ULTRA COMPACT CMOS VOLTAGE REGULATOR S-817 Series

The S-817 is an ultra compact 3-pin positive voltage regulator developed using CMOS technology. Housing into a miniaturized 2.0 x 2.1 mm SC-82AB package, the S-817 offers key advantages for small, portable applications.
The S-817 allows many types of output capacitors including ceramic capacitors and ensures highly-stable operations at light load as low as 1μA.

■ Features

- Low current consumption
  Operating current: Typ. 1.2 μA, Max. 2.5 μA
- Output voltage: 1.1 to 6.0 V(0.1 V step)
- Output voltage accuracy: ±2.0 %
- Output current;
  50 mA capable (3.0 V output product, V_{IN}=5 V) Note
  75 mA capable (5.0 V output product, V_{IN}=7 V) Note
- Dropout voltage
  Typ. 160 mV (V_{OUT} = 5.0 V, I_{OUT} = 10 mA)
- Low ESR capacitor (e.g., a ceramic capacitor of 0.1 μF or more) can be used as an output capacitor.
- Short circuit protection for: Series A
- Excellent Line Regulation: Stable operation at light load of 1 μA

Note)

Power dissipation of the package should be taken into account when the output current is large.

■ Applications

- Power source for battery-powered devices
- Power source for personal communication devices
- Power source for home electric/electronic appliances

■ Packages

- SOT-23-5 (PKG drawing code : MP005-A)
- 4-pin SC-82AB (PKG drawing code : NP004-A)
- 3-pin SOT-89-3 (PKG drawing code : UP003-A)
- TO-92 (PKG drawing code : Y003-A)

■ Block Diagram

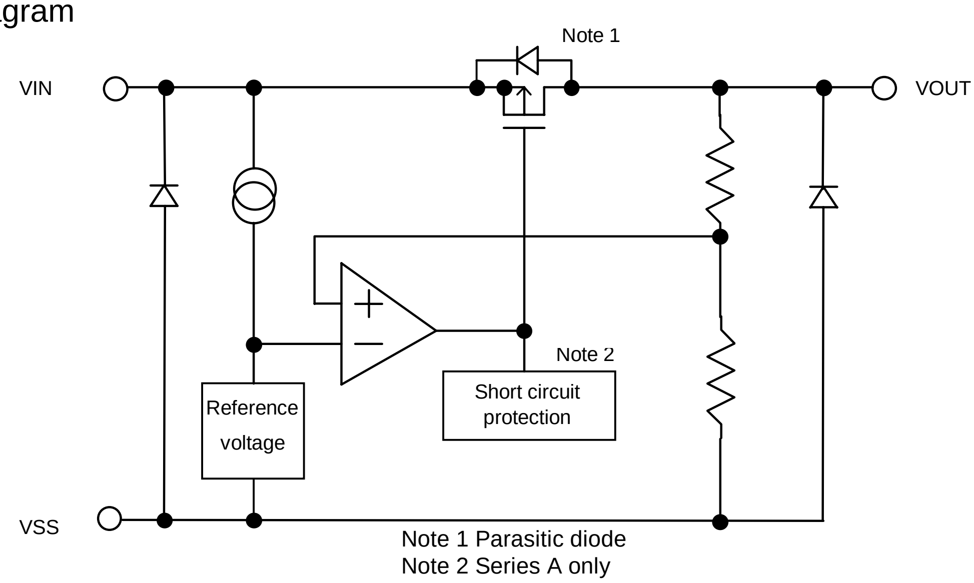


Figure 1 Block Diagram

■ Selection Guide

Product Name

S-817x xx Axx - xxx - T2

- T2: IC orientation for tape specifications
- xxx: Product code
- Axx: Package code
  - NB: SC-82AB UA:SOT-89-3
  - MC: SOT-23-5 Y:TO-92
- xx: Output voltage x 10
- x: Short circuit protection: Yes = A
  No = B

Table 1 Selection Guide

Output Voltage	SC-82AB	SOT-23-5	SOT-89-3	TO-92
1.1 V ± 2.0%	S-817A11ANB-CUA-T2	S-817B11AMC-CWA-T2	S-817B11AUA-CWA-T2	S-817B11AY-X
1.2 V ± 2.0%	S-817A12ANB-CUB-T2	—	—	—
1.3 V ± 2.0%	S-817A13ANB-CUC-T2	S-817B13AMC-CWC-T2	—	—
1.4 V ± 2.0%	S-817A14ANB-CUD-T2	—	—	—
1.5 V ± 2.0%	S-817A15ANB-CUE-T2	S-817B15AMC-CWE-T2	S-817B15AUA-CWE-T2	S-817B15AY-X
1.6 V ± 2.0%	—	—	S-817B16AUA-CWF-T2	—
1.7 V ± 2.0%	—	S-817B17AMC-CWG-T2	—	—
1.8 V ± 2.0%	S-817A18ANB-CUH-T2	S-817B18AMC-CWH-T2	S-817B18AUA-CWH-T2	—
1.9 V ± 2.0%	S-817A19ANB-CUI-T2	—	S-817B19AUA-CWI-T2	—
2.0 V ± 2.0%	S-817A20ANB-CUJ-T2	S-817B20AMC-CWJ-T2	S-817B20AUA-CWJ-T2	—
2.1 V ± 2.0%	S-817A21ANB-CUK-T2	—	—	—
2.2 V ± 2.0%	S-817A22ANB-CUL-T2	S-817B22AMC-CWL-T2	—	—
2.4 V ± 2.0%	S-817A24ANB-CUN-T2	—	—	—
2.5 V ± 2.0%	S-817A25ANB-CUO-T2	S-817B25AMC-CWO-T2	S-817B25AUA-CWO-T2	S-817B25AY-X
2.7 V ± 2.0%	S-817A27ANB-CUQ-T2	—	S-817B27AUA-CWQ-T2	—
2.8 V ± 2.0%	S-817A28ANB-CUR-T2	S-817B28AMC-CWR-T2	—	—
2.9 V ± 2.0%	—	—	—	—
3.0 V ± 2.0%	S-817A30ANB-CUT-T2	S-817B30AMC-CWT-T2	S-817B30AUA-CWT-T2	S-817B30AY-X
3.2 V ± 2.0%	S-817A32ANB-CUV-T2	—	—	—
3.3 V ± 2.0%	S-817A33ANB-CUW-T2	S-817B33AMC-CWW-T2	S-817B33AUA-CWW-T2	S-817B33AY-X
3.4 V ± 2.0%	—	—	—	—
3.5 V ± 2.0%	S-817A35ANB-CUY-T2	S-817B35AMC-CWY-T2	S-817B35AUA-CWY-T2	—
3.6 V ± 2.0%	S-817A36ANB-CUZ-T2	—	S-817B36AUA-CWZ-T2	—
3.7 V ± 2.0%	—	S-817B37AMC-CXA-T2	S-817B37AUA-CXA-T2	S-817B37AY-X
3.8 V ± 2.0%	—	S-817B38AMC-CXB-T2	S-817B38AUA-CXB-T2	—
4.0 V ± 2.0%	S-817A40ANB-CVD-T2	S-817B40AMC-CXD-T2	S-817B40AUA-CXD-T2	S-817B40AY-X
4.2 V ± 2.0%	S-817A42ANB-CVF-T2	S-817B42AMC-CXF-T2	—	—
4.3 V ± 2.0%	S-817A43ANB-CVG-T2	—	S-817B43AUA-CXG-T2	—
4.5 V ± 2.0%	S-817A45ANB-CVI-T2	—	S-817B45AUA-CXI-T2	—
4.8 V ± 2.0%	S-817A48ANB-CVL-T2	—	—	—
5.0 V ± 2.0%	S-817A50ANB-CVN-T2	S-817B50AMC-CXN-T2	S-817B50AUA-CXN-T2	S-817B50AY-X
5.2 V ± 2.0%	—	—	S-817B52AUA-CXP-T2	S-817B52AY-X
5.3 V ± 2.0%	—	—	S-817B53AUA-CXQ-T2	—
5.6 V ± 2.0%	S-817A56ANB-CVT-T2	—	S-817B56AUA-CXT-T2	—
6.0 V ± 2.0%	—	—	S-817B60AUA-CXX-T2	S-817B60AY-X

Note:
Contact SII sales office for products with output voltage not specified above.
X changes according to the packing form in TO-92. Standard forms are B; Bulk and Z; Zigzag (tape and ammo). If tape and reel (T) is needed, please contact SII sales office.

■ Pin Configuration

For details of package, refer to the attached drawing.

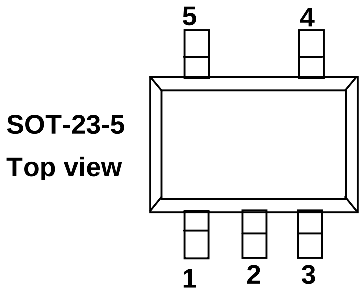


Figure 2 SOT-23-5

Table 2 Pin Assignment

Pin No.	Symbol	Description
1	VSS	GND pin
2	VIN	Input voltage pin
3	VOUT	Output voltage pin
4	N.C.	No connection Note
5	N.C.	No connection Note

Note N.C. pin is electrically open. N.C. pin can be connected to VIN or VSS.

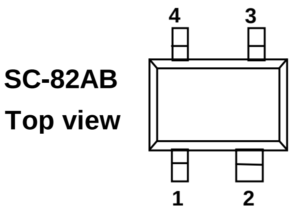


Figure 3 SC-82AB

Table 3 Pin Assignment

Pin No.	Symbol	Description
1	VSS	GND pin
2	VIN	Input voltage pin
3	VOUT	Output voltage pin
4	N.C.	No connection Note

Note N.C. pin is electrically open. N.C. pin can be connected to VIN or VSS.

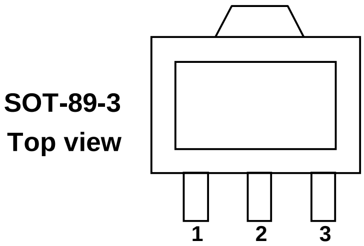


Figure 4 SOT-89-3

Table 4 Pin Assignment

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

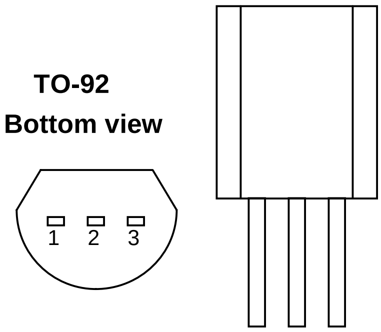


Figure 5 TO-92

Table 5 Pin Assignment

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

■ Absolute Maximum Ratings

Table 6 Absolute Maximum Ratings (Ta=25°C unless otherwise specified)

Item	Symbol	Absolute Maximum Rating		Units
Input voltage	V_{IN}	12		V
Output voltage	V_{OUT}	V_{SS}-0.3 to V_{IN}+0.3		V
Power dissipation	P_D	SOT-23-5	250	mW
		SC-82AB	150	
		SOT-89-3	500	
		TO-92	400	
Operating temperature range	T_{opr}	-40 to +85		°C
Storage temperature range	T_{stg}	-40 to +125		°C

Note: Although the IC contains protection circuit against static electricity, excessive static electricity or voltage which exceeds the limit of the protection circuit should not be applied to.

■ Electrical Characteristics

1. S-817AXXANB

Table 7 Electrical Characteristics (Ta=25°C unless otherwise specified)

Item	Symbol	Conditions		Min.	Typ.	Max.	Units	Test circuits
Output voltage 1)	$V_{OUT}(E)$	$V_{IN}=V_{OUT}(S)+2V$, $I_{OUT}=10mA$		$V_{OUT}(S) \times 0.98$	$V_{OUT}(S)$	$V_{OUT}(S) \times 1.02$	V	1
Output current 2)	I_{OUT}	$V_{OUT}(S)+2V \le V_{IN} \le 10V$	$1.1V \le V_{OUT}(S) \le 1.9V$	20	–	–	mA	3
			$2.0V \le V_{OUT}(S) \le 2.9V$	35	–	–	mA	3
			$3.0V \le V_{OUT}(S) \le 3.9V$	50	–	–	mA	3
			$4.0V \le V_{OUT}(S) \le 4.9V$	65	–	–	mA	3
			$5.0V \le V_{OUT}(S) \le 6.0V$	75	–	–	mA	3
Dropout voltage 3)	Vdrop	I_{OUT} = 10mA	$1.1V \le V_{OUT}(S) \le 1.4V$	–	0.92	1.58	V	1
			$1.5V \le V_{OUT}(S) \le 1.9V$	–	0.58	0.99	V	1
			$2.0V \le V_{OUT}(S) \le 2.4V$	–	0.40	0.67	V	1
			$2.5V \le V_{OUT}(S) \le 2.9V$	–	0.31	0.51	V	1
			$3.0V \le V_{OUT}(S) \le 3.4V$	–	0.25	0.41	V	1
			$3.5V \le V_{OUT}(S) \le 3.9V$	–	0.22	0.35	V	1
			$4.0V \le V_{OUT}(S) \le 4.4V$	–	0.19	0.30	V	1
			$4.5V \le V_{OUT}(S) \le 4.9V$	–	0.18	0.27	V	1
			$5.0V \le V_{OUT}(S) \le 5.4V$	–	0.16	0.25	V	1
			$5.5V \le V_{OUT}(S) \le 6.0V$	–	0.15	0.23	V	1
Line regulation 1	$\Delta V_{OUT}1$	$V_{OUT}(S) + 1 V \le V_{IN} \le 10 V$, I_{OUT} = 1mA		–	5	20	mV	1
Line regulation 2	$\Delta V_{OUT}2$	$V_{OUT}(S) + 1 V \le V_{IN} \le 10 V$, I_{OUT} = 1μA		–	5	20	mV	1
Load regulation	$\Delta V_{OUT}3$	$V_{IN}=V_{OUT}(S)+2V$	$1.1V \le V_{OUT}(S) \le 1.9V$, $1\mu A \le I_{OUT} \le 10mA$	–	5	20	mV	1
			$2.0V \le V_{OUT}(S) \le 2.9V$, $1\mu A \le I_{OUT} \le 20mA$	–	10	30	mV	1
			$3.0V \le V_{OUT}(S) \le 3.9V$, $1\mu A \le I_{OUT} \le 30mA$	–	20	45	mV	1
			$4.0V \le V_{OUT}(S) \le 4.9V$, $1\mu A \le I_{OUT} \le 40mA$	–	25	65	mV	1
			$5.0V \le V_{OUT}(S) \le 6.0V$, $1\mu A \le I_{OUT} \le 50mA$	–	35	80	mV	1
Output voltage temperature coefficient 4)	$\frac{\Delta V_{OUT}}{\Delta Ta \bullet V_{OUT}}$	$V_{IN} = V_{OUT}(S) + 1 V$, I_{OUT} = 10mA, -40°C ≤ Ta ≤ 85°C			±100	–	ppm/°C	1
Current consumption	I_{SS}	$V_{IN} = V_{OUT}(S) + 2 V$, no load		–	1.2	2.5	μA	2
Input voltage	V_{IN}			–	–	10	V	1
Short current limit	I_{OS}	$V_{IN} = V_{OUT}(S) + 2 V$, V_{OUT} pin = 0 V		–	40	–	mA	3

1) V_{OUT}(S)=Specified output voltage
   V_{OUT}(E)=Effective output voltage, i.e., the output voltage when fixing I_{OUT}(=10 mA) and inputting V_{OUT}(S)+2.0 V.
2) Output current at which output voltage becomes 95% of V_{OUT}(E) after gradually increasing output current.
3) Vdrop = V_{IN}1-(V_{OUT}(E) × 0.98), where V_{IN}1 is the Input voltage at which output voltage becomes 98% of V_{OUT}(E) after gradually decreasing input voltage.
4) Temperature change ratio for the output voltage [mV/°C] is calculated using the following equation.

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

Temperature change ratio for output voltage | Specified output voltage | Output voltage temperature coefficient

2. S-817BXXAMC

Table 8 Electrical Characteristics (Ta=25°C unless otherwise specified)

Item	Symbol	Conditions		Min.	Typ.	Max.	Units	Test circuits
Output voltage 1)	V_{OUT}(E)	V_{IN}=V_{OUT}(S)+2V, I_{OUT}=10mA		V_{OUT}(S) × 0.98	V_{OUT}(S)	V_{OUT}(S) × 1.02	V	1
Output current 2)	I_{OUT}	V_{OUT}(S)+2V ≤ V_{IN}≤10V	1.1V ≤ V_{OUT}(S) ≤ 1.9V	20	–	–	mA	3
			2.0V ≤ V_{OUT}(S) ≤ 2.9V	35	–	–	mA	3
			3.0V ≤ V_{OUT}(S) ≤ 3.9V	50	–	–	mA	3
			4.0V ≤ V_{OUT}(S) ≤ 4.9V	65	–	–	mA	3
			5.0V ≤ V_{OUT}(S) ≤ 6.0V	75	–	–	mA	3
Dropout voltage 3)	Vdrop	I_{OUT} = 10mA	1.1V ≤ V_{OUT}(S) ≤ 1.4V	–	0.92	1.58	V	1
			1.5V ≤ V_{OUT}(S) ≤ 1.9V	–	0.58	0.99	V	1
			2.0V ≤ V_{OUT}(S) ≤ 2.4V	–	0.40	0.67	V	1
			2.5V ≤ V_{OUT}(S) ≤ 2.9V	–	0.31	0.51	V	1
			3.0V ≤ V_{OUT}(S) ≤ 3.4V	–	0.25	0.41	V	1
			3.5V ≤ V_{OUT}(S) ≤ 3.9V	–	0.22	0.35	V	1
			4.0V ≤ V_{OUT}(S) ≤ 4.4V	–	0.19	0.30	V	1
			4.5V ≤ V_{OUT}(S) ≤ 4.9V	–	0.18	0.27	V	1
			5.0V ≤ V_{OUT}(S) ≤ 5.4V	–	0.16	0.25	V	1
			5.5V ≤ V_{OUT}(S) ≤ 6.0V	–	0.15	0.23	V	1
Line regulation 1	Δ V_{OUT}1	V_{OUT}(S) + 1 V ≤ V_{IN} ≤ 10 V, I_{OUT} = 1mA		–	5	20	mV	1
Line regulation 2	Δ V_{OUT}2	V_{OUT}(S) + 1 V ≤ V_{IN} ≤ 10 V, I_{OUT} = 1µA		–	5	20	mV	1
Load regulation	Δ V_{OUT}3	V_{IN}= V_{OUT}(S)+ 2 V	1.1V ≤ V_{OUT}(S) ≤ 1.9V, 1µA ≤ I_{OUT} ≤ 10mA	–	5	20	mV	1
			2.0V ≤ V_{OUT}(S) ≤ 2.9V, 1µA ≤ I_{OUT} ≤ 20mA	–	10	30	mV	1
			3.0V ≤ V_{OUT}(S) ≤ 3.9V, 1µA ≤ I_{OUT} ≤ 30mA	–	20	45	mV	1
			4.0V ≤ V_{OUT}(S) ≤ 4.9V, 1µA ≤ I_{OUT} ≤ 40mA	–	25	65	mV	1
			5.0V ≤ V_{OUT}(S) ≤ 6.0V, 1µA ≤ I_{OUT} ≤ 50mA	–	35	80	mV	1
Output voltage temperature coefficient 4)	$\frac{\Delta V_{OUT}}{\Delta Ta \bullet V_{OUT}}$	V_{IN} = V_{OUT}(S) + 1 V, I_{OUT} = 10mA -40°C ≤ Ta ≤ 85°C			±100	–	ppm /°C	1
Current consumption	I_{SS}	V_{IN} = V_{OUT}(S) + 2 V, no load		–	1.2	2.5	µA	2
Input voltage	V_{IN}			–	–	10	V	1

1) V_{OUT}(S)=Specified output voltage
V_{OUT}(E)=Effective output voltage, i.e., the output voltage when fixing I_{OUT}(=10 mA) and inputting V_{OUT}(S)+2.0 V.

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

3) Vdrop = V_{IN}1-(V_{OUT}(E) × 0.98), where V_{IN}1 is the Input voltage at which output voltage becomes 98% of V_{OUT}(E) after gradually decreasing input voltage.

4) Temperature change ratio for the output voltage [mV/°C] is calculated using the following equation.

$$\frac{\Delta V_{OUT}}{\Delta Ta}\left[mV/{}^\circ C\right] = V_{OUT}(S)\left[V\right] \times \frac{\Delta V_{OUT}}{\Delta Ta \bullet V_{OUT}}\left[ppm/{}^\circ C\right] \div 1000$$

Temperature change ratio for output voltage — Specified output voltage — Output voltage temperature coefficient

■ Test Circuits

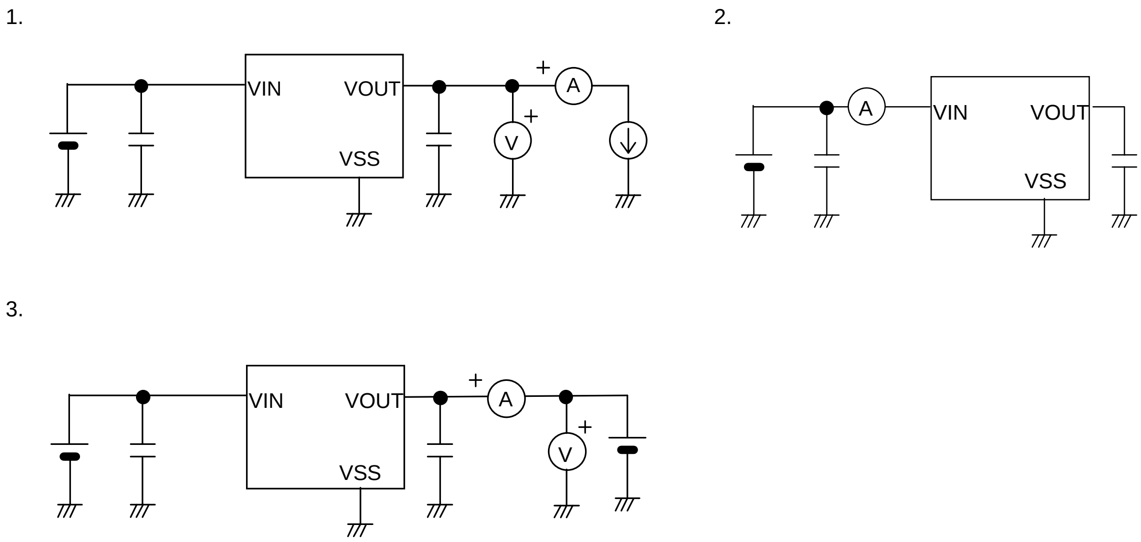
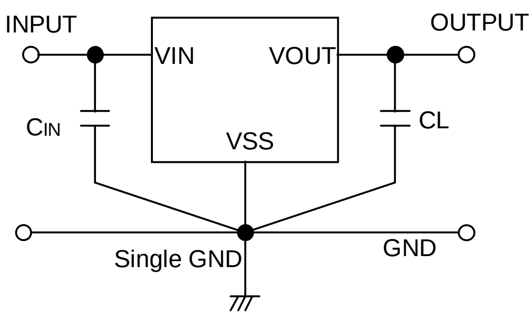


Figure 6 Test Circuits

■ Standard Circuit



In addition to a tantalum capacitor, a ceramic capacitor of 0.1 μF or more can be used for CL.
C_{IN} is a capacitor used to stabilize input.

Figure 7 Standard Circuit

■ Technical Terms

1. Low ESR
   ESR is the abbreviation for Equivalent Series Resistance.
   Low ESR output capacitors (CL) can be used in the S-817 Series.

2. Output voltage (V_{OUT})
   The accuracy of the output voltage is ± 2.0% guaranteed under the specified conditions for input voltage, which differs depending upon the product items, output current, and temperature.
   Note: If the above conditions change, the output voltage value may vary and go out of the accuracy range of the output voltage. See the electrical characteristics and characteristics data for details.

3. Line regulations 1 and 2 (ΔV_{OUT1}, ΔV_{OUT2})
   Indicate the input voltage dependencies of output voltage. That is, the values show how much the output voltage changes due to a change in the input voltage with the output current remained unchanged.

4. Load regulation (ΔV_{OUT3})
   Indicates the output current dependencies of output voltage. That is, the values show how much the output voltage changes due to a change in the output current with the input voltage remained unchanged.

5. Dropout voltage (Vdrop)
   Indicates a difference between input voltage ($V_{IN}1$) and output voltage when output voltage falls by 98 % of V_{OUT} (E) by gradually decreasing the input voltage (V_{IN}).
   Vdrop = $V_{IN}1-[V_{OUT}(E) \times 0.98]$

6. Temperature coefficient of output voltage [$\Delta V_{OUT}/(\Delta Ta \bullet V_{OUT})$]
   The output voltage lies in the shaded area in the whole operating temperature shown in figure 8 when the temperature coefficient of the output voltage is ±100 ppm/°C.

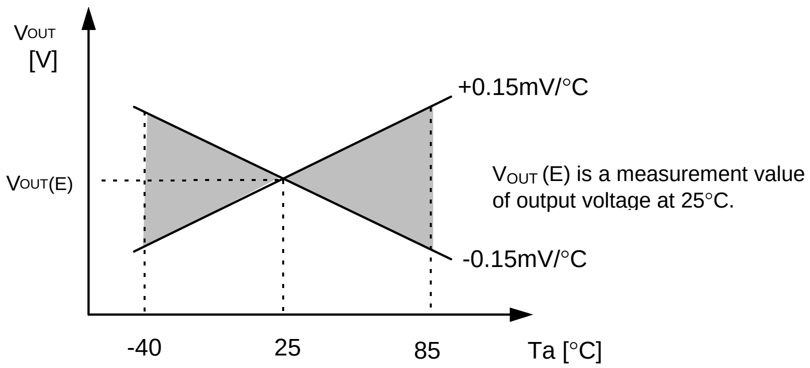


Figure 8 Typical Example of the S-817A15A

Temperature change ratio for output voltage [mV/°C] is calculated by using the following equation.

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

Temperatures change ratio for output voltage

Specified output voltage

Output voltage temperature coefficient

■ Operation

1. Basic Operation
   Figure 9 shows the block diagram of the S-817 series.
   The error amplifier compares a reference voltage V_{ref} with a part of the output voltage divided by the feedback resistors Rs and Rf, and supplies the gate voltage to the output transistor, necessary to ensure certain output voltage independent from change of input voltage and temperature.

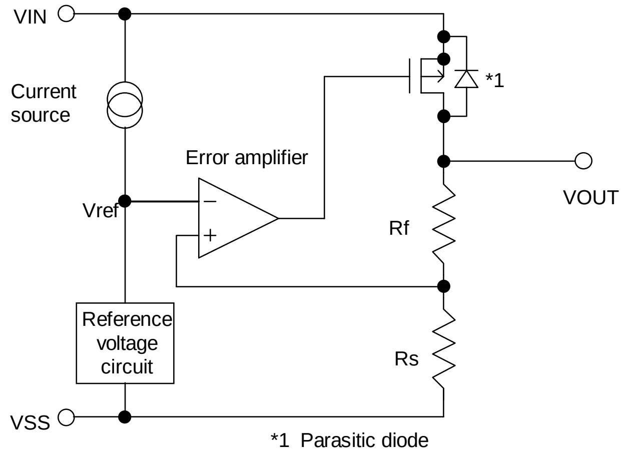


Figure 9 Block Diagram

2. Output Transistor
   The S-817 series uses a Pch MOS transistor as the output transistor.
   The voltage at VOUT must not exceed VIN+0.3V. When the VOUT voltage becomes higher than that of VIN, reverse current flows and may break the regulator since a parasitic diode between VOUT and VIN exists inevitably.

3. Short Circuit Protection
   The S-817A series incorporates a short circuit protection to protect the output transistor against short circuit between VOUT pin and VSS pin. Installation of the short-circuit protection which protects the output transistor against short-circuit between VOUT and VSS can be selected in the S-812C series. The short-circuit protection controls output current as shown in the typical characteristics, (1) OUTPUT VOLTAGE versus OUTPUT CURRENT, and suppresses output current at about 40 mA even if VOUT and VSS pins are short-circuited.
   The short-circuit protection can not at the same time be a thermal protection. Attention should be paid to the Input voltage and the load current under the actual condition so as not to exceed the power dissipation of the package including the case for short-circuit.
   When the output current is large and the difference between input and output voltage is large even if not shorted, the short-circuit protection may work and the output current is suppressed to the specified value.
   Products without short-circuit protection can provide comparatively large current by removing a short-circuit protection.
   For details, refer to (3) MAXIMUM OUTPUT CURRENT versus INPUT VOLTAGE curve.
   The S-817B series can provide comparatively large current by removing a short circuit protection.

■ Selection of Output Capacitor (CL)

To stabilize operation against variation in output load, a capacitor (CL) must be mounted between VOUT and VSS in the S-817 series because the phase is compensated with the help of the internal phase compensation circuit and the ESR of the output capacitor.

When selecting a ceramic or an OS capacitor, capacitance should be 0.1 µF or more, and
when selecting a tantalum or an aluminum electrolytic capacitor, capacitance should be 0.1 µF or more and ESR 30 Ω or less.

When an aluminum electrolytic capacitor is used attention should be especially paid to since the ESR of the aluminum electrolytic capacitor increases at low temperature and possibility of oscillation becomes large. Sufficient evaluation including temperature characteristics is indispensable.
Overshoot and undershoot characteristics differ depending upon the type of the output capacitor.
Refer to CL dependencies in “TRANSIENT RESPONSE CHARACTERISTICS”.

■Applied Circuits

1. Output Current Boosting Circuit

As shown in Figure 10, the output current can be boosted by externally attaching a PNP transistor. The base current of the PNP transistor is controlled so that output voltage VOUT goes the voltage specified in the S-817 when base-emitter voltage VBE necessary to turn on the PNP transistor is obtained between input voltage VIN and S-817 power source pin VIN.

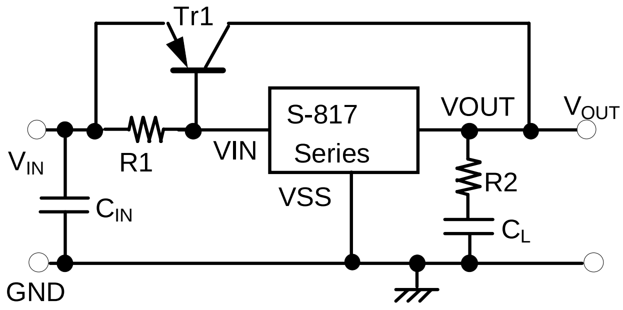


Figure 10 Output Current Boosting

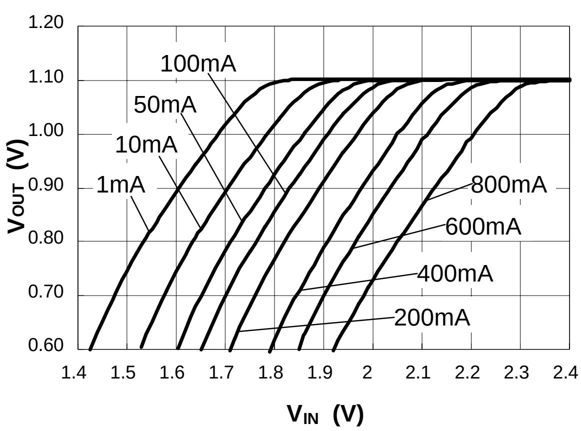
The following are tips and hints for selecting and ensuring optimum use of external parts:

- PNP transistor Tr1:
  1. Set h_{FE} to approx. 100 to 400.
  2. Confirm that no problem occurs due to power dissipation under normal operation conditions.
- Resistor R1:
  Generally set R1 to 1 kΩ ÷ VOUT (S) (the voltage specified in the S-817 Series) or more.
  Output capacitor CL:
  Output capacitor CL is effective in minimizing output fluctuation at powering on or due to power or load fluctuation, but oscillation might occur. Always connect resistor R2 in series to output capacitor CL.
- Resistor R2: Set R2 to 2 Ω x VOUT(S) or more.
- DO NOT attach a capacitor between the S-817 power source VIN and GND pins or between base and emitter of the PNP transistor to avoid oscillation.
- To improve transient response characteristics of the output current boosting circuit shown in Figure 10, check that no problem occurs due to output fluctuation at powering on or due to power or load fluctuation under normal operating conditions.
- Pay attention to the short current limit circuit incorporated into the S-817 Series because it does not function as a shortcircuiting protection circuit for this boosting circuit.

The following graphs show the examples of input-output voltage characteristics (Ta = 25°C, typ.) in the output current boosting circuit:

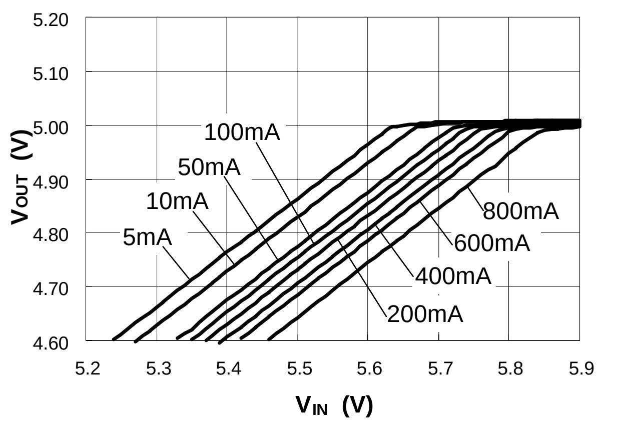
(1) S-817A11ANB/S-817B11AMC

Tr1: 2SA1213Y, R1: 1kΩ, CL: 10µF, R2: 2Ω



(2) S-817A50ANB/S-817B50AMC

Tr1: 2SA1213Y, R1: 200Ω, CL: 10µF, R2: 10Ω



2. Constant Current Circuit

The S-817 Series can be configured as a constant current circuit. See Figure 11. Constant amperage IO is calculated using the following equation

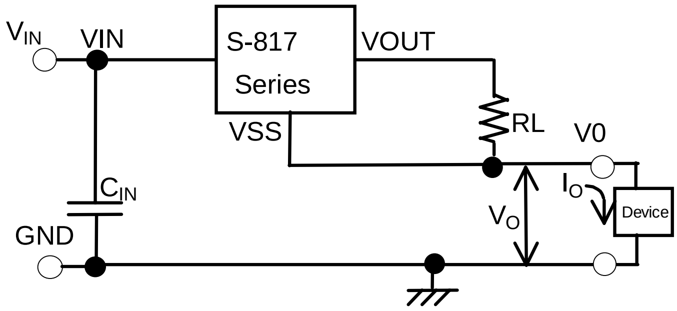
(VOUT (E): Effective output voltage):

IO = (VOUT (E) ÷ RL) +ISS.

Please note that it is impossible to set constant amperage IO in case of circuit (1) of Figure 11 to the value exceeding the drive ability of the S-817.

However, circuit (2) of Figure 11 is an example to set constant amperage to the value exceeding the drive ability of the S-817. Circuit (2) incorporates a current boosting circuit. The maximum input voltage of the constant current circuit is the value obtained by adding 10 V to voltage VO of the device. It is not recommended to attach a capacitor between the S-817 power source VIN and VSS pins or between output VOUT and VSS pins because rush current flows at powering on. An example of input voltage between VIN and VO in circuit (2) vs. IO current characteristics (Ta = 25 °C, typ.) is illustrated in Figure 12.

(1) Constant Current Circuit



(2) Constant Current Boosting Circuit

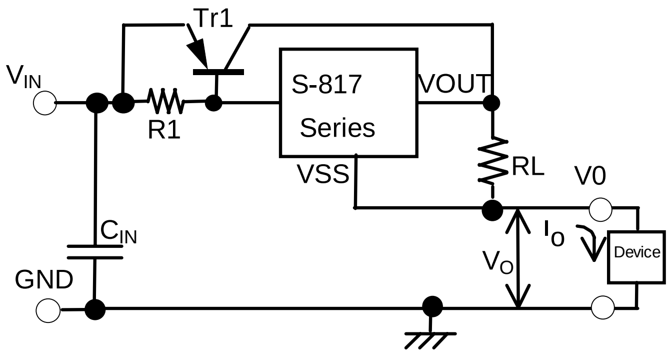


Figure 11 Constant Current Circuit

S-817A11ANB, S-817B11AMC;
VIN-VO pins, Input voltage-IO current

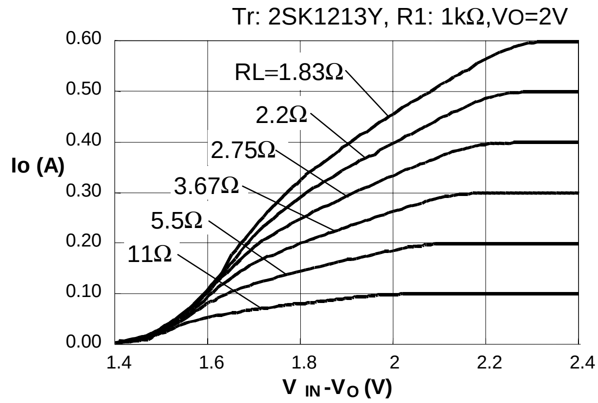


Figure 12 Input Voltage vs Current Characteristics

3. Output Voltage Adjustment Circuit

The output voltage can be boosted by using the configuration shown in Figure 13. The output Voltage VO can be calculated using the following equation (VOUT (E):Effective output voltage):

VO = VOUT (E) x (R1 + R2) ÷ R1 + R2 x ISS

Set R1 and R2 to high values of resistance so as not to be affected by current consumption ISS.

Capacitor C1 is effective in minimizing output fluctuation at powering on or due to power or load fluctuation. Determine the optimum value on your actual device.

It is not also recommended to attach a capacitor between the S-817 power source VIN and VSS pins or between output VOUT and VSS pins because output fluctuation or oscillation at powering on might occur.

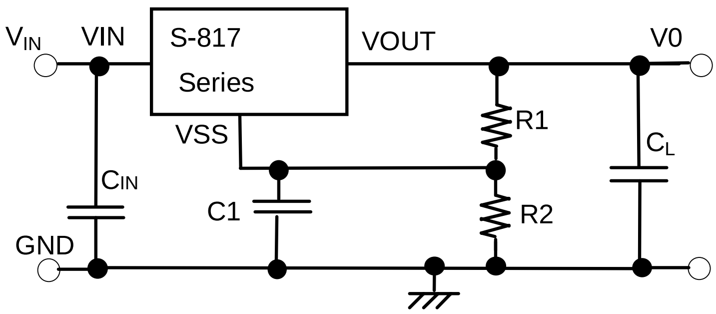


Figure 13 Voltage Adjustment Circuit

■ Notice

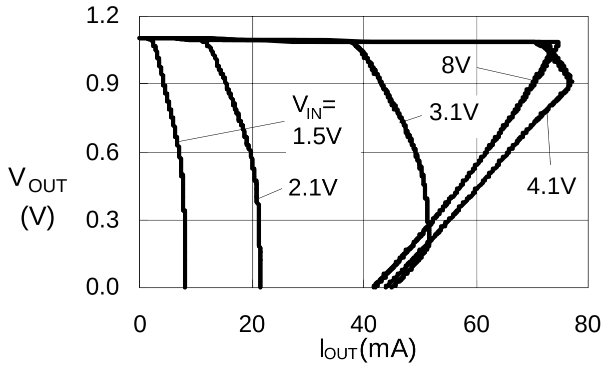
- Design wiring patterns for VIN, VOUT and GND pins to hold low impedance.
  When mounting an output capacitor, the distance from the capacitor to the VOUT pin and to the VSS pin should be as short as possible.
- Note that output voltage may be increased at low load current of less than 1 μA.
- To prevent oscillation, it is recommended to use the external parts under the following conditions.
  * Output capacitor (CL): 0.1 μF or more
  * Equivalent Series Resistance (ESR): 30 Ω or less
  * Input series resistance (R_{IN}): 10 Ω or less
- A voltage regulator may oscillate when power source impedance is high and input capacitor is low or not connected.
- The application condition for input voltage and load current should not exceed the package power dissipation.
- SII claims no responsibility for any and all disputes arising out of or in connection with any infringement of the products including this IC upon patents owned by a third party.

Be sure that input voltage and load current do not exceed the power dissipation level of the package.

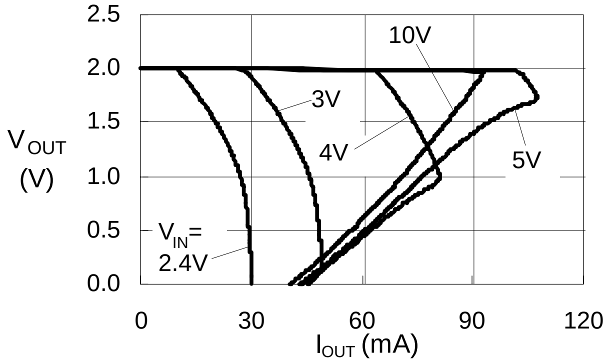
■ Typical Operating Chracteristics

(1) OUTPUT VOLTAGE versus OUTPUT CURRENT (When load current increases)

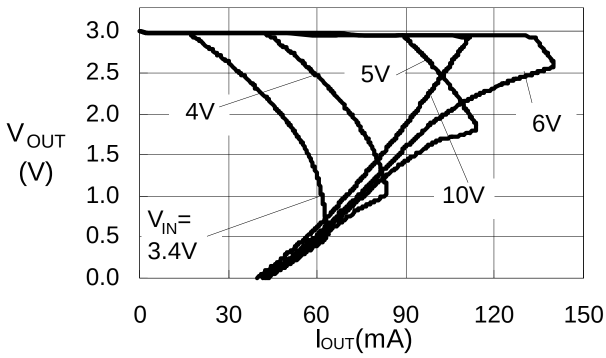
S-817A11A(Ta=25°C)



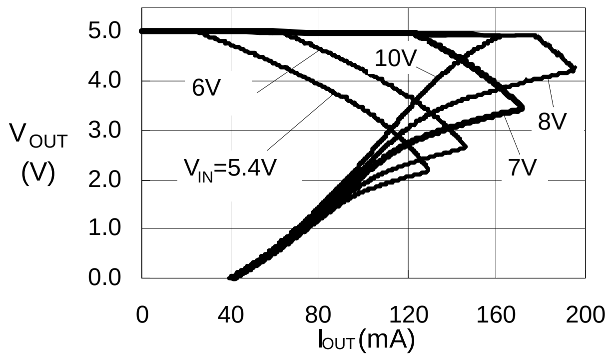
S-817A20A(Ta=25°C)



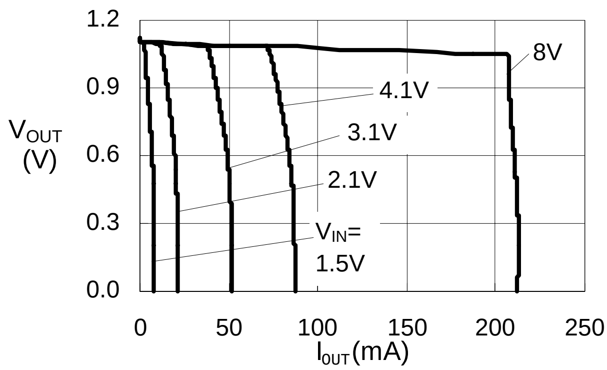
S-817A30A(Ta=25°C)



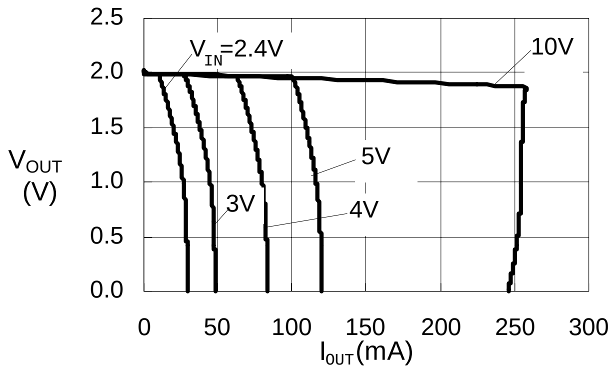
S-817A50A(Ta=25°C)



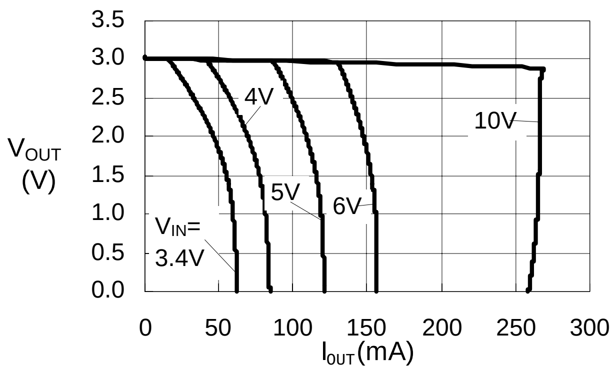
S-817B11A(Ta=25°C)



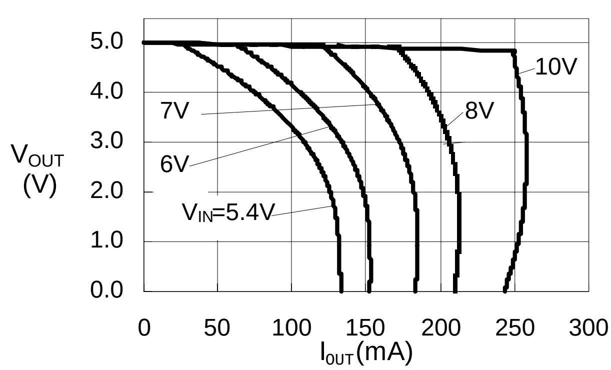
S-817B20A(Ta=25°C)



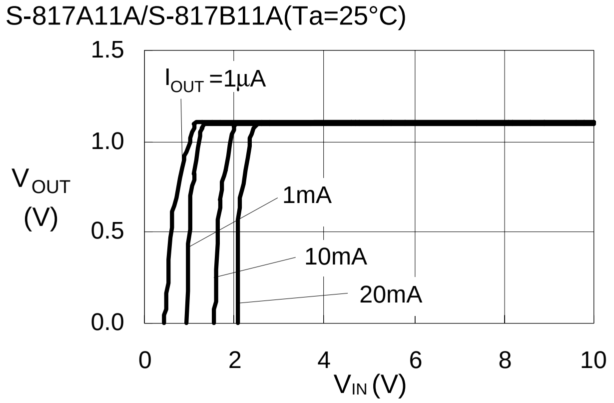
S-817B30A(Ta=25°C)

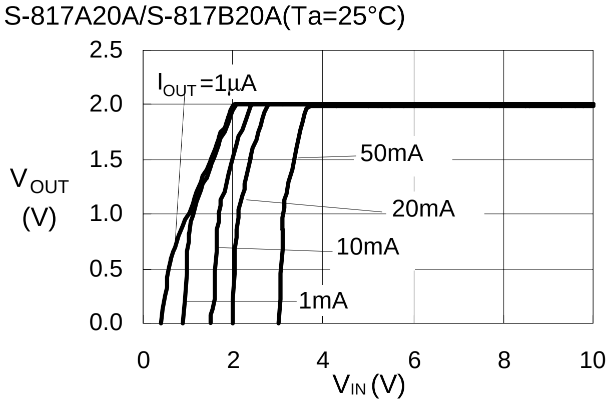


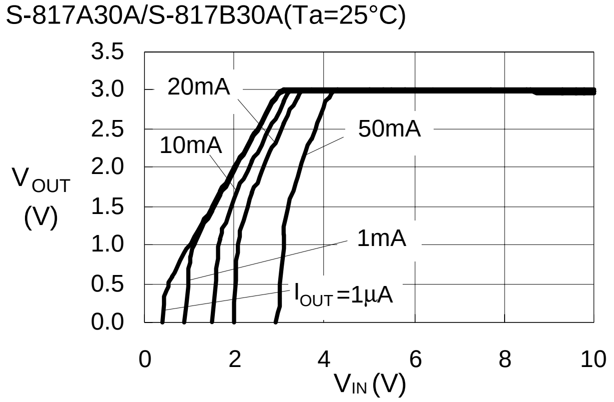
S-817B50A(Ta=25°C)

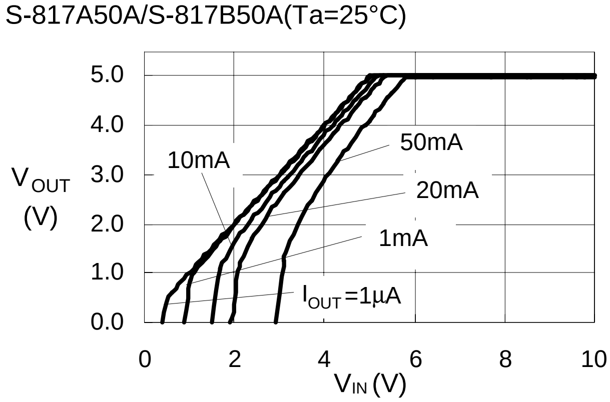


(2) OUTPUT VOLTAGE versus INPUT VOLTAGE





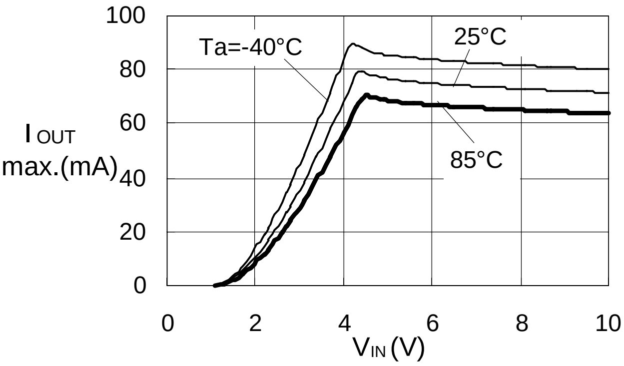




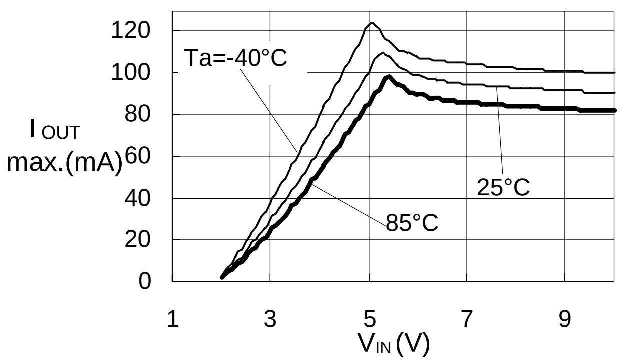
Be sure that input voltage and load current do not exceed the power dissipation level of the package.

(3) MAXIMUM OUTPUT CURRENT versus INPUT VOLTAGE

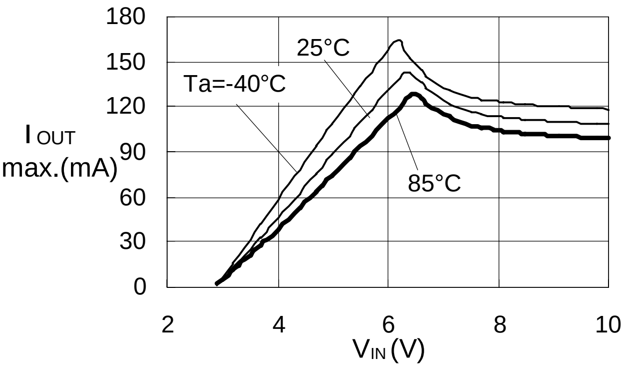
S-817A11A



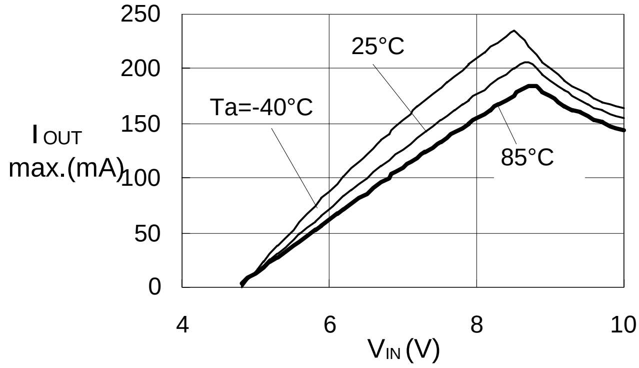
S-817A20A



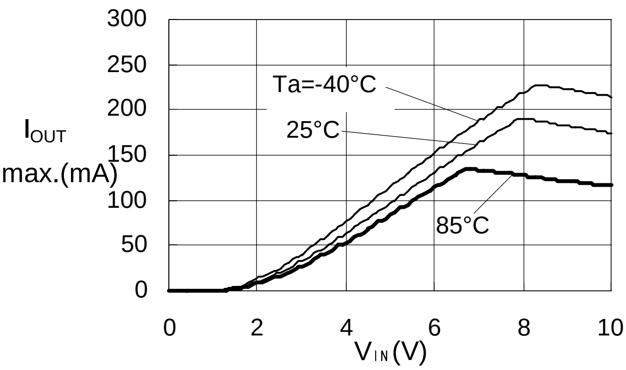
S-817A30A



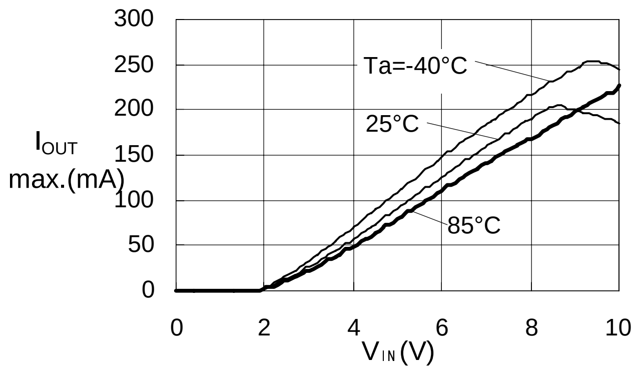
S-817A50A



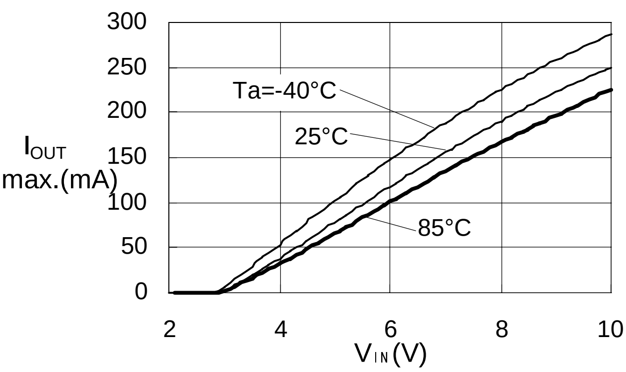
S-817B11A



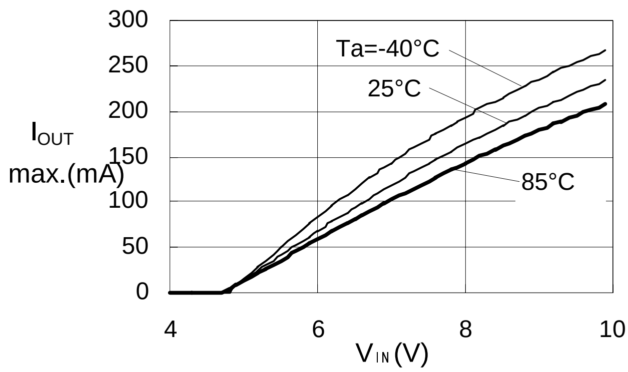
S-817B20A



S-817B30A

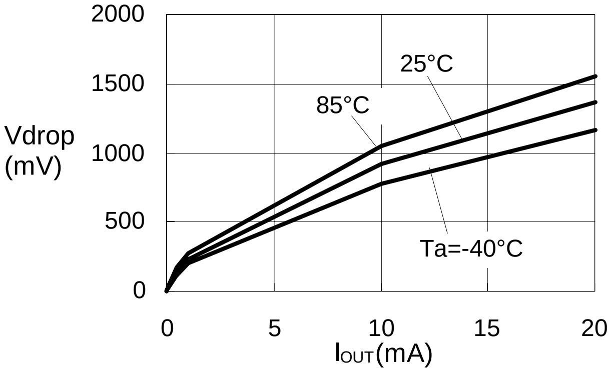


S-817B50A

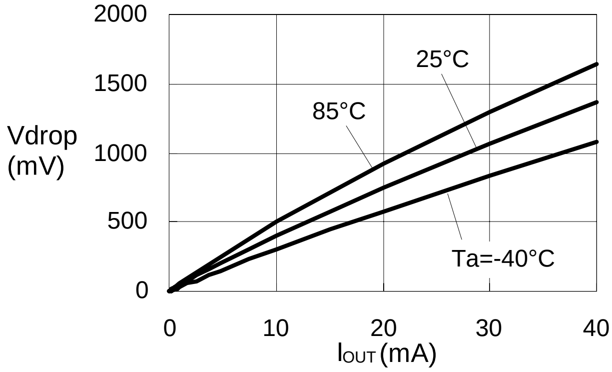


(4) DROPOUT VOLTAGE versus OUTPUT CURRENT

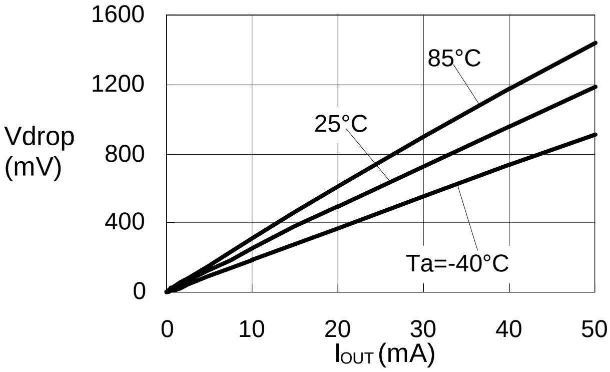
S-817A11A/S-817B11A



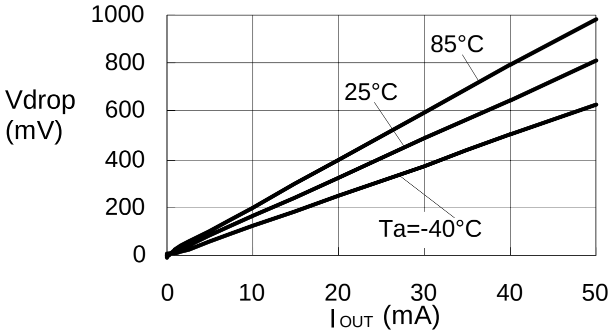
S-817A20A/S-817B20A



S-817A30A/S-817B30A

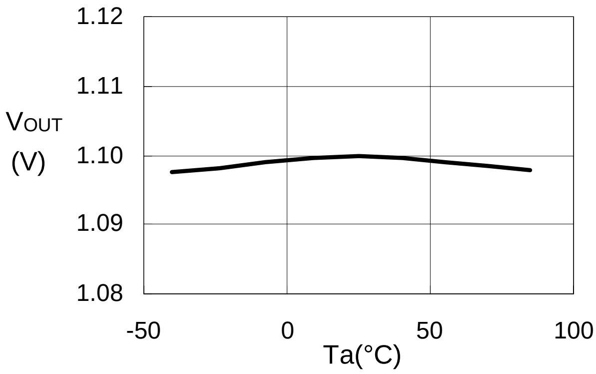


S-817A50A/S-817B50A

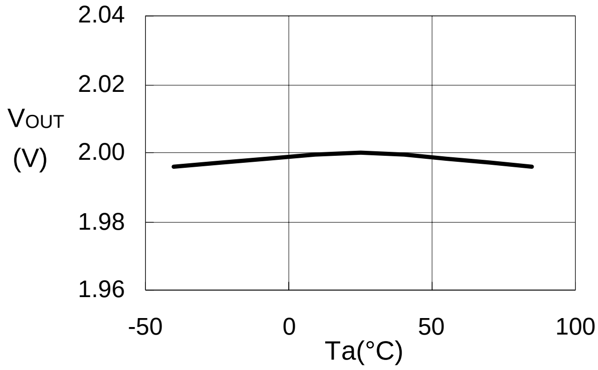


(5) OUTPUT VOLTAGE versus AMBIENT TEMPERATURE

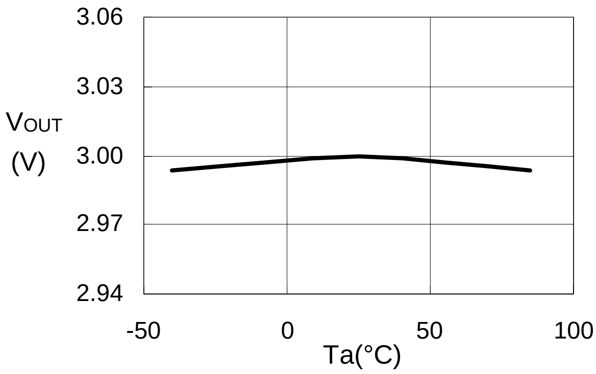
S-817A11A/S-817B11A V_{IN}=3.1V, I_{OUT}=10mA



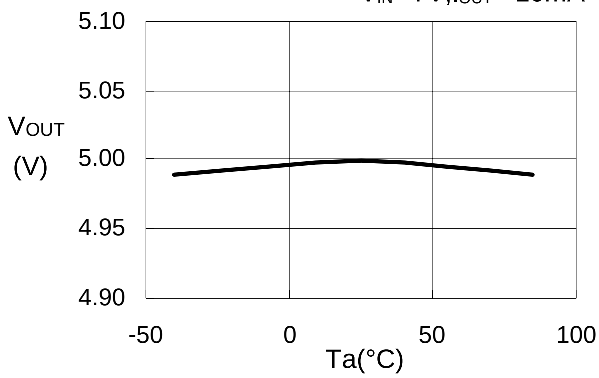
S-817A20A/S-817B20A V_{IN}=4V, I_{OUT}=10mA



S-817A30A/S-817B30A V_{IN}=5V, I_{OUT}=10mA

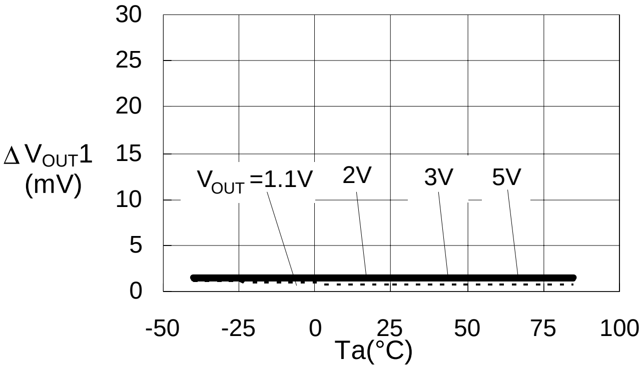


S-817A50A/S-817B50A V_{IN}=7V, I_{OUT}=10mA



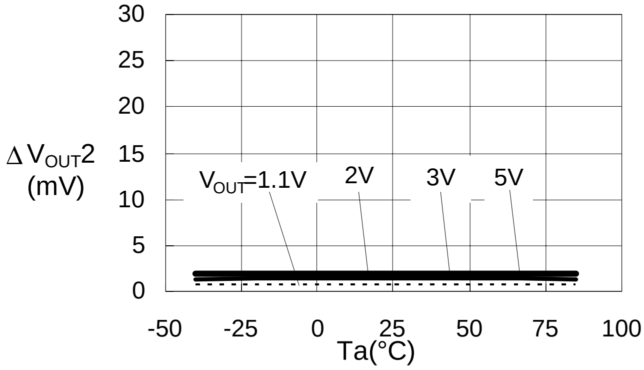
(6) LINE REGULATION 1 versus AMBIENT TEMPERATURE

S-817A11/20/30/50A
S-817B11/20/30/50A $V_{IN}=V_{OUT}(S)+1V \leftrightarrow 10V, I_{OUT}=1mA$



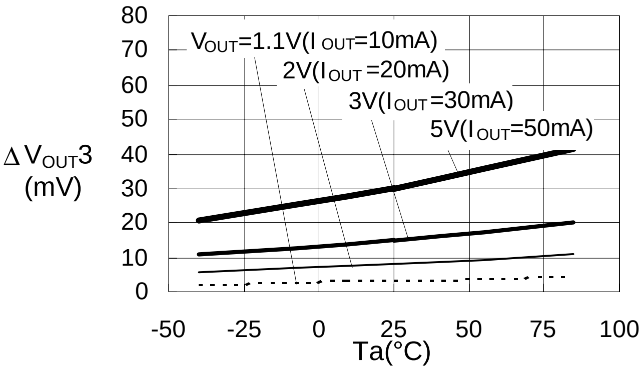
(7) LINE REGULATION 2 versus AMBIENT TEMPERATURE

S-817A11/20/30/50A
S-817B11/20/30/50A $V_{IN}=V_{OUT}(S)+1V \leftrightarrow 10V, I_{OUT}=1\mu A$



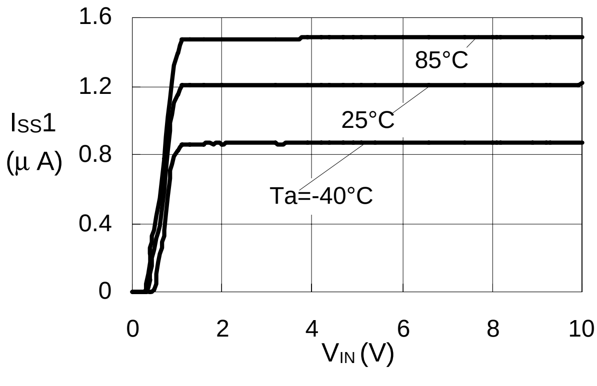
(8) LOAD REGULATION versus AMBIENT TEMPERATURE

S-817A11/20/30/50A
S-817B11/20/30/50A $V_{IN}=V_{OUT}(S)+2V, I_{OUT}=1\mu A \leftrightarrow I_{OUT}$

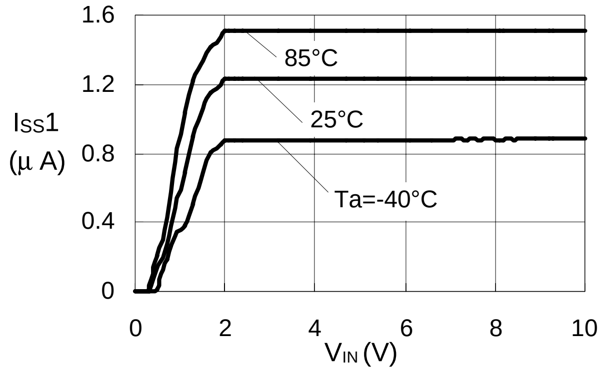


(9) CURRENT CONSUMPTION versus INPUT VOLTAGE

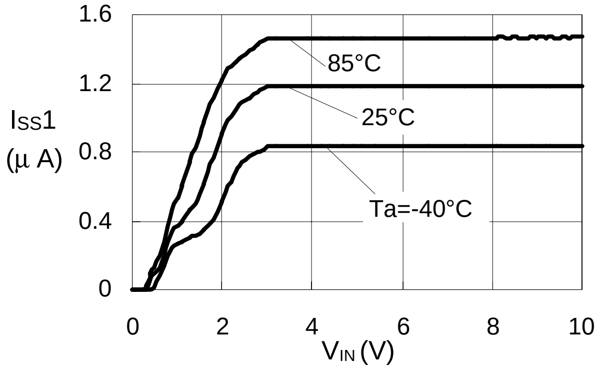
S-817A11A/S-817B11A



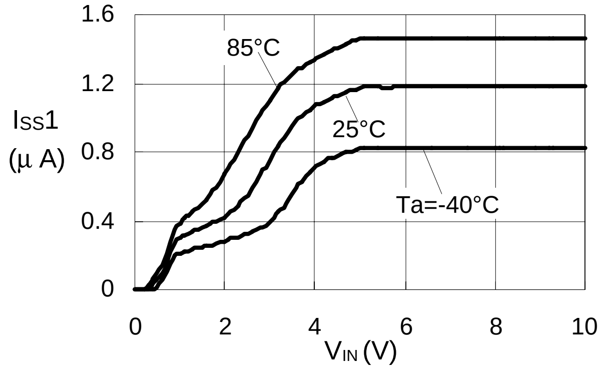
S-817A20A/S-817B20A



S-817A30A/S-817B30A

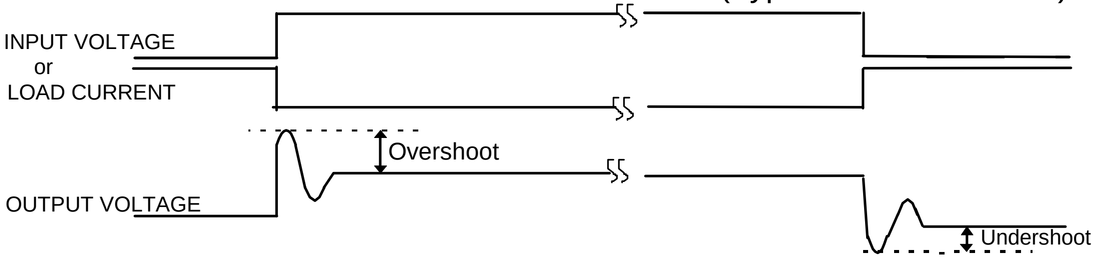


S-817A50A/S-817B50A

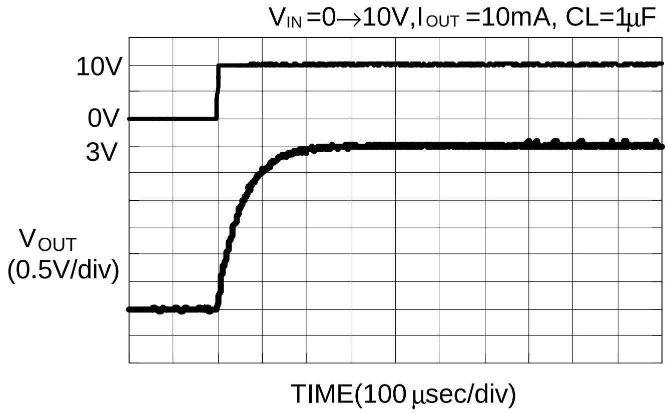


REFERENCE DATA

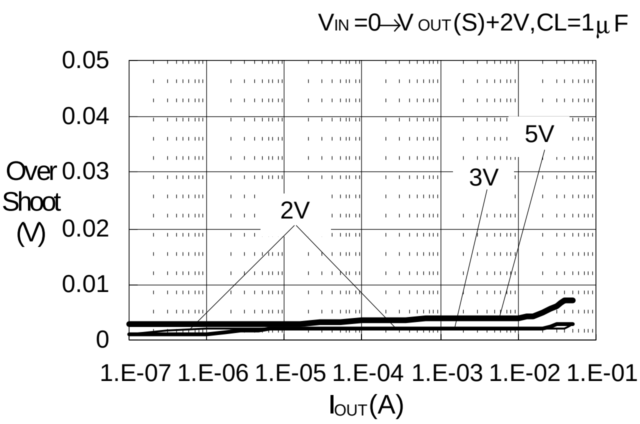
■ TRANSIENT RESPONSE CHARACTERISTICS (Typical data: Ta=25°C)



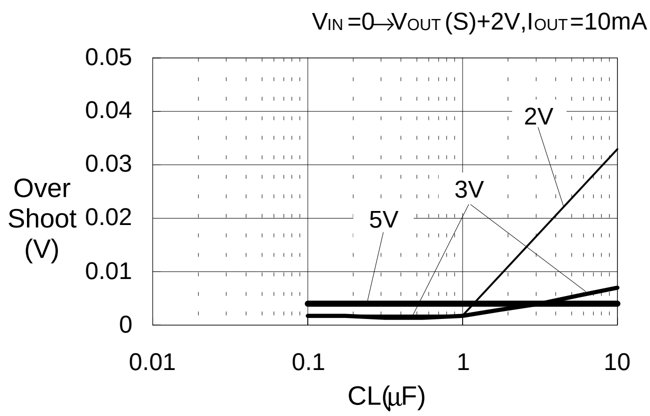
(1) At powering on S-817A30A (when using a ceramic capacitor, CL=1μF)



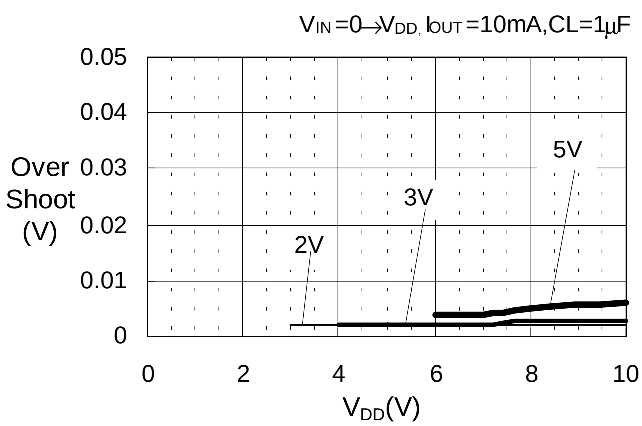
Load dependencies of overshoot at powering on



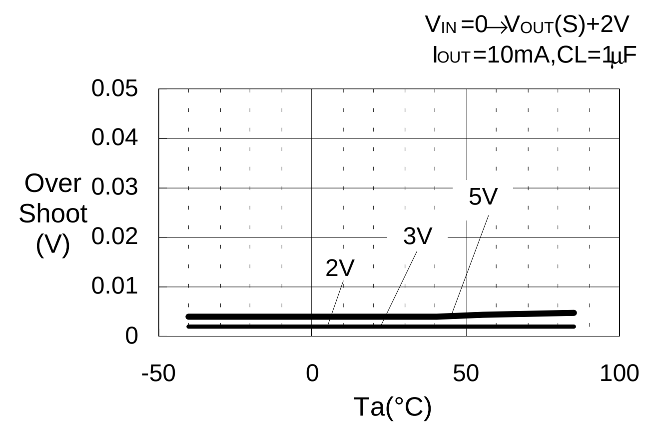
CL dependencies of overshoot at powering on



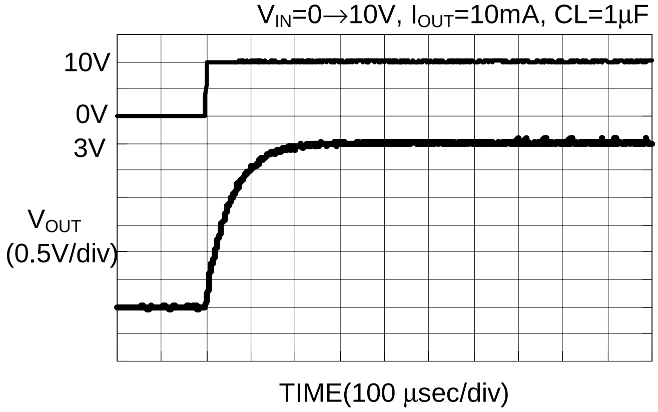
V_{DD} dependencies of overshoot at powering on



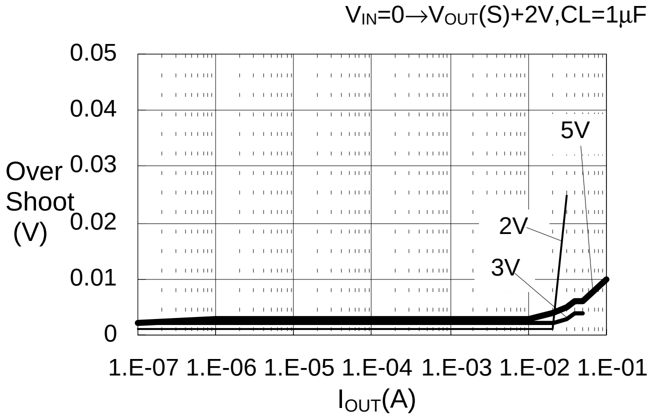
“Ta” dependencies of overshoot at powering on



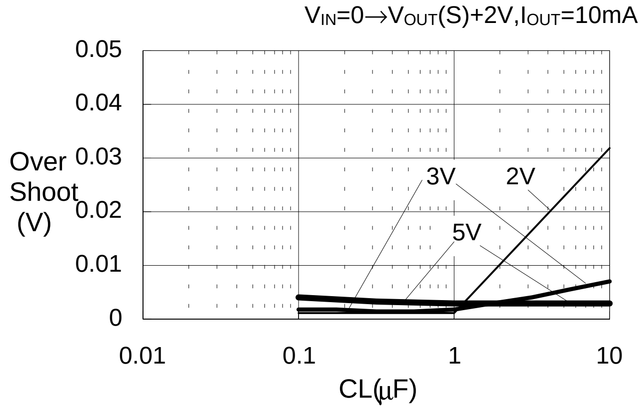
(2) At powering on S-817B30A (when using a ceramic capacitor, CL=1μF)



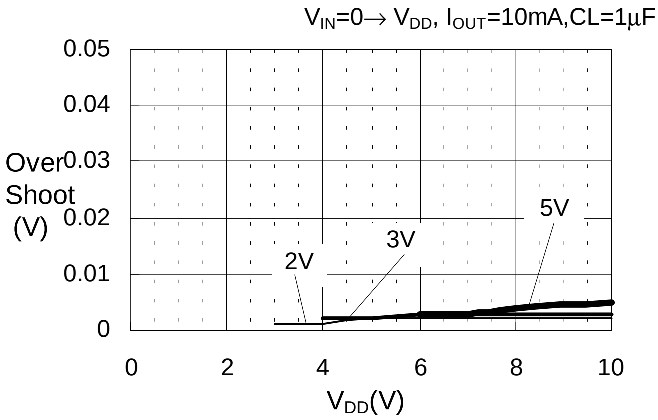
Load dependencies of overshoot at powering on



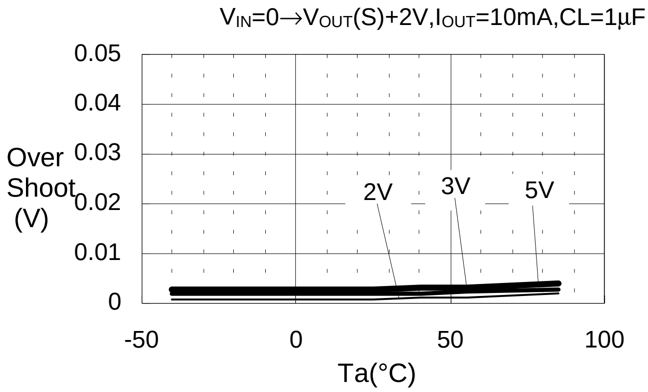
CL dependencies of overshoot at powering on



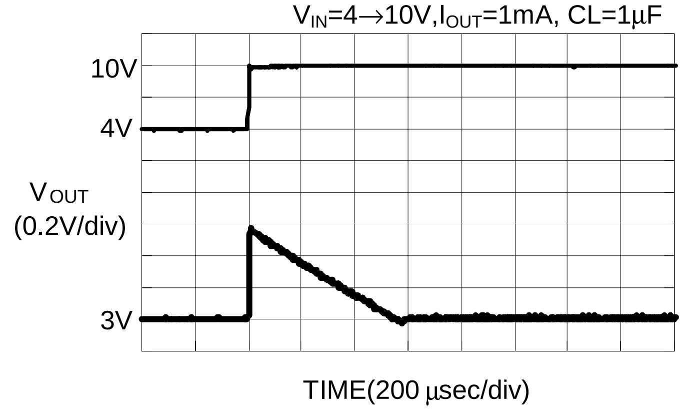
V_{DD} dependencies of overshoot at powering on



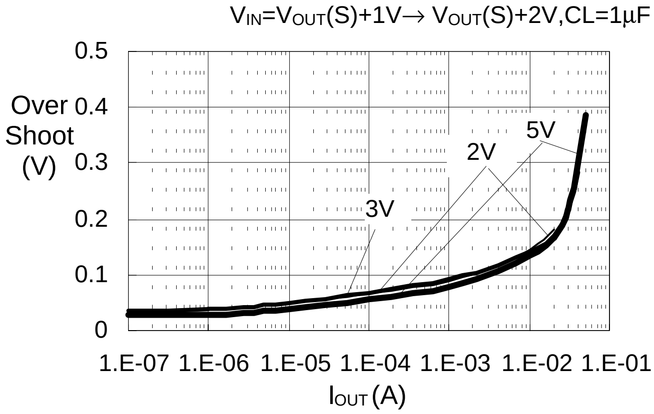
"Ta" dependencies of overshoot at powering on



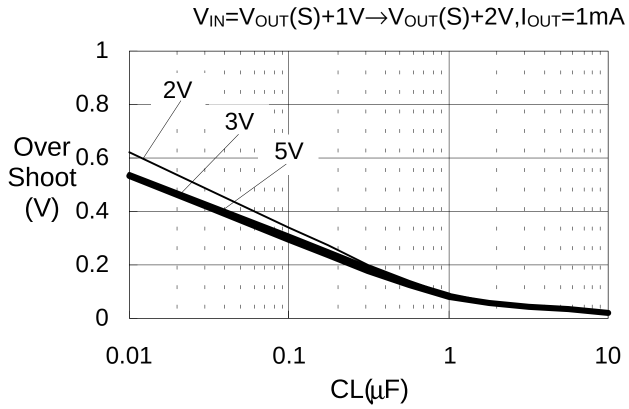
(3) Power fluctuation S-817A30A/S-817B30A (when using a ceramic capacitor, CL=1μF)



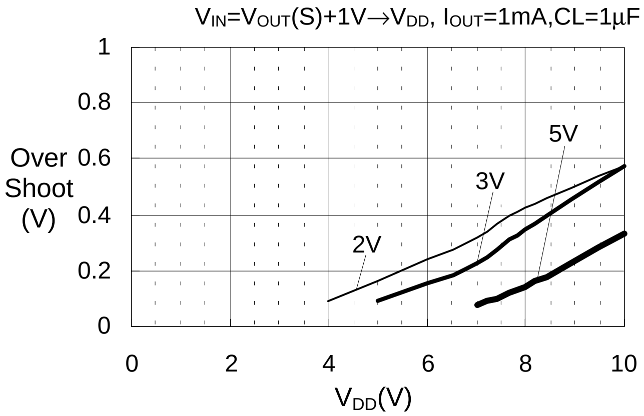
Load dependencies of overshoot at power fluctuation



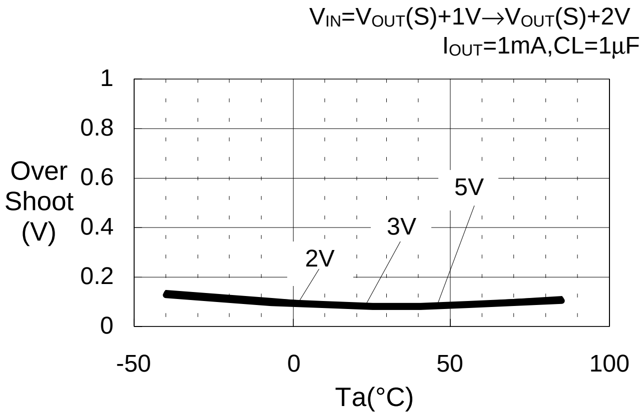
CL dependencies of overshoot at power fluctuation

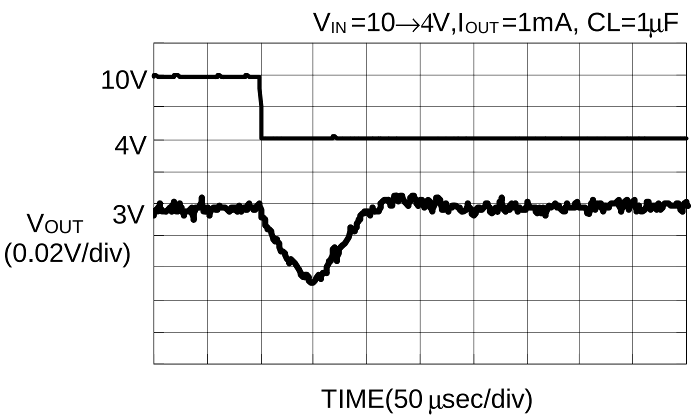


V_{DD} dependencies of overshoot at power fluctuation

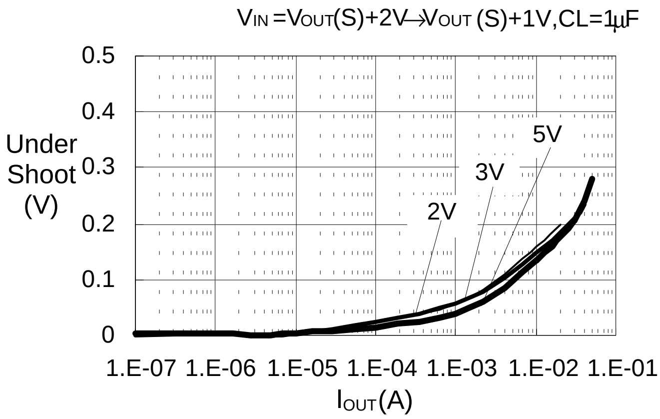


"Ta" dependencies of overshoot at power fluctuation

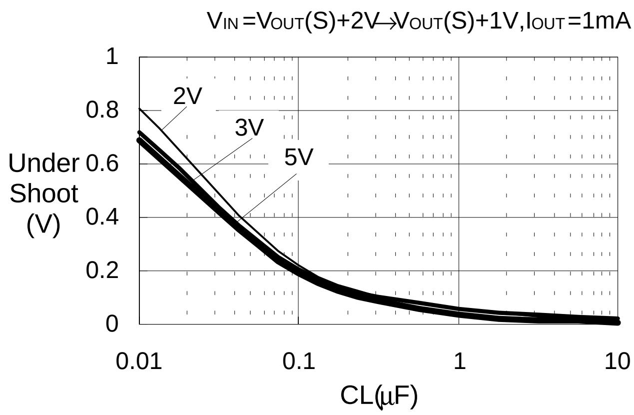




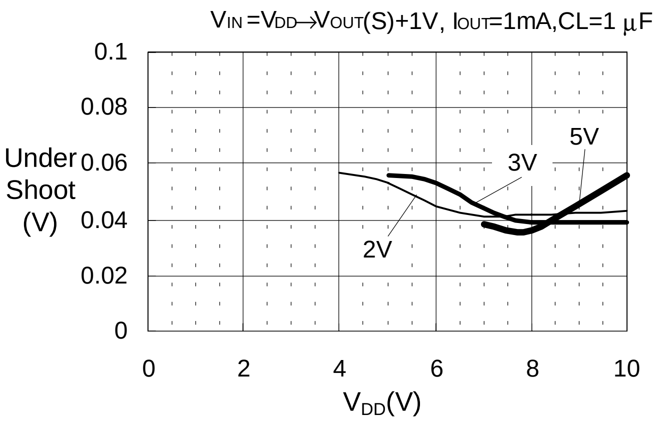
Load dependencies of undershoot at power fluctuation



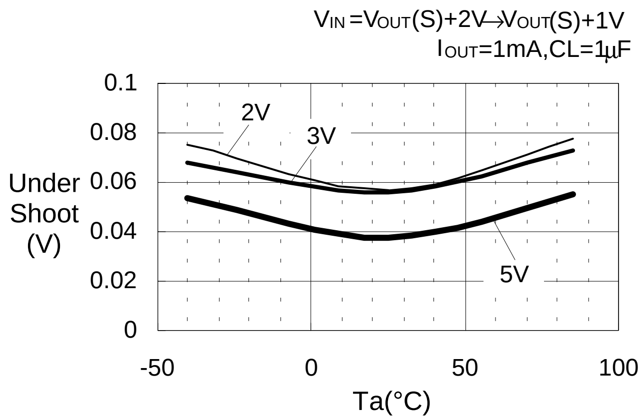
CL dependencies of undershoot at power fluctuation



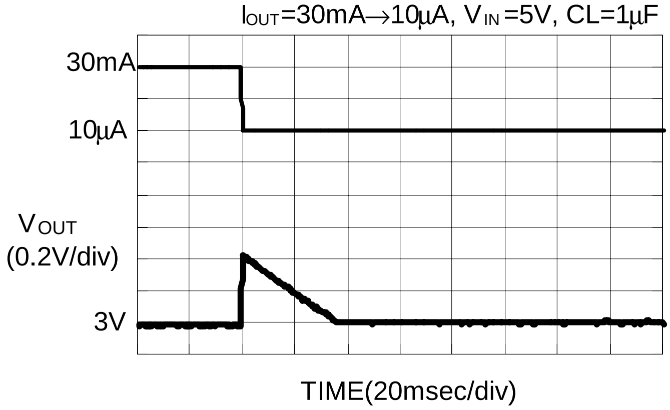
V_{DD} dependencies of undershoot at power fluctuation



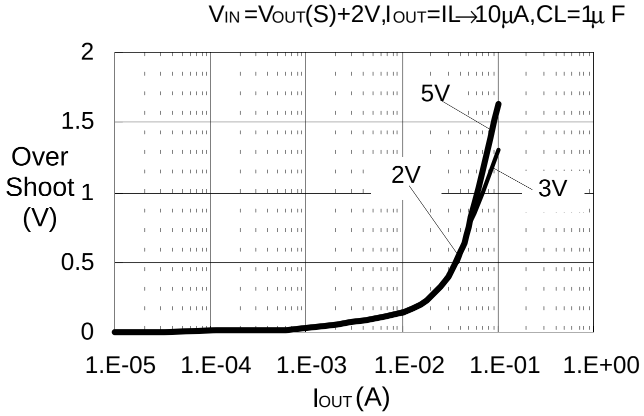
"Ta" dependencies of undershoot at power fluctuation



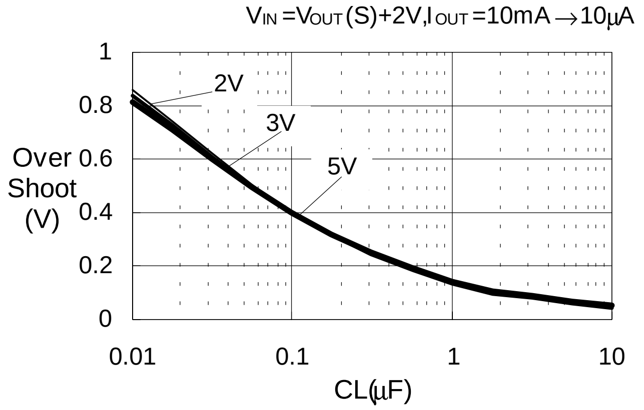
(4) Load fluctuation S-817A30A/S-817B30A (when using a ceramic capacitor, CL=1μF)



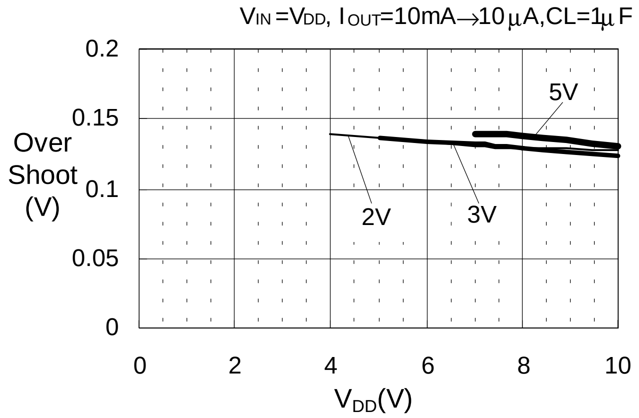
Load current dependencies of overshoot at load fluctuation



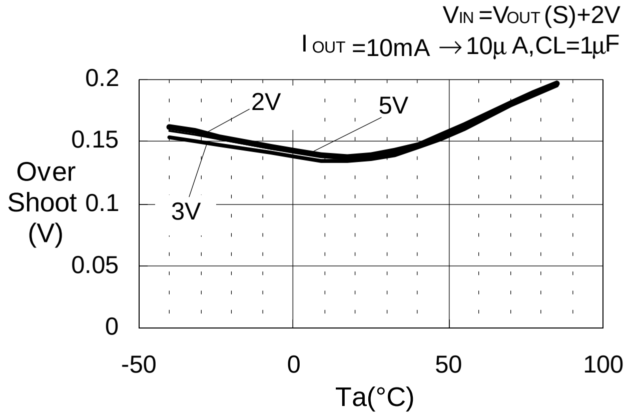
CL dependencies of overshoot at load fluctuation

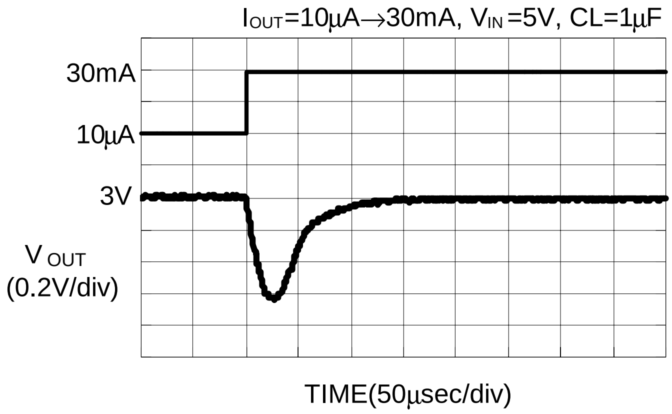


V_{DD} dependencies of overshoot at load fluctuation

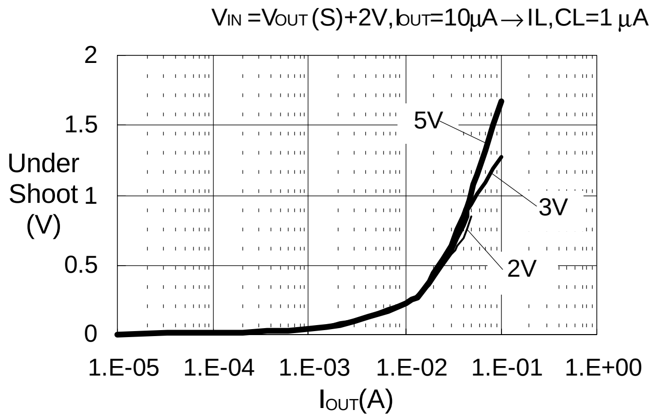


"Ta" dependencies of overshoot at load fluctuation

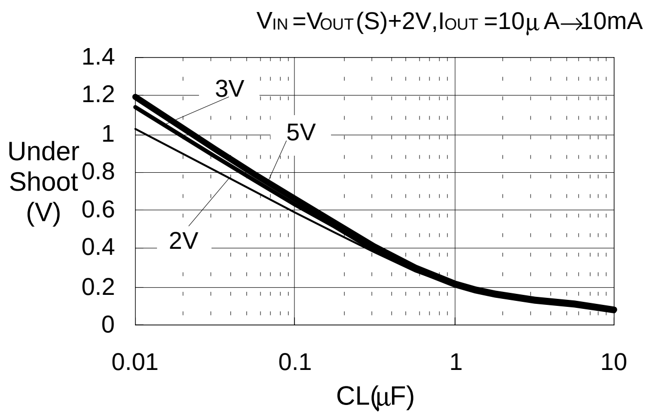




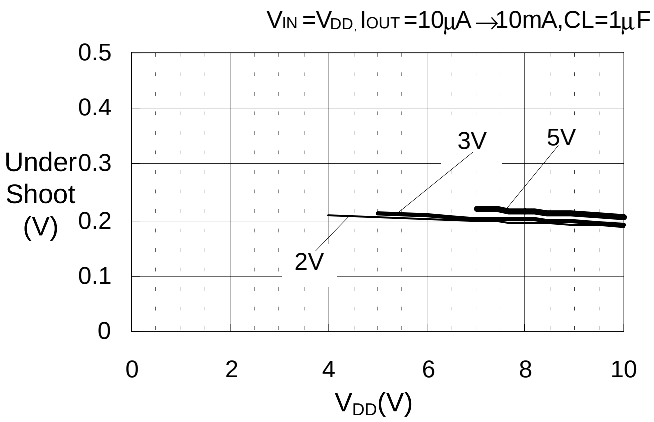
Load current dependencies of undershoot at load fluctuation



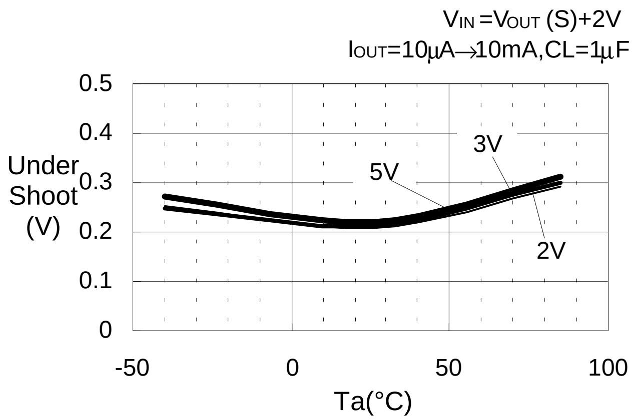
CL dependencies of undershoot at load fluctuation



V_{DD} dependencies of undershoot at load fluctuation



"Ta" dependencies of undershoot at load fluctuation

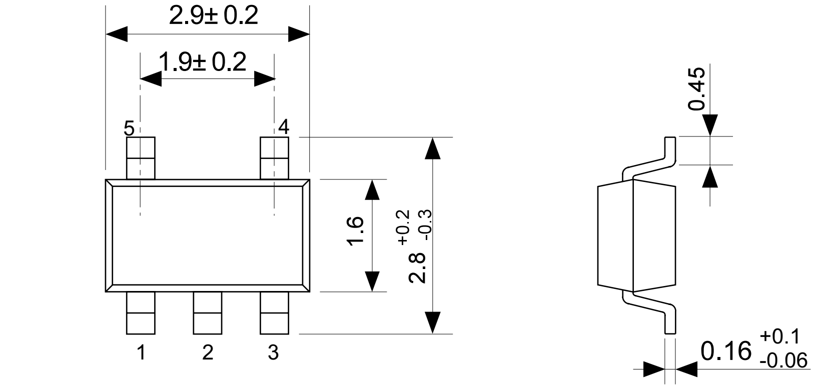


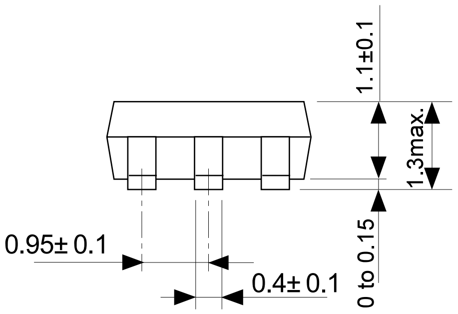
■ SOT-23-5

MP005-A   010907

● Dimensions

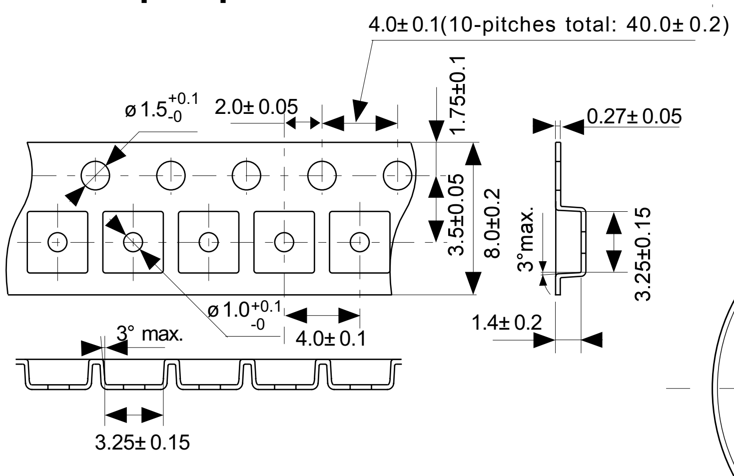
Unit : mm

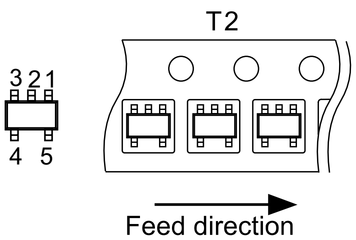




No. MP005-A-P-SD-1.1

● Tape Specifications

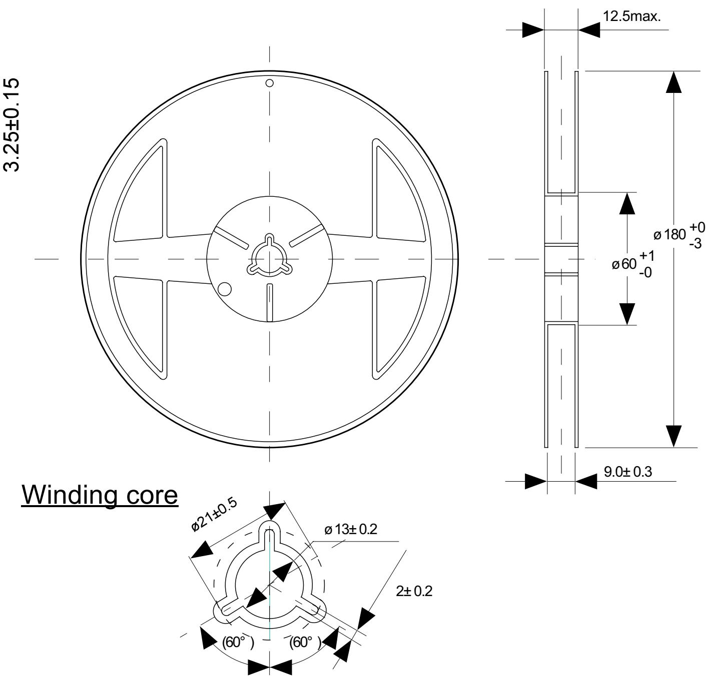




No. : MP005-A-C-SD-1.0

● Reel Specifications

3000 pcs./reel



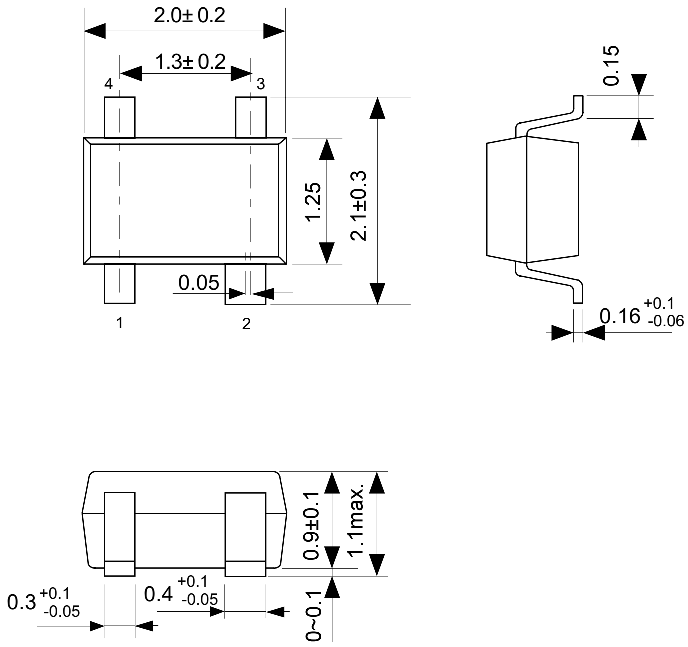
No. MP005-A-R-SD-1. 0

■ SC-82AB

NP004-A Rev.1.0 020109

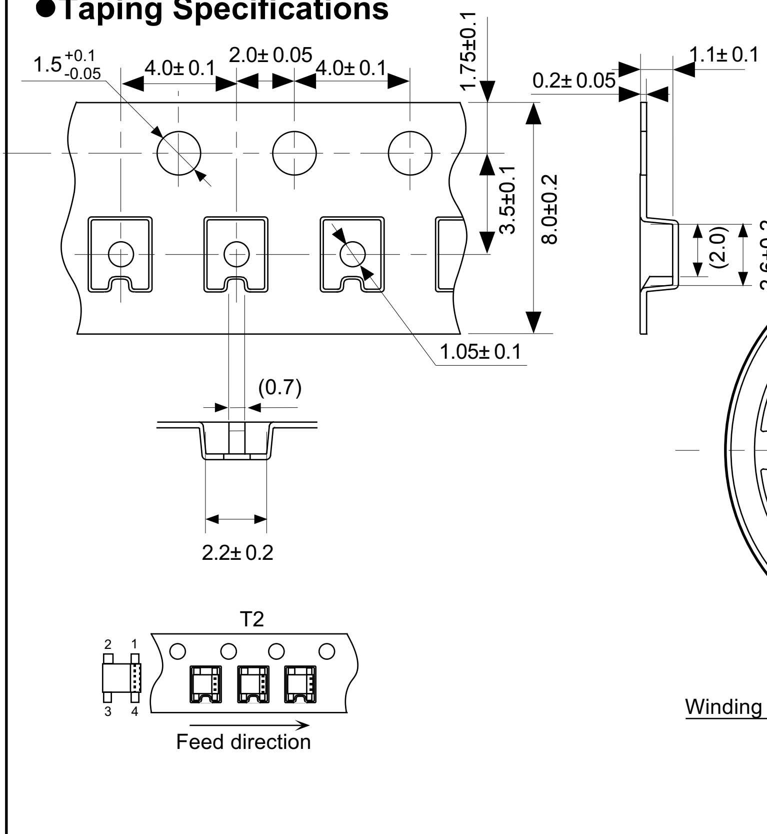
Unit:mm

●Dimensions



No. NP004-A-P-SD-1.0

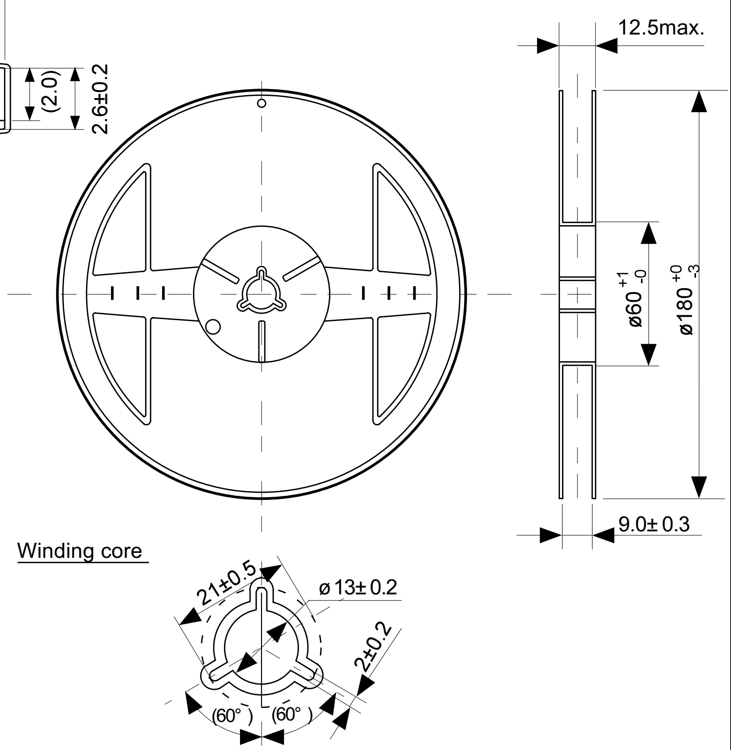
●Taping Specifications



No. NP004-A-C-SD-1.0

●Reel Specifications

3000 pcs / reel



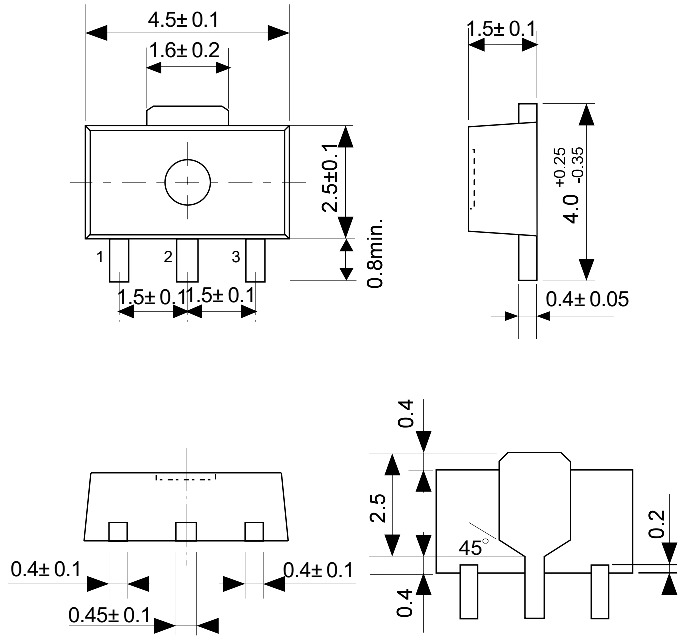
No. NP004-A-R-SD-1.0

■ SOT-89-3

UP003-A **Rev.1.0** 020109

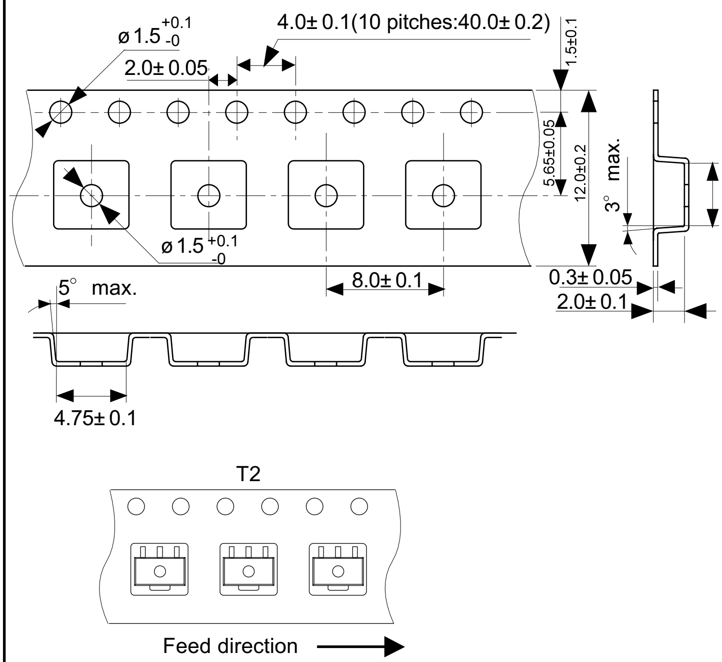
●Dimensions

Unit:mm



No. UP003-A-P-SD-1.0

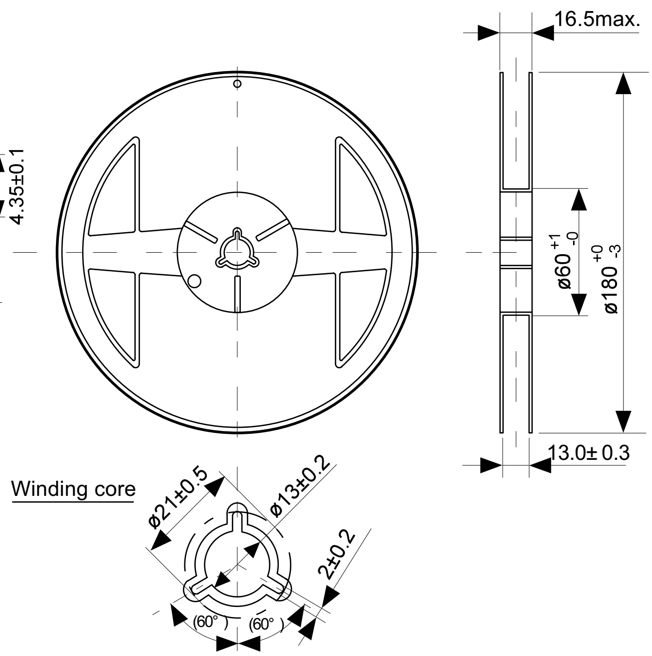
●Taping Specifications



No. UP003-A-C-SD-1.0

●Reel Specifications

1 reel holds 1000 ICs.



No. UP003-A-R-SD-1.0

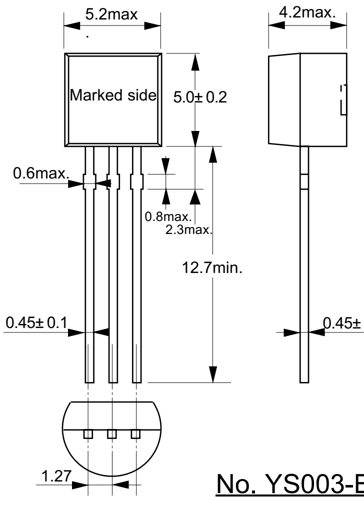
■ TO-92

Y003-A Rev.1.0 011220

Unit:mm

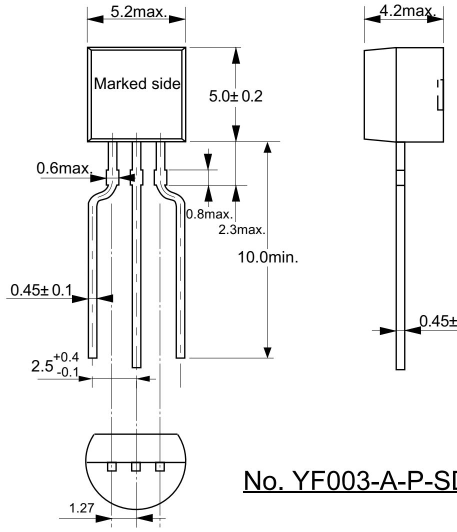
●Dimensions

(1) Bulk



No. YS003-B-P-SD-1.0

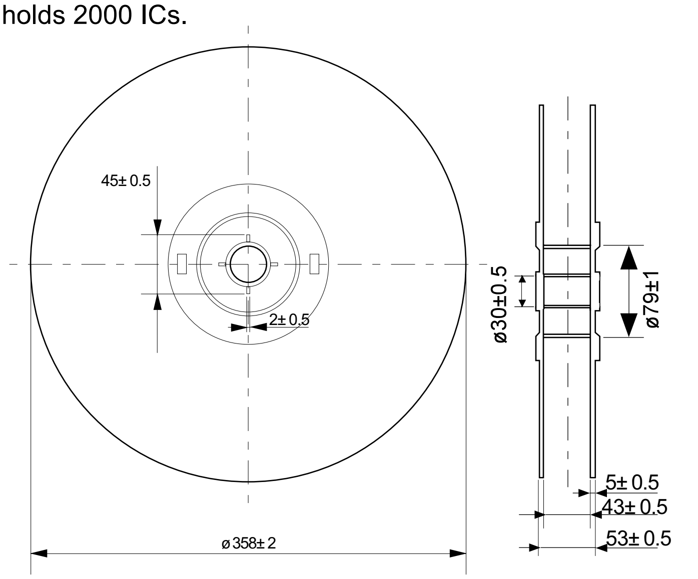
(2) Leadforming for tape (reel/zigzag)



No. YF003-A-P-SD-1.0

●Reel

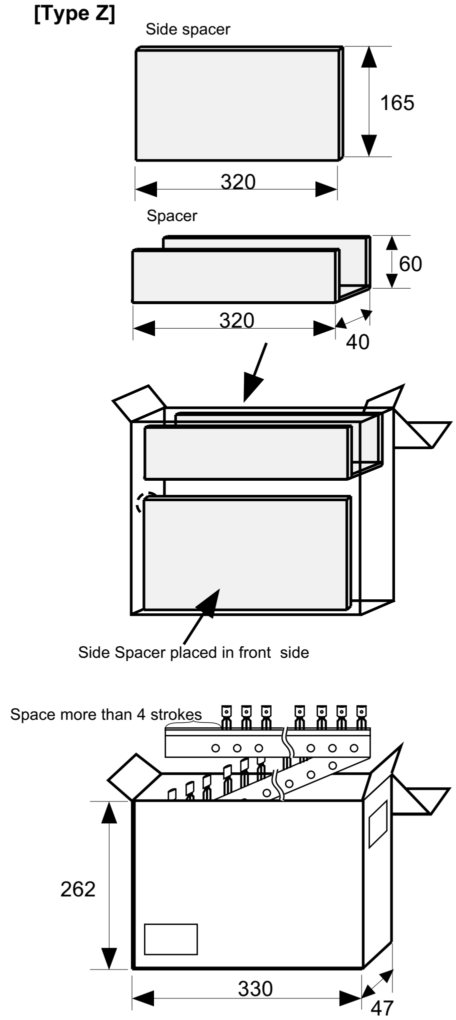
1 reel holds 2000 ICs.



No. YF003-A-R-SD-2.0

●Zigzag

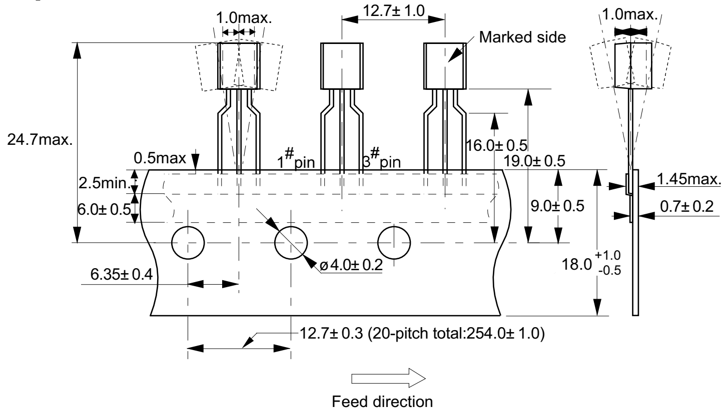
[Type Z]



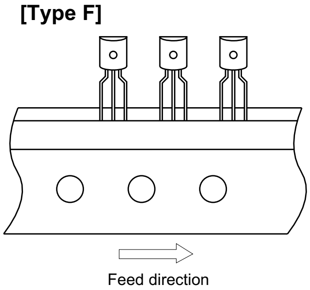
No. YZ003-C-Z-SD-2.0

1 box holds 2500 ICs.

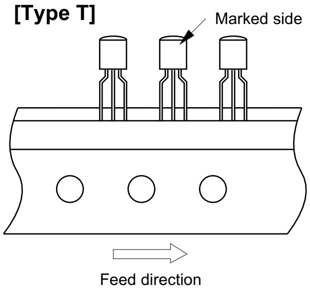
●Tape



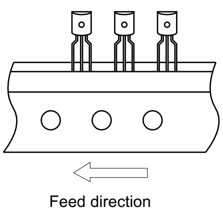
[Type F]



[Type T]



No. YF003-A-C-SD-1.0



No. YZ003-C-C-SD-1.0