

# HD74UH04

## Inverter

REJ03D0201-0400Z  
(Previous ADE-205-016B (Z))  
Rev.4.00  
Feb.02.2004

### Description

The HD74UH04 is high-speed CMOS inverter 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.

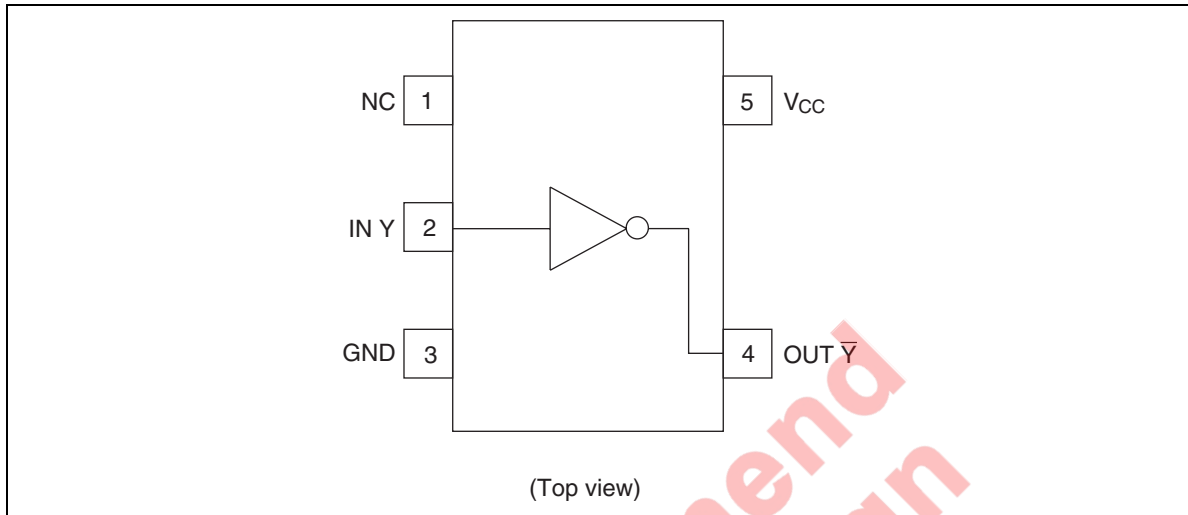
### Features

- 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 Renesas uni logic series.
- Supplied on emboss taping for high-speed automatic mounting.
- Electrical characteristics equivalent to the HD74HC04  
Supply voltage range: 2 to 6 V  
Operating temperature range:  $-40$  to  $+85^{\circ}\text{C}$
- $|I_{OH}| = I_{OL} = 2$  mA (min)
- Ordering Information

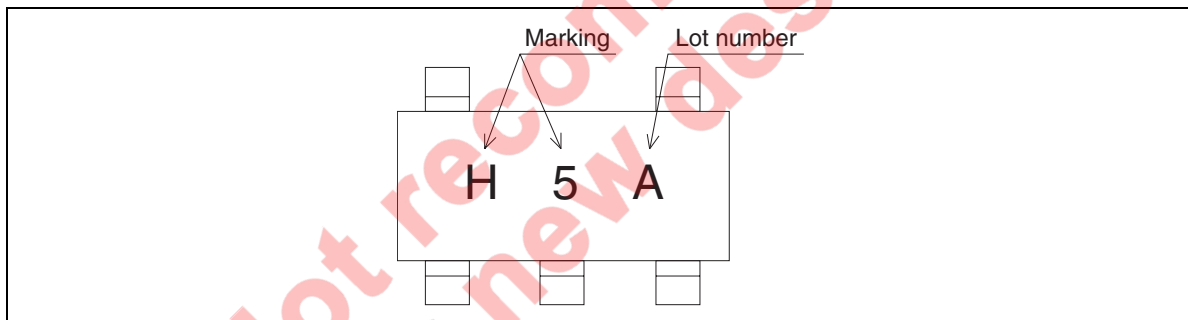
Part Name	Package Type	Package Code	Package Abbreviation	Taping Abbreviation (Quantity)
HD74UH04EL	MPAK-5 pin	MPAK-5V	–	EL (3,000 pcs/reel)

## HD74UH04

### Pin Arrangement



### Article Indication



### Absolute Maximum Ratings

Item	Symbol	Ratings	Unit
Supply voltage	V <sub>CC</sub>	-0.5 to +7.0	V
Input voltage	V <sub>IN</sub>	-0.5 to V <sub>CC</sub> +0.5	V
Output voltage	V <sub>OUT</sub>	-0.5 to V <sub>CC</sub> +0.5	V
Input diode current	I <sub>IK</sub>	±20	mA
Output diode current	I <sub>OK</sub>	±20	mA
Output current	I <sub>OUT</sub>	±25	mA
V <sub>CC</sub> /GND current	I <sub>CC</sub> , I <sub>GND</sub>	±25	mA
Power dissipation	P <sub>T</sub>	200	mW
Storage temperature	T <sub>stg</sub>	-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**

tem	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } 85^\circ\text{C}$		Unit	Test Conditions	
			Min	Typ	Max	Min	Max			
Input voltage	$V_{IH}$	2.0	1.5	—	—	1.5	—	V		
		4.5	3.15	—	—	3.15	—			
		6.0	4.2	—	—	4.2	—			
	$V_{IL}$	2.0	—	—	0.5	—	0.5	V		
		4.5	—	—	1.35	—	1.35			
		6.0	—	—	1.8	—	1.8			
Output voltage	$V_{OH}$	2.0	1.9	2.0	—	1.9	—	V	$V_{IN} = V_{IL}$ $I_{OH} = -20 \mu\text{A}$	
		4.5	4.4	4.5	—	4.4	—			
		6.0	5.9	6.0	—	5.9	—			
		4.5	4.18	4.31	—	4.31	—			$I_{OH} = -2 \text{ mA}$
		6.0	5.68	5.80	—	5.63	—			
		6.0	5.68	5.80	—	5.63	—			
	$V_{OL}$	2.0	—	0.0	0.1	—	0.1	V	$V_{IN} = V_{IH}$ $I_{OL} = 20 \mu\text{A}$	
		4.5	—	0.0	0.1	—	0.1			
		6.0	—	0.0	0.1	—	0.1			
		4.5	—	0.17	0.26	—	0.33			$I_{OL} = 2 \text{ mA}$
		6.0	—	0.18	0.26	—	0.33			
		6.0	—	0.18	0.26	—	0.33			
Input current	$I_{IN}$	6.0	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu\text{A}$	$V_{IN} = V_{CC}$ or GND	
Operating current	$I_{CC}$	6.0	—	—	1.0	—	10.0		$V_{IN} = V_{CC}$ or GND	

## HD74UH04

### Switching Characteristics

( $C_L = 15 \text{ pF}$ ,  $t_r = t_f = 6 \text{ ns}$ ,  $V_{CC} = 5 \text{ V}$ )

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

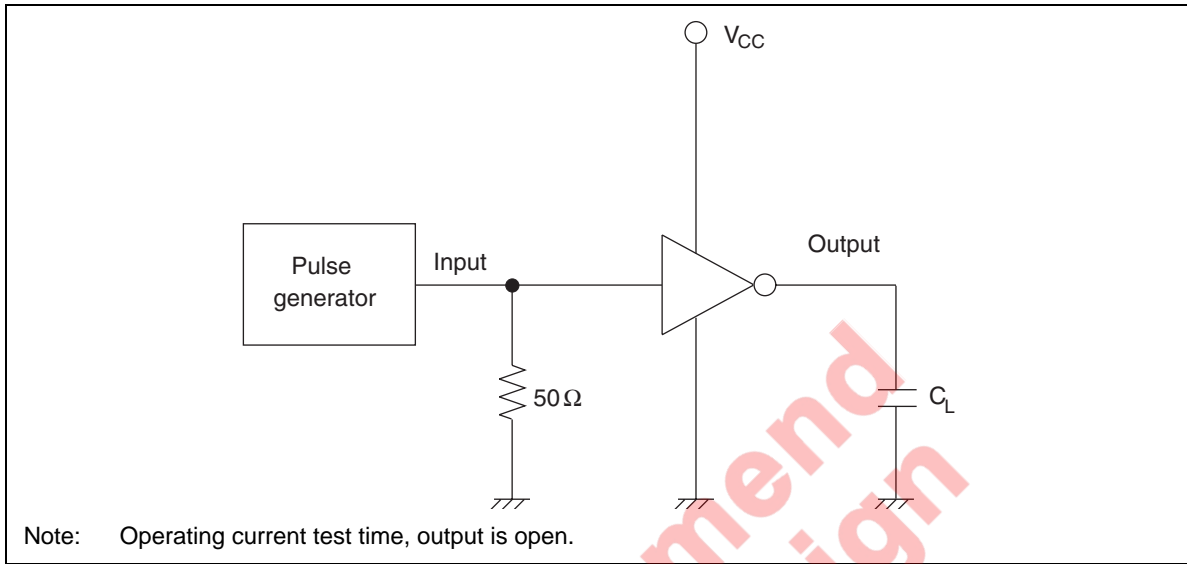
( $C_L = 50 \text{ pF}$ ,  $t_r = t_f = 6 \text{ ns}$ )

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

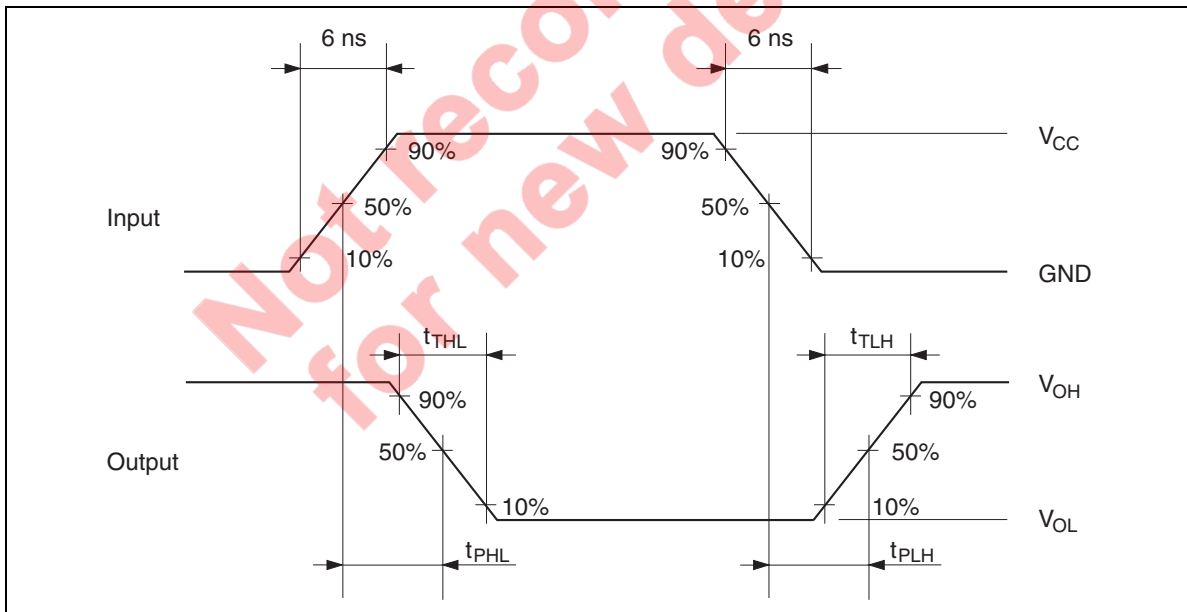
Note:  $C_{PD}$  is equivalent capacitance inside of the IC calculated from the operating current without load (see test circuit). The average operating current without load is calculated according to the expression below.

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

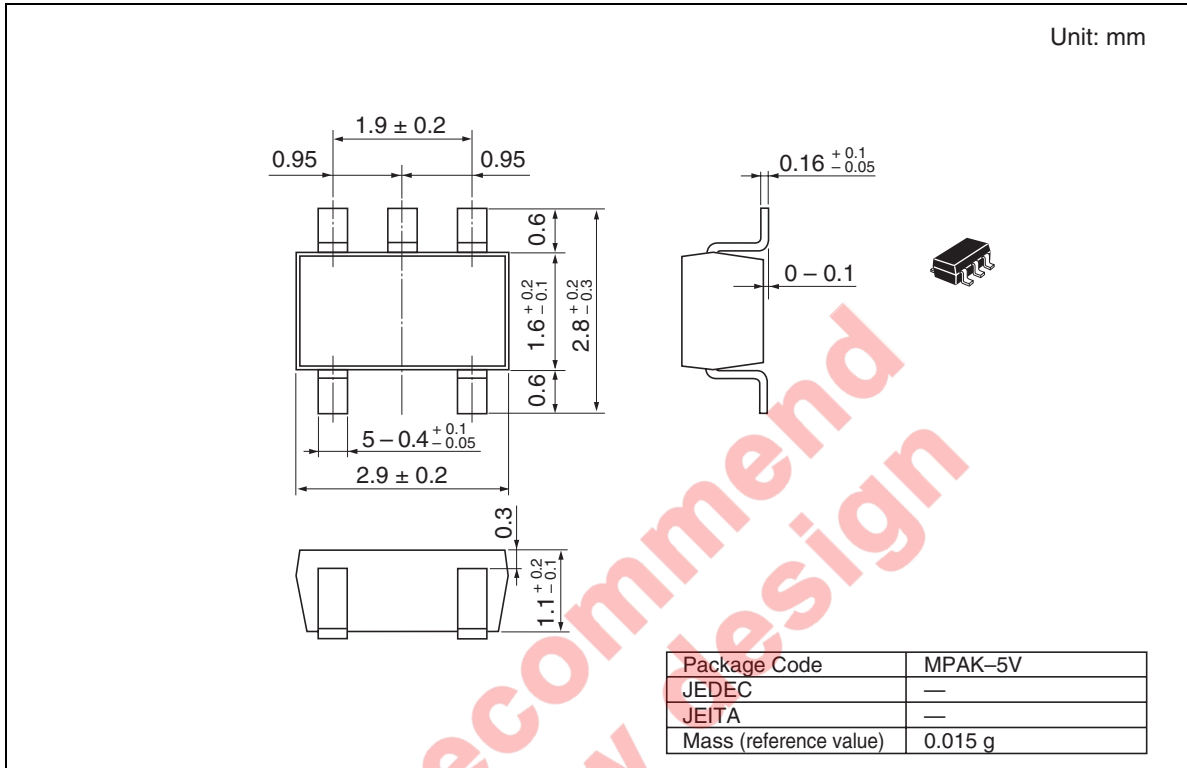
Test Circuit



Waveforms



Package Dimensions >



**Renesas Technology Corp.** Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

---

**Keep safety first in your circuit designs!**

1. Renesas Technology Corp. puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage. Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

**Notes regarding these materials**

1. These materials are intended as a reference to assist our customers in the selection of the Renesas Technology Corp. product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Renesas Technology Corp. or a third party.
  2. Renesas Technology Corp. assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
  3. All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Renesas Technology Corp. without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor for the latest product information before purchasing a product listed herein.  
The information described here may contain technical inaccuracies or typographical errors.  
Renesas Technology Corp. assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.  
Please also pay attention to information published by Renesas Technology Corp. by various means, including the Renesas Technology Corp. Semiconductor home page (<http://www.renesas.com>).
  4. When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Renesas Technology Corp. assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
  5. Renesas Technology Corp. semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
  6. The prior written approval of Renesas Technology Corp. is necessary to reprint or reproduce in whole or in part these materials.
  7. If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.  
Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
  8. Please contact Renesas Technology Corp. for further details on these materials or the products contained therein.
- 



**RENESAS SALES OFFICES**

<http://www.renesas.com>

**Renesas Technology America, Inc.**

450 Holger Way, San Jose, CA 95134-1368, U.S.A  
Tel: <1> (408) 382-7500 Fax: <1> (408) 382-7501

**Renesas Technology Europe Limited.**

Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, United Kingdom  
Tel: <44> (1628) 585 100, Fax: <44> (1628) 585 900

**Renesas Technology Europe GmbH**

Dornacher Str. 3, D-85622 Feldkirchen, Germany  
Tel: <49> (89) 380 70 0, Fax: <49> (89) 929 30 11

**Renesas Technology Hong Kong Ltd.**

7/F., North Tower, World Finance Centre, Harbour City, Canton Road, Hong Kong  
Tel: <852> 2265-6688, Fax: <852> 2375-6836

**Renesas Technology Taiwan Co., Ltd.**

FL 10, #99, Fu-Hsing N. Rd., Taipei, Taiwan  
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

**Renesas Technology (Shanghai) Co., Ltd.**

26/F., Ruijin Building, No.205 Maoming Road (S), Shanghai 200020, China  
Tel: <86> (21) 6472-1001, Fax: <86> (21) 6415-2952

**Renesas Technology Singapore Pte. Ltd.**

1, Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632  
Tel: <65> 6213-0200, Fax: <65> 6278-8001

