

# SN54ALS251, SN74ALS251 1-OF-8 DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

SDAS215A – APRIL 1982 – REVISED DECEMBER 1994

- 3-State Version of the 'ALS151
- 3-State Outputs Interface Directly With System Bus
- Perform Parallel-to-Serial Conversion
- Complementary Outputs Provide True and Inverted Data
- Package Options Include Plastic Small-Outline (D) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

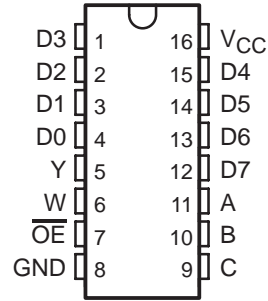
## description

These data selectors/multiplexers contain full binary decoding to select one-of-eight data sources and feature controlled complementary 3-state outputs.

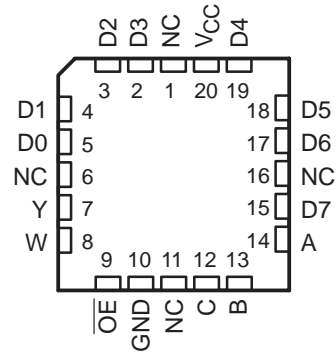
The 3-state outputs can interface with and drive data lines of bus-organized systems. With all but one of the common outputs disabled (at the high-impedance state), the low impedance of the signal-enabled output drives the bus line to a high or low logic level. Both outputs are controlled by the output-enable ( $\overline{OE}$ ) input. The outputs are disabled when  $\overline{OE}$  is high.

The SN54ALS251 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN74ALS251 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

SN54ALS251 . . . J PACKAGE  
SN74ALS251 . . . D OR N PACKAGE  
(TOP VIEW)



SN54ALS251 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

FUNCTION TABLE

INPUTS				OUTPUTS	
SELECT			$\overline{OE}$		
C	B	A		Y	W
X	X	X	H	Z	Z
L	L	L	L	D0	$\overline{D0}$
L	L	H	L	D1	$\overline{D1}$
L	H	L	L	D2	$\overline{D2}$
L	H	H	L	D3	$\overline{D3}$
H	L	L	L	D4	$\overline{D4}$
H	L	H	L	D5	$\overline{D5}$
H	H	L	L	D6	$\overline{D6}$
H	H	H	L	D7	$\overline{D7}$

D0, D1, . . . D7 = the level of the respective D input

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The diagram illustrates the internal structure of a 74151 8-to-1 Multiplexer (MUX). It shows the following components and connections:

- Inputs:**
  - EN (Enable):** Input 7, active-low (indicated by a bubble).
  - Selection Inputs:** Inputs 11 (A), 10 (B), and 9 (C) are connected to the selection inputs 0, 2, and 2 respectively, as indicated by the bracket labeled  $G \frac{0}{7}$ .
  - Data Inputs:** Inputs 4 (D0), 3 (D1), 2 (D2), 1 (D3), 15 (D4), 14 (D5), 13 (D6), and 12 (D7) are connected to the data inputs 0 through 7.
- Outputs:**
  - Y (Output):** Output 5, active-low (indicated by a bubble).
  - W (Output):** Output 6, active-low (indicated by a bubble).
- Internal Structure:** The MUX is represented by a large block labeled "MUX" with a vertical line indicating the internal data path.

The diagram illustrates a 4-to-16 decoder implemented with 8 AND gates and 1 OR gate. The inputs are divided into two groups: Data Inputs (D0-D7) and Data Select (binary) (A, B, C). The output is a 16-bit bus (Y, W).

- Data Inputs (D0-D7):** These are the 4-bit data inputs, labeled 4 through 11 in the diagram.
- Data Select (binary) (A, B, C):** These are the 3-bit select inputs, labeled 9 through 11 in the diagram.
- AND Gates:** There are 8 AND gates. Each gate takes a 4-bit data input and a 3-bit select input (A, B, C) as inputs. The select inputs are inverted (A, B, C) and then connected to the AND gates. The data inputs are connected to the AND gates in a way that each gate outputs a unique 16-bit bus value.
- OR Gate:** The outputs of the 8 AND gates are connected to a single OR gate, which produces the final 16-bit bus output (Y, W).



**TEXAS  
INSTRUMENTS**

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# SN54ALS251, SN74ALS251

## 1-OF-8 DATA SELECTORS/MULTIPLEXERS

### WITH 3-STATE OUTPUTS

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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
Voltage applied to a disabled 3-state output	5.5 V
Operating free-air temperature range, $T_A$ : SN54ALS251	–55°C to 125°C
SN74ALS251	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

		SN54ALS251			SN74ALS251			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			–1			–2.6	mA
$I_{OL}$	Low-level output current			12			24	mA
$T_A$	Operating free-air temperature	–55		125	0		70	°C

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

PARAMETER		TEST CONDITIONS		SN54ALS251			SN74ALS251			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V <sub>IK</sub>		V <sub>CC</sub> = 4.5 V, I <sub>I</sub> = –18 mA		–1.5			–1.5			V
V <sub>OH</sub>		V <sub>CC</sub> = 4.5 V to 5.5 V, I <sub>OH</sub> = –0.4 mA		V <sub>CC</sub> – 2			V <sub>CC</sub> – 2			V
		V <sub>CC</sub> = 4.5 V		I <sub>OH</sub> = –1 mA		2.4 3.3				
				I <sub>OH</sub> = –2.6 mA				2.4 3.2		
V <sub>OL</sub>		V <sub>CC</sub> = 4.5 V		I <sub>OL</sub> = 12 mA		0.25 0.4		0.25 0.4		V
				I <sub>OL</sub> = 24 mA				0.35 0.5		
I <sub>OZH</sub>		V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.7 V		20			20			μA
I <sub>OZL</sub>		V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 0.4 V		–20			–20			μA
I <sub>I</sub>		V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 7 V		0.1			0.1			mA
I <sub>IH</sub>		V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 2.7 V		20			20			μA
I <sub>IL</sub>		V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 0.4 V		–0.1			–0.1			mA
I <sub>O</sub> §		V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 4.5 V		–20		–112	–30		–112	mA
I <sub>CC</sub>	Enabled	V <sub>CC</sub> = 5.5 V		Inputs at GND		7 10		7 10		mA
	Inputs at 4.5 V			9.4 14		9.4 14				

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

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



# SN54ALS251, SN74ALS251

## 1-OF-8 DATA SELECTORS/MULTIPLEXERS

### WITH 3-STATE OUTPUTS

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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>1</sub> = 500 Ω, R <sub>2</sub> = 500 Ω, T <sub>A</sub> = MIN to MAX†				UNIT
			SN54ALS251		SN74ALS251		
			MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	A, B, or C	Y	1	21	5	18	ns
t <sub>PHL</sub>			7	34	8	24	
t <sub>PLH</sub>	A, B, or C	W	5	38	8	24	ns
t <sub>PHL</sub>			7	26	7	23	
t <sub>PLH</sub>	Any D	Y	2	15	2	10	ns
t <sub>PHL</sub>			3	23	3	15	
t <sub>PLH</sub>	Any D	W	3	25	3	15	ns
t <sub>PHL</sub>			3	20	3	15	
t <sub>PZH</sub>	$\overline{OE}$	Y	3	21	3	15	ns
t <sub>PZL</sub>			3	19	3	15	
t <sub>PZH</sub>	$\overline{OE}$	W	3	21	3	15	ns
t <sub>PZL</sub>			3	19	3	15	
t <sub>PZH</sub>	$\overline{OE}$	Y	2	12	2	10	ns
t <sub>PZL</sub>			1	18	1	10	
t <sub>PZH</sub>	$\overline{OE}$	W	2	12	2	10	ns
t <sub>PZL</sub>			1	18	1	10	

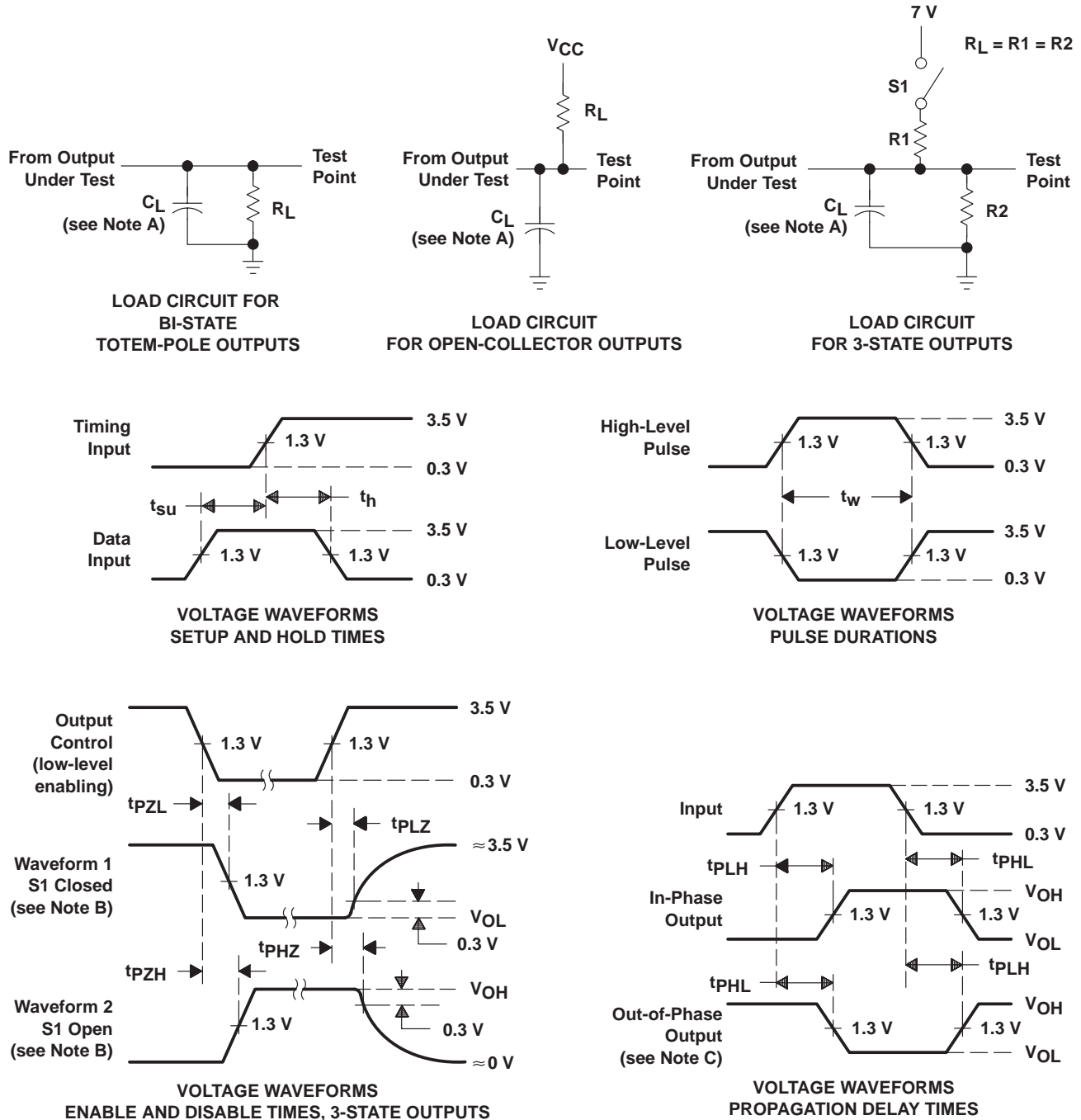
† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.



# SN54ALS251, SN74ALS251 1-OF-8 DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

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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 (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
84135012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	84135012A SNJ54ALS 251FK	<a href="#">Samples</a>
8413501EA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	8413501EA SNJ54ALS251J	<a href="#">Samples</a>
8413501FA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	8413501FA SNJ54ALS251W	<a href="#">Samples</a>
SN54ALS251J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	SN54ALS251J	<a href="#">Samples</a>
SN74ALS251D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS251	<a href="#">Samples</a>
SN74ALS251DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS251	<a href="#">Samples</a>
SN74ALS251DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS251	<a href="#">Samples</a>
SN74ALS251DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS251	<a href="#">Samples</a>
SN74ALS251DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS251	<a href="#">Samples</a>
SN74ALS251DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS251	<a href="#">Samples</a>
SN74ALS251N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74ALS251N	<a href="#">Samples</a>
SN74ALS251NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	0 to 70	SN74ALS251N	<a href="#">Samples</a>
SN74ALS251NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS251	<a href="#">Samples</a>
SN74ALS251NSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS251	<a href="#">Samples</a>
SN74ALS251NSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS251	<a href="#">Samples</a>
SNJ54ALS251FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	84135012A SNJ54ALS 251FK	<a href="#">Samples</a>

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SNJ54ALS251J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	8413501EA SNJ54ALS251J	<a href="#">Samples</a>
SNJ54ALS251W	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type	-55 to 125	8413501FA SNJ54ALS251W	<a href="#">Samples</a>

(1) 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.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), 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.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**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)

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

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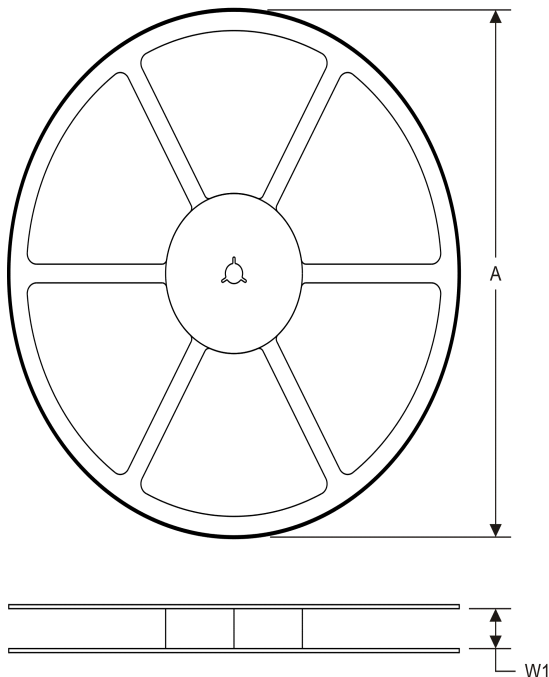
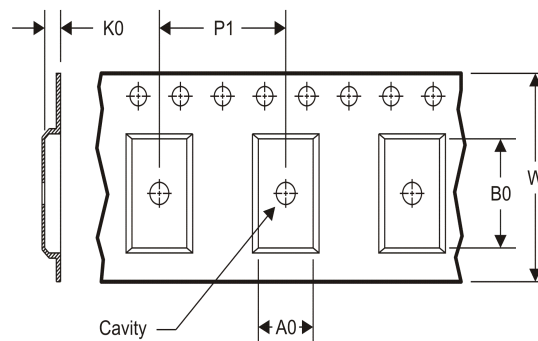
**OTHER QUALIFIED VERSIONS OF SN54ALS251, SN74ALS251 :**

- Catalog: [SN74ALS251](#)
- Military: [SN54ALS251](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications



**TAPE AND REEL INFORMATION**
**REEL DIMENSIONS**

**TAPE DIMENSIONS**


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

**TAPE AND REEL INFORMATION**

\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74ALS251DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74ALS251NSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ALS251DR	SOIC	D	16	2500	333.2	345.9	28.6
SN74ALS251NSR	SO	NS	16	2000	367.0	367.0	38.0

J (R-GDIP-T\*\*)

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



PINS ** DIM	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



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)



4040140/D 01/11

- 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.
  - 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



4040047-6/M 06/11

NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
- D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AC.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



# 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.