TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74HC14AP, TC74HC14AF

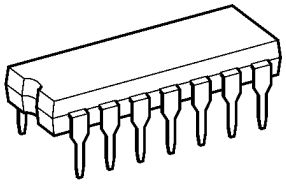
Hex Schmitt Inverter

The TC74HC14A is a high speed CMOS SCHMITT INVERTER fabricated with silicon gate C^2MOS technology.

It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation. Pin configuration and function are the same as the TC74HC04A but the inputs have 25% V_{CC} hysteresis and with its schmitt trigger function, the TC74HC14A can be used as a line receivers which will receive slow input signals.

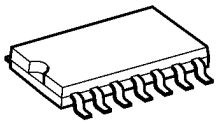
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

TC74HC14AP



DIP14-P-300-2.54

TC74HC14AF



SOP14-P-300-1.27A

Weight

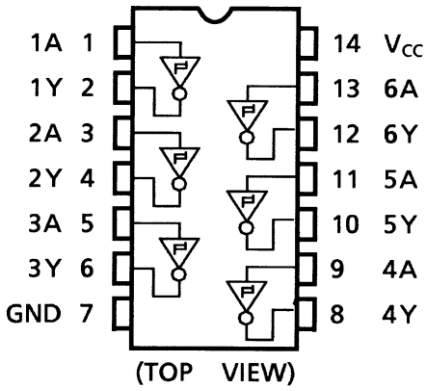
DIP14-P-300-2.54 : 0.96 g (typ.)

SOP14-P-300-1.27A : 0.18 g (typ.)

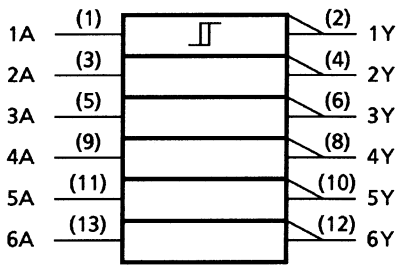
Features

- High speed: t_{pd} = 11 ns (typ.) at V_{CC} = 5 V
- Low power dissipation: I_{CC} = 1.0 μA (max) at Ta = 25°C
- High noise immunity: V_H = 1.1 V at V_{CC} = 4.5 V
- Output drive capability: 10 LSTTL loads
- Symmetrical output impedance: $|I_{OH}| = I_{OL}$ = 4 mA (min)
- Balanced propagation delays: $t_{pLH} \simeq t_{pHL}$
- Wide operating voltage range: V_{CC} (opr) = 2.0 to 6.0 V
- Pin and function compatible with 74LS14

Pin Assignment



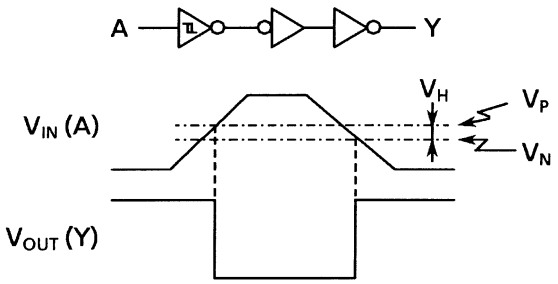
IEC Logic Symbol



Truth Table

A	Y
L	H
H	L

System Diagram, Waveform



Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	−0.5 to 7.0	V
DC input voltage	V_{IN}	−0.5 to V_{CC} + 0.5	V
DC output voltage	V_{OUT}	−0.5 to V_{CC} + 0.5	V
Input diode current	I_{IK}	±20	mA
Output diode current	I_{OK}	±20	mA
DC output current	I_{OUT}	±25	mA
DC V_{CC}/ground current	I_{CC}	±50	mA
Power dissipation	P_D	500 (DIP) (Note 2)/180 (SOP)	mW
Storage temperature	T_{stg}	−65 to 150	°C

Note 1: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.
Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook (“Handling Precautions”/“Derating Concept and Methods”) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 2: 500 mW in the range of Ta = −40°C to 65°C. From Ta = 65°C to 85°C a derating factor of −10 mW/°C shall be applied until 300 mW.

Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2.0 to 6.0	V
Input voltage	V_{IN}	0 to V_{CC}	V
Output voltage	V_{OUT}	0 to V_{CC}	V
Operating temperature	T_{opr}	−40 to 85	°C

Note: The operating ranges must be maintained to ensure the normal operation of the device.
Unused inputs must be tied to either V_{CC} or GND.

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C				Ta = −40 to 85°C		Unit
			V_{CC} (V)	Min	Typ.	Max		Min	Max	
Positive threshold voltage	V_P	—	2.0	1.0	1.25	1.50		1.0	1.50	V
			4.5	2.3	2.70	3.15		2.3	3.15	
			6.0	3.0	3.50	4.20		3.0	4.20	
Negative threshold voltage	V_N	—	2.0	0.30	0.65	0.9		0.30	0.9	V
			4.5	1.13	1.60	2.0		1.13	2.0	
			6.0	1.50	2.30	2.6		1.50	2.6	
Hysteresis voltage	V_H	—	2.0	0.3	0.6	1.0		0.3	1.0	V
			4.5	0.6	1.1	1.4		0.6	1.4	
			6.0	0.8	1.2	1.7		0.8	1.7	
High-level output voltage	V_{OH}	$V_{IN} = V_{IL}$	I_{OH} = −20 μA	2.0	1.9	2.0	—	1.9	—	V
				4.5	4.4	4.5	—	4.4	—	
				6.0	5.9	6.0	—	5.9	—	
			I_{OH} = −4 mA	4.5	4.18	4.31	—	4.13	—	
			I_{OH} = −5.2 mA	6.0	5.68	5.80	—	5.63	—	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH}$	I_{OL} = 20 μA	2.0	—	0.0	0.1	—	0.1	V
				4.5	—	0.0	0.1	—	0.1	
				6.0	—	0.0	0.1	—	0.1	
			I_{OL} = 4 mA	4.5	—	0.17	0.26	—	0.33	
			I_{OL} = 5.2 mA	6.0	—	0.18	0.26	—	0.33	
Input leakage current	I_{IN}	$V_{IN} = V_{CC}$ or GND		6.0	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC}$ or GND		6.0	—	—	1.0	—	10.0	μA

AC Characteristics (C_L = 15 pF, V_{CC} = 5 V, Ta = 25°C, input: t_r = t_f = 6 ns)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Output transition time	t_{TLH} t_{THL}	—	—	4	8	ns
Propagation delay time	t_{pLH} t_{pHL}	—	—	11	21	ns

AC Characteristics (C_L = 50 pF, input: t_r = t_f = 6 ns)

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = −40 to 85°C		Unit
			V_{CC} (V)	Min	Typ.	Max	Min	Max	
Output transition time	t_{TLH} t_{THL}	—	2.0	—	30	75	—	95	ns
			4.5	—	8	15	—	19	
			6.0	—	7	13	—	16	
Propagation delay time	t_{pLH} t_{pHL}	—	2.0	—	42	125	—	155	ns
			4.5	—	14	25	—	31	
			6.0	—	12	21	—	26	
Input capacitance	C_{IN}	—		—	5	10	—	10	pF
Power dissipation capacitance	C_{PD} (Note)	—		—	28	—	—	—	pF

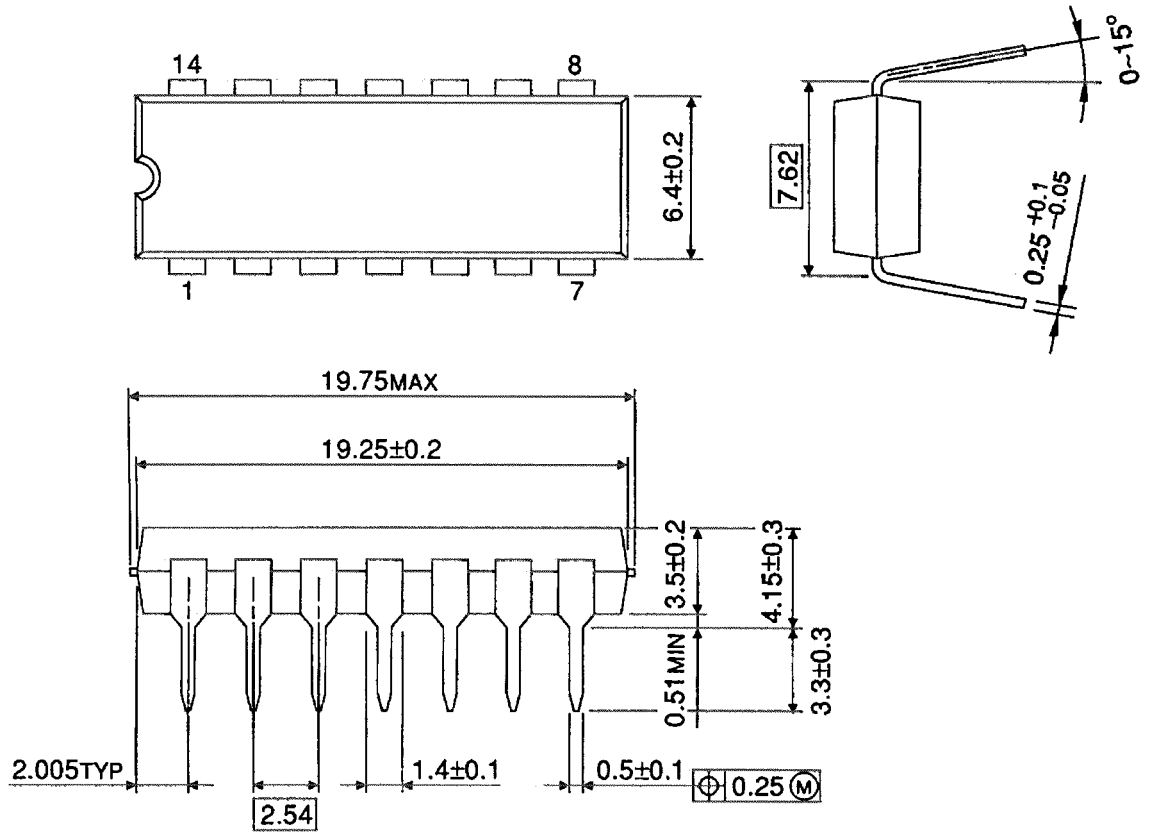
Note: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

$$I_{CC}\ (opr) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/6\ (\text{per 1 gate})$$

Package Dimensions

DIP14-P-300-2.54 Unit : mm

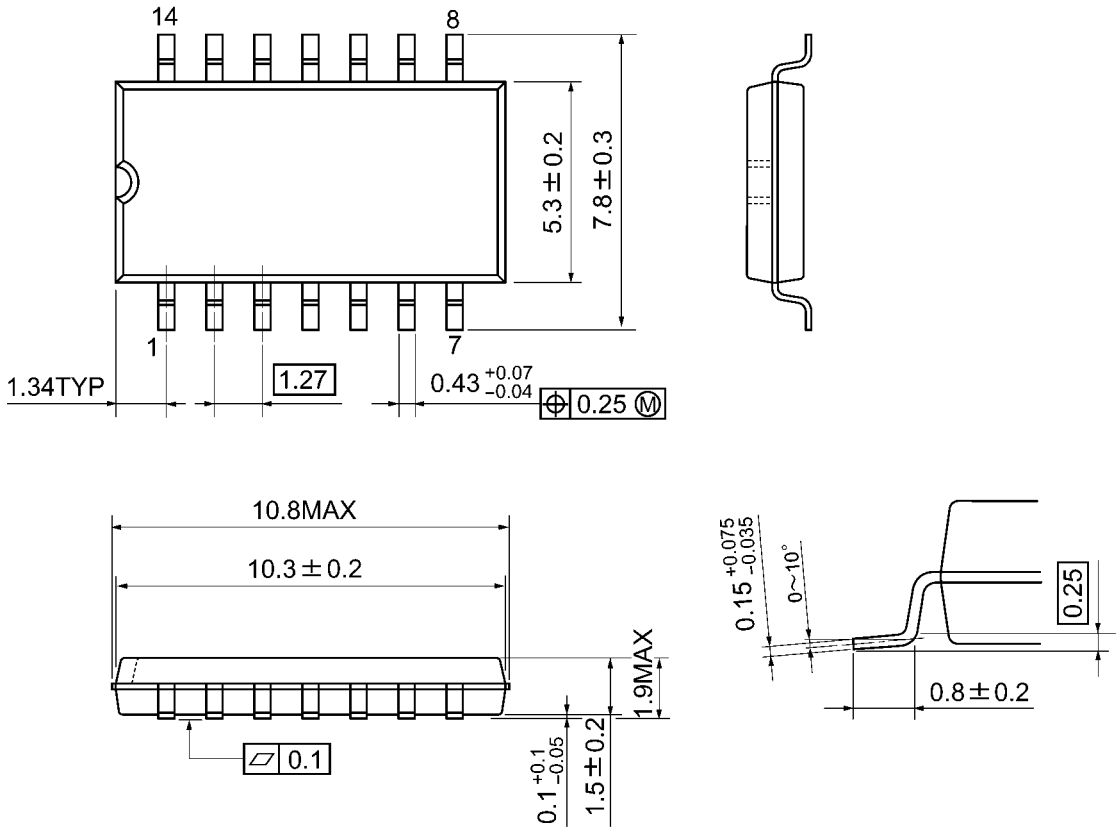


Weight: 0.96 g (typ.)

Package Dimensions

SOP14-P-300-1.27A

Unit: mm



Weight: 0.18 g (typ.)

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