

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 (1.65V 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

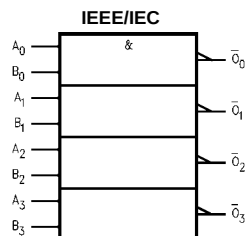
- 1.65V to 3.6V V_{CC} supply operation
- 3.6V tolerant inputs and outputs
- t_{PD}
 - 2.8 ns max for 3.0V to 3.6V V_{CC}
 - 3.7 ns max for 2.3V to 2.7V V_{CC}
 - 7.4 ns max for 1.65V to 1.95V V_{CC}
- Power-off high impedance inputs and outputs
- Static Drive (I_{OH}/I_{OL})
 - ±24 mA @ 3.0V V_{CC}
 - ±18 mA @ 2.3V V_{CC}
 - ±6 mA @ 1.65V V_{CC}
- Uses patented Quiet Series™ noise/EMI reduction circuitry
- Latchup performance exceeds 300 mA
- ESD performance:
 - Human body model > 2000V
 - Machine model > 250V

Ordering Code:

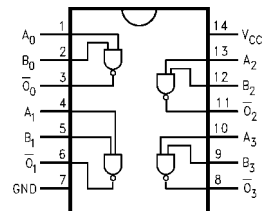
Order Number	Package Number	Package Description
74VCX00M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow
74VCX00MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

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
$\bar{O}_n$	Outputs

Quiet Series™ is a trademark of Fairchild Semiconductor Corporation.

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	1.65V to 3.6V
Data Retention Only	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
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_{IK} Absolute Maximum Rating must be observed.

Note 3: Floating or unused inputs must be held HIGH or LOW

DC Electrical Characteristics (2.7V < $V_{CC} \leq 3.6V$)

Symbol	Parameter	Conditions	V_{CC} (V)	Min	Max	Units
V_{IH}	HIGH Level Input Voltage		2.7–3.6	2.0		V
V_{IL}	LOW Level Input Voltage		2.7–3.6		0.8	V
V_{OH}	HIGH Level Output Voltage	$I_{OH} = -100 \mu A$ $I_{OH} = -12 \text{ mA}$ $I_{OH} = -18 \text{ mA}$ $I_{OH} = -24 \text{ mA}$	2.7–3.6 2.7 3.0 3.0	$V_{CC} - 0.2$ 2.2 2.4 2.2		V
V_{OL}	LOW Level Output Voltage	$I_{OL} = 100 \mu A$ $I_{OL} = 12 \text{ mA}$ $I_{OL} = 18 \text{ mA}$ $I_{OL} = 24 \text{ mA}$	2.7–3.6 2.7 3.0 3.0		0.2 0.4 0.4 0.55	V
I_I	Input Leakage Current	$0 \leq V_I \leq 3.6V$	2.7–3.6		±5.0	μA
I_{OFF}	Power-Off Leakage Current	$0 \leq (V_I, V_O) \leq 3.6V$	0		10	μA
I_{CC}	Quiescent Supply Current	$V_I = V_{CC}$ or GND $V_{CC} \leq V_I \leq 3.6V$	2.7–3.6 2.7–3.6		20 ±20	μA
ΔI_{CC}	Increase in I_{CC} per Input	$V_{IH} = V_{CC} - 0.6V$	2.7–3.6		750	μA

DC Electrical Characteristics ($2.3V \leq V_{CC} \leq 2.7V$)

Symbol	Parameter	Conditions	V_{CC} (V)	Min	Max	Units
V_{IH}	HIGH Level Input Voltage		2.3–2.7	1.6		V
V_{IL}	LOW Level Input Voltage		2.3–2.7		0.7	V
V_{OH}	HIGH Level Output Voltage	$I_{OH} = -100 \mu A$ $I_{OH} = -6 \text{ mA}$ $I_{OH} = -12 \text{ mA}$ $I_{OH} = -18 \text{ mA}$	2.3–2.7 2.3 2.3 2.3	$V_{CC} - 0.2$ 2.0 1.8 1.7		V
V_{OL}	LOW Level Output Voltage	$I_{OL} = 100 \mu A$ $I_{OL} = 12 \text{ mA}$ $I_{OL} = 18 \text{ mA}$	2.3–2.7 2.3 2.3		0.2 0.4 0.6	V
I_I	Input Leakage Current	$0 \leq V_I \leq 3.6V$	2.3–2.7		± 5.0	μA
I_{OFF}	Power-Off Leakage Current	$0 \leq (V_I, V_O) \leq 3.6V$	0		10	μA
I_{CC}	Quiescent Supply Current	$V_I = V_{CC}$ or GND $V_{CC} \leq V_I \leq 3.6V$	2.3–2.7 2.3–2.7		20 ± 20	μA

DC Electrical Characteristics ($1.65V \leq V_{CC} < 2.3V$)

Symbol	Parameter	Conditions	V_{CC} (V)	Min	Max	Units
V_{IH}	HIGH Level Input Voltage		1.65–2.3	$0.65 \times V_{CC}$		V
V_{IL}	LOW Level Input Voltage		1.65–2.3		$0.35 \times V_{CC}$	V
V_{OH}	HIGH Level Output Voltage	$I_{OH} = -100 \mu A$ $I_{OH} = -6 \text{ mA}$	1.65–2.3 1.65	$V_{CC} - 0.2$ 1.25		V
V_{OL}	LOW Level Output Voltage	$I_{OL} = 100 \mu A$ $I_{OL} = 6 \text{ mA}$	1.65–2.3 1.65		0.2 0.3	V
I_I	Input Leakage Current	$0 \leq V_I \leq 3.6V$	1.65–2.3		± 5.0	μA
I_{OFF}	Power-Off Leakage Current	$0 \leq (V_I, V_O) \leq 3.6V$	0		10	μA
I_{CC}	Quiescent Supply Current	$V_I = V_{CC}$ or GND $V_{CC} \leq V_I \leq 3.6V$	1.65–2.3 1.65–2.3		20 ± 20	μA

AC Electrical Characteristics (Note 4)

Symbol	Parameter	T _A = -40°C to +85°C, C _L = 30pF, R _L = 500Ω						Units
		V _{CC} = 3.3V ± 0.3V		V _{CC} = 2.5V ± 0.2V		V _{CC} = 1.8V ± 0.15V		
		Min	Max	Min	Max	Min	Max	
t _{PHL}	Propagation Delay	0.6	2.8	0.8	3.7	1.0	7.4	ns
t _{PLH}								
t _{OSHL}	Output to Output Skew (Note 5)		0.5		0.5		0.75	ns
t _{OSLH}								

Note 4: For $C_L = 50 \text{ pF}$, add approximately 300 ps to the AC maximum specification

Note 5: 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

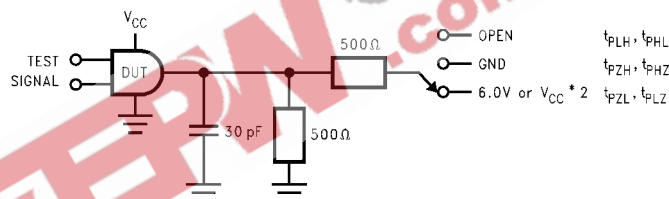


FIGURE 1. AC Test Circuit

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

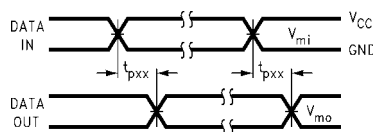
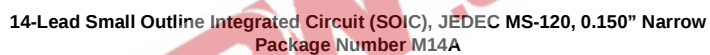
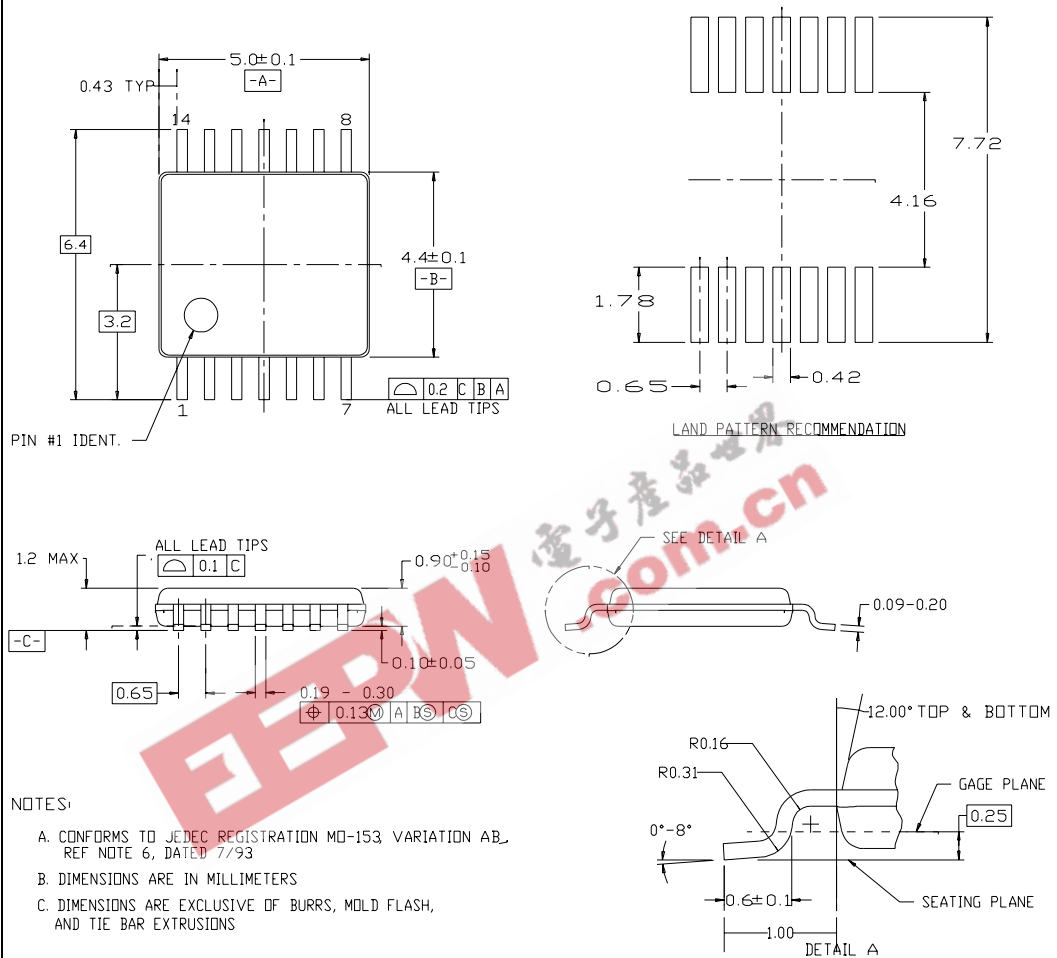


FIGURE 2. Waveform for Inverting and Non-inverting Functions

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



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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