

SN54AHC139, SN74AHC139 DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

SCLS259H – DECEMBER 1995 – REVISED JANUARY 2000

- **EPIC™** (Enhanced-Performance Implanted CMOS) Process
- Operating Range 2-V to 5.5-V V_{CC}
- Designed Specifically for High-Speed Memory Decoders and Data-Transmission Systems
- Incorporate Two Enable Inputs to Simplify Cascading and/or Data Reception
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model ($C = 200$ pF, $R = 0$)
- Package Options Include Plastic Small-Outline (D), Shrink Small-Outline (DB), Thin Very Small-Outline (DGV), Thin Shrink Small-Outline (PW), and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) DIPs

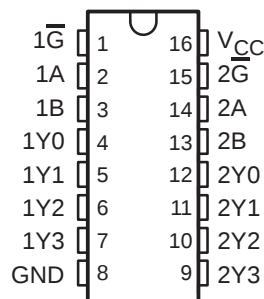
description

The 'AHC139 devices are dual 2-line to 4-line decoders/demultiplexers designed for 2-V to 5.5-V V_{CC} operation. These devices are designed to be used in high-performance memory-decoding or data-routing applications requiring very short propagation delay times. In high-performance memory systems, these decoders can be used to minimize the effects of system decoding. When used with high-speed memories utilizing a fast enable circuit, the delay times of these decoders and the enable time of the memory usually are less than the typical access time of the memory. This means that the effective system delay introduced by the decoders is negligible.

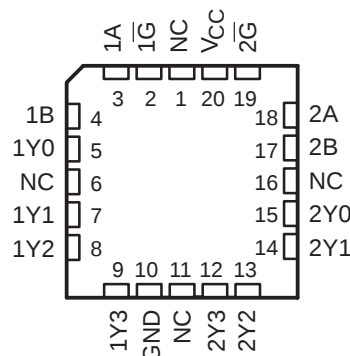
The active-low enable ($\overline{G}$) input can be used as a data line in demultiplexing applications. These decoders/demultiplexers feature fully buffered inputs, each of which represents only one normalized load to its driving circuit.

The SN54AHC139 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74AHC139 is characterized for operation from -40°C to 85°C .

SN54AHC139 . . . J OR W PACKAGE
SN74AHC139 . . . D, DB, DGV, N, OR PW PACKAGE
(TOP VIEW)



SN54AHC139 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection



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**TEXAS
INSTRUMENTS**

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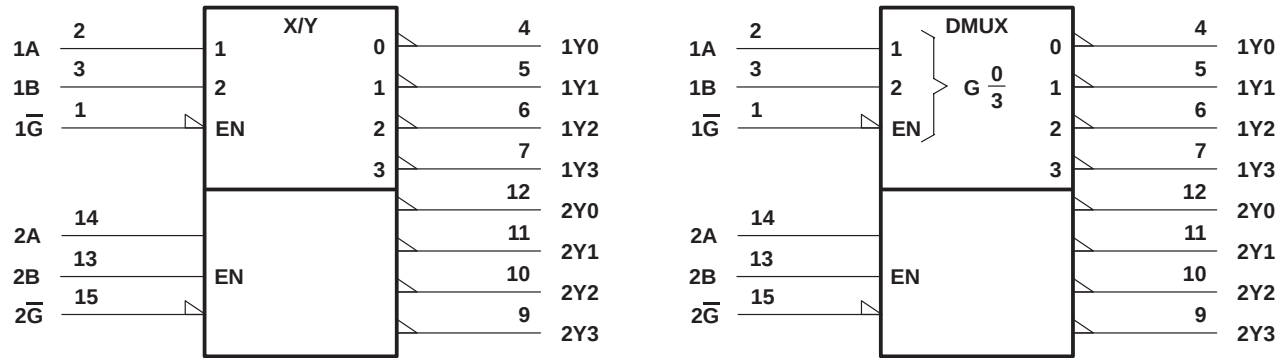
SN54AHC139, SN74AHC139
DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

SCLS259H – DECEMBER 1995 – REVISED JANUARY 2000

FUNCTION TABLE
(each decoder/demultiplexer)

INPUTS			OUTPUTS			
$\overline{G}$	SELECT					
	B	A	Y0	Y1	Y2	Y3
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	L	H	H	L	H	H
L	H	L	H	H	L	H
L	H	H	H	H	H	L

logic symbols (alternatives)[†]



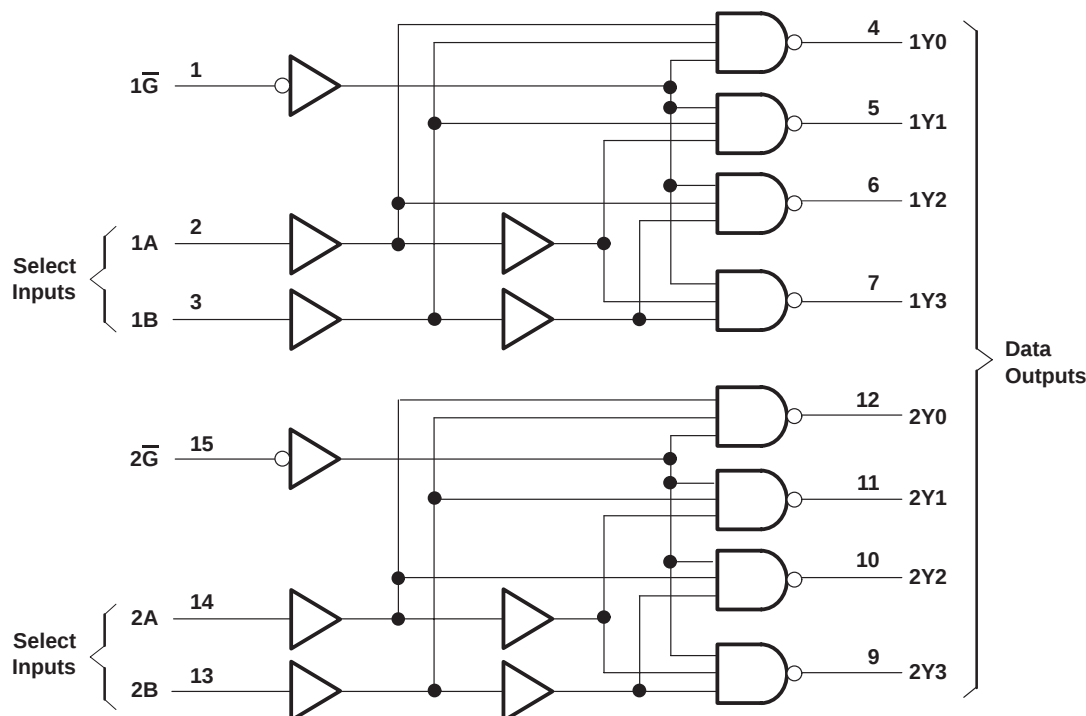
[†] These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for the D, DB, DGV, J, N, PW, and W packages.

SN54AHC139, SN74AHC139

DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

SCLS259H – DECEMBER 1995 – REVISED JANUARY 2000

logic diagram (positive logic)



Pin numbers shown are for the D, DB, DGV, J, N, PW, and W packages.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

Supply voltage range, V_{CC}	–0.5 V to 7 V
Input voltage range, V_I (see Note 1)	–0.5 V to 7 V
Output voltage range, V_O (see Note 1)	–0.5 V to $V_{CC} + 0.5$ V
Input clamp current, I_{IK} ($V_I < 0$)	–20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$)	±20 mA
Continuous output current, I_O ($V_O = 0$ to V_{CC})	±25 mA
Continuous current through V_{CC} or GND	±75 mA
Package thermal impedance, θ_{JA} (see Note 2):	
D package	73°C/W
DB package	82°C/W
DGV package	120°C/W
N package	67°C/W
PW package	108°C/W
Storage temperature range, T_{stg}	–65°C to 150°C

[†] Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. The package thermal impedance is calculated in accordance with JESD 51.

SN54AHC139, SN74AHC139

DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

SCLS259H – DECEMBER 1995 – REVISED JANUARY 2000

recommended operating conditions (see Note 3)

			SN54AHC139		SN74AHC139		UNIT
			MIN	MAX	MIN	MAX	
V _{CC}	Supply voltage		2	5.5	2	5.5	V
V _{IH}	High-level input voltage	V _{CC} = 2 V	1.5		1.5		V
		V _{CC} = 3 V	2.1		2.1		
		V _{CC} = 5.5 V	3.85		3.85		
V _{IL}	Low-level input voltage	V _{CC} = 2 V	0.5		0.5		V
		V _{CC} = 3 V	0.9		0.9		
		V _{CC} = 5.5 V	1.65		1.65		
V _I	Input voltage		0	5.5	0	5.5	V
V _O	Output voltage		0	V _{CC}	0	V _{CC}	V
I _{OH}	High-level output current	V _{CC} = 2 V	−50		−50		μA
		V _{CC} = 3.3 V ± 0.3 V	−4		−4		mA
		V _{CC} = 5 V ± 0.5 V	−8		−8		
I _{OL}	Low-level output current	V _{CC} = 2 V	50		50		μA
		V _{CC} = 3.3 V ± 0.3 V	4		4		mA
		V _{CC} = 5 V ± 0.5 V	8		8		
Δt/Δv	Input transition rise or fall rate	V _{CC} = 3.3 V ± 0.3 V	100		100		ns/V
		V _{CC} = 5 V ± 0.5 V	20		20		
T _A	Operating free-air temperature		−55	125	−40	85	°C

NOTE 3: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS	V_{CC}	$T_A = 25^{\circ}\text{C}$			SN54AHC139		SN74AHC139		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V_{OH}	$I_{OH} = -50\text{ }\mu\text{A}$	2 V	1.9	2		1.9		1.9		V
		3 V	2.9	3		2.9		2.9		
		4.5 V	4.4	4.5		4.4		4.4		
	$I_{OH} = -4\text{ mA}$	3 V	2.58			2.48		2.48		
	$I_{OH} = -8\text{ mA}$	4.5 V	3.94			3.8		3.8		
V_{OL}	$I_{OL} = 50\text{ }\mu\text{A}$	2 V			0.1		0.1		0.1	V
		3 V			0.1		0.1		0.1	
		4.5 V			0.1		0.1		0.1	
	$I_{OL} = 4\text{ mA}$	3 V			0.36		0.5		0.44	
	$I_{OL} = 8\text{ mA}$	4.5 V			0.36		0.5		0.44	
I_I	$V_I = V_{CC}$ or GND	0 V to 5.5 V			± 0.1		$\pm 1^*$		± 1	μA
I_{CC}	$V_I = V_{CC}$ or GND, $I_O = 0$	5.5 V			4		40		40	μA
C_i	$V_I = V_{CC}$ or GND	5 V		2	10				10	pF

* On products compliant to MIL-PRF-38535, this parameter is not production tested at $V_{CC} = 0\text{ V}$.

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SN54AHC139, SN74AHC139

DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

SCLS259H – DECEMBER 1995 – REVISED JANUARY 2000

switching characteristics over recommended operating free-air temperature range,
 $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			SN54AHC139		SN74AHC139		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A or B	Y	$C_L = 15 \text{ pF}$		7.2*	11*	1*	13*	1	13	ns
t_{PHL}					7.2*	11*	1*	13*	1	13	
t_{PLH}	$\overline{G}$	Y	$C_L = 15 \text{ pF}$		6.4*	9.2*	1*	11*	1	11	ns
t_{PHL}					6.4*	9.2*	1*	11*	1	11	
t_{PLH}	A or B	Y	$C_L = 50 \text{ pF}$		9.7	14.5	1	16.5	1	16.5	ns
t_{PHL}					9.7	14.5	1	16.5	1	16.5	
t_{PLH}	$\overline{G}$	Y	$C_L = 50 \text{ pF}$		8.9	12.7	1	14.5	1	14.5	ns
t_{PHL}					8.9	12.7	1	14.5	1	14.5	

* On products compliant to MIL-PRF-38535, this parameter is not production tested.

switching characteristics over recommended operating free-air temperature range,
 $V_{CC} = 5 \text{ V} \pm 0.5 \text{ V}$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			SN54AHC139		SN74AHC139		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A or B	Y	$C_L = 15 \text{ pF}$		5*	7.2*	1*	8.5*	1	8.5	ns
t_{PHL}					5*	7.2*	1*	8.5*	1	8.5	
t_{PLH}	$\overline{G}$	Y	$C_L = 15 \text{ pF}$		4.4*	6.3*	1*	7.5*	1	7.5	ns
t_{PHL}					4.4*	6.3*	1*	7.5*	1	7.5	
t_{PLH}	A or B	Y	$C_L = 50 \text{ pF}$		6.5	9.2	1	10.5	1	10.5	ns
t_{PHL}					6.5	9.2	1	10.5	1	10.5	
t_{PLH}	$\overline{G}$	Y	$C_L = 50 \text{ pF}$		5.9	8.3	1	9.5	1	9.5	ns
t_{PHL}					5.9	8.3	1	9.5	1	9.5	

* On products compliant to MIL-PRF-38535, this parameter is not production tested.

operating characteristics, $V_{CC} = 5 \text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TYP	UNIT
C_{pd} Power dissipation capacitance	No load, $f = 1 \text{ MHz}$	13	pF

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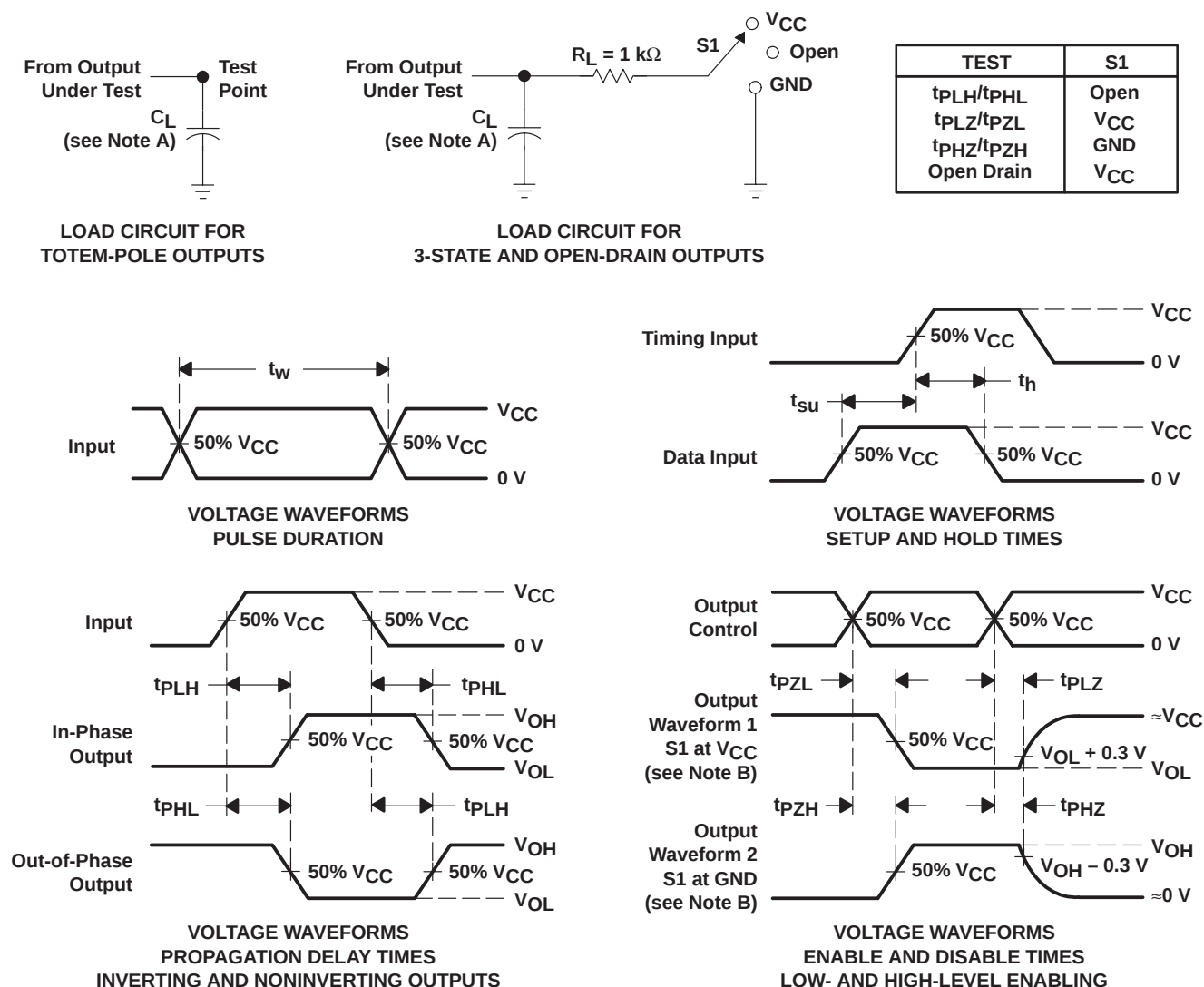


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SCLS259H – DECEMBER 1995 – REVISED JANUARY 2000

PARAMETER MEASUREMENT INFORMATION



- NOTES: A. C_L includes probe and jig capacitance.
- B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1\text{ MHz}$, $Z_O = 50\ \Omega$, $t_r \leq 3\text{ ns}$, $t_f \leq 3\text{ ns}$.
- D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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