

# TC74HC4078AP, TC74HC4078AF

## 8-Input OR/NOR Gate

The TC74HC4078A is a high speed CMOS 8-INPUT NOR 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.

Output X is an 8-INPUT NOR, output Y is an 8-INPUT OR.

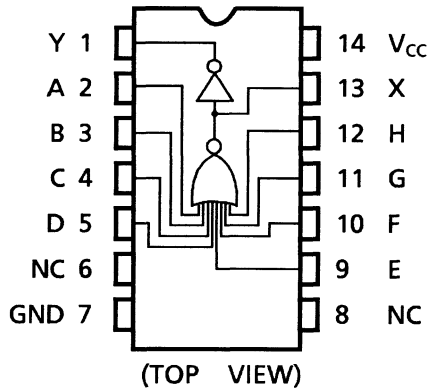
Each output has a buffer, which provide high noise immunity and stable output.

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

### Features

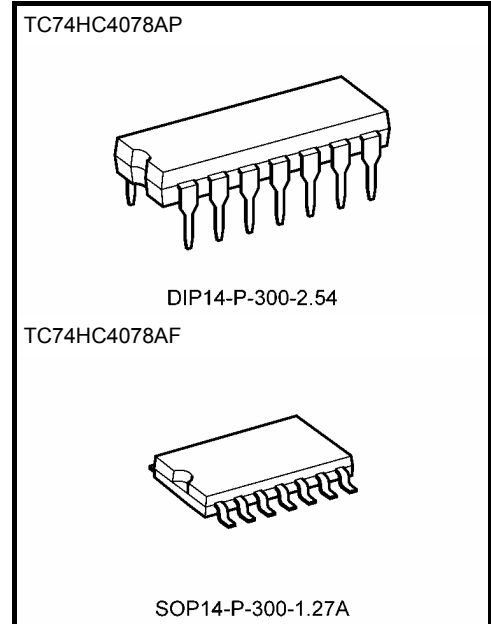
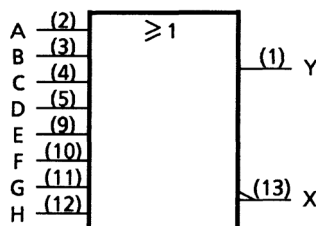
- High speed:  $t_{pd} = 13 \text{ ns}$  (typ.) at  $V_{CC} = 5 \text{ V}$
- Low power dissipation:  $I_{CC} = 1 \mu\text{A}$  (max) at  $T_a = 25^\circ\text{C}$
- High noise immunity:  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (min)
- Output drive capability: 10 LSTTL loads
- Symmetrical output impedance:  $|I_{OH}| = I_{OL} = 4 \text{ mA}$  (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 4078B

### Pin Assignment



NC: No connection

### IEC Logic Symbol



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

## Truth Table

Inputs A Through H	Outputs	
	X	Y
All Inputs L	H	L
All Other Combination	L	H

## 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	$^{\circ}C$

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  $65^{\circ}C$ . From  $T_a = 65$  to  $85^{\circ}C$  a derating factor of  $-10$  mW/ $^{\circ}C$  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	$^{\circ}C$
Input rise and fall time	$t_r, t_f$	0 to 1000 ( $V_{CC} = 2.0$ V) 0 to 500 ( $V_{CC} = 4.5$ V) 0 to 400 ( $V_{CC} = 6.0$ 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	1.50	—	—	1.50	—	V
				4.5	3.15	—	—	3.15	—	
				6.0	4.20	—	—	4.20	—	
Low-level input voltage	V <sub>IL</sub>	—		2.0	—	—	0.50	—	0.50	V
				4.5	—	—	1.35	—	1.35	
				6.0	—	—	1.80	—	1.80	
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	1.9	2.0	—	1.9	—	V
				4.5	4.4	4.5	—	4.4	—	
				6.0	5.9	6.0	—	5.9	—	
			I <sub>OH</sub> = -4 mA	4.5	4.18	4.31	—	4.13	—	
				6.0	5.68	5.80	—	5.63	—	
				I <sub>OH</sub> = -5.2 mA	4.5	—	—	—	—	
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	—	0.0	0.1	—	0.1	V
				4.5	—	0.0	0.1	—	0.1	
				6.0	—	0.0	0.1	—	0.1	
			I <sub>OL</sub> = 4 mA	4.5	—	0.17	0.26	—	0.33	
				6.0	—	0.18	0.26	—	0.33	
				I <sub>OL</sub> = 5.2 mA	4.5	—	—	—	—	
6.0	—	—	—	—	—	—				
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>	—	—	13	22	ns
	t <sub>pHL</sub>					

## AC Characteristics (C<sub>L</sub> = 50 pF, input: t<sub>r</sub> = t<sub>f</sub> = 6 ns)

Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40 to 85°C		Unit
				Min	Typ.	Max	Min	Max	
Output transition time	t <sub>TLH</sub>	—	2.0	—	30	75	—	95	ns
	t <sub>THL</sub>		4.5	—	8	15	—	19	
			6.0	—	7	13	—	16	
Propagation delay time	t <sub>pLH</sub>	—	2.0	—	50	130	—	165	ns
	t <sub>pHL</sub>		4.5	—	16	26	—	33	
			6.0	—	14	22	—	28	
Input capacitance	C <sub>IN</sub>	—	—	5	10	—	10	pF	
Power dissipation capacitance	C <sub>PD</sub>	(Note)	—	40	—	—	—	pF	

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.

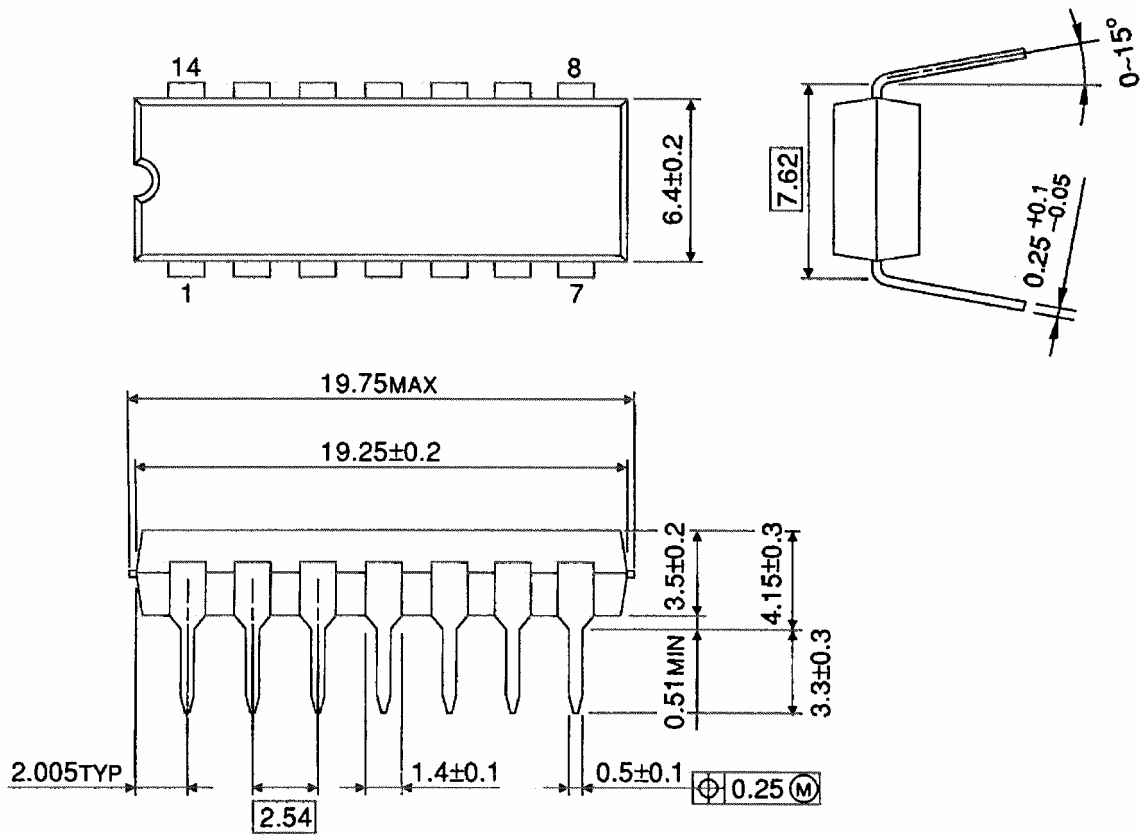
Average operating current can be obtained by the equation:

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

## Package Dimensions

DIP14-P-300-2.54

Unit : mm

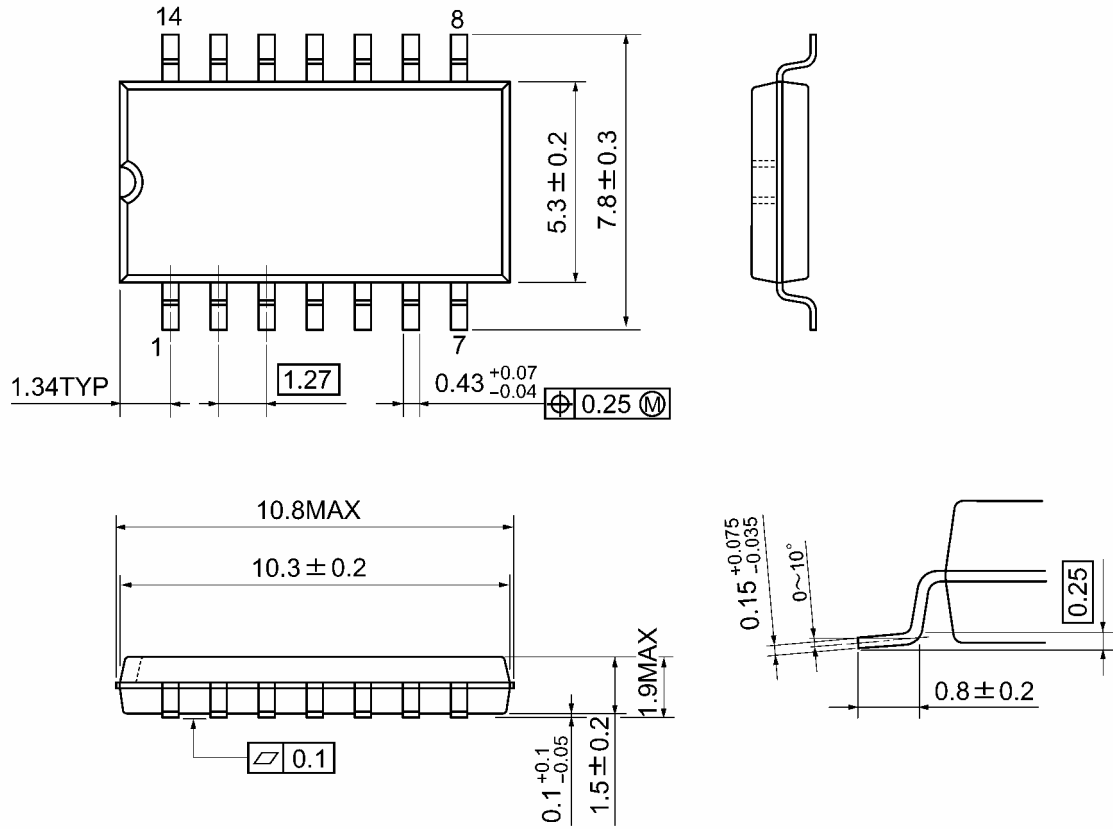


Weight: 0.96 g (typ.)

## Package Dimensions

SOP14-P-300-1.27A

Unit: mm



Weight: 0.18 g (typ.)

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20070701-EN GENERAL

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