

# MCR12DSM, MCR12DSN

## 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
- Epoxy Meets UL 94 V-0 @ 0.125 in
- ESD Ratings: Human Body Model, 3B > 8000 V  
Machine Model, C > 400 V
- 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) (T <sub>J</sub> = -40 to 110°C, Sine Wave, 50 Hz to 60 Hz) MCR12DSM MCR12DSN	V <sub>DRM</sub> , V <sub>RRM</sub>	600 800	V
On-State RMS Current (180° Conduction Angles; T <sub>C</sub> = 75°C)	I <sub>T(RMS)</sub>	12	A
Average On-State Current (180° Conduction Angles; T <sub>C</sub> = 75°C)	I <sub>T(AV)</sub>	7.6	A
Peak Non-Repetitive Surge Current (1/2 Cycle, Sine Wave 60 Hz, T <sub>J</sub> = 110°C)	I <sub>TSM</sub>	100	A
Circuit Fusing Consideration (t = 8.3 msec)	I <sup>2</sup> t	41	A <sup>2</sup> sec
Forward Peak Gate Power (Pulse Width ≤ 10 μsec, T <sub>C</sub> = 75°C)	P <sub>GM</sub>	5.0	W
Forward Average Gate Power (t = 8.3 msec, T <sub>C</sub> = 75°C)	P <sub>G(AV)</sub>	0.5	W
Forward Peak Gate Current (Pulse Width ≤ 10 μsec, T <sub>C</sub> = 75°C)	I <sub>GM</sub>	2.0	A
Operating Junction Temperature Range	T <sub>J</sub>	-40 to 110	°C
Storage Temperature Range	T <sub>stg</sub>	-40 to 150	°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<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; 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 device are exceeded.



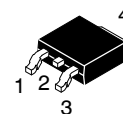
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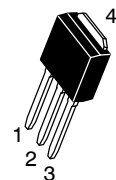
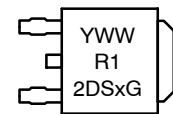
SCRs  
12 AMPERES RMS  
600 – 800 VOLTS



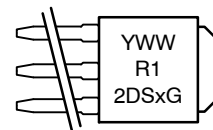
#### MARKING DIAGRAMS



DPAK  
CASE 369C  
STYLE 4



IPAK  
CASE 369D  
STYLE 4



Y = Year  
WW = Work Week  
R12DSx = Device Code  
x = M or N  
G = Pb-Free Package

#### 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 5 of this data sheet.

# MCR12DSM, MCR12DSN

## 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 (Note 3)	$T_L$	260	$^{\circ}C$

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

Characteristics	Symbol	Min	Typ	Max	Unit
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## OFF CHARACTERISTICS

Peak Repetitive Forward or Reverse Blocking Current (Note 4) ( $V_{AK} = \text{Rated } V_{DRM} \text{ or } V_{RRM}; R_{GK} = 1.0 \text{ K}\Omega$ )	$I_{DRM},$ $I_{RRM}$	–	–	10	$\mu A$
$T_J = 25^{\circ}C$		–	–	500	
$T_J = 110^{\circ}C$		–	–		

## ON CHARACTERISTICS

Peak Reverse Gate Blocking Voltage, ( $I_{GR} = 10 \mu A$ )	$V_{GRM}$	10	12.5	18	V
Peak Reverse Gate Blocking Current, ( $V_{GR} = 10 \text{ V}$ )	$I_{GRM}$	–	–	1.2	$\mu A$
Peak Forward On–State Voltage (Note 5), ( $I_{TM} = 20 \text{ A}$ )	$V_{TM}$	–	1.3	1.9	V
Gate Trigger Current (Continuous dc) (Note 6) ( $V_D = 12 \text{ V}, R_L = 100 \Omega$ )	$I_{GT}$	5.0	12	200	$\mu A$
$T_J = 25^{\circ}C$		–	–	300	
$T_J = -40^{\circ}C$					
Gate Trigger Voltage (Continuous dc) (Note 6) ( $V_D = 12 \text{ V}, R_L = 100 \Omega$ )	$V_{GT}$	0.45	0.65	1.0	V
$T_J = 25^{\circ}C$		–	–	1.5	
$T_J = -40^{\circ}C$		0.2	–	–	
$T_J = 110^{\circ}C$					
Holding Current ( $V_D = 12 \text{ V}, \text{Initiating Current} = 200 \text{ mA}, R_{GK} = 1 \text{ k}\Omega$ )	$I_H$	0.5	1.0	6.0	mA
$T_J = 25^{\circ}C$		–	–	10	
$T_J = -40^{\circ}C$					
Latching Current ( $V_D = 12 \text{ V}, I_G = 2.0 \text{ mA}, R_{GK} = 1 \text{ k}\Omega$ )	$I_L$	0.5	1.0	6.0	mA
$T_J = 25^{\circ}C$		–	–	10	
$T_J = -40^{\circ}C$					
Turn–On Time (Source Voltage = 12 V, $R_S = 6.0 \text{ K}\Omega$ , $I_T = 16 \text{ A(pk)}$ , $R_{GK} = 1.0 \text{ K}\Omega$ ) ( $V_D = \text{Rated } V_{DRM}$ , 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 ( $V_D = 0.67 \times \text{Rated } V_{DRM}$ , Exponential Waveform, $R_{GK} = 1.0 \text{ K}\Omega$ , $T_J = 110^{\circ}C$ )	dv/dt	2.0	10	–	V/ $\mu s$
Critical Rate of Rise of On–State Current ( $I_{PK} = 50 \text{ A}$ , $P_W = 40 \mu sec$ , diG/dt = 1 A/ $\mu sec$ , $I_{GT} = 10 \text{ mA}$ )	di/dt	–	50	100	A/ $\mu s$

2. These ratings are applicable when surface mounted on the minimum pad sizes recommended.

3. 1/8" from case for 10 seconds.

4. 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.

5. Pulse Test: Pulse Width  $\leq 2.0 \text{ msec}$ , Duty Cycle  $\leq 2\%$ .

6.  $R_{GK}$  current not included 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

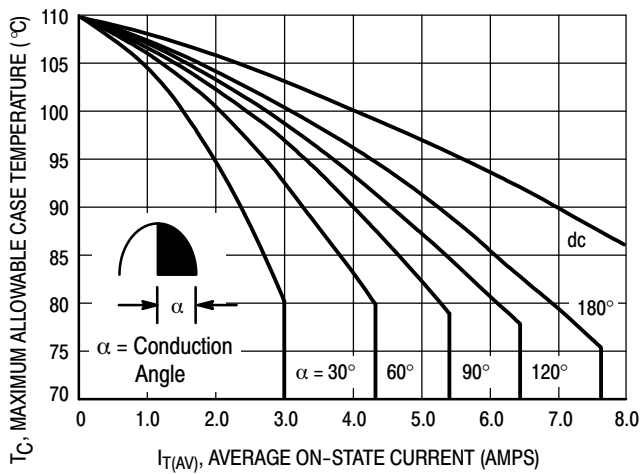
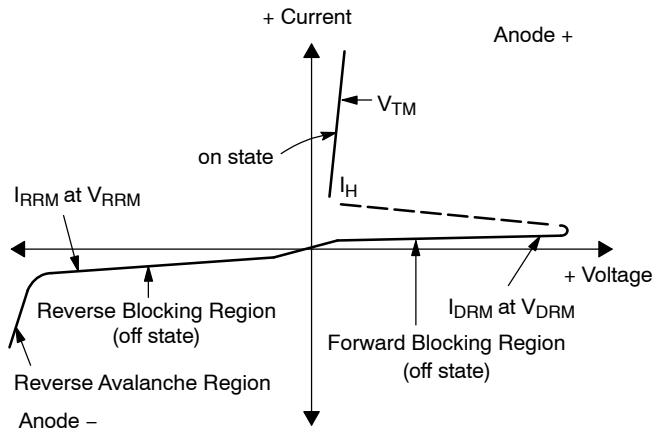


Figure 1. Average Current Derating

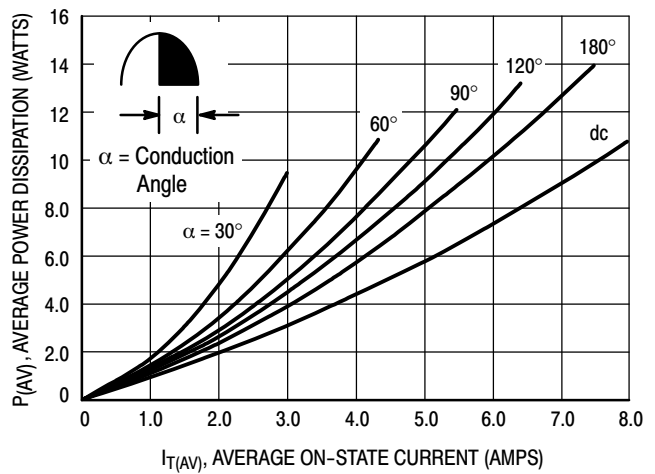


Figure 2. On-State Power Dissipation

# MCR12DSM, MCR12DSN

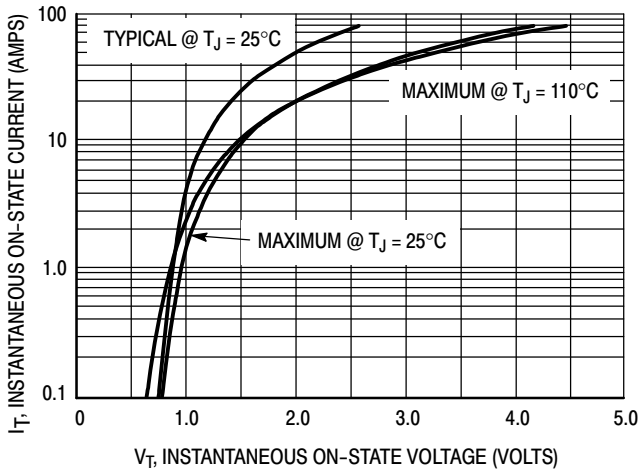


Figure 3. On-State Characteristics

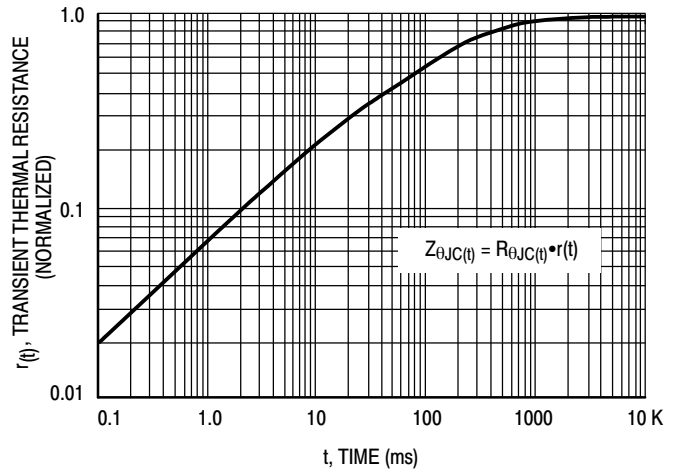


Figure 4. Transient Thermal Response

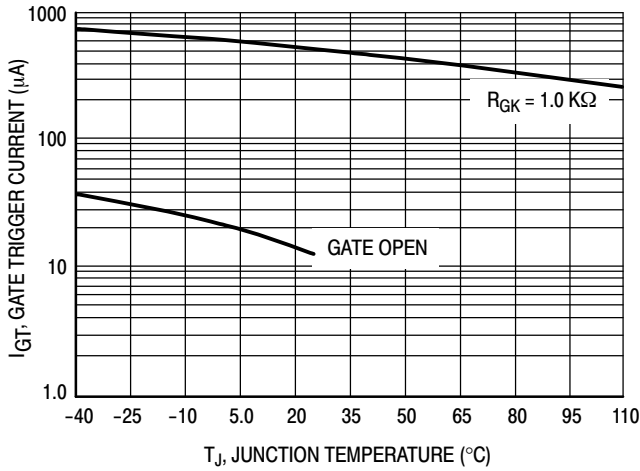


Figure 5. Typical Gate Trigger Current versus Junction Temperature

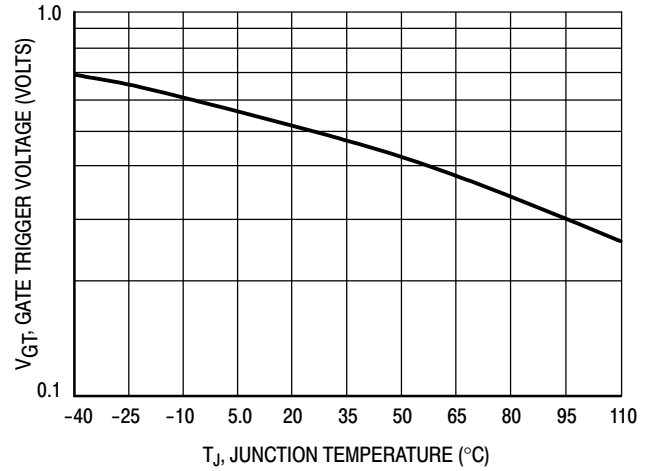


Figure 6. Typical Gate Trigger Voltage versus Junction Temperature

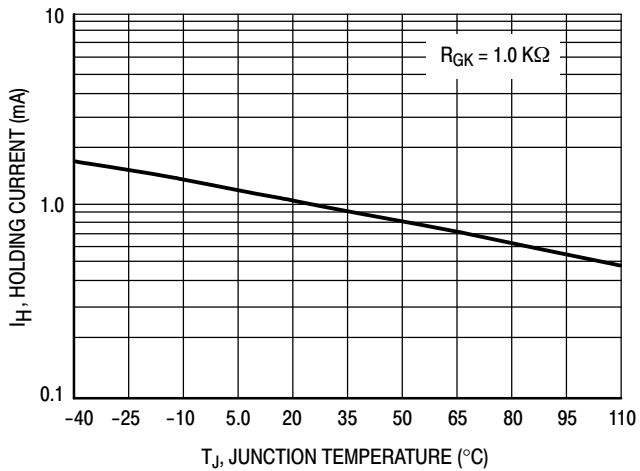


Figure 7. Typical Holding Current versus Junction Temperature

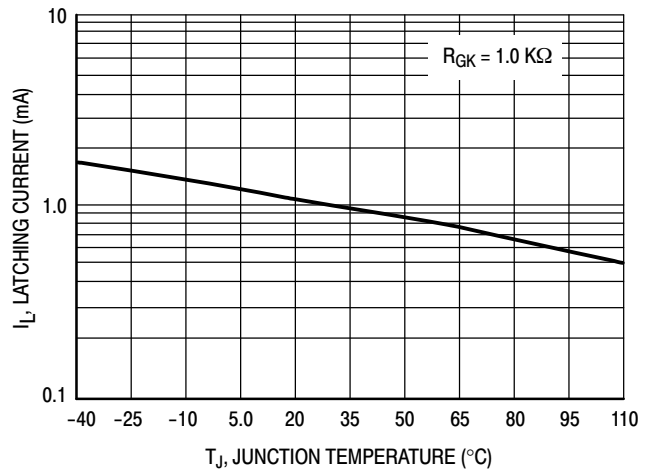
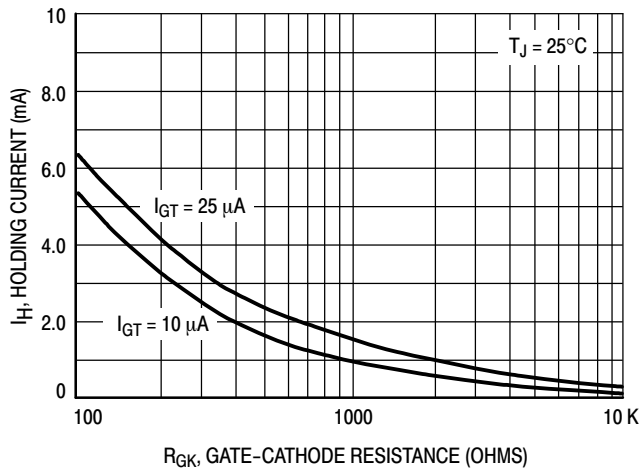
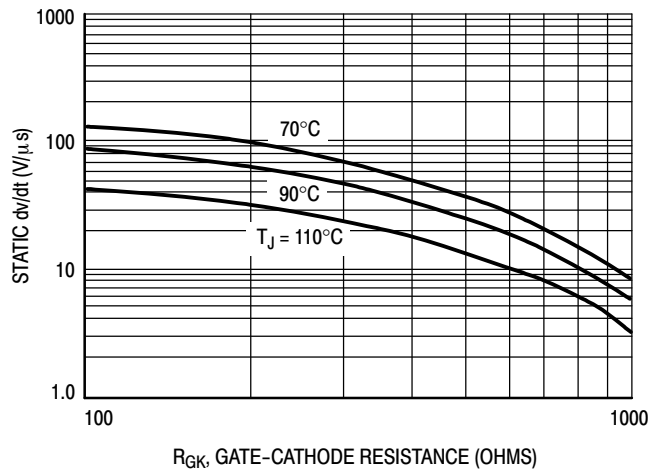


Figure 8. Typical Latching Current versus Junction Temperature

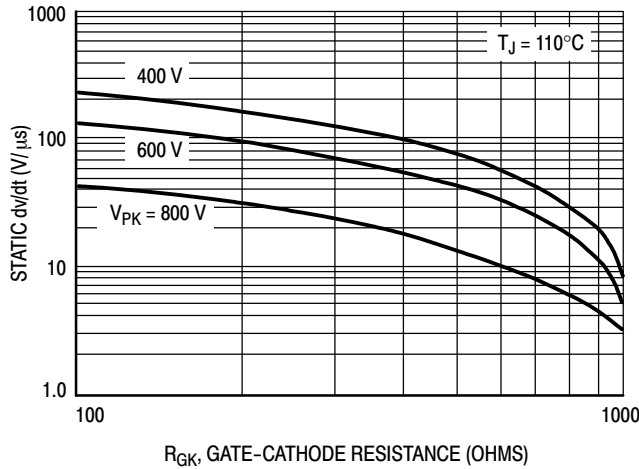
## MCR12DSM, MCR12DSN



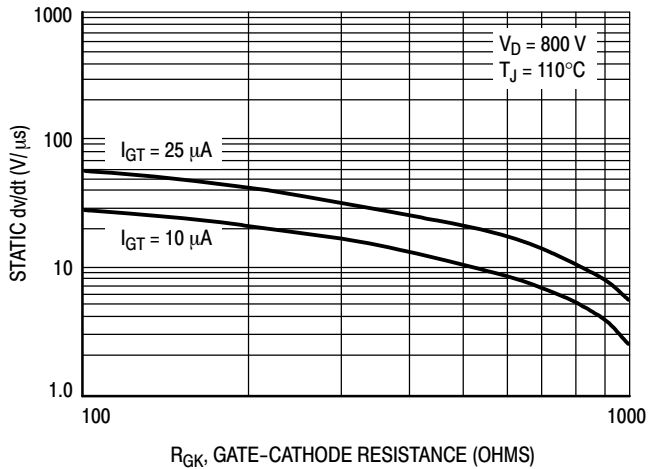
**Figure 9. Holding Current versus Gate-Cathode Resistance**



**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**

### ORDERING INFORMATION

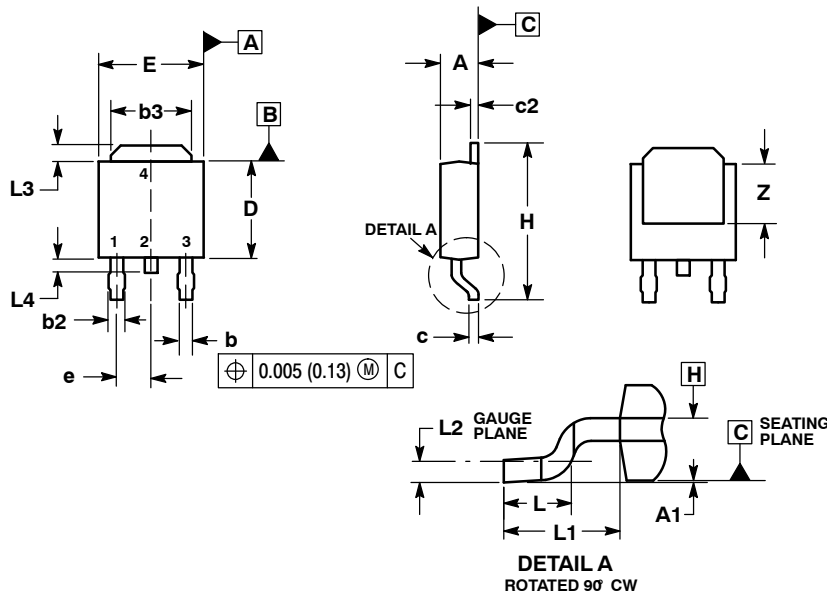
Device	Package Type	Package	Shipping†
MCR12DSMT4G	DPAK (Pb-Free)	369C	2500 / Tape & Reel
MCR12DSN-1G	IPAK (Pb-Free)	369D	75 Units / Rail
MCR12DSNT4G	DPAK (Pb-Free)	369C	2500 / Tape & Reel

†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.

# MCR12DSM, MCR12DSN

## PACKAGE DIMENSIONS

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



**NOTES:**

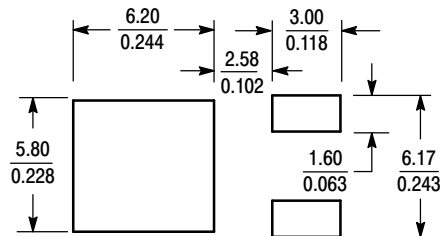
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: INCHES.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3 and Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.006 INCHES PER SIDE.
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:**

- PIN 1. CATHODE
- ANODE
- GATE
- ANODE

### SOLDERING FOOTPRINT\*



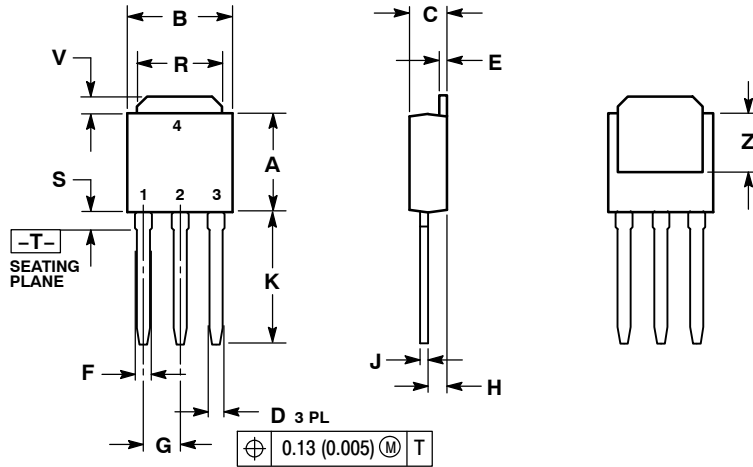
SCALE 3:1  $\left(\frac{\text{mm}}{\text{inches}}\right)$

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

# MCR12DSM, MCR12DSN

## PACKAGE DIMENSIONS

### IPAK CASE 369D ISSUE C




#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.245	5.97	6.35
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.018	0.023	0.46	0.58
F	0.037	0.045	0.94	1.14
G	0.090 BSC		2.29 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.350	0.380	8.89	9.65
R	0.180	0.215	4.45	5.45
S	0.025	0.040	0.63	1.01
V	0.035	0.050	0.89	1.27
Z	0.155	---	3.93	---

#### STYLE 4:

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

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**MCR12DSM/D**