

SN54LS540, SN54LS541, SN74LS540, SN74LS541 OCTAL BUFFERS AND LINE DRIVERS WITH 3-STATE OUTPUTS

SDLS180 - AUGUST 1979 - REVISED MARCH 1988

- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- P-N-P Inputs Reduce D-C Loading
- Hysteresis at Inputs Improves Noise Margins
- Data Flow-thru Pinout (All Inputs on Opposite Side from Outputs)

description

These octal buffers and line drivers are designed to have the performance of the popular SN54LS240/SN74LS240 series and, at the same time, offer a pinout having the inputs and outputs on opposite sides of the package. This arrangement greatly enhances printed circuit board layout.

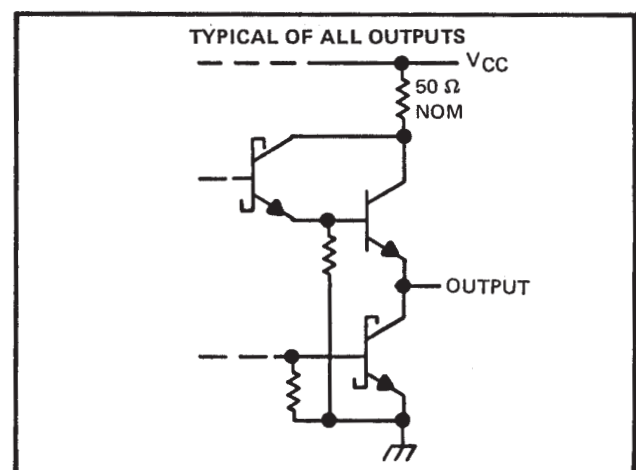
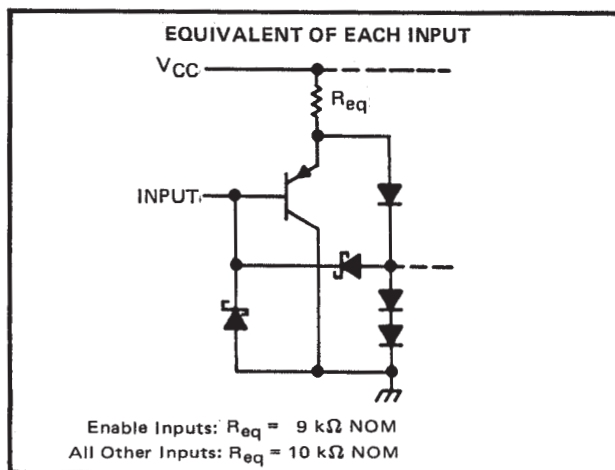
The three-state control gate is a 2-input NOR such that if either $\overline{G1}$ or $\overline{G2}$ are high, all eight outputs are in the high-impedance state.

The 'LS540 offers inverting data and the 'LS541 offers true data at the outputs.

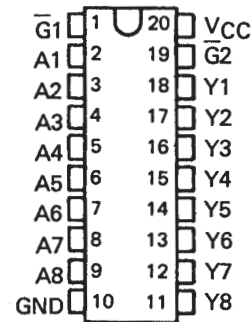
The SN54LS540 and SN54LS541 are characterized for operation over the full military temperature range of -55°C to 125°C . The SN74LS540 and SN74LS541 are characterized for operation from 0°C to 70°C .

TYPE	RATED I_{OL} (SINK CURRENT)	RATED I_{OH} (SOURCE CURRENT)	TYPICAL POWER DISSIPATION (ENABLED)	
			'LS540	'LS541
SN54LS'	12 mA	- 12 mA	92.5 mW	120 mW
SN74LS'	24 mA	- 15 mA	92.5 mW	120 mW

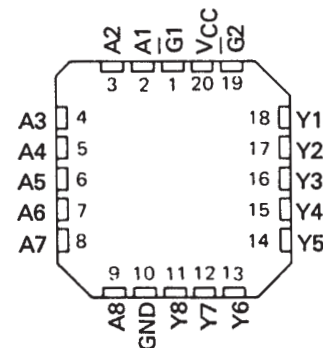
schematics of inputs and outputs



SN54LS540, SN54LS541 . . . J OR W PACKAGE
SN74LS540, SN74LS541 . . . DW OR N PACKAGE
(TOP VIEW)



SN54LS540, SN54LS541 . . . FK PACKAGE
(TOP VIEW)



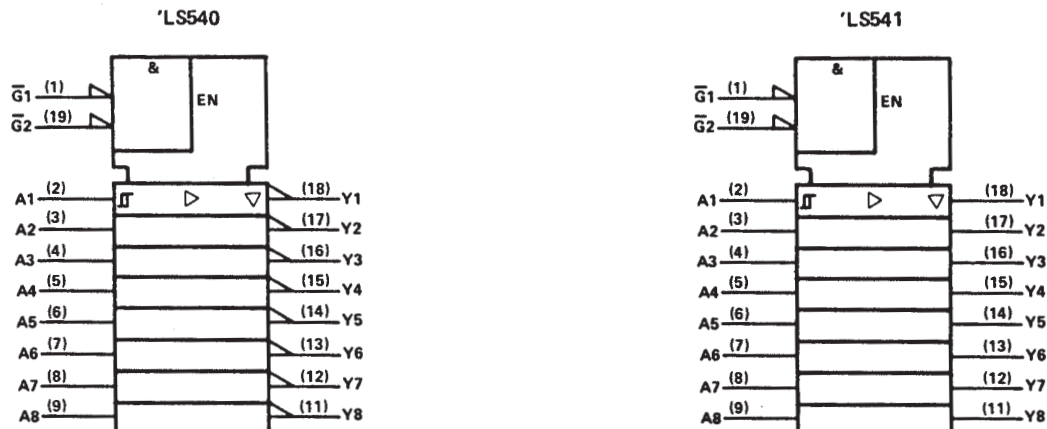
SN54LS540, SN54LS541, SN74LS540, SN74LS541

OCTAL BUFFERS AND LINE DRIVERS

WITH 3-STATE OUTPUTS

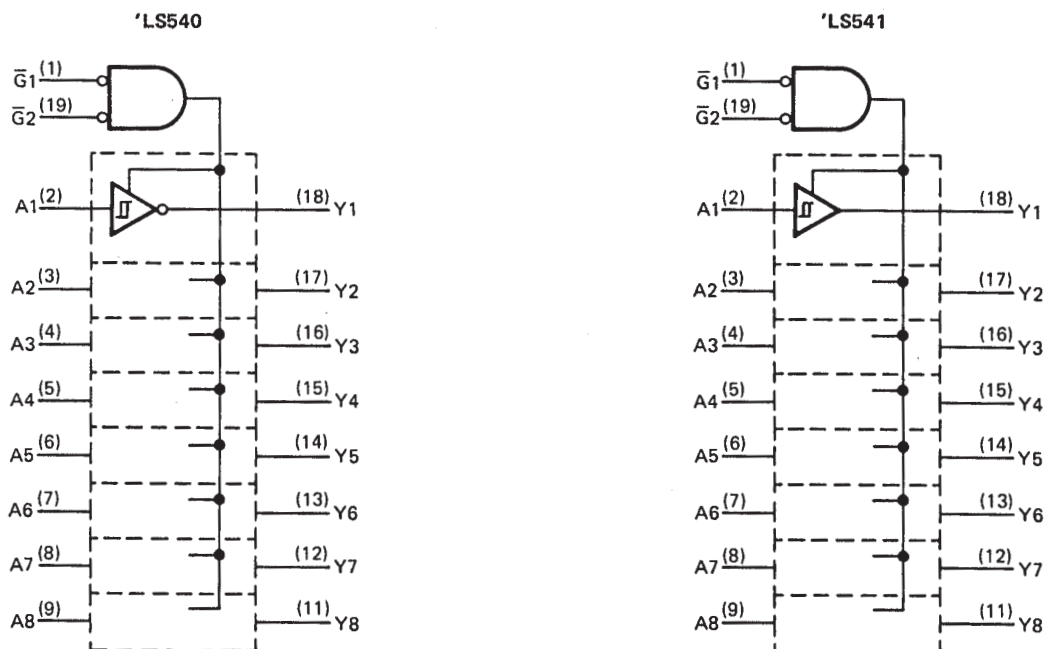
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logic symbols†



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

logic diagram (positive logic)



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

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	7 V
Operating free-air temperature range: SN54LS540, SN54LS541	– 55°C to 125°C
SN74LS540, SN74LS541	0°C to 70°C
Storage temperature range	– 65°C to 150°C

NOTE 1: Voltage values are with respect to the network ground terminal.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

SN54LS540, SN54LS541, SN74LS540, SN74LS541

OCTAL BUFFERS AND LINE DRIVERS

WITH 3-STATE OUTPUTS

SDLS180 – AUGUST 1979 – REVISED MARCH 1988

recommended operating conditions

PARAMETER	SN54LS'			SN74LS'			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC} (see Note 1)	4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}			-12			-15	mA
Low-level output current, I_{OL}			12			24	mA
Operating free-air temperature, T_A	-55		125	0		70	°C

NOTE 1: Voltage values are with respect to network ground terminal.

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

PARAMETER		TEST CONDITIONS†	SN54LS'			SN74LS'			UNIT
			MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V _{IH}	High-level input voltage		2			2			V
V _{IL}	Low-level input voltage				0.6			0.6	V
V _{IK}	Input clamp voltage	V _{CC} = MIN, I _I = -18 mA			-1.5			-1.5	V
	Hysteresis (V _{T+} - V _{T-})	V _{CC} = MIN	0.2	0.4		0.2	0.4		V
V _{OH}	High-level output voltage	V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = V _{IL} max, I _{OH} = -3 mA	2.4	3.4		2.4	3.4		V
		V _{CC} = MIN, V _{IH} = 2V, V _{IL} = 0.5 V, I _{OH} = MAX	2			2			
V _{OL}	Low-level output voltage	V _{CC} = MIN, V _{IH} = 2 V, V _{IL} = V _{IL} max	I _{OL} = 12 mA	0.25	0.4		0.25	0.4	V
			I _{OL} = 24 mA				0.35	0.5	
I _{OZH}	Off-state output current, high-level voltage applied	V _{CC} = MAX, V _{IH} = 2 V, V _{IL} = V _{IL} max	V _O = 2.7 V		20		20		μA
I _{OZL}	Off-state output current, low-level voltage applied		V _O = 0.4 V		-20		-20		
I _I	Input current at maximum input voltage	V _{CC} = MAX, V _I = 7 V			0.1		0.1		mA
I _{IH}	High-level input current, any input	V _{CC} = MAX, V _I = 2.7 V			20		20		μA
I _{IL}	Low-level input current	V _{CC} = MAX, V _I = 0.4 V			-0.2		-0.2		mA
I _{OS}	Short-circuit output current§	V _{CC} = MAX	-40		-225	-40		-225	mA
I _{CC}	Outputs high	V _{CC} = MAX, Outputs open	'LS540	13	25		13	25	mA
			'LS541	18	32		18	32	
	Outputs low		'LS540	24	45		24	45	
			'LS541	30	52		30	52	
	All outputs disabled		'LS540	30	52		30	52	
			'LS541	32	55		32	55	

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

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

§Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

SN54LS540, SN54LS541, SN74LS540, SN74LS541

OCTAL BUFFERS AND LINE DRIVERS

WITH 3-STATE OUTPUTS

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switching characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	'LS540			'LS541			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
t_{PLH} Propagation delay time, low-to-high-level output	$C_L = 45\text{ pF}$, $R_L = 667\ \Omega$, See Note 2		9	15		9	15	ns
t_{PHL} Propagation delay time, high-to-low-level output			9	15		10	18	ns
t_{PZL} Output enable time to low level			25	38		25	38	ns
t_{PZH} Output enable time to high level			15	25		20	32	ns
t_{PLZ} Output disable time from low level	$C_L = 5\text{ pF}$, $R_L = 667\ \Omega$, See Note 2		10	18		10	18	ns
t_{PHZ} Output disable time from high level			15	25		18	29	ns

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.



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PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
84155012A	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	84155012A SNJ54LS 540FK
8415501RA	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	8415501RA SNJ54LS540J
8415501RA	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	8415501RA SNJ54LS540J
8415601SA	Active	Production	CFP (W) 20	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	8415601SA SNJ54LS541W
8415601SA	Active	Production	CFP (W) 20	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	8415601SA SNJ54LS541W
JM38510/32404B2A	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 32404B2A
JM38510/32404B2A	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 32404B2A
JM38510/32404BRA	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 32404BRA
JM38510/32404BRA	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 32404BRA
JM38510/32405BRA	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 32405BRA
JM38510/32405BRA	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 32405BRA
SN54LS540J	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS540J
SN54LS540J	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS540J
SN54LS541J	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS541J
SN54LS541J	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54LS541J
SN74LS540DBR	Active	Production	SSOP (DB) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS540
SN74LS540DBR	Active	Production	SSOP (DB) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS540
SN74LS540DWR	Active	Production	SOIC (DW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS540
SN74LS540DWR	Active	Production	SOIC (DW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS540
SN74LS540N	Active	Production	PDIP (N) 20	20 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS540N

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
SN74LS540N	Active	Production	PDIP (N) 20	20 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS540N
SN74LS540NSR	Active	Production	SOP (NS) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS540
SN74LS540NSR	Active	Production	SOP (NS) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS540
SN74LS541DW	Active	Production	SOIC (DW) 20	25 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS541
SN74LS541DW	Active	Production	SOIC (DW) 20	25 TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS541
SN74LS541DWR	Active	Production	SOIC (DW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS541
SN74LS541DWR	Active	Production	SOIC (DW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	LS541
SN74LS541N	Active	Production	PDIP (N) 20	20 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS541N
SN74LS541N	Active	Production	PDIP (N) 20	20 TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	SN74LS541N
SN74LS541NSR	Active	Production	SOP (NS) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS541
SN74LS541NSR	Active	Production	SOP (NS) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	74LS541
SNJ54LS540FK	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	84155012A SNJ54LS 540FK
SNJ54LS540FK	Active	Production	LCCC (FK) 20	55 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	84155012A SNJ54LS 540FK
SNJ54LS540J	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	8415501RA SNJ54LS540J
SNJ54LS540J	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	8415501RA SNJ54LS540J
SNJ54LS541J	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54LS541J
SNJ54LS541J	Active	Production	CDIP (J) 20	20 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54LS541J
SNJ54LS541W	Active	Production	CFP (W) 20	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	8415601SA SNJ54LS541W
SNJ54LS541W	Active	Production	CFP (W) 20	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	8415601SA SNJ54LS541W

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts 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.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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OTHER QUALIFIED VERSIONS OF SN54LS540, SN54LS541, SN74LS540, SN74LS541 :

● Catalog : [SN74LS540](#), [SN74LS541](#)

● Military : [SN54LS540](#), [SN54LS541](#)

NOTE: Qualified Version Definitions:

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

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
SN74LS540DBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN74LS540DWR	SOIC	DW	20	2000	330.0	24.4	10.9	13.3	2.7	12.0	24.0	Q1
SN74LS540DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74LS540NSR	SOP	NS	20	2000	330.0	24.4	8.4	13.0	2.5	12.0	24.0	Q1
SN74LS540NSR	SOP	NS	20	2000	330.0	24.4	8.4	13.0	2.5	12.0	24.0	Q1
SN74LS541DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74LS541NSR	SOP	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)
SN74LS540DBR	SSOP	DB	20	2000	356.0	356.0	35.0
SN74LS540DWR	SOIC	DW	20	2000	356.0	356.0	45.0
SN74LS540DWR	SOIC	DW	20	2000	367.0	367.0	45.0
SN74LS540NSR	SOP	NS	20	2000	367.0	367.0	45.0
SN74LS540NSR	SOP	NS	20	2000	367.0	367.0	45.0
SN74LS541DWR	SOIC	DW	20	2000	367.0	367.0	45.0
SN74LS541NSR	SOP	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)
84155012A	FK	LCCC	20	55	506.98	12.06	2030	NA
8415601SA	W	CFP	20	25	506.98	26.16	6220	NA
JM38510/32404B2A	FK	LCCC	20	55	506.98	12.06	2030	NA
M38510/32404B2A	FK	LCCC	20	55	506.98	12.06	2030	NA
SN74LS540N	N	PDIP	20	20	506	13.97	11230	4.32
SN74LS541DW	DW	SOIC	20	25	507	12.83	5080	6.6
SN74LS541N	N	PDIP	20	20	506	13.97	11230	4.32
SN74LS541NE4	N	PDIP	20	20	506	13.97	11230	4.32
SNJ54LS540FK	FK	LCCC	20	55	506.98	12.06	2030	NA
SNJ54LS541W	W	CFP	20	25	506.98	26.16	6220	NA

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.

GENERIC PACKAGE VIEW

FK 20

LCCC - 2.03 mm max height

8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



4229370VA\

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS **	14	16	18	20
DIM				
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



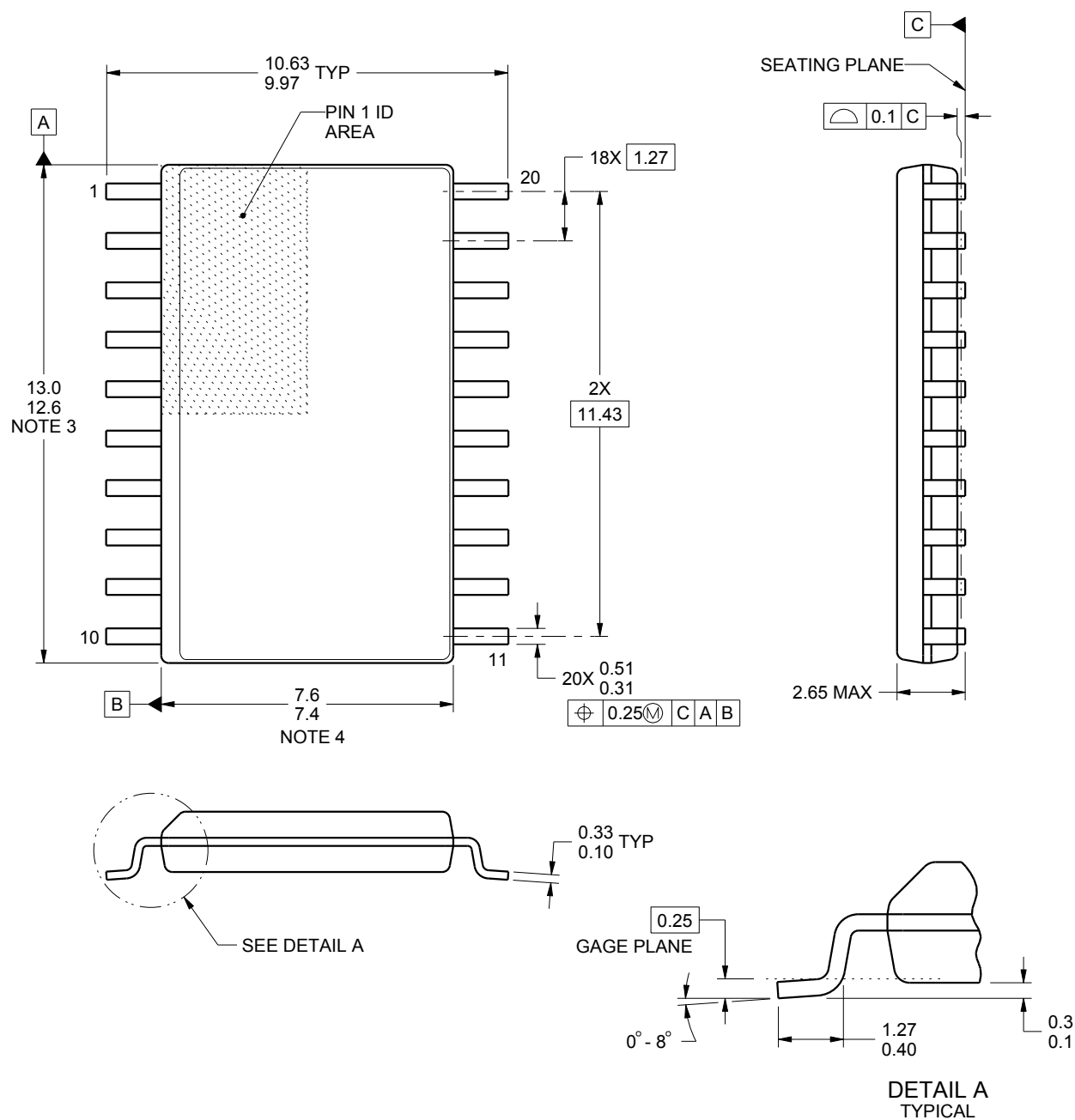
14/18 Pin Only
20 Pin vendor option

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.

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.

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.

W (R-GDFP-F20)

CERAMIC DUAL FLATPACK



NOTES:

- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package can be hermetically sealed with a ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification only.
- E. Falls within Mil-Std 1835 GDFP2-F20



4214851/B 08/2019

NOTES:

1. All linear dimensions are in millimeters. Any 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 0.25 mm per side.
5. Reference JEDEC registration MO-150.

EXAMPLE BOARD LAYOUT

DB0020A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



SOLDER MASK DETAILS

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



DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

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- 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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