# CD54/74AC153, CD54/74ACT153

Data sheet acquired from Harris Semiconductor
SCHS237A

September 1998 - Revised May 2000

## Dual 4-Input Multiplexer

### Features

- **Buffered Inputs**
- **Typical Propagation Delay**
  - **6.3ns at $V_{CC}$ = 5V, $T_A$ = 25°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**
- **±24mA Output Drive Current**
  - **Fanout to 15 FAST™ ICs**
  - **Drives 50Ω Transmission Lines**

### Description

The ’AC153 and ’ACT153 are dual 4-input multiplexers that utilize Advanced CMOS Logic technology. One of the four sources for each section is selected by the common Select inputs, S0 and S1. When the Enable inputs ($\overline{1E}$, $\overline{2E}$) are HIGH, the outputs are in the low state.

### Ordering Information

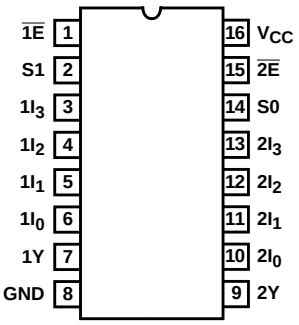
| PART NUMBER | TEMP. RANGE (°C) | PACKAGE |
|---|---|---|
| CD54AC153F3A | -55 to 125 | 16 Ld CERDIP |
| CD74AC153E | 0 to 70°C, -40 to 85, -55 to 125 | 16 Ld PDIP |
| CD74AC153M96 | 0 to 70°C, -40 to 85, -55 to 125 | 16 Ld SOIC |
| CD54ACT153F3A | -55 to 125 | 16 Ld CERDIP |
| CD74ACT153E | 0 to 70°C, -40 to 85, -55 to 125 | 16 Ld PDIP |
| CD74ACT153M | 0 to 70°C, -40 to 85, -55 to 125 | 16 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 and die for this part number is available which meets all electrical specifications. Please contact your local TI sales office or customer service for ordering information.

### Pinout

**CD54AC153, CD54ACT153**
**(CERDIP)**
**CD74AC153, CD74ACT153**
**(PDIP, SOIC)**
**TOP VIEW**




CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper IC Handling Procedures.

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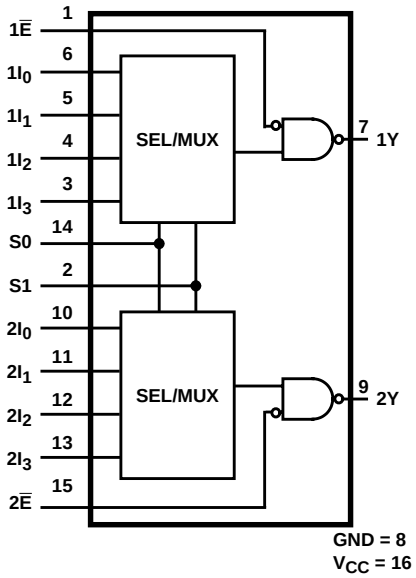
## Functional Diagram




**TRUTH TABLE**

| SELECT INPUTS | | DATA INPUTS | | | | ENABLE INPUTS | OUTPUT |
|---|---|---|---|---|---|---|---|
| S1 | S0 | $nI_0$ | $nI_1$ | $nI_2$ | $nI_3$ | $\overline{nE}$ | nY |
| X | X | X | X | X | X | H | L |
| L | L | L | X | X | X | L | L |
| L | L | H | X | X | X | L | H |
| L | H | X | L | X | X | L | L |
| L | H | X | H | X | X | L | H |
| H | L | X | X | L | X | L | L |
| H | L | X | X | H | X | L | H |
| H | H | X | X | X | L | L | L |
| H | H | X | X | X | H | L | H |

Select inputs S1 and S0 are common to both sections. H = High Level, L = Low Level, X = Don't Care, Z = High Impedance.

## 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 . . . . . ±20mA
DC Output Diode Current, $I_{OK}$
For $V_O$ < -0.5V or $V_O$ > $V_{CC}$ + 0.5V . . . . . ±50mA
DC Output Source or Sink Current per Output Pin, $I_O$
For $V_O$ > -0.5V or $V_O$ < $V_{CC}$ + 0.5V . . . . . ±50mA
DC $V_{CC}$ or Ground Current, $I_{CC}$ or $I_{GND}$ (Note 3) . . . . . ±100mA

## Operating Conditions

Temperature Range, $T_A$ . . . . . -55°C to 125°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)

## Thermal Information

Thermal Resistance (Typical, Note 5) $\theta_{JA}$ (°C/W)
PDIP Package . . . . . 90
SOIC Package . . . . . 160
Maximum Junction Temperature (Plastic Package) . . . . . 150°C
Maximum Storage Temperature Range . . . . . -65°C to 150°C
Maximum Lead Temperature (Soldering 10s) . . . . . 300°C

*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:

3. For up to 4 outputs per device, add ±25mA for each additional output.
4. Unless otherwise specified, all voltages are referenced to ground.
5. $\theta_{JA}$ is measured with the component mounted on an evaluation PC board in free air.

## DC Electrical Specifications

| PARAMETER | SYMBOL | TEST CONDITIONS | | $V_{CC}$ (V) | 25°C | | -40°C TO 85°C | | -55°C TO 125°C | | UNITS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_I$ (V) | $I_O$ (mA) | | MIN | MAX | MIN | MAX | MIN | MAX | |
| **AC TYPES** | | | | | | | | | | | |
| High Level Input Voltage | $V_{IH}$ | - | - | 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 | $V_{IL}$ | - | - | 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 | $V_{OH}$ | $V_{IH}$ or $V_{IL}$ | -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 (Note 6, 7) | 5.5 | - | - | 3.85 | - | - | - | V |
| | | | -50 (Note 6, 7) | 5.5 | - | - | - | - | 3.85 | - | V |

## DC Electrical Specifications (Continued)

| PARAMETER | SYMBOL | TEST CONDITIONS | | $V_{CC}$ (V) | 25°C | | -40°C TO 85°C | | -55°C TO 125°C | | UNITS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_I$ (V) | $I_O$ (mA) | | MIN | MAX | MIN | MAX | MIN | MAX | |
| Low Level Output Voltage | $V_{OL}$ | $V_{IH}$ or $V_{IL}$ | 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 (Note 6, 7) | 5.5 | - | - | - | 1.65 | - | - | V |
| | | | 50 (Note 6, 7) | 5.5 | - | - | - | - | - | 1.65 | V |
| Input Leakage Current | $I_I$ | $V_{CC}$ or GND | - | 5.5 | - | ±0.1 | - | ±1 | - | ±1 | µA |
| Quiescent Supply Current MSI | $I_{CC}$ | $V_{CC}$ or GND | 0 | 5.5 | - | 8 | - | 80 | - | 160 | µA |
| **ACT TYPES** | | | | | | | | | | | |
| High Level Input Voltage | $V_{IH}$ | - | - | 4.5 to 5.5 | 2 | - | 2 | - | 2 | - | V |
| Low Level Input Voltage | $V_{IL}$ | - | - | 4.5 to 5.5 | - | 0.8 | - | 0.8 | - | 0.8 | V |
| High Level Output Voltage | $V_{OH}$ | $V_{IH}$ or $V_{IL}$ | -0.05 | 4.5 | 4.4 | - | 4.4 | - | 4.4 | - | V |
| | | | -24 | 4.5 | 3.94 | - | 3.8 | - | 3.7 | - | V |
| | | | -75 (Note 6, 7) | 5.5 | - | - | 3.85 | - | - | - | V |
| | | | -50 (Note 6, 7) | 5.5 | - | - | - | - | 3.85 | - | V |
| Low Level Output Voltage | $V_{OL}$ | $V_{IH}$ or $V_{IL}$ | 0.05 | 4.5 | - | 0.1 | - | 0.1 | - | 0.1 | V |
| | | | 24 | 4.5 | - | 0.36 | - | 0.44 | - | 0.5 | V |
| | | | 75 (Note 6, 7) | 5.5 | - | - | - | 1.65 | - | - | V |
| | | | 50 (Note 6, 7) | 5.5 | - | - | - | - | - | 1.65 | V |
| Input Leakage Current | $I_I$ | $V_{CC}$ or GND | - | 5.5 | - | ±0.1 | - | ±1 | - | ±1 | µA |
| Quiescent Supply Current MSI | $I_{CC}$ | $V_{CC}$ or GND | 0 | 5.5 | - | 8 | - | 80 | - | 160 | µA |
| Additional Supply Current per Input Pin TTL Inputs High 1 Unit Load | $\Delta I_{CC}$ | $V_{CC}$ -2.1 | - | 4.5 to 5.5 | - | 2.4 | - | 2.8 | - | 3 | mA |

NOTES:

6. 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.
7. Test verifies a minimum 50Ω transmission-line-drive capability at 85°C, 75Ω at 125°C.

## ACT Input Load Table

| INPUT | UNIT LOAD |
|---|---|
| S0, S1, nI0, nI1 | 1 |
| $\overline{nE}$ | 0.47 |

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 | $V_{CC}$ (V) | -40°C TO 85°C | | | -55°C TO 125°C | | | UNITS |
|---|---|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| **AC TYPES** | | | | | | | | | |
| Propagation Delay, S0, S1, to Y | $t_{PLH}$, $t_{PHL}$ | 1.5 | - | - | 227 | - | - | 250 | ns |
| | | 3.3 (Note 9) | 7.2 | - | 25.5 | 7 | - | 28 | ns |
| | | 5 (Note 10) | 5.2 | - | 18.2 | 5 | - | 20 | ns |
| Propagation Delay, nI to Y | $t_{PLH}$, $t_{PHL}$ | 1.5 | - | - | 151 | - | - | 166 | ns |
| | | 3.3 | 4.8 | - | 16.9 | 4.7 | - | 18.6 | ns |
| | | 5 | 3.4 | - | 12.1 | 3.3 | - | 13.3 | ns |
| Propagation Delay, $\overline{nE}$ to Y | $t_{PLH}$, $t_{PHL}$ | 1.5 | - | - | 134 | - | - | 148 | ns |
| | | 3.3 | 4.3 | - | 15 | 4.1 | - | 16.5 | ns |
| | | 5 | 3.1 | - | 10.7 | 3 | - | 11.8 | ns |
| Input Capacitance | $C_I$ | - | - | - | 10 | - | - | 10 | pF |
| Power Dissipation Capacitance | $C_{PD}$ (Note 11) | - | - | 93 | - | - | 93 | - | pF |
| **ACT TYPES** | | | | | | | | | |
| Propagation Delay, S0, S1, to Y | $t_{PLH}$, $t_{PHL}$ | 5 (Note 10) | 5.7 | - | 20 | 5.5 | - | 22 | ns |
| Propagation Delay, nI to Y | $t_{PLH}$, $t_{PHL}$ | 5 | 4.6 | - | 16.4 | 4.5 | - | 18 | ns |
| Propagation Delay, $\overline{nE}$ to Y | $t_{PLH}$, $t_{PHL}$ | 5 | 3.2 | - | 11.5 | 3.2 | - | 12.6 | ns |
| Input Capacitance | $C_I$ | - | - | - | 10 | - | - | 10 | pF |
| Power Dissipation Capacitance | $C_{PD}$ (Note 11) | - | - | 93 | - | - | 93 | - | pF |

NOTES:

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

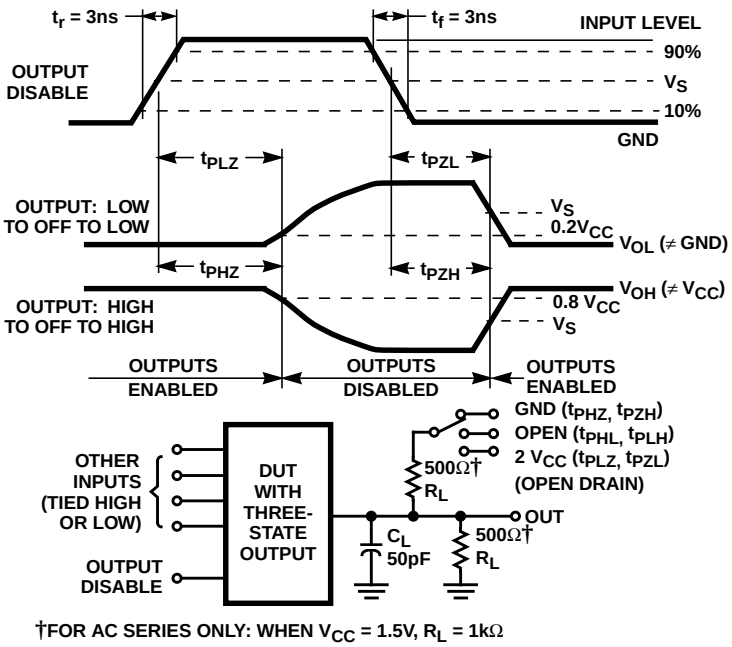



**FIGURE 1. THREE-STATE PROPAGATION DELAY WAVEFORMS AND TEST CIRCUIT**

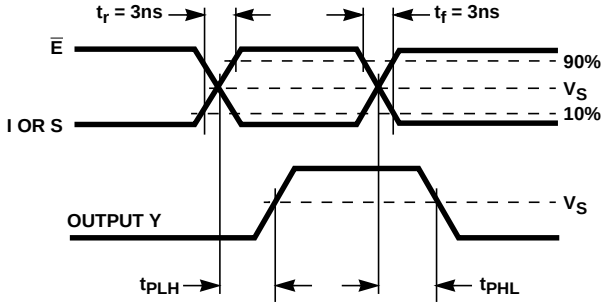
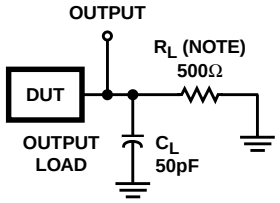



**FIGURE 2. PROPAGATION DELAY TIMES AND TEST CIRCUIT**




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

| | AC | ACT |
|---|---|---|
| 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**

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