



# THE DATASHEET OF MC74LCX14DR2G

# MC74LCX14

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

The MC74LCX14 is a high performance hex inverter with Schmitt-Trigger inputs operating from a 2.3 to 3.6 V supply. High impedance TTL compatible inputs significantly reduce current loading to input drivers, while TTL compatible outputs offer improved switching noise performance. A  $V_I$  specification of 5.5 V allows MC74LCX14 inputs to be safely driven from 5.0 V devices.

Pin configuration and function are the same as the MC74LCX04, but the inputs have hysteresis and, with its Schmitt trigger function, the LCX14 can be used as a line receiver which will receive slow input signals.

### Features

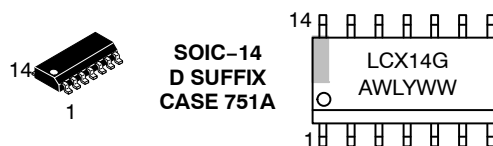
- Designed for 2.3 V to 3.6 V  $V_{CC}$  Operation
- 5.0 V Tolerant Inputs – Interface Capability with 5.0 V TTL Logic
- LVTTTL Compatible
- LVCMOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current (10  $\mu$ A) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500 mA
- Current Drive Capability is 24 mA at Source/Sink
- Pin and Function Compatible with Other Standard Logic Families
- ESD Performance: Human Body Model >2000 V  
Machine Model >100 V
- Chip Complexity: 41 Equivalent Gates
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant



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### MARKING DIAGRAMS



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 4 of this data sheet.

# MC74LCX14

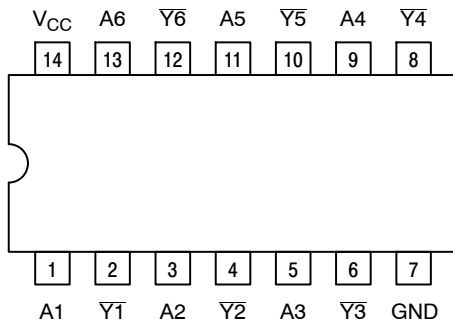


Figure 1. Pinout: 14-Lead (Top View)

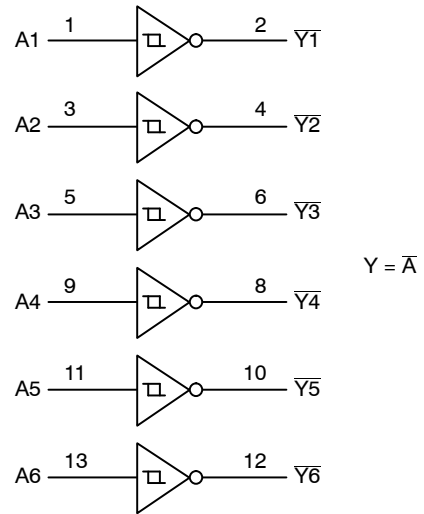


Figure 2. Logic Diagram

## PIN NAMES

| Pins           | Function    |
|----------------|-------------|
| A <sub>n</sub> | Data Inputs |
| $\bar{Y}_n$    | Outputs     |

## TRUTH TABLE

| Inputs | Outputs   |
|--------|-----------|
| A      | $\bar{Y}$ |
| L      | H         |
| H      | L         |

## MAXIMUM RATINGS

| Symbol           | Parameter                        | Value                                         | Condition                             | Units |
|------------------|----------------------------------|-----------------------------------------------|---------------------------------------|-------|
| V <sub>CC</sub>  | DC Supply Voltage                | -0.5 to +7.0                                  |                                       | V     |
| V <sub>I</sub>   | DC Input Voltage                 | -0.5 ≤ V <sub>I</sub> ≤ +7.0                  |                                       | V     |
| V <sub>O</sub>   | DC Output Voltage                | -0.5 ≤ V <sub>O</sub> ≤ V <sub>CC</sub> + 0.5 | Output in HIGH or LOW State. (Note 1) | V     |
| I <sub>IK</sub>  | DC Input Diode Current           | -50                                           | V <sub>I</sub> < GND                  | mA    |
| I <sub>OK</sub>  | DC Output Diode Current          | -50                                           | V <sub>O</sub> < GND                  | mA    |
|                  |                                  | +50                                           | V <sub>O</sub> > V <sub>CC</sub>      | mA    |
| I <sub>O</sub>   | DC Output Source/Sink Current    | ±50                                           |                                       | mA    |
| I <sub>CC</sub>  | DC Supply Current Per Supply Pin | ±100                                          |                                       | mA    |
| I <sub>GND</sub> | DC Ground Current Per Ground Pin | ±100                                          |                                       | mA    |
| T <sub>STG</sub> | Storage Temperature Range        | -65 to +150                                   |                                       | °C    |
| MSL              | Moisture Sensitivity             |                                               | Level 1                               |       |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

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

# MC74LCX14

## RECOMMENDED OPERATING CONDITIONS

| Symbol   | Parameter                                                                                                                                               | Min        | Typ        | Max              | Units |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------|------------------|-------|
| $V_{CC}$ | Supply Voltage<br>Operating<br>Data Retention Only                                                                                                      | 2.0<br>1.5 | 2.5 to 3.3 | 3.6<br>3.6       | V     |
| $V_I$    | Input Voltage                                                                                                                                           | 0          |            | 5.5              | V     |
| $V_O$    | Output Voltage (HIGH or LOW State)                                                                                                                      | 0          |            | $V_{CC}$         | V     |
| $I_{OH}$ | HIGH Level Output Current<br>$V_{CC} = 3.0\text{ V} - 3.6\text{ V}$<br>$V_{CC} = 2.7\text{ V} - 3.0\text{ V}$<br>$V_{CC} = 2.3\text{ V} - 2.7\text{ V}$ |            |            | -24<br>-12<br>-8 | mA    |
| $I_{OL}$ | LOW Level Output Current<br>$V_{CC} = 3.0\text{ V} - 3.6\text{ V}$<br>$V_{CC} = 2.7\text{ V} - 3.0\text{ V}$<br>$V_{CC} = 2.3\text{ V} - 2.7\text{ V}$  |            |            | +24<br>+12<br>+8 | mA    |
| $T_A$    | Operating Free-Air Temperature                                                                                                                          | -40        |            | +85              | °C    |

## DC ELECTRICAL CHARACTERISTICS

| Symbol          | Characteristic                              | Condition                                                                     | $T_A = -40\text{ to }85^\circ\text{C}$ |            | Units         |
|-----------------|---------------------------------------------|-------------------------------------------------------------------------------|----------------------------------------|------------|---------------|
|                 |                                             |                                                                               | Min                                    | Max        |               |
| $V_{T+}$        | Positive Input Threshold Voltage (Figure 3) | $V_{CC} = 2.5\text{ V}$<br>$V_{CC} = 3.0\text{ V}$                            | 0.9<br>1.2                             | 1.7<br>2.2 | V             |
| $V_{T-}$        | Negative Input Threshold Voltage (Figure 3) | $V_{CC} = 2.5\text{ V}$<br>$V_{CC} = 3.0\text{ V}$                            | 0.4<br>0.6                             | 1.1<br>1.5 | V             |
| $V_H$           | Input Hysteresis Voltage (Figure 3)         | $V_{CC} = 2.5\text{ V}$<br>$V_{CC} = 3.0\text{ V}$                            | 0.3<br>0.4                             | 1.0<br>1.2 | V             |
| $V_{OH}$        | HIGH Level Output Voltage                   | $2.3\text{ V} \leq V_{CC} \leq 3.6\text{ V}; I_{OL} = 100\text{ }\mu\text{A}$ | $V_{CC} - 0.2$                         |            | V             |
|                 |                                             | $V_{CC} = 2.3\text{ V}; I_{OH} = -8\text{ mA}$                                | 1.8                                    |            |               |
|                 |                                             | $V_{CC} = 2.7\text{ V}; I_{OH} = -12\text{ mA}$                               | 2.2                                    |            |               |
|                 |                                             | $V_{CC} = 3.0\text{ V}; I_{OH} = -18\text{ mA}$                               | 2.4                                    |            |               |
|                 |                                             | $V_{CC} = 3.0\text{ V}; I_{OH} = -24\text{ mA}$                               | 2.2                                    |            |               |
| $V_{OL}$        | LOW Level Output Voltage                    | $2.3\text{ V} \leq V_{CC} \leq 3.6\text{ V}; I_{OL} = 100\text{ }\mu\text{A}$ |                                        | 0.2        | V             |
|                 |                                             | $V_{CC} = 2.3\text{ V}; I_{OL} = 8\text{ mA}$                                 |                                        | 0.3        |               |
|                 |                                             | $V_{CC} = 2.7\text{ V}; I_{OL} = 12\text{ mA}$                                |                                        | 0.4        |               |
|                 |                                             | $V_{CC} = 3.0\text{ V}; I_{OL} = 16\text{ mA}$                                |                                        | 0.4        |               |
|                 |                                             | $V_{CC} = 3.0\text{ V}; I_{OL} = 24\text{ mA}$                                |                                        | 0.55       |               |
| $I_{OFF}$       | Power Off Leakage Current                   | $V_{CC} = 0, V_{IN} = 5.5\text{ V}$ or $V_{OUT} = 5.5\text{ V}$               |                                        | 10         | $\mu\text{A}$ |
| $I_{IN}$        | Input Leakage Current                       | $V_{CC} = 3.6\text{ V}, V_{IN} = 5.5\text{ V}$ or GND                         |                                        | $\pm 5.0$  | $\mu\text{A}$ |
| $I_{CC}$        | Quiescent Supply Current                    | $V_{CC} = 3.6\text{ V}, V_{IN} = 5.5\text{ V}$ or GND                         |                                        | 10         | $\mu\text{A}$ |
| $\Delta I_{CC}$ | Increase in $I_{CC}$ per Input              | $2.3 \leq V_{CC} \leq 3.6\text{ V}; V_{IH} = V_{CC} - 0.6\text{ V}$           |                                        | 500        | $\mu\text{A}$ |

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## AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 2.5$ ns)

| Symbol                                 | Parameter                         | Waveform | Limits                          |            |                         |            |                                 |            | Units |
|----------------------------------------|-----------------------------------|----------|---------------------------------|------------|-------------------------|------------|---------------------------------|------------|-------|
|                                        |                                   |          | T <sub>A</sub> = −40°C to +85°C |            |                         |            |                                 |            |       |
|                                        |                                   |          | V <sub>CC</sub> = 3.3 V ± 0.3 V |            | V <sub>CC</sub> = 2.7 V |            | V <sub>CC</sub> = 2.5 V ± 0.2 V |            |       |
|                                        |                                   |          | C <sub>L</sub> = 50 pF          |            | C <sub>L</sub> = 50 pF  |            | C <sub>L</sub> = 30 pF          |            |       |
|                                        |                                   |          | Min                             | Max        | Min                     | Max        | Min                             | Max        |       |
| t <sub>PLH</sub><br>t <sub>PHL</sub>   | Propagation Delay Input to Output | 1        | 1.5<br>1.5                      | 6.5<br>6.5 | 1.5<br>1.5              | 7.5<br>7.5 | 1.5<br>1.5                      | 7.8<br>7.8 | ns    |
| t <sub>OSHL</sub><br>t <sub>OSLH</sub> | Output-to-Output Skew (Note 2)    |          |                                 | 1.0<br>1.0 |                         |            |                                 |            | ns    |

2. 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 ( $t_{OSHL}$ ) or LOW-to-HIGH ( $t_{OSLH}$ ); parameter guaranteed by design.

## DYNAMIC SWITCHING CHARACTERISTICS

| Symbol    | Characteristic                      | Condition                                                                                                                                                                                            | $T_A = +25^{\circ}\text{C}$ |              |     | Units |
|-----------|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------|-----|-------|
|           |                                     |                                                                                                                                                                                                      | Min                         | Typ          | Max |       |
| $V_{OLP}$ | Dynamic LOW Peak Voltage (Note 3)   | $V_{CC} = 3.3\text{ V}$ , $C_L = 50\text{ pF}$ , $V_{IH} = 3.3\text{ V}$ , $V_{IL} = 0\text{ V}$<br>$V_{CC} = 2.5\text{ V}$ , $C_L = 30\text{ pF}$ , $V_{IH} = 2.5\text{ V}$ , $V_{IL} = 0\text{ V}$ |                             | 0.8<br>0.6   |     | V     |
| $V_{OLV}$ | Dynamic LOW Valley Voltage (Note 3) | $V_{CC} = 3.3\text{ V}$ , $C_L = 50\text{ pF}$ , $V_{IH} = 3.3\text{ V}$ , $V_{IL} = 0\text{ V}$<br>$V_{CC} = 2.5\text{ V}$ , $C_L = 30\text{ pF}$ , $V_{IH} = 2.5\text{ V}$ , $V_{IL} = 0\text{ V}$ |                             | -0.8<br>-0.6 |     | V     |

3. 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 |
|-----------|-------------------------------|------------------------------------------------------------------|---------|-------|
| $C_{IN}$  | Input Capacitance             | $V_{CC} = 3.3\text{ V}$ , $V_I = 0\text{ V}$ or $V_{CC}$         | 7       | pF    |
| $C_{OUT}$ | Output Capacitance            | $V_{CC} = 3.3\text{ V}$ , $V_I = 0\text{ V}$ or $V_{CC}$         | 8       | pF    |
| $C_{PD}$  | Power Dissipation Capacitance | 10 MHz, $V_{CC} = 3.3\text{ V}$ , $V_I = 0\text{ V}$ or $V_{CC}$ | 25      | pF    |

## ORDERING INFORMATION

| Device         | Package            | Shipping <sup>†</sup> |
|----------------|--------------------|-----------------------|
| MC74LCX14DG    | SOIC-14 (Pb-Free)  | 55 Units / Rail       |
| MC74LCX14DR2G  | SOIC-14 (Pb-Free)  | 2500 Tape & Reel      |
| MC74LCX14DTG   | TSSOP-14 (Pb-Free) | 96 Units / Rail       |
| MC74LCX14DTR2G | 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, BRD8011/D.

# MC74LCX14

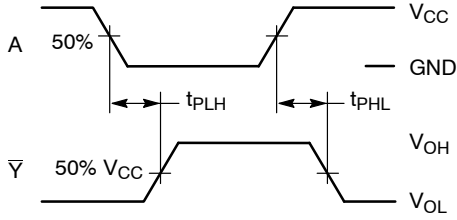
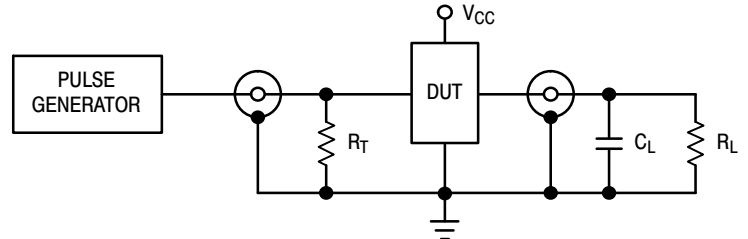


Figure 3. Switching Waveforms



$C_L = 50 \text{ pF}$  at  $V_{CC} = 3.3 \pm 0.3 \text{ V}$  or equivalent  
(includes jig and probe capacitance)  
 $R_L = R_1 = 500 \Omega$  or equivalent  
 $R_T = Z_{OUT}$  of pulse generator (typically  $50 \Omega$ )

Figure 4. Test Circuit

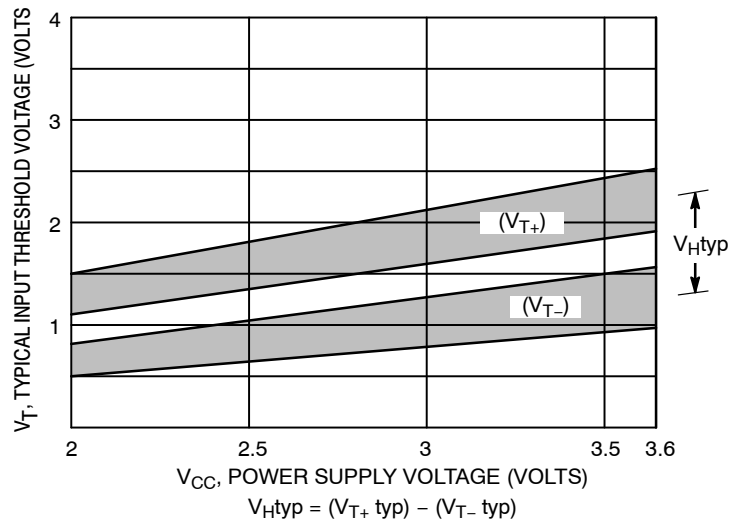
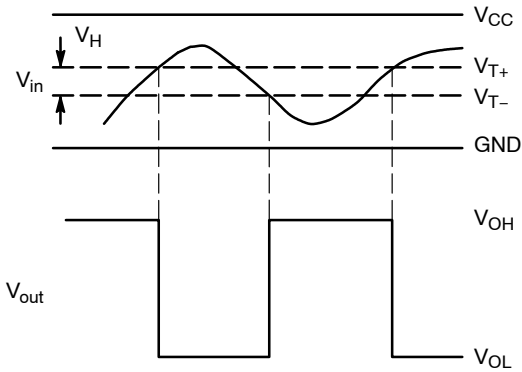


Figure 5. Typical Input Threshold,  $V_{T+}$ ,  $V_{T-}$  versus Power Supply Voltage

(a) A Schmitt-Trigger Squares Up Inputs With Slow Rise and Fall Times



(b) A Schmitt-Trigger Offers Maximum Noise Immunity

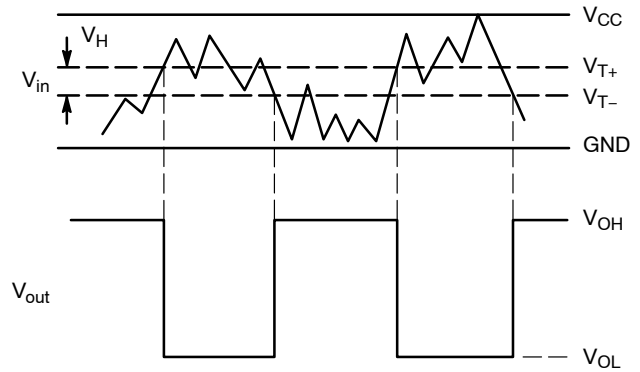


Figure 6. Typical Schmitt-Trigger Applications

# MC74LCX14

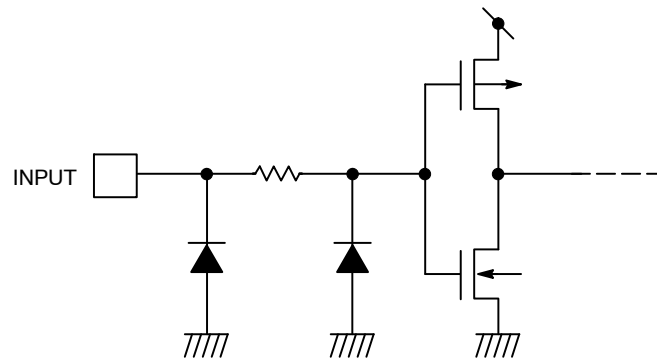
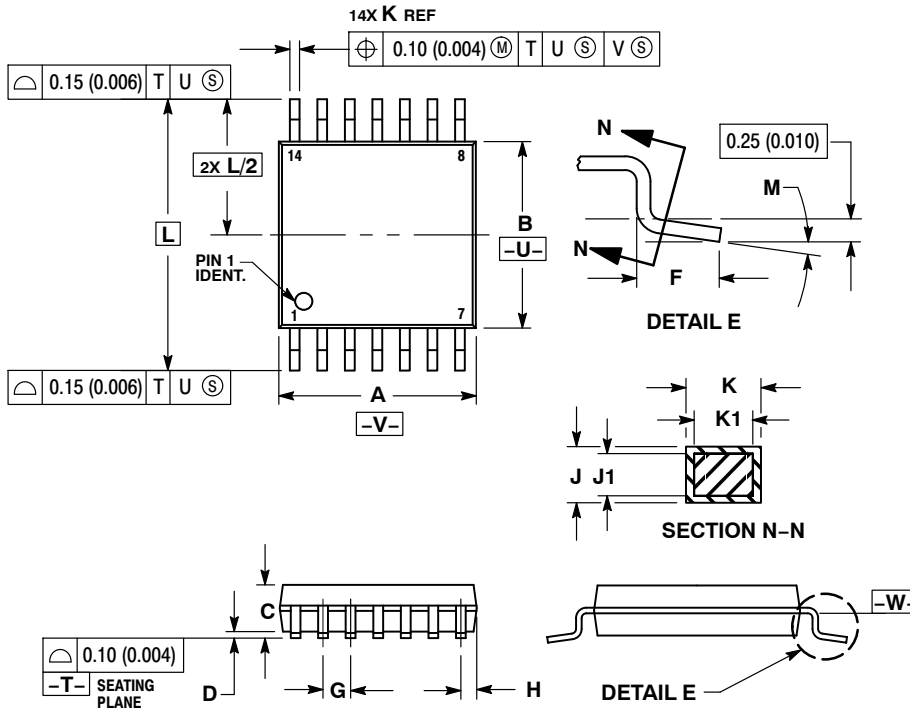


Figure 7. Input Equivalent Circuit

# MC74LCX14

## PACKAGE DIMENSIONS

TSSOP-14  
CASE 948G  
ISSUE B

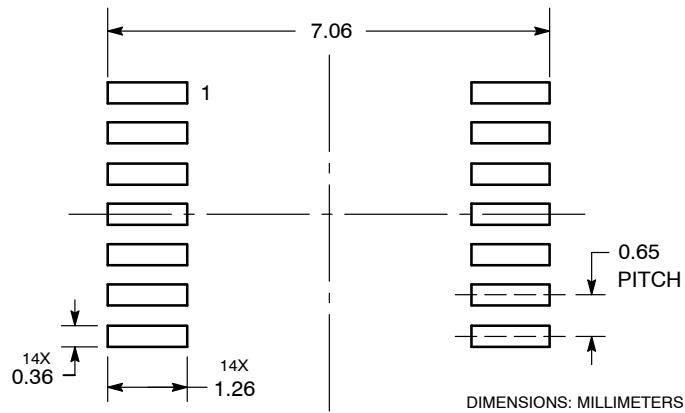


### NOTES:

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.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. 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 REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 4.90        | 5.10 | 0.193     | 0.200 |
| B   | 4.30        | 4.50 | 0.169     | 0.177 |
| C   | ---         | 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 |       |
| H   | 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 |       |
| M   | 0°          | 8°   | 0°        | 8°    |

### SOLDERING FOOTPRINT\*



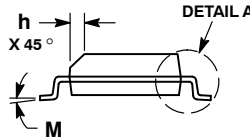
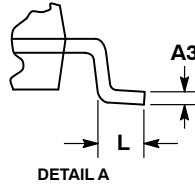
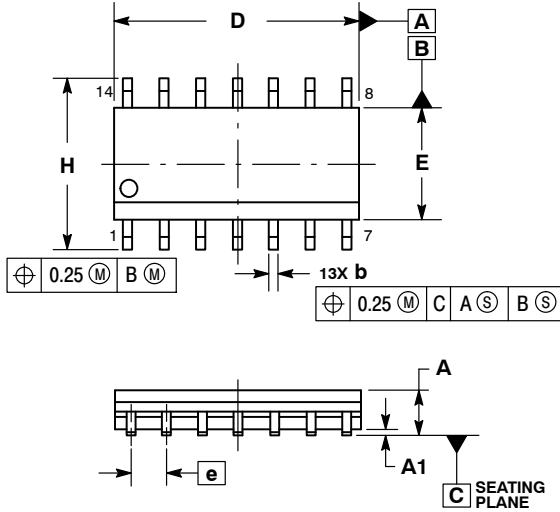
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



# MC74LCX14

## PACKAGE DIMENSIONS

SOIC-14 NB  
CASE 751A-03  
ISSUE K

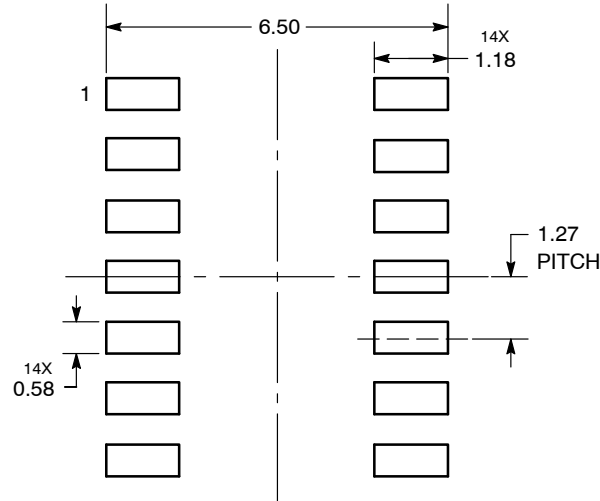


### NOTES:

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

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 1.35        | 1.75 | 0.054     | 0.068 |
| A1  | 0.10        | 0.25 | 0.004     | 0.010 |
| A3  | 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 |
| E   | 3.80        | 4.00 | 0.150     | 0.157 |
| e   | 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 |
| M   | 0°          | 7°   | 0°        | 7°    |

### SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

\*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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