

SN74AHC541-Q1 具有三态输出的八路缓冲器/驱动器

1 特性

- 符合汽车应用要求
- 工作范围为 2V 至 5.5V V_{CC}
- 闩锁性能超过 250mA，符合 JESD 17 规范

2 应用

- 启用或禁用数字信号
- 消除慢速或高噪声输入信号
- 在控制器复位期间保持信号
- 对开关进行去抖

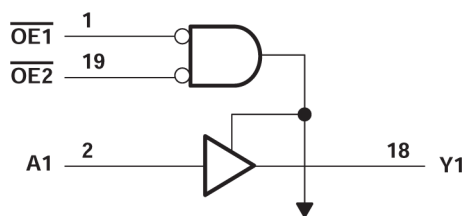
3 说明

SN74AHC541 八路缓冲器/驱动器非常适合用于驱动总线或缓冲存储器地址寄存器。该器件在封装的相对两侧具有输入端和输出端，有助于印刷电路板布局布线。

封装信息

器件型号	封装 ⁽¹⁾	封装尺寸 ⁽²⁾	本体尺寸 ⁽³⁾
SN74AHC541-Q1	PW (TSSOP , 20)	6.5mm × 6.4mm	6.5mm × 4.4mm

- (1) 有关更多信息，请参阅节 11。
- (2) 封装尺寸 (长 × 宽) 为标称值，并包括引脚 (如适用)。
- (3) 本体尺寸 (长 × 宽) 为标称值，不包括引脚。



To Seven Other Channels
逻辑图 (正逻辑)



Table of Contents

1 特性	1	7.2 Functional Block Diagram.....	8
2 应用	1	7.3 Device Functional Modes.....	8
3 说明	1	8 Application and Implementation	9
4 Pin Configuration and Functions	3	8.1 Power Supply Recommendations.....	9
5 Specifications	4	8.2 Layout.....	9
5.1 Absolute Maximum Ratings.....	4	9 Device and Documentation Support	11
5.2 Recommended Operating Conditions.....	4	9.1 Document Support (Analog).....	11
5.3 Thermal Information.....	5	9.2 接收文档更新通知.....	11
5.4 Electrical Characteristics.....	5	9.3 支持资源.....	11
5.5 Switching Characteristics, $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	5	9.4 Trademarks.....	11
5.6 Switching Characteristics, $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$	6	9.5 静电放电警告.....	11
5.7 Noise Characteristics.....	6	9.6 术语表.....	11
5.8 Operating Characteristics.....	6	10 Revision History	11
6 Parameter Measurement Information	7	11 Mechanical, Packaging, and Orderable Information	12
7 Detailed Description	8		
7.1 Overview.....	8		

4 Pin Configuration and Functions

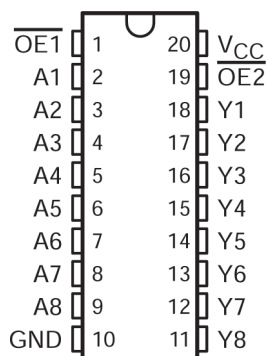


图 4-1. D or PW Package (Top View)

表 4-1. Pin Functions

PIN		I/O	DESCRIPTION
NAME	NO.		
OE1	1	I	Output Enable 1
A1	2	I	A1 Input
A2	3	I	A2 Input
A3	4	I	A3 Input
A4	5	I	A4 Input
A5	6	I	A5 Input
A6	7	I	A6 Input
A7	8	I	A7 Input
A8	9	I	A8 Input
GND	10	—	Ground
Y8	11	O	Y8 Output
Y7	12	O	Y7 Output
Y6	13	O	Y6 Output
Y5	14	O	Y5 Output
Y4	15	O	Y4 Output
Y3	16	O	Y3 Output
Y2	17	O	Y2 Output
Y1	18	O	Y1 Output
OE2	19	I	Output Enable 2
V _{CC}	20	—	Power Pin

5 Specifications

5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

		MIN	MAX	UNIT
V_{CC}	Supply voltage range	-0.5	7	V
V_I ⁽²⁾	Input voltage range	-0.5	7	V
V_O ⁽²⁾	Output voltage range	-0.5	$V_{CC} + 0.5$	V
I_{IK} ($V_I < 0$)	Input clamp current		-20	mA
I_{OK} ($V_O < 0$ or $V_O > V_{CC}$)	Output clamp current		± 20	mA
I_O ($V_O = 0$ to V_{CC})	Continuous output current		± 25	mA
	Continuous current through V_{CC} or GND		± 75	mA
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

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

		MIN	MAX	UNIT
V_{CC}	Supply voltage	2	5.5	V
V_{IH}	High-level input voltage	$V_{CC} = 2\text{ V}$	1.5	V
		$V_{CC} = 3\text{ V}$	2.1	
		$V_{CC} = 5.5\text{ V}$	3.85	
V_{IL}	Low-level input voltage	$V_{CC} = 2\text{ V}$	0.5	V
		$V_{CC} = 3\text{ V}$	0.9	
		$V_{CC} = 5.5\text{ V}$	1.65	
V_I	Input voltage	0	5.5	V
V_O	Output voltage	0	V_{CC}	V
I_{OH}	High-level output current	$V_{CC} = 2\text{ V}$	-50	mA
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	-4	mA
		$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$	-8	
I_{OL}	Low-level output current	$V_{CC} = 2\text{ V}$	50	mA
		$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	4	mA
		$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$	8	
$\Delta t/\Delta v$	Input transition rise or fall rate	$V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$	100	ns/V
		$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$	20	
T_A	Operating free-air temperature	-40	125	°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

THERMAL METRIC ⁽¹⁾	SN74AHC541-Q1		UNIT
	DW (SOIC)	PW (TSSOP)	
	20 PINS	20 PINS	
$R_{\theta JA}$ Junction-to-ambient thermal resistance	58	116.8	°C/W

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, ([SPRA953](#)).

5.4 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	V_{CC}	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C TO } 125^\circ\text{C}$		$T_A = -40^\circ\text{C TO } 85^\circ\text{C}$		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V_{OH}	$I_{OH} = -50\text{ mA}$	2 V	1.9	2		1.9		1.9		V
		3 V	2.9	3		2.9		2.9		
		4.5 V	4.4	4.5		4.4		4.4		
	$I_{OH} = -4\text{ mA}$	3 V	2.58			2.48		2.48		
		4.5 V	3.94			3.8		3.8		
V_{OL}	$I_{OL} = 50\text{ mA}$	2 V			0.1		0.1		0.1	V
		3 V			0.1		0.1		0.1	
		4.5 V			0.1		0.1		0.1	
	$I_{OL} = 4\text{ mA}$	3 V			0.36		0.5		0.44	
		4.5 V			0.36		0.5		0.44	
I_I	$V_I = 5.5\text{ V or GND}$	0 V to 5.5 V			± 0.1		± 1		± 1	μA
I_{OZ} ⁽¹⁾	$V_O = V_{CC}\text{ or GND, } V_I (\text{OE}) = V_{IL}\text{ or } V_{IH}$	5.5 V			± 0.25		± 2.5		± 2.5	μA
I_{CC}	$V_I = V_{CC}\text{ or GND, } I_O = 0$	5.5 V			4		40		40	μA
C_i	$V_I = V_{CC}\text{ or GND}$	5 V			2 10				10	pF
C_o	$V_O = V_{CC}\text{ or GND}$	5 V			4					pF

(1) For input and output, I_{OZ} includes the input leakage current.

5.5 Switching Characteristics, $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$

over recommended operating free-air temperature range, $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ (unless otherwise noted) (see [图 6-1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C TO } 125^\circ\text{C}$		$T_A = -40^\circ\text{C TO } 85^\circ\text{C}$		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	Y	$C_L = 15\text{ pF}$		5	7	1	8.5	1	8.5	ns
t_{PHL}					5	7	1	8.5	1	8.5	
t_{PZH}	$\overline{\text{OE}}$	Y	$C_L = 15\text{ pF}$		6	10.5	1	11	1	11	ns
t_{PZL}					6	10.5	1	11	1	11	
t_{PHZ}	$\overline{\text{OE}}$	Y	$C_L = 15\text{ pF}$		7	11	1	12	1	12	ns
t_{PLZ}					7	11	1	12	1	12	
t_{PLH}	A	Y	$C_L = 50\text{ pF}$		7.5	10.5	1	12	1	12	ns
t_{PHL}					7.5	10.5	1	12	1	12	
t_{PZH}	$\overline{\text{OE}}$	Y	$C_L = 50\text{ pF}$		8	14	1	16	1	16	ns
t_{PZL}					8	14	1	16	1	16	
t_{PHZ}	$\overline{\text{OE}}$	Y	$C_L = 50\text{ pF}$		9	15.4	1	17.5	1	17.5	ns
t_{PLZ}					9	15.4	1	17.5	1	17.5	

over recommended operating free-air temperature range, $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ (unless otherwise noted) (see 图 6-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C TO } 125^\circ\text{C}$		$T_A = -40^\circ\text{C TO } 85^\circ\text{C}$		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
tsk(o)			$C_L = 50\text{ pF}$			1.5				1.5	ns

5.6 Switching Characteristics, $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$

over recommended operating free-air temperature range, $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$ (unless otherwise noted) (see 图 6-1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C TO } 125^\circ\text{C}$		$T_A = -40^\circ\text{C TO } 85^\circ\text{C}$		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A	Y	$C_L = 15\text{ pF}$		3.5	5	1	6	1	6	ns
t_{PHL}					3.5	5	1	6	1	6	
t_{PZH}	$\overline{OE}$	Y	$C_L = 15\text{ pF}$		4.7	7.2	1	8.5	1	8.5	ns
t_{PZL}					4.7	7.2	1	8.5	1	8.5	
t_{PHZ}	$\overline{OE}$	Y	$C_L = 15\text{ pF}$		5	7.5	1	8	1	8	ns
t_{PLZ}					5	7.5	1	8	1	8	
t_{PLH}	A	Y	$C_L = 50\text{ pF}$		5	7	1	8	1	8	ns
t_{PHL}					5	7	1	8	1	8	
t_{PZH}	$\overline{OE}$	Y	$C_L = 50\text{ pF}$		6.2	9.2	1	10.5	1	10.5	ns
t_{PZL}					6.2	9.2	1	10.5	1	10.5	
t_{PHZ}	$\overline{OE}$	Y	$C_L = 50\text{ pF}$		6	8.8	1	10	1	10	ns
t_{PLZ}					6	8.8	1	10	1	10	
tsk(o)			$C_L = 50\text{ pF}$			1			1		ns

5.7 Noise Characteristics

$V_{CC} = 5\text{ V}$, $C_L = 50\text{ pF}$, $T_A = 25^\circ\text{C}$ (1)

PARAMETER		MIN	MAX	UNIT
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}		0.8	V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}		-0.8	V
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}	4.7		V
$V_{IH(D)}$	High-level dynamic input voltage	3.5		V
$V_{IL(D)}$	Low-level dynamic input voltage		1.5	V

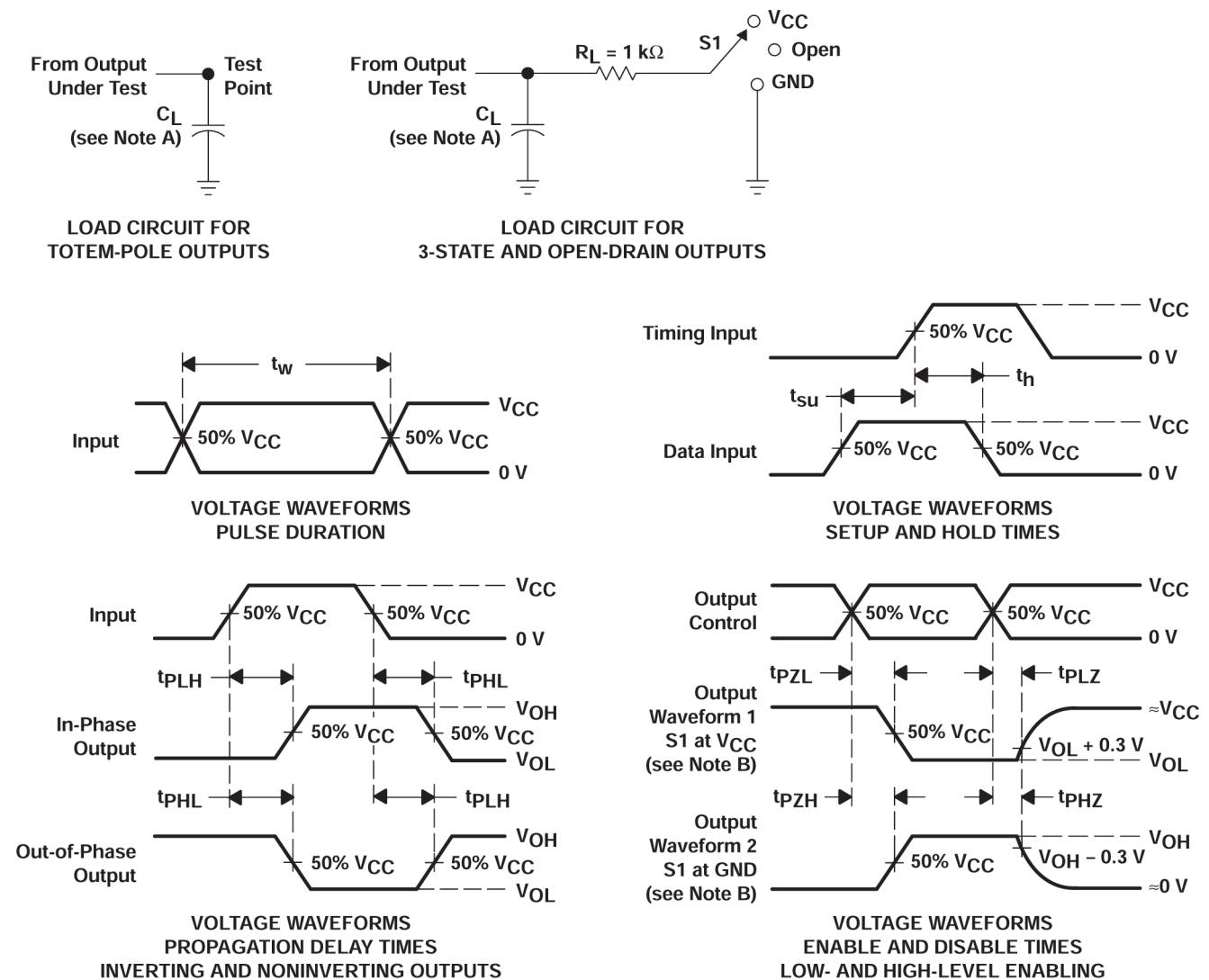
(1) Characteristics are for surface-mount packages only.

5.8 Operating Characteristics

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

PARAMETER		TEST CONDITIONS		TYP	UNIT
C_{pd}	Power dissipation capacitance	No load,	$f = 1\text{ MHz}$	12	pF

6 Parameter Measurement Information



- 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. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1$ MHz, $Z_O = 50 \Omega$, $t_r \leq 3$ ns, $t_f \leq 3$ ns.
- D. The outputs are measured one at a time, with one input transition per measurement.
- E. All parameters and waveforms are not applicable to all devices.

图 6-1. Load Circuit and Voltage Waveforms

TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{CC}
t_{PHZ}/t_{PZH}	GND
Open Drain	V_{CC}

7 Detailed Description

7.1 Overview

The 3-state control gate is a two-input AND gate with active-low inputs so that if either output-enable ($\overline{OE1}$ or $\overline{OE2}$) input is high, all corresponding outputs are in the high-impedance state. The outputs provide noninverted data when they are not in the high-impedance state.

To ensure the high-impedance state during power up or power down, $\overline{OE}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

7.2 Functional Block Diagram

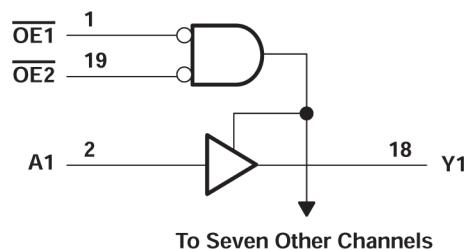


图 7-1. Logic Diagram (Positive Logic)

7.3 Device Functional Modes

表 7-1. (Each Buffer/Driver)

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

8 Application and Implementation

备注

以下应用部分中的信息不属于 TI 器件规格的范围，TI 不担保其准确性和完整性。TI 的客户应负责确定器件是否适用于其应用。客户应验证并测试其设计，以确保系统功能。

8.1 Power Supply Recommendations

The power supply can be any voltage between the MIN and MAX supply voltage rating located in the [Recommended Operating Conditions](#) table.

Each V_{CC} pin should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, 0.1 μF is recommended. If there are multiple V_{CC} pins, 0.01 μF or 0.022 μF is recommended for each power pin. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. A 0.1 μF and 1 μF are commonly used in parallel. The bypass capacitor should be installed as close to the power pin as possible for best results.

8.2 Layout

8.2.1 Layout Guidelines

When using multiple bit logic devices inputs should not ever float.

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 input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. Specified in [Layout Diagram](#) are the rules that must be observed under all circumstances. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that should be applied to any particular unused input depends on the function of the device. Generally they will be tied to GND or V_{CC} ; whichever makes more sense or is more convenient. It is generally acceptable to float outputs unless the part is a transceiver. If the transceiver has an output enable pin, it will disable the outputs section of the part when asserted. This will not disable the input section of the IOs, so they cannot float when disabled.

8.2.1.1 Layout Example

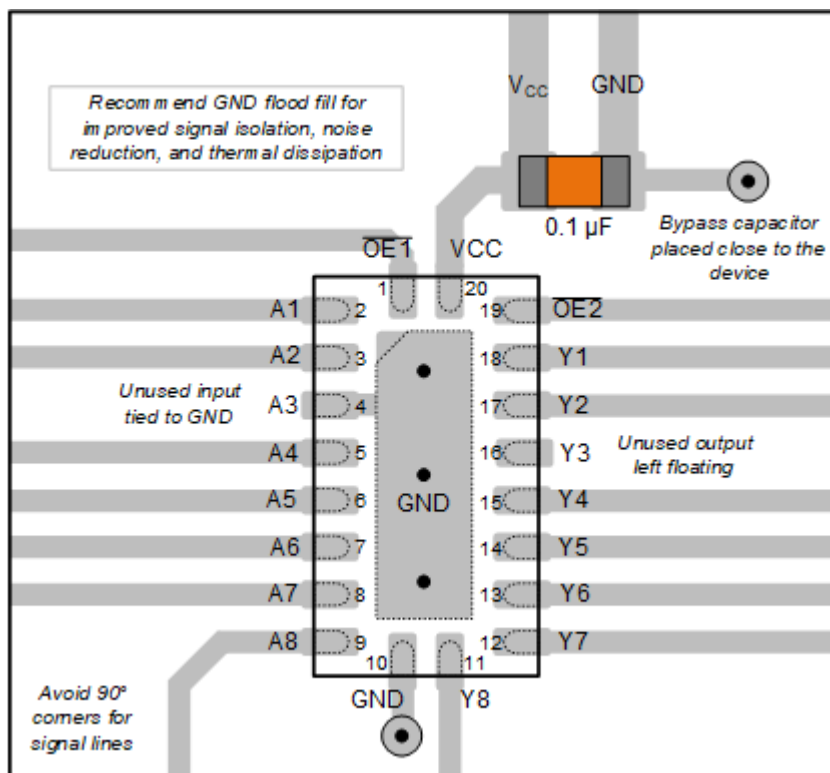


图 8-1. Layout Diagram

9 Device and Documentation Support

9.1 Document Support (Analog)

9.1.1 Related Documentation

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

表 9-1. Related Links

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
SN74AHC541-Q1	Click here	Click here	Click here	Click here	Click here

9.2 接收文档更新通知

要接收文档更新通知，请导航至 [ti.com](#) 上的器件产品文件夹。点击 [通知](#) 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

9.3 支持资源

[TI E2E™ 中文支持论坛](#) 是工程师的重要参考资料，可直接从专家处获得快速、经过验证的解答和设计帮助。搜索现有解答或提出自己的问题，获得所需的快速设计帮助。

链接的内容由各个贡献者“按原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的 [使用条款](#)。

9.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

所有商标均为其各自所有者的财产。

9.5 静电放电警告



静电放电 (ESD) 会损坏这个集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理和安装程序，可能会损坏集成电路。

ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

9.6 术语表

[TI 术语表](#) 本术语表列出并解释了术语、首字母缩略词和定义。

10 Revision History

注：以前版本的页码可能与当前版本的页码不同

Changes from Revision B (April 2023) to Revision C (July 2024)	Page
• Updated thermal values for PW package from $R_{\theta JA} = 58$ to 116.8, all values in °C/W	5

Changes from Revision A (April 2008) to Revision B (April 2023)	Page
• 添加了应用、封装信息表、引脚功能表、ESD 等级表、热性能信息表、器件功能模式、应用和实施部分、电源相关建议部分、布局部分、器件和文档支持部分以及机械、封装和可订购信息部分	1

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)
SN74AHC541QPWRG4Q1	Active	Production	TSSOP (PW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHC541Q
SN74AHC541QPWRG4Q1.A	Active	Production	TSSOP (PW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHC541Q
SN74AHC541QPWRQ1	Active	Production	TSSOP (PW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHC541Q
SN74AHC541QPWRQ1.A	Active	Production	TSSOP (PW) 20	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHC541Q
SN74AHC541QPWRQ1.B	Active	Production	TSSOP (PW) 20	2000 LARGE T&R	-	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHC541Q

⁽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 SN74AHC541-Q1 :

- Catalog : [SN74AHC541](#)
- Military : [SN54AHC541](#)

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
SN74AHC541QPWRG4Q1	TSSOP	PW	20	2000	330.0	16.4	6.95	7.0	1.4	8.0	16.0	Q1
SN74AHC541QPWRG4Q1	TSSOP	PW	20	2000	330.0	16.4	6.95	7.0	1.4	8.0	16.0	Q1
SN74AHC541QPWRQ1	TSSOP	PW	20	2000	330.0	16.4	6.95	7.0	1.4	8.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS



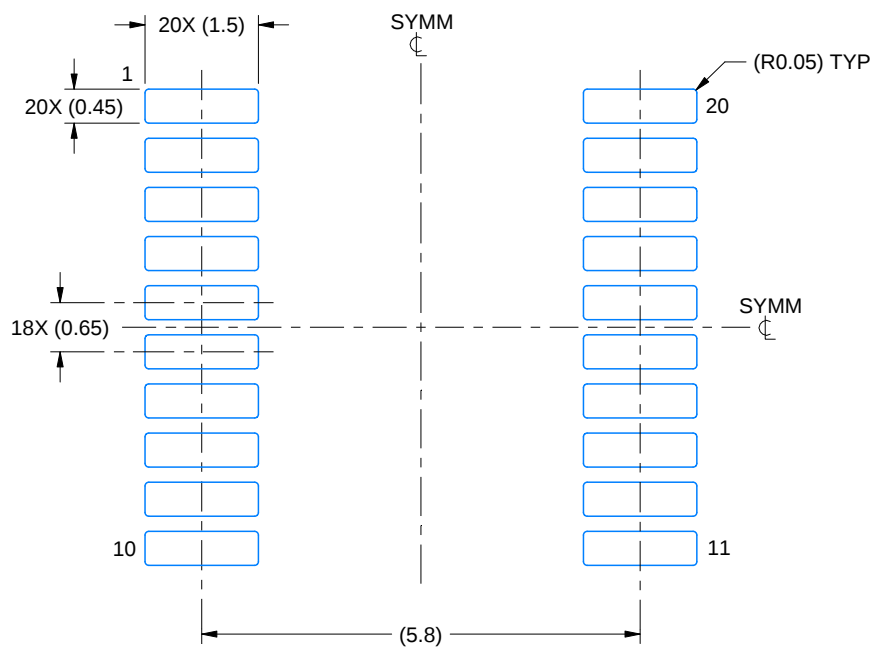
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AHC541QPWRG4Q1	TSSOP	PW	20	2000	353.0	353.0	32.0
SN74AHC541QPWRG4Q1	TSSOP	PW	20	2000	353.0	353.0	32.0
SN74AHC541QPWRQ1	TSSOP	PW	20	2000	353.0	353.0	32.0

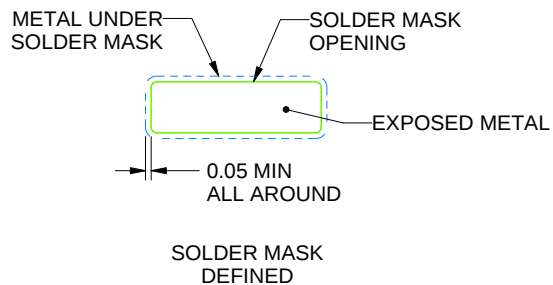
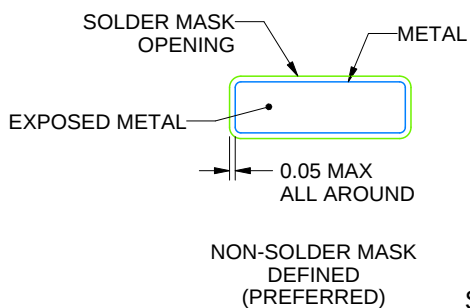
PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



SOLDER MASK DETAILS

4220206/A 02/2017

NOTES: (continued)

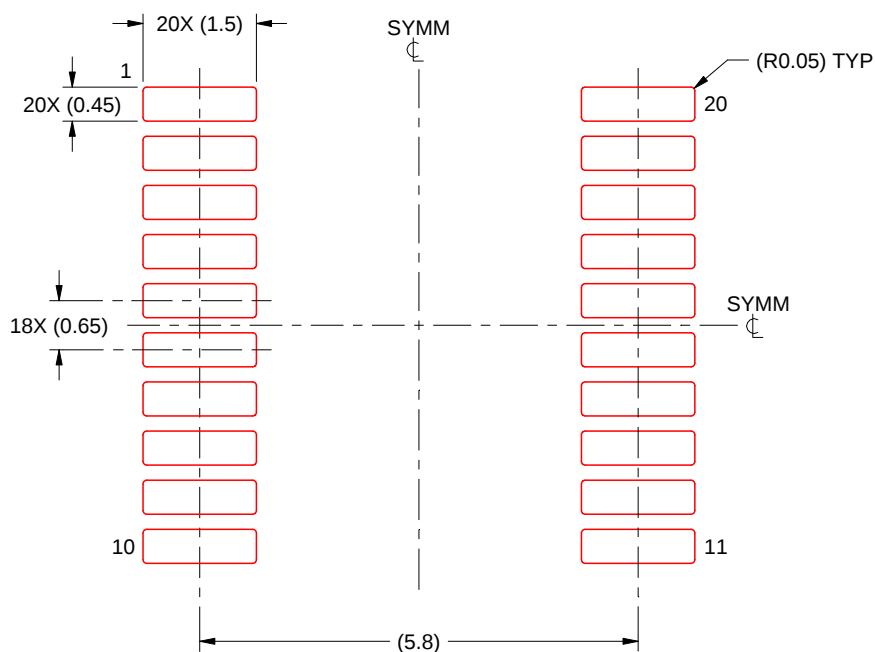
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

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.

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