S-11L10 Series

3.65 V INPUT, 150 mA, LOW OUTPUT VOLTAGE (0.8 V) VOLTAGE REGULATOR

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The S-11L10 Series, developed by using the CMOS technology, is a positive voltage regulator IC which has low output voltage, high-accuracy output voltage and low current consumption (150 mA output current).
A 1.0 µF small ceramic capacitor can be used. It operates with low current consumption of 9 µA typ.
The overcurrent protection circuit prevents the load current from exceeding the current capacity of the output transistor. The ON / OFF circuit ensures longer battery life.
Various capacitors, also small ceramic capacitors, can be used for this IC more than for the conventional regulator ICs which have CMOS technology.
Furthermore, small SOT-23-5 and SNT-6A(H) packages realize high-density mounting.

■ Features

- Output voltage: 0.8 V to 3.3 V, selectable in 0.05 V step
- Input voltage: 1.2 V to 3.65 V
- Output voltage accuracy: ±1.0% (0.8 V to 1.45 V output product : ±15 mV)
- Dropout voltage: 210 mV typ. (1.5 V output product, I_{OUT} = 100 mA)
- Current consumption: During operation: 9 µA typ., 16 µA max.
  During power-off: 0.1 µA typ., 0.9 µA max.
- Output current: Possible to output 150 mA ($V_{IN} \geq V_{OUT(S)} + 1.0$ V)*1
- Input and output capacitors: A ceramic capacitor of 1.0 µF or more can be used.
- Ripple rejection: 60 dB typ. (1.25 V output product, f = 1.0 kHz)
- Built-in overcurrent protection circuit: Limits overcurrent of output transistor.
- Built-in ON / OFF circuit: Ensures long battery life.
  Discharge shunt function is available.
  Pull-down function “available” / “unavailable” is selectable.
- Operation temperature range: Ta = −40°C to +85°C
- Lead-free (Sn 100%), halogen-free

***1.** Attention should be paid to the power dissipation of the package when the output current is large.

■ Applications

- Power supply for battery-powered device
- Power supply for mobile phone
- Power supply for portable equipment

■ Packages

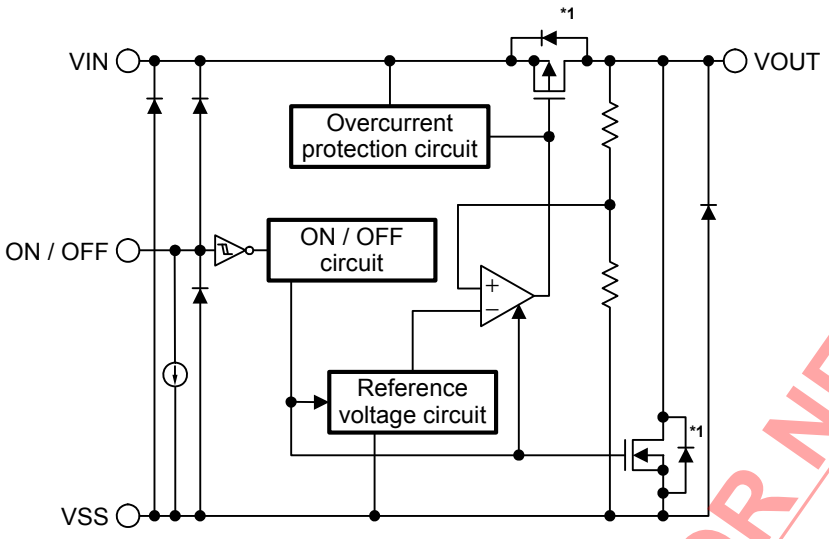
- SOT-23-5
- SNT-6A(H)

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■ Block Diagrams

1. S-11L10 Series B type

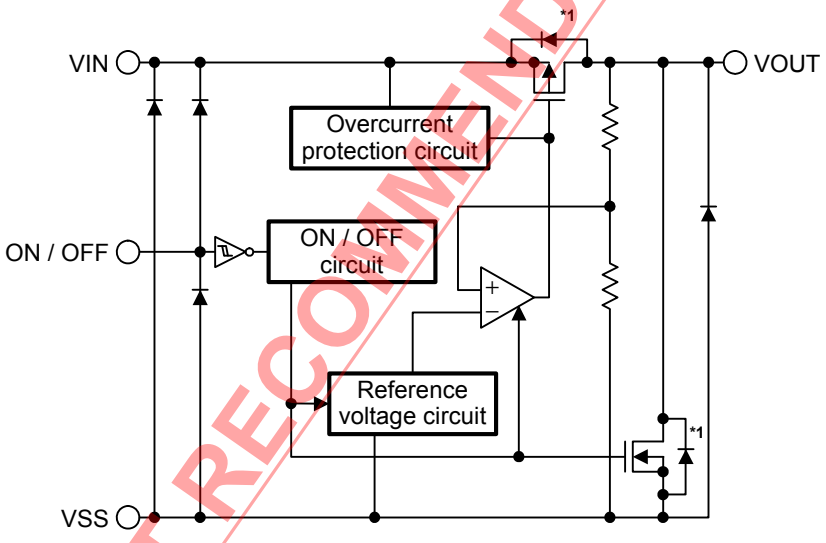


Function	Status
ON / OFF logic	Active “H”
Constant current source pull-down	Available

*1. Parasitic diode

Figure 1

2. S-11L10 Series D type



Function	Status
ON / OFF logic	Active “H”
Constant current source pull-down	Unavailble

*1. Parasitic diode

Figure 2

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■ Product Name Structure

Users can select the product type, output voltage, and package type for the S-11L10 Series. Refer to "**1. Product name**" regarding the contents of product name, "**2. Function list of product type**" regarding the product type, "**3. Package**" regarding the package drawings, "**4. Product name list**" regarding details of the product name.

1. Product name

S-11L10 x xx - xxxx U

- Environmental code
  - U: Lead-free (Sn 100%), halogen-free
- Package abbreviation and IC packing specifications*1
  - M5T1: SOT-23-5, Tape
  - I6T2: SNT-6A(H), Tape
- Output voltage*2
  - 08 to 33
  - (e.g., when the output voltage is 1.0 V, it is expressed as 10.)
- Product type*3
  - B or D

***1.** Refer to the tape drawing.
***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	Constant Current Source Pull-down
B	Active "H"	Available
D	Active "H"	Unavailble

3. Packages

Package Name	Drawing Code			
	Package	Tape	Reel	Land
SOT-23-5	MP005-A-P-SD	MP005-A-C-SD	MP005-A-R-SD	—
SNT-6A(H)	PI006-A-P-SD	PI006-A-C-SD	PI006-A-R-SD	PI006-A-L-SD

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4. Product name list

4. 1 S-11L10 Series B type

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

Table 2

Output voltage	SOT-23-5	SNT-6A(H)
0.8 V±15 mV	S-11L10B08-M5T1U	S-11L10B08-I6T2U
0.9 V±15 mV	S-11L10B09-M5T1U	S-11L10B09-I6T2U
1.0 V±15 mV	S-11L10B10-M5T1U	S-11L10B10-I6T2U
1.1 V±15 mV	S-11L10B11-M5T1U	S-11L10B11-I6T2U
1.2 V±15 mV	S-11L10B12-M5T1U	S-11L10B12-I6T2U
1.3 V±15 mV	S-11L10B13-M5T1U	S-11L10B13-I6T2U
1.4 V±15 mV	S-11L10B14-M5T1U	S-11L10B14-I6T2U
1.5 V±1.0%	S-11L10B15-M5T1U	S-11L10B15-I6T2U
1.6 V±1.0%	S-11L10B16-M5T1U	S-11L10B16-I6T2U
1.7 V±1.0%	S-11L10B17-M5T1U	S-11L10B17-I6T2U
1.8 V±1.0%	S-11L10B18-M5T1U	S-11L10B18-I6T2U
1.9 V±1.0%	S-11L10B19-M5T1U	S-11L10B19-I6T2U
2.0 V±1.0%	S-11L10B20-M5T1U	S-11L10B20-I6T2U
2.1 V±1.0%	S-11L10B21-M5T1U	S-11L10B21-I6T2U
2.2 V±1.0%	S-11L10B22-M5T1U	S-11L10B22-I6T2U
2.3 V±1.0%	S-11L10B23-M5T1U	S-11L10B23-I6T2U
2.4 V±1.0%	S-11L10B24-M5T1U	S-11L10B24-I6T2U
2.5 V±1.0%	S-11L10B25-M5T1U	S-11L10B25-I6T2U
2.6 V±1.0%	S-11L10B26-M5T1U	S-11L10B26-I6T2U
2.7 V±1.0%	S-11L10B27-M5T1U	S-11L10B27-I6T2U
2.8 V±1.0%	S-11L10B28-M5T1U	S-11L10B28-I6T2U
2.9 V±1.0%	S-11L10B29-M5T1U	S-11L10B29-I6T2U
3.0 V±1.0%	S-11L10B30-M5T1U	S-11L10B30-I6T2U
3.1 V±1.0%	S-11L10B31-M5T1U	S-11L10B31-I6T2U
3.2 V±1.0%	S-11L10B32-M5T1U	S-11L10B32-I6T2U
3.3 V±1.0%	S-11L10B33-M5T1U	S-11L10B33-I6T2U

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

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4. 2 S-11L10 Series D type

ON / OFF logic: Active “H” Constant current source pull-down: Unavailable

Table 3

Output voltage	SOT-23-5	SNT-6A(H)
0.8 V±15 mV	S-11L10D08-M5T1U	S-11L10D08-I6T2U
0.9 V±15 mV	S-11L10D09-M5T1U	S-11L10D09-I6T2U
1.0 V±15 mV	S-11L10D10-M5T1U	S-11L10D10-I6T2U
1.1 V±15 mV	S-11L10D11-M5T1U	S-11L10D11-I6T2U
1.2 V±15 mV	S-11L10D12-M5T1U	S-11L10D12-I6T2U
1.3 V±15 mV	S-11L10D13-M5T1U	S-11L10D13-I6T2U
1.4 V±15 mV	S-11L10D14-M5T1U	S-11L10D14-I6T2U
1.5 V±1.0%	S-11L10D15-M5T1U	S-11L10D15-I6T2U
1.6 V±1.0%	S-11L10D16-M5T1U	S-11L10D16-I6T2U
1.7 V±1.0%	S-11L10D17-M5T1U	S-11L10D17-I6T2U
1.8 V±1.0%	S-11L10D18-M5T1U	S-11L10D18-I6T2U
1.9 V±1.0%	S-11L10D19-M5T1U	S-11L10D19-I6T2U
2.0 V±1.0%	S-11L10D20-M5T1U	S-11L10D20-I6T2U
2.1 V±1.0%	S-11L10D21-M5T1U	S-11L10D21-I6T2U
2.2 V±1.0%	S-11L10D22-M5T1U	S-11L10D22-I6T2U
2.3 V±1.0%	S-11L10D23-M5T1U	S-11L10D23-I6T2U
2.4 V±1.0%	S-11L10D24-M5T1U	S-11L10D24-I6T2U
2.5 V±1.0%	S-11L10D25-M5T1U	S-11L10D25-I6T2U
2.6 V±1.0%	S-11L10D26-M5T1U	S-11L10D26-I6T2U
2.7 V±1.0%	S-11L10D27-M5T1U	S-11L10D27-I6T2U
2.8 V±1.0%	S-11L10D28-M5T1U	S-11L10D28-I6T2U
2.9 V±1.0%	S-11L10D29-M5T1U	S-11L10D29-I6T2U
3.0 V±1.0%	S-11L10D30-M5T1U	S-11L10D30-I6T2U
3.1 V±1.0%	S-11L10D31-M5T1U	S-11L10D31-I6T2U
3.2 V±1.0%	S-11L10D32-M5T1U	S-11L10D32-I6T2U
3.3 V±1.0%	S-11L10D33-M5T1U	S-11L10D33-I6T2U

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

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■ Pin Configuration

1. SOT-23-5

Top view

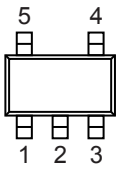


Figure 3

Table 4

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 pin or VSS pin.

2. SNT-6A(H)

Top view

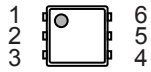


Figure 4

Table 5

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	VSS	GND pin
6	VIN	Input voltage pin

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

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■ Absolute Maximum Ratings

Table 6

(Ta = +25°C unless otherwise specified)

Item		Symbol	Absolute Maximum Rating	Unit
Input voltage		V_{IN}	V_{SS} – 0.3 to V_{SS} + 4.0	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-23-5	P_D	600*1	mW
	SNT-6A(H)		500*1	mW
Operation ambient temperature		T_{opr}	–40 to +85	°C
Storage temperature		T_{stg}	–40 to +125	°C

*1. When mounted on board
[Mounted board]
(1) Board size: 114.3 mm × 76.2 mm × t1.6 mm
(2) Name: JEDEC STANDARD51-7

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

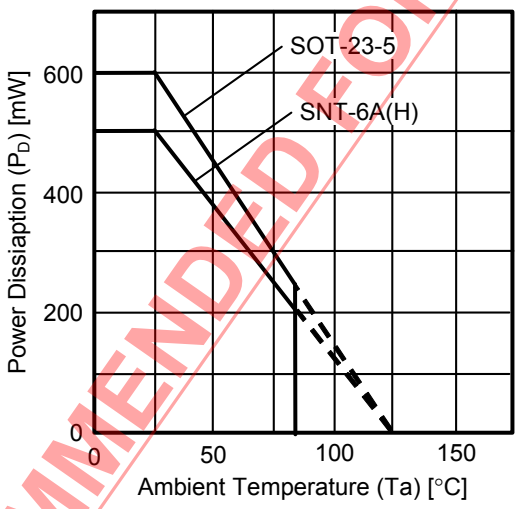


Figure 5 Power Dissipation of Package (When Mounted on Board)

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■ Electrical Characteristics

Table 7 (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	0.8 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 ≤ $V_{OUT(S)}$ ≤ 2.65 V	$V_{OUT(S)} \times 0.99$	$V_{OUT(S)}$	$V_{OUT(S)} \times 1.01$	V	1
		V_{IN} = 3.65 V, I_{OUT} = 30 mA	2.65 V < $V_{OUT(S)}$ ≤ 3.3 V	$V_{OUT(S)} \times 0.99$	$V_{OUT(S)}$	$V_{OUT(S)} \times 1.01$	V	1
Output current*2	I_{OUT}	$V_{IN} \geq V_{OUT(S)} + 1.0$ V	0.8 V ≤ $V_{OUT(S)}$ ≤ 2.65 V	150*5	—	—	mA	3
		V_{IN} = 3.65 V	2.65 V < $V_{OUT(S)}$ ≤ 3.3 V	150*5	—	—	mA	3
Dropout voltage*3	V_{drop}	I_{OUT} = 100 mA	0.8 V ≤ $V_{OUT(S)}$ < 1.1 V	0.40	0.44	0.48	V	1
			1.1 V ≤ $V_{OUT(S)}$ < 1.3 V	—	0.28	0.42	V	1
			1.3 V ≤ $V_{OUT(S)}$ < 1.5 V	—	0.24	0.36	V	1
			1.5 V ≤ $V_{OUT(S)}$ < 1.7 V	—	0.21	0.32	V	1
			1.7 V ≤ $V_{OUT(S)}$ ≤ 3.3 V	—	0.19	0.29	V	1
Line regulation	$\frac{\Delta V_{OUT1}}{\Delta V_{IN} \bullet V_{OUT}}$	$V_{OUT(S)}$ + 0.5 V ≤ V_{IN} ≤ 3.65 V, I_{OUT} = 30 mA	0.8 V ≤ $V_{OUT(S)}$ < 2.9 V	—	0.05	0.2	%/V	1
		3.4 V ≤ V_{IN} ≤ 3.65 V, I_{OUT} = 30 mA	2.9 V ≤ $V_{OUT(S)}$ ≤ 3.3 V	—	0.05	0.2	%/V	1
Load regulation	ΔV_{OUT2}	$V_{IN} = V_{OUT(S)} + 1.0$ V, 10 µA ≤ I_{OUT} ≤ 100 mA	0.8 V ≤ $V_{OUT(S)}$ ≤ 2.65 V	—	20	40	mV	1
		V_{IN} = 3.65 V, 10 µA ≤ I_{OUT} ≤ 100 mA	2.65 V < $V_{OUT(S)}$ ≤ 3.3 V	—	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} = 30 mA, –40°C ≤ Ta ≤ +85°C	0.8 V ≤ $V_{OUT(S)}$ ≤ 2.65 V	—	±150	—	ppm/°C	1
		V_{IN} = 3.65 V, I_{OUT} = 30 mA, –40°C ≤ Ta ≤ +85°C	2.65 V < $V_{OUT(S)}$ ≤ 3.3 V	—	±150	—	ppm/°C	1
Current consumption during operation	I_{SS1}	$V_{IN} = V_{OUT(S)} + 1.0$ V, ON / OFF pin = ON, no load	0.8 V ≤ $V_{OUT(S)}$ ≤ 2.65 V	—	9	16	µA	2
		V_{IN} = 3.65 V, ON / OFF pin = ON, no load	2.65 V < $V_{OUT(S)}$ ≤ 3.3 V	—	9	16	µA	2
Current consumption during power-off	I_{SS2}	$V_{IN} = V_{OUT(S)} + 1.0$ V, ON / OFF pin = OFF, no load	0.8 V ≤ $V_{OUT(S)}$ ≤ 2.65 V	—	0.1	0.9	µA	2
		V_{IN} = 3.65 V, ON / OFF pin = OFF, no load	2.65 V < $V_{OUT(S)}$ ≤ 3.3 V	—	0.1	0.9	µA	2

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Table 7 (2 / 2)

(Ta = +25°C unless otherwise specified)

Item	Symbol	Conditions		Min.	Typ.	Max.	Unit	Test Circuit
Input voltage	V_{IN}	—		1.2	—	3.65	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	0.8 V ≤ $V_{OUT(S)}$ ≤ 2.65 V	0.9	—	—	V	4
		$V_{IN} = 3.65$ V, $R_L = 1.0$ kΩ, determined by V_{OUT} output level	2.65 V < $V_{OUT(S)}$ ≤ 3.3 V	0.9	—	—	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	0.8 V ≤ $V_{OUT(S)}$ ≤ 2.65 V	—	—	0.2	V	4
		$V_{IN} = 3.65$ V, $R_L = 1.0$ kΩ, determined by V_{OUT} output level	2.65 V < $V_{OUT(S)}$ ≤ 3.3 V	—	—	0.2	V	4
ON / OFF pin input current "H"	I_{SH}	$V_{IN} = 3.65$ V, $V_{ON / OFF} = 3.65$ V	B type	0.05	—	0.55	µA	4
			D type	−0.1	—	0.1	µA	4
ON / OFF pin input current "L"	I_{SL}	$V_{IN} = 3.65$ 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, $\Delta V_{rip} = 0.5$ Vrms, $I_{OUT} = 30$ mA	0.8 V ≤ $V_{OUT(S)}$ ≤ 1.25 V	—	60	—	dB	5
			1.25 V < $V_{OUT(S)}$ ≤ 2.65 V	—	55	—	dB	5
		$V_{IN} = 3.65$ V, f = 1.0 kHz, $\Delta V_{rip} = 0.5$ Vrms, $I_{OUT} = 30$ mA	2.65 V < $V_{OUT(S)}$ ≤ 3.3 V	—	55	—	dB	5
Short-circuit current	I_{short}	$V_{IN} = V_{OUT(S)} + 1.0$ V, ON / OFF pin = ON, $V_{OUT} = 0$ V	0.8 V ≤ $V_{OUT(S)}$ ≤ 2.65 V	—	150	—	mA	3
		$V_{IN} = 3.65$ V, ON / OFF pin = ON, $V_{OUT} = 0$ V	2.65 V < $V_{OUT(S)}$ ≤ 3.3 V	—	150	—	mA	3
Discharge shunt resistance during power-off	R_{LOW}	$V_{OUT} = 0.1$ V, $V_{IN} = 3.65$ V		—	100	—	Ω	3

***1.** $V_{OUT(S)}$: Set output voltage
$V_{OUT(E)}$: Actual output voltage
Output voltage when fixing I_{OUT}(= 30 mA) and inputting $V_{OUT(S)}$ +1.0 V or 3.65 V

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

***3.** $V_{drop} = V_{IN1} - (V_{OUT3} \times 0.98)$
V_{OUT3} is the output voltage when $V_{IN} = V_{OUT(S)} + 1.0$ V or 3.65 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 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

***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.

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■ Test Circuits

1.

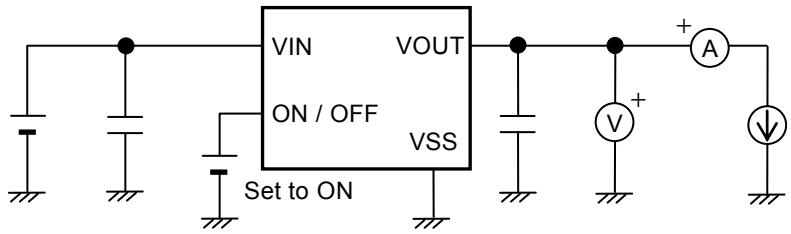


Figure 6

2.

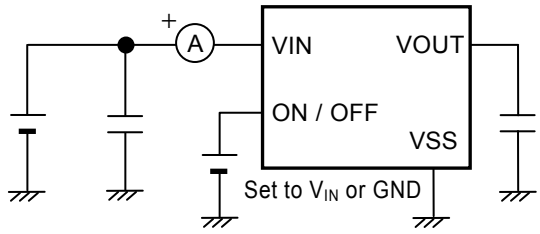


Figure 7

3.

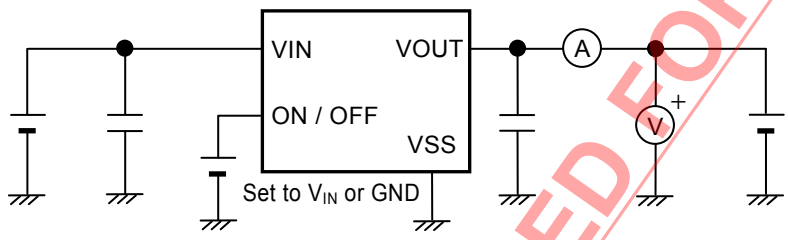


Figure 8

4.

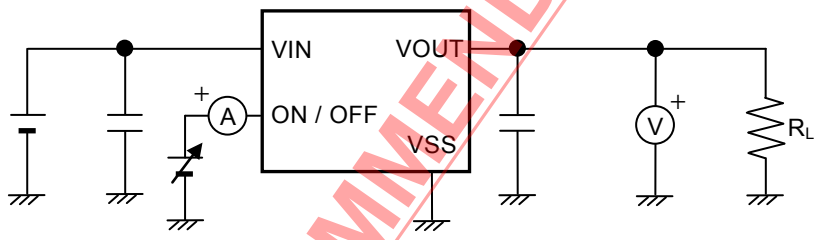


Figure 9

5.

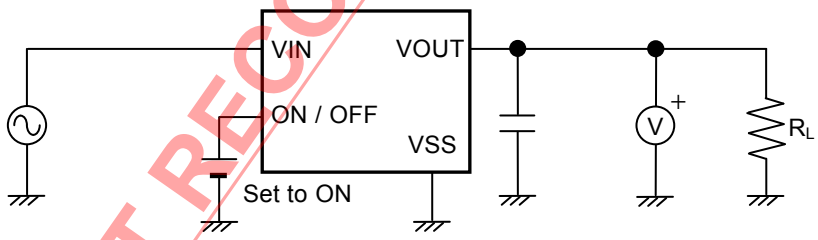
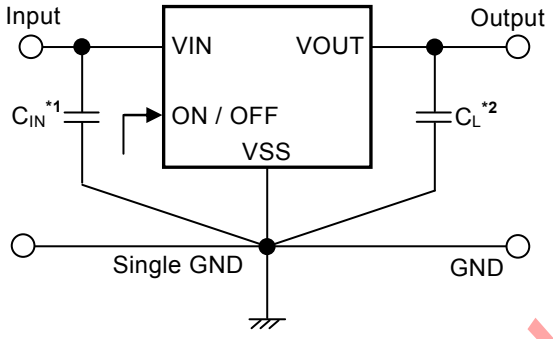


Figure 10

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■ Standard Circuit



*1. C_{IN} is a capacitor for stabilizing the input.
*2. A ceramic capacitor of 1.0 µF or more can be used as C_L.

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): 1.0 µF or more

Caution Generally a series regulator may cause oscillation, depending on the selection of external parts. 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-11L10 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 1.0 µF or more over the entire temperature range. When using an OS capacitor, a tantalum capacitor, or an aluminum electrolytic capacitor, the capacitance must be 1.0 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 $C_{IN} \geq 1.0$ µF, $C_L \geq 1.0$ µF; however, when selecting the output capacitor, perform sufficient evaluation, including evaluation of temperature characteristics, on the actual device.

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■ 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% or ±15 mV[*1] under the specified conditions of fixed input voltage[*2], fixed output current, and fixed temperature.

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

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

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

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

4. Load regulation (ΔV_{OUT2})

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

5. Dropout voltage (V_{drop})

Indicates the difference between input voltage (V_{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.

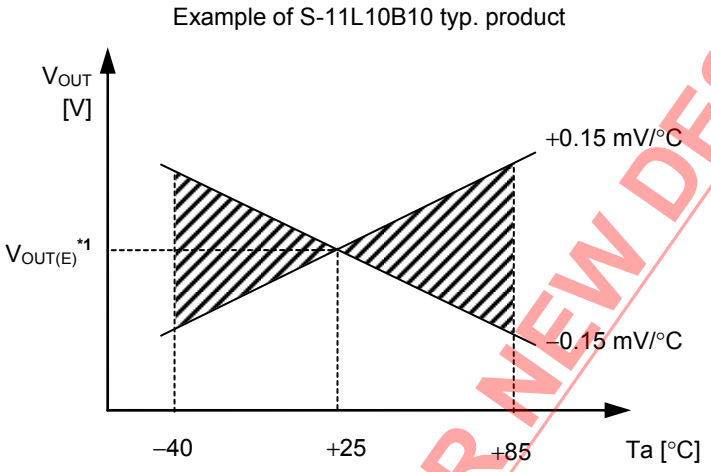
$V_{drop} = V_{IN1} - (V_{OUT3} \times 0.98)$

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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 ±150 ppm/°C.



***1.** $V_{OUT(E)}$ 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

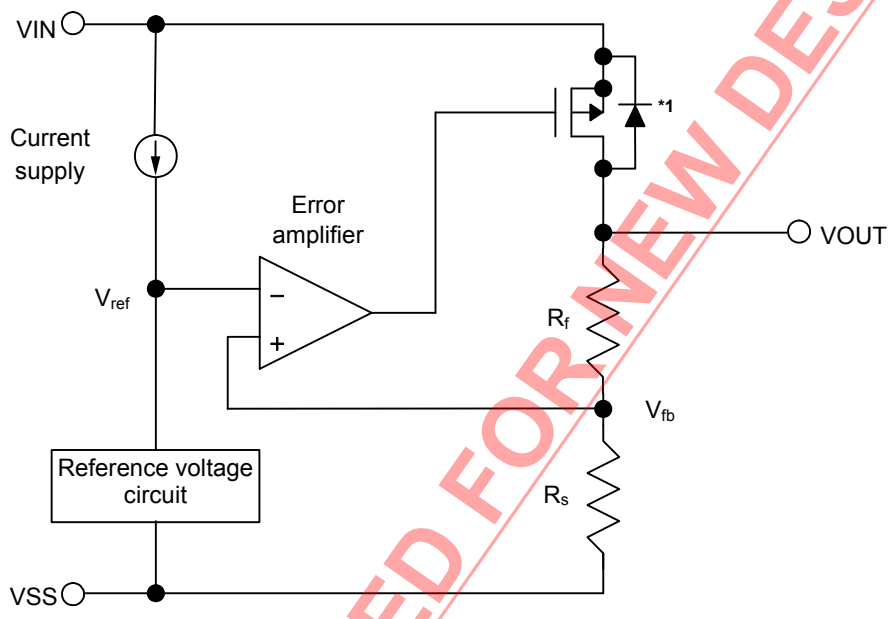
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■ Operation

1. Basic operation

Figure 13 shows the block diagram of the S-11L10 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-11L10 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}.

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3. ON / OFF pin

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.

Since the S-11L10 Series has a built-in discharge shunt circuit to discharge the output capacitance, the VOUT pin is forcibly set to the V_{SS} level. The ON / OFF pin is configured as shown in **Figure 14** and **Figure 15**.

3. 1 S-11L10 Series B type

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

3. 2 S-11L10 Series D type

The ON / OFF pin is internally not pulled up or pulled down, so do not use this pin in the floating status. When not using the ON / OFF pin, connect it to the VIN pin.

Caution Under high temperature in the S-11L10 Series, this IC's current consumption may increase if applying voltage of 0.2 V to 0.9 V to the ON / OFF pin.

Table 8

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

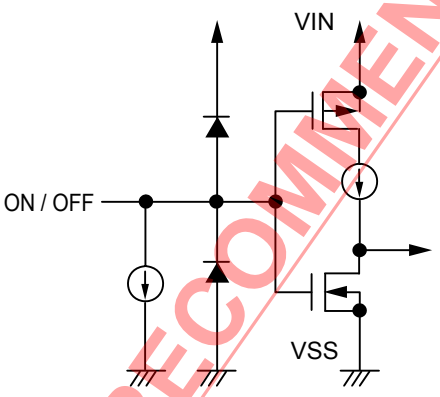


Figure 14 S-11L10 Series B Type

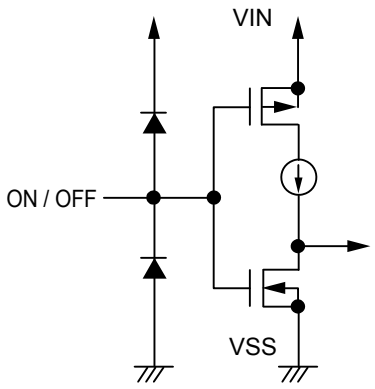


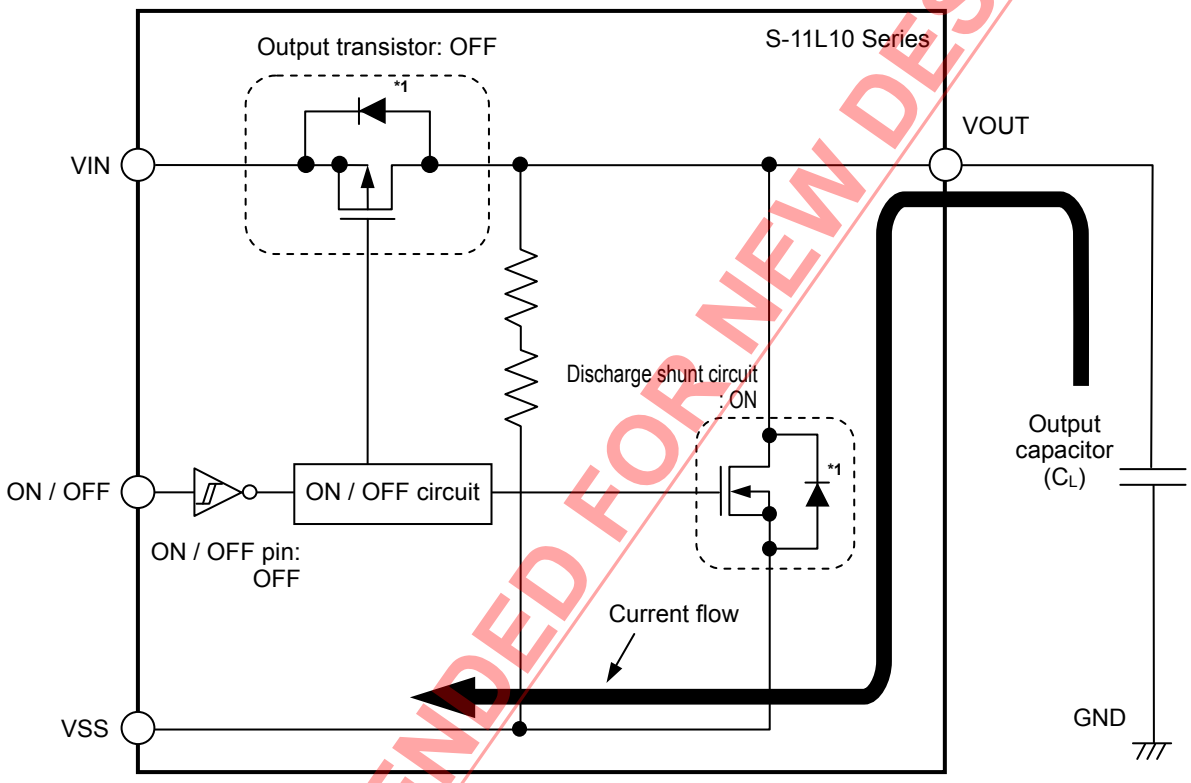
Figure 15 S-11L10 Series D Type

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4. Discharge shunt function

The S-11L10 Series has a built-in discharge shunt circuit to discharge the output capacitance. When the ON / OFF pin is set to OFF level, turns the output transistor off, and turns the discharge shunt function on so that the output capacitor discharges. The VOUT pin is set to the V_{SS} level faster, compared to the product which does not have a discharge shunt circuit.



***1**. Parasitic diode

Figure 16

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5. Overcurrent protection circuit

The S-11L10 Series includes 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 pin and VSS pin. The current when the output pin is short-circuited (I_{short}) is internally set at approx. 150 mA typ., and the normal value is restored for the output voltage, if releasing a short circuit once.

Caution This overcurrent protection circuit does not work as for thermal protection. If this IC long keeps short circuiting inside, pay attention to the conditions of input voltage and load current so that, under the usage conditions including short circuit, the loss of the IC will not exceed power dissipation of the package.

6. Constant current source pull-down (S-11L10 Series B type)

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

Note that the IC's current consumption increases as much as the constant current flows when the ON / OFF pin is connected to the VIN pin and the S-11L10 Series B type is operating.

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■ 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 (100 μA or less).
- Note that generally the output voltage may increase due to the leakage current from an output driver when a series regulator is used at high temperature.
- At high temperature, the current consumption of the S-11L10 Series may increase if applying voltage of 0.2 V to 0.9 V to the ON / OFF pin.
- The S-11L10 Series may oscillate if power supply's inductance is high. Select an input capacitor after performing sufficient evaluation under the actual usage conditions including evaluation of temperature characteristics.
- Generally a series regulator may cause oscillation, depending on the selection of external parts. The following conditions are recommended for the S-11L10 Series. However, be sure to perform sufficient evaluation under the actual usage conditions for selection, including evaluation of temperature characteristics. Refer to "**5. Example of Equivalent Series Resistance vs. Output Current Characteristics (Ta = +25°C)**" in "**■ Reference Data**" for the equivalent series resistance (R_{ESR}) of the output capacitor.

  Input capacitor (C_{IN}): 1.0 μF or more
  Output capacitor (C_L): 1.0 μF or more

- 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, power supply's fluctuation and the characteristics of load fluctuation become worse. Sufficiently evaluate the output voltage's fluctuation with the actual device.
- 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 7** 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.

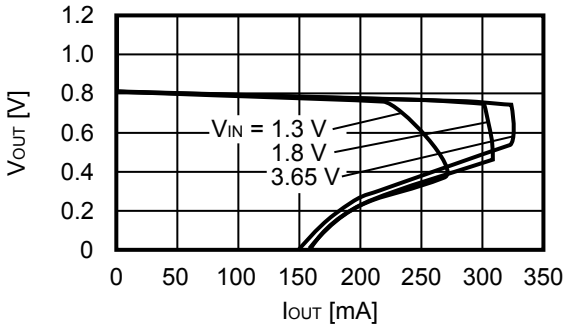
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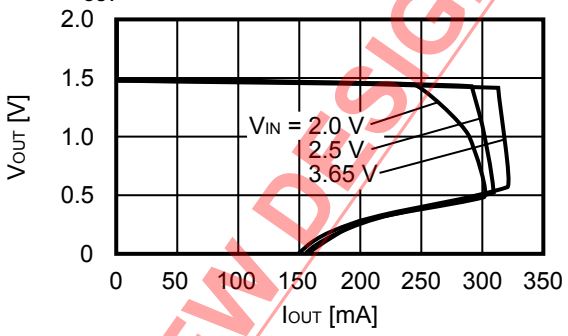
■ Characteristics (Typical Data)

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

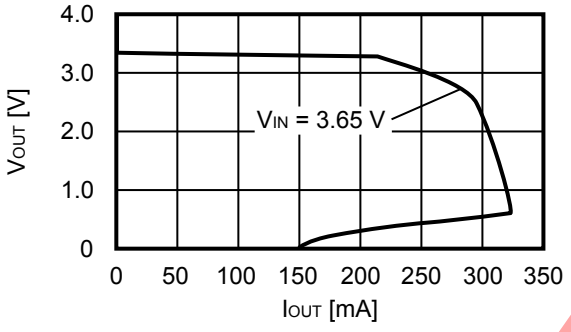
1. 1 V_{OUT} = 0.8 V



1. 2 V_{OUT} = 1.5 V



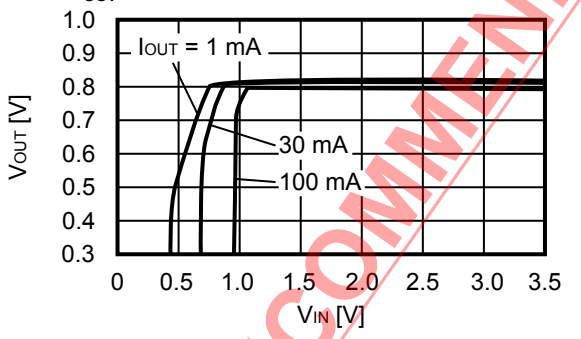
1. 3 V_{OUT} = 3.3 V



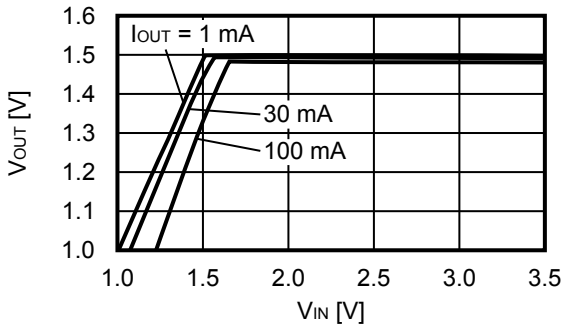
Remark In determining the output current, attention should be paid to the following.
1. The minimum output current value and footnote ***5** in **Table 7** in "■ **Electrical Characteristics**"
2. The package power dissipation

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

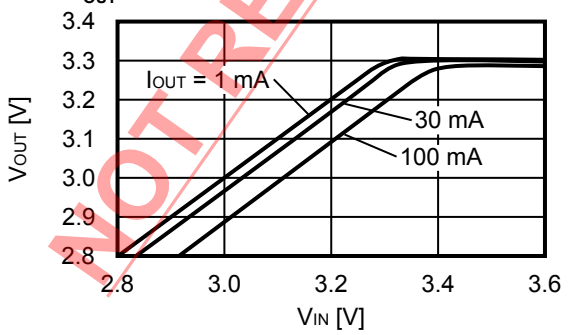
2. 1 V_{OUT} = 0.8 V



2. 2 V_{OUT} = 1.5 V



2. 3 V_{OUT} = 3.3 V

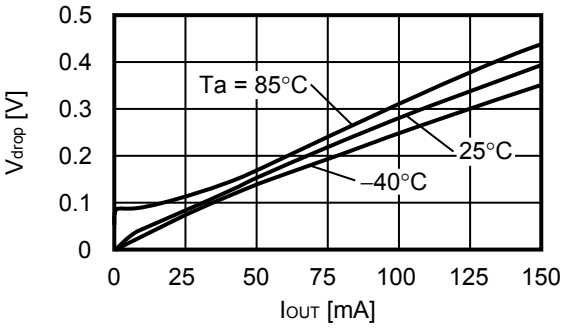


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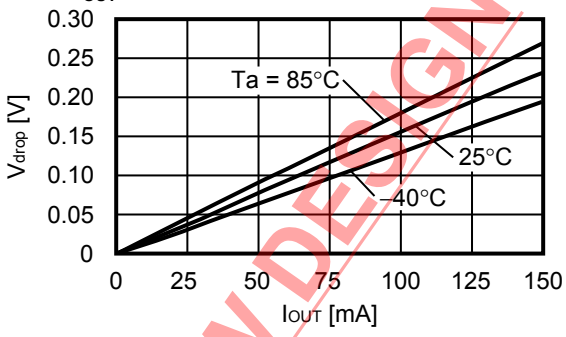
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3. Dropout Voltage vs. Output Current

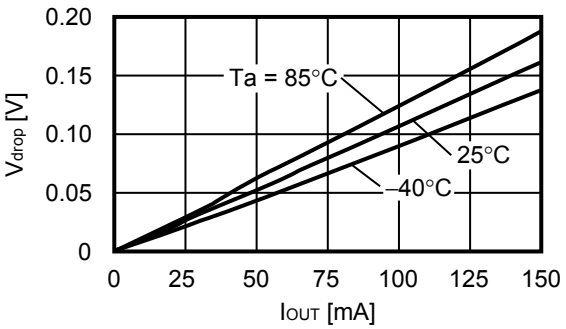
3. 1 V_{OUT} = 0.8 V



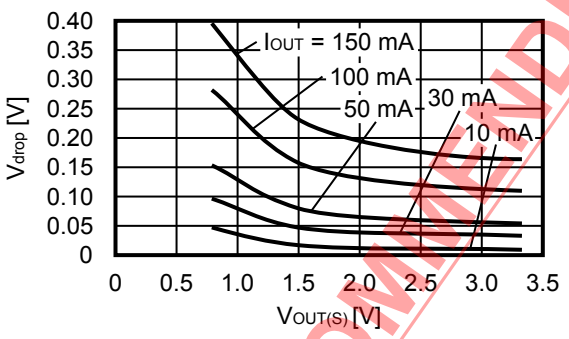
3. 2 V_{OUT} = 1.5 V



3. 3 V_{OUT} = 3.3 V



4. Dropout Voltage vs. Set Output Voltage

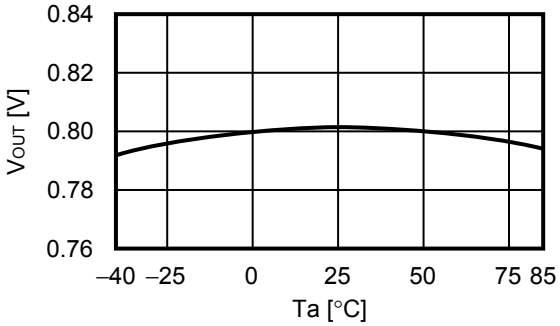


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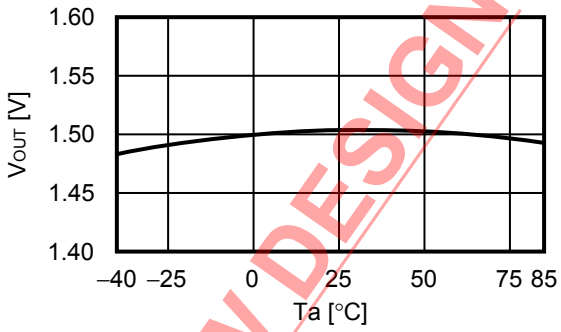
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5. Output Voltage vs. Ambient Temperature

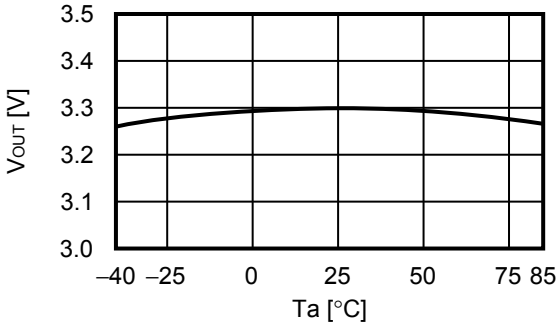
5. 1 V_{OUT} = 0.8 V



5. 2 V_{OUT} = 1.5 V

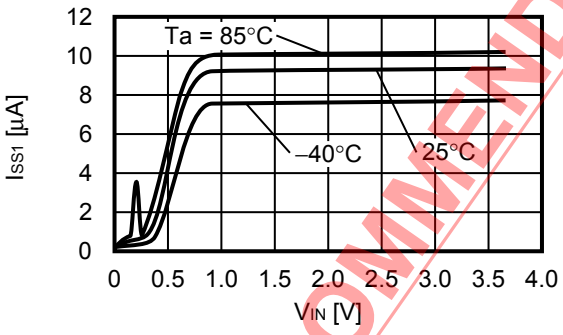


5. 3 V_{OUT} = 3.3 V

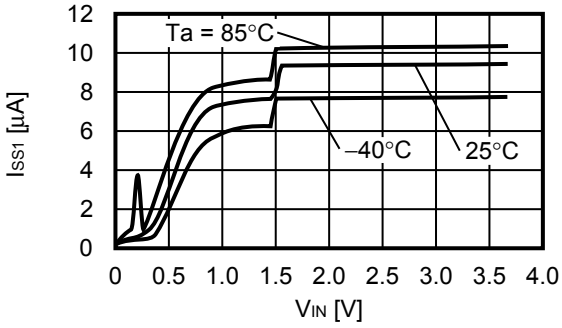


6. Current Consumption vs. Input Voltage

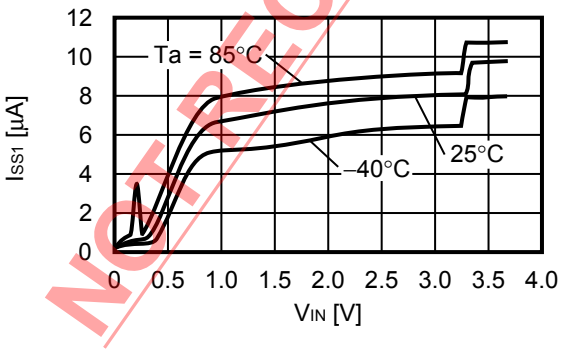
6. 1 V_{OUT} = 0.8 V



6. 2 V_{OUT} = 1.5 V



6. 3 V_{OUT} = 3.3 V

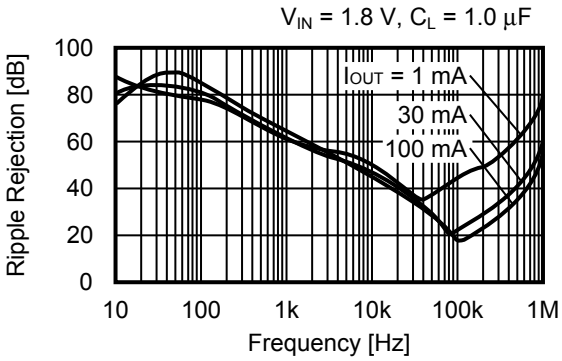


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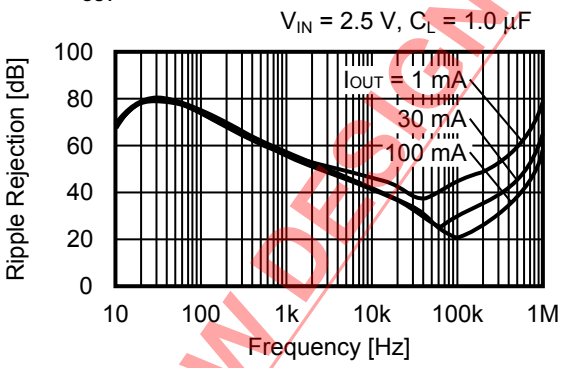
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7. Ripple Rejection (Ta = +25°C)

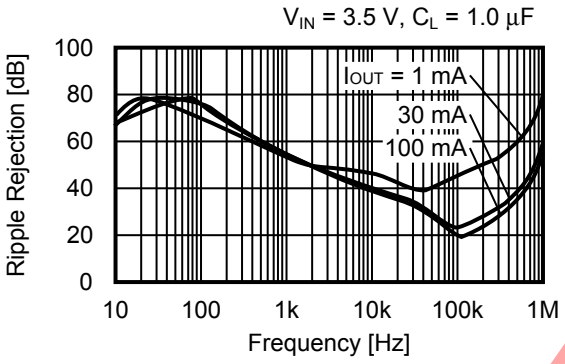
7. 1 V_{OUT} = 0.8 V



7. 2 V_{OUT} = 1.5 V



7. 3 V_{OUT} = 2.5 V



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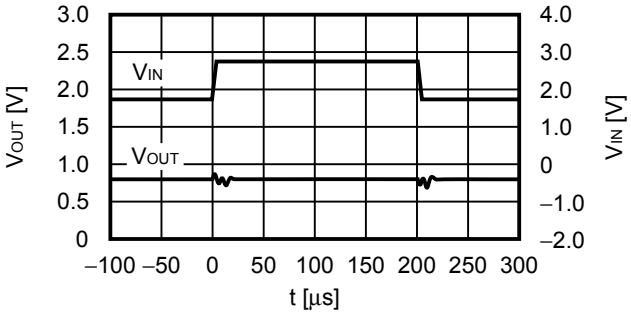
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■ Reference Data

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

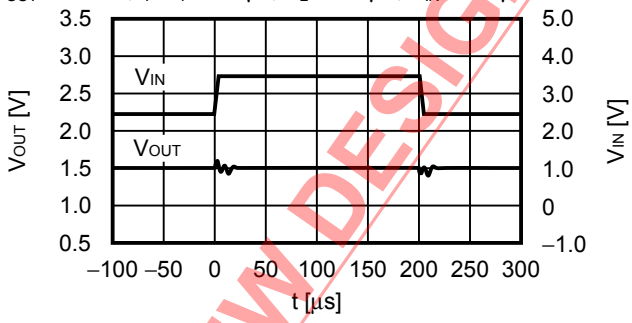
1. 1 V_{OUT} = 0.8 V

I_{OUT} = 30 mA, $t_r = t_f$ = 5.0 µs, C_L = 1.0 µF, C_{IN} = 1.0 µF



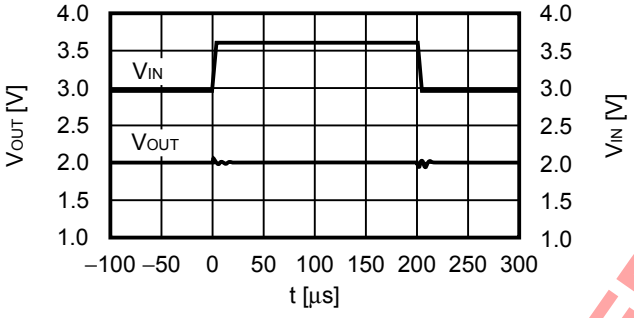
1. 2 V_{OUT} = 1.5 V

I_{OUT} = 30 mA, $t_r = t_f$ = 5.0 µs, C_L = 1.0 µF, C_{IN} = 1.0 µF



1. 3 V_{OUT} = 2.0 V

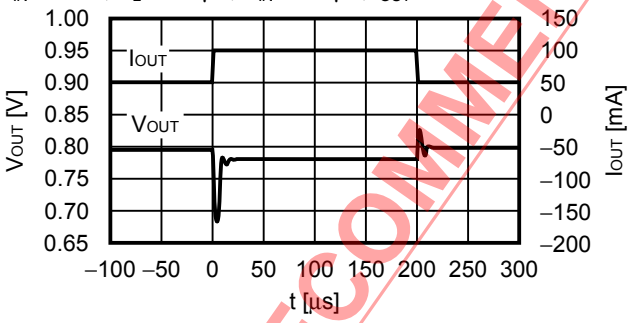
I_{OUT} = 30 mA, $t_r = t_f$ = 5.0 µs, C_L = 1.0 µF, C_{IN} = 1.0 µF



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

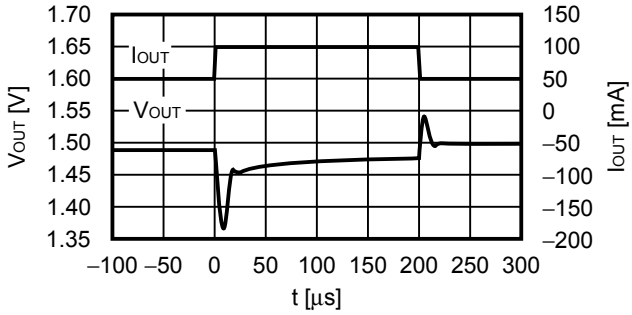
2. 1 V_{OUT} = 0.8 V

V_{IN} = 1.8 V, C_L = 1.0 µF, C_{IN} = 1.0 µF, I_{OUT} = 50 mA ↔ 100 mA



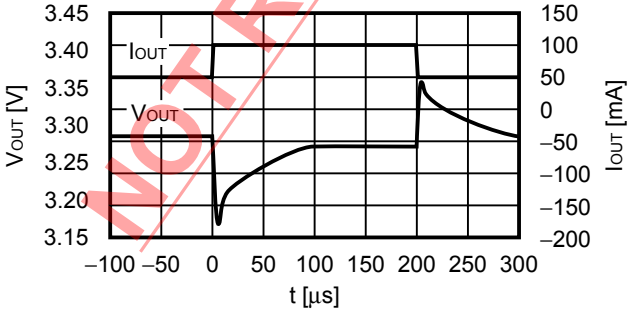
2. 2 V_{OUT} = 1.5 V

V_{IN} = 2.5 V, C_L = 1.0 µF, C_{IN} = 1.0 µF, I_{OUT} = 50 mA ↔ 100 mA



2. 3 V_{OUT} = 3.3 V

V_{IN} = 3.65 V, C_L = 1.0 µF, C_{IN} = 1.0 µF, I_{OUT} = 50 mA ↔ 100 mA



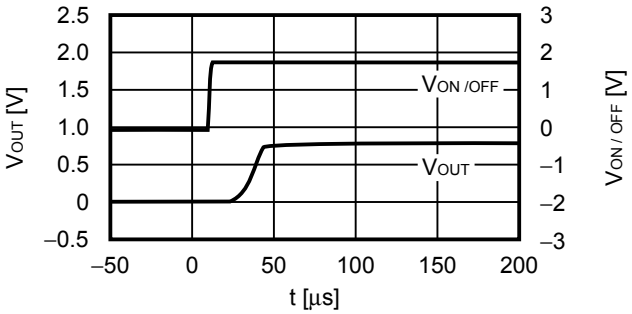
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3. Transient Response Characteristics of ON / OFF Pin (Ta = +25°C)

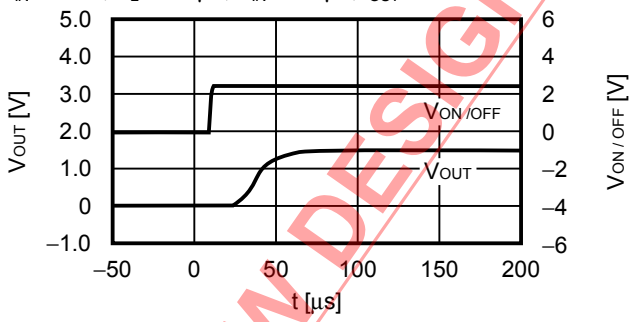
3. 1 V_{OUT} = 0.8 V

V_{IN} = 1.8 V, C_L = 1.0 µF, C_{IN} = 1.0 µF, I_{OUT} = 100 mA



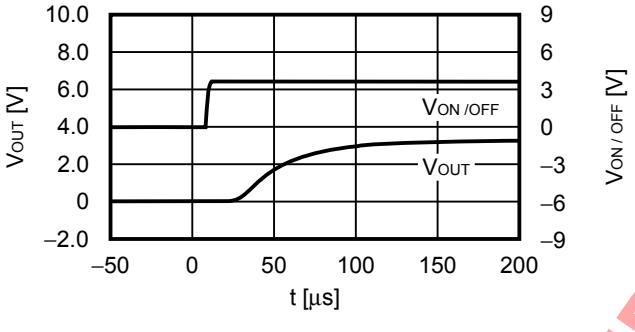
3. 2 V_{OUT} = 1.5 V

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



3. 3 V_{OUT} = 3.3 V

V_{IN} = 3.65 V, C_L = 1.0 µF, C_{IN} = 1.0 µF, I_{OUT} = 100 mA



4. Output Capacitance vs. Characteristics of Discharge Time (Ta = +25°C)

V_{IN} = V_{OUT} + 1.0 V (max.: 3.65 V), I_{OUT} = no load
$V_{ON/OFF}$ = V_{OUT} + 1.0 V → V_{SS}, t_f = 1 µs

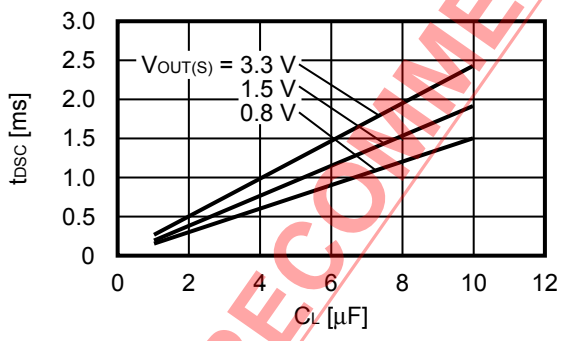


Figure 17

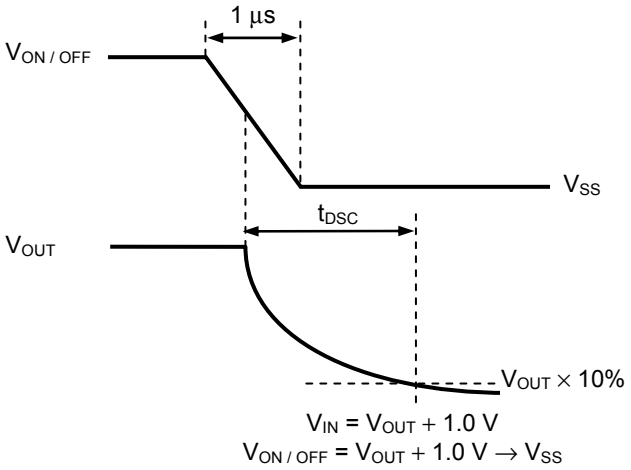


Figure 18 Measurement Condition of Discharge Time

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

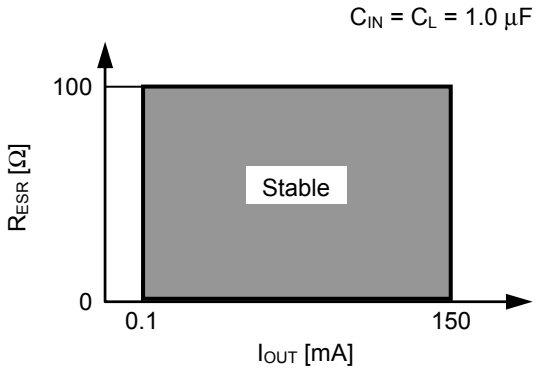
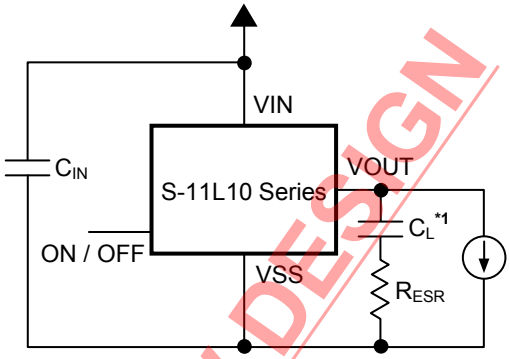


Figure 19



***1.** C_L: TDK Corporation C3216X8R1E105K (1.0 µF)

Figure 20

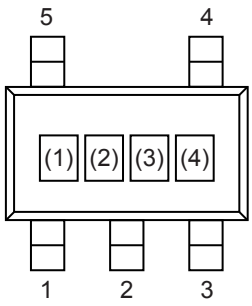
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■ Marking Specifications

1. SOT-23-5

Top view



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

Product name vs. Product code

1. 1 S-11L10 Series B type

Product Name	Product code		
	(1)	(2)	(3)
S-11L10B08-M5T1U	T	V	A
S-11L10B09-M5T1U	T	V	B
S-11L10B10-M5T1U	T	V	C
S-11L10B11-M5T1U	T	V	D
S-11L10B12-M5T1U	T	V	E
S-11L10B13-M5T1U	T	V	F
S-11L10B14-M5T1U	T	V	G
S-11L10B15-M5T1U	T	V	H
S-11L10B16-M5T1U	T	V	I
S-11L10B17-M5T1U	T	V	J
S-11L10B18-M5T1U	T	V	K
S-11L10B19-M5T1U	T	V	L
S-11L10B20-M5T1U	T	V	M
S-11L10B21-M5T1U	T	V	N
S-11L10B22-M5T1U	T	V	O
S-11L10B23-M5T1U	T	V	P
S-11L10B24-M5T1U	T	V	Q
S-11L10B25-M5T1U	T	V	R
S-11L10B26-M5T1U	T	V	S
S-11L10B27-M5T1U	T	V	T
S-11L10B28-M5T1U	T	V	U
S-11L10B29-M5T1U	T	V	V
S-11L10B30-M5T1U	T	V	W
S-11L10B31-M5T1U	T	V	X
S-11L10B32-M5T1U	T	V	Y
S-11L10B33-M5T1U	T	V	Z

1. 2 S-11L10 Series D type

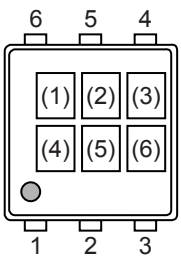
Product Name	Product code		
	(1)	(2)	(3)
S-11L10D08-M5T1U	T	X	A
S-11L10D09-M5T1U	T	X	B
S-11L10D10-M5T1U	T	X	C
S-11L10D11-M5T1U	T	X	D
S-11L10D12-M5T1U	T	X	E
S-11L10D13-M5T1U	T	X	F
S-11L10D14-M5T1U	T	X	G
S-11L10D15-M5T1U	T	X	H
S-11L10D16-M5T1U	T	X	I
S-11L10D17-M5T1U	T	X	J
S-11L10D18-M5T1U	T	X	K
S-11L10D19-M5T1U	T	X	L
S-11L10D20-M5T1U	T	X	M
S-11L10D21-M5T1U	T	X	N
S-11L10D22-M5T1U	T	X	O
S-11L10D23-M5T1U	T	X	P
S-11L10D24-M5T1U	T	X	Q
S-11L10D25-M5T1U	T	X	R
S-11L10D26-M5T1U	T	X	S
S-11L10D27-M5T1U	T	X	T
S-11L10D28-M5T1U	T	X	U
S-11L10D29-M5T1U	T	X	V
S-11L10D30-M5T1U	T	X	W
S-11L10D31-M5T1U	T	X	X
S-11L10D32-M5T1U	T	X	Y
S-11L10D33-M5T1U	T	X	Z

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2. SNT-6A(H)

Top view



(1) to (3) : Product code (Refer to **Product name vs. Product code**)
(4) to (6) : Lot number

Product name vs. Product code

2. 1 S-11L10 Series B type

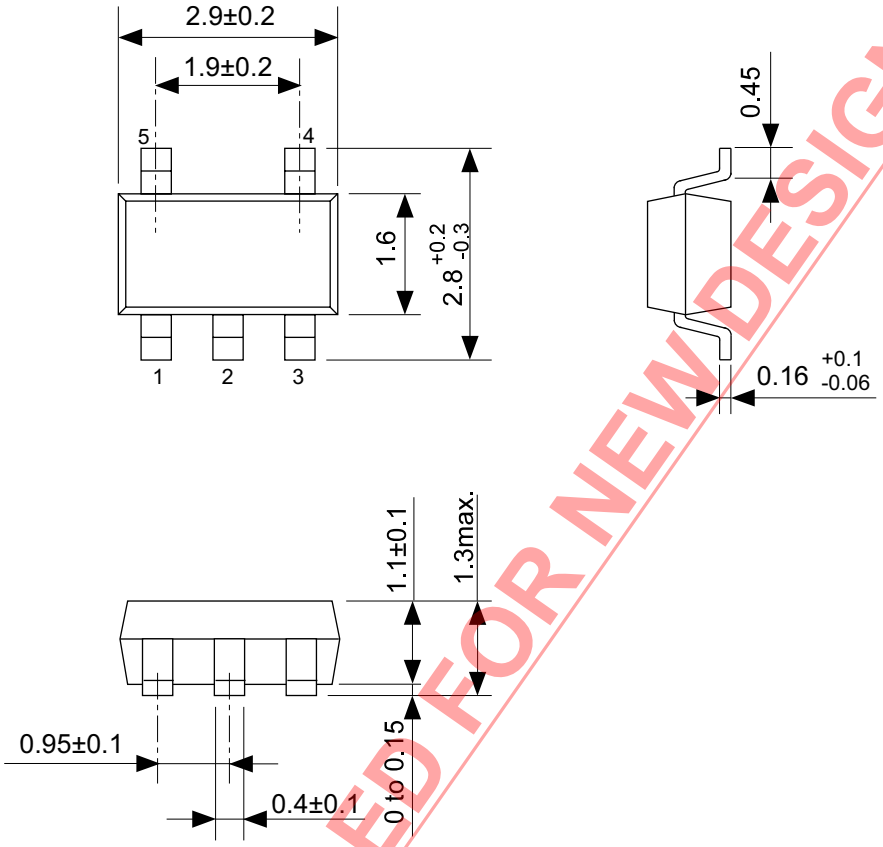
Product Name	Product code		
	(1)	(2)	(3)
S-11L10B08-I6T2U	T	V	A
S-11L10B09-I6T2U	T	V	B
S-11L10B10-I6T2U	T	V	C
S-11L10B11-I6T2U	T	V	D
S-11L10B12-I6T2U	T	V	E
S-11L10B13-I6T2U	T	V	F
S-11L10B14-I6T2U	T	V	G
S-11L10B15-I6T2U	T	V	H
S-11L10B16-I6T2U	T	V	I
S-11L10B17-I6T2U	T	V	J
S-11L10B18-I6T2U	T	V	K
S-11L10B19-I6T2U	T	V	L
S-11L10B20-I6T2U	T	V	M
S-11L10B21-I6T2U	T	V	N
S-11L10B22-I6T2U	T	V	O
S-11L10B23-I6T2U	T	V	P
S-11L10B24-I6T2U	T	V	Q
S-11L10B25-I6T2U	T	V	R
S-11L10B26-I6T2U	T	V	S
S-11L10B27-I6T2U	T	V	T
S-11L10B28-I6T2U	T	V	U
S-11L10B29-I6T2U	T	V	V
S-11L10B30-I6T2U	T	V	W
S-11L10B31-I6T2U	T	V	X
S-11L10B32-I6T2U	T	V	Y
S-11L10B33-I6T2U	T	V	Z

2. 2 S-11L10 Series D type

Product Name	Product code		
	(1)	(2)	(3)
S-11L10D08-I6T2U	T	X	A
S-11L10D09-I6T2U	T	X	B
S-11L10D10-I6T2U	T	X	C
S-11L10D11-I6T2U	T	X	D
S-11L10D12-I6T2U	T	X	E
S-11L10D13-I6T2U	T	X	F
S-11L10D14-I6T2U	T	X	G
S-11L10D15-I6T2U	T	X	H
S-11L10D16-I6T2U	T	X	I
S-11L10D17-I6T2U	T	X	J
S-11L10D18-I6T2U	T	X	K
S-11L10D19-I6T2U	T	X	L
S-11L10D20-I6T2U	T	X	M
S-11L10D21-I6T2U	T	X	N
S-11L10D22-I6T2U	T	X	O
S-11L10D23-I6T2U	T	X	P
S-11L10D24-I6T2U	T	X	Q
S-11L10D25-I6T2U	T	X	R
S-11L10D26-I6T2U	T	X	S
S-11L10D27-I6T2U	T	X	T
S-11L10D28-I6T2U	T	X	U
S-11L10D29-I6T2U	T	X	V
S-11L10D30-I6T2U	T	X	W
S-11L10D31-I6T2U	T	X	X
S-11L10D32-I6T2U	T	X	Y
S-11L10D33-I6T2U	T	X	Z

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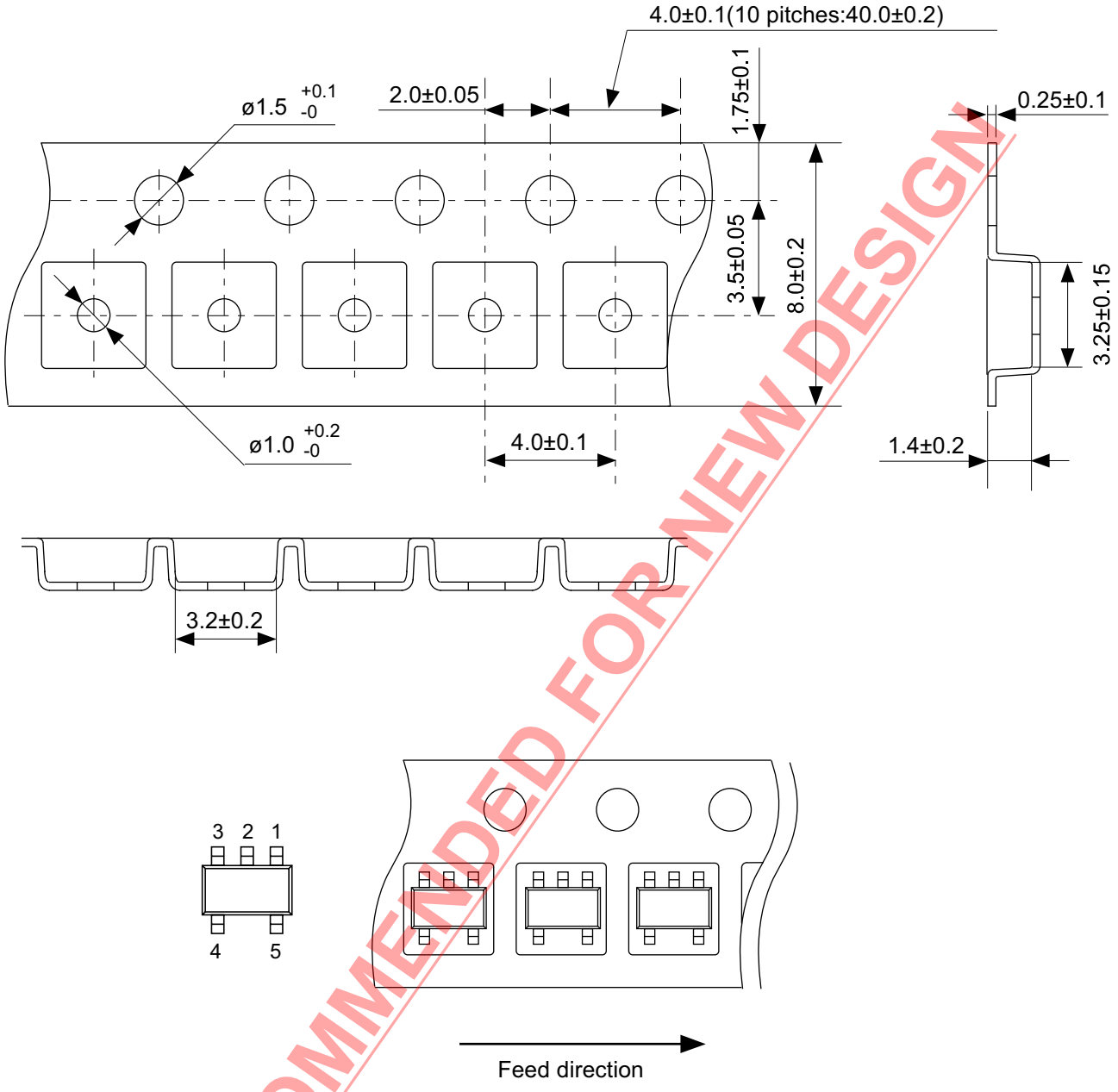
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No. MP005-A-P-SD-1.3

TITLE	SOT235-A-PKG Dimensions
No.	MP005-A-P-SD-1.3
ANGLE	
UNIT	mm

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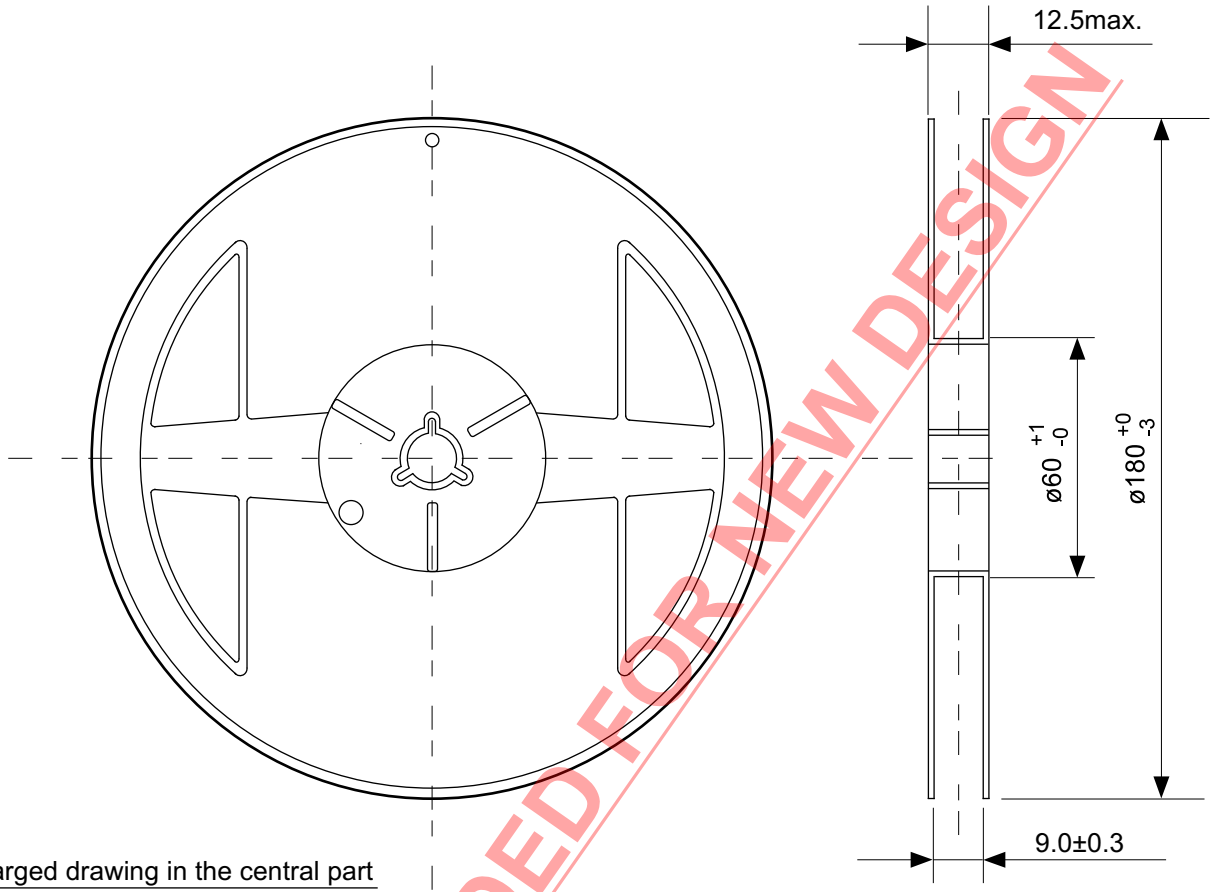


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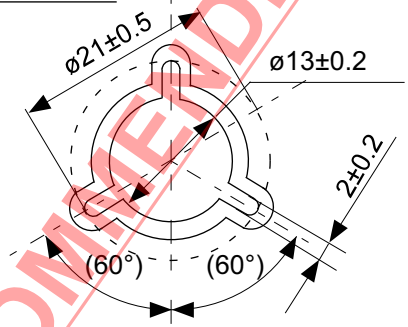
No. MP005-A-C-SD-2.1

TITLE	SOT235-A-Carrier Tape
No.	MP005-A-C-SD-2.1
ANGLE	
UNIT	mm
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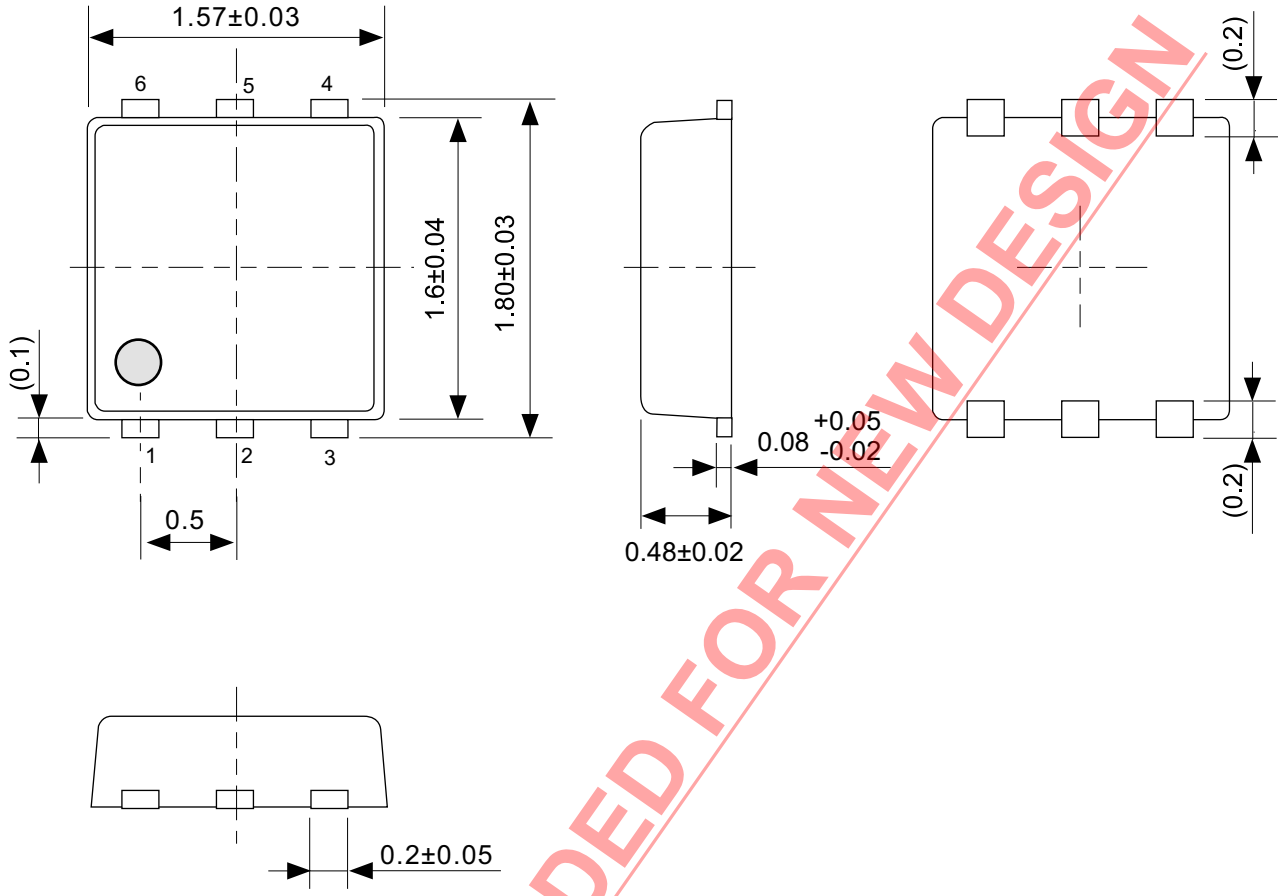


No. MP005-A-R-SD-1.1

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TITLE	SOT235-A-Reel		
No.	MP005-A-R-SD-1.1		
ANGLE		QTY.	3,000
UNIT	mm		
ABLIC Inc.			

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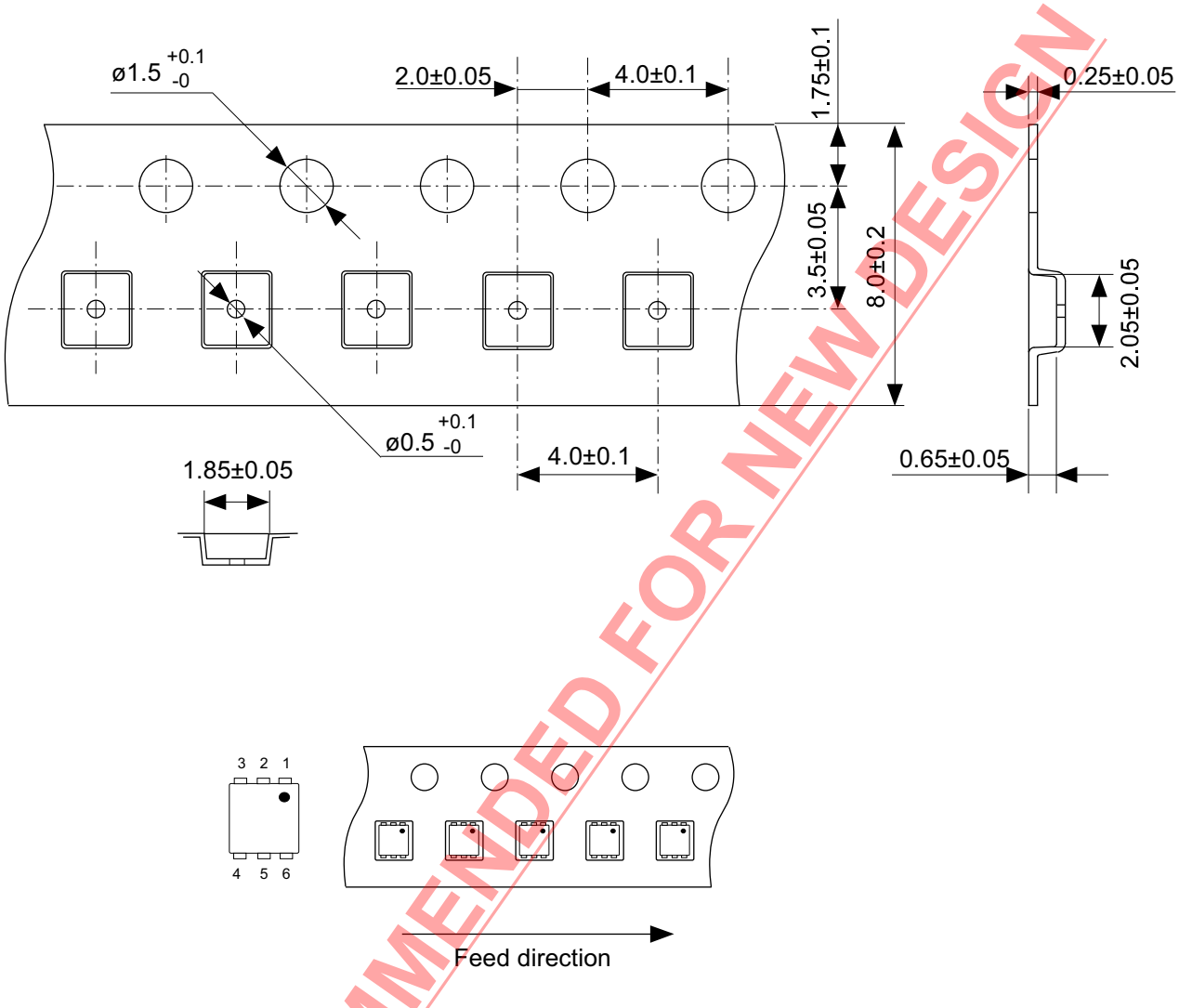
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No. PI006-A-P-SD-2.1

TITLE	SNT-6A(H)-A-PKG Dimensions
No.	PI006-A-P-SD-2.1
ANGLE	
UNIT	mm

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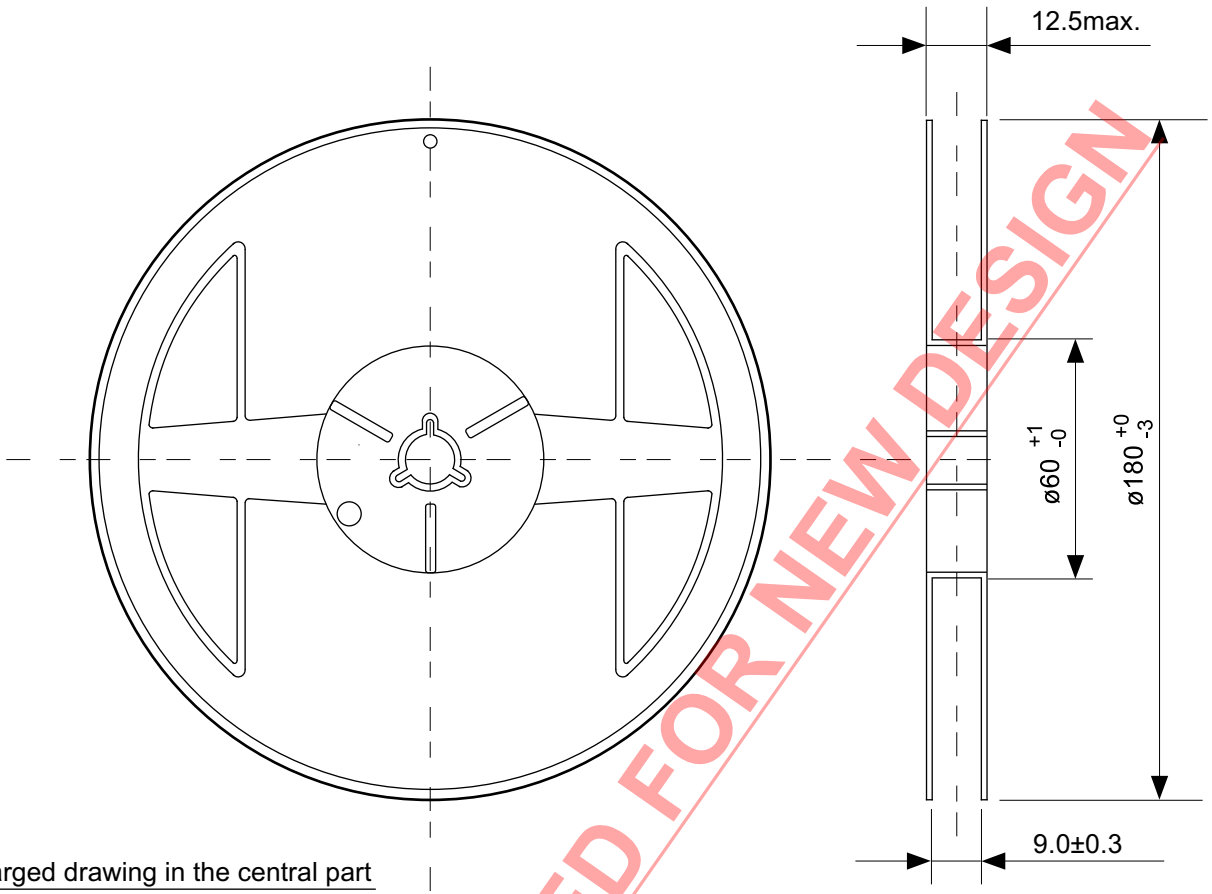
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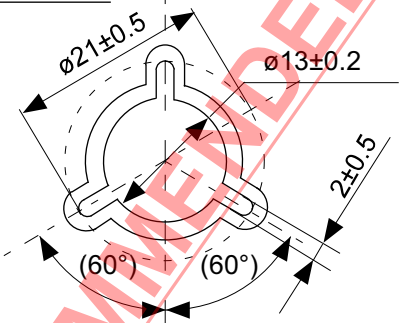
TITLE	SNT-6A(H)-A-Carrier Tape
No.	PI006-A-C-SD-2.0
ANGLE	
UNIT	mm

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Enlarged drawing in the central part

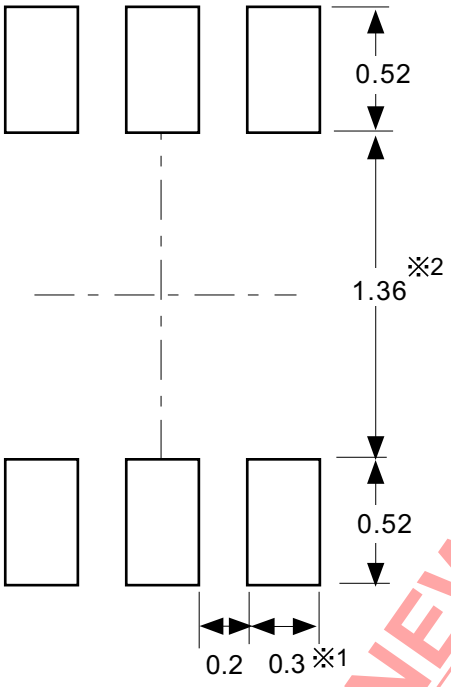


No. PI006-A-R-SD-1.0

NOT RECOMMENDED FOR NEW DESIGN

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

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※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. **钢网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"。**

NOT RECOMMENDED FOR NEW DESIGN

No. PI006-A-L-SD-4.1

TITLE	SNT-6A(H)-A -Land Recommendation
No.	PI006-A-L-SD-4.1
ANGLE	
UNIT	mm

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   Prior consultation with our sales office is required when considering the above uses.
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   The user of the products should therefore take responsibility to give thorough consideration to safety design including redundancy, fire spread prevention measures, and malfunction prevention to prevent accidents causing injury or death, fires and social damage, etc. that may ensue from the products' failure or malfunction.
   The entire system must be sufficiently evaluated and applied on customer's own responsibility.
10. The products are not designed to be radiation-proof. The necessary radiation measures should be taken in the product design by the customer depending on the intended use.
11. The products do not affect human health under normal use. However, they contain chemical substances and heavy metals and should therefore not be put in the mouth. The fracture surfaces of wafers and chips may be sharp. Be careful when handling these with the bare hands to prevent injuries, etc.
12. When disposing of the products, comply with the laws and ordinances of the country or region where they are used.
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