Dual 1-of-4 Decoder/Demultiplexer

74AC139, 74ACT139

General Description

The AC139/ACT139 is a high−speed, dual 1−of−4 decoder/demultiplexer. The device has two independent decoders, each accepting two inputs and providing four mutually−exclusive active − LOW outputs. Each decoder has an active−LOW Enable input which can be used as a data input for a 4−output demultiplexer. Each half of the AC/ACT139 can be used as a function generator providing all four minterms of two variables.

Features

- I_{CC} Reduced by 50%
- Multifunctional Capability
- Two Completely Independent 1−of−4 Decoders
- Active LOW Mutually Exclusive Outputs
- Outputs Source/Sink 24 mA
- ACT139 has TTL−Compatible Inputs
- These are Pb−Free Devices

PIN DESCRIPTIONS

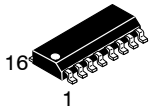
PIN	FUNCTION
A_0, A_1	Address Inputs
$\overline{E}$	Enable Inputs
$\overline{O}_0$–$\overline{O}_3$	Outputs

TRUTH TABLE

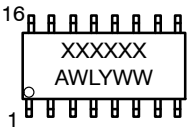
Inputs			Outputs			
E	A_0	A_1	$\overline{O}_0$	$\overline{O}_1$	$\overline{O}_2$	$\overline{O}_3$
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	H	L	H	L	H	H
L	L	H	H	H	L	H
L	H	H	H	H	H	L

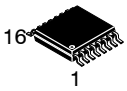
H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial

MARKING DIAGRAMS

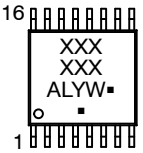


SOIC−16
CASE 751BG





TSSOP−16
CASE 948AH



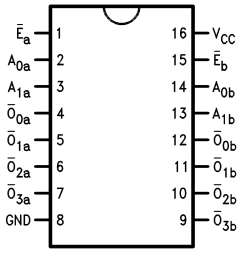
XXX = Specific Device Code
A = Assembly Location
WL or L = Wafer Lot
Y = Year
WW or W = Work Week
G or ▪ = Pb−Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

CONNECTION DIAGRAM



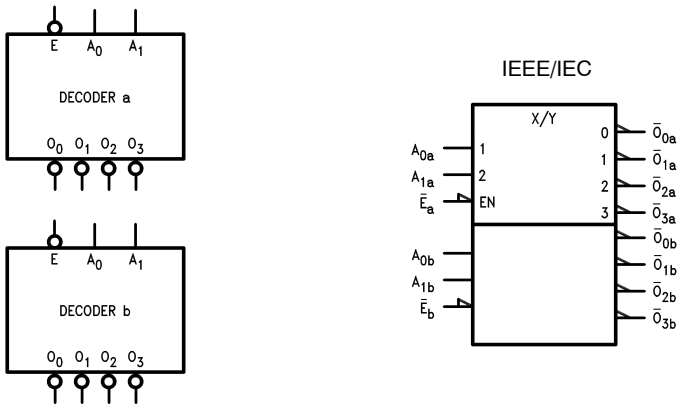
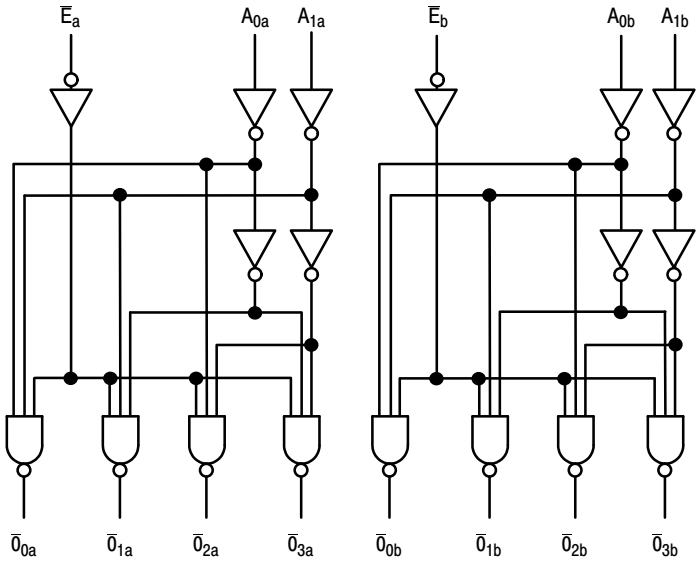


Figure 1. Logic Symbols



NOTE: This diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Figure 2. Logic Diagram

Functional Description

The AC139/ACT139 is a high−speed dual 1−of−4 decoder/demultiplexer. The device has two independent decoders, each of which accepts two binary weighted inputs (A_0−A_1) and provides four mutually exclusive active−LOW outputs ($\overline{O}_0$−$\overline{O}_3$). Each decoder has an active−LOW enable ($\overline{E}$). When $\overline{E}$ is HIGH all outputs are forced HIGH. The enable can be used as the data input for a 4−output demultiplexer application. Each half of the AC139/ACT139 generates all four minterms of two variables. These four minterms are useful in some applications, replacing multiple gate functions as shown in Figure 3, and thereby reducing the number of packages required in a logic network.

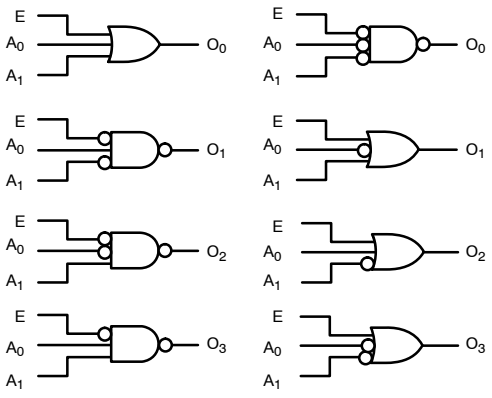


Figure 3. Gate Functions (Each Half)

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Rating	Unit
V_{CC}	Supply Voltage	−0.5 to +6.5	V
I_{IK}	DC Input Diode Current V_I = −0.5 V V_I = V_{CC} + 0.5 V	 −20 +20	mA
V_I	DC Input Voltage	−0.5 to V_{CC} + 0.5	V
I_{OK}	DC Output Diode Current V_O = −0.5 V V_O = V_{CC} + 0.5 V	 −20 +20	mA
V_O	DC Output Voltage	−0.5 to V_{CC} + 0.5	V
I_O	DC Output Source or Sink Current	±50	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current per Output Pin	±50	mA
T_{STG}	Storage Temperature	−65 to +150	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply Voltage AC ACT	 2.0 4.5	 6.0 5.5	V
V_I	Input Voltage	0	V_{CC}	V
V_O	Output Voltage	0	V_{CC}	V
T_A	Operating Temperature	−40	85	°C
$\Delta V/\Delta t$	Minimum Input Edge Rate, AC Devices: V_{IN} from 30% to 70% V_{CC}, V_{CC} @ 3.3 V, 4.5 V, 5.5 V	125		mV/ns
$\Delta V/\Delta t$	Minimum Input Edge Rate, ACT Devices: V_{IN} from 0.8 V to 2.0 V, V_{CC} @ 4.5 V, 5.5 V	125		mV/ns

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

DC ELECTRICAL CHARACTERISTICS FOR AC

Symbol	Parameter	V_{CC} (V)	Conditions	T_A = +25°C	T_A = −40°C to +85°C		Unit
				Typ	Guaranteed Limits		
V_{IH}	Minimum HIGH Level Input Voltage	3.0	V_{OUT} = 0.1 V or V_{CC} − 0.1 V	1.5	2.1	2.1	V
		4.5		2.25	3.15	3.15	
		5.5		2.75	3.85	3.85	
V_{IL}	Maximum LOW Level Input Voltage	3.0	V_{OUT} = 0.1 V or V_{CC} − 0.1 V	1.5	0.9	0.9	V
		4.5		2.25	1.35	1.35	
		5.5		2.75	1.65	1.65	
V_{OH}	Minimum HIGH Level Output Voltage	3.0	I_{OUT} = −50 μA	2.99	2.9	2.9	V
		4.5		4.49	4.4	4.4	
		5.5		5.49	5.4	5.4	
		3.0	V_{IN} = V_{IL} or V_{IH}, I_{OH} = −12 mA		2.56	2.46	
		4.5	V_{IN} = V_{IL} or V_{IH}, I_{OH} = −24 mA		3.86	3.76	
		5.5	V_{IN} = V_{IL} or V_{IH}, I_{OH} = −24 mA (Note 1)		4.86	4.76	
V_{OL}	Maximum LOW Level Output Voltage	3.0	I_{OUT} = 50 μA	0.002	0.1	0.1	V
		4.5		0.001	0.1	0.1	
		5.5		0.001	0.1	0.1	
		3.0	V_{IN} = V_{IL} or V_{IH}, I_{OL} = 12 mA		0.36	0.44	
		4.5	V_{IN} = V_{IL} or V_{IH}, I_{OL} = 24 mA		0.36	0.44	
		5.5	V_{IN} = V_{IL} or V_{IH}, I_{OL} = 24 mA (Note 1)		0.36	0.44	
I_{IN} (Note 2)	Maximum Input Leakage Current	5.5	V_I = V_{CC}, GND		±0.1	±1.0	μA
I_{OLD}	Minimum Dynamic Output Current (Note 3)	5.5	V_{OLD} = 1.65 V Max			75	mA
I_{OHD}		5.5	V_{OHD} = 3.85 V Min			−75	mA
I_{CC} (Note 2)	Maximum Quiescent Supply Current	5.5	V_{IN} = V_{CC} or GND		4.0	40.0	μA

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

1. All outputs loaded; thresholds on input associated with output under test.
2. I_{IN} and I_{CC} @ 3.0 V are guaranteed to be less than or equal to the respective limit @ 5.5 V V_{CC}.
3. Maximum test duration 2.0 ms, one output loaded at a time.

DC ELECTRICAL CHARACTERISTICS FOR ACT

Symbol	Parameter	V_{CC} (V)	Conditions	T_A = +25°C	T_A = −40°C to +85°C		Unit
				Typ	Guaranteed Limits		
V_{IH}	Minimum HIGH Level Input Voltage	4.5	V_{OUT} = 0.1 V or V_{CC} − 0.1 V	1.5	2.0	2.0	V
		5.5		1.5	2.0	2.0	
V_{IL}	Maximum LOW Level Input Voltage	4.5	V_{OUT} = 0.1 V or V_{CC} − 0.1 V	1.5	0.8	0.8	V
		5.5		1.5	0.8	0.8	
V_{OH}	Minimum HIGH Level Output Voltage	4.5	I_{OUT} = −50 μA	4.49	4.4	4.4	V
		5.5		5.49	5.4	5.4	
		4.5	V_{IN} = V_{IL} or V_{IH}, I_{OH} = −24 mA		3.86	3.76	
		5.5	V_{IN} = V_{IL} or V_{IH}, I_{OH} = −24 mA (Note 4)		4.86	4.76	
V_{OL}	Maximum LOW Level Output Voltage	4.5	I_{OUT} = 50 μA	0.001	0.1	0.1	V
		5.5		0.001	0.1	0.1	
		4.5	V_{IN} = V_{IL} or V_{IH}, I_{OL} = 24 mA		0.36	0.44	
		5.5	V_{IN} = V_{IL} or V_{IH}, I_{OL} = 24 mA (Note 4)		0.36	0.44	
I_{IN}	Maximum Input Leakage Current	5.5	V_I = V_{CC}, GND		±0.1	±1.0	μA
I_{CCT}	Maximum I_{CC}/Input	5.5	V_I = V_{CC} − 2.1 V	0.6		1.5	mA
I_{OLD}	Minimum Dynamic Output Current (Note 5)	5.5	V_{OLD} = 1.65 V Max			75	mA
I_{OHD}		5.5	V_{OHD} = 3.85 V Min			−75	mA
I_{CC}	Maximum Quiescent Supply Current	5.5	V_{IN} = V_{CC} or GND		4.0	40.0	μA

4. All outputs loaded; thresholds on input associated with output under test.
5. Maximum test duration 2.0 ms, one output loaded at a time.

AC ELECTRICAL CHARACTERISTICS FOR AC

Symbol	Parameter	V_{CC} (V) (Note 6)	T_A = +25°C, C_L = 50 pF			T_A = −40°C to +85°C, C_L = 50 pF		Unit
			Min	Typ	Max	Min	Max	
t_{PLH}	Propagation Delay, A_n to $\overline{O}_n$	3.3	4.0	8.0	11.5	3.5	13.0	ns
		5.0	3.0	6.5	8.5	2.5	9.5	
t_{PHL}	Propagation Delay, A_n to $\overline{O}_n$	3.3	3.0	7.0	10.0	2.5	11.0	ns
		5.0	2.5	5.5	7.5	2.0	8.5	
t_{PLH}	Propagation Delay, $\overline{E}_n$ to $\overline{O}_n$	3.3	4.5	9.5	12.0	3.5	13.0	ns
		5.0	3.5	7.0	8.5	3.0	10.0	
t_{PHL}	Propagation Delay, $\overline{E}_n$ to $\overline{O}_n$	3.3	4.0	8.0	10.0	3.0	11.0	ns
		5.0	2.5	6.0	7.5	2.5	8.5	

6. Voltage range 3.3 is 3.3 V ± 0.3 V.
   Voltage range 5.0 is 5.0 V ± 0.5 V.

AC ELECTRICAL CHARACTERISTICS FOR ACT

Symbol	Parameter	V_{CC} (V) (Note 7)	T_A = +25°C, C_L = 50 pF			T_A = −40°C to +85°C, C_L = 50 pF		Unit
			Min	Typ	Max	Min	Max	
t_{PLH}	Propagation Delay, A_n to $\overline{O}_n$	5.0	1.5	6.0	8.5	1.5	9.5	ns
t_{PHL}	Propagation Delay, A_n to $\overline{O}_n$	5.0	1.5	6.0	9.5	1.5	10.5	ns
t_{PLH}	Propagation Delay, $\overline{E}_n$ to $\overline{O}_n$	5.0	2.5	7.0	10.0	2.0	11.0	ns
t_{PHL}	Propagation Delay, $\overline{E}_n$ to $\overline{O}_n$	5.0	2.5	7.0	9.5	1.5	10.5	ns

7. Voltage range 5.0 is 5.0 V ± 0.5 V.

CAPACITANCE

Symbol	Parameter	Conditions	Typ	Unit
C_{IN}	Input Capacitance	V_{CC} = OPEN	4.5	pF
C_{PD}	Power Dissipation Capacitance	V_{CC} = 5.0 V	40.0	pF

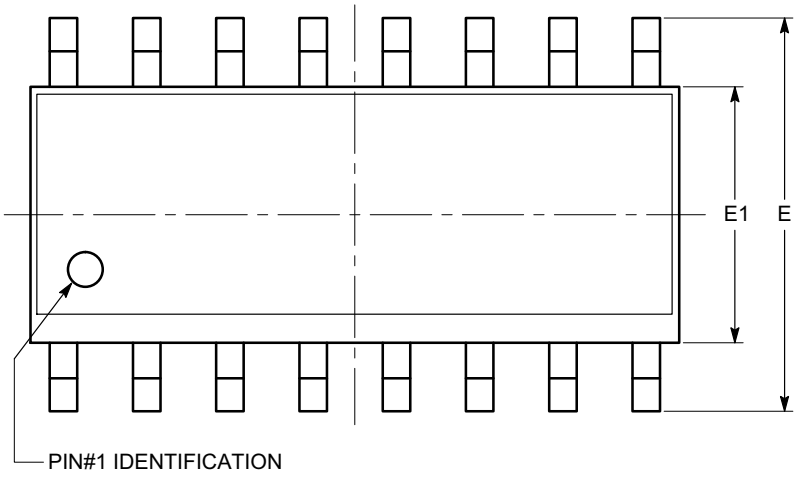
ORDERING INFORMATION

Device	Marking	Package	Shipping†
74AC139MTCX	AC 139	TSSOP−16 (Pb−Free)	2500 / Tape & Reel
74AC139SCX	AC139	SOIC−16 (Pb−Free)	2500 / Tape & Reel
74ACT139MTCX	ACT 139	TSSOP−16 (Pb−Free)	2500 / Tape & Reel
74ACT139SCX	ACT139	SOIC−16 (Pb−Free)	2500 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

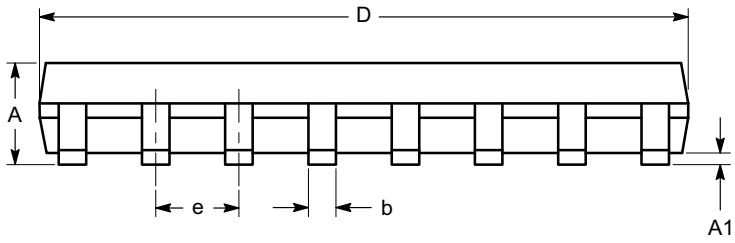
SOIC−16, 150 mils
CASE 751BG
ISSUE O

DATE 19 DEC 2008

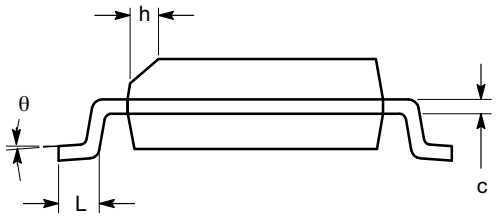


TOP VIEW

SYMBOL	MIN	NOM	MAX
A	1.35		1.75
A1	0.10		0.25
b	0.33		0.51
c	0.19		0.25
D	9.80	9.90	10.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27 BSC		
h	0.25		0.50
L	0.40		1.27
θ	0º		8º



SIDE VIEW



END VIEW

Notes:
(1) All dimensions are in millimeters. Angles in degrees.
(2) Complies with JEDEC MS-012.

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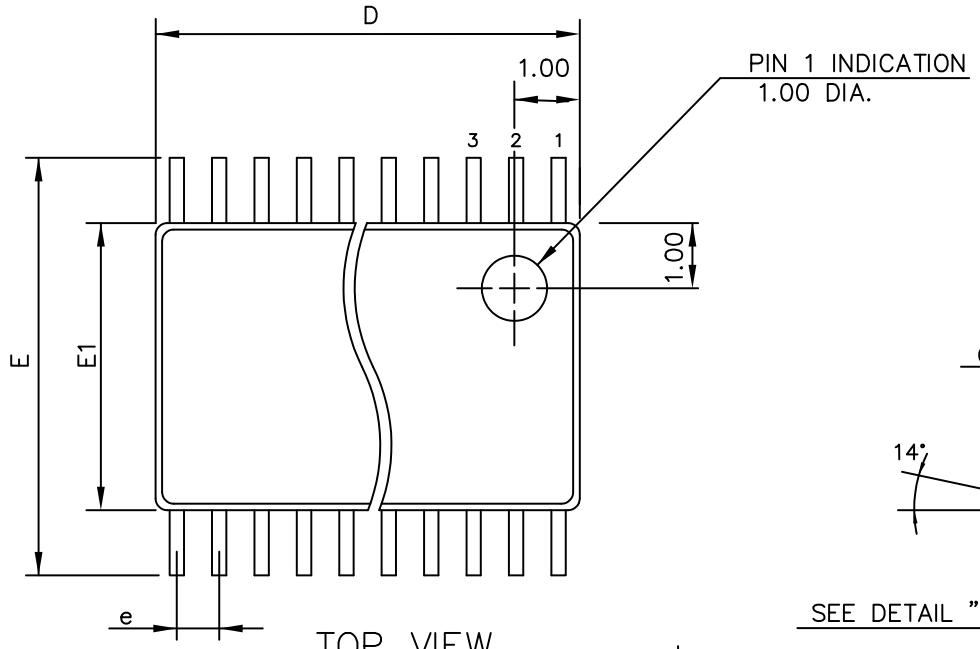
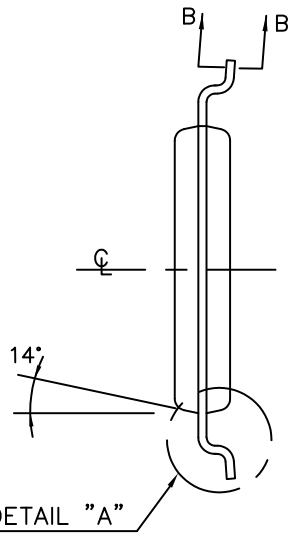


TOP VIEW



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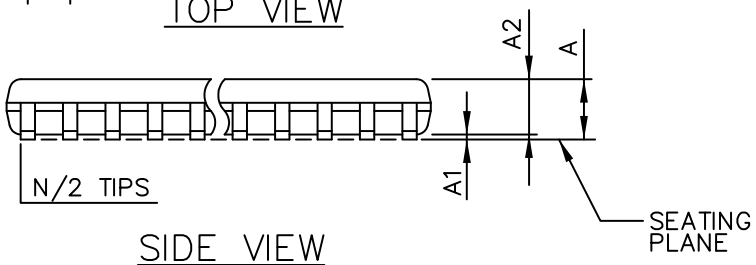

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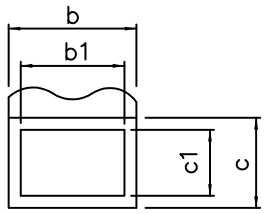
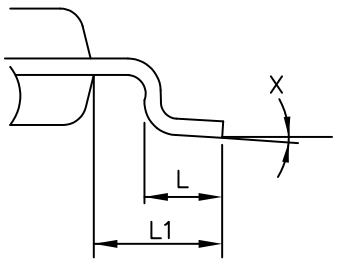


SECTION "B–B"

THIS TABLE FOR 0.65mm PITCH

SYMBOL	COMMON DIMENSIONS		
	MIN.	NOM.	MAX.
A	——	——	1.10
A_1	0.05	——	0.15
A_2	0.85	0.90	0.95
b	0.19	–	0.30
b1	0.19	0.22	0.25
c	0.09	–	0.20
c1	0.09	0.127	0.16
D	SEE VARIATIONS		
E1	4.30	4.40	4.50
e	0.65 BSC		
E	6.40 BSC		
L	0.50	0.60	0.70
L1	1.00 REF		
N	SEE VARIATIONS		
X	0°	——	8°

NOTE VARIATIONS	D	N
AA/AAT	3.00 BSC	8
AB–1/ABT	5.00 BSC	14
AB/ABT	5.00 BSC	16
AD/ADT	7.80 BSC	24



DETAIL 'A'

ALL DIMENSIONS IN MILLIMETERS

MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15mm ON D PER SIDE

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