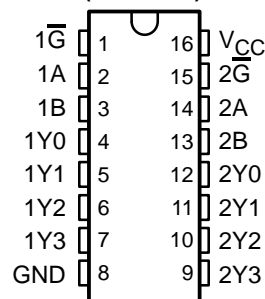


CD54AC139, CD74AC139 DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

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
- ± 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.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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.

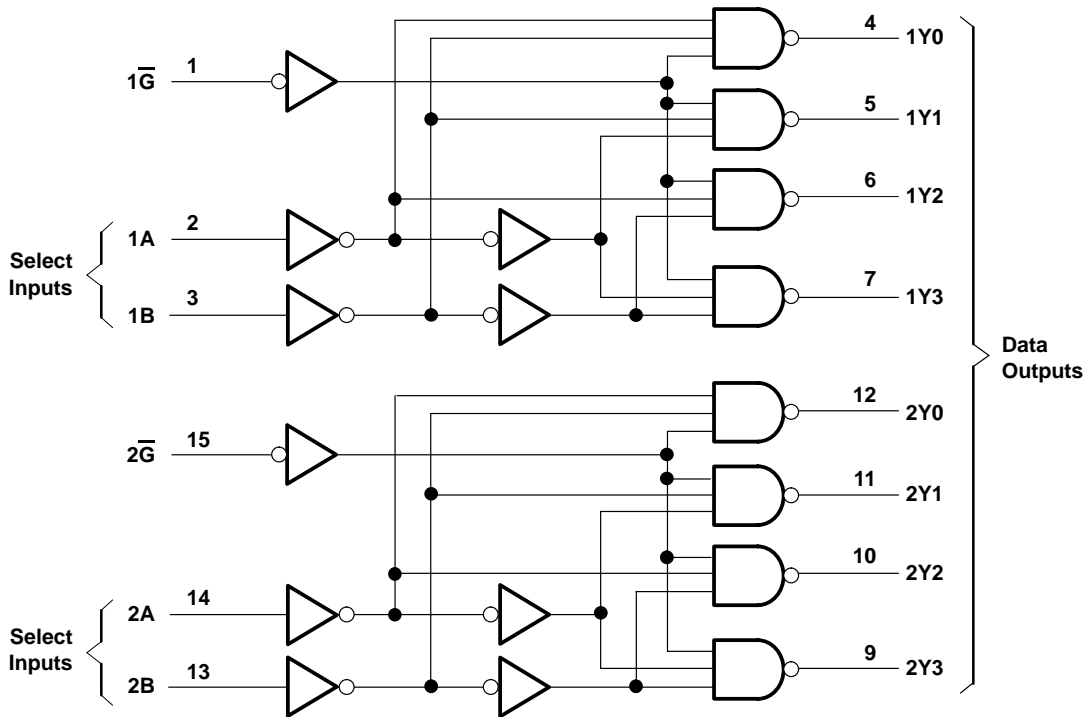
CD54AC139, CD74AC139
DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

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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)[†]

| | |
|---|----------------|
| 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, θ_{JA} (see Note 2): E package | 67°C/W |
| M package | 73°C/W |
| Storage temperature range, T_{stg} | –65°C to 150°C |

[†] 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 | | ± 0.1 | | ± 1 | | ± 1 | μA |
| I_{CC} | $V_I = V_{CC} \text{ or } \text{GND}, I_O = 0$ | | 5.5 V | | 8 | | 160 | | 80 | μA |
| C_i | | | | | 10 | | 10 | | 10 | pF |

[†] 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- Ω transmission-line drive capability at 85°C and 75- Ω 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 V, C_L = 50 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 pF | 131 | | 119 | | ns |
| t _{PHL} | | | | 131 | | 119 | | |
| t _{PLH} | \overline{G} | Any Y | C _L = 50 pF | 131 | | 119 | | ns |
| t _{PHL} | | | | 131 | | 119 | | |

**switching characteristics over recommended operating free-air temperature range,
V_{CC} = 3.3 V ± 0.3 V, C_L = 50 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 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 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 V ± 0.5 V, C_L = 50 pF (unless otherwise noted) (see Figure 1)**

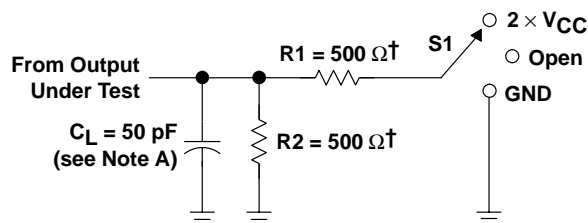
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | LOAD CAPACITANCE | –55°C to 125°C | | –40°C to 85°C | | UNIT |
|------------------|-----------------|----------------|------------------------|-------------------|------|------------------|-----|------|
| | | | | MIN | MAX | MIN | MAX | |
| t _{PLH} | A or B | Any Y | C _L = 50 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 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 V, T_A = 25°C

| PARAMETER | | TYP | UNIT |
|-----------------|-------------------------------|-----|------|
| C _{pd} | Power dissipation capacitance | 83 | pF |



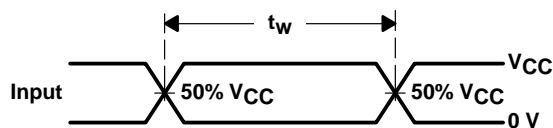
PARAMETER MEASUREMENT INFORMATION



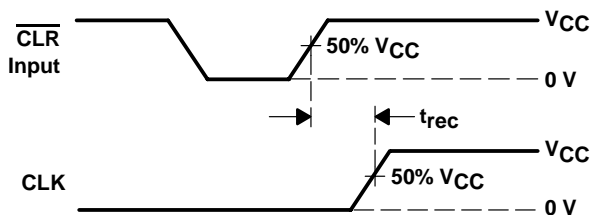
† When $V_{CC} = 1.5\ \text{V}$, $R1 = R2 = 1\ \text{k}\Omega$

LOAD CIRCUIT

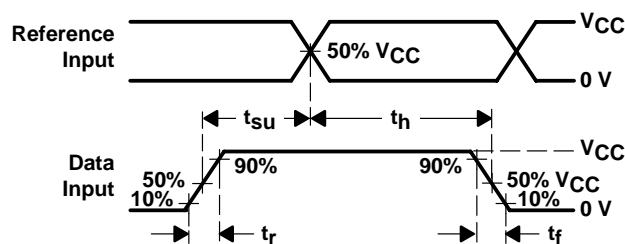
| TEST | S1 |
|-------------------|-------------------|
| t_{PLH}/t_{PHL} | Open |
| t_{PLZ}/t_{PZL} | $2 \times V_{CC}$ |
| t_{PHZ}/t_{PZH} | GND |



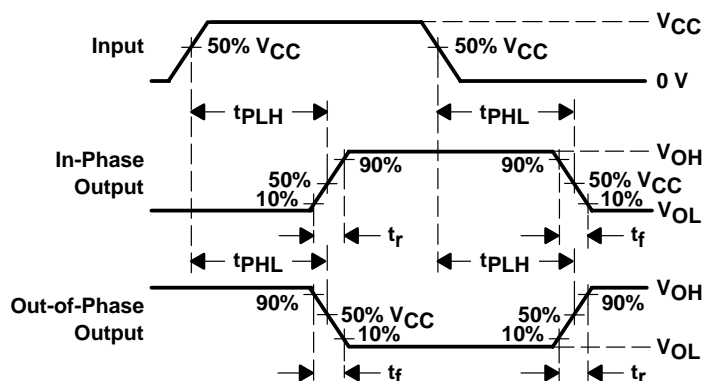
VOLTAGE WAVEFORMS
PULSE DURATION



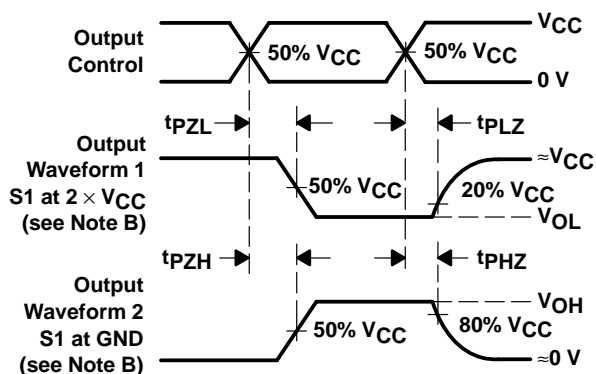
VOLTAGE WAVEFORMS
RECOVERY TIME



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:
- A. C_L includes probe and test-fixture capacitance.
 - B. 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.
 - C. 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.
 - D. For clock inputs, f_{max} is measured with the input duty cycle at 50%.
 - E. The outputs are measured one at a time with one input transition per measurement.
 - F. t_{PLH} and t_{PHL} are the same as t_{pd} .
 - G. t_{PZL} and t_{PZH} are the same as t_{en} .
 - H. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - I. 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) |
|------------------------------|---------------|----------------------|----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| CD54AC139F3A | 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 |
| CD74AC139E | 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 |
| CD74AC139M | Obsolete | Production | SOIC (D) 16 | - | - | Call TI | Call TI | -55 to 125 | AC139M |
| CD74AC139M96 | 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.
- $\triangle C$ 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.

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.
 - Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - The 20 pin end lead shoulder width is a vendor option, either half or full width.

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