

# MC74LCXU04DR2 Datasheet



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DiGi Electronics Part Number MC74LCXU04DR2-DG

Manufacturer onsemi

Manufacturer Product Number MC74LCXU04DR2

Description IC INVERTER 6CH 1-INP 14SOIC

Detailed Description Inverter IC 6 Channel 14-SOIC



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DiGi is a global authorized distributor of electronic components.



## **Purchase and inquiry**

Manufacturer Product Number:	Manufacturer:
MC74LCXU04DR2	onsemi
Series:	Product Status:
74LCX	Obsolete
Logic Type:	Number of Circuits:
Inverter	6
Number of Inputs:	Features:
1	
Voltage - Supply:	Current - Quiescent (Max):
2V ~ 3.6V	10 μΑ
Current - Output High, Low:	Input Logic Level - Low:
18mA, 16mA	0.55V
Input Logic Level - High:	Max Propagation Delay @ V, Max CL:
1.7V ~ 2.7V	3.6ns @ 3.3V, 50pF
Operating Temperature:	Mounting Type:
-40°C ~ 85°C	Surface Mount
Supplier Device Package:	Package / Case:
14-SOIC	14-SOIC (0.154", 3.90mm Width)
Base Product Number:	
74LCXU04	

## **Environmental & Export classification**

RoHS Status:	Moisture Sensitivity Level (MSL):
RoHS non-compliant	1 (Unlimited)
REACH Status:	ECCN:
REACH Unaffected	EAR99
HTSUS:	

8542.39.0001





# Low-Voltage CMOS Unbuffered Hex Inverter With 5 V-Tolerant Inputs

### MC74LCXU04

The MC74LCXU04 is a high performance unbuffered hex inverter operating from a 1.65 to 5.5 V supply. (High impedance TTL compatible inputs significantly reduce current loading to input drivers while TTL compatible outputs offer improved switching noise performance.) A  $V_{\rm I}$  specification of 5.5 V allows MC74LCXU04 inputs to be safely driven from 5 V devices.

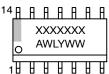
#### **Features**

- Designed for 1.65 to 5.5 V V<sub>CC</sub> Operation
- 5 V Tolerant Inputs Interface Capability With 5 V TTL Logic
- LVTTL Compatible
- LVCMOS Compatible
- Near Zero Static Supply Current (10 μA) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 100 mA
- ESD Performance:
  - ♦ Human Body Model >2000 V
- These Devices are Pb–Free, Halogen Free/BFR Free and are RoHS Compliant

## MARKING DIAGRAMS



SOIC-14 D SUFFIX CASE 751A





TSSOP-14 DT SUFFIX CASE 948G



XXXXXX = Specific Device Code A = Assembly Location

L, WL = Wafer Lot Y, YY = Year W, WW = Work Week G or = Pb-Free Package

(Note: Microdot may be in either location)

#### **ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

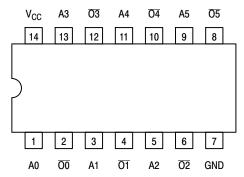


Figure 1. Pinout: 14-Lead (Top View)

#### **PIN NAMES**

Pins	Function		
An	Data Inputs		
On	Outputs		

#### **TRUTH TABLE**

An	On
L	Н
Н	L

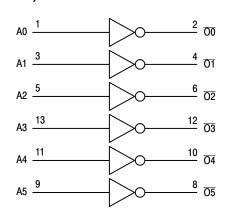


Figure 2. Logic Diagram

#### **MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit	
$V_{CC}$	DC Supply Voltage		-0.5 to +6.5	V
VI	DC Input Voltage (Note 1)		-0.5 to +6.5	V
V <sub>O</sub>	DC Output Voltage (Note 1)		-0.5 to V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	DC Input Diode Current	V <sub>I</sub> < GND	-50	mA
lok	DC Output Diode Current	V <sub>O</sub> > V <sub>CC</sub> , V <sub>O</sub> < GND	±50	mA
I <sub>O</sub>	DC Output Source/Sink Current		±50	mA
I <sub>CC</sub> or I <sub>GND</sub>	DC Supply Current per Supply Pin or Ground Pin		±100	mA
T <sub>STG</sub>	Storage Temperature Range		-65 to +150	°C
TL	Lead Temperature, 1 mm from Case for 10 secs		260	°C
TJ	Junction Temperature Under Bias		+150	°C
$\theta_{\sf JA}$	Thermal Resistance (Note 1)	SOIC-14 TSSOP-14	116 150	°C/W
$P_{D}$	Power Dissipation in Still Air at 125°C	SOIC-14 TSSOP-14	1077 833	mW
MSL	Moisture Sensitivity		Level 1	-
F <sub>R</sub>	Flammability Rating	Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in	-
V <sub>ESD</sub>	ESD Withstand Voltage (Note 3)	Human Body Model Charged Device Model	2000 N/A	٧

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. I<sub>O</sub> absolute maximum rating must be observed.

- Measured with minimum pad spacing on an FR4 board, using 76mm-by-114mm, 2-ounce copper trace no air flow per JESD51-7.
   HBM tested to EIA / JESD22-A114-A. CDM tested to JESD22-C101-A. JEDEC recommends that ESD qualification to EIA/JESD22-A115A (Machine Model) be discontinued.

#### RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Тур	Max	Unit
V <sub>CC</sub>	Supply Voltage Operating Data Retention Only	1.65 1.5	3.3 3.3	5.5 5.5	V
VI	Digital Input Voltage	0	-	5.5	V
Vo	Output Voltage	0	-	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Free-Air Temperature	-40	-	+125	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise or Fall Rate $V_{CC} = 1.65 \ V \ to \ 1.95 \ V$ $V_{CC} = 2.3 \ V \ to \ 2.7 \ V$ $V_{IN} \ from \ 0.8 \ V \ to \ 2.0 \ V, \ V_{CC} = 3.0 \ V$ $V_{CC} = 4.5 \ V \ to \ 5.5 \ V$	0 0 0	1 1 1	20 20 10 5	nS/V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

#### DC ELECTRICAL CHARACTERISTICS

				T <sub>A</sub> = -40°0	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$		$T_A = -40^{\circ}C \text{ to } +125^{\circ}C$	
Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	Min	Max	Min	Max	Unit
V <sub>IH</sub>	HIGH Level Input		1.65	1.2	_	1.2	-	V
	Voltage		2.3	1.7	_	1.7	-	1
			2.7	2.1	_	2.1	-	1
			3.0	2.2	_	2.2	-	1
			3.6	2.7	-	2.7	-	
			4.5	3.4	-	3.4	-	
V <sub>IL</sub>	LOW Level Input		1.65	-	0.4	-	0.4	V
	Voltage		2.3	-	0.6	-	0.6	
			2.7	=	0.7	=	0.7	
			3.0	=	0.8	=	0.8	
			3.6	=	0.9	=	0.9	
			4.5	=	1.1	=	1.1	
V <sub>OH</sub>	High-Level Output Voltage	$\begin{aligned} &V_I = GND \\ &I_{OH} = -100 \ \mu A \\ &I_{OH} = -4 \ mA \\ &I_{OH} = -8 \ mA \\ &I_{OH} = -12 \ mA \\ &I_{OH} = -18 \ mA \\ &I_{OH} = -24 \ mA \end{aligned}$	1.65 to 5.5 1.65 2.3 2.7 3.0 4.5	V <sub>CC</sub> - 0.2 1.29 1.8 2.2 2.4 3.7	1 1 1 1 1 1	V <sub>CC</sub> - 0.2 1.29 1.8 2.2 2.4 3.7	11111	V
V <sub>OL</sub>	Low-Level Output Voltage	$\begin{aligned} &V_{I} = V_{CC} \\ &I_{OL} = 100 \; \mu\text{A} \\ &I_{OL} = 4 \; \text{mA} \\ &I_{OL} = 8 \; \text{mA} \\ &I_{OL} = 12 \; \text{mA} \\ &I_{OL} = 18 \; \text{mA} \\ &I_{OL} = 24 \; \text{mA} \end{aligned}$	1.65 to 5.5 1.65 2.3 2.7 3.0 4.5	- - - - -	0.2 0.36 0.6 0.4 0.5 0.55	-	0.3 0.36 0.6 0.4 0.55 0.55	V
II	Input Leakage Current	V <sub>I</sub> = 0 to 5.5 V	3.6	-	±5.0	_	±5.0	μΑ
l <sub>OFF</sub>	Power Off Leak- age Current	V <sub>I</sub> = 5.5 V	0	-	10	-	10	μΑ
I <sub>CC</sub>	Quiescent Supply Current	V <sub>I</sub> = 5.5 V or GND	3.6	-	10	-	10	μΑ
$\Delta I_{CC}$	Increase in I <sub>CC</sub> per Input	$V_{IH} = V_{CC} - 0.6 V$	2.3 to 3.6	-	500	_	500	μΑ

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

<sup>4.</sup> Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V<sub>CC</sub>). Unused outputs must be left open.

#### **AC ELECTRICAL CHARACTERISTICS**

				$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$		T <sub>A</sub> = -40°C	to +125°C	
Symbol	Parameter	Test Condition	V <sub>CC</sub> (V)	Min	Max	Min	Max	Unit
t <sub>PLH</sub> ,	Propagation Delay,	See Figures 3 and 4	1.65 to 1.95	-	4.6	-	4.6	ns
t <sub>PHL</sub>	Input to Output		2.3 to 2.7	-	4.3	-	4.3	
			2.7	-	4.5	-	4.5	
			3.0 to 3.6	-	3.6	-	3.6	
			4.5 to 5.5	-	3.3	-	3.3	
toshL,	Output to Output Skew		1.65 to 1.95	-	-	-	-	ns
<sup>t</sup> oslh	LH		2.3 to 2.7	-	-	-	-	
			2.7	-	-	-	-	
			3.0 to 3.6	-	1.0	-	1.0	
			4.5 to 5.5	_	_	-	-	

#### **DYNAMIC SWITCHING CHARACTERISTICS**

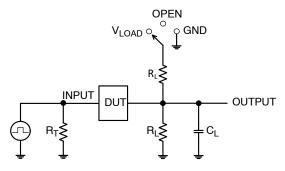
			T <sub>A</sub> = +25°C			
Symbol	Characteristic	Condition	Min	Тур	Max	Units
V <sub>OLP</sub>	Dynamic LOW Peak Voltage (Note 7)	$\begin{array}{c} V_{CC} = 3.3 \text{ V}, \text{ C}_{L} = 50 \text{ pF}, \text{ V}_{IH} = 3.3 \text{ V}, \text{ V}_{IL} = 0 \text{ V} \\ V_{CC} = 2.5 \text{ V}, \text{ C}_{L} = 30 \text{ pF}, \text{ V}_{IH} = 2.5 \text{ V}, \text{ V}_{IL} = 0 \text{ V} \end{array}$		0.8 0.6		V
V <sub>OLV</sub>	Dynamic LOW Valley Voltage (Note 7)	$\begin{array}{c} V_{CC} = 3.3 \text{ V}, \ C_L = 50 \text{ pF}, \ V_{IH} = 3.3 \text{ V}, \ V_{IL} = 0 \text{ V} \\ V_{CC} = 2.5 \text{ V}, \ C_L = 30 \text{ pF}, \ V_{IH} = 2.5 \text{ V}, \ V_{IL} = 0 \text{ V} \end{array}$		-0.8 -0.6		V

<sup>7.</sup> Number of outputs defined as "n". Measured with "n-1" outputs switching from HIGH-to-LOW or LOW-to-HIGH. The remaining output is measured in the LOW state.

#### **CAPACITIVE CHARACTERISTICS**

Symbol	Parameter	Condition	Typical	Units
C <sub>IN</sub>	Input Capacitance	$V_{CC}$ = 3.3 V, $V_I$ = 0 V or $V_{CC}$	7	pF
C <sub>OUT</sub>	Output Capacitance	$V_{CC}$ = 3.3 V, $V_I$ = 0 V or $V_{CC}$	8	pF
C <sub>PD</sub>	Power Dissipation Capacitance	10 MHz, $V_{CC}$ = 3.3 V, $V_{I}$ = 0 V or $V_{CC}$	25	pF

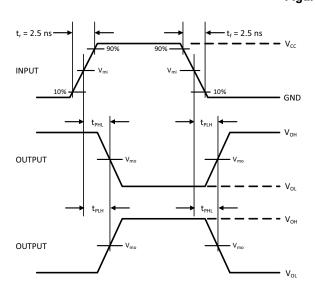
These AC parameters are preliminary and may be modified.
 Skew is defined as the absolute value of the difference between the actual propagation delay for any two separate outputs of the same device.
 The specification applies to any outputs switching in the same direction, either HIGH-to-LOW (t<sub>OSHL</sub>) or LOW-to-HIGH (t<sub>OSLH</sub>); parameter
 guaranteed by design.

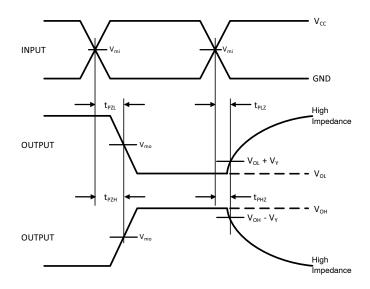


Test	Switch Position
t <sub>PLH</sub> / t <sub>PHL</sub>	Open
t <sub>PLZ</sub> / t <sub>PZL</sub>	$V_{LOAD}$
t <sub>PHZ</sub> / t <sub>PZH</sub>	GND

 $C_L$  includes probe and jig capacitance  $R_T$  is  $Z_{OUT}$  of pulse generator (typically 50  $\Omega)$  f = 1 MHz, tw = 500 ns

Figure 3. Test Circuit





V <sub>CC</sub> , V	$R_L,\Omega$	C <sub>L</sub> , pF	V <sub>LOAD</sub>	V <sub>m</sub> , V	V <sub>Y</sub> , V
1.65 to 1.95	500	30	2 x V <sub>CC</sub>	V <sub>CC</sub> /2	0.15
2.3 to 2.7	500	30	2 x V <sub>CC</sub>	V <sub>CC</sub> /2	0.15
2.7	500	50	6 V	1.5	0.3
3.0 to 3.6	500	50	6 V	1.5	0.3
4.5 to 5.5	500	50	2 x V <sub>CC</sub>	V <sub>CC</sub> /2	0.3

Figure 4. Switching Waveforms

#### **ORDERING INFORMATION**

Device	Marking	Package	Shipping <sup>†</sup>
MC74LCXU04DG	LCXU04G	SOIC-14 (Pb-Free)	55 Units / Rail
MC74LCXU04DR2G	LCXU04G	SOIC-14 (Pb-Free)	2500 Tape & Reel
MC74LCXU04DTR2G	LCX U04	TSSOP-14 (Pb-Free)	2500 Tape & Reel

<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, <u>BRD8011/D</u>.



## **MECHANICAL CASE OUTLINE**

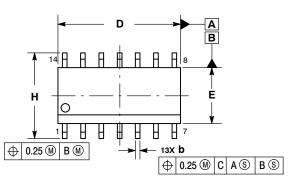
PACKAGE DIMENSIONS

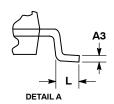


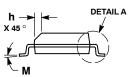
△ 0.10

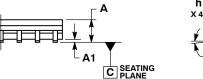
SOIC-14 NB CASE 751A-03 ISSUE L

**DATE 03 FEB 2016** 





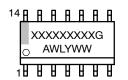




- NOTES:
  1. DIMENSIONING AND TOLERANCING PER
  - ASME Y14.5M, 1994.
    CONTROLLING DIMENSION: MILLIMETERS.
  - DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF AT
  - MAXIMUM MATERIAL CONDITION.
    DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSIONS.
- 5. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
Α	1.35	1.75	0.054	0.068
A1	0.10	0.25	0.004	0.010
АЗ	0.19	0.25	0.008	0.010
b	0.35	0.49	0.014	0.019
D	8.55	8.75	0.337	0.344
Е	3.80	4.00	0.150	0.157
е	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
h	0.25	0.50	0.010	0.019
L	0.40	1.25	0.016	0.049
М	0 °	7°	0 °	7°

#### **GENERIC MARKING DIAGRAM\***

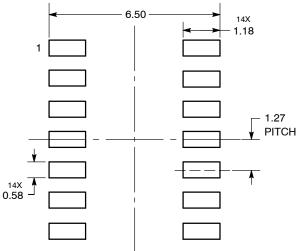


XXXXX = Specific Device Code Α = Assembly Location

WL = Wafer Lot Υ = Year WW = Work Week = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "■", may or may not be present. Some products may not follow the Generic Marking.

#### **SOLDERING FOOTPRINT\***



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

#### **STYLES ON PAGE 2**

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#### SOIC-14 CASE 751A-03 ISSUE L

DATE 03 FEB 2016

STYLE 1: PIN 1. COMMON CATHODE 2. ANODE/CATHODE 3. ANODE/CATHODE 4. NO CONNECTION 5. ANODE/CATHODE 6. NO CONNECTION 7. ANODE/CATHODE 8. ANODE/CATHODE 9. ANODE/CATHODE 10. NO CONNECTION 11. ANODE/CATHODE 12. ANODE/CATHODE 13. NO CONNECTION 14. COMMON ANODE	STYLE 2: CANCELLED	STYLE 3: PIN 1. NO CONNECTION 2. ANODE 3. ANODE 4. NO CONNECTION 5. ANODE 6. NO CONNECTION 7. ANODE 8. ANODE 9. ANODE 10. NO CONNECTION 11. ANODE 12. ANODE 13. NO CONNECTION 14. COMMON CATHODE	STYLE 4: PIN 1. NO CONNECTION 2. CATHODE 3. CATHODE 4. NO CONNECTION 5. CATHODE 6. NO CONNECTION 7. CATHODE 8. CATHODE 9. CATHODE 10. NO CONNECTION 11. CATHODE 12. CATHODE 13. NO CONNECTION 14. COMMON ANODE
STYLE 5: PIN 1. COMMON CATHODE 2. ANODE/CATHODE 3. ANODE/CATHODE 4. ANODE/CATHODE 5. ANODE/CATHODE 6. NO CONNECTION 7. COMMON ANODE 8. COMMON CATHODE 9. ANODE/CATHODE 10. ANODE/CATHODE 11. ANODE/CATHODE 12. ANODE/CATHODE 13. NO CONNECTION 14. COMMON ANODE	STYLE 6: PIN 1. CATHODE 2. CATHODE 3. CATHODE 4. CATHODE 5. CATHODE 6. CATHODE 7. CATHODE 8. ANODE 9. ANODE 10. ANODE 11. ANODE 12. ANODE 13. ANODE 14. ANODE	STYLE 7: PIN 1. ANODE/CATHODE 2. COMMON ANODE 3. COMMON CATHODE 4. ANODE/CATHODE 5. ANODE/CATHODE 6. ANODE/CATHODE 7. ANODE/CATHODE 8. ANODE/CATHODE 9. ANODE/CATHODE 10. ANODE/CATHODE 11. COMMON CATHODE 12. COMMON ANODE 13. ANODE/CATHODE 14. ANODE/CATHODE	STYLE 8: PIN 1. COMMON CATHODE 2. ANODE/CATHODE 3. ANODE/CATHODE 4. NO CONNECTION 5. ANODE/CATHODE 6. ANODE/CATHODE 7. COMMON ANODE 8. COMMON ANODE 9. ANODE/CATHODE 10. ANODE/CATHODE 11. NO CONNECTION 12. ANODE/CATHODE 13. ANODE/CATHODE 14. COMMON CATHODE

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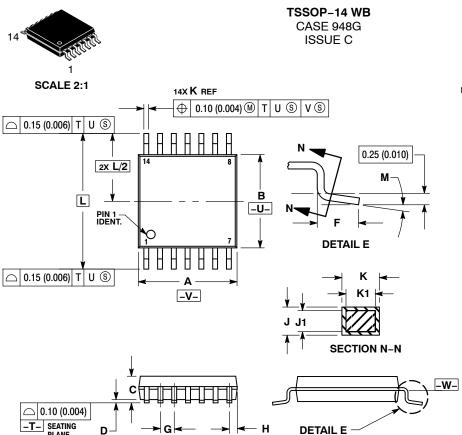
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## **MECHANICAL CASE OUTLINE**

PACKAGE DIMENSIONS

**DATE 17 FEB 2016** 



- NOTES.

  1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

  2. CONTROLLING DIMENSION: MILLIMETER.

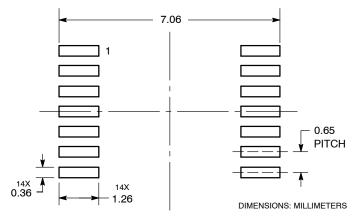
  3. DIMENSION A DOES NOT INCLUDE MOLD
- FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT
- EXCEED 0.15 (0.006) PER SIDE.
  DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION.
  INTERLEAD FLASH OR PROTRUSION SHALL
- INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.

  5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.

  6. TERMINAL NUMBERS ARE SHOWN FOR DEFERENCE ONLY
- REFERENCE ONLY.
  DIMENSION A AND B ARE TO BE
- DETERMINED AT DATUM PLANE -W-.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
Α	4.90	5.10	0.193	0.200
В	4.30	4.50	0.169	0.177
С		1.20		0.047
D	0.05	0.15	0.002	0.006
F	0.50	0.75	0.020	0.030
G	0.65 BSC		0.026 BSC	
Н	0.50	0.60	0.020	0.024
J	0.09	0.20	0.004	0.008
J1	0.09	0.16	0.004	0.006
K	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40 BSC		0.252 BSC	
М	o°	8 °	0 °	8 °

#### **RECOMMENDED SOLDERING FOOTPRINT\***



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

#### **GENERIC MARKING DIAGRAM\***



= Assembly Location

= Wafer Lot = Year = Work Week W

= Pb-Free Package (Note: Microdot may be in either location)

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "■", may or may not be present. Some products may not follow the Generic Marking.

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