

## 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 (1.4V 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

- 1.4V to 3.6V  $V_{CC}$  supply operation
- 3.6V tolerant inputs and outputs
- $I_{PD}$ 
  - 3.3 ns max for 3.0V to 3.6V  $V_{CC}$
- Power-off high impedance inputs and outputs
- Static Drive ( $I_{OH}/I_{OL}$ )
  - $\pm 24$  mA @ 3.0V  $V_{CC}$
- Uses patented Quiet Series™ 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:

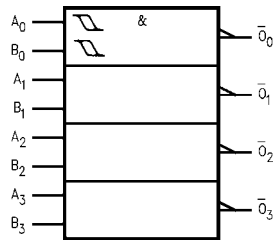
Order Number	Package Number	Package Description
74VCX132M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74VCX132BQX (Note 1)	MLP014A	Pb-Free 14-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 3.0mm
74VCX132MTC	MTC14	14-Lead Thin Shrink 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.  
Pb-Free package per JEDEC J-STD-020B.

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

Quiet Series™ is a trademark of Fairchild Semiconductor Corporation.

**Logic Diagram**

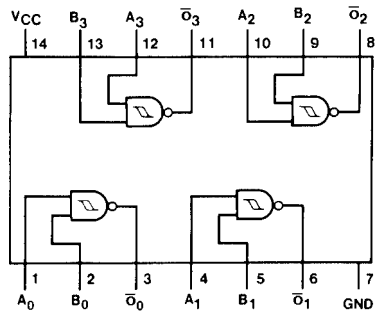


**Pin Descriptions**

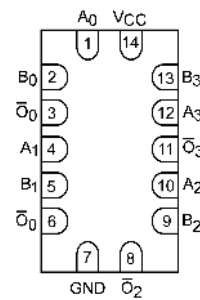
Pin Name	Description
$A_n, B_n$	Inputs
$\bar{O}_n$	Outputs

**Connection Diagrams**

Pin Assignments for SOIC and TSSOP



Pad Assignments for DQFN



(Top View)

**Absolute Maximum Ratings**(Note 2)

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 3)	-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 4)

Power Supply	1.4V to 3.6V
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

**Note 2:** 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 3:**  $I_O$  Absolute Maximum Rating must be observed.

**Note 4:** Floating or unused inputs must be held HIGH or LOW.

**DC Electrical Characteristics**

Symbol	Parameter	Conditions	$V_{CC}$ (V)	Min	Max	Units
$V_{t+}$	HIGH Level Input Voltage		3.6		2.2	V
			3.0		2.0	
			2.3		1.6	
			1.6		1.2	
			1.4		1.2	
$V_{t-}$	LOW Level Input Voltage		3.6	0.8		V
			3.0	0.7		
			2.3	0.5		
			1.6	0.2		
			1.4	0.2		
$V_H$	Input Hysteresis		3.6	0.3	1.2	V
			3.0	0.3	1.2	
			2.3	0.3	1.0	
			1.6	0.15	0.9	
			1.4	0.15	0.9	
$V_{OH}$	HIGH Level Output Voltage	$I_{OH} = -100 \mu A$	2.7 - 3.6	$V_{CC} - 0.2$		V
		$I_{OH} = -12 \text{ mA}$	2.7	2.2		
		$I_{OH} = -18 \text{ mA}$	3.0	2.4		
		$I_{OH} = -24 \text{ mA}$	3.0	2.2		
		$I_{OH} = -100 \mu A$	2.3 - 2.7	$V_{CC} - 0.2$		
		$I_{OH} = -6 \text{ mA}$	2.3	2.0		
		$I_{OH} = -12 \text{ mA}$	2.3	1.8		
		$I_{OH} = -18 \text{ mA}$	2.3	1.7		
		$I_{OH} = -100 \mu A$	1.65 - 2.3	$V_{CC} - 0.2$		
		$I_{OH} = -6 \text{ mA}$	1.65	1.25		
$I_{OH} = -100 \mu A$	1.4 - 1.6	$V_{CC} - 0.2$				
$I_{OH} = -2 \text{ mA}$	1.4	1.05				

### DC Electrical Characteristics (Continued)

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	Min	Max	Units
V <sub>OL</sub>	LOW Level Output Voltage	I <sub>OL</sub> = 100 μA	2.7 - 3.6		0.2	V
		I <sub>OL</sub> = 12 μA	2.7		0.4	
		I <sub>OL</sub> = 18 mA	3.0		0.4	
		I <sub>OL</sub> = 24 mA	3.0		0.55	
		I <sub>OL</sub> = 100 μA	2.3 - 2.7		0.2	
		I <sub>OL</sub> = 12 mA	2.3		0.4	
		I <sub>OL</sub> = 18 mA	2.3		0.6	
		I <sub>OL</sub> = 100 μA	1.65 - 2.3		0.2	
		I <sub>OL</sub> = 6 mA	1.65		0.3	
		I <sub>OL</sub> = 100 μA	1.4 - 1.6		0.2	
		I <sub>OL</sub> = 2 mA	1.4		0.35	
I <sub>I</sub>	Input Leakage Current	0 ≤ V <sub>I</sub> ≤ 3.6V	1.4 - 3.6		±5.0	μA
I <sub>OZ</sub>	3-STATE Output Leakage	0 ≤ V <sub>O</sub> ≤ 3.6V V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	1.4 - 3.6		±10.0	μA
I <sub>OFF</sub>	Power Off Leakage Current	0 ≤ (V <sub>I</sub> , V <sub>O</sub> ) ≤ 3.6V	0		10.0	μA
I <sub>CC</sub>	Quiescent Supply Current	V <sub>I</sub> = V <sub>CC</sub> or GND V <sub>CC</sub> ≤ V <sub>I</sub> ≤ 3.6V	1.4 - 3.6 1.4 - 3.6		20.0 ±20.0	μA
ΔI <sub>CC</sub>	Increase in I <sub>CC</sub> per Input	V <sub>IH</sub> = V <sub>CC</sub> - 0.6V	2.7 - 3.6		750	μA

### AC Electrical Characteristics (Note 5)

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = -40°C to +85°C		Units	Figure Number
				Min	Max		
t <sub>PHL</sub> t <sub>PLH</sub>	Propagation Delay	C <sub>L</sub> = 30 pF, R <sub>L</sub> = 500Ω	3.3 ± 0.3	0.6	3.3	ns	Figures 1, 2
			2.5 ± 0.2	0.8	4.1		
			1.8 ± 0.15	1.0	8.2		
		C <sub>L</sub> = 15 pF, R <sub>L</sub> = 2kΩ	1.5 ± 0.1	1.0	16.4		Figures 3, 4
t <sub>OSHL</sub> t <sub>OSLH</sub>	Output-to-Output Skew (Note 6)	C <sub>L</sub> = 30 pF, R <sub>L</sub> = 500Ω	3.3 ± 0.3		0.5	ns	
			2.5 ± 0.2		0.5		
			1.8 ± 0.15		0.75		
			1.5 ± 0.1		1.5		
		C <sub>L</sub> = 15 pF, R <sub>L</sub> = 2kΩ	1.5 ± 0.1		1.5		

**Note 5:** For C<sub>L</sub> = 50 pF, 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<sub>OSHL</sub>) or LOW-to-HIGH (t<sub>OSLH</sub>).

### Dynamic Switching Characteristics

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = +25°C	Units
				Typical	
V <sub>OLP</sub>	Quiet Output Dynamic Peak V <sub>OL</sub>	C <sub>L</sub> = 30 pF, V <sub>IH</sub> = V <sub>CC</sub> , V <sub>IL</sub> = 0V	1.8	0.25	V
			2.5	0.6	
			3.3	0.8	
V <sub>OLV</sub>	Quiet Output Dynamic Valley V <sub>OL</sub>	C <sub>L</sub> = 30 pF, V <sub>IH</sub> = V <sub>CC</sub> , V <sub>IL</sub> = 0V	1.8	-0.25	V
			2.5	-0.6	
			3.3	-0.8	
V <sub>OHV</sub>	Quiet Output Dynamic Valley V <sub>OH</sub>	C <sub>L</sub> = 30 pF, V <sub>IH</sub> = V <sub>CC</sub> , V <sub>IL</sub> = 0V	1.8	1.5	V
			2.5	1.9	
			3.3	2.2	

### Capacitance

Symbol	Parameter	Conditions	T <sub>A</sub> = +25°C	Units
			Typical	
C <sub>IN</sub>	Input Capacitance	V <sub>I</sub> = 0V or V <sub>CC</sub> , V <sub>CC</sub> = 1.8V, 2.5V or 3.3V	6.0	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>I</sub> = 0V or V <sub>CC</sub> , V <sub>CC</sub> = 1.8V, 2.5V or 3.3V	7.0	pF
C <sub>PD</sub>	Power Dissipation Capacitance	V <sub>I</sub> = 0V or V <sub>CC</sub> , f = 10MHz, V <sub>CC</sub> = 1.8V, 2.5V or 3.3V	20.0	pF

### AC Loading and Waveforms (V<sub>CC</sub> 3.3V ± 0.3V to 1.8V ± 0.15V)

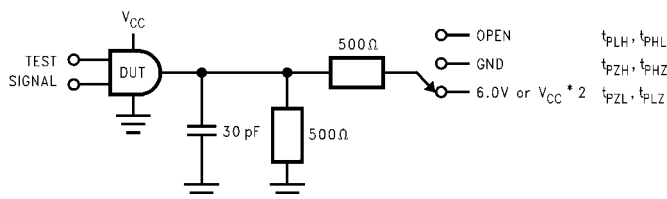


FIGURE 1. AC Test Circuit

TEST	SWITCH
t <sub>PLH</sub> , t <sub>PHL</sub>	Open

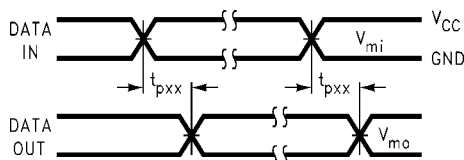
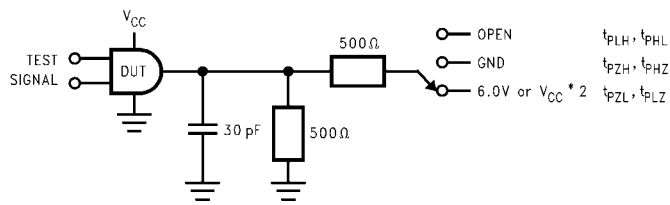


FIGURE 2. Waveform for Inverting and Non-inverting Functions

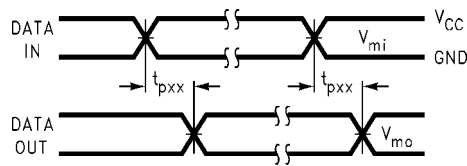
Symbol	V <sub>CC</sub>		
	3.3V ± 0.3V	2.5V ± 0.2V	1.8V ± 0.15V
V <sub>mi</sub>	1.5V	V <sub>CC</sub> /2	V <sub>CC</sub> /2
V <sub>mo</sub>	1.5V	V <sub>CC</sub> /2	V <sub>CC</sub> /2

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



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**

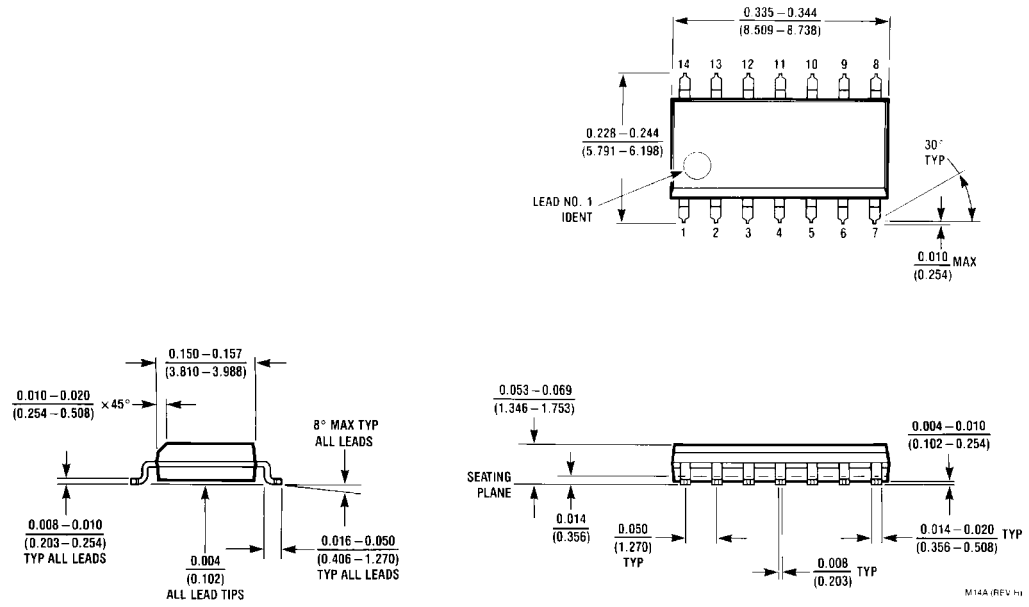


**FIGURE 4. Waveform for Inverting and Non-inverting Functions**

Symbol	$V_{CC}$
	$V_{mi}$
$V_{mo}$	$V_{CC}/2$



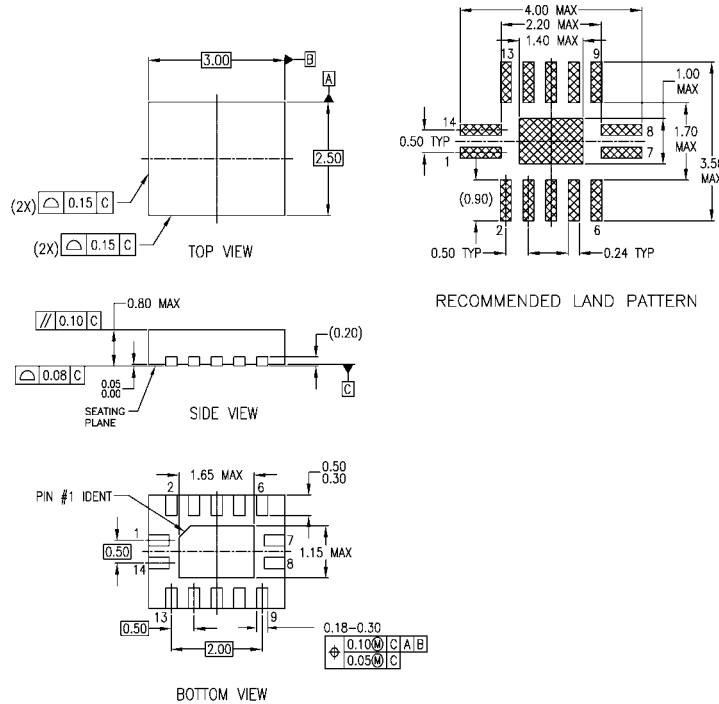
**Physical Dimensions** inches (millimeters) unless otherwise noted



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



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



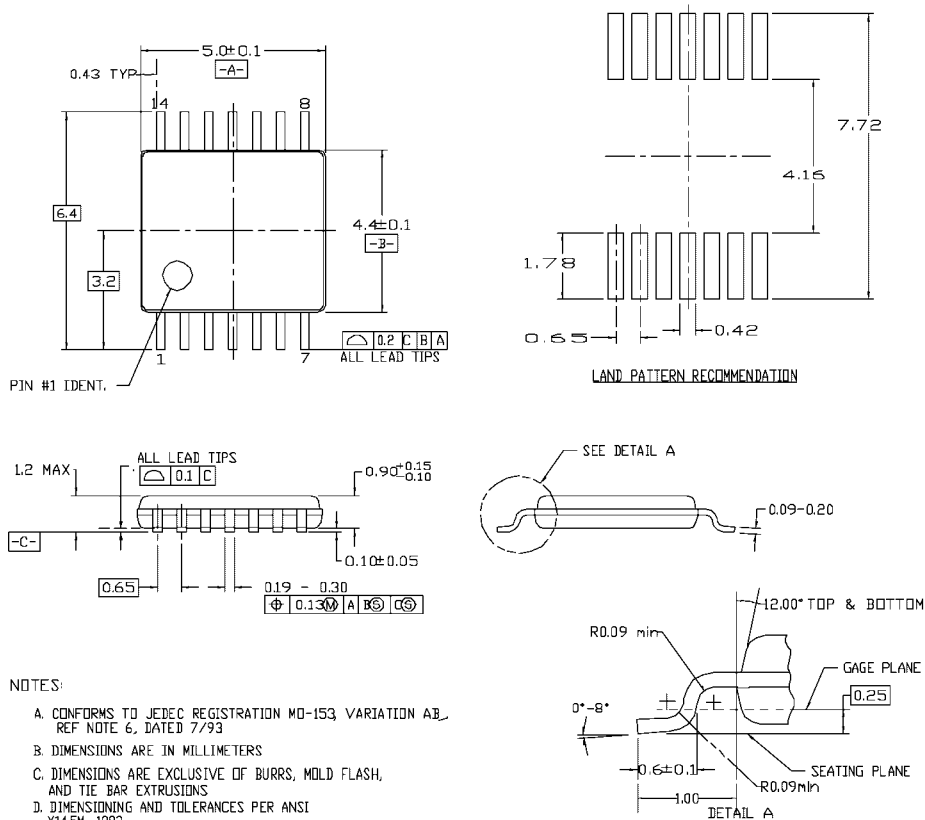
NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-241, VARIATION AA
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. 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)



- 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
  - D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 1982

MTC14revD

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

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