

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74VHC14F, TC74VHC14FK**Hex Schmitt Inverter**

The TC74VHC14 is an advanced high speed CMOS Schmitt INVERTER fabricated with silicon gate C²MOS technology.

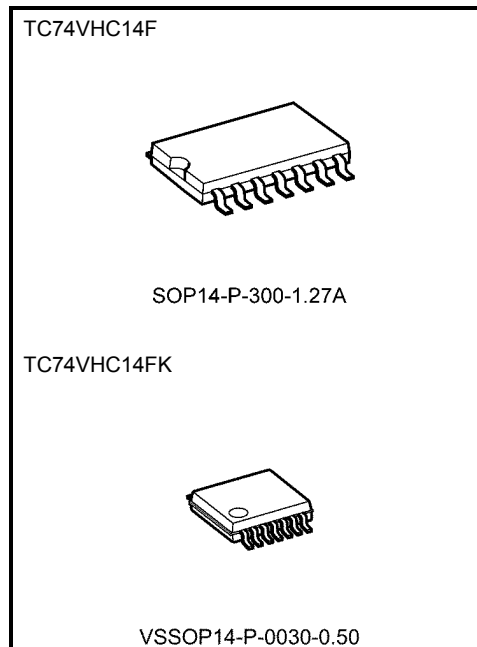
It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

Pin configuration and function are the same as the TC74VHC04 but the inputs have hysteresis and with its schmitt trigger function, the TC74VHC14 can be used as a line receivers which will receive slow input signals.

An input protection circuit ensures that 0 to 5.5 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

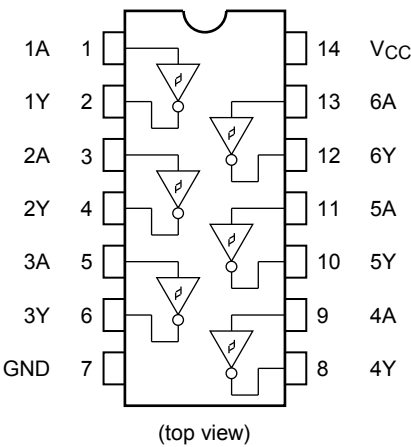
- High speed: $t_{pd} = 5.5 \text{ ns}$ (typ.) at $V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 2 \mu\text{A}$ (max) at $T_a = 25^\circ\text{C}$
- Power down protection is provided on all inputs.
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC}(\text{opr}) = 2 \text{ V}$ to 5.5 V
- Low noise: $V_{OLP} = 0.8 \text{ V}$ (max)
- Pin and function compatible with 74ALS14

**Weight**

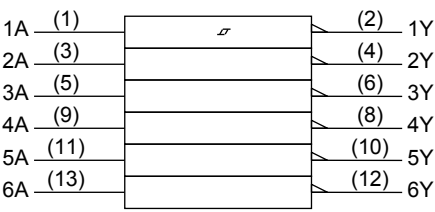
SOP14-P-300-1.27A	: 0.18 g (typ.)
VSSOP14-P-0030-0.50	: 0.02 g (typ.)

Start of commercial production
1991-05

Pin Assignment



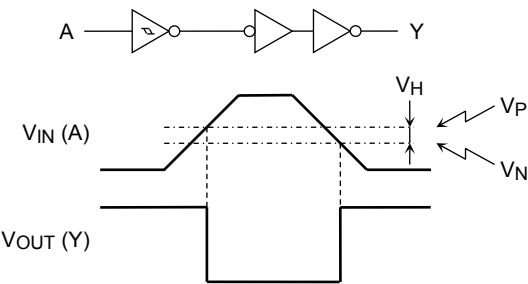
IEC Logic Symbol



Truth Table

A	Y
L	H
H	L

System Diagram, Waveform



Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage range	VCC	-0.5 to 7.0	V
DC input voltage	VIN	-0.5 to 7.0	V
DC output voltage	VOUT	-0.5 to VCC + 0.5	V
Input diode current	IIK	-20	mA
Output diode current	IOK	±20	mA
DC output current	IOUT	±25	mA
DC VCC/ground current	ICC	±50	mA
Power dissipation	PD	180	mW
Storage temperature	Tstg	-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).

Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V _{CC}	2.0 to 5.5	V
Input voltage	V _{IN}	0 to 5.5	V
Output voltage	V _{OUT}	0 to V _{CC}	V
Operating temperature	T _{opr}	-40 to 85	°C

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.

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit	
				VCC (V)	Min	Typ.	Max	Min		Max
Positive threshold voltage	VP	—		3.0 4.5 5.5	— — —	— — —	2.20 3.15 3.85	— — —	2.20 3.15 3.85	V
Negative threshold voltage	VN	—		3.0 4.5 5.5	0.90 1.35 1.65	— — —	— — —	0.90 1.35 1.65	— — —	V
Hysteresis voltage	VH	—		3.0 4.5 5.5	0.30 0.40 0.50	— — —	1.20 1.40 1.60	0.30 0.40 0.50	1.20 1.40 1.60	V
High-level output voltage	VOH	VIN = VIL	IOH = -50 μA	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	—	
			IOH = -4 mA		3.0	2.58	—	—	2.48	
IOH = -8 mA		4.5	3.94	—	—	3.80	—			
Low-level output voltage	VOL	VIN = VIH	IOL = 50 μA	2.0	—	0.0	0.1	—	0.1	V
				3.0	—	0.0	0.1	—	0.1	
				4.5	—	0.0	0.1	—	0.1	
			IOL = 4 mA		3.0	—	—	0.36	—	
IOL = 8 mA		4.5	—	—	0.36	—	0.44			
Input leakage current	IIN	VIN = 5.5 V or GND		0 to 5.5	—	—	±0.1	—	±1.0	μA
Quiescent supply current	ICC	VIN = VCC 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	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	pF
Power dissipation capacitance	CPD	(Note)		—	21	—	—	—	pF

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

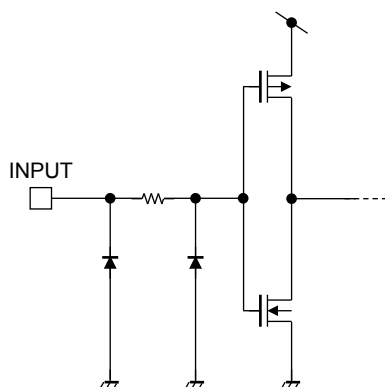
Average operating current can be obtained by the equation:

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

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	5.0	0.4 0.8	V
Quiet output minimum dynamic V _{OL}	V _{OLV}	C _L = 50 pF	5.0	-0.4 -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

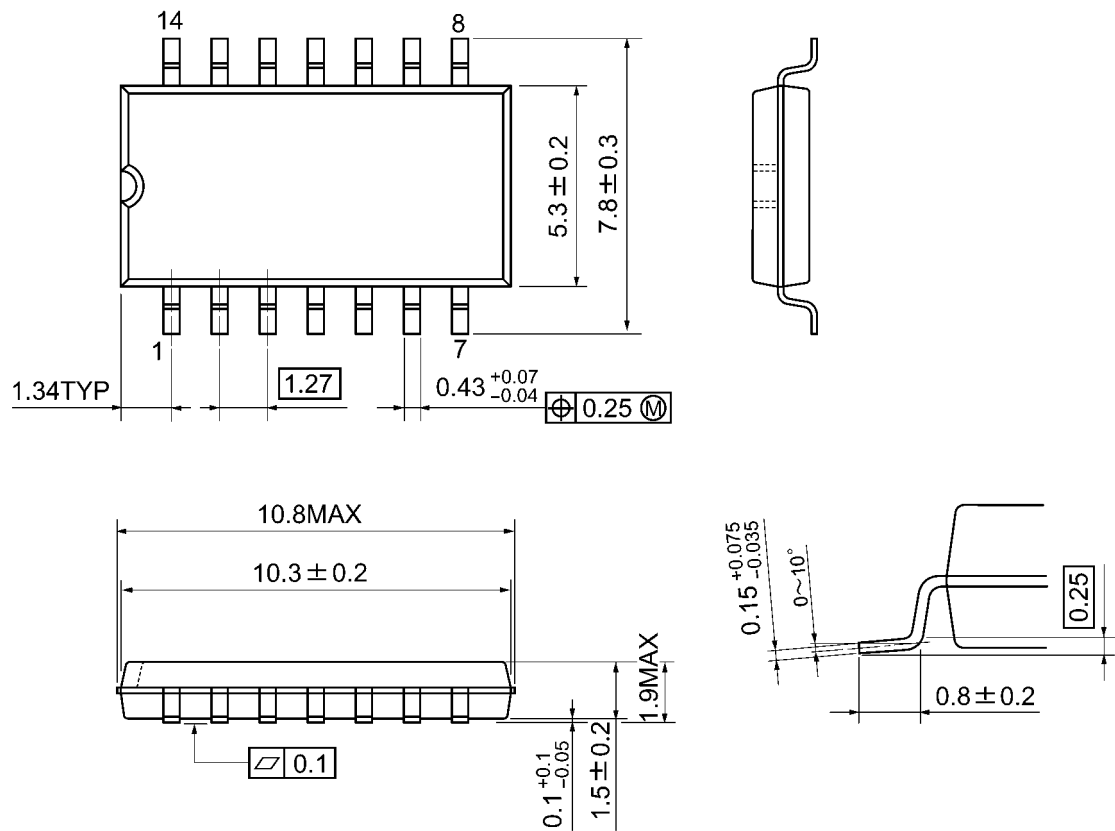
Input Equivalent Circuit



Package Dimensions

SOP14-P-300-1.27A

Unit: mm

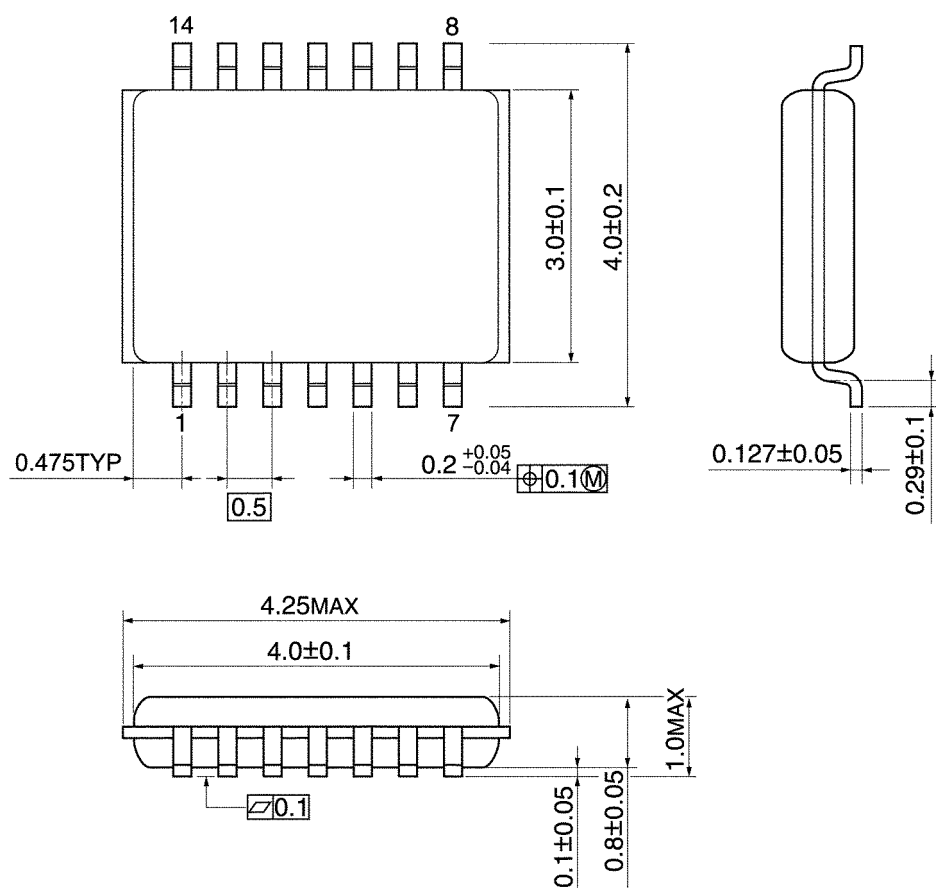


Weight: 0.18 g (typ.)

Package Dimensions

VSSOP14-P-0030-0.50

Unit: mm



Weight: 0.02 g (typ.)

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