

TC74LVX374F, TC74LVX374FW, TC74LVX374FT

Octal D-Type Flip-Flop with 3-State Output

The TC74LVX374F/ FW/ FT is a high-speed CMOS octal D-flip flop fabricated with silicon gate CMOS technology. Designed for use in 3-V systems, it achieves high-speed operation while maintaining the CMOS low power dissipation.

This device is suitable for low-voltage and battery operated systems.

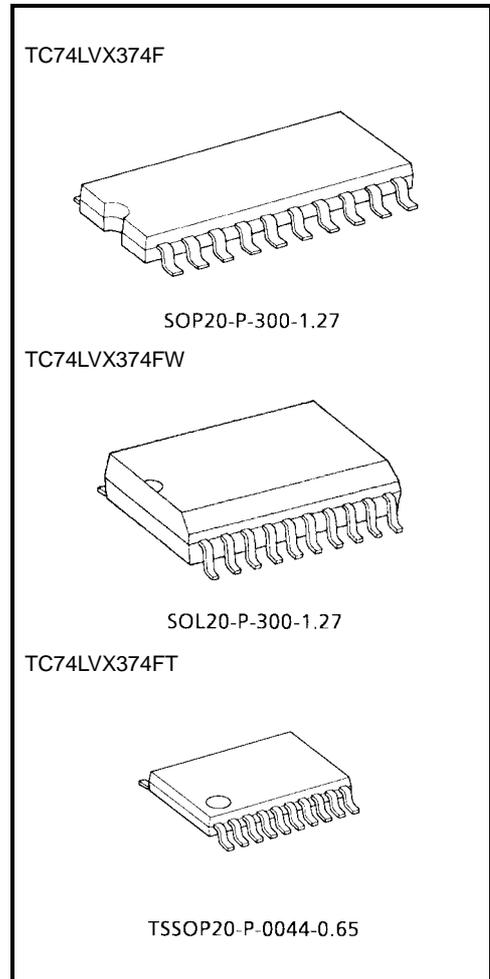
This 8-bit D-type flip-flop is controlled by a clock input (CK) and a output enable input (OE). When the OE input is high, the eight outputs are in a high-impedance state.

An input protection circuit ensures that 0 to 5.5V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

Features

- High-speed: $f_{max} = 160$ MHz (typ.) ($V_{CC} = 3.3$ V)
- Low power dissipation: $I_{CC} = 4$ μ A (max) ($T_a = 25^\circ$ C)
- Input voltage level: $V_{IL} = 0.8$ V (max) ($V_{CC} = 3$ V)
 $V_{IH} = 2.0$ V (min) ($V_{CC} = 3$ V)
- Power-down protection is provided on all inputs
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Low noise: $V_{OLP} = 0.8$ V (max)
- Pin and function compatible with 74HC374

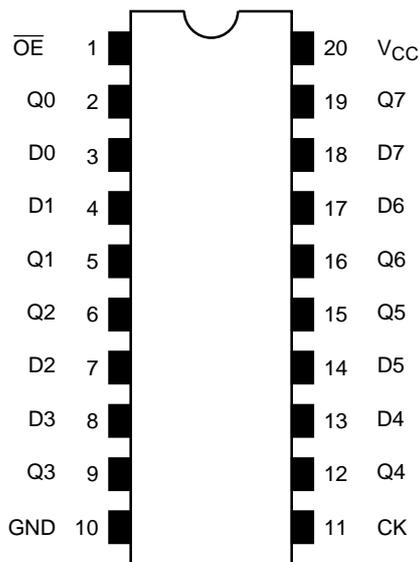
Note: xxxFW (JEDEC SOP) is not available in Japan.



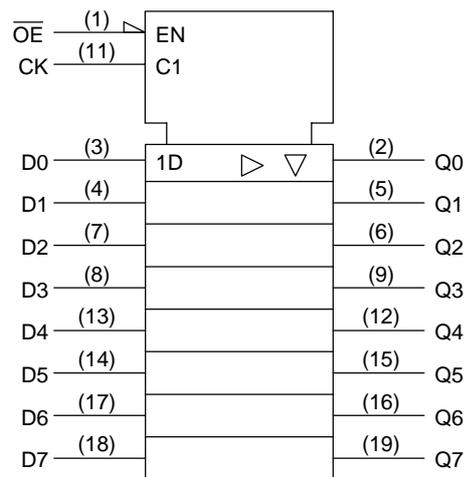
Weight

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

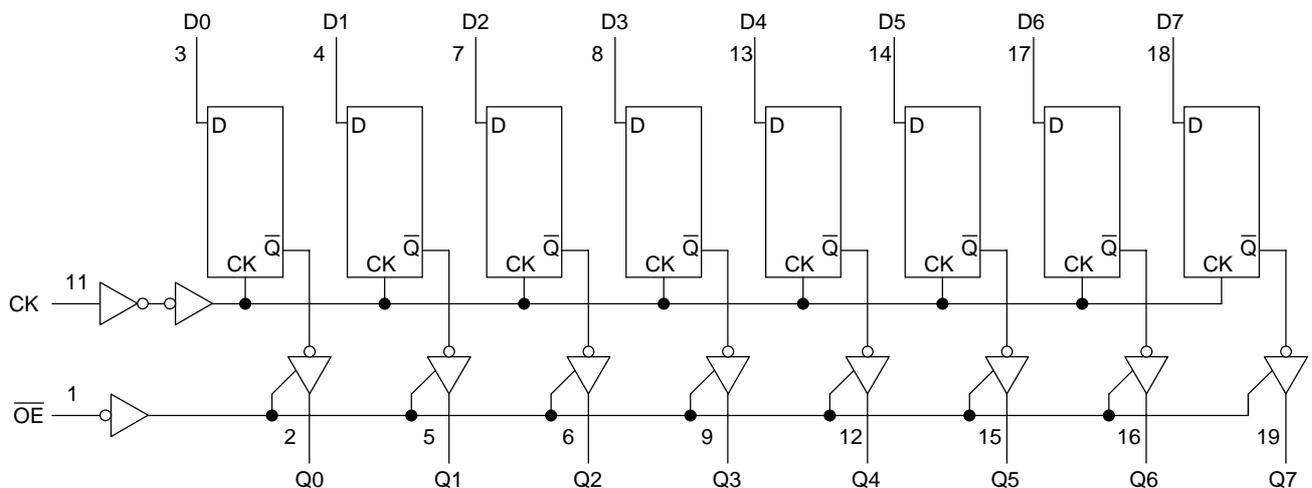
Inputs			Outputs
\overline{OE}	CK	D	
H	X	X	Z
L	\downarrow	X	Qn
L	\uparrow	L	L
L	\uparrow	H	H

X: Don't care

Z: High impedance

Qn: No change

System Diagram



Maximum Ratings

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 $V_{CC} + 0.5$	V
Input diode current	I_{IK}	-20	mA
Output diode current	I_{OK}	± 20	mA
DC output current	I_{OUT}	± 25	mA
DC V_{CC} /ground current	I_{CC}	± 75	mA
Power dissipation	P_D	180	mW
Storage temperature	T_{stg}	-65 to 150	$^{\circ}C$

Recommended Operating Conditions

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2.0 to 3.6	V
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to V_{CC}	V
Operating temperature	T_{opr}	-40 to 85	$^{\circ}C$
Input rise and fall time	dt/dv	0 to 100	ns/V

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition	$T_a = 25^{\circ}C$			$T_a = -40$ to $85^{\circ}C$		Unit			
			V_{CC} (V)	Min	Typ.	Max	Min		Max		
Input voltage	H-level	V_{IH}	—	2.0	1.5	—	—	1.5	—	V	
				3.0	2.0	—	—	2.0	—		
				3.6	2.4	—	—	2.4	—		
	L-level	V_{IL}	—	2.0	—	—	0.5	—	0.5		
				3.0	—	—	0.8	—	0.8		
				3.6	—	—	0.8	—	0.8		
Output voltage	H-level	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -50 \mu A$	2.0	1.9	2.0	—	1.9	—	V
				$I_{OH} = -50 \mu A$	3.0	2.9	3.0	—	2.9	—	
				$I_{OH} = -4 mA$	3.0	2.58	—	—	2.48	—	
	L-level	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 50 \mu A$	2.0	—	0	0.1	—	0.1	
				$I_{OL} = 50 \mu A$	3.0	—	0	0.1	—	0.1	
				$I_{OL} = 4 mA$	3.0	—	—	0.36	—	0.44	
3-state output Off-state current	I_{OZ}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = V_{CC}$ or GND	3.6	—	—	± 0.25	—	± 2.5	μA		
Input leakage current	I_{IN}	$V_{IN} = 5.5 V$ or GND	3.6	—	—	± 0.1	—	± 1.0	μA		
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC}$ or GND	3.6	—	—	4.0	—	40.0	μA		

Timing Requirements (input: $t_r = t_f = 3 \text{ ns}$)

Characteristics	Symbol	Test Condition	Ta = 25°C		Ta = -40 to 85°C	Unit
			V _{CC} (V)	Limit	Limit	
Minimum pulse width (CK)	t _W (H)	—	2.7	7.5	8.0	ns
	t _W (L)	—	3.3 ± 0.3	5.0	5.5	
Minimum set-up time	t _s	—	2.7	6.5	6.5	ns
			3.3 ± 0.3	4.5	4.5	
Minimum hold time	t _h	—	2.7	2.0	2.0	ns
			3.3 ± 0.3	2.0	2.0	

AC Characteristics (input: $t_r = t_f = 3 \text{ ns}$)

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit		
			V _{CC} (V)	C _L (pF)	Min	Typ.	Max		Min	Max
Propagation delay time (CK-Q)	t _{pLH}	—	2.7	15	—	8.5	16.3	1.0	19.5	ns
				50	—	11.0	19.8	1.0	23.0	
	t _{pHL}		3.3 ± 0.3	15	—	6.7	10.6	1.0	12.5	
				50	—	9.2	14.1	1.0	16.0	
Output enable time	t _{pZL}	R _L = 1 kΩ	2.7	15	—	7.6	14.5	1.0	17.5	ns
				50	—	10.1	18.0	1.0	21.0	
	t _{pZH}		3.3 ± 0.3	15	—	5.9	9.3	1.0	11.0	
				50	—	8.4	12.8	1.0	14.5	
Output disable time	t _{pLZ} t _{pHZ}	R _L = 1 kΩ	2.7	50	—	11.5	18.5	1.0	22.0	ns
				3.3 ± 0.3	50	—	9.6	13.2	1.0	
Maximum clock frequency	f _{max}	—	2.7	15	60	115	—	50	—	MHz
				50	45	60	—	40	—	
			3.3 ± 0.3	15	100	160	—	85	—	
				50	60	95	—	55	—	
Output to output skew	t _{osLH} t _{osHL}	(Note 1)	2.7	50	—	—	1.5	—	1.5	ns
				3.3 ± 0.3	50	—	—	1.5	—	
Input capacitance	C _{IN}	(Note 2)		—	4	10	—	10	pF	
Output capacitance	C _{OUT}	—		—	6	—	—	—	pF	
Power dissipation capacitance	C _{PD}	(Note 3)		—	32	—	—	—	pF	

Note 1: Parameter guaranteed by design.
 (t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|)

Note 2: Parameter guaranteed by design.

Note 3: 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:

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

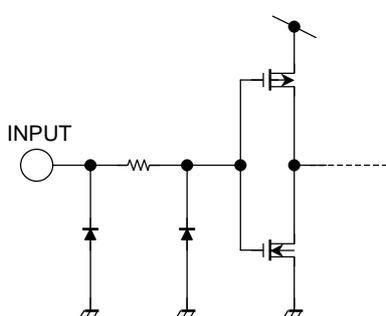
And the total C_{PD} when n pcs. of Flip Flop operate can be gained by the following equation:

$$C_{PD} \text{ (total)} = 20 + 12 \cdot n$$

Noise Characteristics (Ta = 25°C, input: tr = tf = 3 ns, CL = 50 pF)

Characteristics	Symbol	Test Condition	VCC (V)	Typ.	Limit	Unit
Quiet output maximum dynamic	V _{OL}	V _{OLP}	3.3	0.5	0.8	V
Quiet output minimum dynamic	V _{OL}	V _{OLV}	3.3	-0.5	-0.8	V
Minimum high level dynamic input voltage	V _{IH}	V _{IHD}	3.3	—	2.0	V
Maximum low level dynamic input voltage	V _{IL}	V _{ILD}	3.3	—	0.8	V

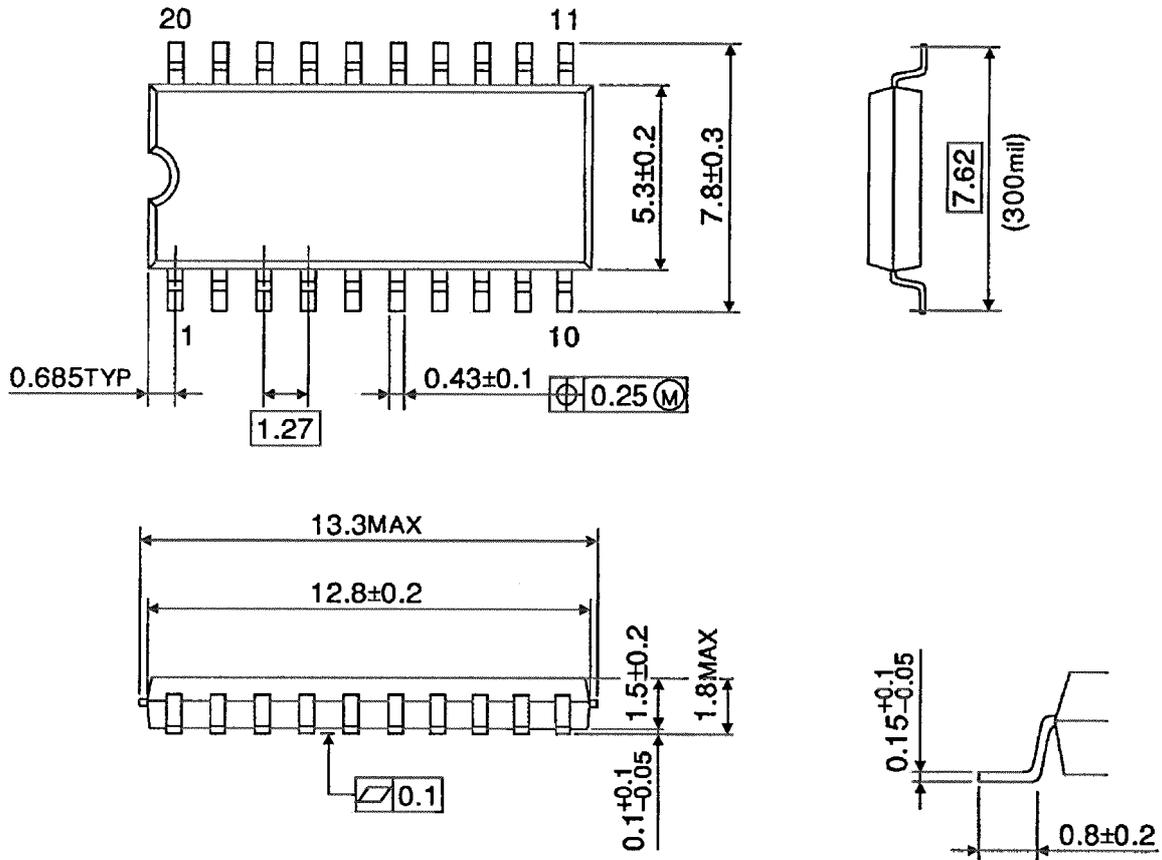
Input Equivalent Circuit



Package Dimensions

SOP20-P-300-1.27

Unit : mm

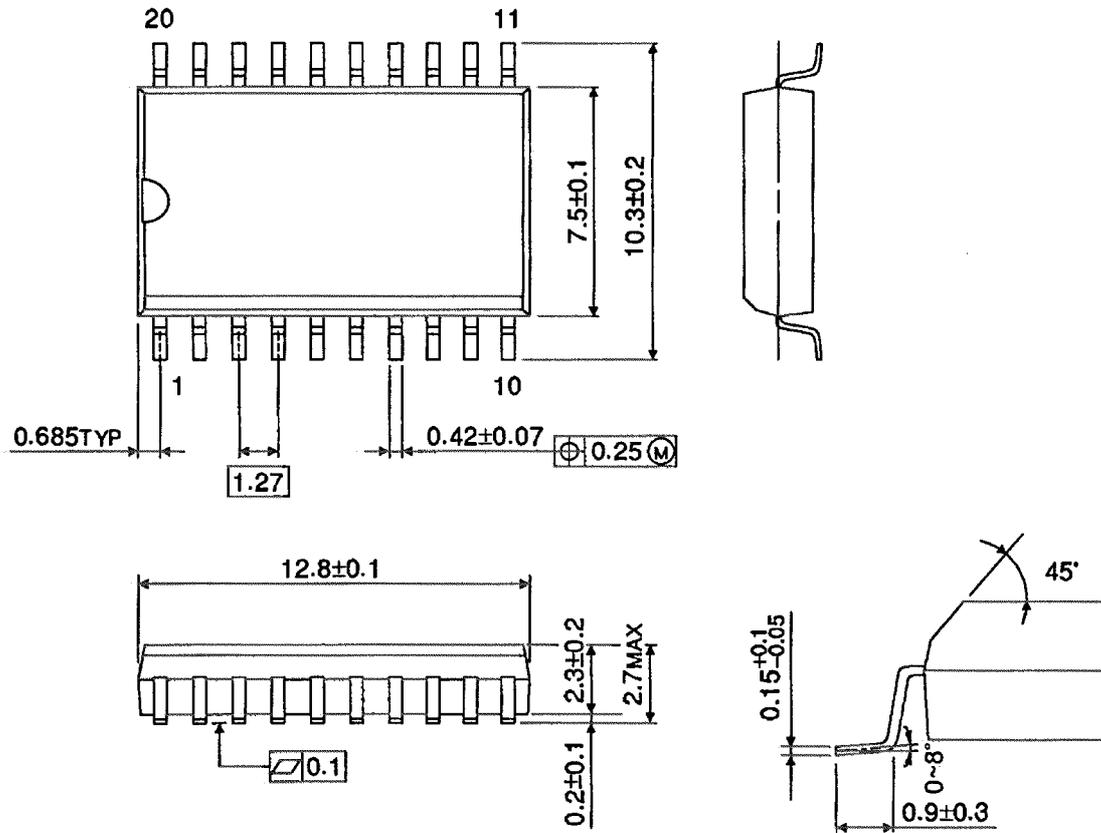


Weight: 0.22 g (typ.)

Package Dimensions

SOL20-P-300-1.27

Unit : mm

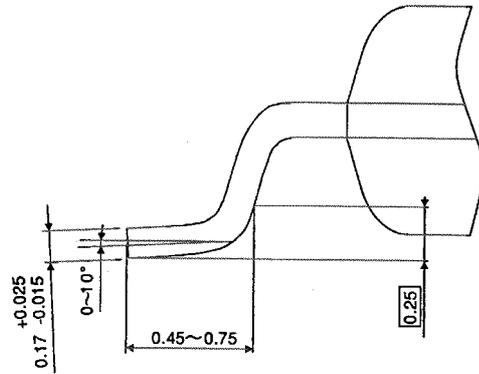
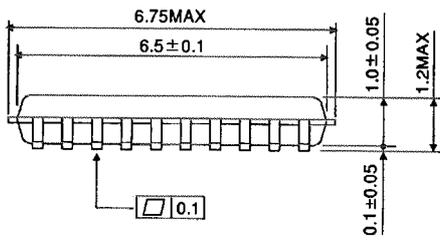
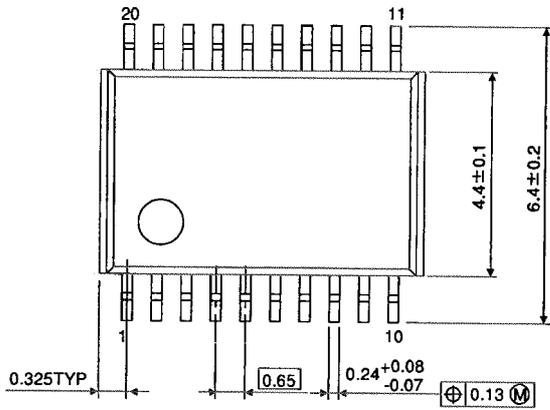


Weight: 0.46 g (typ.)

Package Dimensions

TSSOP20-P-0044-0.65

Unit : mm



Weight: 0.08 g (typ.)

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