TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC74LCX32F,TC74LCX32FN,TC74LCX32FT

Low-Voltage Quad 2-Input OR Gate with 5-V Tolerant Inputs and Outputs

The TC74LCX32F/FN/FT is a high-performance CMOS 2-input OR gate. Designed for use in 3.3-V systems, it achieves high-speed operation while maintaining the CMOS low-power dissipation.

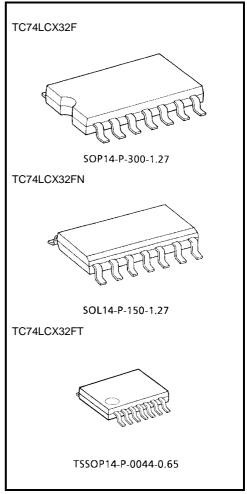
The device is designed for low-voltage (3.3 V) VCC applications, but it could be used to interface to 5-V supply environment for inputs.

All inputs are equipped with protection circuits against static discharge.

#### **Features**

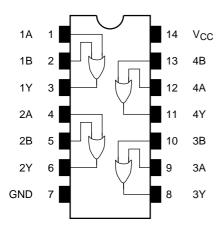
- Low-voltage operation: V<sub>CC</sub> = 2.0 to 3.6 V
- High-speed operation:  $t_{pd} = 5.5 \text{ ns (max) (VCC} = 3.0 \text{ to } 3.6 \text{ V)}$
- Output current:  $|I_{OH}|/I_{OL} = 24 \text{ mA (min)} (V_{CC} = 3.0 \text{ V})$
- Latch-up performance: ±500 mA
- Available in JEDEC SOP, JEITA SOP and TSSOP
- · Power-down protection provided on all inputs and outputs
- Pin and function compatible with the 74 series (74AC/VHC/HC/F/ALS/LS etc.) 32 type

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



Weight SOP14-P-300-1.27: 0.18 g (typ.) SOL14-P-150-1.27: 0.12 g (typ.) TSSOP14-P-0044-0.65: 0.06 g (typ.)

### Pin Assignment (top view)



### **IEC Logic Symbol**

1A — 1 1B — 2	≥ 1	3 1Y
2A — 4 2B — 5		6 2Y
3A — 9 3B — 10		8 3Y
4A 12 4B 13		11 4Y

#### **Truth Table**

Inputs		Outputs		
Α	В	Y		
L	L	L		
L	Н	Н		
Н	L	Н		
Н	Н	Н		

### **Maximum Ratings**

Characteristics	Symbol	Rating	Unit
Power supply voltage	V <sub>CC</sub>	-0.5 to 7.0	V
DC input voltage	V <sub>IN</sub>	-0.5 to 7.0	٧
		-0.5 to 7.0 (Note 1)	
DC output voltage	Vout	$-0.5$ to $V_{CC} + 0.5$	V
		(Note 2)	
Input diode current	I <sub>IK</sub>	-50	mA
Output diode current	lok	±50 (Note 3)	mA
DC output current	lout	±50	mA
Power dissipation	P <sub>D</sub>	180	mW
DC V <sub>CC</sub> /ground current	I <sub>CC</sub> /I <sub>GND</sub>	±100	mA
Storage temperature	T <sub>stg</sub>	-65 to 150	°C

Note 1:  $V_{CC} = 0 V$ 

Note 2: High or low state.  $I_{\mbox{OUT}}$  absolute maximum rating must be observed.

Note 3:  $V_{OUT} < GND$ ,  $V_{OUT} > V_{CC}$ 



### **Recommended Operating Conditions**

Characteristics	Symbol	Rating	Unit	
Power supply voltage	V <sub>CC</sub>	2.0 to 3.6	V	
Fower supply voltage	vCC	1.5 to 3.6 (Note 4)	V	
Input voltage	V <sub>IN</sub>	0 to 5.5	V	
Output voltage	Vout	0 to 5.5 (Note 5)	V	
		0 to V <sub>CC</sub> (Note 6)	V	
Output current	I <sub>OH</sub> /I <sub>OL</sub>	±24 (Note 7)	mA	
Output current	IOH/IOL	±12 (Note 8)	IIIA	
Operating temperature	T <sub>opr</sub>	-40 to 85	°C	
Input rise and fall time	dt/dv	0 to 10 (Note 9)	ns/V	

Note 4: Data retention only

Note 5:  $V_{CC} = 0 \text{ V}$ 

Note 6: High or low state

Note 7:  $V_{CC} = 3.0 \text{ to } 3.6 \text{ V}$ 

Note 8:  $V_{CC} = 2.7 \text{ to } 3.0 \text{ V}$ 

Note 9:  $V_{IN} = 0.8 \text{ to } 2.0 \text{ V}, V_{CC} = 3.0 \text{ V}$ 

#### **Electrical Characteristics**

### DC Characteristics ( $Ta = -40 \text{ to } 85^{\circ}\text{C}$ )

Characteristi	teristics Symbol Test Condition			Min	Max	Unit		
Onaracionsti	<b>C</b> 3	Cymbol	1031 0	orianion	V <sub>CC</sub> (V)		IVIAX	Offic
Input voltage	H-level	V <sub>IH</sub>		_	2.7 to 3.6	2.0	_	V
input voltage	L-level	V <sub>IL</sub>		_ 2		_	0.8	V
				I <sub>OH</sub> = -100 μA	2.7 to 3.6	V <sub>CC</sub> - 0.2	_	
H-level	Voh	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	$I_{OH} = -12 \text{ mA}$	2.7	2.2	_		
				I <sub>OH</sub> = -18 mA	3.0	2.4	_	V
Output voltage				I <sub>OH</sub> = -24 mA	3.0	2.2	_	
L-level		V <sub>OL</sub>	$V_{IN} = V_{IL}$	I <sub>OL</sub> = 100 μA	2.7 to 3.6		0.2	
	Llovol			I <sub>OL</sub> = 12 mA	2.7	_	0.4	
	L-level			I <sub>OL</sub> = 16 mA	3.0	_	0.4	
				I <sub>OL</sub> = 24 mA	3.0		0.55	
Input leakage current		I <sub>IN</sub>	V <sub>IN</sub> = 0 to 5.5 V	•	2.7 to 3.6		±5.0	μΑ
Power-off leakage curr	ent	I <sub>OFF</sub>	$V_{IN}/V_{OUT} = 5.5 V$		0	_	10.0	μΑ
Quiescent supply current		Icc	V <sub>IN</sub> = V <sub>CC</sub> or GND		2.7 to 3.6	_	10.0	
			V <sub>IN</sub> = 3.6 to 5.5 V		2.7 to 3.6	_	±10.0	μΑ
Increase in Icc per inpu	ıt	Δlcc	$V_{IH} = V_{CC} - 0.6 V$		2.7 to 3.6	_	500	

3

#### AC Characteristics ( $Ta = -40 \text{ to } 85^{\circ}\text{C}$ )

Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Min	Max	Unit
Propagation delay time	t <sub>pLH</sub>	Figure 1, Figure 2	2.7		6.2	ns
	$t_{pHL}$		$3.3 \pm 0.3$	1.5	5.5	
Output to output skew	t <sub>osLH</sub>	(Note 10)	2.7		_	no
	$t_{osHL}$	(Note 10)	$3.3 \pm 0.3$	_	1.0	ns

Note 10: Parameter guaranteed by design.

 $(t_{OSLH} = |t_{DLHm} - t_{DLHn}|, t_{OSHL} = |t_{DHLm} - t_{DHLn}|)$ 

#### **Dynamic Switching Characteristics**

(Ta = 25°C, input:  $t_r = t_f = 2.5 \text{ ns}$ ,  $C_L = 50 \text{ pF}$ ,  $R_L = 500 \Omega$ )

Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Тур.	Unit
Quiet output maximum dynamic V <sub>OL</sub>	V <sub>OLP</sub>	$V_{IH} = 3.3 \text{ V}, V_{IL} = 0 \text{ V}$	3.3	8.0	٧
Quiet output minimum dynamic V <sub>OL</sub>	V <sub>OLV</sub>	$V_{IH} = 3.3 \text{ V}, V_{IL} = 0 \text{ V}$	3.3	8.0	٧

#### **Capacitive Characteristics (Ta = 25°C)**

Characteristics	Symbol	Test Condition		V <sub>CC</sub> (V)	Тур.	Unit
Input capacitance	C <sub>IN</sub>	_		3.3	7	pF
Output capacitance	C <sub>OUT</sub>	_		0	8	pF
Power dissipation capacitance	C <sub>PD</sub>	$f_{IN} = 10 \text{ MHz}$	Note 11)	3.3	25	pF

Note 11: 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:

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

#### **AC Test Circuit**

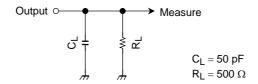


Figure 1

#### **AC Waveform**

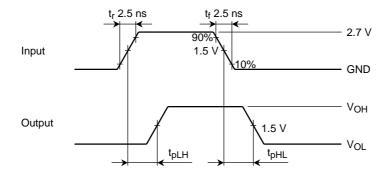
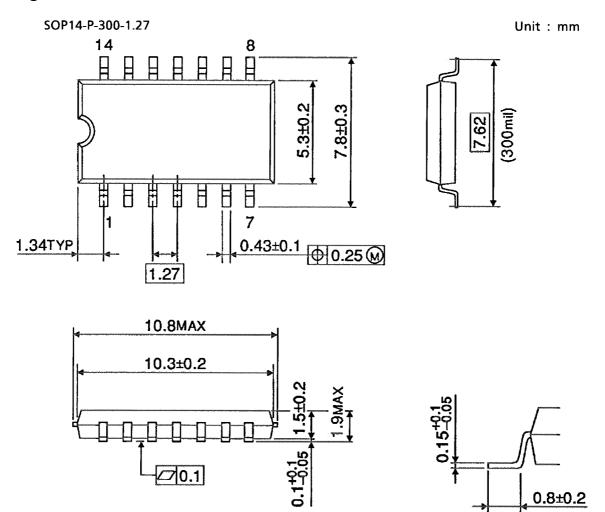


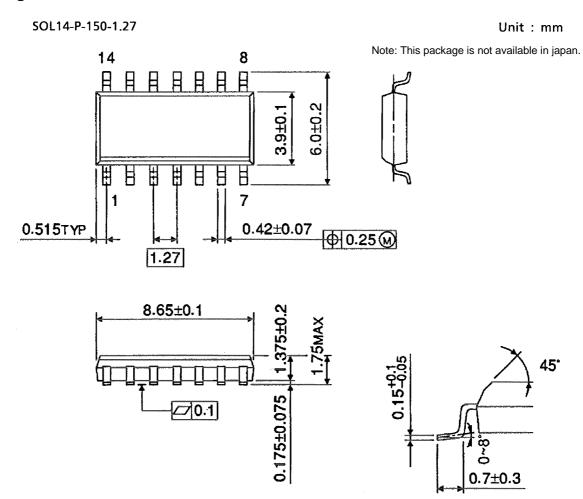
Figure 2 t<sub>pLH</sub>, t<sub>pHL</sub>

## **Package Dimensions**



Weight: 0.18 g (typ.)

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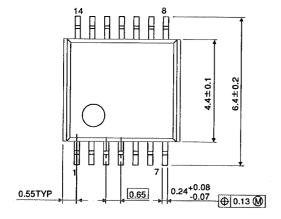


Weight: 0.12 g (typ.)

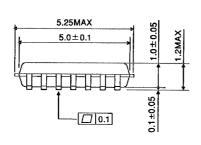
Unit: mm

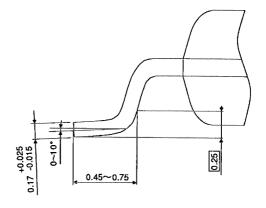
### **Package Dimensions**

TSSOP14-P-0044-0.65









Weight: 0.06 g (typ.)

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