

# MCR8SD, MCR8SM, MCR8SN

Preferred Device

## Sensitive Gate 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

- Sensitive Gate Allows Triggering by Microcontrollers and other Logic Circuits
- Blocking Voltage to 800 Volts
- On-State Current Rating of 8 Amperes RMS at 80°C
- High Surge Current Capability – 80 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
- Immunity to  $dv/dt$  – 5 V/ $\mu$ sec Minimum at 110°C
- Pb-Free Packages are Available\*

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

| Rating                                                                                                                     | Symbol                                 | Value             | Unit               |
|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------|-------------------|--------------------|
| Peak Repetitive Off-State Voltage (Note 1)<br>( $T_J = -40$ to $110^\circ\text{C}$ , Sine Wave,<br>50 to 60 Hz, Gate Open) | $V_{\text{DRM}}$ ,<br>$V_{\text{RRM}}$ | 400<br>600<br>800 | V                  |
| On-State RMS Current<br>(180° Conduction Angles; $T_C = 80^\circ\text{C}$ )                                                | $I_{\text{T(RMS)}}$                    | 8.0               | A                  |
| Peak Non-Repetitive Surge Current<br>(1/2 Cycle, Sine Wave, 60 Hz, $T_J = 110^\circ\text{C}$ )                             | $I_{\text{TSM}}$                       | 80                | A                  |
| Circuit Fusing Consideration ( $t = 8.33$ ms)                                                                              | $I^2t$                                 | 26.5              | A <sup>2</sup> sec |
| Forward Peak Gate Power<br>(Pulse Width $\leq 1.0$ $\mu$ s, $T_C = 80^\circ\text{C}$ )                                     | $P_{\text{GM}}$                        | 5.0               | W                  |
| Forward Average Gate Power<br>( $t = 8.3$ ms, $T_C = 80^\circ\text{C}$ )                                                   | $P_{\text{G(AV)}}$                     | 0.5               | W                  |
| Forward Peak Gate Current<br>(Pulse Width $\leq 1.0$ $\mu$ s, $T_C = 80^\circ\text{C}$ )                                   | $I_{\text{GM}}$                        | 2.0               | A                  |
| Operating Junction Temperature Range                                                                                       | $T_J$                                  | -40 to 110        | °C                 |
| Storage Temperature Range                                                                                                  | $T_{\text{stg}}$                       | -40 to 150        | °C                 |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1.  $V_{\text{DRM}}$  and  $V_{\text{RRM}}$  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.

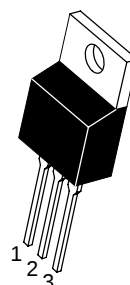
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



ON Semiconductor®

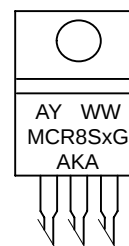
<http://onsemi.com>

SCRs  
8 AMPERES RMS  
400 thru 800 VOLTS



TO-220AB  
CASE 221A-09  
STYLE 3

### MARKING DIAGRAM



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

### PIN ASSIGNMENT

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

### ORDERING INFORMATION

| Device  | Package               | Shipping        |
|---------|-----------------------|-----------------|
| MCR8SD  | TO-220AB              | 50 Units / Rail |
| MCR8SDG | TO-220AB<br>(Pb-Free) | 50 Units / Rail |
| MCR8SM  | TO-220AB              | 50 Units / Rail |
| MCR8SMG | TO-220AB<br>(Pb-Free) | 50 Units / Rail |
| MCR8SN  | TO-220AB              | 50 Units / Rail |
| MCR8SNG | TO-220AB<br>(Pb-Free) | 50 Units / Rail |

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

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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 (Note 3)<br>( $V_D = \text{Rated } V_{DRM} \text{ and } V_{RRM}; R_{GK} = 1 \text{ k}\Omega$ ) | $I_{DRM}, I_{RRM}$ | – | – | 10  | $\mu\text{A}$ |
| $T_J = 110^{\circ}\text{C}$                                                                                                                        |                    | – | – | 500 |               |

### ON CHARACTERISTICS

|                                                                                              |          |     |      |     |               |
|----------------------------------------------------------------------------------------------|----------|-----|------|-----|---------------|
| Peak Forward On-State Voltage (Note 2)<br>( $I_{TM} = 16 \text{ A}$ )                        | $V_{TM}$ | –   | –    | 1.8 | V             |
| Gate Trigger Current (Continuous dc) (Note 4)<br>( $V_D = 12 \text{ V}; R_L = 100 \Omega$ )  | $I_{GT}$ | 5.0 | 25   | 200 | $\mu\text{A}$ |
| Holding Current (Note 4)<br>( $V_D = 12 \text{ V}$ , Gate Open, Initiating Current = 200 mA) | $I_H$    | –   | 0.5  | 6.0 | mA            |
| Latch Current (Note 4)<br>( $V_D = 12 \text{ V}, I_G = 200 \mu\text{A}$ )                    | $I_L$    | –   | 0.6  | 8.0 | mA            |
| Gate Trigger Voltage (Continuous dc) (Note 4)<br>( $V_D = 12 \text{ V}; R_L = 100 \Omega$ )  | $V_{GT}$ | 0.3 | 0.65 | 1.0 | V             |
| $T_J = 25^{\circ}\text{C}$<br>$T_J = -40^{\circ}\text{C}$                                    |          | –   | –    | 1.5 |               |
| Gate Non-Trigger Voltage<br>( $V_D = 12 \text{ V}, R_L = 100 \Omega$ )                       | $V_{GD}$ | 0.2 | –    | –   | V             |
| $T_J = 110^{\circ}\text{C}$                                                                  |          |     |      |     |               |

### DYNAMIC CHARACTERISTICS

|                                                                                                                                                         |         |     |    |     |                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----|----|-----|------------------------|
| Critical Rate of Rise of Off-State Voltage<br>( $V_D = 67\% V_{DRM}, R_{GK} = 1 \text{ k}\Omega, C_{GK} = 0.1 \mu\text{F}, T_J = 110^{\circ}\text{C}$ ) | $dv/dt$ | 5.0 | 15 | –   | $\text{V}/\mu\text{s}$ |
| Critical Rate of Rise of On-State Current<br>IPK = 50 A, Pw = 40 $\mu\text{sec}$ , $di/dt = 1 \text{ A}/\mu\text{sec}$ , $I_{gt} = 10 \text{ mA}$       | $di/dt$ | –   | –  | 100 | $\text{A}/\mu\text{s}$ |

- Indicates Pulse Test: Pulse Width  $\leq 2.0 \text{ ms}$ , Duty Cycle  $\leq 2\%$ .
- $R_{GK} = 1000 \text{ Ohms}$  included in measurement.
- Does not include  $R_{GK}$  in measurement.

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## 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                           |

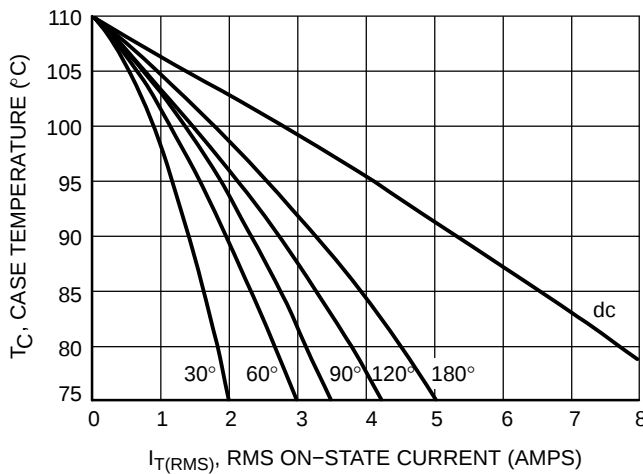
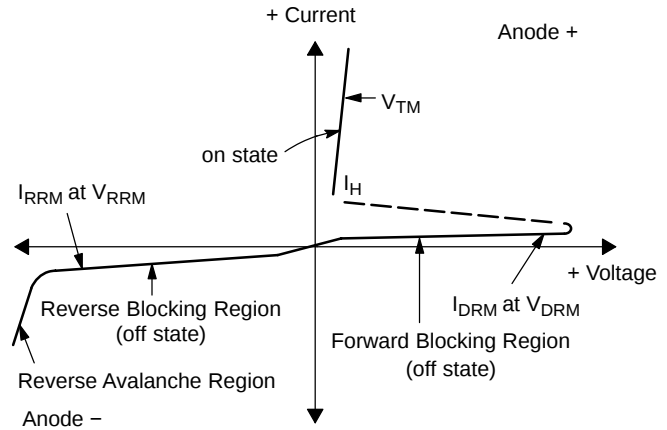


Figure 1. Typical RMS Current Derating

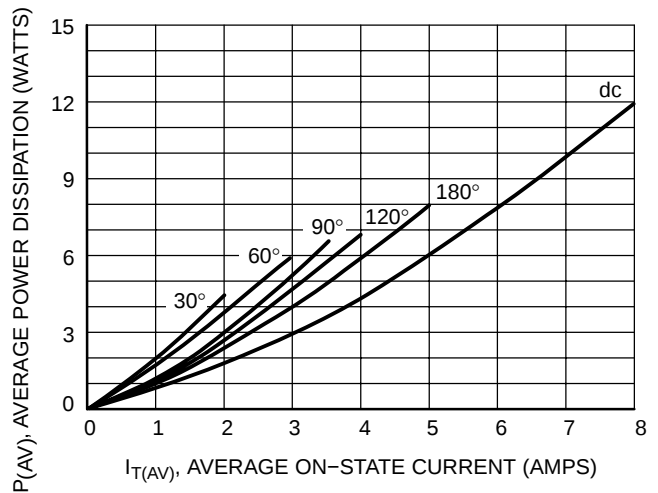


Figure 2. On-State Power Dissipation

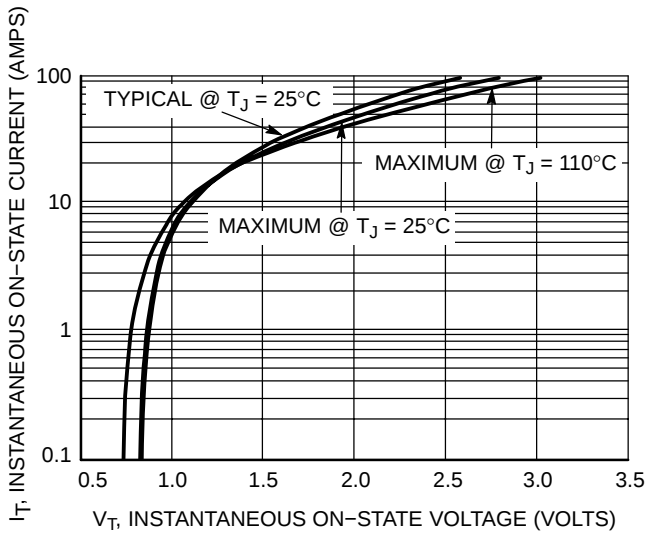


Figure 3. Typical On-State Characteristics

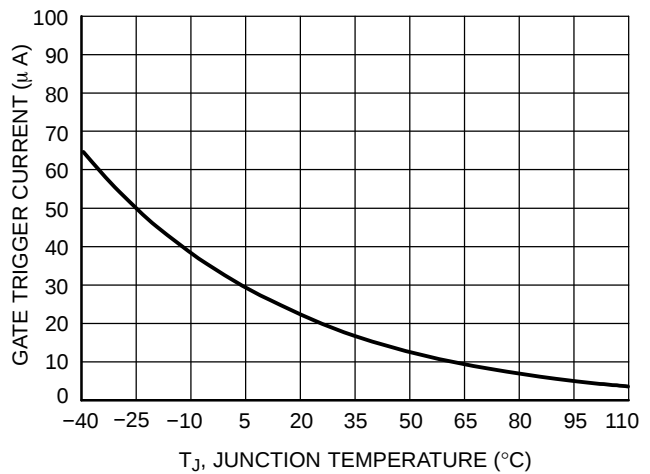
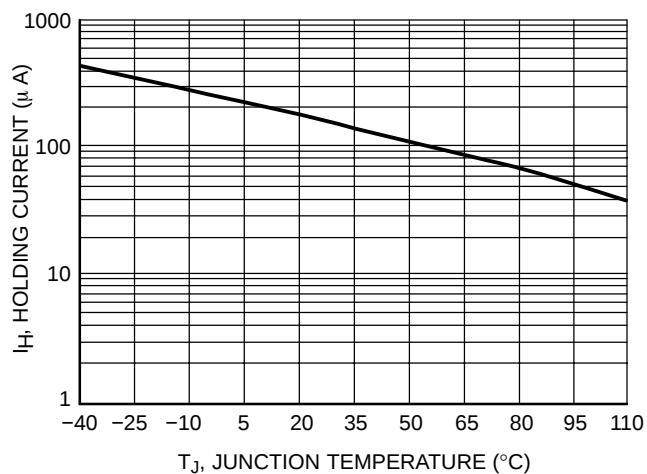
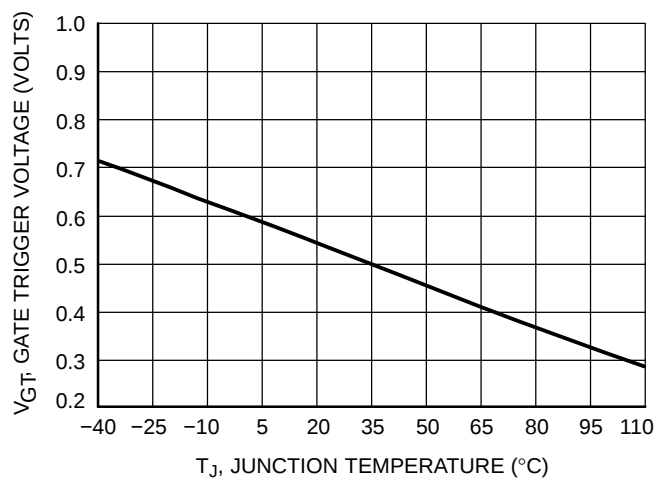


Figure 4. Typical Gate Trigger Current versus Junction Temperature

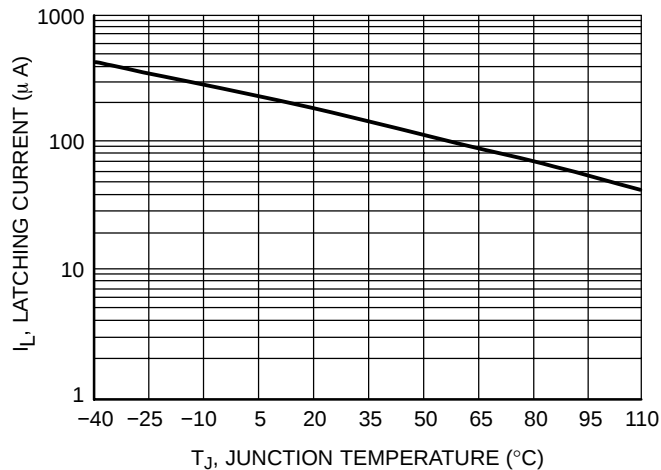
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**Figure 5. Typical Holding Current versus Junction Temperature**



**Figure 6. Typical Gate Trigger Voltage versus Junction Temperature**

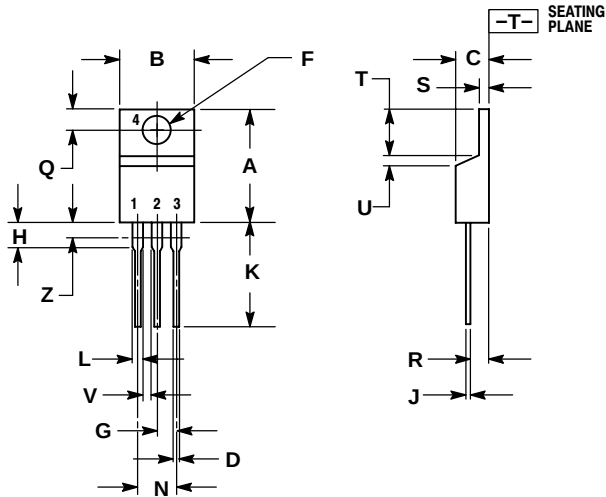


**Figure 7. Typical Latching Current versus Junction Temperature**

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## PACKAGE DIMENSIONS

### TO-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 3:

- PIN 1. CATHODE
- ANODE
- GATE
- ANODE

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