

# HD74UH04

## Inverter

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

### Description

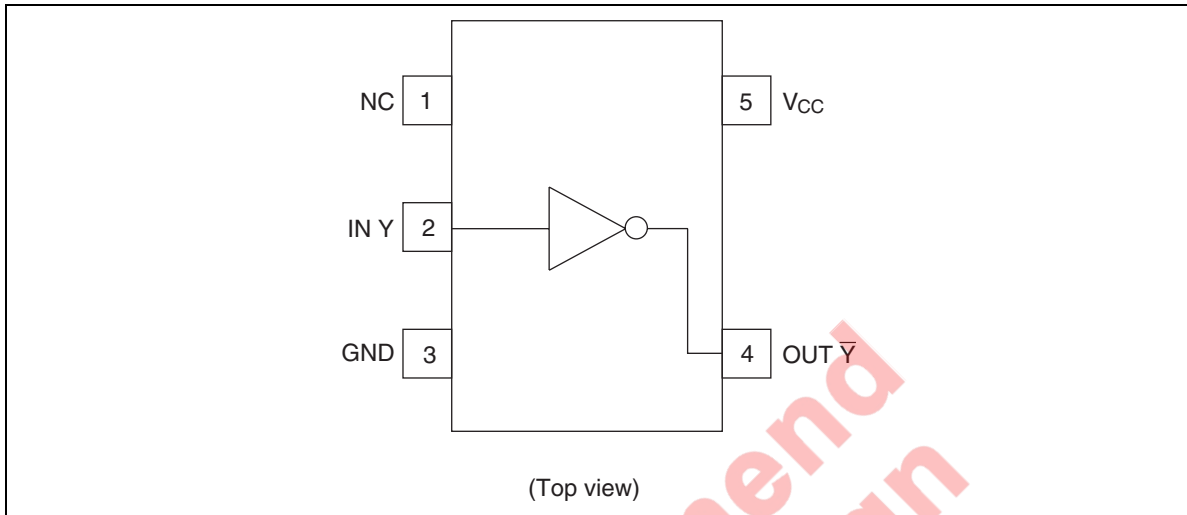
The HD74UH04 is high-speed CMOS inverter using silicon gate CMOS process. With CMOS low power dissipation, it provides high-speed equivalent to LS-TTL series. The internal circuit of three stages construction with buffer provides wide noise margin and stable output.

### Features

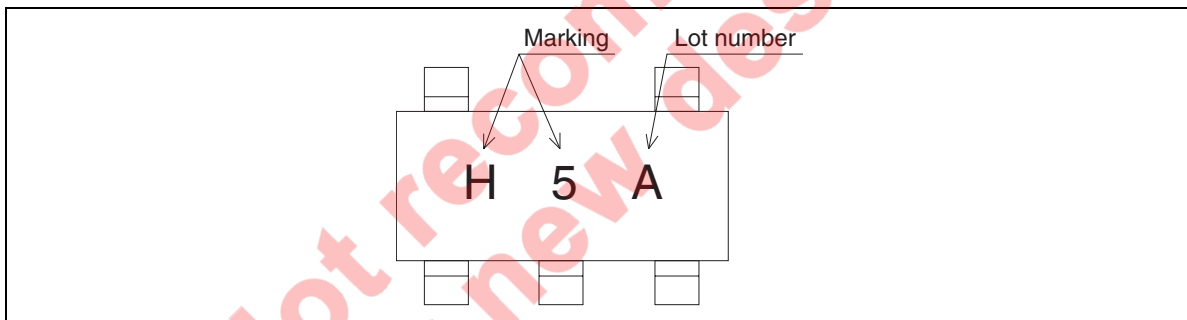
- Encapsulated in very small 5pins package of  $2.9 \times 1.6 \times 1.1$  mm, the efficiency to mount on substrate is significantly improved.
- The basic gate function is lined up as Renesas uni logic series.
- Supplied on emboss taping for high-speed automatic mounting.
- Electrical characteristics 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)

## Pin Arrangement



## 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	$^{\circ}C$

## 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	—		$I_{OH} = -2.6 \text{ mA}$
	$V_{OL}$	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		$I_{OL} = 2.6 \text{ mA}$
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

## 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
	$t_{THL}$	—	5	10		
Propagation delay time	$t_{PLH}$	—	7	15	ns	See Test circuit
	$t_{PHL}$	—	7	15		

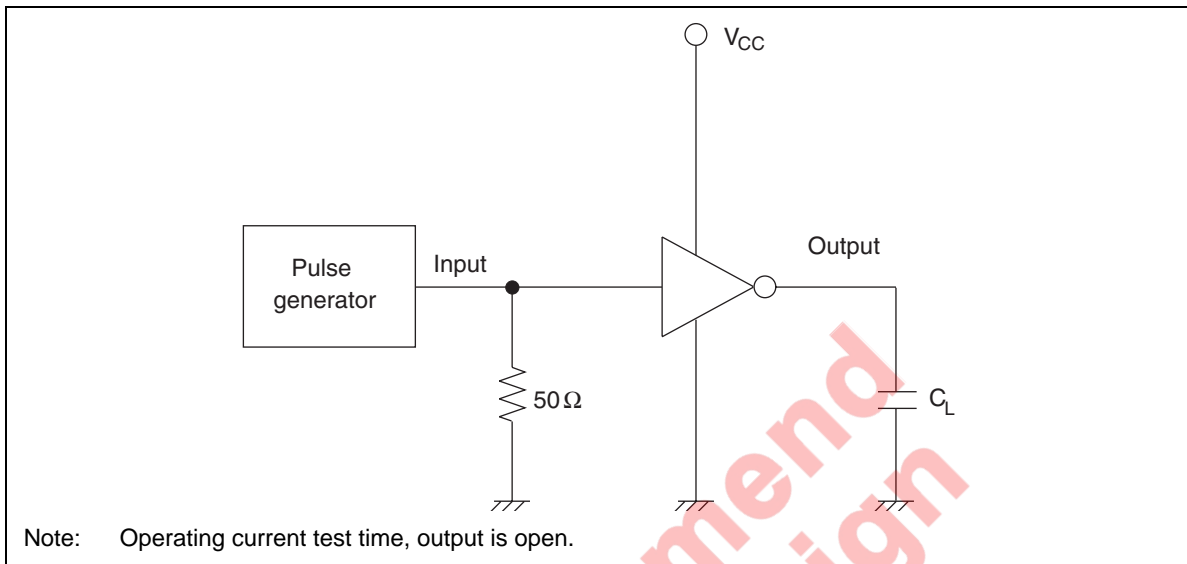
( $C_L = 50 \text{ pF}$ ,  $t_r = t_f = 6 \text{ ns}$ )

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	—	—	—		

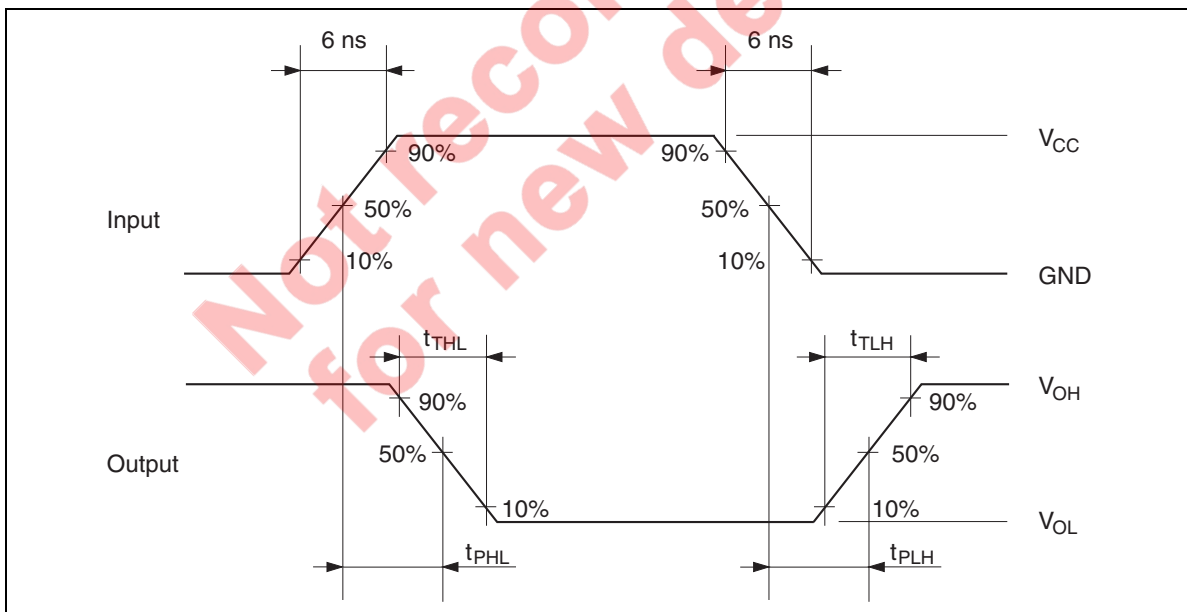
Note:  $C_{PD}$  is equivalent capacitance inside of the IC calculated from the operating current without load (see test circuit). The average operating current without load is calculated according to the expression below.

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

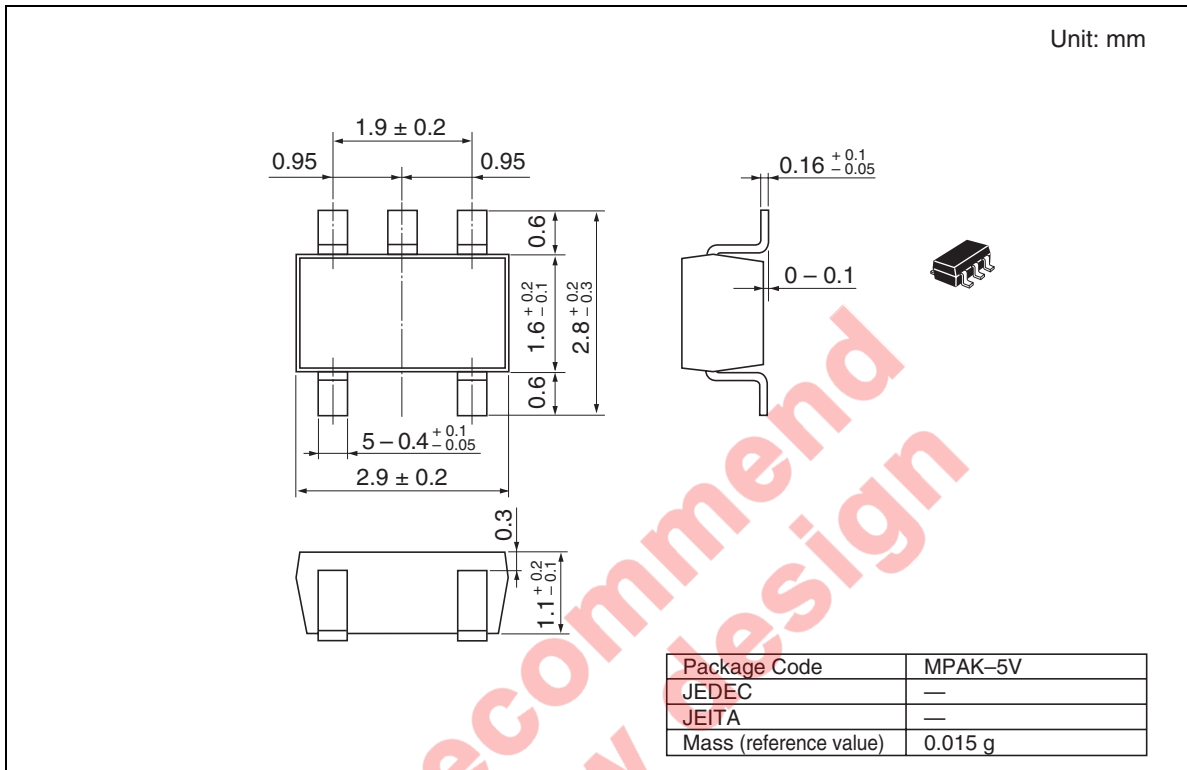
## Test Circuit



## Waveforms



Package Dimensions >



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