

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7W04FU, TC7W04FK

3 Inverters

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

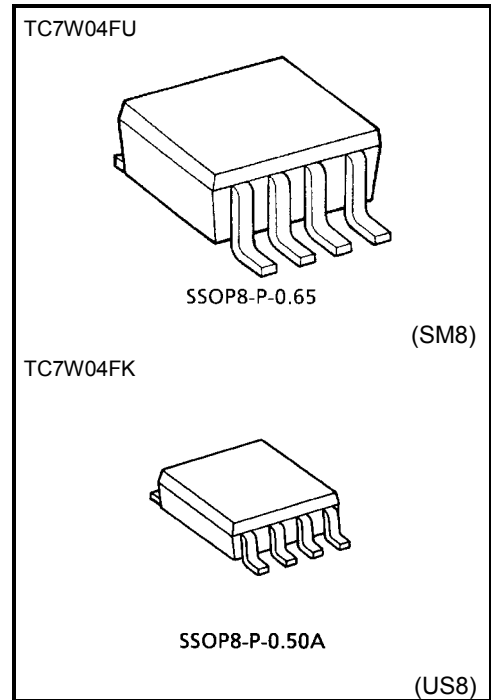
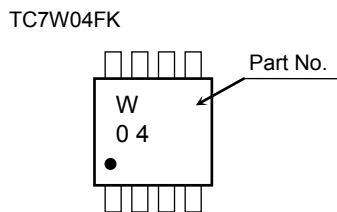
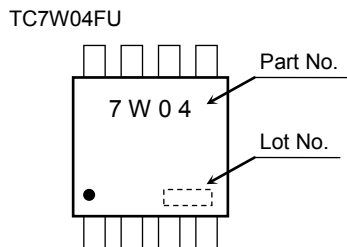
The internal circuit is composed of 3 stages including buffer output, which enables high noise immunity and stable output.

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: $I_{CC} = 1\mu\text{A (max)}$ at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (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



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

Start of commercial production
 1991-09

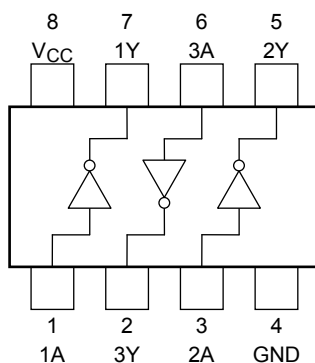
Absolute Maximum Ratings (Ta = 25°C)

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 (SM8)	mW
		200 (US8)	
Storage temperature range	T _{stg}	-65 to 150	°C
Lead temperature (10 s)	T _L	260	°C

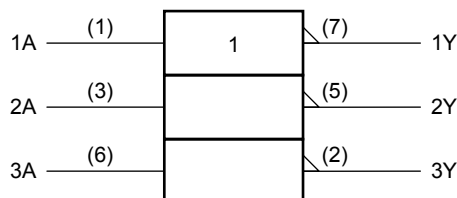
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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	$T_a = 25^\circ\text{C}$			$T_a = -40$ 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}	$V_{IN} = V_{IL}$		$I_{OH} = -20 \mu\text{A}$	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	—	
				$I_{OH} = -4 \text{ mA}$	4.5	4.18	4.31	—	4.13	—		
					6.0	5.68	5.80	—	5.63	—		
					Low level	V_{OL}	$V_{IN} = V_{IH}$	$I_{OL} = 20 \mu\text{A}$	2.0	—	0	
	4.5	—	0	0.1					—	0.1		
	6.0	—	0	0.1					—	0.1		
	$I_{OL} = 4 \text{ mA}$	4.5	—	0.17				0.26	—	0.33		
		$I_{OL} = 5.2 \text{ mA}$	6.0	—				0.18	0.26	—	0.33	
			—	—				—	—	—	—	
	Input leakage current		I_{IN}	$V_{IN} = V_{CC}$ or GND	6.0	—	—	± 0.1	—	± 1.0	μA	
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	$T_a = 25^\circ\text{C}$			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 ($C_L = 50 \text{ pF}$, input $t_r = t_f = 6 \text{ ns}$)

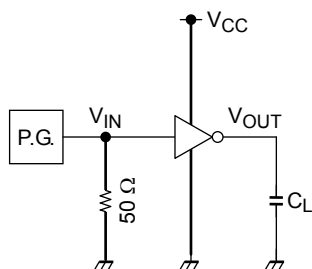
Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit	
			V _{CC} (V)	Min	Typ.	Max	Min		Max
Output transition time	t _{TLH} t _{THL}	—	2.0	—	30	75	—	95	ns
			4.5	—	8	15	—	19	
			6.0	—	7	13	—	16	
Propagation delay time	t _{pLH} t _{pHL}	—	2.0	—	27	75	—	95	ns
			4.5	—	9	15	—	19	
			6.0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

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).

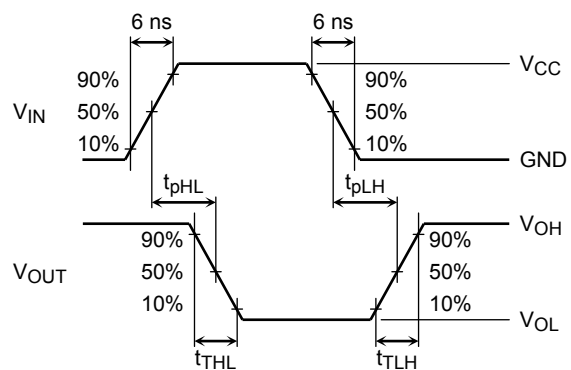
Average operating current can be obtained by the equation hereunder.

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

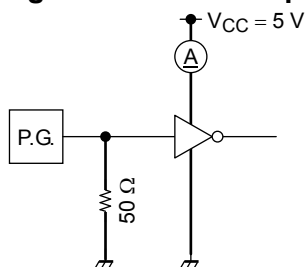
AC Electrical Characteristics Test Circuit



AC Electrical Characteristics Test Waveform



Operating Current Consumption Test Circuit

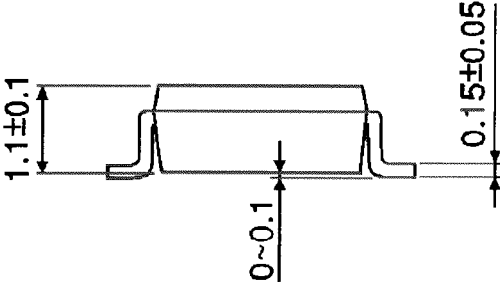


This input waveform is equal to the AC electrical characteristics test waveform.

Package Dimensions

SSOP8-P-0.65

Unit : mm

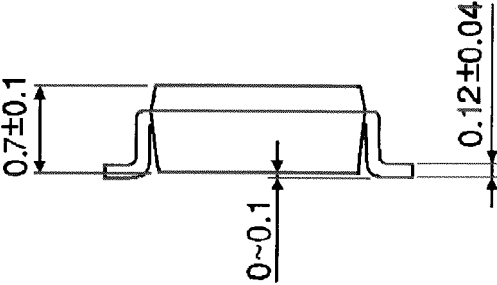
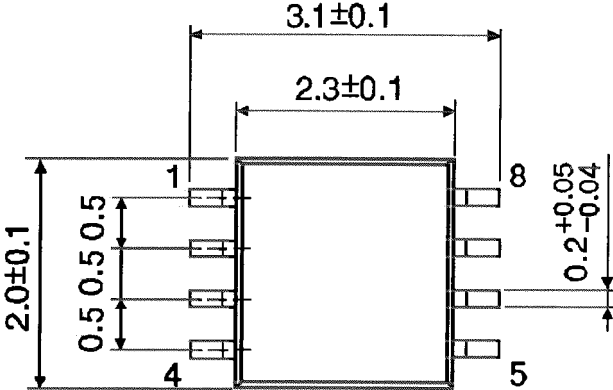


Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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