VOLTAGE REGULATOR

S-802, 812, 813 series

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 μA 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 / °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

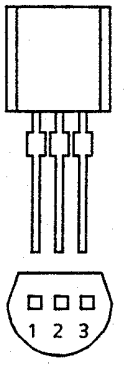
■ Applications

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

■ Pin Arrangement

(1) TO-92

1. S-802 ,S-812 Series



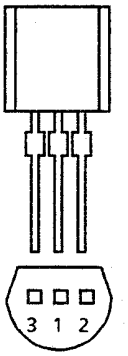
1 GND*
2 V_{IN}
3 V_{OUT}

* S-802XXAG : V_{DD}
S-812XXAG/HG : V_{SS}
S-813XXAG : V_{SS}

Bottom view

Figure 1

2. S-813 Series

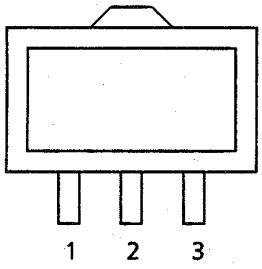


Bottom view

Figure 2

(2) SOT-89 mini-powermold

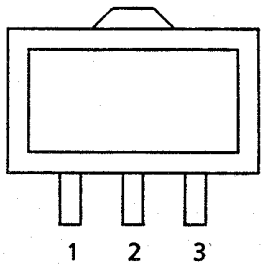
1. S-802 Series



1 V_{OUT}
2 GND
3 V_{IN}

Figure 3

2. S-812 Series



1 GND
2 V_{IN}
3 V_{OUT}

Figure 4

■ Block Diagram

1. S-802 Series

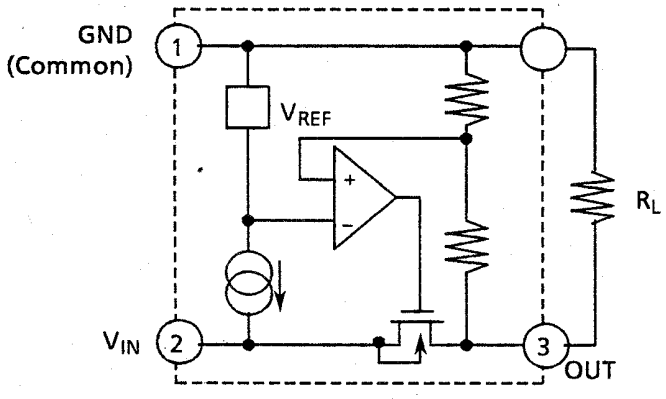


Figure 5 (TO-92)

2. S-812, S-813 Series

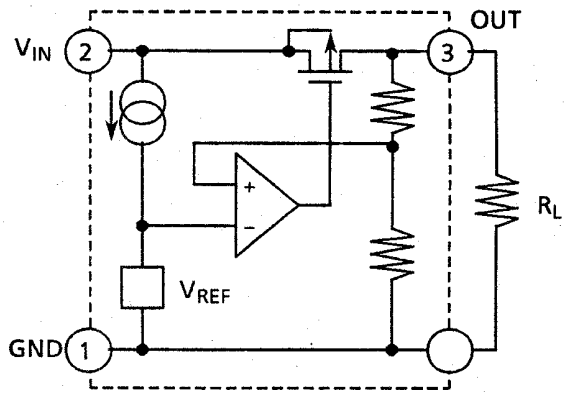


Figure 6

■ 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 ± 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-powermold plastic package product.

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

■ 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	$\triangle V_{OUT}$	1 mA ≦ I_{OUT} ≦ 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, No load	—	2.5	6.0	μA	2
Input stability	$\frac{\triangle V_{OUT}}{\triangle V_{IN} \cdot V_{OUT}}$	−10 V ≦ V_{IN} ≦ −4 V	—	0.1	—	%/V	1
Input voltage	V_{IN}		−10	—	—	V	—
Temperature characteristic of $\triangle V_{OUT}$	$\frac{\triangle V_{OUT}}{\triangle Ta}$	I_{OUT} = 10 mA −20°C ≦ Ta ≦ 70°C	—	±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	$\triangle V_{OUT}$	1 mA ≦ I_{OUT} 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, No load	—	3.0	7.0	μA	2
Input stability	$\frac{\triangle V_{OUT}}{\triangle V_{IN} \cdot V_{OUT}}$	−10 V ≦ V_{IN} ≦ −6 V	—	0.1	—	%/V	1
Input voltage	V_{IN}		−10	—	—	V	—
Temperature characteristic of $\triangle V_{OUT}$	$\frac{\triangle V_{OUT}}{\triangle Ta}$	I_{OUT} = 10 mA −20°C ≦ Ta ≦ 70°C	—	±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_{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	$\triangle V_{OUT}$	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	$\frac{\triangle V_{OUT}}{\triangle V_{IN} \cdot V_{OUT}}$	1.55 V ≦ V_{IN} ≦ 10 V	—	—	1.0	% / V	3
Input voltage	V_{IN}		—	—	10	V	—
Temperature characteristic of $\triangle V_{OUT}$	$\frac{\triangle V_{OUT}}{\triangle Ta}$	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	$\triangle V_{OUT}$	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	$\frac{\triangle V_{OUT}}{\triangle V_{IN} \cdot V_{OUT}}$	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 $\triangle V_{OUT}$	$\frac{\triangle V_{OUT}}{\triangle Ta}$	I_{OUT} = 0.5 mA − 20°C ≦ Ta ≦ 70°C	—	± 0.19	—	mV /°C	—

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	$\triangle V_{OUT}$	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	$\frac{\triangle V_{OUT}}{\triangle V_{IN} \cdot V_{OUT}}$	3.5 V ≦ V_{IN} ≦ 10 V	—	0.1	—	% / V	3
Input voltage	V_{IN}		—	—	10	V	—
Temperature characteristic of $\triangle V_{OUT}$	$\frac{\triangle V_{OUT}}{\triangle Ta}$	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	$\triangle V_{OUT}$	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	$\frac{\triangle V_{OUT}}{\triangle V_{IN} \cdot V_{OUT}}$	4 V ≦ V_{IN} ≦ 10 V	—	0.1	—	% / V	3
Input voltage	V_{IN}		—	—	10	V	—
Temperature characteristic of $\triangle V_{OUT}$	$\frac{\triangle V_{OUT}}{\triangle Ta}$	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	$\triangle V_{OUT}$	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	$\frac{\triangle V_{OUT}}{\triangle V_{IN} \cdot V_{OUT}}$	4.5 V ≦ V_{IN} ≦ 10 V	—	0.1	—	% / V	3
Input voltage	V_{IN}		—	—	10	V	—
Temperature characteristic of $\triangle V_{OUT}$	$\frac{\triangle V_{OUT}}{\triangle Ta}$	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	$\triangle V_{OUT}$	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	$\frac{\triangle V_{OUT}}{\triangle V_{IN} \cdot V_{OUT}}$	4.7 V ≦ V_{IN} ≦ 10 V	—	0.1	—	% / V	3
Input voltage	V_{IN}		—	—	10	V	—
Temperature characteristic of $\triangle V_{OUT}$	$\frac{\triangle V_{OUT}}{\triangle Ta}$	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 V, I_{OUT} = 10 mA	3.80	4.0	4.20	V	3
Output current	I_{OUT}	V_{IN} = 6 V	30	40	—	mA	3
Load stability	$\triangle V_{OUT}$	1 mA ≦ I_{OUT} ≦ 30 mA V_{IN} = 6 V	—	50	90	mV	3
I/O voltage difference	V_{dif}	I_{OUT} = 1 mA	—	50	—	mV	—
Current consumption	I_{SS}	V_{IN} = 6 V, No load	—	3.0	7.0	μA	4
Input stability	$\frac{\triangle V_{OUT}}{\triangle V_{IN} \cdot V_{OUT}}$	5 V ≦ V_{IN} ≦ 10 V	—	0.1	—	% / V	3
Input voltage	V_{IN}		—	—	10	V	—
Temperature characteristic of $\triangle V_{OUT}$	$\frac{\triangle V_{OUT}}{\triangle Ta}$	I_{OUT} = 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_{OUT}	V_{IN} = 7 V, I_{OUT} = 10 mA	4.75	5.00	5.25	V	3
Output current	I_{OUT}	V_{IN} = 7 V	40	50	—	mA	3
Load stability	$\triangle V_{OUT}$	1 mA ≦ I_{OUT} ≦ 40 mA V_{IN} = 7 V	—	40	80	mV	3
I/O voltage difference	V_{dif}	I_{OUT} = 1 mA	—	30	—	mV	—
Current consumption	I_{SS}	V_{IN} = 7 V, No load	—	3.0	7.0	μA	4
Input stability	$\frac{\triangle V_{OUT}}{\triangle V_{IN} V_{OUT}}$	6 V ≦ V_{IN} ≦ 10 V	—	0.1	—	% / V	3
Input voltage	V_{IN}		—	—	12	V	—
Temperature characteristic of $\triangle V_{OUT}$	$\frac{\triangle V_{OUT}}{\triangle Ta}$	I_{OUT} = 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 V, I_{OUT} = 10 mA	5.0	5.20	5.40	V	3
Output current	I_{OUT}	V_{IN} = 7.2 V	40	50	—	mA	3
Load stability	$\triangle V_{OUT}$	1 mA ≦ I_{OUT} ≦ 40 mA V_{IN} = 7.2 V	—	40	80	mV	3
I/O voltage difference	V_{dif}	I_{OUT} = 1 mA	—	30	—	mV	—
Current consumption	I_{SS}	V_{IN} = 7.2 V, No load	—	3.0	7.0	μA	4
Input stability	$\frac{\triangle V_{OUT}}{\triangle V_{IN} V_{OUT}}$	6.2 V ≦ V_{IN} ≦ 15 V	—	0.1	—	% / V	3
Input voltage	V_{IN}		—	—	15	V	—
Temperature characteristic of $\triangle V_{OUT}$	$\frac{\triangle V_{OUT}}{\triangle Ta}$	I_{OUT} = 10 mA −20°C ≦ Ta ≦ 70°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 V, I_{OUT} = 10 mA	4.75	5.00	5.25	V	3
Output current	I_{OUT}	V_{IN} = V_{OUT} + 0.2 V	25	40	—	mA	3
Load stability	$\triangle V_{OUT}$	1 mA ≦ I_{OUT} ≦ 40 mA V_{IN} = 7 V	—	—	120	mV	3
Current consumption	I_{SS}	V_{IN} = 7 V, No load	—	25	40	μA	4
Input stability	$\frac{\triangle V_{OUT}}{\triangle V_{IN} V_{OUT}}$	6.3 V ≦ V_{IN} ≦ 8 V	—	0.1	—	% / V	3
Input voltage	V_{IN}		—	—	10	V	—
Temperature characteristic of $\triangle V_{OUT}$	$\frac{\triangle V_{OUT}}{\triangle Ta}$	I_{OUT} = 10 mA −15°C ≦ Ta ≦ 45°C	—	±0.38	—	mV /°C	—

■ Test Circuit

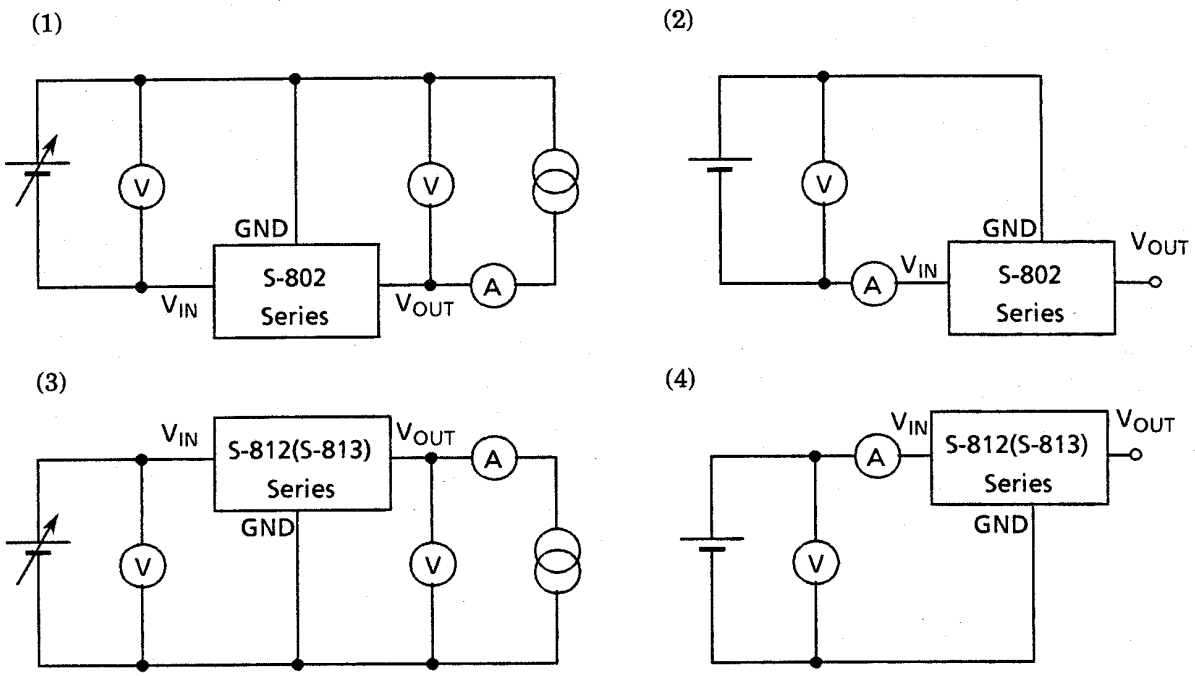
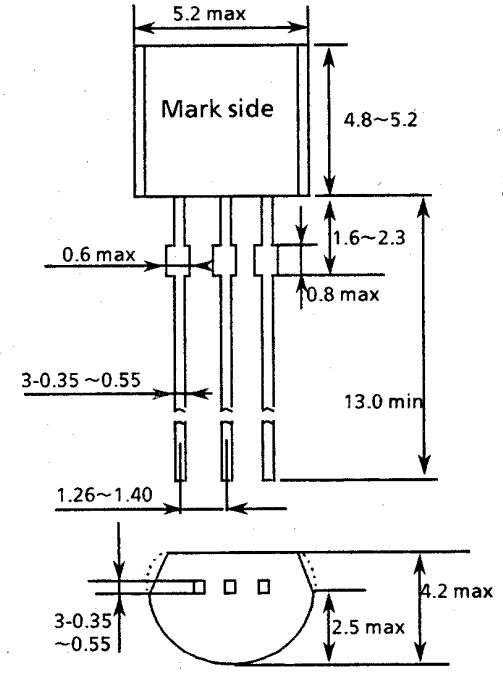


Figure 7 Test circuit

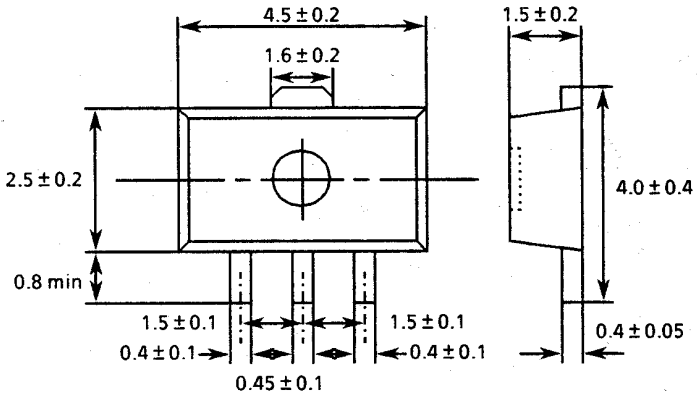
■ Dimensions

(1) TO-92



and are available.

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



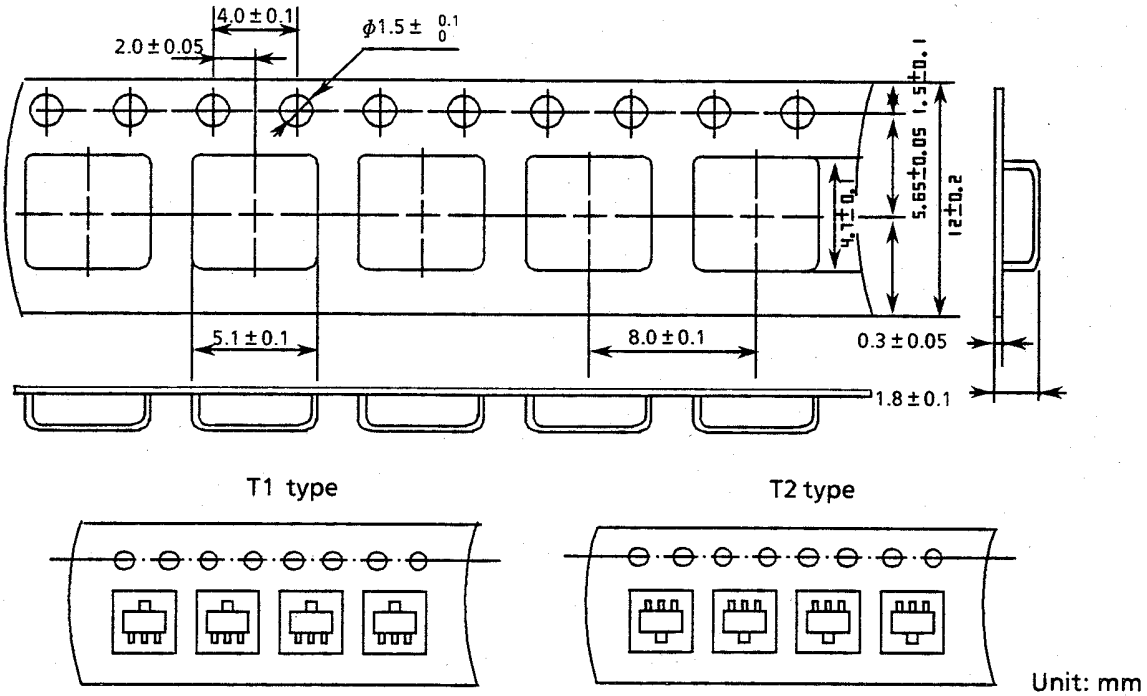
Unit : mm

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.



Unit: mm

Figure 9

. Reel specifications

1 reel has 1000 regulators.

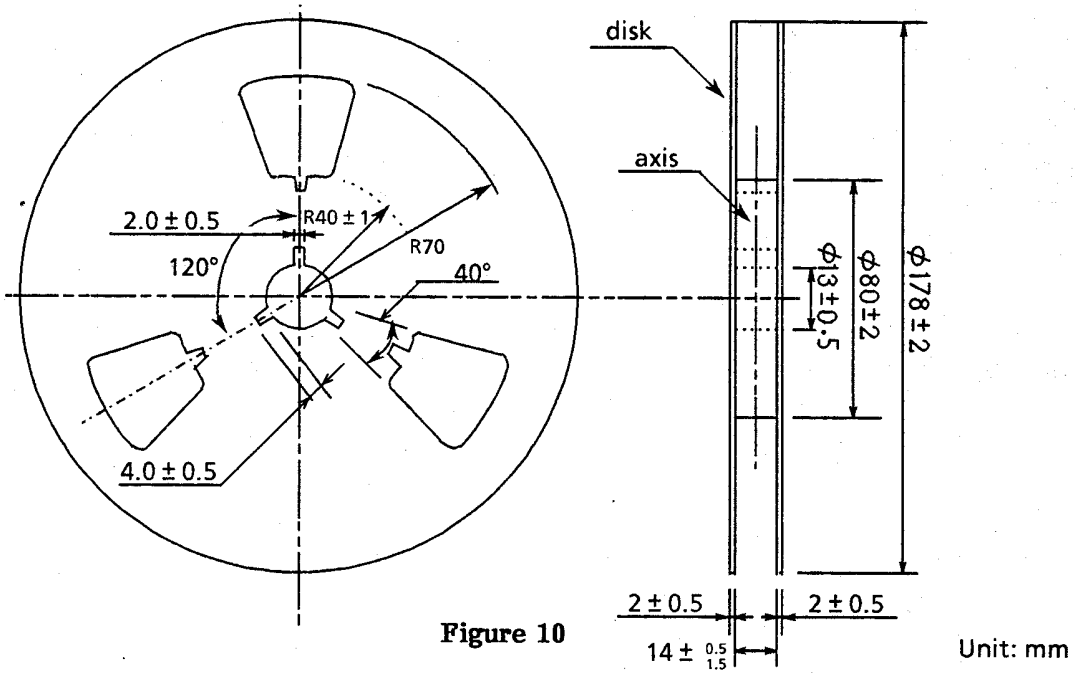
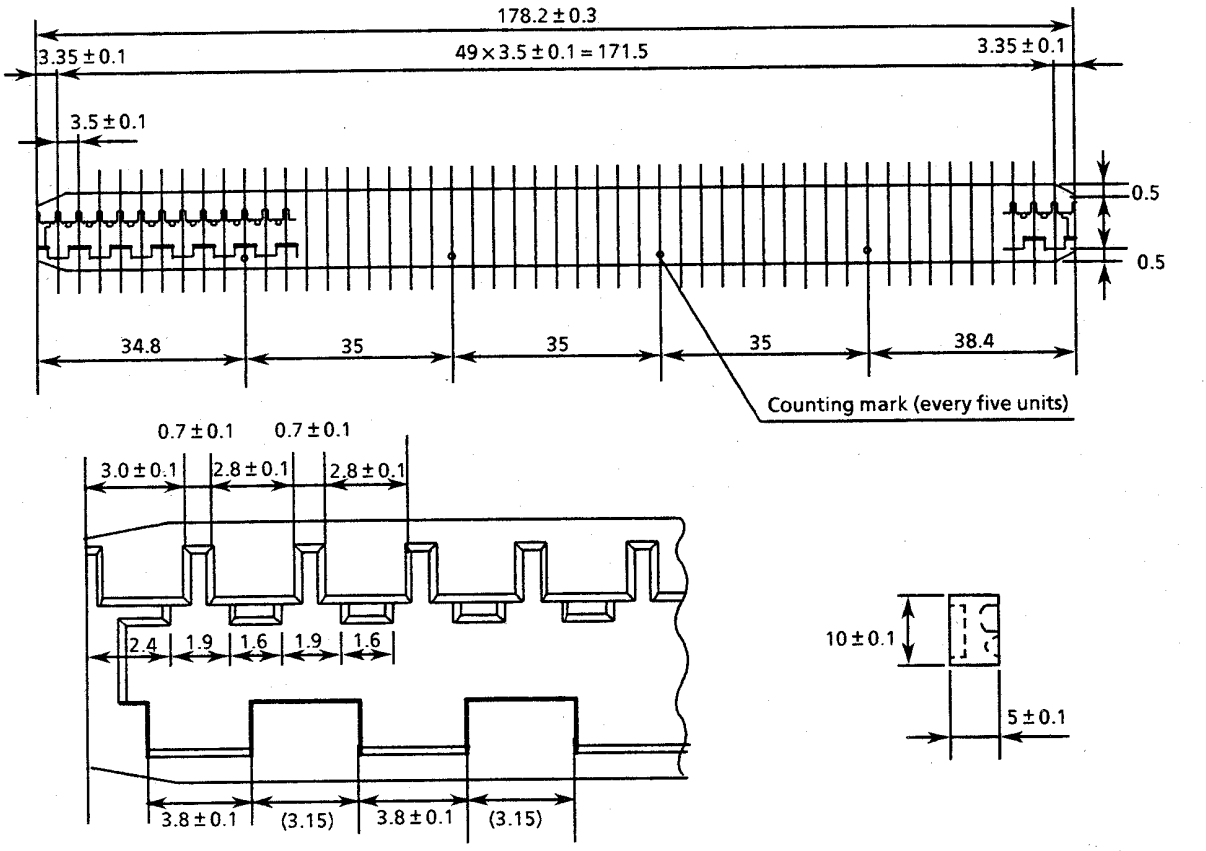


Figure 10

Unit: mm

■ Magazine Dimensions

1 stick has 25 regulators.

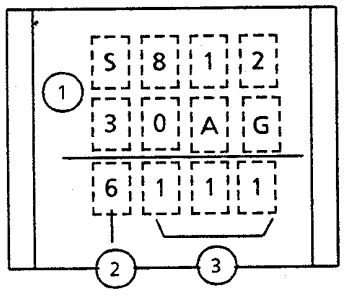


Unit: mm

Figure 11

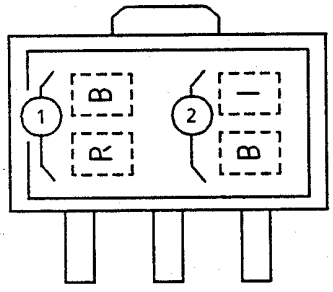
■ Markings

(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