

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

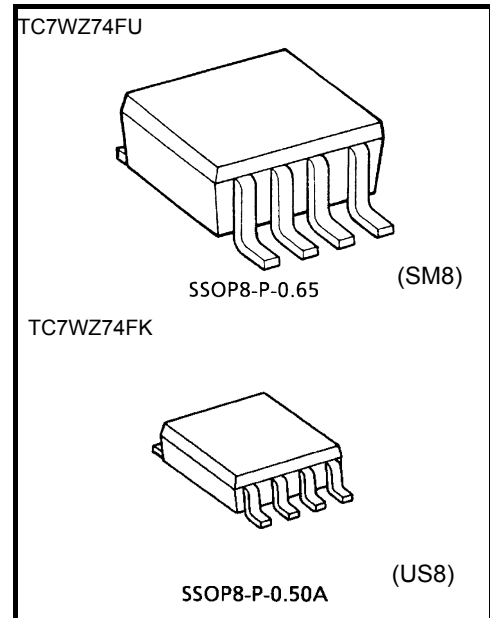
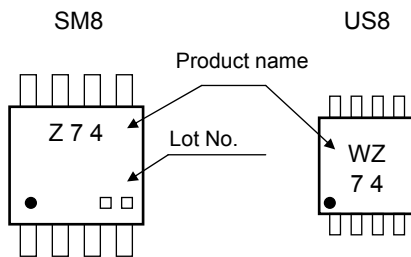
# TC7WZ74FU, TC7WZ74FK

## D-Type Flip Flop with Preset and Clear

### Features

- High output current:  $\pm 24$  mA (min) at  $V_{CC} = 3$  V
- Super high speed operation:  $t_{pd} = 2.8$  ns (typ.)  
at  $V_{CC} = 5$  V, 50 pF
- Operating voltage range:  $V_{CC(opr)} = 1.65$  to 5.5 V
- 5.5-V Tolerant inputs
- 5.5-V Power down protection outputs
- Matches the performance of TC74LCX series when operated at 3.3- V  $V_{CC}$

### Marking

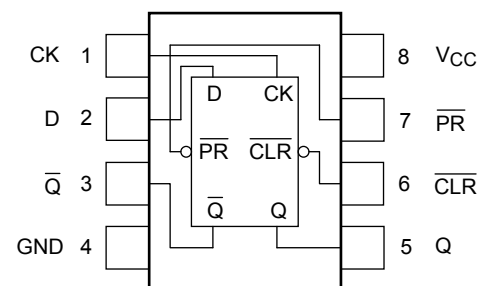


Weight  
 SSOP8-P-0.65 : 0.02 g (typ.)  
 SSOP8-P-0.50A : 0.01 g (typ.)

### Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage range	$V_{CC}$	-0.5 to 6	V
DC input voltage	$V_{IN}$	-0.5 to 6	V
DC output voltage	$V_{OUT}$	-0.5 to 6 (Note 1)	V
		-0.5 to $V_{CC}+0.5$ (Note 2)	
Input diode current	$I_{IK}$	-20	mA
Output diode current	$I_{OK}$	-20 (Note 3)	mA
DC output current	$I_{OUT}$	$\pm 50$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 50$	mA
Power dissipation	$P_D$	300 (SM8) 200 (US8)	mW
Storage temperature	$T_{stg}$	-65 to 150	°C
Lead temperature (10s)	$T_L$	260	°C

### Pin Assignment (top view)



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:  $V_{CC} = 0$  V

Note 2: High or Low State. Do not exceed  $I_{OUT}$  of absolute maximum ratings.

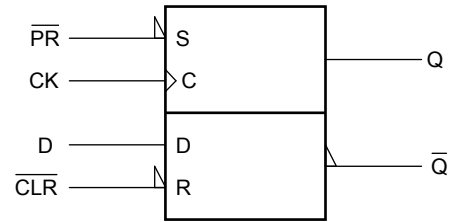
Note 3:  $V_{OUT} < GND$

## 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	Qn	No Change

X: Don't care

## IEC Logic Symbol



## Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	1.65 to 5.5	V
		1.5 to 5.5 (Note 4)	
Input voltage	$V_{IN}$	0 to 5.5	V
Output voltage	$V_{OUT}$	0 to 5.5 (Note 5)	V
		0 to $V_{CC}$ (Note 6)	
Operating temperature	$T_{opr}$	-40 to 85	°C
Input rise and fall time	dt/dv	0 to 20 ( $V_{CC} = 1.80 \text{ V} \pm 0.15 \text{ V}$ , $2.5 \text{ V} \pm 0.2 \text{ V}$ )	ns/V
		0 to 10 ( $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ )	
		0 to 5 ( $V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$ )	

Note 4: Data retention only

Note 5:  $V_{CC} = 0 \text{ V}$

Note 6: High or low state

## Electrical Characteristics

### DC Characteristics

Characteristics		Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit	
					V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max
Input voltage	High level	V <sub>IH</sub>	—	1.65 to 1.8	V <sub>CC</sub> × 0.75	—	—	V <sub>CC</sub> × 0.75	—	V	
				2.3 to 5.5	V <sub>CC</sub> × 0.7	—	—	V <sub>CC</sub> × 0.7	—		
	Low level	V <sub>IL</sub>	—	1.65 to 1.8	—	—	V <sub>CC</sub> × 0.25	—	V <sub>CC</sub> × 0.25		
				2.3 to 5.5	—	—	V <sub>CC</sub> × 0.3	—	V <sub>CC</sub> × 0.3		
Output voltage	High level	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -100 μA	1.65	1.55	1.65	—	1.55	—	V
					2.3	2.2	2.3	—	2.2	—	
					3.0	2.9	3.0	—	2.9	—	
					4.5	4.4	4.5	—	4.4	—	
				I <sub>OH</sub> = -4 mA	1.65	1.29	1.52	—	1.29	—	
					2.3	1.9	2.15	—	1.9	—	
					3.0	2.4	2.8	—	2.4	—	
					4.5	3.8	4.2	—	3.8	—	
	Low level	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 100 μA	1.65	—	0	0.1	—	0.1	V
					2.3	—	0	0.1	—	0.1	
					3.0	—	0	0.1	—	0.1	
					4.5	—	0	0.1	—	0.1	
				I <sub>OL</sub> = 4 mA	1.65	—	0.08	0.24	—	0.24	
					2.3	—	0.1	0.3	—	0.3	
					3.0	—	0.15	0.4	—	0.4	
					4.5	—	0.22	0.55	—	0.55	
I <sub>OL</sub> = 8 mA	1.65	—	0.15	0.55	—	0.55					
	2.3	—	0.22	0.55	—	0.55					
	3.0	—	0.22	0.55	—	0.55					
	4.5	—	0.22	0.55	—	0.55					
Input leakage current		I <sub>IN</sub>	V <sub>IN</sub> = 5.5 V or GND	0 to 5.5	—	—	±1	—	±10	μA	
Power off leakage current		I <sub>OFF</sub>	V <sub>IN</sub> or V <sub>OUT</sub> = 5.5 V	0.0	—	—	1	—	10	μA	
Quiescent supply current		I <sub>CC</sub>	V <sub>IN</sub> = 5.5 V or GND	1.65 to 5.5	—	—	1	—	10	μA	

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

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit	
			V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max
Maximum clock frequency	f <sub>MAX</sub>	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	1.80 ± 0.15	51	—	—	38	—	MHz
			2.5 ± 0.2	130	—	—	100	—	
			3.3 ± 0.3	200	—	—	150	—	
			5.0 ± 0.5	200	—	—	180	—	
Propagation delay time (CK-Q, $\bar{Q}$ )	t <sub>pLH</sub>	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 MΩ	1.80 ± 0.15	2.5	10.0	18.0	2.1	23.0	ns
			2.5 ± 0.2	2.0	4.9	7.5	1.7	9.0	
			3.3 ± 0.3	1.5	3.3	4.8	1.3	5.6	
	t <sub>pHL</sub>	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	5.0 ± 0.5	1.0	2.4	3.5	1.0	3.9	
			3.3 ± 0.3	2.0	4.3	5.7	1.5	7.0	
			5.0 ± 0.5	1.5	2.8	4.0	1.3	4.4	
Propagation delay time ( $\bar{CLR}$ , $\bar{PR}$ -Q, $\bar{Q}$ )	t <sub>pLH</sub>	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 MΩ	1.80 ± 0.15	2.5	10.0	17.0	2.1	21.0	ns
			2.5 ± 0.2	2.0	5.0	7.3	1.7	8.8	
			3.3 ± 0.3	1.5	3.4	4.8	1.3	5.6	
	t <sub>pHL</sub>	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	5.0 ± 0.5	1.5	2.2	3.5	1.0	3.9	
			3.3 ± 0.3	2.0	4.3	5.7	1.5	7.0	
			5.0 ± 0.5	1.0	3.1	3.9	1.0	4.3	
Minimum setup time	t <sub>s</sub>	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	2.5 ± 0.2	3.4	—	—	4.1	—	ns
			3.3 ± 0.3	2.1	—	—	2.5	—	
			5.0 ± 0.5	1.5	—	—	1.7	—	
Minimum hold time	t <sub>h</sub>	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	2.5 ± 0.2	2.4	—	—	2.9	—	ns
			3.3 ± 0.3	1.4	—	—	1.5	—	
			5.0 ± 0.5	1.0	—	—	1.1	—	
Minimum pulse width (CK)	t <sub>w</sub> (L) t <sub>w</sub> (H)	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	2.5 ± 0.2	3.0	—	—	3.6	—	ns
			3.3 ± 0.3	3.0	—	—	3.3	—	
			5.0 ± 0.5	3.0	—	—	3.2	—	
Minimum pulse width ( $\bar{CLR}$ , $\bar{PR}$ )	t <sub>w</sub> (L)	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	2.5 ± 0.2	3.0	—	—	3.6	—	ns
			3.3 ± 0.3	3.0	—	—	3.3	—	
			5.0 ± 0.5	3.0	—	—	3.2	—	
Minimum removal time	t <sub>rem</sub>	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	2.5 ± 0.2	3.6	—	—	4.4	—	ns
			3.3 ± 0.3	2.2	—	—	2.5	—	
			5.0 ± 0.5	1.3	—	—	1.4	—	
Input capacitance	C <sub>IN</sub>	—	0 to 0.5	—	3.0	—	—	pF	
Output capacitance	C <sub>OUT</sub>	—	0 to 0.5	—	5.0	—	—	pF	
Power dissipation capacitance	C <sub>PD</sub>	(Note 7)	3.3	—	30	—	—	—	pF
			5.5	—	47	—	—	—	

Note 7: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

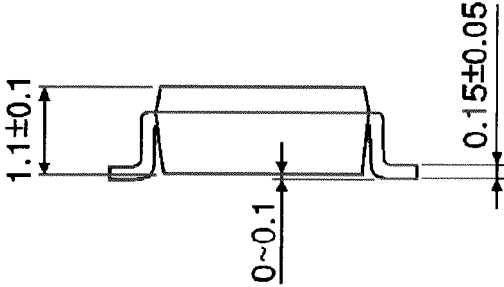
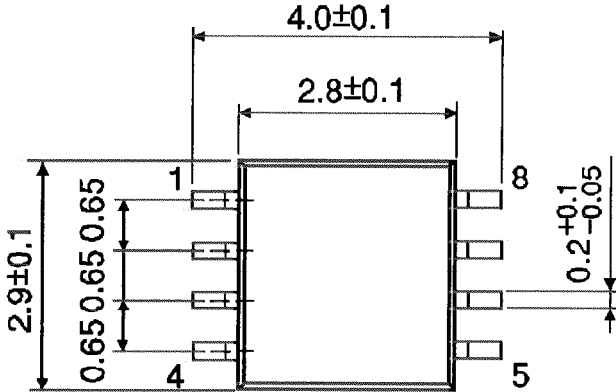
Average operating current can be obtained by the equation:

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

Package Dimensions

SSOP8-P-0.65

Unit : mm

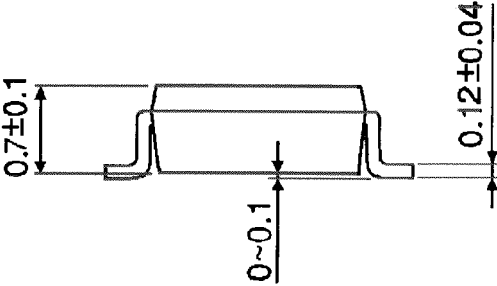
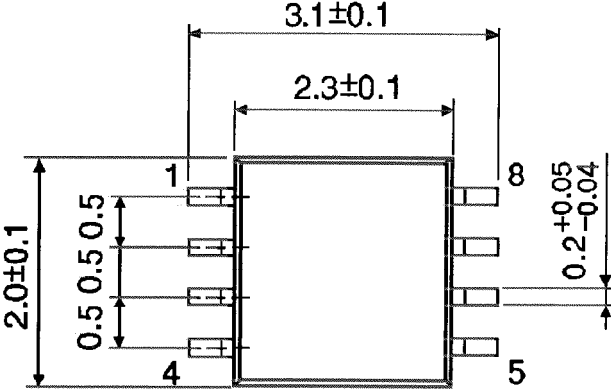


Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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- Подбор аналогов;
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