

## OCTAL D-TYPE FLIP-FLOP; POSITIVE EDGE-TRIGGER; 3-STATE

## FEATURES

- 3-state non-inverting outputs for bus oriented applications
- 8-bit positive, edge-triggered register
- Common 3-state output enable input
- Independent register and 3-state buffer operation
- Output capability: bus driver
- I<sub>CC</sub> category: MSI

## GENERAL DESCRIPTION

The 74HC/HCT374 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/HCT374 are octal D-type flip-flops featuring separate D-type inputs for each flip-flop and 3-state outputs for bus oriented applications. A clock (CP) and an output enable ( $\overline{OE}$ ) input are common to all flip-flops.

The 8 flip-flops will store the state of their individual D-inputs that meet the set-up and hold times requirements on the LOW-to-HIGH CP transition.

When  $\overline{OE}$  is LOW, the contents of the 8 flip-flops are available at the outputs. When  $\overline{OE}$  is HIGH, the outputs go to the high impedance OFF-state. Operation of the  $\overline{OE}$  input does not affect the state of the flip-flops.

The "374" is functionally identical to the "534", but has non-inverting outputs.

SYMBOL	PARAMETER	CONDITIONS	TYPICAL		UNIT
			HC	HCT	
$t_{PHL}/t_{PLH}$	propagation delay CP to Q <sub>n</sub>	C <sub>L</sub> = 15 pF V <sub>CC</sub> = 5 V	15	13	ns
f <sub>max</sub>	maximum clock frequency		77	48	MHz
C <sub>I</sub>	input capacitance		3.5	3.5	pF
CPD	power dissipation capacitance per flip-flop	notes 1 and 2	17	17	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):

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

f<sub>i</sub> = input frequency in MHz                      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

20-lead DIL; plastic (SOT146).

20-lead mini-pack; plastic (SO20; SOT163A).

## PIN DESCRIPTION

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

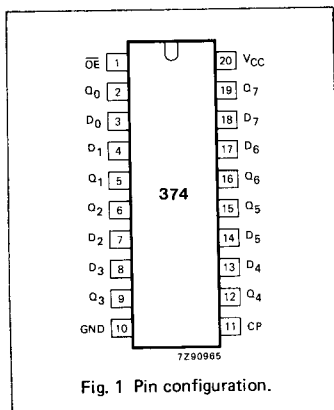


Fig. 1 Pin configuration.

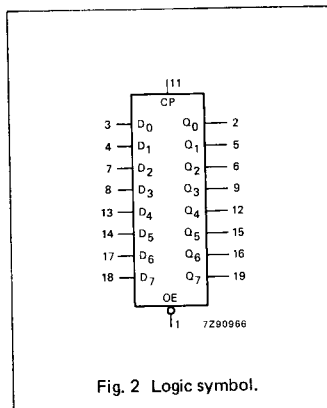


Fig. 2 Logic symbol.

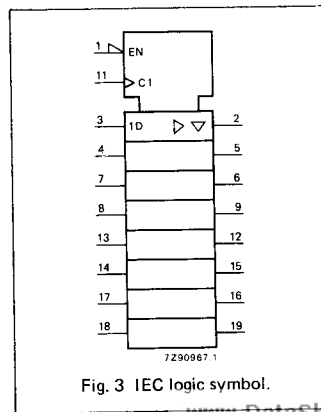


Fig. 3 IEC logic symbol.

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**MSI**

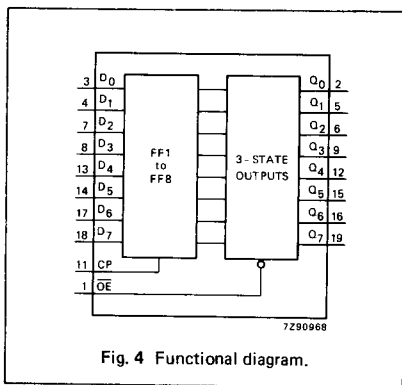


Fig. 4 Functional diagram.

**FUNCTION TABLE**

OPERATING MODES	INPUTS			INTERNAL FLIP-FLOPS	OUTPUTS Q <sub>0</sub> to Q <sub>7</sub>
	$\overline{OE}$	CP	D <sub>n</sub>		
load and read register	L	↑	l	L H	L H
load register and disable outputs	H	↑	l	L H	Z Z

H = HIGH voltage level  
h = HIGH voltage level one set-up time prior to the LOW-to-HIGH CP transition

L = LOW voltage level  
l = LOW voltage level one set-up time prior to the LOW-to-HIGH CP transition

Z = high impedance OFF-state  
↑ = LOW-to-HIGH CP transition

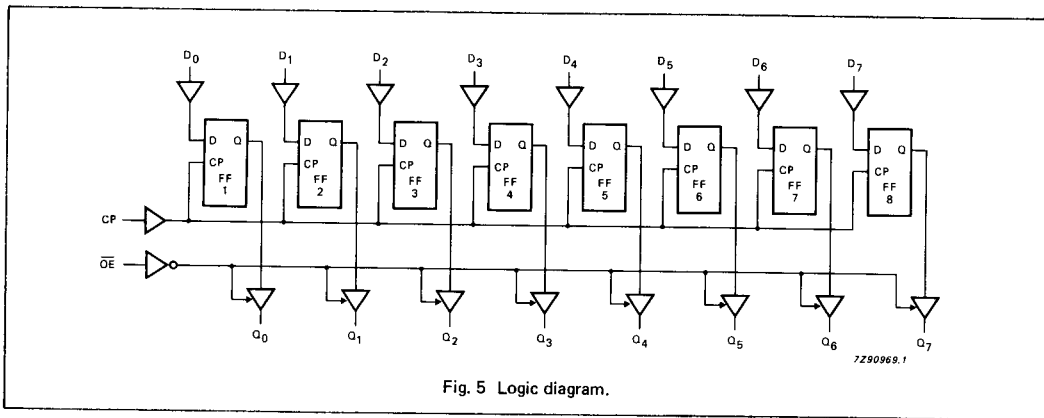


Fig. 5 Logic diagram.

## Octal D-type flip-flop; positive edge-trigger; 3-state

74HC/HCT374

MSI

## DC CHARACTERISTICS FOR 74HC

For the DC characteristics see chapter "HCMOS family characteristics", section "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 Q <sub>n</sub>		50 18 14	165 33 28		205 41 35		250 50 43	ns	2.0 4.5 6.0	Fig. 6
t <sub>PZH</sub> / t <sub>PZL</sub>	3-state output enable time OE to Q <sub>n</sub>		41 15 12	150 30 26		190 38 33		225 45 38	ns	2.0 4.5 6.0	Fig. 7
t <sub>PHZ</sub> / t <sub>PLZ</sub>	3-state output disable time OE to Q <sub>n</sub>		50 18 14	150 30 26		190 38 33		225 45 38	ns	2.0 4.5 6.0	Fig. 7
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	Fig. 6
t <sub>W</sub>	clock pulse width HIGH or LOW	80 16 14	19 7 6		100 20 17		120 24 20		ns	2.0 4.5 6.0	Fig. 6
t <sub>su</sub>	set-up time D <sub>n</sub> to CP	60 12 10	14 5 4		75 15 13		90 18 15		ns	2.0 4.5 6.0	Fig. 8
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. 8
f <sub>max</sub>	maximum clock pulse frequency	6.0 30 35	23 70 83		4.8 24 28		4.0 20 24		MHz	2.0 4.5 6.0	Fig. 6

## 74HC/HCT374

MSI

## DC CHARACTERISTICS FOR 74HCT

For the DC characteristics see chapter "HCMOS family characteristics", section "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.

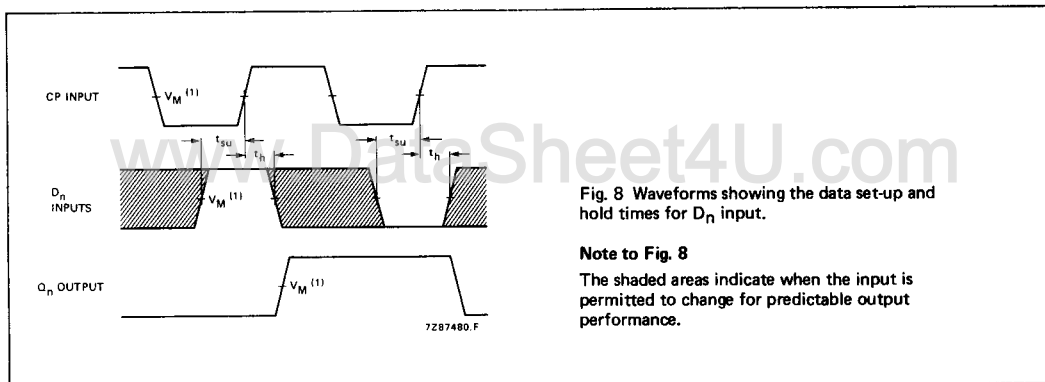
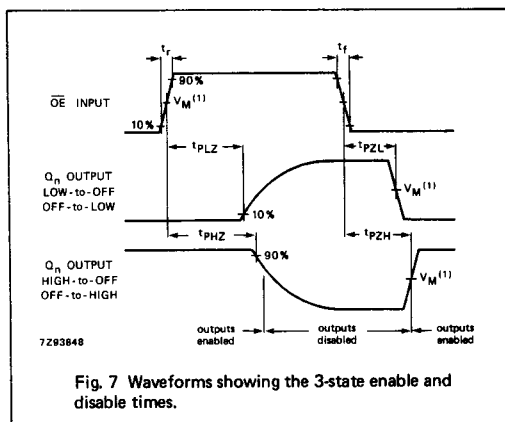
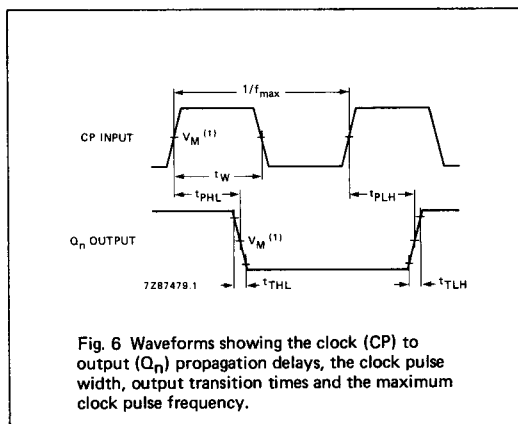
INPUT	UNIT LOAD COEFFICIENT
$\overline{OE}$	1.25
CP	0.90
D <sub>n</sub>	0.35

## 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 CP to Q <sub>n</sub>	16	32		40		48	ns	4.5	Fig. 6	
t <sub>PZH</sub> / t <sub>PZL</sub>	3-state output enable time OE to Q <sub>n</sub>		16	30		38		45	ns	4.5	Fig. 7
t <sub>PHZ</sub> / t <sub>PLZ</sub>	3-state output disable time OE to Q <sub>n</sub>		18	28		35		42	ns	4.5	Fig. 7
t <sub>THL</sub> / t <sub>TLH</sub>	output transition time		5	12		15		18	ns	4.5	Fig. 6
t <sub>W</sub>	clock pulse width HIGH or LOW	19	11		24		29		ns	4.5	Fig. 6
t <sub>su</sub>	set-up time D <sub>n</sub> to CP	12	7		15		18		ns	4.5	Fig. 8
t <sub>h</sub>	hold time D <sub>n</sub> to CP	5	-3		5		5		ns	4.5	Fig. 8
f <sub>max</sub>	maximum clock pulse frequency	26	44		21		17		MHz	4.5	Fig. 6

## AC WAVEFORMS



## Note to Fig. 8

The shaded areas indicate when the input is permitted to change for predictable output performance.

## Note to AC waveforms

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