

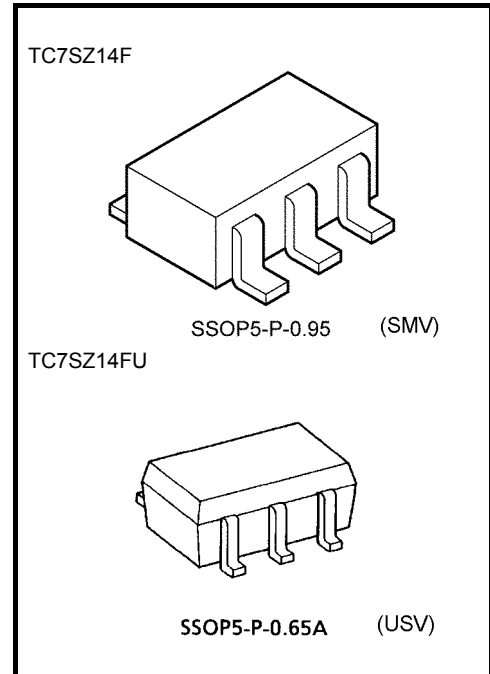
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC7SZ14F, TC7SZ14FU

## Schmitt Inverter

### Features

- High output drive:  $\pm 24$  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:  $V_{CC (opr)} = 1.65 \sim 5.5$  V
- 5.5-V tolerant inputs
- 5.5-V power down protection output
- Matches the performance of TC74LCX series when operated at 3.3-V  $V_{CC}$



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

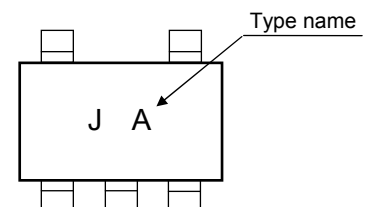
### Absolute Maximum Ratings (Ta = 25°C)

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

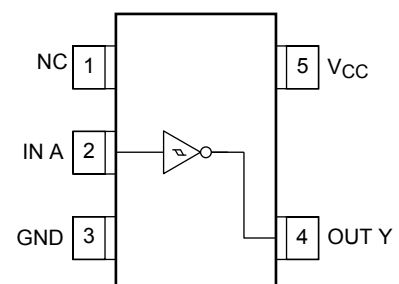
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

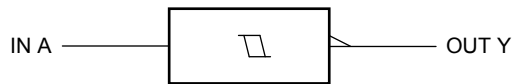
### Marking



### Pin Assignment (top view)



## Logic Diagram



## 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 1)	
Input voltage	$V_{IN}$	0 to 5.5	V
Output voltage	$V_{OUT}$	0 to 5.5 (Note 2)	V
		0 to $V_{CC}$ (Note 3)	
Operating temperature	$T_{opr}$	-40 to 85	°C

Note 1: Data retention only

Note 2:  $V_{CC} = 0\text{ V}$

Note 3: High or Low State

## Electrical Characteristics

### DC Electrical Characteristics

Characteristics	Symbol	Test Condition	$V_{CC}$ (V)	$T_a = 25^\circ\text{C}$			$T_a = -40\sim 85^\circ\text{C}$		Unit
				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	
	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	
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 <sub>CC</sub> (V)	Ta = 25°C			Ta = -40~85°C		Unit	
				Min	Typ.	Max	Min	Max		
Output voltage	High level	V <sub>OH</sub> V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OH</sub> = -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 <sub>OH</sub> = -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	—	
				3.0	2.3	2.68	—	2.3	—	
	Low level	V <sub>OL</sub> V <sub>IN</sub> = V <sub>IH</sub>	I <sub>OL</sub> = 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 <sub>OL</sub> = 4 mA	1.65	—	0.08	0.24	—	0.24	
				2.3	—	0.1	0.3	—	0.3	
			I <sub>OL</sub> = 8 mA	3.0	—	0.15	0.4	—	0.4	
				3.0	—	0.22	0.55	—	0.55	
I <sub>OL</sub> = 16 mA	4.5	—	0.22	0.55	—	0.55				
	4.5	—	0.22	0.55	—	0.55				
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = 5.5 V or GND	0~5.5	—	—	±1	—	±10	μA	
Power OFF leakage current	I <sub>OFF</sub>	V <sub>IN</sub> or V <sub>OUT</sub> = 5.5 V	0.0	—	—	1	—	10	μA	
Quiescent supply current	I <sub>CC</sub>	V <sub>IN</sub> = 5.5 V or GND	1.65~5.5	—	—	1	—	10	μA	

### AC Electrical Characteristics (Unless otherwise specified Input: t<sub>r</sub> = t<sub>f</sub> = 3 ns)

Characteristics	Symbol	Test Condition	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40~85°C		Unit	
				Min	Typ.	Max	Min	Max		
Propagation delay time	t <sub>pLH</sub> t <sub>pHL</sub>	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 MΩ	1.65	2.0	9.1	15.0	2.0	15.6	ns	
			1.8	2.0	7.6	12.5	2.0	13		
			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 <sub>L</sub> = 50 pF, R <sub>L</sub> = 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 <sub>IN</sub>	—	0~5.5	—	4		—
Power dissipation capacitance	C <sub>PD</sub>	(Note 4)	3.3	—	24	—	—	—	pF	
			5.5	—	30	—	—	—	pF	

Note 4: CPD is defined as the value of the internal equivalent capacitance which is Calculated from the operating current consumption without load.

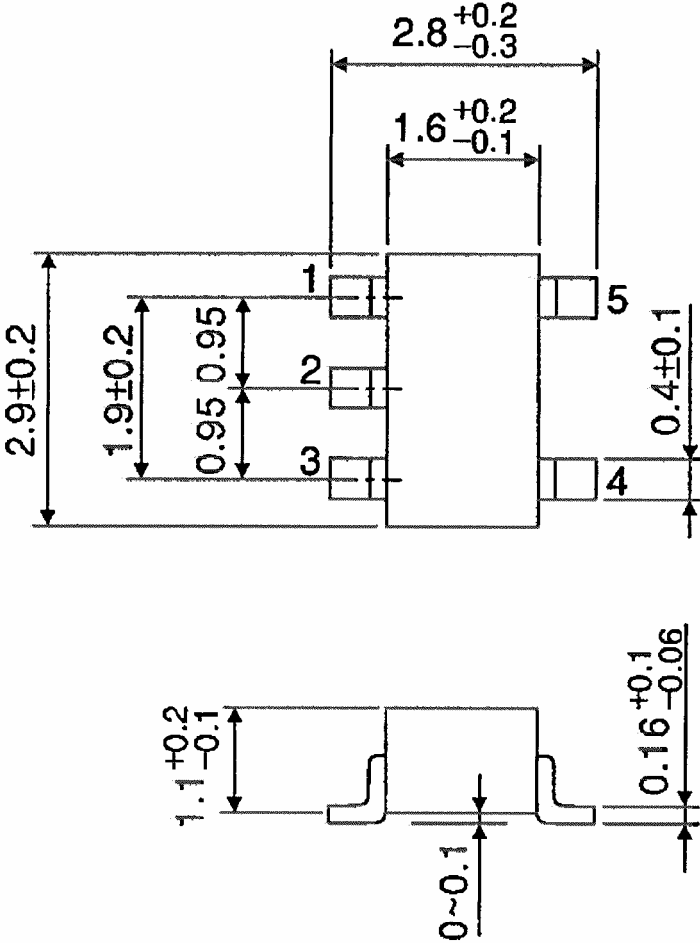
Average operating current can be obtained by the equation.

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

Package Dimensions

SSOP5-P-0.95

Unit : mm

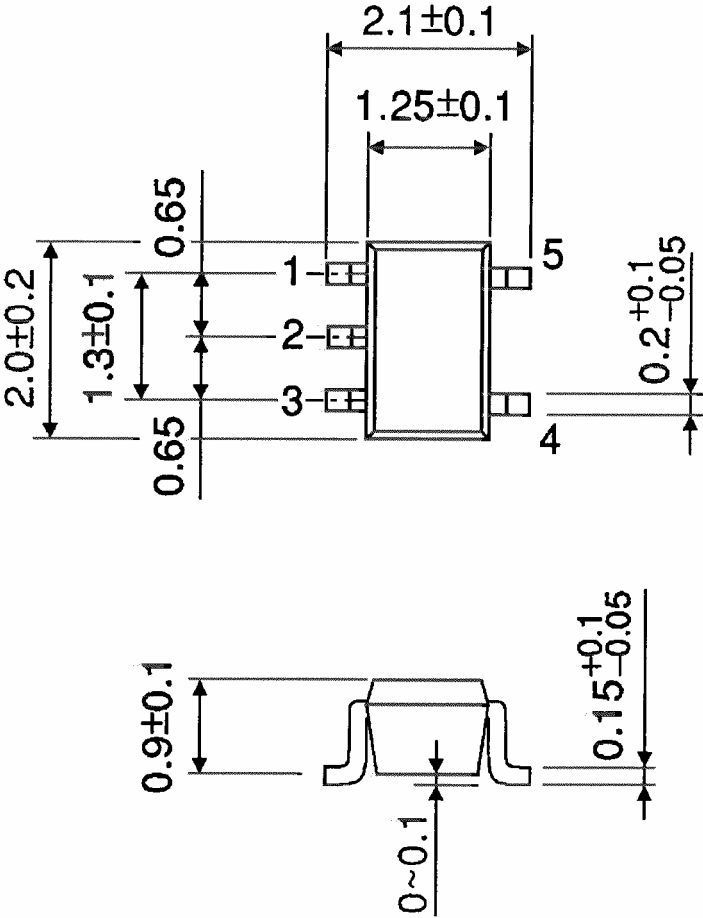


Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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20070701-EN GENERAL

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