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 $V_{\rm I}$ 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
- LVTTL Compatible
- LVCMOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current (10 μA) Substantially Reduces System Power Requirements
- Latchup Performance Exceeds 500 mA
- ESD Performance: Human Body Model >2000 V

Machine Model >200 V

• Pb-Free Packages are Available*

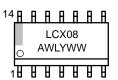


http://onsemi.com

MARKING DIAGRAMS



SOIC-14 D SUFFIX CASE 751A

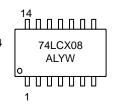




TSSOP-14 DT SUFFIX CASE 948G







A = Assembly Location

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

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

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

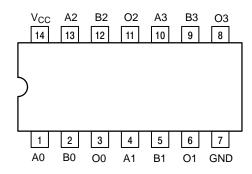


Figure 1. Pinout: 14-Lead (Top View)

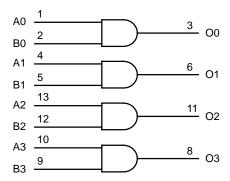


Figure 2. Logic Diagram

PIN NAMES

Pins	Function	
An, Bn	Data Inputs	
On	Outputs	

TRUTH TABLE

Inp	uts	Outputs
An	Bn	On
L	L	L
L	Н	L
Н	L	L
Н	Н	Н

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
VI	DC Input Voltage	$-0.5 \le V_1 \le +7.0$		V
Vo	DC Output Voltage	$-0.5 \le V_{O} \le V_{CC} + 0.5$	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		°C

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_O absolute maximum rating must be observed.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Туре	Max	Unit
V _{CC}	,	Operating Data Retention Only	2.0 1.5	2.5, 3.3 2.5, 3.3	3.6 3.6	V
VI	Input Voltage		0		5.5	V
V _O		(HIGH or LOW State) (3-State)	0		V _{CC}	V
I _{OH}		$V_{CC} = 3.0 \text{ V} - 3.6 \text{ V}$ $V_{CC} = 2.7 \text{ V} - 3.0 \text{ V}$ $V_{CC} = 2.3 \text{ V} - 2.7 \text{ V}$			-24 -12 -8	mA
I _{OL}		$V_{CC} = 3.0 \text{ V} - 3.6 \text{ V}$ $V_{CC} = 2.7 \text{ V} - 3.0 \text{ V}$ $V_{CC} = 2.3 \text{ V} - 2.7 \text{ V}$			+24 +12 +8	mA
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

DC ELECTRICAL CHARACTERISTICS

			T _A = -40°C		
Symbol	Characteristic	Condition	Min	Max	Unit
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	$2.3 \text{ V} \le \text{V}_{CC} \le 3.6 \text{ V}; \text{ I}_{OH} = -100 \mu\text{A}$	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 V; I _{OH} = -18 mA	2.4		
		V _{CC} = 3.0 V; I _{OH} = -24 mA	2.2		
V _{OL}	LOW Level Output Voltage	$2.3 \text{ V} \le \text{V}_{CC} \le 3.6 \text{ V}; \text{I}_{OL} = 100 \mu\text{A}$		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 _I	Input Leakage Current	$2.3 \text{ V} \le \text{V}_{CC} \le 3.6 \text{ V}; 0 \text{ V} \le \text{V}_{I} \le 5.5 \text{ V}$		±5	μΑ
I _{CC}	Quiescent Supply Current	$2.3 \le V_{CC} \le 3.6 \text{ V}; V_I = \text{GND or } V_{CC}$		10	μΑ
		$2.3 \le V_{CC} \le 3.6 \text{ V}; 3.6 \le V_{I} \text{ or } V_{O} \le 5.5 \text{ V}$		±10	
ΔI_{CC}	Increase in I _{CC} per Input	$2.3 \le V_{CC} \le 3.6 \text{ V}; V_{IH} = V_{CC} - 0.6 \text{ V}$		500	μΑ

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

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

			Limits						
				$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$					
			V _{CC} = 3.3	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ $V_{CC} = 2.7 \text{ V}$ $V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$					
			C _L =	C _L = 50 pF		50 pF	C _L = 3	30 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	
toshl	Output-to-Output Skew			1.0					ns
toslh	(Note 3)			1.0					

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

			T _A = +25°C			
Symbol	Characteristic	Condition	Min	Тур	Max	Unit
V _{OLP}	Dynamic LOW Peak Voltage	$V_{CC} = 3.3 \text{ V}, C_L = 50 \text{ pF}, V_{IH} = 3.3 \text{ V}, V_{IL} = 0 \text{ V}$		8.0		V
	(Note 4)	$V_{CC} = 2.5 \text{ V}, C_L = 30 \text{ pF}, V_{IH} = 2.5 \text{ V}, V_{IL} = 0 \text{ V}$		0.6		V
V _{OLV}	Dynamic LOW Valley Voltage	$V_{CC} = 3.3 \text{ V}, C_L = 50 \text{ pF}, V_{IH} = 3.3 \text{ V}, V_{IL} = 0 \text{ V}$		-0.8		V
	(Note 4)	$V_{CC} = 2.5 \text{ V}, C_L = 30 \text{ pF}, V_{IH} = 2.5 \text{ V}, V_{IL} = 0 \text{ V}$		-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

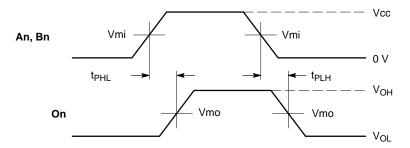
Symbol	Parameter	Parameter Condition		Unit
C _{IN}	Input Capacitance	$V_{CC} = 3.3 \text{ V}, V_I = 0 \text{ V or } V_{CC}$	7	pF
C _{OUT}	Output Capacitance	$V_{CC} = 3.3 \text{ V}, V_I = 0 \text{ V or } V_{CC}$	8	pF
C _{PD}	Power Dissipation Capacitance	10 MHz, V_{CC} = 3.3 V, V_{I} = 0 V or V_{CC}	25	pF

ORDERING INFORMATION

Device	Package	Shipping [†]
MC74LCX08D	SOIC-14	55 Units / Rail
MC74LCX08DG	SOIC-14 (Pb-Free)	55 Units / Rail
MC74LCX08DR2	SOIC-14	2500 Tape & Reel
MC74LCX08DR2G	SOIC-14 (Pb-Free)	2500 Tape & Reel
MC74LCX08DT	TSSOP-14*	96 Units / Rail
MC74LCX08DTG	TSSOP-14*	96 Units / Rail
MC74LCX08DTR2	TSSOP-14*	2500 Tape & Reel
MC74LCX08DTR2G	TSSOP-14*	2500 Tape & Reel
MC74LCX08M	SOEIAJ-14	50 Units / Rail
MC74LCX08MEL	SOEIAJ-14	2000 Tape & Reel
MC74LCX08MELG	SOEIAJ-14 (Pb-Free)	2000 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.

^{*}This package is inherently Pb-Free.

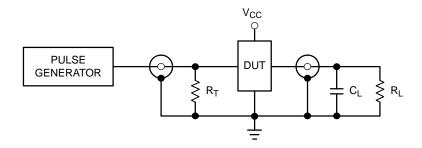


WAVEFORM 1 - PROPAGATION DELAYS

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

	Vcc				
Symbol	3.3 V <u>+</u> 0.3 V	2.7 V	2.5 V <u>+</u> 0.2 V		
Vmi	1.5 V	1.5 V	Vcc/2		
Vmo	1.5 V	1.5 V	Vcc/2		

Figure 3. AC Waveforms



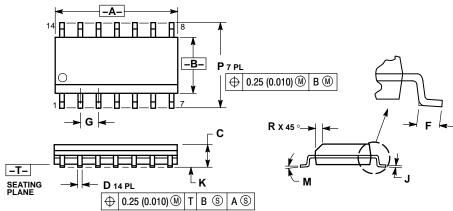
 $C_L=50$ pF at $V_{CC}=3.3\pm0.3$ V or equivalent (includes jig and probe capacitance) $C_L=30$ pF at $V_{CC}=2.5\pm0.2$ V or equivalent (includes jig and probe capacitance) $R_L=R_1=500$ Ω or equivalent

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

Figure 4. Test Circuit

PACKAGE DIMENSIONS

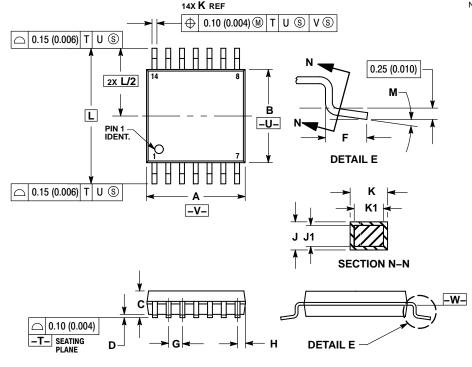
SOIC-14 **D SUFFIX** CASE 751A-03 ISSUE G



- 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.
- 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.

	MILLIMETERS INCHES		HES	
DIM	MIN	MAX	MIN	MAX
Α	8.55	8.75	0.337	0.344
В	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	
7	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
М	0 °	7°	0 °	7°
Р	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 A**



NOTES:

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

 CONTROLLING DIMENSION: MILLIMETER.

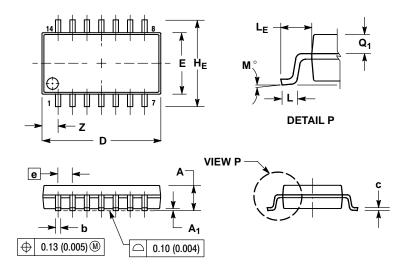
 DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.

 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-.

	MILLIN	LLIMETERS INCHES		HES
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
Κ	0.19	0.30	0.007	0.012
K1	0.19	0.25	0.007	0.010
L	6.40		0.252 BSC	
М	0 °	8 °	0°	8 °

PACKAGE DIMENSIONS

SOEIAJ-14 **M SUFFIX** CASE 965-01 **ISSUE O**



NOTES:

- 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).

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
Α		2.05		0.081
A ₁	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
е	1.27 BSC		0.050 BSC	
HE	7.40	8.20	0.291	0.323
L	0.50	0.85	0.020	0.033
LE	1.10	1.50	0.043	0.059
M	0 °	10°	0 °	10°
Q ₁	0.70	0.90	0.028	0.035
Z		1.42		0.056

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