

September 1998 - Revised May 2002

## Dual 4-Input Multiplexer

### Features

- **Buffered Inputs**
- **Typical Propagation Delay**
  - 6.3ns 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**
- **±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 (1E, 2E) are HIGH, the outputs are in the low state.

### Ordering Information

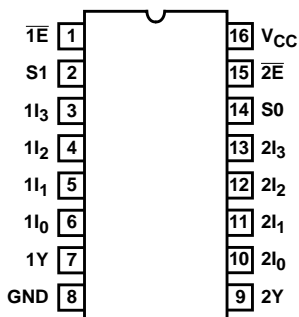
PART NUMBER	TEMP. RANGE (°C)	PACKAGE
CD54AC153F3A	-55 to 125	16 Ld Cerdip
CD74AC153E	0 to 70°C, -40 to 85	16 Ld PDIP
CD74AC153M96	0 to 70°C, -40 to 85	16 Ld SOIC
CD54ACT153F3A	-55 to 125	16 Ld Cerdip
CD74ACT153E	0 to 70°C, -40 to 85	16 Ld PDIP
CD74ACT153M	0 to 70°C, -40 to 85	16 Ld SOIC

#### 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.

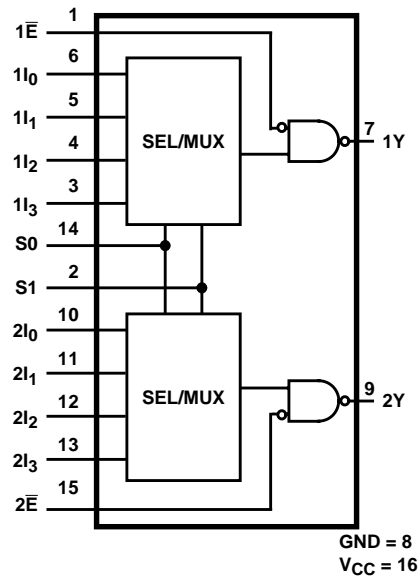
### Pinout

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



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

# Functional Diagram



TRUTH TABLE

SELECT INPUTS		DATA INPUTS				ENABLE INPUTS	OUTPUT
S1	S0	nI <sub>0</sub>	nI <sub>1</sub>	nI <sub>2</sub>	nI <sub>3</sub>	$\overline{nE}$	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.

# CD54/74AC153, CD54/74ACT153

## 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	90
SOIC Package	160
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, $T_A$ :	
CD54	-55 $^{\circ}C$ to 125 $^{\circ}C$
CD74	0 $^{\circ}C$ to 70 $^{\circ}C$ and -40 $^{\circ}C$ to 85 $^{\circ}C$
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 (Note 6, 7)	5.5	-	-	3.85	-	-	-	V
			-50 (Note 6, 7)	5.5	-	-	-	-	3.85	-	V

# **CD54/74AC153, CD54/74ACT153**

## **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 (Note 6, 7)	5.5	-	-	-	1.65	-	-	V
			50 (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
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 (Note 6, 7)	5.5	-	-	3.85	-	-	-	V
			-50 (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 (Note 6, 7)	5.5	-	-	-	1.65	-	-	V
			50 (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
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.

### **ACT Input Load Table**

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

NOTE: Unit load is ΔI<sub>CC</sub> limit specified in DC Electrical Specifications Table, e.g., 2.4mA max at 25°C.

# **CD54/74AC153, CD54/74ACT153**

## **Switching Specifications** Input $t_r, t_f = 3\text{ns}$ , $C_L = 50\text{pF}$ (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, S0, S1, to Y	t <sub>PLH</sub> , t <sub>PHL</sub>	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 <sub>PLH</sub> , t <sub>PHL</sub>	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 <sub>PLH</sub> , t <sub>PHL</sub>	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 <sub>I</sub>	-	-	-	10	-	-	10	pF
Power Dissipation Capacitance	C <sub>PD</sub> (Note 11)	-	-	93	-	-	93	-	pF
ACT TYPES									
Propagation Delay, S0, S1, to Y	t <sub>PLH</sub> , t <sub>PHL</sub>	5 (Note 10)	5.7	-	20	5.5	-	22	ns
Propagation Delay, nI to Y	t <sub>PLH</sub> , t <sub>PHL</sub>	5	4.6	-	16.4	4.5	-	18	ns
Propagation Delay, $\overline{nE}$ to Y	t <sub>PLH</sub> , t <sub>PHL</sub>	5	3.2	-	11.5	3.2	-	12.6	ns
Input Capacitance	C <sub>I</sub>	-	-	-	10	-	-	10	pF
Power Dissipation Capacitance	C <sub>PD</sub> (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.

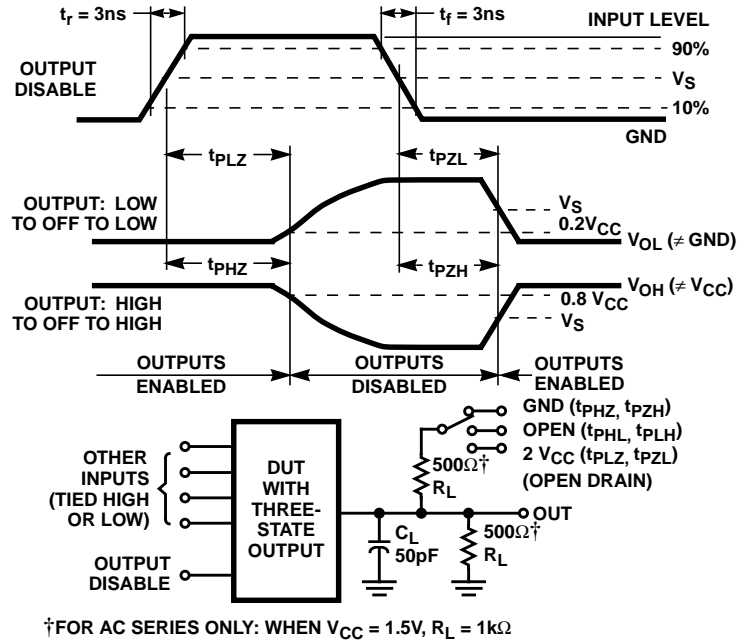


FIGURE 1. THREE-STATE PROPAGATION DELAY WAVEFORMS AND TEST CIRCUIT

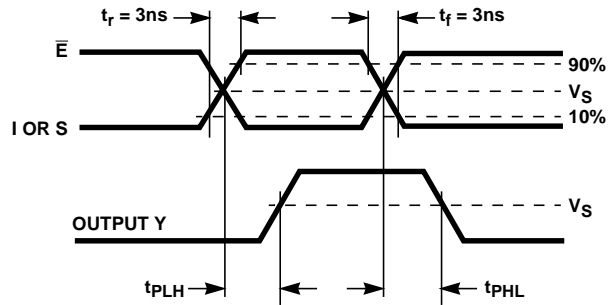
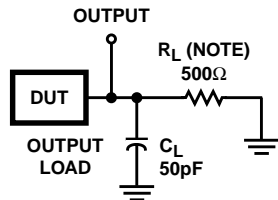


FIGURE 2. PROPAGATION DELAY TIMES AND TEST CIRCUIT



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

	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

## **IMPORTANT NOTICE**

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Mailing Address:

Texas Instruments  
Post Office Box 655303  
Dallas, Texas 75265