TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7PA175FU

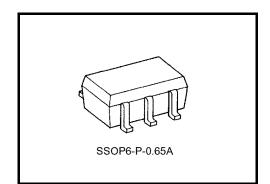
D-Type Flip-Flop with Clear

Features

- Operating voltage range: V_{CC} = 1.8~3.6 V
- High-speed operation: t_{pd} = 3.5 ns (max) at V_{CC} = 3.0~3.6 V
 - t_{pd} = 4.6 ns (max) at V_{CC} = 2.3~2.7 V t_{pd} = 9.2 ns (max) at V_{CC} = 1.8 V
- High-level output current:

 $I_{OH}/I_{OL} = \pm 24$ mA (min) at V_{CC} = 3.0 V $I_{OH}/I_{OL} = \pm 18$ mA (min) at V_{CC} = 2.3 V $I_{OH}/I_{OL} = \pm 6$ mA (min) at V_{CC} = 1.8 V

- 3.6-V tolerant inputs
- 3.6-V power down protection output



Weight: 0.0068 g (typ.)

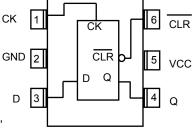
Marking

Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol Value		Unit
Power supply voltage	V _{CC}	-0.5~4.6	V
DC input voltage	VIN	-0.5~4.6	V
		-0.5~4.6 (Note 1)	
DC output voltage	V _{OUT}	-0.5~V _{CC} + 0.5 (Note 2)	V
Input diode current	I _{IK}	-50	mA
Output diode current	I _{OK}	-50 (Note 3)	mA
DC output current	IOUT	±50	mA
Power dissipation	PD	200	mW
DC V _{CC} /ground current	ICC	±100	mA
Storage temperature	T _{stg}	-65~150	°C



EAH



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. The I_{OUT} absolute maximum rating must be adhered to.

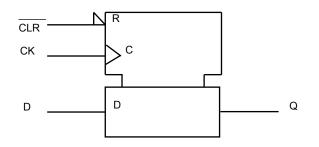
Note 3: V_{OUT} < GND

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Product name

TOSHIBA

IEC Logic Symbol



Truth Table

	INPUTS		OUTPUT	FUNCTION
CLR	D	СК	Q	FUNCTION
L	х	х	L	CLEAR
н	L		L	_
н	Н		Н	
н	х	_	Qn	NO CHANGE

X: Don't care

Operating Ranges

Characteristics	Symbol	Value	Unit	
Power supply voltage	Vee	1.8~3.6	V	
	V _{CC}	1.2~3.6 (Note 4)		
Input voltage	VIN	-0.3~3.6	V	
Output voltage	Varia	0~3.6 (Note 5)	V	
	Vout	0~V _{CC} (Note 6)	v	
		±24 (Note 7)		
Output Current	I _{OH} /I _{OL}	±18 (Note 8)	mA	
		±6 (Note 9)		
Operating temperature	T _{opr}	-40~85	°C	
Input rise and fall time	d _t /d _v	0~10 (Note 10)	ns/V	

Note 4: Data retention only

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

Note 6: High or Low state

- Note 7: $V_{CC} = 3.0 \sim 3.6 \text{ V}$
- Note 8: $V_{CC} = 2.3 \sim 2.7 \text{ V}$

Note 9: $V_{CC} = 1.8 V$

Note 10: $V_{IN} = 0.8 \sim 2.0 \text{ V}, \text{ V}_{CC} = 3.0 \text{ V}$

DC Electrical Characteristics (Ta = -40~85°C, 2.7 V < V_{CC} \leq 3.6 V)

Characteristics	Symbol	Symbol Test Condition			Min	Max	Unit
Characteristics	Symbol			V _{CC} (V)	IVIIII		
High-Level Input Voltage	V _{IH}			2.7~3.6	2.0	_	v
Low-Level Input Voltage	VIL			2.7~3.6	_	0.8	v
			I _{OH} = -100 μA	2.7~3.6	V _{CC} - 0.2	_	
High-Level Output Voltage	Vон	$V_{IN} = V_{IH}$	I _{OH} = -12 mA	2.7	2.2	_	
			I _{OH} = -18 mA	3.0	2.4	_	
			I _{OH} =24 mA	3.0	2.2	_	v
		$V_{IN} = V_{IH}$ or V_{IL}	I _{OL} = 100 μA	2.7~3.6	_	0.2	
Low Lovel Output Voltage	Max		I _{OL} = 12 mA	2.7	_	0.4	
Low-Level Output Voltage	V _{OL}		I _{OL} = 18 mA	3.0	_	0.4	
			I _{OL} = 24 mA	3.0	_	0.55	
Input Leakage Current	I _{IN}	V _{IN} = 0~3.6 V		2.7~3.6	_	±5.0	μA
Power-off Leakage Current	IOFF	V _{IN} , V _{OUT} = 0~3.	V _{IN} , V _{OUT} = 0~3.6 V		_	10.0	μA
Quiescent Supply Current		V _{IN} = V _{CC} or GND		2.7~3.6	_	20.0	
	Icc	$V_{CC} \leq (V_{IN}, V_{OUT}) \leq 3.6 \text{ V}$		2.7~3.6	_	±20.0	μA
Increase in I _{CC} per Input	Δl _{CC}	$V_{IH} = V_{CC} - 0.6$ V	/	2.7~3.6	_	750	

DC Electrical Characteristics (Ta = -40~85°C, 2.3 V \leq V_{CC} \leq 2.7 V)

Characteristics	Symbol	Test C	Test Condition		Min	Max	Unit
High-Level Input Voltage	VIH			2.3~2.7	1.6	_	V
Low-Level Input Voltage	V _{IL}			2.3~2.7	_	0.7	v
High-Level Output Voltage			I _{OH} = -100 μA	2.3~2.7	V _{CC} - 0.2	_	
	V _{OH}	$v_{\text{IN}} = v_{\text{IH}}$	I _{OH} = -6 mA	2.3	2.0	_	
			I _{OH} = -12 mA	2.3	1.8	_	v
			I _{OH} = -18 mA	2.3	1.7	_	
			I _{OL} = 100 μA	2.3~2.7		0.2	
Low-Level Output Voltage	V _{OL}	$V_{IN} = V_{IH} \text{ or } V_{IL}$	I _{OL} = 12 mA	2.3		0.4	1
			I _{OL} = 18 mA	2.3		0.6	
Input Leakage Current	l _{IN}	V _{IN} = 0~3.6 V	V _{IN} = 0~3.6 V			±5.0	μA
Power-off Leakage Current	IOFF	V _{IN} , V _{OUT} = 0~3.6 V		0		10.0	μA
Quiescent Supply Current		V _{IN} = V _{CC} or GND		2.3~2.7		20.0	^
	Icc	$V_{CC} \leq (V_{IN}, V_{OU})$	r)≦ 3.6 V	2.3~2.7	_	±20.0	μA

DC Electrical Characteristics (Ta = $-40 \sim 85^{\circ}$ C, 1.8 V \leq V_{CC} < 2.3 V)

Characteristics	Symbol	Symbol Test Condition			Min	Max	Unit
Characteristics	Symbol Test Condition		V _{CC} (V)	IVIIII	IVIAX	Unit	
High-Level Input Voltage	V _{IH}	—		1.8~2.3	$0.7 \times V_{CC}$		V
Low-Level Input Voltage	VIL	—		1.8~2.3		$0.2 \times V_{CC}$	v
High-Level Output Voltage V _{OH}	V _{OH}	$V_{IN} = V_{IH}$	I _{OH} = -100 μA	1.8	V _{CC} - 0.2	_	
			I _{OH} =6 mA	1.8	1.4	_	V
Low-Level Output Voltage	Mai	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 100 μA	1.8	_	0.2	
Low-Level Output voltage	V _{OL}	VIN = VIH OI VIL	I _{OL} = 6 mA	1.8	_	0.3	
Input Leakage Current	I _{IN}	V _{IN} = 0~3.6 V		1.8	_	±5.0	μA
Power-off Leakage Current	I _{OFF}	V _{IN} , V _{OUT} = 0~3.6 V		0	_	10.0	μA
Quiescent Supply Current		$V_{IN} = V_{CC}$ or GND		1.8	_	20.0	μA
Quescent Supply Surrent	Icc	$V_{CC} \leq (V_{IN}, V_{OUT}) \leq 3.6 \text{ V}$		1.8	_	±20.0	μΑ

AC Electrical Characteristics (Ta = -40~85°C, input t_r = t_f = 2.0 ns, C_L = 30 pF, R_L = 500 Ω)

Characteristics	Symbol	Test Condition		Min	Max	Unit
	Gymbol	rest condition	V _{CC} (V)			Office
			1.8	100	_	
Maximam Clock Frequency	f _{max}		2.5 ± 0.2	200	_	MHz
			$\textbf{3.3}\pm\textbf{0.3}$	250	_	
Propagation Delay Time	+		1.8	1.0	9.2	
(CK-Q)	t _{pLH}	(Figure 1 and 2)	2.5 ± 0.2	0.8	4.6	ns
(CK-Q)	t _{pHL}		3.3 ± 0.3	0.6	3.5	
Propagation Delay Time			1.8	1.0	9.2	
(CLR-Q)	t _{pHL}	(Figure 1 and 3)	2.5 ± 0.2	0.8	4.6	ns
			$\textbf{3.3}\pm\textbf{0.3}$	0.6	3.5	
			1.8	3.0	_	
Minimum Set-up Time	ts	(Figure 1 and 2)	2.5 ± 0.2	1.5	_	ns
			$\textbf{3.3}\pm\textbf{0.3}$	1.5	_	
			1.8	3.0	_	
Minimum Hold time	t _h	(Figure 1 and 2)	2.5 ± 0.2	1.7	_	ns
			$\textbf{3.3}\pm\textbf{0.3}$	1.7	_	
Minimun Pulse Width	1 (1)		1.8	4.0	_	
(CK)	t _w (H)	(Figure 1 and 2)	2.5 ± 0.2	2.3	_	ns
(CK)	t _w (L)		$\textbf{3.3}\pm\textbf{0.3}$	2.3	_	
Minimun Pulse Width			1.8	4.0	_	
(CLR)	t _w (L)	(Figure 1 and 3)	2.5 ± 0.2	2.3	_	ns
			$\textbf{3.3}\pm\textbf{0.3}$	2.3	—	
			1.8	3.1	—	
Minimum Removal Time	t _{rem}	(Figure 1 and 3)	2.5 ± 0.2	2.0	_	ns
			3.3 ± 0.3	1.5	—	

For $C_L = 50 \text{ pF}$, add approximately 300 ps to the AC maximum specification.

Capacitive Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition		TYP.	Unit	
Characteristics	Symbol			V _{CC} (V)	ITF.	Unit
Input Capacitance	C _{IN}	—		1.8, 2.5, 3.3	2.4	pF
Power Dissipation Capacitance	C _{PD}	f _{IN} = 10 MHz	(Note 11)	1.8, 2.5, 3.3	11	pF

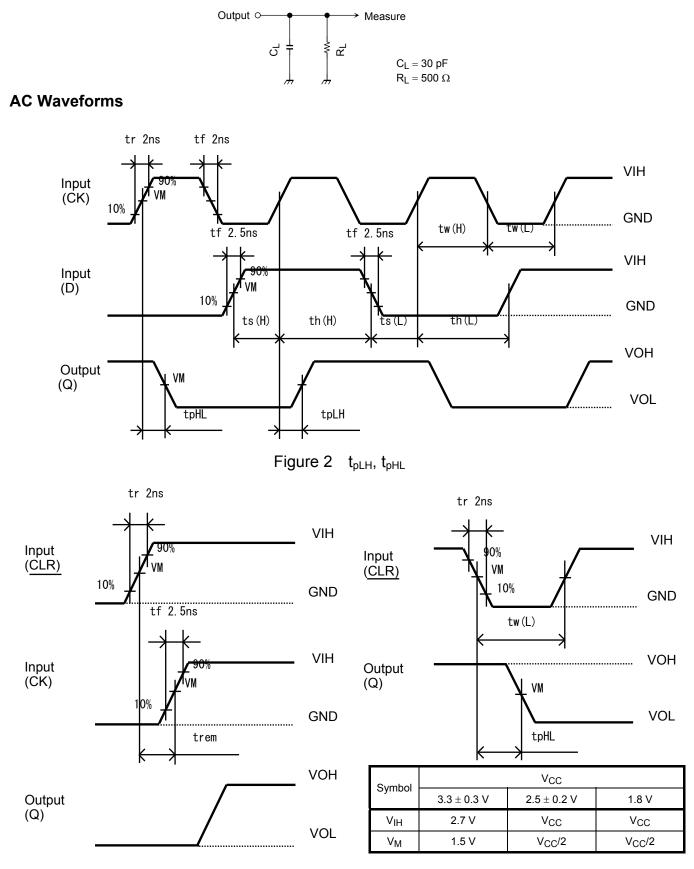
Note11: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

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

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Figure 1 Test Circuit

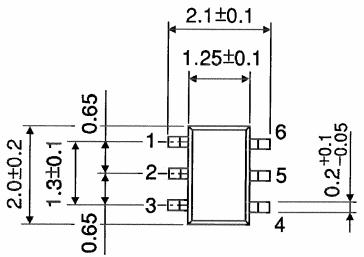


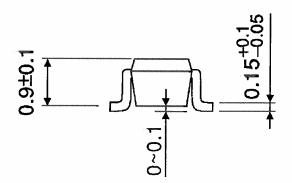
 $\label{eq:Figure 3} \quad t_{rem}\,,\,t_{pHL}\,,\,t_{w}\left(L\right)$

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Package Dimensions

SSOP6-P-0.65A





Weight: 0.0068 g (typ.)

Unit: mm

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20070701-EN GENERAL

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