

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC74VHCT32AF, TC74VHCT32AFK

## Quad 2-Input OR Gate

The TC74VHCT32A is an advanced high speed CMOS 2-INPUT OR GATE fabricated with silicon gate C<sup>2</sup>MOS technology.

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

The internal circuit is composed of 4 stages including buffer output, which provide high noise immunity and stable output.

The input voltage are compatible with TTL output voltage.

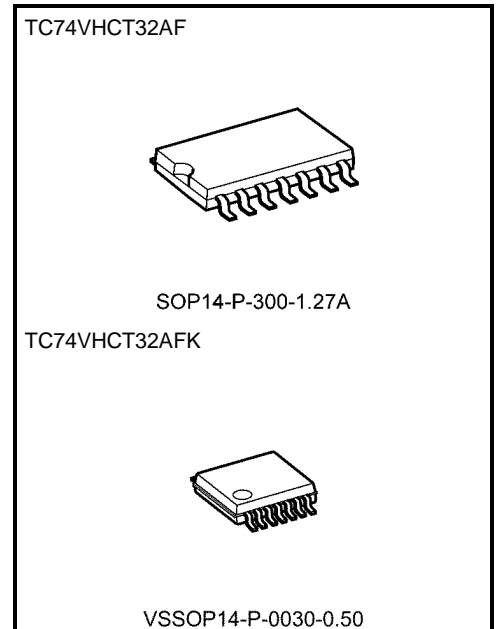
This device may be used as a level converter for interfacing 3.3 V to 5 V system.

Input protection and output circuit ensure that 0 to 5.5 V can be applied to the input and output (Note) pins without regard to the supply voltage. These structure prevents device destruction due to mismatched supply and input/output voltages such as battery back up, hot board insertion, etc.

Note:  $V_{CC} = 0\text{ V}$

## Features

- High speed:  $t_{pd} = 3.8\text{ ns (typ.)}$  at  $V_{CC} = 5\text{ V}$
- Low power dissipation:  $I_{CC} = 2\text{ }\mu\text{A (max)}$  at  $T_a = 25^\circ\text{C}$
- Compatible with TTL inputs:  $V_{IL} = 0.8\text{ V (max)}$   
 $V_{IH} = 2.0\text{ V (min)}$
- Power down protection is provided on all inputs and outputs.
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Low noise:  $V_{OLP} = 0.8\text{ V (max)}$
- Pin and function compatible with the 74 series (74AC/HC/F/ALS/LS etc.) 32 type.



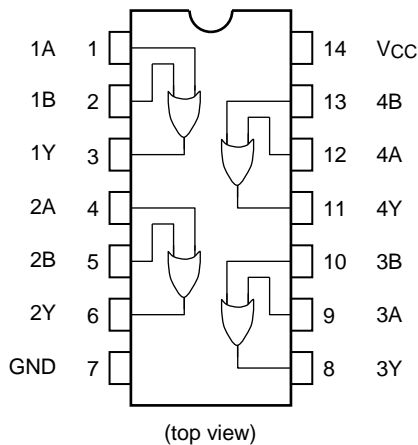
Weight

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

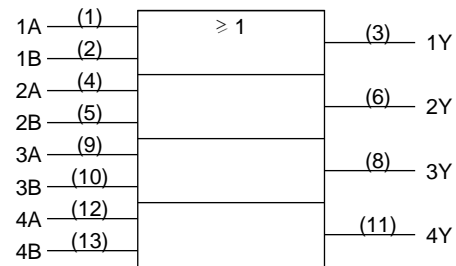
VSSOP14-P-0030-0.50: 0.02 g (typ.)

Start of commercial production  
1998-01

### Pin Assignment



### IEC Logic Symbol



### Truth Table

A	B	Y
H	H	H
L	H	H
H	L	H
L	L	L

### Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V <sub>CC</sub>	-0.5 to 7.0	V
DC input voltage	V <sub>IN</sub>	-0.5 to 7.0	V
DC output voltage	V <sub>OUT</sub>	-0.5 to 7.0 (Note 2)	V
		-0.5 to V <sub>CC</sub> + 0.5 (Note 3)	
Input diode current	I <sub>IK</sub>	-20	mA
Output diode current	I <sub>OK</sub>	±20 (Note 4)	mA
DC output current	I <sub>OUT</sub>	±25	mA
DC V <sub>CC</sub> /ground current	I <sub>CC</sub>	±50	mA
Power dissipation	P <sub>D</sub>	180	mW
Storage temperature	T <sub>stg</sub>	-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: V<sub>CC</sub> = 0 V

Note 3: High or low state. I<sub>OUT</sub> absolute maximum rating must be observed.

Note 4: V<sub>OUT</sub> < GND, V<sub>OUT</sub> > V<sub>CC</sub>

### Operating Ranges (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	4.5 to 5.5	V
Input voltage	V <sub>IN</sub>	0 to 5.5	V
Output voltage	V <sub>OUT</sub>	0 to 5.5 (Note 2)	V
		0 to V <sub>CC</sub> (Note 3)	
Operating temperature	T <sub>opr</sub>	-40 to 85	°C
Input rise and fall time	dt/dV	0 to 20	ns/V

Note 1: The operating ranges must be maintained to ensure the normal operation of the device.  
Unused inputs must be tied to either V<sub>CC</sub> or GND.

Note 2: V<sub>CC</sub> = 0 V

Note 3: High or low state

### Electrical Characteristics

#### DC Characteristics

Characteristics	Symbol	Test Condition	T <sub>a</sub> = 25°C			T <sub>a</sub> = -40 to 85°C		Unit		
			V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max	
High-level input voltage	V <sub>IH</sub>	—	4.5 to 5.5	2.0	—	—	2.0	—	V	
Low-level input voltage	V <sub>IL</sub>	—	4.5 to 5.5	—	—	0.8	—	0.8	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> = -50 μA	4.5	4.40	4.50	—	4.40	—	V
			I <sub>OH</sub> = -8 mA	4.5	3.94	—	—	3.80	—	
Low-level output voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OL</sub> = 50 μA	4.5	—	0.0	0.1	—	0.1	V
			I <sub>OL</sub> = 8 mA	4.5	—	—	0.36	—	0.44	
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = 5.5 V or GND	0 to 5.5	—	—	±0.1	—	±1.0	μA	
Quiescent supply current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5	—	—	2.0	—	20.0	μA	
	I <sub>CCCT</sub>	Per input: V <sub>IN</sub> = 3.4 V Other input: V <sub>CC</sub> or GND	5.5	—	—	1.35	—	1.50	mA	
Output leakage current (Power-OFF)	I <sub>OPD</sub>	V <sub>OUT</sub> = 5.5 V	0	—	—	0.5	—	5.0	μA	

### AC Characteristics (input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit	
		VCC (V)	CL (pF)	Min	Typ.	Max	Min	Max		
Propagation delay time	$t_{pLH}$	—	5.0 ± 0.5	15	—	3.8	5.5	1.0	6.5	ns
	$t_{pHL}$			50	—	5.3	7.5	1.0	8.5	
Input capacitance	CIN	—		—	4	10	—	10	pF	
Power dissipation capacitance	CPD	(Note)		—	14	—	—	—	pF	

Note: CPD 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:

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

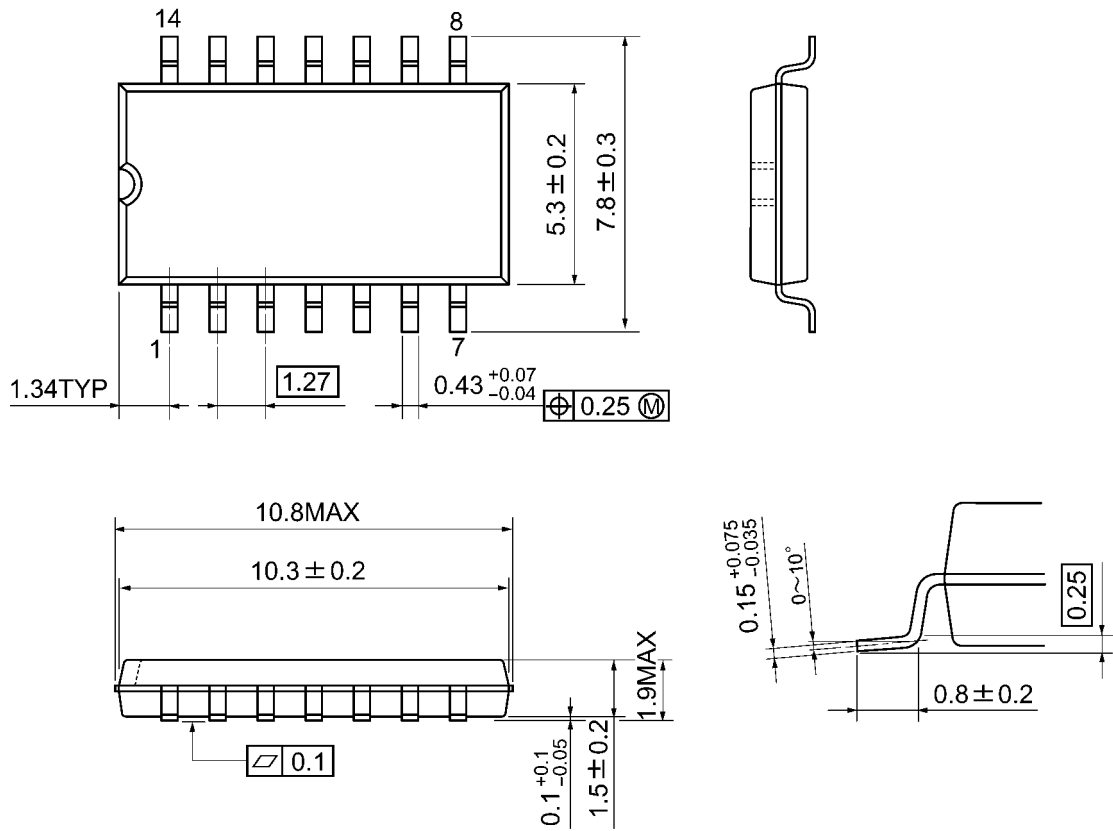
### Noise Characteristics (input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Test Condition	Ta = 25°C			Unit
			VCC (V)	Typ.	Limit	
Quiet output maximum dynamic VOL	VOLP	CL = 50 pF	5.0	0.4	0.8	V
Quiet output minimum dynamic VOL	VOLV	CL = 50 pF	5.0	-0.4	-0.8	V
Minimum high level dynamic input voltage	VIHD	CL = 50 pF	5.0	—	2.0	V
Maximum low level dynamic input voltage	VILD	CL = 50 pF	5.0	—	0.8	V

### Package Dimensions

SOP14-P-300-1.27A

Unit: mm

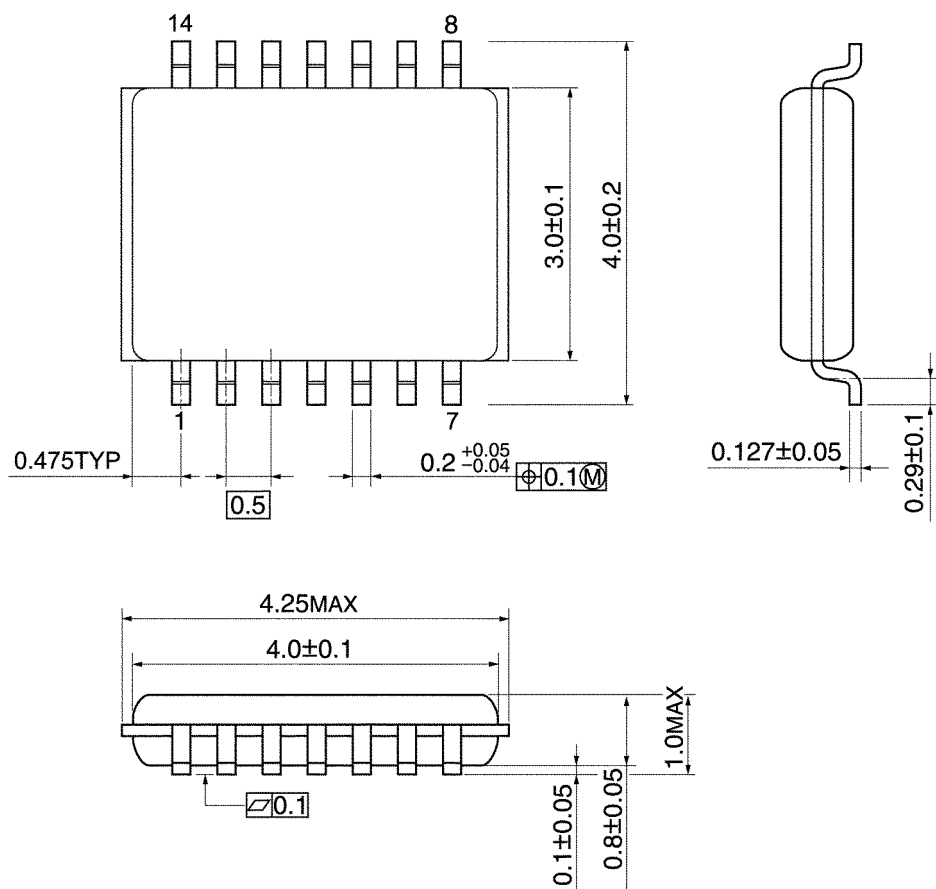


Weight: 0.18 g (typ.)

### Package Dimensions

VSSOP14-P-0030-0.50

Unit: mm



Weight: 0.02 g (typ.)

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