

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

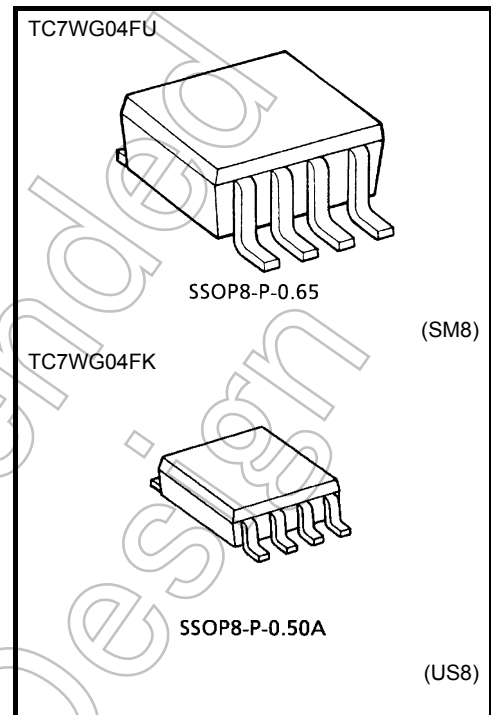
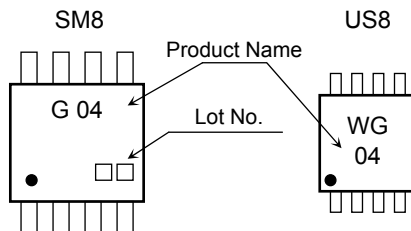
TC7WG04FU, TC7WG04FK

Triple Inverter

Features

- High output current : ± 8 mA (min) at $V_{CC} = 3$ V
- Super high speed operation : $t_{pd} = 2.7$ 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

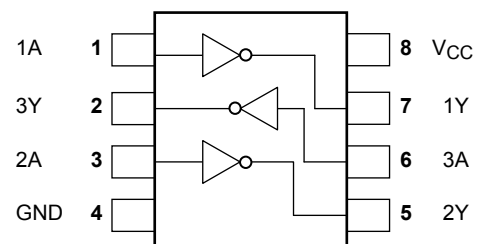
SSOP8-P-0.65 : 0.02 g (typ.)

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

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

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 (Note 3)	mA
DC output current	I_{OUT}	± 25	mA
DC V_{CC} /GND current	I_{CC}	± 50	mA
Power dissipation	P_D	300 (SM8)	mW
		200 (US8)	
Storage temperature	T_{stg}	-65 to 150	$^\circ\text{C}$

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).

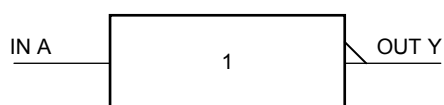
Note 1: $V_{CC} = 0$ V

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

Note 3: $V_{OUT} < GND$

Start of commercial production
2005-09

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) 0 to V_{CC} (Note 5)	V
Output current	I_{OH}/I_{OL}	± 8.0 (Note 6) ± 4.0 (Note 7) ± 3.0 (Note 8) ± 1.7 (Note 9) ± 0.3 (Note 10) ± 0.02 (Note 11)	mA
Operating temperature	T_{opr}	-40 to 85	°C
Input rise and fall time	dt/dv	0 to 10 (Note 12)	ns/V

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

Note 5: High or Low state.

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

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

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

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

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

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

Note 12: $V_{IN} = 0.8$ to $2.0V$, $V_{CC} = 3.0V$

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 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 to 1.3	V _{CC} × 0.7	—	—	V _{CC} × 0.7	—	
				1.4 to 1.6	V _{CC} × 0.65	—	—	V _{CC} × 0.65	—	
				1.65 to 1.95	V _{CC} × 0.65	—	—	V _{CC} × 0.65	—	
				2.3 to 2.7	1.7	—	—	1.7	—	
				3.0 to 3.6	2.0	—	—	2.0	—	
Low-level input voltage	V _{IL}	—		0.9	—	—	GND	—	GND	V
				1.1 to 1.3	—	—	V _{CC} × 0.3	—	V _{CC} × 0.3	
				1.4 to 1.6	—	—	V _{CC} × 0.35	—	V _{CC} × 0.35	
				1.65 to 1.95	—	—	V _{CC} × 0.35	—	V _{CC} × 0.35	
				2.3 to 2.7	—	—	0.7	—	0.7	
				3.0 to 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
			I _{OH} = -0.3 mA	1.1 to 1.3	V _{CC} × 0.75	—	—	V _{CC} × 0.75	—	
			I _{OH} = -1.7 mA	1.4 to 1.6	V _{CC} × 0.75	—	—	V _{CC} × 0.75	—	
			I _{OH} = -3.0 mA	1.65 to 1.95	V _{CC} -0.45	—	—	V _{CC} -0.45	—	
			I _{OH} = -4.0 mA	2.3 to 2.7	2.0	—	—	2.0	—	
			I _{OH} = -8.0 mA	3.0 to 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
			I _{OL} = 0.3 mA	1.1 to 1.3	—	—	V _{CC} × 0.25	—	V _{CC} × 0.25	
			I _{OL} = 1.7 mA	1.4 to 1.6	—	—	V _{CC} × 0.25	—	V _{CC} × 0.25	
			I _{OL} = 3.0 mA	1.65 to 1.95	—	—	0.45	—	0.45	
			I _{OL} = 4.0 mA	2.3 to 2.7	—	—	0.4	—	0.4	
			I _{OL} = 8.0 mA	3.0 to 3.6	—	—	0.4	—	0.4	
Input leakage current	I _{IN}	V _{IN} = 0 to 5.5 V		0 to 3.6	—	—	±0.1	—	±1.0	μA
Power off leakage current	I _{OFF}	V _{IN} = 0 to 5.5 V V _{OUT} = 0 to 3.6 V		0	—	—	1.0	—	10.0	μA
Quiescent supply current	I _{CC}	V _{IN} = V _{CC} or GND		3.6	—	—	1.0	—	10.0	μA

AC Characteristics (unless otherwise specified, Input: $t_r = t_f = 3 \text{ ns}$)

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit
			V _{CC} (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	—	24.4	—	—	—
			1.1 to 1.3	—	11.6	21.7	1.0	40.5
			1.4 to 1.6	—	6.5	9.8	1.0	11.6
			1.65 to 1.95	—	4.9	7.0	1.0	7.6
			2.3 to 2.7	—	3.2	4.4	1.0	4.9
			3.0 to 3.6	—	2.4	3.5	1.0	4.1
		$C_L = 15 \text{ pF}$, $R_L = 1 \text{ M}\Omega$	0.9	—	36.9	—	—	—
			1.1 to 1.3	—	12.7	24.2	1.0	42.1
			1.4 to 1.6	—	7.1	10.7	1.0	12.9
			1.65 to 1.95	—	5.3	7.5	1.0	7.7
			2.3 to 2.7	—	3.5	4.8	1.0	5.5
			3.0 to 3.6	—	2.7	3.8	1.0	4.4
		$C_L = 30 \text{ pF}$, $R_L = 1 \text{ M}\Omega$	0.9	—	37.0	—	—	—
			1.1 to 1.3	—	17.1	33.9	1.0	64.1
			1.4 to 1.6	—	9.3	14.3	1.0	17.4
			1.65 to 1.95	—	6.9	9.8	1.0	10.2
			2.3 to 2.7	—	4.6	6.2	1.0	6.6
			3.0 to 3.6	—	3.7	4.8	1.0	5.2
Input capacitance	C_{IN}	—	3.6	—	3	—	—	pF
Power dissipation capacitance	C_{PD}	(Note13)	0.9 to 3.6	—	10	—	—	pF

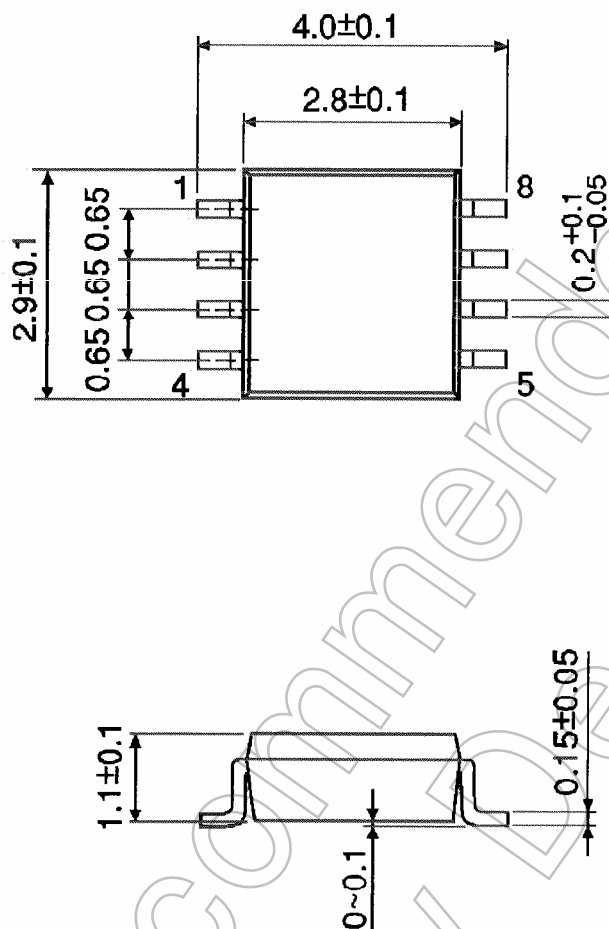
Note 13: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation:

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

SSOP8-P-0.65

Unit : mm

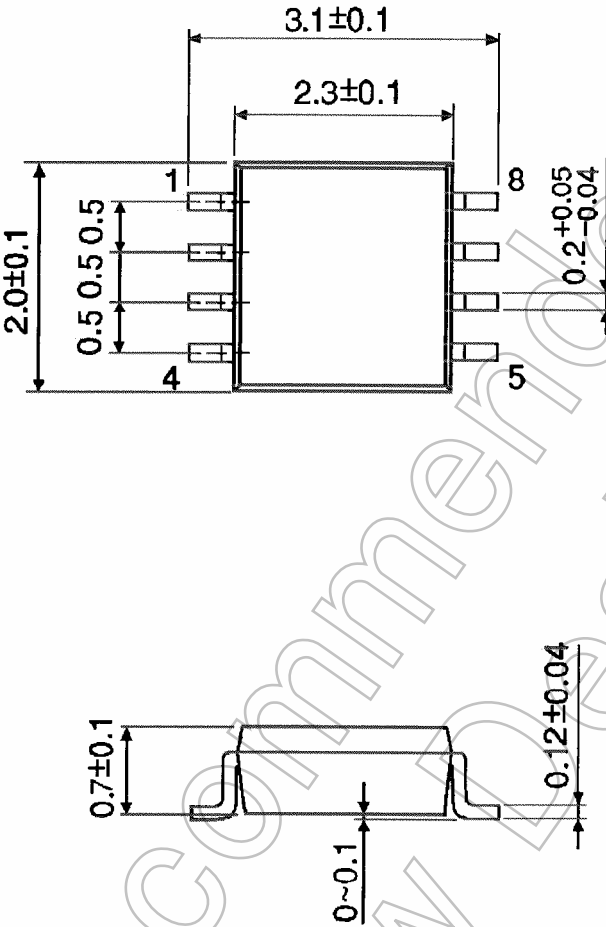


Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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