

REFERENCE

SPEC. No. ED-05Q001C
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SHARP

OPTO-ANALOG DEVICES DIVISION
ELECTRONIC COMPONENTS GROUP
SHARP CORPORATION

SPECIFICATION

DEVICE SPECIFICATION FOR	
	VOLTAGE REGULATOR
MODEL No.	
	PQ***GN01ZPH

Applied model name

	PQ008GN01ZPH
	PQ010GN01ZPH
	PQ012GN01ZPH

Specified for _____

Enclosed please find copies of the Specifications which consists of 18 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 copy of the Specifications
with approving signature on each.

CUSTOMER'S APPROVAL

DATE _____

BY _____

PRESENTED

DATE Mar. 27, 2007

BY H. Imanaka

H. Imanaka,
Department General Manager of
Engineering Dept., II
Opto-Analog Devices Div.
ELECOM Group
SHARP CORPORATION

REFERENCEProduct name : VOLTAGE REGULATORModel No. : PQ***GN01ZPH

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(Precautions)

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

{	• OA equipment • Audio visual equipment • Home appliances
	• Telecommunication equipment (Terminal) • Measuring equipment
	• Tooling machines • Computers

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 ;

{	• Transportation control and safety equipment (aircraft, train, automobile etc.)
	• Traffic signals • Gas leakage sensor breakers • Rescue and security equipment
	• Other safety equipment

- (3) Please do not use this product for equipment which require extremely high reliability and safety in function and precision, such as ;

{	• Space equipment • Telecommunication equipment (for trunk lines)
	• Nuclear power control equipment • Medical equipment

- (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.

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1. Application

This specification applies to the outline and characteristics of series regulator (linear type), Model No. PQ***GN01ZPH.

Applied Model name

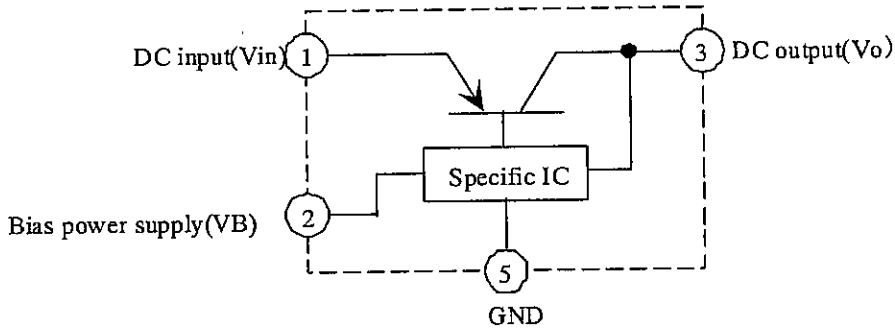
PQ008GN01ZPH, PQ010GN01ZPH, PQ012GN01ZPH

Usage

PQ***GN01ZPH is the device for stabilization of DC positive output voltage with the over current protection function, the overheat protection function.

This device is possible to use in power supply circuit up to current capacity 1A.

Block diagram



2. Outline : Refer to the attached sheet, Page 4.

3. Ratings and characteristics : Refer to the attached sheet, Page 5 to 8.

- 3.1 Absolute maximum ratings
- 3.2 Electrical characteristics
- 3.3 Electrical characteristics measuring circuit
- 3.4 Pd-Ta rating (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 14.

- 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)

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6.4 Compliance with each regulation

6.4.1 The RoHS directive(2002/95/EC)

This product complies with the RoHS directive(2002/95/EC) .

Object substances: mercury, lead (except for lead in high melting temperature type solders^{*1}), cadmium hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE)

*1 : i.e. tin-lead solder alloys containing more than 85% lead

6.4.2 Content of six substances specified in Management Methods for Control of Pollution Caused by Electronic Information

Products Regulation (Chinese : 电子信息产品污染控制管理办法).

Category	Toxic and hazardous substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent chromium (Cr ⁶⁺)	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
Voltage regulator	*	✓	✓	✓	✓	✓

✓ : indicates that the content of the toxic and hazardous substance in all the homogeneous materials of the part is below the concentration limit requirement as described in SJ/T 11363-2006 standard .

* : indicates that the content of the toxic and hazardous substance in at least one homogeneous material of the part exceeds the concentration limit requirement as described in SJ/T 11363-2006 standard.

Lead in high melting temperature type solders (i.e. tin-lead solder alloys containing more than 85% lead) (designated by “*” in the above table) are exempt from the RoHS directive (2002/95/EC) , because there is no effective way to eliminate or substitute them by present scientific technology.

6.5 Specified brominated flame retardants

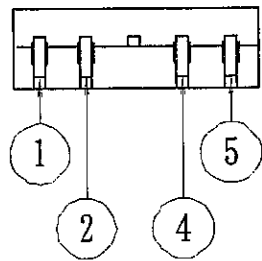
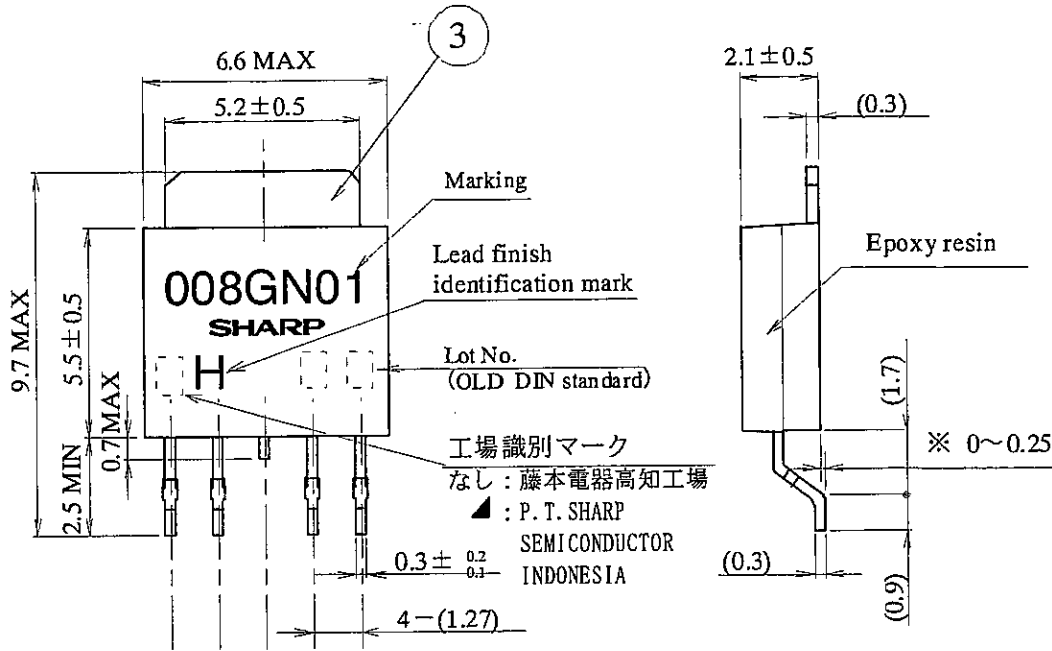
Specified brominated flame retardants (PBB and PBDE) are not used in this device at all.

6.6 This product is not designed as electromagnetic and ionized-particle radiation resistant.

7. Notes : Refer to the attached sheet, Page 15 to 17.

- 7.1 External connection
- 7.2 Thermal protection design
- 7.3 Static electricity
- 7.4 Soldering
- 7.5 Cleaning

2. Outline



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

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

*Marked model No. is in accordance with the applied model.

Applied model No.	Marking
PQ008GN01ZPH	008GN01
PQ010GN01ZPH	010GN01
PQ012GN01ZPH	012GN01

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

Lead material : Cu

Product mass : (0.23g)

3. Ratings and characteristics

3.1 Absolute maximum ratings

Ta=25°C

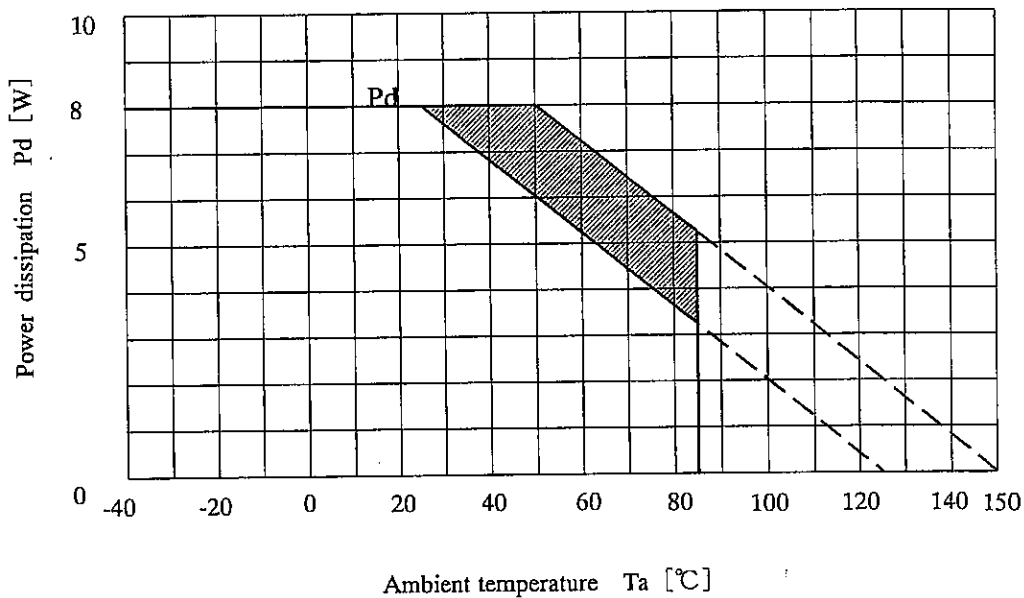
Parameter	Symbol	Rating	Unit	Conditions
Input voltage (*1)	Vin	5.5	V	
Bias power supply voltage (*1)	VB	7	V	
Output current	Io	1	A	
Power dissipation (*2)	Pd	8	W	Refer to Fig. 1
Junction temperature (*3)	Tj	150	°C	
Operating temperature	ToPr	-40 to +85	°C	
Storage temperature	Tstg	-40 to +150	°C	
Soldering 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 $V_{in} = 1.8V$, $V_B = 3.3V$, $I_o = 0.5A$, $T_a = 25^\circ C$

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Conditions
Input voltage range	V_{in}	1.7	-	5.5	V	
Bias supply voltage	V_B	2.35	-	7.0	V	
Output voltage	V_o	Refer to Fig. 1			V	
Load regulation	RegL	-	0.2	0.5	%	$I_o = 5mA$ to 1A
Line regulation	RegI	-	0.3	0.7	%	$V_{in} = 1.7V$ to 5.5V $V_B = 2.35$ to 7V, $I_o = 5mA$
Temperature coefficient of output voltage	$T_c V_o$	-	± 0.5	-	%	$I_o = 5mA$, $T_j = 0$ to $125^\circ C$
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	$I_o = 0A$

Fig. 1 Output voltage range

Unless otherwise specified condition shall be $V_{in} = 1.8V$, $V_B = 3.3V$, $I_o = 0.5A$, $T_a = 25^\circ C$

Model No.	Symbol	MIN.	TYP.	MAX.	Unit	Conditions
PQ008GN01ZPH	V_o	0.77	0.80	0.83	V	
PQ010GN01ZPH	V_o	0.97	1.00	1.03	V	
PQ012GN01ZPH	V_o	1.17	1.20	1.23	V	

3.3 Electrical characteristics measuring circuit

Fig. 2 Standard measuring circuit of Regulator portion

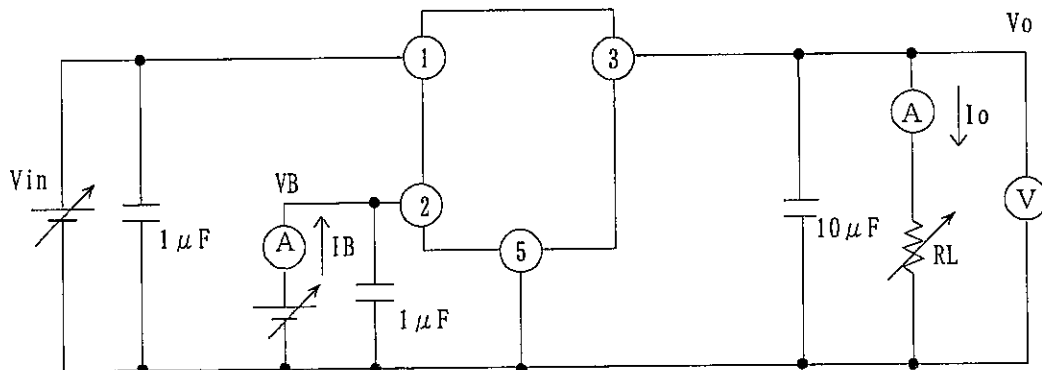


Fig. 3 Standard measuring circuit of critical rate of ripple rejection

$f=120\text{Hz}$ sine wave, $e_i(\text{rms})=0.1\text{V}$, $V_{in}=1.8\text{V}$, $V_B=3.3\text{V}$, $I_o=0.3\text{A}$

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

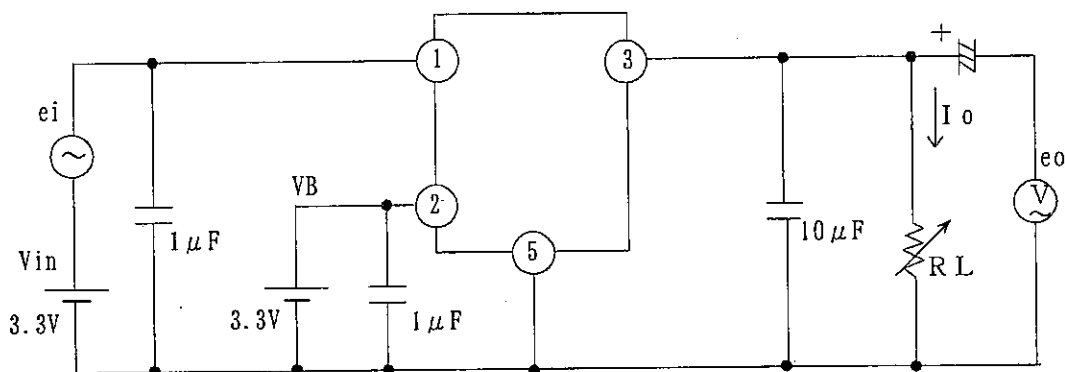
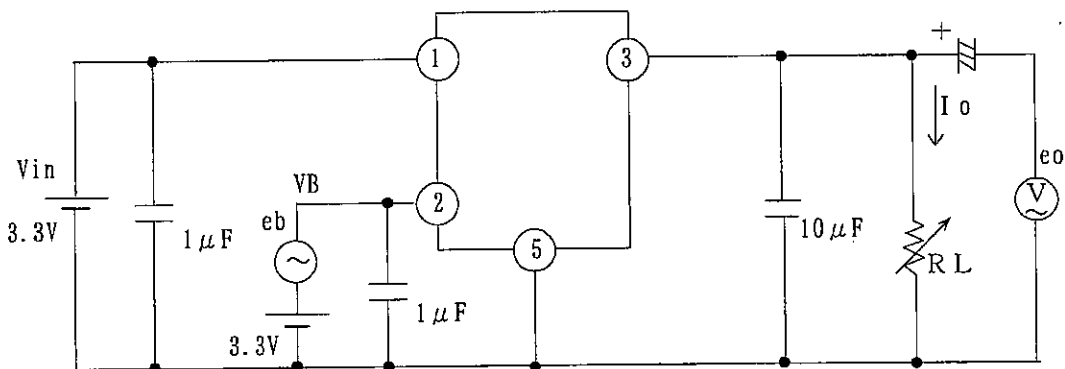


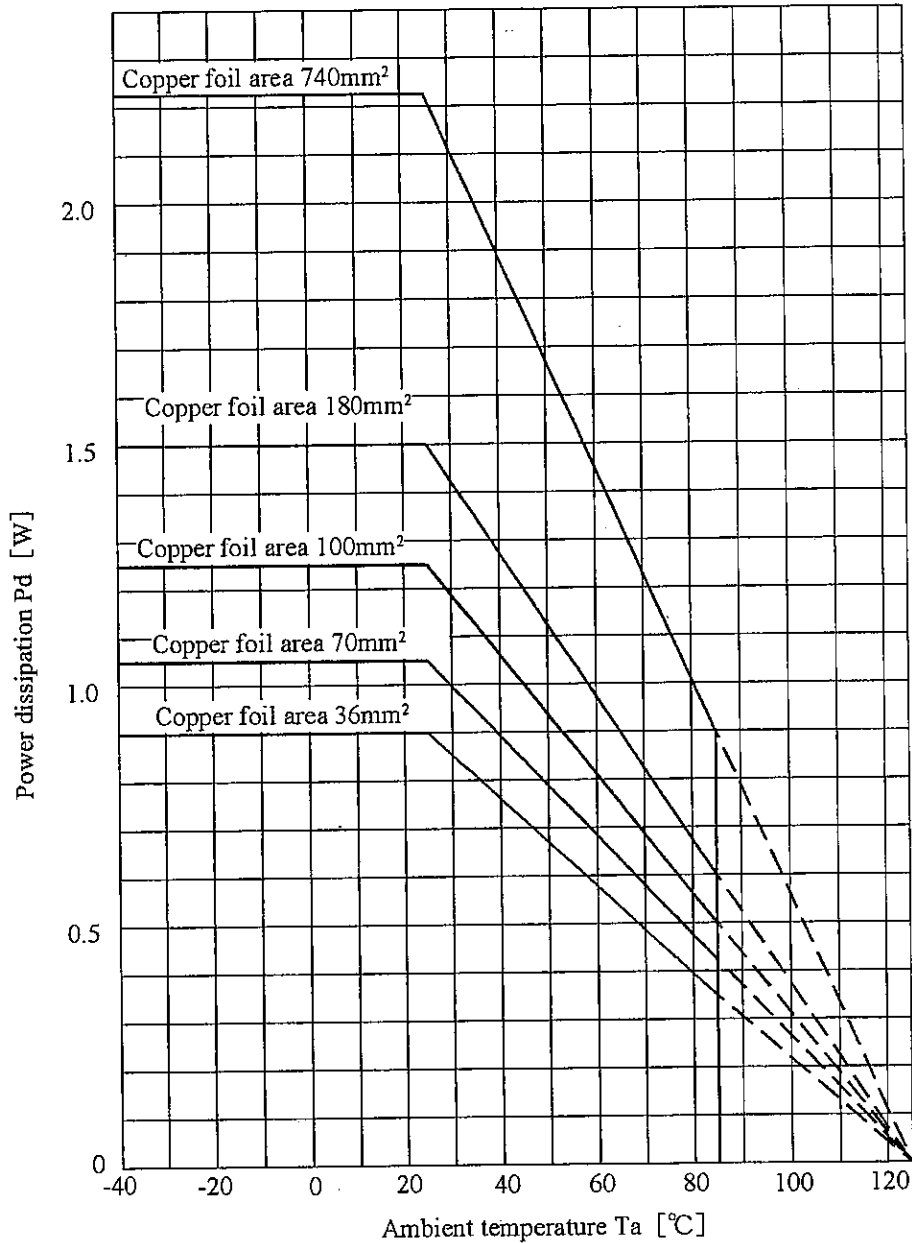
Fig. 4 Standard measuring circuit of critical rate of ripple rejection

$f=120\text{Hz}$ sine wave, $e_b(\text{rms})=0.1\text{V}$, $V_{in}=1.8\text{V}$, $V_B=3.3\text{V}$, $I_o=0.3\text{A}$

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



3.4 Pd - Ta rating (Typical value)

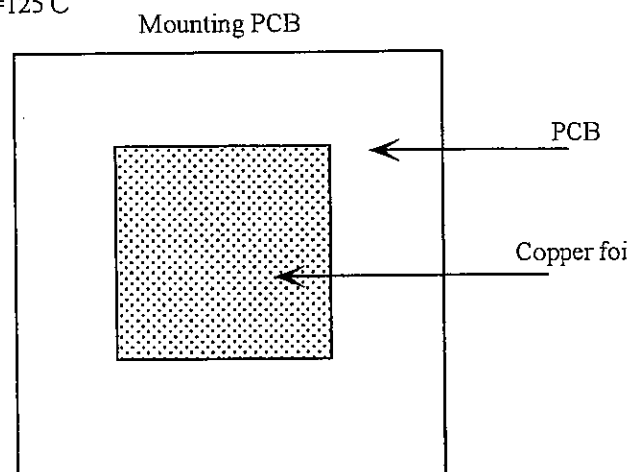


※The graph (power dissipation vs. Ambient temperature) indicates $T_j = 125^\circ\text{C}$

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: $35 \mu\text{m}$

4. Reliability

The reliability of products shall satisfy items listed below.

Confidence level : 90%

LTPD : 10 or 20

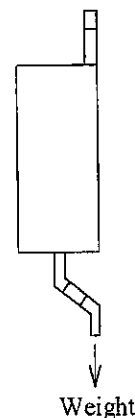
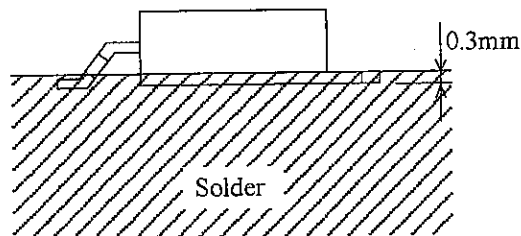
Test Items	Test Conditions	Failure Judgment Criteria	Samples (n)	
			Defective(C)	
Temperature cycling	1 cycle; -40°C (30min) to +150°C (30min) 20 cycles test	$V_o < L \times 0.8$ $V_o > U \times 1.2$ $RegL > U \times 1.2$ $RegI > U \times 1.2$ U: Upper specification limit L: Lower specification limit	n=22, C=0	
Humidity (Steady State)	+60°C, 90%RH, 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	Ta=25°C, Pd=0.8W, 1000h Mount on PCB copper foil area 36 mm ² in Para.3-4.		n=22, C=0	
Mechanical shock	15km/s ² , 0.5ms each 3 times / ±X, ±Y, ±Z		n=11, C=0	
Vibration (Variable frequency)	200m/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 in solder up to the position of 0.3mm 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	±250V, 200pF, 0Ω Between GND and each terminal / each 3 times		n=11, C=0	
Robustness of Termination (Tensile test)	Weight : 10N 10s/ each terminal *3		Failure if it has breakdown and loosened pin *4	n=11, C=0
Solderability	245±2°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 A 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 judgment 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 0.3mm from the interface between the heat sink and the resin portion, and excepting for heat sink upper portion and side portion, and lead pins tiber cut portion.

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5. Outgoing inspection

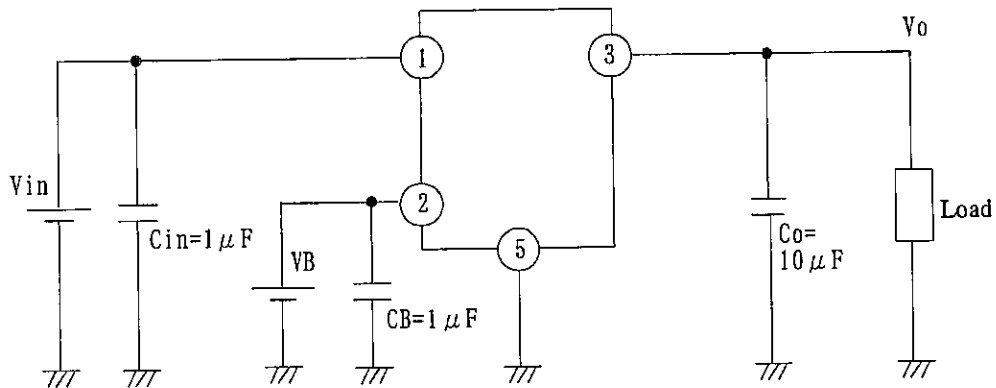
A single sampling plan, normal inspection level II based on ISO 2859 is applied.

The AQL according to the inspection items are shown below.

Defect	Inspection items	AQL (%)	Judgment 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

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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 structure in which a cover tape is sealed heat-pressed on the carrier tape of polystyrene emboss protect against static electricity. 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)

Product direction in carrier tape shall direct to the radiate fin of product at the hole side on the 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 30mm or more. If bended tape radius is 30mm less than, there is case that cover tape come off carrier tape.

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

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 20 pitch or more of empty cavities to the trailer and attach 10 pitch or more 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 * Packing date

(2) Package case

The label shall be pasted on the outer packaging case to indicate following contents.

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

6.2.5 Storage environment

The products shall be stored at the temperature 5 to 30°C and the humidity 70%RH or less avoiding direct sunlight. If taped products aren't used for 10days or more, Please rewind the tape pulled out and store.

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

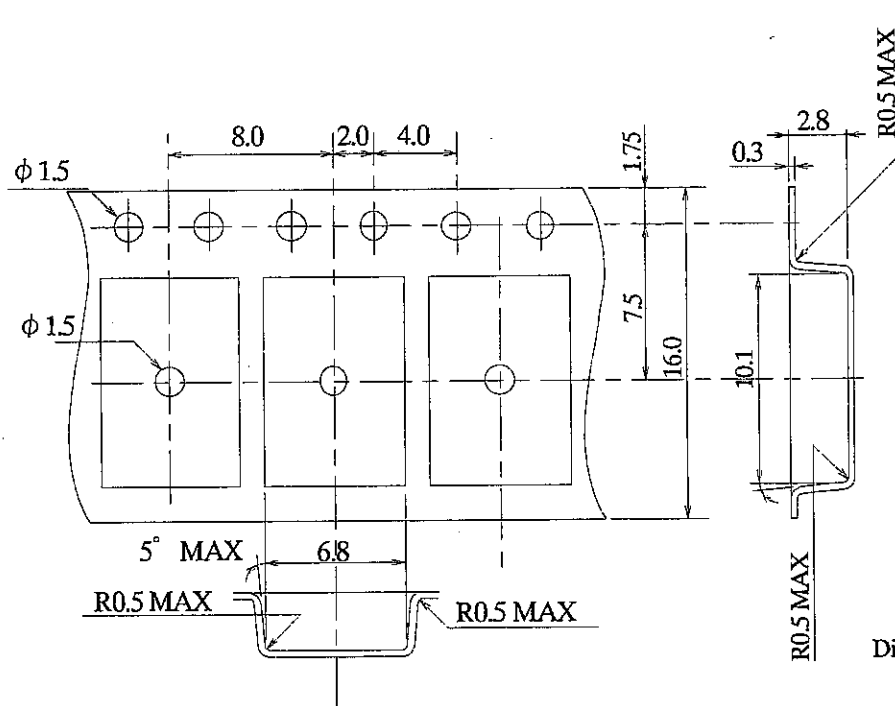
(1) Joint of tape

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

(2) The way to repair taped failure devices

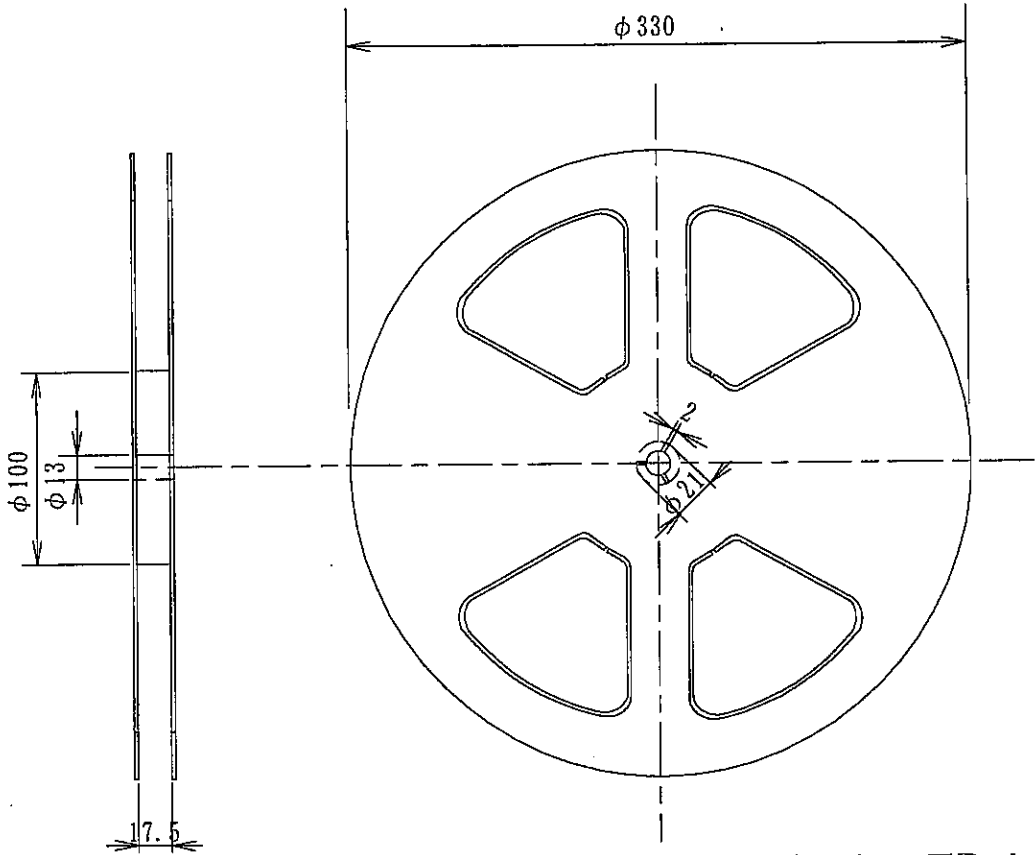
Cutting a bottom of carrier tape with a cutter, and after replacing to good devices, the cutting portion shall be sealed with adhesive tape.

Fig. A Tape structure and Dimensions



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Fig.B. Reel structure Dimensions



Dimensions : TYP.value
Unit : mm

Fig.C. Direction of product insertion

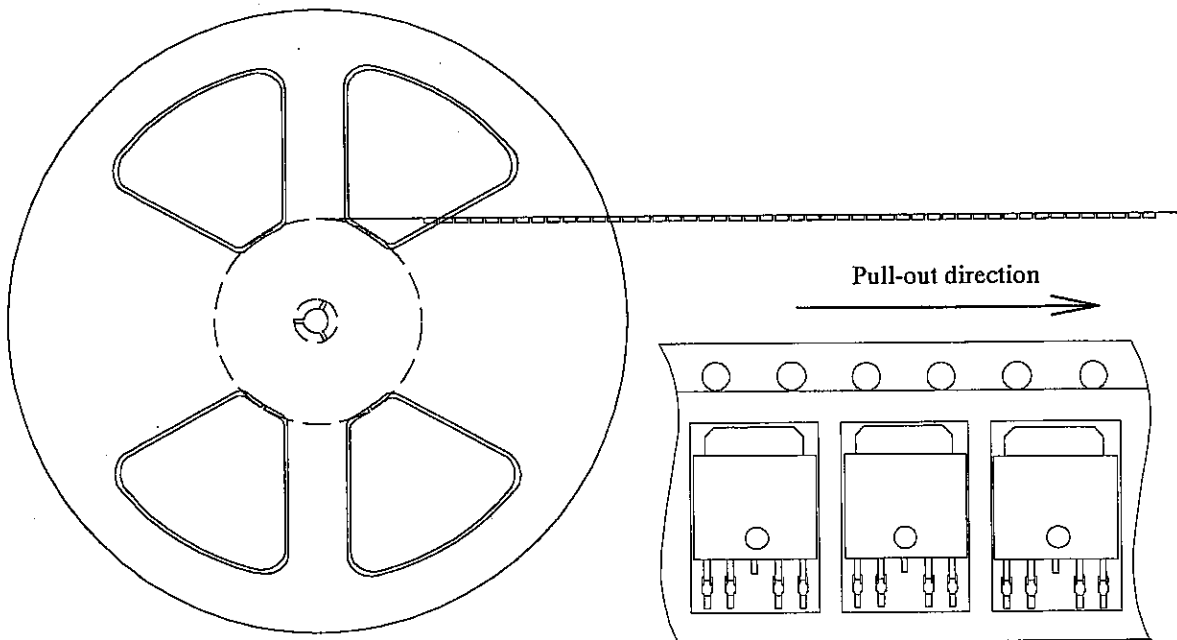
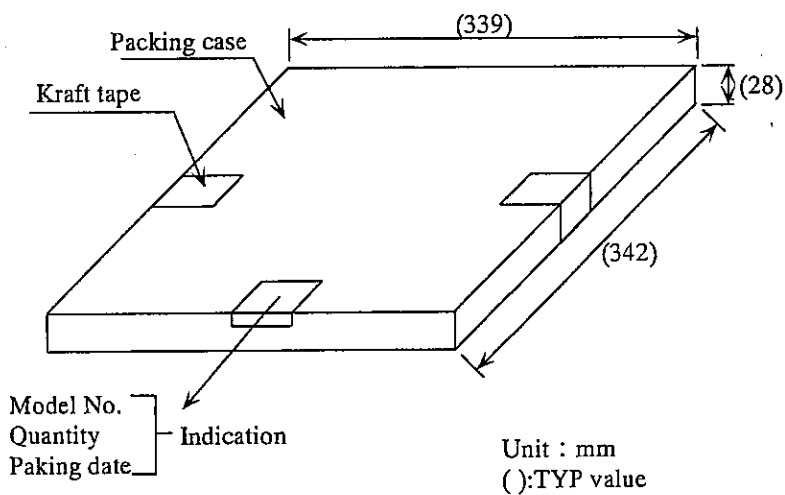
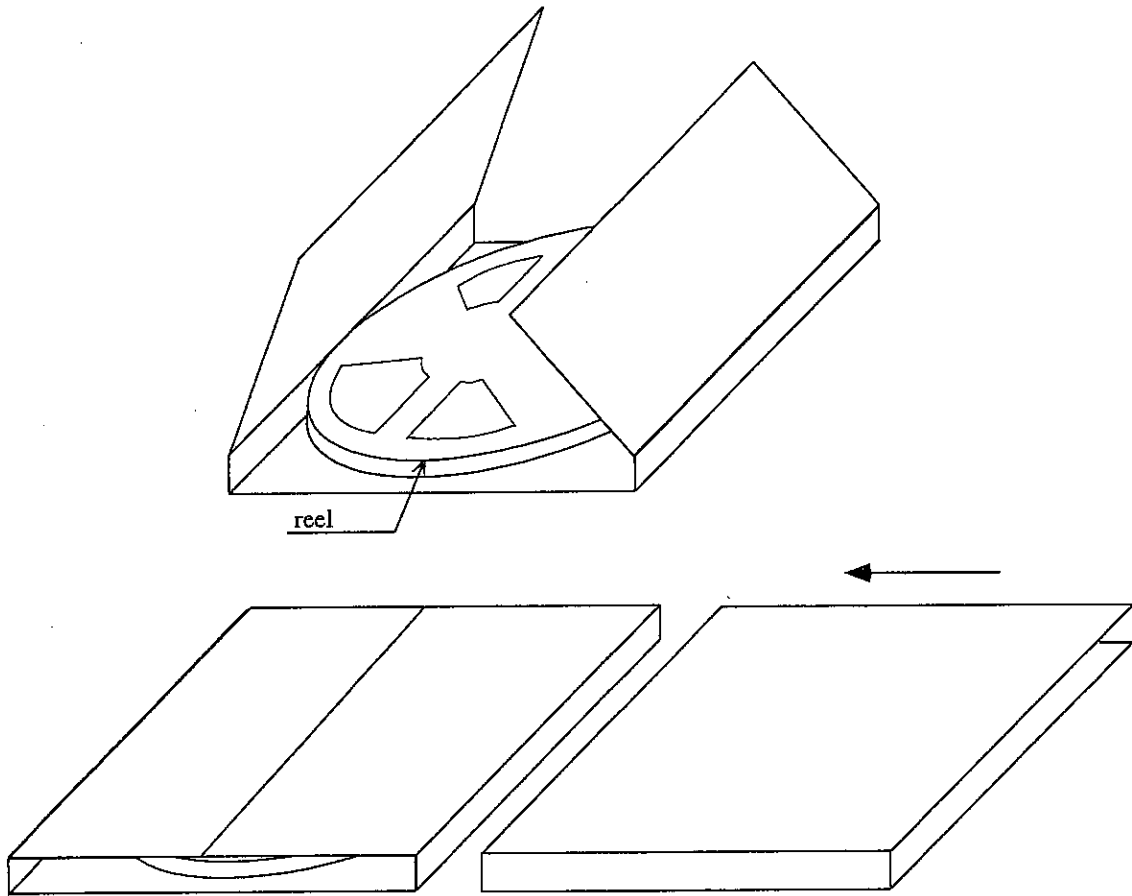
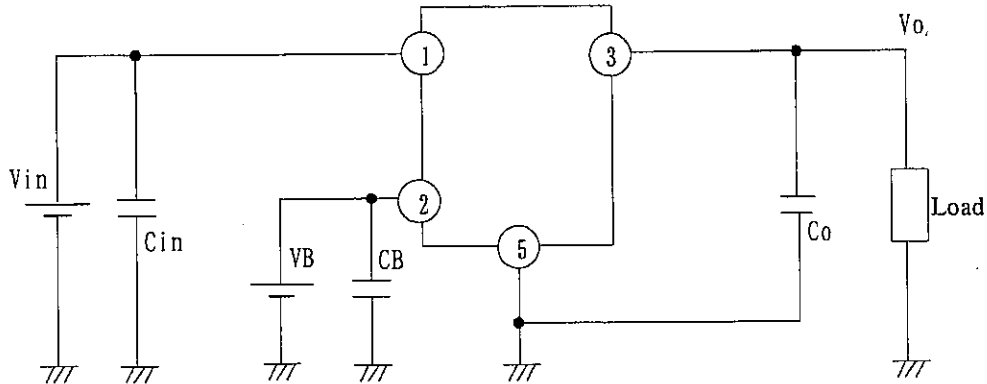


Fig.D. Packing case

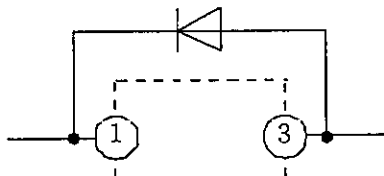


7. Notes

7.1 External connection



- (1) Please perform shortest wiring for connection between C_{in} , 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. We do not recommend to use low ESR ceramic condenser for C_o because there is an case that oscillation will occur. And especially when it is used at low temperature, we recommend to use tantalum condenser which is 10uF or more (ESR:0.5 to 100) for C_o .
- (2) The input terminal for ON/OFF output control ; ④ is compatible with LS-TTL, and direct driving by TTL or C-MOS standard logic (RCA 4000 series) is also available. In case that ON/OFF terminal is not used, we recommend to connect the ON/OFF terminal directly to the input terminal ; ② Bias power supply.
- (3) Voltage application under conditions that the device pin is inserted divergently or reversely, may occur the degradation of characteristics or breakdown of the device, please avoid it absolutely.
- (4) In applying greater voltage to the output terminal ③ than the voltage of the DC input terminal ①, breakdown of the device may cause. Especially in the case that the DC input terminal ① is short-circuited with GND, under the normal condition, the charge that is being charged into the output capacitor (C_o) flows into the input side. This may cause breakdown of the device. To prevent such a breakdown, please connect a silicon diode as shown below in the schematic.



7.2 Thermal protection design

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

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

If the maximum operating temperature and P_d when the device is operating are determined, use such a heat sink as allows the device to operate 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.

In the case of being out of 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 Ω 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.)

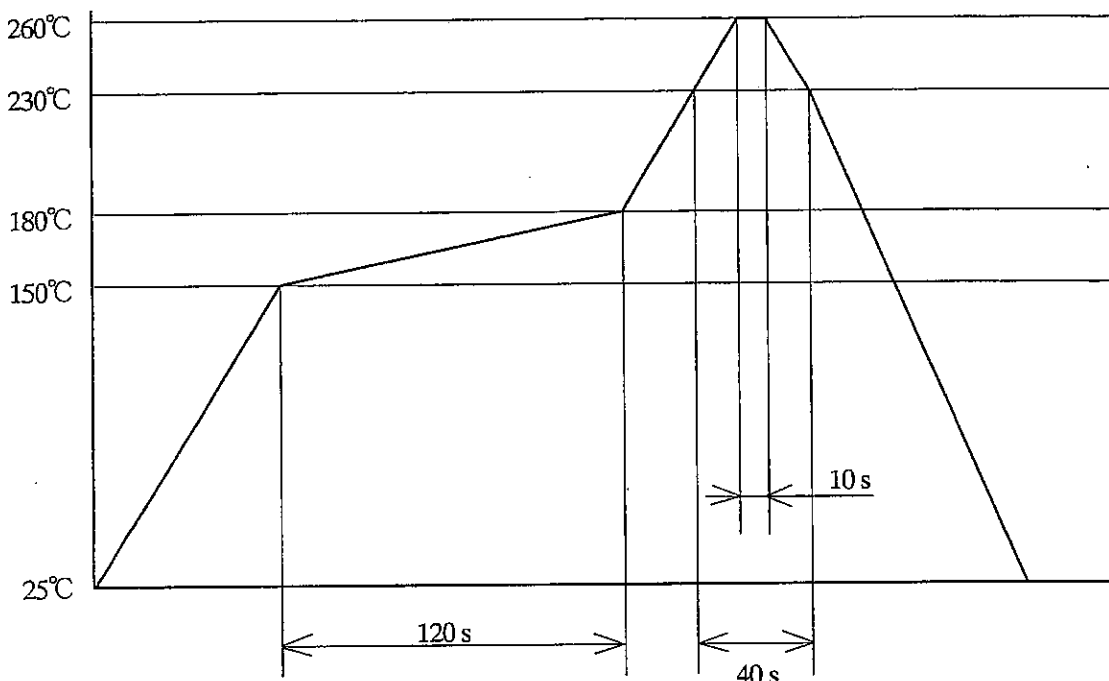
It is recommended that the second reflow start after the temperature of the device falls out the room temperature.

Please obey the note items below concerning solder reflow.

- (a) An infrared lamp used 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 does not give the mechanical force or the impact force 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 counter measured 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 touch soldering iron edge to leads directly etc. in order not to give any stress to the leads.

Please be careful, 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 stress 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.