
Circuit Fusing Consideration ($t = 8.3$ ms)		I^2t	33	A ² sec
Peak Gate Power (Pulse Width ≤ 1.0 μs , $T_C = 80^\circ\text{C}$)		P_{GM}	16	W
Average Gate Power ($t = 8.3$ ms, $T_C = 80^\circ\text{C}$)		$P_{G(AV)}$	0.35	W
Operating Junction Temperature Range		T_J	-40 to +110	$^\circ\text{C}$
Storage Temperature Range		T_{stg}	-40 to +150	$^\circ\text{C}$

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. V_{DRM} and V_{RRM} for all types can be applied on a continuous basis. Ratings apply for zero or negative gate voltage; however, positive gate voltage shall not be applied concurrent with negative potential on the anode. Blocking voltages shall not be tested with a constant current source such that the voltage ratings of the devices are exceeded.

Thermal Characteristics

Rating		Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (AC) Junction-to-Ambient		$R_{\theta JC}$ $R_{\theta JA}$	2.2 62.5	$^\circ\text{C}/\text{W}$
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds		T_L	260	$^\circ\text{C}$

Electrical Characteristics - OFF ($T_J = 25^\circ\text{C}$ unless otherwise noted ; Electricals apply in both directions)

Characteristic		Symbol	Min	Typ	Max	Unit
Peak Repetitive Blocking Current ($V_D = V_{DRM} = V_{RRM}$; Gate Open)	$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$	I_{DRM} I_{RRM}	- -	- -	0.01 2.0	mA

Electrical Characteristics - ON ($T_J = 25^\circ\text{C}$ unless otherwise noted; Electricals apply in both directions)

Characteristic		Symbol	Min	Typ	Max	Unit
Peak On-State Voltage (Note 2) ($I_{TM} = \pm 11$ A)		V_{TM}	-	1.2	1.85	V
Gate Trigger Current (Continuous dc) ($V_D = 12$ V, $R_L = 100$ Ω)	MT2(+), G(+) MT2(+), G(-) MT2(-), G(-)	I_{GT}	- - -	13 13 13	5.0 5.0 5.0	mA
Holding Current ($V_D = 12$ V, Gate Open, Initiating Current = ± 150 mA)		I_H	-	30	10	mA
Latching Current ($V_D = 24$ V, $I_G = 50$ mA)	MT2(+), G(+) MT2(+), G(-) MT2(-), G(-)	I_L	- - -	20 30 20	15 20 15	mA
Gate Trigger Voltage ($V_D = 12$ V, $R_L = 100$ Ω)	MT2(+), G(+) MT2(+), G(-) MT2(-), G(-)	V_{GT}	0.45 0.45 0.45	0.68 0.62 0.67	1.5 1.5 1.5	V

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.

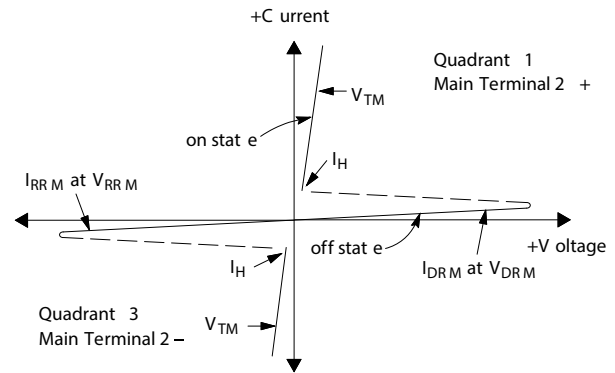
2. Indicates Pulse Test: Pulse Width ≤ 2.0 ms, Duty Cycle $\leq 2\%$.

Dynamic Characteristics

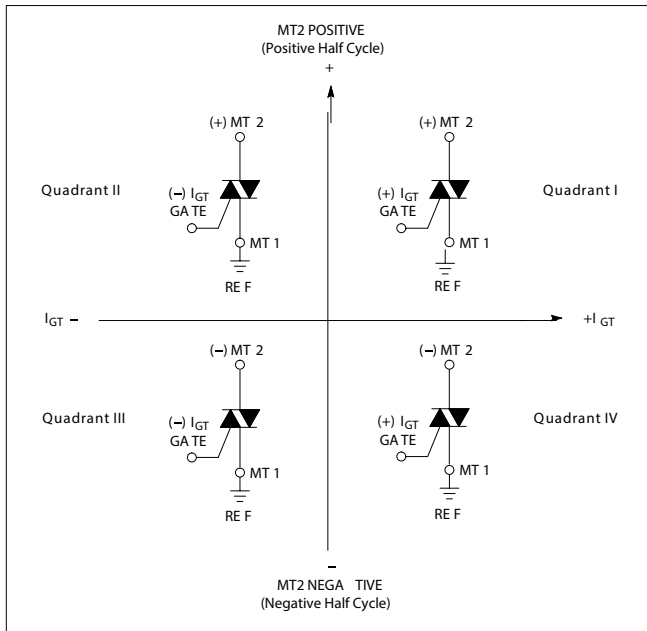
Characteristic	Symbol	Min	Typ	Max	Unit
Rate of Change of Commutating Current See Figure 10. 400 V, $I_{TM} = 4.4$ A, Commutating $dv/dt = 18$ V/ μ s, Gate Open, $T_j = 125^\circ\text{C}$, $f = 250$ Hz, No Snubber) $C_L = 10$ μ F $L_L = 40$ mH	dV/dt	8.0	10	–	A/ms
Critical Rate of Rise of Off-State Voltage (VD = Rated VDRM, Exponential Waveform, Gate Open, $T_J = 125^\circ\text{C}$)	dV/dt	15	40	–	V/ μ s
Repetitive Critical Rate of Rise of On-State Current IPK = 50 A; PW = 40 μ sec; $di/dt = 100$ mA/ μ sec; $I_{gt} = 100$ mA; $f = 60$ Hz	di/dt	–	–	10	A/ μ s

Voltage Current Characteristic of SCR

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

Figure 1. Typical Gate Trigger Current vs Junction Temperature

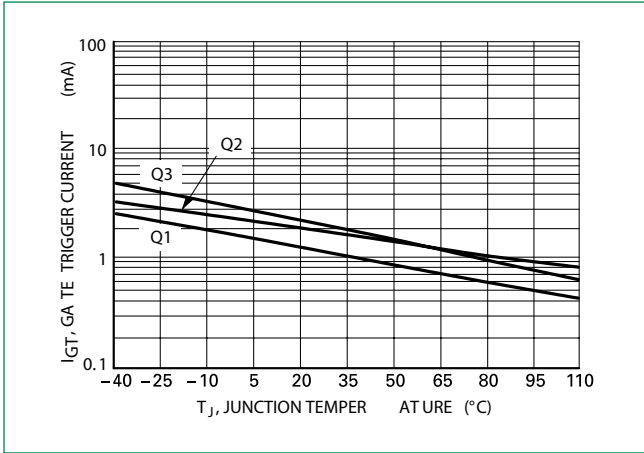


Figure 2. Typical Gate Trigger Voltage vs Junction Temperature

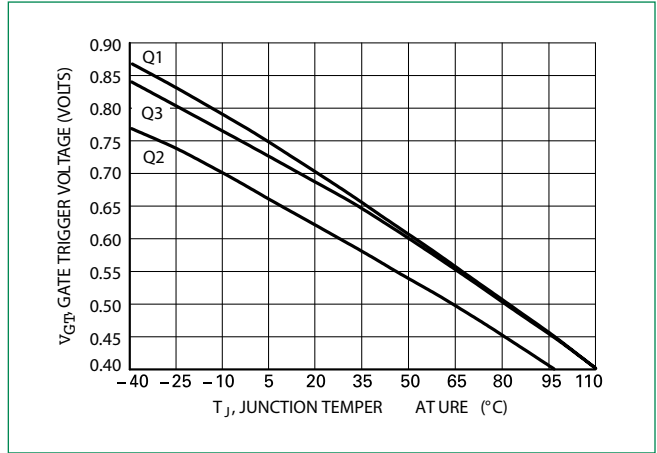


Figure 3. Typical Holding Current vs Junction Temperature

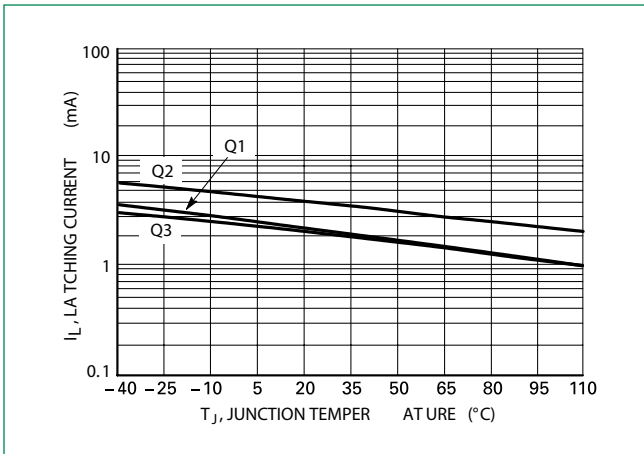


Figure 4. Typical Latching Current vs Junction Temperature

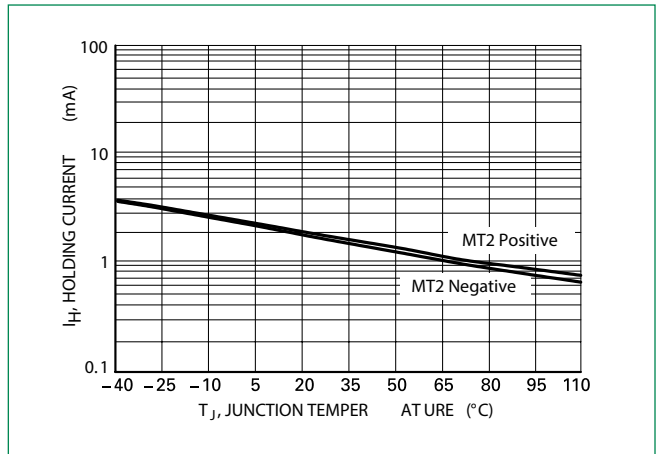


Figure 5. Typical RMS Current Derating

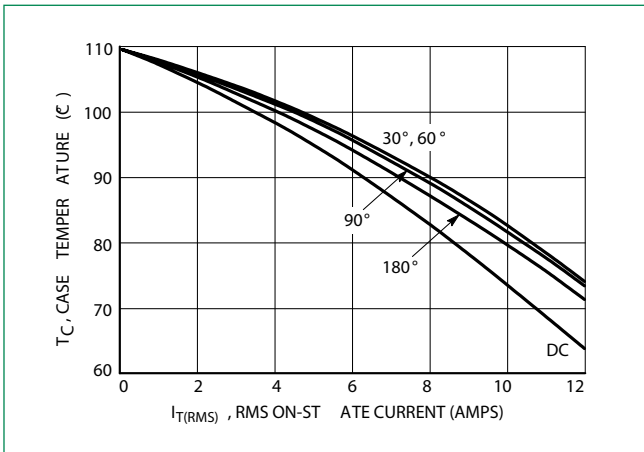


Figure 6. On-State Power Dissipation

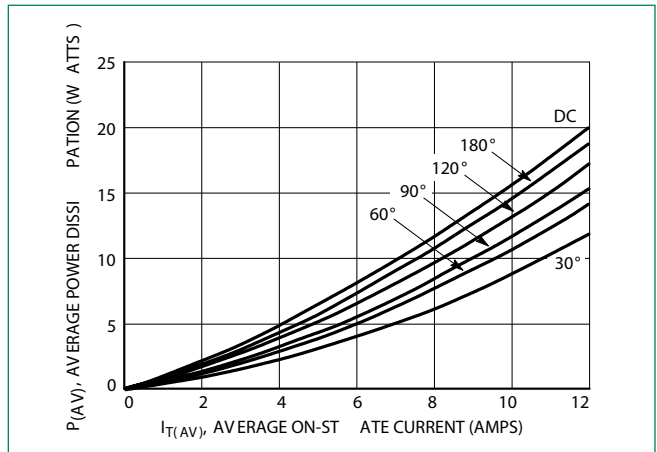


Figure 7. Typical On-State Characteristics

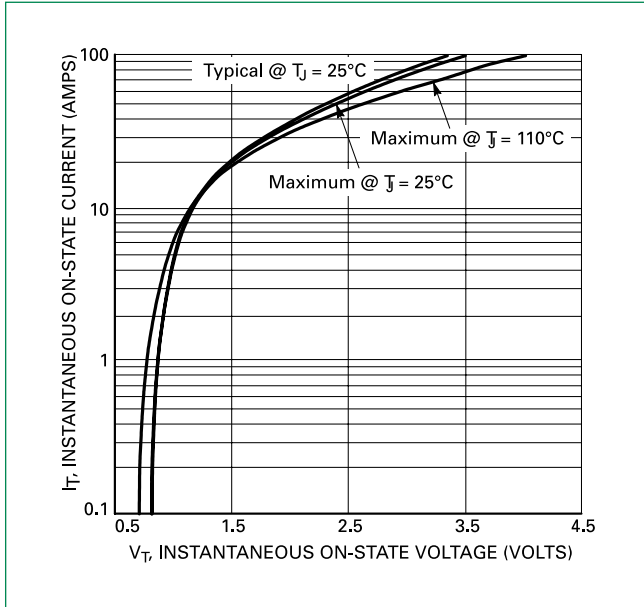
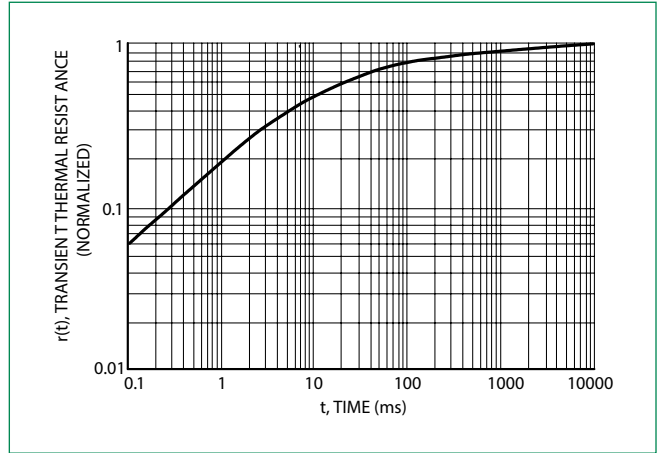
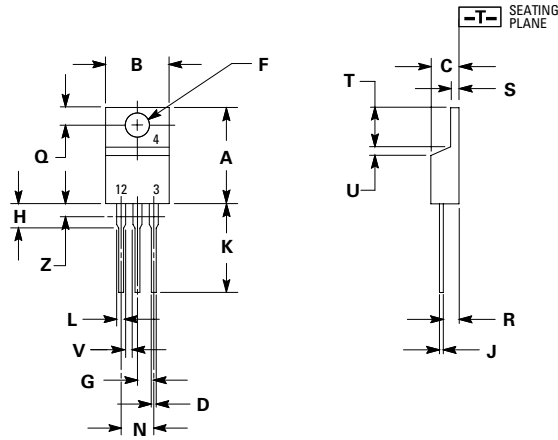


Figure 8. Typical Thermal Response



Dimensions

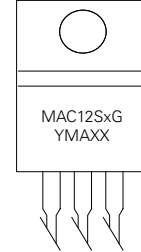


Part Marking System



**TO-220AB
CASE 221A
STYLE 12**

x =M or N
Y =Year
M =Month
A =Assembly Site
XX =Lot Serial Code
G =Pb-Free Package



Dim	Inches		Millimeters	
	Min	Max	Min	Max
A	0.590	0.620	14.99	15.75
B	0.380	0.420	9.65	10.67
C	0.178	0.188	4.52	4.78
D	0.025	0.035	0.64	0.89
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.41	2.67
H	0.110	0.130	2.79	3.30
J	0.018	0.024	0.46	0.61
K	0.540	0.575	13.72	14.61
L	0.060	0.075	1.52	1.91
N	0.195	0.205	4.95	5.21
Q	0.105	0.115	2.67	2.92
R	0.085	0.095	2.16	2.41
S	0.045	0.060	1.14	1.52
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

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.

Pin Assignment	
1	Main Terminal 1
2	Main Terminal 2
3	Gate
4	No Connection

Ordering Information

Device	Package	Shipping
MAC12SMG	TO-220AB (Pb-Free)	500 Units / Rail
MAC12SNG		

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Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru

moschip.ru_4

moschip.ru_6

moschip.ru_9