S-1313 Series

SUPER LOW CURRENT CONSUMPTION LOW DROPOUT CMOS VOLTAGE REGULATOR

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Rev.1.0_00

S-1313 Series, developed by using the CMOS technology, is a positive voltage regulator IC which has the super low current consumption and the low dropout voltage.
Current consumption is as low as 0.9 μA typ., and ceramic capacitor of 0.1 μF or more can be used as the input and output capacitor.
It also has high-accuracy output voltage of ±1.0%.

■ Features

- Output voltage: 1.0 V to 3.5 V, selectable in 0.05 V step.
- Input voltage: 1.5 V to 5.5 V
- High-accuracy output voltage: ±1.0% (1.0 V to 1.45 V output product : ±15 mV)
- Low dropout voltage: 170 mV typ. (products having the output of 2.8 V, I_{OUT} = 100 mA)
- Low current consumption: During operation: 0.9 μA typ., 1.35 μA max.
  During power-off: 0.1 μA typ., 1.0 μA max.
- Output current: Possible to output 200 mA (at $V_{OUT(S)} \geq 1.4$ V, $V_{IN} \geq V_{OUT(S)} + 1.0$ V)*1
- Low equivalent series resistance capacitor : Ceramic capacitor of 0.1 μF or more can be used as the output capacitor.
- Built-in overcurrent protection circuit: limits overcurrent of output transistor
- Built-in thermal shutdown circuit: prevents damage caused by heat
- Built-in ON / OFF circuit: Ensures long battery life.
- Constant current source pull-down is selectable.
- Discharge shunt circuit can be selected.
- Lead-free (Sn 100%), halogen-free*2

***1.** Attention should be paid to the power dissipation of the package when the output current is large.
***2.** Refer to "■ **Product Name Structure**" for details.

■ Applications

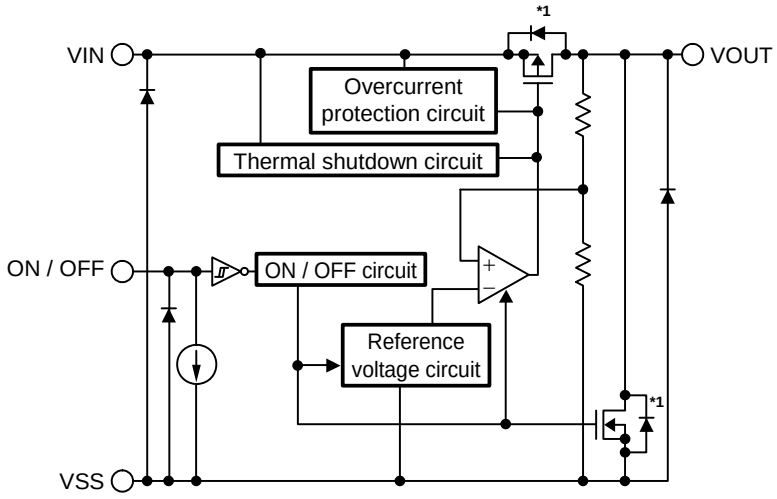
- Power supply for portable communication devices, digital cameras, and digital audio players
- Power supply for battery-powered devices
- Power supply for home electric / electronic appliances

■ Packages

- HSNT-4(0808)
- SOT-23-5
- SC-82AB

■ Block Diagrams

1. S-1313 Series A type

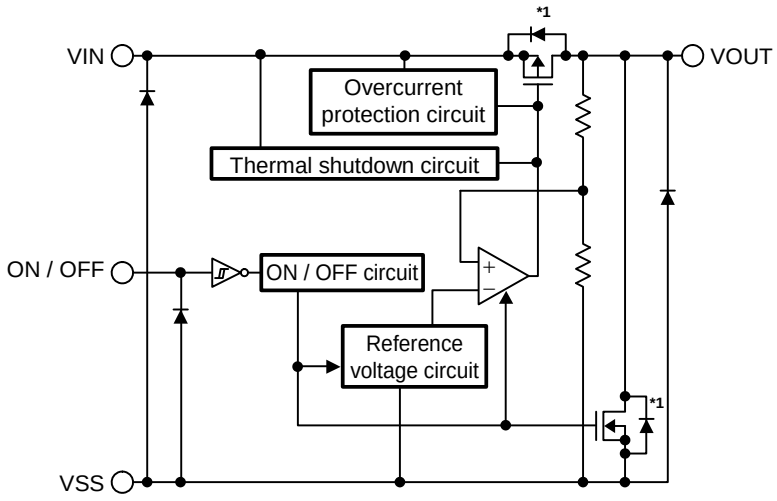


Function	Status
ON / OFF logic	Active “H”
Discharge shunt function	Available
Constant current source pull-down	Available

***1.** Parasitic diode

Figure 1

2. S-1313 Series B type

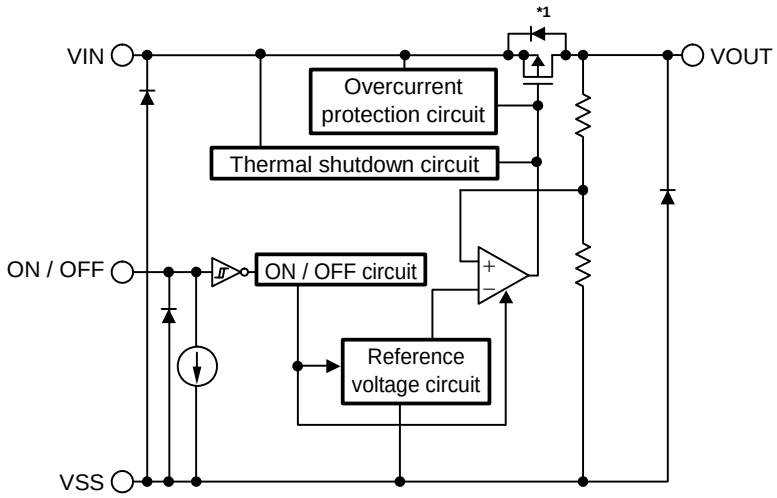


Function	Status
ON / OFF logic	Active “H”
Discharge shunt function	Available
Constant current source pull-down	None

***1.** Parasitic diode

Figure 2

3. S-1313 Series C type

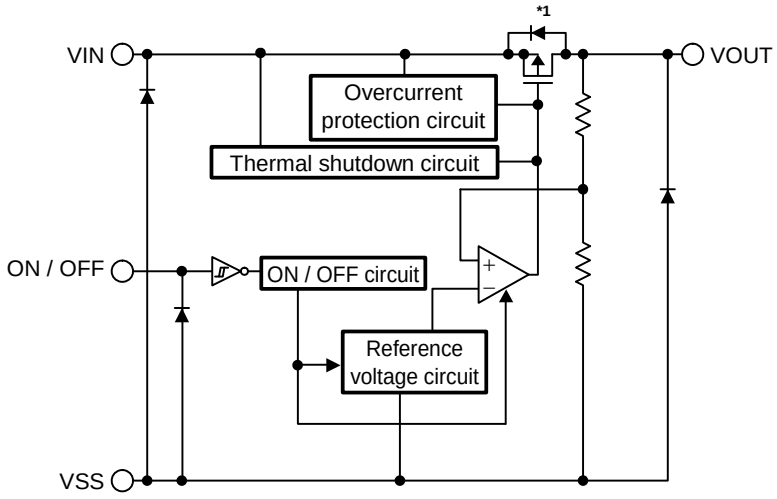


Function	Status
ON / OFF logic	Active “H”
Discharge shunt function	None
Constant current source pull-down	Available

***1.** Parasitic diode

Figure 3

4. S-1313 Series D type



Function	Status
ON / OFF logic	Active “H”
Discharge shunt function	None
Constant current source pull-down	None

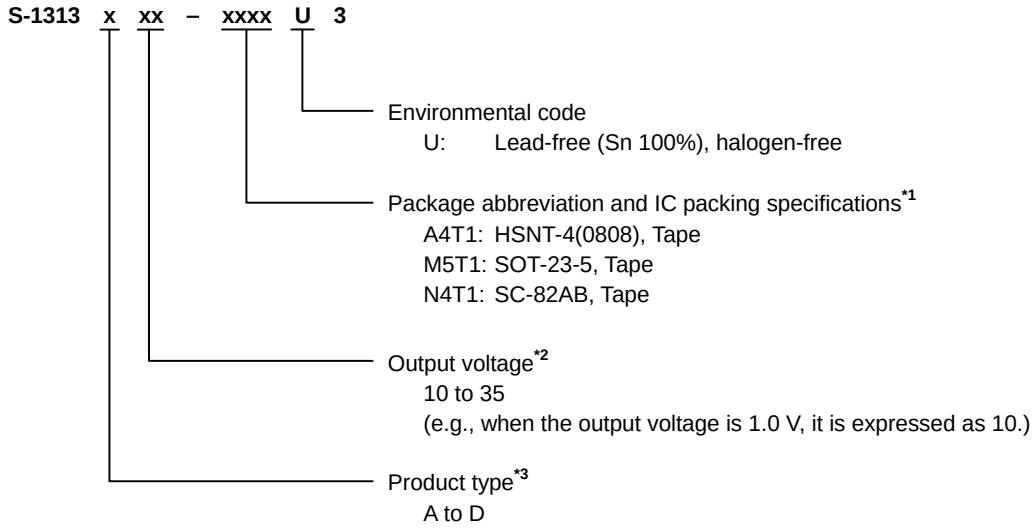
***1.** Parasitic diode

Figure 4

■ Product Name Structure

Users can select the product type, output voltage, and package type for the S-1313 Series. Refer to "**1. Product name**" regarding the contents of product name, "**2. Function list of product type**" regarding the product type, "**3. Packages**" regarding the package drawings.

1. Product name



***1.** Refer to the tape specifications.
***2.** If you request the product which has 0.05 V step, contact our sales office.
***3.** Refer to "**2. Function list of product type**".

2. Function list of product type

Table 1

Product Type	ON / OFF Logic	Discharge Shunt Function	Constant current source pull-down
A	Active "H"	Available	Available
B	Active "H"	Available	None
C	Active "H"	None	Available
D	Active "H"	None	None

3. Packages

Package Name	Drawing Code			
	Package	Tape	Reel	Land
HSNT-4(0808)	PK004-A-P-SD	PK004-A-C-SD	PK004-A-R-SD	PK004-A-L-SD
SOT-23-5	MP005-A-P-SD	MP005-A-C-SD	MP005-A-R-SD	—
SC-82AB	NP004-A-P-SD	NP004-A-C-SD NP004-A-C-S1	NP004-A-R-SD	—

4. Product name list

4. 1 S-1313 Series A type

ON / OFF logic: Active “H”
Discharge shunt function: Available Constant current source pull-down: Available

Table 2

Output Voltage	HSNT-4(0808)	SOT-23-5	SC-82AB
1.0 V ± 15 mV	S-1313A10-A4T1U3	S-1313A10-M5T1U3	S-1313A10-N4T1U3
1.1 V ± 15 mV	S-1313A11-A4T1U3	S-1313A11-M5T1U3	S-1313A11-N4T1U3
1.2 V ± 15 mV	S-1313A12-A4T1U3	S-1313A12-M5T1U3	S-1313A12-N4T1U3
1.3 V ± 15 mV	S-1313A13-A4T1U3	S-1313A13-M5T1U3	S-1313A13-N4T1U3
1.4 V ± 15 mV	S-1313A14-A4T1U3	S-1313A14-M5T1U3	S-1313A14-N4T1U3
1.5 V ± 1.0%	S-1313A15-A4T1U3	S-1313A15-M5T1U3	S-1313A15-N4T1U3
1.6 V ± 1.0%	S-1313A16-A4T1U3	S-1313A16-M5T1U3	S-1313A16-N4T1U3
1.7 V ± 1.0%	S-1313A17-A4T1U3	S-1313A17-M5T1U3	S-1313A17-N4T1U3
1.8 V ± 1.0%	S-1313A18-A4T1U3	S-1313A18-M5T1U3	S-1313A18-N4T1U3
1.85 V ± 1.0%	S-1313A1J-A4T1U3	S-1313A1J-M5T1U3	S-1313A1J-N4T1U3
1.9 V ± 1.0%	S-1313A19-A4T1U3	S-1313A19-M5T1U3	S-1313A19-N4T1U3
2.0 V ± 1.0%	S-1313A20-A4T1U3	S-1313A20-M5T1U3	S-1313A20-N4T1U3
2.1 V ± 1.0%	S-1313A21-A4T1U3	S-1313A21-M5T1U3	S-1313A21-N4T1U3
2.2 V ± 1.0%	S-1313A22-A4T1U3	S-1313A22-M5T1U3	S-1313A22-N4T1U3
2.3 V ± 1.0%	S-1313A23-A4T1U3	S-1313A23-M5T1U3	S-1313A23-N4T1U3
2.4 V ± 1.0%	S-1313A24-A4T1U3	S-1313A24-M5T1U3	S-1313A24-N4T1U3
2.5 V ± 1.0%	S-1313A25-A4T1U3	S-1313A25-M5T1U3	S-1313A25-N4T1U3
2.6 V ± 1.0%	S-1313A26-A4T1U3	S-1313A26-M5T1U3	S-1313A26-N4T1U3
2.7 V ± 1.0%	S-1313A27-A4T1U3	S-1313A27-M5T1U3	S-1313A27-N4T1U3
2.8 V ± 1.0%	S-1313A28-A4T1U3	S-1313A28-M5T1U3	S-1313A28-N4T1U3
2.85 V ± 1.0%	S-1313A2J-A4T1U3	S-1313A2J-M5T1U3	S-1313A2J-N4T1U3
2.9 V ± 1.0%	S-1313A29-A4T1U3	S-1313A29-M5T1U3	S-1313A29-N4T1U3
3.0 V ± 1.0%	S-1313A30-A4T1U3	S-1313A30-M5T1U3	S-1313A30-N4T1U3
3.1 V ± 1.0%	S-1313A31-A4T1U3	S-1313A31-M5T1U3	S-1313A31-N4T1U3
3.2 V ± 1.0%	S-1313A32-A4T1U3	S-1313A32-M5T1U3	S-1313A32-N4T1U3
3.3 V ± 1.0%	S-1313A33-A4T1U3	S-1313A33-M5T1U3	S-1313A33-N4T1U3
3.4 V ± 1.0%	S-1313A34-A4T1U3	S-1313A34-M5T1U3	S-1313A34-N4T1U3
3.5 V ± 1.0%	S-1313A35-A4T1U3	S-1313A35-M5T1U3	S-1313A35-N4T1U3

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

4. 2 S-1313 Series B type

ON / OFF logic: Active “H”
Discharge shunt function: Available Constant current source pull-down: None

Table 3

Output Voltage	HSNT-4(0808)	SOT-23-5	SC-82AB
1.0 V ± 15 mV	S-1313B10-A4T1U3	S-1313B10-M5T1U3	S-1313B10-N4T1U3
1.1 V ± 15 mV	S-1313B11-A4T1U3	S-1313B11-M5T1U3	S-1313B11-N4T1U3
1.2 V ± 15 mV	S-1313B12-A4T1U3	S-1313B12-M5T1U3	S-1313B12-N4T1U3
1.3 V ± 15 mV	S-1313B13-A4T1U3	S-1313B13-M5T1U3	S-1313B13-N4T1U3
1.4 V ± 15 mV	S-1313B14-A4T1U3	S-1313B14-M5T1U3	S-1313B14-N4T1U3
1.5 V ± 1.0%	S-1313B15-A4T1U3	S-1313B15-M5T1U3	S-1313B15-N4T1U3
1.6 V ± 1.0%	S-1313B16-A4T1U3	S-1313B16-M5T1U3	S-1313B16-N4T1U3
1.7 V ± 1.0%	S-1313B17-A4T1U3	S-1313B17-M5T1U3	S-1313B17-N4T1U3
1.8 V ± 1.0%	S-1313B18-A4T1U3	S-1313B18-M5T1U3	S-1313B18-N4T1U3
1.85 V ± 1.0%	S-1313B1J-A4T1U3	S-1313B1J-M5T1U3	S-1313B1J-N4T1U3
1.9 V ± 1.0%	S-1313B19-A4T1U3	S-1313B19-M5T1U3	S-1313B19-N4T1U3
2.0 V ± 1.0%	S-1313B20-A4T1U3	S-1313B20-M5T1U3	S-1313B20-N4T1U3
2.1 V ± 1.0%	S-1313B21-A4T1U3	S-1313B21-M5T1U3	S-1313B21-N4T1U3
2.2 V ± 1.0%	S-1313B22-A4T1U3	S-1313B22-M5T1U3	S-1313B22-N4T1U3
2.3 V ± 1.0%	S-1313B23-A4T1U3	S-1313B23-M5T1U3	S-1313B23-N4T1U3
2.4 V ± 1.0%	S-1313B24-A4T1U3	S-1313B24-M5T1U3	S-1313B24-N4T1U3
2.5 V ± 1.0%	S-1313B25-A4T1U3	S-1313B25-M5T1U3	S-1313B25-N4T1U3
2.6 V ± 1.0%	S-1313B26-A4T1U3	S-1313B26-M5T1U3	S-1313B26-N4T1U3
2.7 V ± 1.0%	S-1313B27-A4T1U3	S-1313B27-M5T1U3	S-1313B27-N4T1U3
2.8 V ± 1.0%	S-1313B28-A4T1U3	S-1313B28-M5T1U3	S-1313B28-N4T1U3
2.85 V ± 1.0%	S-1313B2J-A4T1U3	S-1313B2J-M5T1U3	S-1313B2J-N4T1U3
2.9 V ± 1.0%	S-1313B29-A4T1U3	S-1313B29-M5T1U3	S-1313B29-N4T1U3
3.0 V ± 1.0%	S-1313B30-A4T1U3	S-1313B30-M5T1U3	S-1313B30-N4T1U3
3.1 V ± 1.0%	S-1313B31-A4T1U3	S-1313B31-M5T1U3	S-1313B31-N4T1U3
3.2 V ± 1.0%	S-1313B32-A4T1U3	S-1313B32-M5T1U3	S-1313B32-N4T1U3
3.3 V ± 1.0%	S-1313B33-A4T1U3	S-1313B33-M5T1U3	S-1313B33-N4T1U3
3.4 V ± 1.0%	S-1313B34-A4T1U3	S-1313B34-M5T1U3	S-1313B34-N4T1U3
3.5 V ± 1.0%	S-1313B35-A4T1U3	S-1313B35-M5T1U3	S-1313B35-N4T1U3

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

4. 3 S-1313 Series C type

ON / OFF logic: Active “H”
Discharge shunt function: None Constant current source pull-down: Available

Table 4

Output Voltage	HSNT-4(0808)	SOT-23-5	SC-82AB
1.0 V ± 15 mV	S-1313C10-A4T1U3	S-1313C10-M5T1U3	S-1313C10-N4T1U3
1.1 V ± 15 mV	S-1313C11-A4T1U3	S-1313C11-M5T1U3	S-1313C11-N4T1U3
1.2 V ± 15 mV	S-1313C12-A4T1U3	S-1313C12-M5T1U3	S-1313C12-N4T1U3
1.3 V ± 15 mV	S-1313C13-A4T1U3	S-1313C13-M5T1U3	S-1313C13-N4T1U3
1.4 V ± 15 mV	S-1313C14-A4T1U3	S-1313C14-M5T1U3	S-1313C14-N4T1U3
1.5 V ± 1.0%	S-1313C15-A4T1U3	S-1313C15-M5T1U3	S-1313C15-N4T1U3
1.6 V ± 1.0%	S-1313C16-A4T1U3	S-1313C16-M5T1U3	S-1313C16-N4T1U3
1.7 V ± 1.0%	S-1313C17-A4T1U3	S-1313C17-M5T1U3	S-1313C17-N4T1U3
1.8 V ± 1.0%	S-1313C18-A4T1U3	S-1313C18-M5T1U3	S-1313C18-N4T1U3
1.85 V ± 1.0%	S-1313C1J-A4T1U3	S-1313C1J-M5T1U3	S-1313C1J-N4T1U3
1.9 V ± 1.0%	S-1313C19-A4T1U3	S-1313C19-M5T1U3	S-1313C19-N4T1U3
2.0 V ± 1.0%	S-1313C20-A4T1U3	S-1313C20-M5T1U3	S-1313C20-N4T1U3
2.1 V ± 1.0%	S-1313C21-A4T1U3	S-1313C21-M5T1U3	S-1313C21-N4T1U3
2.2 V ± 1.0%	S-1313C22-A4T1U3	S-1313C22-M5T1U3	S-1313C22-N4T1U3
2.3 V ± 1.0%	S-1313C23-A4T1U3	S-1313C23-M5T1U3	S-1313C23-N4T1U3
2.4 V ± 1.0%	S-1313C24-A4T1U3	S-1313C24-M5T1U3	S-1313C24-N4T1U3
2.5 V ± 1.0%	S-1313C25-A4T1U3	S-1313C25-M5T1U3	S-1313C25-N4T1U3
2.6 V ± 1.0%	S-1313C26-A4T1U3	S-1313C26-M5T1U3	S-1313C26-N4T1U3
2.7 V ± 1.0%	S-1313C27-A4T1U3	S-1313C27-M5T1U3	S-1313C27-N4T1U3
2.8 V ± 1.0%	S-1313C28-A4T1U3	S-1313C28-M5T1U3	S-1313C28-N4T1U3
2.85 V ± 1.0%	S-1313C2J-A4T1U3	S-1313C2J-M5T1U3	S-1313C2J-N4T1U3
2.9 V ± 1.0%	S-1313C29-A4T1U3	S-1313C29-M5T1U3	S-1313C29-N4T1U3
3.0 V ± 1.0%	S-1313C30-A4T1U3	S-1313C30-M5T1U3	S-1313C30-N4T1U3
3.1 V ± 1.0%	S-1313C31-A4T1U3	S-1313C31-M5T1U3	S-1313C31-N4T1U3
3.2 V ± 1.0%	S-1313C32-A4T1U3	S-1313C32-M5T1U3	S-1313C32-N4T1U3
3.3 V ± 1.0%	S-1313C33-A4T1U3	S-1313C33-M5T1U3	S-1313C33-N4T1U3
3.4 V ± 1.0%	S-1313C34-A4T1U3	S-1313C34-M5T1U3	S-1313C34-N4T1U3
3.5 V ± 1.0%	S-1313C35-A4T1U3	S-1313C35-M5T1U3	S-1313C35-N4T1U3

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

4. 4 S-1313 Series D type

ON / OFF logic: Active “H”
Discharge shunt function: None Constant current source pull-down: None

Table 5

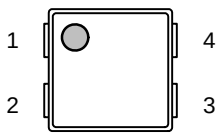
Output Voltage	HSNT-4(0808)	SOT-23-5	SC-82AB
1.0 V ± 15 mV	S-1313D10-A4T1U3	S-1313D10-M5T1U3	S-1313D10-N4T1U3
1.1 V ± 15 mV	S-1313D11-A4T1U3	S-1313D11-M5T1U3	S-1313D11-N4T1U3
1.2 V ± 15 mV	S-1313D12-A4T1U3	S-1313D12-M5T1U3	S-1313D12-N4T1U3
1.3 V ± 15 mV	S-1313D13-A4T1U3	S-1313D13-M5T1U3	S-1313D13-N4T1U3
1.4 V ± 15 mV	S-1313D14-A4T1U3	S-1313D14-M5T1U3	S-1313D14-N4T1U3
1.5 V ± 1.0%	S-1313D15-A4T1U3	S-1313D15-M5T1U3	S-1313D15-N4T1U3
1.6 V ± 1.0%	S-1313D16-A4T1U3	S-1313D16-M5T1U3	S-1313D16-N4T1U3
1.7 V ± 1.0%	S-1313D17-A4T1U3	S-1313D17-M5T1U3	S-1313D17-N4T1U3
1.8 V ± 1.0%	S-1313D18-A4T1U3	S-1313D18-M5T1U3	S-1313D18-N4T1U3
1.85 V ± 1.0%	S-1313D1J-A4T1U3	S-1313D1J-M5T1U3	S-1313D1J-N4T1U3
1.9 V ± 1.0%	S-1313D19-A4T1U3	S-1313D19-M5T1U3	S-1313D19-N4T1U3
2.0 V ± 1.0%	S-1313D20-A4T1U3	S-1313D20-M5T1U3	S-1313D20-N4T1U3
2.1 V ± 1.0%	S-1313D21-A4T1U3	S-1313D21-M5T1U3	S-1313D21-N4T1U3
2.2 V ± 1.0%	S-1313D22-A4T1U3	S-1313D22-M5T1U3	S-1313D22-N4T1U3
2.3 V ± 1.0%	S-1313D23-A4T1U3	S-1313D23-M5T1U3	S-1313D23-N4T1U3
2.4 V ± 1.0%	S-1313D24-A4T1U3	S-1313D24-M5T1U3	S-1313D24-N4T1U3
2.5 V ± 1.0%	S-1313D25-A4T1U3	S-1313D25-M5T1U3	S-1313D25-N4T1U3
2.6 V ± 1.0%	S-1313D26-A4T1U3	S-1313D26-M5T1U3	S-1313D26-N4T1U3
2.7 V ± 1.0%	S-1313D27-A4T1U3	S-1313D27-M5T1U3	S-1313D27-N4T1U3
2.8 V ± 1.0%	S-1313D28-A4T1U3	S-1313D28-M5T1U3	S-1313D28-N4T1U3
2.85 V ± 1.0%	S-1313D2J-A4T1U3	S-1313D2J-M5T1U3	S-1313D2J-N4T1U3
2.9 V ± 1.0%	S-1313D29-A4T1U3	S-1313D29-M5T1U3	S-1313D29-N4T1U3
3.0 V ± 1.0%	S-1313D30-A4T1U3	S-1313D30-M5T1U3	S-1313D30-N4T1U3
3.1 V ± 1.0%	S-1313D31-A4T1U3	S-1313D31-M5T1U3	S-1313D31-N4T1U3
3.2 V ± 1.0%	S-1313D32-A4T1U3	S-1313D32-M5T1U3	S-1313D32-N4T1U3
3.3 V ± 1.0%	S-1313D33-A4T1U3	S-1313D33-M5T1U3	S-1313D33-N4T1U3
3.4 V ± 1.0%	S-1313D34-A4T1U3	S-1313D34-M5T1U3	S-1313D34-N4T1U3
3.5 V ± 1.0%	S-1313D35-A4T1U3	S-1313D35-M5T1U3	S-1313D35-N4T1U3

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

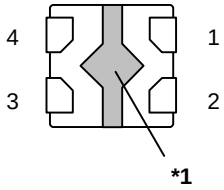
■ Pin Configurations

HSNT-4(0808)

Top view



Bottom view



***1.** Connect the heatsink of backside at shadowed area to the board, and set electric potential open or GND.
However, do not use it as the function of electrode.

Figure 5

Table 6

Pin No.	Symbol	Description
1	VOUT	Output voltage pin
2	VSS	GND pin
3	ON / OFF	ON / OFF pin
4	VIN	Input voltage pin

SOT-23-5

Top view

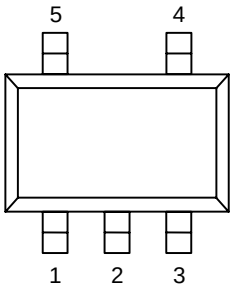


Figure 6

Table 7

Pin No.	Symbol	Description
1	VIN	Input voltage pin
2	VSS	GND pin
3	ON / OFF	ON / OFF pin
4	NC*1	No connection
5	VOUT	Output voltage pin

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

SC-82AB

Top view

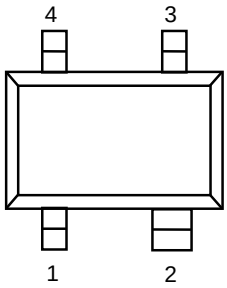


Figure 7

Table 8

Pin No.	Symbol	Description
1	ON / OFF	ON / OFF pin
2	VSS	GND pin
3	VOUT	Output voltage pin
4	VIN	Input voltage pin

■ Absolute Maximum Ratings

Table 9

(Ta = 25°C unless otherwise specified)

Item		Symbol	Absolute Maximum Rating	Unit
Input voltage		V_{IN}	V_{SS} − 0.3 to V_{SS} + 6.0	V
		$V_{ON / OFF}$	V_{SS} − 0.3 to V_{SS} + 6.0	V
Output voltage		V_{OUT}	V_{SS} − 0.3 to V_{IN} + 0.3	V
Output current		I_{OUT}	240	mA
Power dissipation	HSNT-4(0808)	P_D	335[*1]	mW
	SOT-23-5		600[*1]	mW
	SC-82AB		400[*1]	mW
Operating ambient temperature		T_{opr}	−40 to +85	°C
Storage ambient 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.

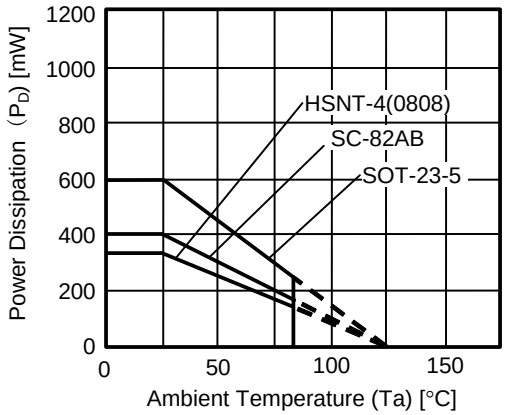


Figure 8 Power Dissipation of Package

Power Dissipation of HSNT-4(0808) (Reference)

Power dissipation of package differs depending on the mounting conditions.
Consider the power dissipation characteristics under the following conditions as reference.

[Mounted board]

(1) Board size : 40 mm × 40 mm × t0.8 mm
(2) Board material : Glass epoxy resin (four layers)
(3) Wiring ratio : 50%
(4) Test conditions : When mounted on board (wind speed : 0 m / s)
(5) Land pattern : Refer to the recommended land pattern (drawing code : PK004-A-L-SD)

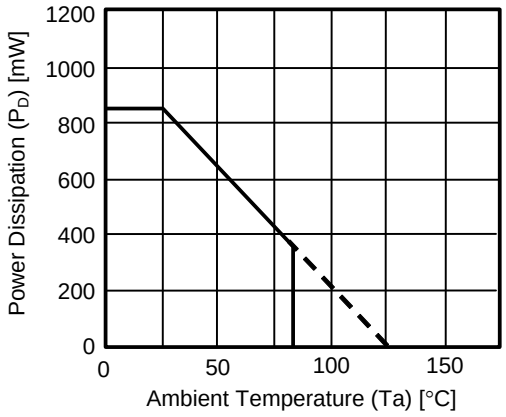


Figure 9 Power Dissipation of Package

Table 10

Condition	Power Dissipation (Reference)	Thermal Resistance Value (θj–a)
HSNT-4(0808) (When mounted on board)	850 mW	117 °C / W

■ Electrical Characteristics

Table 11 (1 / 2)

(Ta = 25°C unless otherwise specified)

Item	Symbol	Conditions		Min.	Typ.	Max.	Unit	Test Circuit
Output voltage[*1]	$V_{OUT(E)}$	$V_{IN} = V_{OUT(S)} + 1.0$ V, I_{OUT} = 30 mA	$1.0\ V \le V_{OUT(S)} < 1.5$ V	$V_{OUT(S)} - 0.015$	$V_{OUT(S)}$	$V_{OUT(S)} + 0.015$	V	1
			$1.5\ V \le V_{OUT(S)} \le 3.5$ V	$V_{OUT(S)} \times 0.99$	$V_{OUT(S)}$	$V_{OUT(S)} \times 1.01$	V	1
Output current[*2]	I_{OUT}	$V_{IN} \ge V_{OUT(S)} + 1.0$ V	$1.0\ V \le V_{OUT(S)} < 1.1$ V	100[*5]	—	—	mA	3
			$1.1\ V \le V_{OUT(S)} < 1.2$ V	125[*5]	—	—	mA	3
			$1.2\ V \le V_{OUT(S)} < 1.3$ V	150[*5]	—	—	mA	3
			$1.3\ V \le V_{OUT(S)} < 1.4$ V	175[*5]	—	—	mA	3
			$1.4\ V \le V_{OUT(S)} \le 3.5$ V	200[*5]	—	—	mA	3
Dropout voltage[*3]	V_{drop}	I_{OUT} = 100 mA	$1.0\ V \le V_{OUT(S)} < 1.1$ V	0.50	0.76	1.55	V	1
			$1.1\ V \le V_{OUT(S)} < 1.2$ V	—	0.67	1.39	V	1
			$1.2\ V \le V_{OUT(S)} < 1.3$ V	—	0.58	1.25	V	1
			$1.3\ V \le V_{OUT(S)} < 1.4$ V	—	0.49	1.11	V	1
			$1.4\ V \le V_{OUT(S)} < 1.5$ V	—	0.43	0.99	V	1
			$1.5\ V \le V_{OUT(S)} < 1.7$ V	—	0.37	0.85	V	1
			$1.7\ V \le V_{OUT(S)} < 1.8$ V	—	0.31	0.68	V	1
			$1.8\ V \le V_{OUT(S)} < 2.0$ V	—	0.27	0.58	V	1
			$2.0\ V \le V_{OUT(S)} < 2.5$ V	—	0.23	0.49	V	1
			$2.5\ V \le V_{OUT(S)} < 2.8$ V	—	0.18	0.38	V	1
			$2.8\ V \le V_{OUT(S)} < 3.0$ V	—	0.17	0.33	V	1
			$3.0\ V \le V_{OUT(S)} \le 3.5$ V	—	0.16	0.32	V	1
Line regulation	$\frac{\Delta V_{OUT1}}{\Delta V_{IN} \bullet V_{OUT}}$	$V_{OUT(S)} + 0.5\ V \le V_{IN} \le 5.5$ V, I_{OUT} = 1 μA	$1.0\ V \le V_{OUT(S)} \le 3.5$ V	—	0.05	0.2	%/V	1
		$V_{OUT(S)} + 0.5\ V \le V_{IN} \le 5.5$ V, I_{OUT} = 30 mA	$1.0\ V \le V_{OUT(S)} < 1.1$ V	—	0.07	2.0	%/V	1
			$1.1\ V \le V_{OUT(S)} < 1.2$ V	—	0.06	1.0	%/V	1
			$1.2\ V \le V_{OUT(S)} \le 3.5$ V	—	0.05	0.2	%/V	1
Load regulation	ΔV_{OUT2}	$V_{IN} = V_{OUT(S)} + 1.0$ V, 1 μA ≤ I_{OUT} ≤ 100 mA	$1.0\ V \le V_{OUT(S)} \le 3.5$ V	—	20	40	mV	1
		$V_{IN} = V_{OUT(S)} + 1.0$ V, 100 μA ≤ I_{OUT} ≤ 200 mA	$1.0\ V \le V_{OUT(S)} < 1.1$ V	—	40	640	mV	1
			$1.1\ V \le V_{OUT(S)} < 1.2$ V	—	40	400	mV	1
			$1.2\ V \le V_{OUT(S)} < 1.3$ V	—	40	160	mV	1
			$1.3\ V \le V_{OUT(S)} < 1.4$ V	—	40	80	mV	1
			$1.4\ V \le V_{OUT(S)} \le 3.5$ V	—	40	80	mV	1
Output voltage temperature coefficient[*4]	$\frac{\Delta V_{OUT}}{\Delta Ta \bullet V_{OUT}}$	$V_{IN} = V_{OUT(S)} + 1.0$ V, I_{OUT} = 30 mA, −40°C ≤ Ta ≤ +85°C		—	±130	—	ppm/°C	1
Current consumption during operation	I_{SS1}	$V_{IN} = V_{OUT(S)} + 1.0$ V, ON / OFF pin = ON, no load		—	0.9	1.35	μA	2
Current consumption during power-off	I_{SS2}	$V_{IN} = V_{OUT(S)} + 1.0$ V, ON / OFF pin = OFF, no load		—	0.1	1.0	μA	2
Input voltage	V_{IN}	—		1.5	—	5.5	V	—
ON / OFF pin input voltage "H"	V_{SH}	$V_{IN} = V_{OUT(S)} + 1.0$ V, R_L = 1.0 kΩ determined by V_{OUT} output level		1.0	—	—	V	4
ON / OFF pin input voltage "L"	V_{SL}	$V_{IN} = V_{OUT(S)} + 1.0$ V, R_L = 1.0 kΩ determined by V_{OUT} output level		—	—	0.25	V	4
ON / OFF pin input current "H"	I_{SH}	$V_{IN} = V_{OUT(S)} + 1.0$ V, $V_{ON / OFF}$ = 5.5 V		−0.1	—	0.1	μA	4
ON / OFF pin input current "L"	I_{SL}	$V_{IN} = V_{OUT(S)} + 1.0$ V, $V_{ON / OFF}$ = 0 V		−0.1	—	0.1	μA	4
Short-circuit current	I_{short}	$V_{IN} = V_{OUT(S)} + 1.0$ V, ON / OFF pin = ON, V_{OUT} = 0 V		—	50	—	mA	3
Thermal shutdown detection temperature	T_{SD}	Junction temperature		—	150	—	°C	—
Thermal shutdown release temperature	T_{SR}	Junction temperature		—	120	—	°C	—

Table 11 (2 / 2)

S-1313 Series A / B type (With discharge shunt function)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit	Test Circuit
"L" output Nch ON resistance	R_{LOW}	V_{OUT} = 0.1 V, V_{IN} = 5.5 V	—	35	—	Ω	3

S-1313 Series A / C type (Constant current source pull-down)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit	Test Circuit
Constant current source power-off pull-down	I_{SHPD}	V_{IN} = $V_{OUT(S)}$ + 1.0 V, $V_{ON / OFF}$ = 5.5 V	0.05	0.10	0.20	μA	4

***1.** $V_{OUT(S)}$: Specified output voltage
$V_{OUT(E)}$: Actual output voltage
Output voltage when fixing I_{OUT} (= 30 mA) and inputting $V_{OUT(S)}$ +1.0 V

***2.** The output current at which the output voltage becomes 95% of $V_{OUT(E)}$ after gradually increasing the output current.

***3.** $V_{drop} = V_{IN1} - (V_{OUT3} \times 0.98)$
V_{OUT3} is the output voltage when V_{IN} = $V_{OUT(S)}$ + 1.0 V and I_{OUT} = 100 mA.
V_{IN1} is the input voltage at which the output voltage becomes 98% of V_{OUT3} after gradually decreasing the input voltage.

***4.** The change in temperature [mV/°C] is calculated using the following equation.

$$\frac{\Delta V_{OUT}}{\Delta Ta}[\text{mV/°C}]^{*1} = V_{OUT(S)}[\text{V}]^{*2} \times \frac{\Delta V_{OUT}}{\Delta Ta \bullet V_{OUT}}[\text{ppm/°C}]^{*3} \div 1000$$

***1.** Change in temperature of the output voltage
***2.** Specified output voltage
***3.** Output voltage temperature coefficient

***5.** The output current can be at least this value.
Due to restrictions on the package power dissipation, this value may not be satisfied. Attention should be paid to the power dissipation of the package when the output current is large.
This specification is guaranteed by design.

■ Test Circuits

1.

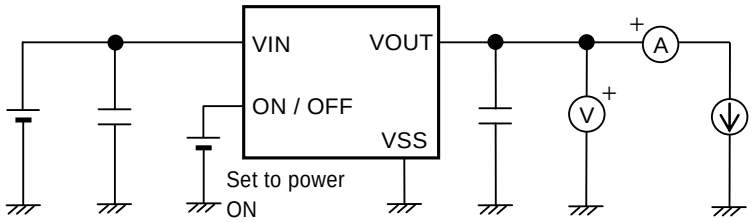


Figure 10

2.

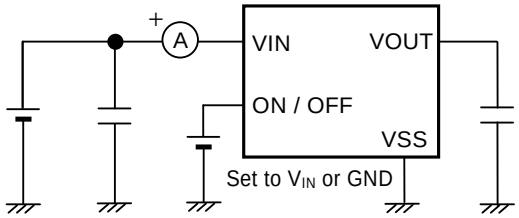


Figure 11

3.

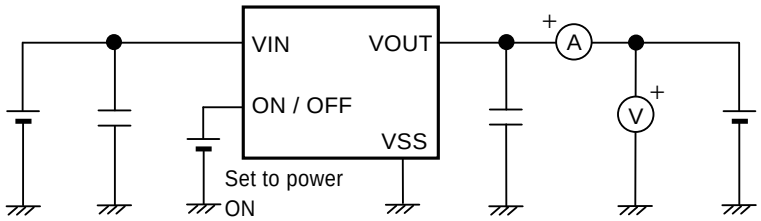


Figure 12

4.

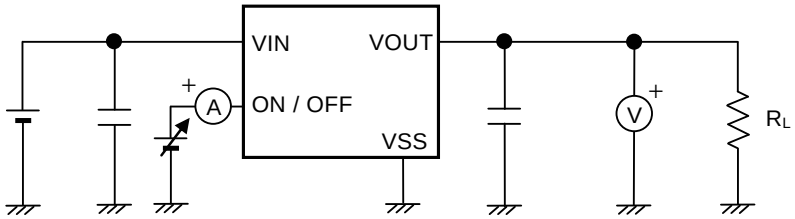


Figure 13

5.

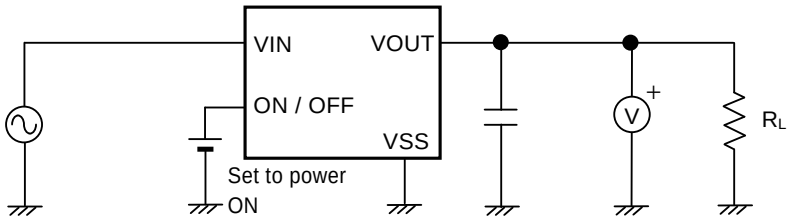
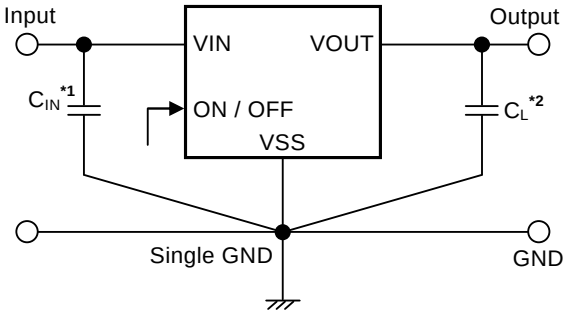


Figure 14

■ Standard Circuit



***1.** C_{IN} is a capacitor for stabilizing the input.
***2.** Ceramic capacitor of 0.1 μF or more can be used as C_L.

Figure 15

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

■ Condition of Application

Input capacitor (C_{IN}) : 0.1 μF or more
Output capacitor (C_L) : 0.1 μF or more (Ceramic capacitor)

Caution A general series regulator may oscillate, depending on the external components. Confirm that no oscillation occurs in the application for which the above capacitors are used.

■ Selection of Input and Output Capacitors (C_{IN}, C_L)

The S-1313 Series requires an output capacitor between the VOUT and VSS pin for phase compensation. Operation is stabilized by a ceramic capacitor with an output capacitance of 0.1 μF or more over the entire temperature range. When using an OS capacitor, tantalum capacitor, or aluminum electrolytic capacitor, the capacitance must be 0.1 μF or more.

The value of the output overshoot or undershoot transient response varies depending on the value of the output capacitor. The required capacitance of the input capacitor differs depending on the application.

The recommended capacitance for an application is $C_{IN} \geq 0.1$ μF, $C_L \geq 0.1$ μF; however, when selecting the output capacitor, perform sufficient evaluation, including evaluation of temperature characteristics, on the actual device.

■ Explanation of Terms

1. Low dropout voltage regulator

This IC's voltage regulator has the low dropout voltage due to its built-in low on-resistance transistor.

2. Output voltage (V_{OUT})

The accuracy of the output voltage is ensured at ±1.0% or ±15 mV[*1] under the specified conditions of fixed input voltage[*2], fixed output current, and fixed temperature.

***1.** When V_{OUT} < 1.5 V : ±15 mV, When 1.5 V ≤ V_{OUT} : ±1.0%
***2.** Differs depending on the product.

Caution **If the above conditions change, the output voltage value may vary and exceed the accuracy range of the output voltage. Refer to "■ Electrical Characteristics" and "■ Characteristics (Typical Data)" for details.**

3. Line regulation $\left(\frac{\Delta V_{OUT1}}{\Delta V_{IN} \bullet V_{OUT}}\right)$

Indicates the dependency of the output voltage on the input voltage. That is, the values show how much the output voltage changes due to a change in the input voltage with the output current remaining unchanged.

4. Load regulation (ΔV_{OUT2})

Indicates the dependency of the output voltage on the output current. That is, the values show how much the output voltage changes due to a change in the output current with the input voltage remaining unchanged.

5. Dropout voltage (V_{drop})

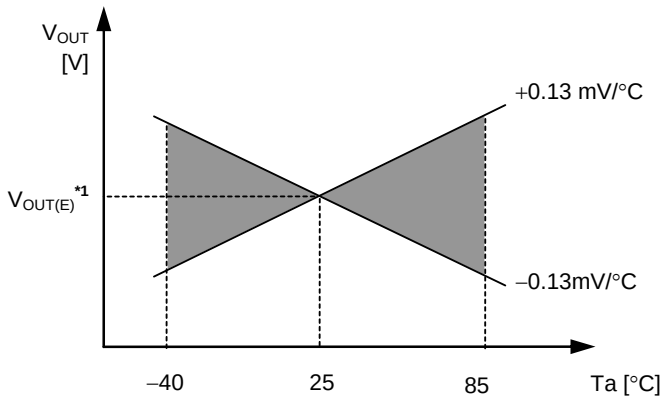
Indicates the difference between input voltage V_{IN} and the output voltage when; decreasing input voltage V_{IN} gradually until the output voltage has dropped out to the value of 98% of output voltage V_{OUT3}, which is at V_{IN} = $V_{OUT(S)}$ + 1.0 V.

$V_{drop} = V_{IN1} - (V_{OUT3} \times 0.98)$

6. Temperature coefficient of output voltage $\left(\frac{\Delta V_{OUT}}{\Delta Ta \bullet V_{OUT}}\right)$

The shaded area in **Figure 16** is the range where V_{OUT} varies in the operating temperature range when the temperature coefficient of the output voltage is ±130 ppm/°C.

Example of S-1313A10 typ. products



***1.** $V_{OUT(E)}$ is the value of the output voltage measured at 25°C.

Figure 16

A change in the temperature of the output voltage [mV/°C] is calculated using the following equation.

$$\frac{\Delta V_{OUT}}{\Delta Ta}[\text{mV/°C}]^{*1} = V_{OUT(S)}[\text{V}]^{*2} \times \frac{\Delta V_{OUT}}{\Delta Ta \bullet V_{OUT}}[\text{ppm/°C}]^{*3} \div 1000$$

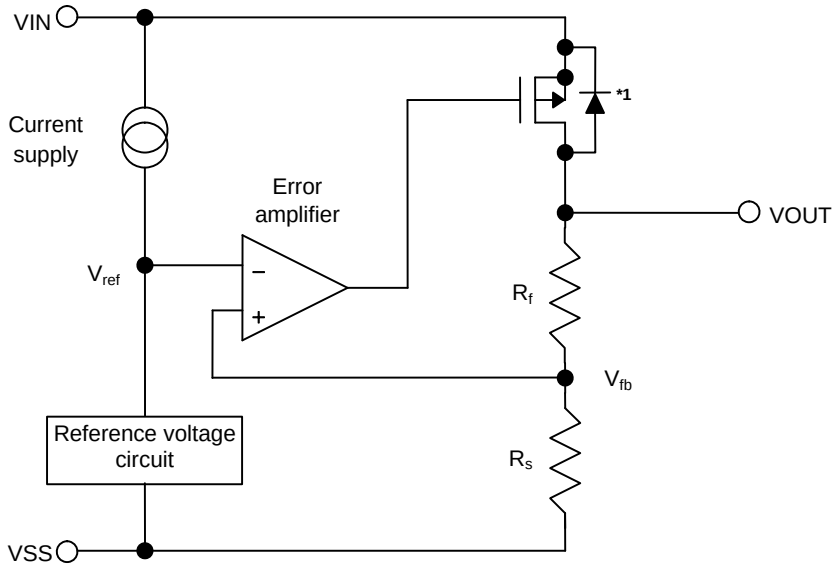
***1.** Change in temperature of output voltage
***2.** Specified output voltage
***3.** Output voltage temperature coefficient

■ Operation

1. Basic operation

Figure 17 shows the block diagram of S-1313 Series.

The error amplifier compares the reference voltage (V_{ref}) with V_{fb}, which is the output voltage resistance-divided by feedback resistors R_s and R_f. It supplies the gate voltage necessary to maintain the constant output voltage which is not influenced by the input voltage and temperature change, to the output transistor.



***1**. Parasitic diode

Figure 17

2. Output transistor

In the S-1313 Series, a low on-resistance P-channel MOS FET is used as the output transistor.
Be sure that V_{OUT} does not exceed V_{IN} + 0.3 V to prevent the voltage regulator from being damaged due to inverse current flowing from the VOUT pin through a parasitic diode to the VIN pin.

3. ON / OFF pin

This pin starts and stops the regulator.

When the ON / OFF pin is set to the power-off level, the entire internal circuit stops operating, and the built-in P-channel MOS FET output transistor between the VIN and VOUT pins is turned off, reducing current consumption significantly.
Note that the current consumption increases when a voltage of 0.25 V to 0.1 V (Ta = 25°C) is applied to the ON / OFF pin. The ON / OFF pin is configured as shown in **Figures 18** and **19**.

3.1 S-1313 Series A / C Type

The ON / OFF pin is internally pulled down to VSS by constant current source, so the VOUT pin is set to the V_{SS} level in the floating status. For the ON / OFF pin current, refer to the A / C type of ON / OFF pin input current "H" in "■ **Electrical Characteristics**".

3.2 S-1313 Series B / D Type

Do not use the ON / OFF pin in the floating state because this pin is internally not pulled up or pulled down. When not using the ON / OFF pin, connect the pin to the VIN pin.

Table 12

Product Type	ON / OFF Pin	Internal Circuits	VOUT Pin Voltage	Current Consumption
A / B / C / D	"H": Power-on	Operate	Set value	I_{SS1} *1
A / B / C / D	"L": Power-off	Stop	V_{SS} level	I_{SS2}

***1**. IC's current consumption increases as much as current flows into the constant current source when the ON / OFF pin is connected to VIN and the S-1313 Series A / C types is operating (**Figure 18**).

(1) S-1313 Series A / C Type

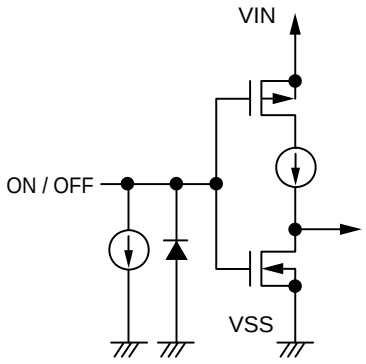


Figure 18

(2) S-1313 Series B / D Type

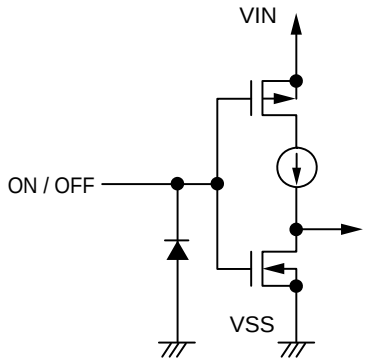
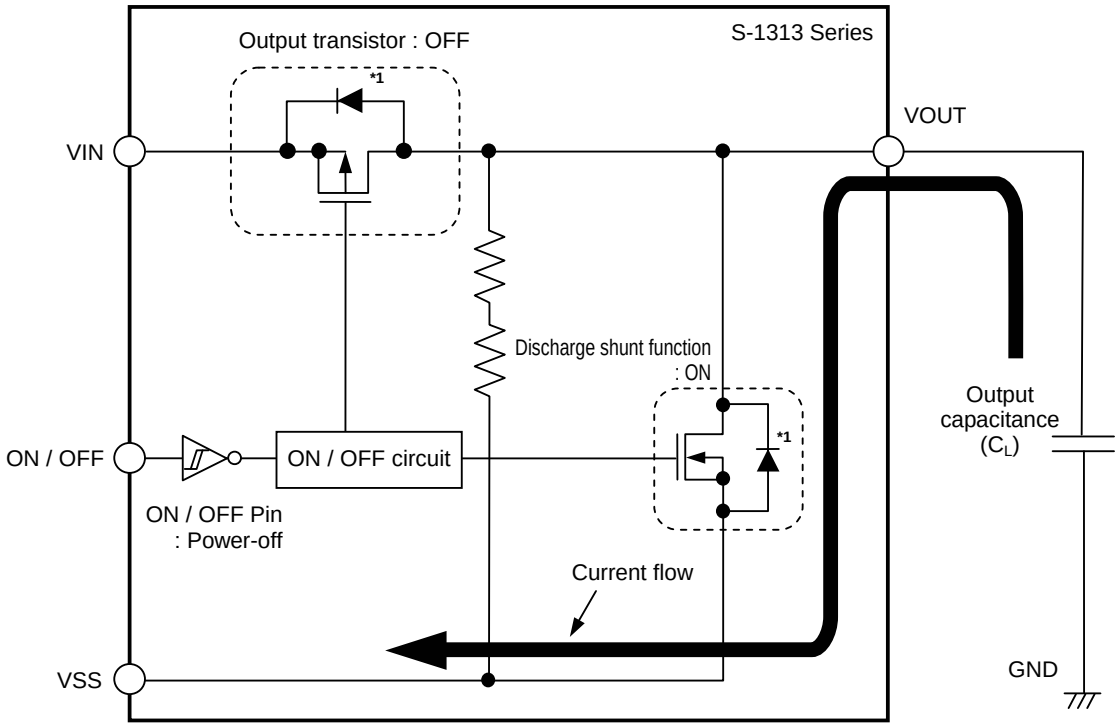


Figure 19

4. Discharge shunt function (S-1313 Series A / B types)

The S-1313 Series A / B types have a built-in discharge shunt circuit to discharge the output capacitance. When the ON / OFF pin is set to power-off level, the V_{OUT} pin becomes V_{SS} level after the output capacitor discharges if the output transistor is turned off and the discharge shunt function is turned on. In the S-1313 Series C / D types, the VOUT pin is set to V_{SS} level through several MΩ internal divided resistors between the VOUT and VSS pins. S-1313 Series A / B types allow for the VOUT pin reach the V_{SS} level faster than the S-1313 Series C / D types that do not have a discharge shunt circuit.



***1**. Parasitic diode

Figure 20

5. Overcurrent protection circuit

The S-1313 Series has an overcurrent protection circuit having the characteristics shown in "**(1) Output Voltage vs. Output Current (When Load Current Increases) (Ta = 25°C)**" in "**■ Characteristics (Typical Data)**", in order to protect the output transistor against an excessive output current and short circuiting between the VOUT and VSS pins. The current (I_{short}) when the output pin is short-circuited is internally set at approx. 50 mA (typ.), and the normal value is restored for the output voltage, if releasing a short circuit once.

Caution Using the overcurrent protection circuit is to protect the output transistor from accidental conditions such as short circuited load and the rapid and large current flow in the large capacitor. The overcurrent protection circuit is not suitable for use under the short circuit status or large current flowing (240 mA or more) that lasts long.

6. Constant current source pull-down (S-1313 Series A / C types)

In the S-1313 Series A / C types, the ON / OFF pin is internally pulled down to VSS, so the VOUT pin is in the V_{SS} level when in the floating status.

IC's current consumption increases as much as 0.1 μA (typ.) of the constant current source when the ON / OFF pin is connected to VIN and the S-1313 Series A / C types is operating.

7. Thermal shutdown circuit

The S-1313 Series has a thermal shutdown circuit to protect the device from damage due to overheat. When the junction temperature rises to 150°C (Typ.), the thermal shutdown circuit operates to stop regulating. When the junction temperature drops to 120°C (Typ.), the thermal shutdown circuit is released to restart regulating.
Due to self-heating of the S-1313 Series, if the thermal shutdown circuit starts operating, it stops regulating so that the output voltage drops. When regulation stops, the S-1313 Series does not itself generate heat and the IC's temperature drops. When the temperature drops, the thermal shutdown circuit is released to restart regulating, thus this IC generates heat again. Repeating this procedure makes the waveform of the output voltage into a pulse-like form. Stop or restart of regulation continues unless decreasing either both of the input voltage and the output voltage in order to reduce the internal current consumption, or decreasing the ambient temperature.

Table 13

Thermal Shutdown Circuit	VOUT Pin Voltage
Operate : 150°C (Typ.)*1	V_{SS} level
Release : 120°C (Typ.)*1	Set value

***1.** Junction temperature

8. Thermal shutdown circuit stop function

The 1313 Series has a thermal shutdown circuit stop function during low load current.
When the load current is approximately 0.2mA (typ.) or less, the current that flows in the thermal shutdown circuit is stopped and the thermal shutdown circuit stops operating. This makes the super low current consumption operation possible.
When the load current is approximately 0.5 mA (typ.) or more, a current is applied to the thermal shutdown circuit, thus making the protect operation possible.

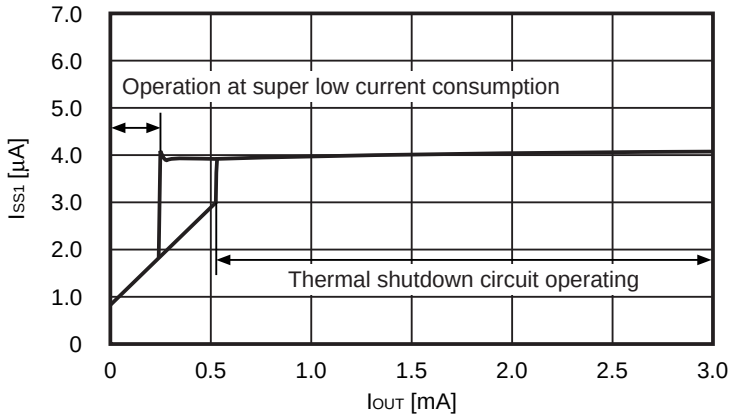


Figure 21

■ Precautions

- Wiring patterns for the VIN, VOUT and GND pins should be designed so that the impedance is low. When mounting an output capacitor between the VOUT and VSS pins (C_L) and the capacitor for stabilizing the input between the VIN and VSS pins (C_{IN}), the distance from the capacitors to these pins should be as short as possible.
- Note that the output voltage may increase when a series regulator is used at low load current (10 μA or less).
- Note that the output voltage may increase due to the leakage current from a driver when a series regulator is used at high temperature.
- Note that the output voltage may increase due to the leakage current from a driver even if the ON / OFF pin is at the power-off level when a series regulator is used at a high temperature.
- Generally a series regulator may cause oscillation, depending on the selection of external parts. The following conditions are recommended for this IC. However, be sure to perform sufficient evaluation under the actual usage conditions for selection, including evaluation of temperature characteristics. See "**(5) Example of Equivalent Series Resistance vs. Output Current Characteristics (Ta = 25°C)**" in "■ **Reference Data**" for the equivalent series resistance (R_{ESR}) of the output capacitor.

  Input capacitor (C_{IN}) : 0.1 μF or more
  Output capacitor (C_L) : 0.1 μF or more

- The voltage regulator may oscillate when the impedance of the power supply is high and the input capacitor is small or an input capacitor is not connected.
- Ringing may occur when these three conditions below are satisfied. Before selecting an input capacitor, be sure to evaluate sufficiently under the actual usage conditions, including the temperature characteristics.

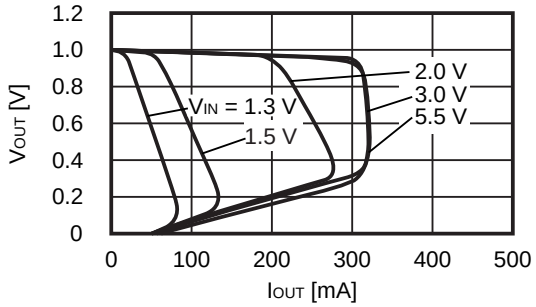
  The power supply inductance is high.
  The load current is 100 mA or more.
  The difference between the input voltage and the output voltage is close to the value of dropout voltage.

- If the output capacitance is small, power supply's fluctuation and the characteristics of load fluctuation become worse. Sufficiently evaluate the output voltage's fluctuation with the actual device.
- A momentary overshoot may be output when the power supply suddenly increases, and the output capacitance is small. It is therefore important to sufficiently evaluate the output voltage at power application in actual device.
- The application conditions for the input voltage, output voltage, and load current should 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.
- In determining the output current, attention should be paid to the output current value specified in **Table 11** in "■ **Electrical Characteristics**" and footnote ***5** of the table.
- 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.

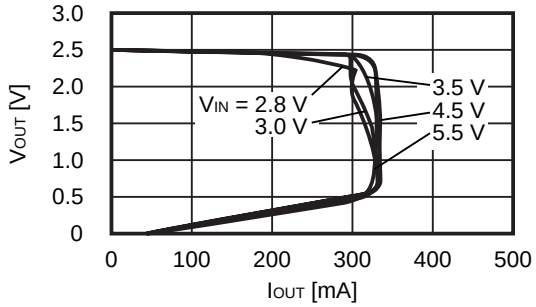
■ Characteristics (Typical Data)

(1) Output Voltage vs. Output Current (When Load Current Increases) (Ta = 25°C)

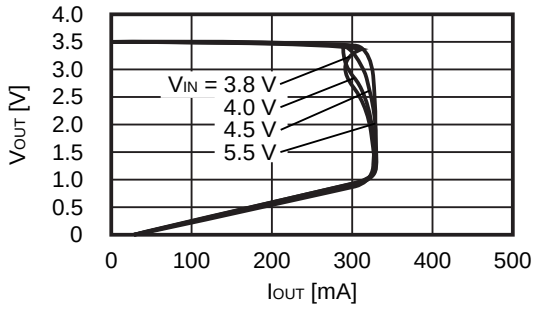
V_{OUT} = 1.0 V



V_{OUT} = 2.5 V



V_{OUT} = 3.5 V

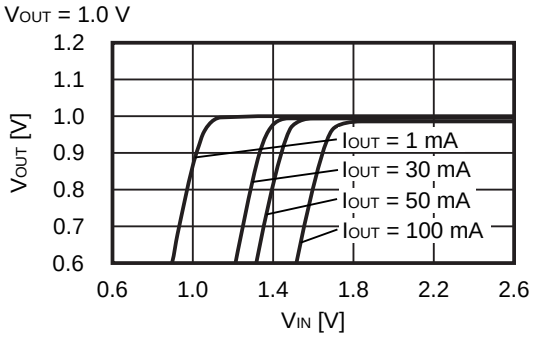


Remark In determining the output current, attention should be paid to the following.

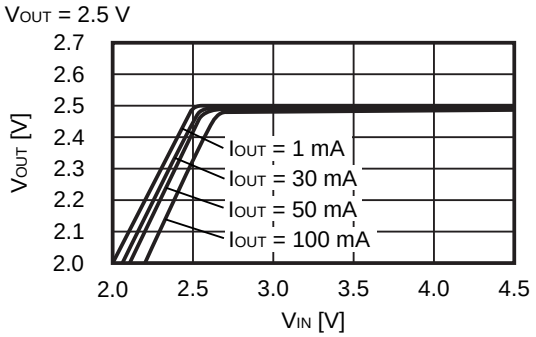
1. The minimum output current value and footnote ***5** in **Table 11** in the "■ **Electrical Characteristics**"
2. The package power dissipation

(2) Output Voltage vs. Input Voltage (Ta = 25°C)

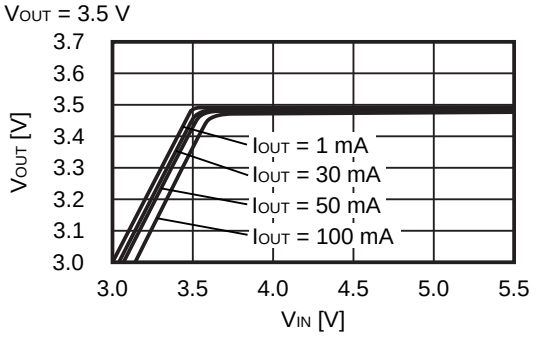
V_{OUT} = 1.0 V



V_{OUT} = 2.5 V

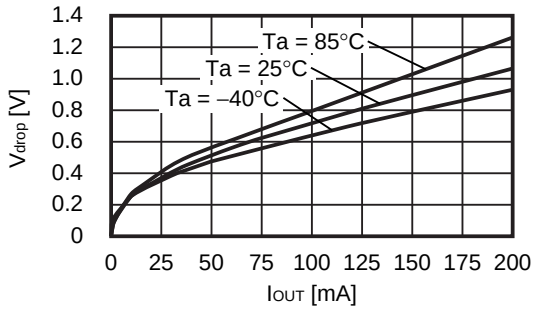


V_{OUT} = 3.5 V

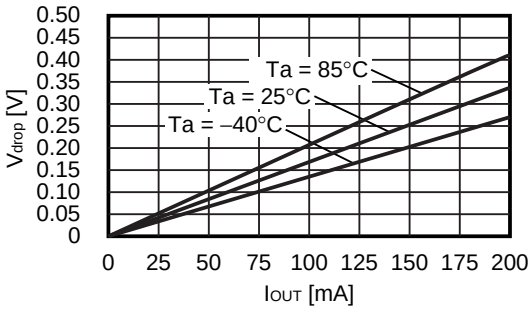


(3) Dropout Voltage vs. Output Current

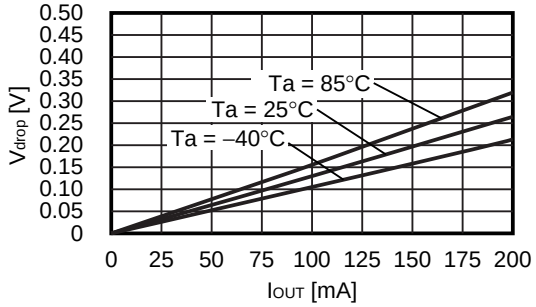
V_{OUT} = 1.0 V



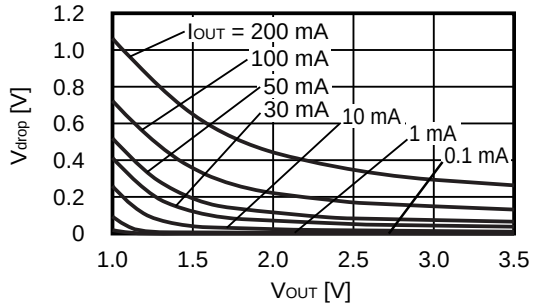
V_{OUT} = 2.5 V



V_{OUT} = 3.5 V

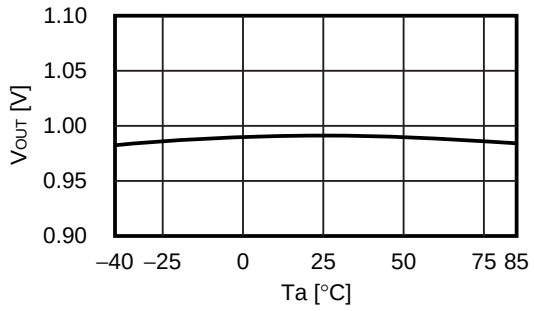


(4) Dropout Voltage vs. Set Output Voltage

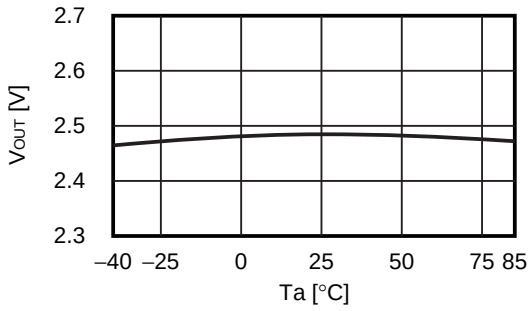


(5) Output Voltage vs. Ambient Temperature

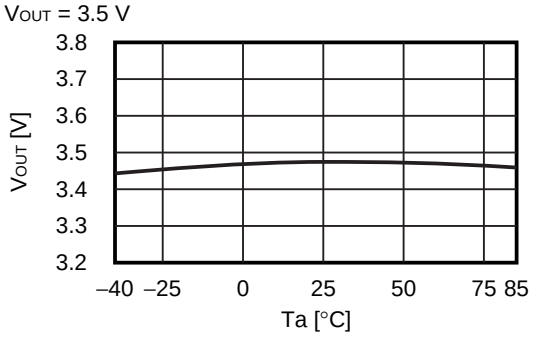
V_{OUT} = 1.0 V



V_{OUT} = 2.5 V

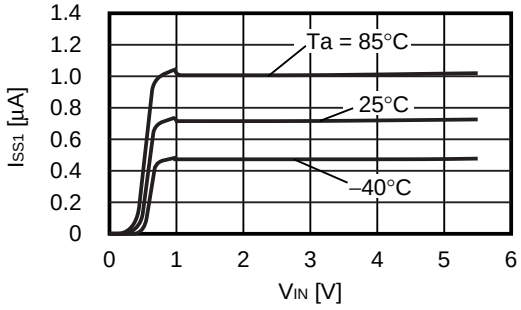


V_{OUT} = 3.5 V

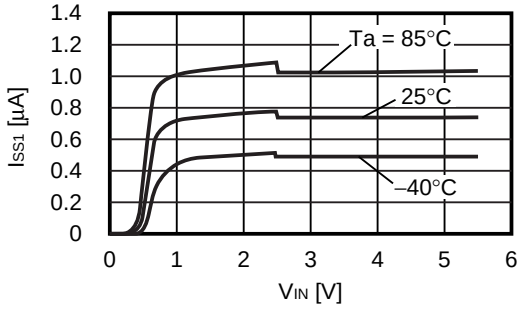


(6) Current Consumption vs. Input Voltage

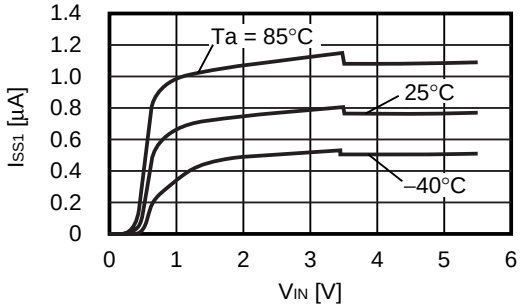
V_{OUT} = 1.0 V



V_{OUT} = 2.5 V

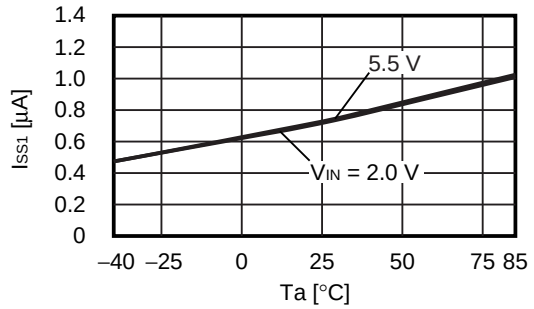


V_{OUT} = 3.5 V

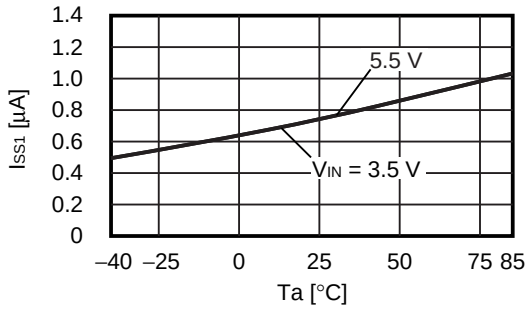


(7) Current Consumption vs. Ambient Temperature

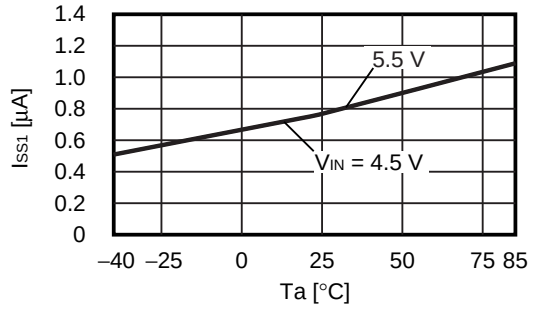
V_{OUT} = 1.0 V



V_{OUT} = 2.5 V

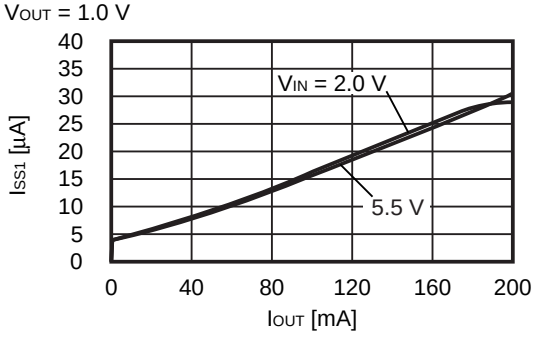


V_{OUT} = 3.5 V

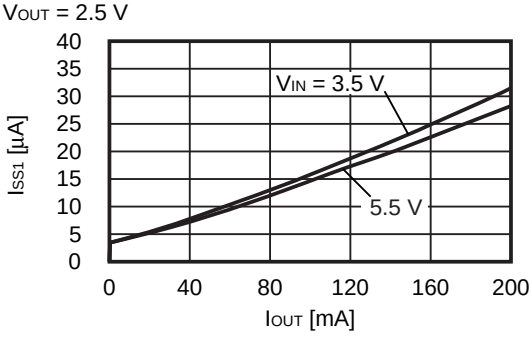


(8) Current Consumption vs. Output Current

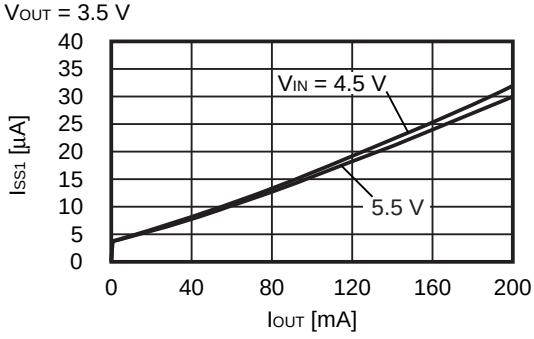
V_{OUT} = 1.0 V



V_{OUT} = 2.5 V



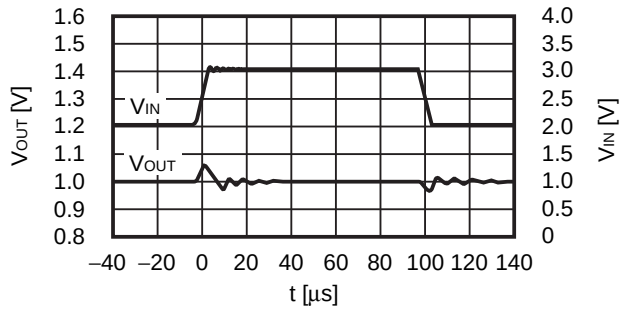
V_{OUT} = 3.5 V



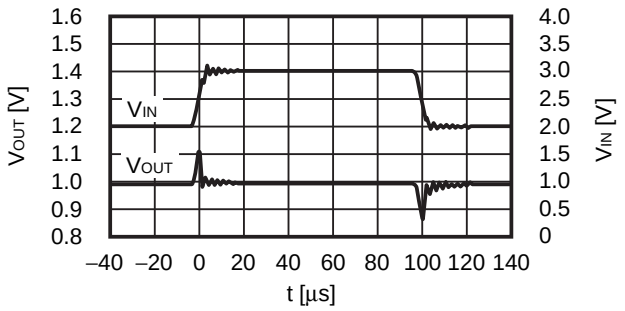
■ Reference Data

(1) Transient Response Characteristics when Input (Ta = 25°C)

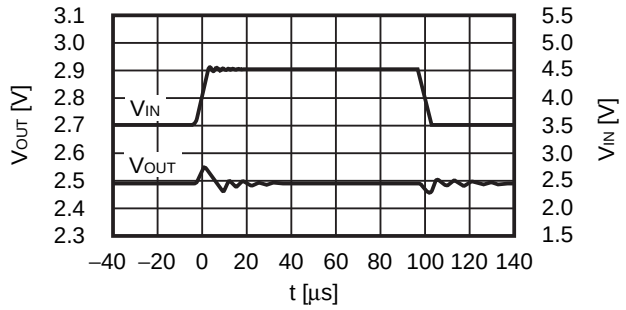
V_{OUT} = 1.0 V
I_{OUT} = 1 mA, tr = tf = 5.0 µs, C_{IN} = C_L = 0.1 µF



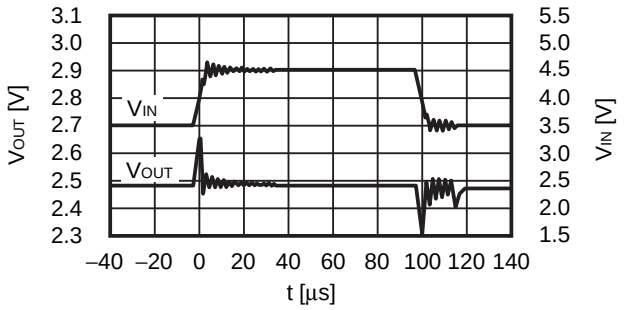
V_{OUT} = 1.0 V
I_{OUT} = 100 mA, tr = tf = 5.0 µs, C_{IN} = C_L = 0.1 µF



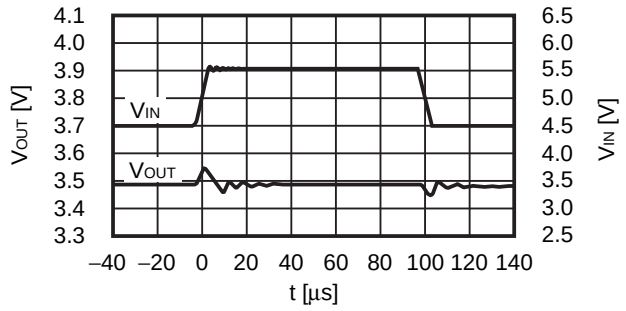
V_{OUT} = 2.5 V
I_{OUT} = 1 mA, tr = tf = 5.0 µs, C_{IN} = C_L = 0.1 µF



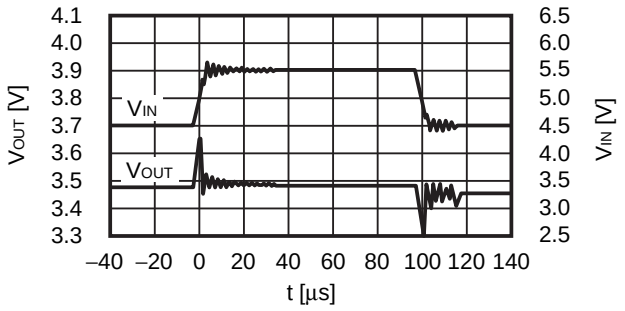
V_{OUT} = 2.5 V
I_{OUT} = 100 mA, tr = tf = 5.0 µs, C_{IN} = C_L = 0.1 µF



V_{OUT} = 3.5 V
I_{OUT} = 1 mA, tr = tf = 5.0 µs, C_{IN} = C_L = 0.1 µF

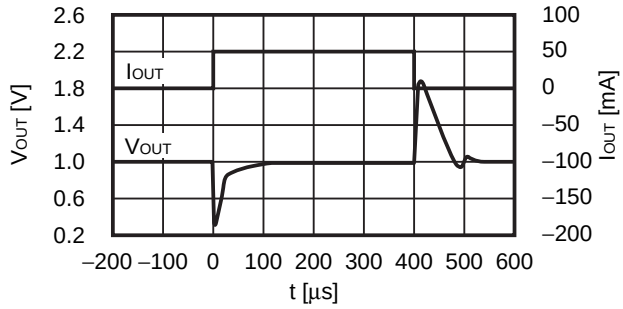


V_{OUT} = 3.5 V
I_{OUT} = 100 mA, tr = tf = 5.0 µs, C_{IN} = C_L = 0.1 µF

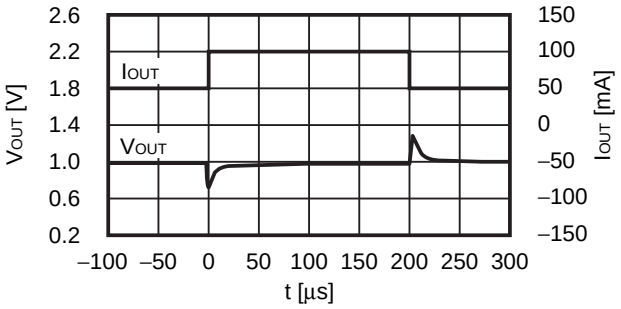


(2) Transient Response Characteristics of Load (Ta = 25°C)

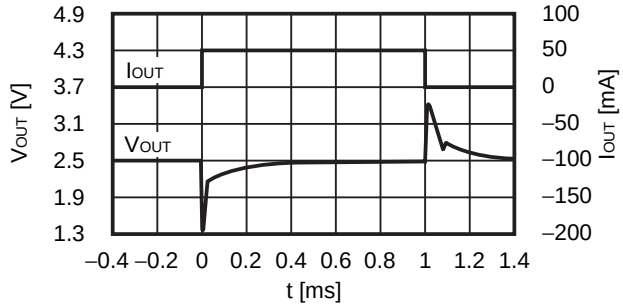
V_{OUT} = 1.0 V
V_{IN} = 2.0 V, C_{IN} = C_L = 0.1 µF, I_{OUT} = 1 ↔ 50 mA



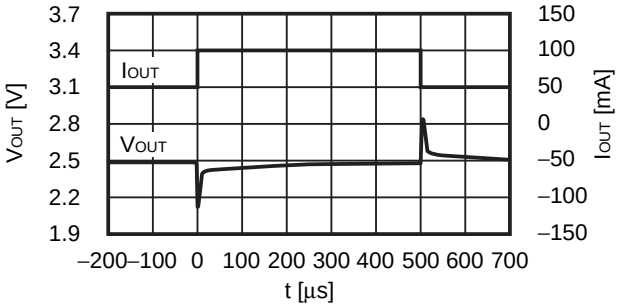
V_{OUT} = 1.0 V
V_{IN} = 2.0 V, C_{IN} = C_L = 0.1 µF, I_{OUT} = 50 ↔ 100 mA



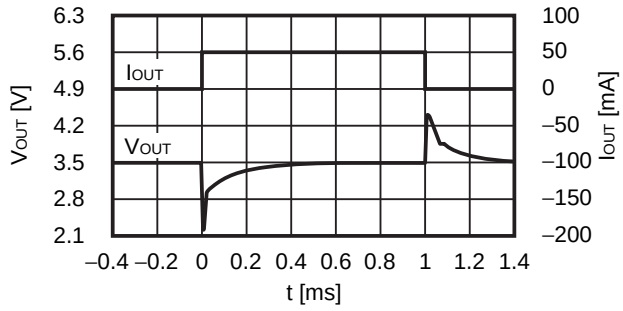
V_{OUT} = 2.5 V
V_{IN} = 3.5 V, C_{IN} = C_L = 0.1 µF, I_{OUT} = 1 ↔ 50 mA



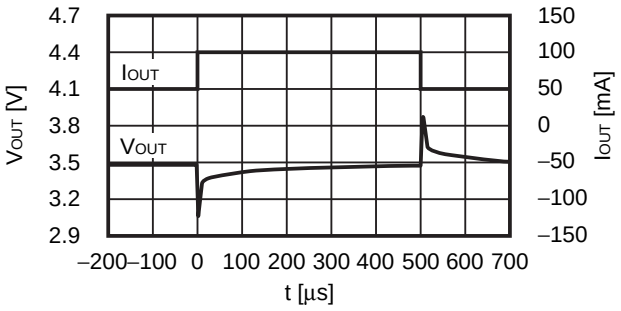
V_{OUT} = 2.5 V
V_{IN} = 3.5 V, C_{IN} = C_L = 0.1 µF, I_{OUT} = 50 ↔ 100 mA



V_{OUT} = 3.5 V
V_{IN} = 4.5 V, C_{IN} = C_L = 0.1 µF, I_{OUT} = 1 ↔ 50 mA

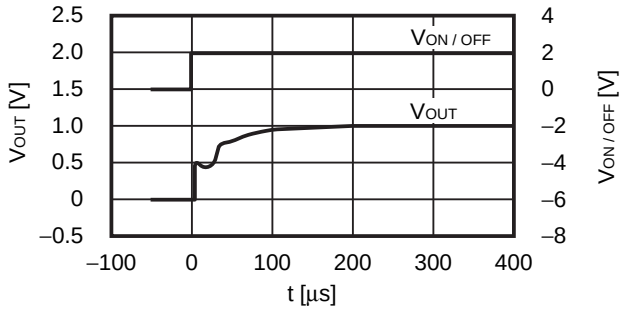


V_{OUT} = 3.5 V
V_{IN} = 4.5 V, C_{IN} = C_L = 0.1 µF, I_{OUT} = 50 ↔ 100 mA

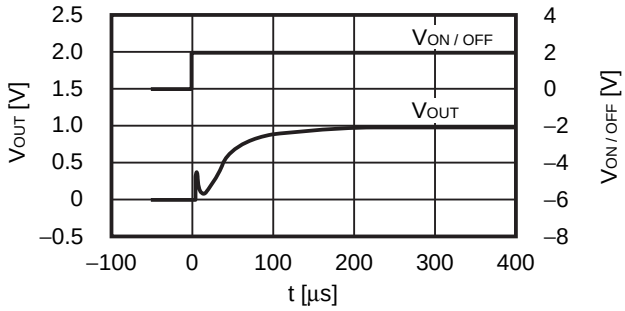


(3) Transient Response Characteristics of ON / OFF Pin (Ta = 25°C)

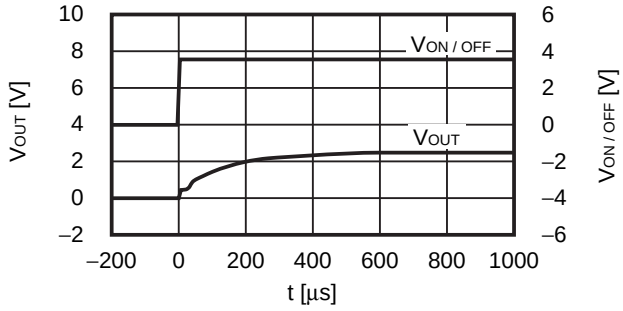
V_{OUT} = 1.0 V
V_{IN} = 2.0 V, tr = 1.0 µs, C_{IN} = C_L = 0.1 µF, I_{OUT} = 1 mA



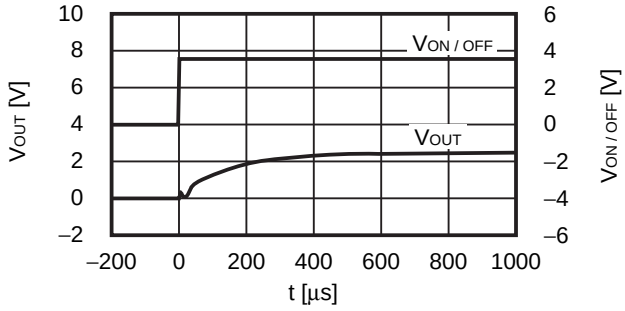
V_{OUT} = 1.0 V
V_{IN} = 2.0 V, tr = 1.0 µs, C_{IN} = C_L = 0.1 µF, I_{OUT} = 100 mA



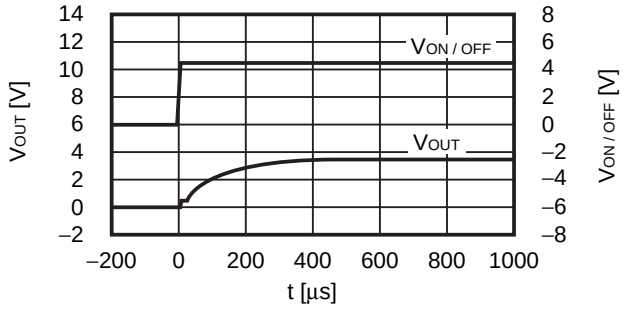
V_{OUT} = 2.5 V
V_{IN} = 3.5 V, tr = 1.0 µs, C_{IN} = C_L = 0.1 µF, I_{OUT} = 1 mA



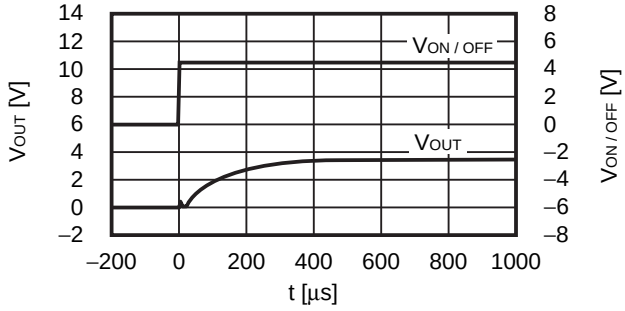
V_{OUT} = 2.5 V
V_{IN} = 3.5 V, tr = 1.0 µs, C_{IN} = C_L = 0.1 µF, I_{OUT} = 100 mA



V_{OUT} = 3.5 V
V_{IN} = 4.5 V, tr = 1.0 µs, C_{IN} = C_L = 0.1 µF, I_{OUT} = 1 mA

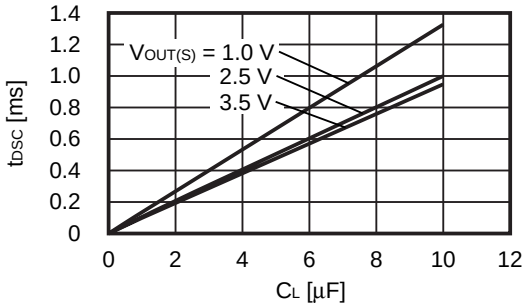


V_{OUT} = 3.5 V
V_{IN} = 4.5 V, tr = 1.0 µs, C_{IN} = C_L = 0.1 µF, I_{OUT} = 100 mA



(4) Output Capacitance vs. Characteristics of Discharge Time (Ta = 25°C)
S-1313 Series A / B type (with discharge shunt function)

$V_{IN} = V_{OUT} + 1.0$ V, I_{OUT} = no load
$V_{ON / OFF} = V_{OUT} + 1.0$ V → V_{SS}, tf = 1 µs



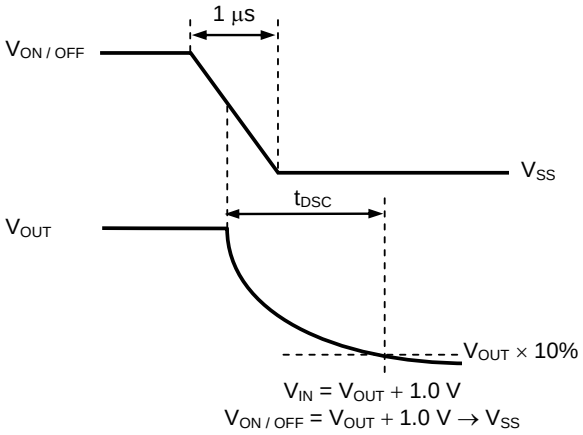
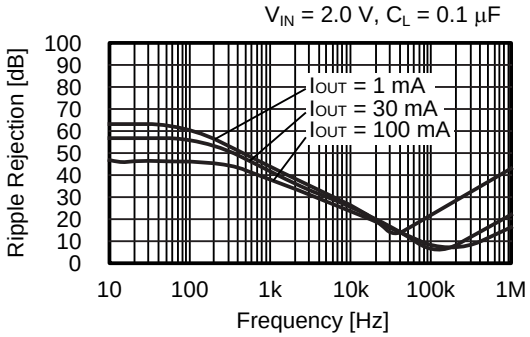


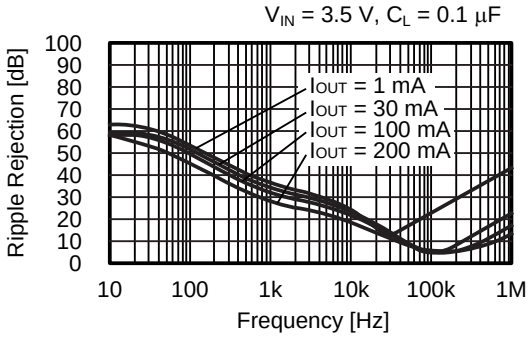
Figure 22 Measurement Condition of Discharge Time

(5) Ripple Rejection (Ta = 25°C)

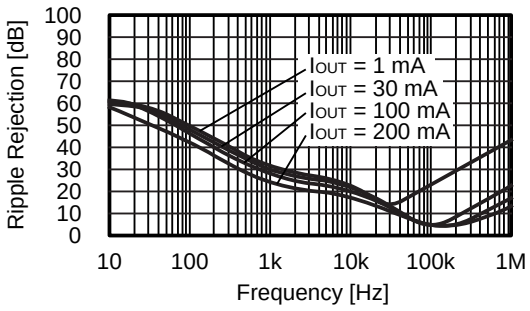
V_{OUT} = 1.0 V



V_{OUT} = 2.5 V

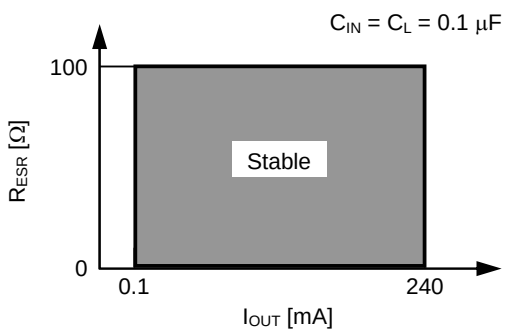


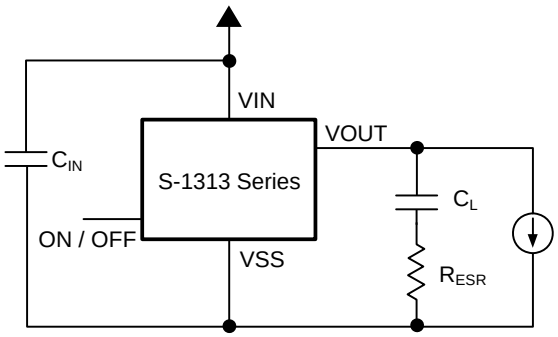
V_{OUT} = 3.5 V



(6) Example of Equivalent Series Resistance vs. Output Current Characteristics (Ta = 25°C)

C_L: Murata Manufacturing Co., Ltd. GRM31CR72E104K

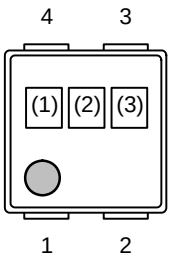




■ Marking Specifications

(1) HSNT-4(0808)

HSNT-4(0808)
Top view



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

Product name vs. Product code

(a) S-1313 Series A type

Product Name	Product code		
	(1)	(2)	(3)
S-1313A10-A4T1U3	1	L	A
S-1313A11-A4T1U3	1	L	B
S-1313A12-A4T1U3	1	L	C
S-1313A13-A4T1U3	1	L	D
S-1313A14-A4T1U3	1	L	E
S-1313A15-A4T1U3	1	L	F
S-1313A16-A4T1U3	1	L	G
S-1313A17-A4T1U3	1	L	H
S-1313A18-A4T1U3	1	L	J
S-1313A1J-A4T1U3	1	L	K
S-1313A19-A4T1U3	1	L	L
S-1313A20-A4T1U3	1	L	N
S-1313A21-A4T1U3	1	L	O
S-1313A22-A4T1U3	1	L	P
S-1313A23-A4T1U3	1	L	Q
S-1313A24-A4T1U3	1	L	R
S-1313A25-A4T1U3	1	L	S
S-1313A26-A4T1U3	1	L	T
S-1313A27-A4T1U3	1	L	V
S-1313A28-A4T1U3	1	L	U
S-1313A2J-A4T1U3	1	L	X
S-1313A29-A4T1U3	1	L	Y
S-1313A30-A4T1U3	1	L	Z
S-1313A31-A4T1U3	1	L	1
S-1313A32-A4T1U3	1	L	2
S-1313A33-A4T1U3	1	L	3
S-1313A34-A4T1U3	1	L	4
S-1313A35-A4T1U3	1	L	5

(b) S-1313 Series B type

Product Name	Product code		
	(1)	(2)	(3)
S-1313B10-A4T1U3	1	N	A
S-1313B11-A4T1U3	1	N	B
S-1313B12-A4T1U3	1	N	C
S-1313B13-A4T1U3	1	N	D
S-1313B14-A4T1U3	1	N	E
S-1313B15-A4T1U3	1	N	F
S-1313B16-A4T1U3	1	N	G
S-1313B17-A4T1U3	1	N	H
S-1313B18-A4T1U3	1	N	J
S-1313B1J-A4T1U3	1	N	K
S-1313B19-A4T1U3	1	N	L
S-1313B20-A4T1U3	1	N	N
S-1313B21-A4T1U3	1	N	O
S-1313B22-A4T1U3	1	N	P
S-1313B23-A4T1U3	1	N	Q
S-1313B24-A4T1U3	1	N	R
S-1313B25-A4T1U3	1	N	S
S-1313B26-A4T1U3	1	N	T
S-1313B27-A4T1U3	1	N	U
S-1313B28-A4T1U3	1	N	V
S-1313B2J-A4T1U3	1	N	X
S-1313B29-A4T1U3	1	N	Y
S-1313B30-A4T1U3	1	N	Z
S-1313B31-A4T1U3	1	N	1
S-1313B32-A4T1U3	1	N	2
S-1313B33-A4T1U3	1	N	3
S-1313B34-A4T1U3	1	N	4
S-1313B35-A4T1U3	1	N	5

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

(c) S-1313 Series C type

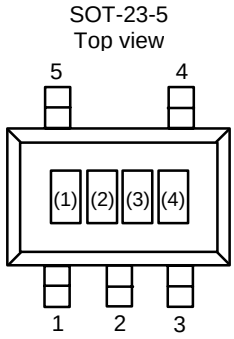
Product Name	Product code		
	(1)	(2)	(3)
S-1313C10-A4T1U3	1	O	A
S-1313C11-A4T1U3	1	O	B
S-1313C12-A4T1U3	1	O	C
S-1313C13-A4T1U3	1	O	D
S-1313C14-A4T1U3	1	O	E
S-1313C15-A4T1U3	1	O	F
S-1313C16-A4T1U3	1	O	G
S-1313C17-A4T1U3	1	O	H
S-1313C18-A4T1U3	1	O	J
S-1313C1J-A4T1U3	1	O	K
S-1313C19-A4T1U3	1	O	L
S-1313C20-A4T1U3	1	O	N
S-1313C21-A4T1U3	1	O	O
S-1313C22-A4T1U3	1	O	P
S-1313C23-A4T1U3	1	O	Q
S-1313C24-A4T1U3	1	O	R
S-1313C25-A4T1U3	1	O	S
S-1313C26-A4T1U3	1	O	T
S-1313C27-A4T1U3	1	O	U
S-1313C28-A4T1U3	1	O	V
S-1313C2J-A4T1U3	1	O	X
S-1313C29-A4T1U3	1	O	Y
S-1313C30-A4T1U3	1	O	Z
S-1313C31-A4T1U3	1	O	1
S-1313C32-A4T1U3	1	O	2
S-1313C33-A4T1U3	1	O	3
S-1313C34-A4T1U3	1	O	4
S-1313C35-A4T1U3	1	O	5

(d) S-1313 Series D type

Product Name	Product code		
	(1)	(2)	(3)
S-1313D10-A4T1U3	1	P	A
S-1313D11-A4T1U3	1	P	B
S-1313D12-A4T1U3	1	P	C
S-1313D13-A4T1U3	1	P	D
S-1313D14-A4T1U3	1	P	E
S-1313D15-A4T1U3	1	P	F
S-1313D16-A4T1U3	1	P	G
S-1313D17-A4T1U3	1	P	H
S-1313D18-A4T1U3	1	P	J
S-1313D1J-A4T1U3	1	P	K
S-1313D19-A4T1U3	1	P	L
S-1313D20-A4T1U3	1	P	N
S-1313D21-A4T1U3	1	P	O
S-1313D22-A4T1U3	1	P	P
S-1313D23-A4T1U3	1	P	Q
S-1313D24-A4T1U3	1	P	R
S-1313D25-A4T1U3	1	P	S
S-1313D26-A4T1U3	1	P	T
S-1313D27-A4T1U3	1	P	U
S-1313D28-A4T1U3	1	P	V
S-1313D2J-A4T1U3	1	P	X
S-1313D29-A4T1U3	1	P	Y
S-1313D30-A4T1U3	1	P	Z
S-1313D31-A4T1U3	1	P	1
S-1313D32-A4T1U3	1	P	2
S-1313D33-A4T1U3	1	P	3
S-1313D34-A4T1U3	1	P	4
S-1313D35-A4T1U3	1	P	5

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

(2) SOT-23-5



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

Product name vs. Product code

(a) S-1313 Series A type

Product Name	Product code		
	(1)	(2)	(3)
S-1313A10-M5T1U3	1	L	A
S-1313A11-M5T1U3	1	L	B
S-1313A12-M5T1U3	1	L	C
S-1313A13-M5T1U3	1	L	D
S-1313A14-M5T1U3	1	L	E
S-1313A15-M5T1U3	1	L	F
S-1313A16-M5T1U3	1	L	G
S-1313A17-M5T1U3	1	L	H
S-1313A18-M5T1U3	1	L	J
S-1313A1J-M5T1U3	1	L	K
S-1313A19-M5T1U3	1	L	L
S-1313A20-M5T1U3	1	L	N
S-1313A21-M5T1U3	1	L	O
S-1313A22-M5T1U3	1	L	P
S-1313A23-M5T1U3	1	L	Q
S-1313A24-M5T1U3	1	L	R
S-1313A25-M5T1U3	1	L	S
S-1313A26-M5T1U3	1	L	T
S-1313A27-M5T1U3	1	L	V
S-1313A28-M5T1U3	1	L	U
S-1313A2J-M5T1U3	1	L	X
S-1313A29-M5T1U3	1	L	Y
S-1313A30-M5T1U3	1	L	Z
S-1313A31-M5T1U3	1	L	1
S-1313A32-M5T1U3	1	L	2
S-1313A33-M5T1U3	1	L	3
S-1313A34-M5T1U3	1	L	4
S-1313A35-M5T1U3	1	L	5

(b) S-1313 Series B type

Product Name	Product code		
	(1)	(2)	(3)
S-1313B10-M5T1U3	1	N	A
S-1313B11-M5T1U3	1	N	B
S-1313B12-M5T1U3	1	N	C
S-1313B13-M5T1U3	1	N	D
S-1313B14-M5T1U3	1	N	E
S-1313B15-M5T1U3	1	N	F
S-1313B16-M5T1U3	1	N	G
S-1313B17-M5T1U3	1	N	H
S-1313B18-M5T1U3	1	N	J
S-1313B1J-M5T1U3	1	N	K
S-1313B19-M5T1U3	1	N	L
S-1313B20-M5T1U3	1	N	N
S-1313B21-M5T1U3	1	N	O
S-1313B22-M5T1U3	1	N	P
S-1313B23-M5T1U3	1	N	Q
S-1313B24-M5T1U3	1	N	R
S-1313B25-M5T1U3	1	N	S
S-1313B26-M5T1U3	1	N	T
S-1313B27-M5T1U3	1	N	U
S-1313B28-M5T1U3	1	N	V
S-1313B2J-M5T1U3	1	N	X
S-1313B29-M5T1U3	1	N	Y
S-1313B30-M5T1U3	1	N	Z
S-1313B31-M5T1U3	1	N	1
S-1313B32-M5T1U3	1	N	2
S-1313B33-M5T1U3	1	N	3
S-1313B34-M5T1U3	1	N	4
S-1313B35-M5T1U3	1	N	5

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

(c) S-1313 Series C type

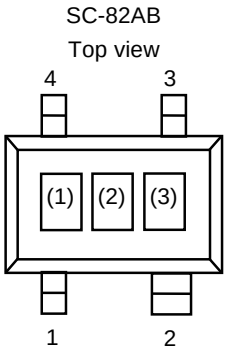
Product Name	Product code		
	(1)	(2)	(3)
S-1313C10-M5T1U3	1	O	A
S-1313C11-M5T1U3	1	O	B
S-1313C12-M5T1U3	1	O	C
S-1313C13-M5T1U3	1	O	D
S-1313C14-M5T1U3	1	O	E
S-1313C15-M5T1U3	1	O	F
S-1313C16-M5T1U3	1	O	G
S-1313C17-M5T1U3	1	O	H
S-1313C18-M5T1U3	1	O	J
S-1313C1J-M5T1U3	1	O	K
S-1313C19-M5T1U3	1	O	L
S-1313C20-M5T1U3	1	O	N
S-1313C21-M5T1U3	1	O	O
S-1313C22-M5T1U3	1	O	P
S-1313C23-M5T1U3	1	O	Q
S-1313C24-M5T1U3	1	O	R
S-1313C25-M5T1U3	1	O	S
S-1313C26-M5T1U3	1	O	T
S-1313C27-M5T1U3	1	O	U
S-1313C28-M5T1U3	1	O	V
S-1313C2J-M5T1U3	1	O	X
S-1313C29-M5T1U3	1	O	Y
S-1313C30-M5T1U3	1	O	Z
S-1313C31-M5T1U3	1	O	1
S-1313C32-M5T1U3	1	O	2
S-1313C33-M5T1U3	1	O	3
S-1313C34-M5T1U3	1	O	4
S-1313C35-M5T1U3	1	O	5

(d) S-1313 Series D type

Product Name	Product code		
	(1)	(2)	(3)
S-1313D10-M5T1U3	1	P	A
S-1313D11-M5T1U3	1	P	B
S-1313D12-M5T1U3	1	P	C
S-1313D13-M5T1U3	1	P	D
S-1313D14-M5T1U3	1	P	E
S-1313D15-M5T1U3	1	P	F
S-1313D16-M5T1U3	1	P	G
S-1313D17-M5T1U3	1	P	H
S-1313D18-M5T1U3	1	P	J
S-1313D1J-M5T1U3	1	P	K
S-1313D19-M5T1U3	1	P	L
S-1313D20-M5T1U3	1	P	N
S-1313D21-M5T1U3	1	P	O
S-1313D22-M5T1U3	1	P	P
S-1313D23-M5T1U3	1	P	Q
S-1313D24-M5T1U3	1	P	R
S-1313D25-M5T1U3	1	P	S
S-1313D26-M5T1U3	1	P	T
S-1313D27-M5T1U3	1	P	U
S-1313D28-M5T1U3	1	P	V
S-1313D2J-M5T1U3	1	P	X
S-1313D29-M5T1U3	1	P	Y
S-1313D30-M5T1U3	1	P	Z
S-1313D31-M5T1U3	1	P	1
S-1313D32-M5T1U3	1	P	2
S-1313D33-M5T1U3	1	P	3
S-1313D34-M5T1U3	1	P	4
S-1313D35-M5T1U3	1	P	5

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

(3) SC-82AB



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

Product name vs. Product code

(a) S-1313 Series A type

Product Name	Product code		
	(1)	(2)	(3)
S-1313A10-N4T1U3	1	L	A
S-1313A11-N4T1U3	1	L	B
S-1313A12-N4T1U3	1	L	C
S-1313A13-N4T1U3	1	L	D
S-1313A14-N4T1U3	1	L	E
S-1313A15-N4T1U3	1	L	F
S-1313A16-N4T1U3	1	L	G
S-1313A17-N4T1U3	1	L	H
S-1313A18-N4T1U3	1	L	J
S-1313A1J-N4T1U3	1	L	K
S-1313A19-N4T1U3	1	L	L
S-1313A20-N4T1U3	1	L	N
S-1313A21-N4T1U3	1	L	O
S-1313A22-N4T1U3	1	L	P
S-1313A23-N4T1U3	1	L	Q
S-1313A24-N4T1U3	1	L	R
S-1313A25-N4T1U3	1	L	S
S-1313A26-N4T1U3	1	L	T
S-1313A27-N4T1U3	1	L	V
S-1313A28-N4T1U3	1	L	U
S-1313A2J-N4T1U3	1	L	X
S-1313A29-N4T1U3	1	L	Y
S-1313A30-N4T1U3	1	L	Z
S-1313A31-N4T1U3	1	L	1
S-1313A32-N4T1U3	1	L	2
S-1313A33-N4T1U3	1	L	3
S-1313A34-N4T1U3	1	L	4
S-1313A35-N4T1U3	1	L	5

(b) S-1313 Series B type

Product Name	Product code		
	(1)	(2)	(3)
S-1313B10-N4T1U3	1	N	A
S-1313B11-N4T1U3	1	N	B
S-1313B12-N4T1U3	1	N	C
S-1313B13-N4T1U3	1	N	D
S-1313B14-N4T1U3	1	N	E
S-1313B15-N4T1U3	1	N	F
S-1313B16-N4T1U3	1	N	G
S-1313B17-N4T1U3	1	N	H
S-1313B18-N4T1U3	1	N	J
S-1313B1J-N4T1U3	1	N	K
S-1313B19-N4T1U3	1	N	L
S-1313B20-N4T1U3	1	N	N
S-1313B21-N4T1U3	1	N	O
S-1313B22-N4T1U3	1	N	P
S-1313B23-N4T1U3	1	N	Q
S-1313B24-N4T1U3	1	N	R
S-1313B25-N4T1U3	1	N	S
S-1313B26-N4T1U3	1	N	T
S-1313B27-N4T1U3	1	N	U
S-1313B28-N4T1U3	1	N	V
S-1313B2J-N4T1U3	1	N	X
S-1313B29-N4T1U3	1	N	Y
S-1313B30-N4T1U3	1	N	Z
S-1313B31-N4T1U3	1	N	1
S-1313B32-N4T1U3	1	N	2
S-1313B33-N4T1U3	1	N	3
S-1313B34-N4T1U3	1	N	4
S-1313B35-N4T1U3	1	N	5

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

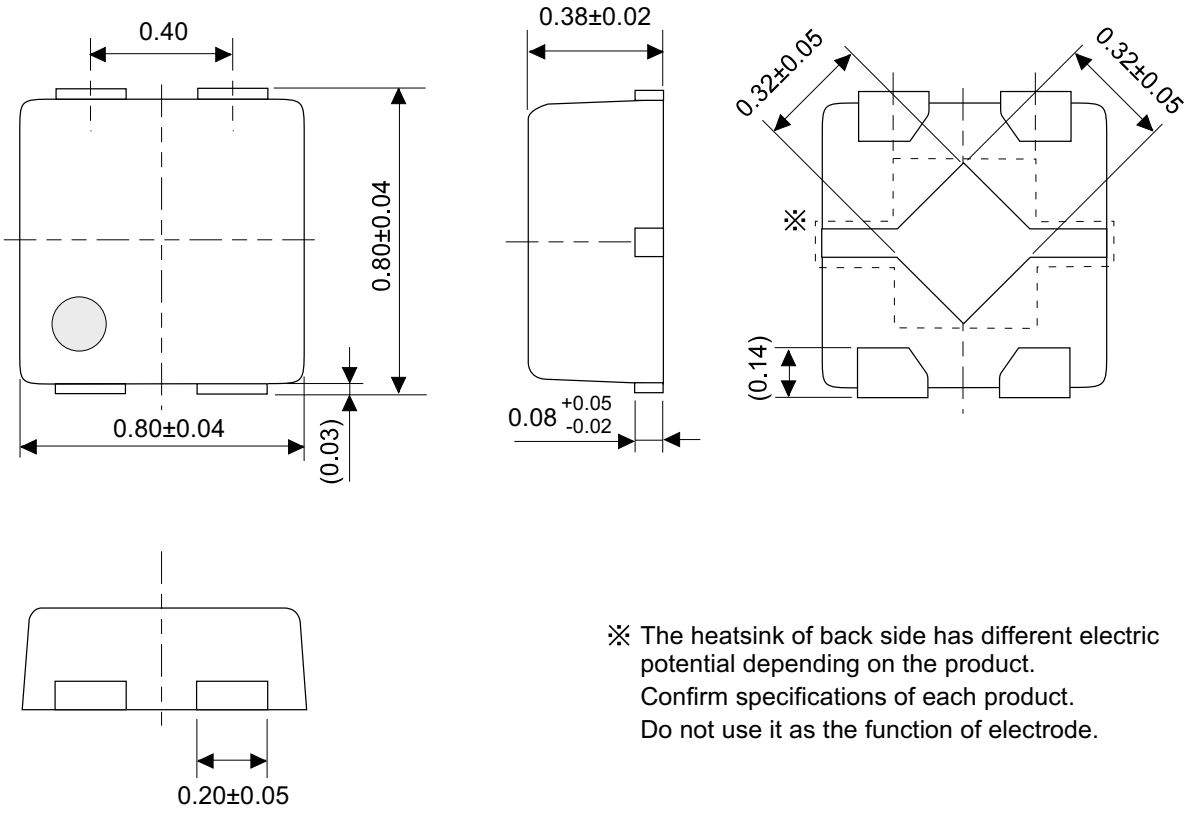
(c) S-1313 Series C type

Product Name	Product code		
	(1)	(2)	(3)
S-1313C10-N4T1U3	1	O	A
S-1313C11-N4T1U3	1	O	B
S-1313C12-N4T1U3	1	O	C
S-1313C13-N4T1U3	1	O	D
S-1313C14-N4T1U3	1	O	E
S-1313C15-N4T1U3	1	O	F
S-1313C16-N4T1U3	1	O	G
S-1313C17-N4T1U3	1	O	H
S-1313C18-N4T1U3	1	O	J
S-1313C1J-N4T1U3	1	O	K
S-1313C19-N4T1U3	1	O	L
S-1313C20-N4T1U3	1	O	N
S-1313C21-N4T1U3	1	O	O
S-1313C22-N4T1U3	1	O	P
S-1313C23-N4T1U3	1	O	Q
S-1313C24-N4T1U3	1	O	R
S-1313C25-N4T1U3	1	O	S
S-1313C26-N4T1U3	1	O	T
S-1313C27-N4T1U3	1	O	U
S-1313C28-N4T1U3	1	O	V
S-1313C2J-N4T1U3	1	O	X
S-1313C29-N4T1U3	1	O	Y
S-1313C30-N4T1U3	1	O	Z
S-1313C31-N4T1U3	1	O	1
S-1313C32-N4T1U3	1	O	2
S-1313C33-N4T1U3	1	O	3
S-1313C34-N4T1U3	1	O	4
S-1313C35-N4T1U3	1	O	5

(d) S-1313 Series D type

Product Name	Product code		
	(1)	(2)	(3)
S-1313D10-N4T1U3	1	P	A
S-1313D11-N4T1U3	1	P	B
S-1313D12-N4T1U3	1	P	C
S-1313D13-N4T1U3	1	P	D
S-1313D14-N4T1U3	1	P	E
S-1313D15-N4T1U3	1	P	F
S-1313D16-N4T1U3	1	P	G
S-1313D17-N4T1U3	1	P	H
S-1313D18-N4T1U3	1	P	J
S-1313D1J-N4T1U3	1	P	K
S-1313D19-N4T1U3	1	P	L
S-1313D20-N4T1U3	1	P	N
S-1313D21-N4T1U3	1	P	O
S-1313D22-N4T1U3	1	P	P
S-1313D23-N4T1U3	1	P	Q
S-1313D24-N4T1U3	1	P	R
S-1313D25-N4T1U3	1	P	S
S-1313D26-N4T1U3	1	P	T
S-1313D27-N4T1U3	1	P	U
S-1313D28-N4T1U3	1	P	V
S-1313D2J-N4T1U3	1	P	X
S-1313D29-N4T1U3	1	P	Y
S-1313D30-N4T1U3	1	P	Z
S-1313D31-N4T1U3	1	P	1
S-1313D32-N4T1U3	1	P	2
S-1313D33-N4T1U3	1	P	3
S-1313D34-N4T1U3	1	P	4
S-1313D35-N4T1U3	1	P	5

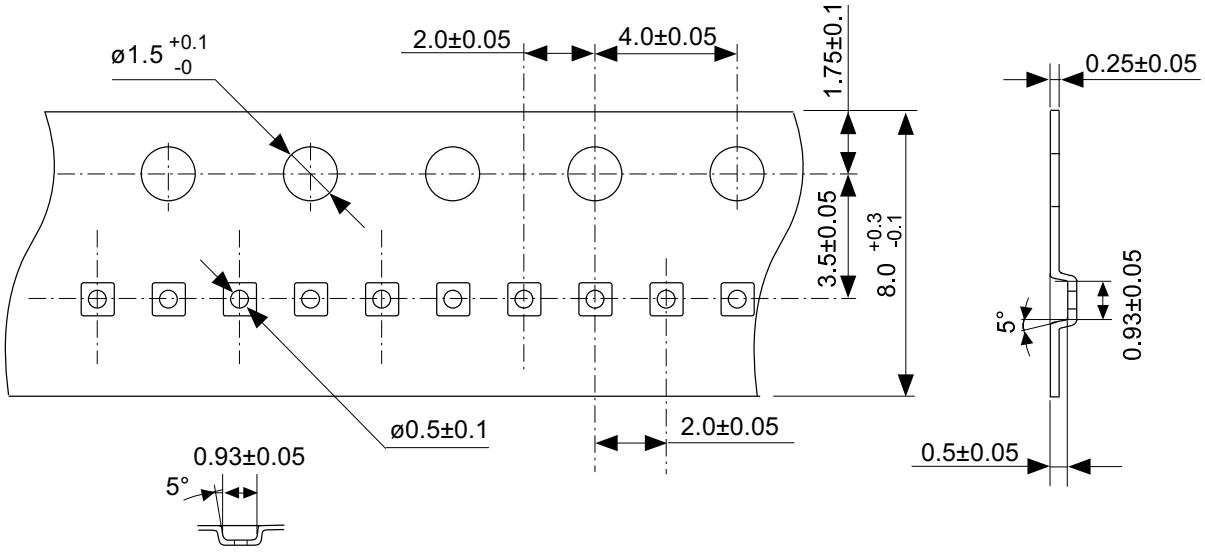
Remark Please contact our sales office for products with specifications other than the above.

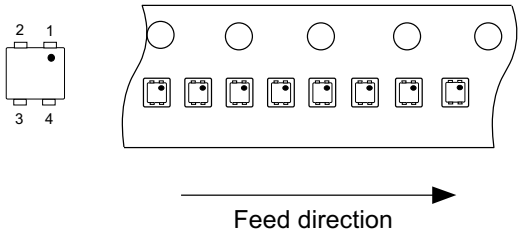


※ The heatsink of back side has different electric potential depending on the product.
Confirm specifications of each product.
Do not use it as the function of electrode.

No. PK004-A-P-SD-1.0

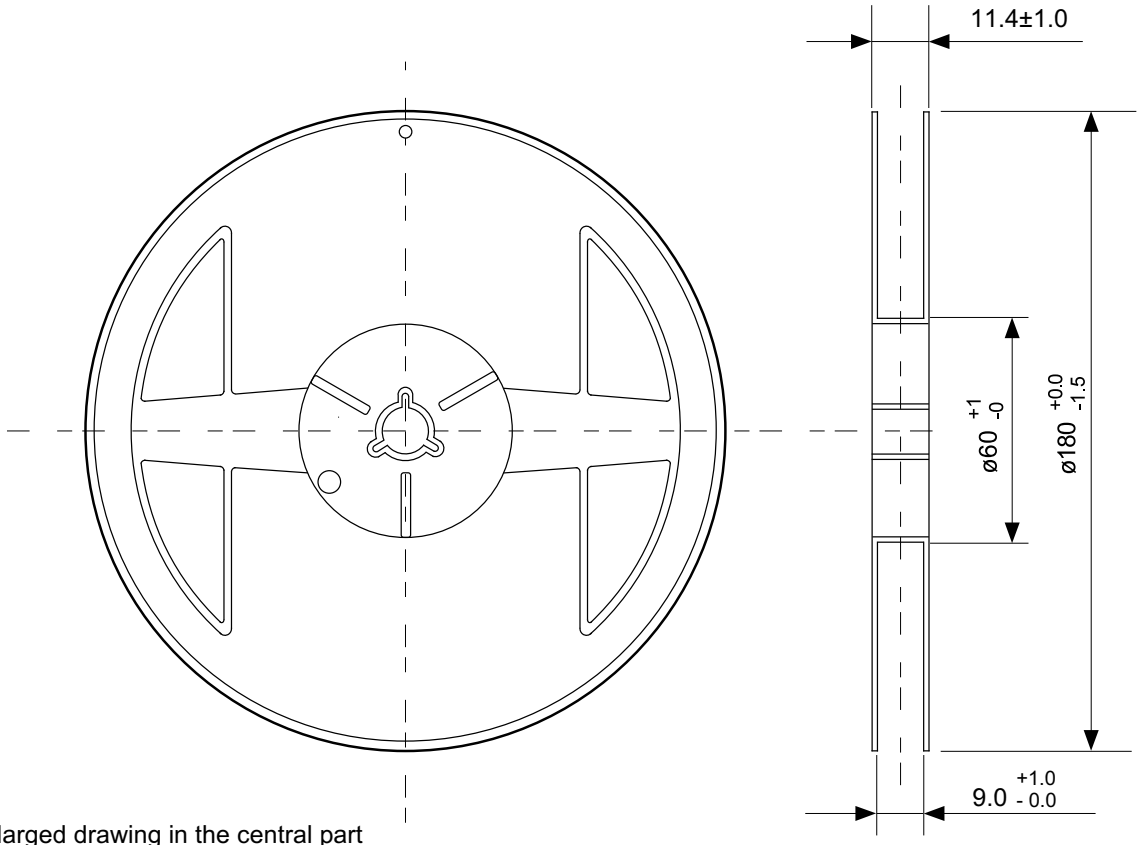
TITLE	HSNT-4-A-PKG Dimensions
No.	PK004-A-P-SD-1.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	



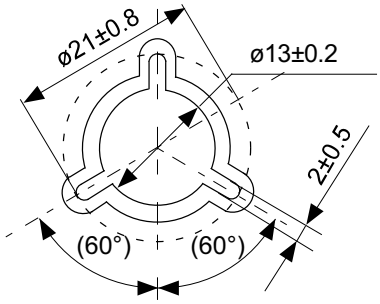


No. PK004-A-C-SD-1.0

TITLE	HSNT-4-A-Carrier Tape
No.	PK004-A-C-SD-1.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	



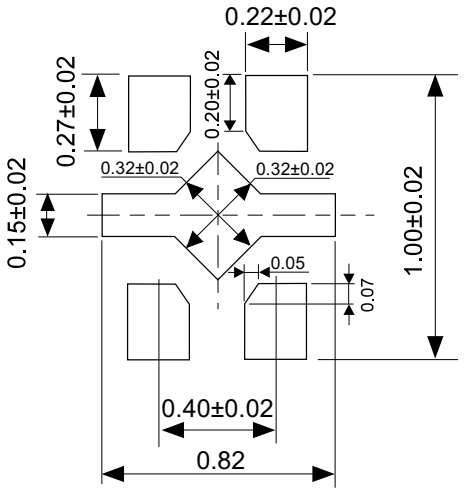
Enlarged drawing in the central part



No. PK004-A-R-SD-1.0

TITLE	HSNT-4-A-Reel		
No.	PK004-A-R-SD-1.0		
SCALE		QTY.	10,000
UNIT	mm		
Seiko Instruments Inc.			

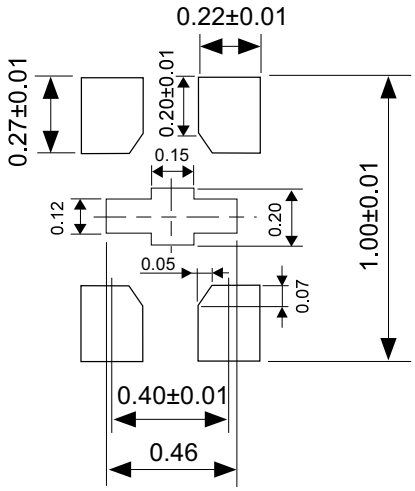
Land Pattern



Caution It is recommended to solder the heatsink to a board in order to ensure the heat radiation.

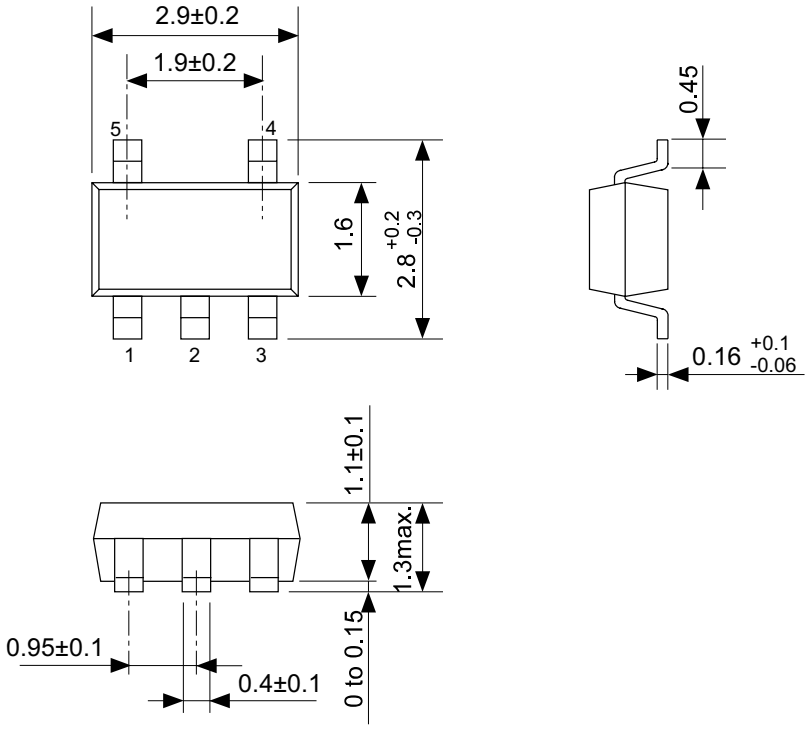
注意 放熱性を確保する為に、PKGの裏面放熱板（ヒートシンク）を基板に半田付けする事を推奨いたします。

Metal Mask Pattern



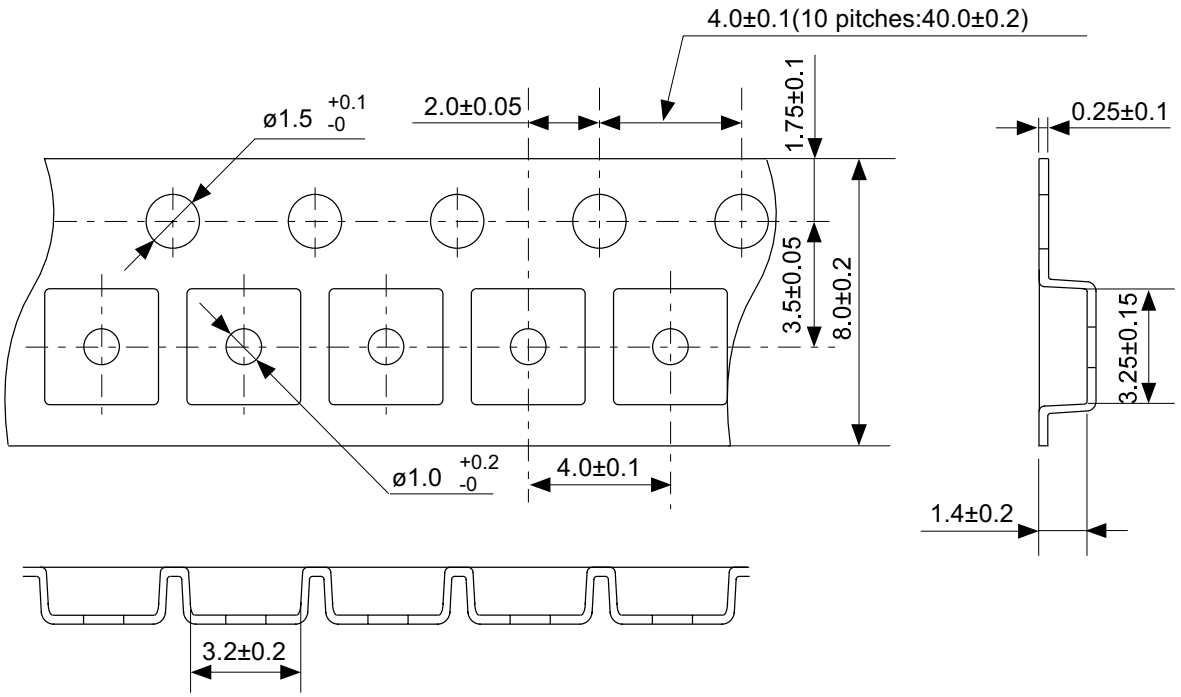
No. PK004-A-L-SD-1.0

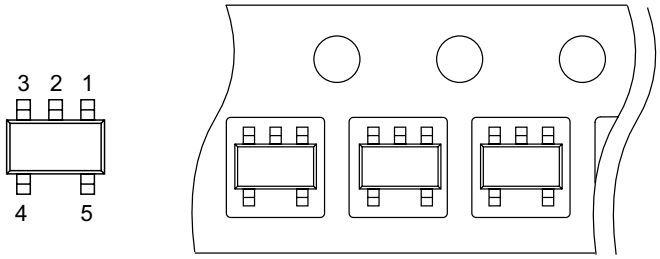
TITLE	HSNT-4-A-Land Recommendation
No.	PK004-A-L-SD-1.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	



No. MP005-A-P-SD-1.2

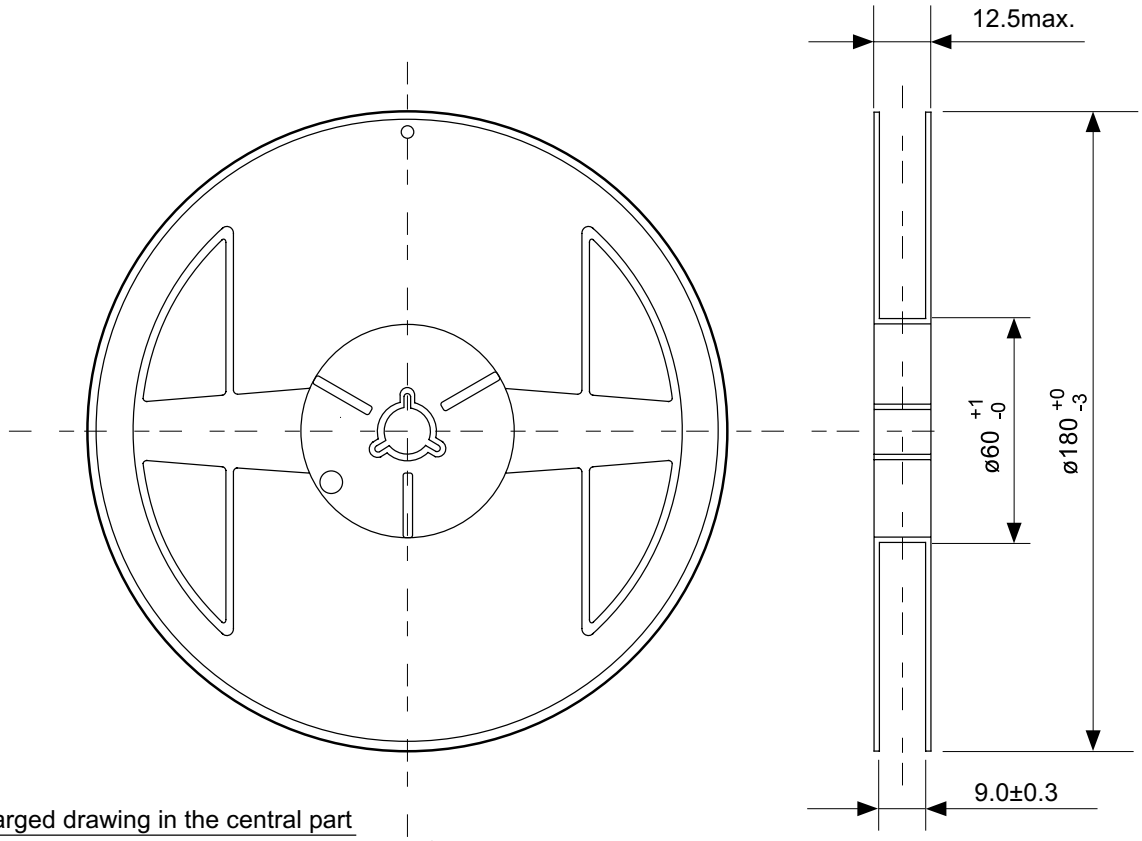
TITLE	SOT235-A-PKG Dimensions
No.	MP005-A-P-SD-1.2
SCALE	
UNIT	mm
Seiko Instruments Inc.	



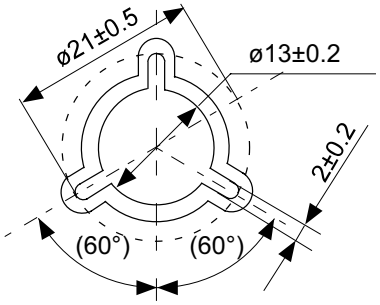


No. MP005-A-C-SD-2.1

TITLE	SOT235-A-Carrier Tape
No.	MP005-A-C-SD-2.1
SCALE	
UNIT	mm
Seiko Instruments Inc.	

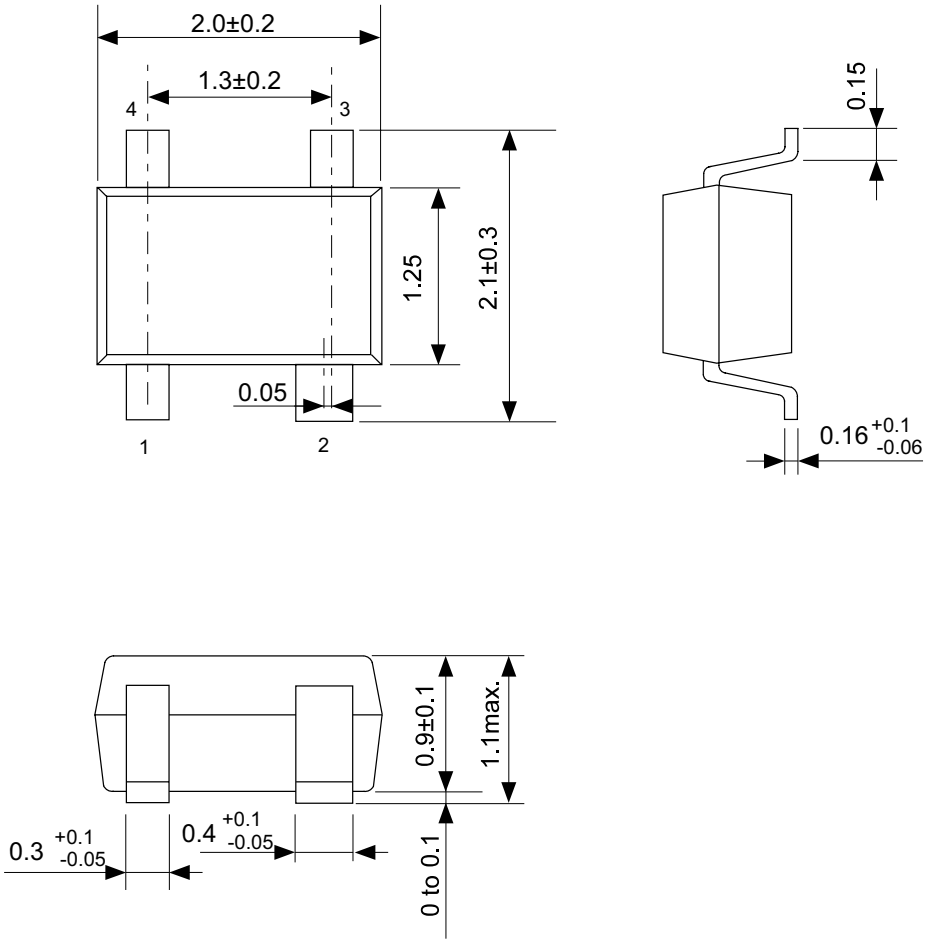


Enlarged drawing in the central part



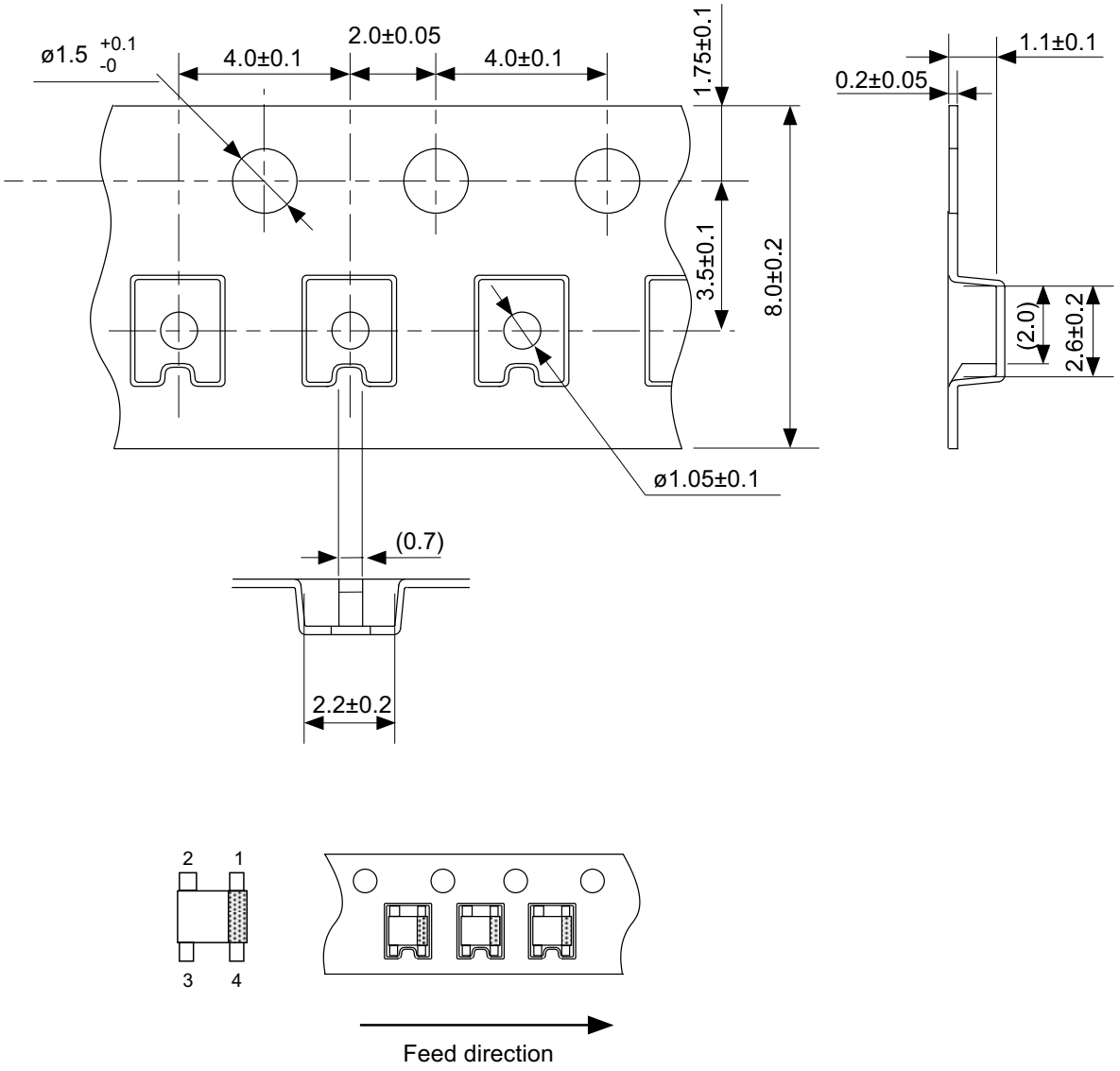
No. MP005-A-R-SD-1.1

TITLE	SOT235-A-Reel		
No.	MP005-A-R-SD-1.1		
SCALE		QTY.	3,000
UNIT	mm		
Seiko Instruments Inc.			



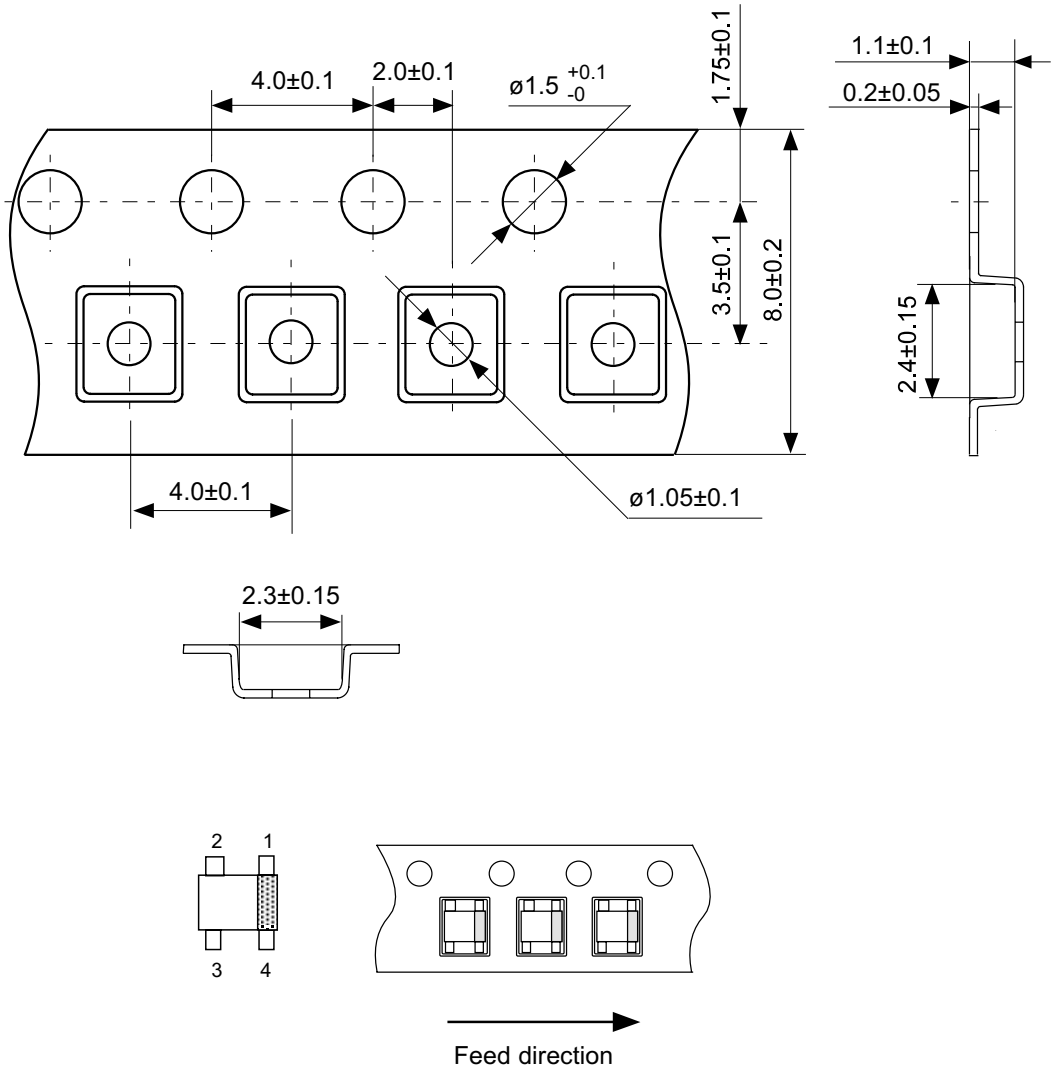
No. NP004-A-P-SD-1.1

TITLE	SC82AB-A-PKG Dimensions
No.	NP004-A-P-SD-1.1
SCALE	
UNIT	mm
Seiko Instruments Inc.	



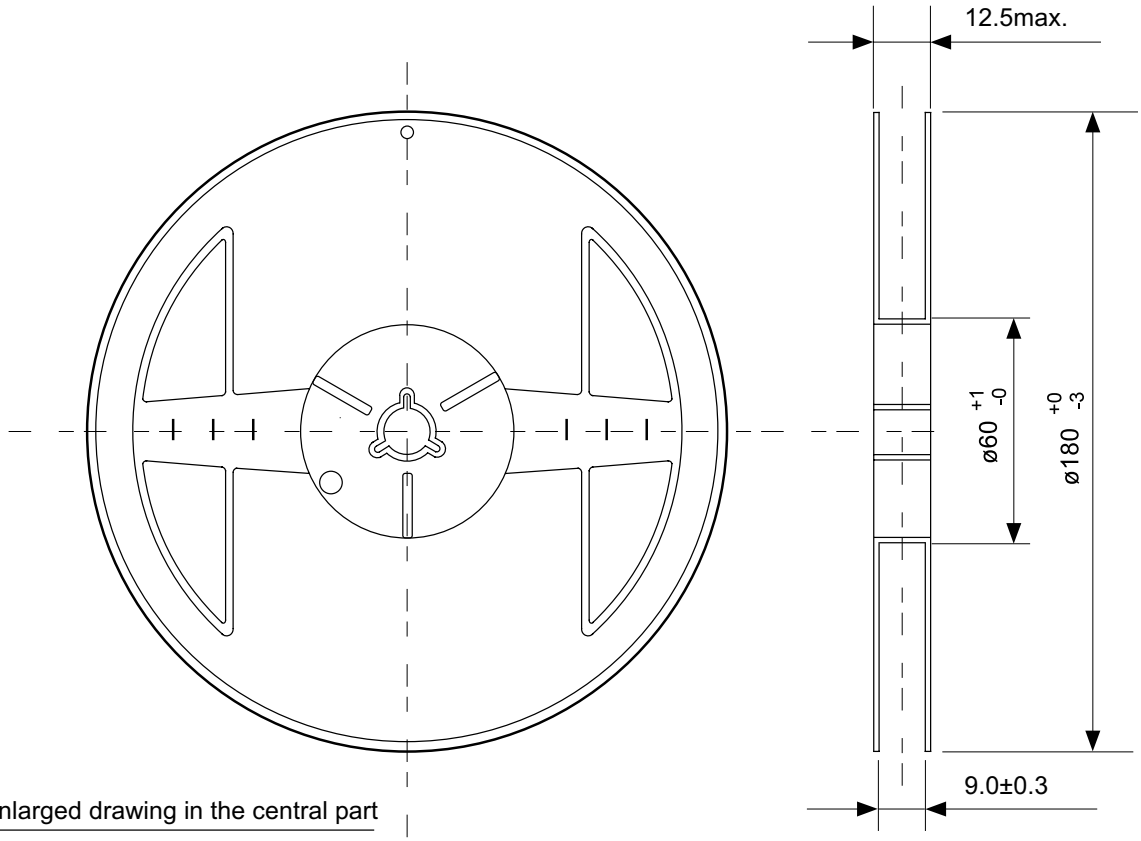
No. NP004-A-C-SD-3.0

TITLE	SC82AB-A-Carrier Tape
No.	NP004-A-C-SD-3.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	

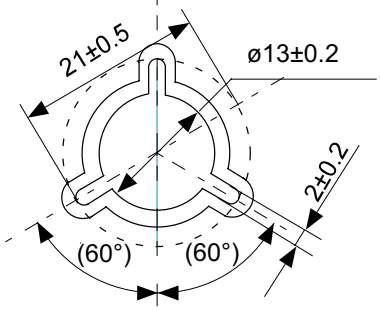


No. NP004-A-C-S1-2.0

TITLE	SC82AB-A-Carrier Tape
No.	NP004-A-C-S1-2.0
SCALE	
UNIT	mm
Seiko Instruments 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		
SCALE		QTY.	3,000
UNIT	mm		
Seiko Instruments Inc.			

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