

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

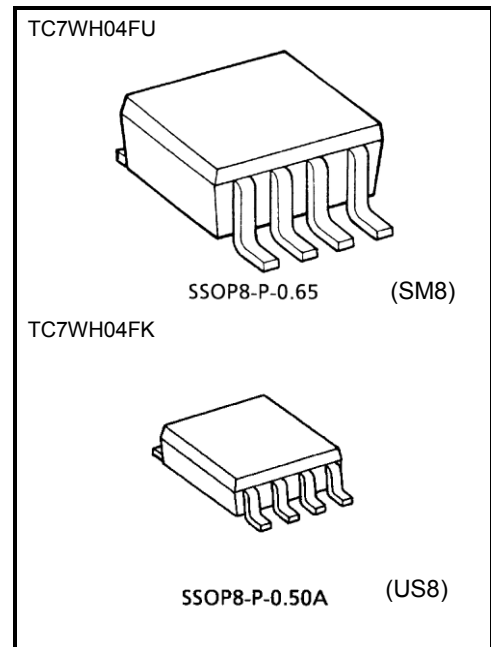
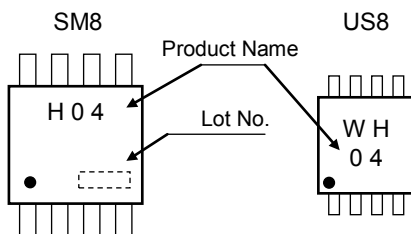
TC7WH04FU, TC7WH04FK

Triple Inverter

Features

- High speed: $t_{pd} = 3.8\text{ns}$ (typ.) at $V_{CC} = 5\text{V}$, $C_L = 15\text{pF}$
- Low power dissipation: $I_{CC} = 2\mu\text{A}$ (max) at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (min)
- 5.5-V Tolerant inputs.
- Wide operating voltage range: $V_{CC} = 2$ to 5.5V
- Identical pin assignment and function with TC7W04

Marking

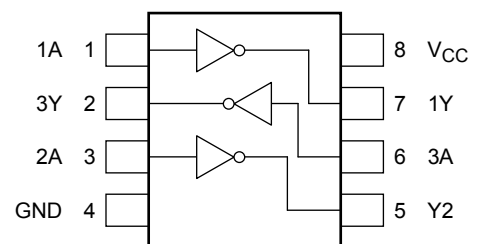


Weight
 SSOP8-P-0.65: 0.02 g (typ.)
 SSOP8-P-0.50A: 0.01 g (typ.)

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

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	-0.5 to 7.0	V
DC input voltage	V_{IN}	-0.5 to 7.0	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 (Note1)	mA
DC output current	I_{OUT}	± 25	mA
DC V_{CC} /ground current	I_{CC}	± 50	mA
Power dissipation	P_D	300 (SM8)	mW
		200 (US8)	
Storage temperature	T_{stg}	-65 to 150	$^\circ\text{C}$
Lead temperature (10 s)	T_L	260	$^\circ\text{C}$

Pin Assignment (top view)



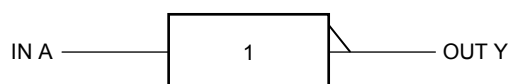
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

Start of commercial production
 1997-07

IEC Logic Symbol



Truth Table

A	Y
L	H
H	L

Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2.0 to 5.5	V
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to V_{CC}	V
Operating temperature	T_{opr}	-40 to 85	°C
Input rise and fall time	dt/dv	0 to 100 ($V_{CC} = 3.3 \pm 0.3$ V)	ns/V
		0 to 20 ($V_{CC} = 5.0 \pm 0.5$ V)	

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}	—		2.0	1.50	—	—	1.50	—	V
				3.0 to 5.5	V _{CC} × 0.7	—	—	V _{CC} × 0.7	—	
Low-level input voltage	V _{IL}	—		2.0	—	—	0.50	—	0.50	V
				3.0 to 5.5	—	—	V _{CC} × 0.3	—	V _{CC} × 0.3	
High-level output voltage	V _{OH}	V _{IN} = V _{IL}	I _{OH} = -50 μA	2.0	1.9	2.0	—	1.9	—	V
				3.0	2.9	3.0	—	2.9	—	
				4.5	4.4	4.5	—	4.4	—	
			I _{OH} = -4 mA	3.0	2.58	—	—	2.48	—	
				4.5	3.94	—	—	3.80	—	
Low-level output voltage	V _{OL}	V _{IN} = V _{IH}	I _{OL} = 50 μA	2.0	—	0.0	0.1	—	0.1	V
				3.0	—	0.0	0.1	—	0.1	
				4.5	—	0.0	0.1	—	0.1	
			I _{OL} = 4 mA	3.0	—	—	0.36	—	0.44	
				4.5	—	—	0.36	—	0.44	
Input leakage current	I _{IN}	V _{IN} = 5.5 V or GND		0 to 5.5	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I _{CC}	V _{IN} = V _{CC} or GND		5.5	—	—	2.0	—	20.0	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)	C _L (pF)	Min	Typ.	Max	Min	Max		
Propagation delay time	t _{pLH}	—	3.3 ± 0.3	15	—	5.0	7.1	1.0	8.5	ns
				50	—	7.5	10.6	1.0	12.0	
	t _{pHL}	—	5.0 ± 0.5	15	—	3.8	5.5	1.0	6.5	
				50	—	5.3	7.5	1.0	8.5	
Input capacitance	C _{IN}	—		—	4	10	—	10	pF	
Power dissipation capacitance	C _{PD}	(Note2)		—	18	—	—	—	pF	

Note 2: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

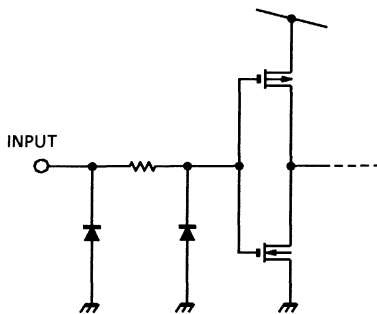
Average operating current can be obtained by the equation:

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

Noise Characteristics (Ta = 25°C, input: $t_r = t_f = 3 \text{ ns}$)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Typ.	Limit	Unit
Quiet output maximum dynamic V _{OL}	V _{OLP}	C _L = 50 pF	5.0	0.3	0.8	V
Quiet output minimum dynamic V _{OL}	V _{OLV}	C _L = 50 pF	5.0	-0.3	-0.8	V
Minimum high level dynamic V _{IH}	V _{IHD}	C _L = 50 pF	5.0	—	3.5	V
Maximum low level dynamic V _{IH}	V _{ILD}	C _L = 50 pF	5.0	—	1.5	V

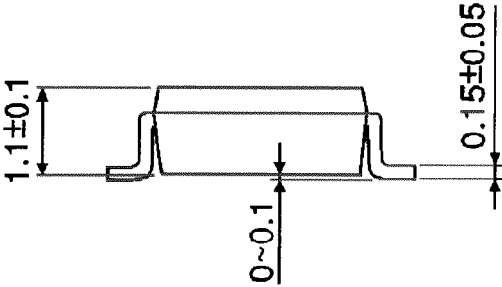
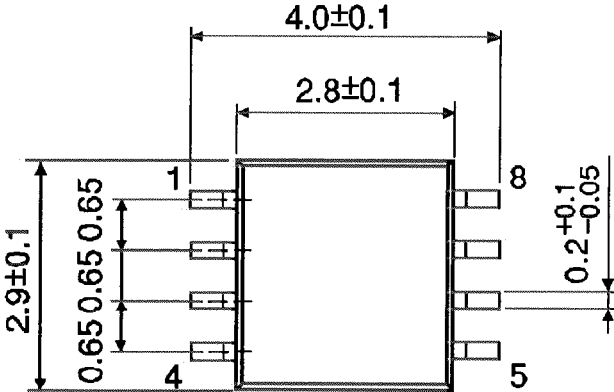
Input Equivalent Circuit



Package Dimensions

SSOP8-P-0.65

Unit : mm

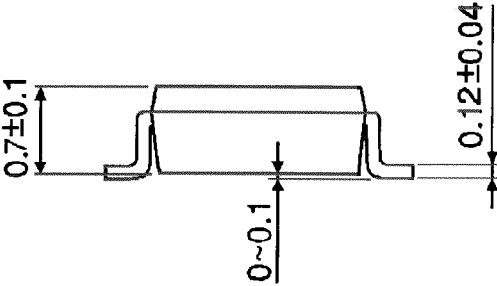
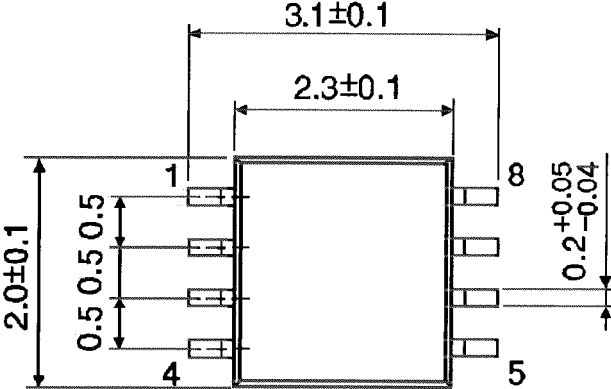


Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (typ.)

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