

TC74VHC74F, TC74VHC74FT, TC74VHC74FK

Dual D-Type Flip-Flop with Preset and Clear

The TC74VHC74 is an advanced high speed CMOS D-FLIP FLOP fabricated with silicon gate C²MOS technology.

It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

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

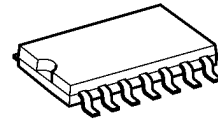
$\overline{\text{CLR}}$ and $\overline{\text{PR}}$ are independent of the CK and are accomplished by setting the appropriate input low.

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

Features

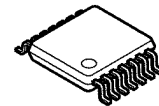
- High speed: $f_{\text{max}} = 170 \text{ MHz}$ (typ.) at $V_{\text{CC}} = 5 \text{ V}$
- Low power dissipation: $I_{\text{CC}} = 2 \mu\text{A}$ (max) at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_{\text{NIH}} = V_{\text{NIL}} = 28\% V_{\text{CC}}$ (min)
- Power down protection is provided on all inputs.
- Balanced propagation delays: $t_{\text{pLH}} \approx t_{\text{pHL}}$
- Wide operating voltage range: $V_{\text{CC (opr)}} = 2 \text{ V to } 5.5 \text{ V}$
- Pin and function compatible with 74ALS74

TC74VHC74F



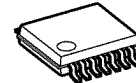
SOP14-P-300-1.27A

TC74VHC74FT



TSSOP14-P-0044-0.65A

TC74VHC74FK



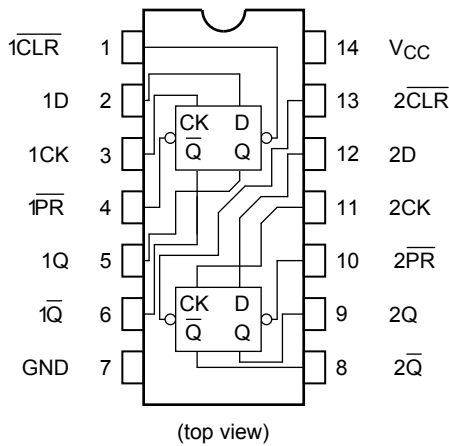
VSSOP14-P-0030-0.50

Weight

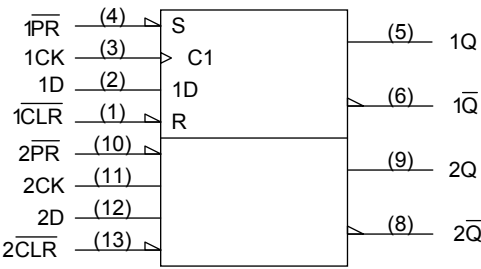
SOP14-P-300-1.27A	: 0.18 g (typ.)
TSSOP14-P-0044-0.65A	: 0.06 g (typ.)
VSSOP14-P-0030-0.50	: 0.02 g (typ.)

Start of commercial production
1991-05

Pin Assignment



IEC Logic Symbol



Truth Table

Inputs				Outputs		Function
$\overline{CLR}$	$\overline{PR}$	D	CK	Q	$\overline{Q}$	
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	$\overline{Q}_n$	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 5.5	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 ($V_{CC} = 3.3 \pm 0.3$ V) 0 to 20 ($V_{CC} = 5 \pm 0.5$ V)	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		Ta = 25°C			Ta = -40 to 85°C		Unit
				Min	Typ.	Max	Min	Max	
High-level input voltage	V_{IH}	—	2.0 3.0 to 5.5	1.50 $V_{CC} \times 0.7$	— —	— —	1.50 $V_{CC} \times 0.7$	— —	V
Low-level input voltage	V_{IL}	—	2.0 3.0 to 5.5	— —	— —	0.50 $V_{CC} \times 0.3$	— —	0.50 $V_{CC} \times 0.3$	V
High-level output voltage	V_{OH}	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -50 \mu A$	2.0 3.0 4.5	1.9 2.9 4.4	2.0 3.0 4.5	— — —	1.9 2.9 4.4	V
			$I_{OH} = -4 \text{ mA}$	3.0	2.58	—	—	2.48	
			$I_{OH} = -8 \text{ mA}$	4.5	3.94	—	—	3.80	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 50 \mu A$	2.0 3.0 4.5	— — —	0.0 0.0 0.0	0.1 0.1 0.1	— — —	V
			$I_{OL} = 4 \text{ mA}$	3.0	—	—	0.36	—	
			$I_{OL} = 8 \text{ mA}$	4.5	—	—	0.36	—	
Input leakage current	I_{IN}	$V_{IN} = 5.5 \text{ V or GND}$	0 to 5.5	—	—	± 0.1	—	± 1.0	μA
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC} \text{ or GND}$	5.5	—	—	2.0	—	20.0	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 (L)	—	3.3 ± 0.3	6.0	7.0	ns
	t _w (H)		5.0 ± 0.5	5.0	5.0	
Minimum pulse width ($\overline{\text{CLR}}$, $\overline{\text{PR}}$)	t _w (L)	—	3.3 ± 0.3	6.0	7.0	ns
			5.0 ± 0.5	5.0	5.0	
Minimum set-up time	t _s	—	3.3 ± 0.3	6.0	7.0	ns
			5.0 ± 0.5	5.0	5.0	
Minimum hold time	t _h	—	3.3 ± 0.3	0.5	0.5	ns
			5.0 ± 0.5	0.5	0.5	
Minimum removal time ($\overline{\text{CLR}}$, $\overline{\text{PR}}$)	t _{rem}	—	3.3 ± 0.3	5.0	5.0	ns
			5.0 ± 0.5	3.0	3.0	

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

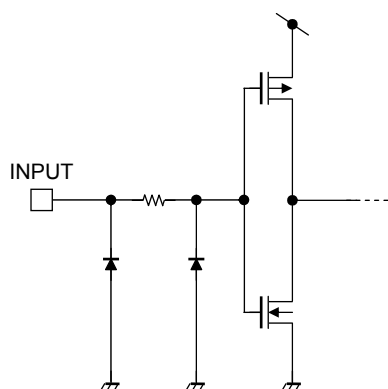
Characteristics	Symbol	Test Condition			Ta = 25°C			Ta = -40 to 85°C		Unit
			V _{CC} (V)	C _L (pF)	Min	Typ.	Max	Min	Max	
Propagation delay time (CK-Q, $\overline{Q}$)	t_{pLH} t_{pHL}	—	3.3 ± 0.3	15	—	6.7	11.9	1.0	14.0	ns
				50	—	9.2	15.4	1.0	17.5	
			5.0 ± 0.5	15	—	4.6	7.3	1.0	8.5	
				50	—	6.1	9.3	1.0	10.5	
Propagation delay time ($\overline{CLR}$, $\overline{PR}$ -Q, $\overline{Q}$)	t_{pLH} t_{pHL}	—	3.3 ± 0.3	15	—	7.6	12.3	1.0	14.5	ns
				50	—	10.1	15.8	1.0	18.0	
			5.0 ± 0.5	15	—	4.8	7.7	1.0	9.0	
				50	—	6.3	9.7	1.0	11.0	
Maximum clock frequency	f _{max}	—	3.3 ± 0.3	15	80	125	—	70	—	MHz
				50	50	75	—	45	—	
			5.0 ± 0.5	15	130	170	—	110	—	
				50	90	115	—	75	—	
Input capacitance	C _{IN}	—			—	4	10	—	10	pF
Power dissipation capacitance	C _{PD}	(Note)			—	25	—	—	—	pF

Note: 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:

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

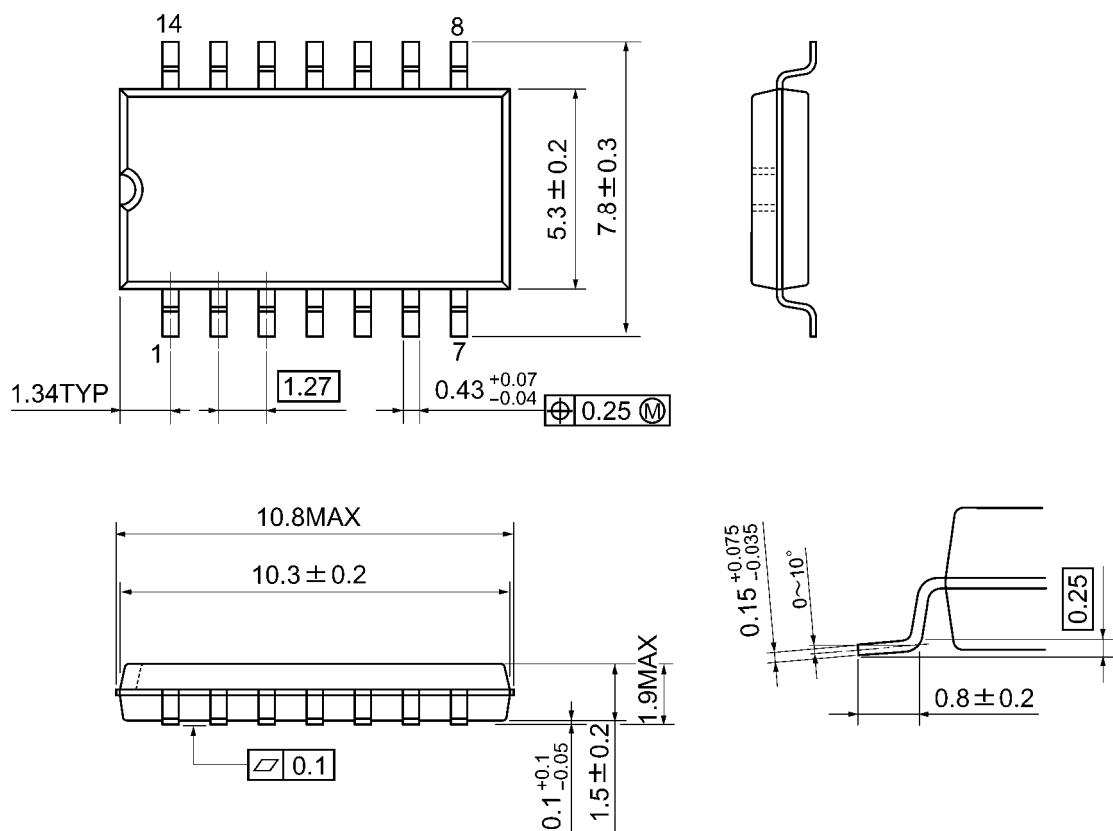
Input Equivalent Circuit



Package Dimensions

SOP14-P-300-1.27A

Unit: mm

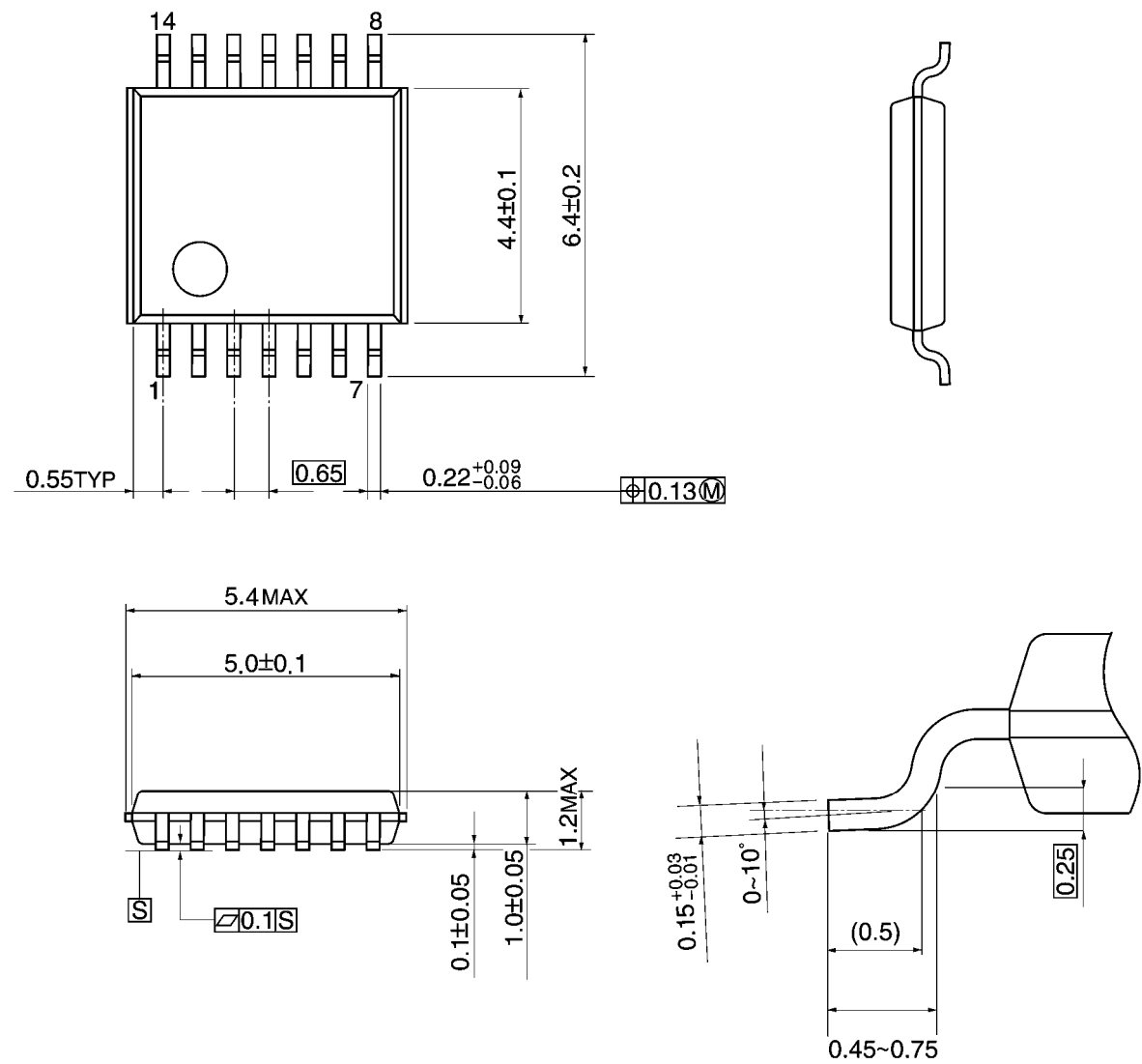


Weight: 0.18 g (typ.)

Package Dimensions

TSSOP14-P-0044-0.65A

Unit: mm

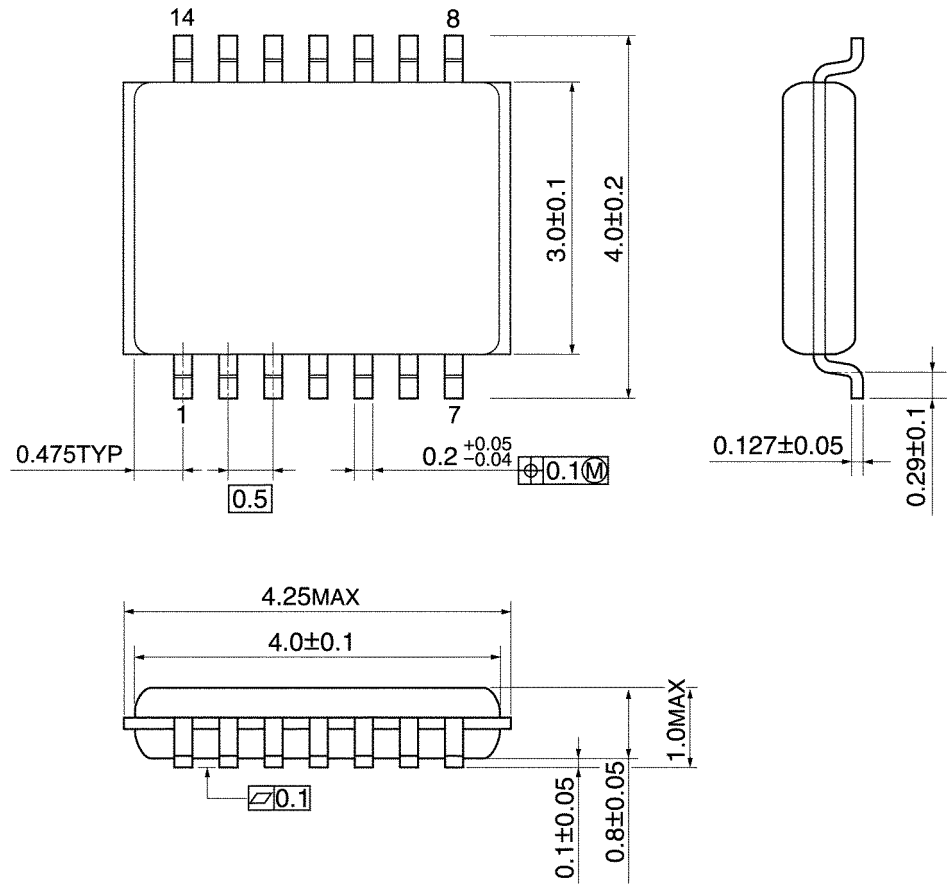


Weight: 0.06 g (typ.)

Package Dimensions

VSSOP14-P-0030-0.50

Unit: mm



Weight: 0.02 g (typ.)

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