CD74AC253, CD54/74ACT253

Data sheet acquired from Harris Semiconductor
SCHS247A

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°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 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 ($\overline{1OE}$ or $\overline{2OE}$) is HIGH, the output is in the high-impedance state.

Ordering Information

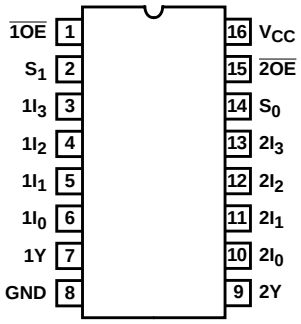
PART NUMBER	TEMP. RANGE (°C)	PACKAGE
CD74AC253E	0 to 70°C, -40 to 85, -55 to 125	16 Ld PDIP
CD74AC253M	0 to 70°C, -40 to 85, -55 to 125	16 Ld SOIC
CD54ACT253F3A	-55 to 125	16 Ld CERDIP
CD74ACT253E	0 to 70°C, -40 to 85, -55 to 125	16 Ld PDIP
CD74ACT253M	0 to 70°C, -40 to 85, -55 to 125	16 Ld SOIC

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.

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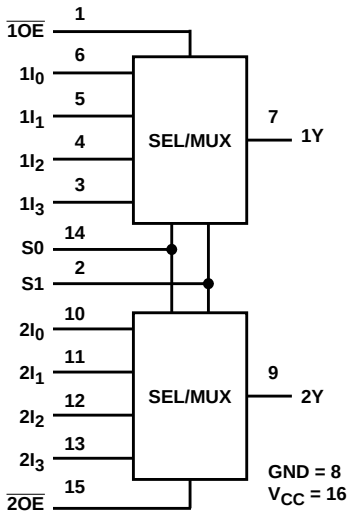
Functional Diagram



TRUTH TABLE

SELECT INPUTS		DATA INPUTS				ENABLE INPUTS	OUTPUT
S1	S0	nI_0	nI_1	nI_2	nI_3	$\overline{nOE}$	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.

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) θ_{JA} (°C/W)
PDIP Package . . . . . ___
SOIC Package . . . . . ___
Maximum Junction Temperature (Plastic Package) 150C
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. θ_{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
Three-State Leakage Current	I_{OZ}	V_{IH} or V_{IL} $V_O = V_{CC}$ or GND	-	5.5	-	±0.5	-	±5	-	±10	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
Three-State or Leakage Current	I_{OZ}	V_{IH} or V_{IL} $V_O = V_{CC}$ or GND	-	5.5	-	±0.5	-	±5	-	±10	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	ΔI_{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, nI_0, nI_1	1
$\overline{nOE}$	0.83

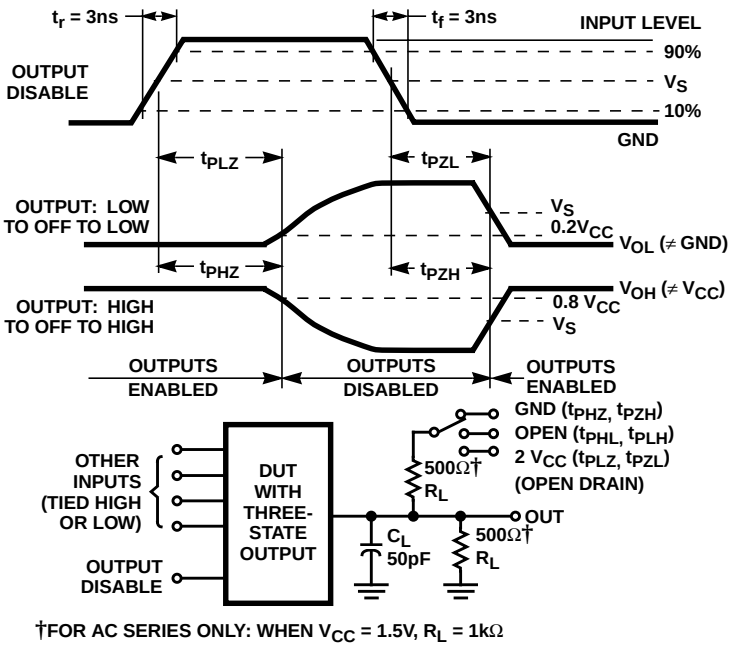
NOTE: Unit load is ΔI_{CC} limit specified in DC Electrical Specifications Table, e.g., 2.4mA max at 25^oC.

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

PARAMETER	SYMBOL	V_{CC} (V)	-40^oC TO 85^oC			-55^oC TO 125^oC			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	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, Output Enable, Output Disable to Y	t_{PLZ}, t_{PHZ}, t_{PZL}, t_{PZH}	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_O	-	-	-	15	-	-	15	pF
Input Capacitance	C_I	-	-	-	10	-	-	10	pF
Power Dissipation Capacitance	C_{PD} (Note 11)	-	-	107	-	-	107	-	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, Output Enable, Output Disable to Y	t_{PLZ}, t_{PHZ}, t_{PZL}, t_{PZH}	5	3.2	-	11.5	3.2	-	12.6	ns
Three-State Output Capacitance	C_O	-	-	-	15	-	-	15	pF
Input Capacitance	C_I	-	-	-	10	-	-	10	pF
Power Dissipation Capacitance	C_{PD} (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_{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.



†FOR AC SERIES ONLY: WHEN V_{CC} = 1.5V, R_L = 1kΩ

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

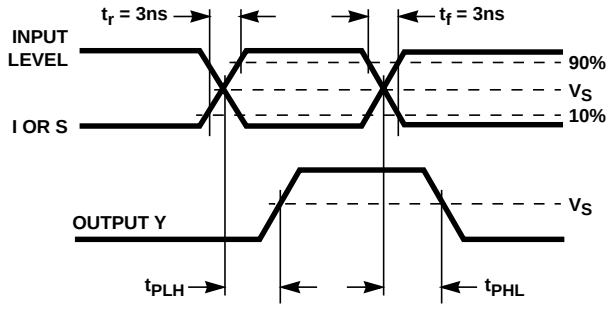
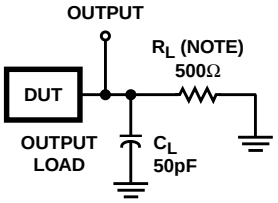


FIGURE 2. PROPAGATION DELAY TIMES



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

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
CD74AC253M	ACTIVE	SOIC	D	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	AC253M	Samples
CD74AC253M96	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	AC253M	Samples
CD74ACT253E	ACTIVE	PDIP	N	16	25	RoHS & Green	NIPDAU	N / A for Pkg Type	-55 to 125	CD74ACT253E	Samples
CD74ACT253EE4	ACTIVE	PDIP	N	16	25	RoHS & Green	NIPDAU	N / A for Pkg Type	-55 to 125	CD74ACT253E	Samples
CD74ACT253M	ACTIVE	SOIC	D	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	ACT253M	Samples
CD74ACT253M96	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	ACT253M	Samples

(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.
OBSOLETE: 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.

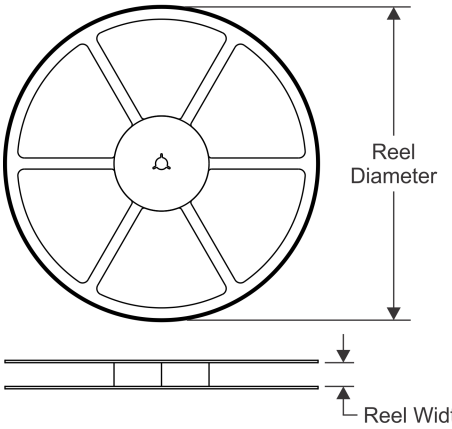
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(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.

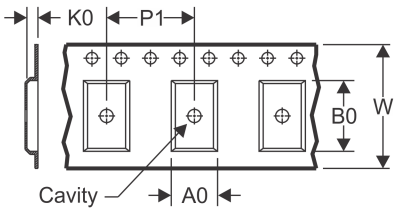
(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

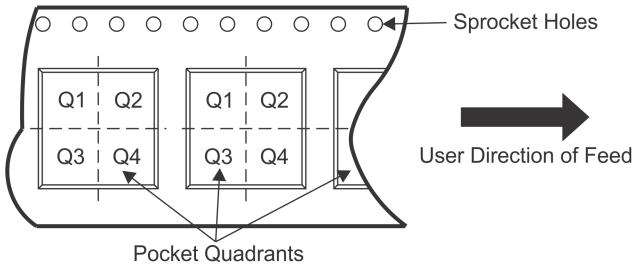


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

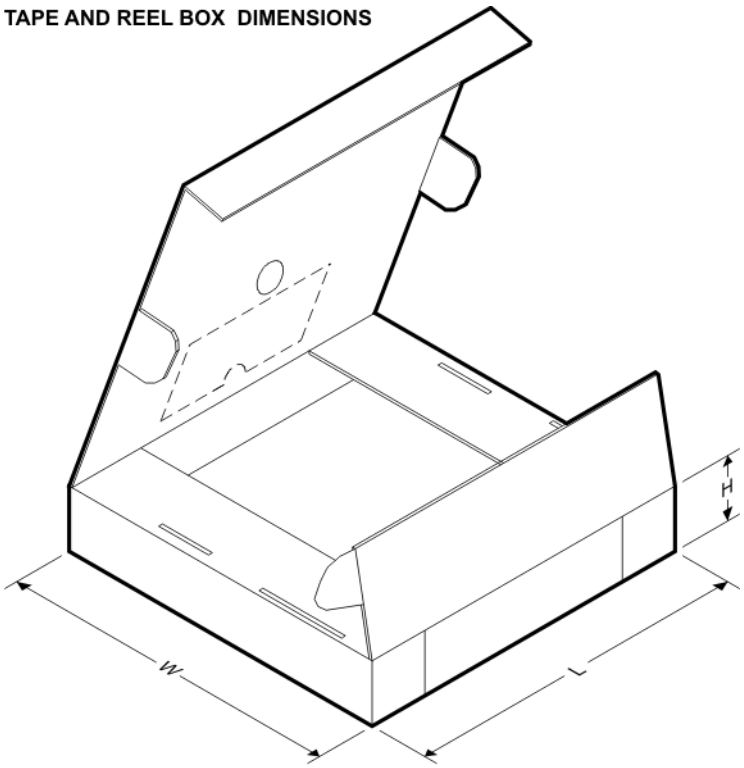
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
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

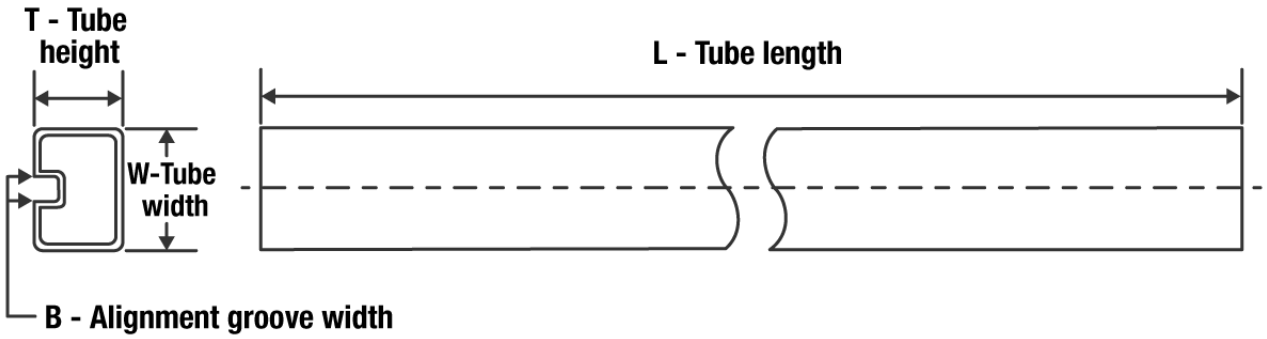
TAPE AND REEL BOX DIMENSIONS



*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



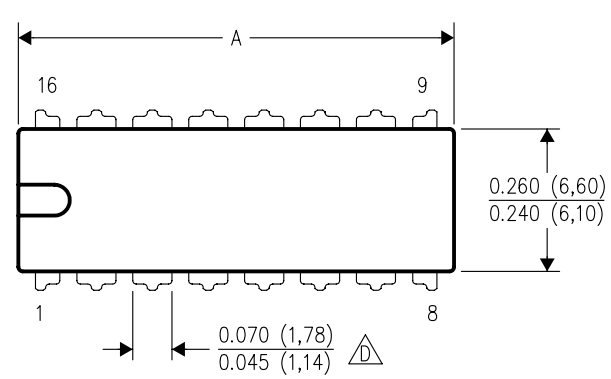
*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
CD74AC253M	D	SOIC	16	40	507	8	3940	4.32
CD74ACT253E	N	PDIP	16	25	506	13.97	11230	4.32
CD74ACT253E	N	PDIP	16	25	506	13.97	11230	4.32
CD74ACT253EE4	N	PDIP	16	25	506	13.97	11230	4.32
CD74ACT253EE4	N	PDIP	16	25	506	13.97	11230	4.32
CD74ACT253M	D	SOIC	16	40	507	8	3940	4.32

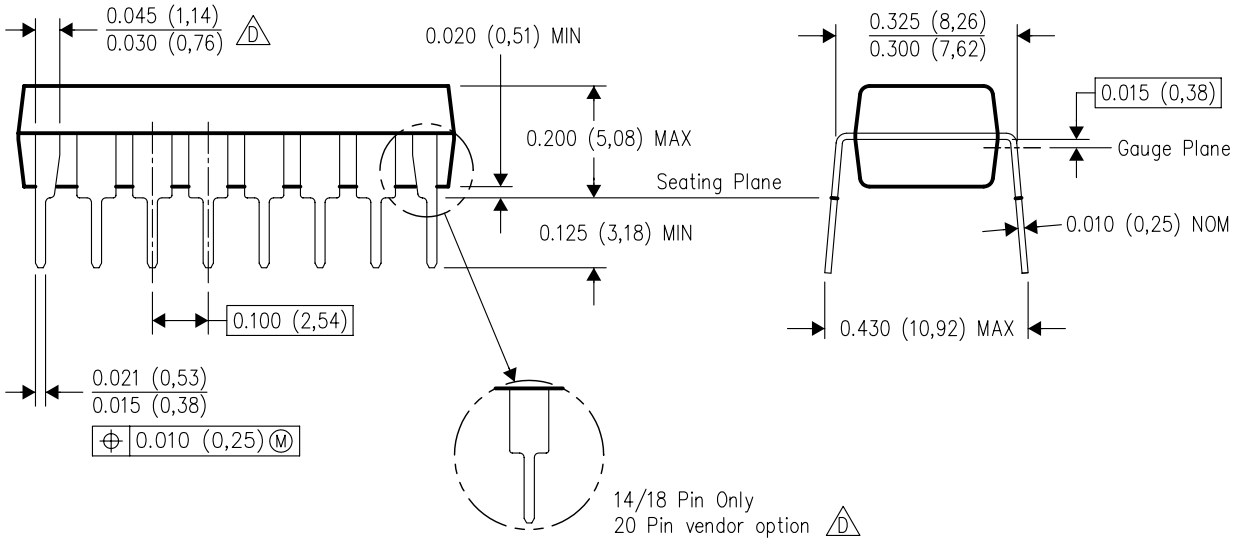
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



DIM \ PINS **	14	16	18	20
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 (C)	AA	BB	AC	AD



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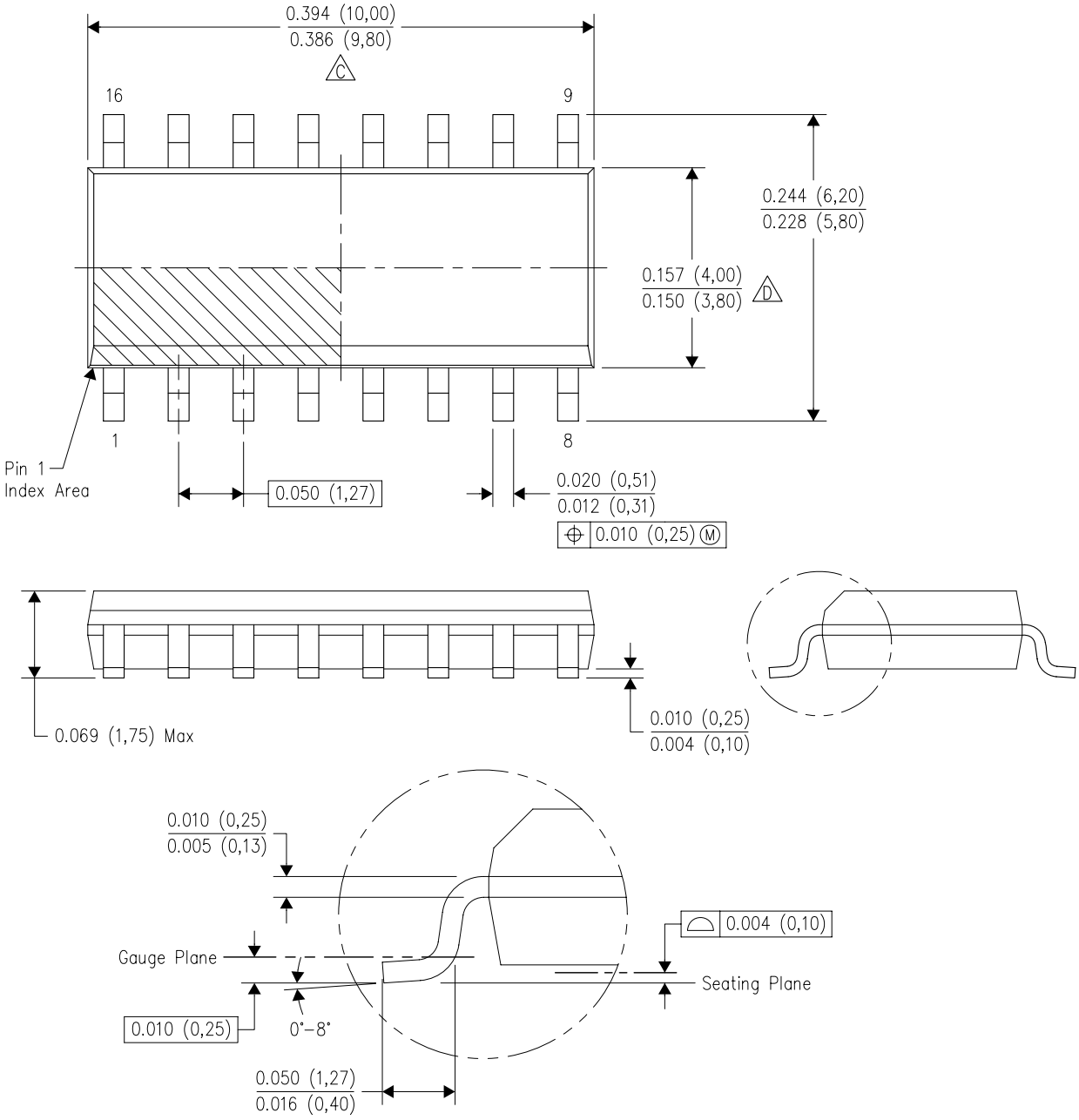
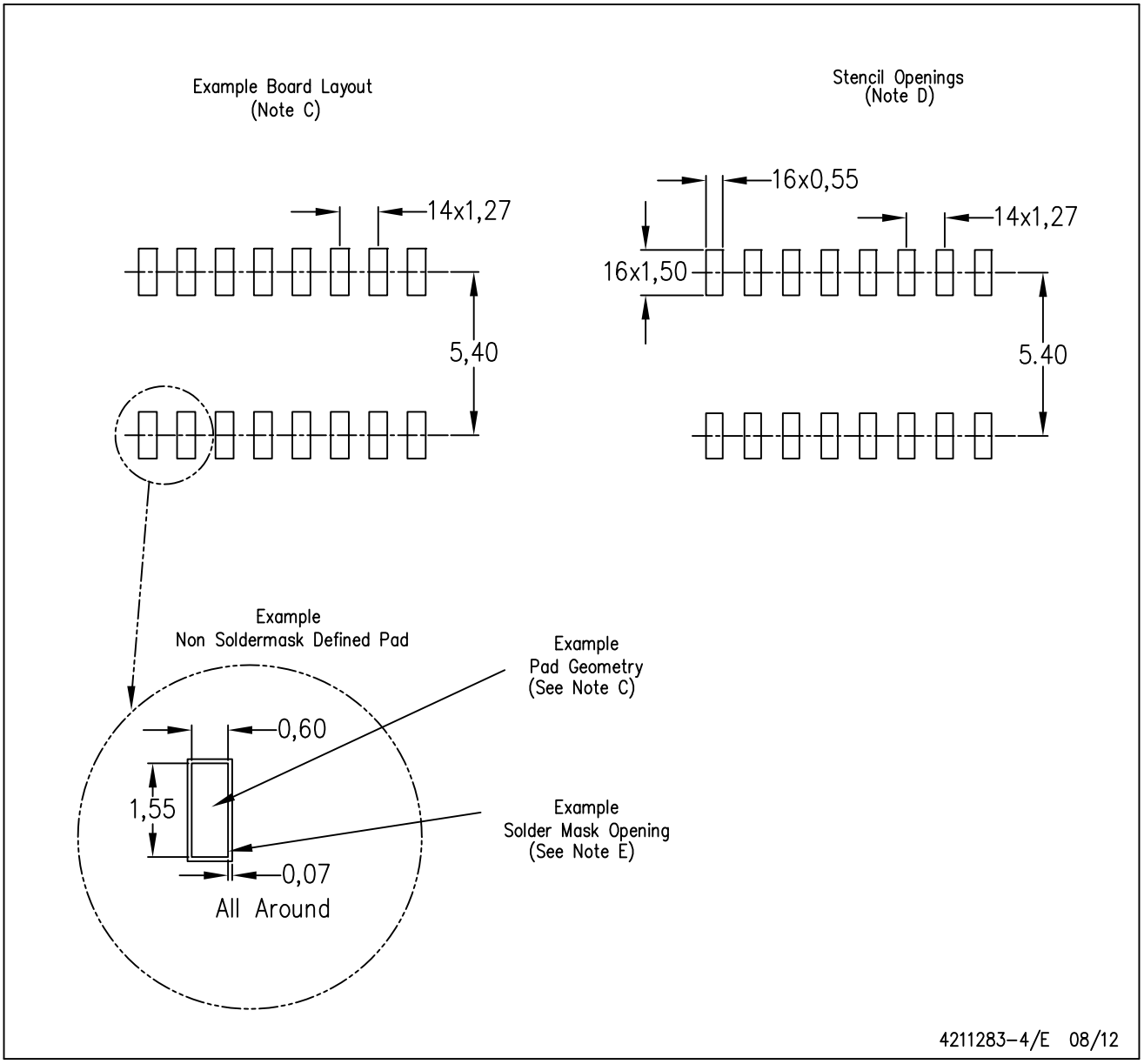
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001, except 18 and 20 pin minimum body length (Dim A).
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

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:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. 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.
E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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