S-19259 Series

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AUTOMOTIVE, 125°C OPERATION,
5.5 V INPUT, 1000 mA VOLTAGE REGULATOR

Rev.1.2_00

This IC is a positive voltage regulator with a low voltage operation, high-accuracy output voltage, and high output current developed based on CMOS technology.
A 1.0 μF small ceramic capacitor can be used, and the very small dropout voltage and the large output current due to the built-in transistor with low on-resistance are provided. This IC includes an overcurrent protection circuit that prevents the load current from exceeding the current capacity of the output transistor and a thermal shutdown circuit that prevents damage due to overheating. In addition to the types in which output voltage is set inside the IC, a type for which output voltage can be set via an external resistor is added to a lineup. Also, this IC includes an inrush current limit circuit to limit the excess inrush current generated at power-on or at the time when the ON / OFF pin is set to ON.

ABLIC Inc. offers a "thermal simulation service" which supports the thermal design in conditions when our power management ICs are in use by customers. Our thermal simulation service will contribute to reducing the risk in the thermal design at customers' development stage.
ABLIC Inc. also offers FIT rate calculated based on actual customer usage conditions in order to support customer functional safety design.
Contact our sales representatives for details.

Caution This product can be used in vehicle equipment and in-vehicle equipment. Before using the product for these purposes, it is imperative to contact our sales representatives.

■ Features

- Output voltage (internally set): 0.9 V to 3.5 V, selectable in 0.05 V step
- Output voltage (externally set): 0.9 V to 5.0 V, settable via external resistor
- Input voltage: 1.5 V to 5.5 V
- Output voltage accuracy: ±2.0% (T_j = −40°C to +125°C)
- Dropout voltage: 70 mV typ. (3.0 V output product, I_{OUT} = 300 mA)
- Current consumption: During operation: 60 μA typ., 114 μA max.
  During power-off: 0.1 μA typ., 10 μA max.
- Output current: Possible to output 1000 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: 70 dB typ. (f = 1.0 kHz)
- Built-in overcurrent protection circuit: Limits overcurrent of output transistor.
- Built-in thermal shutdown circuit: Detection temperature 170°C typ.
- Built-in inrush current limit circuit: Limits excessive inrush current generated at power-on or at the time when the ON / OFF pin is set to ON.
- Built-in ON / OFF circuit: Ensures long battery life.
  Discharge shunt function "available" / "unavailable" is selectable.
  Pull-down function "available" / "unavailable" is selectable.
- Operation temperature range: Ta = −40°C to +125°C
- Lead-free (Sn 100%), halogen-free
- AEC-Q100 in process*2

***1.** Please make sure that the loss of the IC will not exceed the power dissipation when the output current is large.
***2.** Contact our sales representatives for details.

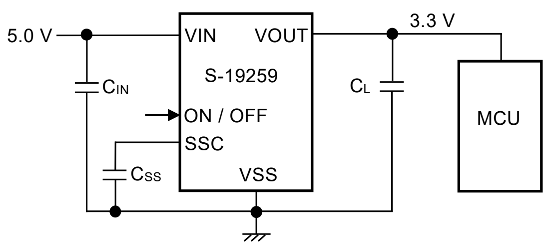
■ Applications

- For automotive use (engine, transmission, suspension, ABS, related-devices for EV / HEV / PHEV, etc.)
- Constant-voltage power supply for electrical application for vehicle interior
- Constant-voltage power supply for home electric appliance

■ Packages

- TO-252-5S(A)
- HSOP-8A
- HSNT-8(2030)

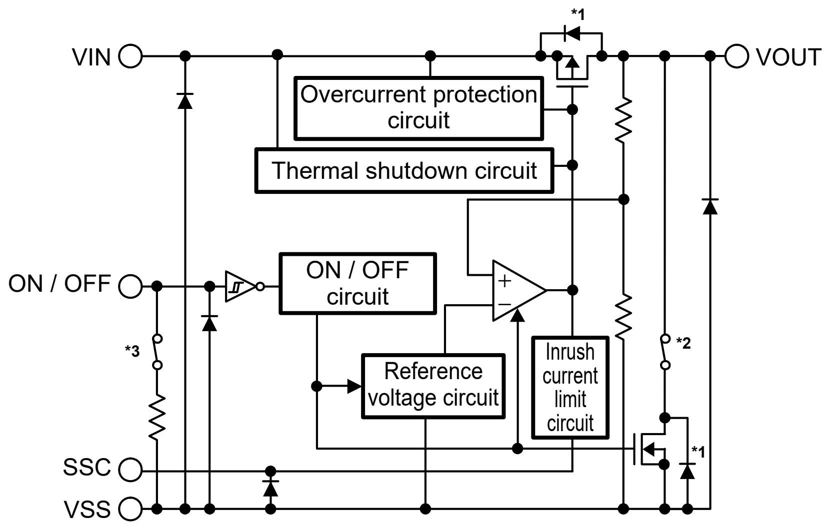
■ Typical Application Circuit



■ Block Diagrams

1. Types in which output voltage is internally set

1. 1 S-19259 Series A / B / C / D type (TO-252-5S(A), HSOP-8A)

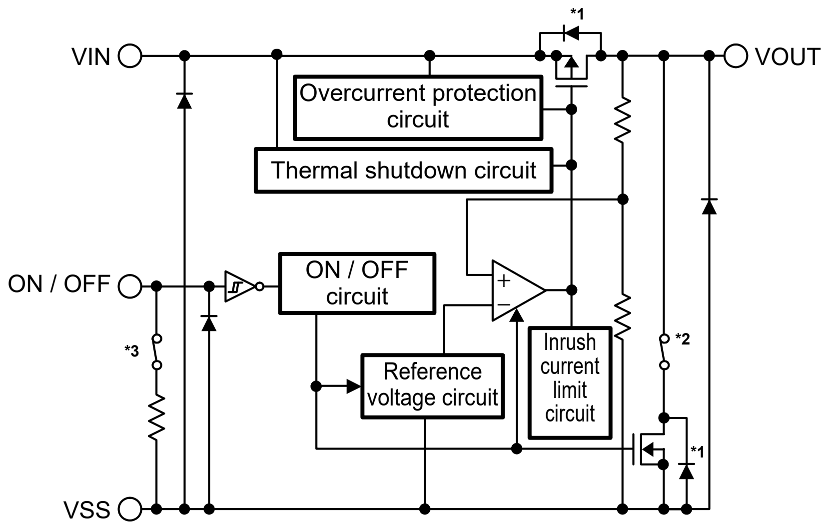


Product Type	ON / OFF Logic	Discharge Shunt Function*2	Pull-down Resistor*3	Inrush Current Limit Time
A	Active "H"	Available	Available	Adjustable via an external capacitor (C_{SS})
B	Active "H"	Available	Unavailable	Adjustable via an external capacitor (C_{SS})
C	Active "H"	Unavailable	Available	Adjustable via an external capacitor (C_{SS})
D	Active "H"	Unavailable	Unavailable	Adjustable via an external capacitor (C_{SS})

***1.** Parasitic diode
***2.** A / B type (With discharge shunt function): ON, C / D type (Without discharge shunt function): OFF
***3.** A / C type (With pull-down resistor): ON, B / D type (Without pull-down resistor): OFF

Figure 1

1. 2 S-19259 Series A / B / C / D type (HSNT-8(2030)), E / F / G / H type (HSOP-8A)



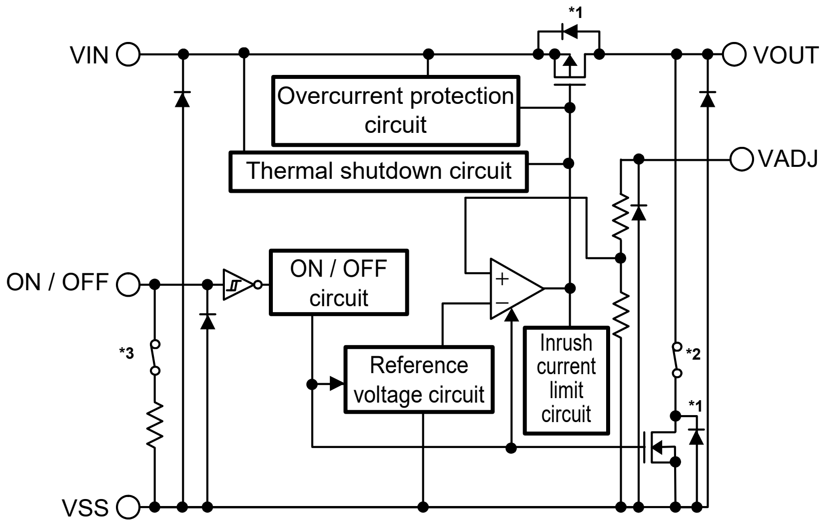
Product Type	ON / OFF Logic	Discharge Shunt Function*2	Pull-down Resistor*3	Inrush Current Limit Time
A	Active "H"	Available	Available	Fixed to 0.4 ms typ.
B	Active "H"	Available	Unavailable	Fixed to 0.4 ms typ.
C	Active "H"	Unavailable	Available	Fixed to 0.4 ms typ.
D	Active "H"	Unavailable	Unavailable	Fixed to 0.4 ms typ.
E	Active "H"	Available	Available	Fixed to 0.4 ms typ.
F	Active "H"	Available	Unavailable	Fixed to 0.4 ms typ.
G	Active "H"	Unavailable	Available	Fixed to 0.4 ms typ.
H	Active "H"	Unavailable	Unavailable	Fixed to 0.4 ms typ.

***1.** Parasitic diode
***2.** A / B / E / F type (With discharge shunt function): ON, C / D / G / H type (Without discharge shunt function): OFF
***3.** A / C / E / G type (With pull-down resistor): ON, B / D / F / H type (Without pull-down resistor): OFF

Figure 2

2. Types in which output voltage is externally set

2. 1 S-19259 Series A / B / C / D type (TO-252-5S(A), HSOP-8A, HSNT-8(2030))



Product Type	ON / OFF Logic	Discharge Shunt Function*2	Pull-down Resistor*3	Inrush Current Limit Time
A	Active "H"	Available	Available	Fixed to 0.4 ms typ.
B	Active "H"	Available	Unavailable	Fixed to 0.4 ms typ.
C	Active "H"	Unavailable	Available	Fixed to 0.4 ms typ.
D	Active "H"	Unavailable	Unavailable	Fixed to 0.4 ms typ.

***1.** Parasitic diode
***2.** A / B type (With discharge shunt function): ON, C / D type (Without discharge shunt function): OFF
***3.** A / C type (With pull-down resistor): ON, B / D type (Without pull-down resistor): OFF

Figure 3

■ AEC-Q100 in Process

Contact our sales representatives for details of AEC-Q100 reliability specification.

■ Product Name Structure

Users can select the product type, output voltage, and package type for this IC. Refer to "**1. Product name**" regarding the contents of product name, "**2. Function list of product type**" regarding the product type, "**3. Packages**" regarding the package drawings, "**4. Product name list**" regarding details of the product name.

1. Product name

S-19259 x xx A - xxxx U

- **U** — Environmental code
  - U: Lead-free (Sn 100%), halogen-free
- **xxxx** — Package abbreviation and IC packing specifications*1
  - V5T2: TO-252-5S(A), Tape
  - E8T1: HSOP-8A, Tape
  - A8T1: HSNT-8(2030), Tape
- **A** — Operation temperature
  - A: Ta = –40°C to +125°C
- **xx** — Output voltage*2
  - 00: Externally set
  - 09 to 35: Internally set
  - (e.g., when the output voltage is 0.9 V, it is expressed as 09.)
- **x** — Product type*3
  - A to H

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

2. Function list of product type

2. 1 Types in which output voltage is internally set

Table 1 TO-252-5S(A)

Product Type	ON / OFF Logic	Discharge Shunt Function	Pull-down Resistor	Inrush Current Limit Time
A	Active "H"	Available	Available	Adjustable via an external capacitor (C_{SS})
B	Active "H"	Available	Unavailable	Adjustable via an external capacitor (C_{SS})
C	Active "H"	Unavailable	Available	Adjustable via an external capacitor (C_{SS})
D	Active "H"	Unavailable	Unavailable	Adjustable via an external capacitor (C_{SS})

Table 2 HSOP-8A

Product Type	ON / OFF Logic	Discharge Shunt Function	Pull-down Resistor	Inrush Current Limit Time
A	Active "H"	Available	Available	Adjustable via an external capacitor (C_{SS})
B	Active "H"	Available	Unavailable	Adjustable via an external capacitor (C_{SS})
C	Active "H"	Unavailable	Available	Adjustable via an external capacitor (C_{SS})
D	Active "H"	Unavailable	Unavailable	Adjustable via an external capacitor (C_{SS})
E	Active "H"	Available	Available	Fixed to 0.4 ms typ.
F	Active "H"	Available	Unavailable	Fixed to 0.4 ms typ.
G	Active "H"	Unavailable	Available	Fixed to 0.4 ms typ.
H	Active "H"	Unavailable	Unavailable	Fixed to 0.4 ms typ.

Table 3 HSNT-8(2030)

Product Type	ON / OFF Logic	Discharge Shunt Function	Pull-down Resistor	Inrush Current Limit Time
A	Active "H"	Available	Available	Fixed to 0.4 ms typ.
B	Active "H"	Available	Unavailable	Fixed to 0.4 ms typ.
C	Active "H"	Unavailable	Available	Fixed to 0.4 ms typ.
D	Active "H"	Unavailable	Unavailable	Fixed to 0.4 ms typ.

2. 2 Types in which output voltage is externally set

Table 4 TO-252-5S(A), HSOP-8A, HSNT-8(2030)

Product Type	ON / OFF Logic	Discharge Shunt Function	Pull-down Resistor	Inrush Current Limit Time
A	Active "H"	Available	Available	Fixed to 0.4 ms typ.
B	Active "H"	Available	Unavailable	Fixed to 0.4 ms typ.
C	Active "H"	Unavailable	Available	Fixed to 0.4 ms typ.
D	Active "H"	Unavailable	Unavailable	Fixed to 0.4 ms typ.

3. Packages

Table 5 Package Drawing Codes

Package Name	Dimension	Tape	Reel	Land	Stencil Opening
TO-252-5S(A)	VA005-A-P-SD	VA005-A-C-SD	VA005-A-R-SD	VA005-A-L-SD	−
HSOP-8A	FH008-A-P-SD	FH008-A-C-SD	FH008-A-R-SD	FH008-A-L-SD	−
HSNT-8(2030)	PP008-A-P-SD	PP008-A-C-SD	PP008-A-R-SD	PP008-A-L-SD	PP008-A-L-S1

4. Product name list

4. 1 S-19259 Series A type

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

Table 6

Output Voltage	TO-252-5S(A)	HSOP-8A	HSNT-8(2030)
Externally set	S-19259A00A-V5T2U	S-19259A00A-E8T1U	S-19259A00A-A8T1U
1.1 V ± 2.3%	S-19259A11A-V5T2U	S-19259A11A-E8T1U	S-19259A11A-A8T1U
1.2 V ± 2.3%	S-19259A12A-V5T2U	S-19259A12A-E8T1U	S-19259A12A-A8T1U
1.5 V ± 2.3%	S-19259A15A-V5T2U	S-19259A15A-E8T1U	S-19259A15A-A8T1U
1.8 V ± 2.3%	S-19259A18A-V5T2U	S-19259A18A-E8T1U	S-19259A18A-A8T1U
3.3 V ± 2.0%	S-19259A33A-V5T2U	S-19259A33A-E8T1U	S-19259A33A-A8T1U

Remark 1. Refer to "**2. Function list of product type**" for inrush current limit time.
2. Please contact our sales representatives for products other than the above.

4. 2 S-19259 Series E type

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

Table 7

Output Voltage	HSOP-8A
1.1 V ± 2.3%	S-19259E11A-E8T1U
1.2 V ± 2.3%	S-19259E12A-E8T1U
1.5 V ± 2.3%	S-19259E15A-E8T1U
1.8 V ± 2.3%	S-19259E18A-E8T1U
3.3 V ± 2.0%	S-19259E33A-E8T1U

Remark 1. Refer to "**2. Function list of product type**" for inrush current limit time.
2. Please contact our sales representatives for products other than the above.

■ Pin Configurations

1. TO-252-5S(A)

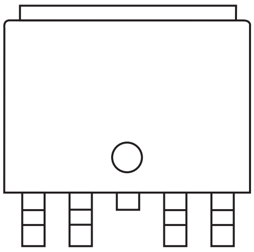


Figure 4

Table 8 S-19259 Series Output Voltage Internally Set A / B / C / D Type

Pin No.	Symbol	Description
1	VOUT	Output voltage pin
2	ON / OFF	ON / OFF pin
3	VSS	GND pin
4	SSC*1	Inrush current limit pin
5	VIN	Input voltage pin

Table 9 S-19259 Series Output Voltage Externally Set A / B / C / D Type

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

***1.** Connect a capacitor between the SSC pin and the VSS pin.
The inrush current limit time of the VOUT pin at power-on or at the time when the ON / OFF pin is set to ON can be adjusted according to the capacitance.
Moreover, the SSC pin is available even when it is open.
For details, refer to "**■ Selection of Capacitor for Inrush Current Limit (C_{SS}) (Output Voltage Internally Set A / B / C / D Type (TO-252-5S(A), HSOP-8A))**".

2. HSOP-8A

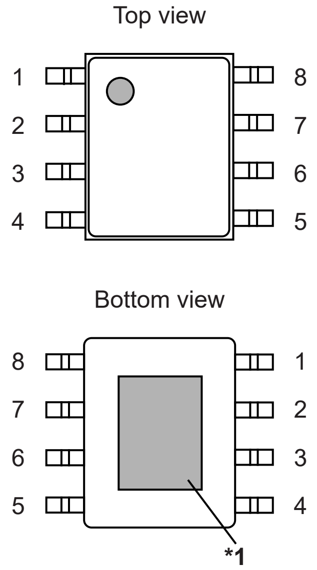


Figure 5

Table 10 S-19259 Series Output Voltage Internally Set A / B / C / D type

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

Table 11 S-19259 Series Output Voltage Internally Set E / F / G / H Type

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

Table 12 S-19259 Series Output Voltage Externally Set A / B / C / D Type

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

***1.** Connect the heat sink of backside at shadowed area to the board, and set electric potential GND. However, do not use it as the function of electrode.
***2.** The NC pin is electrically open. The NC pin can be connected to the VIN pin or the VSS pin.
***3.** Connect a capacitor between the SSC pin and the VSS pin. The inrush current limit time of the VOUT pin at power-on or at the time when the ON / OFF pin is set to ON can be adjusted according to the capacitance. Moreover, the SSC pin is available even when it is open. For details, refer to "**■ Selection of Capacitor for Inrush Current Limit (C_{SS}) (Output Voltage Internally Set A / B / C / D Type (TO-252-5S(A), HSOP-8A))**".
***4.** Although pins of number 1 and 2 are connected internally, be sure to short-circuit them nearest in use.

3. HSNT-8(2030)

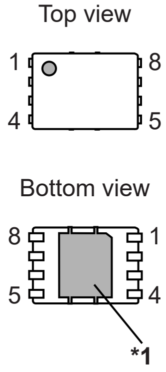


Figure 6

Table 13 S-19259 Series Output Voltage Internally Set A / B / C / D Type

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

Table 14 S-19259 Series Output Voltage Externally Set A / B / C / D Type

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

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

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

***3.** Although pins of number 1 and 2 are connected internally, be sure to short-circuit them nearest in use.

***4.** Although pins of number 7 and 8 are connected internally, be sure to short-circuit them nearest in use.

■ Absolute Maximum Ratings

Table 15

(Ta = +25°C unless otherwise specified)

Item	Symbol	Absolute Maximum Rating	Unit
Input voltage	V_{IN}	V_{SS} − 0.3 to V_{SS} + 6.0	V
	$V_{ON / OFF}$	V_{SS} − 0.3 to V_{SS} + 6.0	V
	V_{SSC}	V_{SS} − 0.3 to V_{IN} + 0.3	V
	V_{VADJ}	V_{SS} − 0.3 to V_{SS} + 6.0	V
Output voltage	V_{OUT}	V_{SS} − 0.3 to V_{IN} + 0.3	V
Output current	I_{OUT}	1100	mA
Junction temperature	T_j	−40 to +150	°C
Operation ambient temperature	T_{opr}	−40 to +125	°C
Storage temperature	T_{stg}	−40 to +150	°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.

■ Thermal Resistance Value

Table 16

Item	Symbol	Condition		Min.	Typ.	Max.	Unit
Junction-to-ambient thermal resistance*1	θ_{JA}	TO-252-5S(A)	Board A	−	86	−	°C/W
			Board B	−	60	−	°C/W
			Board C	−	38	−	°C/W
			Board D	−	31	−	°C/W
			Board E	−	28	−	°C/W
		HSOP-8A	Board A	−	104	−	°C/W
			Board B	−	74	−	°C/W
			Board C	−	39	−	°C/W
			Board D	−	37	−	°C/W
			Board E	−	31	−	°C/W
		HSNT-8(2030)	Board A	−	181	−	°C/W
			Board B	−	135	−	°C/W
			Board C	−	40	−	°C/W
			Board D	−	42	−	°C/W
			Board E	−	32	−	°C/W

***1.** Test environment: compliance with JEDEC STANDARD JESD51-2A

Remark Refer to "**■ Power Dissipation**" and "**Test Board**" for details.

■ Electrical Characteristics

1. Types in which output voltage is internally set (S-19259x09 to S-19259x35)

Table 17 (1 / 2)

(T_j = −40°C to +125°C unless otherwise specified)

Item	Symbol	Condition		Min.	Typ.	Max.	Unit	Test Circuit
Output voltage[*1]	$V_{OUT(E)}$	$V_{OUT(S)}$ + 1.0 V ≤ V_{IN} ≤ $V_{OUT(S)}$ + 2.0 V, 1 mA ≤ I_{OUT} ≤ 200 mA	0.9 V ≤ $V_{OUT(S)}$ < 1.1 V	$V_{OUT(S)}$ − 0.025	$V_{OUT(S)}$	$V_{OUT(S)}$ + 0.025	V	1
			1.1 V ≤ $V_{OUT(S)}$ < 2.6 V	$V_{OUT(S)}$ × 0.977	$V_{OUT(S)}$	$V_{OUT(S)}$ × 1.023	V	1
			2.6 V ≤ $V_{OUT(S)}$ ≤ 3.5 V	$V_{OUT(S)}$ × 0.980	$V_{OUT(S)}$	$V_{OUT(S)}$ × 1.020	V	1
Output current[*2]	I_{OUT}	V_{IN} ≥ 2.0 V	0.9 V ≤ $V_{OUT(S)}$ < 1.0 V	1000[*4]	−	−	mA	3
		V_{IN} ≥ $V_{OUT(S)}$ + 1.0 V	1.0 V ≤ $V_{OUT(S)}$ ≤ 3.5 V	1000[*4]	−	−	mA	3
Dropout voltage[*3]	V_{drop}	I_{OUT} = 300 mA, Ta = +25°C	0.9 V ≤ $V_{OUT(S)}$ < 1.0 V	0.60	0.64	0.68	V	1
			1.0 V ≤ $V_{OUT(S)}$ < 1.1 V	0.50	0.54	0.58	V	1
			1.1 V ≤ $V_{OUT(S)}$ < 1.2 V	−	0.44	0.48	V	1
			1.2 V ≤ $V_{OUT(S)}$ < 1.3 V	−	0.34	0.38	V	1
			1.3 V ≤ $V_{OUT(S)}$ < 1.4 V	−	0.24	0.28	V	1
			1.4 V ≤ $V_{OUT(S)}$ < 1.5 V	−	0.14	0.18	V	1
			1.5 V ≤ $V_{OUT(S)}$ < 1.6 V	−	0.11	0.16	V	1
			1.6 V ≤ $V_{OUT(S)}$ < 2.6 V	−	0.10	0.15	V	1
			2.6 V ≤ $V_{OUT(S)}$ ≤ 3.5 V	−	0.07	0.11	V	1
		I_{OUT} = 1000 mA, Ta = +25°C	0.9 V ≤ $V_{OUT(S)}$ < 1.0 V	−	1.00	1.05	V	1
			1.0 V ≤ $V_{OUT(S)}$ < 1.1 V	−	0.90	0.95	V	1
			1.1 V ≤ $V_{OUT(S)}$ < 1.2 V	−	0.80	0.85	V	1
			1.2 V ≤ $V_{OUT(S)}$ < 1.3 V	−	0.70	0.75	V	1
			1.3 V ≤ $V_{OUT(S)}$ < 1.4 V	−	0.60	0.65	V	1
			1.4 V ≤ $V_{OUT(S)}$ < 1.5 V	−	0.50	0.60	V	1
			1.5 V ≤ $V_{OUT(S)}$ < 1.8 V	−	0.44	0.50	V	1
			1.8 V ≤ $V_{OUT(S)}$ < 2.5 V	−	0.40	0.45	V	1
			2.5 V ≤ $V_{OUT(S)}$ ≤ 3.5 V	−	0.23	0.37	V	1
Line regulation	$\frac{\Delta V_{OUT1}}{\Delta V_{IN} \bullet V_{OUT}}$	1.5 V ≤ V_{IN} ≤ 5.5 V, I_{OUT} = 100 mA	0.9 V ≤ $V_{OUT(S)}$ < 1.0 V	−	0.05	0.2	%/V	1
		$V_{OUT(S)}$ + 0.5 V ≤ V_{IN} ≤ 5.5 V, I_{OUT} = 100 mA	1.0 V ≤ $V_{OUT(S)}$ ≤ 3.5 V	−	0.05	0.2	%/V	1
Load regulation	ΔV_{OUT2}	V_{IN} = $V_{OUT(S)}$ + 1.0 V, 1 mA ≤ I_{OUT} ≤ 200 mA		−20	−3	20	mV	1
Current consumption during operation	I_{SS1}	V_{IN} = $V_{OUT(S)}$ + 1.0 V, ON / OFF pin = ON, no load		−	60	114	μA	2
Current consumption during power-off	I_{SS2}	V_{IN} = $V_{OUT(S)}$ + 1.0 V, ON / OFF pin = OFF, no load		−	0.1	10	μA	2
Input voltage	V_{IN}	−		1.5	−	5.5	V	−

Table 17 (2 / 2)

(T_j = −40°C to +125°C unless otherwise specified)

Item	Symbol	Condition		Min.	Typ.	Max.	Unit	Test Circuit
ON / OFF pin input voltage "H"	V_{SH}	$V_{IN} = V_{OUT(S)} + 1.0$ V, $R_L = 1.0$ kΩ, determined by V_{OUT} output level		1.0	−	−	V	4
ON / OFF pin input voltage "L"	V_{SL}	$V_{IN} = V_{OUT(S)} + 1.0$ V, $R_L = 1.0$ kΩ, determined by V_{OUT} output level		−	−	0.3	V	4
ON / OFF pin input current "H"	I_{SH}	$V_{IN} = 5.5$ V, $V_{ON / OFF} = 5.5$ V	B / D / F / H type (without pull-down resistor)	−0.1	−	0.1	μA	4
			A / C / E / G type (with pull-down resistor)	1.0	2.5	6.1	μA	4
ON / OFF pin input current "L"	I_{SL}	$V_{IN} = 5.5$ V, $V_{ON / OFF} = 0$ V		−0.1	−	0.1	μA	4
Ripple rejection	|RR|	$V_{IN} = 2.0$ V, f = 1.0 kHz, $\Delta V_{rip} = 1.0$ Vp-p, $I_{OUT} = 100$ mA, Ta = +25°C	$0.9 \text{ V} \le V_{OUT(S)} < 1.0 \text{ V}$	−	70	−	dB	5
		$V_{IN} = V_{OUT(S)} + 1.0$ V, f = 1.0 kHz, $\Delta V_{rip} = 1.0$ Vp-p, $I_{OUT} = 100$ mA, Ta = +25°C	$1.0 \text{ V} \le V_{OUT(S)} < 1.2 \text{ V}$	−	65	−	dB	5
			$1.2 \text{ V} \le V_{OUT(S)} \le 3.5 \text{ V}$	−	60	−	dB	5
Short-circuit current	I_{short}	$V_{IN} = V_{OUT(S)} + 1.0$ V, ON / OFF pin = ON, $V_{OUT} = 0$ V, Ta = +25°C		−	200	−	mA	3
Thermal shutdown detection temperature	T_{SD}	Junction temperature		−	170	−	°C	−
Thermal shutdown release temperature	T_{SR}	Junction temperature		−	140	−	°C	−
Inrush current limit time	t_{RUSH}	$V_{IN} = V_{OUT(S)} + 1.0$ V, ON / OFF pin = ON, $I_{OUT} = 1000$ mA, $C_{SS} = 1.0$ nF		−	0.7	−	ms	6
		$V_{IN} = V_{OUT(S)} + 1.0$ V, ON / OFF pin = ON, $I_{OUT} = 1000$ mA, $C_{SS} = 0$ nF		−	0.4	−	ms	6
		$V_{IN} = V_{OUT(S)} + 1.0$ V, ON / OFF pin = ON, $I_{OUT} = 1000$ mA		−	0.4*5	−	ms	6
Discharge shunt resistance during power-off	R_{LOW}	$V_{IN} = 5.5$ V, $V_{OUT} = 0.1$ V	A / B / E / F type (with discharge shunt function)	−	35	−	Ω	3
Power-off pull-down resistance	R_{PD}	−	A / C / E / G type (with pull-down resistor)	0.9	2.2	5.5	MΩ	4

***1.** $V_{OUT(S)}$: Set output voltage
$V_{OUT(E)}$: Actual output voltage
Output voltage when fixing I_{OUT} (= 100 mA) and inputting $V_{OUT(S)} + 1.0$ V

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

***3.** When $I_{OUT} = 1000$ mA and $0.9 \text{ V} \le V_{OUT(S)} < 1.0 \text{ V}$
$V_{drop} = V_{IN1} - (V_{OUT3} \times 0.98)$
V_{OUT3} is the output voltage when $V_{IN} = 2.0$ V and $I_{OUT} = 1000$ mA.
V_{IN1} is the input voltage at which the output voltage becomes 98% of V_{OUT3} after gradually decreasing the input voltage.
When other cases
$V_{drop} = V_{IN1} - (V_{OUT3} \times 0.98)$
V_{OUT3} is the output voltage when $V_{IN} = V_{OUT(S)} + 1.0$ V and $I_{OUT} = 300$ mA and1000 mA.
V_{IN1} is the input voltage at which the output voltage becomes 98% of V_{OUT3} after gradually decreasing the input voltage.

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

***5.** When output voltage internally set A / B / C / D type (HSNT-8(2030)) and E / F / G / H type (HSOP-8A).

2. Types in which output voltage is externally set (S-19259x00)

Table 18

(T_j = −40°C to +125°C unless otherwise specified)

Item	Symbol	Condition		Min.	Typ.	Max.	Unit	Test Circuit
Output voltage of adjust pin*1	V_{VADJ}	$V_{VADJ} = V_{OUT}$, $V_{OUT(S)}$ + 1.0 V ≤ V_{IN} ≤ $V_{OUT(S)}$ + 2.0 V, 1 mA ≤ I_{OUT} ≤ 200 mA		0.875	0.9	0.925	V	7
Output voltage range	V_{ROUT}	−		0.9	−	5.0	V	13
Internal resistance value of adjust pin	R_{VADJ}	−		230	400	−	kΩ	−
Output current*2	I_{OUT}	V_{IN} ≥ 2.0 V, $V_{VADJ} = V_{OUT}$		1000*4	−	−	mA	9
Dropout voltage*3	V_{drop}	$V_{VADJ} = V_{OUT}$, I_{OUT} = 300 mA, Ta = +25°C		0.60	0.64	0.68	V	7
		$V_{VADJ} = V_{OUT}$, I_{OUT} = 1000 mA, Ta = +25°C		−	1.00	1.05	V	7
Line regulation	$\frac{\Delta V_{OUT1}}{\Delta V_{IN} \bullet V_{OUT}}$	$V_{VADJ} = V_{OUT}$, 1.5 V ≤ V_{IN} ≤ 5.5 V, I_{OUT} = 100 mA		−	0.05	0.2	%/V	7
Load regulation	ΔV_{OUT2}	$V_{VADJ} = V_{OUT}$, $V_{IN} = V_{OUT(S)}$ + 1.0 V, 1 mA ≤ I_{OUT} ≤ 200 mA		−20	−3	20	mV	7
Current consumption during operation	I_{SS1}	$V_{VADJ} = V_{OUT}$, $V_{IN} = V_{OUT(S)}$ + 1.0 V, ON / OFF pin = ON, no load		−	60	114	μA	8
Current consumption during power-off	I_{SS2}	$V_{VADJ} = V_{OUT}$, $V_{IN} = V_{OUT(S)}$ + 1.0 V, ON / OFF pin = OFF, no load		−	0.1	10	μA	8
Input voltage	V_{IN}	−		1.5	−	5.5	V	−
ON / OFF pin input voltage "H"	V_{SH}	$V_{IN} = V_{OUT(S)}$ + 1.0 V, R_L = 1.0 kΩ, determined by V_{OUT} output level		1.0	−	−	V	10
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		−	−	0.3	V	10
ON / OFF pin input current "H"	I_{SH}	V_{IN} = 5.5 V, $V_{ON/OFF}$ = 5.5 V	B / D type (without pull-down resistor)	−0.1	−	0.1	μA	10
			A / C type (with pull-down resistor)	1.0	2.5	6.1	μA	10
ON / OFF pin input current "L"	I_{SL}	V_{IN} = 5.5 V, $V_{ON/OFF}$ = 0 V		−0.1	−	0.1	μA	10
Ripple rejection	|RR|	$V_{VADJ} = V_{OUT}$, V_{IN} = 2.0 V, f = 1.0 kHz, ΔV_{rip} = 1.0 Vp-p, I_{OUT} = 100 mA, Ta = +25°C		−	70	−	dB	11
Short-circuit current	I_{short}	$V_{IN} = V_{OUT(S)}$ + 1.0 V, ON / OFF pin = ON, V_{OUT} = 0 V, Ta = +25°C		−	200	−	mA	9
Thermal shutdown detection temperature	T_{SD}	Junction temperature		−	170	−	°C	−
Thermal shutdown release temperature	T_{SR}	Junction temperature		−	140	−	°C	−
Inrush current limit time	t_{RUSH}	$V_{IN} = V_{OUT(S)}$ + 1.0 V, ON / OFF pin = ON, I_{OUT} = 1000 mA		−	0.4	−	ms	12
Discharge shunt resistance during power-off	R_{LOW}	V_{IN} = 5.5 V, V_{OUT} = 0.1 V	A / B type (with discharge shunt function)	−	35	−	Ω	9
Power-off pull-down resistor	R_{PD}	−	A / C type (with pull-down resistor)	0.9	2.2	5.5	MΩ	10

***1.** $V_{OUT(S)}$: Set output voltage (= 0.9 V)

***2.** The output current at which the output voltage becomes 95% of V_{VADJ} after gradually increasing the output current.

***3.** When I_{OUT} = 1000 mA

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

V_{OUT3} is the output voltage when V_{IN} = 2.0 V and I_{OUT} = 1000 mA.

V_{IN1} is the input voltage at which the output voltage becomes 98% of V_{OUT3} after gradually decreasing the input voltage.

When I_{OUT} = 300 mA

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

V_{OUT3} is the output voltage when $V_{IN} = V_{OUT(S)}$ + 1.0 V and I_{OUT} = 300 mA.

V_{IN1} is the input voltage at which the output voltage becomes 98% of V_{OUT3} after gradually decreasing the input voltage.

***4.** The output current can be at least this value.

Due to limitation of the package power dissipation, this value may not be satisfied. Attention should be paid to the power dissipation when the output current is large.

This specification is guaranteed by design.

■ Test Circuits

1. Types in which output voltage is internally set (S-19259x09 to S-19259x35)

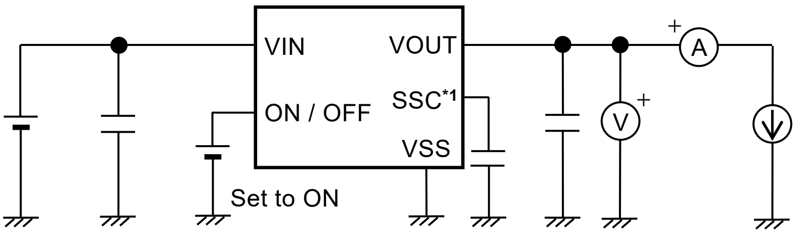


Figure 7 Test Circuit 1

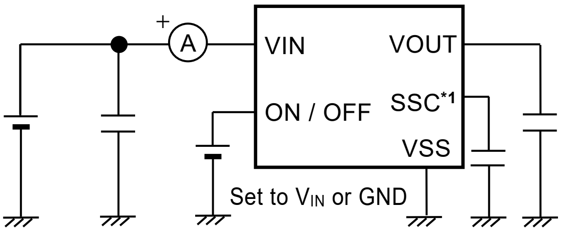


Figure 8 Test Circuit 2

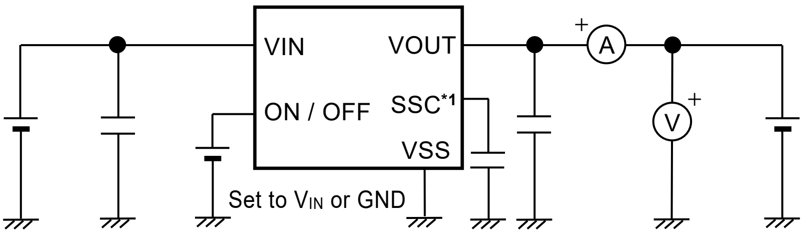


Figure 9 Test Circuit 3

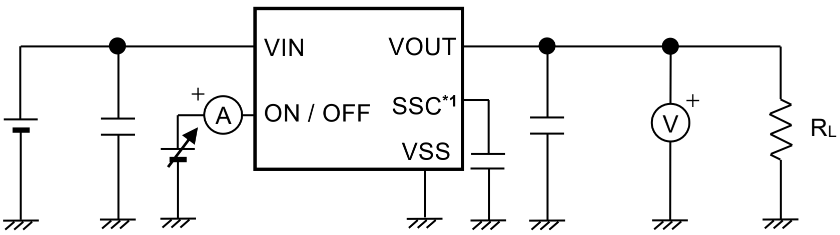


Figure 10 Test Circuit 4

***1.** Output voltage internally set A / B / C / D type (TO-252-5S(A), HSOP-8A) only.

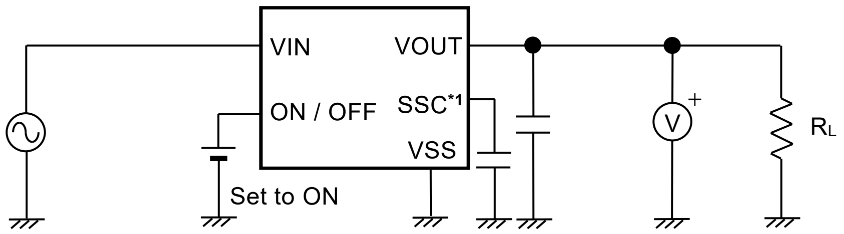


Figure 11 Test Circuit 5

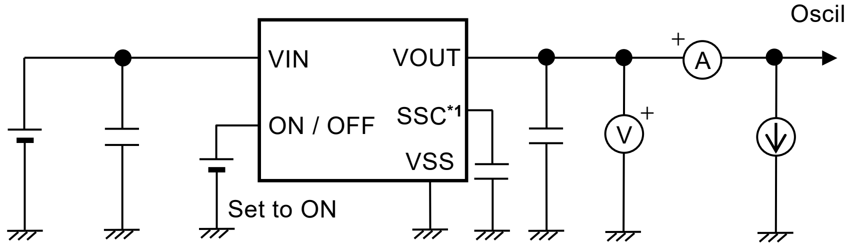


Figure 12 Test Circuit 6

***1.** Output voltage internally set A / B / C / D type (TO-252-5S(A), HSOP-8A) only.

2. Types in which output voltage is externally set (S-19259x00)

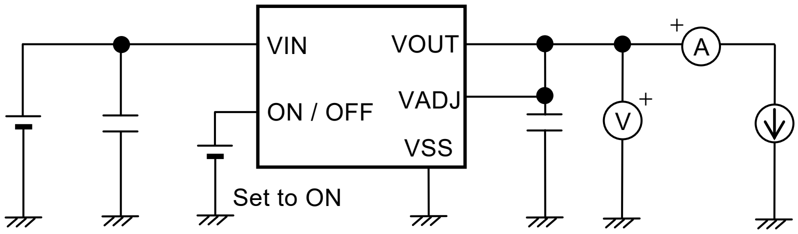


Figure 13 Test Circuit 7

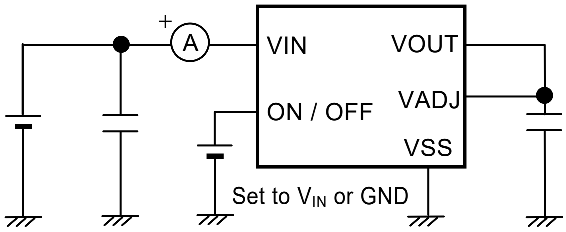


Figure 14 Test Circuit 8

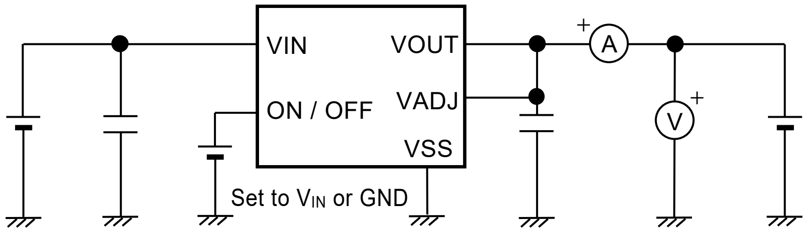


Figure 15 Test Circuit 9

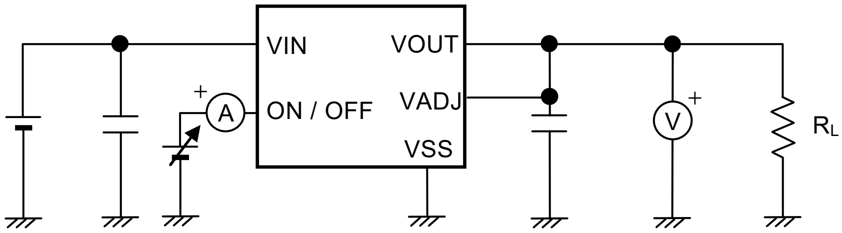


Figure 16 Test Circuit 10

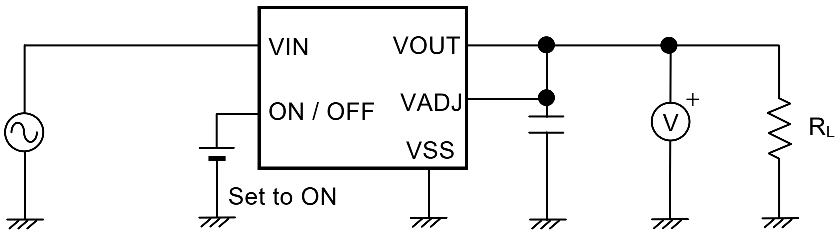


Figure 17 Test Circuit 11

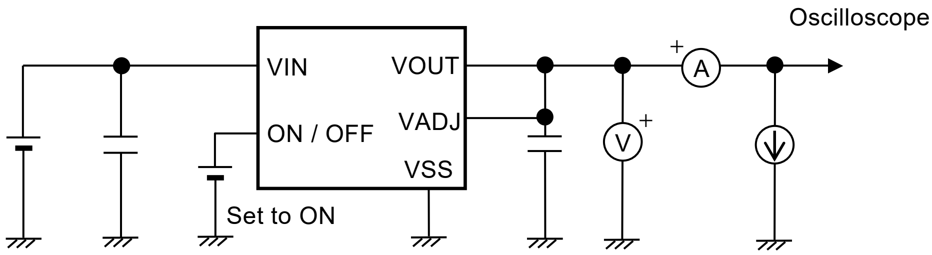


Figure 18 Test Circuit 12

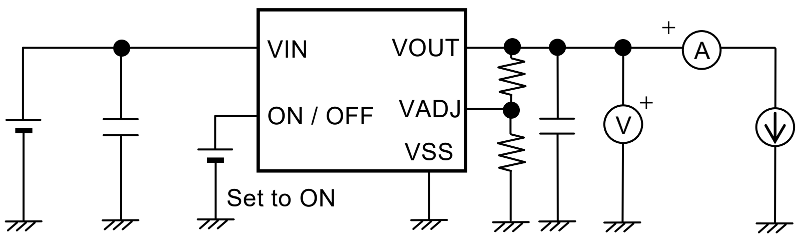
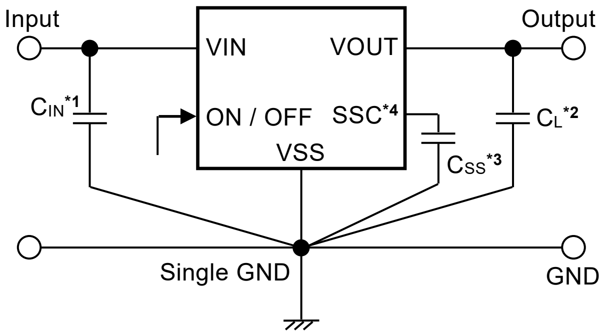


Figure 19 Test Circuit 13

■ Standard Circuits

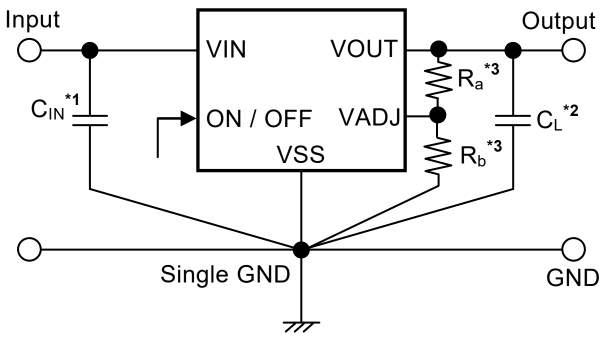
1. Types in which output voltage is internally set (S-19259x09 to S-19259x35)



***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.
***3.** A ceramic capacitor of 22 nF or less can be used as C_{SS}.
***4.** Output voltage internally set A / B / C / D type (TO-252-5S(A), HSOP-8A) only.

Figure 20

2. Types in which output voltage is externally set (S-19259x00)



***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.
***3.** Resistors of 0.1 kΩ to 606 kΩ can be used for R_a and 2 kΩ to 200 kΩ for R_b.

Figure 21

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, in a voltage regulator, an oscillation may occur depending on the selection of the external parts. Perform thorough evaluation including the temperature characteristics with an actual application using the above capacitors to confirm no oscillation occurs.

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

This IC requires an output capacitor between the VOUT pin and the 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 values of output overshoot and undershoot, which are transient response characteristics, vary depending on the value of the output capacitor.
The required capacitance for the input capacitor differs depending on the application.
Set the capacitance for input capacitor (C_{IN}) and output capacitor (C_L) as follows.

- $C_{IN} \geq 1.0$ μF
- $C_L \geq 1.0$ μF

■ Selection of Capacitor for Inrush Current Limit (C_{SS}) (Output Voltage Internally Set A / B / C / D Type (TO-252-5S(A), HSOP-8A))

In this IC, the inrush current limit time (t_{RUSH}) is adjustable by connecting a capacitor for inrush current limit (C_{SS}) between the SSC pin and the VSS pin. This IC operates stably even with no C_{SS} connection (in the state the SSC pin is leaved open).
The recommended value for C_{SS} is 0 nF*1 ≤ C_{SS} ≤ 22 nF, however, define the values by sufficient evaluation including the temperature characteristics under the usage condition.

***1.** In case this IC is used without C_{SS} connection (C_{SS} = 0 nF), be sure to leave the SSC pin open and do not connect it to the VIN pin and the VSS pin.

■ Selection of Resistor for Output Voltage External Setting (R_a, R_b) (Output Voltage Externally Set A / B / C / D Type)

This IC provides the types in which output voltage can be set via the external resistor. The output voltage can be set by connecting a resistor (R_a) between the VOUT pin and the VADJ pin, and a resistor (R_b) between the VADJ pin and the VSS pin.
Depending on the intended output voltage, select R_a and R_b from the range shown in **Table 19**.

Caution Since the VADJ pin impedance is comparatively high and is easily affected by noise, pay adequate attention to the wiring pattern.

Table 19

V_{OUT}	R_a	R_b
0.9 V	Connect to VOUT pin	Unnecessary
0.95 V to 5.0 V	0.1 kΩ to 606 kΩ	2 kΩ to 200 kΩ

■ Explanation of Terms

1. Output voltage (V_{OUT})

The values*2 specified in "**■ Electrical Characteristics**" are assured when the input voltage, output current, and temperature meet certain conditions*1.

***1.** Differs depending on the product.
***2.** When 0.9 V ≤ V_{OUT} < 1.1 V: ±25 mV,
When 1.1 V ≤ V_{OUT} < 2.6 V: ±2.3%,
When 2.6 V ≤ V_{OUT} ≤ 3.5 V: ±2.0%

Caution If a certain condition is not met, the output voltage accuracy may remain out of range. Refer to "■ Electrical Characteristics" and "■ Characteristics (Typical Data)" for details.

2. 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.

3. 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.

4. Dropout voltage (V_{drop})

Indicates the difference between the input voltage (V_{IN1}) and the output voltage when the output voltage becomes 98% of the output voltage value (V_{OUT3}) at $V_{IN} = V_{OUT(S)} + 1.0$ V*1 after the input voltage (V_{IN}) is decreased gradually.

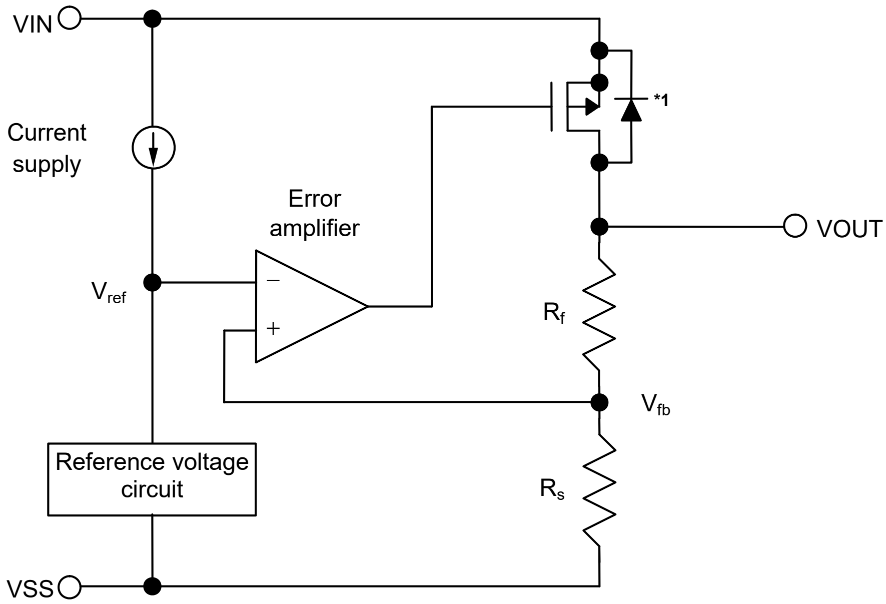
$V_{drop} = V_{IN1} - (V_{OUT3} \times 0.98)$

***1.** V_{IN} = 2.0 V only when I_{OUT} = 1000 mA and 0.9 V ≤ $V_{OUT(S)}$ < 1.0 V.

■ Operation

1. Basic operation

Figure 22 shows the block diagram of this IC.
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 22

2. Output transistor

In this IC, a low on-resistance P-channel MOS FET is used between the VIN pin and the VOUT pin as the output transistor. In order to keep V_{OUT} constant, the on-resistance of the output transistor varies appropriately according to the output current (I_{OUT}).

Caution Since a parasitic diode exists between the VIN pin and the VOUT pin due to the structure of the transistor, the IC may be damaged by a reverse current if V_{OUT} becomes higher than V_{IN}. Therefore, be sure that V_{OUT} does not exceed V_{IN} + 0.3 V.

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 output transistor between the VIN pin and the VOUT pin is turned off, reducing current consumption significantly. Note that the current consumption increases when a voltage of 0.3 V to V_{IN} – 0.3 V is applied to the ON / OFF pin.
The ON / OFF pin is configured as shown in **Figure 23** and **Figure 24**.

3. 1 S-19259 Series A / C / E / G 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.

3. 2 S-19259 Series B / D / F / H type

The ON / OFF pin is not internally pulled down to the VSS pin, so do not use these types with the ON / OFF pin in the floating status. When not using the ON / OFF pin, connect the pin to the VIN pin.

Table 20

Product Type	ON / OFF Pin	Internal Circuit	VOUT Pin Voltage	Current Consumption
A / B / C / D / E / F / G / H	"H": ON	Operate	Constant value*1	I_{SS1}*2
A / B / C / D / E / F / G / H	"L": OFF	Stop	Pulled down to V_{SS}*3	I_{SS2}

***1.** The constant value is output due to the regulating based on the set output voltage value.
***2.** Note that the IC's current consumption increases as much as current flows into the pull-down resistor when the ON / OFF pin is connected to the VIN pin and the S-19259 Series A / C / E / G type is operating (refer to **Figure 23**).
***3.** The VOUT pin voltage of the S-19259 Series A / B / E / F type is pulled down to V_{SS} due to combined resistance (R_{LOW} = 35 Ω typ.) of the discharge shunt circuit and the feedback resistors, and a load.

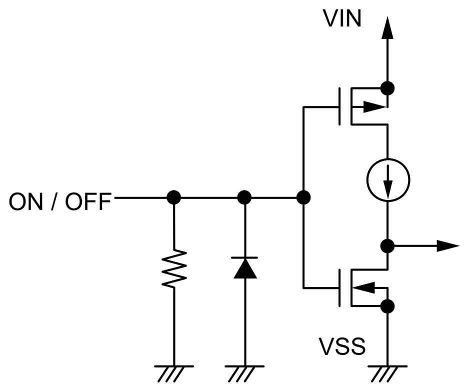


Figure 23 S-19259 Series A / C / E / G type

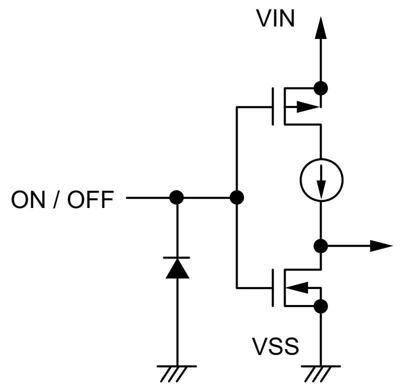


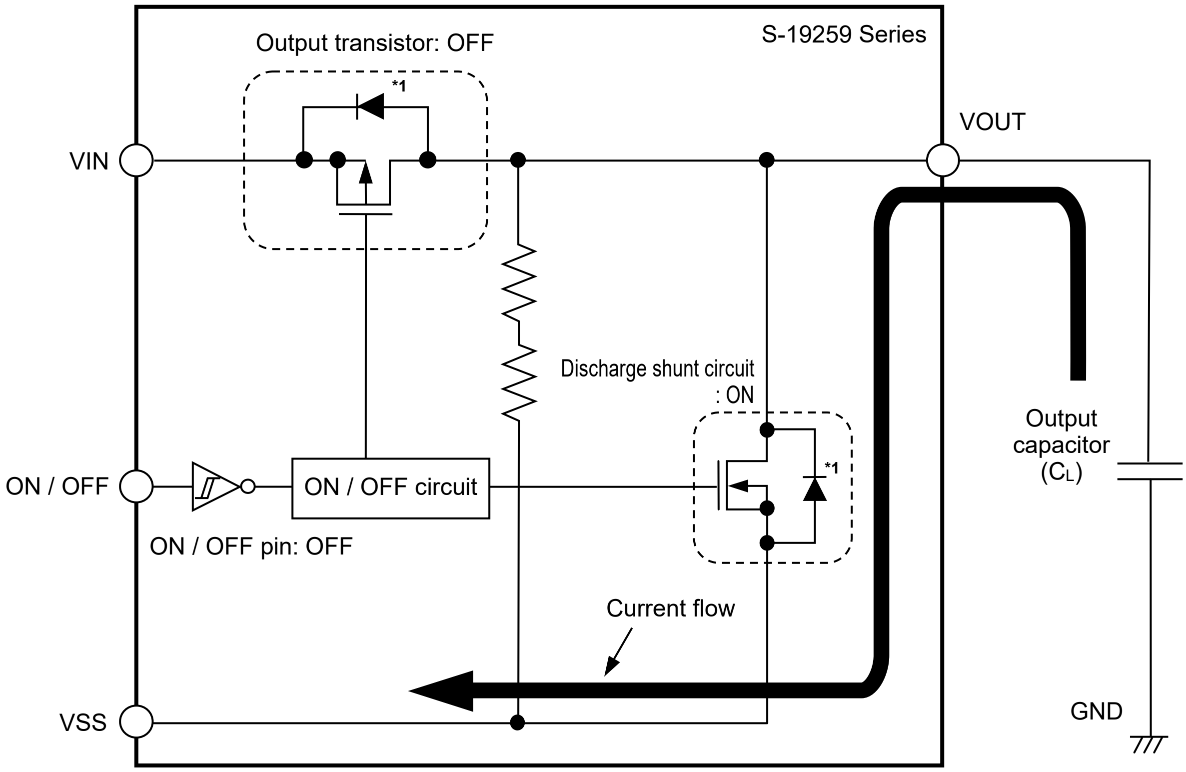
Figure 24 S-19259 Series B / D / F / H type

4. Discharge shunt function (S-19259 Series A / B / E / F type)

The S-19259 Series A / B / E / F type has a built-in discharge shunt circuit to discharge the output capacitance. The output capacitance is discharged as follows so that the VOUT pin reaches the V_{SS} level.

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

Since the S-19259 Series C / D / G / H type does not have a discharge shunt circuit, the VOUT pin is set to the V_{SS} level through several hundred kΩ internal divided resistors between the VOUT pin and the VSS pin. The S-19259 Series A / B / E / F type allows the VOUT pin to reach the V_{SS} level rapidly due to the discharge shunt circuit.



***1**. Parasitic diode

Figure 25

5. Pull-down resistor (S-19259 Series A / C / E / G 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 current flows into the pull-down resistor of 2.2 MΩ typ. when the ON / OFF pin is connected to the VIN pin.

6. Overcurrent protection circuit

This IC has a built-in overcurrent protection circuit to limit the overcurrent of the output transistor. When the VOUT pin is shorted to the VSS pin, that is, at the time of the output short-circuit, the output current is limited to 200 mA typ. due to the overcurrent protection circuit operation. This IC restarts regulating when the output transistor is released from the overcurrent status.

Caution This overcurrent protection circuit does not work as for thermal protection. For example, when the output transistor keeps the overcurrent status long at the time of output short-circuit or due to other reasons, pay attention to the conditions of the input voltage and the load current so as not to exceed the power dissipation.

7. Thermal shutdown circuit

This IC has a thermal shutdown circuit to protect the device from damage due to overheat. When the junction temperature rises to 170°C typ., the thermal shutdown circuit operates to stop regulating. When the junction temperature drops to 140°C typ., the thermal shutdown circuit is released to restart regulating.
Due to self-heating of this IC, if the thermal shutdown circuit starts operating, it stops regulating so that the output voltage drops. When regulation stops, this IC does not itself generate heat so that the IC's temperature drops. When the temperature drops, the thermal shutdown circuit is released to restart regulating, thus this IC generates heat again. Repeating this procedure makes waveform of the output voltage pulse-like form. Stop or restart of regulation continues unless decreasing either or both of the input voltage and the output voltage in order to reduce the internal power consumption, or decreasing the ambient temperature.

Table 21

Thermal Shutdown Circuit	VOUT Pin Voltage
Release: 140°C typ.*1	Constant value*2
Detection: 170°C typ.*1	Pulled down to V_{SS}*3

***1.** Junction temperature
***2.** The constant value is output due to the regulating based on the set output voltage value.
***3.** The VOUT pin voltage is pulled down to V_{SS} due to the feedback resistors (R_s and R_f) and a load.

8. Inrush current limit circuit

The S-19259 Series has a built-in inrush current limit circuit to limit the inrush current and the overshoot of the output voltage generated at power-on or at the time when the ON / OFF pin is set to ON. The inrush current is limited to 700 mA typ. The inrush current limit circuit starts to operate from the following times.

- Immediately after power-on
- At the time when the ON / OFF pin is set to ON

Figure 26 shows the relation between the inrush current limit time (t_{RUSH}) and the inrush current limit capacitor (C_{SS}).

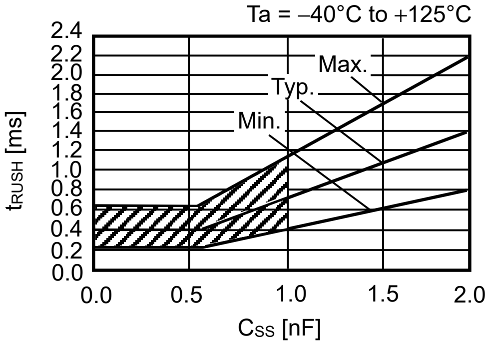


Figure 26

(1) C_{SS} = 0 nF

t_{RUSH} is determined by the internal capacitor (about 20 pF) and the time constant of the built-in constant current (about 0.04 μA). t_{RUSH} value is 0.23 ms min., 0.40 ms typ., 0.63 ms max.

(2) $C_{SS} \geq$ 1 nF

t_{RUSH} can be adjusted by the C_{SS} which is connected externally between the SSC pin*1 and the VSS pin. It is calculated by the following formula depending on the built-in constant (about 1 μA) and the C_{SS} time constant.
The inrush current limit coefficient is 0.4 min., 0.7 typ., 1.1 max. at Ta = +25°C.

t_{RUSH} [ms] = the inrush current limit coefficient × C_{SS} [nF]

(3) 0 nF < C_{SS} < 1 nF

Since the internal capacitor, the built-in constant current and C_{SS} have a variation each, t_{RUSH} is the one of following (a) and (b) in which the time is longer.

(a) The time determined by the internal capacitor (about 20 pF) and the time constant of the built-in constant current (about 0.04 μA).
(b) The time determined by C_{SS} connected externally between the SSC pin*1 and the VSS pin and the built-in constant current (about 1 μA).

When 0 nF < C_{SS}< 1 nF, t_{RUSH} is the range of the shaded area shown in **Figure 26**.

***1.** Output voltage internally set A / B / C / D type (TO-252-5S(A), HSOP-8A) only.

9. Externally setting output voltage (Output voltage externally set A / B / C / D type)

S-19259 series A / B / C / D type provides the types in which output voltage can be set via the external resistor. The output voltage can be set by connecting a resistor (R_a) between the VOUT pin and the VADJ pin, and a resistor (R_b) between the VADJ pin and the VSS pin.
The output voltage is determined by the following formulas.

$V_{OUT} = 0.9 + R_a \times I_a$ ······················(1)
By substituting $I_a = I_{VADJ} + 0.9 / R_b$ to above formula (1),
$V_{OUT} = 0.9 + R_a \times (I_{VADJ} + 0.9 / R_b) = 0.9 \times (1.0 + R_a / R_b) + R_a \times I_{VADJ}$ ··········(2)

In above formula (2), $R_a \times I_{VADJ}$ is a factor for the output voltage error.
Whether the output voltage error is minute is judged depending on the following (3) formula.

By substituting $I_{VADJ} = 0.9 / R_{VADJ}$ to $R_a \times I_{VADJ}$
$V_{OUT} = 0.9 \times (1.0 + R_a / R_b) + 0.9 \times R_a / R_{VADJ}$ ···················(3)

If R_{VADJ} is sufficiently larger than R_a, the error is judged as minute.

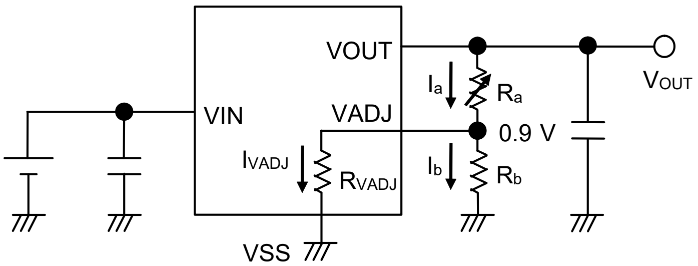


Figure 27

The following expression is in order to determine output voltage V_{OUT} = 3.0 V.
If resistance R_b = 2 kΩ, substitute R_{VADJ} = 400 kΩ typ. into (3),
Resistance $R_a = (3.0 / 0.9 - 1.0) \times ((2\text{ k} \times 400\text{ k}) / (2\text{ k} + 400\text{ k})) \cong 4.6\text{ k}\Omega$

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

■ Precautions

- Generally, when a voltage regulator is used under the condition that the load current value is small (1.0 mA or less), the output voltage may increase due to the leakage current of an output transistor.
- Generally, when a voltage regulator is used under the condition that the temperature is high, the output voltage may increase due to the leakage current of an output transistor.
- Generally, when the ON / OFF pin is used under the condition of OFF, the output voltage may increase due to the leakage current of an output transistor.
- Generally, when a voltage regulator is used under the condition that the impedance of the power supply is high, an oscillation may occur. Perform thorough evaluation including the temperature characteristics with an actual application to select C_{IN}.
- Generally, in a voltage regulator, an oscillation may occur depending on the selection of the external parts. The following use conditions are recommended in this IC; however, perform thorough evaluation including the temperature characteristics with an actual application to select C_{IN} and C_L. Refer to "**6. Example of equivalent series resistance vs. Output current characteristics (Ta = −40°C to +125°C)**" in "**■ Reference Data**" for the equivalent series resistance (R_{ESR}) of the output capacitor.

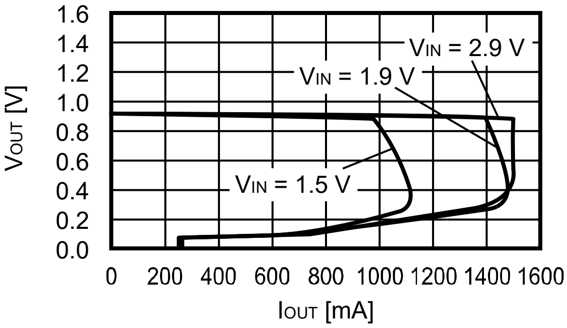
  Input capacitor (C_{IN}): 1.0 μF or more
  Output capacitor (C_L): 1.0 μF or more

- Generally, in a voltage regulator, the values of an overshoot and an undershoot in the output voltage vary depending on the variation factors of input voltage start-up, input voltage fluctuation, load fluctuation etc., or the capacitance of C_{IN} or C_L and the value of the equivalent series resistance (ESR), which may cause a problem to the stable operation. Perform thorough evaluation including the temperature characteristics with an actual application to select C_{IN} and C_L.
- Generally, in a voltage regulator, an overshoot may occur in the output voltage momentarily if the input voltage steeply changes when the input voltage is started up, the input voltage fluctuates, etc. Perform thorough evaluation including the temperature characteristics with an actual application to confirm no problems happen.
- Generally, in a voltage regulator, if the VOUT pin is steeply shorted with GND, a negative voltage exceeding the absolute maximum ratings may occur in the VOUT pin due to resonance phenomenon of the inductance and the capacitance including C_L on the application. The resonance phenomenon is expected to be weakened by inserting a series resistor into the resonance path, and the negative voltage is expected to be limited by inserting a protection diode between the VOUT pin and the VSS pin.
- Make sure of the conditions for the input voltage, output voltage and the load current so that the internal loss does not exceed the power dissipation.
- Do not apply an electrostatic discharge to this IC that exceeds the performance ratings of the built-in electrostatic protection circuit.
- When considering the output current value that the IC is able to output, make sure of the output current value specified in **Table 17** and **Table 18** in "**■ Electrical Characteristics**" and footnote ***4** of the table.
- Wiring patterns on the application related to the VIN pin, the VOUT pin and the VSS pin should be designed so that the impedance is low. When mounting C_{IN} between the VIN pin and the VSS pin, C_L between the VOUT pin and the VSS pin and C_{SS} between the SSC pin and the VSS pin, connect the capacitors as close as possible to the respective destination pins of the IC.
- When setting the output voltage by using an external resistor, connect a resistor (R_a) between the VOUT pin and the VADJ pin and a resistor (R_b) between the VADJ pin and the VSS pin close to the respective pins.
- In the package equipped with heat sink of backside, mount the heat sink firmly. Since the heat radiation differs according to the condition of the application, perform thorough evaluation with an actual application to confirm no problems happen.
- 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.

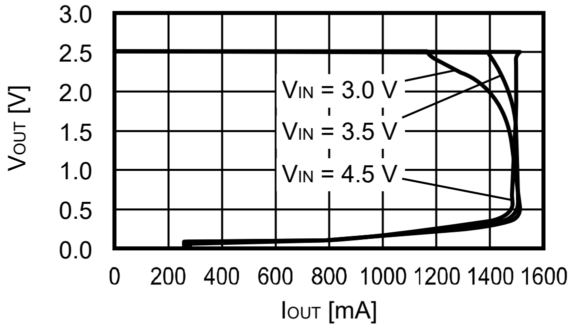
■ Characteristics (Typical Data)

1. Output voltage vs. Output current (When load current increases) (Ta = +25°C)

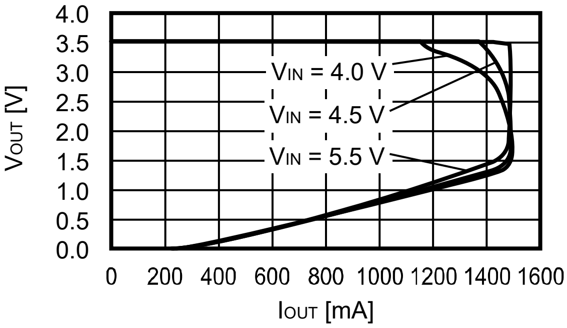
1. 1 V_{OUT} = 0.9 V



1. 2 V_{OUT} = 2.5 V



1. 3 V_{OUT} = 3.5 V

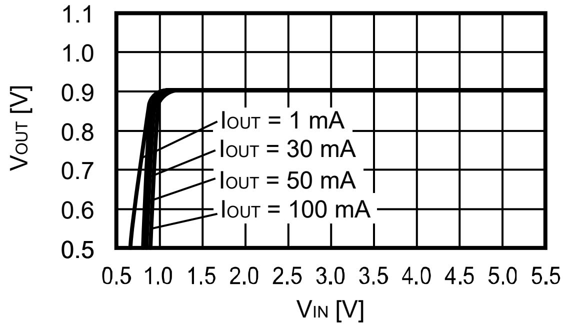


Remark In determining the output current, attention should be paid to the following.

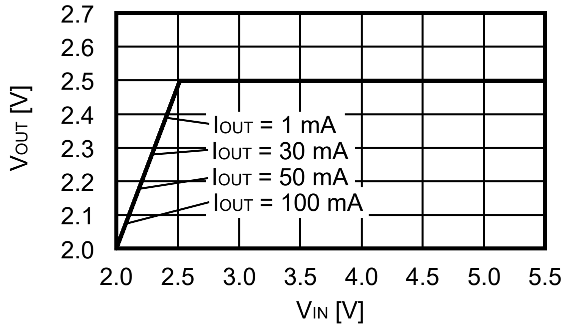
1. The minimum output current value and footnote ***4** of **Table 17** and **Table 18** in "**■ Electrical Characteristics**"
2. The power dissipation

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

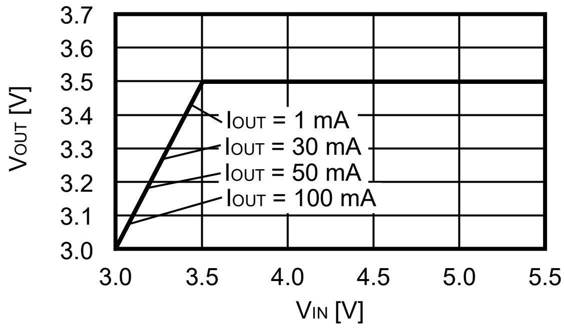
2. 1 V_{OUT} = 0.9 V



2. 2 V_{OUT} = 2.5 V

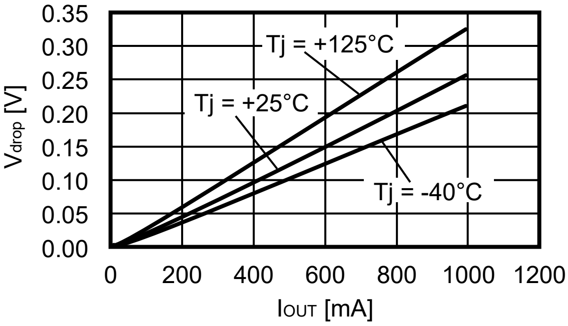


2. 3 V_{OUT} = 3.5 V

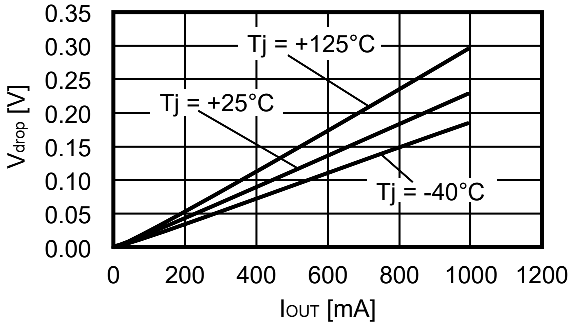


3. Dropout voltage vs. Output current

3. 1 V_{OUT} = 2.5 V

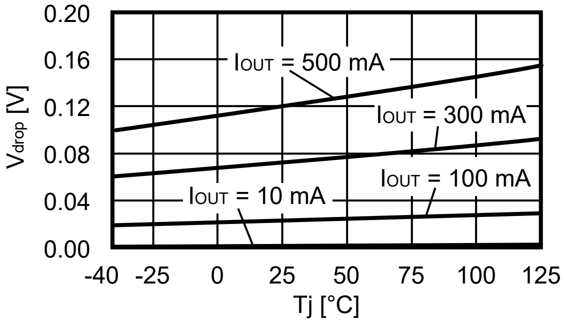


3. 2 V_{OUT} = 3.5 V

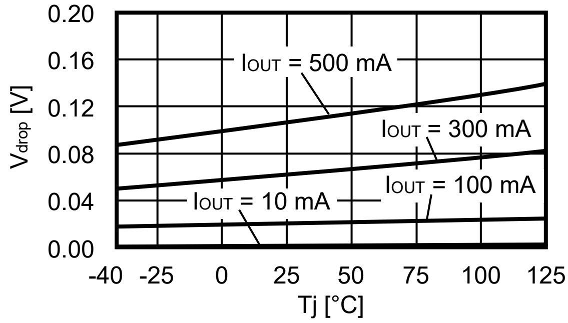


4. Dropout voltage vs. Junction temperature

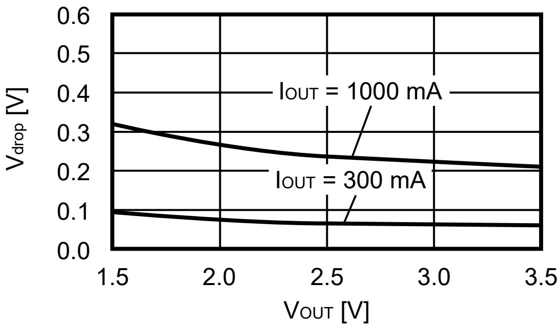
4. 1 V_{OUT} = 2.5 V



4. 2 V_{OUT} = 3.5 V

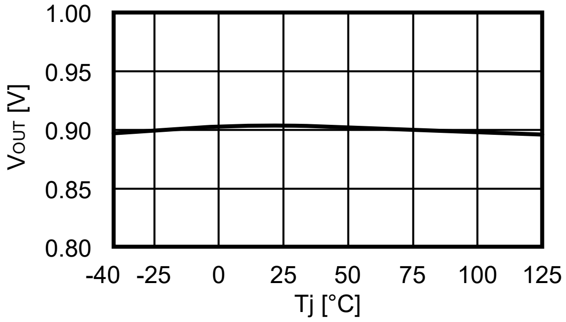


5. Dropout voltage vs. Set output voltage (Ta = +25°C)

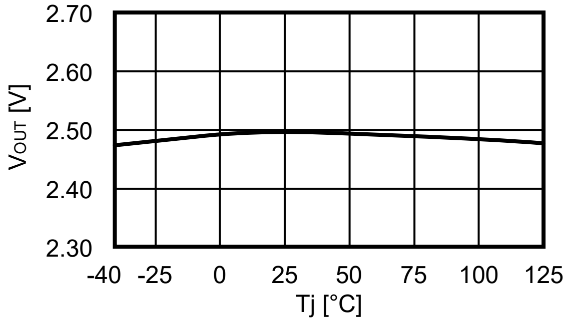


6. Output voltage vs. Junction temperature

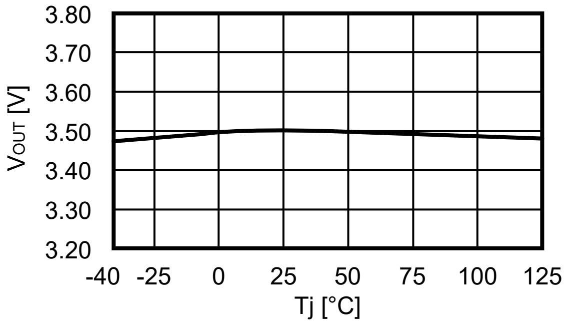
6. 1 V_{OUT} = 0.9 V



6. 2 V_{OUT} = 2.5 V

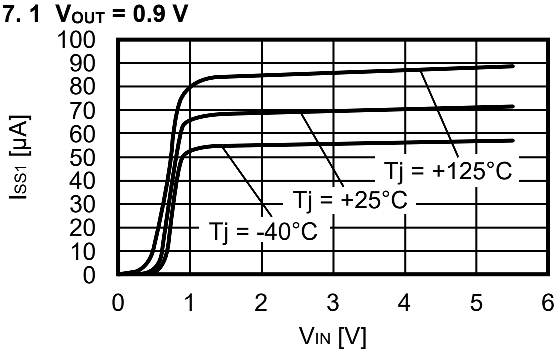


6. 3 V_{OUT} = 3.5 V

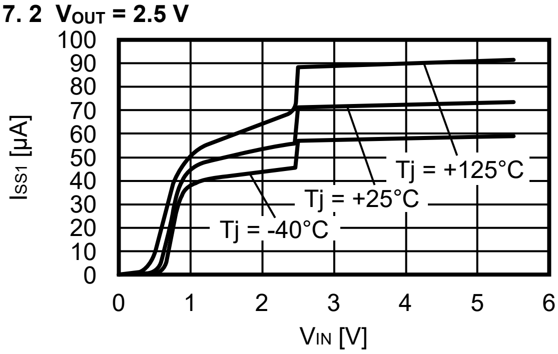


7. Current consumption during operation vs. Input voltage

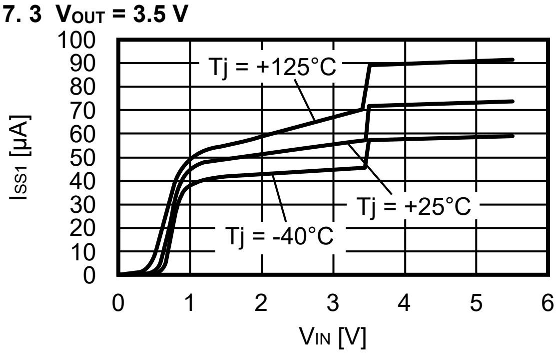
7. 1 V_{OUT} = 0.9 V



7. 2 V_{OUT} = 2.5 V

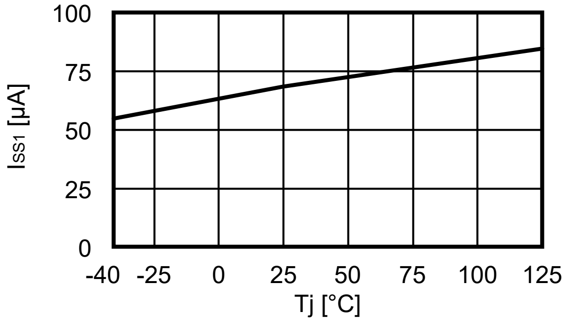


7. 3 V_{OUT} = 3.5 V

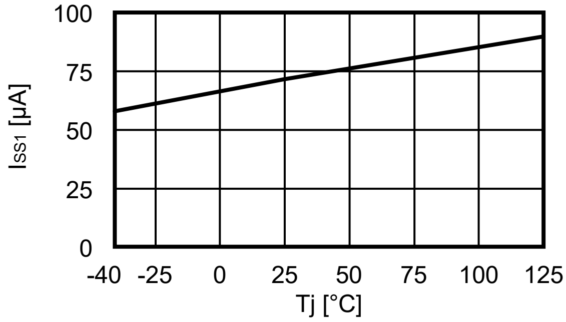


8. Current consumption during operation vs. Junction temperature

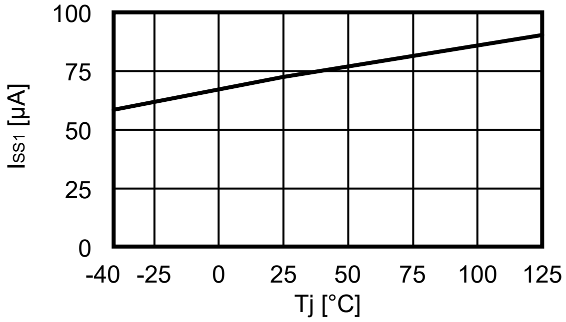
8. 1 V_{OUT} = 0.9 V



8. 2 V_{OUT} = 2.5 V

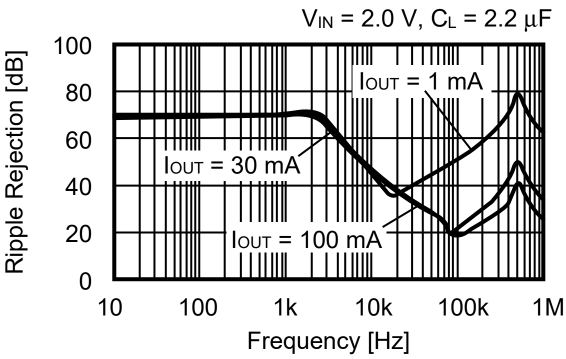


8. 3 V_{OUT} = 3.5 V

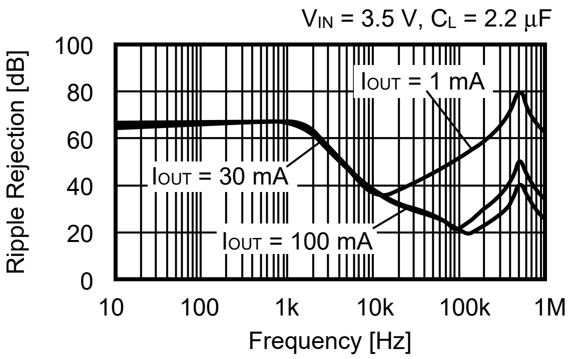


9. Ripple rejection (Ta = +25°C)

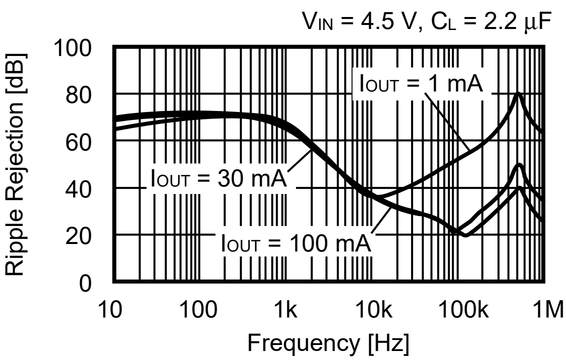
9. 1 V_{OUT} = 0.9 V



9. 2 V_{OUT} = 2.5 V



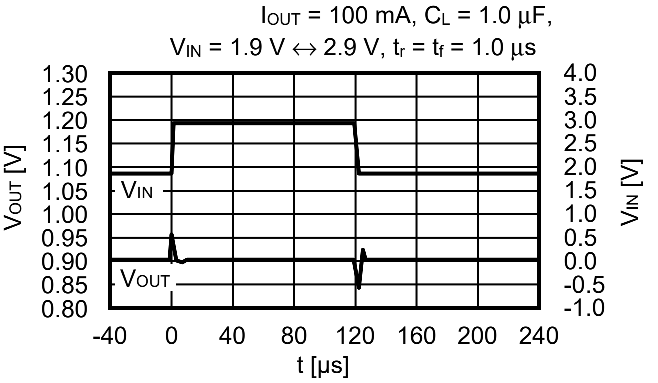
9. 3 V_{OUT} = 3.5 V



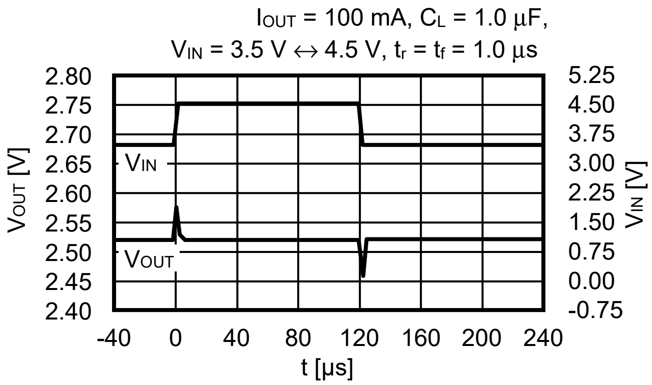
■ Reference Data

1. Transient response characteristics when input (Ta = +25°C)

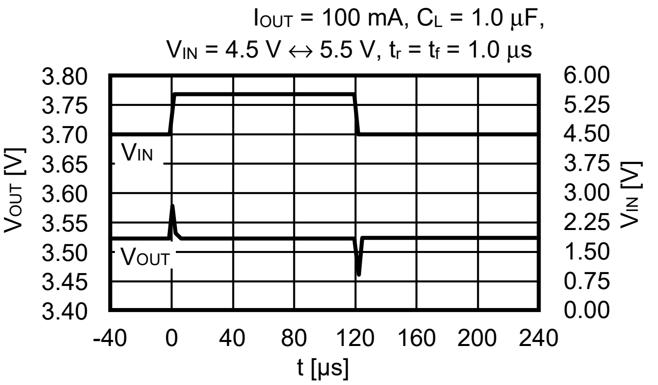
1. 1 V_{OUT} = 0.9 V



1. 2 V_{OUT} = 2.5 V



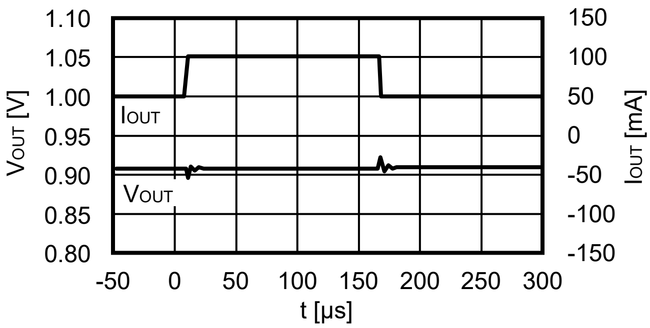
1. 3 V_{OUT} = 3.5 V



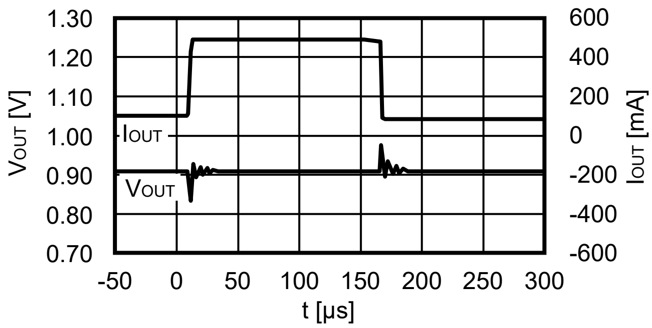
2. Transient response characteristics of load (Ta = +25°C)

2. 1 V_{OUT} = 0.9 V

V_{IN} = 1.9 V, C_{IN} = C_L = 2.2 μF, I_{OUT} = 50 mA ↔ 100 mA

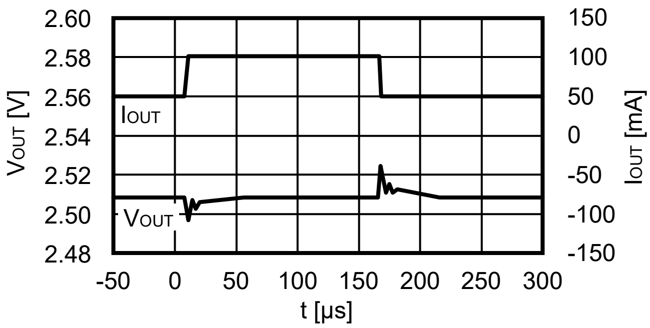


V_{IN} = 1.9 V, C_{IN} = C_L = 2.2 μF, I_{OUT} = 100 mA ↔ 500 mA

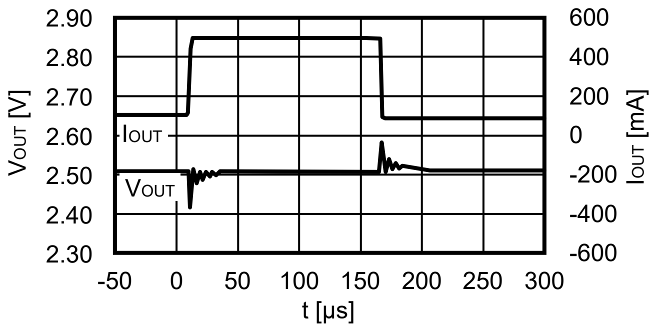


2. 2 V_{OUT} = 2.5 V

V_{IN} = 3.5 V, C_{IN} = C_L = 2.2 μF, I_{OUT} = 50 mA ↔ 100 mA

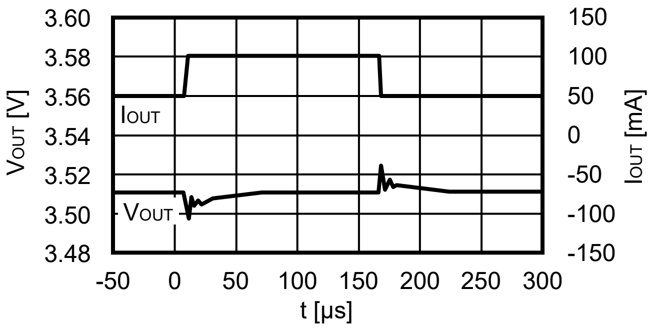


V_{IN} = 3.5 V, C_{IN} = C_L = 2.2 μF, I_{OUT} = 100 mA ↔ 500 mA

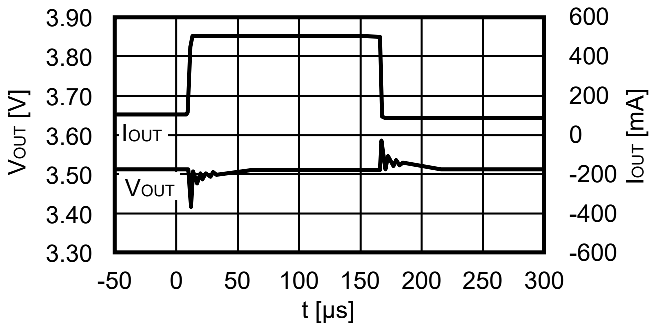


2. 3 V_{OUT} = 3.5 V

V_{IN} = 4.5 V, C_{IN} = C_L = 2.2 μF, I_{OUT} = 50 mA ↔ 100 mA



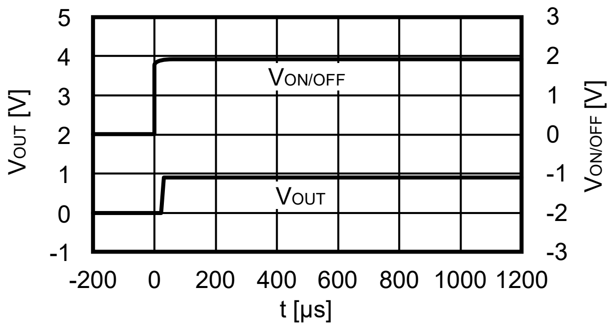
V_{IN} = 4.5 V, C_{IN} = C_L = 2.2 μF, I_{OUT} = 100 mA ↔ 500 mA



3. Transient response characteristics of ON / OFF pin (Ta = +25°C)

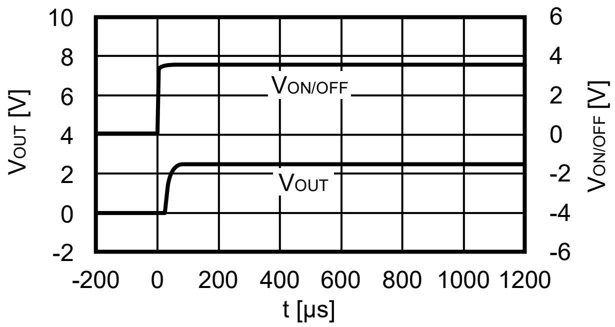
3. 1 V_{OUT} = 0.9 V

V_{IN} = 1.9 V, C_{IN} = C_L = 1.0 μF, I_{OUT} = 100 mA,
$V_{ON / OFF}$ = 0 V → 1.9 V, t_r = 1.0 μs



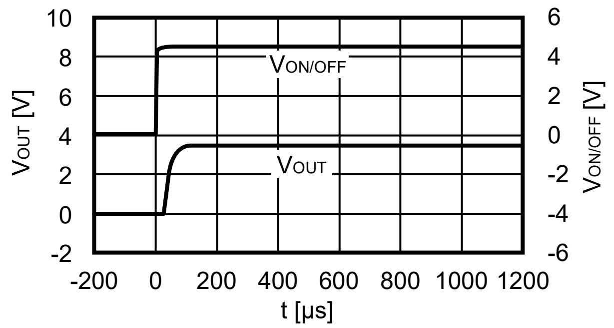
3. 2 V_{OUT} = 2.5 V

V_{IN} = 3.5 V, C_{IN} = C_L = 1.0 μF, I_{OUT} = 100 mA,
$V_{ON / OFF}$ = 0 V → 3.5 V, t_r = 1.0 μs



3. 3 V_{OUT} = 3.5 V

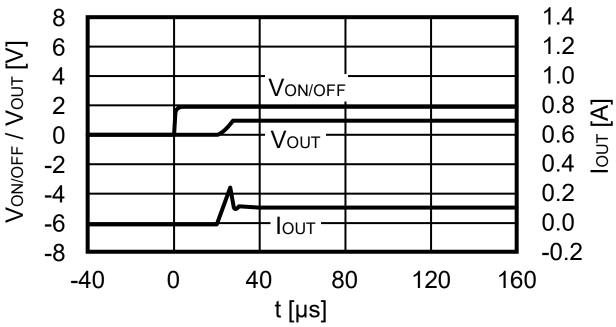
V_{IN} = 4.5 V, C_{IN} = C_L = 1.0 μF, I_{OUT} = 100 mA,
$V_{ON / OFF}$ = 0 V → 4.5 V, t_r = 1.0 μs



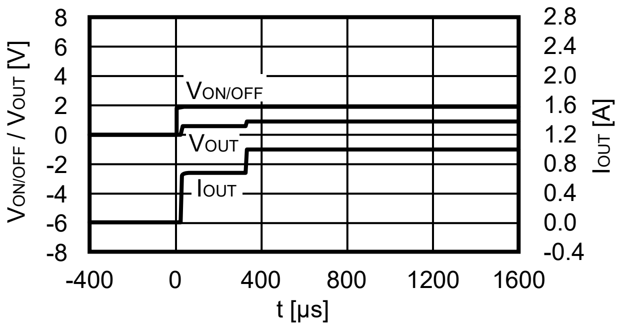
4. Characteristics of inrush current (Ta = +25°C)

4. 1 V_{OUT} = 0.9 V

V_{IN} = 1.9 V, C_{IN} = C_L = 1.0 μF, C_{SS} = 0 nF, I_{OUT} = 100 mA,
$V_{ON/OFF}$ = 0 V → 1.9 V, t_r = 1.0 μs

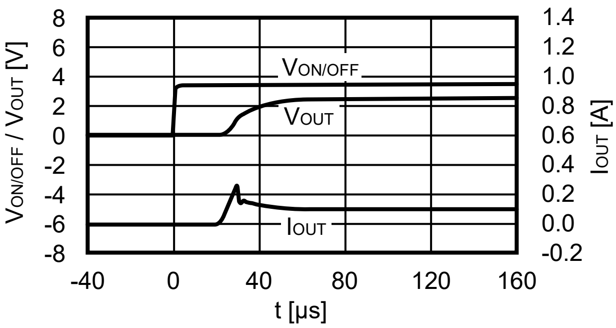


V_{IN} = 1.9 V, C_{IN} = C_L = 1.0 μF, C_{SS} = 0 nF, I_{OUT} = 1000 mA,
$V_{ON/OFF}$ = 0 V → 1.9 V, t_r = 1.0 μs

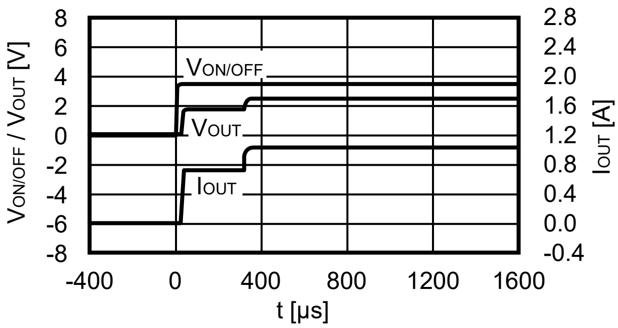


4. 2 V_{OUT} = 2.5 V

V_{IN} = 3.5 V, C_{IN} = C_L = 1.0 μF, C_{SS} = 0 nF, I_{OUT} = 100 mA,
$V_{ON/OFF}$ = 0 V → 3.5 V, t_r = 1.0 μs

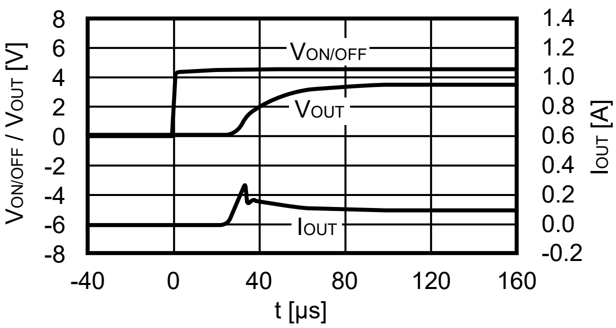


V_{IN} = 3.5 V, C_{IN} = C_L = 1.0 μF, C_{SS} = 0 nF, I_{OUT} = 1000 mA,
$V_{ON/OFF}$ = 0 V → 3.5 V, t_r = 1.0 μs

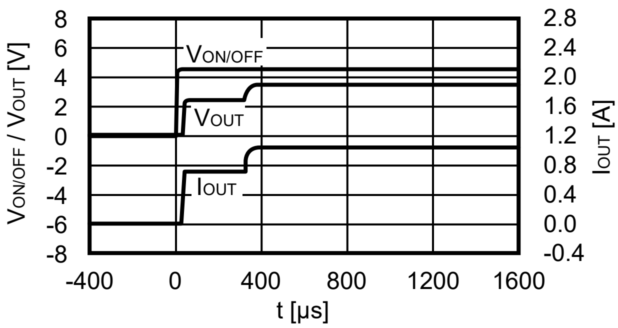


4. 3 V_{OUT} = 3.5 V

V_{IN} = 4.5 V, C_{IN} = C_L = 1.0 μF, C_{SS} = 0 nF, I_{OUT} = 100 mA,
$V_{ON/OFF}$ = 0 V → 4.5 V, t_r = 1.0 μs



V_{IN} = 4.5 V, C_{IN} = C_L = 1.0 μF, C_{SS} = 0 nF, I_{OUT} = 1000 mA,
$V_{ON/OFF}$ = 0 V → 4.5 V, t_r = 1.0 μs



5. Output capacitance vs. Characteristics of discharge time (Ta = +25°C)

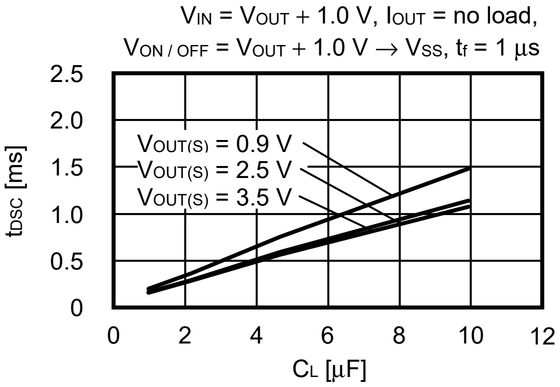


Figure 28 S-19259 Series A / B / E / F type (with discharge shunt function)

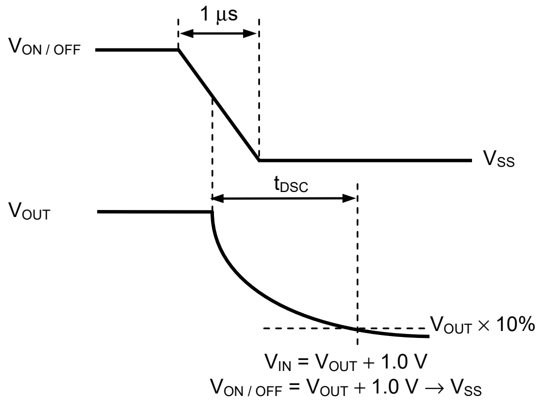


Figure 29 Measurement Condition of Discharge Time

6. Example of equivalent series resistance vs. Output current characteristics (Ta = −40°C to +125°C)

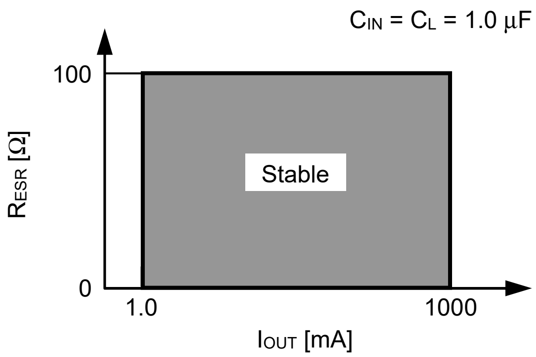
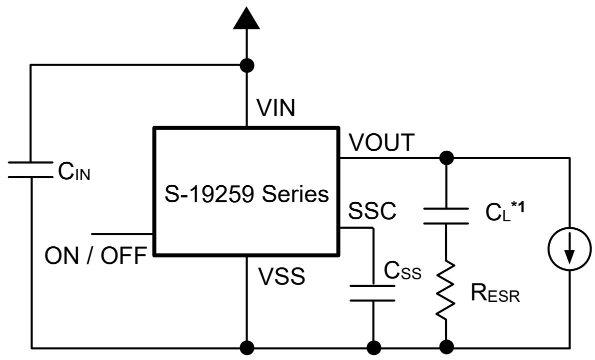


Figure 30

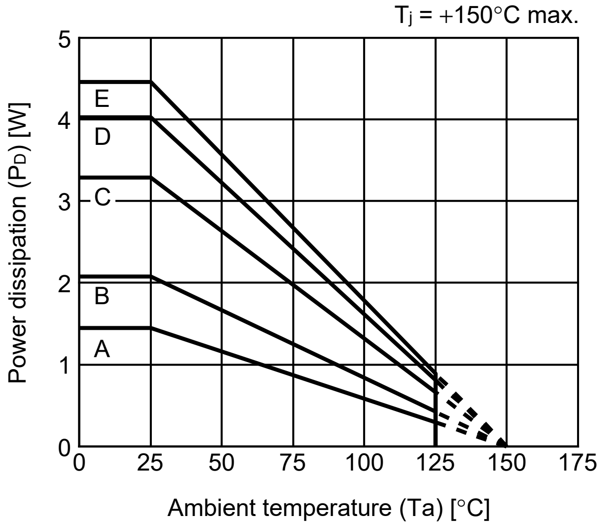


***1.** C_L: TDK Corporation CGA5L3X8R1H105K (1.0 μF)

Figure 31

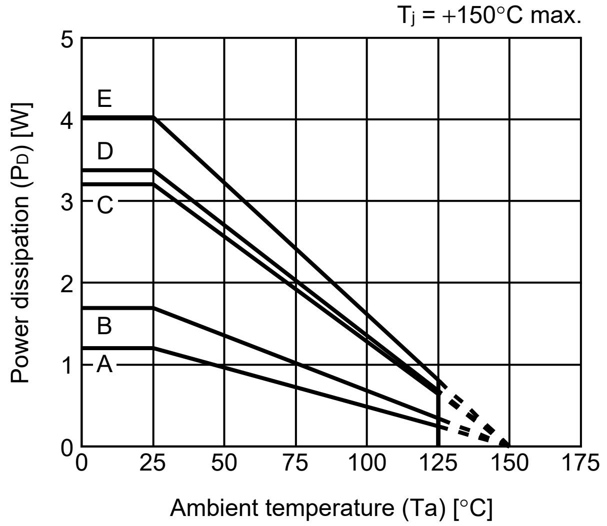
■ Power Dissipation

TO-252-5S(A)



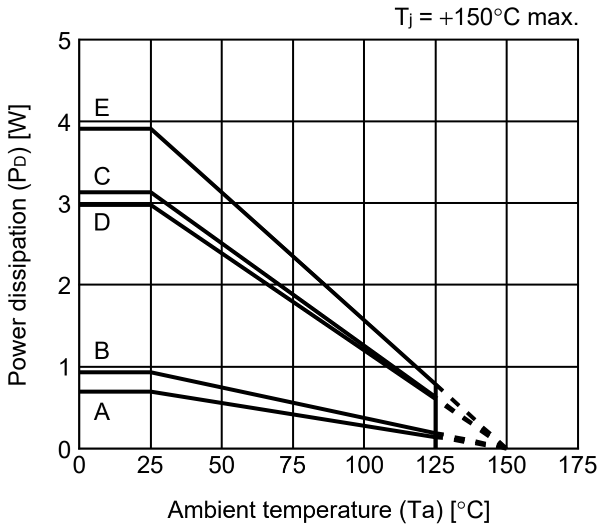
Board	Power Dissipation (P_D)
A	1.45 W
B	2.08 W
C	3.29 W
D	4.03 W
E	4.46 W

HSOP-8A



Board	Power Dissipation (P_D)
A	1.20 W
B	1.69 W
C	3.21 W
D	3.38 W
E	4.03 W

HSNT-8(2030)

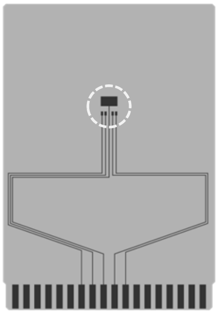


Board	Power Dissipation (P_D)
A	0.69 W
B	0.93 W
C	3.13 W
D	2.98 W
E	3.91 W

TO-252-5S Test Board

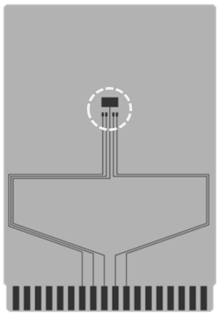
IC Mount Area

(1) Board A



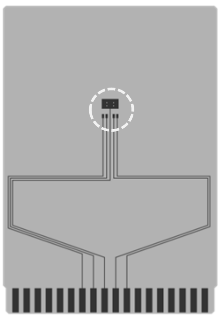
Item		Specification
Size [mm]		114.3 x 76.2 x t1.6
Material		FR-4
Number of copper foil layer		2
Copper foil layer [mm]	1	Land pattern and wiring for testing: t0.070
	2	-
	3	-
	4	74.2 x 74.2 x t0.070
Thermal via		-

(2) Board B

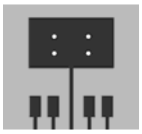


Item		Specification
Size [mm]		114.3 x 76.2 x t1.6
Material		FR-4
Number of copper foil layer		4
Copper foil layer [mm]	1	Land pattern and wiring for testing: t0.070
	2	74.2 x 74.2 x t0.035
	3	74.2 x 74.2 x t0.035
	4	74.2 x 74.2 x t0.070
Thermal via		-

(3) Board C



Item		Specification
Size [mm]		114.3 x 76.2 x t1.6
Material		FR-4
Number of copper foil layer		4
Copper foil layer [mm]	1	Land pattern and wiring for testing: t0.070
	2	74.2 x 74.2 x t0.035
	3	74.2 x 74.2 x t0.035
	4	74.2 x 74.2 x t0.070
Thermal via		Number: 4 Diameter: 0.3 mm



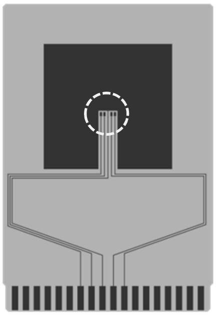
enlarged view

No. TO252-5S-A-Board-SD-1.0

TO-252-5S Test Board

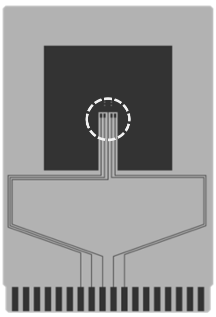
(4) Board D

IC Mount Area



Item		Specification
Size [mm]		114.3 x 76.2 x t1.6
Material		FR-4
Number of copper foil layer		4
Copper foil layer [mm]	1	Pattern for heat radiation: 2000mm^2 t0.070
	2	74.2 x 74.2 x t0.035
	3	74.2 x 74.2 x t0.035
	4	74.2 x 74.2 x t0.070
Thermal via		-

(5) Board E



Item		Specification
Size [mm]		114.3 x 76.2 x t1.6
Material		FR-4
Number of copper foil layer		4
Copper foil layer [mm]	1	Pattern for heat radiation: 2000mm^2 t0.070
	2	74.2 x 74.2 x t0.035
	3	74.2 x 74.2 x t0.035
	4	74.2 x 74.2 x t0.070
Thermal via		Number: 4 Diameter: 0.3 mm

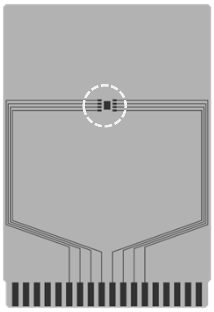
enlarged view

No. TO252-5S-A-Board-SD-1.0

HSOP-8A Test Board

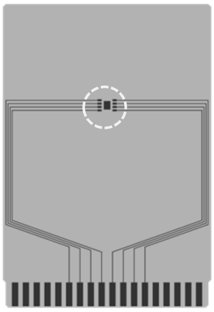
IC Mount Area

(1) Board A



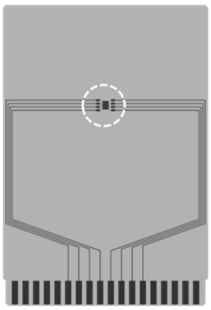
Item		Specification
Size [mm]		114.3 x 76.2 x t1.6
Material		FR-4
Number of copper foil layer		2
Copper foil layer [mm]	1	Land pattern and wiring for testing: t0.070
	2	-
	3	-
	4	74.2 x 74.2 x t0.070
Thermal via		-

(2) Board B

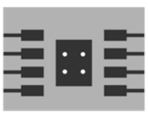


Item		Specification
Size [mm]		114.3 x 76.2 x t1.6
Material		FR-4
Number of copper foil layer		4
Copper foil layer [mm]	1	Land pattern and wiring for testing: t0.070
	2	74.2 x 74.2 x t0.035
	3	74.2 x 74.2 x t0.035
	4	74.2 x 74.2 x t0.070
Thermal via		-

(3) Board C



Item		Specification
Size [mm]		114.3 x 76.2 x t1.6
Material		FR-4
Number of copper foil layer		4
Copper foil layer [mm]	1	Land pattern and wiring for testing: t0.070
	2	74.2 x 74.2 x t0.035
	3	74.2 x 74.2 x t0.035
	4	74.2 x 74.2 x t0.070
Thermal via		Number: 4 Diameter: 0.3 mm



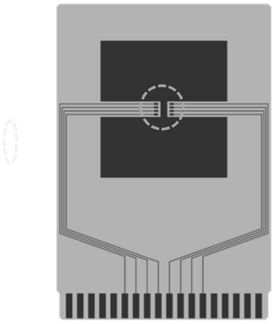
enlarged view

No. HSOP8A-A-Board-SD-1.0

HSOP-8A Test Board

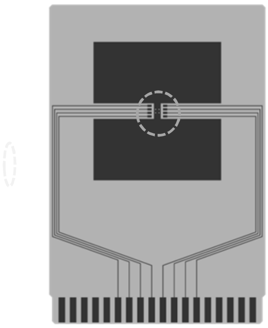
IC Mount Area

(4) Board D

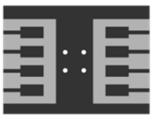


Item		Specification
Size [mm]		114.3 x 76.2 x t1.6
Material		FR-4
Number of copper foil layer		4
Copper foil layer [mm]	1	Pattern for heat radiation: 2000mm2 t0.070
	2	74.2 x 74.2 x t0.035
	3	74.2 x 74.2 x t0.035
	4	74.2 x 74.2 x t0.070
Thermal via		-

(5) Board E



Item		Specification
Size [mm]		114.3 x 76.2 x t1.6
Material		FR-4
Number of copper foil layer		4
Copper foil layer [mm]	1	Pattern for heat radiation: 2000mm^2 t0.070
	2	74.2 x 74.2 x t0.035
	3	74.2 x 74.2 x t0.035
	4	74.2 x 74.2 x t0.070
Thermal via		Number: 4 Diameter: 0.3 mm



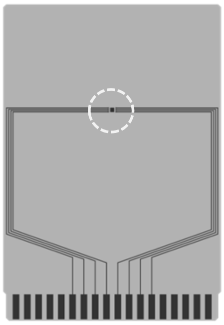
enlarged view

No. HSOP8A-A-Board-SD-1.0

HSNT-8(2030) Test Board

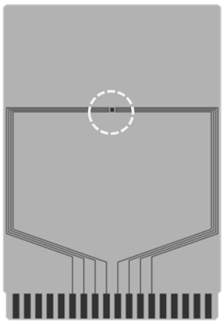
IC Mount Area

(1) Board A



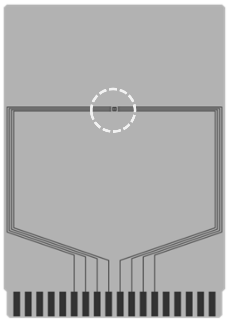
Item		Specification
Size [mm]		114.3 x 76.2 x t1.6
Material		FR-4
Number of copper foil layer		2
Copper foil layer [mm]	1	Land pattern and wiring for testing: t0.070
	2	-
	3	-
	4	74.2 x 74.2 x t0.070
Thermal via		-

(2) Board B

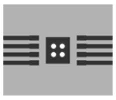


Item		Specification
Size [mm]		114.3 x 76.2 x t1.6
Material		FR-4
Number of copper foil layer		4
Copper foil layer [mm]	1	Land pattern and wiring for testing: t0.070
	2	74.2 x 74.2 x t0.035
	3	74.2 x 74.2 x t0.035
	4	74.2 x 74.2 x t0.070
Thermal via		-

(3) Board C



Item		Specification
Size [mm]		114.3 x 76.2 x t1.6
Material		FR-4
Number of copper foil layer		4
Copper foil layer [mm]	1	Land pattern and wiring for testing: t0.070
	2	74.2 x 74.2 x t0.035
	3	74.2 x 74.2 x t0.035
	4	74.2 x 74.2 x t0.070
Thermal via		Number: 4 Diameter: 0.3 mm



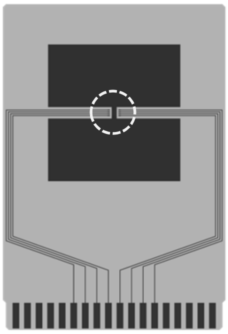
enlarged view

No. HSNT8-A-Board-SD-2.0

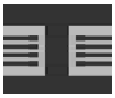
HSNT-8(2030) Test Board

IC Mount Area

(4) Board D

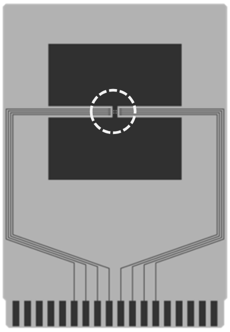


Item		Specification
Size [mm]		114.3 x 76.2 x t1.6
Material		FR-4
Number of copper foil layer		4
Copper foil layer [mm]	1	Pattern for heat radiation: 2000mm^2 t0.070
	2	74.2 x 74.2 x t0.035
	3	74.2 x 74.2 x t0.035
	4	74.2 x 74.2 x t0.070
Thermal via		-

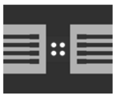


enlarged view

(5) Board E

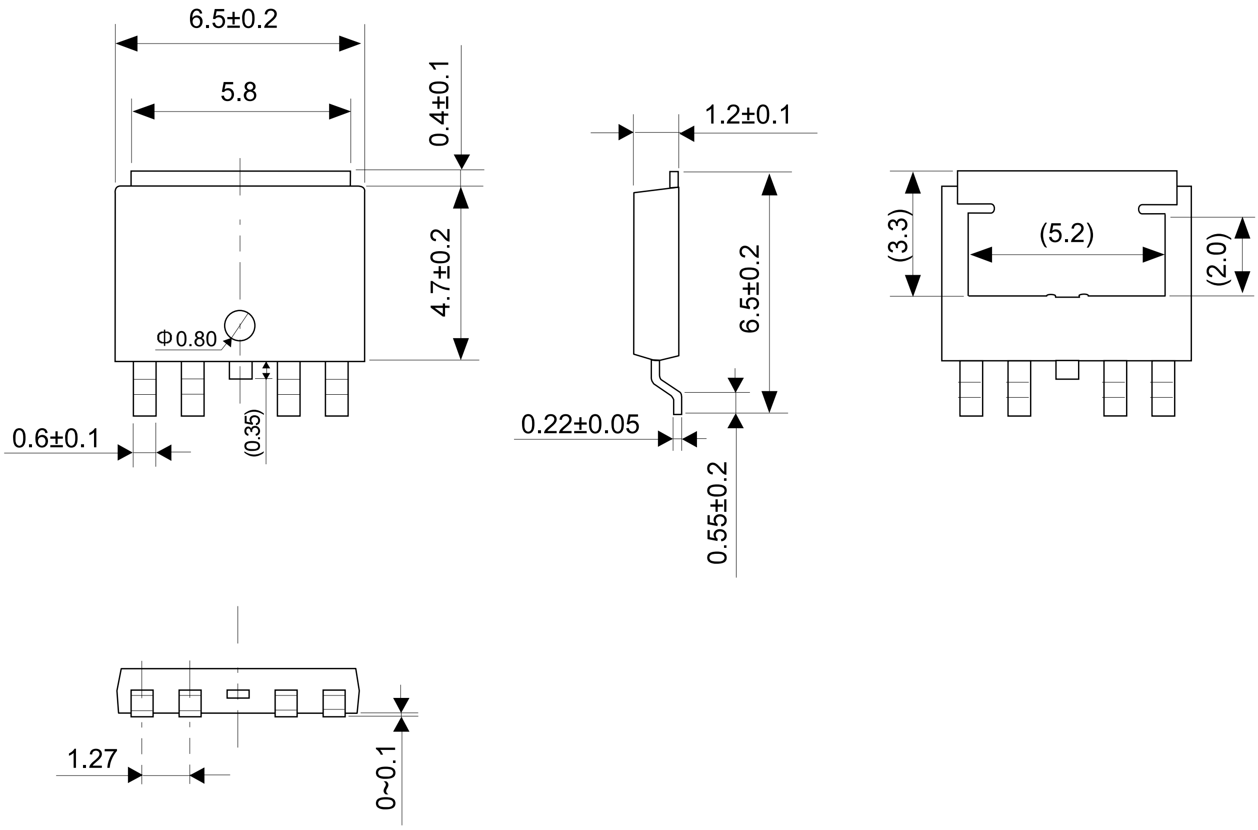


Item		Specification
Size [mm]		114.3 x 76.2 x t1.6
Material		FR-4
Number of copper foil layer		4
Copper foil layer [mm]	1	Pattern for heat radiation: 2000mm^2 t0.070
	2	74.2 x 74.2 x t0.035
	3	74.2 x 74.2 x t0.035
	4	74.2 x 74.2 x t0.070
Thermal via		Number: 4 Diameter: 0.3 mm



enlarged view

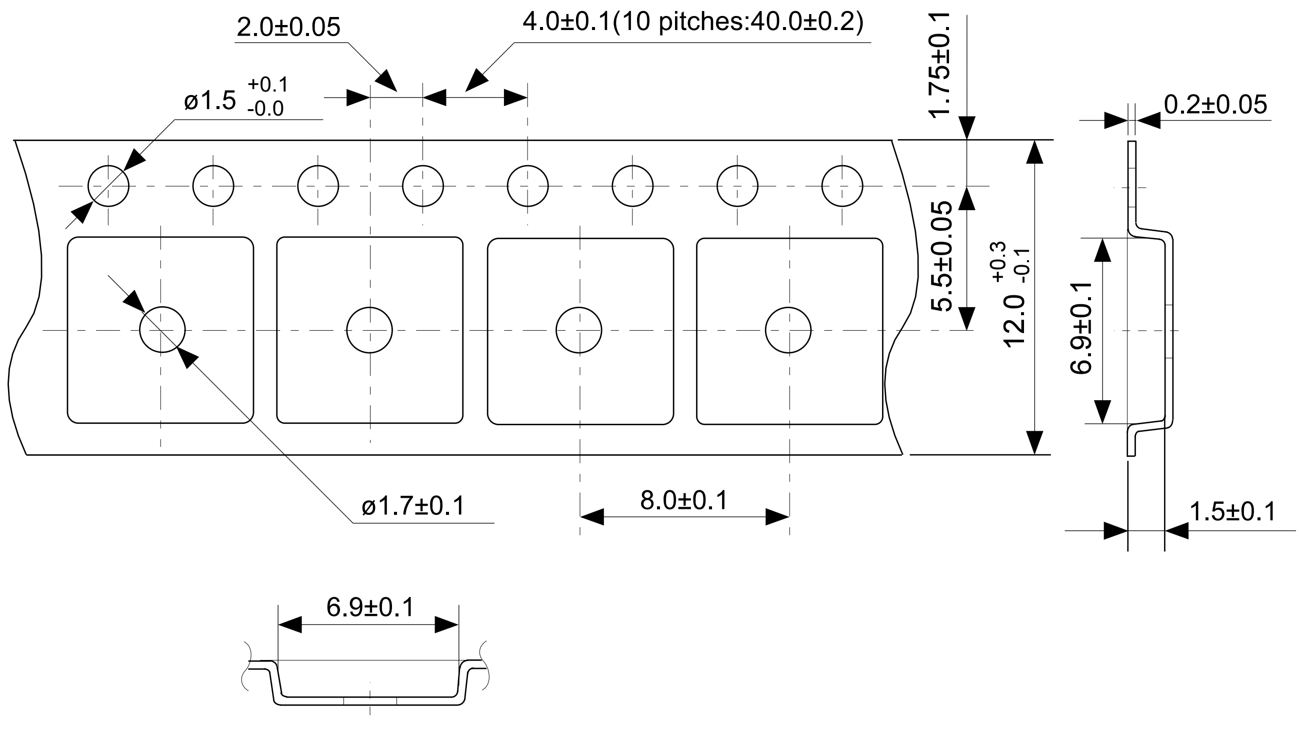
No. HSNT8-A-Board-SD-2.0

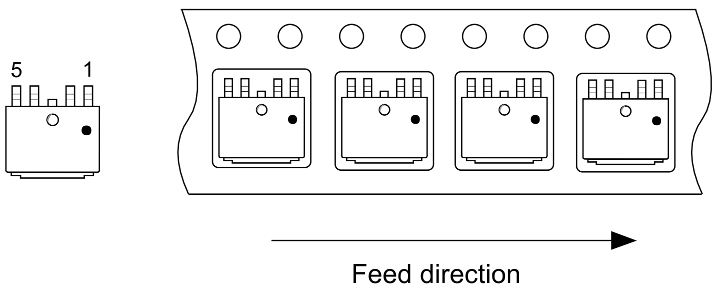


No. VA005-A-P-SD-2.0

TITLE	TO-252-5S-A-PKG Dimensions
No.	VA005-A-P-SD-2.0
ANGLE	
UNIT	mm

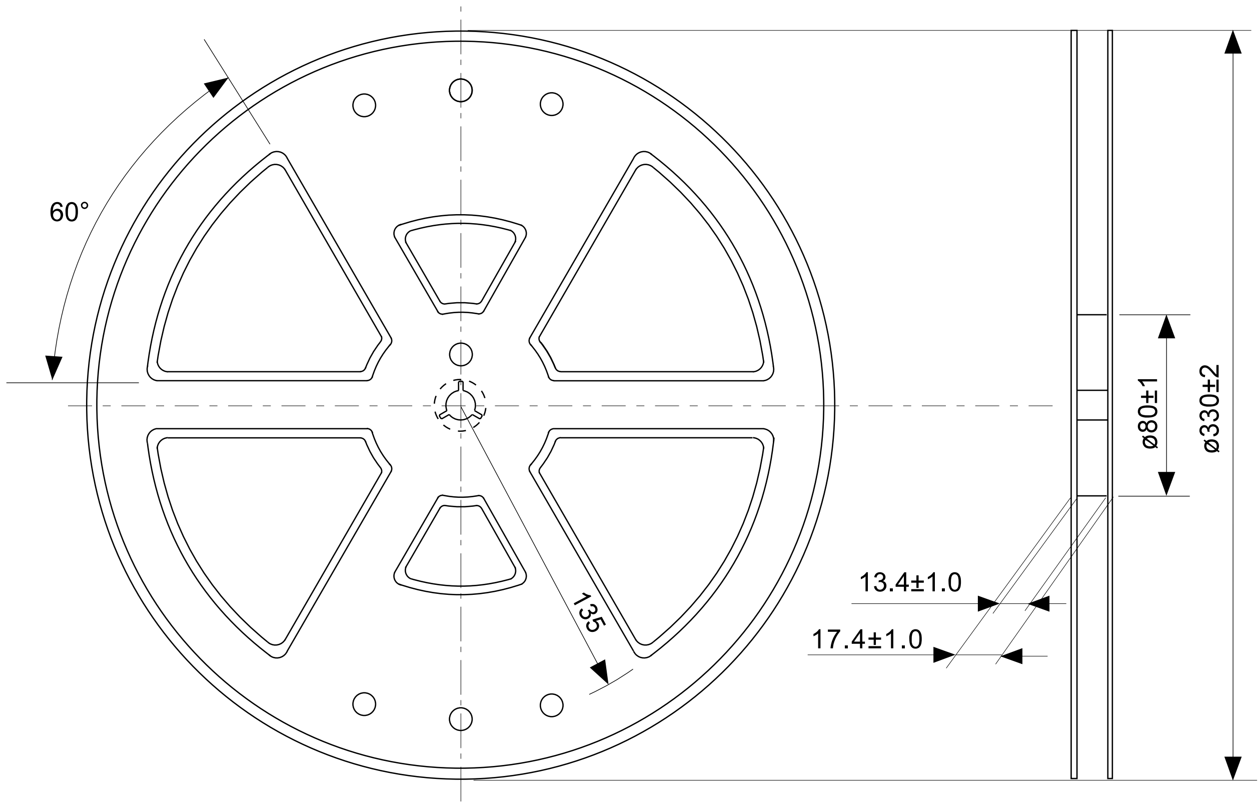
ABLIC Inc.



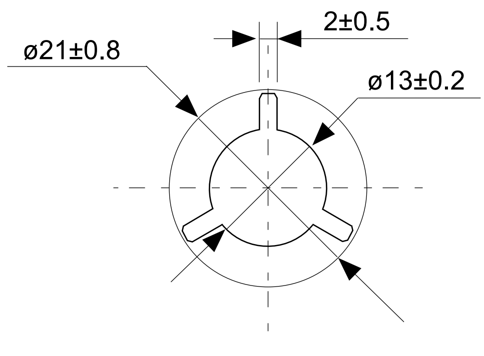


No. VA005-A-C-SD-1.0

TITLE	TO-252-5S-A-Carrier Tape
No.	VA005-A-C-SD-1.0
ANGLE	
UNIT	mm
ABLIC Inc.	



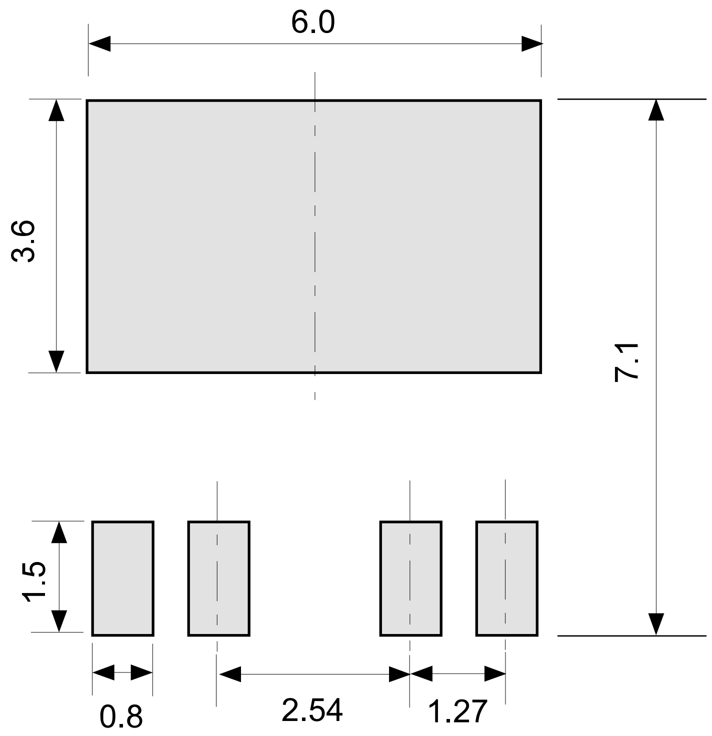
Enlarged drawing in the central part



No. VA005-A-R-SD-1.1

TITLE	TO-252-5S-A-Reel		
No.	VA005-A-R-SD-1.1		
ANGLE		QTY.	4,000
UNIT	mm		

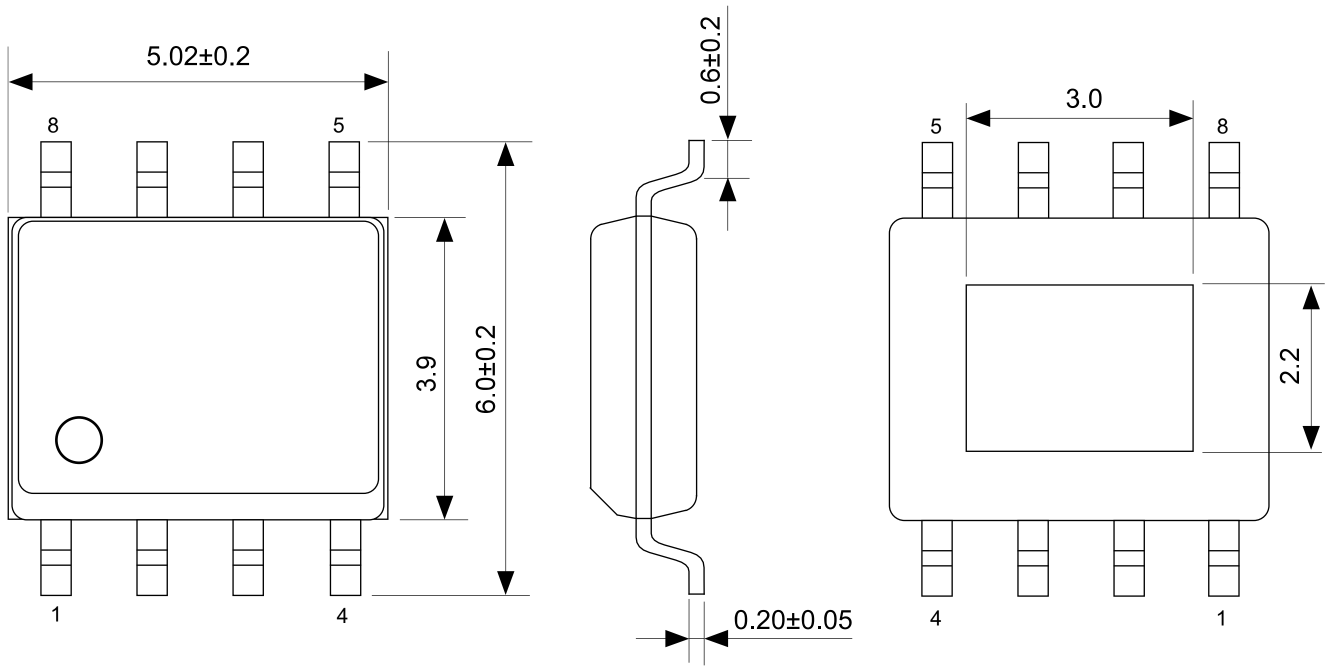
ABLIC Inc.

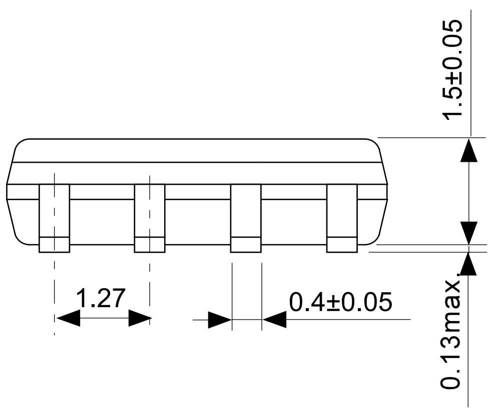


No. VA005-A-L-SD-1.0

TITLE	TO-252-5S-A -Land Recommendation
No.	VA005-A-L-SD-1.0
ANGLE	
UNIT	mm

ABLIC Inc.

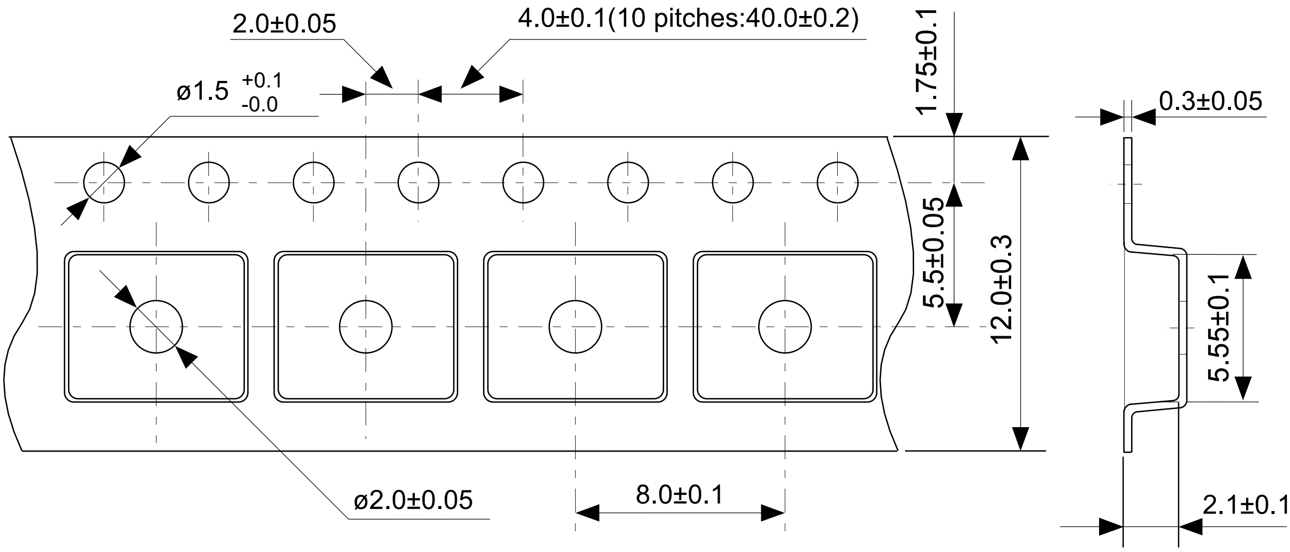


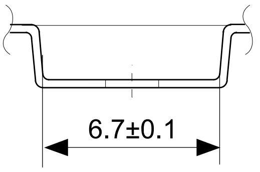


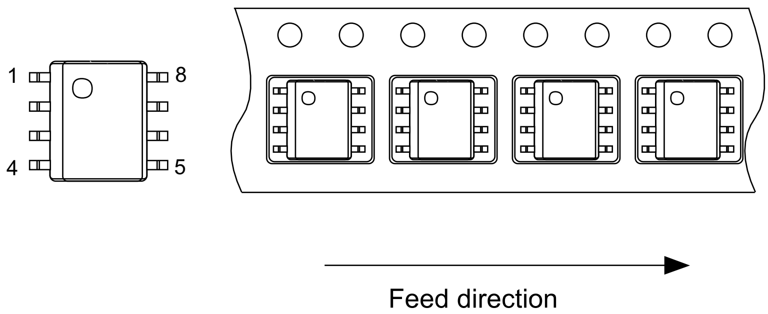
No. FH008-A-P-SD-2.0

TITLE	HSOP8A-A-PKG Dimensions
No.	FH008-A-P-SD-2.0
ANGLE	
UNIT	mm

ABLIC Inc.

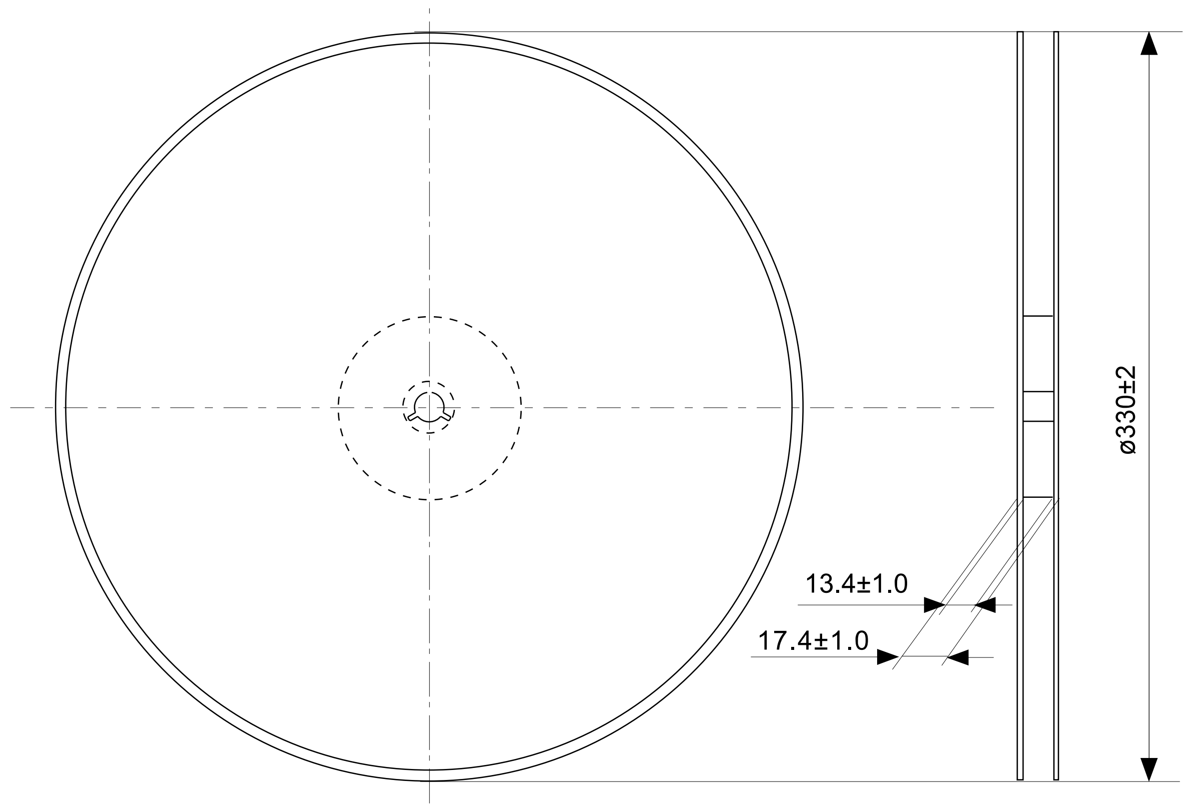




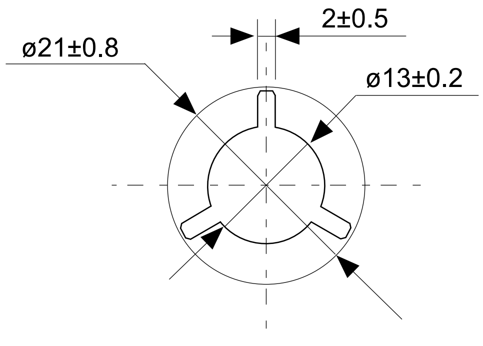


No. FH008-A-C-SD-1.0

TITLE	HSOP8A-A-Carrier Tape
No.	FH008-A-C-SD-1.0
ANGLE	
UNIT	mm
ABLIC Inc.	



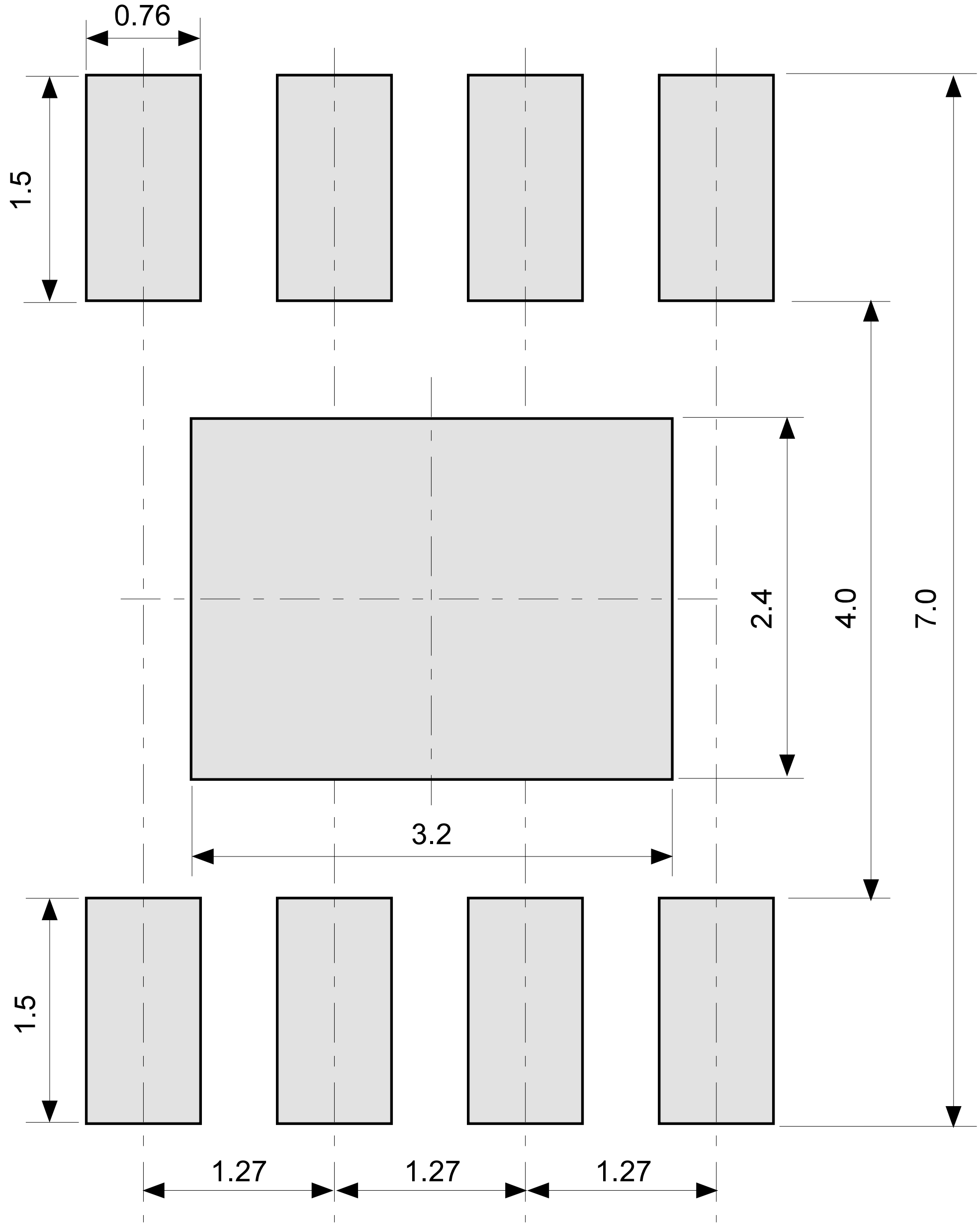
Enlarged drawing in the central part



No. FH008-A-R-SD-1.1

TITLE	HSOP8A-A-Reel		
No.	FH008-A-R-SD-1.1		
ANGLE		QTY.	4,000
UNIT	mm		

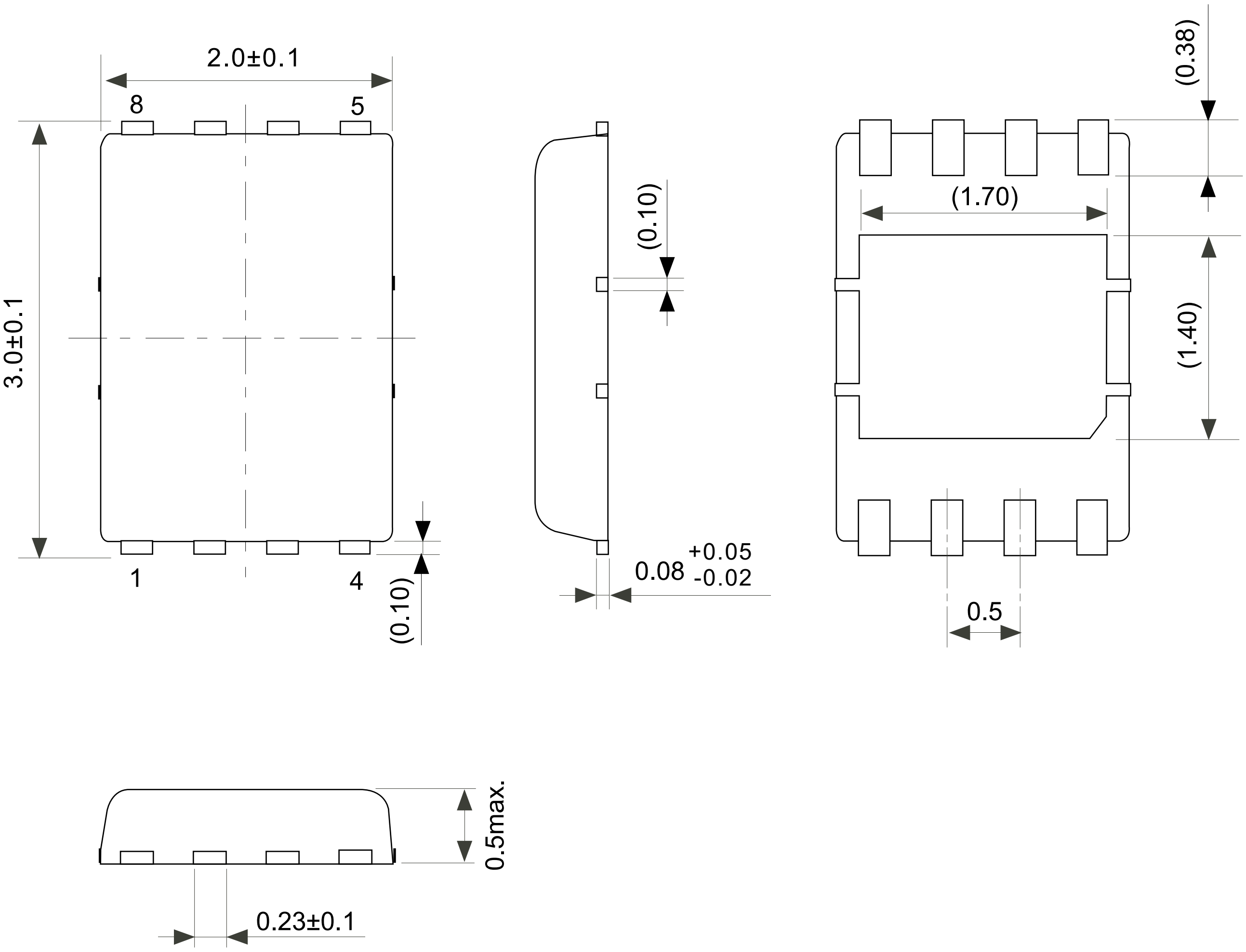
ABLIC Inc.



No. FH008-A-L-SD-1.0

TITLE	HSOP8A-A -Land Recommendation
No.	FH008-A-L-SD-1.0
ANGLE	
UNIT	mm

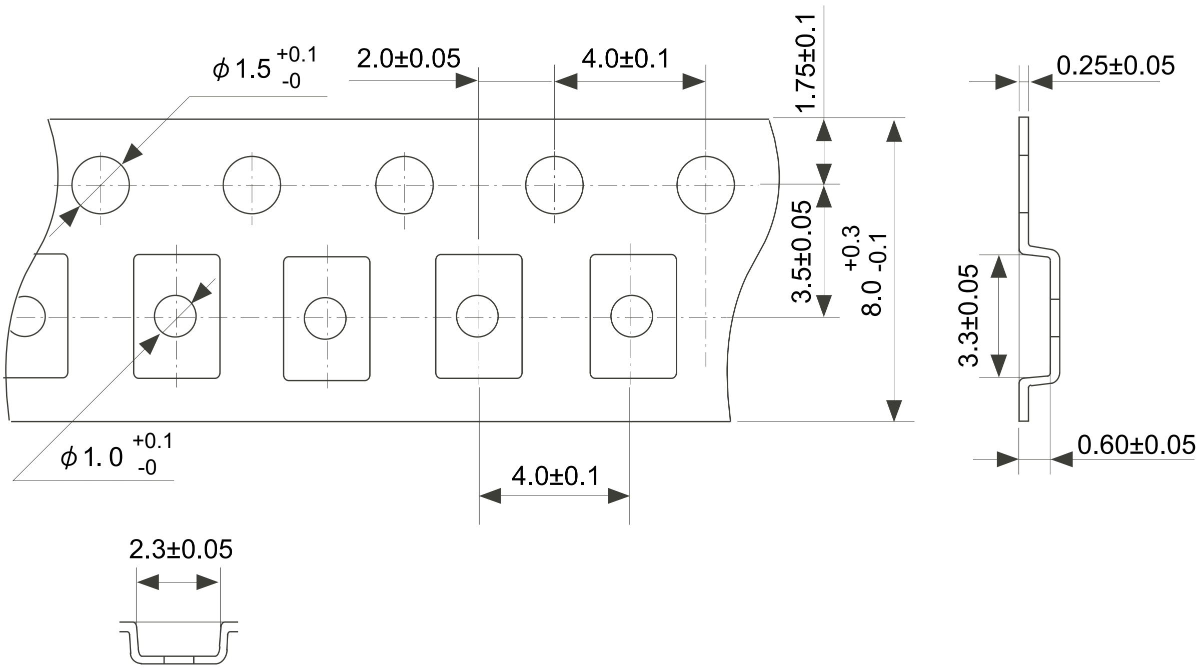
ABLIC Inc.

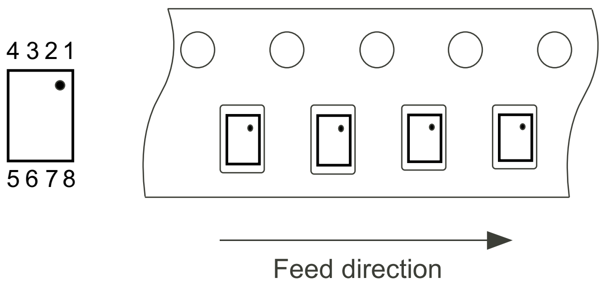


No. PP008-A-P-SD-3.0

TITLE	HSNT-8-A-PKG Dimensions
No.	PP008-A-P-SD-3.0
ANGLE	
UNIT	mm

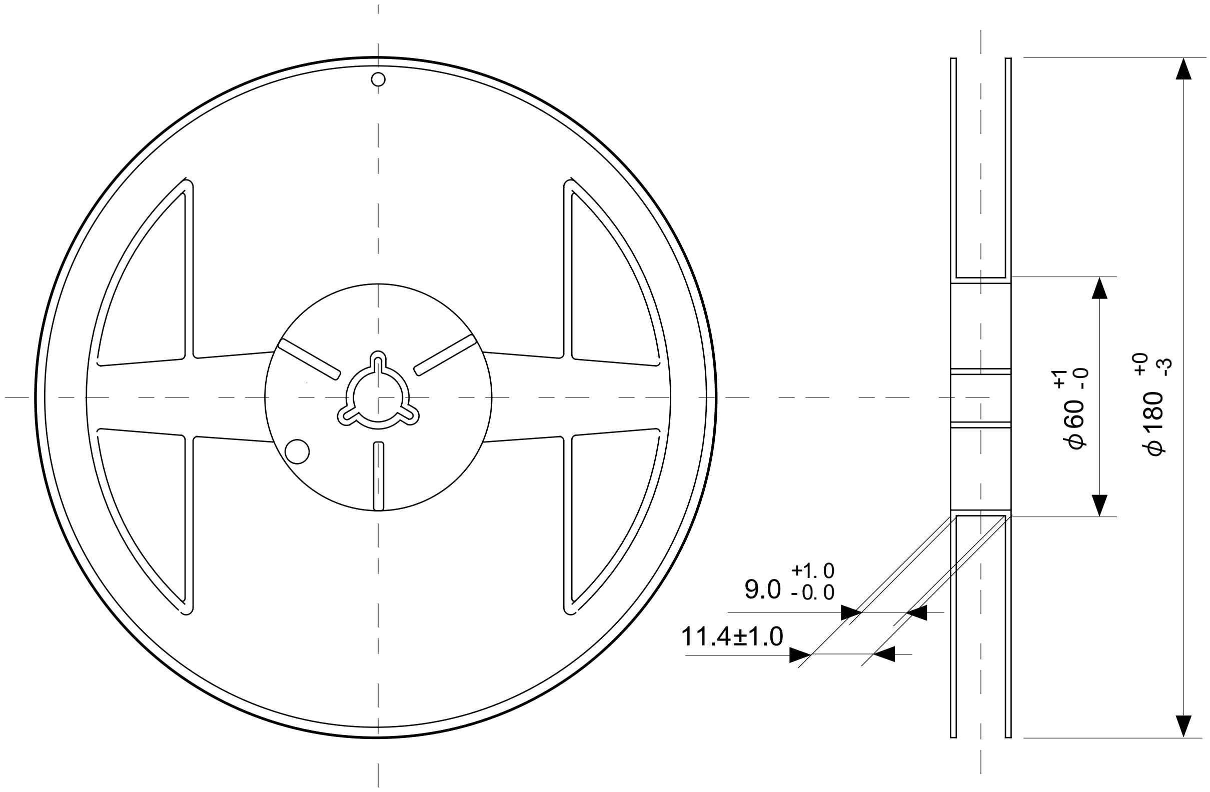
ABLIC Inc.



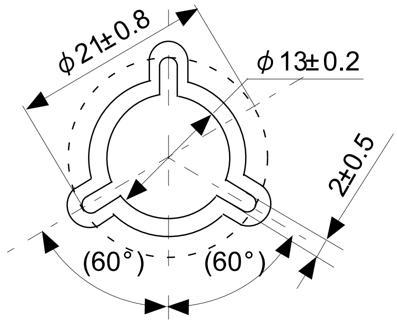


No. PP008-A-C-SD-1.0

TITLE	HSNT-8-A-Carrier Tape	
No.	PP008-A-C-SD-1.0	
ANGLE		
UNIT	mm	
ABLIC Inc.		



Enlarged drawing in the central part



No. PP008-A-R-SD-2.0

TITLE	HSNT-8-A-Reel		
No.	PP008-A-R-SD-2.0		
ANGLE		QTY.	5,000
UNIT	mm		

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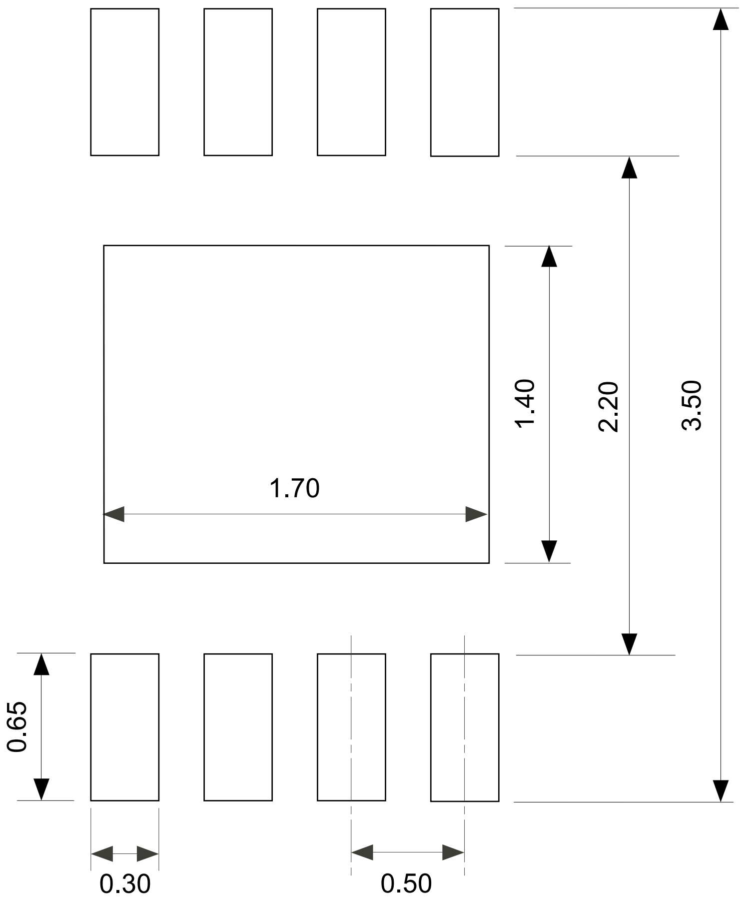

No. PP008-A-L-SD-2.0

TITLE	HSNT-8-A -Land Recommendation
No.	PP008-A-L-SD-2.0
ANGLE	
UNIT	mm

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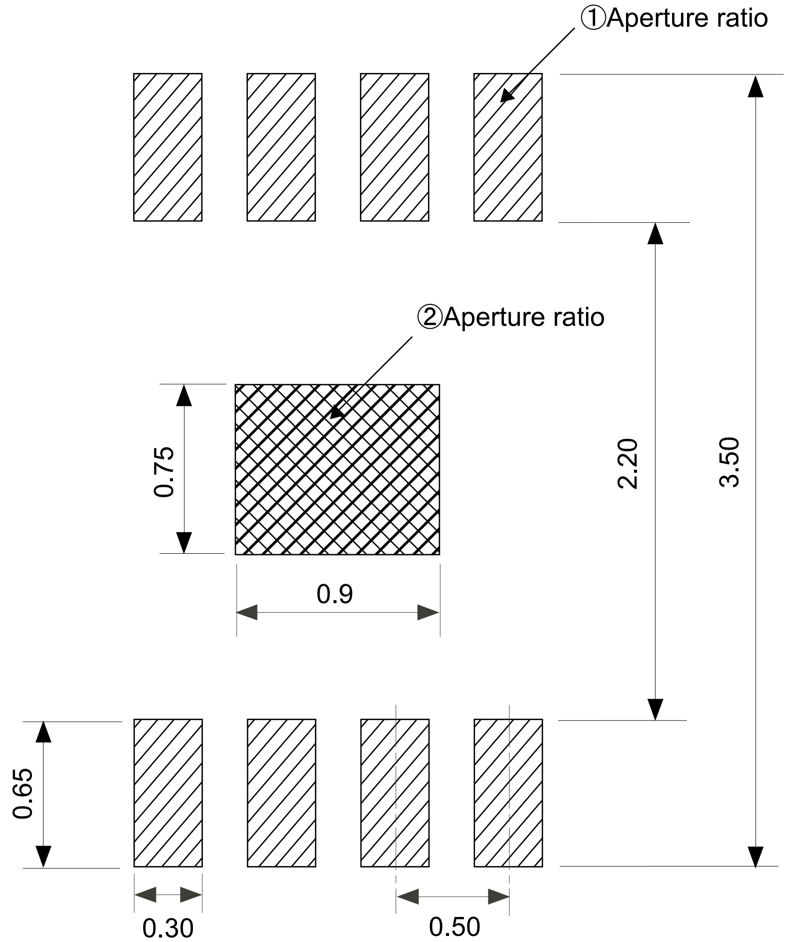

Caution ① Mask aperture ratio of the lead mounting part is 100%.
② Mask aperture ratio of the heat sink mounting part is approximately 30%.
③ Mask thickness: t0.12 mm
④ Reflow atmosphere: Nitrogen atmosphere is recommended.
(Oxygen concentration: 1000ppm or less)

注意 ①リード実装部のマスク開口率 : 100%
②放熱板実装のマスク開口率 : 約30%
③マスク厚み : t 0.12 mm
④リフロー雰囲気 : 窒素雰囲気(酸素濃度1000ppm以下)推奨

No. PP008-A-L-S1-2.0

TITLE	HSNT-8-A-Stencil Opening
No.	PP008-A-L-S1-2.0
ANGLE	
UNIT	mm
ABLIC Inc.	

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