

# MCR8DSM, MCR8DSN

Preferred Device

## Sensitive Gate Silicon Controlled Rectifiers

### Reverse Blocking Thyristors

Designed for high volume, low cost, industrial and consumer applications such as motor control; process control; temperature, light and speed control.

#### Features

- Small Size
- Passivated Die for Reliability and Uniformity
- Low Level Triggering and Holding Characteristics
- Available in Two Package Styles  
Surface Mount Lead Form – Case 369C  
Miniature Plastic Package – Straight Leads – Case 369
- Epoxy Meets UL 94 V-0 @ 0.125 in
- ESD Ratings: Human Body Model, 3B > 8000 V  
Machine Model, C > 400 V
- 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, 50 Hz to 60 Hz)<br>MCR8DSM<br>MCR8DSN | $V_{\text{DRM}}$ ,<br>$V_{\text{RRM}}$ | 600<br>800 | V                      |
| On-State RMS Current<br>( $180^\circ$ Conduction Angles; $T_C = 90^\circ\text{C}$ )   | $I_{\text{T(RMS)}}$                    | 8.0        | A                      |
| Average On-State Current<br>( $180^\circ$ Conduction Angles; $T_C = 90^\circ\text{C}$ )   | $I_{\text{T(AV)}}$                     | 5.1        | A                      |
| Peak Non-Repetitive Surge Current<br>(1/2 Cycle, Sine Wave 60 Hz, $T_J = 110^\circ\text{C}$ )   | $I_{\text{TSM}}$                       | 90         | A                      |
| Circuit Fusing Consideration ( $t = 8.3$ msec)  | $I^2t$                                 | 34         | $\text{A}^2\text{sec}$ |
| Forward Peak Gate Power<br>(Pulse Width $\leq 10$ $\mu\text{sec}$ , $T_C = 90^\circ\text{C}$ )  | $P_{\text{GM}}$                        | 5.0        | W                      |
| Forward Average Gate Power<br>( $t = 8.3$ msec, $T_C = 90^\circ\text{C}$ )  | $P_{\text{G(AV)}}$                     | 0.5        | W                      |
| Forward Peak Gate Current<br>(Pulse Width $\leq 10$ $\mu\text{sec}$ , $T_C = 90^\circ\text{C}$ )                                      | $I_{\text{GM}}$                        | 2.0        | A                      |
| Operating Junction Temperature Range  | $T_J$                                  | -40 to 110 | $^\circ\text{C}$       |
| Storage Temperature Range   | $T_{\text{stg}}$                       | -40 to 150 | $^\circ\text{C}$       |

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.  $V_{\text{DRM}}$  and  $V_{\text{RRM}}$  for all types can be applied on a continuous basis. Ratings apply for 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 device are exceeded.



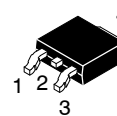
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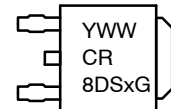
SCRs  
8 AMPERES RMS  
600 – 800 VOLTS



#### MARKING DIAGRAM



DPAK  
CASE 369C  
STYLE 4



Y = Year  
WW = Work Week  
CR8DSx = Device Code  
x = M or N  
G = Pb-Free Package

#### PIN ASSIGNMENT

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

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

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

# MCR8DSM, MCR8DSN

## THERMAL CHARACTERISTICS

| Characteristic  | Symbol          | Max | Unit          |
|---|-----------------|-----|---------------|
| Thermal Resistance – Junction-to-Case   | $R_{\theta JC}$ | 2.2 | $^{\circ}C/W$ |
| – Junction-to-Ambient   | $R_{\theta JA}$ | 88  |               |
| – Junction-to-Ambient (Note 2)  | $R_{\theta JA}$ | 80  |               |
| Maximum Lead Temperature for Soldering Purposes 1/8" from Case for 10 Seconds | $T_L$           | 260 | $^{\circ}C$   |

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

| Characteristics | Symbol | Min | Typ | Max | Unit |
|-----------------|--------|-----|-----|-----|------|
|-----------------|--------|-----|-----|-----|------|

## OFF CHARACTERISTICS

|  |                        |   |   |           |   |
|--|------------------------|---|---|-----------|---|
| Peak Repetitive Forward or Reverse Blocking Current<br>( $V_{AK} = \text{Rated } V_{DRM}$ or $V_{RRM}$ ; $R_{GK} = 1.0 \text{ k}\Omega$ ) (Note 3) | $I_{DRM}$<br>$I_{RRM}$ | – | – | 10<br>500 | $\mu A$                                     |
|  |                        |   |   |           | $T_J = 25^{\circ}C$<br>$T_J = 110^{\circ}C$ |

## ON CHARACTERISTICS

|  |           |                  |                |                 |   |
|--|-----------|------------------|----------------|-----------------|---|
| Peak Reverse Gate Blocking Voltage ( $I_{GR} = 10 \mu A$ )   | $V_{GRM}$ | 10               | 12.5           | 18              | V   |
| Peak Reverse Gate Blocking Current ( $V_{GR} = 10 \text{ V}$ )   | $I_{RGM}$ | –                | –              | 1.2             | $\mu A$   |
| Peak Forward On-State Voltage (Note 4) ( $I_{TM} = 16 \text{ A}$ )   | $V_{TM}$  | –                | 1.4            | 1.8             | V   |
| Gate Trigger Current (Continuous dc) (Note 5)<br>( $V_D = 12 \text{ V}$ , $R_L = 100 \Omega$ )   | $I_{GT}$  | 5.0<br>–         | 12<br>–        | 200<br>300      | $\mu A$   |
|  |           |                  |                |                 | $T_J = 25^{\circ}C$<br>$T_J = -40^{\circ}C$                         |
| Gate Trigger Voltage (Continuous dc) (Note 5)<br>( $V_D = 12 \text{ V}$ , $R_L = 100 \Omega$ )   | $V_{GT}$  | 0.45<br>–<br>0.2 | 0.65<br>–<br>– | 1.0<br>1.5<br>– | V   |
|  |           |                  |                |                 | $T_J = 25^{\circ}C$<br>$T_J = -40^{\circ}C$<br>$T_J = 110^{\circ}C$ |
| Holding Current<br>( $V_D = 12 \text{ V}$ , Initiating Current = 200 mA, $R_{GK} = 1 \text{ k}\Omega$ )  | $I_H$     | 0.5<br>–         | 1.0<br>–       | 6.0<br>10       | mA  |
|  |           |                  |                |                 | $T_J = 25^{\circ}C$<br>$T_J = -40^{\circ}C$                         |
| Latching Current<br>( $V_D = 12 \text{ V}$ , $I_G = 2.0 \text{ mA}$ , $R_{GK} = 1 \text{ k}\Omega$ )   | $I_L$     | 0.5<br>–         | 1.0<br>–       | 6.0<br>10       | mA  |
|  |           |                  |                |                 | $T_J = 25^{\circ}C$<br>$T_J = -40^{\circ}C$                         |
| Total Turn-On Time<br>(Source Voltage = 12 V, $R_S = 6.0 \text{ k}\Omega$ , $I_T = 16 \text{ A(pk)}$ , $R_{GK} = 1.0 \text{ k}\Omega$ )<br>( $V_D = \text{Rated } V_{DRM}$ , Rise Time = 20 ns, Pulse Width = 10 $\mu s$ ) | tgt       | –                | 2.0            | 5.0             | $\mu s$   |

## DYNAMIC CHARACTERISTICS

|  |       |     |    |   |            |
|--|-------|-----|----|---|------------|
| Critical Rate of Rise of Off-State Voltage<br>( $V_D = 0.67 \times \text{Rated } V_{DRM}$ , Exponential Waveform,<br>$R_{GK} = 1.0 \text{ k}\Omega$ , $T_J = 110^{\circ}C$ ) | dv/dt | 2.0 | 10 | – | V/ $\mu s$ |
|--|-------|-----|----|---|------------|

- Surface mounted on minimum recommended pad size.
- Ratings apply for negative gate voltage or  $R_{GK} = 1.0 \text{ k}\Omega$ . Devices shall not have a positive gate voltage concurrently with a negative voltage on the anode. Devices should not be tested with a constant current source for forward and reverse blocking capability such that the voltage applied exceeds the rated blocking voltage.
- Pulse Test; Pulse Width  $\leq 2.0 \text{ msec}$ , Duty Cycle  $\leq 2\%$ .
- $R_{GK}$  current not included in measurements.

## ORDERING INFORMATION

| Device     | Package           | Shipping†          |
|------------|-------------------|--------------------|
| MCR8DSMT4  | DPAK              | 2500 / Tape & Reel |
| MCR8DSMT4G | DPAK<br>(Pb-Free) |                    |
| MCR8DSNT4  | DPAK              |                    |
| MCR8DSNT4G | DPAK<br>(Pb-Free) |                    |

†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.

# MCR8DSM, MCR8DSN

## 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                           |

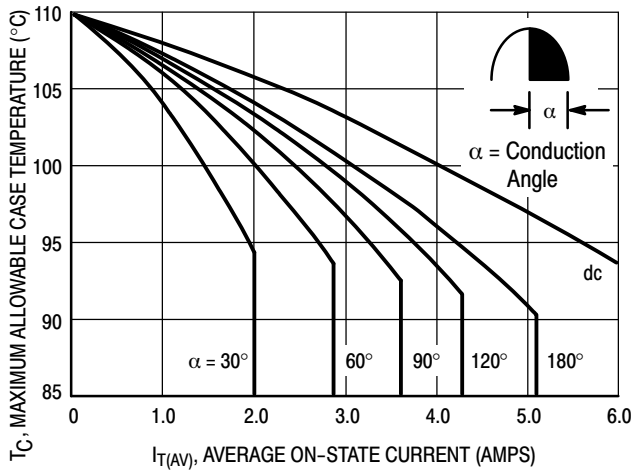
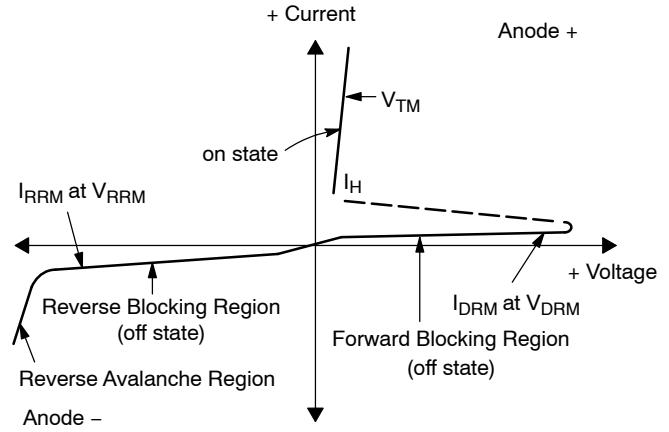


Figure 1. Average Current Derating

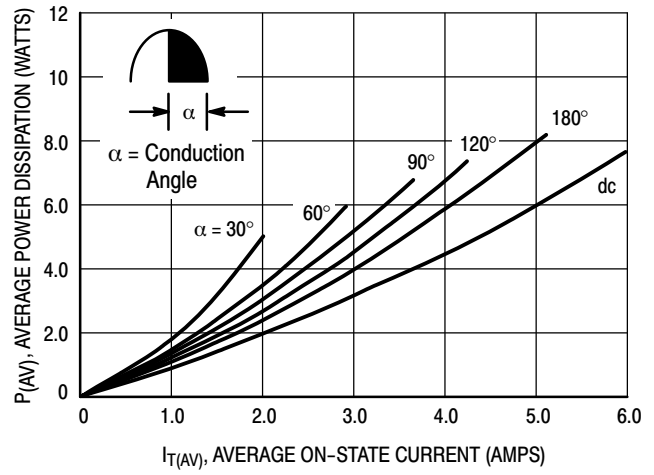


Figure 2. On-State Power Dissipation

# MCR8DSM, MCR8DSN

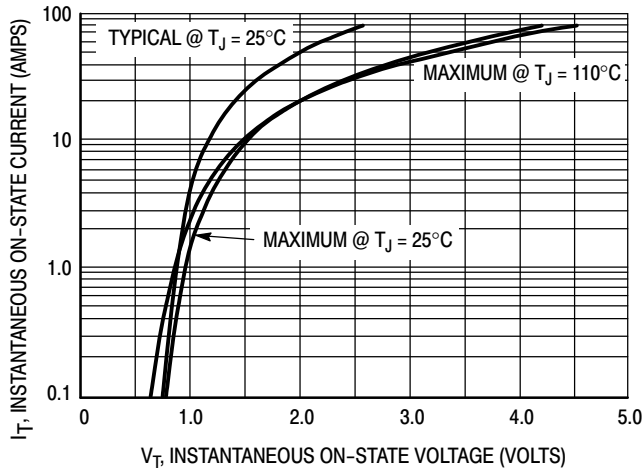


Figure 3. On-State Characteristics

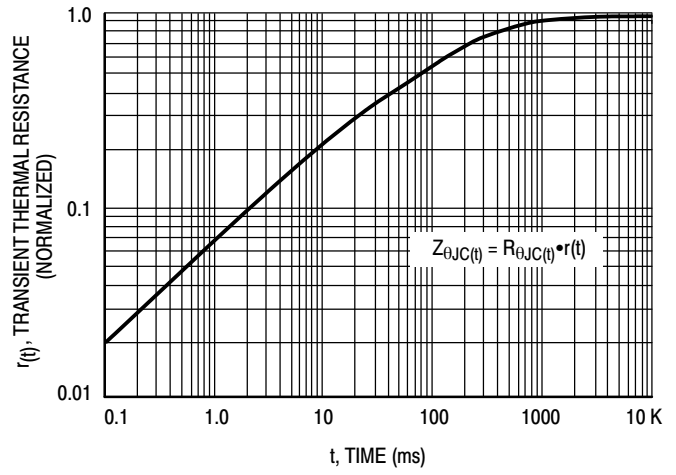


Figure 4. Transient Thermal Response

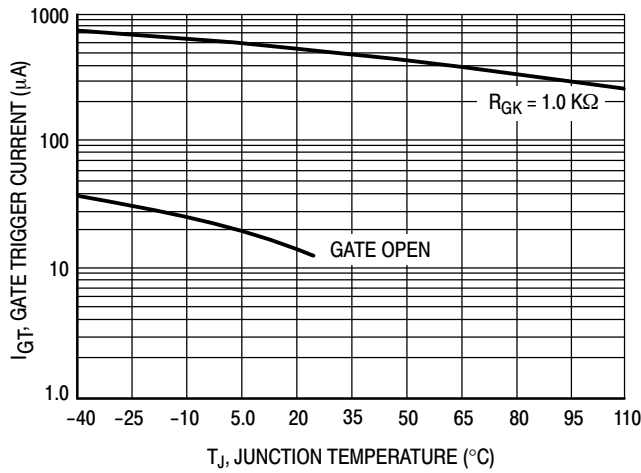


Figure 5. Typical Gate Trigger Current versus Junction Temperature

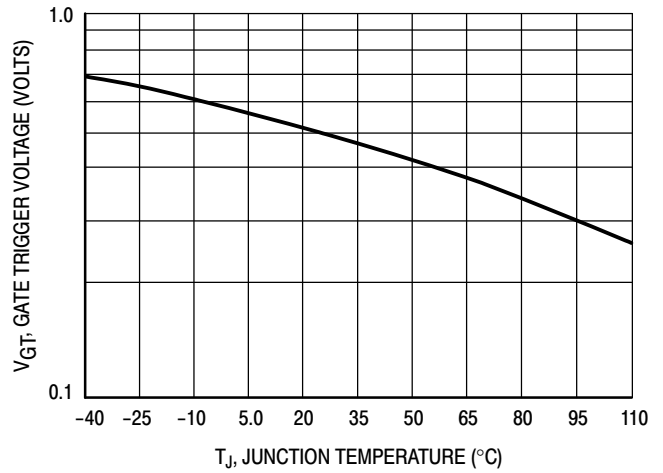


Figure 6. Typical Gate Trigger Voltage versus Junction Temperature

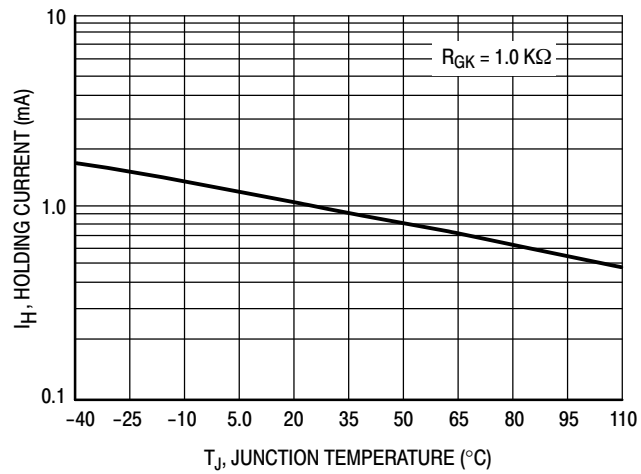


Figure 7. Typical Holding Current versus Junction Temperature

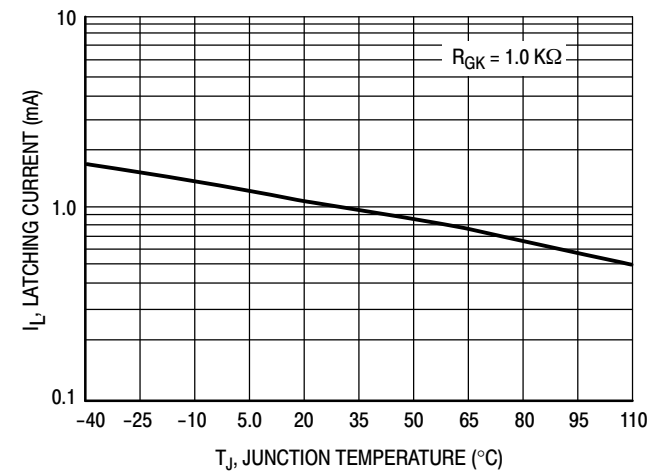
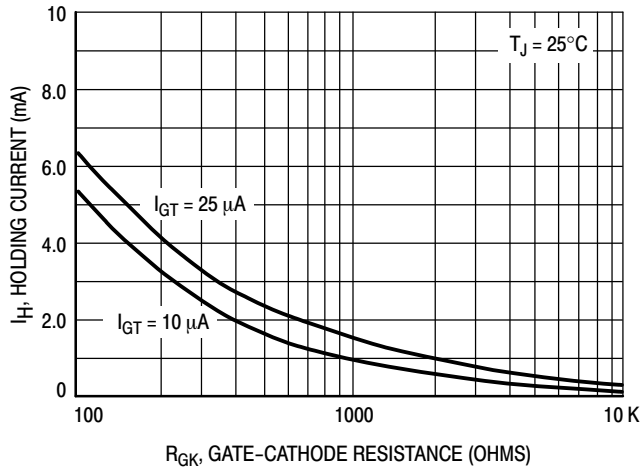
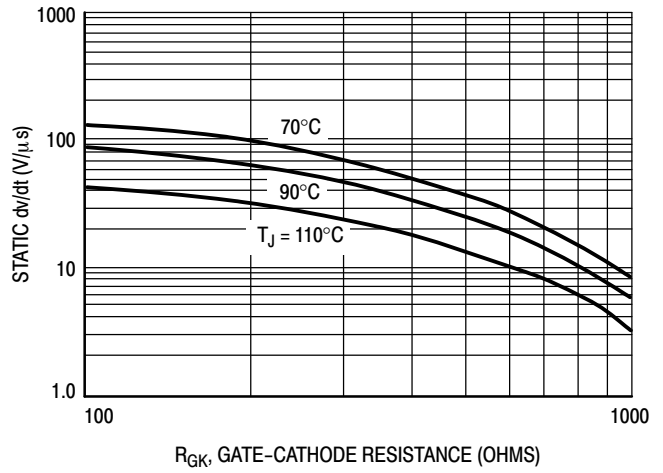


Figure 8. Typical Latching Current versus Junction Temperature

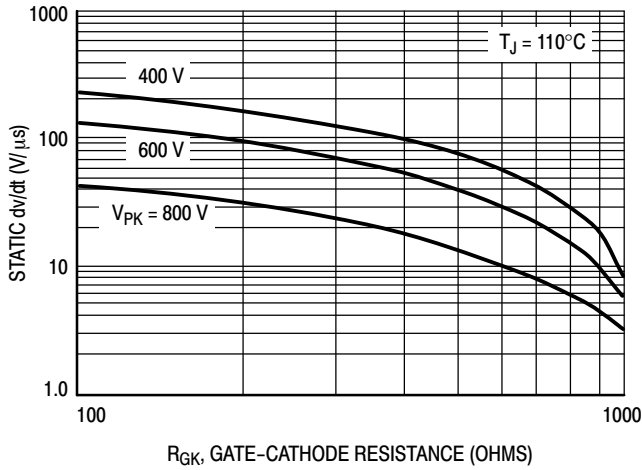
# MCR8DSM, MCR8DSN



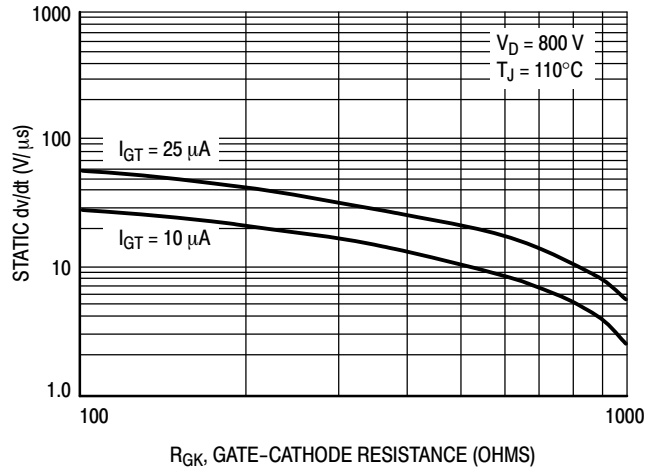
**Figure 9. Holding Current versus Gate-Cathode Resistance**



**Figure 10. Exponential Static  $dv/dt$  versus Gate-Cathode Resistance and Junction Temperature**



**Figure 11. Exponential Static  $dv/dt$  versus Gate-Cathode Resistance and Peak Voltage**

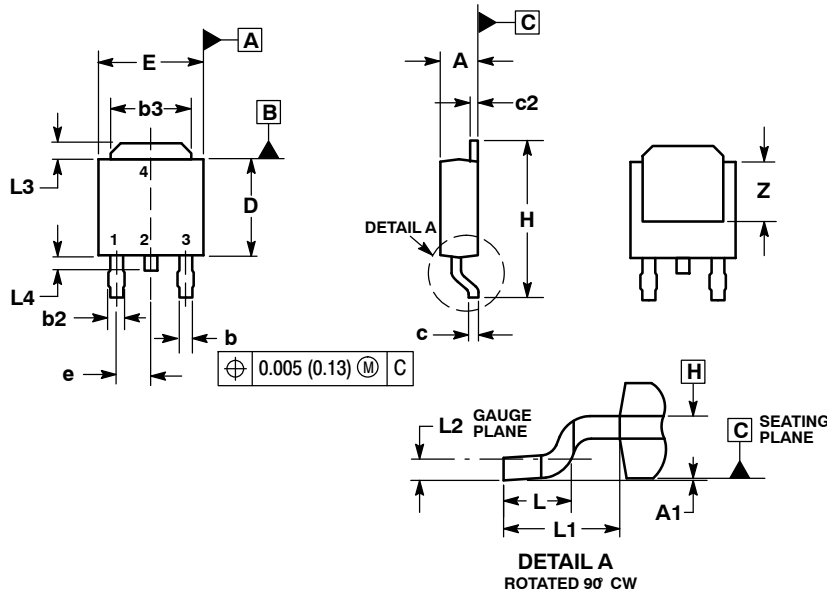


**Figure 12. Exponential Static  $dv/dt$  versus Gate-Cathode Resistance and Gate Trigger Current Sensitivity**

# MCR8DSM, MCR8DSN

## PACKAGE DIMENSIONS

### DPAK (SINGLE GAUGE) CASE 369C-01 ISSUE D



**NOTES:**

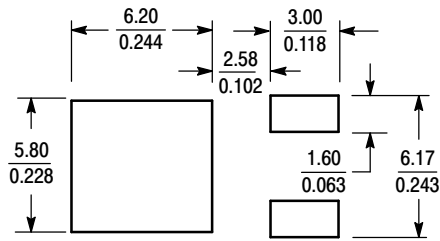
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.086  | 0.094 | 2.18        | 2.38  |
| A1  | 0.000  | 0.005 | 0.00        | 0.13  |
| b   | 0.025  | 0.035 | 0.63        | 0.89  |
| b2  | 0.030  | 0.045 | 0.76        | 1.14  |
| b3  | 0.180  | 0.215 | 4.57        | 5.46  |
| c   | 0.018  | 0.024 | 0.46        | 0.61  |
| c2  | 0.018  | 0.024 | 0.46        | 0.61  |
| D   | 0.235  | 0.245 | 5.97        | 6.22  |
| E   | 0.250  | 0.265 | 6.35        | 6.73  |
| e   | 0.090  | BSC   | 2.29        | BSC   |
| H   | 0.370  | 0.410 | 9.40        | 10.41 |
| L   | 0.055  | 0.070 | 1.40        | 1.78  |
| L1  | 0.108  | REF   | 2.74        | REF   |
| L2  | 0.020  | BSC   | 0.51        | BSC   |
| L3  | 0.035  | 0.050 | 0.89        | 1.27  |
| L4  | ---    | 0.040 | ---         | 1.01  |
| Z   | 0.155  | ---   | 3.93        | ---   |

**STYLE 4:**

1. CATHODE
2. ANODE
3. GATE
4. ANODE

### SOLDERING FOOTPRINT\*



SCALE 3:1 (mm / inches)

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

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