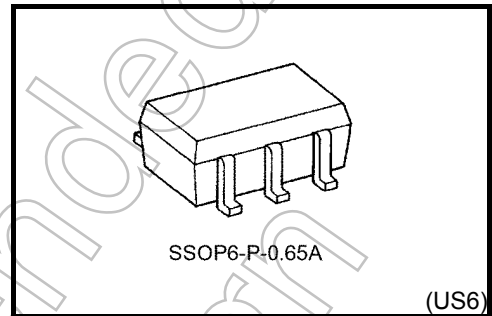


TC7PAU04FU

Dual Inverter (unbuffer) with 3.6 V Tolerant Input

Features

- Low voltage operation: $V_{CC} = 1.8$ to 3.6 V
- Quiescent supply current: $I_{CC} < 20\mu A$ (max)
($V_{CC} = 3.6$ V, $T_a = -40$ to $85^\circ C$)
- High-speed operation: $t_{pd} = 3.5$ ns (max) ($V_{CC} = 3.0$ to 3.6 V)
 $t_{pd} = 4.2$ ns (max) ($V_{CC} = 2.3$ to 2.7 V)
 $t_{pd} = 8.4$ ns (max) ($V_{CC} = 1.8$ V)
- High-output current: $I_{OH}/I_{OL} = \pm 24$ mA (min) ($V_{CC} = 3.0$ V)
 $I_{OH}/I_{OL} = \pm 18$ mA (min) ($V_{CC} = 2.3$ V)
 $I_{OH}/I_{OL} = \pm 6$ mA (min) ($V_{CC} = 1.8$ V)
- Latch-up performance: ± 300 mA
- ESD Performance: ± 200 V (JEITA)
 ± 2000 V (MIL)
- 3.6 V tolerant function for input and power down protection are provided.



Weight: 0.0068 g (typ.)

Absolute Maximum Ratings ($T_a = 25^\circ C$)

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 $V_{CC} + 0.5$ (Note 1)	V
Input diode current	I_{IK}	-50	mA
Output diode current	I_{OK}	± 50 (Note 2)	mA
DC output current	I_{OUT}	± 50	mA
DC V_{CC} /ground current	I_{CC}	± 100	mA
Power dissipation	P_D	200	mW
Storage temperature	T_{stg}	-65 to 150	$^\circ C$

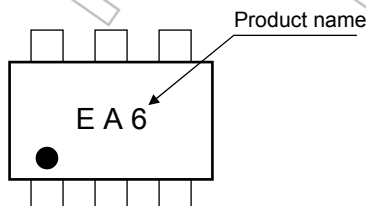
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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).

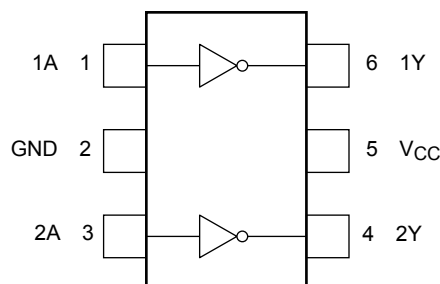
Note 1: High or low state. V_{OUT} absolute maximum rating must be observed.

Note 2: $V_{OUT} < GND$, $V_{OUT} > V_{CC}$

Marking

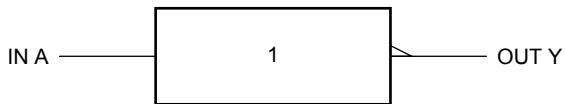


Pin Assignment (top view)



Start of commercial production
2001-10

IEC Logic Symbol



Truth Table

A	Y
L	H
H	L

Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	1.8 to 3.6	V
		1.2 to 3.6 (Note 3)	
Input voltage	V_{IN}	-0.3 to 3.6	V
Output voltage	V_{OUT}	0 to V_{CC} (Note 4)	V
Output Current	I_{OH}/I_{OL}	± 24 (Note 5)	mA
		± 18 (Note 6)	
		± 6 (Note 7)	
Operating temperature	T_{opr}	-40 to 85	$^{\circ}C$
Input rise and fall time	dt/dv	0 to 10 (Note 8)	ns/V

Note 3: Date Retention Only

Note 4: High or low state

Note 5: $V_{CC} = 3.0$ to 3.6 V

Note 6: $V_{CC} = 2.3$ to 2.7 V

Note 7: $V_{CC} = 1.8$ V

Note 8: $V_{CC} = 3.0$ V

Not Recommended for New Design

Electrical Characteristics

DC Characteristics (Ta = -40 to 85°C)

Characteristics		Symbol	Test Condition	V _{CC} (V)	Min	Max	Unit		
Input voltage	"H" level	V _{IH}	—	1.8	V _{CC} × 0.85	—	V		
				2.3 to 3.6	V _{CC} × 0.8	—			
	"L" level	V _{IL}		1.8	—	V _{CC} × 0.15			
				2.3 to 3.6	—	V _{CC} × 0.2			
Output voltage	"H" level	V _{OH}	V _{IN} = V _{IL}	I _{OH} = -100 μA	1.8 to 3.6	V _{CC} - 0.2	—	V	
				I _{OH} = -6 mA	1.8	1.4	—		
				I _{OH} = -12 mA	2.3	1.8	—		
				I _{OH} = -18 mA	2.3	1.7	—		
				I _{OH} = -12 mA	2.7	2.2	—		
				I _{OH} = -18 mA	3.0	2.4	—		
				I _{OH} = -24 mA	3.0	2.2	—		
	"L" level	V _{OL}		V _{IN} = V _{IH}	I _{OL} = 100 μA	1.8 to 3.6	—		0.2
					I _{OL} = 6 mA	1.8	—		0.3
					I _{OL} = 12 mA	2.3	—		0.4
					I _{OL} = 18 mA	2.3	—		0.6
					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} = 0~3.6 V		2.7 to 3.6	—	±5.0	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		

Not for New

AC Characteristics (Ta = -40 to 85°C, input tr = tf = 2.0 ns, CL = 30 pF, RL = 500 Ω)

Characteristics	Symbol	Test Condition	VCC (V)	Min	Max	Unit
			1.8	1.0	8.4	ns
2.5 ± 0.2	0.8	4.2				
3.3 ± 0.3	0.6	3.5				

For CL = pF, add approximately 300 ps to the Ac maximum specification.

Dynamic Switching Characteristics (Ta = 25°C, input tr = tf = 2.0 ns, CL = 30 pF)

Characteristics	Symbol	Test Condition	VCC (V)	Typ.	Unit
			1.8	0.25	ns
2.5	0.6				
3.3	0.8				
Quiet output maximum dynamic VOL	VOLP	VIN = 1.8 V, VIL = 0 V (Note 9)	1.8	-0.25	ns
		VIN = 2.5 V, VIL = 0 V (Note 9)	2.5	-0.6	
		VIN = 3.3 V, VIL = 0 V (Note 9)	3.3	-0.8	
Quiet output maximum dynamic VOL	VOLV	VIN = 1.8 V, VIL = 0 V (Note 9)	1.8	-0.25	ns
		VIN = 2.5 V, VIL = 0 V (Note 9)	2.5	-0.6	
		VIN = 3.3 V, VIL = 0 V (Note 9)	3.3	-0.8	
Quiet output maximum dynamic VOH	VOHP	VIN = 1.8 V, VIL = 0 V (Note 9)	1.8	1.5	ns
		VIN = 2.5 V, VIL = 0 V (Note 9)	2.5	1.9	
		VIN = 3.3 V, VIL = 0 V (Note 9)	3.3	2.2	

Note 9: Parameter guaranteed by design.

Capacitive Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	VCC (V)	Typ.	Unit
			1.8, 2.5, 3.3	4	pF
Power dissipation capacitance	CPD	fIN = 10 MHz (Note 10)	1.8, 2.5, 3.3	7	pF

Note 10: CPD 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:

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

Test Circuit

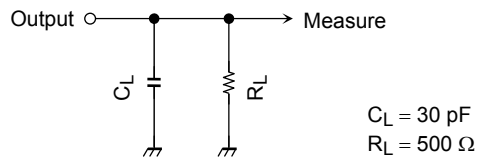


Figure 1

AC Waveform

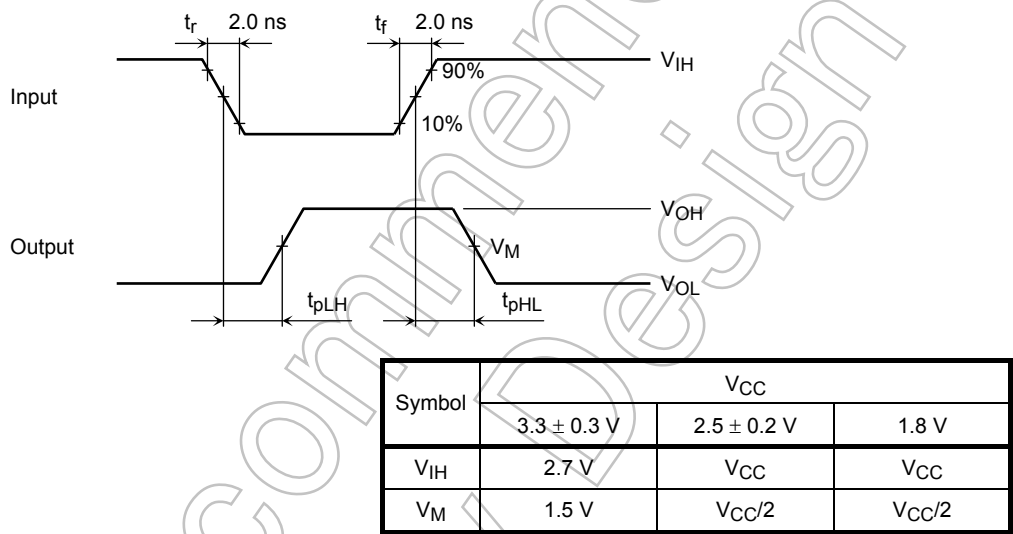


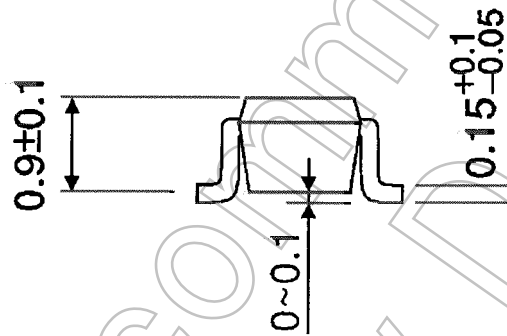
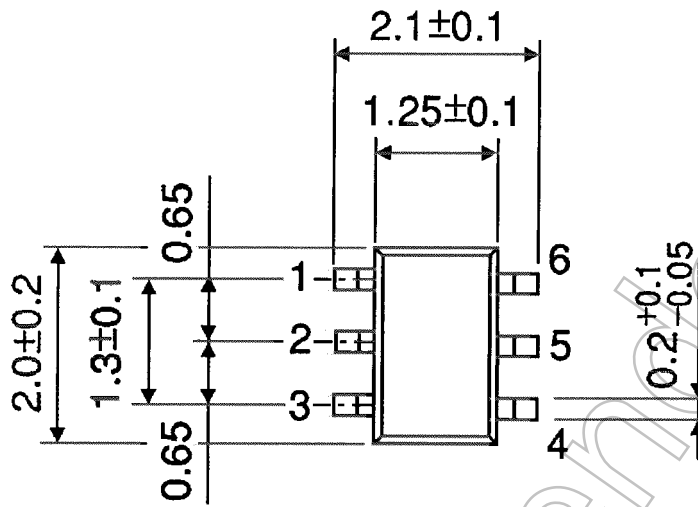
Figure 2 t_{pLH} , t_{pHL}

Not Recommended for New Design

Package Dimensions

SSOP6-P-0.65A

Unit: mm



Weight: 0.0068 g (typ.)

Not Recommended for New Design

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