

# 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/HCT139** Dual 2-to-4 line decoder/demultiplexer

Product specification  
File under Integrated Circuits, IC06

September 1993

## 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<sub>CC</sub> 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<sub>amb</sub> = 25 °C; t<sub>r</sub> = t<sub>f</sub> = 6 ns

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			
	nA <sub>n</sub> to n $\bar{Y}_n$		11	13	ns
	n $\bar{E}_3$ to n $\bar{Y}_n$		10	13	ns
C <sub>I</sub>	input capacitance		3.5	3.5	pF
C <sub>PD</sub>	power dissipation capacitance per multiplexer	notes 1 and 2	42	44	pF

## Notes

1. C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in  $\mu$ 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<sub>i</sub> = input frequency in MHz

f<sub>o</sub> = output frequency in MHz

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

C<sub>L</sub> = output load capacitance in pF

V<sub>CC</sub> = supply voltage in V

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

## APPLICATIONS

- Memory decoding or data-routing
- Code conversion

## ORDERING INFORMATION

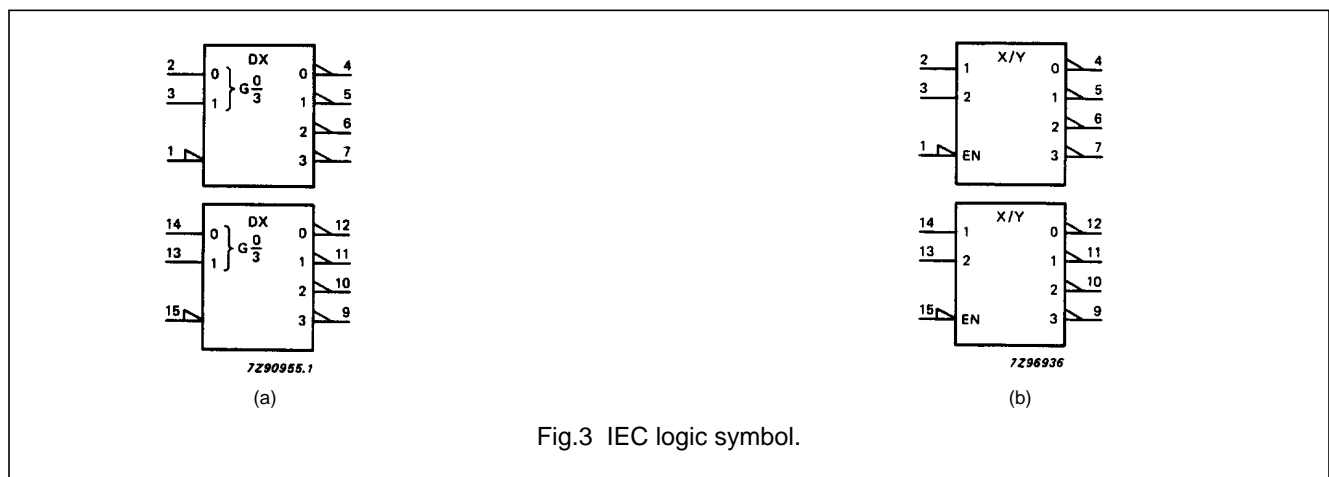
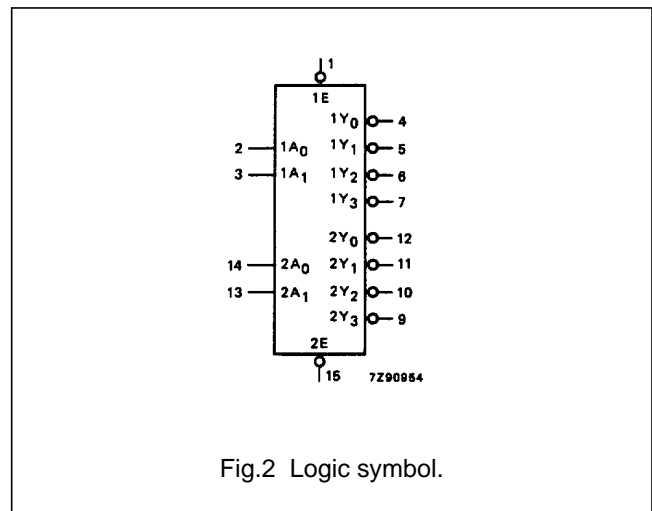
See "74HC/HCT/HCU/HCMOS Logic Package Information".

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## PIN DESCRIPTION

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



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Fig.4 Functional diagram.

FUNCTION TABLE

INPUTS			OUTPUTS			
$n\bar{E}$	$nA_0$	$nA_1$	$n\bar{Y}_0$	$n\bar{Y}_1$	$n\bar{Y}_2$	$n\bar{Y}_3$
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



Fig.5 Logic diagram (one decoder/demultiplexer).

## Dual 2-to-4 line decoder/demultiplexer

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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> (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 nA <sub>n</sub> 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 <sub>PHL</sub> / t <sub>PLH</sub>	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 <sub>THL</sub> / t <sub>TLH</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

## Dual 2-to-4 line decoder/demultiplexer

## 74HC/HCT139

**DC CHARACTERISTICS FOR HCT**

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
1A <sub>n</sub>	0.70
2A <sub>n</sub>	0.70
n $\bar{E}$	1.35

**AC CHARACTERISTICS FOR 74HCT**

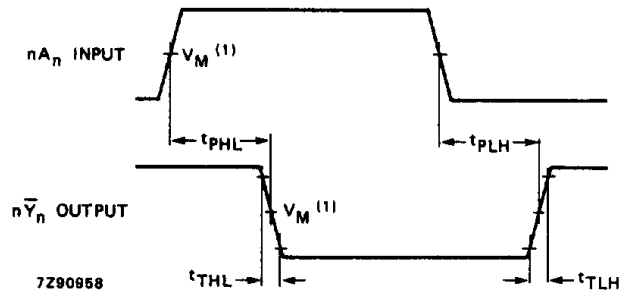
GND = 0 V; t<sub>r</sub> = t<sub>f</sub> = 6 ns; C<sub>L</sub> = 50 pF

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 nA <sub>n</sub> to $\bar{Y}_n$		16	34		43		51	ns	4.5	Fig.6	
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay n $\bar{E}$ to n $\bar{Y}_n$		16	34		43		51	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	

## Dual 2-to-4 line decoder/demultiplexer

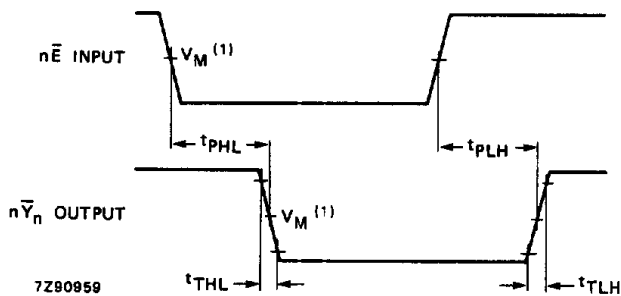
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## AC WAVEFORMS



(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".