

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.

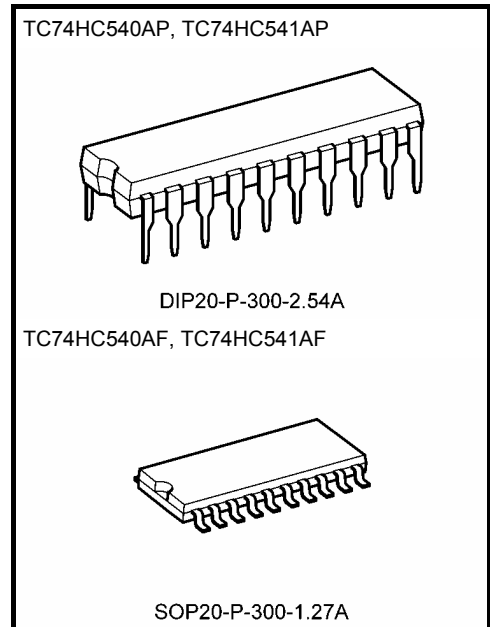
The TC74HC540A is an inverting type, and the TC74HC541A is a non-inverting type.

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

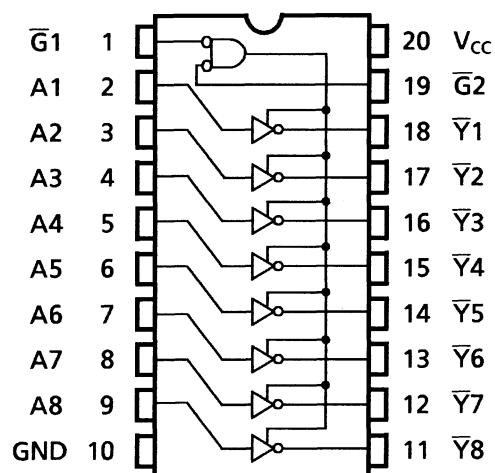


Weight

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

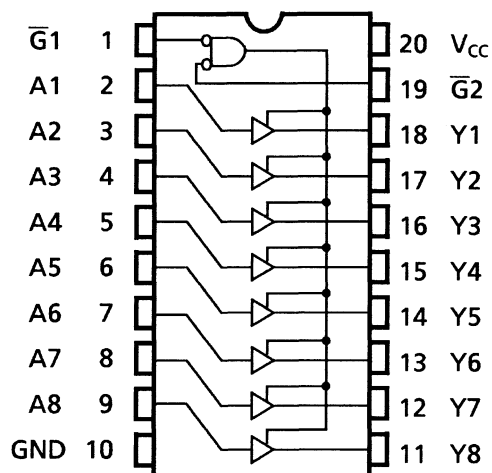
Pin Assignment

TC74HC540A



(TOP VIEW)

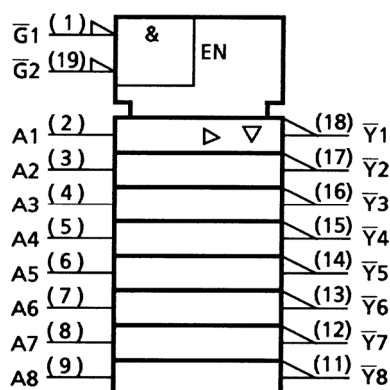
TC74HC541A



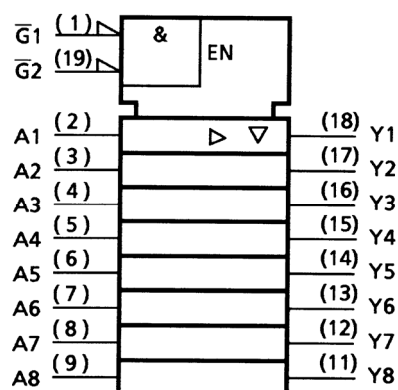
(TOP VIEW)

IEC Logic Symbol

TC74HC540A



TC74HC541A



Truth Table

| Inputs | | | Outputs | |
|--------|----|----|---------|-----|
| G1 | G2 | An | Yn* | 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 HC541

Yn 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 | °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°C . From $T_a = 65$ to 85°C a derating factor of $-10 \text{ mW}/^\circ\text{C}$ 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 | °C |
| Input rise and fall time | t_r, t_f | 0 to 1000 ($V_{CC} = 2.0 \text{ V}$) 0 to 500 ($V_{CC} = 4.5 \text{ V}$) 0 to 400 ($V_{CC} = 6.0 \text{ V}$) | ns |

Note: The operating ranges must be maintained to ensure the normal operation of the device. Unused inputs must be tied to either VCC 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 4.5 6.0 | 1.50 3.15 4.20 | — — — | — — — | 1.50 3.15 4.20 | — — — | V |
| Low-level input voltage | V _{IL} | — | | 2.0 4.5 6.0 | — — — | — — — | 0.50 1.35 1.80 | — — — | 0.50 1.35 1.80 | V |
| 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 | — | |
| | | | I _{OH} = -6 mA I _{OH} = -7.8 mA | 6.0 | 5.9 | 6.0 | — | 5.9 | — | |
| | | | | 4.5 | 4.18 | 4.31 | — | 4.13 | — | |
| Low-level output voltage | V _{OL} | V _{IN} = V _{IH} or V _{IL} | I _{OL} = 20 μA | 6.0 | 5.68 | 5.80 | — | 5.63 | — | V |
| | | | | 4.5 | 4.18 | 4.31 | — | 4.13 | — | |
| | | | I _{OL} = 6 mA I _{OL} = 7.8 mA | 6.0 | 5.68 | 5.80 | — | 5.63 | — | |
| | | | | 4.5 | 4.18 | 4.31 | — | 4.13 | — | |
| 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 |
| | | | | 4.5 | — | 7 | 12 | — | 15 |
| | | | | 6.0 | — | 6 | 10 | — | 13 |
| Propagation delay time | t_{pLH} t_{pHL} | — | 50 | 2.0 | — | 36 | 90 | — | 115 |
| | | | | 4.5 | — | 12 | 18 | — | 23 |
| | | | | 6.0 | — | 10 | 15 | — | 20 |
| | | | 150 | 2.0 | — | 51 | 130 | — | 165 |
| | | | | 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 |
| | | | | 4.5 | — | 14 | 25 | — | 31 |
| | | | | 6.0 | — | 12 | 21 | — | 26 |
| | | | 150 | 2.0 | — | 60 | 165 | — | 205 |
| | | | | 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 |
| | | | | 4.5 | — | 16 | 25 | — | 31 |
| | | | | 6.0 | — | 14 | 21 | — | 26 |
| Input capacitance | C_{IN} | — | | | — | 5 | 10 | — | 10 |
| Output capacitance | C_{OUT} | — | | | — | 10 | — | — | — |
| 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

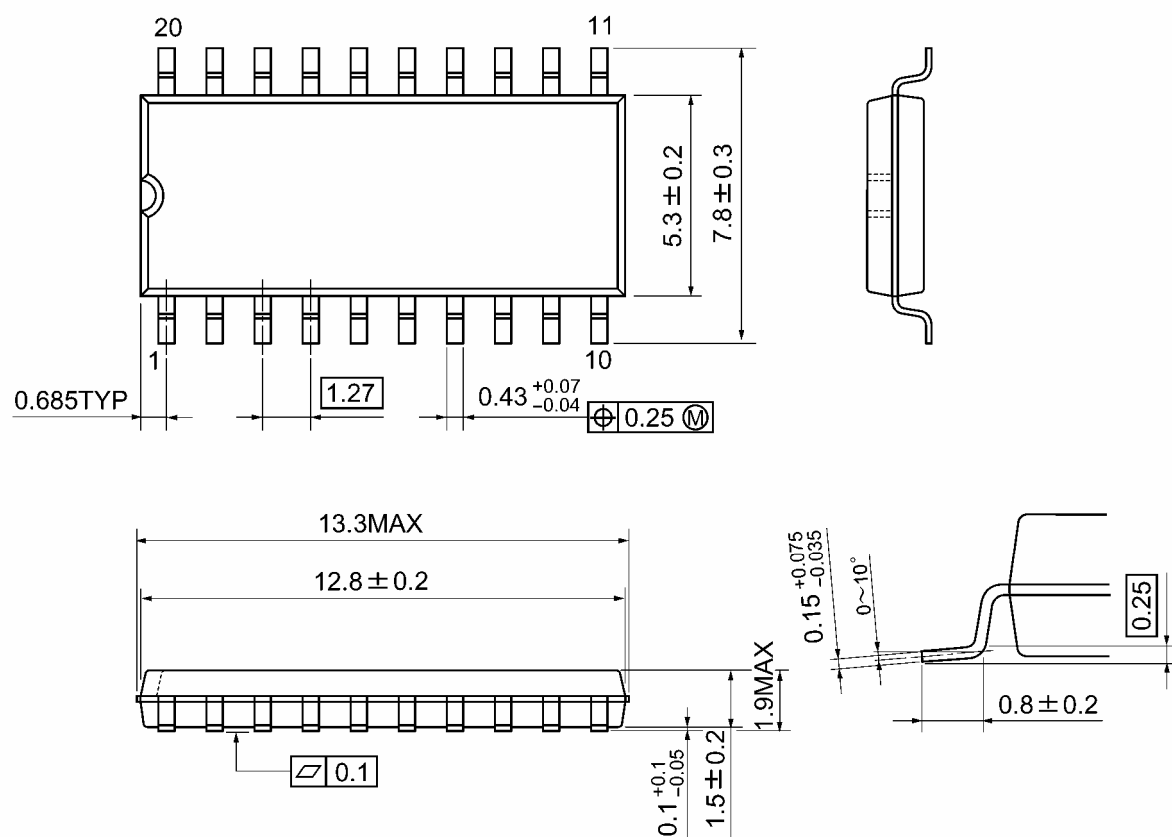


Weight: 1.30 g (typ.)

Package Dimensions

SOP20-P-300-1.27A

Unit: mm



Weight: 0.22 g (typ.)

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20070701-EN GENERAL

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