TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7WU04FU, TC7WU04FK

3 Inverters

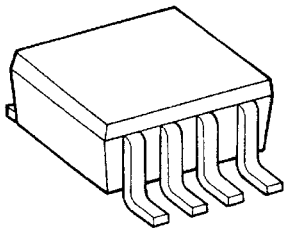
The TC7WU04 is a high speed CMOS Inverter fabricated with silicon gate CMOS technology.

It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

As the internal circuit is composed of single stage inverter, it can be applied for crystal oscillation.

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

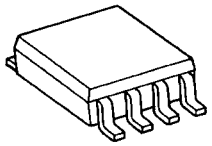
TC7WU04FU



SSOP8-P-0.65

(SM8)

TC7WU04FK



SSOP8-P-0.50A

(US8)

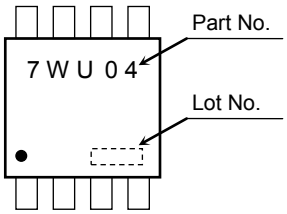
Weight
SSOP8-P-0.65: 0.02 g (typ.)
SSOP8-P-0.50A: 0.01 g (typ.)

Features

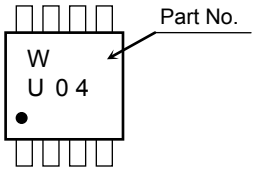
- High speed: t_{pd} = 6 ns (typ.) at V_{CC} = 4.5 V
- Low power dissipation: I_{CC} = 1 μA (max) at Ta = 25°C
- High noise immunity: $V_{NIH} = V_{NIL}$ = 10% V_{CC} (min)
- Output drive capability: 10 LSTTL loads
- Symmetrical output impedance: $|I_{OH}| = I_{OL}$ = 4 mA (min)
- Balanced propagation delays: $t_{pLH} \simeq t_{pHL}$
- Wide operating voltage range: V_{CC} (opr) = 2 to 6 V

Marking

TC7WU04FU



TC7WU04FK



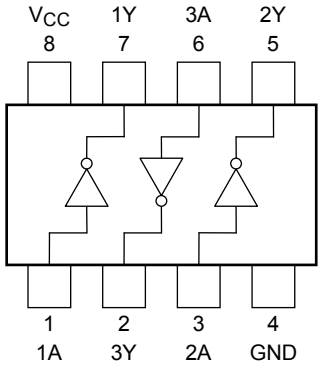
Start of commercial production
1991-09

Absolute Maximum Ratings (Ta = 25°C)

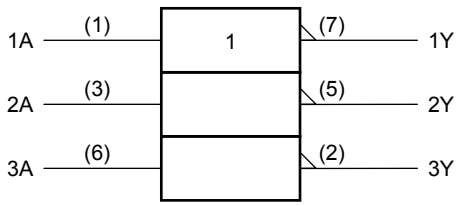
Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	−0.5 to 7	V
DC input voltage	V_{IN}	−0.5 to V_{CC} + 0.5	V
DC output voltage	V_{OUT}	−0.5 to V_{CC} + 0.5	V
Input diode current	I_{IK}	±20	mA
Output diode current	I_{OK}	±20	mA
DC output current	I_{OUT}	±25	mA
DC V_{CC}/ground current	I_{CC}	±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

Electrical Characteristics

DC Electrical Characteristics

Characteristics		Symbol	Test Condition		V_{CC} (V)	Ta = 25°C Min	Ta = 25°C Typ.	Ta = 25°C Max	Ta = −40 to 85°C Min	Ta = −40 to 85°C Max	Unit
Input voltage	High level	V_{IH}	—		2.0	1.7	—	—	1.7	—	V
					4.5	3.6	—	—	3.6	—	
					6.0	4.8	—	—	4.8	—	
	Low level	V_{IL}	—		2.0	—	—	0.3	—	0.3	
					4.5	—	—	0.9	—	0.9	
					6.0	—	—	1.2	—	1.2	
Output voltage	High level	V_{OH}	V_{IN} = V_{IL}	I_{OH} = −20 μA	2.0	1.8	2.0	—	1.8	—	V
					4.5	4.0	4.5	—	4.0	—	
					6.0	5.5	5.9	—	5.5	—	
			V_{IN} = GND	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	0.2	—	0.2	
					4.5	—	0	0.5	—	0.5	
					6.0	—	0.1	0.5	—	0.5	
			V_{IN} = V_{CC}	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	—	—	±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 pF, V_{CC} = 5 V, Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Output transition time	t_{TLH} t_{THL}	—	—	4	8	ns
Propagation delay time	t_{pLH} t_{pHL}	—	—	4	8	ns

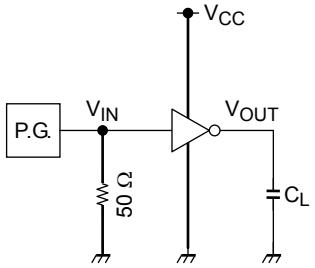
AC Electrical Characteristics (C_L = 50 pF, input $t_r = t_f$ = 6 ns)

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	ns
			4.5	—	8	15	—	19	
			6.0	—	7	13	—	16	
Propagation delay time	t_{pLH} t_{pHL}	—	2.0	—	18	60	—	75	ns
			4.5	—	6	12	—	15	
			6.0	—	5	10	—	13	
Input capacitance	C_{IN}	—		—	9	15	—	15	pF
Power dissipation capacitance	C_{PD}	(Note)		—	13	—	—	—	pF

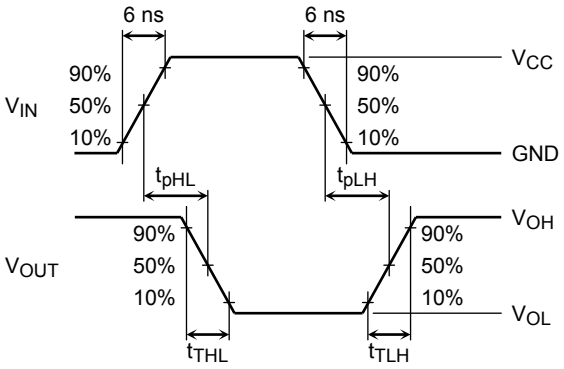
Note: C_{PD} is defined as the value of internal equivalent capacitance of IC which is calculated from the operating current consumption without load (refer to test circuit).
Average operating current can be obtained by the equation hereunder.

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

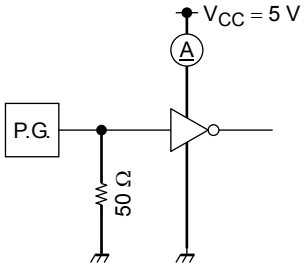
AC Electrical Characteristics Test Circuit



AC Electrical Characteristics Test Waveform



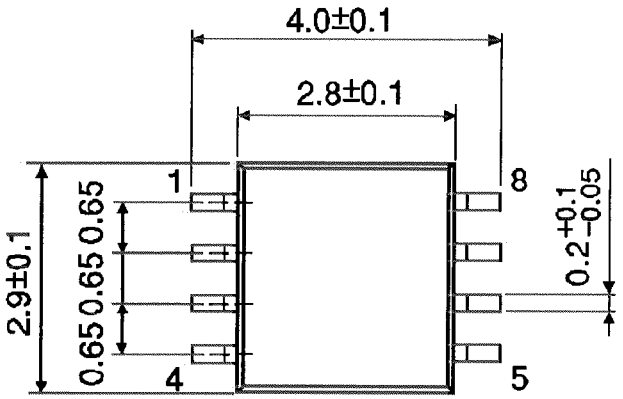
Operating Current Consumption Test Circuit

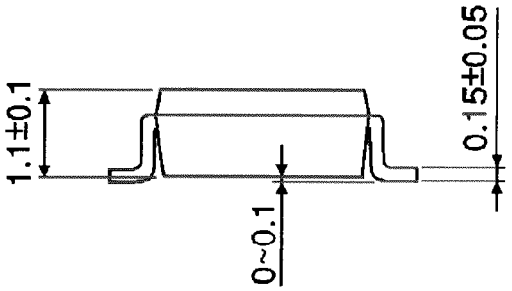


This input waveform is equal to the AC electrical characteristics test waveform.

Package Dimensions

SSOP8-P-0.65 Unit : mm

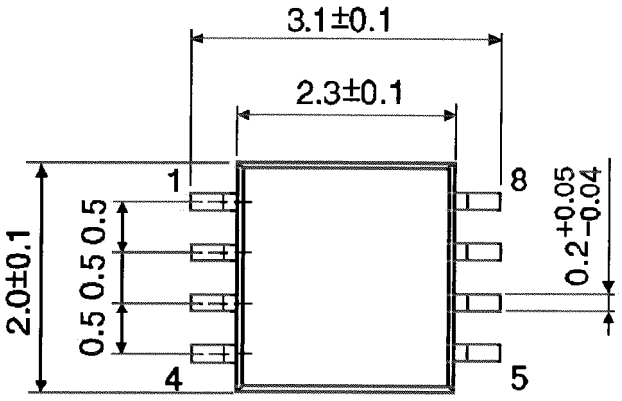


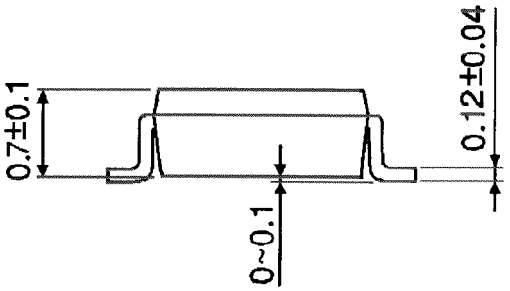


Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A Unit : mm





Weight: 0.01 g (typ.)

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