

LOW VOLTAGE OPERATION BOTH POLES / UNIPOLAR DETECTION TYPE HALL IC

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Rev.1.0_00

The S-5717 Series, developed by CMOS technology, is a high-accuracy Hall IC that operates at a low voltage and low current consumption.

The output voltage changes when the S-5717 Series detects the intensity level of flux density. Using the S-5717 Series with a magnet makes it possible to detect the open / close in various devices.

High-density mounting is possible by using the super-small SNT-4A package.

Due to its low voltage operation and low current consumption, the S-5717 Series is suitable for battery-operated portable devices. Also, due to its high-accuracy magnetic characteristics, the S-5717 Series can make operation's dispersion in the system combined with magnet smaller.

Caution This product is intended to use in general electronic devices such as consumer electronics, office equipment, and communications devices. Before using the product in medical equipment or automobile equipment including car audio, keyless entry and engine control unit, contact to SII is indispensable.

■ Features

- | | |
|---|--|
| • Pole detection ^{*1} : | Detection of both poles, S pole or N pole |
| • Detection logic for magnetism ^{*1} : | Active "L", active "H" |
| • Output form ^{*1} : | Nch open-drain output, CMOS output |
| • Magnetic sensitivity: | $B_{OP} = 3.3 \text{ mT typ.}$ |
| • Operating cycle (current consumption) ^{*1} : | Product with both poles detection
$t_{CYCLE} = 50.50 \text{ ms } (I_{DD} = 2.0 \text{ } \mu\text{A}) \text{ typ.}$
Product with S pole or N pole detection
$t_{CYCLE} = 50.85 \text{ ms } (I_{DD} = 1.4 \text{ } \mu\text{A}) \text{ typ.}$ |
| • Power supply voltage range: | $V_{DD} = 1.6 \text{ V to } 3.6 \text{ V}$ |
| • Operation temperature range: | $T_a = -40^{\circ}\text{C to } +85^{\circ}\text{C}$ |
| • Lead-free (Sn 100%), halogen-free | |

^{*1}. The option can be selected.

■ Applications

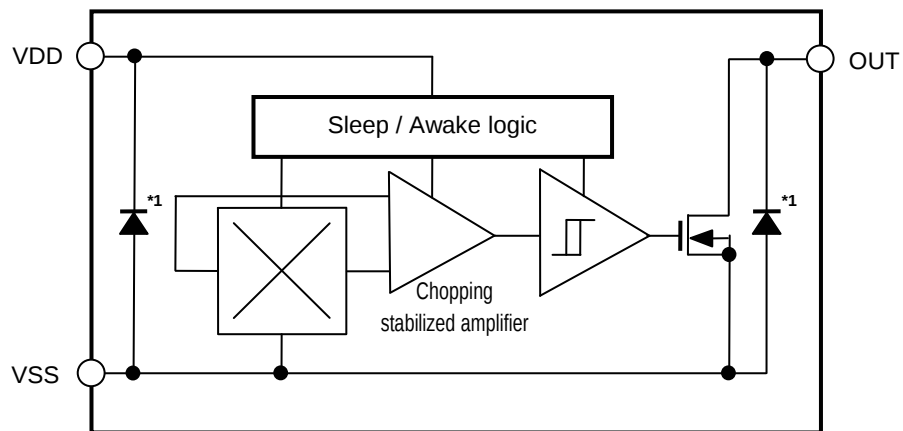
- Mobile phone, smart phone
- Notebook PC, tablet PC
- Digital video camera
- Plaything, portable game
- Home appliance

■ Package

- SNT-4A

■ Block Diagrams

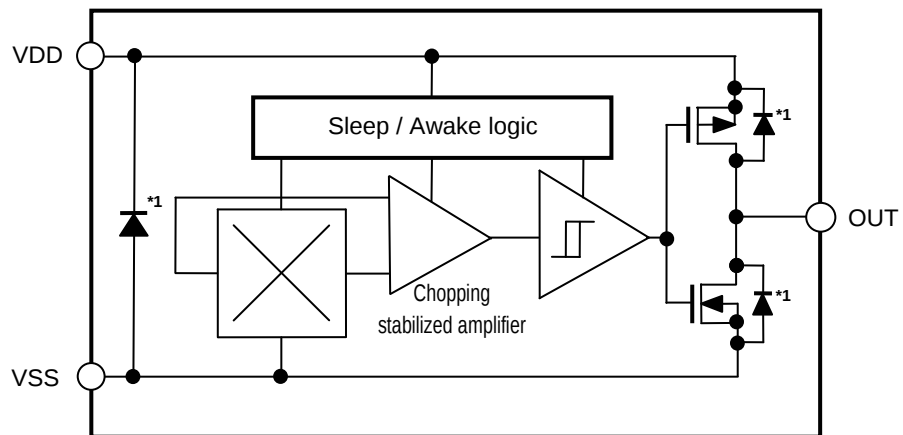
1. Nch open-drain output product



*1. Parasitic diode

Figure 1

2. CMOS output product

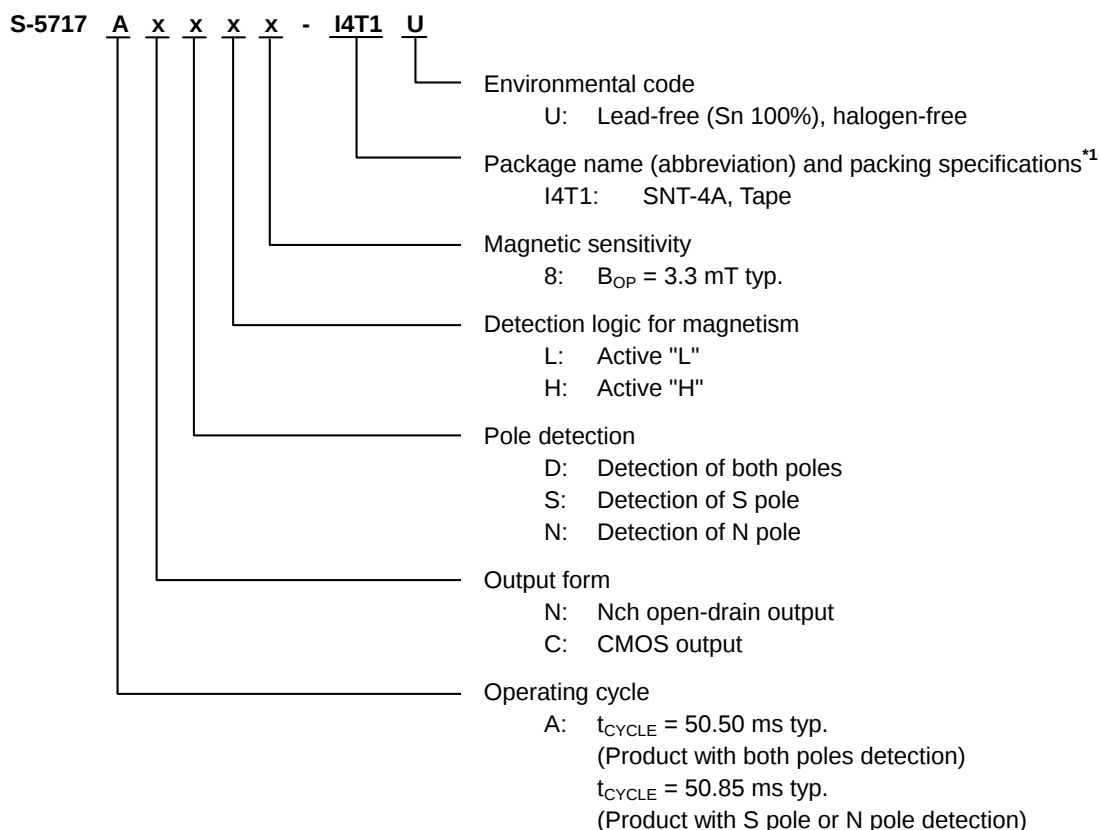


*1. Parasitic diode

Figure 2

■ Product Name Structure

1. Product name



*1. Refer to the tape drawing.

2. Package

Table 1 Package Drawing Codes

Package Name	Dimension	Tape	Reel	Land
SNT-4A	PF004-A-P-SD	PF004-A-C-SD	PF004-A-R-SD	PF004-A-L-SD

3. Product name list

3.1 SNT-4A

3.1.1 Nch open-drain output product

Table 2

Product Name	Operating Cycle (t_{CYCLE})	Output Form	Pole Detection	Detection Logic for Magnetism	Magnetic Sensitivity (B_{OP})
S-5717ANDL8-I4T1U	50.50 ms typ.	Nch open-drain output	Both poles	Active "L"	3.3 mT typ.

Remark Please contact our sales office for products other than the above.

3.1.2 CMOS output product

Table 3

Product Name	Operating Cycle (t_{CYCLE})	Output Form	Pole Detection	Detection Logic for Magnetism	Magnetic Sensitivity (B_{OP})
S-5717ACDL8-I4T1U	50.50 ms typ.	CMOS output	Both poles	Active "L"	3.3 mT typ.

Remark Please contact our sales office for products other than the above.

■ Pin Configuration

1. SNT-4A

Top view

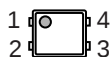


Figure 3

Table 4

Pin No.	Symbol	Pin Description
1	OUT	Output pin
2	VSS	GND pin
3	NC ^{*1}	No connection
4	VDD	Power supply pin

^{*1}. The NC pin is electrically open.

The NC pin can be connected to the VDD pin or the VSS pin.

■ Absolute Maximum Ratings

Table 5

(Ta = +25°C unless otherwise specified)

Item		Symbol	Absolute Maximum Rating	Unit
Power supply voltage		V _{DD}	V _{SS} – 0.3 to V _{SS} + 7.0	V
Output current		I _{OUT}	±1.0	mA
Output voltage	Nch open-drain output product	V _{OUT}	V _{SS} – 0.3 to V _{SS} + 7.0	V
	CMOS output product		V _{SS} – 0.3 to V _{DD} + 0.3	V
Power dissipation		P _D	300 ^{*1}	mW
Operation ambient temperature		T _{opr}	–40 to +85	°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 × 1.6 mm

(2) 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.

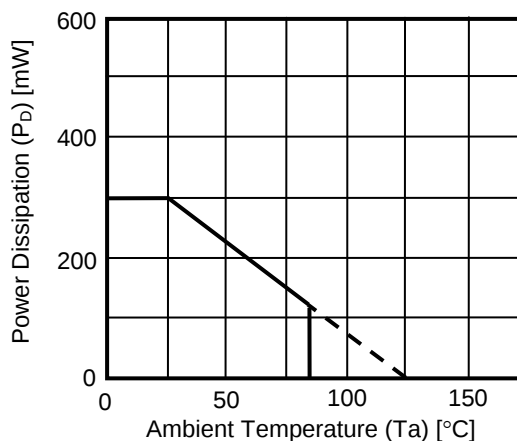


Figure 4 Power Dissipation of Package (When Mounted on Board)

■ Electrical Characteristics

1. Product with both poles detection

1.1 S-5717AxDxx

Table 6

(Ta = +25°C, V_{DD} = 1.85 V, V_{SS} = 0 V unless otherwise specified)

Item	Symbol	Condition		Min.	Typ.	Max.	Unit	Test Circuit
Power supply voltage	V _{DD}	—		1.60	1.85	3.60	V	—
Current consumption	I _{DD}	Average value		—	2.0	3.5	μA	1
Output voltage	V _{OUT}	Nch open-drain output product	Output transistor Nch, I _{OUT} = 0.5 mA	—	—	0.2	V	2
		CMOS output product	Output transistor Nch, I _{OUT} = 0.5 mA	—	—	0.2	V	2
			Output transistor Pch, I _{OUT} = -0.5 mA	V _{DD} - 0.2	—	—	V	3
Leakage current	I _{LEAK}	Nch open-drain output product Output transistor Nch, V _{OUT} = 3.5 V		—	—	1	μA	4
Awake mode time	t _{AW}	—		—	0.10	—	ms	—
Sleep mode time	t _{SL}	—		—	50.40	—	ms	—
Operating cycle	t _{CYCLE}	t _{AW} + t _{SL}		—	50.50	100.00	ms	—

2. Product with S pole or N pole detection

2.1 S-5717AxSxx, S-5717AxNxx

Table 7

(Ta = +25°C, V_{DD} = 1.85 V, V_{SS} = 0 V unless otherwise specified)

Item	Symbol	Condition		Min.	Typ.	Max.	Unit	Test Circuit
Power supply voltage	V _{DD}	—		1.60	1.85	3.60	V	—
Current consumption	I _{DD}	Average value		—	1.4	3.0	μA	1
Output voltage	V _{OUT}	Nch open-drain output product	Output transistor Nch, I _{OUT} = 0.5 mA	—	—	0.2	V	2
		CMOS output product	Output transistor Nch, I _{OUT} = 0.5 mA	—	—	0.2	V	2
			Output transistor Pch, I _{OUT} = -0.5 mA	V _{DD} - 0.2	—	—	V	3
Leakage current	I _{LEAK}	Nch open-drain output product Output transistor Nch, V _{OUT} = 3.5 V		—	—	1	μA	4
Awake mode time	t _{AW}	—		—	0.05	—	ms	—
Sleep mode time	t _{SL}	—		—	50.80	—	ms	—
Operating cycle	t _{CYCLE}	t _{AW} + t _{SL}		—	50.85	100.00	ms	—

■ Magnetic Characteristics

1. Product with both poles detection

1.1 Product with $B_{OP} = 3.3$ mT typ.

Table 8

($T_a = +25^\circ\text{C}$, $V_{DD} = 1.85$ V, $V_{SS} = 0$ V unless otherwise specified)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Test Circuit
Operation point*1	S pole	B _{OPS}	–	2.3	3.3	4.7	mT	5
	N pole	B _{OPN}	–	–4.7	–3.3	–2.3	mT	5
Release point*2	S pole	B _{RPS}	–	1.2	2.4	3.4	mT	5
	N pole	B _{RPN}	–	–3.4	–2.4	–1.2	mT	5
Hysteresis width*3	S pole	B _{HYSS}	B _{HYSS} = B _{OPS} – B _{RPS}	–	0.9	–	mT	5
	N pole	B _{HYSN}	B _{HYSN} = B _{OPN} – B _{RPN}	–	0.9	–	mT	5

2. Product with S pole detection

2.1 Product with $B_{OP} = 3.3$ mT typ.

Table 9

($T_a = +25^\circ\text{C}$, $V_{DD} = 1.85$ V, $V_{SS} = 0$ V unless otherwise specified)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Test Circuit
Operation point ^{*1}	S pole	B _{OPS}	–	2.3	3.3	4.7	mT	5
Release point ^{*2}	S pole	B _{RPS}	–	1.2	2.4	3.4	mT	5
Hysteresis width ^{*3}	S pole	B _{HYSS}	B _{HYSS} = B _{OPS} – B _{RPS}	–	0.9	–	mT	5

3. Product with N pole detection

3.1 Product with $B_{OP} = 3.3$ mT typ.

Table 10

($T_a = +25^\circ\text{C}$, $V_{DD} = 1.85$ V, $V_{SS} = 0$ V unless otherwise specified)

(Ta = +25 °C, VDD = 1.65 V, VSS = 0 V unless otherwise specified)								
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Test Circuit
Operation point ^{*1}	N pole	B _{OPN}	–	–4.7	–3.3	–2.3	mT	5
Release point ^{*2}	N pole	B _{RPN}	–	–3.4	–2.4	–1.2	mT	5
Hysteresis width ^{*3}	N pole	B _{HYSN}	B _{HYSN} = B _{OPN} – B _{RPN}	–	0.9	–	mT	5

***1.** B_{OPN} , B_{OPS} : Operation points

B_{OPN} and B_{OPS} are the values of magnetic flux density when the output voltage (V_{OUT}) is inverted after the magnetic flux density applied to the S-5717 Series by the magnet (N pole or S pole) is increased (the magnet is moved closer). Even when the magnetic flux density exceeds B_{OPN} or B_{OPS} , V_{OUT} retains the status.

***2.** B_{RPN} , B_{RPS} : Release points

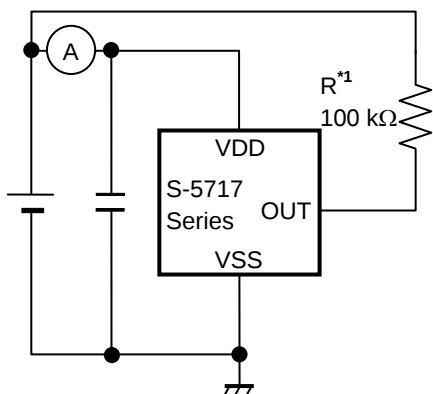
B_{RPN} and B_{RPS} are the values of magnetic flux density when the output voltage (V_{OUT}) is inverted after the magnetic flux density applied to the S-5717 Series by the magnet (N pole or S pole) is decreased (the magnet is moved further away). Even when the magnetic flux density falls below B_{RPN} or B_{RPS} , V_{OUT} retains the status.

***3.** B_{HYSN} , B_{HYSS} : Hysteresis widths

B_{HYSN} and B_{HYSS} are the difference between B_{OPN} and B_{RPN} , and B_{OPS} and B_{RPS} , respectively.

Remark The unit of magnetic density mT can be converted by using the formula 1 mT = 10 Gauss.

■ Test Circuits



*1. Resistor (R) is unnecessary for the CMOS output product.

Figure 5 Test Circuit 1

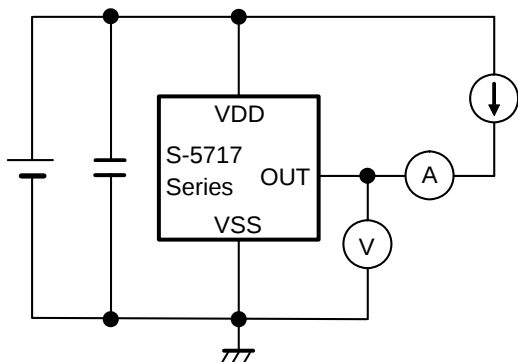


Figure 6 Test Circuit 2

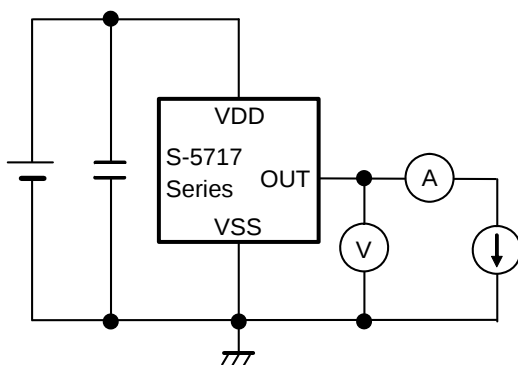


Figure 7 Test Circuit 3

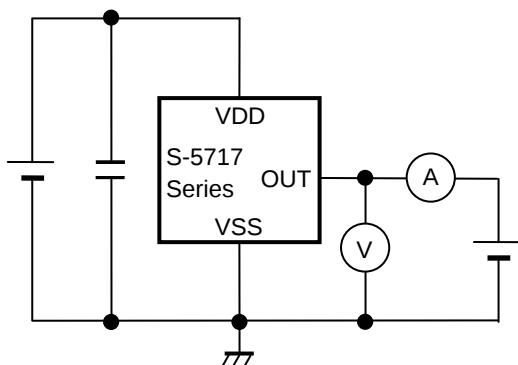
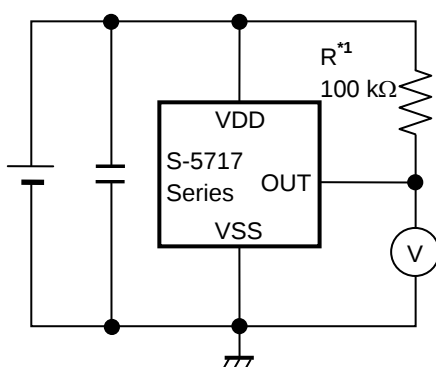


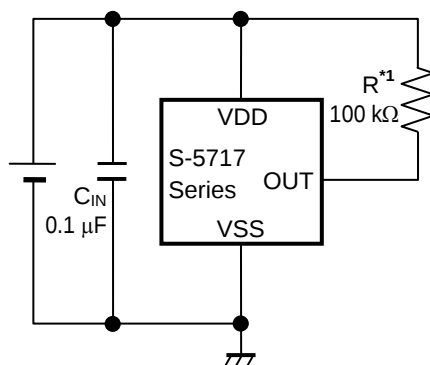
Figure 8 Test Circuit 4



*1. Resistor (R) is unnecessary for the CMOS output product.

Figure 9 Test Circuit 5

■ Standard Circuit



*1. Resistor (R) is unnecessary for the CMOS output product.

Figure 10

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

■ Operation

1. Direction of applied magnetic flux

The S-5717 Series detects the flux density which is vertical to the marking surface.

In the product with both poles detection, the output voltage (V_{OUT}) is inverted when the S pole or N pole is moved closer to the marking surface.

In the product with S pole detection, V_{OUT} is inverted when the S pole is moved closer to the marking surface.

In the product with N pole detection, V_{OUT} is inverted when the N pole is moved closer to the marking surface.

Figure 11 shows the direction in which magnetic flux is being applied.

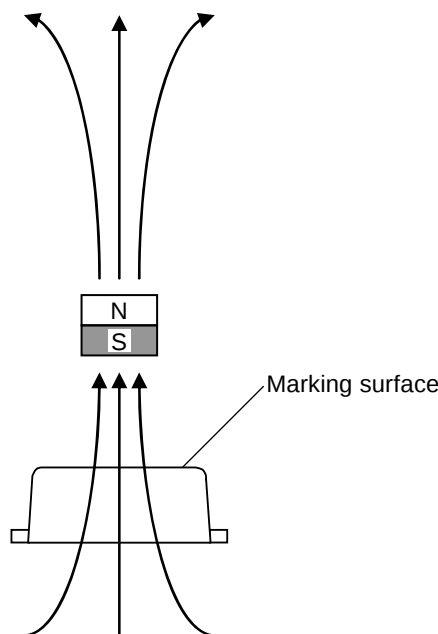


Figure 11

2. Position of Hall sensor

Figure 12 shows the position of Hall sensor.

The center of this Hall sensor is located in the area indicated by a circle, which is in the center of a package as described below.

The following also shows the distance (typ. value) between the marking surface and the chip surface of a package.

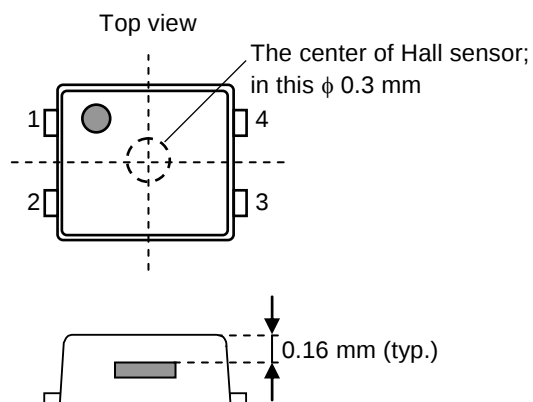


Figure 12

3. Basic operation

The S-5717 Series changes the output voltage level (V_{OUT}) according to the level of the magnetic flux density (N pole or S pole) applied by a magnet.

The following explains the operation when the magnetism detection logic is active "L".

3.1 Product with both poles detection

When the magnetic flux density vertical to the marking surface exceeds the operation point (B_{OPN} or B_{OPS}) after the S pole or N pole of a magnet is moved closer to the marking surface of the S-5717 Series, V_{OUT} changes from "H" to "L". When the S pole or N pole of a magnet is moved further away from the marking surface of the S-5717 Series and the magnetic flux density is lower than the release point (B_{RPN} or B_{RPS}), V_{OUT} changes from "L" to "H".

Figure 13 shows the relationship between the magnetic density and V_{OUT} .

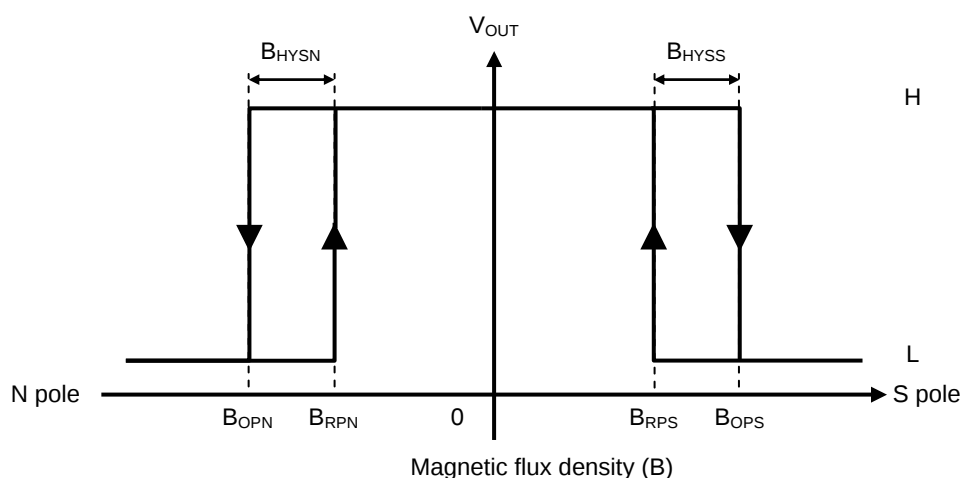


Figure 13

3.2 Product with S pole detection

When the magnetic flux density vertical to the marking surface exceeds B_{OPS} after the S pole of a magnet is moved closer to the marking surface of the S-5717 Series, V_{OUT} changes from "H" to "L". When the S pole of a magnet is moved further away from the marking surface of the S-5717 Series and the magnetic flux density is lower than B_{RPS} , V_{OUT} changes from "L" to "H".

Figure 14 shows the relationship between the magnetic density and V_{OUT} .

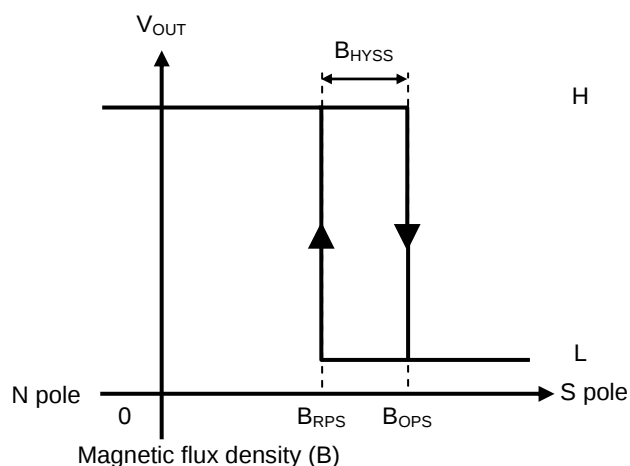


Figure 14

3.3 Product with N pole detection

When the magnetic flux density vertical to the marking surface exceeds B_{OPN} after the N pole of a magnet is moved closer to the marking surface of the S-5717 Series, V_{OUT} changes from "H" to "L". When the N pole of a magnet is moved further away from the marking surface of the S-5717 Series and the magnetic flux density is lower than B_{RPN} , V_{OUT} changes from "L" to "H".

Figure 15 shows the relationship between the magnetic density and V_{OUT} .

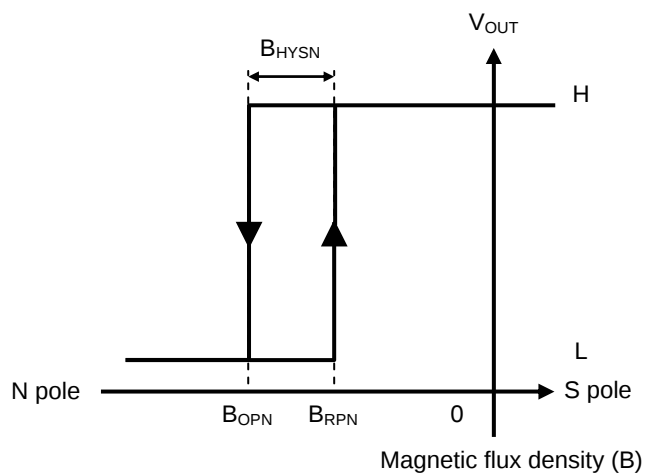


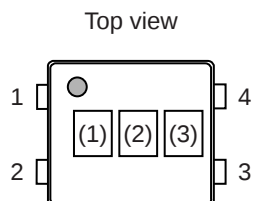
Figure 15

■ Precautions

- If the impedance of the power supply is high, the IC may malfunction due to a supply voltage drop caused by feed-through current. Take care with the pattern wiring to ensure that the impedance of the power supply is low.
- Note that the IC may malfunction if the power supply voltage rapidly changes.
- Do not apply an electrostatic discharge to this IC that exceeds the performance ratings of the built-in electrostatic protection circuit.
- Large stress on this IC may affect on the magnetic characteristics. Avoid large stress which is caused by bend and distortion during mounting the IC on a board or handle after mounting.
- SII claims no responsibility for any disputes arising out of or in connection with any infringement by products including this IC of patents owned by a third party.

■ Marking Specification

1. SNT-4A



(1) to (3): Product code (Refer to **Product name vs. Product code.**)

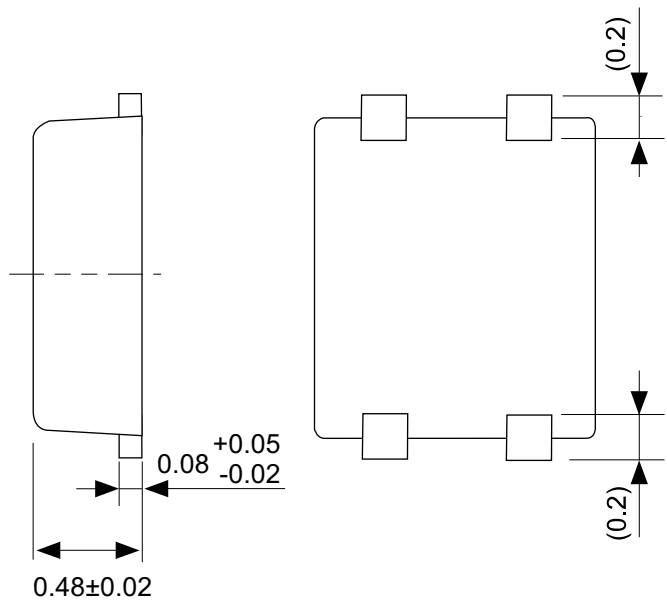
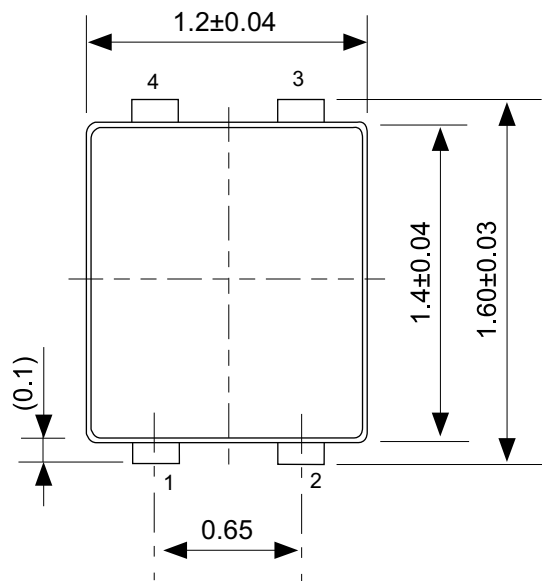
Product name vs. Product code

1.1 Nch open-drain output product

Product Name	Product Code		
	(1)	(2)	(3)
S-5717ANDL8-I4T1U	4	S	A

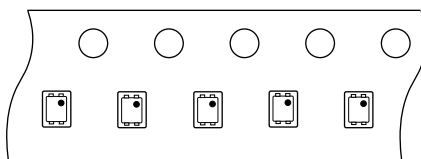
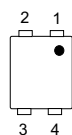
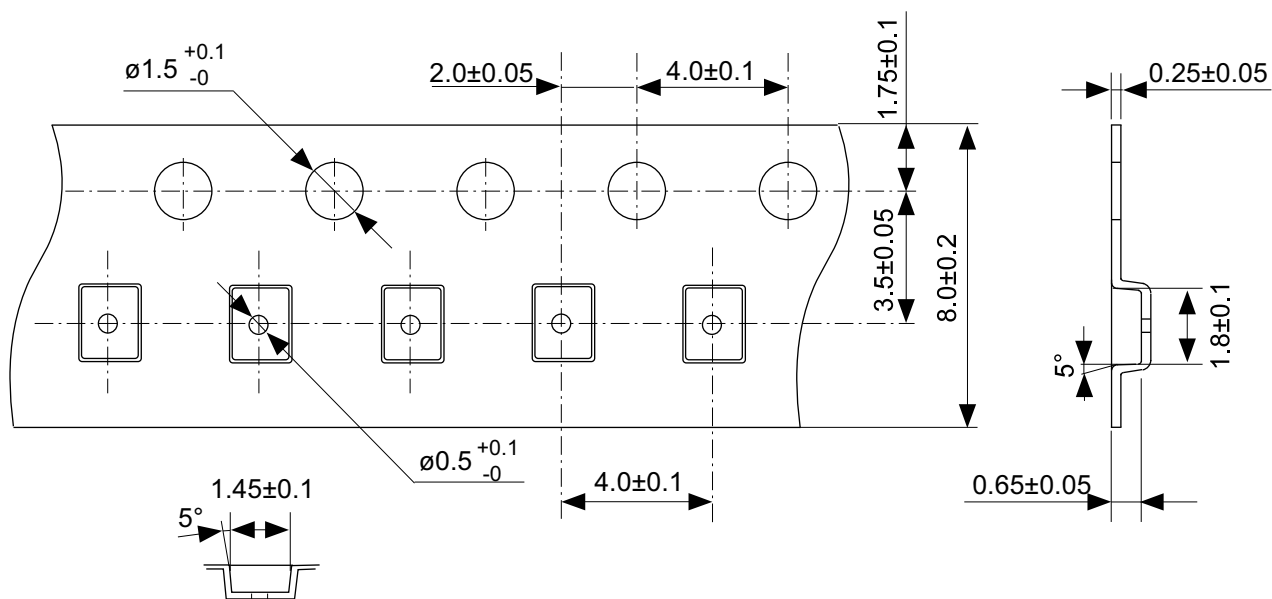
1.2 CMOS output product

Product Name	Product Code		
	(1)	(2)	(3)
S-5717ACDL8-I4T1U	4	S	B



No. PF004-A-P-SD-4.0

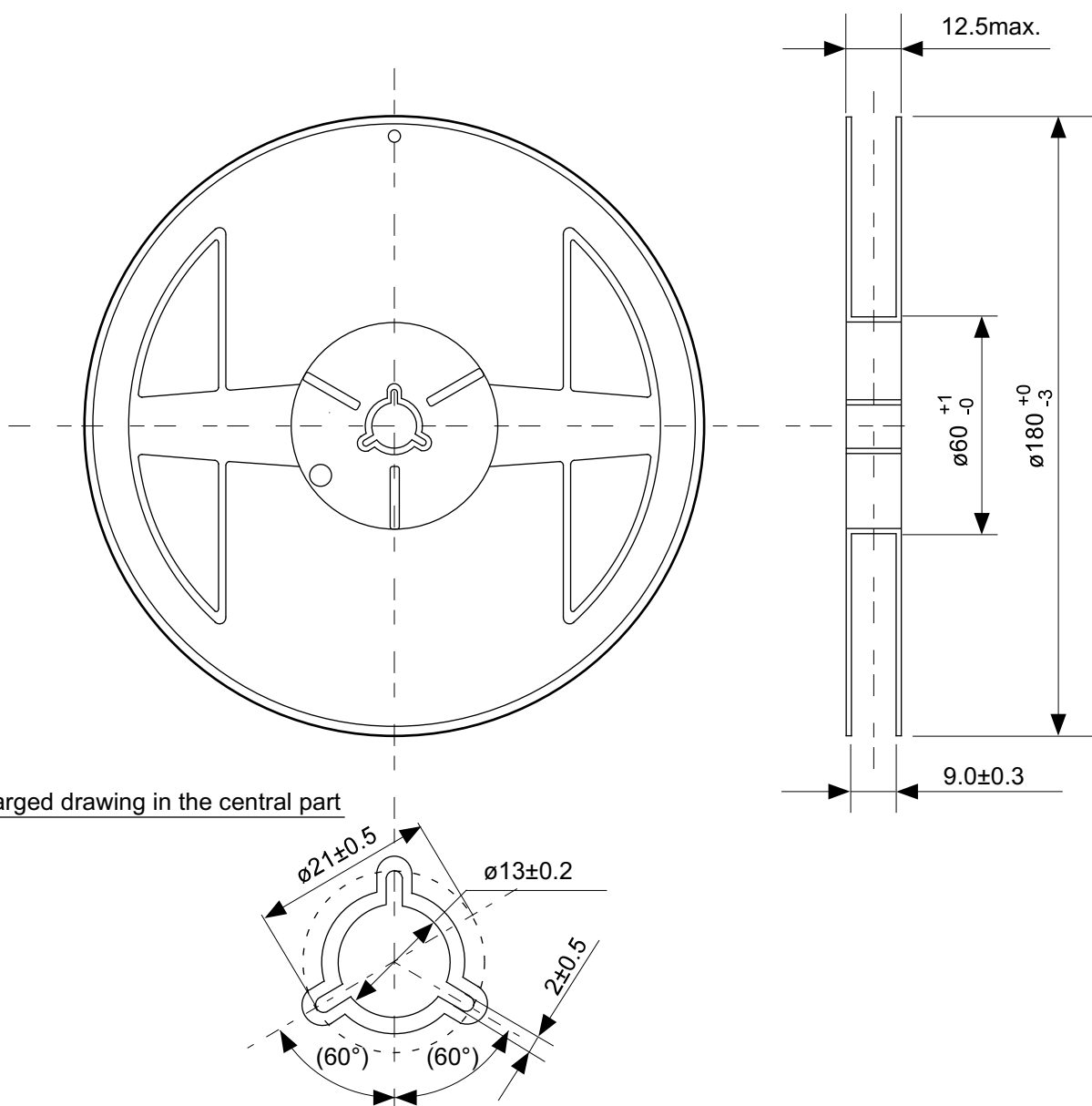
TITLE	SNT-4A-A-PKG Dimensions
No.	PF004-A-P-SD-4.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	



Feed direction

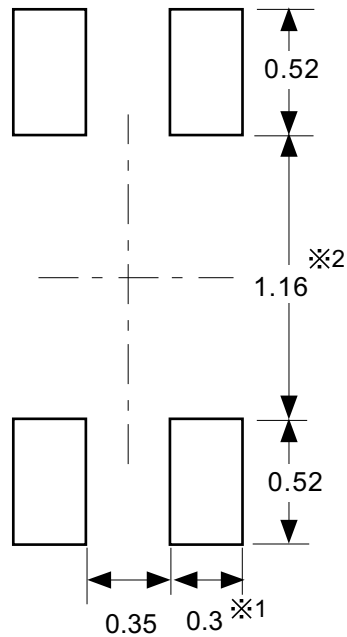
No. PF004-A-C-SD-1.0

TITLE	SNT-4A-A-Carrier Tape
No.	PF004-A-C-SD-1.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	



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		
Seiko Instruments 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. 掩膜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-4.0

TITLE	SNT-4A-A-Land Recommendation
No.	PF004-A-L-SD-4.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	



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