

4-TO-16 LINE DECODER/DEMULTIPLEXER WITH INPUT LATCHES

FEATURES

- Non-inverting outputs
- Output capability: standard
- I<sub>CC</sub> category: MSI

GENERAL DESCRIPTION

The 74HC/HCT4514 are high-speed Si-gate CMOS devices and are pin compatible with "4514" of the "4000B" series. They are specified in compliance with JEDEC standard no. 7A.

The 74HC/HCT4514 are 4-to-16 line decoders/demultiplexers having four binary weighted address inputs (A<sub>0</sub> to A<sub>3</sub>), with latches, a latch enable input (LE), and an active LOW enable input ( $\bar{E}$ ). The 16 outputs (Q<sub>0</sub> to Q<sub>15</sub>) are mutually exclusive active HIGH. When LE is HIGH, the selected output is determined by the data on A<sub>n</sub>. When LE goes LOW, the last data present at A<sub>n</sub> are stored in the latches and the outputs remain stable. When  $\bar{E}$  is LOW, the selected output, determined by the contents of the latch, is HIGH. At  $\bar{E}$  HIGH, all outputs are LOW. The enable input ( $\bar{E}$ ) does not affect the state of the latch.

When the "4514" is used as a demultiplexer,  $\bar{E}$  is the data input and A<sub>0</sub> to A<sub>3</sub> are the address inputs.

SYMBOL	PARAMETER	CONDITIONS	TYPICAL		UNIT
			HC	HCT	
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay A <sub>n</sub> to Q <sub>n</sub>	C <sub>L</sub> = 15 pF V <sub>CC</sub> = 5 V	23	26	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	44	45	pF

GND = 0 V; T<sub>amb</sub> = 25 °C; t<sub>r</sub> = t<sub>f</sub> = 6 ns

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                      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

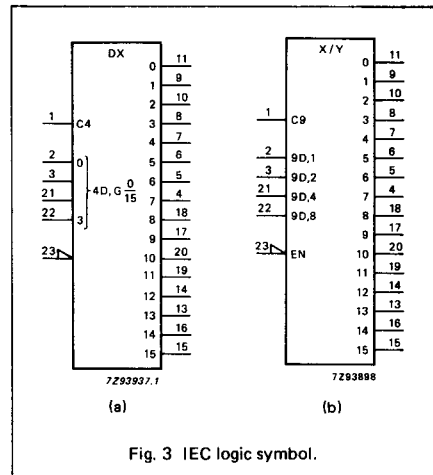
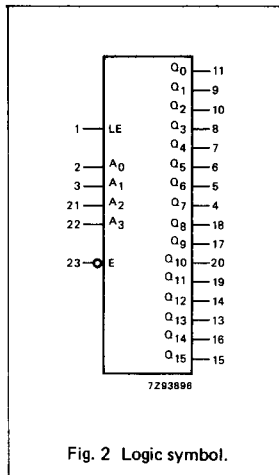
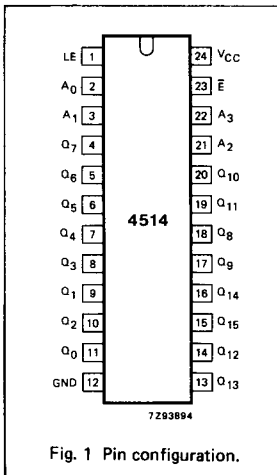
2. For HC the condition is V<sub>I</sub> = GND to V<sub>CC</sub>  
 For HCT the condition is V<sub>I</sub> = GND to V<sub>CC</sub> - 1.5 V

PACKAGE OUTLINES

24-lead DIL; plastic (SOT101A).  
 24-lead mini-pack; plastic (SO24; SOT137A).

PIN DESCRIPTION

PIN NO.	SYMBOL	NAME AND FUNCTION
1	LE	latch enable input (active HIGH)
2, 3, 21, 22	A <sub>0</sub> to A <sub>3</sub>	address inputs
11, 9, 10, 8, 7, 6, 5, 4, 18, 17, 20, 19, 14, 13, 16, 15	Q <sub>0</sub> to Q <sub>15</sub>	multiplexer outputs (active HIGH)
12	GND	ground (0 V)
23	$\bar{E}$	enable input (active LOW)
24	V <sub>CC</sub>	positive supply voltage



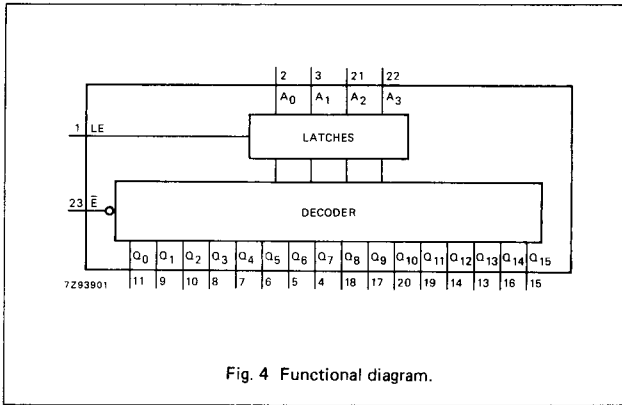


Fig. 4 Functional diagram.

**APPLICATIONS**

- Digital multiplexing
- Address decoding
- Hexadecimal/BCD decoding

**FUNCTION TABLE**

INPUTS					OUTPUTS																
$\bar{E}$	A <sub>0</sub>	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	Q <sub>0</sub>	Q <sub>1</sub>	Q <sub>2</sub>	Q <sub>3</sub>	Q <sub>4</sub>	Q <sub>5</sub>	Q <sub>6</sub>	Q <sub>7</sub>	Q <sub>8</sub>	Q <sub>9</sub>	Q <sub>10</sub>	Q <sub>11</sub>	Q <sub>12</sub>	Q <sub>13</sub>	Q <sub>14</sub>	Q <sub>15</sub>	
H	X	X	X	X	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L
L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L
L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L
L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L
L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L
L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L
L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L
L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L
L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L	L
L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L	L
L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L	L
L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L	L
L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L	L
L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	L

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

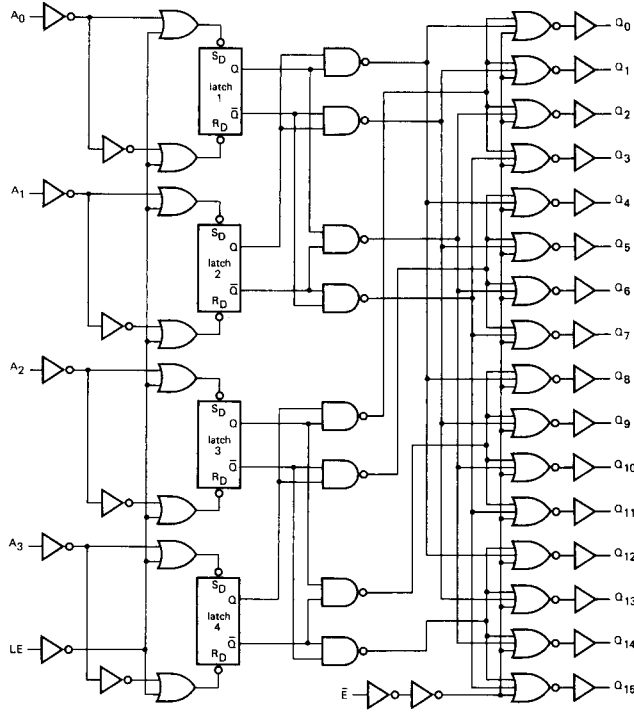


Fig. 5 Logic diagram.

**DC CHARACTERISTICS FOR 74HC**

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

Output capability: standard

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 A <sub>n</sub> to Q <sub>n</sub>		74 27 22	230 46 39		290 58 49		345 69 59	ns	2.0 4.5 6.0	Fig. 6
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay LE to Q <sub>n</sub>		74 27 22	230 46 39		290 58 49		345 69 59	ns	2.0 4.5 6.0	Fig. 6
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay E to Q <sub>n</sub>		41 15 12	175 35 30		220 44 37		265 53 45	ns	2.0 4.5 6.0	Fig. 6
t <sub>THL</sub> / t <sub>TLH</sub>	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 <sub>W</sub>	latch enable pulse width HIGH	80 16 14	14 5 4		100 20 17		120 24 20		ns	2.0 4.5 6.0	Fig. 7
t <sub>su</sub>	set-up time A <sub>n</sub> to LE	90 18 15	25 9 7		115 23 20		135 27 23		ns	2.0 4.5 6.0	Fig. 7
t <sub>h</sub>	hold time A <sub>n</sub> to LE	1 1 1	-11 -4 -3		1 1 1		1 1 1		ns	2.0 4.5 6.0	Fig. 7

**DC CHARACTERISTICS FOR 74HCT**

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

Output capability: standard

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
A <sub>n</sub>	0.65
LE	1.40
$\bar{E}$	1.00

**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 A <sub>n</sub> to Q <sub>n</sub>		30	55		69		83	ns	4.5	Fig. 6
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay LE to Q <sub>n</sub>		29	50		63		75	ns	4.5	Fig. 6
t <sub>PHL</sub> / t <sub>PLH</sub>	propagation delay $\bar{E}$ to Q <sub>n</sub>		17	40		50		60	ns	4.5	Fig. 6
t <sub>THL</sub> / t <sub>TLH</sub>	output transition time		7	15		19		22	ns	4.5	Fig. 6
t <sub>W</sub>	latch enable pulse width HIGH	16	4		20		24		ns	4.5	Fig. 7
t <sub>su</sub>	set-up time A <sub>n</sub> to LE	18	9		23		27		ns	4.5	Fig. 7
t <sub>h</sub>	hold time A <sub>n</sub> to LE	3	-3		3		3		ns	4.5	Fig. 7

AC WAVEFORMS

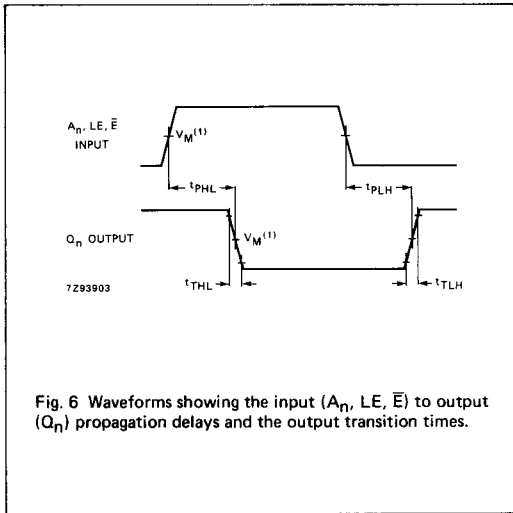


Fig. 6 Waveforms showing the input ( $A_n$ , LE,  $\bar{E}$ ) to output ( $Q_n$ ) propagation delays and the output transition times.

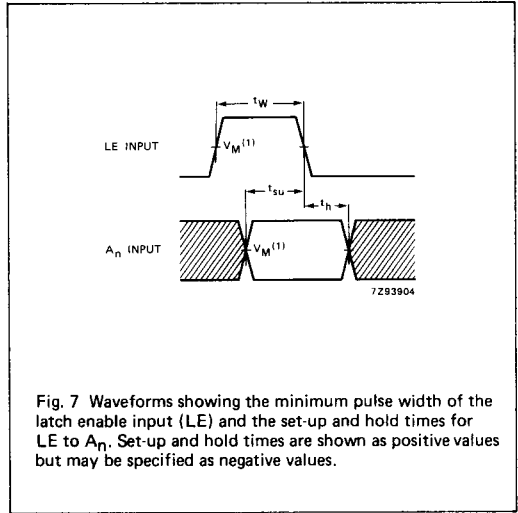


Fig. 7 Waveforms showing the minimum pulse width of the latch enable input (LE) and the set-up and hold times for LE to  $A_n$ . Set-up and hold times are shown as positive values but may be specified as negative values.

Note to AC waveforms

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

Note to Fig. 7

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

APPLICATION INFORMATION

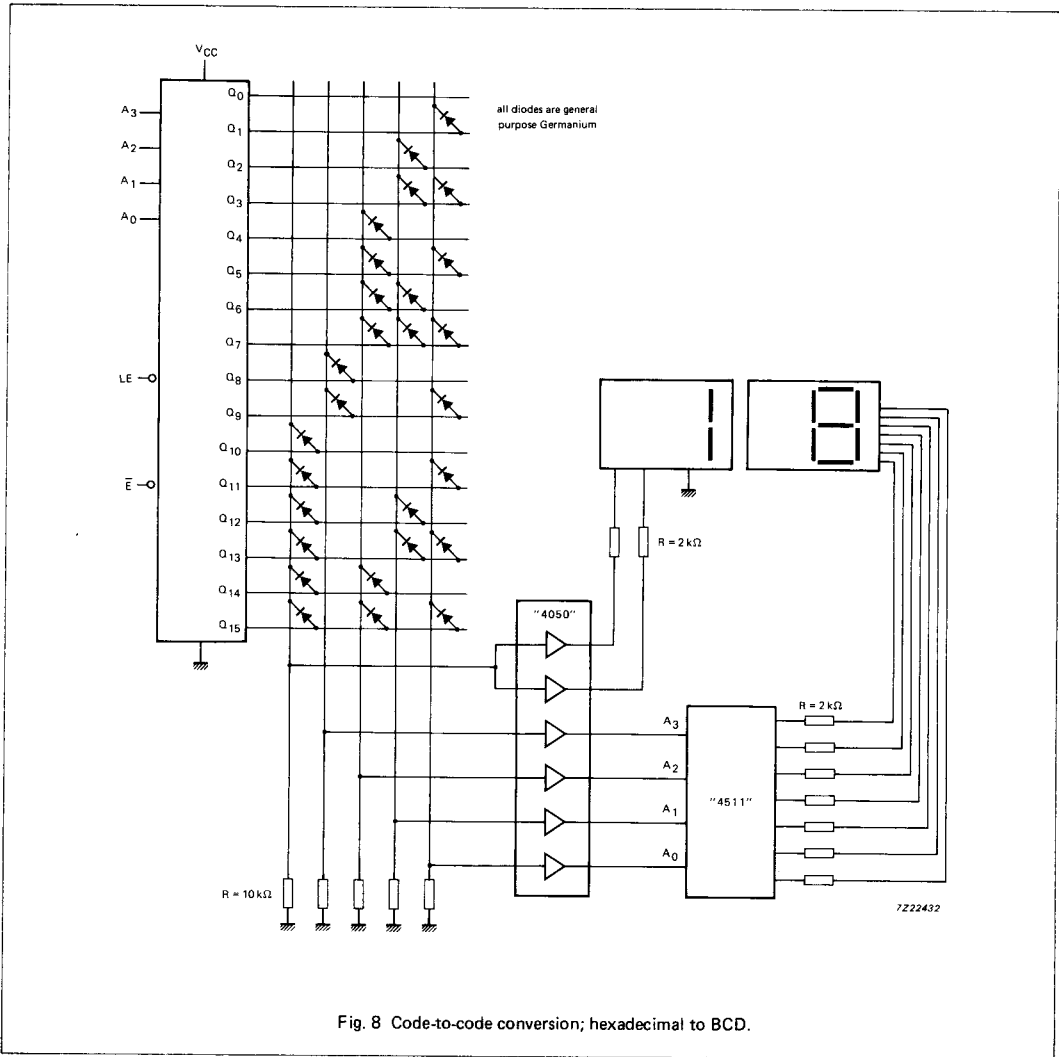


Fig. 8 Code-to-code conversion; hexadecimal to BCD.