CMOS Digital Integrated Circuits Silicon Monolithic

74HCT02D

1. Functional Description

- Quad 2-Input NOR Gate

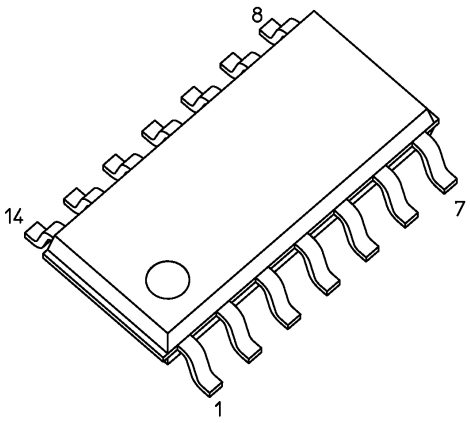
2. General

The 74HCT02D is a high speed CMOS 2-INPUT NOR GATE fabricated with silicon gate C^2MOS technology.
It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.
This device may be used as a level converter for interfacing TTL or NMOS to High Speed CMOS. The inputs are compatible with TTL, NMOS and CMOS output voltage levels.
The internal circuit is composed of 3 stages, including buffer output, which provide high noise immunity and stable output.
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

3. Features

(1) High speed: t_{pd} = 9 ns (typ.) at V_{CC} = 5 V
(2) Low power dissipation: I_{CC} = 1.0 μA (max) at T_a = 25 °C
(3) Compatible with TTL outputs: V_{IH} = 2.0 V (min)
: V_{IL} = 0.8 V (max)
(4) Wide interfacing ability: LSTTL, NMOS, CMOS
(5) Balanced propagation delays: $t_{PLH} \approx t_{PHL}$

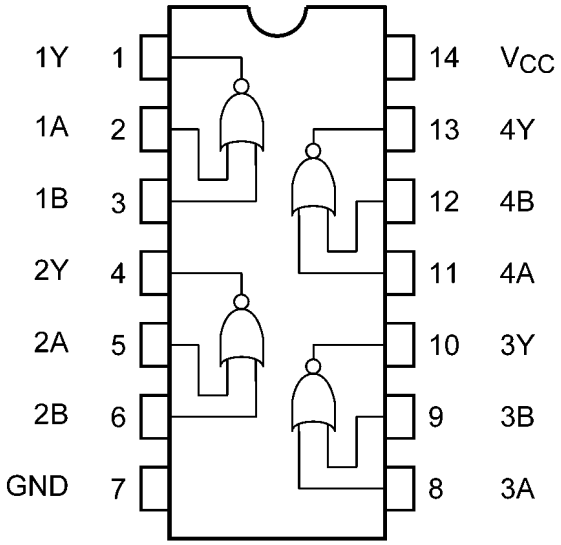
4. Packaging



SOIC14

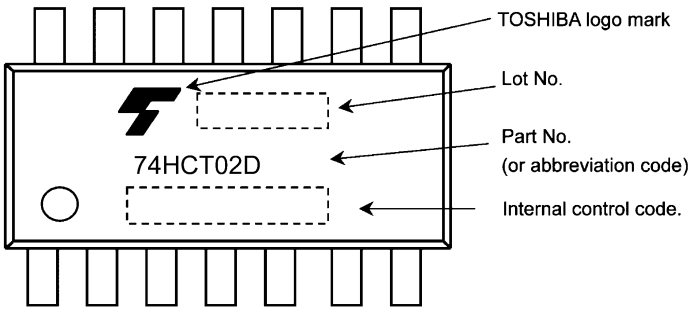
Start of commercial production
2016-05

5. Pin Assignment

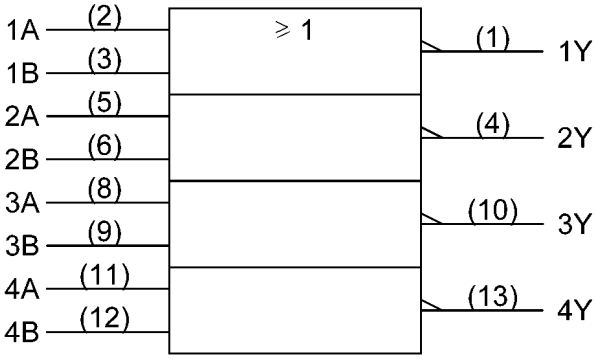


(top view)

6. Marking



7. IEC Logic Symbol



8. Truth Table

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

9. Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	-0.5 to 7.0	V
Input voltage	V_{IN}	-0.5 to V_{CC} + 0.5	V
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
Output current	I_{OUT}	±25	mA
V_{CC}/ground current	I_{CC}	±50	mA
Power dissipation	P_D	500	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).

10. Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	4.5 to 5.5	V
Input voltage	V_{IN}	0 to V_{CC}	V
Output voltage	V_{OUT}	0 to V_{CC}	V
Operating temperature	T_{opr}	-40 to 85	°C
Input rise and fall times	t_r,t_f	0 to 500	ns

Note: The operating ranges are required to ensure the normal operation of the device.
Unused inputs must be tied to either V_{CC} or GND.

11. Electrical Characteristics

11.1. DC Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Test Condition		V_{CC} (V)	Min	Typ.	Max	Unit
High-level input voltage	V_{IH}	—		4.5 to 5.5	2.0	—	—	V
Low-level input voltage	V_{IL}	—		4.5 to 5.5	—	—	0.8	V
High-level output voltage	V_{OH}	V_{IN} = V_{IL}	I_{OH} = -20 μA	4.5	4.4	4.5	—	V
			I_{OH} = -4 mA	4.5	4.18	4.31	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 20 μA	4.5	—	0.0	0.1	V
			I_{OL} = 4 mA	4.5	—	0.17	0.26	
Input leakage current	I_{IN}	V_{IN} = V_{CC} or GND		5.5	—	—	±0.1	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND		5.5	—	—	1.0	μA
	I_{CCT}	Per input: V_{IN} = 0.5 V or 2.4 V Other input: V_{CC} or GND		5.5	—	—	2.0	mA

11.2. DC Characteristics (Unless otherwise specified, T_a = -40 to 85 °C)

Characteristics	Symbol	Test Condition		V_{CC} (V)	Min	Max	Unit
High-level input voltage	V_{IH}	—		4.5 to 5.5	2.0	—	V
Low-level input voltage	V_{IL}	—		4.5 to 5.5	—	0.8	V
High-level output voltage	V_{OH}	V_{IN} = V_{IL}	I_{OH} = -20 μA	4.5	4.4	—	V
			I_{OH} = -4 mA	4.5	4.13	—	
Low-level output voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 20 μA	4.5	—	0.1	V
			I_{OL} = 4 mA	4.5	—	0.33	
Input leakage current	I_{IN}	V_{IN} = V_{CC} or GND		5.5	—	±1.0	μA
Quiescent supply current	I_{CC}	V_{IN} = V_{CC} or GND		5.5	—	10.0	μA
	I_{CCT}	Per input: V_{IN} = 0.5 V or 2.4 V Other input: V_{CC} or GND		5.5	—	2.9	mA

11.3. AC Characteristics (Unless otherwise specified, C_L = 15 pF, V_{CC}= 5 V, T_a = 25 °C, Input: $t_r = t_f$ = 6 ns)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Output transition time	t_{TLH},t_{THL}	—	—	6	12	ns
Propagation delay time	t_{PLH},t_{PHL}	—	—	9	15	

11.4. AC Characteristics (Unless otherwise specified, C_L = 50 pF, T_a = 25 °C, Input: $t_r = t_f$ = 6 ns)

Characteristics	Symbol	Note	V_{CC} (V)	Min	Typ.	Max	Unit
Output transition time	t_{TLH},t_{THL}		4.5	—	8	15	ns
			5.5	—	7	13	ns
Propagation delay time	t_{PLH},t_{PHL}		4.5	—	12	18	ns
			5.5	—	11	16	ns
Input capacitance	C_{IN}		—	—	5	—	pF
Power dissipation capacitance	C_{PD}	(Note 1)	—	—	18	—	pF

Note 1: C_{PD} 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.

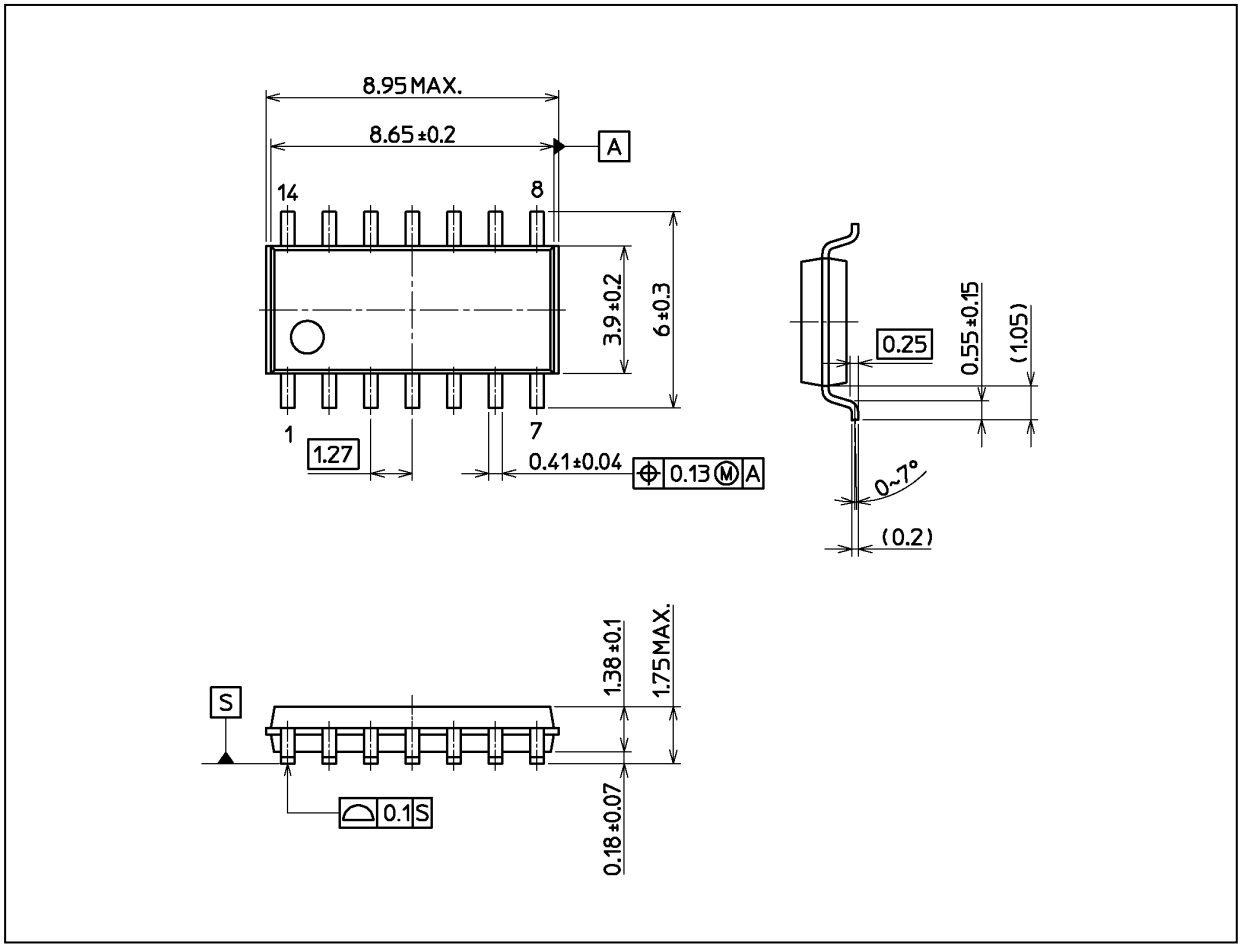
$I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/4$ (per gate)

11.5. AC Characteristics (Unless otherwise specified, C_L = 50pF, T_a = -40 to 85 °C, Input: $t_r = t_f$ = 6 ns)

Characteristics	Symbol	V_{CC} (V)	Min	Max	Unit
Output transition time	t_{TLH},t_{THL}	4.5	—	19	ns
		5.5	—	16	ns
Propagation delay time	t_{PLH},t_{PHL}	4.5	—	23	ns
		5.5	—	20	ns

Package Dimensions

Unit: mm



Weight: 0.13 g (typ.)

Package Name(s)
Nickname: SOIC14

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