

74VCX00

Low Voltage Quad 2-Input NAND Gate with 3.6V Tolerant Inputs and Outputs

General Description

The VCX00 contains four 2-input NAND gates. This product is designed for low voltage (1.2V to 3.6V) V_{CC} applications with I/O compatibility up to 3.6V.

The VCX00 is fabricated with an advanced CMOS technology to achieve high-speed operation while maintaining low CMOS power dissipation.

Features

- 1.2V to 3.6V V_{CC} supply operation
- 3.6V tolerant inputs and outputs
- t_{PD}
2.8 ns max for 3.0V to 3.6V V_{CC}
- Power-off high impedance inputs and outputs
- Static Drive (I_{OH}/I_{OL})
±24 mA @ 3.0V V_{CC}
- Uses patented noise/EMI reduction circuitry
- Latchup performance exceeds JEDEC 78 conditions
- ESD performance:
Human body model > 2000V
Machine model > 250V
- Leadless Pb-Free DQFN package

Ordering Code:

Order Number	Package Number	Package Description
74VCX00M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74VCX00BQX (Note 1)	MLP014A	Pb-Free 14-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 3.0mm
74VCX00MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74VCX00MTCX_NL (Note 2)	MTC14	Pb-Free 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

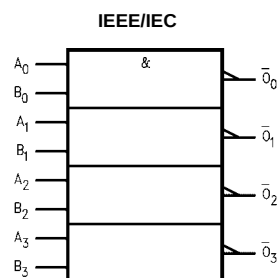
Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.
Pb-Free package per JEDEC J-STD-020B.

Note 1: DQFN package available in Tape and Reel only.

Note 2: " _NL" indicates Pb-Free package (per JEDEC J-STD-020B). Device available in Tape and Reel only.

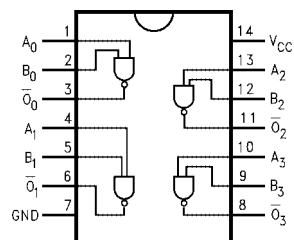
74VCX00 Low Voltage Quad 2-Input NAND Gate with 3.6V Tolerant Inputs and Outputs

Logic Symbol



Connection Diagrams

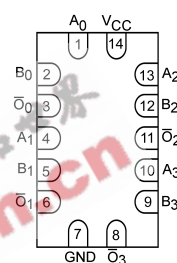
Pin Assignments for SOIC and TSSOP



Pin Descriptions

Pin Names	Description
A_n, B_n	Inputs
$\bar{O}_n$	Outputs

Pad Assignments for DQFN



(Top View)

Absolute Maximum Ratings (Note 3)

Supply Voltage (V_{CC})	-0.5V to +4.6V
DC Input Voltage (V_I)	-0.5V to +4.6V
Output Voltage (V_O)	
HIGH or LOW State (Note 4)	-0.5V to $V_{CC} + 0.5V$
$V_{CC} = 0V$	-0.5V to +4.6V
DC Input Diode Current (I_{IK})	
$V_I < 0V$	-50 mA
DC Output Diode Current (I_{OK})	
$V_O < 0V$	-50 mA
$V_O > V_{CC}$	+50 mA
DC Output Source/Sink Current (I_{OL}/I_{OL})	± 50 mA
DC V_{CC} or Ground Current per	± 100 mA
Supply Pin (I_{CC} or Ground)	
Storage Temperature Range (T_{stg})	-65°C to +150°C

Recommended Operating Conditions (Note 5)

Power Supply	
Operating	1.2V to 3.6V
Input Voltage	-0.3V to 3.6V
Output Voltage (V_O)	
HIGH or LOW State	0V to V_{CC}
Output Current in I_{OH}/I_{OL}	
$V_{CC} = 3.0V$ to 3.6V	± 24 mA
$V_{CC} = 2.3V$ to 2.7V	± 18 mA
$V_{CC} = 1.65V$ to 2.3V	± 6 mA
$V_{CC} = 1.4V$ to 1.6V	± 2 mA
$V_{CC} = 1.2V$	± 100 μ A
Free Air Operating Temperature (T_A)	-40°C to +85°C
Minimum Input Edge Rate ($\Delta V/\Delta t$)	
$V_{IN} = 0.8V$ to 2.0V, $V_{CC} = 3.0V$	10 ns/V

Note 3: The Absolute Maximum Ratings are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the Absolute Maximum Ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Note 4: I_O Absolute Maximum Rating must be observed.

Note 5: Floating or unused inputs must be held HIGH or LOW

DC Electrical Characteristics

Symbol	Parameter	Conditions	V_{CC} (V)	Min	Max	Units
V_{IH}	HIGH Level Input Voltage		2.7 - 3.6 2.3 - 2.7 1.65 - 2.3 1.4 - 1.6 1.2	2.0 1.6 $0.65 \times V_{CC}$ $0.65 \times V_{CC}$ $0.65 \times V_{CC}$		V
V_{IL}	LOW Level Input Voltage		2.7 - 3.6 2.3 - 2.7 1.65 - 2.3 1.4 - 1.6 1.2		0.8 0.7 $0.35 \times V_{CC}$ $0.35 \times V_{CC}$ $0.05 \times V_{CC}$	V
V_{OH}	HIGH Level Output Voltage	$I_{OH} = -100 \mu A$ $I_{OH} = -12$ mA $I_{OH} = -18$ mA $I_{OH} = -24$ mA	2.7 - 3.6 2.7 3.0 3.0	$V_{CC} - 0.2$ 2.2 2.4 2.2		V
		$I_{OH} = -100 \mu A$ $I_{OH} = -6$ mA $I_{OH} = -12$ mA $I_{OH} = -18$ mA	2.3 - 2.7 2.3 2.3 2.3	$V_{CC} - 0.2$ 2.0 1.8 1.7		
		$I_{OH} = -100 \mu A$ $I_{OH} = -6$ mA	1.65 - 2.3 1.65	$V_{CC} - 0.2$ 1.25		
		$I_{OH} = -100 \mu A$ $I_{OH} = -2$ mA $I_{OH} = -100 \mu A$	1.4 - 1.6 1.4 1.2	$V_{CC} - 0.2$ 1.05 $V_{CC} - 0.2$		

DC Electrical Characteristics (Continued)

Symbol	Parameter	Conditions	V _{CC} (V)	Min	Max	Units
V _{OL}	LOW Level Output Voltage	I _{OL} = 100 μ A	2.7 - 3.6		0.2	V
		I _{OL} = 12 mA	2.7		0.4	
		I _{OL} = 18 mA	3.0		0.4	
		I _{OL} = 24 mA	3.0		0.55	
		I _{OL} = 100 μ A	2.3 - 2.7		0.2	
		I _{OL} = 12 mA	2.3		0.4	
		I _{OL} = 18 mA	2.3		0.6	
		I _{OL} = 100 μ A	1.65 - 2.3		0.2	
		I _{OL} = 6 mA	1.65		0.3	
I _I	Input Leakage Current	I _{OL} = 100 μ A	1.4 - 1.6		0.2	
		I _{OL} = 2 mA	1.4		0.35	
I _{OZ}	3-STATE Output Leakage	I _{OL} = 100 μ A	1.2		0.05	
I _{OFF}	Power-OFF Leakage Current	0 $\leq$ V _I $\leq$ 3.6V	0		10	μ A
I _{CC}	Quiescent Supply Current	V _I = V _{CC} or GND	1.4 - 3.6		20	μ A
Δ I _{CC}	Increase in I _{CC} per Input	V _{CC} $\leq$ (V _I , V _O) $\leq$ 3.6V (Note 6)	1.4 - 3.6		$\pm$ 20	μ A
		V _{IH} = V _{CC} - 0.6V	2.7 - 3.6		750	μ A

Note 6: Outputs disabled or 3-STATE only.

AC Electrical Characteristics (Note 7)

Symbol	Parameter	Conditions	V _{CC} (V)	T _A = −40°C to +85°C		Units	Figure Number	
				Min	Max			
t _{PHL} , t _{PLH}	Propagation Delay	C _L = 30 pF, R _L = 500Ω	3.3 ± 0.3	0.6	2.8	ns	Figures 1, 2	
			2.5 ± 0.2	0.8	3.7			
			1.8 ± 0.15	1.0	7.4			
		C _L = 15 pF, R _L = 2kΩ	1.5 ± 0.1	1.0	14.8		Figures 3, 4	
			1.2	1.5	37.0			
t _{OSHL} , t _{OSLH}	Output to Output Skew (Note 8)	C _L = 30 pF, R _L = 500Ω	3.3 ± 0.3		0.5	ns		
			2.5 ± 0.2		0.5			
			1.8 ± 0.15		0.75			
		C _L = 15 pF, R _L = 2kΩ	1.5 ± 0.1		1.5			
			1.2		1.5			

Note 7: For C_L = 50pF, add approximately 300 ps to the AC maximum specification.

Note 8: 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}).

Dynamic Switching Characteristics					
Symbol	Parameter	Conditions	V _{CC} (V)	T _A = 25°C	Unit
				Typical	
V _{OLP}	Quiet Output Dynamic Peak V _{OL}	C _L = 30 pF, V _{IH} = V _{CC} , V _{IL} = 0V	1.8 2.5 3.3	0.25 0.6 0.8	V
V _{OLV}	Quiet Output Dynamic Valley V _{OL}	C _L = 30 pF, V _{IH} = V _{CC} , V _{IL} = 0V	1.8 2.5 3.3	-0.25 -0.6 -0.8	V
V _{OHV}	Quiet Output Dynamic Valley V _{OH}	C _L = 30 pF, V _{IH} = V _{CC} , V _{IL} = 0V	1.8 2.5 3.3	1.5 1.9 2.2	V

Capacitance				
Symbol	Parameter	Conditions	T _A = +25°C	Units
			Typical	
C _{IN}	Input Capacitance	V _I = 0V or V _{CC} , V _{CC} = 1.8V, 2.5V or 3.3V	6	pF
C _{OUT}	Output Capacitance	V _I = 0V or V _{CC} , V _{CC} = 1.8V, 2.5V or 3.3V	7	pF
C _{PD}	Power Dissipation Capacitance	V _I = 0V or V _{CC} , f = 10 MHz, V _{CC} = 1.8V, 2.5V or 3.3V	20	pF

AC Loading and Waveforms (V_{CC} 3.3V ± 0.3V to 1.8V ± 0.15V)

Figure 1 shows the AC test circuit. A DUT is connected to a 30 pF capacitor and a 500 ohm resistor. The output is connected to a switch that can be OPEN, GND, or 6.0V or V_{CC} * 2. Timing parameters t_{PLH}, t_{PHL}, t_{PZH}, t_{PHZ}, t_{PZL}, t_{PLZ} are indicated.

FIGURE 1. AC Test Circuit

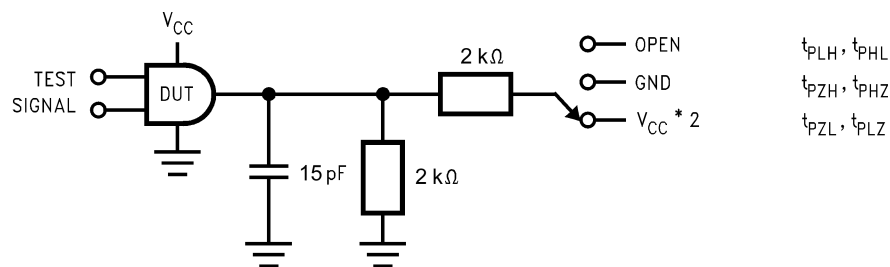
TEST	SWITCH
t _{PLH} , t _{PHL}	Open

Figure 2 shows the waveform for inverting and non-inverting functions. The inverting function shows a transition from V_{mi} to V_{mo}. The non-inverting function shows a transition from V_{mi} to V_{mo}. Timing parameters t_{pxx} are indicated.

FIGURE 2. Waveform for Inverting and Non-inverting Functions

Symbol	V _{CC}		
	3.3V ± 0.3V	2.5V ± 0.2V	1.8V ± 0.15V
V _{mi}	1.5V	V _{CC} /2	V _{CC} /2
V _{mo}	1.5V	V _{CC} /2	V _{CC} /2

AC Loading and Waveforms ($V_{CC} 1.5 \pm 0.1V$ to $1.2V$)



TEST	SWITCH
t_{PLH} , t_{PHL}	Open
t_{PZL} , t_{PLZ}	$V_{CC} \times 2$ at $V_{CC} = 1.5V \pm 0.1V$
t_{PZH} , t_{PHZ}	GND

FIGURE 3. AC Test Circuit

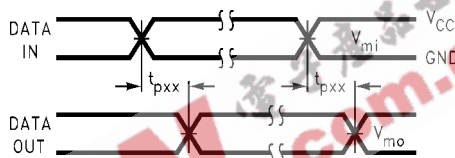
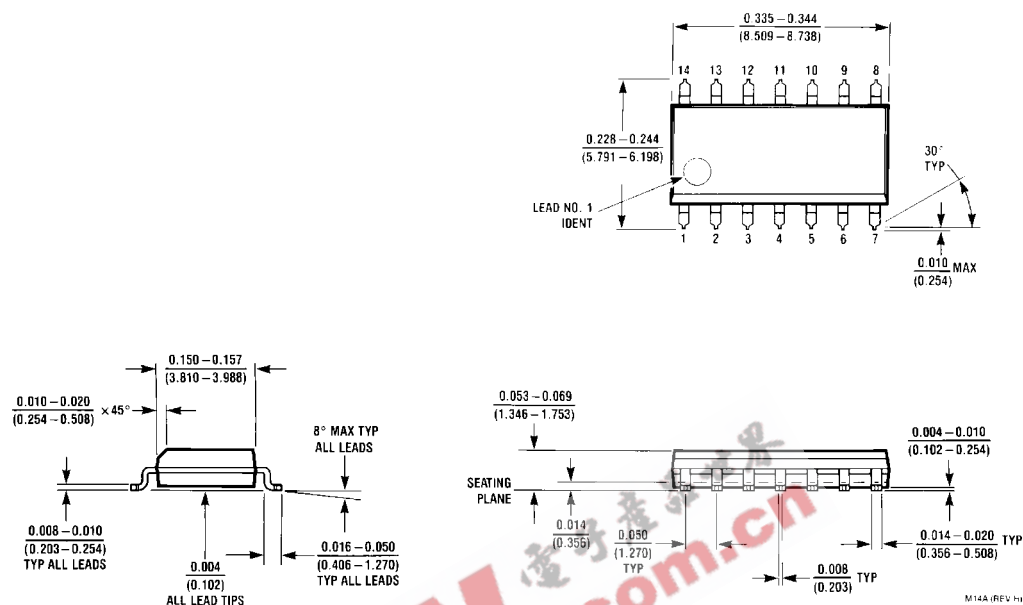


FIGURE 4. Waveform for Inverting and Non-Inverting Functions

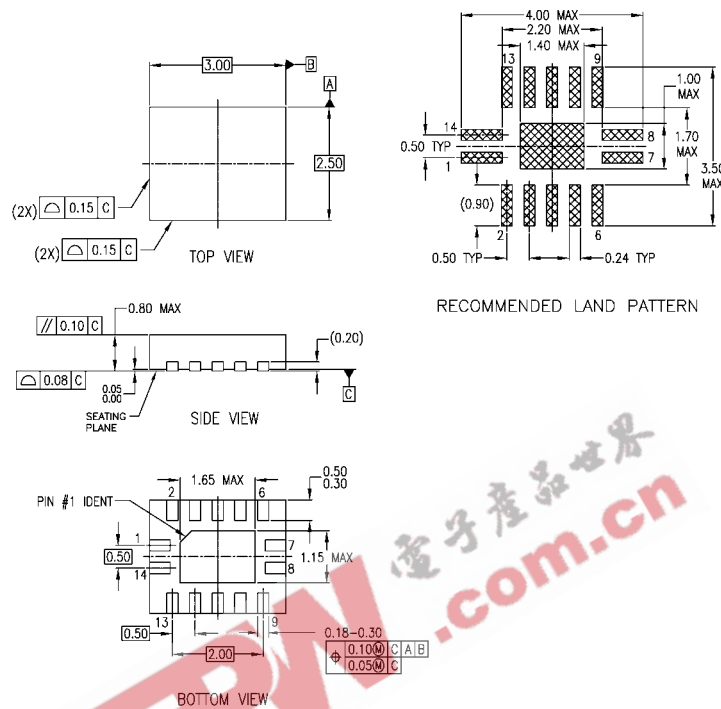
Symbol	V_{CC}
	$1.5V \pm 0.1V$
V_{mi}	$V_{CC}/2$
V_{mo}	$V_{CC}/2$

Physical Dimensions inches (millimeters) unless otherwise noted



14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
Package Number M14A

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



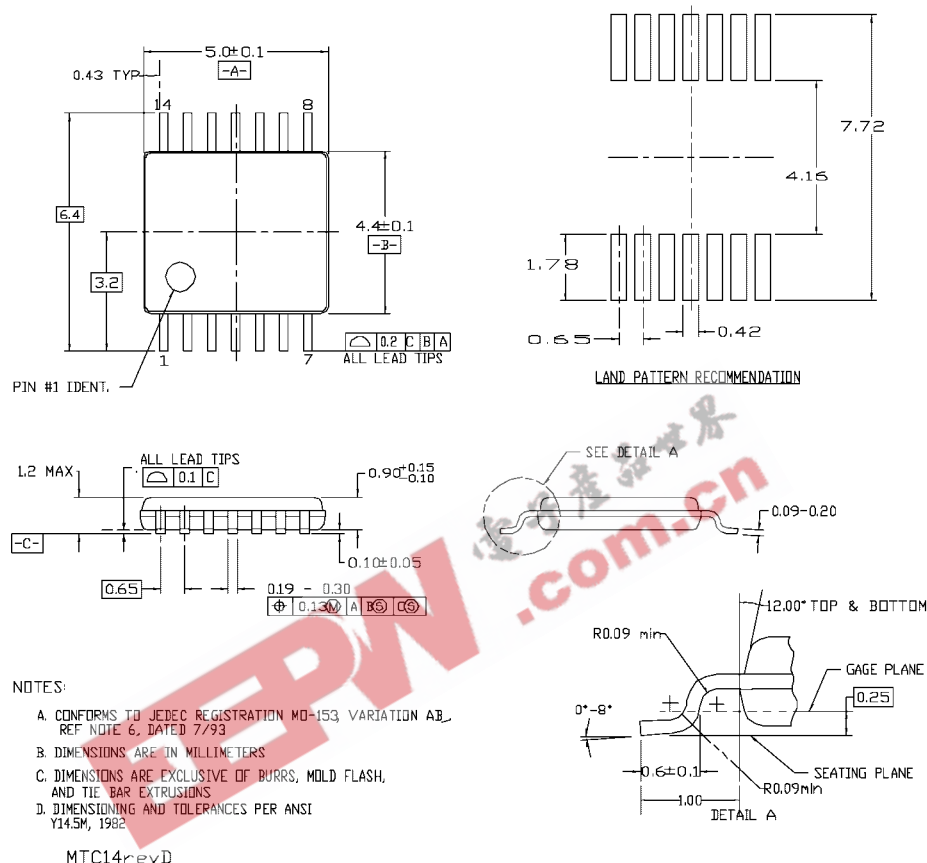
NOTES:

- CONFORMS TO JEDEC REGISTRATION MO-241, VARIATION AA
- DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

MLP014ArevA

**Pb-Free 14-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 3.0mm
Package Number MLP014A**

Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
Package Number MTC14

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