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/HCT153
Dual 4-input multiplexer

Product specification
File under Integrated Circuits, IC06

December 1990

Philips Semiconductors

PHILIPS

Dual 4-input multiplexer 74HC/HCT153

FEATURES

- Non-inverting output
- Separate enable for each output
- Common select inputs
- See '253" for 3-state version
- Permits multiplexing from n lines to 1 line
- Enable line provided for cascading (n lines to 1 line)
- Output capability: standard
- I_{CC} category: MSI

GENERAL DESCRIPTION

The 74HC/HCT153 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/HCT153 have two identical 4-input multiplexers which select two bits of data from up to four sources selected by common data select inputs (S_0, S_1). The two 4-input multiplexer circuits have individual active LOW output enable inputs ($1\overline{E}$, $2\overline{E}$) which can be used to strobe the outputs independently. The outputs (1Y, 2Y) are forced LOW when the corresponding output enable inputs are HIGH.

The "153" is the logic implementation of a 2-pole, 4-position switch, where the position of the switch is determined by the logic levels applied to S_0 and S_1.

The logic equations for the outputs are:

$$1Y = 1\overline{E}.(1I_0.\overline{S}_1.\overline{S}_0+1I_1.\overline{S}_1.S_0+ +1I_2.S_1.\overline{S}_0+1I_3.S_1.S_0)$$

$$2Y = 2\overline{E}.(2I_0.\overline{S}_1.\overline{S}_0+2I_1.\overline{S}_1.S_0+ +2I_2.S_1.\overline{S}_0+2I_3.S_1.S_0)$$

The "153" can be used to move data to a common output bus from a group of registers. The state of the select inputs would determine the particular register from which the data came. An alternative application is a function generator. The device can generate two functions or three variables. This is useful for implementing highly irregular random logic.

The "153" is similar to the "253" but has standard outputs.

QUICK REFERENCE DATA

GND = 0 V; T_{amb} = 25 °C; $t_r = t_f$ = 6 ns

SYMBOL	PARAMETER	CONDITIONS	TYPICAL		UNIT
			HC	HCT	
t_{PHL}/ t_{PLH}	propagation delay	C_L = 15 pF; V_{CC} = 5 V			
	$1I_n$, $2I_n$ to nY		14	16	ns
	S_n to nY		15	17	ns
	$n\overline{E}$ to nY		10	11	ns
C_I	input capacitance		3.5	3.5	pF
C_{PD}	power dissipation capacitance per multiplexer	notes 1 and 2	30	30	pF

Notes

1. C_{PD} is used to determine the dynamic power dissipation (P_D in µW):

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

   f_i = input frequency in MHz

   f_o = output frequency in MHz

   C_L = output load capacitance in pF

   V_{CC} = supply voltage in V

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

2. For HC the condition is V_I = GND to V_{CC}

   For HCT the condition is V_I = GND to V_{CC} – 1.5 V

ORDERING INFORMATION

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

PIN DESCRIPTION

PIN NO.	SYMBOL	NAME AND FUNCTION
1, 15	$1\overline{E}$, $2\overline{E}$	output enable inputs (active LOW)
14, 2	S_0, S_1	common data select inputs
6, 5, 4, 3	$1I_0$ to $1I_3$	data inputs from source 1
7	1Y	multiplexer output from source 1
8	GND	ground (0 V)
9	2Y	multiplexer output from source 2
10, 11, 12, 13	$2I_0$ to $2I_3$	data inputs from source 2
16	V_{CC}	positive supply voltage

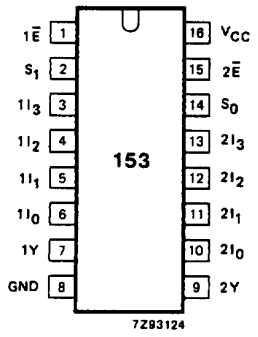


Fig.1 Pin configuration.

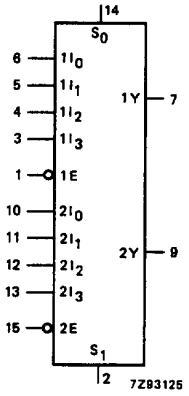


Fig.2 Logic symbol.

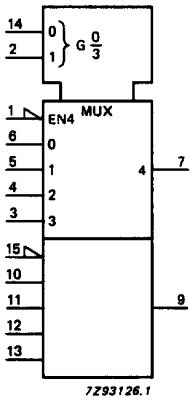


Fig.3 IEC logic symbol.

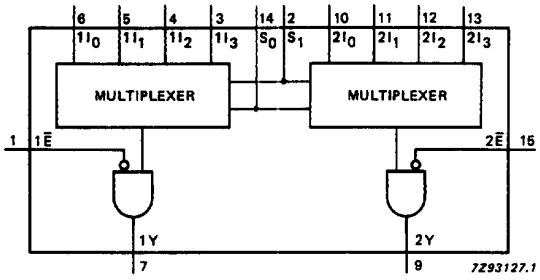


Fig.4 Functional diagram.

FUNCTION TABLE

SELECT INPUTS		DATA INPUTS				OUTPUT ENABLE	OUTPUT
S_0	S_1	nI_0	nI_1	nI_2	nI_3	$n\overline{E}$	nY
X	X	X	X	X	X	H	L
L	L	L	X	X	X	L	L
L	L	H	X	X	X	L	H
H	L	X	L	X	X	L	L
H	L	X	H	X	X	L	H
L	H	X	X	L	X	L	L
L	H	X	X	H	X	L	H
H	H	X	X	X	L	L	L
H	H	X	X	X	H	L	H

Note

1. H = HIGH voltage level
   L = LOW voltage level
   X = don't care

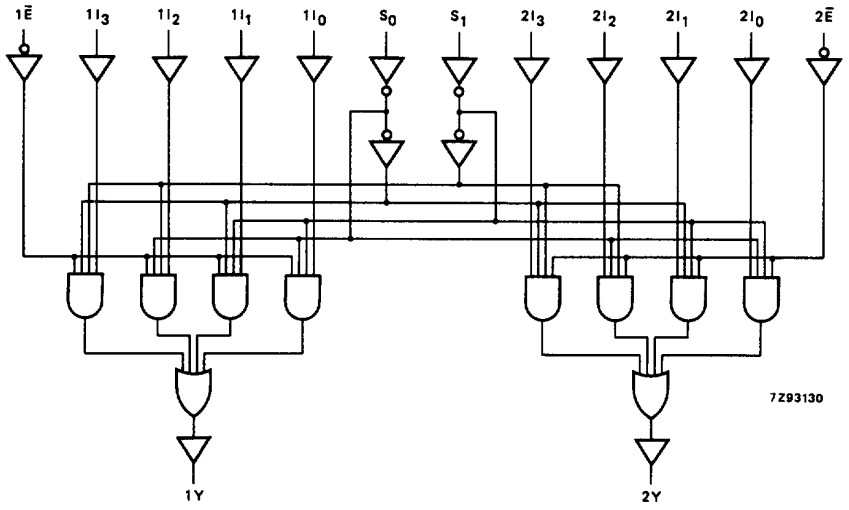


Fig.5 Logic diagram.

DC CHARACTERISTICS FOR 74HC

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

Output capability: standard
I_{CC} category: MSI

AC CHARACTERISTICS FOR 74HC

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

SYMBOL	PARAMETER	T_{amb} (°C)							UNIT	TEST CONDITIONS	
		74HC								V_{CC} (V)	WAVEFORMS
		+25			–40 to+85		–40 to+125				
		min.	typ.	max.	min.	max.	min.	max.			
t_{PHL}/ t_{PLH}	propagation delay $1I_n$ to nY; $2I_n$ to nY		47 17 14	145 29 25		180 36 31		220 44 38	ns	2.0 4.5 6.0	Fig.6
t_{PHL}/ t_{PLH}	propagation delay S_n to nY		50 18 14	150 30 26		190 38 33		225 45 38	ns	2.0 4.5 6.0	Fig.7
t_{PHL}/ t_{PLH}	propagation delay $n\overline{E}$ to nY		33 12 10	100 20 17		125 25 21		150 30 26	ns	2.0 4.5 6.0	Fig.7
t_{THL}/ t_{TLH}	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 *"74HC/HCT/HCU/HCMOS Logic Family Specifications"*.

Output capability: standard
I_{CC} category: MSI

Note to HCT types

The value of additional quiescent supply current (ΔI_{CC}) for a unit load of 1 is given in the family specifications. To determine ΔI_{CC} per input, multiply this value by the unit load coefficient shown in the table below.

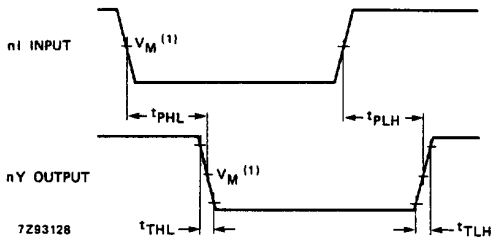
INPUT	UNIT LOAD COEFFICIENT
$1I_n$, $2I_n$	0.45
$n\overline{E}$	0.60
S_n	1.35

AC CHARACTERISTICS FOR 74HCT

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

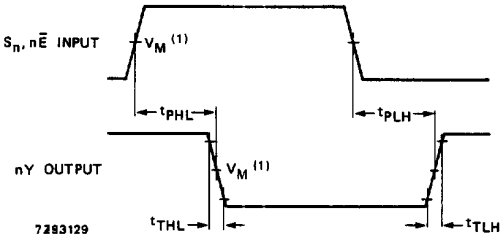
SYMBOL	PARAMETER	T_{amb} (°C)							UNIT	TEST CONDITIONS	
		74HCT								V_{CC} (V)	WAVEFORMS
		+25			−40 to+85		−40 to+125				
		min.	typ.	max.	min.	max.	min.	max.			
t_{PHL}	propagation delay $1I_n$ to nY; $2I_n$ to nY		19	34		43		51	ns	4.5	Fig.6
t_{PLH}	propagation delay $1I_n$ to nY; $2I_n$ to nY		13	24		30		36	ns	4.5	Fig.6
t_{PHL}/ t_{PLH}	propagation delay S_n to nY		20	34		43		51	ns	4.5	Fig.7
t_{PHL}/ t_{PLH}	propagation delay $n\overline{E}$ to nY		14	27		34		41	ns	4.5	Fig.7
t_{THL}/ t_{TLH}	output transition time		7	15		19		22	ns	4.5	Figs 6 and 7

AC WAVEFORMS



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

Fig.6 Waveforms showing the input ($1I_n$, $2I_n$) to output (1Y, 2Y) propagation delays and the output transition times.



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

Fig.7 Waveforms showing the select input (S_0, S_1) and the output enable input ($\bar{E}$) to output (1Y, 2Y) propagation delays and the output transition times.

PACKAGE OUTLINES

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