SN74AHCT1G126-Q1 Automotive Single Bus Buffer Gate with 3-State Output

1 Features

- Qualified for Automotive Applications
- Operating Range of 3 V to 5.5 V
- Max t_{pd} of 6 ns at 5 V
- Low Power Consumption, 10-µA Max I_{CC}
- ±8-mA Output Drive at 5 V
- Inputs Are TTL-Voltage Compatible

2 Description

The SN74AHCT1G126 is a single bus buffer gate/line driver with 3-state output.

Package Information

PART NUMBER	PACKAGE[1]	PACKAGE SIZE[2]
SN74AHCT1G126-Q1	DCK (SOT-SC70, 5)	2 mm x 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.

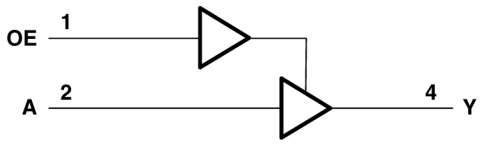


Figure 2-1. Logic Diagram (Positive Logic)

Table of Contents

1 Features....1
2 Description....1
3 Revision History....2
4 Pin Configuration and Functions....3
5 Specifications....4
5.1 Absolute Maximum Ratings....4
5.2 ESD Ratings....4
5.3 Recommended Operating Conditions....4
5.4 Thermal Information....5
5.5 Electrical Characteristics....5
5.6 Switching Characteristics, V_{CC} = 3 V ± 0.3 V....5
5.7 Switching Characteristics, V_{CC} = 5 V ± 0.5 V....6
5.8 Operating Characteristics....6
6 Parameter Measurement Information....7
7 Detailed Description....8
7.1 Overview....8
7.2 Functional Block Diagram....8
7.3 Device Functional Modes....8
8 Device and Documentation Support....9
8.1 Documentation Support (Analog)....9
8.2 Receiving Notification of Documentation Updates....9
8.3 Support Resources....9
8.4 Trademarks....9
8.5 Electrostatic Discharge Caution....9
8.6 Glossary....9
9 Mechanical, Packaging, and Orderable Information....9

3 Revision History

Changes from Revision B (February 2008) to Revision C (July 2023)	Page
• Added *Package Information* table, *Pin Functions* table, *ESD Ratings* table, *Thermal Information* table, *Device Functional Modes, Device and Documentation Support* section, and *Mechanical, Packaging, and Orderable Information* section	1
• Updated thermal values for DCK package from RθJA = 252 to 293.4, all values in °C/W	5

4 Pin Configuration and Functions

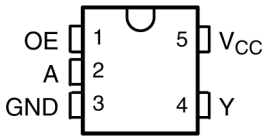


Figure 4-1. DCK Package (Top View)

PIN		TYPE	DESCRIPTION
NO.	NAME		
1	OE	I	Output Enable
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 range		–0.5	7	V
V_I [1]	Input voltage range		–0.5	7	V
V_O [1]	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 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
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM)(1)	±2000	V
		Charged device model (CDM)	±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) [1]

			MIN	MAX	UNIT
V_{CC}	Supply voltage		3	5.5	V
V_{IH}	High-level input voltage	V_{CC} = 3.0 V	1.4		V
		V_{CC} = 4.5 V to 5.5 V	2		
V_{IL}	Low-level input voltage	V_{CC} = 3.0 V		0.53	V
		V_{CC} = 4.5 V to 5.5 V		0.8	
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*, literature number SCBA004.

5.4 Thermal Information

THERMAL METRIC[1]		DCK (SC70)	UNIT
		5 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	293.4	°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_{CC}	T_A = 25°C			MIN	MAX	UNIT
					MIN	TYP	MAX			
V_{OH}	I_{OH} = –50 µA			3 V	2.9	3		2.9		V
				4.5 V	4.4	4.5		4.4		
	I_{OH} = –4 mA			3 V	2.58			2.34		
	I_{OH} = –8 mA			4.5 V	3.94			3.66		
V_{OL}	I_{OL} = 50 µA			3 V and 4.5 V			0.1		0.1	V
	I_{OL} = 4 mA			3 V			0.36		0.52	
	I_{OL} = 8 mA			4.5 V			0.36		0.52	
I_I	V_I = 5.5 V or GND			0 V to 5.5 V			±0.1		±1	µA
I_{OZ}	V_O = V_{CC} or GND			5.5 V			±0.25		±2.5	µA
I_{CC}	V_I = V_{CC} or GND,	I_O = 0,	OE high or low	3 V and 5.5 V			1		10	µA
ΔI_{CC} [1]	One input at 3.4 V,	Other input 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
C_O	V_O = V_{CC} or GND			5 V		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, V_{CC} = 3 V ± 0.3 V

over recommended operating free-air temperature range, V_{CC} = 3 V ± 0.3 V (unless otherwise noted) (see Load Circuit and Voltage Waveforms)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			MIN	MAX	UNIT
				MIN	TYP	MAX			
t_{PLH}	A	Y	C_L = 15 pF		5.6	8		12	ns
t_{PHL}					5.6	8		12	
t_{PZH}	$\overline{OE}$	Y	C_L = 15 pF		5.4	8		11.5	ns
t_{PZL}					5.4	8		11.5	
t_{PHZ}	$\overline{OE}$	Y	C_L = 15 pF		6.5	9.7		14.5	ns
t_{PLZ}					6.5	9.7		14.5	
t_{PLH}	A	Y	C_L = 50 pF		8.1	11.5		16	ns
t_{PHL}					8.1	11.5		16	
t_{PZH}	$\overline{OE}$	Y	C_L = 50 pF		7.9	11.5		15	ns
t_{PZL}					7.9	11.5		15	
t_{PHZ}	$\overline{OE}$	Y	C_L = 50 pF		8	13.2		18	ns
t_{PLZ}					8	13.2		18	

5.7 Switching Characteristics, V_{CC} = 5 V ± 0.5 V

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

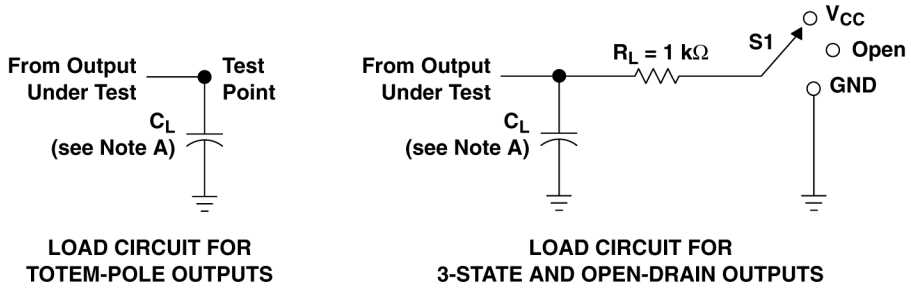
PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			MIN	MAX	UNIT
				MIN	TYP	MAX			
t_{PLH}	A	Y	C_L = 15 pF		3.8	5.5		8.5	ns
t_{PHL}					3.8	5.5		8.5	
t_{PZH}	OE	Y	C_L = 15 pF		3.6	5.1		7.5	ns
t_{PZL}					3.6	5.1		7.5	
t_{PHZ}	OE	Y	C_L = 15 pF		4.8	6.8		10	ns
t_{PLZ}					4.8	6.8		10	
t_{PLH}	A	Y	C_L = 50 pF		5.3	7.5		10.5	ns
t_{PHL}					5.3	7.5		10.5	
t_{PZH}	OE	Y	C_L = 50 pF		5.1	7.1		9.5	ns
t_{PZL}					5.1	7.1		9.5	
t_{PHZ}	OE	Y	C_L = 50 pF		7	8.8		12	ns
t_{PLZ}					7	8.8		12	

5.8 Operating Characteristics

V_{CC} = 5 V, T_A = 25°C

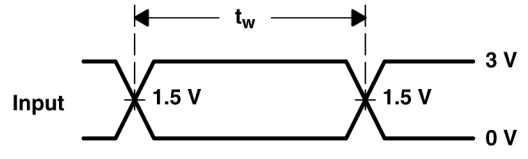
PARAMETER		TEST CONDITIONS		TYP	UNIT
C_{pd}	Power dissipation capacitance	No load,	f = 1 MHz	14	pF

6 Parameter Measurement Information

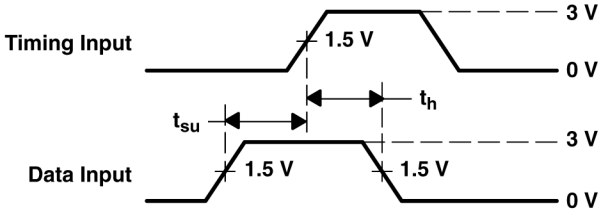


LOAD CIRCUIT FOR TOTEM-POLE OUTPUTS

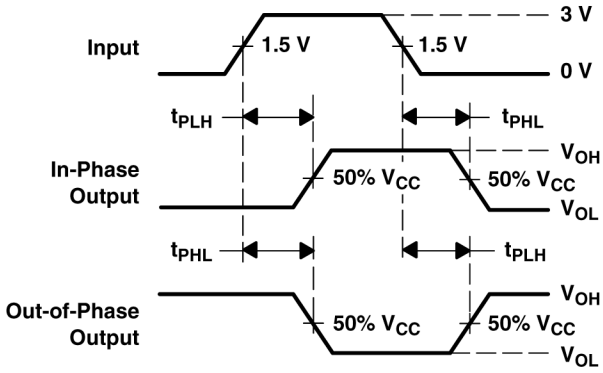
LOAD CIRCUIT FOR 3-STATE AND OPEN-DRAIN OUTPUTS



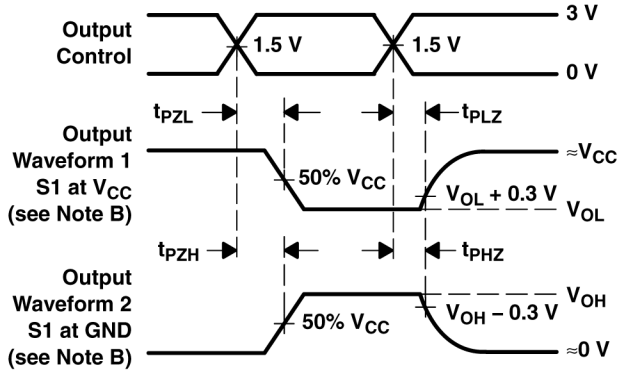
VOLTAGE WAVEFORMS PULSE DURATION



VOLTAGE WAVEFORMS SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS ENABLE AND DISABLE TIMES LOW- AND HIGH-LEVEL ENABLING

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 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 SN74AHCT1G126 is a single bus buffer gate/line driver with 3-state output. The output is disabled when the output-enable (OE) input is low. When OE is high, true data is passed from the A input to the Y output.

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

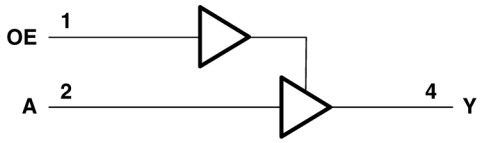


Figure 7-1. Logic Diagram (Positive Logic)

7.3 Device Functional Modes

Table 7-1. Function Table

INPUTS		OUTPUT
OE	A	Y
H	H	H
H	L	L
L	X	Z

8 Device and Documentation Support

8.1 Documentation Support (Analog)

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.

Table 8-1. Related Links

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
SN74AHCT1G126-Q1	Click here	Click here	Click here	Click here	Click here

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 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.

8.6 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 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
CAHCT1G126QDCKRG4	ACTIVE	SC70	DCK	5	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	BNU	Samples
CAHCT1G126QDCKRG4Q	ACTIVE	SC70	DCK	5	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	BNS	Samples
CAHCT1G126QDCKRQ1	ACTIVE	SC70	DCK	5	3000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	BNS	Samples

(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.

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 SN74AHCT1G126-Q1 :

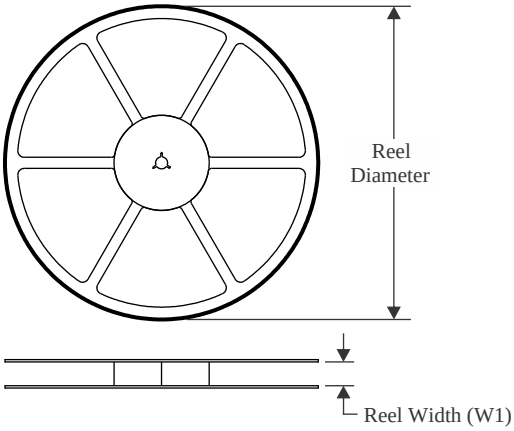
- Catalog : SN74AHCT1G126

NOTE: Qualified Version Definitions:

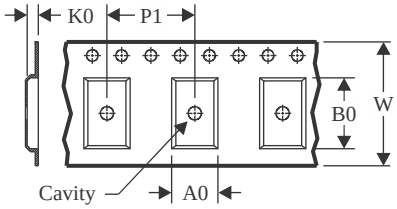
- Catalog - TI's standard catalog product

TAPE AND REEL INFORMATION

REEL DIMENSIONS

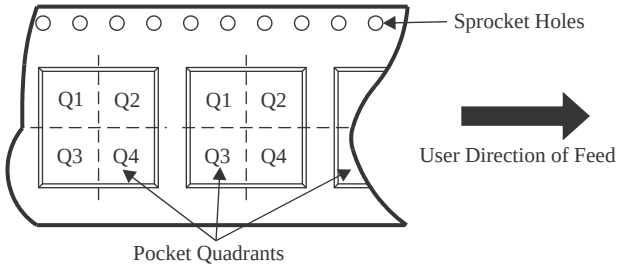


TAPE DIMENSIONS



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

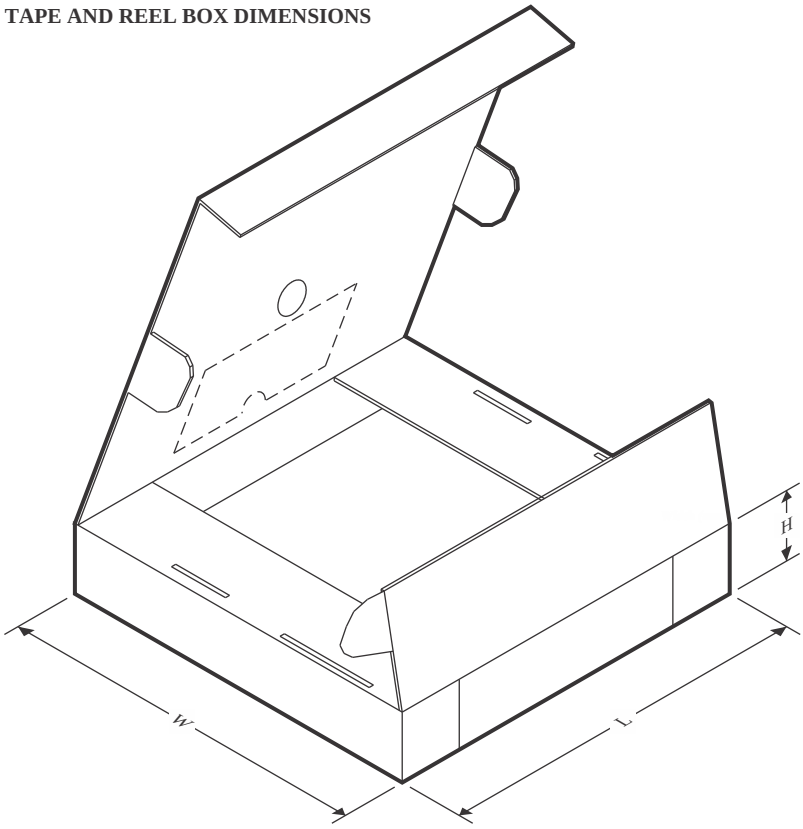
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
CAHCT1G126QDCKRG4	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

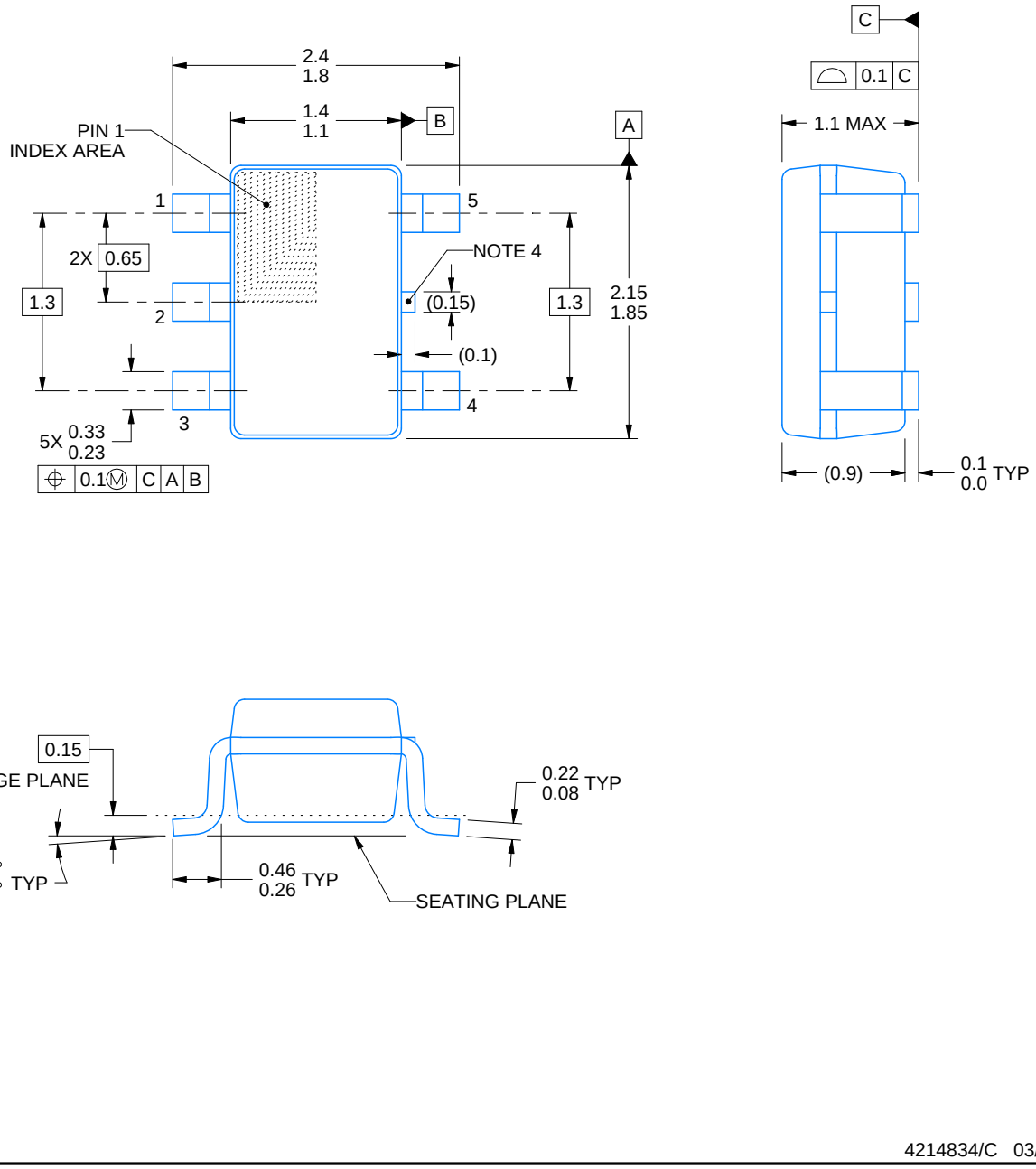
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CAHCT1G126QDCKRG4	SC70	DCK	5	3000	200.0	183.0	25.0

PACKAGE OUTLINE

DCK0005A

SOT - 1.1 max height

SMALL OUTLINE TRANSISTOR



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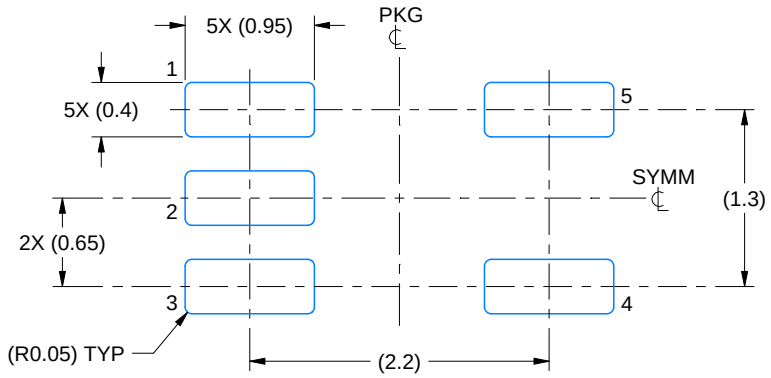
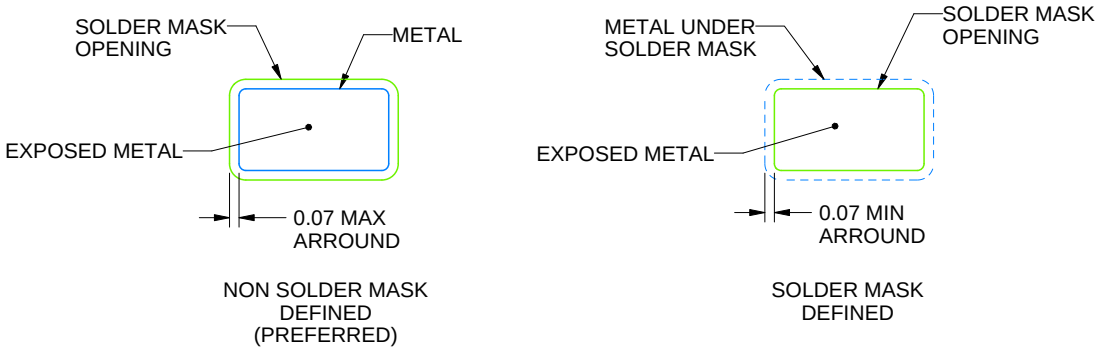
NOTES:

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-203.
4. Support pin may differ or may not be present.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:18X



SOLDER MASK DETAILS

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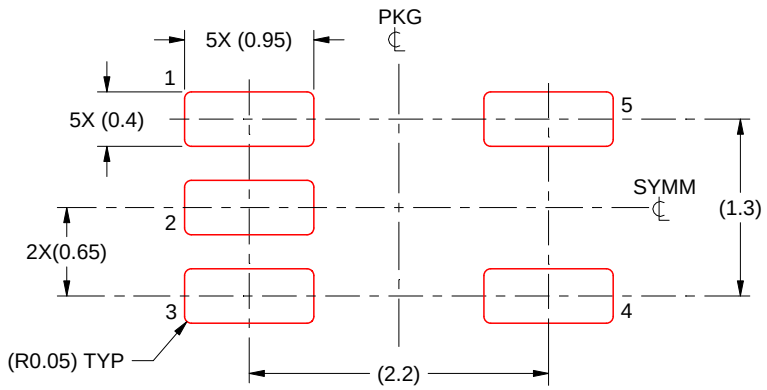
NOTES: (continued)

4. Publication IPC-7351 may have alternate designs.
5. 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

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NOTES: (continued)

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

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