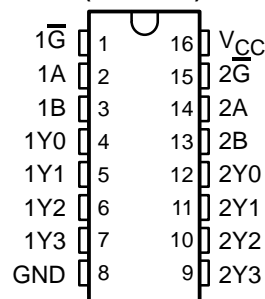


# CD54AC139, CD74AC139 DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

SCHS332 – MARCH 2003

- AC Types Feature 1.5-V to 5.5-V Operation and Balanced Noise Immunity at 30% of the Supply Voltage
- Buffered Inputs
- Incorporate Two Enable Inputs to Simplify Cascading and/or Data Reception
- Speed of Bipolar F, AS, and S, With Significantly Reduced Power Consumption
- Balanced Propagation Delays
- $\pm 24$ -mA Output Drive Current  
– Fanout to 15 F Devices
- SCR-Latchup-Resistant CMOS Process and Circuit Design
- Exceeds 2-kV ESD Protection Per MIL-STD-883, Method 3015

CD54AC139 . . . F PACKAGE  
CD74AC139 . . . E OR M PACKAGE  
(TOP VIEW)



## description/ordering information

The 'AC139 devices are dual 2-line to 4-line decoders/demultiplexers designed for 1.5-V to 5.5-V  $V_{CC}$  operation. These devices are designed to be used in high-performance memory-decoding or data-routing applications requiring very short propagation delay times. In high-performance memory systems, these decoders can be used to minimize the effects of system decoding. When used with high-speed memories utilizing a fast enable circuit, the delay times of these decoders and the enable time of the memory usually are less than the typical access time of the memory. This means that the effective system delay introduced by the decoders is negligible.

The active-low enable ( $\overline{G}$ ) input can be used as a data line in demultiplexing applications. These decoders/demultiplexers feature fully buffered inputs, each of which represents only one normalized load to its driving circuit.

## ORDERING INFORMATION

TA	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–55°C to 125°C	PDIP – E	Tube	CD74AC139E	CD74AC139E
	SOIC – M	Tube	CD74AC139M	AC139M
		Tape and reel	CD74AC139M96	
	CDIP – F	Tube	CD54AC139F3A	CD54AC139F3A

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS  
INSTRUMENTS**

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

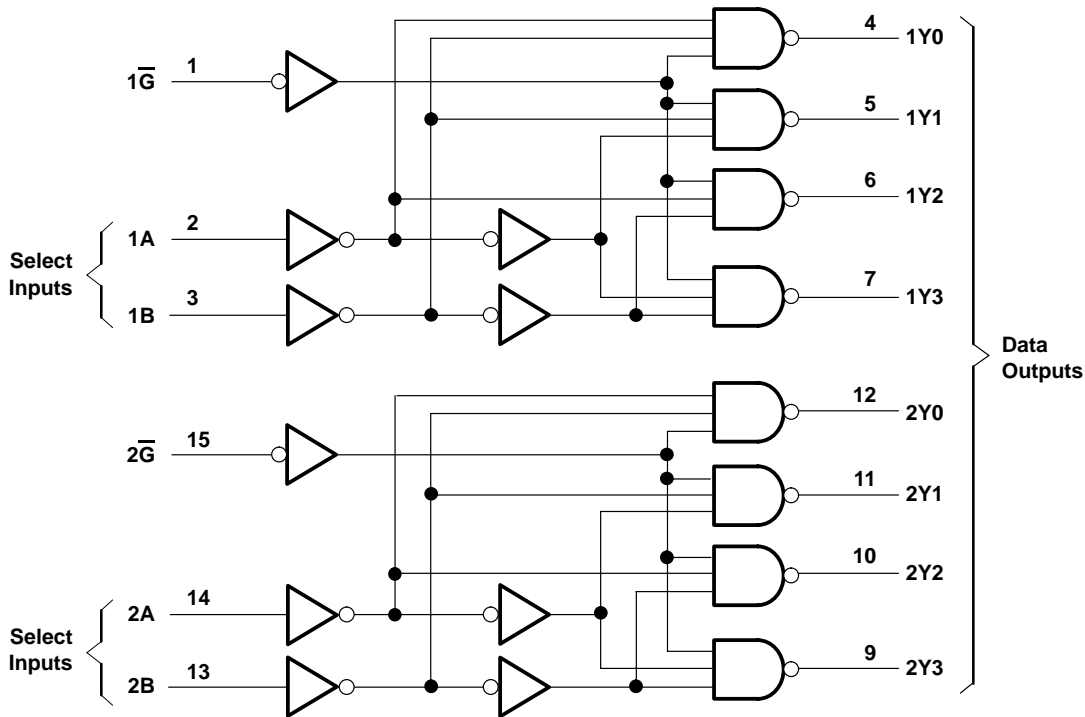
CD54AC139, CD74AC139  
DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

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FUNCTION TABLE  
(each decoder/demultiplexer)

INPUTS			OUTPUTS			
$\overline{\text{G}}$	SELECT		Y0	Y1	Y2	Y3
	B	A				
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	L	H	H	L	H	H
L	H	L	H	H	L	H
L	H	H	H	H	H	L

logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

Supply voltage range, $V_{CC}$	–0.5 V to 6 V
Input clamp current, $I_{IK}$ ( $V_I < 0$ V or $V_I > V_{CC}$ ) (see Note 1)	±20 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ V or $V_O > V_{CC}$ ) (see Note 1)	±50 mA
Continuous output current, $I_O$ ( $V_O > 0$ V or $V_O < V_{CC}$ )	±50 mA
Continuous current through $V_{CC}$ or GND	±100 mA
Package thermal impedance, $\theta_{JA}$ (see Note 2): E package	67°C/W
M package	73°C/W
Storage temperature range, $T_{stg}$	–65°C to 150°C

<sup>†</sup> Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
2. The package thermal impedance is calculated in accordance with JESD 51-7.



# CD54AC139, CD74AC139

## DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

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### recommended operating conditions (see Note 3)

			$T_A = 25^\circ\text{C}$		$-55^\circ\text{C to } 125^\circ\text{C}$		$-40^\circ\text{C to } 85^\circ\text{C}$		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
$V_{CC}$	Supply voltage		1.5	5.5	1.5	5.5	1.5	5.5	V
$V_{IH}$	High-level input voltage	$V_{CC} = 1.5\text{ V}$	1.2		1.2		1.2		V
		$V_{CC} = 3\text{ V}$	2.1		2.1		2.1		
		$V_{CC} = 5.5\text{ V}$	3.85		3.85		3.85		
$V_{IL}$	Low-level input voltage	$V_{CC} = 1.5\text{ V}$		0.3		0.3		0.3	V
		$V_{CC} = 3\text{ V}$		0.9		0.9		0.9	
		$V_{CC} = 5.5\text{ V}$		1.65		1.65		1.65	
$V_I$	Input voltage		0	$V_{CC}$	0	$V_{CC}$	0	$V_{CC}$	V
$V_O$	Output voltage		0	$V_{CC}$	0	$V_{CC}$	0	$V_{CC}$	V
$I_{OH}$	High-level output current	$V_{CC} = 4.5\text{ V to } 5.5\text{ V}$		-24		-24		-24	mA
$I_{OL}$	Low-level output current	$V_{CC} = 4.5\text{ V to } 5.5\text{ V}$		24		24		24	mA
$\Delta t/\Delta v$	Input transition rise or fall rate	$V_{CC} = 1.5\text{ V to } 3\text{ V}$		50		50		50	ns/V
		$V_{CC} = 3.6\text{ V to } 5.5\text{ V}$		20		20		20	

NOTE 3: All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

### electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS		$V_{CC}$	$T_A = 25^\circ\text{C}$		$-55^\circ\text{C to } 125^\circ\text{C}$		$-40^\circ\text{C to } 85^\circ\text{C}$		UNIT
				MIN	MAX	MIN	MAX	MIN	MAX	
$V_{OH}$	$V_I = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -50\text{ }\mu\text{A}$	1.5 V	1.4		1.4		1.4		V
			3 V	2.9		2.9		2.9		
			4.5 V	4.4		4.4		4.4		
		$I_{OH} = -4\text{ mA}$	3 V	2.58		2.4		2.48		
		$I_{OH} = -24\text{ mA}$	4.5 V	3.94		3.7		3.8		
		$I_{OH} = -50\text{ mA}^\dagger$	5.5 V			3.85				
		$I_{OH} = -75\text{ mA}^\dagger$	5.5 V					3.85		
$V_{OL}$	$V_I = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 50\text{ }\mu\text{A}$	1.5 V		0.1		0.1		0.1	V
			3 V		0.1		0.1		0.1	
			4.5 V		0.1		0.1		0.1	
		$I_{OL} = 12\text{ mA}$	3 V		0.36		0.5		0.44	
		$I_{OL} = 24\text{ mA}$	4.5 V		0.36		0.5		0.44	
		$I_{OL} = 50\text{ mA}^\dagger$	5.5 V				1.65		—	
		$I_{OL} = 75\text{ mA}^\dagger$	5.5 V						1.65	
$I_I$	$V_I = V_{CC} \text{ or } \text{GND}$		5.5 V		$\pm 0.1$		$\pm 1$		$\pm 1$	$\mu\text{A}$
$I_{CC}$	$V_I = V_{CC} \text{ or } \text{GND}, I_O = 0$		5.5 V		8		160		80	$\mu\text{A}$
$C_i$					10		10		10	pF

<sup>†</sup> Test one output at a time, not exceeding 1-second duration. Measurement is made by forcing indicated current and measuring voltage to minimize power dissipation. Test verifies a minimum 50- $\Omega$  transmission-line drive capability at 85°C and 75- $\Omega$  transmission-line drive capability at 125°C.



# CD54AC139, CD74AC139

## DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

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switching characteristics over recommended operating free-air temperature range,  
 $V_{CC} = 1.5\text{ V}$ ,  $C_L = 50\text{ pF}$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	–55°C to 125°C		–40°C to 85°C		UNIT
				MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	A or B	Any Y	C <sub>L</sub> = 50 pF	131		119		ns
t <sub>PHL</sub>				131		119		
t <sub>PLH</sub>	$\overline{G}$	Any Y	C <sub>L</sub> = 50 pF	131		119		ns
t <sub>PHL</sub>				131		119		

switching characteristics over recommended operating free-air temperature range,  
 $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ ,  $C_L = 50\text{ pF}$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	–55°C to 125°C		–40°C to 85°C		UNIT
				MIN	MAX	MIN	MAX	
$t_{PLH}$	A or B	Any Y	$C_L = 50\text{ pF}$	3.7	14.7	3.9	13.4	ns
$t_{PHL}$				3.7	14.7	3.9	13.4	
$t_{PLH}$	$\overline{G}$	Any Y	$C_L = 50\text{ pF}$	3.7	14.7	3.9	13.4	ns
$t_{PHL}$				3.7	14.7	3.9	13.4	

switching characteristics over recommended operating free-air temperature range,  
 $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ ,  $C_L = 50\text{ pF}$  (unless otherwise noted) (see Figure 1)

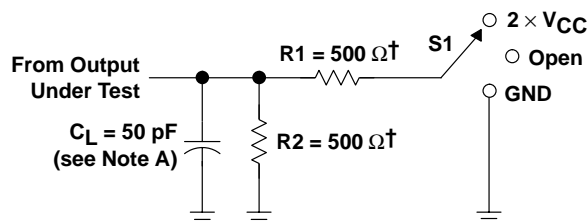
PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	–55°C to 125°C		–40°C to 85°C		UNIT
				MIN	MAX	MIN	MAX	
$t_{PLH}$	A or B	Any Y	$C_L = 50\text{ pF}$	2.6	10.5	2.8	9.5	ns
$t_{PHL}$				2.6	10.5	2.8	9.5	
$t_{PLH}$	$\overline{G}$	Any Y	$C_L = 50\text{ pF}$	2.6	10.5	2.8	9.5	ns
$t_{PHL}$				2.6	10.5	2.8	9.5	

operating characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER		TYP	UNIT
$C_{pd}$	Power dissipation capacitance	83	pF



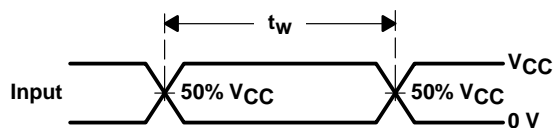
# PARAMETER MEASUREMENT INFORMATION



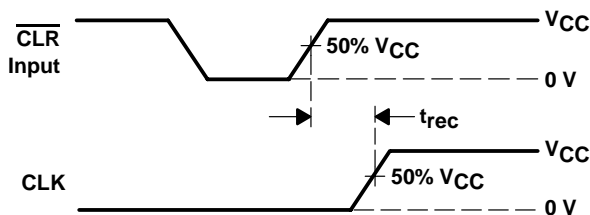
† When  $V_{CC} = 1.5\ \text{V}$ ,  $R1 = R2 = 1\ \text{k}\Omega$

LOAD CIRCUIT

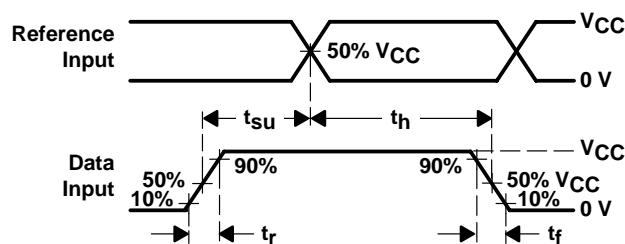
TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	$2 \times V_{CC}$
$t_{PHZ}/t_{PZH}$	GND



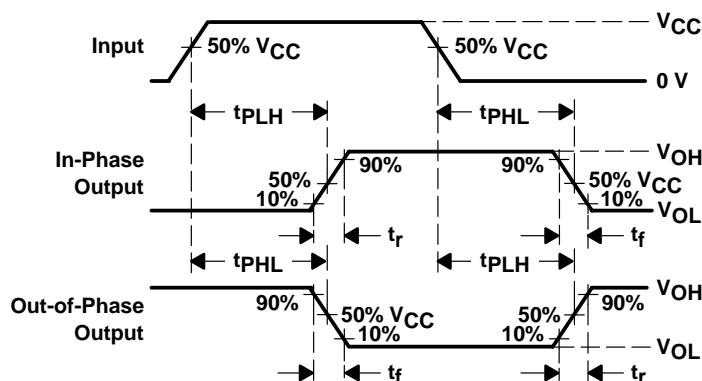
VOLTAGE WAVEFORMS  
PULSE DURATION



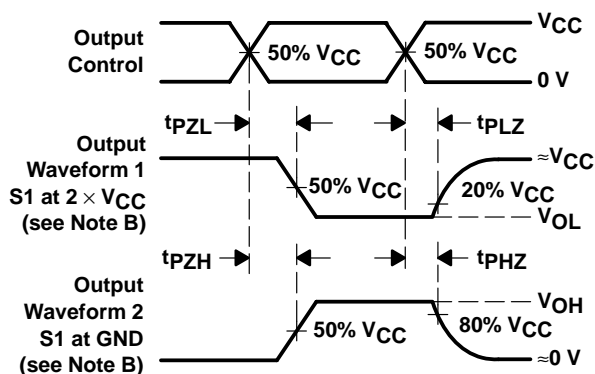
VOLTAGE WAVEFORMS  
RECOVERY TIME



VOLTAGE WAVEFORMS  
SETUP AND HOLD AND INPUT RISE AND FALL TIMES



VOLTAGE WAVEFORMS  
PROPAGATION DELAY AND OUTPUT TRANSITION TIMES



VOLTAGE WAVEFORMS  
OUTPUT ENABLE AND DISABLE TIMES

- NOTES:
- $C_L$  includes probe and test-fixture capacitance.
  - Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
  - All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1\ \text{MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r = 3\ \text{ns}$ ,  $t_f = 3\ \text{ns}$ . Phase relationships between waveforms are arbitrary.
  - For clock inputs,  $f_{max}$  is measured with the input duty cycle at 50%.
  - The outputs are measured one at a time with one input transition per measurement.
  - $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
  - $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

## 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="#">CD54AC139F3A</a>	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD54AC139F3A
CD54AC139F3A.A	Active	Production	CDIP (J)   16	25   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD54AC139F3A
<a href="#">CD74AC139E</a>	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD74AC139E
CD74AC139E.A	Active	Production	PDIP (N)   16	25   TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD74AC139E
<a href="#">CD74AC139M</a>	Obsolete	Production	SOIC (D)   16	-	-	Call TI	Call TI	-55 to 125	AC139M
<a href="#">CD74AC139M96</a>	Active	Production	SOIC (D)   16	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	AC139M
CD74AC139M96.A	Active	Production	SOIC (D)   16	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	AC139M

(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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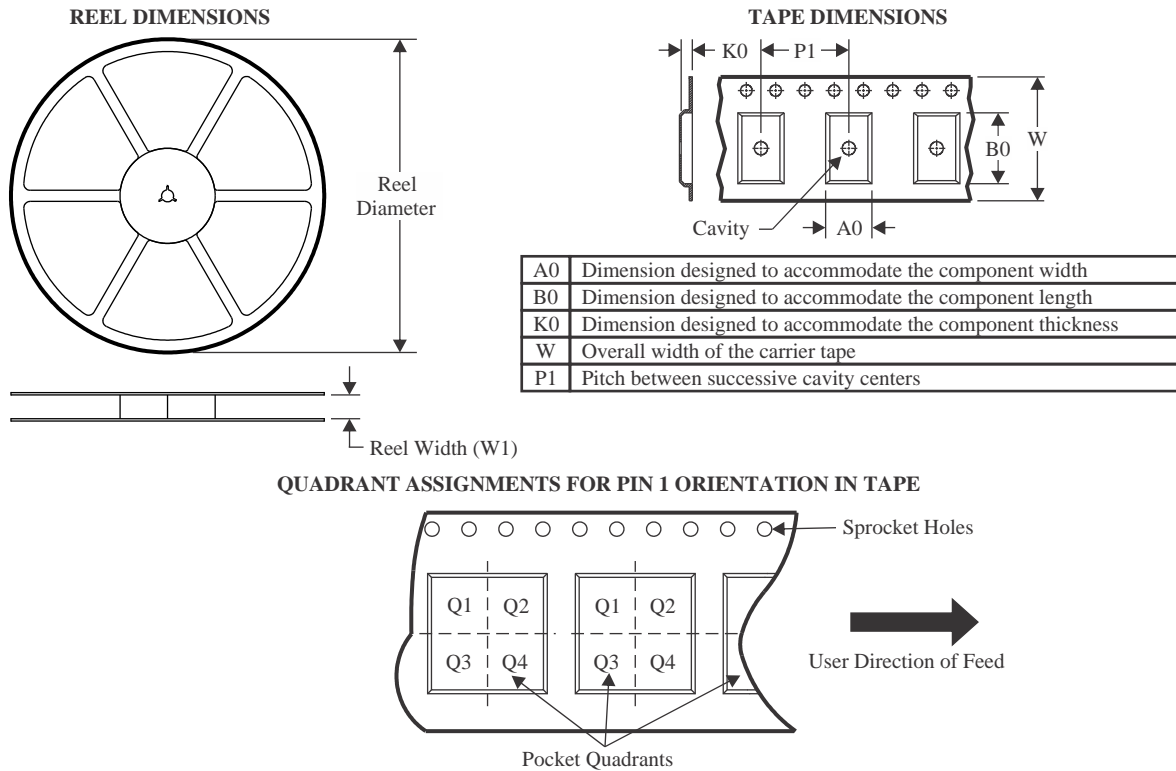
**OTHER QUALIFIED VERSIONS OF CD54AC139, CD74AC139 :**

- Catalog : [CD74AC139](#)
- Military : [CD54AC139](#)

## NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

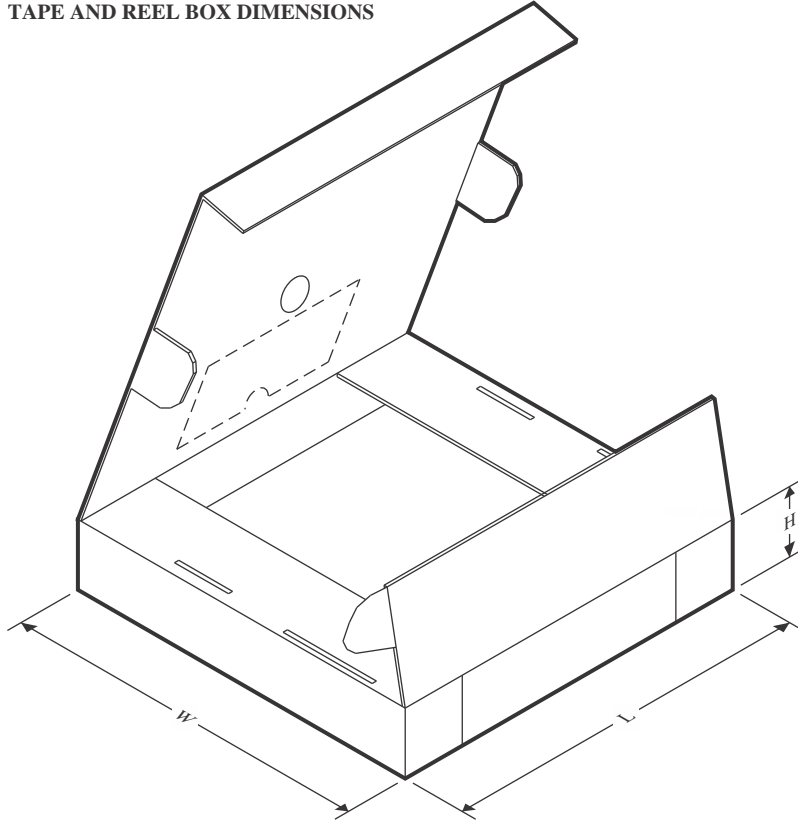
## TAPE AND REEL INFORMATION



\*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
CD74AC139M96	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)
CD74AC139M96	SOIC	D	16	2500	353.0	353.0	32.0

## TUBE

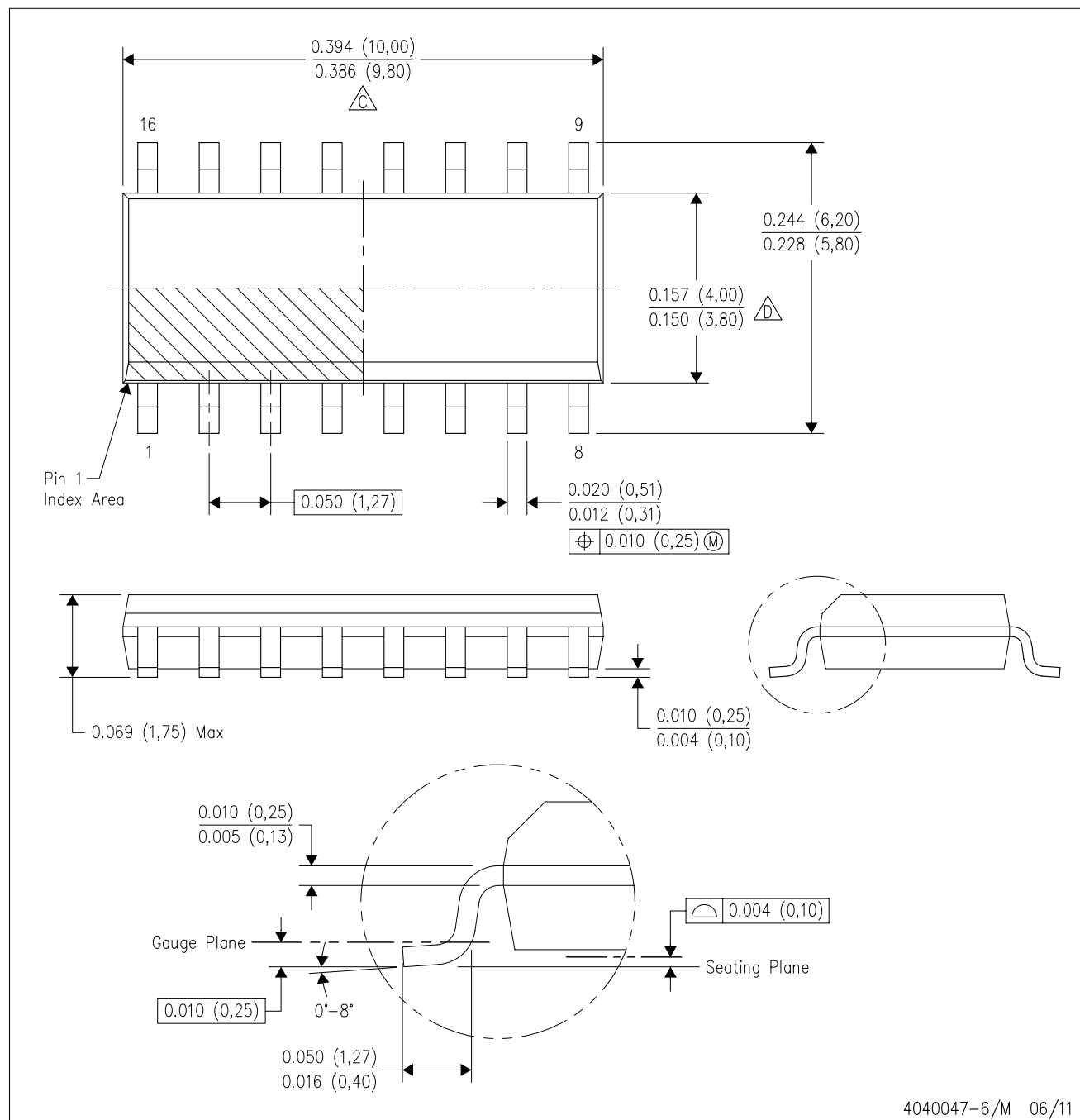




\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
CD74AC139E	N	PDIP	16	25	506	13.97	11230	4.32
CD74AC139E	N	PDIP	16	25	506	13.97	11230	4.32
CD74AC139E.A	N	PDIP	16	25	506	13.97	11230	4.32
CD74AC139E.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.
  -  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.

J (R-GDIP-T\*\*)

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



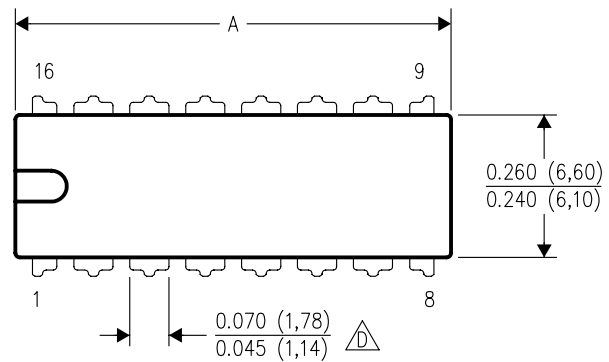
4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

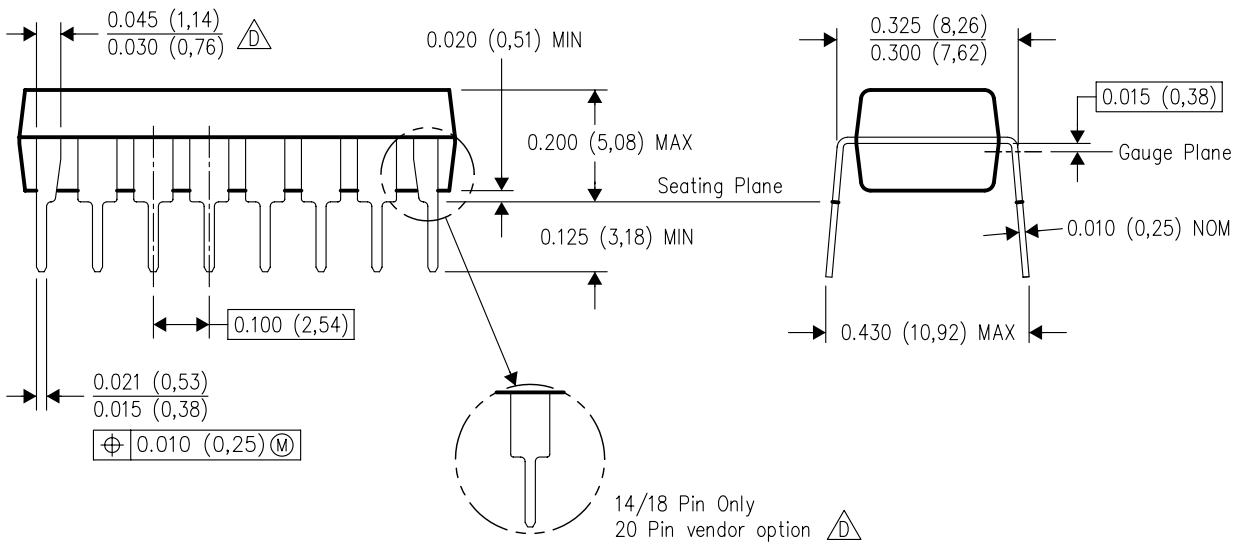
## N (R-PDIP-T\*\*)

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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