

August 1998

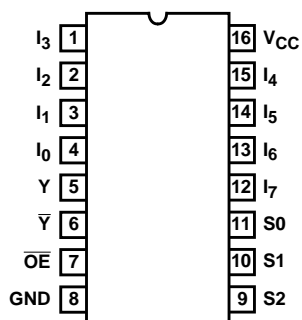
## 8-Input Multiplexer, Three-State

### 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 ( $\bar{OE}$ ) input. The  $\bar{OE}$  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.

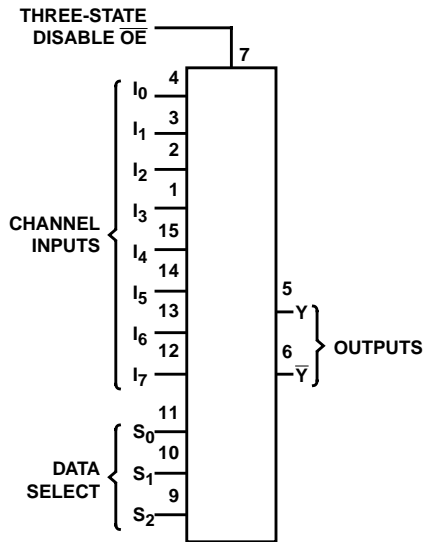
### Ordering Information

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 <sub>0</sub>	$\overline{I_0}$
L	L	H	L	I <sub>1</sub>	$\overline{I_1}$
L	H	L	L	I <sub>2</sub>	$\overline{I_2}$
L	H	H	L	I <sub>3</sub>	$\overline{I_3}$
H	L	L	L	I <sub>4</sub>	$\overline{I_4}$
H	L	H	L	I <sub>5</sub>	$\overline{I_5}$
H	H	L	L	I <sub>6</sub>	$\overline{I_6}$
H	H	H	L	I <sub>7</sub>	$\overline{I_7}$

H = High logic level, L = Low logic level, Z = High impedance (off),  
 X = Irrelevant, I<sub>0</sub>, I<sub>1</sub>...I<sub>7</sub> = 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)	$\theta_{JA}$ (°C/W)
PDIP Package .....	—
SOIC Package .....	—
Maximum Junction Temperature (Plastic Package) .....	150°C
Maximum Storage Temperature Range .....	-65°C to 150°C
Maximum Lead Temperature (Soldering 10s) .....	300°C

## 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)

*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  $\pm 25mA$  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		
<b>AC TYPES</b>												
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	-0.05	1.5	1.4	-	1.4	-	1.4	-	V
			-0.05	-0.05	3	2.9	-	2.9	-	2.9	-	V
			-0.05	-0.05	4.5	4.4	-	4.4	-	4.4	-	V
			-4	-4	3	2.58	-	2.48	-	2.4	-	V
			-24	-24	4.5	3.94	-	3.8	-	3.7	-	V
			-75 (Note 6, 7)	-75	5.5	-	-	3.85	-	-	-	V
			-50 (Note 6, 7)	-50	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 (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
Three-State Leakage Current	I <sub>OZ</sub>	V <sub>IH</sub> or V <sub>IL</sub> 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 (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
Three-State or Leakage Current	I <sub>OZ</sub>	V <sub>IH</sub> or V <sub>IL</sub> 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:**

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.

## 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	
<b>AC TYPES</b>									
Propagation Delay, Data to Y Output	t <sub>PLH</sub> , t <sub>PHL</sub>	1.5	-	-	153	-	-	169	ns
		3.3 (Note 9)	4.9	-	17.2	4.7	-	18.9	ns
		5 (Note 10)	3.5	-	12.3	3.4	-	13.5	ns
Propagation Delay, 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, 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, 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, Output Enable and Output Disable to Output	t <sub>PZH</sub> , t <sub>PZL</sub> , 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 Capacitance	C <sub>O</sub>	-	-	-	15	-	-	15	pF
Input Capacitance	C <sub>I</sub>	-	-	-	10	-	-	10	pF
Power Dissipation Capacitance	C <sub>PD</sub> (Note 11)	-	-	120	-	-	120	-	pF
<b>ACT TYPES</b>									
Propagation Delay, Data to Y Output	t <sub>PLH</sub> , t <sub>PHL</sub>	5 (Note 10)	3.5	-	12.3	3.4	-	13.5	ns
Propagation Delay, 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, Select to Y Output	t <sub>PLH</sub> , t <sub>PHL</sub>	5	4.7	-	16.5	4.6	-	18.2	ns
Propagation Delay, 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, Output Enable and Output Disable to Output	t <sub>PZH</sub> , t <sub>PZL</sub> , t <sub>PHZ</sub> , t <sub>PLZ</sub>	5	3.5	-	12.3	3.4	-	13.5	ns

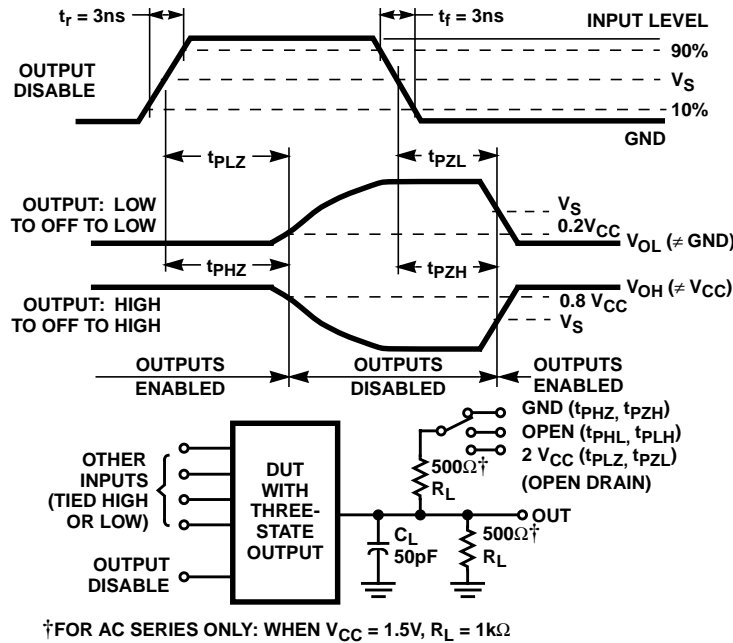
# CD74AC251, CD74ACT251

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

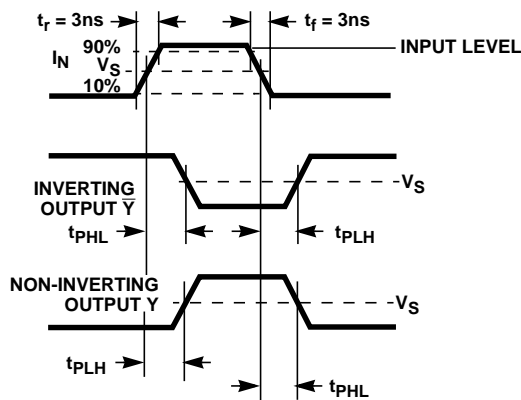
PARAMETER	SYMBOL	$V_{CC}$ (V)	-40°C TO 85°C			-55°C TO 125°C			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
Three-State Output Capacitance	$C_O$								
Input Capacitance	$C_I$	-	-	-	10	-	-	10	pF
Power Dissipation Capacitance	$C_{PD}$ (Note 11)	-	-	45	-	-	45	-	pF

**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.

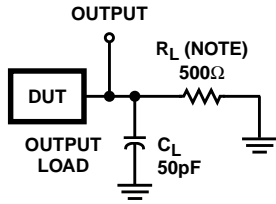


**FIGURE 1. THREE-STATE PROPAGATION DELAY WAVEFORMS AND TEST CIRCUIT**



**FIGURE 2. PROPAGATION DELAY TIMES**

**CD74AC251, CD74ACT251**



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**

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
CD74AC251M	ACTIVE	SOIC	D	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	AC251M	<a href="#">Samples</a>
CD74AC251M96	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	AC251M	<a href="#">Samples</a>
CD74AC251M96E4	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	AC251M	<a href="#">Samples</a>
CD74AC251MG4	ACTIVE	SOIC	D	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	AC251M	<a href="#">Samples</a>

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSELETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
CD74AC251M96	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD74AC251M96	SOIC	D	16	2500	340.5	336.1	32.0

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AC.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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