

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

SDAS203C – APRIL 1982 – REVISED JANUARY 1995

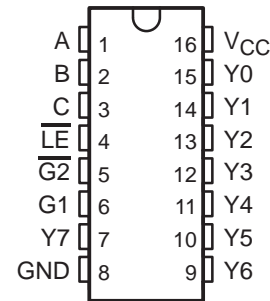
- Combines Decoder and 3-Bit Address Latch
- Incorporates Two Output Enables to Simplify Cascading
- Package Options Include Plastic Small-Outline (D) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

## description

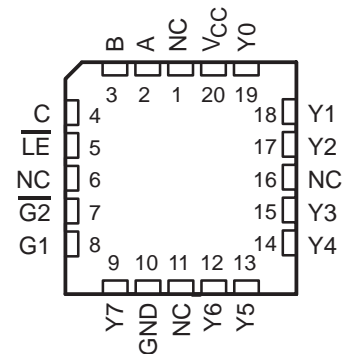
The SN54ALS137A, SN74ALS137A, and SN74AS137 are 3-line to 8-line decoders/demultiplexers with latches on the three address inputs. When the latch-enable ( $\overline{\text{LE}}$ ) input is low, the devices act as decoders/demultiplexers. When  $\overline{\text{LE}}$  goes from low to high, the address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

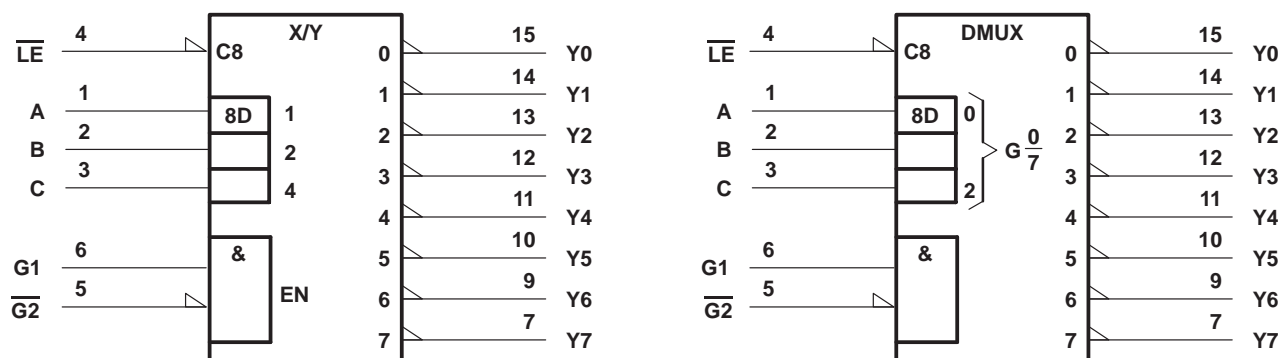
# SN54ALS137A, SN74ALS137A, SN74AS137

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

### WITH ADDRESS LATCHES

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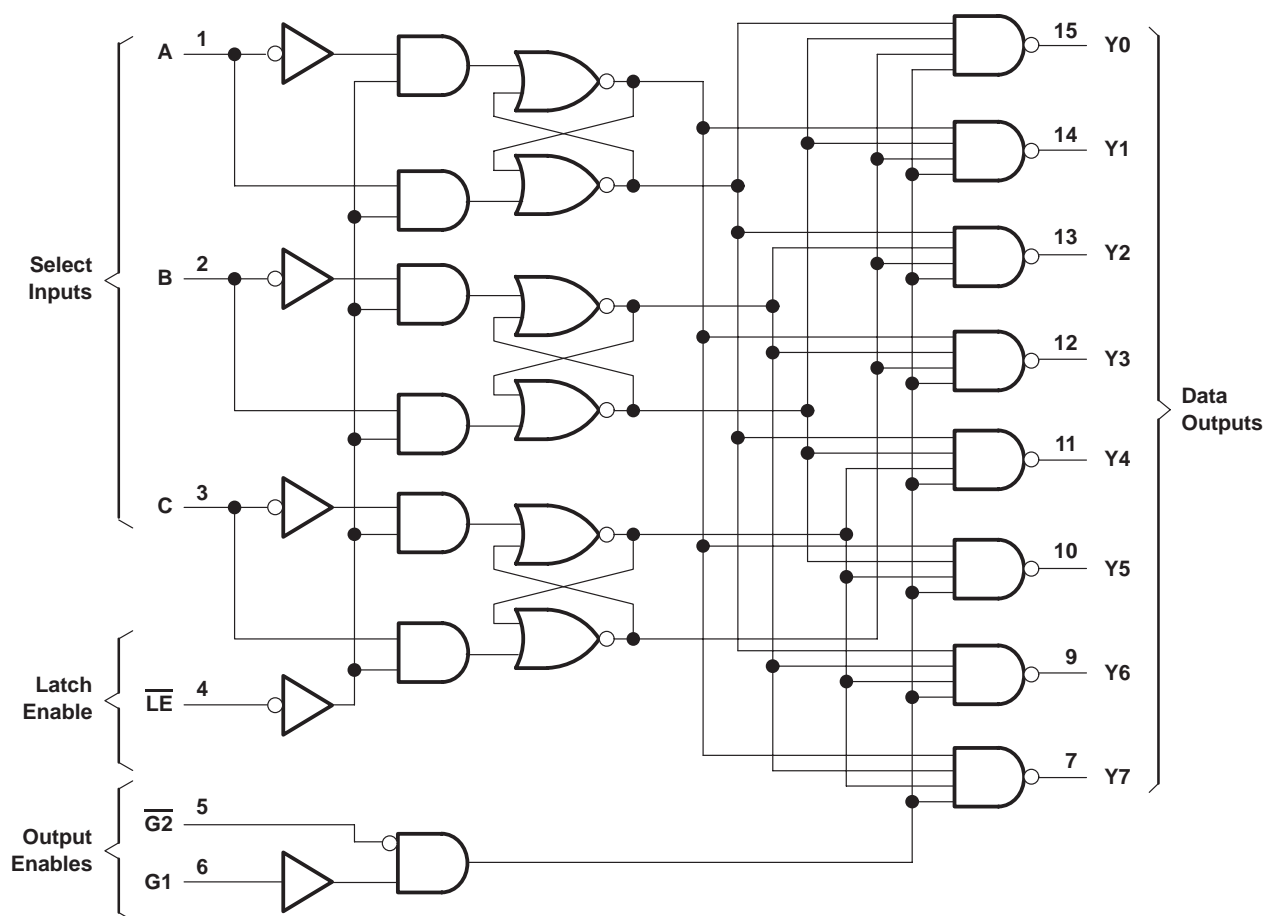
#### logic symbols (alternatives)<sup>†</sup>



<sup>†</sup> 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.

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

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

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

<sup>†</sup> 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 <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	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

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

<sup>\S</sup> 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



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# 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	μA
$I_{IL}$	$V_{CC} = 5.5\text{ V}$ , $V_I = 0.4\text{ V}$			-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)

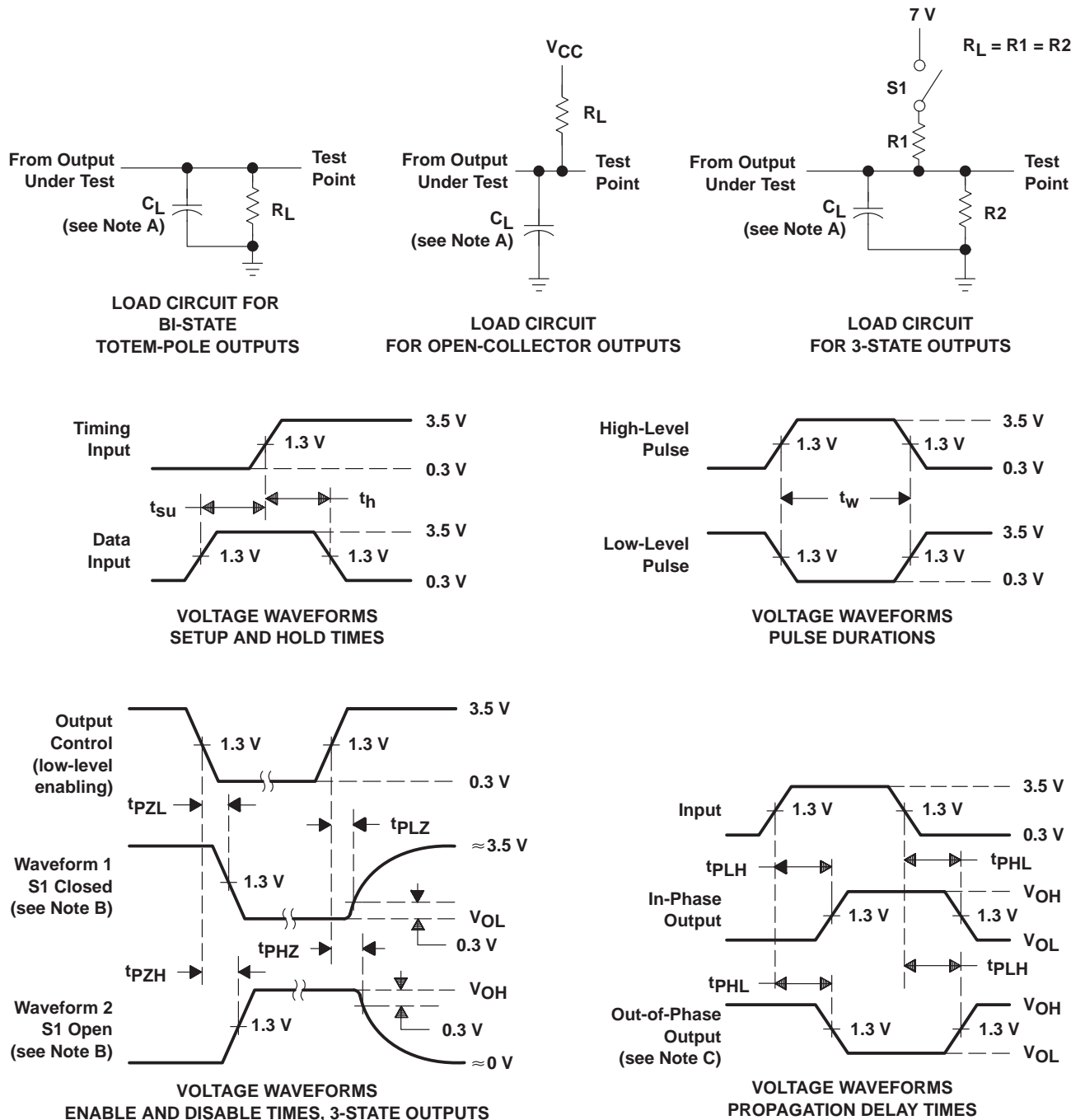
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub> = 4.5 V to 5.5 V, C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω, T <sub>A</sub> = MIN to MAX§		UNIT
			SN74AS137		
			MIN	MAX	
t <sub>PLH</sub>	A, B, C	Y	2	12.5	ns
t <sub>PHL</sub>			2	12.5	
t <sub>PLH</sub>	$\overline{G2}$	Y	2	8	ns
t <sub>PHL</sub>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

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

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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

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
5962-9066501M2A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
5962-9066501MEA	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
5962-9066501MFA	ACTIVE	CFP	W	16	1	TBD	Call TI	Level-NC-NC-NC
SN74ALS137AD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS137ADE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS137ADR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS137ADRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS137AN	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74ALS137ANE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74ALS137ANSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ALS137ANSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AS137D	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI
SN74AS137DR	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI
SN74AS137N	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SNJ54ALS137AFK	ACTIVE	LCCC	FK	20	1	TBD	Call TI	Level-NC-NC-NC
SNJ54ALS137AJ	ACTIVE	CDIP	J	16	1	TBD	Call TI	Level-NC-NC-NC
SNJ54ALS137AW	ACTIVE	CFP	W	16	1	TBD	Call TI	Level-NC-NC-NC

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

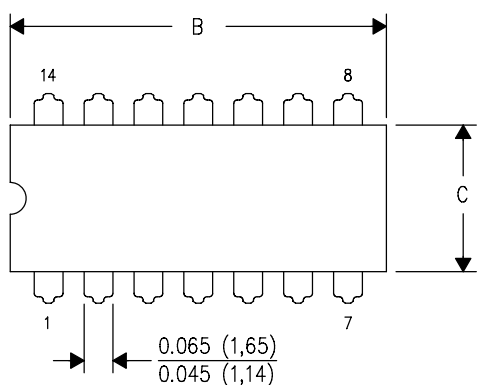
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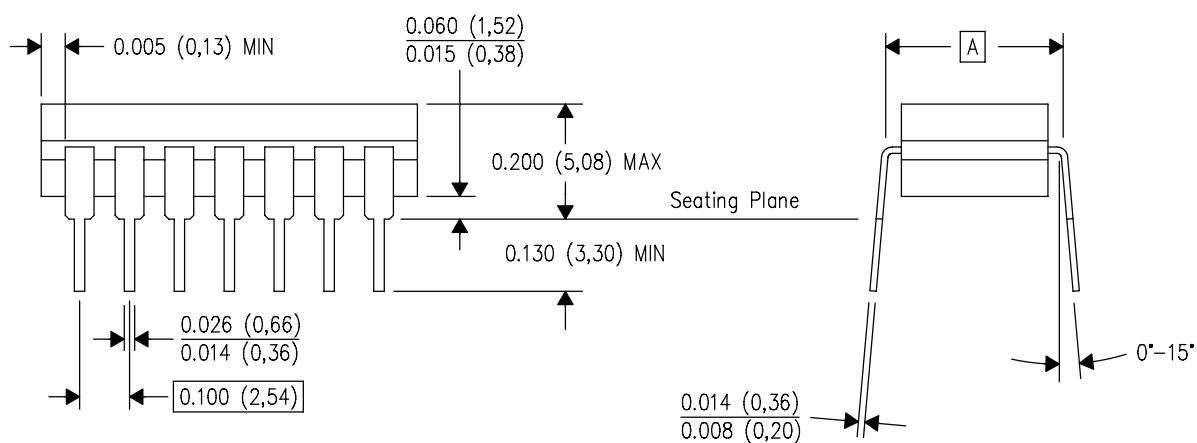


14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package is hermetically sealed with a ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
- E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

W (R-GDFP-F16)

CERAMIC DUAL FLATPACK



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only.
  - Falls within MIL STD 1835 GDFP1-F16 and JEDEC MO-092AC

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN

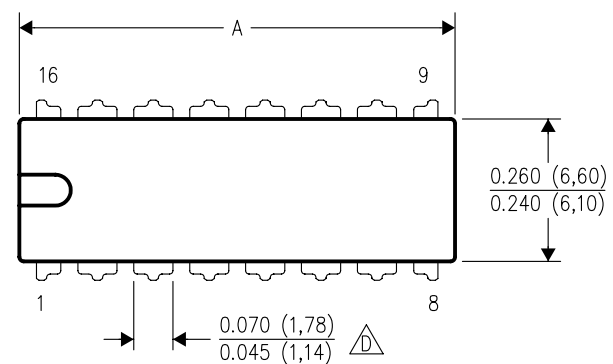


- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - The terminals are gold plated.
  - Falls within JEDEC MS-004

N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



4040049/E 12/2002

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  -  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  -  The 20 pin end lead shoulder width is a vendor option, either half or full width.

## D (R-PDSO-G16)

## PLASTIC SMALL-OUTLINE PACKAGE



4040047-4/F 07/2004

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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Interface	<a href="http://interface.ti.com">interface.ti.com</a>	Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>	Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>	Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>	Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
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