

Dual 2-to-4 line decoder/demultiplexer

74HC/HCT139

FEATURES

- Demultiplexing capability
- Two independent 2-to-4 decoders
- Multifunction capability
- Active LOW mutually exclusive outputs
- Output capability: standard
- I_{CC} category: MSI

GENERAL DESCRIPTION

The 74HC/HCT139 are high-speed Si-gate CMOS devices and are pin compatible with low power Schottky TTL (LSTTL). It is specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT139 are high-speed, dual 2-to-4 line decoder/multiplexers. This device has two independent decoders, each accepting two binary weighted inputs (nA_0 and nA_1) and providing four mutually exclusive active LOW outputs ($n\bar{Y}_0$ to $n\bar{Y}_3$). Each decoder has an active LOW enable input ($n\bar{E}$).

When $n\bar{E}$ is HIGH, every output is forced HIGH. The enable can be used as the data input for a 1-to-4 demultiplexer application.

The "139" is identical to the HEF4556 of the HE4000B family.

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 nA_n to $n\bar{Y}_n$	$C_L = 15\text{ pF}$; $V_{CC} = 5\text{ V}$	11	13	ns
	$n\bar{E}_3$ to $n\bar{Y}_n$		10	13	ns
C_I	input capacitance		3.5	3.5	pF
C_{PD}	power dissipation capacitance per multiplexer	notes 1 and 2	42	44	pF

Notes

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

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

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 $V_I = \text{GND to } V_{CC} - 1.5\text{ V}$

APPLICATIONS

- Memory decoding or data-routing
- Code conversion

ORDERING INFORMATION

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

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PIN DESCRIPTION

PIN NO.	SYMBOL	NAME AND FUNCTION
1, 15	$1\overline{E}, 2\overline{E}$	enable inputs (active LOW)
2, 3	$1A_0, 1A_1$	address inputs
4, 5, 6, 7	$1\overline{Y}_0$ to $1\overline{Y}_3$	outputs (active LOW)
8	GND	ground (0 V)
12, 11, 10, 9	$2\overline{Y}_0$ to $2\overline{Y}_3$	outputs (active LOW)
14, 13	$2A_0, 2A_1$	address inputs
16	V_{CC}	positive supply voltage

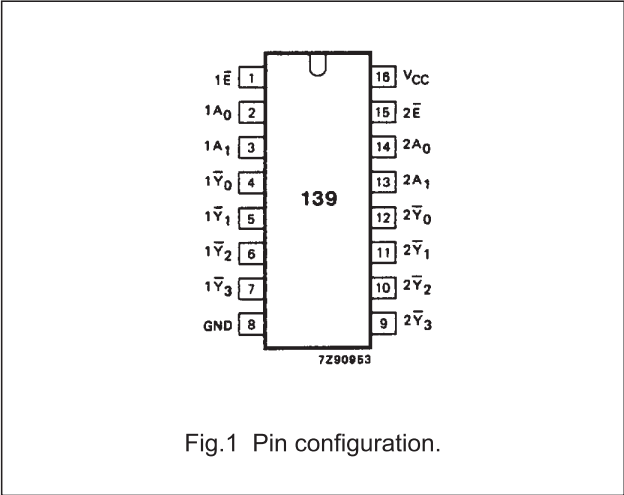


Fig.1 Pin configuration.

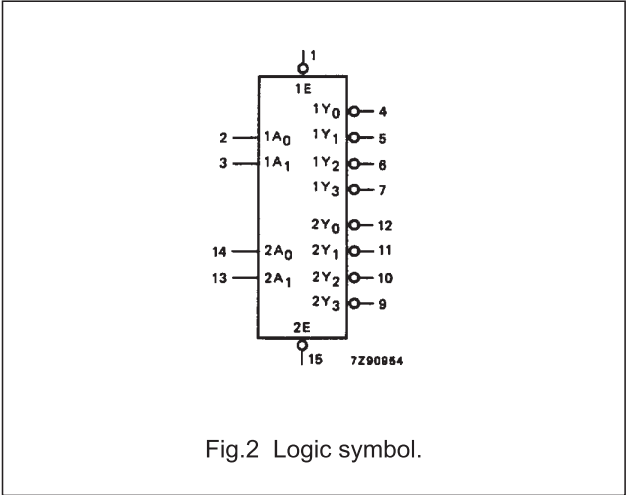


Fig.2 Logic symbol.

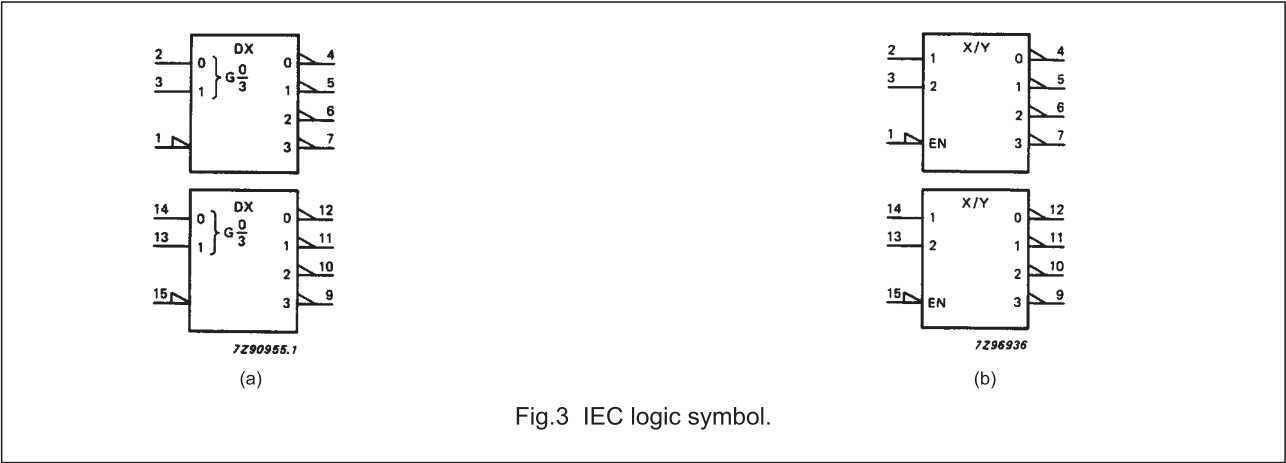
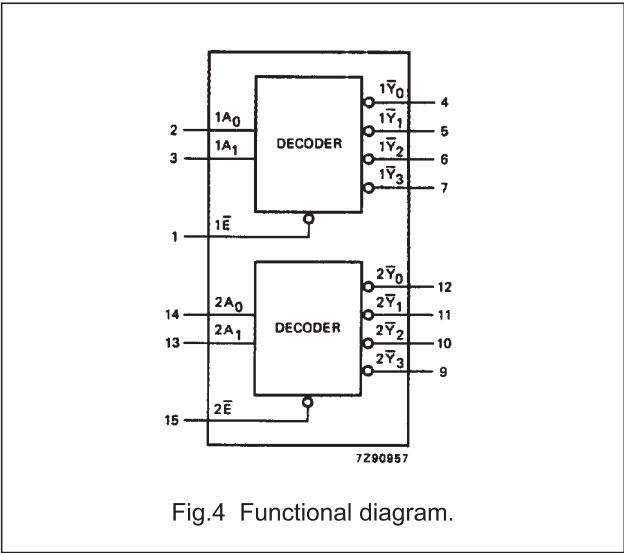


Fig.3 IEC logic symbol.

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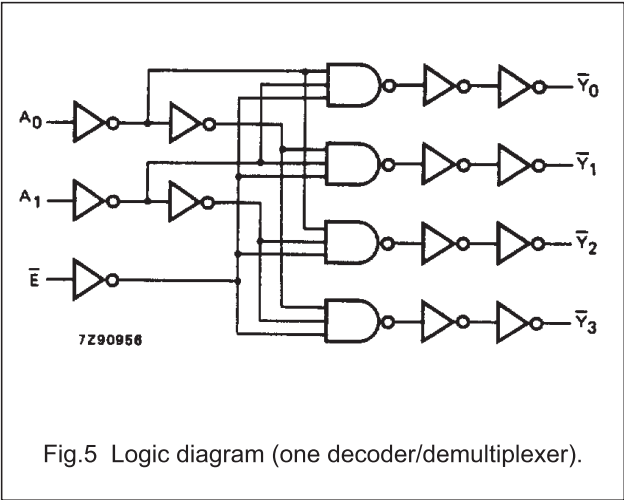


FUNCTION TABLE

INPUTS			OUTPUTS			
$\overline{nE}$	nA_0	nA_1	$\overline{nY_0}$	$\overline{nY_1}$	$\overline{nY_2}$	$\overline{nY_3}$
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	H	L	H	L	H	H
L	L	H	H	H	L	H
L	H	H	H	H	H	L

Notes

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



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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 nA _n to $\bar{Y}_n$		39 14 11	145 29 25		180 36 31		220 44 38	ns	2.0 4.5 6.0	Fig.6
t _{PHL} / t _{PLH}	propagation delay n $\bar{E}$ to n $\bar{Y}_n$		33 12 10	135 27 23		170 34 29		205 41 35	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

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DC CHARACTERISTICS FOR HCT

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
1A _n	0.70
2A _n	0.70
n $\bar{E}$	1.35

AC CHARACTERISTICS FOR 74HCT

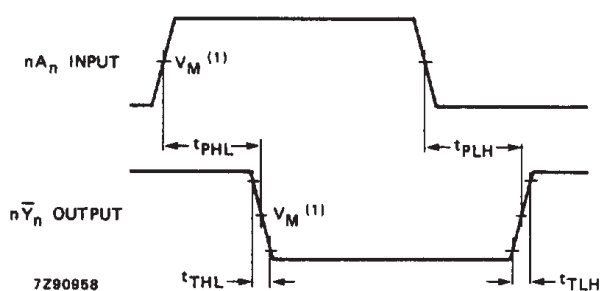
GND = 0 V; t_f = t_r = 6 ns; C_L = 50 pF

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} / t _{PLH}	propagation delay nA _n to $\bar{Y}_n$		16	34		43		51	ns	4.5	Fig.6
t _{PHL} / t _{PLH}	propagation delay n $\bar{E}$ to n $\bar{Y}_n$		16	34		43		51	ns	4.5	Fig.7
t _{THL} / t _{TLH}	output transition time		7	15		19		22	ns	4.5	Figs 6 and 7

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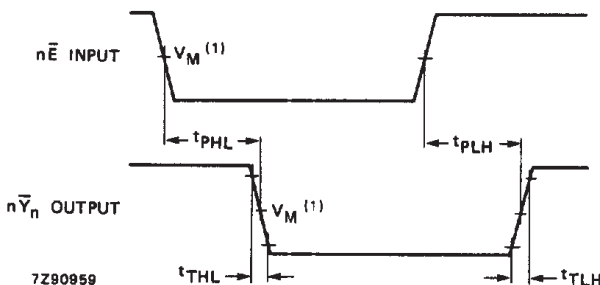
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AC WAVEFORMS



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

Fig.6 Waveforms showing the address input (nA_n) to output ($n\bar{Y}_n$) propagation delays and the output transition times.



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

Fig.7 Waveforms showing the enable input ($n\bar{E}$) to output ($n\bar{Y}_n$) propagation delays and the output transition times.

PACKAGE OUTLINES

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