

## ULTRA LOW CURRENT CONSUMPTION AND LOW DROPOUT CMOS VOLTAGE REGULATOR

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Rev.3.0\_00

The S-1206 Series is a positive voltage regulator with ultra low current consumption, low dropout voltage, high output voltage accuracy, and 250 mA output current developed based on CMOS technology.

I/O capacitors are as small as 0.1  $\mu$ F. S-1206 Series operates at ultra low current consumption of 1.0  $\mu$ A (typ.).

The built-in low-on-resistance transistor realizes low dropout voltage and high output current. A built-in overcurrent protection circuit prevents the load current from exceeding the current capacitance of the output transistor.

Three packages, SOT-23-3, SOT-89-3, and SNT-6A(H), are available.

Compared with voltage regulators using a conventional CMOS process, more types of capacitors, including small I/O capacitors, can be used with the S-1206 Series. The S-1206 Series features ultra-low current consumption and comes in a small package, making them most suitable for portable equipment.

### ■ Features

- Output voltage : 1.2 V to 5.2 V, selectable in 0.05 V steps.
- Low equivalent series resistance capacitor can be used : A ceramic capacitor of 0.1  $\mu$ F or more can be used for the I/O capacitor.
- Wide input voltage range : 1.7 V to 6.5 V
- High-accuracy output voltage :  $\pm 1.0\%$  (1.2 V to 1.45 V output product :  $\pm 15$  mV)
- Low dropout voltage : 150 mV typ. (3.0 V output product, at  $I_{OUT} = 100$  mA)
- Low current consumption : During operation : 1.0  $\mu$ A typ., 1.5  $\mu$ A max.
- High output current : 250 mA output is possible. (3.0 V output product, at  $V_{IN} \geq V_{OUT(S)} + 1.0$  V)<sup>\*1</sup>
- Built-in overcurrent protection circuit : Overcurrent of output transistor can be restricted.
- Lead-free, Sn 100%, halogen-free<sup>\*2</sup>

\*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.

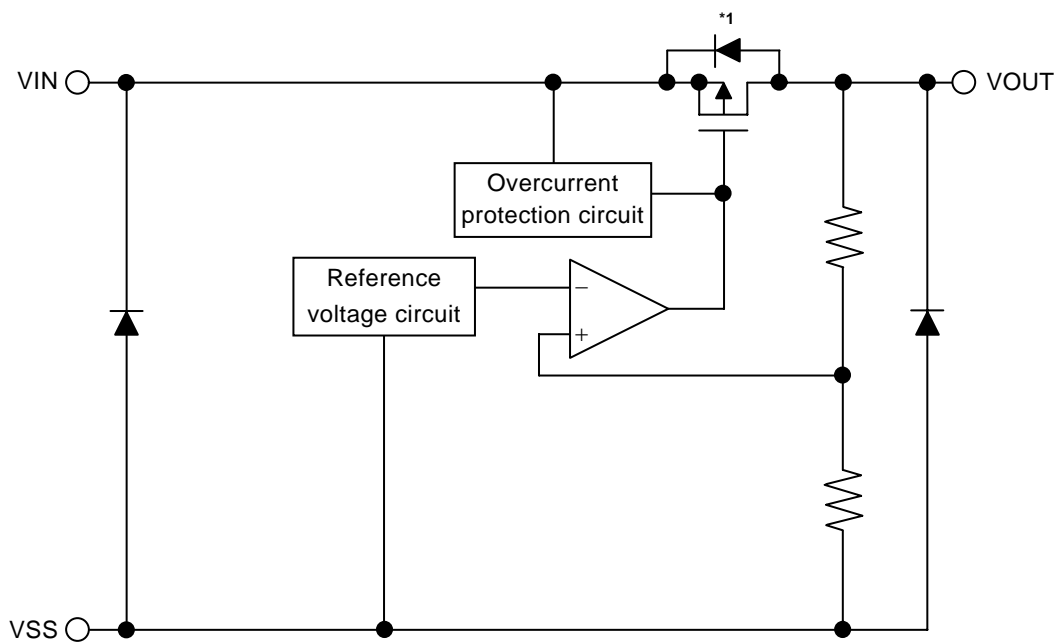
### ■ Applications

- Power supply for battery-powered devices
- Constant-voltage power supply for cellular phones
- Constant-voltage power supply for portable equipments

### ■ Packages

- SOT-23-5
- SOT-89-3
- SNT-6A(H)

■ Block Diagram



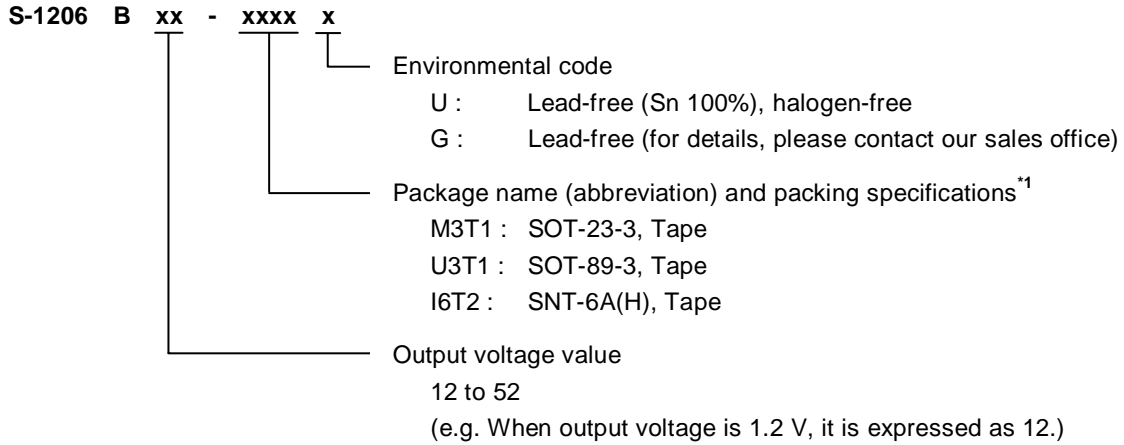
\*1. Parasitic diode

Figure 1

■ **Product Name Structure**

The output voltage value and package types for the S-1206 Series can be selected at the user's request. Refer to the "1. Product Name" for the meanings of the characters in the product name, "2. Package" regarding the package drawings and "3. Product Name List" for the full product names.

1. **Product Name**



\*1. Refer to the tape specifications.

2. **Package**

Package Name	Drawing Code			
	Package	Tape	Reel	Land
SOT-23-3	MP003-C-P-SD	MP003-C-C-SD	MP003-Z-R-SD	-
SOT-89-3	UP003-A-P-SD	UP003-A-C-SD	UP003-A-R-SD	-
SNT-6A(H)	PI006-A-P-SD	PI006-A-C-SD	PI006-A-R-SD	PI006-A-L-SD

3. Product Name List

Table 1

Output Voltage	SOT-23-3	SOT-89-3	SNT-6A(H)
1.2 V $\pm$ 15 mV	S-1206B12-M3T1x	S-1206B12-U3T1x	S-1206B12-I6T2x
1.3 V $\pm$ 15 mV	S-1206B13-M3T1x	S-1206B13-U3T1x	S-1206B13-I6T2x
1.4 V $\pm$ 15 mV	S-1206B14-M3T1x	S-1206B14-U3T1x	S-1206B14-I6T2x
1.5 V $\pm$ 1.0%	S-1206B15-M3T1x	S-1206B15-U3T1x	S-1206B15-I6T2x
1.6 V $\pm$ 1.0%	S-1206B16-M3T1x	S-1206B16-U3T1x	S-1206B16-I6T2x
1.7 V $\pm$ 1.0%	S-1206B17-M3T1x	S-1206B17-U3T1x	S-1206B17-I6T2x
1.8 V $\pm$ 1.0%	S-1206B18-M3T1x	S-1206B18-U3T1x	S-1206B18-I6T2x
1.85 V $\pm$ 1.0%	S-1206B1J-M3T1x	S-1206B1J-U3T1x	S-1206B1J-I6T2x
1.9 V $\pm$ 1.0%	S-1206B19-M3T1x	S-1206B19-U3T1x	S-1206B19-I6T2x
2.0 V $\pm$ 1.0%	S-1206B20-M3T1x	S-1206B20-U3T1x	S-1206B20-I6T2x
2.1 V $\pm$ 1.0%	S-1206B21-M3T1x	S-1206B21-U3T1x	S-1206B21-I6T2x
2.2 V $\pm$ 1.0%	S-1206B22-M3T1x	S-1206B22-U3T1x	S-1206B22-I6T2x
2.3 V $\pm$ 1.0%	S-1206B23-M3T1x	S-1206B23-U3T1x	S-1206B23-I6T2x
2.4 V $\pm$ 1.0%	S-1206B24-M3T1x	S-1206B24-U3T1x	S-1206B24-I6T2x
2.5 V $\pm$ 1.0%	S-1206B25-M3T1x	S-1206B25-U3T1x	S-1206B25-I6T2x
2.6 V $\pm$ 1.0%	S-1206B26-M3T1x	S-1206B26-U3T1x	S-1206B26-I6T2x
2.7 V $\pm$ 1.0%	S-1206B27-M3T1x	S-1206B27-U3T1x	S-1206B27-I6T2x
2.8 V $\pm$ 1.0%	S-1206B28-M3T1x	S-1206B28-U3T1x	S-1206B28-I6T2x
2.85 V $\pm$ 1.0%	S-1206B2J-M3T1x	S-1206B2J-U3T1x	S-1206B2J-I6T2x
2.9 V $\pm$ 1.0%	S-1206B29-M3T1x	S-1206B29-U3T1x	S-1206B29-I6T2x
3.0 V $\pm$ 1.0%	S-1206B30-M3T1x	S-1206B30-U3T1x	S-1206B30-I6T2x
3.1 V $\pm$ 1.0%	S-1206B31-M3T1x	S-1206B31-U3T1x	S-1206B31-I6T2x
3.2 V $\pm$ 1.0%	S-1206B32-M3T1x	S-1206B32-U3T1x	S-1206B32-I6T2x
3.3 V $\pm$ 1.0%	S-1206B33-M3T1x	S-1206B33-U3T1x	S-1206B33-I6T2x
3.4 V $\pm$ 1.0%	S-1206B34-M3T1x	S-1206B34-U3T1x	S-1206B34-I6T2x
3.5 V $\pm$ 1.0%	S-1206B35-M3T1x	S-1206B35-U3T1x	S-1206B35-I6T2x
3.6 V $\pm$ 1.0%	S-1206B36-M3T1x	S-1206B36-U3T1x	S-1206B36-I6T2x
3.7 V $\pm$ 1.0%	S-1206B37-M3T1x	S-1206B37-U3T1x	S-1206B37-I6T2x
3.8 V $\pm$ 1.0%	S-1206B38-M3T1x	S-1206B38-U3T1x	S-1206B38-I6T2x
3.9 V $\pm$ 1.0%	S-1206B39-M3T1x	S-1206B39-U3T1x	S-1206B39-I6T2x
4.0 V $\pm$ 1.0%	S-1206B40-M3T1x	S-1206B40-U3T1x	S-1206B40-I6T2x
4.1 V $\pm$ 1.0%	S-1206B41-M3T1x	S-1206B41-U3T1x	S-1206B41-I6T2x
4.2 V $\pm$ 1.0%	S-1206B42-M3T1x	S-1206B42-U3T1x	S-1206B42-I6T2x
4.3 V $\pm$ 1.0%	S-1206B43-M3T1x	S-1206B43-U3T1x	S-1206B43-I6T2x
4.4 V $\pm$ 1.0%	S-1206B44-M3T1x	S-1206B44-U3T1x	S-1206B44-I6T2x
4.5 V $\pm$ 1.0%	S-1206B45-M3T1x	S-1206B45-U3T1x	S-1206B45-I6T2x
4.6 V $\pm$ 1.0%	S-1206B46-M3T1x	S-1206B46-U3T1x	S-1206B46-I6T2x
4.7 V $\pm$ 1.0%	S-1206B47-M3T1x	S-1206B47-U3T1x	S-1206B47-I6T2x
4.8 V $\pm$ 1.0%	S-1206B48-M3T1x	S-1206B48-U3T1x	S-1206B48-I6T2x
4.9 V $\pm$ 1.0%	S-1206B49-M3T1x	S-1206B49-U3T1x	S-1206B49-I6T2x
5.0 V $\pm$ 1.0%	S-1206B50-M3T1x	S-1206B50-U3T1x	S-1206B50-I6T2x
5.1 V $\pm$ 1.0%	S-1206B51-M3T1x	S-1206B51-U3T1x	S-1206B51-I6T2x
5.2 V $\pm$ 1.0%	S-1206B52-M3T1x	S-1206B52-U3T1x	S-1206B52-I6T2x

Remark 1. Please contact our sales office for products with output voltage values other than the above.

2. x: G or U

3. Please select products of environmental code = U for Sn 100%, halogen-free products.

■ Pin Configurations

SOT-23-3  
 Top view

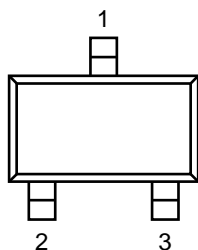


Figure 2

Table 2

Pin No.	Symbol	Description
1	VIN	Input voltage pin
2	VSS	GND pin
3	VOOUT	Output voltage pin

SOT-89-3  
 Top view

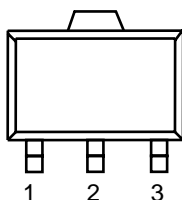


Figure 3

Table 3

Pin No.	Symbol	Description
1	VSS	GND pin
2	VIN	Input voltage pin
3	VOOUT	Output voltage pin

SNT-6A(H)  
 Top view

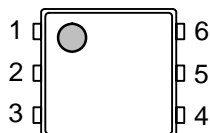


Figure 4

Table 4

Pin No.	Symbol	Description
1	VOOUT	Output voltage pin
2	VIN	Input voltage pin
3	VSS	GND pin
4	NC*1	No connection
5	VIN	Input voltage pin
6	NC*1	No connection

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

■ **Absolute Maximum Ratings**

**Table 5**

(Ta = 25°C unless otherwise specified)

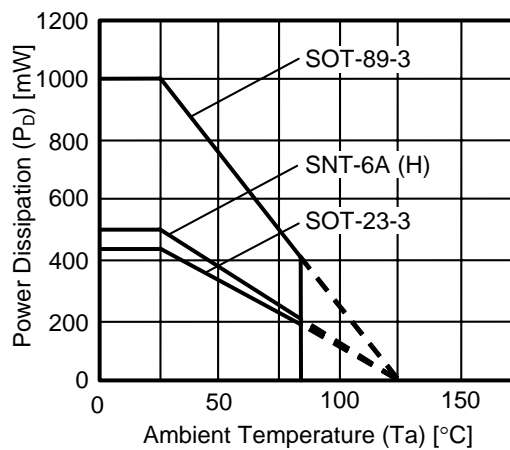
Item	Symbol	Absolute Maximum Rating	Unit
Input voltage	V <sub>IN</sub>	V <sub>SS</sub> - 0.3 to V <sub>SS</sub> + 7	V
Output voltage	V <sub>OUT</sub>	V <sub>SS</sub> - 0.3 to V <sub>IN</sub> + 0.3	V
Power dissipation	SOT-23-3	430 <sup>*1</sup>	mW
	SOT-89-3	1000 <sup>*1</sup>	mW
	SNT-6A(H)	500 <sup>*1</sup>	mW
Operating ambient temperature	T <sub>opr</sub>	-40 to +85	°C
Storage temperature	T <sub>stg</sub>	-40 to +125	°C

\*1. When mounted on board

[Mounted board]

- (1) Board size : 114.3 mm × 76.2 mm × t1.6 mm
- (2) Board name : JEDEC STANDARD51-7

**Caution** The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded under any conditions.



**Figure 5 Power Dissipation of Package (When Mounted on Board)**

■ Electrical Characteristics

Table 6

(Ta = 25°C unless otherwise specified)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Measurement Circuit	
Output voltage *1	V <sub>OUT(E)</sub>	V <sub>IN</sub> = V <sub>OUT(S)</sub> + 1.0 V, I <sub>OUT</sub> = 30 mA, 1.2 V ≤ V <sub>OUT(S)</sub> < 1.5 V	V <sub>OUT(S)</sub> -15 mV	V <sub>OUT(S)</sub>	V <sub>OUT(S)</sub> +15 mV	V	1	
		V <sub>IN</sub> = V <sub>OUT(S)</sub> + 1.0 V, I <sub>OUT</sub> = 30 mA, 1.5 V ≤ V <sub>OUT(S)</sub>	V <sub>OUT(S)</sub> × 0.99	V <sub>OUT(S)</sub>	V <sub>OUT(S)</sub> × 1.01	V	1	
Output current *2	I <sub>OUT</sub>	V <sub>IN</sub> ≥ V <sub>OUT(S)</sub> + 1.0 V, 1.2 V ≤ V <sub>OUT(S)</sub> < 1.5 V	150 *5	–	–	mA	3	
		V <sub>IN</sub> ≥ V <sub>OUT(S)</sub> + 1.0 V, 1.5 V ≤ V <sub>OUT(S)</sub>	250 *5	–	–	mA	3	
Dropout voltage *3	V <sub>drop</sub>	I <sub>OUT</sub> = 100 mA	1.2 V ≤ V <sub>OUT(S)</sub> < 1.3 V	0.5	0.54	0.81	V	1
			1.3 V ≤ V <sub>OUT(S)</sub> < 1.4 V	–	0.50	0.73	V	1
			1.4 V ≤ V <sub>OUT(S)</sub> < 1.5 V	–	0.43	0.66	V	1
			1.5 V ≤ V <sub>OUT(S)</sub> < 1.7 V	–	0.35	0.53	V	1
			1.7 V ≤ V <sub>OUT(S)</sub> < 1.9 V	–	0.33	0.50	V	1
			1.9 V ≤ V <sub>OUT(S)</sub> < 2.1 V	–	0.26	0.43	V	1
			2.1 V ≤ V <sub>OUT(S)</sub> < 3.0 V	–	0.23	0.36	V	1
			3.0 V ≤ V <sub>OUT(S)</sub> ≤ 5.2 V	–	0.15	0.23	V	1
Line regulation	$\frac{\Delta V_{OUT1}}{\Delta V_{IN} \bullet V_{OUT}}$	V <sub>OUT(S)</sub> + 0.5 V ≤ V <sub>IN</sub> ≤ 6.5 V	I <sub>OUT</sub> = 1 μA	–	0.05	0.2	%/V	1
			I <sub>OUT</sub> = 30 mA	–	0.05	0.2	%/V	1
Load regulation	ΔV <sub>OUT2</sub>	V <sub>IN</sub> = V <sub>OUT(S)</sub> + 1.0 V, 1 μA ≤ I <sub>OUT</sub> ≤ 100 mA	–	20	40	mV	1	
Output voltage temperature coefficient *4	$\frac{\Delta V_{OUT}}{\Delta Ta \bullet V_{OUT}}$	V <sub>IN</sub> = V <sub>OUT(S)</sub> + 1.0 V, I <sub>OUT</sub> = 30 mA, -40°C ≤ Ta ≤ 85°C	–	±120	–	ppm/°C	1	
Current consumption during operation	I <sub>SS1</sub>	V <sub>IN</sub> = V <sub>OUT(S)</sub> + 1.0 V, no load	–	1.0	1.5	μA	2	
Input voltage	V <sub>IN</sub>	–	1.7	–	6.5	V	–	
Short-circuit current	I <sub>SHORT</sub>	V <sub>IN</sub> = V <sub>OUT(S)</sub> + 1.0 V, V <sub>OUT</sub> = 0 V	1.2 V ≤ V <sub>OUT</sub> < 2.3 V	–	130	–	mA	3
			2.3 V ≤ V <sub>OUT</sub> ≤ 5.2 V	–	100	–	mA	3

\*1. V<sub>OUT(S)</sub> : Specified output voltage

V<sub>OUT(E)</sub> : Actual output voltage at the fixed load

Output voltage when fixing I<sub>OUT</sub> (= 30 mA) and inputting V<sub>OUT(S)</sub> + 1.0 V

\*2. Output current at which the output voltage becomes 95% of V<sub>OUT(E)</sub> after gradually increasing the output current.

\*3. V<sub>drop</sub> = V<sub>IN1</sub> - (V<sub>OUT3</sub> × 0.98)

V<sub>OUT3</sub> : Output voltage when V<sub>IN</sub> = V<sub>OUT(S)</sub> + 1.0 V and I<sub>OUT</sub> = 100 mA

V<sub>IN1</sub> : Input voltage at which the output voltage becomes 98% of V<sub>OUT3</sub> after gradually decreasing the input voltage

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

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

\*1. Temperature change ratio of the output voltage

\*2. Specified output voltage

\*3. Output voltage temperature coefficient

\*5. The output current can be supplied at least to 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.

■ Measurement Circuits

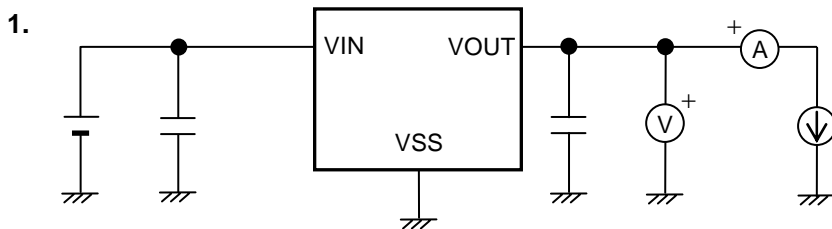


Figure 6

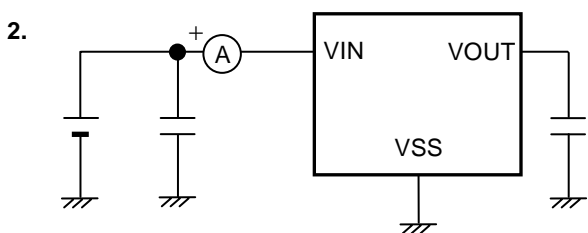


Figure 7

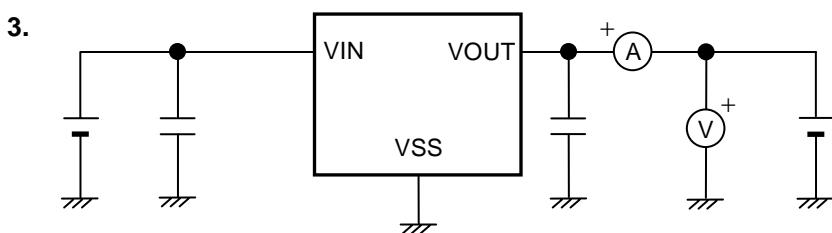
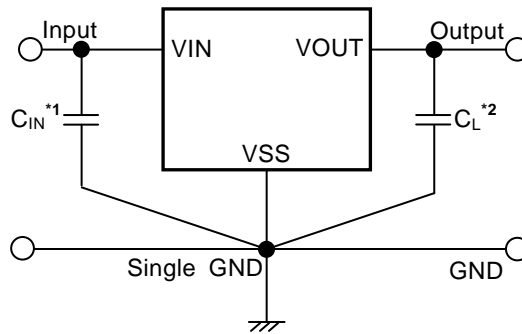


Figure 8



■ **Standard Circuit**



- \*1. A capacitor for stabilizing the input.
- \*2. A ceramic capacitor of 0.1  $\mu$ F or more can be used.

Figure 9

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

■ **Application Conditions**

Input capacitor ( $C_{IN}$ ) : 0.1  $\mu$ F or more  
 Output capacitor ( $C_L$ ) : 0.1  $\mu$ F or more (ceramic capacitor)

**Caution** A general series regulator may oscillate, depending on the external components selected. Check that no oscillation occurs in the actual device using the above capacitor.

■ **Selection of Input Capacitor ( $C_{IN}$ ) and Output Capacitor ( $C_L$ )**

The S-1206 Series requires an output capacitor between the VOUT pin and VSS pin for phase compensation. Operation is stabilized by a ceramic capacitor with an output capacitance of 0.1  $\mu$ F or more in the entire temperature range. However, when using an OS capacitor, tantalum capacitor, or aluminum electrolytic capacitor with a capacitance of 0.1  $\mu$ F or more less is required.

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 value for an application is 0.1  $\mu$ F or more for  $C_{IN}$  and 0.1  $\mu$ F or more for  $C_L$ ; however, when selecting these capacitors, perform sufficient evaluation, including evaluation of temperature characteristics, on the actual device.

## ■ Technical Terms

### 1. Low Dropout Voltage Regulator

The low dropout voltage regulator is a voltage regulator whose dropout voltage is low due to its built-in low-on-resistance transistor.

### 2. Low Equivalent Series Resistance

A capacitor whose equivalent series resistance ( $R_{ESR}$ ) is low. The S-1206 Series enables use of a low equivalent series resistance capacitor, such as a ceramic capacitor, for the output-side capacitor ( $C_L$ ).

### 3. Output Voltage ( $V_{OUT}$ )

The accuracy of the output voltage is ensured at  $\pm 1.0\%$  or  $\pm 15 \text{ mV}^2$  under the specified conditions of fixed input voltage<sup>\*1</sup>, fixed output current, and fixed temperature.

\*1. Differs depending on the product.

\*2. When  $V_{OUT} < 1.5 \text{ V}$  :  $\pm 15 \text{ mV}$ , When  $1.5 \text{ V} \leq V_{OUT}$  :  $\pm 1.0\%$

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

### 4. Line Regulation $\left( \frac{\Delta V_{OUT1}}{\Delta V_{IN} \cdot V_{OUT}} \right)$

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.

### 5. Load Regulation ( $\Delta V_{OUT2}$ )

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.

### 6. Dropout Voltage ( $V_{drop}$ )

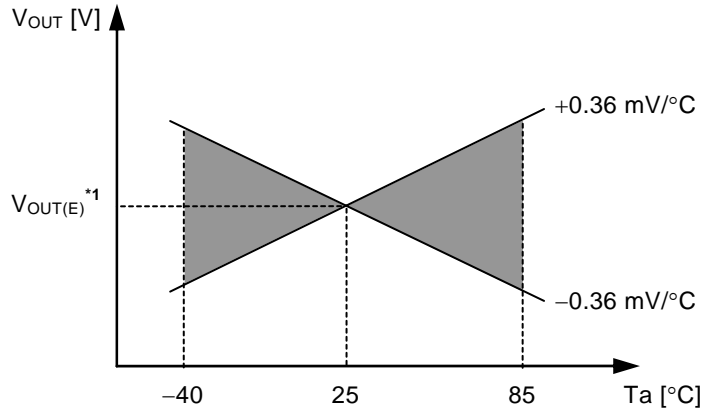
Indicates the difference between the input voltage ( $V_{IN1}$ ), which is the input voltage ( $V_{IN}$ ) at the point where the output voltage has fallen to 98% of the output voltage value ( $V_{OUT3}$ ) after  $V_{IN}$  was gradually decreased from  $V_{IN} = V_{OUT(S)} + 1.0 \text{ V}$ , and the output voltage at that point ( $V_{OUT3} \times 0.98$ ).

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

**7. Temperature Coefficient of Output Voltage**  $\left( \frac{\Delta V_{OUT}}{\Delta T_a \bullet V_{OUT}} \right)$

The shadowed area in **Figure 10** is the range where  $V_{OUT}$  varies in the operating temperature range when the temperature coefficient of the output voltage is  $\pm 120$  ppm/ $^{\circ}$ C.

e.g. S-1206B30 Typ.



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

**Figure 10**

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

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

- \*1. The temperature change ratio of the output voltage
- \*2. Specified output voltage
- \*3. Output voltage temperature coefficient

■ **Operation**

**1. Basic Operation**

Figure 11 shows the block diagram of the S-1206 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 output transistor with the gate voltage necessary to ensure a certain output voltage free of any fluctuations of input voltage and temperature.

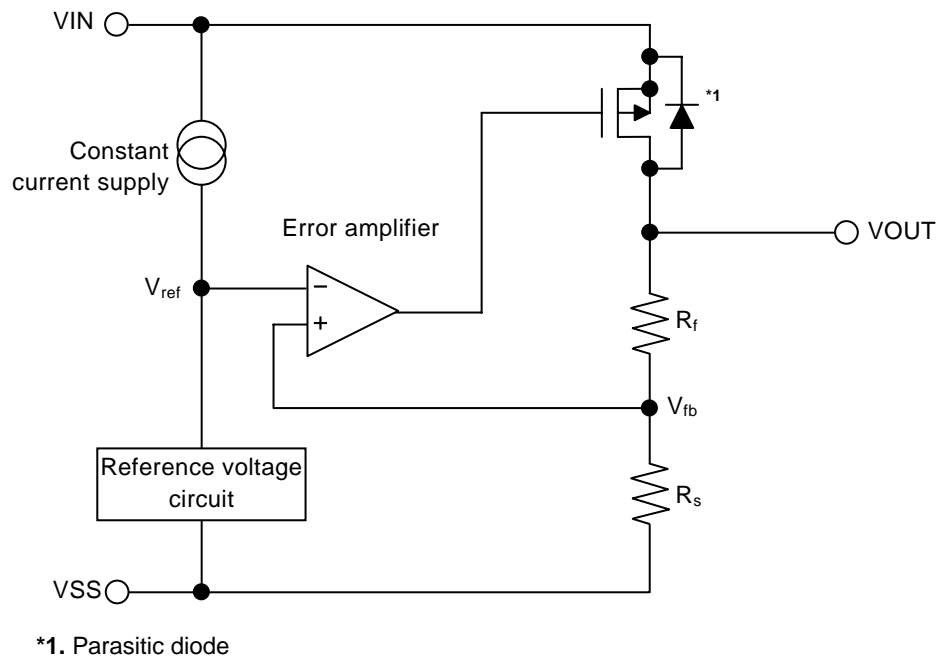


Figure 11

**2. Output Transistor**

The S-1206 Series uses a low-on-resistance P-channel MOS FET as the output transistor.

Be sure that  $V_{OUT}$  does not exceed  $V_{IN} + 0.3$  V to prevent the IC from being damaged due to inverse current flowing from the VOUT pin through a parasitic diode to the VIN pin.

**3. Overcurrent protector**

The S-1206 Series has an overcurrent protection circuit having the characteristics shown in “(1) Output Voltage vs. Output Current ( $T_a = 25^\circ\text{C}$ )” 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. 130 mA (typ.) ( $1.2\text{ V} \leq V_{OUT} < 2.3\text{ V}$ ) or approx. 100 mA (typ.) ( $2.3\text{ V} \leq V_{OUT} < 5.2\text{ V}$ ), 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 (150 mA or more ( $1.2\text{ V} \leq V_{OUT(S)} < 1.5\text{ V}$ ), or 250 mA or more ( $1.5\text{ V} \leq V_{OUT(S)}$ )) that last long.

## ■ Precautions

- Wiring patterns for the VIN pin, VOUT pin and GND pin should be designed so that the impedance is low. When mounting an output capacitor between the VOUT pin and VSS pin ( $C_L$ ) and a capacitor for stabilizing the input between the VIN pin and VSS pin ( $C_{IN}$ ), the distance from the capacitors to these pins should be as short as possible.
- Note that the output voltage may generally increase when a series regulator is used at low load current (10  $\mu$ A or less).
- Note that the output voltage may generally increase due to driver leakage when a series regulator is used at high temperatures.
- 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. For the equivalent series resistance ( $R_{ESR}$ ) of the output capacitor, refer to **(5) Equivalent Series Resistance vs. Output Current Characteristics Example ( $T_a = 25^\circ\text{C}$ )** in “■ Reference Data”.

Input capacitor ( $C_{IN}$ ) :	0.1 $\mu$ F or more
Output capacitor ( $C_L$ ) :	0.1 $\mu$ F or more

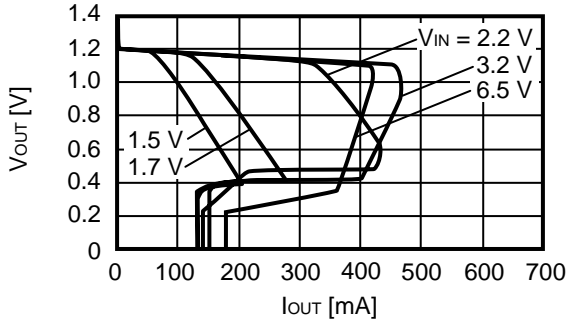
Use an I/O capacitor with good temperature characteristics (conforming to the ceramic capacitor EIA X5R (JIS B) characteristics).

- The voltage regulator may oscillate when the impedance of the power supply is high and the input capacitance is small or an input capacitor is not connected.
- If the output capacitance is small, the power supply fluctuation and load fluctuation characteristics become worse. Sufficiently evaluate the output voltage fluctuation with the actual device.
- If the power supply suddenly increases sharply when the output capacitance is small, a momentary overshoot may be output. It is therefore important to sufficiently evaluate the output voltage at power application in the 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 6** 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.

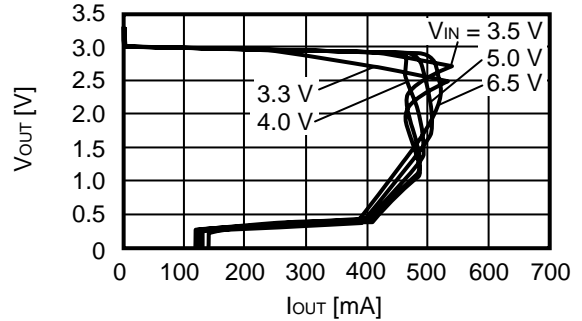
■ **Characteristics (Typical Data)**

**(1) Output Voltage vs. Output Current (Ta = 25°C)**

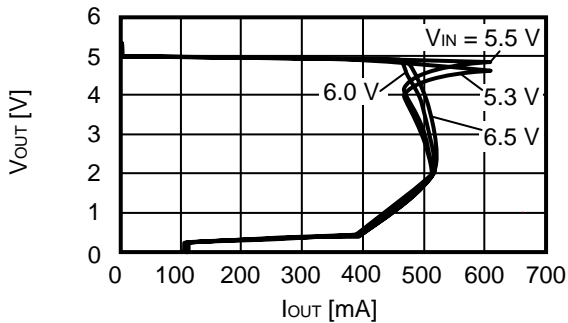
S-1206B12



S-1206B30



S-1206B50

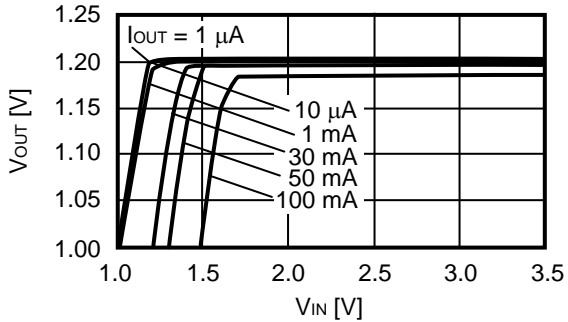


**Remark** In determining the output current, attention should be paid to the following.

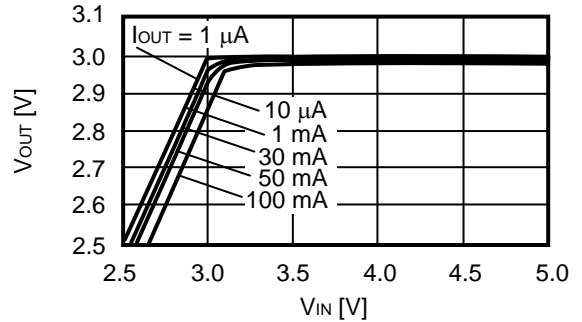
1. Minimum output current value specified in **Table 6** and footnote \*5 in "■ **Electrical Characteristics**"
2. Power dissipation of package

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

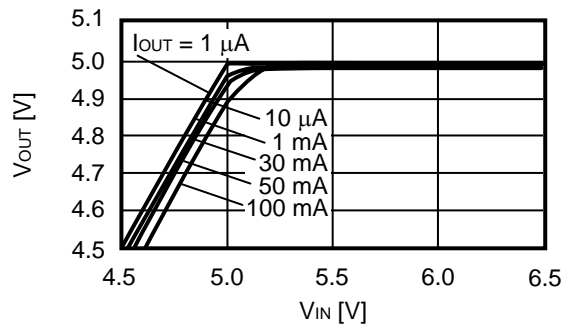
S-1206B12



S-1206B30

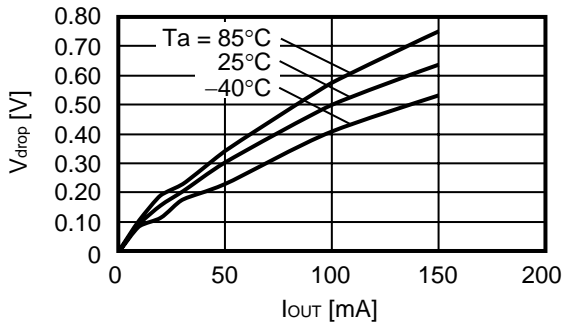


S-1206B50

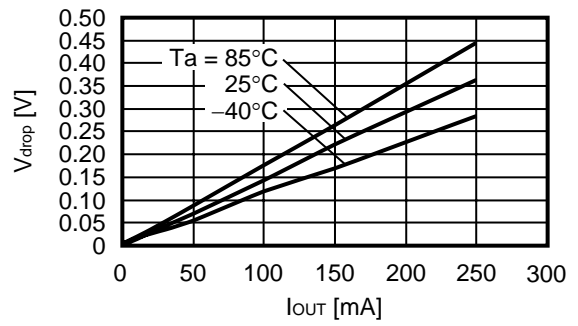


**(3) Dropout Voltage vs. Output Current**

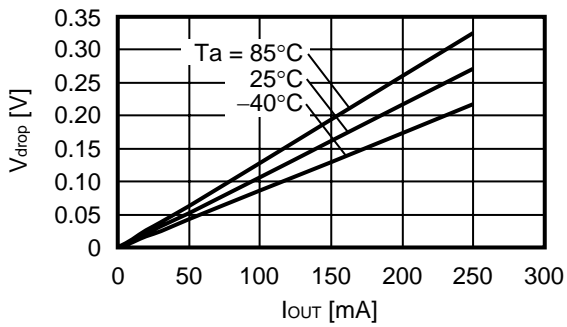
S-1206B12



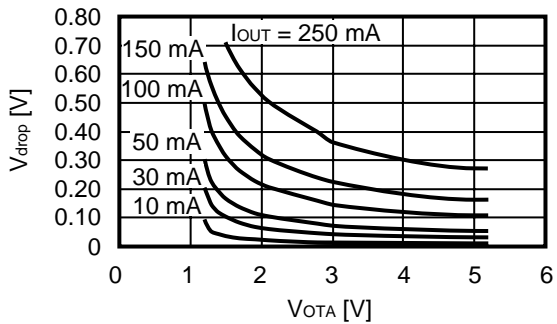
S-1206B30



S-1206B50

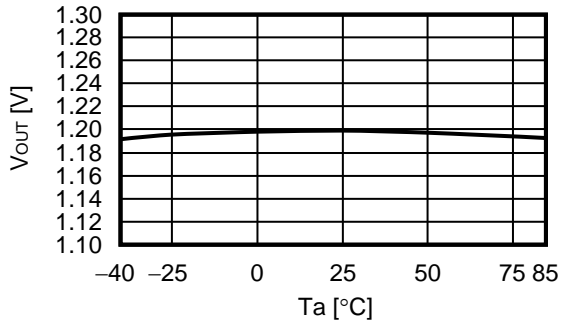


**(4) Dropout Voltage vs. Set Output Voltage**

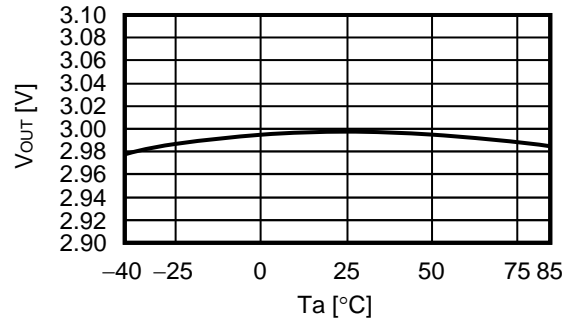


**(5) Output Voltage vs. Ambient Temperature**

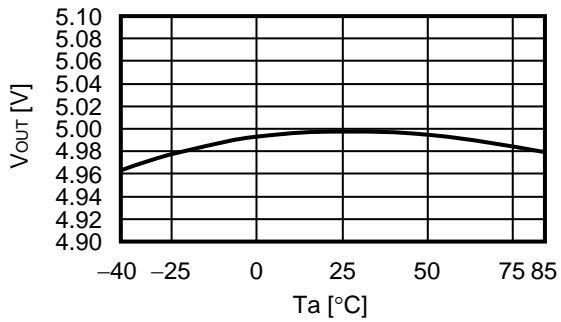
S-1206B12



S-1206B30

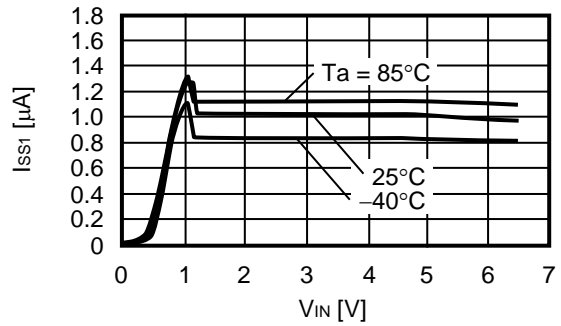


S-1206B50

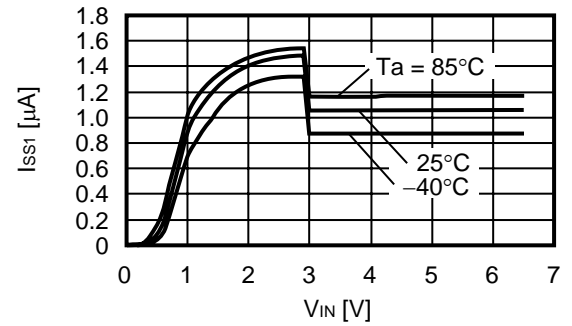


**(6) Current Consumption vs. Input Voltage**

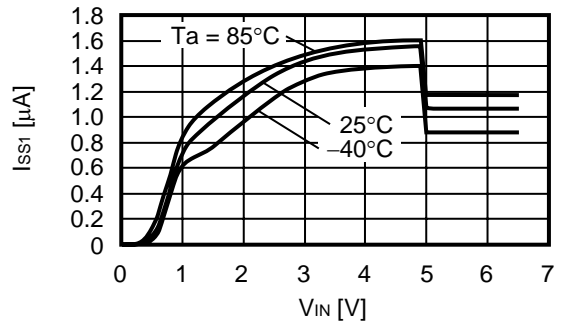
S-1206B12



S-1206B30



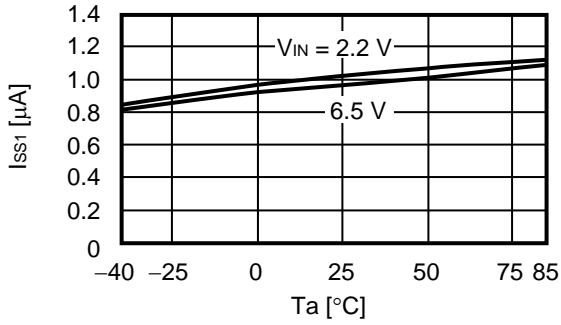
S-1206B50



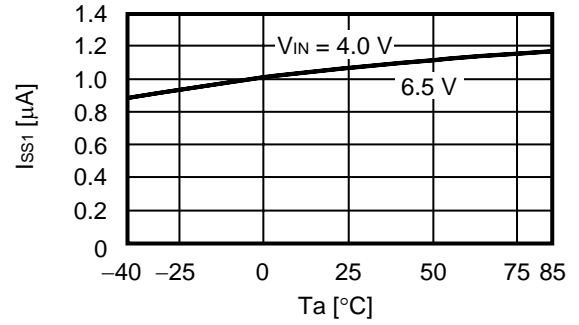


**(7) Current Consumption vs. Ambient Temperature**

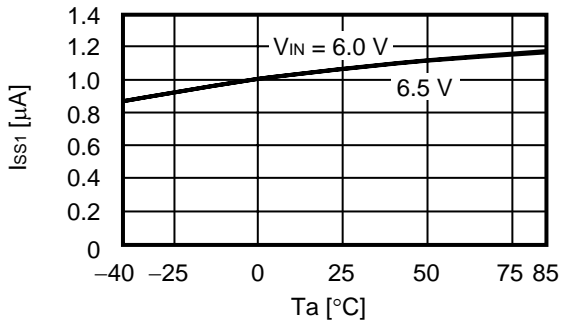
S-1206B12



S-1206B30



S-1206B50

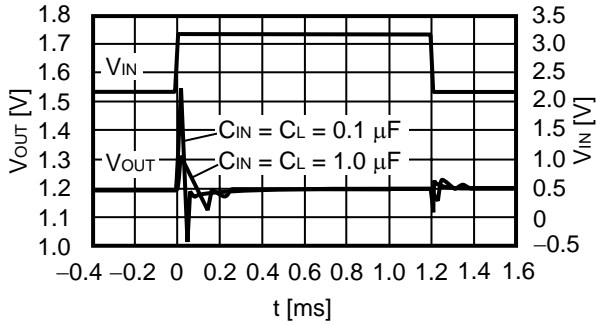


■ Reference Data

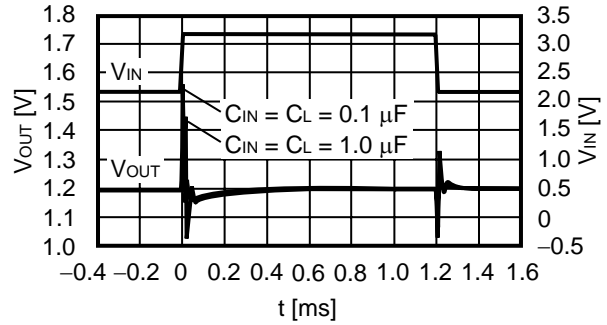
(1) Input Transient Response Characteristics (Ta = 25°C)

S-1206B12

$I_{OUT} = 1 \text{ mA}$ ,  $t_r = t_f = 5.0 \mu\text{s}$

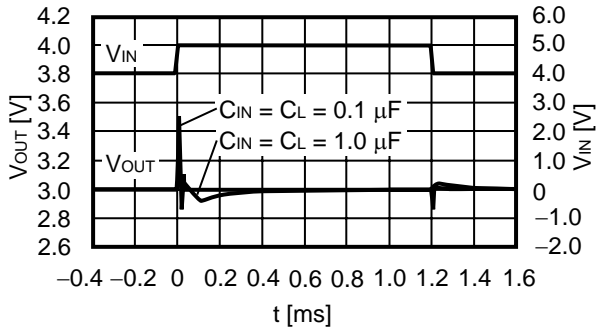


$I_{OUT} = 100 \text{ mA}$ ,  $t_r = t_f = 5.0 \mu\text{s}$

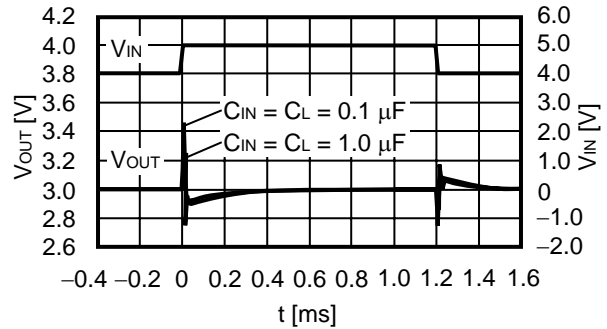


S-1206B30

$I_{OUT} = 1 \text{ mA}$ ,  $t_r = t_f = 5.0 \mu\text{s}$

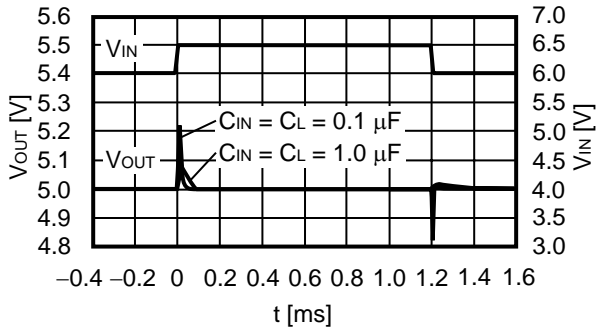


$I_{OUT} = 100 \text{ mA}$ ,  $t_r = t_f = 5.0 \mu\text{s}$

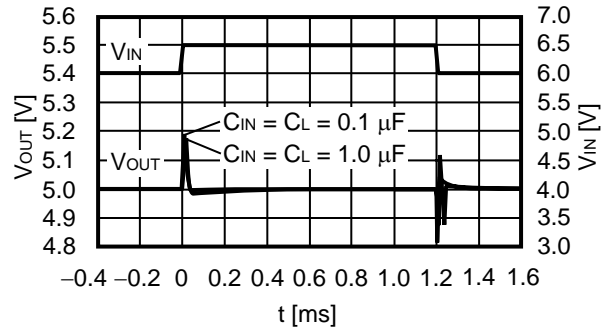


S-1206B50

$I_{OUT} = 1 \text{ mA}$ ,  $t_r = t_f = 5.0 \mu\text{s}$



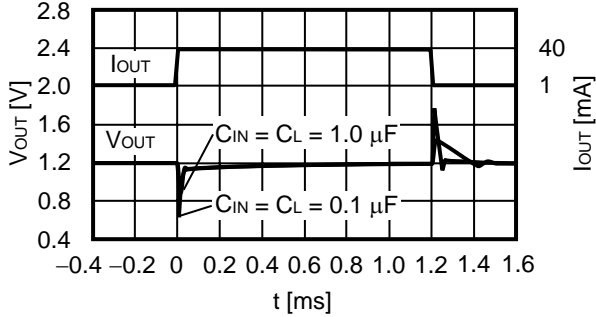
$I_{OUT} = 100 \text{ mA}$ ,  $t_r = t_f = 5.0 \mu\text{s}$



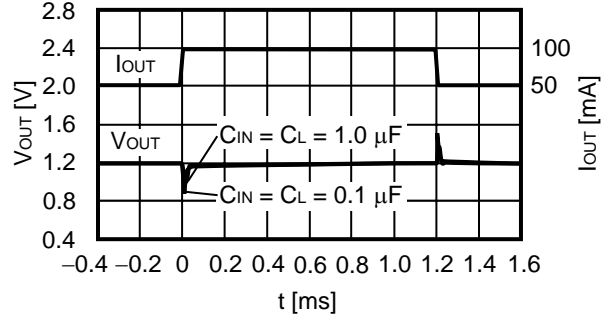
**(2) Load Transient Response Characteristics (Ta = 25°C)**

S-1206B12

V<sub>IN</sub> = 2.2 V, I<sub>OUT</sub> = 1 ↔ 40 mA

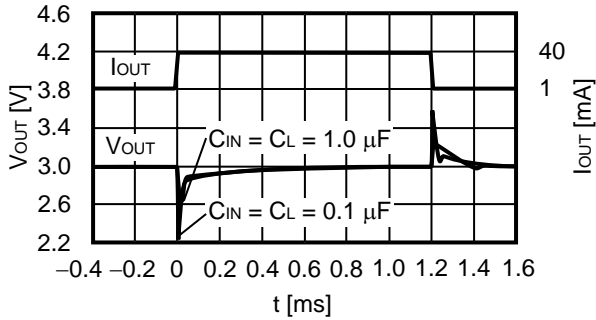


V<sub>IN</sub> = 2.2 V, I<sub>OUT</sub> = 50 ↔ 100 mA

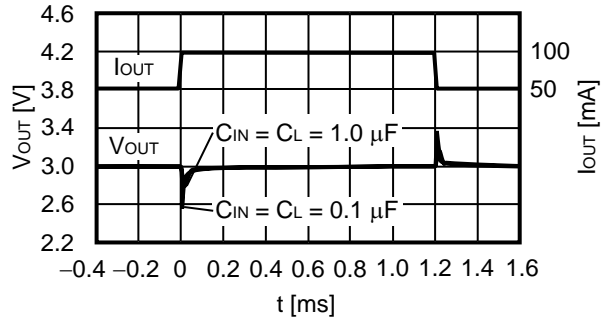


S-1206B30

V<sub>IN</sub> = 4.0 V, I<sub>OUT</sub> = 1 ↔ 40 mA

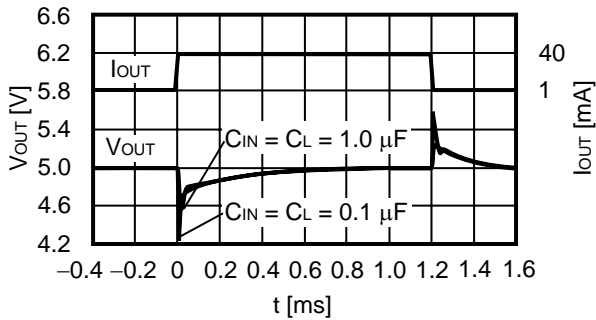


V<sub>IN</sub> = 4.0 V, I<sub>OUT</sub> = 50 ↔ 100 mA

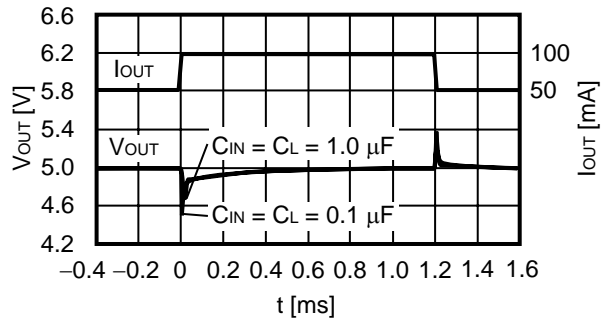


S-1206B50

V<sub>IN</sub> = 6.0 V, I<sub>OUT</sub> = 1 ↔ 40 mA



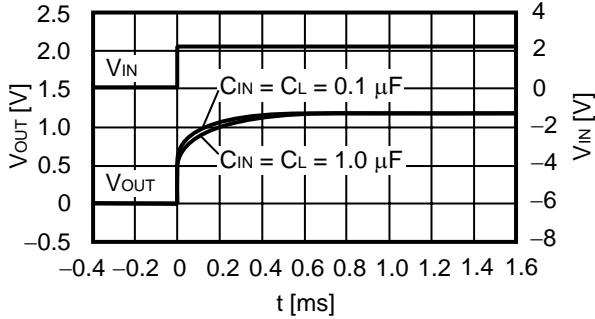
V<sub>IN</sub> = 6.0 V, I<sub>OUT</sub> = 50 ↔ 100 mA



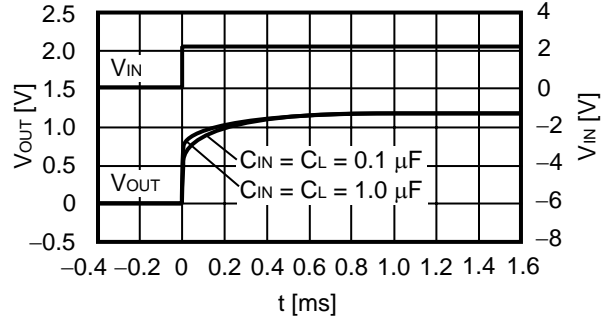
**(3) Input Voltage Transient Response Characteristics (Ta = 25°C)**

S-1206B12

$V_{IN} = 2.2\text{ V}$ ,  $I_{OUT} = 1\text{ mA}$

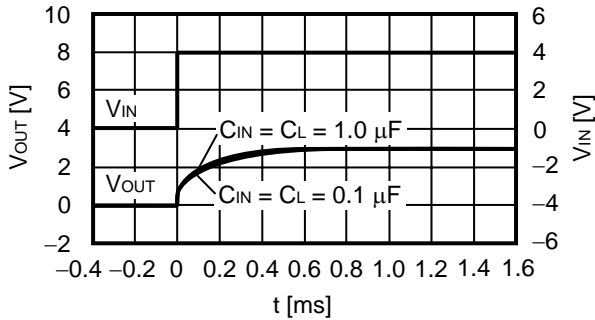


$V_{IN} = 2.2\text{ V}$ ,  $I_{OUT} = 100\text{ mA}$

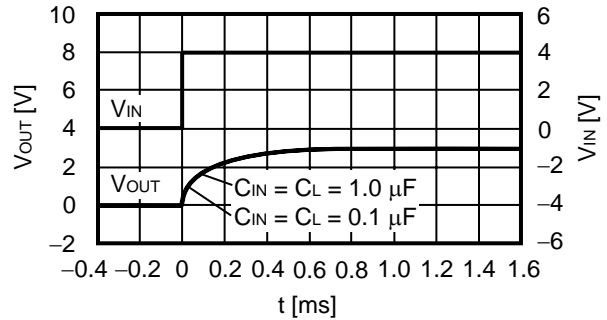


S-1206B30

$V_{IN} = 4.0\text{ V}$ ,  $I_{OUT} = 1\text{ mA}$

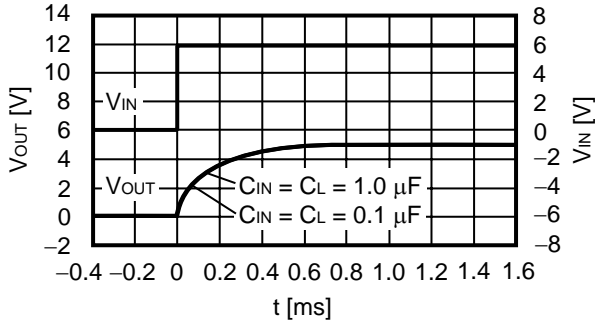


$V_{IN} = 4.0\text{ V}$ ,  $I_{OUT} = 100\text{ mA}$

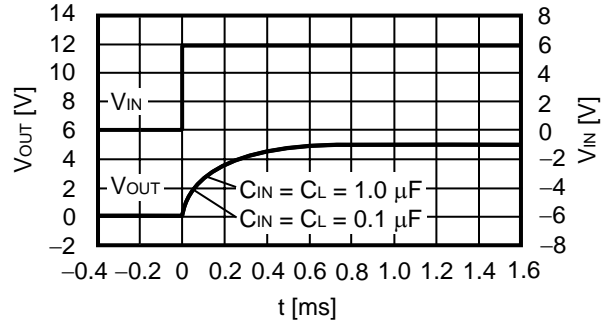


S-1206B50

$V_{IN} = 6.0\text{ V}$ ,  $I_{OUT} = 1\text{ mA}$

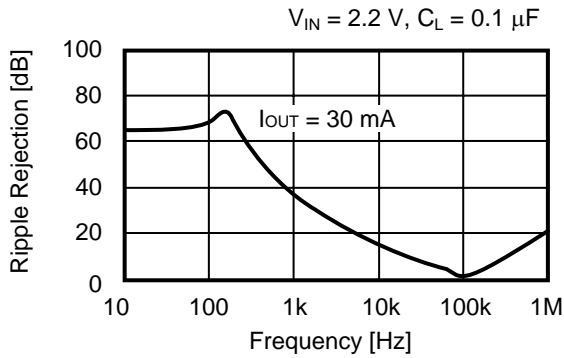


$V_{IN} = 6.0\text{ V}$ ,  $I_{OUT} = 100\text{ mA}$

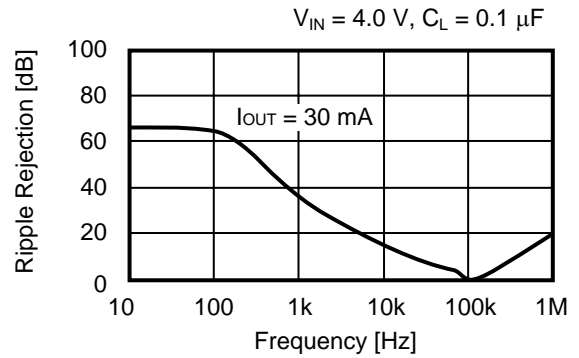


**(4) Ripple Rejection ( $T_a = 25^\circ\text{C}$ )**

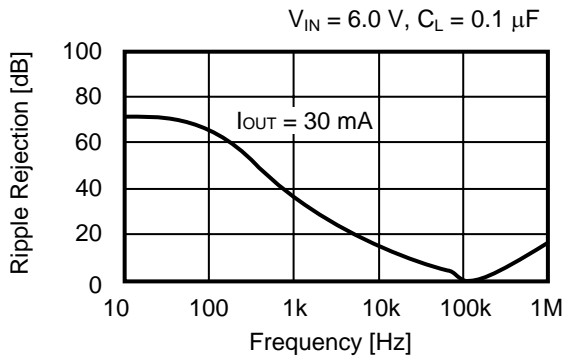
S-1206B12



S-1206B30

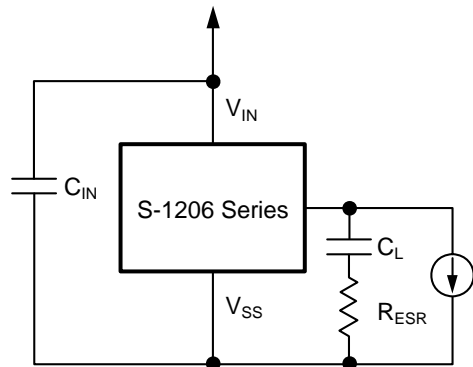
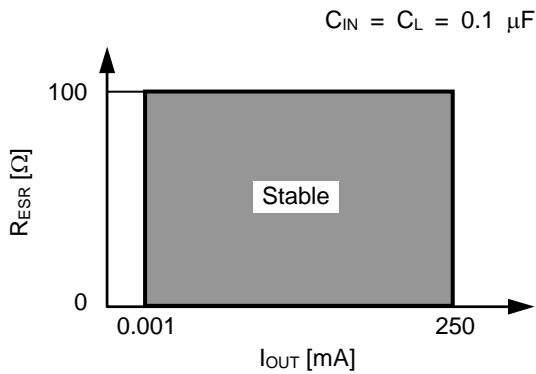


S-1206B50



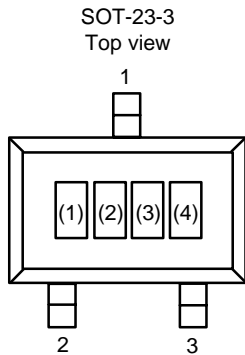
**(5) Equivalent Series Resistance vs. Output Current Characteristics Example ( $T_a = 25^\circ\text{C}$ )**

$C_L$ : Murata Manufacturing Company, Ltd.  
 GRM115R71C104K (0.1  $\mu\text{F}$ )



■ **Marking Specifications**

(1) **SOT-23-3**



(1) to (3) : Product abbreviation (refer to **Product Name vs. Product Code**)  
 (4) : Lot number

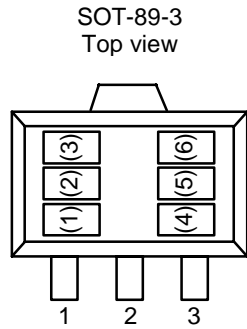
**List of Product Name vs. Product Code**

Product Name	Product Code		
	(1)	(2)	(3)
S-1206B12-M3T1x	S	A	A
S-1206B13-M3T1x	S	A	B
S-1206B14-M3T1x	S	A	C
S-1206B15-M3T1x	S	A	D
S-1206B16-M3T1x	S	A	E
S-1206B17-M3T1x	S	A	F
S-1206B18-M3T1x	S	A	G
S-1206B1J-M3T1x	S	A	H
S-1206B19-M3T1x	S	A	I
S-1206B20-M3T1x	S	A	J
S-1206B21-M3T1x	S	A	K
S-1206B22-M3T1x	S	A	L
S-1206B23-M3T1x	S	A	M
S-1206B24-M3T1x	S	A	N
S-1206B25-M3T1x	S	A	O
S-1206B26-M3T1x	S	A	P
S-1206B27-M3T1x	S	A	Q
S-1206B28-M3T1x	S	A	R
S-1206B2J-M3T1x	S	A	S
S-1206B29-M3T1x	S	A	T
S-1206B30-M3T1x	S	A	U
S-1206B31-M3T1x	S	A	V

Product Name	Product Code		
	(1)	(2)	(3)
S-1206B32-M3T1x	S	A	W
S-1206B33-M3T1x	S	A	X
S-1206B34-M3T1x	S	A	Y
S-1206B35-M3T1x	S	A	Z
S-1206B36-M3T1x	S	B	A
S-1206B37-M3T1x	S	B	B
S-1206B38-M3T1x	S	B	C
S-1206B39-M3T1x	S	B	D
S-1206B40-M3T1x	S	B	E
S-1206B41-M3T1x	S	B	F
S-1206B42-M3T1x	S	B	G
S-1206B43-M3T1x	S	B	H
S-1206B44-M3T1x	S	B	I
S-1206B45-M3T1x	S	B	J
S-1206B46-M3T1x	S	B	K
S-1206B47-M3T1x	S	B	L
S-1206B48-M3T1x	S	B	M
S-1206B49-M3T1x	S	B	N
S-1206B50-M3T1x	S	B	O
S-1206B51-M3T1x	S	B	P
S-1206B52-M3T1x	S	B	Q

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

(2) SOT-89-3



(1) to (3) : Product abbreviation (refer to **Product Name vs. Product Code**)  
 (4) to (6) : Lot number

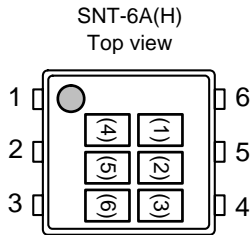
List of Product Name vs. Product Code

Product Name	Product Code		
	(1)	(2)	(3)
S-1206B12-U3T1x	S	A	A
S-1206B13-U3T1x	S	A	B
S-1206B14-U3T1x	S	A	C
S-1206B15-U3T1x	S	A	D
S-1206B16-U3T1x	S	A	E
S-1206B17-U3T1x	S	A	F
S-1206B18-U3T1x	S	A	G
S-1206B1J-U3T1x	S	A	H
S-1206B19-U3T1x	S	A	I
S-1206B20-U3T1x	S	A	J
S-1206B21-U3T1x	S	A	K
S-1206B22-U3T1x	S	A	L
S-1206B23-U3T1x	S	A	M
S-1206B24-U3T1x	S	A	N
S-1206B25-U3T1x	S	A	O
S-1206B26-U3T1x	S	A	P
S-1206B27-U3T1x	S	A	Q
S-1206B28-U3T1x	S	A	R
S-1206B2J-U3T1x	S	A	S
S-1206B29-U3T1x	S	A	T
S-1206B30-U3T1x	S	A	U
S-1206B31-U3T1x	S	A	V

Product Name	Product Code		
	(1)	(2)	(3)
S-1206B32-U3T1x	S	A	W
S-1206B33-U3T1x	S	A	X
S-1206B34-U3T1x	S	A	Y
S-1206B35-U3T1x	S	A	Z
S-1206B36-U3T1x	S	B	A
S-1206B37-U3T1x	S	B	B
S-1206B38-U3T1x	S	B	C
S-1206B39-U3T1x	S	B	D
S-1206B40-U3T1x	S	B	E
S-1206B41-U3T1x	S	B	F
S-1206B42-U3T1x	S	B	G
S-1206B43-U3T1x	S	B	H
S-1206B44-U3T1x	S	B	I
S-1206B45-U3T1x	S	B	J
S-1206B46-U3T1x	S	B	K
S-1206B47-U3T1x	S	B	L
S-1206B48-U3T1x	S	B	M
S-1206B49-U3T1x	S	B	N
S-1206B50-U3T1x	S	B	O
S-1206B51-U3T1x	S	B	P
S-1206B52-U3T1x	S	B	Q

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

**(3) SNT-6A(H)**



(1) to (3) : Product abbreviation (refer to **Product Name vs. Product Code**)  
 (4) to (6) : Lot number

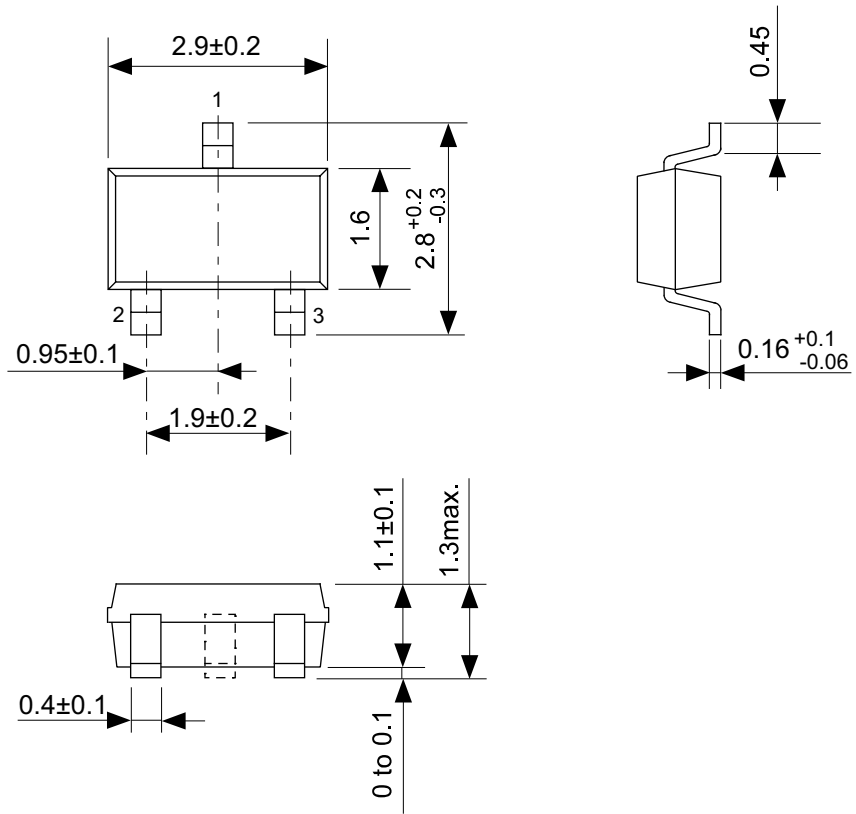
**List of Product Name vs. Product Code**

Product Name	Product Code		
	(1)	(2)	(3)
S-1206B12-I6T2x	S	A	A
S-1206B13-I6T2x	S	A	B
S-1206B14-I6T2x	S	A	C
S-1206B15-I6T2x	S	A	D
S-1206B16-I6T2x	S	A	E
S-1206B17-I6T2x	S	A	F
S-1206B18-I6T2x	S	A	G
S-1206B1J-I6T2x	S	A	H
S-1206B19-I6T2x	S	A	I
S-1206B20-I6T2x	S	A	J
S-1206B21-I6T2x	S	A	K
S-1206B22-I6T2x	S	A	L
S-1206B23-I6T2x	S	A	M
S-1206B24-I6T2x	S	A	N
S-1206B25-I6T2x	S	A	O
S-1206B26-I6T2x	S	A	P
S-1206B27-I6T2x	S	A	Q
S-1206B28-I6T2x	S	A	R
S-1206B2J-I6T2x	S	A	S
S-1206B29-I6T2x	S	A	T
S-1206B30-I6T2x	S	A	U
S-1206B31-I6T2x	S	A	V

Product Name	Product Code		
	(1)	(2)	(3)
S-1206B32-I6T2x	S	A	W
S-1206B33-I6T2x	S	A	X
S-1206B34-I6T2x	S	A	Y
S-1206B35-I6T2x	S	A	Z
S-1206B36-I6T2x	S	B	A
S-1206B37-I6T2x	S	B	B
S-1206B38-I6T2x	S	B	C
S-1206B39-I6T2x	S	B	D
S-1206B40-I6T2x	S	B	E
S-1206B41-I6T2x	S	B	F
S-1206B42-I6T2x	S	B	G
S-1206B43-I6T2x	S	B	H
S-1206B44-I6T2x	S	B	I
S-1206B45-I6T2x	S	B	J
S-1206B46-I6T2x	S	B	K
S-1206B47-I6T2x	S	B	L
S-1206B48-I6T2x	S	B	M
S-1206B49-I6T2x	S	B	N
S-1206B50-I6T2x	S	B	O
S-1206B51-I6T2x	S	B	P
S-1206B52-I6T2x	S	B	Q

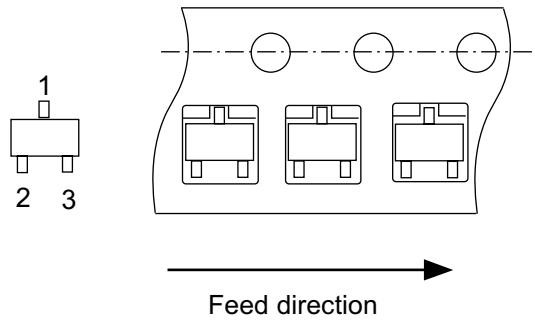
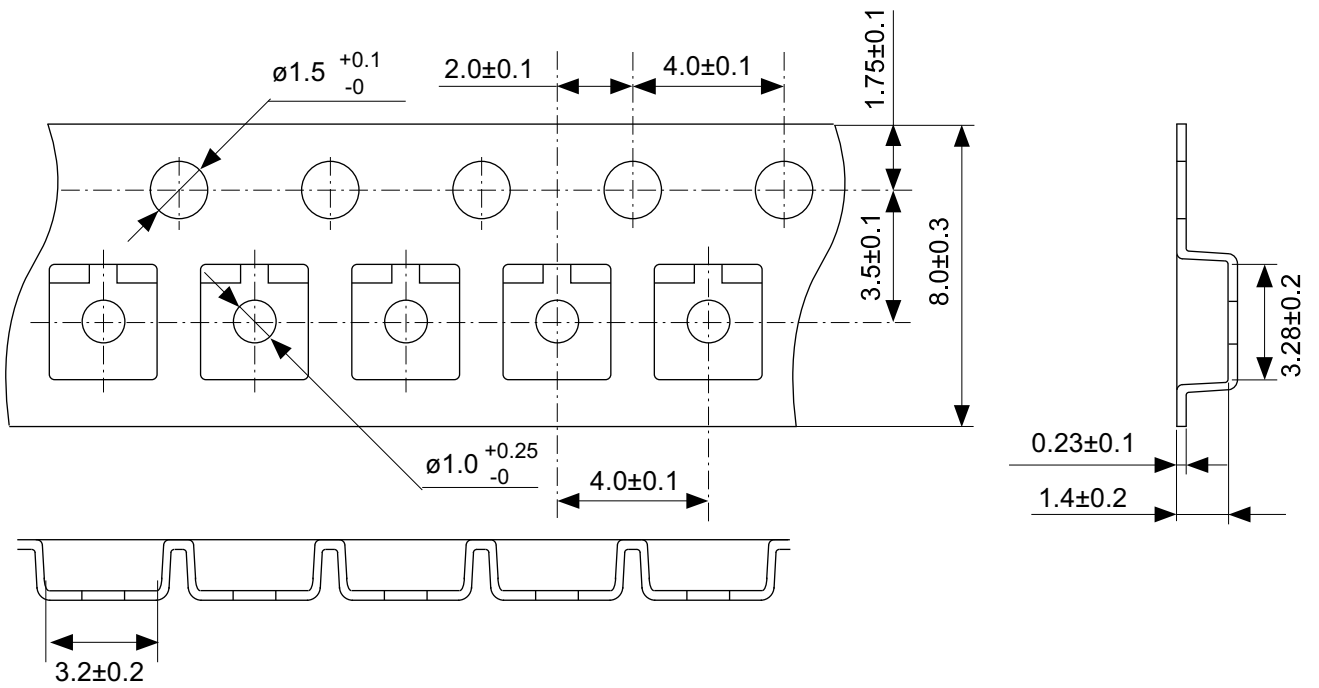
- Remark 1.** Please contact our sales office for products with output voltage values other than the above.  
**2.** x: G or U  
**3.** Please select products of environmental code = U for Sn 100%, halogen-free products.





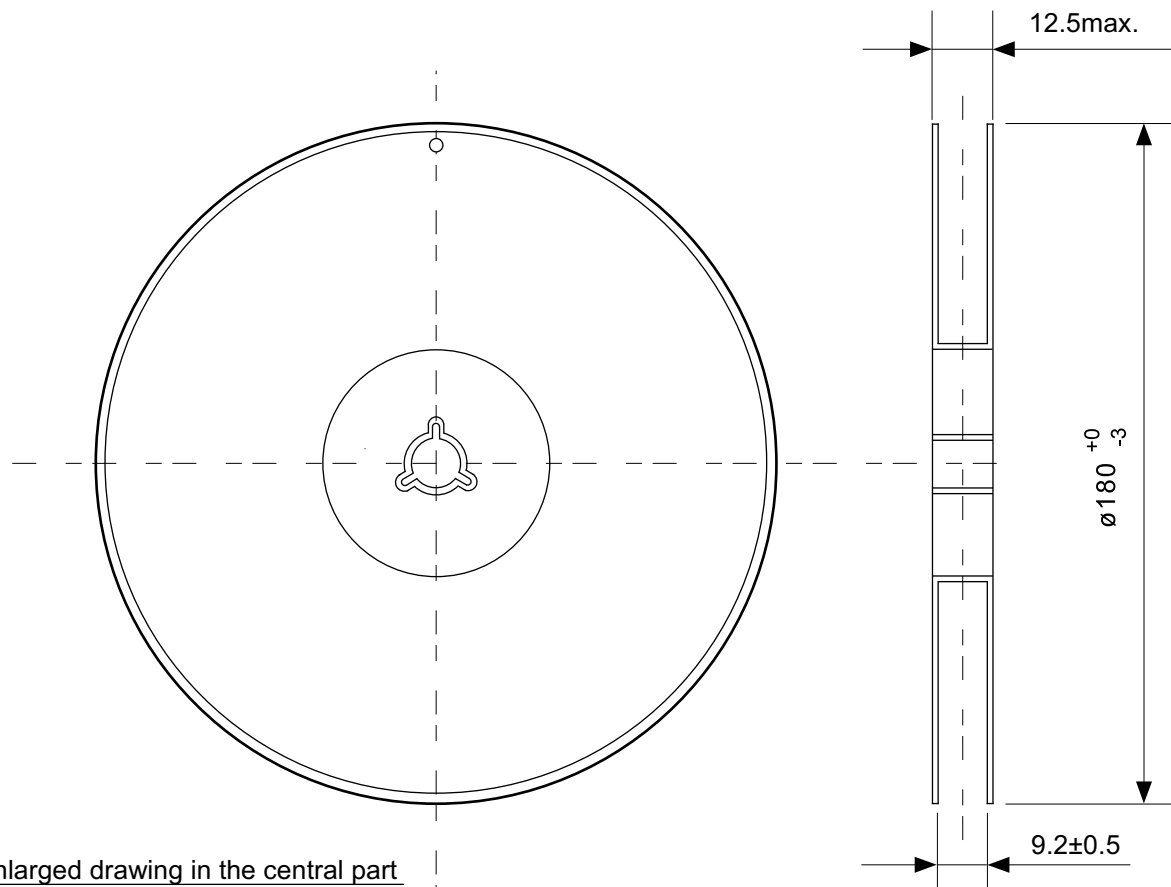
No. MP003-C-P-SD-1.0

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

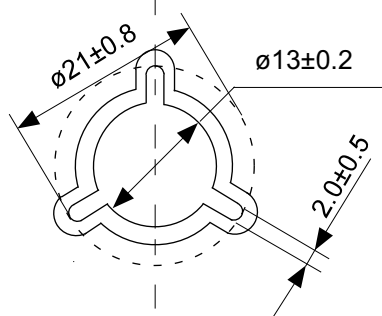


No. MP003-C-C-SD-2.0

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

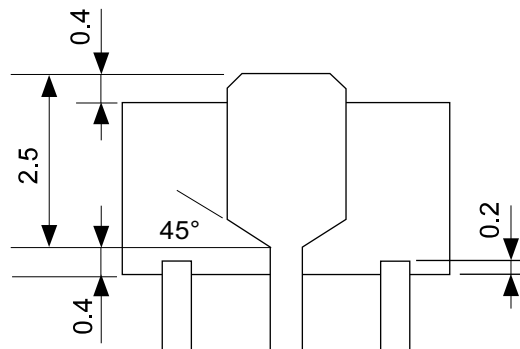
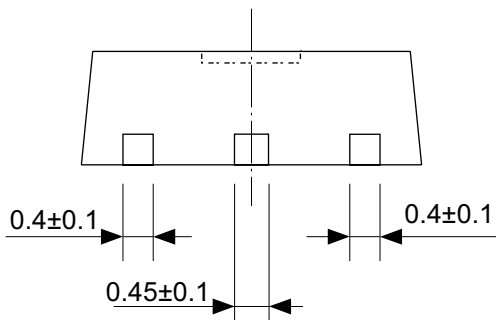
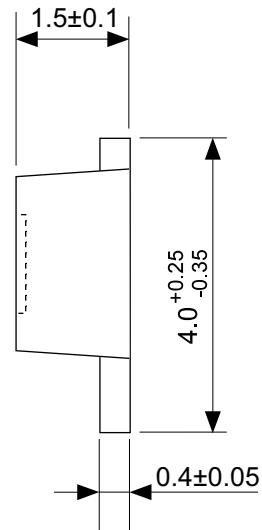
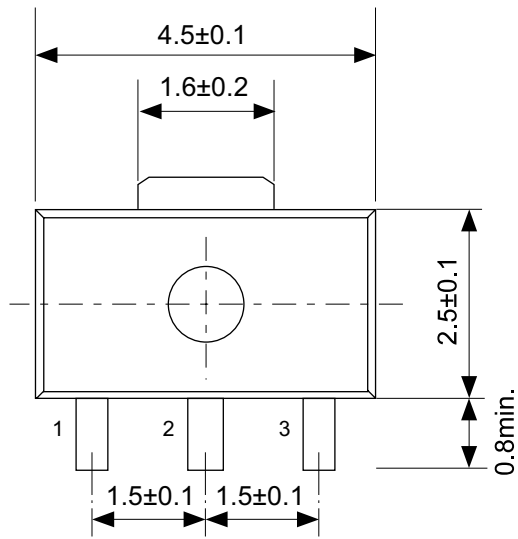


Enlarged drawing in the central part



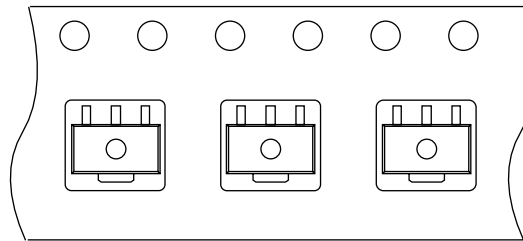
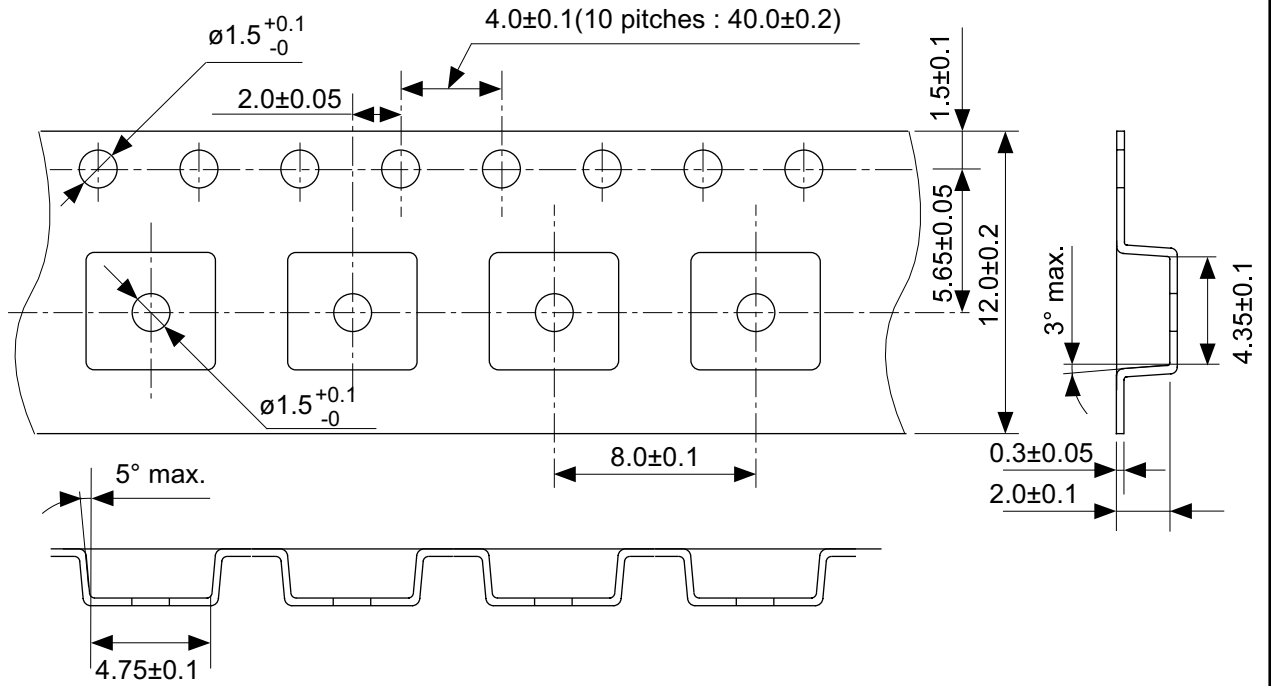
No. MP003-Z-R-SD-1.0

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



No. UP003-A-P-SD-1.1

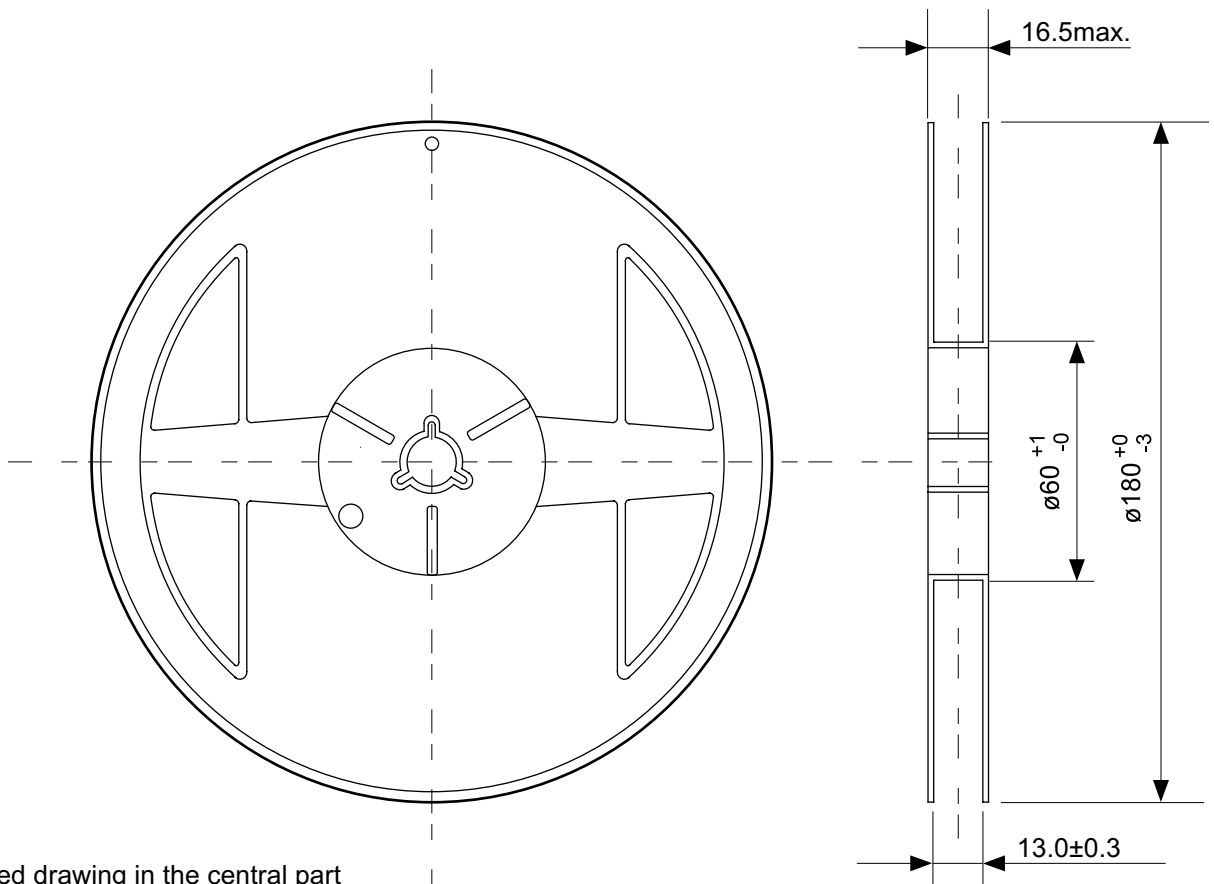
TITLE	SOT893-A-PKG Dimensions
No.	UP003-A-P-SD-1.1
SCALE	
UNIT	mm
Seiko Instruments Inc.	



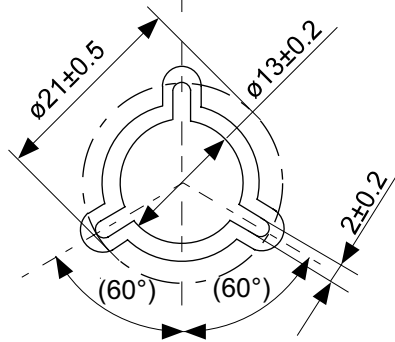
→  
Feed direction

No. UP003-A-C-SD-1.1

TITLE	SOT893-A-Carrier Tape
No.	UP003-A-C-SD-1.1
SCALE	
UNIT	mm
Seiko Instruments Inc.	



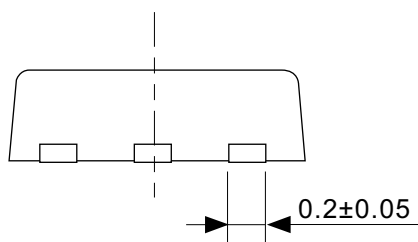
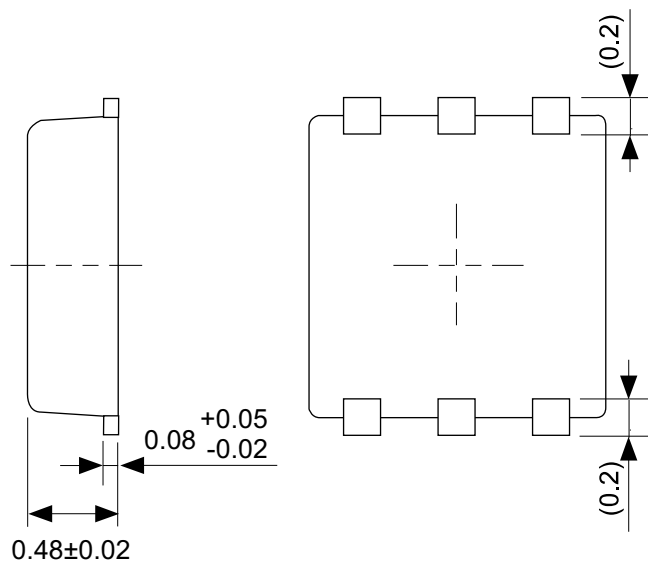
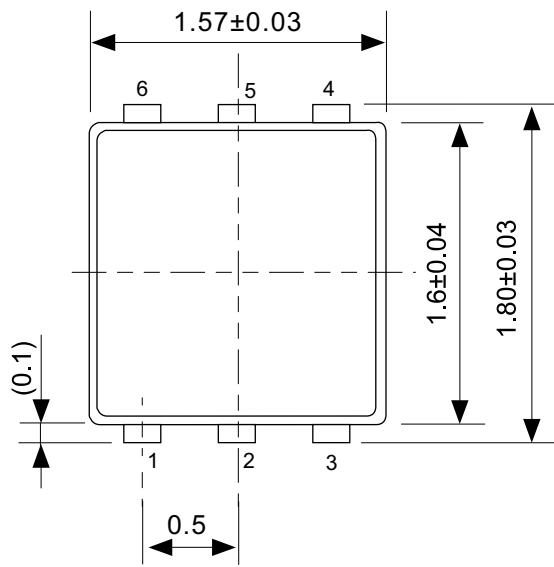
Enlarged drawing in the central part



No. UP003-A-R-SD-1.1

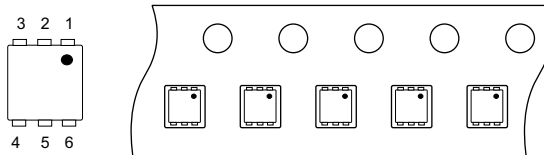
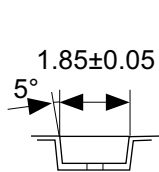
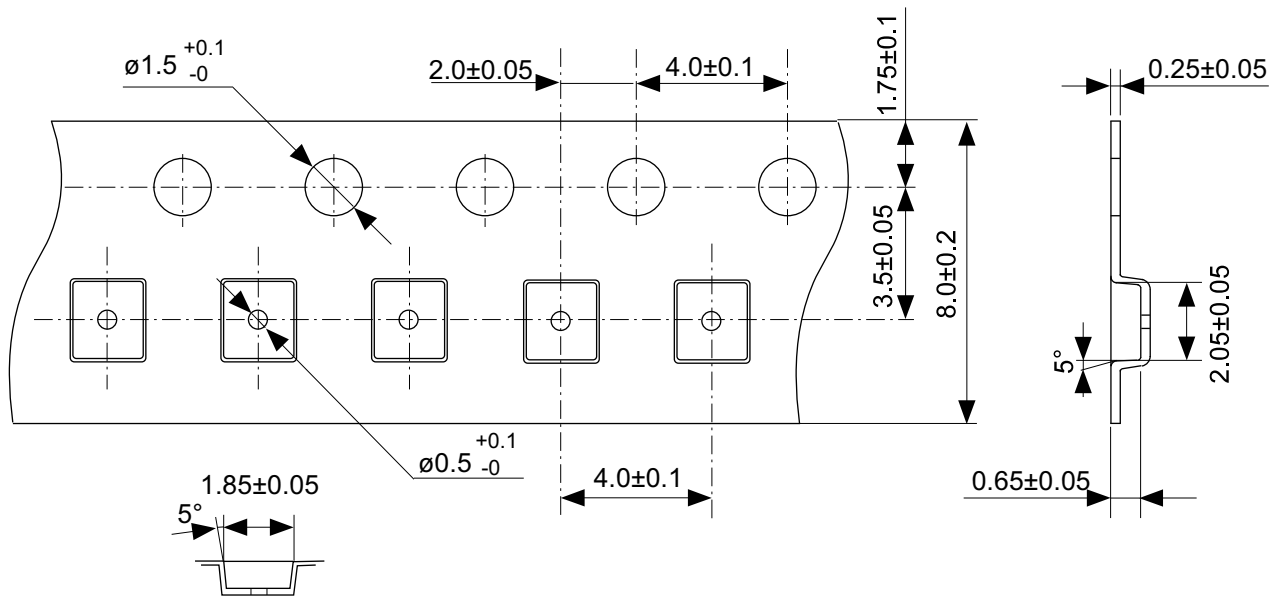
TITLE	SOT893-A-Reel		
No.	UP003-A-R-SD-1.1		
SCALE		QTY.	1,000
UNIT	mm		

Seiko Instruments Inc.



No. PI006-A-P-SD-2.0

TITLE	SNT-6A(H)-A-PKG Dimensions
No.	PI006-A-P-SD-2.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	

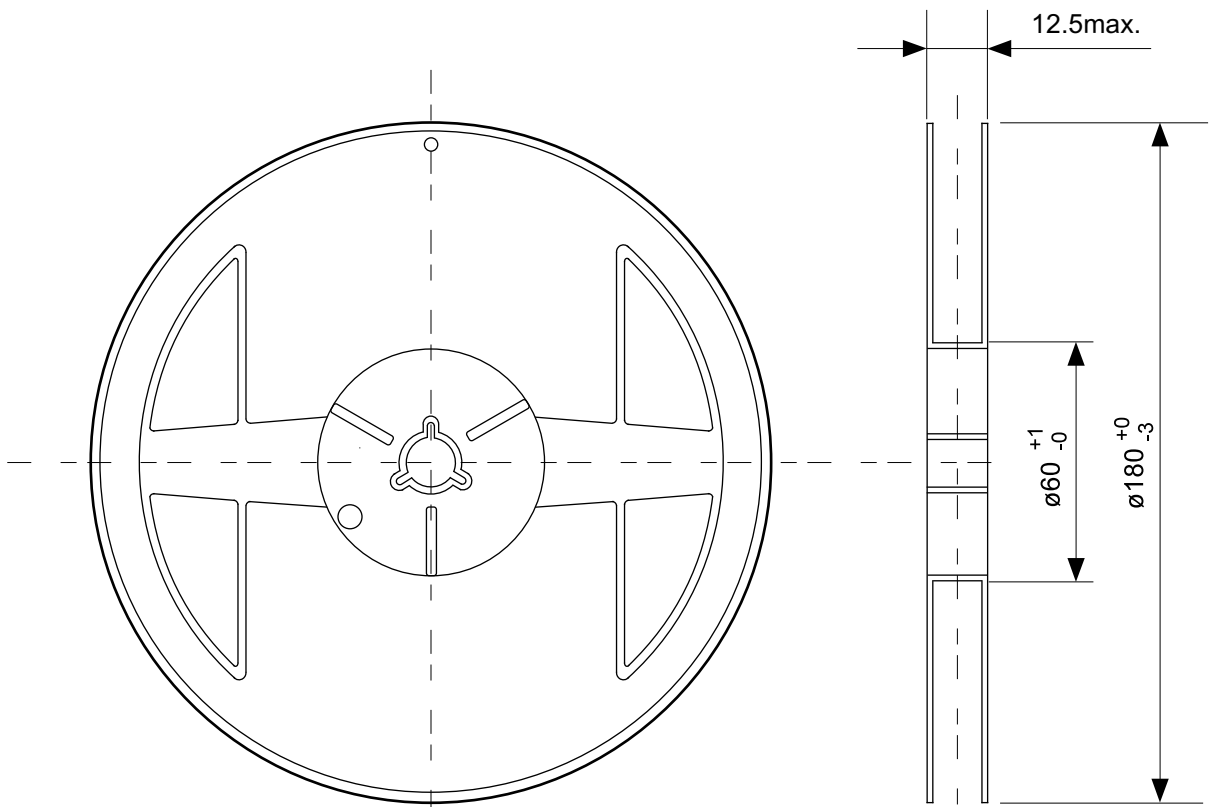


→  
Feed direction

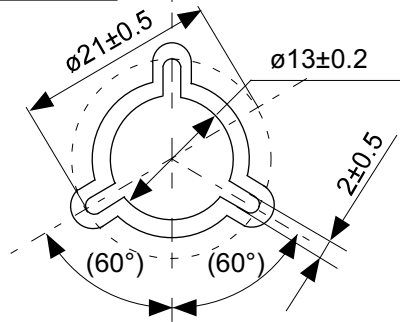
No. PI006-A-C-SD-1.0

TITLE	SNT-6A(H)-A-Carrier Tape
No.	PI006-A-C-SD-1.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	



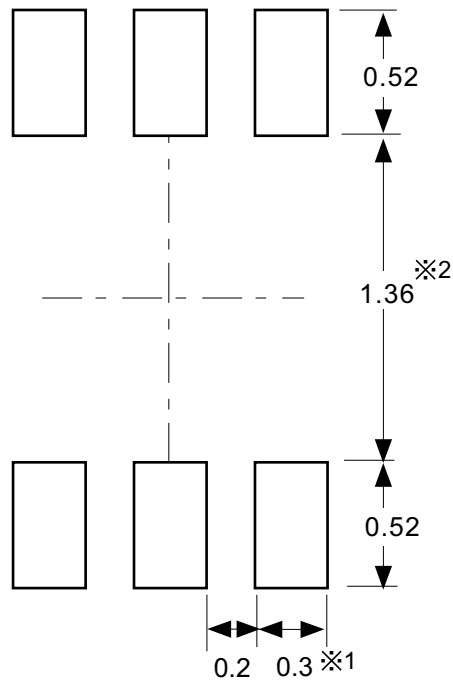


Enlarged drawing in the central part



No. PI006-A-R-SD-1.0

TITLE	SNT-6A(H)-A-Reel		
No.	PI006-A-R-SD-1.0		
SCALE		QTY.	5,000
UNIT	mm		
Seiko Instruments Inc.			



※1. ランドパターンの幅に注意してください (0.25 mm min. / 0.30 mm typ.).

※2. パッケージ中央にランドパターンを広げないでください (1.30 mm ~ 1.40 mm)。

- 注意
1. パッケージのモールド樹脂下にシルク印刷やハンダ印刷などしないでください。
  2. パッケージ下の配線上のソルダーレジストなどの厚みをランドパターン表面から0.03 mm以下にしてください。
  3. マスク開口サイズと開口位置はランドパターンと合わせてください。
  4. 詳細は "SNTパッケージ活用の手引き" を参照してください。

※1. Pay attention to the land pattern width (0.25 mm min. / 0.30 mm typ.).

※2. Do not widen the land pattern to the center of the package (1.30 mm to 1.40 mm).

- Caution**
1. Do not do silkscreen printing and solder printing under the mold resin of the package.
  2. The thickness of the solder resist on the wire pattern under the package should be 0.03 mm or less from the land pattern surface.
  3. Match the mask aperture size and aperture position with the land pattern.
  4. Refer to "SNT Package User's Guide" for details.

※1. 请注意焊盘模式的宽度 (0.25 mm min. / 0.30 mm typ.)。

※2. 请勿向封装中间扩展焊盘模式 (1.30 mm ~ 1.40 mm)。

- 注意
1. 请勿在树脂型封装的下面印刷丝网、焊锡。
  2. 在封装下、布线上的阻焊膜厚度 (从焊盘模式表面起) 请控制在0.03 mm以下。
  3. 掩膜的开口尺寸和开口位置请与焊盘模式对齐。
  4. 详细内容请参阅 "SNT封装的应用指南"。

No. PI006-A-L-SD-4.0

TITLE	SNT-6A(H)-A-Land Recommendation
No.	PI006-A-L-SD-4.0
SCALE	
UNIT	mm
Seiko Instruments Inc.	



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