



Data sheet acquired from Harris Semiconductor  
SCHS168A

November 1997 - Revised May 2000

# CD74HCT242, CD54/74HC243, CD54/74HCT243

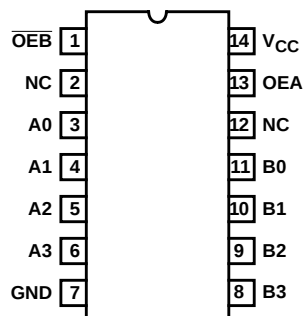
## High Speed CMOS Logic Quad-Bus Transceiver with Three-State Outputs

### Features

- Typical Propagation Delay (A to B, B to A) of 7ns at  $V_{CC} = 5V$ ,  $C_L = 15pF$ ,  $T_A = 25^{\circ}C$
- Three-State Outputs
- Buffered Inputs
- Fanout (Over Temperature Range)
  - Standard Outputs . . . . . 10 LSTTL Loads
  - Bus Driver Outputs . . . . . 15 LSTTL Loads
- Wide Operating Temperature Range . . .  $-55^{\circ}C$  to  $125^{\circ}C$
- 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

CD54HC243, CD54HCT243  
(CERDIP)  
CD74HCT242, CD74HC243, CD74HCT243  
(PDIP, SOIC)  
TOP VIEW



### Description

The CD74HCT242, 'HC243 and 'HCT243 silicon-gate CMOS three-state bidirectional inverting and non-inverting buffers are intended for two-way asynchronous communication between data buses. They have high drive current outputs which enable high-speed operation when driving large bus capacitances. These circuits possess the low power dissipation of CMOS circuits, and have speeds comparable to low power Schottky TTL circuits. They can drive 15 LSTTL loads.

The CD74HCT242 is an inverting buffer; the 'HC243 and 'HCT243 are non-inverting buffers.

The states of the output enables ( $\overline{OEB}$ , OEA) determine both the direction of flow (A to B, B to A), and the three-state mode.

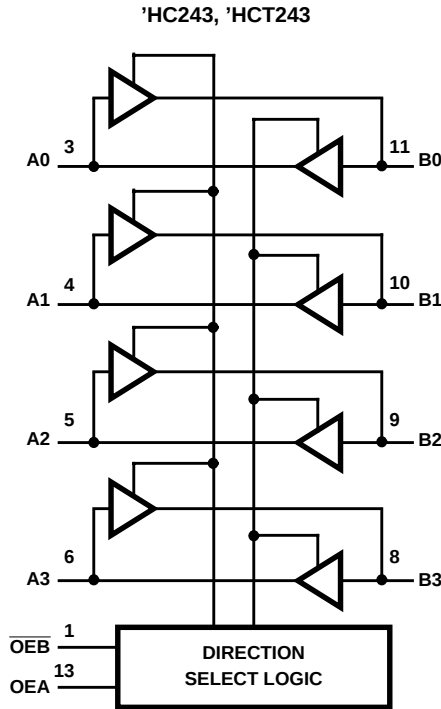
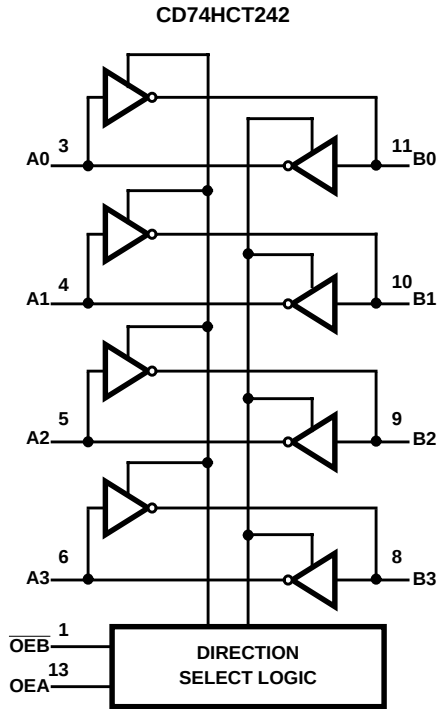
### Ordering Information

| PART NUMBER   | TEMP. RANGE<br>( $^{\circ}C$ ) | PACKAGE      |
|---------------|--------------------------------|--------------|
| CD54HC243F    | -55 to 125                     | 14 Ld CERDIP |
| CD54HC243F3A  | -55 to 125                     | 14 Ld CERDIP |
| CD74HC243E    | -55 to 125                     | 14 Ld PDIP   |
| CD74HC243M    | -55 to 125                     | 14 Ld SOIC   |
| CD54HCT243F3A | -55 to 125                     | 14 Ld CERDIP |
| CD74HCT243M   | -55 to 125                     | 14 Ld SOIC   |

#### 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 TI sales office.

Functional Diagrams



TRUTH TABLE

| CONTROL INPUTS |     | HCT242 SERIES    |           | HC, HCT243 SERIES |    |
|----------------|-----|------------------|-----------|-------------------|----|
|                |     | DATA PORT STATUS |           | DATA PORT STATUS  |    |
| OEB            | OEA | An               | Bn        | An                | Bn |
| H              | H   | $\bar{O}$        | I         | O                 | I  |
| L              | H   | Z                | Z         | Z                 | Z  |
| H              | L   | Z                | Z         | Z                 | Z  |
| L              | L   | I                | $\bar{O}$ | I                 | O  |

NOTE:  
H = High Voltage Level  
L = Low Voltage Level  
I = Input  
O = Output (Same Level as Input)  
 $\bar{O}$  = Output (Inversion of Input Level)  
Z = High Impedance  
To prevent excess currents in the High Z modes all I/O terminals should be terminated with 10k $\Omega$  to 1M $\Omega$  resistors.

# CD74HCT242, CD54/74HC243, CD54/74HCT243

## 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 Drain Current, per Output, $I_O$                    |             |
| For $-0.5V < V_O < V_{CC} + 0.5V$                      | $\pm 35mA$  |
| 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, $I_{CC}$                | $\pm 70mA$  |

## Thermal Information

|                                          |                                  |
|------------------------------------------|----------------------------------|
| Thermal Resistance (Typical, Note 3)     | $\theta_{JA}$ ( $^{\circ}C/W$ )  |
| PDIP Package                             | 90                               |
| SOIC Package                             | 175                              |
| 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<br>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     |
| High Level Output Voltage<br>TTL Loads  |                 |                                       | -6                  | 4.5                 | 3.98 | -   | -    | 3.84          | -    | 3.7            | -    | V     |
|                                         |                 |                                       | -7.8                | 6                   | 5.48 | -   | -    | 5.34          | -    | 5.2            | -    | V     |
| Low Level Output Voltage<br>CMOS Loads  | V <sub>OL</sub> | V <sub>IH</sub> or<br>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   |                 |                                       | 6                   | 4.5                 | -    | -   | 0.26 | -             | 0.33 | -              | 0.4  | V     |
|                                         |                 |                                       | 7.8                 | 6                   | -    | -   | 0.26 | -             | 0.33 | -              | 0.4  | V     |

**CD74HCT242, CD54/74HC243, CD54/74HCT243**

**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 |       |
| 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    |
| Three-State Leakage Current                                             | I <sub>OZ</sub>  | V <sub>IL</sub> or V <sub>IH</sub> | -                   | 6                   | -    | -   | ±0.5 | -             | ±0.5 | -              | ±10 | μA    |
| <b>HCT TYPES</b>                                                        |                  |                                    |                     |                     |      |     |      |               |      |                |     |       |
| 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                                  |                  |                                    | -6                  | 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                                   |                  |                                    | 6                   | 4.5                 | -    | -   | 0.26 | -             | 0.33 | -              | 0.4 | V     |
| Input Leakage Current                                                   | I <sub>I</sub>   | V <sub>CC</sub> to 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 (Note 4) | ΔI <sub>CC</sub> | V <sub>CC</sub> -2.1               | -                   | 4.5 to 5.5          | -    | 100 | 360  | -             | 450  | -              | 490 | μA    |
| Three-State Leakage Current                                             | I <sub>OZ</sub>  | V <sub>IL</sub> or V <sub>IH</sub> | -                   | 5.5                 | -    | -   | ±0.5 | -             | ±5.0 | -              | ±10 | μA    |

NOTE:

4. 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 |
|---------------------------------|------------|
| A <sub>n</sub> , B <sub>n</sub> | 1.1        |
| OEA, $\overline{\text{OEB}}$    | 0.6        |

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

# **CD74HCT242, CD54/74HC243, CD54/74HCT243**

## **Switching Specifications** Input $t_r, t_f = 6\text{ns}$

| PARAMETER                                          | SYMBOL                              | TEST CONDITIONS       | V <sub>CC</sub> (V) | 25°C |     | -40°C TO 85°C | -55°C TO 125°C | UNITS |
|----------------------------------------------------|-------------------------------------|-----------------------|---------------------|------|-----|---------------|----------------|-------|
|                                                    |                                     |                       |                     | TYP  | MAX | MAX           | MAX            |       |
| HC TYPES                                           |                                     |                       |                     |      |     |               |                |       |
| Propagation Delay Data to Outputs (HC243)          | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 2                   | -    | 90  | 115           | 135            | ns    |
|                                                    |                                     |                       | 4.5                 | -    | 18  | 23            | 27             | ns    |
|                                                    |                                     | C <sub>L</sub> = 15pF | 5                   | 7    | -   | -             | -              | ns    |
|                                                    |                                     | CL = 50pF             | 6                   | -    | 15  | 20            | 23             | ns    |
| Output High-Z, to High Level to Low Level          | t <sub>PZL</sub> , t <sub>PZH</sub> | C <sub>L</sub> = 50pF | 2                   | -    | 150 | 190           | 225            | ns    |
|                                                    |                                     | CL = 50pF             | 4.5                 | -    | 30  | 38            | 45             | ns    |
|                                                    |                                     | CL = 15pF             | 5                   | 12   | -   | -             | -              | ns    |
|                                                    |                                     | CL = 50pF             | 6                   | -    | 26  | 33            | 38             | ns    |
| Output High Level, Output Low Level to High-Z      | t <sub>PHZ</sub> , t <sub>PLZ</sub> | C <sub>L</sub> = 50pF | 2                   | -    | 150 | 190           | 225            | ns    |
|                                                    |                                     | CL = 50pF             | 4.5                 | -    | 30  | 38            | 45             | ns    |
|                                                    |                                     | CL = 15pF             | 5                   | 12   | -   | -             | -              | ns    |
|                                                    |                                     | CL = 50pF             | 6                   | -    | 26  | 33            | 38             | ns    |
| Output Transition Times                            | t <sub>TLH</sub> , t <sub>THL</sub> | C <sub>L</sub> = 50pF | 2                   | -    | 60  | 75            | 90             | ns    |
|                                                    |                                     |                       | 4.5                 | -    | 12  | 15            | 18             | ns    |
|                                                    |                                     |                       | 6                   | -    | 10  | 13            | 15             | ns    |
| Input Capacitance                                  | C <sub>I</sub>                      | -                     | -                   | -    | 10  | 10            | 10             | pF    |
| Three-State Output Capacitance                     | C <sub>O</sub>                      | -                     | -                   | -    | 20  | 20            | 20             | pF    |
| Power Dissipation Capacitance (HC243) (Notes 5, 6) | C <sub>PD</sub>                     | -                     | 5                   | 80   | -   | -             | -              | pF    |
| HCT TYPES                                          |                                     |                       |                     |      |     |               |                |       |
| Propagation Delay Data to Outputs (HCT242)         | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 4.5                 | -    | 20  | 25            | 30             | ns    |
|                                                    |                                     | C <sub>L</sub> = 15pF | 5                   | 8    | -   | -             | -              | ns    |
| Propagation Delay Data to Outputs (HCT243)         | t <sub>PLH</sub> , t <sub>PHL</sub> | C <sub>L</sub> = 50pF | 4.5                 | -    | 22  | 28            | 33             | ns    |
|                                                    |                                     | C <sub>L</sub> = 15pF | 5                   | 9    | -   | -             | -              | ns    |
| Output High-Z to High Level to Low Level           | t <sub>PZH</sub> , t <sub>PZL</sub> | C <sub>L</sub> = 50pF | 4.5                 | -    | 34  | 43            | 51             | ns    |
|                                                    |                                     | C <sub>L</sub> = 15pF | 5                   | 14   | -   | -             | -              | ns    |
| Output High Level, Output Low Level to High-Z      | t <sub>PHZ</sub> , t <sub>PLZ</sub> | C <sub>L</sub> = 50pF | 4.5                 | -    | 35  | 44            | 53             | ns    |
|                                                    |                                     | C <sub>L</sub> = 15pF | 5                   | 14   | -   | -             | -              | ns    |
| Output Transition Times                            | t <sub>TLH</sub> , t <sub>THL</sub> | C <sub>L</sub> = 50pF | 4.5                 | -    | 12  | 15            | 18             | ns    |
| Input Capacitance                                  | C <sub>I</sub>                      | -                     | -                   | -    | 10  | 10            | 10             | pF    |
| Three-State Output Capacitance                     | C <sub>O</sub>                      | -                     | -                   | -    | 20  | 20            | 20             | pF    |
| Power Dissipation Capacitance (Notes 5, 6)         | C <sub>PD</sub>                     | HCT242                | 5                   | 90   | -   | -             | -              | pF    |
|                                                    |                                     | HCT243                | 5                   | 91   | -   | -             | -              | pF    |

### **NOTES:**

- $C_{PD}$  is used to determine the dynamic power consumption, per channel.
- $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$  where  $f_i$  = Input Frequency,  $f_O$  = Output Frequency,  $C_L$  = Output Load Capacitance,  $V_{CC}$  = Supply Voltage.

## Test Circuits and Waveforms

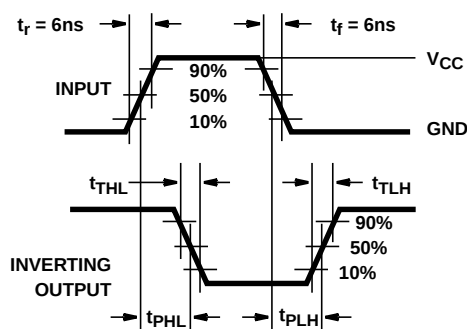


FIGURE 1. HC and HCU TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

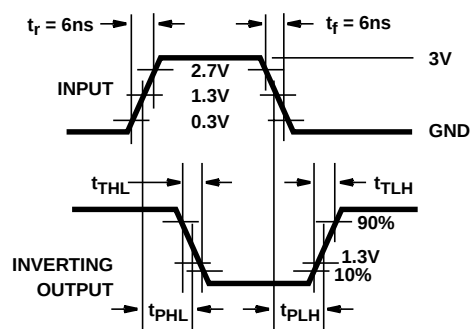


FIGURE 2. HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

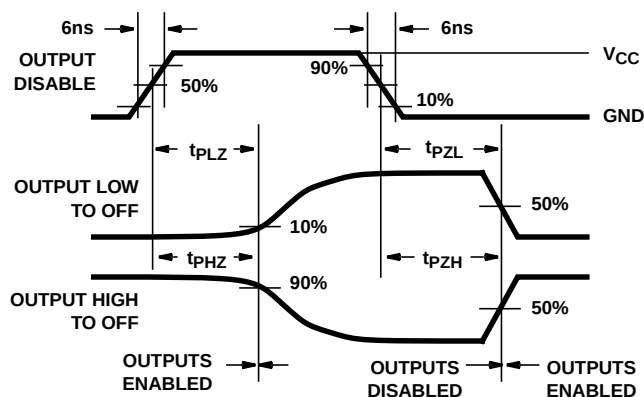


FIGURE 3. HC THREE-STATE PROPAGATION DELAY WAVEFORM

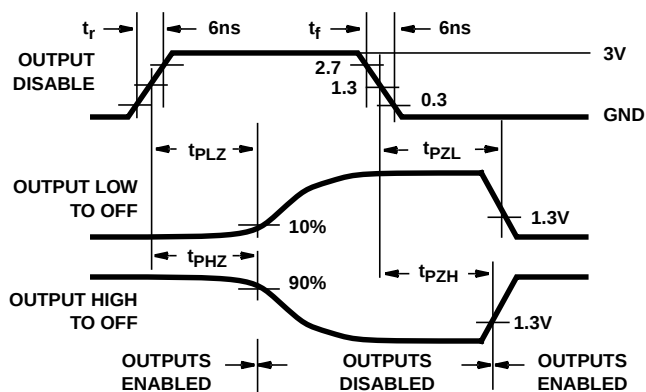
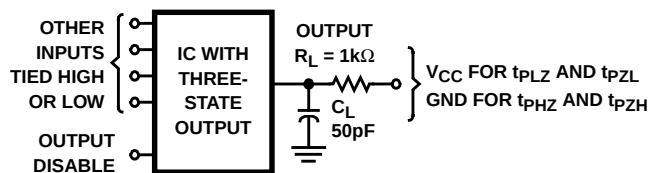


FIGURE 4. HCT THREE-STATE PROPAGATION DELAY WAVEFORM



NOTE: Open drain waveforms  $t_{PLZ}$  and  $t_{PZL}$  are the same as those for three-state shown on the left. The test circuit is Output  $R_L = 1k\Omega$  to  $V_{CC}$ ,  $C_L = 50pF$ .

FIGURE 5. HC AND HCT THREE-STATE PROPAGATION DELAY TEST CIRCUIT

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