

## Dual 2-to-4-Line Decoder/Demultiplexer

### Features

- **Buffered Inputs**
- **Typical Propagation Delay**
  - 5.4ns 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**
- **±24mA Output Drive Current**
  - Fanout to 15 FAST™ ICs
  - Drives 50Ω Transmission Lines

### Description

The 'AC139 and 'ACT139 are dual 2-to-4-line decoders/demultiplexers that utilize Advanced CMOS Logic technology. These devices contain two independent binary to one-of-four decoders, each with a single active LOW enable input ( $\overline{1E}$  or  $\overline{2E}$ ). Data on the select inputs (1A0 and 1A1 or 2A0 and 2A1) cause one of the four normally HIGH outputs to go LOW.

If the enable input is HIGH, all four outputs remain HIGH. For demultiplexer operation, the enable input is the data input. The enable input also functions as a chip select when these devices are cascaded.

### Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE
CD54AC139F3A	-55 to 125	16 Ld CERDIP
CD74AC139E	0 to 70°C, -40 to 85, -55 to 125	16 Ld PDIP
CD74AC139M96	0 to 70°C, -40 to 85, -55 to 125	16 Ld SOIC
CD54ACT139F3A	-55 to 125	16 Ld CERDIP
CD74ACT139E	0 to 70°C, -40 to 85, -55 to 125	16 Ld PDIP
CD74ACT139M	0 to 70°C, -40 to 85, -55 to 125	16 Ld SOIC

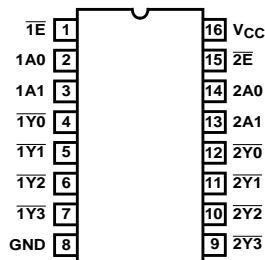
#### NOTES:

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

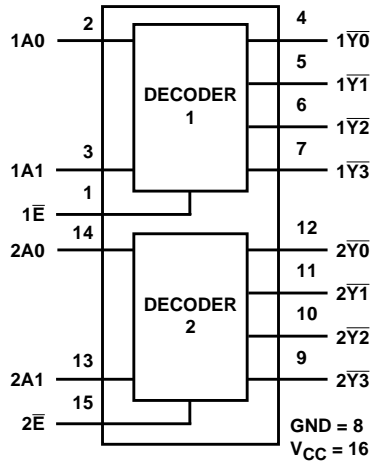
CD54AC139, CD54ACT139  
(CERDIP)

CD74AC139, CD74ACT139  
(PDIP, SOIC)  
TOP VIEW



CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper IC Handling Procedures.

**Functional Diagram**



**TRUTH TABLE**

INPUTS			OUTPUTS			
ENABLE	SELECT		$\overline{Y3}$	$\overline{Y2}$	$\overline{Y1}$	$\overline{Y0}$
$\overline{E}$	A1	A0				
L	L	L	H	H	H	L
L	L	H	H	H	L	H
L	H	L	H	L	H	H
L	H	H	L	H	H	H
H	X	X	H	H	H	H

X = Don't Care

## CD54/74AC139, CD54/74ACT139

### 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 .....	90
SOIC Package .....	160
Maximum Junction Temperature (Plastic Package) .....	$150^{\circ}C$
Maximum Storage Temperature Range .....	$-65^{\circ}C$ to $150^{\circ}C$
Maximum Lead Temperature (Soldering 10s) .....	$300^{\circ}C$

### Operating Conditions

Temperature Range, $T_A$ .....	$-55^{\circ}C$ to $125^{\circ}C$
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 $^{\circ}C$		-40 $^{\circ}C$ TO 85 $^{\circ}C$		-55 $^{\circ}C$ TO 125 $^{\circ}C$		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 (Note 6, 7)	5.5	-	-	3.85	-	-	-	V
-50 (Note 6, 7)	-50 (Note 6, 7)	5.5	-	-	-	-	3.85	-	V			

**CD54/74AC139, CD54/74ACT139**

**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
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
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.

**ACT Input Load Table**

INPUT	UNIT LOAD
A0, A1	1
$\bar{E}$	0.67

NOTE: Unit load is ΔI<sub>CC</sub> limit specified in DC Electrical Specifications Table, e.g., 2.4mA max at 25°C.

## CD54/74AC139, CD54/74ACT139

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

PARAMETER	SYMBOL	$V_{CC}$ (V)	-40°C TO 85°C			-55°C TO 125°C			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
<b>AC TYPES</b>									
Propagation Delay, A0, A1 to Outputs	$t_{PLH}$ , $t_{PHL}$	1.5	-	-	119	-	-	131	ns
		3.3 (Note 9)	3.9	-	13.4	3.7	-	14.7	ns
		5 (Note 10)	2.8	-	9.5	2.6	-	10.5	ns
Propagation Delay, $\bar{E}$ to Outputs	$t_{PLH}$ , $t_{PHL}$	1.5	-	-	119	-	-	131	ns
		3.1	3.9	-	13.4	3.7	-	14.7	ns
		5	2.8	-	9.5	2.6	-	10.5	ns
Input Capacitance	$C_I$	-	-	-	10	-	-	10	pF
Power Dissipation Capacitance	$C_{PD}$ (Note 11)	-	-	83	-	-	83	-	pF
<b>ACT TYPES</b>									
Propagation Delay, A0, A1 to Outputs	$t_{PLH}$ , $t_{PHL}$	5 (Note 10)	3.1	-	10.5	2.9	-	11.5	ns
Propagation Delay, $\bar{E}$ to Outputs	$t_{PLH}$ , $t_{PHL}$	5	3.2	-	10.9	3	-	12	ns
Input Capacitance	$C_I$	-	-	-	10	-	-	10	pF
Power Dissipation Capacitance	$C_{PD}$ (Note 11)	-	-	83	-	-	83	-	pF

**NOTES:**

8. Limits tested at 100%.
9. 3.3V Min at 3.6V, Max at 3V.
10. 5V Min at 5.5V, Max at 4.5V.
11.  $C_{PD}$  is used to determine the dynamic power consumption per decoder/demultiplexer.  
 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.

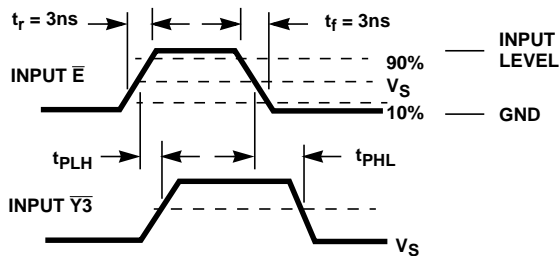


FIGURE 1.

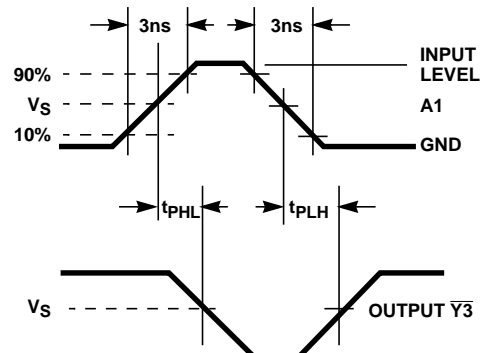
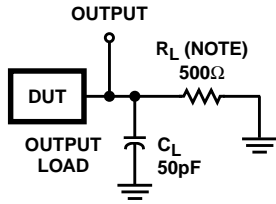


FIGURE 2.



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

## **IMPORTANT NOTICE**

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgment, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

Customers are responsible for their applications using TI components.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.