

# 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/HCT251** 8-input multiplexer; 3-state

Product specification  
File under Integrated Circuits, IC06

December 1990

## 8-input multiplexer; 3-state

## 74HC/HCT251

## FEATURES

- True and complement outputs
- Both outputs are 3-state for further multiplexer expansion
- Multifunction capability
- Permits multiplexing from n-lines to one line
- Output capability: standard
- $I_{CC}$  category: MSI

## GENERAL DESCRIPTION

The 74HC/HCT251 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/HCT251 are the logic implementations of single-pole 8-position switches with the state of three select inputs ( $S_0, S_1, S_2$ ) controlling the switch positions. Assertion ( $Y$ ) and negation ( $\bar{Y}$ ) outputs are both provided. The output enable input ( $\overline{OE}$ ) is active LOW. The logic function provided at the output, when activated, is:

$$Y = \overline{OE} \cdot (I_0 \cdot \bar{S}_0 \cdot \bar{S}_1 \cdot \bar{S}_2 + I_1 \cdot S_0 \cdot \bar{S}_1 \cdot \bar{S}_2 + I_2 \cdot \bar{S}_0 \cdot S_1 \cdot \bar{S}_2 + I_3 \cdot S_0 \cdot S_1 \cdot \bar{S}_2 + I_4 \cdot \bar{S}_0 \cdot \bar{S}_1 \cdot S_2 + I_5 \cdot S_0 \cdot \bar{S}_1 \cdot S_2 + I_6 \cdot \bar{S}_0 \cdot S_1 \cdot S_2 + I_7 \cdot S_0 \cdot S_1 \cdot S_2)$$

Both outputs are in the high impedance OFF-state ( $Z$ ) when the output enable input is HIGH, allowing multiplexer expansion by tying the outputs.

## 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<br>$I_n$ to $Y$<br>$I_n$ to $\bar{Y}$<br>$S_n$ to $Y$<br>$S_n$ to $\bar{Y}$ | $C_L = 15\text{ pF}$ ; $V_{CC} = 5\text{ V}$ | 15<br>17<br>20<br>21 | 19<br>19<br>20<br>21 | ns<br>ns<br>ns<br>ns |
| $C_I$               | input capacitance                                                                             |                                              | 3.5                  | 3.5                  | pF                   |
| $C_{PD}$            | power dissipation capacitance per package                                                     | notes 1 and 2                                | 44                   | 46                   | 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

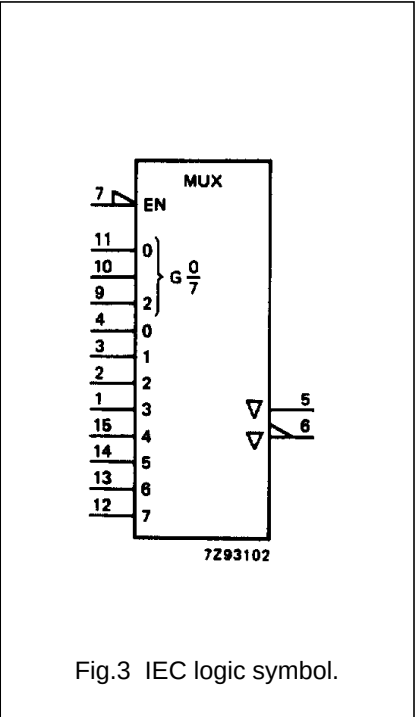
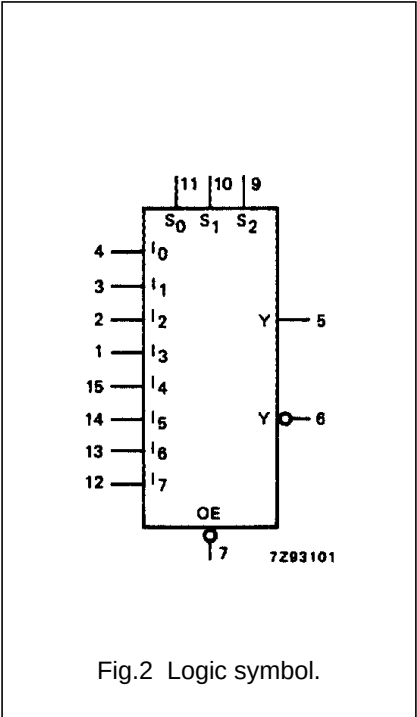
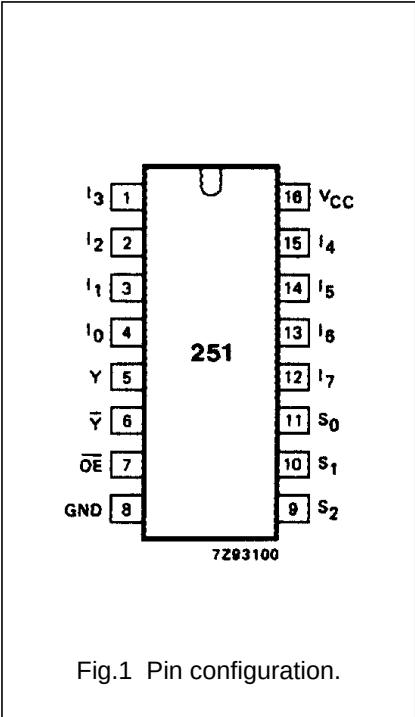
See "74HC/HCT/HCU/HCMOS Logic Package Information".

8-input multiplexer; 3-state

74HC/HCT251

PIN DESCRIPTION

| PIN NO.                    | SYMBOL          | NAME AND FUNCTION                        |
|----------------------------|-----------------|------------------------------------------|
| 4, 3, 2, 1, 15, 14, 13, 12 | $I_0$ to $I_7$  | multiplexer inputs                       |
| 5                          | $Y$             | multiplexer output                       |
| 6                          | $\overline{Y}$  | complementary multiplexer output         |
| 7                          | $\overline{OE}$ | 3-state output enable input (active LOW) |
| 8                          | GND             | ground (0 V)                             |
| 11, 10, 9                  | $S_0, S_1, S_2$ | select inputs                            |
| 16                         | $V_{CC}$        | positive supply voltage                  |



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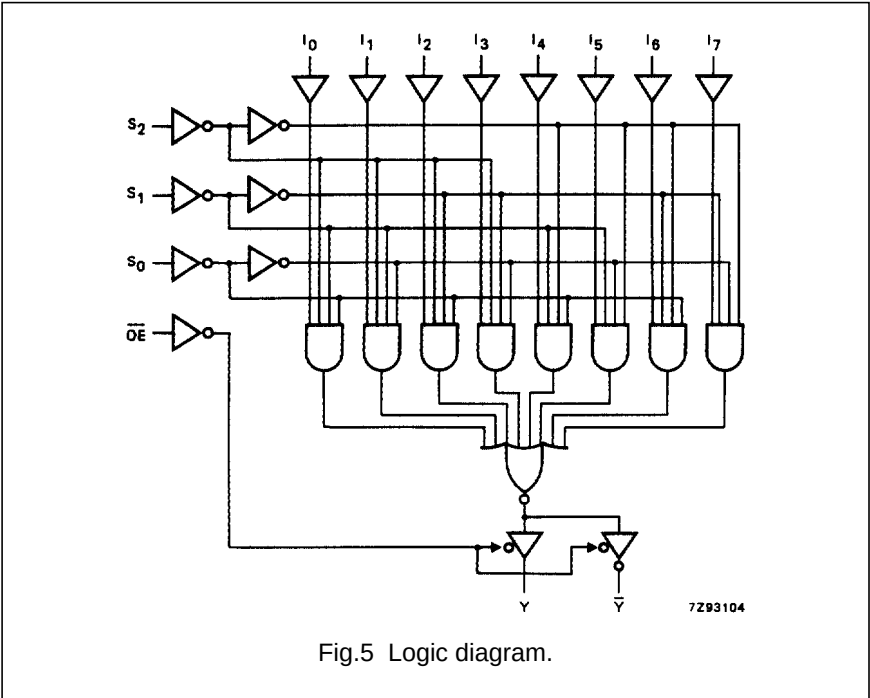
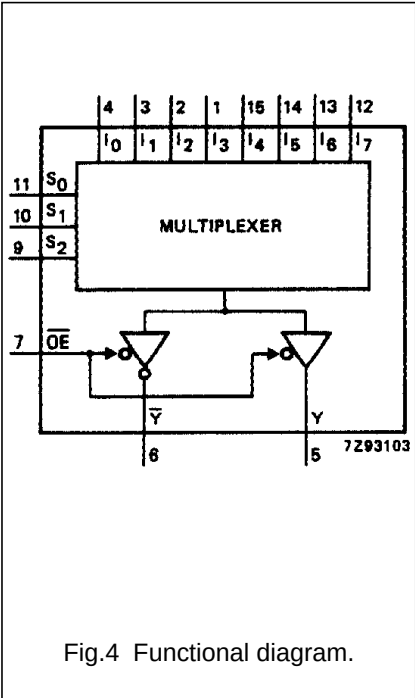
74HC/HCT251

FUNCTION TABLE

| INPUTS |                |                |                |                |                |                |                |                |                |                |                | OUTPUTS |   |
|--------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|---------|---|
| OE     | S <sub>2</sub> | S <sub>1</sub> | S <sub>0</sub> | I <sub>0</sub> | I <sub>1</sub> | I <sub>2</sub> | I <sub>3</sub> | I <sub>4</sub> | I <sub>5</sub> | I <sub>6</sub> | I <sub>7</sub> | Y       | Y |
| H      | X              | X              | X              | X              | X              | X              | X              | X              | X              | X              | X              | Z       | Z |
| L      | L              | L              | L              | L              | X              | X              | X              | X              | X              | X              | X              | H       | L |
| L      | L              | L              | L              | H              | X              | X              | X              | X              | X              | X              | X              | L       | H |
| L      | L              | L              | H              | X              | L              | X              | X              | X              | X              | X              | X              | H       | L |
| L      | L              | L              | H              | X              | H              | X              | X              | X              | X              | X              | X              | L       | H |
| L      | L              | H              | L              | X              | X              | L              | X              | X              | X              | X              | X              | H       | L |
| L      | L              | H              | L              | X              | X              | H              | X              | X              | X              | X              | X              | L       | H |
| L      | L              | H              | H              | X              | X              | X              | L              | X              | X              | X              | X              | H       | L |
| L      | L              | H              | H              | X              | X              | X              | H              | X              | X              | X              | X              | L       | H |
| L      | H              | L              | L              | X              | X              | X              | X              | L              | X              | X              | X              | H       | L |
| L      | H              | L              | L              | X              | X              | X              | X              | H              | X              | X              | X              | L       | H |
| L      | H              | L              | H              | X              | X              | X              | X              | X              | L              | X              | X              | H       | L |
| L      | H              | L              | H              | X              | X              | X              | X              | X              | H              | X              | X              | L       | H |
| L      | H              | H              | L              | X              | X              | X              | X              | X              | X              | L              | X              | H       | L |
| L      | H              | H              | L              | X              | X              | X              | X              | X              | X              | H              | X              | L       | H |
| L      | H              | H              | H              | X              | X              | X              | X              | X              | X              | X              | L              | H       | L |
| L      | H              | H              | H              | X              | X              | X              | X              | X              | X              | X              | H              | L       | H |

Note

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



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**DC CHARACTERISTICS FOR 74HC**

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

Output capability: standard

I<sub>CC</sub> category: MSI

**AC CHARACTERISTICS FOR 74HC**

GND = 0 V; t<sub>r</sub> = t<sub>f</sub> = 6 ns; C<sub>L</sub> = 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>I <sub>n</sub> to Y                       |                       | 50<br>18<br>14 | 170<br>34<br>29 |            | 215<br>43<br>37 |             | 255<br>51<br>43 | ns   | 2.0<br>4.5<br>6.0      | Fig.6        |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>I <sub>n</sub> to $\bar{Y}$               |                       | 55<br>20<br>16 | 175<br>35<br>30 |            | 220<br>44<br>37 |             | 265<br>53<br>45 | ns   | 2.0<br>4.5<br>6.0      | Fig.7        |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>S <sub>n</sub> to Y                       |                       | 66<br>24<br>19 | 205<br>41<br>35 |            | 255<br>51<br>43 |             | 310<br>62<br>53 | ns   | 2.0<br>4.5<br>6.0      | Fig.6        |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>S <sub>n</sub> to $\bar{Y}$               |                       | 69<br>25<br>20 | 205<br>41<br>35 |            | 255<br>51<br>43 |             | 310<br>62<br>53 | ns   | 2.0<br>4.5<br>6.0      | Fig.7        |
| t <sub>PZH</sub> / t <sub>PZL</sub> | 3-state output enable time<br>$\overline{OE}$ to Y, $\bar{Y}$  |                       | 36<br>13<br>10 | 140<br>28<br>24 |            | 175<br>35<br>30 |             | 210<br>42<br>36 | ns   | 2.0<br>4.5<br>6.0      | Fig.7        |
| t <sub>PHZ</sub> / t <sub>PLZ</sub> | 3-state output disable time<br>$\overline{OE}$ to Y, $\bar{Y}$ |                       | 39<br>14<br>11 | 140<br>28<br>24 |            | 170<br>35<br>30 |             | 210<br>42<br>36 | ns   | 2.0<br>4.5<br>6.0      | Fig.7        |
| t <sub>THL</sub> / t <sub>TLH</sub> | output transition time                                         |                       | 19<br>7<br>6   | 75<br>15<br>13  |            | 95<br>19<br>16  |             | 110<br>22<br>19 | ns   | 2.0<br>4.5<br>6.0      | Figs 6 and 7 |

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## 74HC/HCT251

**DC CHARACTERISTICS FOR 74HCT**

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

Output capability: standard

I<sub>CC</sub> 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 |
|---------------------------------|-----------------------|
| I <sub>n</sub>                  | 1.00                  |
| S <sub>0</sub>                  | 1.50                  |
| S <sub>1</sub> , S <sub>2</sub> | 1.50                  |
| $\overline{OE}$                 | 1.50                  |

**AC CHARACTERISTICS FOR HCT**

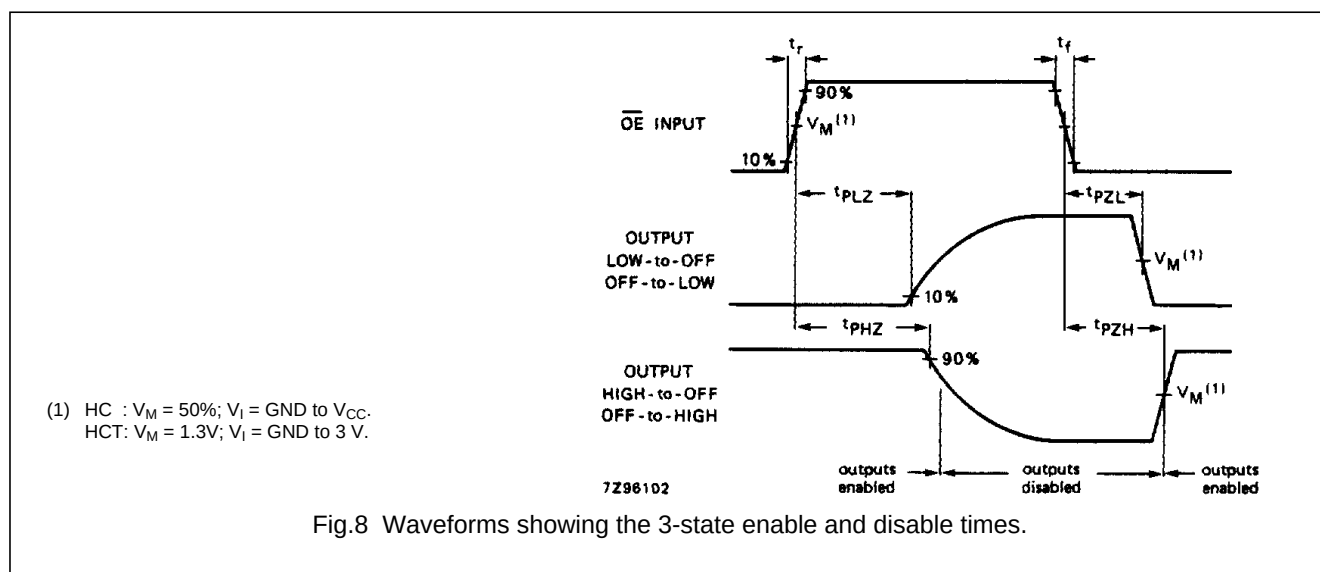
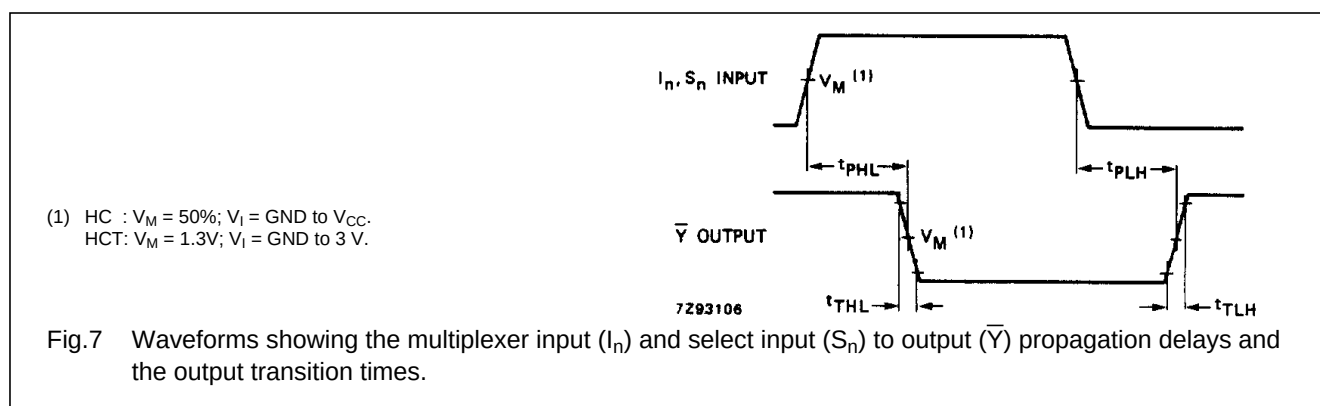
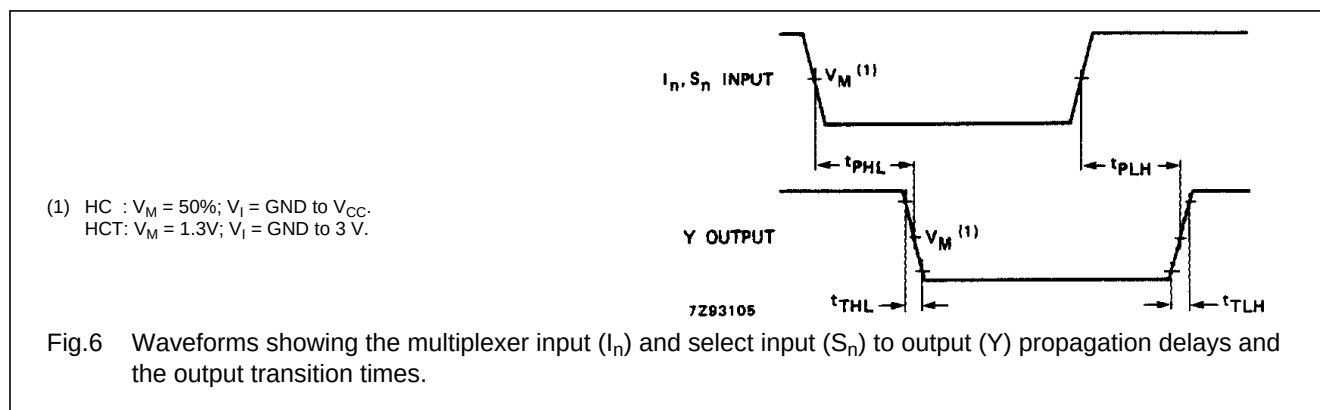
GND = 0 V; t<sub>r</sub> = t<sub>f</sub> = 6 ns; C<sub>L</sub> = 50 pF

| 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>I <sub>n</sub> to Y                            |                       | 22   | 35   |            | 44   |             | 53   | ns   | 4.5                    | Fig.6        |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>I <sub>n</sub> to $\overline{Y}$               |                       | 22   | 35   |            | 44   |             | 53   | ns   | 4.5                    | Fig.7        |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>S <sub>n</sub> to Y                            |                       | 24   | 44   |            | 55   |             | 66   | ns   | 4.5                    | Fig.6        |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>S <sub>n</sub> to $\overline{Y}$               |                       | 25   | 44   |            | 55   |             | 66   | ns   | 4.5                    | Fig.7        |
| t <sub>PZH</sub> / t <sub>PZL</sub> | 3-state output enable time<br>$\overline{OE}$ to Y, $\overline{Y}$  |                       | 13   | 28   |            | 35   |             | 42   | ns   | 4.5                    | Fig.7        |
| t <sub>PHZ</sub> / t <sub>PLZ</sub> | 3-state output disable time<br>$\overline{OE}$ to Y, $\overline{Y}$ |                       | 14   | 28   |            | 35   |             | 42   | ns   | 4.5                    | Fig.7        |
| t <sub>THL</sub> / t <sub>TLH</sub> | output transition time                                              |                       | 7    | 15   |            | 19   |             | 22   | ns   | 4.5                    | Figs 6 and 7 |

## 8-input multiplexer; 3-state

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## AC WAVEFORMS



## PACKAGE OUTLINES

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