

## TC74HC10AP, TC74HC10AF, TC74HC10AFN

### Triple 3-Input NAND Gate

The TC74HC10A is a high speed CMOS 3-INPUT NAND GATE fabricated with silicon gate C<sup>2</sup>MOS technology.

It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

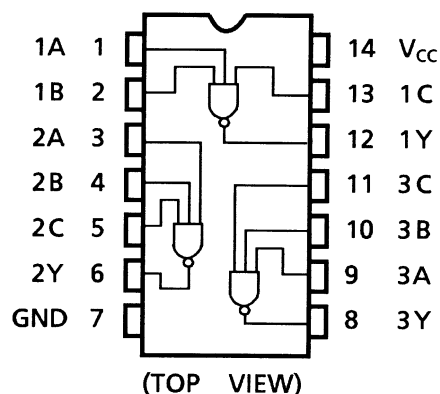
The internal circuit is composed of 3 stages including buffer output, which provide high noise immunity and stable output.

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

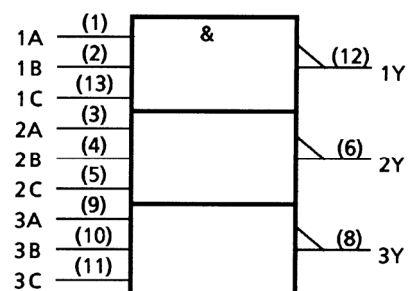
### Features

- High speed:  $t_{pd} = 6 \text{ ns (typ.)}$  at  $V_{CC} = 5 \text{ V}$
- Low power dissipation:  $I_{CC} = 1 \mu\text{A (max)}$  at  $T_a = 25^\circ\text{C}$
- High noise immunity:  $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (min)}$
- Output drive capability: 10 LSTTL loads
- Symmetrical output impedance:  $|I_{OH}| = I_{OL} = 4 \text{ mA (min)}$
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range:  $V_{CC} \text{ (opr)} = 2 \text{ to } 6 \text{ V}$
- Pin and function compatible with 74LS10

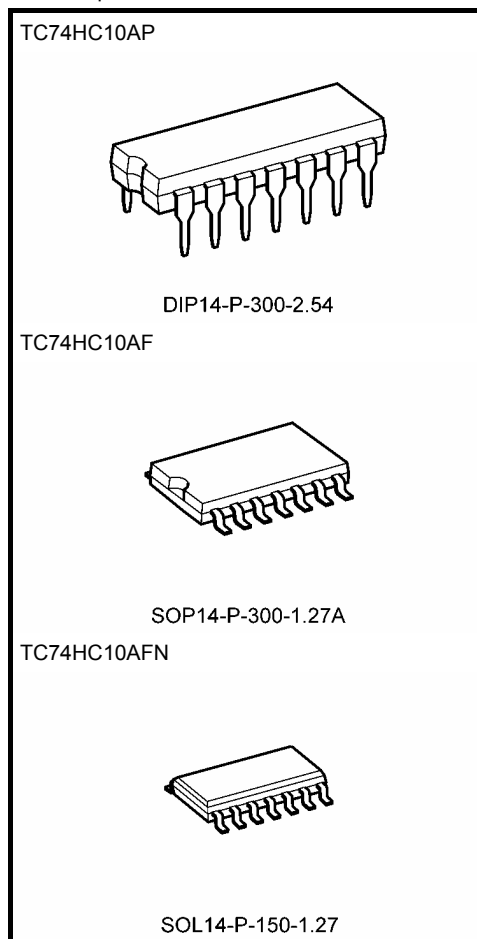
### Pin Assignment



### IEC Logic Symbol



Note: xxxFN (JEDEC SOP) is not available in Japan.



Weight	
DIP14-P-300-2.54	: 0.96 g (typ.)
SOP14-P-300-1.27A	: 0.18 g (typ.)
SOL14-P-150-1.27	: 0.12 g (typ.)

## Truth Table

A	B	C	Y
L	X	X	H
X	L	X	H
X	X	L	H
H	H	H	L

X: Don't care

## Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	$V_{CC}$	-0.5 to 7	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	$I_{IK}$	$\pm 20$	mA
Output diode current	$I_{OK}$	$\pm 20$	mA
DC output current	$I_{OUT}$	$\pm 25$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 50$	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  $T_a = -40$  to  $65^\circ\text{C}$ . From  $T_a = 65$  to  $85^\circ\text{C}$  a derating factor of  $-10\text{ mW}/^\circ\text{C}$  shall be applied until 300 mW.

## Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	2 to 6	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
Input rise and fall time	$t_r, t_f$	0 to 1000 ( $V_{CC} = 2.0\text{ V}$ ) 0 to 500 ( $V_{CC} = 4.5\text{ V}$ ) 0 to 400 ( $V_{CC} = 6.0\text{ V}$ )	ns

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 <sub>CC</sub> (V)	Min	Typ.	Max	Min	Max
High-level input voltage	V <sub>IH</sub>	—		2.0 4.5 6.0	1.50 3.15 4.20	— — —	— — —	1.50 3.15 4.20	V
Low-level input voltage	V <sub>IL</sub>	—		2.0 4.5 6.0	— — —	— — —	0.50 1.35 1.80	— — —	V
High-level output voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -20 µA	2.0 4.5 6.0	1.9 4.4 5.9	2.0 4.5 6.0	— — —	1.9 4.4 5.9	V
			I <sub>OH</sub> = -4 mA	4.5 6.0	4.18 5.68	4.31 5.80	— —	4.13 5.63	
			I <sub>OH</sub> = -5.2 mA	6.0	5.68	5.80	—	5.63	
Low-level output voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 20 µA	2.0 4.5 6.0	— — —	0.0 0.0 0.0	0.1 0.1 0.1	— — —	V
			I <sub>OL</sub> = 4 mA	4.5 6.0	— —	0.17 0.18	0.26 0.26	— —	
			I <sub>OL</sub> = 5.2 mA	6.0	—	0.18	0.26	—	
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		6.0	—	—	±0.1	—	±1.0 µA
Quiescent supply current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		6.0	—	—	1.0	—	10.0 µA

**AC Characteristics (C<sub>L</sub> = 15 pF, V<sub>CC</sub> = 5 V, Ta = 25°C, input: t<sub>r</sub> = t<sub>f</sub> = 6 ns)**

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Output transition time	t <sub>TLH</sub>	—	—	4	8	ns
	t <sub>THL</sub>					
Propagation delay time	t <sub>pLH</sub>	—	—	6	12	ns
	t <sub>pHL</sub>					

**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 <sub>CC</sub> (V)	Min	Typ.	Max	Min	Max
Output transition time	$t_{TLH}$ $t_{THL}$	—	2.0	—	25	75	—	95
			4.5	—	7	15	—	19
			6.0	—	6	13	—	16
Propagation delay time	$t_{pLH}$ $t_{pHL}$	—	2.0	—	27	75	—	95
			4.5	—	9	15	—	19
			6.0	—	8	13	—	16
Input capacitance	C <sub>IN</sub>	—	—	—	5	10	—	10
Power dissipation capacitance	C <sub>PD</sub> (Note)	—	—	—	23	—	—	—

Note: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

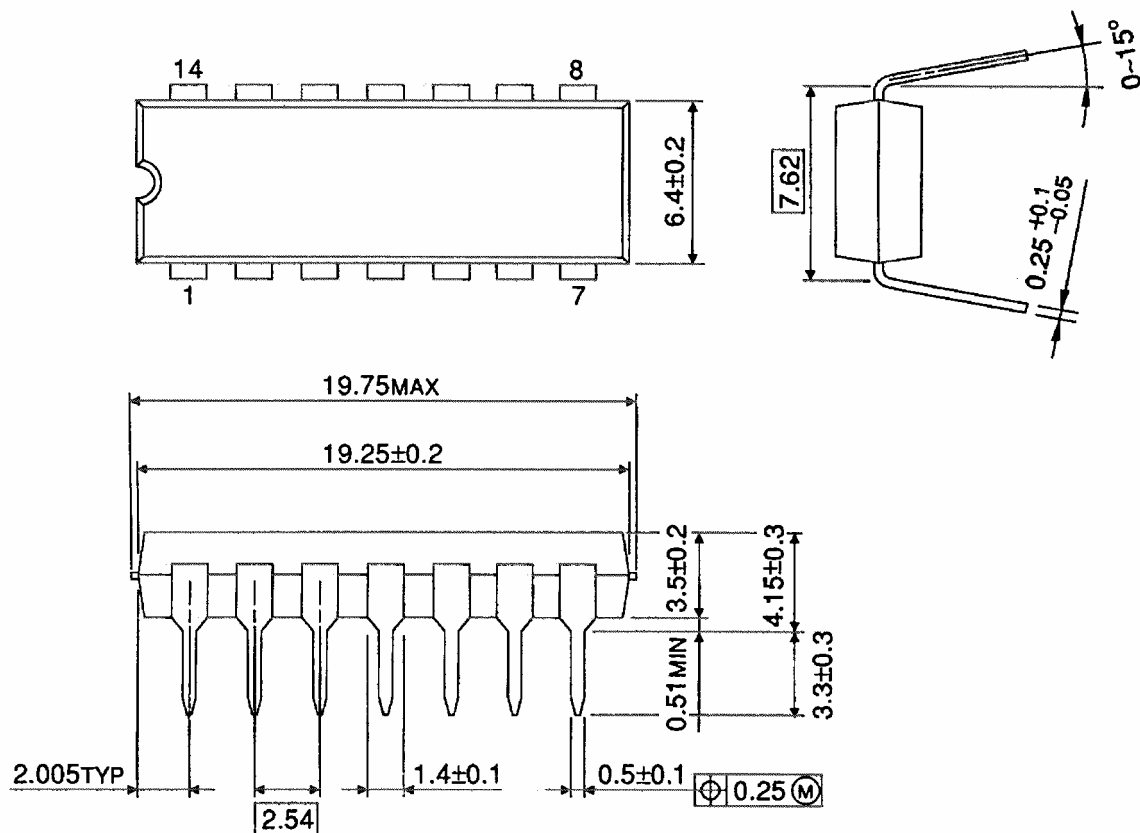
Average operating current can be obtained by the equation:

$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/4 \text{ (per gate)}$$

## Package Dimensions

DIP14-P-300-2.54

Unit : mm

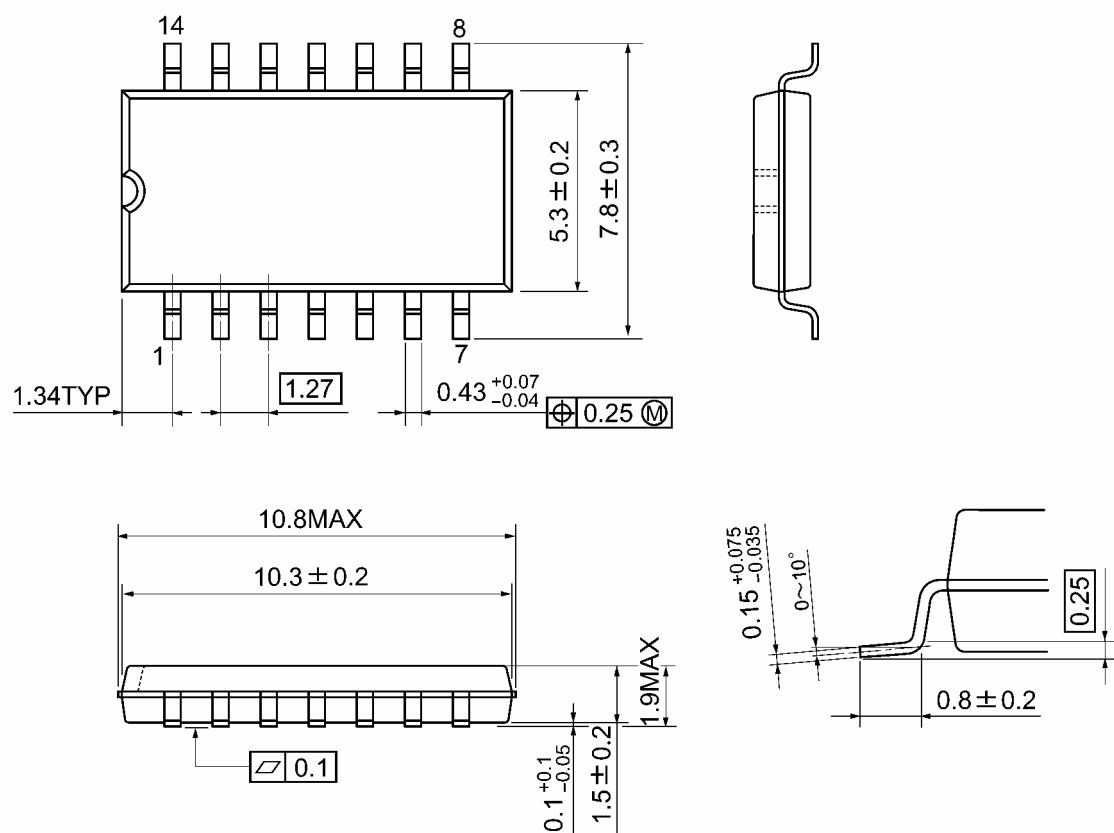


Weight: 0.96 g (typ.)

## Package Dimensions

SOP14-P-300-1.27A

Unit: mm

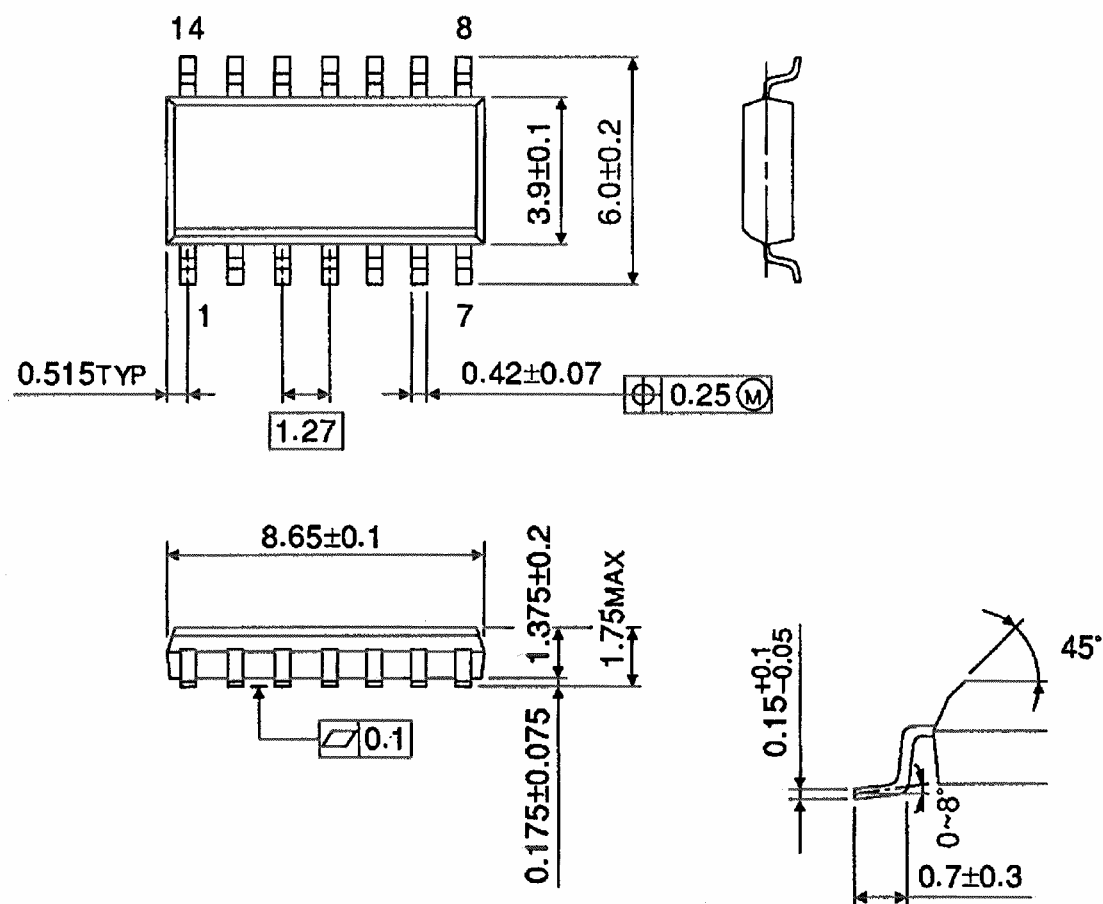


Weight: 0.18 g (typ.)

## Package Dimensions (Note)

SOL14-P-150-1.27

Unit : mm



Note: This package is not available in Japan.

Weight: 0.12 g (typ.)

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20070701-EN GENERAL

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