CMOS Digital Integrated Circuits Silicon Monolithic

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. There 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 $V_{CC} = 5.0 \text{ V}$
- (4) Quiescent supply current: $I_{CC} = 4.0 \mu A \text{ (max)}$ at $T_a = 25 \text{ °C}$
- (5) Compatible with TTL input: $V_{IL} = 0.8 \text{ V(max)}$

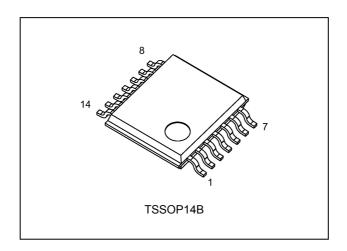
$$V_{IH} = 2.0 \text{ V(min)}$$

- (6) Power down protection is provided on all inputs and outputs.
- (7) Balanced propagation delays: $t_{PLH} \approx t_{PHL}$
- (8) Low noise: $V_{OLP} = 0.8 \text{ V (max)}$
- (9) Pin and function compatible with the 74 series

(ACT/HCT/AHCT etc.) 125/126 type.

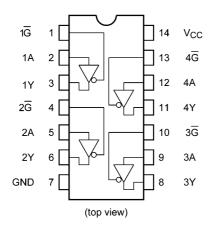
Note 1: This device is compliant with the reliability requirements of AEC-Q100. For details, contact your Toshiba sales representative.

4. Packaging

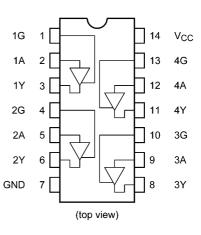


5. Pin Assignment

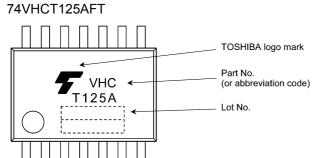
74VHCT125AFT



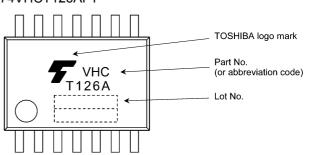
74VHCT126AFT



6. Marking



74VHCT126AFT



7. IEC Logic Symbol

74VHCT125AFT

1G (1) N	EN	⊳	∇	(3) 1Y
$2\overline{G} - (4)$ $2A - (5)$				<u>(6)</u> 2Y
3G (10) N				(8) 3Y
4 G (13) 4A (12)				<u>(11)</u> 4Y

74VHCT126AFT

1G (1) 1A (2) 2G (4) 2A (5) 3G (10)	EN	Þ	∇	(3) 1Y (6) 2Y (8) 3Y
2G (F)				(6) 2Y
2A (10)				
3A (9)				(8) 3Y
4G (13)				(11)
4A (12)				(11) 4Y



8. Truth Table

Input G (74VHCT125AFT)	Input G (74VHCT126AFT)	· I Inniit Δ I	
Н	L	X	Z
L	Н	L	L
L	Н	Н	Н

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	Icc		±50	mA
Power dissipation	P _D	(Note 4)	180	mW
Storage temperature	T _{stg}		-65 to 150	°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: $V_{OUT} < GND$, $V_{OUT} > V_{CC}$

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 mW/°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	°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, $T_a = 25$ °C)

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

11.2. DC Characteristics (Unless otherwise specified, T_a = -40 to 85 °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 μA	4.5	4.4		V
			I_{OH} = -8 mA	4.5	3.80	_	
Low-level output voltage	V_{OL}	V _{IN} = V _{IH} or V _{IL}	I_{OL} = 50μ A	4.5	ı	0.1	V
			I _{OL} = 8 mA	4.5		0.44	
3-state output OFF-state leakage current	I _{OZ}	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = V_{CC} \text{ or GND}$		5.5		±2.50	μА
Input leakage current	I _{IN}	V _{IN} = 5.5 V or GND		0 to 5.5	_	±1.0	μА
Quiescent supply current	Icc	V _{IN} = V _{CC} or GND	V _{IN} = V _{CC} or GND		_	40.0	μА
Quiescent supply current	I _{CCT}	Per input: V _{IN} = 3.4 V Other input: V _{CC} or GND		5.5	_	1.50	mA
Output leakage current (Power-OFF)	I _{OPD}	V _{OUT} = 5.5 V		0	_	5.0	μА

11.3. DC Characteristics (Unless otherwise specified, T_a = -40 to 125 °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 μA	4.5	4.4	_	V
			I _{OH} = -8 mA	4.5	3.70	_	
Low-level output voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 50 μA	4.5	_	0.1	V
			I _{OL} = 8 mA	4.5	_	0.55	
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	μА
Input leakage current	I _{IN}	V _{IN} = 5.5 V or GND		0 to 5.5	_	±2.0	μА
Quiescent supply	I _{CC}	V _{IN} = V _{CC} or GND		5.5	_	80.0	μА
current	Per input: V _{IN} = 3.4 V Other input: V _{CC} or GND			5.5	_	1.50	mA
Output leakage current (Power-OFF)	I _{OPD}	V _{OUT} = 5.5 V		0	_	20.0	μА



11.4. AC Characteristics (Unless otherwise specified, $T_a = 25$ °C, Input: $t_r = t_f = 3$ ns)

Characteristics	Part Number	Symbol	Note	Test Condition	V _{CC} (V)	C _L (pF)	Min	Тур.	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}		$R_L = 1 k\Omega$	5.0 ± 0.5	15	_	3.6	5.1	ns
						50	_	5.1	7.1	
3-state output disable time		t_{PLZ}, t_{PHZ}		$R_L = 1 k\Omega$	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	74VHCT125AFT	C _{PD}	(Note 2)	_		Ī		14		pF
capacitance	74VHCT126AFT						_	15		

Note 1: Parameter guaranteed by design. $(t_{osLH} = |t_{PLH}m-t_{PLH}n|, t_{osHL} = |t_{PHL}m-t_{PHL}n|)$

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.

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

11.5. AC Characteristics (Unless otherwise specified, $T_a = -40$ to 85 °C, Input: $t_r = t_f = 3$ 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}		$R_L = 1 k\Omega$	5.0 ± 0.5	15	1.0	6.0	ns
					50	1.0	8.0	
3-state output disable time	t _{PLZ} ,t _{PHZ}		$R_L = 1 k\Omega$	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. $(t_{osLH} = |t_{PLH}m-t_{PLH}n|, t_{osHL} = |t_{PHL}m-t_{PHL}n|)$

11.6. AC Characteristics (Unless otherwise specified, $T_a = -40$ to 125 °C, Input: $t_r = t_f = 3$ 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}		$R_L = 1 k\Omega$	5.0 ± 0.5	15	1.0	6.5	ns
					50	1.0	9.0	
3-state output disable time	t_{PLZ}, t_{PHZ}		$R_L = 1 k\Omega$	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} = $|t_{PLH}m-t_{PLH}n|$, t_{osHL} = $|t_{PHL}m-t_{PHL}n|$)

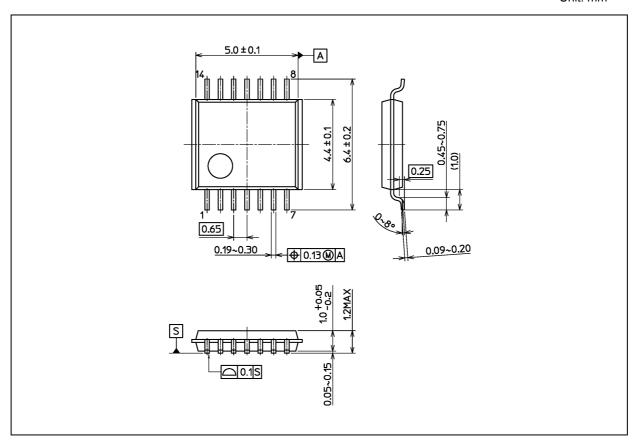
11.7. Noise Characteristics (Unless otherwise specified, $T_a = 25$ °C, Input: $t_f = t_f = 3$ ns)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Тур.	Limit	Unit
Quiet output maximum dynamic V _{OL}	V _{OLP}	C _L = 50 pF	5.0	0.5	0.8	٧
Quiet output minimum dynamic V _{OL}	V _{OLV}	C _L = 50 pF	5.0	-0.5	-0.8	
Minimum high-level dynamic input voltage	V _{IHD}	C _L = 50 pF	5.0	_	2.0	
Maximum low-level dynamic input voltage	V _{ILD}	C _L = 50 pF	5.0	_	0.8	



Package Dimensions

Unit: mm



Weight: 0.054 g (typ.)

	Package Name(s)
Nickname: TSSOP14B	



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