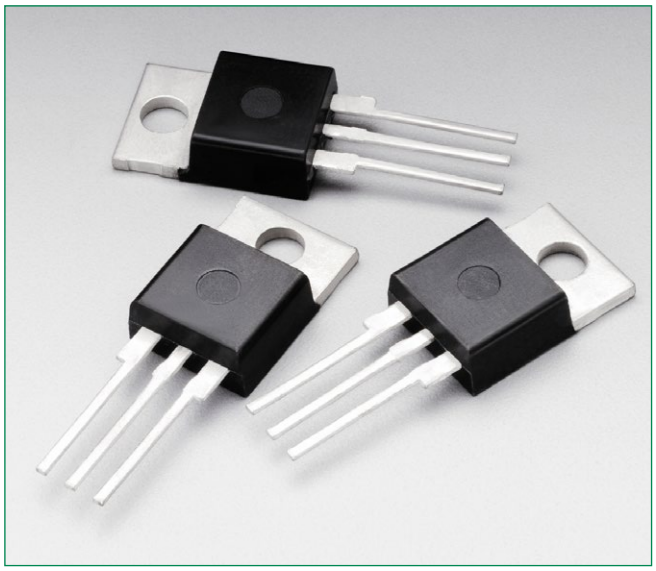
MAC12D, MAC12M, MAC12N



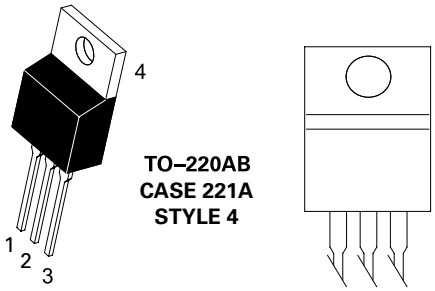
Description

Designed for high performance full–wave ac control applications where high noise immunity and commutating di/dt are required.

Features

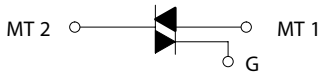
- Blocking Voltage to 800 Volts
- On–State Current Rating of 12 Amperes RMS at 70°C
- Uniform Gate Trigger Currents in Three Quadrants, Q1, Q2, and Q3
- High Immunity to dv/dt – 250 V/µs Minimum at 125°C
- High Commutating di/dt – 6.5 A/ms Minimum at 125°C
- Industry Standard TO–220 Package
- High Surge Current Capability – 100 Amperes
- These Devices are Pb–Free and are RoHS Compliant

Pin Out



TO–220AB
CASE 221A
STYLE 4

Functional Diagram



Additional Information

Datasheet | **Resources** | **Samples**

Revised: 06/18/19

Maximum Ratings (T_J = 25°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° to 100°C)	MAC12D MAC12M MAC12N	V_{DRM}, V_{RRM}	400 600 800	V
On-State RMS Current (Full Cycle Sine Wave, 60 Hz, T_C = 70°C)		$I_{T\ (RMS)}$	10	A
Peak Non-Repetitive Surge Current (One Full Cycle Sine Wave, 60 Hz, T_C= 125°C)		I_{TSM}	100	A
Circuit Fusing Consideration (t = 8.3 ms)		I^2t	41	A^2sec
Peak Gate Power (Pulse Width ≤ 1.0 µs, T_C = 80°C)		P_{GM}	16	W
Average Gate Power (t = 8.3 ms, T_C = 80°C)		$P_{G(AV)}$	0.35	W
Operating Junction Temperature Range		T_J	-40 to +125	°C
Storage Temperature Range		T_{stg}	-40 to +125	°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	°C/W
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds		T_L	260	°C

Electrical Characteristics - OFF (T_J = 25°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°C	I_{DRM}, I_{RRM}	-	-	0.01	mA
	T_J = 125°C		-	-	2.0	

Electrical Characteristics - ON (T_J = 25°C unless otherwise noted; Electricals apply in both directions)

Characteristic		Symbol	Min	Typ	Max	Unit
Peak On–State Voltage (Note 2) (I_{TM} = ±11 A)		V_{TM}	–	1.2	1.6	V
Gate Trigger Current (Continuous dc) (V_D = 12 V, R_L = 100 Ω)	MT2(+), G(+)	I_{GT}	5.0	13	35	mA
	MT2(+), G(–)		5.0	13	35	
	MT2(–), G(–)		5.0	13	35	
Holding Current (V_D = 12 V, Gate Open, Initiating Current = ±150 mA))		I_H	–	30	40	mA
Latching Current (V_D = 24 V, I_G = 50 mA)	MT2(+), G(+)	I_L	_	20	50	mA
	MT2(+), G(–)		_	30	80	
	MT2(–), G(–)		_	20	50	
Gate Trigger Voltage (V_D = 12 V, R_L = 100 Ω)	MT2(+), G(+)	V_{GT}	0.5	0.78	1.5	V
	MT2(+), G(–)		0.5	0.70	1.5	
	MT2(–), G(–)		0.5	0.71	1.5	

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 ≤ 2%.

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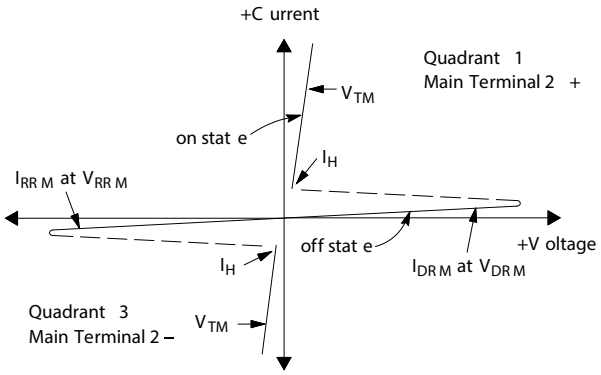
Dynamic Characteristics

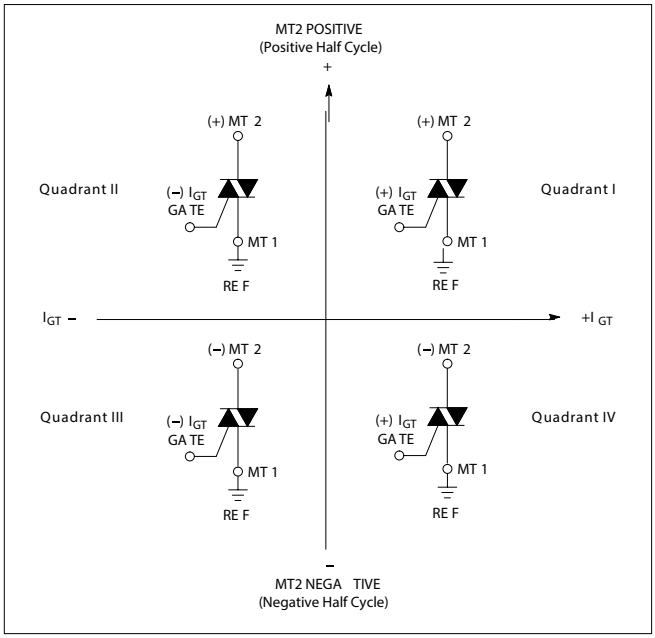
Characteristic	Symbol	Min	Typ	Max	Unit
Rate of Change of Commutating Current See Figure 10. (V_D = 400 V, I_{TM} = 4.4 A, Commutating dv/dt = 18 V/µs,Gate Open, T_J = 125°C, f = 250 Hz, No Snubber) C_L = 10 µF L_L = 40 mH	dV/dt	6.5	–	–	A/ms
Critical Rate of Rise of Off-State Voltage (V_D = Rated V_{DRM}, Exponential Waveform, R_{GK} = 510 Ω, T_J = 125°C)	dV/dt	500	–	–	V/µs
Repetitive Critical Rate of Rise of On-State Current IPK = 50 A; PW = 40 µsec; diG/dt = 200 mA/µsec; f = 60 Hz	di/dt	–	–	10	A/µs

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

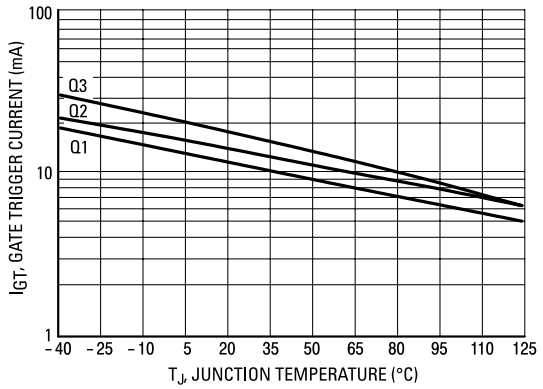


Figure 2. Typical Gate Trigger Voltage vs Junction Temperature

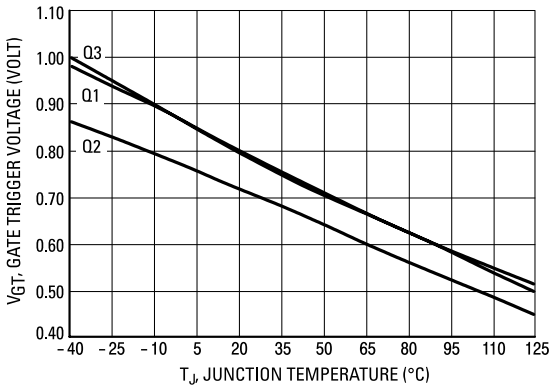


Figure 3. Typical Holding Current vs Junction Temperature

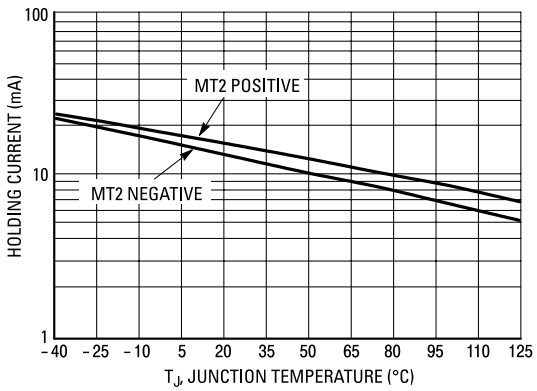


Figure 4. Typical Latching Current vs Junction Temperature

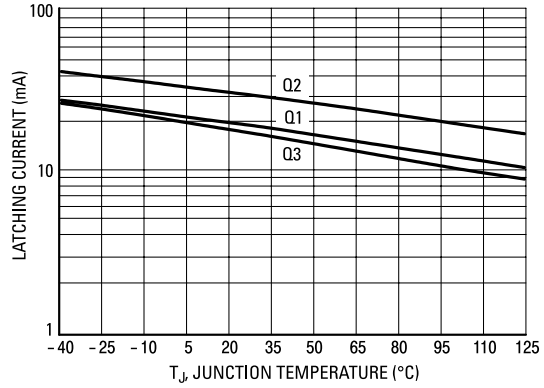


Figure 5. Typical RMS Current Derating

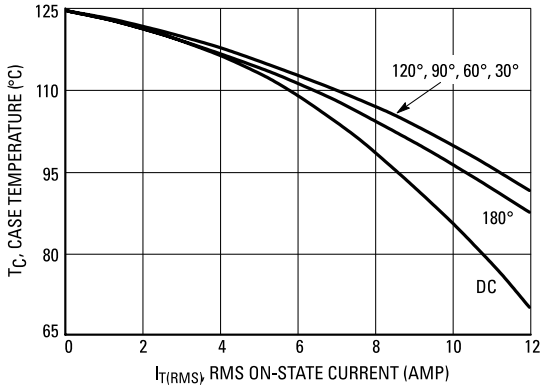


Figure 6. On-State Power Dissipation

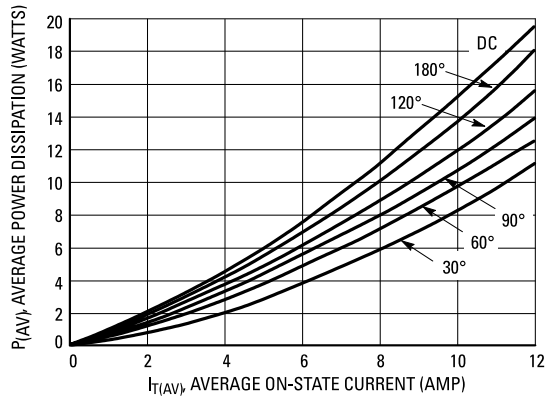


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Figure 7. Typical On-State Characteristics

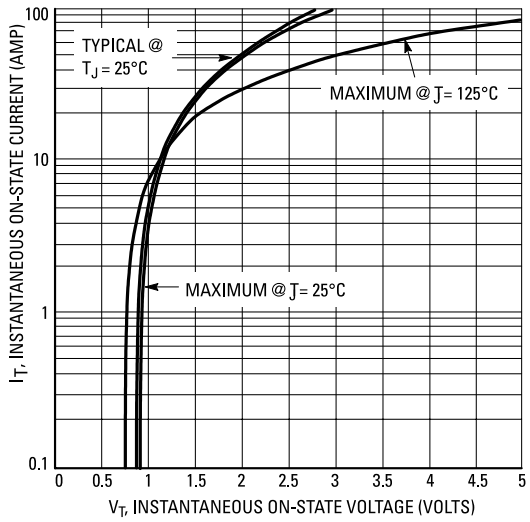
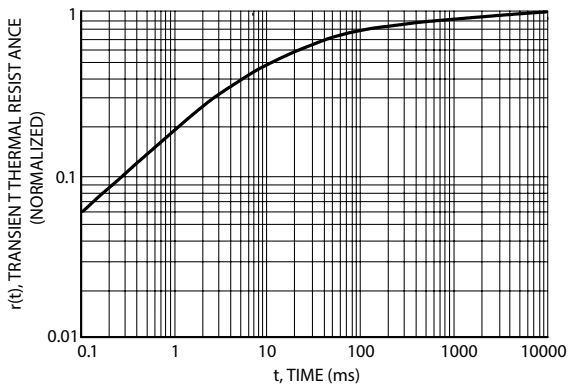


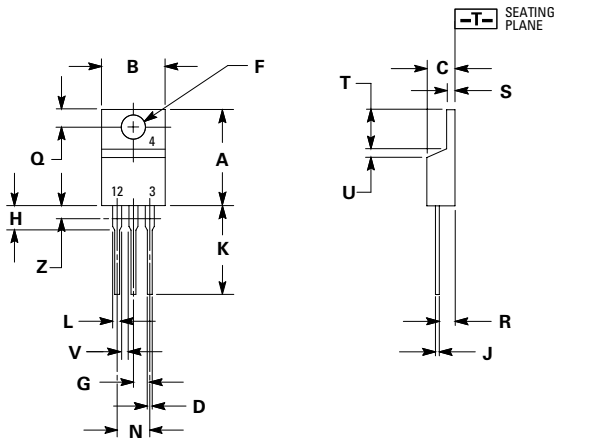
Figure 8. Typical Thermal Response



Thyristors

Surface Mount – 400V - 800V > MAC12D, MAC12M, MAC12N

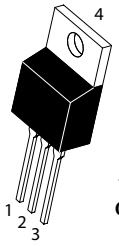
Dimensions



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.

Part Marking System



TO–220AB
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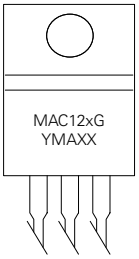

x =D, M, or N
Y =Year
M =Month
A =Assembly Site
XX =Lot Serial Code
G =Pb-Free Package

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

Ordering Information

Device	Package	Shipping
MAC12DG	TO-220AB (Pb-Free)	500 Units / Rail
MAC12MG		
MAC12NG		