Dual 1-of-4 Decoder/Demultiplexer

The MC74AC139/74ACT139 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 MC74AC139/74ACT139 can be used as a function generator providing four minterms of two variables.

Features

- 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

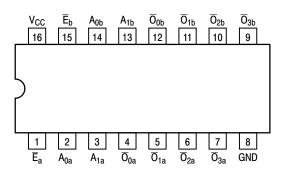


Figure 1. Pinout: 16–Lead Packages Conductors (Top View)

PIN ASSIGNMENT

PIN	FUNCTION
A ₀ , A ₁	Address Inputs
Ē	Enable Inputs
$\overline{O}_0 - \overline{O}_3$	Outputs

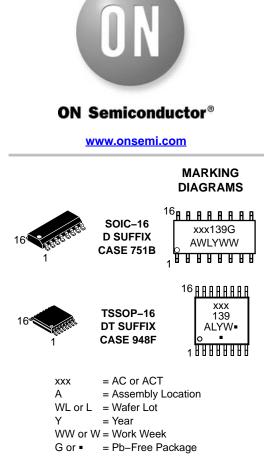
TRUTH TABLE

I	nputs	;		Ou	tputs	
Ē	A ₀	A ₁	\overline{O}_0	\overline{O}_1	\overline{O}_2	\overline{O}_3
н	Х	Х	Н	Н	Н	Н
L	L	L	L	Н	н	н
L	Н	L	н	L	н	Н
L	L	Н	Н	Н	L	Н
L	н	Н	Н	Н	Н	L

H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial



(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

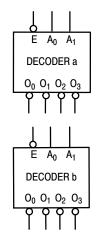
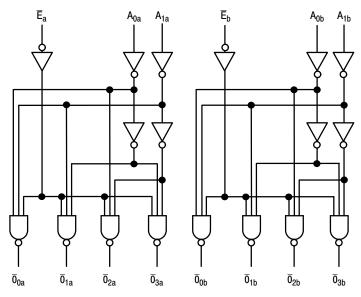
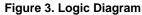


Figure 2. Logic Symbol



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



FUNCTIONAL DESCRIPTION

The MC74AC139/74ACT139 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 MC74AC139/74ACT139 generates all four minterms of two variables. These four minterms are useful in some applications, replacing multiple gate functions as shown in Figure 4, and thereby reducing the number of packages required in a logic network.

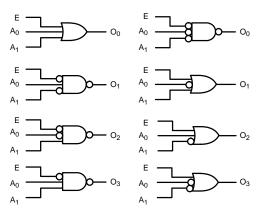


Figure 4. Gate Functions (Each Half)

MAXIMUM RATINGS

Symbol	Parameter		Value	Unit
V _{CC}	DC Supply Voltage		-0.5 to +7.0	V
VI	DC Input Voltage		$-0.5 \leq V_I \leq V_{CC} + 0.5$	V
Vo	DC Output Voltage	(Note 1)	$-0.5 \leq V_O \leq V_{CC} + 0.5$	V
I _{IK}	DC Input Diode Current		±20	mA
I _{OK}	DC Output Diode Current		±50	mA
I _O	DC Output Sink/Source Current		±50	mA
I _{CC}	DC Supply Current per Output Pin		±50	mA
I _{GND}	DC Ground Current per Output Pin		±50	mA
T _{STG}	Storage Temperature Range		-65 to +150	°C
TL	Lead temperature, 1 mm from Case for 10 Seconds		260	°C
TJ	Junction temperature under Bias		+ 150	°C
θ_{JA}	Thermal Resistance (Note 2)	SOIC TSSOP	69.1 103.8	°C/W
P _D	Power Dissipation in Still Air at 65°C (Note 3)	SOIC TSSOP	500 500	mW
MSL	Moisture Sensitivity		Level 1	
F _R	Flammability Rating Oxygen	Index: 30% – 35%	UL 94 V-0 @ 0.125 in	
V _{ESD}	Mach	dy Model (Note 4) ine Model (Note 5) ice Model (Note 6)	> 2000 > 200 > 1000	V
I _{Latch-Up}	Latch–Up Performance Above V _{CC} and Below GN	D at 85°C (Note 7)	±100	mA

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.

1. I_O absolute maximum rating must be observed.

2. The package thermal impedance is calculated in accordance with JESD51-7.

3. 500 mW at 65°C; derate to 300 mW by 10 mW/ from 65°C to 85°C.

4. Tested to EIA/JESD22-A114-A.

5. Tested to EIA/JESD22-A115-A.

6. Tested to JESD22-C101-A.

7. Tested to EIA/JESD78.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter			Тур	Max	Unit
、 <i>,</i>		′AC	2.0	5.0	6.0	
V _{CC}	Supply Voltage	ΆCΤ	4.5	5.0	5.5	V
V _{IN} , V _{OUT}	DC Input Voltage, Output Voltage (Ref. to GND)		0	_	V _{CC}	V
		V _{CC} @ 3.0 V	-	150	-	
t _r , t _f Input Rise and Fall Time (Note 1) 'AC Devices except Schmitt Inputs	V _{CC} @ 4.5 V	-	40	-	ns/V	
		V _{CC} @ 5.5 V	-	25	-	
	Input Rise and Fall Time (Note 2)	V _{CC} @ 4.5 V	-	10	-	20/1
t _r , t _f	'ACT Devices except Schmitt Inputs	V _{CC} @ 5.5 V	-	8.0	-	ns/V
TJ	Junction Temperature (PDIP)	•	_	_	140	°C
T _A	Operating Ambient Temperature Range			25	85	°C
I _{OH}	Output Current – High		-	-	-24	mA
I _{OL}	Output Current – Low			_	24	mA

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.

1. V_{IN} from 30% to 70% V_{CC} ; see individual Data Sheets for devices that differ from the typical input rise and fall times. 2. V_{IN} from 0.8 V to 2.0 V; see individual Data Sheets for devices that differ from the typical input rise and fall times.

DC CHARACTERISTICS

			74	AC	74AC		
		V _{cc}	T _A = -	⊦25°C	T _A = –40°C to +85°C		
Symbol	Parameter	(V)	Тур	Gua	aranteed Limits	Unit	Conditions
V _{IH}	Minimum High Level Input Voltage	3.0 4.5 5.5	1.5 2.25 2.75	2.1 3.15 3.85	2.1 3.15 3.85	V	$V_{OUT} = 0.1 V$ or $V_{CC} - 0.1 V$
V _{IL}	Maximum Low Level Input Voltage	3.0 4.5 5.5	1.5 2.25 2.75	0.9 1.35 1.65	0.9 1.35 1.65	V	$V_{OUT} = 0.1 V$ or $V_{CC} - 0.1 V$
V _{OH}	Minimum High Level Output Voltage	3.0 4.5 5.5	2.99 4.49 5.49	2.9 4.4 5.4	2.9 4.4 5.4	V	I _{OUT} = -50 μA
		3.0 4.5 5.5	- - -	2.56 3.86 4.86	2.46 3.76 4.76	V	$V_{IN} = V_{IL} \text{ or } V_{IH}$ -12 mA I_{OH} -24 mA -24 mA
V _{OL}	Maximum Low Level Output Voltage	3.0 4.5 5.5	0.002 0.001 0.001	0.1 0.1 0.1	0.1 0.1 0.1	V	I _{OUT} = 50 μA
		3.0 4.5 5.5	- - -	0.36 0.36 0.36	0.44 0.44 0.44	V	$V_{IN} = V_{IL} \text{ or } V_{IH}$ 12 mA I_{OL} 24 mA 24 mA
I _{IN}	Maximum Input Leakage Current	5.5	-	±0.1	±1.0	μΑ	$V_I = V_{CC}, GND$
I _{OLD}	†Minimum Dynamic	5.5	-	-	75	mA	V _{OLD} = 1.65 V Max
I _{OHD}	Output Current	5.5	-	-	-75	mA	V _{OHD} = 3.85 V Min
I _{CC}	Maximum Quiescent Supply Current	5.5	-	8.0	80	μΑ	$V_{IN} = V_{CC}$ or GND

*All outputs loaded; thresholds on input associated with output under test.

†Maximum test duration 2.0 ms, one output loaded at a time.

NOTE: 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}.

AC CHARACTERISTICS

				74AC		74/	AC		
		V _{CC} *		_A = +25° C _L = 50 p		T _A = -40°C C _L = \$			Fig.
Symbol	Parameter	(V)	Min	Тур	Max	Min	Max	Unit	No.
t _{PLH}	Propagation Delay A_n to \overline{O}_n	3.3 5.0	4.0 3.0	8.0 6.5	11.5 8.5	3.5 2.5	13 9.5	ns	3–6
t _{PHL}	Propagation Delay A _n to Ō _n	3.3 5.0	3.0 2.5	7.0 5.5	10 7.5	2.5 2.0	11 8.5	ns	3–6
t _{PLH}	Propagation Delay \overline{E}_n to \overline{O}_n	3.3 5.0	4.5 3.5	9.5 7.0	12 8.5	3.5 3.0	13 10	ns	3–6
t _{PHL}	Propagation Delay \overline{E}_n to \overline{O}_n	3.3 5.0	4.0 2.5	8.0 6.0	10 7.5	3.0 2.5	11 8.5	ns	3–6

*Voltage Range 3.3 V is 3.3 V ± 0.3 V. *Voltage Range 5.0 V is 5.0 V ± 0.5 V.

DC CHARACTERISTICS

			74 <i>A</i>	СТ	74ACT		
		V _{cc}	T _A = -	+25°C	T _A = –40°C to +85°C		
Symbol	Parameter	(V)	Тур	Gua	ranteed Limits	Unit	Conditions
V _{IH}	Minimum High Level Input Voltage	4.5 5.5	1.5 1.5	2.0 2.0	2.0 2.0	V	$V_{OUT} = 0.1 V$ or $V_{CC} - 0.1 V$
V _{IL}	Maximum Low Level Input Voltage	4.5 5.5	1.5 1.5	0.8 0.8	0.8 0.8	V	$V_{OUT} = 0.1 V$ or $V_{CC} - 0.1 V$
V _{OH}	Minimum High Level Output Voltage	4.5 5.5	4.49 5.49	4.4 5.4	4.4 5.4	V	I _{OUT} = -50 μA
		4.5 5.5		3.86 4.86	3.76 4.76	V	$V_{IN} = V_{IL} \text{ or } V_{IH}$ -24 mA I_{OH} -24 mA
V _{OL}	Maximum Low Level Output Voltage	4.5 5.5	0.001 0.001	0.1 0.1	0.1 0.1	V	l _{OUT} = 50 μA
		4.5 5.5		0.36 0.36	0.44 0.44	V	$V_{IN} = V_{IL} \text{ or } V_{IH}$ 24 mA I_{OL} 24 mA
I _{IN}	Maximum Input Leakage Current	5.5	_	±0.1	±1.0	μΑ	$V_{I} = V_{CC}, GND$
ΔI_{CCT}	Additional Max. I _{CC} /Input	5.5	0.6	-	1.5	mA	$V_{I} = V_{CC} - 2.1 V$
I _{OLD}	†Minimum Dynamic	5.5	-	-	75	mA	V_{OLD} = 1.65 V Max
I _{OHD}	Output Current	5.5	-	-	-75	mA	V _{OHD} = 3.85 V Min
I _{CC}	Maximum Quiescent Supply Current	5.5	_	8.0	80	μΑ	$V_{IN} = V_{CC}$ or GND

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

AC CHARACTERISTICS

				74ACT		74A	СТ		
		v _{cc*}	T, C	₄ = +25° ₁_ = 50 p	ЧС	T _A = -40°C C _L = 5			Fig.
Symbol	Parameter	(V)	Min	Тур	Max	Min	Max	Unit	No.
t _{PLH}	Propagation Delay A_n to \overline{O}_n	5.0	1.5	6.0	8.5	1.5	9.5	ns	3–6
t _{PHL}	Propagation Delay A_n to \overline{O}_n	5.0	1.5	6.0	9.5	1.5	10.5	ns	3–6
t _{PLH}	Propagation Delay \overline{E}_n to \overline{O}_n	5.0	2.5	7.0	10.0	2.0	11.0	ns	3–6
t _{PHL}	Propagation Delay \overline{E}_n to \overline{O}_n	5.0	2.0	7.0	9.5	1.5	10.5	ns	3–6

*Voltage Range 5.0 V is 5.0 V ± 0.5 V.

CAPACITANCE

Symbol	Parameter	Value Typ	Unit	Test Conditions
C _{IN}	Input Capacitance	4.5	pF	$V_{CC} = 5.0 V$
C _{PD}	Power Dissipation Capacitance	40	pF	$V_{CC} = 5.0 V$

ORDERING INFORMATION

Device Order Number	Package	Shipping [†]
MC74AC139DG	SOIC-16 (Pb-Free)	48 Units / Rail
MC74AC139DR2G	SOIC-16 (Pb-Free)	2500 Tape & Reel
MC74AC139DTR2G	TSSOP-16 (Pb-Free)	2500 Tape & Reel
MC74ACT139DG	SOIC-16 (Pb-Free)	48 Units / Rail
MC74ACT139DR2G	SOIC-16 (Pb-Free)	2500 Tape & Reel
MC74ACT139DTR2G	TSSOP-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.



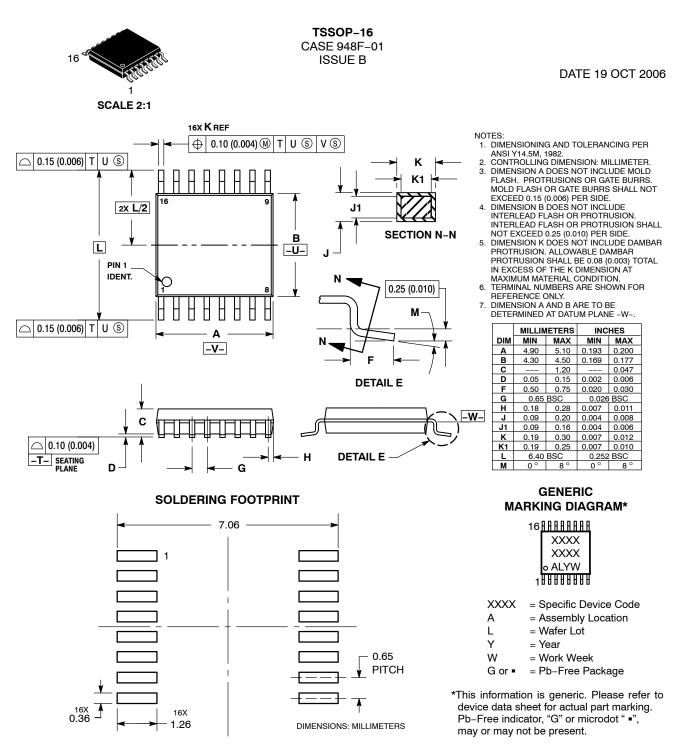


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