

# MC74LCX08

## Low-Voltage CMOS Quad 2-Input AND Gate

### With 5 V-Tolerant Inputs

The MC74LCX08 is a high performance, quad 2-input AND gate 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 MC74LCX08 inputs to be safely driven from 5 V devices.

Current drive capability is 24 mA at the outputs.

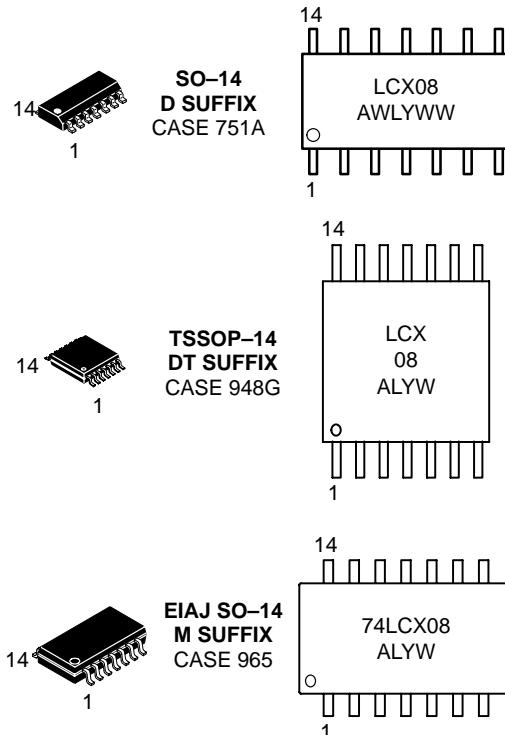
- Designed for 2.3 V to 3.6 V  $V_{CC}$  Operation
- 5 V Tolerant Inputs – Interface Capability With 5 V TTL Logic
- LVTTL Compatible
- LVCMS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current (10  $\mu$ A) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500 mA
- ESD Performance: Human Body Model >2000 V; Machine Model >200 V



ON Semiconductor™

<http://onsemi.com>

#### MARKING DIAGRAMS



A = Assembly Location  
L, WL = Wafer Lot  
Y = Year  
W, WW = Work Week

#### ORDERING INFORMATION

| Device        | Package    | Shipping        |
|---------------|------------|-----------------|
| MC74LCX08D    | SO-14      | 55 Units/Rail   |
| MC74LCX08DR2  | SO-14      | 2500 Units/Reel |
| MC74LCX08DT   | TSSOP-14   | 96 Units/Rail   |
| MC74LCX08DTR2 | TSSOP-14   | 2500 Units/Reel |
| MC74LCX08M    | EIAJ SO-14 | 50 Units/Rail   |
| MC74LCX08MEL  | EIAJ SO-14 | 2000 Units/Reel |

# MC74LCX08

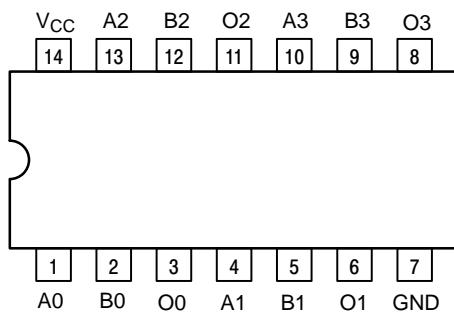


Figure 1. Pinout: 14-Lead (Top View)

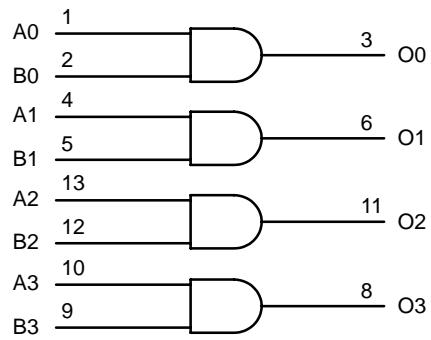


Figure 2. Logic Diagram

## PIN NAMES

| Pins   | Function    |
|--------|-------------|
| An, Bn | Data Inputs |
| On     | Outputs     |

## TRUTH TABLE

| Inputs |    | Outputs |
|--------|----|---------|
| An     | Bn | On      |
| L      | L  | L       |
| L      | H  | L       |
| H      | L  | L       |
| H      | H  | H       |

H = High Voltage Level

L = Low Voltage Level

For I<sub>CC</sub> reasons, DO NOT FLOAT Inputs

## MAXIMUM RATINGS

| Symbol           | Parameter                        | Value   | Condition                             | Unit |
|------------------|----------------------------------|---|---------------------------------------|------|
| 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   |                                       | 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   |

Maximum Ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute maximum-rated conditions is not implied. Functional operation should be restricted to the Recommended Operating Conditions.

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

# MC74LCX08

## RECOMMENDED OPERATING CONDITIONS

| Symbol              | Parameter   | Min        | Type                 | Max              | Unit |
|---------------------|---|------------|----------------------|------------------|------|
| $V_{CC}$            | Supply Voltage<br>Operating<br>Data Retention Only  | 2.0<br>1.5 | 2.5, 3.3<br>2.5, 3.3 | 3.6<br>3.6       | V    |
| $V_I$               | Input Voltage   | 0          |                      | 5.5              | V    |
| $V_O$               | Output Voltage<br>(HIGH or LOW State)<br>(3-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   |
| $\Delta t/\Delta V$ | Input Transition Rise or Fall Rate, $V_{IN}$ from 0.8 V to 2.0 V, $V_{CC} = 3.0\text{ V}$   | 0          |                      | 10               | ns/V |

## DC ELECTRICAL CHARACTERISTICS

| Symbol          | Characteristic                     | Condition   | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ |          | Unit          |
|-----------------|------------------------------------|---|--|----------|---------------|
|                 |                                    |   | Min  | Max      |               |
| $V_{IH}$        | HIGH Level Input Voltage (Note 2.) | $2.3\text{ V} \leq V_{CC} \leq 2.7\text{ V}$  | 1.7  |          | V             |
|                 |                                    | $2.7\text{ V} \leq V_{CC} \leq 3.6\text{ V}$  | 2.0  |          |               |
| $V_{IL}$        | LOW Level Input Voltage (Note 2.)  | $2.3\text{ V} \leq V_{CC} \leq 2.7\text{ V}$  |  | 0.7      | V             |
|                 |                                    | $2.7\text{ V} \leq V_{CC} \leq 3.6\text{ V}$  |  | 0.8      |               |
| $V_{OH}$        | HIGH Level Output Voltage          | $2.3\text{ V} \leq V_{CC} \leq 3.6\text{ V}; I_{OH} = -100\text{ }\mu\text{A}$      | $V_{CC} - 0.2$                                   |          | 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             |
|                 |                                    | $V_{CC} = 2.3\text{ V}; I_{OL} = 8\text{ mA}$                                       |  | 0.6      |               |
|                 |                                    | $V_{CC} = 2.7\text{ V}; I_{OL} = 12\text{ mA}$                                      |  | 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     |               |
| $I_I$           | Input Leakage Current              | $2.3\text{ V} \leq V_{CC} \leq 3.6\text{ V}; 0\text{ V} \leq V_I \leq 5.5\text{ V}$ |  | $\pm 5$  | $\mu\text{A}$ |
| $I_{CC}$        | Quiescent Supply Current           | $2.3 \leq V_{CC} \leq 3.6\text{ V}; V_I = \text{GND or } V_{CC}$                    |  | 10       | $\mu\text{A}$ |
|                 |                                    | $2.3 \leq V_{CC} \leq 3.6\text{ V}; 3.6 \leq V_I \text{ or } V_O \leq 5.5\text{ V}$ |  | $\pm 10$ |               |
| $\Delta I_{CC}$ | 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      | $\mu\text{A}$ |

2. These values of  $V_I$  are used to test DC electrical characteristics only.

# MC74LCX08

**AC CHARACTERISTICS**  $t_R = t_F = 2.5$  ns;  $R_L = 500 \Omega$

| Symbol     | Parameter              | Waveform | Limits   |     |                          |     |  |     | Unit |  |
|------------|------------------------|----------|--|-----|--------------------------|-----|--|-----|------|--|
|            |                        |          | $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ |     |                          |     |  |     |      |  |
|            |                        |          | $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$       |     | $V_{CC} = 2.7 \text{ V}$ |     | $V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$ |     |      |  |
|            |                        |          | $C_L = 50 \text{ pF}$                            |     | $C_L = 50 \text{ pF}$    |     | $C_L = 30 \text{ pF}$                      |     |      |  |
| Symbol     | Parameter              | Waveform | Min  | Max | Min                      | Max | Min  | Max | Unit |  |
| $t_{PLH}$  | Propagation Delay Time | 1        | 1.5  | 5.5 | 1.5                      | 6.2 | 1.5  | 6.6 | ns   |  |
| $t_{PHL}$  | Input to Output        |          | 1.5  | 5.5 | 1.5                      | 6.2 | 1.5  | 6.6 |      |  |
| $t_{OSHL}$ | Output-to-Output Skew  |          |  | 1.0 |                          |     |  |     | ns   |  |
| $t_{OSLH}$ | (Note 3.)              |          |  | 1.0 |                          |     |  |     |      |  |

3. 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

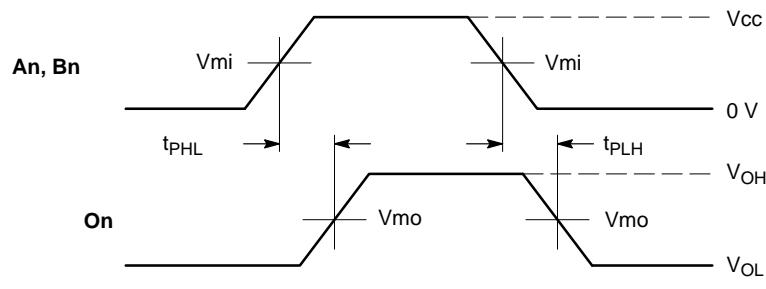
| Symbol    | Characteristic                          | Condition  | $T_A = +25^\circ\text{C}$ |      |     | Unit |
|-----------|---|--|---------------------------|------|-----|------|
|           |   |  | Min                       | Typ  | Max |      |
| $V_{OLP}$ | Dynamic LOW Peak Voltage<br>(Note 4.)   | $V_{CC} = 3.3 \text{ V}, C_L = 50 \text{ pF}, V_{IH} = 3.3 \text{ V}, V_{IL} = 0 \text{ V}$<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  |     | V    |
| $V_{OLV}$ | Dynamic LOW Valley Voltage<br>(Note 4.) | $V_{CC} = 3.3 \text{ V}, C_L = 50 \text{ pF}, V_{IH} = 3.3 \text{ V}, V_{IL} = 0 \text{ V}$<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 |     | V    |

4. 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 | Unit |
|-----------|-------------------------------|---|---------|------|
| $C_{IN}$  | 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   |

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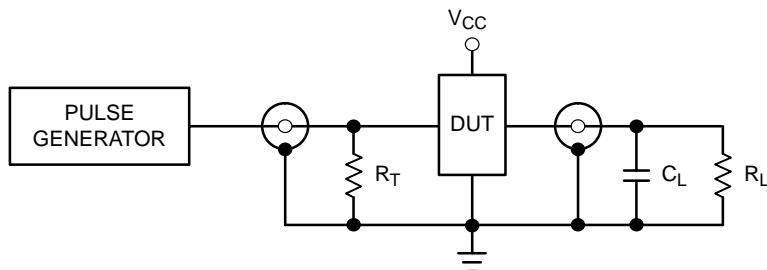


**WAVEFORM 1 – PROPAGATION DELAYS**

$t_R = t_F = 2.5\text{ ns}$ , 10% to 90%;  $f = 1\text{ MHz}$ ;  $t_W = 500\text{ ns}$

| Symbol   | V <sub>cc</sub>   |       |                   |
|----------|-------------------|-------|-------------------|
|          | 3.3 V $\pm$ 0.3 V | 2.7 V | 2.5 V $\pm$ 0.2 V |
| $V_{mi}$ | 1.5 V             | 1.5 V | $V_{cc}/2$        |
| $V_{mo}$ | 1.5 V             | 1.5 V | $V_{cc}/2$        |

**Figure 3. AC Waveforms**



$C_L = 50\text{ pF}$  at  $V_{CC} = 3.3 \pm 0.3\text{ V}$  or equivalent (includes jig and probe capacitance)

$C_L = 30\text{ pF}$  at  $V_{CC} = 2.5 \pm 0.2\text{ V}$  or equivalent (includes jig and probe capacitance)

$R_L = R_1 = 500\text{ }\Omega$  or equivalent

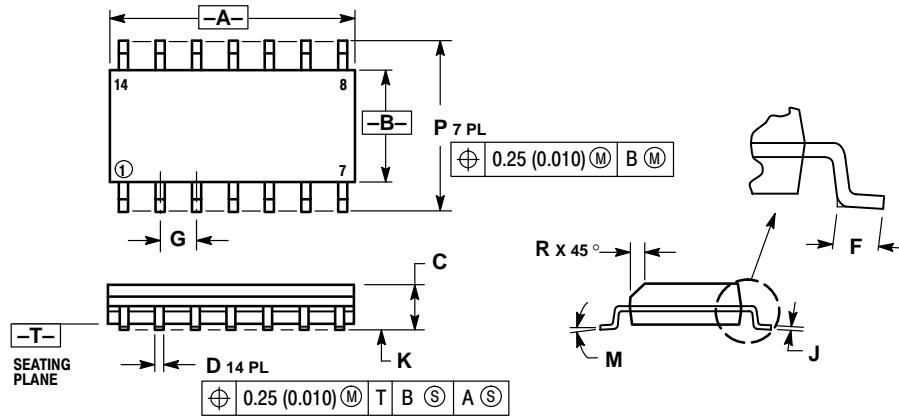
$R_T = Z_{OUT}$  of pulse generator (typically 50  $\Omega$ )

**Figure 4. Test Circuit**

# MC74LCX08

## PACKAGE DIMENSIONS

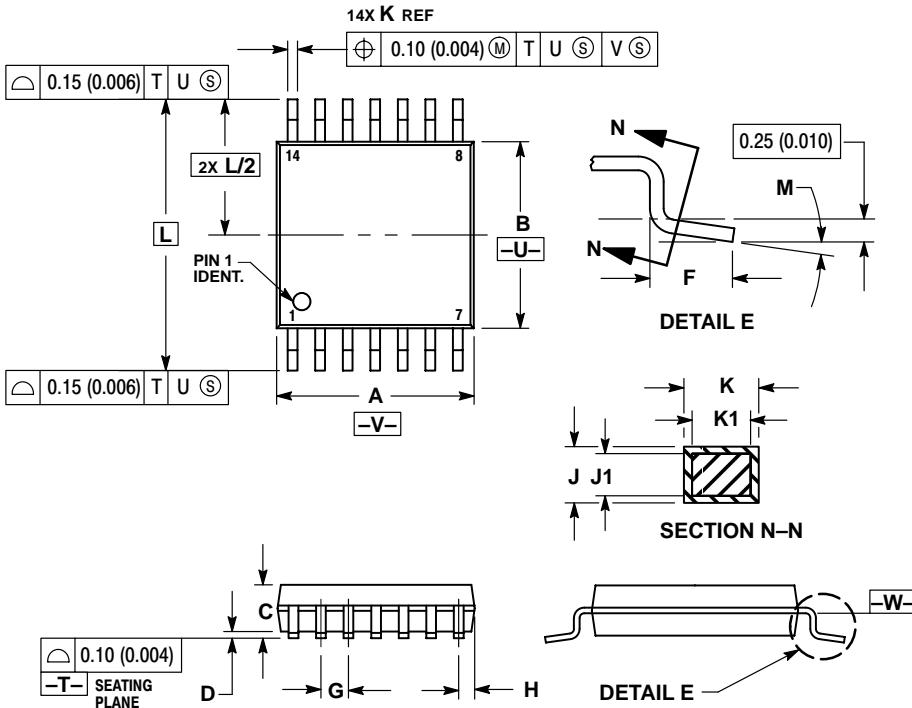
**SO-14  
D SUFFIX  
CASE 751A-03  
ISSUE F**



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
  5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 8.55        | 8.75 | 0.337     | 0.344 |
| B   | 3.80        | 4.00 | 0.150     | 0.157 |
| C   | 1.35        | 1.75 | 0.054     | 0.068 |
| D   | 0.35        | 0.49 | 0.014     | 0.019 |
| F   | 0.40        | 1.25 | 0.016     | 0.049 |
| G   | 1.27 BSC    |      | 0.050 BSC |       |
| J   | 0.19        | 0.25 | 0.008     | 0.009 |
| K   | 0.10        | 0.25 | 0.004     | 0.009 |
| M   | 0 °         | 7 °  | 0 °       | 7 °   |
| P   | 5.80        | 6.20 | 0.228     | 0.244 |
| R   | 0.25        | 0.50 | 0.010     | 0.019 |

**TSSOP-14  
DT SUFFIX  
CASE 948G-01  
ISSUE O**



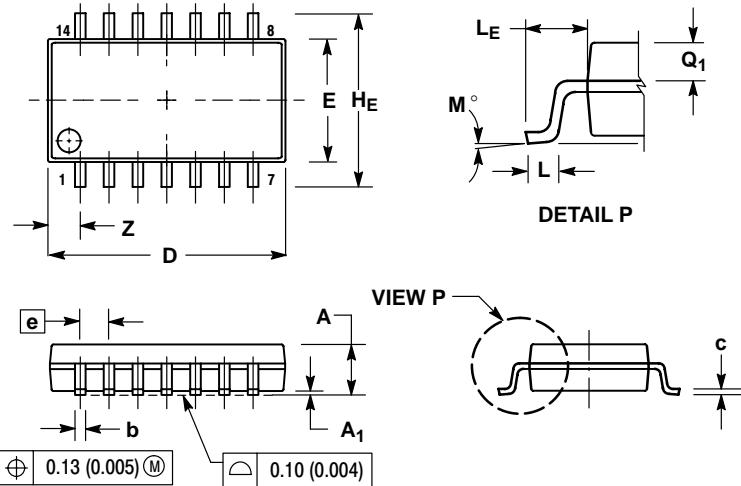
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
  4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. 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 °   |

# MC74LCX08

## PACKAGE DIMENSIONS

**EIAJ SO-14  
M SUFFIX  
CASE 965-01  
ISSUE O**



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

| DIM            | MILLIMETERS |       | INCHES    |       |
|----------------|-------------|-------|-----------|-------|
|                | MIN         | MAX   | MIN       | MAX   |
| A              | ---         | 2.05  | ---       | 0.081 |
| A <sub>1</sub> | 0.05        | 0.20  | 0.002     | 0.008 |
| b              | 0.35        | 0.50  | 0.014     | 0.020 |
| c              | 0.18        | 0.27  | 0.007     | 0.011 |
| D              | 9.90        | 10.50 | 0.390     | 0.413 |
| E              | 5.10        | 5.45  | 0.201     | 0.215 |
| e              | 1.27 BSC    |       | 0.050 BSC |       |
| H <sub>E</sub> | 7.40        | 8.20  | 0.291     | 0.323 |
| L              | 0.50        | 0.85  | 0.020     | 0.033 |
| L <sub>E</sub> | 1.10        | 1.50  | 0.043     | 0.059 |
| M              | 0 °         | 10 °  | 0 °       | 10 °  |
| Q <sub>1</sub> | 0.70        | 0.90  | 0.028     | 0.035 |
| Z              | ---         | 1.42  | ---       | 0.056 |

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