

# MCR12D, MCR12M, MCR12N

Preferred Device

## 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.

- Blocking Voltage to 800 Volts
- On-State Current Rating of 12 Amperes RMS at 80°C
- High Surge Current Capability — 100 Amperes
- Rugged, Economical TO220AB 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
- Device Marking: Logo, Device Type, e.g., MCR12D, Date Code

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

| Rating  | Symbol                                 | Value          | Unit               |
|---|--|----------------|--------------------|
| Peak Repetitive Off-State Voltage <sup>(1)</sup><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> |                | Volts              |
| MCR12D  |  | 400            |                    |
| MCR12M  |  | 600            |                    |
| MCR12N  |  | 800            |                    |
| 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,<br>T <sub>J</sub> = 125°C)                              | I <sub>TSM</sub>                       | 100            | A                  |
| Circuit Fusing Consideration<br>(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            | Watts              |
| Forward Average Gate Power<br>(t = 8.3 ms, T <sub>C</sub> = 80°C)   | P <sub>G(AV)</sub>                     | 0.5            | Watts              |
| Forward Peak Gate Current<br>(Pulse Width ≤ 1.0 μs, T <sub>C</sub> = 80°C)  | I <sub>GM</sub>                        | 2.0            | A                  |
| Operating Junction Temperature Range  | T <sub>J</sub>                         | -40 to<br>+125 | °C                 |
| Storage Temperature Range   | T <sub>stg</sub>                       | -40 to<br>+150 | °C                 |

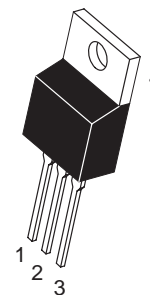
(1) V<sub>DRM</sub> and V<sub>RRM</sub> for all types can be applied on a continuous basis. Ratings apply for zero or negative gate voltage; positive gate voltage shall not be applied concurrent with negative potential on the anode. Blocking voltages shall not be tested with a constant current source such that the voltage ratings of the devices are exceeded.



ON Semiconductor

<http://onsemi.com>

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



TO-220AB  
CASE 221A  
STYLE 3

#### PIN ASSIGNMENT

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

#### ORDERING INFORMATION

| Device | Package | Shipping      |
|--------|---------|---------------|
| MCR12D | TO220AB | 50 Units/Rail |
| MCR12M | TO220AB | 50 Units/Rail |
| MCR12N | TO220AB | 50 Units/Rail |

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

# MCR12D, MCR12M, MCR12N

## THERMAL CHARACTERISTICS

| Characteristic  | Symbol                             | Value       | Unit                        |
|---|------------------------------------|-------------|-----------------------------|
| Thermal Resistance — Junction to Case<br>— Junction to Ambient                | $R_{\theta JC}$<br>$R_{\theta JA}$ | 2.2<br>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 ( $T_J = 25^{\circ}\text{C}$ unless otherwise noted)

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

## OFF CHARACTERISTICS

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

## ON CHARACTERISTICS

|  |          |     |      |     |       |
|--|----------|-----|------|-----|-------|
| Peak Forward On-State Voltage* ( $I_{TM} = 24 \text{ A}$ )                         | $V_{TM}$ | —   | —    | 2.2 | Volts |
| 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 | Volts |

## 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>$I_{PK} = 50 \text{ A}$ , $P_w = 40 \mu\text{sec}$ , $di_G/dt = 1 \text{ A}/\mu\text{sec}$ , $I_{gt} = 50 \text{ mA}$ | $di/dt$ | —   | —   | 50 | $\text{A}/\mu\text{s}$ |

\*Indicates Pulse Test: Pulse Width  $\leq 2.0 \text{ ms}$ , Duty Cycle  $\leq 2\%$ .

# MCR12D, MCR12M, MCR12N

## 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                           |

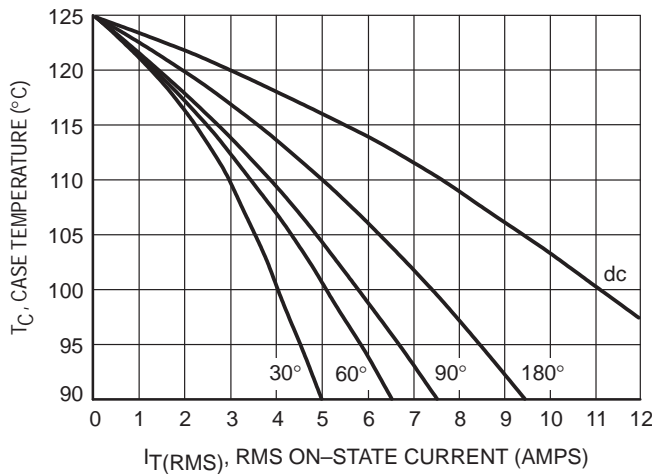
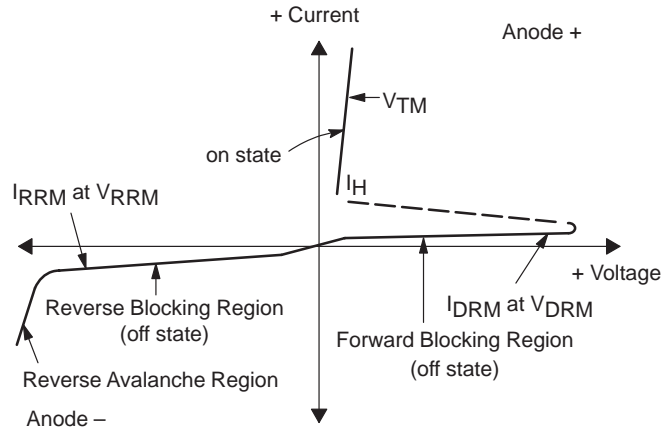


Figure 1. Typical RMS Current Derating

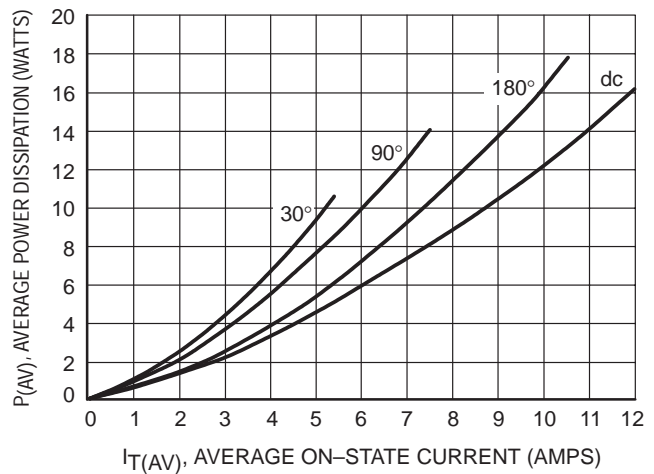


Figure 2. On-State Power Dissipation

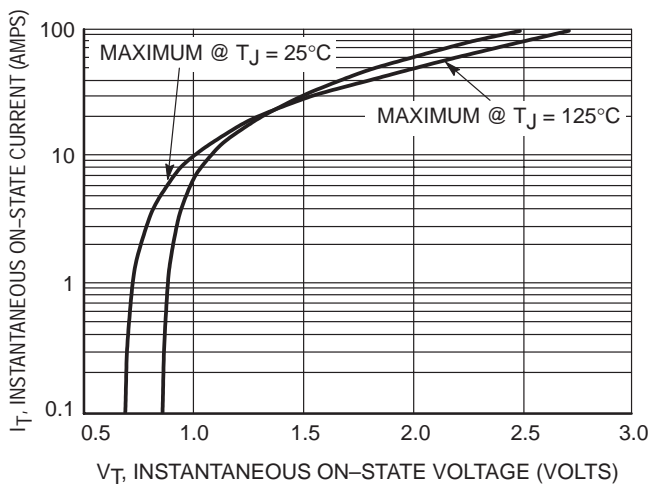


Figure 3. Typical On-State Characteristics

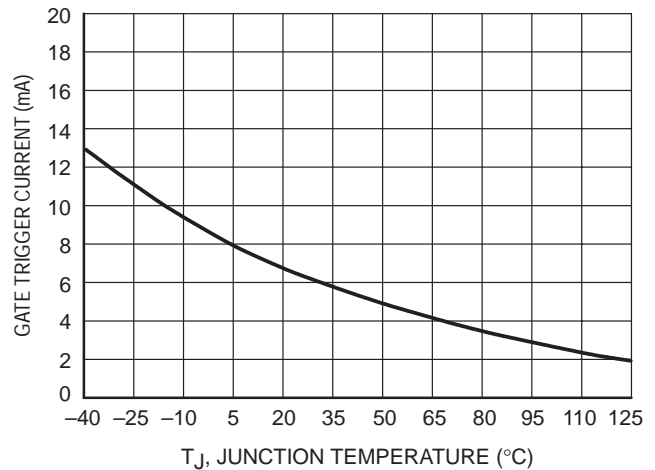
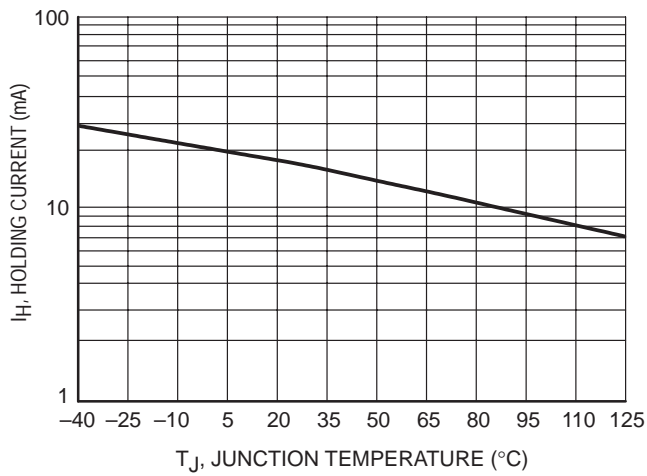
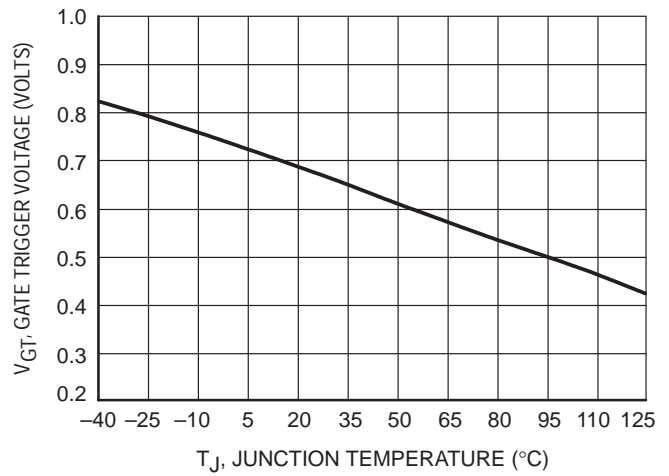


Figure 4. Typical Gate Trigger Current versus Junction Temperature

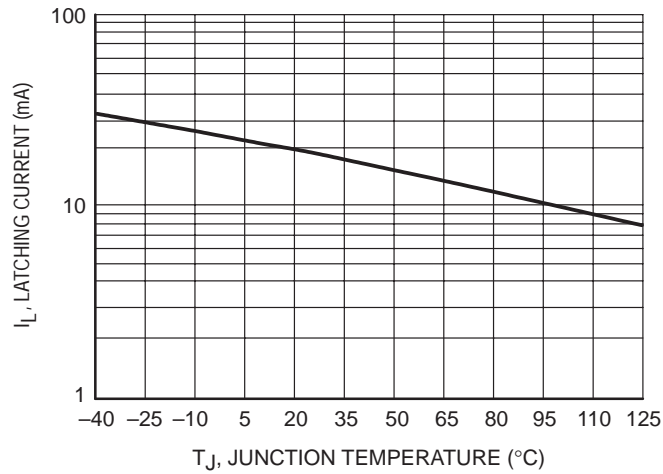
## MCR12D, MCR12M, MCR12N



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



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

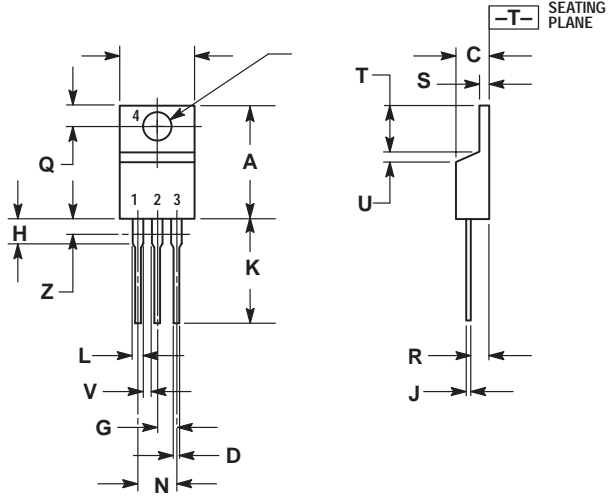


**Figure 7. Typical Latching Current versus Junction Temperature**

# MCR12D, MCR12M, MCR12N

## PACKAGE DIMENSIONS

### TO-220AB CASE 221A-09 ISSUE Z



#### 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

## **Notes**

## **Notes**

**ON Semiconductor** and  are trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer.

## PUBLICATION ORDERING INFORMATION

### **NORTH AMERICA Literature Fulfillment:**

Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** ONlit@hibbertco.com  
Fax Response Line: 303-675-2167 or 800-344-3810 Toll Free USA/Canada

**N. American Technical Support:** 800-282-9855 Toll Free USA/Canada

**EUROPE:** LDC for ON Semiconductor – European Support

**German Phone:** (+1) 303-308-7140 (M–F 1:00pm to 5:00pm Munich Time)  
**Email:** ONlit-german@hibbertco.com  
**French Phone:** (+1) 303-308-7141 (M–F 1:00pm to 5:00pm Toulouse Time)  
**Email:** ONlit-french@hibbertco.com  
**English Phone:** (+1) 303-308-7142 (M–F 12:00pm to 5:00pm UK Time)  
**Email:** ONlit@hibbertco.com

**EUROPEAN TOLL-FREE ACCESS\*: 00-800-4422-3781**

\*Available from Germany, France, Italy, England, Ireland

### **CENTRAL/SOUTH AMERICA:**

**Spanish Phone:** 303-308-7143 (Mon–Fri 8:00am to 5:00pm MST)  
**Email:** ONlit-spanish@hibbertco.com

**ASIA/PACIFIC:** LDC for ON Semiconductor – Asia Support

**Phone:** 303-675-2121 (Tue–Fri 9:00am to 1:00pm, Hong Kong Time)  
Toll Free from Hong Kong & Singapore:  
**001-800-4422-3781**  
**Email:** ONlit-asia@hibbertco.com

**JAPAN:** ON Semiconductor, Japan Customer Focus Center  
4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan 141-8549  
**Phone:** 81-3-5740-2745

**Email:** r14525@onsemi.com

**ON Semiconductor Website:** <http://onsemi.com>

For additional information, please contact your local Sales Representative.