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# HD74LVU04A

Hex Inverters

# HITACHI

ADE-205-248 (Z)  
1st Edition  
March 1999

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## Description

The HD74LVU04A has six inverters with unbuffered outputs in a 14-pin package. Low-voltage and high-speed operation is suitable for the battery-powered products (e.g., notebook computers), and the low-power consumption extends the battery life.

## Features

- $V_{CC} = 2.0\text{ V}$  to  $5.5\text{ V}$  operation
- All inputs  $V_{IH}(\text{Max.}) = 5.5\text{ V}$  ( $@V_{CC} = 0\text{ V}$  to  $5.5\text{ V}$ )
- All outputs  $V_O(\text{Max.}) = 5.5\text{ V}$  ( $@V_{CC} = 0\text{ V}$ )
- Typical  $V_{OL}$  ground bounce  $< 0.8\text{ V}$  ( $@V_{CC} = 3.3\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )
- Typical  $V_{OH}$  undershoot  $> 2.3\text{ V}$  ( $@V_{CC} = 3.3\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )
- Output current  $\pm 6\text{ mA}$  ( $@V_{CC} = 3.0\text{ V}$  to  $3.6\text{ V}$ ),  $\pm 12\text{ mA}$  ( $@V_{CC} = 4.5\text{ V}$  to  $5.5\text{ V}$ )

## Function Table

Input A	Output Y
H	L
L	H

Note: H: High level

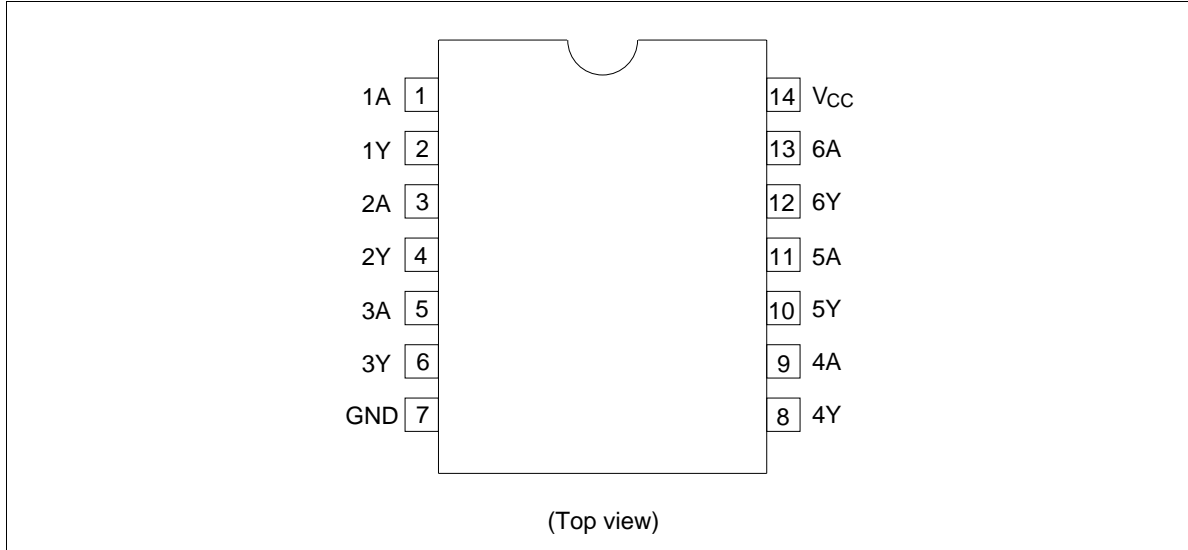
L: Low level

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## Pin Arrangement



**Absolute Maximum Ratings**

<b>Item</b>	<b>Symbol</b>	<b>Ratings</b>	<b>Unit</b>	<b>Conditions</b>
Supply voltage range	$V_{CC}$	-0.5 to 7.0	V	
Input voltage range* <sup>1</sup>	$V_I$	-0.5 to 7.0	V	
Output voltage range* <sup>1, 2</sup>	$V_O$	-0.5 to $V_{CC} + 0.5$	V	Output: H or L
Input clamp current	$I_{IK}$	-20	mA	$V_I < 0$
Output clamp current	$I_{OK}$	$\pm 50$	mA	$V_O < 0$ or $V_O > V_{CC}$
Continuous output current	$I_O$	$\pm 25$	mA	$V_O = 0$ to $V_{CC}$
Continuous current through $V_{CC}$ or GND	$I_{CC}$ or $I_{GND}$	$\pm 50$	mA	
Maximum power dissipation at $T_a = 25^\circ\text{C}$ (in still air)* <sup>3</sup>	$P_T$	785	mW	SOP
		500		TSSOP
Storage temperature	$T_{stg}$	-65 to 150	$^\circ\text{C}$	

Notes: The absolute maximum ratings are values which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

1. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. This value is limited to 5.5 V maximum.
3. The maximum package power dissipation was calculated using a junction temperature of  $150^\circ\text{C}$ .

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## HD74LVU04A

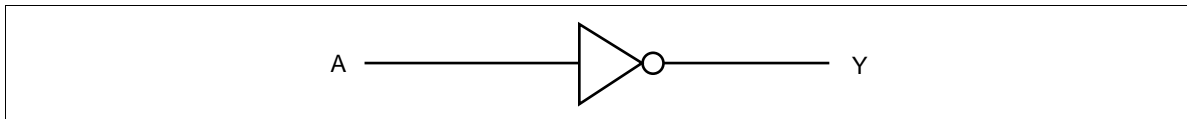
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### Recommended Operating Conditions

Item	Symbol	Min	Max	Unit	Conditions
Supply voltage range	$V_{CC}$	2.0	5.5	V	
Input voltage range	$V_I$	0	5.5	V	
Output voltage range	$V_O$	0	$V_{CC}$	V	
Output current	$I_{OH}$	—	-50	$\mu A$	$V_{CC} = 2.0 V$
		—	-2	mA	$V_{CC} = 2.3 \text{ to } 2.7 V$
		—	-6		$V_{CC} = 3.0 \text{ to } 3.6 V$
		—	-12		$V_{CC} = 4.5 \text{ to } 5.5 V$
	$I_{OL}$	—	50	$\mu A$	$V_{CC} = 2.0 V$
		—	2	mA	$V_{CC} = 2.3 \text{ to } 2.7 V$
		—	6		$V_{CC} = 3.0 \text{ to } 3.6 V$
		—	12		$V_{CC} = 4.5 \text{ to } 5.5 V$
Operating free-air temperature	$T_a$	-40	85	$^{\circ}C$	

Note: Unused or floating inputs must be held high or low.

### Logic Diagram



DC Electrical Characteristics

• Ta = -40 to 85°C

Item	Symbol	V <sub>CC</sub> (V)*	Min	Typ	Max	Unit	Test Conditions	
Input voltage	V <sub>IH</sub>	2.0	1.7	—	—	V		
		2.3 to 2.7	V <sub>CC</sub> × 0.8	—	—			
		3.0 to 3.6	V <sub>CC</sub> × 0.8	—	—			
		4.5 to 5.5	V <sub>CC</sub> × 0.8	—	—			
	V <sub>IL</sub>	2.0	—	—	0.3			
		2.3 to 2.7	—	—	V <sub>CC</sub> × 0.2			
		3.0 to 3.6	—	—	V <sub>CC</sub> × 0.2			
		4.5 to 5.5	—	—	V <sub>CC</sub> × 0.2			
Output voltage	V <sub>OH</sub>	Min to Max	V <sub>CC</sub> - 0.1	—	—	V	I <sub>OL</sub> = -50 μA	
		2.3	2.0	—	—		I <sub>OL</sub> = -2 mA	
		3.0	2.48	—	—		I <sub>OL</sub> = -6 mA	
		4.5	3.8	—	—		I <sub>OL</sub> = -12 mA	
	V <sub>OL</sub>	Min to Max	—	—	0.1	V	I <sub>OL</sub> = 50 μA	
		2.3	—	—	0.4		I <sub>OL</sub> = 2 mA	
		3.0	—	—	0.44		I <sub>OL</sub> = 6 mA	
		4.5	—	—	0.55		I <sub>OL</sub> = 12 mA	
	Input current	I <sub>IN</sub>	0 to 5.5	—	—	±1	μA	V <sub>IN</sub> = 5.5 V or GND
	Quiescent supply current	I <sub>CC</sub>	5.5	—	—	20	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0
Input capacitance	C <sub>IN</sub>	3.3	—	4.0	—	pF	V <sub>I</sub> = V <sub>CC</sub> or GND	

Note: For conditions shown as Min or Max, use the appropriate values under recommended operating conditions.

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## Switching Characteristics

- $V_{CC} = 2.5 \pm 0.2 \text{ V}$

Item	Symbol	Ta = 25°C			Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Typ	Max	Min	Max				
Propagation delay time	$t_{PLH}$	—	3.2	10.9	1.0	14.0	ns	$C_L = 15 \text{ pF}$	A	Y
	$t_{PHL}$	—	6.6	13.4	1.0	16.0		$C_L = 50 \text{ pF}$		

- $V_{CC} = 3.3 \pm 0.3 \text{ V}$

Item	Symbol	Ta = 25°C			Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Typ	Max	Min	Max				
Propagation delay time	$t_{PLH}$	—	2.5	8.9	1.0	10.5	ns	$C_L = 15 \text{ pF}$	A	Y
	$t_{PHL}$	—	4.7	11.4	1.0	13.0		$C_L = 50 \text{ pF}$		

- $V_{CC} = 5.0 \pm 0.5 \text{ V}$

Item	Symbol	Ta = 25°C			Ta = -40 to 85°C		Unit	Test Conditions	FROM (Input)	TO (Output)
		Min	Typ	Max	Min	Max				
Propagation delay time	$t_{PLH}$	—	2.2	5.5	1.0	6.5	ns	$C_L = 15 \text{ pF}$	A	Y
	$t_{PHL}$	—	3.9	7.0	1.0	8.0		$C_L = 50 \text{ pF}$		

**Operating Characteristics**

- $C_L = 50 \text{ pF}$

Item	Symbol	$V_{CC} \text{ (V)}$	$T_a = 25^\circ\text{C}$			Unit	Test Conditions
			Min	Typ	Max		
Power dissipation capacitance	$C_{PD}$	3.3	—	5.6	—	pF	f = 10 MHz
		5.0	—	6.7	—		

**Noise Characteristics**

- $C_L = 50 \text{ pF}$

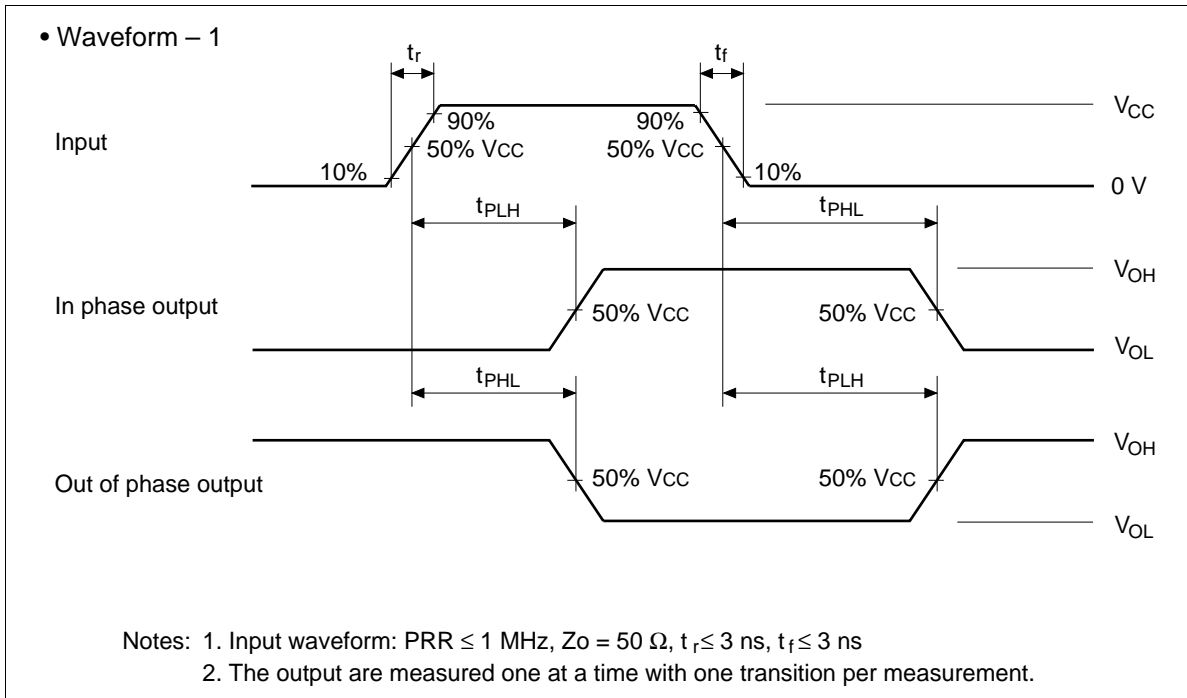
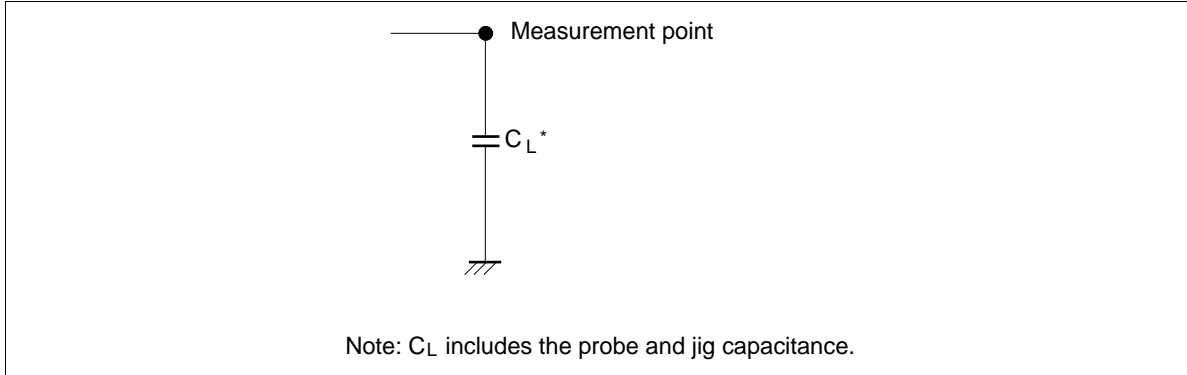
Item	Symbol	$V_{CC} \text{ (V)}$	$T_a = 25^\circ\text{C}$			Unit	Test Conditions
			Min	Typ	Max		
Quiet output, maximum dynamic $V_{OL}$	$V_{OL(P)}$	3.3	—	0.5	0.8	V	
Quiet output, minimum dynamic $V_{OL}$	$V_{OL(V)}$	3.3	—	-0.1	-0.8		
Quiet output, minimum dynamic $V_{OH}$	$V_{OH(V)}$	3.3	—	3.0	—	V	
High-level dynamic put voltage	$V_{IH(D)}$	3.3	2.31	—	—		
Low-level dynamic put voltage	$V_{IL(D)}$	3.3	—	—	0.99		

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### Test Circuit

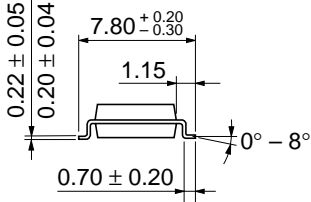
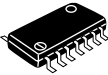
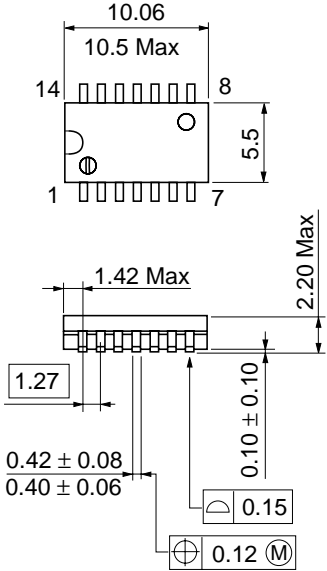


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Package Dimensions

Unit: mm

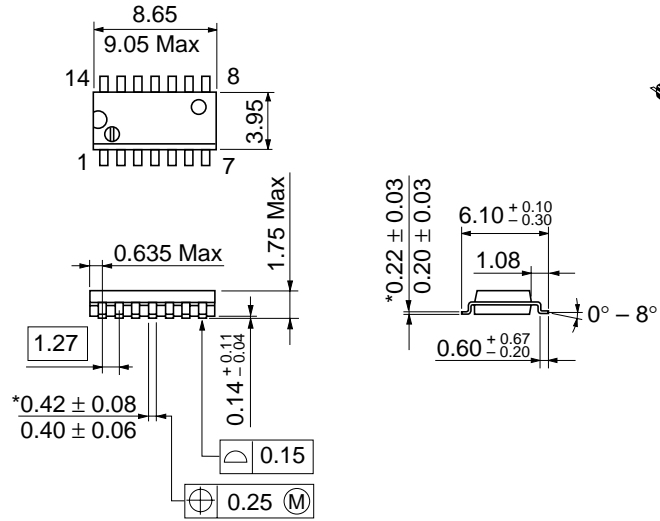


Dimension including the plating thickness  
Base material dimension

Hitachi Code	FP-14DA
JEDEC	—
EIAJ	Conforms
Weight (reference value)	0.23 g

# HD74LVU04A

Unit: mm

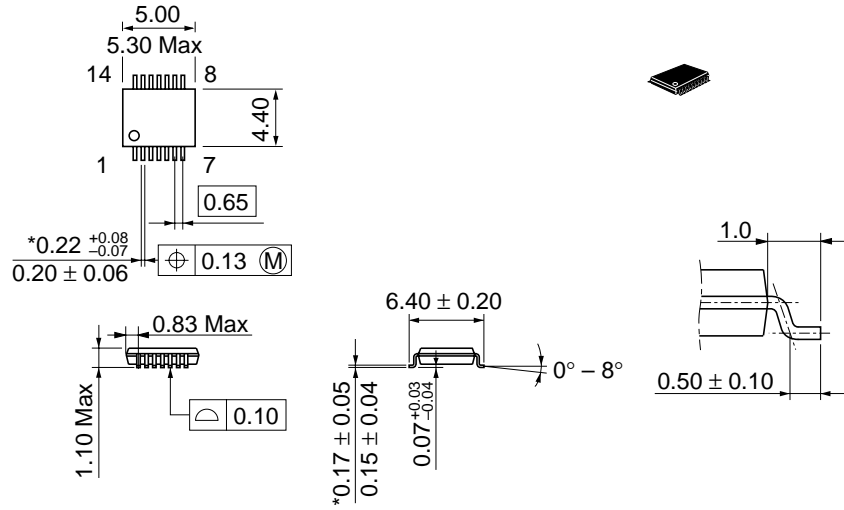


\*Dimension including the plating thickness  
Base material dimension

Hitachi Code	FP-14DN
JEDEC	Conforms
EIAJ	Conforms
Weight (reference value)	0.13 g

# HD74LVU04A

Unit: mm



\*Dimension including the plating thickness  
Base material dimension

Hitachi Code	TTP-14D
JEDEC	—
EIAJ	—
Weight (reference value)	0.05 g

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