

## 74VCX86

### Low Voltage Quad 2-Input Exclusive-OR Gate with 3.6V Tolerant Inputs and Outputs

#### General Description

The VCX86 contains four 2-input exclusive OR 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 74VCX86 is fabricated with an advanced CMOS technology to achieve high-speed operation while maintaining low CMOS power dissipation.

#### Features

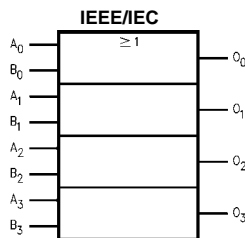
- 1.65V-3.6V  $V_{CC}$  supply operation
- 3.6V tolerant inputs and outputs
- $t_{PD}$ 
  - 3.0 ns max for 3.0V to 3.6V  $V_{CC}$
  - 3.9 ns max for 2.3V to 2.7V  $V_{CC}$
  - 7.8 ns max for 1.65V to 1.95V  $V_{CC}$
- Power-off high impedance inputs and outputs
- Static Drive ( $I_{OH}/I_{OL}$ )
  - $\pm 24$  mA @ 3.0V  $V_{CC}$
  - $\pm 18$  mA @ 2.3V  $V_{CC}$
  - $\pm 6$  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:

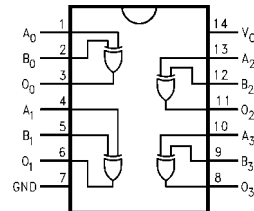
Order Number	Package Number	Package Description
74VCX86M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-120, 0.150" Narrow
74VCX86MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

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
$O_n$	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 ( $I_{OH}/I_{OL}$ )	$\pm 50$ mA
DC $V_{CC}$ or Ground Current per Supply Pin ( $I_{CC}$ or Ground)	$\pm 100$ mA
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	$\pm 24$ mA
$V_{CC} = 2.3V$ to 2.7V	$\pm 18$ mA
$V_{CC} = 1.65V$ to 2.3V	$\pm 6$ 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:**  $I_O$  Absolute Maximum Rating must be observed.

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

**DC Electrical Characteristics (2.7V <  $V_{CC}$  ≤ 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		$\pm 5.0$	$\mu A$
$I_{OFF}$	Power-Off Leakage Current	$0 \leq (V_I, V_O) \leq 3.6V$	0		10	$\mu A$
$I_{CC}$	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 $\pm 20$	$\mu A$
$\Delta I_{CC}$	Increase in $I_{CC}$ per Input	$V_{IH} = V_{CC} - 0.6V$	2.7-3.6		750	$\mu A$

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		$\pm 5.0$	$\mu A$		
$I_{OFF}$	Power-Off Leakage Current	$0 \leq (V_I, V_O) \leq 3.6V$	0		10	$\mu A$		
$I_{CC}$	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 $\pm 20$	$\mu A$		
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		$\pm 5.0$	$\mu A$		
$I_{OFF}$	Power-Off Leakage Current	$0 \leq (V_I, V_O) \leq 3.6V$	0		10	$\mu A$		
$I_{CC}$	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 $\pm 20$	$\mu A$		
AC Electrical Characteristics (Note 4)								
Symbol	Parameter	$T_A = -40^\circ C$ to $+85^\circ C$ , $C_L = 30pF$ , $R_L = 500\Omega$						Units
		$V_{CC} = 3.3V \pm 0.3V$		$V_{CC} = 2.5V \pm 0.2V$		$V_{CC} = 1.8V \pm 0.15V$		
		Min	Max	Min	Max	Min	Max	
$t_{PHL}$	Propagation Delay	0.6	3.0	0.8	3.9	1.0	7.8	ns
$t_{PLH}$								
$t_{OSHL}$	Output to Output Skew (Note 5)		0.5		0.5		0.75	ns
$t_{OSLH}$								
<b>Note 4:</b> For $C_L = 50 \text{ pF}$ , add approximately 300 ps to the AC maximum specification.								
<b>Note 5:</b> 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 <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	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	pF
C <sub>PD</sub>	Power Dissipation Capacitance	V <sub>I</sub> = 0V or V <sub>CC</sub> , f = 10 MHz, V <sub>CC</sub> = 1.8V, 2.5V or 3.3V	20	pF

### AC Loading and Waveforms

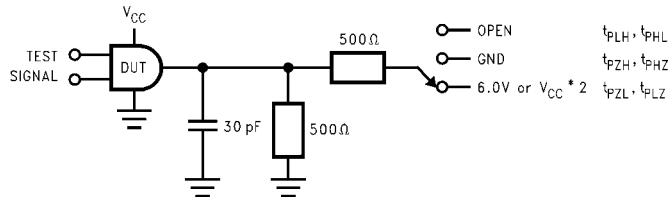


FIGURE 1. AC Test Circuit

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

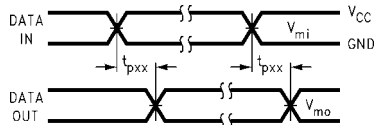
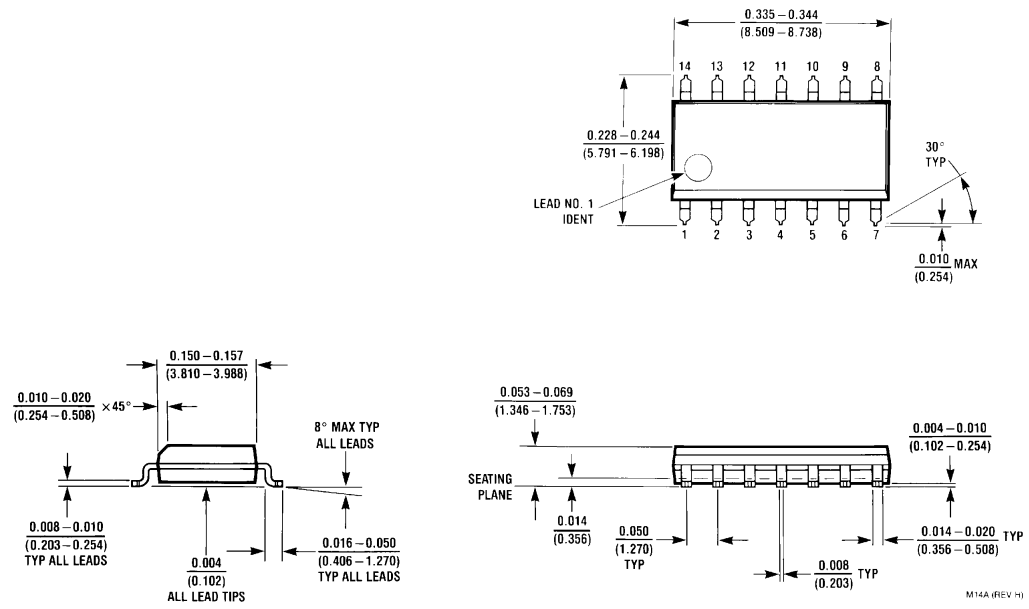


FIGURE 2. Waveform for Inverting and Non-inverting Functions

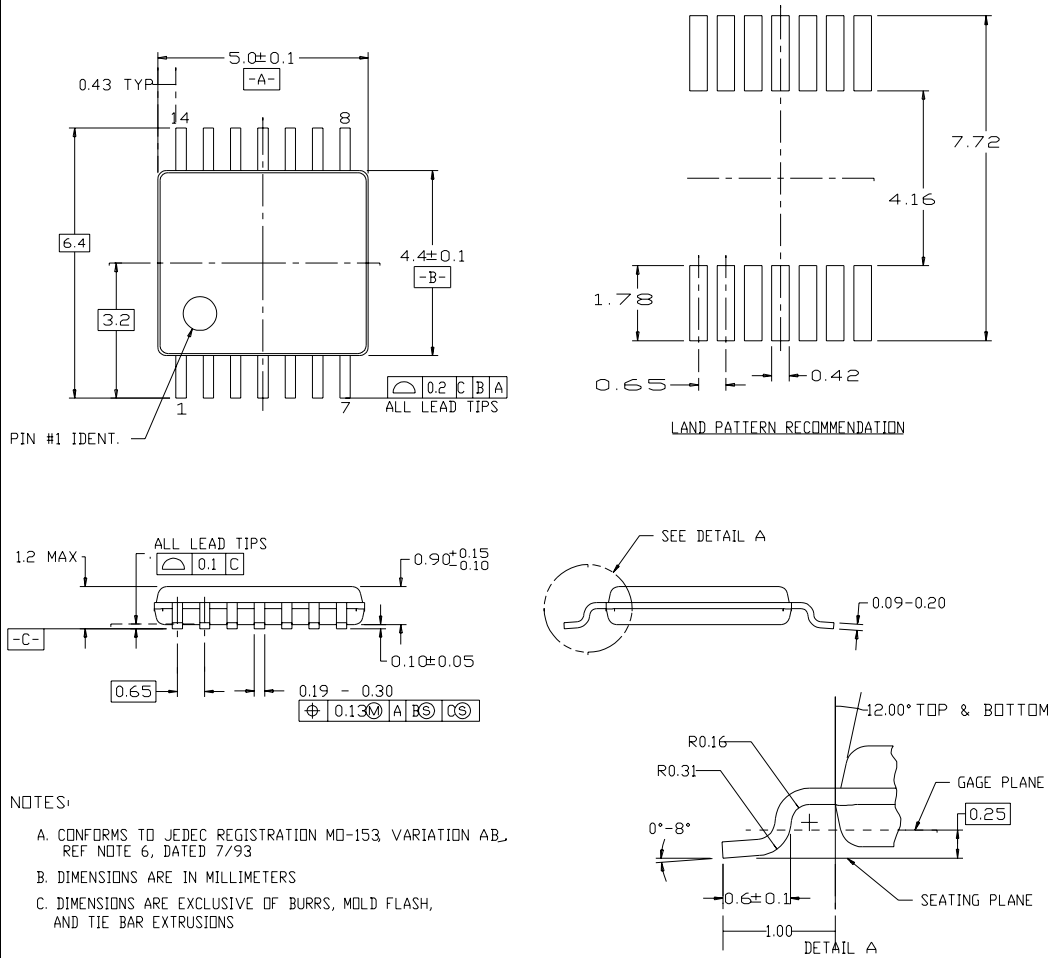
Symbol	V <sub>CC</sub>		
	3.3V ± 0.3V	2.5V ± 0.2V	1.8V ± 0.15V
V <sub>mi</sub>	1.5V	V <sub>CC</sub> /2	V <sub>CC</sub> /2
V <sub>mo</sub>	1.5V	V <sub>CC</sub> /2	V <sub>CC</sub> /2

**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**

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