

# DATA SHEET

For a complete data sheet, please also download:

- The IC06 74HC/HCT/HCU/HCMOS Logic Family Specifications
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Information
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Outlines

## **74HC/HCT7541**

Octal Schmitt trigger buffer/line driver; 3-state

Product specification  
Supersedes data of March 1988  
File under Integrated Circuits, IC06

December 1990

## Octal Schmitt trigger buffer/line driver; 3-state

## 74HC/HCT7541

## FEATURES

- Non-inverting outputs
- Schmitt trigger action on all data inputs
- Output capability: bus driver
- $I_{CC}$  category: MSI

## GENERAL DESCRIPTION

The 74HC/HCT7541 are high-speed Si-gate CMOS devices and are pin compatible with low power Schottky TTL (LSTTL). They are specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT7541 are octal Schmitt trigger non-inverting buffer/line drivers with 3-state outputs. The 3-state outputs are controlled by the output enable inputs  $\overline{OE}_1$  and  $\overline{OE}_2$ .

A HIGH on  $\overline{OE}_n$  causes the outputs to assume a high impedance OFF-state.

The Schmitt trigger action in the data inputs transforms slowly changing input signals into sharply defined jitter-free output signals.

The "7541" is identical to the "541" but has hysteresis on the data inputs.

## QUICK REFERENCE DATA

GND = 0 V;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $t_r = t_f = 6\text{ ns}$

| SYMBOL            | PARAMETER                                   | CONDITIONS                                   | TYPICAL |     | UNIT |
|-------------------|---------------------------------------------|----------------------------------------------|---------|-----|------|
|                   |                                             |                                              | HC      | HCT |      |
| $t_{PHL}/t_{PLH}$ | propagation delay $A_n$ to $\overline{Y}_n$ | $C_L = 15\text{ pF}$ ; $V_{CC} = 5\text{ V}$ | 10      | 16  | ns   |
| $C_I$             | input capacitance                           |                                              | 3.5     | 3.5 | pF   |
| $C_{PD}$          | power dissipation capacitance per buffer    | notes 1 and 2                                | 30      | 32  | pF   |

## Notes

1.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ):

$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

$f_i$  = input frequency in MHz

$f_o$  = output frequency in MHz

$\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of outputs

$C_L$  = output load capacitance in pF

$V_{CC}$  = supply voltage in V

2. For HC the condition is  $V_I = \text{GND to } V_{CC}$   
For HCT the condition is  $V_I = \text{GND to } V_{CC} - 1.5\text{ V}$

## ORDERING INFORMATION

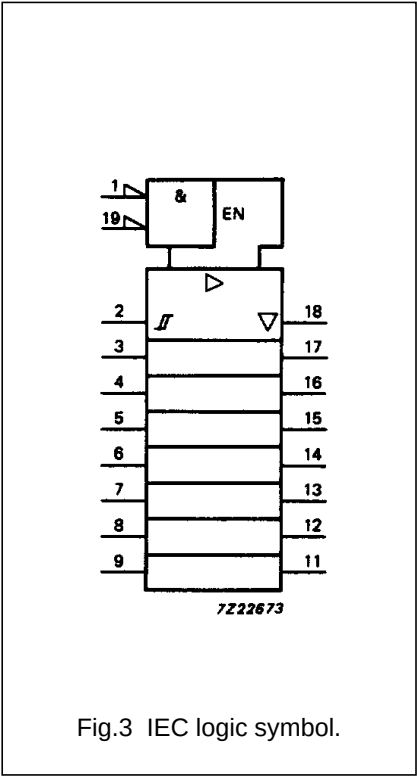
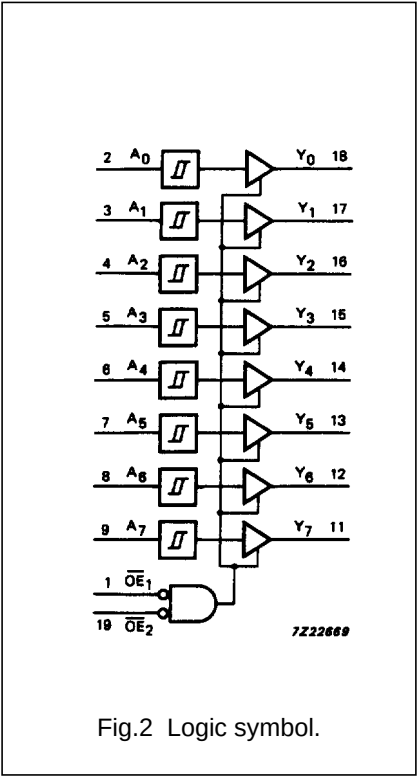
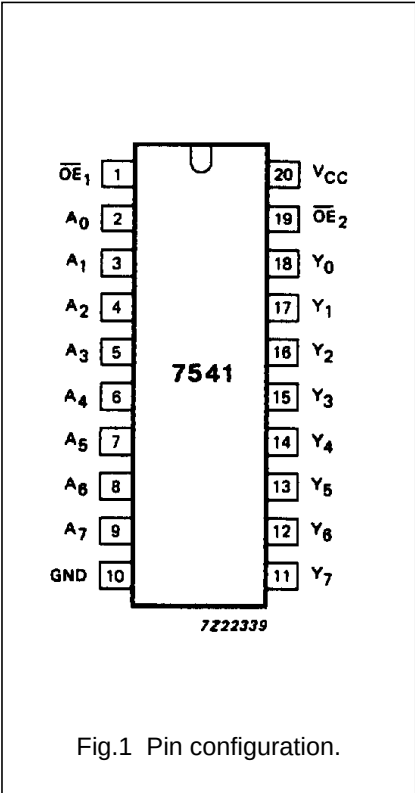
See "74HC/HCT/HCU/HCMOS Logic Package Information".

Octal Schmitt trigger buffer/line driver; 3-state

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PIN DESCRIPTION

| PIN NO.                        | SYMBOL                             | NAME AND FUNCTION                 |
|--------------------------------|------------------------------------|-----------------------------------|
| 1, 19                          | $\overline{OE}_1, \overline{OE}_2$ | output enable inputs (active LOW) |
| 2, 3, 4, 5, 6, 7, 8, 9         | $A_0$ to $A_7$                     | data inputs                       |
| 10                             | GND                                | ground (0 V)                      |
| 18, 17, 16, 15, 14, 13, 12, 11 | $Y_0$ to $Y_7$                     | bus outputs                       |
| 20                             | $V_{CC}$                           | positive supply voltage           |



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FUNCTION TABLE

| INPUTS            |                   |       | OUTPUTS |
|-------------------|-------------------|-------|---------|
| $\overline{OE}_1$ | $\overline{OE}_2$ | $A_n$ | $Y_n$   |
| L                 | L                 | L     | L       |
| L                 | L                 | H     | H       |
| X                 | H                 | X     | Z       |
| H                 | X                 | X     | Z       |

- Notes
- H = HIGH voltage level  
L = LOW voltage level  
X = don't care  
Z = high impedance OFF-state

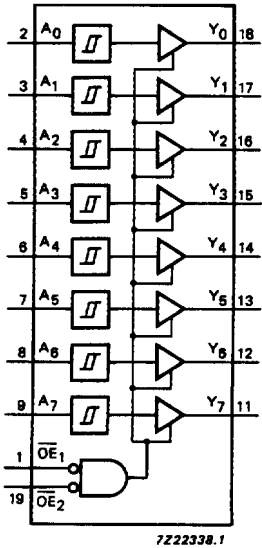


Fig.4 Functional diagram.

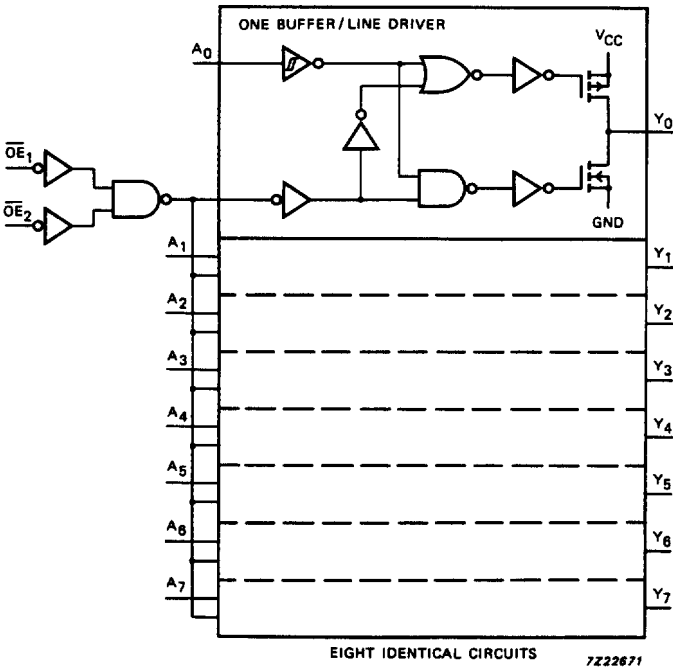


Fig.5 Logic diagram.

## Octal Schmitt trigger buffer/line driver; 3-state

## 74HC/HCT7541

**DC CHARACTERISTICS FOR 74HC**

For the DC characteristics see *"74HC/HCT/HCU/HCMOS Logic Family Specifications"*.

Transfer characteristics are given below (not applicable for  $\overline{OE}_n$  inputs).

Output capability: bus driver

$I_{CC}$  category: MSI

**AC CHARACTERISTICS FOR 74HC**

GND = 0 V;  $t_r = t_f = 6$  ns;  $C_L = 50$  pF

| SYMBOL                              | PARAMETER                                                        | T <sub>amb</sub> (°C) |                |                 |            |                 |             |                 | UNIT | TEST CONDITIONS        |           |
|-------------------------------------|------------------------------------------------------------------|-----------------------|----------------|-----------------|------------|-----------------|-------------|-----------------|------|------------------------|-----------|
|                                     |                                                                  | 74HC                  |                |                 |            |                 |             |                 |      | V <sub>CC</sub><br>(V) | WAVEFORMS |
|                                     |                                                                  | +25                   |                |                 | −40 to +85 |                 | −40 to +125 |                 |      |                        |           |
|                                     |                                                                  | min.                  | typ.           | max.            | min.       | max.            | min.        | max.            |      |                        |           |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>A <sub>n</sub> to Y <sub>n</sub>            |                       | 39<br>14<br>11 | 120<br>24<br>20 |            | 150<br>30<br>26 |             | 180<br>36<br>32 | ns   | 2.0<br>4.5<br>6.0      | Fig.8     |
| t <sub>PZH</sub> / t <sub>PZL</sub> | 3-state output enable time<br>OE <sub>n</sub> to Y <sub>n</sub>  |                       | 44<br>16<br>13 | 160<br>32<br>27 |            | 200<br>40<br>34 |             | 240<br>48<br>41 | ns   | 2.0<br>4.5<br>6.0      | Fig.8     |
| t <sub>PHZ</sub> / t <sub>PLZ</sub> | 3-state output disable time<br>OE <sub>n</sub> to Y <sub>n</sub> |                       | 58<br>21<br>17 | 160<br>32<br>27 |            | 200<br>40<br>34 |             | 240<br>48<br>41 | ns   | 2.0<br>4.5<br>6.0      | Fig.8     |
| t <sub>THL</sub> / t <sub>TLH</sub> | output transition time                                           |                       | 14<br>5<br>4   | 60<br>12<br>10  |            | 75<br>15<br>13  |             | 90<br>18<br>15  | ns   | 2.0<br>4.5<br>6.0      | Fig.8     |

**TRANSFER CHARACTERISTICS FOR 74HC**

Voltages are referred to GND (ground = 0 V)

| SYMBOL          | PARAMETER                                       | T <sub>amb</sub> (°C) |                      |                      |                      |                      |                      |                      |   | UNIT              | TEST CONDITIONS        |           |
|-----------------|-------------------------------------------------|-----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|---|-------------------|------------------------|-----------|
|                 |                                                 | 74HC                  |                      |                      |                      |                      |                      |                      |   |                   | V <sub>CC</sub><br>(V) | WAVEFORMS |
|                 |                                                 | +25                   |                      |                      | −40 to +85           |                      | −40 to +125          |                      |   |                   |                        |           |
|                 |                                                 | min.                  | typ.                 | max.                 | min.                 | max.                 | min.                 | max.                 |   |                   |                        |           |
| V <sub>T+</sub> | positive-going threshold                        |                       |                      | 1.50<br>3.15<br>4.20 |                      | 1.50<br>3.15<br>4.20 |                      | 1.50<br>3.15<br>4.20 | V | 2.0<br>4.5<br>6.0 | Figs 6 and 7           |           |
| V <sub>T−</sub> | negative-going threshold                        | 0.30<br>1.35<br>1.80  |                      |                      | 0.30<br>1.35<br>1.80 |                      | 0.30<br>1.35<br>1.80 |                      | V | 2.0<br>4.5<br>6.0 | Figs 6 and 7           |           |
| V <sub>H</sub>  | hysteresis (V <sub>T+</sub> − V <sub>T−</sub> ) | 0.10<br>0.25<br>0.30  | 0.20<br>0.40<br>0.50 |                      | 0.10<br>0.25<br>0.30 |                      | 0.10<br>0.25<br>0.30 |                      | V | 2.0<br>4.5<br>6.0 | Figs 6 and 7           |           |

## Octal Schmitt trigger buffer/line driver; 3-state

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**DC CHARACTERISTICS FOR 74HCT**

For the DC characteristics see *"74HC/HCT/HCU/HCMOS Logic Family Specifications"*.

Transfer characteristics are given below (not applicable for  $\overline{OE}_n$  inputs).

Output capability: bus driver

$I_{CC}$  category: MSI

**Note to HCT types**

The value of additional quiescent supply current ( $\Delta I_{CC}$ ) for a unit load of 1 is given in the family specifications.

To determine  $\Delta I_{CC}$  per input, multiply this value by the unit load coefficient shown in the table below.

| INPUT             | UNIT LOAD COEFFICIENT |
|-------------------|-----------------------|
| $\overline{OE}_1$ | 1.30                  |
| $\overline{OE}_2$ | 1.30                  |
| $A_n$             | 0.20                  |

**AC CHARACTERISTICS FOR 74HCT**

GND = 0 V;  $t_r = t_f = 6$  ns;  $C_L = 50$  pF

| SYMBOL                              | PARAMETER                                                        | T <sub>amb</sub> (°C) |      |     |            |     |             |      | UNIT | TEST CONDITIONS        |           |
|-------------------------------------|------------------------------------------------------------------|-----------------------|------|-----|------------|-----|-------------|------|------|------------------------|-----------|
|                                     |                                                                  | 74HCT                 |      |     |            |     |             |      |      | V <sub>CC</sub><br>(V) | WAVEFORMS |
|                                     |                                                                  | +25                   |      |     | −40 to +85 |     | −40 to +125 |      |      |                        |           |
|                                     |                                                                  | min                   | typ. | max | min.       | max | min.        | max. |      |                        |           |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>A <sub>n</sub> to Y <sub>n</sub>            |                       | 19   | 32  |            | 40  |             | 48   | ns   | 4.5                    | Fig.8     |
| t <sub>PZH</sub> / t <sub>PZL</sub> | 3-state output enable time<br>OE <sub>n</sub> to Y <sub>n</sub>  |                       | 18   | 32  |            | 40  |             | 48   | ns   | 4.5                    | Fig.8     |
| t <sub>PHZ</sub> / t <sub>PLZ</sub> | 3-state output disable time<br>OE <sub>n</sub> to Y <sub>n</sub> |                       | 20   | 32  |            | 40  |             | 48   | ns   | 4.5                    | Fig.8     |
| t <sub>THL</sub> / t <sub>TLH</sub> | output transition time                                           |                       | 5    | 12  |            | 15  |             | 18   | ns   | 4.5                    | Fig.8     |

**TRANSFER CHARACTERISTICS FOR 74HCT**

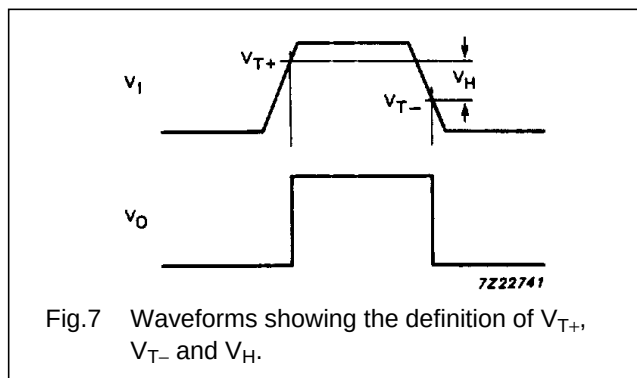
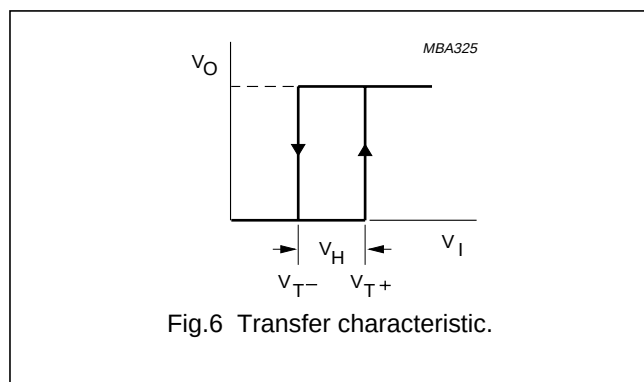
Voltages are referred to GND (ground = 0 V)

| SYMBOL          | PARAMETER                                       | T <sub>amb</sub> (°C) |              |            |              |            |              |            | UNIT | TEST CONDITIONS        |              |
|-----------------|-------------------------------------------------|-----------------------|--------------|------------|--------------|------------|--------------|------------|------|------------------------|--------------|
|                 |                                                 | 74HCT                 |              |            |              |            |              |            |      | V <sub>CC</sub><br>(V) | WAVEFORMS    |
|                 |                                                 | +25                   |              |            | −40 to +85   |            | −40 to +125  |            |      |                        |              |
|                 |                                                 | min.                  | typ.         | max.       | min.         | max.       | min.         | max.       |      |                        |              |
| V <sub>T+</sub> | positive-going threshold                        |                       |              | 2.0<br>2.1 |              | 2.0<br>2.1 |              | 2.0<br>2.1 | V    | 4.5<br>5.5             | Figs 6 and 7 |
| V <sub>T−</sub> | negative-going threshold                        | 0.70<br>0.80          |              |            | 0.64<br>0.74 |            | 0.60<br>0.70 |            | V    | 4.5<br>5.5             | Figs 6 and 7 |
| V <sub>H</sub>  | hysteresis (V <sub>T+</sub> − V <sub>T−</sub> ) | 0.17<br>0.17          | 0.23<br>0.23 |            |              |            |              |            | V    | 4.5<br>5.5             | Figs 6 and 7 |

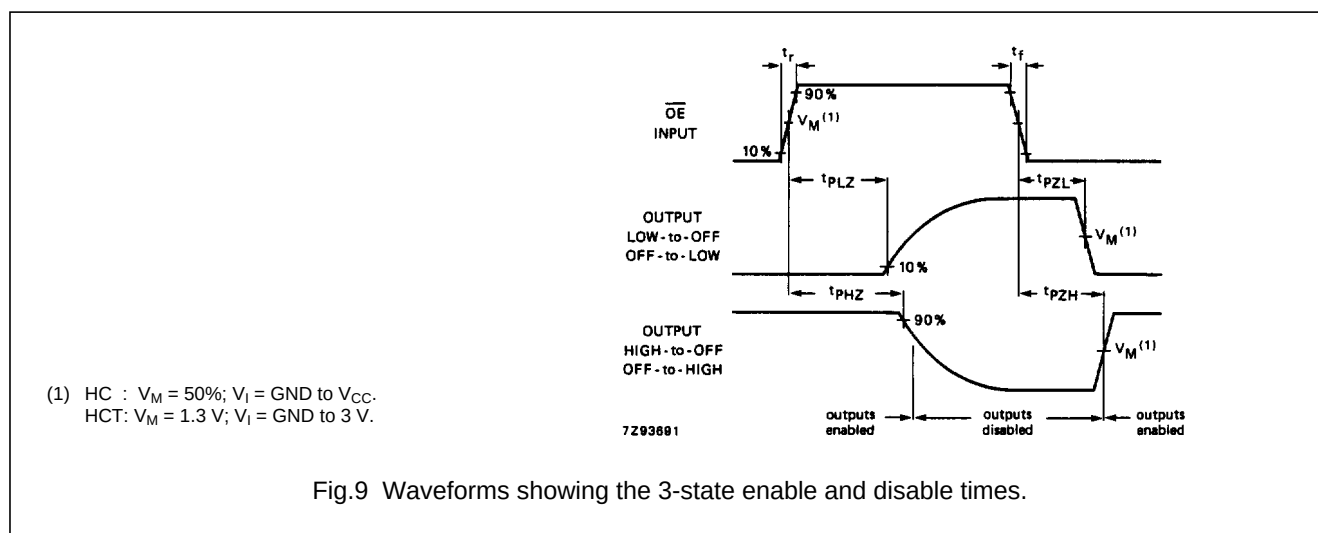
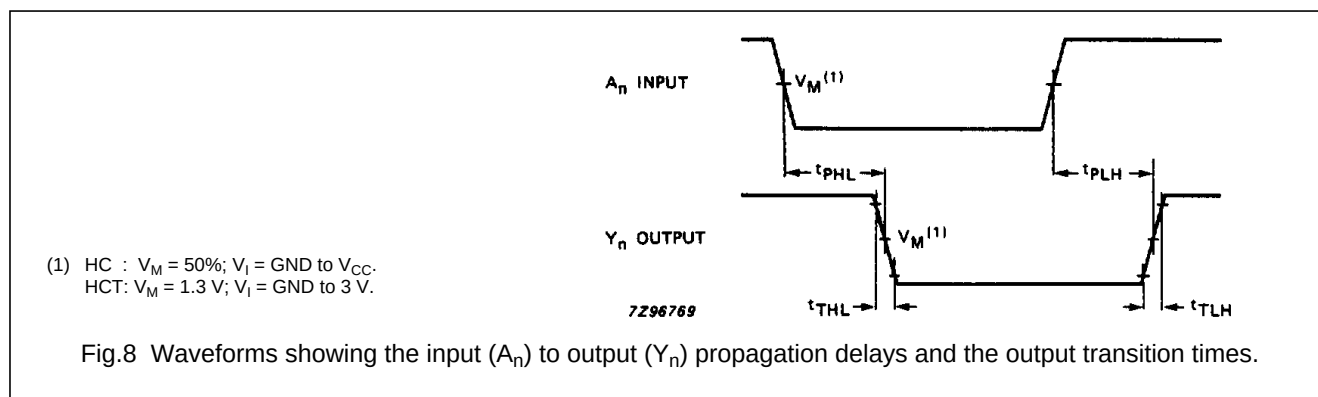
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## TRANSFER CHARACTERISTIC WAVEFORMS



## AC WAVEFORMS



## PACKAGE OUTLINES

See "74HC/HCT/HCU/HCMOS Logic Package Outlines".