

REFERENCE

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SHARP

OPTO-ELECTRONIC DEVICES DIVISION
ELECTRONIC COMPONENTS GROUP
SHARP CORPORATION

SPECIFICATION

DEVICE SPECIFICATION FOR

VOLTAGE REGULATOR

MODEL No.

PQ035ZN1HZPH

Specified for

Enclosed please find copies of the Specifications which consists of 17 pages including cover.
This specification sheets and attached sheets shall be both side copy.
After confirmation of the contents, please be sure to send back copies of the Specifications
with approving signature on each.

CUSTOMER'S APPROVAL

DATE

BY

PRESENTED

DATE

BY

H. Imanaka
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Department General Manager of
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Opto-Electronic Devices Div.
ELECOM Group
SHARP CORPORATION

Product name : VOLTAGE REGULATOR

Model No. : PQ035ZN1HZPH

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2. When using this product, please observe the absolute maximum ratings and the instructions for use outlined in these specification sheets, as well as the precautions mentioned below. Sharp assumes no responsibility for any damage resulting from use of the product which does not comply with the absolute maximum ratings and the instructions included in these specification sheets, and the precautions mentioned below.

(Precautions)

- (1) This product is designed for use in the following application areas ;

{	<ul style="list-style-type: none"> • OA equipment • Audio visual equipment • Home appliances • Telecommunication equipment (Terminal) • Measuring equipment • Tooling machines • Computers 	}
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If the use of the product in the above application areas is for equipment listed in paragraphs (2) or (3), please be sure to observe the precautions given in those respective paragraphs.

- (2) Appropriate measures, such as fail-safe design and redundant design considering the safety design of the overall system and equipment, should be taken to ensure reliability and safety when this product is used for equipment which demands high reliability and safety in function and precision, such as ;

{	<ul style="list-style-type: none"> • Transportation control and safety equipment (aircraft, train, automobile etc.) • Traffic signals • Gas leakage sensor breakers • Rescue and security equipment • Other safety equipment 	}
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- (3) Please do not use this product for equipment which require extremely high reliability and safety in function and precision, such as ;

{	<ul style="list-style-type: none"> • Space equipment • Telecommunication equipment (for trunk lines) • Nuclear power control equipment • Medical equipment 	}
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- (4) Please contact and consult with a Sharp sales representative if there are any questions regarding interpretation of the above three paragraphs.

3. Please contact and consult with a Sharp sales representative for any questions about this product.

1. Application

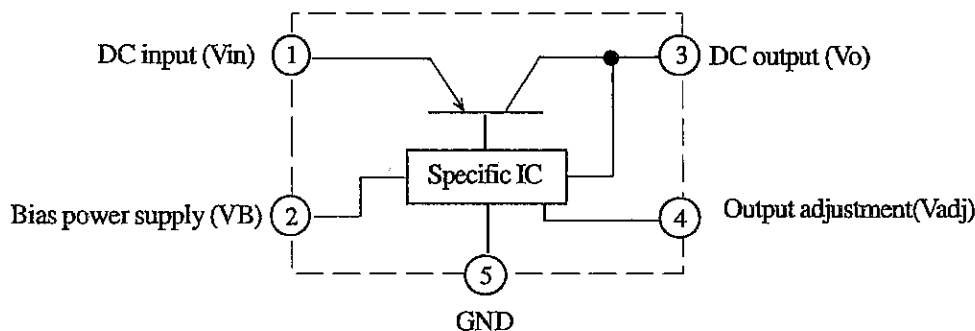
This specification applies to the outline and characteristics of series regulator (linear type), Model No. PQ035ZN1HZPH.

Usage

PQ035ZN1HZPH is the device for stabilization of positive output voltage with the over current protection function, the overheat protection function and DC output voltage is adjustable by using external resistance.

This device is possible to use in power supply circuit up to current capacity 1.5A.

Block diagram



2. Outline : Refer to the attached sheet, Page 3.
3. Ratings and characteristics : Refer to the attached sheet, Page 4 to 8.
 - 3.1 Absolute maximum ratings
 - 3.2 Electrical characteristics
 - 3.3 Electrical characteristics measuring circuit
 - 3.4 Pd-Ta rating (Typical value)
 - 3.5 Output voltage adjustment characteristics (Typical value)
4. Reliability : Refer to the attached sheet, Page 9.
5. Outgoing inspection : Refer to the attached sheet, Page 10.
6. Supplement : Refer to the attached sheet, Page 10 to 13.
 - 6.1 Example of application
 - 6.2 Taping and reel packaging
 - 6.3 ODS materials

This product shall not contain the following materials.

Also, the following materials shall not be used in the production process for this product.

Materials for ODS : CFC_s, Halon, Carbon tetrachloride, 1.1.1-Trichloroethane (Methylchloroform)
 - 6.4. The directive of RoHS

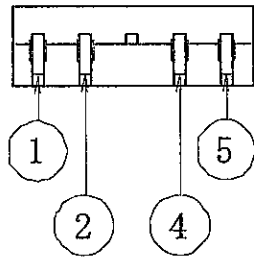
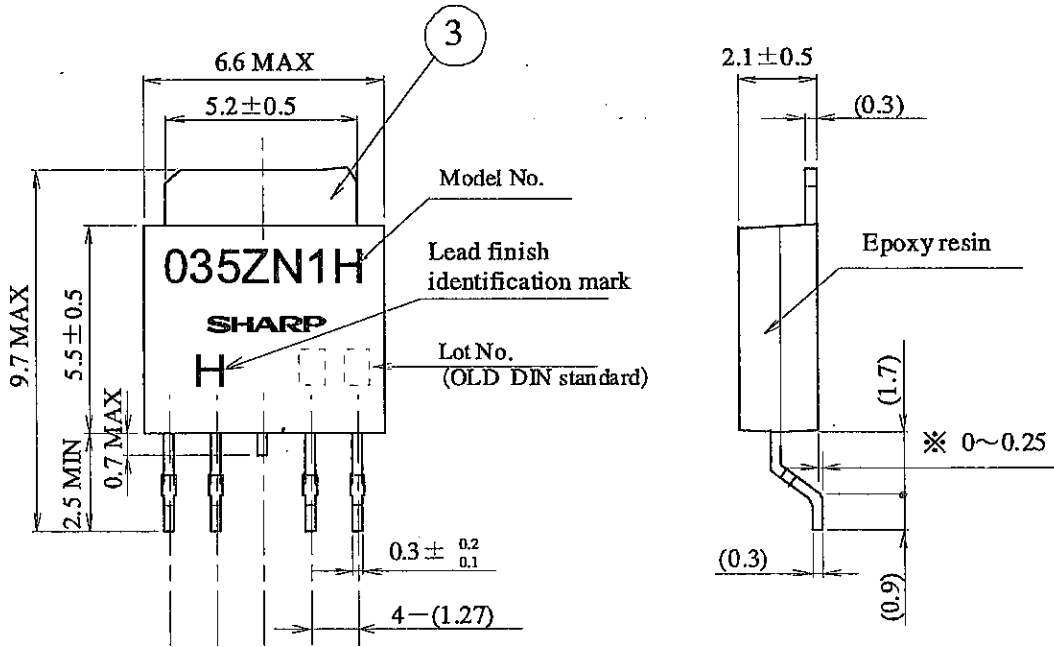
This product conforms to the directive of RoHS.

Material for RoHS: mercury, lead (Except for high-melting point Solder), cadmium, hexavalent chromium, polybrominated biphenyls and Polybrominated diphenyl ethers
 - 6.5 Brominated flame retardants

Specific brominated flame retardants such as the PBBO_s and PBB_s are not used in this device at all.
 - 6.6 This product is not designed as electromagnetic and ionized-particle radiation resistant.
7. Notes : Refer to the attached sheet, Page 14 to 16.
 - 7.1 External connection
 - 7.2 Thermal protection design
 - 7.3 Static electricity
 - 7.4 Soldering
 - 7.5 Cleaning
 - 7.6 Output voltage fine tuning

REFERENCE

2. Outline



- ※ Reference value
- () : TYP.
- Unit : mm
- Scale : 5/1

- ① DC input (Vin)
- ② Bias power supply (VB)
- ③ DC output (Vo)
- ④ Output adjustment (Vadj)
- ⑤ GND

Lead finish : Lead-free solder plating
(Composition : Sn2Cu)

Lead material : Cu

Product mass : 0.2g

3. Ratings and characteristics

3.1 Absolute maximum ratings

Ta=25°C

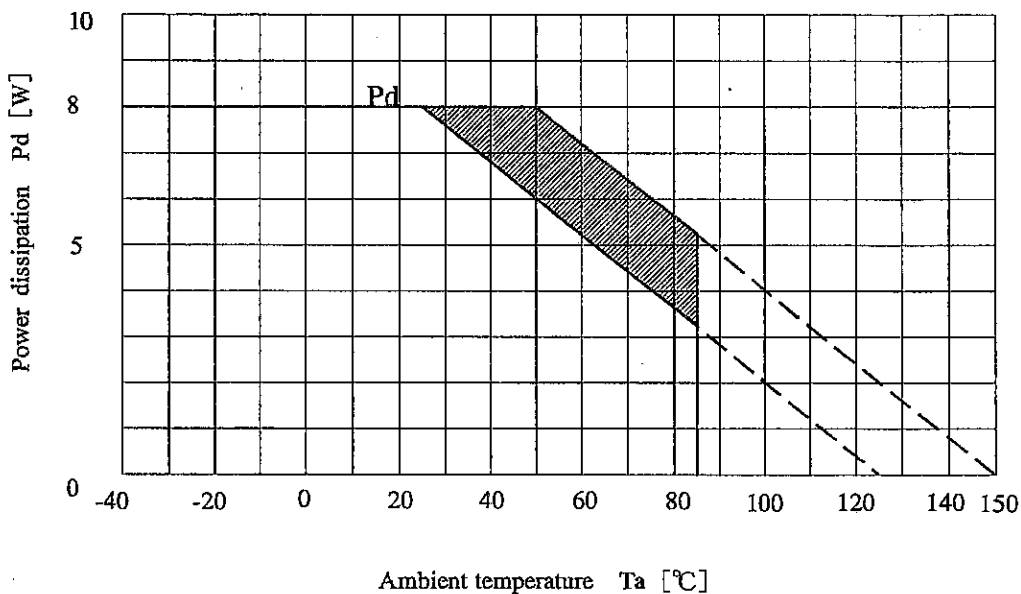
Parameter	Symbol	Rating	Unit	Conditions
Input voltage (*1)	Vin	5.5	V	
Bias power supply voltage (*1)	VB	7	V	
Output adjustment pin voltage (*1)	Vadj	5	V	
Output current	Io	1.5	A	
Power dissipation (*2)	Pd	8	W	Refer to Fig. 1
Junction temperature (*3)	Tj	150	°C	
Operating temperature	Topr	-40 to +85	°C	
Storage temperature	Tstg	-40 to +150	°C	
Soldering temperature	Tsol	260	°C	For 10s

(*1) All are open except GND and applicable terminals.

(*2) Pd : With infinite heat sink

(*3) There is case that over heat protection function operates at the temperature Tj=125 to 150°C,so this item cannot be used in this temperature range.

Fig. 1 Inner derating curve



Pd : With infinite heat sink

(Note) There is case that over heat protection function operates at oblique line portion.

Regarding thermal design, please consider “3.4 Power dissipation vs Ambient temperature” with priority.

3.2 Electrical characteristics

Unless otherwise specified condition shall be $V_{in}=1.8V$, $V_B=3.3V$, $V_o=1.2V$ ($R_1=1k\Omega$) $I_o=0.5A$, $T_a=25^\circ C$

Parameter	Symbol	MIN	TYP	MAX	Unit	Conditions
Input voltage range	V_{in}	1.7	—	5.5	V	$0.8V \leq V_o \leq 1.2V$
		$V_o+0.5$	—	5.5	V	$1.2V < V_o \leq 3.5V$
Bias supply voltage	V_B	2.35	—	7.0	V	
Output voltage	V_o	0.8	—	3.5	V	
Load regulation	RegL	—	0.3	1.0	%	$I_o=5mA \sim 1.5A$
Line regulation	RegI	—	0.3	1.0	%	$V_{in}=1.7V \sim 5.5V, V_B=2.35 \sim 7V,$ $I_o=5mA$
Reference voltage	V_{ref}	0.57	0.6	0.63	V	
Temperature coefficient of reference voltage	$T_c V_{ref}$	—	± 0.5	—	%	$I_o=5mA, T_j=0 \sim 125^\circ C$
Ripple rejection	RR1	—	60	—	dB	Refer to Fig. 3
	RR2	—	53	—	dB	Refer to Fig. 4
Bias power supply input current	I_B	—	1.5	2	mA	$I_o=0A$

3.3 Electrical characteristics measuring circuit

Fig. 2 Standard measuring circuit of Regulator portion

$$V_o = V_{ref} \times (1 + R_2/R_1)$$

$$\approx 0.6 \times (1 + R_2/R_1)$$

[R1=1kΩ, Vref≈0.6V]

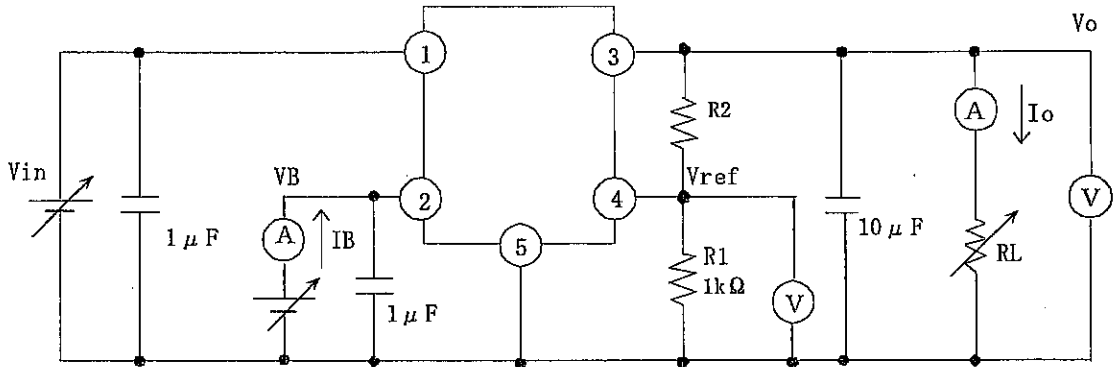


Fig. 3 Standard measuring circuit of critical rate of ripple rejection

f=120Hz sine wave, ei(rms)=0.1V, Vin=1.8V, VB=3.3V, Vo=1.2V (R1=1kΩ), Io=0.3A

$$RR = 20 \log \{ e_i(rms) / e_o(rms) \}$$

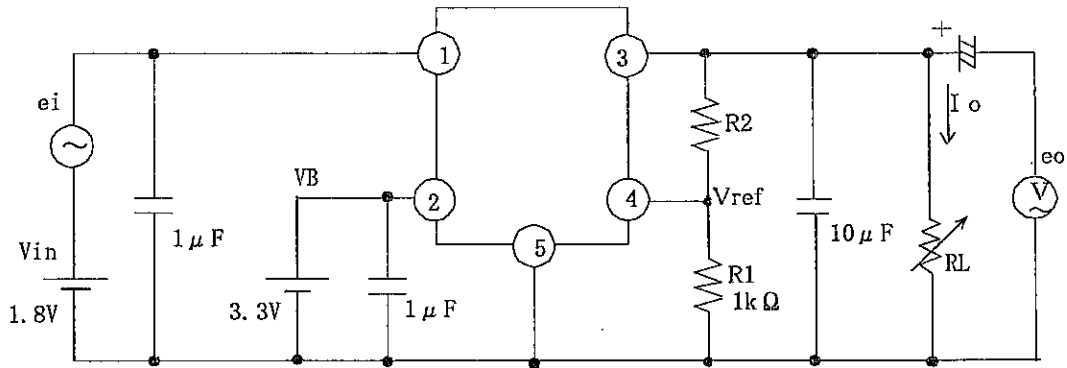
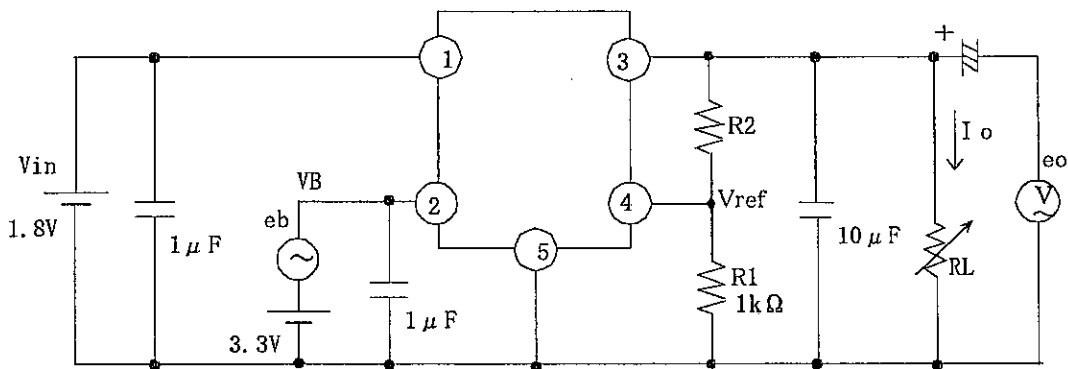


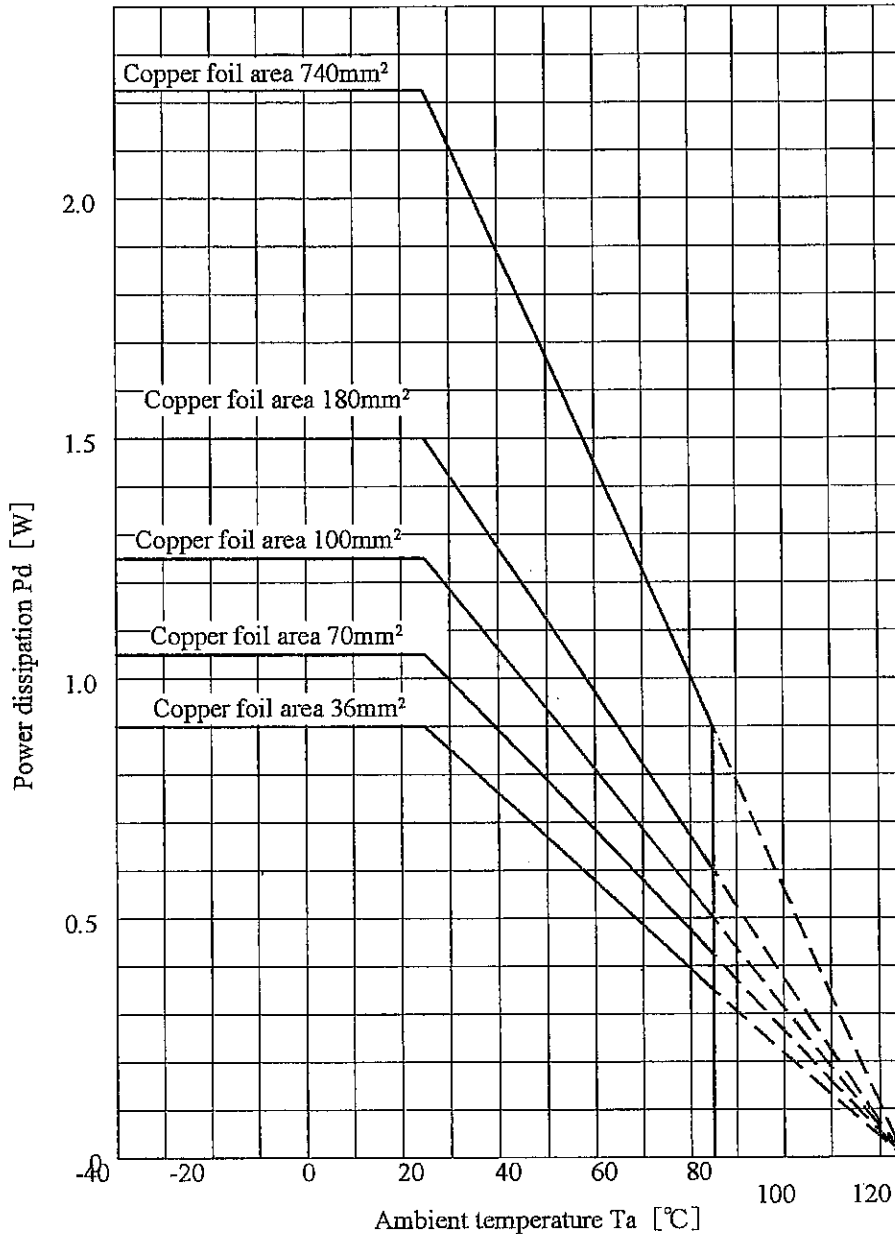
Fig. 4 Standard measuring circuit of critical rate of ripple rejection

f=120Hz sine wave, eb(rms)=0.1V, Vin=1.8V, VB=3.3V, Vo=1.2V Vo=1.2V (R1=1kΩ), Io=0.3A

$$RR = 20 \log \{ e_b(rms) / e_o(rms) \}$$



3.4 Pd - Ta rating (Typical value)



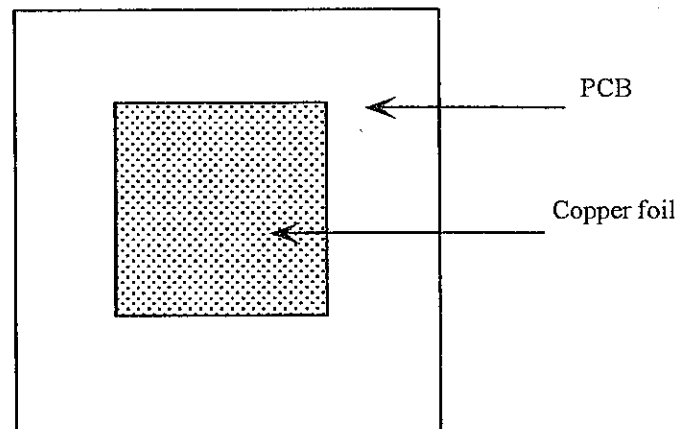
※The graph (power dissipation vs. Ambient temperature) indicates $T_j=125^\circ\text{C}$

Mounting PCB

Thermal design shall be considered in the safety operating area in the graph above. Even though in the safety operating area, please consider thermal design well.

In case of insufficient thermal design or using by exceeding the safety operating area, there is possibility that this device does not operate well or the reliability may have bad affection.

In case of using by exceeding the safety operating area, this device will not work because overheat protection function will operate.

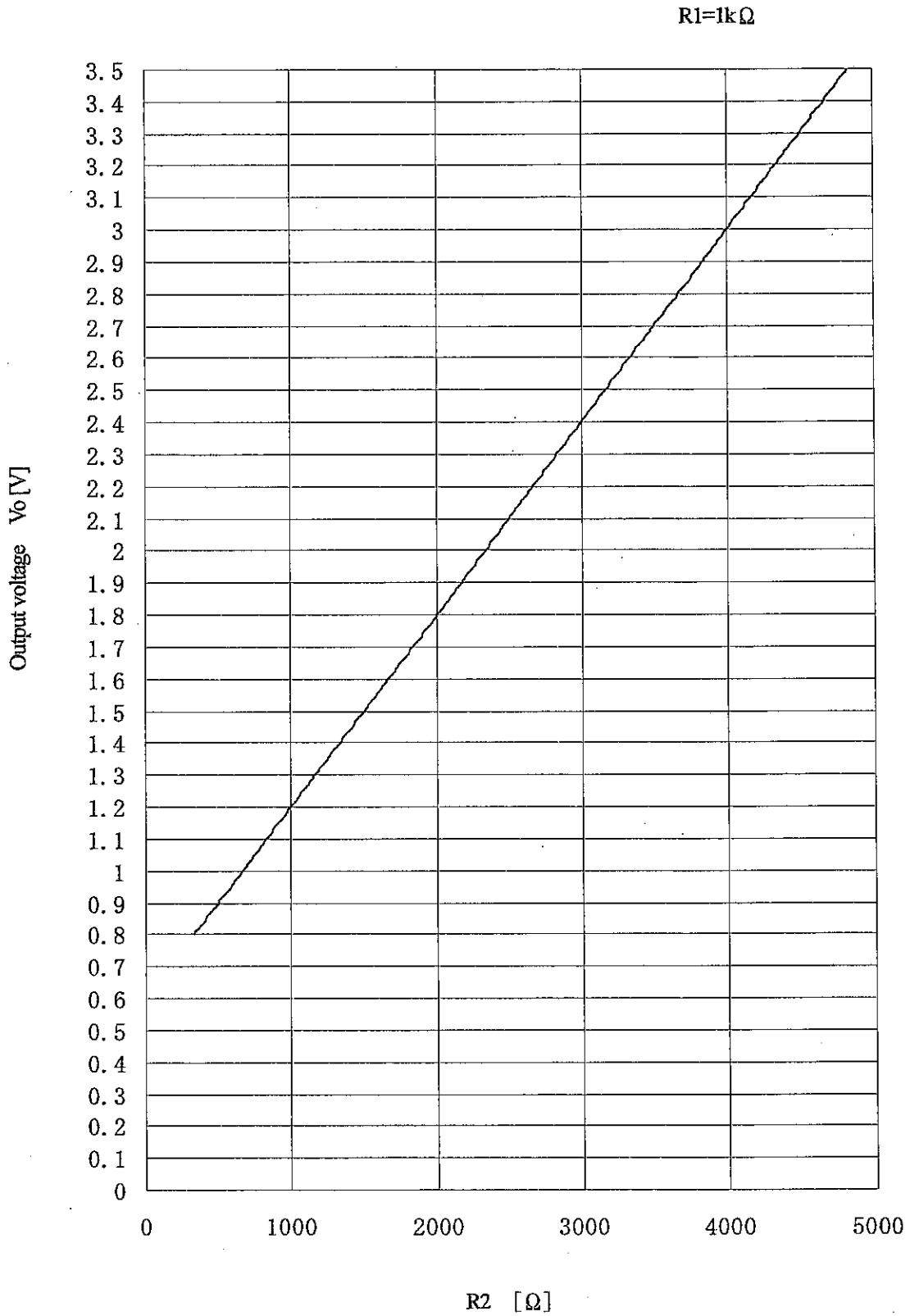


Material: Glass-cloth epoxy resin

Size: $50 \times 50 \times 1.6\text{mm}$

Thickness of copper foil: $35 \mu\text{m}$

3.5 Output voltage adjustment characteristics (Typical value)



4. Reliability

The reliability of products shall satisfy items listed below.

Confidence level : 90%

LTPD : 10 or 20

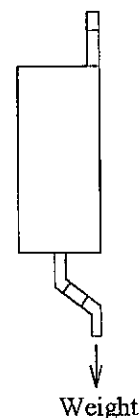
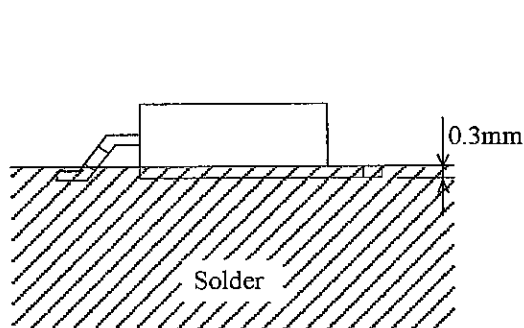
Test Items	Test Conditions	Failure Judgement Criteria	Samples (n)	
			Defective(C)	
Temperature cycling	1 cycle; -40°C (30min) to +150°C (30min) 20 cycles test	$V_{ref} < L \times 0.8$ $V_{ref} > U \times 1.2$ $RegL > U \times 1.2$ $RegI > U \times 1.2$ U: Upper specification limit L: Lower specification limit	n=22, C=0	
Temperature humidity bias	+85°C, 85%RH, $V_{in}=5.5V$, $V_B=7V$, $I_o=0A$, 1000h			
Damp Heat cycling	1 cycle : -20°C(2h) to 70°C(2h) Transfer time between high and low temp. is 1h. 40 cycles test, 90%RH		n=22, C=0	
High temp. storage	+150°C, 1000h		n=22, C=0	
Low temp. storage	-40°C, 1000h		n=22, C=0	
Operation life	$T_a=25^\circ C$, $P_d=0.8W$, 1000h Mount on PCB copper foil area 36 mm^2 in Para.3-4.		n=22, C=0	
Mechanical shock	15 km/s^2 , 0.5ms each 3 times/ $\pm X$, $\pm Y$, $\pm Z$		n=11, C=0	
Vibration (Variable frequency)	200 m/s^2 100 to 2000 to 100Hz/ 4min each 4 times/ X, Y, Z direction		n=11, C=0	
Soldering heat	260°C, 10s, Dip it into solder to the position of 0.5mm from resin portion *2		n=11, C=0	
Reflow Soldering heat	Temperature profile as shown in the item 7-4, twice.		n=11, C=0	
Electrostatic discharge	$\pm 250V$, 200pF, 0Ω Between GND and each terminal/ each 3 times		n=11, C=0	
Robustness of Termination (Tensile test)	Weight : 5N 10s/ each terminal *3		Failure if it has breakdown and loosened pin *4	n=11, C=0
Solderability	$245 \pm 2^\circ C$, 3 s Solder : Sn/3.0Ag/0.5Cu Use EC19S(TAMURA KAKEN Corporation made flux) *2		Failure if solder does not adhere on to the area of 95% or more in portion. *5	n=11, C=0

*1 There are cases that heat sink and terminals will change their surface color.

The color change should be excluded from the failure judgement criteria

*2 Soldering area is shown below.

*3 Terminal tensile direction is shown below.



*4 Except for the bending of terminal.

*5 Except for the portion within 0.5mm from the interface between the heat sink and the resin portion, and excepting for heat sink upper portion and side portion, and lead pins fiber cut portion.

5. Outgoing inspection

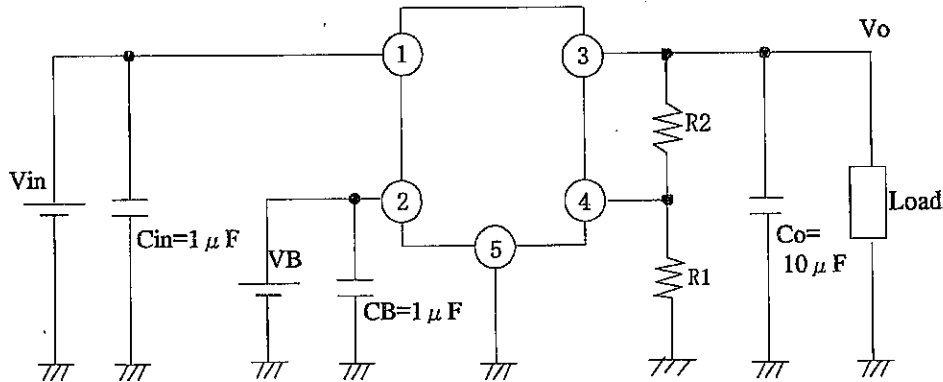
A single sampling plan, normal inspection level II based on ISO 2859 is applied.

The AQL according to the inspection items are shown below.

Defect	Inspection items	AQL (%)	Judgement criteria
Major defect	Electrical characteristics	0.1	It is based on the contents in the specification.
	Marking		To be recognized.
Minor defect	Dimensions	0.4	It is based on the contents in the specification.
	Appearance		Having no resin break off and lead bending.

6. Supplement

6.1 Example of application



Co:murata GRM42-6 B 106K 6.3

6.2 Taping and reel packaging

6.2.1 Packing form

(1) Tape structure and Dimensions (Refer to Fig. A)

The carrier tape shall have a heat-pressed structure in which emboss tape of polystyrene protected against static electricity is sealed by a cover tape. Dimensions are shown in Fig. A.

(2) Reel structure and Dimensions (Refer to Fig. B)

The reel shall be made of polystyrene. Dimensions are shown in Fig. B.

(3) Direction of product insertion (Refer to Fig. C)

This product is arranged so that the heat radiation fin comes to the hole side of tape.

6.2.2 Tape characteristics

(1) Adhesiveness of cover tape

The peel-back force between carrier tape and cover tape shall be 0.1N to 0.8N for the angle 160° to 180° .

(Tape speed : 5mm/s)

(2) Bending strength

Sealed tape : Bended tape radius shall be more than 30mm. If bended tape radius is less than 30mm, there is case that cover tape come off carrier tape.

(3) Carrier tape : Bended tape radius shall be more than 15mm.

6.2.3 Rolling method and quantity

(1) Rolling method

Wind the tape back on the reel so that the cover tape will be outside the tape.

Attach more than 20 pitch of empty cavities to the trailer and attach more than 10 pitch of empty cavities to the leader of the tape and fix the both ends with adhesive tape.

(2) Quantity

Basically, one package shall contain 3000pcs./package.

6.2.4 Indication

(1) Reel

The label shall be pasted on the reel to indicate following contents.

* Model No. * Number of pieces contained * Production date

(2) Package case

The outer packaging case shall be marked with following information.

* Model No. * Number of pieces contained * Inspection date

6.2.5 Storage environment

The products shall be stored at the temperature 5 to 30°C and the humidity less than 70%RH, avoiding direct sunlight.

If taped products aren't used for 10days or more, Please rewind the tape pulled out and storage.

Regarding the devices stored for long time, there is possibility that deterioration of lead pin color and solderability may be caused. Please use the devices after checking the solderability in advance.

6.2.6 Others

(1) Joint of tape

The cover tape and carrier tape in one reel shall be jointless.

(2) The way to repair taped failure devices

Cutting a bottom of carrier tape with a cutter, and after replacing to good devices, the cutting portion shall be sealed with adhesive tape.

Fig. A Tape structure and Dimensions

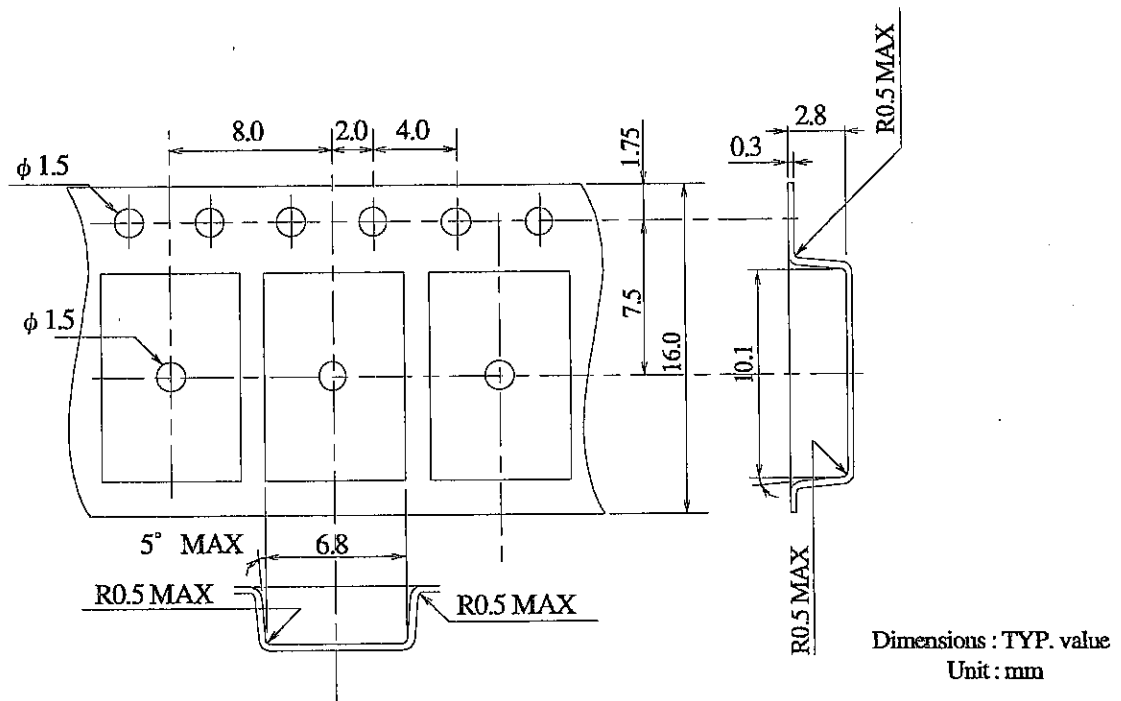
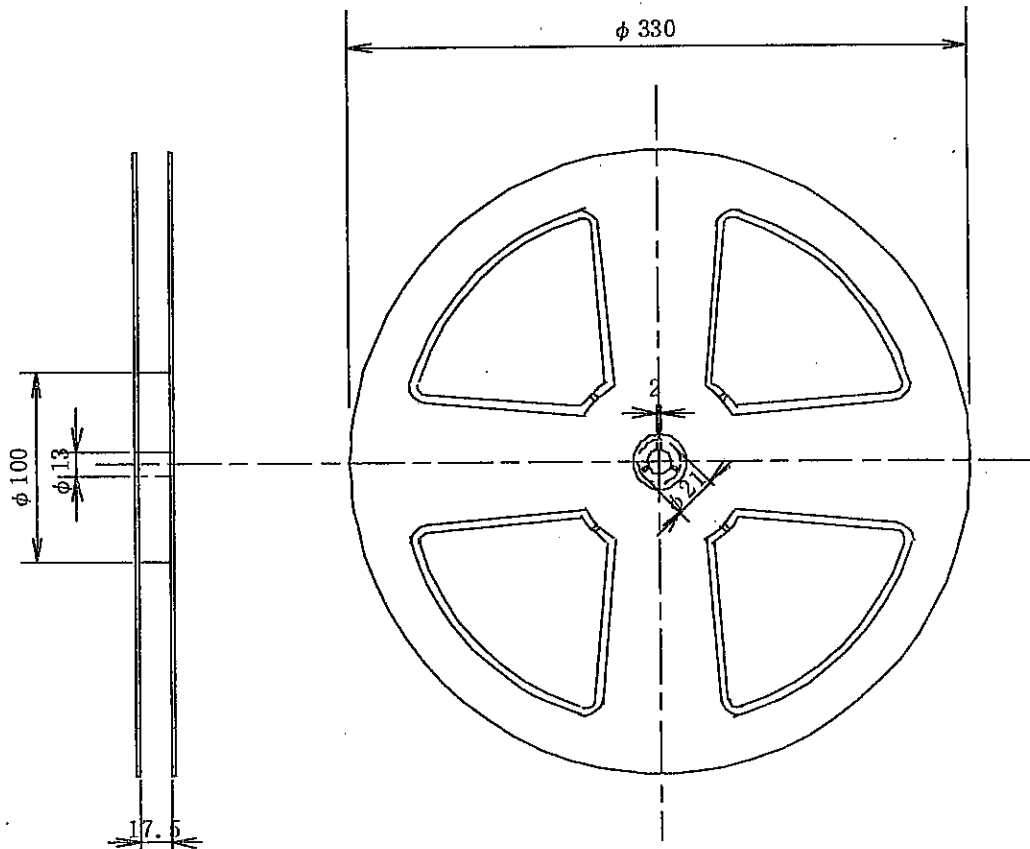
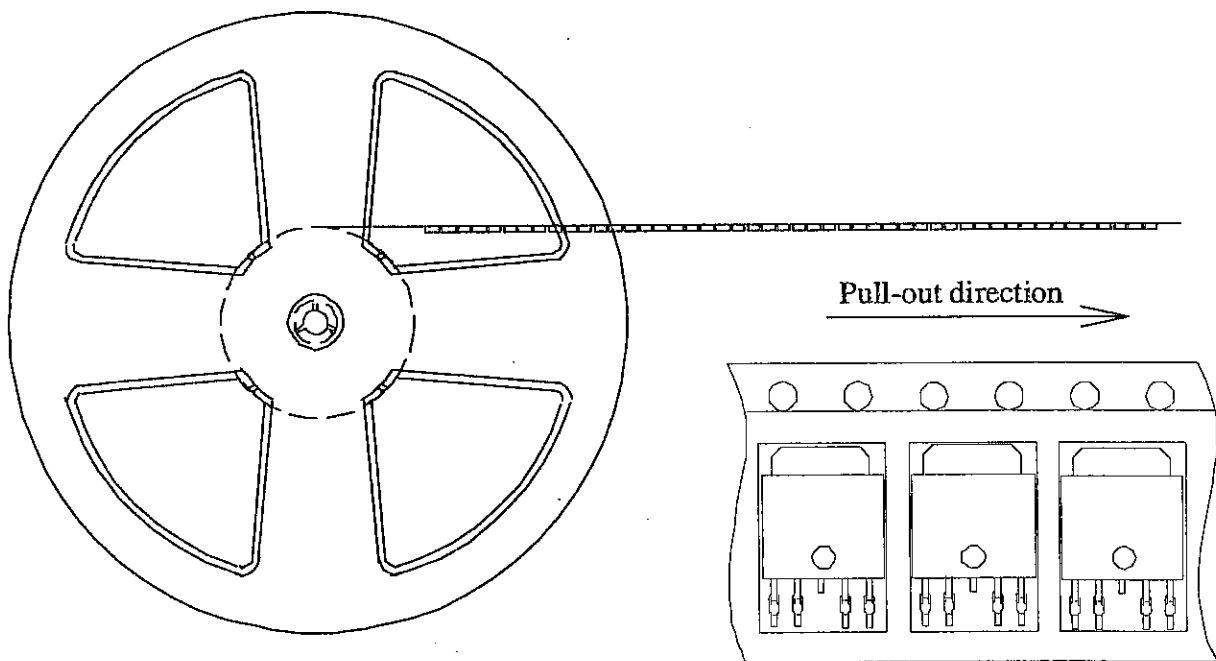


Fig. B Reel structure and Dimensions



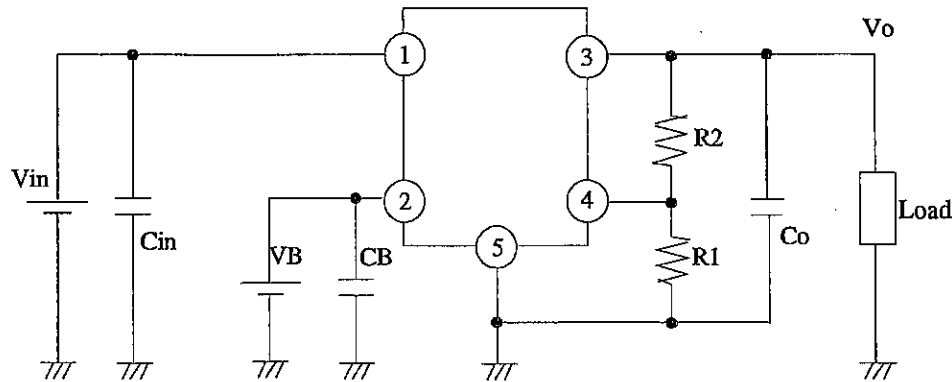
Dimensions : TYP. value
Unit : mm

Fig. C Direction of product insertion



7. Notes

7.1 External connection



- (1) Please perform shortest wiring for connection between C_{in} , C_B , C_o and the individual terminal. There is case that oscillation occurs easily by kinds of capacitor and capacity. Before you use this device, you should confirm output voltage on your use mounting state.
- (2) As voltage application under conditions that the device pin is inserted divergently or reversely, may cause the degradation of characteristics or breakdown of the device, please avoid it absolutely.

7.2 Thermal protection design

Internal power dissipation (P_d) of device is obtained by the following equation.

$$P_d = I_o \times (V_{in} - V_o) + V_B \times I_B$$

When the maximum operating temperature (T_a) and P_d (MAX.) under the device operation are determined, please do the design of sufficient heat radiation to operate the device within the safety operation area specified by the derating curve in para. 3.4.

Insufficient radiation or using over the limitation of the inner power dissipation curve gives an unfavorable influence to the normal operation and reliability of the device.

When deviating from the safety operational territory illustrated by the derating curve,

the overheat protection circuit operates to let output fall down, please avoid keeping such condition for a long time.

7.3 Static electricity

Good caution must be exercised against static electricity since this device consists of a bipolar IC.

Following are some examples of preventive measures against excessive voltages such as caused by static electricity.

- (a) Human body must be grounded to discharge the static electricity from the body or cloth.
- (b) Anything that is in contact with the device such as workbench, inserter, or measuring instrument must be grounded.
- (c) Use a solder dip basin with a minimum leak current (isolation resistance $10M \Omega$ or more) from the commercial power supply. Also the solder dip basin must be grounded.

7.4 Soldering

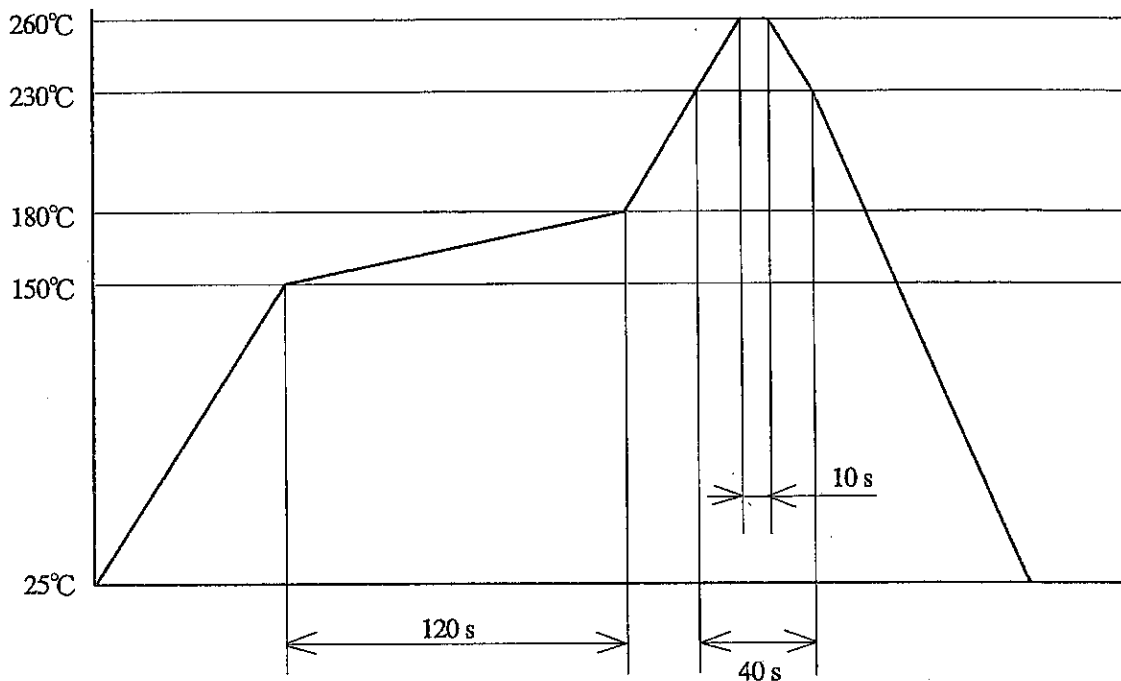
(1) Reflow soldering

It is recommended that within two times soldering be done at the temperature and the time within the temperature profile as shown in the figure. (The temperature shown in the figure is fin portion temperature of the device.)

It is recommended that the second reflow start after the temperature of the device falls out the room temperature.

Please obey the note items below concerning solder reflow.

- (a) An infrared lamp used to heat up for soldering may cause a localized temperature rise in the resin.
The temperature of resin portion should be within the temperature profile below.
- (b) The temperature sloping when soldering-reflow is $4^{\circ}\text{C}/\text{s}$ or less.



(2) Dip soldering

We recommend that solder dip should be 260°C or less (Solder temp.) within 10s and 1 time only.

Please obey the note items below concerning solder dip.

- (a) After solder dip, please do cooling naturally.
- (b) Please shall not give the mechanical stress or the impact stress to the device.

In advance, please confirm fully the dip soldering conditions etc. in the actual application in order to avoid any soldering bridge.

(3) Hand soldering

This device is basically designed for the soldering such as reflow soldering.

In case when hand soldering is reluctantly needed for modification etc., soldering iron should be countermeasured for static electricity, it is recommended that definitely only one hand soldering should be done at 350°C or less of soldering iron edge temperature, for 3s or less.

Please be careful not to apply any external force to terminals by soldering iron. For example, soldering iron should not touch terminals directly.

Please be carefully, especially, when heat sink is heated up by soldering iron, there is possibility that internal device may have over heat and the reliability of the internal device may have bad affection.

Even if the above conditions regarding solder reflow, solder dip or hand soldering there is the possibility that the force given to the terminals by the deformation of PCB makes the wire in the device package cut. In advance, please confirm fully at the actual application.

7.5 Cleaning

- (1) Solvent cleaning : Solvent temperature 45°C or less, Immersion for 3 min or less
- (2) Ultrasonic cleaning : The effect to device by ultrasonic cleaning differs by cleaning bath size, ultrasonic power output, cleaning time, PCB size or device mounting condition etc. Please test it in actual using condition and confirm that doesn't occur any defect before starting the ultrasonic cleaning.
- (3) Applicable solvent : Ethyl alcohol, Methyl alcohol, Isopropyl alcohol

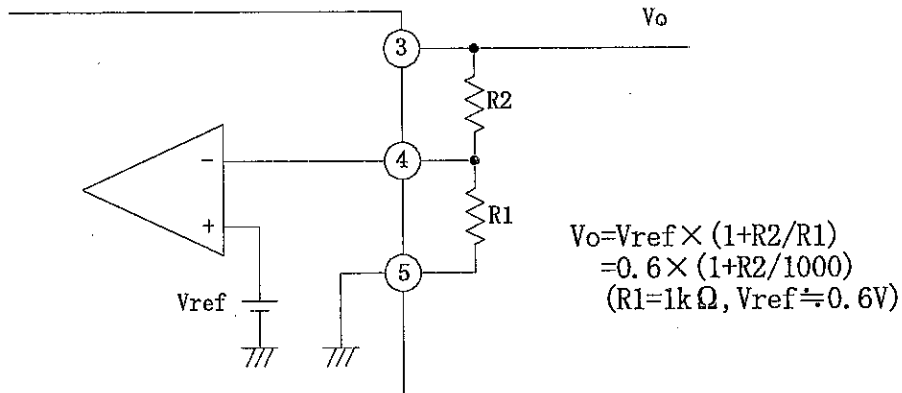
When the other solvent is used, there are cases that the packaging resin is eroded.

Please use the other solvent after thorough confirmation is performed in actual using condition.

7.6 Output voltage fine tuning

Connecting external resistors R1 and R2 to terminals ③, ④, ⑤ allows the output voltage to be fine tuned from 0.8V to 3.5V.

Refer to the figure below and "Paragraph 3.5 Output voltage adjustment characteristics" when connecting external resistors for fine tuning output voltage.



$$\begin{aligned}
 V_o &= V_{ref} \times (1 + R_2/R_1) \\
 &= 0.6 \times (1 + R_2/1000) \\
 &\quad (R_1 = 1k\Omega, V_{ref} \approx 0.6V)
 \end{aligned}$$