

# DATA SHEET

**74ALS139**

Dual 1-of-4 decoder/demultiplexer

Product specification

1991 Feb 08

IC05 Data Handbook

# Dual 1-of-4 decoder/demultiplexer

# 74ALS139

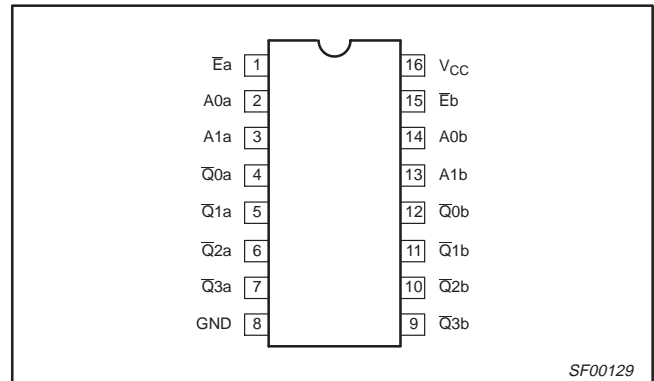
## FEATURES

- Demultiplexing capability
- Two independent 1-of-4 decoders
- Multi-function capability

## DESCRIPTION

The 74ALS139 is a dual 1-of-4 decoder/demultiplexer. This device has two independent decoders, each accepting two binary weighted inputs ( $A_{0n}$ ,  $A_{1n}$ ) and providing four mutually exclusive active-Low outputs ( $\bar{Q}_{0n}$ – $\bar{Q}_{3n}$ ). Each decoder has an active-Low enable ( $\bar{E}$ ). When  $\bar{E}$  is High, every output is forced High. The enable can be used as the data input for a 1-of-4 demultiplexer application.

## PIN CONFIGURATION



SF00129

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
74ALS139	6.0ns	4mA

## ORDERING INFORMATION

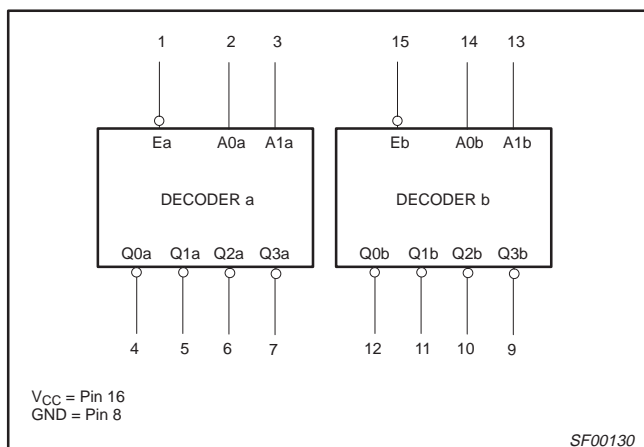
DESCRIPTION	ORDER CODE	DRAWING NUMBER
	COMMERCIAL RANGE $V_{CC} = 5V \pm 10\%$ , $T_{amb} = 0^{\circ}C$ to $+70^{\circ}C$	
16-pin plastic DIP	74ALS139N	SOT38-4
16-pin plastic SO	74ALS139D	SOT109-1

## INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

PINS	DESCRIPTION	74ALS (U.L.) HIGH/LOW	LOAD VALUE HIGH/LOW
$A_{0n}$ , $A_{1n}$	Address inputs	1.0/1.0	20 $\mu$ A/0.1mA
$\bar{E}_a$ , $\bar{E}_b$	Enable inputs (active-Low)	1.0/1.0	20 $\mu$ A/0.1mA
$\bar{Q}_{0n}$ , $\bar{Q}_{1n}$	Data outputs	20/80	0.4mA/8mA

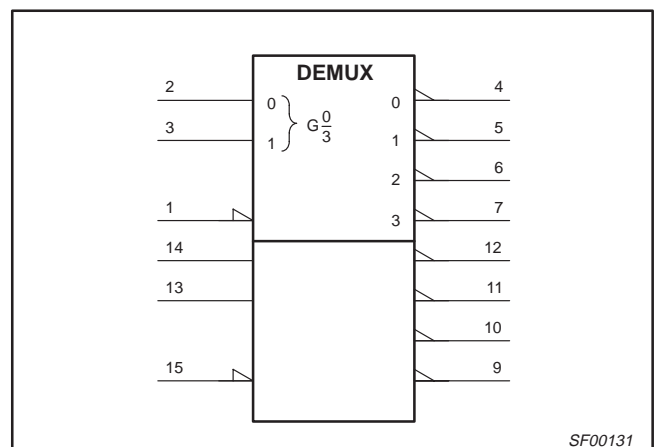
**NOTE:** One (1.0) ALS unit load is defined as: 20 $\mu$ A in the High state and 0.1mA in the Low state.

## LOGIC SYMBOL



SF00130

## IEC/IEEE SYMBOL

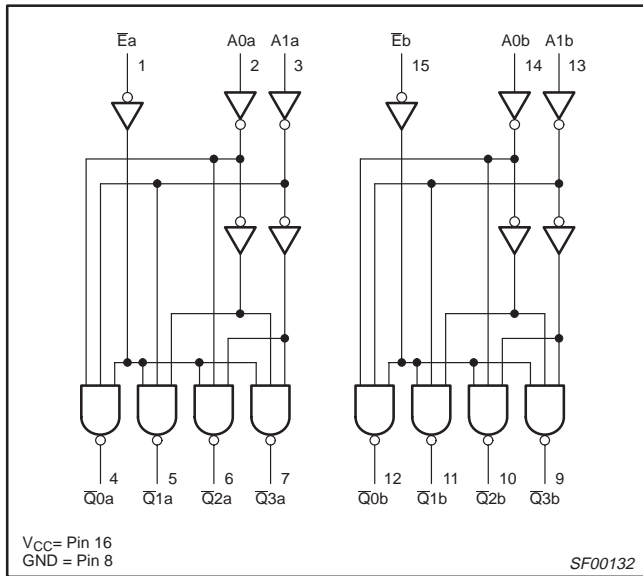


SF00131

# Dual 1-of-4 decoder/demultiplexer

# 74ALS139

## LOGIC DIAGRAM



## FUNCTION TABLE

INPUTS			OUTPUTS			
$\bar{E}$	A0	A1	$\bar{Q}0$	$\bar{Q}1$	$\bar{Q}2$	$\bar{Q}3$
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 = Don't care

## ABSOLUTE MAXIMUM RATINGS

(Operation beyond the limit set forth in this table may impair the useful life of the device. Unless otherwise noted these limits are over the operating free-air temperature range.)

SYMBOL	PARAMETER	RATING	UNIT
$V_{CC}$	Supply voltage	-0.5 to +7.0	V
$V_{IN}$	Input voltage	-0.5 to +7.0	V
$I_{IN}$	Input current	-30 to +5	mA
$V_{OUT}$	Voltage applied to output in High output state	-0.5 to $V_{CC}$	V
$I_{OUT}$	Current applied to output in Low output state	16	mA
$T_{amb}$	Operating free-air temperature range	0 to +70	°C
$T_{stg}$	Storage temperature range	-65 to +150	°C

## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	LIMITS			UNIT
		MIN	NOM	MAX	
$V_{CC}$	Supply voltage	4.5	5.0	5.5	V
$V_{IH}$	High-level input voltage	2.0			V
$V_{IL}$	Low-level input voltage			0.8	V
$I_{IK}$	Input clamp current			-18	mA
$I_{OH}$	High-level output current			-0.4	mA
$I_{OL}$	Low-level output current			8	mA
$T_{amb}$	Operating free-air temperature range	0		+70	°C

# Dual 1-of-4 decoder/demultiplexer

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## DC ELECTRICAL CHARACTERISTICS

(Over recommended operating free-air temperature range unless otherwise noted.)

SYMBOL	PARAMETER	TEST CONDITIONS <sup>1</sup>	LIMITS			UNIT
			MIN	TYP <sup>2</sup>	MAX	
V <sub>OH</sub>	High-level output voltage	V <sub>CC</sub> ±10%, V <sub>IL</sub> = MAX, V <sub>IH</sub> = MIN, I <sub>OH</sub> = -0.4mA	V <sub>CC</sub> - 2			V
V <sub>OL</sub>	Low-level output voltage	V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>IH</sub> = MIN	I <sub>OL</sub> = 4mA	0.25	0.40	V
			I <sub>OL</sub> = 8mA	0.35	0.50	V
V <sub>IK</sub>	Input clamp voltage	V <sub>CC</sub> = MIN, I <sub>I</sub> = I <sub>IK</sub>		-0.73	-1.5	V
I <sub>I</sub>	Input current at maximum input voltage	V <sub>CC</sub> = MAX, V <sub>I</sub> = 7.0V			0.1	mA
I <sub>IH</sub>	High-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7V			20	µA
I <sub>IL</sub>	Low-level input current	V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5V			-0.1	mA
I <sub>O</sub>	Output current <sup>3</sup>	V <sub>CC</sub> = MAX, V <sub>O</sub> = 2.25V	-30		-112	mA
I <sub>CC</sub>	Supply current (total)	V <sub>CC</sub> = MAX		4.0	7.0	mA

### NOTES:

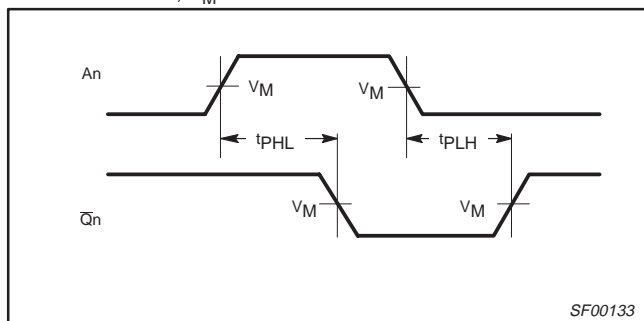
1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
2. All typical values are at V<sub>CC</sub> = 5V, T<sub>amb</sub> = 25°C.
3. The output conditions have been chosen to produce a current that closely approximate one half of the true short-circuit output current, I<sub>OS</sub>.

## AC ELECTRICAL CHARACTERISTICS

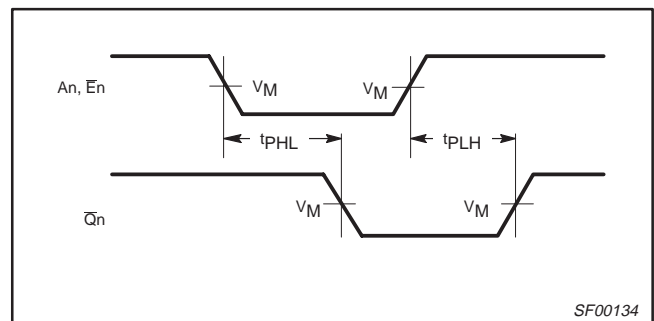
SYMBOL	PARAMETER	TEST CONDITION	LIMITS		UNIT
			T <sub>amb</sub> = 0°C to +70°C V <sub>CC</sub> = +5.0V ± 10% C <sub>L</sub> = 50pF, R <sub>L</sub> = 500Ω		
			MIN	MAX	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay An to Q <sub>n</sub>	Waveform 1, 2	3.0 3.0	10.0 12.0	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay Ēn to Q <sub>n</sub>	Waveform 2	3.0 3.0	8.0 8.0	ns

## AC WAVEFORMS

For all waveforms, V<sub>M</sub> = 1.3V.



Waveform 1. Propagation Delay for Inverting Outputs

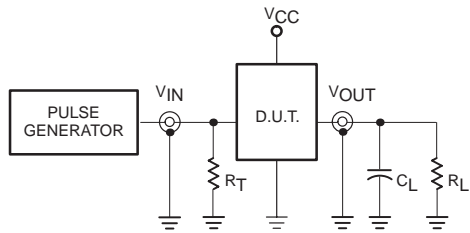


Waveform 2. Propagation Delay for Non-inverting Outputs

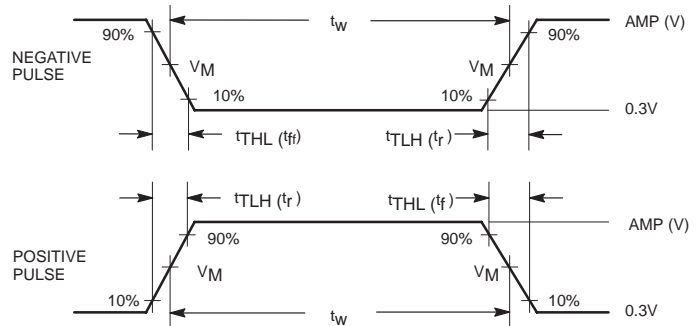
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## TEST CIRCUIT AND WAVEFORMS



**Test Circuit for Totem-pole Outputs**



**Input Pulse Definition**

**DEFINITIONS:**

- $R_L$  = Load resistor; see AC electrical characteristics for value.
- $C_L$  = Load capacitance includes jig and probe capacitance; see AC electrical characteristics for value.
- $R_T$  = Termination resistance should be equal to  $Z_{OUT}$  of pulse generators.

Family	INPUT PULSE REQUIREMENTS					
	Amplitude	$V_M$	Rep.Rate	$t_w$	$t_{TLH}$	$t_{THL}$
74ALS	3.5V	1.3V	1MHz	500ns	2.0ns	2.0ns

SC00005

# Dual 1-of-4 decoder/demultiplexer

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**DIP16: plastic dual in-line package; 16 leads (300 mil)**

**SOT38-4**



**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

UNIT	A max.	A <sub>1</sub> min.	A <sub>2</sub> max.	b	b <sub>1</sub>	b <sub>2</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	L	M <sub>E</sub>	M <sub>H</sub>	w	Z <sup>(1)</sup> max.
mm	4.2	0.51	3.2	1.73 1.30	0.53 0.38	1.25 0.85	0.36 0.23	19.50 18.55	6.48 6.20	2.54	7.62	3.60 3.05	8.25 7.80	10.0 8.3	0.254	0.76
inches	0.17	0.020	0.13	0.068 0.051	0.021 0.015	0.049 0.033	0.014 0.009	0.77 0.73	0.26 0.24	0.10	0.30	0.14 0.12	0.32 0.31	0.39 0.33	0.01	0.030

**Note**

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

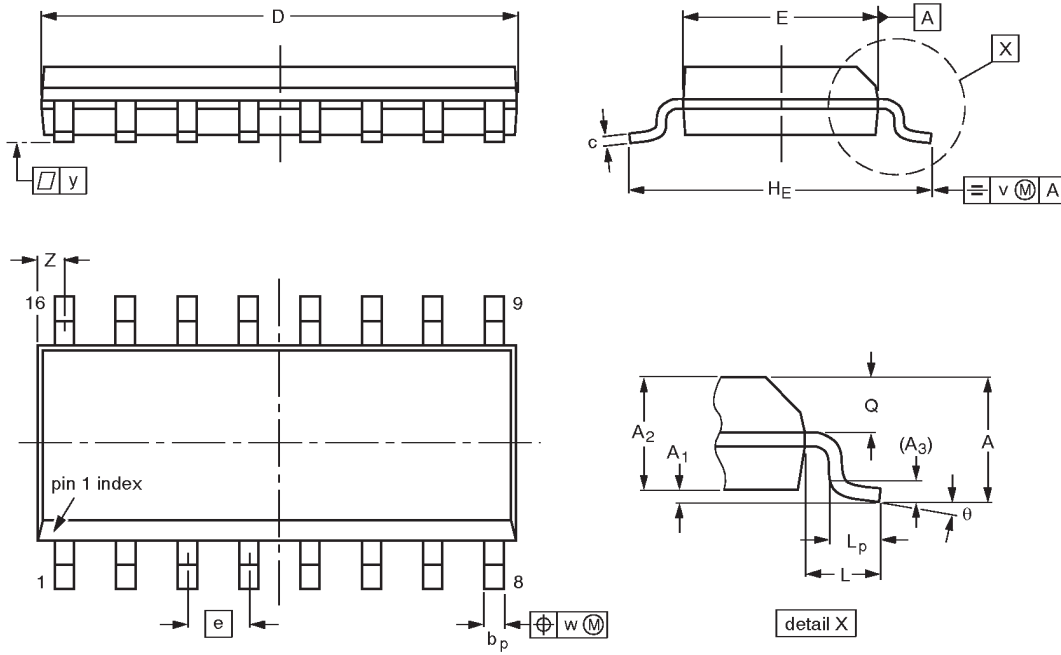
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT38-4						-92-11-17 95-01-14

# Dual 1-of-4 decoder/demultiplexer

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**SO16: plastic small outline package; 16 leads; body width 3.9 mm**

**SOT109-1**



**DIMENSIONS (inch dimensions are derived from the original mm dimensions)**

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>E</sub>	L	L <sub>p</sub>	Q	v	w	y	z <sup>(1)</sup>	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.0098 0.0039	0.057 0.049	0.01	0.019 0.014	0.0098 0.0075	0.39 0.38	0.16 0.15	0.050	0.24 0.23	0.041	0.039 0.016	0.028 0.020	0.01	0.01	0.004	0.028 0.012	

**Note**

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT109-1	076E07S	MS-012AC				91-08-13 95-01-23

## Dual 1-of-4 decoder/demultiplexer

74ALS139

## DEFINITIONS

Data Sheet Identification	Product Status	Definition
<i>Objective Specification</i>	<b>Formative or in Design</b>	This data sheet contains the design target or goal specifications for product development. Specifications may change in any manner without notice.
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