

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 μ 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 : ± 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

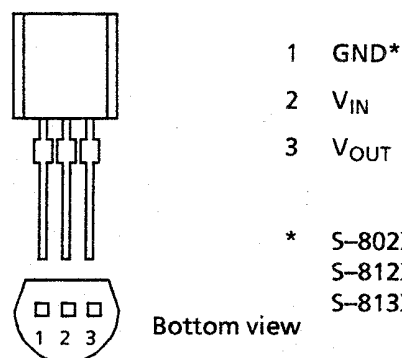


Figure 1

2. S-813 Series

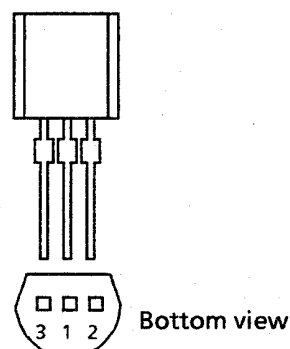


Figure 2

(2) SOT-89 mini-powermold

1. S-802 Series

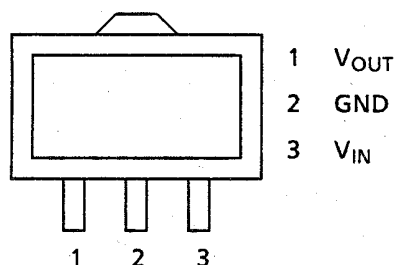


Figure 3

2. S-812 Series

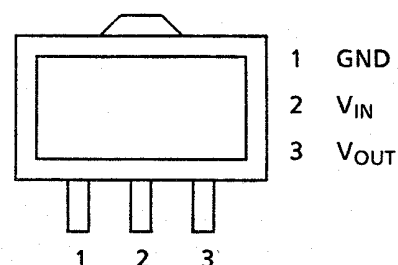


Figure 4

■ Block Diagram

1. S-802 Series

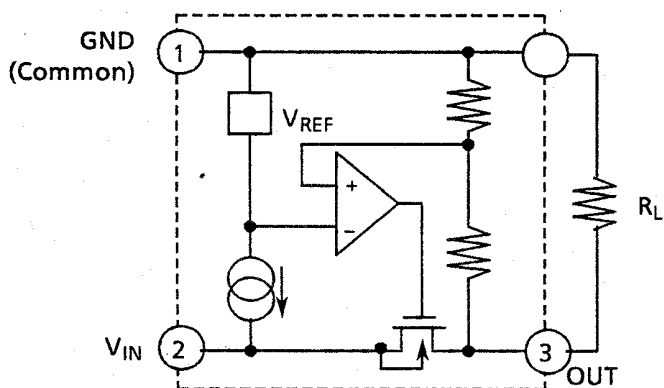


Figure 5 (TO-92)

2. S-812, S-813 Series

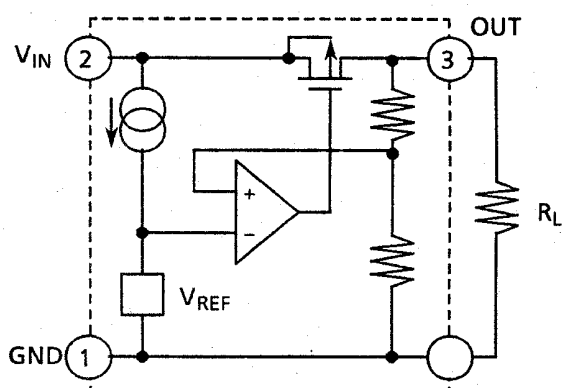


Figure 6

■ Absolute Maximum Ratings

Table 1

Item		Symbol	Ratings	Unit
Input voltage	S-802 Series	V_{IN}	- 12	V
	S-812,813Series		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 $\pm$ 5%	S-80230AG	S-80230AG-GA-X
-5 V $\pm$ 5%	S-80250AG	S-80250AG-GB-X
1.1 V $\pm$ 5%	S-81211AG	—
1.5 V $\pm$ 5%	—	S-81215AG-RK-X
2.5 V $\pm$ 5%	—	S-81225AG-RH-X
3.0 V $\pm$ 5%	S-81230AG	S-81230AG-RB-X
3.5 V $\pm$ 5%	—	S-81235AG-RI-X
3.7 V $\pm$ 5%	S-81237AG	S-81237AG-RE-X
4.0 V $\pm$ 5%	—	S-81240AG-RJ-X
5.0 V $\pm$ 5%	S-81250HG	S-81250HG-RD-X
5.2 V $\pm$ 5%	S-81252HG	—
5.0 V $\pm$ 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: $T_a = 25^\circ\text{C}$)

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

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

Table 4

(Unless otherwise specified: $T_a = 25^\circ\text{C}$)

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

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 _{OUT}	V _{IN} = 1.5 V, I _{OUT} = 0.5 mA	1.045	1.100	1.150	V	3
Output current	I _{OUT}	V _{IN} = 1.5 V	0.5	—	—	mA	3
Load stability	ΔV _{OUT}	40 μA ≤ I _{OUT} ≤ 500 μA V _{IN} = 1.5 V	—	—	100	mV	3
I/O voltage difference	V _{dif}	I _{OUT} = 1.0 mA	—	250	400	mV	—
Current consumption	I _{SS}	V _{IN} = 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 _{IN} ≤ 10 V	—	—	1.0	% / V	3
Input voltage	V _{IN}		—	—	10	V	—
Temperature characteristic of ΔV _{OUT}	$\frac{\Delta V_{OUT}}{\Delta T_a}$	I _{OUT} = 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 _{OUT}	V _{IN} = 3.5 V, I _{OUT} = 0.5 mA	1.425	1.50	1.575	V	3
Output current	I _{OUT}	V _{IN} = 3.5 V	7.0	—	—	mA	3
Load stability	ΔV _{OUT}	1 mA ≤ I _{OUT} ≤ 7 mA V _{IN} = 3.5 V	—	80	—	mV	3
I/O voltage difference	V _{dif}	I _{OUT} = 0.5 mA	—	300	—	mV	—
Current consumption	I _{SS}	V _{IN} = 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 _{IN} ≤ 10 V I _{OUT} = 0.5 mA	—	0.1	—	% / V	3
Input voltage	V _{IN}		—	—	10	V	—
Temperature characteristic of ΔV _{OUT}	$\frac{\Delta V_{OUT}}{\Delta T_a}$	I _{OUT} = 0.5 mA - 20°C ≤ Ta ≤ 70°C	—	± 0.19	—	mV / °C	—

VOLTAGE REGULATOR
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 _{OUT}	V _{IN} = 4.5 V, I _{OUT} = 10 mA	2.375	2.500	2.625	V	3
Output current	I _{OUT}	V _{IN} = 4.5 V	10	25	—	mA	3
Load stability	ΔV _{OUT}	1 mA ≤ I _{OUT} ≤ 10 mA V _{IN} = 4.5 V	—	80	120	mV	3
I/O voltage difference	V _{dif}	I _{OUT} = 1.0 mA	—	100	—	mV	—
Current consumption	I _{SS}	V _{IN} = 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 _{IN} ≤ 10 V	—	0.1	—	% / V	3
Input voltage	V _{IN}		—	—	10	V	—
Temperature characteristic of ΔV _{OUT}	$\frac{\Delta V_{OUT}}{\Delta T_a}$	I _{OUT} = 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 _{OUT}	V _{IN} = 5 V, I _{OUT} = 10 mA	2.85	3.00	3.15	V	3
Output current	I _{OUT}	V _{IN} = 5 V	20	30	—	mA	3
Load stability	ΔV _{OUT}	1 mA ≤ I _{OUT} ≤ 20 mA V _{IN} = 5 V	—	60	100	mV	3
I/O voltage difference	V _{dif}	I _{OUT} = 1 mA	—	60	—	mV	—
Current consumption	I _{SS}	V _{IN} = 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 _{IN} ≤ 10 V	—	0.1	—	% / V	3
Input voltage	V _{IN}		—	—	10	V	—
Temperature characteristic of ΔV _{OUT}	$\frac{\Delta V_{OUT}}{\Delta T_a}$	I _{OUT} = 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 _{OUT}	V _{IN} = 5.5 V, I _{OUT} = 10 mA	3.325	3.50	3.675	V	3
Output current	I _{OUT}	V _{IN} = 5.5 V	20	30	—	mA	3
Load stability	ΔV _{OUT}	1 mA ≤ I _{OUT} ≤ 30 mA V _{IN} = 5.5 V	—	60	100	mV	3
I/O voltage difference	V _{dif}	I _{OUT} = 1 mA	—	60	—	mV	—
Current consumption	I _{SS}	V _{IN} = 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 _{IN} ≤ 10 V	—	0.1	—	% / V	3
Input voltage	V _{IN}		—	—	10	V	—
Temperature characteristic of ΔV _{OUT}	$\frac{\Delta V_{OUT}}{\Delta T_a}$	I _{OUT} = 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 _{OUT}	V _{IN} = 5.7 V, I _{OUT} = 10 mA	3.50	3.70	3.90	V	3
Output current	I _{OUT}	V _{IN} = 5.7 V	20	30	—	mA	3
Load stability	ΔV _{OUT}	1 mA ≤ I _{OUT} ≤ 20 mA V _{IN} = 5.7 V	—	60	100	mV	3
I/O voltage difference	V _{dif}	I _{OUT} = 1 mA	—	60	—	mV	—
Current consumption	I _{SS}	V _{IN} = 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 _{IN} ≤ 10 V	—	0.1	—	% / V	3
Input voltage	V _{IN}		—	—	10	V	—
Temperature characteristic of ΔV _{OUT}	$\frac{\Delta V_{OUT}}{\Delta T_a}$	I _{OUT} = 10 mA -20°C ≤ Ta ≤ 70°C	—	± 0.46	—	mV / °C	—

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_{OUT}	$V_{IN} = 6\text{ V}$, $I_{OUT} = 10\text{ mA}$	3.80	4.0	4.20	V	3
Output current	I_{OUT}	$V_{IN} = 6\text{ V}$	30	40	—	mA	3
Load stability	ΔV_{OUT}	$1\text{ mA} \leq I_{OUT} \leq 30\text{ mA}$ $V_{IN} = 6\text{ V}$	—	50	90	mV	3
I/O voltage difference	V_{dif}	$I_{OUT} = 1\text{ mA}$	—	50	—	mV	—
Current consumption	I_{SS}	$V_{IN} = 6\text{ V}$, No load	—	3.0	7.0	μA	4
Input stability	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	$5\text{ V} \leq V_{IN} \leq 10\text{ V}$	—	0.1	—	% / V	3
Input voltage	V_{IN}		—	—	10	V	—
Temperature characteristic of ΔV_{OUT}	$\frac{\Delta V_{OUT}}{\Delta T_a}$	$I_{OUT} = 10\text{ mA}$ $-20^\circ\text{C} \leq T_a \leq 70^\circ\text{C}$	—	± 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_{OUT}	$V_{IN} = 7\text{ V}$, $I_{OUT} = 10\text{ mA}$	4.75	5.00	5.25	V	3
Output current	I_{OUT}	$V_{IN} = 7\text{ V}$	40	50	—	mA	3
Load stability	ΔV_{OUT}	$1\text{ mA} \leq I_{OUT} \leq 40\text{ mA}$ $V_{IN} = 7\text{ V}$	—	40	80	mV	3
I/O voltage difference	V_{dif}	$I_{OUT} = 1\text{ mA}$	—	30	—	mV	—
Current consumption	I_{SS}	$V_{IN} = 7\text{ V}$, No load	—	3.0	7.0	μA	4
Input stability	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	$6\text{ V} \leq V_{IN} \leq 10\text{ V}$	—	0.1	—	% / V	3
Input voltage	V_{IN}		—	—	12	V	—
Temperature characteristic of ΔV_{OUT}	$\frac{\Delta V_{OUT}}{\Delta T_a}$	$I_{OUT} = 10\text{ mA}$ $-20^\circ\text{C} \leq T_a \leq 70^\circ\text{C}$	—	± 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	ΔV_{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	μA	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 ΔV_{OUT}	$\frac{\Delta V_{OUT}}{\Delta T_a}$	$I_{OUT} = 10 \text{ mA}$ $-20^\circ\text{C} \leq T_a \leq 70^\circ\text{C}$	—	± 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	ΔV_{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	μA	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 ΔV_{OUT}	$\frac{\Delta V_{OUT}}{\Delta T_a}$	$I_{OUT} = 10 \text{ mA}$ $-15^\circ\text{C} \leq T_a \leq 45^\circ\text{C}$	—	± 0.38	—	mV / °C	—

VOLTAGE REGULATOR S-802, 812, 813 series

■ Test Circuit

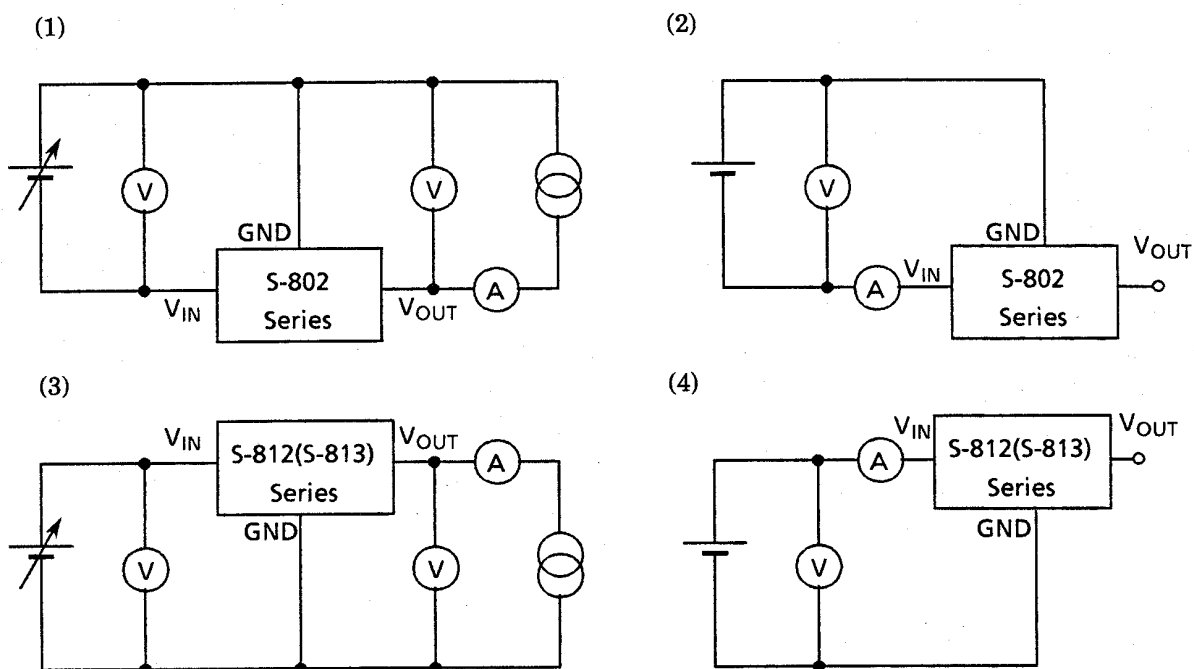
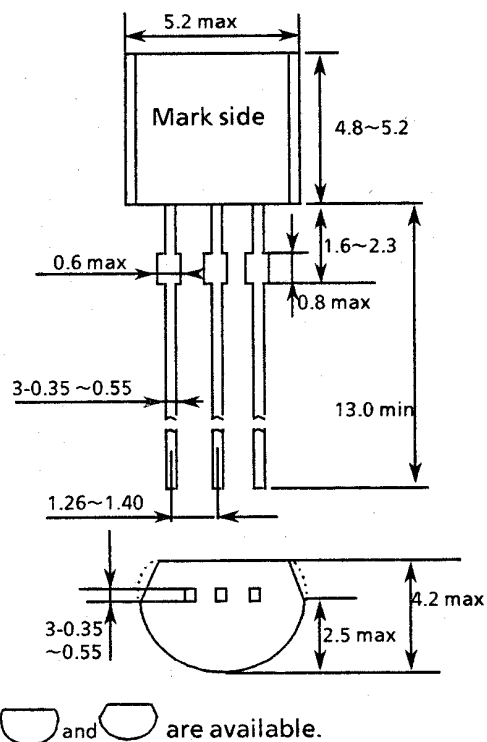


Figure 7 Test circuit

■ Dimensions

(1) TO-92



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

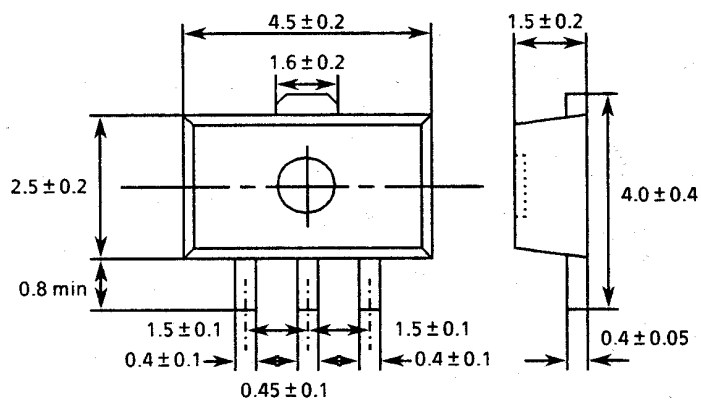


Figure 8 Dimensions

■ Taping Dimensions

.. Tape specifications

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

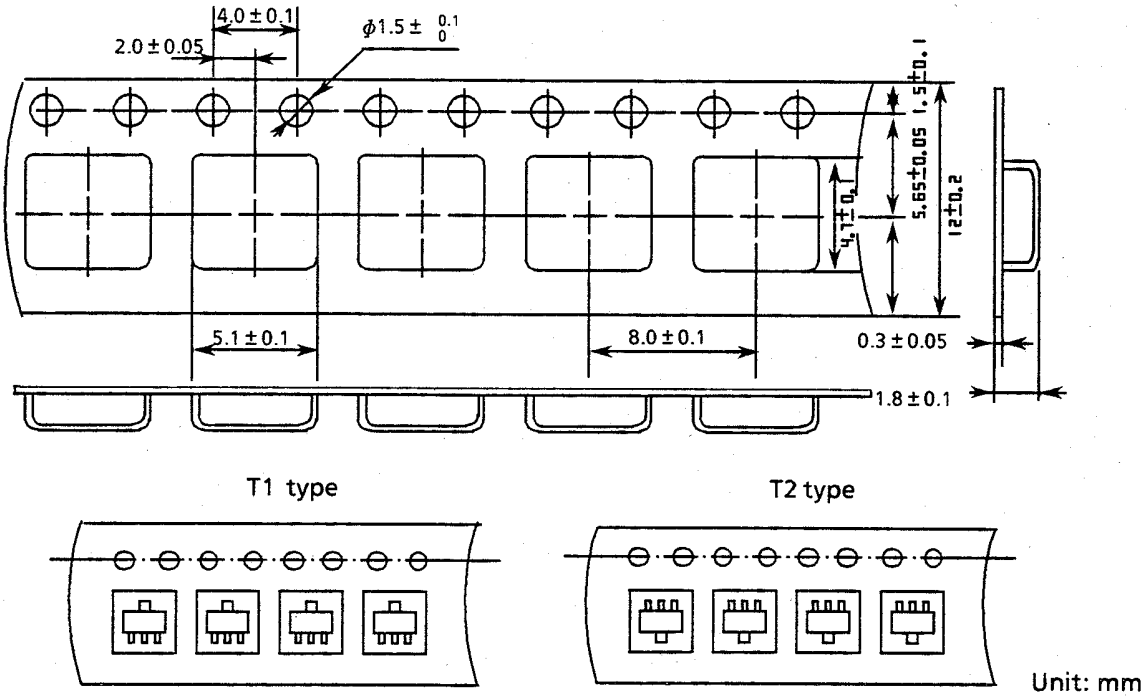


Figure 9

.. Reel specifications

1 reel has 1000 regulators.

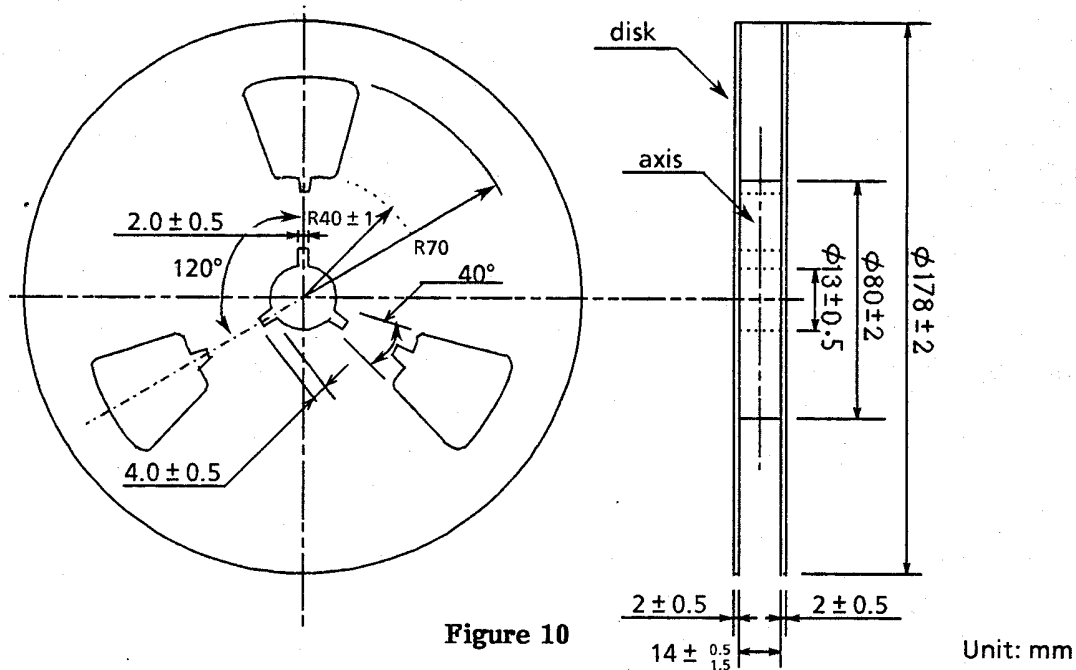


Figure 10

VOLTAGE REGULATOR S-802, 812, 813 series

■ Magazine Dimensions

1 stick has 25 regulators.

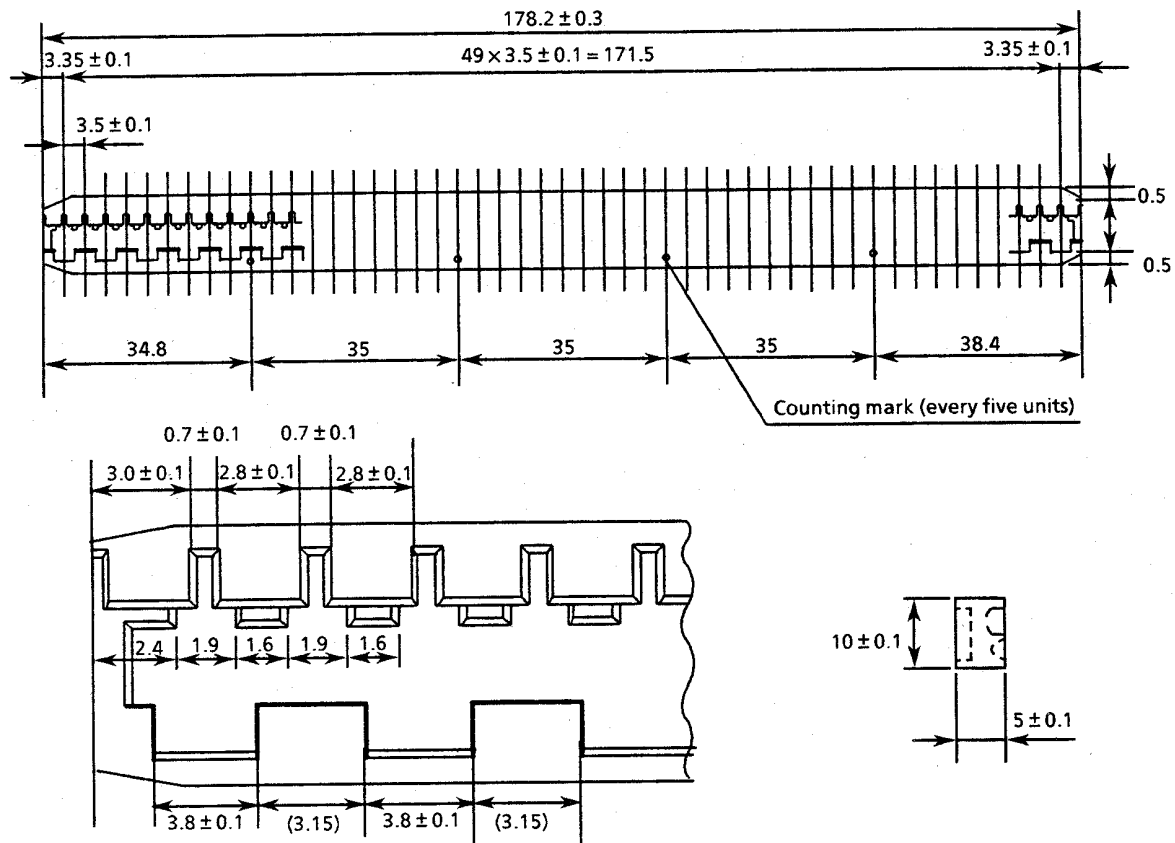
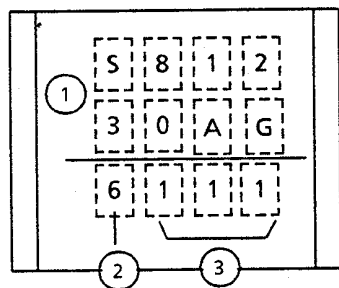


Figure 11

Unit: mm

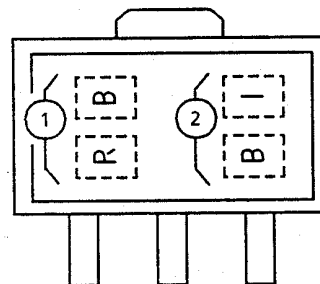
■ Markings

(1) TO-92



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

(2) SOT-89 mini-powermold



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

Figure 12 S-81230AG marking example