

# 74HCT240D, 74HCT244D

## 1. Functional Description

- Octal Bus Buffer

74HCT240D: INVERTED, 3-STATE OUTPUTS

74HCT244D: NON-INVERTED, 3-STATE OUTPUTS

## 2. General

The 74HCT240D, and 74HCT244D are high speed CMOS OCTAL BUS BUFFERS fabricated with silicon gate C<sup>2</sup>MOS technology.

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

Their inputs are compatible with TTL, NMOS, and CMOS output voltage levels. The 74HCT240D is an inverting 3-state buffer having two active-low output enables. The 74HCT244D is non-inverting 3-state buffer the HCT244A has two active-low output enables.

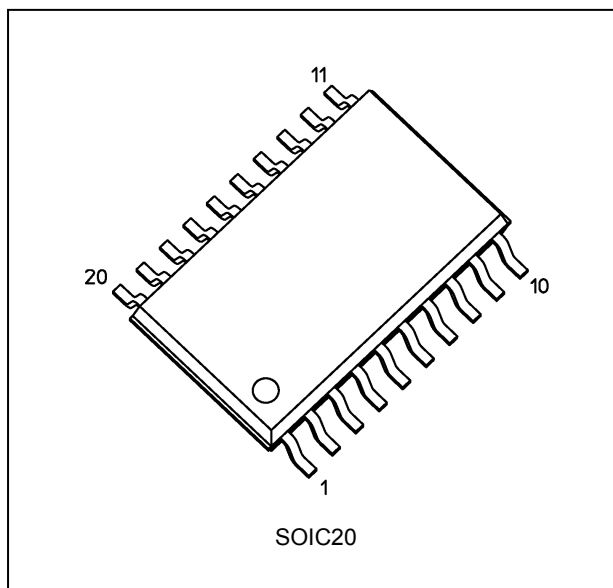
These devices are designed to be used with 3-state memory address drivers, etc.

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

## 3. Features

- (1) High speed:  $t_{pd} = 13 \text{ ns (typ.)}$  at  $V_{CC} = 5.5 \text{ V}$
- (2) Low power dissipation:  $I_{CC} = 4.0 \mu\text{A (max)}$  at  $T_a = 25 \text{ }^\circ\text{C}$
- (3) Compatible with TTL outputs:  $V_{IL} = 0.8 \text{ V(max)}$   
 $V_{IH} = 2.0 \text{ V(min)}$
- (4) Wide interfacing ability: LSTTL, NMOS, CMOS
- (5) Balanced propagation delays:  $t_{PLH} \approx t_{PHL}$

## 4. Packaging

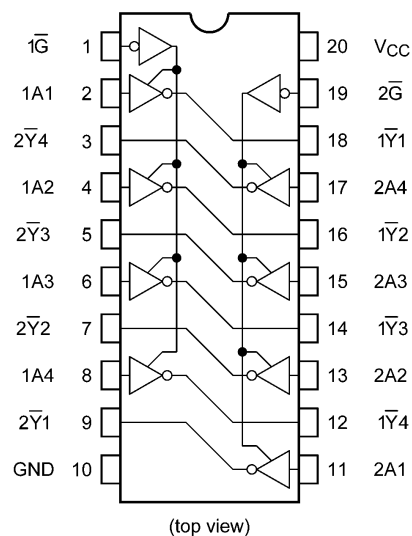


Start of commercial production

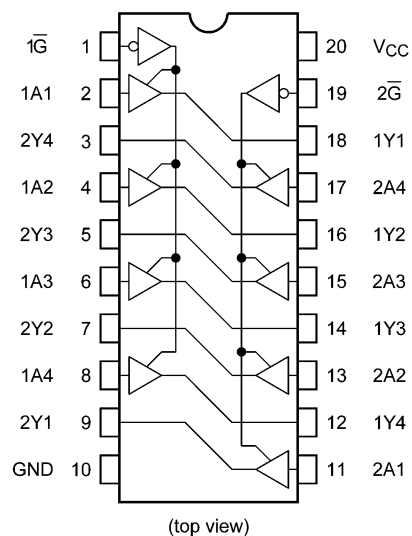
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## 5. Pin Assignment

74HCT240D

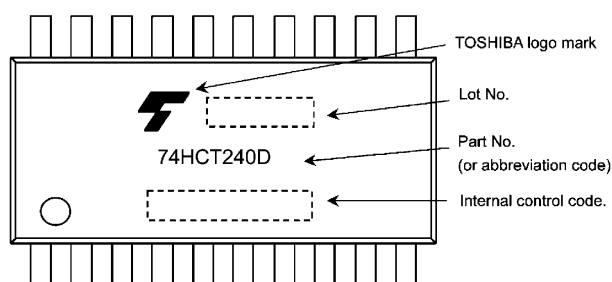


74HCT244D

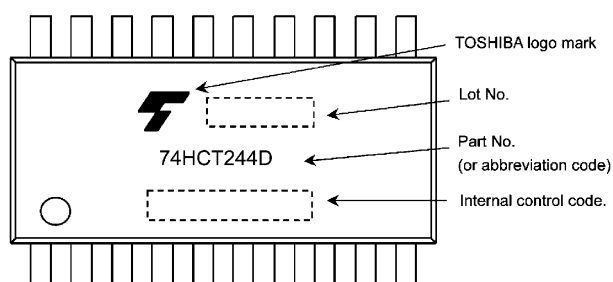


## 6. Marking

74HCT240D

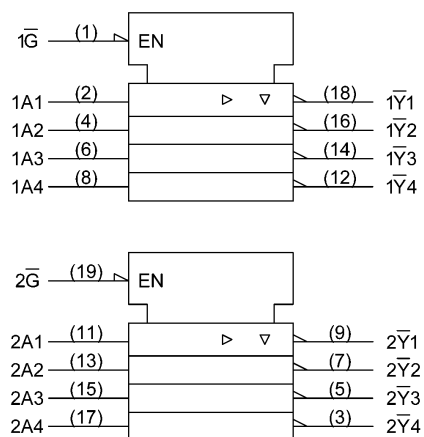


74HCT244D

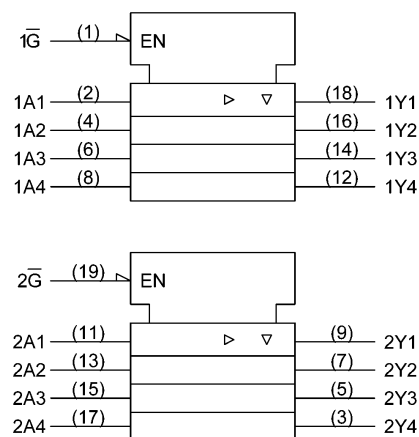


## 7. IEC Logic Symbol

74HCT240D



74HCT244D



## 8. Truth Table

| Input $\bar{G}$ | Input $A_n$ | Output $Y_n$ | Output $\bar{Y}_n$ |
|-----------------|-------------|--------------|--------------------|
| L               | L           | L            | H                  |
| L               | H           | H            | L                  |
| H               | X           | Z            | Z                  |

X: Don't care

Z: High impedance

 $Y_n$ : 74HCT244D $\bar{Y}_n$ : 74HCT240D

## 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      | $I_{IK}$  |      | $\pm 20$               | mA   |
| Output diode current     | $I_{OK}$  |      | $\pm 20$               | mA   |
| Output current           | $I_{OUT}$ |      | $\pm 35$               | mA   |
| $V_{CC}$ /ground current | $I_{CC}$  |      | $\pm 75$               | mA   |
| Power dissipation        | $P_D$     |      | 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).

## 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     | °C   |
| 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,  $T_a = 25\text{ }^{\circ}\text{C}$ )

| 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                | $V_{OH}$  | $V_{IN} = V_{IH} \text{ or } V_{IL}$                                                        | $I_{OH} = -20\text{ }\mu\text{A}$ | 4.5 | 4.4  | 4.5       | V             |
|                                          |           |                                                                                             | $I_{OH} = -6\text{ mA}$           | 4.5 | 4.18 | 4.31      |               |
| Low-level output voltage                 | $V_{OL}$  | $V_{IN} = V_{IH} \text{ or } V_{IL}$                                                        | $I_{OL} = 20\text{ }\mu\text{A}$  | 4.5 | —    | 0.0       | V             |
|                                          |           |                                                                                             | $I_{OL} = 6\text{ mA}$            | 4.5 | —    | 0.17      |               |
| 3-state output OFF-state leakage current | $I_{OZ}$  | $V_{IN} = V_{IH} \text{ or } V_{IL}$<br>$V_{OUT} = V_{CC} \text{ or GND}$                   | 5.5                               | —   | —    | $\pm 0.5$ | $\mu\text{A}$ |
| Input leakage current                    | $I_{IN}$  | $V_{IN} = V_{CC} \text{ or GND}$                                                            | 5.5                               | —   | —    | $\pm 0.1$ | $\mu\text{A}$ |
| Quiescent supply current                 | $I_{CC}$  | $V_{IN} = V_{CC} \text{ or GND}$                                                            | 5.5                               | —   | —    | 4.0       | $\mu\text{A}$ |
|                                          | $I_{CCT}$ | Per input: $V_{IN} = 0.5\text{ V or } 2.4\text{ V}$<br>Other input: $V_{CC} \text{ or GND}$ | 5.5                               | —   | —    | 2.0       | mA            |

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

| 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                | $V_{OH}$  | $V_{IN} = V_{IH} \text{ or } V_{IL}$                                                        | $I_{OH} = -20\text{ }\mu\text{A}$ | 4.5 | 4.4       | V             |
|                                          |           |                                                                                             | $I_{OH} = -6\text{ mA}$           | 4.5 | 4.13      |               |
| Low-level output voltage                 | $V_{OL}$  | $V_{IN} = V_{IH} \text{ or } V_{IL}$                                                        | $I_{OL} = 20\text{ }\mu\text{A}$  | 4.5 | —         | V             |
|                                          |           |                                                                                             | $I_{OL} = 6\text{ mA}$            | 4.5 | —         |               |
| 3-state output OFF-state leakage current | $I_{OZ}$  | $V_{IN} = V_{IH} \text{ or } V_{IL}$<br>$V_{OUT} = V_{CC} \text{ or GND}$                   | 5.5                               | —   | $\pm 5.0$ | $\mu\text{A}$ |
| Input leakage current                    | $I_{IN}$  | $V_{IN} = V_{CC} \text{ or GND}$                                                            | 5.5                               | —   | $\pm 1.0$ | $\mu\text{A}$ |
| Quiescent supply current                 | $I_{CC}$  | $V_{IN} = V_{CC} \text{ or GND}$                                                            | 5.5                               | —   | 40.0      | $\mu\text{A}$ |
|                                          | $I_{CCT}$ | Per input: $V_{IN} = 0.5\text{ V or } 2.4\text{ V}$<br>Other input: $V_{CC} \text{ or GND}$ | 5.5                               | —   | 2.9       | mA            |

11.3. AC Characteristics (Unless otherwise specified,  $T_a = 25^\circ\text{C}$ , 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         | 4.5          | —   | 7    | 12  | ns   |
|                               |             |                    |          |                          |            | 5.5          | —   | 6    | 11  |      |
| Propagation delay time        | 74HCT240D   | $t_{PLH}, t_{PHL}$ |          | —                        | 50         | 4.5          | —   | 15   | 22  | ns   |
|                               |             |                    |          |                          |            | 5.5          | —   | 13   | 20  |      |
|                               |             |                    |          |                          | 150        | 4.5          | —   | 21   | 30  |      |
|                               |             |                    |          |                          |            | 5.5          | —   | 16   | 27  |      |
| Propagation delay time        | 74HCT244D   | $t_{PLH}, t_{PHL}$ |          | —                        | 50         | 4.5          | —   | 15   | 25  | ns   |
|                               |             |                    |          |                          |            | 5.5          | —   | 13   | 22  |      |
|                               |             |                    |          |                          | 150        | 4.5          | —   | 21   | 33  |      |
|                               |             |                    |          |                          |            | 5.5          | —   | 18   | 29  |      |
| 3-state output enable time    |             | $t_{PZL}, t_{PZH}$ |          | $R_L = 1\text{ k}\Omega$ | 50         | 4.5          | —   | 17   | 30  | ns   |
|                               |             |                    |          |                          |            | 5.5          | —   | 14   | 27  |      |
|                               |             |                    |          |                          | 150        | 4.5          | —   | 23   | 38  |      |
|                               |             |                    |          |                          |            | 5.5          | —   | 20   | 34  |      |
| 3-state output disable time   |             | $t_{PLZ}, t_{PHZ}$ |          | $R_L = 1\text{ k}\Omega$ | 50         | 4.5          | —   | 16   | 30  | ns   |
|                               |             |                    |          |                          |            | 5.5          | —   | 13   | 27  |      |
| Input capacitance             |             | $C_{IN}$           |          | —                        |            |              | —   | 5    | 10  | pF   |
| Output capacitance            |             | $C_{OUT}$          |          | —                        |            |              | —   | 10   | —   | pF   |
| Power dissipation capacitance | 74HCT240D   | $C_{PD}$           | (Note 1) | —                        |            |              | —   | 33   | —   | pF   |
|                               | 74HCT244D   | $C_{PD}$           |          | —                        |            |              | —   | 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.

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

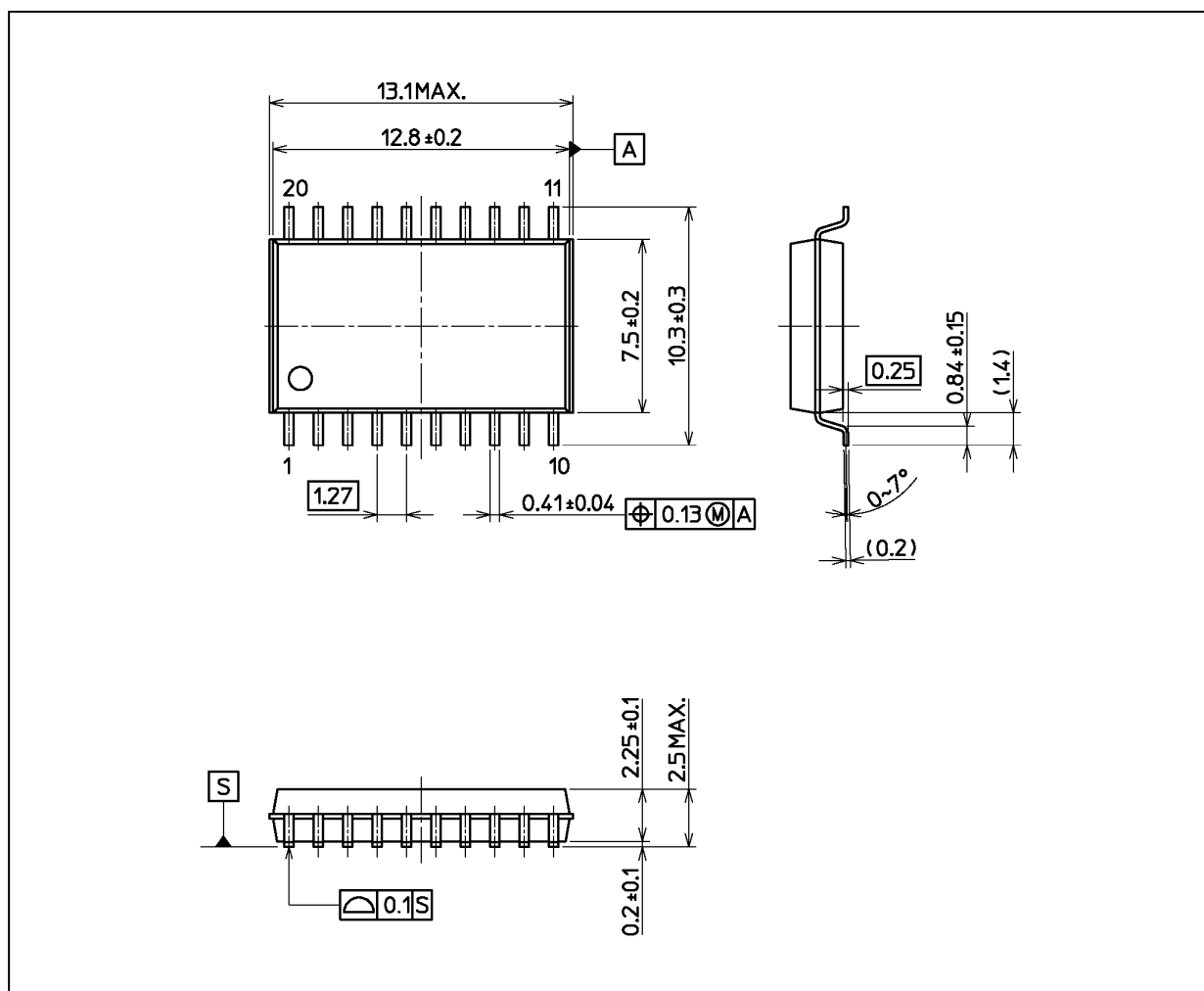
## 11.4. AC Characteristics

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

| 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      | 74HCT240D   | $t_{PLH}, t_{PHL}$ | —                        | 50         | 4.5          | —   | 28  | ns   |
|                             |             |                    |                          |            | 5.5          | —   | 25  |      |
|                             |             |                    |                          | 150        | 4.5          | —   | 38  |      |
|                             |             |                    |                          |            | 5.5          | —   | 34  |      |
| Propagation delay time      | 74HCT244D   | $t_{PLH}, t_{PHL}$ | —                        | 50         | 4.5          | —   | 31  | ns   |
|                             |             |                    |                          |            | 5.5          | —   | 28  |      |
|                             |             |                    |                          | 150        | 4.5          | —   | 41  |      |
|                             |             |                    |                          |            | 5.5          | —   | 37  |      |
| 3-state output enable time  |             | $t_{PZL}, t_{PZH}$ | $R_L = 1\text{ k}\Omega$ | 50         | 4.5          | —   | 38  | ns   |
|                             |             |                    |                          |            | 5.5          | —   | 34  |      |
|                             |             |                    |                          | 150        | 4.5          | —   | 48  |      |
|                             |             |                    |                          |            | 5.5          | —   | 43  |      |
| 3-state output disable time |             | $t_{PLZ}, t_{PHZ}$ | $R_L = 1\text{ k}\Omega$ | 50         | 4.5          | —   | 38  | ns   |
|                             |             |                    |                          |            | 5.5          | —   | 34  |      |
| Input capacitance           |             | $C_{IN}$           | —                        |            |              | —   | 10  | pF   |

## Package Dimensions

Unit: mm



Weight: 0.51 g (typ.)

| Package Name(s)  |
|------------------|
| Nickname: SOIC20 |

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