

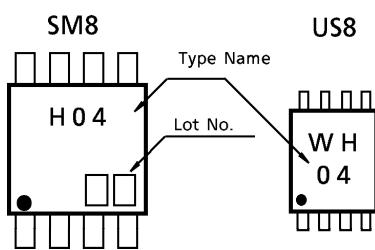
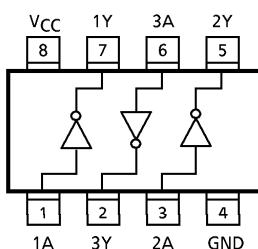
TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC7WH04FU, TC7WH04FK**TRIPLE INVERTER**

The TC7WH04 is an advanced high speed CMOS INVERTER fabricated with silicon gate CMOS technology. It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation. The internal circuit is composed of 3 stages including buffer output, which provide high noise immunity and stable output. An input protection circuit ensures that 0 to 7V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

FEATURES

- High Speed $t_{pd} = 3.8\text{ns} (\text{Typ.})$ at $V_{CC} = 5\text{V}$
- Low Power Dissipation $I_{CC} = 2\mu\text{A} (\text{Max.})$ at $T_a = 25^\circ\text{C}$
- High Noise Immunity $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (Min.)
- Power Down Protection is provided on all inputs.
- Balanced Propagation Delays $t_{pLH} = t_{pHL}$
- Wide Operating Voltage Range $V_{CC} (\text{opr}) = 2\text{~}5.5\text{V}$

MARKING**PIN ASSIGNMENT (TOP VIEW)**

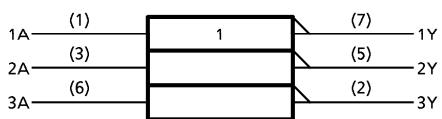
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MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage Range	V_{CC}	$-0.5 \sim 7.0$	V
DC Input Voltage	V_{IN}	$-0.5 \sim 7.0$	V
DC Output Voltage	V_{OUT}	$-0.5 \sim V_{CC} + 0.5$	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}	± 50	mA
Power Dissipation	P_D	300 (SM8) 200 (US8)	mW
Storage Temperature	T_{stg}	$-65 \sim 150$	$^\circ\text{C}$
Lead Temperature (10 s)	T_L	260	$^\circ\text{C}$

LOGIC DIAGRAM



TRUTH TABLE

A	Y
L	H
H	L

RECOMMENDED OPERATING CONDITIONS

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{CC}	$2.0 \sim 5.5$	V
Input Voltage	V_{IN}	$0 \sim 5.5$	V
Output Voltage	V_{OUT}	$0 \sim V_{CC}$	V
Operating Temperature	T_{opr}	$-40 \sim 85$	$^\circ\text{C}$
Input Rise and Fall Time	dt/dv	$0 \sim 100 \text{ (} V_{CC} = 3.3 \pm 0.3\text{V) }$ $0 \sim 20 \text{ (} V_{CC} = 5 \pm 0.5\text{V) }$	ns / V

DC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	SYMBOL	TEST CONDITION	V _{CC} (V)	Ta = 25°C			Ta = - 40~85°C		UNIT
				MIN.	TYP.	MAX.	MIN.	MAX.	
High-Level Input Voltage	V _{IH}	—	2.0	1.50	—	—	1.50	—	V
			3.0~5.5	V _{CC} × 0.7	—	—	V _{CC} × 0.7	—	
Low-Level Input Voltage	V _{IL}	—	2.0	—	—	0.50	—	0.50	V
			3.0~5.5	—	—	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} = - 4mA	3.0	2.58	—	—	2.48	
			I _{OH} = - 8mA	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	—	V
				3.0	—	0.0	0.1	—	
				4.5	—	0.0	0.1	—	
			I _{OL} = 4mA	3.0	—	—	0.36	—	
			I _{OL} = 8mA	4.5	—	—	0.36	—	
Input Leakage Current	I _{IN}	V _{IN} = 5.5V or GND	0~5.5	—	—	± 0.1	—	± 1.0	μA
Quiescent Supply Current	I _{CC}	V _{IN} = V _{CC} or GND	5.5	—	—	2.0	—	20.0	μA

AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3\text{ns}$)

CHARACTERISTIC	SYMBOL	TEST CONDITION		Ta = 25°C			Ta = - 40~85°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	
			5.0	—	7.5	10.6	1.0	12.0	ns	
	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}	(Note 1)			—	18	—	—	—	pF

(Note 1) : C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

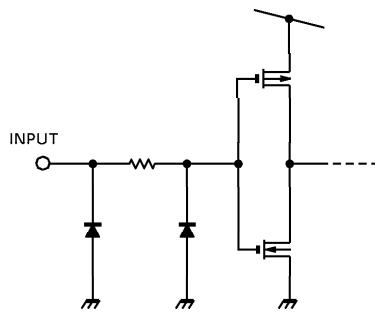
Average operating current can be obtained by the equation :

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

NOISE CHARACTERISTICS (Ta = 25°C, Input $t_r = t_f = 3\text{ns}$)

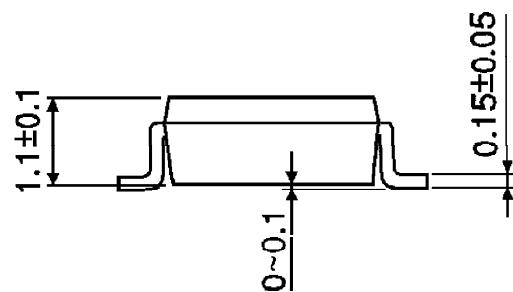
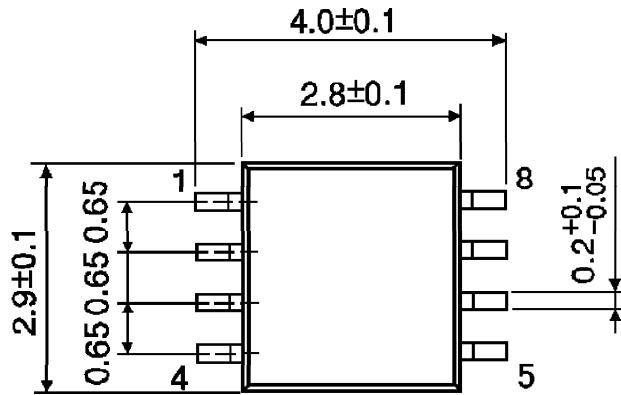
CHARACTERISTIC	SYMBOL	TEST CONDITION	V _{CC} (V)	TYP.	LIMIT	UNIT
Quiet Output Maximum Dynamic V _{OL}	V _{O LP}	C _L = 50pF	5.0	0.3	0.8	V
Quiet Output Minimum Dynamic V _{OL}	V _{O LV}	C _L = 50pF	5.0	-0.3	-0.8	V
Minimum High Level Dynamic Input Voltage	V _{I HD}	C _L = 50pF	5.0	—	3.5	V
Maximum Low Level Dynamic Input Voltage	V _{I LD}	C _L = 50pF	5.0	—	1.5	V

INPUT EQUIVALENT CIRCUIT



OUTLINE DRAWING
SSOP8-P-0.65

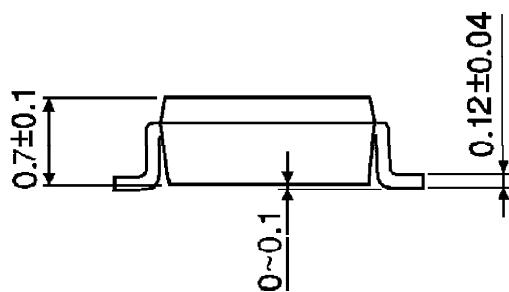
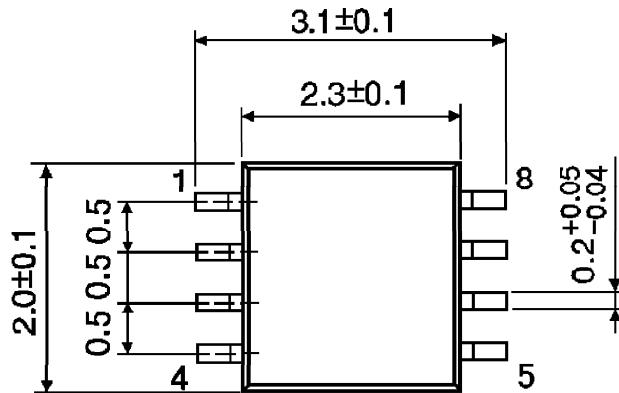
Unit : mm



Weight : 0.02g (Typ.)

OUTLINE DRAWING
SSOP8-P-0.50A

Unit : mm



Weight : 0.01g (Typ.)