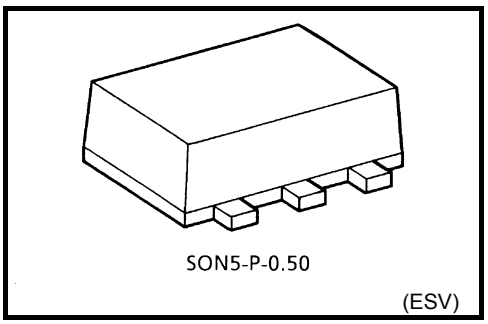
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7SZ14FE

Schmitt Inverter

Features

- High output current : ±24 mA (min) at V_{CC} = 3 V
- Super high speed operation : t_{pd} = 3.7 ns (typ.) at V_{CC} = 5 V, C_L = 50 pF
- Operation voltage range : $V_{CC\ (opr.)}$ = 1.65 to 5.5 V
- 5.5-V tolerant input
- 5.5-V power down protection output
- ESD performance : Machine model ≥ ±200 V
  Human body model ≥ ±2000 V
- Matches the performance of TC74LCX series when operated at 3.3-V V_{CC}

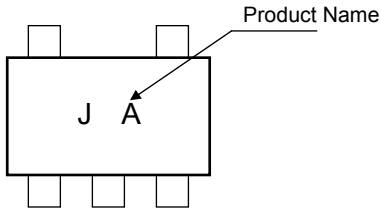


Weight : 3.0 mg (typ.)

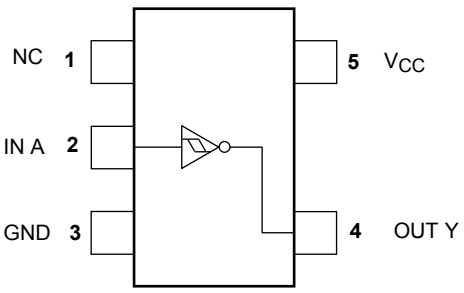
Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	−0.5 to 6	V
DC input voltage	V_{IN}	−0.5 to 6	V
DC output voltage	V_{OUT}	−0.5 to 6 (Note1)	V
		−0.5 to V_{CC} +0.5 V (Note 2)	
Input diode current	I_{IK}	−20	mA
Output diode current	I_{OK}	−20 (Note3)	mA
DC output current	I_{OUT}	±50	mA
DC V_{CC}/ground current	I_{CC}	±50	mA
Power dissipation	P_D	150	mW
Storage temperature	T_{stg}	−65 to 150	°C

Marking



Pin Assignment (top view)



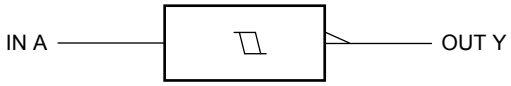
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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}=0V

Note 2: High or Low state. Do not exceed I_{OUT} of absolute maximum ratings.

Note 3: V_{OUT}<GND

IEC Logic Symbol



Truth Table

A	Y
L	H
H	L

Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	1.65 to 5.5	V
		1.5 to 5.5 (Note 4)	
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to 5.5 (Note 5)	V
		0 to V_{CC} (Note 6)	
Operating temperature	T_{opr}	−40 to 85	°C

Note 4: Data retention only
Note 5: V_{CC} = 0V
Note 6: High or Low State

Electrical Characteristics

DC Characteristics

Characteristics		Symbol	Test Condition	Ta = 25°C			Ta = −40 to 85°C		Unit
			V_{CC} (V)	Min	Typ.	Max	Min	Max	
Threshold voltage	High-level	V_P	—	1.65	0.6	1.0	1.4	0.6	1.4	V
				1.8	0.7	1.1	1.5	0.7	1.5	
				2.3	1.0	1.4	1.8	1.0	1.8	
				3.0	1.3	1.75	2.2	1.3	2.2	
				4.5	1.9	2.45	3.1	1.9	3.1	
				5.5	2.2	2.9	3.6	2.2	3.6	
	Low-level	V_N	—	1.65	0.2	0.5	0.8	0.2	0.8	
				1.8	0.25	0.55	0.9	0.25	0.9	
				2.3	0.40	0.75	1.15	0.40	1.15	
				3.0	0.6	1.0	1.5	0.6	1.5	
				4.5	1.0	1.43	2.0	1.0	2.0	
				5.5	1.2	1.70	2.4	1.2	2.4	
Hysteresis voltage		V_H	—	1.65	0.1	0.48	0.9	0.1	1.0	V
				1.8	0.15	0.54	1.0	0.15	1.0	
				2.3	0.25	0.65	1.1	0.25	1.1	
				3.0	0.4	0.77	1.2	0.4	1.2	
				4.5	0.6	1.01	1.5	0.6	1.5	
				5.5	0.7	1.18	1.7	0.7	1.7	

Characteristics	Symbol	Test Condition		V_{CC} (V)	Ta = 25°C Min	Ta = 25°C Typ.	Ta = 25°C Max	Ta = −40 to 85°C Min	Ta = −40 to 85°C Max	Unit
High-level output voltage	V_{OH}	V_{IN} = V_N	I_{OH} = −100 μA	1.65	1.55	1.65	—	1.55	—	V
				1.8	1.7	1.8	—	1.7	—	
				2.3	2.2	2.3	—	2.2	—	
				3.0	2.9	3.0	—	2.9	—	
				4.5	4.4	4.5	—	4.4	—	
			I_{OH} = −4 mA	1.65	1.29	1.52	—	1.29	—	
			I_{OH} = −8 mA	2.3	1.9	2.15	—	1.9	—	
			I_{OH} = −16 mA	3.0	2.4	2.8	—	2.4	—	
			I_{OH} = −24 mA	3.0	2.3	2.68	—	2.3	—	
			I_{OH} = −32 mA	4.5	3.8	4.2	—	3.8	—	
Low-level output voltage	V_{OL}	V_{IN} = V_P	I_{OL} = 100 μA	1.65	—	0	0.1	—	0.1	V
				1.8	—	0	0.1	—	0.1	
				2.3	—	0	0.1	—	0.1	
				3.0	—	0	0.1	—	0.1	
				4.5	—	0	0.1	—	0.1	
			I_{OL} = 4 mA	1.65	—	0.08	0.24	—	0.24	
			I_{OL} = 8 mA	2.3	—	0.1	0.3	—	0.3	
			I_{OL} = 16 mA	3.0	—	0.15	0.4	—	0.4	
			I_{OL} = 24 mA	3.0	—	0.22	0.55	—	0.55	
			I_{OL} = 32 mA	4.5	—	0.22	0.55	—	0.55	
Input leakage current	I_{IN}	V_{IN} = 5.5 V or GND		0 to 5.5	—	—	±1	—	±10	μA
Power OFF leakage current	I_{OFF}	V_{IN} or V_{OUT} = 5.5 V		0.0	—	—	1	—	10	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND		1.65 to 5.5	—	—	2	—	20	μA

AC Characteristics (unless otherwise specified, Input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Test Condition	V_{CC} (V)	Ta = 25°C Min	Ta = 25°C Typ.	Ta = 25°C Max	Ta = −40 to 85°C Min	Ta = −40 to 85°C Max	Unit
Propagation delay time	t_{pLH} t_{pHL}	C_L = 15 pF, R_L = 1 MΩ	1.8± 0.15	2.0	9.1	15.0	2.0	15.6	ns
			2.5 ± 0.2	1.0	5.0	9.0	1.0	9.5	
			3.3 ± 0.3	1.0	3.7	6.3	1.0	6.5	
			5.0 ± 0.5	0.5	3.1	5.2	0.5	5.5	
		C_L = 50 pF, R_L = 500 Ω	3.3 ± 0.3	1.5	4.4	7.2	1.5	7.5	
			5.0 ± 0.5	0.5	3.7	5.9	0.5	6.2	
Input capacitance	C_{IN}	—	0 to 5.5	—	4	—	—	—	pF
Power dissipation capacitance	C_{PD}	(Note 7)	3.3	—	24	—	—	—	pF
			5.5	—	30	—	—	—	

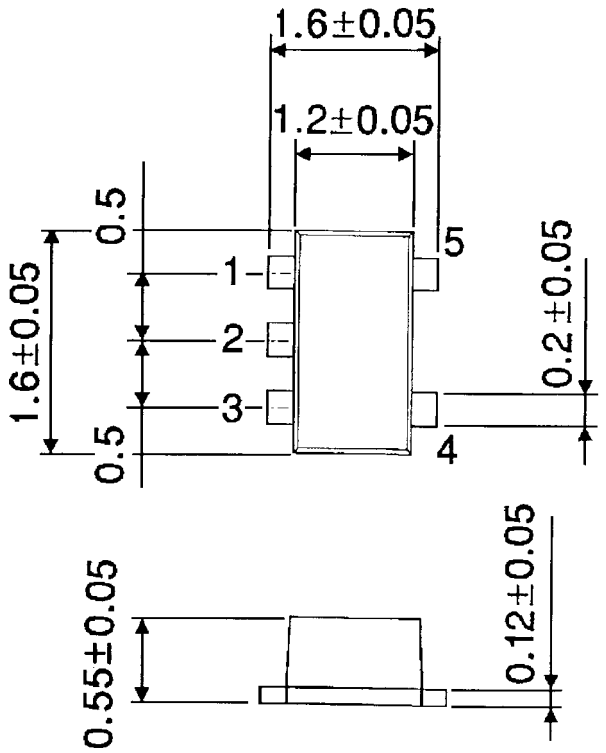
Note 7: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation.

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

Package Dimensions

SON5-P-0.50 Unit : mm



Weight: 3.0 mg (typ.)

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