

**TC74VHCT32AF, TC74VHCT32AFT, 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.

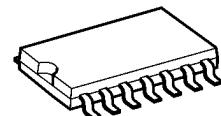
Input protection and output circuit ensure that 0 to 5.5 V can be applied to the input and output <sup>(Note)</sup> pins without regard to the supply voltage. These structure prevents device destruction due to mismatched supply and input/output voltages such as battery back up, hot board insertion, etc.

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

**Features**

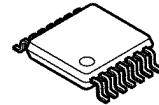
- High speed:  $t_{pd} = 3.8 \text{ ns (typ.)}$  at  $V_{CC} = 5 \text{ V}$
- Low power dissipation:  $I_{CC} = 2 \mu\text{A}$  (max) at  $T_a = 25^\circ\text{C}$
- Compatible with TTL inputs:  $V_{IL} = 0.8 \text{ V}$  (max)  
 $V_{IH} = 2.0 \text{ V}$  (min)
- Power down protection is provided on all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

TC74VHCT32AF



SOP14-P-300-1.27A

TC74VHCT32AFT



TSSOP14-P-0044-0.65A

TC74VHCT32AFK



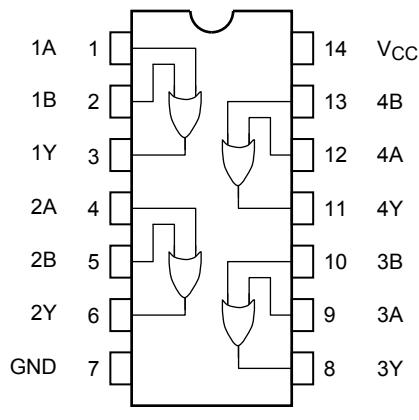
VSSOP14-P-0030-0.50

**Weight**

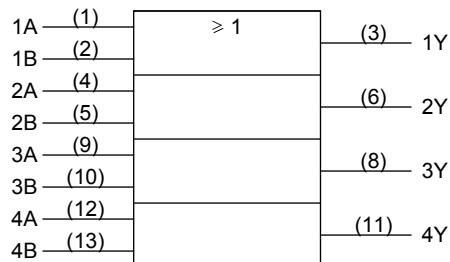
SOP14-P-300-1.27A: 0.18 g (typ.)  
TSSOP14-P-0044-0.65A: 0.06 g (typ.)  
VSSOP14-P-0030-0.50: 0.02 g (typ.)

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	$V_{CC}$	-0.5 to 7.0	V
DC input voltage	$V_{IN}$	-0.5 to 7.0	V
DC output voltage	$V_{OUT}$	-0.5 to 7.0 (Note 2)	V
		-0.5 to $V_{CC} + 0.5$ (Note 3)	
Input diode current	$I_{IK}$	-20	mA
Output diode current	$I_{OK}$	$\pm 20$ (Note 4)	mA
DC output current	$I_{OUT}$	$\pm 25$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 50$	mA
Power dissipation	$P_D$	180	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:  $V_{CC} = 0$  V

Note 3: High or low state.  $I_{OUT}$  absolute maximum rating must be observed.

Note 4:  $V_{OUT} < GND$ ,  $V_{OUT} > V_{CC}$

## Operating Ranges (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	4.5 to 5.5	V
Input voltage	$V_{IN}$	0 to 5.5	V
Output voltage	$V_{OUT}$	0 to 5.5 (Note 2)	V
		0 to $V_{CC}$ (Note 3)	
Operating temperature	$T_{opr}$	-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  $V_{CC}$  or GND.

Note 2:  $V_{CC} = 0$  V

Note 3: High or low state

## Electrical Characteristics

## DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit	
				$V_{CC}$ (V)	Min	Typ.	Max	Min		
High-level input voltage	$V_{IH}$	—		4.5 to 5.5	2.0	—	—	2.0	—	V
Low-level input voltage	$V_{IL}$	—		4.5 to 5.5	—	—	0.8	—	0.8	V
High-level output voltage	$V_{OH}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -50$ $\mu$ A	4.5	4.40	4.50	—	4.40	—	V
			$I_{OH} = -8$ mA	4.5	3.94	—	—	3.80	—	
Low-level output voltage	$V_{OL}$	$V_{IN} = V_{IL}$	$I_{OL} = 50$ $\mu$ A	4.5	—	0.0	0.1	—	0.1	V
			$I_{OL} = 8$ mA	4.5	—	—	0.36	—	0.44	
Input leakage current	$I_{IN}$	$V_{IN} = 5.5$ V or GND		0 to 5.5	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu$ A
Quiescent supply current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND		5.5	—	—	2.0	—	20.0	$\mu$ A
	$I_{CCT}$	Per input: $V_{IN} = 3.4$ V Other input: $V_{CC}$ or GND		5.5	—	—	1.35	—	1.50	mA
Output leakage current	$I_{OPD}$	$V_{OUT} = 5.5$ V		0	—	—	0.5	—	5.0	$\mu$ A

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

Characteristics	Symbol	Test Condition			Ta = 25°C			Ta = -40 to 85°C		Unit	
			V <sub>CC</sub> (V)	C <sub>L</sub> (pF)	Min	Typ.	Max	Min	Max		
Propagation delay time	t <sub>pLH</sub> t <sub>pHL</sub>	—	5.0 ± 0.5	15	—	3.8	5.5	1.0	6.5	ns	
				50	—	5.3	7.5	1.0	8.5		
Input capacitance	C <sub>IN</sub>	—			—	4	10	—	10	pF	
Power dissipation capacitance	C <sub>PD</sub>				(Note)	—	14	—	—	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:

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

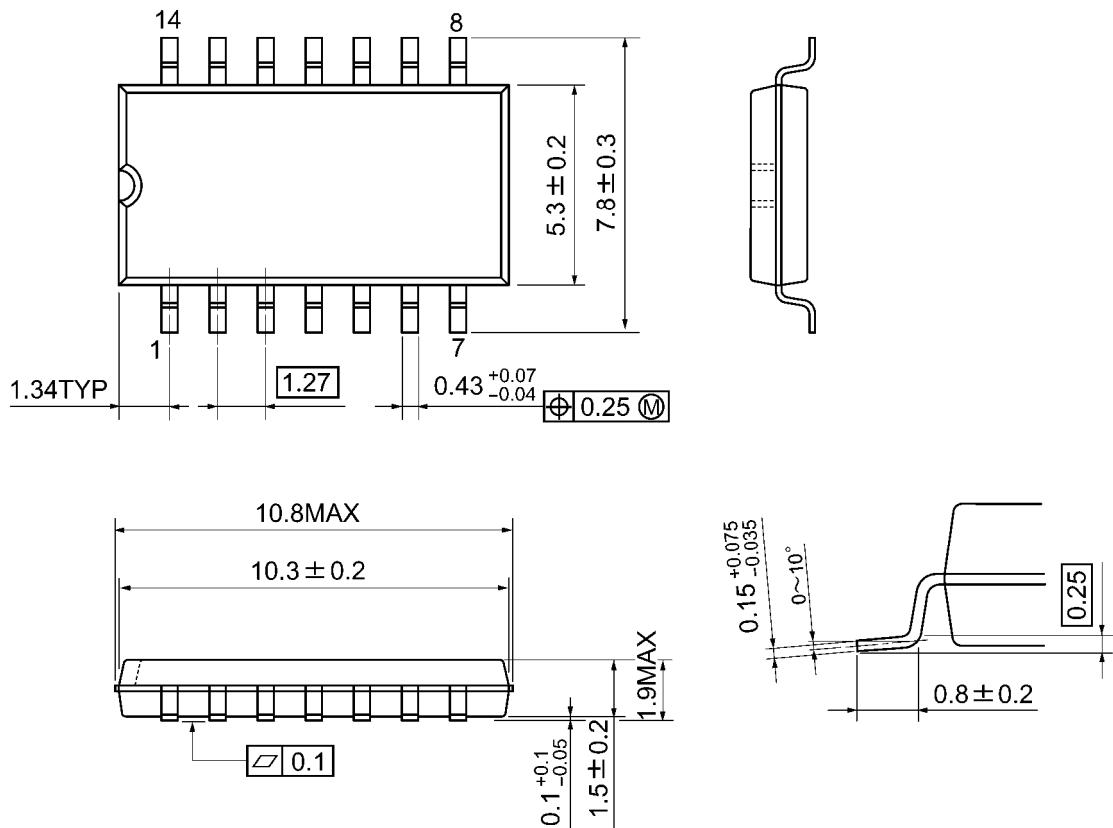
Noise Characteristics (input:  $t_r = t_f = 3$  ns)

Characteristics	Symbol	Test Condition			Ta = 25°C		Unit
				V <sub>CC</sub> (V)	Typ.	Limit	
Quiet output maximum dynamic V <sub>OL</sub>	V <sub>O LP</sub>	C <sub>L</sub> = 50 pF		5.0	0.4	0.8	V
Quiet output minimum dynamic V <sub>OL</sub>	V <sub>O LV</sub>	C <sub>L</sub> = 50 pF		5.0	-0.4	-0.8	V
Minimum high level dynamic input voltage	V <sub>I HD</sub>	C <sub>L</sub> = 50 pF		5.0	—	2.0	V
Maximum low level dynamic input voltage	V <sub>I LD</sub>	C <sub>L</sub> = 50 pF		5.0	—	0.8	V

**Package Dimensions**

SOP14-P-300-1.27A

Unit: mm

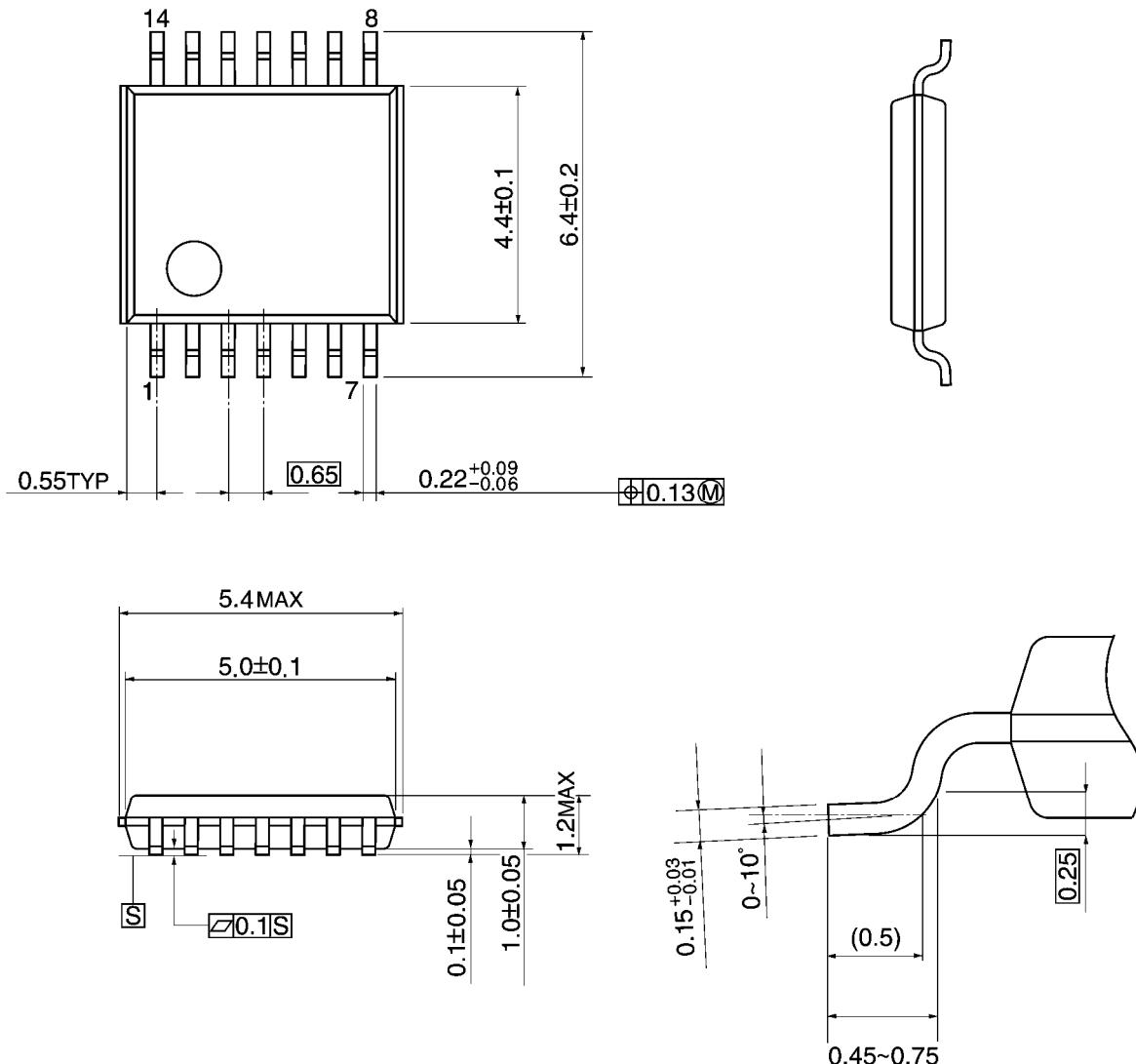


Weight: 0.18 g (typ.)

**Package Dimensions**

TSSOP14-P-0044-0.65A

Unit: mm

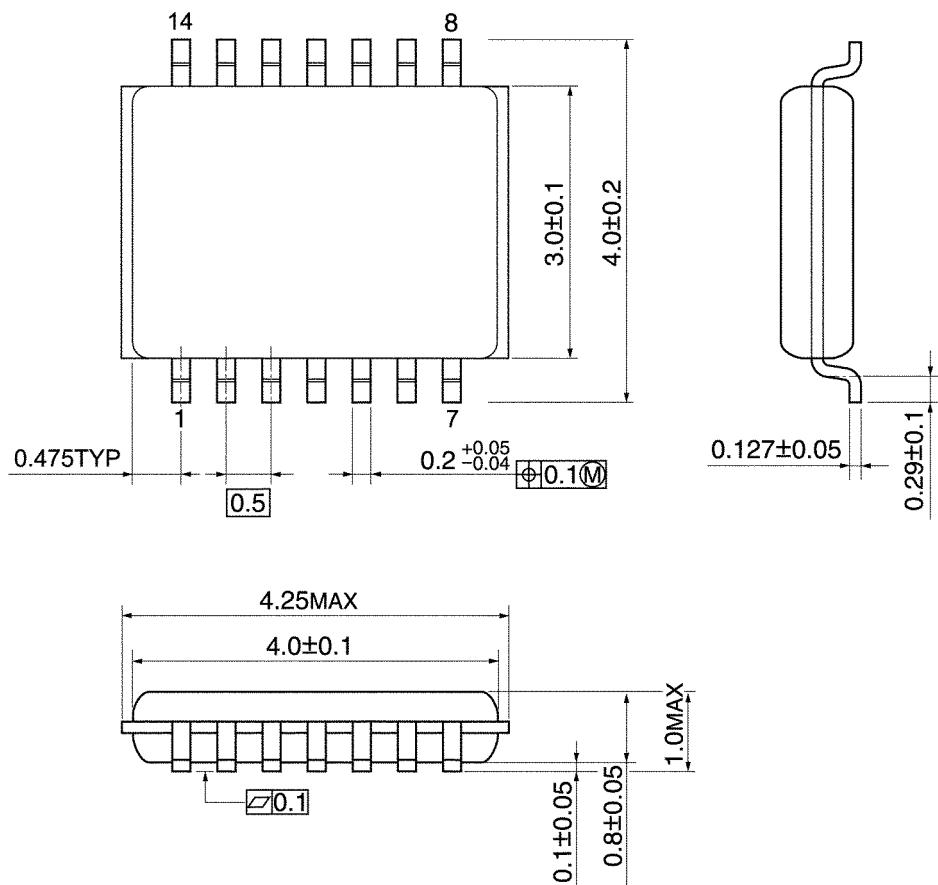


Weight: 0.06 g (typ.)

**Package Dimensions**

VSSOP14-P-0030-0.50

Unit: mm



Weight: 0.02 g (typ.)

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