S-8110C/8120C Series

CMOS TEMPERATURE SENSOR IC

www.sii-ic.com

Rev.5.1_01

The S-8110C/8120C Series is a family of high-precision temperature sensor ICs on a single chip with a linear output voltage for temperature changes.
Each chip is composed of a temperature sensor, a constant current circuit, and an operational amplifier.
It can be used at temperatures ranging from –40°C to +100°C. These devices have much better linearity than other temperature sensors such as thermistors, and can be used for a wide range of temperature control applications.

■ Features

- Temperature accuracy: S-8110C Series: ±5.0°C (–30°C to +100°C)
  S-8120C Series: ±2.5°C (–30°C to +100°C)
- Linear output voltage: –8.20 mV/°C typ.
  Ta = –30°C: 1.951 V typ.
  Ta = +30°C: 1.474 V typ.
  Ta = +100°C: 0.882 V typ.
- Nonlinearity: ±0.5% typ. (–20°C to +80°C)
- Wide power supply voltage operation: V_{DD} = 2.4 V to 10.0 V
- Low current consumption: 4.5 μA typ. (+25°C)
- Built-in operational amplifier
- V_{SS} standard output
- Lead-free, Sn 100%, halogen-free*1

***1.** Refer to "■ **Product Name Structure**" for details.

■ Applications

- Compensation of high-frequency circuits such as cellular phones and radio equipment
- Compensation of oscillation frequency in crystal oscillator
- LCD contrast compensation
- Compensation of amplifier gain
- Compensation of auto focus circuits
- Temperature detection in battery management
- Overheating prevention for charged batteries or halogen lights

■ Packages

- SC-82AB
- SNT-4A

■ Block Diagram

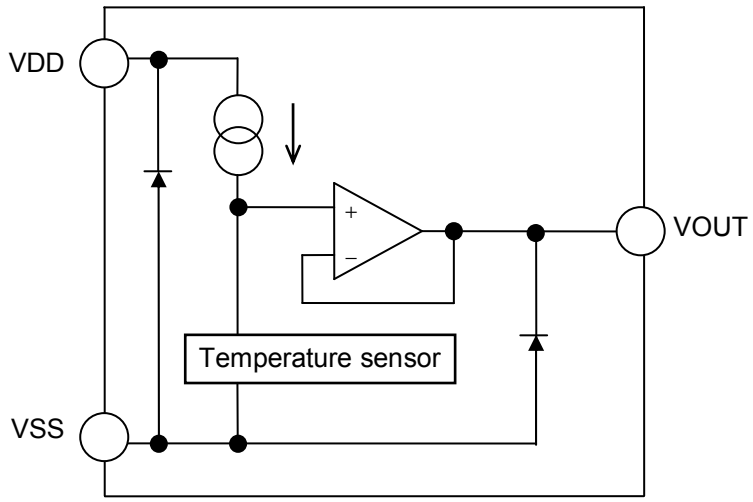


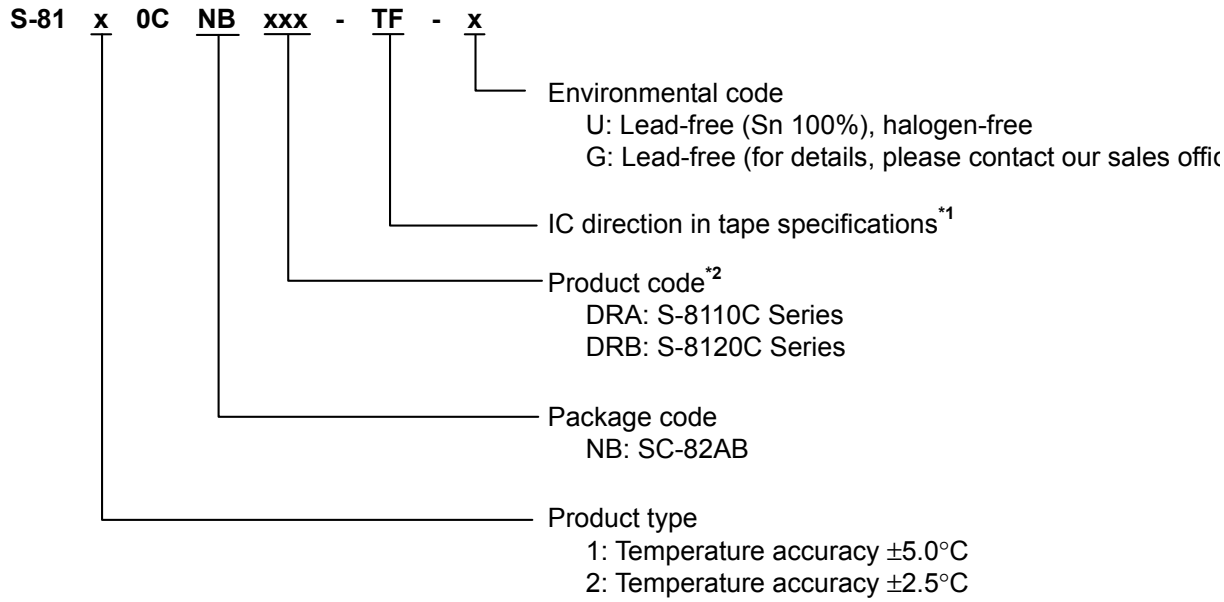
Figure 1

■ Product Name Structure

The product types and package types for S-8110C/8120C Series can be selected at the user's request. Please refer to the "**1. Product Name**" for the construction of the product name "**2. Package**" regarding the package drawings and "**3. Product Name List**" for the full product names.

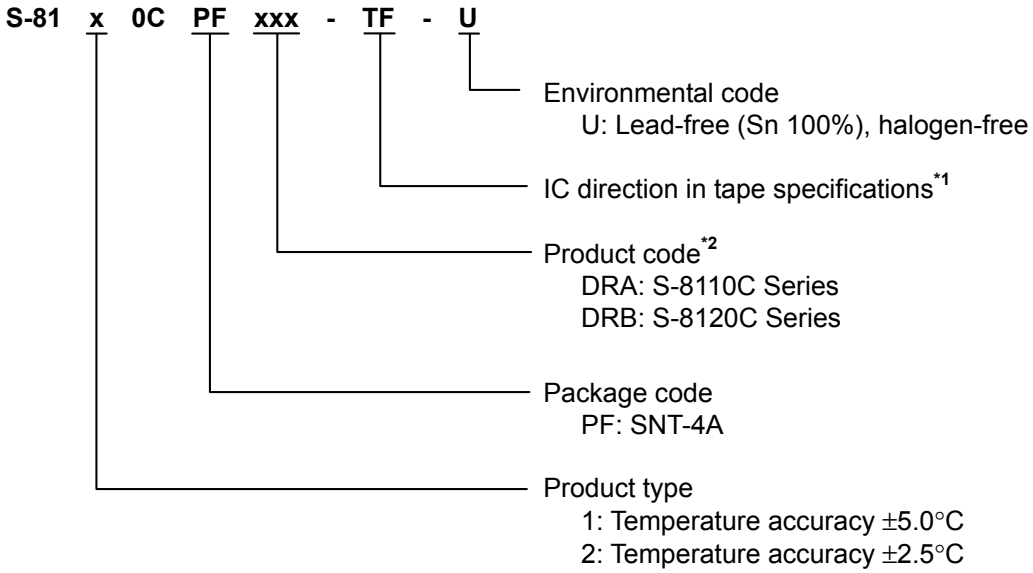
1. Product Name

1. 1 SC-82AB



***1.** Refer to the tape drawing.
***2.** Refer to "**3. Product Name List**"

1. 2 SNT-4A



***1.** Refer to the tape drawing.
***2.** Refer to "**3. Product Name List**".

2. Package

Package name	Drawing code			
	Package	Tape	Reel	Land
SC-82AB	NP004-A-P-SD	NP004-A-C-SD NP004-A-C-S1	NP004-A-R-SD	—
SNT-4A	PF004-A-P-SD	PF004-A-C-SD	PF004-A-R-SD	PF004-A-L-SD

3. Product Name List

Table 1

Series name	SC-82AB	SNT-4A
S-8110C Series	S-8110CNB-DRA-TF-x	S-8110CPF-DRA-TF-U
S-8120C Series	S-8120CNB-DRB-TF-x	S-8120CPF-DRB-TF-U

Remark 1. x: G or U
2. Please select products of environmental code = U for Sn 100%, halogen-free products.

■ Pin Configurations

SC-82AB
Top view

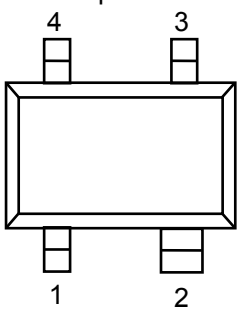


Figure 2

Table 2

Pin No.	Pin name	Pin description
1	VDD	Power supply pin
2	VSS	GND pin
3	NC*1	No connection
4	VOUT	Output voltage pin

***1.** The NC pin is electrically open.
The NC pin can be connected to VDD or VSS.

SNT-4A
Top view

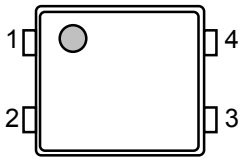


Figure 3

Table 3

Pin No.	Pin name	Pin description
1	VSS	GND pin
2	VDD	Power supply pin
3	VOUT	Output voltage pin
4	NC*1	No connection

***1.** The NC pin is electrically open.
The NC pin can be connected to VDD or VSS.

■ Absolute Maximum Ratings

Table 4

(Ta = +25°C unless otherwise specified)

Item		Symbol	Absolute maximum ratings	Unit
Power supply pin voltage		V_{DD}	V_{SS}–0.3 to V_{SS}+12.0	V
Output voltage		V_{OUT}	V_{SS}–0.3 to V_{DD}+0.3	V
Power dissipation	SC-82AB	P_D	150 (When not mounted on board)	mW
			350*1	mW
	SNT-4A		140 (When not mounted on board)	mW
			300*1	mW
Operating ambient temperature		T_{opr}	–40 to +100	°C
Storage temperature		T_{stg}	–40 to +125	°C

***1.** When mounted on board
[Mounted board]
(1) Board size : 114.3 mm × 76.2 mm × t1.6 mm
(2) Board name : JEDEC STANDARD51-7

Caution The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded under any conditions.

■ Electrical Characteristics

1. S-8110C Series

Table 5

($Ta = +25°C$, $V_{DD} = 5.0$ V, $I_{OUT} = 0$ A unless otherwise specified)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Test circuit
Power supply voltage	V_{DD}	—	2.4	—	10.0	V	1
Output voltage	V_{OUT}	$Ta = -30°C$	1.911	1.951	1.991	V	1
		$Ta = +30°C$	1.434	1.474	1.514	V	1
		$Ta = +100°C$	0.842	0.882	0.922	V	1
Temperature sensitivity	V_{SE}	$-30°C \le Ta \le +100°C$	−8.40	−8.20	−8.00	mV/°C	—
Nonlinearity	ΔN_L	$-20°C \le Ta \le +80°C$	—	±0.5	—	%	—
Operating temperature range	T_{opr}	—	−40	—	100	°C	—
Current consumption	I_{DD}	—	—	4.5	8.0	μA	1
Line regulation	ΔV_{OUT1}	$V_{DD} = 2.4$ V to 10.0 V	—	—	0.05	%/ V	2
Load regulation*1	ΔV_{OUT2}	$I_{OUT} = 0$ μA to 200 μA	—	—	1.0	mV	2

***1.** Do not flow sink current into the output voltage pin.

2. S-8120C Series

Table 6

($Ta = +25°C$, $V_{DD} = 5.0$ V, $I_{OUT} = 0$ A unless otherwise specified)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Test Circuit
Power supply voltage	V_{DD}	—	2.4	—	10.0	V	1
Output voltage	V_{OUT}	$Ta = -30°C$	1.931	1.951	1.971	V	1
		$Ta = +30°C$	1.454	1.474	1.494	V	1
		$Ta = +100°C$	0.862	0.882	0.902	V	1
Temperature sensitivity	V_{SE}	$-30°C \le Ta \le +100°C$	−8.40	−8.20	−8.00	mV/°C	—
Nonlinearity	ΔN_L	$-20°C \le Ta \le +80°C$	—	±0.5	—	%	—
Operating temperature range	T_{opr}	—	−40	—	100	°C	—
Current consumption	I_{DD}	—	—	4.5	8.0	μA	1
Line regulation	ΔV_{OUT1}	$V_{DD} = 2.4$ V to 10.0 V	—	—	0.05	%/ V	2
Load regulation*1	ΔV_{OUT2}	$I_{OUT} = 0$ μA to 200 μA	—	—	1.0	mV	2

***1.** Do not flow sink current into the output voltage pin.

■ Test Circuits

1.

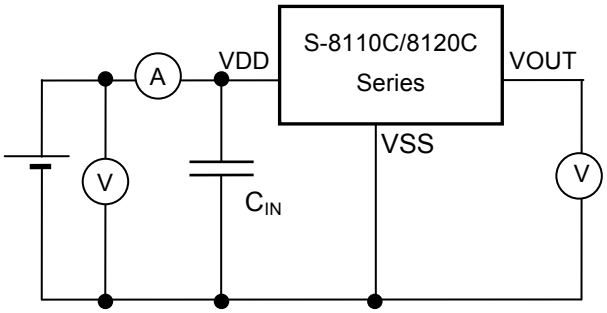


Figure 4

2.

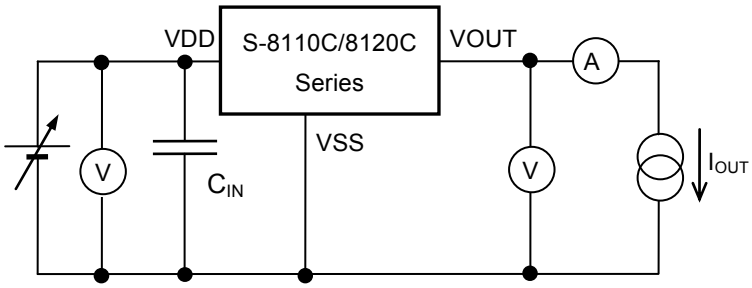


Figure 5

■ Technical Terms

1. Output Voltage (V_{OUT})

V_{OUT} indicates the output voltage at Ta = −30°C, Ta = +30°C and Ta = +100°C.

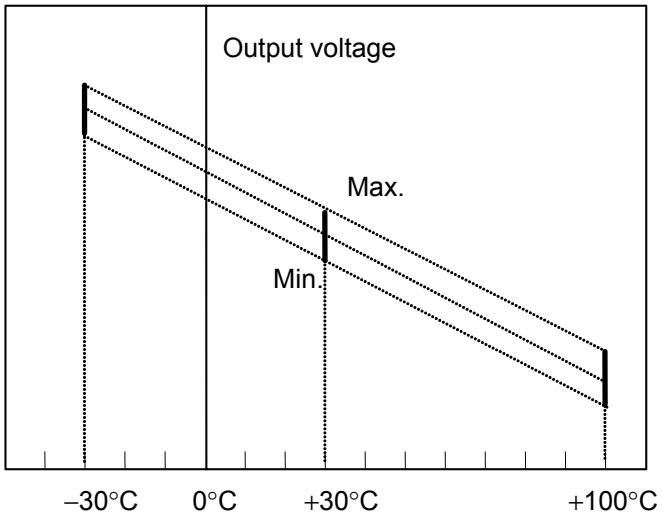


Figure 6

2. Temperature Sensitivity (V_{SE})

V_{SE} indicates the temperature coefficient of the output voltage calculated using the output voltage at Ta = –30°C and Ta = +100°C.
V_{SE} is calculated using the following formula.

$$V_{SE} = \frac{\left[V_{OUT}{}^{*1} - V_{OUT}{}^{*2}\right]}{130^{*3}}$$

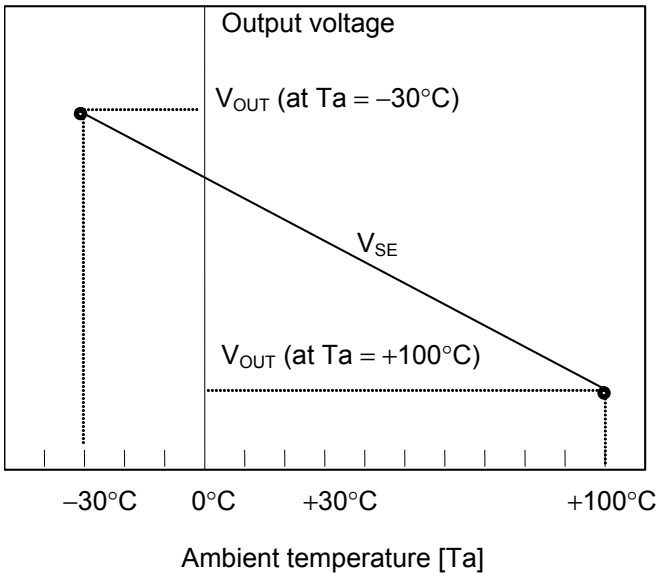


Figure 7

***1.** V_{OUT} value at Ta = +100°C. [V]
***2.** V_{OUT} value at Ta = –30°C. [V]
***3.** The difference of the temperature from Ta = +100°C to Ta = –30°C. [°C]

3. Nonlinearity (ΔN_L)

ΔN_L indicates the nonlinearity of the output voltage and is defined as the difference of the characteristic curve of the output voltage and the approximated straight line shown below.
ΔN_L is calculated using the following formula.

$$\Delta N_L = \frac{a^{*1}}{b^{*2}} \times 100$$

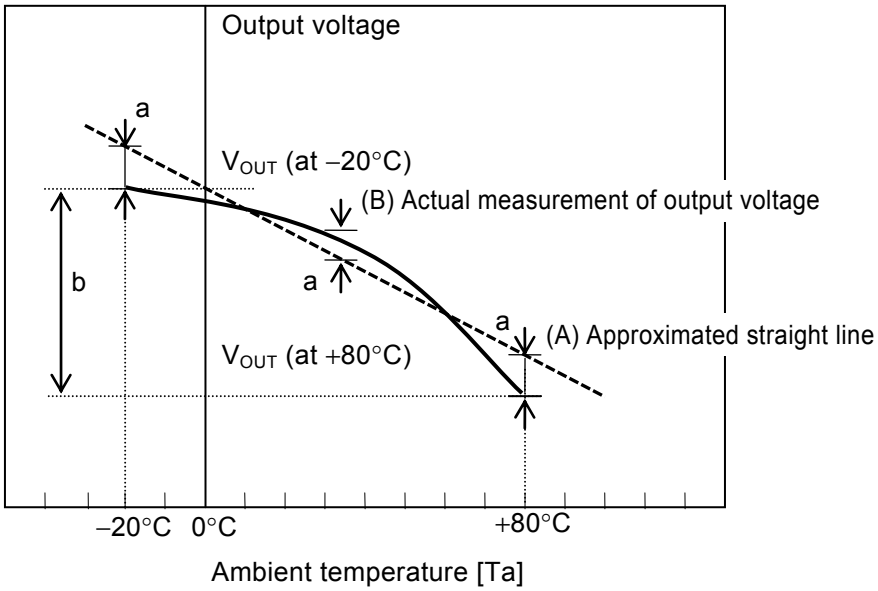


Figure 8

***1.** The maximum deviation of the actual measurement of output voltage (B) and an approximated straight line (A) in temperature within −20°C to +80°C. (An approximated straight line is taken as the straight line when the "a" becomes the minimum.)
***2.** The difference of the output voltage within −20°C to +80°C.

4. Line Regulation (ΔV_{OUT1})

ΔV_{OUT1} indicates the output voltage dependence on the input voltage. That is, the values express how the output voltage changes, when input voltage is changed under the condition that output current is fixed.

5. Load regulation (ΔV_{OUT2})

ΔV_{OUT2} indicates the output voltage dependence on the output current. That is, the values express how the output voltage changes, when output current is changed under the condition that input voltage is fixed.

■ Precautions

- Wiring patterns for VDD pin, VOUT pin and VSS pin should be designed to hold low impedance.
- In this IC, if load capacitance of VOUT pin is large, VOUT pin voltage may oscillate. It is recommended not to use the external capacitor between the VOUT and VSS pin. In case of using external capacitor, mount it near the VOUT pin.
  When connecting A/D converter etc. to the VOUT pin, input pin capacitance of A/D converter and the parasitic capacitance component between wires are included as load capacitance.
  To prevent oscillation, it is recommended to use the following output load condition.

  Load capacitance of VOUT pin (C_L) : 100 pF or less
- In this IC, if load resistance of VOUT pin is small, VOUT pin voltage may oscillate. It is recommended not to use the external resistor between the VOUT and VSS pin.
  When connecting A/D converter etc. to the VOUT pin, input resistance of A/D converter and the parasitic resistance component between wires are included as load resistance.
  To prevent oscillation, it is recommended to use the following output load condition.

  Load resistance of VOUT pin (R_L) : 500 kΩ or more

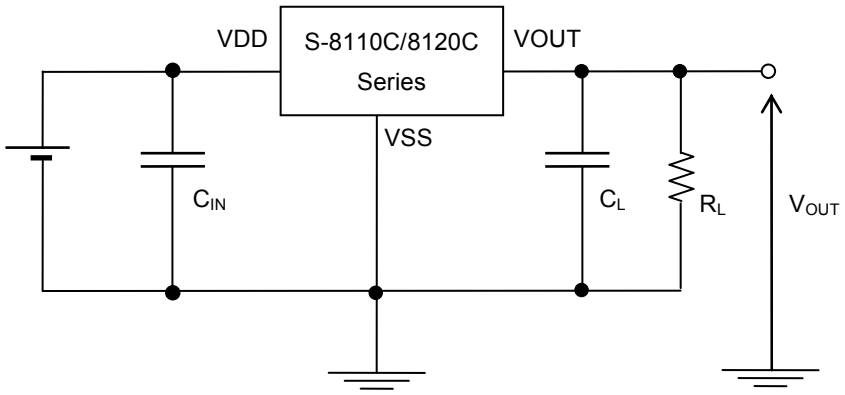


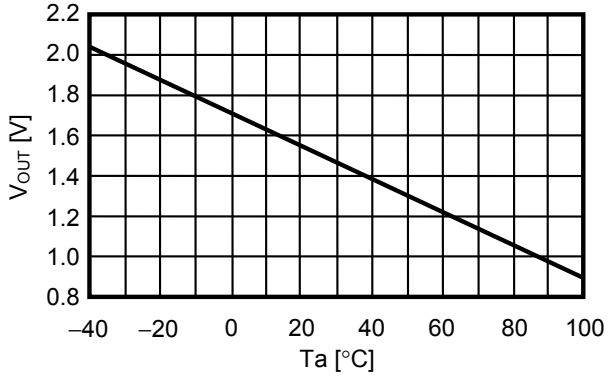
Figure 9

Caution The above connection diagram and constant will not guarantee successful operation. Perform through evaluation using the actual application to set the constant.

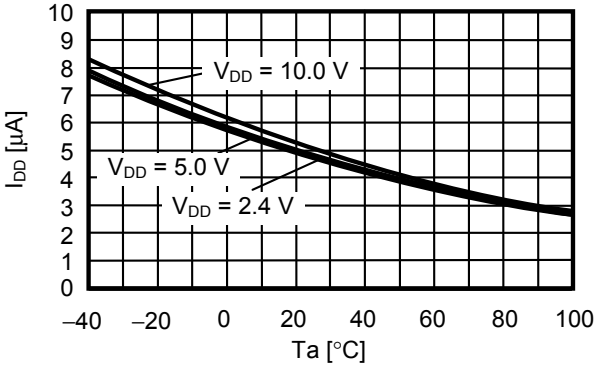
- Please do not connect a pull-up resistor to the output voltage pin.
- The application condition for input voltage, output voltage and load current must not exceed the package power dissipation.
- Do not apply an electrostatic discharge to this IC that exceeds the performance ratings of the built-in electrostatic protection circuit.
- Regarding the current at the output pin, refer to load regulation and **footnote *1** in **Table 5** to **Table 6** "■ **Electrical Characteristics**".
- SII Semiconductor Corporation claims no responsibility for any and all disputes arising out of or in connection with any infringement of the products including this IC upon patents owned by a third party.

■ Typical Characteristics

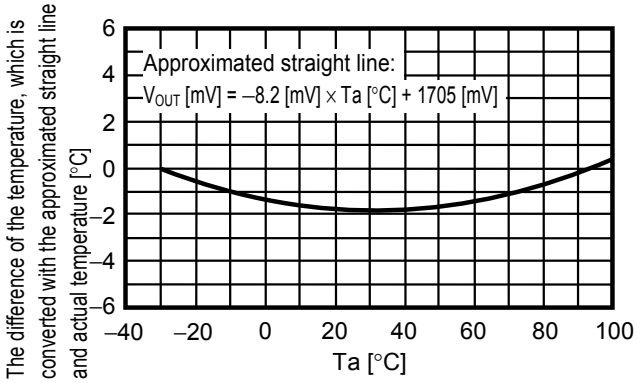
1. Temperature (Ta) vs. Output voltage (V_{OUT})



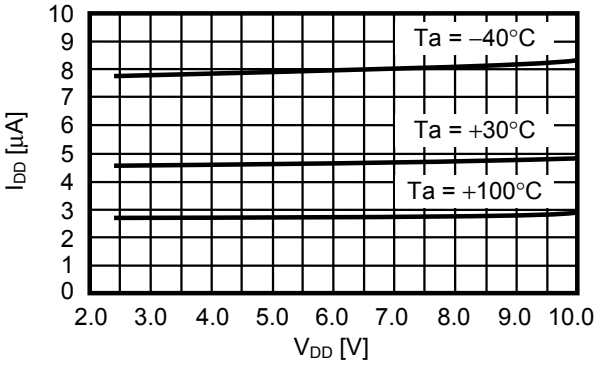
2. Temperature (Ta) vs. Current consumption (I_{DD})



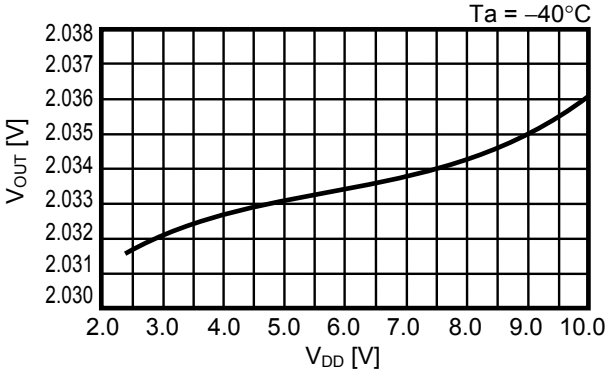
3. Error range of each temperature

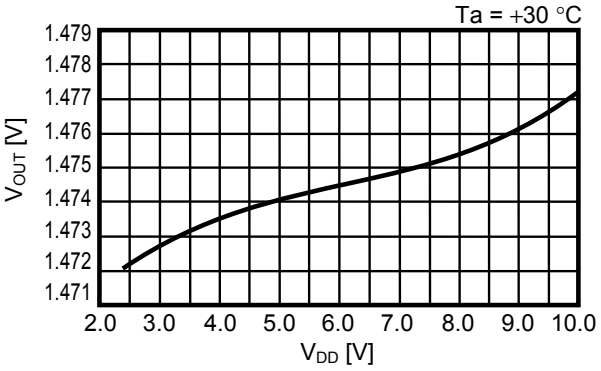


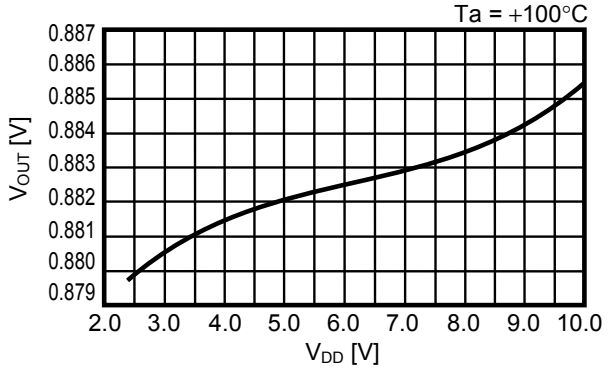
4. Power supply voltage (V_{DD}) vs. Current consumption (I_{DD})



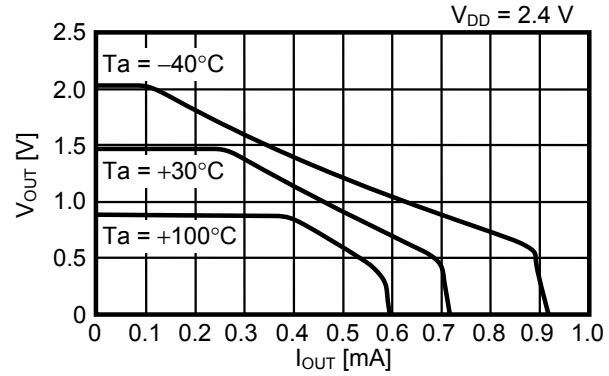
5. Power supply voltage (V_{DD}) vs. Output voltage (V_{OUT})

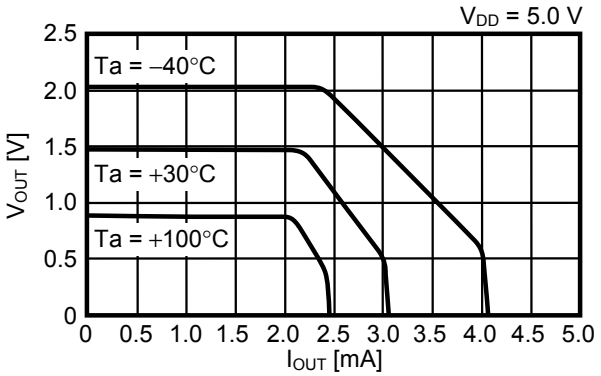


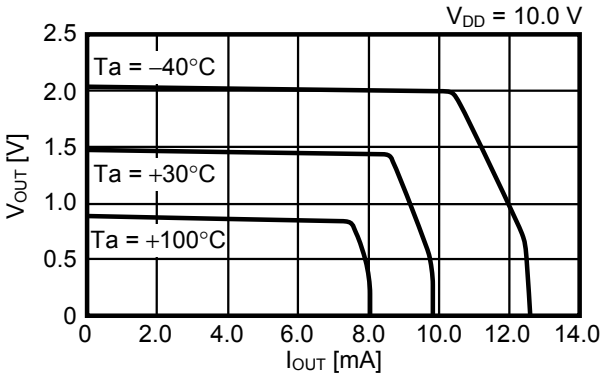




6. Load current (I_{OUT}) vs. Output voltage (V_{OUT})



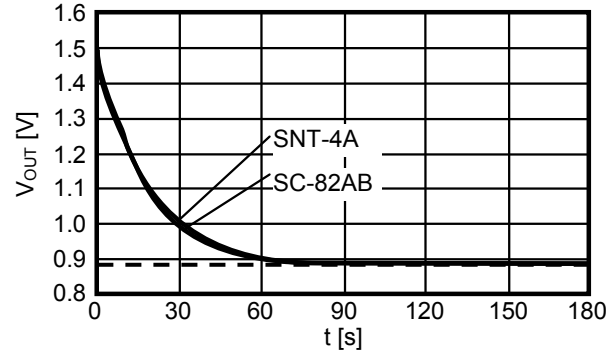




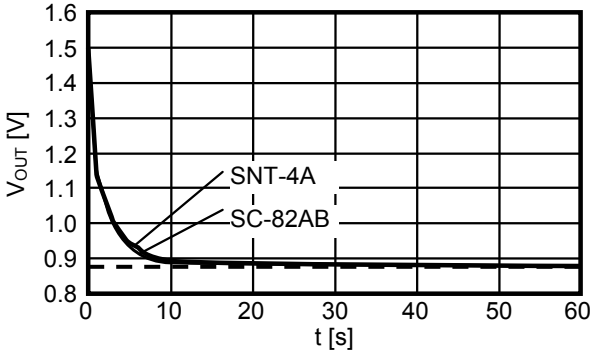
7. Heat response

Time (t) vs. Output voltage (V_{OUT})

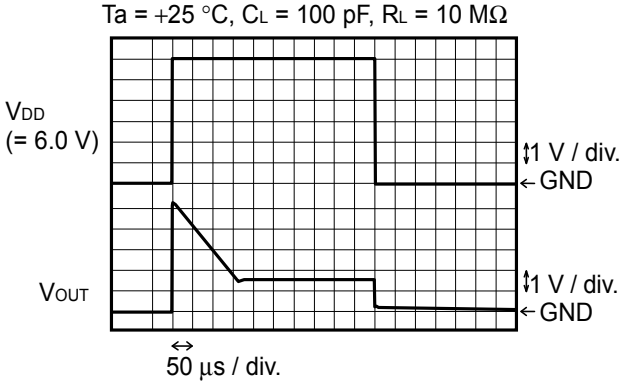
When packages are put into the air of +100 degrees from the air of +25 degrees

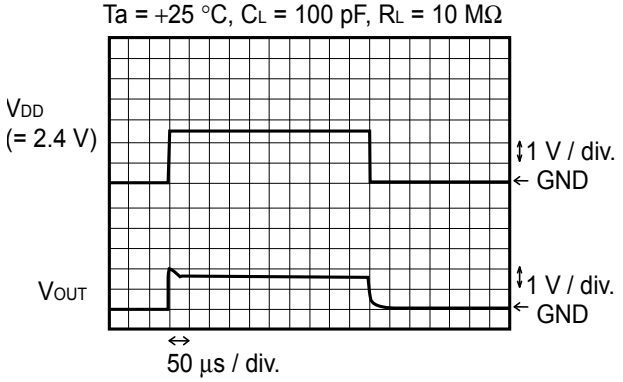


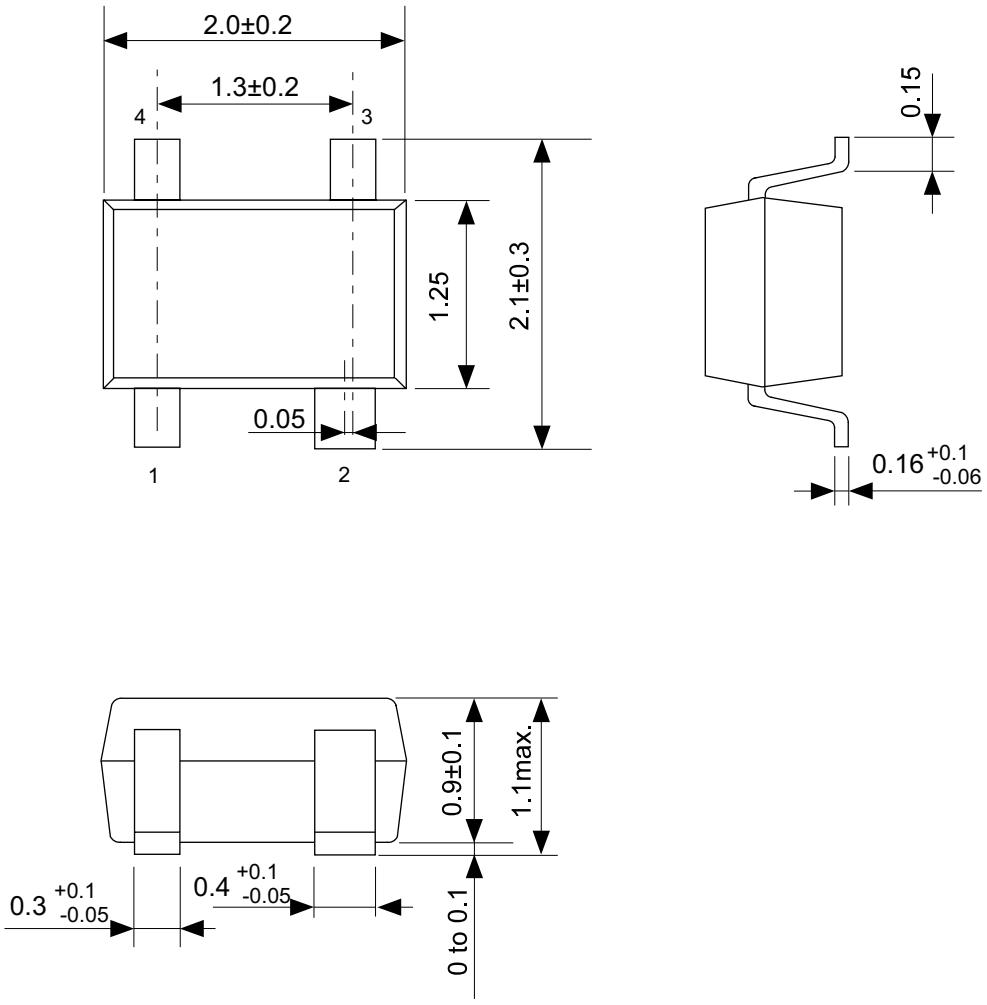
When packages are put into the liquid of +100 degrees from the air of +25 degrees



8. Start up response

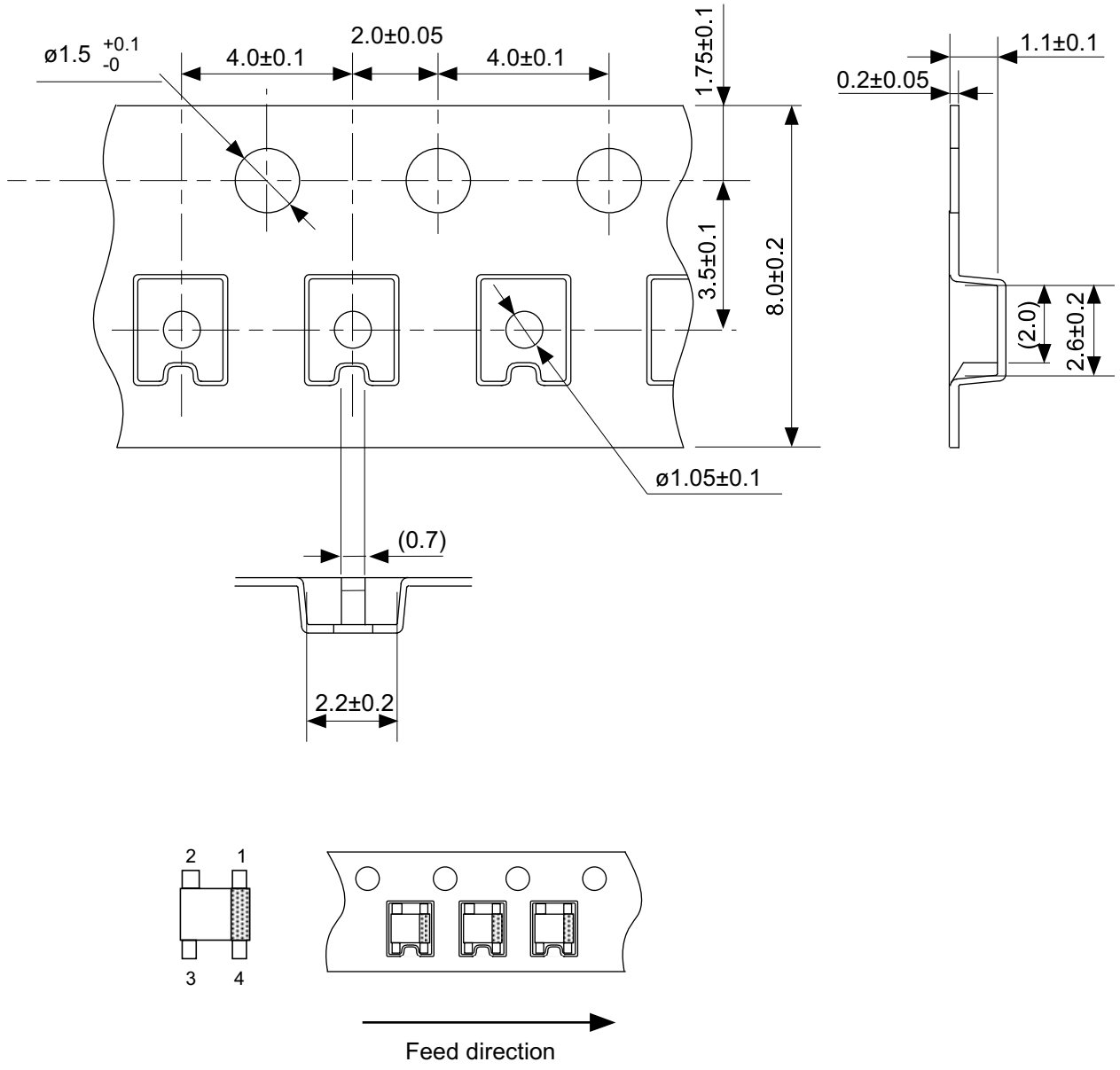






No. NP004-A-P-SD-1.1

TITLE	SC82AB-A-PKG Dimensions
No.	NP004-A-P-SD-1.1
SCALE	
UNIT	mm
SII Semiconductor Corporation	

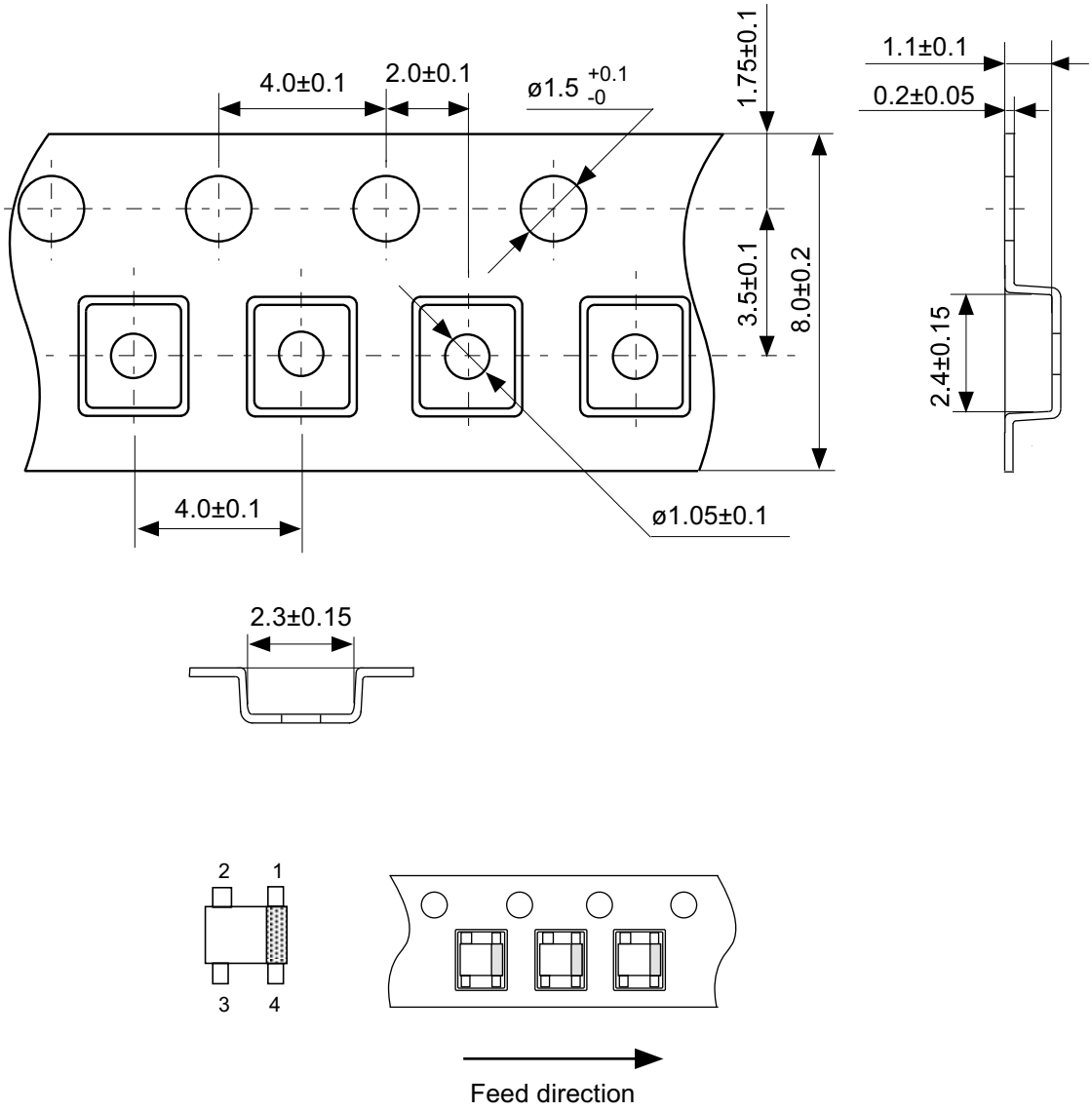


Feed direction

No. NP004-A-C-SD-3.0

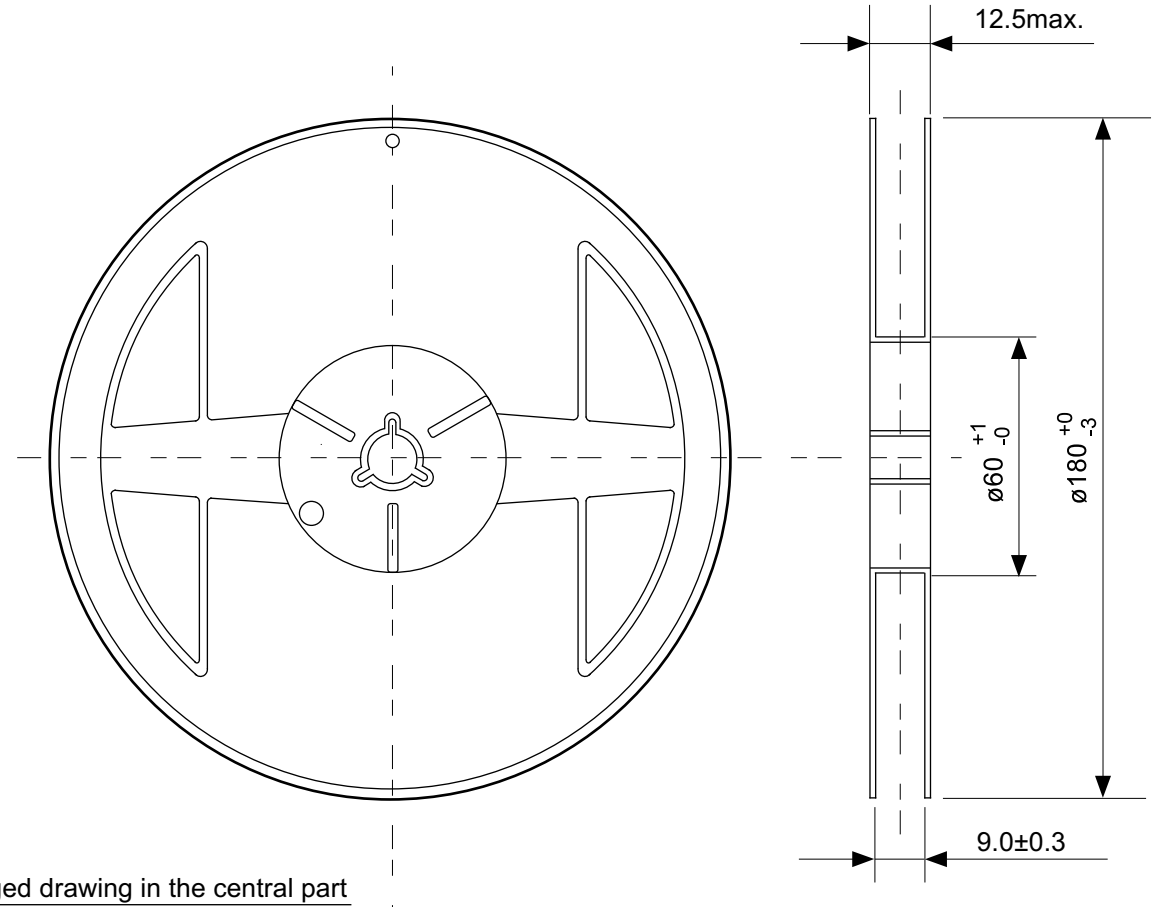
TITLE	SC82AB-A-Carrier Tape
No.	NP004-A-C-SD-3.0
SCALE	
UNIT	mm

SII Semiconductor Corporation

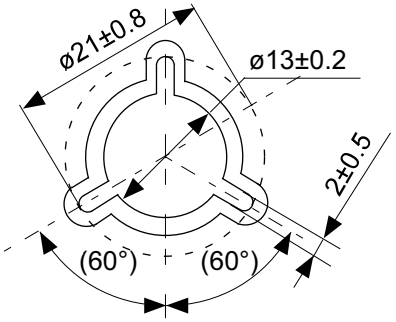


No. NP004-A-C-S1-2.0

TITLE	SC82AB-A-Carrier Tape
No.	NP004-A-C-S1-2.0
SCALE	
UNIT	mm
SII Semiconductor Corporation	

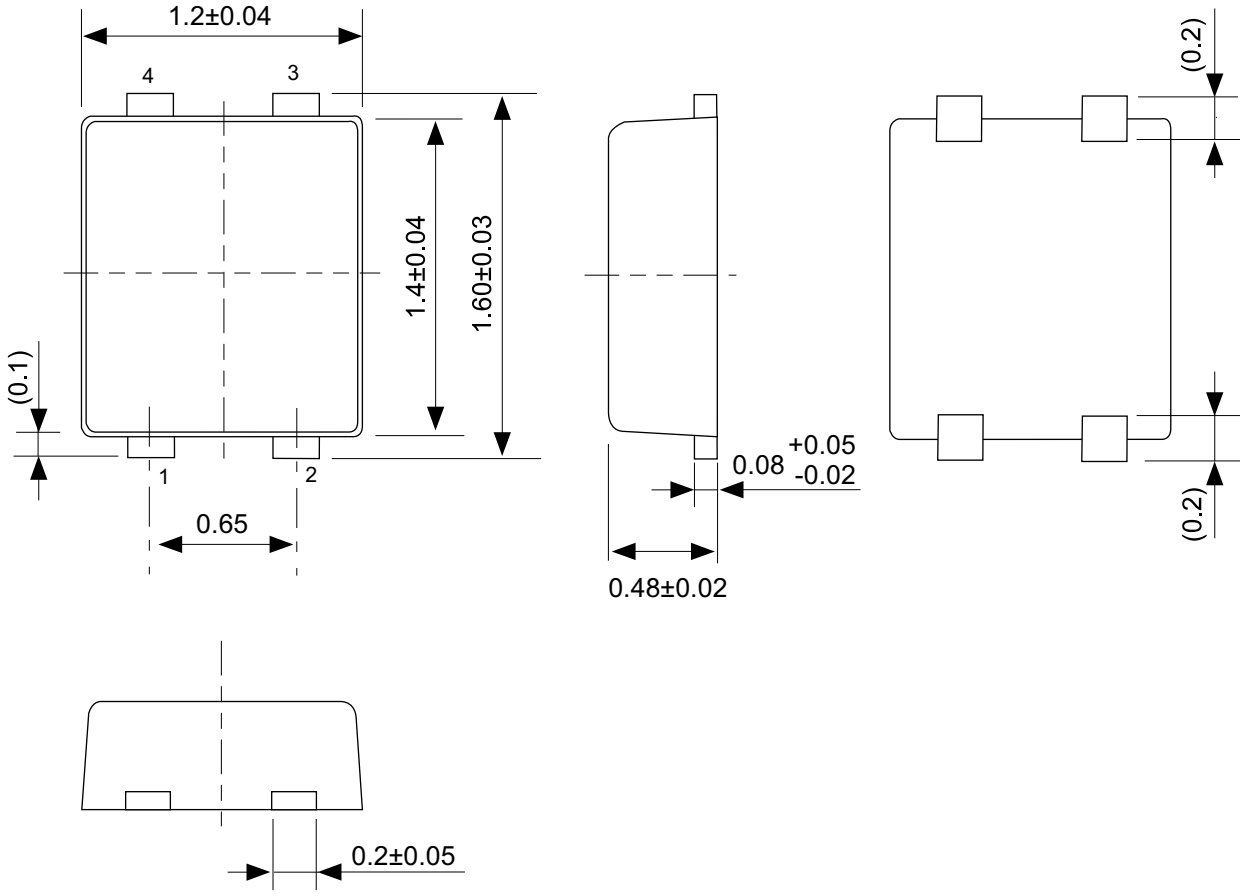


Enlarged drawing in the central part



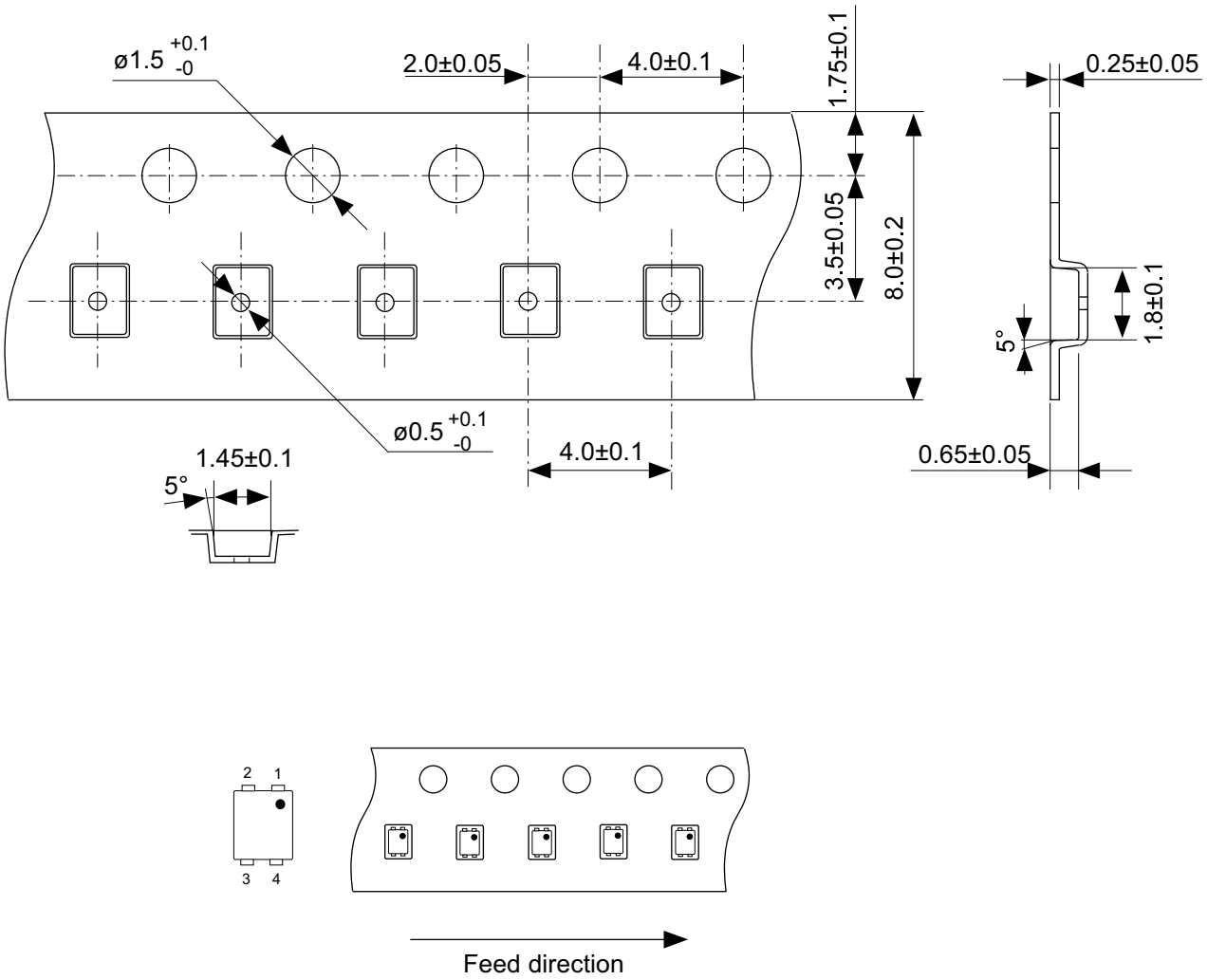
No. NP004-A-R-SD-1.1

TITLE	SC82AB-A-Reel		
No.	NP004-A-R-SD-1.1		
SCALE		QTY.	3,000
UNIT	mm		
SII Semiconductor Corporation			



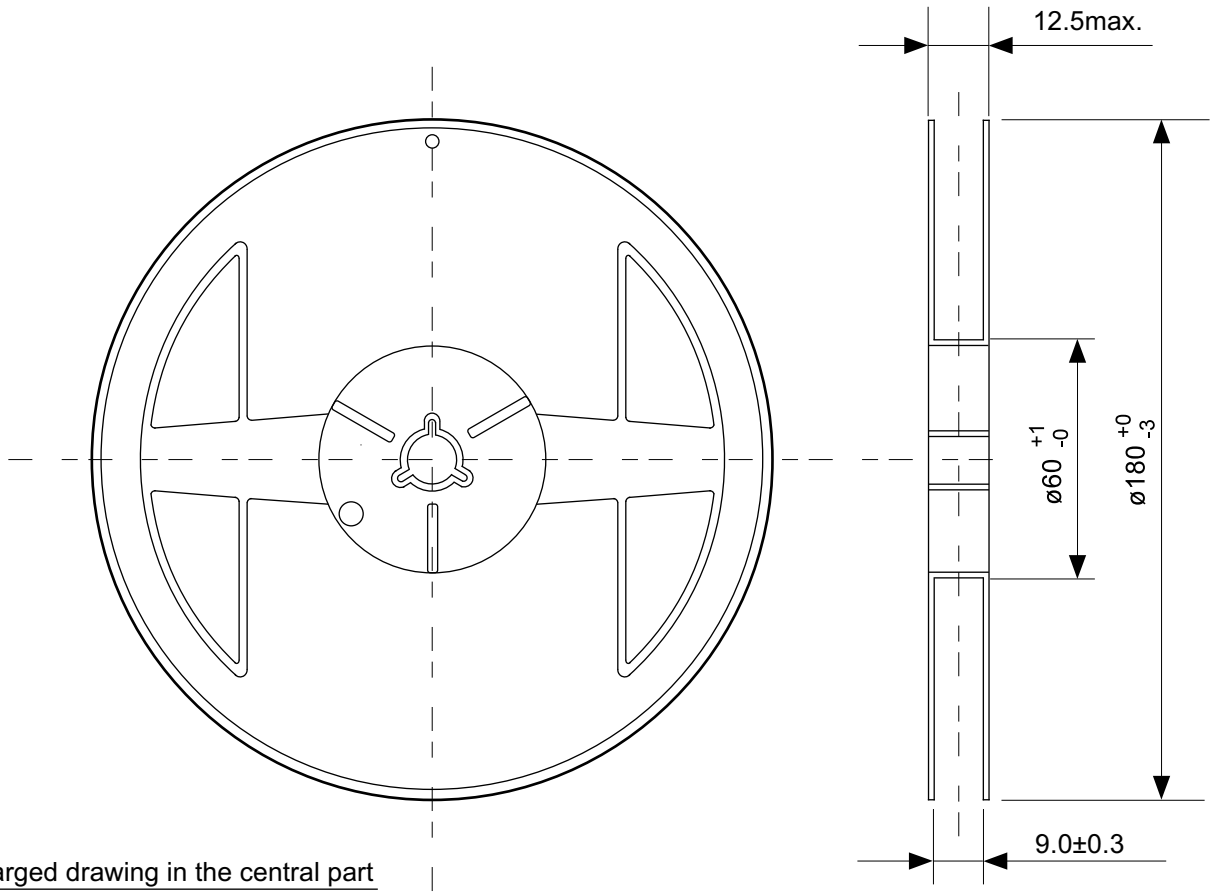
No. PF004-A-P-SD-4.0

TITLE	SNT-4A-A-PKG Dimensions
No.	PF004-A-P-SD-4.0
SCALE	
UNIT	mm
SII Semiconductor Corporation	

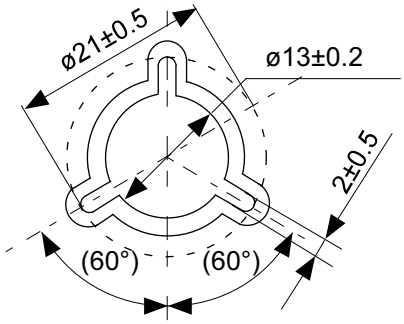


No. PF004-A-C-SD-1.0

TITLE	SNT-4A-A-Carrier Tape
No.	PF004-A-C-SD-1.0
SCALE	
UNIT	mm
SII Semiconductor Corporation	

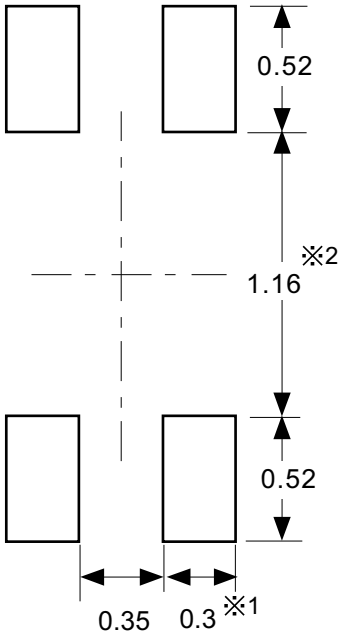


Enlarged drawing in the central part



No. PF004-A-R-SD-1.0

TITLE	SNT-4A-A-Reel		
No.	PF004-A-R-SD-1.0		
SCALE		QTY.	5,000
UNIT	mm		
SII Semiconductor Corporation			



※1. ランドパターンの幅に注意してください (0.25 mm min. / 0.30 mm typ.)。
※2. パッケージ中央にランドパターンを広げないでください (1.10 mm ~ 1.20 mm)。

注意 1. パッケージのモールド樹脂下にシルク印刷やハンダ印刷などしないでください。
2. パッケージ下の配線上のソルダーレジストなどの厚みをランドパターン表面から**0.03 mm** 以下にしてください。
3. マスク開口サイズと開口位置はランドパターンと合わせてください。
4. 詳細は "SNTパッケージ活用の手引き" を参照してください。

※1. Pay attention to the land pattern width (0.25 mm min. / 0.30 mm typ.).
※2. Do not widen the land pattern to the center of the package (1.10 mm to 1.20 mm).

Caution 1. Do not do silkscreen printing and solder printing under the mold resin of the package.
2. The thickness of the solder resist on the wire pattern under the package should be 0.03 mm or less from the land pattern surface.
3. Match the mask aperture size and aperture position with the land pattern.
4. Refer to "SNT Package User's Guide" for details.

※1. 请注意焊盘模式的宽度 (0.25 mm min. / 0.30 mm typ.)。
※2. 请勿向封装中间扩展焊盘模式 (1.10 mm ~ 1.20 mm)。

注意 1. 请勿在树脂型封装的下面印刷丝网、焊锡。
2. 在封装下、布线上的阻焊膜厚度 (从焊盘模式表面起) 请控制在 0.03 mm 以下。
3. 钢网的开口尺寸和开口位置请与焊盘模式对齐。
4. 详细内容请参阅 "SNT 封装的应用指南"。

No. PF004-A-L-SD-4.1

TITLE	SNT-4A-A -Land Recommendation
No.	PF004-A-L-SD-4.1
SCALE	
UNIT	mm
SII Semiconductor Corporation	

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