

## 74VHC02 Quad 2-Input NOR Gate

### General Description

The VHC02 is an advanced high-speed CMOS 2-Input NOR Gate fabricated with silicon gate CMOS technology. It achieves the high-speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation. The internal circuit is composed of 3 stages, including buffer output, which provide high noise immunity and stable output. An input protection circuit insures that 0V to 7V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and two supply systems such as battery backup. This circuit prevents device destruction due to mismatched supply and input voltages.

### Features

- High Speed:  $t_{PD} = 3.6$  ns (typ) at  $V_{CC} = 5V$
- Low power dissipation:  $I_{CC} = 2$   $\mu A$  (max) at  $T_A = 25^\circ C$
- High noise immunity:  $V_{NIH} = V_{NIL} = 28\%$   $V_{CC}$  (min)
- Power down protection is provided on all inputs
- Low noise:  $V_{OLP} = 0.8V$  (max)
- Pin and function compatible with 74HC02

### Ordering Code:

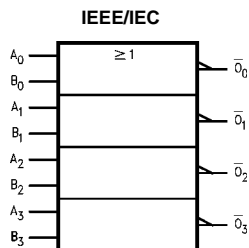
Order Number	Package Number	Package Description
74VHC02M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74VHC02MX_NL (Note 1)	M14A	Pb-Free 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74VHC02SJ	M14D	Pb-Free 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74VHC02MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74VHC02MTCX_NL (Note 1)	MTC14	Pb-Free 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74VHC02N	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

Surface mount packages are also available on Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

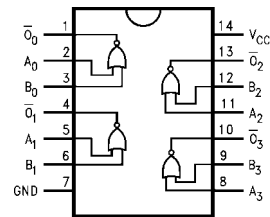
Pb-Free package per JEDEC J-STD-020B.

Note 1: "\_NL" indicates Pb-Free package (per JEDEC J-STD-020B). Device available in Tape and Reel only.

### Logic Symbol



### Connection Diagram



### Truth Table

A	B	$\bar{O}$
L	L	H
L	H	L
H	L	L
H	H	L

### Pin Descriptions

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

Absolute Maximum Ratings (Note 2)		Recommended Operating Conditions (Note 3)	
Supply Voltage ( $V_{CC}$ )	-0.5V to +7.0V	Supply Voltage ( $V_{CC}$ )	2.0V to +5.5V
DC Input Voltage ( $V_{IN}$ )	-0.5V to +7.0V	Input Voltage ( $V_{IN}$ )	0V to +5.5V
DC Output Voltage ( $V_{OUT}$ )	-0.5V to $V_{CC} + 0.5V$	Output Voltage ( $V_{OUT}$ )	0V to $V_{CC}$
Input Diode Current ( $I_{IK}$ )	-20 mA	Operating Temperature ( $T_{OPR}$ )	-40°C to +85°C
Output Diode Current ( $I_{OK}$ )	±20 mA	Input Rise and Fall Time ( $t_r, t_f$ )	$V_{CC} = 3.3V \pm 0.3V$ 0 ~ 100 ns/V $V_{CC} = 5.0V \pm 0.5V$ 0 ~ 20 ns/V
DC Output Current ( $I_{OUT}$ )	±25 mA		
DC $V_{CC}$ /GND Current ( $I_{CC}$ )	±50 mA		
Storage Temperature ( $T_{STG}$ )	-65°C to +150°C		
Lead Temperature ( $T_L$ ) (Soldering, 10 seconds)	260°C		

**Note 2:** Absolute Maximum Ratings are values beyond which the device may be damaged or have its useful life impaired. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation outside databook specifications.

**Note 3:** Unused inputs must be held HIGH or LOW. They may not float.

### DC Electrical Characteristics

Symbol	Parameter	$V_{CC}$ (V)	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C to } +85^\circ\text{C}$		Units	Conditions	
			Min	Typ	Max	Min	Max			
$V_{IH}$	HIGH Level Input Voltage	2.0	1.50			1.50		V		
		3.0 – 5.5	$0.7 V_{CC}$			$0.7 V_{CC}$				
$V_{IL}$	LOW Level Input Voltage	2.0		0.50		0.50		V		
		3.0 – 5.5		$0.3 V_{CC}$		$0.3 V_{CC}$				
$V_{OH}$	HIGH Level Output Voltage	2.0	1.9	2.0		1.9		V	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -50 \mu\text{A}$
		3.0	2.9	3.0		2.9				
	4.5	4.4	4.5		4.4		V		$I_{OH} = -4 \text{ mA}$ $I_{OH} = -8 \text{ mA}$	
	3.0	2.58			2.48					
4.5	3.94			3.80						
$V_{OL}$	LOW Level Output Voltage	2.0		0.0	0.1		0.1	V	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 50 \mu\text{A}$
		3.0		0.0	0.1		0.1			
	4.5		0.0	0.1		0.1	V		$I_{OL} = 4 \text{ mA}$ $I_{OL} = 8 \text{ mA}$	
	3.0			0.36		0.44				
4.5			0.36		0.44					
$I_{IN}$	Input Leakage Current	0 – 5.5			±0.1		±1.0	μA	$V_{IN} = 5.5V$ or GND	
$I_{CC}$	Quiescent Supply Current	5.5			2.0		20.0	μA	$V_{IN} = V_{CC}$ or GND	

### Noise Characteristics

Symbol	Parameter	$V_{CC}$ (V)	$T_A = 25^\circ\text{C}$		Units	Conditions
			Typ	Limits		
$V_{OLP}$ (Note 4)	Quiet Output Maximum Dynamic $V_{OL}$	5.0	0.3	0.8	V	$C_L = 50 \text{ pF}$
$V_{OLV}$ (Note 4)	Quiet Output Minimum Dynamic $V_{OL}$	5.0	-0.3	-0.8	V	$C_L = 50 \text{ pF}$
$V_{IHD}$ (Note 4)	Minimum HIGH Level Dynamic Input Voltage	5.0		3.5	V	$C_L = 50 \text{ pF}$
$V_{ILD}$ (Note 4)	Maximum LOW Level Dynamic Input Voltage	5.0		1.5	V	$C_L = 50 \text{ pF}$

**Note 4:** Parameter guaranteed by design.

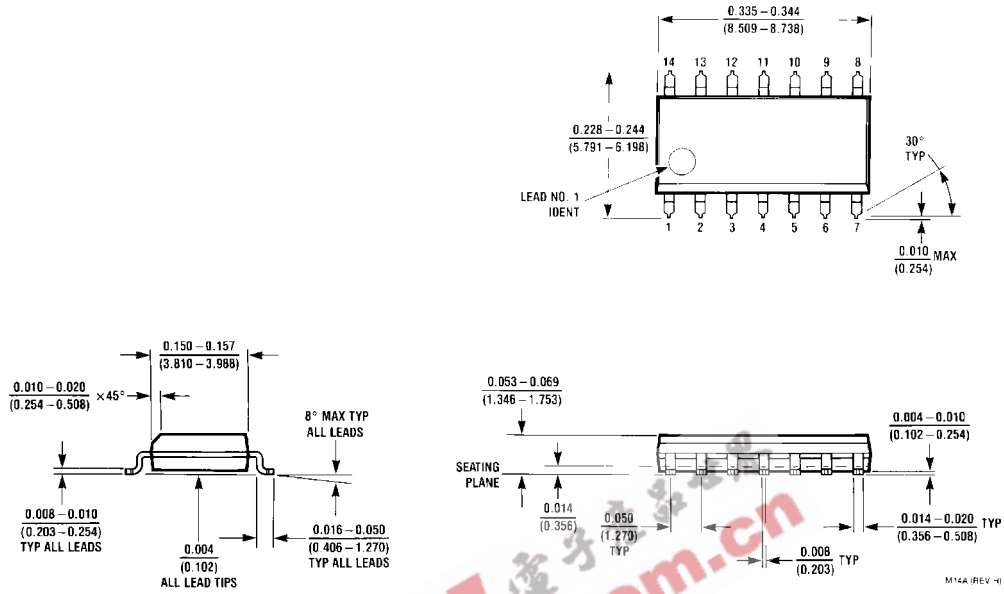
## AC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40°C to -85°C		Units	Conditions
			Min	Typ	Max	Min	Max		
t <sub>PHL</sub>	Propagation Delay	3.3 ± 0.3	5.6	7.9	1.0	9.5	ns	C <sub>L</sub> = 15 pF	
t <sub>PLH</sub>			8.1	11.4	1.0	13.0		C <sub>L</sub> = 50 pF	
		5.0 ± 0.5	3.6	5.5	1.0	6.5	ns	C <sub>L</sub> = 15 pF	
			5.1	7.5	1.0	8.5		C <sub>L</sub> = 50 pF	
C <sub>IN</sub>	Input Capacitance		4	10	10	pF	V <sub>CC</sub> = Open		
C <sub>PD</sub>	Power Dissipation Capacitance		15			pF	(Note 5)		

**Note 5:** C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I<sub>CC (opr.)</sub> = C<sub>PD</sub> \* V<sub>CC</sub> \* f<sub>IN</sub> + I<sub>CC</sub>/4 (per gate).

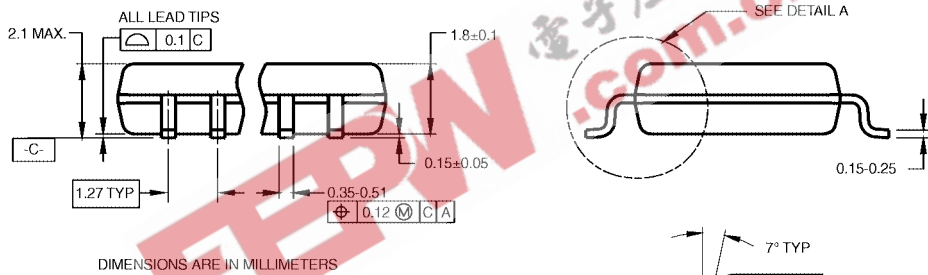
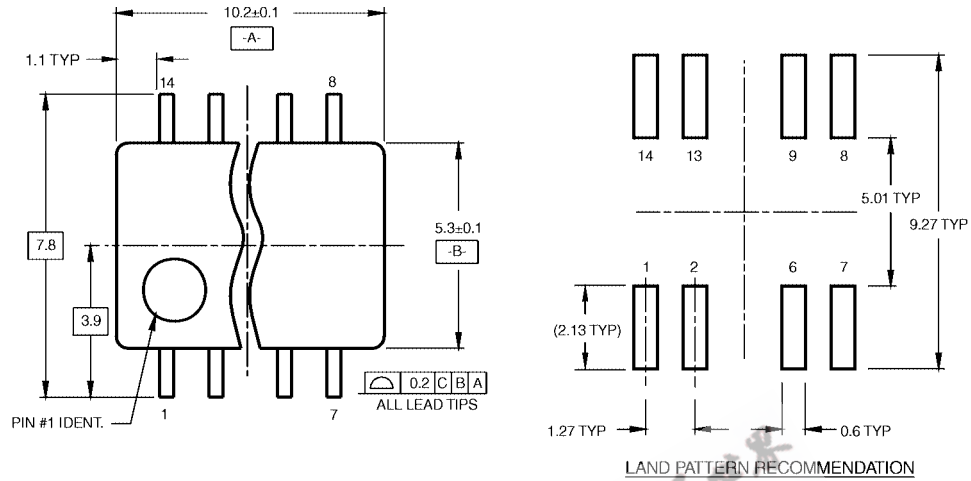
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**Physical Dimensions** inches (millimeters) unless otherwise noted



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

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



DIMENSIONS ARE IN MILLIMETERS

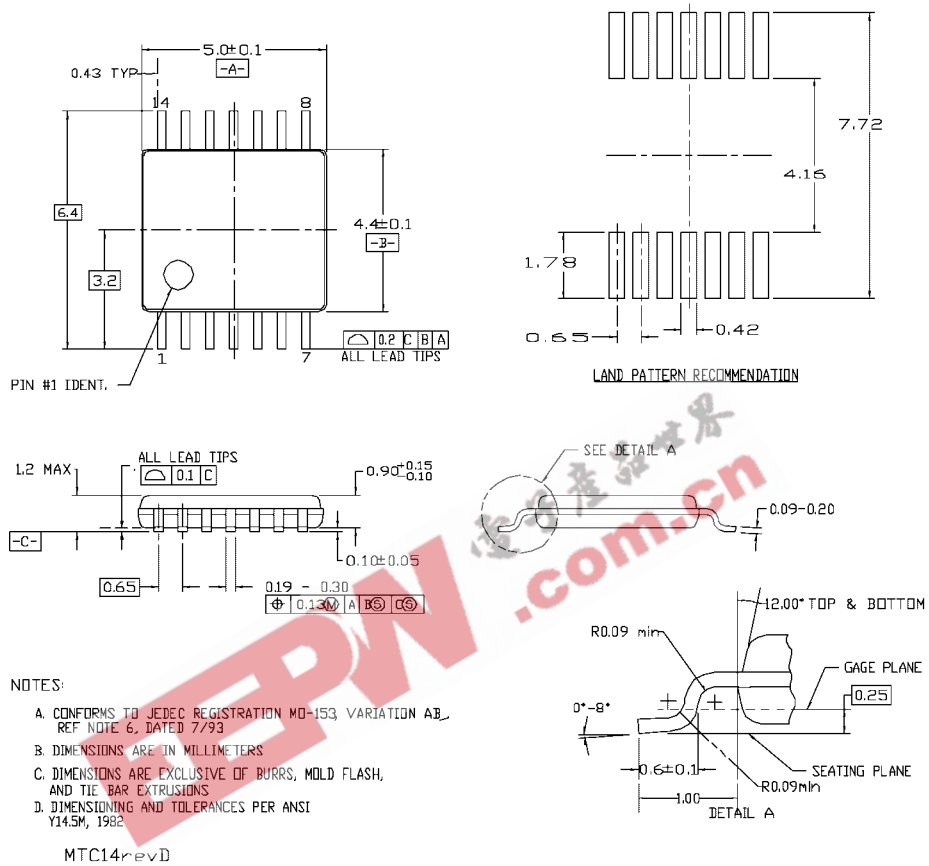
- NOTES:  
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 B. DIMENSIONS ARE IN MILLIMETERS.  
 C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

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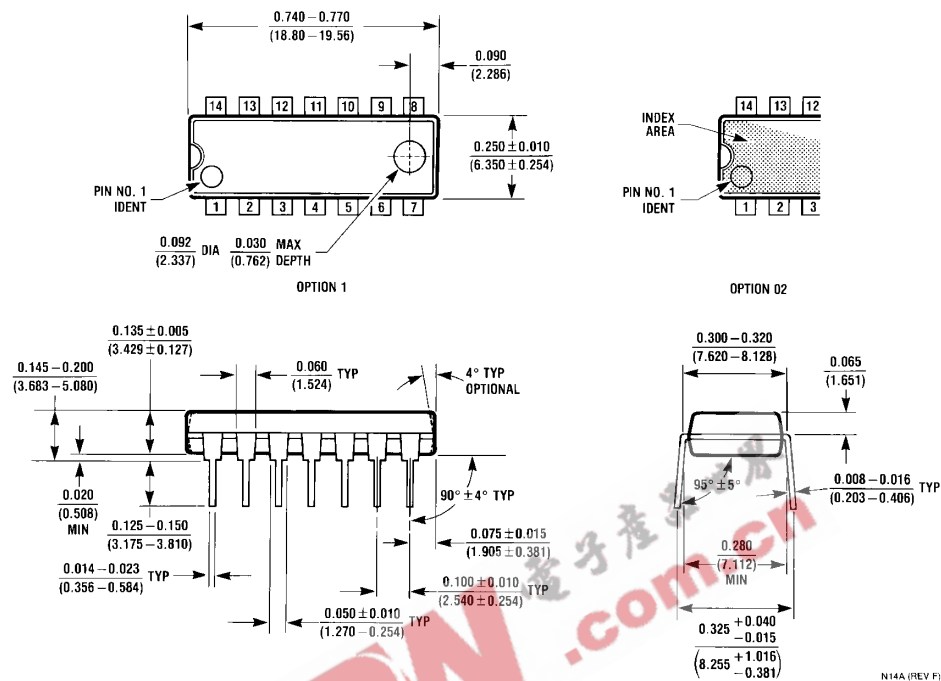
**Pb-Free 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide Package Number M14D**

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



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

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



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