3-TO-8 LINE DECODER/DEMULTIPLEXER WITH ADDRESS LATCHES; INVERTING

FEATURES

- **Combines 3-to-8 decoder with 3-bit latch**
- **Multiple input enable for easy expansion or independent controls**
- **Active LOW mutually exclusive outputs**
- **Output capability: standard**
- **I_{CC} category: MSI**

GENERAL DESCRIPTION

The 74HC/HCT137 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/HCT137 are 3-to-8 line decoder/demultiplexers with latches at the three address inputs (A_n). The "137" essentially combines the 3-to-8 decoder function with a 3-bit storage latch. When the latch is enabled ($\overline{LE}$ = LOW), the "137" acts as a 3-to-8 active LOW decoder. When the latch enable ($\overline{LE}$) goes from LOW-to-HIGH, the last data present at the inputs before this transition, is stored in the latches. Further address changes are ignored as long as $\overline{LE}$ remains HIGH.

The output enable input ($\overline{E}_1$ and E_2) controls the state of the outputs independent of the address inputs or latch operation. All outputs are HIGH unless $\overline{E}_1$ is LOW and E_2 is HIGH.

The "137" is ideally suited for implementing non-overlapping decoders in 3-state systems and strobed (stored address) applications in bus oriented systems.

SYMBOL	PARAMETER	CONDITIONS	TYPICAL		UNIT
			HC	HCT	
t_{PHL}/t_{PLH}	propagation delay A_n to $\overline{Y}_n$ $\overline{LE}$ to $\overline{Y}_n$ $\overline{E}_1$ to $\overline{Y}_n$ E_2 to $\overline{Y}_n$	C_L = 15 pF V_{CC} = 5 V	 18 17 15 15	 19 21 17 15	 ns ns ns ns
C_I	input capacitance		3.5	3.5	pF
C_{PD}	power dissipation capacitance per package	notes 1 and 2	57	59	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

16-lead DIL; plastic (SOT38Z).
16-lead mini-pack; plastic (SO16; SOT109A).

PIN DESCRIPTION

PIN NO.	SYMBOL	NAME AND FUNCTION
1, 2, 3	A_0 to A_2	data inputs
4	$\overline{LE}$	latch enable input (active LOW)
5	$\overline{E}_1$	data enable input (active LOW)
6	E_2	data enable input (active HIGH)
8	GND	ground (0 V)
15, 14, 13, 12, 11, 10, 9, 7	$\overline{Y}_0$ to $\overline{Y}_7$	multiplexer outputs
16	V_{CC}	positive supply voltage

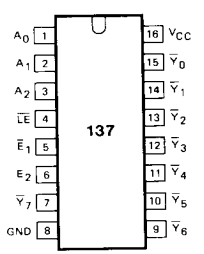

Fig. 1 Pin configuration.

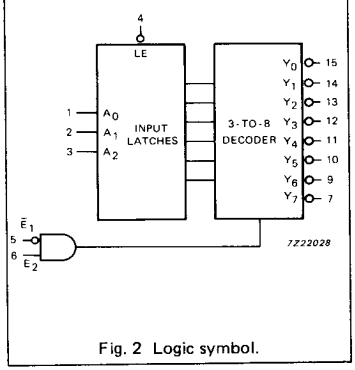

Fig. 2 Logic symbol.

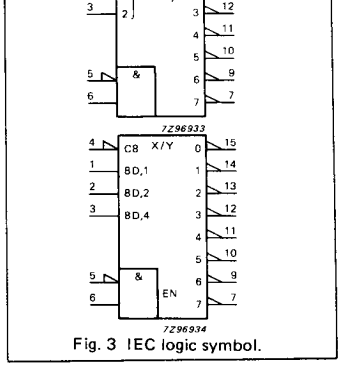

Fig. 3 IEC logic symbol.

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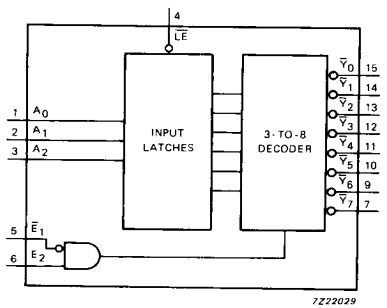

Fig. 4 Functional diagram.

FUNCTION TABLE

INPUTS						OUTPUTS							
$\overline{LE}$	$\overline{E}_1$	E_2	A_0	A_1	A_2	$\overline{Y}_0$	$\overline{Y}_1$	$\overline{Y}_2$	$\overline{Y}_3$	$\overline{Y}_4$	$\overline{Y}_5$	$\overline{Y}_6$	$\overline{Y}_7$
H	L	H	X	X	X	stable							
X	H	X	X	X	X	H	H	H	H	H	H	H	H
X	X	L	X	X	X	H	H	H	H	H	H	H	H
L	L	H	L	L	L	L	H	H	H	H	H	H	H
L	L	H	H	L	L	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	L	H	H	H	H	H
L	L	H	H	H	L	H	H	H	L	H	H	H	H
L	L	H	L	L	H	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	L	H	H
L	L	H	L	H	H	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	L

H = HIGH voltage level
L = LOW voltage level
X = don't care

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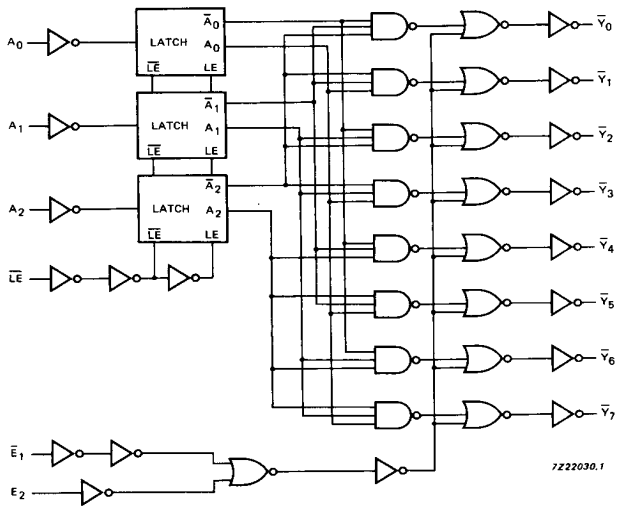

Fig. 5 Logic diagram.

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DC CHARACTERISTICS FOR 74HC

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

Output capability: standard
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 A_n to $\overline{Y}_n$		58 21 17	180 36 31		225 45 38		270 54 46	ns	2.0 4.5 6.0	Fig. 6
t_{PHL}/t_{PLH}	propagation delay $\overline{LE}$ to $\overline{Y}_n$		55 20 16	190 38 32		240 48 41		285 57 48	ns	2.0 4.5 6.0	Fig. 7
t_{PHL}/t_{PLH}	propagation delay $\overline{E}_1$ to $\overline{Y}_n$		50 18 14	145 29 25		180 36 31		220 44 38	ns	2.0 4.5 6.0	Fig. 7
t_{PHL}/t_{PLH}	propagation delay E_2 to $\overline{Y}_n$		50 18 14	145 29 25		180 36 31		220 44 38	ns	2.0 4.5 6.0	Fig. 6
t_{THL}/t_{TLH}	output transition time		19 7 6	75 15 13		95 19 16		110 22 19	ns	2.0 4.5 6.0	Fig. 6
t_W	$\overline{LE}$ pulse width HIGH	50 10 9	11 4 3		65 13 11		75 15 13		ns	2.0 4.5 6.0	Fig. 8
t_{su}	set-up time A_n to $\overline{LE}$	50 10 9	3 1 1		65 13 11		75 15 13		ns	2.0 4.5 6.0	Fig. 8
t_h	hold time A_n to $\overline{LE}$	30 6 5	3 1 1		40 8 7		45 9 8		ns	2.0 4.5 6.0	Fig. 8

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DC CHARACTERISTICS FOR 74HCT

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

Output capability: standard
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
A_n	1.50
$\overline{E}_1$	1.50
E_2	1.50
$\overline{LE}$	1.50

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 A_n to $\overline{Y}_n$		22	38		48		57	ns	4.5	Fig. 6
t_{PHL}/t_{PLH}	propagation delay $\overline{LE}$ to $\overline{Y}_n$		25	44		55		66	ns	4.5	Fig. 7
t_{PHL}/t_{PLH}	propagation delay $\overline{E}_1$ to $\overline{Y}_n$		20	37		46		56	ns	4.5	Fig. 7
t_{PHL}/t_{PLH}	propagation delay E_2 to $\overline{Y}_n$		18	35		44		53	ns	4.5	Fig. 6
t_{THL}/t_{TLH}	output transition time		7	15		19		22	ns	4.5	Fig. 6
t_W	$\overline{LE}$ pulse width HIGH	10	5		13		15		ns	4.5	Fig. 8
t_{su}	set-up time A_n to $\overline{LE}$	10	2		13		15		ns	4.5	Fig. 8
t_h	hold time A_n to $\overline{LE}$	7	2		9		11		ns	4.5	Fig. 8

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AC WAVEFORMS

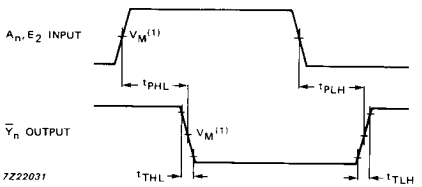

Fig. 6 Waveforms showing the address input (A_n) and enable inputs (E_2) to output ($\overline{Y}_n$) propagation delays and the output transition times.

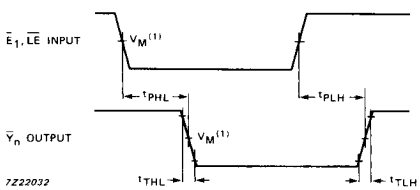

Fig. 7 Waveforms showing the enable input ($\overline{E}_1$, $\overline{LE}$) to output ($\overline{Y}_n$) propagation delays and the output transition times.

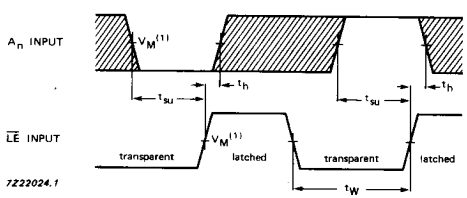

Fig. 8 Waveforms showing the data set-up, hold times for A_n input to $\overline{LE}$ input and the latch enable pulse width.

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

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APPLICATION INFORMATION

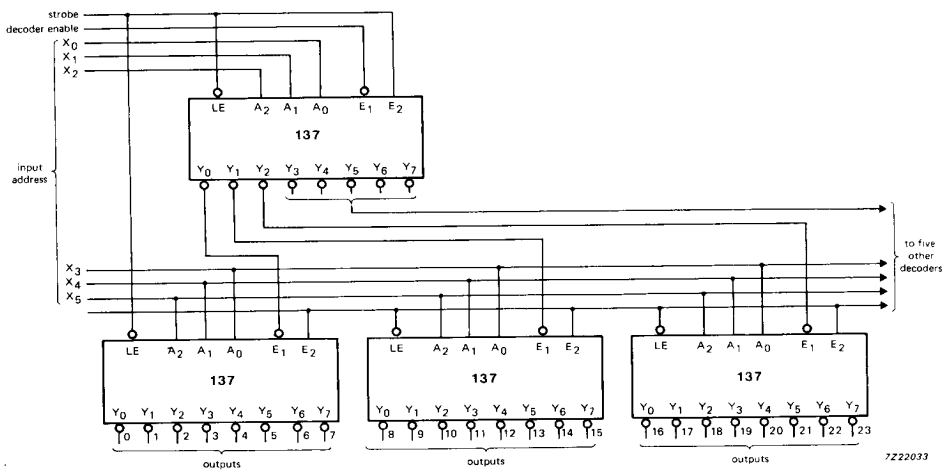

Fig. 9 6-to-64 line decoder with input address storage.

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