

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

**TC7SH14F, TC7SH14FU****SCHMITT INVERTER**

The TC7SH14 is an advanced high speed CMOS SCHMITT INVERTER fabricated with silicon gate CMOS technology. It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation. Pin configuration and function are the same as the TC7SH14 but the inputs have hysteresis and with its schmitt trigger function, the TC7SH14 can be used as a line receivers which will receive slow input signals.

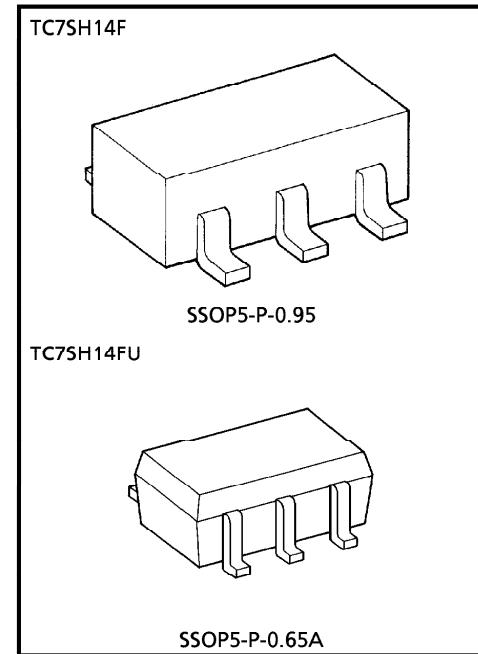
An input protection circuit ensures that 0V to 7V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V system and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

**FEATURES**

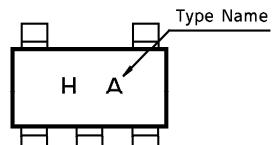
- High Speed .....  $t_{pd} = 5.5\text{ns}$  (Typ.) at  $V_{CC} = 5\text{V}$
- Low Power Dissipation .....  $I_{CC} = 2\mu\text{A}$  (Max.) at  $T_a = 25^\circ\text{C}$
- High Noise Immunity .....  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (Min.)
- Power Down Protection is provided on all inputs.
- Balanced Propagation Delays .....  $t_{pLH} = t_{pHL}$
- Wide Operation Voltage Range .....  $V_{CC}(\text{opr}) = 2\text{V} \sim 5.5\text{V}$

**MAXIMUM RATINGS**

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage Range	$V_{CC}$	-0.5~7.0	V
DC Input Voltage	$V_{IN}$	-0.5~7.0	V
DC Output Voltage	$V_{OUT}$	-0.5~ $V_{CC} + 0.5$	V
Input Diode Current	$I_{IK}$	-20	mA
Output Diode Current	$I_{OK}$	$\pm 20$	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	$T_{stg}$	-65~150	°C
Lead Temperature (10s)	$T_L$	260	°C



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

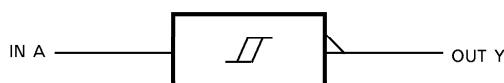
**MARKING****TRUTH TABLE**

A	Y
L	H
H	L

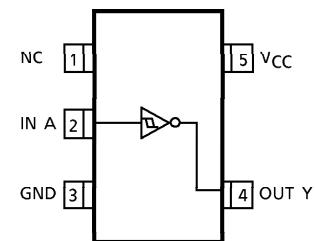
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## LOGIC DIAGRAM



## PIN ASSIGNMENT (TOP VIEW)



## RECOMMENDED OPERATING CONDITIONS

CHARACTERISTIC	SYMBOL	RATING		UNIT
Supply Voltage	$V_{CC}$	2.0~5.5		V
Input Voltage	$V_{IN}$	0~5.5		V
Output Voltage	$V_{OUT}$	0~ $V_{CC}$		V
Operating Temperature	$T_{opr}$	-40~85		°C
Input Rise and Fall Time	$dt/dv$	0~100 ( $V_{CC} = 3.3 \pm 0.3$ V) 0~20 ( $V_{CC} = 5 \pm 0.5$ V)		ns/V

## DC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	TEST CONDITION	$T_a = 25^\circ C$			$T_a = -40 \sim 85^\circ C$		UNIT
			$V_{CC}$	MIN.	TYP.	MAX.	MIN.	
Positive Threshold Voltage	$V_p$		3.0	—	—	2.20	—	2.20
			4.5	—	—	3.15	—	3.15
			5.5	—	—	3.85	—	3.85
Negative Threshold Voltage	$V_N$		3.0	0.90	—	—	0.90	—
			4.5	1.35	—	—	1.35	—
			6.0	1.65	—	—	1.65	—
Hysteresis Voltage	$V_H$		3.0	0.30	—	1.20	0.30	1.20
			4.5	0.40	—	1.40	0.40	1.40
			5.5	0.50	—	1.60	0.50	1.60
High-Level Output Voltage	$V_{OH}$	$V_{IN} = V_{IL}$	$I_{OH} = -50 \mu A$	2.0	1.9	2.0	—	1.9
			$I_{OH} = -4mA$	3.0	2.9	3.0	—	2.9
			$I_{OH} = -8mA$	4.5	4.4	4.5	—	4.4
			$I_{OH} = -50 \mu A$	3.0	2.58	—	—	2.48
			$I_{OH} = -4mA$	4.5	3.94	—	—	3.80
Low-Level Output Voltage	$V_{OL}$	$V_{IN} = V_{IH}$	$I_{OL} = 50 \mu A$	2.0	—	0.0	0.1	—
			$I_{OL} = 4mA$	3.0	—	0.0	0.1	—
			$I_{OL} = 8mA$	4.5	—	0.0	0.1	—
			$I_{OL} = 50 \mu A$	3.0	—	0.36	—	0.44
			$I_{OL} = 4mA$	4.5	—	0.36	—	0.44
Input Leakage Current	$I_{IN}$	$V_{IN} = 5.5V$ or GND	0~5.5	—	—	$\pm 0.1$	—	$\pm 1.0$
Quiescent Supply Current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND	5.5	—	—	2.0	—	20.0
								$\mu A$

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AC ELECTRICAL CHARACTERISTICS (Input  $t_r = t_f = 3\text{ns}$ )

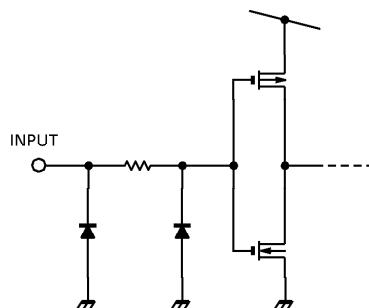
CHARACTERISTIC	SYMBOL	TEST CONDITION		Ta = 25°C			Ta = -40~85°C		UNIT	
		V <sub>CC</sub> (V)	C <sub>L</sub> (pF)	MIN.	TYP.	MAX.	MIN.	MAX.		
Propagation Delay Time	t <sub>pLH</sub>	3.3 ± 0.3	15	—	8.3	12.8	1.0	15.0	ns	
			50	—	10.8	16.3	1.0	18.5		
	t <sub>pHL</sub>	5.0 ± 0.5	15	—	5.5	8.6	1.0	10.0		
			50	—	7.0	10.6	1.0	12.0		
Input Capacitance	C <sub>IN</sub>				—	4	10	—	10	pF
Power Dissipation Capacitance	C <sub>PD</sub>	(Note 1)			—	21	—	—	—	pF

(Note 1) : 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 :

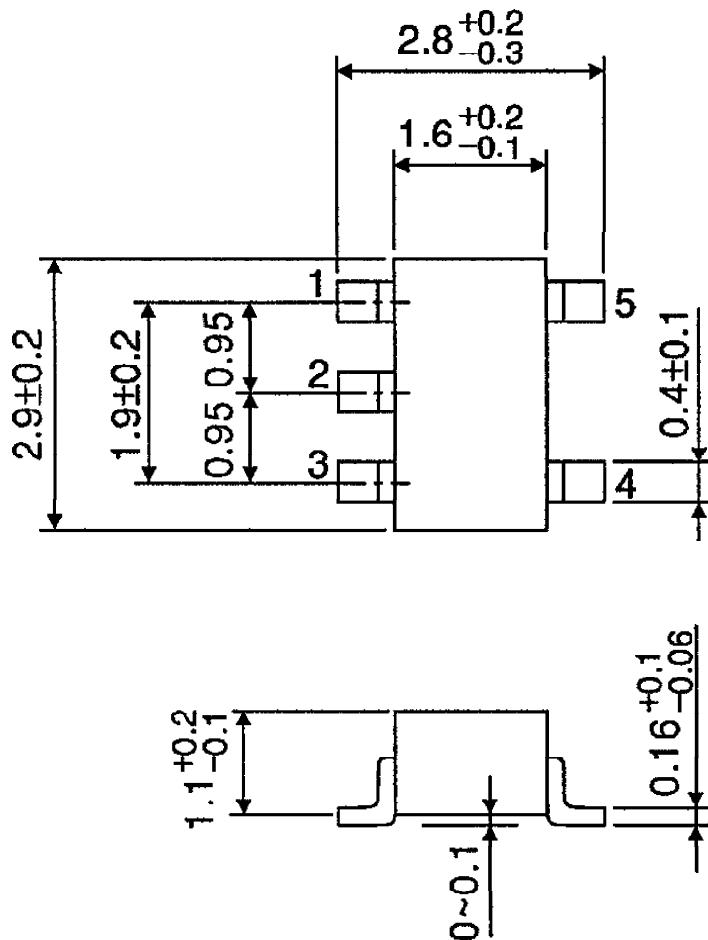
$$I_{CC(\text{opr})} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

## INPUT EQUIVALENT CIRCUIT



**OUTLINE DRAWING**  
SSOP5-P-0.95

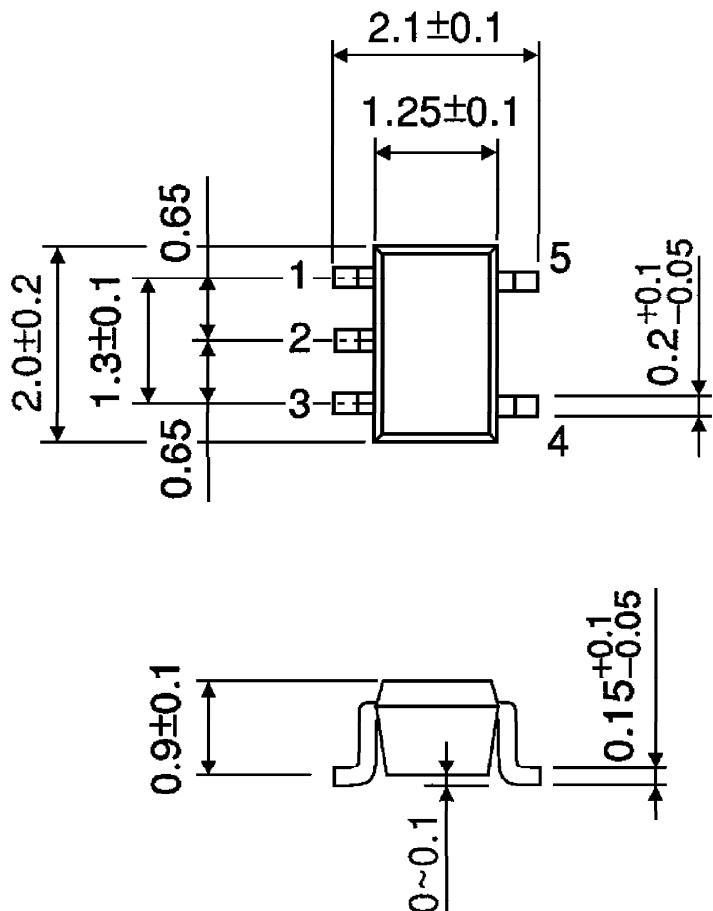
Unit : mm



Weight : 0.016g (Typ.)

## OUTLINE DRAWING

Unit : mm



Weight : 0.006g (Typ.)