

- **EPIC™ (Enhanced-Performance Implanted CMOS) Process**
- **Inputs Are TTL-Voltage Compatible**
- **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**

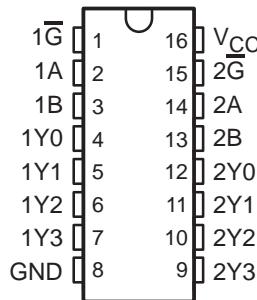
description

The 'AHCT139 devices are dual 2-line to 4-line decoders/demultiplexers designed for 4.5-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.

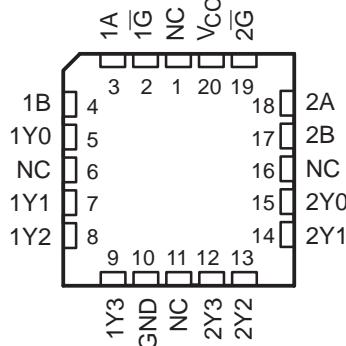
The active-low enable (\bar{G}) input can be used as a data line in demultiplexing applications. These decoders/demultiplexers feature fully buffered inputs, each of which represents only one normalized load to its driving circuit.

The SN54AHCT139 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74AHCT139 is characterized for operation from -40°C to 85°C .

SN54AHCT139 . . . J OR W PACKAGE
SN74AHCT139 . . . D, DB, DGV, N, OR PW PACKAGE
(TOP VIEW)



SN54AHCT139 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection



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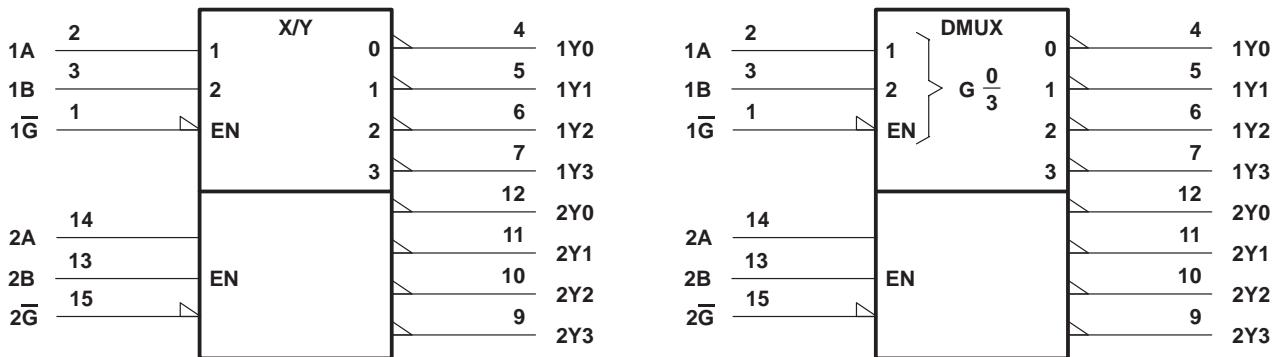
SN54AHCT139, SN74AHCT139 DUAL 2-LINE TO 4-LINE DECODERS/DEMULITPLEXERS

SCLS267K – DECEMBER 1995 – REVISED JANUARY 2000

FUNCTION TABLE
(each decoder/demultiplexer)

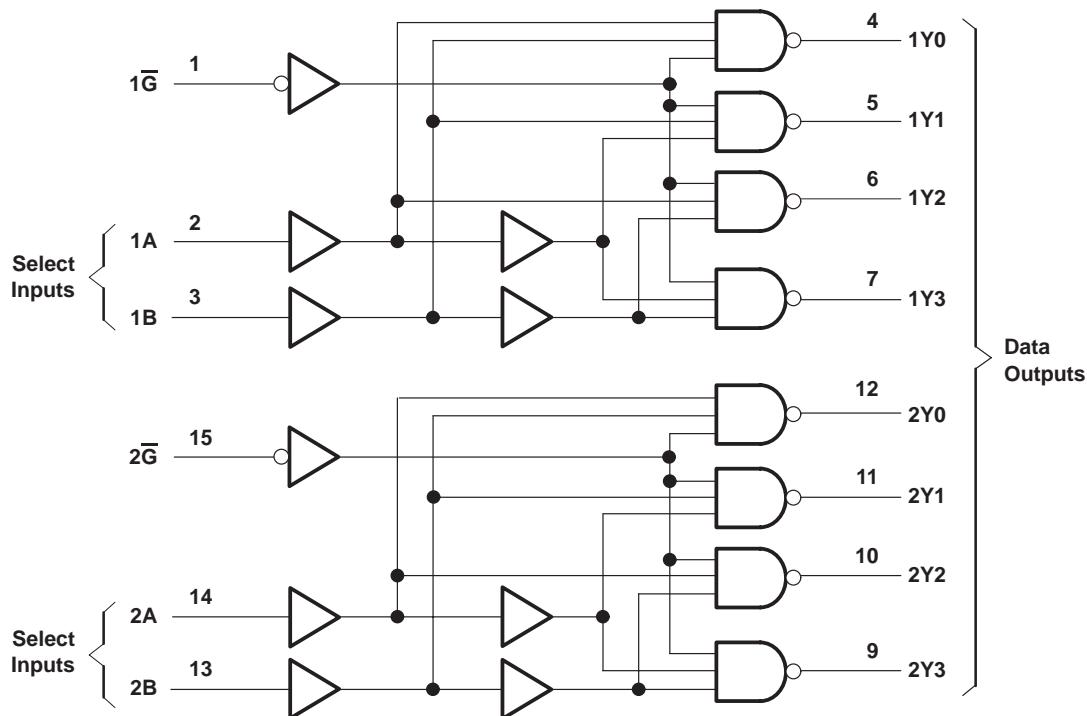
G	INPUTS		OUTPUTS			
	B	A	Y₀	Y₁	Y₂	Y₃
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	L	H	H	L	H	H
L	H	L	H	H	L	H
L	H	H	H	H	H	L

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.

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.

SN54AHCT139, SN74AHCT139 DUAL 2-LINE TO 4-LINE DECODERS/DEMULITPLEXERS

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recommended operating conditions (see Note 3)

		SN54AHCT139		SN74AHCT139		UNIT
		MIN	MAX	MIN	MAX	
V _{CC}	Supply voltage	4.5	5.5	4.5	5.5	V
V _{IH}	High-level input voltage	2		2		V
V _{IL}	Low-level input voltage		0.8		0.8	V
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		-8		-8	mA
I _{OL}	Low-level output current		8		8	mA
Δt/Δv	Input transition rise or fall rate		20		20	ns/V
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°C			SN54AHCT139	SN74AHCT139	UNIT
			MIN	TYP	MAX			
V _{OH}	I _{OH} = -50 μA	4.5 V	4.4	4.5		4.4	4.4	V
	I _{OH} = -8 mA		3.94			3.8	3.8	
V _{OL}	I _{OL} = 50 μA	4.5 V		0.1		0.1	0.1	V
	I _{OL} = 8 mA			0.36		0.44	0.44	
I _I	V _I = V _{CC} or GND	0 V to 5.5 V		±0.1		±1*	±1	μA
I _{CC}	V _I = V _{CC} or GND, I _O = 0	5.5 V		2		20	20	μA
ΔI _{CC} †	One input at 3.4 V, Other inputs at V _{CC} or GND	5.5 V		1.35		1.5	1.5	mA
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 V.

† This is the increase in supply current for each input at one of the specified TTL voltage levels rather than 0 V or V_{CC}.

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T _A = 25°C			SN54AHCT139	SN74AHCT139	UNIT
				MIN	TYP	MAX			
t _{PLH}	A or B	Y	C _L = 15 pF	5**	7.2**		1**	8.5**	ns
				5**	7.2**		1**	8.5**	
t _{PLH}	G	Y	C _L = 15 pF	4.4**	6.3**		1**	7.5**	ns
				4.4**	6.3**		1**	7.5**	
t _{PLH}	A or B	Y	C _L = 50 pF	6.5	9.2		1	10.5	ns
				6.5	9.2		1	10.5	
t _{PLH}	G	Y	C _L = 50 pF	5.9	8.3		1	9.5	ns
				5.9	8.3		1	9.5	

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

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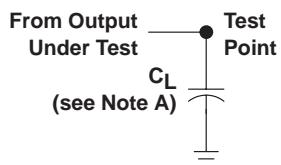


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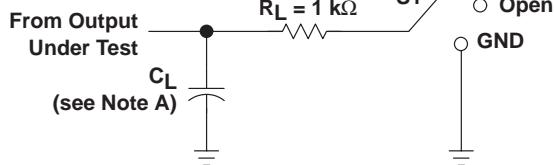
operating characteristics, $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$

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

PARAMETER MEASUREMENT INFORMATION

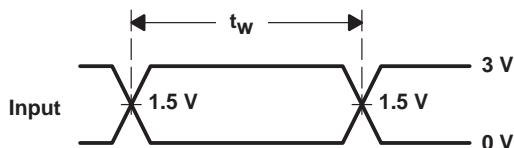


LOAD CIRCUIT FOR
TOTEM-POLE OUTPUTS

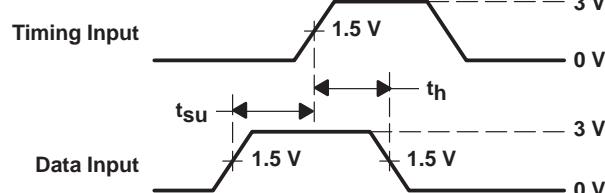


LOAD CIRCUIT FOR
3-STATE AND OPEN-DRAIN OUTPUTS

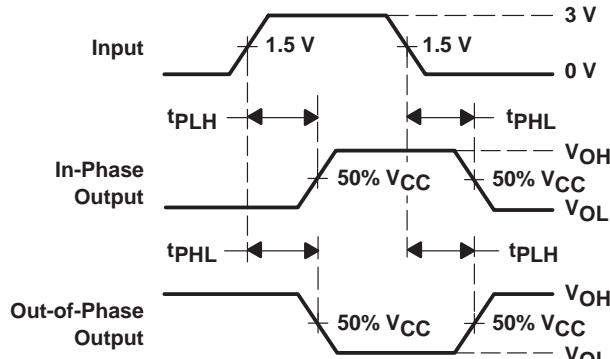
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{CC}
t_{PHZ}/t_{PZH}	GND
	Open Drain
	V_{CC}



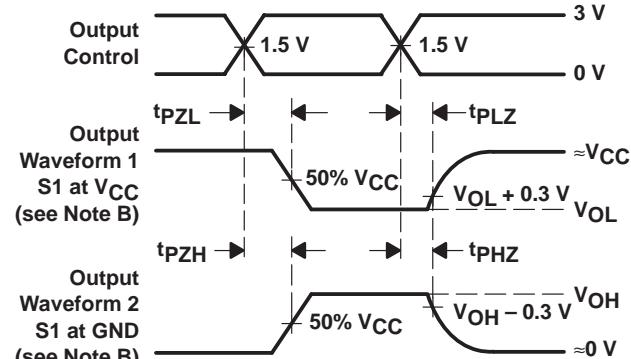
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

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: $PRR \leq 1$ MHz, $Z_O = 50 \Omega$, $t_r \leq 3$ ns, $t_f \leq 3$ 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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