FAIRCHILD SEMICONDUCTOR™

July 1999
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74VCX132

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

General Description

The VCX132 contains four 2-input NAND gates with Schmitt Trigger Inputs. The pin configuration and function are the same as the VCX00 except the inputs have hysteresis between the positive-going and negative-going input thresholds. This hysteresis is useful for transforming slowly switching input signals into sharply defined, jitter-free output signals. This product should be used where noise margin greater than that of conventional gates is required.

The VCX132 is designed for low voltage (1.65V to 3.6V) V_{CC} applications with I/O compatibility up to 3.6V.

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

Features

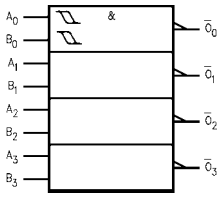
- 1.65V-3.6V V_{CC} supply operation
- 3.6V tolerant inputs and outputs
- t_{PD}
  - 3.3 ns max for 3.0V to 3.6V V_{CC}
  - 4.1 ns max for 2.3V to 2.7V V_{CC}
  - 8.2 ns max for 1.65V to 1.95V V_{CC}
- Power-off high impedance inputs and outputs
- Static Drive (I_{OH}/I_{OL})
  - ±24 mA @ 3.0V V_{CC}
  - ±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:

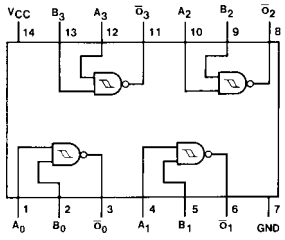
Order Number	Package Number	Package Description
74VCX132M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow
74VCX132MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

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

Logic Diagram



Connection Diagram



Pin Descriptions

Pin Name	Description
A_n, B_n	Inputs
$\overline{O}_n$	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
DC 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_{OH}/I_{OL})	±50 mA
DC V_{CC} or Ground Current per Supply Pin (I_{CC} or Ground)	±100 mA
Storage Temperature (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

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

Symbol	Parameter	Conditions	V_{CC} (V)	Min	Max	Units
V_{t+}	Positive Threshold		3.6		2.2	V
			3.0		2.0	
V_{t-}	Negative Threshold		3.6	0.8		V
			3.0	0.7		
V_H	Input Hysteresis		3.6	0.3	1.2	V
			3.0	0.3	1.2	
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} = −24mA	3.0	2.2		
V_{OL}	LOW Level Output Voltage	I_{OL} = 100 µA	2.7–3.6		0.2	V
		I_{OL} = 12 µA	2.7		0.4	
		I_{OL} = 18 mA	3.0		0.4	
		I_{OL} = 24 mA	3.0		0.55	
I_I	Input Leakage Current	0 ≤ V_I ≤ 3.6V	2.7–3.6		±15.0	µA
I_{OFF}	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	2.7–3.6		20	µA
		V_{CC} ≤ V_I ≤ 3.6V	2.7–3.6		±20	
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_t+	Positive Threshold		2.3		1.6	V
V_t-	Negative Threshold		2.3	0.5		V
ΔV_T	Input Hysteresis		2.3	0.3	1.0	V
V_{OH}	HIGH Level Output Voltage	$I_{OH} = -100\ \mu A$	2.3–2.7	$V_{CC}-0.2$		V
		$I_{OH} = -6$ mA	2.3	2.0		
		$I_{OH} = -12$ mA	2.3	1.8		
		$I_{OH} = -18$ mA	2.3	1.7		
V_{OL}	LOW Level Output Voltage	$I_{OL} = 100\ \mu A$	2.3–2.7		0.2	V
		$I_{OL} = 12\ \mu A$	2.3		0.4	
		$I_{OL} = 18$ mA	2.3		0.6	
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	2.3–2.7		20	μA
		$V_{CC} \leq V_I \leq 3.6V$	2.3–2.7		±20	

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

Symbol	Parameter	Conditions	V_{CC} (V)	Min	Max	Units
V_t+	Positive Threshold		1.65		1.3	V
V_t-	Negative Threshold		1.65	0.25		V
ΔV_T	Input Hysteresis		1.65	0.2	0.9	V
V_{OH}	HIGH Level Output Voltage	$I_{OH} = -100\ \mu A$	1.65–2.3	$V_{CC}-0.2$		V
		$I_{OH} = -6$ mA	1.65	1.25		
V_{OL}	LOW Level Output Voltage	$I_{OL} = 100\ \mu A$	1.65–2.3		0.2	V
		$I_{OL} = 6$ mA	1.65		0.3	
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	1.65–2.3		20	μA
		$V_{CC} \leq V_I \leq 3.6V$	1.65–2.3		±20	

AC Electrical Characteristics (Note 4)

Symbol	Parameter	$T_A = -40°C$ to $+85°C$, $C_L = 30$ pF, $R_L = 500\Omega$						Units
		$V_{CC} = 3.3\ V \pm 0.3V$		$V_{CC} = 2.5\ V \pm 0.2V$		$V_{CC} = 1.8\ V \pm 0.15V$		
		Min	Max	Min	Max	Min	Max	
t_{PHL} t_{PLH}	Propagation Delay	0.6	3.3	0.8	4.1	1.0	8.2	ns
t_{OSHL} t_{OSLH}	Output to Output Skew (Note 5)		0.5		0.5		0.75	ns

Note 4: For $C_L = 50$ 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)	$T_A = +25°C$ Typical	Units
V_{OLP}	Quiet Output Dynamic Peak V_{OL}	C_L = 30 pF, $V_{IH} = V_{CC}$, V_{IL} = 0V	1.8	0.25	V
			2.5	0.6	
			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	V
			2.5	−0.6	
			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	V
			2.5	1.9	
			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 = 10MHz, V_{CC} = 1.8V, 2.5V or 3.3V	20	pF

AC Loading and Waveforms

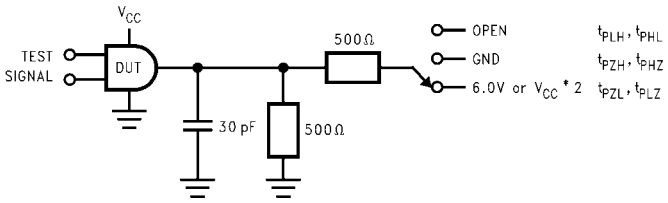


FIGURE 1. AC Test Circuit

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

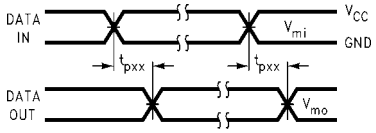
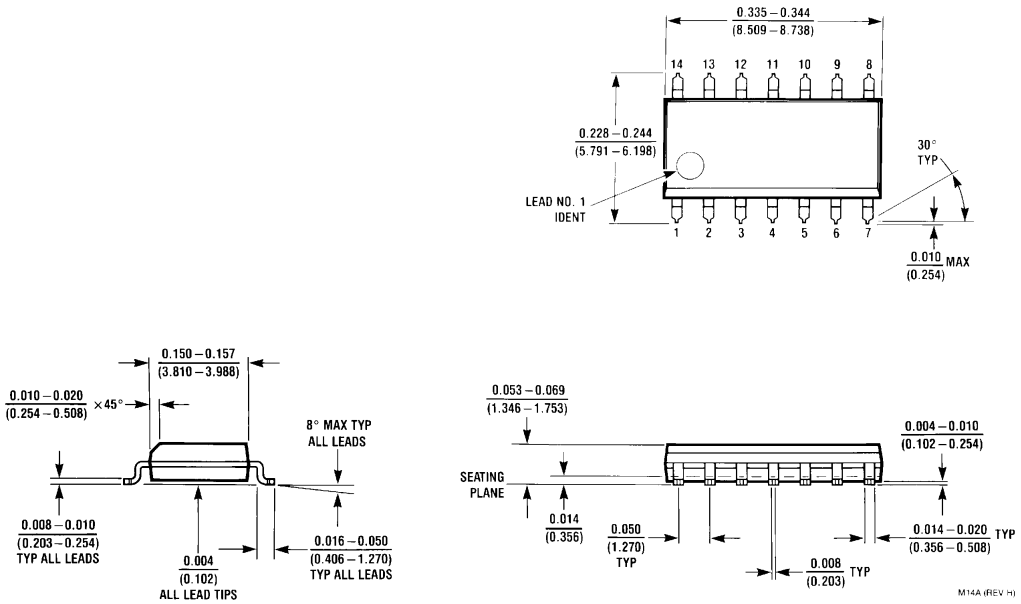


FIGURE 2. Waveform for Inverting and Non-inverting Functions

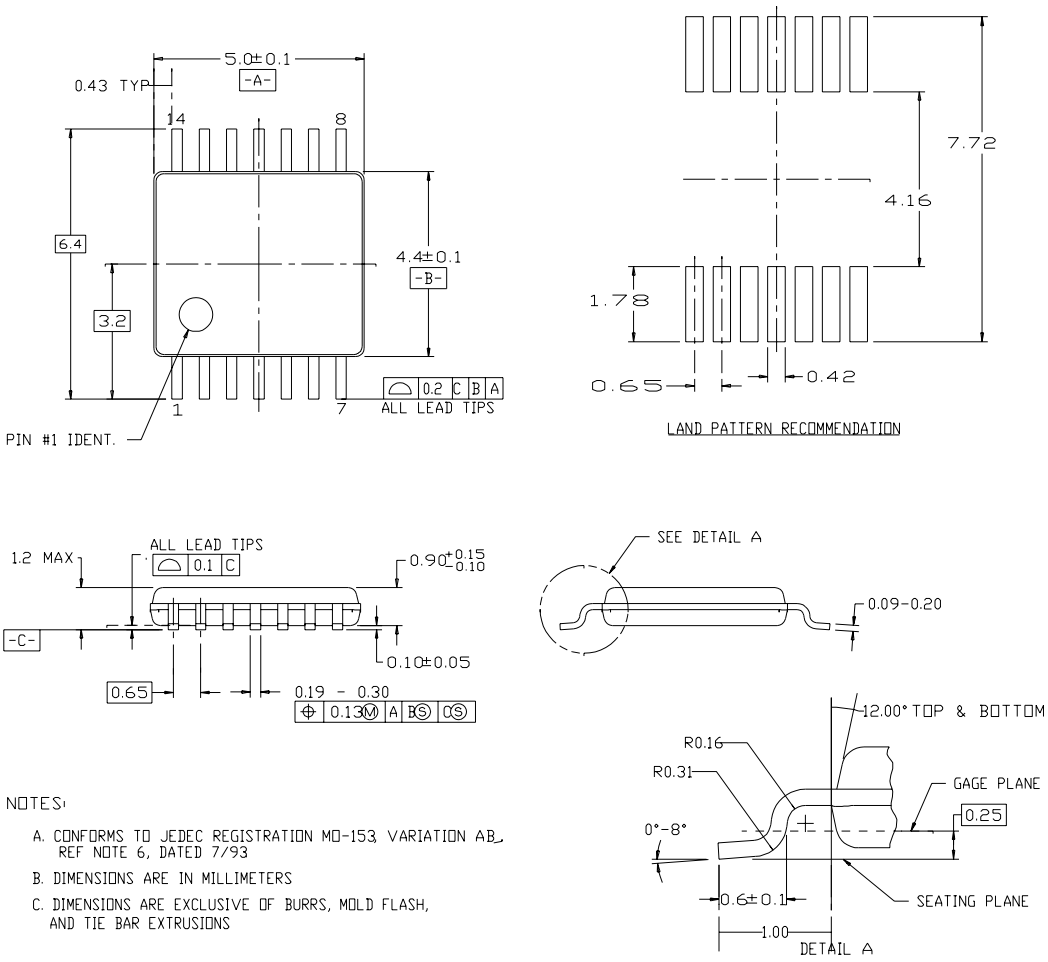
Symbol	V_{CC}		
	3.3V ± 0.3V	**2.5V ± 0.2V**	**1.8V ± 0.15V**
V_{mi}	1.5V	$V_{CC}/2$	$V_{CC}/2$
V_{mo}	1.5V	$V_{CC}/2$	$V_{CC}/2$

Physical Dimensions inches (millimeters) unless otherwise noted



14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 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, DATED 7/93

B. DIMENSIONS ARE IN MILLIMETERS

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

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