TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC74VHC08F,TC74VHC08FN,TC74VHC08FT,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.

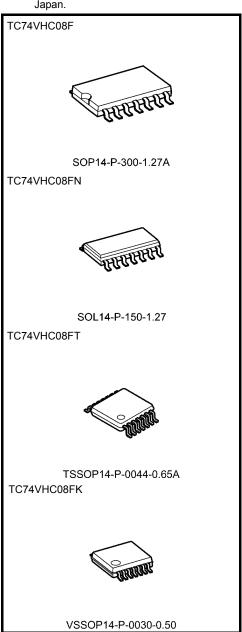
The internal circuit is composed of 4 stages including buffer output, which provide high noise immunity and stable output.

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:  $I_{CC} = 2 \mu A \text{ (max)}$  at  $T_{a} = 25 \text{°C}$
- High noise immunity: V<sub>NIH</sub> = V<sub>NIL</sub> = 28% V<sub>CC</sub> (min)
- Power down protection is provided on all inputs.
- Balanced propagation delays:  $t_{pLH} \simeq t_{pHL}$
- Wide operating voltage range:  $V_{CC(opr)} = 2 \text{ V to } 5.5 \text{ V}$
- Low noise: VOLP = 0.8 V (max)
- Pin and function compatible with 74ALS08

Note: xxxFN (JEDEC SOP) is not available in Japan.



Weight

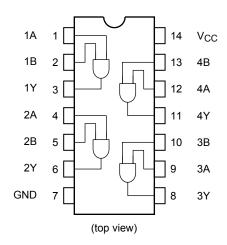
 SOP14-P-300-1.27A
 : 0.18 g (typ.)

 SOL14-P-150-1.27
 : 0.12 g (typ.)

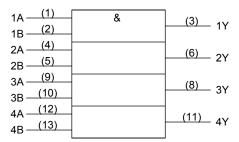
 TSSOP14-P-0044-0.65A
 : 0.06 g (typ.)

 VSSOP14-P-0030-0.50
 : 0.02 g (typ.)

#### **Pin Assignment**



## **IEC Logic Symbol**



#### **Truth Table**

Α	В	Υ
L	L	L
L	Н	L
Н	L	L
Н	Н	Н

## **Absolute Maximum Ratings (Note)**

Characteristics	Symbol	Rating	Unit
Supply voltage range	Vcc	−0.5 to 7.0	V
DC input voltage	V <sub>IN</sub>	-0.5 to 7.0	V
DC output voltage	V <sub>OUT</sub>	-0.5 to V <sub>CC</sub> + 0.5	V
Input diode current	I <sub>IK</sub>	-20	mA
Output diode current	lok	±20	mA
DC output current	lout	±25	mA
DC V <sub>cc</sub> /ground current	I <sub>CC</sub>	±50	mA
Power dissipation	PD	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 <sub>IN</sub>	0 to 5.5	V	
Output voltage	V <sub>OUT</sub>	0 to V <sub>CC</sub>	V	
Operating temperature	T <sub>opr</sub>	-40 to 85	°C	
Input rise and fall time	dt/dv	0 to 100 (V <sub>CC</sub> = $3.3 \pm 0.3$ V)	ns/V	
input rise and fail time	ui/uv	0 to 20 (V <sub>CC</sub> = $5 \pm 0.5$ V)		

Note: The operating ranges must be maintained to ensure the normal operation of the device. Unused inputs must be tied to either VCC or GND.

#### **Electrical Characteristics**

#### **DC Characteristics**

Characteristics Symbol		Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit	
	,			V <sub>CC</sub> (V)	Min	Тур.	Max	Min	Max	
High lavelings				2.0	1.50	_	_	1.50	_	
voltage	High-level input VIH		_		V <sub>CC</sub> × 0.7	_	_	V <sub>CC</sub> × 0.7	_	V
Low-level input						_	0.50	_	0.50	
voltage	$V_{IL}$		_	3.0 to 5.5	_	_	V <sub>CC</sub> × 0.3	_	V <sub>CC</sub> × 0.3	V
				2.0	1.9	2.0	_	1.9	_	
		V <sub>IN</sub> = V <sub>IH</sub>	$I_{OH} = -50 \mu A$	3.0	2.9	3.0	_	2.9	_	
High-level output voltage	$V_{OH}$			4.5	4.4	4.5	_	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		
				2.0		0.0	0.1	_	0.1	
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	$I_{OL} = 50 \mu A$	3.0	_	0.0	0.1	_	0.1	
Low-level output voltage	$V_{OL}$			4.5	_	0.0	0.1	_	0.1	V
			I <sub>OL</sub> = 4 mA	3.0	_	_	0.36	_	0.44	
			I <sub>OL</sub> = 8 mA	4.5	_	_	0.36	_	0.44	
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = 5.5 V or GND		0 to 5.5			±0.1	_	±1.0	μΑ
Quiescent supply current	Icc	V <sub>IN</sub> = V <sub>CC</sub> or GND		5.5	_	_	2.0	_	20.0	μΑ

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## AC Characteristics (input: $t_r = t_f = 3$ ns)

Characteristics Symbol	Symbol	Test Condition			Ta = 25°C			Ta = -40 to 85°C		Unit
	- <b>,</b>	,	V <sub>CC</sub> (V)	C <sub>L</sub> (pF)	Min	Тур.	Max	Min	Max	
time			3.3 ± 0.3	15	_	6.2	8.8	1.0	10.5	ns
	t <sub>pLH</sub> t <sub>pHL</sub>	_		50	_	8.7	12.3	1.0	14.0	
			5.0 ± 0.5	15	_	4.3	5.9	1.0	7.0	
				50	_	5.8	7.9	1.0	9.0	
Input capacitance	C <sub>IN</sub>		_		_	4	10	_	10	pF
Power dissipation capacitance	C <sub>PD</sub>			(Note)		18			_	pF

Note: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

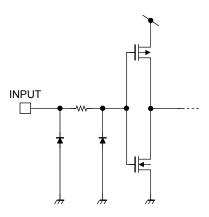
Average operating current can be obtained by the equation:

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

## Noise Characteristics (input: $t_r = t_f = 3$ ns)

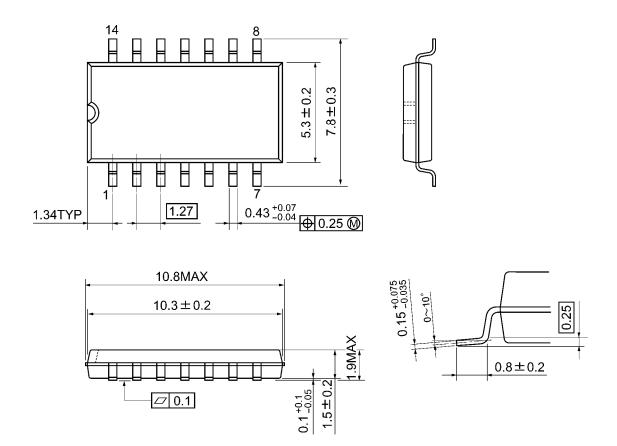
Characteristics	Cumbal	Test Condition	Ta =	- Unit		
Characteristics	Symbol		V <sub>CC</sub> (V)	Тур.	Limit	Offic
Quiet output maximum dynamic V <sub>OL</sub>	V <sub>OLP</sub>	C <sub>L</sub> = 50 pF	5.0	0.3	0.8	V
Quiet output minimum dynamic V <sub>OL</sub>	V <sub>OLV</sub>	C <sub>L</sub> = 50 pF	5.0	-0.3	-0.8	V
Minimum high level dynamic input voltage	$V_{IHD}$	C <sub>L</sub> = 50 pF	5.0	_	3.5	V
Maximum low level dynamic input voltage	V <sub>ILD</sub>	C <sub>L</sub> = 50 pF	5.0	_	1.5	V

## **Input Equivalent Circuit**



# **Package Dimensions**

SOP14-P-300-1.27A Unit: mm



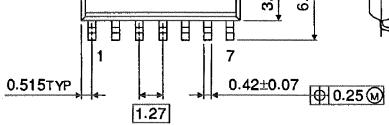
5

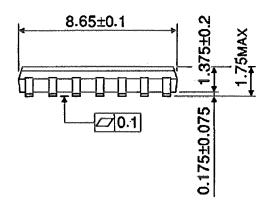
Weight: 0.18 g (typ.)

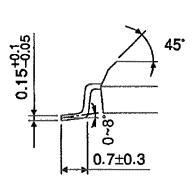
# **Package Dimensions (Note)**

SOL14-P-150-1.27

Unit: mm 14 月月月月







This package is not available in Japan. Note:

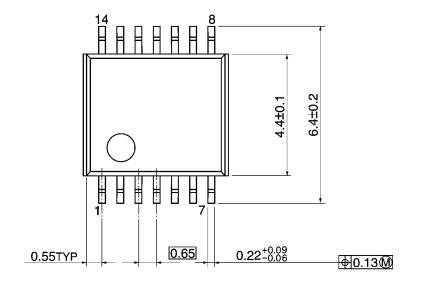
Weight: 0.12 g (typ.)

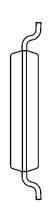
6

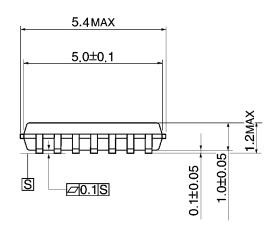
# **Package Dimensions**

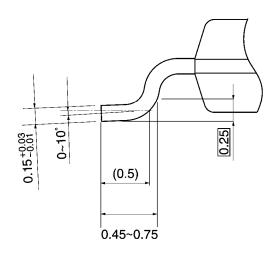
TSSOP14-P-0044-0.65A

Unit: mm







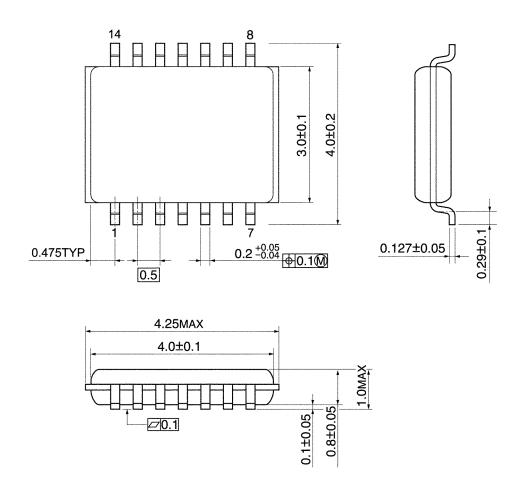


Weight: 0.06 g (typ.)

# **TOSHIBA**

# **Package Dimensions**

VSSOP14-P-0030-0.50 Unit: mm



Weight: 0.02 g (typ.)

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