

CMOS Digital Integrated Circuits Silicon Monolithic

74HC540D,74HC541D

1. Functional Description

- Octal Bus Buffer
- 74HC540D: INVERTING, 3-STATE OUTPUTS
- 74HC541D: NON-INVERTING, 3-STATE OUTPUTS

2. General

The 74HC540D/74HC541D are high speed CMOS OCTAL BUS BUFFERS fabricated with silicon gate C²MOS technology.

They achieve the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

The 74HC540D is an inverting type, and the 74HC541D is a non-inverting type.

When either $\overline{G1}$ or $\overline{G2}$ are high, the terminal outputs are in the high-impedance state.

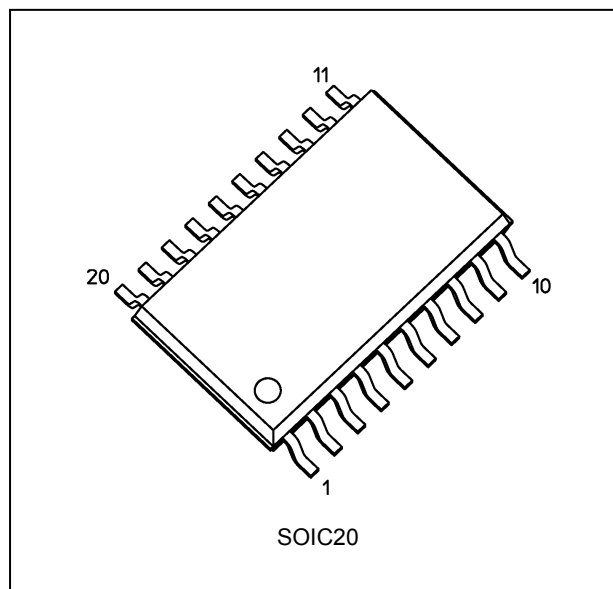
All inputs are equipped with protection circuits against static discharge or transient excess voltage.

3. Features

- (1) Wide operating temperature range: $T_{opr} = -40$ to 125 °C (Note 1)
- (2) High speed: $t_{pd} = 10$ ns (typ.) at $V_{CC} = 6.0$ V
- (3) Low power dissipation: $I_{CC} = 4.0$ μ A (max) at $T_a = 25$ °C
- (4) Balanced propagation delays: $t_{PLH} \approx t_{PHL}$
- (5) Wide operating voltage range: $V_{CC(opr)} = 2.0$ V to 6.0 V

Note 1: Operating Range spec of $T_{opr} = -40$ °C to 125 °C is applicable only for the products which manufactured after July 2020.

4. Packaging

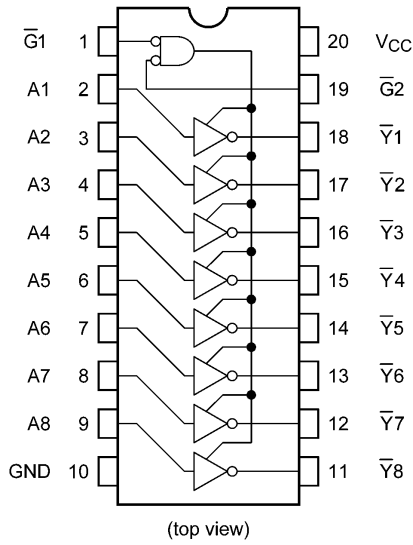


Start of commercial production

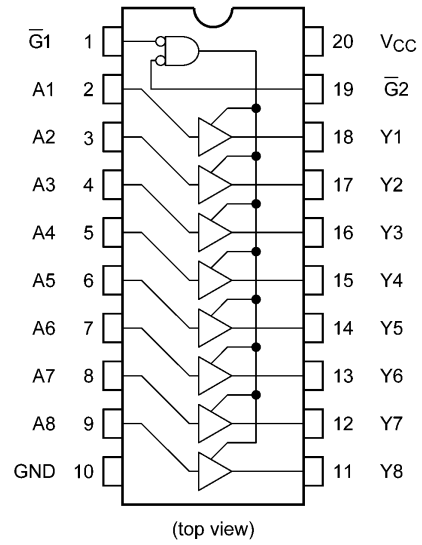
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5. Pin Assignment

74HC540D

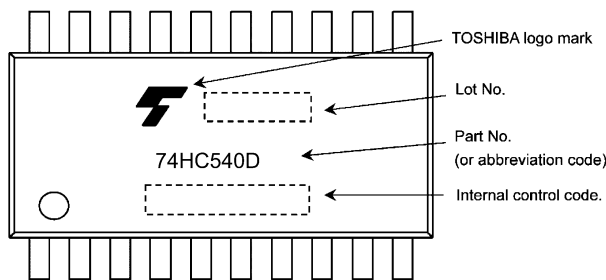


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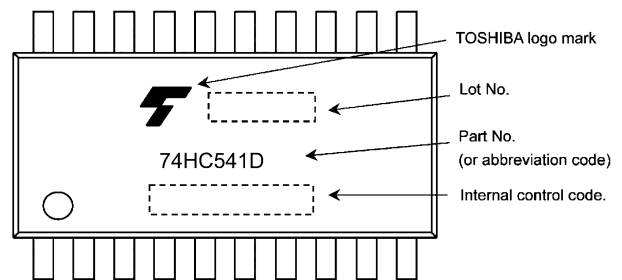


6. Marking

74HC540D

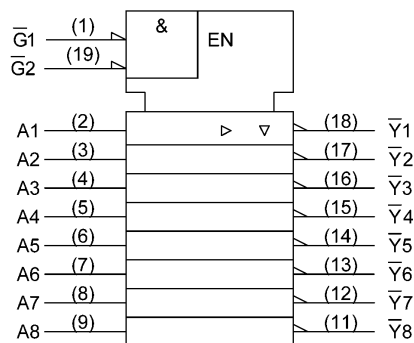


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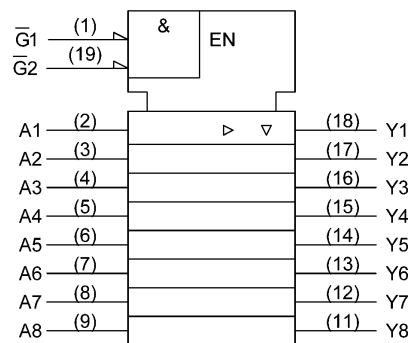


7. IEC Logic Symbol

74HC540D



74HC541D



8. Truth Table

Input $\bar{G}1$	Input $\bar{G}2$	Input A_n	Output Y_n	Output \bar{Y}_n
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
 Y_n : 74HC541D
 \bar{Y}_n : 74HC540D

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	(Note 1)	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).

Note 1: P_D derates linearly with -8 mW/°C above 85 °C

10. Operating Ranges (Note)

Characteristics	Symbol	Test Condition	Note	Rating	Unit
Supply voltage	V_{CC}			2.0 to 6.0	V
Input voltage	V_{IN}			0 to V_{CC}	V
Output voltage	V_{OUT}			0 to V_{CC}	V
Operating temperature	T_{opr}		(Note 1)	-40 to 125	°C
Input rise and fall times	t_r, t_f	$V_{CC} = 2.0\text{ V}$		0 to 1000	ns
		$V_{CC} = 4.5\text{ V}$		0 to 500	
		$V_{CC} = 6.0\text{ V}$		0 to 400	

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.

Note 1: Operating Range spec of $T_{opr} = -40\text{ °C}$ to 125 °C is applicable only for the products which manufactured after July 2020.

11. Electrical Characteristics

11.1. DC Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$)

Characteristics	Symbol	Test Condition	V_{CC} (V)	Min	Typ.	Max	Unit	
High-level input voltage	V_{IH}	—	2.0	1.50	—	—	V	
			4.5	3.15	—	—		
			6.0	4.20	—	—		
Low-level input voltage	V_{IL}	—	2.0	—	—	0.50	V	
			4.5	—	—	1.35		
			6.0	—	—	1.80		
High-level output voltage	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -20\text{ }\mu\text{A}$	2.0	1.9	2.0	—	V
				4.5	4.4	4.5	—	
			6.0	5.9	6.0	—		
			$I_{OH} = -6\text{ mA}$	4.5	4.18	4.31	—	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 20\text{ }\mu\text{A}$	2.0	—	0.0	0.1	V
				4.5	—	0.0	0.1	
				6.0	—	0.0	0.1	
			$I_{OL} = 6\text{ mA}$	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	6.0	—	—	± 0.5	μA	
				6.0	—	—		± 0.1
Input leakage current	I_{IN}	$V_{IN} = V_{CC}$ or GND	6.0	—	—	± 0.1	μA	
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC}$ or GND	6.0	—	—	4.0	μA	

11.2. DC Characteristics (Unless otherwise specified, $T_a = -40$ to $85\text{ }^\circ\text{C}$)

Characteristics	Symbol	Test Condition	V_{CC} (V)	Min	Max	Unit	
High-level input voltage	V_{IH}	—	2.0	1.50	—	V	
			4.5	3.15	—		
			6.0	4.20	—		
Low-level input voltage	V_{IL}	—	2.0	—	0.50	V	
			4.5	—	1.35		
			6.0	—	1.80		
High-level output voltage	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -20\text{ }\mu\text{A}$	2.0	1.9	—	V
				4.5	4.4	—	
			6.0	5.9	—		
			$I_{OH} = -6\text{ mA}$	4.5	4.13	—	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 20\text{ }\mu\text{A}$	2.0	—	0.1	V
				4.5	—	0.1	
				6.0	—	0.1	
			$I_{OL} = 6\text{ mA}$	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	6.0	—	—	± 5.0	μA
				6.0	—	—	
Input leakage current	I_{IN}	$V_{IN} = V_{CC}$ or GND	6.0	—	—	± 1.0	μA
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC}$ or GND	6.0	—	—	40.0	μA

11.3. DC Characteristics (Note) (Unless otherwise specified, $T_a = -40$ to 125 °C)

Characteristics	Symbol	Test Condition	V_{CC} (V)	Min	Max	Unit	
High-level input voltage	V_{IH}	—	2.0	1.50	—	V	
			4.5	3.15	—		
			6.0	4.20	—		
Low-level input voltage	V_{IL}	—	2.0	—	0.50	V	
			4.5	—	1.35		
			6.0	—	1.80		
High-level output voltage	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -20$ μ A	2.0	1.9	—	V
				4.5	4.4	—	
				6.0	5.9	—	
			$I_{OH} = -6$ mA	4.5	3.7	—	
				6.0	5.2	—	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 20$ μ A	2.0	—	0.1	V
				4.5	—	0.1	
				6.0	—	0.1	
			$I_{OL} = 6$ mA	4.5	—	0.4	
				6.0	—	0.4	
3-state output OFF-state leakage current	I_{OZ}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = V_{CC}$ or GND	6.0	—	± 5.0	μ A	
Input leakage current	I_{IN}	$V_{IN} = V_{CC}$ or GND	6.0	—	± 1.0	μ A	
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC}$ or GND	6.0	—	80.0	μ A	

Note: Operating Range spec of $T_{opr} = -40$ °C to 125 °C is applicable only for the products which manufactured after July 2020.

11.4. AC Characteristics (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$, Input: $t_r = t_f = 6\text{ ns}$)

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	2.0	—	25	60	ns
						4.5	—	7	12	
						6.0	—	6	10	
Propagation delay time		t_{PLH}, t_{PHL}			50	2.0	—	36	90	ns
						4.5	—	12	18	
						6.0	—	10	15	
					150	2.0	—	51	130	
						4.5	—	17	26	
						6.0	—	14	22	
Output enable time		t_{PZL}, t_{PZH}		$R_L = 1\text{ k}\Omega$	50	2.0	—	45	125	ns
						4.5	—	14	25	
						6.0	—	12	21	
					150	2.0	—	60	165	
						4.5	—	19	33	
						6.0	—	16	28	
Output disable time		t_{PLZ}, t_{PHZ}		$R_L = 1\text{ k}\Omega$	50	2.0	—	40	125	ns
						4.5	—	16	25	
						6.0	—	14	21	
Input capacitance		C_{IN}		—		—	5	10	pF	
Output capacitance		C_{OUT}		—		—	10	—	pF	
Power dissipation capacitance	74HC540D	C_{PD}	(Note 1)	—			—	32	—	pF
	74HC541D							—	35	

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.

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

11.5. AC Characteristics (Unless otherwise specified, $T_a = -40\text{ to }85\text{ }^\circ\text{C}$, Input: $t_r = t_f = 6\text{ ns}$)

Characteristics	Symbol	Test Condition	C_L (pF)	V_{CC} (V)	Min	Max	Unit
Output transition time	t_{TLH}, t_{THL}	—	50	2.0	—	75	ns
				4.5	—	15	
				6.0	—	13	
Propagation delay time	t_{PLH}, t_{PHL}	—	50	2.0	—	115	ns
				4.5	—	23	
				6.0	—	20	
			150	2.0	—	165	
				4.5	—	33	
				6.0	—	28	
Output enable time	t_{PZL}, t_{PZH}	$R_L = 1\text{ k}\Omega$	50	2.0	—	155	ns
				4.5	—	31	
				6.0	—	26	
			150	2.0	—	205	
				4.5	—	41	
				6.0	—	35	
Output disable time	t_{PLZ}, t_{PHZ}	$R_L = 1\text{ k}\Omega$	50	2.0	—	155	ns
				4.5	—	31	
				6.0	—	26	
Input capacitance	C_{IN}	—			—	10	pF

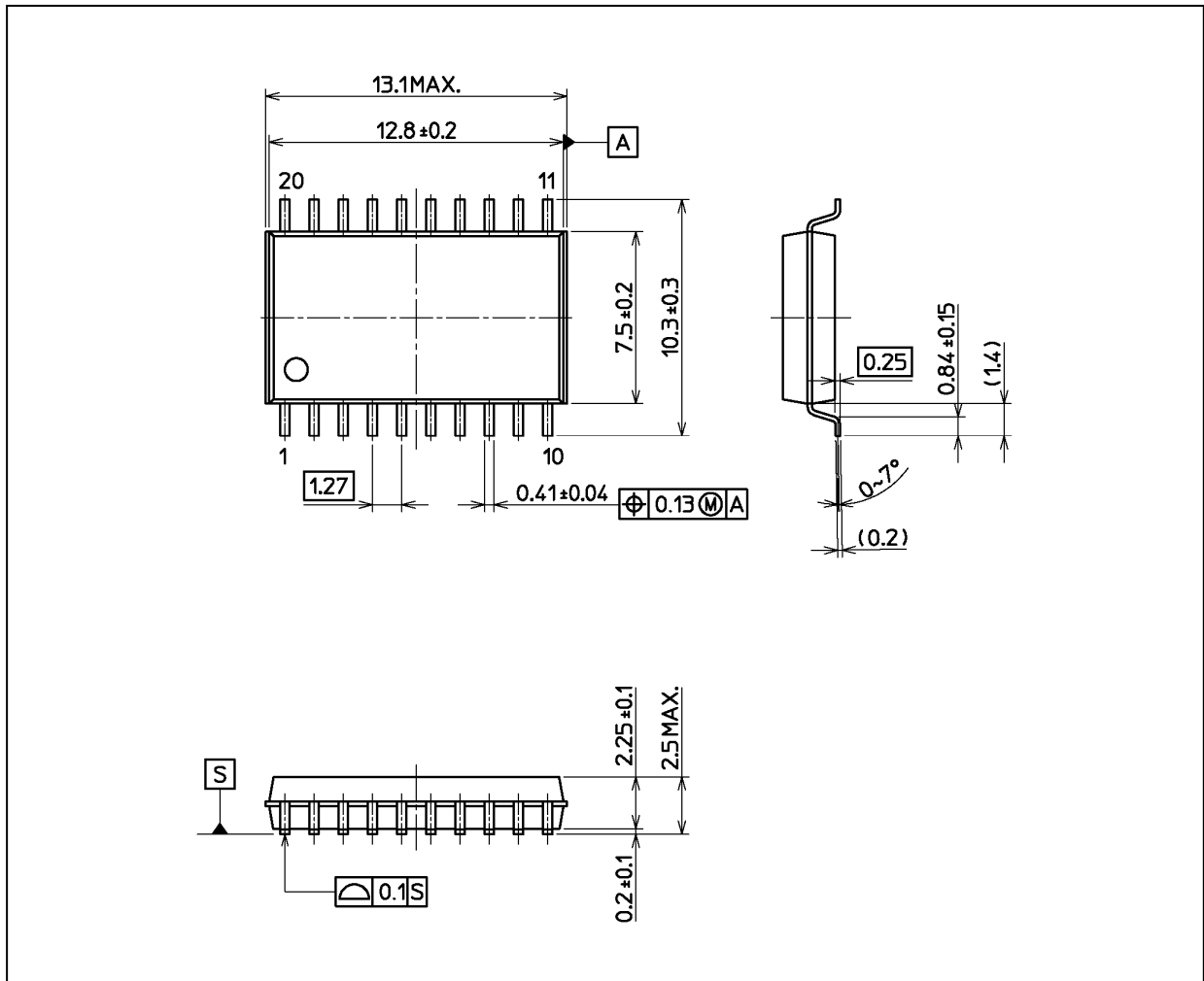
11.6. AC Characteristics (Note) (Unless otherwise specified, $T_a = -40$ to 125 °C, Input: $t_r = t_f = 6$ ns)

Characteristics	Symbol	Test Condition	C_L (pF)	V_{CC} (V)	Min	Max	Unit
Output transition time	t_{TLH}, t_{THL}	—	50	2.0	—	85	ns
				4.5	—	17	
				6.0	—	15	
Propagation delay time	t_{PLH}, t_{PHL}	—	50	2.0	—	135	ns
				4.5	—	27	
				6.0	—	24	
			150	2.0	—	190	
				4.5	—	38	
				6.0	—	32	
Output enable time	t_{PZL}, t_{PZH}	$R_L = 1$ k Ω	50	2.0	—	175	ns
				4.5	—	35	
				6.0	—	30	
			150	2.0	—	235	
				4.5	—	47	
				6.0	—	40	
Output disable time	t_{PLZ}, t_{PHZ}	$R_L = 1$ k Ω	50	2.0	—	175	ns
				4.5	—	35	
				6.0	—	30	
Input capacitance	C_{IN}	—			—	10	pF

Note: Operating Range spec of $T_{opr} = -40$ °C to 125 °C is applicable only for the products which manufactured after July 2020.

Package Dimensions

Unit: mm



Weight: 0.51 g (typ.)

Package Name(s)
Nickname: SOIC20

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