HIGH-SPEED UNIPOLAR DETECTION TYPE HALL IC

S-5713A Series

The S-5713A Series, developed by CMOS technology, is a unipolar detection type Hall IC with high-speed detection.
The output voltage changes when the S-5713A Series detects the intensity level of flux density and a polarity. Using the S-5713A Series with a magnet makes it possible to detect opening/closing and rotation in various devices.
High-density mounting is possible by using the small SOT-23-3 package.

■ Features

- Built-in chopping stabilized amplifier
- Detection of unipolar magnetic fields
- Applicable in various devices with wide range of option
  - Pole detection : Detection of S pole or N pole
  - Detection logic for magnetism : Active “L”, active “H”
  - Output form : Nch open drain output, CMOS output
- High-speed detection : Operating cycle 132 μs typ., 240 μs max.
- Operating temperature range : −40°C to +85°C
  Small dependency magnetic characteristics against temperature
- Small package : SOT-23-3
- Lead-free product

■ Applications

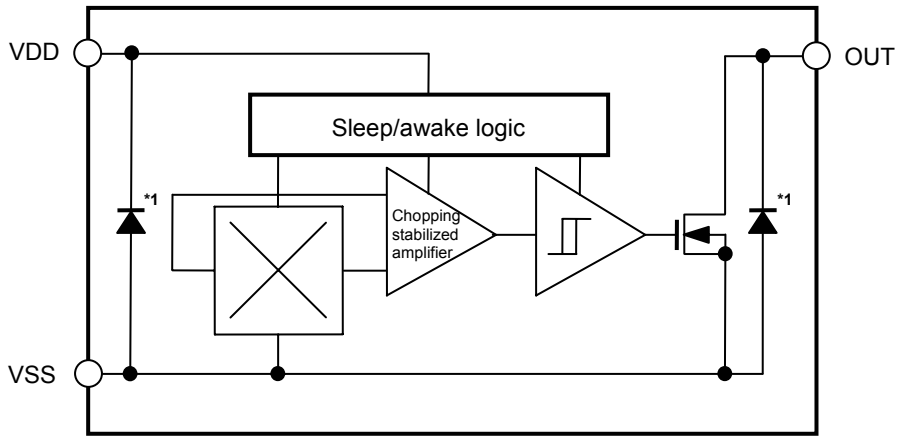
- Playthings, portable games
- Home appliances

■ Package

Package Name	Drawing Code		
	Package	Tape	Reel
SOT-23-3	MP003-C	MP003-C	MP003-Z

■ Block Diagrams

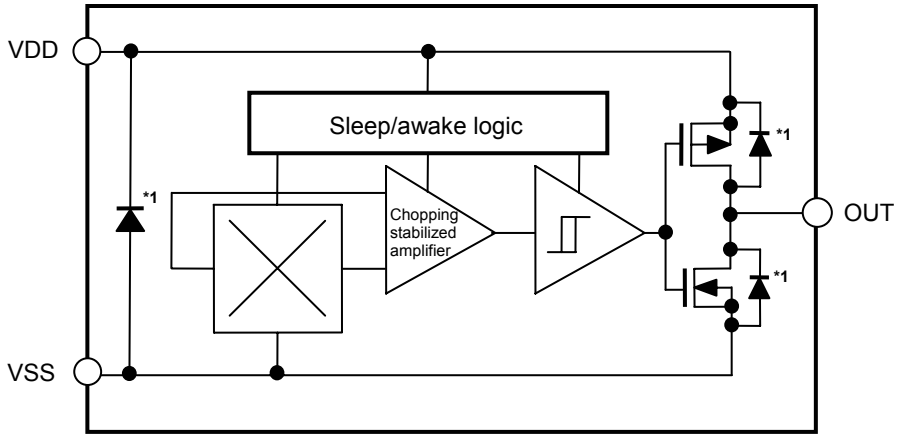
1. Nch open drain output product



***1.** Parasitic diode

Figure 1

2. CMOS output product

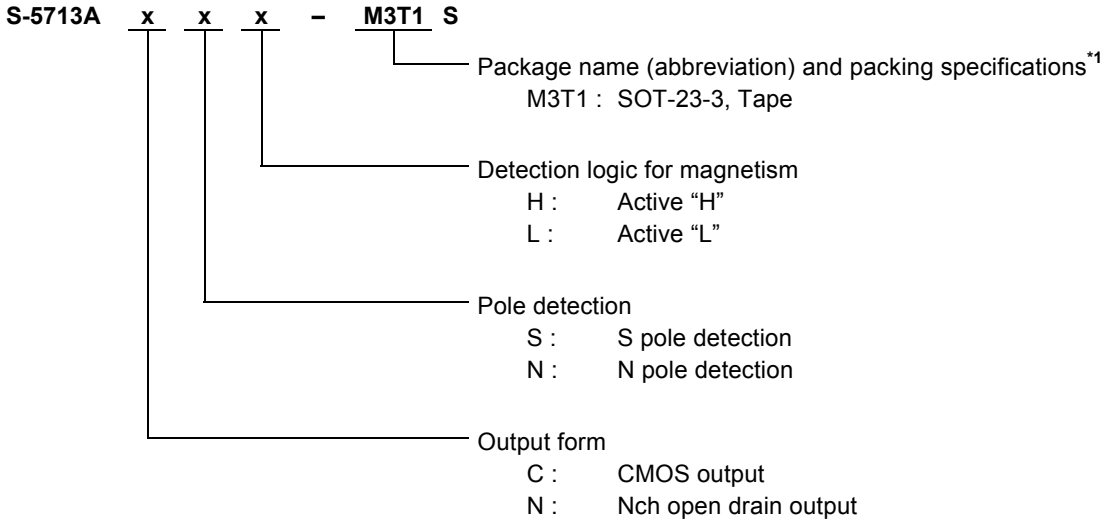


***1.** Parasitic diode

Figure 2

■ Product Name Structure

1. Product name



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

2. Product name list

Table 1

Output Form	Pole Detection	Detection Logic for Magnetism	Product Name
Nch open drain output	S pole detection	Active “L”	S-5713ANSL-M3T1S

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

■ Pin Configuration

SOT-23-3
Top view

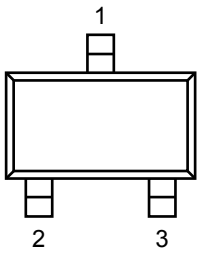


Figure 3

Table 2

Pin No.	Symbol	Pin Description
1	VSS	GND pin
2	VDD	Power supply pin
3	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
Output voltage	Nch open drain output	V_{OUT}	V_{SS} – 0.3 to V_{SS} + 7.0	V
	CMOS output		V_{SS} – 0.3 to V_{DD} + 0.3	V
Power dissipation		P_D	430*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.

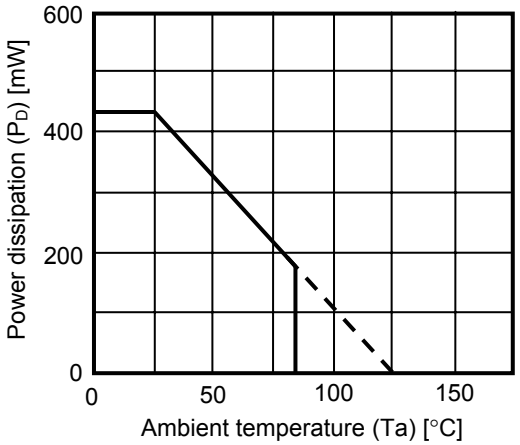


Figure 4 Power Dissipation of Package (When Mounted on Board)

■ Electrical Characteristics

Table 4

($Ta = 25°C$, $V_{DD} = 5.0$ V, $V_{SS} = 0$ V unless otherwise specified)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit	Test Circuit
Power supply voltage	V_{DD}	–	4.5	5.0	5.5	V	–
Average current consumption	I_{DD}	Average value	–	1750	2200	μA	1
Output current	I_{OUT}	Output transistor Nch, $V_{OUT} = 0.4$ V	1	–	–	mA	2
		CMOS output Output transistor Pch, $V_{OUT} = V_{DD} - 0.4$ V	–	–	–1	mA	2
Output leakage current	I_{LEAK}	Nch open drain output Output transistor Nch, $V_{OUT} = 5.5$ V	–	–	1	μA	2
Awake mode time	t_{AW}	–	–	121	–	μs	–
Sleep mode time	t_{SL}	–	–	11	–	μs	–
Operating cycle	t_{CYCLE}	$t_{AW} + t_{SL}$	–	132	240	μs	–

■ Magnetic Characteristics

1. Product with detection of S pole

Table 5

($Ta = 25°C$, $V_{DD} = 5.0$ V, $V_{SS} = 0$ V unless otherwise specified)

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit	Test Circuit
Operating point *1	S pole	B_{OPS}	–	–	6.1	9.1	mT	3
Release point *2	S pole	B_{RPS}	–	2.4	4.9	–	mT	3
Hysteresis width *3	S pole	B_{HYSS}	$B_{HYSS} = B_{OPS} - B_{RPS}$	–	1.2	–	mT	3

2. Product with detection of N pole

Table 6

($Ta = 25°C$, $V_{DD} = 5.0$ V, $V_{SS} = 0$ V unless otherwise specified)

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit	Test Circuit
Operating point *1	N pole	B_{OPN}	–	–9.1	–6.1	–	mT	3
Release point *2	N pole	B_{RPN}	–	–	–4.9	–2.4	mT	3
Hysteresis width *3	N pole	B_{HYSN}	$B_{HYSN} = \lvert B_{OPN} - B_{RPN} \rvert$	–	1.2	–	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-5713A 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.

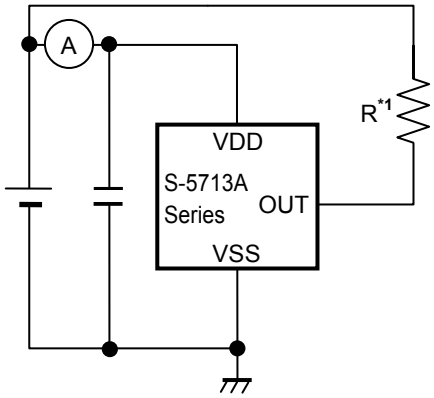
***2.** B_{RPN}, B_{RPS} : Release points
The release points are the values of magnetic flux density when the output voltage (V_{OUT}) is inverted after the magnetic flux density applied to the S-5713A Series by the magnet (N or S pole) is decreased (the magnet is moved further away).
Even when the magnetic flux density is lowered than B_{RPN} or B_{RPS}, V_{OUT} retains the status.

***3.** B_{HYSN}, B_{HYSS} : Hysteresis widths
B_{HYSN} and B_{HYSS} are the differences 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.



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

Figure 5

2.

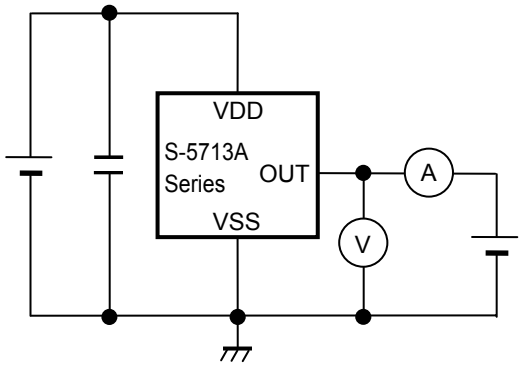
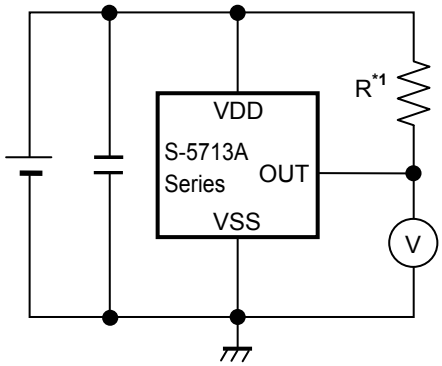


Figure 6

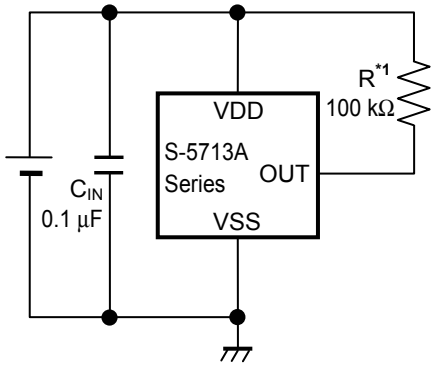
3.



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

Figure 7

■ Standard Circuit



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

Figure 8

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-5713A Series detects the flux density which is vertical to the marking surface.
Figure 9 shows the direction in which magnetic flux is being applied.

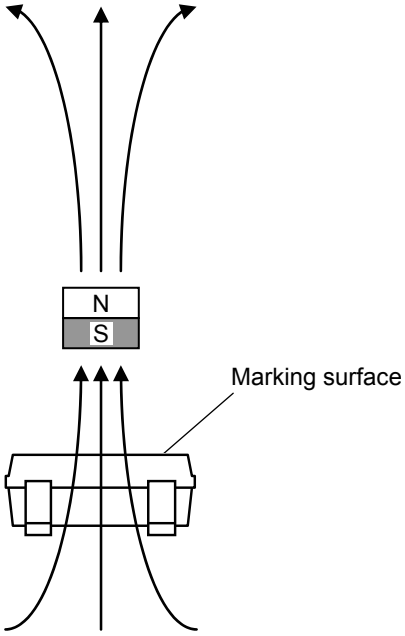


Figure 9

Figure 10 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.

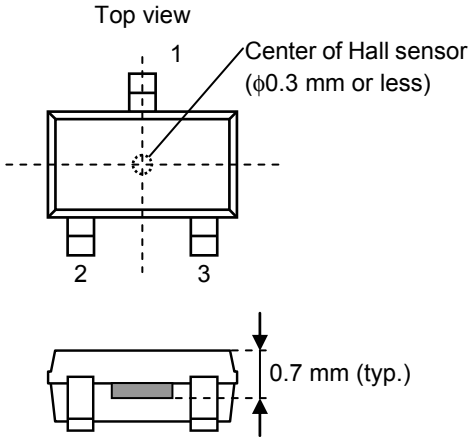


Figure 10

2. Basic operation

The S-5713A 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 active “L”.

(1) Products with detection of S pole

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-5713A 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-5713A Series and the magnetic flux density is lower than B_{RPS}, V_{OUT} changes from “L” to “H”.

(2) Products with detection of N pole

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-5713A 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-5713A Series and the magnetic flux density is lower than B_{RPN}, V_{OUT} changes from “L” to “H”.

Figures 11 to **12** show the relationship between the magnetic flux density and V_{OUT}.

(1) Products with detection of S pole

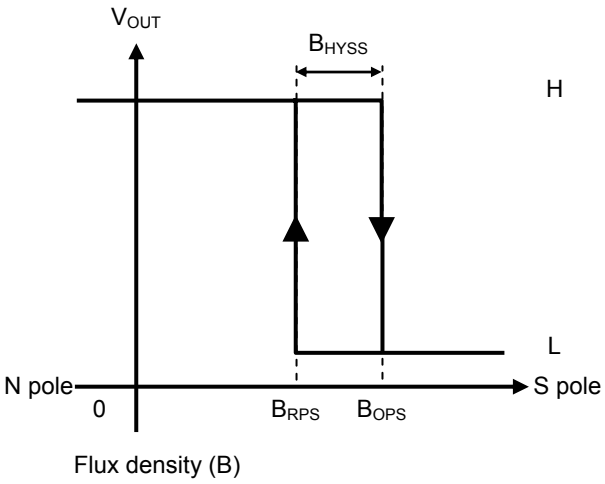


Figure 11

(2) Products with detection of N pole

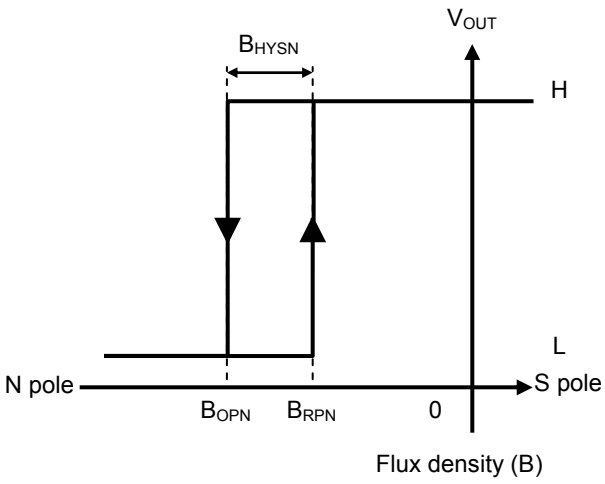


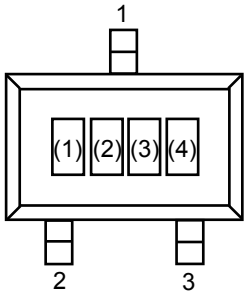
Figure 12

■ 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

SOT-23-3
Top view

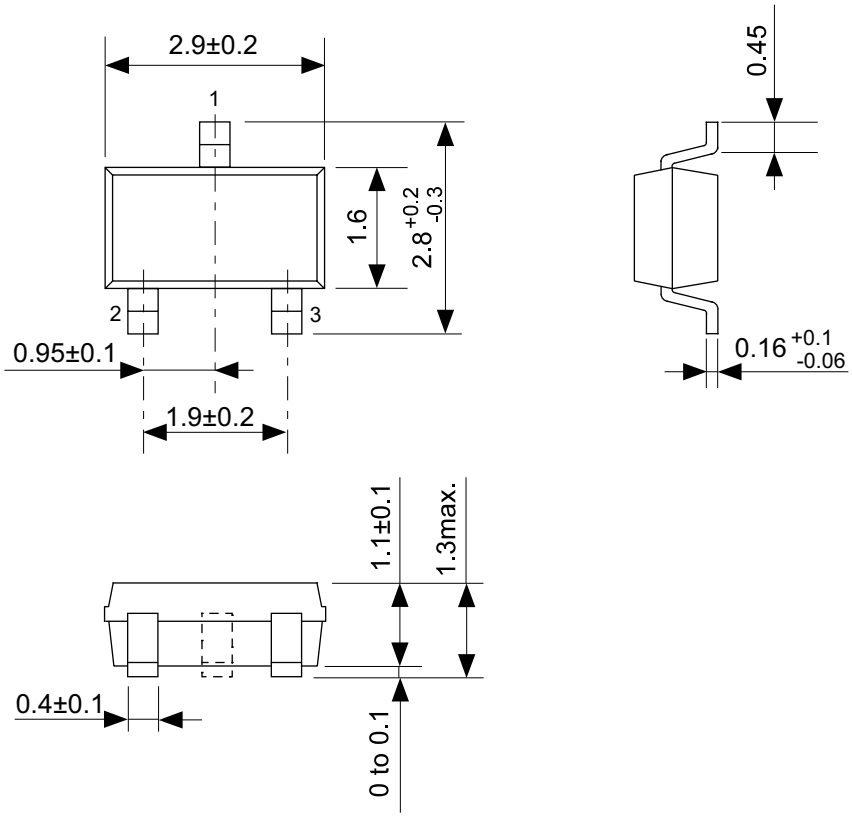


(1) to (3) : Product code (Refer to **Product name vs. Product code**.)
(4) : Lot number

Product name vs. Product code

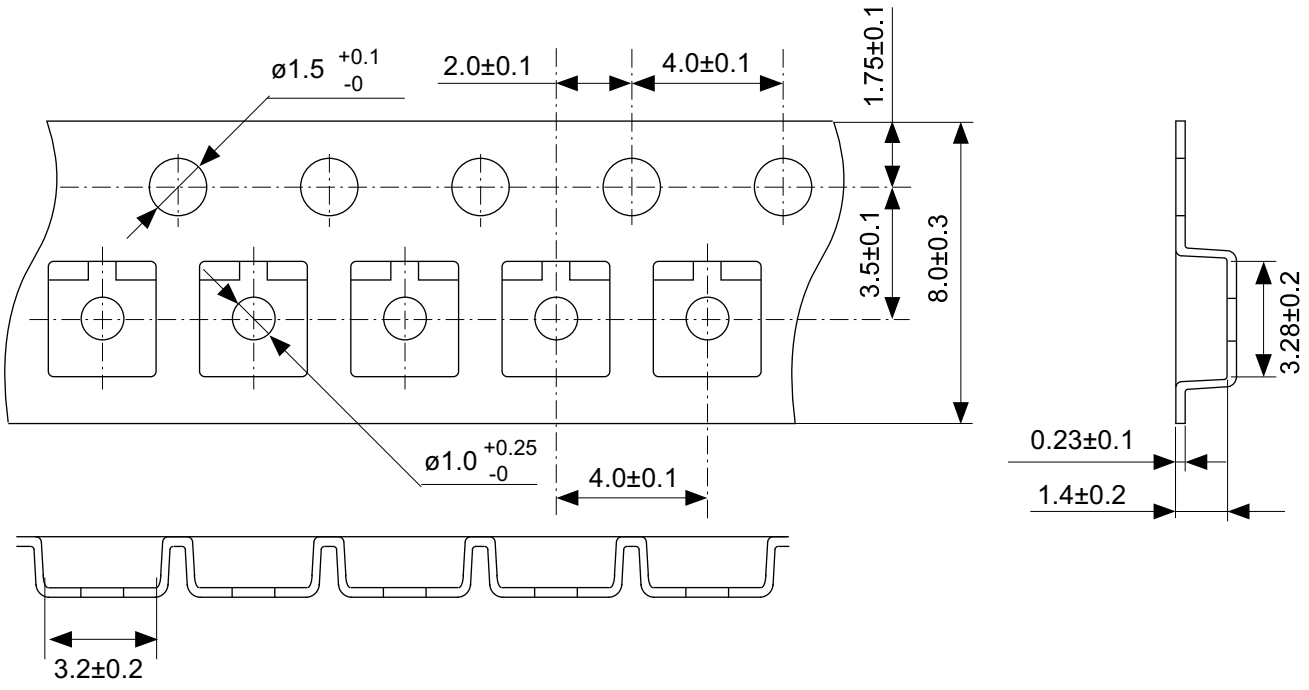
Product Name	Product Code		
	(1)	(2)	(3)
S-5713ANSL-M3T1S	T	2	D

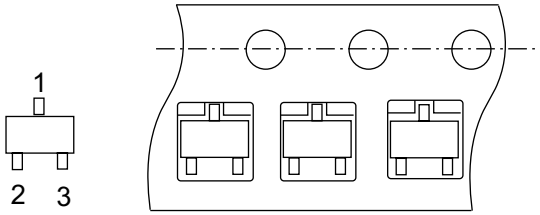
Remark Please contact our sales office for products other than the above.



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.	

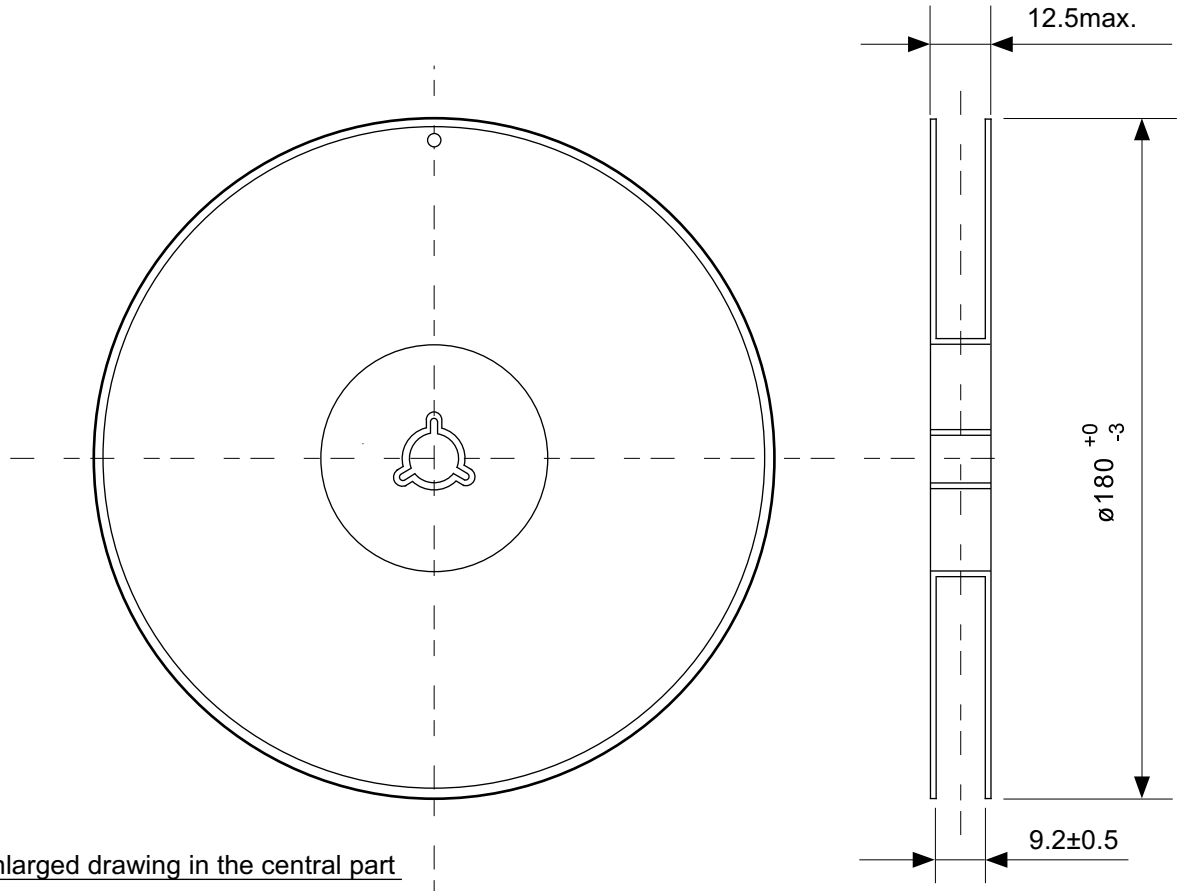




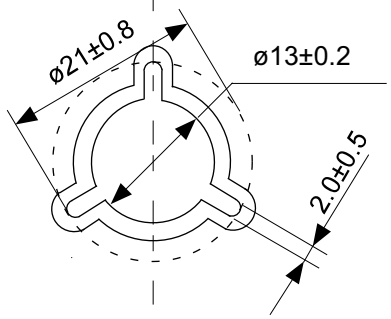
Feed direction

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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