

Quad 2-Input NOR Gate With 5 V-Tolerant Inputs

The MC74LVX02 is an advanced high speed CMOS 2-input NOR gate. The inputs tolerate voltages up to 7 V, allowing the interface of 5 V systems to 3 V systems.

- High Speed: $t_{pD} = 4.5 \text{ ns}$ (Typ) at $V_{CC} = 3.3 \text{ V}$
- Low Power Dissipation: $I_{CC} = 2\mu\text{A}$ (Max) at $T_A = 25^\circ\text{C}$
- Power Down Protection Provided on Inputs
- Balanced Propagation Delays
- Low Noise: $V_{OLP} = 0.5 \text{ V}$ (Max)
- Pin and Function Compatible with Other Standard Logic Families
- Latchup Performance Exceeds 300 mA
- ESD Performance: $\text{HBM} > 2000 \text{ V}$; Machine Model $> 200 \text{ V}$

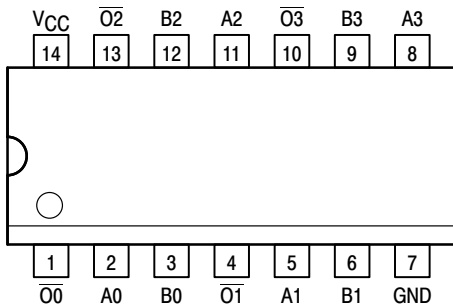


Figure 1. Figure 1. 14-Lead Pinout (Top View)

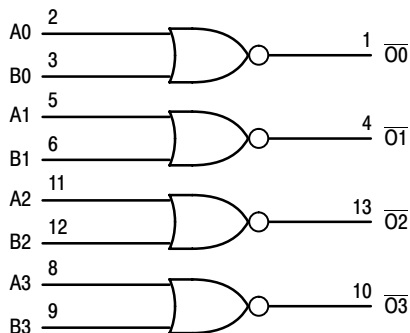


Figure 2. Figure 2. Logic Diagram

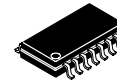
MC74LVX02



D SUFFIX
14-LEAD SOIC PACKAGE
CASE 751A



DT SUFFIX
14-LEAD TSSOP PACKAGE
CASE 948G



M SUFFIX
14-LEAD SOIC EIAJ PACKAGE
CASE 965

PIN NAMES

Pins	Function
A_n, B_n	Data Inputs
\overline{O}_n	Outputs

FUNCTION TABLE

INPUTS		OUTPUTS
A_n	B_n	\overline{O}_n
L	L	H
L	H	L
H	L	L
H	H	L

MC74LVX02

MAXIMUM RATINGS*

Symbol	Parameter	Value	Unit
V _{CC}	DC Supply Voltage	-0.5 to +7.0	V
V _{in}	DC Input Voltage	-0.5 to +7.0	V
V _{out}	DC Output Voltage	-0.5 to V _{CC} +0.5	V
I _{IK}	Input Diode Current	-20	mA
I _{OK}	Output Diode Current	±20	mA
I _{out}	DC Output Current, per Pin	±25	mA
I _{CC}	DC Supply Current, V _{CC} and GND Pins	±50	mA
P _D	Power Dissipation	180	mW
T _{stg}	Storage Temperature	-65 to +150	°C

* Absolute maximum continuous 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.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V _{CC}	DC Supply Voltage	2.0	3.6	V
V _{in}	DC Input Voltage	0	5.5	V
V _{out}	DC Output Voltage	0	V _{CC}	V
T _A	Operating Temperature, All Package Types	-40	+85	°C
Δt/ΔV	Input Rise and Fall Time	0	100	ns/V

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	V _{CC} V	T _A = 25°C			T _A = -40 to 85°C		Unit
				Min	Typ	Max	Min	Max	
V _{IH}	High-Level Input Voltage		2.0	1.5			1.5		V
			3.0	2.0			2.0		
			3.6	2.4			2.4		
V _{IL}	Low-Level Input Voltage		2.0			0.5		0.5	V
			3.0			0.8		0.8	
			3.6			0.8		0.8	
V _{OH}	High-Level Output Voltage (V _{in} = V _{IH} or V _{IL})	I _{OH} = -50 μA I _{OH} = -50 μA I _{OH} = -4 mA	2.0	1.9	2.0		1.9		V
			3.0	2.9	3.0		2.9		
			3.0	2.58			2.48		
V _{OL}	Low-Level Output Voltage (V _{in} = V _{IH} or V _{IL})	I _{OL} = 50 μA I _{OL} = 50 μA I _{OL} = 4 mA	2.0		0.0	0.1		0.1	V
			3.0		0.0	0.1		0.1	
			3.0			0.36		0.44	
I _{in}	Input Leakage Current	V _{in} = 5.5 V or GND	3.6			±0.1		±1.0	μA
I _{CC}	Quiescent Supply Current	V _{in} = V _{CC} or GND	3.6			2.0		20.0	μA

MC74LVX02

AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0\text{ns}$)

Symbol	Parameter	Test Conditions	$T_A = 25^\circ\text{C}$			$T_A = -40 \text{ to } 85^\circ\text{C}$		Unit
			Min	Typ	Max	Min	Max	
t_{PLH} , t_{PHL}	Propagation Delay, Input to Output	$V_{CC} = 2.7\text{ V}$ $C_L = 15\text{ pF}$		5.9	10.7	1.0	13.5	ns
		$V_{CC} = 2.7\text{ V}$ $C_L = 50\text{ pF}$		8.4	14.2	1.0	17.0	
		$V_{CC} = 3.3 \pm 0.3\text{ V}$ $C_L = 15\text{ pF}$		4.5	6.6	1.0	8.0	ns
		$V_{CC} = 3.3 \pm 0.3\text{ V}$ $C_L = 50\text{ pF}$		7.0	10.1	1.0	11.5	
t_{OSHL} t_{OSLH}	Output-to-Output Skew (Note 1.)	$V_{CC} = 2.7\text{ V}$ $C_L = 50\text{ pF}$ $V_{CC} = 3.3 \pm 0.3\text{ V}$ $C_L = 50\text{ pF}$			1.5		1.5	ns
					1.5		1.5	

1. 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.

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	$T_A = 25^\circ\text{C}$			$T_A = -40 \text{ to } 85^\circ\text{C}$		Unit
		Min	Typ	Max	Min	Max	
C_{in}	Input Capacitance		4	10		10	pF
C_{PD}	Power Dissipation Capacitance (Note 2.)		15				pF

2. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}/4$ (per gate). C_{PD} is used to determine the no-load dynamic power consumption; $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$.

NOISE CHARACTERISTICS (Input $t_r = t_f = 3.0\text{ ns}$, $C_L = 50\text{ pF}$, $V_{CC} = 3.3\text{ V}$, Measured in SOIC Package)

Symbol	Characteristic	$T_A = 25^\circ\text{C}$		Unit
		Typ	Max	
V_{OLP}	Quiet Output Maximum Dynamic V_{OL}	0.3	0.5	V
V_{OLV}	Quiet Output Minimum Dynamic V_{OL}	-0.3	-0.5	V
V_{IHD}	Minimum High Level Dynamic Input Voltage		2.0	V
V_{ILD}	Maximum Low Level Dynamic Input Voltage		0.8	V

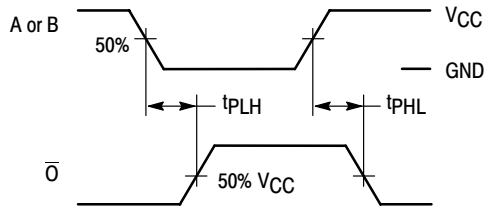
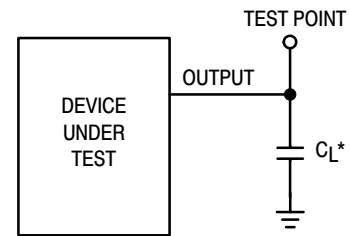


Figure 3. Switching Waveforms



*Includes all probe and jig capacitance

Figure 4. Test Circuit