

SN74AHCT1G86 シングル 2 入力排他 OR ゲート

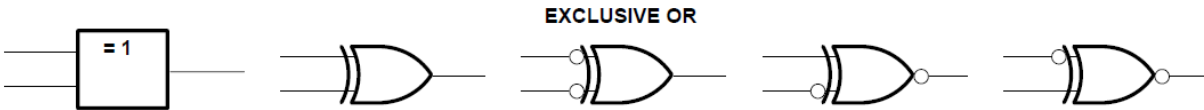
1 特長

- 動作範囲: 4.5V~5.5V
- 最大 t_{pd} : 8ns (5V 時)
- 低消費電力、 I_{CC} の最大値 10A
- 5V で 8mA の出力駆動能力
- 入力は TTL 電圧互換
- JESD 17 準拠で 250mA 超のラッチアップ性能

2 アプリケーション

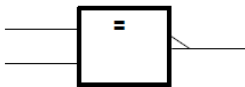
- 産業用 PC
- ステッピング・モーター
- AC インバータ・ドライブ
- ノート PC
- スマート・メーター: データ・コンセントレータ
- エンタープライズ・サーバー

An exclusive-OR gate has many applications, some of which can be represented better by alternative logic symbols.



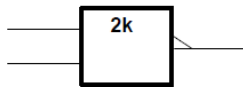
These five equivalent exclusive-OR symbols are valid for an SN74AHCT1G86 gate in positive logic; negation may be shown at any two ports.

LOGIC-IDENTITY ELEMENT



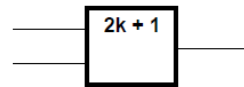
The output is active (low) if all inputs stand at the same logic level (i.e., $A = B$).

EVEN-PARITY ELEMENT



The output is active (low) if an even number of inputs (i.e., 0 or 2) are active.

ODD-PARITY ELEMENT



The output is active (high) if an odd number of inputs (i.e., only 1 of the 2) are active.

排他 OR ロジック

3 概要

SN74AHCT1G86 はシングル 2 入力排他 OR ゲートです。ブール関数 $Y = A \oplus B$ 、つまり $Y = \bar{A}B + A\bar{B}$ を正論理で実行します。

パッケージ情報

部品番号	パッケージ (1)	パッケージサイズ (2)	本体サイズ (3)
SN74AHCT1G86	DBV (SOT-23, 5)	2.90mm × 2.8mm	2.9mm × 1.6mm
	DCK (SC-70, 5)	2.00mm × 1.25mm	2.00mm × 1.25mm

- 詳細については、[セクション 11](#) を参照してください。
- パッケージサイズ (長さ×幅) は公称値で、該当する場合はピンも含まれます。
- 本体サイズ (長さ×幅) は公称値であり、ピンは含まれません。



Table of Contents

1 特長	1	7.3 Feature Description.....	8
2 アプリケーション	1	7.4 Device Functional Modes.....	8
3 概要	1	8 Application and Implementation	9
4 Pin Configuration and Functions	3	8.1 Application Information.....	9
5 Specifications	4	8.2 Typical Application.....	9
5.1 Absolute Maximum Ratings.....	4	8.3 Power Supply Recommendations.....	11
5.2 ESD Ratings.....	4	8.4 Layout.....	11
5.3 Recommended Operating Conditions.....	4	9 Device and Documentation Support	12
5.4 Thermal Information.....	5	9.1 Documentation Support.....	12
5.5 Electrical Characteristics.....	5	9.2 ドキュメントの更新通知を受け取る方法.....	12
5.6 Switching Characteristics.....	5	9.3 サポート・リソース.....	12
5.7 Operating Characteristics.....	6	9.4 Trademarks.....	12
5.8 Typical Characteristics.....	6	9.5 静電気放電に関する注意事項.....	12
6 Parameter Measurement Information	7	9.6 用語集.....	12
7 Detailed Description	8	10 Revision History	12
7.1 Overview.....	8	11 Mechanical, Packaging, and Orderable Information	13
7.2 Functional Block Diagram.....	8		

4 Pin Configuration and Functions

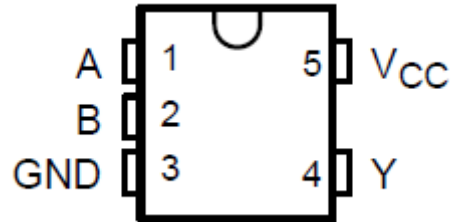


図 4-1. DBV or DCK Package 5-Pin SOT-23 Top View

PIN		TYPE ⁽¹⁾	DESCRIPTION
NO.	NAME		
1	A	I	A input
2	B	I	B input
3	GND	–	Ground pin
4	Y	O	Output
5	V _{CC}	–	Power pin

(1) Signal Types: I = Input, O = Output, I/O = Input or Output

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		
T _J	Junction Temperature		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
		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)

		MIN	NOM	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
t/v	Input transition rise or fall rate			20	ns/V
T _A	Operating free-air temperature	-40		125	°C

5.4 Thermal Information

THERMAL METRIC ⁽¹⁾		SN74AHCT1G86		UNIT
		DBV (SOT-23)	DCK (SC-70)	
		5 PINS	5 PINS	
R _{θJA}	Junction-to-ambient thermal resistance	278	289.2	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	180.5	205.8	
R _{θJB}	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 _{θJC(bot)}	Junction-to-case (bot) 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}	High level output voltage I _{OH} = –50 μA I _{OH} = –8 mA	4.5 V	4.4	4.5		4.4		4.4		V
V _{OL}	Low level output voltage I _{OL} = 50 μA I _{OL} = 8 mA	4.5 V			0.1			0.1		V
I _I	Input leakage current V _I = 5.5 V or GND	0 V to 5.5 V			±0.1			±1		μA
I _{CC}	Supply current V _I = V _{CC} or GND, I _O = 0	5.5 V			1			10		μA
ΔI _{CC} ⁽¹⁾	Supply-current change One input at 3.4 V, Other inputs at V _{CC} or GND	5.5 V			1.35			1.5		mA
C _i	Input capacitance V _I = V _{CC} or GND	5 V		2	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 Circuit and Voltage Waveforms](#))

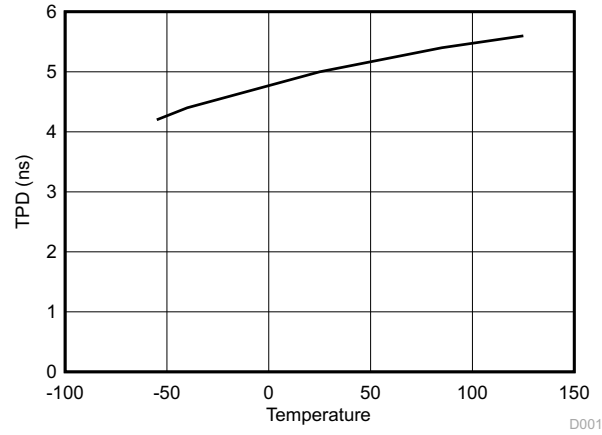
PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T _A = 25°C		–40°C to 85°C		–40°C to 125°C		UNIT
				TYP	MAX	MIN	MAX	MIN	MAX	
t _{PLH}	A or B	Y	C _L = 15 pF	5	6.2	1	8	1	9	ns
t _{PHL}				5	6.2	1	8	1	9	
t _{PLH}	A or B	Y	C _L = 50 pF	5.5	7.9	1	9	1	10	ns
t _{PHL}				5.5	7.9	1	9	1	10	

5.7 Operating Characteristics

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

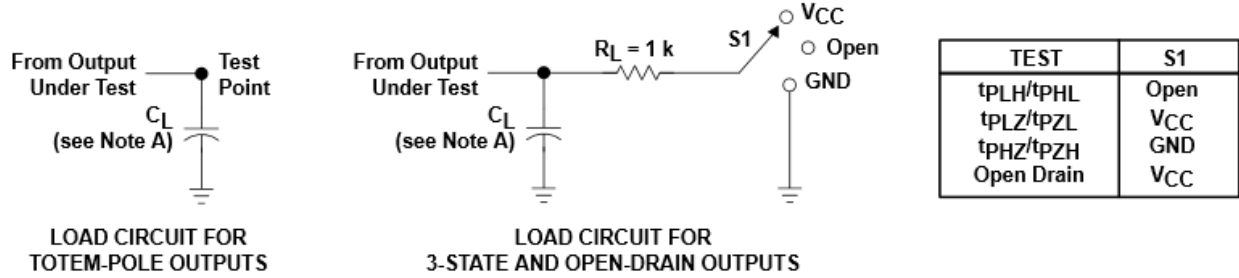
PARAMETER	TEST CONDITIONS	TYP	UNIT
C_{pd} Power dissipation capacitance	No load, $f = 1\text{ MHz}$	18	pF

5.8 Typical Characteristics



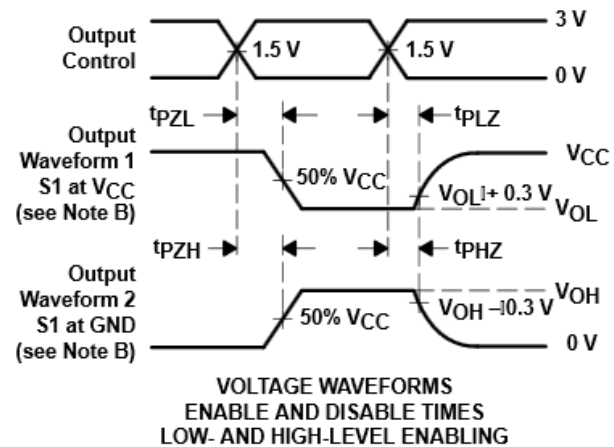
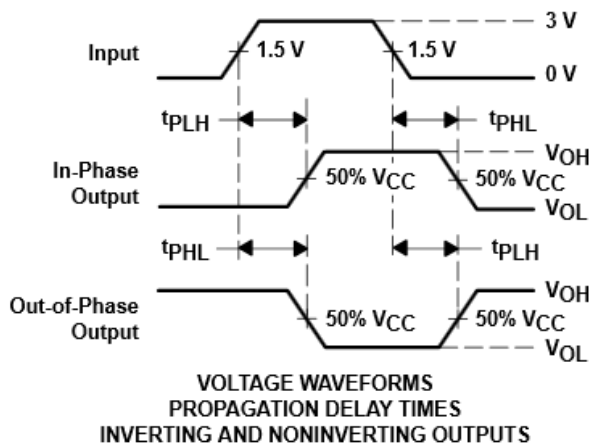
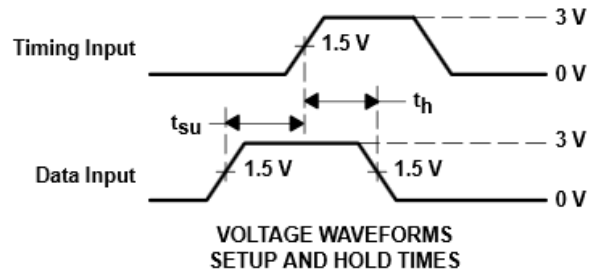
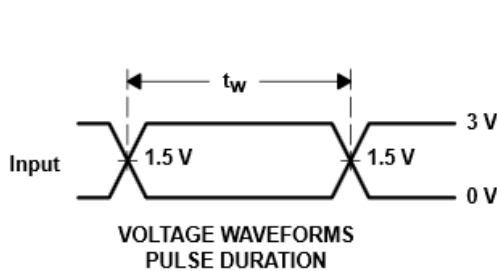
5-1. TPD vs. Temperature

6 Parameter Measurement Information



LOAD CIRCUIT FOR
TOTEM-POLE OUTPUTS

LOAD CIRCUIT FOR
3-STATE AND OPEN-DRAIN OUTPUTS



- 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, $Z_O = 50 \Omega$, $t_r = 3$ 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.

6-1. Load Circuit and Voltage Waveforms

7 Detailed Description

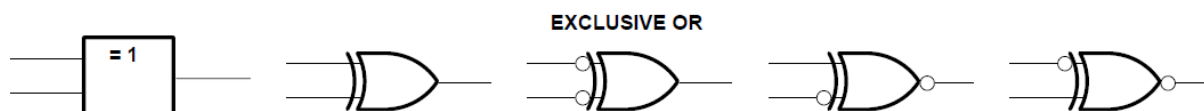
7.1 Overview

The SN74AHCT1G86 is a single 2-input exclusive-OR gate. The device performs the Boolean function $Y = A \oplus B$ or $Y = \bar{A}B + A\bar{B}$ in positive logic.

To ensure the high-impedance state during power up or power down, OE should be tied to GND through a pulldown resistor; the minimum value of the resistor is determined by the current-sourcing capability of the driver.

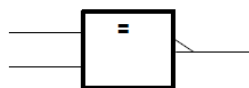
7.2 Functional Block Diagram

An exclusive-OR gate has many applications, some of which can be represented better by alternative logic symbols.



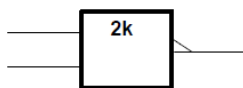
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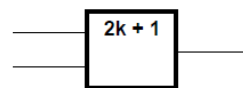
The output is active (low) if all inputs stand at the same logic level (i.e., $A = B$).

EVEN-PARITY ELEMENT



The output is active (low) if an even number of inputs (i.e., 0 or 2) are active.

ODD-PARITY ELEMENT



The output is active (high) if an odd number of inputs (i.e., only 1 of the 2) are active.

7-1. Exclusive-OR 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

表 7-1. Function Table

INPUTS ⁽¹⁾		OUTPUT ⁽²⁾
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	L

- (1) H = High Voltage Level, L = Low Voltage Level, X = Don't Care
 (2) H = Driving High, L = Driving Low, Z = High Impedance State

8 Application and Implementation

注

以下のアプリケーション情報は、TI の製品仕様に含まれるものではなく、TI ではその正確性または完全性を保証いたしません。個々の目的に対する製品の適合性については、お客様の責任で判断していただくこととなります。お客様は自身の設計実装を検証しテストすることで、システムの機能を確認する必要があります。

8.1 Application Information

The SN74AHCT1G86 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 input switching levels have been lowered to accommodate TTL inputs of 0.8-V V_{IL} and 2-V V_{IH} . This feature makes it Ideal for translating up from 3.3 V to 5 V.

8.2 Typical Application

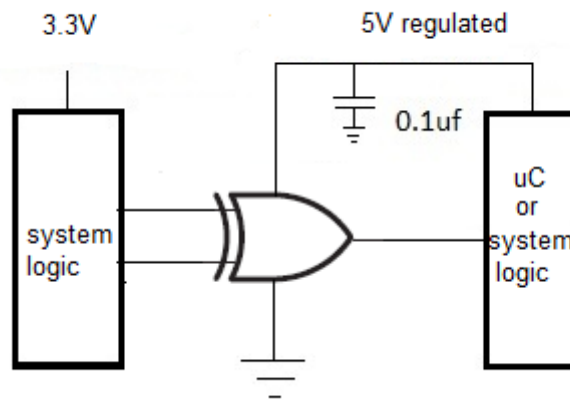


図 8-1. Typical Application Schematic

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.

8.2.2 Detailed Design Procedure

- Recommended input conditions:
 - Rise time and fall time specs. See $(\Delta t/\Delta V)$ in [セクション 5.3](#).
 - Specified high and low levels. See $(V_{IH}$ and $V_{IL})$ in [セクション 5.3](#).
- 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} .

8.2.3 Application Curves

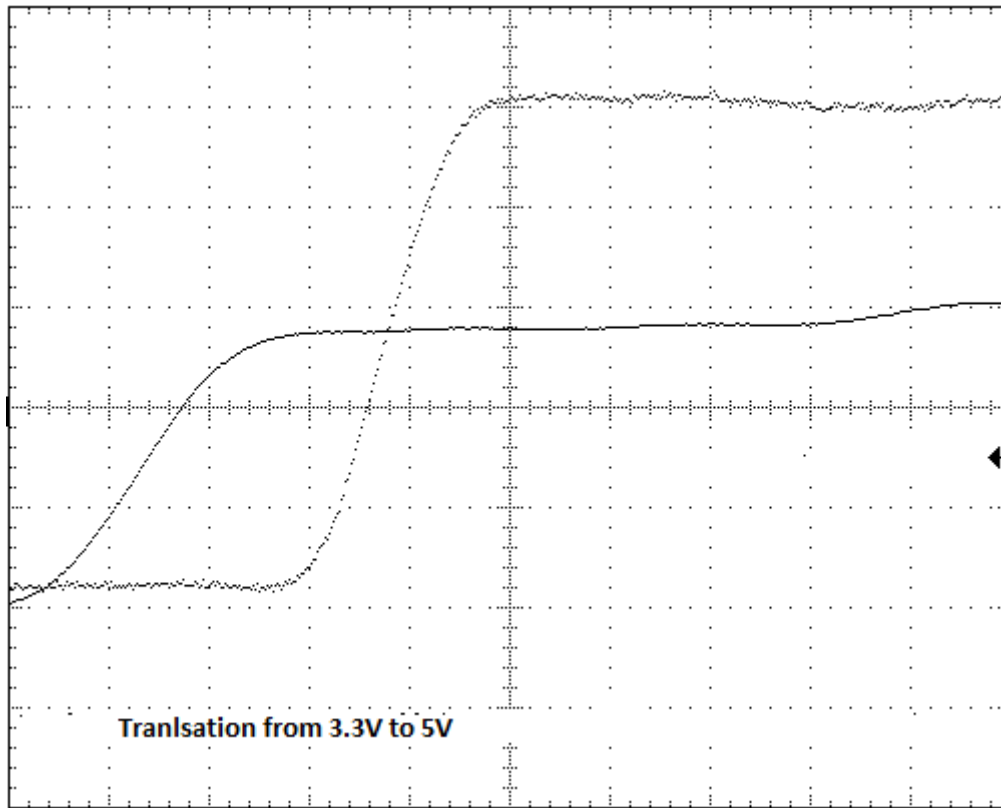


図 8-2. Translation From 3.3 V to 5.5 V

8.3 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the [セクション 5.3](#).

Each V_{CC} terminal should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, TI recommends a 0.1- μF capacitor and if there are multiple V_{CC} terminals then TI recommends a 0.01- μF or 0.022- μF capacitor for each power terminal. Multiple bypass capacitors can be paralleled to reject different frequencies of noise. Frequencies of 0.1 μF and 1 μF are commonly used in parallel. The bypass capacitor should be installed as close as possible to the power terminal for best results.

8.4 Layout

8.4.1 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 three of the four 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 below 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 make more sense or is more convenient. Floating outputs is generally acceptable, 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 I.O's so they also cannot float when disabled.

8.4.2 Layout Example

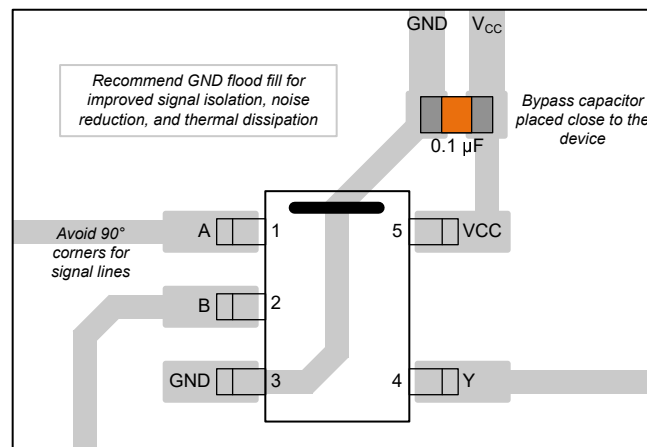


図 8-3. Layout Example for the SN74AHCT1G86

9 Device and Documentation Support

9.1 Documentation Support

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 ドキュメントの更新通知を受け取る方法

ドキュメントの更新についての通知を受け取るには、[ti.com](#) のデバイス製品フォルダを開いてください。「更新の通知を受け取る」をクリックして登録すると、変更されたすべての製品情報に関するダイジェストを毎週受け取れます。変更の詳細については、修正されたドキュメントに含まれている改訂履歴をご覧ください。

9.3 サポート・リソース

[TI E2E™ サポート・フォーラム](#)は、エンジニアが検証済みの回答と設計に関するヒントをエキスパートから迅速かつ直接得ることができる場所です。既存の回答を検索したり、独自の質問をしたりすることで、設計に必要な支援を迅速に得ることができます。

リンクされているコンテンツは、該当する貢献者により、現状のまま提供されるものです。これらは TI の仕様を構成するものではなく、必ずしも TI の見解を反映したものではありません。TI の[使用条件](#)を参照してください。

9.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.

すべての商標は、それぞれの所有者に帰属します。

9.5 静電気放電に関する注意事項



この IC は、ESD によって破損する可能性があります。テキサス・インスツルメンツは、IC を取り扱う際には常に適切な注意を払うことを推奨します。正しい取り扱いおよび設置手順に従わない場合、デバイスを破損するおそれがあります。

ESD による破損は、わずかな性能低下からデバイスの完全な故障まで多岐にわたります。精密な IC の場合、パラメータがわずかに変化するだけで公表されている仕様から外れる可能性があるため、破損が発生しやすくなっています。

9.6 用語集

[テキサス・インスツルメンツ用語集](#) この用語集には、用語や略語の一覧および定義が記載されています。

10 Revision History

Changes from Revision O (October 2023) to Revision P (February 2024)

Page

- Updated thermal values for DBV package from R θ JA = 208.2 to 278, R θ JC(top) = 76.1 to 180.5, R θ JB = 52.5 to 184.4, Ψ JT = 4 to 115.4, Ψ JB = 51.8 to 183.4, R θ JC(bot) = N/A, all values in °C/W 5

Changes from Revision N (August 2022) to Revision O (October 2023)

Page

- Updated thermal values for DCK package from R θ JA = 287.6 to 289.2, R θ JC(top) = 97.7 to 205.8, R θ JB = 65 to 176.2, Ψ JT = 2 to 117.6, Ψ JB = 64.2 to 175.1, R θ JC(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 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
74AHCT1G86DBVRG4	ACTIVE	SOT-23	DBV	5	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	B86G	Samples
74AHCT1G86DBVTG4	OBSOLETE	SOT-23	DBV	5		TBD	Call TI	Call TI	-40 to 125	B86G	
SN74AHCT1G86DBVR	ACTIVE	SOT-23	DBV	5	3000	RoHS & Green	NIPDAU SN	Level-1-260C-UNLIM	-40 to 125	(39EH, 3CDF, B863, B86G, B86J, B86S)	Samples
SN74AHCT1G86DBVT	OBSOLETE	SOT-23	DBV	5		TBD	Call TI	Call TI	-40 to 125	(B863, B86G, B86J, B86S)	
SN74AHCT1G86DCKR	ACTIVE	SC70	DCK	5	3000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 125	(1QV, BH3, BHG, BHJ, BHL, BHS)	Samples
SN74AHCT1G86DCKT	OBSOLETE	SC70	DCK	5		TBD	Call TI	Call TI	-40 to 125	(BH3, BHG, BHJ, BHS)	

(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.

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OTHER QUALIFIED VERSIONS OF SN74AHCT1G86 :

- Automotive : [SN74AHCT1G86-Q1](#)

NOTE: Qualified Version Definitions:

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

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
74AHCT1G86DBVRG4	SOT-23	DBV	5	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
SN74AHCT1G86DBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
SN74AHCT1G86DCKR	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)
74AHCT1G86DBVRG4	SOT-23	DBV	5	3000	180.0	180.0	18.0
SN74AHCT1G86DBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
SN74AHCT1G86DCKR	SC70	DCK	5	3000	210.0	185.0	35.0

EXAMPLE BOARD LAYOUT

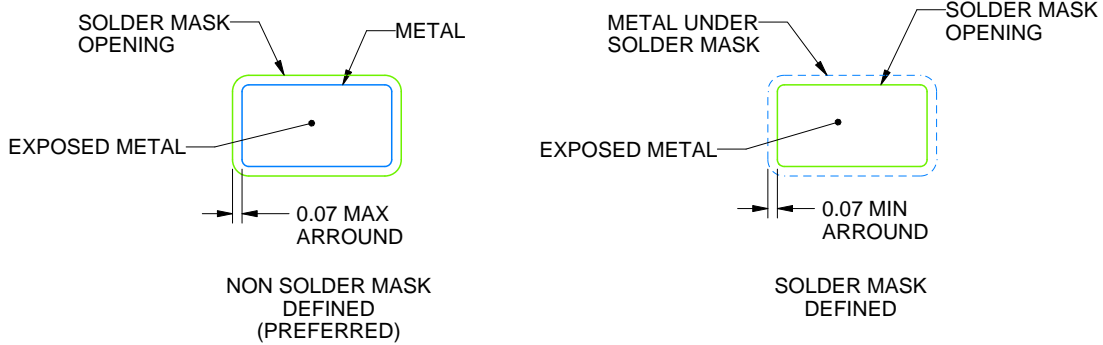
DCK0005A

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

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.



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.

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