

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

## TC74AC540P, TC74AC540F, TC74AC540FT TC74AC541P, TC74AC541F, TC74AC541FT

### Octal Bus Buffer

TC74AC540P/F/FT	Inverting, 3-State Outputs
TC74AC541P/F/FT	Non-Inverting, 3-State Outputs

The TC74AC540/TC74AC541 are advanced high speed CMOS OCTAL BUS BUFFERS fabricated with silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology. They achieve the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

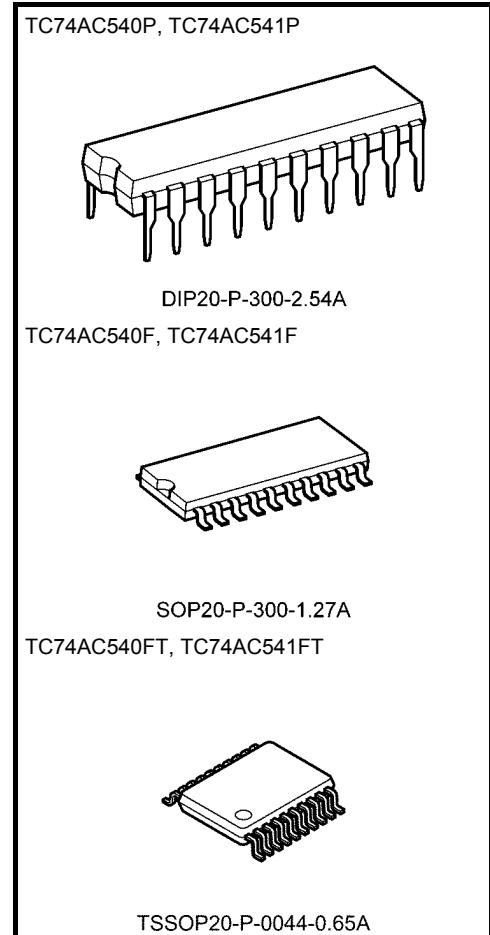
The TC74AC540 is an inverting type, and the TC74AC541 is a non-inverting type.

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:  $t_{pd} = 4.0 \text{ ns (typ.)}$  at  $V_{CC} = 5 \text{ V}$
- Low power dissipation:  $I_{CC} = 8 \mu\text{A (max)}$  at  $T_a = 25^\circ\text{C}$
- High noise immunity:  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (min)
- Symmetrical output impedance:  $|I_{OH}| = I_{OL} = 24 \text{ mA (min)}$   
Capability of driving  $50 \Omega$  transmission lines.
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range:  $V_{CC (opr)} = 2 \text{ to } 5.5 \text{ V}$
- Pin and function compatible with 74F540/541

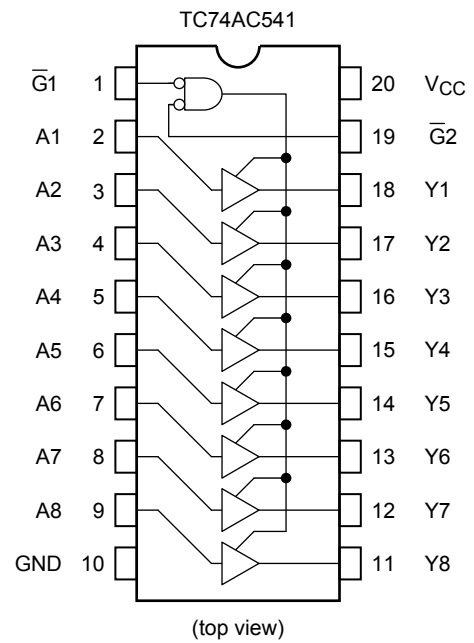
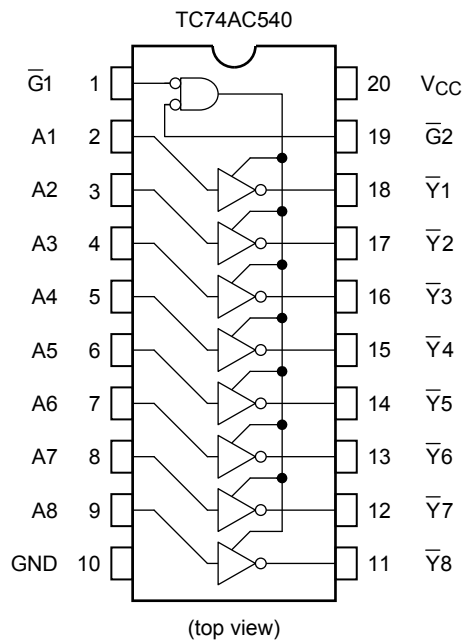


### Weight

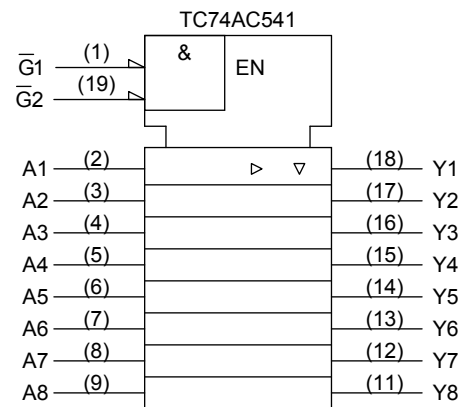
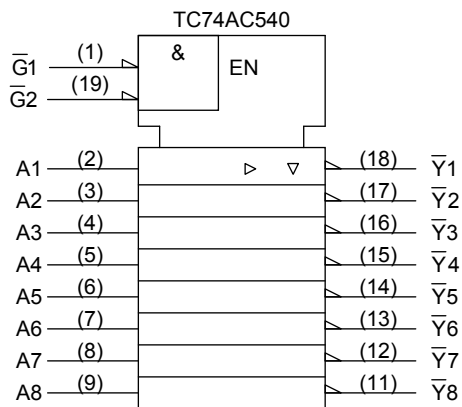
DIP20-P-300-2.54A	: 1.30 g (typ.)
SOP20-P-300-1.27A	: 0.22 g (typ.)
TSSOP20-P-0044-0.65A	: 0.08 g (typ.)

Start of commercial production  
1988-10

## Pin Assignment



## IEC Logic Symbol



## Truth Table

Inputs			Outputs	
$\bar{G}1$	$\bar{G}2$	$A_n$	$Y_n$	$\bar{Y}_n$
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

$Y_n$ : AC541

$\bar{Y}_n$ : AC540

**Absolute Maximum Ratings (Note 1)**

Characteristics	Symbol	Rating	Unit
Supply voltage range	$V_{CC}$	-0.5 to 7.0	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	$I_{IK}$	$\pm 20$	mA
Output diode current	$I_{OK}$	$\pm 50$	mA
DC output current	$I_{OUT}$	$\pm 50$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 200$	mA
Power dissipation	$P_D$	500 (DIP) (Note 2)/180 (SOP/TSSOP)	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/ $^{\circ}C$  should be applied up to 300 mW.

**Operating Ranges (Note)**

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	2.0 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	$^{\circ}C$
Input rise and fall time	dt/dV	0 to 100 ( $V_{CC} = 3.3 \pm 0.3$ V) 0 to 20 ( $V_{CC} = 5 \pm 0.5$ 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	
				V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max
High-level input voltage	V <sub>IH</sub>	—		2.0	1.50	—	—	1.50	—	V
				3.0	2.10	—	—	2.10	—	
				5.5	3.85	—	—	3.85	—	
Low-level input voltage	V <sub>IL</sub>	—		2.0	—	—	0.50	—	0.50	V
				3.0	—	—	0.90	—	0.90	
				5.5	—	—	1.65	—	1.65	
High-level output voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -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 <sub>OH</sub> = -4 mA	3.0	2.58	—	—	2.48	—	
				4.5	3.94	—	—	3.80	—	
I <sub>OH</sub> = -24 mA	4.5	3.94	—	—	3.80	—				
I <sub>OH</sub> = -75 mA (Note)	5.5	—	—	—	3.85	—				
Low-level output voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 50 μA	2.0	—	0.0	0.1	—	0.1	V
				3.0	—	0.0	0.1	—	0.1	
				4.5	—	0.0	0.1	—	0.1	
			I <sub>OL</sub> = 12 mA	3.0	—	—	0.36	—	0.44	
				4.5	—	—	0.36	—	0.44	
I <sub>OL</sub> = 24 mA	4.5	—	—	0.36	—	0.44				
I <sub>OL</sub> = 75 mA (Note)	5.5	—	—	—	—	1.65				
3-state output off-state current	I <sub>OZ</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>OUT</sub> = V <sub>CC</sub> or GND		5.5	—	—	±0.5	—	±5.0	μA
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		5.5	—	—	±0.1	—	±1.0	μA
Quiescent supply current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		5.5	—	—	8.0	—	80.0	μA

Note: This spec indicates the capability of driving 50 Ω transmission lines.  
One output should be tested at a time for a 10 ms maximum duration.

## AC Characteristics ( $C_L = 50 \text{ pF}$ , $R_L = 500 \text{ } \Omega$ , input: $t_r = t_f = 3 \text{ ns}$ )

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit	
			V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max
Propagation delay time (Note 2)	t <sub>pLH</sub>	—	3.3 ± 0.3	—	6.8	10.5	1.0	12.0	ns
	t <sub>pHL</sub>	—	5.0 ± 0.5	—	4.7	7.0	1.0	8.0	
Propagation delay time (Note 3)	t <sub>pLH</sub>	—	3.3 ± 0.3	—	6.8	11.4	1.0	13.0	ns
	t <sub>pHL</sub>	—	5.0 ± 0.5	—	4.7	7.5	1.0	8.5	
Output enable time	t <sub>pZL</sub>	—	3.3 ± 0.3	—	9.6	15.8	1.0	18.0	ns
	t <sub>pZH</sub>	—	5.0 ± 0.5	—	6.4	10.0	1.0	11.4	
Output disable time	t <sub>pLZ</sub>	—	3.3 ± 0.3	—	7.7	12.3	1.0	14.0	ns
	t <sub>pHZ</sub>	—	5.0 ± 0.5	—	6.4	9.2	1.0	10.5	
Input capacitance	C <sub>IN</sub>	—	—	5	10	—	10	pF	
Output capacitance	C <sub>OUT</sub>	—	—	10	—	—	—	pF	
Power dissipation capacitance	C <sub>PD</sub> (Note 1)	TC74AC540	—	25	—	—	—	pF	
		TC74AC541	—	28	—	—	—		

Note1: C<sub>PD</sub> 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:

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

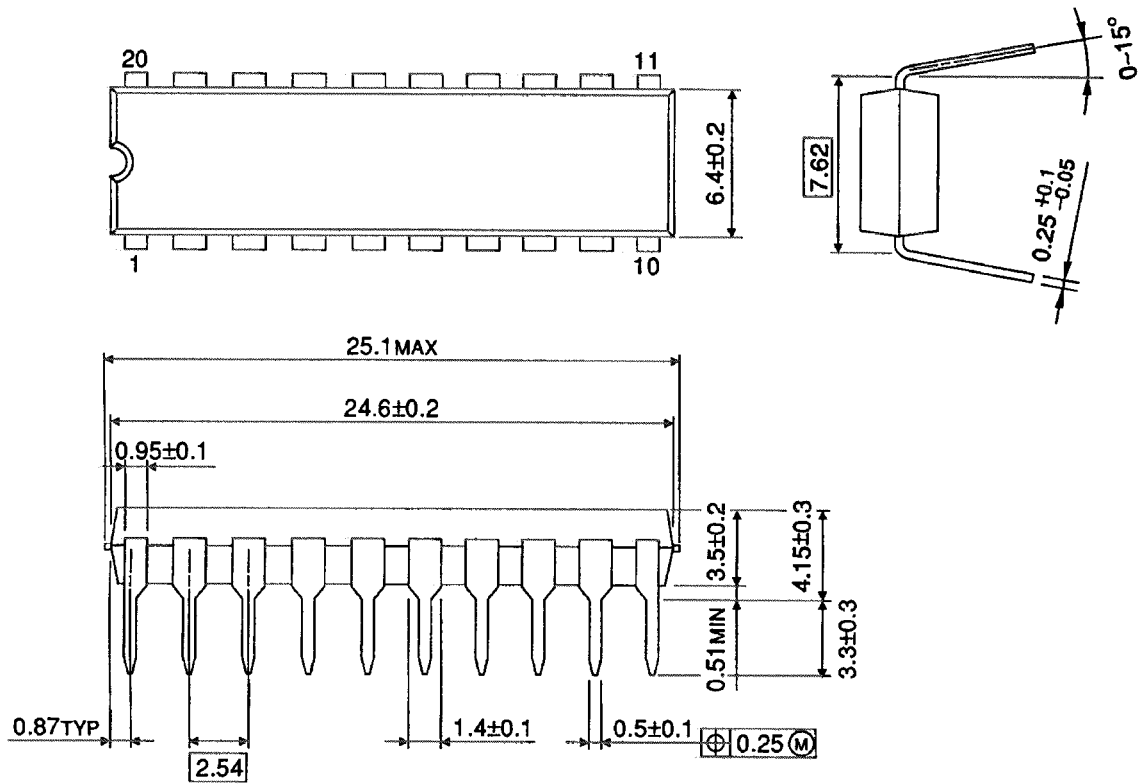
Note 2: For TC74AC540 only

Note 3: For TC74AC541 only

## Package Dimensions

DIP20-P-300-2.54A

Unit : mm

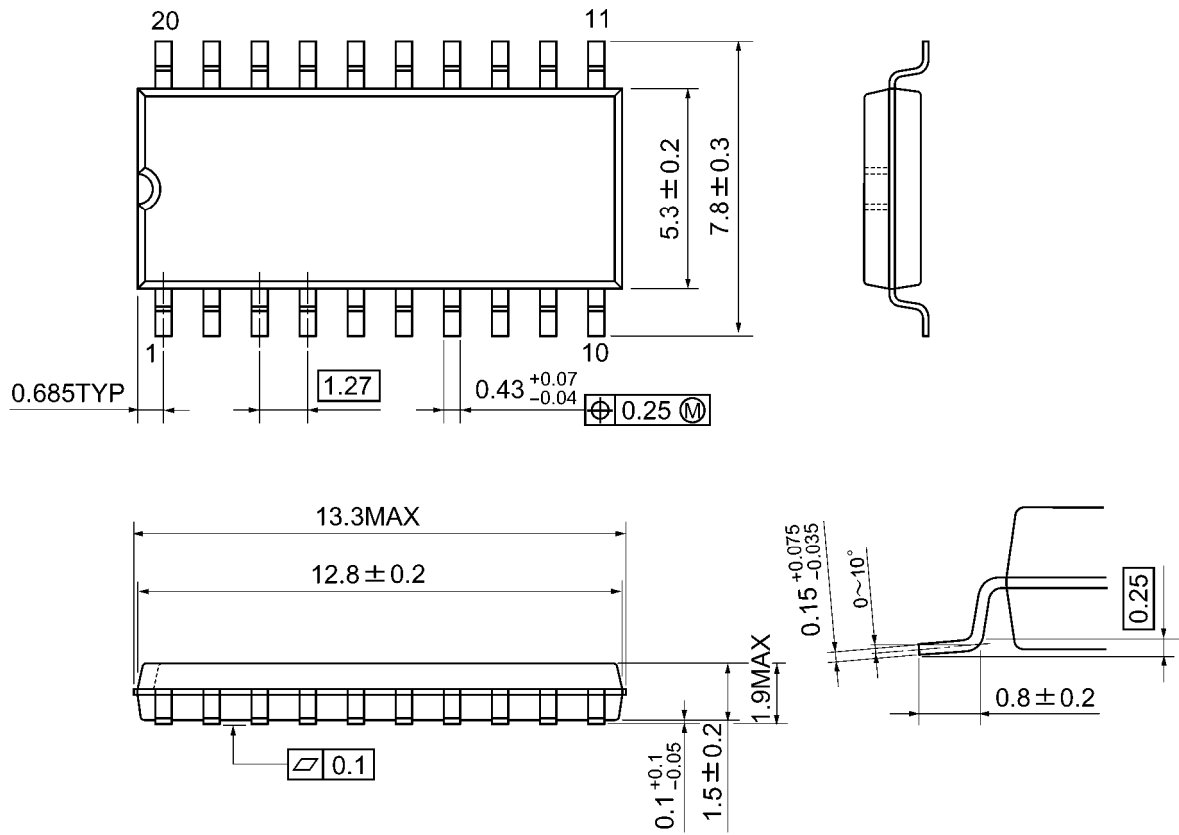


Weight: 1.30 g (typ.)

**Package Dimensions**

SOP20-P-300-1.27A

Unit: mm

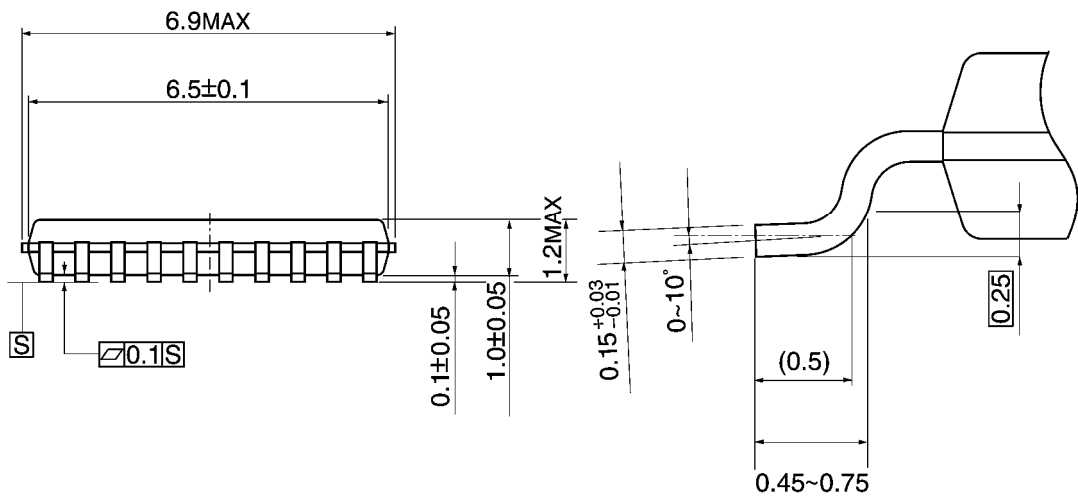
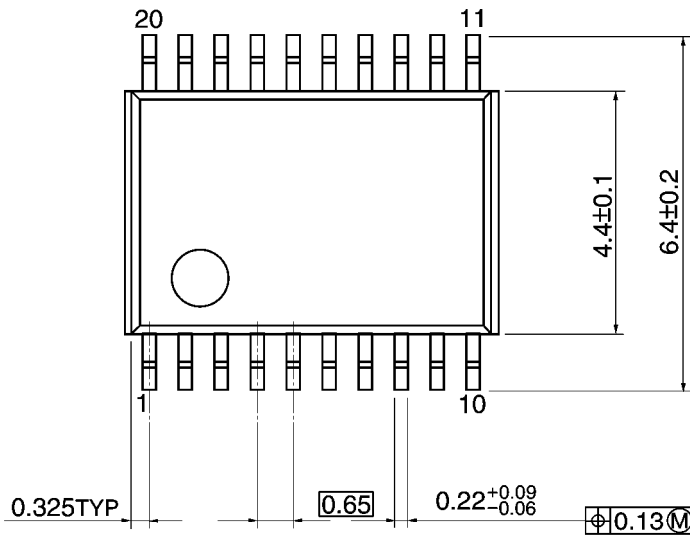


Weight: 0.22 g (typ.)

**Package Dimensions**

TSSOP20-P-0044-0.65A

Unit: mm



Weight: 0.08 g (typ.)



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