

## BOTH POLES / UNIPOLAR DETECTION TYPE HALL IC

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Rev.3.0\_00

The S-5711A Series, developed by CMOS technology, is a Hall IC with a high-sensitivity and operates on a low current. The output voltage changes when the S-5711A Series detects the intensity level of flux density. Using the S-5711A Series with a magnet makes it possible to detect the open/close state in various devices. High-density mounting is possible by using the super-small SNT-4A, SOT-23-3 packages. Also, the S-5711A Series is the most suitable for portable devices due to the low current consumption.

### ■ Features

- Built-in chopping stabilized amplifier
- Applicable in various devices with wide range of option
 

Pole detection :	Detection of both poles, south pole or north pole
Detection logic for magnetism :	Active "L", active "H"
Output form :	Nch open drain output, CMOS output
- Wide power supply voltage range : 2.4 V to 5.5 V
- Low current consumption : 5.0  $\mu$ A typ., 8.0  $\mu$ A max.
- Range of operation temperature: -40°C to +85°C
- Small magnetic characteristics against temperature dependency
- Lead-free, Sn 100%, halogen-free<sup>\*1</sup>

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

### ■ Applications

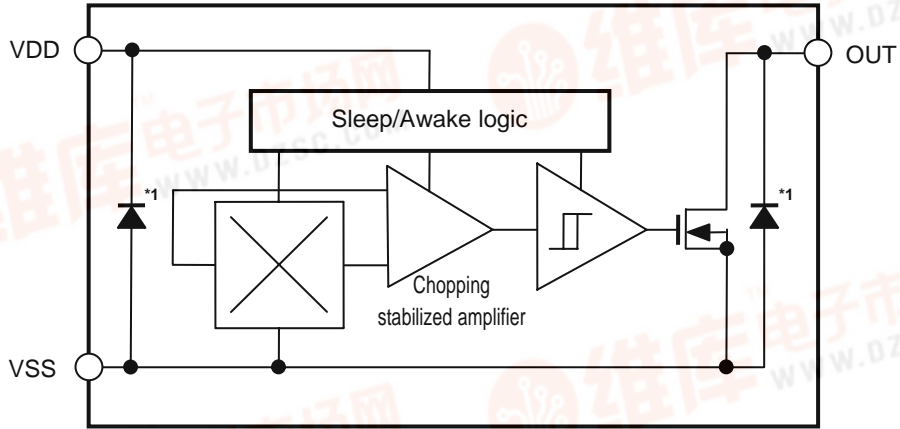
- Mobile phones (flip type, slide type, etc.)
- Laptop PCs
- Digital video cameras
- Playthings, portable games
- Home appliances

### ■ Packages

- SNT-4A
- SOT-23-3

■ Block Diagrams

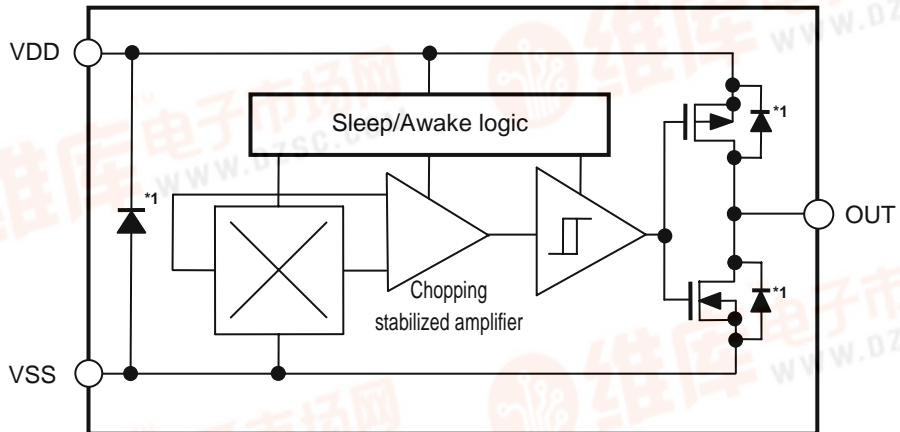
1. Nch open drain output product



\*1. Parasitic diode

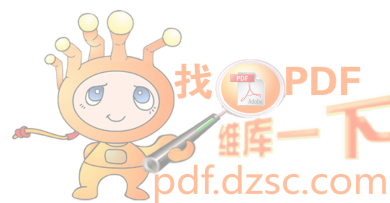
Figure 1

2. CMOS output product



\*1. Parasitic diode

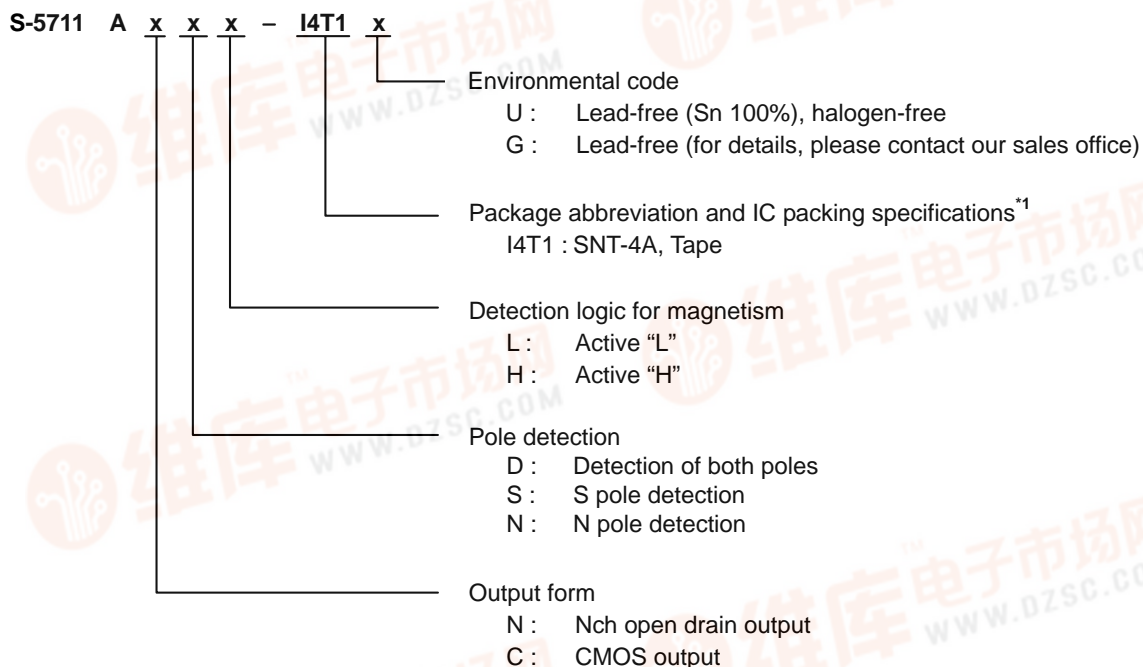
Figure 2



■ **Product Name Structure**

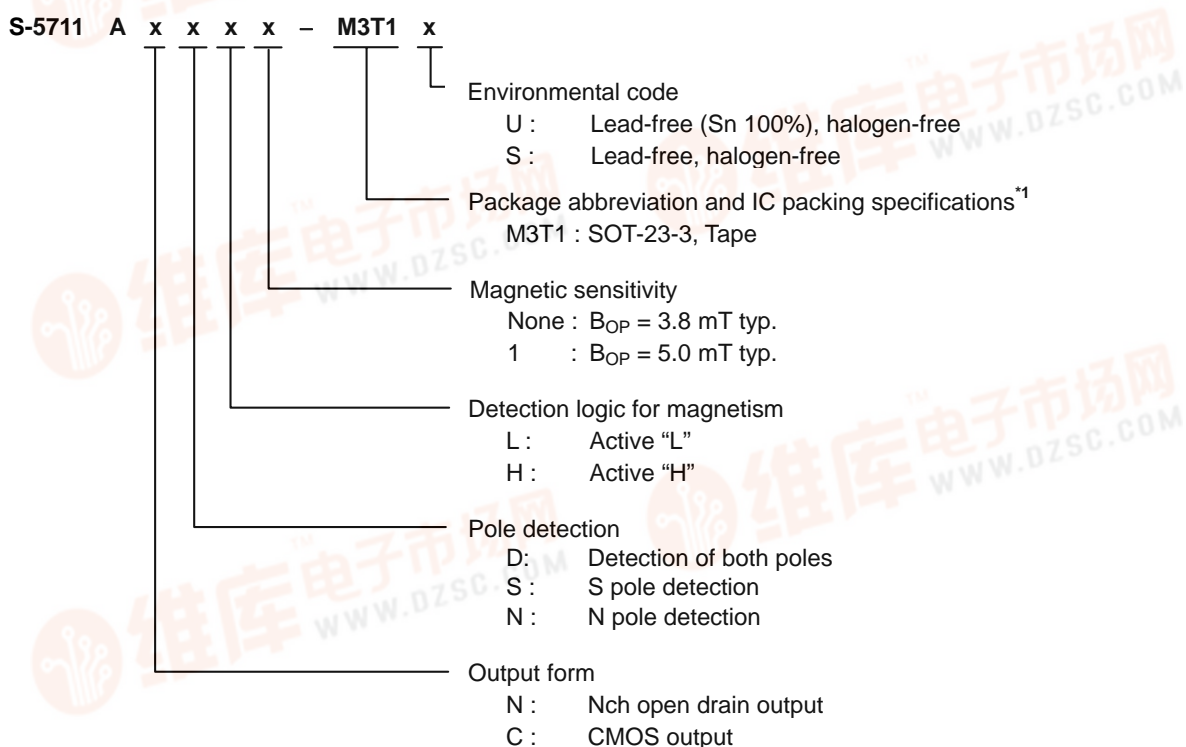
1. **Product name**

(1) **SNT-4A**



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

(2) **SOT-23-3**



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



**2. Package**

Package Name	Drawing Code			
	Package	Tape	Reel	Land
SNT-4A	PF004-A-P-SD	PF004-A-C-SD	PF004-A-R-SD	PF004-A-L-SD
SOT-23-3	MP003-C-P-SD	MP003-C-C-SD	MP003-Z-R-SD	-

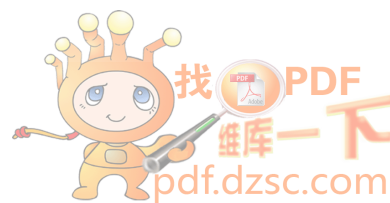
**3. Product name list**

**Table 1**

Output Form	Pole Detection	Detection Logic for Magnetism	Magnetic Sensitivity (B <sub>OP</sub> )	SNT-4A	SOT-23-3
Nch open drain output	Both poles	Active "L"	3.8 mT typ.	S-5711ANDL-I4T1x	S-5711ANDL-M3T1y
CMOS output	Both poles	Active "L"	3.8 mT typ.	S-5711ACDL-I4T1x	S-5711ACDL-M3T1y
CMOS output	Both poles	Active "H"	3.8 mT typ.	S-5711ACDH-I4T1x	S-5711ACDH-M3T1y
Nch open drain output	South pole	Active "L"	3.8 mT typ.	S-5711ANSL-I4T1x	S-5711ANSL-M3T1y
CMOS output	South pole	Active "L"	3.8 mT typ.	S-5711ACSL-I4T1x	S-5711ACSL-M3T1y
CMOS output	North pole	Active "L"	3.8 mT typ.	-	S-5711ACNL-M3T1y
Nch open drain output	Both poles	Active "L"	5.0 mT typ.	-	S-5711ANDL1-M3T1y
CMOS output	Both poles	Active "L"	5.0 mT typ.	-	S-5711ACDL1-M3T1y

**Remark 1.** Please contact our sales office for products with specifications other than the above.

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



■ Pin Configurations

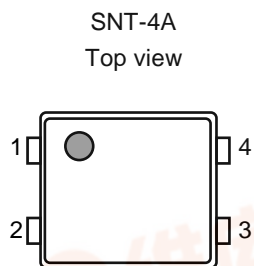


Figure 3

**Table 2**

Pin No.	Symbol	Pin Description
1	VDD	Power supply pin
2	VSS	GND pin
3	NC <sup>*1</sup>	No connection
4	OUT	Output pin

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

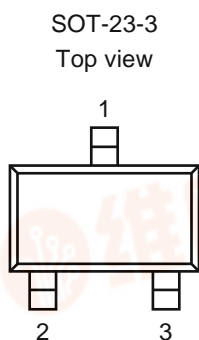


Figure 4

**Table 3**

Pin No.	Symbol	Pin Description
1	VSS	GND pin
2	VDD	Power supply pin
3	OUT	Output pin



■ **Absolute Maximum Ratings**

**Table 4**

(Ta = 25°C unless otherwise specified)

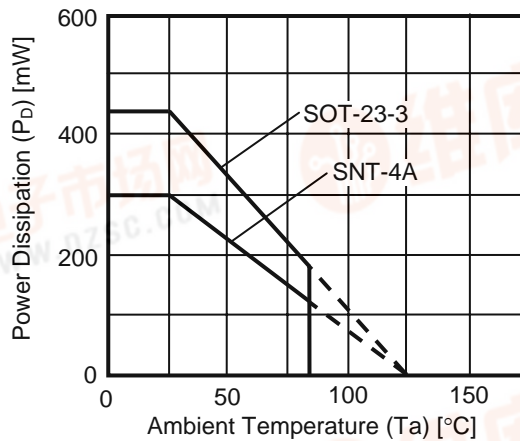
Item	Symbol	Absolute Maximum Rating	Unit
Power supply voltage	V <sub>DD</sub>	V <sub>SS</sub> -0.3 to V <sub>SS</sub> +7.0	V
Output voltage	Nch open drain output	V <sub>SS</sub> -0.3 to V <sub>SS</sub> +7.0	V
	CMOS output	V <sub>SS</sub> -0.3 to V <sub>DD</sub> +0.3	V
Power dissipation	SNT-4A	300 <sup>*1</sup>	mW
	SOT-23-3	430 <sup>*1</sup>	mW
Operating ambient temperature	T <sub>opr</sub>	-40 to +85	°C
Storage temperature	T <sub>stg</sub>	-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 5 Power Dissipation of Package (When Mounted on Board)**



■ **Electrical Characteristics**

1. **Nch open drain output product**

**Table 5**

(Ta = 25°C, V<sub>DD</sub> = 3.0 V, V<sub>SS</sub> = 0 V unless otherwise specified)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit	Test Circuit
Power supply voltage	V <sub>DD</sub>	–	2.4	3.0	5.5	V	–
Current consumption	I <sub>DD</sub>	Average value	–	5.0	8.0	μA	1
Output current	I <sub>OUT</sub>	Output transistor Nch, V <sub>OUT</sub> = 0.4 V	1	–	–	mA	2
Leakage current	I <sub>LEAK</sub>	Output transistor Nch, V <sub>OUT</sub> = 5.5 V	–	–	1	μA	2
Awake mode time	t <sub>AW</sub>	–	–	130	–	μs	–
Sleep mode time	t <sub>SL</sub>	–	–	50	100	ms	–

2. **CMOS output product**

**Table 6**

(Ta = 25°C, V<sub>DD</sub> = 3.0 V, V<sub>SS</sub> = 0 V unless otherwise specified)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit	Test Circuit
Power supply voltage	V <sub>DD</sub>	–	2.4	3.0	5.5	V	–
Current consumption	I <sub>DD</sub>	Average value	–	5.0	8.0	μA	1
Output current	I <sub>OUT</sub>	Output transistor Nch, V <sub>OUT</sub> = 0.4 V	1	–	–	mA	2
		Output transistor Pch, V <sub>OUT</sub> = V <sub>DD</sub> –0.4 V	–	–	–1	mA	2
Awake mode time	t <sub>AW</sub>	–	–	130	–	μs	–
Sleep mode time	t <sub>SL</sub>	–	–	50	100	ms	–

**■ Magnetic Characteristics**

**1. Product with detection of both poles**

(1)  $B_{OP} = 3.8 \text{ mT typ.}$

**Table 7**

( $T_a = 25^\circ\text{C}$ ,  $V_{DD} = 3.0 \text{ V}$ ,  $V_{SS} = 0 \text{ V}$  unless otherwise specified)

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit	Test Circuit
Operating point* <sup>1</sup>	S pole	$B_{OPS}$	–	0.9	3.8	6.0	mT	3
	N pole	$B_{OPN}$	–	–6.0	–3.8	–0.9	mT	3
Release point* <sup>2</sup>	S pole	$B_{RPS}$	–	0.5	2.8	5.5	mT	3
	N pole	$B_{RPN}$	–	–5.5	–2.8	–0.5	mT	3
Hysteresis width* <sup>3</sup>	S pole	$B_{HYSS}$	$B_{HYSS} = B_{OPS} - B_{RPS}$	–	1.0	–	mT	3
	N pole	$B_{HYSN}$	$B_{HYSN} =  B_{OPN} - B_{RPN} $	–	1.0	–	mT	3

(2)  $B_{OP} = 5.0 \text{ mT typ.}$

**Table 8**

( $T_a = 25^\circ\text{C}$ ,  $V_{DD} = 3.0 \text{ V}$ ,  $V_{SS} = 0 \text{ V}$  unless otherwise specified)

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit	Test Circuit
Operating point* <sup>1</sup>	S pole	$B_{OPS}$	–	1.9	5.0	8.0	mT	3
	N pole	$B_{OPN}$	–	–8.0	–5.0	–1.9	mT	3
Release point* <sup>2</sup>	S pole	$B_{RPS}$	–	1.5	3.9	7.5	mT	3
	N pole	$B_{RPN}$	–	–7.5	–3.9	–1.5	mT	3
Hysteresis width* <sup>3</sup>	S pole	$B_{HYSS}$	$B_{HYSS} = B_{OPS} - B_{RPS}$	–	1.1	–	mT	3
	N pole	$B_{HYSN}$	$B_{HYSN} =  B_{OPN} - B_{RPN} $	–	1.1	–	mT	3

**2. Product with detection of south pole**

**Table 9**

( $T_a = 25^\circ\text{C}$ ,  $V_{DD} = 3.0 \text{ V}$ ,  $V_{SS} = 0 \text{ V}$  unless otherwise specified)

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit	Test Circuit
Operating point* <sup>1</sup>	S pole	$B_{OPS}$	–	0.9	3.8	6.0	mT	3
Release point* <sup>2</sup>	S pole	$B_{RPS}$	–	0.5	2.8	5.5	mT	3
Hysteresis width* <sup>3</sup>	S pole	$B_{HYSS}$	$B_{HYSS} = B_{OPS} - B_{RPS}$	–	1.0	–	mT	3

**3. Product with detection of north pole**

**Table 10**

( $T_a = 25^\circ\text{C}$ ,  $V_{DD} = 3.0 \text{ V}$ ,  $V_{SS} = 0 \text{ V}$  unless otherwise specified)

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit	Test Circuit
Operating point* <sup>1</sup>	N pole	$B_{OPN}$	–	–6.0	–3.8	–0.9	mT	3
Release point* <sup>2</sup>	N pole	$B_{RPN}$	–	–5.5	–2.8	–0.5	mT	3
Hysteresis width* <sup>3</sup>	N pole	$B_{HYSN}$	$B_{HYSN} =  B_{OPN} - B_{RPN} $	–	1.0	–	mT	3

\*1.  $B_{OPN}$ ,  $B_{OPS}$  : Operating points

The operating points are the values of magnetic flux density when the output voltage ( $V_{OUT}$ ) is inverted after the magnetic flux density applied to the S-5711A Series by the magnet (N 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

The release points are the values of magnetic flux density when the output voltage ( $V_{OUT}$ ) is inverted after the magnetic flux density applied to the S-5711A Series by the magnet (N 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

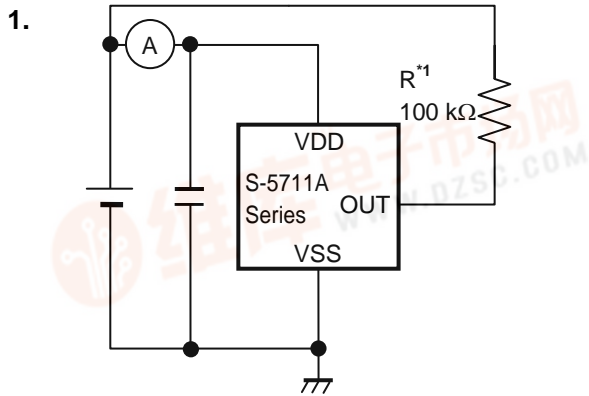
$B_{HYSN}$  and  $B_{HYSS}$  are the difference between  $B_{OPN}$  and  $B_{RPN}$ , and  $B_{OPS}$  and  $B_{RPS}$ , respectively.

**Remark** The unit of magnetic density mT can be converted by using the formula  $1 \text{ mT} = 10 \text{ Gauss}$ .





■ Test Circuits



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

Figure 6

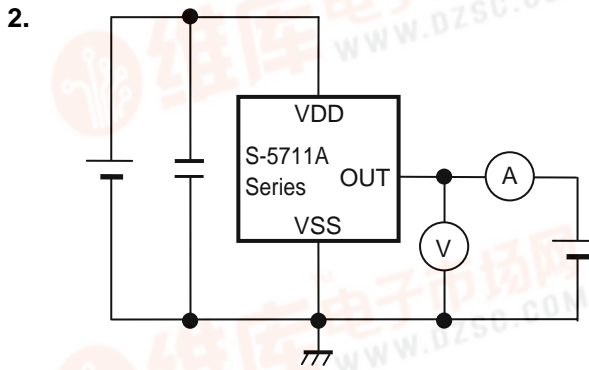
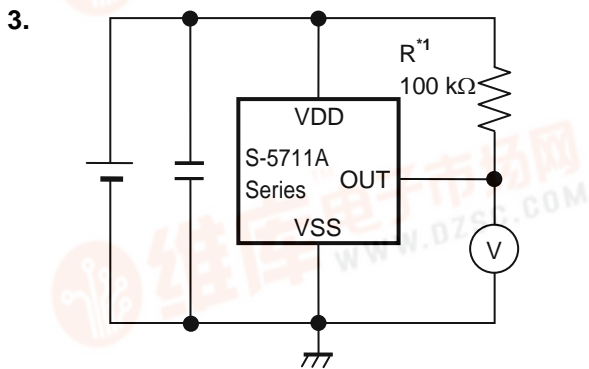


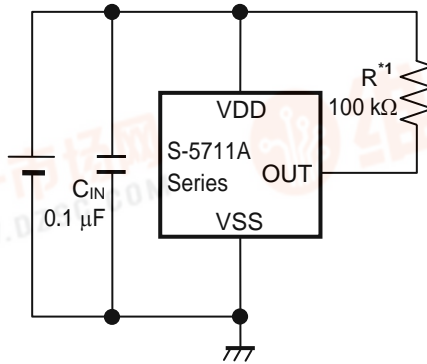
Figure 7



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

Figure 8

■ Standard Circuit



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

Figure 9

**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-5711A Series detects the flux density which is vertical to the marking surface.

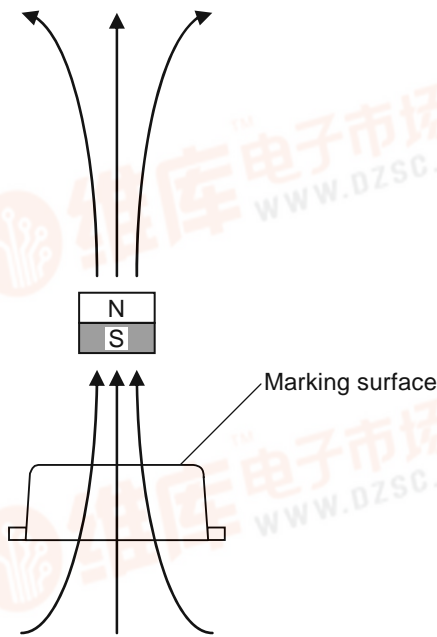
In products with detection of both poles, the output voltage ( $V_{OUT}$ ) is inverted when the south or north pole is moved closer to the marking surface.

In products with detection of the south pole, the output voltage ( $V_{OUT}$ ) is inverted when the south pole is moved closer to the marking surface.

In products with detection of the north pole, the output voltage ( $V_{OUT}$ ) is inverted when the north pole is moved closer to the marking surface.

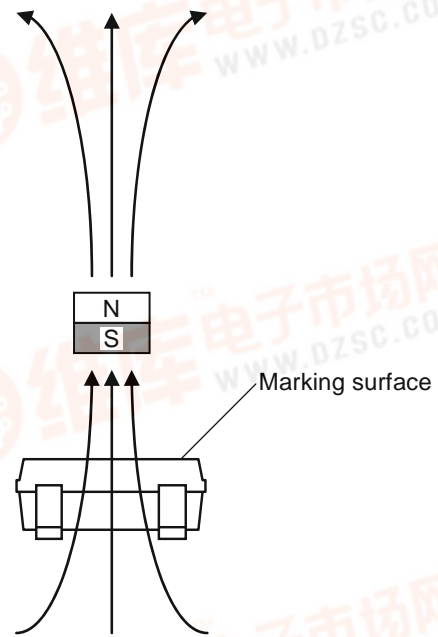
**Figures 10 and 11** show the direction in which magnetic flux is being applied.

(1) **SNT-4A**



**Figure 10**

(2) **SOT-23-3**



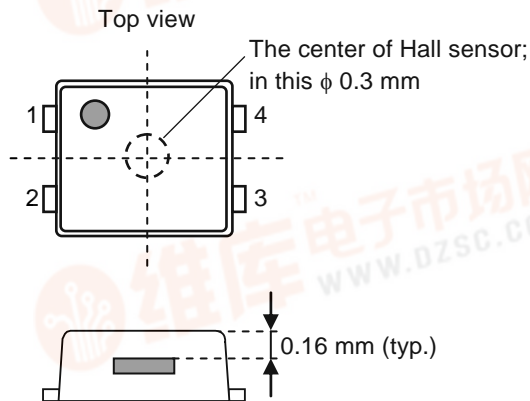
**Figure 11**

**Figures 12 and 13** show 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.

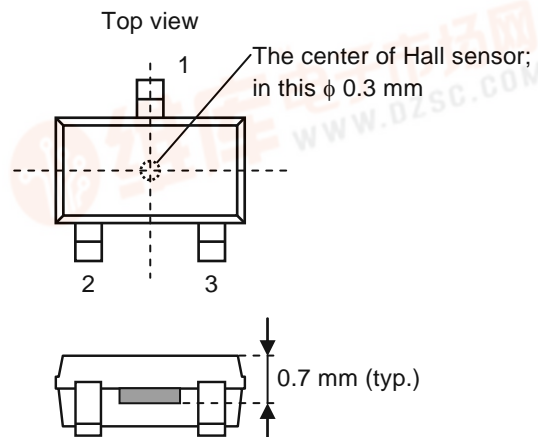
The following also shows the distance (typ. value) between the marking surface and the chip surface of a package.

(1) **SNT-4A**



**Figure 12**

(2) **SOT-23-3**



**Figure 13**



## 2. Basic operation

The S-5711A Series changes the output voltage level ( $V_{OUT}$ ) according to the level of the magnetic flux density (north or south pole) applied by a magnet.

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

### (1) Products with detection of both poles

When the magnetic flux density vertical to the marking surface exceeds  $B_{OPN}$  or  $B_{OPS}$  after the south or north pole of a magnet is moved closer to the marking surface of the S-5711A Series,  $V_{OUT}$  changes from "H" to "L". When the south or north pole of a magnet is moved further away from the marking surface of the S-5711A Series and the magnetic flux density is lower than  $B_{RPN}$  or  $B_{RPS}$ ,  $V_{OUT}$  changes from "L" to "H".

### (2) Products with detection of south pole

When the magnetic flux density vertical to the marking surface exceeds  $B_{OPS}$  after the south pole of a magnet is moved closer to the marking surface of the S-5711A Series,  $V_{OUT}$  changes from "H" to "L". When the south pole of a magnet is moved further away from the marking surface of the S-5711A Series and the magnetic flux density is lower than  $B_{RPS}$ ,  $V_{OUT}$  changes from "L" to "H".

### (3) Products with detection of north pole

When the magnetic flux density vertical to the marking surface exceeds  $B_{OPN}$  after the north pole of a magnet is moved closer to the marking surface of the S-5711A Series,  $V_{OUT}$  changes from "H" to "L". When the north pole of a magnet is moved further away from the marking surface of the S-5711A Series and the magnetic flux density is lower than  $B_{RPN}$ ,  $V_{OUT}$  changes from "L" to "H".



Figures 14 to 16 show the relationship between the magnetic flux density and  $V_{OUT}$ .

(1) Products with detection of both poles

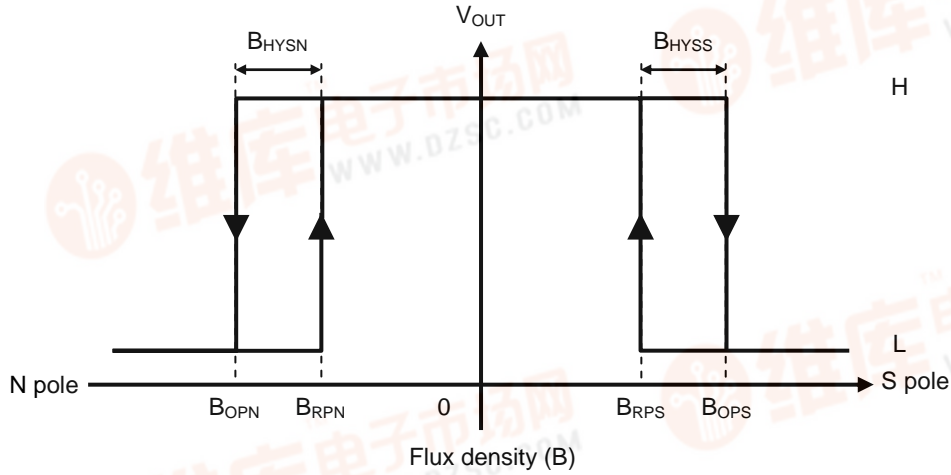


Figure 14

(2) Products with detection of south pole

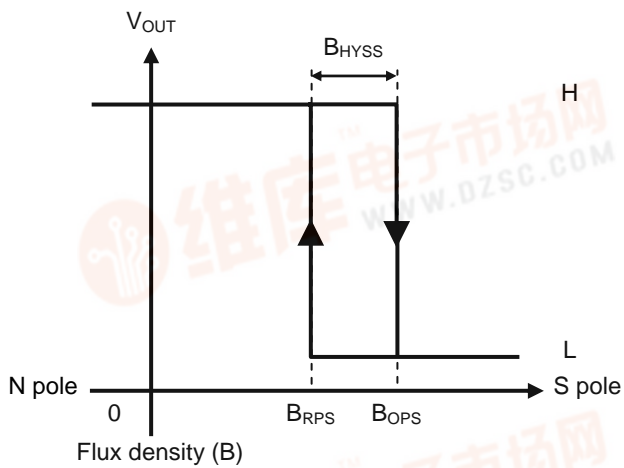


Figure 15

(3) Products with detection of north pole

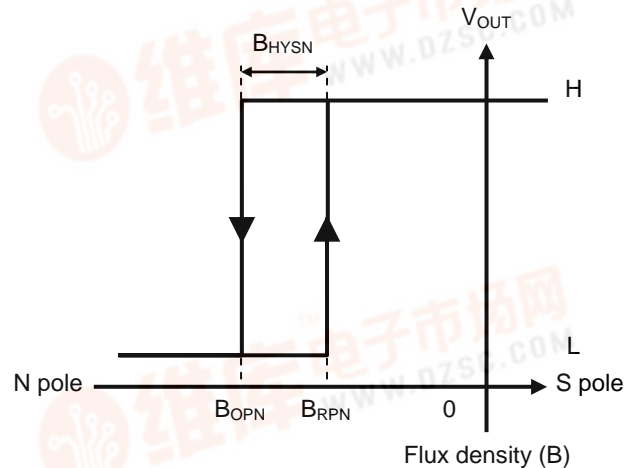


Figure 16



### 3. Time dependency in the current consumption

The S-5711A Series performs the intermittent operation. The S-5711A Series operates with low current consumption due to repeating the sleep mode (50 ms typ.) and the awake mode (130  $\mu$ s typ.).

Figure 17 shows the time dependency in the current consumption.

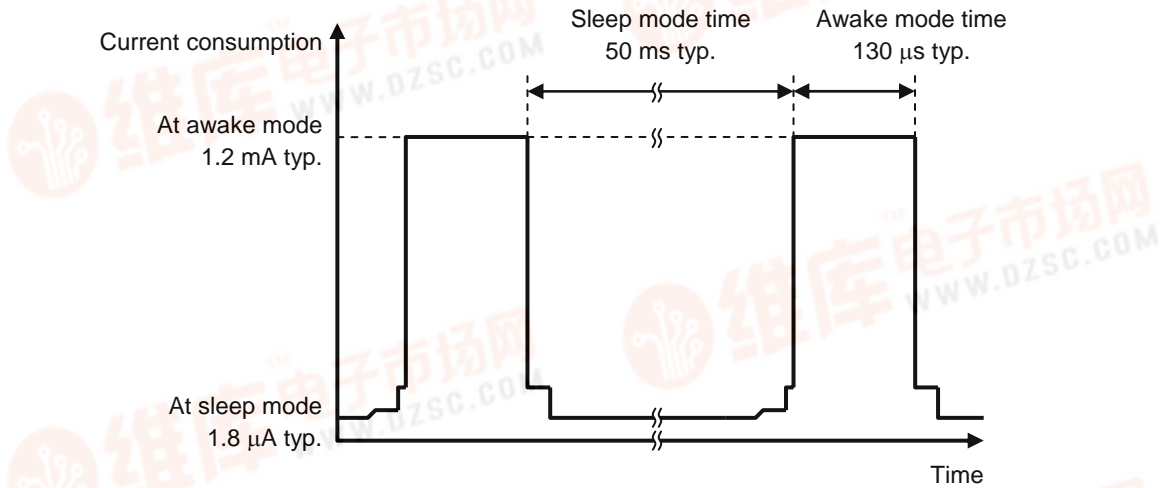


Figure 17

#### 4. Timing chart

Figure 18 shows the operation timing of the S-5711A Series.

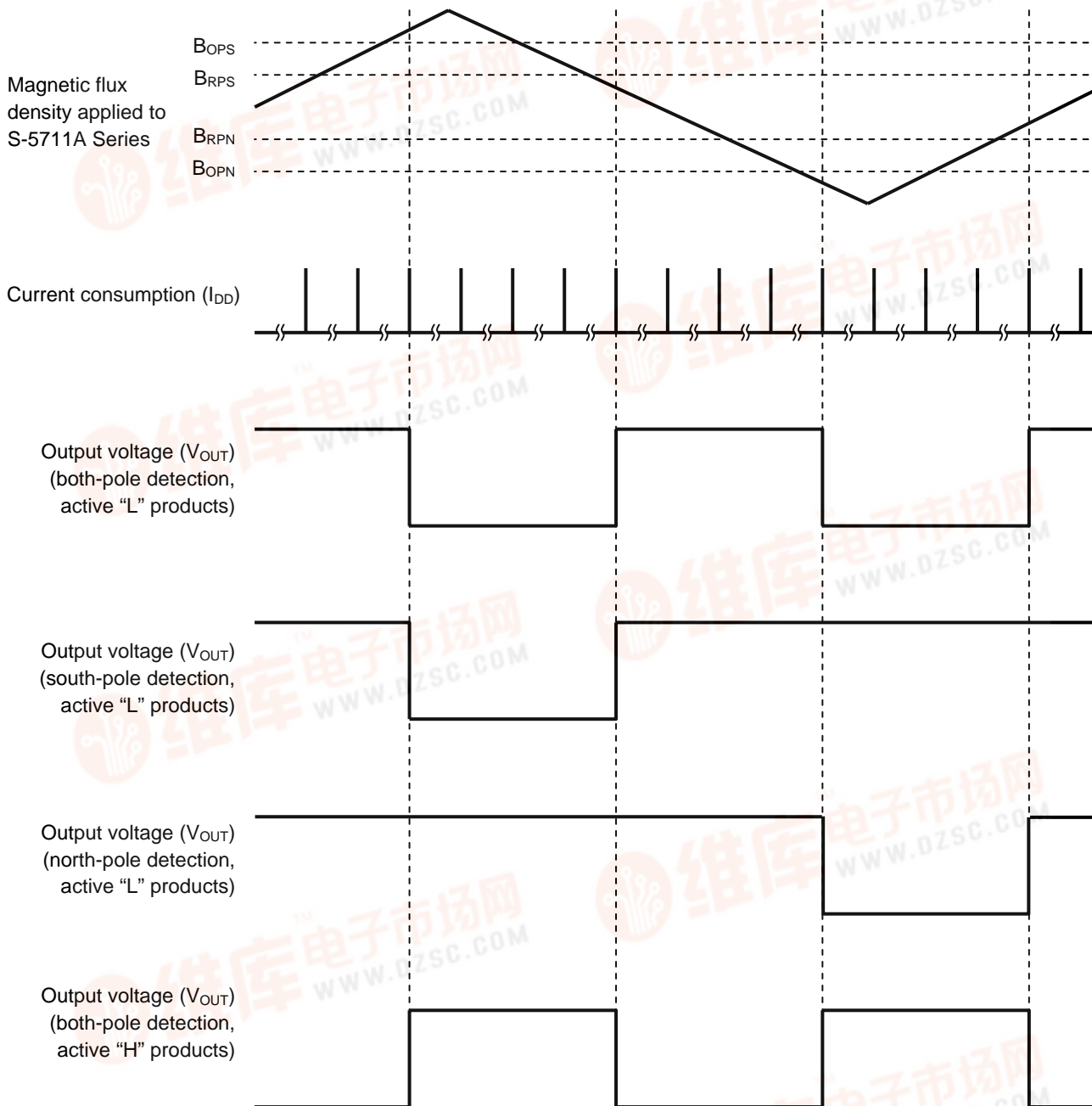


Figure 18

## ■ Precautions

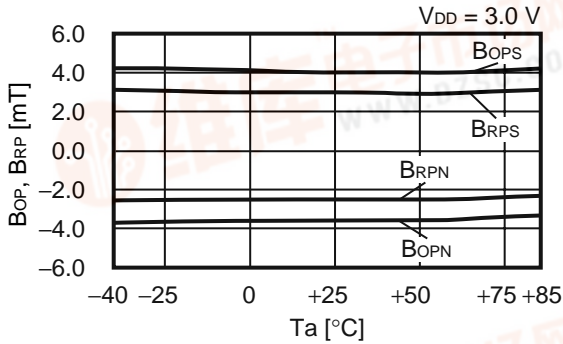
- If the impedance of the power supply is high, the IC may malfunction due to a supply voltage drop caused by through-type current. Take care with the pattern wiring to ensure that the impedance of the power supply is low.
- Note that the IC may malfunction if the power supply voltage rapidly changes.
- 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.



■ **Characteristics (Typical Data)**

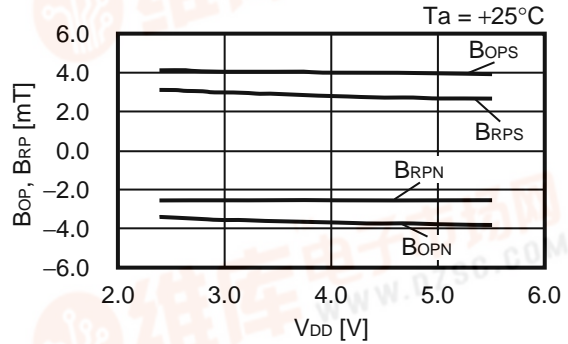
**1. Operating point, release point ( $B_{OP}$ ,  $B_{RP}$ ) — Temperature ( $T_a$ )**

Detection of both poles,  $B_{OP} = 3.8$  mT typ.

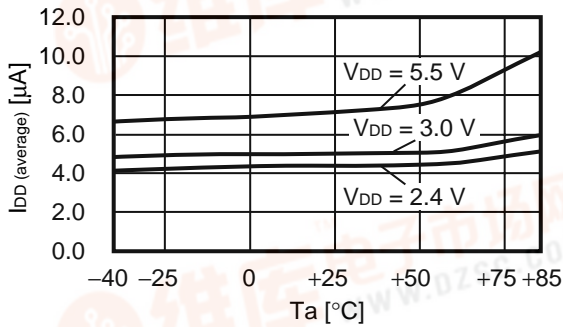


**2. Operating point, release point ( $B_{OP}$ ,  $B_{RP}$ ) — Power supply voltage ( $V_{DD}$ )**

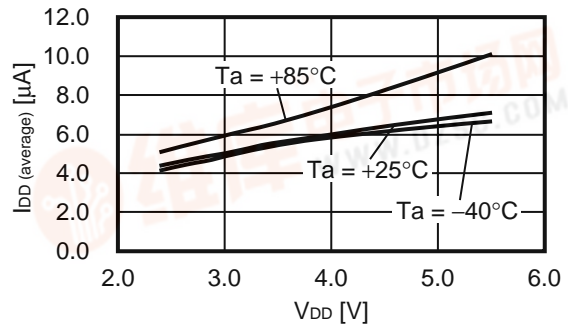
Detection of both poles,  $B_{OP} = 3.8$  mT typ.



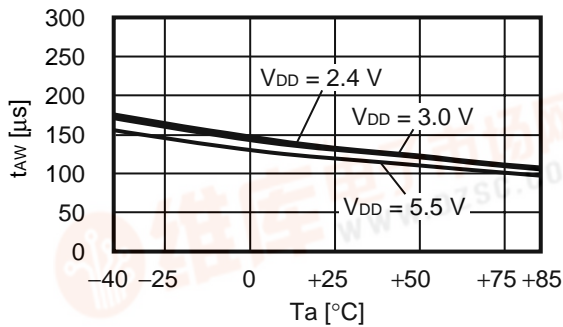
**3. Current consumption (average) ( $I_{DD}$  (average)) — Temperature ( $T_a$ )**



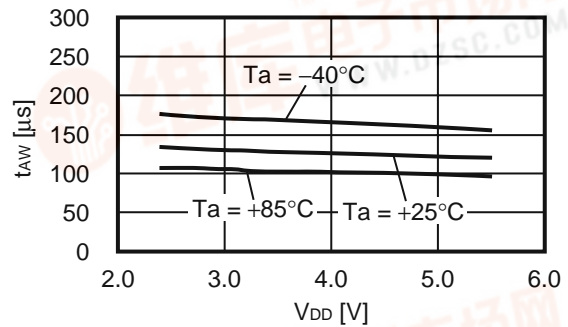
**4. Current consumption (average) ( $I_{DD}$  (average)) — Power supply voltage ( $V_{DD}$ )**



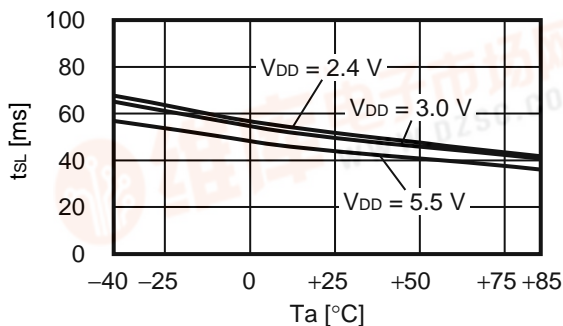
**5. Awake mode time ( $t_{AW}$ ) — Temperature ( $T_a$ )**



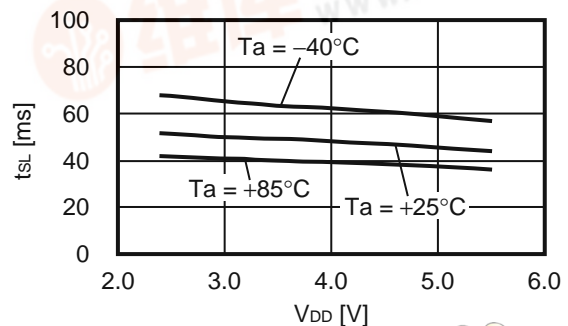
**6. Awake mode time ( $t_{AW}$ ) — Power supply voltage ( $V_{DD}$ )**



**7. Sleep mode time ( $t_{SL}$ ) — Temperature ( $T_a$ )**

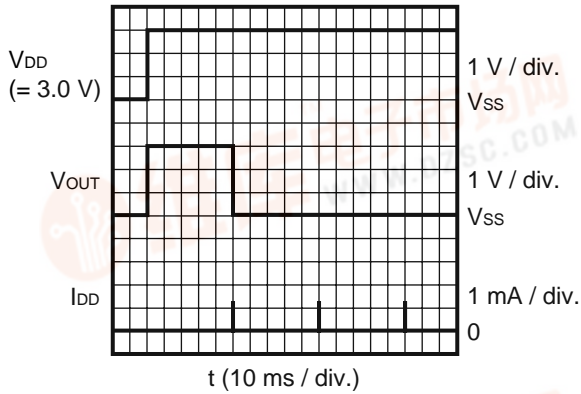


**8. Sleep mode time ( $t_{SL}$ ) — Power supply voltage ( $V_{DD}$ )**



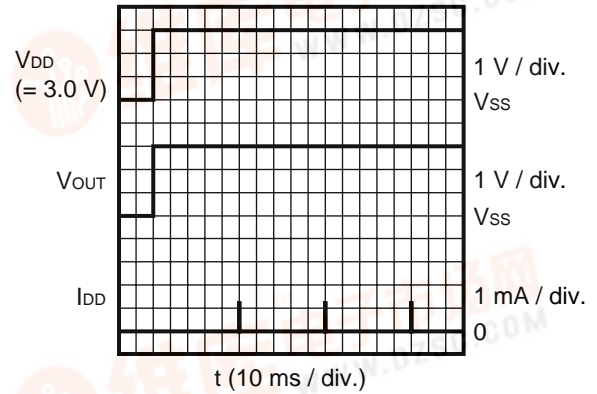
**9. Start up response (Detection of both poles)**

(1) Active "L",  $B > B_{OPS}$  or  $B < B_{OPN}$   
 $T_a = +25^\circ\text{C}$



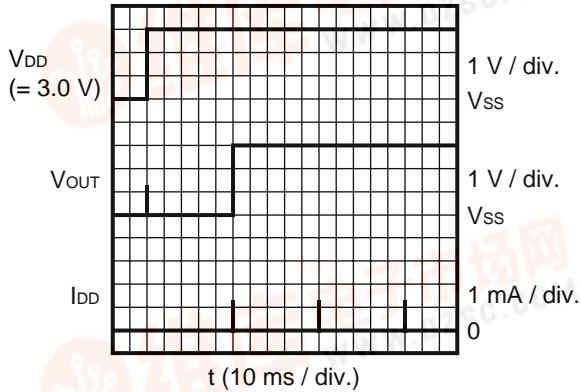
(2) Active "L",  $B_{RPN} < B < B_{RPS}$

$T_a = +25^\circ\text{C}$



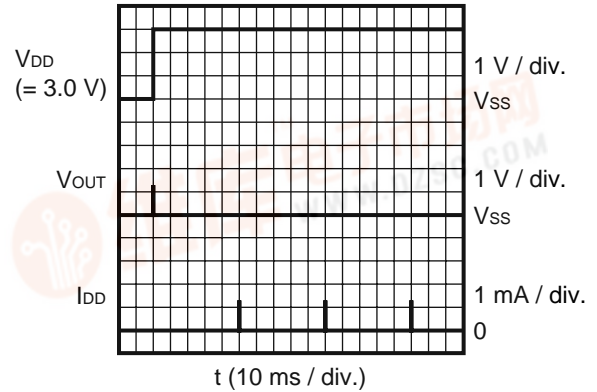
(3) Active "H",  $B > B_{OPS}$  or  $B < B_{OPN}$

$T_a = +25^\circ\text{C}$



(4) Active "H",  $B_{RPN} < B < B_{RPS}$

$T_a = +25^\circ\text{C}$

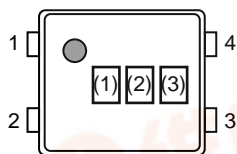




■ **Marking Specifications**

**(1) SNT-4A**

SNT-4A  
Top view



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

**Product name vs. Product code**

**(a) Nch open drain output product**

Product Name	Product Code		
	(1)	(2)	(3)
S-5711ANDL-I4T1x	T	Z	A
S-5711ANSL-I4T1x	T	Z	E

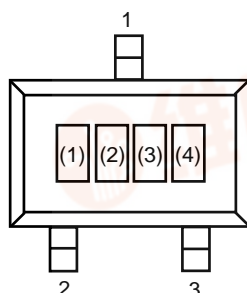
**(b) CMOS output product**

Product Name	Product Code		
	(1)	(2)	(3)
S-5711ACDL-I4T1x	T	Z	1
S-5711ACDH-I4T1x	T	Z	2
S-5711ACSL-I4T1x	T	Z	5

- Remark 1.** Please contact our sales office for products with specifications other than the above.  
**2.** x: G or U  
**3.** Please select products of environmental code = U for Sn 100%, halogen-free products.

**(2) SOT-23-3**

SOT-23-3  
Top view



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

**Product name vs. Product code**

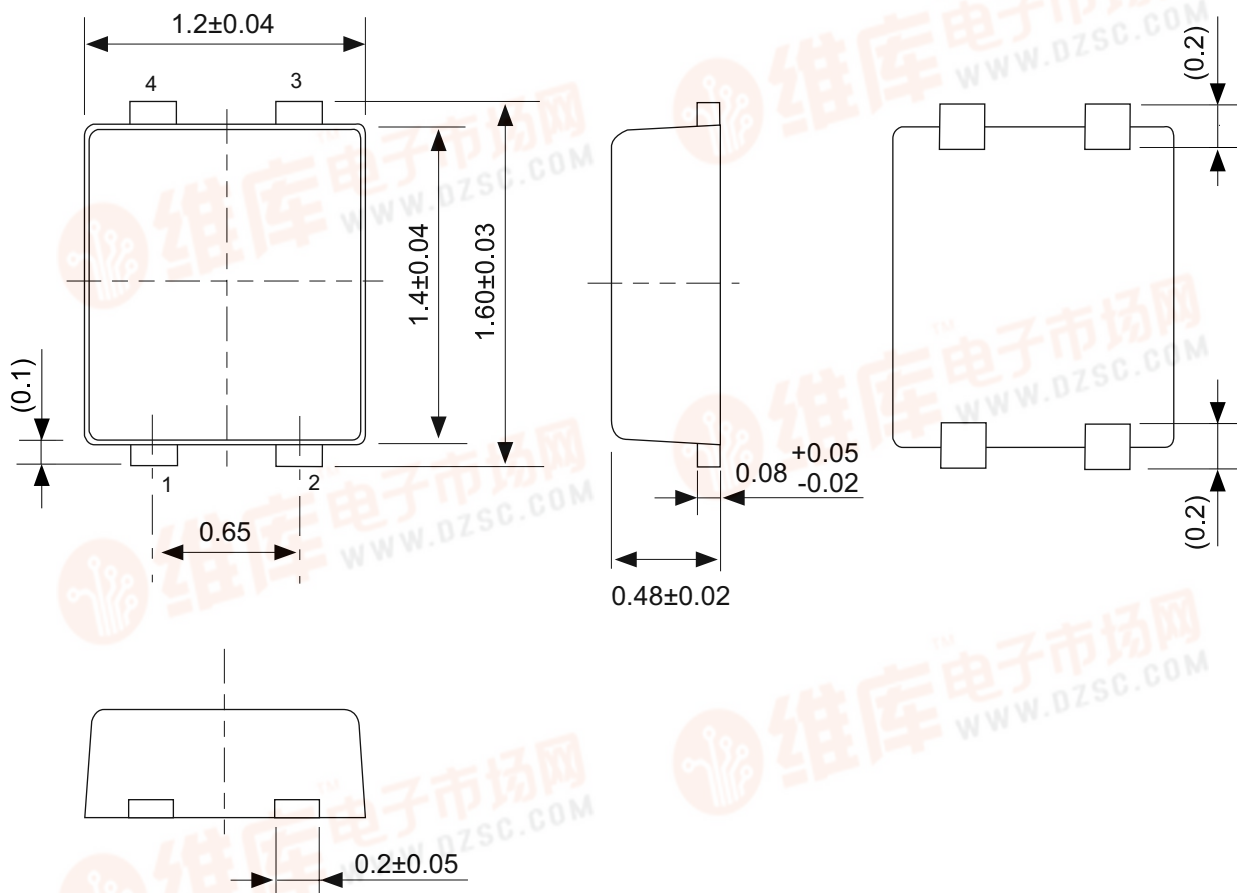
**(a) Nch open drain output product**

Product Name	Product Code		
	(1)	(2)	(3)
S-5711ANDL-M3T1y	T	Z	A
S-5711ANSL-M3T1y	T	Z	E
S-5711ANDL1-M3T1y	T	Y	1

**(b) CMOS output product**

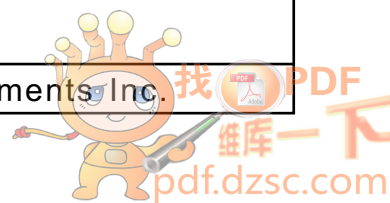
Product Name	Product Code		
	(1)	(2)	(3)
S-5711ACDL-M3T1y	T	Z	1
S-5711ACDH-M3T1y	T	Z	2
S-5711ACSL-M3T1y	T	Z	5
S-5711ACNL-M3T1y	T	Z	3
S-5711ACDL1-M3T1y	T	Y	A

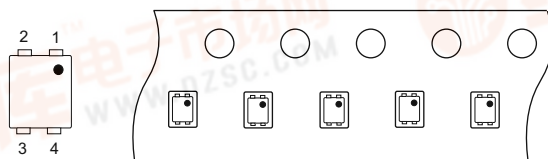
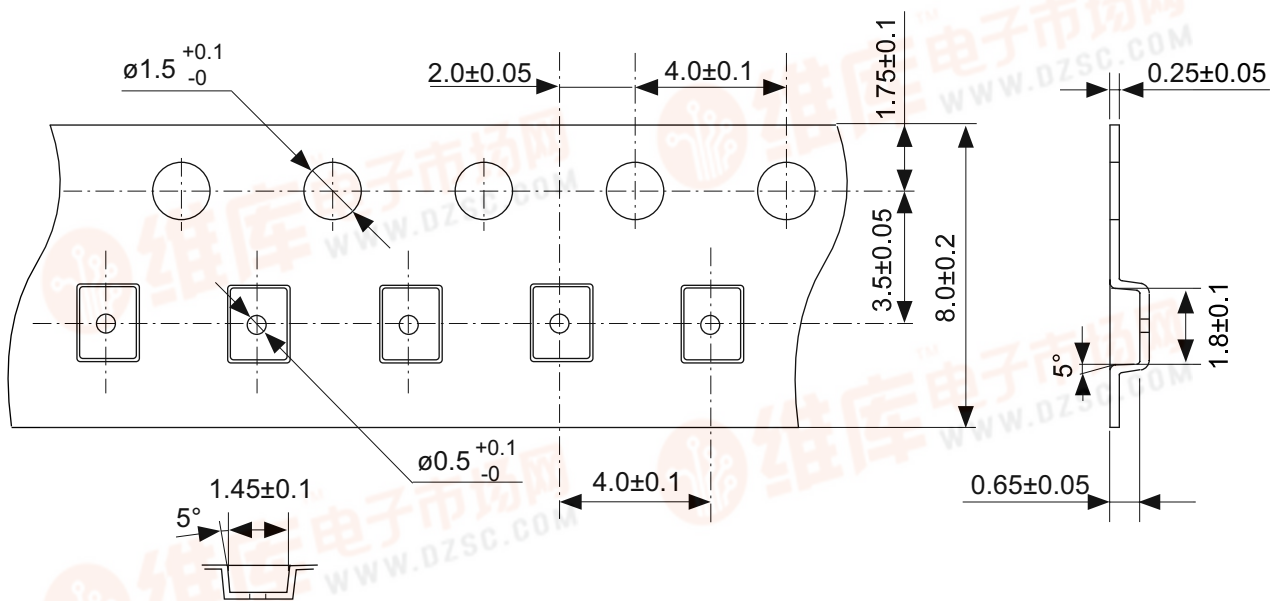
- Remark 1.** Please contact our sales office for products with specifications other than the above.  
**2.** y: S or U  
**3.** Please select products of environmental code = U for Sn 100%, halogen-free products.



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.	

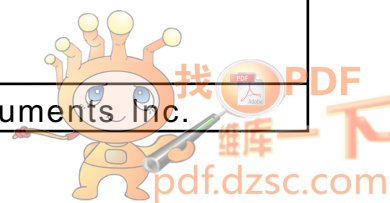


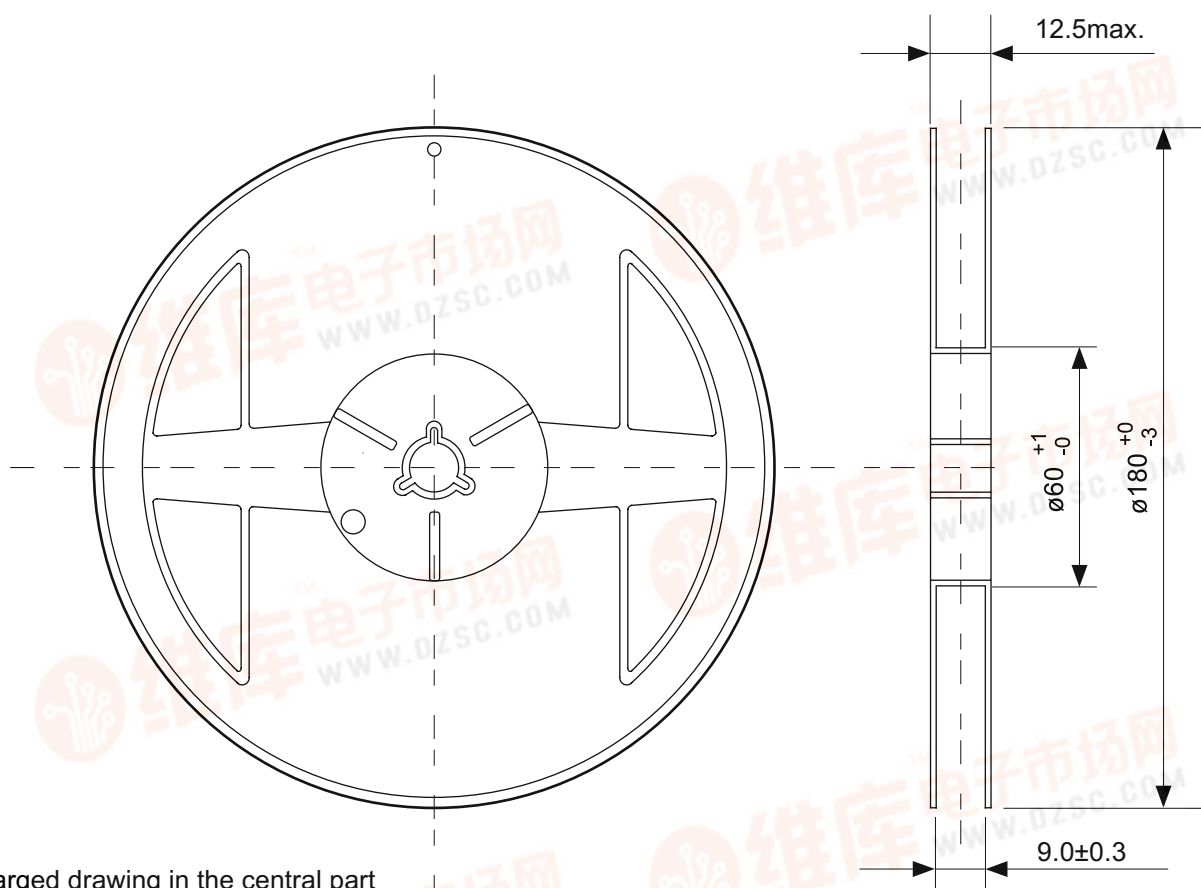


Feed direction →

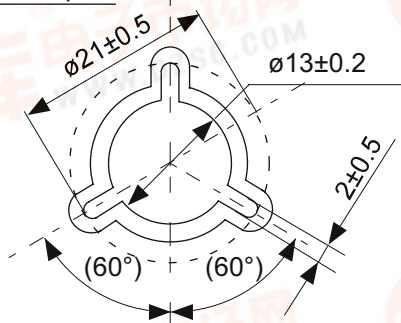
No. PF004-A-C-SD-1.0

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



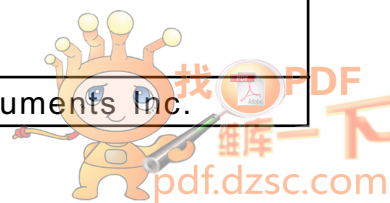


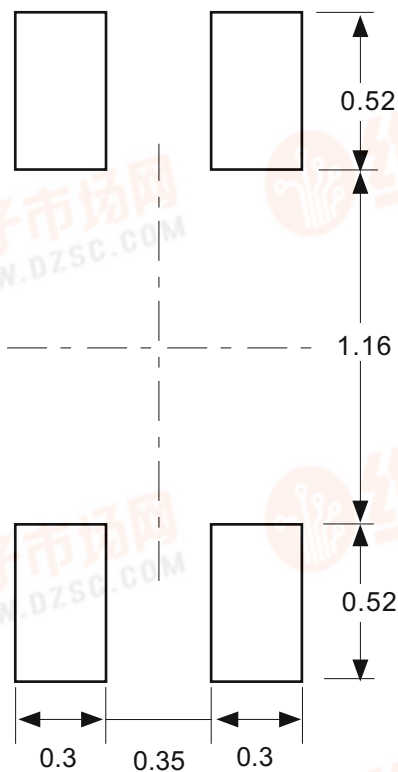
Enlarged drawing in the central part



No. PF004-A-R-SD-1.0

TITLE	SNT-4A-A-Reel		
No.	PF004-A-R-SD-1.0		
SCALE		QTY.	5,000
UNIT	mm		
Seiko Instruments Inc.			



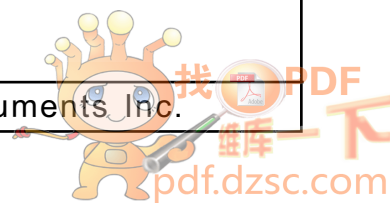


Caution Making the wire pattern under the package is possible. However, note that the package may be upraised due to the thickness made by the silk screen printing and of a solder resist on the pattern because this package does not have the standoff.

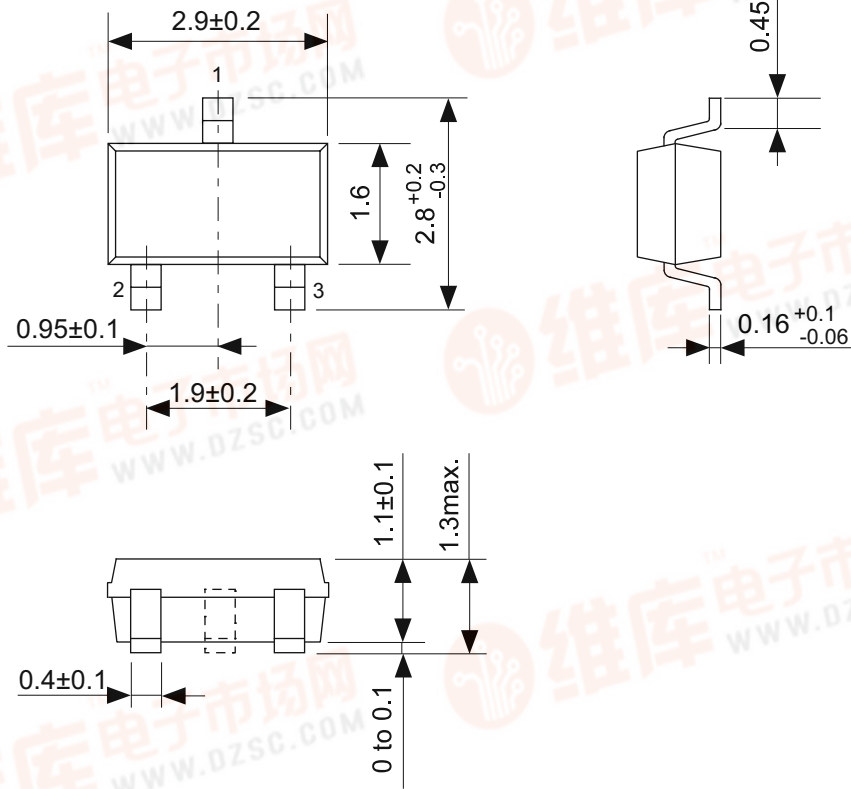
注意 パッケージ下への配線パターン形成は可能ですが、本パッケージはスタンドオフが無いので、パターン上のレジスト厚み、シルク印刷の厚みによってパッケージが持ち上がる場合がありますのでご配慮ください。

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.	

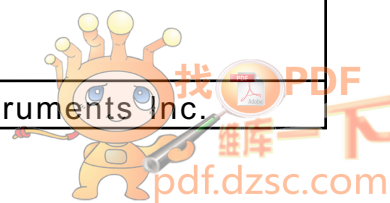




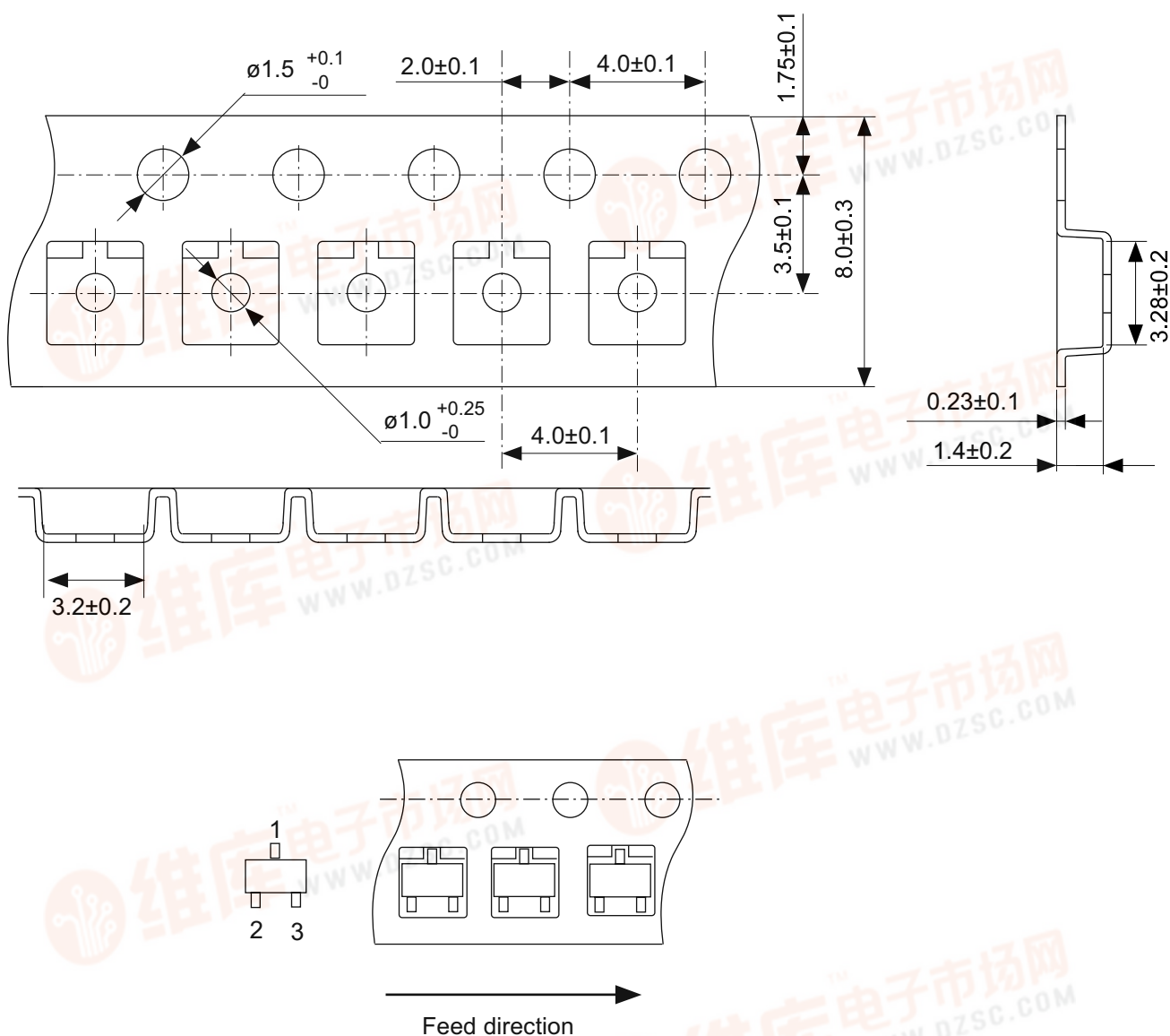


No. MP003-C-P-SD-1.0

TITLE	SOT233-C-PKG Dimensions
No.	MP003-C-P-SD-1.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	

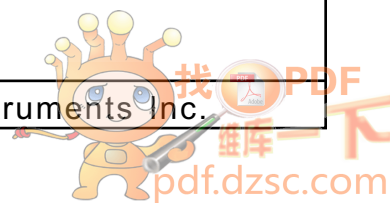


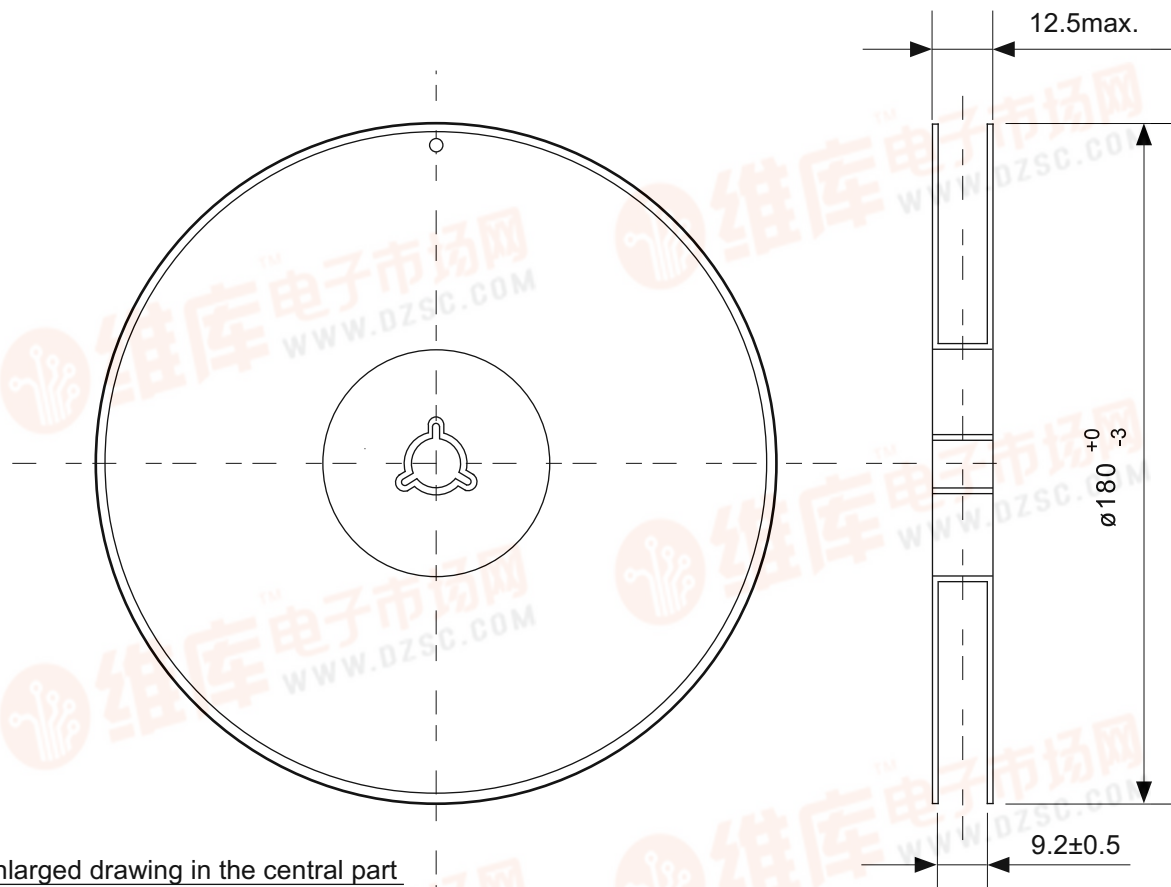
查询S-5711A供应商



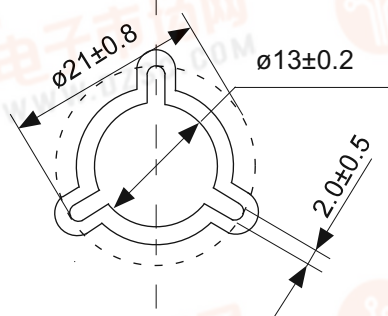
No. MP003-C-C-SD-2.0

TITLE	SOT233-C-Carrier Tape
No.	MP003-C-C-SD-2.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	



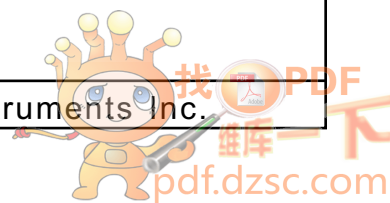


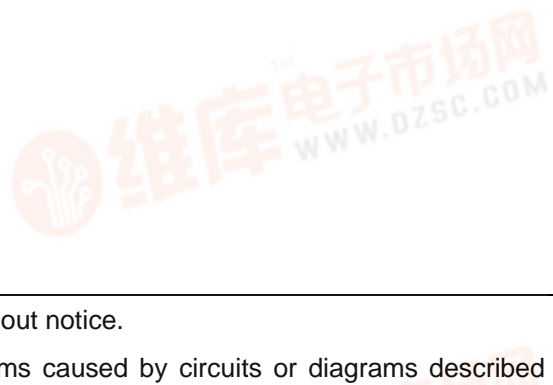
Enlarged drawing in the central part



No. MP003-Z-R-SD-1.0

TITLE	SOT233-C-Reel		
No.	MP003-Z-R-SD-1.0		
SCALE		QTY.	3,000
UNIT	mm		
Seiko Instruments Inc.			





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