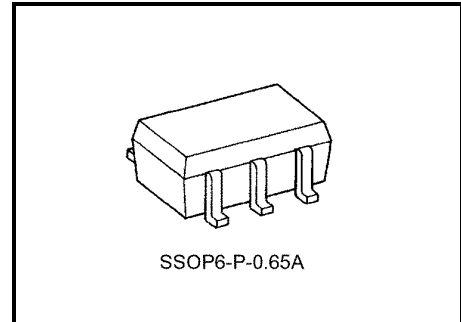


TC7PA04FU

Dual Inverter

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:
 $I_{OH}/I_{OL} = \pm 24\text{ mA (min) at } V_{CC} = 3.0\text{ V}$
 $I_{OH}/I_{OL} = \pm 18\text{ mA (min) at } V_{CC} = 2.3\text{ V}$
 $I_{OH}/I_{OL} = \pm 6\text{ mA (min) at } V_{CC} = 1.8\text{ V}$
- 3.6-V tolerant inputs
- 3.6-V power down protection outputs



Weight: 0.0068 g (typ.)

Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Value	Unit
Power supply voltage	V_{CC}	-0.5~4.6	V
DC input voltage	V_{IN}	-0.5~4.6	V
DC output voltage	V_{OUT}	-0.5~4.6 (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	°C

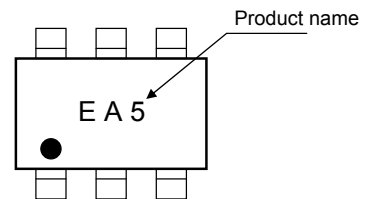
Note 1: $V_{CC} = 0\text{ V}$

Note 2: High or Low state.

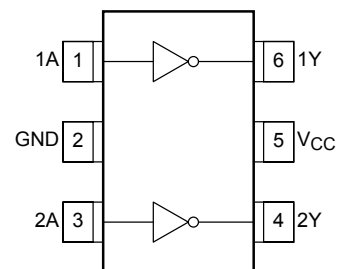
I_{OUT} absolute maximum rating must be observed.

Note 3: $V_{OUT} < GND$

Marking



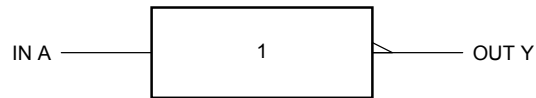
Pin Assignment (top view)



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	$^{\circ}C$
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 < V_{CC} ≤ 3.6 V)

Characteristics	Symbol	Test Condition	V _{CC} (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 Electrical Characteristics (Ta = -40~85°C, 2.3 V ≤ V_{CC} ≤ 2.7 V)

Characteristics	Symbol	Test Condition	V _{CC} (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 Electrical Characteristics (Ta = -40~85°C, 1.8 V ≤ VCC < 2.3 V)

Characteristics	Symbol	Test Condition		Min	Max	Unit	
			VCC (V)				
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		Min	Max	Unit	
			VCC (V)				
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	VCC (V)	Typ.	Unit
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	VOHV	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: Parameter guaranteed by design.

Capacitive Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	VCC (V)	TYP.	Unit
Input Capacitance	CIN	—	1.8, 2.5, 3.3	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:

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

AC Test Circuit

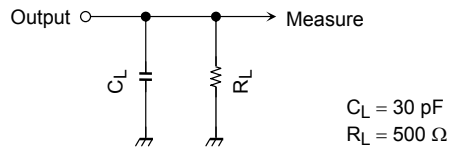
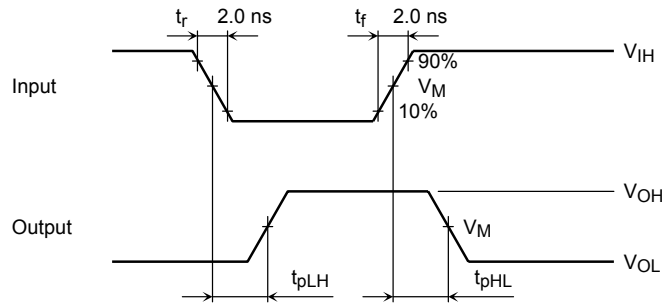


Figure 1

AC Waveforms



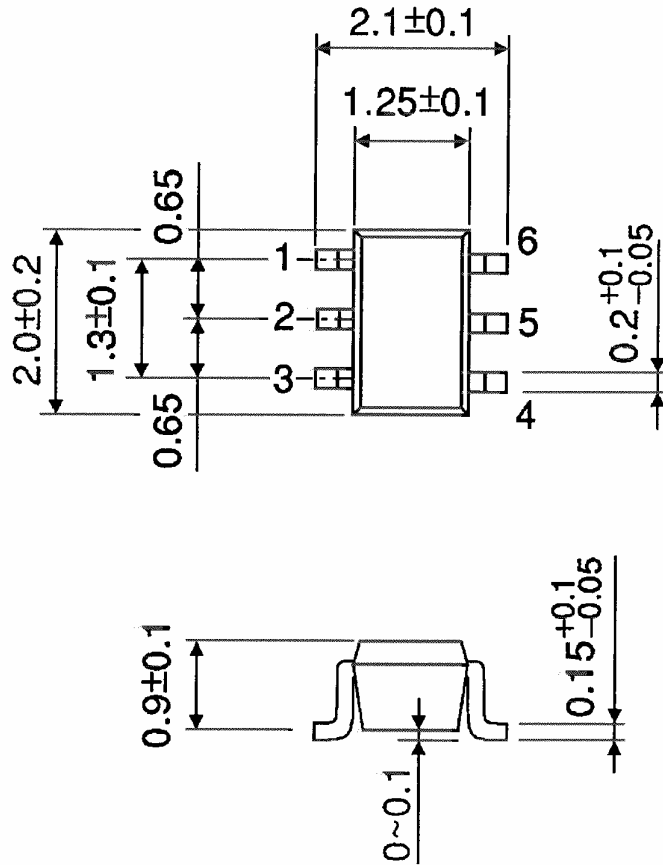
Symbol	V_{CC}		
	$3.3 \pm 0.3 \text{ V}$	$2.5 \pm 0.2 \text{ V}$	1.8 V
V_{IH}	2.7 V	V_{CC}	V_{CC}
V_M	1.5 V	$V_{CC}/2$	$V_{CC}/2$

Figure 2 t_{pLH} , t_{pHL}

Package Dimensions

SSOP6-P-0.65A

Unit: mm



Weight: 0.0068 g (typ.)

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