

# MCR716, MCR718

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
- Surface Mount Lead Form – Case 369C
- 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<br>(Note 1) ( $T_J = -40$ to $110^\circ\text{C}$ , Sine Wave,<br>50 to 60 Hz, $R_{GK} = 1\text{ k}\Omega$ )<br>MCR716<br>MCR718 | $V_{DRM}$ ,<br>$V_{RRM}$ | 400<br>600      | V                      |
| On-State RMS Current<br>( $180^\circ$ Conduction Angles; $T_C = 90^\circ\text{C}$ )                                                                               | $I_{T(RMS)}$             | 4.0             | A                      |
| Average On-State Current<br>( $180^\circ$ Conduction Angles; $T_C = 90^\circ\text{C}$ )                                                                           | $I_{T(AV)}$              | 2.6             | A                      |
| Peak Non-Repetitive Surge Current<br>(1/2 Cycle, Sine Wave 60 Hz, $T_J = 110^\circ\text{C}$ )                                                                     | $I_{TSM}$                | 25              | A                      |
| Circuit Fusing Consideration ( $t = 8.3\text{ msec}$ )                                                                                                            | $I^2t$                   | 2.6             | $\text{A}^2\text{sec}$ |
| Forward Peak Gate Power<br>(Pulse Width $\leq 1.0\text{ }\mu\text{sec}$ , $T_C = 90^\circ\text{C}$ )                                                              | $P_{GM}$                 | 0.5             | W                      |
| Forward Average Gate Power<br>( $t = 8.3\text{ msec}$ , $T_C = 90^\circ\text{C}$ )                                                                                | $P_{G(AV)}$              | 0.1             | W                      |
| Forward Peak Gate Current<br>(Pulse Width $\leq 1.0\text{ }\mu\text{sec}$ , $T_C = 90^\circ\text{C}$ )                                                            | $I_{GM}$                 | 0.2             | A                      |
| Operating Junction Temperature Range                                                                                                                              | $T_J$                    | $-40$ to $+110$ | $^\circ\text{C}$       |
| Storage Temperature Range                                                                                                                                         | $T_{stg}$                | $-40$ 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.

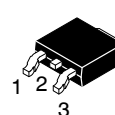
1.  $V_{DRM}$  and  $V_{RRM}$  for all types can be applied on a continuous basis. Ratings apply for zero or negative gate voltage; positive gate voltage shall not be applied concurrent with negative potential on the anode. Blocking voltages shall not be tested with a constant current source such that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



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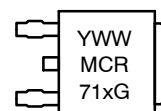
<http://onsemi.com>

SCRs  
4.0 AMPERES RMS  
400 – 600 VOLTS



DPAK  
CASE 369C  
STYLE 4

#### MARKING DIAGRAM



Y = Year  
WW = Work Week  
MCR71x = Device Code  
x = 6 or 8  
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.

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## THERMAL CHARACTERISTICS

| Characteristic                                                                | Symbol          | Max | Unit |
|-------------------------------------------------------------------------------|-----------------|-----|------|
| Thermal Resistance, Junction-to-Case                                          | $R_{\theta JC}$ | 3.0 | °C/W |
| Thermal Resistance, Junction-to-Ambient (Note 2)                              | $R_{\theta JA}$ | 80  | °C/W |
| Maximum Lead Temperature for Soldering Purposes 1/8" from Case for 10 Seconds | $T_L$           | 260 | °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; $R_{GK} = 1\text{ k}\Omega$ (Note 3)<br>( $V_{AK} = \text{Rated } V_{DRM} \text{ or } V_{RRM}$ ) | $I_{DRM}$<br>$I_{RRM}$ | –<br>– | –<br>– | 10<br>200 | $\mu\text{A}$                                         |
|                                                                                                                                                       |                        |        |        |           | $T_C = 25^\circ\text{C}$<br>$T_C = 110^\circ\text{C}$ |

### ON CHARACTERISTICS

|                                                                                                                                                                                                                            |           |                 |                |                 |                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------------|----------------|-----------------|------------------------------------------------------------------------------------|
| Peak Reverse Gate Blocking Voltage ( $I_{GR} = 10\text{ }\mu\text{A}$ )                                                                                                                                                    | $V_{RGM}$ | 10              | 12.5           | 18              | V                                                                                  |
| Peak Reverse Gate Blocking Current ( $V_{GR} = 10\text{ V}$ )                                                                                                                                                              | $I_{RGM}$ | –               | –              | 1.2             | $\mu\text{A}$                                                                      |
| Peak Forward On-State Voltage (Note 4)<br>( $I_{TM} = 5.0\text{ A Peak}$ )<br>( $I_{TM} = 8.2\text{ A Peak}$ )                                                                                                             | $V_{TM}$  | –<br>–          | 1.3<br>1.5     | 1.5<br>2.2      | V                                                                                  |
| Gate Trigger Current (Continuous dc) (Note 5)<br>( $V_D = 12\text{ Vdc}$ , $R_L = 30\text{ }\Omega$ )                                                                                                                      | $I_{GT}$  | 1.0<br>–        | 25<br>–        | 75<br>300       | $\mu\text{A}$                                                                      |
|                                                                                                                                                                                                                            |           |                 |                |                 | $T_C = 25^\circ\text{C}$<br>$T_C = -40^\circ\text{C}$                              |
| Gate Trigger Voltage (Continuous dc) (Note 5)<br>( $V_D = 12\text{ Vdc}$ , $R_L = 30\text{ }\Omega$ )                                                                                                                      | $V_{GT}$  | 0.3<br>–<br>0.2 | 0.55<br>–<br>– | 0.8<br>1.0<br>– | V                                                                                  |
|                                                                                                                                                                                                                            |           |                 |                |                 | $T_C = 25^\circ\text{C}$<br>$T_C = -40^\circ\text{C}$<br>$T_C = 110^\circ\text{C}$ |
| Holding Current (Note 3)<br>( $V_D = 12\text{ Vdc}$ , Initiating Current = 20 mA, $R_{GK} = 1\text{ k}\Omega$ )                                                                                                            | $I_H$     | 0.4<br>–        | 1.0<br>–       | 5.0<br>10       | mA                                                                                 |
|                                                                                                                                                                                                                            |           |                 |                |                 | $T_C = 25^\circ\text{C}$<br>$T_C = -40^\circ\text{C}$                              |
| Latching Current (Note 3) ( $R_{GK} = 1\text{ k}\Omega$ )<br>( $V_D = 12\text{ Vdc}$ , $I_G = 2.0\text{ mA}$ , $T_C = 25^\circ\text{C}$ )<br>( $V_D = 12\text{ Vdc}$ , $I_G = 2.0\text{ mA}$ , $T_C = -40^\circ\text{C}$ ) | $I_L$     | –<br>–          | –<br>–         | 5.0<br>10       | mA                                                                                 |
|                                                                                                                                                                                                                            |           |                 |                |                 | $T_C = 25^\circ\text{C}$<br>$T_C = -40^\circ\text{C}$                              |
| Total Turn-On Time<br>(Source Voltage = 12 V, $R_S = 6\text{ k}\Omega$ , $I_T = 8\text{ A(pk)}$ , $R_{GK} = 1\text{ k}\Omega$ )<br>( $V_D = \text{Rated } V_{DRM}$ , Rise Time = 20 ns, Pulse Width = 10 $\mu\text{s}$ )   | $t_{gt}$  | –               | 2.0            | 5.0             | $\mu\text{s}$                                                                      |

### DYNAMIC CHARACTERISTICS

|                                                                                                                                                                              |         |     |    |     |                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----|----|-----|------------------|
| Critical Rate of Rise of Off-State Voltage<br>( $V_D = 0.67 \times \text{Rated } V_{DRM}$ , $R_{GK} = 1\text{ k}\Omega$ , Exponential Waveform, $T_J = 110^\circ\text{C}$ )  | $dv/dt$ | 5.0 | 10 | –   | V/ $\mu\text{s}$ |
| Repetitive Critical Rate of Rise of On-State Current<br>( $f = 60\text{ Hz}$ , $I_{PK} = 30\text{ A}$ , $PW = 100\text{ }\mu\text{s}$ , $dI_G/dt = 1\text{ A}/\mu\text{s}$ ) | $di/dt$ | –   | –  | 100 | A/ $\mu\text{s}$ |

- Case 369C, when surface mounted on minimum recommended pad size.
- Ratings apply for negative gate voltage or  $R_{GK} = 1\text{ k}\Omega$ . 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  $\leq 2\text{ ms}$ , Duty Cycle  $\leq 2\%$ .
- $R_{GK}$  current not included in measurements.

## ORDERING INFORMATION

| Device    | Package           | Shipping†            |
|-----------|-------------------|----------------------|
| MCR716T4  | DPAK              | 2500 / Tape and Reel |
| MCR716T4G | DPAK<br>(Pb-Free) |                      |
| MCR718T4  | DPAK              |                      |
| MCR718T4G | 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.

# MCR716, MCR718

## 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                           |

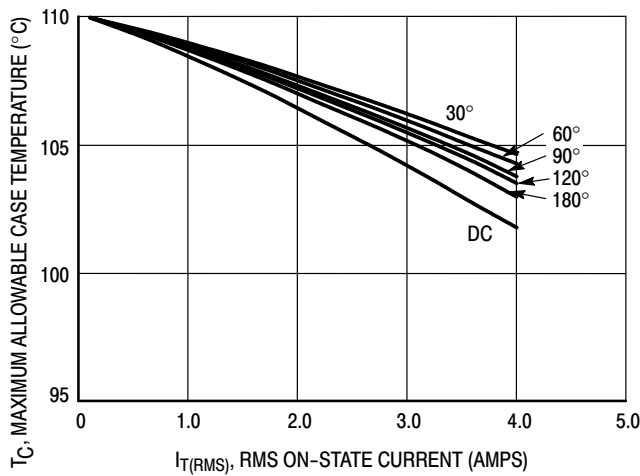
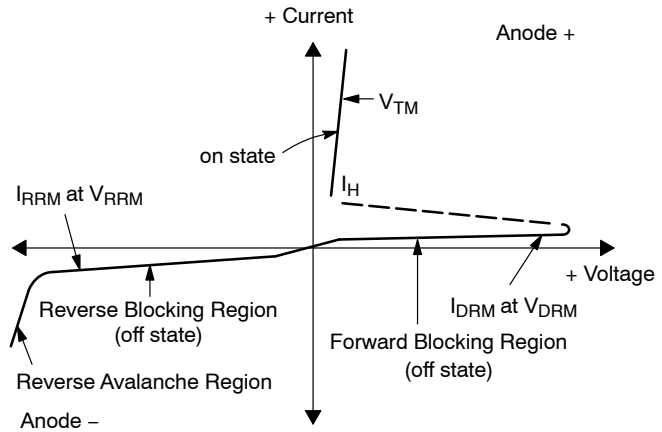


Figure 1. RMS Current Derating

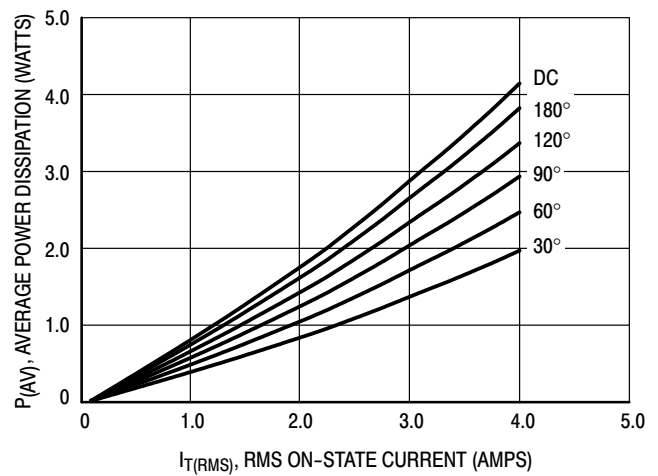


Figure 2. On-State Power Dissipation

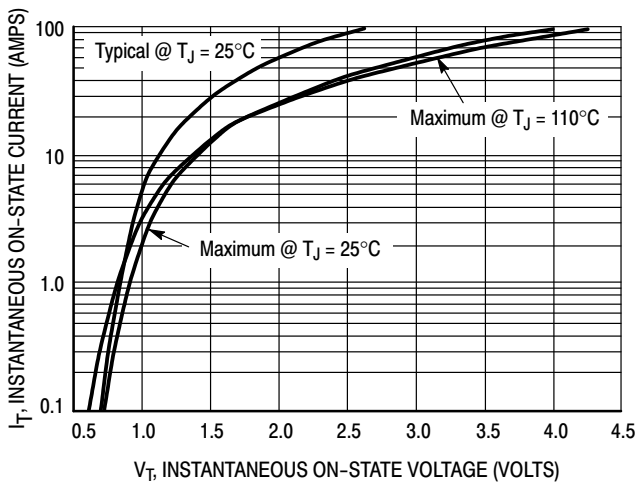


Figure 3. On-State Characteristics

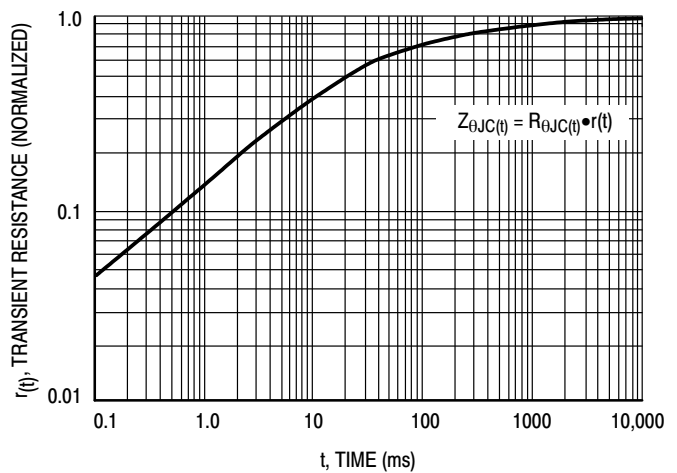


Figure 4. Transient Thermal Response

## MCR716, MCR718

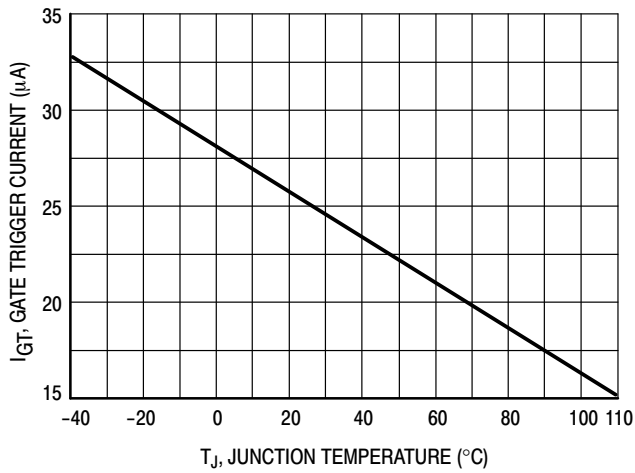


Figure 5. Typical Gate Trigger Current versus Junction Temperature

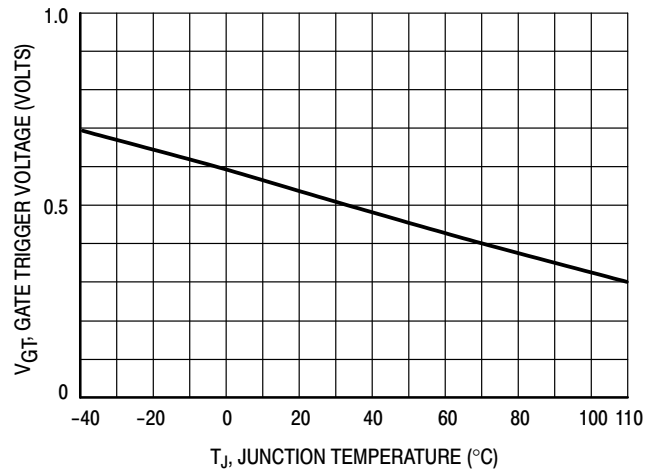


Figure 6. Typical Gate Trigger Voltage versus Junction Temperature

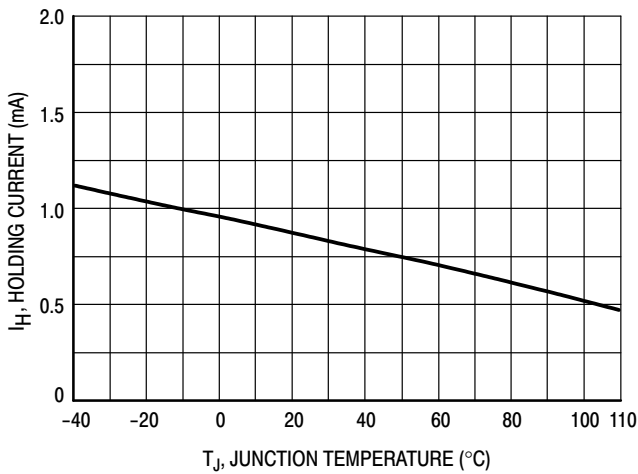


Figure 7. Typical Holding Current versus Junction Temperature

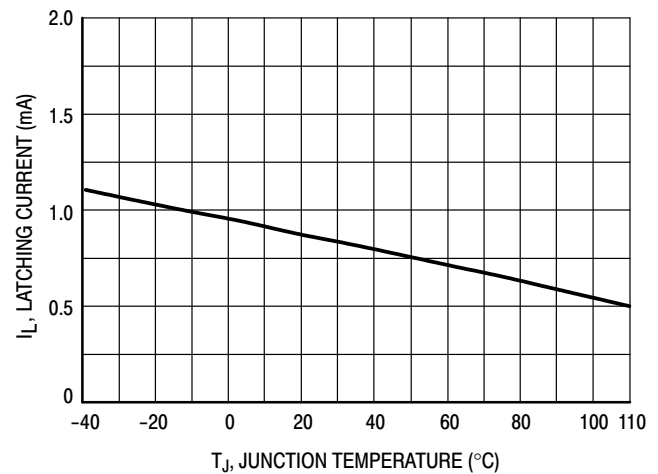
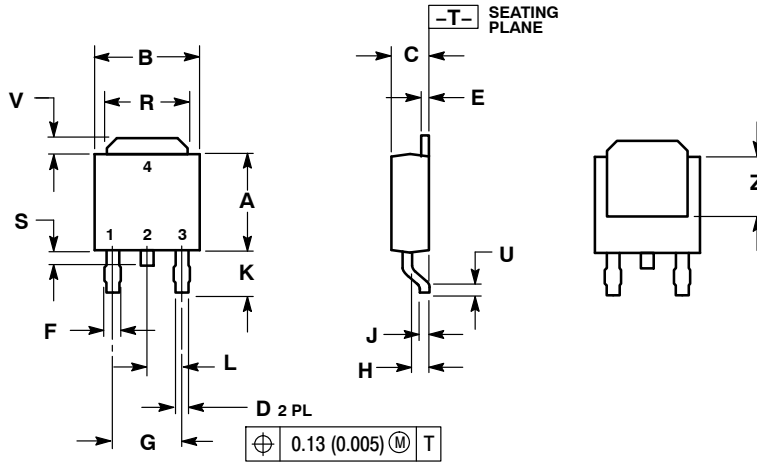


Figure 8. Typical Latching Current versus Junction Temperature

# MCR716, MCR718

## PACKAGE DIMENSIONS

### DPAK CASE 369C-01 ISSUE A

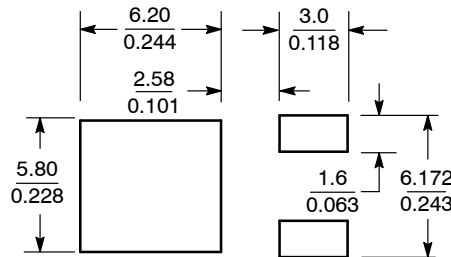


- NOTES:  
1. DIMENSIONING AND TOLERANCING  
PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES    |       | MILLIMETERS |      |
|-----|-----------|-------|-------------|------|
|     | MIN       | MAX   | MIN         | MAX  |
| A   | 0.235     | 0.245 | 5.97        | 6.22 |
| 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   | 0.180 BSC |       | 4.58 BSC    |      |
| H   | 0.034     | 0.040 | 0.87        | 1.01 |
| J   | 0.018     | 0.023 | 0.46        | 0.58 |
| K   | 0.102     | 0.114 | 2.60        | 2.89 |
| L   | 0.090 BSC |       | 2.29 BSC    |      |
| R   | 0.180     | 0.215 | 4.57        | 5.45 |
| S   | 0.025     | 0.040 | 0.63        | 1.01 |
| U   | 0.020     | ---   | 0.51        | ---  |
| V   | 0.035     | 0.050 | 0.89        | 1.27 |
| Z   | 0.155     | ---   | 3.93        | ---  |

- STYLE 4:  
PIN 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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