

# 74LS139, S139

## Decoders/Demultiplexers

Dual 1-of-4 Decoder/Demultiplexer  
Product Specification

### Logic Products

#### FEATURES

- Demultiplexing capability
- Two independent 1-of-4 decoders
- Multifunction capability
- Replaces 9321 and 93L21 for higher performance

#### DESCRIPTION

The '139 is a high-speed, dual 1-of-4 decoder/demultiplexer. This device has two independent decoders, each accepting two binary weighted inputs ( $A_0$ ,  $A_1$ ) and providing four mutually exclusive active LOW outputs ( $\bar{0}$  -  $\bar{3}$ ). 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.

TYPE	TYPICAL PROPAGATION DELAY (ENABLE AT 2 LOGIC LEVELS)	TYPICAL SUPPLY CURRENT (TOTAL)
74LS139	19ns	6.8mA
74S139	6ns	60mA

#### ORDERING CODE

PACKAGES	COMMERCIAL RANGE $V_{CC} = 5V \pm 5\%$ ; $T_A = 0^\circ C$ to $+70^\circ C$
Plastic DIP	N74S139N, N74LS139N
Plastic SO	N74LS139D, N74S139D

#### NOTE:

For information regarding devices processed to Military Specifications, see the Signetics Military Products Data Manual.

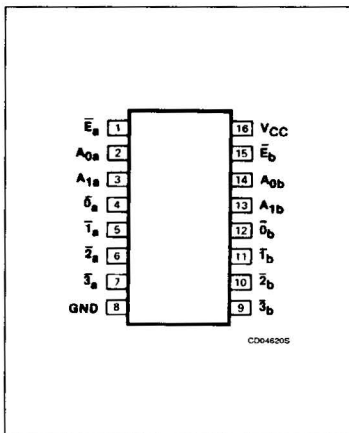
#### INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

PINS	DESCRIPTION	74S	74LS
All	Inputs	1Sul	1LSul
All	Outputs	10Sul	10LSul

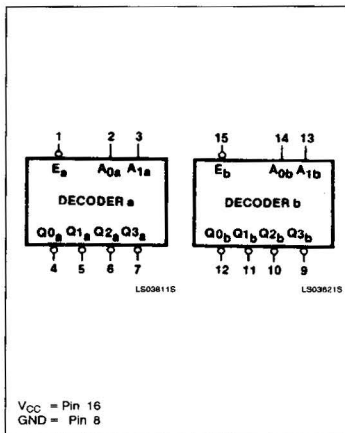
#### NOTE:

A 74S unit load (Sul) is  $50\mu A$   $I_{IH}$  and  $-2.0mA$   $I_{IL}$ , and a 74LS unit load (LSul) is  $20\mu A$   $I_{IH}$  and  $-0.4mA$   $I_{IL}$ .

#### PIN CONFIGURATION

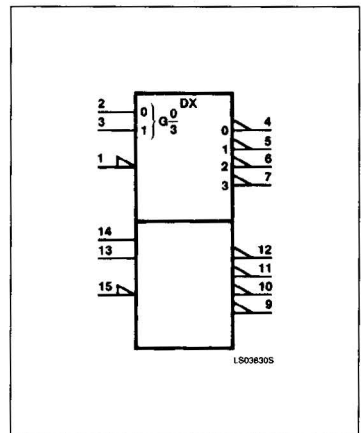


#### LOGIC SYMBOL



$V_{CC} = \text{Pin } 16$   
 $GND = \text{Pin } 8$

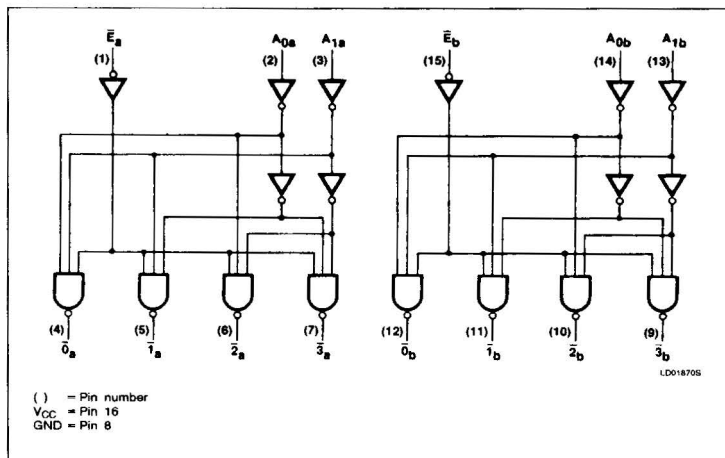
#### LOGIC SYMBOL (EEE/IEC)



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## LOGIC DIAGRAM



## FUNCTION TABLE

$\bar{E}$	INPUTS		OUTPUTS			
	$A_0$	$A_1$	$\bar{0}$	$\bar{1}$	$\bar{2}$	$\bar{3}$
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

## ABSOLUTE MAXIMUM RATINGS (Over operating free-air temperature range unless otherwise noted.)

PARAMETER		74LS	74S	UNIT
V <sub>CC</sub>	Supply voltage	7.0	7.0	V
V <sub>IN</sub>	Input voltage	-0.5 to +7.0	-0.5 to +5.5	V
I <sub>IN</sub>	Input current	-30 to +1	-30 to +5	mA
V <sub>OUT</sub>	Voltage applied to output in HIGH output state	-0.5 to +V <sub>CC</sub>	-0.5 to +V <sub>CC</sub>	V
T <sub>A</sub>	Operating free-air temperature range	0 to 70		°C

## RECOMMENDED OPERATING CONDITIONS

PARAMETER	74LS			74S			UNIT	
	Min	Nom	Max	Min	Nom	Max		
V <sub>CC</sub>	Supply voltage	4.75	5.0	5.25	4.75	5.0	5.25	V
V <sub>IH</sub>	HIGH-level input voltage	2.0			2.0			V
V <sub>IL</sub>	LOW-level input voltage			+0.8			+0.8	V
I <sub>IK</sub>	Input clamp current			-18			-18	mA
I <sub>OH</sub>	HIGH-level output current			-400			-1000	μA
I <sub>OL</sub>	LOW-level output current			8			20	mA
T <sub>A</sub>	Operating free-air temperature	0		70	0		70	°C

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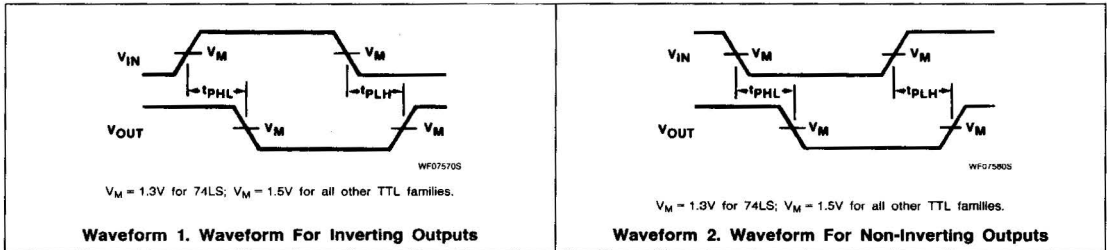
## DC ELECTRICAL CHARACTERISTICS (Over recommended operating free-air temperature range unless otherwise noted.)

PARAMETER	TEST CONDITIONS <sup>1</sup>	74LS139			74S139			UNIT
		Min	Typ <sup>2</sup>	Max	Min	Typ <sup>2</sup>	Max	
V <sub>OH</sub> HIGH-level output voltage	V <sub>CC</sub> = MIN, V <sub>IH</sub> = MIN, V <sub>IL</sub> = MAX, I <sub>OH</sub> = MAX	2.7	3.4		2.7	3.4		V
V <sub>OL</sub> LOW-level output voltage	V <sub>CC</sub> = MIN, V <sub>IH</sub> = MIN, V <sub>IL</sub> = MAX	I <sub>OL</sub> = MAX		0.35	0.5		0.5	V
		I <sub>OL</sub> = 4mA (74LS)		0.25	0.4			V
V <sub>IK</sub> Input clamp voltage	V <sub>CC</sub> = MIN, I <sub>I</sub> = I <sub>IK</sub>			-1.5			-1.2	V
I <sub>I</sub> Input current at maximum input voltage	V <sub>CC</sub> = MAX	V <sub>I</sub> = 5.5V					1.0	mA
		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			50	μA
I <sub>IL</sub> LOW-level input current	V <sub>CC</sub> = MAX	V <sub>I</sub> = 0.4V		-0.4				mA
		V <sub>I</sub> = 0.5V					-2	mA
I <sub>OS</sub> Short-circuit output current <sup>3</sup>	V <sub>CC</sub> = MAX	-15		-100	-40		-100	mA
I <sub>CC</sub> Supply current <sup>4</sup> (total)	V <sub>CC</sub> = MAX		6.8	11		60	90	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>A</sub> = 25°C.
3. I<sub>OS</sub> is tested with V<sub>OUT</sub> = +0.5V and V<sub>CC</sub> = V<sub>CC</sub> MAX + 0.5V. Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.
4. To measure I<sub>CC</sub>, outputs must be enabled and open.

## AC WAVEFORMS



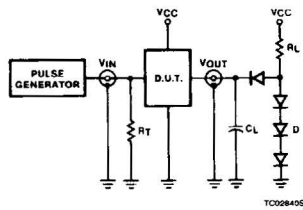
## AC ELECTRICAL CHARACTERISTICS T<sub>A</sub> = 25°C, V<sub>CC</sub> = 5.0V

PARAMETER	TEST CONDITIONS	74LS		74S		UNIT
		C <sub>L</sub> = 15pF, R <sub>L</sub> = 2kΩ		C <sub>L</sub> = 15pF, R <sub>L</sub> = 280Ω		
		Min	Max	Min	Max	
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay Address to output	Waveform 2 2 logic levels		20 33	7.5 10	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay Address to output	Waveform 1 3 logic levels		29 38	12 12	ns
t <sub>PLH</sub> t <sub>PHL</sub>	Propagation delay Enable to output	Waveform 2 2 logic levels		24 32	8 10	ns

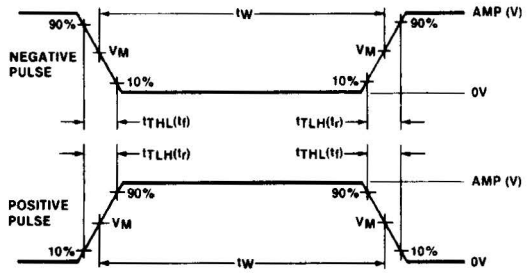
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## TEST CIRCUITS AND WAVEFORMS



TC028456



WF064505

$V_M = 1.3V$  for 74LS;  $V_M = 1.5V$  for all other TTL families.

### Test Circuit For 74 Totem-Pole Outputs

#### DEFINITIONS

$R_L$  = Load resistor to  $V_{CC}$ ; see AC CHARACTERISTICS for value.

$C_L$  = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

$R_T$  = Termination resistance should be equal to  $Z_{OUT}$  of Pulse Generators.

D = Diodes are 1N916, 1N3064, or equivalent.

$t_{LH}$ ,  $t_{THL}$  Values should be less than or equal to the table entries.

### Input Pulse Definition

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	Pulse Width	$t_{LH}$	$t_{THL}$
74	3.0V	1MHz	500ns	7ns	7ns
74LS	3.0V	1MHz	500ns	15ns	6ns
74S	3.0V	1MHz	500ns	2.5ns	2.5ns