

# SN54ALS541, SN74ALS540, SN74ALS541 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

SDAS025D – APRIL 1982 – REVISED MARCH 2002

- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- pnp Inputs Reduce dc Loading
- Data Flowthrough Pinout (All Inputs on Opposite Side From Outputs)

## description

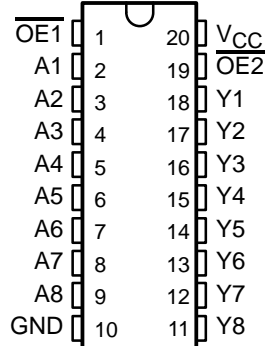
These octal buffers and line drivers are designed to have the performance of the popular SN54ALS240A/SN74ALS240A series and, at the same time, offer a pinout with inputs and outputs on opposite sides of the package. This arrangement greatly facilitates printed circuit board layout.

The 3-state control gate is a 2-input NOR gate such that, if either output-enable ( $\overline{OE1}$  or  $\overline{OE2}$ ) input is high, all eight outputs are in the high-impedance state.

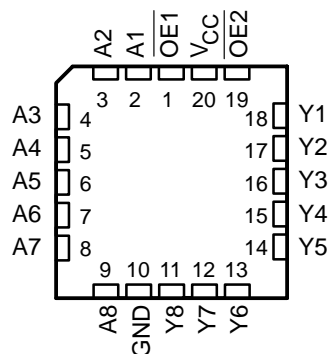
The SN74ALS540 provides inverted data. The 'ALS541 provide true data at the outputs.

The -1 versions of SN74ALS540 and SN74ALS541 are identical to the standard versions, except that the recommended maximum  $I_{OL}$  is increased to 48 mA. There is no -1 version of the SN54ALS541.

SN54ALS541 . . . J PACKAGE  
SN74ALS540 . . . DW, N, OR NS PACKAGE  
SN74ALS541 . . . DB, DW, N, OR NS PACKAGE  
(TOP VIEW)



SN54ALS541 . . . FK PACKAGE  
(TOP VIEW)



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS  
INSTRUMENTS**

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# SN54ALS541, SN74ALS540, SN74ALS541 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

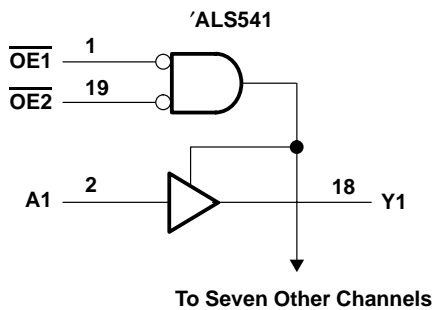
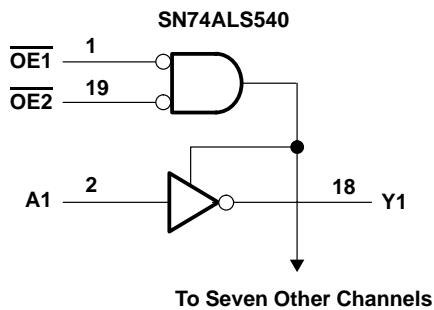
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## ORDERING INFORMATION

T <sub>A</sub>	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	PDIP – N	Tube	SN74ALS540N	SN74ALS540N
			SN74ALS540-1N	SN74ALS540-1N
			SN74ALS541N	SN74ALS541N
			SN74ALS541-1N	SN74ALS541-1N
	SOIC – DW	Tube	SN74ALS540DW	ALS540
		Tape and reel	SN74ALS540DWR	
		Tube	SN74ALS540-1DW	ALS540-1
		Tube	SN74ALS541DW	
		Tape and reel	SN74ALS541DWR	ALS541
		Tube	SN74ALS541-1DW	
	SOP – NS	Tape and reel	SN74ALS540NSR	ALS540
			SN74ALS540-1NSR	ALS540-1
			SN74ALS541NSR	ALS541
	SSOP – DB	Tape and reel	SN74ALS541DBR	G541
SN74ALS541-1DBR			G541-1	
–55°C to 125°C	CDIP – J	Tube	SNJ54ALS541J	SNJ54ALS541J
	LCCC – FK	Tube	SNJ54ALS541FK	SNJ54ALS541FK

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

## logic diagrams (positive logic)



# SN54ALS541, SN74ALS540, SN74ALS541 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

SDAS025D – APRIL 1982 – REVISED MARCH 2002

## absolute maximum ratings over operating free-air temperature (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
Package thermal impedance, $\theta_{JA}$ (see Note 1): DB package .....	70°C/W
DW package .....	58°C/W
N package .....	69°C/W
NS package .....	60°C/W
Storage temperature range, $T_{stg}$ .....	–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.

NOTE 1: The package thermal impedance is calculated in accordance with JESD 51-7.

## recommended operating conditions

		SN54ALS541			SN74ALS540 SN74ALS541			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			–12			–15	mA
$I_{OL}$	Low-level output current			12			24	mA
							48 <sup>†</sup>	
$T_A$	Operating free-air temperature	–55		125	0		70	°C

<sup>†</sup> Applies only to the -1 version and only if  $V_{CC}$  is between 4.75 V and 5.25 V



# SN54ALS541, SN74ALS540, SN74ALS541

## OCTAL BUFFERS AND LINE DRIVERS

### WITH 3-STATE OUTPUTS

SDAS025D – APRIL 1982 – REVISED MARCH 2002

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

PARAMETER	TEST CONDITIONS		SN54ALS541			SN74ALS540 SN74ALS541			UNIT
			MIN	TYP <sup>‡</sup>	MAX	MIN	TYP <sup>‡</sup>	MAX	
V <sub>IK</sub>	V <sub>CC</sub> = 4.5 V, I <sub>I</sub> = -18 mA		-1.2			-1.2			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> = -3 mA	2.4	3.2	2.4	3.2			
		I <sub>OH</sub> = -12 mA	2		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				
		I <sub>OL</sub> = 24 mA			0.35 0.5				
		I <sub>OL</sub> = 48 mA <sup>†</sup>			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	-0.2			-0.1			mA	
I <sub>O</sub> <sup>§</sup>	V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.25 V	-20	-112		-30	-112		mA	
I <sub>CC</sub>	SN74ALS540	V <sub>CC</sub> = 5.5 V	Outputs high		5 10				
			Outputs low		13 22				
			Outputs disabled		11 19				
	'ALS541	V <sub>CC</sub> = 5.5 V	Outputs high		6	14	6	14	
			Outputs low		15	25	15	25	
			Outputs disabled		13.5	32	13.5	22	

<sup>†</sup> Applies only to the -1 version and only if V<sub>CC</sub> is between 4.75 V and 5.25 V

<sup>‡</sup> All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°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<sub>OS</sub>.

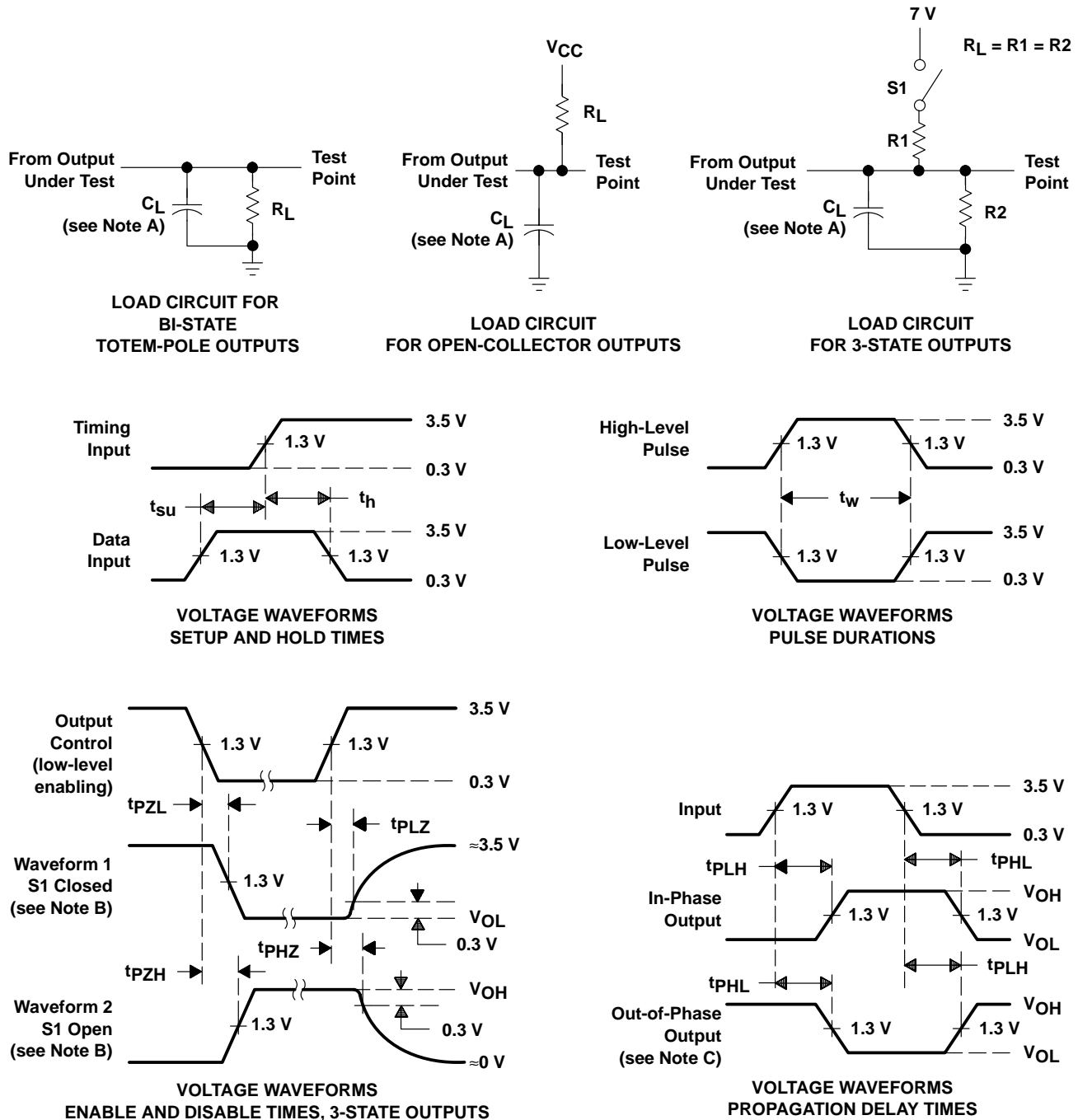
### switching characteristics (see Figure 1)

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 <sup>†</sup>						UNIT
			SN54ALS541		SN74ALS540		SN74ALS541		
			MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	A	Y	4	17	2	12	4	14	ns
t <sub>PHL</sub>			2	14	2	9	2	10	
t <sub>PZH</sub>	$\overline{OE}$	Y	5	18	5	15	5	15	ns
t <sub>PZL</sub>			8	28	8	20	8	20	
t <sub>PHZ</sub>	$\overline{OE}$	Y	1	12	1	10	1	10	ns
t <sub>PLZ</sub>			2	14	2	12	2	12	

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



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 finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-8960201RA	ACTIVE	CDIP	J	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-8960201RA SNJ54ALS541J	<a href="#">Samples</a>
SN54ALS541J	ACTIVE	CDIP	J	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SN54ALS541J	<a href="#">Samples</a>
SN74ALS540-1N	ACTIVE	PDIP	N	20	20	RoHS & Non-Green	NIPDAU	N / A for Pkg Type	0 to 70	SN74ALS540-1N	<a href="#">Samples</a>
SN74ALS540-1NSR	ACTIVE	SO	NS	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS540-1	<a href="#">Samples</a>
SN74ALS540DW	LIFEBUY	SOIC	DW	20	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS540	
SN74ALS540DWR	ACTIVE	SOIC	DW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS540	<a href="#">Samples</a>
SN74ALS540N	ACTIVE	PDIP	N	20	20	RoHS & Non-Green	NIPDAU	N / A for Pkg Type	0 to 70	SN74ALS540N	<a href="#">Samples</a>
SN74ALS540NSR	ACTIVE	SO	NS	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS540	<a href="#">Samples</a>
SN74ALS541-1DW	ACTIVE	SOIC	DW	20	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS541-1	<a href="#">Samples</a>
SN74ALS541-1N	ACTIVE	PDIP	N	20	20	RoHS & Non-Green	NIPDAU	N / A for Pkg Type	0 to 70	SN74ALS541-1N	<a href="#">Samples</a>
SN74ALS541-1NE4	ACTIVE	PDIP	N	20	20	RoHS & Non-Green	NIPDAU	N / A for Pkg Type	0 to 70	SN74ALS541-1N	<a href="#">Samples</a>
SN74ALS541-1NSR	ACTIVE	SO	NS	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS541-1	<a href="#">Samples</a>
SN74ALS541DB	LIFEBUY	SSOP	DB	20	70	RoHS & Green	NIPDAU	Level-1-260C-UNLIM		G541	
SN74ALS541DBR	ACTIVE	SSOP	DB	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	G541	<a href="#">Samples</a>
SN74ALS541DW	LIFEBUY	SOIC	DW	20	25	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS541	
SN74ALS541DWR	ACTIVE	SOIC	DW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS541	<a href="#">Samples</a>
SN74ALS541N	ACTIVE	PDIP	N	20	20	RoHS & Non-Green	NIPDAU	N / A for Pkg Type	0 to 70	SN74ALS541N	<a href="#">Samples</a>
SN74ALS541NSR	ACTIVE	SO	NS	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS541	<a href="#">Samples</a>
SN74ALS541NSRE4	ACTIVE	SO	NS	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	ALS541	<a href="#">Samples</a>

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SNJ54ALS541J	ACTIVE	CDIP	J	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-8960201RA SNJ54ALS541J	Samples

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(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.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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**OTHER QUALIFIED VERSIONS OF SN54ALS541, SN74ALS541 :**

- Catalog : [SN74ALS541](#)
- Military : [SN54ALS541](#)

NOTE: Qualified Version Definitions:

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



**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*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
SN74ALS540-1NSR	SO	NS	20	2000	330.0	24.4	8.4	13.0	2.5	12.0	24.0	Q1
SN74ALS540DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74ALS540NSR	SO	NS	20	2000	330.0	24.4	8.4	13.0	2.5	12.0	24.0	Q1
SN74ALS541-1NSR	SO	NS	20	2000	330.0	24.4	8.4	13.0	2.5	12.0	24.0	Q1
SN74ALS541DBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN74ALS541DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74ALS541NSR	SO	NS	20	2000	330.0	24.4	8.4	13.0	2.5	12.0	24.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74ALS540-1NSR	SO	NS	20	2000	367.0	367.0	45.0
SN74ALS540DWR	SOIC	DW	20	2000	367.0	367.0	45.0
SN74ALS540NSR	SO	NS	20	2000	367.0	367.0	45.0
SN74ALS541-1NSR	SO	NS	20	2000	367.0	367.0	45.0
SN74ALS541DBR	SSOP	DB	20	2000	356.0	356.0	35.0
SN74ALS541DWR	SOIC	DW	20	2000	367.0	367.0	45.0
SN74ALS541NSR	SO	NS	20	2000	367.0	367.0	45.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74ALS540-1N	N	PDIP	20	20	506	13.97	11230	4.32
SN74ALS540DW	DW	SOIC	20	25	507	12.83	5080	6.6
SN74ALS540N	N	PDIP	20	20	506	13.97	11230	4.32
SN74ALS541-1DW	DW	SOIC	20	25	507	12.83	5080	6.6
SN74ALS541-1N	N	PDIP	20	20	506	13.97	11230	4.32
SN74ALS541-1NE4	N	PDIP	20	20	506	13.97	11230	4.32
SN74ALS541DB	DB	SSOP	20	70	530	10.5	4000	4.1
SN74ALS541DW	DW	SOIC	20	25	507	12.83	5080	6.6
SN74ALS541N	N	PDIP	20	20	506	13.97	11230	4.32

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

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

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

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



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

# DW0020A



# PACKAGE OUTLINE

## SOIC - 2.65 mm max height

SOIC



4220724/A 05/2016

**NOTES:**

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm per side.
5. Reference JEDEC registration MS-013.

# EXAMPLE BOARD LAYOUT

DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:6X



SOLDER MASK DETAILS

4220724/A 05/2016

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:6X

4220724/A 05/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.



# DB0020A



# PACKAGE OUTLINE

## SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



4214851/B 08/2019

# EXAMPLE BOARD LAYOUT

DB0020A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



4214851/B 08/2019

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DB0020A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 10X

4214851/B 08/2019

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

# 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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