

## SN74AHC1G08-Q1 汽车类单通道双输入正与门

### 1 特性

- 符合汽车应用要求
- 工作电压范围为 2V 至 5.5V
- 电压为 5V 时， $t_{pd}$  最大值为 9ns
- 低功耗， $I_{CC}$  最大值为 20  $\mu$ A
- 5V 时，输出驱动为  $\pm 8$ mA
- 所有输入端均采用施密特触发器，使得电路能够承受较慢的输入上升和下降时间

### 2 应用

- 启用或禁用数字信号
- 控制指示灯 LED
- 通信模块和系统控制器之间的转换

### 3 说明

SN74AHC1G08 是一个单通道 2 输入正与门。该器件以正逻辑执行布尔函数  $Y = A \cdot B$  或  $Y = \overline{A+B}$ 。

#### 封装信息

器件型号	封装 <sup>(1)</sup>	封装尺寸 <sup>(2)</sup>	封装尺寸 <sup>(3)</sup>
SN74AHC1G08-Q1	DBV ( SOT-23 , 5 )	2.8mm × 2.8mm	2.9mm × 1.6mm
	DCK ( SC-70 , 5 )	2.00mm × 1.25mm	2mm × 1.25mm

- 更多相关信息，请参阅第 11 节。
- 封装尺寸 (长 × 宽) 为标称值，并包括引脚 (如适用)。
- 封装尺寸 (长 × 宽) 为标称值，不包括引脚。



逻辑图 (正逻辑)



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## 4 Pin Configuration and Functions

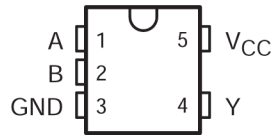


图 4-1. DBV or DCK Package (Top View)

表 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 <sub>CC</sub>	—	Power Pin

## 5 Specifications

### 5.1 Absolute Maximum Ratings

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

		MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage	-0.5	7	V
V <sub>I</sub> <sup>(2)</sup>	Input voltage	-0.5	7	V
V <sub>O</sub> <sup>(2)</sup>	Output voltage	-0.5	V <sub>CC</sub> + 0.5	V
I <sub>IK</sub>	Input clamp current	(V <sub>I</sub> < 0)	-20	mA
I <sub>OK</sub>	Output clamp current	(V <sub>O</sub> < 0 or V <sub>O</sub> > V <sub>CC</sub> )	±20	mA
I <sub>O</sub>	Continuous output current	(V <sub>O</sub> = 0 to V <sub>CC</sub> )	±25	mA
Continuous current through V <sub>CC</sub> or GND			±50	mA
T <sub>stg</sub>	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 ESD Ratings

		VALUE	UNIT
V <sub>(ESD)</sub>	Electrostatic discharge	Human body model (HBM), per AEC Q100-002 <sup>(1)</sup>	±2000
		Charged device model (CDM), per AEC Q100-011	±1000

- (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 recommended operating free-air temperature range (unless otherwise noted)<sup>3</sup>

		MIN	MAX	MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage	2	5.5	2	5.5	V
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 2 V	1.5	1.5		V
		V <sub>CC</sub> = 3 V	2.1	2.1		
		V <sub>CC</sub> = 5.5 V	3.85	3.85		
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 2 V		0.5	0.5	V
		V <sub>CC</sub> = 3 V		0.9	0.9	
		V <sub>CC</sub> = 5.5 V		1.65	1.65	
V <sub>I</sub>	Input voltage	0	5.5	0	5.5	V
V <sub>O</sub>	Output voltage	0	V <sub>CC</sub>	0	V <sub>CC</sub>	V
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 2 V		-50	-50	μA
		V <sub>CC</sub> = 3.3 V ± 0.3 V		-4	-4	mA
		V <sub>CC</sub> = 5 V ± 0.5 V		-8	-8	
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 2 V		50	50	μA
		V <sub>CC</sub> = 3.3 V ± 0.3 V		4	4	mA
		V <sub>CC</sub> = 5 V ± 0.5 V		8	8	
Δt/Δv	Input transition rise or fall rate	V <sub>CC</sub> = 3.3 V ± 0.3 V		100	100	ns/V
		V <sub>CC</sub> = 5 V ± 0.5 V		20	20	

over recommended operating free-air temperature range (unless otherwise noted)<sup>3</sup>

		MIN	MAX	MIN	MAX	UNIT
T <sub>A</sub>	Operating free-air temperature	I Suffix	-40	85		°C
		Q Suffix			-40	

(1) All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

### 5.4 Thermal Information

THERMAL METRIC <sup>(1)</sup>		SN74AHC1G08-Q1		UNIT
		DBV	DCK	
		5 PINS	5 PINS	
R <sub>θJA</sub>	Junction-to-ambient thermal resistance	278	289.2	°C/W

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

### 5.5 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			- 40°C TO 85°C		- 40 C TO 125°C		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>OH</sub>	I <sub>OH</sub> = -50 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 <sub>OH</sub> = -4 mA	3 V	2.58			2.48		2.4		
	I <sub>OH</sub> = -8 mA	4.5 V	3.94			3.8		3.7		
V <sub>OL</sub>	I <sub>OL</sub> = 50 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 <sub>OL</sub> = 4 mA	3 V			0.36		0.44	0.52		
	I <sub>OL</sub> = 8 mA	4.5 V			0.36		0.44	0.52		
I <sub>I</sub>	V <sub>I</sub> = 5.5 V or GND	0 V to 5.5 V			±0.1		±1	±1	μA	
I <sub>CC</sub>	V <sub>I</sub> = V or GND, I <sub>O</sub> = 0	5.5 V			1		10	20	μA	
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	5 V		4	10		10	10	pF	

### 5.6 Switching Characteristics, V<sub>CC</sub> = 3.3 V ± 0.3 V

over recommended operating free-air temperature range, V<sub>CC</sub> = 3.3 V ± 0.3 V (unless otherwise noted) (see [Load Circuit and Voltage Waveforms](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	OUTPUT CAPACITANCE	T <sub>A</sub> = 25 C			- 40°C TO 85°C		- 40°C TO 125°C		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	A or B	Y	C <sub>L</sub> = 15 pF		6.2	8.8	1	10.5		12.5	ns
t <sub>PHL</sub>					6.2	8.8	1	10.5		12.5	
t <sub>PLH</sub>	A or B	Y	C <sub>L</sub> = 50 pF		8.7	12.3	1	14		16.5	ns
t <sub>PHL</sub>					8.7	12.3	1	14		16.5	

## 5.7 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 [Load Circuit and Voltage Waveforms](#))

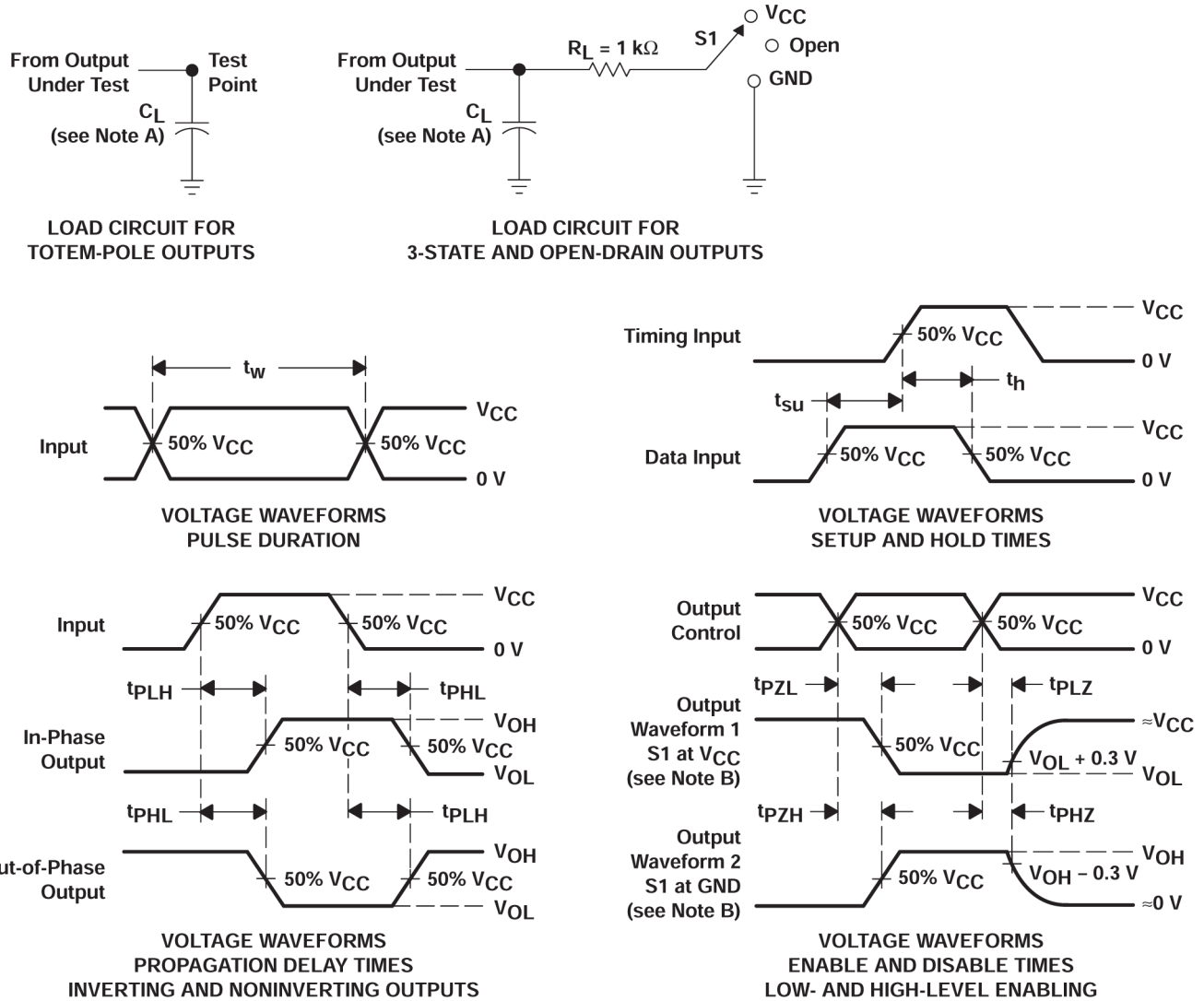
PARAMETER	FROM (INPUT)	TO (OUTPUT)	OUTPUT CAPACITANCE	$T_A = 25^\circ\text{C}$			$-40^\circ\text{C TO } 85^\circ\text{C}$		$-40^\circ\text{C TO } 125^\circ\text{C}$		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	A or B	Y	$C_L = 15\text{ pF}$		4.3	5.9		7		9	ns
$t_{PHL}$					4.3	5.9		7		9	
$t_{PLH}$	A or B	Y	$C_L = 50\text{ pF}$		5.8	7.9		9		11	ns
$t_{PHL}$					5.8	7.9		9		11	

## 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,	$f = 1\text{ MHz}$	18	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,  $Z_0 = 50 \Omega$ ,  $t_r \leq 3$  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 SN74AHC1G08-Q1 contains four independent 2-input AND Gates with Schmitt-trigger inputs. Each gate performs the Boolean function  $Y = A \times B$  in positive logic. The output level is referenced to the supply voltage ( $V_{CC}$ ) and supports 1.8-V, 2.5-V, 3.3-V, and 5-V CMOS levels.

### 7.2 Functional Block Diagram



图 7-1. Logic Diagram (Positive Logic)

### 7.3 Feature Description

#### 7.3.1 CMOS Schmitt-Trigger Inputs

This device includes inputs with the Schmitt-trigger architecture. These inputs are high impedance and are typically modeled as a resistor in parallel with the input capacitance given in the *Electrical Characteristics* table from the input to ground. The worst case resistance is calculated with the maximum input voltage, given in the *Absolute Maximum Ratings* table, and the maximum input leakage current, given in the *Electrical Characteristics* table, using Ohm's law ( $R = V \div I$ ).

The Schmitt-trigger input architecture provides hysteresis as defined by  $\Delta V_T$  in the *Electrical Characteristics* table, which makes this device extremely tolerant to slow or noisy inputs. While the inputs can be driven much slower than standard CMOS inputs, it is still recommended to properly terminate unused inputs. Driving the inputs with slow transitioning signals will increase dynamic current consumption of the device. For additional information regarding Schmitt-trigger inputs, please see [Understanding Schmitt Triggers](#).

### 7.4 Device Functional Modes

表 7-1 lists the functional modes of the SN74AHC1G08-Q1.

表 7-1. Function Table

INPUTS <sup>(1)</sup>		OUTPUT
A	B	Y
H	H	H
L	X	L
X	L	L

(1) H = high voltage level, L = low voltage level, X = do not care, Z = high impedance



## 8 Application and Implementation

### 备注

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 Typical Application

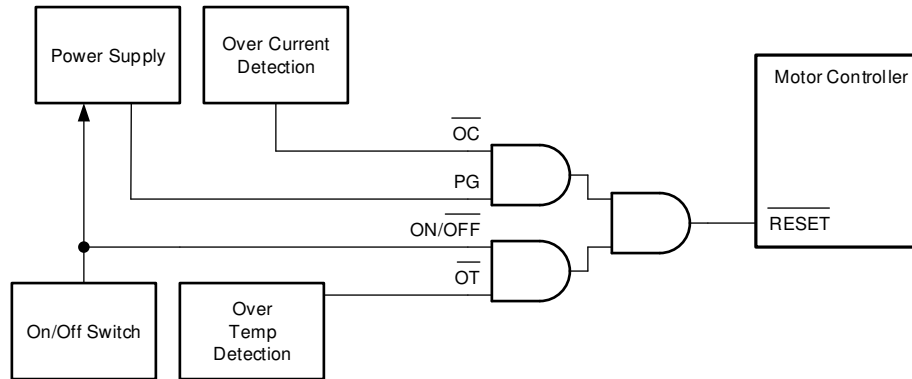


图 8-1. Typical Application Block Diagram

### 8.2 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 capacitors 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, as shown in the following layout example.

### 8.3 Layout

#### 8.3.1 Layout Guidelines

When using multiple-input and multiple-channel logic devices, inputs must never 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.

### 8.3.1.1 Layout Example

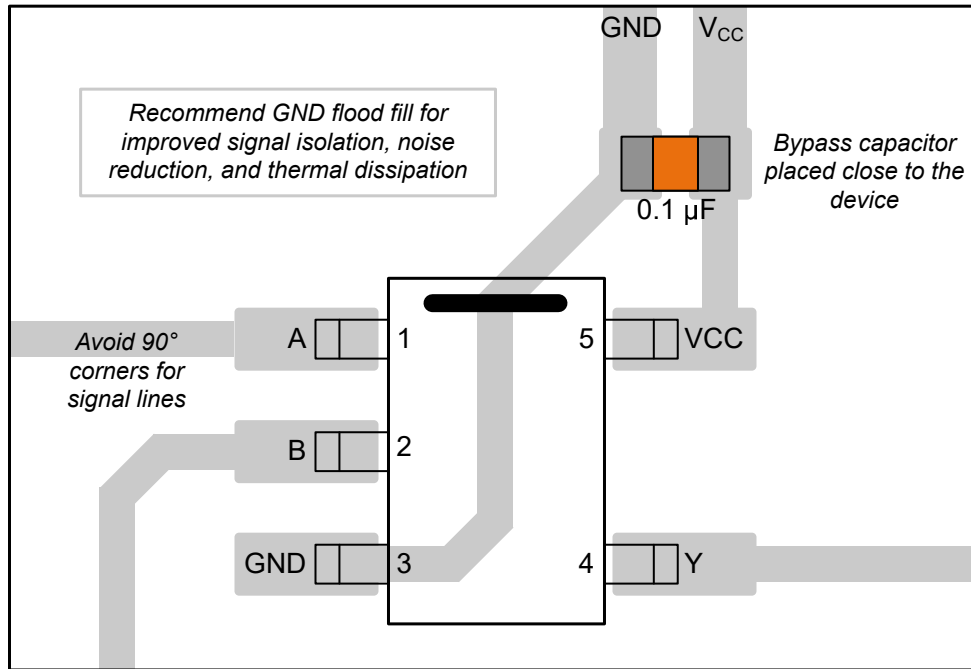


图 8-2. Example Layout for the SN74AHC1G08-Q1

## 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 接收文档更新通知

要接收文档更新通知，请导航至 [ti.com](http://ti.com) 上的器件产品文件夹。点击 [订阅更新](#) 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™ 支持论坛](#) 是工程师的重要参考资料，可直接从专家获得快速、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可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

<b>Changes from Revision D (October 2023) to Revision E (February 2024)</b>	<b>Page</b>
• Updated R <sub>θ</sub> JA values: DBV = 206 to 278, all values in °C/W .....	5

<b>Changes from Revision C (October 2004) to Revision D (October 2023)</b>	<b>Page</b>
• 添加了应用部分、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、器件和文档支持部分以及机械、封装和可订购信息部分 .....	1
• Updated R <sub>θ</sub> JA values: DCK = 252 to 289.2, 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 Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74AHC1G08QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	A08U	<a href="#">Samples</a>
SN74AHC1G08QDCKRQ1	ACTIVE	SC70	DCK	5	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	AEU	<a href="#">Samples</a>

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices 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.

**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 SN74AHC1G08-Q1 :**

- Catalog : [SN74AHC1G08](#)

## 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
SN74AHC1G08QDBVRQ1	SOT-23	DBV	5	3000	179.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
SN74AHC1G08QDCKRQ1	SC70	DCK	5	3000	179.0	8.4	2.2	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)
SN74AHC1G08QDBVRQ1	SOT-23	DBV	5	3000	200.0	183.0	25.0
SN74AHC1G08QDCKRQ1	SC70	DCK	5	3000	200.0	183.0	25.0



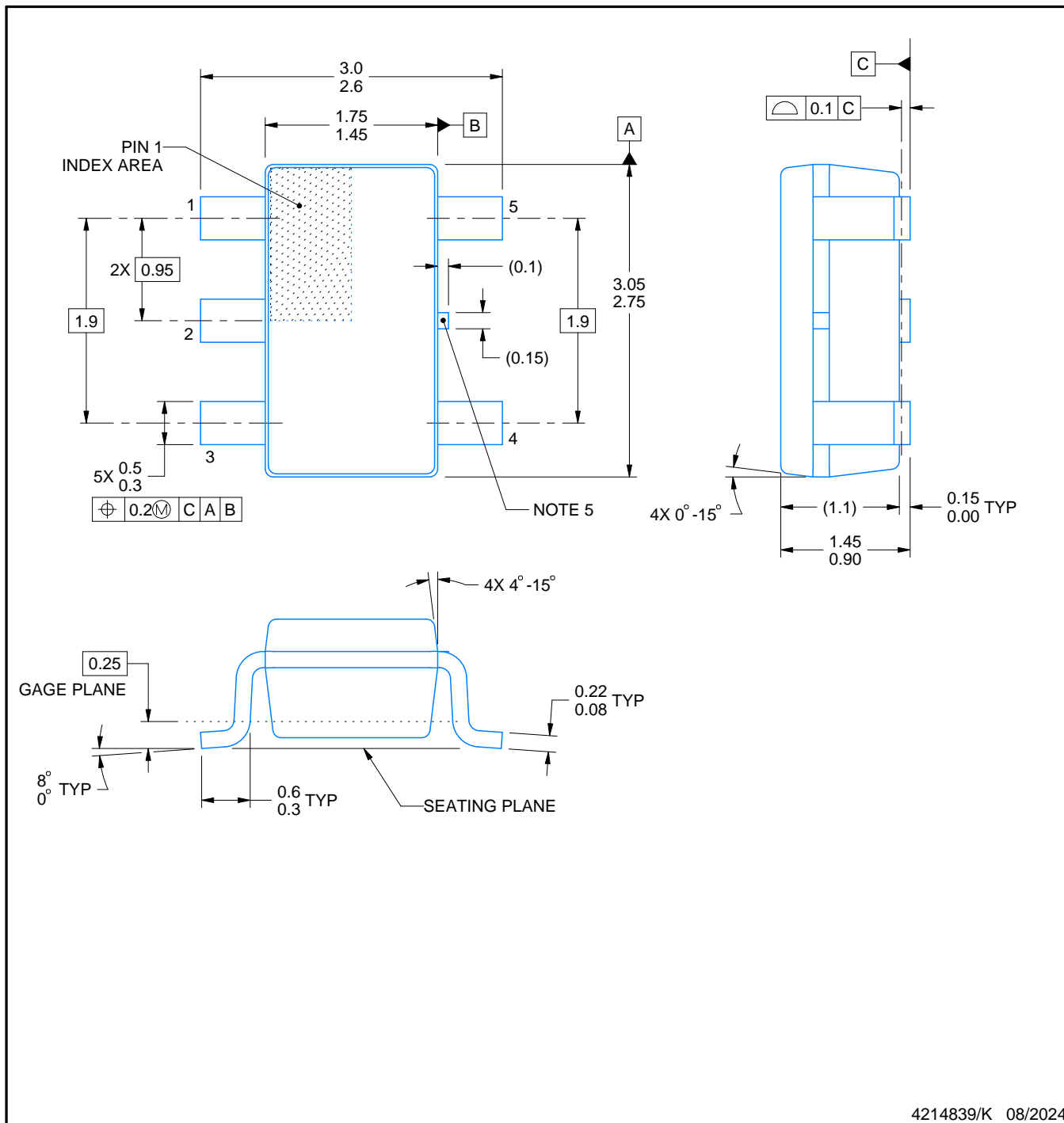


# DBV0005A

# PACKAGE OUTLINE

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



4214839/K 08/2024

### 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-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.

# EXAMPLE BOARD LAYOUT

DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:15X



SOLDER MASK DETAILS

4214839/K 08/2024

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

DBV0005A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



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.

# DCK0005A



## PACKAGE OUTLINE

SOT - 1.1 max height

SMALL OUTLINE TRANSISTOR



4214834/E 06/2024

### 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

# EXAMPLE BOARD LAYOUT

DCK0005A

SOT - 1.1 max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE:18X



SOLDER MASK DETAILS

4214834/E 06/2024

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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