

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

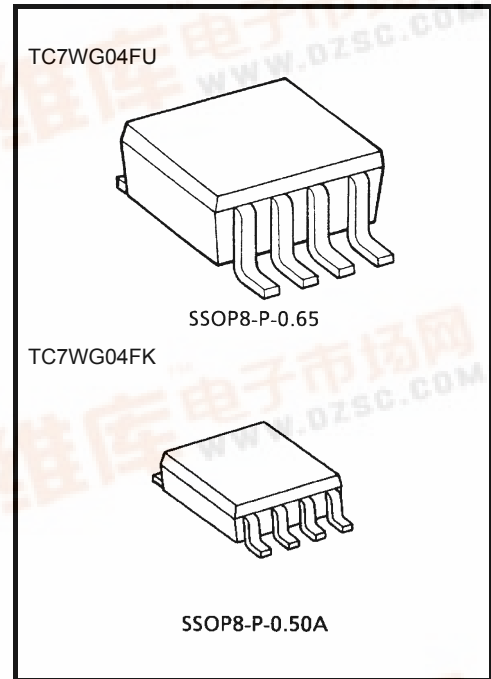
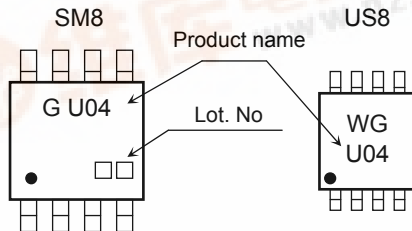
TC7WGU04FU,TC7WGU04FK

Triple Inverter (Un-Buffer)

Features

- High-level output current: $I_{OH}/I_{OL} = \pm 8 \text{ mA (min)}$
at $V_{CC} = 3 \text{ V}$
- High-speed operation: $t_{pd} = 1.9 \text{ ns (typ.)}$
at $V_{CC} = 3.3 \text{ V}, 15 \text{ pF}$
- Operating voltage range: $V_{CC} = 0.9 \sim 3.6 \text{ V}$
- 3.6-V tolerant inputs

Marking



Weight

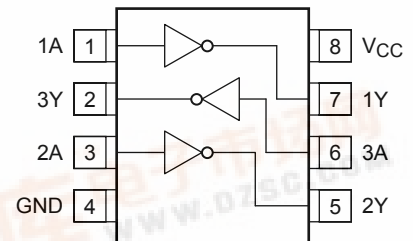
SSOP8-P-0.65 : 0.02 g (typ.)

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

Absolute Maximum Ratings (Ta = 25°C)

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

Pin Assignment (top view)

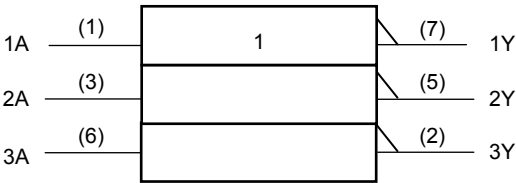


Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

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}	0~3.6	V
Output voltage	V_{OUT}	0~ V_{CC}	V
Output Current	I_{OH}/I_{OL}	± 8.0 (Note 2)	mA
		± 4.0 (Note 3)	
		± 3.0 (Note 4)	
		± 1.7 (Note 5)	
		± 0.3 (Note 6)	
		± 0.02 (Note 7)	
Operating temperature	T_{opr}	-40~85	°C

Note 2: $V_{CC} = 3.0\sim 3.6$ V

Note 3: $V_{CC} = 2.3\sim 2.7$ V

Note 4: $V_{CC} = 1.65\sim 1.95$ V

Note 5: $V_{CC} = 1.4\sim 1.6$ V

Note 6: $V_{CC} = 1.1\sim 1.3$ V

Note 7: $V_{CC} = 0.9$ V

Electrical Characteristics

DC Electrical Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C				Ta = -40~85°C		Unit
				V _{CC} (V)	Min	Typ.	Max	Min	Max	
High-level input voltage	V _{IH}	—		0.9	V _{CC}	—	—	V _{CC}	—	V
				1.1~1.3	V _{CC} × 0.7	—	—	V _{CC} × 0.7	—	
				1.4~1.6	V _{CC} × 0.65	—	—	V _{CC} × 0.65	—	
				1.65~1.95	V _{CC} × 0.65	—	—	V _{CC} × 0.65	—	
				2.3~2.7	1.7	—	—	1.7	—	
				3.0~3.6	2.0	—	—	2.0	—	
Low-level input voltage	V _{IL}	—		0.9	—	—	GND	—	GND	V
				1.1~1.3	—	—	V _{CC} × 0.3	—	V _{CC} × 0.3	
				1.4~1.6	—	—	V _{CC} × 0.35	—	V _{CC} × 0.35	
				1.65~1.95	—	—	V _{CC} × 0.35	—	V _{CC} × 0.35	
				2.3~2.7	—	—	0.7	—	0.7	
				3.0~3.6	—	—	0.8	—	0.8	
High-level output voltage	V _{OH}	V _{IN} = V _{IL}	I _{OH} = -0.02 mA	0.9	0.75	—	—	0.75	—	V
		V _{IN} = GND	I _{OH} = -0.3 mA	1.1~1.3	V _{CC} × 0.75	—	—	V _{CC} × 0.75	—	
			I _{OH} = -1.7 mA	1.4~1.6	V _{CC} × 0.75	—	—	V _{CC} × 0.75	—	
			I _{OH} = -3.0 mA	1.65~1.95	V _{CC} -0.45	—	—	V _{CC} -0.45	—	
			I _{OH} = -4.0 mA	2.3~2.7	2.0	—	—	2.0	—	
			I _{OH} = -8.0 mA	3.0~3.6	2.48	—	—	2.48	—	
Low-level output voltage	V _{OL}	V _{IN} = V _{IH}	I _{OL} = 0.02 mA	0.9	—	—	0.1	—	0.1	V
		V _{IN} = V _{CC}	I _{OL} = 0.3 mA	1.1~1.3	—	—	V _{CC} × 0.25	—	V _{CC} × 0.25	
			I _{OL} = 1.7 mA	1.4~1.6	—	—	V _{CC} × 0.25	—	V _{CC} × 0.25	
			I _{OL} = 3.0 mA	1.65~1.95	—	—	0.45	—	0.45	
			I _{OL} = 4.0 mA	2.3~2.7	—	—	0.4	—	0.4	
			I _{OL} = 8.0 mA	3.0~3.6	—	—	0.4	—	0.4	
Input leakage current	I _{IN}	V _{IN} = 0~3.6 V		0~3.6	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I _{CC}	V _{IN} = V _{CC} or GND		3.6	—	—	1.0	—	10.0	μA

AC Electrical Characteristics (input $t_r = t_f = 3$ ns)

Characteristics	Symbol	Test Condition	V_{CC} (V)	$T_a = 25^\circ\text{C}$			$T_a = -40\sim 85^\circ\text{C}$		Unit
				Min	Typ.	Max	Min	Max	
Propagation delay time	t_{pLH} t_{pHL}	$C_L = 10$ pF, $R_L = 1$ M Ω	0.9	—	15.0	—	—	—	ns
			1.1~1.3	—	6.0	18.4	1.0	34.2	
			1.4~1.6	—	3.2	8.5	1.0	10.0	
			1.65~1.95	—	2.6	6.2	1.0	6.7	
			2.3~2.7	—	2.0	3.9	1.0	4.4	
			3.0~3.6	—	1.7	3.1	1.0	3.7	
		$C_L = 15$ pF, $R_L = 1$ M Ω	0.9	—	18.8	—	—	—	
			1.1~1.3	—	7.0	21.5	1.0	37.2	
			1.4~1.6	—	3.5	9.3	1.0	11.2	
			1.65~1.95	—	3.0	6.9	1.0	7.1	
			2.3~2.7	—	2.3	4.4	1.0	5.0	
			3.0~3.6	—	1.9	3.4	1.0	3.9	
		$C_L = 30$ pF, $R_L = 1$ M Ω	0.9	—	33.0	—	—	—	
			1.1~1.3	—	12.0	30.4	1.0	58.0	
			1.4~1.6	—	6.0	13.1	1.0	15.9	
			1.65~1.95	—	4.5	9.2	1.0	9.6	
			2.3~2.7	—	3.2	5.7	1.0	6.1	
			3.0~3.6	—	2.5	4.4	1.0	4.8	
Input capacitance	C_{IN}	—	3.6	—	3	—	—	—	pF
Power dissipation capacitance	C_{PD}	(Note 8)	0.9 ~ 3.6	—	10	—	—	—	pF

Note 8: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

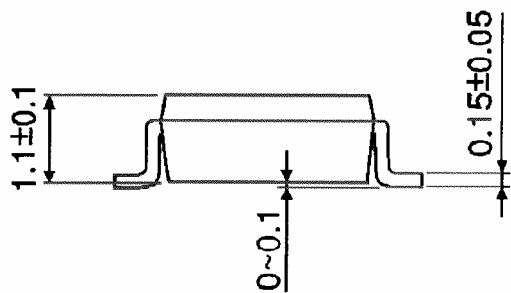
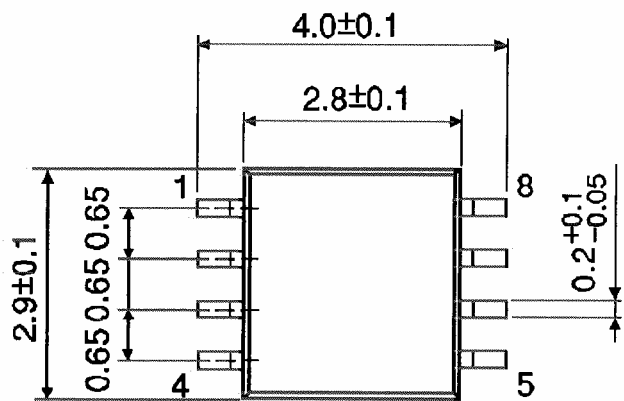
Average operating current can be obtained by the equation:

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

Package Dimensions

SSOP8-P-0.65

Unit : mm

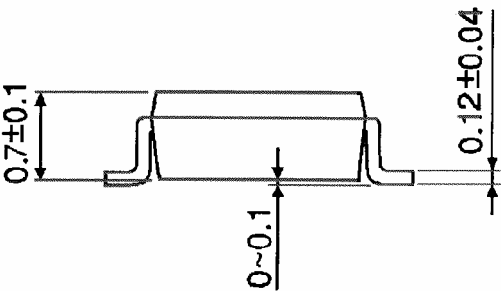
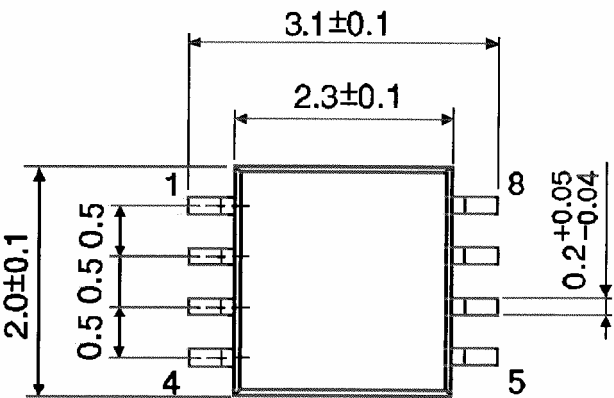


Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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20070701-EN GENERAL

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