S-1131 Series

HIGH RIPPLE-REJECTION AND LOW DROPOUT MIDDLE OUTPUT CURRENT CMOS VOLTAGE REGULATOR

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Rev.4.1_02

The S-1131 Series is a positive voltage regulator with a low dropout voltage, high-accuracy output voltage, and low current consumption developed based on CMOS technology.
A built-in low on-resistance transistor provides a low dropout voltage and large output current, and a built-in overcurrent protection circuit prevents the load current from exceeding the current capacitance of the output transistor. An ON/OFF circuit ensures a long battery life, and small SOT-89-3, SOT-89-5 and 6-Pin HSON(A) packages realize high-density mounting.

■ Features

• Output voltage:	1.5 V to 5.5 V, selectable in 0.1 V step
• Output voltage accuracy:	±1.0%
• Dropout voltage:	250 mV typ. (3.0 V output product, I_{OUT} = 100 mA)
• Current consumption:	During operation: 35 μA typ., 65 μA max.
	During power-off: 0.1 μA typ., 1.0 μA max.
• Output current:	Possible to output 300 mA ($V_{IN} \geq V_{OUT(S)} + 1.0$ V)*1
• Ripple rejection:	70 dB typ. (f = 1.0 kHz)
• Built-in overcurrent protection circuit:	Limits overcurrent of output transistor.
• Built-in ON/OFF circuit:	Ensures long battery life.
• Operation temperature range:	Ta = −40°C to +85°C
• 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

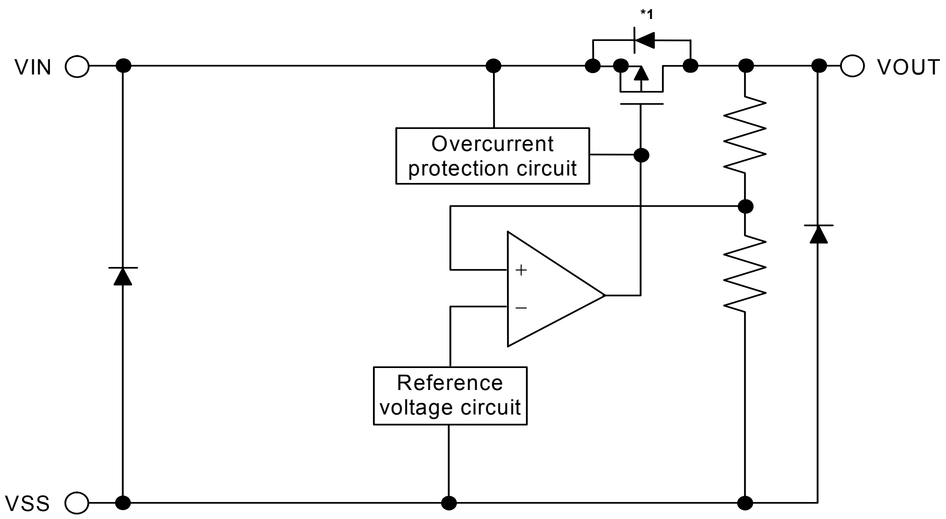
- Constant-voltage power supply for DVD and CD-ROM drive
- Constant-voltage power supply for battery-powered device
- Constant-voltage power supply for personal communication device
- Constant-voltage power supply for note book PC

■ Packages

- SOT-89-3
- SOT-89-5
- 6-Pin HSON(A)

■ Block Diagrams

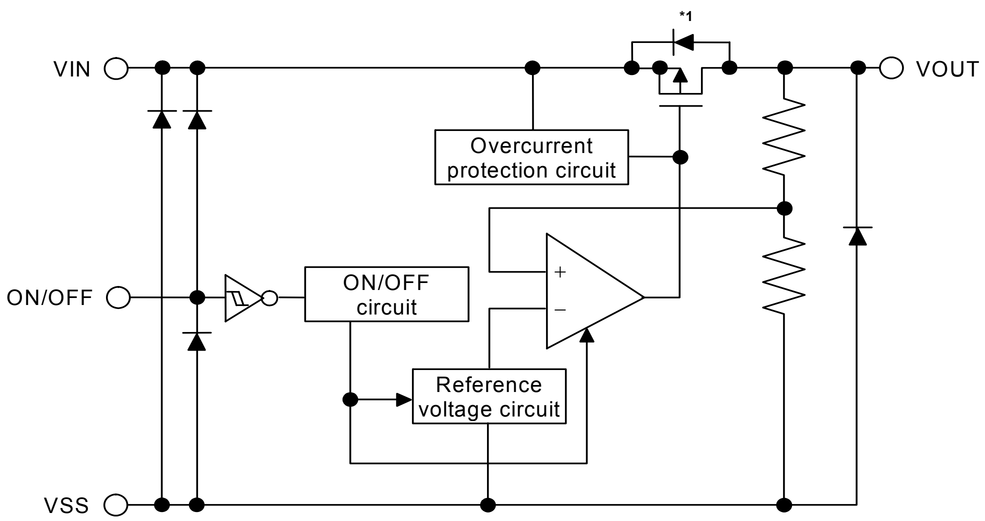
(1) Without ON/OFF circuit (Package: SOT-89-3)



***1.** Parasitic diode

Figure 1

(2) With ON/OFF circuit (Package: SOT-89-5, 6-Pin HSON(A))



***1.** Parasitic diode

Figure 2

■ Product Name Structure

- Users can select the product type, output voltage, and package type for the S-1131 Series. Refer to "**1. Product name**" regarding the contents of product name, "**2. Packages**" regarding the package drawings, "**3. Product name list**" regarding details of the product name.

1. Product name

(1) SOT-89-3, SOT-89-5

S-1131 x xx xx - xxx TF x

- x (last): Environmental code
  - U: Lead-free (Sn 100%), halogen-free
  - G: Lead-free (for details, please contact our sales office)
- TF: IC direction in tape specifications*1
- xxx: Product name (abbreviation)*2
- xx (second): Package name (abbreviation)
  - UA: SOT-89-3
  - UC: SOT-89-5
- xx (first): Output voltage
  - 15 to 55
  - (e.g., when the output voltage is 1.5 V, it is expressed as 15.)
- x (first): Product type*3
  - A: ON/OFF pin negative logic
  - B: ON/OFF pin positive logic

***1.** Refer to the tape drawing.
***2.** Refer to the product name list.
***3.** Refer to "**3. ON/OFF pin**" in "■ **Operation**" (Expect SOT-89-3).

(2) 6-Pin HSON(A)

S-1131 x xx PD - xxx TF x

- x: Environmental code
  - S: Lead-free, halogen-free
  - G: Lead-free (for details, please contact our sales office)
- TF: IC direction in tape specifications*1
- xxx: Product name (abbreviation)*2
- PD: Package name (abbreviation)
  - PD: 6-Pin HSON(A)
- xx: Output voltage
  - 15 to 55
  - (e.g., when the output voltage is 1.5 V, it is expressed as 15.)
- x: Product type*3
  - A: ON/OFF pin negative logic
  - B: ON/OFF pin positive logic

***1.** Refer to the tape drawing.
***2.** Refer to the product name list.
***3.** Refer to "**3. ON/OFF pin**" in "■ **Operation**"

2. Packages

Package Name	Drawing Code		
	Package	Tape	Reel
SOT-89-3	UP003-A-P-SD	UP003-A-C-SD	UP003-A-R-SD
SOT-89-5	UP005-A-P-SD	UP005-A-C-SD	UP005-A-R-SD
6-Pin HSON(A)	PD006-A-P-SD	PD006-A-C-SD	PD006-A-R-SD

3. Product name list

Table 1

Output voltage	SOT-89-3	SOT-89-5	6-Pin HSON(A)
1.5V±1.0%	S-1131B15UA-N4ATFx	S-1131B15UC-N4ATFx	S-1131B15PD-N4ATFz
1.6V±1.0%	S-1131B16UA-N4BTFx	S-1131B16UC-N4BTFx	S-1131B16PD-N4BTFz
1.7V±1.0%	S-1131B17UA-N4CTFx	S-1131B17UC-N4CTFx	S-1131B17PD-N4CTFz
1.8V±1.0%	S-1131B18UA-N4DTFx	S-1131B18UC-N4DTFx	S-1131B18PD-N4DTFz
1.9V±1.0%	S-1131B19UA-N4ETFx	S-1131B19UC-N4ETFx	S-1131B19PD-N4ETFz
2.0V±1.0%	S-1131B20UA-N4FTFx	S-1131B20UC-N4FTFx	S-1131B20PD-N4FTFz
2.1V±1.0%	S-1131B21UA-N4GTFx	S-1131B21UC-N4GTFx	S-1131B21PD-N4GTFz
2.2V±1.0%	S-1131B22UA-N4HTFx	S-1131B22UC-N4HTFx	S-1131B22PD-N4HTFz
2.3V±1.0%	S-1131B23UA-N4ITFx	S-1131B23UC-N4ITFx	S-1131B23PD-N4ITFz
2.4V±1.0%	S-1131B24UA-N4JTFx	S-1131B24UC-N4JTFx	S-1131B24PD-N4JTFz
2.5V±1.0%	S-1131B25UA-N4KTFx	S-1131B25UC-N4KTFx	S-1131B25PD-N4KTFz
2.6V±1.0%	S-1131B26UA-N4LTFx	S-1131B26UC-N4LTFx	S-1131B26PD-N4LTFz
2.7V±1.0%	S-1131B27UA-N4MTFx	S-1131B27UC-N4MTFx	S-1131B27PD-N4MTFz
2.8V±1.0%	S-1131B28UA-N4NTFx	S-1131B28UC-N4NTFx	S-1131B28PD-N4NTFz
2.9V±1.0%	S-1131B29UA-N4OTFx	S-1131B29UC-N4OTFx	S-1131B29PD-N4OTFz
3.0V±1.0%	S-1131B30UA-N4PTFx	S-1131B30UC-N4PTFx	S-1131B30PD-N4PTFz
3.1V±1.0%	S-1131B31UA-N4QTFx	S-1131B31UC-N4QTFx	S-1131B31PD-N4QTFz
3.2V±1.0%	S-1131B32UA-N4RTFx	S-1131B32UC-N4RTFx	S-1131B32PD-N4RTFz
3.3V±1.0%	S-1131B33UA-N4STFx	S-1131B33UC-N4STFx	S-1131B33PD-N4STFz
3.4V±1.0%	S-1131B34UA-N4TTFx	S-1131B34UC-N4TTFx	S-1131B34PD-N4TTFz
3.5V±1.0%	S-1131B35UA-N4UTFx	S-1131B35UC-N4UTFx	S-1131B35PD-N4UTFz
3.6V±1.0%	S-1131B36UA-N4VTFx	S-1131B36UC-N4VTFx	S-1131B36PD-N4VTFz
3.7V±1.0%	S-1131B37UA-N4WTFx	S-1131B37UC-N4WTFx	S-1131B37PD-N4WTFz
3.8V±1.0%	S-1131B38UA-N4XTFx	S-1131B38UC-N4XTFx	S-1131B38PD-N4XTFz
3.9V±1.0%	S-1131B39UA-N4YTFx	S-1131B39UC-N4YTFx	S-1131B39PD-N4YTFz
4.0V±1.0%	S-1131B40UA-N4ZTFx	S-1131B40UC-N4ZTFx	S-1131B40PD-N4ZTFz
4.1V±1.0%	S-1131B41UA-N5ATFx	S-1131B41UC-N5ATFx	S-1131B41PD-N5ATFz
4.2V±1.0%	S-1131B42UA-N5BTFx	S-1131B42UC-N5BTFx	S-1131B42PD-N5BTFz
4.3V±1.0%	S-1131B43UA-N5CTFx	S-1131B43UC-N5CTFx	S-1131B43PD-N5CTFz
4.4V±1.0%	S-1131B44UA-N5DTFx	S-1131B44UC-N5DTFx	S-1131B44PD-N5DTFz
4.5V±1.0%	S-1131B45UA-N5ETFx	S-1131B45UC-N5ETFx	S-1131B45PD-N5ETFz
4.6V±1.0%	S-1131B46UA-N5FTFx	S-1131B46UC-N5FTFx	S-1131B46PD-N5FTFz
4.7V±1.0%	S-1131B47UA-N5GTFx	S-1131B47UC-N5GTFx	S-1131B47PD-N5GTFz
4.8V±1.0%	S-1131B48UA-N5HTFx	S-1131B48UC-N5HTFx	S-1131B48PD-N5HTFz
4.9V±1.0%	S-1131B49UA-N5ITFx	S-1131B49UC-N5ITFx	S-1131B49PD-N5ITFz
5.0V±1.0%	S-1131B50UA-N5JTFx	S-1131B50UC-N5JTFx	S-1131B50PD-N5JTFz
5.1V±1.0%	S-1131B51UA-N5KTFx	S-1131B51UC-N5KTFx	S-1131B51PD-N5KTFz
5.2V±1.0%	S-1131B52UA-N5LTFx	S-1131B52UC-N5LTFx	S-1131B52PD-N5LTFz
5.3V±1.0%	S-1131B53UA-N5MTFx	S-1131B53UC-N5MTFx	S-1131B53PD-N5MTFz
5.4V±1.0%	S-1131B54UA-N5NTFx	S-1131B54UC-N5NTFx	S-1131B54PD-N5NTFz
5.5V±1.0%	S-1131B55UA-N5OTFx	S-1131B55UC-N5OTFx	S-1131B55PD-N5OTFz

Remark 1. Please contact our sales office for type A products.
2. x: G or U
z: G or S
3. Please select products of environmental code = U for Sn 100%, halogen-free products.

■ Pin Configurations

SOT-89-3
Top view

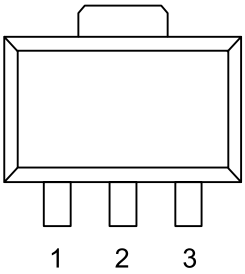


Figure 3

Table 2

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

SOT-89-5
Top view

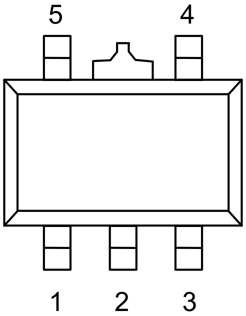


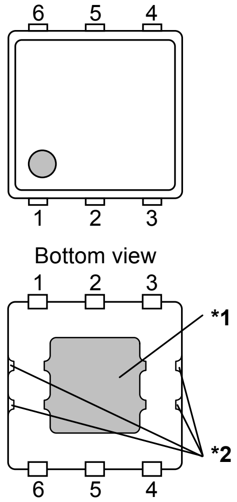
Figure 4

Table 3

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

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

6-Pin HSON(A)
Top view



***1.** Connect the exposed thermal die pad at shadowed area to the board, and set electric potential open or VSS.
However, do not use it as the function of electrode.

***2.** Be careful of the contact with other wires because the pinch lead has the same electric potential as VSS.

Figure 5

Table 4

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

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

■ Absolute Maximum Ratings

Table 5

(Ta = 25°C unless otherwise specified)

Item		Symbol	Absolute Maximum Rating	Unit
Input voltage		V_{IN}	V_{SS} – 0.3 to V_{SS} + 7	V
		$V_{ON/OFF}$	V_{SS} – 0.3 to V_{IN} + 0.3	V
Output voltage		V_{OUT}	V_{SS} – 0.3 to V_{IN} + 0.3	V
Power dissipation	SOT-89-3	P_D	500	mW
	SOT-89-5		500	mW
	6-Pin HSON(A)		500	mW
Operation ambient temperature		T_{opr}	–40 to +85	°C
Storage temperature		T_{stg}	–40 to +125	°C

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.

■ Electrical Characteristics

Table 6

(Ta = 25°C unless otherwise specified)

Item	Symbol	Conditions		Min.	Typ.	Max.	Unit	Test Circuit
Output voltage*1	$V_{OUT(E)1}$	$V_{IN} = V_{OUT(S)} + 1.0$ V, $I_{OUT} = 30$ mA		$V_{OUT(S)} \times 0.99$	$V_{OUT(S)}$	$V_{OUT(S)} \times 1.01$	V	1
	$V_{OUT(E)2}$	$V_{IN} = V_{OUT(S)} + 1.0$ V, $I_{OUT} = 80$ mA		$V_{OUT(S)} \times 0.98$	$V_{OUT(S)}$	$V_{OUT(S)} \times 1.02$	V	1
Output current*2	I_{OUT}	$V_{IN} \geq V_{OUT(S)} + 1.0$ V		300*5	—	—	mA	3
Dropout voltage*3	V_{drop}	$I_{OUT} = 100$ mA	$V_{OUT(S)} = 1.5$ V	—	1.00	1.05	V	1
			$V_{OUT(S)} = 1.6$ V	—	0.90	0.95	V	1
			$V_{OUT(S)} = 1.7$ V	—	0.80	0.85	V	1
			$V_{OUT(S)} = 1.8$ V	—	0.70	0.75	V	1
			$V_{OUT(S)} = 1.9$ V	—	0.60	0.65	V	1
			$V_{OUT(S)} = 2.0$ V	—	0.50	0.60	V	1
			$V_{OUT(S)} = 2.1$ V	—	0.40	0.55	V	1
			$2.2\text{ V} \leq V_{OUT(S)} \leq 2.5$ V	—	0.30	0.49	V	1
			$2.6\text{ V} \leq V_{OUT(S)} \leq 3.3$ V	—	0.25	0.34	V	1
			$3.4\text{ V} \leq V_{OUT(S)} \leq 5.5$ V	—	0.20	0.28	V	1
Line regulation	$\frac{\Delta V_{OUT1}}{\Delta V_{IN} \bullet V_{OUT}}$	$V_{OUT(S)} + 0.5\text{ V} \leq V_{IN} \leq 6.5$ V, $I_{OUT} = 80$ mA		—	0.05	0.2	%/V	1
Load regulation	ΔV_{OUT2}	$V_{IN} = V_{OUT(S)} + 1.0$ V, $1.0\text{ mA} \leq I_{OUT} \leq 80$ mA		—	20	40	mV	1
Output voltage temperature coefficient*4	$\frac{\Delta V_{OUT}}{\Delta Ta \bullet V_{OUT}}$	$V_{IN} = V_{OUT(S)} + 1.0$ V, $I_{OUT} = 10$ mA, $-40°C \leq Ta \leq 85°C$		—	±100	—	ppm/°C	1
Current consumption during operation	I_{SS1}	$V_{IN} = V_{OUT(S)} + 1.0$ V, ON/OFF pin = ON, no load		—	35	65	μA	2
Input voltage	V_{IN}	—		2.0	—	6.5	V	—
Ripple rejection	$\mid RR \mid$	$V_{IN} = V_{OUT(S)} + 1.0$ V, f = 1.0 kHz, $\Delta V_{rip} = 0.5$ Vrms, $I_{OUT} = 80$ mA		—	70	—	dB	5
Short-circuit current	I_{short}	$V_{IN} = V_{OUT(S)} + 1.0$ V, ON/OFF pin = ON, $V_{OUT} = 0$ V		—	450	—	mA	3
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
ON/OFF pin input voltage "H"	V_{SH}	$V_{IN} = V_{OUT(S)} + 1.0$ V, $R_L = 1.0$ kΩ		1.5	—	—	V	4
ON/OFF pin input voltage "L"	V_{SL}	$V_{IN} = V_{OUT(S)} + 1.0$ V, $R_L = 1.0$ kΩ		—	—	0.3	V	4
ON/OFF pin input current "H"	I_{SH}	$V_{IN} = 6.5$ V, $V_{ON/OFF} = 6.5$ V		−0.1	—	0.1	μA	4
ON/OFF pin input current "L"	I_{SL}	$V_{IN} = 6.5$ V, $V_{ON/OFF} = 0$ V		−0.1	—	0.1	μA	4

***1.** $V_{OUT(S)}$: Set output voltage
$V_{OUT(E)1}$: Actual output voltage
Output voltage when fixing I_{OUT}(= 30 mA) and inputting $V_{OUT(S)} + 1.0$ V
$V_{OUT(E)2}$: Actual output voltage
Output voltage when fixing I_{OUT}(= 80 mA) and inputting $V_{OUT(S)} + 1.0$ V

***2.** The output current at which the output voltage becomes 95% of $V_{OUT(E)1}$ after gradually increasing the output current.

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

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

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

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

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

■ Test Circuits

1.

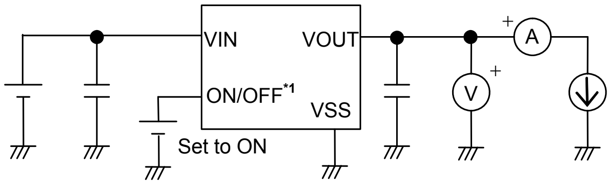


Figure 6

2.

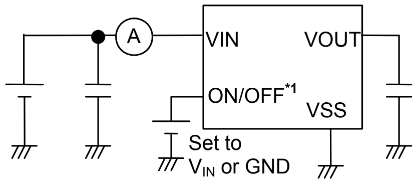


Figure 7

3.

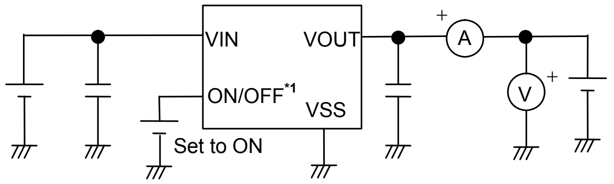


Figure 8

4.

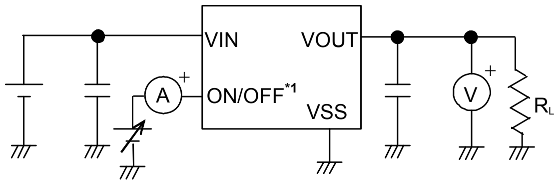


Figure 9

5.

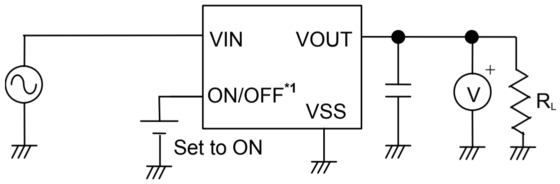
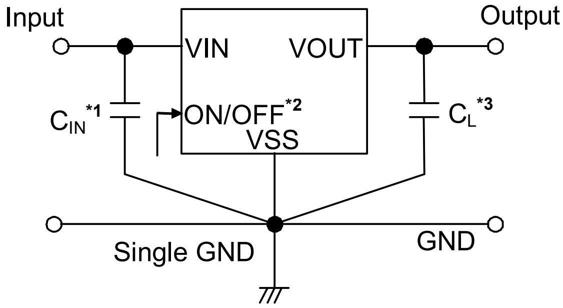


Figure 10

***1.** In case of product with ON/OFF circuit.

■ Standard Circuit



***1.** C_{IN} is a capacitor for stabilizing the input.
***2.** In case of product with ON/OFF circuit.
***3.** A tantalum capacitor (2.2 μF or more) can be used.

Figure 11

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}): 1.0 μF or more
Output capacitor (C_L): 2.2 μF or more (tantalum capacitor)

Caution Generally a series regulator may cause oscillation, depending on the selection of external parts. Check that no oscillation occurs with the application using the above capacitor.

■ Explanation of Terms

1. Low dropout voltage regulator

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

2. Output voltage (V_{OUT})

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

***1.** Differs depending 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 value shows 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 value shows 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})

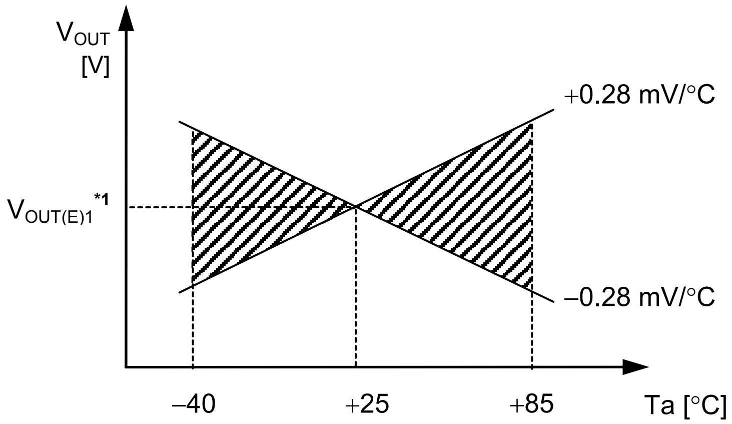
Indicates the difference between input voltage (V_{IN1}) and the output voltage when; decreasing input voltage (V_{IN}) gradually until the output voltage has dropped out to the value of 98% of output voltage (V_{OUT3}), which is at $V_{IN} = V_{OUT(S)} + 1.0$ V.

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

6. Output voltage temperature coefficient $\left(\frac{\Delta V_{OUT}}{\Delta Ta \bullet V_{OUT}}\right)$

The shaded area in **Figure 12** is the range where V_{OUT} varies in the operation temperature range when the output voltage temperature coefficient is ±100 ppm/°C.

Example of S-1131B28 typ. product



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

Figure 12

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

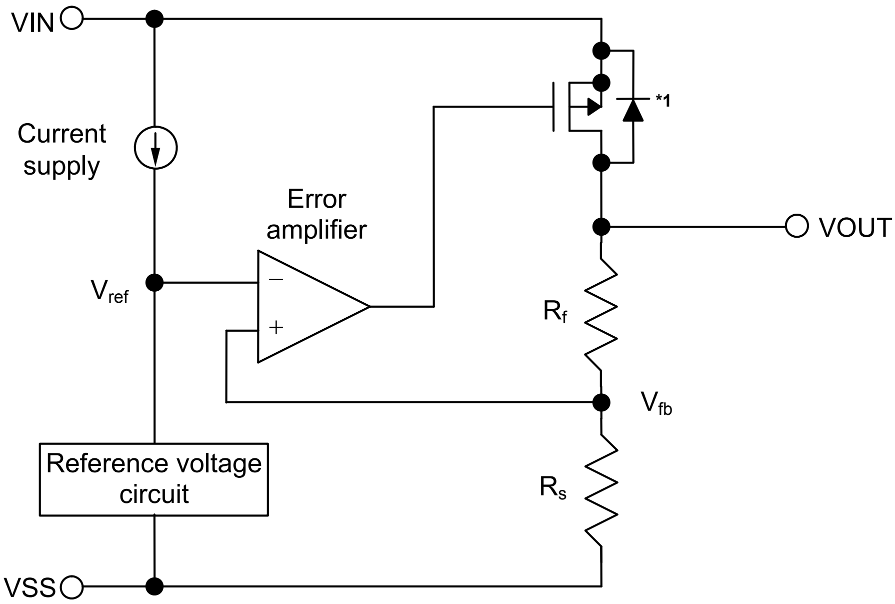
$$\frac{\Delta V_{OUT}}{\Delta Ta} \text{ [mV/°C]}^{*1} = V_{OUT(S)} \text{ [V]}^{*2} \times \frac{\Delta V_{OUT}}{\Delta Ta \bullet V_{OUT}} \text{ [ppm/°C]}^{*3} \div 1000$$

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

■ Operation

1. Basic operation

Figure 13 shows the block diagram of the S-1131 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 13

2. Output transistor

In the S-1131 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 reverse current flowing from the VOUT pin through a parasitic diode to the VIN pin, when the potential of V_{OUT} became higher than V_{IN}.

3. ON/OFF pin

In case of product with ON/OFF circuit, this pin starts and stops the regulator.

When the ON/OFF pin is set to OFF level, the entire internal circuit stops operating, and the built-in P-channel MOS FET output transistor between the VIN pin and the VOUT pin is turned off, reducing current consumption significantly. The VOUT pin becomes the Vss level due to the internally divided resistance of several hundreds kΩ between the VOUT pin and the VSS pin.
The structure of the ON/OFF pin is as shown in **Figure 14**. Since the ON/OFF pin is neither pulled down nor pulled up internally, do not use it in the floating states. In addition, note that the current consumption increases if a voltage of 0.3 V to V_{IN} – 0.3 V is applied to the ON/OFF pin. When not using the ON/OFF pin, connect it to the VSS pin in the product A type, and connect it to the VIN pin in B type.

Table 7

Product Type	ON/OFF Pin	Internal Circuit	VOUT Pin Voltage	Current Consumption
A	"L": ON	Operate	Set value	I_{SS1}
A	"H": OFF	Stop	V_{SS} level	I_{SS2}
B	"L": OFF	Stop	V_{SS} level	I_{SS2}
B	"H": ON	Operate	Set value	I_{SS1}

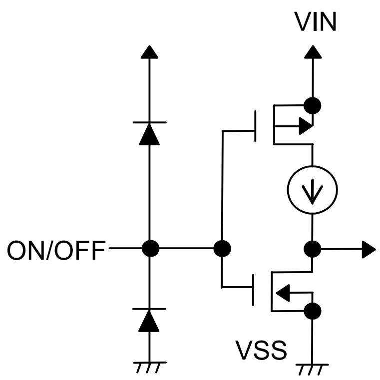


Figure 14

■ Selection of Output Capacitor (C_L)

The S-1131 Series performs phase compensation using the internal phase compensator in the IC and the ESR (Equivalent Series Resistance) of the output capacitor to enable stable operation independent of changes in the output load. Therefore, always place a capacitor (C_L) of 2.2 μF or more between the VOUT pin and the VSS pin.
For stable operation of the S-1131 Series, it is essential to employ a capacitor whose ESR is within an optimum range. Using a capacitor whose ESR is outside the optimum range (approximately 0.5 Ω to 5 Ω), whether larger or smaller, may cause an unstable output, resulting in oscillation. For this reason, a tantalum electrolytic capacitor is recommended.
When a ceramic capacitor or an OS capacitor with a low ESR is used, it is necessary to connect an additional resistor that serves as the ESR in series with the output capacitor. The required resistance value is approximately 0.5 Ω to 5 Ω, which varies depending on the usage conditions, so perform sufficient evaluation for selection. Ordinarily, around 1.0 Ω is recommended.
Note that an aluminum electrolytic capacitor may increase the ESR at a low temperature, causing oscillation. When using this kind of capacitor, perform thorough evaluation, including evaluation of temperature characteristics.

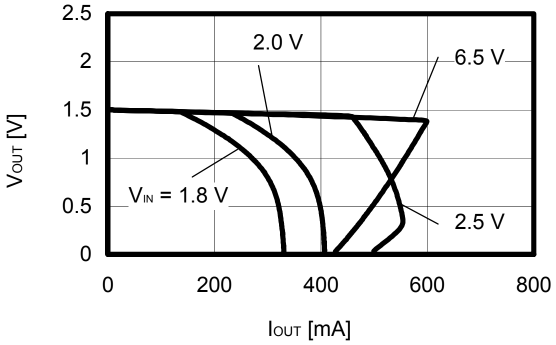
■ Precautions

- Wiring patterns for the VIN pin, the VOUT pin and GND should be designed so that the impedance is low. When mounting an output capacitor between the VOUT pin and the VSS pin (C_L) and a capacitor for stabilizing the input between the VIN pin and the VSS pin (C_{IN}), the distance from the capacitors to these pins should be as short as possible.
- Note that generally the output voltage may increase when a series regulator is used at low load current (1.0 mA or less).
- The S-1131 Series performs phase compensation by using an internal phase compensator and the ESR of an output capacitor. Therefore, always place a capacitor of 2.2 μF or more between the VOUT pin and the VSS pin. A tantalum type capacitor is recommended. Moreover, to secure stable operation of the S-1131 Series, it is necessary to employ a capacitor with an ESR within an optimum range (0.5 Ω to 5 Ω). Using a capacitor whose ESR is outside the optimum range (approximately 0.5 Ω to 5 Ω), whether larger or smaller, may cause an unstable output, resulting in oscillation. Perform sufficient evaluation under the actual usage conditions for selection, including evaluation of temperature 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.
- Overshoot may occur in the output voltage momentarily if the voltage is rapidly raised at power-on or when the power supply fluctuates. Sufficiently evaluate the output voltage at power-on with the actual device.
- The application conditions for the input voltage, the output voltage, and the 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.
- ABLIC Inc. 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.

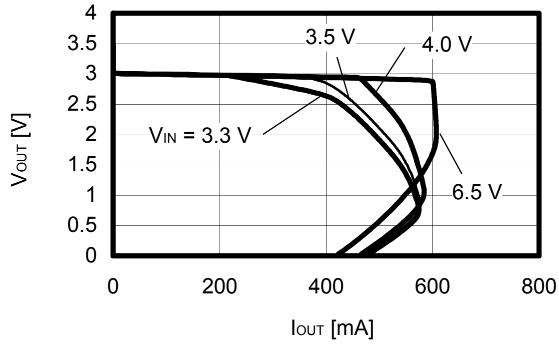
■ Characteristics (Typical Data)

(1) Output voltage vs. Output current (when load current increases)

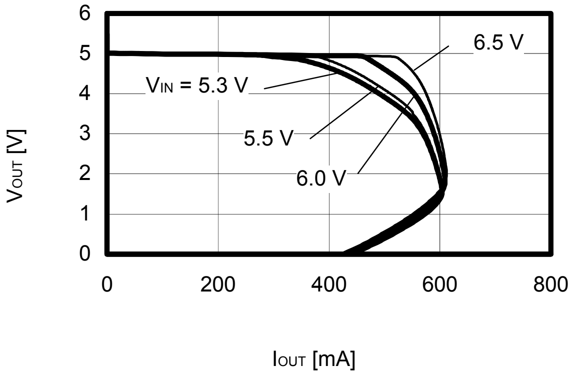
S-1131B15 (Ta = 25°C)



S-1131B30 (Ta = 25°C)



S-1131B50 (Ta = 25°C)



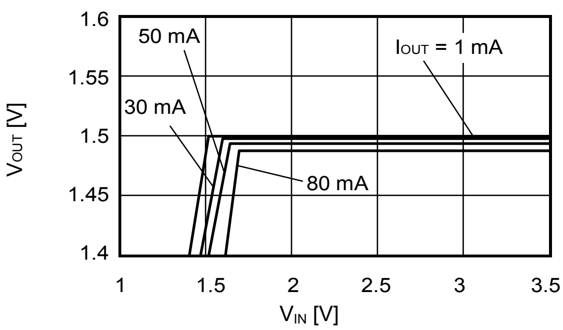
Remark In determining the output current, attention should be paid to the following.

1) The minimum output current value and footnote ***5** of **Table 6** in the "■ **Electrical Characteristics**"

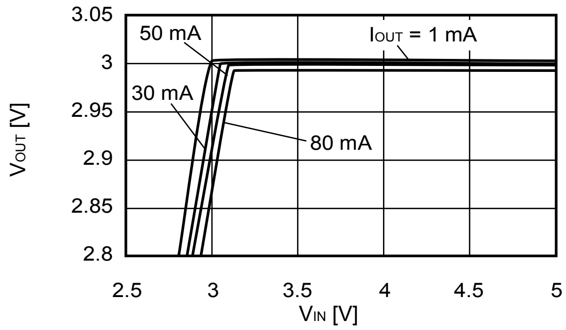
2) The package power dissipation

(2) Output voltage vs. Input voltage

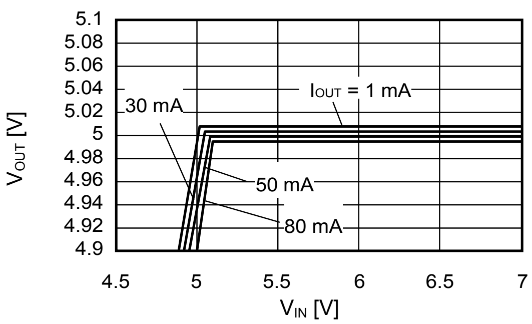
S-1131B15 (Ta = 25°C)



S-1131B30 (Ta = 25°C)

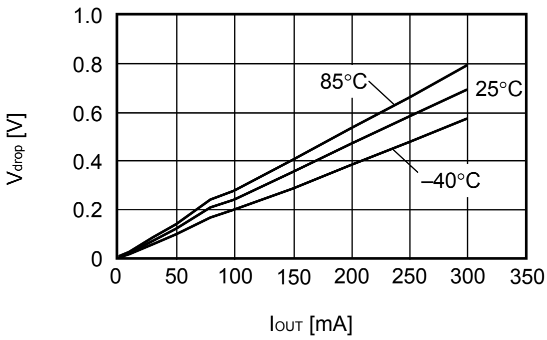


S-1131B50 (Ta = 25°C)

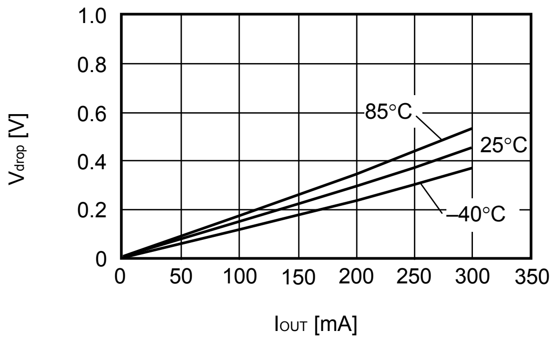


(3) Dropout voltage vs. Output current

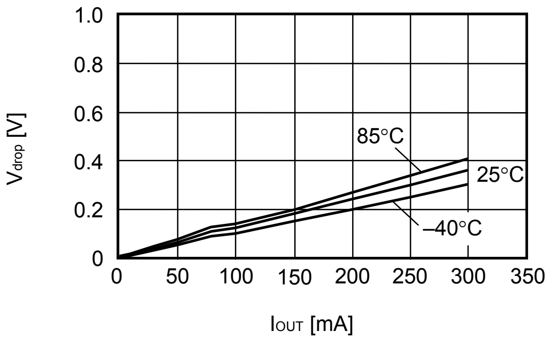
S-1131B15



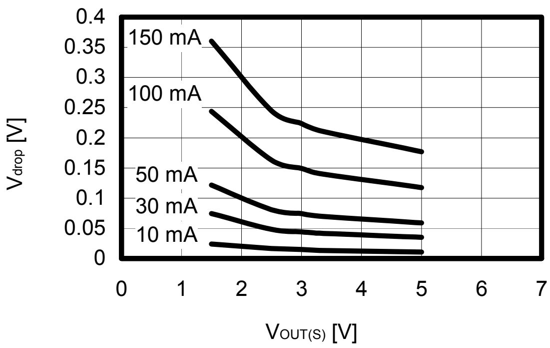
S-1131B30



S-1131B50

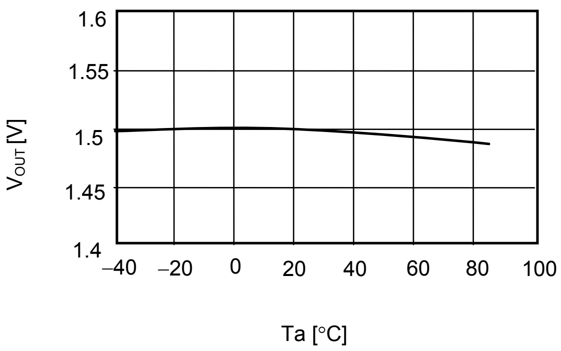


(4) Dropout voltage vs. Set output voltage

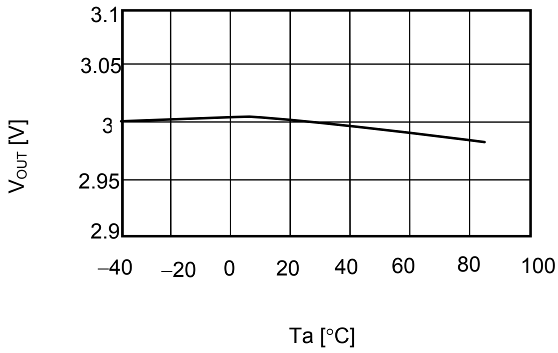


(5) Output voltage vs. Ambient temperature

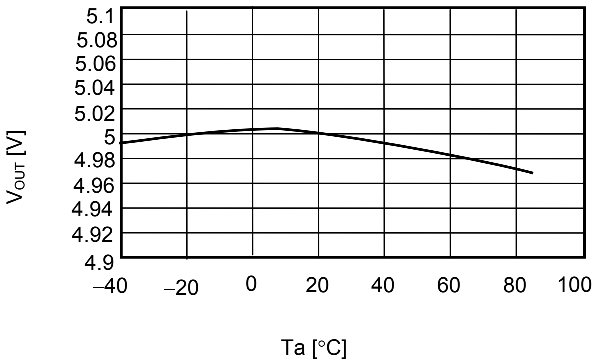
S-1131B15



S-1131B30

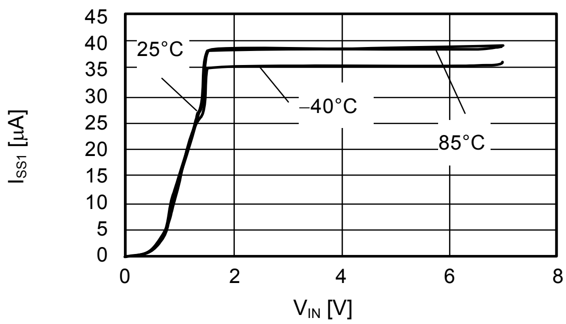


S-1131B50

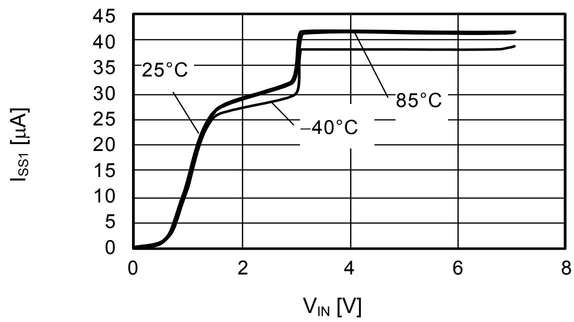


(6) Current consumption vs. Input voltage

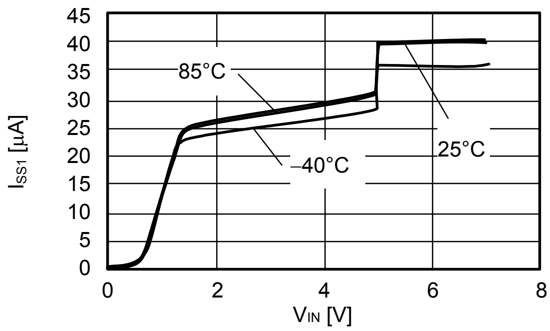
S-1131B15



S-1131B30

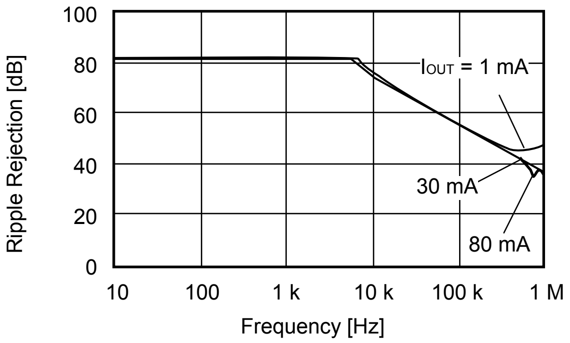


S-1131B50

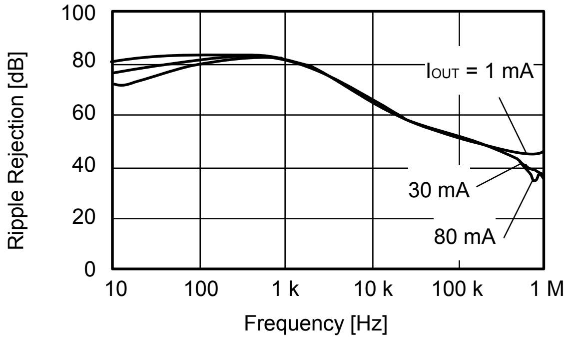


(7) Ripple rejection

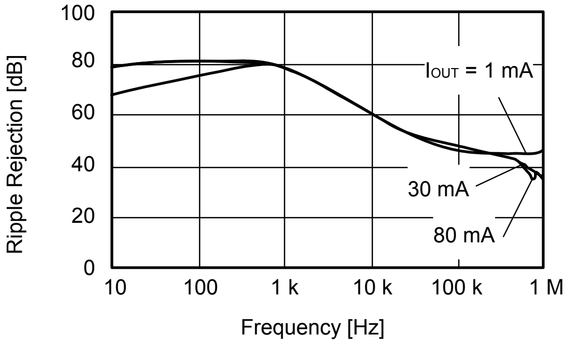
S-1131B15 (Ta = 25°C)
V_{IN} = 2.5 V, C_{OUT} = 2.2 μF



S-1131B30 (Ta = 25°C)
V_{IN} = 4.0 V, C_{OUT} = 2.2 μF



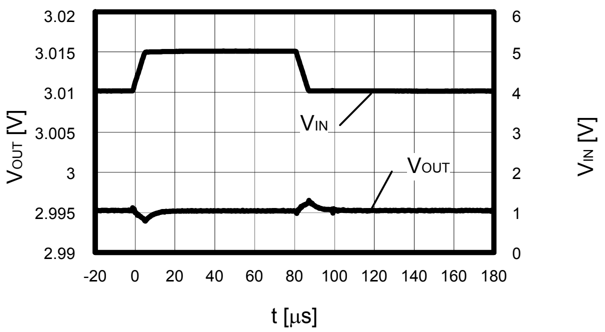
S-1131B50 (Ta = 25°C)
V_{IN} = 6.0 V, C_{OUT} = 2.2 μF



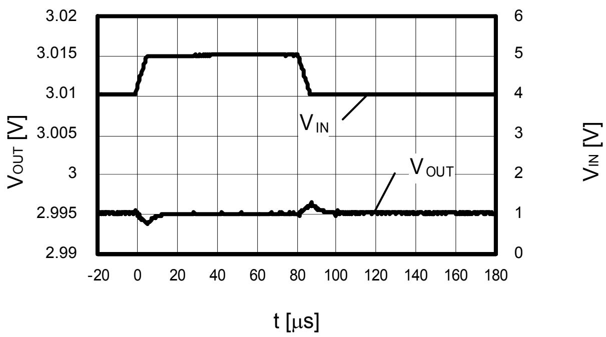
■ Reference Data

(1) Input transient response characteristics

I_{OUT} = 80 mA, t_r = t_f = 5.0 μs, C_{OUT} = 2.2 μF, C_{IN} = 0 μF

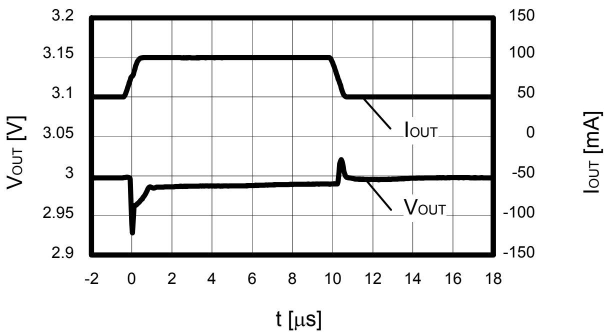


I_{OUT} = 80 mA, t_r = t_f = 5.0 μs, C_{OUT} = 4.7 μF, C_{IN} = 0 μF

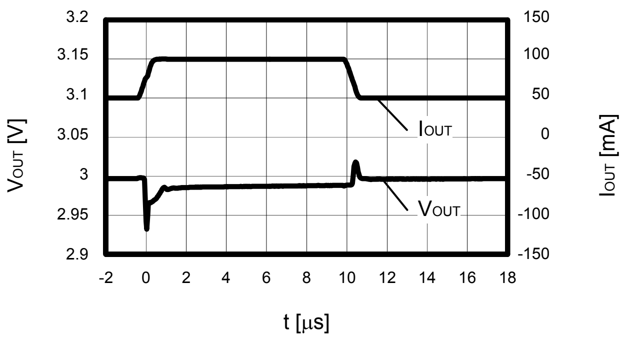


(2) Load transient response characteristics

V_{IN} = 4.0 V, C_{OUT} = 2.2 μF, C_{IN} = 1.0 μF,
I_{OUT} = 50 mA↔100 mA

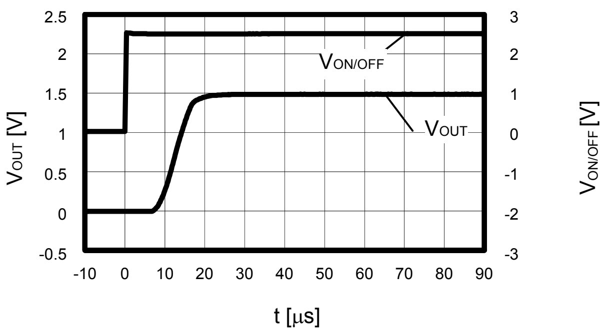


V_{IN} = 4.0 V, C_{OUT} = 4.7 μF, C_{IN} = 1.0 μF,
I_{OUT} = 50 mA↔100 mA

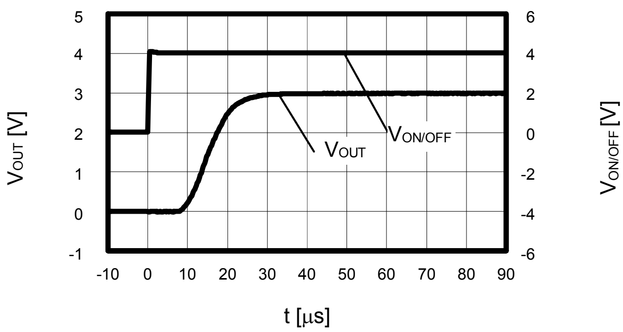


(3) ON/OFF pin transient response characteristics

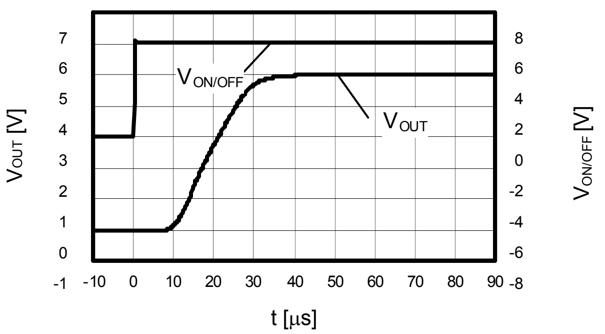
S-1131B15 (Ta = 25°C)
V_{IN} = 2.5 V, C_{OUT} = 2.2 μF, C_{IN} = 1.0 μF

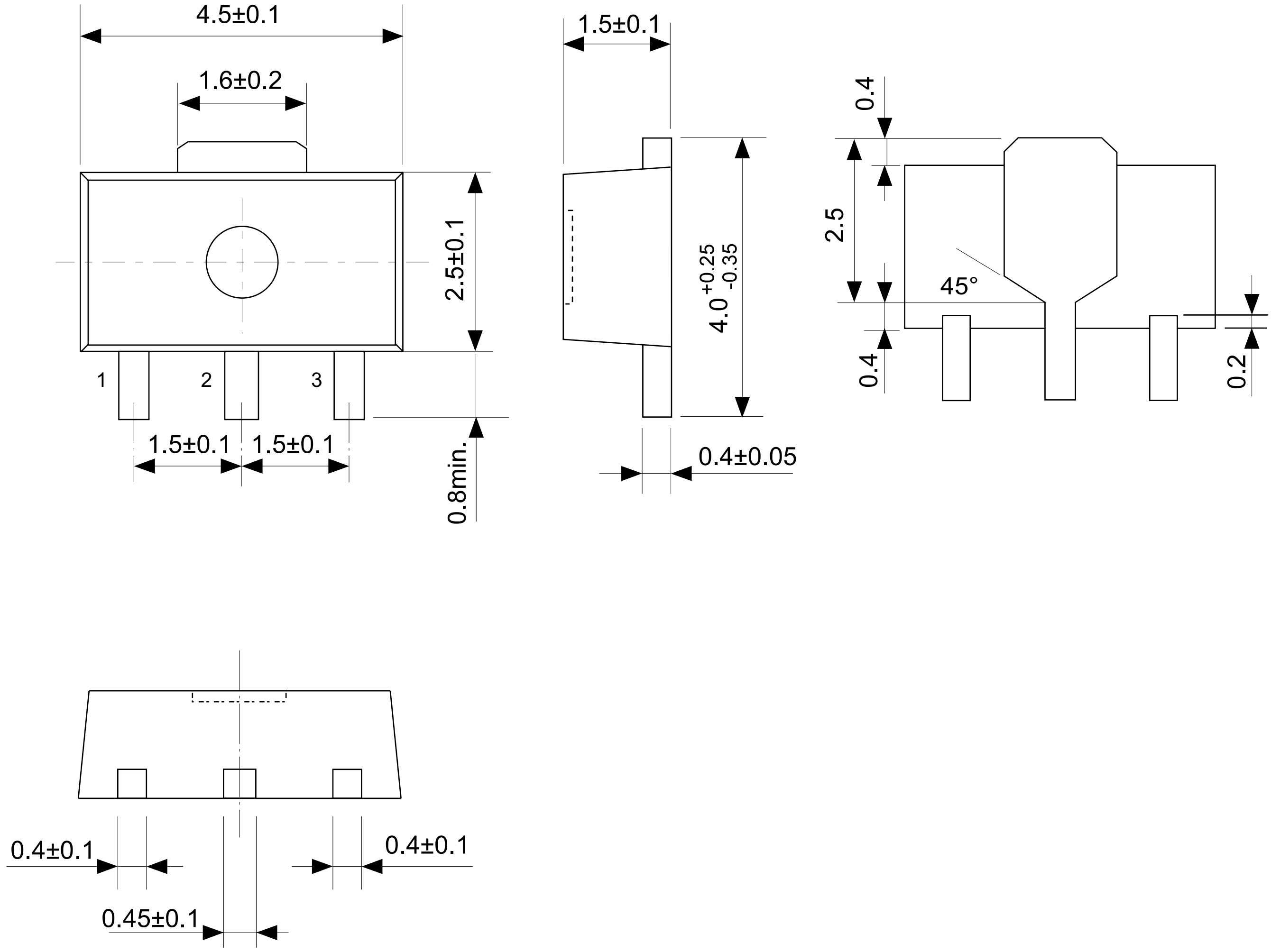


S-1131B30 (Ta = 25°C)
V_{IN} = 4.0 V, C_{OUT} = 2.2 μF, C_{IN} = 1.0 μF



S-1131B50 (Ta = 25°C)
V_{IN} = 6.0 V, C_{OUT} = 2.2 μF, C_{IN} = 1.0 μF





No. UP003-A-P-SD-2.0

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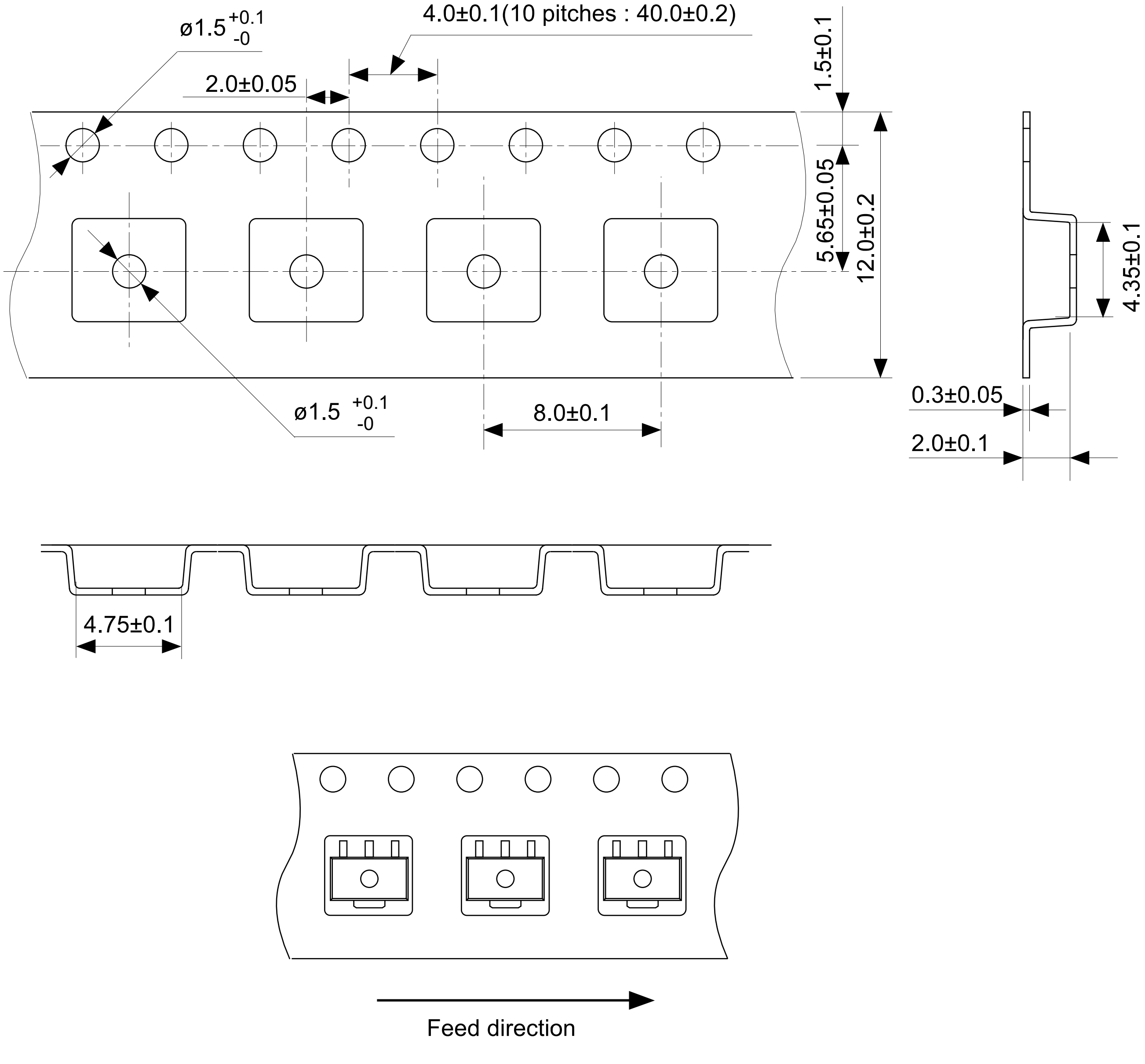
UNIT	mm

ABLIC Inc.



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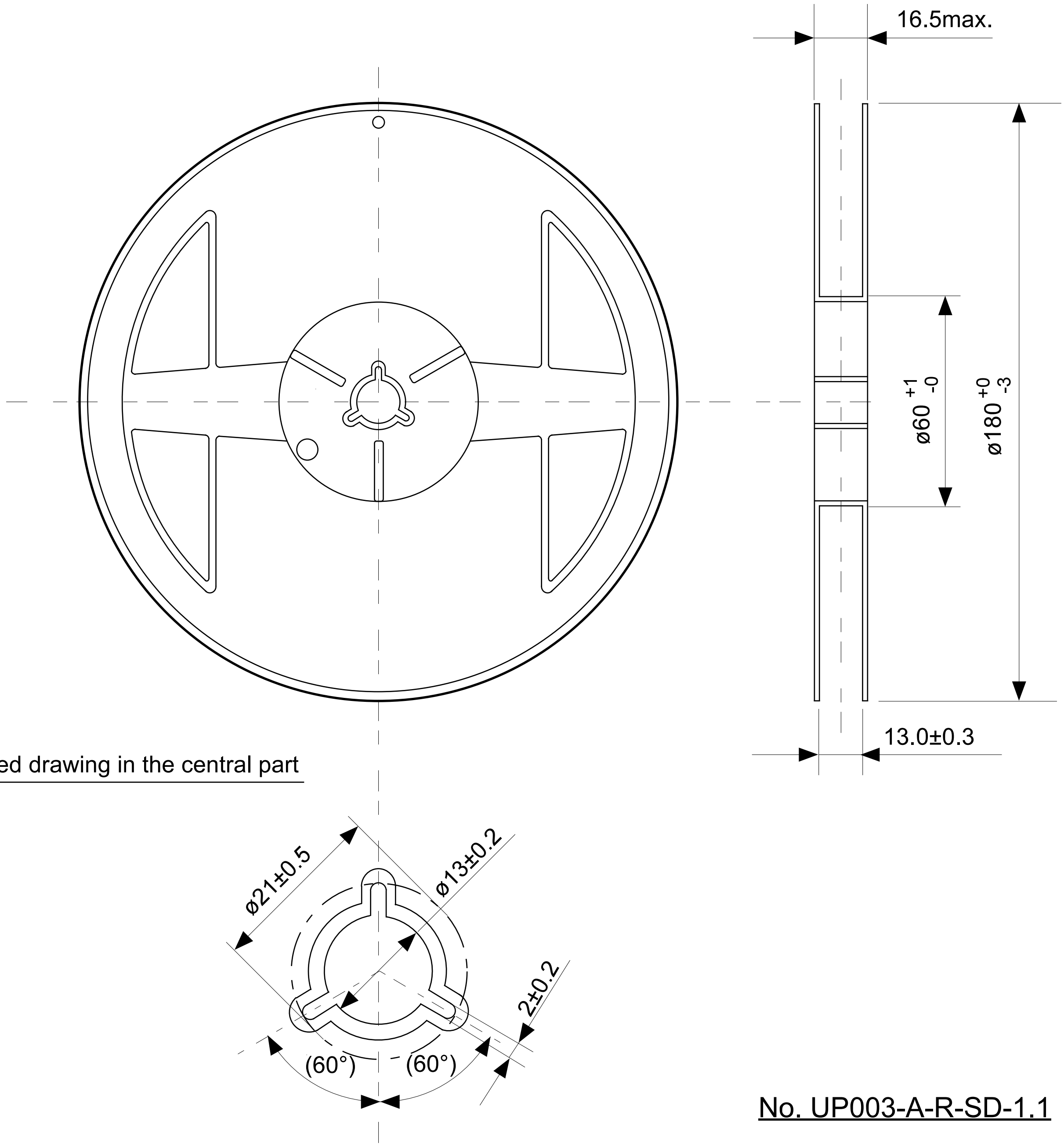
ABLIC Inc.



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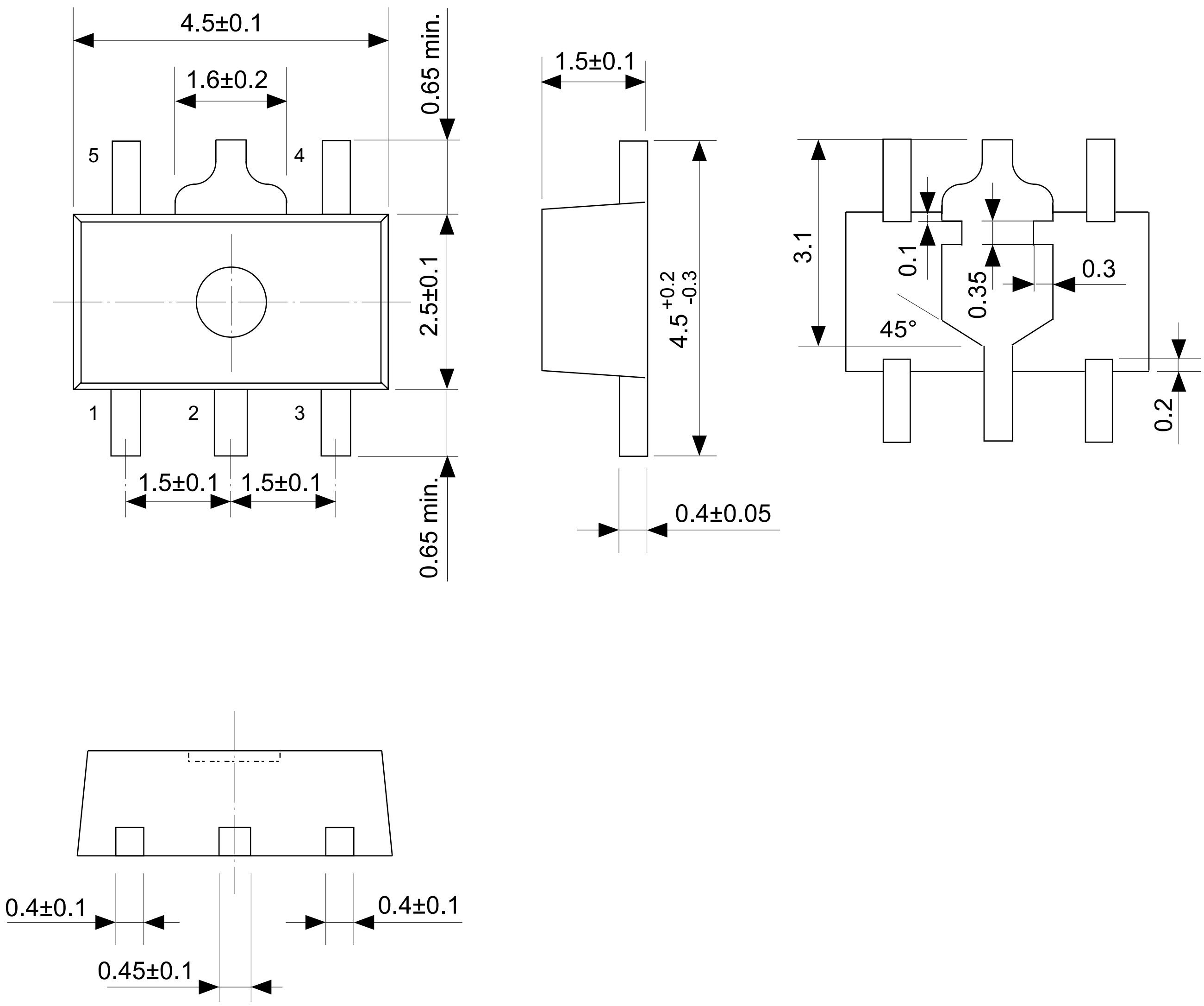
ABLIC Inc.			



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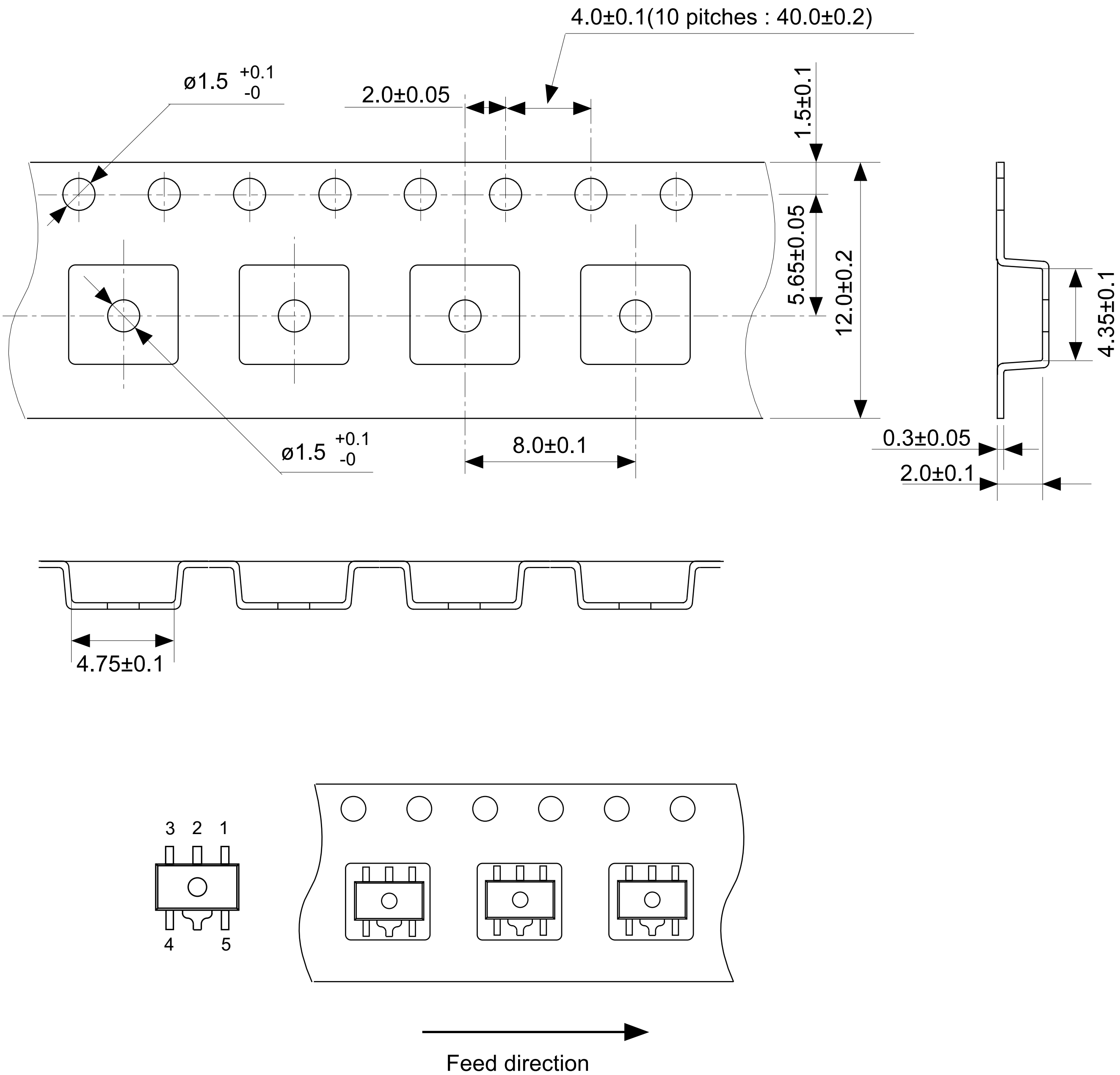

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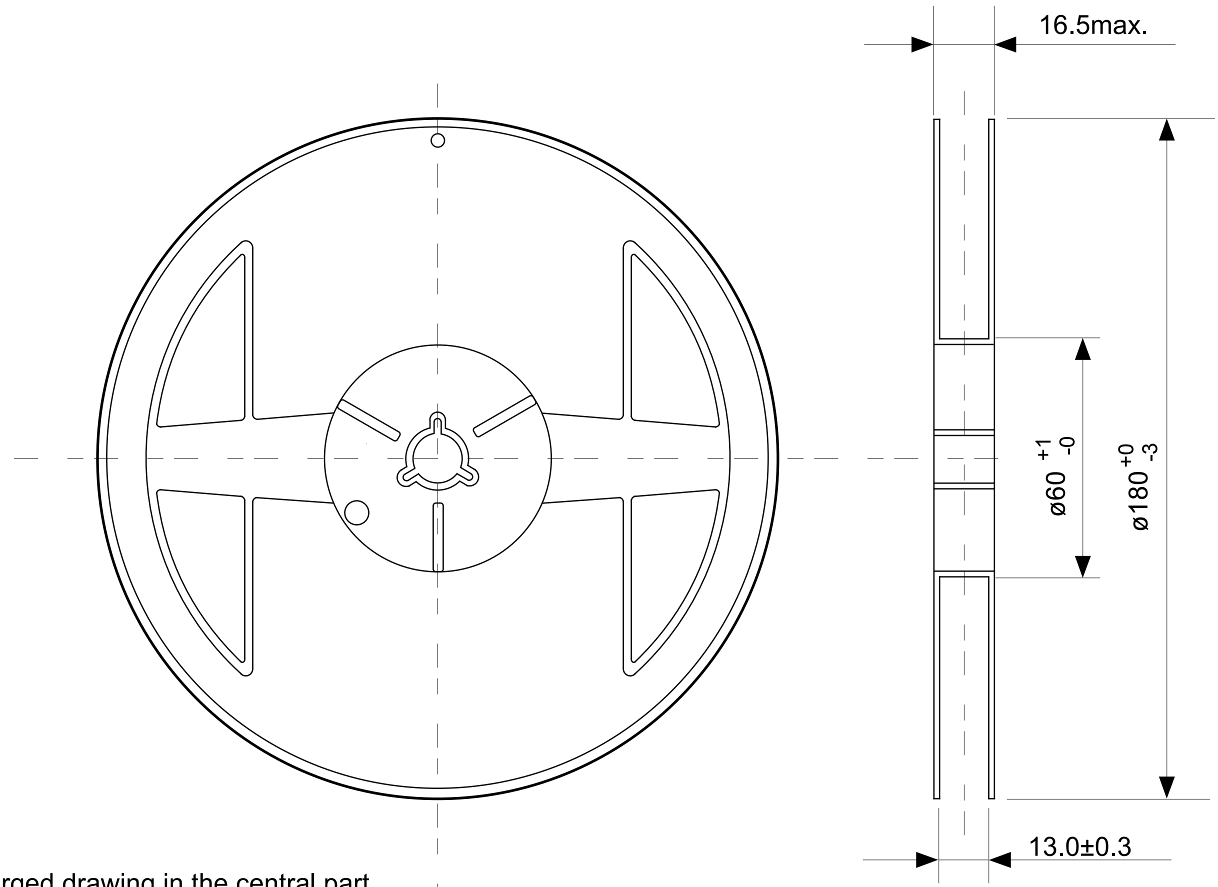
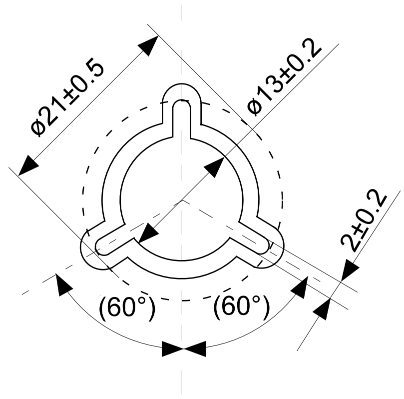


Enlarged drawing in the central part



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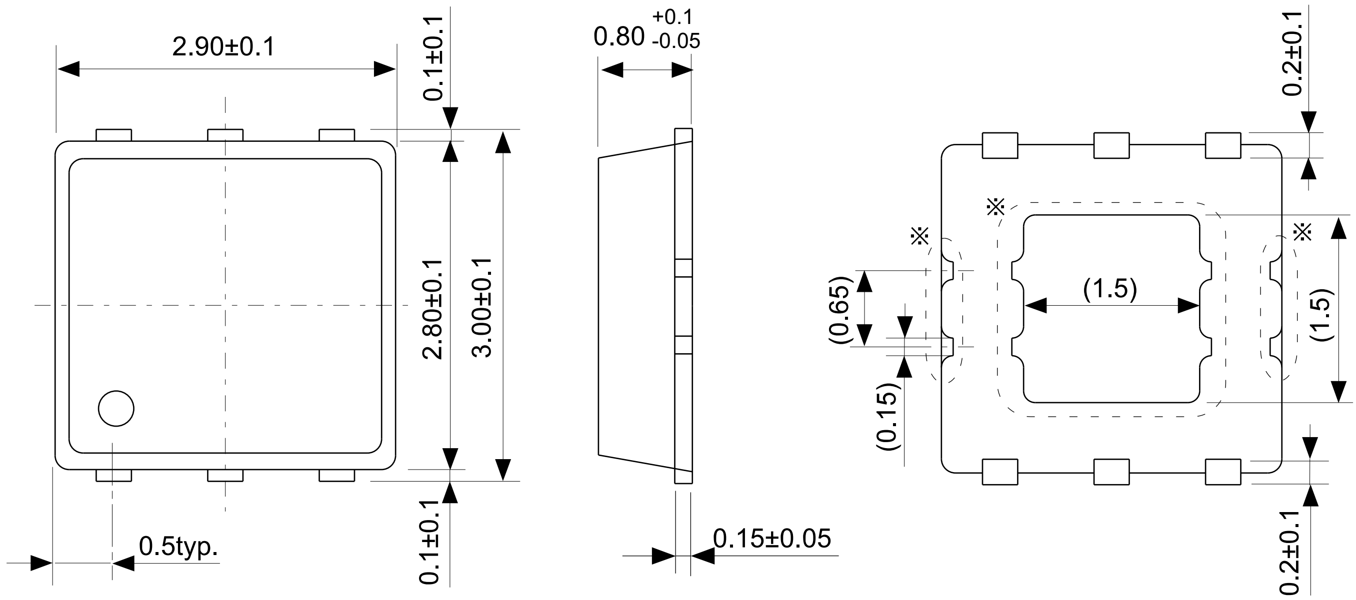

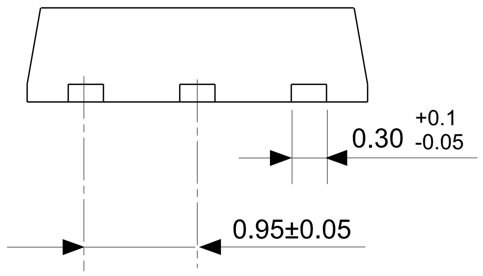

※ The exposed thermal die pad has different electric potential depending on the product. Confirm specifications of each product. Do not use it as the function of electrode.

No. PD006-A-P-SD-5.0

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No.	PD006-A-P-SD-5.0
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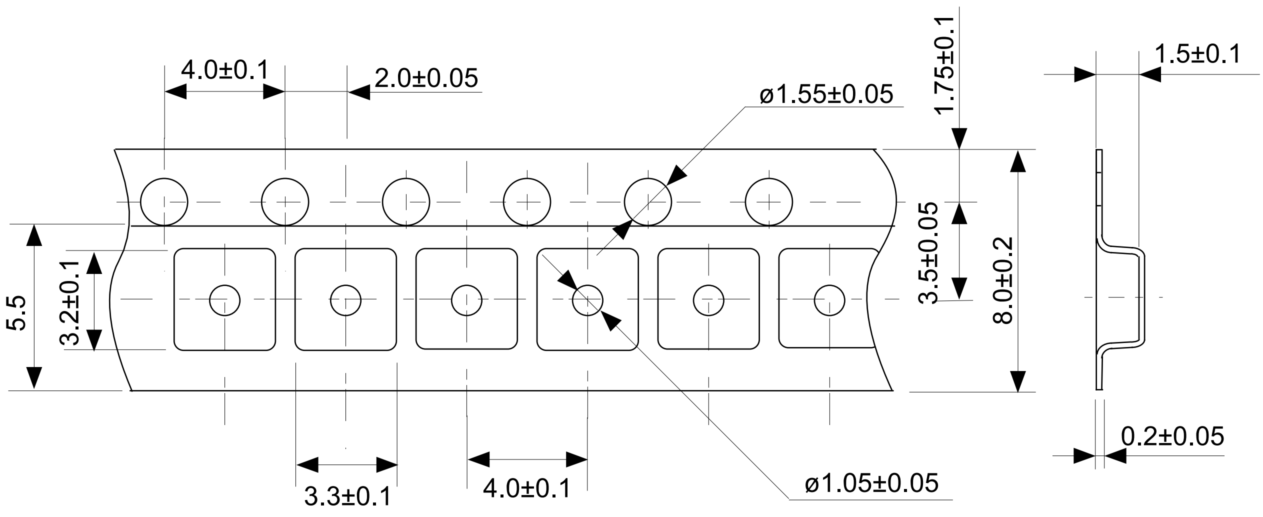
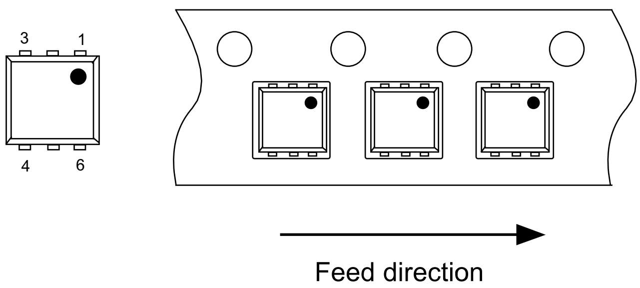
UNIT	mm

ABLIC Inc.





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No.	PD006-A-C-SD-2.0
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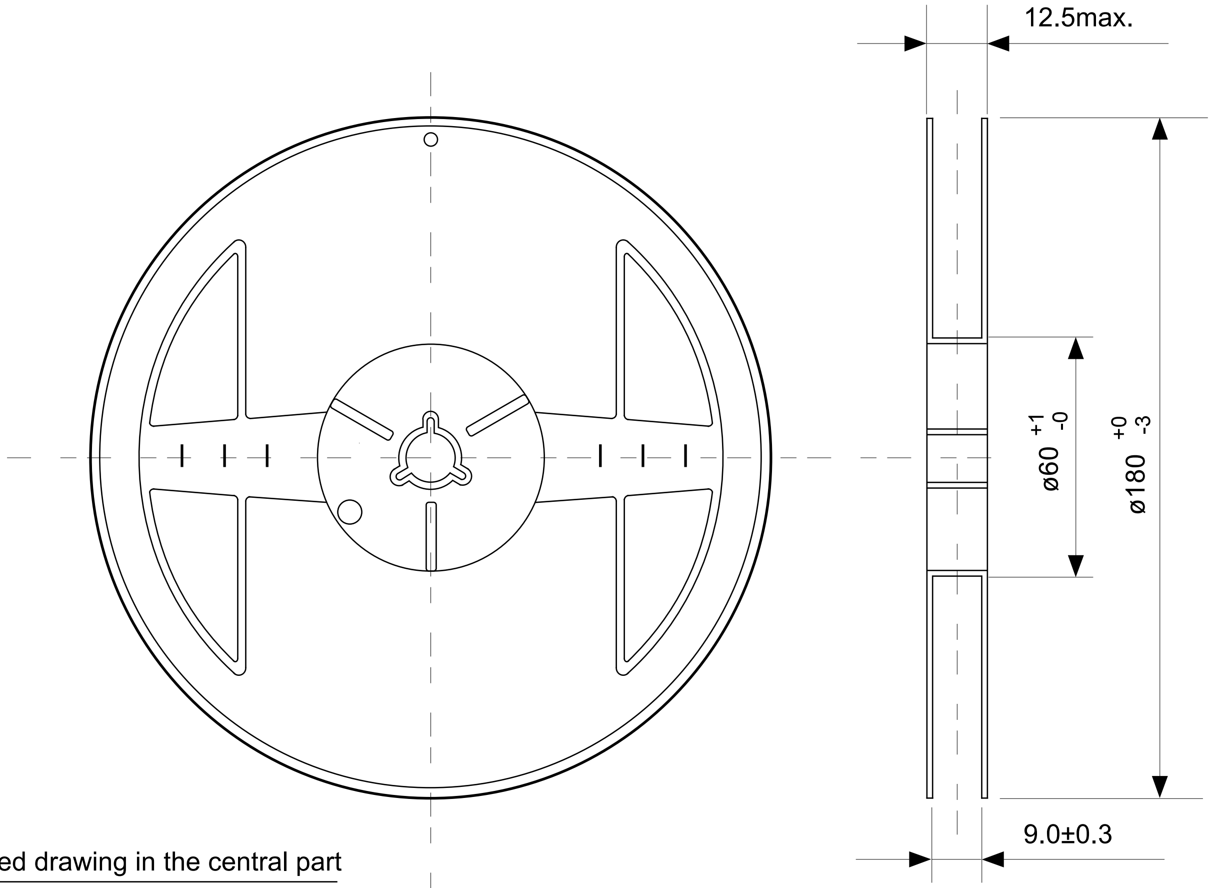
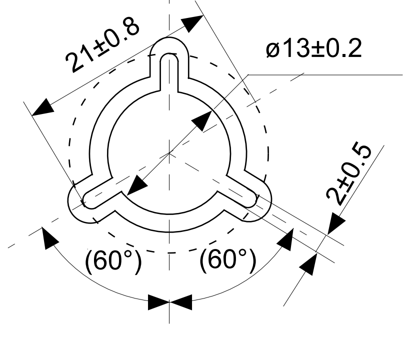
ABLIC Inc.



Enlarged drawing in the central part



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UNIT	mm		
ABLIC Inc.			

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