

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

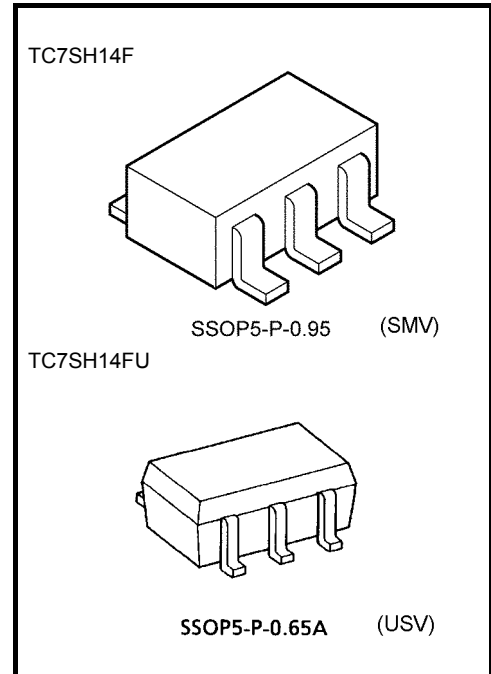
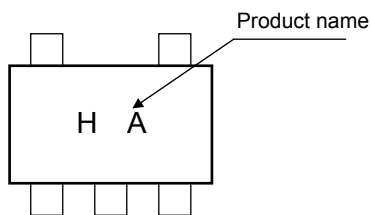
## TC7SH14F, TC7SH14FU

### Schmitt Inverter

#### Features

- High speed operation :  $t_{pd} = 5.5 \text{ ns (typ.)}$   
at  $V_{CC} = 5 \text{ V}$ ,  $C_L = 15 \text{ pF}$
- Low power dissipation :  $I_{CC} = 2 \text{ } \mu\text{A (max)}$  at  $T_a = 25^\circ\text{C}$
- High noise immunity :  $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (min)}$
- Wide operating voltage range:  $V_{CC} = 2 \text{ to } 5.5 \text{ V}$
- 5.5-V tolerant input

#### Marking



#### Weight

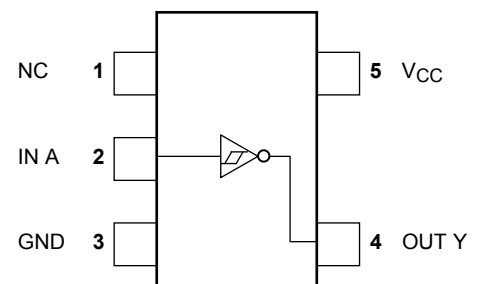
SSOP5-P-0.95 : 0.016 g (typ.)

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

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

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	-0.5 to 7	V
DC input voltage	$V_{IN}$	-0.5 to 7	V
DC output voltage	$V_{OUT}$	-0.5 to $V_{CC} + 0.5$	V
Input diode current	$I_{IK}$	-20	mA
Output diode current	$I_{OK}$	$\pm 20$ (Note 1)	mA
DC output current	$I_{OUT}$	$\pm 25$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 50$	mA
Power dissipation	$P_D$	200	mW
Storage temperature	$T_{stg}$	-65 to 150	$^\circ\text{C}$
Lead temperature (10 s)	$T_L$	260	$^\circ\text{C}$

#### Pin Assignment (top view)

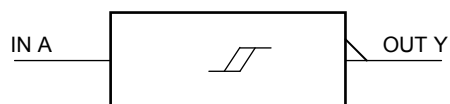


Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

Note1:  $V_{OUT} < GND$ ,  $V_{OUT} > V_{CC}$

## IEC Logic Symbol



## Truth Table

A	Y
L	H
H	L

## Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	2.0 to 5.5	V
Input voltage	$V_{IN}$	0 to 5.5	V
Output voltage	$V_{OUT}$	0 to $V_{CC}$	V
Operating temperature	$T_{opr}$	-40 to 85	°C

## Electrical Characteristics

### DC Characteristics

Characteristics		Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit			
					V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max		
Input voltage	Positive threshold voltage	V <sub>P</sub>	—	3.0	—	—	2.20	—	2.20	V			
				4.5	—	—	3.15	—	3.15				
				5.5	—	—	3.85	—	3.85				
	Negative threshold voltage	V <sub>N</sub>	—	3.0	0.90	—	—	0.90	—				
				4.5	1.35	—	—	1.35	—				
				5.5	1.65	—	—	1.65	—				
Hysteresis Voltage		V <sub>H</sub>	—	3.0	0.30	—	1.20	0.30	1.20	V			
				4.5	0.40	—	1.40	0.40	1.40				
				5.5	0.50	—	1.60	0.50	1.60				
Output voltage	High level	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OH</sub> = -50 μA	2.0	1.9	2.0	—	1.9	—	V		
					3.0	2.9	3.0	—	2.9	—			
					4.5	4.4	4.5	—	4.4	—			
				I <sub>OH</sub> = -4 mA	3.0	2.58	—	—	2.48	—			
					I <sub>OH</sub> = -8 mA	4.5	3.94	—	—	3.80		—	
						Low level	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub>	I <sub>OL</sub> = 50 μA	2.0		—	0
	3.0	—	0	0.1						—		0.1	
	4.5	—	0	0.1	—					0.1			
	I <sub>OL</sub> = 4 mA	3.0	—	—	0.36				—	0.44			
		I <sub>OL</sub> = 8 mA	4.5	—	—				0.36	—		0.44	
			Input leakage current		I <sub>IN</sub>				V <sub>IN</sub> = 5.5 V or GND	0 to 5.5		—	—
	Quiescent supply current		I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5	—	—	2.0	—	20.0		μA	

**AC Characteristics (unless otherwise specified, Input:  $t_r = t_f = 3 \text{ ns}$ )**

Characteristics	Symbol	Test Condition			Ta = 25°C			Ta = −40 to 85°C		Unit
			VCC (V)	CL (pF)	Min	Typ.	Max	Min	Max	
Propagation delay time	tPLH tPHL		3.3 ± 0.3	15	—	8.3	12.8	1.0	15.0	ns
				50	—	10.8	16.3	1.0	18.5	
			5.0 ± 0.5	15	—	5.5	8.6	1.0	10.0	
				50	—	7.0	10.6	1.0	12.0	
Input capacitance	CIN	—			—	4	10	—	10	pF
Power dissipation capacitance	CPD	(Note 2)			—	14	—	—	—	pF

Note 2: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

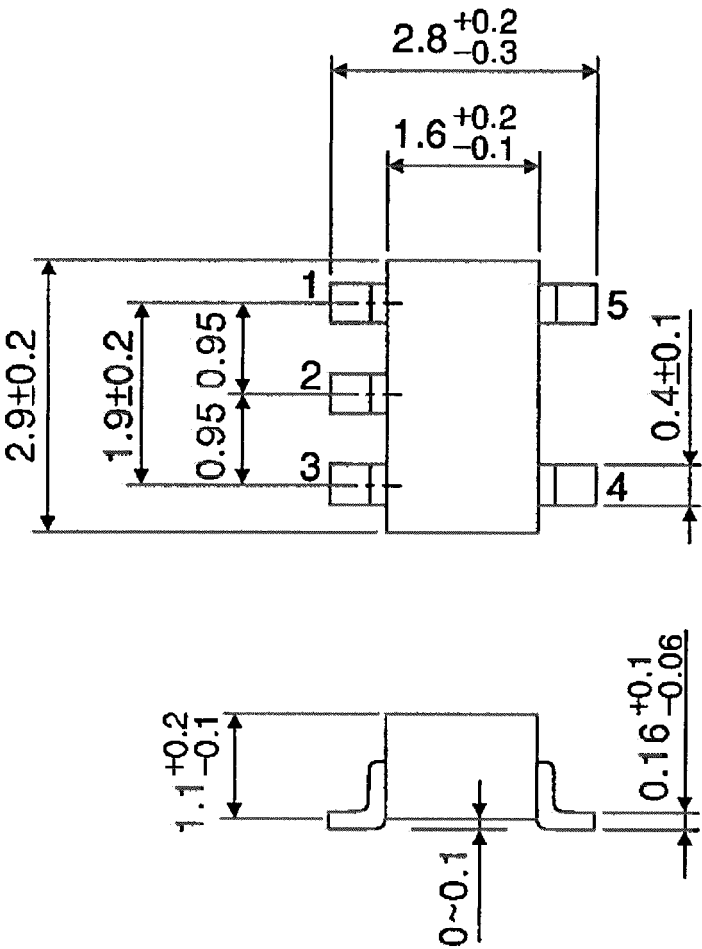
Average operating current can be obtained by the equation.

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

Package Dimensions

SSOP5-P-0.95

Unit : mm

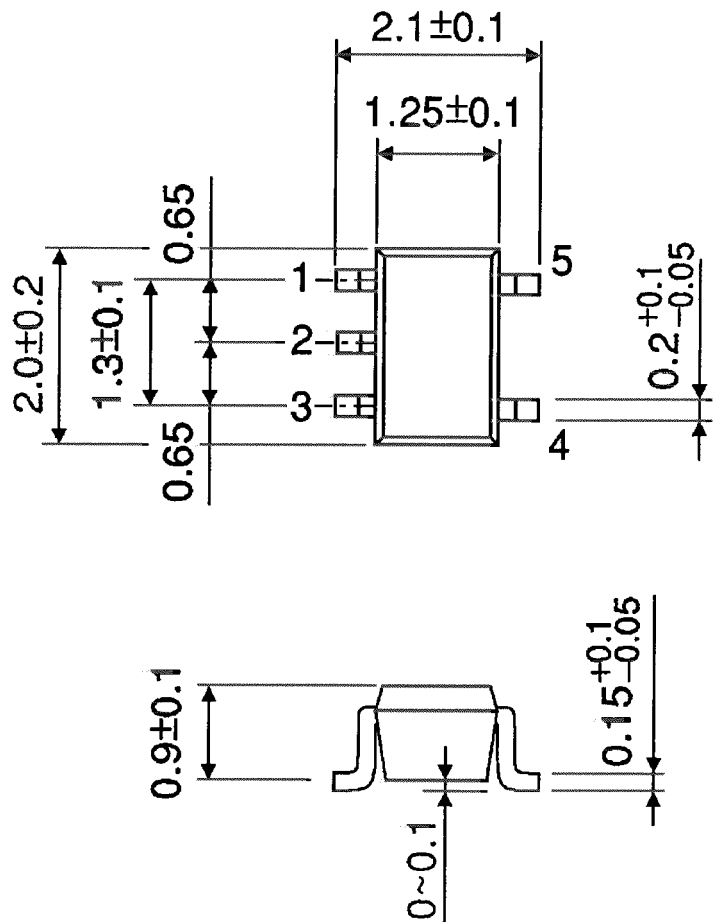


Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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