

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

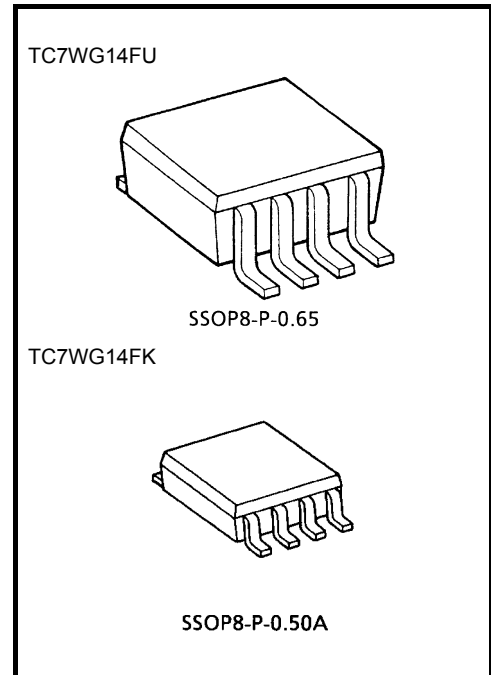
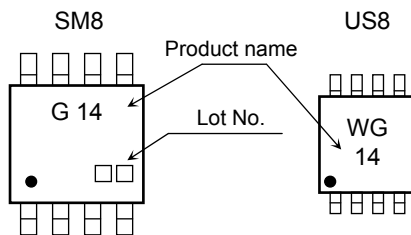
# TC7WG14FU, TC7WG14FK

Triple Schmitt Inverter

## Features

- High-level output current:  $I_{OH}/I_{OL} = \pm 8 \text{ mA (min)}$   
at  $V_{CC} = 3 \text{ V}$
- High-speed operation:  $t_{pd} = 4.0 \text{ ns (typ.)}$   
at  $V_{CC} = 3.3 \text{ V}, 15\text{pF}$
- Operating voltage range:  $V_{CC} = 0.9 \sim 3.6 \text{ V}$
- 5.5-V tolerant inputs
- 3.6-V power down protection outputs

## Marking



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

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

Characteristics	Symbol	Value	Unit
Power supply voltage	$V_{CC}$	$-0.5 \sim 4.6$	V
DC input voltage	$V_{IN}$	$-0.5 \sim 7.0$	V
DC output voltage	$V_{OUT}$	$-0.5 \sim 4.6$ (Note 1)	V
		$-0.5 \sim V_{CC} + 0.5$ (Note 2)	
Input diode current	$I_{IK}$	-20	mA
Output diode current	$I_{OK}$	-20 (Note 3)	mA
DC output current	$I_{OUT}$	$\pm 25$	mA
DC $V_{CC}$ / ground current	$I_{CC}$	$\pm 50$	mA
Power dissipation	$P_D$	300 (SM8) 200 (US8)	mW
Storage temperature	$T_{stg}$	$-65 \sim 150$	$^\circ\text{C}$

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.

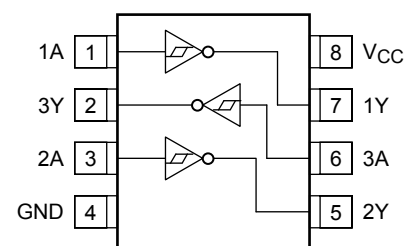
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/Derating Concept and Methods) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1:  $V_{CC} = 0\text{V}$

Note 2: High or Low State.  $I_{OUT}$  absolute maximum rating must be observed.

Note 3:  $V_{OUT} < \text{GND}$

## Pin Assignment (top view)



IEC Logic Symbol



Truth Table

A	Y
L	H
H	L

Operating Ranges

Characteristics	Symbol	Value	Unit
Power supply voltage	$V_{CC}$	0.9~3.6	V
Input voltage	$V_{IN}$	0~5.5	V
Output voltage	$V_{OUT}$	0~3.6 (Note 4)	V
		0~ $V_{CC}$ (Note 5)	
Output Current	$I_{OH}/I_{OL}$	±8.0 (Note 6)	mA
		±4.0 (Note 7)	
		±3.0 (Note 8)	
		±1.7 (Note 9)	
		±0.3 (Note 10)	
		±0.02 (Note 11)	
Operating temperature	$T_{opr}$	-40~85	°C

- Note 4:  $V_{CC} = 0V$
- Note 5: High or Low state.
- Note 6:  $V_{CC} = 3.0\sim 3.6\text{ V}$
- Note 7:  $V_{CC} = 2.3\sim 2.7\text{ V}$
- Note 8:  $V_{CC} = 1.65\sim 1.95\text{ V}$
- Note 9:  $V_{CC} = 1.4\sim 1.6\text{ V}$
- Note 10:  $V_{CC} = 1.1\sim 1.3\text{ V}$
- Note 11:  $V_{CC} = 0.9\text{ V}$

## Electrical Characteristics

## DC Electrical Characteristics

Characteristics		Symbol	Test Condition		Ta = 25°C				Ta = -40~85°C		Unit
					V <sub>CC</sub> (V)	Min	Typ.	Max	Min	Max	
Threshold voltage	High level	V <sub>P</sub>	—	0.9	—	—	0.73	—	0.80	V	
				1.1	—	—	0.86	—	0.93		
				1.4	—	—	1.07	—	1.12		
				1.65	—	—	1.23	—	1.25		
				2.3	—	—	1.66	—	1.68		
				3.0	—	—	2.14	—	2.15		
	Low level	V <sub>N</sub>	—	0.9	0.18	—	—	0.07	—		
				1.1	0.26	—	—	0.18	—		
				1.4	0.36	—	—	0.31	—		
				1.65	0.45	—	—	0.41	—		
				2.3	0.69	—	—	0.64	—		
				3.0	0.96	—	—	0.91	—		
Hysteresis voltage		V <sub>H</sub>	—	0.9	0.20	—	0.38	0.15	0.53	V	
				1.1	0.25	—	0.41	0.21	0.53		
				1.4	0.35	—	0.48	0.34	0.57		
				1.65	0.42	—	0.56	0.40	0.60		
				2.3	0.60	—	0.74	0.61	0.76		
				3.0	0.79	—	0.93	0.80	0.94		
Output voltage	High level	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OH</sub> = -0.02 mA	0.9	0.75	—	—	0.75	—	V
				I <sub>OH</sub> = -0.3 mA	1.1~1.3	V <sub>CC</sub> × 0.75	—	—	V <sub>CC</sub> × 0.75	—	
				I <sub>OH</sub> = -1.7 mA	1.4~1.6	V <sub>CC</sub> × 0.75	—	—	V <sub>CC</sub> × 0.75	—	
				I <sub>OH</sub> = -3.0 mA	1.65~1.95	V <sub>CC</sub> -0.45	—	—	V <sub>CC</sub> -0.45	—	
				I <sub>OH</sub> = -4.0 mA	2.3~2.7	2.0	—	—	2.0	—	
				I <sub>OH</sub> = -8.0 mA	3.0~3.6	2.48	—	—	2.48	—	
	Low level	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub>	I <sub>OL</sub> = 0.02 mA	0.9	—	—	0.1	—	0.1	
				I <sub>OL</sub> = 0.3 mA	1.1~1.3	—	—	V <sub>CC</sub> × 0.25	—	V <sub>CC</sub> × 0.25	
				I <sub>OL</sub> = 1.7 mA	1.4~1.6	—	—	V <sub>CC</sub> × 0.25	—	V <sub>CC</sub> × 0.25	
				I <sub>OL</sub> = 3.0 mA	1.65~1.95	—	—	0.45	—	0.45	
				I <sub>OL</sub> = 4.0 mA	2.3~2.7	—	—	0.4	—	0.4	
				I <sub>OL</sub> = 8.0 mA	3.0~3.6	—	—	0.4	—	0.4	
Input leakage current		I <sub>IN</sub>	V <sub>IN</sub> = 0~5.5V	0~3.6	—	—	±0.1	—	±1.0	μA	
Power off leakage current		I <sub>OFF</sub>	V <sub>IN</sub> = 0~5.5V V <sub>OUT</sub> = 0~3.6V	0	—	—	1.0	—	10.0	μA	
Quiescent supply current		I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	3.6	—	—	1.0	—	10.0	μA	

## AC Electrical Characteristics (input $t_r = t_f = 3 \text{ ns}$ )

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40~85°C		Unit
			V <sub>CC</sub> (V)	Min	Typ.	Max	Min	Max
Propagation delay time	$t_{pLH}$ $t_{pHL}$	$C_L = 10 \text{ pF}$ , $R_L = 1 \text{ M}\Omega$	0.9	—	41.3	—	—	—
			1.1~1.3	—	18.0	25.4	1.0	40.8
			1.4~1.6	—	9.5	12.2	1.0	13.5
			1.65~1.95	—	7.0	8.7	1.0	9.3
			2.3~2.7	—	4.7	5.7	1.0	6.2
			3.0~3.6	—	3.7	4.5	1.0	4.7
		$C_L = 15 \text{ pF}$ , $R_L = 1 \text{ M}\Omega$	0.9	—	44.4	—	—	—
			1.1~1.3	—	19.3	27.7	1.0	46.9
			1.4~1.6	—	10.2	13.1	1.0	14.7
			1.65~1.95	—	7.5	9.3	1.0	9.9
			2.3~2.7	—	5.0	5.9	1.0	6.4
			3.0~3.6	—	4.0	4.8	1.0	5.2
		$C_L = 30 \text{ pF}$ , $R_L = 1 \text{ M}\Omega$	0.9	—	55.8	—	—	—
			1.1~1.3	—	24.7	36.3	1.0	59.6
			1.4~1.6	—	12.9	16.8	1.0	19.2
			1.65~1.95	—	9.2	11.5	1.0	12.9
			2.3~2.7	—	5.9	7.1	1.0	8.3
			3.0~3.6	—	4.9	5.7	1.0	6.6
Input capacitance	$C_{IN}$	—	3.6	—	3	—	—	pF
Power dissipation capacitance	$C_{PD}$	(Note 12)	0.9 ~ 3.6	—	11	—	—	pF

Note 12:  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

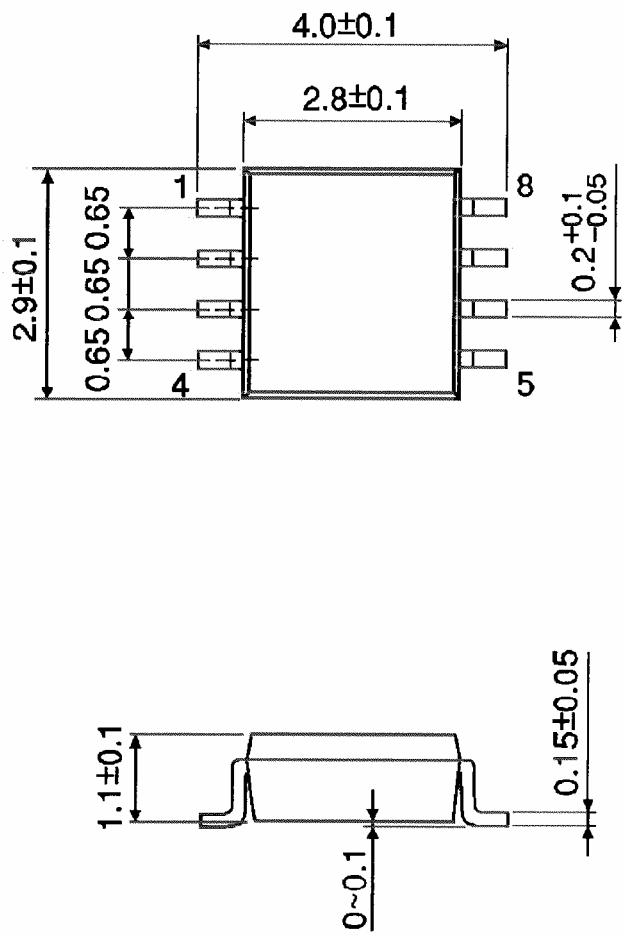
Average operating current can be obtained by the equation:

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

Package Dimensions

SSOP8-P-0.65

Unit : mm

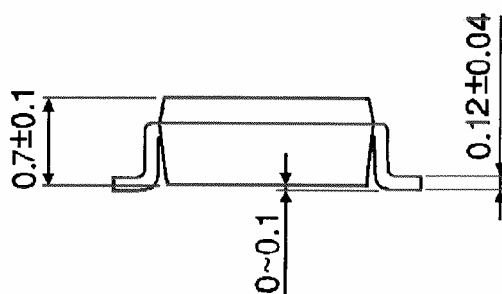
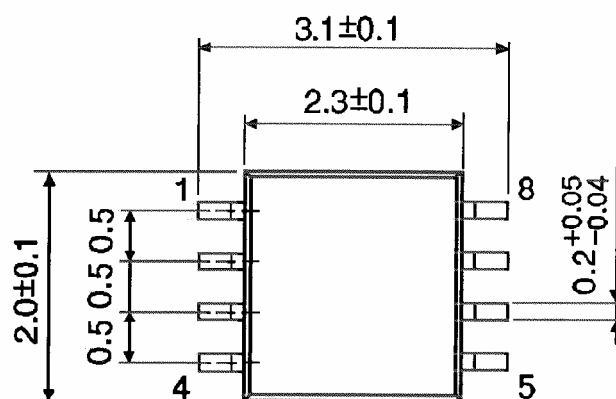


Weight: 0.02 g (typ.)

## Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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20070701-EN GENERAL

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