

LOW CURRENT CONSUMPTION HIGH RIPPLE-REJECTION LOW DROPOUT CMOS VOLTAGE REGULATOR

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Rev.1.1_00

S-1312 Series, developed by using the CMOS technology, is a positive voltage regulator IC which has the low current consumption, the high ripple-rejection and the low dropout voltage.

Even with low current consumption of 20 μ A typ., it has high ripple-rejection of 75 dB typ., and ceramic capacitor of 0.22 μ F or more can be used as the input and output capacitor.

It also has high-accuracy output voltage of $\pm 1.0\%$.

■ 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: $\pm 1.0\%$ (1.0 V to 1.45 V output product : ± 15 mV)
- Dropout voltage: 160 mV typ. (products having the output of 2.8 V, $I_{OUT} = 100$ mA)
- Low current consumption:
 - During operation: 20 μ A typ., 30 μ A max.
 - During power-off: 0.1 μ A typ., 1.0 μ A max.
- High output current: Possible to output 150 mA (at $V_{IN} \geq V_{OUT(S)} + 1.0$ V)^{*1}
- Low equivalent series resistance capacitor: A ceramic capacitor of 0.22 μ F or more can be used for the output capacitor.
- High ripple rejection:
 - 75 dB typ. (products having the output of 1.2 V, at $f = 1.0$ kHz)
 - 70 dB typ. (products having the output of 2.85 V, at $f = 1.0$ kHz)
- 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.
- Pull-down resistor is selectable.
- Discharge shunt circuit is selectable.
- 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

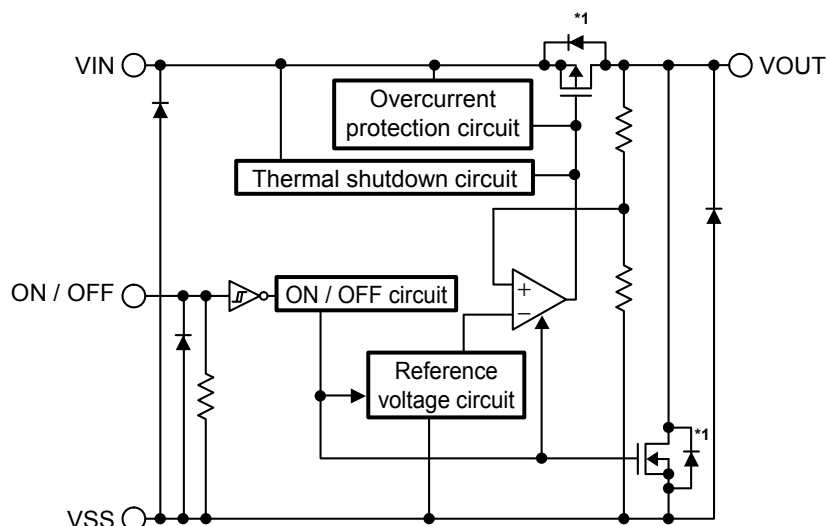
- Constant-voltage power supply for portable communication devices, digital cameras, and digital audio players
- Constant-voltage power supply for battery-powered devices
- Constant-voltage power supply for home electric / electronic appliances

■ Packages

- HSNT-4(0808)
- SOT-23-5

■ Block Diagrams

1. S-1312 Series A type

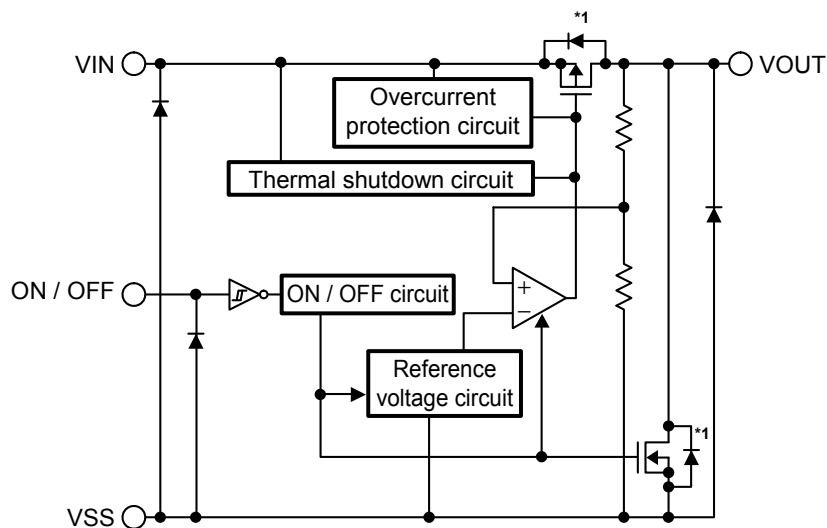


Function	Status
ON / OFF logic	Active "H"
Discharge shunt function	Available
Pull-down resistor	Available

*1. Parasitic diode

Figure 1

2. S-1312 Series B type

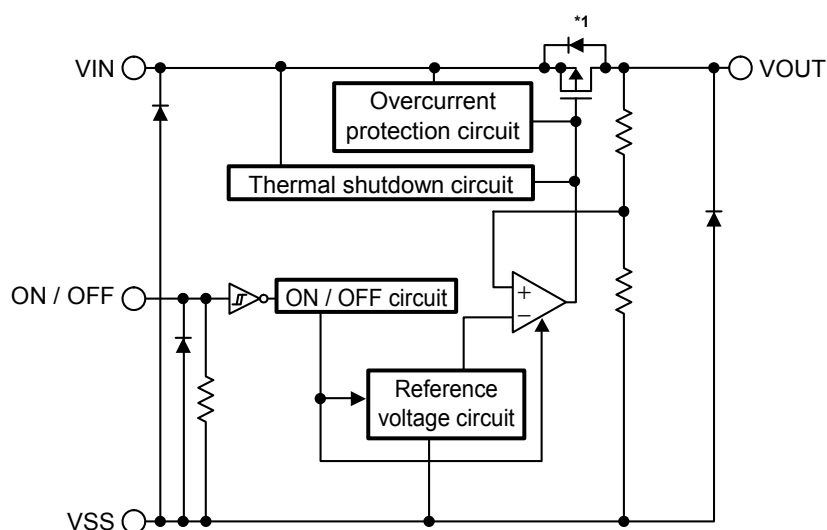


Function	Status
ON / OFF logic	Active "H"
Discharge shunt function	Available
Pull-down resistor	None

*1. Parasitic diode

Figure 2

3. S-1312 Series C type

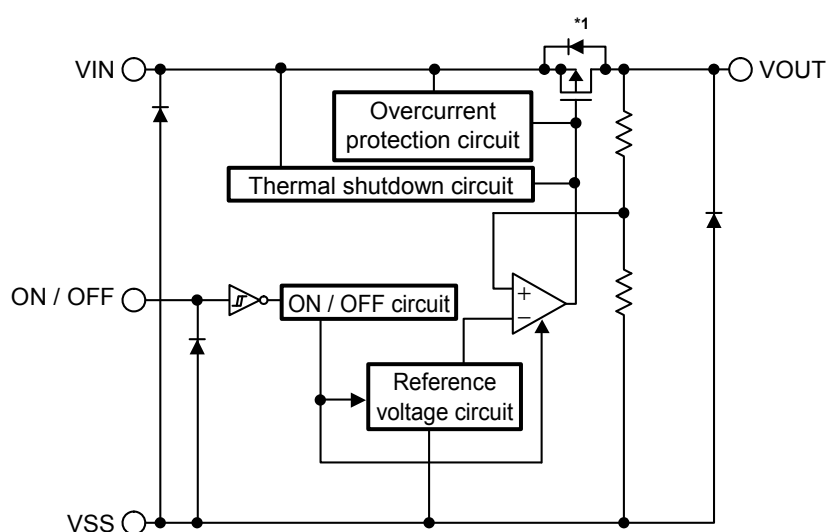


Function	Status
ON / OFF logic	Active "H"
Discharge shunt function	None
Pull-down resistor	Available

*1. Parasitic diode

Figure 3

4. S-1312 Series D type



Function	Status
ON / OFF logic	Active "H"
Discharge shunt function	None
Pull-down resistor	None

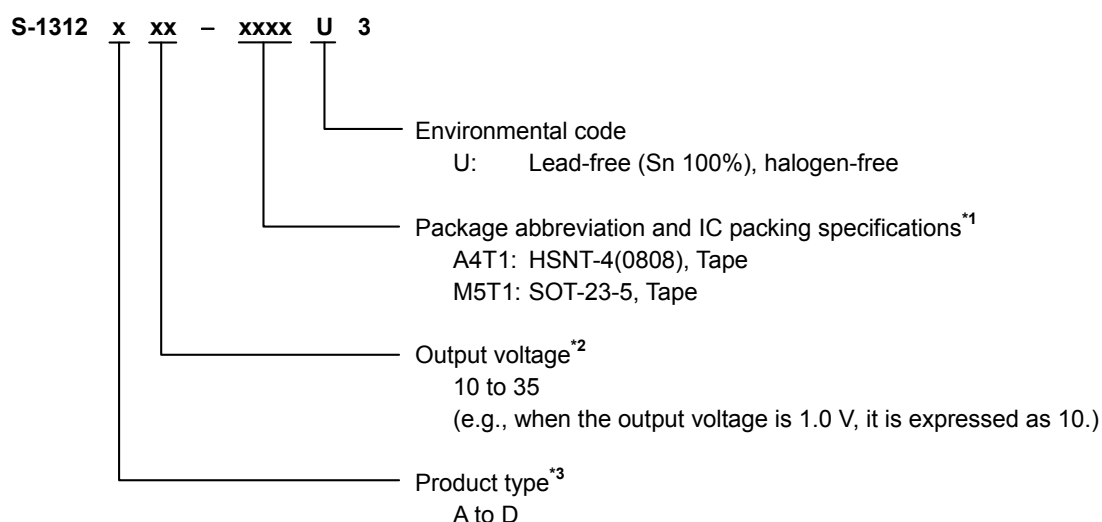
*1. Parasitic diode

Figure 4

■ Product Name Structure

Users can select the product type, output voltage, and package type for the S-1312 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, “**4. Product name list**” regarding details of the product name.

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	Pull-down Resistor
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	—

4. Product name list

4.1 S-1312 Series A type

ON / OFF logic : Active "H"
Discharge shunt function : Available Pull-down resistor : Available

Table 2

Output Voltage	HSNT-4(0808)	SOT-23-5
1.0 V $\pm$ 15 mV	S-1312A10-A4T1U3	S-1312A10-M5T1U3
1.1 V $\pm$ 15 mV	S-1312A11-A4T1U3	S-1312A11-M5T1U3
1.2 V $\pm$ 15 mV	S-1312A12-A4T1U3	S-1312A12-M5T1U3
1.3 V $\pm$ 15 mV	S-1312A13-A4T1U3	S-1312A13-M5T1U3
1.4 V $\pm$ 15 mV	S-1312A14-A4T1U3	S-1312A14-M5T1U3
1.5 V $\pm$ 1.0%	S-1312A15-A4T1U3	S-1312A15-M5T1U3
1.6 V $\pm$ 1.0%	S-1312A16-A4T1U3	S-1312A16-M5T1U3
1.7 V $\pm$ 1.0%	S-1312A17-A4T1U3	S-1312A17-M5T1U3
1.8 V $\pm$ 1.0%	S-1312A18-A4T1U3	S-1312A18-M5T1U3
1.85 V $\pm$ 1.0%	S-1312A1J-A4T1U3	S-1312A1J-M5T1U3
1.9 V $\pm$ 1.0%	S-1312A19-A4T1U3	S-1312A19-M5T1U3
2.0 V $\pm$ 1.0%	S-1312A20-A4T1U3	S-1312A20-M5T1U3
2.1 V $\pm$ 1.0%	S-1312A21-A4T1U3	S-1312A21-M5T1U3
2.2 V $\pm$ 1.0%	S-1312A22-A4T1U3	S-1312A22-M5T1U3
2.3 V $\pm$ 1.0%	S-1312A23-A4T1U3	S-1312A23-M5T1U3
2.4 V $\pm$ 1.0%	S-1312A24-A4T1U3	S-1312A24-M5T1U3
2.5 V $\pm$ 1.0%	S-1312A25-A4T1U3	S-1312A25-M5T1U3
2.6 V $\pm$ 1.0%	S-1312A26-A4T1U3	S-1312A26-M5T1U3
2.7 V $\pm$ 1.0%	S-1312A27-A4T1U3	S-1312A27-M5T1U3
2.8 V $\pm$ 1.0%	S-1312A28-A4T1U3	S-1312A28-M5T1U3
2.85 V $\pm$ 1.0%	S-1312A2J-A4T1U3	S-1312A2J-M5T1U3
2.9 V $\pm$ 1.0%	S-1312A29-A4T1U3	S-1312A29-M5T1U3
3.0 V $\pm$ 1.0%	S-1312A30-A4T1U3	S-1312A30-M5T1U3
3.1 V $\pm$ 1.0%	S-1312A31-A4T1U3	S-1312A31-M5T1U3
3.2 V $\pm$ 1.0%	S-1312A32-A4T1U3	S-1312A32-M5T1U3
3.3 V $\pm$ 1.0%	S-1312A33-A4T1U3	S-1312A33-M5T1U3
3.4 V $\pm$ 1.0%	S-1312A34-A4T1U3	S-1312A34-M5T1U3
3.5 V $\pm$ 1.0%	S-1312A35-A4T1U3	S-1312A35-M5T1U3

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

4.2 S-1312 Series B type

ON / OFF logic : Active "H"
 Discharge shunt function : Available Pull-down resistor : None

Table 3

Output Voltage	HSNT-4(0808)	SOT-23-5
1.0 V $\pm$ 15 mV	S-1312B10-A4T1U3	S-1312B10-M5T1U3
1.1 V $\pm$ 15 mV	S-1312B11-A4T1U3	S-1312B11-M5T1U3
1.2 V $\pm$ 15 mV	S-1312B12-A4T1U3	S-1312B12-M5T1U3
1.3 V $\pm$ 15 mV	S-1312B13-A4T1U3	S-1312B13-M5T1U3
1.4 V $\pm$ 15 mV	S-1312B14-A4T1U3	S-1312B14-M5T1U3
1.5 V $\pm$ 1.0%	S-1312B15-A4T1U3	S-1312B15-M5T1U3
1.6 V $\pm$ 1.0%	S-1312B16-A4T1U3	S-1312B16-M5T1U3
1.7 V $\pm$ 1.0%	S-1312B17-A4T1U3	S-1312B17-M5T1U3
1.8 V $\pm$ 1.0%	S-1312B18-A4T1U3	S-1312B18-M5T1U3
1.85 V $\pm$ 1.0%	S-1312B1J-A4T1U3	S-1312B1J-M5T1U3
1.9 V $\pm$ 1.0%	S-1312B19-A4T1U3	S-1312B19-M5T1U3
2.0 V $\pm$ 1.0%	S-1312B20-A4T1U3	S-1312B20-M5T1U3
2.1 V $\pm$ 1.0%	S-1312B21-A4T1U3	S-1312B21-M5T1U3
2.2 V $\pm$ 1.0%	S-1312B22-A4T1U3	S-1312B22-M5T1U3
2.3 V $\pm$ 1.0%	S-1312B23-A4T1U3	S-1312B23-M5T1U3
2.4 V $\pm$ 1.0%	S-1312B24-A4T1U3	S-1312B24-M5T1U3
2.5 V $\pm$ 1.0%	S-1312B25-A4T1U3	S-1312B25-M5T1U3
2.6 V $\pm$ 1.0%	S-1312B26-A4T1U3	S-1312B26-M5T1U3
2.7 V $\pm$ 1.0%	S-1312B27-A4T1U3	S-1312B27-M5T1U3
2.8 V $\pm$ 1.0%	S-1312B28-A4T1U3	S-1312B28-M5T1U3
2.85 V $\pm$ 1.0%	S-1312B2J-A4T1U3	S-1312B2J-M5T1U3
2.9 V $\pm$ 1.0%	S-1312B29-A4T1U3	S-1312B29-M5T1U3
3.0 V $\pm$ 1.0%	S-1312B30-A4T1U3	S-1312B30-M5T1U3
3.1 V $\pm$ 1.0%	S-1312B31-A4T1U3	S-1312B31-M5T1U3
3.2 V $\pm$ 1.0%	S-1312B32-A4T1U3	S-1312B32-M5T1U3
3.3 V $\pm$ 1.0%	S-1312B33-A4T1U3	S-1312B33-M5T1U3
3.4 V $\pm$ 1.0%	S-1312B34-A4T1U3	S-1312B34-M5T1U3
3.5 V $\pm$ 1.0%	S-1312B35-A4T1U3	S-1312B35-M5T1U3

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

4.3 S-1312 Series C type

ON / OFF logic : Active "H"
Discharge shunt function : None Pull-down resistor : Available

Table 4

Output Voltage	HSNT-4(0808)	SOT-23-5
1.0 V $\pm$ 15 mV	S-1312C10-A4T1U3	S-1312C10-M5T1U3
1.1 V $\pm$ 15 mV	S-1312C11-A4T1U3	S-1312C11-M5T1U3
1.2 V $\pm$ 15 mV	S-1312C12-A4T1U3	S-1312C12-M5T1U3
1.3 V $\pm$ 15 mV	S-1312C13-A4T1U3	S-1312C13-M5T1U3
1.4 V $\pm$ 15 mV	S-1312C14-A4T1U3	S-1312C14-M5T1U3
1.5 V $\pm$ 1.0%	S-1312C15-A4T1U3	S-1312C15-M5T1U3
1.6 V $\pm$ 1.0%	S-1312C16-A4T1U3	S-1312C16-M5T1U3
1.7 V $\pm$ 1.0%	S-1312C17-A4T1U3	S-1312C17-M5T1U3
1.8 V $\pm$ 1.0%	S-1312C18-A4T1U3	S-1312C18-M5T1U3
1.85 V $\pm$ 1.0%	S-1312C1J-A4T1U3	S-1312C1J-M5T1U3
1.9 V $\pm$ 1.0%	S-1312C19-A4T1U3	S-1312C19-M5T1U3
2.0 V $\pm$ 1.0%	S-1312C20-A4T1U3	S-1312C20-M5T1U3
2.1 V $\pm$ 1.0%	S-1312C21-A4T1U3	S-1312C21-M5T1U3
2.2 V $\pm$ 1.0%	S-1312C22-A4T1U3	S-1312C22-M5T1U3
2.3 V $\pm$ 1.0%	S-1312C23-A4T1U3	S-1312C23-M5T1U3
2.4 V $\pm$ 1.0%	S-1312C24-A4T1U3	S-1312C24-M5T1U3
2.5 V $\pm$ 1.0%	S-1312C25-A4T1U3	S-1312C25-M5T1U3
2.6 V $\pm$ 1.0%	S-1312C26-A4T1U3	S-1312C26-M5T1U3
2.7 V $\pm$ 1.0%	S-1312C27-A4T1U3	S-1312C27-M5T1U3
2.8 V $\pm$ 1.0%	S-1312C28-A4T1U3	S-1312C28-M5T1U3
2.85 V $\pm$ 1.0%	S-1312C2J-A4T1U3	S-1312C2J-M5T1U3
2.9 V $\pm$ 1.0%	S-1312C29-A4T1U3	S-1312C29-M5T1U3
3.0 V $\pm$ 1.0%	S-1312C30-A4T1U3	S-1312C30-M5T1U3
3.1 V $\pm$ 1.0%	S-1312C31-A4T1U3	S-1312C31-M5T1U3
3.2 V $\pm$ 1.0%	S-1312C32-A4T1U3	S-1312C32-M5T1U3
3.3 V $\pm$ 1.0%	S-1312C33-A4T1U3	S-1312C33-M5T1U3
3.4 V $\pm$ 1.0%	S-1312C34-A4T1U3	S-1312C34-M5T1U3
3.5 V $\pm$ 1.0%	S-1312C35-A4T1U3	S-1312C35-M5T1U3

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

4.4 S-1312 Series D type

ON / OFF logic : Active "H"

Discharge shunt function : None

Pull-down resistor : None

Table 5

Output Voltage	HSNT-4(0808)	SOT-23-5
1.0 V $\pm$ 15 mV	S-1312D10-A4T1U3	S-1312D10-M5T1U3
1.1 V $\pm$ 15 mV	S-1312D11-A4T1U3	S-1312D11-M5T1U3
1.2 V $\pm$ 15 mV	S-1312D12-A4T1U3	S-1312D12-M5T1U3
1.3 V $\pm$ 15 mV	S-1312D13-A4T1U3	S-1312D13-M5T1U3
1.4 V $\pm$ 15 mV	S-1312D14-A4T1U3	S-1312D14-M5T1U3
1.5 V $\pm$ 1.0%	S-1312D15-A4T1U3	S-1312D15-M5T1U3
1.6 V $\pm$ 1.0%	S-1312D16-A4T1U3	S-1312D16-M5T1U3
1.7 V $\pm$ 1.0%	S-1312D17-A4T1U3	S-1312D17-M5T1U3
1.8 V $\pm$ 1.0%	S-1312D18-A4T1U3	S-1312D18-M5T1U3
1.85 V $\pm$ 1.0%	S-1312D1J-A4T1U3	S-1312D1J-M5T1U3
1.9 V $\pm$ 1.0%	S-1312D19-A4T1U3	S-1312D19-M5T1U3
2.0 V $\pm$ 1.0%	S-1312D20-A4T1U3	S-1312D20-M5T1U3
2.1 V $\pm$ 1.0%	S-1312D21-A4T1U3	S-1312D21-M5T1U3
2.2 V $\pm$ 1.0%	S-1312D22-A4T1U3	S-1312D22-M5T1U3
2.3 V $\pm$ 1.0%	S-1312D23-A4T1U3	S-1312D23-M5T1U3
2.4 V $\pm$ 1.0%	S-1312D24-A4T1U3	S-1312D24-M5T1U3
2.5 V $\pm$ 1.0%	S-1312D25-A4T1U3	S-1312D25-M5T1U3
2.6 V $\pm$ 1.0%	S-1312D26-A4T1U3	S-1312D26-M5T1U3
2.7 V $\pm$ 1.0%	S-1312D27-A4T1U3	S-1312D27-M5T1U3
2.8 V $\pm$ 1.0%	S-1312D28-A4T1U3	S-1312D28-M5T1U3
2.85 V $\pm$ 1.0%	S-1312D2J-A4T1U3	S-1312D2J-M5T1U3
2.9 V $\pm$ 1.0%	S-1312D29-A4T1U3	S-1312D29-M5T1U3
3.0 V $\pm$ 1.0%	S-1312D30-A4T1U3	S-1312D30-M5T1U3
3.1 V $\pm$ 1.0%	S-1312D31-A4T1U3	S-1312D31-M5T1U3
3.2 V $\pm$ 1.0%	S-1312D32-A4T1U3	S-1312D32-M5T1U3
3.3 V $\pm$ 1.0%	S-1312D33-A4T1U3	S-1312D33-M5T1U3
3.4 V $\pm$ 1.0%	S-1312D34-A4T1U3	S-1312D34-M5T1U3
3.5 V $\pm$ 1.0%	S-1312D35-A4T1U3	S-1312D35-M5T1U3

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

■ Pin Configurations

1. HSNT-4(0808)

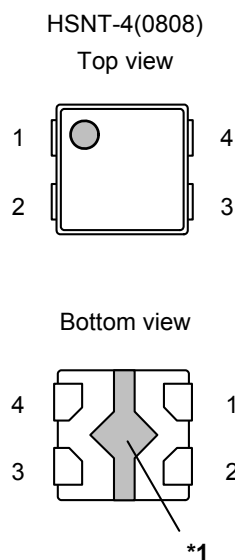


Table 6

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

*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

2. SOT-23-5

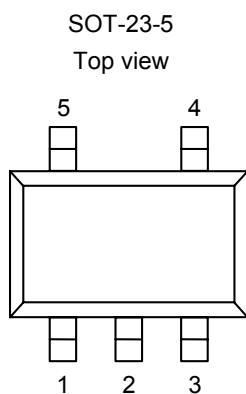


Table 7

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.

Figure 6

■ Absolute Maximum Ratings

Table 8

(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}	180	mA
Power dissipation	HSNT-4(0808)	335^{*1}	mW
	SOT-23-5	600^{*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.

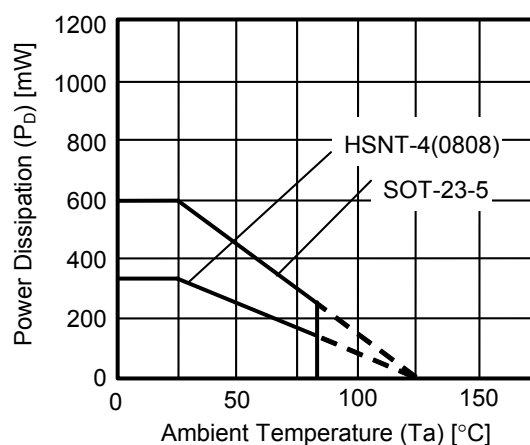


Figure 7 Power Dissipation of Package (When Mounted on Board)

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)

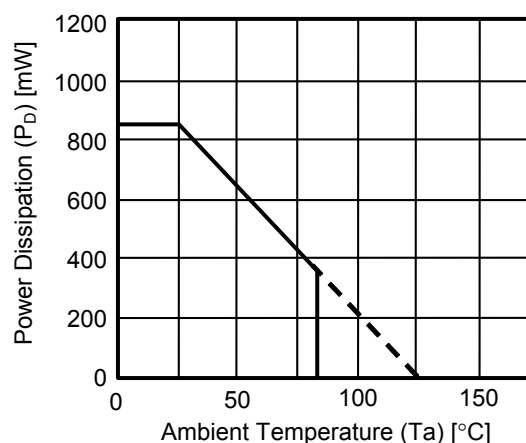


Figure 8 Power Dissipation of Package (When Mounted on Board)

Table 9

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

■ Electrical Characteristics

Table 10 (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 ≤ V _{OUT(S)} < 1.5 V	V _{OUT(S)} − 0.015	V _{OUT(S)}	V _{OUT(S)} + 0.015	V	1
			1.5 V ≤ V _{OUT(S)} ≤ 3.5 V	V _{OUT(S)} × 0.99	V _{OUT(S)}	V _{OUT(S)} × 1.01	V	1
Output current ^{*2}	I _{OUT}	V _{IN} ≥ V _{OUT(S)} + 1.0 V		150 ^{*5}	—	—	mA	3
Dropout voltage ^{*3}	V _{drop}	I _{OUT} = 100 mA	1.0 V ≤ V _{OUT(S)} < 1.1 V	0.50	0.68	0.86	V	1
			1.1 V ≤ V _{OUT(S)} < 1.2 V	—	0.52	0.71	V	1
			1.2 V ≤ V _{OUT(S)} < 1.3 V	—	0.31	0.63	V	1
			1.3 V ≤ V _{OUT(S)} < 1.4 V	—	0.28	0.56	V	1
			1.4 V ≤ V _{OUT(S)} < 1.5 V	—	0.26	0.50	V	1
			1.5 V ≤ V _{OUT(S)} < 1.7 V	—	0.24	0.47	V	1
			1.7 V ≤ V _{OUT(S)} < 2.0 V	—	0.22	0.43	V	1
			2.0 V ≤ V _{OUT(S)} < 2.5 V	—	0.18	0.36	V	1
			2.5 V ≤ V _{OUT(S)} < 3.0 V	—	0.16	0.32	V	1
			3.0 V ≤ V _{OUT(S)} < 3.3 V	—	0.15	0.28	V	1
3.3 V ≤ V _{OUT(S)} ≤ 3.5 V	—	0.14	0.27	V	1			
Line regulation	$\frac{\Delta V_{OUT1}}{\Delta V_{IN} \bullet V_{OUT}}$	1.0 V ≤ V _{OUT(S)} < 1.1 V 1.6 V ≤ V _{IN} ≤ 5.5 V, I _{OUT} = 30 mA		—	0.02	0.1	%/V	1
		1.1 V ≤ V _{OUT(S)} ≤ 3.5 V V _{OUT(S)} + 0.5 V ≤ V _{IN} ≤ 5.5 V, I _{OUT} = 30 mA		—	0.02	0.1	%/V	1
Load regulation	ΔV _{OUT2}	V _{IN} = V _{OUT(S)} + 1.0 V, 100 μA ≤ I _{OUT} ≤ 100 mA		—	20	40	mV	1
Output voltage temperature coefficient ^{*4}	$\frac{\Delta V_{OUT}}{\Delta T_a \bullet V_{OUT}}$	V _{IN} = V _{OUT(S)} + 1.0 V, I _{OUT} = 30 mA, −40°C ≤ T _a ≤ +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		—	20	30	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} = 5.5 V, V _{ON / OFF} = 5.5 V	B / D type	−0.1	—	0.1	μA	4
			A / C type	1.0	2.5	5.0	μA	4
ON / OFF pin input current “L”	I _{SL}	V _{IN} = 5.5 V, V _{ON / OFF} = 0 V		−0.1	—	0.1	μA	4
Ripple rejection	RR	V _{IN} = V _{OUT(S)} + 1.0 V, f = 1.0 kHz, ΔV _{rip} = 0.5 V _{rms} , I _{OUT} = 30 mA	1.0 V ≤ V _{OUT(S)} ≤ 1.2 V	—	75	—	dB	5
			1.2 V < V _{OUT(S)} ≤ 2.85 V	—	70	—	dB	5
			2.85 V < V _{OUT(S)} ≤ 3.5 V	—	65	—	dB	5
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 10 (2 / 2)

S-1312 Series A / B types (With discharge shunt function)

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

S-1312 Series A / C types (pull-down resistor)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit	Test Circuit
Power-off pull-down resistor	R_{PD}	—	1.0	2.2	5.0	$M\Omega$	4

*1. $V_{OUT(S)}$: Specified output voltage

$V_{OUT(E)}$: Actual output voltage

Output voltage when fixing I_{OUT} (= 30 mA) and inputting $V_{OUT(S)} + 1.0 \text{ V}$

*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 $V_{IN} = V_{OUT(S)} + 1.0 \text{ V}$ and $I_{OUT} = 100 \text{ mA}$.

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 [$mV/^{\circ}C$] is calculated using the following equation.

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

*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

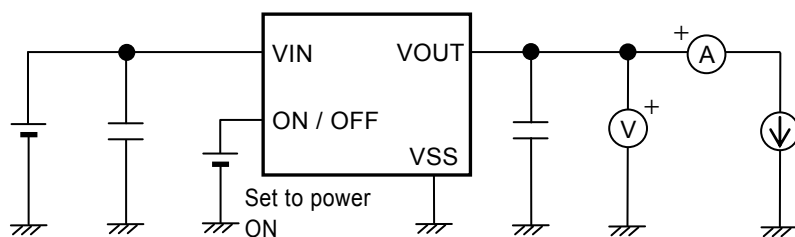


Figure 9 Test Circuit 1

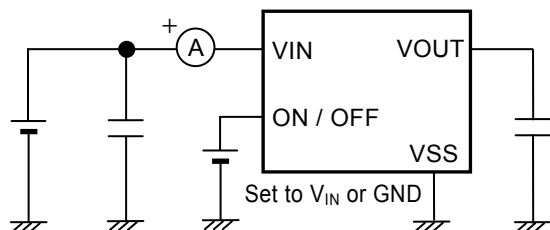


Figure 10 Test Circuit 2

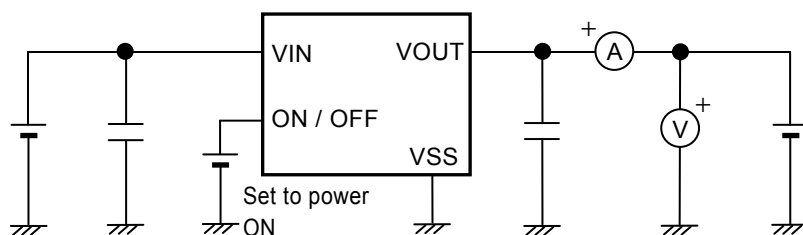


Figure 11 Test Circuit 3

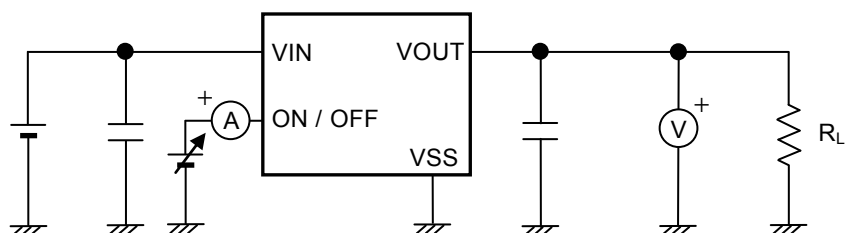


Figure 12 Test Circuit 4

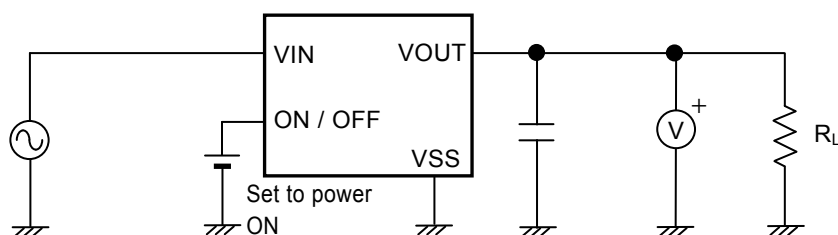
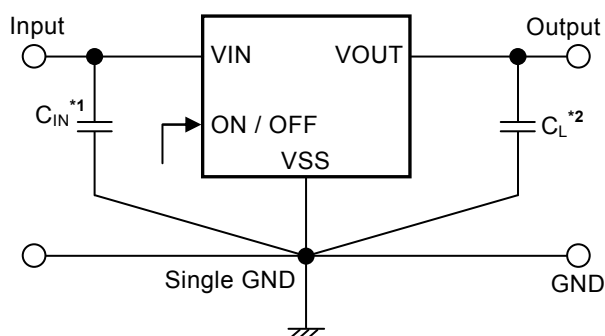


Figure 13 Test Circuit 5

■ Standard Circuit



- *1. C_{IN} is a capacitor for stabilizing the input.
- *2. Ceramic capacitor of 0.22 μF or more can be used as C_L .

Figure 14

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}) : 0.22 μF or more
 Output capacitor (C_L) : 0.22 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-1312 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 0.22 μF or more over the entire temperature range. When using an OS capacitor, tantalum capacitor, or aluminum electrolytic capacitor, the capacitance must be 0.22 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 $C_{IN} \geq 0.22 \mu\text{F}$, $C_L \geq 0.22 \mu\text{F}$; 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 $\pm 1.0\%$ or $\pm 15 \text{ mV}^{*1}$ under the specified conditions of fixed input voltage^{*2}, fixed output current, and fixed temperature.

*1. When $V_{OUT} < 1.5 \text{ V}$: $\pm 15 \text{ mV}$, When $V_{OUT} \geq 1.5 \text{ V}$: $\pm 1.0\%$

*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.

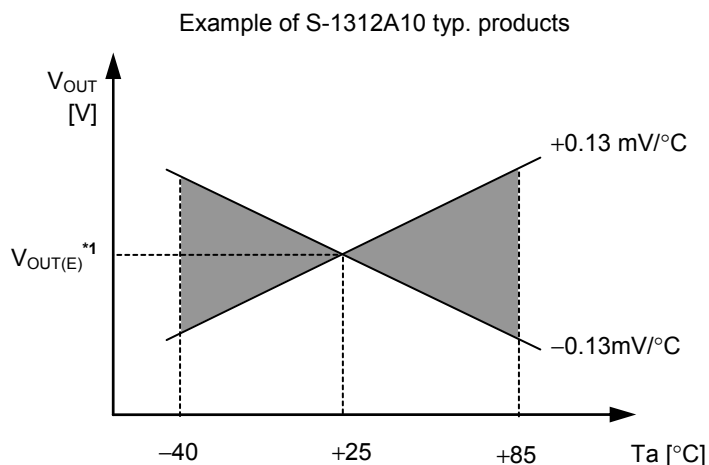
5. Dropout voltage (V_{drop})

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 $V_{IN} = V_{OUT(S)} + 1.0 \text{ V}$.

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

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

The shaded area in **Figure 15** is the range where V_{OUT} varies in the operating temperature range when the temperature coefficient of the output voltage is ± 130 ppm/ $^{\circ}\text{C}$.



*1. $V_{OUT(E)}$ is the value of the output voltage measured at $+25^{\circ}\text{C}$.

Figure 15

A change in the temperature of the output voltage [mV/ $^{\circ}\text{C}$] is calculated using the following equation.

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

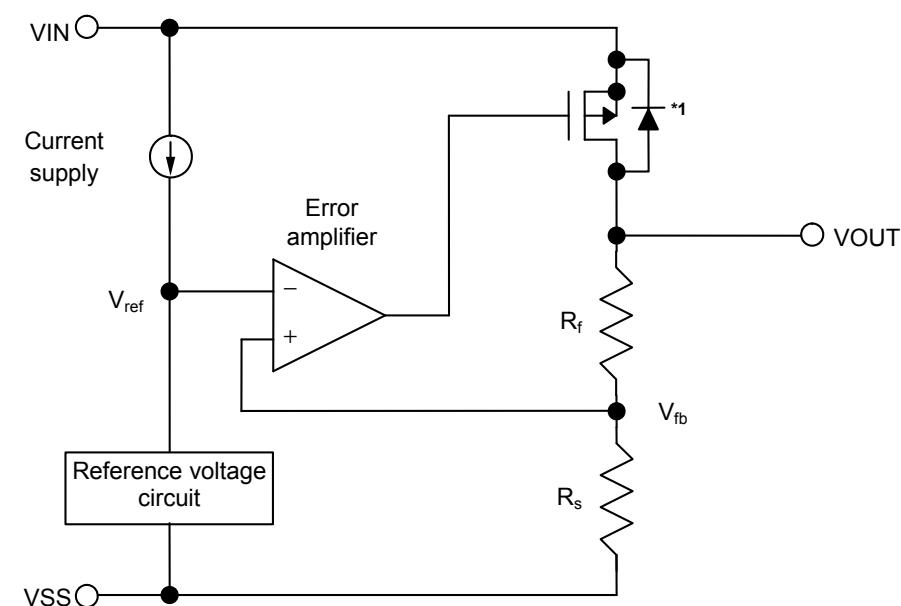
- *1. Change in temperature of output voltage
- *2. Specified output voltage
- *3. Output voltage temperature coefficient

■ Operation

1. Basic operation

Figure 16 shows the block diagram of S-1312 Series.

The error amplifier compares the reference voltage (V_{ref}) with feedback voltage (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 16

2. Output transistor

In the S-1312 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 V_{OUT} pin through a parasitic diode to the V_{IN} 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 $V_{IN} - 0.3$ V is applied to the ON / OFF pin. The ON / OFF pin is configured as shown in **Figures 17** and **18**.

3.1 S-1312 Series A / C types

The ON / OFF pin is internally pulled down to VSS in the floating status, so the VOUT pin is set to the V_{SS} level. 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-1312 Series B / D types

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 11

Logic 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}. Note that the IC’s current consumption increases as much as current flows into the pull-down resistor when the ON / OFF pin is connected to VIN and the S-1312 Series A/C types is operating (refer to **Figure 17**)

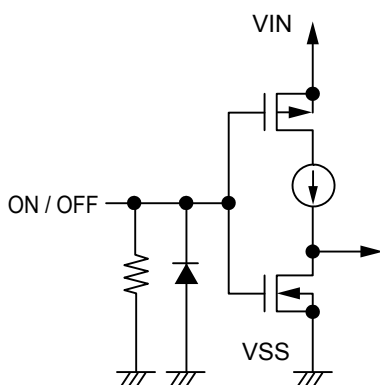


Figure 17 S-1312 Series A / C types

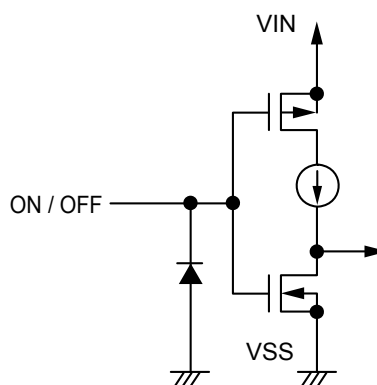


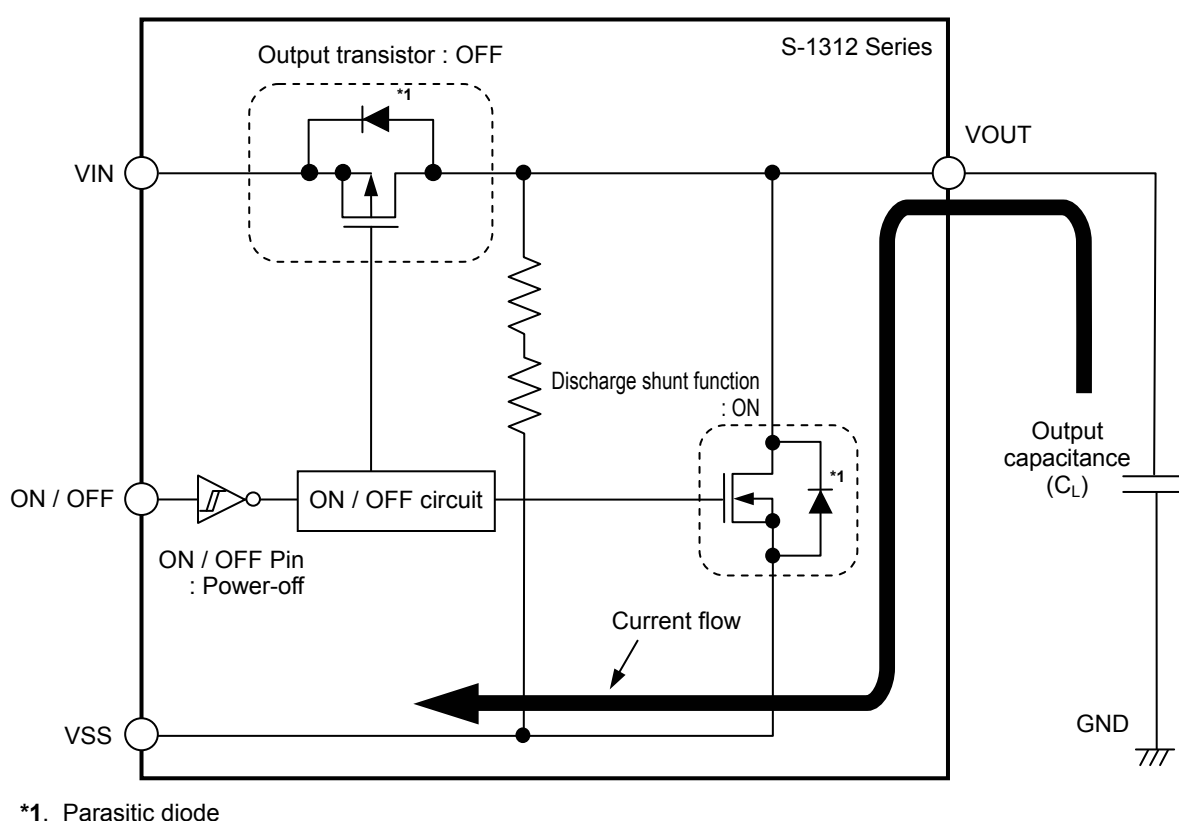
Figure 18 S-1312 Series B / D types

4. Discharge shunt function (S-1312 Series A / B types)

The S-1312 Series A / B types have built-in discharge shunt circuits to discharge the output capacitance. The output capacitance is discharged as follows so that the VOUT pin reaches the V_{SS} level.

- (1) The ON / OFF pin is set to power-off level.
- (2) The output transistor is turned off.
- (3) The discharge shunt circuit is turned on.
- (4) The output capacitor discharges

Since the S-1312 Series C / D types do not have discharge shunt circuits, the VOUT pin is set to V_{SS} level through several hundred k Ω internal divided resistors between the VOUT and V_{SS} pins. The S-1312 Series A / B types allow for the VOUT pin to reach the V_{SS} level rapidly due to the discharge shunt circuits.



*1. Parasitic diode

Figure 19

5. Pull-down resistor (S-1312 Series A / C types)

In the S-1312 Series A / C types, the ON / OFF pin is internally pulled down to V_{SS} , so the VOUT pin is in the V_{SS} level when in the floating status.

IC's current consumption increases as much as current flows into the pull-down resistor of 2.2 M Ω typ. when the ON / OFF pin is connected to VIN and the S-1312 Series A / C types is operating.

6. Overcurrent protection circuit

The S-1312 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 (180 mA or more) that lasts long.

7. Thermal shutdown circuit

The S-1312 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-1312 Series, if the thermal shutdown circuit starts operating, it stops regulating so that the output voltage drops. When regulation stops, the S-1312 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 12

Thermal Shutdown Circuit	VOUT Pin Voltage
Operate : 150°C typ.*1	V _{SS} level
Release : 120°C typ.*1	Set value

*1. Junction temperature

■ 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 (1.0 mA 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 ($T_a = +25^\circ\text{C}$)” in “■ Reference Data” for the equivalent series resistance (R_{ESR}) of the output capacitor.

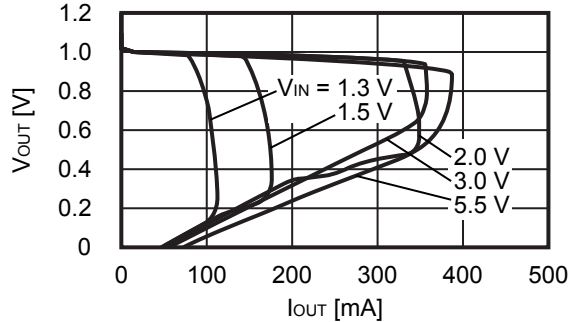
Input capacitor (C_{IN}) :	0.22 μF or more
Output capacitor (C_L) :	0.22 μF or more

- 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.
- 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 10** 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.

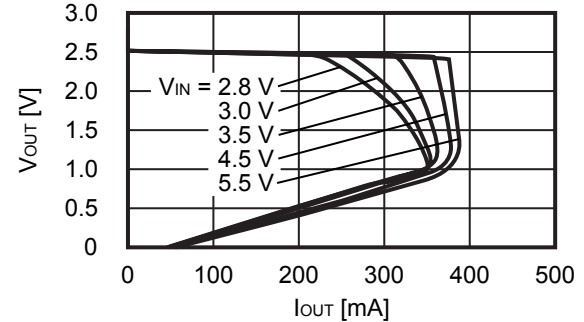
■ Characteristics (Typical Data)

1. Output voltage vs. Output current (When Load Current Increases) ($T_a = +25^\circ\text{C}$)

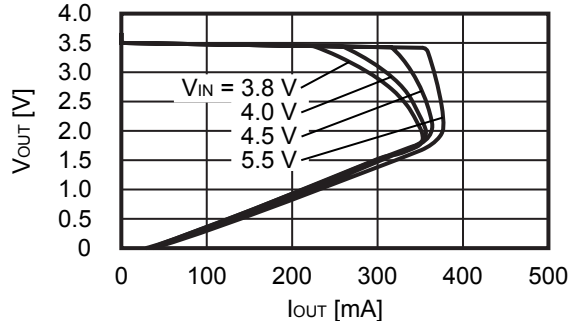
1.1 $V_{\text{OUT}} = 1.0 \text{ V}$



1.2 $V_{\text{OUT}} = 2.5 \text{ V}$



1.3 $V_{\text{OUT}} = 3.5 \text{ V}$

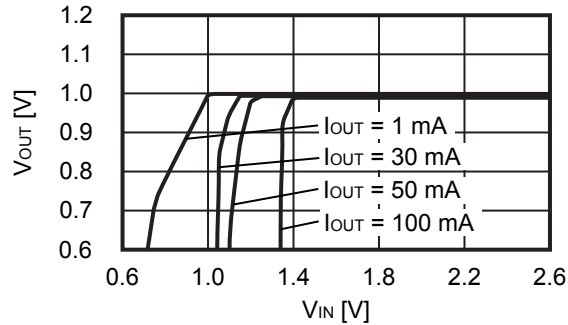


Remark In determining the output current, attention should be paid to the following.

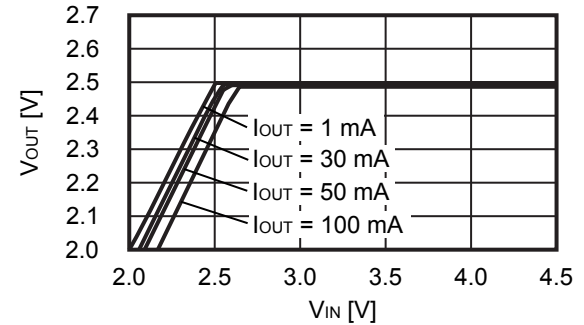
1. The minimum output current value and footnote *5 in Table 10 in the "■ Electrical Characteristics"
2. The package power dissipation

2. Output voltage vs. Input voltage ($T_a = +25^\circ\text{C}$)

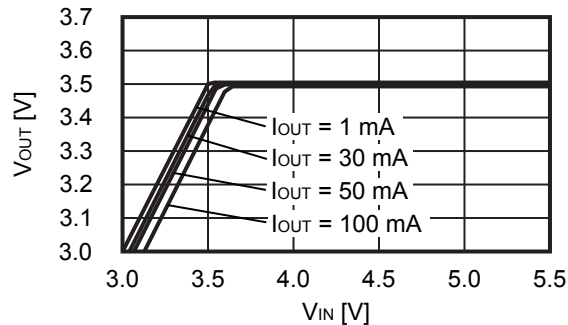
2.1 $V_{\text{OUT}} = 1.0 \text{ V}$



2.2 $V_{\text{OUT}} = 2.5 \text{ V}$

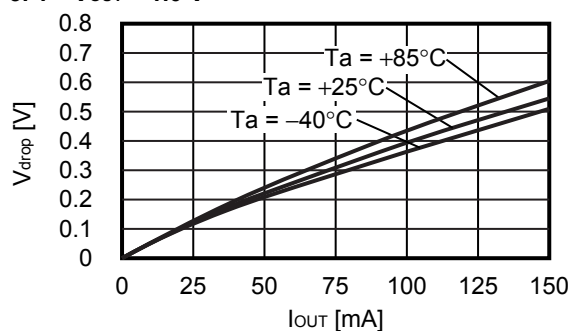


2.3 $V_{\text{OUT}} = 3.5 \text{ V}$

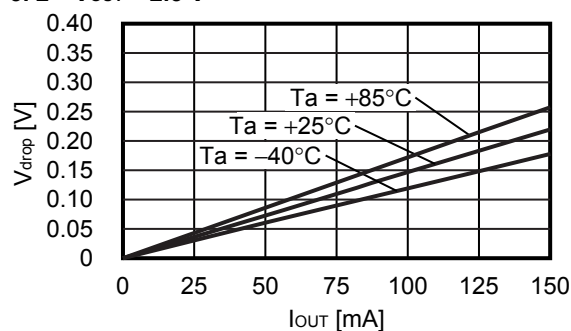


3. Dropout voltage vs. Output current

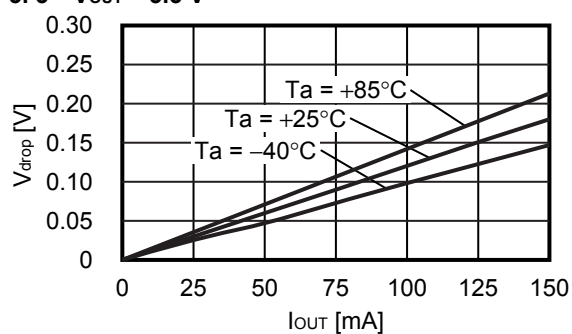
3.1 $V_{OUT} = 1.0\text{ V}$



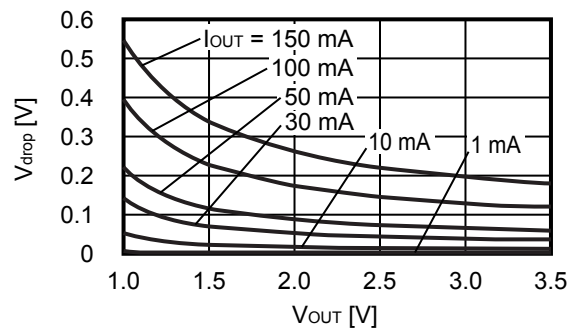
3.2 $V_{OUT} = 2.5\text{ V}$



3.3 $V_{OUT} = 3.5\text{ V}$

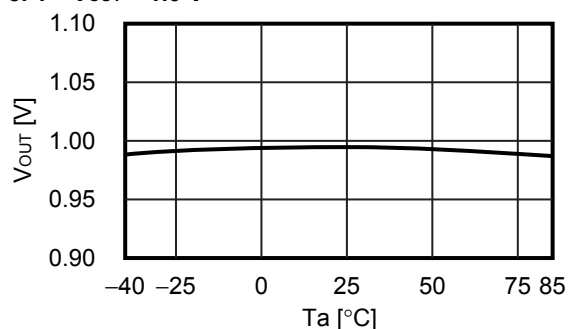


4. Dropout voltage vs. Set output voltage

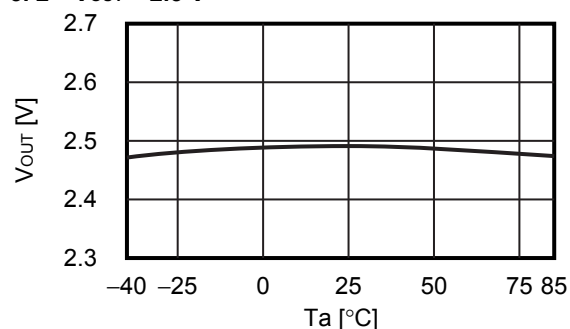


5. Output voltage vs. Ambient temperature

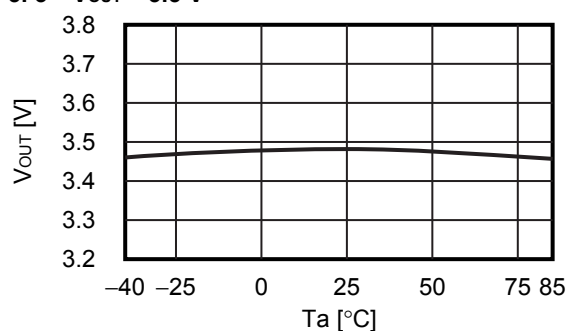
5.1 $V_{OUT} = 1.0\text{ V}$



5.2 $V_{OUT} = 2.5\text{ V}$

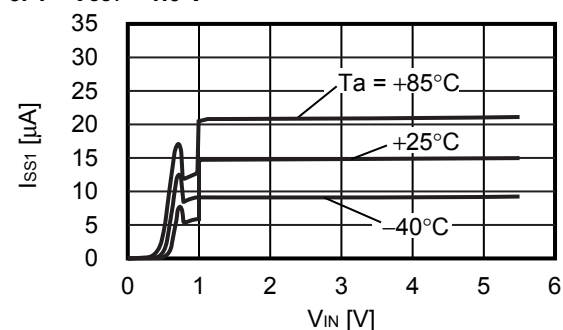


5.3 $V_{OUT} = 3.5\text{ V}$

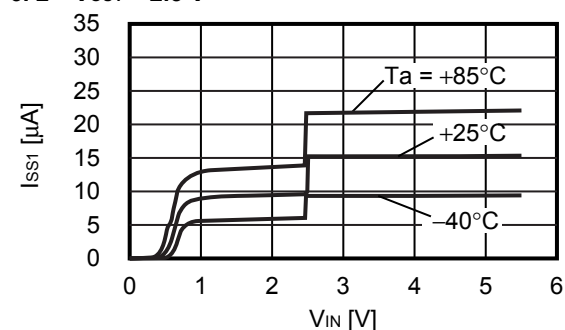


6. Current consumption vs. Input voltage

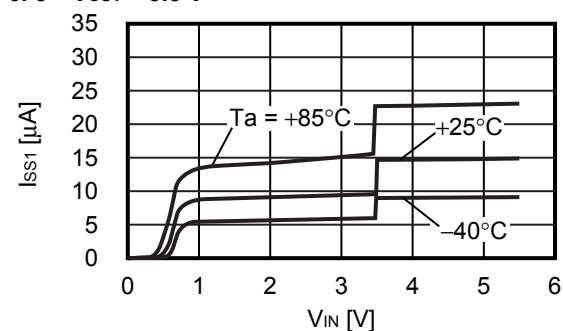
6.1 $V_{OUT} = 1.0\text{ V}$



6.2 $V_{OUT} = 2.5\text{ V}$

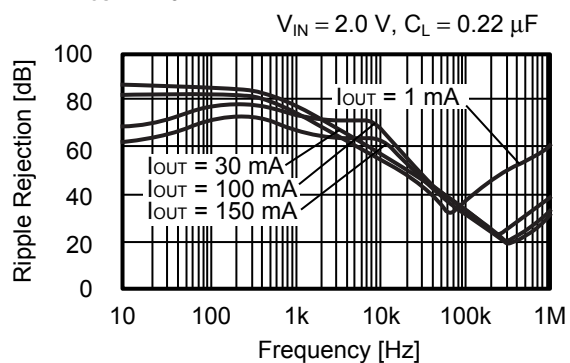


6.3 $V_{OUT} = 3.5\text{ V}$

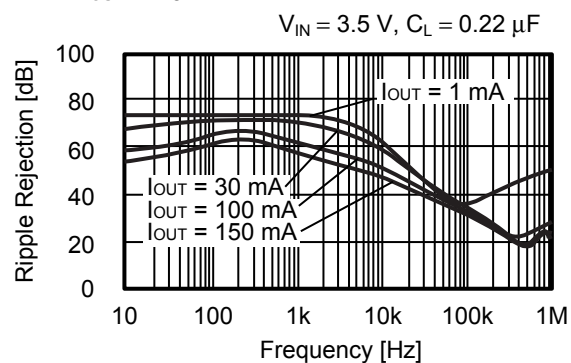


7. Ripple rejection ($T_a = +25^\circ\text{C}$)

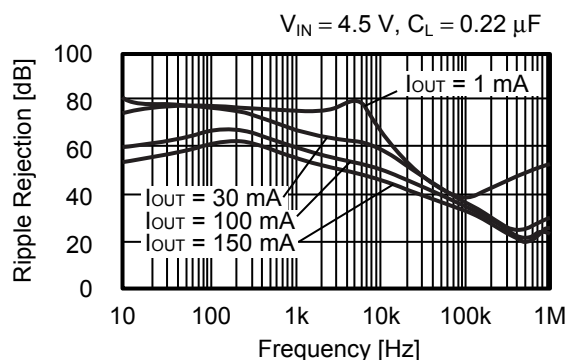
7.1 $V_{OUT} = 1.0\text{ V}$



7.2 $V_{OUT} = 2.5\text{ V}$



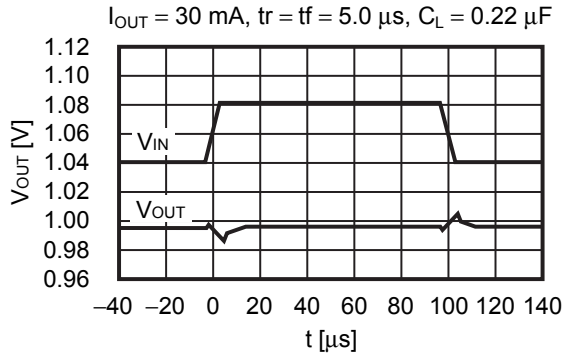
7.3 $V_{OUT} = 3.5\text{ V}$



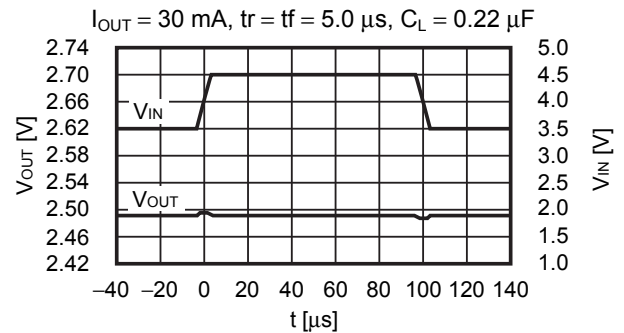
■ Reference Data

1. Transient response characteristics when input ($T_a = +25^\circ\text{C}$)

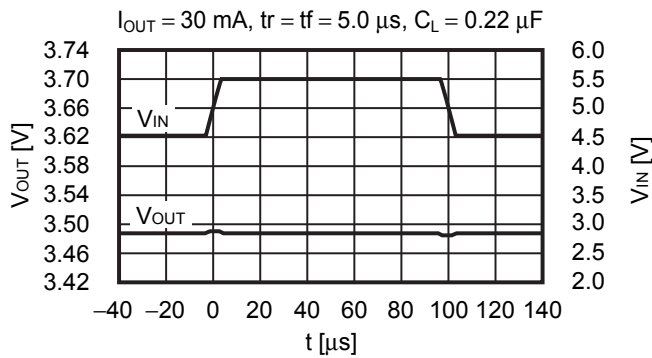
1.1 $V_{OUT} = 1.0\text{ V}$



1.2 $V_{OUT} = 2.5\text{ V}$

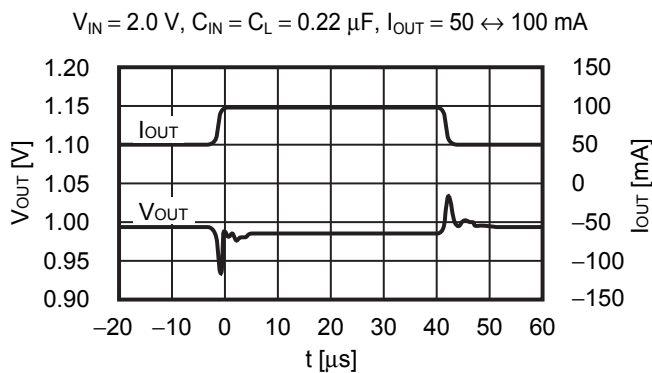


1.3 $V_{OUT} = 3.5\text{ V}$

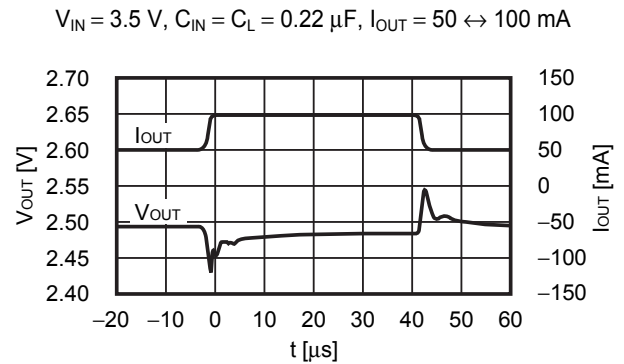


2. Transient response characteristics of load ($T_a = +25^\circ\text{C}$)

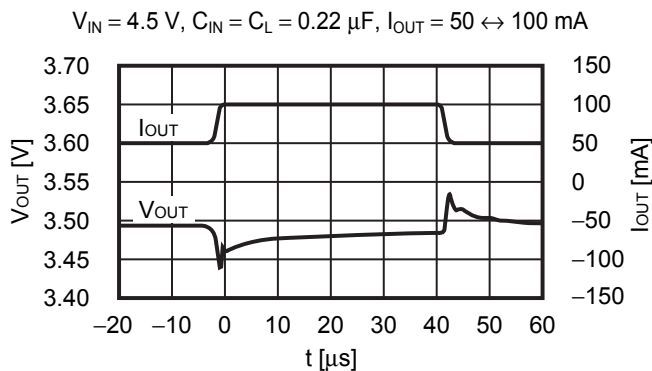
2.1 $V_{OUT} = 1.0\text{ V}$



2.2 $V_{OUT} = 2.5\text{ V}$



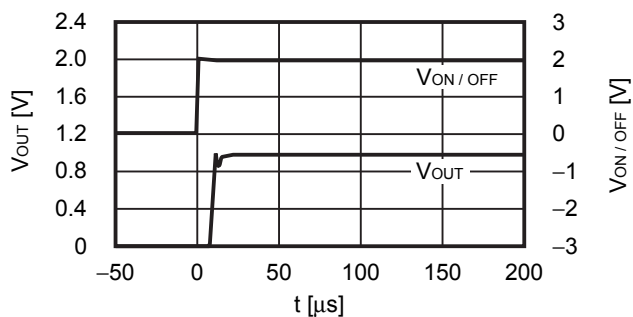
2.3 $V_{OUT} = 3.5\text{ V}$



3. Transient response characteristics of ON / OFF pin ($T_a = +25^\circ\text{C}$)

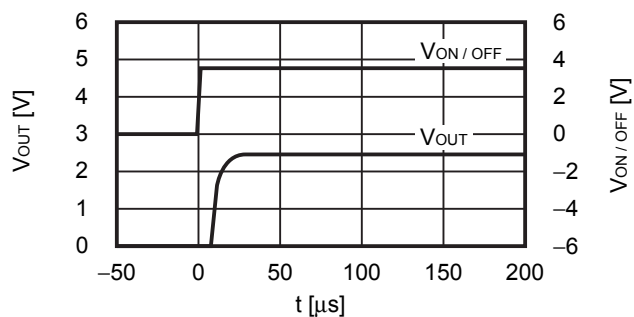
3.1 $V_{OUT} = 1.0\text{ V}$

$V_{IN} = 2.0\text{ V}$, $t_r = 1.0\text{ }\mu\text{s}$, $C_{IN} = C_L = 0.22\text{ }\mu\text{F}$, $I_{OUT} = 100\text{ mA}$



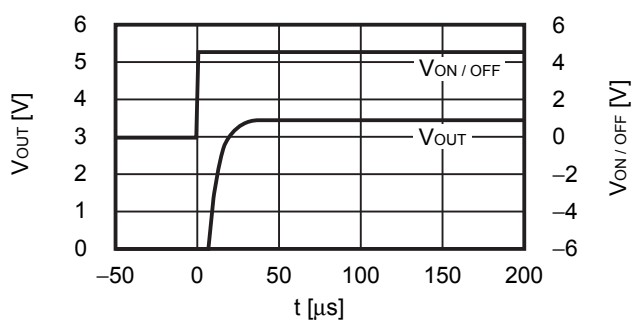
3.2 $V_{OUT} = 2.5\text{ V}$

$V_{IN} = 3.5\text{ V}$, $t_r = 1.0\text{ }\mu\text{s}$, $C_{IN} = C_L = 0.22\text{ }\mu\text{F}$, $I_{OUT} = 100\text{ mA}$



3.3 $V_{OUT} = 3.5\text{ V}$

$V_{IN} = 4.5\text{ V}$, $t_r = 1.0\text{ }\mu\text{s}$, $C_{IN} = C_L = 0.22\text{ }\mu\text{F}$, $I_{OUT} = 100\text{ mA}$



4. Output capacitance vs. Characteristics of discharge time ($T_a = +25^\circ\text{C}$)

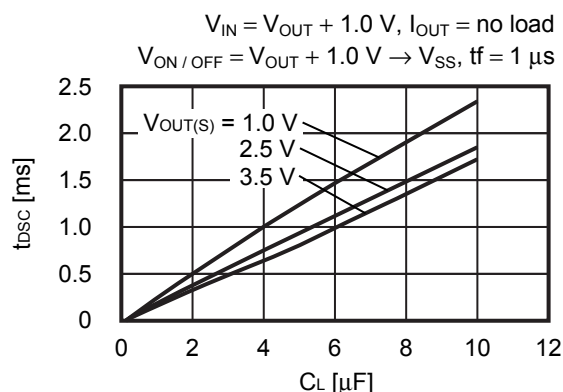


Figure 20 S-1312 Series A / B types
(with discharge shunt function)

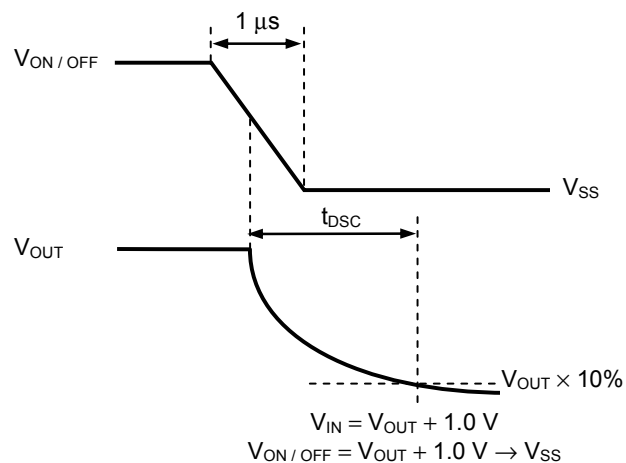


Figure 21 Measurement Condition of Discharge Time

5. Example of equivalent series resistance vs. Output current characteristics ($T_a = +25^\circ\text{C}$)

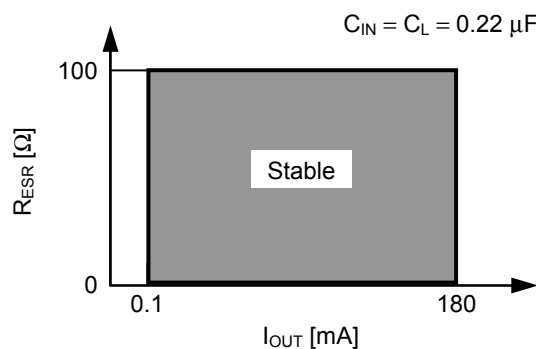
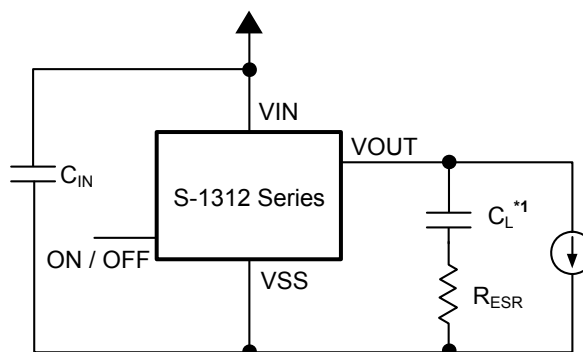


Figure 22



*1. C_L : TDK Corporation C2012X7R1H224K

Figure 23

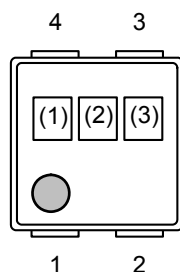
■ Marking Specifications

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

1.1 S-1312 Series A type

Product Name	Product code		
	(1)	(2)	(3)
S-1312A10-A4T1U3	1	D	A
S-1312A11-A4T1U3	1	D	B
S-1312A12-A4T1U3	1	D	C
S-1312A13-A4T1U3	1	D	D
S-1312A14-A4T1U3	1	D	E
S-1312A15-A4T1U3	1	D	F
S-1312A16-A4T1U3	1	D	G
S-1312A17-A4T1U3	1	D	H
S-1312A18-A4T1U3	1	D	J
S-1312A1J-A4T1U3	1	D	K
S-1312A19-A4T1U3	1	D	L
S-1312A20-A4T1U3	1	D	M
S-1312A21-A4T1U3	1	D	N
S-1312A22-A4T1U3	1	D	O
S-1312A23-A4T1U3	1	D	P
S-1312A24-A4T1U3	1	D	Q
S-1312A25-A4T1U3	1	D	R
S-1312A26-A4T1U3	1	D	S
S-1312A27-A4T1U3	1	D	T
S-1312A28-A4T1U3	1	D	U
S-1312A2J-A4T1U3	1	D	V
S-1312A29-A4T1U3	1	D	W
S-1312A30-A4T1U3	1	D	X
S-1312A31-A4T1U3	1	D	Y
S-1312A32-A4T1U3	1	D	Z
S-1312A33-A4T1U3	1	D	1
S-1312A34-A4T1U3	1	D	2
S-1312A35-A4T1U3	1	D	3

1.2 S-1312 Series B type

Product Name	Product code		
	(1)	(2)	(3)
S-1312B10-A4T1U3	1	E	A
S-1312B11-A4T1U3	1	E	B
S-1312B12-A4T1U3	1	E	C
S-1312B13-A4T1U3	1	E	D
S-1312B14-A4T1U3	1	E	E
S-1312B15-A4T1U3	1	E	F
S-1312B16-A4T1U3	1	E	G
S-1312B17-A4T1U3	1	E	H
S-1312B18-A4T1U3	1	E	J
S-1312B1J-A4T1U3	1	E	K
S-1312B19-A4T1U3	1	E	L
S-1312B20-A4T1U3	1	E	M
S-1312B21-A4T1U3	1	E	N
S-1312B22-A4T1U3	1	E	O
S-1312B23-A4T1U3	1	E	P
S-1312B24-A4T1U3	1	E	Q
S-1312B25-A4T1U3	1	E	R
S-1312B26-A4T1U3	1	E	S
S-1312B27-A4T1U3	1	E	T
S-1312B28-A4T1U3	1	E	U
S-1312B2J-A4T1U3	1	E	V
S-1312B29-A4T1U3	1	E	W
S-1312B30-A4T1U3	1	E	X
S-1312B31-A4T1U3	1	E	Y
S-1312B32-A4T1U3	1	E	Z
S-1312B33-A4T1U3	1	E	1
S-1312B34-A4T1U3	1	E	2
S-1312B35-A4T1U3	1	E	3

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

1.3 S-1312 Series C type

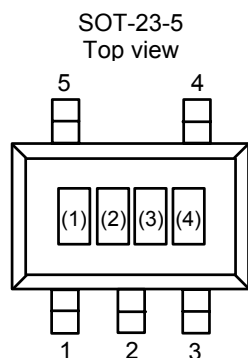
Product Name	Product code		
	(1)	(2)	(3)
S-1312C10-A4T1U3	1	F	A
S-1312C11-A4T1U3	1	F	B
S-1312C12-A4T1U3	1	F	C
S-1312C13-A4T1U3	1	F	D
S-1312C14-A4T1U3	1	F	E
S-1312C15-A4T1U3	1	F	F
S-1312C16-A4T1U3	1	F	G
S-1312C17-A4T1U3	1	F	H
S-1312C18-A4T1U3	1	F	J
S-1312C1J-A4T1U3	1	F	K
S-1312C19-A4T1U3	1	F	L
S-1312C20-A4T1U3	1	F	M
S-1312C21-A4T1U3	1	F	N
S-1312C22-A4T1U3	1	F	O
S-1312C23-A4T1U3	1	F	P
S-1312C24-A4T1U3	1	F	Q
S-1312C25-A4T1U3	1	F	R
S-1312C26-A4T1U3	1	F	S
S-1312C27-A4T1U3	1	F	T
S-1312C28-A4T1U3	1	F	U
S-1312C2J-A4T1U3	1	F	V
S-1312C29-A4T1U3	1	F	W
S-1312C30-A4T1U3	1	F	X
S-1312C31-A4T1U3	1	F	Y
S-1312C32-A4T1U3	1	F	Z
S-1312C33-A4T1U3	1	F	1
S-1312C34-A4T1U3	1	F	2
S-1312C35-A4T1U3	1	F	3

1.4 S-1312 Series D type

Product Name	Product code		
	(1)	(2)	(3)
S-1312D10-A4T1U3	1	G	A
S-1312D11-A4T1U3	1	G	B
S-1312D12-A4T1U3	1	G	C
S-1312D13-A4T1U3	1	G	D
S-1312D14-A4T1U3	1	G	E
S-1312D15-A4T1U3	1	G	F
S-1312D16-A4T1U3	1	G	G
S-1312D17-A4T1U3	1	G	H
S-1312D18-A4T1U3	1	G	J
S-1312D1J-A4T1U3	1	G	K
S-1312D19-A4T1U3	1	G	L
S-1312D20-A4T1U3	1	G	M
S-1312D21-A4T1U3	1	G	N
S-1312D22-A4T1U3	1	G	O
S-1312D23-A4T1U3	1	G	P
S-1312D24-A4T1U3	1	G	Q
S-1312D25-A4T1U3	1	G	R
S-1312D26-A4T1U3	1	G	S
S-1312D27-A4T1U3	1	G	T
S-1312D28-A4T1U3	1	G	U
S-1312D2J-A4T1U3	1	G	V
S-1312D29-A4T1U3	1	G	W
S-1312D30-A4T1U3	1	G	X
S-1312D31-A4T1U3	1	G	Y
S-1312D32-A4T1U3	1	G	Z
S-1312D33-A4T1U3	1	G	1
S-1312D34-A4T1U3	1	G	2
S-1312D35-A4T1U3	1	G	3

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

2.1 S-1312 Series A type

Product Name	Product code		
	(1)	(2)	(3)
S-1312A10-M5T1U3	1	D	A
S-1312A11-M5T1U3	1	D	B
S-1312A12-M5T1U3	1	D	C
S-1312A13-M5T1U3	1	D	D
S-1312A14-M5T1U3	1	D	E
S-1312A15-M5T1U3	1	D	F
S-1312A16-M5T1U3	1	D	G
S-1312A17-M5T1U3	1	D	H
S-1312A18-M5T1U3	1	D	J
S-1312A1J-M5T1U3	1	D	K
S-1312A19-M5T1U3	1	D	L
S-1312A20-M5T1U3	1	D	M
S-1312A21-M5T1U3	1	D	N
S-1312A22-M5T1U3	1	D	O
S-1312A23-M5T1U3	1	D	P
S-1312A24-M5T1U3	1	D	Q
S-1312A25-M5T1U3	1	D	R
S-1312A26-M5T1U3	1	D	S
S-1312A27-M5T1U3	1	D	T
S-1312A28-M5T1U3	1	D	U
S-1312A2J-M5T1U3	1	D	V
S-1312A29-M5T1U3	1	D	W
S-1312A30-M5T1U3	1	D	X
S-1312A31-M5T1U3	1	D	Y
S-1312A32-M5T1U3	1	D	Z
S-1312A33-M5T1U3	1	D	1
S-1312A34-M5T1U3	1	D	2
S-1312A35-M5T1U3	1	D	3

2.2 S-1312 Series B type

Product Name	Product code		
	(1)	(2)	(3)
S-1312B10-M5T1U3	1	E	A
S-1312B11-M5T1U3	1	E	B
S-1312B12-M5T1U3	1	E	C
S-1312B13-M5T1U3	1	E	D
S-1312B14-M5T1U3	1	E	E
S-1312B15-M5T1U3	1	E	F
S-1312B16-M5T1U3	1	E	G
S-1312B17-M5T1U3	1	E	H
S-1312B18-M5T1U3	1	E	J
S-1312B1J-M5T1U3	1	E	K
S-1312B19-M5T1U3	1	E	L
S-1312B20-M5T1U3	1	E	M
S-1312B21-M5T1U3	1	E	N
S-1312B22-M5T1U3	1	E	O
S-1312B23-M5T1U3	1	E	P
S-1312B24-M5T1U3	1	E	Q
S-1312B25-M5T1U3	1	E	R
S-1312B26-M5T1U3	1	E	S
S-1312B27-M5T1U3	1	E	T
S-1312B28-M5T1U3	1	E	U
S-1312B2J-M5T1U3	1	E	V
S-1312B29-M5T1U3	1	E	W
S-1312B30-M5T1U3	1	E	X
S-1312B31-M5T1U3	1	E	Y
S-1312B32-M5T1U3	1	E	Z
S-1312B33-M5T1U3	1	E	1
S-1312B34-M5T1U3	1	E	2
S-1312B35-M5T1U3	1	E	3

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

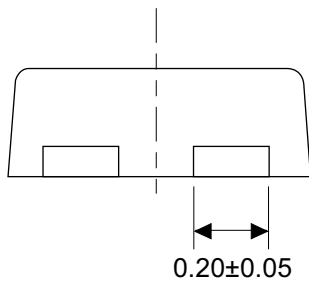
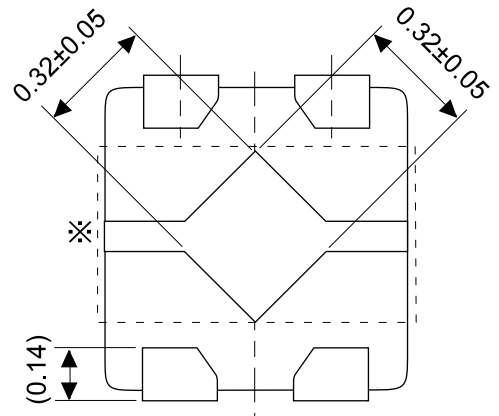
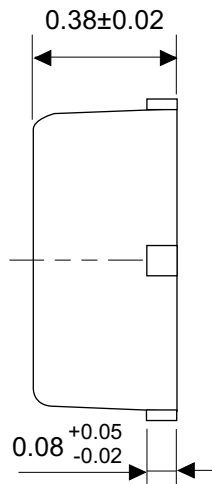
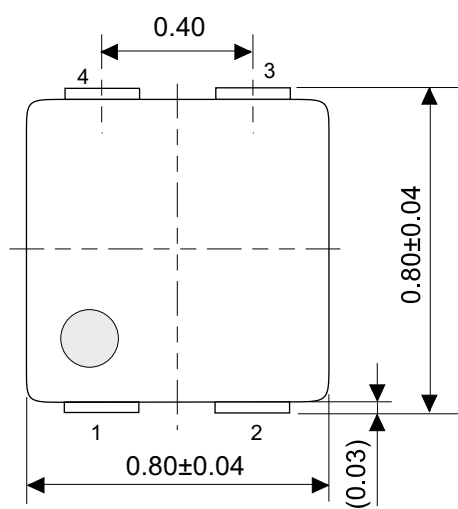
2.3 S-1312 Series C type

Product Name	Product code		
	(1)	(2)	(3)
S-1312C10-M5T1U3	1	F	A
S-1312C11-M5T1U3	1	F	B
S-1312C12-M5T1U3	1	F	C
S-1312C13-M5T1U3	1	F	D
S-1312C14-M5T1U3	1	F	E
S-1312C15-M5T1U3	1	F	F
S-1312C16-M5T1U3	1	F	G
S-1312C17-M5T1U3	1	F	H
S-1312C18-M5T1U3	1	F	J
S-1312C1J-M5T1U3	1	F	K
S-1312C19-M5T1U3	1	F	L
S-1312C20-M5T1U3	1	F	M
S-1312C21-M5T1U3	1	F	N
S-1312C22-M5T1U3	1	F	O
S-1312C23-M5T1U3	1	F	P
S-1312C24-M5T1U3	1	F	Q
S-1312C25-M5T1U3	1	F	R
S-1312C26-M5T1U3	1	F	S
S-1312C27-M5T1U3	1	F	T
S-1312C28-M5T1U3	1	F	U
S-1312C2J-M5T1U3	1	F	V
S-1312C29-M5T1U3	1	F	W
S-1312C30-M5T1U3	1	F	X
S-1312C31-M5T1U3	1	F	Y
S-1312C32-M5T1U3	1	F	Z
S-1312C33-M5T1U3	1	F	1
S-1312C34-M5T1U3	1	F	2
S-1312C35-M5T1U3	1	F	3

2.4 S-1312 Series D type

Product Name	Product code		
	(1)	(2)	(3)
S-1312D10-M5T1U3	1	G	A
S-1312D11-M5T1U3	1	G	B
S-1312D12-M5T1U3	1	G	C
S-1312D13-M5T1U3	1	G	D
S-1312D14-M5T1U3	1	G	E
S-1312D15-M5T1U3	1	G	F
S-1312D16-M5T1U3	1	G	G
S-1312D17-M5T1U3	1	G	H
S-1312D18-M5T1U3	1	G	J
S-1312D1J-M5T1U3	1	G	K
S-1312D19-M5T1U3	1	G	L
S-1312D20-M5T1U3	1	G	M
S-1312D21-M5T1U3	1	G	N
S-1312D22-M5T1U3	1	G	O
S-1312D23-M5T1U3	1	G	P
S-1312D24-M5T1U3	1	G	Q
S-1312D25-M5T1U3	1	G	R
S-1312D26-M5T1U3	1	G	S
S-1312D27-M5T1U3	1	G	T
S-1312D28-M5T1U3	1	G	U
S-1312D2J-M5T1U3	1	G	V
S-1312D29-M5T1U3	1	G	W
S-1312D30-M5T1U3	1	G	X
S-1312D31-M5T1U3	1	G	Y
S-1312D32-M5T1U3	1	G	Z
S-1312D33-M5T1U3	1	G	1
S-1312D34-M5T1U3	1	G	2
S-1312D35-M5T1U3	1	G	3

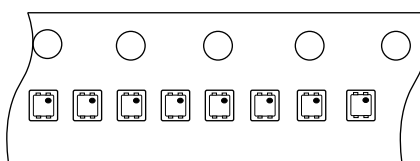
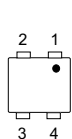
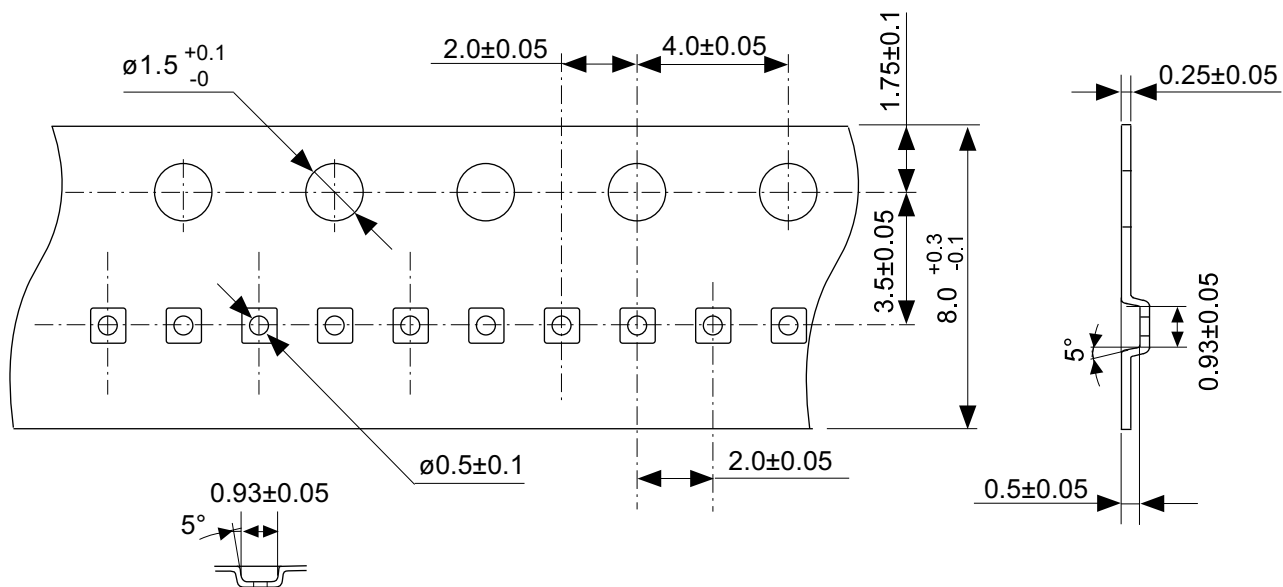
Remark Please contact our sales office for products with specifications other than the above.



※ 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

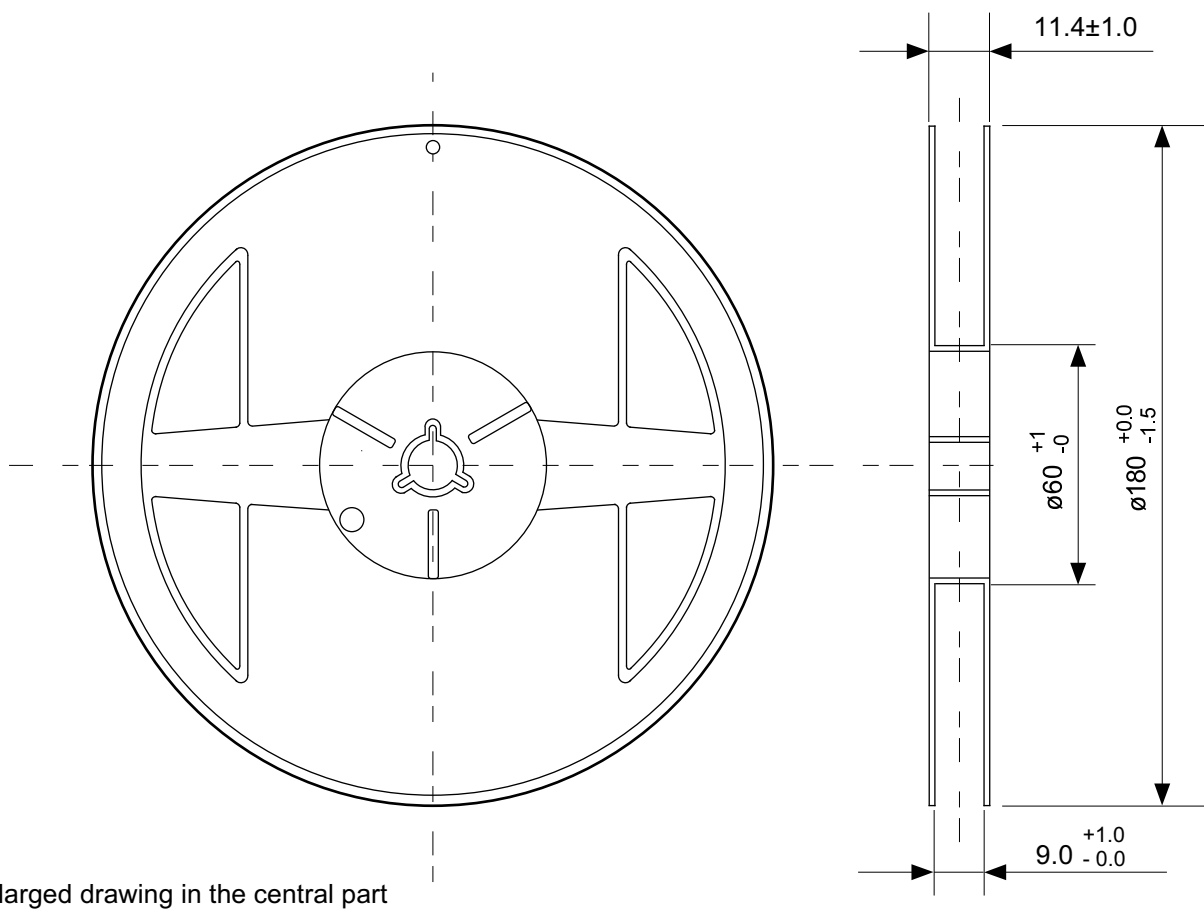
TITLE	HSNT-4-A-PKG Dimensions
No.	PK004-A-P-SD-1.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	



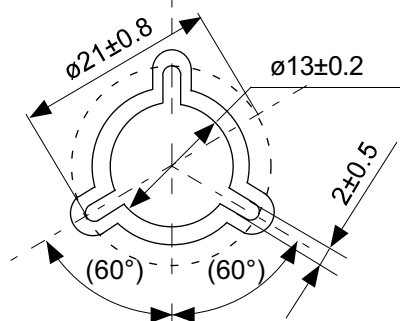
Feed direction →

No. PK004-A-C-SD-1.0

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



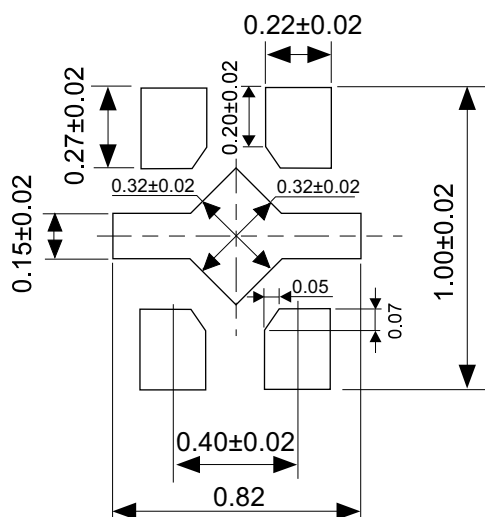
Enlarged drawing in the central part



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.			

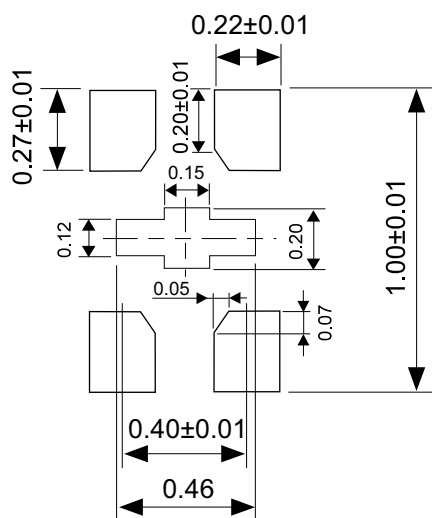
Land Pattern



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

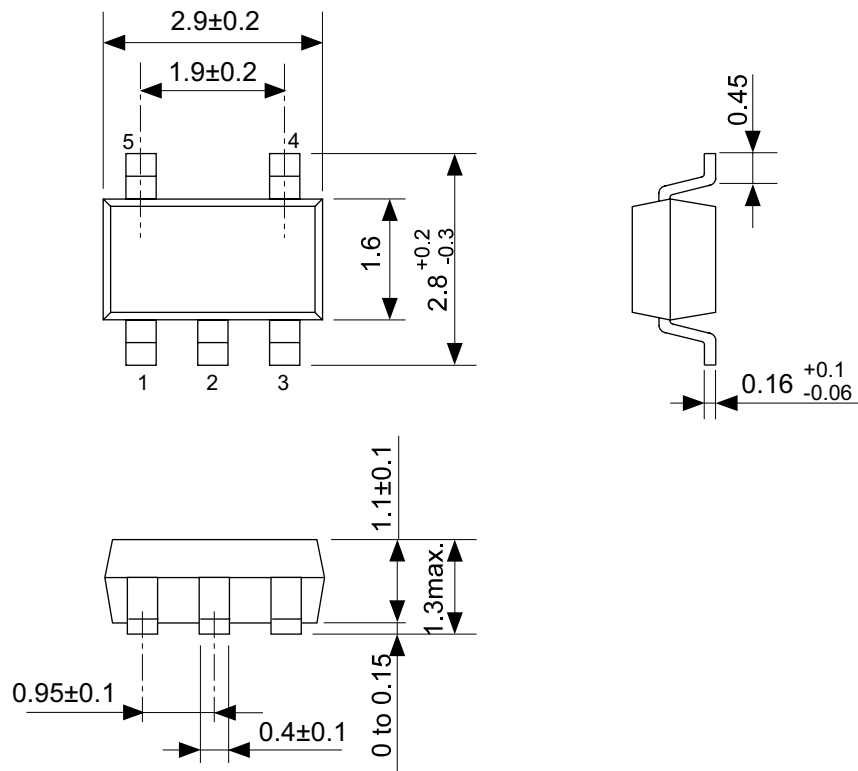
注意 放熱性を確保する為に、PKGの裏面放熱板(ヒートシンク)を基板に半田付けする事を推奨いたします。

Metal Mask Pattern



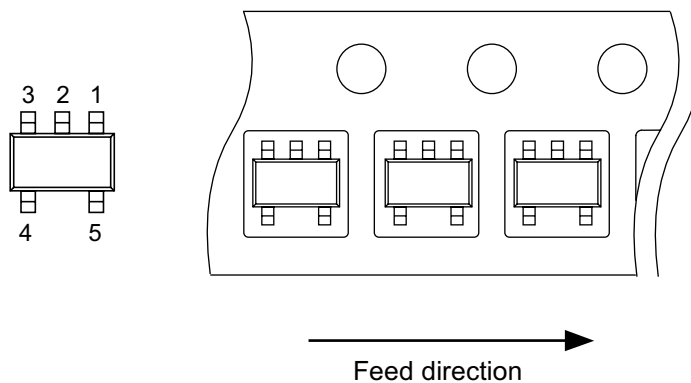
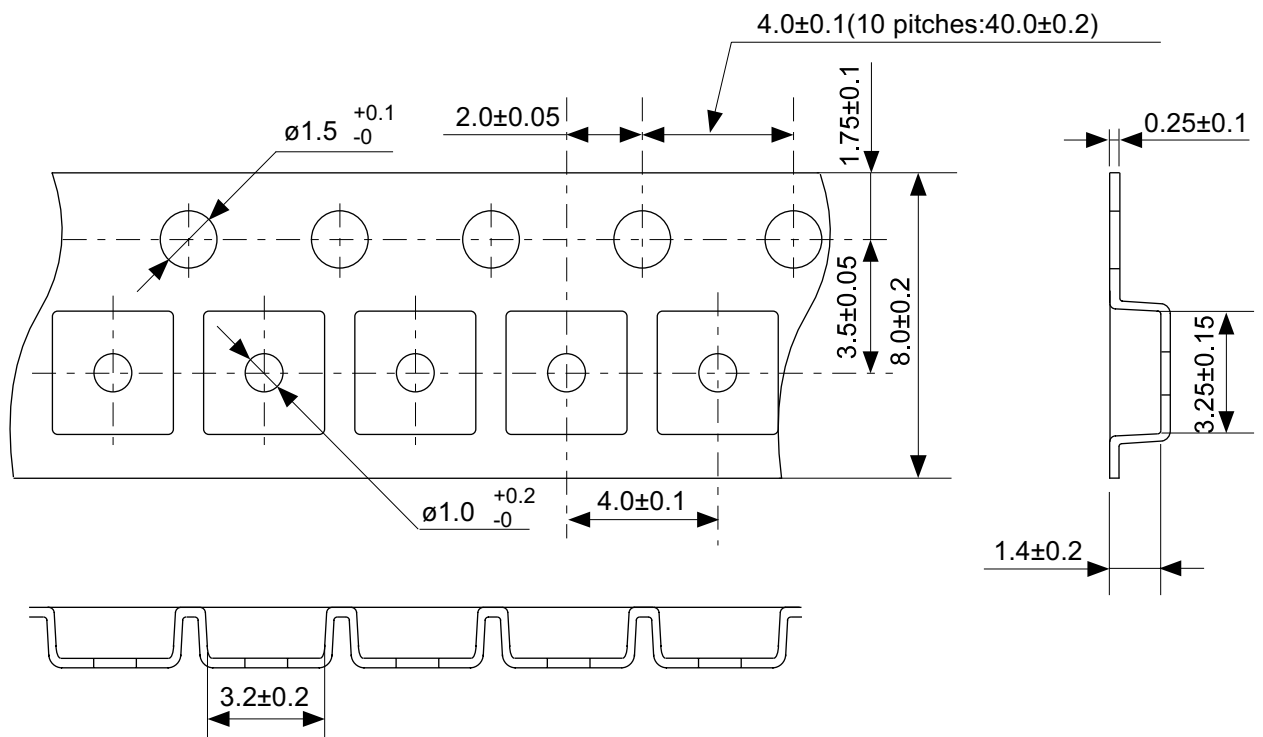
No. PK004-A-L-SD-1.0

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



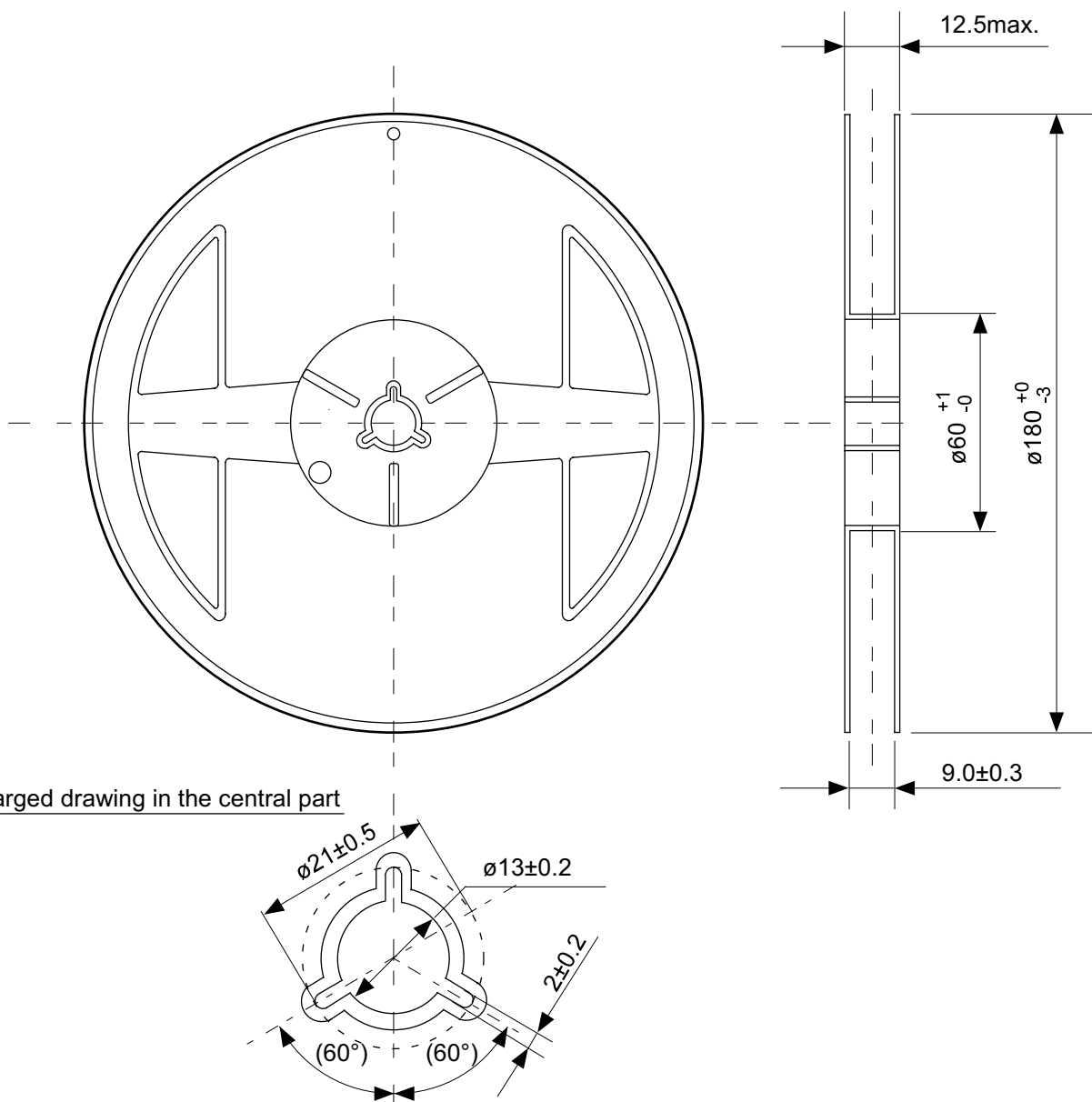
No. MP005-A-P-SD-1.2

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.			



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