

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7W04F, TC7W04FU, TC7W04FK

3 Inverters

The TC7W04 is a high speed C²MOS Buffer fabricated with silicon gate C²MOS technology.

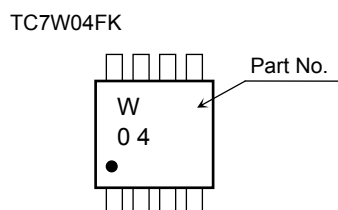
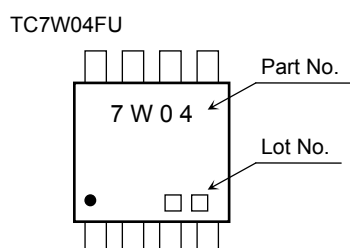
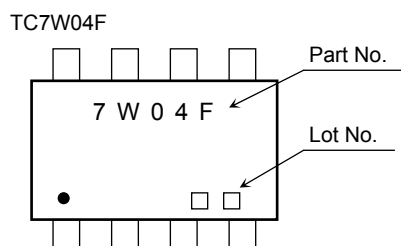
The internal circuit is composed of 3 stages including buffer output, which enables high noise immunity and stable output.

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

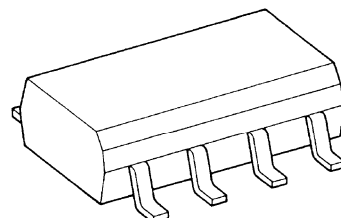
Features

- High speed: $t_{pd} = 6 \text{ ns (typ.)}$ at $V_{CC} = 5V$
- Low power dissipation: $I_{CC} = 1\mu A \text{ (max)}$ at $T_a = 25^\circ C$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (min)}$
- 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: $V_{CC} \text{ (opr)} = 2 \text{ to } 6V$

Marking

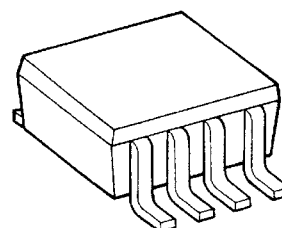


TC7W04F



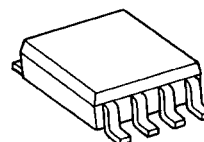
SOP8-P-1.27

TC7W04FU



SSOP8-P-0.65

TC7W04FK



SSOP8-P-0.50A

Weight

SOP8-P-1.27: 0.05 g (typ.)

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

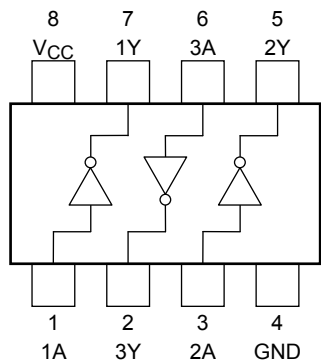
SSOP8-P-0.50A: 0.01 g (typ.)

Absolute Maximum Ratings (Ta = 25°C)

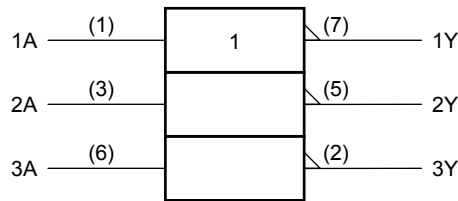
Characteristics	Symbol	Rating	Unit
Supply voltage range	V _{CC}	−0.5 to 7	V
DC input voltage	V _{IN}	−0.5 to V _{CC} + 0.5	V
DC output voltage	V _{OUT}	−0.5 to V _{CC} + 0.5	V
Input diode current	I _{IK}	±20	mA
Output diode current	I _{OK}	±20	mA
DC output current	I _{OUT}	±25	mA
DC V _{CC} /ground current	I _{CC}	±25	mA
Power dissipation	P _D	300 (FM8, SM8)	mW
		200 (US8)	
Storage temperature range	T _{stg}	−65 to 150	°C
Lead temperature (10 s)	T _L	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
Input rise and fall time	t_r, t_f	0 to 1000 ($V_{CC} = 2.0$ V)	ns
		0 to 500 ($V_{CC} = 4.5$ V)	
		0 to 400 ($V_{CC} = 6.0$ V)	

Electrical Characteristics

DC Electrical Characteristics

Characteristics		Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit				
					V _{CC} (V)	Min	Typ.	Max	Min		Max			
Input voltage	High level	V _{IH}	—		2.0	1.5	—	—	1.5	V				
					4.5	3.15	—	—	3.15		—			
					6.0	4.2	—	—	4.2		—			
	Low level	V _{IL}	—		2.0	—	—	0.5	—		0.5			
					4.5	—	—	1.35	—		1.35			
					6.0	—	—	1.8	—		1.8			
Output voltage	High level	V _{OH}	V _{IN} = V _{IL}	I _{OH} = -20 μA	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 mA	4.5	4.18	4.31	—	4.13	—				
					I _{OH} = -5.2 mA	6.0	5.68	5.80	—	5.63		—		
						Low level	V _{OL}	V _{IN} = V _{IH}	I _{OL} = 20 μA	2.0		—	0	0.1
	4.5	—	0	0.1						—		0.1		
	6.0	—	0	0.1	—					0.1				
	I _{OL} = 4 mA	4.5	—	0.17	0.26				—	0.33				
		I _{OL} = 5.2 mA	6.0	—	0.18				0.26	—		0.33		
			Input leakage current		I _{IN}				V _{IN} = V _{CC} or GND			6.0	—	—
	Quiescent supply current		I _{CC}	V _{IN} = V _{CC} or GND		6.0	—	—	1.0	—		10.0	μA	

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

Characteristics	Symbol	Test Condition	Ta = 25°C			Unit
			Min	Typ.	Max	
Output transition time	t_{TLH} t_{THL}	—	—	4	8	ns
Propagation delay time	t_{PLH} t_{PHL}	—	—	6	12	ns

AC Electrical Characteristics (C_L = 50 pF, input t_r = t_f = 6 ns)

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit
			V _{CC} (V)	Min	Typ.	Max	Min	Max
Output transition time	t _{TLH} t _{THL}	—	2.0	—	30	75	—	95
			4.5	—	8	15	—	19
			6.0	—	7	13	—	16
Propagation delay time	t _{pLH} t _{pHL}	—	2.0	—	27	75	—	95
			4.5	—	9	15	—	19
			6.0	—	8	13	—	16
Input capacitance	C _{IN}	—	—	—	5	10	—	10
Power dissipation capacitance	C _{PD}	(Note)	—	—	20	—	—	—

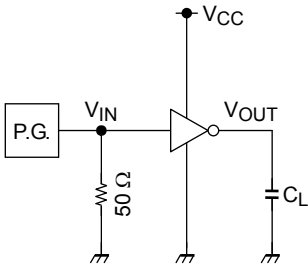
Note: C_{PD} is defined as the value of internal equivalent capacitance of IC which is calculated from the operating current consumption without load (refer to test circuit).

Average operating current can be obtained by the equation hereunder.

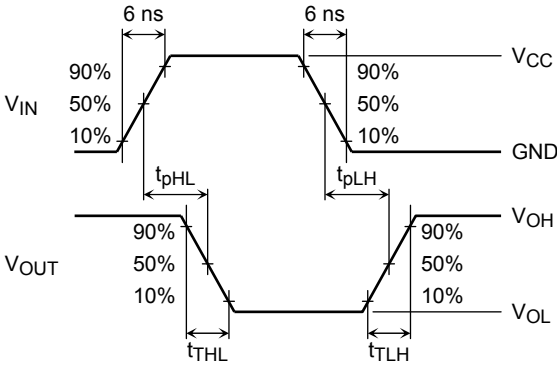
$$I_{CC (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/3 \text{ (per gate)}$$

Switching Characteristics

Test Circuit

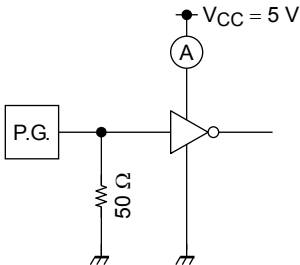


Waveform



Operating Current Consumption

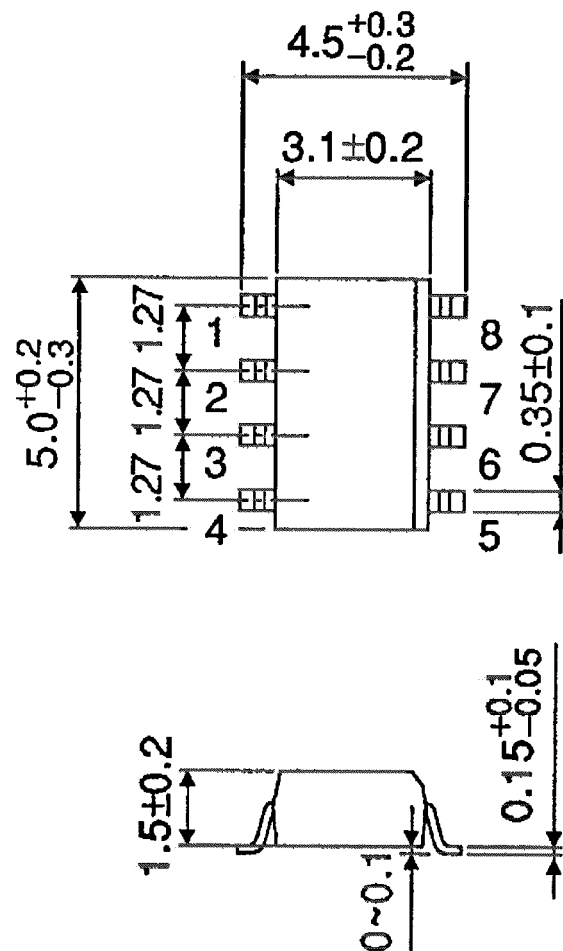
Test Circuit



This input waveform is equal to the switching characteristics test circuit input waveform.

SOP8-P-1.27

Unit : mm

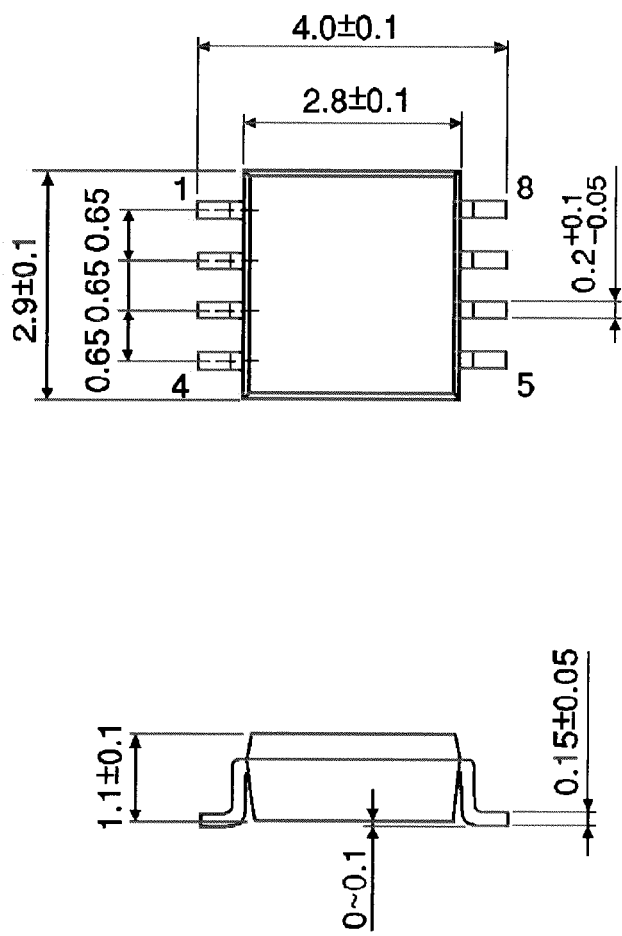


Weight: 0.05 g (typ.)

Package Dimensions

SSOP8-P-0.65

Unit : mm

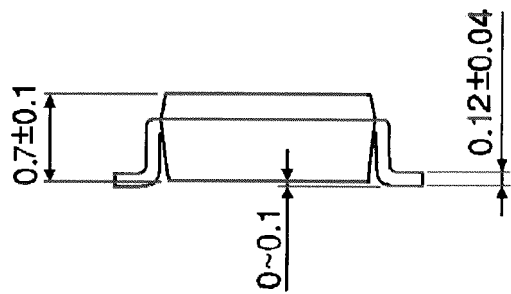
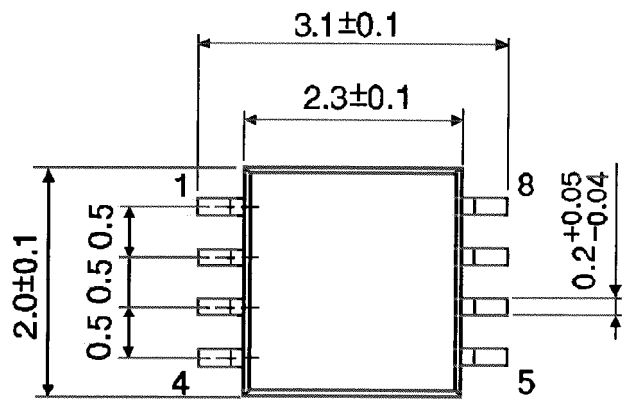


Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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