Advanced CMOS Logic – 74AC14

Hex Schmitt-Trigger Inverter Logic IC in bare die form

Rev 1.0
15/02/22

Description

The 74AC14 Hex Schmitt-Trigger Inverter is fabricated using a 1.5µm 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 74AC14 is useful in noisy environments.

Features:

- Outputs Sink/Source 24mA
- Low Input Current: 1µA
- Outputs directly interface CMOS, NMOS and TTL
- Operating Voltage Range: 2V to 6V
- CMOS High Noise Immunity
- Function compatible with 74HC14 or 74LS14
- Full Military Temperature Range.

Ordering Information

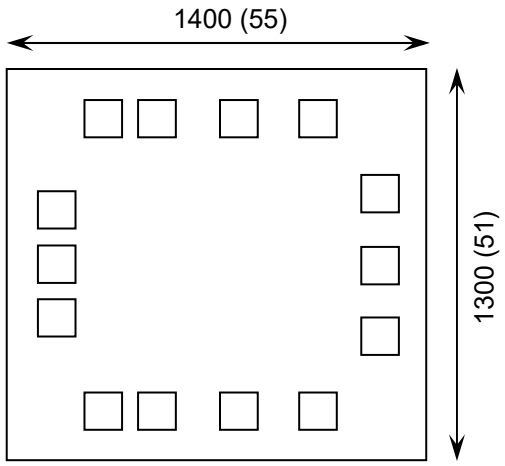
The following part suffixes apply:

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

For High Reliability versions of this product please see

54AC14

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)	1400 x 1300 55 x 51	µm mils
Minimum Bond Pad Size	120 x 120 4.72 x 4.72	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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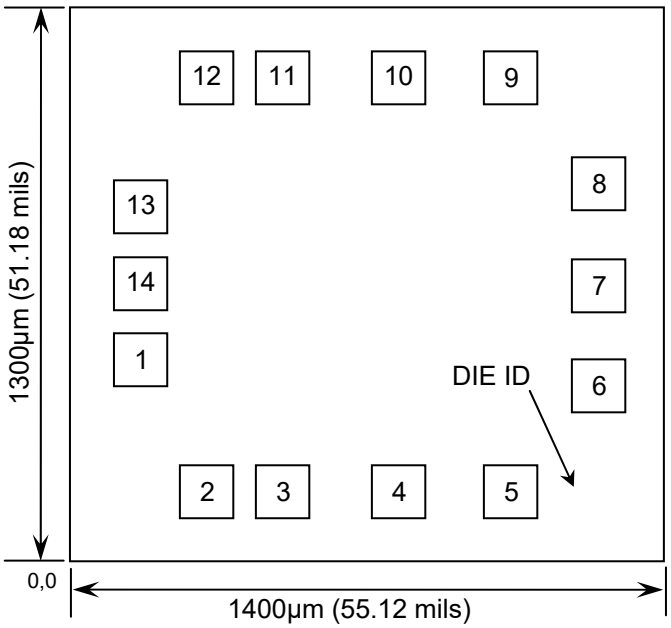
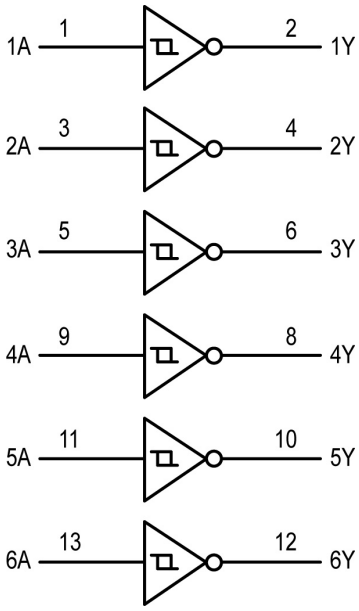
Pad Layout and Functions



PAD	FUNCTION	COORDINATES (mm)	
		X	Y
1	1A	0.100	0.411
2	1Y	0.256	0.100
3	2A	0.436	0.100
4	2Y	0.711	0.100
5	3A	0.975	0.100
6	3Y	1.180	0.35
7	GND	1.180	0.585
8	4Y	1.180	0.830
9	4A	0.975	1.080
10	5Y	0.711	1.080
11	5A	0.436	1.080
12	6Y	0.256	1.080
13	6A	0.100	0.775
14	V_{CC}	0.100	0.593
CONNECT CHIP BACK TO V_{CC}			

Logic Diagram



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)	

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}	±50	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
DC 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	-40	+85	°C
Output Current – High		I_{OH}	-	-24	mA
Output Current – Low		I_{OL}	-	24	mA
Input Rise and Fall Time (Except Schmitt Inputs), V_{IN} from 30% to 70% V_{CC}	V_{CC} = 3.0V	t_r, t_f	0	150	ns/V
	V_{CC} = 4.5V		0	40	
	V_{CC} = 5.5V		0	24	

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 Threshold	V_{T+}	3.0V	V_{OUT} = 0.1V	2.2	2.2	2.2	V
		4.5V		3.2	3.2	3.2	
		5.5V		3.9	3.9	3.9	
Minimum Negative Threshold	V_{T-}	3.0V	V_{OUT} = 0.1V	0.5	0.5	0.5	V
		4.5V		0.9	0.9	0.9	
		5.5V		1.1	1.1	1.1	

4. -40˚C ≤ T_J ≤ +85˚C

DC Electrical Characteristics Continued (Voltages Referenced to GND)

PARAMETER	SYMBOL	V_{CC}	CONDITIONS	LIMITS			UNITS
				25°C	85°C	FULL RANGE[4]	
Maximum Hysteresis Voltage[5]	$V_{H\ MAX}$	3.0V	V_{OUT} = 0.1V or V_{CC} -0.1V	1.2	1.2	1.2	V
		4.5V		1.4	1.4	1.4	V
		5.5V		1.6	1.6	1.6	V
Minimum Hysteresis Voltage[5]	$V_{H\ MIN}$	3.0V	V_{OUT} = 0.1V or V_{CC} -0.1V	0.3	0.3	0.3	V
		4.5V		0.4	0.4	0.4	V
		5.5V		0.5	0.5	0.5	V
Minimum High-Level Output Voltage	V_{OH}	3.0V	$I_{OUT} \leq$ -50µA	2.9	2.9	2.9	V
		4.5V		4.4	4.4	4.4	
		5.5V		5.4	5.4	5.4	
		3.0V	$V_{IN} \leq V_{T-}$ min, I_{OH} = -12mA[6]	2.56	2.46	2.46	
		4.5V	$V_{IN} \leq V_{T-}$ min, I_{OH} = -24mA[6]	3.86	3.76	3.76	
		5.5V	$V_{IN} \leq V_{T-}$ min, I_{OH} = -24mA[6]	4.86	4.76	4.76	
		5.5V	$V_{IN} \leq V_{T-}$ min, I_{OH} = -75mA[7]	-	-	3.85	
Maximum Low-Level Output Voltage	V_{OL}	3.0V	$I_{OUT} \leq$ 50µA	0.1	0.1	0.1	V
		4.5V		0.1	0.1	0.1	
		5.5V		0.1	0.1	0.1	
		3.0V	$V_{IN} \geq V_{T-}$ min, I_{OL} = 12mA[6]	0.36	0.44	0.44	
		4.5V	$V_{IN} \geq V_{T-}$ min, I_{OL} = 24mA[6]	0.36	0.44	0.44	
		5.5V	$V_{IN} \geq V_{T-}$ min, I_{OL} = 24mA[6]	0.36	0.44	0.44	
		5.5V	$V_{IN} \geq V_{T-}$ min, I_{OL} = 75mA[7]	-	-	1.65	
Maximum Input Leakage Current	I_{IN}	5.5V	V_{IN} = V_{CC} or GND	±0.1	±1.0	±1.0	µA
Minimum Dynamic Output Current[8]	I_{OLD}	5.5V	V_{OLD} = 1.65V Max	-	75	75	mA
	I_{OHD}	5.5V	V_{OHD} = 3.85V Min	-	-75	-75	
Maximum Quiescent Supply Current	I_{CC}	5.5V	V_{IN} = V_{CC} or GND	4	40	40	µA

5. $V_H = (V_{T+}) - (V_{T-})$ **6.** All outputs loaded; thresholds on input associated with output under test. **7.** Test time 1sec max, measurement made by forcing indicated current and measuring voltage to minimize power dissipation. Test verifies a minimum 75Ω transmission-line drive capability at 85°C
8. Maximum test duration 2ms, one output loaded at a time.

AC Electrical Characteristics[9]

PARAMETER	SYMBOL	V_{CC}[10]	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}	3.3V	C_L = 50pF, Input t_r=t_f= 3ns	13.5	15.0	15.0	ns
		5.0V		10.0	11.0	11.0	
	t_{PHL}	3.3V	C_L = 50pF, Input t_r=t_f= 3ns	11.5	13.0	13.0	ns
		5.0V		8.5	9.5	9.5	
Maximum Input Capacitance	C_{IN}	5	-	4.5	4.5	4.5	pF
Power Dissipation Capacitance Per Gate[11]	C_{PD}	-	T_A = 25°C, V_{CC} =5.0V	TYPICAL			pF
				25			

9. Not production tested in die form, characterized by chip design and tested in package. **10.** ± 10% **11.** Used to determine the no-load dynamic power consumption: $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$.

Switching Waveform

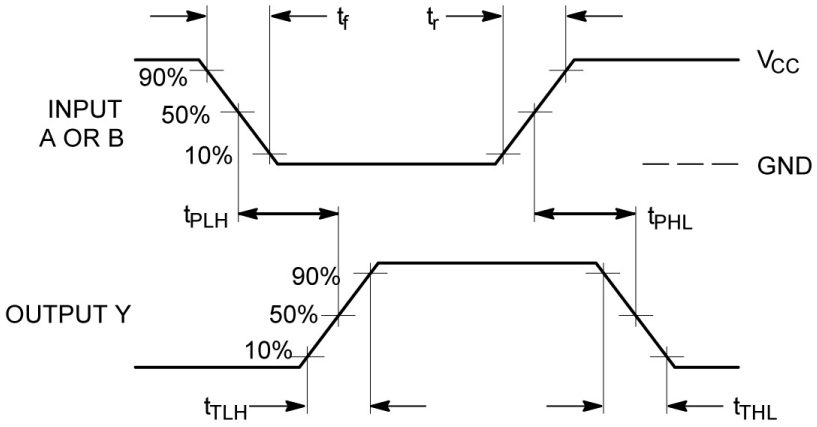
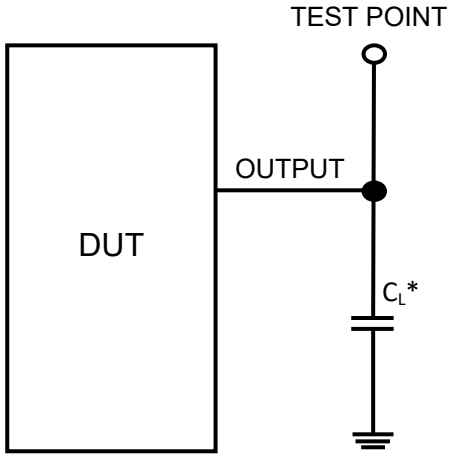


Figure 1 – Propagation Delay & Output Transition Time

Test Circuit



* Includes all probe and jig capacitance

Figure 2