High Speed CMOS Logic – 74HC14

Hex Schmitt-Trigger Inverter Logic IC in bare die form

Rev 1.0
24/11/17

Description

The 74HC14 Hex Schmitt-Trigger Inverter is fabricated using a 2.5µm 5V CMOS process with the same high speed performance of LSTTL combined with CMOS low power consumption. The device performs the Boolean function Y = Ā in positive logic. Device inputs are compatible with Standard CMOS outputs; with pull-up resistors, they are compatible with LSTTL outputs. Schmitt-Trigger inputs transform slow input rise and fall times into sharply defined jitter-free output signals. Due to the hysteresis voltage of the Schmitt trigger, the 74HC14 is useful in noisy environments.

Features:

- Output Drive Capability: 10 LSTTL Loads
- Low Input Current: 1µA
- Outputs directly interface CMOS, NMOS and TTL
- Operating Voltage Range: 2V to 6V
- CMOS High Noise Immunity
- Function compatible with 74LS14.

Ordering Information

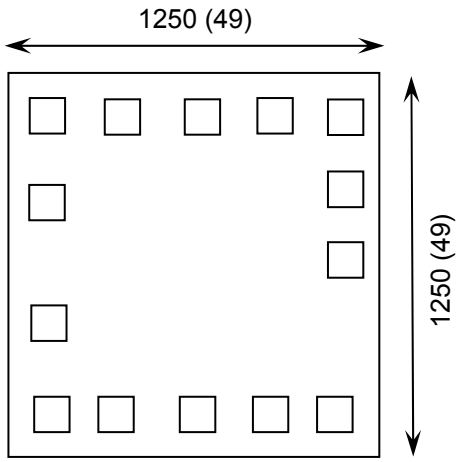
The following part suffixes apply:

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

For High Reliability versions of this product please see

54HC14

Die Dimensions in µm (mils)



Supply Formats:

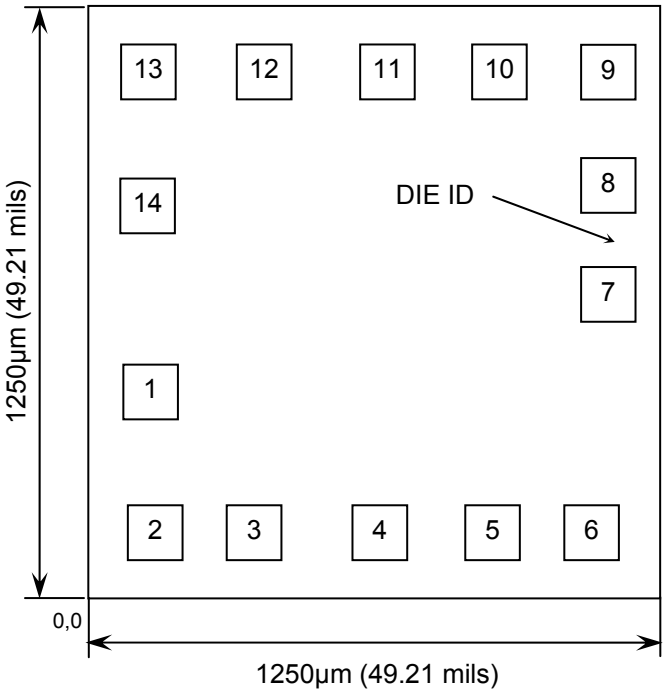
- Default – Die in Waffle Pack (400 per tray capacity)
- Sawn Wafer on Tape – On request
- Unsawn Wafer – On request
- Die Thickness <> 350µm(14 Mils) – On request
- Assembled into Ceramic Package – On request

Mechanical Specification

Die Size (Unsawn)	1250 x 1250 49 x 49	µm mils
Minimum Bond Pad Size	100 x 100 3.94 x 3.94	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	

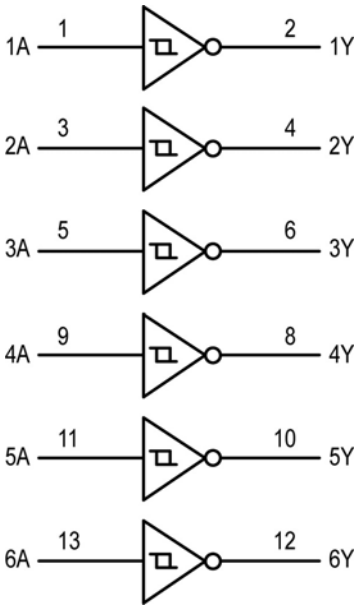
Rev 1.0
24/11/17

Pad Layout and Functions



PAD	FUNCTION	COORDINATES (mm)	
		X	Y
1	1A	0.14	0.345
2	1Y	0.14	0.141
3	2A	0.319	0.141
4	2Y	0.577	0.141
5	3A	0.817	0.141
6	3Y	1.019	0.141
7	GND	1.036	0.47
8	4Y	1.036	0.749
9	4A	1.006	1.007
10	5Y	0.8	1.007
11	5A	0.584	1.007
12	6Y	0.334	1.007
13	6A	0.141	0.969
14	V_{CC}	0.14	0.663
CONNECT CHIP BACK TO V_{CC} OR FLOAT			

Logic Diagram



$Y = \bar{A}$

Pad 14 = V_{CC}
Pad 7 = GND

Function Table

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

Rev 1.0
24/11/17

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} = 2.0V	-	No limit*	ns
		V_{CC} = 4.5V			
		V_{CC} = 6.0V			
* When V_{IN} = 50% V_{CC}, I_{CC} > 1mA.					

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]	
Maximum Positive-Going Input Threshold Voltage	$V_{T+\ MAX}$	2.0V	V_{OUT} = 0.1V $\lvert I_{OUT} \rvert$ ≤ 20µA	1.50	1.50	1.50	V
		3.0V		2.15	2.15	2.15	
		4.5V		3.15	3.15	3.15	
		6.0V		4.20	4.20	4.20	
Minimum Positive-Going Input Threshold Voltage	$V_{T+\ MIN}$	2.0V	V_{OUT} = 0.1V $\lvert I_{OUT} \rvert$ ≤ 20µA	1.0	0.95	0.95	V
		3.0V		1.5	1.45	1.45	
		4.5V		2.3	2.25	2.25	
		6.0V		3.0	2.95	2.95	
Maximum Negative-Going Input Threshold Voltage	$V_{T-\ MAX}$	2.0V	V_{OUT} = V_{CC} -0.1V $\lvert I_{OUT} \rvert$ ≤ 20µA	0.9	0.95	0.95	V
		3.0V		1.4	1.45	1.45	
		4.5V		2.0	2.05	2.05	
		6.0V		2.6	2.65	2.65	

DC Electrical Characteristics Continued (Voltages referenced to GND)

PARAMETER	SYMBOL	V_{CC}	CONDITIONS	LIMITS			UNITS
				25°C	85°C	FULL RANGE[4]	
Minimum Negative-Going Input Threshold Voltage	$V_{T- MIN}$	2.0V	$V_{OUT} = V_{CC}$ -0.1V $\lvert I_{OUT} \rvert \le 20\mu A$	0.3	0.3	0.3	V
		3.0V		0.5	0.5	0.5	
		4.5V		0.9	0.9	0.9	
		6.0V		1.2	1.2	1.2	
Maximum Hysteresis Voltage[4]	$V_{H MAX}$	2.0V	V_{OUT} = 0.1V or V_{CC} -0.1V $\lvert I_{OUT} \rvert \le 20\mu A$	1.20	1.20	1.20	V
		3.0V		1.65	1.65	1.65	
		4.5V		2.25	2.25	2.25	
		6.0V		3.00	3.00	3.00	
Minimum Hysteresis Voltage[3]	$V_{H MIN}$	2.0V	V_{OUT} = 0.1V or V_{CC} -0.1V $\lvert I_{OUT} \rvert \le 20\mu A$	0.20	0.20	0.20	V
		3.0V		0.25	0.25	0.25	
		4.5V		0.40	0.40	0.40	
		6.0V		0.50	0.50	0.50	
Minimum High-Level Output Voltage	V_{OH}	2.0V	$V_{IN} \le V_{T- MIN}$ $\lvert I_{OUT} \rvert \le 20\mu A$	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	$V_{IN} \le V_{T- MIN}$ $\lvert I_{OUT} \rvert \le 2.4mA$	2.48	2.34	2.34	V
		4.5V	$V_{IN} \le V_{T- MIN}$ $\lvert I_{OUT} \rvert \le 4.0mA$	3.98	3.84	3.84	V
		6.0V	$V_{IN} \le V_{T- MIN}$ $\lvert I_{OUT} \rvert \le 5.2mA$	5.48	5.34	5.34	V
Maximum Low-Level Output Voltage	V_{OL}	2.0V	$V_{IN} \ge V_{T+ MAX}$ $\lvert I_{OUT} \rvert \le 20\mu A$	0.1	0.1	0.1	V
		4.5V		0.1	0.1	0.1	
		6.0V		0.1	0.1	0.1	
		3.0	$V_{IN} \ge V_{T+ MAX}$ $\lvert I_{OUT} \rvert \le 2.4mA$	0.26	0.33	0.33	V
		4.5V	$V_{IN} \ge V_{T+ MAX}$ $\lvert I_{OUT} \rvert \le 4.0mA$	0.26	0.33	0.33	V
		6.0V	$V_{IN} \ge V_{T+ MAX}$ $\lvert I_{OUT} \rvert \le 5.2mA$	0.26	0.33	0.33	V
Maximum Input Leakage Current	I_{IN}	6.0V	$V_{IN} = V_{CC}$ or GND	±0.1	±1.0	±1.0	µA
Maximum Quiescent Supply Current	I_{CC}	6.0V	$V_{IN} = V_{CC}$ or GND, I_{OUT} = 0µA	1.0	10	10	µA

4. $0^{\circ}C \le T_J \le +85^{\circ}C$ **5.** $V_{H MIN} > (V_{T+ MIN}) - (V_{T- MAX})$; $V_{H MAX} = (V_{T+ MAX}) + (V_{T- MIN})$

AC Electrical Characteristics[6]

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)	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 Transition Time, Any Output (Figure 1)	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	
Maximum Input Capacitance	C_{IN}	-	-	10	10	10	pF
Power Dissipation Capacitance[7]	C_{PD}	-	T_J = 25°C, V_{CC} = 5.0V	TYPICAL			pF
				22			

6. Not production tested in die form, characterized by chip design and tested in package LAT.
7. Used to determine the no-load dynamic power consumption: $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$.

Switching Waveform

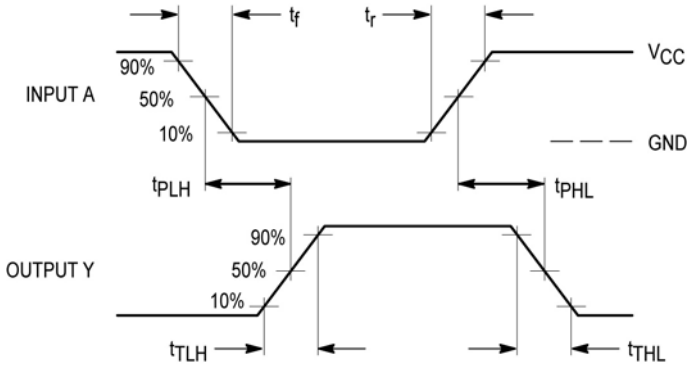
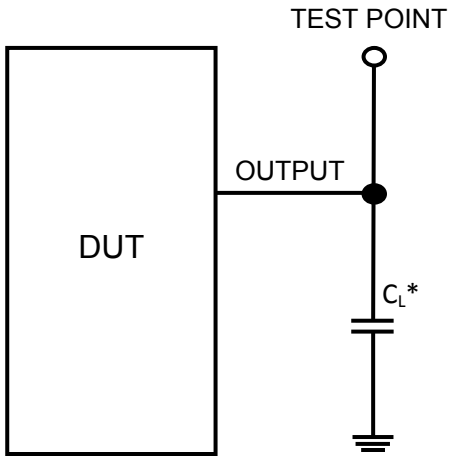


Figure 1 – Propagation Delay, Transition Timing

Test Circuit



* Includes all probe and jig capacitance