

**TC74LVX374F, TC74LVX374FW, TC74LVX374FT**

**OCTAL D-TYPE FLIP FLOP WITH 3-STATE OUTPUT**

The TC74LVX374 is a high speed CMOS OCTAL D-FLIP FLOP fabricated with silicon gate C<sup>2</sup>MOS technology. Designed for use in 3.3 Volt 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 ( $\overline{OE}$ ).

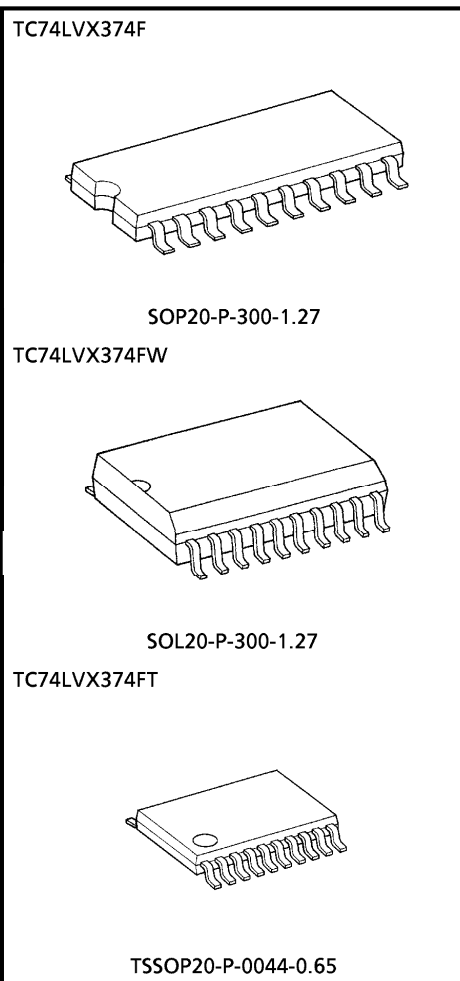
When the  $\overline{OE}$  input is high, the eight outputs are in a high impedance state.

An input protection circuit ensures that 0 to 7V 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 :  $f_{MAX} = 160\text{MHz}$  (Typ.) ( $V_{CC} = 3.3\text{V}$ )
- Low power dissipation :  $I_{CC} = 4\mu\text{A}$  (Max.) ( $T_a = 25^\circ\text{C}$ )
- Input voltage level :  $V_{IL} = 0.8\text{V}$  (Max.) ( $V_{CC} = 3\text{V}$ )  
 $V_{IH} = 2.0\text{V}$  (Min.) ( $V_{CC} = 3\text{V}$ )
- Power down protection is provided on all inputs.
- Balanced propagation delays :  $t_{pLH} \approx t_{pHL}$
- Low noise :  $V_{OLP} = 0.8\text{V}$  (Max.)
- Pin and function compatible with 74HC374

(Note) The JEDEC SOP (FW) is not available in Japan.



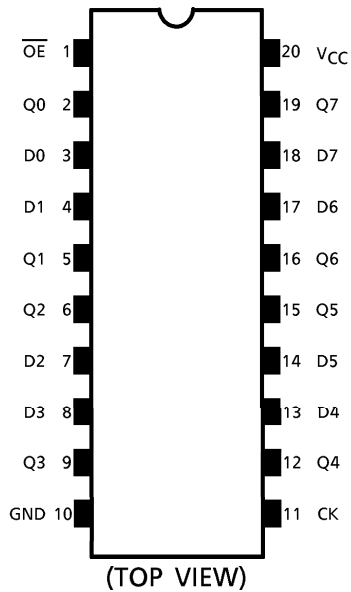
**Weight**

SOP20-P-300-1.27	: 0.22g (Typ.)
SOL20-P-300-1.27	: 0.46g (Typ.)
TSSOP20-P-0044-0.65	: 0.08g (Typ.)

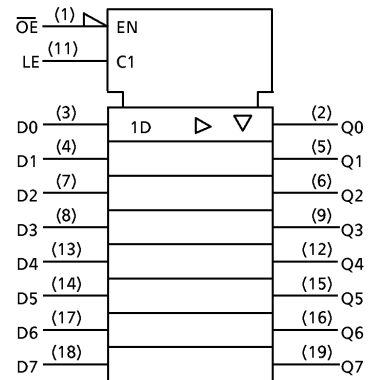
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**PIN ASSIGNMENT**



**IEC LOGIC SYMBOL**

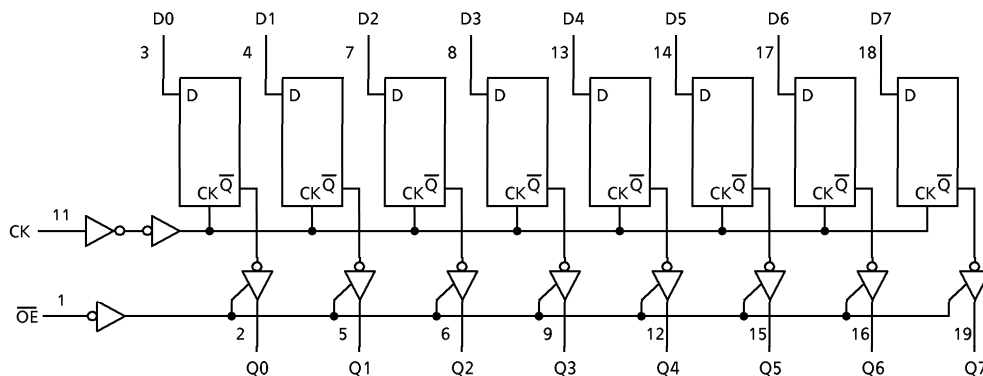


**TRUTH TABLE**

INPUTS			OUTPUTS
$\overline{OE}$	LE	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**



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**MAXIMUM RATINGS**

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage Range	V <sub>CC</sub>	-0.5~7.0	V
DC Input Voltage	V <sub>IN</sub>	-0.5~7.0	V
DC Output Voltage	V <sub>OUT</sub>	-0.5~V <sub>CC</sub> +0.5	V
Input Diode Current	I <sub>IK</sub>	-20	mA
Output Diode Current	I <sub>OK</sub>	±20	mA
DC Output Current	I <sub>OUT</sub>	±25	mA
DC V <sub>CC</sub> /Ground Current	I <sub>CC</sub>	±75	mA
Power Dissipation	P <sub>D</sub>	180	mW
Storage Temperature	T <sub>stg</sub>	-65~150	°C

**RECOMMENDED OPERATING CONDITIONS**

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V <sub>CC</sub>	2.0~3.6	V
Input Voltage	V <sub>IN</sub>	0~5.5	V
Output Voltage	V <sub>OUT</sub>	0~V <sub>CC</sub>	V
Operating Temperature	T <sub>opr</sub>	-40~85	°C
Input Rise And Fall Time	dt/dv	0~100	ns/V

**ELECTRICAL CHARACTERISTICS**

DC characteristics

PARAMETER	SYM-BOL	TEST CONDITION	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40~85°C		UNIT	
				MIN.	TYP.	MAX.	MIN.	MAX.		
Input Voltage	"H" Level	V <sub>IH</sub>	2.0	1.5	—	—	1.5	—	V	
			3.0	2.0	—	—	2.0	—		
			3.6	2.4	—	—	2.4	—		
	"L" Level	V <sub>IL</sub>	2.0	—	—	0.5	—	0.5		
			3.0	—	—	0.8	—	0.8		
			3.6	—	—	0.8	—	0.8		
Output Voltage	"H" Level	V <sub>OH</sub> V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -50μA	2.0	1.9	2.0	—	1.9	—	V
			I <sub>OH</sub> = -50μA	3.0	2.9	3.0	—	2.9	—	
			I <sub>OH</sub> = -4mA	3.0	2.58	—	—	2.48	—	
	"L" Level	V <sub>OL</sub> V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 50μA	2.0	—	0.0	0.1	—	0.1	
			I <sub>OL</sub> = 50μA	3.0	—	0.0	0.1	—	0.1	
			I <sub>OL</sub> = 4mA	3.0	—	—	0.36	—	0.44	
3-state Output Off-state Current	I <sub>OZ</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>OUT</sub> = V <sub>CC</sub> or GND	3.6	—	—	±0.25	—	±2.5	μA	
Input Leakage Current	I <sub>IN</sub>	V <sub>IN</sub> = 5.5V or GND	3.6	—	—	±0.1	—	±1.0	μA	
Quiescent Supply Current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	3.6	—	—	4.0	—	40.0	μA	

**TIMING REQUIREMENTS (Input  $t_r = t_f = 3\text{ns}$ )**

PARAMETER	SYM-BOL	TEST CONDITION	Ta = 25°C		Ta = -40~85°C		UNIT
			V <sub>CC</sub> (V)	LIMIT	LIMIT	LIMIT	
Minimum Pulse Width (CK)	t <sub>W</sub> (H)		2.7	7.5	8.0	ns	
	t <sub>W</sub> (L)		3.3 ± 0.3	5.0	5.5		
Minimum Set-up Time	t <sub>s</sub>		2.7	6.5	6.5	ns	
			3.3 ± 0.3	4.5	4.5		
Minimum Hold Time	t <sub>h</sub>		2.7	2.0	2.0	ns	
			3.3 ± 0.3	2.0	2.0		

**AC characteristics (Input  $t_r = t_f = 3\text{ns}$ )**

PARAMETER	SYM-BOL	TEST CONDITION	Ta = 25°C			Ta = -40~85°C		UNIT		
			V <sub>CC</sub> (V)	C <sub>L</sub> (pF)	MIN.	TYP.	MAX.		MIN.	MAX.
Propagation Delay Time (CK-Q)	t <sub>pLH</sub>		2.7	15	—	8.5	16.3	1.0	19.5	ns
				50	—	11.0	19.8	1.0	23.0	
	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 <sub>pZL</sub>	R <sub>L</sub> = 1kΩ	2.7	15	—	7.6	14.5	1.0	17.5	ns
				50	—	10.1	18.0	1.0	21.0	
	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 <sub>pLZ</sub>	R <sub>L</sub> = 1kΩ	2.7	50	—	11.5	18.5	1.0	22.0	ns
				50	—	9.6	13.2	1.0	15.0	
3.3 ± 0.3	50		—	9.6	13.2	1.0	15.0			
								50	—	
Maximum Clock Frequency	f <sub>MAX</sub>		2.7	15	60	115	—	50	—	ns
				50	45	60	—	40	—	
			3.3 ± 0.3	15	100	160	—	85	—	
				50	60	95	—	55	—	
Output To Output Skew	t <sub>osLH</sub>	(Note 1)	2.7	50	—	—	1.5	—	1.5	ns
				50	—	—	1.5	—	1.5	
3.3 ± 0.3	50		—	—	1.5	—	1.5			
								50	—	
Input Capacitance	C <sub>IN</sub>	(Note 2)			—	4	10	—	10	pF
Output Capacitance	C <sub>OUT</sub>				—	6	—	—	—	pF
Power Dissipation Capacitance	C <sub>PD</sub>	(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<sub>PD</sub> 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 :

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

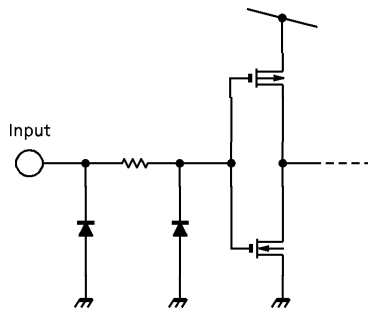
And the total C<sub>PD</sub> when n pcs. of Flip Flop operate can be gained by the following equation :

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

Noise characteristics ( $T_a = 25^\circ\text{C}$ , Input  $t_r = t_f = 3\text{ns}$ ,  $C_L = 50\text{pF}$ )

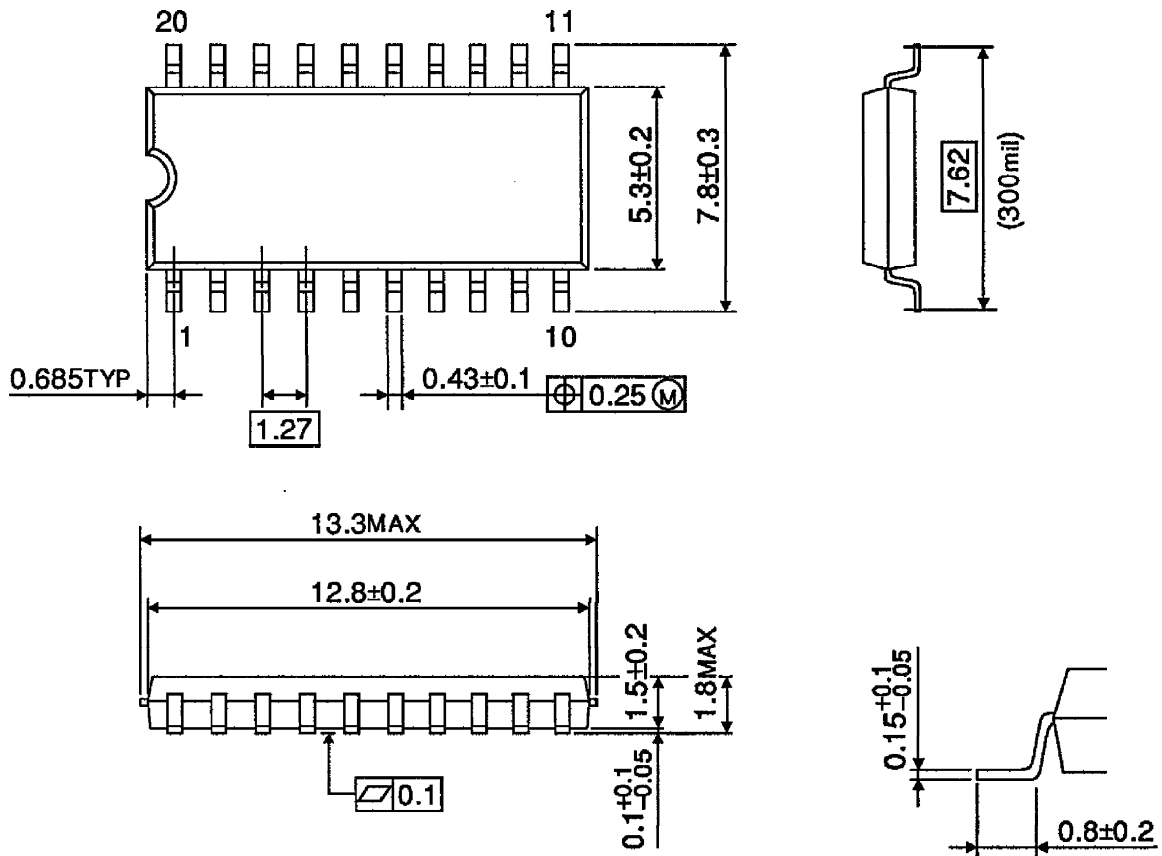
PARAMETER	SYMBOL	TEST CONDITION	$V_{CC}$ (V)	TYP.	LIMIT	UNIT
Quiet Output Maximum Dynamic $V_{OL}$	$V_{OLP}$		3.3	0.5	0.8	V
Quiet Output Minimum Dynamic $V_{OL}$	$V_{OLV}$		3.3	-0.5	-0.8	V
Minimum High Level Dynamic Input Voltage	$V_{IHD}$		3.3	—	2.0	V
Maximum Low Level Dynamic Input Voltage	$V_{ILD}$		3.3	—	0.8	V

**INPUT EQUIVALENT CIRCUIT**



**OUTLINE DRAWING**  
SOP20-P-300-1.27

Unit : mm

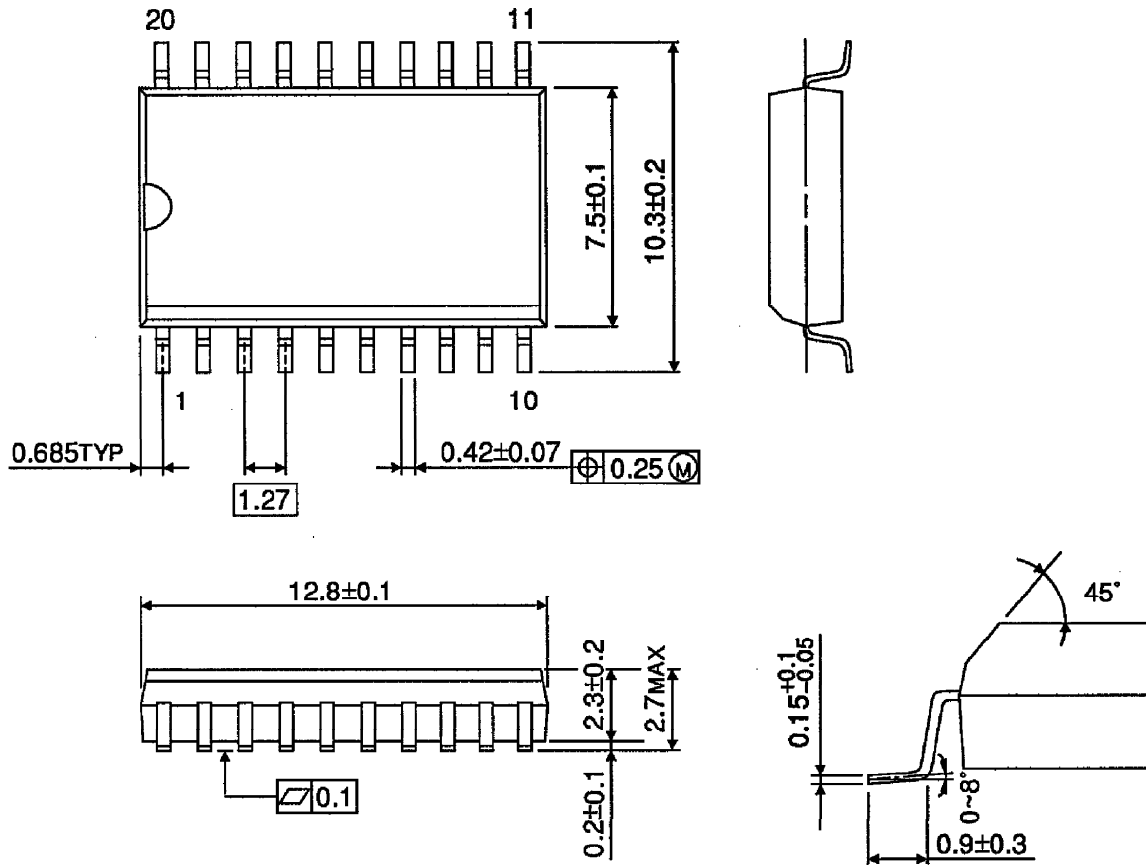


Weight : 0.22g (Typ.)

**OUTLINE DRAWING**  
SOL20-P-300-1.27

Unit : mm

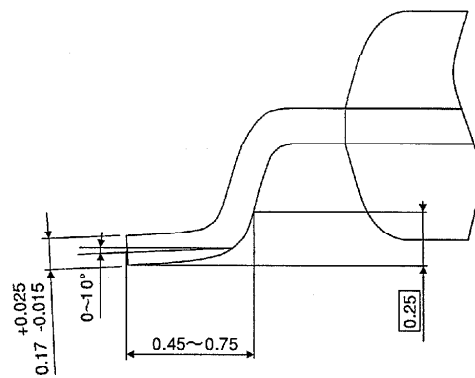
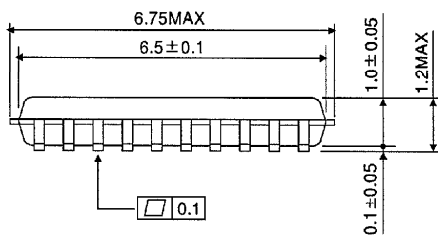
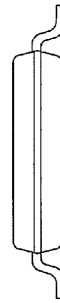
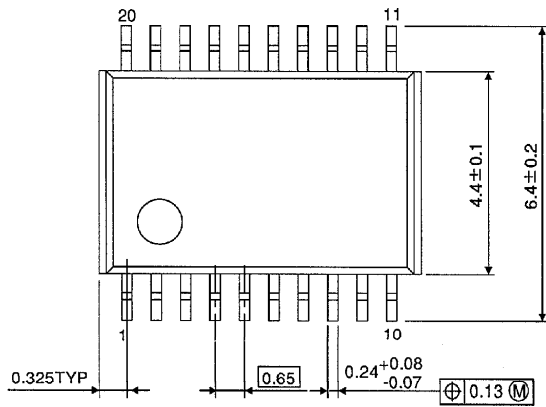
(Note) This package is not available in Japan.



Weight : 0.46g (Typ.)

**OUTLINE DRAWING**  
TSSOP20-P-0044-0.65

Unit : mm



Weight : 0.08g (Typ.)