TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC7S14F, TC7S14FU

#### Schmitt Inverter

The TC7S14 is a high speed  $\rm C^2MOS$  Schmitt Inverter fabricated with silicon gate  $\rm C^2MOS$  technology.

It achieves a high speed operation similar to equivalent LSTTL while maintaining the  $C^2MOS$  low power dissipation.

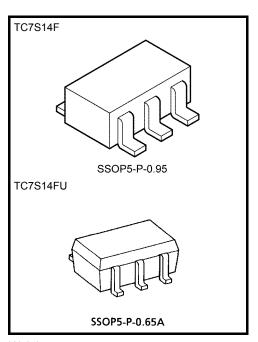
Pin Configuration and function are the same as the TC7SU04F but input have 25%  $V_{CC}$  hysteresis and with its schmitt trigger function, the TC7S14F can be used as line receivers which will receive slow input signal.

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:  $I_{CC} = 1 \ \mu A \ (max)$  at  $Ta = 25^{\circ}C$
- High noise immunity:  $V_H = 1.1 \text{ V}$  at  $V_{CC} = 5 \text{ V}$
- Output drive capability: 5 LSTTL loads
- Symmetrical output impedance: |IOH| = IOL = 2 mA (min)
- Balanced propagation delays:  $t_{pLH} \simeq t_{pHL}$
- Wide operating voltage range: V<sub>CC</sub> (opr) = 2 to 6 V



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 <sub>CC</sub>	–0.5 to 7	V	
DC input voltage	V <sub>IN</sub>	$-0.5$ to $V_{CC}$ + 0.5	V	
DC output voltage	V <sub>OUT</sub>	$-0.5$ to $V_{CC}$ + 0.5	V	
Input diode current	I <sub>IK</sub>	±20	mA	
Output diode current	IOK	±20	mA	
DC output current	IOUT	±12.5	mA	
DC V <sub>CC</sub> /ground current	ICC	±25	mA	
Power dissipation	PD	200	mW	
Storage temperature range	T <sub>stg</sub>	–65 to 150	°C	
Lead temperature (10 s)	ΤL	260	°C	

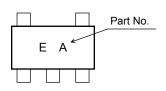
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

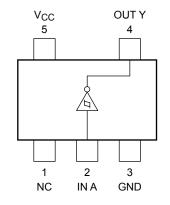
Start of commercial production 1991-06

# <u>TOSHIBA</u>

#### Marking



## Pin Configuration (top view)



## Logic Diagram



А	Y
L	Н
н	L

**Truth Table** 

#### **Operating Ranges**

Characteristics	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	2 to 6	V
Input voltage	V <sub>IN</sub>	0 to V <sub>CC</sub>	V
Output voltage	V <sub>OUT</sub>	0 to V <sub>CC</sub>	V
Operating temperature range	T <sub>opr</sub>	–40 to 85	°C

#### **Electrical Characteristics**

#### **DC Electrical Characteristics**

Characteristics Symbol		Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit		
					$V_{CC}(V)$	Min	Тур.	Max	Min	Max	
						1.0	1.25	1.5	1.0	1.5	-
Threshold voltage Negative	VP		2.3			2.7	3.15	2.3	3.15		
			3.0			3.5	4.2	3.0	4.2	V	
					2.0	0.3	0.65	0.9	0.3	0.9	v
	Negative	V <sub>N</sub>	_		4.5	1.13	1.6	2.0	1.13	2.0	
					6.0	1.5	2.3	2.6	1.5	2.6	
						0.3	0.6	1.0	0.3	1.0	v
Hysteresis volt	age	V <sub>H</sub>	—		4.5	0.6	1.1	1.4	0.6	1.4	
					6.0	0.8	1.2	1.7	0.8	1.7	
			V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OH</sub> = -20 μA	2.0	1.9	2.0		1.9	_	
					4.5	4.4	4.5		4.4	_	
	High level	h level V <sub>OH</sub>			6.0	5.9	6.0		5.9	—	
				$I_{OH} = -2 \text{ mA}$	4.5	4.18	4.31		4.13	_	
Output				I <sub>OH</sub> = -2.6 mA	6.0	5.68	5.80		5.63	—	v
voltage Low level		/ level V <sub>OL</sub> V <sub>IN</sub>			2.0	_	0	0.1	_	0.1	v
				$I_{OL} = 20 \ \mu A$	4.5	_	0	0.1	_	0.1	
	Low level		$V_{IN} = V_{IH}$		6.0	_	0	0.1	_	0.1	
				$I_{OL} = 2 \text{ mA}$	4.5		0.17	0.26		0.33	
				I <sub>OL</sub> = 2.6 mA	6.0		0.18	0.26		0.33	
Input leakage	current	l <sub>IN</sub>	$V_{IN} = V_{CC}$ or GND		6.0			±0.1		±1.0	μA
Quiescent sup	Quiescent supply current $I_{CC}$ $V_{IN} = V_{CC}$ or GND		6.0			1.0		10.0	μA		

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

#### AC Electrical Characteristics (CL = 15 pF, V<sub>CC</sub> = 5 V, Ta = 25°C)

Characteristics	Symbol	Test Condition	-	Unit		
		Test Condition	Min	Тур.	Max	Unit
Output transition time	t <sub>TLH</sub> t <sub>THL</sub>	_	_	4	8	ns
Propagation delay time	t <sub>pLH</sub> t <sub>pHL</sub>	_		11	21	ns

#### AC Electrical Characteristics ( $C_L = 50 \text{ pF}$ , input $t_r = t_f = 6 \text{ ns}$ )

Characteristics	Symbol Test Condition	_	Ta = 25°C			Ta = -40 to 85°C		Unit	
			V <sub>CC</sub> (V)	Min	Тур.	Max	Min	Max	
Output transition time	tт∟н tтн∟	—	2.0	_	50	125	_	145	
			4.5	_	14	25	_	30	ns
			6.0	_	12	21	_	24	
Propagation delay time	<sup>t</sup> pLH t <sub>pHL</sub>	_	2.0	_	48	100	—	235	
			4.5	_	12	20	—	48	ns
			6.0	_	9	17	—	40	
Input capacitance	C <sub>IN</sub>	—		_	5	10	—	10	pF
Power dissipation capacitance	C <sub>PD</sub>		(Note)		28	_	_		pF

Note: 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:

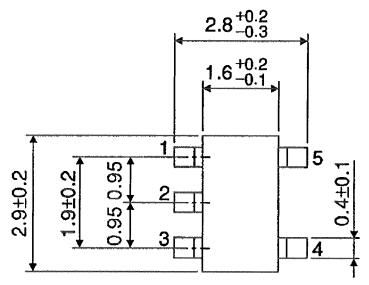
 $I_{CC \text{ (opr)}} = C_{PD} \bullet V_{CC} \bullet f_{IN} + I_{CC}$ 

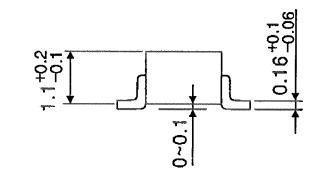
## **TOSHIBA**

## Package Dimensions

SSOP5-P-0.95

Unit : mm

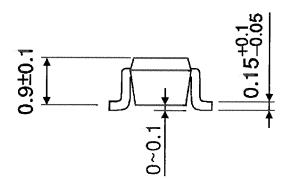




Weight: 0.016 g (typ.)

#### **Package Dimensions**

#### SSOP5-P-0.65A 2.1±0.1 1.25±0.1 0.65 5 1-EE $2.0\pm0.2$ 1.3±0. 2-EE N o -3-EE 0.65 4



Weight: 0.006 g (typ.)

Unit : mm

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