

# MCR12DG, MCR12MG, MCR12NG

## Silicon Controlled Rectifiers Reverse Blocking Thyristors

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

### Features

- Blocking Voltage to 800 Volts
- On-State Current Rating of 12 Amperes RMS at 80°C
- High Surge Current Capability – 100 Amperes
- Rugged, Economical TO-220AB Package
- Glass Passivated Junctions for Reliability and Uniformity
- Minimum and Maximum Values of IGT, VGT and IH Specified for Ease of Design
- High Immunity to dv/dt – 100 V/μsec Minimum at 125°C
- These are Pb-Free Devices

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

| Rating  | Symbol                                 | Value             | Unit               |
|---|--|-------------------|--------------------|
| Peak Repetitive Off-State Voltage (Note 1)<br>(T <sub>J</sub> = -40 to 125°C, Sine Wave,<br>50 to 60 Hz, Gate Open) | V <sub>DRM</sub> ,<br>V <sub>RRM</sub> | 400<br>600<br>800 | V                  |
| On-State RMS Current<br>(180° Conduction Angles; T <sub>C</sub> = 80°C)   | I <sub>T(RMS)</sub>                    | 12                | A                  |
| Peak Non-repetitive Surge Current<br>(1/2 Cycle, Sine Wave 60 Hz, T <sub>J</sub> = 125°C)                           | I <sub>TSM</sub>                       | 100               | A                  |
| Circuit Fusing Consideration (t = 8.33 ms)  | I <sup>2</sup> t                       | 41                | A <sup>2</sup> sec |
| Forward Peak Gate Power<br>(Pulse Width ≤ 1.0 μs, T <sub>C</sub> = 80°C)  | P <sub>GM</sub>                        | 5.0               | W                  |
| Forward Average Gate Power<br>(t = 8.3 ms, T <sub>C</sub> = 80°C)   | P <sub>G(AV)</sub>                     | 0.5               | W                  |
| Average On-State Current<br>(180° Conduction Angles; T <sub>C</sub> = 80°C)   | I <sub>T(AV)</sub>                     | 7.8               | A                  |
| Forward Peak Gate Current<br>(Pulse Width ≤ 1.0 μs, T <sub>C</sub> = 90°C)  | I <sub>GM</sub>                        | 2.0               | A                  |
| Operating Junction Temperature Range  | T <sub>J</sub>                         | -40 to +125       | °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. Ratings apply for zero or negative gate voltage; 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.



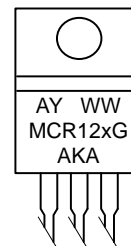
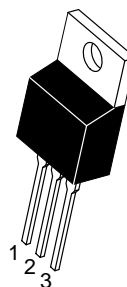
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**SCRs**  
**12 AMPERES RMS**  
**400 thru 800 VOLTS**



### MARKING DIAGRAM



**TO-220**  
**CASE 221A-09**  
**STYLE 3**

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

### PIN ASSIGNMENT

| Pin | Assignment |
|-----|------------|
| 1   | Cathode    |
| 2   | Anode      |
| 3   | Gate       |
| 4   | Anode      |

### ORDERING INFORMATION

| Device  | Package            | Shipping        |
|---------|--------------------|-----------------|
| MCR12DG | TO-220AB (Pb-Free) | 50 Units / Rail |
| MCR12MG | TO-220AB (Pb-Free) | 50 Units / Rail |
| MCR12NG | TO-220AB (Pb-Free) | 50 Units / Rail |

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## THERMAL CHARACTERISTICS

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

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

## OFF CHARACTERISTICS

|   |                          |   |   |             |    |
|---|--------------------------|---|---|-------------|----|
| Peak Repetitive Forward or Reverse Blocking Current<br>( $V_D = \text{Rated } V_{DRM}$ and $V_{RRM}$ ; Gate Open) | $I_{DRM}$ ,<br>$I_{RRM}$ | – | – | 0.01<br>2.0 | mA |
| $T_J = 25^{\circ}\text{C}$  |                          |   |   |             |    |
| $T_J = 125^{\circ}\text{C}$   |                          |   |   |             |    |

## ON CHARACTERISTICS

|  |          |     |      |     |    |
|--|----------|-----|------|-----|----|
| Peak Forward On-State Voltage (Note 2) ( $I_{TM} = 24 \text{ A}$ )                 | $V_{TM}$ | –   | –    | 2.2 | V  |
| Gate Trigger Current (Continuous dc) ( $V_D = 12 \text{ V}$ ; $R_L = 100 \Omega$ ) | $I_{GT}$ | 2.0 | 8.0  | 20  | mA |
| Holding Current ( $V_D = 12 \text{ V}$ , Gate Open, Initiating Current = 200 mA)   | $I_H$    | 4.0 | 20   | 40  | mA |
| Latch Current ( $V_D = 12 \text{ V}$ , $I_G = 20 \text{ mA}$ )                     | $I_L$    | 6.0 | 25   | 60  | mA |
| Gate Trigger Voltage (Continuous dc) ( $V_D = 12 \text{ V}$ ; $R_L = 100 \Omega$ ) | $V_{GT}$ | 0.5 | 0.65 | 1.0 | V  |

## DYNAMIC CHARACTERISTICS

|  |         |     |     |    |                        |
|--|---------|-----|-----|----|------------------------|
| Critical Rate of Rise of Off-State Voltage<br>( $V_D = \text{Rated } V_{DRM}$ , Exponential Waveform, Gate Open, $T_J = 125^{\circ}\text{C}$ )               | $dv/dt$ | 100 | 250 | –  | $\text{V}/\mu\text{s}$ |
| Repetitive Critical Rate of Rise of On-State Current<br>IPK = 50 A, Pw = 40 $\mu\text{sec}$ , $di/dt = 1 \text{ A}/\mu\text{sec}$ , $I_{gt} = 50 \text{ mA}$ | $di/dt$ | –   | –   | 50 | $\text{A}/\mu\text{s}$ |

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  $\leq 2\%$ .

## Voltage Current Characteristic of SCR

| Symbol    | Parameter                                 |
|-----------|---|
| $V_{DRM}$ | Peak Repetitive Off State Forward Voltage |
| $I_{DRM}$ | Peak Forward Blocking Current             |
| $V_{RRM}$ | Peak Repetitive Off State Reverse Voltage |
| $I_{RRM}$ | Peak Reverse Blocking Current             |
| $V_{TM}$  | Peak On State Voltage                     |
| $I_H$     | Holding Current                           |

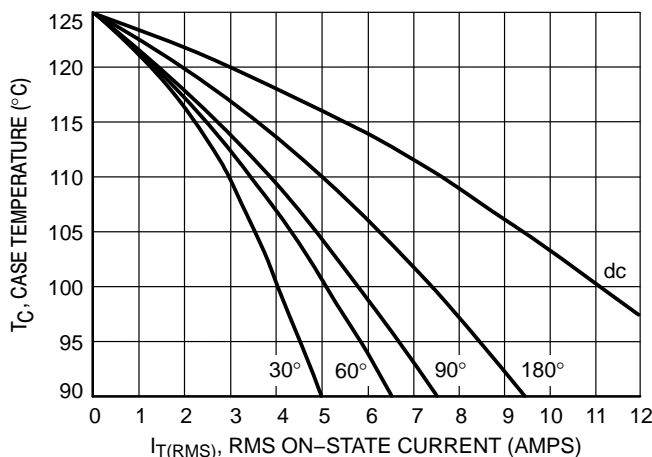
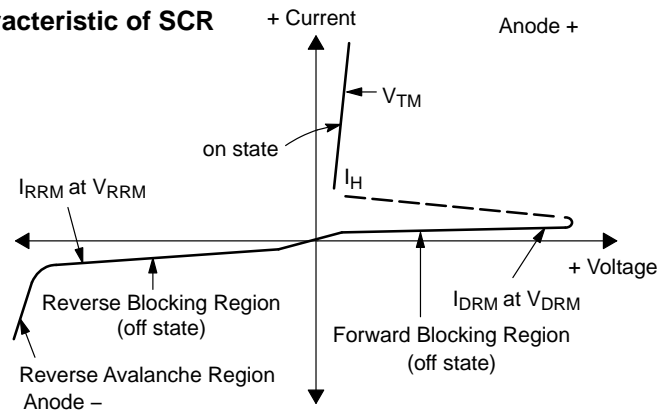


Figure 1. Typical RMS Current Derating

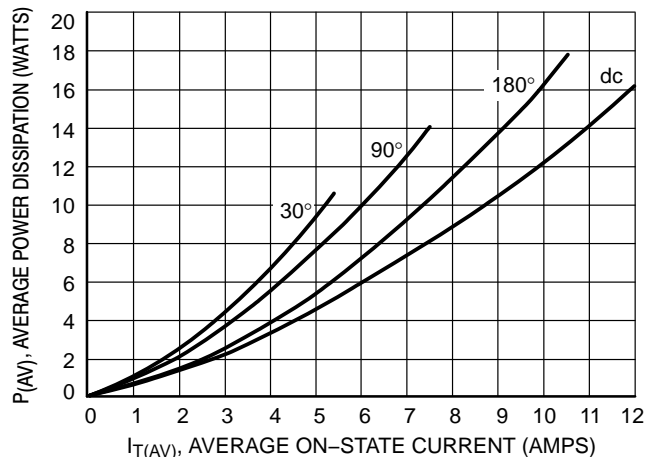


Figure 2. On-State Power Dissipation

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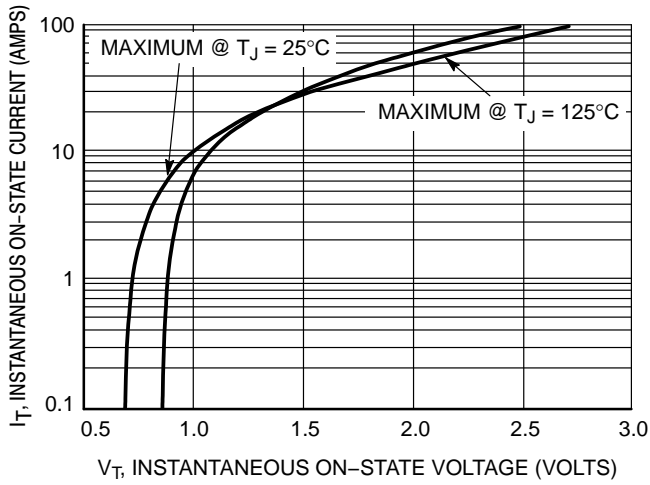


Figure 3. Typical On-State Characteristics

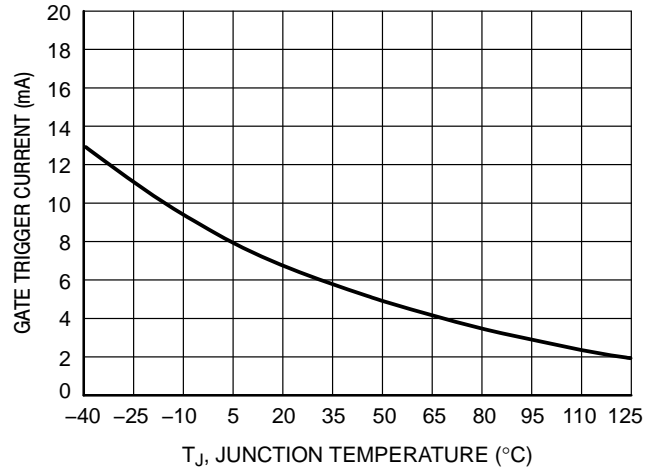


Figure 4. Typical Gate Trigger Current versus Junction Temperature

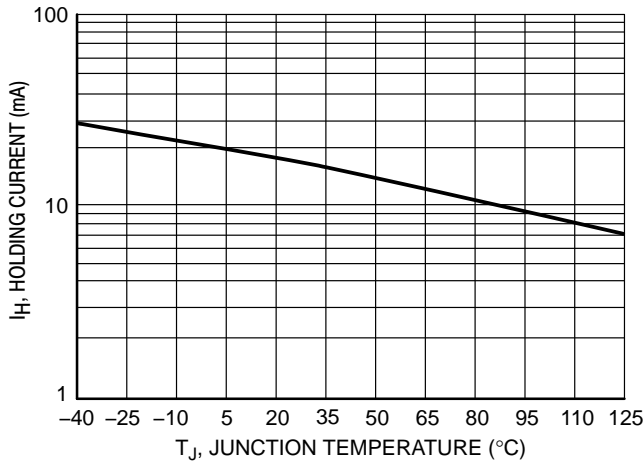


Figure 5. Typical Holding Current versus Junction Temperature

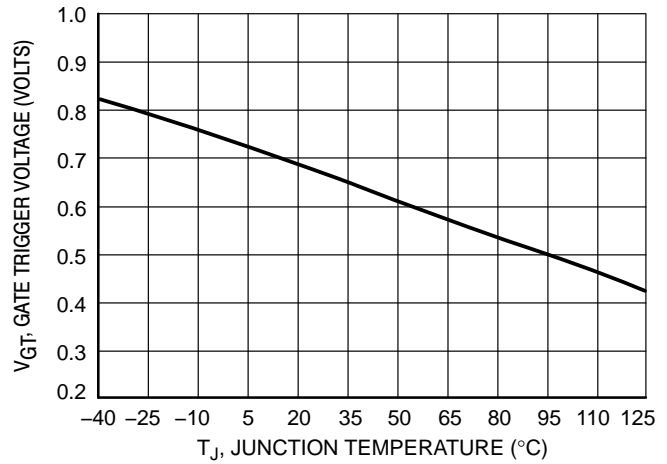


Figure 6. Typical Gate Trigger Voltage versus Junction Temperature

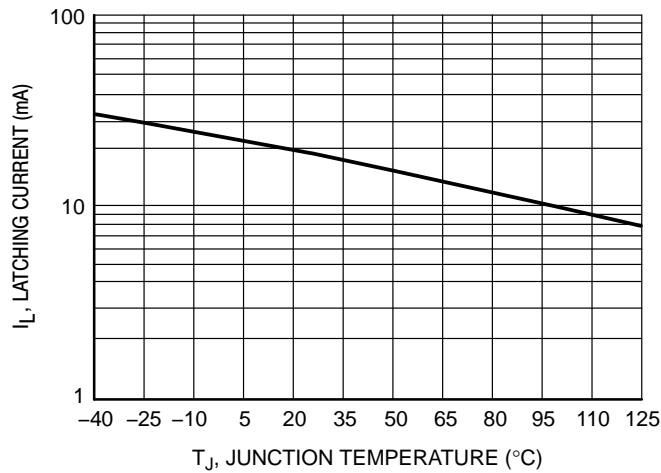
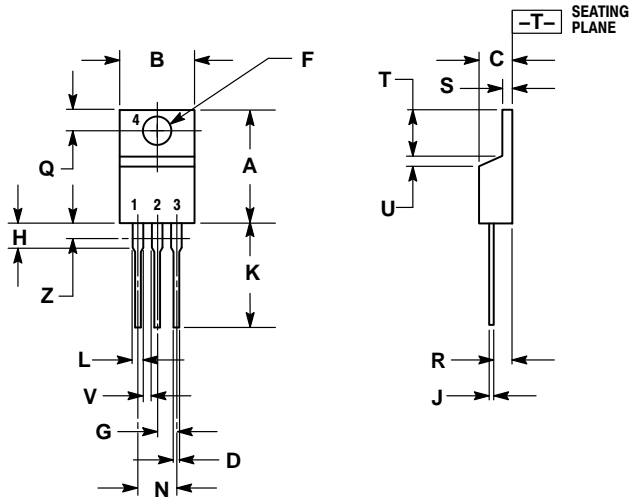


Figure 7. Typical Latching Current versus Junction Temperature

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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 3:

- PIN 1: CATHODE  
2. ANODE  
3. GATE  
4. ANODE

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