

74VHCT125AFT, 74VHCT126AFT

1. Functional Description

- Quad Bus Buffer, Non-Inverted 3-State Outputs
74VHCT125AFT: QUAD BUS BUFFER
74VHCT126AFT: QUAD BUS BUFFER

2. General

The 74VHCT125AFT and 74VHCT126AFT are high speed CMOS QUAD BUS BUFFERS fabricated with silicon gate C²MOS technology.

They achieve the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

The 74VHCT125AFT requires the 3-state control input $\overline{G}$ to be set high to place the output into the high impedance state, whereas the 74VHCT126AFT requires the control input G to be set low to place the output into high impedance.

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.

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. Their structure prevents device destruction due to mismatched supply and input/output voltages such as battery back up, hot board insertion, etc.

Note: Output in off-state

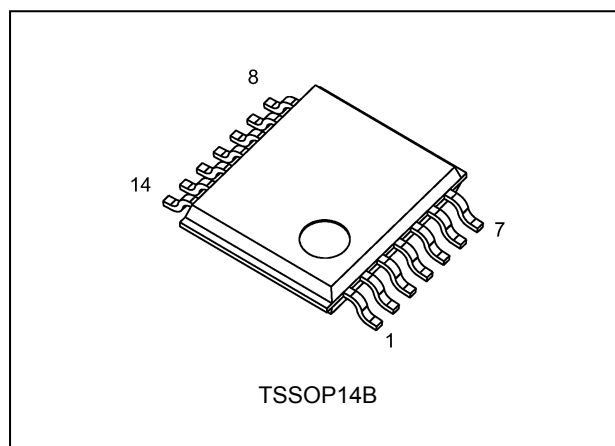
3. Features

- (1) AEC-Q100 (Rev. H) (Note 1)
- (2) Wide operating temperature range: $T_{opr} = -40$ to 125°C
- (3) High speed: Propagation delay time = 3.8 ns (typ.) at $V_{CC} = 5.0$ V
- (4) Quiescent supply current: $I_{CC} = 4.0$ μA (max) at $T_a = 25^{\circ}\text{C}$
- (5) Compatible with TTL input: $V_{IL} = 0.8$ V(max)
 $V_{IH} = 2.0$ V(min)
- (6) Power down protection is provided on all inputs and outputs.
- (7) Balanced propagation delays: $t_{PLH} \approx t_{PHL}$
- (8) Low noise: $V_{OLP} = 0.8$ V (max)
- (9) Pin and function compatible with the 74 series
(ACT/HCT/AHCT etc.) 125/126 type.

Note 1: This device is compliant with the reliability requirements of AEC-Q100. For details, contact your Toshiba sales representative.

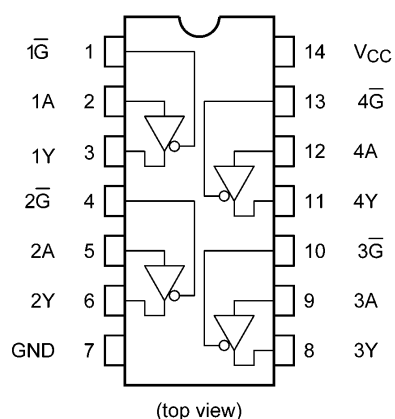
Start of commercial production
2013-01

4. Packaging

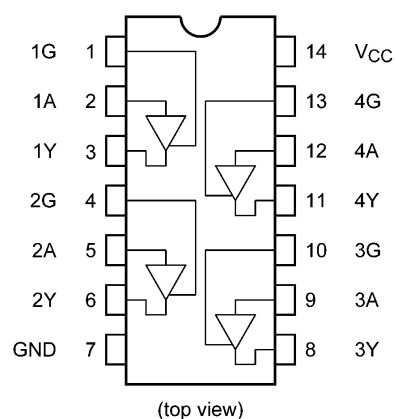


5. Pin Assignment

74VHCT125AFT

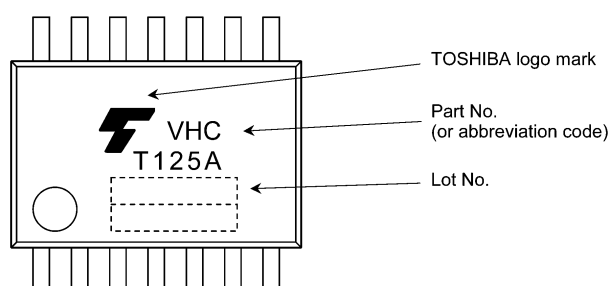


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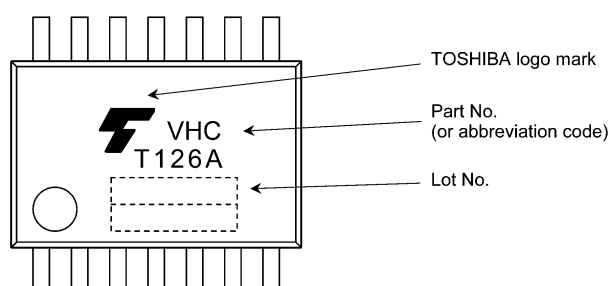


6. Marking

74VHCT125AFT

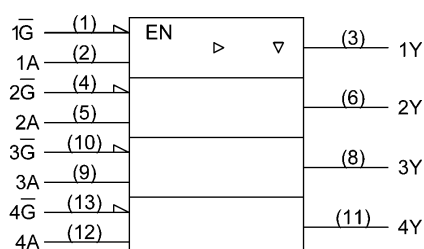


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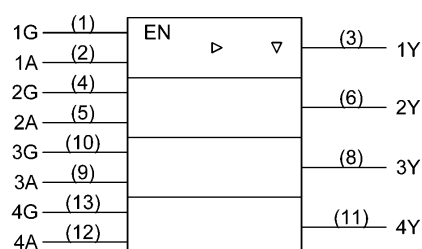


7. IEC Logic Symbol

74VHCT125AFT



74VHCT126AFT



8. Truth Table

Input $\bar{G}$ (74VHCT125AFT)	Input G (74VHCT126AFT)	Input A	Output Y
H	L	X	Z
L	H	L	L
L	H	H	H

X: Don't care

Z: High impedance

9. Absolute Maximum Ratings (Note)

Characteristics	Symbol	Note	Rating	Unit
Supply voltage	V_{CC}		-0.5 to 7.0	V
Input voltage	V_{IN}		-0.5 to 7.0	V
Output voltage	V_{OUT}	(Note 1)	-0.5 to 7.0	V
		(Note 2)	-0.5 to $V_{CC} + 0.5$	
Input diode current	I_{IK}		-20	mA
Output diode current	I_{OK}	(Note 3)	± 20	mA
Output current	I_{OUT}		± 25	mA
V_{CC} /ground current	I_{CC}		± 50	mA
Power dissipation	P_D	(Note 4)	180	mW
Storage temperature	T_{stg}		-65 to 150	$^{\circ}\text{C}$

Note: 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 1: Output in OFF state.

Note 2: High (H) or Low (L) state. I_{OUT} absolute maximum rating must be observed.

Note 3: $V_{OUT} < \text{GND}$, $V_{OUT} > V_{CC}$

Note 4: 180 mW in the range of $T_a = -40$ to 85°C . From $T_a = 85$ to 125°C a derating factor of $-3.25 \text{ mW}/^{\circ}\text{C}$ shall be applied until 50 mW.

10. Operating Ranges (Note)

Characteristics	Symbol	Note	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}	(Note 1)	0 to 5.5	V
		(Note 2)	0 to V_{CC}	
Operating temperature	T_{opr}		-40 to 125	$^{\circ}\text{C}$
Input rise and fall times	dt/dv		0 to 20	ns/V

Note: 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 1: Output in OFF state.

Note 2: High (H) or Low (L) state.

11. Electrical Characteristics

11.1. DC Characteristics (Unless otherwise specified, $T_a = 25\text{ }^{\circ}\text{C}$)

Characteristics	Symbol	Test Condition	V_{CC} (V)	Min	Typ.	Max	Unit
High-level input voltage	V_{IH}	—	4.5 to 5.5	2.0	—	—	V
Low-level input voltage	V_{IL}	—	4.5 to 5.5	—	—	0.8	V
High-level output voltage	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -50\text{ }\mu\text{A}$	4.5	4.4	4.5	V
			$I_{OH} = -8\text{ mA}$	4.5	3.94	—	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 50\text{ }\mu\text{A}$	4.5	—	0.0	V
			$I_{OL} = 8\text{ mA}$	4.5	—	0.36	
3-state output OFF-state leakage current	I_{OZ}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = V_{CC}$ or GND	5.5	—	—	± 0.25	μA
Input leakage current	I_{IN}	$V_{IN} = 5.5\text{ V}$ or GND	0 to 5.5	—	—	± 0.1	μA
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC}$ or GND	5.5	—	—	4.0	μA
	I_{CCT}	Per input: $V_{IN} = 3.4\text{ V}$ Other input: V_{CC} or GND	5.5	—	—	1.35	mA
Output leakage current (Power-OFF)	I_{OPD}	$V_{OUT} = 5.5\text{ V}$	0	—	—	0.5	μA

11.2. DC Characteristics (Unless otherwise specified, $T_a = -40\text{ to }85\text{ }^{\circ}\text{C}$)

Characteristics	Symbol	Test Condition	V_{CC} (V)	Min	Max	Unit
High-level input voltage	V_{IH}	—	4.5 to 5.5	2.0	—	V
Low-level input voltage	V_{IL}	—	4.5 to 5.5	—	0.8	V
High-level output voltage	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -50\text{ }\mu\text{A}$	4.5	4.4	V
			$I_{OH} = -8\text{ mA}$	4.5	3.80	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 50\text{ }\mu\text{A}$	4.5	—	V
			$I_{OL} = 8\text{ mA}$	4.5	—	
3-state output OFF-state leakage current	I_{OZ}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = V_{CC}$ or GND	5.5	—	± 2.50	μA
Input leakage current	I_{IN}	$V_{IN} = 5.5\text{ V}$ or GND	0 to 5.5	—	± 1.0	μA
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC}$ or GND	5.5	—	40.0	μA
Quiescent supply current	I_{CCT}	Per input: $V_{IN} = 3.4\text{ V}$ Other input: V_{CC} or GND	5.5	—	1.50	mA
Output leakage current (Power-OFF)	I_{OPD}	$V_{OUT} = 5.5\text{ V}$	0	—	5.0	μA

11.3. DC Characteristics (Unless otherwise specified, $T_a = -40\text{ to }125\text{ }^{\circ}\text{C}$)

Characteristics	Symbol	Test Condition	V_{CC} (V)	Min	Max	Unit
High-level input voltage	V_{IH}	—	4.5 to 5.5	2.0	—	V
Low-level input voltage	V_{IL}	—	4.5 to 5.5	—	0.8	V
High-level output voltage	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -50\text{ }\mu\text{A}$	4.5	4.4	V
			$I_{OH} = -8\text{ mA}$	4.5	3.70	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 50\text{ }\mu\text{A}$	4.5	—	V
			$I_{OL} = 8\text{ mA}$	4.5	—	
3-state output OFF-state leakage current	I_{OZ}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = V_{CC}$ or GND	5.5	—	± 10.0	μA
Input leakage current	I_{IN}	$V_{IN} = 5.5\text{ V}$ or GND	0 to 5.5	—	± 2.0	μA
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC}$ or GND	5.5	—	80.0	μA
	I_{CCT}	Per input: $V_{IN} = 3.4\text{ V}$ Other input: V_{CC} or GND	5.5	—	1.50	mA
Output leakage current (Power-OFF)	I_{OPD}	$V_{OUT} = 5.5\text{ V}$	0	—	20.0	μA

11.4. AC Characteristics (Unless otherwise specified, $T_a = 25\text{ }^{\circ}\text{C}$, Input: $t_r = t_f = 3\text{ ns}$)

Characteristics	Part Number	Symbol	Note	Test Condition	V_{CC} (V)	C_L (pF)	Min	Typ.	Max	Unit
Propagation delay time		t_{PLH}, t_{PHL}		—	5.0 ± 0.5	15	—	3.8	5.5	ns
						50	—	5.3	7.5	
3-state output enable time		t_{PZL}, t_{PZH}		$R_L = 1\text{ k}\Omega$	5.0 ± 0.5	15	—	3.6	5.1	ns
						50	—	5.1	7.1	
3-state output disable time		t_{PLZ}, t_{PHZ}		$R_L = 1\text{ k}\Omega$	5.0 ± 0.5	50	—	6.1	8.8	ns
Output skew		t_{osLH}, t_{osHL}	(Note 1)	—	5.0 ± 0.5	50	—	—	1.0	ns
Input capacitance		C_{IN}		—			—	4	10	pF
Output capacitance		C_{OUT}		—			—	6	—	pF
Power dissipation capacitance	74VHCT125AFT	C_{PD}	(Note 2)	—			—	14	—	pF
	74VHCT126AFT						—	15	—	

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.

$$I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/4 \text{ (per gate)}$$

11.5. AC Characteristics

(Unless otherwise specified, $T_a = -40\text{ to }85\text{ }^{\circ}\text{C}$, Input: $t_r = t_f = 3\text{ ns}$)

Characteristics	Symbol	Note	Test Condition	V_{CC} (V)	C_L (pF)	Min	Max	Unit
Propagation delay time	t_{PLH}, t_{PHL}		—	5.0 ± 0.5	15	1.0	6.5	ns
					50	1.0	8.5	
3-state output enable time	t_{PZL}, t_{PZH}		$R_L = 1\text{ k}\Omega$	5.0 ± 0.5	15	1.0	6.0	ns
					50	1.0	8.0	
3-state output disable time	t_{PLZ}, t_{PHZ}		$R_L = 1\text{ k}\Omega$	5.0 ± 0.5	50	1.0	10.0	ns
Output skew	t_{osLH}, t_{osHL}	(Note 1)	—	5.0 ± 0.5	50	—	1.0	ns
Input capacitance	C_{IN}		—			—	10	pF

Note 1: Parameter guaranteed by design. ($t_{osLH} = |t_{PLHM} - t_{PLHN}|$, $t_{osHL} = |t_{PHLM} - t_{PHLN}|$)

11.6. AC Characteristics

(Unless otherwise specified, $T_a = -40\text{ to }125\text{ }^{\circ}\text{C}$, Input: $t_r = t_f = 3\text{ ns}$)

Characteristics	Symbol	Note	Test Condition	V_{CC} (V)	C_L (pF)	Min	Max	Unit
Propagation delay time	t_{PLH}, t_{PHL}		—	5.0 ± 0.5	15	1.0	7.0	ns
					50	1.0	9.5	
3-state output enable time	t_{PZL}, t_{PZH}		$R_L = 1\text{ k}\Omega$	5.0 ± 0.5	15	1.0	6.5	ns
					50	1.0	9.0	
3-state output disable time	t_{PLZ}, t_{PHZ}		$R_L = 1\text{ k}\Omega$	5.0 ± 0.5	50	1.0	11.0	ns
Output skew	t_{osLH}, t_{osHL}	(Note 1)	—	5.0 ± 0.5	50	—	1.0	ns
Input capacitance	C_{IN}		—			—	10	pF

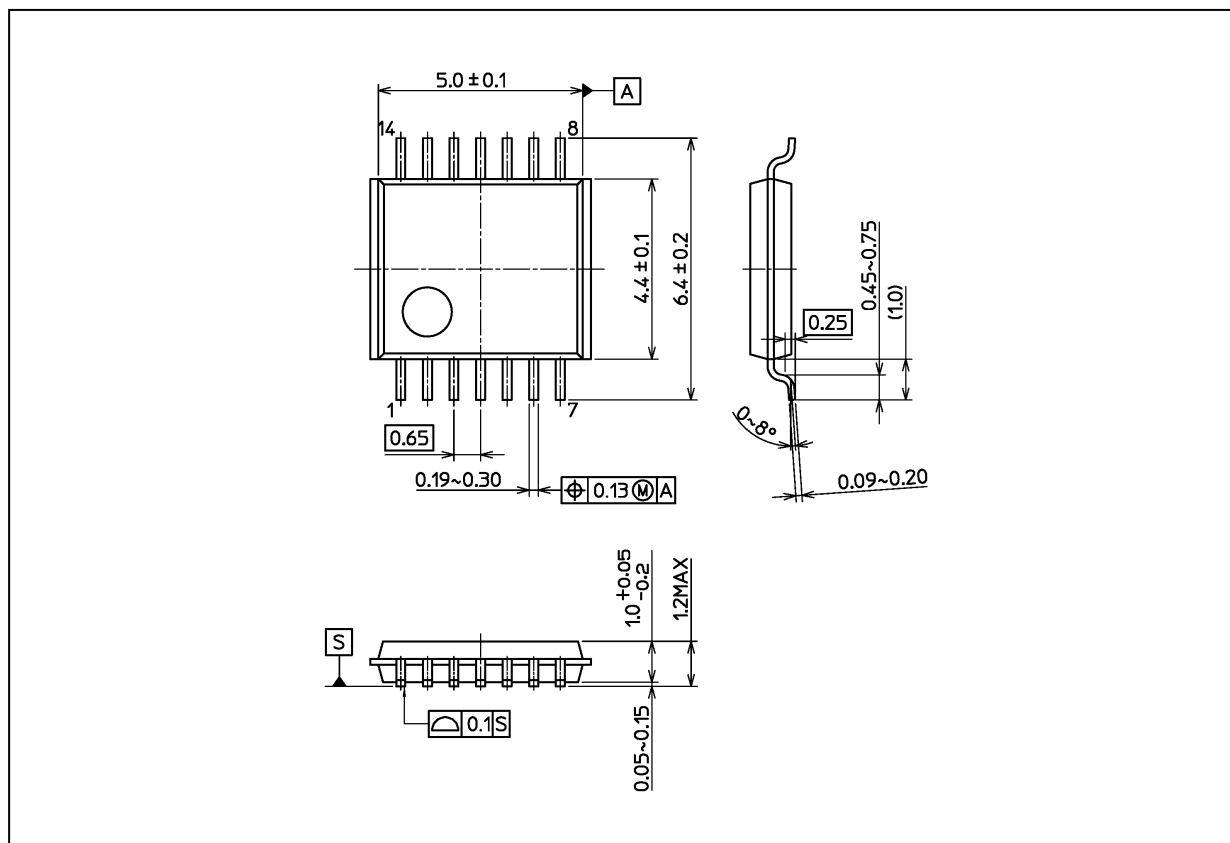
Note 1: Parameter guaranteed by design. ($t_{osLH} = |t_{PLHM} - t_{PLHN}|$, $t_{osHL} = |t_{PHLM} - t_{PHLN}|$)

11.7. Noise Characteristics (Unless otherwise specified, $T_a = 25\text{ }^{\circ}\text{C}$, 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}	$C_L = 50\text{ pF}$	5.0	0.5	0.8	V
Quiet output minimum dynamic V_{OL}	V_{OLV}	$C_L = 50\text{ pF}$	5.0	-0.5	-0.8	
Minimum high-level dynamic input voltage	V_{IHD}	$C_L = 50\text{ pF}$	5.0	—	2.0	
Maximum low-level dynamic input voltage	V_{ILD}	$C_L = 50\text{ pF}$	5.0	—	0.8	

Package Dimensions

Unit: mm



Weight: 0.054 g (typ.)

Package Name(s)
Nickname: TSSOP14B

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