FAIRCHILD SEMICONDUCTOR™

July 1999
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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 (1.4V 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

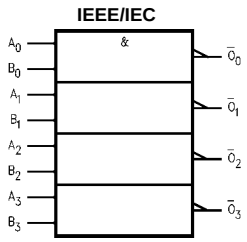
- 1.4V to 3.6V V_{CC} supply operation
- 3.6V tolerant inputs and outputs
- t_{PD}
  2.8 ns max for 3.0V to 3.6V V_{CC}
- Power-off high impedance inputs and outputs
- Static Drive (I_{OH}/I_{OL})
  ±24 mA @ 3.0V V_{CC}
- Uses patented noise/EMI reduction circuitry
- Latchup performance exceeds 300 mA
- ESD performance:
  Human body model > 2000V
  Machine model > 250V

Ordering Code:

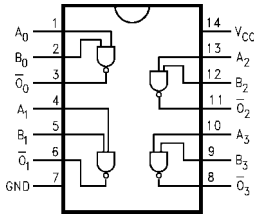
Order Number	Package Number	Package Description
74VCX00M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74VCX00MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Logic Symbol



Connection Diagram



Pin Descriptions

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

Absolute Maximum Ratings (Note 1)

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 2)	−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 3)

Power Supply	
Operating	1.4V 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
Free Air Operating Temperature (T_A)	−40°C to +85°C
Minimum Input Edge Rate ($\Delta t/\Delta V$)	
V_{IN} = 0.8V to 2.0V, V_{CC} = 3.0V	10 ns/V

Note 1: 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 2: I_O Absolute Maximum Rating must be observed.

Note 3: 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	2.0		V
			2.3 - 2.7	1.6		
			1.65 - 2.3	$0.65 \times V_{CC}$		
			1.4 - 1.6	$0.65 \times V_{CC}$		
V_{IL}	LOW Level Input Voltage		2.7–3.6		0.8	V
			2.3–2.7		0.7	
			1.65–2.3		$0.35 \times V_{CC}$	
			1.4 - 1.6		$0.35 \times V_{CC}$	
V_{OH}	HIGH Level Output Voltage	I_{OH} = −100 µA	2.7–3.6	V_{CC} − 0.2		V
		I_{OH} = −12 mA	2.7	2.2		
		I_{OH} = −18 mA	3.0	2.4		
		I_{OH} = −24 mA	3.0	2.2		
		I_{OH} = −100 µA	2.3–2.7	V_{CC} − 0.2		
		I_{OH} = −6 mA	2.3	2.0		
		I_{OH} = −12 mA	2.3	1.8		
		I_{OH} = −18 mA	2.3	1.7		
		I_{OH} = −100 µA	1.65–2.3	V_{CC} − 0.2		
		I_{OH} = −6 mA	1.65	1.25		
		I_{OH} = −100 µA	1.4 - 1.6	V_{CC} − 0.2		
		I_{OH} = −2 mA	1.4	1.05		

DC Electrical Characteristics (Continued)

Symbol	Parameter	Conditions	V_{CC} (V)	Min	Max	Units
V_{OL}	LOW Level Output Voltage	I_{OL} = 100 µA	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 µA	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 µA	1.65–2.3		0.2	
		I_{OL} = 6 mA	1.65		0.3	
		I_{OL} = 100 µA	1.4 - 1.6		0.2	
		I_{OL} = 2 mA	1.4		0.35	
I_I	Input Leakage Current	0 ≤ V_I ≤ 3.6V	1.4–3.6		±5.0	µA
I_{OZ}	3-STATE Output Leakage	0 ≤ V_O ≤ 3.6V V_I = V_{IH} or V_{IL}	1.4–3.6		±10	µA
I_{OFF}I	Power-OFF Leakage Current	0 ≤ (V_I, V_O) ≤ 3.6V	0		10	µA
I_{CC}	Quiescent Supply Current	V_I = V_{CC} or GND	1.4–3.6		20	µA
		V_{CC} ≤ (V_I, V_O) ≤ 3.6V (Note 4)	1.4–3.6		±20	
ΔI_{CC}	Increase in I_{CC} per Input	V_{IH} = V_{CC} −0.6V	2.7–3.6		750	µA

Note 4: Outputs disabled or 3-STATE only.

AC Electrical Characteristics (Note 5)

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
t_{OSHL}	Output to Output Skew	C_L = 30 pF, R_L = 500Ω	3.3 ± 0.3		0.5	ns	
t_{OSLH}	(Note 6)		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		

Note 5: For C_L = 50$_P$F, add approximately 300 ps to the AC maximum specification.

Note 6: 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 Typical	Unit
V_{OLP}	Quiet Output Dynamic Peak V_{OL}	C_L = 30 pF, V_{IH} = V_{CC}, V_{IL} = 0V	1.8	0.25	
			2.5	0.6	V
			3.3	0.8	
V_{OLV}	Quiet Output Dynamic Valley V_{OL}	C_L = 30 pF, V_{IH} = V_{CC}, V_{IL} = 0V	1.8	–0.25	
			2.5	–0.6	V
			3.3	–0.8	
V_{OHV}	Quiet Output Dynamic Valley V_{OH}	C_L = 30 pF, V_{IH} = V_{CC}, V_{IL} = 0V	1.8	1.5	
			2.5	1.9	V
			3.3	2.2	

Capacitance

Symbol	Parameter	Conditions	T_A = +25°C Typical	Units
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)

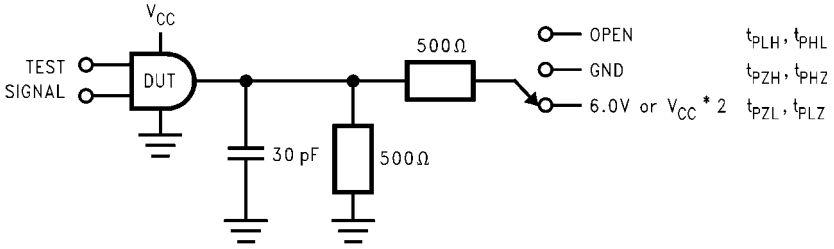


FIGURE 1. AC Test Circuit

TEST	SWITCH
t_{PLH}, t_{PHL}	Open

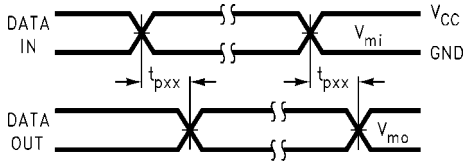
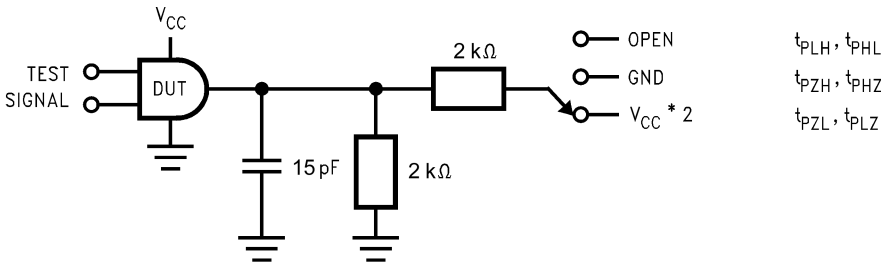


FIGURE 2. Waveform for Inverting and Non-inverting Functions

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 ± 0.1V)



TEST	SWITCH
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	V_{CC} x 2 at V_{CC} = 1.5V ± 0.1V
t_{PZH}, t_{PHZ}	GND

FIGURE 3. AC Test Circuit

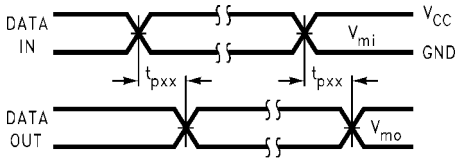
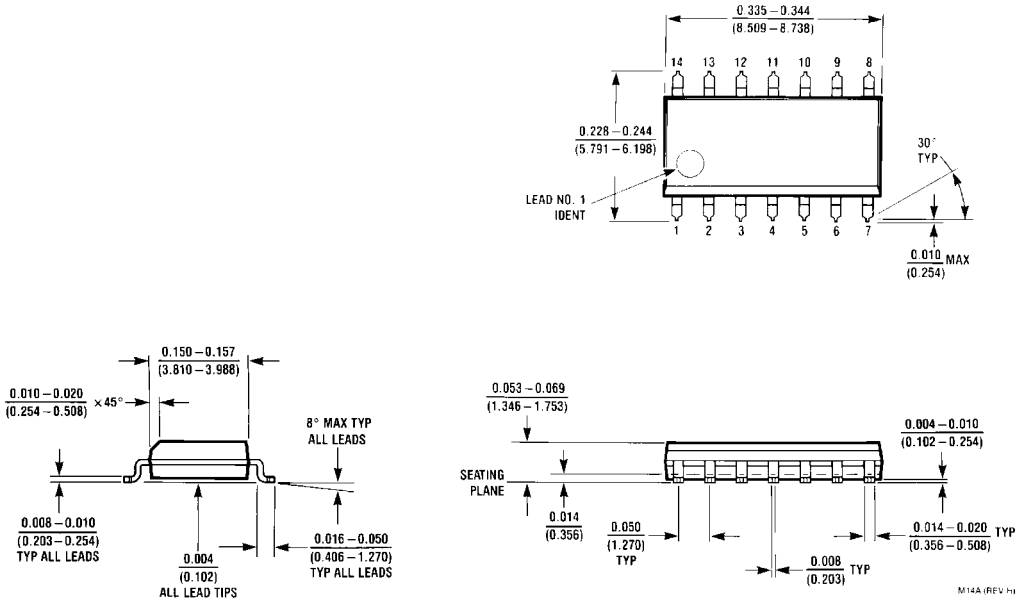


FIGURE 4. Waveform for Inverting and Non-Inverting Functions

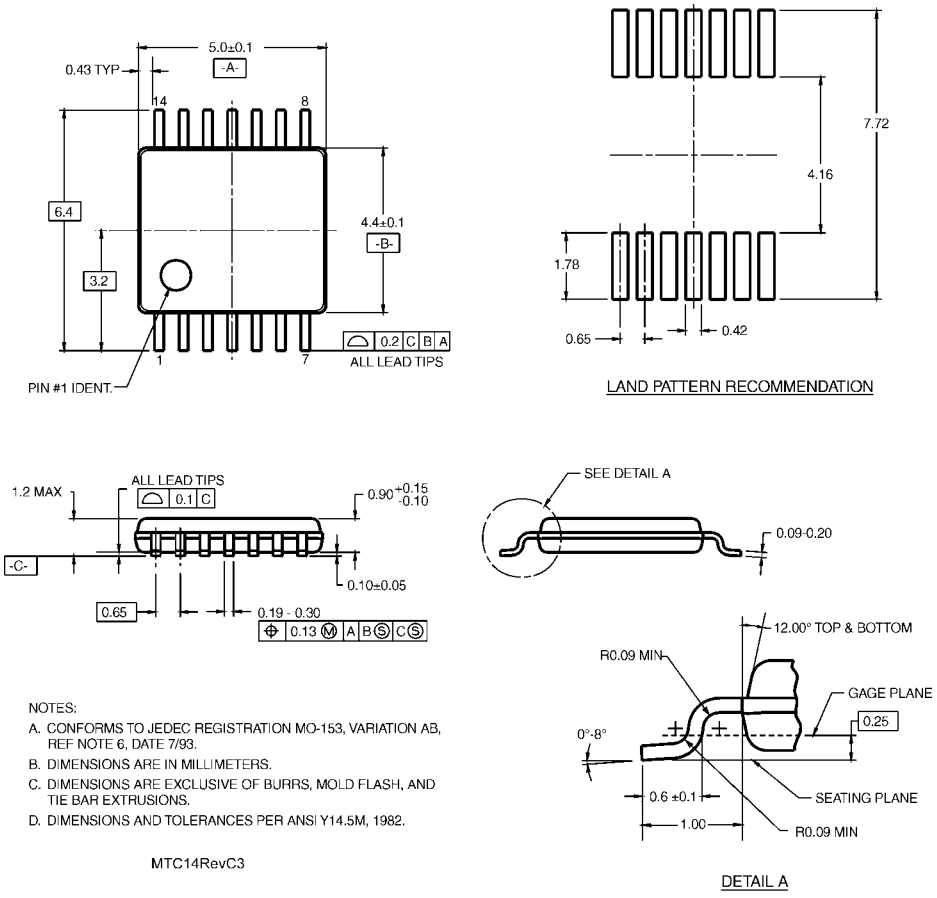
Symbol	V_{CC}
	1.5V ± 0.1V
V_{mi}	$V_{CC}/2$
V_{mo}	$V_{CC}/2$

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:

A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6, DATE 7/93.

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

MTC14RevC3

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

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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