

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74LVX74F, TC74LVX74FT

Dual D-Type Flip-Flop with Preset and Clear

The TC74LVX74F/ FT is a high-speed CMOS 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.

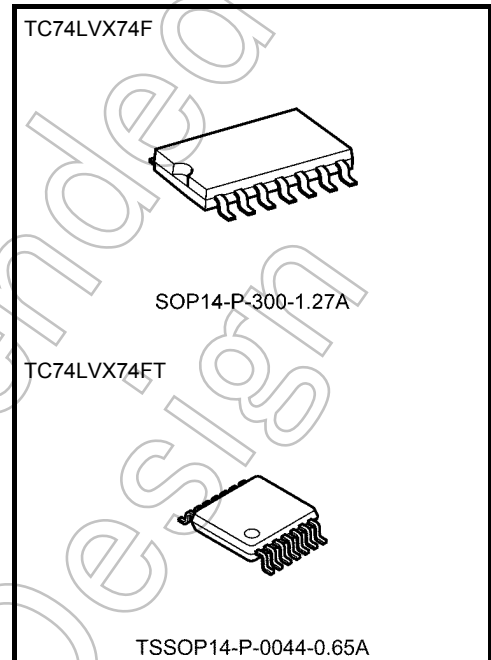
The signal level applied to the D input is transferred to Q output during the positive going transition of the CK pulse.

CLR and PR are independent of the CK and are accomplished by setting the appropriate input low.

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: $f_{max} = 145 \text{ MHz (typ.) (VCC = 3.3 V)}$
- Low power dissipation: $I_{CC} = 2 \mu\text{A (max) (Ta = 25^\circ\text{C})}$
- Input voltage level: $V_{IL} = 0.8 \text{ V (max) (VCC = 3 V)}$
 $V_{IH} = 2.0 \text{ V (min) (VCC = 3 V)}$
- Power-down protection provided on all inputs
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Pin and function compatible with 74HC74

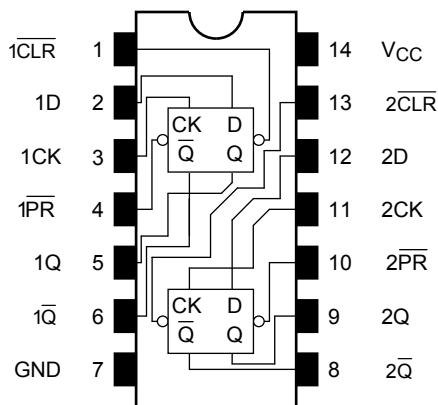


Weight	
SOP14-P-300-1.27A	: 0.18 g (typ.)
TSSOP14-P-0044-0.65A	: 0.06 g (typ.)

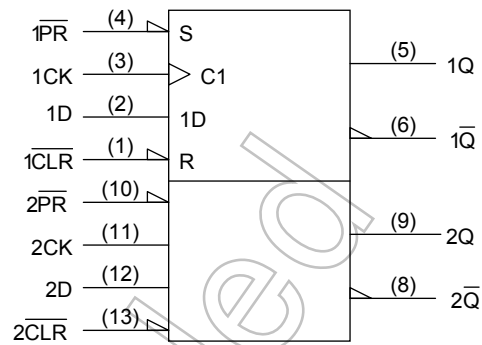
Not Recommended for New Design

Start of commercial production
1993-01

Pin Assignment (top view)



IEC Logic Symbol



Truth Table

Inputs				Outputs		Function
CLR	PR	D	CK	Q	Q̄	
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	Q̄ _n	No change

X: Don't care

Absolute Maximum Ratings (Note)

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}	±50	mA
Power dissipation	P _D	180	mW
Storage temperature	T _{stg}	-65 to 150	°C

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Operating Ranges (Note)

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	°C
Input rise and fall time	dt/dv	0 to 100	ns/V

Note: The operating ranges must be maintained to ensure the normal operation of the device.
Unused inputs must be tied to either V_{CC} or GND.

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition	$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } 85^\circ\text{C}$		Unit			
			V_{CC} (V)	Min	Typ.	Max	Min		Max		
Input voltage	H-level	—	2.0	1.5	—	—	1.5	—	V		
			3.0	2.0	—	—	2.0	—			
			3.6	2.4	—	—	2.4	—			
	L-level		2.0	—	—	0.5	—	0.5			
			3.0	—	—	0.8	—	0.8			
			3.6	—	—	0.8	—	0.8			
Output voltage	H-level	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -50 \mu\text{A}$	2.0	1.9	2.0	—	1.9	—	V	
			$I_{OH} = -50 \mu\text{A}$	3.0	2.9	3.0	—	2.9	—		
			$I_{OH} = -4 \text{ mA}$	3.0	2.58	—	—	2.48	—		
	L-level		$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 50 \mu\text{A}$	2.0	—	0	0.1	—		0.1
				$I_{OL} = 50 \mu\text{A}$	3.0	—	0	0.1	—		0.1
				$I_{OL} = 4 \text{ mA}$	3.0	—	—	0.36	—		0.44
Input leakage current	I_{IN}	$V_{IN} = 5.5 \text{ V or GND}$	3.6	—	—	± 0.1	—	± 1.0	μA		
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC} \text{ or GND}$	3.6	—	—	2.0	—	20.0	μA		

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

Characteristics	Symbol	Test Condition	$T_a = 25^\circ\text{C}$		$T_a = -40 \text{ to } 85^\circ\text{C}$		Unit
			V_{CC} (V)	Limit	Limit	Limit	
Minimum pulse width (CK)	t_W (L)	—	2.7	8.5	10.0	ns	
	t_W (H)		3.3 ± 0.3	6.0	7.0		
Minimum pulse width ($\overline{\text{CLR}}$, $\overline{\text{PR}}$)	t_W (L)	—	2.7	8.5	10.0	ns	
			3.3 ± 0.3	6.0	7.0		
Minimum set-up time	t_s	—	2.7	8.0	9.5	ns	
			3.3 ± 0.3	5.5	6.5		
Minimum hold time	t_h	—	2.7	0.5	0.5	ns	
			3.3 ± 0.3	0.5	0.5		
Minimum removal time ($\overline{\text{CLR}}$, $\overline{\text{PR}}$)	t_{rem}	—	2.7	6.5	7.5	ns	
			3.3 ± 0.3	5.0	5.0		

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, \bar{Q})	t_{pLH}	—	2.7	15	—	7.3	15.0	1.0	18.5	ns
				50	—	9.8	18.5	1.0	22.0	
	t_{pHL}		3.3 ± 0.3	15	—	5.7	9.7	1.0	11.5	
				50	—	8.2	13.2	1.0	15.0	
Propagation delay time (\bar{CLR} , \bar{PR} -Q, \bar{Q})	t_{pLH}	—	2.7	15	—	8.4	15.6	1.0	18.5	ns
				50	—	10.9	19.1	1.0	22.0	
	t_{pHL}		3.3 ± 0.3	15	—	6.6	10.1	1.0	12.0	
				50	—	9.1	13.6	1.0	15.5	
Maximum clock frequency	f_{max}	—	2.7	15	55	135	—	50	—	MHz
				50	45	60	—	40	—	
			3.3 ± 0.3	15	95	145	—	80	—	
				50	60	85	—	50	—	
Output to output skew	t_{osLH}	(Note 1)	2.7	50	—	—	1.5	—	1.5	ns
	t_{osHL}			3.3 ± 0.3	50	—	—	1.5	—	
Input capacitance	C _{IN}			(Note 2)	—	4	10	—	10	pF
Power dissipation capacitance	C _{PD}			(Note 3)	—	25	—	—	—	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.

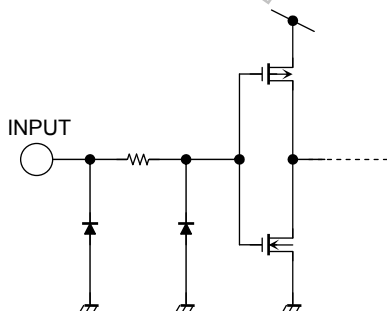
Average operating current can be obtained by the equation:

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

Noise Characteristics (Ta = 25°C, input: $t_r = t_f = 3 \text{ ns}$, C_L = 50 pF)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Typ.	Limit	Unit
Quiet output minimum dynamic V _{OL}	V _{OLV}	—	3.3	-0.3	-0.5	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

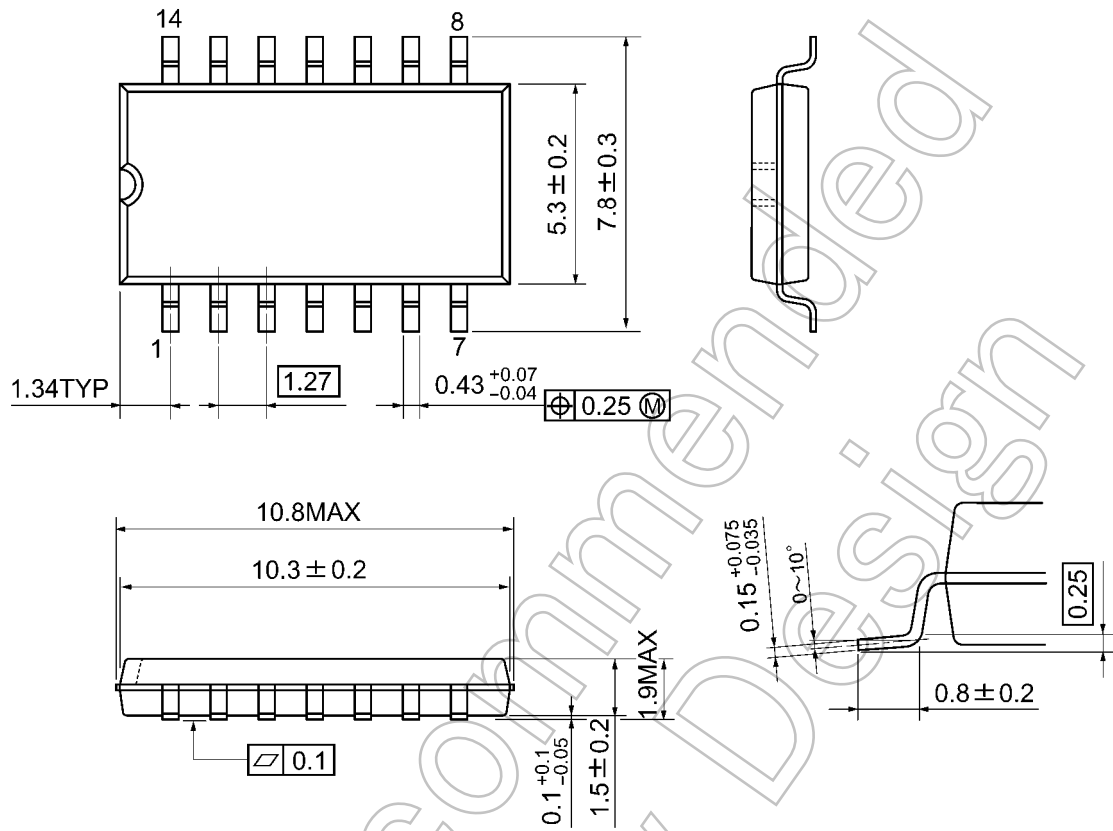
Input Equivalent Circuit



Package Dimensions

SOP14-P-300-1.27A

Unit: mm



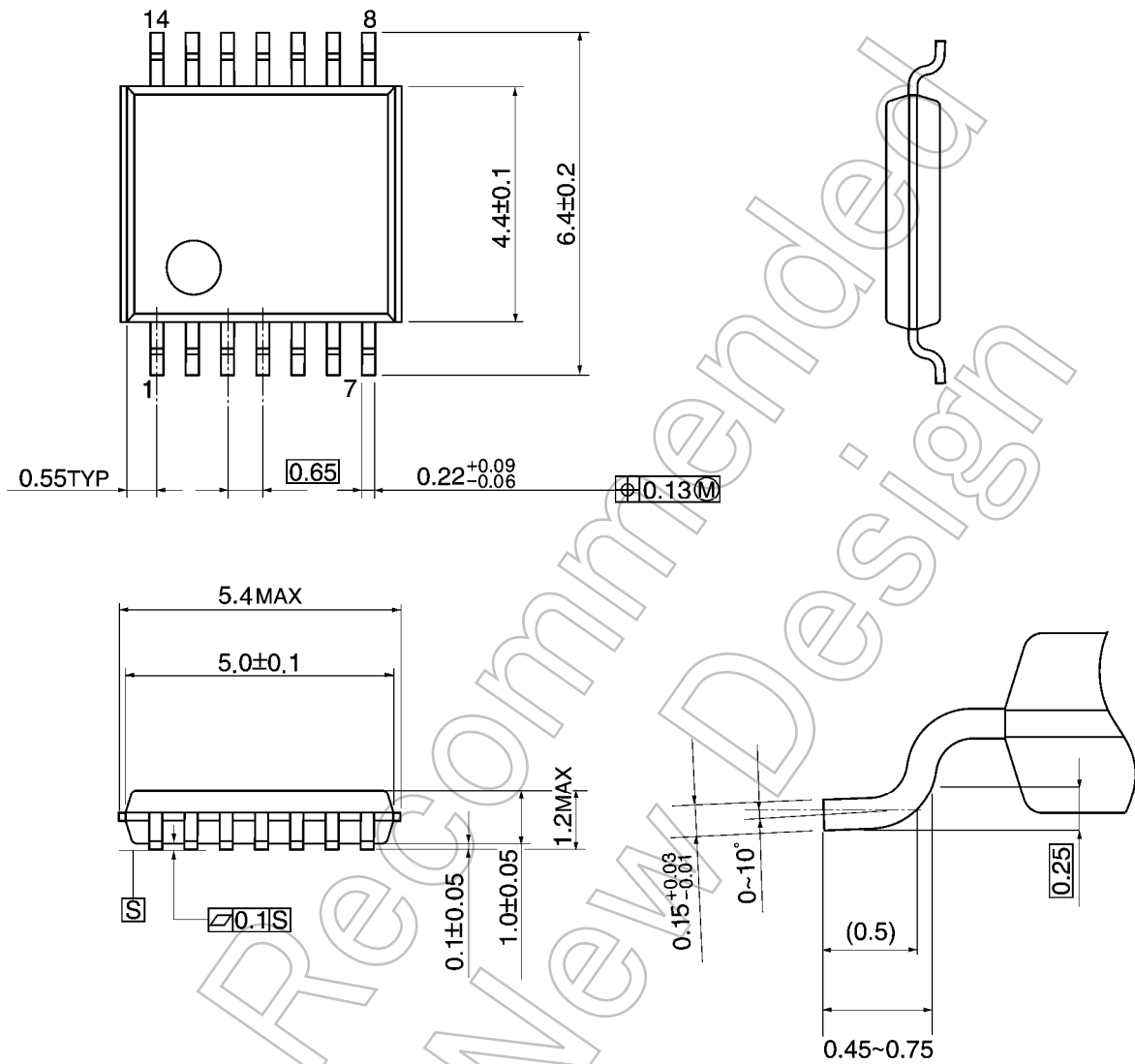
Weight: 0.18 g (typ.)

Not Recommended for New Design

Package Dimensions

TSSOP14-P-0044-0.65A

Unit: mm



Weight: 0.06 g (typ.)

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