

# DATA SHEET

For a complete data sheet, please also download:

- The IC06 74HC/HCT/HCU/HCMOS Logic Family Specifications
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Information
- The IC06 74HC/HCT/HCU/HCMOS Logic Package Outlines

## **74HC/HCT4514**

4-to-16 line decoder/demultiplexer  
with input latches

Product specification  
File under Integrated Circuits, IC06

September 1993

## 4-to-16 line decoder/demultiplexer with input latches

**74HC/HCT4514**

### FEATURES

- Non-inverting outputs
- Output capability: standard
- $I_{CC}$  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 ( $A_0$  to  $A_3$ ), with latches, a latch enable input (LE), and an active LOW enable input ( $\bar{E}$ ). The 16 outputs ( $Q_0$  to  $Q_{15}$ ) are mutually exclusive active HIGH. When LE is HIGH, the selected output is determined by the data on  $A_n$ . When LE goes LOW, the last data present at  $A_n$  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  $A_0$  to  $A_3$  are the address inputs.

### QUICK REFERENCE DATA

GND = 0 V;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $t_r = t_f = 6\text{ ns}$

| SYMBOL            | PARAMETER                                 | CONDITIONS                                   | TYPICAL |     | UNIT |
|-------------------|-------------------------------------------|----------------------------------------------|---------|-----|------|
|                   |                                           |                                              | HC      | HCT |      |
| $t_{PHL}/t_{PLH}$ | propagation delay $A_n$ to $Q_n$          | $C_L = 15\text{ pF}$ ; $V_{CC} = 5\text{ V}$ | 23      | 26  | ns   |
| $C_I$             | input capacitance                         |                                              | 3.5     | 3.5 | pF   |
| $C_{PD}$          | power dissipation capacitance per package | notes 1 and 2                                | 44      | 45  | pF   |

### Notes

1.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ):

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

$f_i$  = input frequency in MHz

$f_o$  = output frequency in MHz

$\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of outputs

$C_L$  = output load capacitance in pF

$V_{CC}$  = supply voltage in V

2. For HC the condition is  $V_I = \text{GND to } V_{CC}$   
For HCT the condition is  $V_I = \text{GND to } V_{CC} - 1.5\text{ V}$

### ORDERING INFORMATION

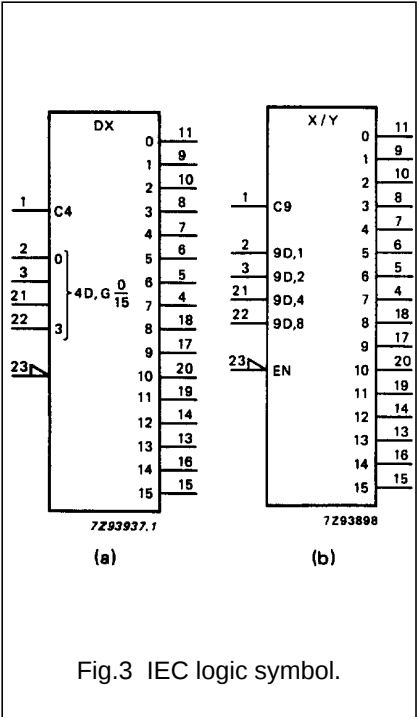
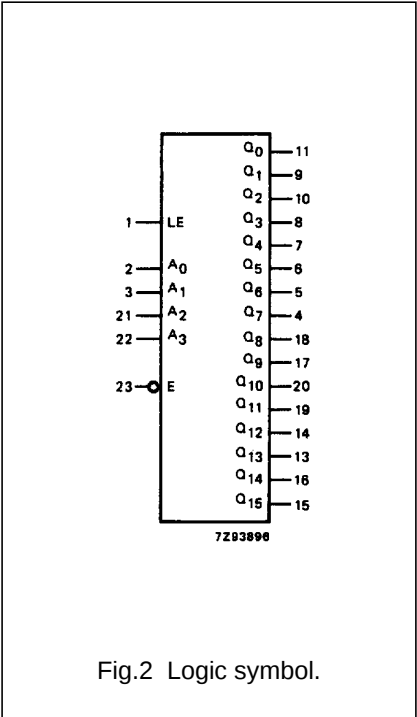
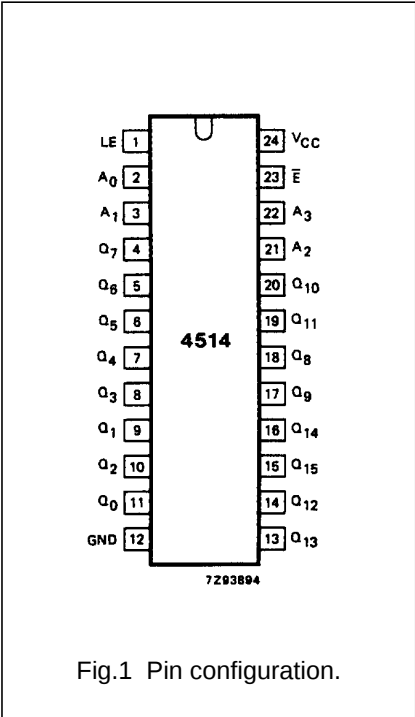
See "74HC/HCT/HCU/HCMOS Logic Package Information".

4-to-16 line decoder/demultiplexer with  
input latches

74HC/HCT4514

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                                                       | $\overline{E}$                    | enable input (active LOW)         |
| 24                                                       | V <sub>CC</sub>                   | positive supply voltage           |



# 4-to-16 line decoder/demultiplexer with input latches

## 74HC/HCT4514

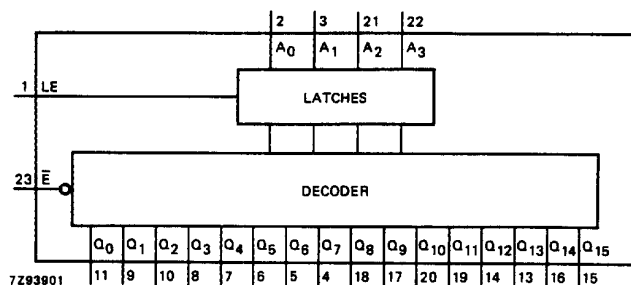


Fig.4 Functional diagram.

### 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              | H              | L              | L              | L              | L              | L              | L              | L              | L              | L              | L               | L               | L               | L               | L               | L               |
| L         | H              | L              | L              | L              | L              | H              | L              | L              | L              | L              | L              | L              | L              | L              | L               | L               | L               | L               | L               | L               |
| L         | L              | H              | L              | L              | L              | L              | H              | L              | L              | L              | L              | L              | L              | L              | L               | L               | L               | L               | L               | L               |
| L         | H              | H              | L              | L              | L              | L              | L              | H              | L              | L              | L              | L              | L              | L              | L               | L               | L               | L               | L               | L               |
| L         | L              | L              | H              | L              | L              | L              | L              | L              | H              | L              | L              | L              | L              | L              | L               | L               | L               | L               | L               | L               |
| L         | H              | L              | H              | L              | L              | L              | L              | L              | L              | H              | L              | L              | L              | L              | L               | L               | L               | L               | L               | L               |
| L         | L              | H              | H              | L              | L              | L              | L              | L              | L              | L              | H              | L              | L              | L              | L               | L               | L               | L               | L               | L               |
| L         | H              | H              | H              | L              | L              | L              | L              | L              | L              | L              | L              | H              | L              | L              | L               | L               | L               | L               | L               | L               |
| L         | L              | L              | L              | H              | L              | L              | L              | L              | L              | L              | L              | L              | H              | L              | L               | L               | L               | L               | L               | L               |
| L         | H              | L              | L              | H              | L              | L              | L              | L              | L              | L              | L              | L              | L              | H              | L               | L               | L               | L               | L               | L               |
| L         | L              | H              | L              | H              | L              | L              | L              | L              | L              | L              | L              | L              | L              | L              | H               | L               | L               | L               | L               | L               |
| L         | L              | L              | H              | H              | L              | L              | L              | L              | L              | L              | L              | L              | L              | L              | L               | H               | L               | L               | L               | L               |
| L         | H              | H              | L              | H              | L              | L              | L              | L              | L              | L              | L              | L              | L              | L              | L               | L               | H               | L               | L               | L               |
| L         | L              | H              | H              | H              | L              | L              | L              | L              | L              | L              | L              | L              | L              | L              | L               | L               | L               | H               | L               | L               |
| L         | H              | H              | H              | H              | L              | L              | L              | L              | L              | L              | L              | L              | L              | L              | L               | L               | L               | L               | H               | L               |

### Notes

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

4-to-16 line decoder/demultiplexer with  
input latches

74HC/HCT4514

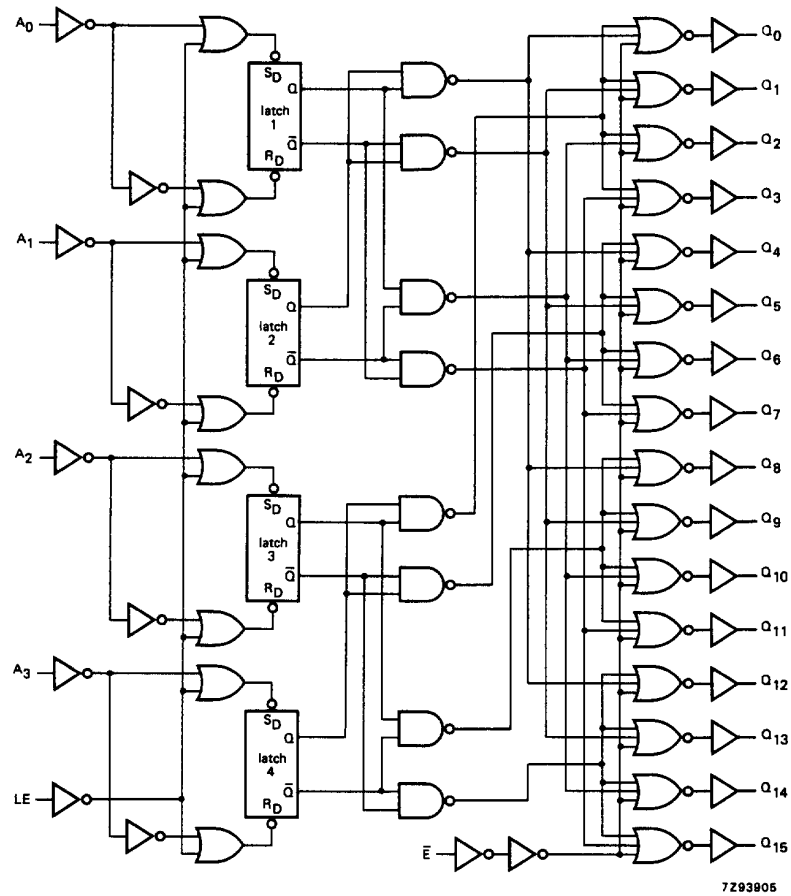


Fig.5 Logic diagram.

# 4-to-16 line decoder/demultiplexer with input latches

74HC/HCT4514

## DC CHARACTERISTICS FOR 74HC

For the DC characteristics see *"74HC/HCT/HCU/HCMOS Logic 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><br>(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<br>A <sub>n</sub> to Q <sub>n</sub> |                       | 74<br>27<br>22  | 230<br>46<br>39 |                 | 290<br>58<br>49 |                 | 345<br>69<br>59 | ns   | 2.0<br>4.5<br>6.0      | Fig.6     |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>LE to Q <sub>n</sub>             |                       | 74<br>27<br>22  | 230<br>46<br>39 |                 | 290<br>58<br>49 |                 | 345<br>69<br>59 | ns   | 2.0<br>4.5<br>6.0      | Fig.6     |
| t <sub>PHL</sub> / t <sub>PLH</sub> | propagation delay<br>E̅ to Q <sub>n</sub>             |                       | 41<br>15<br>12  | 175<br>35<br>30 |                 | 220<br>44<br>37 |                 | 265<br>53<br>45 | ns   | 2.0<br>4.5<br>6.0      | Fig.6     |
| t <sub>THL</sub> / t <sub>TLH</sub> | output transition time                                |                       | 19<br>7<br>6    | 75<br>15<br>13  |                 | 95<br>19<br>16  |                 | 110<br>22<br>19 | ns   | 2.0<br>4.5<br>6.0      | Fig.6     |
| t <sub>W</sub>                      | latch enable pulse width<br>HIGH                      | 80<br>16<br>14        | 14<br>5<br>4    |                 | 100<br>20<br>17 |                 | 120<br>24<br>20 |                 | ns   | 2.0<br>4.5<br>6.0      | Fig.7     |
| t <sub>su</sub>                     | set-up time<br>A <sub>n</sub> to LE                   | 90<br>18<br>15        | 25<br>9<br>7    |                 | 115<br>23<br>20 |                 | 135<br>27<br>23 |                 | ns   | 2.0<br>4.5<br>6.0      | Fig.7     |
| t <sub>h</sub>                      | hold time<br>A <sub>n</sub> to LE                     | 1<br>1<br>1           | −11<br>−4<br>−3 |                 | 1<br>1<br>1     |                 | 1<br>1<br>1     |                 | ns   | 2.0<br>4.5<br>6.0      | Fig.7     |

# 4-to-16 line decoder/demultiplexer with input latches

74HC/HCT4514

## DC CHARACTERISTICS FOR 74HCT

For the DC characteristics see *"74HC/HCT/HCU/HCMOS Logic 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                  |
| $\overline{E}$ | 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><br>(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<br>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<br>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<br>E̅ 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<br>HIGH                      | 16                    | 4    |      | 20         |      | 24          |      | ns   | 4.5                    | Fig.7     |
| t <sub>su</sub>                     | set-up time<br>A <sub>n</sub> to LE                   | 18                    | 9    |      | 23         |      | 27          |      | ns   | 4.5                    | Fig.7     |
| t <sub>h</sub>                      | hold time<br>A <sub>n</sub> to LE                     | 3                     | −3   |      | 3          |      | 3           |      | ns   | 4.5                    | Fig.7     |

# 4-to-16 line decoder/demultiplexer with input latches

74HC/HCT4514

## AC WAVEFORMS

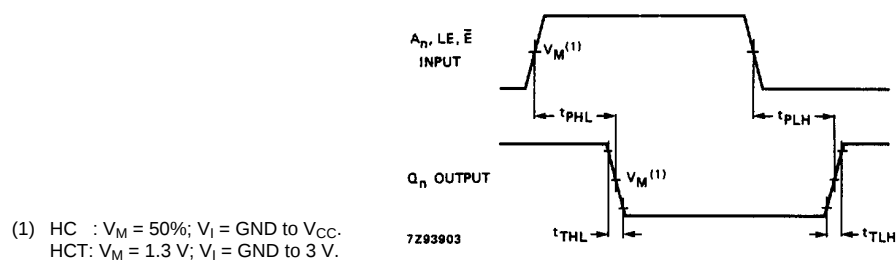


Fig.6 Waveforms showing the input ( $A_n$ , LE,  $\bar{E}$ ) to output ( $Q_n$ ) propagation delays and the output transition times.

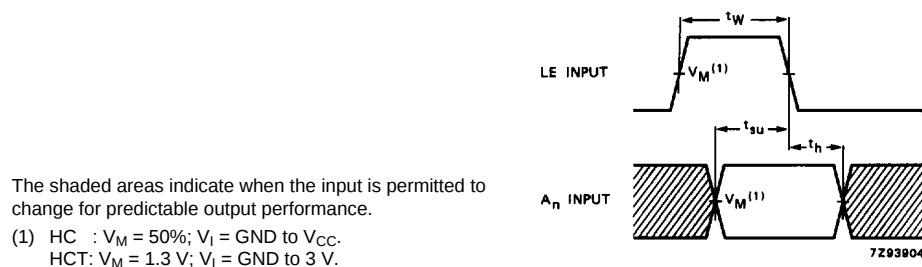


Fig.7 Waveforms showing the minimum pulse width of the latch enable input (LE) and the set-up and hold times for LE to  $A_n$ . Set-up and hold times are shown as positive values but may be specified as negative values.

## 4-to-16 line decoder/demultiplexer with input latches

74HC/HCT4514

## APPLICATION INFORMATION

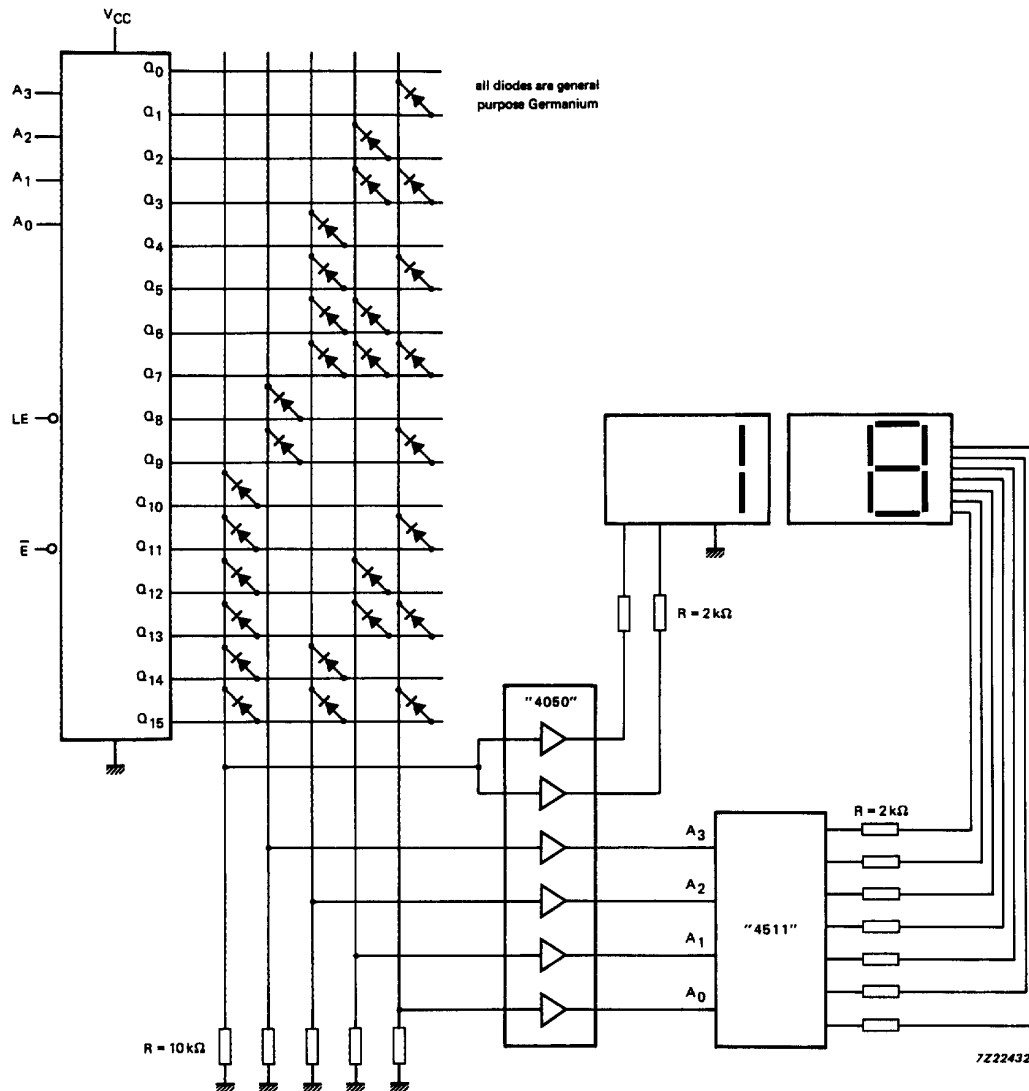


Fig.8 Code-to-code conversion; hexadecimal to BCD.

## PACKAGE OUTLINES

See “74HC/HCT/HCU/HCMOS Logic Package Outlines”.