

# SNx4HCT541 Octal Buffers and Line Drivers With 3-State Outputs

## 1 Features

- Operating voltage range of 4.5 V to 5.5 V
- High-current 3-state outputs interface directly with system bus or can drive up to 15 LSTTL loads
- Low power consumption, 80- $\mu$ A max  $I_{CC}$
- Typical  $t_{pd} = 12$  ns
- $\pm 6$ -mA output drive at 5 V
- Low input current of 1  $\mu$ A max
- Inputs are TTL-voltage compatible
- Data flow-through pinout (all inputs on opposite side from outputs)

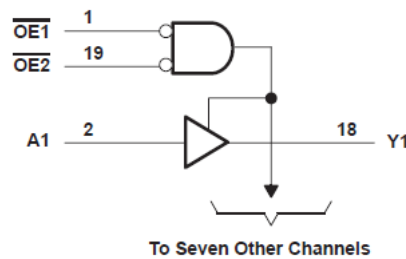
## 2 Description

These octal buffers and line drivers are designed to have the performance of the popular 'HC240 series devices and to offer a pinout with inputs and outputs on opposite sides of the package. This arrangement greatly facilitates printed circuit board layout.

### Device Information

PART NUMBER	PACKAGE <sup>(1)</sup>	BODY SIZE (NOM)
SN74HCT541DW	SOIC (20)	12.80 mm $\times$ 7.50 mm
SN74HCT541DB	SSOP (20)	7.20 mm $\times$ 5.30 mm
SN74HCT541N	PDIP (20)	25.40 mm $\times$ 6.35 mm
SN74HCT541NS	SO (20)	15.00 mm $\times$ 5.30 mm
SN74HCT541PW	TSSOP (20)	6.50 mm $\times$ 4.40 mm
SN54HCT541J	CDIP (20)	26.92 mm $\times$ 6.92 mm
SNJ54HCT541FK	LCCC (20)	8.89 mm $\times$ 8.45 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.



### Functional Block Diagram



## Table of Contents

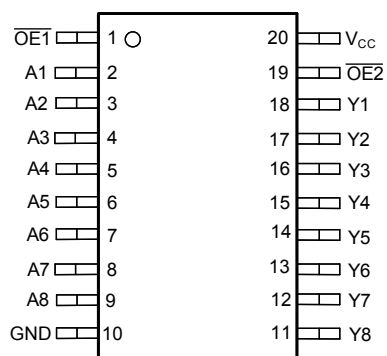
<b>1 Features</b> .....	<b>1</b>	7.1 Overview.....	<b>7</b>
<b>2 Description</b> .....	<b>1</b>	7.2 Functional Block Diagram.....	<b>7</b>
<b>3 Revision History</b> .....	<b>2</b>	7.3 Device Functional Modes.....	<b>7</b>
<b>4 Pin Configuration and Functions</b> .....	<b>3</b>	<b>8 Power Supply Recommendations</b> .....	<b>8</b>
<b>5 Specifications</b> .....	<b>4</b>	<b>9 Layout</b> .....	<b>8</b>
5.1 Absolute Maximum Ratings.....	<b>4</b>	9.1 Layout Guidelines.....	<b>8</b>
5.2 Recommended Operating Conditions <sup>(1)</sup> .....	<b>4</b>	<b>10 Device and Documentation Support</b> .....	<b>9</b>
5.3 Thermal Information.....	<b>4</b>	10.1 Receiving Notification of Documentation Updates.....	<b>9</b>
5.4 Electrical Characteristics.....	<b>5</b>	10.2 Support Resources.....	<b>9</b>
5.5 Switching Characteristics.....	<b>5</b>	10.3 Trademarks.....	<b>9</b>
5.6 Switching Characteristics.....	<b>5</b>	10.4 Electrostatic Discharge Caution.....	<b>9</b>
5.7 Operating Characteristics.....	<b>5</b>	10.5 Glossary.....	<b>9</b>
<b>6 Parameter Measurement Information</b> .....	<b>6</b>	<b>11 Mechanical, Packaging, and Orderable Information</b> .....	<b>10</b>
<b>7 Detailed Description</b> .....	<b>7</b>		

## 3 Revision History

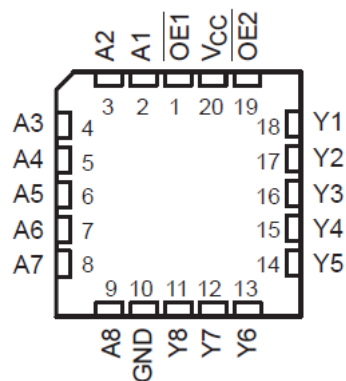
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

<b>Changes from Revision D (February 2022) to Revision E (May 2022)</b>	<b>Page</b>
<ul style="list-style-type: none"> <li>Junction-to-ambient thermal resistance values increased. DW was 58 is now 109.1, DB was 70 is now 122.7, N was 69 is now 84.6, NS was 60 is now 113.4, PW was 83 is now 131.8.....</li> </ul>	<b>4</b>
<b>Changes from Revision C (August 2003) to Revision D (February 2022)</b>	<b>Page</b>
<ul style="list-style-type: none"> <li>Updated the numbering, formatting, tables, figures, and cross-references throughout the document to reflect modern data sheet standards.....</li> </ul>	<b>1</b>

## 4 Pin Configuration and Functions



**J, DB, DW, N, NS, or PW Package**  
**20-Pin CDIP, SSOP, SOIC, PDIP, SO, or TSSOP**  
**Top View**



**FK Package**  
**20-Pin LCCC**  
**Top View**

## 5 Specifications

### 5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

			MIN	MAX	UNIT
$V_{CC}$	Supply voltage range		–0.5	7	V
$I_{IK}$	Input clamp current <sup>(2)</sup>	$V_I < 0$ or $V_I > V_{CC}$		±20	mA
$I_{OK}$	Output clamp current <sup>(2)</sup>	$V_O < 0$ or $V_O > V_{CC}$		±20	mA
$I_O$	Continuous output current	$V_O = 0$ to $V_{CC}$		±35	mA
	Continuous current through $V_{CC}$ or GND			±70	mA
$T_J$	Junction temperature			150	°C
$T_{stg}$	Storage temperature range		–65	150	°C

- (1) 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.
- (2) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

### 5.2 Recommended Operating Conditions<sup>(1)</sup>

			SN54HCT541			SN74HCT541			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	$V_{CC} = 4.5$ V to 5.5 V	2			2			V
$V_{IL}$	Low-level input voltage	$V_{CC} = 4.5$ V to 5.5 V			0.8			0.8	V
$V_I$	Input voltage		0		$V_{CC}$	0		$V_{CC}$	V
$V_O$	Output voltage		0		$V_{CC}$	0		$V_{CC}$	V
$\Delta t/\Delta v$	Input transition rise and fall time				500			500	ns
$T_A$	Operating free-air temperature		–55		125	–40		85	°C

- (1) All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number [SCBA004](#).

### 5.3 Thermal Information

		DW (SOIC)	DB (SSOP)	N (PDIP)	NS (SO)	PW (TSSOP)	UNIT
THERMAL METRIC		20 PINS	20 PINS	20 PINS	20 PINS	20 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	109.1	122.7	84.6	113.4	131.8	°C/W
$R_{\theta JC (top)}$	Junction-to-case (top) thermal resistance	76	81.6	72.5	78.6	72.2	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	77.6	77.5	65.3	78.4	82.8	°C/W
$\Psi_{JT}$	Junction-to-top characterization parameter	51.5	46.1	55.3	47.1	21.5	°C/W
$\Psi_{JB}$	Junction-to-board characterization parameter	77.1	77.1	65.2	78.1	82.4	°C/W
$R_{\theta JC (bot)}$	Junction-to-case (bottom) thermal resistance	N/A	N/A	N/A	N/A	N/A	°C/W

## 5.4 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS		V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN54HCT541		SN74HCT541		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>OH</sub>	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -20 µA	4.5 V	4.4	4.499		4.4		4.4		V
		I <sub>OH</sub> = -6 mA		3.98	4.3		3.7		3.84		
V <sub>OL</sub>	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 20 µA	4.5 V		0.001	0.1		0.1		0.1	V
		I <sub>OL</sub> = 6 mA			0.17	0.26		0.4		0.33	
I <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or 0		5.5 V		±0.1	±100		±1000		±1000	nA
I <sub>OZ</sub>	V <sub>O</sub> = V <sub>CC</sub> or 0, V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>		5.5 V		±0.01	±0.5		±10		±5	µA
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or 0, I <sub>O</sub> = 0		5.5 V			8		160		80	µA
ΔI <sub>CC</sub> <sup>(1)</sup>	One input at 0.5 V or 2.4 V, Other inputs at 0 or V <sub>CC</sub>		5.5 V		1.4	2.4		3		2.9	mA
C <sub>i</sub>			4.5 V to 5.5 V		3	10		10		10	pF

(1) This is the increase in supply current for each input that is at one of the specified TTL voltage levels, rather than 0 V or V<sub>CC</sub>.

## 5.5 Switching Characteristics

over recommended operating free-air temperature range, C<sub>L</sub> = 50 pF (unless otherwise noted) (see Figure 6-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN54HCT541		SN74HCT541		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t <sub>pd</sub>	A	Y	4.5 V		13	23		34		29	ns
			5.5 V		12	21		31		26	
t <sub>en</sub>	OE	Y	4.5 V		21	30		45		38	ns
			5.5 V		19	27		41		34	
t <sub>dis</sub>	OE	Y	4.5 V		19	30		45		38	ns
			5.5 V		18	27		41		34	
tt		Y	4.5 V		8	12		18		15	ns
			5.5 V		7	11		16		14	

## 5.6 Switching Characteristics

over recommended operating free-air temperature range, C<sub>L</sub> = 150 pF (unless otherwise noted) (see Figure 6-1)

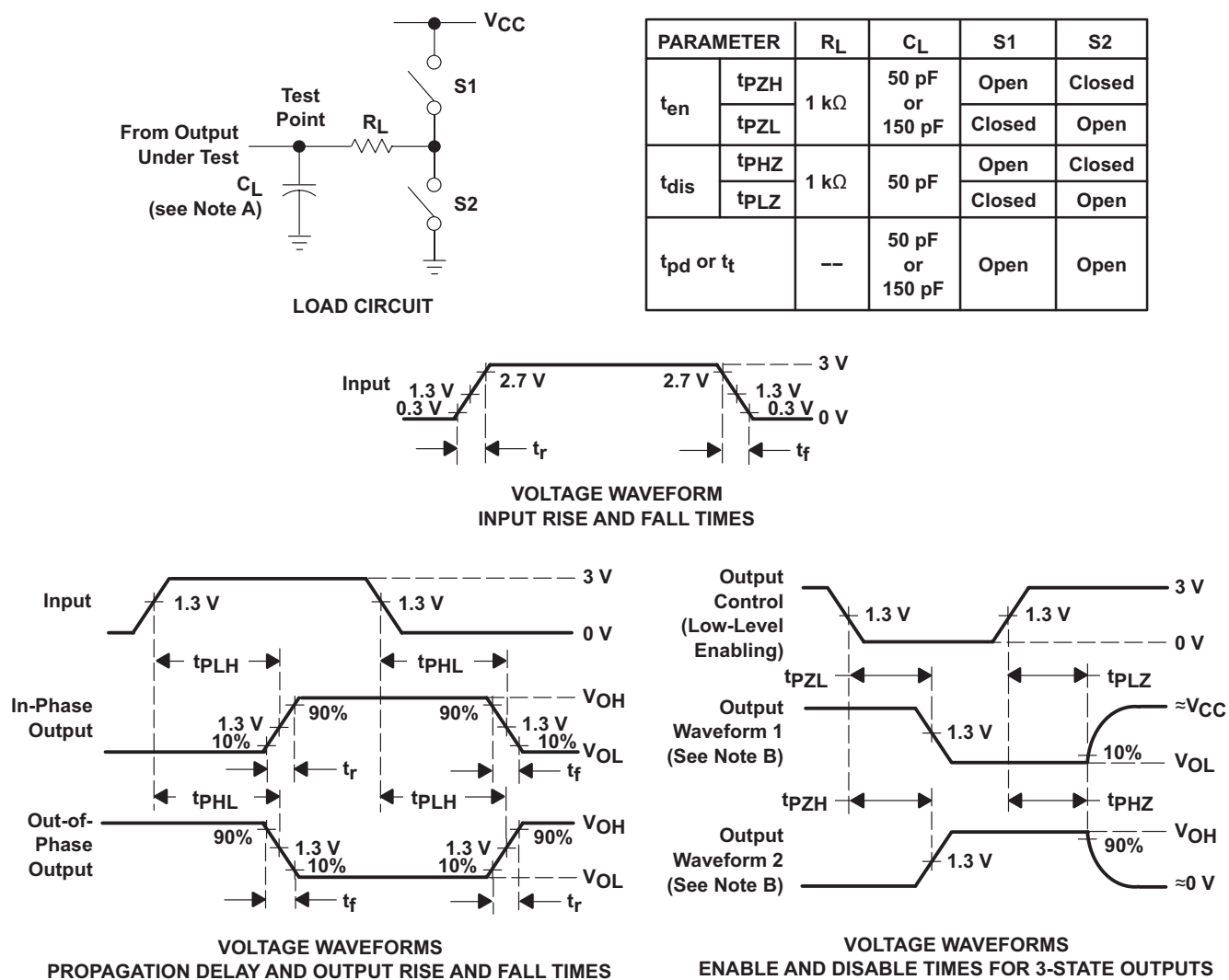
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN54HCT541		SN74HCT541		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t <sub>pd</sub>	A	Y	4.5 V		20	33		49		42	ns
			5.5 V		19	30		45		38	
t <sub>en</sub>	OE	Y	4.5 V		26	40		60		50	ns
			5.5 V		25	36		54		45	
t <sub>t</sub>		Y	4.5 V		17	42		63		53	ns
			5.5 V		14	38		57		48	

## 5.7 Operating Characteristics

T<sub>A</sub> = 25°C

PARAMETER		TEST CONDITIONS	TYP	UNIT
C <sub>pd</sub>	Power dissipation capacitance per buffer/driver	No load	35	pF

## 6 Parameter Measurement Information



- NOTES:
- A.  $C_L$  includes probe and test-fixture 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. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1\text{ MHz}$ ,  $Z_O = 50\text{ }\Omega$ ,  $t_r = 6\text{ ns}$ ,  $t_f = 6\text{ ns}$ .
  - D. The outputs are measured one at a time with one input transition per measurement.
  - E.  $tpLZ$  and  $tpHZ$  are the same as  $t_{dis}$ .
  - F.  $tpZL$  and  $tpZH$  are the same as  $t_{en}$ .
  - G.  $tpLH$  and  $tpHL$  are the same as  $t_{pd}$ .

**Figure 6-1. Load Circuit and Voltage Waveforms**

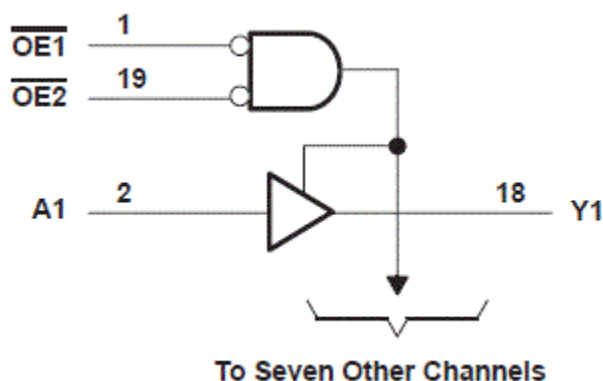
## 7 Detailed Description

### 7.1 Overview

These octal buffers and line drivers are designed to have the performance of the popular 'HC240 series devices and to 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. If either output-enable ( $\overline{OE1}$  or  $\overline{OE2}$ ) input is high, all eight outputs are in the high-impedance state. The 'HCT541 devices provide true data at the outputs.

### 7.2 Functional Block Diagram



### 7.3 Device Functional Modes

**Table 7-1. Function Table  
(Each Buffer/Driver)**

INPUTS			OUTPUT Y
$\overline{OE1}$	$\overline{OE2}$	A	
L	L	L	L
L	L	H	H
H	X	X	Z
X	H	X	Z

## 8 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the *Recommended Operating Conditions*. Each  $V_{CC}$  terminal should have a good bypass capacitor to prevent power disturbance. A 0.1- $\mu$ F capacitor is recommended for this device. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. The 0.1- $\mu$ F and 1- $\mu$ F capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results.

## 9 Layout

### 9.1 Layout Guidelines

When using multiple-input and multiple-channel logic devices inputs must not ever be left floating. In many cases, functions or parts of functions of digital logic devices are unused; for example, when only two inputs of a triple-input AND gate are used or only 3 of the 4 buffer gates are used. Such unused input pins must not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. All unused inputs of digital logic devices must be connected to a logic high or logic low voltage, as defined by the input voltage specifications, to prevent them from floating. The logic level that must be applied to any particular unused input depends on the function of the device. Generally, the inputs are tied to GND or  $V_{CC}$ , whichever makes more sense for the logic function or is more convenient.



## 10 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

### 10.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](http://ti.com). Click on *Subscribe to updates* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 10.2 Support Resources

[TI E2E™ support forums](#) are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's [Terms of Use](#).

### 10.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.

All trademarks are the property of their respective owners.

### 10.4 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### 10.5 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

## 11 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

**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)
<a href="#">JM38510/65761BRA</a>	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 65761BRA
JM38510/65761BRA.A	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 65761BRA
<a href="#">M38510/65761BRA</a>	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	JM38510/ 65761BRA
<a href="#">SN54HCT541J</a>	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54HCT541J
SN54HCT541J.A	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54HCT541J
<a href="#">SN74HCT541DBR</a>	Active	Production	SSOP (DB)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HT541
SN74HCT541DBR.A	Active	Production	SSOP (DB)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HT541
<a href="#">SN74HCT541DW</a>	Obsolete	Production	SOIC (DW)   20	-	-	Call TI	Call TI	-40 to 85	HCT541
<a href="#">SN74HCT541DWR</a>	Active	Production	SOIC (DW)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HCT541
SN74HCT541DWR.A	Active	Production	SOIC (DW)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HCT541
SN74HCT541DWRE4	Active	Production	SOIC (DW)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HCT541
SN74HCT541DWRG4	Active	Production	SOIC (DW)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HCT541
<a href="#">SN74HCT541N</a>	Active	Production	PDIP (N)   20	20   TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	SN74HCT541N
SN74HCT541N.A	Active	Production	PDIP (N)   20	20   TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	SN74HCT541N
<a href="#">SN74HCT541NSR</a>	Active	Production	SOP (NS)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HCT541
SN74HCT541NSR.A	Active	Production	SOP (NS)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HCT541
SN74HCT541NSRE4	Active	Production	SOP (NS)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HCT541
SN74HCT541NSRG4	Active	Production	SOP (NS)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HCT541
<a href="#">SN74HCT541PW</a>	Obsolete	Production	TSSOP (PW)   20	-	-	Call TI	Call TI	-40 to 85	HT541
<a href="#">SN74HCT541PWR</a>	Active	Production	TSSOP (PW)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HT541
SN74HCT541PWR.A	Active	Production	TSSOP (PW)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HT541
SN74HCT541PWRG4	Active	Production	TSSOP (PW)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HT541
<a href="#">SN74HCT541PWT</a>	Obsolete	Production	TSSOP (PW)   20	-	-	Call TI	Call TI	-40 to 85	HT541
<a href="#">SNJ54HCT541FK</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54HCT 541FK
SNJ54HCT541FK.A	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54HCT 541FK

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)
SNJ54HCT541J	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54HCT541J
SNJ54HCT541J.A	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SNJ54HCT541J

- (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.

**Important Information and Disclaimer:**The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**OTHER QUALIFIED VERSIONS OF SN54HCT541, SN74HCT541 :**

- Catalog : [SN74HCT541](#)
- Military : [SN54HCT541](#)

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
SN74HCT541DBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN74HCT541DWR	SOIC	DW	20	2000	330.0	24.4	10.9	13.3	2.7	12.0	24.0	Q1
SN74HCT541NSR	SOP	NS	20	2000	330.0	24.4	8.4	13.0	2.5	12.0	24.0	Q1
SN74HCT541PWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.0	1.4	8.0	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)
SN74HCT541DBR	SSOP	DB	20	2000	353.0	353.0	32.0
SN74HCT541DWR	SOIC	DW	20	2000	356.0	356.0	45.0
SN74HCT541NSR	SOP	NS	20	2000	356.0	356.0	45.0
SN74HCT541PWR	TSSOP	PW	20	2000	353.0	353.0	32.0

## TUBE



\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN74HCT541N	N	PDIP	20	20	506	13.97	11230	4.32
SN74HCT541N.A	N	PDIP	20	20	506	13.97	11230	4.32
SNJ54HCT541FK	FK	LCCC	20	55	506.98	12.06	2030	NA
SNJ54HCT541FK.A	FK	LCCC	20	55	506.98	12.06	2030	NA





## TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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-153.

# EXAMPLE BOARD LAYOUT

PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



4220206/A 02/2017

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

PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

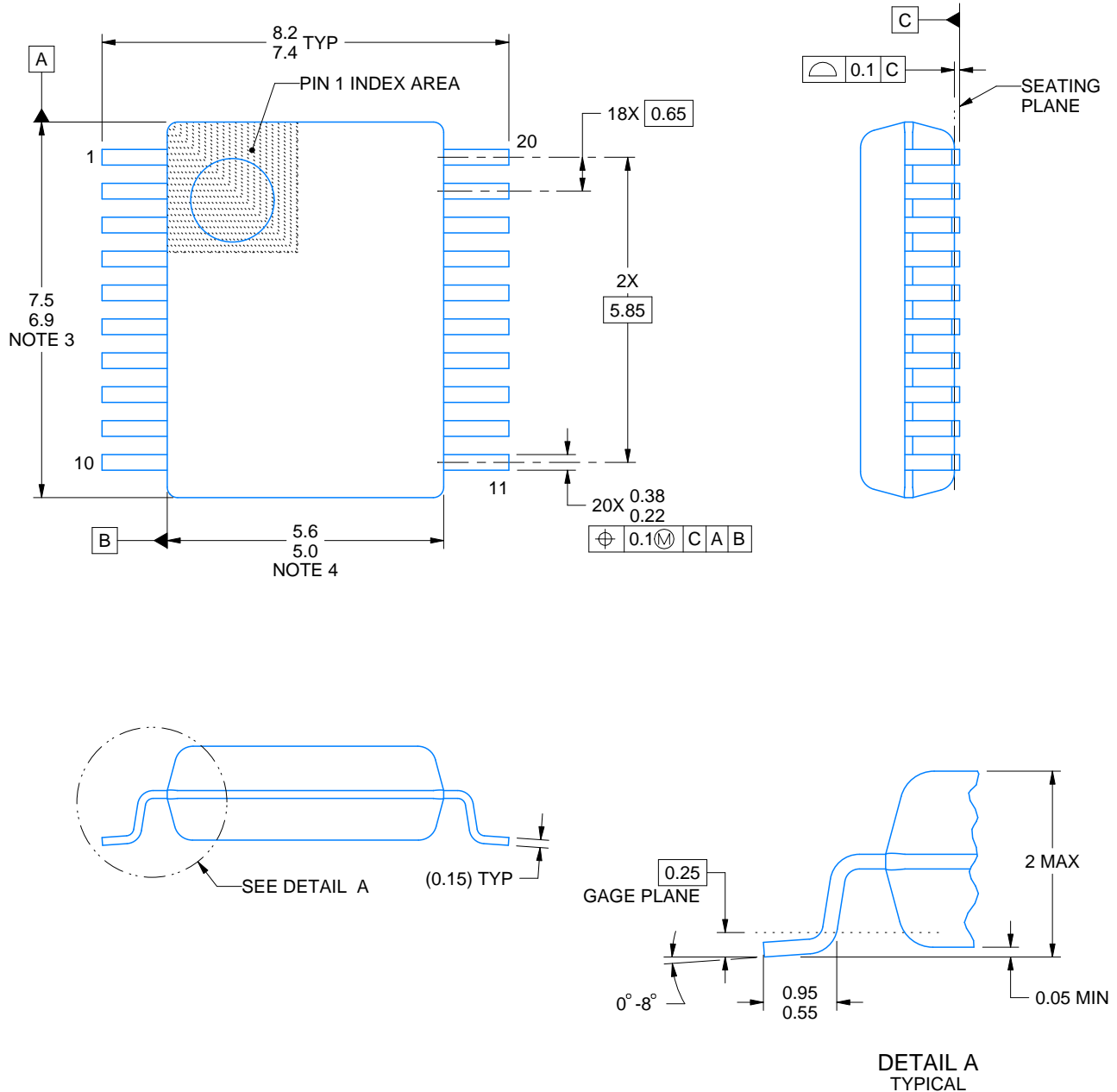


SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 10X

4220206/A 02/2017

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.



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)

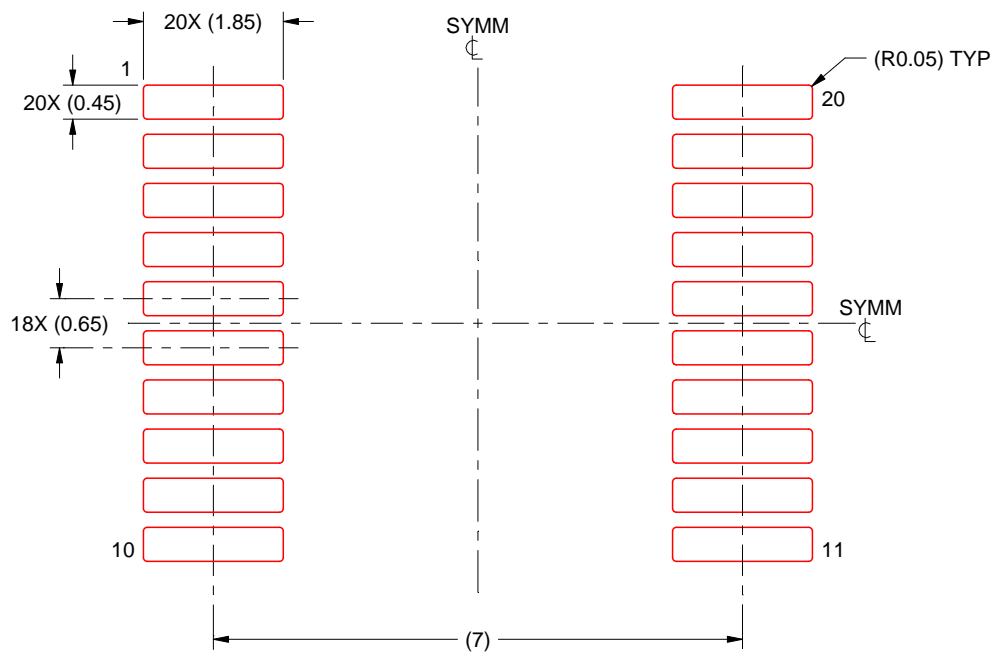
6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

**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.

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 ** 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.



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

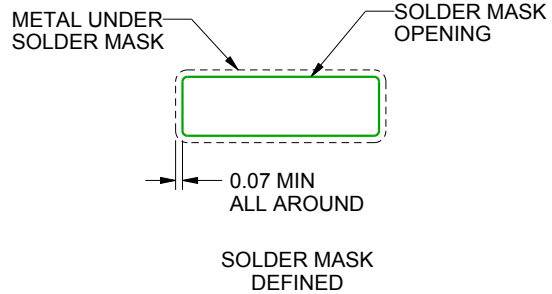
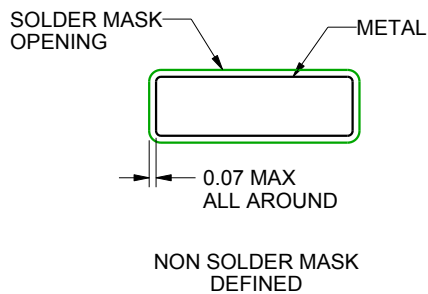
DW0020A

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.

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