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April 1, 2003

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# HD74LV05A

## Hex Inverters with Open Drain Outputs



ADE-205-249C (Z)

4th Edition  
Jul. 2001

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### Description

The HD74LV05A has six inverters with open drain 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  $V_{IH}$  (Max.) =  $5.5\text{ V}$  (@ $V_{CC} = 0\text{ V}$  to  $5.5\text{ V}$ )
- All outputs  $V_o$  (Max.) =  $5.5\text{ V}$  (@ $V_{CC} = 0\text{ V}$ )
- All outputs  $V_o$  (Max.) =  $5.5\text{ V}$  (@ $V_{CC} = 2.0\text{ V}$  to  $5.5\text{ V}$ , Output “Z” state)
- Typical  $V_{OL}$  ground bounce <  $0.8\text{ V}$  (@ $V_{CC} = 3.3\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )
- 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  $5.5\text{ V}$ )

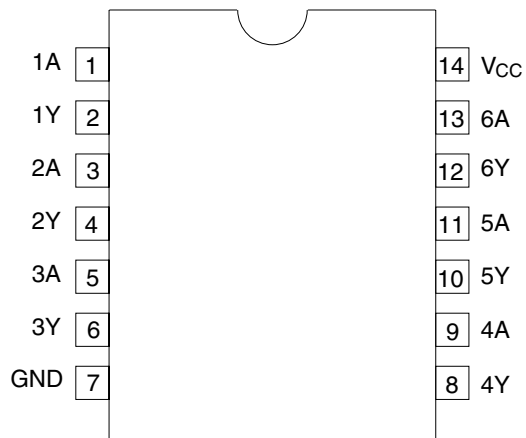
### Function Table

Input A	Output Y
L	Z
H	L

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Note: H: High level  
L: Low level  
Z: High impedance

## Pin Arrangement



(Top view)

### Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Conditions
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: Z or L
		-0.5 to 7.0		$V_{CC}$ : OFF
Input clamp current	$I_{IK}$	-20	mA	$V_I < 0$
Output clamp current	$I_{OK}$	±50	mA	$V_O < 0$
Continuous output current	$I_O$	±25	mA	$V_O = 0$ to $V_{CC}$
Continuous current through $V_{CC}$ or GND	$I_{CC}$ or $I_{GND}$	±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	°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.

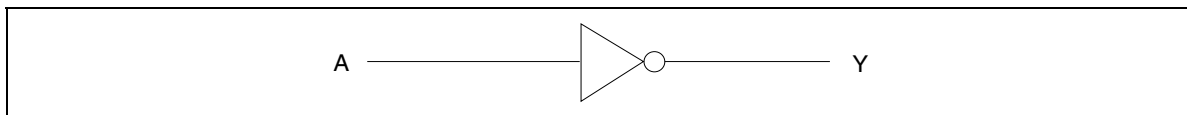
1. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. This value is limited to 7.0 V maximum.
3. The maximum package power dissipation was calculated using a junction temperature of 150°C.

## 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	5.5	V	
Output current	$I_{OL}$	—	50	$\mu$ A	$V_{CC} = 2.0$ V
		—	2	mA	$V_{CC} = 2.3$ to 2.7 V
		—	6		$V_{CC} = 3.0$ to 3.6 V
		—	12		$V_{CC} = 4.5$ to 5.5 V
Input transition rise or fall rate	$\Delta t / \Delta v$	0	200	ns/V	$V_{CC} = 2.3$ to 2.7 V
		0	100		$V_{CC} = 3.0$ to 3.6 V
		0	20		$V_{CC} = 4.5$ 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	1.5	—	—	V	
		2.3 to 2.7	V <sub>cc</sub> × 0.7	—	—		
		3.0 to 3.6	V <sub>cc</sub> × 0.7	—	—		
		4.5 to 5.5	V <sub>cc</sub> × 0.7	—	—		
	V <sub>IL</sub>	2.0	—	—	0.5		
		2.3 to 2.7	—	—	V <sub>cc</sub> × 0.3		
		3.0 to 3.6	—	—	V <sub>cc</sub> × 0.3		
		4.5 to 5.5	—	—	V <sub>cc</sub> × 0.3		
Output voltage	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
Off state output current	I <sub>OZ</sub>	Min to Max	—	—	±2.5	μA	V <sub>O</sub> = 5.5 V
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
Output leakage current	I <sub>OFF</sub>	0	—	—	5	μA	V <sub>I</sub> or V <sub>O</sub> = 0 to 5.5 V
Input capacitance	C <sub>IN</sub>	3.3	—	2.3	—	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.

## 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 <sub>PLH</sub>	—	4.7	10.4	1.0	13.0	ns	C <sub>L</sub> = 15 pF	A	Y
		—	9.5	15.2	1.0	18.0		C <sub>L</sub> = 50 pF		
	t <sub>PHL</sub>	—	5.4	10.4	1.0	13.0		C <sub>L</sub> = 15 pF		
		—	7.9	15.2	1.0	18.0		C <sub>L</sub> = 50 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 <sub>PLH</sub>	—	4.0	7.1	1.0	8.5	ns	C <sub>L</sub> = 15 pF	A	Y
		—	7.3	10.6	1.0	12.0		C <sub>L</sub> = 50 pF		
	t <sub>PHL</sub>	—	4.3	7.1	1.0	8.5		C <sub>L</sub> = 15 pF		
		—	5.8	10.6	1.0	12.0		C <sub>L</sub> = 50 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 <sub>PLH</sub>	—	3.3	5.5	1.0	6.5	ns	C <sub>L</sub> = 15 pF	A	Y
		—	5.6	7.5	1.0	8.5		C <sub>L</sub> = 50 pF		
	t <sub>PHL</sub>	—	3.4	5.5	1.0	6.5		C <sub>L</sub> = 15 pF		
		—	4.1	7.5	1.0	8.5		C <sub>L</sub> = 50 pF		



Operating Characteristics

$C_L = 50 \text{ pF}$

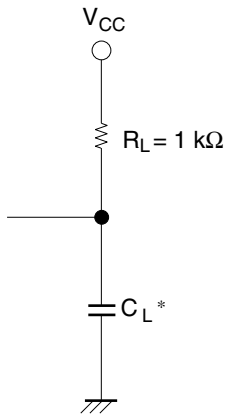
Item	Symbol	$V_{CC} \text{ (V)}$	$T_a = 25^\circ\text{C}$			Unit	Test Conditions
			Min	Typ	Max		
Power dissipation capacitance	$C_{PD}$	3.3	—	2.5	—	pF	f = 10 MHz
		5.0	—	3.0	—		

Noise Characteristics

$C_L = 50 \text{ pF}$

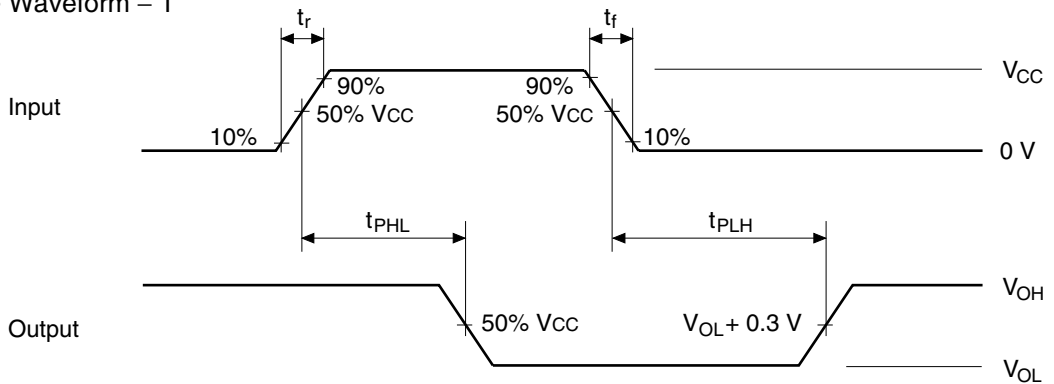
Item	Symbol	$V_{CC} \text{ (V)}$	$T_a = 25^\circ\text{C}$			Unit	Test Conditions
			Min	Typ	Max		
Quiet output, maximum dynamic $V_{OL}$	$V_{OL(P)}$	3.3	—	0.3	0.8	V	
Quiet output, minimum dynamic $V_{OL}$	$V_{OL(V)}$	3.3	—	-0.1	-0.8		
High-level dynamic input voltage	$V_{IH(D)}$	3.3	2.31	—	—	V	
Low-level dynamic input voltage	$V_{IL(D)}$	3.3	—	—	0.99		

## Test Circuit



Note:  $C_L$  includes the probe and jig capacitance.

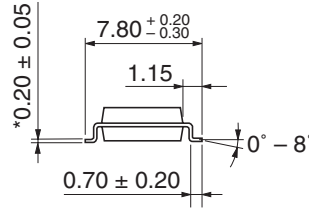
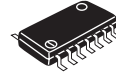
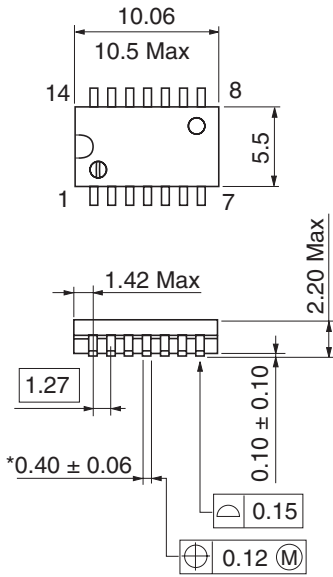
### • Waveform – 1



- Notes: 1. Input waveform:  $PRR \leq 1\text{ MHz}$ ,  $Z_o = 50\ \Omega$ ,  $t_r \leq 3\text{ ns}$ ,  $t_f \leq 3\text{ ns}$   
2. The output are measured one at a time with one transition per measurement.

Package Dimensions

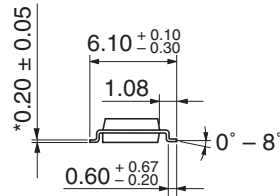
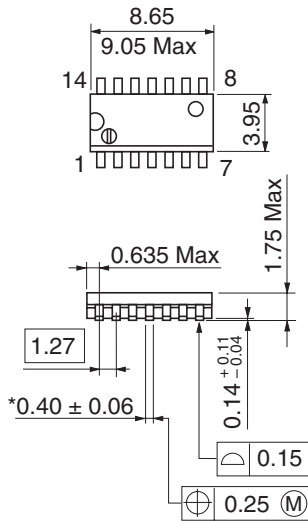
As of July, 2001  
Unit: mm



\*Pd plating

Hitachi Code	FP-14DAV
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.23 g

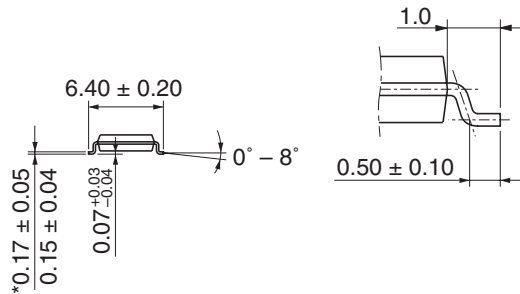
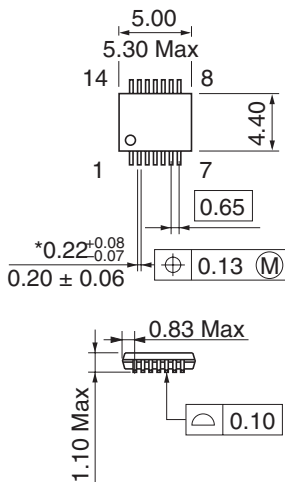
As of July, 2001  
Unit: mm



Hitachi Code	FP-14DNV
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	0.13 g

\*Pd plating

As of July, 2001  
Unit: mm



Hitachi Code	TTP-14D
JEDEC	—
JEITA	—
Mass (reference value)	0.05 g

\*Dimension including the plating thickness  
Base material dimension

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