

8-INPUT MULTIPLEXER; 3-STATE

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<sub>CC</sub> 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<sub>0</sub>, S<sub>1</sub>, S<sub>2</sub>) controlling the switch positions.

Assertion (Y) and negation (Ȳ) outputs are both provided.

The output enable input (ȪE) is active LOW. The logic function provided at the output, when activated, is:

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

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

SYMBOL	PARAMETER	CONDITIONS	TYPICAL		UNIT
			HC	HCT	
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay	C <sub>L</sub> = 15 pF V <sub>CC</sub> = 5 V	15	19	ns
	I <sub>n</sub> to Y		17	19	ns
	I <sub>n</sub> to Ȳ		20	20	ns
	S <sub>n</sub> to Y S <sub>n</sub> to Ȳ		21	21	ns
C <sub>i</sub>	input capacitance		3.5	3.5	pF
CPD	power dissipation capacitance per package	notes 1 and 2	44	46	pF

GND = 0 V; T<sub>amb</sub> = 25 °C; t<sub>r</sub> = t<sub>f</sub> = 6 ns

Notes

1. CPD is used to determine the dynamic power dissipation (P<sub>D</sub> in μW):  
P<sub>D</sub> = CPD × V<sub>CC</sub><sup>2</sup> × f<sub>i</sub> + Σ (C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) where:  
f<sub>i</sub> = input frequency in MHz      C<sub>L</sub> = output load capacitance in pF  
f<sub>o</sub> = output frequency in MHz      V<sub>CC</sub> = supply voltage in V  
Σ (C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of outputs
2. For HC the condition is V<sub>i</sub> = GND to V<sub>CC</sub>  
For HCT the condition is V<sub>i</sub> = GND to V<sub>CC</sub> - 1.5 V

PACKAGE OUTLINES

SEE PACKAGE INFORMATION SECTION

PIN DESCRIPTION

PIN NO.	SYMBOL	NAME AND FUNCTION
4, 3, 2, 1, 15, 14, 13, 12	I <sub>0</sub> to I <sub>7</sub>	multiplexer inputs
5	Y	multiplexer output
6	Ȳ	complementary multiplexer output
7	ȪE	3-state output enable input (active LOW)
8	GND	ground (0 V)
11, 10, 9	S <sub>0</sub> , S <sub>1</sub> , S <sub>2</sub>	select inputs
16	V <sub>CC</sub>	positive supply voltage

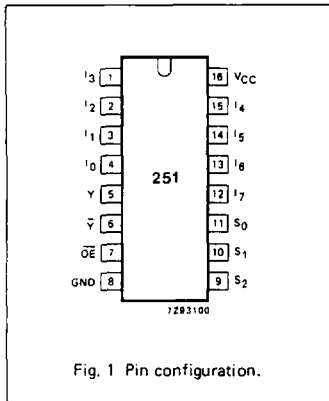


Fig. 1 Pin configuration.

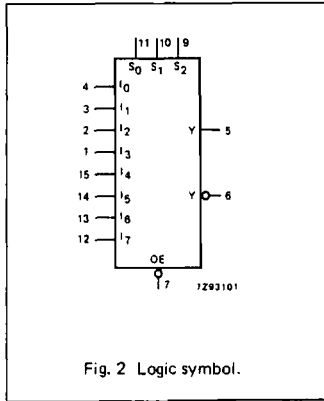


Fig. 2 Logic symbol.

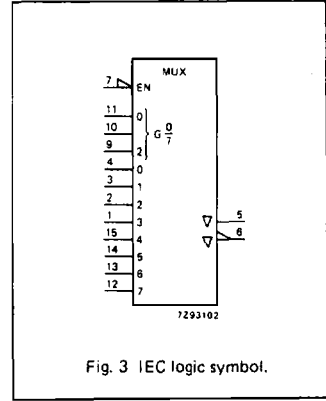


Fig. 3 IEC logic symbol.

74HC/HCT251  
MSI

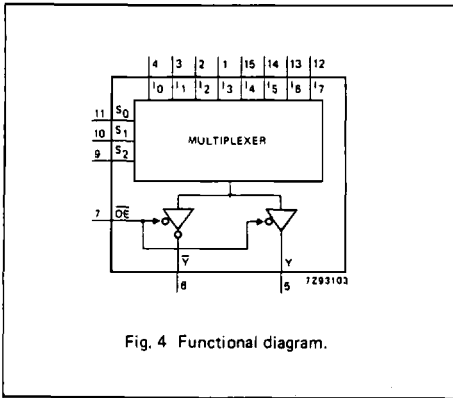


Fig. 4 Functional diagram.

FUNCTION TABLE

INPUTS												OUTPUTS	
$\overline{OE}$	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>	$\overline{Y}$	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	L	X	X	X	X	H	L
L	H	L	L	X	X	X	X	L	X	X	X	L	H
L	H	L	H	X	X	X	X	H	X	X	X	L	H
L	H	H	L	X	X	X	X	X	L	X	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	X	L	H
L	H	H	H	X	X	X	X	X	X	X	H	L	H

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

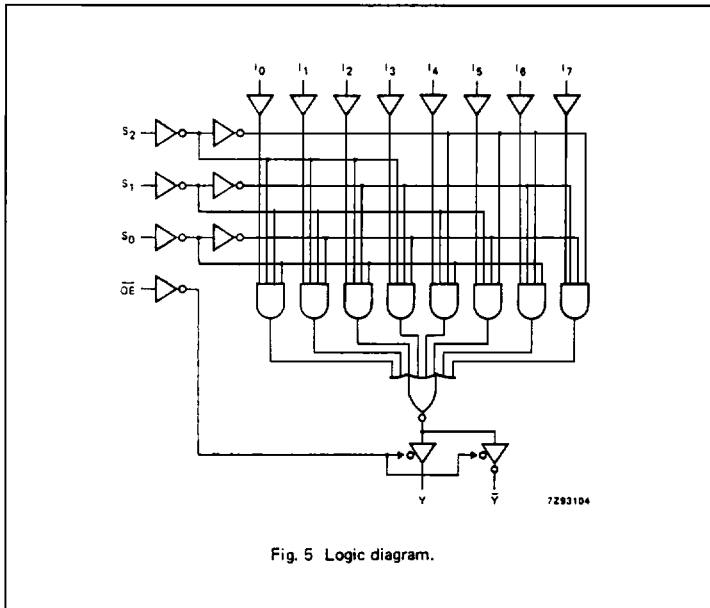


Fig. 5 Logic diagram.

## DC CHARACTERISTICS FOR 74HC

For the DC characteristics see chapter "HCMOS family characteristics", section "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> 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 I <sub>n</sub> to Y		50 18 14	170 34 29		215 43 37		255 51 43	ns	2.0 4.5 6.0	Fig. 6
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay I <sub>n</sub> to $\bar{Y}$		55 20 16	175 35 30		220 44 37		265 53 45	ns	2.0 4.5 6.0	Fig. 7
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay S <sub>n</sub> to Y		66 24 19	205 41 35		255 51 43		310 62 53	ns	2.0 4.5 6.0	Fig. 6
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay S <sub>n</sub> to $\bar{Y}$		69 25 20	205 41 35		255 51 43		310 62 53	ns	2.0 4.5 6.0	Fig. 7
t <sub>PZH</sub> / t <sub>PZL</sub>	3-state output enable time $\bar{OE}$ to Y, $\bar{Y}$		36 13 10	140 28 24		175 35 30		210 42 36	ns	2.0 4.5 6.0	Fig. 8
t <sub>PHZ</sub> / t <sub>PLZ</sub>	3-state output disable time $\bar{OE}$ to Y, $\bar{Y}$		39 14 11	140 28 24		170 35 30		210 42 36	ns	2.0 4.5 6.0	Fig. 8
t <sub>THL</sub> / t <sub>T LH</sub>	output transition time		19 7 6	75 15 13		95 19 16		110 22 19	ns	2.0 4.5 6.0	Figs 6 and 7

**DC CHARACTERISTICS FOR 74HCT**

For the DC characteristics see chapter "HCMOS family characteristics", section "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
OE	1.50

**AC CHARACTERISTICS FOR 74HCT**

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> 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 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 I <sub>n</sub> to $\bar{Y}$		22	35		44		53	ns	4.5	Fig. 7
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay 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 S <sub>n</sub> to $\bar{Y}$		25	44		55		66	ns	4.5	Fig. 7
t <sub>PZH</sub> / t <sub>PZL</sub>	3-state output enable time OE to Y, $\bar{Y}$		13	28		35		42	ns	4.5	Fig. 8
t <sub>PHZ</sub> / t <sub>PLZ</sub>	3-state output disable time OE to Y, $\bar{Y}$		14	28		35		42	ns	4.5	Fig. 8
t <sub>THL</sub> / t <sub>TLH</sub>	output transition time		7	15		19		22	ns	4.5	Figs 6 and 7

AC WAVEFORMS

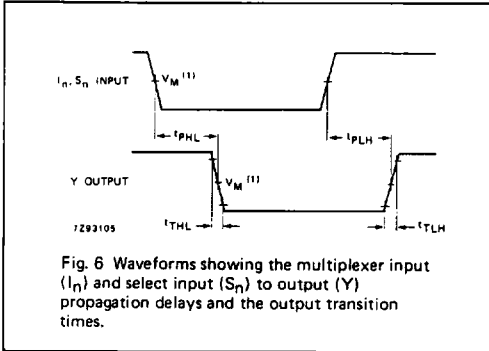


Fig. 6 Waveforms showing the multiplexer input ( $I_n$ ) and select input ( $S_n$ ) to output (Y) propagation delays and the output transition times.

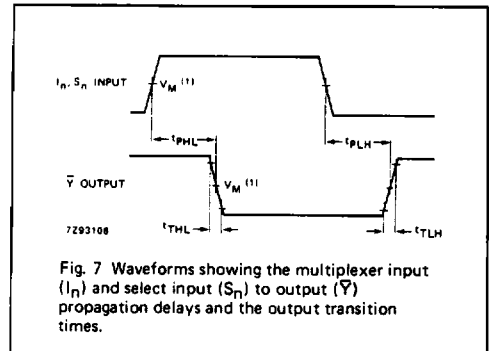


Fig. 7 Waveforms showing the multiplexer input ( $I_n$ ) and select input ( $S_n$ ) to output ( $\bar{Y}$ ) propagation delays and the output transition times.

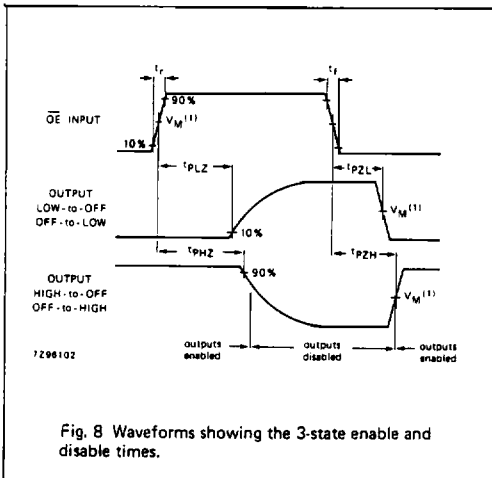


Fig. 8 Waveforms showing the 3-state enable and disable times.

Note to AC waveforms

- (1) HC :  $V_M = 50\%$ ;  $V_I = \text{GND to } V_{CC}$ .
- HCT:  $V_M = 1.3 \text{ V}$ ;  $V_I = \text{GND to } 3 \text{ V}$ .