

The S-802, S-812 and S-813 Series are series of three-terminal voltage regulators that use a CMOS process. The output voltage is fixed internally: The S-802 Series outputs negative voltage, and the S-812, S-813 Series outputs positive voltage. Since the S-802/S-812/S-813 Series consume less current and need a smaller input/output voltage difference than existing three-terminal voltage regulators, battery-powered portable equipment can have a higher capacity and a longer service life.

## ■ Features

- Supplementary components are unnecessary.
- Low power consumption (S-81230AG: 2.5  $\mu$ A typ.)
- Small input/output voltage difference  
(S-81250HG : 30 mV typ.  $I_{OUT}=1$  mA)  
(S-81350AG :200 mV typ.  $I_{OUT}=40$  mA)
- Low temperature coefficient of output voltage  
(S-81230AG :  $\pm 0.375$  mV /  $^{\circ}$ C typ.)
- Wide operating voltage range  
(S-81250HG :12 V max.)
- Good input stability (0.1% / V typ.)
- TO-92 or SOT-89 mini-powermold plastic packages are available

## ■ Applications

- Constant voltage power supply of battery-powered equipment, communications equipment, video equipment and others

# VOLTAGE REGULATOR

## S-802, 812, 813 series

### Pin Arrangement

#### (1) TO-92

##### 1. S-802, S-812 Series

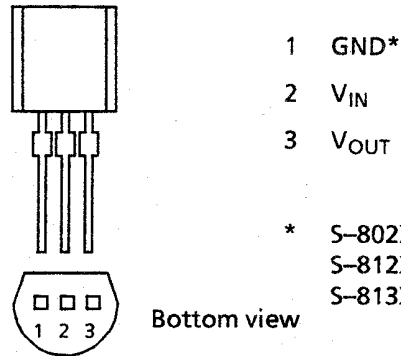


Figure 1

##### 2. S-813 Series

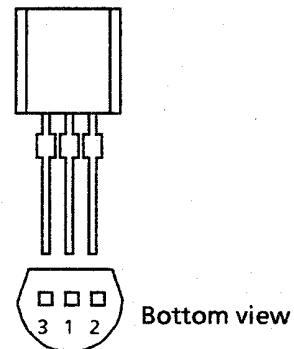


Figure 2

#### (2) SOT-89 mini-powermold

##### 1. S-802 Series

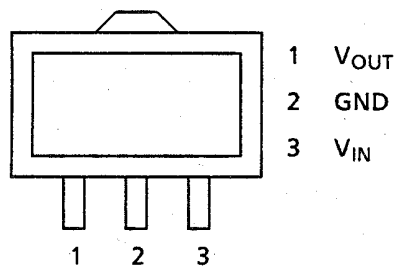


Figure 3

##### 2. S-812 Series

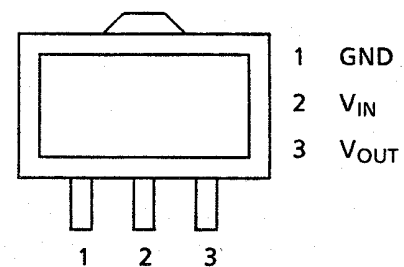


Figure 4

### Block Diagram

##### 1. S-802 Series

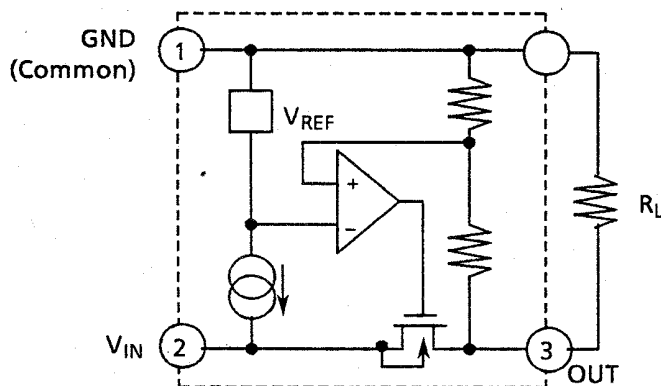


Figure 5 (TO-92)

##### 2. S-812, S-813 Series

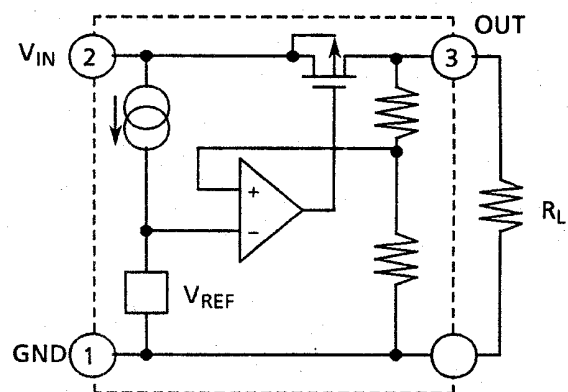


Figure 6

■ Absolute Maximum Ratings

Table 1

Item		Symbol	Ratings	Unit
Input voltage	S-802 Series	$V_{IN}$	- 12	V
	S-812,813 Series		12	
	S-81250HG		18	
Output voltage	S-802 Series	$V_{OUT}$	$V_{IN} - 0.3$ to $V_{SS} + 0.3$	V
	S-812,813 Series		$V_{IN} + 0.3$ to $V_{SS} - 0.3$	
Output current		$I_{OUT}$	100	mA
Allowable dissipation		$P_D$	200	mW
Operating temperature		$T_{opr}$	- 20 to + 70	°C
Storage temperature		$T_{stg}$	- 40 to + 125	
Soldering condition		$T_{slder}$	260°C for 10 seconds	

[ Caution ] Keep static electricity to a minimum.

■ Selection Guide

Table 2

Output voltage	Model name	
	TO-92	SOT-89 mini-power mold*
-3 V ± 5%	S-80230AG	S-80230AG-GA-X
-5 V ± 5%	S-80250AG	S-80250AG-GB-X
1.1 V ± 5%	S-81211AG	-
1.5 V ± 5%	-	S-81215AG-RK-X
2.5 V ± 5%	-	S-81225AG-RH-X
3.0 V ± 5%	S-81230AG	S-81230AG-RB-X
3.5 V ± 5%	-	S-81235AG-RI-X
3.7 V ± 5%	S-81237AG	S-81237AG-RE-X
4.0 V ± 5%	-	S-81240AG-RJ-X
5.0 V ± 5%	S-81250HG	S-81250HG-RD-X
5.2 V ± 5%	S-81252HG	-
5.0 V ± 5%	S-81350AG	-

\* The last part of the model name changes according to the packing form when it is a mini-power mold plastic package product.

X = S : Stick  
X = T1 : Tape  
X = T2 : Tape

# VOLTAGE REGULATOR

## S-802, 812, 813 series

### ■ Electrical Characteristics

#### 1. S-802 Series

##### 1.1 S-80230AG, S-80230AG-GA-X (-3 V output type)

**Table 3**

(Unless otherwise specified: Ta = 25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Test Circuit
Output voltage	$V_{OUT}$	$V_{IN} = -5 V, I_{OUT} = 10 mA$	-3.15	-3.00	-2.85	V	1
Output current	$I_{OUT}$	$V_{IN} = -5 V$	20	30	—	mA	1
Load stability	$\Delta V_{OUT}$	$1 mA \leq I_{OUT} \leq 20 mA$ $V_{IN} = -5 V$	—	60	100	mV	1
I/O voltage difference	$V_{dif}$	$I_{OUT} = 1 mA$	—	60	—	mV	—
Current consumption	$I_{SS}$	$V_{IN} = -5 V, \text{No load}$	—	2.5	6.0	$\mu A$	2
Input stability	$\frac{\Delta V_{OUT}}{\Delta V_{IN} - V_{OUT}}$	$-10 V \leq V_{IN} \leq -4 V$	—	0.1	—	% / V	1
Input voltage	$V_{IN}$		-10	—	—	V	—
Temperature characteristic of $\Delta V_{OUT}$	$\frac{\Delta V_{OUT}}{\Delta Ta}$	$I_{OUT} = 10 mA$ $-20^{\circ}C \leq Ta \leq 70^{\circ}C$	—	$\pm 0.375$	—	mV / °C	—

##### 1.2 S-80250AG, S-80250AG-GB-X (-5 V output type)

**Table 4**

(Unless otherwise specified: Ta = 25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Test Circuit
Output voltage	$V_{OUT}$	$V_{IN} = -7 V, I_{OUT} = 10 mA$	-5.25	-5.00	-4.75	V	1
Output current	$I_{OUT}$	$V_{IN} = -7 V$	40	50	—	mA	1
Load stability	$\Delta V_{OUT}$	$1 mA \leq I_{OUT} \leq 40 mA$ $V_{IN} = -7 V$	—	40	80	mV	1
I/O voltage difference	$V_{dif}$	$I_{OUT} = 1 mA$	—	30	—	mV	—
Current consumption	$I_{SS}$	$V_{IN} = -7 V, \text{No load}$	—	3.0	7.0	$\mu A$	2
Input stability	$\frac{\Delta V_{OUT}}{\Delta V_{IN} - V_{OUT}}$	$-10 V \leq V_{IN} \leq -6 V$	—	0.1	—	% / V	1
Input voltage	$V_{IN}$		-10	—	—	V	—
Temperature characteristic of $\Delta V_{OUT}$	$\frac{\Delta V_{OUT}}{\Delta Ta}$	$I_{OUT} = 10 mA$ $-20^{\circ}C \leq Ta \leq 70^{\circ}C$	—	$\pm 0.625$	—	mV / °C	—

2. S-812 Series

2.1 S-81211AG (+1.1 V output type)

Table 5

(Unless otherwise specified: Ta = 25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Test Circuit
Output voltage	V <sub>OUT</sub>	V <sub>IN</sub> = 1.5 V, I <sub>OUT</sub> = 0.5 mA	1.045	1.100	1.150	V	3
Output current	I <sub>OUT</sub>	V <sub>IN</sub> = 1.5 V	0.5	—	—	mA	3
Load stability	ΔV <sub>OUT</sub>	40 μA ≤ I <sub>OUT</sub> ≤ 500 μA V <sub>IN</sub> = 1.5 V	—	—	100	mV	3
I/O voltage difference	V <sub>dif</sub>	I <sub>OUT</sub> = 1.0 mA	—	250	400	mV	—
Current consumption	I <sub>SS</sub>	V <sub>IN</sub> = 1.5 V, No load	—	2.2	5.0	μA	4
Input stability	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	1.55 V ≤ V <sub>IN</sub> ≤ 10 V	—	—	1.0	% / V	3
Input voltage	V <sub>IN</sub>		—	—	10	V	—
Temperature characteristic of ΔV <sub>OUT</sub>	$\frac{\Delta V_{OUT}}{\Delta T_a}$	I <sub>OUT</sub> = 0.5 mA -20°C ≤ Ta ≤ 70°C	—	± 0.138	—	mV / °C	—

2.2 S-81215AG-RK-X (+1.5 V output type)

Table 6

(Unless otherwise specified: Ta = 25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Test Circuit
Output voltage	V <sub>OUT</sub>	V <sub>IN</sub> = 3.5 V, I <sub>OUT</sub> = 0.5 mA	1.425	1.50	1.575	V	3
Output current	I <sub>OUT</sub>	V <sub>IN</sub> = 3.5 V	7.0	—	—	mA	3
Load stability	ΔV <sub>OUT</sub>	1 mA ≤ I <sub>OUT</sub> ≤ 7 mA V <sub>IN</sub> = 3.5 V	—	80	—	mV	3
I/O voltage difference	V <sub>dif</sub>	I <sub>OUT</sub> = 0.5 mA	—	300	—	mV	—
Current consumption	I <sub>SS</sub>	V <sub>IN</sub> = 3.5 V, No load	—	2.2	5.0	μA	4
Input stability	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	2.5 V ≤ V <sub>IN</sub> ≤ 10 V I <sub>OUT</sub> = 0.5 mA	—	0.1	—	% / V	3
Input voltage	V <sub>IN</sub>		—	—	10	V	—
Temperature characteristic of ΔV <sub>OUT</sub>	$\frac{\Delta V_{OUT}}{\Delta T_a}$	I <sub>OUT</sub> = 0.5 mA -20°C ≤ Ta ≤ 70°C	—	± 0.19	—	mV / °C	—

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S-802, 812, 813 series

2.3 S-81225AG-RH-X (+2.5 V output type)

Table 7

(Unless otherwise specified: Ta = 25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Test Circuit
Output voltage	V <sub>OUT</sub>	V <sub>IN</sub> = 4.5 V, I <sub>OUT</sub> = 10 mA	2.375	2.500	2.625	V	3
Output current	I <sub>OUT</sub>	V <sub>IN</sub> = 4.5 V	10	25	—	mA	3
Load stability	ΔV <sub>OUT</sub>	1 mA ≤ I <sub>OUT</sub> ≤ 10 mA V <sub>IN</sub> = 4.5 V	—	80	120	mV	3
I/O voltage difference	V <sub>dif</sub>	I <sub>OUT</sub> = 1.0 mA	—	100	—	mV	—
Current consumption	I <sub>SS</sub>	V <sub>IN</sub> = 4.5 V	—	2.5	6.0	μA	4
Input stability	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	3.5 V ≤ V <sub>IN</sub> ≤ 10 V	—	0.1	—	%/V	3
Input voltage	V <sub>IN</sub>		—	—	10	V	—
Temperature characteristic of ΔV <sub>OUT</sub>	$\frac{\Delta V_{OUT}}{\Delta T_a}$	I <sub>OUT</sub> = 10 mA -20°C ≤ Ta ≤ 70°C	—	±0.31	—	mV/°C	—

2.4 S-81230AG, S-81230AG-RB-X (+3.0 V output type)

Table 8

(Unless otherwise specified: Ta = 25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Test Circuit
Output voltage	V <sub>OUT</sub>	V <sub>IN</sub> = 5 V, I <sub>OUT</sub> = 10 mA	2.85	3.00	3.15	V	3
Output current	I <sub>OUT</sub>	V <sub>IN</sub> = 5 V	20	30	—	mA	3
Load stability	ΔV <sub>OUT</sub>	1 mA ≤ I <sub>OUT</sub> ≤ 20 mA V <sub>IN</sub> = 5 V	—	60	100	mV	3
I/O voltage difference	V <sub>dif</sub>	I <sub>OUT</sub> = 1 mA	—	60	—	mV	—
Current consumption	I <sub>SS</sub>	V <sub>IN</sub> = 5 V, No load	—	2.5	6.0	μA	4
Input stability	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	4 V ≤ V <sub>IN</sub> ≤ 10 V	—	0.1	—	%/V	3
Input voltage	V <sub>IN</sub>		—	—	10	V	—
Temperature characteristic of ΔV <sub>OUT</sub>	$\frac{\Delta V_{OUT}}{\Delta T_a}$	I <sub>OUT</sub> = 10 mA -20°C ≤ Ta ≤ 70°C	—	±0.375	—	mV/°C	—

2.5 S-81235AG-RI-X (+3.5 V output type)

Table 9

(Unless otherwise specified: Ta = 25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Test Circuit
Output voltage	V <sub>OUT</sub>	V <sub>IN</sub> = 5.5 V, I <sub>OUT</sub> = 10 mA	3.325	3.50	3.675	V	3
Output current	I <sub>OUT</sub>	V <sub>IN</sub> = 5.5 V	20	30	—	mA	3
Load stability	ΔV <sub>OUT</sub>	1 mA ≤ I <sub>OUT</sub> ≤ 30 mA V <sub>IN</sub> = 5.5 V	—	60	100	mV	3
I/O voltage difference	V <sub>dif</sub>	I <sub>OUT</sub> = 1 mA	—	60	—	mV	—
Current consumption	I <sub>SS</sub>	V <sub>IN</sub> = 5.5 V, No load	—	2.5	6.0	μA	4
Input stability	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	4.5 V ≤ V <sub>IN</sub> ≤ 10 V	—	0.1	—	% / V	3
Input voltage	V <sub>IN</sub>		—	—	10	V	—
Temperature characteristic of ΔV <sub>OUT</sub>	$\frac{\Delta V_{OUT}}{\Delta T_a}$	I <sub>OUT</sub> = 10 mA -20°C ≤ Ta ≤ 70°C	—	± 0.438	—	mV / °C	—

2.6 S-81237AG, S-81237AG-RE-X (+3.7 V output type)

Table 10

(Unless otherwise specified: Ta = 25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Test Circuit
Output voltage	V <sub>OUT</sub>	V <sub>IN</sub> = 5.7 V, I <sub>OUT</sub> = 10 mA	3.50	3.70	3.90	V	3
Output current	I <sub>OUT</sub>	V <sub>IN</sub> = 5.7 V	20	30	—	mA	3
Load stability	ΔV <sub>OUT</sub>	1 mA ≤ I <sub>OUT</sub> ≤ 20 mA V <sub>IN</sub> = 5.7 V	—	60	100	mV	3
I/O voltage difference	V <sub>dif</sub>	I <sub>OUT</sub> = 1 mA	—	60	—	mV	—
Current consumption	I <sub>SS</sub>	V <sub>IN</sub> = 5.7 V, No load	—	2.0	4.0	μA	4
Input stability	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	4.7 V ≤ V <sub>IN</sub> ≤ 10 V	—	0.1	—	% / V	3
Input voltage	V <sub>IN</sub>		—	—	10	V	—
Temperature characteristic of ΔV <sub>OUT</sub>	$\frac{\Delta V_{OUT}}{\Delta T_a}$	I <sub>OUT</sub> = 10 mA -20°C ≤ Ta ≤ 70°C	—	± 0.46	—	mV / °C	—

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S-802, 812, 813 series

2.7 S-81240AG-RJ-X (+4.0 V output type)

Table 11

(Unless otherwise specified: Ta = 25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Test Circuit
Output voltage	V <sub>OUT</sub>	V <sub>IN</sub> = 6 V, I <sub>OUT</sub> = 10 mA	3.80	4.0	4.20	V	3
Output current	I <sub>OUT</sub>	V <sub>IN</sub> = 6 V	30	40	—	mA	3
Load stability	ΔV <sub>OUT</sub>	1 mA ≤ I <sub>OUT</sub> ≤ 30 mA V <sub>IN</sub> = 6 V	—	50	90	mV	3
I/O voltage difference	V <sub>dif</sub>	I <sub>OUT</sub> = 1 mA	—	50	—	mV	—
Current consumption	I <sub>SS</sub>	V <sub>IN</sub> = 6 V, No load	—	3.0	7.0	μA	4
Input stability	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	5 V ≤ V <sub>IN</sub> ≤ 10 V	—	0.1	—	% / V	3
Input voltage	V <sub>IN</sub>		—	—	10	V	—
Temperature characteristic of ΔV <sub>OUT</sub>	$\frac{\Delta V_{OUT}}{\Delta T_a}$	I <sub>OUT</sub> = 10 mA -20°C ≤ Ta ≤ 70°C	—	± 0.5	—	mV / °C	—

2.8 S-81250HG, S-81250HG-RD-X (+5.0 V high-pressure-proof output type)

Table 12

(Unless otherwise specified: Ta = 25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Test Circuit
Output voltage	V <sub>OUT</sub>	V <sub>IN</sub> = 7 V, I <sub>OUT</sub> = 10 mA	4.75	5.00	5.25	V	3
Output current	I <sub>OUT</sub>	V <sub>IN</sub> = 7 V	40	50	—	mA	3
Load stability	ΔV <sub>OUT</sub>	1 mA ≤ I <sub>OUT</sub> ≤ 40 mA V <sub>IN</sub> = 7 V	—	40	80	mV	3
I/O voltage difference	V <sub>dif</sub>	I <sub>OUT</sub> = 1 mA	—	30	—	mV	—
Current consumption	I <sub>SS</sub>	V <sub>IN</sub> = 7 V, No load	—	3.0	7.0	μA	4
Input stability	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	6 V ≤ V <sub>IN</sub> ≤ 10 V	—	0.1	—	% / V	3
Input voltage	V <sub>IN</sub>		—	—	12	V	—
Temperature characteristic of ΔV <sub>OUT</sub>	$\frac{\Delta V_{OUT}}{\Delta T_a}$	I <sub>OUT</sub> = 10 mA -20°C ≤ Ta ≤ 70°C	—	± 0.625	—	mV / °C	—



2.9 S-81252HG (+5.2 V high-pressure-proof output type)

Table 13

(Unless otherwise specified: Ta = 25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Test Circuit
Output voltage	$V_{OUT}$	$V_{IN} = 7.2 \text{ V}$ , $I_{OUT} = 10 \text{ mA}$	5.0	5.20	5.40	V	3
Output current	$I_{OUT}$	$V_{IN} = 7.2 \text{ V}$	40	50	—	mA	3
Load stability	$\Delta V_{OUT}$	$1 \text{ mA} \leq I_{OUT} \leq 40 \text{ mA}$ $V_{IN} = 7.2 \text{ V}$	—	40	80	mV	3
I/O voltage difference	$V_{dif}$	$I_{OUT} = 1 \text{ mA}$	—	30	—	mV	—
Current consumption	$I_{SS}$	$V_{IN} = 7.2 \text{ V}$ , No load	—	3.0	7.0	$\mu\text{A}$	4
Input stability	$\frac{\Delta V_{OUT}}{\Delta V_{IN} V_{OUT}}$	$6.2 \text{ V} \leq V_{IN} \leq 15 \text{ V}$	—	0.1	—	% / V	3
Input voltage	$V_{IN}$		—	—	15	V	—
Temperature characteristic of $\Delta V_{OUT}$	$\frac{\Delta V_{OUT}}{\Delta T_a}$	$I_{OUT} = 10 \text{ mA}$ $-20^\circ\text{C} \leq T_a \leq 70^\circ\text{C}$	—	$\pm 0.68$	—	mV / °C	—

3. S-813 Series

3.1 S-81350AG (+5.0 V high-output current type)

Table 14

(Unless otherwise specified: Ta = 25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Test Circuit
Output voltage	$V_{OUT}$	$V_{IN} = 7 \text{ V}$ , $I_{OUT} = 10 \text{ mA}$	4.75	5.00	5.25	V	3
Output current	$I_{OUT}$	$V_{IN} = V_{OUT} + 0.2 \text{ V}$	25	40	—	mA	3
Load stability	$\Delta V_{OUT}$	$1 \text{ mA} \leq I_{OUT} \leq 40 \text{ mA}$ $V_{IN} = 7 \text{ V}$	—	—	120	mV	3
Current consumption	$I_{SS}$	$V_{IN} = 7 \text{ V}$ , No load	—	25	40	$\mu\text{A}$	4
Input stability	$\frac{\Delta V_{OUT}}{\Delta V_{IN} V_{OUT}}$	$6.3 \text{ V} \leq V_{IN} \leq 8 \text{ V}$	—	0.1	—	% / V	3
Input voltage	$V_{IN}$		—	—	10	V	—
Temperature characteristic of $\Delta V_{OUT}$	$\frac{\Delta V_{OUT}}{\Delta T_a}$	$I_{OUT} = 10 \text{ mA}$ $-15^\circ\text{C} \leq T_a \leq 45^\circ\text{C}$	—	$\pm 0.38$	—	mV / °C	—

# VOLTAGE REGULATOR

## S-802, 812, 813 series

### Test Circuit

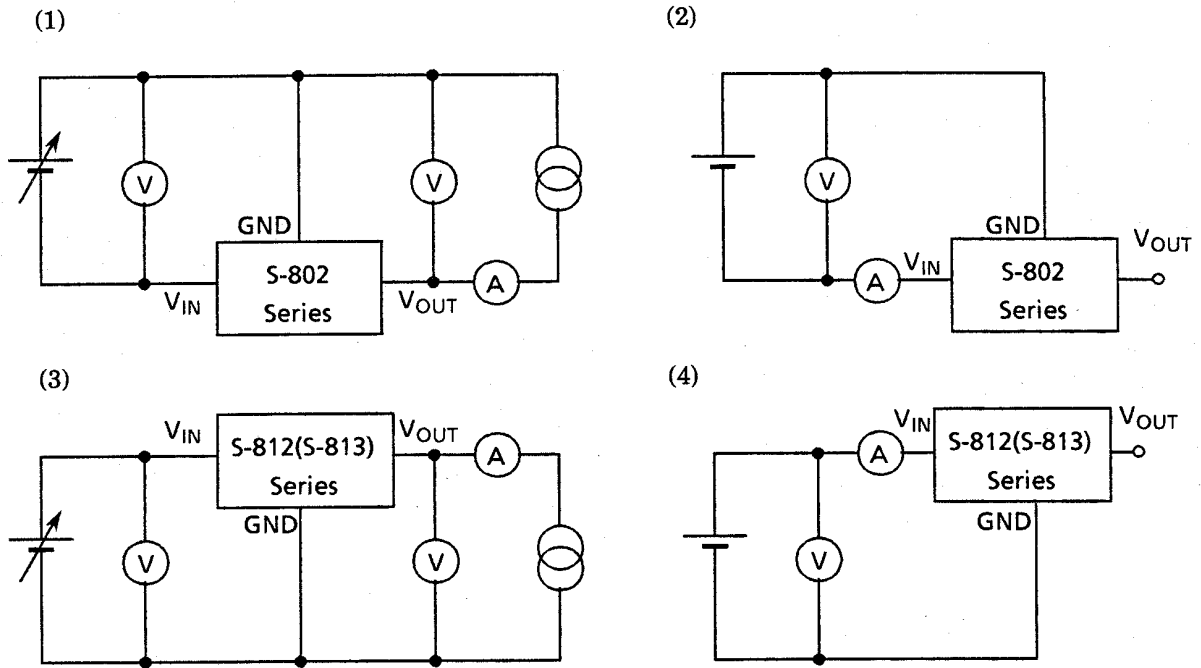
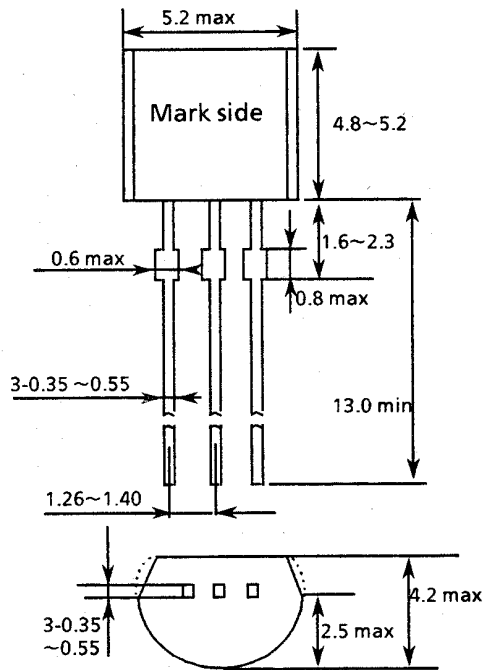


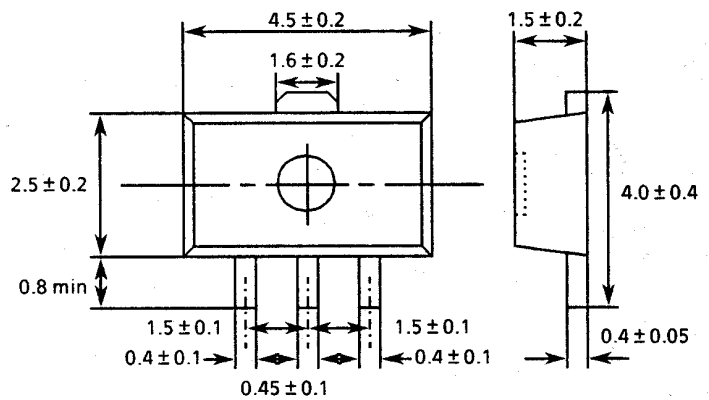
Figure 7 Test circuit

### Dimensions

#### (1) TO-92



#### (2) SOT-89 (mini-power mold)



Unit : mm

and are available.

Figure 8 Dimensions

■ Taping Dimensions

. Tape specifications

T1 and T2 types are available with the tape in the direction of the electrode when pulled out.

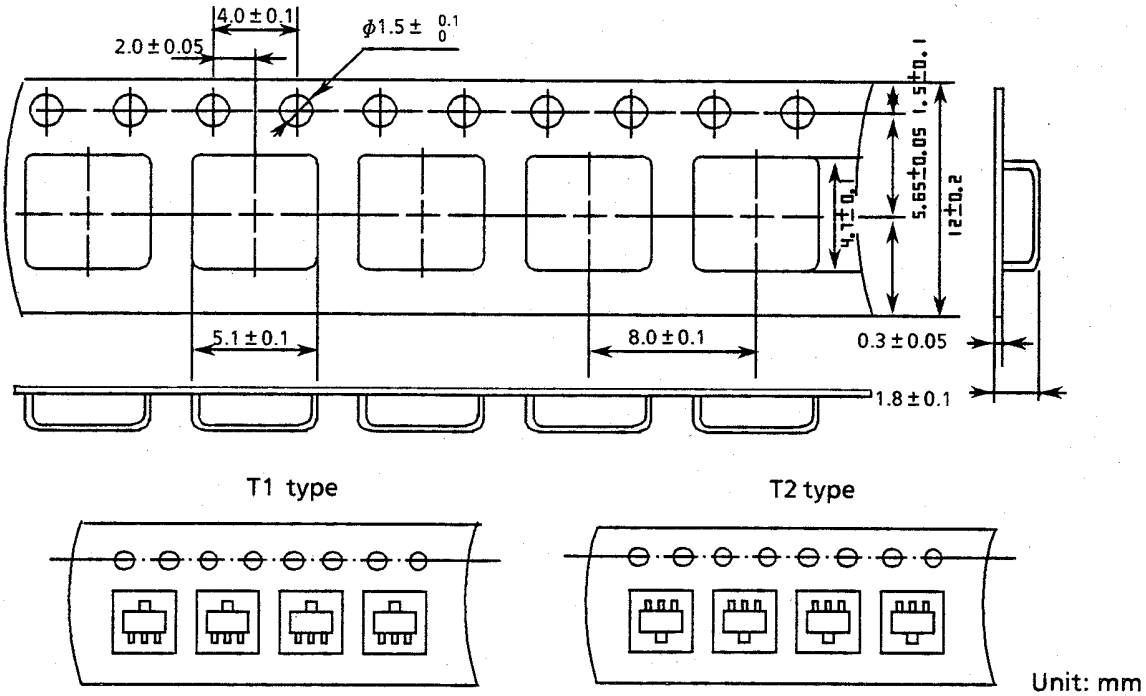


Figure 9

. Reel specifications

1 reel has 1000 regulators.

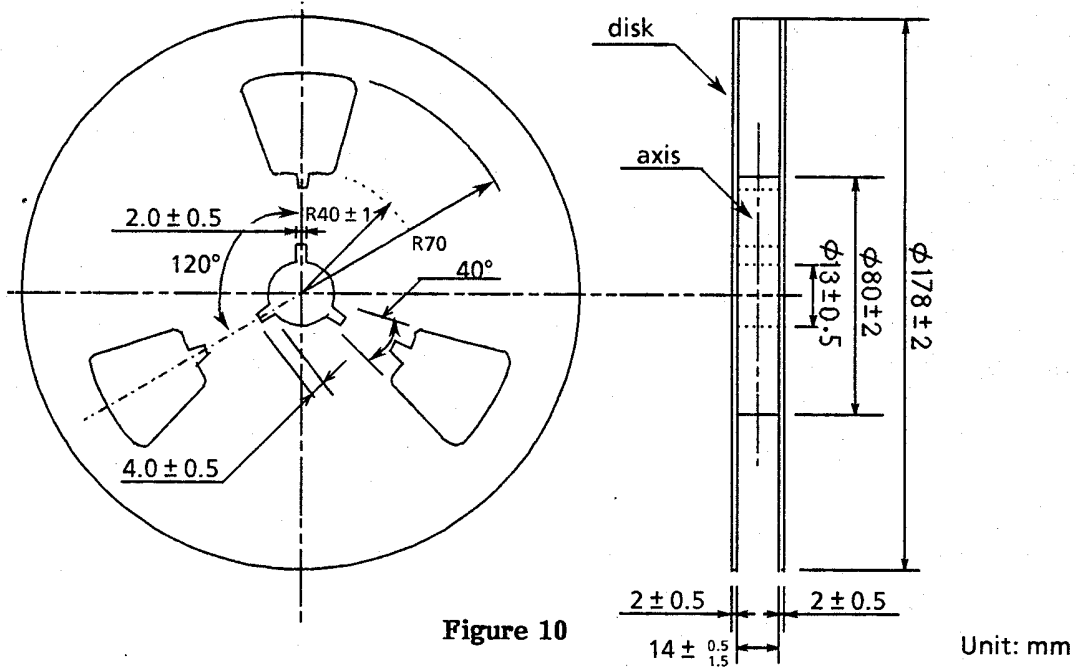


Figure 10

# VOLTAGE REGULATOR

## S-802, 812, 813 series

### Magazine Dimensions

1 stick has 25 regulators.

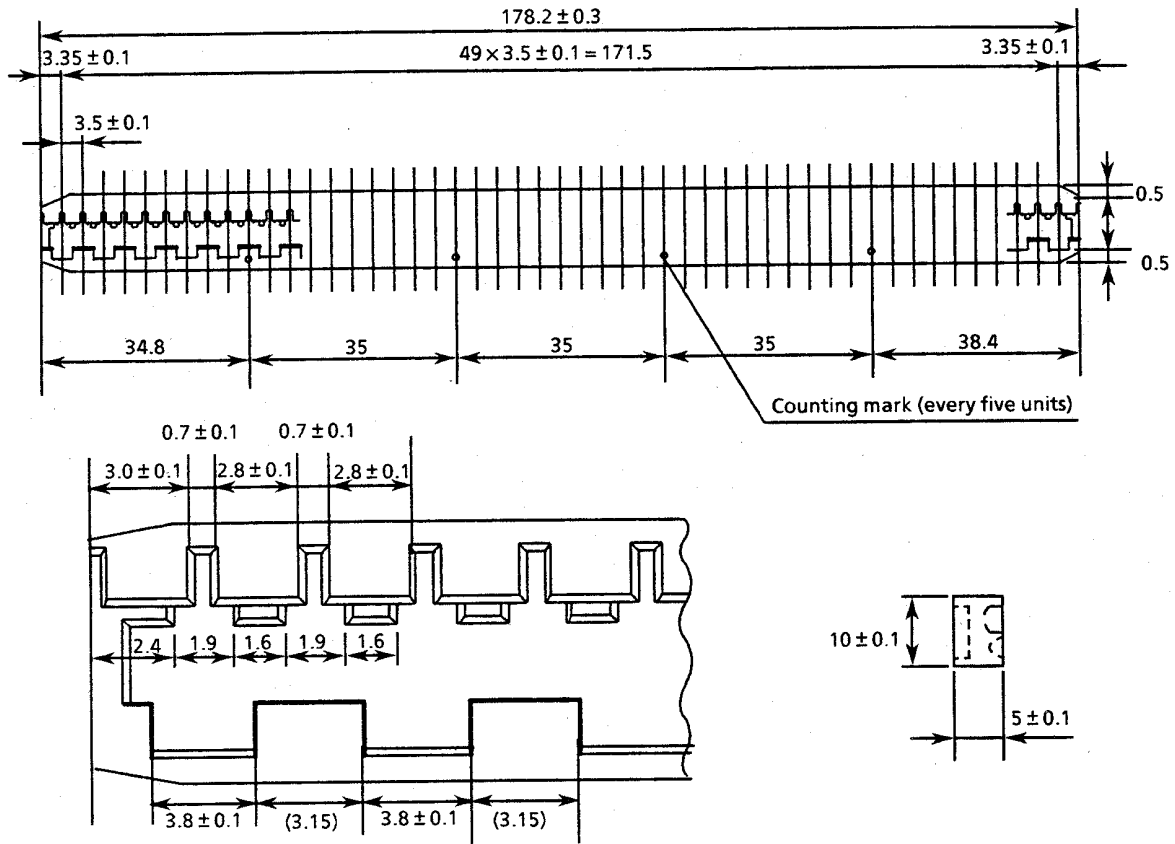


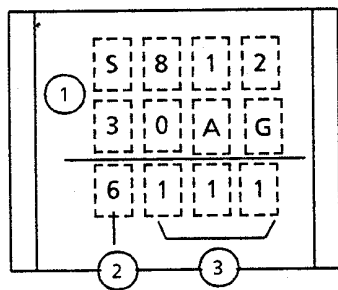
Figure 11

Unit: mm

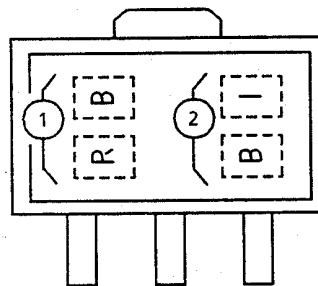
### Markings

(1) TO-92

(2) SOT-89 mini-powermold



- ① Model No.
- ② The last digit of the year
- ③ Lot No.



- ① Model No.(abbreviation)
- ② Lot No.

Figure 12 S-81230AG marking example