

# CD74HC157, CD74HCT157, CD74HC158, CD74HCT158

High Speed CMOS Logic  
Quad 2-Input Multiplexers

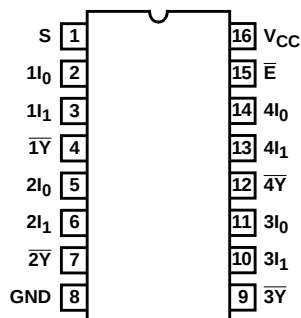
September 1997

## Features

- Common Select Inputs
- Separate Enable Inputs
- Buffered inputs and Outputs
- Fanout (Over Temperature Range)
  - Standard Outputs . . . . . 10 LSTTL Loads
  - Bus Driver Outputs . . . . . 15 LSTTL Loads
- Wide Operating Temperature Range . . . -55°C to 125°C
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- HC Types
  - 2V to 6V Operation
  - High Noise Immunity:  $N_{IL} = 30\%$ ,  $N_{IH} = 30\%$  of  $V_{CC}$  at  $V_{CC} = 5V$
- HCT Types
  - 4.5V to 5.5V Operation
  - Direct LSTTL Input Logic Compatibility,  $V_{IL} = 0.8V$  (Max),  $V_{IH} = 2V$  (Min)
  - CMOS Input Compatibility,  $I_I \leq 1\mu A$  at  $V_{OL}$ ,  $V_{OH}$

## Pinout

CD74HC157, CD74HCT157, CD74HC158, CD74HCT158  
(PDIP, SOIC)  
TOP VIEW



**Description**

The Harris CD74HC157, CD74HCT157, CD74HC158 and CD74HCT158 are quad 2-input multiplexers which select four bits of data from two sources under the control of a common Select input (S). The Enable input ( $\bar{E}$ ) is active Low. When ( $\bar{E}$ ) is High, all of the outputs in the 158, the inverting type, (1Y-4Y) are forced High and in the 157, the non-inverting type, all of the outputs (1Y-4Y) are forced Low, regardless of all other input conditions.

Moving data from two groups of registers to four common output busses is a common use of these devices. The state of the Select input determines the particular register from which the data comes. They can also be used as function generators.

**Ordering Information**

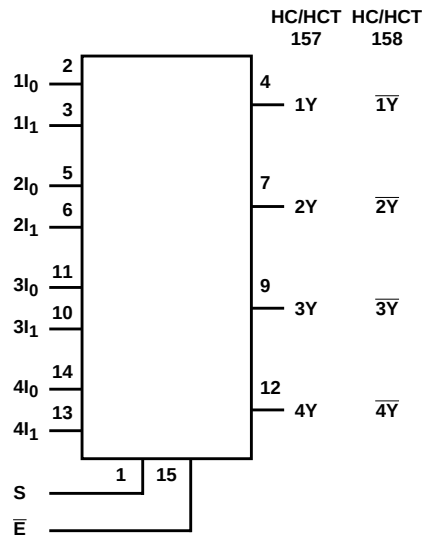
| PART NUMBER | TEMP. RANGE (°C) | PACKAGE    | PKG. NO. |
|-------------|------------------|------------|----------|
| CD74HC157E  | -55 to 125       | 16 Ld PDIP | E16.3    |
| CD74HCT157E | -55 to 125       | 16 Ld PDIP | E16.3    |
| CD74HC158E  | -55 to 125       | 16 Ld PDIP | E16.3    |
| CD74HCT158E | -55 to 125       | 16 Ld PDIP | E16.3    |
| CD74HC157M  | -55 to 125       | 16 Ld SOIC | M16.15   |
| CD74HCT157M | -55 to 125       | 16 Ld SOIC | M16.15   |
| CD74HC158M  | -55 to 125       | 16 Ld SOIC | M16.15   |

**NOTES:**

1. When ordering, use the entire part number. Add the suffix 96 to obtain the variant in the tape and reel.
2. Wafer or die for this part number is available which meets all electrical specifications. Please contact your local sales office or Harris customer service for ordering information.

# CD74HC157, CD74HCT157, CD74HC158, CD74HCT158

## Functional Diagram



TRUTH TABLE

| ENABLE    | SELECT INPUT | DATA INPUTS |    | OUTPUT |           |
|-----------|--------------|-------------|----|--------|-----------|
|           |              |             |    | 157    | 158       |
| $\bar{E}$ | S            | I0          | I1 | Y      | $\bar{Y}$ |
| H         | X            | X           | X  | L      | H         |
| L         | L            | L           | X  | L      | H         |
| L         | L            | H           | X  | H      | L         |
| L         | H            | X           | L  | L      | H         |
| L         | H            | X           | H  | H      | L         |

NOTE: H = High Voltage Level, L = Low Voltage Level, X = Don't Care

# CD74HC157, CD74HCT157, CD74HC158, CD74HCT158

## Absolute Maximum Ratings

DC Supply Voltage,  $V_{CC}$  ..... -0.5V to 7V  
 DC Input Diode Current,  $I_{IK}$   
 For  $V_I < -0.5V$  or  $V_I > V_{CC} + 0.5V$  .....  $\pm 20mA$   
 DC Output Diode Current,  $I_{OK}$   
 For  $V_O < -0.5V$  or  $V_O > V_{CC} + 0.5V$  .....  $\pm 20mA$   
 DC Output Source or Sink Current per Output Pin,  $I_O$   
 For  $V_O > -0.5V$  or  $V_O < V_{CC} + 0.5V$  .....  $\pm 25mA$   
 DC  $V_{CC}$  or Ground Current,  $I_{CC}$  or  $I_{GND}$  .....  $\pm 50mA$

## Thermal Information

Thermal Resistance (Typical, Note 3)  $\theta_{JA}$  ( $^{\circ}C/W$ )  
 PDIP Package ..... 90  
 SOIC Package ..... 115  
 Maximum Junction Temperature .....  $150^{\circ}C$   
 Maximum Storage Temperature Range .....  $-65^{\circ}C$  to  $150^{\circ}C$   
 Maximum Lead Temperature (Soldering 10s) .....  $300^{\circ}C$   
 (SOIC - Lead Tips Only)

## Operating Conditions

Temperature Range ( $T_A$ ) .....  $-55^{\circ}C$  to  $125^{\circ}C$   
 Supply Voltage Range,  $V_{CC}$   
 HC Types ..... 2V to 6V  
 HCT Types ..... 4.5V to 5.5V  
 DC Input or Output Voltage,  $V_I$ ,  $V_O$  ..... 0V to  $V_{CC}$   
 Input Rise and Fall Time  
 2V ..... 1000ns (Max)  
 4.5V ..... 500ns (Max)  
 6V ..... 400ns (Max)

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

- $\theta_{JA}$  is measured with the component mounted on an evaluation PC board in free air.

## DC Electrical Specifications

| PARAMETER                               | SYMBOL          | TEST CONDITIONS                    |                     | V <sub>CC</sub> (V) | 25°C |      |      | -40°C TO 85°C |      | -55°C TO 125°C |      | UNITS |
|-----------------------------------------|-----------------|------------------------------------|---------------------|---------------------|------|------|------|---------------|------|----------------|------|-------|
|                                         |                 | V <sub>I</sub> (V)                 | I <sub>O</sub> (mA) |                     | MIN  | TYP  | MAX  | MIN           | MAX  | MIN            | MAX  |       |
| HC TYPES                                |                 |                                    |                     |                     |      |      |      |               |      |                |      |       |
| High Level Input Voltage                | V <sub>IH</sub> | -                                  | -                   | 2                   | 1.5  | -    | -    | 1.5           | -    | 1.5            | -    | V     |
|                                         |                 |                                    |                     | 4.5                 | 3.15 | -    | -    | 3.15          | -    | 3.15           | -    | V     |
|                                         |                 |                                    |                     | 6                   | 4.2  | -    | -    | 4.2           | -    | 4.2            | -    | V     |
| Low Level Input Voltage                 | V <sub>IL</sub> | -                                  | -                   | 2                   | -    | -    | 0.5  | -             | 0.5  | -              | 0.5  | V     |
|                                         |                 |                                    |                     | 4.5                 | -    | -    | 1.35 | -             | 1.35 | -              | 1.35 | V     |
|                                         |                 |                                    |                     | 6                   | -    | -    | 1.8  | -             | 1.8  | -              | 1.8  | V     |
| High Level Output Voltage<br>CMOS Loads | V <sub>OH</sub> | V <sub>IH</sub> or V <sub>IL</sub> | -0.02               | 2                   | 1.9  | -    | -    | 1.9           | -    | 1.9            | -    | V     |
|                                         |                 |                                    | -0.02               | 4.5                 | 4.4  | -    | -    | 4.4           | -    | 4.4            | -    | V     |
|                                         |                 |                                    | -0.02               | 6                   | 5.9  | -    | -    | 5.9           | -    | 5.9            | -    | V     |
| -                                       |                 |                                    | -                   | -                   | -    | -    | -    | -             | -    | -              | V    |       |
| -                                       |                 |                                    | 4.5                 | 3.98                | -    | -    | 3.84 | -             | 3.7  | -              | V    |       |
| -5.2                                    |                 |                                    | 6                   | 5.48                | -    | -    | 5.34 | -             | 5.2  | -              | V    |       |
| High Level Output Voltage<br>TTL Loads  | V <sub>OL</sub> | V <sub>IH</sub> or V <sub>IL</sub> | 0.02                | 2                   | -    | -    | 0.1  | -             | 0.1  | -              | 0.1  | V     |
|                                         |                 |                                    | 0.02                | 4.5                 | -    | -    | 0.1  | -             | 0.1  | -              | 0.1  | V     |
|                                         |                 |                                    | 0.02                | 6                   | -    | -    | 0.1  | -             | 0.1  | -              | 0.1  | V     |
| -                                       |                 |                                    | -                   | -                   | -    | -    | -    | -             | -    | -              | V    |       |
| 4                                       |                 |                                    | 4.5                 | -                   | -    | 0.26 | -    | 0.33          | -    | 0.4            | V    |       |
| 5.2                                     |                 |                                    | 6                   | -                   | -    | 0.26 | -    | 0.33          | -    | 0.4            | V    |       |
| Low Level Output Voltage<br>CMOS Loads  | V <sub>OL</sub> | V <sub>IH</sub> or V <sub>IL</sub> | 0.02                | 2                   | -    | -    | 0.1  | -             | 0.1  | -              | 0.1  | V     |
| 0.02                                    |                 |                                    | 4.5                 | -                   | -    | 0.1  | -    | 0.1           | -    | 0.1            | V    |       |
| 0.02                                    |                 |                                    | 6                   | -                   | -    | 0.1  | -    | 0.1           | -    | 0.1            | V    |       |
| Low Level Output Voltage<br>TTL Loads   | V <sub>OL</sub> | V <sub>IH</sub> or V <sub>IL</sub> | -                   | -                   | -    | -    | -    | -             | -    | -              | -    | V     |
|                                         |                 |                                    | 4                   | 4.5                 | -    | -    | 0.26 | -             | 0.33 | -              | 0.4  | V     |
|                                         |                 |                                    | 5.2                 | 6                   | -    | -    | 0.26 | -             | 0.33 | -              | 0.4  | V     |
| Input Leakage Current                   | I <sub>I</sub>  | V <sub>CC</sub> or GND             | -                   | 6                   | -    | -    | ±0.1 | -             | ±1   | -              | ±1   | µA    |
| Quiescent Device Current                | I <sub>CC</sub> | V <sub>CC</sub> or GND             | 0                   | 6                   | -    | -    | 8    | -             | 80   | -              | 160  | µA    |

**CD74HC157, CD74HCT157, CD74HC158, CD74HCT158**

**DC Electrical Specifications (Continued)**

| PARAMETER                                                      | SYMBOL           | TEST CONDITIONS                    |                     | V <sub>CC</sub> (V) | 25°C |     |      | -40°C TO 85°C |      | -55°C TO 125°C |     | UNITS |
|----------------------------------------------------------------|------------------|------------------------------------|---------------------|---------------------|------|-----|------|---------------|------|----------------|-----|-------|
|                                                                |                  | V <sub>I</sub> (V)                 | I <sub>O</sub> (mA) |                     | MIN  | TYP | MAX  | MIN           | MAX  | MIN            | MAX |       |
| HCT TYPES                                                      |                  |                                    |                     |                     |      |     |      |               |      |                |     |       |
| High Level Input Voltage                                       | V <sub>IH</sub>  | -                                  | -                   | 4.5 to 5.5          | 2    | -   | -    | 2             | -    | 2              | -   | V     |
| Low Level Input Voltage                                        | V <sub>IL</sub>  | -                                  | -                   | 4.5 to 5.5          | -    | -   | 0.8  | -             | 0.8  | -              | 0.8 | V     |
| High Level Output Voltage<br>CMOS Loads                        | V <sub>OH</sub>  | V <sub>IH</sub> or V <sub>IL</sub> | -0.02               | 4.5                 | 4.4  | -   | -    | 4.4           | -    | 4.4            | -   | V     |
| High Level Output Voltage<br>TTL Loads                         |                  |                                    | -4                  | 4.5                 | 3.98 | -   | -    | 3.84          | -    | 3.7            | -   | V     |
| Low Level Output Voltage<br>CMOS Loads                         | V <sub>OL</sub>  | V <sub>IH</sub> or V <sub>IL</sub> | 0.02                | 4.5                 | -    | -   | 0.1  | -             | 0.1  | -              | 0.1 | V     |
| Low Level Output Voltage<br>TTL Loads                          |                  |                                    | 4                   | 4.5                 | -    | -   | 0.26 | -             | 0.33 | -              | 0.4 | V     |
| Input Leakage Current                                          | I <sub>I</sub>   | V <sub>CC</sub> and GND            | 0                   | 5.5                 | -    |     | ±0.1 | -             | ±1   | -              | ±1  | μA    |
| Quiescent Device Current                                       | I <sub>CC</sub>  | V <sub>CC</sub> or GND             | 0                   | 5.5                 | -    | -   | 8    | -             | 80   | -              | 160 | μA    |
| Additional Quiescent Device Current Per Input Pin: 1 Unit Load | ΔI <sub>CC</sub> | V <sub>CC</sub> -2.1               | -                   | 4.5 to 5.5          | -    | 100 | 360  | -             | 450  | -              | 490 | μA    |

NOTE: For dual-supply systems theoretical worst case (V<sub>I</sub> = 2.4V, V<sub>CC</sub> = 5.5V) specification is 1.8mA.

**HCT Input Loading Table**

| INPUT     | UNIT LOADS |        |
|-----------|------------|--------|
|           | HCT157     | HCT158 |
| I (All)   | 0.95       | 0.4    |
| $\bar{E}$ | 0.6        | 0.6    |
| S         | 3          | 2.8    |

NOTE: Unit Load is ΔI<sub>CC</sub> limit specified in DC Electrical Table, e.g., 360μA max at 25°C.

**Switching Specifications** Input t<sub>r</sub>, t<sub>f</sub> = 6ns

| PARAMETER                    | SYMBOL                              | TEST CONDITIONS       | V <sub>CC</sub> (V) | 25°C |     |     | -40°C TO 85°C |     | -55°C TO 125°C |     | UNITS |
|------------------------------|-------------------------------------|-----------------------|---------------------|------|-----|-----|---------------|-----|----------------|-----|-------|
|                              |                                     |                       |                     | MIN  | TYP | MAX | MIN           | MAX | MIN            | MAX |       |
| HC/HCT157 TYPES              |                                     |                       |                     |      |     |     |               |     |                |     |       |
| Propagation Delay (Figure 1) | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 2                   | -    | -   | 125 | -             | 155 | -              | 190 | ns    |
| Data to Output               |                                     |                       | 4.5                 | -    | -   | 25  | -             | 31  | -              | 38  | ns    |
| HC157                        |                                     | C <sub>L</sub> =15pF  | 5                   | -    | 10  | -   | -             | -   | -              | -   | ns    |
| HCT157                       |                                     |                       |                     | -    | 12  | -   | -             | -   | -              | -   | ns    |
|                              |                                     | C <sub>L</sub> = 50pF | 6                   | -    | -   | 21  | -             | 26  | -              | 32  | ns    |
|                              |                                     |                       |                     |      |     |     |               |     |                |     |       |

**CD74HC157, CD74HCT157, CD74HC158, CD74HCT158**

**Switching Specifications** Input  $t_r, t_f = 6\text{ns}$  (Continued)

| PARAMETER                                  | SYMBOL                              | TEST CONDITIONS       | V <sub>CC</sub> (V) | 25°C |     |     | -40°C TO 85°C |     | -55°C TO 125°C |     | UNITS |
|--------------------------------------------|-------------------------------------|-----------------------|---------------------|------|-----|-----|---------------|-----|----------------|-----|-------|
|                                            |                                     |                       |                     | MIN  | TYP | MAX | MIN           | MAX | MIN            | MAX |       |
| Enable to Output                           | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 2                   | -    | -   | 135 | -             | 170 | -              | 205 | ns    |
|                                            |                                     |                       | 4.5                 | -    | -   | 27  | -             | 34  | -              | 41  | ns    |
| C <sub>L</sub> =15pF                       |                                     | 5                     | -                   | 11   | -   | -   | -             | -   | -              | ns  |       |
|                                            |                                     |                       | -                   | 12   | -   | -   | -             | -   | -              | ns  |       |
| HC157                                      |                                     | C <sub>L</sub> = 50pF | 6                   | -    | -   | 23  | -             | 29  | -              | 35  | ns    |
| HCT157                                     |                                     |                       |                     | -    | -   | -   | -             | -   | -              | -   | ns    |
| Select to Output                           | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 2                   | -    | -   | 145 | -             | 180 | -              | 220 | ns    |
|                                            |                                     |                       | 4.5                 | -    | -   | 29  | -             | 36  | -              | 44  | ns    |
| C <sub>L</sub> =15pF                       |                                     | 5                     | -                   | 12   | -   | -   | -             | -   | -              | ns  |       |
|                                            |                                     |                       | -                   | 15   | -   | -   | -             | -   | -              | ns  |       |
| HC157                                      |                                     | C <sub>L</sub> = 50pF | 6                   | -    | -   | 25  | -             | 31  | -              | 38  | ns    |
| HCT157                                     |                                     |                       |                     | -    | -   | -   | -             | -   | -              | -   | ns    |
| Power Dissipation Capacitance (Notes 4, 5) | C <sub>PD</sub>                     | -                     | 5                   |      |     |     |               |     |                |     |       |
| HC157                                      |                                     |                       |                     | -    | 62  | -   | -             | -   | -              | -   | pF    |
| HCT157                                     |                                     |                       |                     | -    | 70  | -   | -             | -   | -              | -   | pF    |
| HC/HCT158 TYPES                            |                                     |                       |                     |      |     |     |               |     |                |     |       |
| Data to Output                             | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 2                   | -    | -   | 140 | -             | 175 | -              | 210 | ns    |
|                                            |                                     |                       | 4.5                 | -    | -   | 28  | -             | 35  | -              | 42  |       |
| C <sub>L</sub> =15pF                       |                                     | 5                     | -                   | 11   | -   | -   | -             | -   | -              | ns  |       |
|                                            |                                     |                       | -                   | 13   | -   | -   | -             | -   | -              | ns  |       |
| HC158                                      |                                     | C <sub>L</sub> = 50pF | 6                   | -    | -   | 24  | -             | 30  | -              | 36  | ns    |
| HCT 158                                    |                                     |                       |                     | -    | -   | -   | -             | -   | -              | ns  |       |
| Enable to Output                           | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 2                   | -    | -   | 160 | -             | 200 | -              | 240 | ns    |
|                                            |                                     |                       | 4.5                 | -    | -   | 32  | -             | 40  | -              | 48  | ns    |
| C <sub>L</sub> =15pF                       |                                     | 5                     | -                   | 13   | -   | -   | -             | -   | -              | ns  |       |
|                                            |                                     |                       | -                   | 15   | -   | -   | -             | -   | -              | ns  |       |
| HC158                                      |                                     | C <sub>L</sub> = 50pF | 6                   | -    | -   | 27  | -             | 34  | -              | 41  | ns    |
| HCT 158                                    |                                     |                       |                     | -    | -   | -   | -             | -   | -              | ns  |       |
| Select to Output                           | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 2                   | -    | -   | 150 | -             | 190 | -              | 225 | ns    |
|                                            |                                     |                       | 4.5                 | -    | -   | 30  | -             | 38  | -              | 45  | ns    |
| C <sub>L</sub> =15pF                       |                                     | 5                     | -                   | 12   | -   | -   | -             | -   | -              | ns  |       |
|                                            |                                     |                       | -                   | 14   | -   | -   | -             | -   | -              | ns  |       |
| HC158                                      |                                     | C <sub>L</sub> = 50pF | 6                   | -    | -   | 26  | -             | 33  | -              | 38  | ns    |
| HCT 158                                    |                                     |                       |                     | -    | -   | -   | -             | -   | -              | ns  |       |
| Output Transition Time                     | t <sub>TLH</sub> , t <sub>THL</sub> | C <sub>L</sub> = 50pF | 2                   | -    | -   | 75  | -             | 95  | -              | 110 | ns    |
|                                            |                                     |                       | 4.5                 | -    | -   | 15  | -             | 19  | -              | 22  | ns    |
|                                            |                                     |                       | 6                   | -    | -   | 13  | -             | 16  | -              | 19  | ns    |
| Power Dissipation Capacitance (Notes 4, 5) | C <sub>PD</sub>                     | -                     | 5                   |      |     |     |               |     |                |     |       |
| HC158                                      |                                     |                       |                     | -    | 35  | -   | -             | -   | -              | -   | pF    |
| HCT 158                                    |                                     |                       |                     | -    | 35  | -   | -             | -   | -              | -   | pF    |
| Input Capacitance                          | C <sub>IN</sub>                     | C <sub>L</sub> = 50pF | -                   | -    | -   | 10  | -             | 10  | -              | 10  | pF    |

NOTES:

- $C_{PD}$  is used to determine the dynamic power consumption, per multiplexer.
- $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$  where  $f_i$  = input frequency,  $C_L$  = output load capacitance,  $V_{CC}$  = supply voltage.

## Test Circuits and Waveforms

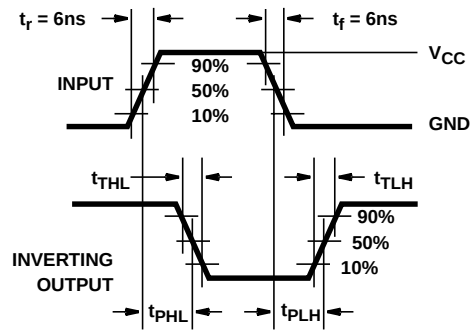


FIGURE 1. HC AND HCU TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

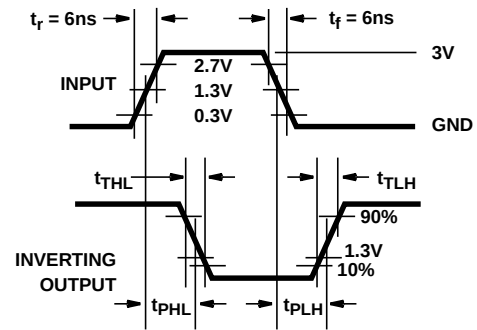


FIGURE 2. HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

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