OCTAL D-TYPE TRANSPARENT LATCH; 3-STATE; INVERTING

FEATURES

- **3-state inverting outputs for bus oriented applications**
- **Common 3-state output enable input**
- **Output capability: bus driver**
- **I_{CC} category: MSI**

GENERAL DESCRIPTION

The 74HC/HCT533 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/HCT533 are octal D-type transparent latches f eaturing 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 "533" consists of eight D-type transparent latches with 3-state inverting outputs. When LE is HIGH, data at the D_n inputs enter 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 "533" is functionally identical to the "373", "563" and "573", but the "373" and "573" have non-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 $\overline{Q}_n$ LE to $\overline{Q}_n$	C_L = 15 pF V_{CC} = 5 V	14 18	16 19	ns ns
C_I	input capacitance		3.5	3.5	pF
C_{PD}	power dissipation capacitance per latch	notes 1 and 2	34	34	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
   C_L = output load capacitance in pF
   V_{CC} = supply voltage in V
   $\Sigma (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs
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	$\overline{Q}_0$ to $\overline{Q}_7$	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

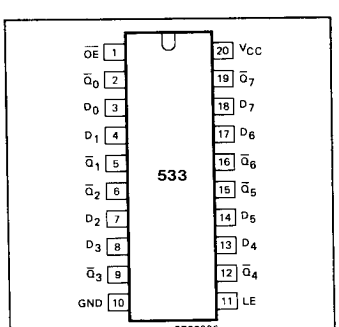

Fig. 1 Pin configuration.

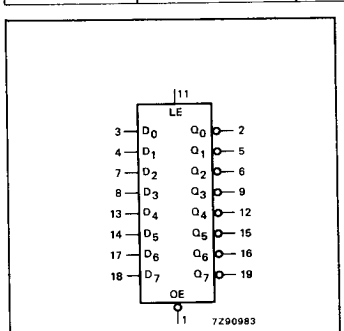

Fig. 2 Logic symbol.

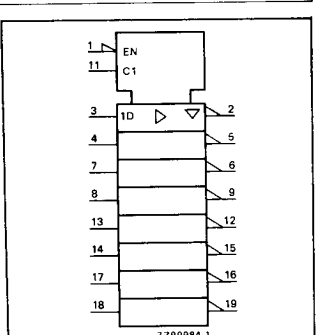

Fig. 3 IEC logic symbol.

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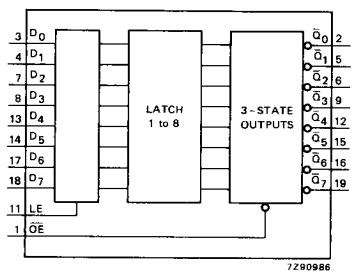

Fig. 4 Functional diagram.

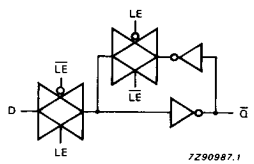

Fig. 5 Logic diagram (one latch).

FUNCTION TABLE

OPERATING MODES	INPUTS			INTERNAL LATCHES	OUTPUTS
	$\overline{OE}$	LE	D_n		$\overline{Q}_0$ to $\overline{Q}_7$
enable and read register (transparent mode)	L	H	L	L	H
	L	H	H	H	L
latch and read register	L	L	l	L	H
	L	L	h	H	L
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 prior to the HIGH-to-LOW LE transition
L = LOW voltage level
l = LOW voltage level ont set-up prior to the HIGH-to-LOW LE transition
X = don't care
Z = high impedance OFF-state

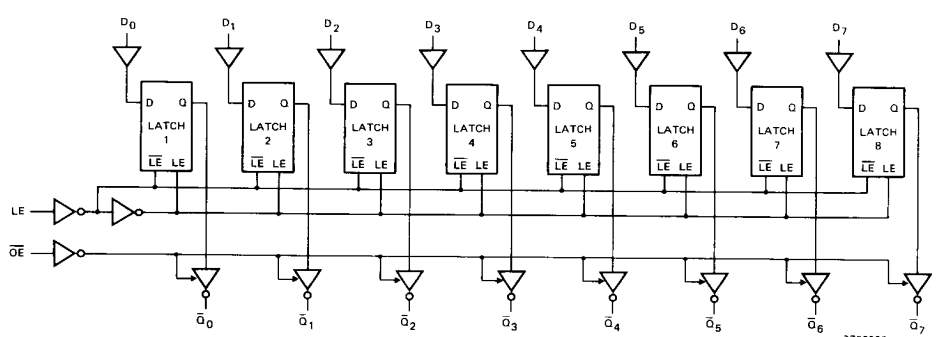

Fig. 6 Logic diagram.

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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 $\overline{Q}_n$		47 17 14	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 $\overline{Q}_n$		58 21 17	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 $\overline{Q}_n$		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 $\overline{Q}_n$		50 18 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	14 5 4		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	3 1 1		65 13 11		75 15 13		ns	2.0 4.5 6.0	Fig. 10
t_h	hold time D_n to LE	35 7 6	3 1 1		45 9 8		55 11 9		ns	2.0 4.5 6.0	Fig. 10

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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	0.15
$\overline{LE}$	0.30
$\overline{OE}$	0.55

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 D_n to $\overline{Q}_n$		19	34		43		51	ns	4.5	Fig. 7
t_{PHL}/t_{PLH}	propagation delay LE to $\overline{Q}_n$		22	38		48		57	ns	4.5	Fig. 8
t_{PZH}/t_{PZL}	3-state output enable time $\overline{OE}$ to $\overline{Q}_n$		19	35		44		53	ns	4.5	Fig. 9
t_{PHZ}/t_{PLZ}	3-state output disable time $\overline{OE}$ to $\overline{Q}_n$		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	5		20		24		ns	4.5	Fig. 8
t_{su}	set-up time D_n to LE	10	3		13		15		ns	4.5	Fig. 10
t_h	hold time D_n to LE	8	2		10		12		ns	4.5	Fig. 10

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AC WAVEFORMS

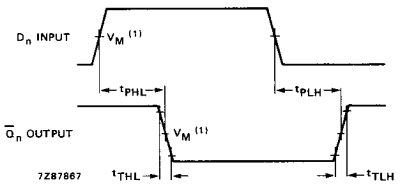

Fig. 7 Waveforms showing the data input (D_n) to output ($\overline{Q}_n$) propagation delays and the output transition times.

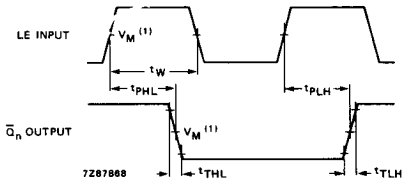

Fig. 8 Waveforms showing the latch enable input (LE) pulse width, the latch enable input to output ($\overline{Q}_n$) propagation delays and the output transition times.

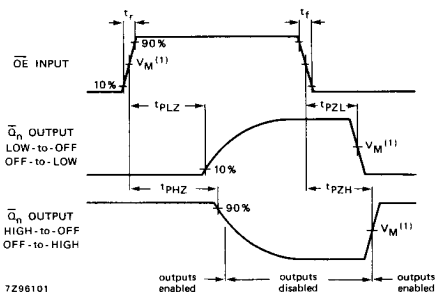

Fig. 9 Waveforms showing the 3-state enable and disable times.

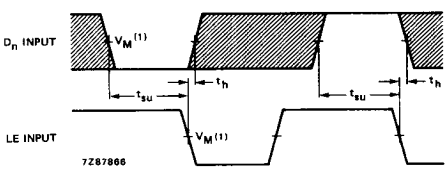

Fig. 10 Waveforms showing the data set-up and hold times for D_n input to LE input.

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.

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