

REFERENCE

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OPTO-ELECTRONIC DEVICES DIVISION
ELECTRONIC COMPONENTS GROUP
SHARP CORPORATION

SPECIFICATION

DEVICE SPECIFICATION FOR

VOLTAGE REGULATOR

MODEL No.

PQ200WNA1ZPH

Specified for

Enclosed please find copies of the Specifications which consists of 18 pages including cover.
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,
Department General Manager of
Engineering Dept.,II
Opto-Electronic Devices Div.
ELECOM Group
SHARP CORPORATION

Product name : VOLTAGE REGULATOR

Model No. : PQ200WNA1ZPH

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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 ;

· 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.

1. Application

This specification applies to the outline and characteristics of series regulator (linear type), Model No. PQ200WNA1ZPH.

Applied Model name

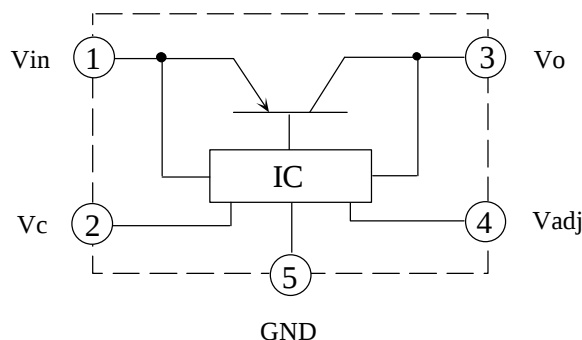
PQ200WNA1ZPH,

Usage

PQ200WNA1ZPH is the device for stabilization of DC positive output voltage with built-in ON/OFF function, the over current protection function, the ASO protection function and the overheat protection function, adjustable DC output voltage by using external resistance and low consumption current at OFF-state (stand-by).

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 3.

3. Ratings and characteristics : Refer to the attached sheet, page 4 to 7.

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 8 to 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 Output voltage adjustment characteristics (Typical value)

6.3 Taping and reel packaging

6.4 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)

6.5 The RoHS directive

This product conforms to the RoHS directive .

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

6.6 Brominated flame retardants

Specific brominated flame retardants such as the PBBO_s and PBB_s are not used in this device at all.

6.7 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

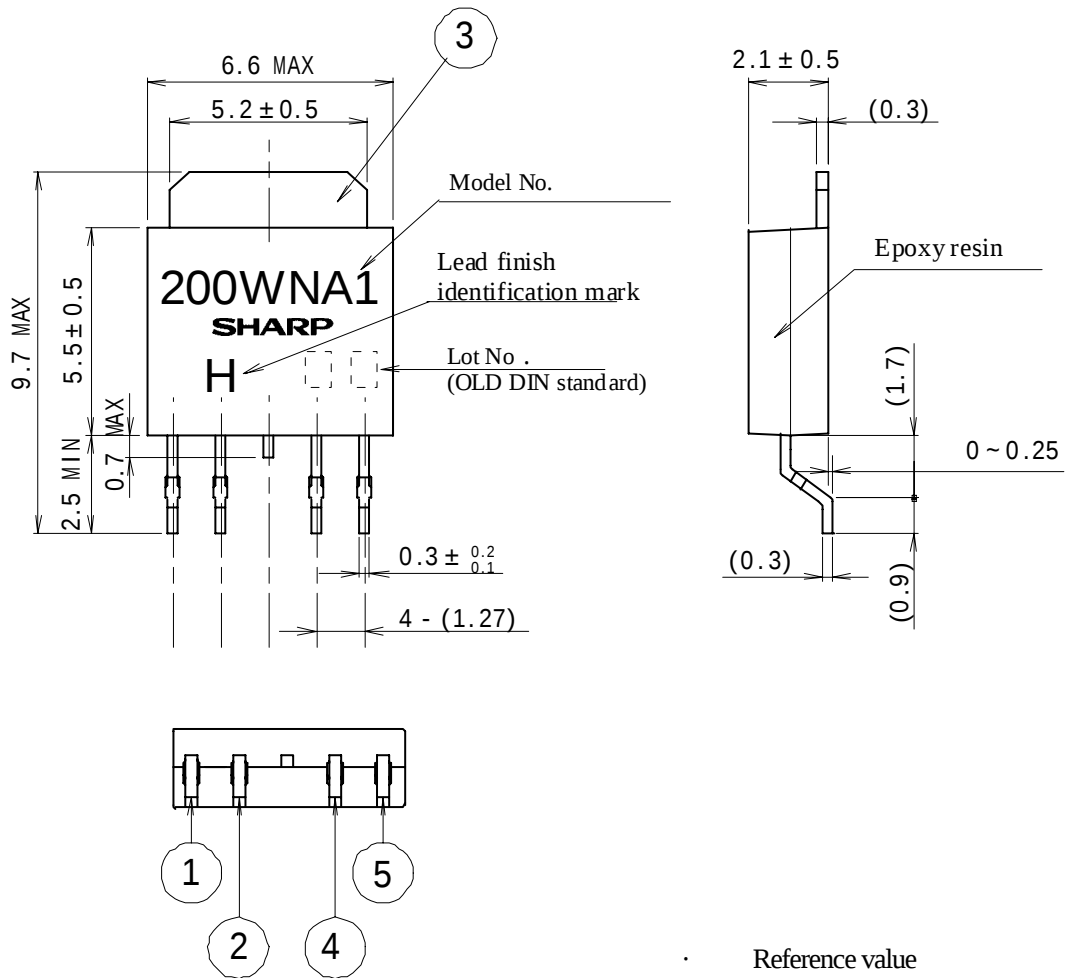
7.3 Static electricity

7.4 Soldering

7.5 Cleaning

7.6 Output voltage fine tuning

2. Outline



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

- ① DC input (Vin)
- ② ON/OFF control (Vc)
- ③ DC output (Vo)
- ④ Output voltage adjustment (Vadj)
- ⑤ GND

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

Lead material : Cu

Product mass : (0.23g)

3. Ratings and characteristics

3.1 Absolute maximum ratings

$T_a=25$

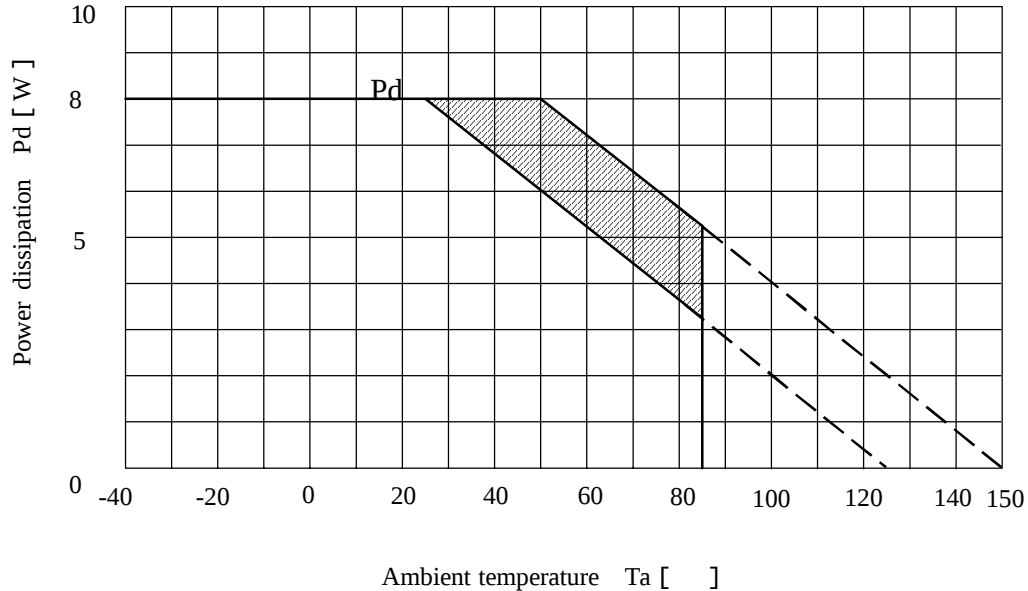
Parameter	Symbol	Rating	Unit	Conditions
Input voltage (*1)	V_{in}	24	V	
ON/OFF control voltage (*1)	V_c	24	V	
Output adjustment pin voltage (*1)	V_{adj}	5	V	
Output current	I_o	1	A	
Power dissipation (*2)	P_d	8	W	Refer to Fig. 1
Junction temperature (*3)	T_j	150		
Operating temperature	T_{opr}	-40 to +85		
Storage temperature	T_{stg}	-40 to +150		
Soldering temperature	T_{sol}	260		For 10 s

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

(*2) P_d : With infinite heat sink

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

Fig. 1 Inner derating curve



P_d : With infinite heat sink

(Note) There is case that over heat protection function operates 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 $V_{in}=5V$, $V_o=3.3V$ ($R1=2k\Omega$), $I_o=0.5A$, $V_c=2.7V$

$T_a=25$

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Conditions
Input voltage	V_{in}	3.5	-	24	V	
Output voltage	V_o	3.0	-	20	V	
Load regulation	Reg_L	-	-	1.0	%	$I_o=5mA$ to 1A
Line regulation	Reg_I	-	-	1.0	%	$V_{in}=4$ to 10V $I_o=5mA$
Ripple rejection	RR	-	60	-	dB	Refer to Fig.3
Dropout voltage	V_{i-o}	-	-	0.5	V	$V_{in}=3.5$
Reference voltage	V_{ref}	2.583	2.65	2.717	V	
Temperature coefficient of reference voltage	TcV_{ref}	-	± 1.0	-	%	$T_j=0$ to 125 $I_o=5mA$
On-state voltage for control	$V_c(on)$	2.0	-	-	V	(*4)
On-state current for control	$I_c(on)$	-	-	200	μA	
Off-state voltage for control	$V_c(off)$	-	-	0.8	V	$I_o=0A$
Off-state current for control	$I_c(off)$	-	-	2	μA	$I_o=0A$, $V_c=0.4V$
Quiescent current	I_q	-	-	8	mA	$I_o=0A$
Output off-state consumption current	I_{qs}	-	-	5	μA	$V_c=0.4V$

(*4) In case of opening control terminal (2th pin), output voltage turns OFF.

3.3 Electrical characteristics measuring circuit

Fig. 2 Standard measuring circuit of Regulator portion

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

$$2.65 \times (1 + R_2/R_1)$$

$$(R_1 = 2k\Omega, V_{ref} = 2.65V)$$

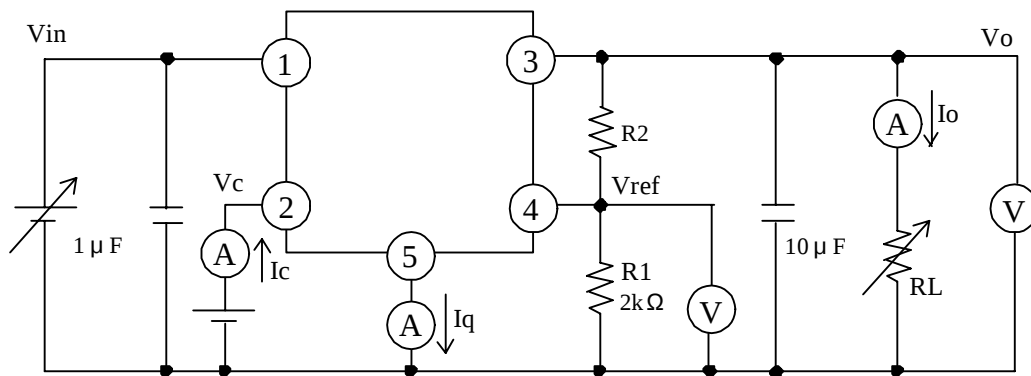


Fig. 3 Standard measuring circuit of critical rate of ripple rejection

$$f = 120\text{Hz} \quad \text{sine wave}$$

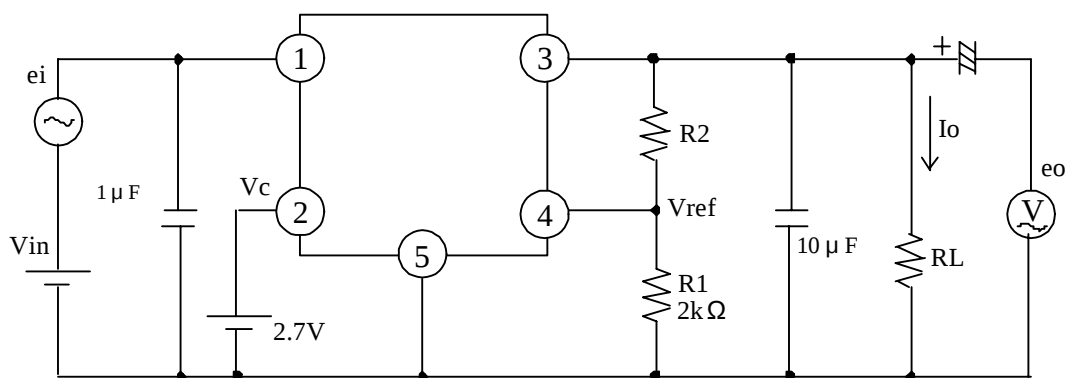
$$e_i(\text{rms}) = 0.5\text{V}$$

$$V_{in} = 5\text{V}$$

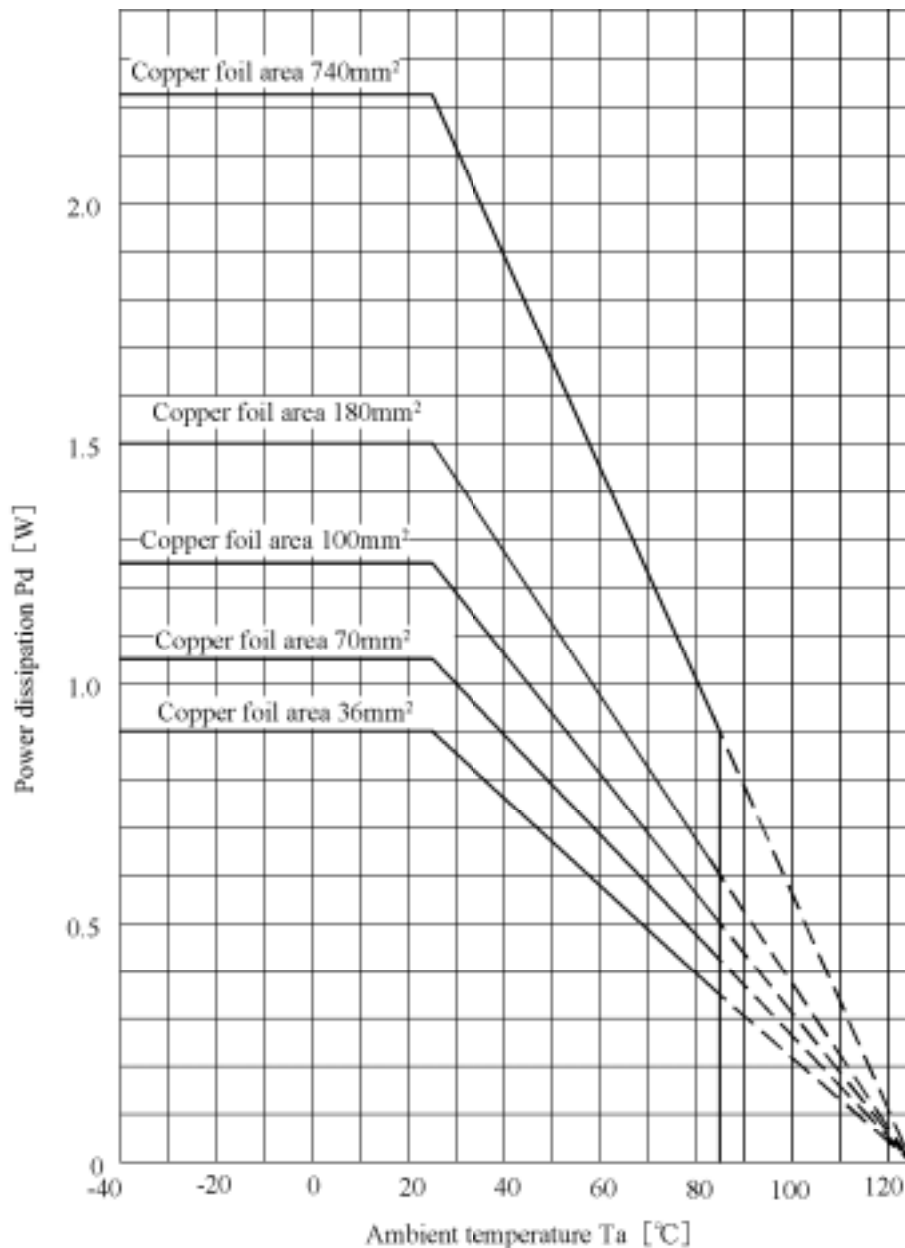
$$V_o = 3.3\text{V} \quad (R_1 = 2k\Omega)$$

$$I_o = 0.3\text{A}$$

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



3.4 Power dissipation- Ta rating (Typical value)

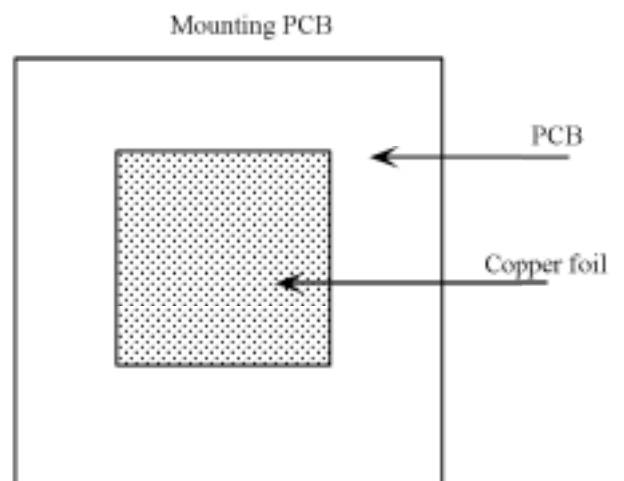


※The graph (power dissipation vs. Ambient temperature) indicates $T_j = 125^\circ\text{C}$

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 at 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 at 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

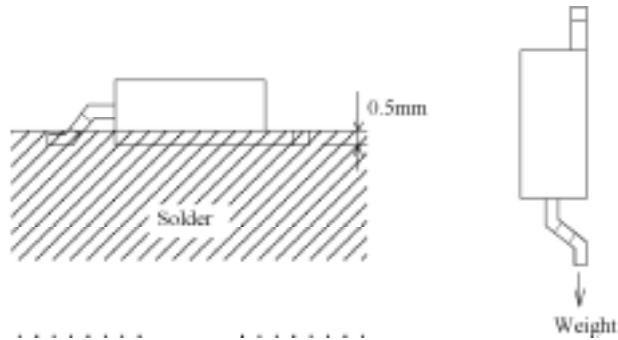
The reliability of products shall satisfy items listed below.

Confidence level : 90%

LTPD : 10 or 20

Test Items	Test Conditions	Failure Judgment Criteria	Samples (n)
			Defective(C)
Temperature cycling	1 cycle -40 (30min) to +150 (30min) 20 cycles test	$V_{ref} < L \times 0.8$ $V_{ref} > U \times 1.2$ $RegL > U \times 1.2$ $RegI > U \times 1.2$ $V_{i-o} > U \times 1.2$ U: Upper specification limit L: Lower specification limit	n=22, C=0
Temperature humidity bias	+85 , 85%RH, $V_{in} = V_c = 24V$, $I_o = 0A$, 1000h		n=22, C=0
Damp Heat cycling	1 cycle : -20 (2h) to 70 (2h) Transfer time between high and low temp. is 1h. or more 40 cycles test, 90%RH		n=22, C=0
High temp. storage	+150 , 1000h		n=22, C=0
Low temp. storage	-40 , 1000h		n=22, C=0
Operation life	$T_a = 25$, $P_d = 0.8W$, 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 / 4 min each 4 times / X, Y, Z direction		n=11, C=0
Soldering heat	260 , 10 s, Dip n solder up 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 10 s/ each terminal *3	Failure if it has breakdown and loosened pin *4	n=11, C=0
Solderability	245 ± 2 , 3 s, Solder : Sn / 3.0Ag / 0.5Cu Use EC19S (TAMURAKAKEN Corporation made flux) *2	Failure if A portion. area is not soldered 95% or more. *5	n=11, C=0

- *1 There is case 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 0.5mm from the interface between the heat sink and the resin portion, the side and top surface of heat sink, and leads tiber cut portion.

5. Outgoing inspection

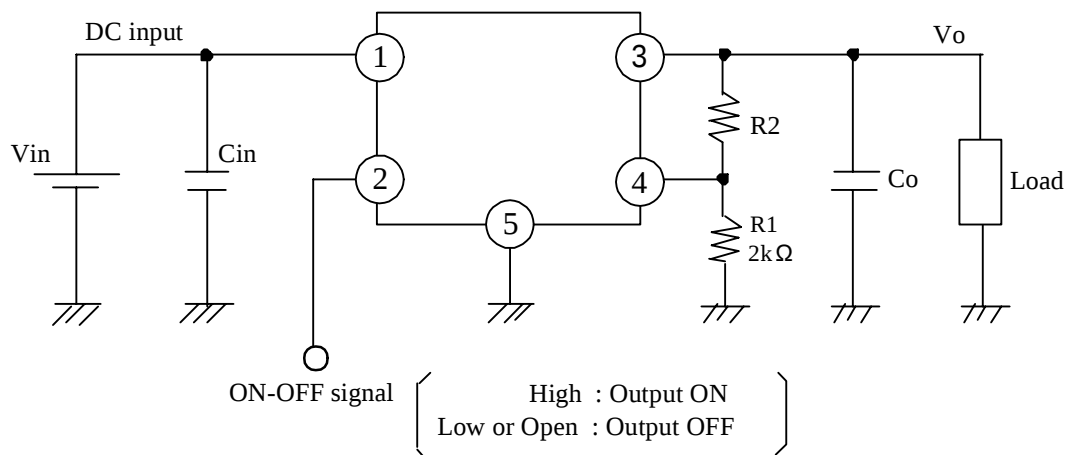
A single sampling plan, normal inspection level II based on ISO 2859 is applied.

The AQL according to the inspection items are shown below.

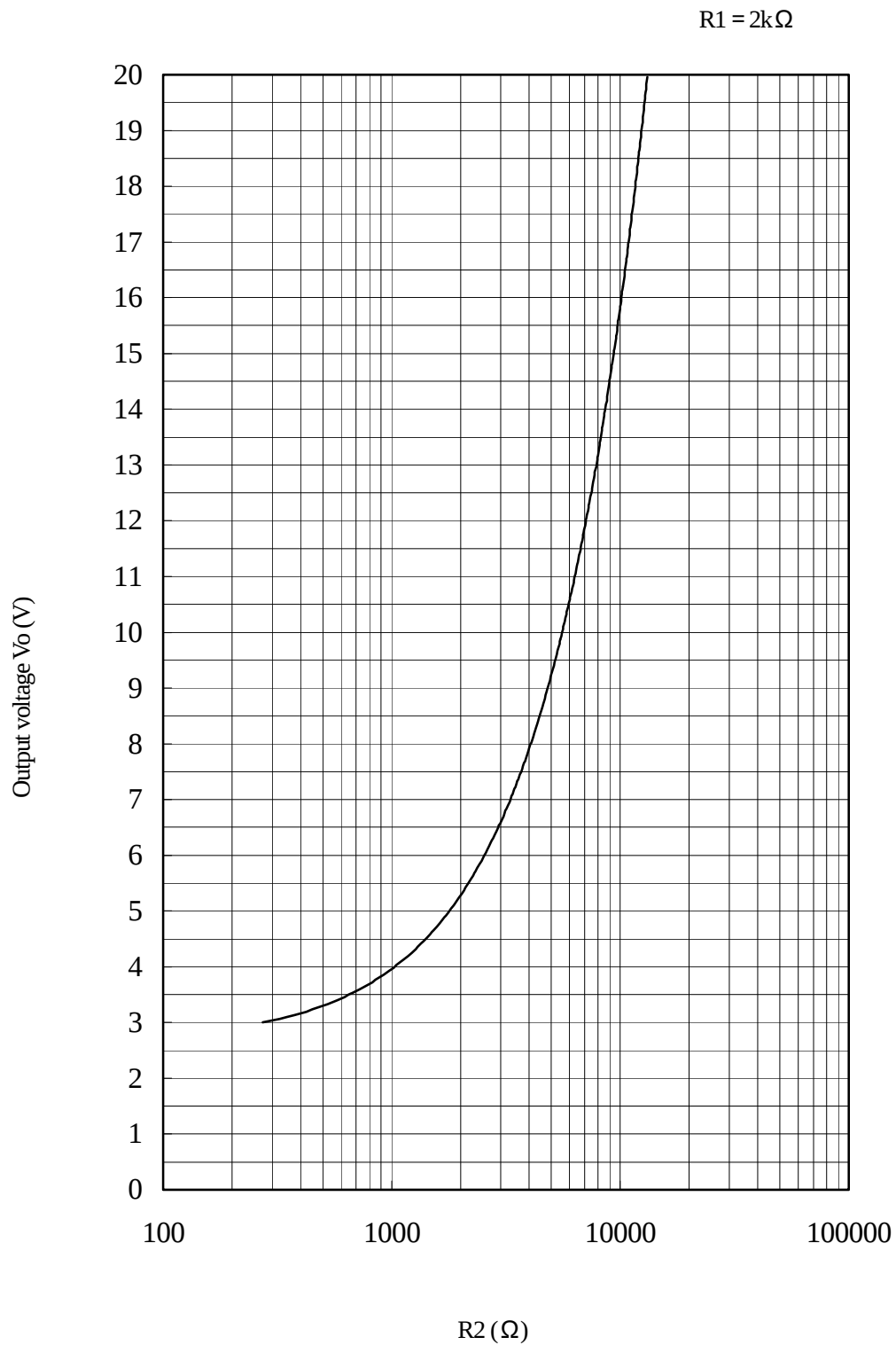
Defect	Inspection items	AQL (%)	Judgment criteria
Major defect	Electrical characteristics	0.1	It is based on the contents in the specification.
	Marking		To be recognized.
Minor defect	Dimensions	0.4	It is based on the contents in the specification.
	Appearance		Having no resin break off and lead bending.

6. Supplement

6.1 Example of application



6.2 Output voltage adjustment characteristics



6.3 Taping and reel packaging

6.3.1 Packing form

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

The 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 in Fig.B)

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

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

Product direction in carrier tape shall direct to the radiate fin of product at the hole side on the tape.

6.3.2 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.

Carrier tape : Allowable bending radius of carrier tape itself shall be 15mm or more.

6.3.3 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 reel shall contain 3000pcs.

6.3.4 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

6.3.5 Storage environment

The taped products shall be stored at the temperature 5 to 30 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 a 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.

6.3.6 Others

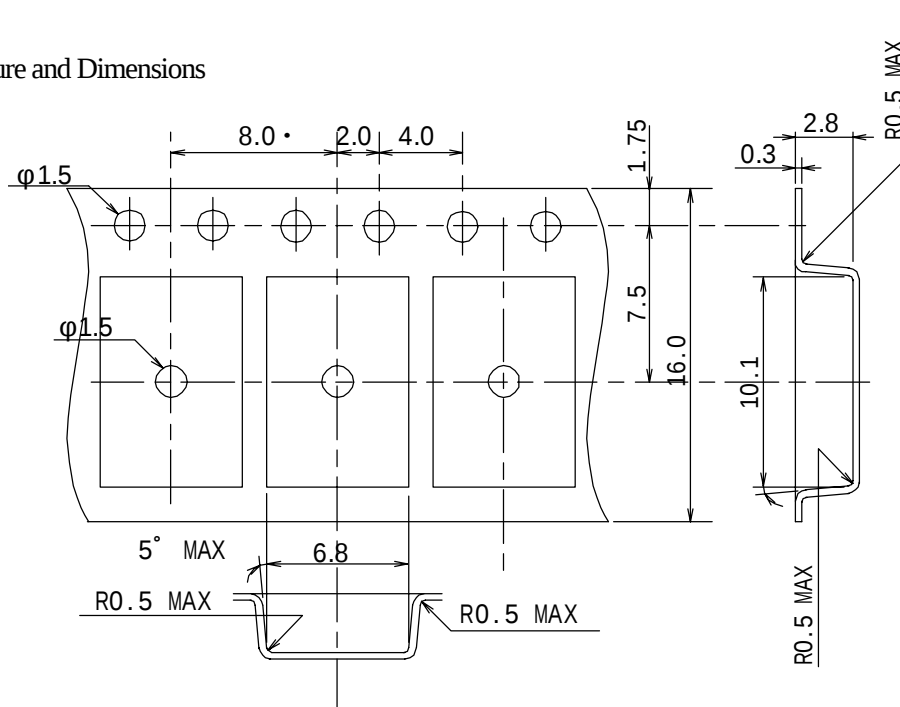
(1) Joint of tape

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



Dimensions : TYP. value

Unit : mm

Fig. B. Reel structure and Dimensions

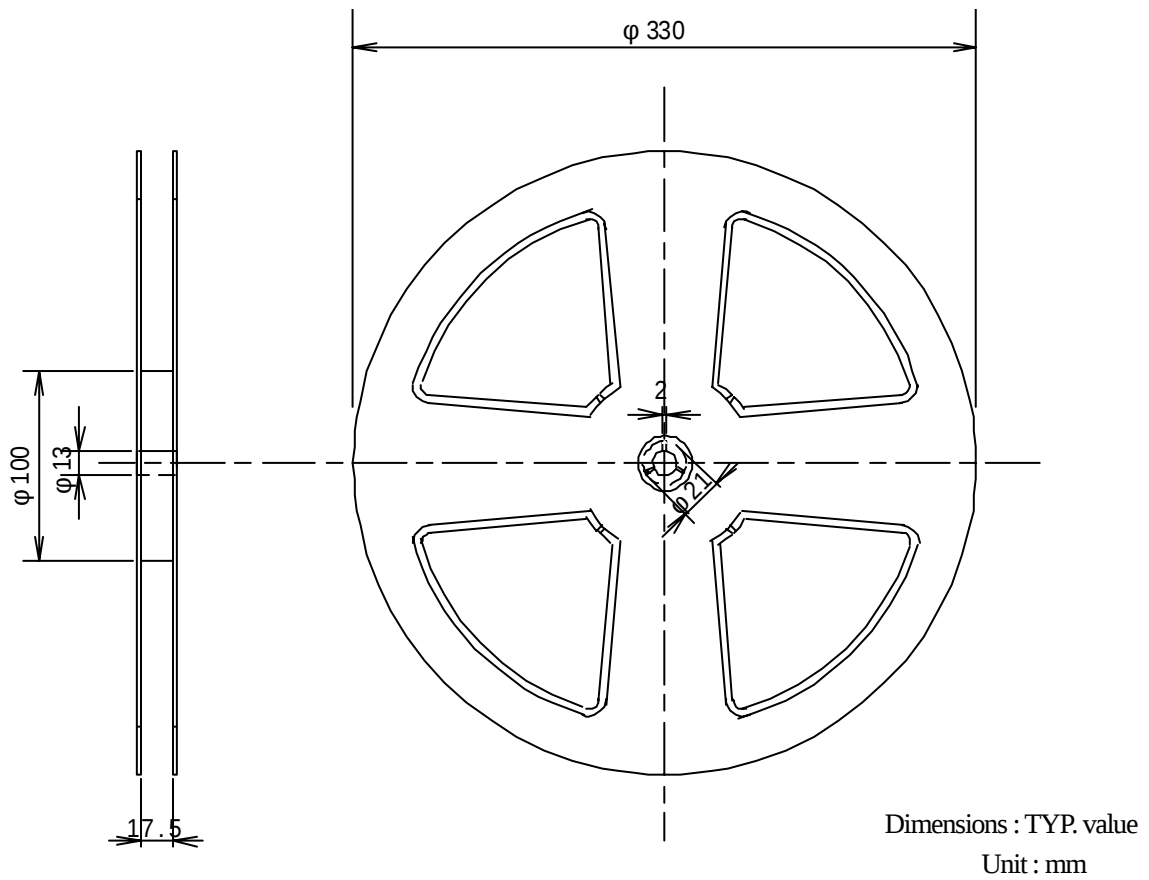
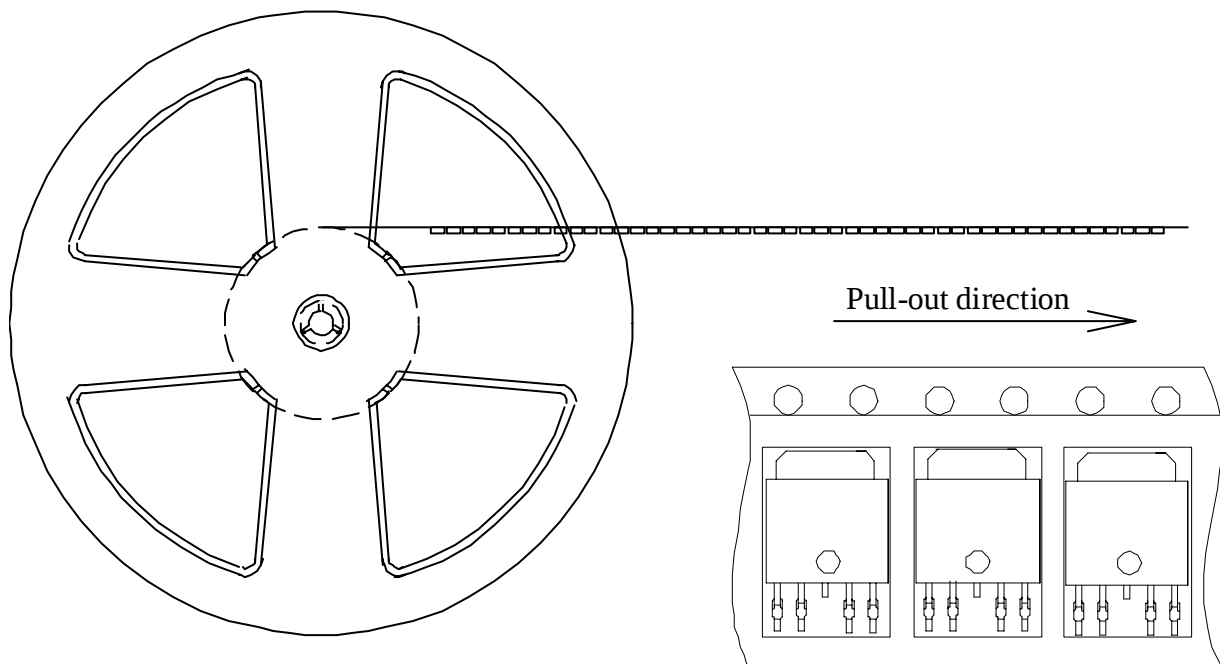
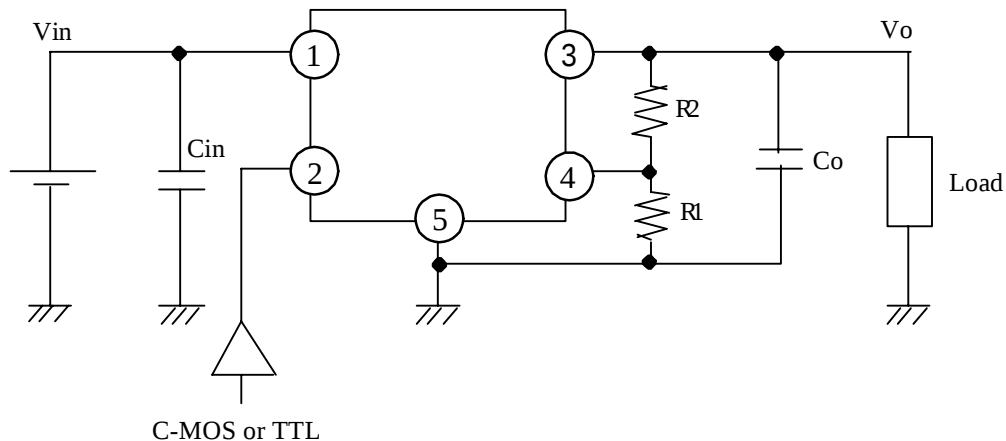


Fig. C Direction of product insertion

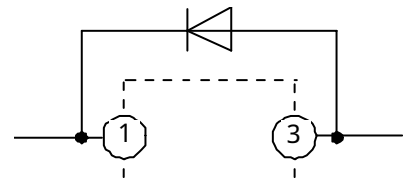


7. Notes

7.1 External connection



- (1) Please perform the shortest wiring for connection between C_{in} , C_o and the individual terminal. There is case that oscillation occurs easily by kinds of capacitor capacity and how to wire. Before you use this device, you should confirm output voltage in your actual using conditions.
- (2) The output ON/OFF control input terminal 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 pull up the ON/OFF terminal without resistance to input voltage.
- (3) As 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 than the voltage of the DC input terminal, breakdown of the device may occur. Especially in the case that the DC input terminal 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 be caused 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.

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

If the ambient temperature and P_d at the device operating state, make the thermal design enough to radiate the heat 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 $10M\Omega$ or more) from the commercial power supply. Also the solder dip basin must be grounded.

7.4 Soldering

(1) Reflow soldering

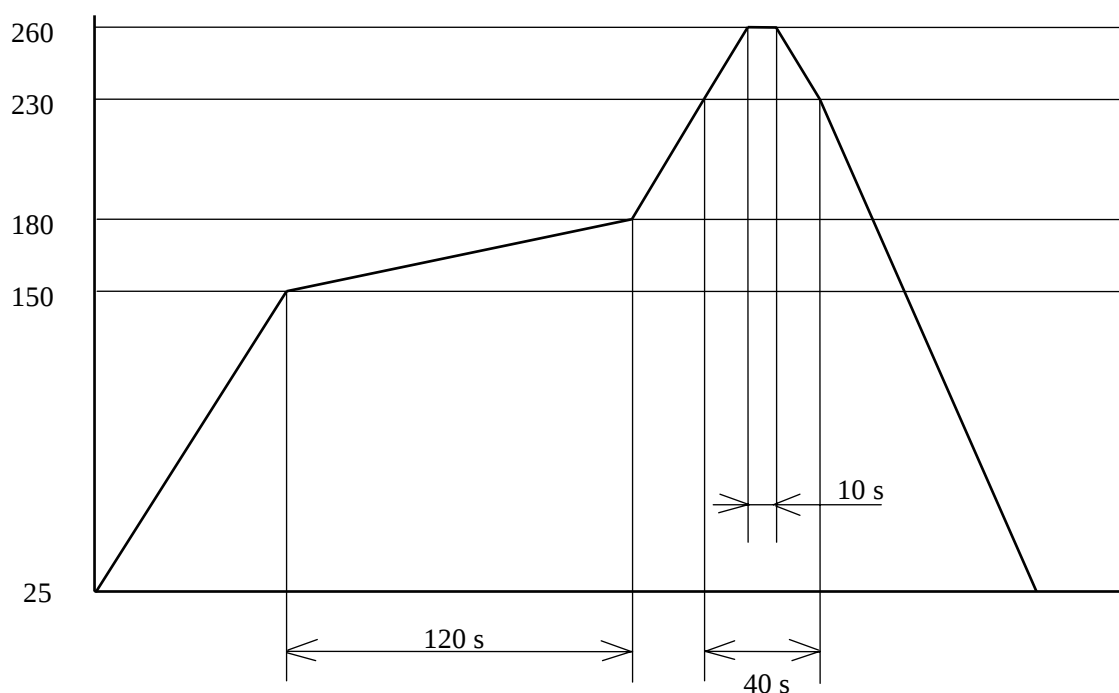
Soldering be done two times or less at the temperature and the time within the temperature profile as shown in the figure.

(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.

However, please obey the following instructions.

- (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 with in the temperature profile below.
- (b) The temperature gradient when soldering-reflow is 4 /s or less.



(2) Dip soldering

We recommend that solder dip should be 260 or less (Solder temp.), 10s or less 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 or dip soldering.

In case when hand soldering is reluctantly needed for modification etc.

Only one hand soldering should be done at 260 or less of soldering iron edge temperature, for 10s or less.

Please be carefully not to give any external force on terminals by soldering iron.

For example, soldering iron should not touch terminals directly.

Even within 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 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 , , allows the output voltage to be fine tuned from 3V to 20V.

Refer to the figure below and "Paragraph 6.3 Output voltage adjustment characteristics" when

connecting external resistors for fine tuning output voltage.

