

SN74AHCT1G04-Q1 具有 TTL 兼容型 CMOS 输入的汽车级单通道 4.5V 至 5.5V 反相器

1 特性

- 符合汽车应用要求
- ESD 保护超过 MIL-STD-883 方法 3015 规定的 1500V
- 工作电压范围为 4.5 V 至 5.5V
- 5V 时， t_{pd} 最大值为 7.5ns
- 低功耗， I_{CC} 最大值为 10 μ A
- 电压为 5V 时，输出驱动为 8mA
- 输入兼容 TTL 电压

2 应用

- 混合、电动和动力传动系统
- 高级驾驶辅助系统 (ADAS)
- 车身电子装置和照明
- 信息娱乐和仪表板

3 说明

SN74AHCT1G04-Q1 包含一个逻辑门。该器件执行布尔函数 $Y = \bar{A}$ 。

封装信息

| 器件型号 | 封装 ⁽¹⁾ | 封装尺寸 ⁽²⁾ | 本体尺寸 ⁽³⁾ |
|-----------------|----------------------|---------------------|---------------------|
| SN74AHCT1G04-Q1 | DCK (SOT-SC70 , 5) | 2mm × 1.25mm | 2mm × 1.25mm |
| | DTX (X2SON , 5) | 1.1mm × 0.85mm | 1.1mm × 0.85mm |

- 如需了解更多信息，请参阅[机械、封装和可订购信息](#)。
- 封装尺寸 (长 × 宽) 为标称值，并包括引脚 (如适用)。
- 本体尺寸 (长 × 宽) 为标称值，不包括引脚。

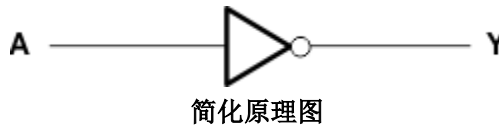


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4 Pin Configuration and Functions

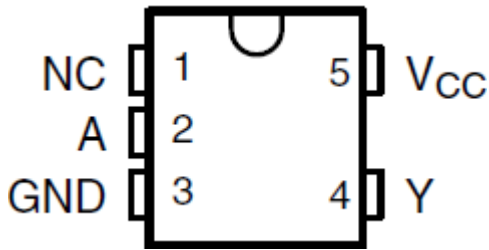
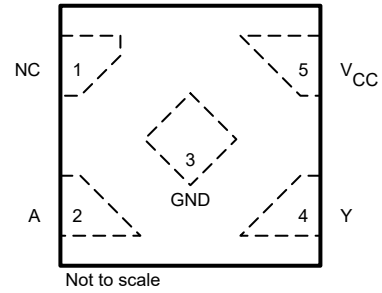


图 4-1. DBV Package, 5-Pin SOT-23; DCK Package (Top View)



NC – No internal connection

图 4-2. DTX Package, 5-Pin X2SON (Top View)

表 4-1. Pin Functions

| PIN | | TYPE | DESCRIPTION |
|-----|-----------------|------|---------------|
| NO. | NAME | | |
| 1 | NC | — | No Connection |
| 2 | A | I | Input A |
| 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 range ⁽²⁾ | - 0.5 | 7 | V |
| V _O | Output voltage range | - 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 | mA |
| I _O | Continuous output current | V _O = 0 to V _{CC} | ±25 | mA |
| | Continuous current through V _{CC} or GND | | ±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, and functional operation of the device at these or any other conditions beyond those indicated under [§ 5.3](#) is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The input and output negative-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, all pins ⁽¹⁾ | ±1500 V |

- (1) AEC Q100-002 indicates that HBM stressing must be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.

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](#).

5.4 Thermal Information

| THERMAL METRIC ⁽¹⁾ | DCK (SOT-SC70) | DTX (X2SON) | UNIT | |
|-------------------------------|----------------------------------------|-------------|-------|------|
| | 5 PINS | 5 PINS | | |
| R _{θJA} | Junction-to-ambient thermal resistance | 293.4 | 184.7 | °C/W |

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

5.5 Electrical Characteristics

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

| PARAMETER | TEST CONDITIONS | V _{CC} | T _A = 25°C | | | - 40°C to +125°C | | UNIT |
|-------------------------------|-------------------------------------------------------------|-----------------|-----------------------|-----|-------|------------------|------|------|
| | | | MIN | TYP | MAX | MIN | MAX | |
| V _{OH} | I _{OH} = - 50 μA | 4.5 V | 4.4 | 4.5 | | 4.4 | V | |
| | I _{OH} = -8 mA | 4.5 V | 3.94 | | | 3.8 | | |
| V _{OL} | I _{OL} = 50 μA | 4.5 V | | | 0.1 | | 0.1 | V |
| | I _{OL} = 8 mA | 4.5 V | | | 0.36 | | 0.44 | |
| I _I | V _I = 5.5 V or GND | 0 V to 5.5 V | | | ± 0.1 | | ±1 | μA |
| I _{CC} | V _I = V _{CC} or GND, I _O = 0 | 5.5 V | | | 1 | | 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 | mA |
| C _i | V _I = V _{CC} or GND | 5 V | | 4 | 10 | | 10 | pF |

5.6 Switching Characteristics

over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see [load circuit and voltage wave forms](#))

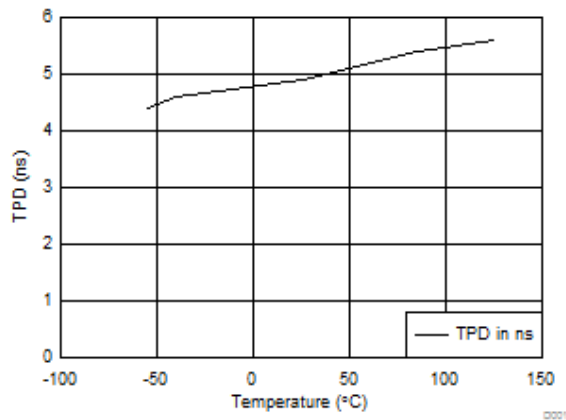
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | T _A = 25°C | | | MIN | MAX | UNIT |
|------------------|--------------|-------------|------------------------|-----------------------|-----|-----|-----|-----|------|
| | | | | MIN | TYP | MAX | | | |
| t _{PLH} | A | Y | C _L = 15 pF | | 4.7 | 6.7 | 1 | 7.5 | ns |
| t _{PHL} | A | Y | C _L = 15 pF | | 4.7 | 6.7 | 1 | 7.5 | |
| t _{PLH} | A | Y | C _L = 50 pF | | 5.5 | 7.7 | 1 | 8.5 | ns |
| t _{PHL} | A | Y | C _L = 50 pF | | 5.5 | 7.7 | 1 | 8.5 | |

5.7 Operating Characteristics

V_{CC} = 5 V, T_A = 25°C

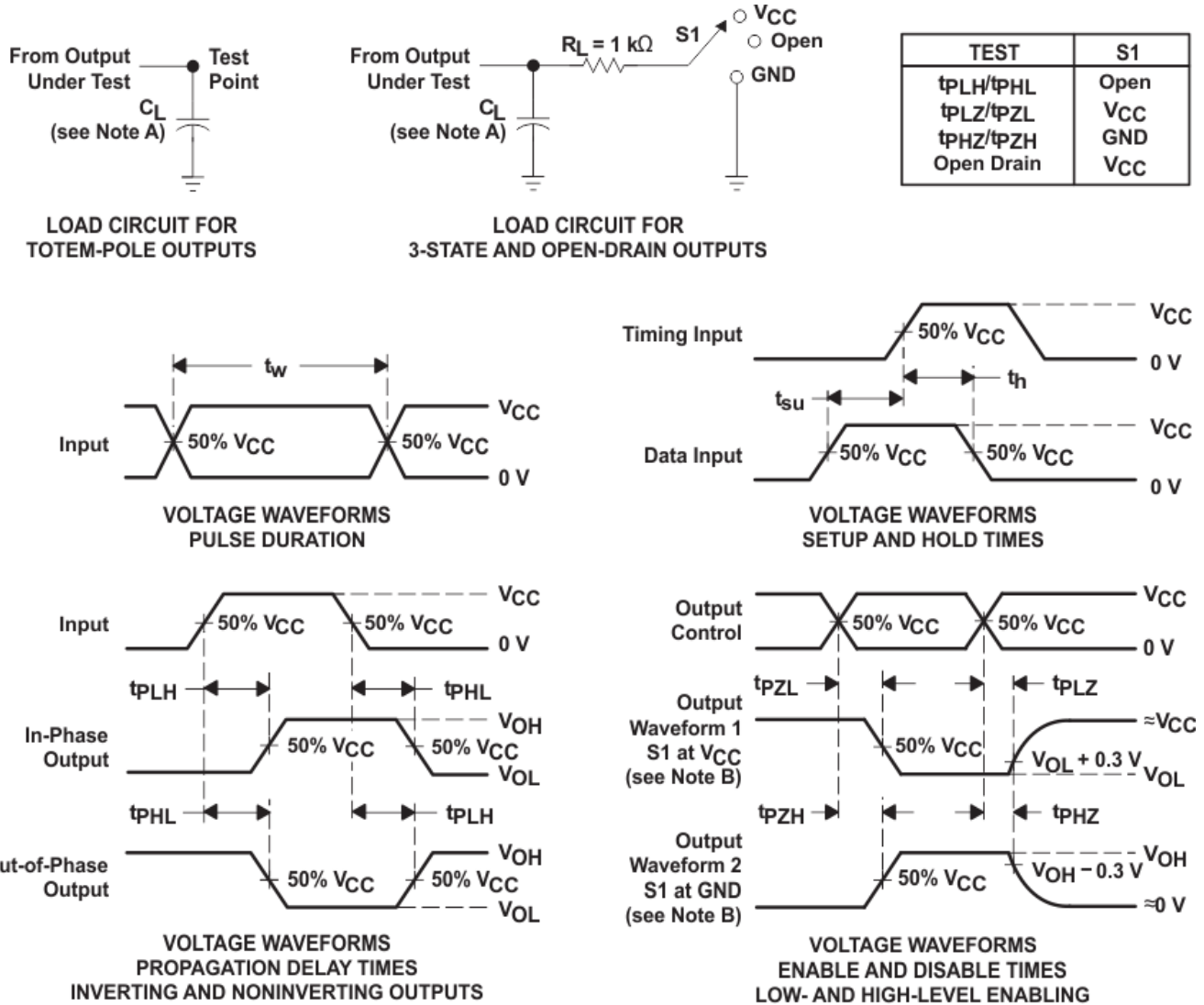
| PARAMETER | TEST CONDITIONS | TYP | UNIT |
|-----------------------------------------------|--------------------|-----|------|
| C _{pd} Power dissipation capacitance | No load, f = 1 MHz | 14 | pF |

5.8 Typical Characteristics



6 Parameter Measurement Information

6.1



- 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: $PRR \leq 1\text{ MHz}$, $Z_O = 50\ \Omega$, $t_r \leq 3\text{ ns}$, $t_f \leq 3\text{ ns}$.
 D. The outputs are measured one at a time, with one input transition per measurement.
 E. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 F. t_{PZL} and t_{PZH} are the same as t_{en} .
 G. t_{PHL} and t_{PLH} are the same as t_{pd} .
 H. All parameters and waveforms are not applicable to all devices.

图 6-1. Load Circuit and Voltage Waveforms

7 Detailed Description

7.1 Functional Block Diagram



7.2 Device Functional Modes

表 7-1. Function Table

| INPUT | OUTPUT |
|-------|--------|
| A | Y |
| H | L |
| L | H |

8 Device and Documentation Support

8.1 Documentation Support

8.1.1 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 8-1. Related Links

| PARTS | PRODUCT FOLDER | SAMPLE & BUY | TECHNICAL DOCUMENTS | TOOLS & SOFTWARE | SUPPORT & COMMUNITY |
|-----------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| SN74AHCT1G04-Q1 | Click here | Click here | Click here | Click here | Click here |

8.2 接收文档更新通知

要接收文档更新通知，请导航至 [ti.com](https://www.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。

8.3 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](#)。

8.4 Trademarks

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8.5 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。

8.6 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。

9 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 C (July 2023) to Revision D (October 2024) Page

- 删除了 *特性* 部分中的机器放电模型..... 1
- 向 *封装信息表*、*引脚配置和功能* 部分以及 *热性能信息表* 中添加了 DTX 封装..... 1

Changes from Revision B (January 2023) to Revision C (July 2023) Page

- Updated thermal values for DCK package from $R^{\theta} JA = 252$ to 293.4, all values in °C/W..... 4

10 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) |
|------------------------------------|---------------|----------------------|-----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| CAHCT1G04QDCKRG4Q1 | NRND | Production | SC70 (DCK) 5 | 3000 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | BCS |
| CAHCT1G04QDCKRG4Q1.A | NRND | Production | SC70 (DCK) 5 | 3000 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | BCS |
| CAHCT1G04QDCKRQ1 | Active | Production | SC70 (DCK) 5 | 3000 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | BCS |
| CAHCT1G04QDCKRQ1.A | Active | Production | SC70 (DCK) 5 | 3000 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | BCS |
| CAHCT1G04WDTXRQ1 | Active | Production | X2SON (DTX) 5 | 3000 LARGE T&R | Yes | SN | Level-1-260C-UNLIM | -40 to 125 | 1 |

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

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

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

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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

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

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

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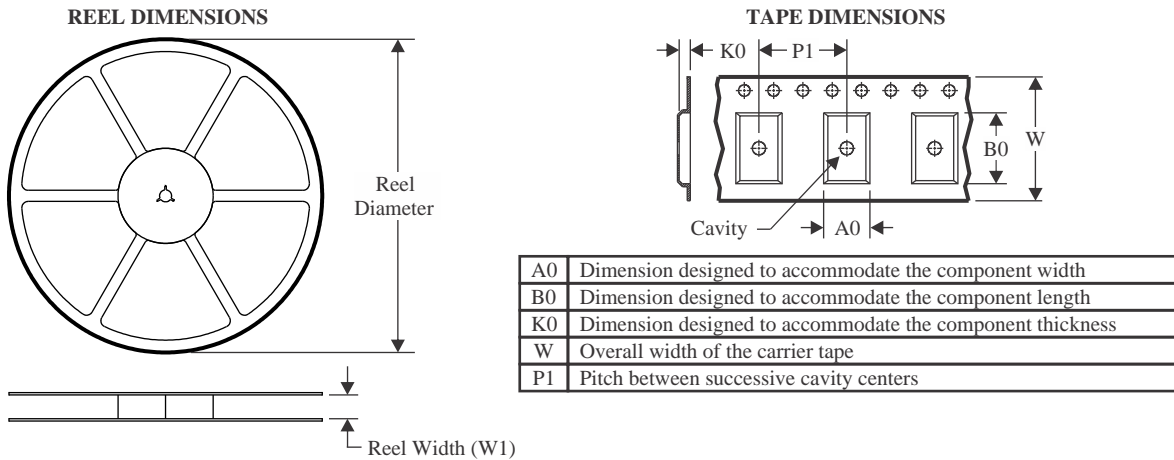
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF SN74AHCT1G04-Q1 :

- Catalog : [SN74AHCT1G04](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

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 |
|------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| CAHCT1G04QDCKRQ1 | 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

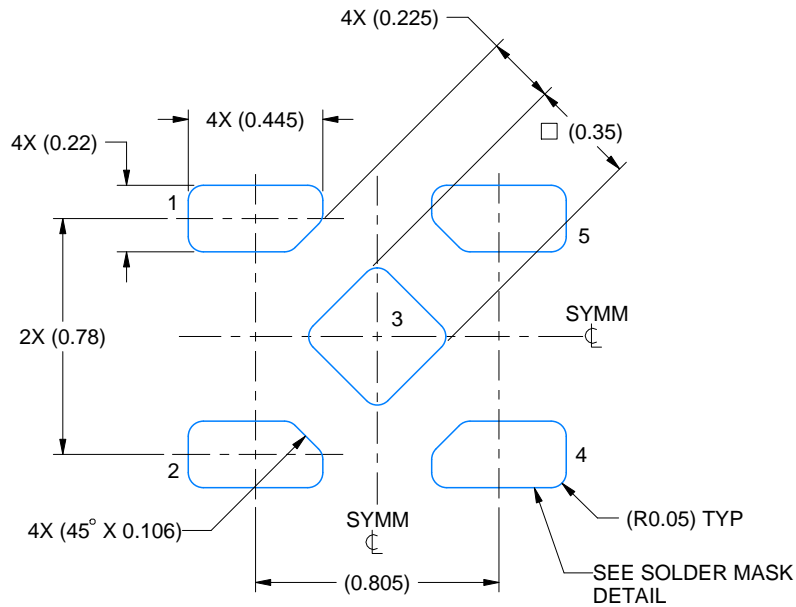
| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| CAHCT1G04QDCKRQ1 | SC70 | DCK | 5 | 3000 | 190.0 | 190.0 | 30.0 |

EXAMPLE BOARD LAYOUT

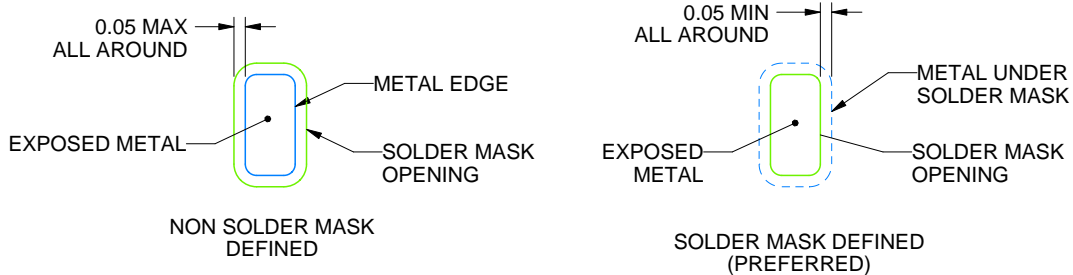
DTX0005A

X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 40X



SOLDER MASK DETAILS

4229388/C 10/2024

NOTES: (continued)

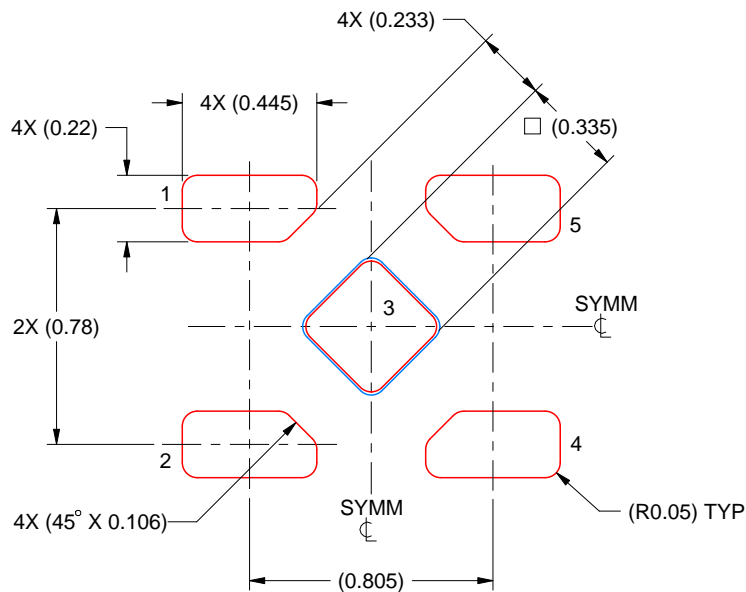
4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).

EXAMPLE STENCIL DESIGN

DTX0005A

X2SON - 0.4 mm max height

PLASTIC SMALL OUTLINE - NO LEAD



SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE: 40X

PRINTED SOLDER PASTE COVERAGE BY AREA UNDER PACKAGE
PAD 5: 92%

4229388/C 10/2024

NOTES: (continued)

5. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.

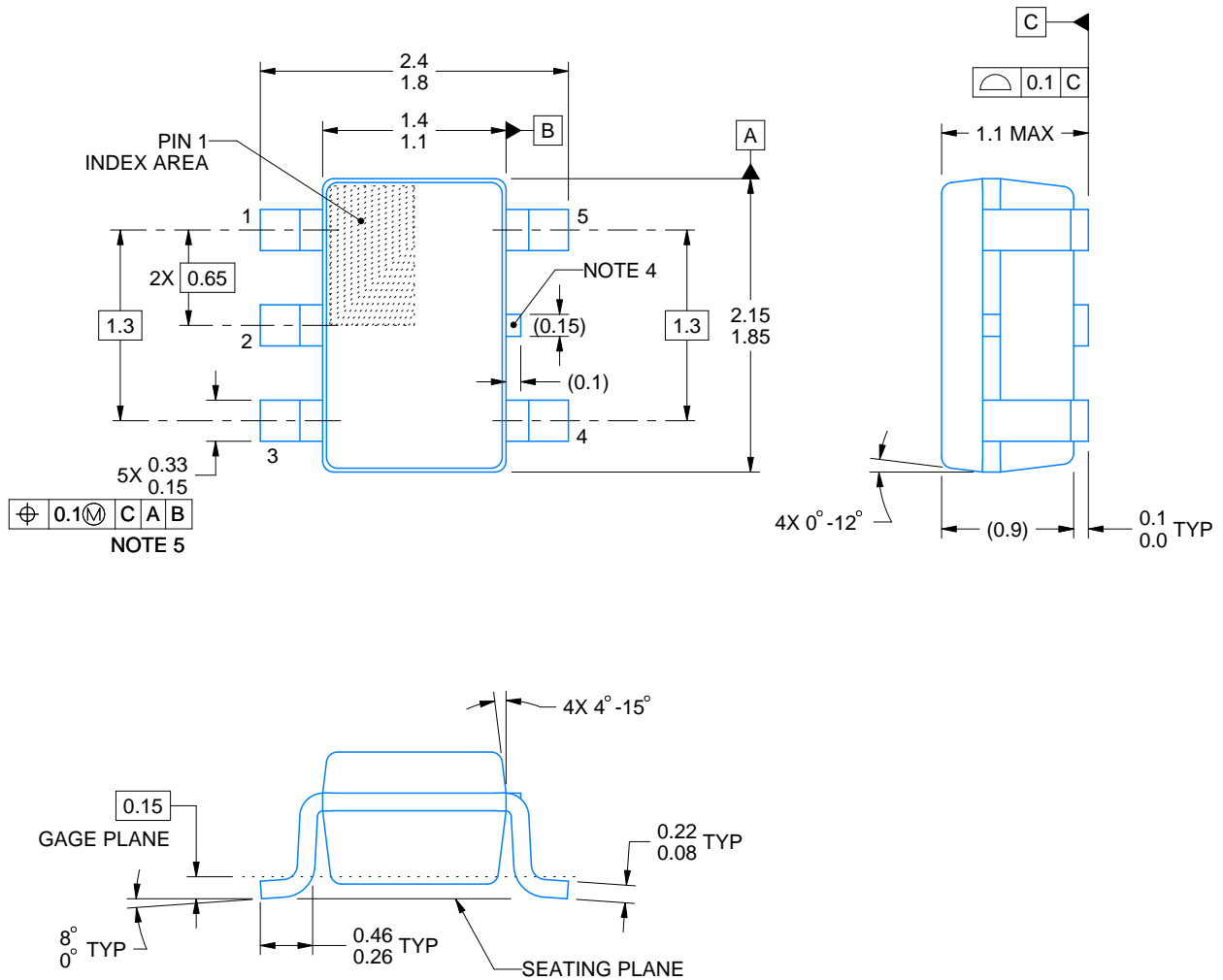
DCK0005A



PACKAGE OUTLINE

SOT - 1.1 max height

SMALL OUTLINE TRANSISTOR



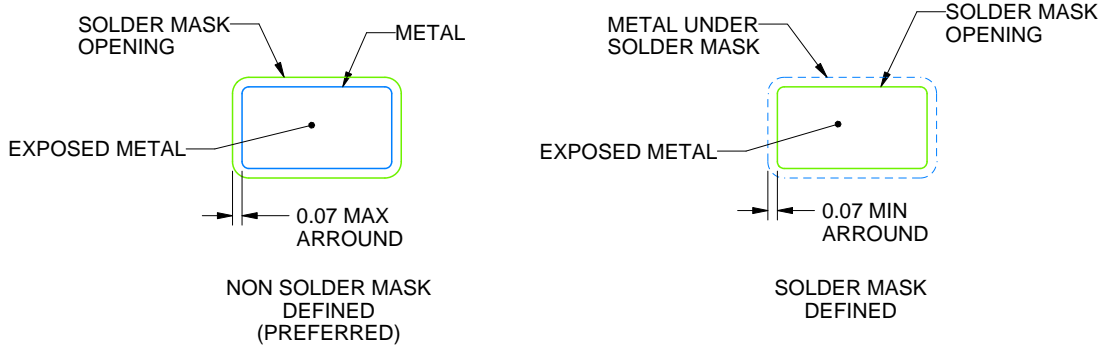
4214834/G 11/2024

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. Reference 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)

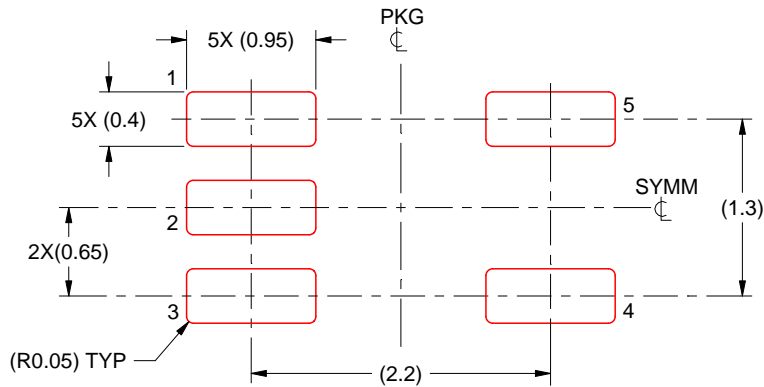
- 7. Publication IPC-7351 may have alternate designs.
- 8. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DCK0005A

SOT - 1.1 max height

SMALL OUTLINE TRANSISTOR



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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