BIPOLAR DETECTION TYPE HALL IC WITH POWER-DOWN FUNCTION

S-5721A/5722A Series

The S-5721A/5722A Series, developed using CMOS technology, is a bipolar detection type Hall IC with a high-sensitivity that operates on a low current.
The output voltage changes when the S-5721A/5722A Series detects the intensity level of flux density and a polarity change. Using the S-5721A/5722A Series with a magnet makes it possible to detect rotation in various devices.
High-density mounting is possible by using the super-small SNT-4A package. Also, the S-5721A/5722A Series is the most suitable for portable devices due to the included power-down circuit.

■ Features

- Built-in chopping stabilized amplifier
- Detection of bipolar magnetic fields
- Applicable in various devices with wide range of option
  - Detection logic for magnetism : Level “H” at S pole detection, level “L” at S pole detection
  - Output types : CMOS output, Nch open drain output
- Wide power supply voltage range : 2.4 V to 5.5 V
- Low current consumption : 80 μA typ., 120 μA max. (S-5721A Series)
- High speed detection : Operating cycle 132 μs typ., 240 μs max. (S-5722A Series)
- Built-in power-down circuit : Extends battery life
  In the power-down mode 1.0 μA max.
- Operating temperature range : –40°C to +85°C
  Small dependency magnetic characteristics against temperature
- Small package : SNT-4A
- Lead-free product

■ Applications

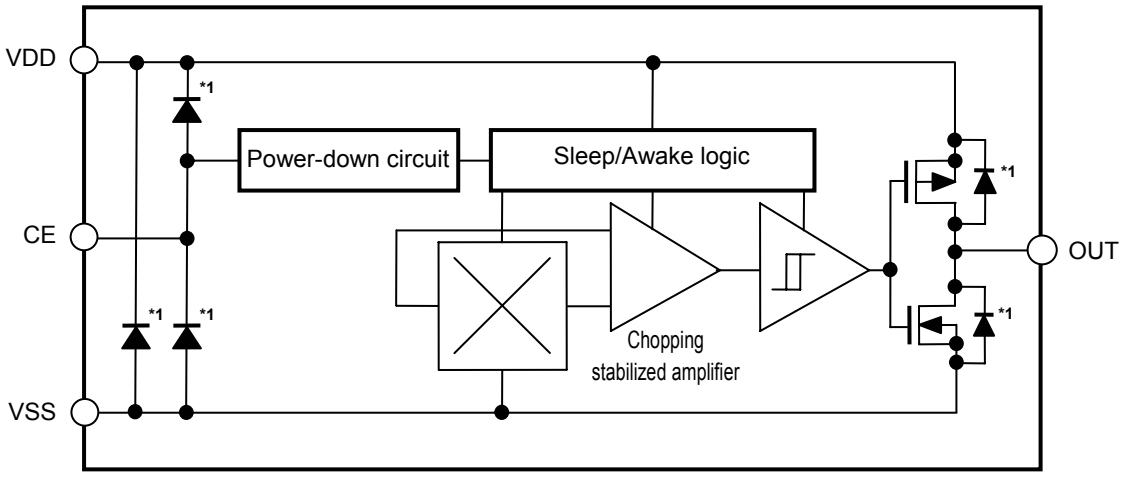
- Jog dials, wheel keys
- Trackballs, mouse devices
- Operation keys
- Playthings, portable games
- Home appliances

■ Package

Package Name	Drawing Code			
	Package	Tape	Reel	Land
SNT-4A	PF004-A	PF004-A	PF004-A	PF004-A

■ Block Diagrams

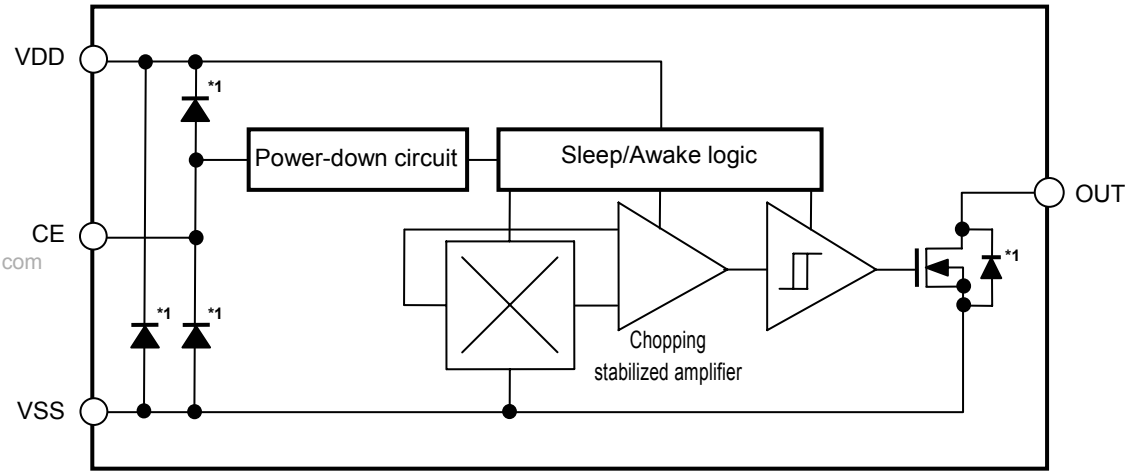
1. CMOS output product



***1.** Parasitic diode

Figure 1

2. Nch open drain output product

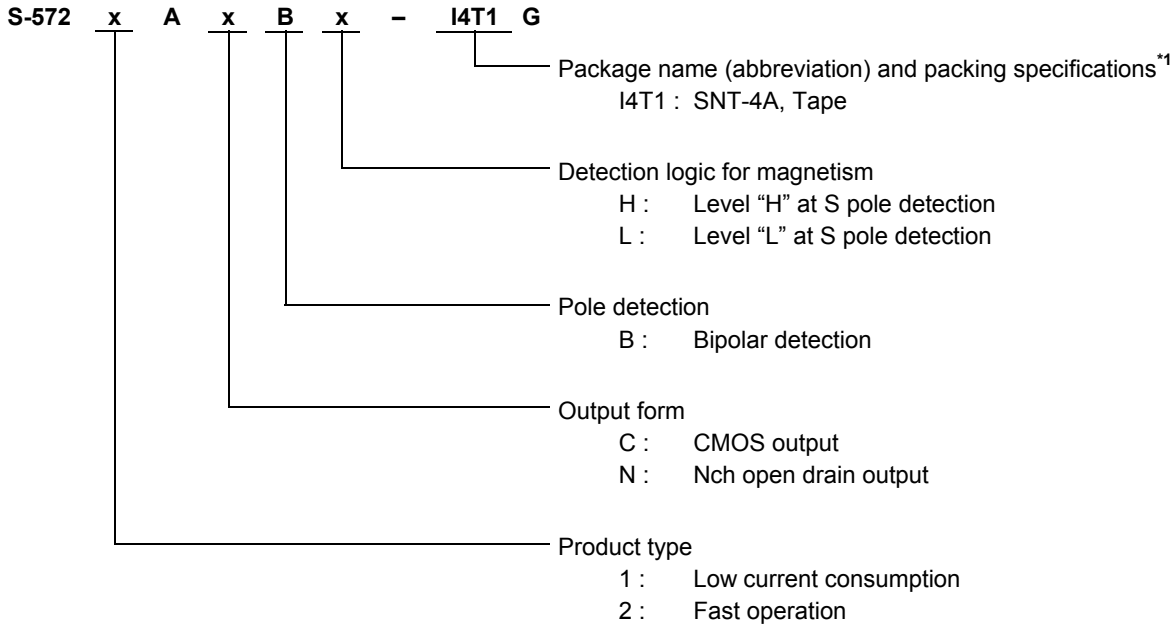


***1.** Parasitic diode

Figure 2

■ Product Name Structure

1. Product name



***1.** Refer to the tape specifications at the end of this book.

2. Product name list

Table 1

Product Type	Output Form	Pole Detection	Detection Logic for Magnetism	Product Name
Low current consumption	CMOS output	Bipolar detection	Level “H” at S pole detection	S-5721ACBH-I4T1G
Low current consumption	Nch open drain output	Bipolar detection	Level “H” at S pole detection	S-5721ANBH-I4T1G
Fast operation	CMOS output	Bipolar detection	Level “H” at S pole detection	S-5722ACBH-I4T1G

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

■ Pin Configurations

SNT-4A
Top view

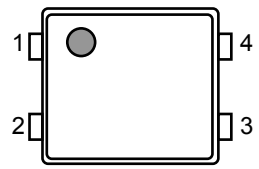


Figure 3

Table 2

Pin No.	Symbol	Pin Description
1	VDD	Power supply pin
2	VSS	GND pin
3	CE	Enabling pin “H” : Enables operation “L” : Power-down
4	OUT	Output pin

■ Absolute Maximum Ratings

Table 3

(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
Input voltage		V_{CE}	V_{SS}–0.3 to V_{DD}+0.3	V
Output voltage	CMOS output	V_{OUT}	V_{SS}–0.3 to V_{DD}+0.3	V
	Nch open drain output		V_{SS}–0.3 to V_{SS}+7.0	V
Power dissipation		P_D	300[*1]	mW
Operating 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 × t1.6 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.

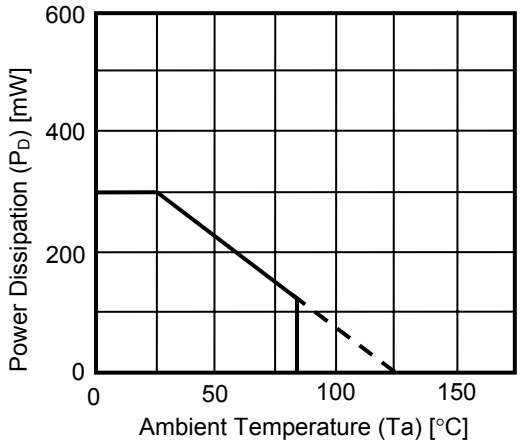


Figure 4 Power Dissipation of Package (When Mounted on Board)

■ Electrical Characteristics

Table 4

(Ta = 25°C, V_{DD} = 3.0 V, and V_{SS} = 0 V unless otherwise specified)

Item	Symbol	Conditions		Min.	Typ.	Max.	Unit	Test Circuit
Power supply voltage	V_{DD}	–		2.4	3.0	5.5	V	–
Current consumption when operation is enabled	I_{DD1}	V_{CE} = V_{DD}, average value	S-5721A Series	–	80	120	μA	1
			S-5722A Series	–	950	1200	μA	1
Current consumption in power-down mode	I_{DD2}	V_{CE} = V_{SS}		–	–	1	μA	2
Output current	I_{OUT}	Output transistor Nch, V_{OUT} = 0.4 V		1	–	–	mA	3
		CMOS output Output transistor Pch, V_{OUT} = V_{DD} – 0.4 V		–	–	–1	mA	3
Output leakage current	I_{LEAK}	Nch open drain output Output transistor Nch, V_{OUT} = 5.5 V		–	–	1	μA	3
Awake mode time	t_{AW}	V_{CE} = V_{DD}		–	121	–	μs	–
Sleep mode time	t_{SL}	V_{CE} = V_{DD}	S-5721A Series	–	1.46	–	ms	–
			S-5722A Series	–	0.011	–	ms	–
Operating cycle	t_{CYCLE}	t_{AW} + t_{SL}, V_{CE} = V_{DD}	S-5721A Series	–	1.58	2.88	ms	–
			S-5722A Series	–	0.132	0.24	ms	–
Enabling pin input voltage “L” level	V_{CEL}	–		–	–	V_{DD} × 0.3	V	–
Enabling pin input voltage “H” level	V_{CEH}	–		V_{DD} × 0.7	–	–	V	–
Enabling pin input current “L” level	I_{CEL}	V_{DD} = 3.0 V, V_{CE} = 0 V		–1	–	1	μA	4
Enabling pin input current “H” level	I_{CEH}	V_{DD} = 3.0 V, V_{CE} = 3.0 V		–1	–	1	μA	5
Power-down transition time	t_{OFF}	–		–	–	240	μs	–
Enable transition time	t_{ON}	–		–	–	160	μs	–
Time for update output logic after input “H” enable pin	t_{OE}	–		–	–	400	μs	–

■ Magnetic Characteristics

Table 5

(Ta = 25°C, V_{DD} = 3.0 V, V_{SS} = 0 V, and V_{CE} = V_{DD} unless otherwise specified)

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit	Test Circuit
Operating point *1	S pole	B_{OP}	–	0.5	2.5	4.6	mT	6
Release point *2	N pole	B_{RP}	–	–4.6	–2.5	–0.5	mT	6
Hysteresis width *3		B_{HYS}	B_{HYS} = B_{OP} – B_{RP}	–	5.0	–	mT	6

***1.** B_{OP} : Operating point
The operating point is the value of magnetic flux density when the detection logic for magnetism is “H” when the S pole is detected, and when the output voltage (V_{OUT}) is inverted from “L” to “H” after the magnetic flux density applied to the S-5721A/5722A Series by the magnet (S pole) is increased (by moving the magnet closer).
V_{OUT} retains the state until a magnetic flux density of the N pole higher than B_{RP} is applied.

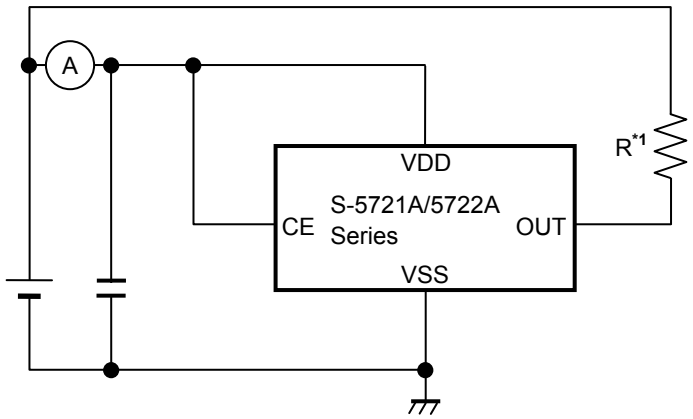
***2.** B_{RP} : Release point
The release point is the value of magnetic flux density when the detection logic for magnetism is “H” when the S pole is detected, and when the output voltage (V_{OUT}) is inverted from “H” to “L” after the magnetic flux density applied to the S-5721A/5722A Series by the magnet (N pole) is increased (by moving the magnet closer).
V_{OUT} retains the state until a magnetic flux density of the S pole higher than B_{OP} is applied.

***3.** B_{HYS} : Hysteresis width
B_{HYS} is the difference between B_{OP} and B_{RP}.

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

■ Test Circuits

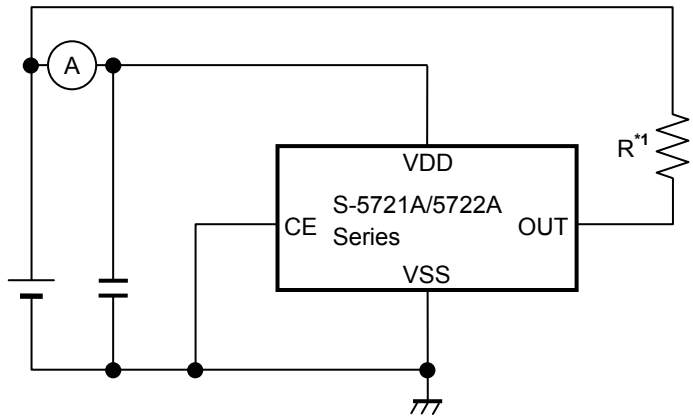
1.



***1.** Resistor (R) is necessary for the Nch open drain output product.

Figure 5

2.



***1.** Resistor (R) is necessary for the Nch open drain output product.

Figure 6

3.

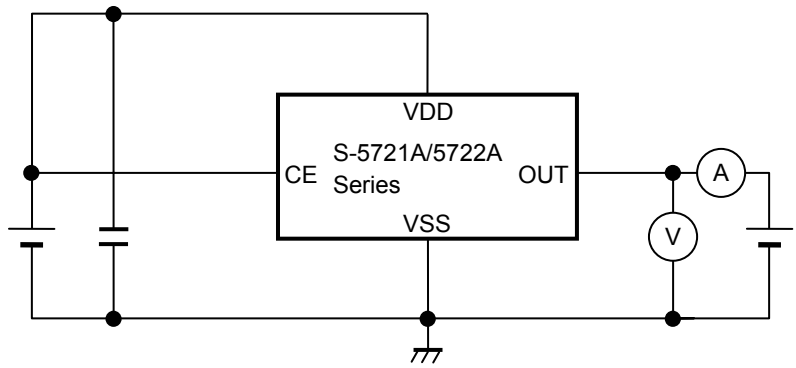


Figure 7

4.

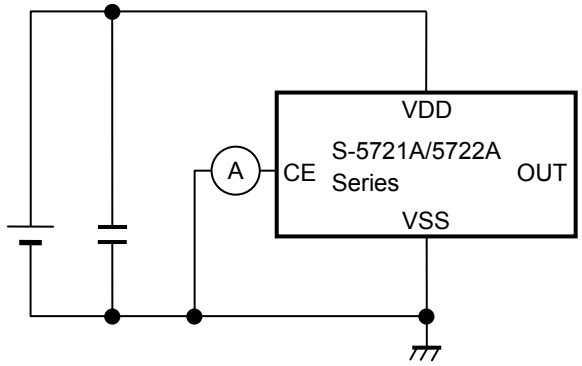


Figure 8

5.

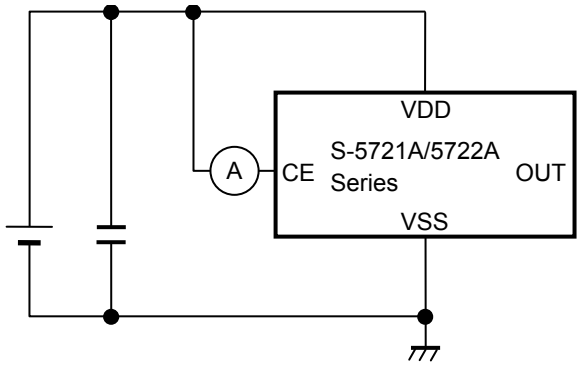
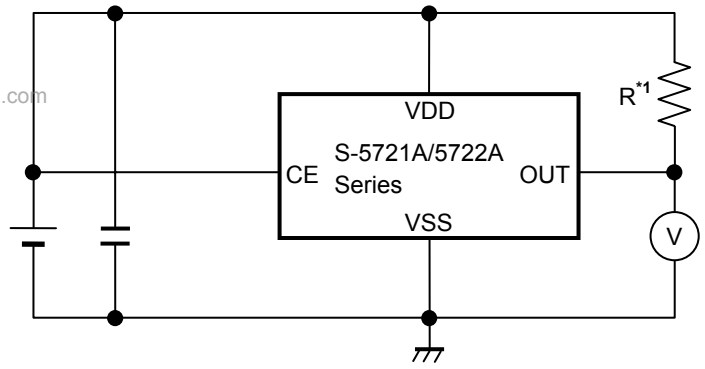


Figure 9

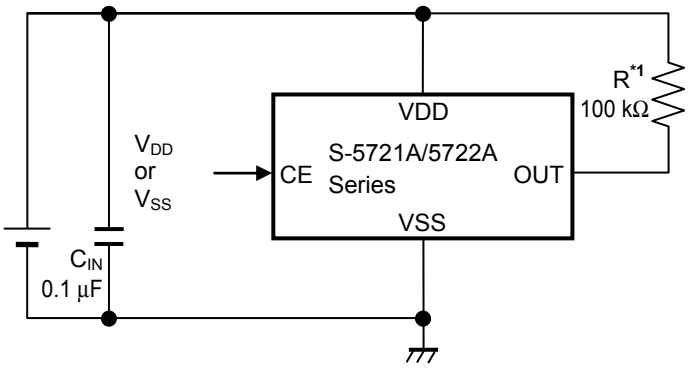
6.



***1.** Resistor (R) is necessary for the Nch open drain output product.

Figure 10

■ Standard Circuit



***1.** Resistor (R) is necessary for the Nch open drain output product.

Figure 11

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 and position of Hall sensor

The S-5721A/5722A Series detects the flux density perpendicular to the marking surface.
Figure 12 shows the direction in which magnetic flux is being applied.

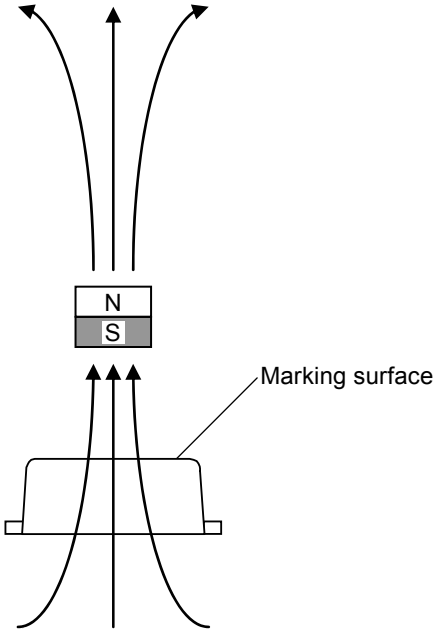


Figure 12

Figure 13 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.

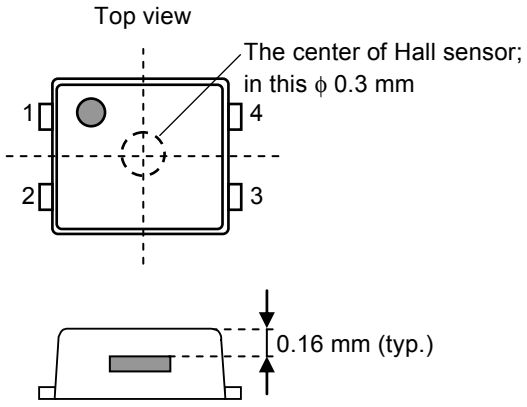


Figure 13

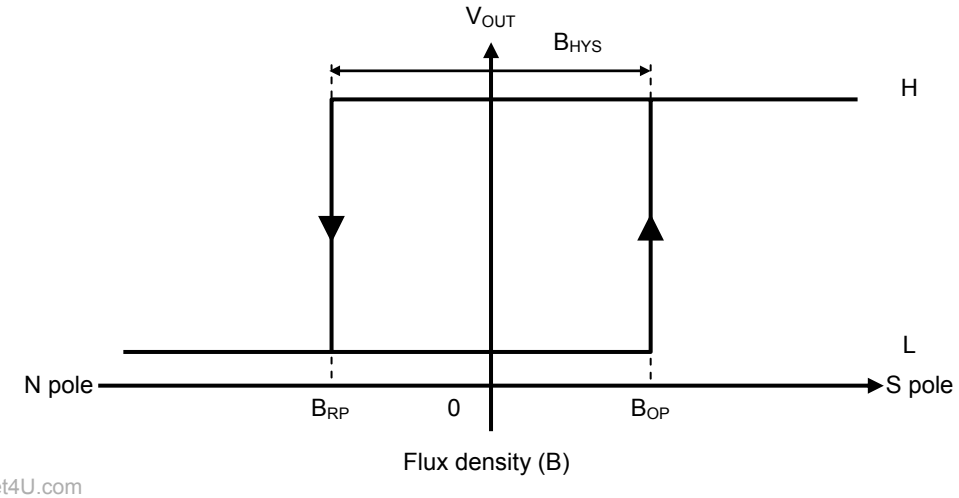
2. Basic operation

The S-5721A/5722A Series changes the output voltage (V_{OUT}) according to the level of the magnetic flux density (N or S pole) applied by a magnet.
The following explains the operation when the magnetism detection logic is “H” at S pole detection.

When the magnetic flux density of the S pole perpendicular to the marking surface exceeds B_{OP} after the S pole of a magnet is moved closer to the marking surface of the S-5721A/5722A Series, V_{OUT} changes from “L” to “H”. When the N pole of a magnet is moved closer to the marking surface of the S-5721A/5722A Series and the magnetic flux density of the N pole is higher than B_{RP}, V_{OUT} changes from “H” to “L”. While the magnetic field is not applied, V_{OUT} retains the state.
V_{OUT} also retains the state when “L” is applied to an enabling pin and the IC is powered down.

When the power is turned on, the output voltage (V_{OUT}) is “H” or “L”.
Definition of the magnetic field is performed every operating cycle indicated in “■ **Electrical Characteristics**”.
Figure 14 shows the relationship between the magnetic flux density and V_{OUT}.

(1) Products level “H” at S pole detection



(2) Products level “L” at S pole detection

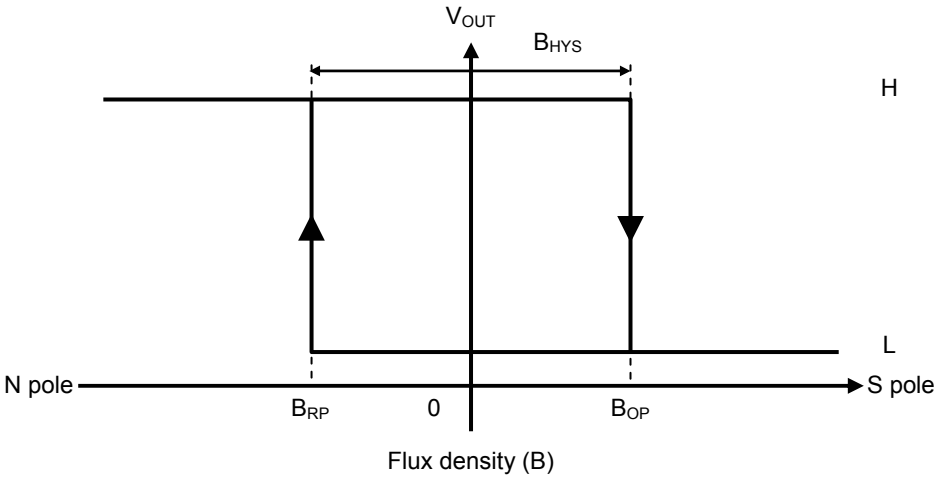


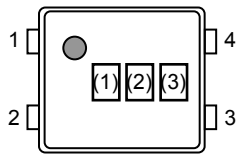
Figure 14

■ Precautions

- If the impedance of the power supply is high, the IC may malfunction due to a supply voltage drop caused by through-type 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.
- When designing for mass production using an application circuit described herein, the product deviation and temperature characteristics of the external parts should be taken into consideration. SII shall not bear any responsibility for patent infringements related to products using the circuits described herein.
- 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 Specifications

SNT-4A
Top view

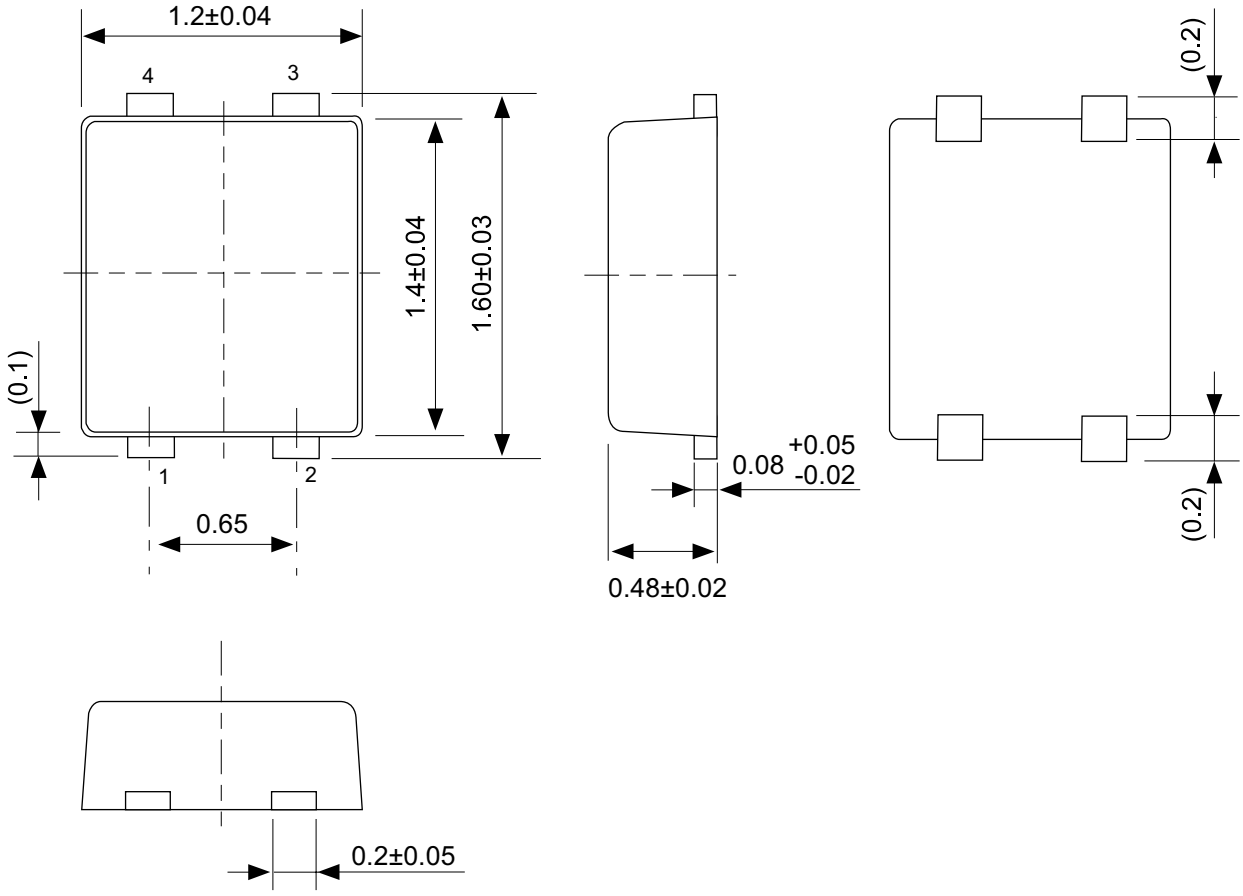


(1) to (3) : Product code (Refer to Product name vs. Product code.)

Product name vs. Product code

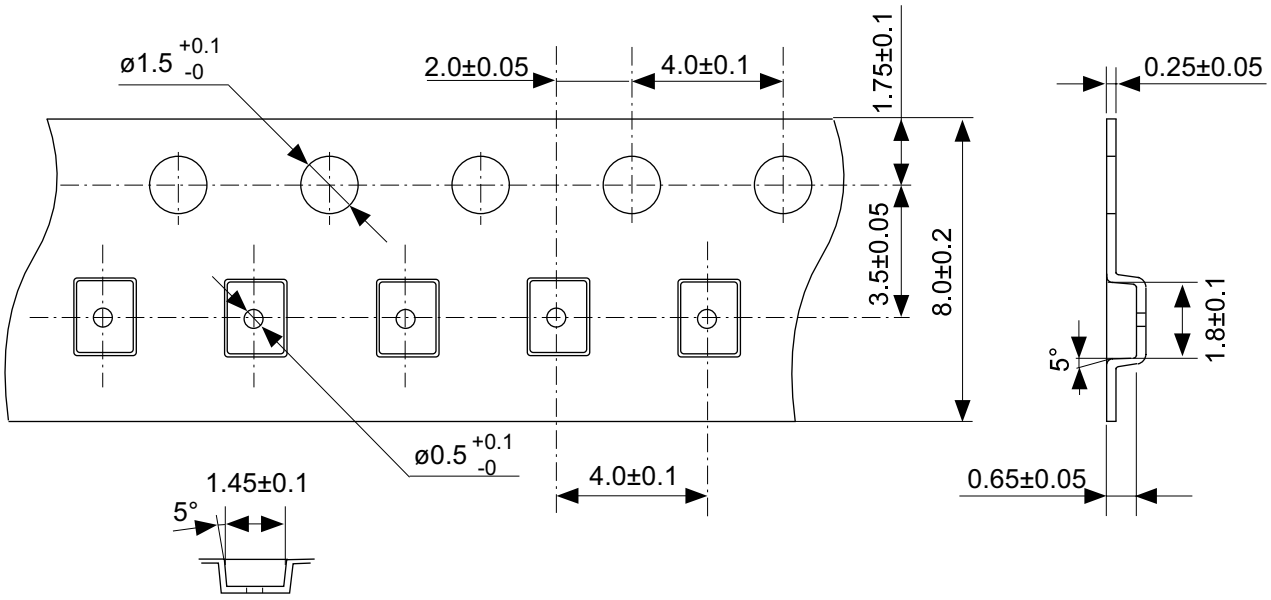
Product Name	Product Code		
	(1)	(2)	(3)
S-5721ACBH-I4T1G	T	3	A
S-5721ANBH-I4T1G	T	3	B
S-5722ACBH-I4T1G	T	4	A

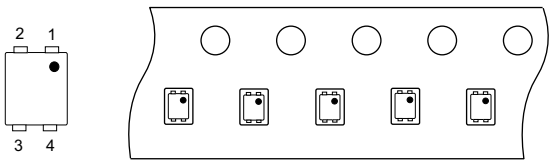
Remark Please contact our sales office for products other than the above.



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.	

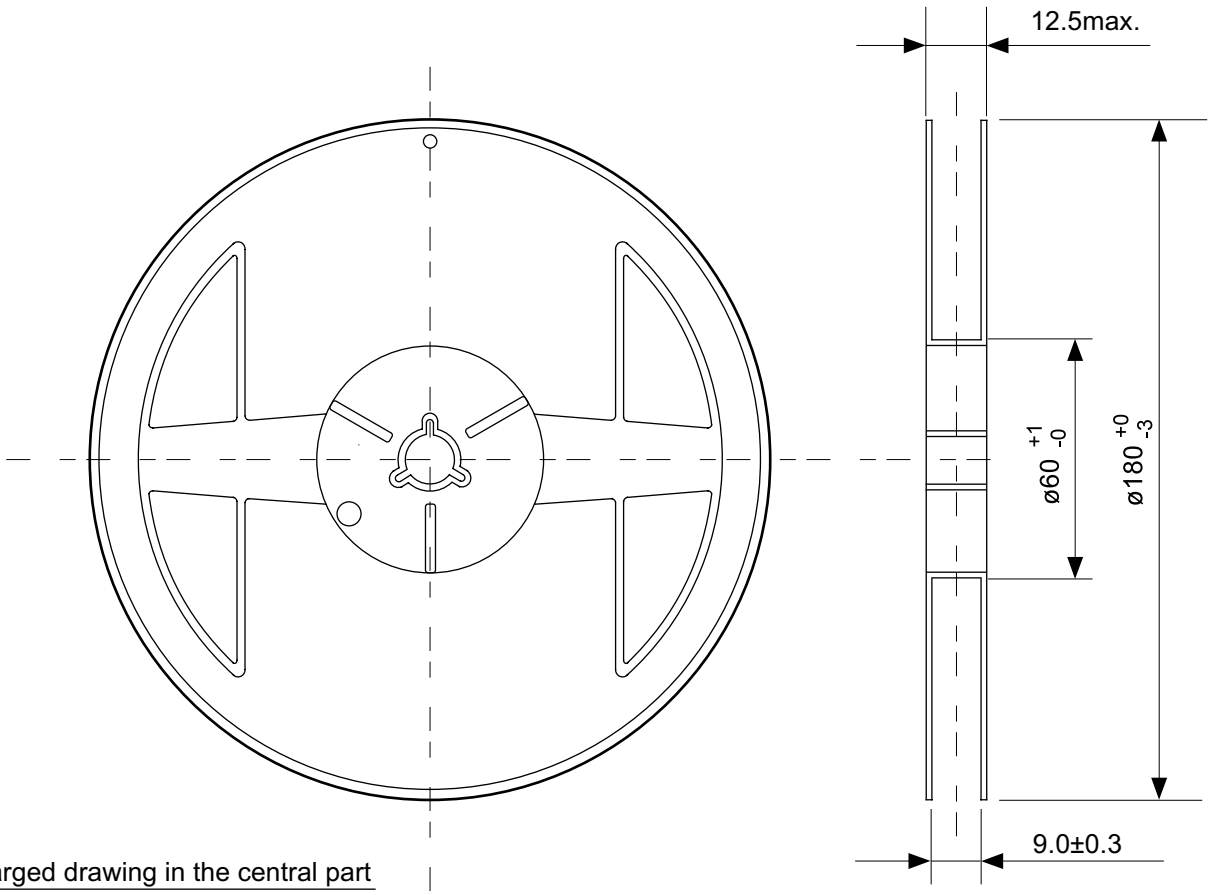




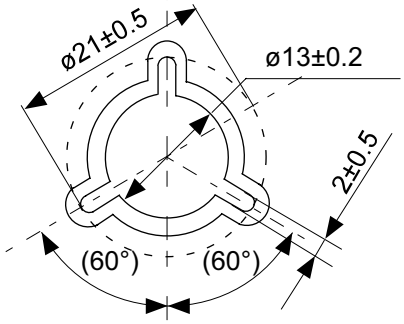
Feed direction

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.	



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		
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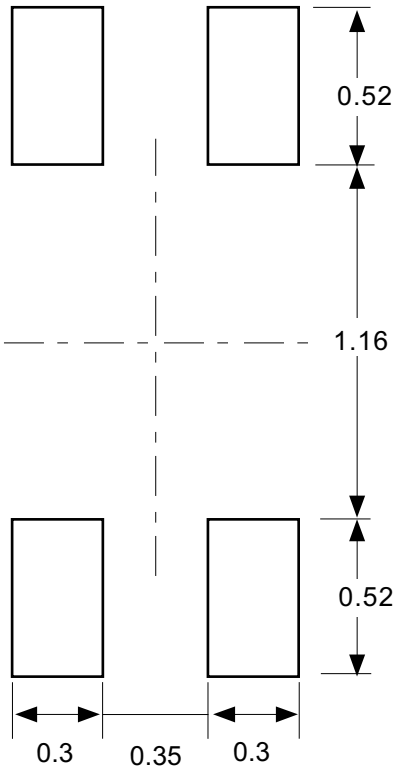
UNIT	mm		
Seiko Instruments Inc.			



Caution Making the wire pattern under the package is possible. However, note that the package may be upraised due to the thickness made by the silk screen printing and of a solder resist on the pattern because this package does not have the standoff.

注意 パッケージ下への配線パターン形成は可能ですが、本パッケージはスタンドオフが無いので、パターン上のレジスト厚み、シルク印刷の厚みによってパッケージが持ち上がることがありますのでご配慮ください。

No. PF004-A-L-SD-3.0

TITLE	SNT-4A-A-Land Recommendation
No.	PF004-A-L-SD-3.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	

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