

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC7WT74FU

## D-Type Flip Flop with Preset and Clear

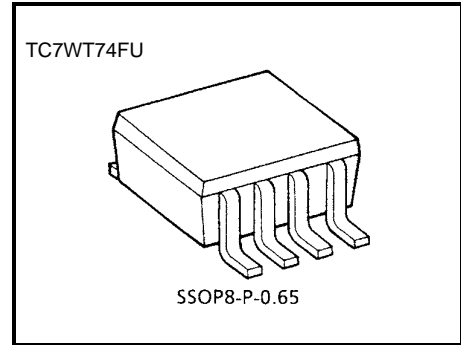
The TC7WT74FU is high speed CMOS D-FLIP FLOP fabricated with silicon gate CMOS technology. It achieves the high speed operation similar to equivalent Bipolar schottky TTL while maintaining the CMOS low power dissipation.

The input threshold levels are compatible with TTL output voltage.

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

CLEAR and PRESET are independent of the CK and are accomplished by setting the appropriate input low.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.

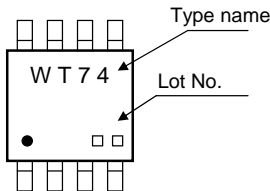


Weight  
SSOP8-P-0.65 : 0.02 g (typ.)

### Features

- High speed:  $f_{MAX} = 53\text{MHz}(\text{typ.})$  at  $V_{CC} = 5\text{V}$
- Low power dissipation:  $I_{CC} = 2\ \mu\text{A}(\text{max.})$  at  $T_a = 25^\circ\text{C}$
- Compatible with TTL outputs:  $V_{IL} = 3\text{V}(\text{max.})$  at  $T_a=25^\circ\text{C}$
- Output drive capability: 10 LSTTL Loads
- Symmetrical output impedance:  $|I_{OH}| = I_{OL} = 4\text{mA}(\text{min.})$

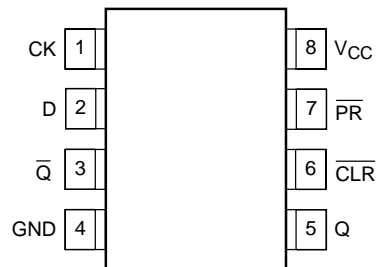
### Marking



### Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage range	$V_{CC}$	-0.5~7	V
DC input voltage	$V_{IN}$	-0.5~ $V_{CC} + 0.5$	V
DC output voltage	$V_{OUT}$	-0.5~ $V_{CC} + 0.5$	V
Input diode current	$I_{IK}$	$\pm 20$	mA
Output diode current	$I_{OK}$	$\pm 20$	mA
DC output current	$I_{OUT}$	$\pm 25$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 25$	mA
Power dissipation	$P_D$	300	mW
Storage temperature	$T_{stg}$	-65~150	°C
Lead temperature (10s)	$T_L$	260	°C

### Pin Assignment (top view)

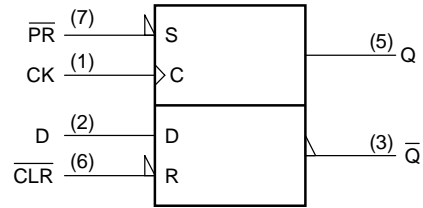


**Truth Table**

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	↘	Qn	Qn	No Change

X: Don't care

**Logic Diagram**



**Recommended Operating Conditions**

Characteristics	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	4.5~5.5	V
Input voltage	V <sub>IN</sub>	0~V <sub>CC</sub>	V
Output voltage	V <sub>OUT</sub>	0~5.5	V
Operating temperature	T <sub>opr</sub>	-40~85	°C
Input rise and fall time	dt/dv	0~500	ns

**DC Electrical Characteristics**

Characteristics		Symbol	Test Condition		Ta = 25°C			Ta = -40~85°C		Unit	
					V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max
Input voltage	High level	V <sub>IH</sub>		4.5~5.5	2.0	—	—	2.0	—	V	
	Low level	V <sub>IL</sub>		4.5~5.5	—	—	0.8	—	0.8		
Output voltage	High level	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub>	I <sub>OH</sub> = -20 μA	4.5	4.4	4.5	—	4.4	—	V
			I <sub>OH</sub> = -4 mA	4.5	4.18	4.31	—	4.13	—		
	Low level	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub>	I <sub>OL</sub> = 20 μA	4.5	—	0.0	0.10	—	0.10	V
				I <sub>OL</sub> = 4 mA	4.5	—	0.17	0.26	—	0.33	
Input leakage current		I <sub>IN</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5	—	—	±0.1	—	±1	μA	
Quiescent supply current		I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5	—	—	2.0	—	20.0	μA	
		I <sub>CC</sub> T	PER INPUT: V <sub>IN</sub> = 0.5 V or 2.4V OTHER INPUT: V <sub>CC</sub> or GND	5.5	—	—	2.0	—	2.9	μμA	

**Timing Requirements (Input:  $t_r = t_f = 6 \text{ ns}$ )**

Characteristics	Symbol	Test Condition	Ta = 25°C		Ta = -40~85°C	Unit	
			V <sub>CC</sub> (V)	Typ	LIMIT		LIMIT
Maximum pulse frequency width (CLOCK)	t <sub>w(L)</sub>		4.5	—	25	29	ns
	t <sub>w(H)</sub>		5.5	—	20	23	
Maximum pulse frequency width (CLR, PR)	t <sub>w(L)</sub>		4.5	—	30	34	ns
			5.5	—	25	28	
Minimum set-up time	t <sub>s</sub>		4.5	—	25	29	ns
			5.5	—	20	23	
Minimum hold time	t <sub>h</sub>		4.5	—	10	10	ns
			5.5	—	8	8	
Maximum removal time (CLR, PR)	t <sub>rem</sub>		4.5	—	10	10	ns
			5.5	—	10	10	
Clock frequency	f		4.5	—	22	16	MHz
			5.5	—	25	19	

**AC Electrical Characteristics (C<sub>L</sub> = 15pF, V<sub>CC</sub> = 5V, Ta = 25°C)**

Characteristics	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Output transition time	t <sub>TLH</sub>	—	—	6	12	ns
	t <sub>THL</sub>					
Propagation delay time (CLOCK - Q, Q)	t <sub>PLH</sub>	—	—	17	28	ns
	t <sub>PHL</sub>					
Propagation delay time (CLR, PR - Q, Q)	t <sub>PLH</sub>	—	—	20	30	ns
	t <sub>PHL</sub>					
Maximum clock time	f <sub>MAX</sub>	—	24	53	—	MHz

## AC Electrical Characteristics (C<sub>L</sub> = 15pF, Input t<sub>r</sub> = t<sub>f</sub> = 6ns)

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40~85°C		Unit	
			V <sub>CC</sub> (V)	Min.	Typ.	Max.	Min.		Max.
Output transition time	t <sub>TLH</sub>	—	4.5	—	8	15	—	19	ns
	t <sub>THL</sub>		5.5	—	7	13	—	16	
Propagation delay time (CLOCK – Q, $\bar{Q}$ )	t <sub>PLH</sub>	—	4.5	—	21	33	—	41	ns
	t <sub>PHL</sub>		5.5	—	19	35	—	37	
Propagation delay time (CLR, PR – Q, $\bar{Q}$ )	t <sub>PLH</sub>	—	4.5	—	23	35	—	43	ns
	t <sub>PHL</sub>		5.5	—	20	32	—	40	
Maximum clock frequency	f <sub>MAX</sub>	—	4.5	22	48	—	16	—	MHz
			5.5	25	53	—	19	—	
Input capacitance	C <sub>IN</sub>	—	—	5	10	—	10	pF	
Power dissipation capacitance	C <sub>PD</sub>	—	—	34	—	—	10	pF	

Note: C<sub>PD</sub> 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:

$$I_{CC (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$



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