

# 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

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## 74HC/HCT356

8-input multiplexer/register; 3-state

Product specification  
File under Integrated Circuits, IC06

December 1990

## 8-input multiplexer/register; 3-state

## 74HC/HCT356

## FEATURES

- Non-transparent data latches
- Transparent address latch
- Easily expanding
- Complementary outputs
- Output capability: bus driver
- I<sub>CC</sub> category: MSI

## GENERAL DESCRIPTION

The 74HC/HCT356 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/HCT356 data selectors/multiplexers contain full on-chip binary decoding, to select one-of-eight data sources. The data select address is stored in transparent latches that are enabled by a LOW on the latch enable input  $\overline{LE}$ .

Data on the 8 input lines (D<sub>0</sub> to D<sub>7</sub>) is clocked into a edge-triggered data register by a LOW-to-HIGH transition of the clock (CP).

When the output enable input  $\overline{OE}_1 = \text{HIGH}$ ,  $\overline{OE}_2 = \text{HIGH}$  or  $\overline{OE}_3 = \text{LOW}$ , the outputs go to the high impedance OFF-state.

Operation of these output enable inputs does not affect the state of the latches and register.

## 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 S <sub>n</sub> , $\overline{LE}$ to Y, $\overline{Y}$ CP to Y, $\overline{Y}$	C <sub>L</sub> = 15 pF; V <sub>CC</sub> = 5 V	24	25	ns
			20	22	ns
C <sub>I</sub>	input capacitance		3.5	3.5	pF
C <sub>PD</sub>	power dissipation capacitance per package	notes 1 and 2	123	125	pF

## Notes

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

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

∑ (C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = 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

## ORDERING INFORMATION

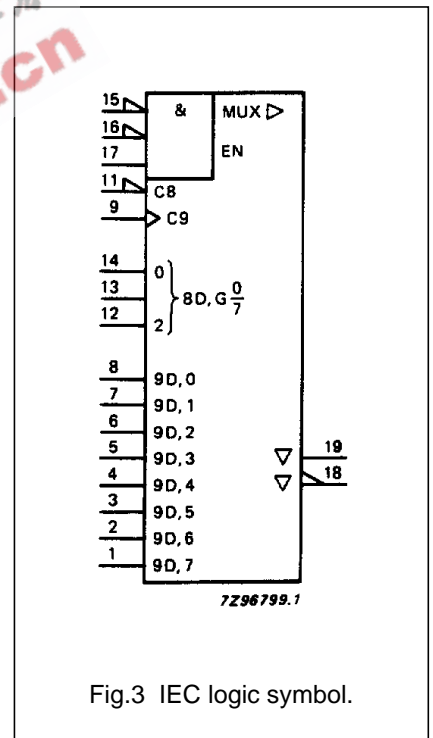
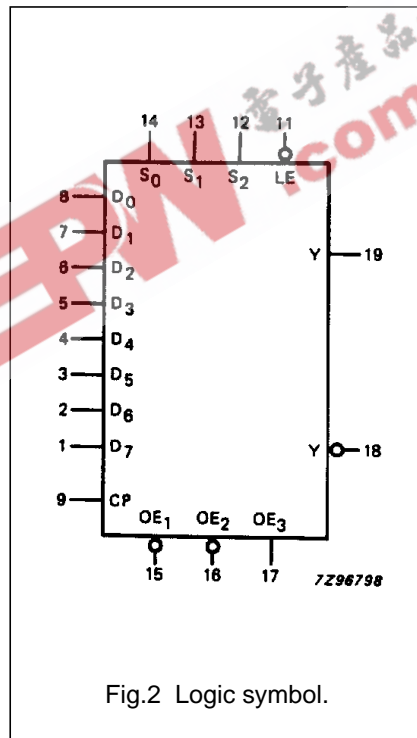
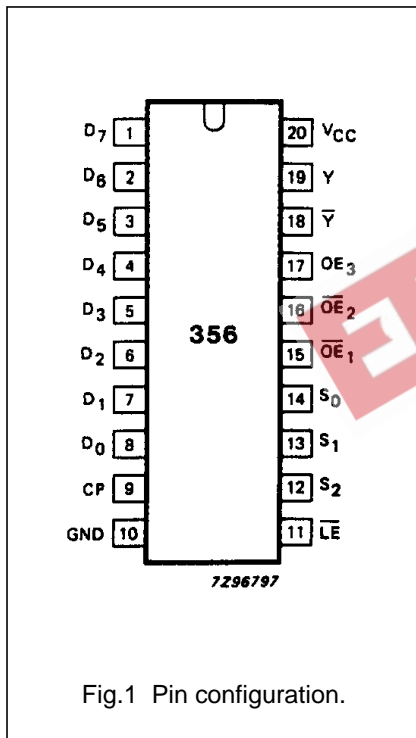
See "74HC/HCT/HCU/HCMOS Logic Package Information".

8-input multiplexer/register; 3-state

74HC/HCT356

PIN DESCRIPTION

PIN NO.	SYMBOL	NAME AND FUNCTION
8, 7, 6, 5, 4, 3, 2, 1	D <sub>0</sub> to D <sub>7</sub>	data inputs
9	CP	clock input data (LOW-to-HIGH, edge-triggered)
10	GND	ground (0 V)
11	$\overline{LE}$	address latch enable input (active LOW)
14, 13, 12	S <sub>0</sub> , S <sub>1</sub> , S <sub>2</sub>	select inputs
15, 16	$\overline{OE}_1$ , $\overline{OE}_2$	output enable inputs (active LOW)
17	OE <sub>3</sub>	output enable input (active HIGH)
18	$\overline{Y}$	3-state multiplexer output (active LOW)
19	Y	3-state multiplexer output (active HIGH)
20	V <sub>CC</sub>	positive supply voltage



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74HC/HCT356

FUNCTION TABLE

INPUTS							OUTPUTS		DESCRIPTION
ADDRESS <sup>(1)</sup>			CP	OUTPUT ENABLE			Y	$\bar{Y}$	
S <sub>2</sub>	S <sub>1</sub>	S <sub>0</sub>		$\overline{OE}_1$	$\overline{OE}_2$	OE <sub>3</sub>			
X	X	X	X	H	X	X	Z	Z	outputs in high impedance OFF-state
X	X	X	X	X	H	X	Z	Z	
X	X	X	X	X	X	L	Z	Z	
L	L	L	↑	L	L	H	D <sub>0n</sub>	$\bar{D}_{0n}$	data is clocked into latch
L	L	H	↑	L	L	H	D <sub>1n</sub>	$\bar{D}_{1n}$	
L	H	L	↑	L	L	H	D <sub>2n</sub>	$\bar{D}_{2n}$	
L	H	H	↑	L	L	H	D <sub>3n</sub>	$\bar{D}_{3n}$	
H	L	L	↑	L	L	H	D <sub>4n</sub>	$\bar{D}_{4n}$	
H	L	H	↑	L	L	H	D <sub>5n</sub>	$\bar{D}_{5n}$	
H	H	L	↑	L	L	H	D <sub>6n</sub>	$\bar{D}_{6n}$	
H	H	H	↑	L	L	H	D <sub>7n</sub>	$\bar{D}_{7n}$	
L	L	L	(2)	L	L	H	D <sub>0p</sub>	$\bar{D}_{0p}$	outputs do not change states
L	L	H	(2)	L	L	H	D <sub>1p</sub>	$\bar{D}_{1p}$	
L	H	L	(2)	L	L	H	D <sub>2p</sub>	$\bar{D}_{2p}$	
L	H	H	(2)	L	L	H	D <sub>3p</sub>	$\bar{D}_{3p}$	
H	L	L	(2)	L	L	H	D <sub>4p</sub>	$\bar{D}_{4p}$	
H	L	H	(2)	L	L	H	D <sub>5p</sub>	$\bar{D}_{5p}$	
H	H	L	(2)	L	L	H	D <sub>6p</sub>	$\bar{D}_{6p}$	
H	H	H	(2)	L	L	H	D <sub>7p</sub>	$\bar{D}_{7p}$	

Notes

1. This column shows the input address set-up with  $\overline{LE} = \text{LOW}$  (address latch is transparent).
2. CP is HIGH, LOW or ↓.
3. D<sub>0n</sub> to D<sub>7n</sub> = data present at inputs D<sub>0</sub> to D<sub>7</sub> when the data latch clock made the transition from LOW-to-HIGH  
 D<sub>0p</sub> to D<sub>7p</sub> = data previously latched into the data latch by the LOW-to-HIGH transition of the data latch clock  
 H = HIGH voltage level  
 L = LOW voltage level  
 X = don't care  
 ↑ = LOW-to-HIGH CP transition  
 ↓ = HIGH-to-LOW CP transition  
 Z = high impedance OFF-state

8-input multiplexer/register; 3-state

74HC/HCT356

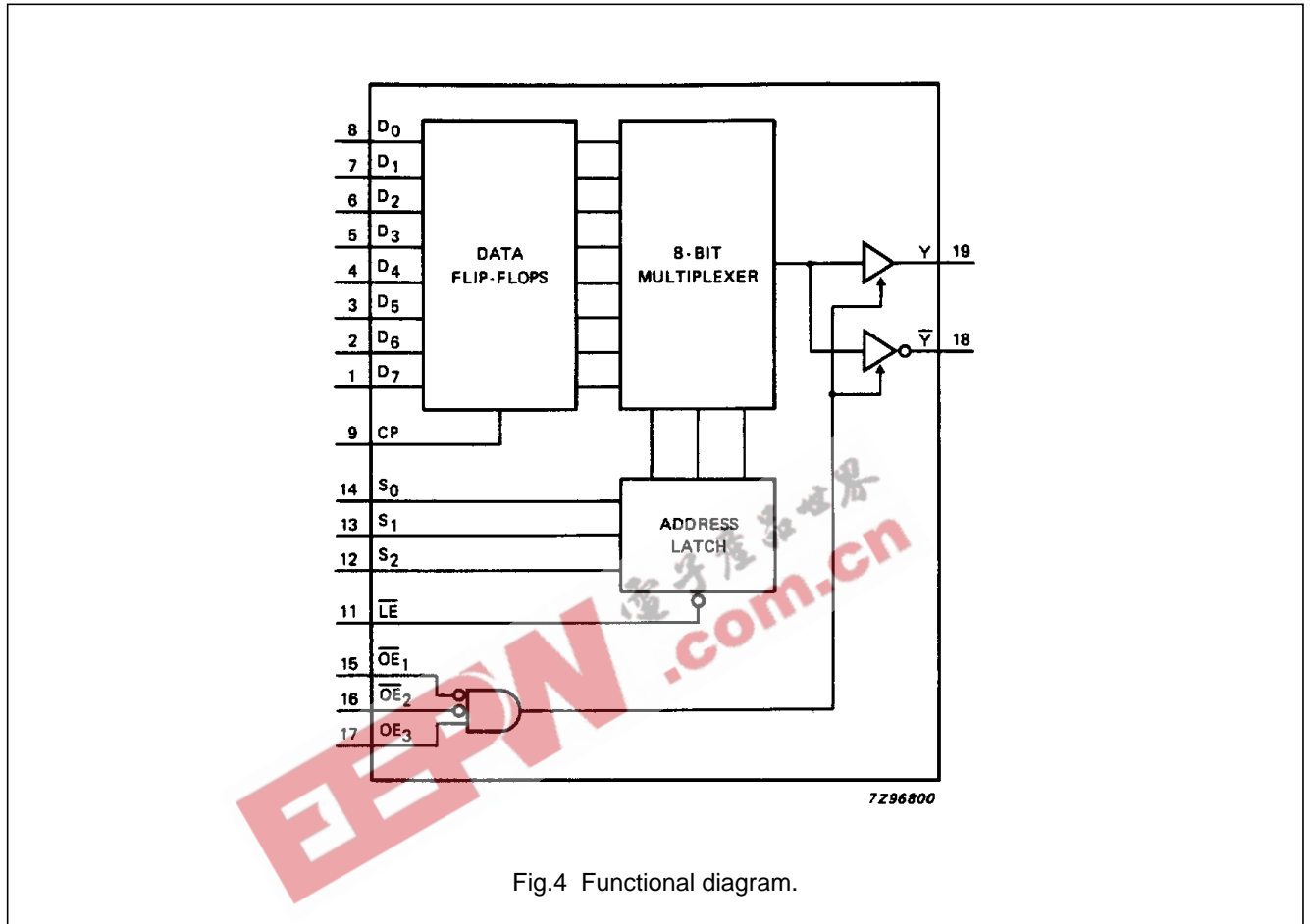
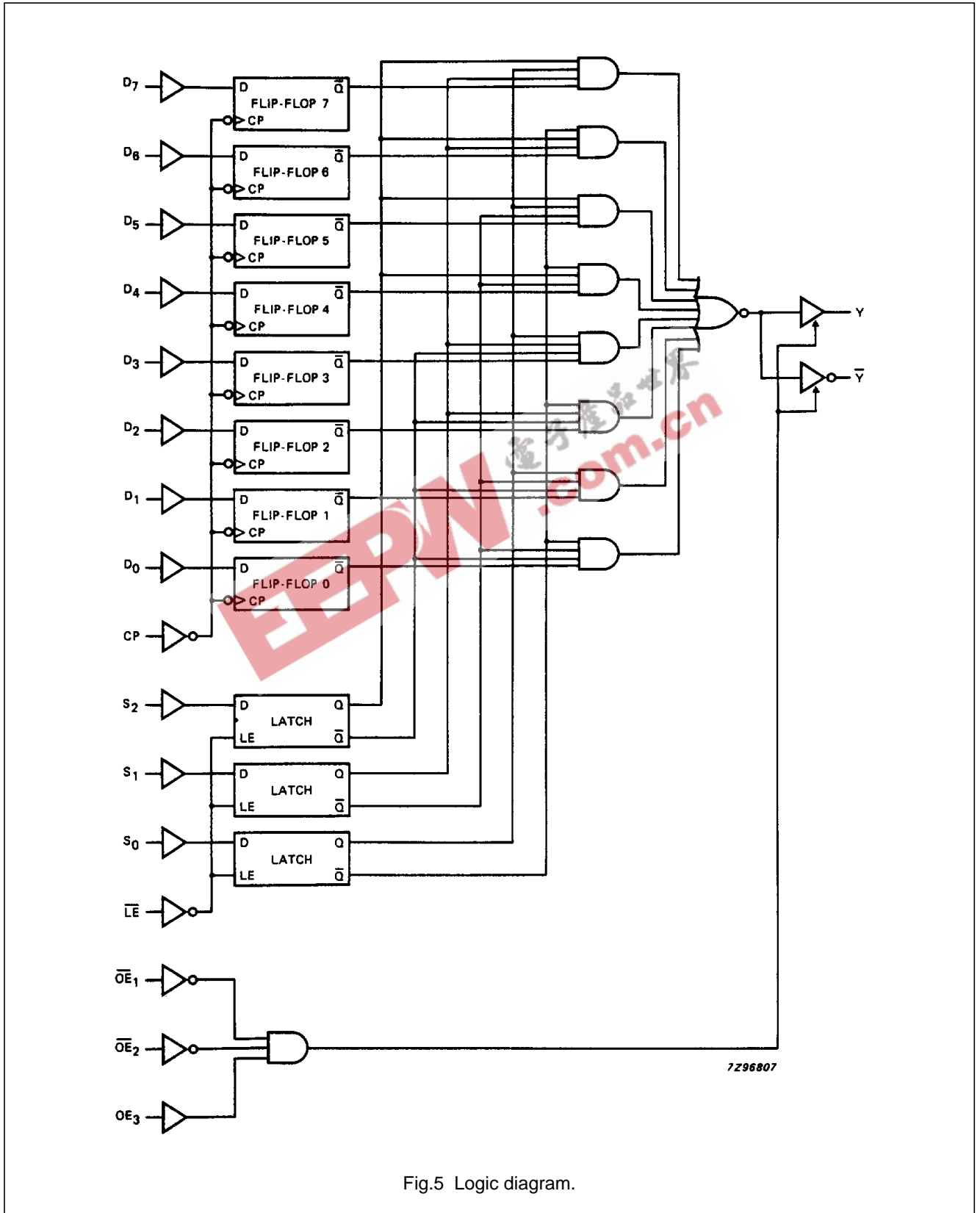


Fig.4 Functional diagram.

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74HC/HCT356



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## 74HC/HCT356

## DC CHARACTERISTICS FOR 74HC

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

Output capability: bus driver

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 CP to Y, $\bar{Y}$		66 24 19	240 48 41		300 60 51	360 72 61	ns	2.0 4.5 6.0	Fig.6	
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay S <sub>n</sub> to Y, $\bar{Y}$		77 28 22	260 52 44		325 65 55	390 78 66	ns	2.0 4.5 6.0	Fig.7	
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay $\bar{LE}$ to Y, $\bar{Y}$		77 28 22	270 54 46		340 68 58	405 81 69	ns	2.0 4.5 6.0	Fig.8	
t <sub>PZH</sub> / t <sub>PZL</sub>	3-state output enable time $\bar{OE}_n$ to Y, $\bar{Y}$		41 15 12	125 25 21		155 31 26	190 38 32	ns	2.0 4.5 6.0	Fig.11	
t <sub>PZH</sub> / t <sub>PZL</sub>	3-state output enable time OE <sub>3</sub> to Y, $\bar{Y}$		47 17 14	150 30 26		190 38 33	225 45 38	ns	2.0 4.5 6.0	Fig.11	
t <sub>PHZ</sub> / t <sub>PLZ</sub>	3-state output disable time $\bar{OE}_n$ to Y, $\bar{Y}$		50 18 14	155 31 26		195 39 33	235 47 40	ns	2.0 4.5 6.0	Fig.11	
t <sub>PHZ</sub> / t <sub>PLZ</sub>	3-state output disable time OE <sub>3</sub> to Y, $\bar{Y}$		58 21 17	155 31 26		195 39 33	235 47 40	ns	2.0 4.5 6.0	Fig.11	
t <sub>THL</sub> / t <sub>TLH</sub>	output transition time		14 5 4	60 12 10		75 15 13	90 18 15	ns	2.0 4.5 6.0	Figs 6, 7 and 8	
t <sub>w</sub>	clock pulse width CP HIGH or LOW	80 16 14	17 6 5		100 20 17		120 24 20	ns	2.0 4.5 6.0	Fig.6	
t <sub>w</sub>	latch enable pulse width $\bar{LE}$ LOW	80 16 14	17 6 5		100 20 17		120 24 20	ns	2.0 4.5 6.0	Fig.8	
t <sub>su</sub>	set-up time D <sub>n</sub> to CP	50 10 9	11 4 3		65 13 11		75 15 13	ns	2.0 4.5 6.0	Fig.10	

## 8-input multiplexer/register; 3-state

## 74HC/HCT356

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>su</sub>	set-up time S <sub>n</sub> to $\overline{LE}$	50 10 9	14 5 4		65 13 11		75 15 13	ns	2.0 4.5 6.0	Fig.9	
t <sub>h</sub>	hold time D <sub>n</sub> to CP	5 5 5	-6 -2 -2		5 5 5		5 5 5	ns	2.0 4.5 6.0	Fig.10	
t <sub>h</sub>	hold time S <sub>n</sub> to $\overline{LE}$	5 5 5	-8 -3 -2		5 5 5		5 5 5	ns	2.0 4.5 6.0	Fig.9	

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## 74HC/HCT356

**DC CHARACTERISTICS FOR 74HCT**

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

Output capability: bus driver

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
D <sub>n</sub> , S <sub>n</sub>	0.2
OE <sub>3</sub>	0.25
$\overline{LE}$	0.5
$\overline{OE}_n$ , CP	1.0

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## 74HC/HCT356

## AC CHARACTERISTICS FOR 74HCT

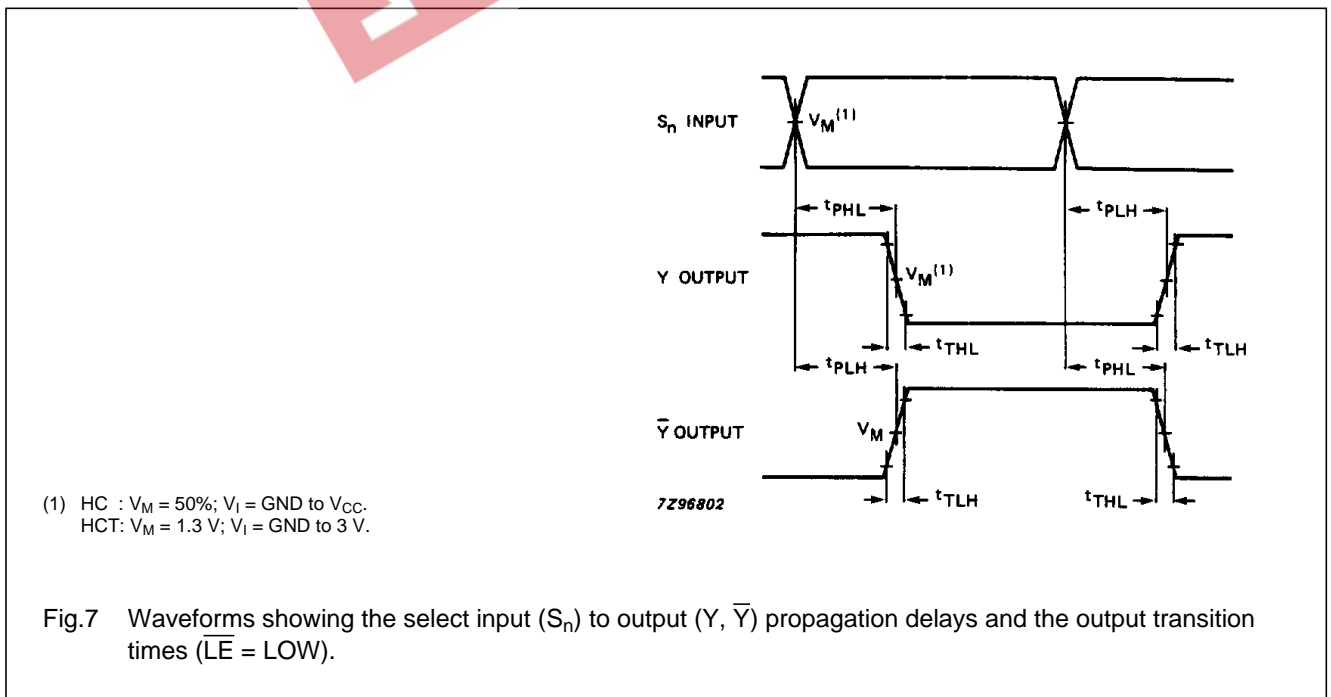
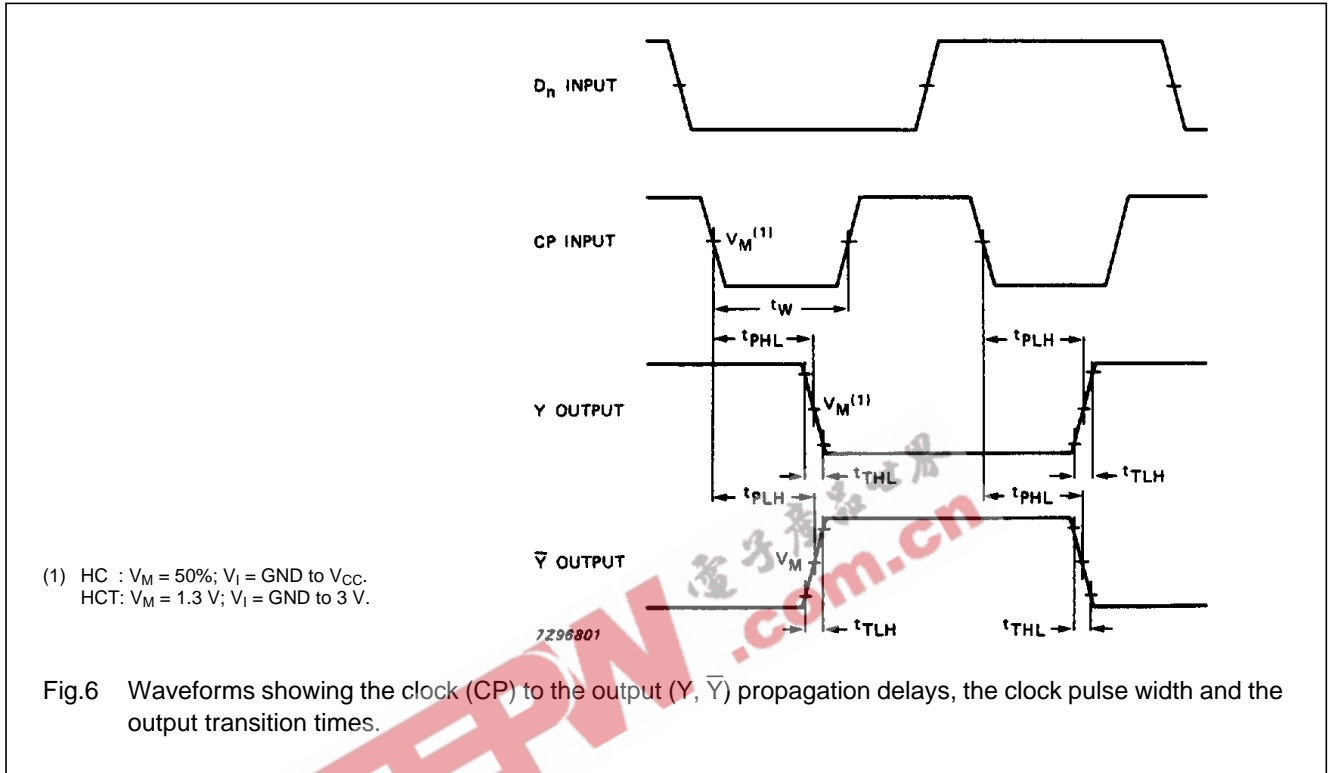
GND = 0 V;  $t_r = t_f = 6$  ns;  $C_L = 50$  pF

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.
$t_{PHL}/t_{PLH}$	propagation delay CP to Y, $\bar{Y}$		26	51		64		77	ns	4.5	Fig.6
$t_{PHL}/t_{PLH}$	propagation delay $S_n$ to Y, $\bar{Y}$		28	59		74		89	ns	4.5	Fig.7
$t_{PHL}/t_{PLH}$	propagation delay $\overline{LE}$ to Y, $\bar{Y}$		29	63		79		95	ns	4.5	Fig.8
$t_{PZH}/t_{PZL}$	3-state output enable time $\overline{OE}_n$ to Y, $\bar{Y}$		17	34		43		51	ns	4.5	Fig.11
$t_{PZH}/t_{PZL}$	3-state output enable time $OE_3$ to Y, $\bar{Y}$		18	34		43		51	ns	4.5	Fig.11
$t_{PHZ}/t_{PLZ}$	3-state output disable time $\overline{OE}_n$ to Y, $\bar{Y}$		17	33		41		50	ns	4.5	Fig.11
$t_{PHZ}/t_{PLZ}$	3-state output disable time $OE_3$ to Y, $\bar{Y}$		20	33		41		50	ns	4.5	Fig.11
$t_{THL}/t_{TLH}$	output transition time		5	12		15		18	ns	4.5	Figs 6, 7 and 8
$t_W$	clock pulse width CP HIGH or LOW	16	8		20		24		ns	4.5	Fig.6
$t_W$	latch enable pulse width $\overline{LE}$ LOW	16	6		20		24		ns	4.5	Fig.8
$t_{su}$	set-up time $D_n$ to CP	10	4		13		15		ns	4.5	Fig.10
$t_{su}$	set-up time $S_n$ to $\overline{LE}$	10	5		13		15		ns	4.5	Fig.9
$t_h$	hold time $D_n$ to CP	5	0		5		5		ns	4.5	Fig.10
$t_h$	hold time $S_n$ to $\overline{LE}$	5	-2		5		5		ns	4.5	Fig.9

8-input multiplexer/register; 3-state

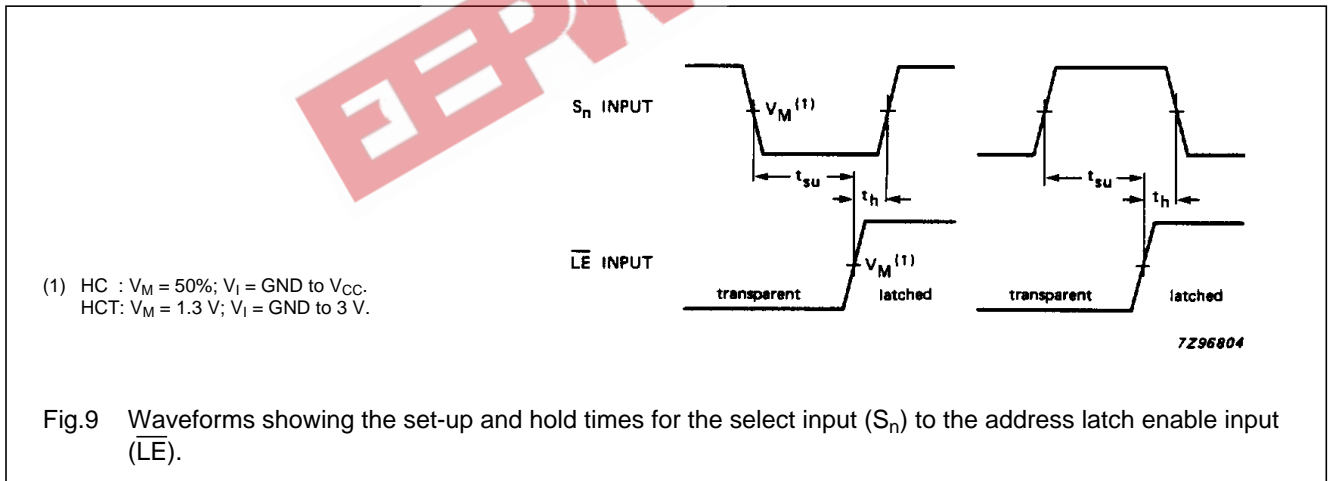
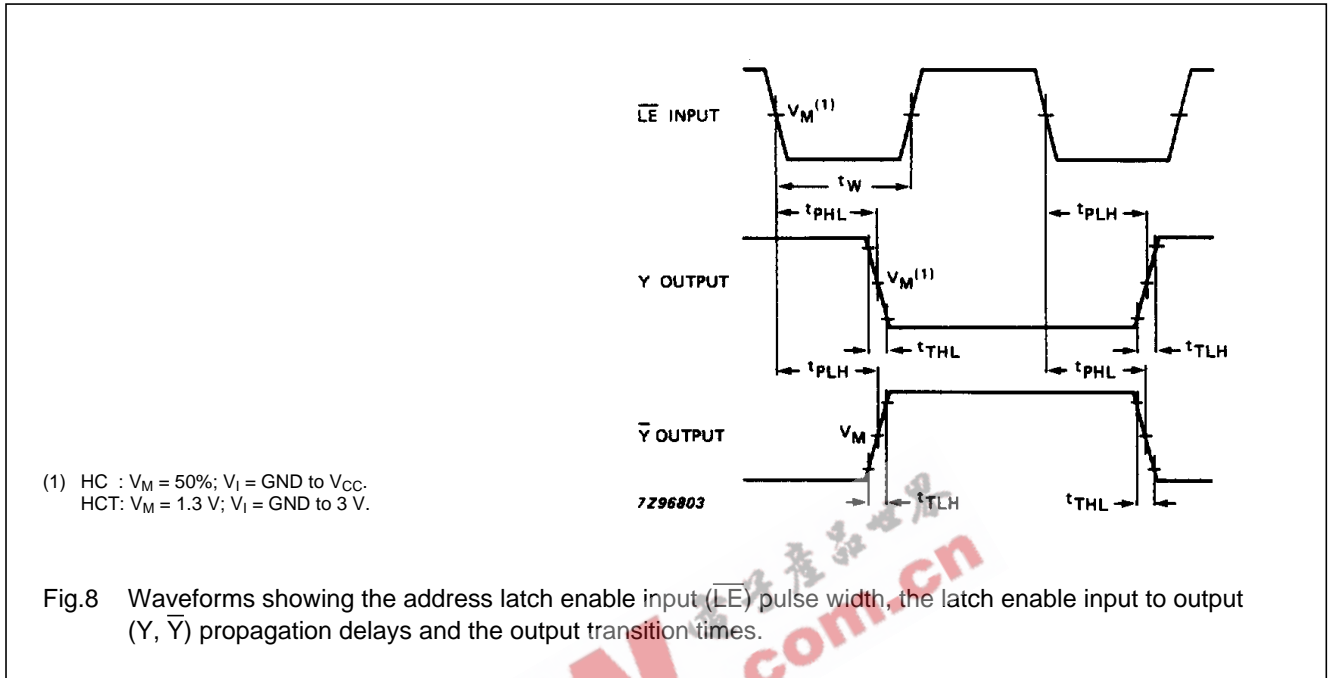
74HC/HCT356

AC WAVEFORMS



8-input multiplexer/register; 3-state

74HC/HCT356



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74HC/HCT356

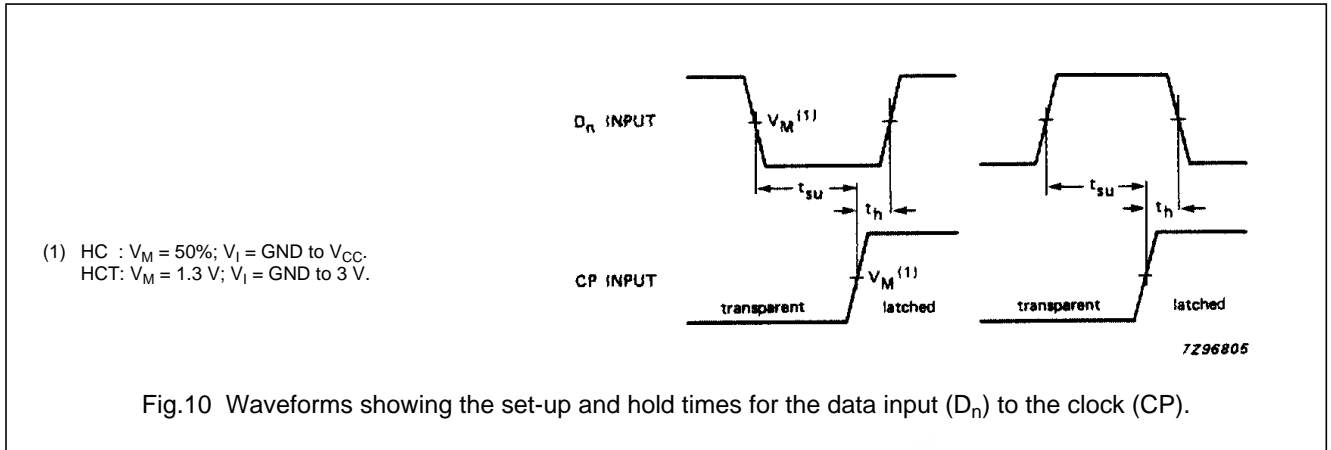


Fig.10 Waveforms showing the set-up and hold times for the data input ( $D_n$ ) to the clock (CP).

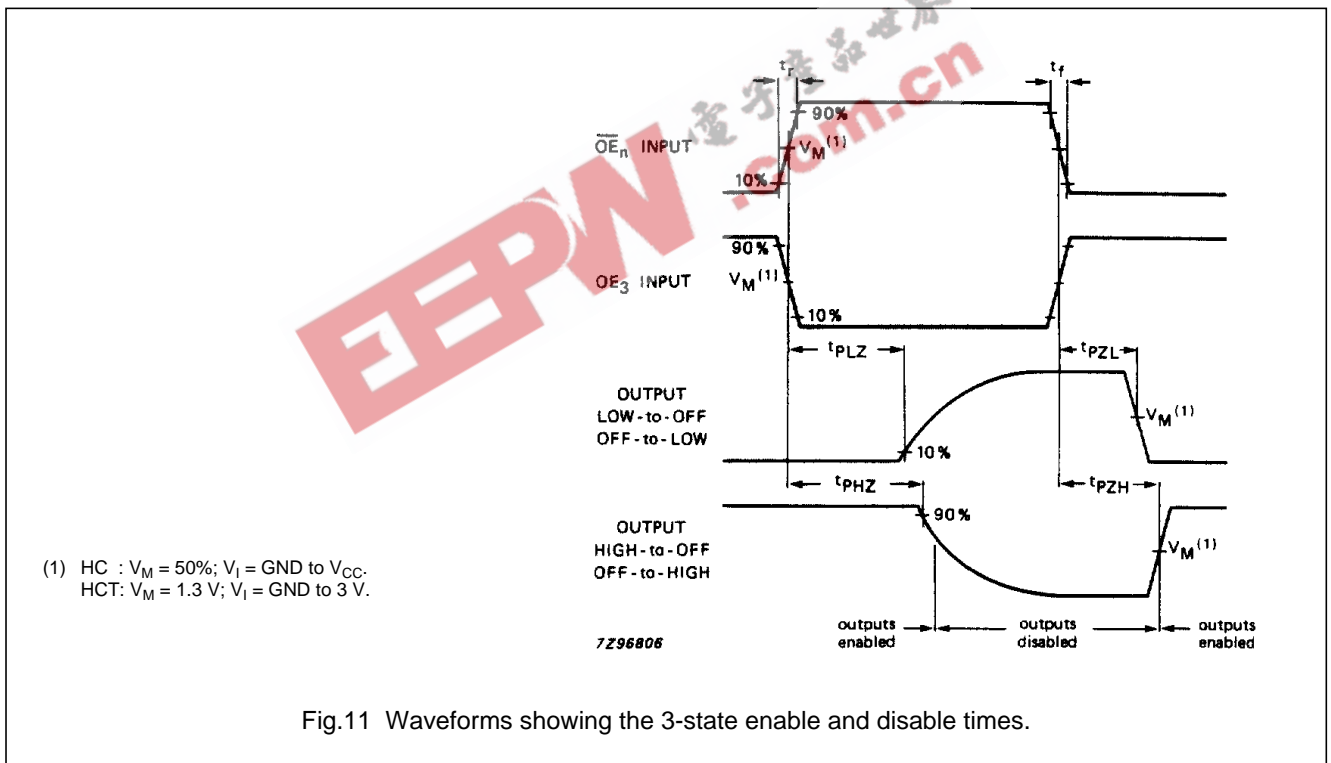


Fig.11 Waveforms showing the 3-state enable and disable times.

PACKAGE OUTLINES

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