

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

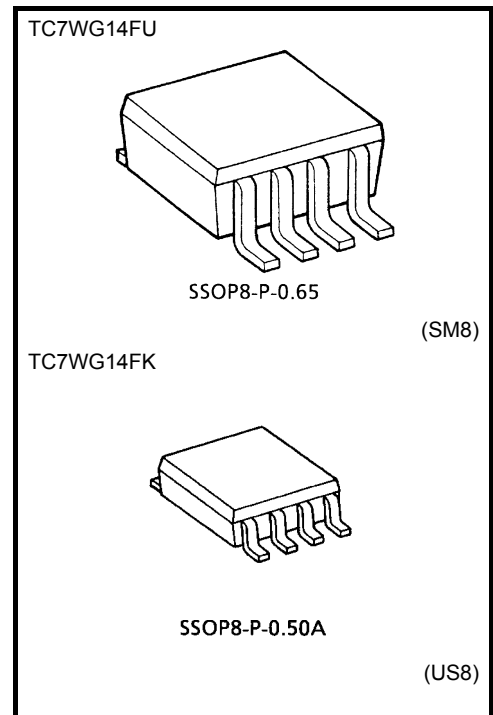
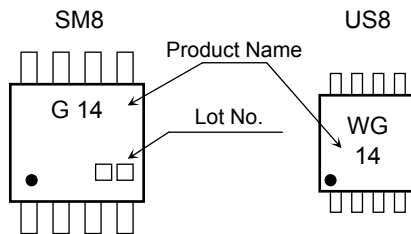
# TC7WG14FU, TC7WG14FK

## Triple Schmitt Inverter

### Features

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

### Marking

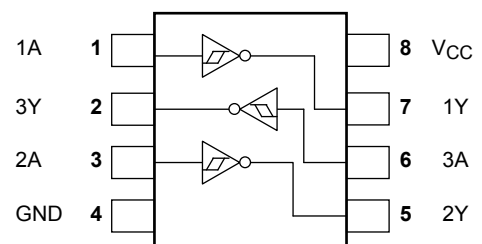


Weight  
 SSOP8-P-0.65 : 0.02 g (typ.)  
 SSOP8-P-0.50A : 0.01 g (typ.)

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

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	-0.5 to 4.6	V
DC input voltage	$V_{IN}$	-0.5 to 7.0	V
DC output voltage	$V_{OUT}$	-0.5 to 4.6 (Note1)	V
		-0.5 to $V_{CC}+0.5$ (Note2)	
Input diode current	$I_{IK}$	-20	mA
Output diode current	$I_{OK}$	-20 (Note3)	mA
DC output current	$I_{OUT}$	$\pm 25$	mA
DC $V_{CC}/GND$ current	$I_{CC}$	$\pm 50$	mA
Power dissipation	$P_D$	300 (SM8)	mW
		200 (US8)	
Storage temperature	$T_{stg}$	-65 to 150	°C

### Pin Assignment (top view)



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).

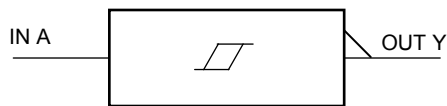
Note 1:  $V_{CC} = 0$  V

Note 2: High or Low State. Do not exceed  $I_{OUT}$  of absolute maximum ratings.

Note 3:  $V_{OUT} < GND$

Start of commercial production  
2006-02

## IEC Logic Symbol



## Truth Table

A	Y
L	H
H	L

## Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	0.9 to 3.6	V
Input voltage	$V_{IN}$	0 to 5.5	V
Output voltage	$V_{OUT}$	0 to 3.6 (Note 4)	V
		0 to $V_{CC}$ (Note 5)	
Output current	$I_{OH}/I_{OL}$	$\pm 8.0$ (Note 6)	mA
		$\pm 4.0$ (Note 7)	
		$\pm 3.0$ (Note 8)	
		$\pm 1.7$ (Note 9)	
		$\pm 0.3$ (Note 10)	
		$\pm 0.02$ (Note 11)	
Operating temperature	$T_{opr}$	-40 to 85	$^{\circ}C$

Note 4:  $V_{CC} = 0V$

Note 5: High or Low state.

Note 6:  $V_{CC} = 3.0$  to  $3.6$  V

Note 7:  $V_{CC} = 2.3$  to  $2.7$  V

Note 8:  $V_{CC} = 1.65$  to  $1.95$  V

Note 9:  $V_{CC} = 1.4$  to  $1.6$  V

Note 10:  $V_{CC} = 1.1$  to  $1.3$  V

Note 11:  $V_{CC} = 0.9$  V

## Electrical Characteristics

### DC Characteristics

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit			
			V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max		
Threshold Voltage	Positive threshold voltage	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		
	Negative threshold voltage	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	—		
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	0.60	0.76			
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 to 1.3	V <sub>CC</sub> × 0.75	—	—	V <sub>CC</sub> × 0.75	—	
				I <sub>OH</sub> = -1.7 mA	1.4 to 1.6	V <sub>CC</sub> × 0.75	—	—	V <sub>CC</sub> × 0.75	—	
				I <sub>OH</sub> = -3.0 mA	1.65 to 1.95	V <sub>CC</sub> - 0.45	—	—	V <sub>CC</sub> - 0.45	—	
				I <sub>OH</sub> = -4.0 mA	2.3 to 2.7	2.0	—	—	2.0	—	
				I <sub>OH</sub> = -8.0 mA	3.0 to 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 to 1.3	—	—	V <sub>CC</sub> × 0.25	—	V <sub>CC</sub> × 0.25	
				I <sub>OL</sub> = 1.7 mA	1.4 to 1.6	—	—	V <sub>CC</sub> × 0.25	—	V <sub>CC</sub> × 0.25	
				I <sub>OL</sub> = 3.0 mA	1.65 to 1.95	—	—	0.45	—	0.45	
				I <sub>OL</sub> = 4.0 mA	2.3 to 2.7	—	—	0.4	—	0.4	
				I <sub>OL</sub> = 8.0 mA	3.0 to 3.6	—	—	0.4	—	0.4	
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = 0 to 5.5 V	0 to 3.6	—	—	±0.1	—	±1.0	μA		
Power off leakage current	I <sub>OFF</sub>	V <sub>IN</sub> = 0 to 5.5 V or V <sub>OUT</sub> = 0 to 3.6 V	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 Characteristics (unless otherwise specified, Input: $t_r = t_f = 3$ ns)

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

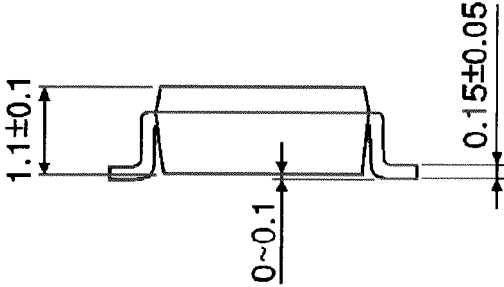
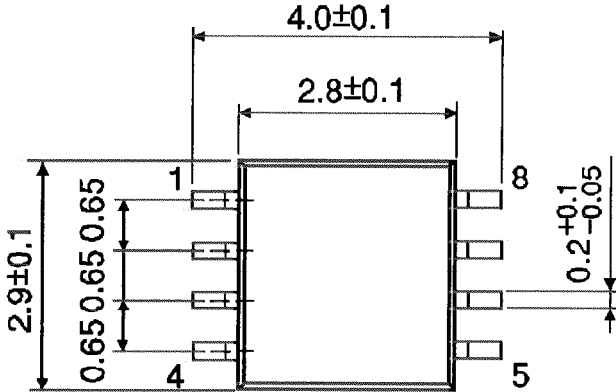
Average operating current can be obtained by the equation:

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

**Package Dimensions**

SSOP8-P-0.65

Unit : mm

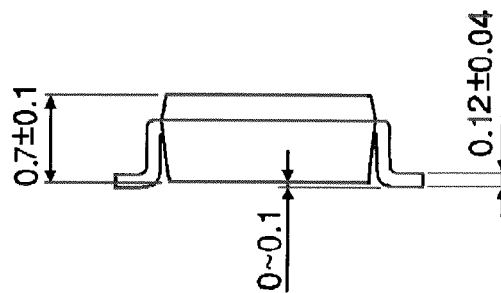
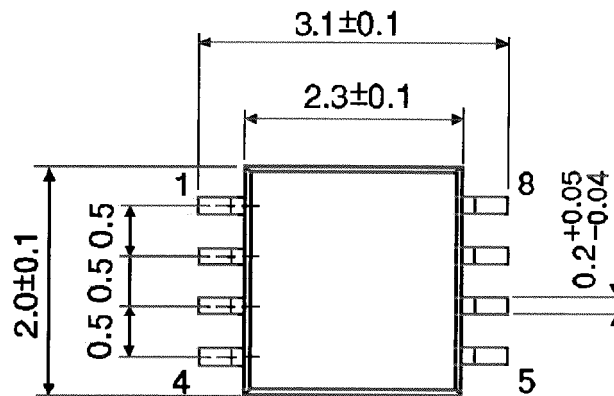


Weight: 0.02 g (typ.)

## Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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