

TC74LCX74F, TC74LCX74FN, TC74LCX74FT

Low-Voltage Dual D-Type Flip-Flop with 5-V Tolerant Inputs and Outputs

The TC74LCX74F/FN/FT is a high-performance CMOS D-type flip-flop. 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.

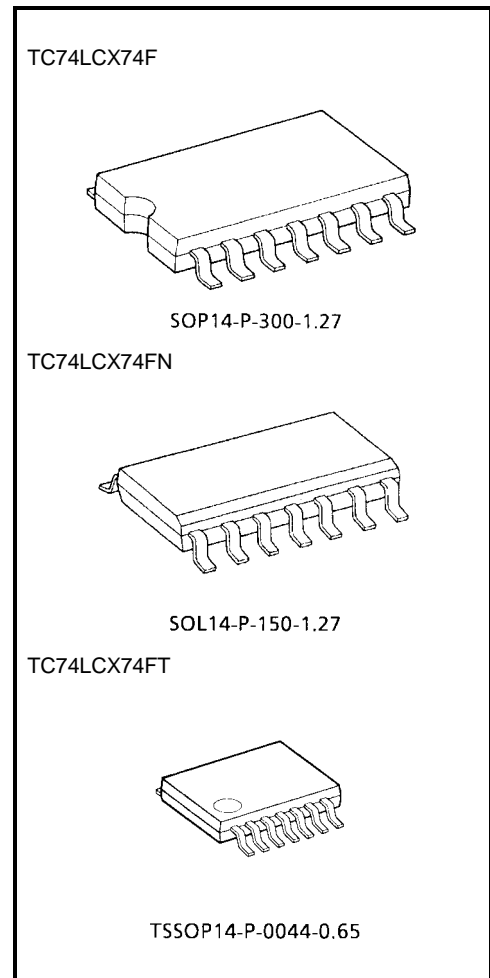
The signal level applied to the D input is transferred to Q output during the positive going transition of the CK pulse. CLR and PR are independent of the CK and are accomplished by setting the appropriate input low.

All inputs are equipped with protection circuits against static discharge.

Features

- Low-voltage operation: $V_{CC} = 2.0$ to 3.6 V
- High-speed operation: $t_{pd} = 7.0$ ns (max) ($V_{CC} = 3.0$ to 3.6 V)
- Output current: $|I_{OH}|/I_{OL} = 24$ mA (min) ($V_{CC} = 3.0$ 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.) 74 type

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



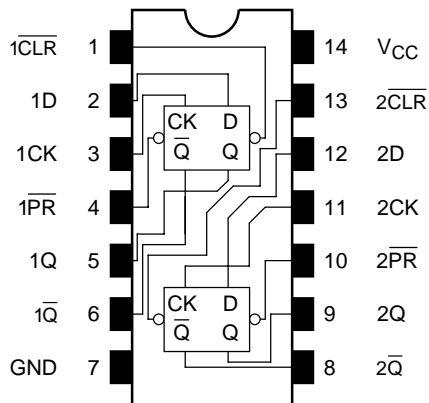
Weight

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

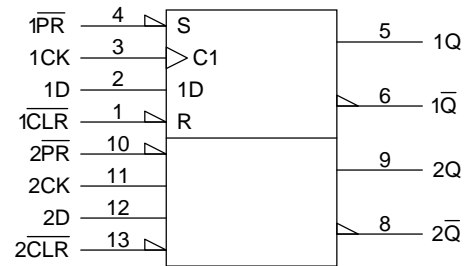
SOL14-P-150-1.27: 0.12 g (typ.)

TSSOP14-P-0044-0.65: 0.06 g (typ.)

Pin Assignment (top view)



IEC Logic Symbol



Truth Table

Inputs				Outputs		Function
CLR	PR	D	CK	Q	Q ⁻	
L	H	X	X	L	H	Clear
H	L	X	X	H	L	Preset
L	L	X	X	H	H	—
H	H	L	↑	L	H	—
H	H	H	↑	H	L	—
H	H	X	↓	Q _n	Q _n ⁻	No change

X: Don't care

Maximum Ratings

Characteristics	Symbol	Rating	Unit
Power supply voltage	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 1)	V
		-0.5 to V _{CC} + 0.5 (Note 2)	
Input diode current	I _{IK}	-50	mA
Output diode current	I _{OK}	±50 (Note 3)	mA
DC output current	I _{OUT}	±50	mA
Power dissipation	P _D	180	mW
DC V _{CC} /ground current	I _{CC} /I _{GND}	±100	mA
Storage temperature	T _{stg}	-65 to 150	°C

Note 1: V_{CC} = 0 V

Note 2: High or low state. I_{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_{CC}	2.0 to 3.6	V
		1.5 to 3.6 (Note 4)	
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to 5.5 (Note 5)	V
		0 to V_{CC} (Note 6)	
Output current	I_{OH}/I_{OL}	± 24 (Note 7)	mA
		± 12 (Note 8)	
Operating temperature	T_{opr}	-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: $V_{CC} = 0$ V

Note 6: High or low state

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

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

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

Electrical Characteristics

DC Characteristics ($T_a = -40$ to 85°C)

Characteristics		Symbol	Test Condition	V_{CC} (V)	Min	Max	Unit	
Input voltage	H-level	V_{IH}	—	2.7 to 3.6	2.0	—	V	
	L-level	V_{IL}	—	2.7 to 3.6	—	0.8		
Output voltage	H-level	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -100 \mu A$	2.7 to 3.6	$V_{CC} - 0.2$	—	V
				$I_{OH} = -12$ mA	2.7	2.2	—	
				$I_{OH} = -18$ mA	3.0	2.4	—	
				$I_{OH} = -24$ mA	3.0	2.2	—	
	L-level	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 100 \mu A$	2.7 to 3.6	—	0.2	
				$I_{OL} = 12$ mA	2.7	—	0.4	
				$I_{OL} = 16$ mA	3.0	—	0.4	
				$I_{OL} = 24$ mA	3.0	—	0.55	
Input leakage current		I_{IN}	$V_{IN} = 0$ to 5.5 V	2.7 to 3.6	—	± 5.0	μA	
Power-off leakage current		I_{OFF}	$V_{IN}/V_{OUT} = 5.5$ V	0	—	10.0	μA	
Quiescent supply current		I_{CC}	$V_{IN} = V_{CC}$ or GND	2.7 to 3.6	—	10.0	μA	
			$V_{IN} = 3.6$ to 5.5 V	2.7 to 3.6	—	± 10.0		
Increase in I_{CC} per input		ΔI_{CC}	$V_{IH} = V_{CC} - 0.6$ V	2.7 to 3.6	—	500		

AC Characteristics (Ta = -40 to 85°C)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Min	Max	Unit
Maximum clock frequency	f _{max}	Figure 1, Figure 2	2.7	—	—	MHz
			3.3 ± 0.3	150	—	
Propagation delay time (CK-Q, \bar{Q})	t _{pLH} t _{pHL}	Figure 1, Figure 2	2.7	—	8.0	ns
			3.3 ± 0.3	1.5	7.0	
Propagation delay time (\bar{CLR} , \bar{PR} -Q, \bar{Q})	t _{pLH} t _{pHL}	Figure 1, Figure 4	2.7	—	8.0	ns
			3.3 ± 0.3	1.5	7.0	
Minimum pulse width (CK)	t _W (H) t _W (L)	Figure 1, Figure 2	2.7	3.3	—	ns
			3.3 ± 0.3	3.3	—	
Minimum pulse width (\bar{CLR} , \bar{PR})	t _W (L)	Figure 1, Figure 4	2.7	3.6	—	ns
			3.3 ± 0.3	3.3	—	
Minimum setup time	t _s	Figure 1, Figure 2	2.7	2.5	—	ns
			3.3 ± 0.3	2.5	—	
Minimum hold time	t _h	Figure 1, Figure 2	2.7	1.5	—	ns
			3.3 ± 0.3	1.5	—	
Minimum removal time	t _{rem}	Figure 1, Figure 3	2.7	3.0	—	ns
			3.3 ± 0.3	2.5	—	
Output to output skew	t _{osLH} t _{osHL}	(Note 10)	2.7	—	—	ns
			3.3 ± 0.3	—	1.0	

Note 10: Parameter guaranteed by design.

$$(t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|)$$

Dynamic Switching Characteristics

(Ta = 25°C, input: t_r = t_f = 2.5 ns, C_L = 50 pF, R_L = 500 Ω)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Typ.	Unit
Quiet output maximum dynamic V _{OL}	V _{OLP}	V _{IH} = 3.3 V, V _{IL} = 0 V	3.3	0.8	V
Quiet output minimum dynamic V _{OL}	V _{OLV}	V _{IH} = 3.3 V, V _{IL} = 0 V	3.3	0.8	V

Capacitive Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Typ.	Unit
Input capacitance	C _{IN}	—	3.3	7	pF
Output capacitance	C _{OUT}	—	0	8	pF
Power dissipation capacitance	C _{PD}	f _{IN} = 10 MHz (Note 11)	3.3	25	pF

Note 11: C_{PD} 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:

$$I_{CC (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2 \text{ (per bit)}$$

AC Test Circuit

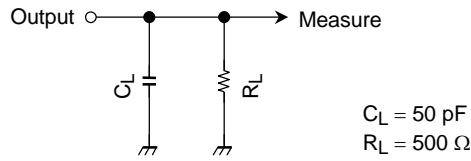


Figure 1

AC Waveform

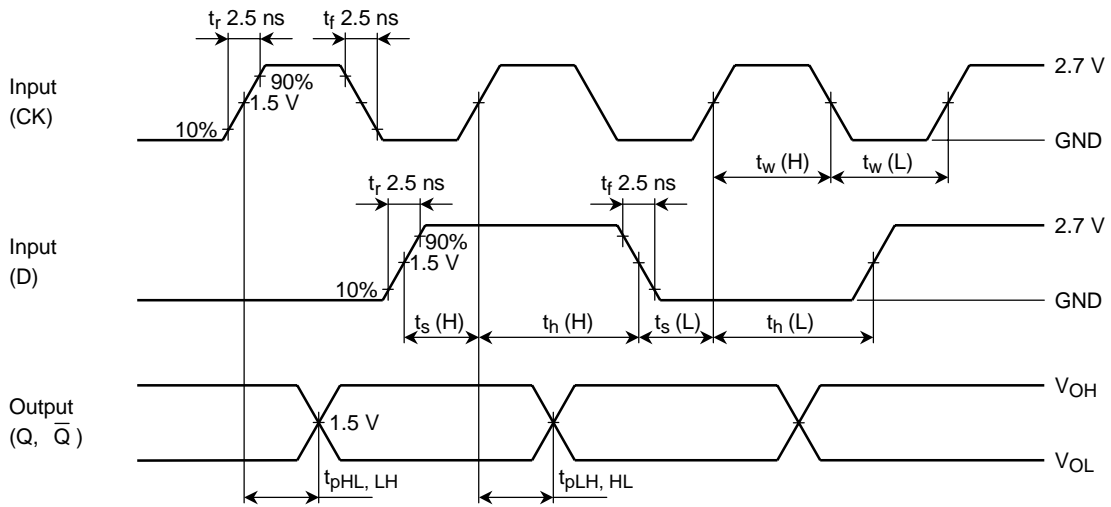


Figure 2 t_{pLH} , t_{pHL} , t_w , t_s , t_h

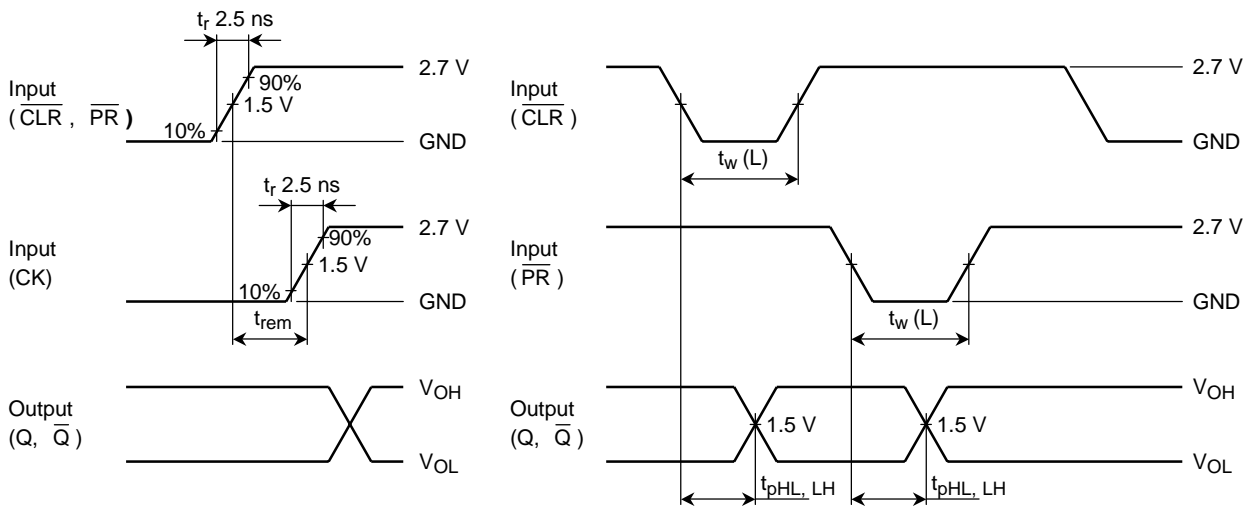


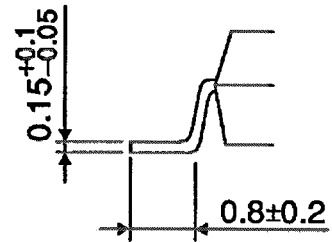
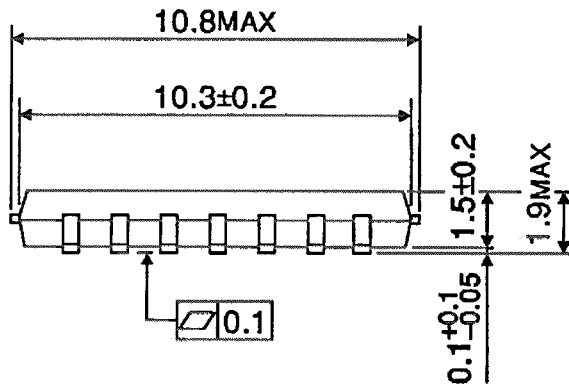
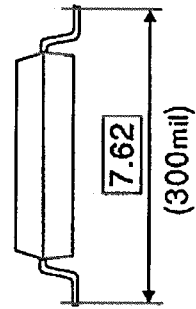
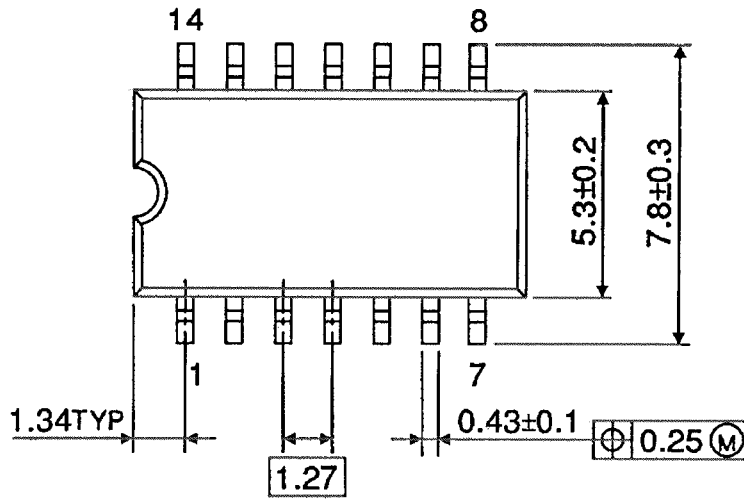
Figure 3 t_{rem}

Figure 4 t_{pLH} , t_{pHL}

Package Dimensions

SOP14-P-300-1.27

Unit : mm



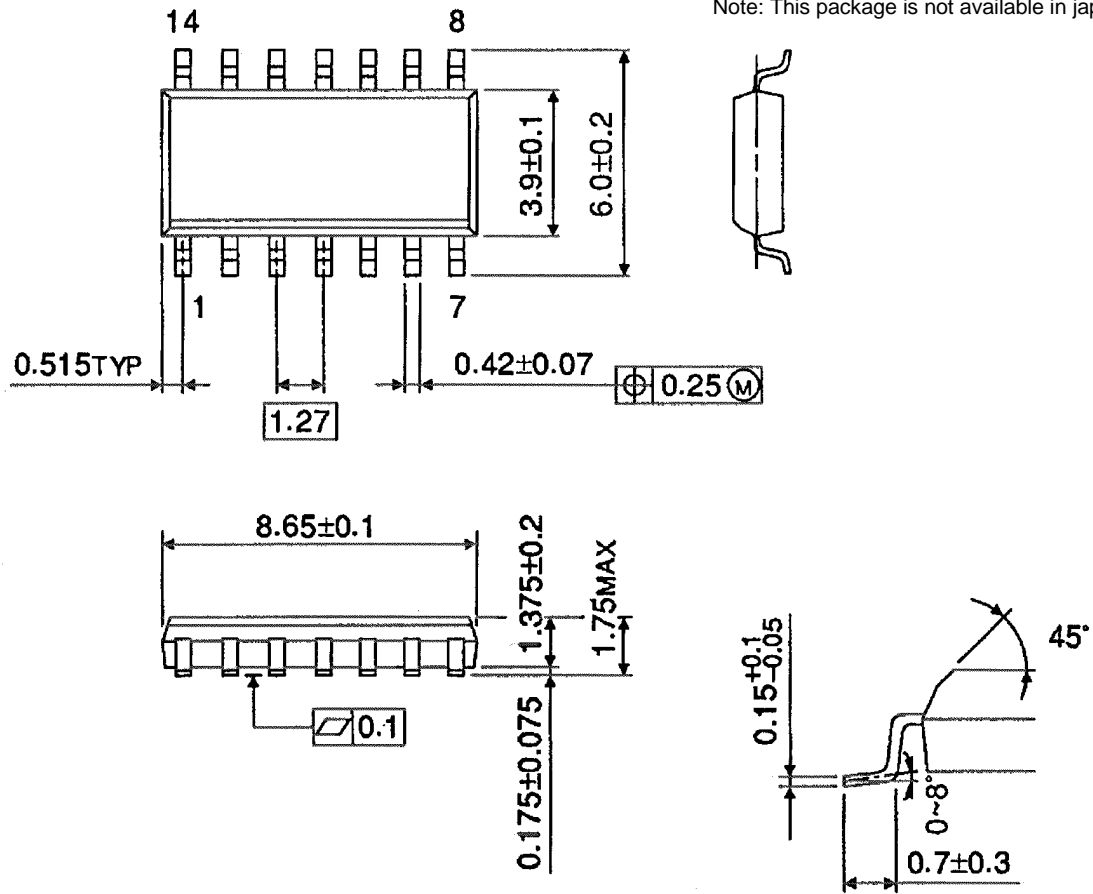
Weight: 0.18 g (typ.)

Package Dimensions

SOL14-P-150-1.27

Unit : mm

Note: This package is not available in japan.

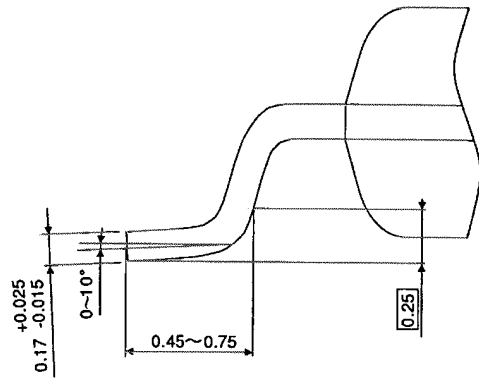
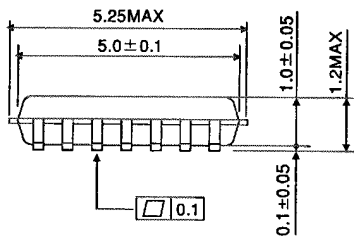
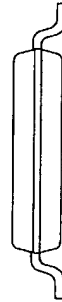
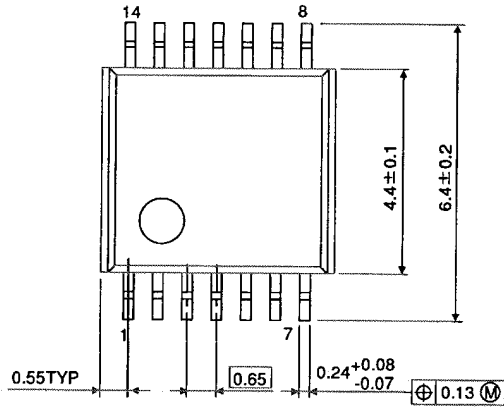


Weight: 0.12 g (typ.)

Package Dimensions

TSSOP14-P-0044-0.65

Unit : mm



Weight: 0.06 g (typ.)

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