

August 1998

# CD74AC251, CD74ACT251

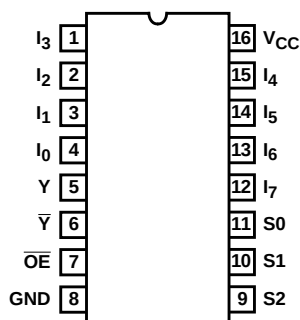
## 8-Input Multiplexer, Three-State

### Features

- Buffered Inputs
- Typical Propagation Delay
  - 6ns at  $V_{CC} = 5V$ ,  $T_A = 25^{\circ}C$ ,  $C_L = 50pF$
- Exceeds 2kV ESD Protection MIL-STD-883, Method 3015
- SCR-Latchup-Resistant CMOS Process and Circuit Design
- Speed of Bipolar FAST™/AS/S with Significantly Reduced Power Consumption
- Balanced Propagation Delays
- AC Types Feature 1.5V to 5.5V Operation and Balanced Noise Immunity at 30% of the Supply
- $\pm 24mA$  Output Drive Current
  - Fanout to 15 FAST™ ICs
  - Drives 50 $\Omega$  Transmission Lines

### Pinout

CD74AC251, CD74ACT251  
(PDIP, SOIC)  
TOP VIEW



### Description

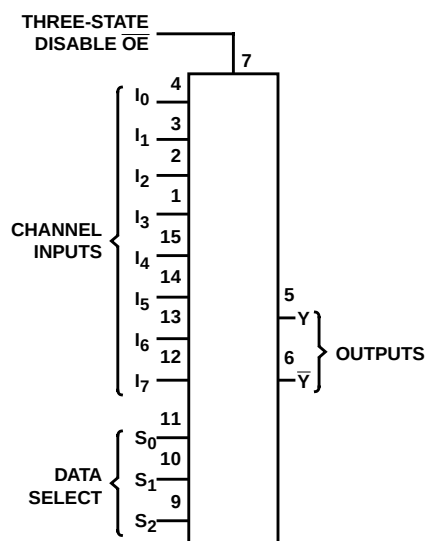
The CD74AC251 and CD74ACT251 8-input multiplexers that utilize the Harris Advanced CMOS Logic technology. This multiplexer features both true (Y) and complement ( $\bar{Y}$ ) outputs as well as an Output Enable (OE) input. The OE must be at a LOW logic level to enable this device. When the  $\bar{OE}$  input is HIGH, both outputs are in the high-impedance state. When enabled, address information on the data select inputs determines which data input is routed to the Y and  $\bar{Y}$  outputs.

### Ordering Information

| PART NUMBER | TEMP. RANGE ( $^{\circ}C$ )                 | PACKAGE    | PKG. NO. |
|-------------|---------------------------------------------|------------|----------|
| CD74AC251E  | 0 to 70 $^{\circ}C$ , -40 to 85, -55 to 125 | 16 Ld PDIP | E16.3    |
| CD74ACT251E | 0 to 70 $^{\circ}C$ , -40 to 85, -55 to 125 | 16 Ld PDIP | E16.3    |
| CD74AC251M  | 0 to 70 $^{\circ}C$ , -40 to 85, -55 to 125 | 16 Ld SOIC | M16.15   |
| CD74ACT251M | 0 to 70 $^{\circ}C$ , -40 to 85, -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 and 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.

**Functional Diagram****TRUTH TABLE**

| INPUTS |    |    | OUTPUTS                       |       |                  |
|--------|----|----|-------------------------------|-------|------------------|
| SELECT |    |    | OUTPUT ENABLE $\overline{OE}$ | Y     | $\overline{Y}$   |
| S2     | S1 | S0 |                               |       |                  |
| X      | X  | X  | H                             | Z     | Z                |
| L      | L  | L  | L                             | $I_0$ | $\overline{I_0}$ |
| L      | L  | H  | L                             | $I_1$ | $\overline{I_1}$ |
| L      | H  | L  | L                             | $I_2$ | $\overline{I_2}$ |
| L      | H  | H  | L                             | $I_3$ | $\overline{I_3}$ |
| H      | L  | L  | L                             | $I_4$ | $\overline{I_4}$ |
| H      | L  | H  | L                             | $I_5$ | $\overline{I_5}$ |
| H      | H  | L  | L                             | $I_6$ | $\overline{I_6}$ |
| H      | H  | H  | L                             | $I_7$ | $\overline{I_7}$ |

H = High logic level, L = Low logic level, Z = High impedance (off),  
 X = Irrelevant,  $I_0, I_1 \dots I_7$  = The level of the respective input

# CD74AC251, CD74ACT251

## Absolute Maximum Ratings

DC Supply Voltage,  $V_{CC}$  ..... -0.5V to 6V  
 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  $V_O > V_{CC} + 0.5V$  .....  $\pm 50mA$   
 DC Output Source or Sink Current per Output Pin,  $I_O$   
     For  $V_O > -0.5V$  or  $V_O < V_{CC} + 0.5V$  .....  $\pm 50mA$   
 DC  $V_{CC}$  or Ground Current,  $I_{CC}$  or  $I_{GND}$  (Note 3) .....  $\pm 100mA$

## Thermal Information

Thermal Resistance (Typical, Note 5)  $\theta_{JA}$  ( $^{\circ}C/W$ )  
     PDIP Package .....  
     SOIC Package .....  
 Maximum Junction Temperature (Plastic Package) .....  $150^{\circ}C$   
 Maximum Storage Temperature Range .....  $-65^{\circ}C$  to  $150^{\circ}C$   
 Maximum Lead Temperature (Soldering 10s) .....  $300^{\circ}C$

## Operating Conditions

Temperature Range,  $T_A$  .....  $-55^{\circ}C$  to  $125^{\circ}C$   
 Supply Voltage Range,  $V_{CC}$  (Note 4)  
     AC Types ..... 1.5V to 5.5V  
     ACT Types ..... 4.5V to 5.5V  
 DC Input or Output Voltage,  $V_I$ ,  $V_O$  ..... 0V to  $V_{CC}$   
 Input Rise and Fall Slew Rate,  $dt/dv$   
     AC Types, 1.5V to 3V ..... 50ns (Max)  
     AC Types, 3.6V to 5.5V ..... 20ns (Max)  
     ACT Types, 4.5V to 5.5V ..... 10ns (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.*

### NOTES:

- For up to 4 outputs per device, add  $\pm 25mA$  for each additional output.
- Unless otherwise specified, all voltages are referenced to ground.
- $\theta_{JA}$  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  | MAX  | MIN           | MAX  | MIN            | MAX  |       |
| AC TYPES                  |                 |                                    |                     |                     |      |      |               |      |                |      |       |
| High Level Input Voltage  | V <sub>IH</sub> | -                                  | -                   | 1.5                 | 1.2  | -    | 1.2           | -    | 1.2            | -    | V     |
|                           |                 |                                    |                     | 3                   | 2.1  | -    | 2.1           | -    | 2.1            | -    | V     |
|                           |                 |                                    |                     | 5.5                 | 3.85 | -    | 3.85          | -    | 3.85           | -    | V     |
| Low Level Input Voltage   | V <sub>IL</sub> | -                                  | -                   | 1.5                 | -    | 0.3  | -             | 0.3  | -              | 0.3  | V     |
|                           |                 |                                    |                     | 3                   | -    | 0.9  | -             | 0.9  | -              | 0.9  | V     |
|                           |                 |                                    |                     | 5.5                 | -    | 1.65 | -             | 1.65 | -              | 1.65 | V     |
| High Level Output Voltage | V <sub>OH</sub> | V <sub>IH</sub> or V <sub>IL</sub> | -0.05               | 1.5                 | 1.4  | -    | 1.4           | -    | 1.4            | -    | V     |
|                           |                 |                                    | -0.05               | 3                   | 2.9  | -    | 2.9           | -    | 2.9            | -    | V     |
|                           |                 |                                    | -0.05               | 4.5                 | 4.4  | -    | 4.4           | -    | 4.4            | -    | V     |
|                           |                 |                                    | -4                  | 3                   | 2.58 | -    | 2.48          | -    | 2.4            | -    | V     |
|                           |                 |                                    | -24                 | 4.5                 | 3.94 | -    | 3.8           | -    | 3.7            | -    | V     |
|                           |                 |                                    | -75<br>(Note 6, 7)  | 5.5                 | -    | -    | 3.85          | -    | -              | -    | V     |
|                           |                 |                                    | -50<br>(Note 6, 7)  | 5.5                 | -    | -    | -             | -    | 3.85           | -    | V     |

# CD74AC251, CD74ACT251

## 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  | MAX  | MIN           | MAX  | MIN            | MAX  |       |
| Low Level Output Voltage                                            | V <sub>OL</sub>  | V <sub>IH</sub> or V <sub>IL</sub>                                            | 0.05                | 1.5                 | -    | 0.1  | -             | 0.1  | -              | 0.1  | V     |
|                                                                     |                  |                                                                               | 0.05                | 3                   | -    | 0.1  | -             | 0.1  | -              | 0.1  | V     |
|                                                                     |                  |                                                                               | 0.05                | 4.5                 | -    | 0.1  | -             | 0.1  | -              | 0.1  | V     |
|                                                                     |                  |                                                                               | 12                  | 3                   | -    | 0.36 | -             | 0.44 | -              | 0.5  | V     |
|                                                                     |                  |                                                                               | 24                  | 4.5                 | -    | 0.36 | -             | 0.44 | -              | 0.5  | V     |
|                                                                     |                  |                                                                               | 75<br>(Note 6, 7)   | 5.5                 | -    | -    | -             | 1.65 | -              | -    | V     |
|                                                                     |                  |                                                                               | 50<br>(Note 6, 7)   | 5.5                 | -    | -    | -             | -    | -              | 1.65 | V     |
| Input Leakage Current                                               | I <sub>I</sub>   | V <sub>CC</sub> or GND                                                        | -                   | 5.5                 | -    | ±0.1 | -             | ±1   | -              | ±1   | μA    |
| Three-State Leakage Current                                         | I <sub>OZ</sub>  | V <sub>IH</sub> or V <sub>IL</sub><br>V <sub>O</sub> = V <sub>CC</sub> or GND | -                   | 5.5                 | -    | ±0.5 | -             | ±5   | -              | ±10  | μA    |
| Quiescent Supply Current MSI                                        | I <sub>CC</sub>  | V <sub>CC</sub> or GND                                                        | 0                   | 5.5                 | -    | 8    | -             | 80   | -              | 160  | μA    |
| <b>ACT 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                                           | V <sub>OH</sub>  | V <sub>IH</sub> or V <sub>IL</sub>                                            | -0.05               | 4.5                 | 4.4  | -    | 4.4           | -    | 4.4            | -    | V     |
|                                                                     |                  |                                                                               | -24                 | 4.5                 | 3.94 | -    | 3.8           | -    | 3.7            | -    | V     |
|                                                                     |                  |                                                                               | -75<br>(Note 6, 7)  | 5.5                 | -    | -    | 3.85          | -    | -              | -    | V     |
|                                                                     |                  |                                                                               | -50<br>(Note 6, 7)  | 5.5                 | -    | -    | -             | -    | 3.85           | -    | V     |
| Low Level Output Voltage                                            | V <sub>OL</sub>  | V <sub>IH</sub> or V <sub>IL</sub>                                            | 0.05                | 4.5                 | -    | 0.1  | -             | 0.1  | -              | 0.1  | V     |
|                                                                     |                  |                                                                               | 24                  | 4.5                 | -    | 0.36 | -             | 0.44 | -              | 0.5  | V     |
|                                                                     |                  |                                                                               | 75<br>(Note 6, 7)   | 5.5                 | -    | -    | -             | 1.65 | -              | -    | V     |
|                                                                     |                  |                                                                               | 50<br>(Note 6, 7)   | 5.5                 | -    | -    | -             | -    | -              | 1.65 | V     |
| Input Leakage Current                                               | I <sub>I</sub>   | V <sub>CC</sub> or GND                                                        | -                   | 5.5                 | -    | ±0.1 | -             | ±1   | -              | ±1   | μA    |
| Three-State or Leakage Current                                      | I <sub>OZ</sub>  | V <sub>IH</sub> or V <sub>IL</sub><br>V <sub>O</sub> = V <sub>CC</sub> or GND | -                   | 5.5                 | -    | ±0.5 | -             | ±5   | -              | ±10  | μA    |
| Quiescent Supply Current MSI                                        | I <sub>CC</sub>  | V <sub>CC</sub> or GND                                                        | 0                   | 5.5                 | -    | 8    | -             | 80   | -              | 160  | μA    |
| Additional Supply Current per Input Pin TTL Inputs High 1 Unit Load | ΔI <sub>CC</sub> | V <sub>CC</sub> -2.1                                                          | -                   | 4.5 to 5.5          | -    | 2.4  | -             | 2.8  | -              | 3    | mA    |

### NOTES:

- Test one output at a time for a 1-second maximum duration. Measurement is made by forcing current and measuring voltage to minimize power dissipation.
- Test verifies a minimum 50Ω transmission-line-drive capability at 85°C, 75Ω at 125°C.

# CD74AC251, CD74ACT251

## ACT Input Load Table

| INPUT                           | UNIT LOAD |
|---------------------------------|-----------|
| S0, S1, S3                      | 1         |
| OE                              | 1         |
| I <sub>0</sub> - I <sub>7</sub> | 1         |

NOTE: Unit load is  $\Delta I_{CC}$  limit specified in DC Electrical Specifications Table, e.g., 2.4mA max at 25°C.

## Switching Specifications Input $t_r$ , $t_f$ = 3ns, $C_L$ = 50pF (Worst Case)

| PARAMETER                                                           | SYMBOL                                                                       | V <sub>CC</sub> (V) | -40°C TO 85°C |     |      | -55°C TO 125°C |     |      | UNITS |
|---------------------------------------------------------------------|------------------------------------------------------------------------------|---------------------|---------------|-----|------|----------------|-----|------|-------|
|                                                                     |                                                                              |                     | MIN           | TYP | MAX  | MIN            | TYP | MAX  |       |
| AC TYPES                                                            |                                                                              |                     |               |     |      |                |     |      |       |
| Propagation Delay,<br>Data to Y Output                              | t <sub>PLH</sub> , t <sub>PHL</sub>                                          | 1.5                 | -             | -   | 153  | -              | -   | 169  | ns    |
|                                                                     |                                                                              | 3.3<br>(Note 9)     | 4.9           | -   | 17.2 | 4.7            | -   | 18.9 | ns    |
|                                                                     |                                                                              | 5<br>(Note 10)      | 3.5           | -   | 12.3 | 3.4            | -   | 13.5 | ns    |
| Propagation Delay,<br>Data to $\bar{Y}$ Output                      | t <sub>PLH</sub> , t <sub>PHL</sub>                                          | 1.5                 | -             | -   | 169  | -              | -   | 186  | ns    |
|                                                                     |                                                                              | 3.3                 | 5.4           | -   | 19   | 5.2            | -   | 20.9 | ns    |
|                                                                     |                                                                              | 5                   | 3.8           | -   | 13.5 | 3.7            | -   | 14.9 | ns    |
| Propagation Delay,<br>Select to Y Output                            | t <sub>PLH</sub> , t <sub>PHL</sub>                                          | 1.5                 | -             | -   | 207  | -              | -   | 228  | ns    |
|                                                                     |                                                                              | 3.3                 | 6.6           | -   | 23.2 | 6.4            | -   | 25.5 | ns    |
|                                                                     |                                                                              | 5                   | 4.7           | -   | 16.5 | 4.6            | -   | 18.2 | ns    |
| Propagation Delay,<br>Select to $\bar{Y}$ Output                    | t <sub>PLH</sub> , t <sub>PHL</sub>                                          | 1.5                 | -             | -   | 223  | -              | -   | 245  | ns    |
|                                                                     |                                                                              | 3.3                 | 7.1           | -   | 24.9 | 6.9            | -   | 27.4 | ns    |
|                                                                     |                                                                              | 5                   | 5.1           | -   | 17.8 | 4.9            | -   | 19.6 | ns    |
| Propagation Delay,<br>Output Enable and Output<br>Disable to Output | t <sub>PZH</sub> , t <sub>PZL</sub> ,<br>t <sub>PHZ</sub> , t <sub>PLZ</sub> | 1.5                 | -             | -   | 155  | -              | -   | 169  | ns    |
|                                                                     |                                                                              | 3.3                 | 5.2           | -   | 18.7 | 5.1            | -   | 20.3 | ns    |
|                                                                     |                                                                              | 5                   | 3.5           | -   | 12.3 | 3.4            | -   | 13.5 | ns    |
| Three-State Output<br>Capacitance                                   | C <sub>O</sub>                                                               | -                   | -             | -   | 15   | -              | -   | 15   | pF    |
| Input Capacitance                                                   | C <sub>I</sub>                                                               | -                   | -             | -   | 10   | -              | -   | 10   | pF    |
| Power Dissipation Capacitance                                       | C <sub>PD</sub><br>(Note 11)                                                 | -                   | -             | 120 | -    | -              | 120 | -    | pF    |
| ACT TYPES                                                           |                                                                              |                     |               |     |      |                |     |      |       |
| Propagation Delay,<br>Data to Y Output                              | t <sub>PLH</sub> , t <sub>PHL</sub>                                          | 5<br>(Note 10)      | 3.5           | -   | 12.3 | 3.4            | -   | 13.5 | ns    |
| Propagation Delay,<br>Data to $\bar{Y}$ Output                      | t <sub>PLH</sub> , t <sub>PHL</sub>                                          | 5                   | 3.8           | -   | 13.5 | 3.7            | -   | 14.9 | ns    |
| Propagation Delay,<br>Select to Y Output                            | t <sub>PLH</sub> , t <sub>PHL</sub>                                          | 5                   | 4.7           | -   | 16.5 | 4.6            | -   | 18.2 | ns    |
| Propagation Delay,<br>Select to $\bar{Y}$ Output                    | t <sub>PLH</sub> , t <sub>PHL</sub>                                          | 5                   | 5.1           | -   | 17.8 | 4.9            | -   | 19.6 | ns    |
| Propagation Delay,<br>Output Enable and Output<br>Disable to Output | t <sub>PZH</sub> , t <sub>PZL</sub> ,<br>t <sub>PHZ</sub> , t <sub>PLZ</sub> | 5                   | 3.5           | -   | 12.3 | 3.4            | -   | 13.5 | ns    |

# CD74AC251, CD74ACT251

## Switching Specifications Input $t_r$ , $t_f = 3\text{ns}$ , $C_L = 50\text{pF}$ (Worst Case) (Continued)

| PARAMETER                      | SYMBOL                | $V_{CC}$ (V) | -40°C TO 85°C |     |     | -55°C TO 125°C |     |     | UNITS |
|--------------------------------|-----------------------|--------------|---------------|-----|-----|----------------|-----|-----|-------|
|                                |                       |              | MIN           | TYP | MAX | MIN            | TYP | MAX |       |
| Three-State Output Capacitance | $C_O$                 |              |               |     |     |                |     |     |       |
| Input Capacitance              | $C_I$                 | -            | -             | -   | 10  | -              | -   | 10  | pF    |
| Power Dissipation Capacitance  | $C_{PD}$<br>(Note 11) | -            | -             | 45  | -   | -              | 45  | -   | pF    |

### NOTES:

8. Limits tested 100%.
9. 3.3V Min is at 3.6V, Max is at 3V.
10. 5V Min is at 5.5V, Max is at 4.5V.
11.  $C_{PD}$  is used to determine the dynamic power consumption per device.  
 $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$  where  $f_i$  = input frequency,  $C_L$  = output load capacitance,  $V_{CC}$  = supply voltage.

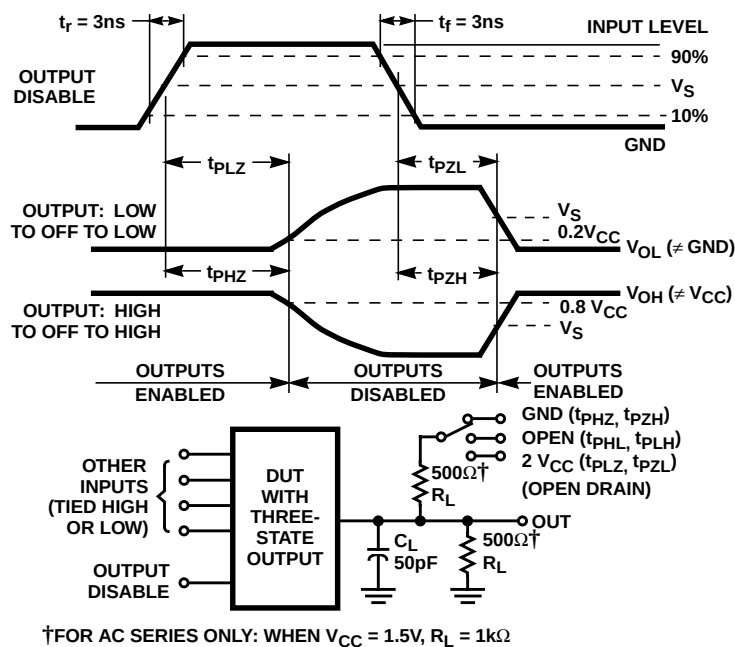


FIGURE 1. THREE-STATE PROPAGATION DELAY WAVEFORMS AND TEST CIRCUIT

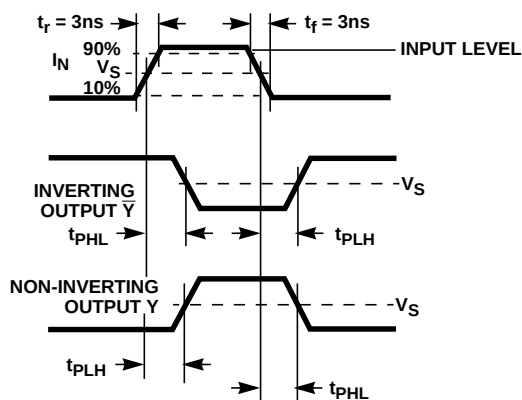
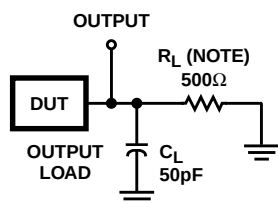


FIGURE 2. PROPAGATION DELAY TIMES



NOTE: For AC Series Only: When  $V_{CC} = 1.5V$ ,  $R_L = 1k\Omega$ .

|                                 | CD74AC       | CD74ACT      |
|---------------------------------|--------------|--------------|
| Input Level                     | $V_{CC}$     | 3V           |
| Input Switching Voltage, $V_S$  | $0.5 V_{CC}$ | 1.5V         |
| Output Switching Voltage, $V_S$ | $0.5 V_{CC}$ | $0.5 V_{CC}$ |

FIGURE 3. PROPAGATION DELAY TIMES

## **IMPORTANT NOTICE**

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.