

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74VHCT9125AFT, TC74VHCT9125AFK TC74VHCT9126AFT, TC74VHCT9126AFK

TC74VHCT9125AFT/FK 5-bit Universal Schmitt Buffer with 3-State Outputs

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The TC74VHCT9125A/9126A are an ultra-high-speed 5-bit Schmitt buffer fabricated using silicon-gate CMOS technology. The TC74VHCT9125A/9126A combines low power consumption of CMOS with Schottky TTL speeds.

The input voltage are compatible with TTL output voltage.

This device may be used as a level converter for interfacing 3.3 V to 5 V system.

Y1 to Y4 outputs can be put in the high-impedance state by placing a logic HIGH on the Enable (\overline{G}) input. The CONT input determines the logical inversion of data. A logic LOW on the CONT input configures the TC74VHCT9125A/9126A as an inverter; a logic HIGH on the CONT input configures the TC74VHCT9125A/9126A as a buffer.

TC74VHCT9125A Y5 output is an inverting type, and the TC74VHCT9126A Y5 output is a non-inverting type.

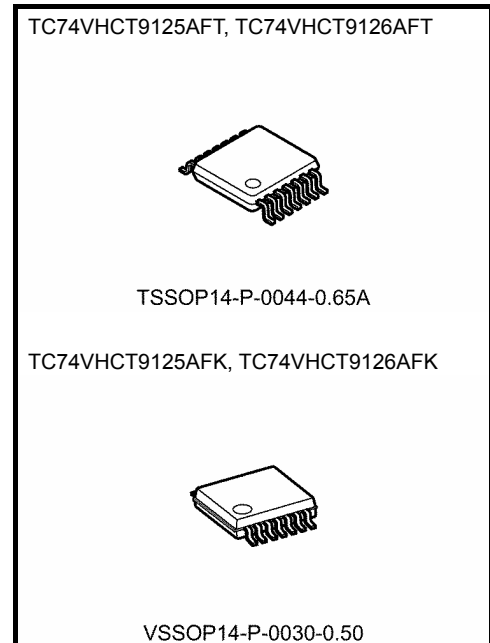
All the inputs have hysteresis between the positive-going and negative-going thresholds. Thus the TC74VHCT9125A/9126A are capable of squaring up transitions of slowly changing input signals and provides an improved noise immunity.

Input protection and output circuit ensure that 0 to 5.5 V can be applied to the input and output (Note) pins without regard to the supply voltage. These structure prevents device destruction due to mismatched supply and input/output voltages such as battery back up, etc.

Note: Output in off-state

Features

- High speed: $t_{pd} = 6.6 \text{ ns (typ.) (VCC = 5 V)}$
- Low supply current: $I_{CC} = 2 \mu\text{A (max) (Ta = 25}^\circ\text{C)}$
- Compatible with TTL inputs
 - $V_{IL} = 0.5 \text{ V (max)}$
 - $V_{IH} = 2.1 \text{ V (min)}$
- Power down protection is provided on all inputs.
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Input terminals are at the opposite side of Output terminals



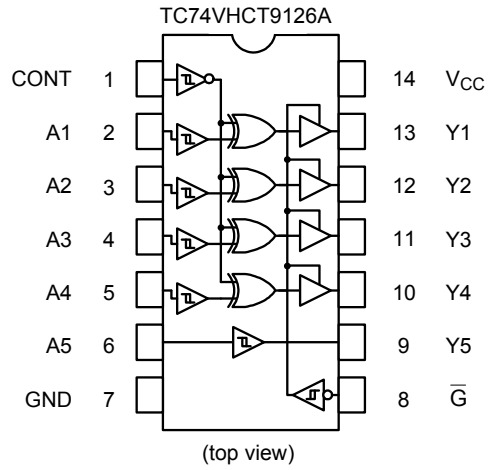
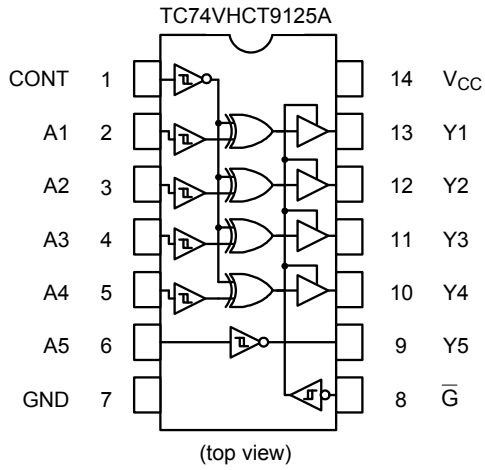
Weight

TSSOP14-P-0044-0.65A : 0.06 g (typ.)

VSSOP14-P-0030-0.50 : 0.02 g (typ.)

Start of commercial production
2010-07

Pin Assignment



Truth Table

Inputs			Outputs
\bar{G}	CONT	A1~4	Y1~4
H	X	X	Z
L	L	L	H
L	L	H	L
L	H	L	L
L	H	H	H

Inputs	Outputs	
A5	Y5(9125)	Y5(9126)
L	H	L
H	L	H

X : Don't care

Z : High impedance

Absolute Maximum Ratings (Note1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	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 7.0 (Note 2)	V
		-0.5 to $V_{CC} + 0.5$ (Note 3)	
Input diode current	I_{IK}	-20	mA
Output diode current	I_{OK}	± 20 (Note 4)	mA
DC output current	I_{OUT}	± 25	mA
DC V_{CC} /ground current	I_{CC}	± 50	mA
Power dissipation	P_D	180	mW
Storage temperature	T_{stg}	-65 to 150	$^{\circ}C$

Note 1: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

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 2: Output in off-state

Note 3: High or low state. I_{OUT} absolute maximum rating must be observed.

Note 4: $V_{OUT} < GND$, $V_{OUT} > V_{CC}$

Operating Ranges (Note1)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	4.5 to 5.5	V
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to 5.5 (Note 2)	V
		0 to V_{CC} (Note 3)	
Operating temperature	T_{opr}	-40 to 85	$^{\circ}C$

Note 1: The operating ranges must be maintained to ensure the normal operation of the device.
Unused inputs must be tied to either V_{CC} or GND.

Note 2: Output in off-state

Note 3: High or low state.

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
Positive threshold voltage	V _P	—		4.5	—	—	1.90	—	1.90	V
				5.5	—	—	2.10	—	2.10	
Negative threshold voltage	V _N	—		4.5	0.50	—	—	0.50	—	V
				5.5	0.60	—	—	0.60	—	
Hysteresis voltage	V _H	—		4.5	0.40	—	1.40	0.40	1.40	V
				5.5	0.40	—	1.50	0.40	1.50	
High-level output voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -50 μA	4.5	4.4	4.5	—	4.4	—	V
			I _{OH} = -8 mA	4.5	3.94	—	—	3.80	—	
Low-level output voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 50 μA	4.5	—	0.0	0.1	—	0.1	V
			I _{OL} = 8 mA	4.5	—	—	0.36	—	0.44	
3-state output off-state current	I _{OZ}	V _{IN} = V _{IH} or V _{IL} V _{OUT} = V _{CC} or GND		5.5	—	—	±0.25	—	±2.5	μA
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
	I _{CCT}	Per input: V _{IN} = 3.4 V Other input: V _{CC} or GND		5.5	—	—	1.35	—	1.50	mA
Output leakage current	I _{OPD}	V _{OUT} = 5.5 V		0	—	—	0.5	—	5.0	μA

AC Characteristics (input: $t_r = t_f = 3$ 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 (A1 to 4 - Y1 to 4)	t _{pLH}	—	5.0 ± 0.5	15	—	6.6	8.5	1.0	10.0	ns
	t _{pHL}			50	—	8.1	11.5	1.0	13.0	
Propagation delay time (CONT-Y1 to 4)	t _{pLH}	—	5.0 ± 0.5	15	—	8.0	10.5	1.0	12.0	ns
	t _{pHL}			50	—	9.9	14.5	1.0	17.0	
Propagation delay time (A5 - Y5)	t _{pLH}	—	5.0 ± 0.5	15	—	6.0	8.0	1.0	9.5	ns
	t _{pHL}			50	—	7.9	10.5	1.0	12.0	
3-state output enable time	t _{pZL}	R _L = 1 kΩ	5.0 ± 0.5	15	—	6.4	8.5	1.0	10.0	ns
	t _{pZH}			50	—	8.4	12.5	1.0	14.5	
3-state output disable time	t _{pLZ} t _{pHZ}	R _L = 1 kΩ	5.0 ± 0.5	50	—	6.7	11.5	1.0	13.0	ns
Output to output skew	t _{osLH} t _{osHL}	(Note 1)	5.0 ± 0.5	50	—	—	1.0	—	1.0	ns
Input capacitance	C _{IN}	—		—	4	10	—	10	pF	
Output capacitance	C _{OUT}	—		—	9	—	—	—	pF	
Power dissipation capacitance (Note 2)	CPD	f _{IN} = 1 MHz		—	14	—	—	—	pF	

Note 1: Parameter guaranteed by design.

$$t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|$$

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:

$$I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 5 \text{ (per bit)}$$

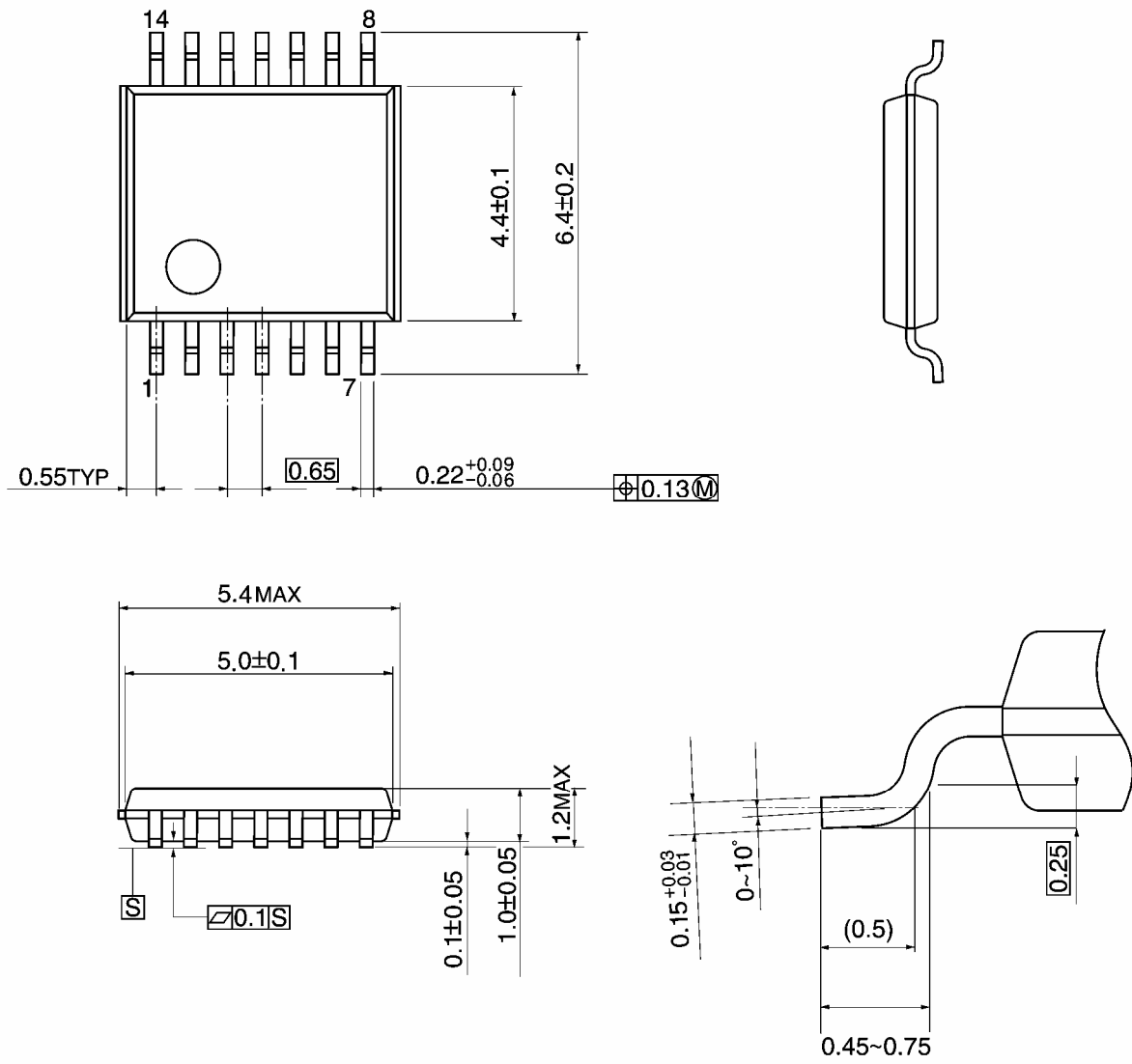
Noise Characteristics (input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Test Condition	Ta = 25°C			Unit
			V _{CC} (V)	Typ.	Limit	
Quiet output maximum dynamic V _{OL}	V _{OLP}	C _L = 50 pF	5.0	0.6	0.8	V
Quiet output minimum dynamic V _{OL}	V _{OLV}	C _L = 50 pF	5.0	-0.2	-0.8	V
Minimum high level dynamic input voltage	V _{IHD}	C _L = 50 pF	5.0	—	2.1	V
Maximum low level dynamic input voltage	V _{ILD}	C _L = 50 pF	5.0	—	0.5	V

Package Dimensions

TSSOP14-P-0044-0.65A

Unit: mm

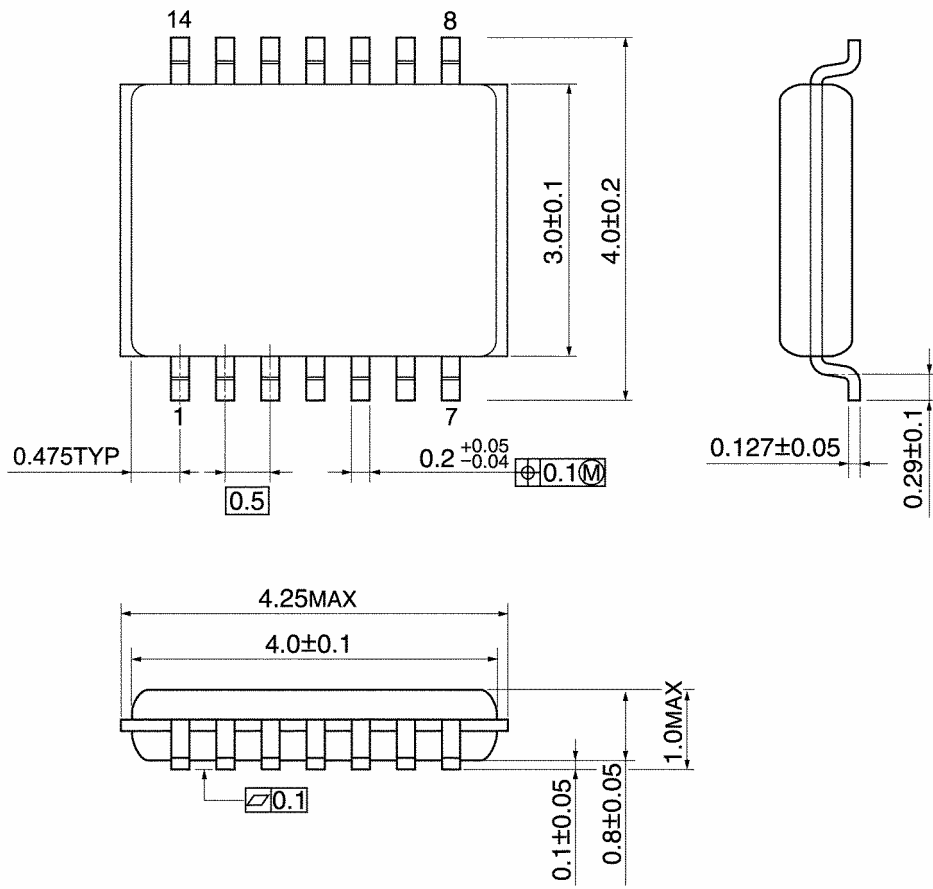


Weight: 0.06 g (typ.)

Package Dimensions

VSSOP14-P-0030-0.50

Unit: mm



Weight: 0.02 g (typ.)

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