

SN74AUP1T08 低功耗、1.8/2.5/3.3V 输入、3.3V CMOS 输出、单路 2 输入{1}正与门

1 特性

- 静电放电 (ESD) 性能测试符合 JESD 22 标准
 - 2000V 人体放电模型{1} (A114-B, II 类)
 - 1000V 充电器件模型 (C101)
- 单电源电压转换器
- 输出电平高达电源 V_{CC} CMOS 电平
 - 1.8V 至 3.3V ($V_{CC}=3.3V$ 时)
 - 2.5V 至 3.3V ($V_{CC}=3.3V$ 时)
 - 1.8V 至 2.5V ($V_{CC}=2.5V$ 时)
 - 3.3V 至 2.5V ($V_{CC}=2.5V$ 时)
- 施密特触发器输入可抑制输入噪声并提供更佳的输出信号完整性
- $I_{关闭}$ 支持部分断电 ($V_{CC}=0$)
- 超低静态功耗：
0.1 μ A
- 超低动态功耗：
0.9 μ A
- 闩锁性能超过 100mA，符合 JESD 78 II 类规范的要求
- 可提供无铅封装：SC70 (DCK)
2 x 2.1 x 0.65mm (高 1.1mm)
- 有关更多逻辑门选项，请访问 www.ti.com/littlelogic

2 说明

SN74AUP1T08 执行布尔函数 $Y = A \cdot B$ or $Y = \overline{A + B}$ ，专门用于逻辑电平转换应用，在此类应用中输出以电源 V_{CC} 为基准。

AUP 技术是行业最低功耗逻辑技术，此技术设计用于扩展运行中的电池寿命。所有接受 1.8V LVCMOS 信号的输入电平，同时由一个单 3.3V 或 2.5V V_{CC} 电源供电运行。该产品还可以保持出色的信号完整性（请见图 5-1 和图 5-2）。

2.3V 至 3.6V 的宽 V_{CC} 范围有可能实现开关输出电平连接至外部控制器或处理器。

施密特触发器输入（正负输入转换之间的 $\Delta V_T=210mV$ ）改进了开关转换期间的抗扰度，这对于模拟混合模式设计十分有用。施密特触发器输入抑制输入噪声、确保输出信号的完整性并可实现慢输入信号转换。

$I_{关闭}$ 特性可实现省电条件 ($V_{CC}=0V$)，这在便携式和移动应用中十分重要。当 $V_{CC}=0V$ 时，介于 0V 至 3.6V 范围内的信号可被施加到器件的输入和输出上。在这些条件下，不会对器件造成损坏。

SN74AUP1T08 经设计优化具有 4mA 电流驱动能力，可减少由高驱动输出导致的线路反射、过冲和下冲。

器件信息

器件型号	封装 ⁽¹⁾	封装尺寸 (标称值)
SN74AUP1T08	SC70 (5)	2mm x 1.25mm

(1) 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。



逻辑图 (与门)



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3 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 * (April 2010) to Revision A (September 2020)	Page
• 添加了器件信息表、器件功能模式、器件和文档支持部分以及机械、封装和可订购信息部分.....	1
• 更新了整个文档的表、图和交叉参考的编号格式.....	1

4 Pin Configuration and Functions

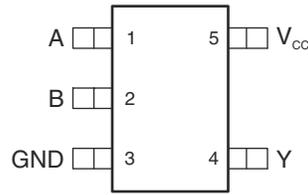


图 4-1. DCK Package 5-Pin SC70 Top View

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	4.6	V
V _I	Input voltage range ⁽²⁾	- 0.5	4.6	V
V _O	Voltage range applied to any output in the high-impedance or power-off state ⁽²⁾	- 0.5	4.6	V
V _O	Output voltage range in the high or low state ⁽²⁾	- 0.5	V _{CC} + 0.5	V
I _{IK}	Input clamp current	V _I < 0		- 50 mA
I _{OK}	Output clamp current	V _O < 0		- 50 mA
I _O	Continuous output current			±20 mA
	Continuous current through V _{CC} or GND			±50 mA
θ _{JA}	Package thermal impedance ⁽³⁾	DCK package		259 °C/W
T _{stg}	Storage temperature	- 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 negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The package thermal impedance is calculated in accordance with JESD 51-7.

5.2 Recommended Operating Conditions

See⁽¹⁾

		MIN	MAX	UNIT
V _{CC}	Supply voltage	2.3	3.6	V
V _I	Input voltage	0	3.6	V
V _O	Output voltage	0	V _{CC}	V
I _{OH}	High-level output current	V _{CC} = 2.3 V	- 3.1	mA
		V _{CC} = 3 V	- 4	
I _{OL}	Low-level output current	V _{CC} = 2.3 V	3.1	mA
		V _{CC} = 3 V	4	
T _A	Operating free-air temperature	- 40	85	°C

- (1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. See [Implications of Slow or Floating CMOS Inputs](#), SCBA004.

5.3 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	V _{CC}	T _A = 25°C			T _A = - 40°C to 85°C		UNIT
			MIN	TYP	MAX	MIN	MAX	
V _{T+} Positive-going input threshold voltage		2.3 V to 2.7 V	0.6		1.1	0.6	1.1	V
		3 V to 3.6 V	0.75		1.16	0.75	1.19	
V _{T-} Negative-going input threshold voltage		2.3 V to 2.7 V	0.35		0.6	0.35	0.6	V
		3 V to 3.6 V	0.5		0.85	0.5	0.85	
ΔV _T Hysteresis (V _{T+} - V _{T-})		2.3 V to 2.7 V	0.23		0.6	0.1	0.6	V
		3 V to 3.6 V	0.25		0.56	0.15	0.56	
V _{OH}	I _{OH} = - 20 μA	2.3 V to 3.6 V	V _{CC} - 0.1		V _{CC} - 0.1		V	

5.3 Electrical Characteristics (continued)

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

PARAMETER	TEST CONDITIONS	V _{CC}	T _A = 25°C			T _A = -40°C to 85°C		UNIT	
			MIN	TYP	MAX	MIN	MAX		
	I _{OH} = -2.3 mA	2.3 V	2.05			1.97			
	I _{OH} = -3.1 mA		1.9			1.85			
	I _{OH} = -2.7 mA	3 V	2.72			2.67			
	I _{OH} = -4 mA		2.6			2.55			
V _{OL}	I _{OL} = 20 μA	2.3 V to 3.6 V				0.1	0.1	V	
	I _{OL} = 2.3 mA	2.3 V				0.31	0.33		
	I _{OL} = 3.1 mA					0.44	0.45		
	I _{OL} = 2.7 mA	3 V				0.31	0.33		
	I _{OL} = 4 mA					0.44	0.45		
I _I	All inputs V _I = 3.6 V or GND	0 V to 3.6 V				0.1	0.5	μA	
I _{off}	V _I or V _O = 0 V to 3.6 V	0 V				0.1	0.5	μA	
Δ I _{off}	V _I or V _O = 3.6 V	0 V to 0.2 V				0.2	0.5	μA	
I _{CC}	V _I = 3.6 V or GND, I _O = 0	2.3 V to 3.6 V				0.5	0.9	μA	
Δ I _{CC}	One input at 0.3 V or 1.1 V, Other inputs at 0 or V _{CC} , I _O = 0	2.3 V to 2.7 V						4	μA
	One input at 0.45 V or 1.2 V, Other inputs at 0 or V _{CC} , I _O = 0	3 V to 3.6 V						12	
C _i	V _I = V _{CC} or GND	3.3 V	1.5					pF	
C _o	V _O = V _{CC} or GND	3.3 V	3					pF	

5.4 Switching Characteristics

over recommended operating free-air temperature range, V_{CC} = 2.5 V ± 0.2 V, V_I = 1.8 V ± 0.15 V (unless otherwise noted) (see [Figure 6-1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	C _L	T _A = 25°C			T _A = -40°C to 85°C		UNIT
				MIN	TYP	MAX	MIN	MAX	
t _{pd}	A or B	Y	5 pF	1.8	2.3	2.9	0.5	6.8	ns
			10 pF	2.3	2.8	3.4	1	7.9	
			15 pF	2.6	3.1	3.8	1	8.7	
			30 pF	3.8	4.4	5.1	1.5	10.8	

5.5 Switching Characteristics

over recommended operating free-air temperature range, $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$, $V_I = 2.5\text{ V} \pm 0.2\text{ V}$ (unless otherwise noted) (see [Figure 6-1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	C_L	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C}$ to 85°C		UNIT
				MIN	TYP	MAX	MIN	MAX	
t_{pd}	A or B	Y	5 pF	1.8	2.3	3.1	0.5	6	ns
			10 pF	2.2	2.8	3.5	1	7.1	
			15 pF	2.6	3.2	5.2	1	7.9	
			30 pF	3.7	4.4	5.2	1.5	10	

5.6 Switching Characteristics

over recommended operating free-air temperature range, $V_{CC} = 2.5\text{ V} \pm 0.2\text{ V}$, $V_I = 3.3\text{ V} \pm 0.3\text{ V}$ (unless otherwise noted) (see [Figure 6-1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	C_L	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C}$ to 85°C		UNIT
				MIN	TYP	MAX	MIN	MAX	
t_{pd}	A or B	Y	5 pF	2	2.7	3.5	0.5	5.5	ns
			10 pF	2.4	3.1	3.9	1	6.5	
			15 pF	2.8	3.5	4.3	1	7.4	
			30 pF	4	4.7	5.5	1.5	9.5	

5.7 Switching Characteristics

over recommended operating free-air temperature range, $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$, $V_I = 1.8\text{ V} \pm 0.15\text{ V}$ (unless otherwise noted) (see [Figure 6-1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	C_L	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C}$ to 85°C		UNIT
				MIN	TYP	MAX	MIN	MAX	
t_{pd}	A or B	Y	5 pF	1.6	2	2.5	0.5	8	ns
			10 pF	2	2.4	2.9	1	8.5	
			15 pF	2.3	2.8	3.3	1	9.1	
			30 pF	3.4	3.9	4.4	1.5	9.8	

5.8 Switching Characteristics

over recommended operating free-air temperature range, $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$, $V_I = 2.5\text{ V} \pm 0.2\text{ V}$ (unless otherwise noted) (see [Figure 6-1](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	C_L	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C}$ to 85°C		UNIT
				MIN	TYP	MAX	MIN	MAX	
t_{pd}	A or B	Y	5 pF	1.6	1.9	2.4	0.5	5.3	ns
			10 pF	2	2.3	2.7	1	6.1	
			15 pF	2.3	2.7	3.1	1	6.8	
			30 pF	3.4	3.8	4.2	1.5	8.5	

5.9 Switching Characteristics

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

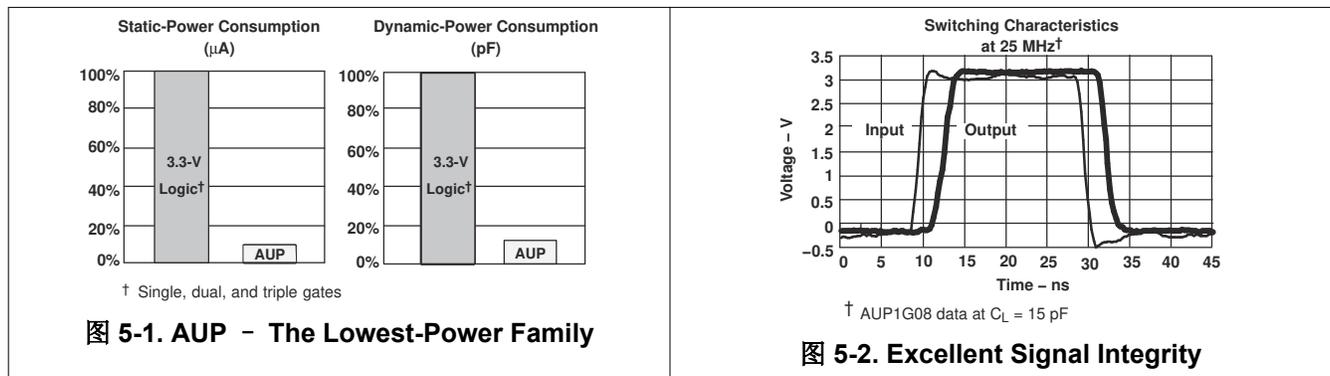
PARAMETER	FROM (INPUT)	TO (OUTPUT)	C_L	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C}$ to 85°C		UNIT
				MIN	TYP	MAX	MIN	MAX	
t_{pd}	A or B	Y	5 pF	1.6	2.1	2.7	0.5	4.7	ns
			10 pF	2	2.4	3	1	5.7	
			15 pF	2.3	2.7	3.3	1	6.2	
			30 pF	3.4	3.8	4.4	1.5	7.8	

5.10 Operating Characteristics

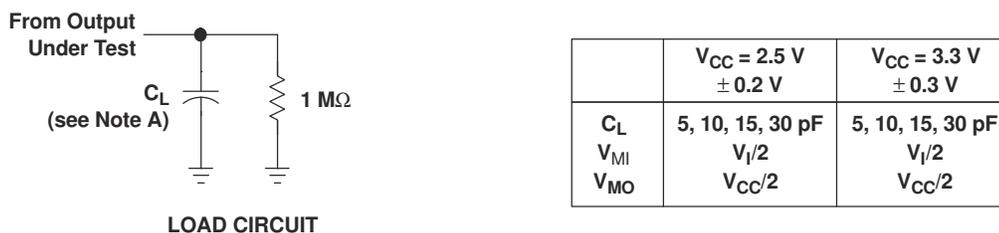
$T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	$V_{CC} = 2.5\text{ V}$	$V_{CC} = 3.3\text{ V}$	UNIT
		TYP	TYP	
C_{pd} Power dissipation capacitance	$f = 10\text{ MHz}$	4	5	pF

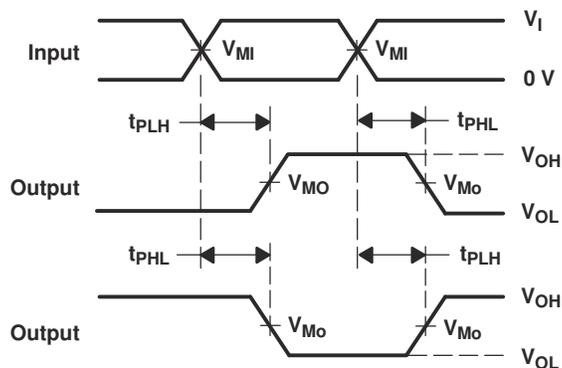
5.11 Typical Characteristics



6 Parameter Measurement Information



LOAD CIRCUIT



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS

- NOTES: A. C_L includes probe and jig capacitance.
 B. All input pulses are supplied by generators having the following characteristics: PRR \leq 10 MHz, $Z_O = 50\ \Omega$, slew rate \geq 1 V/ns.
 C. The outputs are measured one at a time, with one transition per measurement.
 D. t_{PLH} and t_{PHL} are the same as t_{pd} .

图 6-1. Load Circuit And Voltage Waveforms

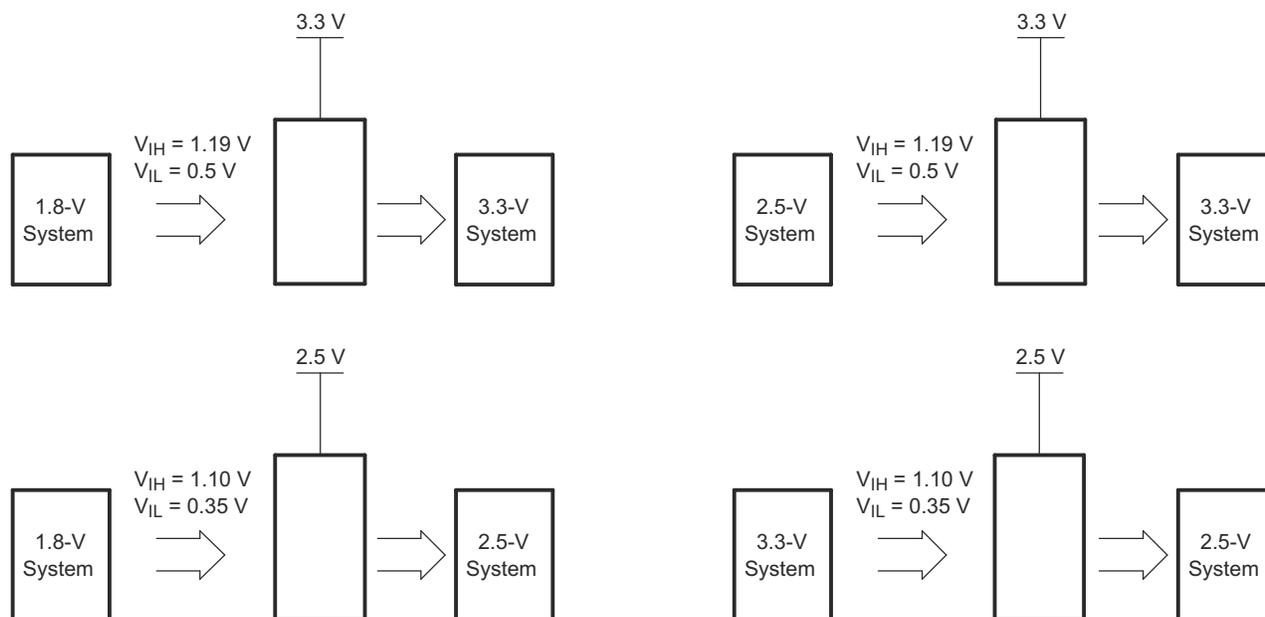


图 6-2. Typical Design Examples

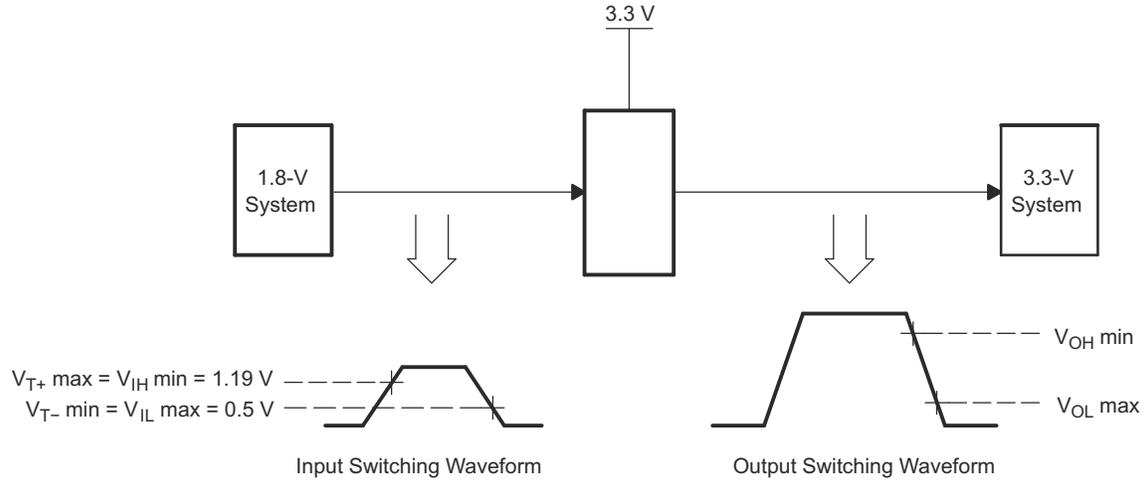


图 6-3. Switching Thresholds For 1.8-V To 3.3-V Translation

7 Detailed Description

7.1 Functional Block Diagram

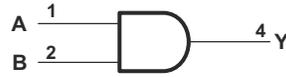


图 7-1. Logic Diagram (AND Gate)

7.2 Device Functional Modes

表 7-1 through 表 7-3 list the functional modes of the SN74AUP1T08 device.

Table 7-1. Function Table

INPUTS (Lower Level Input)		OUTPUT (V_{CC} CMOS)
A	B	Y
H	H	H
L	X	L
X	L	L

Table 7-2. Supply $V_{CC} = 2.3$ V To 2.7 V (2.5 V)

INPUTS V_{T+} max = V_{IH} min V_{T-} min = V_{IL} max		OUTPUT CMOS
A	B	Y
$V_{IH} = 1.1$ V		$V_{OH} = 1.85$ V
$V_{IL} = 0.35$ V		$V_{OL} = 0.45$ V

Table 7-3. Supply $V_{CC} = 3$ V To 3.6 V (3.3 V)

INPUTS V_{T+} max = V_{IH} min V_{T-} min = V_{IL} max		OUTPUT CMOS
A	B	Y
$V_{IH} = 1.19$ V		$V_{OH} = 2.55$ V
$V_{IL} = 0.5$ V		$V_{OL} = 0.45$ V

8 Device and Documentation Support

8.1 Documentation Support

8.1.1 Related Documentation

For related documentation see the following:

[Implications of Slow or Floating CMOS Inputs](#), SCBA004

8.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [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.

8.3 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.

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8.4 Trademarks

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8.5 Glossary

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

9 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)
SN74AUP1T08DCKR	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	NIPDAU SN	Level-1-260C-UNLIM	-40 to 85	6EF
SN74AUP1T08DCKR.B	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	6EF
SN74AUP1T08DCKRG4	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	6EF
SN74AUP1T08DCKRG4.B	Active	Production	SC70 (DCK) 5	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	6EF

(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.

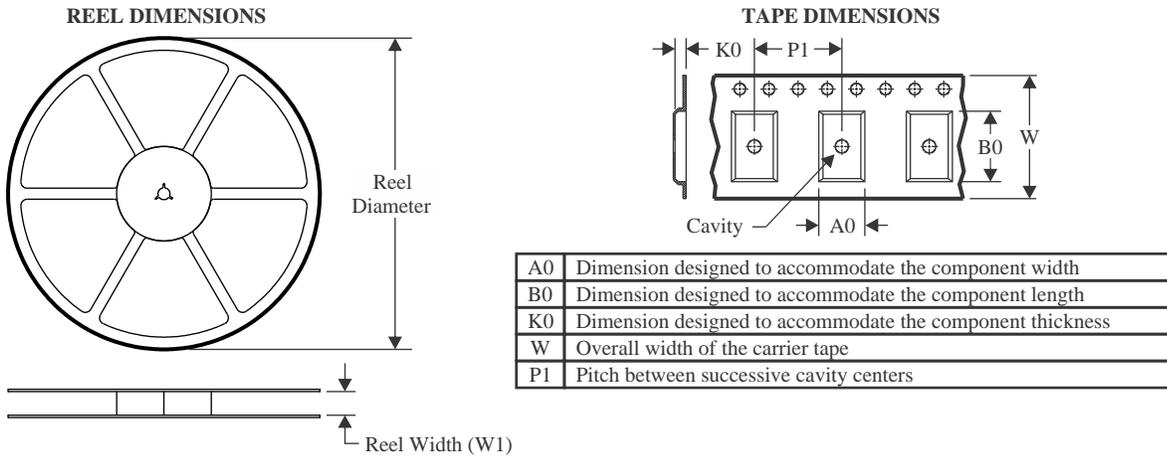
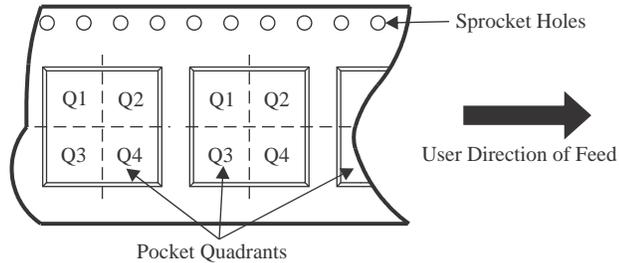
(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will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

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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
SN74AUP1T08DCKR	SC70	DCK	5	3000	178.0	8.4	2.25	2.45	1.2	4.0	8.0	Q3
SN74AUP1T08DCKRG4	SC70	DCK	5	3000	178.0	9.0	2.4	2.5	1.2	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

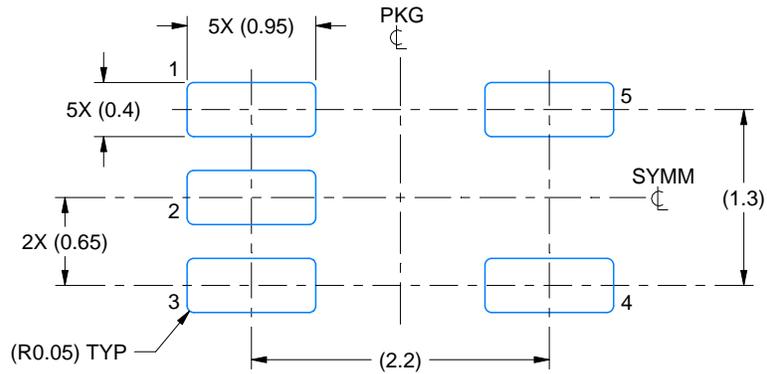
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AUP1T08DCKR	SC70	DCK	5	3000	208.0	191.0	35.0
SN74AUP1T08DCKRG4	SC70	DCK	5	3000	180.0	180.0	18.0

EXAMPLE BOARD LAYOUT

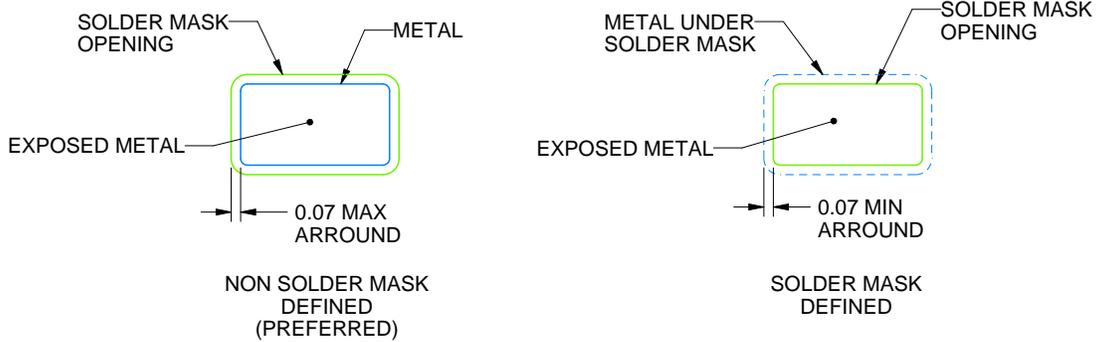
DCK0005A

SOT - 1.1 max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:18X



SOLDER MASK DETAILS

4214834/G 11/2024

NOTES: (continued)

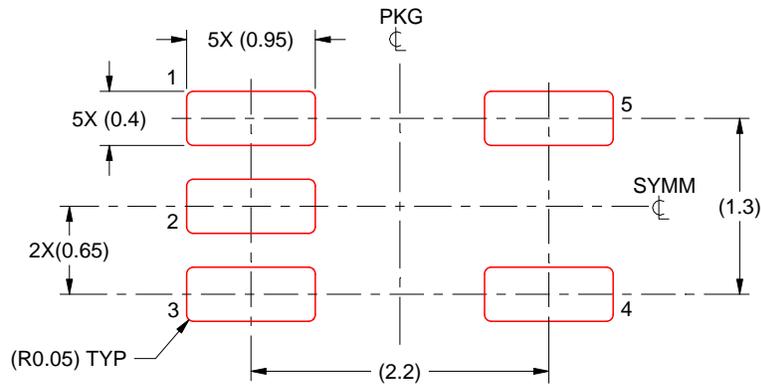
- 7. Publication IPC-7351 may have alternate designs.
- 8. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DCK0005A

SOT - 1.1 max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE
BASED ON 0.125 THICK STENCIL
SCALE: 18X

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NOTES: (continued)

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

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