FAIRCHILD SEMICONDUCTOR™

July 1999
Revised October 2003

74VCX08
Low Voltage Quad 2-Input AND Gate with 3.6V Tolerant Inputs and Outputs

General Description

The VCX08 contains four 2-input AND 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 VCX08 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 Quiet Series™ noise/EMI reduction circuitry
- Latchup performance exceeds 300 mA
- ESD performance:
  Human body model > 2000V
  Machine model > 250V
- Leadless DQFN package

Ordering Code:

Order Number	Package Number	Package Description
74VCX08M (Note 1)	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74VCX08BQX (Note 2) (Preliminary)	MLP014A (Preliminary)	14-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 3.0mm
74VCX08MTC (Note 1)	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

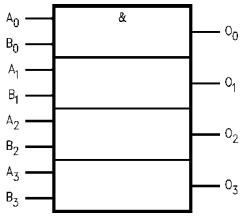
Note 1: Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

Note 2: DQFN package available in Tape and Reel only.

Quiet Series™ is a trademark of Fairchild Semiconductor Corporation.

Logic Symbol

IEEE/IEC

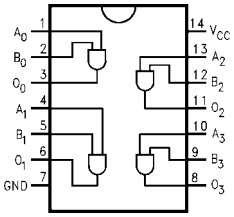


Pin Descriptions

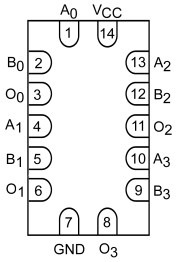
Pin Names	Description
A_n, B_n	Inputs
O_n	Outputs

Connection Diagrams

Pin Assignments for SOIC and TSSOP



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_{OH}/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 µA
Free Air Operating Temperature (T_A)	−40°C to +85°C
Minimum Input Edge Rate (Δt/ΔV)	
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 to 3.6	2.0		
			2.3 to 2.7	1.6		
			1.65 to 2.3	0.65 x V_{CC}		V
			1.4 to 1.6	0.65 x V_{CC}		
			1.2	0.65 x V_{CC}		
V_{IL}	LOW Level Input Voltage		2.7 to 3.6		0.8	
			2.3 to 2.7		0.7	
			1.65 to 2.3		0.35 x V_{CC}	V
			1.4 to 1.6		0.35 x V_{CC}	
			1.2		0.05 x V_{CC}	
V_{OH}	HIGH Level Output Voltage	I_{OH} = −100 µA	2.7 to 3.6	V_{CC} - 0.2		
		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 to 2.7	V_{CC} - 0.2		
		I_{OH} = −6 mA	2.3	2.0		
		I_{OH} = −12 mA	2.3	1.8		V
		I_{OH} = −18 mA	2.3	1.7		
		I_{OH} = −100 µA	1.65 to 2.3	V_{CC} - 0.2		
		I_{OH} = −6 mA	1.65	1.25		
		I_{OH} = −100 µA	1.4 to 1.6	V_{CC} - 0.2		
		I_{OH} = −2 mA	1.4	1.05		
		I_{OH} = −100 µA	1.2	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 µA	2.7 to 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 to 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 to 2.3		0.2	
		I_{OL} = 6 mA	1.65		0.2	
		I_{OL} = 100 µA	1.4 to 1.6		0.2	
		I_{OL} = 2 mA	1.4		0.35	
		I_{OL} = 100 µA	1.2		0.05	
I_I	Input Leakage Current	0 ≤ V_I ≤ 3.6V	1.2 to 3.6		±5.0	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	1.2 to 3.6		20	µA
		V_{CC} ≤ V_I ≤ 3.6V	1.2 to 3.6		±20	
ΔI_{CC}	Increase in I_{CC} per Input	V_{IH} = V_{CC} −0.6V	2.7 to 3.6		750	µA

AC Electrical Characteristics (Note 6)

Symbol	Parameter	Conditions	V_{CC} (V)	T_A = −40°C to +85°C		Units	Figure Number
				Min	Max		
t_{PHL}	Propagation Delay	C_L = 30 pF, R_L = 500Ω	3.3 ± 0.3	0.6	2.8	ns	Figures 1, 2
t_{PLH}			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}	Output to Output Skew	C_L = 30 pF, R_L = 500Ω	3.3 ± 0.3		0.5	ns	
t_{OSLH}	(Note 7)		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 6: For C_L = pF, add approximately 300 ps to the AC maximum specification.

Note 7: 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	6.0	pF
C_{OUT}	Output Capacitance	$V_I = 0V$ or V_{CC}, $V_{CC} = 1.8V$, 2.5V or 3.3V	7.0	pF
C_{PD}	Power Dissipation Capacitance	$V_I = 0V$ or V_{CC}, f = 10 MHz, $V_{CC} = 1.8V$, 2.5V or 3.3V	20.0	pF

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

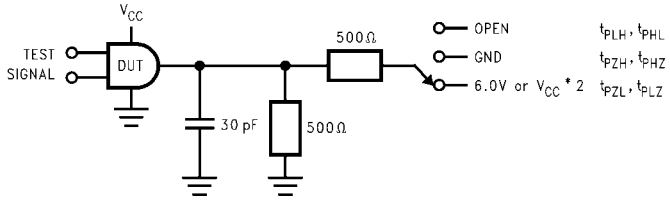


FIGURE 1. AC Test Circuit

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

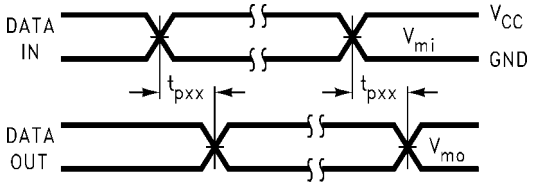
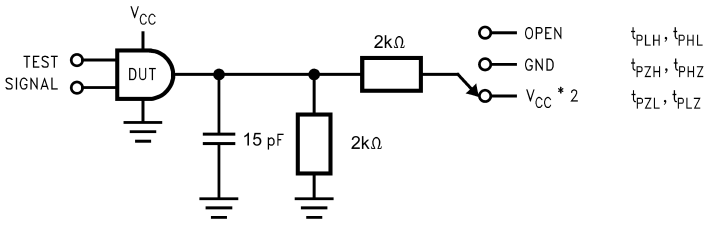


FIGURE 2. Waveform for Inverting and Non-inverting Functions

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 to 1.2V)



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

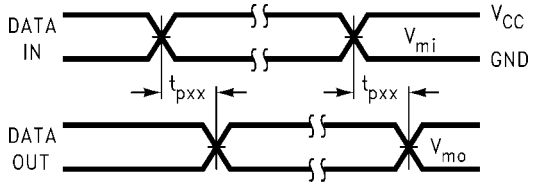
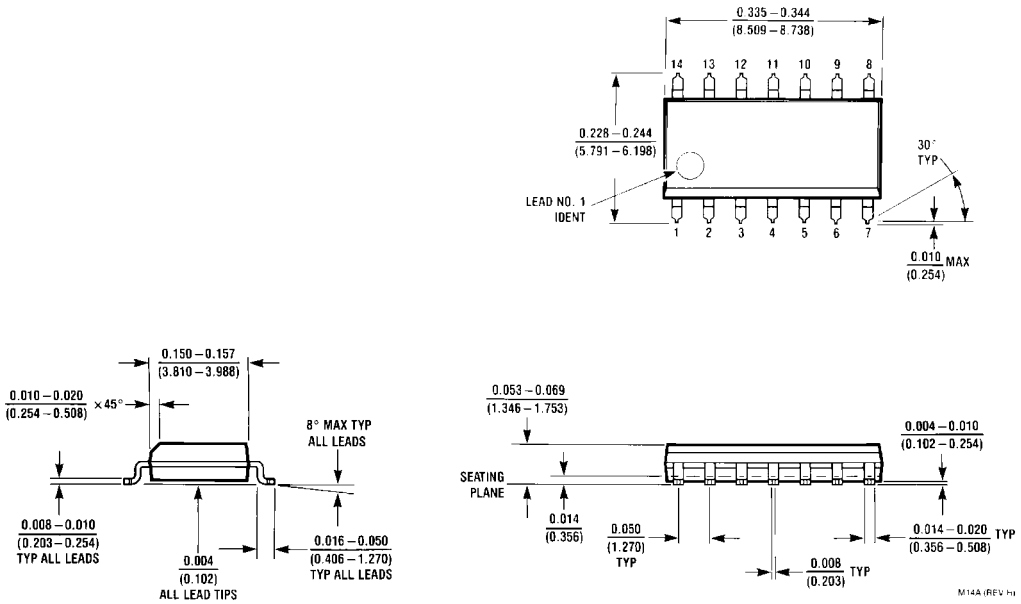


FIGURE 4. Waveform for Inverting and Non-Inverting Functions

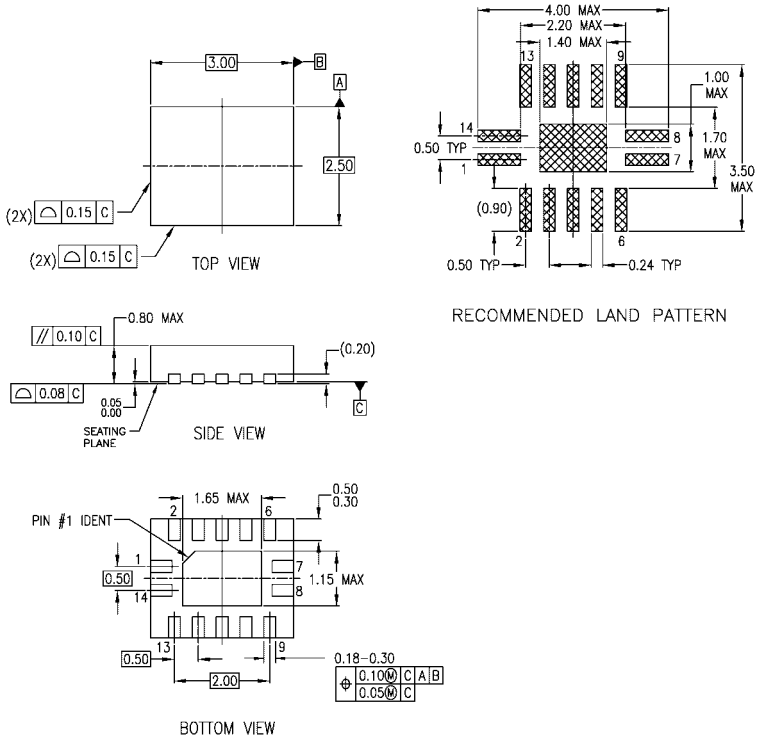
Symbol	V_{CC}
	1.5V ± 0.1V
V_{mi}	V_{CC}/2
V_{mo}	V_{CC}/2

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)



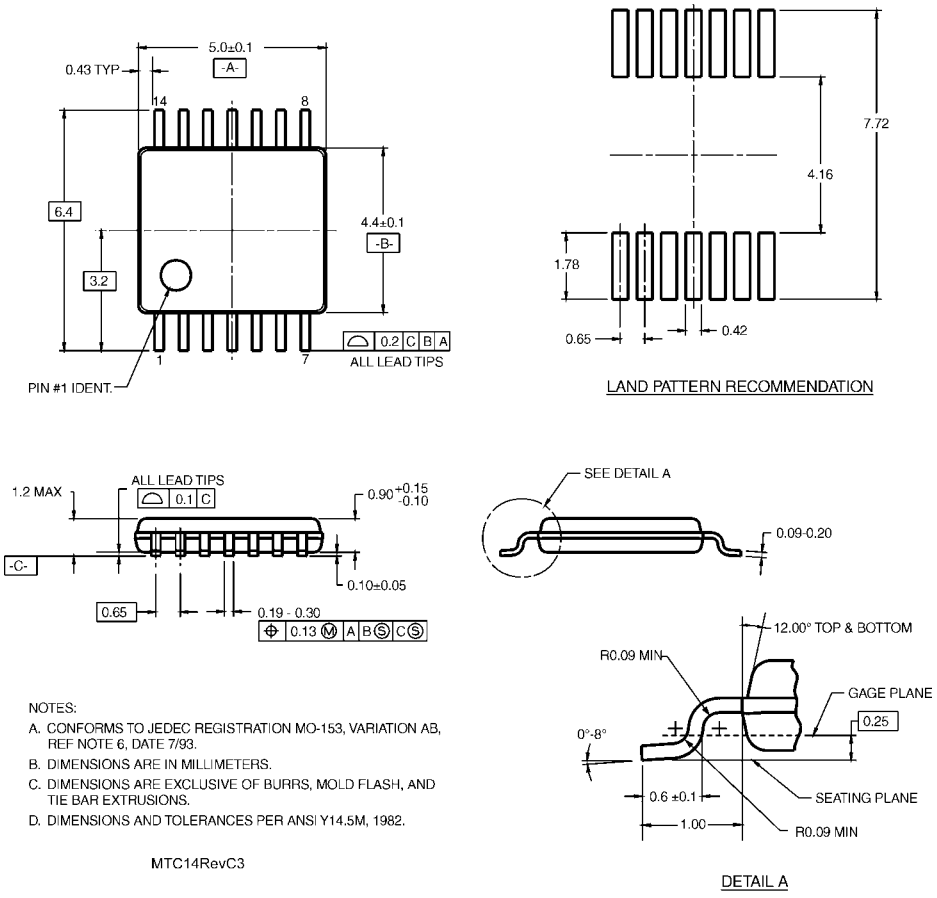
NOTES:

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

MLP014ArevA

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

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