

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 5.0 V devices.

Current drive capability is 24 mA at the outputs.

Features

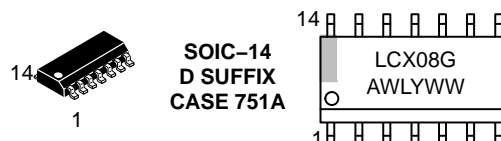
- Designed for 2.3 V to 3.6 V V_{CC} Operation
- 5.0 V Tolerant Inputs – Interface Capability With 5.0 V TTL Logic
- LVTTTL Compatible
- LVCMOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current (10 μ A) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500 mA
- ESD Performance: Human Body Model >2000 V
Machine Model >200 V
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- 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 = 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.

MC74LCX08

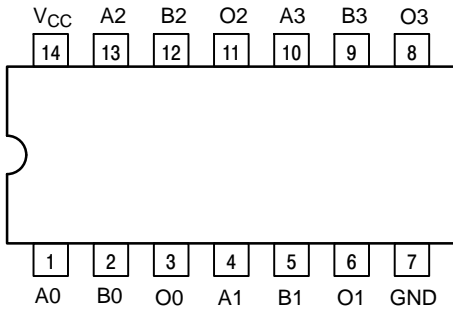


Figure 1. Pinout: 14-Lead (Top View)

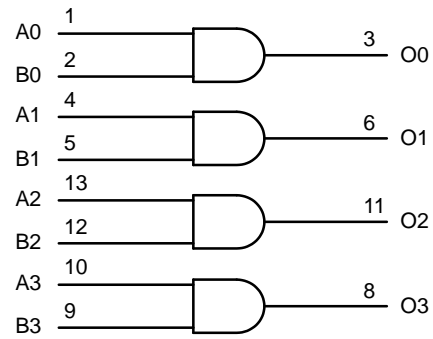


Figure 2. Logic Diagram

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_{CC} reasons, DO NOT FLOAT Inputs

MAXIMUM RATINGS

| Symbol | Parameter | Value | Condition | Unit |
|-----------|----------------------------------|-----------------------------------|--------------------------------------|-------------|
| V_{CC} | DC Supply Voltage | -0.5 to +7.0 | | V |
| V_I | DC Input Voltage | $-0.5 \leq V_I \leq +7.0$ | | V |
| V_O | DC Output Voltage | $-0.5 \leq V_O \leq V_{CC} + 0.5$ | Output in HIGH or LOW State (Note 1) | V |
| I_{IK} | DC Input Diode Current | -50 | $V_I < GND$ | mA |
| I_{OK} | DC Output Diode Current | -50 | $V_O < GND$ | mA |
| | | +50 | $V_O > V_{CC}$ | mA |
| I_O | DC Output Source/Sink Current | ± 50 | | mA |
| I_{CC} | DC Supply Current Per Supply Pin | ± 100 | | mA |
| I_{GND} | DC Ground Current Per Ground Pin | ± 100 | | mA |
| T_{STG} | Storage Temperature Range | -65 to +150 | | $^{\circ}C$ |
| MSL | Moisture Sensitivity | | Level 1 | |

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_O absolute maximum rating must be observed.

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RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Type | Max | Unit |
|-----------------|--|---------------------|----------|------------------|------|
| V _{CC} | Supply Voltage | Operating | 2.5, 3.3 | 3.6 | V |
| | | Data Retention Only | 2.5, 3.3 | 3.6 | |
| V _I | Input Voltage | 0 | | 5.5 | V |
| V _O | Output Voltage (HIGH or LOW State) (3-State) | 0 | | V _{CC} | V |
| I _{OH} | HIGH Level Output Current | | | -24 -12 -8 | mA |
| I _{OL} | LOW Level Output Current | | | +24 | mA |
| | | | | +12 | |
| | | | | +8 | |
| T _A | Operating Free-Air Temperature | -40 | | +85 | °C |
| Δt/ΔV | Input Transition Rise or Fall Rate, V _{IN} from 0.8 V to 2.0 V, V _{CC} = 3.0 V | 0 | | 10 | 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

| Symbol | Characteristic | Condition | T _A = -40°C to +85°C | | Unit |
|------------------|---------------------------------------|--|---------------------------------|------|------|
| | | | Min | Max | |
| V _{IH} | HIGH Level Input Voltage (Note 2) | 2.3 V ≤ V _{CC} ≤ 2.7 V | 1.7 | | V |
| | | 2.7 V ≤ V _{CC} ≤ 3.6 V | 2.0 | | |
| V _{IL} | LOW Level Input Voltage (Note 2) | 2.3 V ≤ V _{CC} ≤ 2.7 V | | 0.7 | V |
| | | 2.7 V ≤ V _{CC} ≤ 3.6 V | | 0.8 | |
| V _{OH} | HIGH Level Output Voltage | 2.3 V ≤ V _{CC} ≤ 3.6 V; I _{OH} = -100 μA | V _{CC} - 0.2 | | V |
| | | V _{CC} = 2.3 V; I _{OH} = -8 mA | 1.8 | | |
| | | V _{CC} = 2.7 V; I _{OH} = -12 mA | 2.2 | | |
| | | V _{CC} = 3.0 V; I _{OH} = -18 mA | 2.4 | | |
| | | V _{CC} = 3.0 V; I _{OH} = -24 mA | 2.2 | | |
| V _{OL} | LOW Level Output Voltage | 2.3 V ≤ V _{CC} ≤ 3.6 V; I _{OL} = 100 μA | | 0.2 | V |
| | | V _{CC} = 2.3 V; I _{OL} = 8 mA | | 0.6 | |
| | | V _{CC} = 2.7 V; I _{OL} = 12 mA | | 0.4 | |
| | | V _{CC} = 3.0 V; I _{OL} = 16 mA | | 0.4 | |
| | | V _{CC} = 3.0 V; I _{OL} = 24 mA | | 0.55 | |
| I _{OFF} | Power Off Leakage Current | V _{CC} = 0, V _{IN} = 5.5 V or V _{OUT} = 5.5 V | | 10 | μA |
| I _{IN} | Input Leakage Current | V _{CC} = 3.6 V, V _{IN} = 5.5 V or GND | | ±5 | μA |
| I _{CC} | Quiescent Supply Current | V _{CC} = 3.6 V, V _{IN} = 5.5 V or GND | | 10 | μA |
| ΔI _{CC} | Increase in I _{CC} per Input | 2.3 ≤ V _{CC} ≤ 3.6 V; V _{IH} = V _{CC} - 0.6 V | | 500 | μA |

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.

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

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AC CHARACTERISTICS ($t_R = t_F = 2.5 \text{ ns}$; $R_L = 500 \Omega$)

| Symbol | Parameter | Waveform | Limits | | | | | | Unit |
|------------|------------------------|----------|---|-----|--------------------------|-----|--|-----|------|
| | | | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ | | | | | | |
| | | | $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ | | $V_{CC} = 2.7 \text{ V}$ | | $V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$ | | |
| | | | $C_L = 50 \text{ pF}$ | | $C_L = 50 \text{ pF}$ | | $C_L = 30 \text{ pF}$ | | |
| | | | Min | Max | Min | Max | Min | Max | |
| 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 (Note 4) | $V_{CC} = 3.3 \text{ V}, C_L = 50 \text{ pF}, V_{IH} = 3.3 \text{ V}, V_{IL} = 0 \text{ V}$ $V_{CC} = 2.5 \text{ V}, C_L = 30 \text{ pF}, V_{IH} = 2.5 \text{ V}, V_{IL} = 0 \text{ V}$ | | 0.8 | | V |
| V_{OLV} | Dynamic LOW Valley Voltage (Note 4) | $V_{CC} = 3.3 \text{ V}, C_L = 50 \text{ pF}, V_{IH} = 3.3 \text{ V}, V_{IL} = 0 \text{ V}$ $V_{CC} = 2.5 \text{ V}, C_L = 30 \text{ pF}, V_{IH} = 2.5 \text{ V}, V_{IL} = 0 \text{ V}$ | | -0.8 | | V |
| | | | | -0.6 | | 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 |

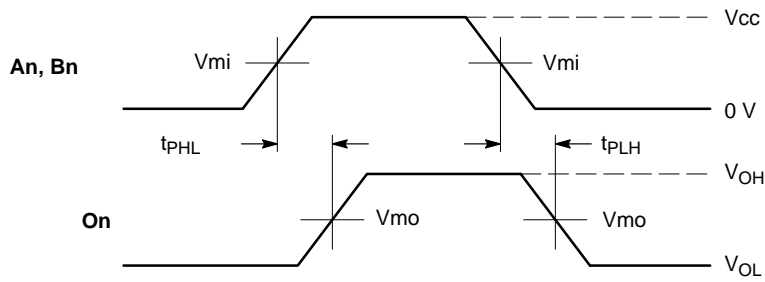
ORDERING INFORMATION

| Device | Package | Shipping† |
|----------------|-----------------------|------------------|
| MC74LCX08DG | SOIC-14 (Pb-Free) | 55 Units / Rail |
| MC74LCX08DR2G | SOIC-14 (Pb-Free) | 2500 Tape & Reel |
| MC74LCX08DTG | TSSOP-14 (Pb-Free) | 96 Units / Rail |
| MC74LCX08DTR2G | TSSOP-14 (Pb-Free) | 2500 Tape & Reel |
| NLVLCX08DTR2G* | TSSOP-14 (Pb-Free) | 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.

*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable.

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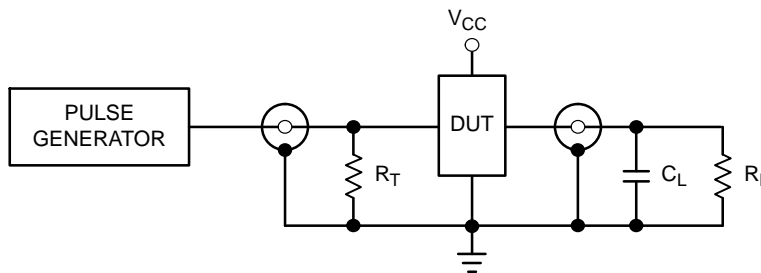


WAVEFORM 1 - PROPAGATION DELAYS

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

| Symbol | Vcc | | |
|--------|---------------|-------|---------------|
| | 3.3 V ± 0.3 V | 2.7 V | 2.5 V ± 0.2 V |
| Vmi | 1.5 V | 1.5 V | $V_{cc}/2$ |
| Vmo | 1.5 V | 1.5 V | $V_{cc}/2$ |

Figure 3. AC Waveforms



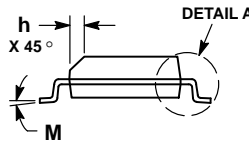
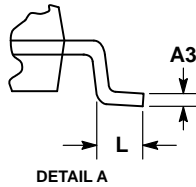
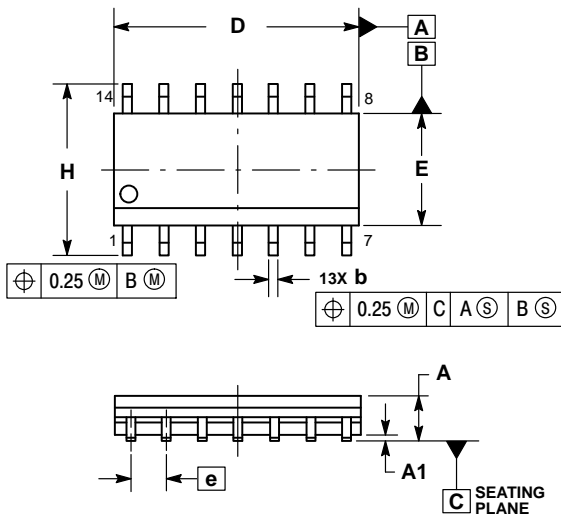
$C_L = 50\text{ pF}$ at $V_{CC} = 3.3 \pm 0.3\text{ V}$ or equivalent (includes jig and probe capacitance)
 $C_L = 30\text{ pF}$ at $V_{CC} = 2.5 \pm 0.2\text{ V}$ or equivalent (includes jig and probe capacitance)
 $R_L = R_1 = 500\ \Omega$ or equivalent
 $R_T = Z_{OUT}$ of pulse generator (typically $50\ \Omega$)

Figure 4. Test Circuit

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PACKAGE DIMENSIONS

SOIC-14 NB CASE 751A-03 ISSUE K

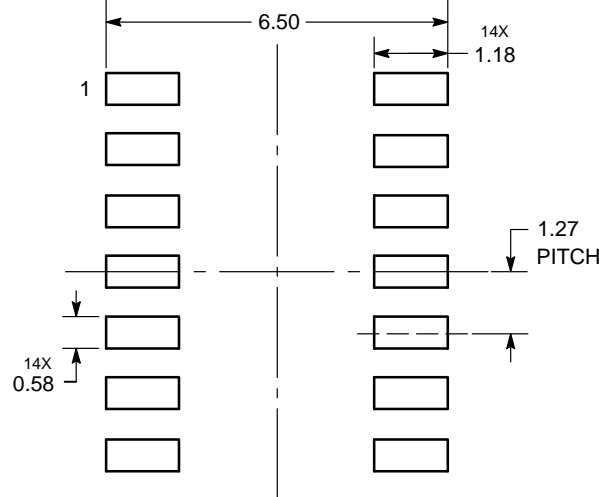


NOTES:

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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