

August 1998 - Revised May 2000

## Dual 4-Input Multiplexer, Three-State

### 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
- $\pm 24mA$  Output Drive Current
  - Fanout to 15 FAST™ ICs
  - Drives 50 $\Omega$  Transmission Lines

### Description

The CD74AC253 and 'ACT253 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 Output Enable (1OE or 2OE) is HIGH, the output is in the high-impedance state.

### Ordering Information

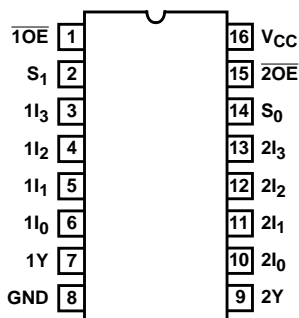
PART NUMBER	TEMP. RANGE (°C)	PACKAGE
CD74AC253E	0 to 70°C, -40 to 85, -55 to 125	16 Ld PDIP
CD74AC253M	0 to 70°C, -40 to 85, -55 to 125	16 Ld SOIC
CD54ACT253F3A	-55 to 125	16 Ld Cerdip
CD74ACT253E	0 to 70°C, -40 to 85, -55 to 125	16 Ld PDIP
CD74ACT253M	0 to 70°C, -40 to 85, -55 to 125	16 Ld SOIC

#### 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.

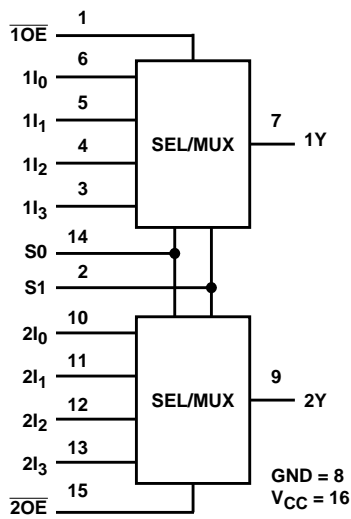
### Pinout

CD54ACT253  
(CERDIP)  
CD74AC253, CD74ACT253  
(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	nl <sub>0</sub>	nl <sub>1</sub>	nl <sub>2</sub>	nl <sub>3</sub>	$\overline{\text{nOE}}$	nY
X	X	X	X	X	X	H	Z
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 inputs, X = Don't care, Z = High impedance.

# CD74AC253, CD54/74ACT253

## 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°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:

- 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

**CD74AC253, CD54/74ACT253**

**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:**

- 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.

# CD74AC253, CD54/74ACT253

## ACT Input Load Table

INPUT	UNIT LOAD
S0, S1, nI <sub>0</sub> , nI <sub>1</sub>	1
nOE	0.83

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, S0, S1, to Y	t <sub>PLH</sub> , t <sub>PHL</sub>	1.5	-	-	227	-	-	250	ns
		3.3 (Note 9)	7.2	-	25	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, Output Enable, Output Disable to Y	t <sub>PLZ</sub> , t <sub>PHZ</sub> , t <sub>PZL</sub> , t <sub>PZH</sub>	1.5	-	-	131	-	-	144	ns
		3.3	4.5	-	15.7	4.3	-	17.3	ns
		5	3	-	10.5	2.9	-	11.5	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)	-	-	107	-	-	107	-	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, Output Enable, Output Disable to Y	t <sub>PLZ</sub> , t <sub>PHZ</sub> , t <sub>PZL</sub> , t <sub>PZH</sub>	5	3.2	-	11.5	3.2	-	12.6	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)	-	-	107	-	-	107	-	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<sub>PD</sub> 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.

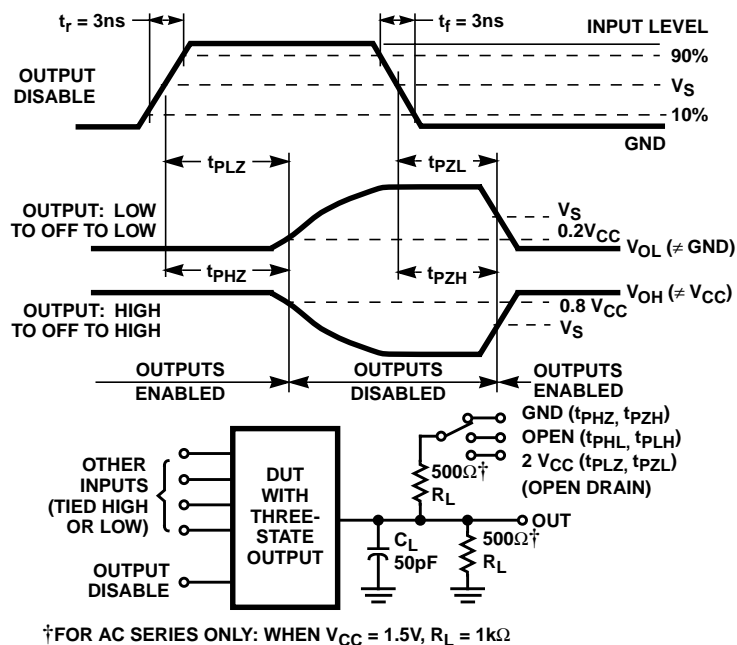


FIGURE 1. THREE-STATE PROPAGATION DELAY WAVEFORMS AND TEST CIRCUIT

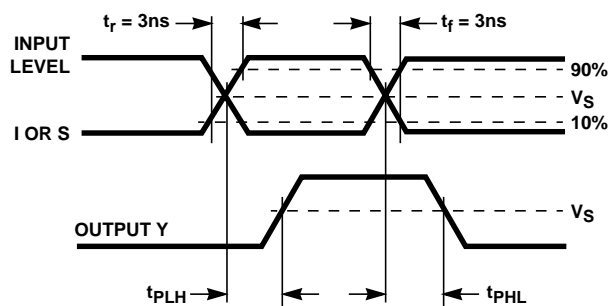
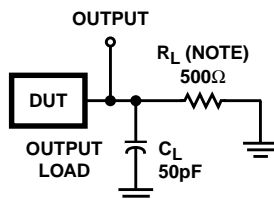


FIGURE 2. PROPAGATION DELAY TIMES



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

## PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">CD74AC253M</a>	Obsolete	Production	SOIC (D)   16	-	-	Call TI	Call TI	-55 to 125	AC253M
<a href="#">CD74AC253M96</a>	Active	Production	SOIC (D)   16	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	AC253M
CD74AC253M96.A	Active	Production	SOIC (D)   16	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	AC253M
<a href="#">CD74ACT253E</a>	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD74ACT253E
CD74ACT253E.A	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD74ACT253E
<a href="#">CD74ACT253M</a>	Obsolete	Production	SOIC (D)   16	-	-	Call TI	Call TI	-55 to 125	ACT253M
<a href="#">CD74ACT253M96</a>	Active	Production	SOIC (D)   16	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	ACT253M
CD74ACT253M96.A	Active	Production	SOIC (D)   16	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	ACT253M

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts 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.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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## TAPE AND REEL INFORMATION



\*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
CD74AC253M96	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
CD74ACT253M96	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)
CD74AC253M96	SOIC	D	16	2500	340.5	336.1	32.0
CD74ACT253M96	SOIC	D	16	2500	340.5	336.1	32.0

## TUBE

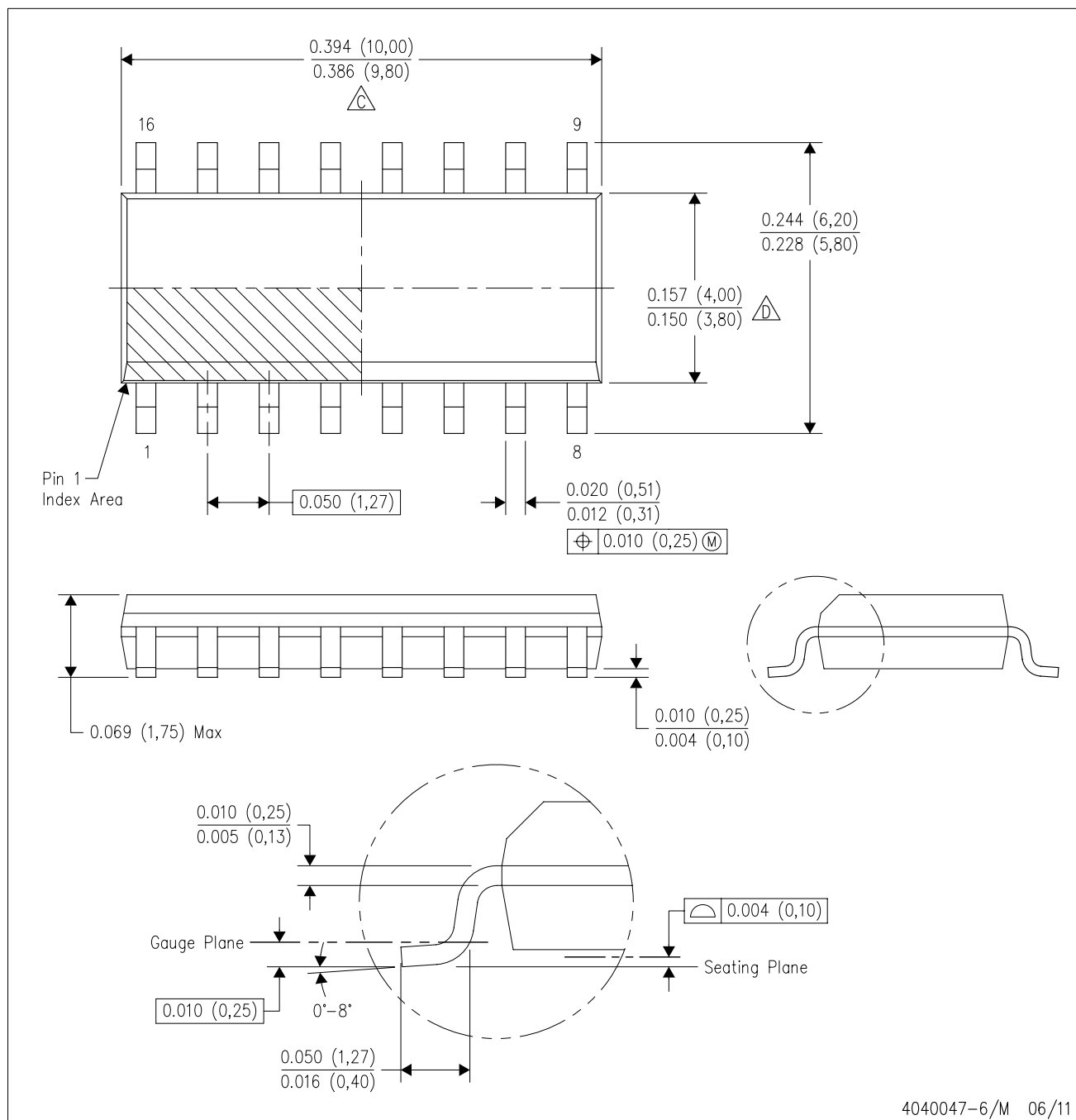


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
CD74ACT253E	N	PDIP	16	25	506	13.97	11230	4.32
CD74ACT253E	N	PDIP	16	25	506	13.97	11230	4.32
CD74ACT253E.A	N	PDIP	16	25	506	13.97	11230	4.32
CD74ACT253E.A	N	PDIP	16	25	506	13.97	11230	4.32

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.
  - $\triangle C$  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.
  - $\triangle D$  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.

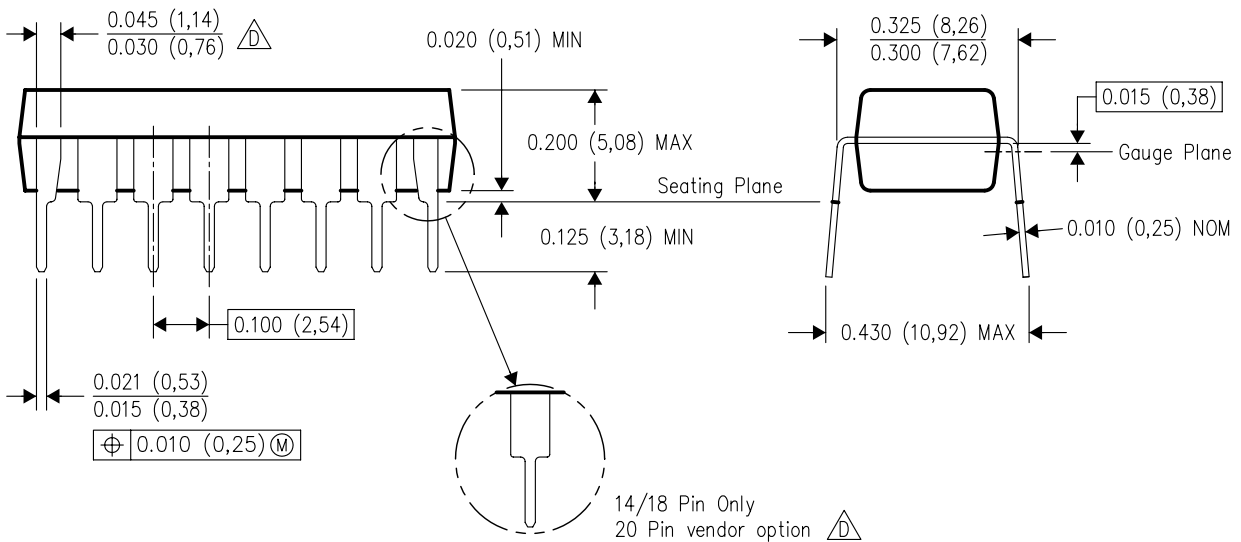
## N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



PINS **	14	16	18	20
DIM				
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

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