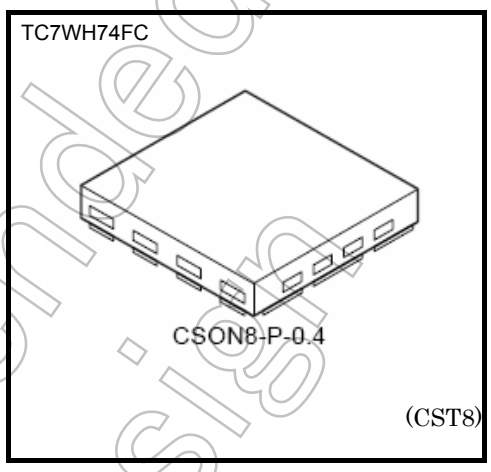
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7WH74FC

D-Type Flip Flop with Preset and Clear

Features

- High-speed : f_{MAX} = 170MHz (typ.) at V_{CC} = 5V
- Low power dissipation : I_{CC} = 2μA (max) at Ta = 25°C
- High noise immunity : $V_{NIH} = V_{NIL}$ = 28% V_{CC} (min)
- Operation voltage range : V_{CC} = 2 to 5.5V
- 5.5-V Tolerant inputs.



Weight: 0.002g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply viltage	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(Note1)	V
Input diode current	I_{IK}	−20	mA
Output diode current	I_{OK}	±20 (Note2)	mA
DC output current	I_{OUT}	±25	mA
DC V_{CC}/GND current	I_{CC}	±50	mA
Power dissipation	P_D	150 (Note3)	mW
Storage temperature	T_{stg}	−65 to 150	°C

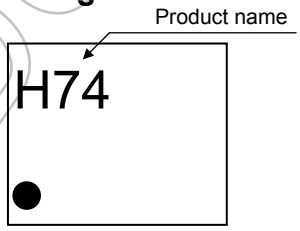
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

Note 1: High or Low State.
I_{OUT} absolute maximum rating must be observed.

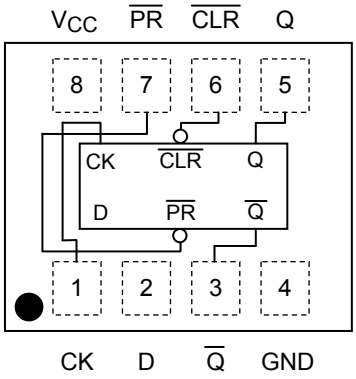
Note 2: V_{OUT} < GND , V_{OUT} > V_{CC}

Note 3: Mounted on an FR4 board.
(25.4 mm × 25.4 mm × 1.6 t, Cu Pad: 11.56 mm^2)

Marking



Pin Assignment (top view)



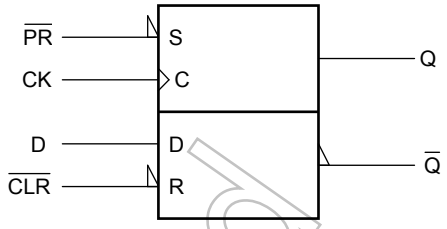
Start of commercial production
2005-06

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	↓	Qn	$\overline{Qn}$	No Change

X: Don't Care

IEC Logic Symbol



Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2 to 5.5	V
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to V	V
Operating temperature	T_{opr}	−40 to 85	°C
Input rise and fall time	dt/dv	0 to 100 (V_{CC} = 3.3 V ± 0.3 V)	ns/V
		0 to 20 (V_{CC} = 5.0 V ± 0.5 V)	

DC Electrical Characteristics

Characteristic	Symbol	Test condition		Ta = 25°C				Ta = −40 to 85°C		Unit
				V_{CC} (V)	Min	Typ.	Max	Min	Max	
High-level input voltage	V_{IH}	—		2.0	1.5	—	—	1.5	—	V
				3.0 to 5.5	V_{CC} × 0.7	—	—	V_{CC} × 0.7	—	
Low-level input voltage	V_{IL}	—		2.0	—	—	0.5	—	0.5	
				3.0 to 5.5	—	—	V_{CC} × 0.3	—	V_{CC} × 0.3	
High-level output voltage	V_{OH}	V_{IN} = V_{IL} or V_{IH}	I_{OH} = −50 μA	2.0	1.9	2.0	—	1.9	—	V
				3.0	2.9	3.0	—	2.9	—	
				4.5	4.4	4.5	—	4.4	—	
			I_{OH} = −4 mA	3.0	2.58	—	—	2.48	—	
			I_{OH} = −8 mA	4.5	3.94	—	—	3.80	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IL} or V_{IH}	I_{OL} = 50 μA	2.0	—	0.0	0.1	—	0.1	
				3.0	—	0.0	0.1	—	0.1	
				4.5	—	0.0	0.1	—	0.1	
			I_{OL} = 4 mA	3.0	—	—	0.36	—	0.44	
			I_{OL} = 8 mA	4.5	—	—	0.36	—	0.44	
Input leakage current	I_{IN}	V_{IN} = 5.5 V or GND		0 to 5.5	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND		5.5	—	—	2.0	—	20.0	μA

Timing Requirements (unless otherwise specified, Input: $t_r = t_f = 3$ ns)

Characteristic	Symbol	Test condision		Ta = 25°C	Ta = −40 to 85°C	Unit
			V_{CC} (V)	LIMIT	LIMIT	
Minimun 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 ($\overline{CLR}$, $\overline{PR}$)	$t_{W(L)}$		3.3 ± 0.3	6.0	7.0	
			5.0 ± 0.5	5.0	5.0	
Minimum set-up time	t_s		3.3 ± 0.3	7.0	7.0	
			5.0 ± 0.5	5.0	5.0	
Minimum hold time	t_h		3.3 ± 0.3	0.5	0.5	
			5.0 ± 0.5	0.5	0.5	
Minimum removal time ($\overline{CLR}$, $\overline{PR}$)	t_{rem}		3.3 ± 0.3	5.0	5.0	
			5.0 ± 0.5	3.0	3.0	

AC Electrical Characteristics (unless otherwise specified, Input: $t_r = t_f = 3$ ns)

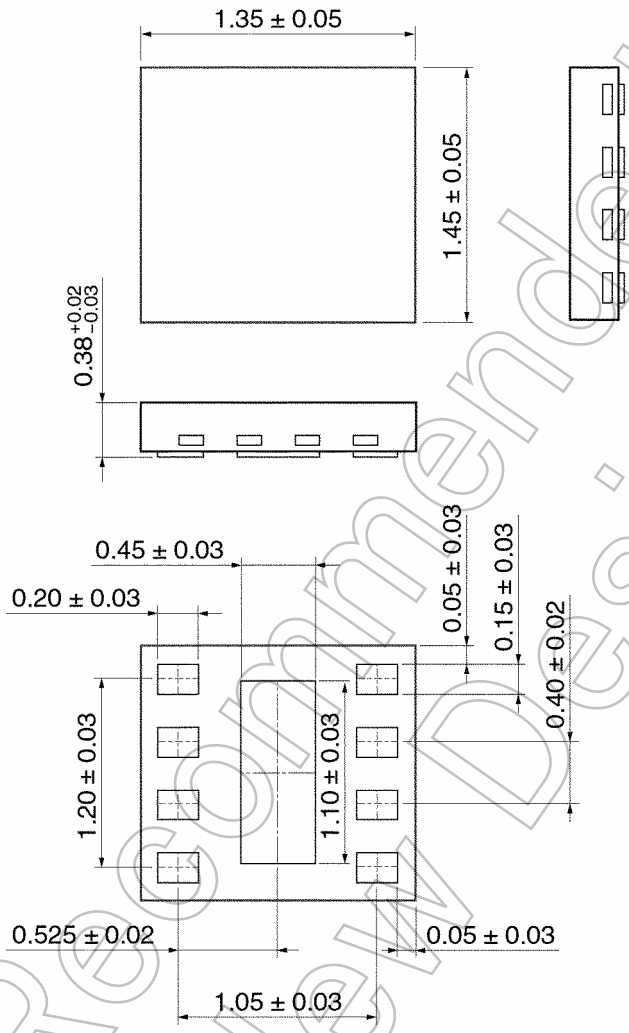
Characteristic	Symbol	Test condition			Ta = 25°C			Ta = −40 to 85°C		Unit
			V_{CC} (V)	C_L (pF)	Min	Typ.	Max	Min	Max	
Propagation deley time (CK – Q , $\overline{Q}$)	t_{pLH} t_{pHL}		3.3 ± 0.3	15	—	6.7	11.9	1.0	14.0	ns
				50	—	9.2	15.4	1.0	17.5	
			5.0 ± 0.5	15	—	4.6	7.3	1.0	8.5	
				50	—	6.1	9.3	1.0	10.5	
Propagation deley 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 capacitanse	C_{PD}	(Note 4)			—	22	—	—	—	pF

Note 4: 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:

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

Package Dimensions

CSON8-P-0.4 Unit: mm



Weight : 0.002 g (typ.)

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