OCTAL D-TYPE TRANSPARENT LATCH; 3-STATE

FEATURES

- 3-state non-inverting outputs for bus oriented applications
- Common 3-state output enable input
- Functionally identical to the "563", "573" and "533"
- Output capability: bus driver
- I_{CC} category: MSI

GENERAL DESCRIPTION

The 74HC/HCT373 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/HCT373 are octal D-type transparent latches featuring separate D-type inputs for each latch and 3-state outputs for bus oriented applications. A latch enable (LE) input and an output enable ($\overline{OE}$) input are common to all latches.

The "373" consists of eight D-type transparent latches with 3-state true outputs. When LE is HIGH, data at the D_n inputs enters the latches. In this condition the latches are transparent, i.e. a latch output will change state each time its corresponding D-input changes.

When LE is LOW the latches store the information that was present at the D-inputs a set-up time preceding the HIGH-to-LOW transition of LE. When $\overline{OE}$ is LOW, the contents of the 8 latches 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 latches.

The "373" is functionally identical to the "533", "563" and "573", but the "563" and "533" have inverted outputs and the "563" and "573" have a different pin arrangement.

SYMBOL	PARAMETER	CONDITIONS	TYPICAL		UNIT
			HC	HCT	
t_{PHL}/t_{PLH}	propagation delay D_n to Q_n LE to Q_n	C_L = 15 pF V_{CC} = 5 V	12 15	14 13	ns ns
C_I	input capacitance		3.5	3.5	pF
C_{PD}	power dissipation capacitance per latch	notes 1 and 2	45	41	pF

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

Notes

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μW):
   $P_D = C_{PD} \times V_{CC}^2 \times f_i + \Sigma (C_L \times V_{CC}^2 \times f_o)$ where:
   f_i = input frequency in MHz
   f_o = output frequency in MHz
   $\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs
   C_L = output load capacitance in pF
   V_{CC} = supply voltage in V
2. For HC the condition is V_I = GND to V_{CC}
   For HCT the condition is V_I = GND to V_{CC} − 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_0 to Q_7	3-state latch outputs
3, 4, 7, 8, 13, 14, 17, 18	D_0 to D_7	data inputs
10	GND	ground (0 V)
11	LE	latch enable input (active HIGH)
20	V_{CC}	positive supply voltage

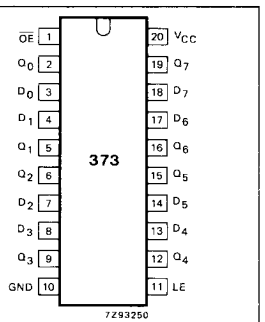

Fig. 1 Pin configuration.

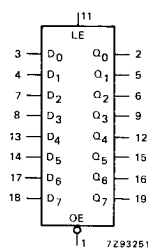

Fig. 2 Logic symbol.

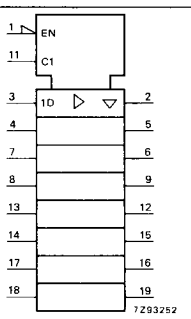

Fig. 3 IEC logic symbol.

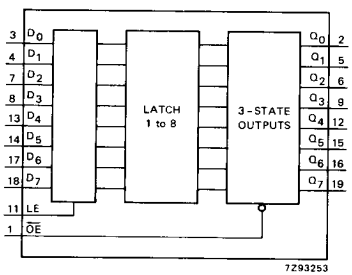

Fig. 4 Functional diagram.

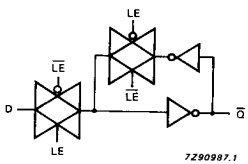

Fig. 5 Logic diagram (one latch).

FUNCTION TABLE

OPERATING MODES	INPUTS			INTERNAL LATCHES	OUTPUTS
	$\overline{OE}$	LE	D_n		Q_0 to Q_7
enable and read register (transparent mode)	L	H	L	L	L
	L	H	H	H	H
latch and read register	L	L	l	L	L
	L	L	h	H	H
latch register and disable outputs	H	X	X	X	Z
	H	X	X	X	Z

H = HIGH voltage level
h = HIGH voltage level one set-up time prior to the HIGH-to-LOW LE transition
L = LOW voltage level
l = LOW voltage level one set-up time prior to the HIGH-to-LOW LE transition
X = don't care
Z = high impedance OFF-state

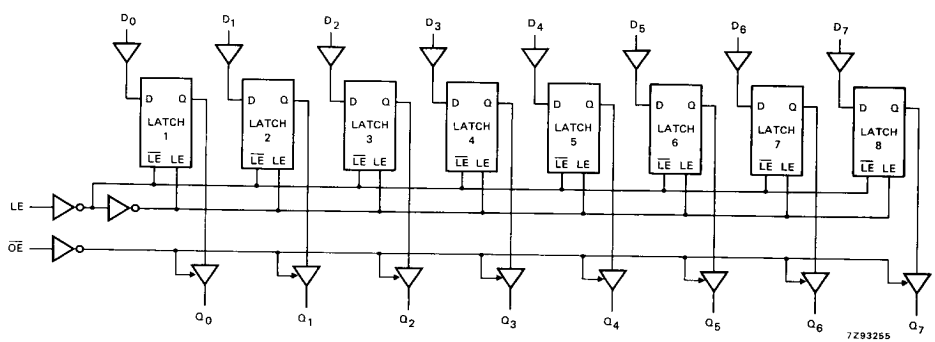

Fig. 6 Logic diagram.

DC CHARACTERISTICS FOR 74HC

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

Output capability: bus driver
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 D_n to Q_n		41 15 12	150 30 26		190 38 33		225 45 38	ns	2.0 4.5 6.0	Fig. 7
t_{PHL}/t_{PLH}	propagation delay LE to Q_n		50 18 14	175 35 30		220 44 37		265 53 45	ns	2.0 4.5 6.0	Fig. 8
t_{PZH}/t_{PZL}	3-state output enable time $\overline{OE}$ to Q_n		44 16 13	150 30 26		190 38 33		225 45 38	ns	2.0 4.5 6.0	Fig. 9
t_{PHZ}/t_{PLZ}	3-state output disable time $\overline{OE}$ to Q_n		47 17 14	150 30 26		190 38 33		225 45 38	ns	2.0 4.5 6.0	Fig. 9
t_{THL}/t_{TLH}	output transition time		14 5 4	60 12 10		75 15 13		90 18 15	ns	2.0 4.5 6.0	Fig. 7
t_W	LE pulse width HIGH	80 16 14	17 6 5		100 20 17		120 24 20		ns	2.0 4.5 6.0	Fig. 8
t_{su}	set-up time D_n to LE	50 10 9	14 5 4		65 13 11		75 15 13		ns	2.0 4.5 6.0	Fig. 10
t_h	hold time D_n to LE	5 5 5	−8 −3 −2		5 5 5		5 5 5		ns	2.0 4.5 6.0	Fig. 10

DC CHARACTERISTICS FOR 74HCT

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

Output capability: bus driver
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
D_n	0.30
$\overline{LE}$	1.50
$\overline{OE}$	1.00

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	
		74CHT								V_{CC} V	WAVEFORMS
		+25			−40 to +85		−40 to +125				
		min.	typ.	max.	min.	max.	min.	max.			
t_{PHL}/t_{PLH}	propagation delay D_n to Q_n		17	30		38		45	ns	4.5	Fig. 7
t_{PHL}/t_{PLH}	propagation delay LE to Q_n		16	32		40		48	ns	4.5	Fig. 8
t_{PZH}/t_{PZL}	3-state output enable time $\overline{OE}$ to Q_n		19	32		40		48	ns	4.5	Fig. 9
t_{PHZ}/t_{PLZ}	3-state output disable time $\overline{OE}$ to Q_n		18	30		38		45	ns	4.5	Fig. 9
t_{THL}/t_{TLH}	output transition time		5	12		15		18	ns	4.5	Fig. 7
t_W	LE pulse width HIGH	16	4		20		24		ns	4.5	Fig. 8
t_{su}	set-up time D_n to LE	12	6		15		18		ns	4.5	Fig. 10
t_h	hold time D_n to LE	4	−1		4		4		ns	4.5	Fig. 10

AC WAVEFORMS

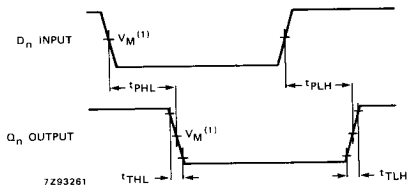

Fig. 7 Waveforms showing the input (D_n) to output (Q_n) propagation delays and the output transition times.

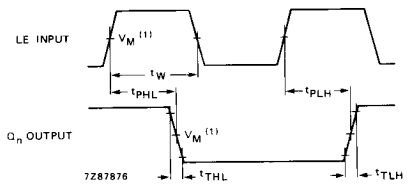

Fig. 8 Waveforms showing the latch enable input (LE) pulse width, the latch enable input to output (Q_n) propagation delays and the output transition times.

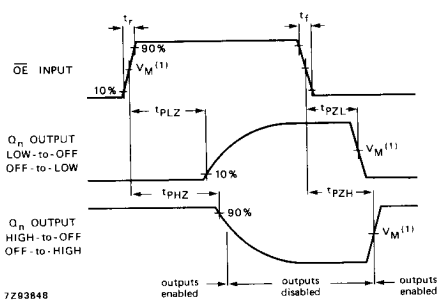

Fig. 9 Waveforms showing the 3-state enable and disable times.

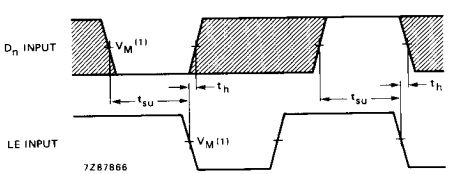

Fig. 10 Waveforms showing the data set-up and hold times for D_n input to LE input.

Note to Fig. 10

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 = GND to V_{CC}.
HCT: V_M = 1.3 V; V_I = GND to 3 V.