

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC74VHC08F, TC74VHC08FK

## Quad 2-Input AND Gate

The TC74VHC08 is an advanced high speed CMOS 2-INPUT AND GATE fabricated with silicon gate C<sup>2</sup>MOS technology.

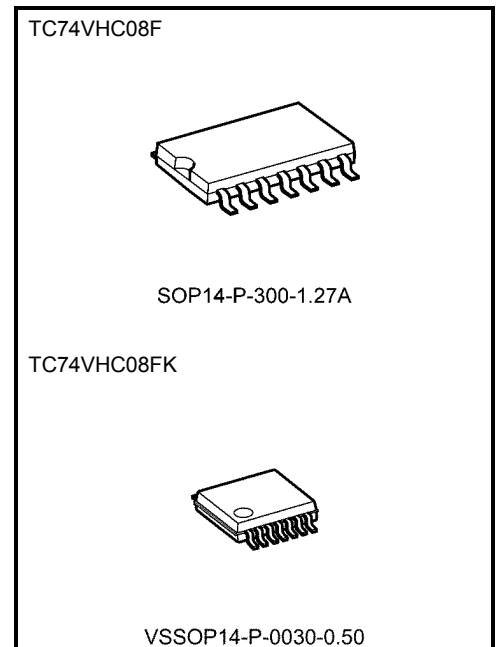
It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

The internal circuit is composed of 4 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:  $t_{pd} = 4.3 \text{ ns (typ.)}$  at  $V_{CC} = 5 \text{ V}$
- Low power dissipation:  $I_{CC} = 2 \mu\text{A (max)}$  at  $T_a = 25^\circ\text{C}$
- 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:  $V_{CC (opr)} = 2 \text{ V to } 5.5 \text{ V}$
- Low noise:  $V_{OLP} = 0.8 \text{ V (max)}$
- Pin and function compatible with 74ALS08

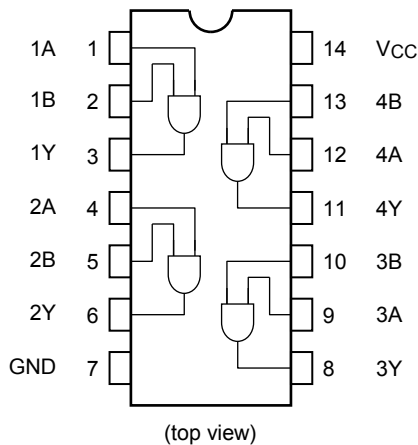


### Weight

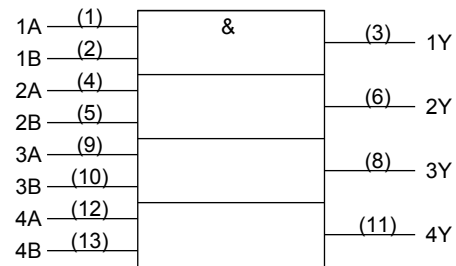
SOP14-P-300-1.27A	: 0.18 g (typ.)
VSSOP14-P-0030-0.50	: 0.02 g (typ.)

Start of commercial production  
1991-05

### Pin Assignment



### IEC Logic Symbol



### Truth Table

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

### 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	I <sub>IK</sub>	-20	mA
Output diode current	I <sub>OK</sub>	±20	mA
DC output current	I <sub>OUT</sub>	±25	mA
DC V <sub>CC</sub> /ground current	I <sub>CC</sub>	±50	mA
Power dissipation	P <sub>D</sub>	180	mW
Storage temperature	T <sub>stg</sub>	-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 ( $V_{CC} = 3.3 \pm 0.3$ V) 0 to 20 ( $V_{CC} = 5 \pm 0.5$ 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		$T_a = 25^\circ\text{C}$			$T_a = -40 \text{ to } 85^\circ\text{C}$		Unit	
				$V_{CC}$ (V)	Min	Typ.	Max	Min		Max
High-level input voltage	$V_{IH}$	—	2.0 3.0 to 5.5	1.50 $V_{CC} \times 0.7$	— —	— —	1.50 $V_{CC} \times 0.7$	— —	V	
Low-level input voltage	$V_{IL}$	—	2.0 3.0 to 5.5	— —	— —	0.50 $V_{CC} \times 0.3$	— —	0.50 $V_{CC} \times 0.3$	V	
High-level output voltage	$V_{OH}$	$V_{IN} = V_{IH}$	$I_{OH} = -50 \mu\text{A}$	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
			$I_{OH} = -4 \text{ mA}$	3.0	2.58	—	—	2.48	—	
			$I_{OH} = -8 \text{ mA}$	4.5	3.94	—	—	3.80	—	
Low-level output voltage	$V_{OL}$	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 50 \mu\text{A}$	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
			$I_{OL} = 4 \text{ mA}$	3.0	—	—	0.36	—	0.44	
			$I_{OL} = 8 \text{ mA}$	4.5	—	—	0.36	—	0.44	
Input leakage current	$I_{IN}$	$V_{IN} = 5.5 \text{ V or GND}$	0 to 5.5	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu\text{A}$	
Quiescent supply current	$I_{CC}$	$V_{IN} = V_{CC} \text{ or GND}$	5.5	—	—	2.0	—	20.0	$\mu\text{A}$	

### 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	$t_{pLH}$ $t_{pHL}$	—	$3.3 \pm 0.3$	15	—	6.2	8.8	1.0	10.5	ns
				50	—	8.7	12.3	1.0	14.0	
			$5.0 \pm 0.5$	15	—	4.3	5.9	1.0	7.0	
				50	—	5.8	7.9	1.0	9.0	
Input capacitance	$C_{IN}$	—	—	4	10	—	10	pF		
Power dissipation capacitance	CPD	(Note)	—	18	—	—	—	pF		

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

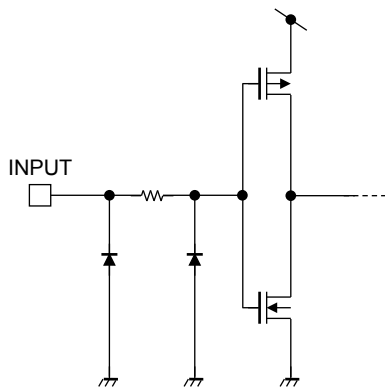
Average operating current can be obtained by the equation:

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

### 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

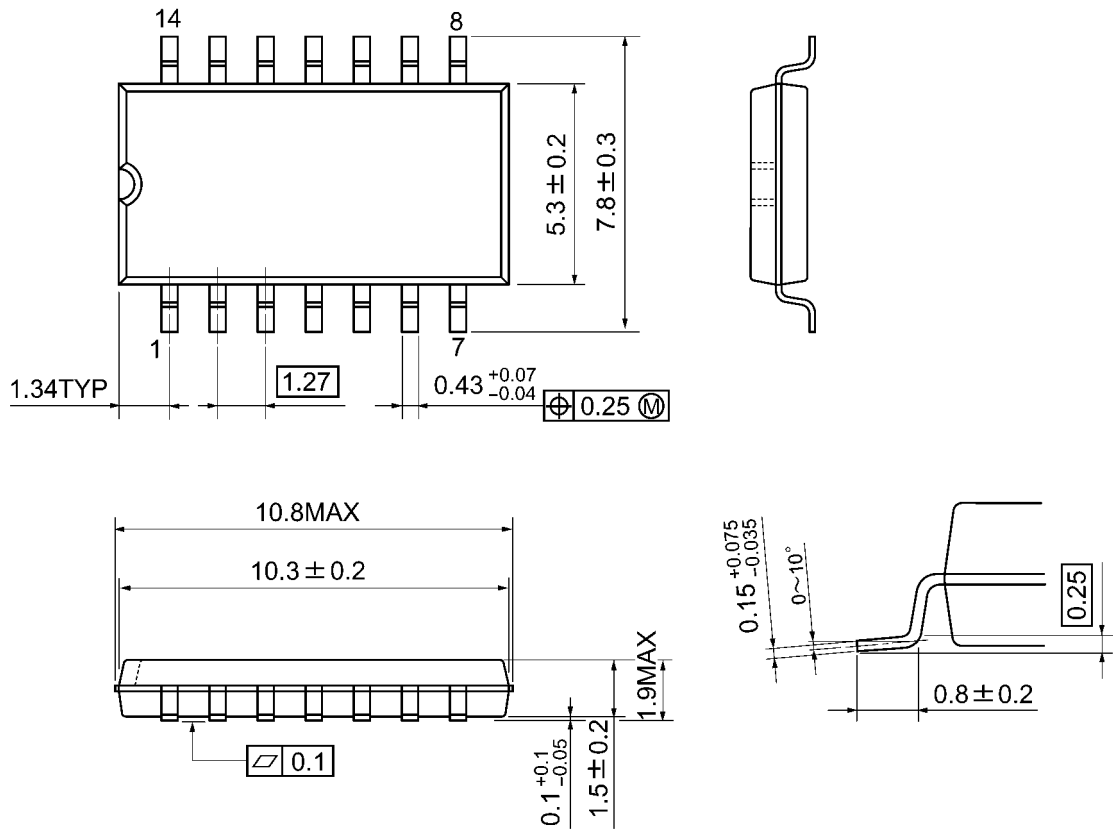
### Input Equivalent Circuit



### Package Dimensions

SOP14-P-300-1.27A

Unit: mm

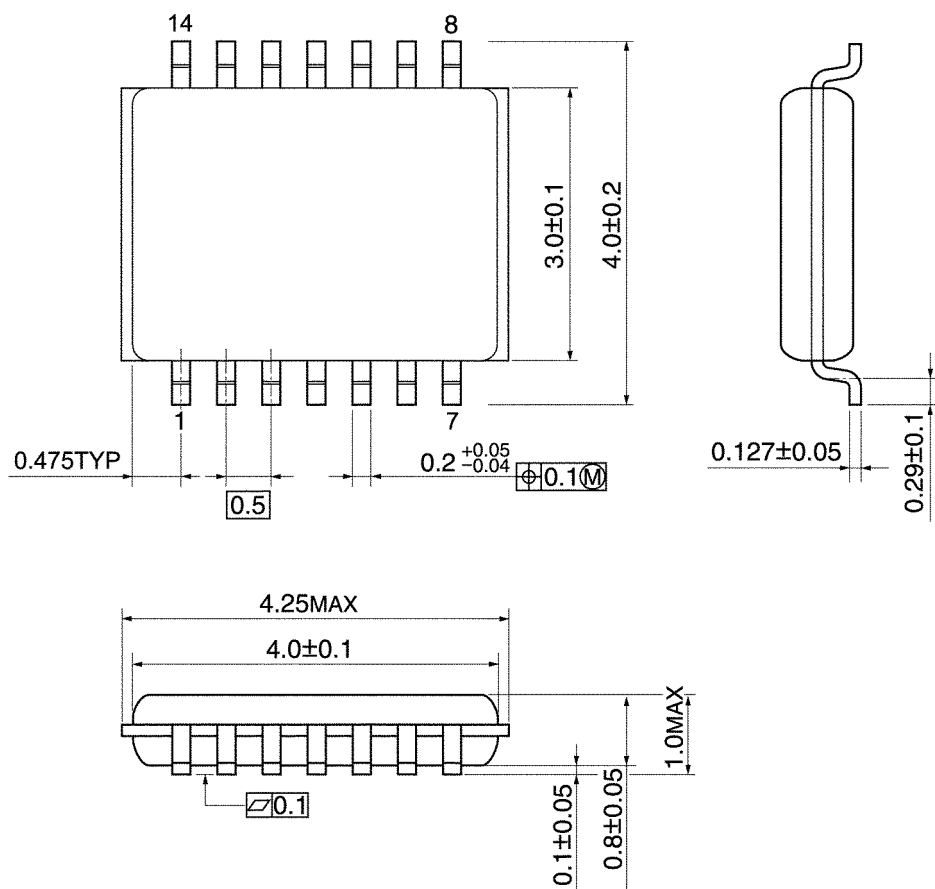


Weight: 0.18 g (typ.)

### Package Dimensions

VSSOP14-P-0030-0.50

Unit: mm



Weight: 0.02 g (typ.)

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