

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC7W14FU, TC7W14FK

## Schmitt Inverter

The TC7W14 is high speed C<sup>2</sup>MOS Schmitt Inverter fabricated with silicon gate C<sup>2</sup>MOS technology.

It achieves the 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 TC7WU04 but the inputs have 25% V<sub>CC</sub> hysteresis and with its Schmitt trigger function, the TC7W14 can be used as a line receivers which will receive slow input signals.

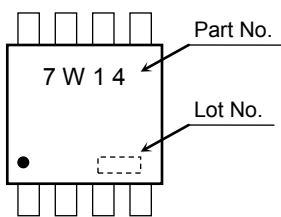
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

### Features

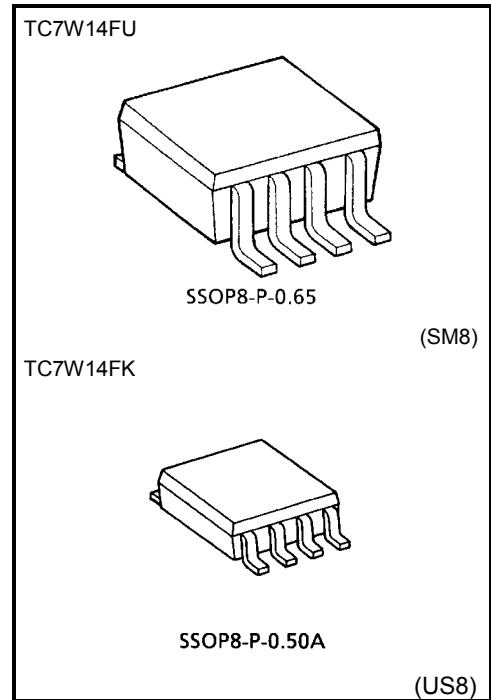
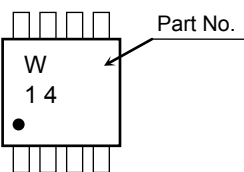
- High speed:  $t_{pd} = 11 \text{ ns (typ.)}$  at  $V_{CC} = 5 \text{ V}$
- Low power dissipation:  $I_{CC} = 1 \mu\text{A (max)}$  at  $T_a = 25^\circ\text{C}$
- High noise immunity:  $V_H = 1.1 \text{ V}$  at  $V_{CC} = 5\text{V}$
- Output drive capability: 10 LSTTL loads
- Symmetrical output impedance:  $|I_{OH}| = I_{OL} = 4\text{mA (min)}$
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range:  $V_{CC} \text{ (opr)} = 2 \text{ to } 6\text{V}$

### Marking

TC7W14FU



TC7W14FK



### Weight

- SSOP8-P-0.65: 0.02 g (typ.)
- SSOP8-P-0.50A: 0.01 g (typ.)

Start of commercial production  
1992-02

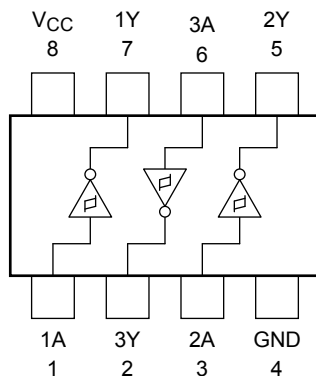
## Absolute Maximum Ratings (Ta = 25°C)

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 <sub>CC</sub> + 0.5	V
DC output voltage	V <sub>OUT</sub>	-0.5 to 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>	±25	mA
DC V <sub>CC</sub> /ground current	I <sub>CC</sub>	±25	mA
Power dissipation	P <sub>D</sub>	300 (SM8)	mW
		200 (US8)	
Storage temperature range	T <sub>stg</sub>	-65 to 150	°C
Lead temperature (10 s)	T <sub>L</sub>	260	°C

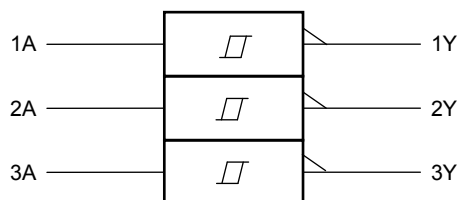
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

## Pin Configuration (top view)



## Logic Diagram



## Truth Table

A	Y
L	H
H	L

## Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	2 to 6	V
Input voltage	$V_{IN}$	0 to $V_{CC}$	V
Output voltage	$V_{OUT}$	0 to $V_{CC}$	V
Operating temperature range	$T_{opr}$	-40 to 85	°C

## Electrical Characteristics

### DC Electrical Characteristics

Characteristics		Symbol	Test Condition	$T_a = 25^\circ\text{C}$			$T_a = -40$ to $85^\circ\text{C}$		Unit					
				$V_{CC}$ (V)	Min	Typ.	Max	Min		Max				
Threshold voltage	High level	$V_P$	—	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					
	Low level	$V_N$		2.0	0.3	0.65	0.9	0.3	0.9					
				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		$V_H$	—	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					
Output voltage	High level	$V_{OH}$	$V_{IN} = V_{IL}$	$I_{OH} = -20 \mu\text{A}$	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	—				
						$I_{OH} = -4 \text{ mA}$	4.5	4.18	4.31	—		4.13	—	
							$I_{OH} = -5.2 \text{ mA}$	6.0	5.68	5.80		—	5.63	—
	Low level	$V_{OL}$	$V_{IN} = V_{IH}$	$I_{OL} = 20 \mu\text{A}$	2.0	—	0	0.1	—	0.1				
					4.5	—	0	0.1	—	0.1				
					6.0	—	0	0.1	—	0.1				
							$I_{OL} = 4 \text{ mA}$	4.5	—	0.17		0.26	—	0.33
		$I_{OL} = 5.2 \text{ mA}$	6.0	—	0.18	0.26		—	0.33					
Input leakage current			$I_{IN}$	$V_{IN} = V_{CC}$ or GND	6.0	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu\text{A}$			
Quiescent supply current		$I_{CC}$	$V_{IN} = V_{CC}$ or GND	6.0	—	—	1.0	—	10.0	$\mu\text{A}$				

### AC Electrical Characteristics ( $C_L = 15 \text{ pF}$ , $V_{CC} = 5 \text{ V}$ , $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Test Condition	$T_a = 25^\circ\text{C}$			Unit
			Min	Typ.	Max	
Output transition time	$t_{TLH}$ $t_{THL}$	—	—	4	8	ns
Propagation delay time	$t_{pLH}$ $t_{pHL}$	—	—	11	21	ns

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

Characteristics	Symbol	Test Condition	$V_{CC} \text{ (V)}$	$T_a = 25^\circ\text{C}$			$T_a = -40$ to $85^\circ\text{C}$		Unit
				Min	Typ.	Max	Min	Max	
Output transition time	$t_{TLH}$ $t_{THL}$	—	2.0	—	30	75	—	95	ns
			4.5	—	8	15	—	19	
			6.0	—	7	13	—	16	
Propagation delay time	$t_{pLH}$ $t_{pHL}$	—	2.0	—	42	125	—	155	ns
			4.5	—	14	25	—	31	
			6.0	—	12	21	—	26	
Input capacitance	$C_{IN}$	—	—	5	10	—	10	pF	
Power dissipation capacitance	$C_{PD}$	(Note)	—	28	—	—	—	pF	

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

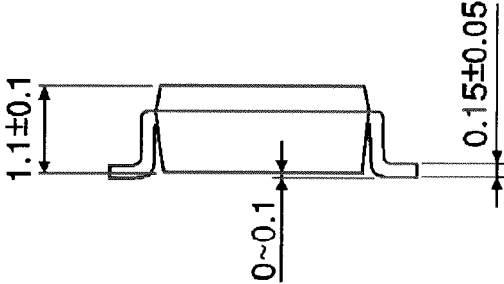
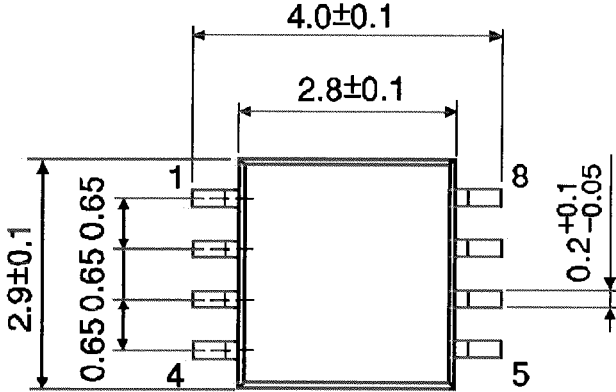
Average operating current can be obtained by the equation hereunder.

$$I_{CC (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/3 \text{ (per gate)}$$

**Package Dimensions**

SSOP8-P-0.65

Unit : mm

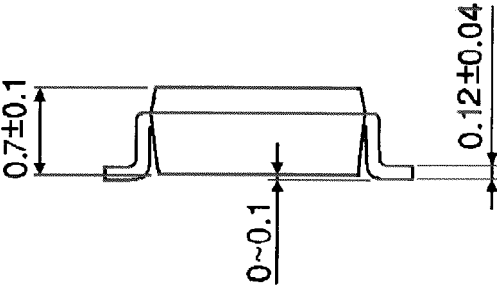
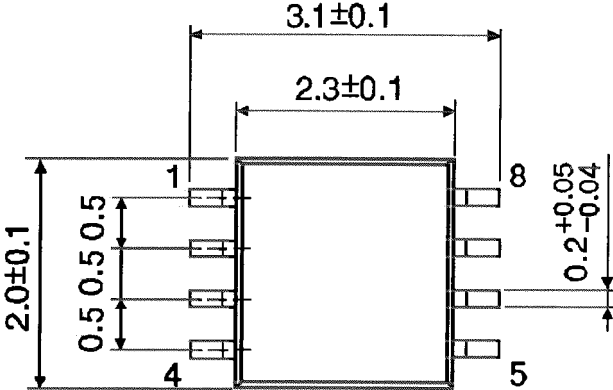


Weight: 0.02 g (typ.)

**Package Dimensions**

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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