

# MCR69-2, MCR69-3

## Silicon Controlled Rectifiers Reverse Blocking Thyristors

Designed for overvoltage protection in crowbar circuits.

### Features

- Glass-Passivated Junctions for Greater Parameter Stability and Reliability
- Center-Gate Geometry for Uniform Current Spreading Enabling High Discharge Current
- Small Rugged, Thermowatt Package Constructed for Low Thermal Resistance and Maximum Power Dissipation and Durability
- High Capacitor Discharge Current, 750 Amps
- 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 $+125^\circ\text{C}$ , Gate Open)<br>MCR69-2<br>MCR69-3 | $V_{\text{DRM}}$ ,<br>$V_{\text{RRM}}$ | 50<br>100       | V                    |
| Peak Discharge Current (Note 2)                                                                                        | $I_{\text{TM}}$                        | 750             | A                    |
| On-State RMS Current<br>( $180^\circ$ Conduction Angles; $T_C = 85^\circ\text{C}$ )                                    | $I_{\text{T(RMS)}}$                    | 25              | A                    |
| Average On-State Current<br>( $180^\circ$ Conduction Angles; $T_C = 85^\circ\text{C}$ )                                | $I_{\text{T(AV)}}$                     | 16              | A                    |
| Peak Non-Repetitive Surge Current<br>(1/2 Cycle, Sine Wave, 60 Hz, $T_J = 125^\circ\text{C}$ )                         | $I_{\text{TSM}}$                       | 300             | A                    |
| Circuit Fusing Considerations ( $t = 8.3$ ms)                                                                          | $I^2t$                                 | 375             | $\text{A}^2\text{s}$ |
| Forward Peak Gate Current<br>( $t \leq 1.0$ $\mu\text{s}$ , $T_C = 85^\circ\text{C}$ )                                 | $I_{\text{GM}}$                        | 2.0             | A                    |
| Forward Peak Gate Power<br>( $t \leq 1.0$ $\mu\text{s}$ , $T_C = 85^\circ\text{C}$ )                                   | $P_{\text{GM}}$                        | 20              | W                    |
| Forward Average Gate Power<br>( $t = 8.3$ ms, $T_C = 85^\circ\text{C}$ )                                               | $P_{\text{G(AV)}}$                     | 0.5             | W                    |
| Operating Junction Temperature Range                                                                                   | $T_J$                                  | $-40$ to $+125$ | $^\circ\text{C}$     |
| Storage Temperature Range                                                                                              | $T_{\text{stg}}$                       | $-40$ to $+150$ | $^\circ\text{C}$     |
| Mounting Torque                                                                                                        | —                                      | 8.0             | in. lb.              |

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; 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.
2. Ratings apply for  $t_w = 1$  ms. See Figure 1 for  $I_{\text{TM}}$  capability for various duration of an exponentially decaying current waveform,  $t_w$  is defined as 5 time constants of an exponentially decaying current pulse.
3. Test Conditions:  $I_G = 150$  mA,  $V_D = \text{Rated } V_{\text{DRM}}$ ,  $I_{\text{TM}} = \text{Rated Value}$ ,  $T_J = 125^\circ\text{C}$ .

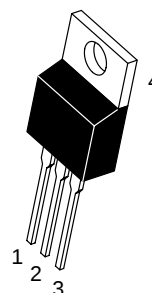
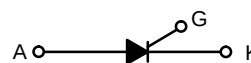
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



ON Semiconductor®

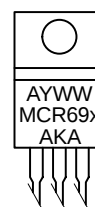
<http://onsemi.com>

SCRs  
25 AMPERES RMS  
50 thru 100 VOLTS



TO-220AB  
CASE 221A  
STYLE 3

### MARKING DIAGRAM



A = Assembly Location  
Y = Year  
WW = Work Week  
MCR69 = Device Code  
x = 2 or 3  
AKA = Location Code

### PIN ASSIGNMENT

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

### ORDERING INFORMATION

| Device   | Package              | Shipping <sup>†</sup> |
|----------|----------------------|-----------------------|
| MCR69-2  | TO220AB              | 500/Box               |
| MCR69-2G | TO220AB<br>(Pb-Free) | 500/Box               |
| MCR69-3  | TO220AB              | 500/Box               |
| MCR69-3G | TO220AB<br>(Pb-Free) | 500/Box               |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# MCR69-2, MCR69-3

## THERMAL CHARACTERISTICS

| Characteristic                                                                  | Symbol          | Max | Unit                 |
|---------------------------------------------------------------------------------|-----------------|-----|----------------------|
| Thermal Resistance, Junction-to-Case                                            | $R_{\theta JC}$ | 1.5 | $^{\circ}\text{C/W}$ |
| Thermal Resistance, Junction-to-Ambient                                         | $R_{\theta JA}$ | 60  | $^{\circ}\text{C/W}$ |
| Maximum Lead Temperature for Soldering Purposes 1/8 in from Case for 10 Seconds | $T_L$           | 260 | $^{\circ}\text{C}$   |

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

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

## OFF CHARACTERISTICS

|                                                                                                                            |                    |   |   |     |               |
|----------------------------------------------------------------------------------------------------------------------------|--------------------|---|---|-----|---------------|
| Peak Repetitive Forward or Reverse Blocking Current<br>( $V_{AK} = \text{Rated } V_{DRM} \text{ or } V_{RRM}$ , Gate Open) | $I_{DRM}, I_{RRM}$ | – | – | 10  | $\mu\text{A}$ |
| $T_J = 25^{\circ}\text{C}$<br>$T_J = 125^{\circ}\text{C}$                                                                  |                    | – | – | 2.0 | $\text{mA}$   |

## ON CHARACTERISTICS

|                                                                                                                                         |          |        |          |          |               |
|-----------------------------------------------------------------------------------------------------------------------------------------|----------|--------|----------|----------|---------------|
| Peak Forward On-State Voltage<br>( $I_{TM} = 50 \text{ A}$ ) (Note 4)<br>( $I_{TM} = 750 \text{ A}$ , $t_w = 1 \text{ ms}$ ) (Note 5)   | $V_{TM}$ | –<br>– | –<br>6.0 | 1.8<br>– | $\text{V}$    |
| Gate Trigger Current (Continuous dc)<br>( $V_D = 12 \text{ V}$ , $R_L = 100 \Omega$ )                                                   | $I_{GT}$ | 2.0    | 7.0      | 30       | $\text{mA}$   |
| Gate Trigger Voltage (Continuous dc)<br>( $V_D = 12 \text{ V}$ , $R_L = 100 \Omega$ )                                                   | $V_{GT}$ | –      | 0.65     | 1.5      | $\text{V}$    |
| Gate Non-Trigger Voltage<br>( $V_D = 12 \text{ Vdc}$ , $R_L = 100 \Omega$ , $T_J = 125^{\circ}\text{C}$ )                               | $V_{GD}$ | 0.2    | 0.40     | –        | $\text{V}$    |
| Holding Current<br>( $V_D = 12 \text{ V}$ , Initiating Current = 200 mA, Gate Open)                                                     | $I_H$    | 3.0    | 15       | 50       | $\text{mA}$   |
| Latching Current<br>( $V_D = 12 \text{ Vdc}$ , $I_G = 150 \text{ mA}$ )                                                                 | $I_L$    | –      | –        | 60       | $\text{mA}$   |
| Gate Controlled Turn-On Time (Note 6)<br>( $V_D = \text{Rated } V_{DRM}$ , $I_G = 150 \text{ mA}$ )<br>( $I_{TM} = 50 \text{ A Peak}$ ) | $t_{gt}$ | –      | 1.0      | –        | $\mu\text{s}$ |

## DYNAMIC CHARACTERISTICS

|                                                                                                                                                |         |    |   |     |                        |
|------------------------------------------------------------------------------------------------------------------------------------------------|---------|----|---|-----|------------------------|
| Critical Rate-of-Rise of Off-State Voltage<br>( $V_D = \text{Rated } V_{DRM}$ , Gate Open, Exponential Waveform, $T_J = 125^{\circ}\text{C}$ ) | $dv/dt$ | 10 | – | –   | $\text{V}/\mu\text{s}$ |
| Critical Rate-of-Rise of On-State Current<br>$I_G = 150 \text{ mA}$<br>$T_J = 125^{\circ}\text{C}$                                             | $di/dt$ | –  | – | 100 | $\text{A}/\mu\text{s}$ |

- Pulse duration  $\leq 300 \mu\text{s}$ , duty cycle  $\leq 2\%$ .
- Ratings apply for  $t_w = 1 \text{ ms}$ . See Figure 1 for  $I_{TM}$  capability for various durations of an exponentially decaying current waveform.  $t_w$  is defined as 5 time constants of an exponentially decaying current pulse.
- The gate controlled turn-on time in a crowbar circuit will be influenced by the circuit inductance.

# 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                           |

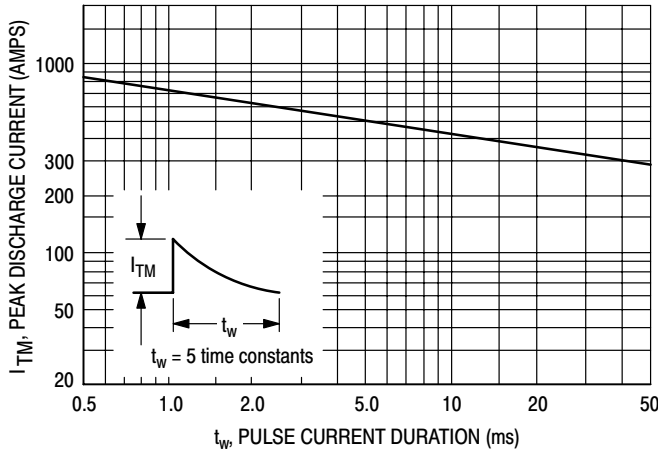
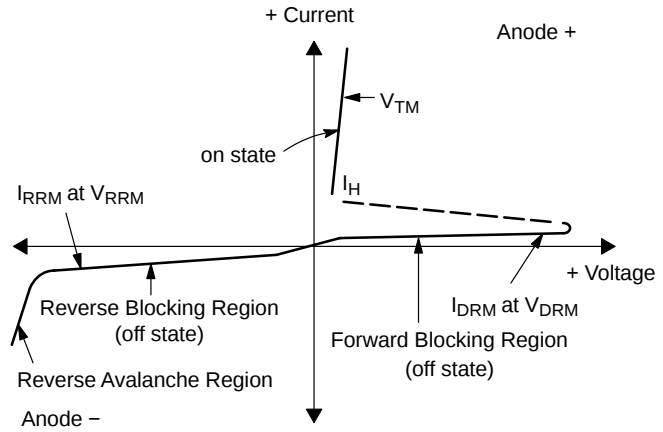


Figure 1. Peak Capacitor Discharge Current

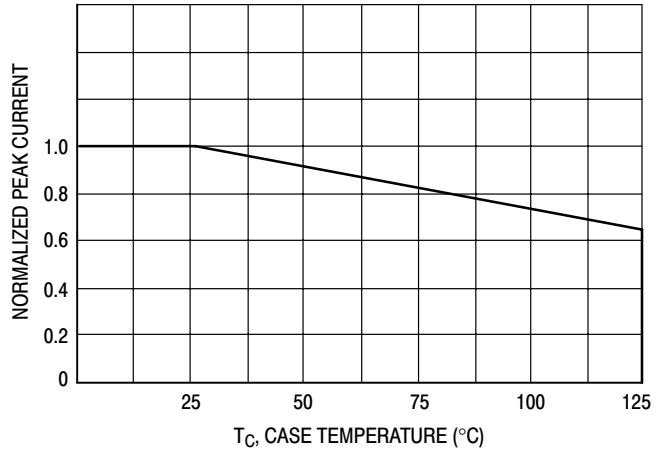


Figure 2. Peak Capacitor Discharge Current Derating

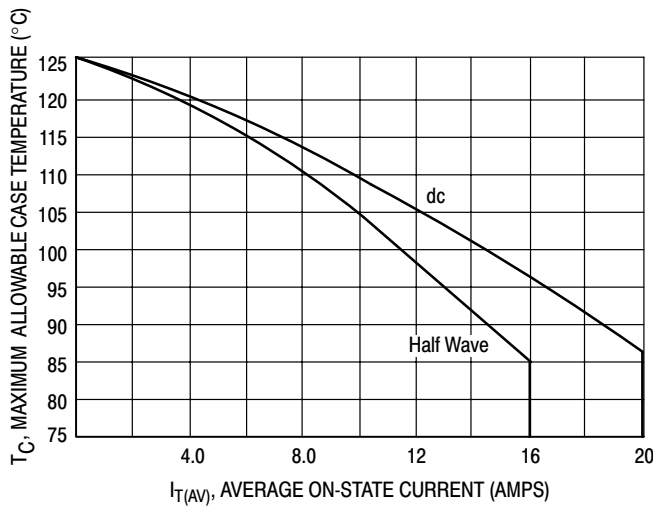


Figure 3. Current Derating

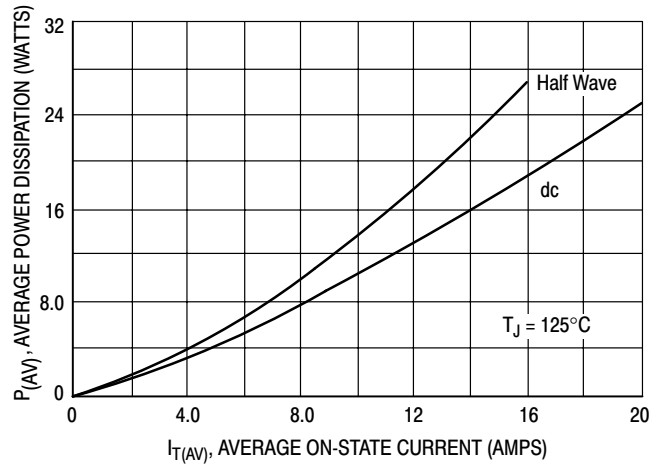


Figure 4. Maximum Power Dissipation

## MCR69-2, MCR69-3

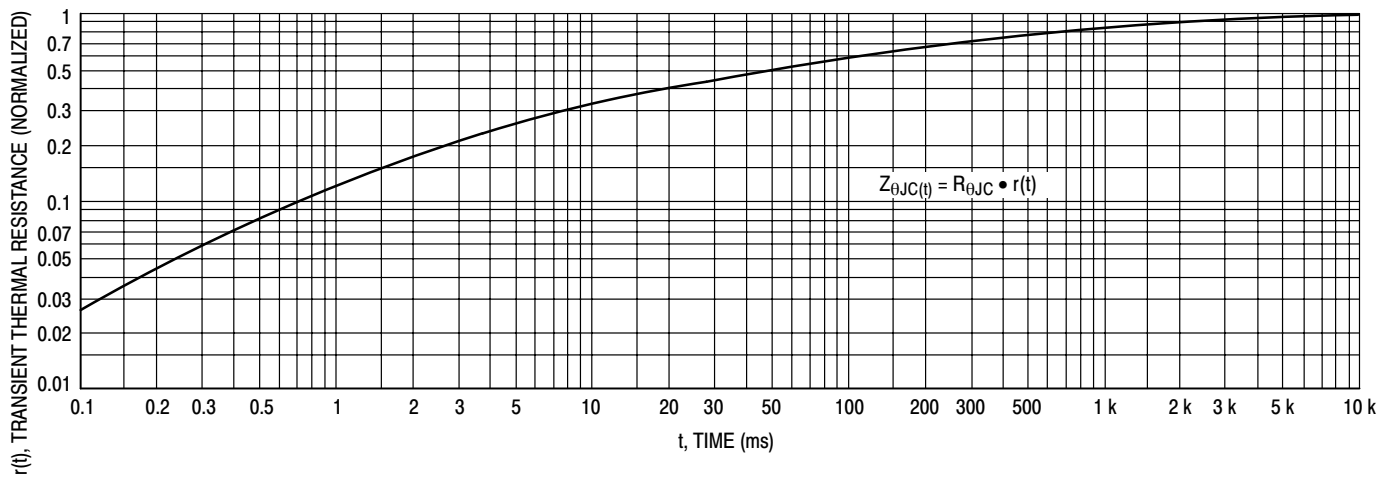


Figure 5. Thermal Response

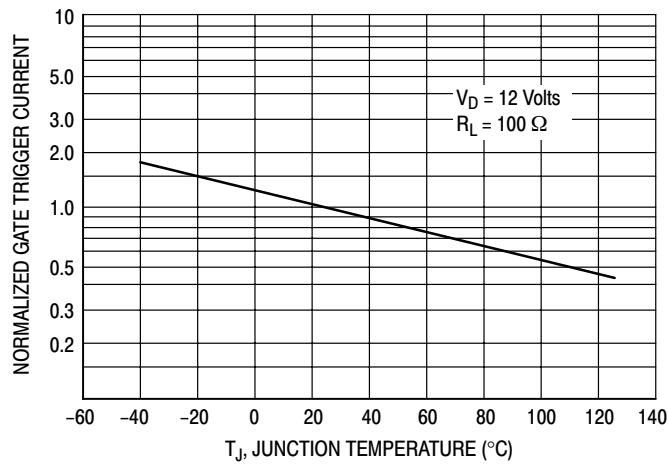


Figure 6. Gate Trigger Current

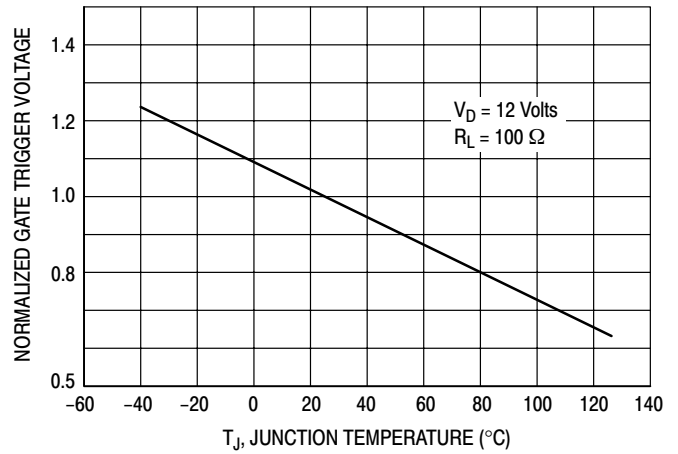


Figure 7. Gate Trigger Voltage

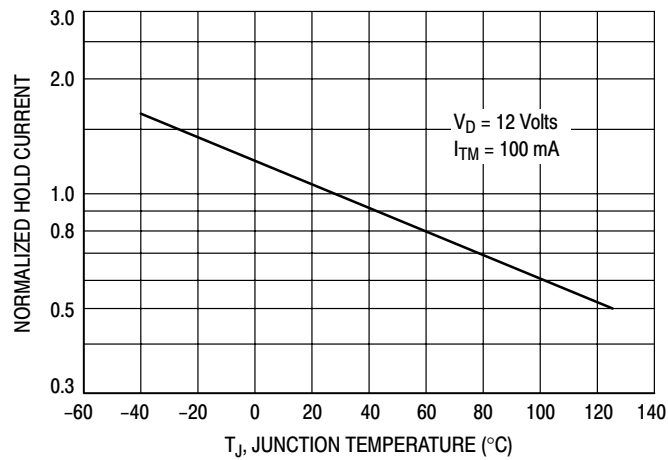
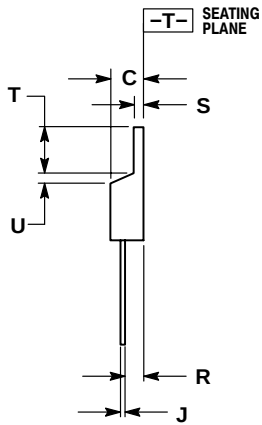
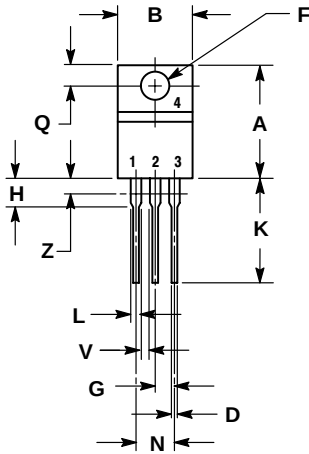


Figure 8. Holding Current

# MCR69-2, MCR69-3

## PACKAGE DIMENSIONS

TO-220AB  
CASE 221A-07  
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   | 0.014  | 0.022 | 0.36        | 0.55  |
| 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

## MCR69-2, MCR69-3

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