

# HD74UH02

2-input NOR Gate

# HITACHI

ADE-205-015A(Z)  
2nd Edition  
August 1993

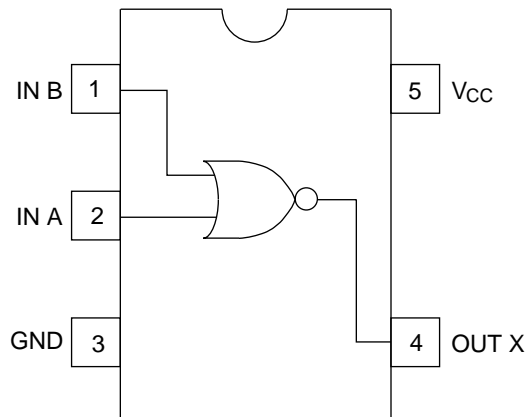
## Description

The HD74UH02 is high speed CMOS two input NOR gate using silicon gate CMOS process. With CMOS low power dissipation, it provides high speed equivalent to LS-TTL series. The internal circuit of three stages construction with buffer provides wide noise margin and stable output.

## Features

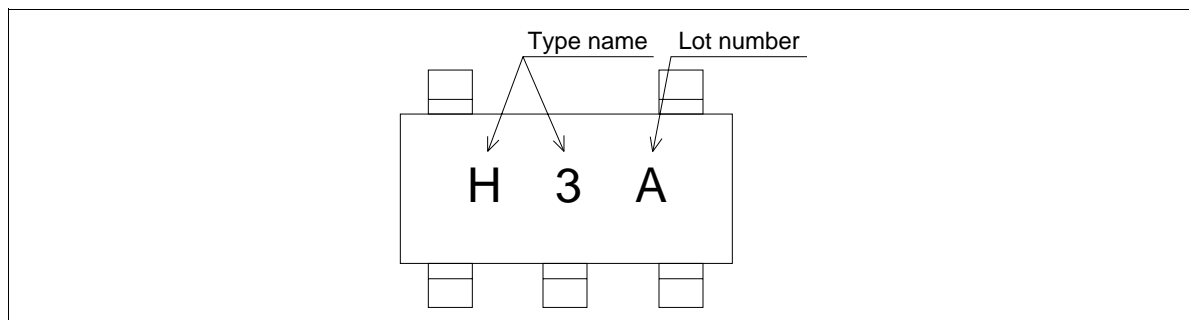
- Encapsulated in very small 5pins package of  $2.9 \times 1.6 \times 1.1$  mm, the efficiency to mount on substrate is significantly improved.
- The basic gate function is lined up as hitachi uni logic series.
- Supplied on embos taping for high speed automatic mounting.
- Electrical characteristics equivalent to the HD74HC02  
Supply voltage range: 2 to 6 V  
Operating temperature range:  $-40$  to  $+85^{\circ}\text{C}$
- $|I_{OH}| = I_{OL} = 2$  mA (min)

## Pin Arrangement



(Top view)

## Article Indication



## Absolute Maximum Ratings

Item	Symbol	Ratings	Unit
Supply voltage	$V_{CC}$	-0.5 to +7.0	V
Input voltage	$V_{IN}$	-0.5 to $V_{CC} + 0.5$	V
Output voltage	$V_{OUT}$	-0.5 to $V_{CC} + 0.5$	V
Input diode current	$I_{IK}$	$\pm 20$	mA
Output diode current	$I_{OK}$	$\pm 20$	mA
Output current	$I_{OUT}$	$\pm 25$	mA
$V_{CC}$ /GND current	$I_{CC}, I_{GND}$	$\pm 25$	mA
Power dissipation	$P_T$	200	mW
Storage temperature	$T_{stg}$	-65 to +150	°C

## Recommended Operating Conditions

Item	Symbol	Ratings	Unit
Supply voltage	$V_{CC}$	2 to 6	V
Input voltage	$V_{IN}$	0 to $V_{CC}$	V
Output voltage	$V_{OUT}$	0 to $V_{CC}$	V
Operating temperature	$T_{opr}$	-40 to +85	°C
Input rise/fall time	$t_r, t_f$	0 to 1000 ( $V_{CC} = 2.0$ V)	ns
		0 to 500 ( $V_{CC} = 4.5$ V)	
		0 to 400 ( $V_{CC} = 6.0$ V)	

Electrical Characteristics

Item	Symbol	Ta = 25°C		Ta = -40 to 85°C		Unit	Test Conditions				
		Min	Typ	Max	Min		Max	V <sub>CC</sub>			
Input voltage	V <sub>IH</sub>	1.5	—	—	1.5	—	V	2.0			
		3.15	—	—	3.15	—		4.5			
		4.2	—	—	4.2	—		6.0			
	V <sub>IL</sub>	—	—	0.5	—	0.5	V	2.0			
		—	—	1.35	—	1.35		4.5			
		—	—	1.8	—	1.8		6.0			
Output voltage	V <sub>OH</sub>	1.9	2.0	—	1.9	—	V	2.0	V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OH</sub> = -20 μA	
		4.4	4.5	—	4.4	—		4.5			
		5.9	6.0	—	5.9	—		6.0			
		4.18	4.31	—	4.31	—		4.5			I <sub>OH</sub> = -2 mA
		5.68	5.80	—	5.63	—		6.0			I <sub>OH</sub> = -2.6 mA
	V <sub>OL</sub>	—	0.0	0.1	—	0.1	V	2.0	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 20 μA	
		—	0.0	0.1	—	0.1		4.5			
		—	0.0	0.1	—	0.1		6.0			
		—	0.17	0.26	—	0.33		4.5			I <sub>OL</sub> = 2 mA
		—	0.18	0.26	—	0.33		6.0			I <sub>OL</sub> = 2.6 mA
		—	—	—	—	—		—			—
Input current	I <sub>IN</sub>	—	—	±0.1	—	±1.0	μA	6.0	V <sub>IN</sub> = V <sub>CC</sub> or GND		
Operating current	I <sub>CC</sub>	—	—	1.0	—	10.0		6.0	V <sub>IN</sub> = V <sub>CC</sub> or GND		

Switching Characteristics

Item	Symbol	Ta = 25°C			Unit	Test Conditions
		Min	Typ	Max		
Output rise/fall time	t <sub>TLH</sub>	—	5	10	ns	See Test circuit
	t <sub>THL</sub>	—	5	10		
Propagation delay time	t <sub>PLH</sub>	—	7	15	ns	See Test circuit
	t <sub>PHL</sub>	—	7	15		

(C<sub>L</sub> = 15 pF, t<sub>r</sub> = t<sub>f</sub> = 6 ns, V<sub>CC</sub> = 5 V)

# HD74UH02

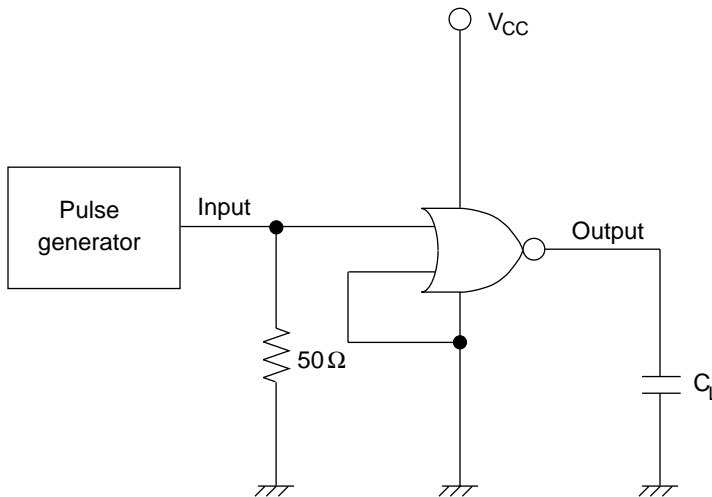
Item	Symbol	Ta = 25°C			Ta = -40 to 85°C		Unit	Test Conditions	
		Min	Typ	Max	Min	Max		V <sub>CC</sub>	
Output rise/fall time	t <sub>TLH</sub>	—	50	125	—	155	ns	2.0	See Test circuit
	t <sub>THL</sub>	—	14	25	—	31		4.5	
		—	12	21	—	26		6.0	
Propagation delay time	t <sub>PLH</sub>	—	48	100	—	125	ns	2.0	See Test circuit
	t <sub>PHL</sub>	—	12	20	—	25		4.5	
		—	9	17	—	21		6.0	
Input capacitance	C <sub>IN</sub>	—	5	10	—	10	pF	—	
Equivalent capacitance	C <sub>PD</sub>	—	10	—	—	—		—	

(C<sub>L</sub> = 50 pF, t<sub>r</sub> = t<sub>f</sub> = 6 ns)

Note: C<sub>PD</sub> is equivalent capacitance inside of the IC calculated from the operating current without load (see test circuit). The average operating current without load is calculated according to the expression below.

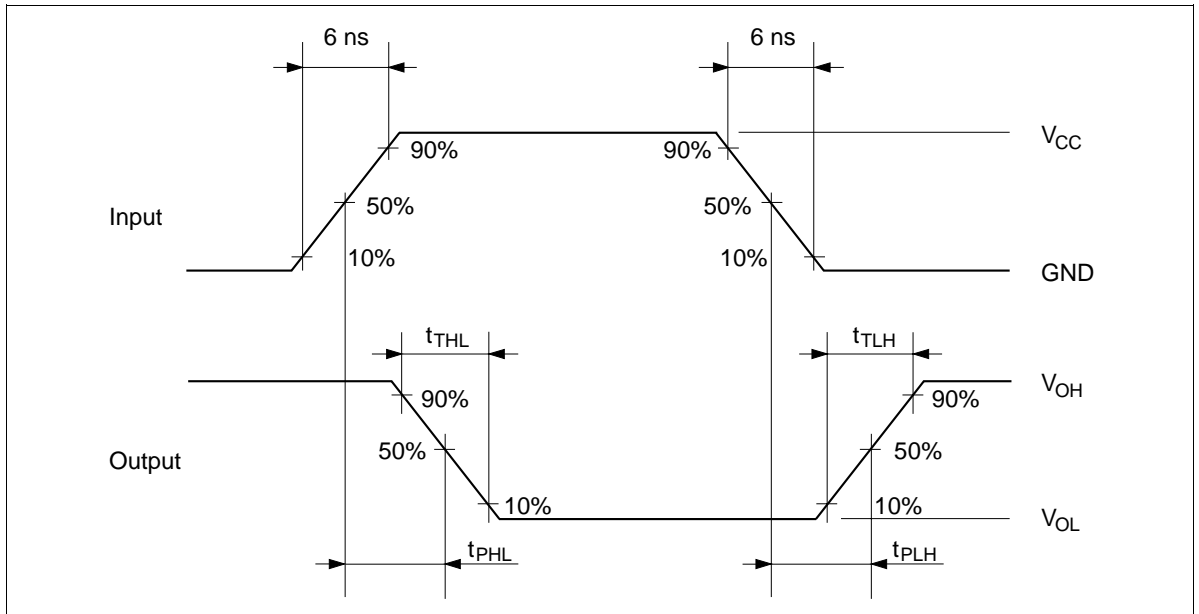
$$I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

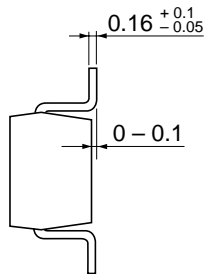
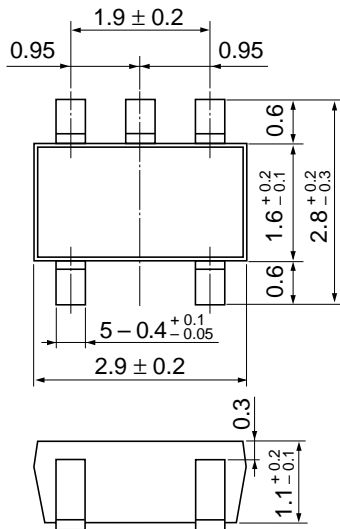
## Test Circuit



Note: Operating current test time, output is open.

Waveforms





Hitachi Code	MPAK-5
JEDEC	—
EIAJ	—
Weight (reference value)	0.015 g

## Cautions

1. Hitachi neither warrants nor grants licenses of any rights of Hitachi's or any third party's patent, copyright, trademark, or other intellectual property rights for information contained in this document. Hitachi bears no responsibility for problems that may arise with third party's rights, including intellectual property rights, in connection with use of the information contained in this document.
2. Products and product specifications may be subject to change without notice. Confirm that you have received the latest product standards or specifications before final design, purchase or use.
3. Hitachi makes every attempt to ensure that its products are of high quality and reliability. However, contact Hitachi's sales office before using the product in an application that demands especially high quality and reliability or where its failure or malfunction may directly threaten human life or cause risk of bodily injury, such as aerospace, aeronautics, nuclear power, combustion control, transportation, traffic, safety equipment or medical equipment for life support.
4. Design your application so that the product is used within the ranges guaranteed by Hitachi particularly for maximum rating, operating supply voltage range, heat radiation characteristics, installation conditions and other characteristics. Hitachi bears no responsibility for failure or damage when used beyond the guaranteed ranges. Even within the guaranteed ranges, consider normally foreseeable failure rates or failure modes in semiconductor devices and employ systemic measures such as fail-safes, so that the equipment incorporating Hitachi product does not cause bodily injury, fire or other consequential damage due to operation of the Hitachi product.
5. This product is not designed to be radiation resistant.
6. No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without written approval from Hitachi.
7. Contact Hitachi's sales office for any questions regarding this document or Hitachi semiconductor products.

# HITACHI

## Hitachi, Ltd.

Semiconductor & Integrated Circuits.  
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan  
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

URL      North America      : <http://semiconductor.hitachi.com/>  
             Europe                 : <http://www.hitachi-eu.com/hel/ecg>  
             Asia (Singapore)       : <http://www.has.hitachi.com.sg/grp3/sicd/index.htm>  
             Asia (Taiwan)             : [http://www.hitachi.com.tw/E/Product/SICD\\_Frame.htm](http://www.hitachi.com.tw/E/Product/SICD_Frame.htm)  
             Asia (HongKong)         : <http://www.hitachi.com.hk/eng/bo/grp3/index.htm>  
             Japan                        : <http://www.hitachi.co.jp/Sicd/indx.htm>

## For further information write to:

Hitachi Semiconductor  
(America) Inc.  
179 East Tasman Drive,  
San Jose, CA 95134  
Tel: <1> (408) 433-1990  
Fax: <1> (408) 433-0223

Hitachi Europe GmbH  
Electronic components Group  
Dornacher Straße 3  
D-85622 Feldkirchen, Munich  
Germany  
Tel: <49> (89) 9 9180-0  
Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.  
Electronic Components Group.  
Whitebrook Park  
Lower Cookham Road  
Maidenhead  
Berkshire SL6 8YA, United Kingdom  
Tel: <44> (1628) 585000  
Fax: <44> (1628) 778322

Hitachi Asia Pte. Ltd.  
16 Collyer Quay #20-00  
Hitachi Tower  
Singapore 049318  
Tel: 535-2100  
Fax: 535-1533

Hitachi Asia Ltd.  
Taipei Branch Office  
3F, Hung Kuo Building, No.167,  
Tun-Hwa North Road, Taipei (105)  
Tel: <886> (2) 2718-3666  
Fax: <886> (2) 2718-8180

Hitachi Asia (Hong Kong) Ltd.  
Group III (Electronic Components)  
7/F., North Tower, World Finance Centre,  
Harbour City, Canton Road, Tsim Sha Tsui,  
Kowloon, Hong Kong  
Tel: <852> (2) 735 9218  
Fax: <852> (2) 730 0281  
Telex: 40815 HITEC HX

Copyright ' Hitachi, Ltd., 1999. All rights reserved. Printed in Japan.

## HITACHI