

TC74LCX374F, TC74LCX374FW, TC74LCX374FT

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

The TC74LCX374F/FW/FT is a high-performance CMOS octal 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 both inputs and outputs.

This 8 bit D-type flip-flop is controlled by a clock input (CK) and a output enable input ($\overline{OE}$). When the $\overline{OE}$ input is high, the eight outputs are in a high impedance state.

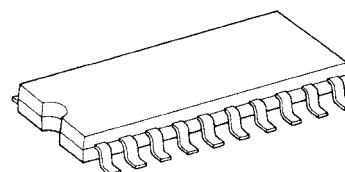
All inputs are equipped with protection circuits against static discharge.

Features

- Low-voltage operation: $V_{CC} = 2.0$ to 3.6 V
- High-speed operation: $t_{pd} = 8.5$ 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.) 374 type

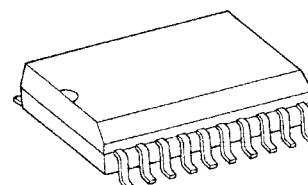
Note: xxxFW (JEDEC SOP) is not available in Japan.

TC74LCX374F



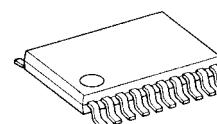
SOP20-P-300-1.27

TC74LCX374FW



SOL20-P-300-1.27

TC74LCX374FT



TSSOP20-P-0044-0.65

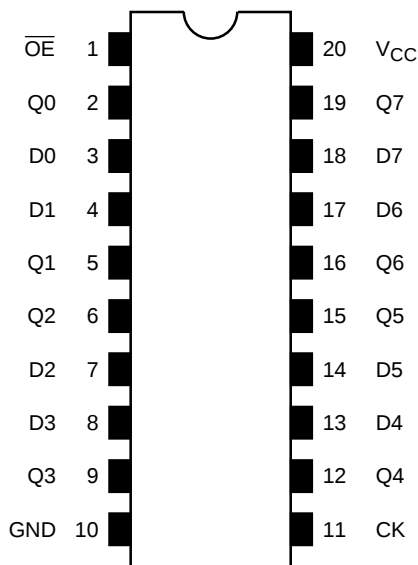
Weight

SOP20-P-300-1.27: 0.22 g (typ.)

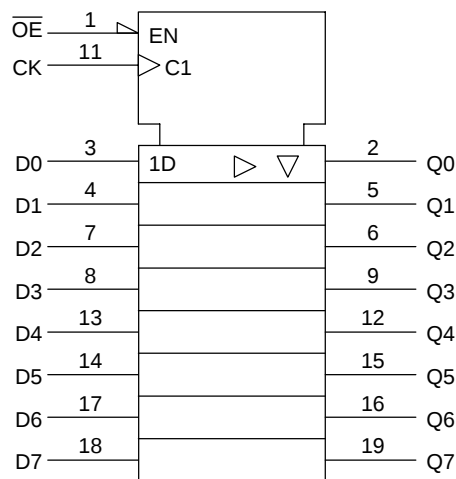
SOL20-P-300-1.27: 0.46 g (typ.)

TSSOP20-P-0044-0.65: 0.08 g (typ.)

Pin Assignment (top view)



IEC Logic Symbol



Truth Table

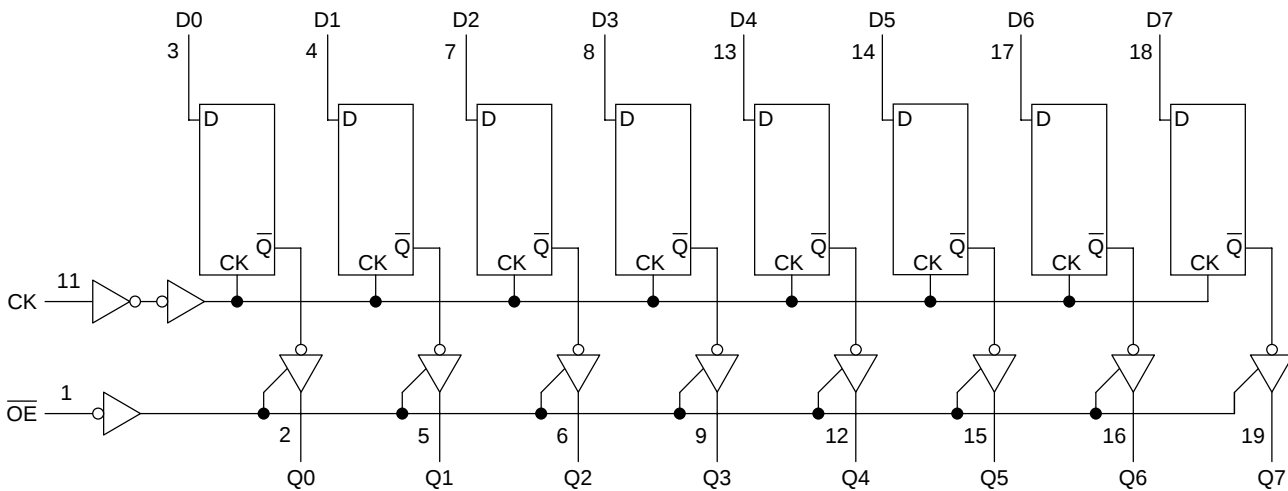
Inputs			Outputs
$\overline{OE}$	CK	D	
H	X	X	Z
L		X	Qn
L		L	L
L		H	H

X: Don't care

Z: High impedance

Qn: No change

System Diagram



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: Output in OFF state

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: Output in OFF state

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 (Ta = -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 μA	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 μA	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
3-state output OFF state current		I _{OZ}	V _{IN} = V _{IH} or V _{IL} V _{OUT} = 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} /V _{OUT} = 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)		t _{pLH} t _{pHL}	Figure 1, Figure 2		2.7	—	9.5	ns
					3.3 ± 0.3	1.5	8.5	
Output enable time		t _{pZL} t _{pZH}	Figure 1, Figure 3		2.7	—	9.5	ns
					3.3 ± 0.3	1.5	8.5	
Output disable time		t _{pLZ} t _{pHZ}	Figure 1, Figure 3		2.7	—	8.5	ns
					3.3 ± 0.3	1.5	7.5	
Minimum pulse width (CK)		t _w (H) t _w (L)	Figure 1, Figure 2		2.7	4.0	—	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	—	
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

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

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

Capacitive Characteristics ($T_a = 25^\circ\text{C}$)

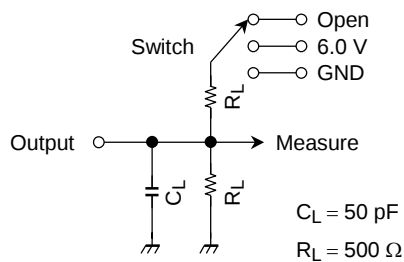
Characteristics	Symbol	Test Condition	$V_{CC} \text{ (V)}$	Typ.	Unit
Input capacitance	C_{IN}	—	3.3	7	pF
Output capacitance	C_{OUT}	—	3.3	8	pF
Power dissipation capacitance	C_{PD}	$f_{IN} = 10 \text{ MHz}$ (Note 11)	3.3	25	pF

Note 11: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption.

Average operating current can be obtained by the equation:

$$I_{CC(\text{opr})} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8 \text{ (per bit)}$$

AC Test Circuit



Parameter	Switch
t_{pLH} , t_{pHL}	Open
t_{pLZ} , t_{pZL}	6.0 V
t_{pHZ} , t_{pZH}	GND
t_w , t_s , t_h , t_{max}	Open

Figure 1

AC Waveform

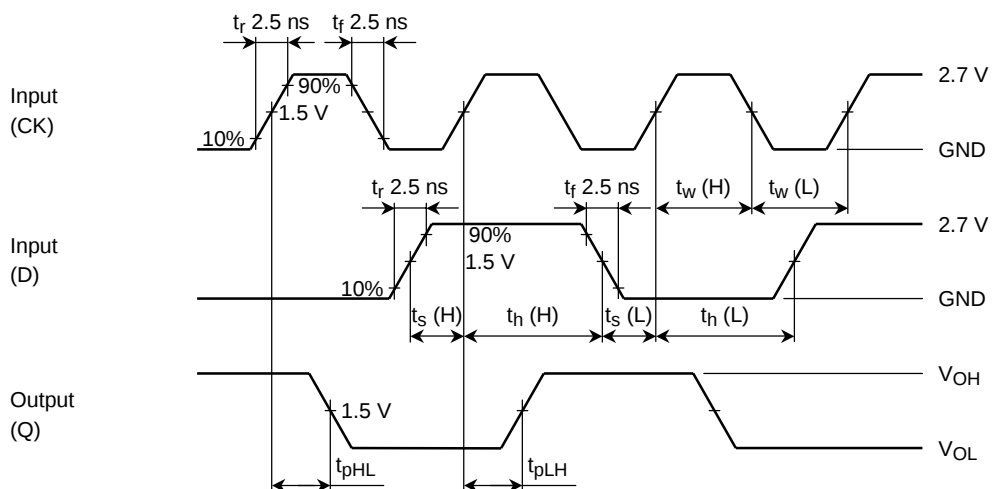


Figure 2 t_{pLH} , t_{pHL} , t_w , t_s , t_h

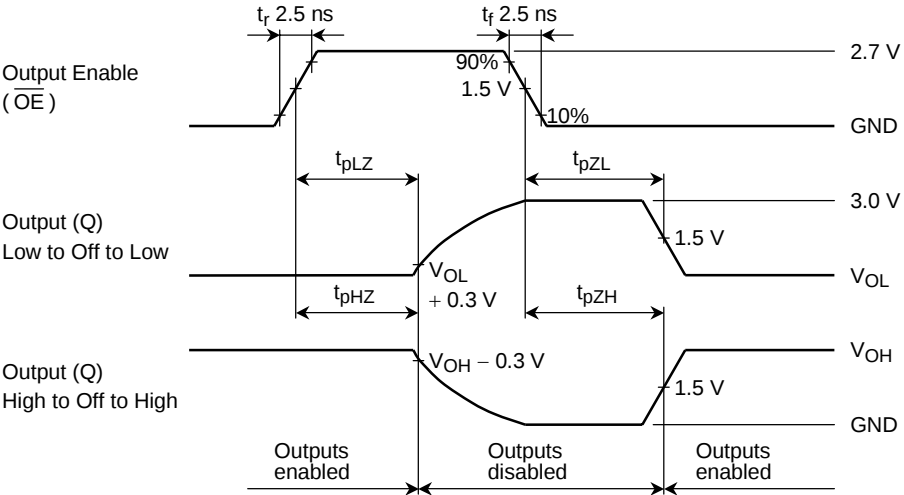
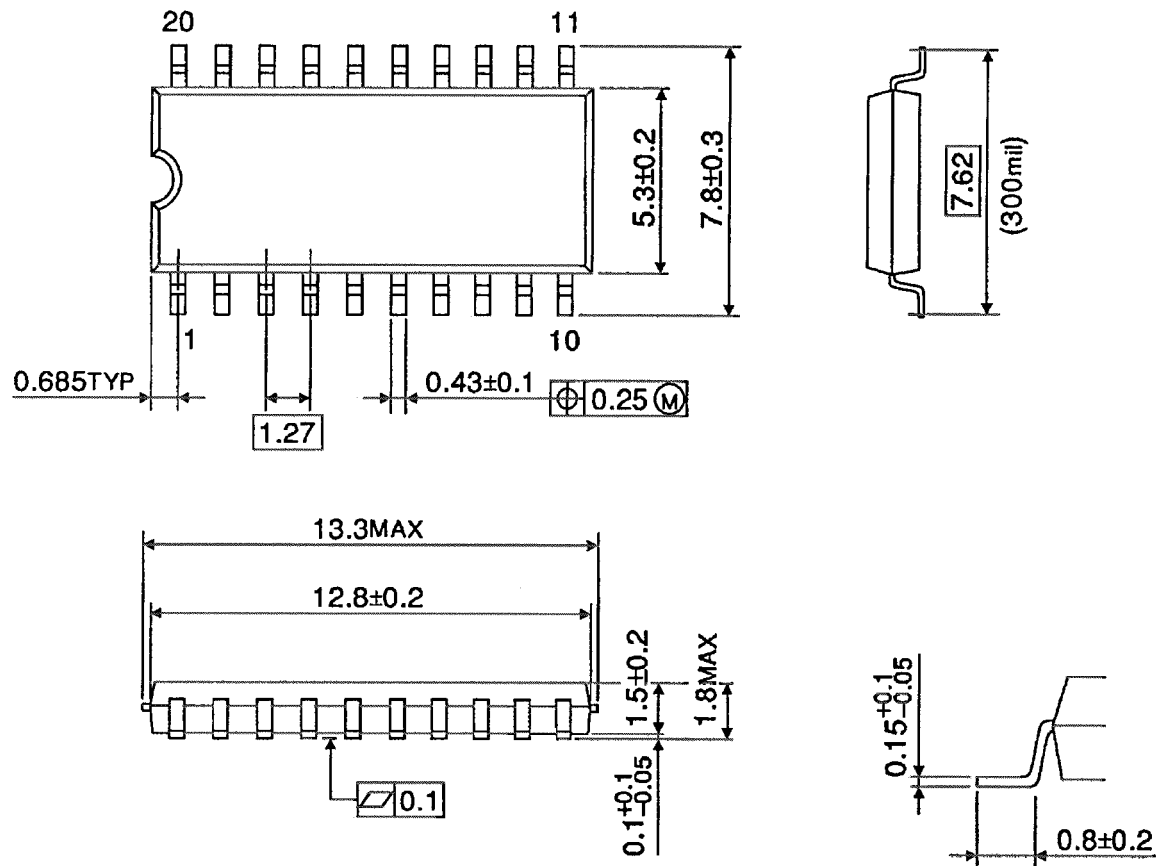


Figure 3 t_{pLZ} , t_{pHZ} , t_{pZL} , t_{pZH}

Package Dimensions

SOP20-P-300-1.27

Unit : mm



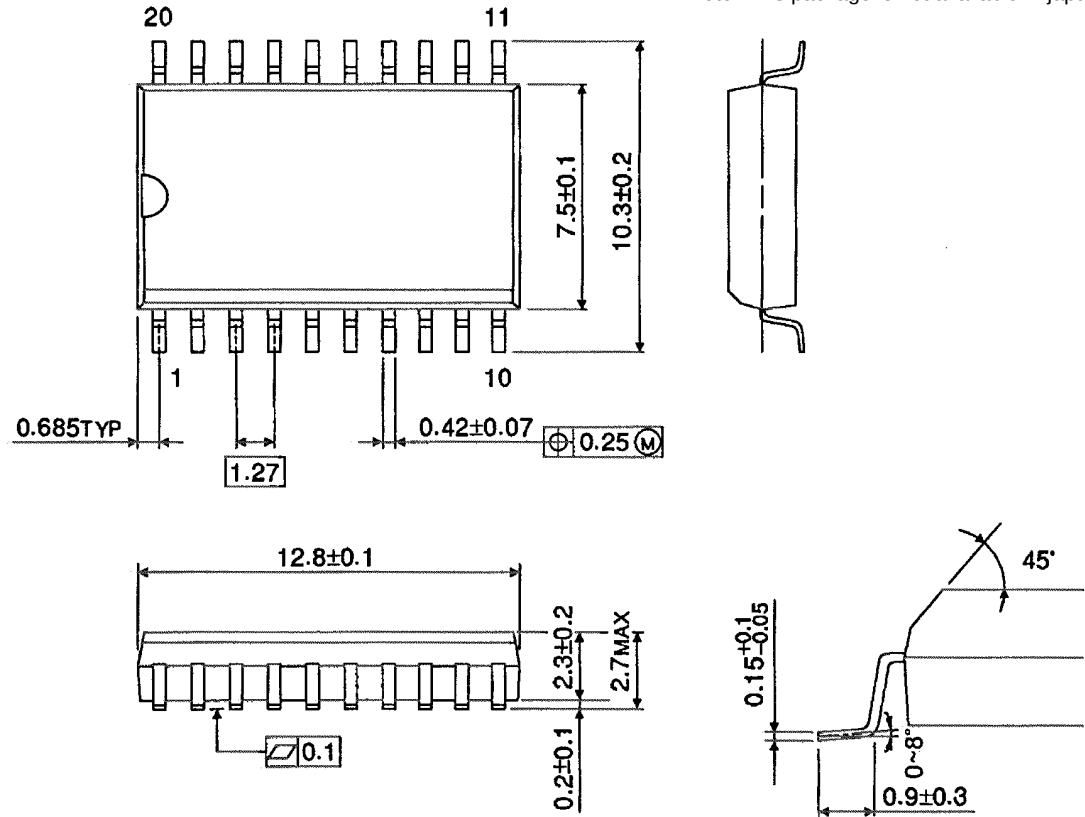
Weight: 0.22 g (typ.)

Package Dimensions

SOL20-P-300-1.27

Unit : mm

Note: This package is not available in japan.

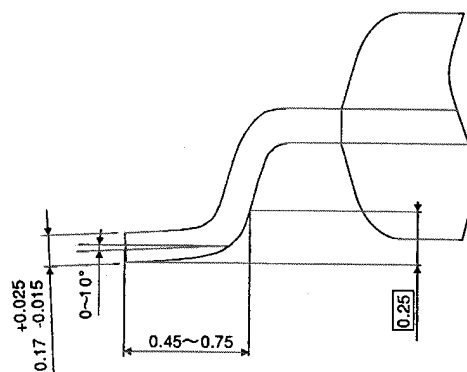
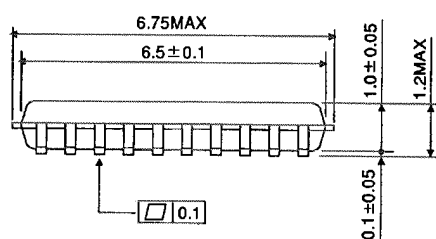
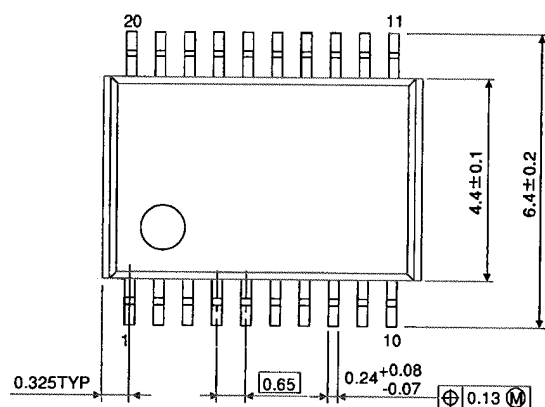


Weight: 0.46 g (typ.)

Package Dimensions

TSSOP20-P-0044-0.65

Unit : mm



Weight: 0.08 g (typ.)

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