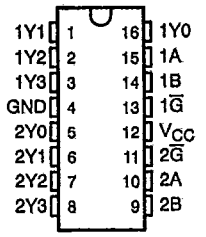
54AC11139, 74AC11139
DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

T-67-21-55

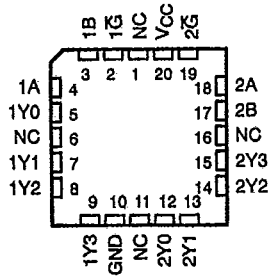
TI0158—D3318, JULY 1989—REVISED MARCH 1990

- Designed Specifically for High-Speed Memory Decoders and Data Transmission Systems
- Incorporates Two Enable Inputs to Simplify Cascading and/or Data Reception
- Flow-Through Architecture to Optimize PCB Layout
- Center-Pin V_{CC} and GND Configurations to Minimize High-Speed Switching Noise
- EPIC™ (Enhanced-Performance Implanted CMOS) 1-μm Process
- 500-mA Typical Latch-Up Immunity at 125°C
- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers, and Standard Plastic and Ceramic 300-mil DIPs

54AC11139 ... J PACKAGE
74AC11139 ... D OR N PACKAGE
(TOP VIEW)



54AC11139 ... FK PACKAGE
(TOP VIEW)



NC—No internal connection

description

The 'AC11139 circuit is designed to be used in high-performance memory-decoding or data-routing applications requiring very short propagation delay times. In high-performance memory systems, this decoder can be used to minimize the effects of system decoding. When employed with high-speed memories utilizing a fast enable circuit, the delay times of this decoder and the enable time of the memory are usually less than the typical access time of the memory. This means that the effective system delay introduced by the decoder is negligible.

The 'AC11139 is comprised of two individual two-line to four-line decoders in a single package. The active-low enable 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 54AC11139 is characterized for operation over the full military temperature range of −55°C to 125°C. The 74AC11139 is characterized for operation from −40°C to 85°C.

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TEXAS INSTRUMENTS
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

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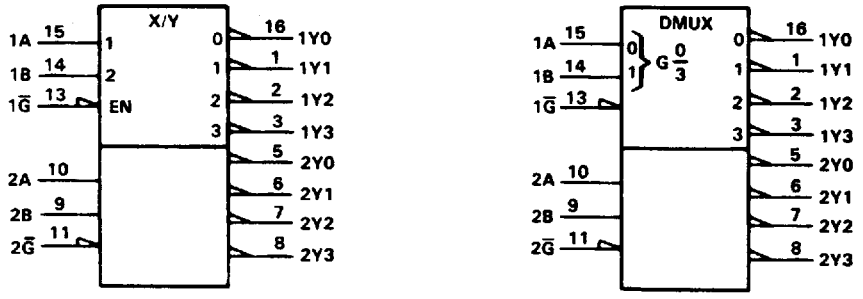
T-67-21-55

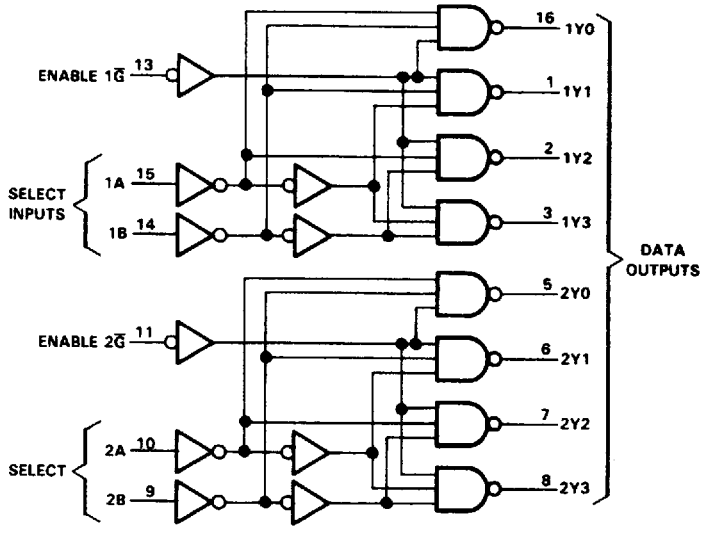
FUNCTION TABLE

ENABLE INPUT	SELECT INPUTS		OUTPUTS			
$\overline{G}$	A	B	Y0	Y1	Y2	Y3
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

logic symbols† (alternatives)



logic diagram (positive logic)



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for D, J, and N packages.

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T-67-21-55

D3318, JULY 1989—REVISED MARCH 1990—TI0158

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 to V_{CC} + 0.5 V
Output voltage range, V_O (see Note 1) ..... −0.5 to V_{CC} + 0.5 V
Input clamp current, I_{IK} (V_I < 0 or V_I > V_{CC}) ..... ±20 mA
Output clamp current, I_{OK} (V_O < 0 or V_O > V_{CC}) ..... ±50 mA
Continuous output current, I_O (V_O = 0 to V_{CC}) ..... ±50 mA
Continuous current through V_{CC} or GND pins ..... ±200 mA
Storage temperature range ..... −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.

NOTE 1: The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

recommended operating conditions

			54AC11139			74AC11139			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage		3	5	5.5	3	5	5.5	V
V_{IH}	High-level input voltage	V_{CC} = 3 V	2.1			2.1			V
		V_{CC} = 4.5 V	3.15			3.15			
		V_{CC} = 5.5 V	3.85			3.85			
V_{IL}	Low-level input voltage	V_{CC} = 3 V			0.9			0.9	V
		V_{CC} = 4.5 V			1.35			1.35	
		V_{CC} = 5.5 V			1.65			1.65	
V_I	Input voltage		0		V_{CC}	0		V_{CC}	V
V_O	Output voltage		0		V_{CC}	0		V_{CC}	V
I_{OH}	High-level output current	V_{CC} = 3 V			−4			−4	mA
		V_{CC} = 4.5 V			−24			−24	
		V_{CC} = 5.5 V			−24			−24	
I_{OL}	Low-level output current	V_{CC} = 3 V			12			12	mA
		V_{CC} = 4.5 V			24			24	
		V_{CC} = 5.5 V			24			24	
$\Delta t/\Delta v$	Input transition rise or fall rate		0		10	0		10	ns/V
T_A	Operating free-air temperature		−55		125	−40		85	°C

T-67-21-55

TI0158—D3318, JULY 1989—REVISED MARCH 1990

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

PARAMETER	TEST CONDITIONS	V_{CC}	T_A = 25°C			54AC11139		74AC11139		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V_{OH}	I_{OH} = −50 μA	3 V	2.9			2.9		2.9		V
		4.5 V	4.4			4.4		4.4		
		5.5 V	5.4			5.4		5.4		
	I_{OH} = −4 mA	3 V	2.58			2.4		2.48		
	I_{OH} = −24 mA	4.5 V	3.94			3.7		3.8		
		5.5 V	4.94			4.7		4.8		
	I_{OH} = −50 mA†	5.5 V				3.85				
	I_{OH} = −75 mA†	5.5 V						3.85		
V_{OL}	I_{OL} = 50 μA	3 V			0.1		0.1		0.1	V
		4.5 V			0.1		0.1		0.1	
		5.5 V			0.1		0.1		0.1	
	I_{OL} = 12 mA	3 V			0.36		0.5		0.44	
	I_{OL} = 24 mA	4.5 V			0.36		0.5		0.44	
		5.5 V			0.36		0.5		0.44	
	I_{OL} = 50 mA†	5.5 V					1.65			
	I_{OL} = 75 mA†	5.5 V							1.65	
I_I	V_I = V_{CC} or GND	5.5 V			±0.1		±1		±1	μA
I_{CC}	V_I = V_{CC} or GND, I_O = 0	5.5 V			8		160		80	μA
C_i	V_I = V_{CC} or GND	5 V		3.5						pF

†Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	T_A = 25°C			54AC11139		74AC11139		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A or B	Y	1.5	5.3	8.1	1.5	9.6	1.5	9	ns
t_{PHL}			1.5	6	8.4	1.5	9.9	1.5	9.4	
t_{PLH}	$\overline{G}$	Y	1.5	5.3	6.9	1.5	8	1.5	7.6	ns
t_{PHL}			1.5	5.6	7.4	1.5	8.5	1.5	8.1	

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T-67-21-55

D3318, JULY 1989—REVISED MARCH 1990—TI0158

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)	T_A = 25°C			54AC11139		74AC11139		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A or B	Y	1.5	3.5	6	1.5	7	1.5	6.6	ns
t_{PHL}			1.5	4.1	6.3	1.5	7.4	1.5	6.9	
t_{PLH}	$\overline{G}$	Y	1.5	3.8	5.2	1.5	6	1.5	5.7	ns
t_{PHL}			1.5	4	5.6	1.5	6.6	1.5	6.2	

operating characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance	C_L = 50 pF, f = 1 MHz	47	pF

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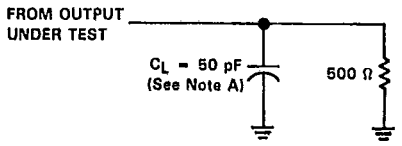
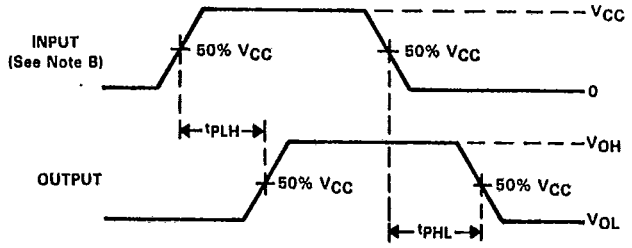
T-67-21-55

PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT



PROPAGATION DELAY TIMES

NOTES: A. C_L includes probe and jig capacitance.
B. Input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω, t_r = 3 ns, t_f = 3 ns.
C. The outputs are measured one at a time with one input transition per measurement.

FIGURE 1. LOAD CIRCUIT AND VOLTAGE WAVEFORMS