
HD74LV20A

Dual 4-input Positive NAND Gates

HITACHI

ADE-205-254 (Z)

1st Edition

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Description

The HD74LV20A performs the Boolean functions $Y = \overline{A} \cdot \overline{B} \cdot \overline{C} \cdot \overline{D}$ or $Y = \overline{A+B+C+D}$ in positive logic.

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 V operation
- All inputs $V_{IH}(\text{Max.}) = 5.5\text{ V}$ ($@V_{CC} = 0\text{ V}$ to 5.5 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 V), $\pm 12\text{ mA}$ ($@V_{CC} = 4.5\text{ V}$ to 5.5 V)

Function Table

Inputs				
A	B	C	D	Output Y
H	H	H	H	L
L	X	X	X	H
X	L	X	X	H
X	X	L	X	H
X	X	X	L	H

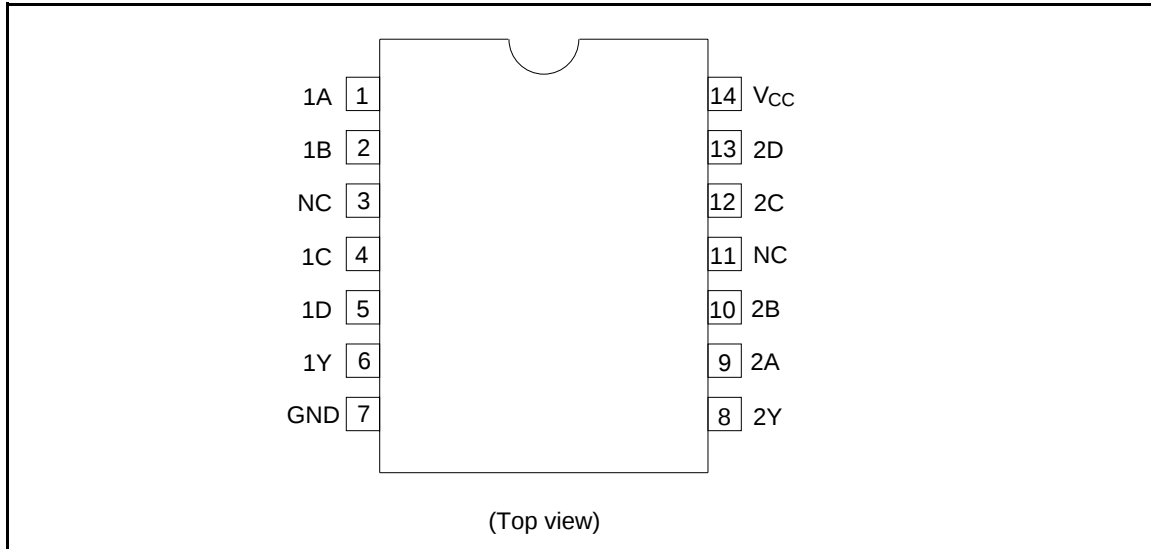
Note: H:High level

L:Low level

X:Immaterial

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Pin Arrangement



Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Conditions
Supply voltage range	V_{CC}	-0.5 to 7.0	V	
Input voltage range ^{*1}	V_I	-0.5 to 7.0	V	
Output voltage range ^{*1, 2}	V_O	-0.5 to $V_{CC} + 0.5$ -0.5 to 7.0	V	Output: H or L V_{CC} : OFF
Input clamp current	I_{IK}	-20	mA	$V_I < 0$
Output clamp current	I_{OK}	± 50	mA	$V_O < 0$ or $V_O > V_{CC}$
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 P_T $T_a = 25^\circ\text{C}$ (in still air) ^{*3}		785 500	mW	SOP 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 even if the input and output clamp-current ratings are observed.

2. This value is limited to 5.5 V maximum.

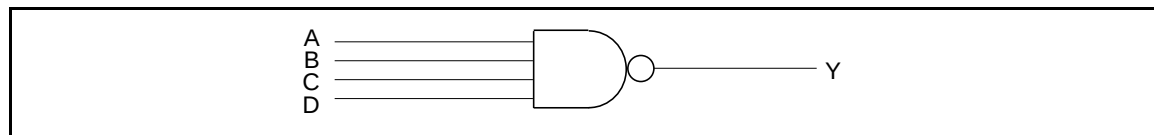
3. The maximum package power dissipation was calculated using a junction temperature of 150 $^\circ\text{C}$.

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	μA	$V_{CC} = 2.0\text{ V}$
		—	–2	mA	$V_{CC} = 2.3\text{ to }2.7\text{ V}$
		—	–6		$V_{CC} = 3.0\text{ to }3.6\text{ V}$
		—	–12		$V_{CC} = 4.5\text{ to }5.5\text{ V}$
	I_{OL}	—	50	μA	$V_{CC} = 2.0\text{ V}$
		—	2	mA	$V_{CC} = 2.3\text{ to }2.7\text{ V}$
		—	6		$V_{CC} = 3.0\text{ to }3.6\text{ V}$
		—	12		$V_{CC} = 4.5\text{ to }5.5\text{ V}$
Input transition rise or fall rate	$\Delta t / \Delta v$	0	200	ns/V	$V_{CC} = 2.3\text{ to }2.7\text{ V}$
		0	100		$V_{CC} = 3.0\text{ to }3.6\text{ V}$
		0	20		$V_{CC} = 4.5\text{ to }5.5\text{ V}$
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

- $T_a = -40\text{ to }85^{\circ}C$

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Item	Symbol	$V_{CC}\text{ (V)}^*$	Min	Typ	Max	Unit	Test Conditions
Input voltage	V_{IH}	2.0	1.5	—	—	V	
		2.3 to 2.7	$V_{CC} \times 0.7$	—	—		
		3.0 to 3.6	$V_{CC} \times 0.7$	—	—		
		4.5 to 5.5	$V_{CC} \times 0.7$	—	—		
	V_{IL}	2.0	—	—	0.5		
		2.3 to 2.7	—	—	$V_{CC} \times 0.3$		
		3.0 to 3.6	—	—	$V_{CC} \times 0.3$		
		4.5 to 5.5	—	—	$V_{CC} \times 0.3$		
Output voltage	V_{OH}	Min to Max	$V_{CC} - 0.1$	—	—	V	$I_{OH} = -50\text{ }\mu A$
		2.3	2.0	—	—		$I_{OH} = -2\text{ mA}$
		3.0	2.48	—	—		$I_{OH} = -6\text{ mA}$
		4.5	3.8	—	—		$I_{OH} = -12\text{ mA}$

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Item	Symbol	V _{CC} (V)*	Min	Typ	Max	Unit	Test Conditions
	V _{OL}	Min to Max	—	—	0.1		I _{OL} = 50 μA
		2.3	—	—	0.4		I _{OL} = 2 mA
		3.0	—	—	0.44		I _{OL} = 6 mA
		4.5	—	—	0.55		I _{OL} = 12 mA
Input current	I _{IN}	0 to 5.5	—	—	±1	μA	V _{IN} = 5.5 V or GND
Quiescent supply current	I _{CC}	5.5	—	—	20	μA	V _{IN} = V _{CC} or GND, I _O = 0
Output leakage current	I _{OFF}	0	—	—	5	μA	V _O = 5.5 V
Input capacitance	C _{IN}	3.3	—	3.5	—	pF	V _I = V _{CC} or GND

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

Switching Characteristics

- V_{CC} = 2.5 ± 0.2 V

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Ta = 25°C					Ta = −40 to 85°C					FROM (Input)	TO (Out-put)
Item	Symbol	Min	Typ	Max	Min	Max	Unit	Test Conditions			
Propagation delay time	t _{PLH}	—	7.8	11.6	1.0	13.5	ns	C _L = 15 pF	A, B, C, or D	Y	
	t _{PHL}	—	10.1	15.3	1.0	18.5		C _L = 50 pF			

- V_{CC} = 3.3 ± 0.3 V

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Ta = 25°C					Ta = −40 to 85°C					FROM (Input)	TO (Out-put)
Item	Symbol	Min	Typ	Max	Min	Max	Unit	Test Conditions			
Propagation delay time	t _{PLH}	—	4.6	6.6	1.0	8.0	ns	C _L = 15 pF		A, B, C, or D	Y
	t _{PHL}	—	7.7	10.1	1.0	11.5		C _L = 50 pF			

- V_{CC} = 5.0 ± 0.5 V

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Ta = 25°C					Ta = −40 to 85°C						
Item	Symbol	Min	Typ	Max	Min	Max	Unit	Test Conditions	FROM (Input)	TO (Out-put)	
Propagation delay time	t _{PLH}	—	3.3	5.0	1.0	6.0	ns	C _L = 15 pF	A, B, C, or D	Y	
	t _{PHL}	—	4.8	7.0	1.0	8.0		C _L = 50 pF			

Operating Characteristics

- $C_L = 50 \text{ pF}$

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Ta = 25°C						
Item	Symbol	V _{CC} (V)	Min	Typ	Max	Unit
Power dissipation capacitance	C _{PD}	3.3	—	9.5	—	pF
		5.0	—	11.0	—	

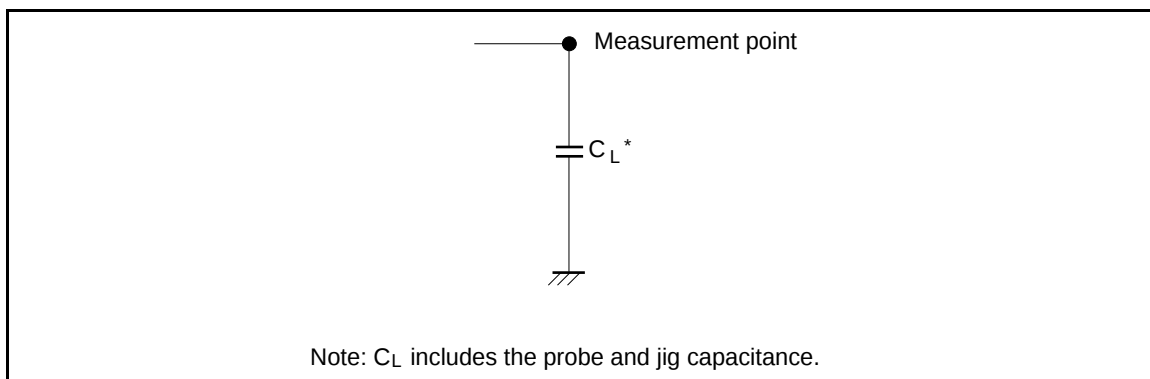
Noise Characteristics

- $C_L = 50 \text{ pF}$

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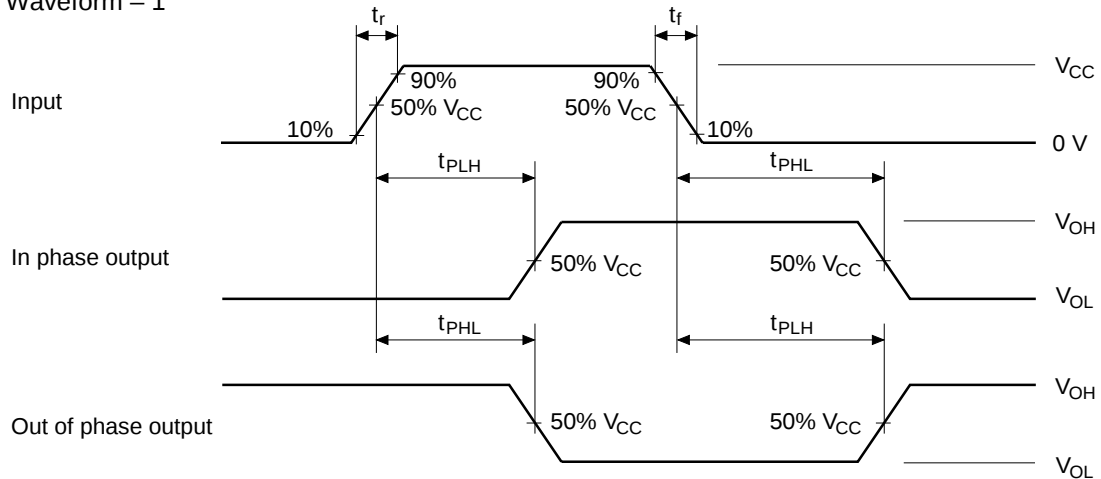
Ta = 25°C						
Item	Symbol	V _{CC} (V)	Min	Typ	Max	Unit
Quiet output, maximum dynamic V _{OL}	V _{OL} (P)	3.3	—	0.2	0.8	V
Quiet output, minimum dynamic V _{OL}	V _{OL} (V)	3.3	—	−0.1	−0.8	
Quiet output, minimum dynamic V _{OH}	V _{OH} (V)	3.3	—	3.2	—	
High-level dynamic input voltage	V _{IH} (D)	3.3	2.31	—	—	V
Low-level dynamic input voltage	V _{IL} (D)	3.3	—	—	0.99	

Test Circuit



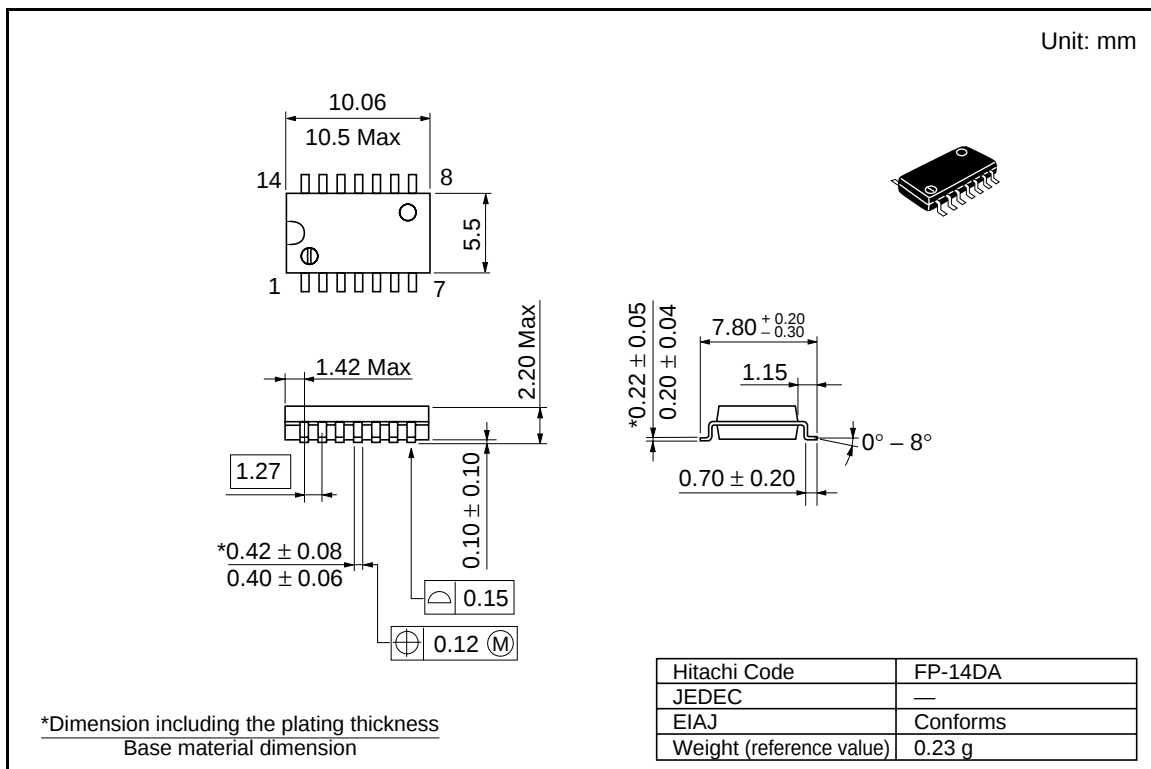
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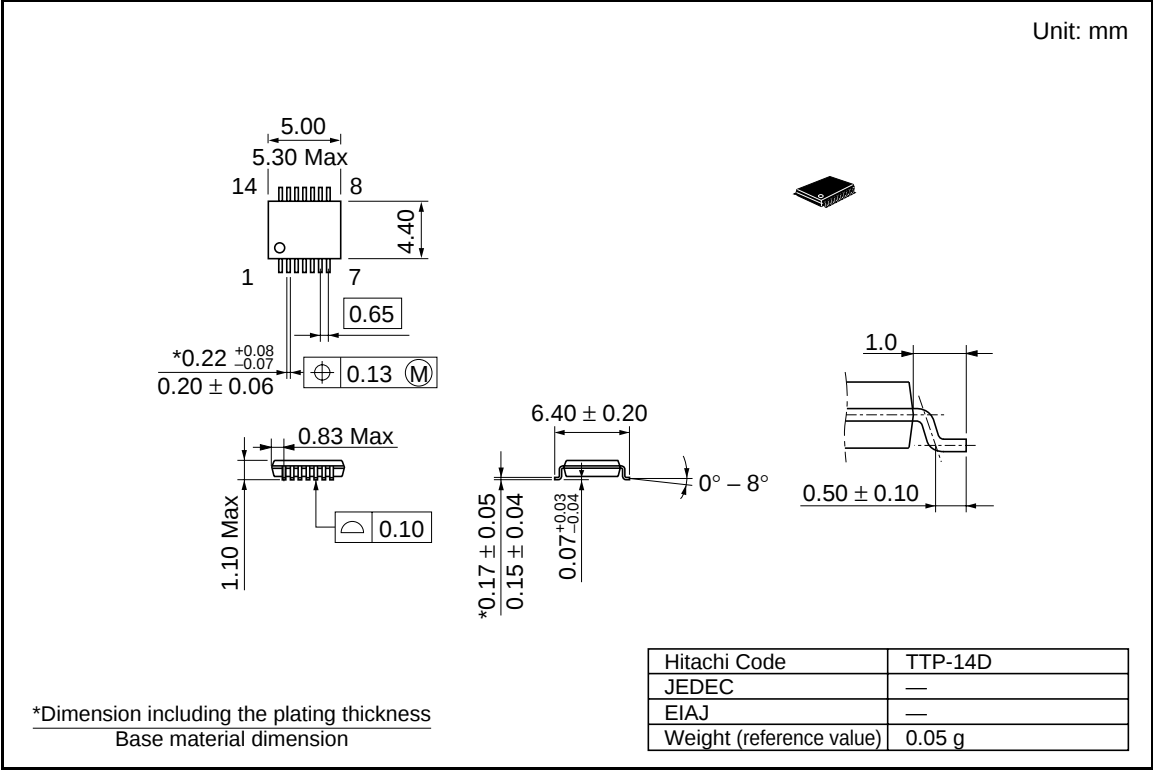
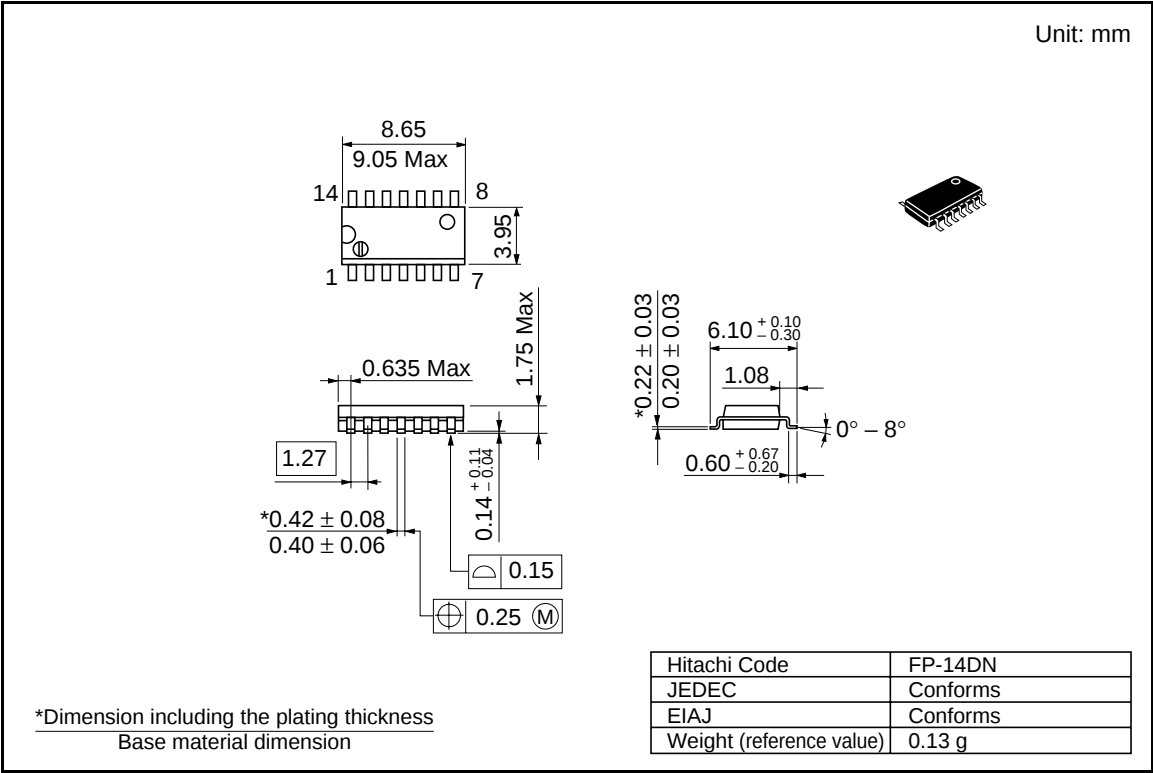
• Waveform – 1



- 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





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