

TC74VHCV17FT, TC74VHCV17FK

Hex Schmitt Buffer

The TC74VHCV17 is an advanced high speed CMOS SCHMITT BUFFER 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.

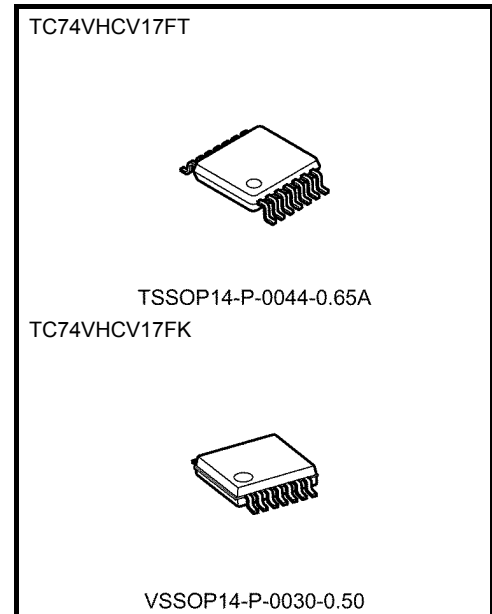
Input pin have hysteresis between the positive-going and negative-going thresholds. Thus the TC74VHCV17 is capable of squaring up transitions of slowly changing input signals such as line receivers.

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: $V_{CC}=0V$.

Features

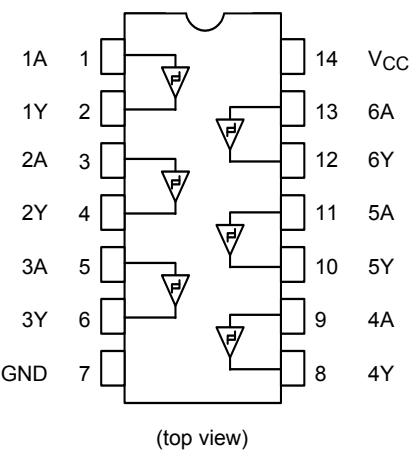
- High speed: $t_{pd} = 4.5 \text{ ns}$ (typ.) at $V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 2 \mu\text{A}$ (max) at $T_a = 25^\circ\text{C}$
- Wide operating voltage range: $V_{CC(\text{opr})} = 1.8 \text{ V}$ to 5.5 V
- Output current: $|I_{OH}|/I_{OL} = 16 \text{ mA}$ (min) ($V_{CC} = 4.5 \text{ V}$)
- Available in TSSOP and VSSOP (US)
- Power-down protection provided on all inputs and outputs



Weight

TSSOP14-P-0044-0.65A	: 0.06 g (typ.)
VSSOP14-P-0030-0.50	: 0.02 g (typ.)

Pin Assignment



Truth Table

A	Y
L	L
H	H

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}	-50	mA
Output diode current	I_{OK}	± 50 (Note 4)	mA
DC output current	I_{OUT}	± 50	mA
Power dissipation	P_D	180	mW
DC V_{CC} /ground current	I_{CC}/I_{GND}	± 100	mA
Storage temperature	T_{stg}	-65 to 150	°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: $V_{CC}=0V$

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
Power supply voltage	V_{CC}	1.8 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	°C
Input rise and fall time	dt/dv	0 to 20($V_{CC}=3.3 \pm 0.3V$) 0 to 1($V_{CC}=5 \pm 0.5V$)	ms/V

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: $V_{CC}=0V$

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	—		1.8	—	—	1.65	—	1.65	V
				2.3	—	—	1.85	—	1.85	
				3.0	—	—	2.20	—	2.20	
				4.5	—	—	3.15	—	3.15	
				5.5	—	—	3.85	—	3.85	
Negative threshold voltage	V _N	—		1.8	0.15	—	—	0.15	—	
				2.3	0.45	—	—	0.45	—	
				3.0	0.90	—	—	0.90	—	
				4.5	1.35	—	—	1.35	—	
				5.5	1.65	—	—	1.65	—	
Hysteresis voltage	V _H	—		1.8	0.15	—	1.05	0.15	1.05	V
				2.3	0.20	—	1.10	0.20	1.10	
				3.0	0.30	—	1.20	0.30	1.20	
				4.5	0.40	—	1.40	0.40	1.40	
				5.5	0.50	—	1.60	0.50	1.60	
High-level output voltage	V _{OH}	V _{IN} = V _{IH}	I _{OH} = -50 μA	1.8	1.7	1.8	—	1.7	—	V
				3.0	2.9	3.0	—	2.9	—	
				4.5	4.4	4.5	—	4.4	—	
			I _{OH} = -8 mA I _{OH} = -16 mA	3.0	2.58	—	—	2.48	—	
				4.5	3.94	—	—	3.80	—	
Low-level output voltage	V _{OL}	V _{IN} = V _{IL}	I _{OL} = 50 μA	1.8	—	0.0	0.1	—	0.1	
				3.0	—	0.0	0.1	—	0.1	
				4.5	—	0.0	0.1	—	0.1	
			I _{OL} = 8 mA I _{OL} = 16 mA	3.0	—	—	0.36	—	0.44	
				4.5	—	—	0.44	—	0.55	
Power-off leakage current	I _{OFF}	V _{IN} /V _{OUT} = 5.5 V		0	—	—	0.5	—	5.0	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

AC Characteristics (input: $t_r = t_f = 3 \text{ ns}$)

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	tpLH tpHL	—	2.5 ± 0.2	15	—	9.3	19.7	1.0	22.0	ns
				50	—	12.4	24.0	1.0	27.0	
			3.3 ± 0.3	15	—	6.5	12.8	1.0	15.0	
				50	—	8.7	16.3	1.0	18.5	
			5.0 ± 0.5	15	—	4.5	8.6	1.0	10.0	
				50	—	6.1	10.6	1.0	12.0	
Input capacitance	C _{IN}	—			—	4	10	—	10	pF
Power dissipation capacitance	C _{PD}	(Note)			—	25	—	—	—	pF

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

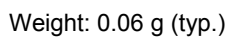
Average operating current can be obtained by the equation:

$$I_{CC(\text{opr})} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/6 \text{ (per gate)}$$

Noise Characteristics (input: $t_r = t_f = 3 \text{ ns}$)

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	3.3 5.0	0.3 0.7	— —	V
Quiet output minimum dynamic V _{OL}	V _{OLV}	C _L = 50 pF	3.3 5.0	-0.1 -0.2	— —	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

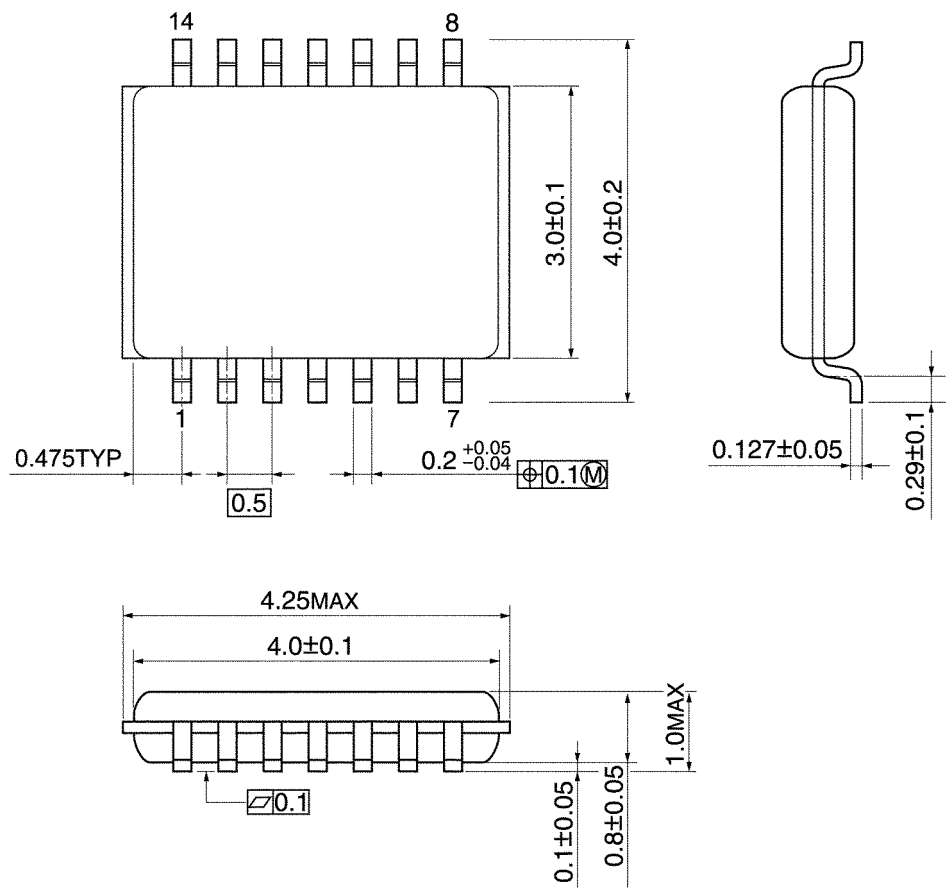
Unit: mm



Package Dimensions

VSSOP14-P-0030-0.50

Unit: mm



Weight: 0.02 g (typ.)

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