High Speed CMOS Logic – 74HC00

Quad 2-Input NAND Gates in bare die form

Rev 1.0
07/02/19

Description

74HC00 provides x4 independent 2-input NAND gates performing the Boolean function $Y = \overline{A \bullet B}$ or $Y = \overline{A} + \overline{B}$. The device is fabricated using a 2.5µm 5V CMOS process combining high speed LSTTL performance with CMOS low power. Internal circuitry comprises of 3 stages and includes buffered output for high noise immunity and stability. Device inputs are compatible with standard CMOS outputs; with pull-up resistors, they are compatible with LSTTL outputs. All inputs are equipped with protection circuits against static discharge and transient excess voltage.

Features:

- Output Drive Capability: 10 LSTTL Loads
- Low Input Current: 1µA
- Outputs directly interface CMOS, NMOS and TTL
- Operating Voltage Range: 2V to 6V
- Function compatible with 74LS00
- High Noise Immunity CMOS process.

Ordering Information

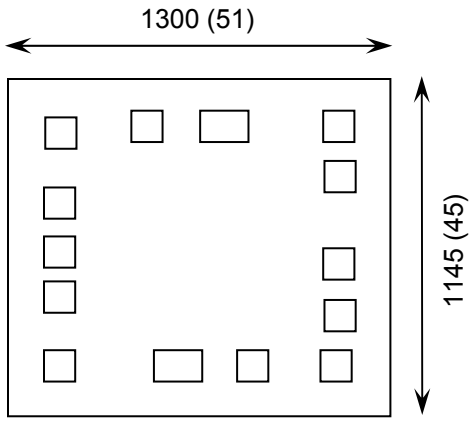
The following part suffixes apply:

- No suffix - MIL-STD-883 /2010B Visual Inspection

For High Reliability versions of this product please see

54HC00

Die Dimensions in µm (mils)



Supply Formats:

- Default – Die in Waffle Pack (400 per tray capacity)
- Sawn Wafer on Tape – On request
- Unsawn Wafer – On request
- Die Thickness <> 350µm(14 Mils) – On request
- Assembled into Ceramic Package – On request

Mechanical Specification

Die Size (Unsawn)	1300 x 1145 51 x 45	µm mils
Minimum Bond Pad Size	106 x 106 4.17 x 4.17	µm mils
Die Thickness	350 (±20) 13.78 (±0.79)	µm mils
Top Metal Composition	Al 1%Si 1.1µm	
Back Metal Composition	N/A – Bare Si	

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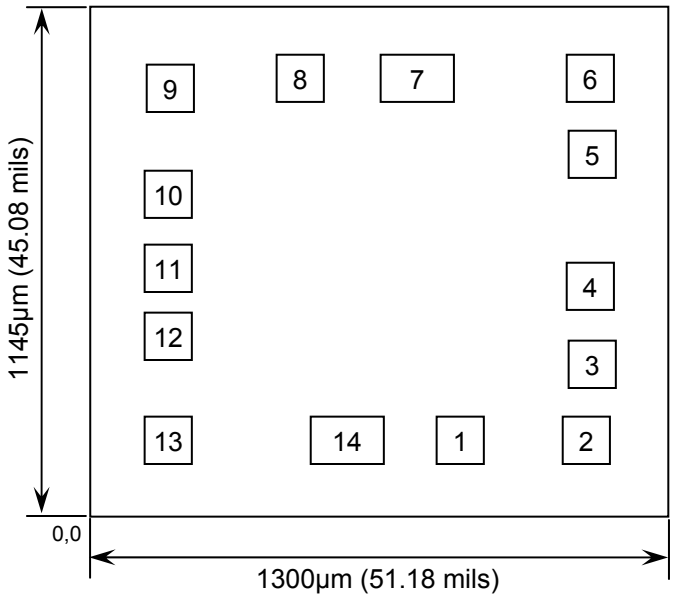
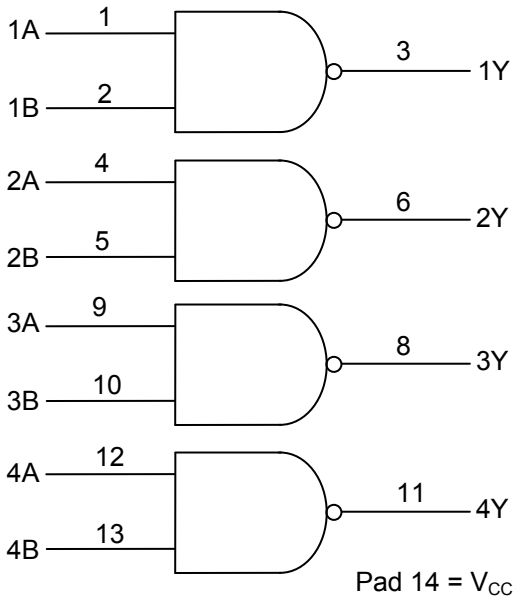
Pad Layout and Functions



COORDINATES MARKED IN DIE PASSIVATION FOR ORIENTATION

PAD	FUNCTION	COORDINATES (mm)	
		X	Y
1	1A	0.132	0.443
2	1B	0.132	0.126
3	1Y	0.315	0.129
4	2A	0.485	0.128
5	2B	0.802	0. 129
6	2Y	0.981	0.129
7	GND	0.981	0.504
8	3Y	0.981	0.807
9	3A	0.971	1.105
10	3B	0.722	1.115
11	4Y	0.551	1.115
12	4A	0.331	1.115
13	4B	0.132	1.105
14	V_{CC}	0.132	0.65
CONNECT CHIP BACK TO V_{CC} OR FLOAT			

Logic Diagram



Pad 14 = V_{CC}
Pad 7 = GND

Function Table

INPUTS		OUTPUT
A	B	Y
L	L	H
L	H	H
H	L	H
H	H	L
H = High level (steady state) L = Low level (steady state)		

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Absolute Maximum Ratings[1]

PARAMETER	SYMBOL	VALUE	UNIT
DC Supply Voltage (Referenced to GND)	V_{CC}	-0.5 to +7.0	V
DC Input Voltage (Referenced to GND)	V_{IN}	-0.5 to V_{CC} +0.5	V
DC Output Voltage (Referenced to GND)	V_{OUT}	-0.5 to V_{CC} +0.5	V
DC Input Current	I_{IN}	±20	mA
DC Output Current, per pad	I_{OUT}	±25	mA
DC Supply Current, V_{CC} or GND, per pad	I_{CC}	±50	mA
Power Dissipation in Still Air[2]	P_D	750	mW
Storage Temperature Range	T_{STG}	-65 to 150	°C

1. Operation above the absolute maximum rating may cause device failure. Operation at the absolute maximum ratings, for extended periods, may reduce device reliability. **2.** Measured in plastic DIP package, results in die form are dependent on die attach and assembly method.

Recommended Operating Conditions[3] (Voltages referenced to GND)

PARAMETER	SYMBOL		MIN	MAX	UNITS
Supply Voltage	V_{CC}		2	6	V
DC Input or Output Voltage	V_{IN} ,V_{OUT}		0	V_{CC}	V
Operating Temperature Range	T_J		0	+85	°C
Input Rise or Fall Times	t_r, t_f	V_{CC} = 2V	0	1000	ns
		V_{CC} = 4.5V	0	500	
		V_{CC} = 6.0V	0	400	

3. This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{IN} and V_{OUT} should be constrained to the range GND ≤ (V_{IN} or V_{OUT}) ≤ V_{CC}. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

DC Electrical Characteristics (Voltages Referenced to GND)

PARAMETER	SYMBOL	V_{CC}	CONDITIONS	LIMITS			UNITS
				25°C	85°C	FULL RANGE[4]	
Minimum High-Level Input Voltage	V_{IH}	2.0V	V_{OUT} = 0.1V or V_{CC} -0.1V $\lvert I_{OUT} \rvert$ ≤ 20μA	1.5	1.5	1.5	V
		3.0V		2.1	2.1	2.1	
		4.5V		3.15	3.15	3.15	
		6.0V		4.2	4.2	4.2	
Maximum Low-Level Input Voltage	V_{IL}	2.0V	V_{OUT} = 0.1V or V_{CC} -0.1V $\lvert I_{OUT} \rvert$ ≤ 20μA	0.5	0.5	0.5	V
		3.0V		0.9	0.9	0.9	
		4.5V		1.35	1.35	1.35	
		6.0V		1.8	1.8	1.8	

DC Electrical Characteristics Continued (Voltages Referenced to GND)

PARAMETER	SYMBOL	V_{CC}	CONDITIONS	LIMITS			UNITS
				25°C	85°C	FULL RANGE[4]	
Minimum High-Level Output Voltage	V_{OH}	2.0V	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_{OUT} \rvert \le 20\mu A$	1.9	1.9	1.9	V
		4.5V		4.4	4.4	4.4	
		6.0V		5.9	5.9	5.9	
		3.0V	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_{OUT} \rvert \le 2.4mA$	2.48	2.34	2.34	V
		4.5V	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_{OUT} \rvert \le 4.0mA$	3.98	3.84	3.84	
		6.0V	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_{OUT} \rvert \le 5.2mA$	5.48	5.34	5.34	
Maximum Low-Level Output Voltage	V_{OL}	2.0V	$V_{IN} = V_{IL}$ or V_{IL} $\lvert I_{OUT} \rvert \le 20\mu A$	0.1	0.1	0.1	V
		4.5V		0.1	0.1	0.1	
		6.0V		0.1	0.1	0.1	
		3.0V	$V_{IN} = V_{IL}$ or V_{IL} $\lvert I_{OUT} \rvert \le 2.4mA$	0.26	0.33	0.33	V
		4.5V	$V_{IN} = V_{IL}$ or V_{IL} $\lvert I_{OUT} \rvert \le 4.0mA$	0.26	0.33	0.33	
		6.0V	$V_{IN} = V_{IL}$ or V_{IL} $\lvert I_{OUT} \rvert \le 5.2mA$	0.26	0.33	0.33	
Maximum Input Leakage Current	I_{IN}	6.0V	$V_{IN} = V_{CC}$ or GND	±0.1	±1.0	±1.0	µA
Maximum Quiescent Supply Leakage Current	I_{CC}	6.0V	$V_{IN} = V_{CC}$ or GND $I_{OUT} = 0\mu A$	1	10	10	µA

4. $0^{\circ}C \le T_J \le +85^{\circ}C$

AC Electrical Characteristics[5]

PARAMETER	SYMBOL	V_{CC}	CONDITIONS	LIMITS			UNITS
				25°C	85°C	FULL RANGE[4]	
Maximum Propagation Delay, Input A or B to Output Y (Figure 1,2)	t_{PLH}, t_{PHL}	2.0V	$C_L = 50pF$, $t_r = t_f = 6ns$	75	95	95	ns
		3.0V		30	40	40	
		4.5V		15	19	19	
		6.0V		13	16	16	
Maximum Output Rise and Fall Time, Any Output (Figure 1,2)	t_{TLH}, t_{THL}	2.0V	$C_L = 50pF$, $t_r = t_f = 6ns$	75	95	95	ns
		3.0V		27	32	32	
		4.5V		15	19	19	
		6.0V		13	16	16	

5. Not production tested in die form, characterized by chip design and tested in package.

AC Electrical Characteristics Continued[5]

PARAMETER	SYMBOL	V_{CC}	CONDITIONS	LIMITS			UNITS
				25°C	85°C	FULL RANGE[4]	
Maximum Input Capacitance	C_{IN}	-	-	10	10	10	pF
Power Dissipation Capacitance Per Gate[6]	C_{PD}	-	T_A = 25°C, V_{CC} =5.0V	TYPICAL			pF
				22			

6. Used to determine the no-load dynamic power consumption: $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$.

Switching Waveform

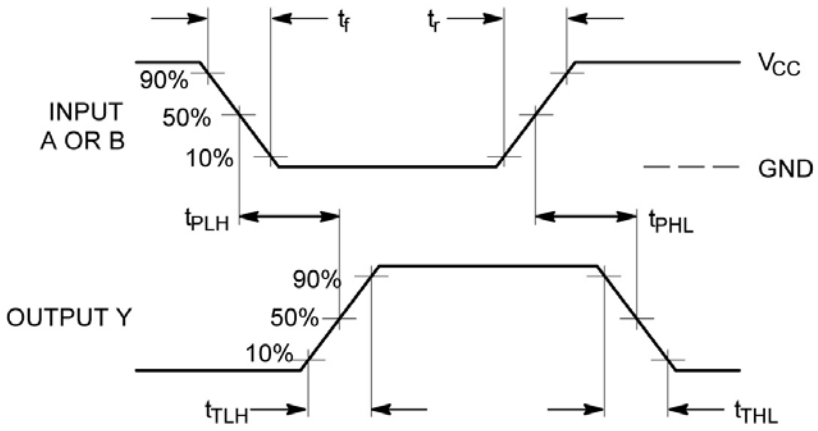
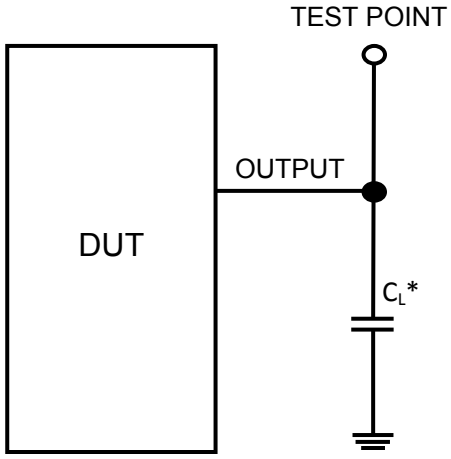


Figure 1 – Propagation Delay & Output Transition Time

Test Circuit



* Includes all probe and jig capacitance

Figure 2