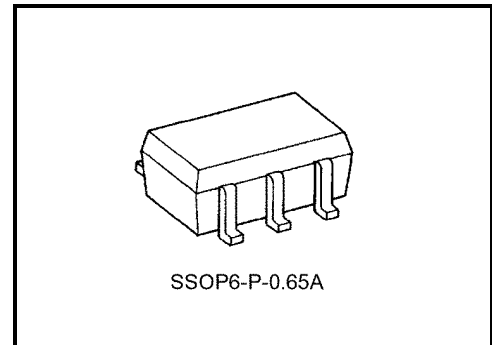


TC7PA04FU

Dual Inverter with 3.6 V Tolerant Input and Output

Features

- Operating voltage range: $V_{CC} = 1.8\sim 3.6\text{ V}$
- High-speed operation: $t_{pd} = 2.8\text{ ns (max)}$ at $V_{CC} = 3.0\sim 3.6\text{ V}$
 $t_{pd} = 3.7\text{ ns (max)}$ at $V_{CC} = 2.3\sim 2.7\text{ V}$
 $t_{pd} = 7.4\text{ ns (max)}$ at $V_{CC} = 1.8\text{ V}$
- High-level output current:
 $I_{OH}/I_{OL} = \pm 24\text{ mA (min)}$ at $V_{CC} = 3.0\text{ V}$
 $I_{OH}/I_{OL} = \pm 18\text{ mA (min)}$ at $V_{CC} = 2.3\text{ V}$
 $I_{OH}/I_{OL} = \pm 6\text{ mA (min)}$ at $V_{CC} = 1.8\text{ V}$
- High latch-up immunity: $\pm 300\text{ mA}$
- High ESD: Higher than or equal to $\pm 200\text{ V (JEITA)}$
- Higher than or equal to $\pm 2000\text{ V (MIL)}$
- 3.6-V tolerant function and power-down protection provided on all inputs and outputs



Weight: 0.0068 g (typ.)

Maximum Ratings ($T_a = 25^\circ\text{C}$)

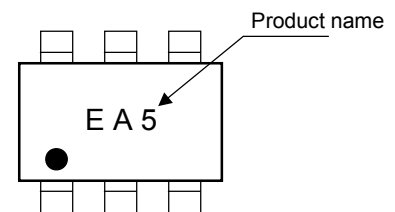
Characteristics	Symbol	Value	Unit
Power supply voltage	V_{CC}	-0.5~6	V
DC input voltage	V_{IN}	-0.5~6	V
DC output voltage	V_{OUT}	-0.5~6 (Note 1)	V
		-0.5~ $V_{CC} + 0.5$ (Note 2)	
Input diode current	I_{IK}	-50	mA
Output diode current	I_{OK}	± 50 (Note 3)	mA
DC output current	I_{OUT}	± 50	mA
Power dissipation	P_D	200	mW
DC V_{CC} /ground current	I_{CC}	± 100	mA
Storage temperature	T_{stg}	-65~150	$^\circ\text{C}$

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

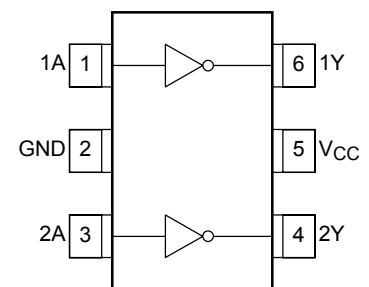
Note 2: High or Low state. The I_{OUT} maximum rating must be adhere to.

Note 3: $V_{OUT} < \text{GND}$, $V_{OUT} > V_{CC}$

Marking



Pin Assignment (top view)



Truth Table

A	Y
L	H
H	L

IEC Logic Symbol



Recommended Operating Conditions

Characteristics	Symbol	Value	Unit
Power supply voltage	V_{CC}	1.8~3.6	V
		1.2~3.6 (Note 4)	
Input voltage	V_{IN}	-0.3~3.6	V
Output voltage	V_{OUT}	0~3.6 (Note 5)	V
		0~ V_{CC} (Note 6)	
Output Current	I_{OH}/I_{OL}	± 24 (Note 7)	mA
		± 18 (Note 8)	
		± 6 (Note 9)	
Operating temperature	T_{opr}	-40~85	°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: $V_{CC} = 3.0\sim 3.6$ V

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

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

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

DC Electrical Characteristics (Ta = -40~85°C, 2.7 V < VCC ≤ 3.6 V)

Characteristics	Symbol	Test Condition		VCC (V)	Min	Max	Unit
High-Level Input Voltage	V _{IH}	—		2.7~3.6	2.0	—	V
Low-Level Input Voltage	V _{IL}	—		2.7~3.6	—	0.8	
High-Level Output Voltage	V _{OH}	V _{IN} = V _{IL}	I _{OH} = -100 μA	2.7~3.6	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 Output Voltage	V _{OL}	V _{IN} = V _{IH}	I _{OL} = 100 μA	2.7~3.6	—	0.2	V
			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		2.7~3.6	—	±5.0	μA
Power-off Leakage Current	I _{OFF}	V _{IN} , V _{OUT} = 0~3.6 V		0	—	10.0	μA
Quiescent Supply Current	I _{CC}	V _{IN} = V _{CC} or GND		2.7~3.6	—	20.0	μA
		V _{CC} ≤ (V _{IN} , V _{OUT}) ≤ 3.6 V		2.7~3.6	—	±20.0	
Increase in I _{CC} per Input	ΔI _{CC}	V _{IH} = V _{CC} - 0.6 V		2.7~3.6	—	750	

DC Characteristics (Ta = -40~85°C, 2.3 V ≤ VCC ≤ 2.7 V)

Characteristics	Symbol	Test Condition		VCC (V)	Min	Max	Unit
High-Level Input Voltage	V _{IH}	—		2.3~2.7	1.6	—	V
Low-Level Input Voltage	V _{IL}	—		2.3~2.7	—	0.7	
High-Level Output Voltage	V _{OH}	V _{IN} = V _{IL}	I _{OH} = -100 μA	2.3~2.7	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 Output Voltage	V _{OL}	V _{IN} = V _{IH}	I _{OL} = 100 μA	2.3~2.7	—	0.2	V
			I _{OL} = 12 mA	2.3	—	0.4	
			I _{OL} = 18 mA	2.3	—	0.6	
Input Leakage Current	I _{IN}	V _{IN} = 0~3.6 V		2.3~2.7	—	±5.0	μA
Power-off Leakage Current	I _{OFF}	V _{IN} , V _{OUT} = 0~3.6 V		0	—	10.0	μA
Quiescent Supply Current	I _{CC}	V _{IN} = V _{CC} or GND		2.3~2.7	—	20.0	μA
		V _{CC} ≤ (V _{IN} , V _{OUT}) ≤ 3.6 V		2.3~2.7	—	±20.0	

DC Characteristics (Ta = -40~85°C, 1.8 V ≤ VCC < 2.3 V)

Characteristics	Symbol	Test Condition		VCC (V)	Min	Max	Unit
High-Level Input Voltage	V _{IH}	—		1.8~2.3	0.7 × V _{CC}	—	V
Low-Level Input Voltage	V _{IL}	—		1.8~2.3	—	0.2 × V _{CC}	
High-Level Output Voltage	V _{OH}	V _{IN} = V _{IL}	I _{OH} = -100 μA	1.8	V _{CC} - 0.2	—	V
			I _{OH} = -6 mA	1.8	1.4	—	
Low-Level Output Voltage	V _{OL}	V _{IN} = V _{IH}	I _{OL} = 100 μA	1.8	—	0.2	
			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	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 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		VCC (V)	Min	Max	Unit
Propagation delay time	t _{pLH} t _{pHL}	(Figure 1 and 2)		1.8	1.0	7.4	ns
				2.5 ± 0.2	0.8	3.7	
				3.3 ± 0.3	0.6	2.8	

For C_L = 50 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		TYP.	Unit	
			VCC (V)			
Quiet Output Maximum Dynamic VOL	VOLP	VIN = 1.8 V, VIL = 0 V	(Note 11)	1.8	0.25	ns
		VIN = 2.5 V, VIL = 0 V	(Note 11)	2.5	0.6	
		VIN = 3.3 V, VIL = 0 V	(Note 11)	3.3	0.8	
Quiet Output Minimum Dynamic VOL	VOLV	VIN = 1.8 V, VIL = 0 V	(Note 11)	1.8	-0.25	ns
		VIN = 2.5 V, VIL = 0 V	(Note 11)	2.5	-0.6	
		VIN = 3.3 V, VIL = 0 V	(Note 11)	3.3	-0.8	
Quiet Output Minimum Dynamic VOH	VOLP	VIN = 1.8 V, VIL = 0 V	(Note 11)	1.8	1.5	ns
		VIN = 2.5 V, VIL = 0 V	(Note 11)	2.5	1.9	
		VIN = 3.3 V, VIL = 0 V	(Note 11)	3.3	2.2	

Note 11: Characteristics guaranteed by design.

Capacitive Characteristics (Ta = 25°C)

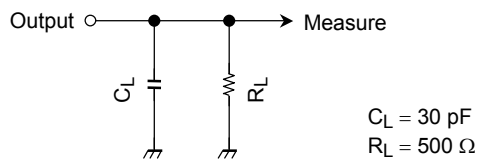
Characteristics	Symbol	Test Condition		TYP.	Unit	
			VCC (V)			
Input Capacitance	CIN	—		5	pF	
Power Dissipation Capacitance	CPD	fIN = 10 MHz	(Note 12)	1.8, 2.5, 3.3	18	pF

Note 12: 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:

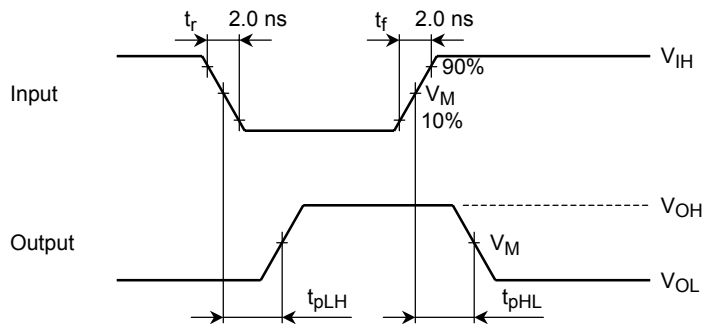
$$I_{CC}(\text{opr.}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2$$

Figure 1 Test Circuit



AC Waveforms

Figure 2 t_{pLH} , t_{pHL}

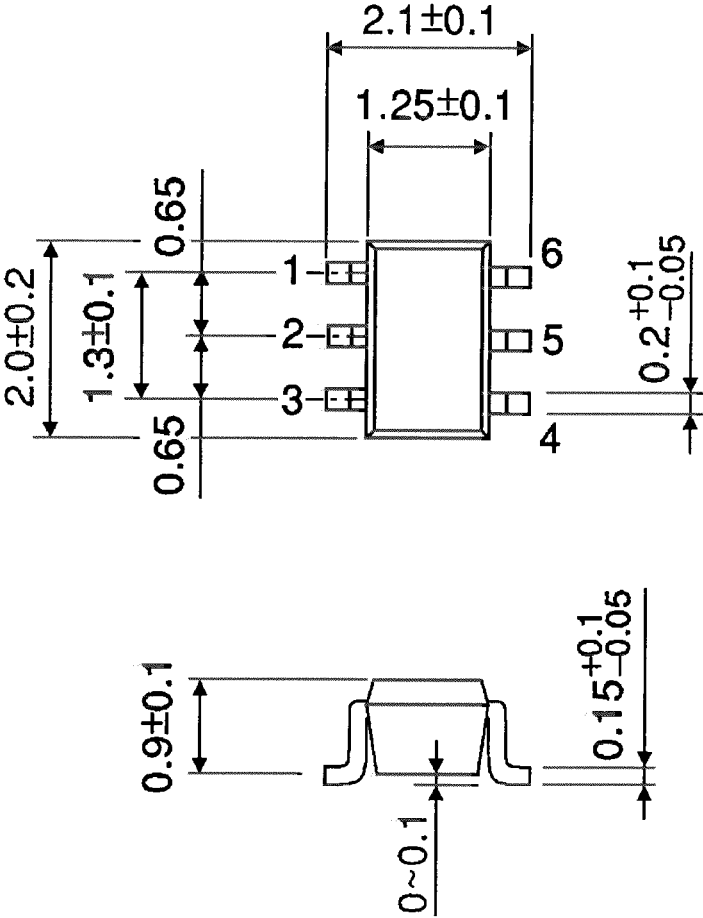


Symbol	V_{CC}		
	$3.3 \pm 0.3 \text{ V}$	$2.5 \pm 0.2 \text{ V}$	1.8 V
V_{IH}	2.7 V	V_{CC}	V_{CC}
V_M	1.5 V	$V_{CC}/2$	$V_{CC}/2$

Package Dimensions

SSOP6-P-0.65A

Unit: mm



Weight: 0.0068 g (typ.)

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000707EBA

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