

# SN54ALS137A, SN74ALS137A, SN74AS137 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS WITH ADDRESS LATCHES

SDAS203C – APRIL 1982 – REVISED JANUARY 1995

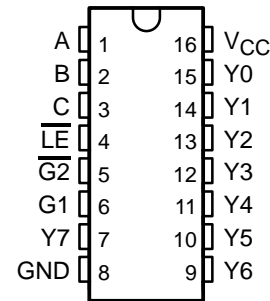
- Combines Decoder and 3-Bit Address Latch
- Incorporates Two Output Enables to Simplify Cascading
- Package Options Include Plastic Small-Outline (D) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

## description

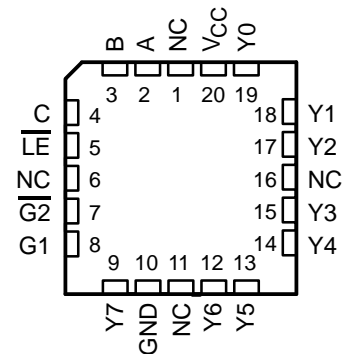
The SN54ALS137A, SN74ALS137A, and SN74AS137 are 3-line to 8-line decoders/demultiplexers with latches on the three address inputs. When the latch-enable ( $\overline{LE}$ ) input is low, the devices act as decoders/demultiplexers. When  $\overline{LE}$  goes from low to high, the address present at the select (A, B, and C) inputs is stored in the latches. Further address changes are ignored as long as  $\overline{LE}$  remains high. The output-enable controls (G1 and  $\overline{G2}$ ) control the outputs independently of the select or latch-enable inputs. All of the outputs are forced high if G1 is low or  $\overline{G2}$  is high. These devices are ideally suited for implementing glitch-free decoders in strobed (stored-address) applications in bus-oriented systems.

The SN54ALS137A is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ALS137A and SN74AS137 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

SN54ALS137A . . . J PACKAGE  
SN74ALS137A, SN74AS137 . . . D OR N PACKAGE  
(TOP VIEW)



SN54ALS137A . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

FUNCTION TABLE

INPUTS			OUTPUTS										
ENABLE			SELECT										
$\overline{LE}$	G1	$\overline{G2}$	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	X	H	X	X	X	H	H	H	H	H	H	H	H
X	L	X	X	X	X	H	H	H	H	H	H	H	H
L	H	L	L	L	L	L	H	H	H	H	H	H	H
L	H	L	L	L	H	H	L	H	H	H	H	H	H
L	H	L	L	H	L	H	H	L	H	H	H	H	H
L	H	L	L	H	H	H	H	L	H	H	H	H	H
L	H	L	H	L	L	H	H	H	H	L	H	H	H
L	H	L	H	L	H	H	H	H	H	H	L	H	H
L	H	L	H	H	L	H	H	H	H	H	H	L	H
L	H	L	H	H	H	H	H	H	H	H	H	H	L
H	H	L	X	X	X	Outputs corresponding to stored address = L; all others = H							

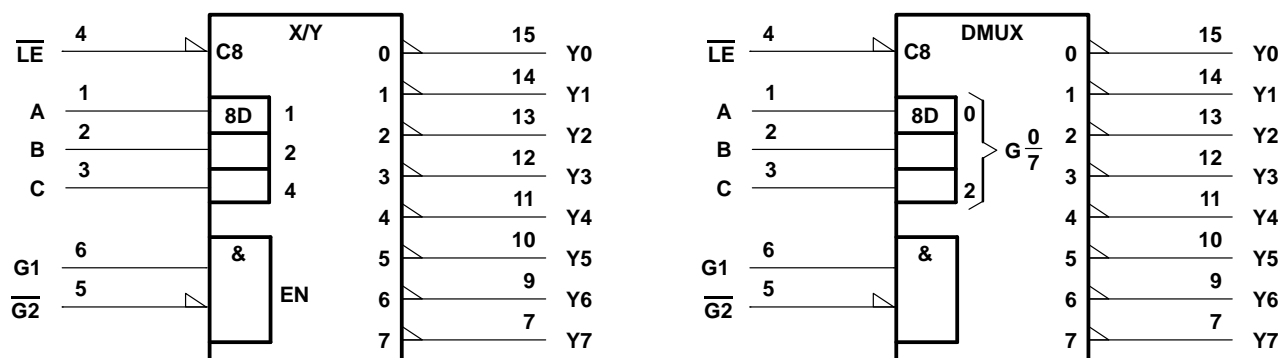
# SN54ALS137A, SN74ALS137A, SN74AS137

## 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

### WITH ADDRESS LATCHES

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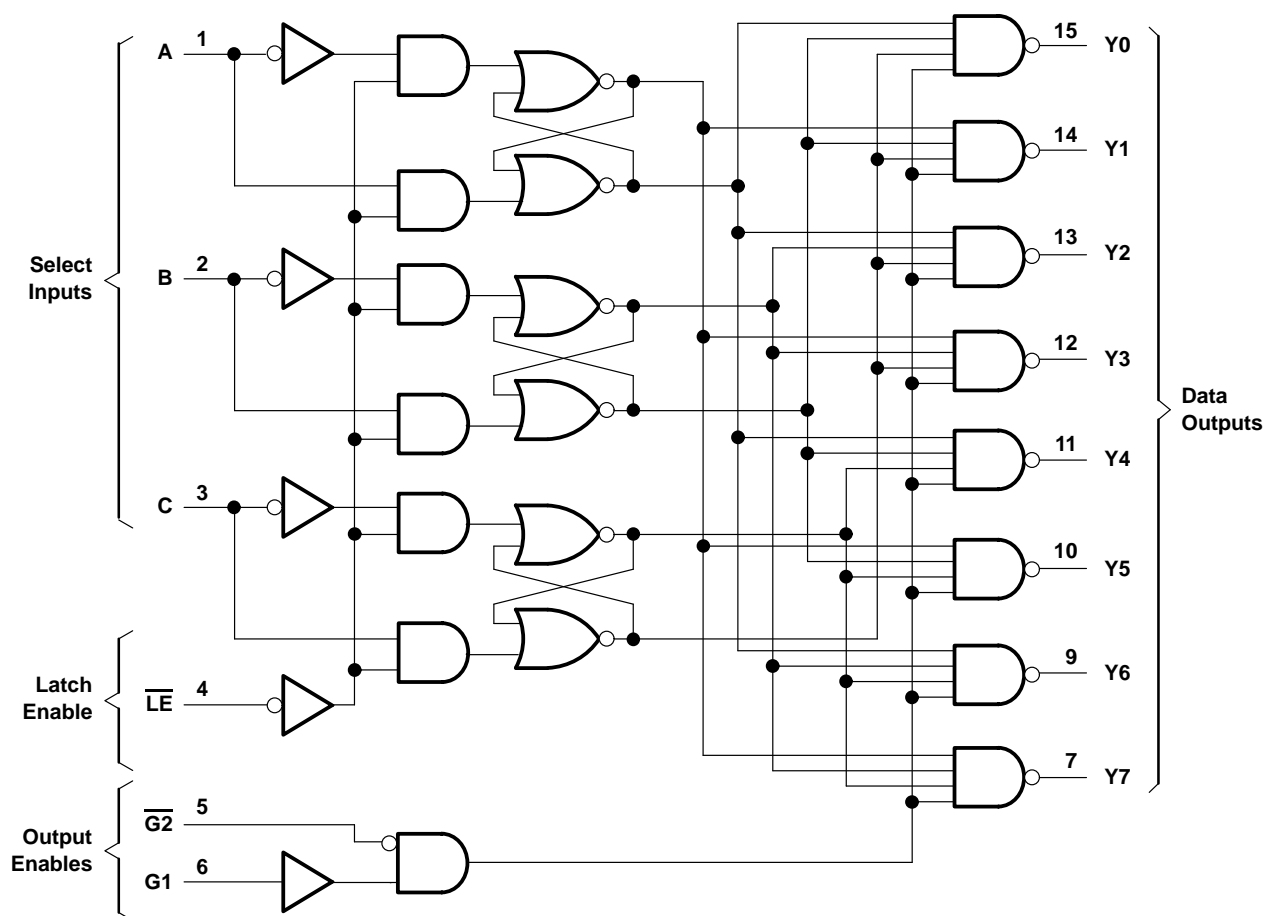
#### logic symbols (alternatives)†



† These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

Pin numbers shown are for the D, J, and N packages.

#### logic diagram (positive logic)



Pin numbers shown are for the D, J, and N packages.

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

Supply voltage, $V_{CC}$	7 V
Input voltage, $V_I$	7 V
Operating free-air temperature range, $T_A$ : SN54ALS137A	–55°C to 125°C
SN74ALS137A	0°C to 70°C
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.

## recommended operating conditions

		SN54ALS137A			SN74ALS137A			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
$V_{IH}$	High-level input voltage	2			2			V
$V_{IL}$	Low-level input voltage			0.7			0.8	V
$I_{OH}$	High-level output current			–0.4			–0.4	mA
$I_{OL}$	Low-level output current			4			8	mA
$t_w$	Pulse duration, $\overline{LE}$ low	15			10			ns
$t_{su}$	Setup time at A, B, and C before $\overline{LE}\uparrow$	15			10			ns
$t_h$	Hold time at A, B, and C after $\overline{LE}\uparrow$	5			5			ns
$T_A$	Operating free-air temperature	–55		125	0		70	°C

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

PARAMETER	TEST CONDITIONS	SN54ALS137A			SN74ALS137A			UNIT
		MIN	TYP‡	MAX	MIN	TYP‡	MAX	
$V_{IK}$	$V_{CC} = 4.5$ V, $I_I = -18$ mA			–1.5			–1.5	V
$V_{OH}$	$V_{CC} = 4.5$ V to 5.5 V, $I_{OH} = -0.4$ mA	$V_{CC} - 2$			$V_{CC} - 2$			V
$V_{OL}$	$V_{CC} = 4.5$ V, $I_{OL} = 4$ mA	0.25	0.4		0.25	0.4		V
	$I_{OL} = 8$ mA				0.35	0.5		
$I_I$	$V_{CC} = 5.5$ V, $V_I = 7$ V			0.1			0.1	mA
$I_{IH}$	$V_{CC} = 5.5$ V, $V_I = 2.7$ V			20			20	μA
$I_{IL}$	$V_{CC} = 5.5$ V, $V_I = 0.4$ V			–0.1			–0.1	mA
$I_{O}^{\S}$	$V_{CC} = 5.5$ V, $V_O = 2.25$ V	–20		–112	–30		–112	mA
$I_{CC}$	$V_{CC} = 5.5$ V		5	11		5	11	mA

‡ All typical values are at  $V_{CC} = 5$  V,  $T_A = 25^\circ\text{C}$ .

§ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

# SN54ALS137A, SN74ALS137A, SN74AS137

## 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

### WITH ADDRESS LATCHES

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#### switching characteristics (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω, T <sub>A</sub> = MIN to MAX†				UNIT
			SN54ALS137A		SN74ALS137A		
			MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	A, B, C	Y	5	25	5	20	ns
t <sub>PHL</sub>			6	25	6	20	
t <sub>PLH</sub>	$\overline{G2}$	Y	4	15	3	12	ns
t <sub>PHL</sub>			5	18	4	15	
t <sub>PLH</sub>	G1	Y	5	21	4	17	ns
t <sub>PHL</sub>			5	19	4	15	
t <sub>PLH</sub>	$\overline{LE}$	Y	7	27	6	22	ns
t <sub>PHI</sub>			7	25	7	20	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

#### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)‡

Supply voltage, V <sub>CC</sub>	7 V
Input voltage, V <sub>I</sub>	7 V
Operating free-air temperature range, T <sub>A</sub> : SN74AS137	0°C to 70°C
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.

#### recommended operating conditions

		SN74AS137			UNIT
		MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage	4.5	5	5.5	V
V <sub>IH</sub>	High-level input voltage	2			V
V <sub>IL</sub>	Low-level input voltage			0.8	V
I <sub>OH</sub>	High-level output current			–2	mA
I <sub>OL</sub>	Low-level output current			20	mA
t <sub>w</sub>	Pulse duration, $\overline{LE}$ low	6.5			ns
t <sub>su</sub>	Setup time at A, B, and C before $\overline{LE}$ ↑	4			ns
t <sub>h</sub>	Hold time at A, B, and C after $\overline{LE}$ ↑	1			ns
T <sub>A</sub>	Operating free-air temperature	0		70	°C



# SN54ALS137A, SN74ALS137A, SN74AS137

## 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

### WITH ADDRESS LATCHES

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

PARAMETER	TEST CONDITIONS	SN74AS137			UNIT
		MIN	TYP†	MAX	
$V_{IK}$	$V_{CC} = 4.5\text{ V}$ , $I_I = -18\text{ mA}$			-1.2	V
$V_{OH}$	$V_{CC} = 4.5\text{ V to } 5.5\text{ V}$ , $I_{OH} = -2\text{ mA}$	$V_{CC}-2$			V
$V_{OL}$	$V_{CC} = 4.5\text{ V}$ , $I_{OL} = 20\text{ mA}$		0.35	0.5	V
$I_I$	$V_{CC} = 5.5\text{ V}$ , $V_I = 7\text{ V}$			0.1	mA
$I_{IH}$	$V_{CC} = 5.5\text{ V}$ , $V_I = 2.7\text{ V}$			20	$\mu\text{A}$
$I_{IL}$	$V_{CC} = 5.5\text{ V}$ , $V_I = 0.4\text{ V}$			-1	mA
$I_{O\ddagger}$	$V_{CC} = 5.5\text{ V}$ , $V_O = 2.25\text{ V}$	-30		-112	mA
$I_{CC}$	$V_{CC} = 5.5\text{ V}$		15	24	mA

† All typical values are at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

‡ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current,  $I_{OS}$ .

switching characteristics (see Figure 1)

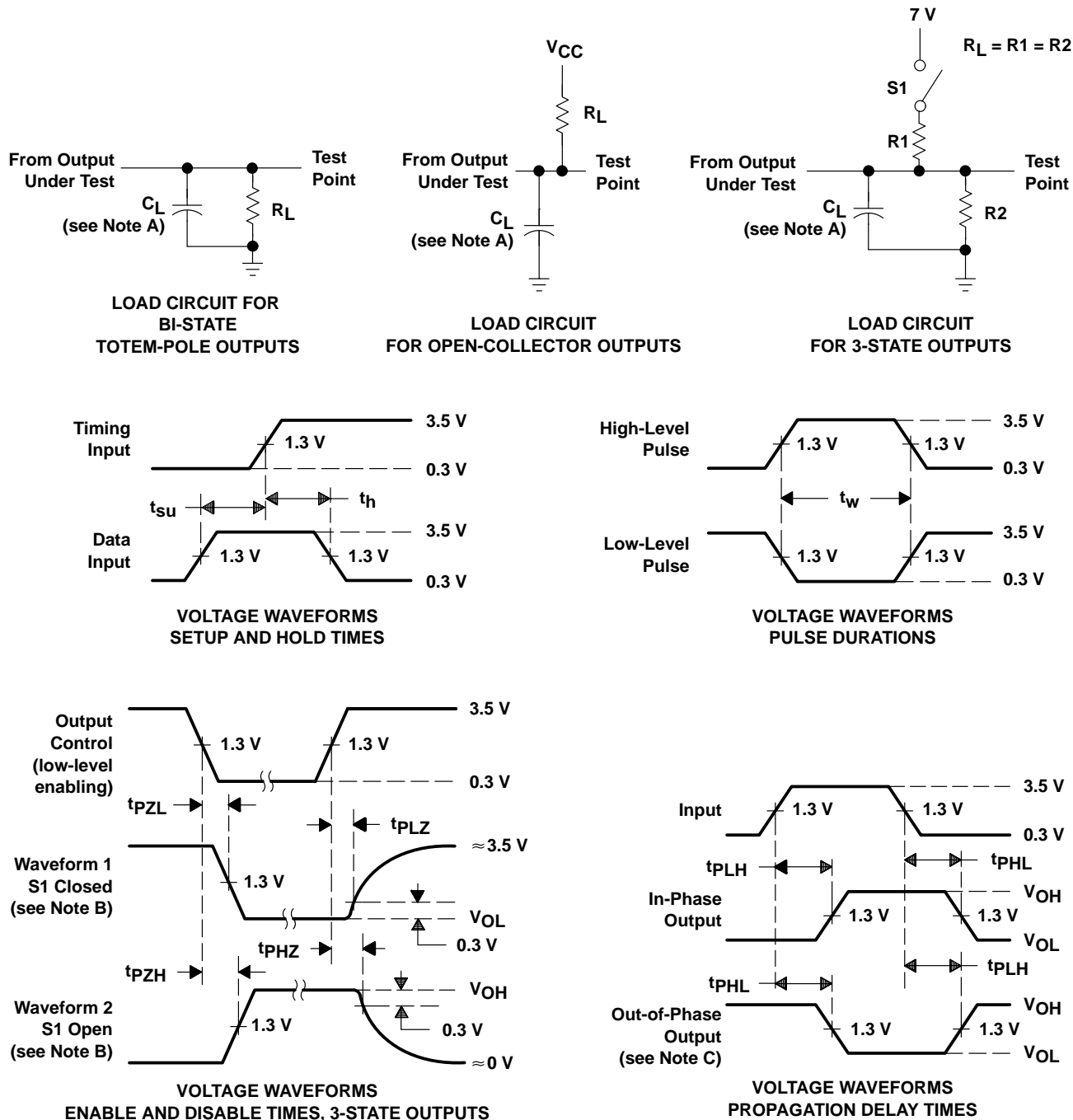
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω, T <sub>A</sub> = MIN to MAX§		UNIT
			SN74AS137		
			MIN	MAX	
t <sub>PLH</sub>	A, B, C	Y	2	12.5	ns
t <sub>PHL</sub>			2	12.5	
t <sub>PLH</sub>	$\overline{G2}$	Y	2	8	ns
t <sub>PHL</sub>			2	8.5	
t <sub>PLH</sub>	G1	Y	2	10	ns
t <sub>PHL</sub>			2	9	
t <sub>PLH</sub>	$\overline{LE}$	Y	3	13.5	ns
t <sub>PHL</sub>			3	14	

§ For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

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## PARAMETER MEASUREMENT INFORMATION SERIES 54ALS/74ALS AND 54AS/74AS DEVICES



- 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. When measuring propagation delay items of 3-state outputs, switch S1 is open.  
 D. All input pulses have the following characteristics:  $PRR \leq 1$  MHz,  $t_r = t_f = 2$  ns, duty cycle = 50%.  
 E. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

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