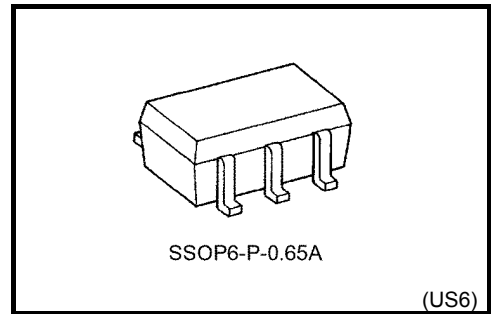


# TC7PA17FU

## 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

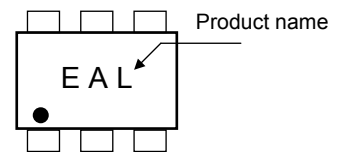


Weight: 0.0068 g (typ.)

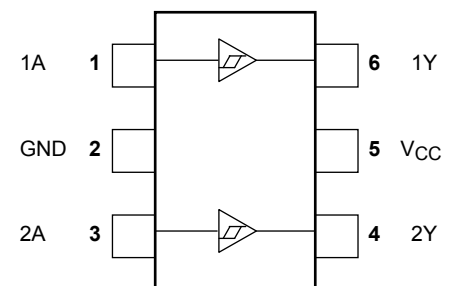
### Absolute Maximum Ratings (Ta = 25°C)

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	$I_{OUT}$	$\pm 50$	mA
Power dissipation	$P_D$	200	mW
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 100$	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.

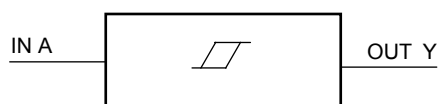
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

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

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

Note 3:  $V_{OUT} < GND$

## 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	$I_{OH}/I_{OL}$	$\pm 24$ (Note 7)	mA
		$\pm 18$ (Note 8)	
		$\pm 6$ (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

## Electrical Characteristics

### DC Characteristics (2.7 V < V<sub>CC</sub> ≤ 3.6 V)

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

### DC Characteristics (2.3 V ≤ V<sub>CC</sub> ≤ 2.7 V)

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

## DC Characteristics ( $1.8\text{ V} \leq V_{CC} < 2.3\text{ V}$ )

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

## AC Characteristics (Input t<sub>r</sub> = t<sub>f</sub> = 2.0 ns, C<sub>L</sub> = 30 pF, R<sub>L</sub> = 500 Ω)

Characteristics		Symbol	Test Condition		Ta = 40 to 85°C		Unit
					V <sub>CC</sub> (V)	Min	
Propagation delay time	t <sub>pLH</sub> t <sub>pHL</sub>	(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<sub>L</sub> = 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 <sub>CC</sub> (V)	Typ	
Quiet Output Maximum Dynamic V <sub>OL</sub>	V <sub>OLP</sub>	V <sub>IN</sub> = 1.8 V, V <sub>IL</sub> = 0 V (Note 10)	1.8	0.25	ns
		V <sub>IN</sub> = 2.5 V, V <sub>IL</sub> = 0 V (Note 10)	2.5	0.6	
		V <sub>IN</sub> = 3.3 V, V <sub>IL</sub> = 0 V (Note 10)	3.3	0.8	
Quiet Output Minimum Dynamic V <sub>OL</sub>	V <sub>OLV</sub>	V <sub>IN</sub> = 1.8 V, V <sub>IL</sub> = 0 V (Note 10)	1.8	-0.25	ns
		V <sub>IN</sub> = 2.5 V, V <sub>IL</sub> = 0 V (Note 10)	2.5	-0.6	
		V <sub>IN</sub> = 3.3 V, V <sub>IL</sub> = 0 V (Note 10)	3.3	-0.8	
Quiet Output Minimum Dynamic V <sub>OH</sub>	V <sub>OLP</sub>	V <sub>IN</sub> = 1.8 V, V <sub>IL</sub> = 0 V (Note 10)	1.8	1.5	ns
		V <sub>IN</sub> = 2.5 V, V <sub>IL</sub> = 0 V (Note 10)	2.5	1.9	
		V <sub>IN</sub> = 3.3 V, V <sub>IL</sub> = 0 V (Note 10)	3.3	2.2	

Note 10: Characteristics guaranteed by design.

## Capacitive Characteristics

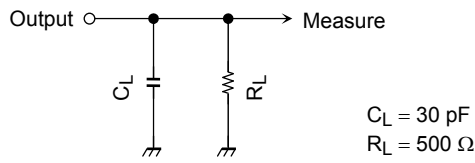
Characteristics	Symbol	Test Condition	Ta = 25°C		Unit
			V <sub>CC</sub> (V)	Typ	
Input Capacitance	C <sub>IN</sub>	—	1.8, 2.5, 3.3	4	pF
Power Dissipation Capacitance	C <sub>PD</sub>	f <sub>IN</sub> = 10 MHz (Note 11)	1.8, 2.5, 3.3	27	pF

Note 11: 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:

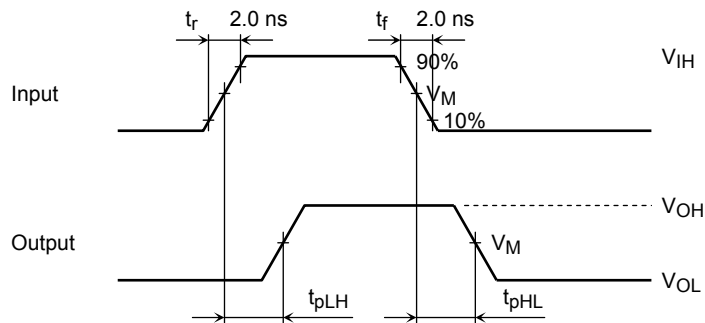
$$I_{CC}(\text{opr.}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2$$

**AC Test Circuit**



**Figure 1**

**AC Waveforms**



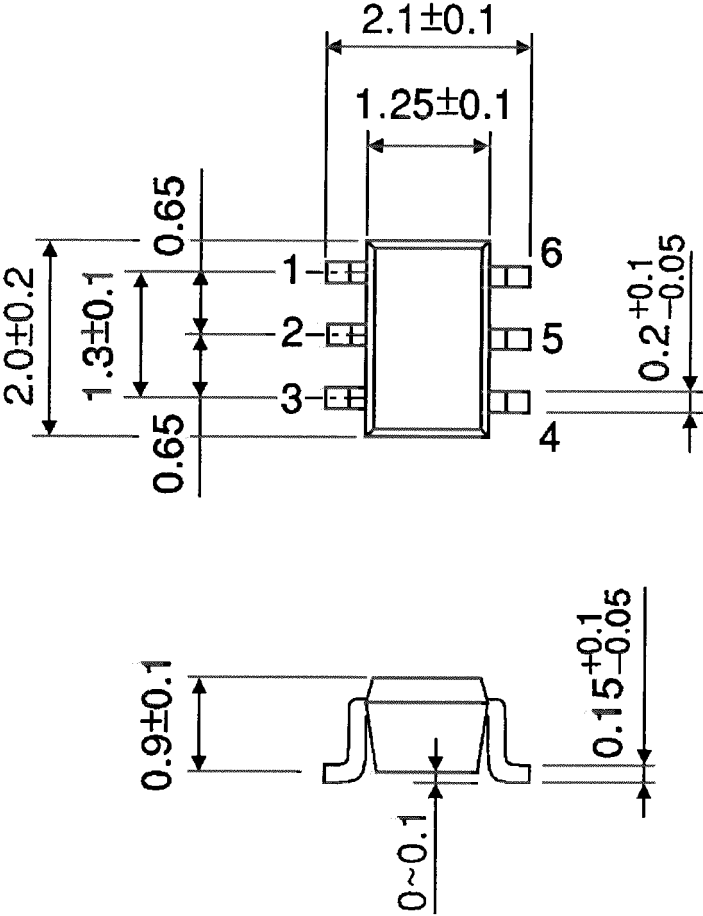
Symbol	$V_{CC}$		
	$3.3 \pm 0.3 \text{ V}$	$2.5 \pm 0.2 \text{ V}$	1.8 V
$V_{IH}$	2.7 V	$V_{CC}$	$V_{CC}$
$V_M$	1.5 V	$V_{CC}/2$	$V_{CC}/2$

**Figure 2  $t_{pLH}$ ,  $t_{pHL}$**

**Package Dimensions**

SSOP6-P-0.65A

Unit: mm



Weight: 0.0068 g (typ.)

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