

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

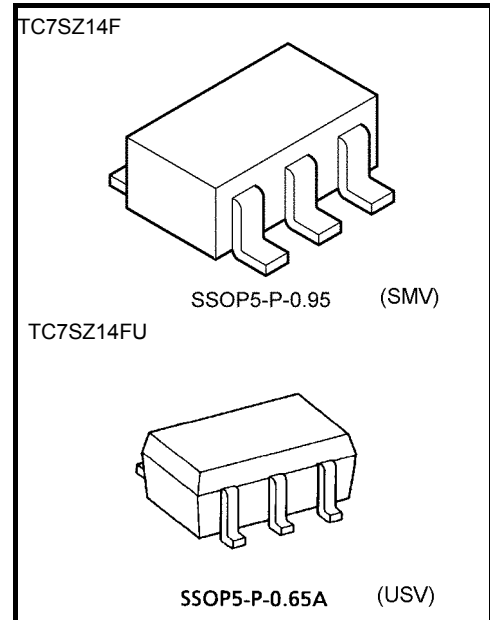
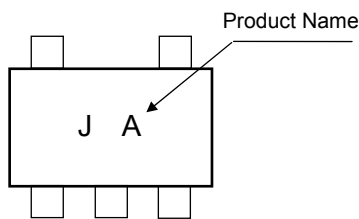
TC7SZ14F, TC7SZ14FU

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, 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
- Matches the performance of TC74LCX series when operated at 3.3-V V_{CC}

Marking

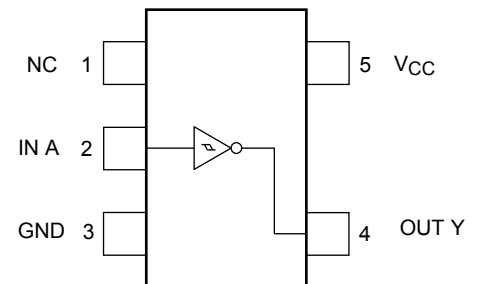


Weight:
 SSOP5-P-0.95 : 0.016 g (typ.)
 SSOP5-P-0.65A : 0.006 g (typ.)

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 (Note 1)	V
		-0.5 to $V_{CC}+0.5$ (Note 2)	
Input diode current	I_{IK}	-20	mA
Output diode current	I_{OK}	-20 (Note 3)	mA
DC output current	I_{OUT}	± 50	mA
DC V_{CC} /ground current	I_{CC}	± 50	mA
Power dissipation	P_D	200	mW
Storage temperature	T_{stg}	-65 to 150	°C
Lead temperature (10 s)	T_L	260	°C

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.

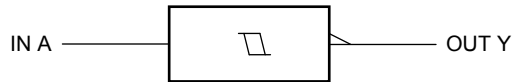
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

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

Note 2: High or Low state. 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 (Note4)	
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: $V_{CC} = 0\text{ V}$

Note 6: High or Low State

Electrical Characteristics

DC Electrical Characteristics

Characteristics	Symbol	Test Condition	$T_a = 25^\circ\text{C}$			$T_a = -40\text{ to }85^\circ\text{C}$		Unit	
			V_{CC} (V)	Min	Typ.	Max	Min		Max
Threshold voltage	High level	—	1.65	0.6	1.0	1.4	0.65	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	—	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	1.7	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			Ta = -40 to 85°C		Unit	
				Min	Typ.	Max	Min	Max		
Output voltage	High level	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	—	
				2.3	1.9	2.15	—	1.9	—	
				3.0	2.4	2.8	—	2.4	—	
				4.5	3.8	4.2	—	3.8	—	
	Low level	V _{OL} V _{IN} = V _P	I _{OL} = 100 μA	1.65	—	0	0.1	—	0.1	
				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	
				2.3	—	0.1	0.3	—	0.3	
				3.0	—	0.15	0.4	—	0.4	
				4.5	—	0.22	0.55	—	0.55	
I _{OL} = 8 mA	2.3	—	0.1	0.3	—	0.3				
	3.0	—	0.15	0.4	—	0.4				
	4.5	—	0.22	0.55	—	0.55				
I _{OL} = 16 mA	3.0	—	0.15	0.4	—	0.4				
	3.0	—	0.22	0.55	—	0.55				
	4.5	—	0.22	0.55	—	0.55				
I _{OL} = 24 mA	3.0	—	0.22	0.55	—	0.55				
	3.0	—	0.22	0.55	—	0.55				
	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} = 5.5 V or GND	1.65 to 5.5	—	—	1	—	10	μA	

AC Electrical Characteristics (Unless otherwise specified Input: t_r = t_f = 3 ns)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Ta = 25°C			Ta = -40~85°C		Unit	
				Min	Typ.	Max	Min	Max		
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	0.8		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	—	—	—	pF	

Note 7: CPD is defined as the value of the internal equivalent capacitance which is Calculated from the operating current consumption without load.

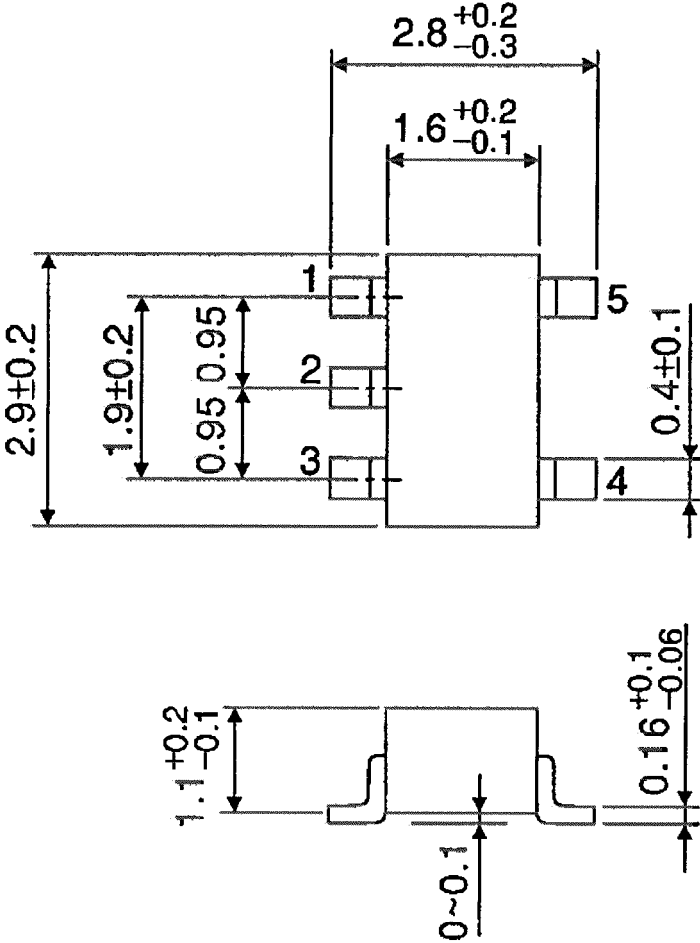
Average operating current can be obtained by the equation.

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

Package Dimensions

SSOP5-P-0.95

Unit : mm

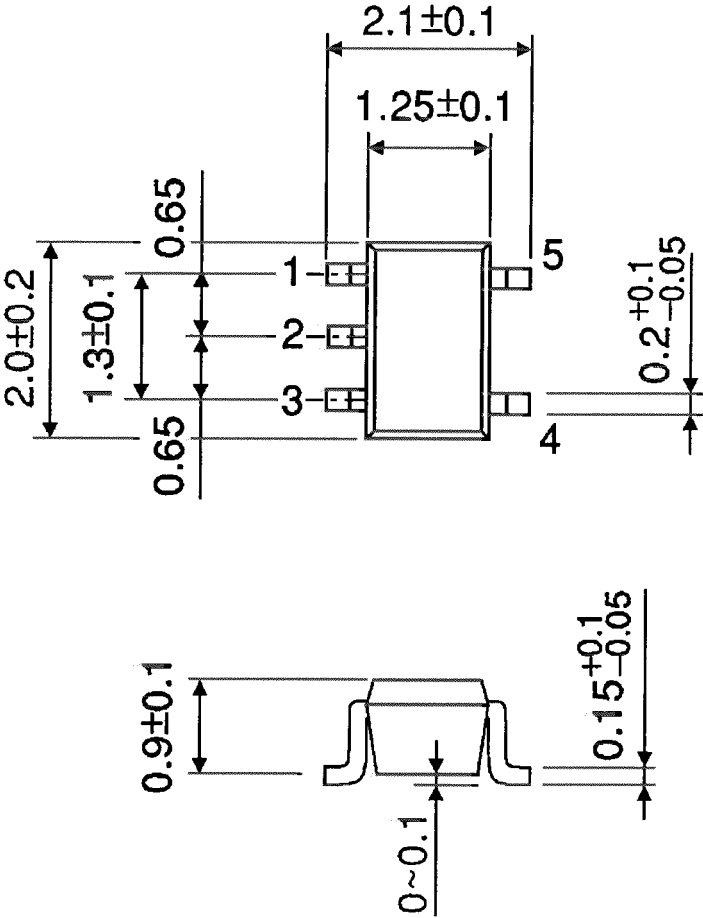


Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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