

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74VHC86F, TC74VHC86FK

Quad Exclusive OR Gate

The TC74VHC86 is an advanced high speed CMOS QUAD EXCLUSIVE OR GATE fabricated with silicon gate C²MOS technology.

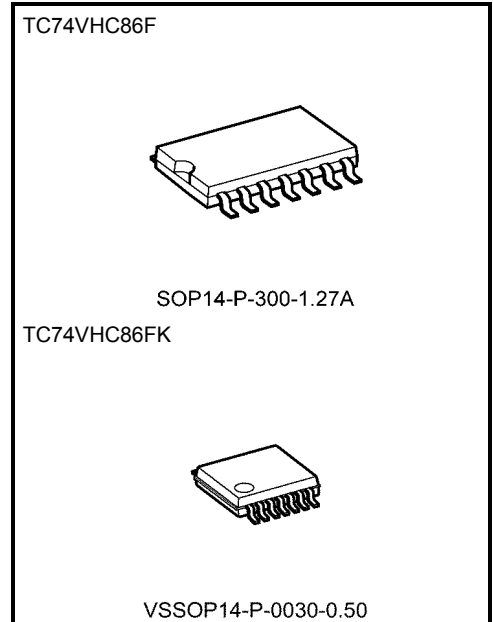
It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

The internal circuit includes an output buffer, which provides 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 on two supply system such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

Features

- High speed: $t_{pd} = 4.8 \text{ ns}$ (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: $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (min)
- Power down protection is provided on all inputs.
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC}(\text{opr}) = 2 \text{ V to } 5.5 \text{ V}$
- Low noise: $V_{OLP} = 0.8 \text{ V}$ (max)
- Pin and function compatible with 74ALS86



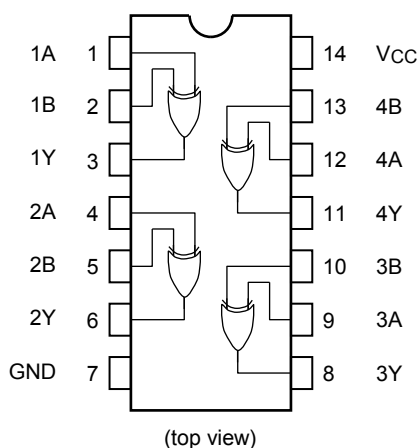
Weight

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

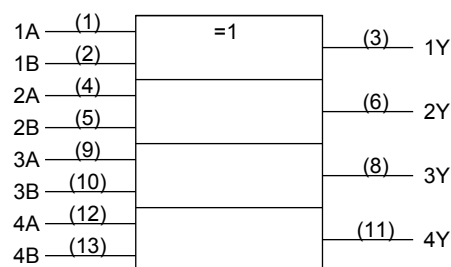
VSSOP14-P-0030-0.50 : 0.02 g (typ.)

Start of commercial production
1991-05

Pin Assignment



IEC Logic Symbol



Truth Table

A	B	Y
L	L	L
L	H	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_{OUT}	±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	
				VCC (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	1.9	2.0	—	1.9	—	V
				3.0	2.9	3.0	—	2.9	—	
				4.5	4.4	4.5	—	4.4	—	
			I _{OH} = –4 mA I _{OH} = –8 mA	3.0 4.5	2.58 3.94	— —	— —	2.48 3.80	— —	
Low-level output voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}		I _{OL} = 50 μA	2.0	—	0.0	0.1	—	0.1
			3.0		—	0.0	0.1	—	0.1	
			4.5		—	0.0	0.1	—	0.1	
			I _{OL} = 4 mA I _{OL} = 8 mA	3.0 4.5	— —	— —	0.36 0.36	— —	0.44 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: tr = tf = 3 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	tpLH tpHL	—	3.3 ± 0.3	15	—	7.0	11.0	1.0	13.0	ns
				50	—	9.5	14.5	1.0	16.5	
			5.0 ± 0.5	15	—	4.8	6.8	1.0	8.0	
				50	—	6.3	8.8	1.0	10.0	
Input capacitance	CIN	—		—	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.

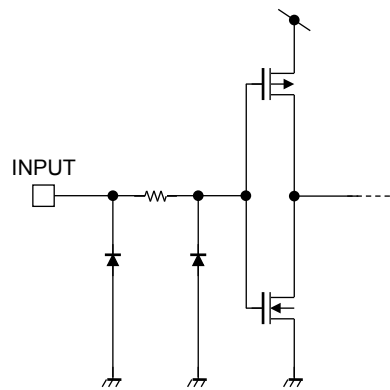
Average operating current can be obtained by the equation:

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

Noise Characteristics (input: tr = tf = 3 ns)

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

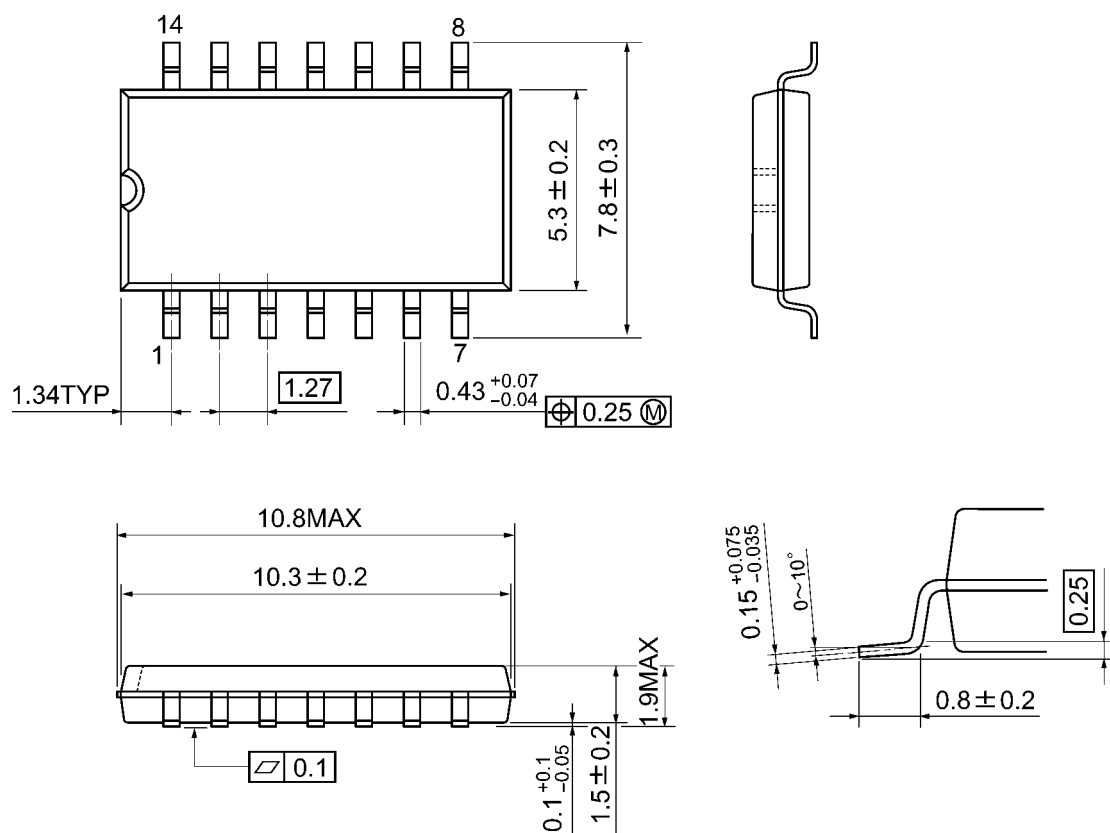
Input Equivalent Circuit



Package Dimensions

SOP14-P-300-1.27A

Unit: mm

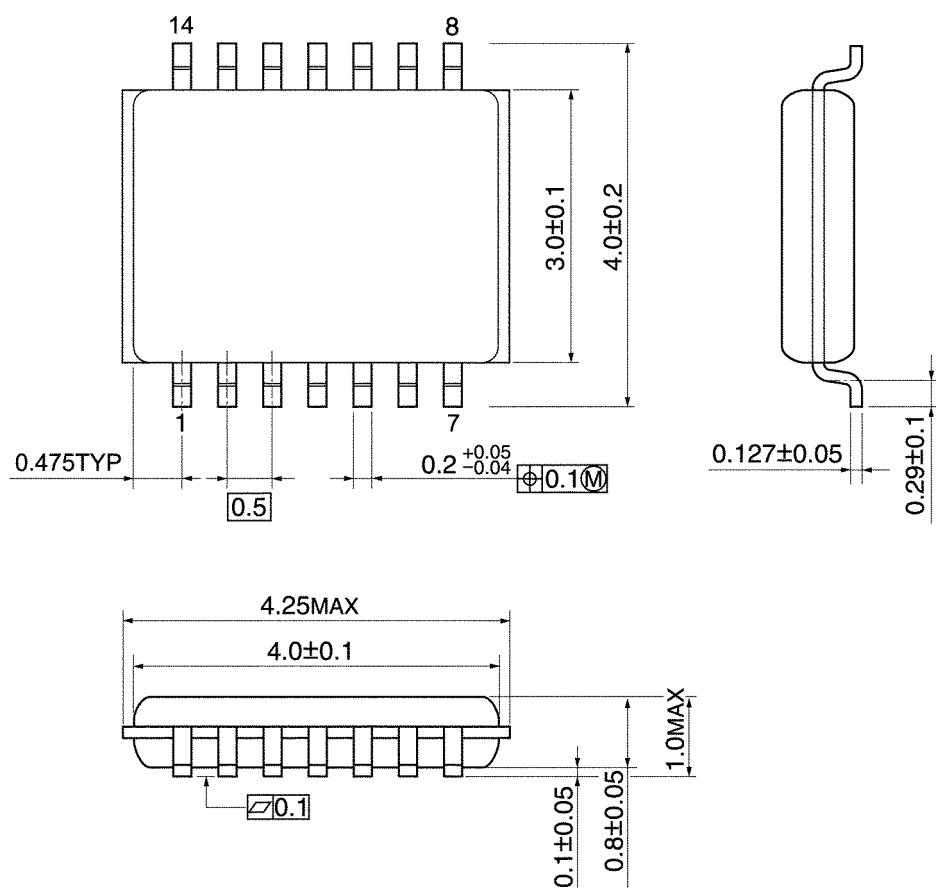


Weight: 0.18 g (typ.)

Package Dimensions

VSSOP14-P-0030-0.50

Unit: mm



Weight: 0.02 g (typ.)

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