

HD74HC133

13-input NAND Gate

REJ03D0568-0200
 (Previous ADE-205-442)
 Rev.2.00
 Oct 11, 2005

Description

This device contains a single 13-input NAND gate. They perform the boolean functions in positive logic.

$$Y = \overline{A \cdot B \cdot C \cdot D \cdot E \cdot F \cdot G \cdot H \cdot I \cdot J \cdot K \cdot L \cdot M} \text{ or}$$

$$Y = \overline{A} + \overline{B} + \overline{C} + \overline{D} + \overline{E} + \overline{F} + \overline{G} + \overline{H} + \overline{I} + \overline{J} + \overline{K} + \overline{L} + \overline{M}$$

Features

- High Speed Operation: $t_{pd} = 12.5 \text{ ns typ (} C_L = 50 \text{ pF)}$
- High Output Current: Fanout of 10 LSTTL Loads
- Wide Operating Voltage: $V_{CC} = 2 \text{ to } 6 \text{ V}$
- Low Input Current: $1 \mu\text{A max}$
- Low Quiescent Supply Current: $I_{CC} \text{ (static)} = 1 \mu\text{A max (} T_a = 25^\circ\text{C)}$
- Ordering Information

Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
HD74HC133FPEL	SOP-16 pin (JEITA)	PRSP0016DH-B (FP-16DAV)	FP	EL (2,000 pcs/reel)
HD74HC133RPEL	SOP-16 pin (JEDEC)	PRSP0016DG-A (FP-16DNV)	RP	EL (2,500 pcs/reel)

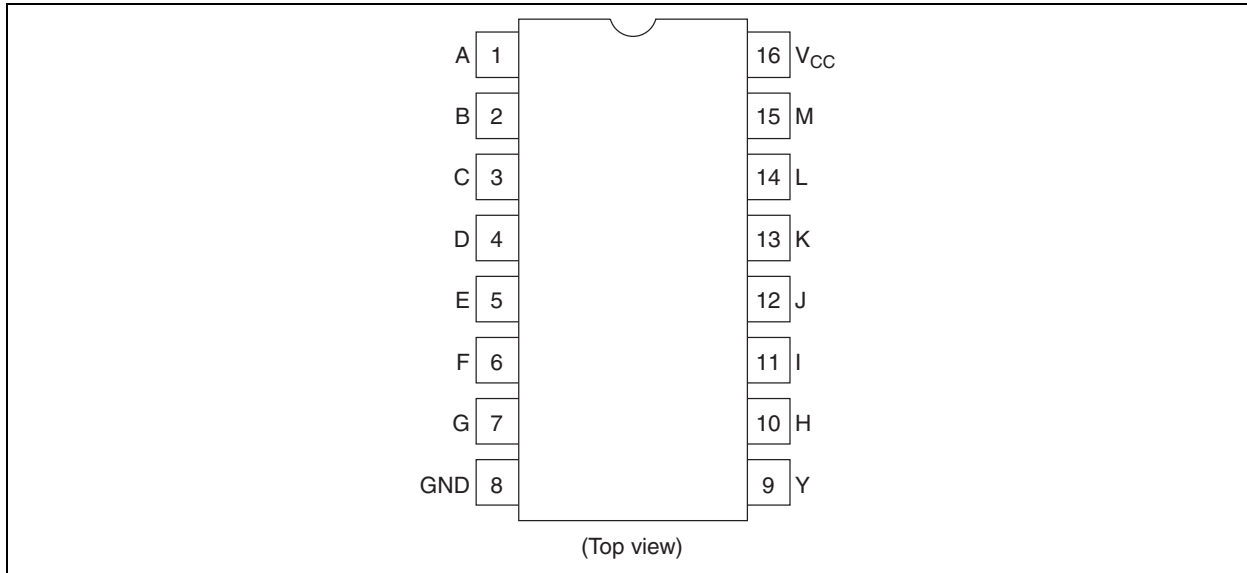
Note: Please consult the sales office for the above package availability.

Function Table

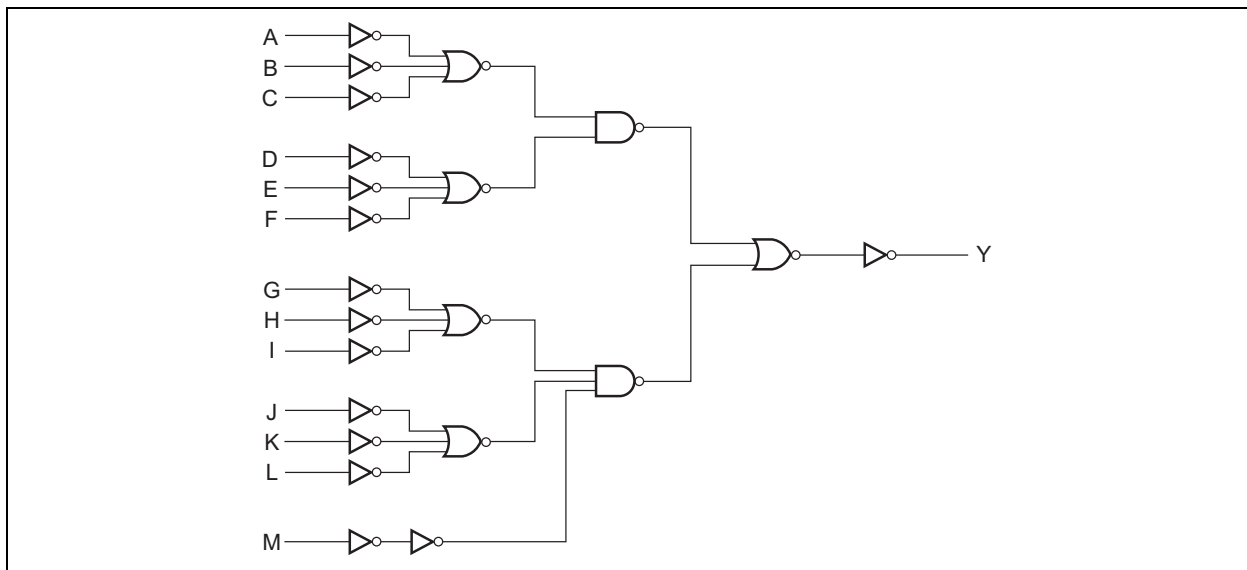
Inputs													Output
A	B	C	D	E	F	G	H	I	J	K	L	M	Y
H	H	H	H	H	H	H	H	H	H	H	H	H	L
L	X	X	X	X	X	X	X	X	X	X	X	X	H
X	L	X	X	X	X	X	X	X	X	X	X	X	H
X	X	L	X	X	X	X	X	X	X	X	X	X	H
X	X	X	L	X	X	X	X	X	X	X	X	X	H
X	X	X	X	L	X	X	X	X	X	X	X	X	H
X	X	X	X	X	L	X	X	X	X	X	X	X	H
X	X	X	X	X	X	L	X	X	X	X	X	X	H
X	X	X	X	X	X	X	L	X	X	X	X	X	H
X	X	X	X	X	X	X	X	L	X	X	X	X	H
X	X	X	X	X	X	X	X	X	L	X	X	X	H
X	X	X	X	X	X	X	X	X	X	L	X	X	H
X	X	X	X	X	X	X	X	X	X	X	L	X	H
X	X	X	X	X	X	X	X	X	X	X	X	L	H

H: High level
 L: Low level
 X: Irrelevant

Pin Arrangement



Logic Diagram



Absolute Maximum Ratings

Item	Symbol	Ratings	Unit
Supply voltage range	V_{CC}	-0.5 to 7.0	V
Input / Output voltage	V_{in}, V_{out}	-0.5 to $V_{CC} + 0.5$	V
Input / Output diode current	I_{IK}, I_{OK}	± 20	mA
Output current	I_O	± 25	mA
V_{CC}, GND current	I_{CC} or I_{GND}	± 50	mA
Power dissipation	P_T	500	mW
Storage temperature	T_{stg}	-65 to +150	$^{\circ}C$

Note: 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.

Recommended Operating Conditions

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	V _{CC}	2 to 6	V	
Input / Output voltage	V _{IN} , V _{OUT}	0 to V _{CC}	V	
Operating temperature	Ta	-40 to 85	°C	
Input rise / fall time ^{*1}	t _r , t _f	0 to 1000	ns	V _{CC} = 2.0 V
		0 to 500		V _{CC} = 4.5 V
		0 to 400		V _{CC} = 6.0 V

Note: 1. This item guarantees maximum limit when one input switches.
 Waveform: Refer to test circuit of switching characteristics.

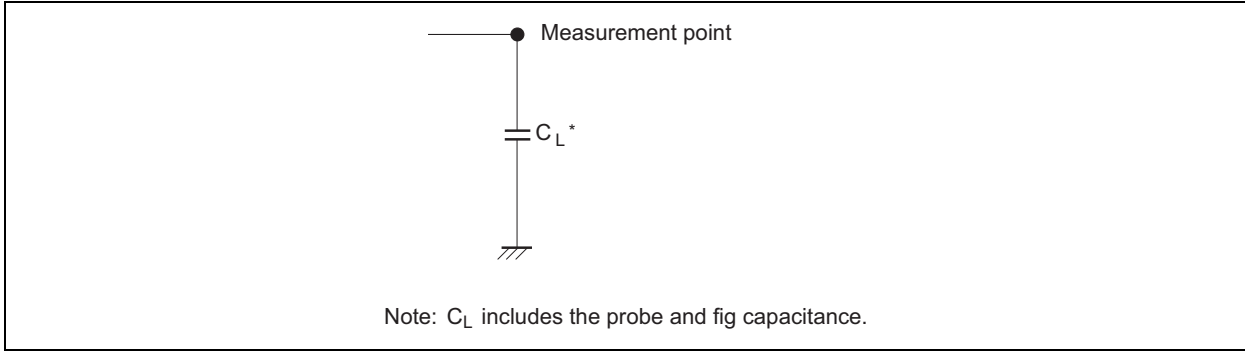
Electrical Characteristics

Item	Symbol	V _{CC} (V)	Ta = 25°C			Ta = -40 to +85°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	Vin = V _{IH} or V _{IL}	I _{OH} = -20 μA
		4.5	4.4	4.5	—	4.4	—			I _{OH} = -4 mA
		6.0	5.9	6.0	—	5.9	—			I _{OH} = -5.2 mA
		4.5	4.18	—	—	4.13	—			
		6.0	5.68	—	—	5.63	—			
	V _{OL}	2.0	—	0.0	0.1	—	0.1	V	Vin = V _{IH} or V _{IL}	I _{OL} = 20 μA
		4.5	—	0.0	0.1	—	0.1			
		6.0	—	0.0	0.1	—	0.1			
		4.5	—	—	0.26	—	0.33			I _{OL} = 4 mA
		6.0	—	—	0.26	—	0.33			I _{OL} = 5.2 mA
Input current	I _{in}	6.0	—	—	±0.1	—	±1.0	μA	Vin = V _{CC} or GND	
Quiescent supply current	I _{CC}	6.0	—	—	1.0	—	10	μA	Vin = V _{CC} or GND, I _{out} = 0 μA	

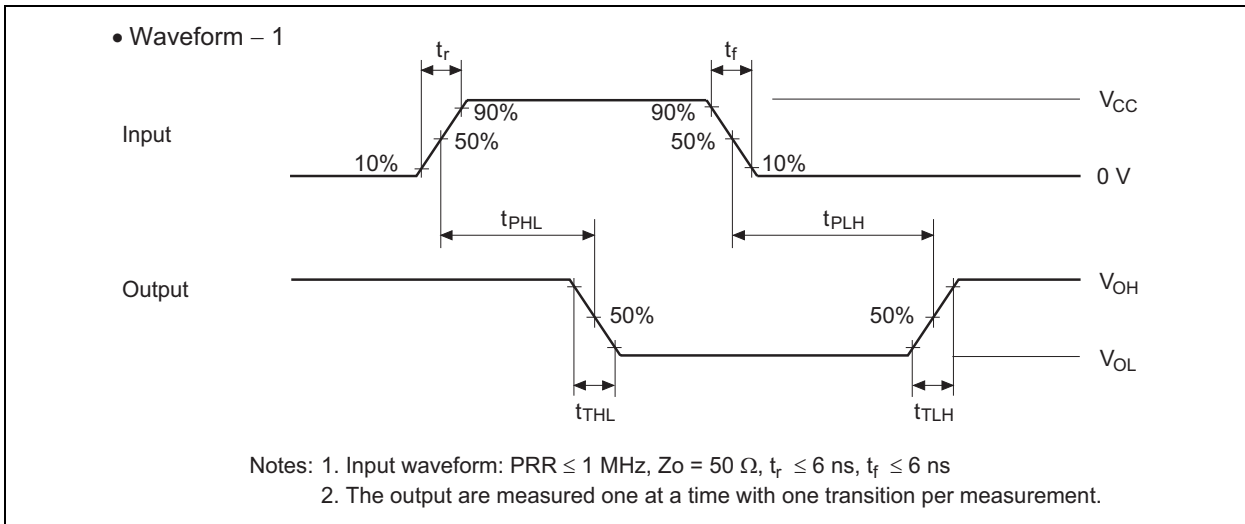
Switching Characteristics (C_L = 50 pF, Input t_r = t_f = 6 ns)

Item	Symbol	V _{CC} (V)	Ta = 25°C			Ta = -40 to +85°C		Unit	Test Conditions	
			Min	Typ	Max	Min	Max			
Propagation delay time	t _{PLH} , t _{PHL}	2.0	—	—	150	—	190	ns		
		4.5	—	12	30	—	38			
		6.0	—	—	26	—	33			
	t _{PLH} , t _{PHL}	2.0	—	—	150	—	190	ns		
		4.5	—	13	30	—	38			
		6.0	—	—	26	—	33			
Output rise/fall time	t _{TLH} , t _{THL}	2.0	—	—	75	—	95	ns		
		4.5	—	5	15	—	19			
		6.0	—	—	13	—	16			
Input capacitance	C _{in}	—	—	5	10	—	10	pF		

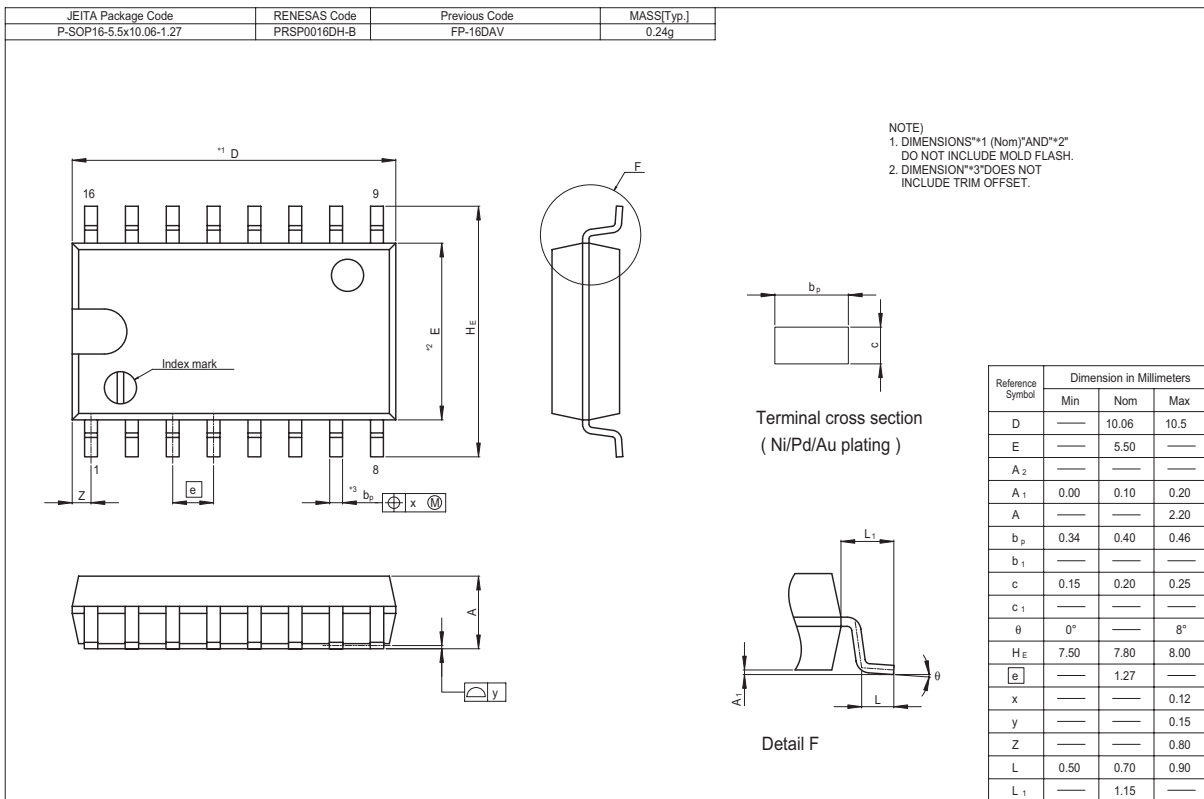
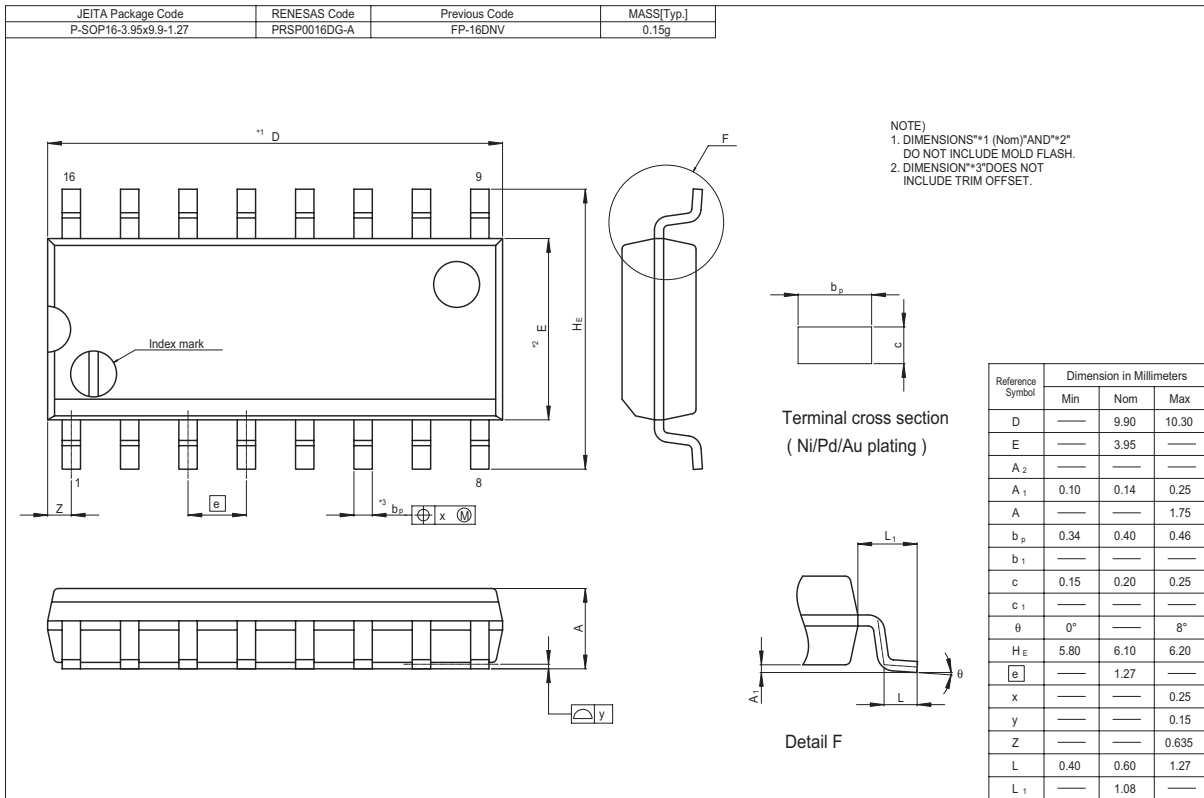
Test Circuit



Waveforms



Package Dimensions



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