SN74AHCT1G00 Single 2-Input Positive-NAND Gate

1 Features

- Operating Range of 4.5 V to 5.5 V
- Maximum t_{pd} of 7.1 ns at 5 V
- Low Power Consumption, 10-µA Maximum I_{CC}
- ±8-mA Output Drive at 5 V
- Inputs Are TTL-Voltage Compatible
- Latch-up Performance Exceeds 250 mA Per JESD 17

2 Applications

- IP Phones
- Notebook PCs
- Printers
- Access Control and Security
- Solar Inverters

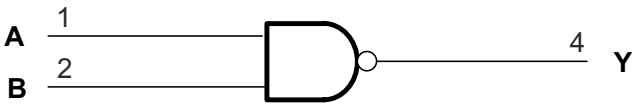
3 Description

The SN74AHCT1G00 device performs the Boolean function $Y = \overline{A \times B}$ or $Y = \overline{A} + \overline{B}$ in positive logic.

Package Information

PART NUMBER	PACKAGE[1]	PACKAGE SIZE[2]
SN74AHCT1G00	DBV (SOT-23, 5)	2.8 mm × 2.8 mm
	DCK (SC-70, 5)	2.00 mm × 1.25 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.



Logic Diagram (Positive Logic)

Table of Contents

4 Pin Configuration and Functions

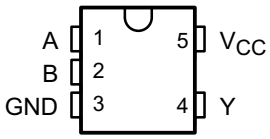


Figure 4-1. DBV or DCK Package 5-PIN SOT-23 OR SC-70 (Top View)

Table 4-1. Pin Functions

PIN		TYPE	DESCRIPTION
NO.	NAME		
1	A	I	Input A
2	B	I	Input B
3	GND	—	Ground Pin
4	Y	O	Output Y
5	V_{CC}	—	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		–0.5	7	V
V_I	Input voltage(2)		–0.5	7	V
V_O	Output voltage(2)		–0.5	V_{CC} + 0.5	V
I_{IK}	Input clamp current	V_I < 0		–20	mA
I_{OK}	Output clamp current	V_O < 0 or V_O > V_{CC}	–20	20	mA
I_O	Continuous output current	V_O = 0 to V_{CC}	–25	25	mA
	Continuous current through V_{CC} or GND		–50	50	mA
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, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. 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 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001(1)	±2000	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101(2)	±1000	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

5.3 Recommended Operating Conditions

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

		MIN	MAX	UNIT
V_{CC}	Supply voltage	4.5	5.5	V
V_{IH}	High-level input voltage	2		V
V_{IL}	Low-level Input voltage		0.8	V
V_I	Input voltage	0	5.5	V
V_O	Output voltage	0	V_{CC}	V
I_{OH}	High-level output current		–8	mA
I_{OL}	Low-level output current		8	mA
Δt/Δv	Input transition rise or fall rate		20	ns/V
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* (SCBA004).

5.4 Thermal Information

THERMAL METRIC[1]		SN74AHCT1G00		UNIT
		DBV (SOT-23)	DCK (SC-70)	
		5 PINS	5 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	278	289.2	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	180.5	205.8	
$R_{\theta JB}$	Junction-to-board thermal resistance	184.4	176.2	
ψ_{JT}	Junction-to-top characterization parameter	115.4	117.6	
ψ_{JB}	Junction-to-board characterization parameter	183.4	175.1	
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	N/A	N/A	

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

5.5 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS	V_{CC}	T_A = 25°C			–40°C to 85°C		–40°C to 125°C		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V_{OH}	I_{OH} = –50 µA	4.5 V	4.4	4.5		4.4		4.4		V
	I_{OH} = –8 mA		3.94			3.8		3.8		
V_{OL}	I_{OL} = 50 µA	4.5 V			0.1		0.1		0.1	V
	I_{OL} = 8 mA				0.36		0.44		0.44	
I_I	V_I = 5.5 V or GND	0 V to 5.5 V			±0.1		±1		±1	µA
I_{CC}	V_I = V_{CC} or GND, I_O = 0	5.5 V			1		10		10	µA
ΔI_{CC} [1]	One input at 3.4 V, Other inputs at V_{CC} or GND	5.5 V			1.35		1.5		1.5	mA
C_i	V_I = V_{CC} or GND	5 V		2	10		10		10	pF

(1) This is the increase in supply current for each input at one of the specified TTL voltage levels, rather than 0 V or V_{CC}.

5.6 Switching Characteristics

over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Load Circuits and Voltage Waveforms)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C		–40°C to 85°C		–40°C to 125°C		UNIT
				TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A or B	Y	C_L = 15 pF	5	6.2	1	7.1	1	8	ns
t_{PHL}				5	6.2	1	7.1	1	8	
t_{PLH}	A or B	Y	C_L = 15 pF	5.5	7.9	1	9	1	10	ns
t_{PHL}				5.5	7.9	1	9	1	10	

5.7 Operating Characteristics

V_{CC} = 5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS		TYP	UNIT
C_{pd}	Power dissipation capacitance	No load,	f = 1 MHz	10.5	pF

5.8 Typical Characteristics

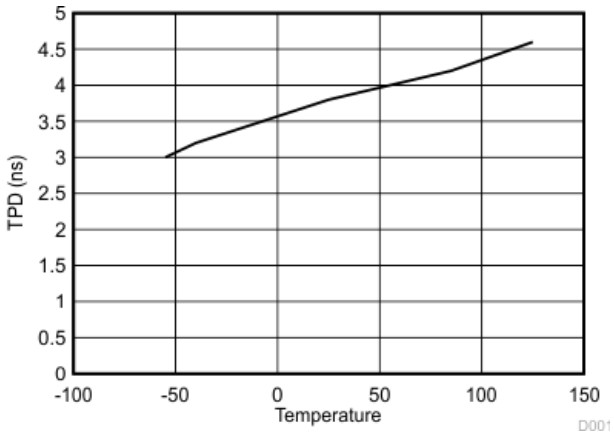
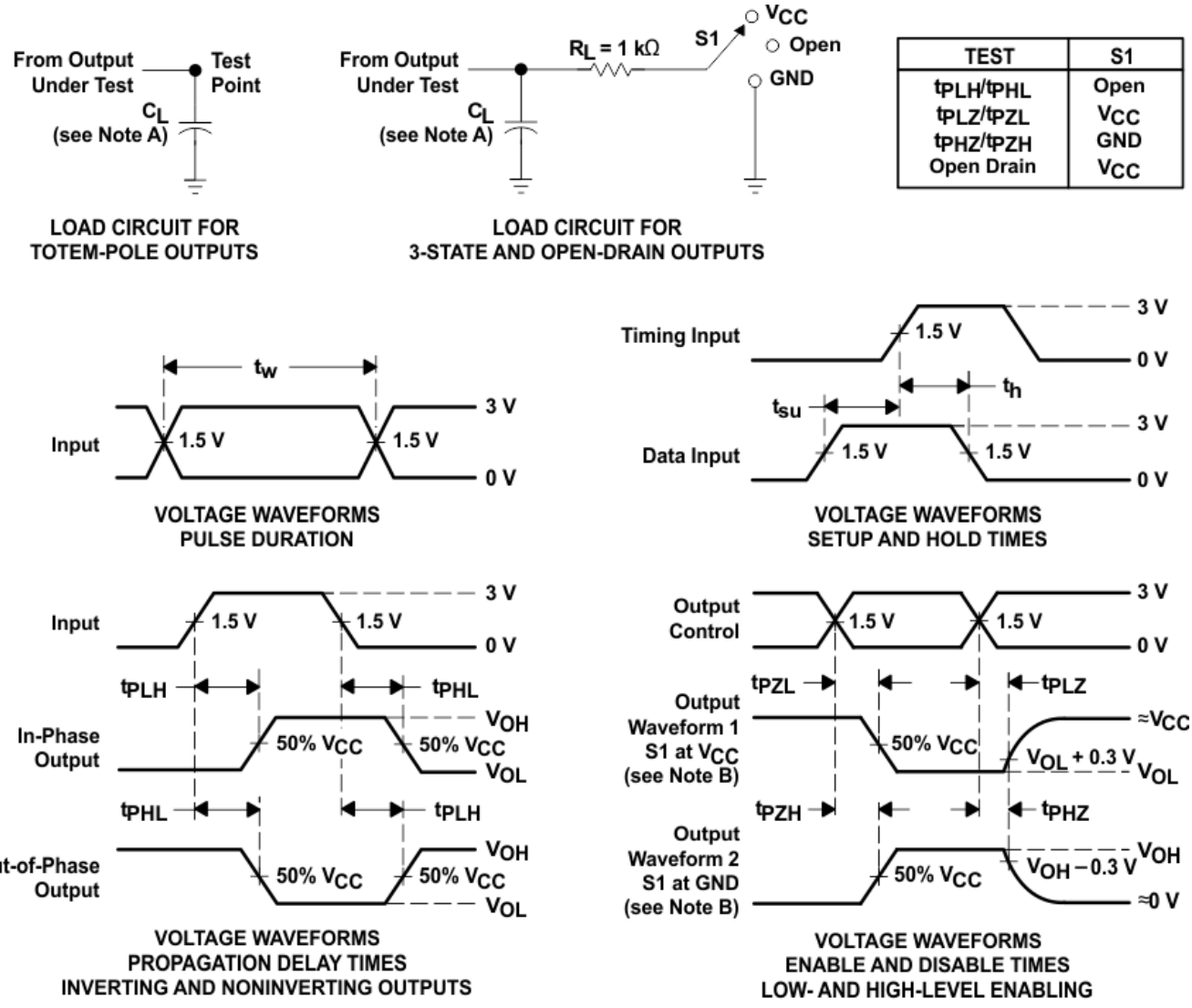


Figure 5-1. TPD vs Temperature

6 Parameter Measurement Information



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. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_r ≤ 3 ns, t_f ≤ 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.

Figure 6-1. Load Circuits and Voltage Waveforms

7 Detailed Description

7.1 Overview

The SN74AHCT1G00 device performs the Boolean function $Y = \overline{A \times B}$ or $Y = \overline{A} + \overline{B}$ in positive logic.

The device has TTL inputs that allow up translation from 3.3 V to 5 V. The inputs are high impedance when V_{CC} = 0 V.

7.2 Functional Block Diagram

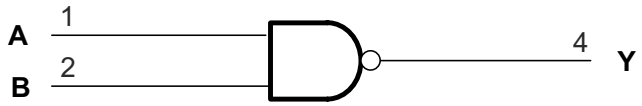


Figure 7-1. Logic Diagram (Positive Logic)

7.3 Feature Description

The device is ideal for operating in a 5-V logic system. The low propagation delay allows fast switching and higher speeds of operation. In addition, the low power consumption makes this device a good choice for portable and battery power-sensitive applications.

7.4 Device Functional Modes

Table 7-1. Function Table

INPUTS		OUTPUT
A	B	Y
H	H	L
L	X	H
X	L	H

8 Application and Implementation

Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

8.1 Application Information

The SN74AHCT1G00 is a low drive CMOS device that can be used for a multitude of bus interface type applications where output ringing is a concern. The low drive and slow edge rates will minimize overshoot and undershoot on the outputs. The TTL inputs can except voltages down to 3.3 V and translate up to 5 V.

8.2 Typical Application

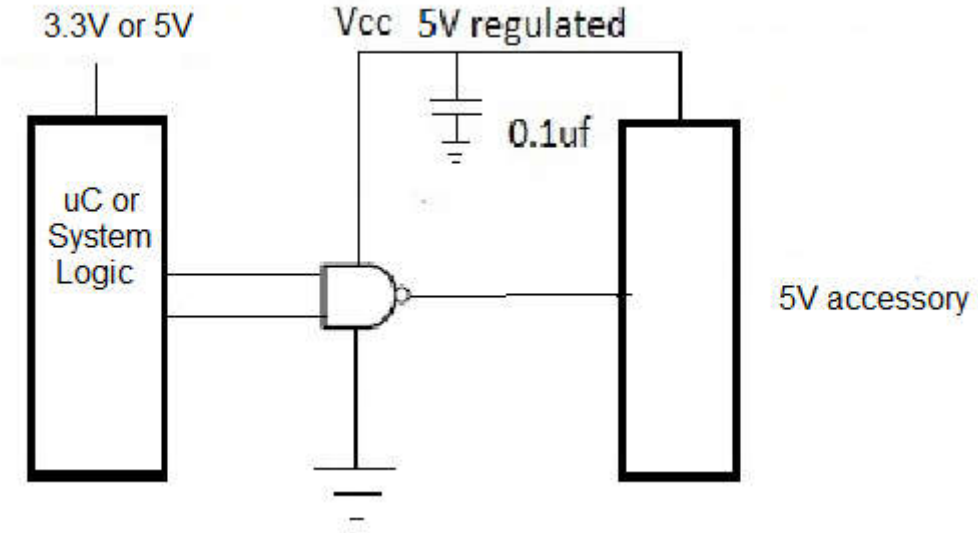


Figure 8-1. Typical Application Schematic

8.2.1 Design Requirements

This device uses CMOS technology and has balanced output drive. Take care to avoid bus contention because it can drive currents that would exceed maximum limits. The high drive will also create fast edges into light loads so consider routing and load conditions to prevent ringing.

8.3 Detailed Design Procedure

- Recommended input conditions:
  - Specified high and low levels. See (V_{IH} and V_{IL}) in *Section 5.3*.
  - Inputs are overvoltage tolerant allowing them to go as high as 5.5 V at any valid V_{CC}.
- Recommended output conditions:
  - Load currents should not exceed 25 mA per output and 50 mA total for the part.
  - Outputs should not be pulled above V_{CC}.

8.4 Application Curves

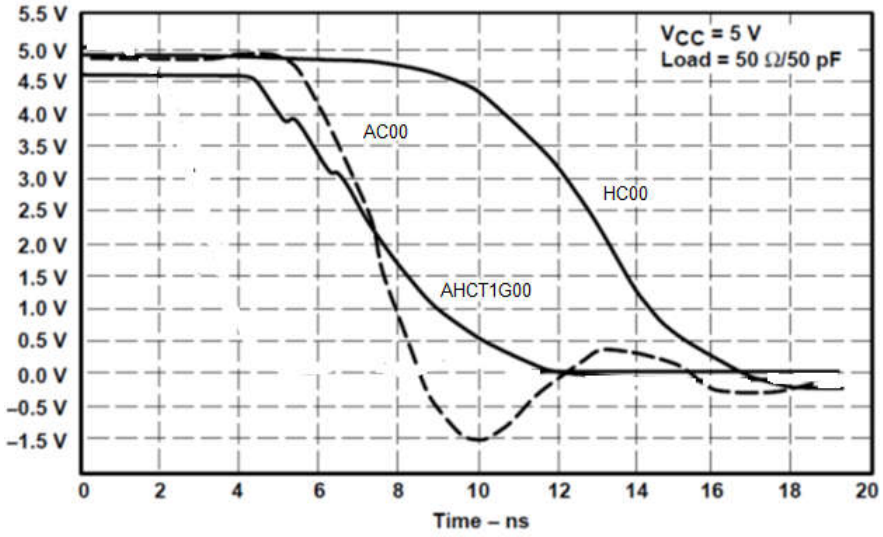


Figure 8-2. Switching Characteristics Comparison

9 Device and Documentation Support

9.1 Documentation Support (Analog)

9.1.1 Related Documentation

For related documentation, see the following:

- Texas Instruments, *CMOS Power Consumption and Cpd Calculation* application note
- Texas Instruments, *Designing With Logic* application note
- Texas Instruments, *Thermal Characteristics of Standard Linear and Logic (SLL) Packages and Devices* application note
- Texas Instruments, *Implications of Slow or Floating CMOS Inputs* application note

9.2 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.

9.3 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.

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.

9.4 Trademarks

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All trademarks are the property of their respective owners.

9.5 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.

9.6 Glossary

TI Glossary — This glossary lists and explains terms, acronyms, and definitions.

10 Revision History

Changes from Revision O (October 2023) to Revision P (February 2024)	Page
• Updated thermal values for DBV package from RθJA = 208.2 to 278, RθJC(top) = 76.1 to 180.5, RθJB = 52.5 to 184.4, ΨJT = 4 to 115.4, ΨJB = 51.8 to 183.4, RθJC(bot) = N/A, all values in °C/W	5

Changes from Revision N (March 2015) to Revision O (October 2023)	Page
• Added package size to *Package Information* table	1
• Updated thermal values for DCK package from RθJA = 287.6 to 289.2, RθJC(top) = 97.7 to 205.8, RθJB = 65 to 176.2, ΨJT = 2 to 117.6, ΨJB = 64.2 to 175.1, RθJC(bot) = N/A, all values in °C/W	5

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)
74AHCT1G00DBVRG4	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	B00G
74AHCT1G00DBVRG4.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	B00G
74AHCT1G00DBVTG4	Obsolete	Production	SOT-23 (DBV) | 5	-	-	Call TI	Call TI	-40 to 125	B00G
74AHCT1G00DCKRE4	Active	Production	SC70 (DCK) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	BA3
74AHCT1G00DCKRG4	Active	Production	SC70 (DCK) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	BA3
74AHCT1G00DCKRG4.A	Active	Production	SC70 (DCK) | 5	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	BA3
74AHCT1G00DCKTG4	Obsolete	Production	SC70 (DCK) | 5	-	-	Call TI	Call TI	-40 to 125	BA3
SN74AHCT1G00DBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(37UH, 3C5F, B003, B00G, B00J, B 00S)
SN74AHCT1G00DBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(37UH, 3C5F, B003, B00G, B00J, B 00S)
SN74AHCT1G00DBVT	Obsolete	Production	SOT-23 (DBV) | 5	-	-	Call TI	Call TI	-40 to 125	(B003, B00G, B00J, B00S)
SN74AHCT1G00DCK3	Active	Production	SC70 (DCK) | 5	3000 | LARGE T&R	Yes	SNBI	Level-1-260C-UNLIM	-40 to 85	BAY
SN74AHCT1G00DCK3.A	Active	Production	SC70 (DCK) | 5	3000 | LARGE T&R	Yes	SNBI	Level-1-260C-UNLIM	-40 to 85	BAY
SN74AHCT1G00DCKR	Active	Production	SC70 (DCK) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(1QO, BA3, BAG, BA J, BAS)
SN74AHCT1G00DCKR.A	Active	Production	SC70 (DCK) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(1QO, BA3, BAG, BA J, BAS)
SN74AHCT1G00DCKT	Obsolete	Production	SC70 (DCK) | 5	-	-	Call TI	Call TI	-40 to 125	(BA3, BAG, BAJ, BA S)

(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.

OTHER QUALIFIED VERSIONS OF SN74AHCT1G00 :

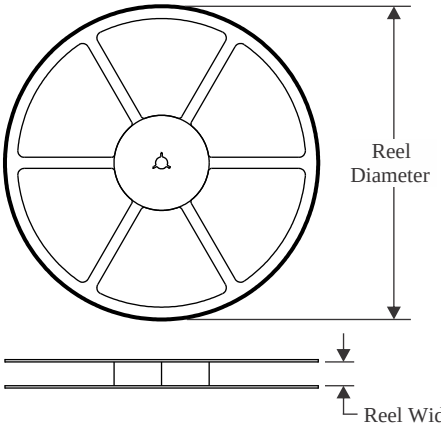
- Automotive : SN74AHCT1G00-Q1

NOTE: Qualified Version Definitions:

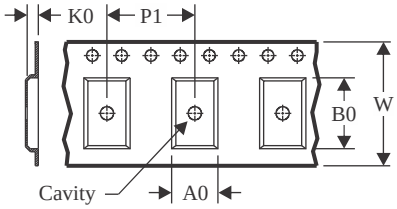
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

TAPE AND REEL INFORMATION

REEL DIMENSIONS

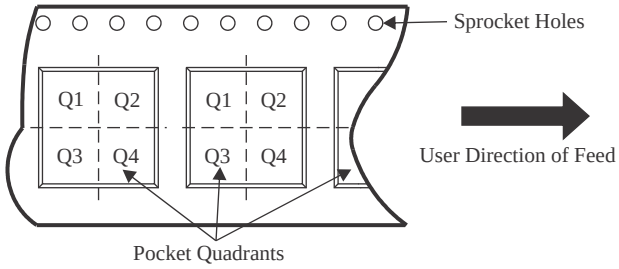


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

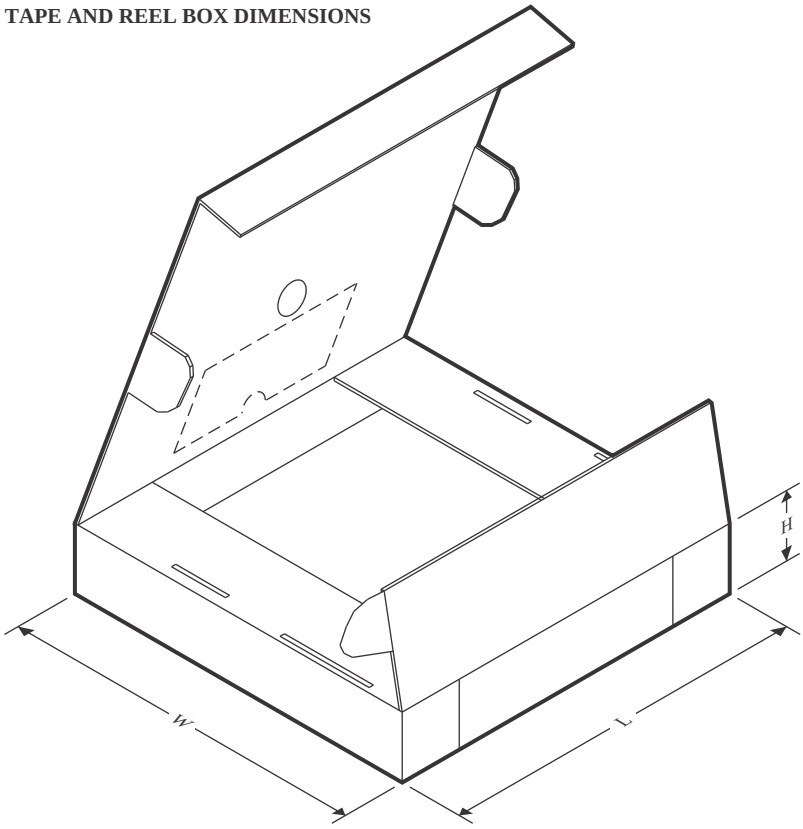
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
74AHCT1G00DBVRG4	SOT-23	DBV	5	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
74AHCT1G00DCKRG4	SC70	DCK	5	3000	178.0	9.2	2.4	2.4	1.22	4.0	8.0	Q3
SN74AHCT1G00DBVR	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
SN74AHCT1G00DCKR	SC70	DCK	5	3000	180.0	8.4	2.3	2.5	1.2	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

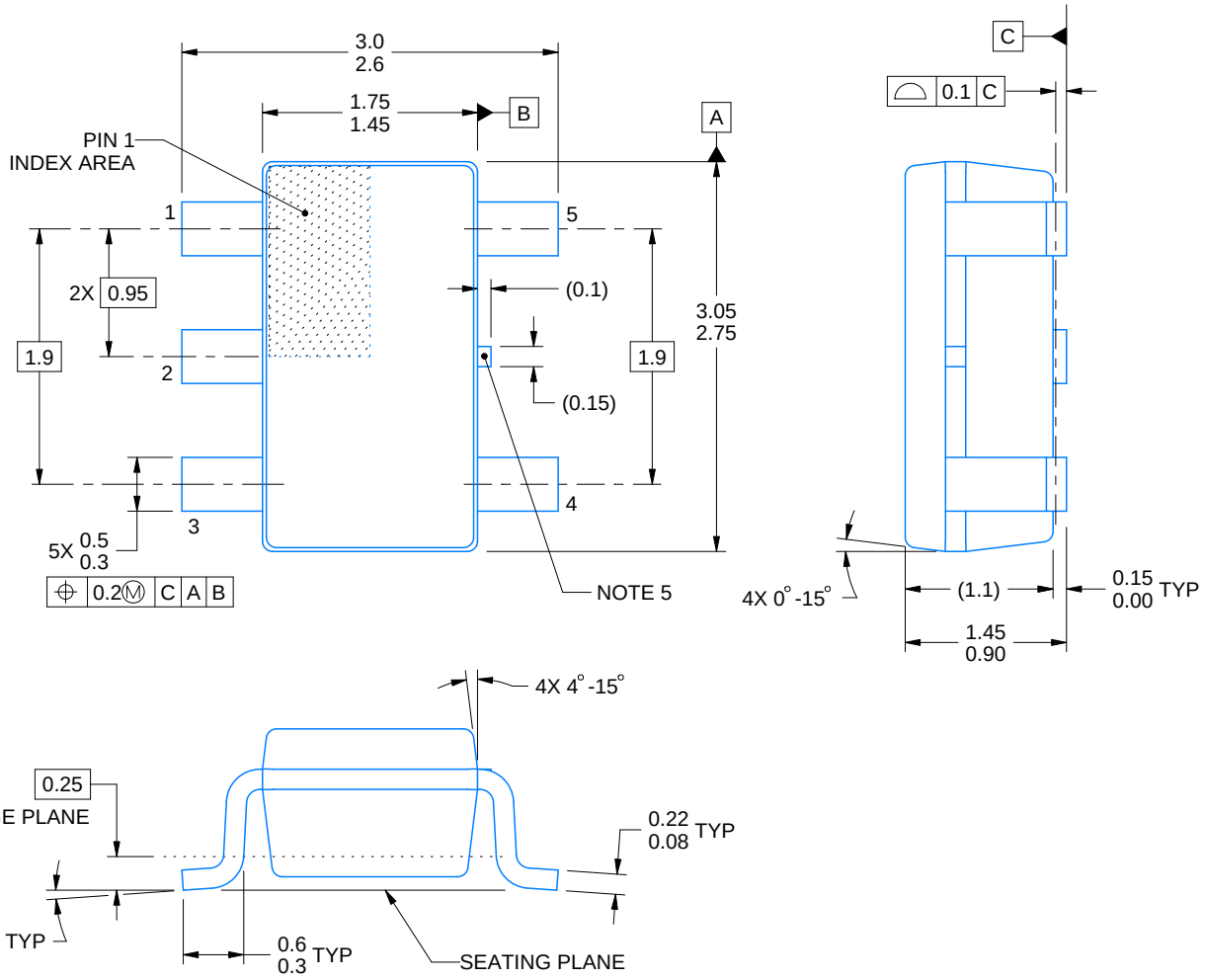
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
74AHCT1G00DBVRG4	SOT-23	DBV	5	3000	180.0	180.0	18.0
74AHCT1G00DCKRG4	SC70	DCK	5	3000	180.0	180.0	18.0
SN74AHCT1G00DBVR	SOT-23	DBV	5	3000	208.0	191.0	35.0
SN74AHCT1G00DCKR	SC70	DCK	5	3000	210.0	185.0	35.0

PACKAGE OUTLINE

DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



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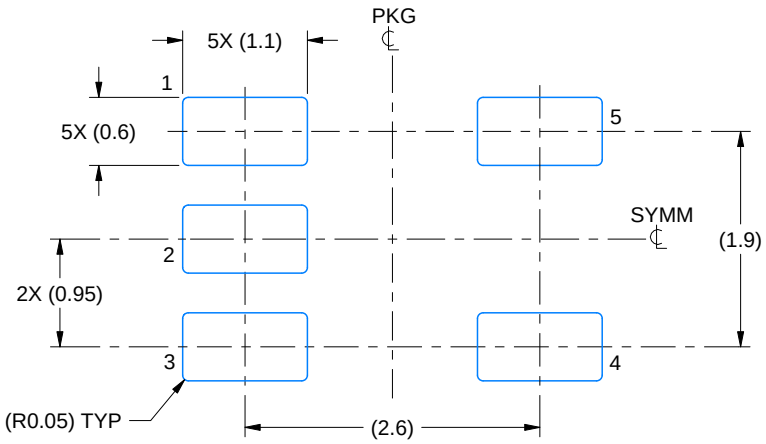
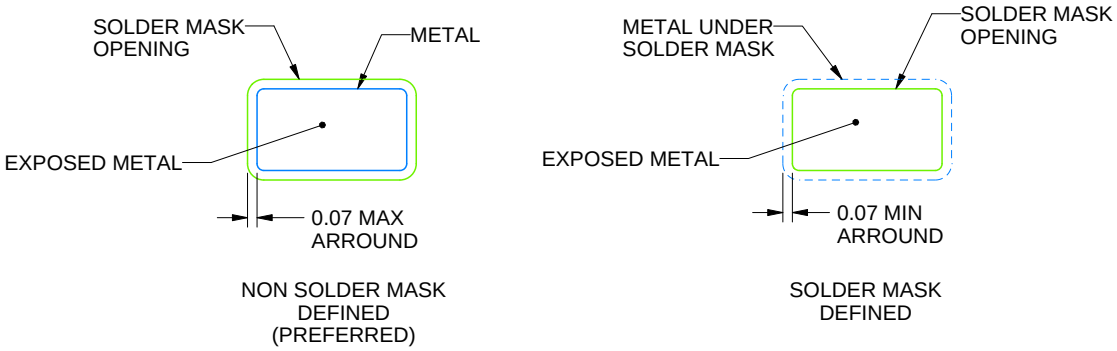
NOTES:

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. Refernce JEDEC MO-178.
4. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25 mm per side.
5. Support pin may differ or may not be present.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK DETAILS

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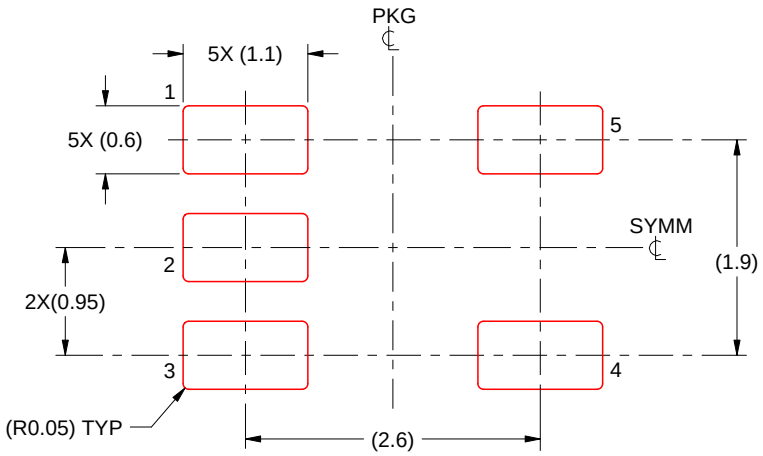
NOTES: (continued)

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



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:15X

4214839/K 08/2024

NOTES: (continued)

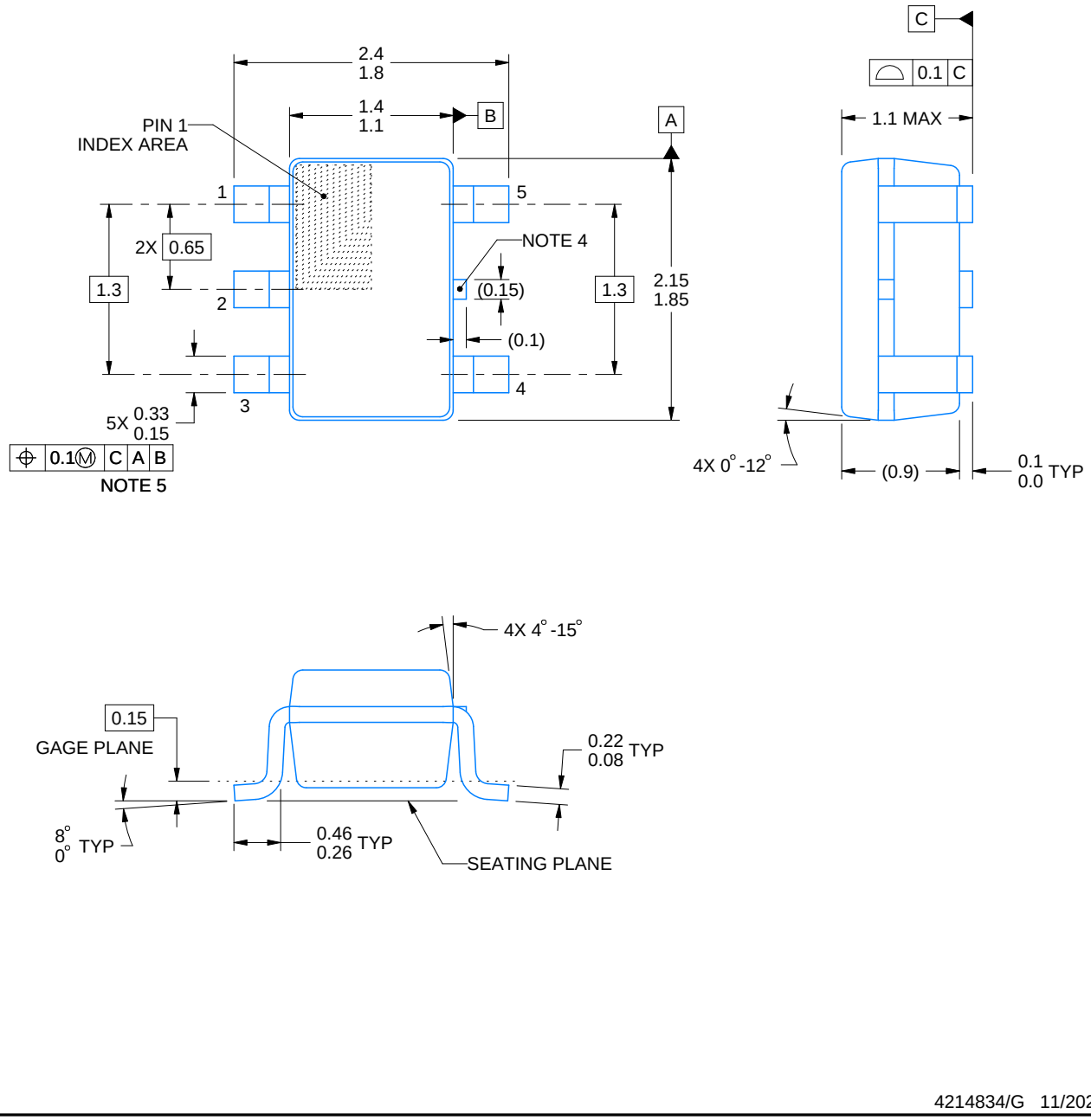
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

PACKAGE OUTLINE

DCK0005A

SOT - 1.1 max height

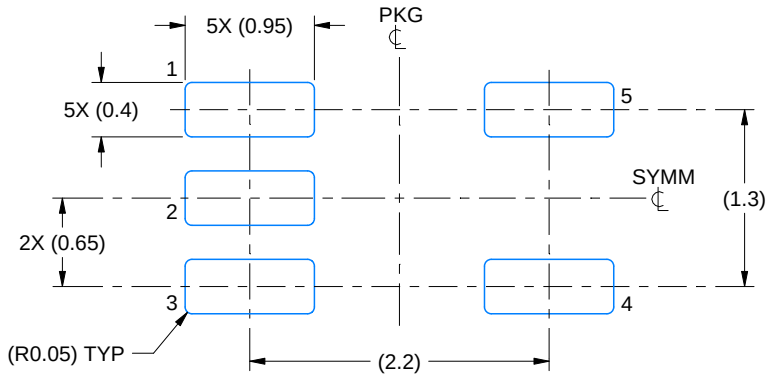
SMALL OUTLINE TRANSISTOR



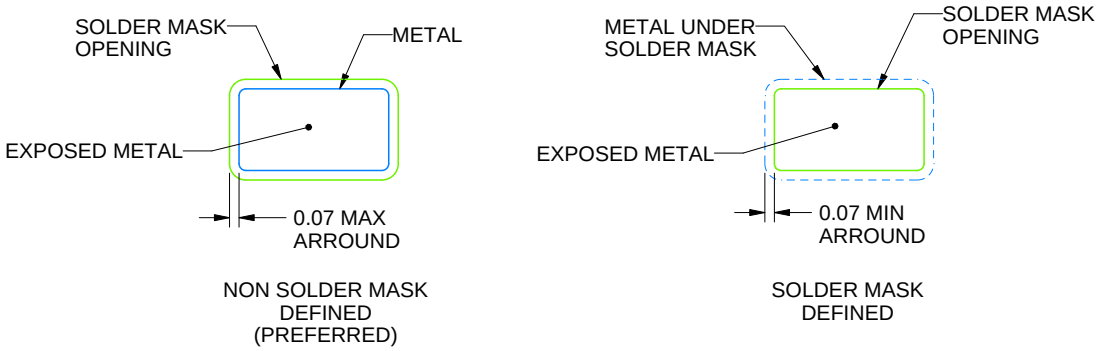
4214834/G 11/2024

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. Refernce JEDEC MO-203.
4. Support pin may differ or may not be present.
5. Lead width does not comply with JEDEC.
6. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25mm per side



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:18X

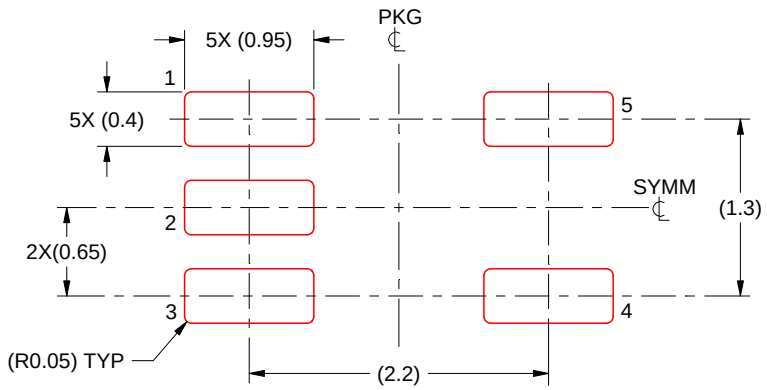


SOLDER MASK DETAILS

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.



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

4214834/G 11/2024

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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