TOSHIBA CMOS Digital Integrated Circuit   Silicon Monolithic
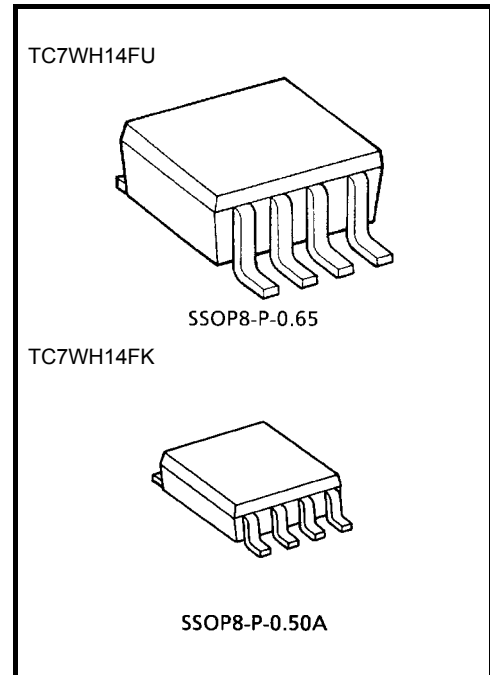
TC7WH14FU,TC7WH14FK

Triple Schmitt Inverter

The TC7WH14 is an advanced high speed CMOS Schmitt 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. Pin configuration and function are the same as the TC7SH14 but the inputs have hysteresis and with its schmitt trigger function, the TC7WH14 can be used as a line receivers which will receive slow input signals.   An input protection circuit ensures that 0 to 7 V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5 V to 3 V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.
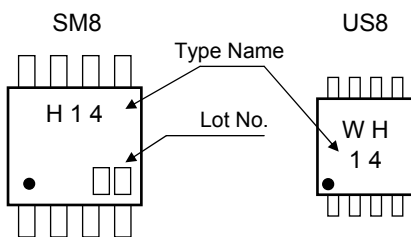
Features

- High speed: t_{pd} = 5.5 ns (typ.) at V_{CC} = 5 V
- Low power dissipation: I_{CC} = 2 μA (max) at Ta = 25°C
- High noise immunity: V_{NIH} = V_{NIL} = 28% V_{CC} (min)
- 5.5-V Tolerant inputs.
- Balanced propagation delays: t_{pLH} ≃ t_{pHL}
- Wide operating voltage range: V_{CC} (opr) = 2~5.5 V

TC7WH14FU

SSOP8-P-0.65
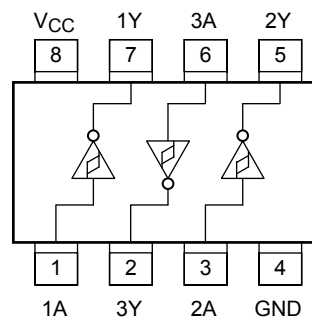
TC7WH14FK

SSOP8-P-0.50A

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

Marking

SM8

Type Name

H 1 4

Lot No.

US8

W H
1 4

Pin Assignment (top view)

V_{CC}	1Y	3A	2Y
8	7	6	5

1	2	3	4
1A	3Y	2A	GND

Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	−0.5~7.0	V
DC input voltage	V_{IN}	−0.5~7.0	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)	mW
		200 (US8)	
Storage temperature	T_{stg}	−65~150	°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).

IEC Logic Symbol
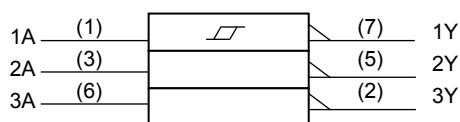
Truth Table

A	Y
L	H
H	L

Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2.0~5.5	V
Input voltage	V_{IN}	0~5.5	V
Output voltage	V_{OUT}	$0 \sim V_{CC}$	V
Operating temperature	T_{opr}	−40~85	°C

Electrical Characteristics

DC Characteristics

Characteristics		Symbol	Test Condition		V_{CC} (V)	Ta = 25°C			Ta = −40~85°C		Unit
						Min	Typ.	Max	Min	Max	
Input voltage	Positive threshold voltage	V_P	—		3.0	—	—	2.20	—	2.20	V
					4.5	—	—	3.15	—	3.15	
					5.5	—	—	3.85	—	3.85	
	Negative threshold voltage	V_N	—		3.0	0.90	—	—	0.90	—	
					4.5	1.35	—	—	1.35	—	
					5.5	1.65	—	—	1.65	—	
Hysteresis voltage		V_H	—		3.0	0.30	—	1.20	0.30	1.20	V
					4.5	0.40	—	1.40	0.40	1.40	
					5.5	0.50	—	1.60	0.50	1.60	
Output voltage	High level	V_{OH}	$V_{IN} = V_{IL}$	$I_{OH} = -50\ \mu A$	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	—	
				$I_{OH} = -8\ mA$	4.5	3.94	—	—	3.80	—	
	Low level	V_{OL}	$V_{IN} = V_{IH}$	$I_{OL} = 50\ \mu A$	2.0	—	0	0.1	—	0.1	
					3.0	—	0	0.1	—	0.1	
					4.5	—	0	0.1	—	0.1	
				$I_{OL} = 4\ mA$	3.0	—	—	0.36	—	0.44	
				$I_{OL} = 8\ mA$	4.5	—	—	0.36	—	0.44	
Input leakage current		I_{IN}	$V_{IN} = 5.5\ V$ 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 Characteristics (input: $t_r = t_f = 3$ ns)

Characteristics	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} t_{pHL}	—	3.3 ± 0.3 → 15	—	8.3	12.8	1.0	15.0	ns
			50	—	10.8	16.3	1.0	18.5	
			5.0 ± 0.5 → 15	—	5.5	8.6	1.0	10.0	
			50	—	7.0	10.6	1.0	12.0	
Input capacitance	C_{IN}	—		—	4	10	—	10	—
Power dissipation capacitance	C_{PD}	(Note)		—	21	—	—	—	—

Note: 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: $t_r = t_f = 3$ 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 input voltage	V_{IHD}	$C_L = 50$ pF	5.0	—	3.5	V
Maximum low level dynamic input voltage	V_{ILD}	$C_L = 50$ pF	5.0	—	1.5	V

Input Equivalent Circuit
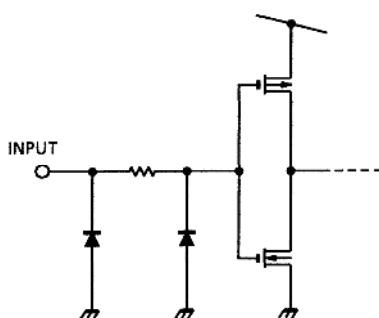
Package Dimensions

SSOP8-P-0.65

Unit : mm

4.0±0.1

2.8±0.1

2.9±0.1

0.65 0.65 0.65

1

4

8

5

$0.2^{+0.1}_{-0.05}$

1.1±0.1

0.15±0.05

0~0.1
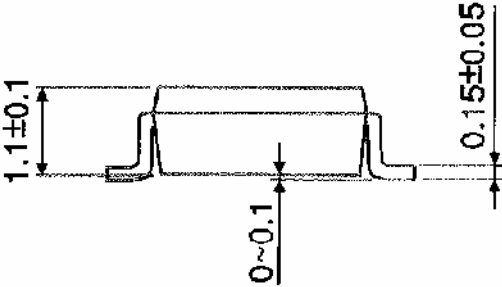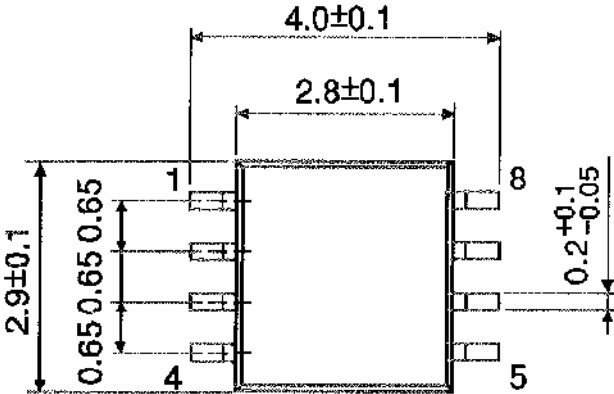
Weight: 0.02 g (typ.)

Package Dimensions

SSOP8-P-0.50A

Unit : mm

3.1±0.1

2.3±0.1

2.0±0.1

0.5 0.5 0.5 0.5

1

8

4

5

$0.2^{+0.05}_{-0.04}$

0.7±0.1

0.12±0.04

0~0.1
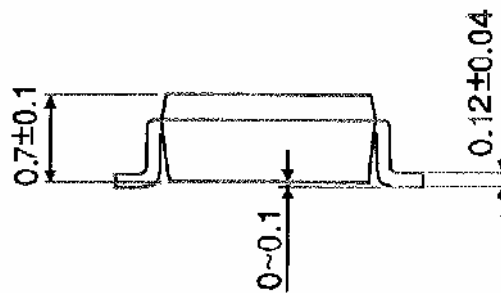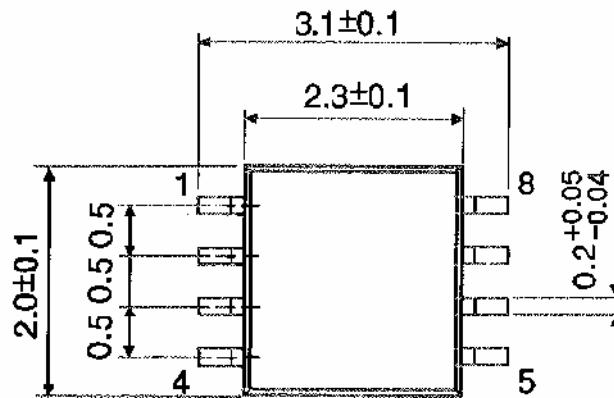
Weight: 0.01 g (typ.)

RESTRICTIONS ON PRODUCT USE