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TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

# TC7S14F, TC7S14FU

## SCHMITT INVERTER

The TC7S14 is a high speed C<sup>2</sup>MOS SCHMITT INVERTER fabricated with silicon gate C<sup>2</sup>MOS technology. It achieves a high speed operation similar to equivalent LSTTL while maintaining the C<sup>2</sup>MOS low power dissipation.

Pin Configuration and function are the same as the TC7SU04F but input have 25% V<sub>CC</sub> hysteresis and with its schmitt trigger function, the TC7S14F can be used as line receivers which will receive slow input signal.

Input is equipped with protection circuits against static discharge or transient excess voltage.

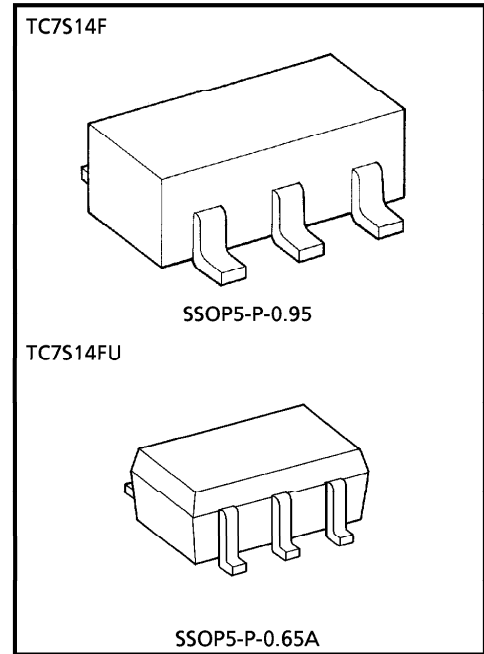
Output currents are 1/2 compared to TC74HC series models.

### FEATURES

- High Speed .....  $t_{pd} = 11\text{ns (Typ.) at } V_{CC} = 5\text{V}$
- Low Power Dissipation .....  $I_{CC} = 1\mu\text{A (Max.) at } T_a = 25^\circ\text{C}$
- High Noise Immunity .....  $V_H = 1.1\text{V at } V_{CC} = 5\text{V}$
- Output Drive Capability ..... 5 LSTTL Loads
- Symmetrical Output Impedance ...  $|I_{OH}| = I_{OL} = 2\text{mA}$
- Balanced Propagation Delays .....  $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range ...  $V_{CC}(\text{opr}) = 2\sim 6\text{V}$

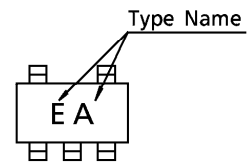
### MAXIMUM RATINGS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage Range	V <sub>CC</sub>	-0.5~7	V
DC Input Voltage	V <sub>IN</sub>	-0.5~V <sub>CC</sub> +0.5	V
DC Output Voltage	V <sub>OUT</sub>	-0.5~V <sub>CC</sub> +0.5	V
Input Diode Current	I <sub>IK</sub>	±20	mA
Output Diode Current	I <sub>OK</sub>	±20	mA
DC Output Current	I <sub>OUT</sub>	±12.5	mA
DC V <sub>CC</sub> / Ground Current	I <sub>CC</sub>	±50	mA
Power Dissipation	P <sub>D</sub>	200	mW
Storage Temperature	T <sub>stg</sub>	-65~150	°C
Lead Temperature (10s)	T <sub>L</sub>	260	°C



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

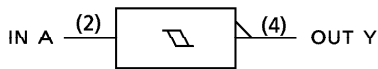
### MARKING



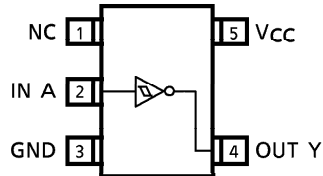
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**LOGIC DIAGRAM**



**PIN ASSIGNMENT (TOP VIEW)**



**TRUTH TABLE**

A	Y
L	H
H	L

**RECOMMENDED OPERATING CONDITIONS**

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V <sub>CC</sub>	2~6	V
Input Voltage	V <sub>IN</sub>	0~V <sub>CC</sub>	V
Output Voltage	V <sub>OUT</sub>	0~V <sub>CC</sub>	V
Operating Temperature	T <sub>opr</sub>	-40~85	°C

**DC ELECTRICAL CHARACTERISTICS**

CHARACTERISTIC	SYMBOL	TEST CONDITION	Ta = 25°C			Ta = -40~85°C		UNIT		
			V <sub>CC</sub>	MIN.	TYP.	MAX.	MIN.		MAX.	
Positive Threshold Voltage	V <sub>p</sub>	—	2.0	1.0	1.25	1.5	1.0	1.5	V	
			4.5	2.3	2.7	3.15	2.3	3.15		
			6.0	3.0	3.5	4.2	3.0	4.2		
Negative Threshold Voltage	V <sub>N</sub>	—	2.0	0.3	0.65	0.9	0.3	0.9	V	
			4.5	1.13	1.6	2.0	1.13	2.0		
			6.0	1.5	2.3	2.6	1.5	2.6		
Hysteresis Voltage	V <sub>H</sub>	—	2.0	0.3	0.6	1.0	0.3	1.0	V	
			4.5	0.6	1.1	1.4	0.6	1.4		
			6.0	0.8	1.2	1.7	0.8	1.7		
High-Level Output Voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OH</sub> = -20μA	2.0	1.9	2.0	—	1.9	—	V
				4.5	4.4	4.5	—	4.4	—	
				6.0	5.9	6.0	—	5.9	—	
Low-Level Output Voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub>	I <sub>OL</sub> = 20μA	2.0	—	0.0	0.1	—	0.1	V
				4.5	—	0.0	0.1	—	0.1	
				6.0	—	0.0	0.1	—	0.1	
Input Leakage Current	I <sub>IN</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		6.0	—	—	±0.1	—	±1.0	μA
				4.5	—	—	—	—	—	
				6.0	—	—	—	—	—	
Quiescent Supply Current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		6.0	—	—	1.0	—	10.0	μA

Output currents are 1/2 compared to TC74HC series models.

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**AC ELECTRICAL CHARACTERISTICS** ( $C_L = 15\text{pF}$ ,  $V_{CC} = 5\text{V}$ ,  $T_a = 25^\circ\text{C}$ )

CHARACTERISTIC	SYMBOL	TEST CONDITION	Ta = 25°C			UNIT
			MIN.	TYP.	MAX.	
Output Transition Time	$t_{TLH}$	—	—	4	8	ns
	$t_{THL}$					
Propagation Delay Time	$t_{pLH}$	—	—	11	21	
	$t_{pHL}$					

**AC ELECTRICAL CHARACTERISTICS** ( $C_L = 50\text{pF}$ , Input  $t_r = t_f = 6\text{ns}$ )

CHARACTERISTIC	SYMBOL	TEST CONDITION	Ta = 25°C			Ta = -40~85°C		UNIT	
			V <sub>CC</sub>	MIN.	TYP.	MAX.	MIN.		MAX.
Output Transition Time	$t_{TLH}$	—	2.0	—	50	125	—	145	ns
	$t_{THL}$		4.5	—	14	25	—	30	
			6.0	—	12	21	—	24	
Propagation Delay Time	$t_{pLH}$	—	2.0	—	48	100	—	235	
	$t_{pHL}$		4.5	—	12	20	—	48	
			6.0	—	9	17	—	40	
Input Capacitance	$C_{IN}$	—	—	5	10	—	10	pF	
Power Dissipation Capacitance	$C_{PD}$	Note (1)	—	28	—	—	—		

Note (1) :  $C_{PD}$  is defined as the value of internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

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