Low-Voltage CMOS Quad 2-Input NOR Gate

With 5 V–Tolerant Inputs

The MC74LCX02 is a high performance, quad 2–input NOR 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 MC74LCX02 inputs to be safely driven from 5 V devices.

Current drive capability is 24 mA at the outputs.

- Designed for 2.3 to 3.6 V V_{CC} Operation
- 5 V Tolerant Inputs – Interface Capability With 5 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

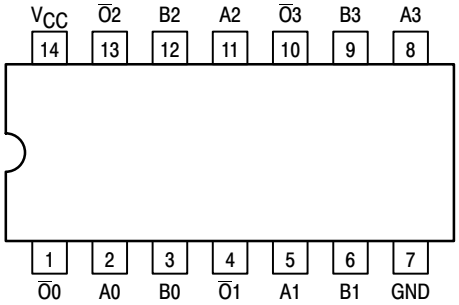


Figure 1. Pinout: 14–Lead (Top View)

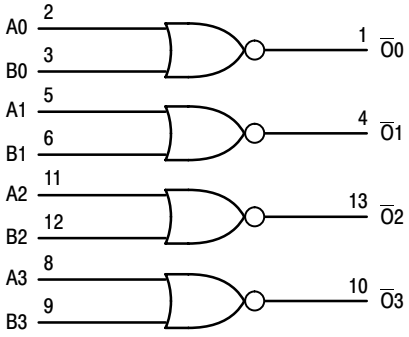
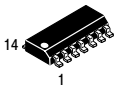


Figure 2. LOGIC DIAGRAM

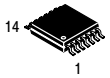
MC74LCX02

LCX

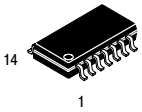
LOW–VOLTAGE CMOS QUAD 2–INPUT NOR GATE



D SUFFIX
PLASTIC SOIC
CASE 751A



DT SUFFIX
PLASTIC TSSOP
CASE 948G



M SUFFIX
PLASTIC SOIC EIAJ
CASE 965

PIN NAMES

Pins	Function
An, Bn $\overline{On}$	Data Inputs Outputs

TRUTH TABLE

INPUTS		OUTPUTS
An	**Bn**	**$\overline{On}$**
L	L	H
L	H	L
H	L	L
H	H	L

MAXIMUM RATINGS

Symbol	Parameter	Value	Condition	Unit
V_{CC}	DC Supply Voltage	–0.5 to +7.0		V
V_I	DC Input Voltage	$–0.5 \le V_I \le +7.0$		V
V_O	DC Output Voltage	$–0.5 \le V_O \le V_{CC} + 0.5$	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 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. Output in HIGH or LOW State. I_O absolute maximum rating must be observed.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Typ	Max	Unit
V_{CC}	Supply Voltage Operating Data Retention Only	2.0 1.5	3.3 3.3	3.6 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, V_{CC} = 3.0 V – 3.6 V			–24	mA
I_{OL}	LOW Level Output Current, V_{CC} = 3.0 V – 3.6 V			24	mA
I_{OH}	HIGH Level Output Current, V_{CC} = 2.7 V – 3.0 V			–12	mA
I_{OL}	LOW Level Output Current, V_{CC} = 2.7 V – 3.0 V			12	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 V	0		10	ns/V

DC ELECTRICAL CHARACTERISTICS

Symbol	Characteristic	Condition	T_A = –40°C to +85°C		Unit
			Min	Max	
V_{IH}	HIGH Level Input Voltage (Note 2.)	$2.7 V \le V_{CC} \le 3.6 V$	2.0		V
V_{IL}	LOW Level Input Voltage (Note 2.)	$2.7 V \le V_{CC} \le 3.6 V$		0.8	V
V_{OH}	HIGH Level Output Voltage	$2.7 V \le V_{CC} \le 3.6 V$; I_{OH} = –100 μA	V_{CC} – 0.2		V
		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	$2.7 V \le V_{CC} \le 3.6 V$; I_{OL} = 100 μA		0.2	V
		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	

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

DC ELECTRICAL CHARACTERISTICS (continued)

Symbol	Characteristic	Condition	T_A = –40°C to +85°C		Unit
			Min	Max	
I_I	Input Leakage Current	2.7 V ≤ V_{CC} ≤ 3.6 V; 0 V ≤ V_I ≤ 5.5 V		±5.0	μA
I_{CC}	Quiescent Supply Current	2.7 ≤ V_{CC} ≤ 3.6 V; V_I = GND or V_{CC}		10	μA
		2.7 ≤ V_{CC} ≤ 3.6 V; 3.6 ≤ V_I ≤ 5.5 V		±10	μA
ΔI_{CC}	Increase in I_{CC} per Input	2.7 ≤ V_{CC} ≤ 3.6 V; V_{IH} = V_{CC} – 0.6 V		500	μA

AC CHARACTERISTICS (t_R = t_F = 2.5ns; C_L = 50pF; R_L = 500Ω)

Symbol	Parameter	Waveform	Limits			Unit
			T_A = –40°C to +85°C			
			V_{CC} = 3.0 V to 3.6 V		V_{CC} = 2.7 V	
			Min	Max	Max	
t_{PLH} t_{PHL}	Propagation Delay Input to Output	1	1.5 1.5	5.2 5.2	6.0 6.0	ns
t_{OSHL} t_{OSLH}	Output–to–Output Skew (Note 3.)			1.0 1.0		ns

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.

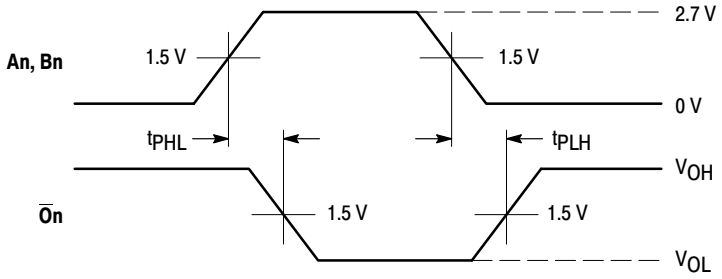
DYNAMIC SWITCHING CHARACTERISTICS

Symbol	Characteristic	Condition	T_A = +25°C			Unit
			Min	Typ	Max	
V_{OLP}	Dynamic LOW Peak Voltage (Note 4.)	V_{CC} = 3.3 V, C_L = 50 pF, V_{IH} = 3.3 V, V_{IL} = 0 V		0.8		V
V_{OLV}	Dynamic LOW Valley Voltage (Note 4.)	V_{CC} = 3.3 V, C_L = 50 pF, V_{IH} = 3.3 V, V_{IL} = 0 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.

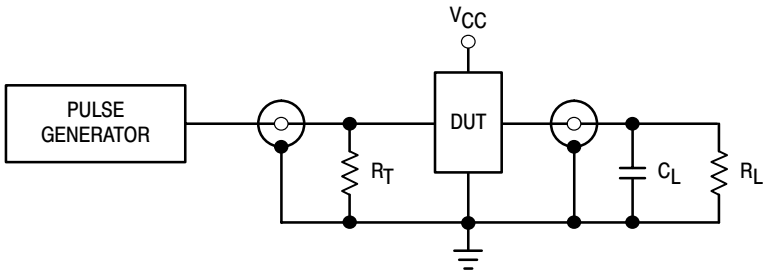
CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Condition	Typical	Unit
C_{IN}	Input Capacitance	V_{CC} = 3.3 V, V_I = 0 V or V_{CC}	7	pF
C_{OUT}	Output Capacitance	V_{CC} = 3.3 V, V_I = 0 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



PROPAGATION DELAYS
$t_R = t_F$ = 2.5 ns, 10% to 90%; f = 1 MHz; t_W = 500 ns

Figure 3. AC Waveforms



C_L = 50 pF 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