TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

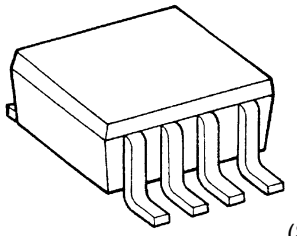
TC7WZ74FU,TC7WZ74FK

D-Type Flip Flop with Preset and Clear

Features

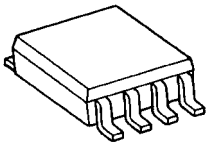
- High output current: ±24 mA (min) at V_{CC} = 3 V
- Super high speed operation: t_{pd} = 2.8 ns (typ.) at V_{CC} = 5 V, 50 pF
- Operating voltage range: $V_{CC\ (opr)}$ = 1.65 to 5.5 V
- 5.5-V Tolerant inputs
- 5.5-V Power down protection outputs
- Matches the performance of TC74LCX series when operated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

TC7WZ74FU



SSOP8-P-0.65 (SM8)

TC7WZ74FK

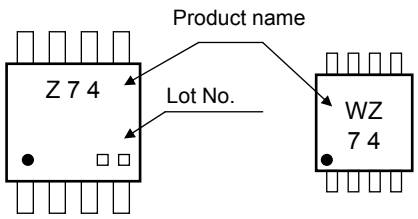


SSOP8-P-0.50A (US8)

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

Marking

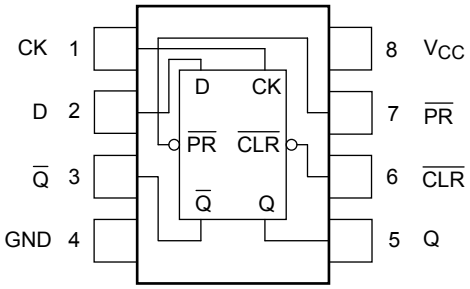
SM8 US8



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}	±50	mA
DC V_{CC}/ground current	I_{CC}	±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.

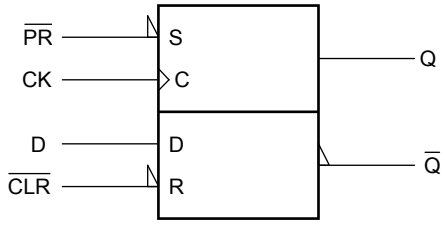
Note 3: V_{OUT} < GND

Truth Table

Inputs				Outputs		Function
$\overline{CLR}$	$\overline{PR}$	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	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 V ± 0.15 V, 2.5 V ± 0.2 V)	ns/V
		0 to 10 (V_{CC} = 3.3 V ± 0.3 V)	
		0 to 5 (V_{CC} = 5.0 V ± 0.5 V)	

Note 4: Data retention only

Note 5: V_{CC} = 0 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_{CC} (V)	Min	Typ.	Max	Min	Max	
Input voltage	High level	V_{IH}	—	1.65 to 1.8	V_{CC} × 0.75	—	—	V_{CC} × 0.75	—	V
				2.3 to 5.5	V_{CC} × 0.7	—	—	V_{CC} × 0.7	—	
	Low level	V_{IL}	—	1.65 to 1.8	—	—	V_{CC} × 0.25	—	V_{CC} × 0.25	
				2.3 to 5.5	—	—	V_{CC} × 0.3	—	V_{CC} × 0.3	
Output voltage	High level	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = −100 μA 1.65	1.55	1.65	—	1.55	—	V
				I_{OH} = −100 μA 2.3	2.2	2.3	—	2.2	—	
				I_{OH} = −100 μA 3.0	2.9	3.0	—	2.9	—	
				I_{OH} = −100 μA 4.5	4.4	4.5	—	4.4	—	
				I_{OH} = −4 mA 1.65	1.29	1.52	—	1.29	—	
				I_{OH} = −8 mA 2.3	1.9	2.15	—	1.9	—	
				I_{OH} = −16 mA 3.0	2.4	2.8	—	2.4	—	
				I_{OH} = −24 mA 3.0	2.3	2.68	—	2.3	—	
				I_{OH} = −32 mA 4.5	3.8	4.2	—	3.8	—	
	Low level	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 100 μA 1.65	—	0	0.1	—	0.1	V
				I_{OL} = 100 μA 2.3	—	0	0.1	—	0.1	
				I_{OL} = 100 μA 3.0	—	0	0.1	—	0.1	
				I_{OL} = 100 μA 4.5	—	0	0.1	—	0.1	
				I_{OL} = 4 mA 1.65	—	0.08	0.24	—	0.24	
				I_{OL} = 8 mA 2.3	—	0.1	0.3	—	0.3	
				I_{OL} = 16 mA 3.0	—	0.15	0.4	—	0.4	
				I_{OL} = 24 mA 3.0	—	0.22	0.55	—	0.55	
				I_{OL} = 32 mA 4.5	—	0.22	0.55	—	0.55	
Input leakage current		I_{IN}	V_{IN} = 5.5 V or GND	0 to 5.5	—	—	±1	—	±10	μA
Power off leakage current		I_{OFF}	V_{IN} or V_{OUT} = 5.5 V	0.0	—	—	1	—	10	μA
Quiescent supply current		I_{CC}	V_{IN} = 5.5 V or GND	1.65 to 5.5	—	—	1	—	10	μA

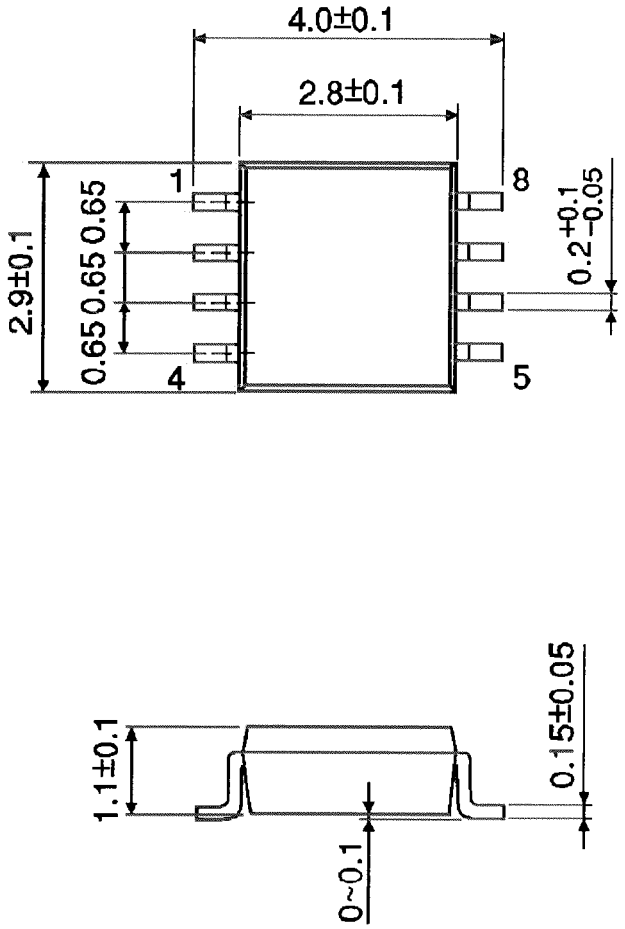
AC Characteristics (unless otherwise specified, Input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = −40 to 85°C		Unit
			V_{CC} (V)	Min	Typ.	Max	Min	Max	
Maximum clock frequency	f_{MAX}	C_L = 50 pF, R_L = 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, $\overline{Q}$)	t_{pLH} t_{pHL}	C_L = 15 pF, R_L = 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	
			5.0 ± 0.5	1.0	2.4	3.5	1.0	3.9	
		C_L = 50 pF, R_L = 500 Ω	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 ($\overline{CLR}$, $\overline{PR}$-Q, $\overline{Q}$)	t_{pLH} t_{pHL}	C_L = 15 pF, R_L = 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	
			5.0 ± 0.5	1.5	2.2	3.5	1.0	3.9	
		C_L = 50 pF, R_L = 500 Ω	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_s	C_L = 50 pF, R_L = 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_h	C_L = 50 pF, R_L = 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_W (L) t_W (H)	C_L = 50 pF, R_L = 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 ($\overline{CLR}$, $\overline{PR}$)	t_W (L)	C_L = 50 pF, R_L = 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_{rem}	C_L = 50 pF, R_L = 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_{IN}	—	0 to 0.5	—	3.0	—	—	—	pF
Output capacitance	C_{OUT}	—	0 tp 0.5	—	5.0	—	—	—	pF
Power dissipation capacitance	C_{PD}	(Note 7)	3.3	—	30	—	—	—	pF
			5.5	—	47	—	—	—	

Note 7: 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

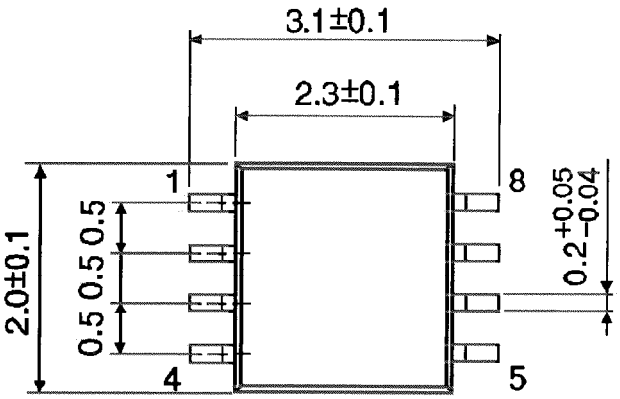
SSOP8-P-0.65 Unit : mm

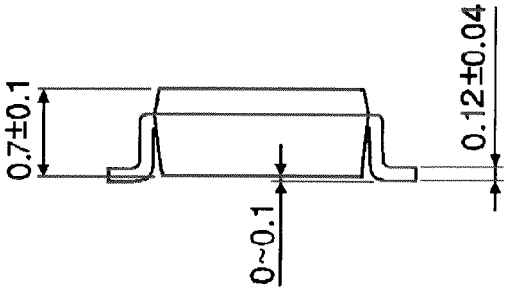


Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A Unit : mm





Weight: 0.01 g (typ.)

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