

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74VHC00F, TC74VHC00FK

Quad 2-Input NAND Gate

The TC74VHC00 is an advanced high speed CMOS 2-INPUT NAND GATE fabricated with silicon gate C²MOS technology.

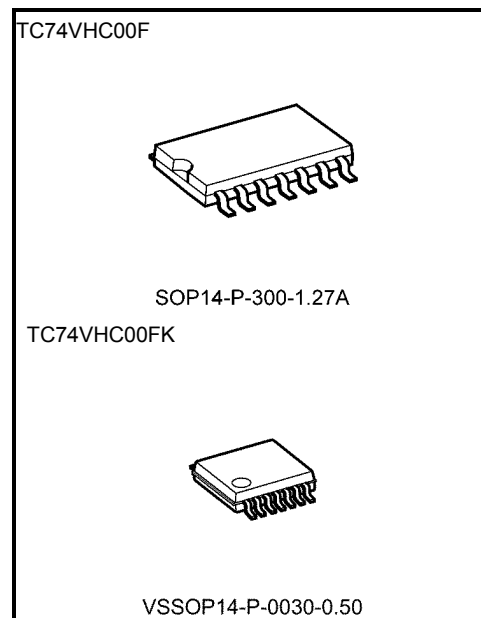
It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

The internal circuit is composed of 3 stages including buffer output, which provide high noise immunity and stable output.

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

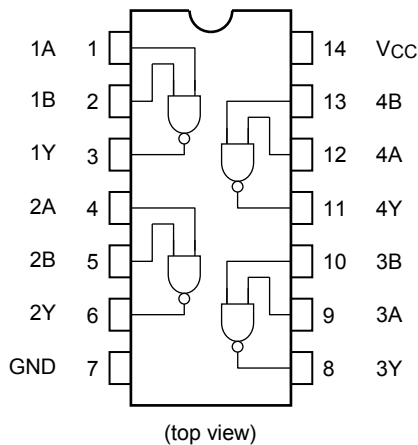
- High speed: $t_{pd} = 3.7 \text{ ns (typ.)}$ at $V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 2 \text{ }\mu\text{A (max)}$ at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC} \text{ (min)}$
- Power down protection is provided on all inputs.
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC} \text{ (opr)} = 2 \text{ to } 5.5 \text{ V}$
- Low noise: $V_{OLP} = 0.8 \text{ V (max)}$
- Pin and function compatible with 74ALS00



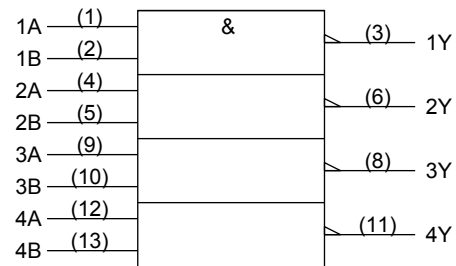
Weigh	
SOP14-P-300-1.27A	: 0.18 g (typ.)
VSSOP14-P-0030-0.50	: 0.02 g (typ.)

Start of commercial production
1991-05

Pin Assignment



IEC Logic Symbol



Truth Table

A	B	Y
L	L	H
L	H	H
H	L	H
H	H	L

Absolute Maximum Ratings (Note)

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 V _{CC} + 0.5	V
Input diode current	I _{IK}	-20	mA
Output diode current	I _{OK}	±20	mA
DC output current	I _O UT	±25	mA
DC V _{CC} /ground current	I _{CC}	±50	mA
Power dissipation	P _D	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).

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
Input rise and fall time	dt/dv	0 to 100 (V _{CC} = 3.3 ± 0.3 V) 0 to 20 (V _{CC} = 5 ± 0.5 V)	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.

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	
High-level input voltage	V _{IH}	—	2.0 3.0 to 5.5	1.50 V _{CC} × 0.7	— —	— —	1.50 V _{CC} × 0.7	— —	V	
Low-level input voltage	V _{IL}	—	2.0 3.0 to 5.5	— —	— —	0.50 V _{CC} × 0.3	— —	0.50 V _{CC} × 0.3	V	
High-level output voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -50 μA	2.0 3.0 4.5	1.9 2.9 4.4	2.0 3.0 4.5	— — —	1.9 2.9 4.4	— — —	V
			I _{OH} = -4 mA	3.0	2.58	—	—	2.48	—	
			I _{OH} = -8 mA	4.5	3.94	—	—	3.80	—	
Low-level output voltage	V _{OL}	V _{IN} = V _{IH}	I _{OL} = 50 μA	2.0 3.0 4.5	— — —	0.0 0.0 0.0	0.1 0.1 0.1	— — —	0.1 0.1 0.1	V
			I _{OL} = 4 mA	3.0	—	—	0.36	—	0.44	
			I _{OL} = 8 mA	4.5	—	—	0.36	—	0.44	
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		
			VCC (V)	CL (pF)	Min	Typ.	Max		Min	Max
Propagation delay time	t_{pLH} t_{pHL}	—	3.3 ± 0.3	15	—	5.5	7.9	1.0	9.5	ns
				50	—	8.0	11.4	1.0	13.0	
			5.0 ± 0.5	15	—	3.7	5.5	1.0	6.5	
				50	—	5.2	7.5	1.0	8.5	
Input capacitance	C_{IN}	—	—	4	10	—	10	pF		
Power dissipation capacitance	CPD	(Note)	—	19	—	—	—	pF		

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

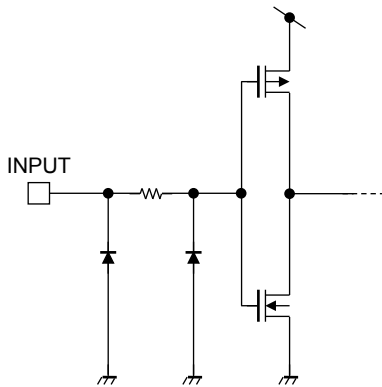
Average operating current can be obtained by the equation:

$$I_{CC}(\text{opr}) = CPD \cdot V_{CC} \cdot f_{IN} + I_{CC}/4 \text{ (per gate)}$$

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

Characteristics	Symbol	Test Condition	Ta = 25°C			Unit
			VCC (V)	Typ.	Limit	
Quiet output maximum dynamic VOL	VOLP	$C_L = 50 \text{ pF}$	5.0	0.3	0.8	V
Quiet output minimum dynamic VOL	VOLV	$C_L = 50 \text{ pF}$	5.0	-0.3	-0.8	V
Minimum high level dynamic input voltage	VIHD	$C_L = 50 \text{ pF}$	5.0	—	3.5	V
Maximum low level dynamic input voltage	VILD	$C_L = 50 \text{ pF}$	5.0	—	1.5	V

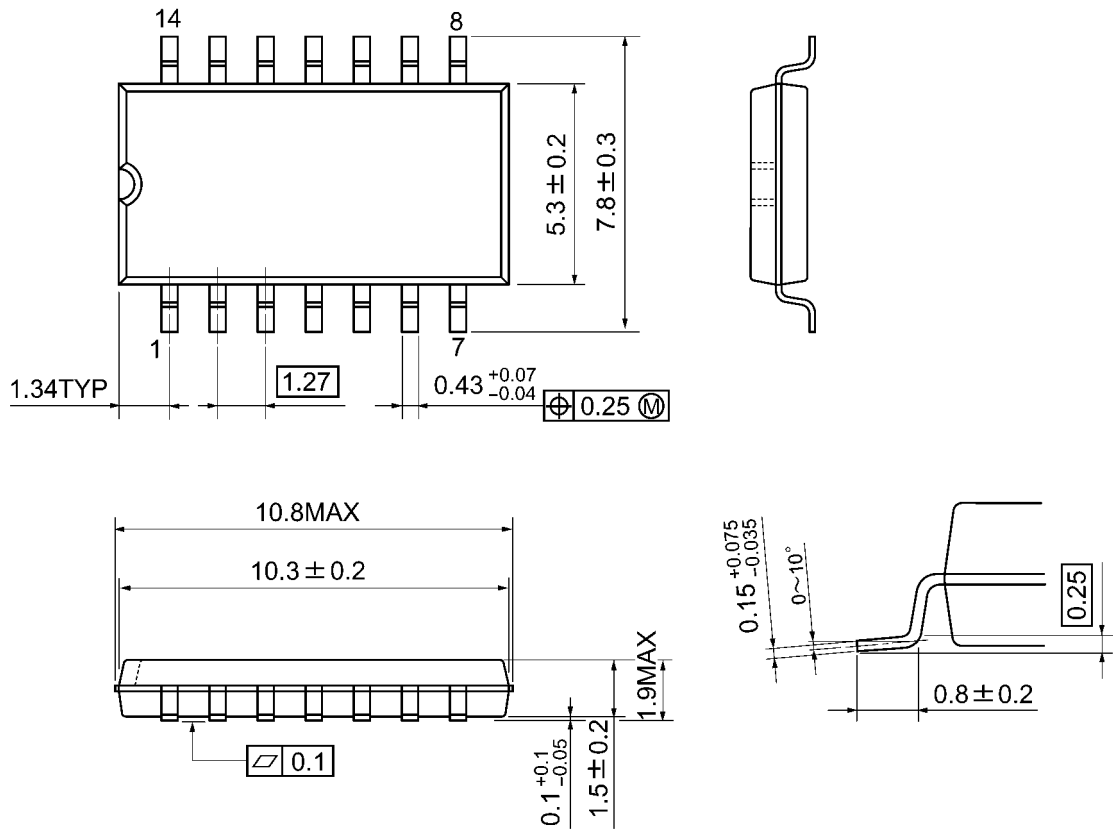
Input Equivalent Circuit



Package Dimensions

SOP14-P-300-1.27A

Unit: mm

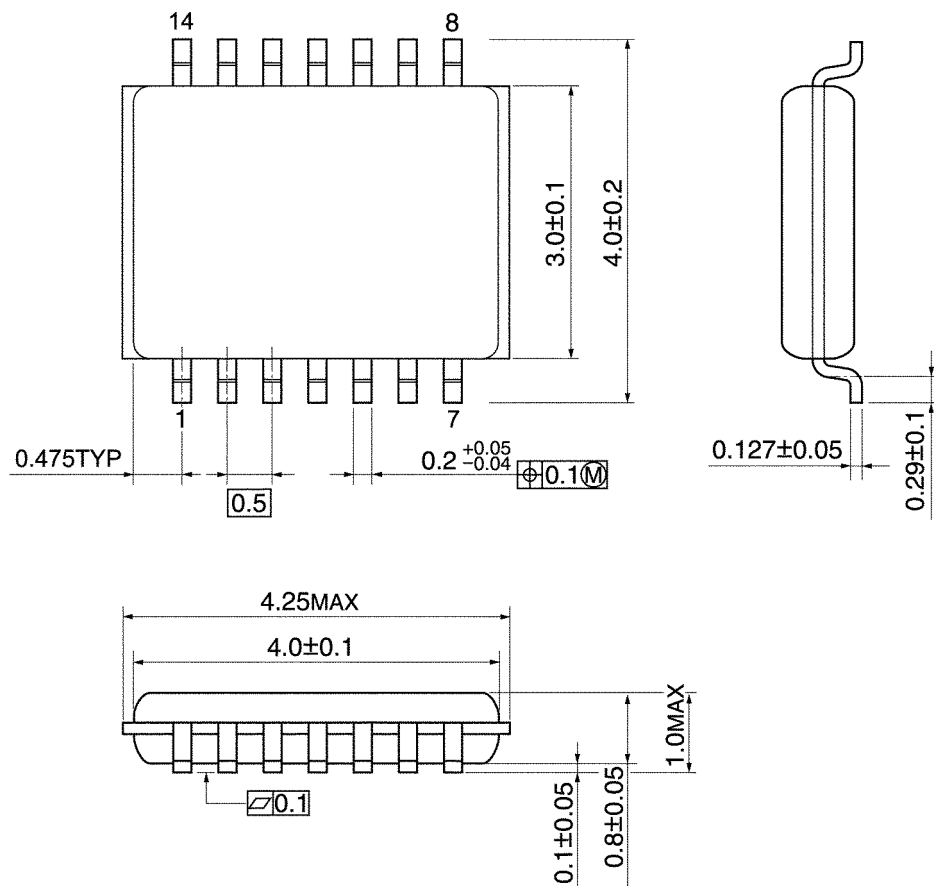


Weight: 0.18 g (typ.)

Package Dimensions

VSSOP14-P-0030-0.50

Unit: mm



Weight: 0.02 g (typ.)

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