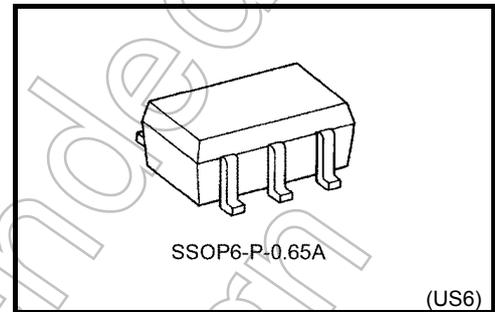


TC7PA17FU

Dual Schmitt Buffer

Features

- Operating voltage range: $V_{CC} = 1.8$ to 3.6 V
- High-speed operation: $t_{pd} = 4.0$ ns (max) at $V_{CC} = 3.0$ to 3.6 V
 $t_{pd} = 4.3$ ns (max) at $V_{CC} = 2.3$ to 2.7 V
 $t_{pd} = 8.6$ 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 outputs

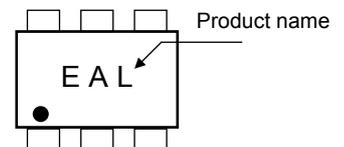


Weight: 0.0068 g (typ.)

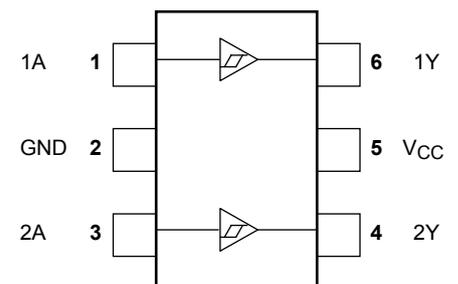
Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	-0.5 to 4.6	V
DC input voltage	V_{IN}	-0.5 to 4.6	V
DC output voltage	V_{OUT}	-0.5 to 4.6 (Note 1)	V
		-0.5 to $V_{CC} + 0.5$ (Note 2)	
Input diode current	I_{IK}	-50	mA
Output diode current	I_{OK}	-50 (Note 3)	mA
DC output current	I_{OUT}	± 50	mA
Power dissipation	P_D	200	mW
DC V_{CC} /ground current	I_{CC}	± 100	mA
Storage temperature	T_{stg}	-65 to 150	°C

Marking



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).

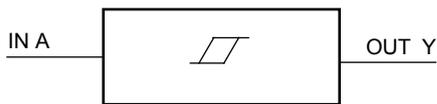
Note 1: $V_{CC} = 0$ V

Note 2: High or Low State. I_{OUT} absolute maximum rating must be observed.

Note 3: $V_{OUT} < GND$

Start of commercial production
2002-12

IEC Logic Symbol



Truth Table

A	Y
L	L
H	H

Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	1.8 to 3.6	V
		1.2 to 3.6 (Note 4)	
Input voltage	V_{IN}	-0.3 to 3.6	V
Output voltage	V_{OUT}	0 to 3.6 (Note 5)	V
		0 to V_{CC} (Note 6)	
Output Current	I_{OH}/I_{OL}	± 24 (Note 7)	mA
		± 18 (Note 8)	
		± 6 (Note 9)	
Operating temperature	T_{opr}	-40 to 85	$^{\circ}C$

Note 4: Data retention only

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

Note 6: High or Low state

Note 7: $V_{CC} = 3.0$ to 3.6 V

Note 8: $V_{CC} = 2.3$ to 2.7 V

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

Not Recommended for New Design

Electrical Characteristics

DC Characteristics (2.7 V < V_{CC} ≤ 3.6 V)

Characteristics		Symbol	Test Condition		Ta = 40 to 85°C			Unit
					V _{CC} (V)	Min	Max	
Threshold Voltage	High level	V _P	—	3.6	—	2.2	V	
				3.0	—	2.0		
	Low level	V _N	—	3.6	0.8	—	V	
				3.0	0.7	—		
Hysteresis Voltage		V _H	—	3.6	0.3	1.2	V	
				3.0	0.3	1.2		
Output Voltage	High level	V _{OH}	V _{IN} = V _{IH}	I _{OH} = -100 μA	2.7 to 3.6	V _{CC} - 0.2	—	V
				I _{OH} = -12 mA	2.7	2.2	—	
				I _{OH} = -18 mA	3.0	2.4	—	
				I _{OH} = -24 mA	3.0	2.2	—	
	Low level	V _{OL}	V _{IN} = V _{IL}	I _{OL} = 100 μA	2.7 to 3.6	—	0.2	
				I _{OL} = 12 mA	2.7	—	0.4	
				I _{OL} = 18 mA	3.0	—	0.4	
				I _{OL} = 24 mA	3.0	—	0.55	
Input Leakage Current		I _{IN}	V _{IN} = 0 to 3.6 V	2.7 to 3.6	—	±5.0	μA	
Power-off Leakage Current		I _{OFF}	V _{IN} , V _{OUT} = 0 to 3.6 V	0	—	10.0	μA	
Quiescent Supply Current		I _{CC}	V _{IN} = V _{CC} or GND	2.7 to 3.6	—	20.0	μA	
			V _{CC} ≤ (V _{IN} , V _{OUT}) ≤ 3.6 V	2.7 to 3.6	—	±20.0		
Increase in I _{CC} per Input		ΔI _{CC}	V _{IH} = V _{CC} - 0.6 V	2.7 to 3.6	—	750		

DC Characteristics (2.3 V ≤ V_{CC} ≤ 2.7 V)

Characteristics		Symbol	Test Condition		Ta = 40 to 85°C			Unit
					V _{CC} (V)	Min	Max	
Threshold Voltage	High level	V _P	—	2.3	—	1.8	V	
	Low level	V _N	—	2.3	0.5	—		
Hysteresis Voltage		V _H	—	2.3	0.3	1.0	V	
Output Voltage	High level	V _{OH}	V _{IN} = V _{IH}	I _{OH} = -100 μA	2.3 to 2.7	V _{CC} - 0.2	—	V
				I _{OH} = -6 mA	2.3	2.0	—	
				I _{OH} = -12 mA	2.3	1.8	—	
				I _{OH} = -18 mA	2.3	1.7	—	
	Low level	V _{OL}	V _{IN} = V _{IL}	I _{OL} = 100 μA	2.3 to 2.7	—	0.2	
				I _{OL} = 12 mA	2.3	—	0.4	
I _{OL} = 18 mA				2.3	—	0.6		
Input Leakage Current		I _{IN}	V _{IN} = 0 to 3.6 V	2.3 to 2.7	—	±5.0	μA	
Power-off Leakage Current		I _{OFF}	V _{IN} , V _{OUT} = 0 to 3.6 V	0	—	10.0	μA	
Quiescent Supply Current		I _{CC}	V _{IN} = V _{CC} or GND	2.3 to 2.7	—	20.0	μA	
			V _{CC} ≤ (V _{IN} , V _{OUT}) ≤ 3.6 V	2.3 to 2.7	—	±20.0		

DC Characteristics (1.8 V ≤ V_{CC} < 2.3 V)

Characteristics		Symbol	Test Condition		Ta = 40 to 85°C		Unit	
					V _{CC} (V)	Min		Max
Threshold Voltage	High level	V _P	—		1.8	—	1.4	V
	Low level	V _N	—		1.8	0.25	—	
Hysteresis Voltage		V _H	—		1.8	0.2	0.95	V
Output Voltage	High level	V _{OH}	V _{IN} = V _{IH}	I _{OH} = -100 μA	1.8	V _{CC} - 0.2	—	V
				I _{OH} = -6 mA	1.8	1.4	—	
	Low level	V _{OL}	V _{IN} = V _{IL}	I _{OL} = 100 μA	1.8	—	0.2	
				I _{OL} = 6 mA	1.8	—	0.3	
Input Leakage Current		I _{IN}	V _{IN} = 0 to 3.6 V		1.8	—	±5.0	μA
Power-off Leakage Current		I _{OFF}	V _{IN} , V _{OUT} = 0 to 3.6 V		0	—	10.0	μA
Quiescent Supply Current		I _{CC}	V _{IN} = V _{CC} or GND		1.8	—	20.0	μA
			V _{CC} ≤ (V _{IN} , V _{OUT}) ≤ 3.6 V		1.8	—	±20.0	

AC Characteristics (Input t_r = t_f = 2.0 ns, C_L = 30 pF, R_L = 500 Ω)

Characteristics		Symbol	Test Condition		Ta = 40 to 85°C		Unit
					V _{CC} (V)	Min	
Propagation delay time	t _{pLH} t _{pHL}	(Figure 1 and 2)	1.8	1.0	8.6	ns	
			2.5 ± 0.2	0.8	4.3		
			3.3 ± 0.3	0.6	4.0		

For C_L = 50 pF, add approximately 300 ps to the AC maximum specification.

Dynamic Switching Characteristics (Input $t_r = t_f = 2.0$ ns, $C_L = 30$ pF)

Characteristics	Symbol	Test Condition	Ta = 25°C		Unit
			V _{CC} (V)	Typ	
Quiet Output Maximum Dynamic V _{OL}	V _{OLP}	V _{IN} = 1.8 V, V _{IL} = 0 V (Note 10)	1.8	0.25	ns
		V _{IN} = 2.5 V, V _{IL} = 0 V (Note 10)	2.5	0.6	
		V _{IN} = 3.3 V, V _{IL} = 0 V (Note 10)	3.3	0.8	
Quiet Output Minimum Dynamic V _{OL}	V _{OLV}	V _{IN} = 1.8 V, V _{IL} = 0 V (Note 10)	1.8	-0.25	ns
		V _{IN} = 2.5 V, V _{IL} = 0 V (Note 10)	2.5	-0.6	
		V _{IN} = 3.3 V, V _{IL} = 0 V (Note 10)	3.3	-0.8	
Quiet Output Minimum Dynamic V _{OH}	V _{OLP}	V _{IN} = 1.8 V, V _{IL} = 0 V (Note 10)	1.8	1.5	ns
		V _{IN} = 2.5 V, V _{IL} = 0 V (Note 10)	2.5	1.9	
		V _{IN} = 3.3 V, V _{IL} = 0 V (Note 10)	3.3	2.2	

Note 10: Characteristics guaranteed by design.

Capacitive Characteristics

Characteristics	Symbol	Test Condition	Ta = 25°C		Unit
			V _{CC} (V)	Typ	
Input Capacitance	C _{IN}	—	1.8, 2.5, 3.3	4	pF
Power Dissipation Capacitance	C _{PD}	f _{IN} = 10 MHz (Note 11)	1.8, 2.5, 3.3	27	pF

Note 11: 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:

$$I_{CC}(\text{opr.}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2$$

AC Test Circuit

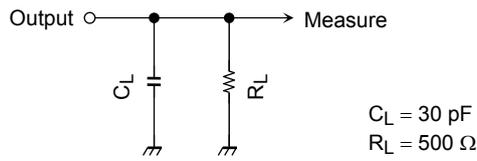
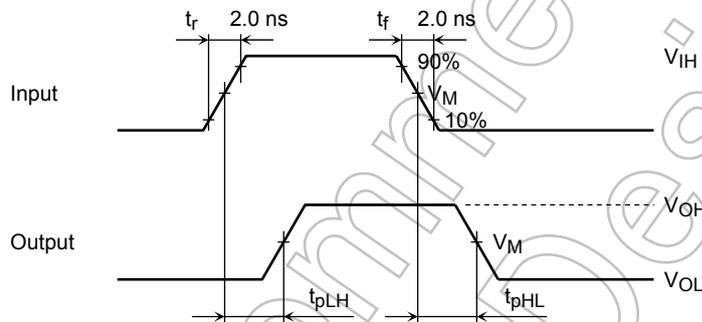


Figure 1

AC Waveforms



Symbol	V_{CC}		
	$3.3 \pm 0.3 \text{ V}$	$2.5 \pm 0.2 \text{ V}$	1.8 V
V_{IH}	2.7 V	V_{CC}	V_{CC}
V_M	1.5 V	$V_{CC}/2$	$V_{CC}/2$

Figure 2 t_{pLH} , t_{pHL}

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