

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC7WT74FU

## D-Type Flip-Flop with Preset and Clear

The TC7WT74FU is high speed CMOS D-TYPE FLIP-FLOP fabricated with silicon gate CMOS technology.

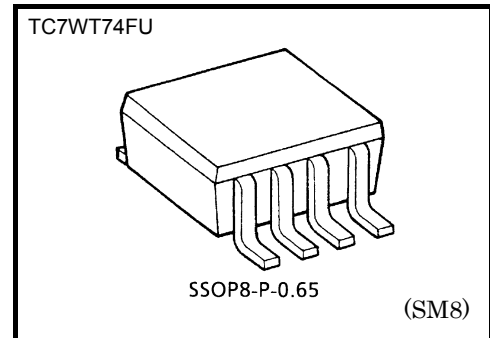
It achieves the high speed operation similar to equivalent Bipolar schottky TTL while maintaining the CMOS low power dissipation.

The input threshold levels are compatible with TTL output voltage.

The signal level applied to the D-INPUT is tranferred 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 dichage or transient excess voltage.



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

## Features

- High speed:  $f_{MAX} = 53 \text{ MHz (typ.) at } V_{CC} = 5 \text{ V}$
- Low power dissipation:  $I_{CC} = 2 \mu\text{A (max) at } T_a = 25^\circ\text{C}$
- Compatible with TTL inputs:  $V_{IL} = 0.8 \text{ V (max) at } T_a = 25^\circ\text{C}$
- Output drive capability: 10 LSTTL Loads
- Symmetrical output impedance:  $|I_{OH}| = I_{OL} = 4 \text{ mA (min)}$

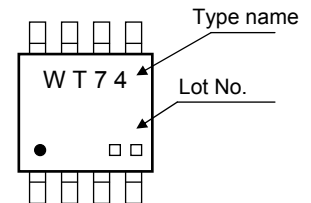
## Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Rating	Unit
Supply voltage range	$V_{CC}$	-0.5 to 7	V
DC input voltage	$V_{IN}$	-0.5 to $V_{CC} + 0.5$	V
DC output voltage	$V_{OUT}$	-0.5 to $V_{CC} + 0.5$	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 to 150	$^\circ\text{C}$
Lead temperature (10s)	$T_L$	260	$^\circ\text{C}$

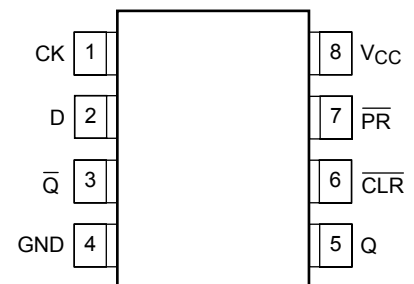
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

## Marking



## Pin Assignment (top view)

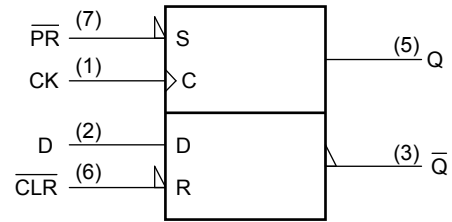


## Truth Table

Inputs				Outputs		Function
$\overline{\text{CLR}}$	$\overline{\text{PR}}$	D	CK	Q	$\overline{\text{Q}}$	
L	H	X	X	L	H	Clear
H	L	X	X	H	L	Preset
L	L	X	X	H	H	—
H	H	L	$\uparrow$	L	H	—
H	H	H	$\uparrow$	H	L	—
H	H	X	$\downarrow$	Qn	$\overline{\text{Qn}}$	No Change

X: Don't care

## IEC Logic Symbol



## Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	4.5 to 5.5	V
Input voltage	$V_{IN}$	0 to $V_{CC}$	V
Output voltage	$V_{OUT}$	0 to $V_{CC}$	V
Operating temperature	$T_{opr}$	-40 to 85	°C
Input rise and fall time	$t_r, t_f$	0 to 500	ns

## DC Electrical Characteristics

Characteristics	Symbol	Test Condition	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } 85^\circ\text{C}$		Unit		
				Min	Typ.	Max	Min	Max			
Input voltage	High level	$V_{IH}$	4.5 to 5.5	2.0	—	—	2.0	—	V		
	Low level	$V_{IL}$	4.5 to 5.5	—	—	0.8	—	0.8			
Output voltage	High level	$V_{OH}$	$V_{IN} = V_{IL} \text{ or } V_{IH}$	$I_{OH} = -20 \mu\text{A}$	4.5	4.4	4.5	—	4.4	—	V
				$I_{OH} = -4 \text{ mA}$	4.5	4.18	4.31	—	4.13	—	
	Low level	$V_{OL}$	$V_{IN} = V_{IL} \text{ or } V_{IH}$	$I_{OL} = 20 \mu\text{A}$	4.5	—	0.0	0.10	—	0.10	V
				$I_{OL} = 4 \text{ mA}$	4.5	—	0.17	0.26	—	0.33	
Input leakage current	$I_{IN}$	$V_{IN} = V_{CC} \text{ or } \text{GND}$	5.5	—	—	$\pm 0.1$	—	$\pm 1$	$\mu\text{A}$		
Quiescent supply current	$I_{CC}$	$V_{IN} = V_{CC} \text{ or } \text{GND}$	5.5	—	—	2.0	—	20.0	$\mu\text{A}$		
	$I_{CCT}$	PER INPUT: $V_{IN} = 0.5 \text{ V or } 2.4\text{V}$ OTHER INPUT: $V_{CC} \text{ or } \text{GND}$	5.5	—	—	2.0	—	2.9	mA		

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

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C	Unit
			V <sub>CC</sub> (V)	Typ	LIMIT		
Minimum pulse width (CLOCK)	t <sub>W(L)</sub>	—	4.5	—	25	29	ns
	t <sub>W(H)</sub>		5.5	—	20	23	
Minimum pulse 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	
Minimum 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 frequency	f <sub>MAX</sub>	—	24	53	—	MHz

## AC Electrical Characteristics ( $C_L = 50\text{pF}$ , Input $t_r = t_f = 6\text{ ns}$ )

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 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, Q)	t <sub>PLH</sub>	—	4.5	—	21	33	—	41	ns
	t <sub>PHL</sub>	—	5.5	—	19	30	—	37	
Propagation delay time (CLR, PR – Q, 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>	(Note)	—	34	—	—	—	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.

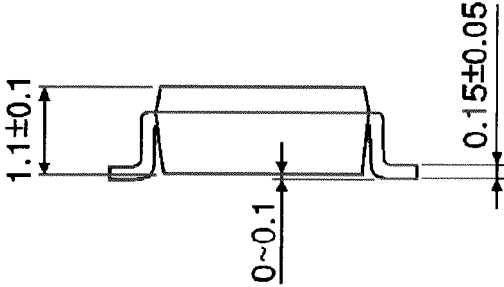
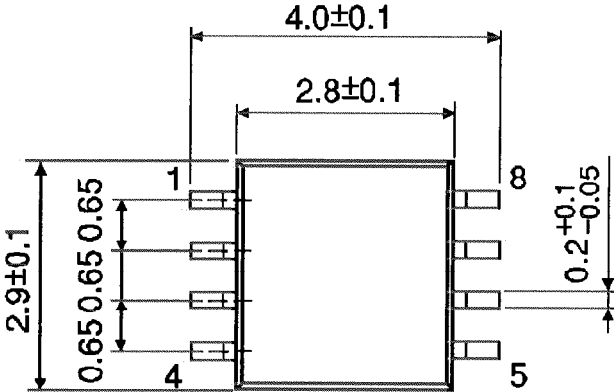
Average operating current can be obtained by the equation:

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

**Package Dimensions**

SSOP8-P-0.65

Unit : mm



Weight: 0.02 g (typ.)

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