CMOS Digital Integrated Circuits Silicon Monolithic

74HCT540D,74HCT541D

1. Functional Description

- Octal Bus Buffer

74HCT540D: INVERTING, 3-STATE OUTPUTS
74HCT541D: NON-INVERTING, 3-STATE OUTPUTS

2. General

The 74HCT540D/74HCT541D are high speed CMOS OCTAL BUS BUFFERs fabricated with silicon gate C^2MOS technology.

These devices 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.

They achive the high speed operation similar to equivalent LSTTL while maintaing the CMOS low power dissipation.

The 74HCT540D is an inverting type, and the 74HCT541D is a non-inverting type.

When either $\overline{G}1$ or $\overline{G}2$ are high, the terminal outputs are in the high-impedance state.

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} = 5.5 V

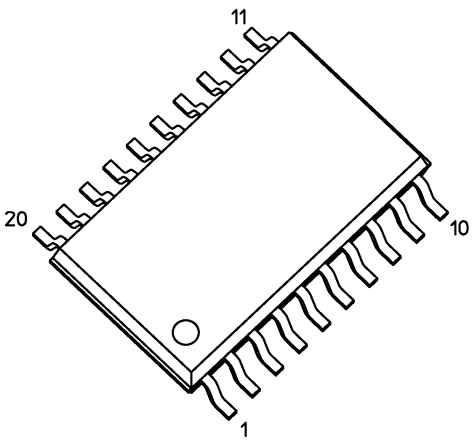
(2) Low power dissipation: I_{CC} = 4.0 μA (max) at T_a = 25 °C

(3) Compatible with TTL outputs: V_{IL} = 0.8 V(max)
V_{IH} = 2.0 V(min)

(4) Wide interfacing ability: LSTTL, NMOS, CMOS

(5) Balanced propagation delays: $t_{PLH} \approx t_{PHL}$

4. Packaging

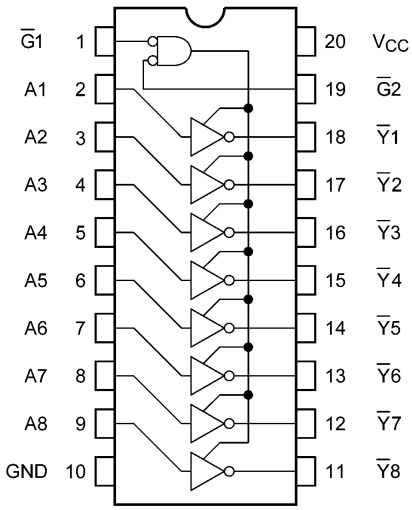


SOIC20

Start of commercial production
2016-05

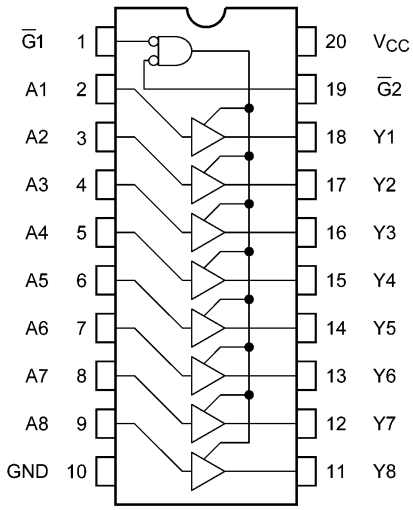
5. Pin Assignment

74HCT540D



(top view)

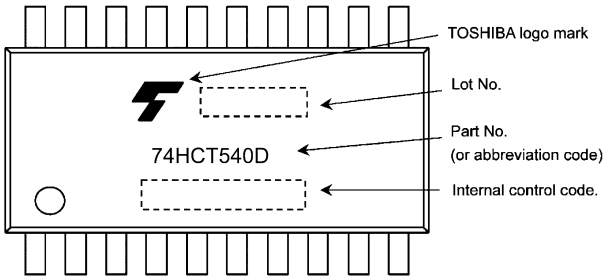
74HCT541D



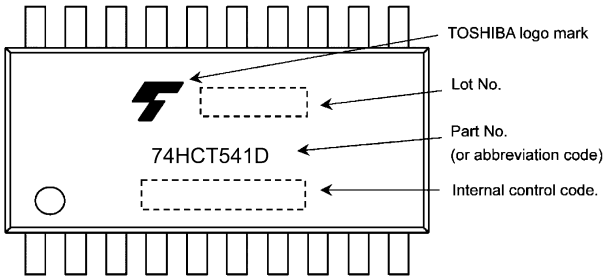
(top view)

6. Marking

74HCT540D

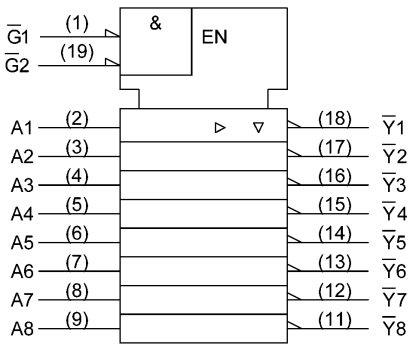


74HCT541D

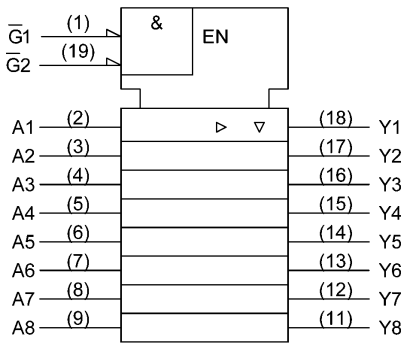


7. IEC Logic Symbol

74HCT540D



74HCT541D



8. Truth Table

Input $\overline{G1}$	Input $\overline{G2}$	Input An	Output Yn	Output $\overline{Yn}$
H	X	X	Z	Z
X	H	X	Z	Z
L	L	H	H	L
L	L	L	L	H

X: Don't care
Z: High impedance
Yn: 74HCT541D
$\overline{Yn}$: 74HCT540D

9. Absolute Maximum Ratings (Note)

Characteristics	Symbol	Note	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}		±35	mA
V_{CC}/ground current	I_{CC}		±75	mA
Power dissipation	P_D		500	mW
Storage temperature	T_{stg}		-65 to 150	℃

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	℃
Input rise and fall times	t_r,t_f	0 to 500	ns

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.

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_{IH} or V_{IL}	I_{OH} = -20 μA	4.5	4.4	4.5	—	V
			I_{OH} = -6 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} = 6 mA	4.5	—	0.17	0.26	
3-state output OFF-state leakage current	I_{OZ}	V_{IN} = V_{IH} or V_{IL} V_{OUT} = V_{CC} or GND		5.5	—	—	±0.5	μA
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	—	—	4.0	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_{IH} or V_{IL}	I_{OH} = -20 μA	4.5	4.4	—	V
			I_{OH} = -6 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} = 6 mA	4.5	—	0.33	
3-state output OFF-state leakage current	I_{OZ}	V_{IN} = V_{IH} or V_{IL} V_{OUT} = V_{CC} or GND		5.5	—	±5.0	μA
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	—	40.0	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, T_a = 25 °C, Input: $t_r = t_f$ = 6 ns)

Characteristics	Part Number	Symbol	Note	Test Condition	C_L (pF)	V_{CC} (V)	Min	Typ.	Max	Unit
Output transition time		t_{TLH},t_{THL}		—	50	4.5	—	7	12	ns
						5.5	—	6	11	
Propagation delay time	74HCT540D	t_{PLH},t_{PHL}		—	50	4.5	—	12	20	ns
						5.5	—	9	18	
					150	4.5	—	17	26	
						5.5	—	14	24	
Propagation delay time	74HCT541D	t_{PLH},t_{PHL}		—	50	4.5	—	14	23	ns
						5.5	—	11	21	
					150	4.5	—	19	29	
						5.5	—	16	27	
3-state output enable time		t_{PZL},t_{PZH}		R_L = 1 kΩ	50	4.5	—	18	30	ns
						5.5	—	16	27	
					150	4.5	—	23	36	
						5.5	—	21	33	
3-state output disable time		t_{PLZ},t_{PHZ}		R_L = 1 kΩ	50	4.5	—	18	30	ns
						5.5	—	16	27	
Input capacitance		C_{IN}		—			—	5	10	pF
Output capacitance		C_{OUT}		—			—	10	—	pF
Power dissipation capacitance	74HCT540D	C_{PD}	(Note 1)	—			—	35	—	pF
	74HCT541D	C_{PD}		—			—	31	—	

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.

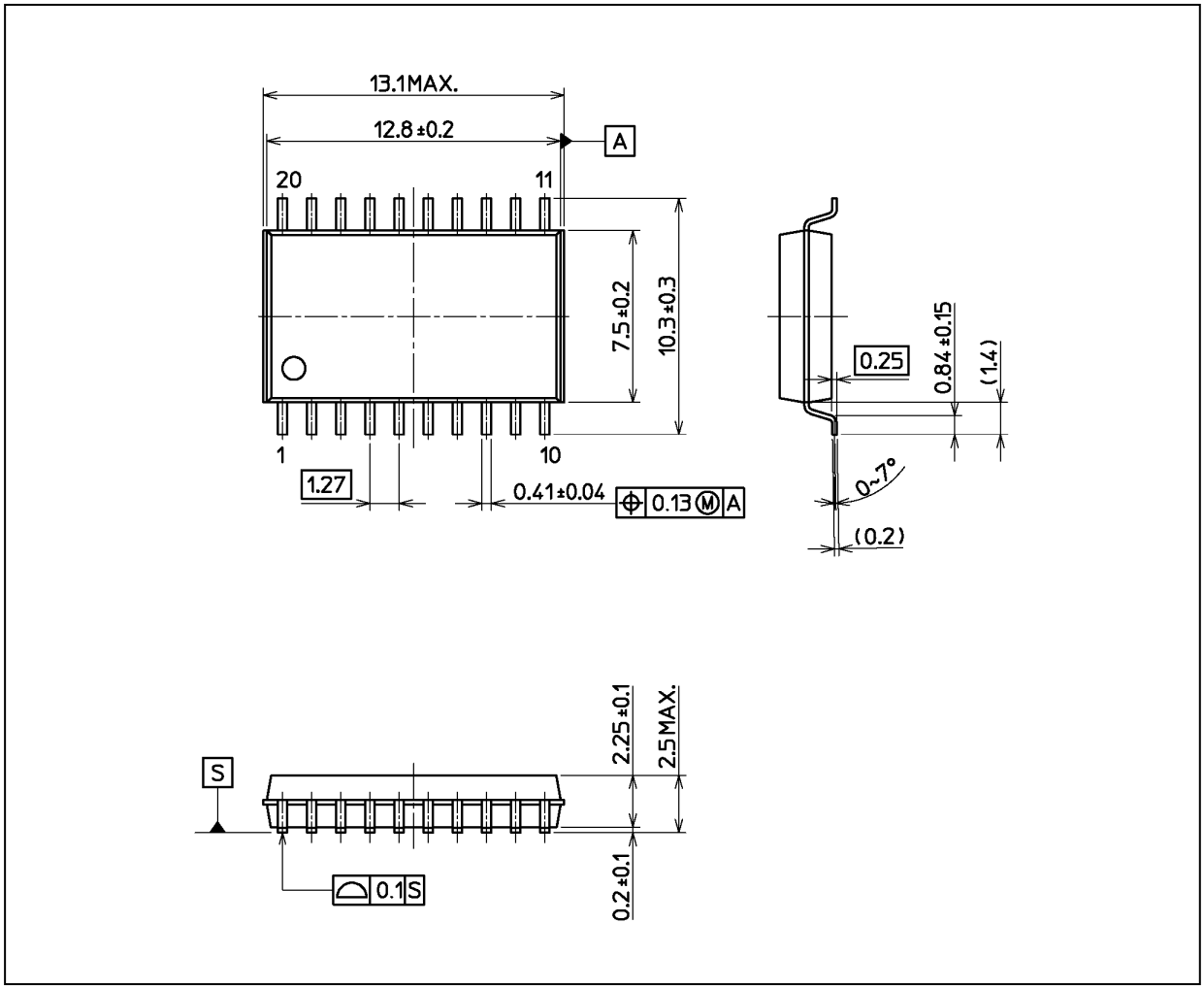
$I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/8$ (per bit)

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

Characteristics	Part Number	Symbol	Test Condition	C_L (pF)	V_{CC} (V)	Min	Max	Unit
Output transition time		t_{TLH},t_{THL}	—	50	4.5	—	15	ns
					5.5	—	14	
Propagation delay time	74HCT540D	t_{PLH},t_{PHL}	—	50	4.5	—	25	ns
					5.5	—	23	
				150	4.5	—	33	
					5.5	—	30	
Propagation delay time	74HCT541D	t_{PLH},t_{PHL}	—	50	4.5	—	29	ns
					5.5	—	27	
				150	4.5	—	36	
					5.5	—	33	
3-state output enable time		t_{PZL},t_{PZH}	R_L = 1 kΩ	50	4.5	—	38	ns
					5.5	—	35	
				150	4.5	—	45	
					5.5	—	41	
3-state output disable time		t_{PLZ},t_{PHZ}	R_L = 1 kΩ	50	4.5	—	38	ns
					5.5	—	35	
Input capacitance		C_{IN}	—			—	10	pF

Package Dimensions

Unit: mm



Weight: 0.51 g (typ.)

Package Name(s)
Nickname: SOIC20

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