

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC74HC540AP, TC74HC540AF TC74HC541AP, TC74HC541AF

Octal Bus Buffer

TC74HC540AP/AF

Inverting, 3-State
Outputs

TC74HC541AP/AF

Non-Inverting,
3-State Outputs

The TC74HC540A/TC74HC541A 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.

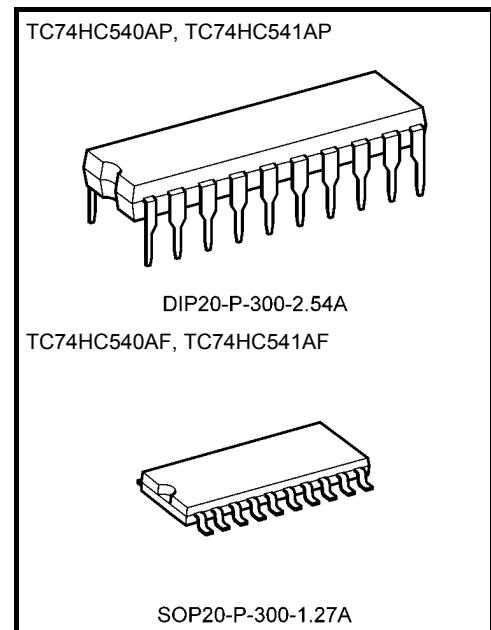
The TC74HC540A is an inverting type, and the TC74HC541A is a non-inverting type.

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.

Features

- High speed: $t_{pd} = 10 \text{ ns}$ (typ.) at $V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 4 \mu\text{A}$ (max) at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (min)
- Output Drive Capability: 15 LSTTL loads
- Symmetrical output impedance: $|I_{OH}| = I_{OL} = 6 \text{ mA}$ (min)
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC} (\text{opr}) = 2 \text{ to } 6 \text{ V}$
- Pin and function compatible with 74LS540/541



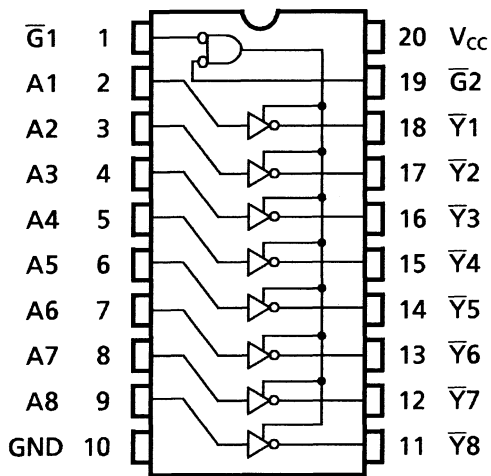
Weight

DIP20-P-300-2.54A	: 1.30 g (typ.)
SOP20-P-300-1.27A	: 0.22 g (typ.)

Start of commercial production
1987-11

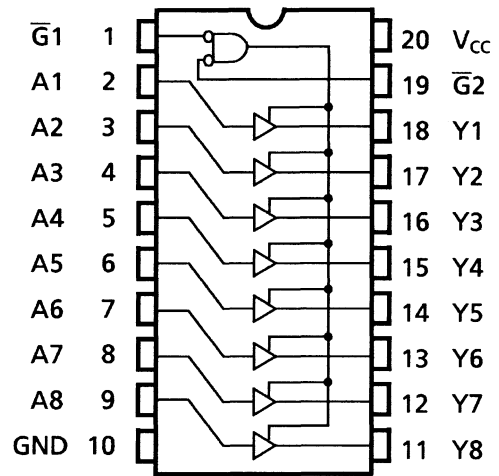
Pin Assignment

TC74HC540A



(TOP VIEW)

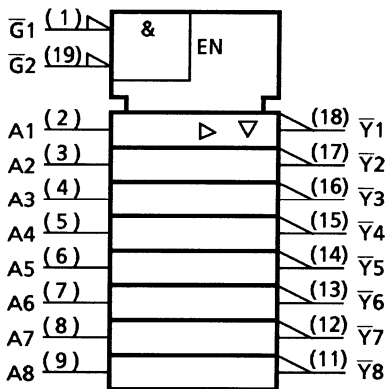
TC74HC541A



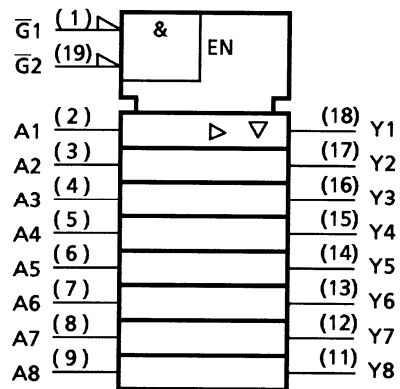
(TOP VIEW)

IEC Logic Symbol

TC74HC540A



TC74HC541A



Truth Table

Inputs			Outputs	
$\overline{G1}$	$\overline{G2}$	A_n	Y_n^*	\overline{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 HC541

\overline{Y}_n HC540

Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	-0.5 to 7	V
DC input voltage	V_{IN}	-0.5 to $V_{CC} + 0.5$	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}	± 35	mA
DC V_{CC} /ground current	I_{CC}	± 75	mA
Power dissipation	P_D	500 (DIP) (Note 2)/180 (SOP)	mW
Storage temperature	T_{stg}	-65 to 150	$^{\circ}C$

Note 1: 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 2: 500 mW in the range of $T_a = -40$ to $65^{\circ}C$. From $T_a = 65$ to $85^{\circ}C$ a derating factor of -10 mW/ $^{\circ}C$ shall be applied until 300 mW.

Operating Ranges (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2 to 6	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	$^{\circ}C$
Input rise and fall time	t_r, t_f	0 to 1000 ($V_{CC} = 2.0$ V) 0 to 500 ($V_{CC} = 4.5$ V) 0 to 400 ($V_{CC} = 6.0$ V)	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.

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit	
				V _{CC} (V)	Min	Typ.	Max	Min		Max
High-level input voltage	V _{IH}	—		2.0	1.50	—	—	1.50	—	V
				4.5	3.15	—	—	3.15	—	
				6.0	4.20	—	—	4.20	—	
Low-level input voltage	V _{IL}	—		2.0	—	—	0.50	—	0.50	V
				4.5	—	—	1.35	—	1.35	
				6.0	—	—	1.80	—	1.80	
High-level output voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -20 μA	2.0	1.9	2.0	—	1.9	—	V
				4.5	4.4	4.5	—	4.4	—	
				6.0	5.9	6.0	—	5.9	—	
			I _{OH} = -6 mA	4.5	4.18	4.31	—	4.13	—	
				6.0	5.68	5.80	—	5.63	—	
				I _{OH} = -7.8 mA	4.5	—	—	—	—	
Low-level output voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 20 μA	2.0	—	0.0	0.1	—	0.1	V
				4.5	—	0.0	0.1	—	0.1	
				6.0	—	0.0	0.1	—	0.1	
			I _{OL} = 6 mA	4.5	—	0.17	0.26	—	0.33	
				6.0	—	0.18	0.26	—	0.33	
				I _{OL} = 7.8 mA	4.5	—	—	—	—	
3-state output off-state current	I _{OZ}	V _{IN} = V _{IH} or V _{IL} V _{OUT} = V _{CC} or GND	6.0	—	—	±0.5	—	±5.0	μA	
Input leakage current	I _{IN}	V _{IN} = V _{CC} or GND	6.0	—	—	±0.1	—	±1.0	μA	
Quiescent supply current	I _{CC}	V _{IN} = V _{CC} or GND	6.0	—	—	4.0	—	40.0	μA	

AC Characteristics (input: $t_r = t_f = 6 \text{ ns}$)

Characteristics	Symbol	Test Condition			Ta = 25°C			Ta = -40 to 85°C		Unit	
		CL (pF)	VCC (V)		Min	Typ.	Max	Min	Max		
Output transition time	t_{TLH} t_{THL}	—	50	2.0	—	25	60	—	75	ns	
				4.5	—	7	12	—	15		
				6.0	—	6	10	—	13		
Propagation delay time	t_{pLH} t_{pHL}	—	50	2.0	—	36	90	—	115	ns	
				4.5	—	12	18	—	23		
				6.0	—	10	15	—	20		
			150	2.0	—	51	130	—	165		ns
				4.5	—	17	26	—	33		
				6.0	—	14	22	—	28		
Output enable time	t_{pZL} t_{pZH}	$R_L = 1 \text{ k}\Omega$	50	2.0	—	45	125	—	155	ns	
				4.5	—	14	25	—	31		
				6.0	—	12	21	—	26		
			150	2.0	—	60	165	—	205		ns
				4.5	—	19	33	—	41		
				6.0	—	16	28	—	35		
Output disable time	t_{pLZ} t_{pHZ}	$R_L = 1 \text{ k}\Omega$	50	2.0	—	40	125	—	155	ns	
				4.5	—	16	25	—	31		
				6.0	—	14	21	—	26		
Input capacitance	C_{IN}	—			—	5	10	—	10	pF	
Output capacitance	C_{OUT}	—			—	10	—	—	—	pF	
Power dissipation capacitance	C_{PD} (Note)	TC74HC540A			—	32	—	—	—	pF	
		TC74HC541A			—	35	—	—	—		

Note: 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:

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

Package Dimensions

DIP20-P-300-2.54A

Unit : mm



Weight: 1.30 g (typ.)

Package Dimensions

SOP20-P-300-1.27A

Unit: mm



Weight: 0.22 g (typ.)

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