

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 $+100^{\circ}\text{C}$. 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: $\pm 5.0^{\circ}\text{C}$ (-30°C to $+100^{\circ}\text{C}$)
S-8120C Series: $\pm 2.5^{\circ}\text{C}$ (-30°C to $+100^{\circ}\text{C}$)
- Linear output voltage
 $-8.20\text{ mV}/^{\circ}\text{C}$ typ.
Ta = -30°C : 1.951 V typ.
Ta = $+30^{\circ}\text{C}$: 1.474 V typ.
Ta = $+100^{\circ}\text{C}$: 0.882 V typ.
- Nonlinearity
 $\pm 0.5\%$ typ. (-20°C to $+80^{\circ}\text{C}$)
- Wide power supply voltage operation $V_{\text{DD}} = 2.4\text{ V}$ to 10.0 V
- Low current consumption
4.5 μA typ. ($+25^{\circ}\text{C}$)
- 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

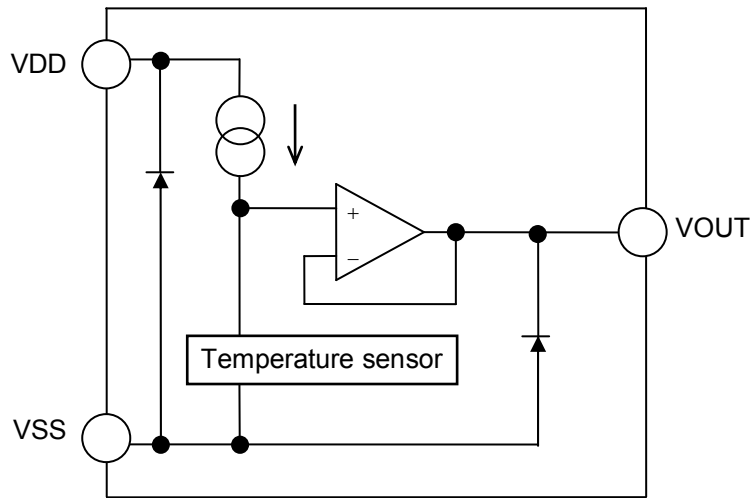


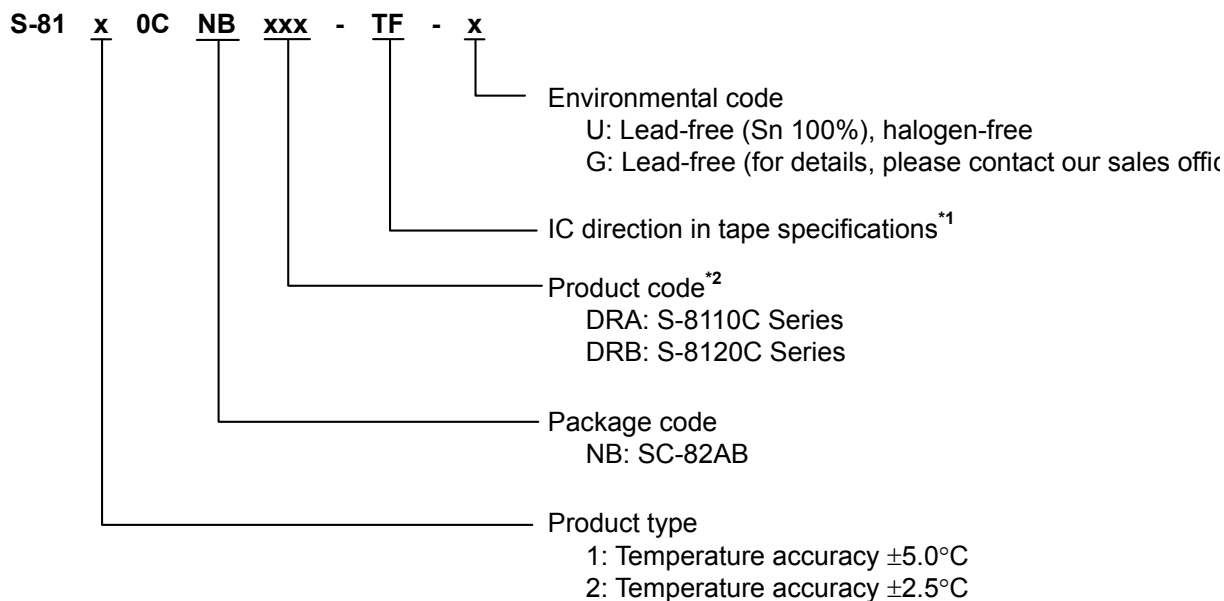
Figure 1

■ **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.

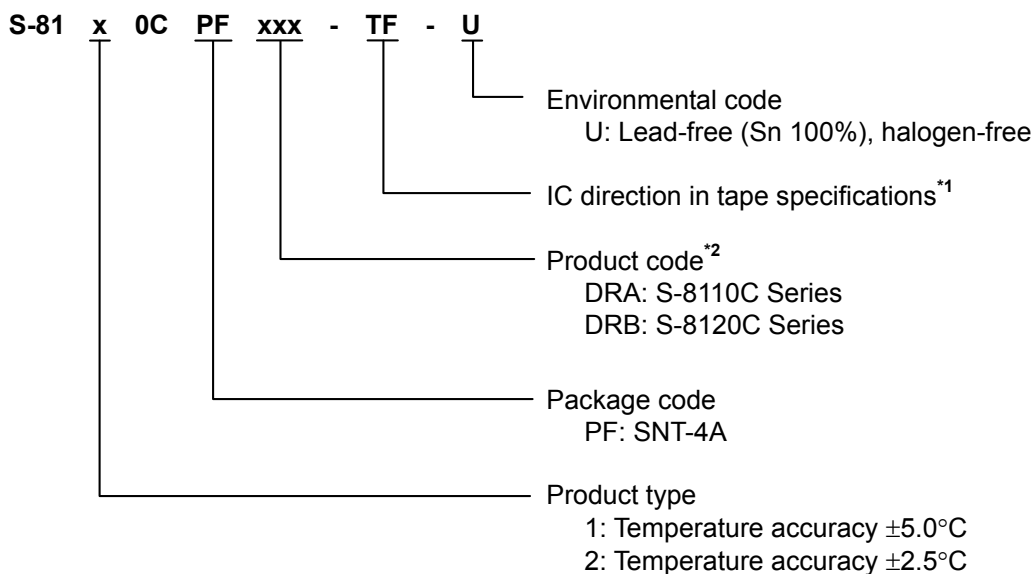
1. Product Name

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

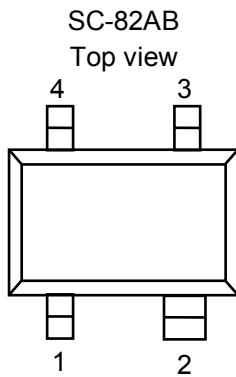


Figure 2

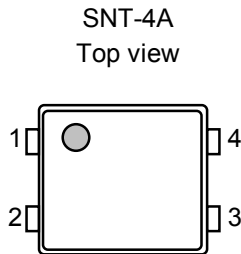


Figure 3

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.

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

($T_a = +25^\circ\text{C}$, $V_{DD} = 5.0\text{ V}$, $I_{OUT} = 0\text{ A}$ 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} | $T_a = -30^\circ\text{C}$ | 1.911 | 1.951 | 1.991 | V | 1 |
| | | $T_a = +30^\circ\text{C}$ | 1.434 | 1.474 | 1.514 | V | 1 |
| | | $T_a = +100^\circ\text{C}$ | 0.842 | 0.882 | 0.922 | V | 1 |
| Temperature sensitivity | V_{SE} | $-30^\circ\text{C} \leq T_a \leq +100^\circ\text{C}$ | -8.40 | -8.20 | -8.00 | mV/°C | — |
| Nonlinearity | ΔN_L | $-20^\circ\text{C} \leq T_a \leq +80^\circ\text{C}$ | — | ± 0.5 | — | % | — |
| Operating temperature range | T_{opr} | — | -40 | — | 100 | °C | — |
| Current consumption | I_{DD} | — | — | 4.5 | 8.0 | μA | 1 |
| Line regulation | ΔV_{OUT1} | $V_{DD} = 2.4\text{ V to } 10.0\text{ V}$ | — | — | 0.05 | %/V | 2 |
| Load regulation ^{*1} | ΔV_{OUT2} | $I_{OUT} = 0\ \mu\text{A to } 200\ \mu\text{A}$ | — | — | 1.0 | mV | 2 |

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

2. S-8120C Series

Table 6

($T_a = +25^\circ\text{C}$, $V_{DD} = 5.0\text{ V}$, $I_{OUT} = 0\text{ A}$ 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} | $T_a = -30^\circ\text{C}$ | 1.931 | 1.951 | 1.971 | V | 1 |
| | | $T_a = +30^\circ\text{C}$ | 1.454 | 1.474 | 1.494 | V | 1 |
| | | $T_a = +100^\circ\text{C}$ | 0.862 | 0.882 | 0.902 | V | 1 |
| Temperature sensitivity | V_{SE} | $-30^\circ\text{C} \leq T_a \leq +100^\circ\text{C}$ | -8.40 | -8.20 | -8.00 | mV/°C | — |
| Nonlinearity | ΔN_L | $-20^\circ\text{C} \leq T_a \leq +80^\circ\text{C}$ | — | ± 0.5 | — | % | — |
| Operating temperature range | T_{opr} | — | -40 | — | 100 | °C | — |
| Current consumption | I_{DD} | — | — | 4.5 | 8.0 | μA | 1 |
| Line regulation | ΔV_{OUT1} | $V_{DD} = 2.4\text{ V to } 10.0\text{ V}$ | — | — | 0.05 | %/V | 2 |
| Load regulation ^{*1} | ΔV_{OUT2} | $I_{OUT} = 0\ \mu\text{A to } 200\ \mu\text{A}$ | — | — | 1.0 | mV | 2 |

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

■ Test Circuits

1.

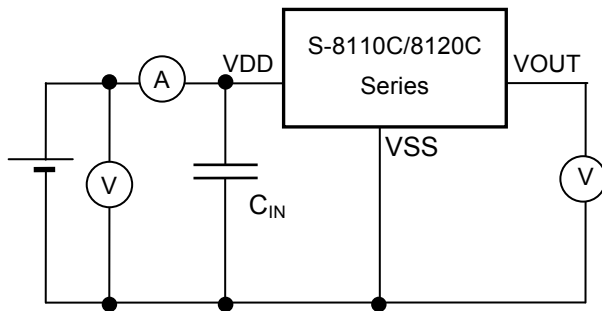


Figure 4

2.

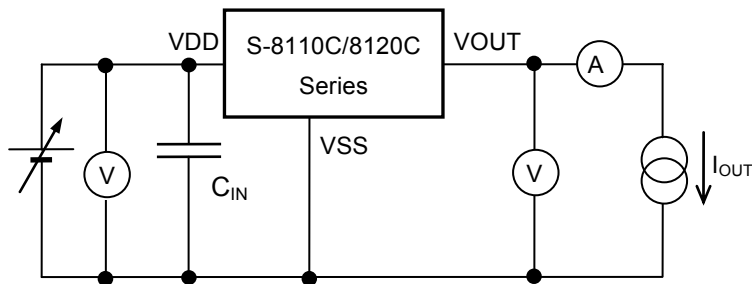


Figure 5

■ Technical Terms

1. Output Voltage (V_{OUT})

V_{OUT} indicates the output voltage at $T_a = -30^\circ\text{C}$, $T_a = +30^\circ\text{C}$ and $T_a = +100^\circ\text{C}$.

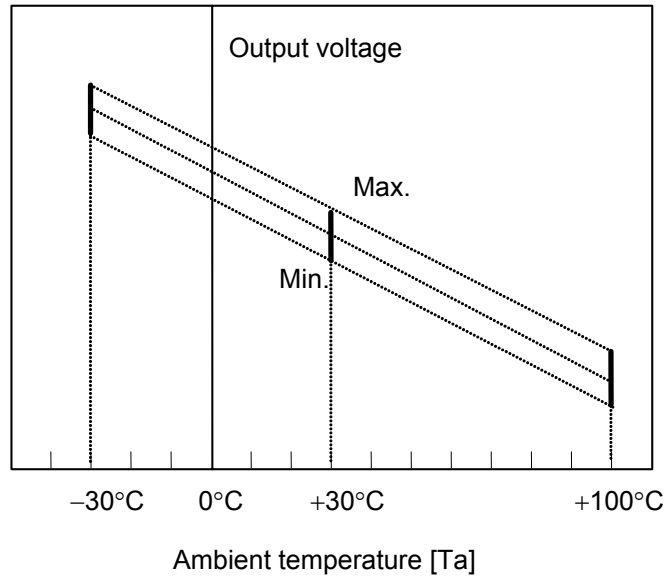


Figure 6

2. Temperature Sensitivity (V_{SE})

V_{SE} indicates the temperature coefficient of the output voltage calculated using the output voltage at $T_a = -30^\circ\text{C}$ and $T_a = +100^\circ\text{C}$.

V_{SE} is calculated using the following formula.

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

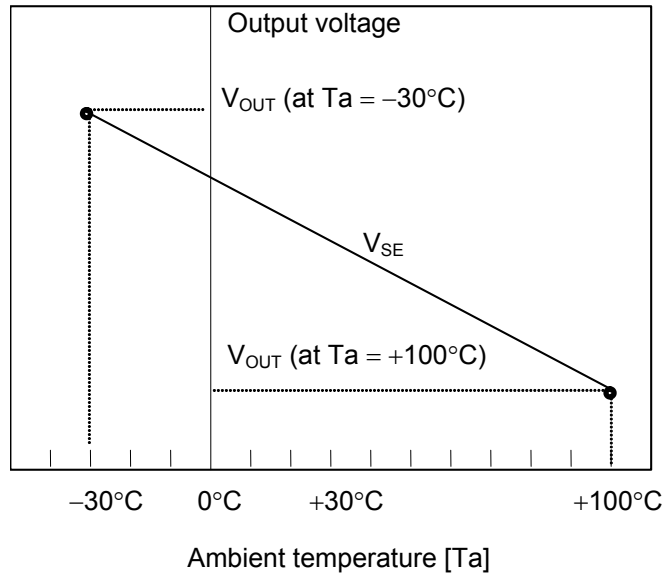


Figure 7

- *1. V_{OUT} value at $T_a = +100^\circ\text{C}$. [V]
- *2. V_{OUT} value at $T_a = -30^\circ\text{C}$. [V]
- *3. The difference of the temperature from $T_a = +100^\circ\text{C}$ to $T_a = -30^\circ\text{C}$. [$^\circ\text{C}$]

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.

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

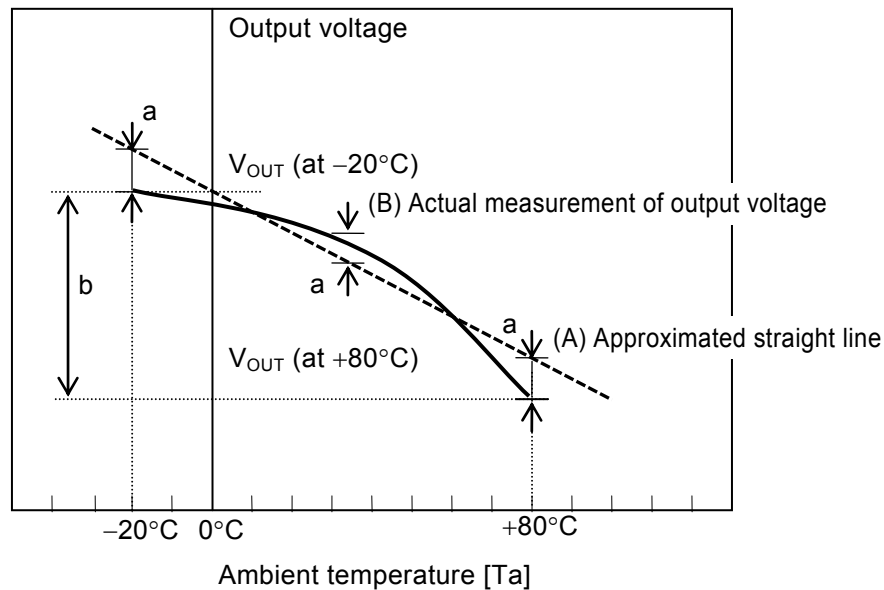


Figure 8

- *1. The maximum deviation of the actual measurement of output voltage (B) and an approximated straight line (A) in temperature within -20°C to $+80^{\circ}\text{C}$. (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 $+80^{\circ}\text{C}$.

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 k Ω or more

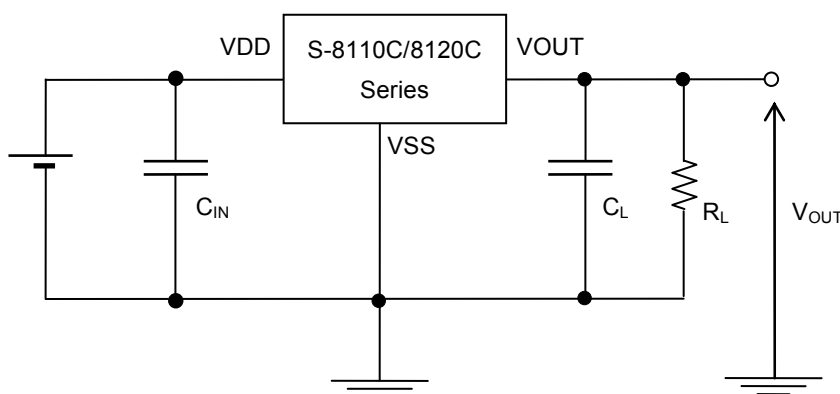


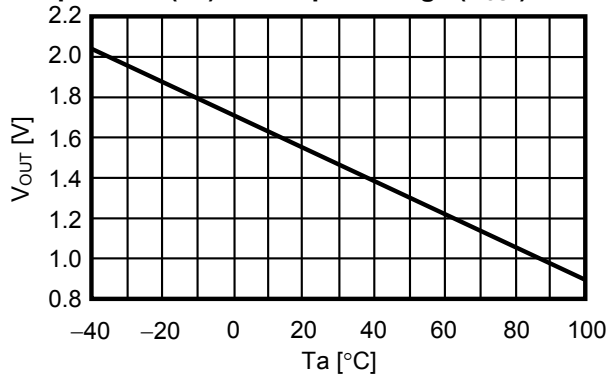
Figure 9

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

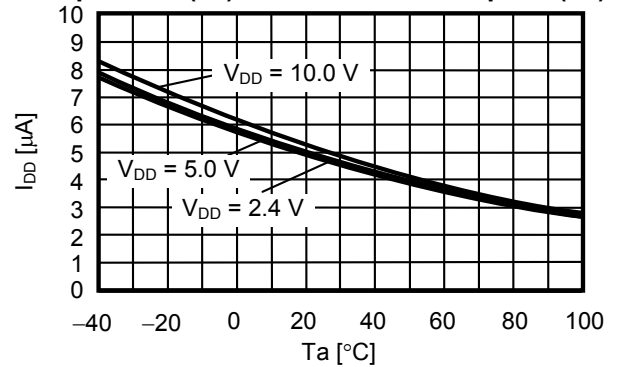
- Please do not connect a pull-up resistor to the output voltage pin.
- The application condition for input voltage, output voltage and load current must not exceed the package power dissipation.
- Do not apply an electrostatic discharge to this IC that exceeds the performance ratings of the built-in 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**”.
- ABLIC Inc. 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

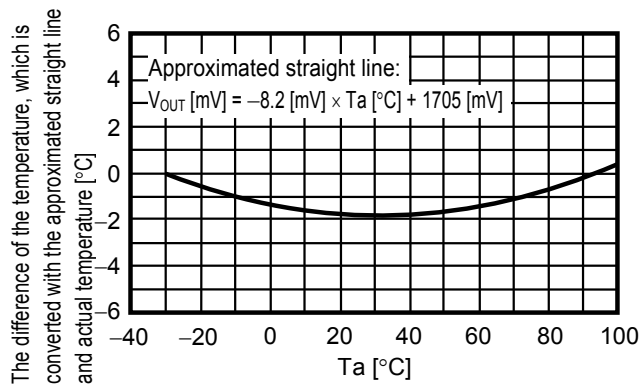
1. Temperature (Ta) vs. Output voltage (V_{OUT})



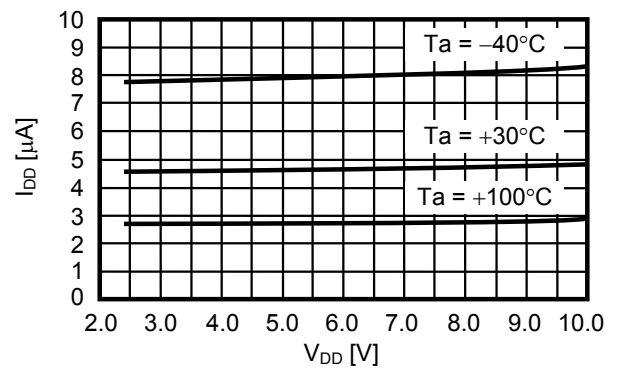
2. Temperature (Ta) vs. Current consumption (I_{DD})



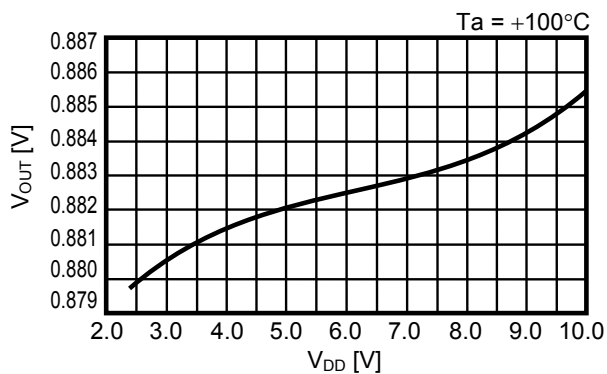
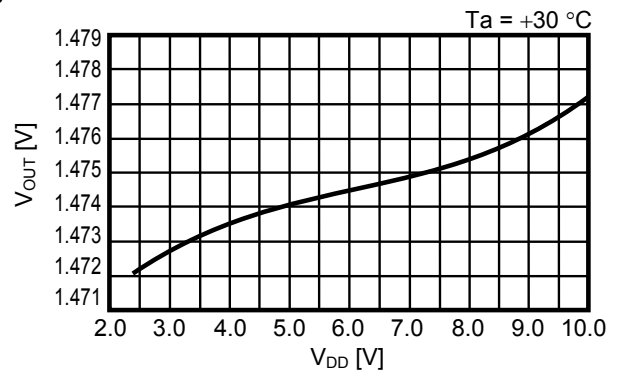
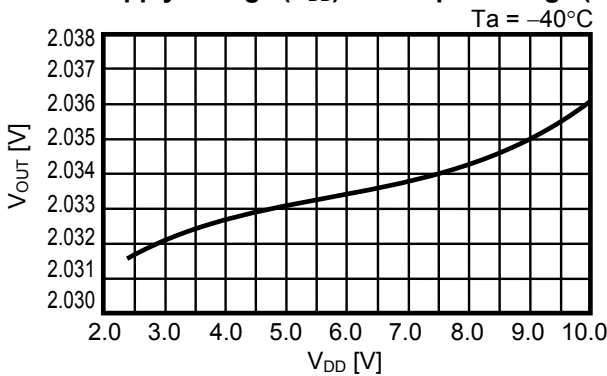
3. Error range of each temperature



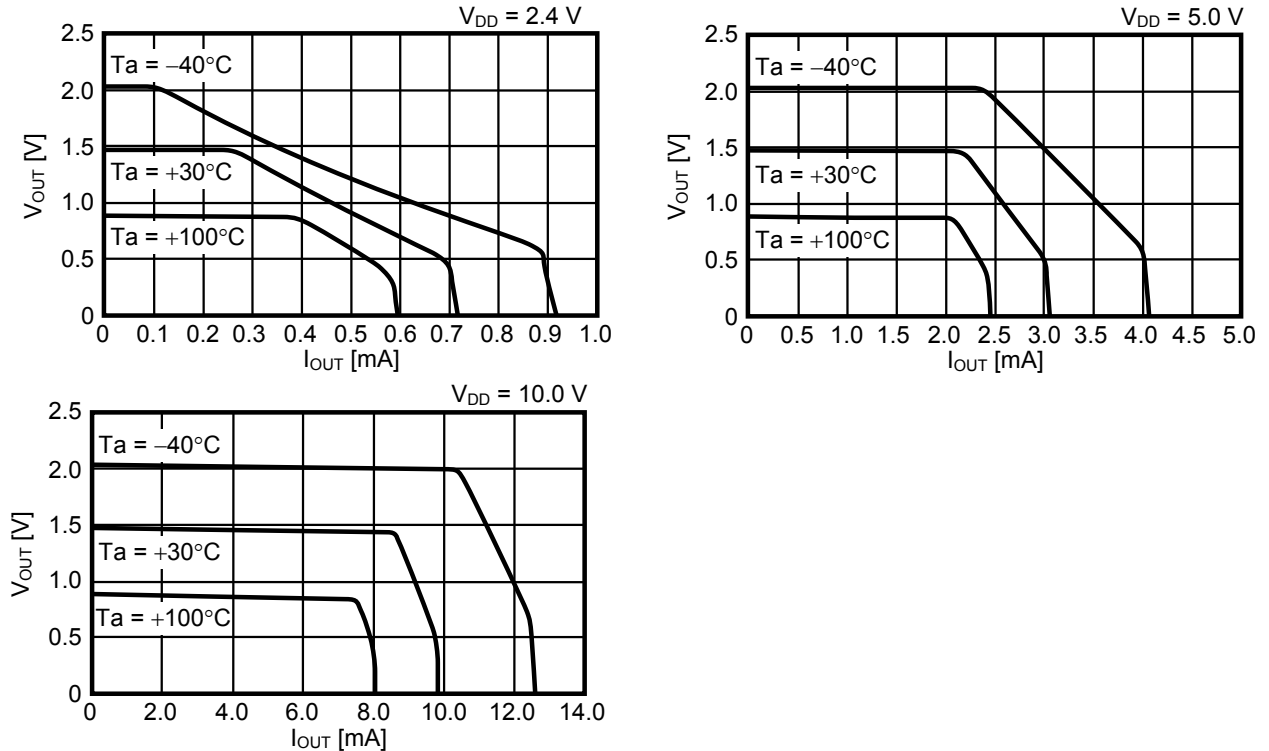
4. Power supply voltage (V_{DD}) vs. Current consumption (I_{DD})



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



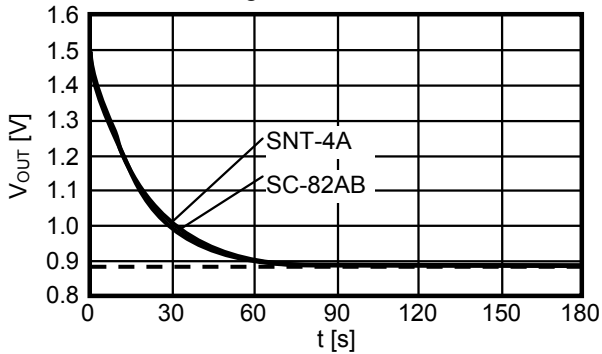
6. Load current (I_{OUT}) vs. Output voltage (V_{OUT})



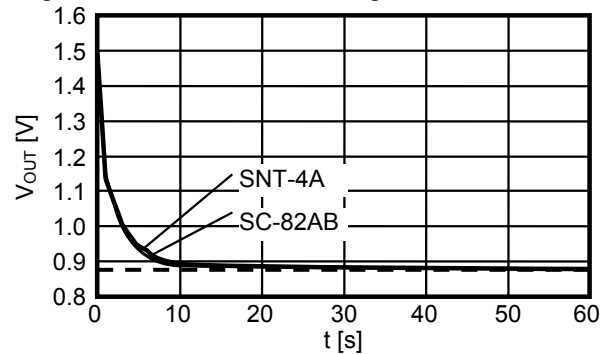
7. Heat response

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

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

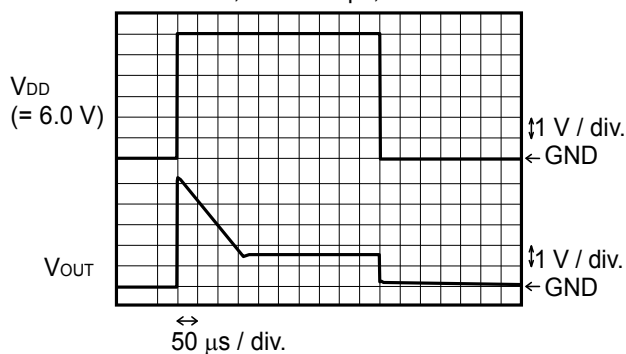


When packages are put into the liquid of $+100$ degrees from the air of $+25$ degrees

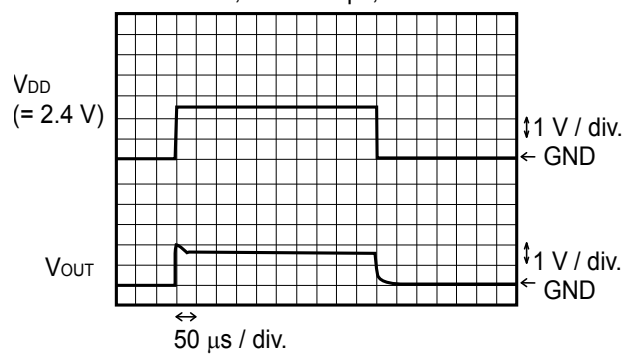


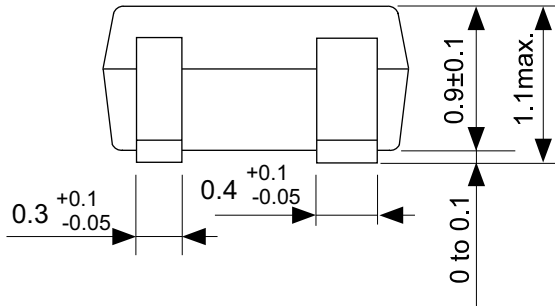
8. Start up response

$T_a = +25^\circ\text{C}$, $C_L = 100\text{ pF}$, $R_L = 10\text{ M}\Omega$



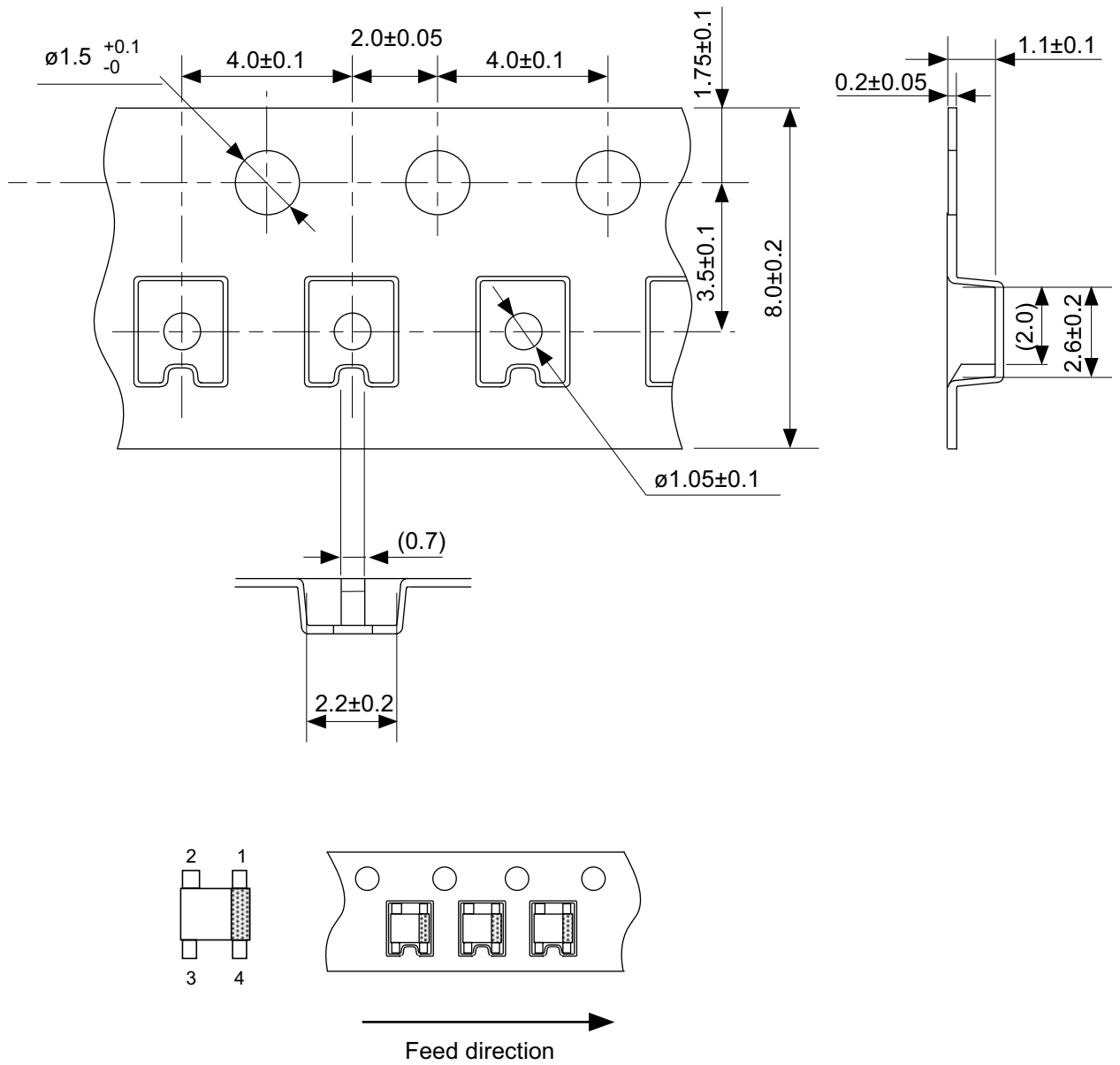
$T_a = +25^\circ\text{C}$, $C_L = 100\text{ pF}$, $R_L = 10\text{ M}\Omega$





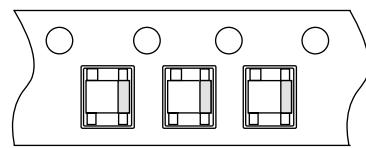
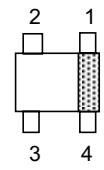
No. NP004-A-P-SD-2.0

| | |
|-------------------|-------------------------|
| TITLE | SC82AB-A-PKG Dimensions |
| No. | NP004-A-P-SD-2.0 |
| ANGLE | |
| UNIT | mm |
| ABLIC Inc. | |



No. NP004-A-C-SD-3.0

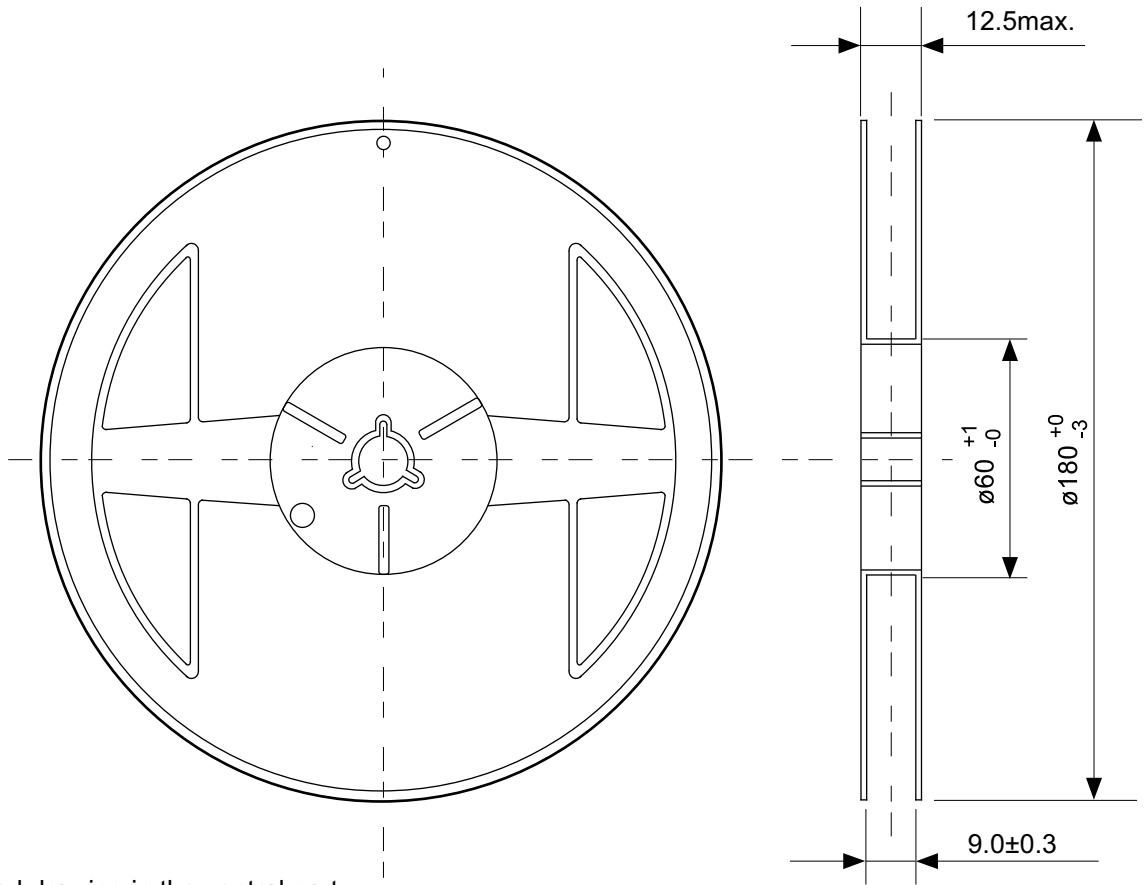
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|-------------------|-----------------------|
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| No. | NP004-A-C-SD-3.0 |
| ANGLE | |
| UNIT | mm |
| | |
| ABLIC Inc. | |



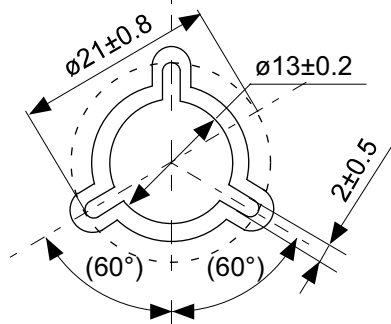
→
Feed direction

No. NP004-A-C-S1-2.0

| | |
|-------------------|-----------------------|
| TITLE | SC82AB-A-Carrier Tape |
| No. | NP004-A-C-S1-2.0 |
| ANGLE | |
| UNIT | mm |
| ABLIC Inc. | |

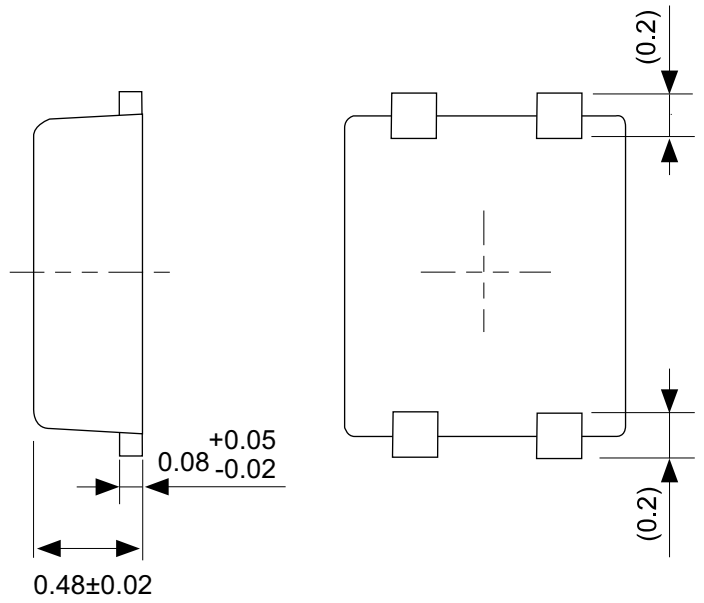
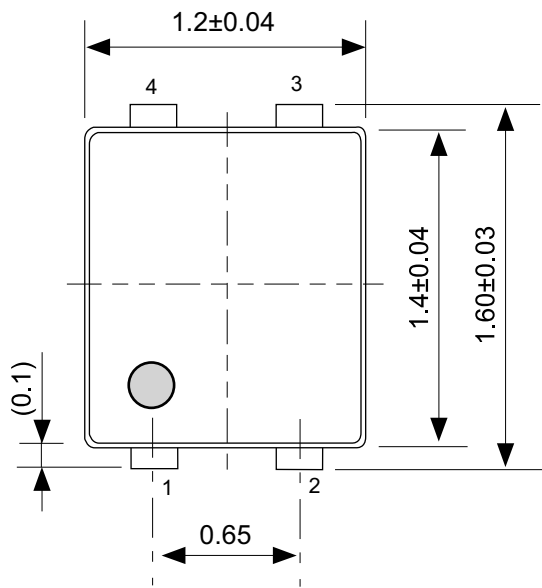


Enlarged drawing in the central part



No. NP004-A-R-SD-1.1

| | | | |
|-------------------|------------------|------|-------|
| TITLE | SC82AB-A-Reel | | |
| No. | NP004-A-R-SD-1.1 | | |
| ANGLE | | QTY. | 3,000 |
| UNIT | mm | | |
| | | | |
| ABLIC Inc. | | | |



No. PF004-A-P-SD-6.0

| | |
|-------------------|-------------------------|
| TITLE | SNT-4A-A-PKG Dimensions |
| No. | PF004-A-P-SD-6.0 |
| ANGLE | |
| UNIT | mm |
| ABLIC Inc. | |



Feed direction →

No. PF004-A-C-SD-2.0

| | |
|-------------------|-----------------------|
| TITLE | SNT-4A-A-Carrier Tape |
| No. | PF004-A-C-SD-2.0 |
| ANGLE | |
| UNIT | mm |
| | |
| ABLIC Inc. | |



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 | | |
| ANGLE | | QTY. | 5,000 |
| UNIT | mm | | |
| | | | |
| ABLIC Inc. | | | |



※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 |
| ANGLE | |
| UNIT | mm |
| ABLIC Inc. | |

Disclaimers (Handling Precautions)

1. All the information described herein (product data, specifications, figures, tables, programs, algorithms and application circuit examples, etc.) is current as of publishing date of this document and is subject to change without notice.
2. The circuit examples and the usages described herein are for reference only, and do not guarantee the success of any specific mass-production design.
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4. Be careful to use the products within their specified ranges. Pay special attention to the absolute maximum ratings, operation voltage range and electrical characteristics, etc.
ABLIC Inc. is not responsible for damages caused by failures and / or accidents, etc. that occur due to the use of the products outside their specified ranges.
5. When using the products, confirm their applications, and the laws and regulations of the region or country where they are used and verify suitability, safety and other factors for the intended use.
6. When exporting the products, comply with the Foreign Exchange and Foreign Trade Act and all other export-related laws, and follow the required procedures.
7. The products must not be used or provided (exported) for the purposes of the development of weapons of mass destruction or military use. ABLIC Inc. is not responsible for any provision (export) to those whose purpose is to develop, manufacture, use or store nuclear, biological or chemical weapons, missiles, or other military use.
8. The products are not designed to be used as part of any device or equipment that may affect the human body, human life, or assets (such as medical equipment, disaster prevention systems, security systems, combustion control systems, infrastructure control systems, vehicle equipment, traffic systems, in-vehicle equipment, aviation equipment, aerospace equipment, and nuclear-related equipment), excluding when specified for in-vehicle use or other uses. Do not apply the products to the above listed devices and equipments without prior written permission by ABLIC Inc. Especially, the products cannot be used for life support devices, devices implanted in the human body and devices that directly affect human life, etc.
Prior consultation with our sales office is required when considering the above uses.
ABLIC Inc. is not responsible for damages caused by unauthorized or unspecified use of our products.
9. Semiconductor products may fail or malfunction with some probability.
The user of the products should therefore take responsibility to give thorough consideration to safety design including redundancy, fire spread prevention measures, and malfunction prevention to prevent accidents causing injury or death, fires and social damage, etc. that may ensue from the products' failure or malfunction.
The entire system must be sufficiently evaluated and applied on customer's own responsibility.
10. The products are not designed to be radiation-proof. The necessary radiation measures should be taken in the product design by the customer depending on the intended use.
11. The products do not affect human health under normal use. However, they contain chemical substances and heavy metals and should therefore not be put in the mouth. The fracture surfaces of wafers and chips may be sharp. Be careful when handling these with the bare hands to prevent injuries, etc.
12. When disposing of the products, comply with the laws and ordinances of the country or region where they are used.
13. The information described herein contains copyright information and know-how of ABLIC Inc.
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14. For more details on the information described herein, contact our sales office.

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