December 1, 1999
K. Shirai

APPROVED BY: DATE:

Y. Y. Dec. 1 '99

SHARP

ELECTRONIC COMPONENTS
GROUP SHARP CORPORATION

SPECIFICATION

ISSUE December 1, 1999
PAGE [illegible] Pages
REPRESENTATIVE DIVISION
OPTO-ELECTRONIC DEVICES DIV.

REFERENCE

DEVICE SPECIFICATION FOR

VOLTAGE REGULATOR

MODEL No.

PQ***EZ01Z

Applied model name

☐	PQ015EZ01ZZ	☐	PQ015EZ01ZP
☐	PQ018EZ01ZZ	☐	PQ018EZ01ZP
☐	PQ025EZ01ZZ	☐	PQ025EZ01ZP
☐	PQ030EZ01ZZ	☐	PQ030EZ01ZP
☐	PQ033EZ01ZZ	☐	PQ033EZ01ZP

1. These specification sheets include materials protected under copyright of Sharp Corporation ("Sharp"). Please do not reproduce or cause anyone to reproduce them without Sharp's consent.

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.

CUSTOMER'S APPROVAL

DATE

BY

DATE

PRESENTED
BY K. H.

K. Hachimura,
Department General Manager of
Engineering Dept.,II
Opto-Electronic Devices Div.
ELECOM Group
SHARP CORPORATION

1. Application

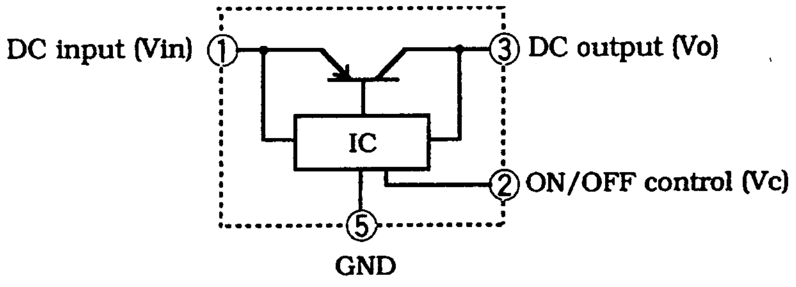
This specification applies to the outline and characteristics of tape packing type series regulator (linear type), Model No. PQ***EZ01Z.
Applied Model name

PQ015EZ01ZZ, PQ018EZ01ZZ, PQ025EZ01ZZ, PQ030EZ01ZZ, PQ033EZ01ZZ
PQ015EZ01ZP, PQ018EZ01ZP, PQ025EZ01ZP, PQ030EZ01ZP, PQ033EZ01ZP

Usage

PQ***EZ01Z are the device for stabilization of DC positive output voltage with built-in ON/OFF function, the over current protection function, the overheat protection function and low consumption current at OFF-state (stand-by).
These devices are 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, 9.

5. Outgoing inspection : Refer to the attached sheet, Page 9.

6. Supplement : Refer to the attached sheet, Page 10 to 15.

6.1 Example of application

6.2 Taping and reel packaging (PQ***EZ01ZP)

6.3 Sleeve packaging (PQ***EZ01ZZ)

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 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 16 to 18.

7.1 External connection

7.2 Thermal protection design

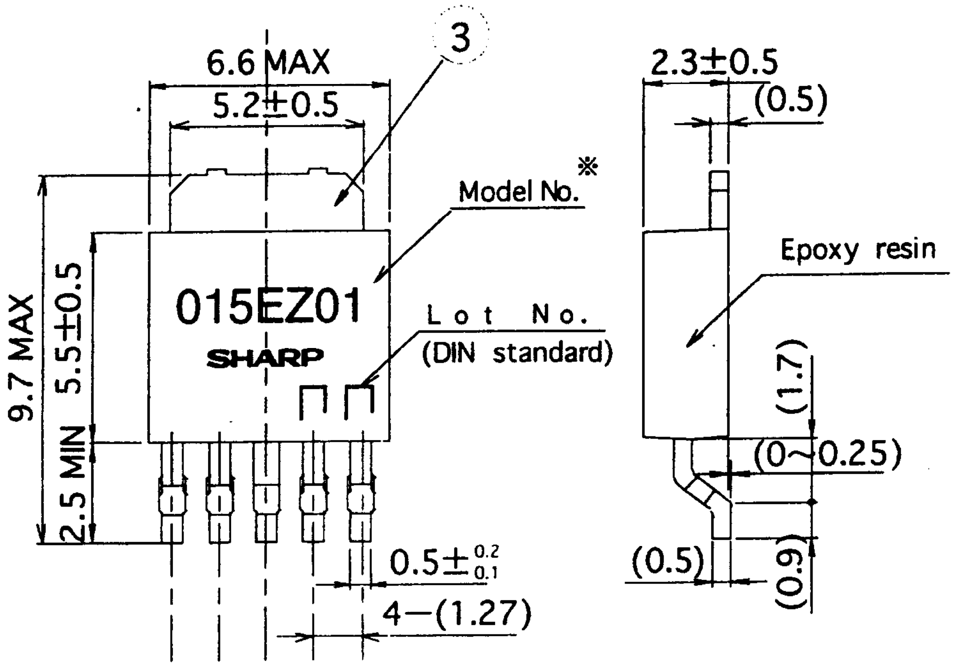
7.3 Static electricity

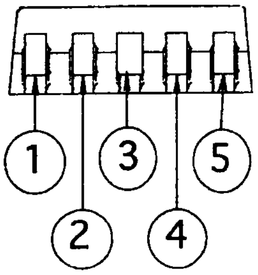
7.4 Soldering

7.5 For cleaning

REFERENCE

2. Outline





Applied model No.	Marked model No.
PQ015EZ01ZZ	015EZ01
PQ018EZ01ZZ	018EZ01
PQ025EZ01ZZ	025EZ01
PQ030EZ01ZZ	030EZ01
PQ033EZ01ZZ	033EZ01
PQ015EZ01ZZ	015EZ01
PQ018EZ01ZZ	018EZ01
PQ025EZ01ZZ	025EZ01
PQ030EZ01ZZ	030EZ01
PQ033EZ01ZZ	033EZ01

① DC input (Vin)
② ON/OFF control (Vc)
③ DC output (Vo)
④ NC
⑤ GND

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

- Lead finish : Solder plating
- Lead material : Cu
- Product mass : 0.3g

※ (Example of the marking in case of the PQ***EZ01Z)

3. Ratings and characteristics

3.1 Absolute maximum ratings

Ta=25℃

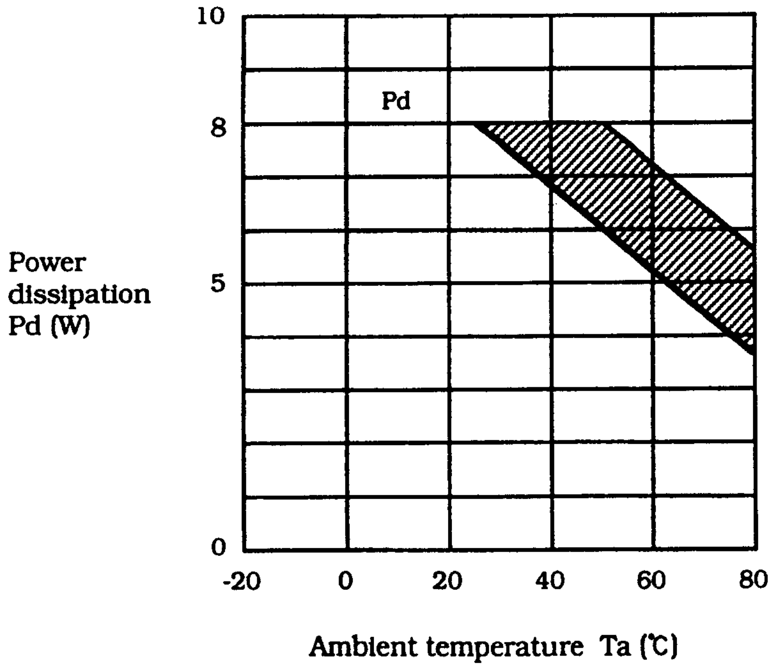
Parameter	Symbol	Rating	Unit	Conditions
Input voltage (*1)	Vin	10	V	
Output control voltage (*1)	Vc	10	V	
Output current	Io	1	A	
Power dissipation (*2)	Pd	8	W	Refer to Fig. 1
Junction temperature (*3)	Tj	150	℃	
Operating temperature	Topr	-40 to +85	℃	
Storage temperature	Tstg	-40 to +150	℃	
Soldering temperature	Tsol	260	℃	For 10 s

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

(*2) Pd : With infinite heat sink

(*3) There is case that over heat protection operates at the condition Tj=125℃ to 150℃

Fig. 1 Pd - Ta rating



Pd : With infinite heat sink

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

3.2 Electrical characteristics

Unless otherwise specified condition shall be Vin=Vo(TYP)+1V, Io=0.5mA, Vc=2.7V, Ta=25℃

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Conditions
Input voltage	Vin	2.35	-	10	V	
Output voltage	Vo	Refer to list 1			V	
Load regulation	RegL	-	0.2	2.0	%	Io=5mA to 1A
Line regulation	RegI	-	0.1	1.0	%/V	Vin=Vo(TYP)+1V to Vo(TYP)+6V Io=5mA
Temperature coefficient of output voltage	TcVo	-	±0.01	-	%/℃	Io=5mA Tj=0 to 125℃
Ripple rejection	RR	45	60	-	dB	Refer to Fig.3
Dropout voltage	Vi-o	-	0.2	0.5	V	(*5), Io=0.5A
On-state voltage for control	Vc (on)	2.0	-	-	V	
On-state current for control	Ic (on)	-	-	200	μA	
Off-state voltage for control	Vc (off)	-	-	0.8	V	
Off-state current for control	Ic (off)	-	-	2	μA	Vc=0.4V
Quiescent current	Iq	-	1	2	mA	Io=0A
Output off-state consumption current	Iqs	-	-	5	μA	Io=0A Vc=0.4V

(*4) Applied to PQ030EZ01Z and PQ033EZ01Z.
(*5) Input voltage when output voltage falls 0.95Vo by input voltage falling down.
(*6) In case that the control terminal (③ pin) is non-connection, output voltage should be OFF state.

List 1 Output voltage

Model No.	Symbol	MIN	TYP	MAX	Unit	Condition
PQ015EZ01Z	Vo	1.45	1.5	1.55	V	
PQ018EZ01Z	Vo	1.75	1.8	1.85	V	
PQ025EZ01Z	Vo	2.438	2.5	2.562	V	
PQ030EZ01Z	Vo	2.925	3.0	3.075	V	
PQ033EZ01Z	Vo	3.218	3.3	3.382	V	

3.3 Electrical characteristics measuring circuit

Fig. 2 Standard measuring circuit of Regulator portion

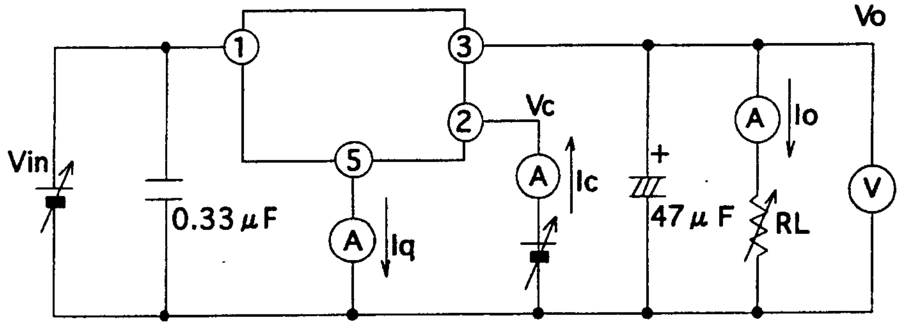
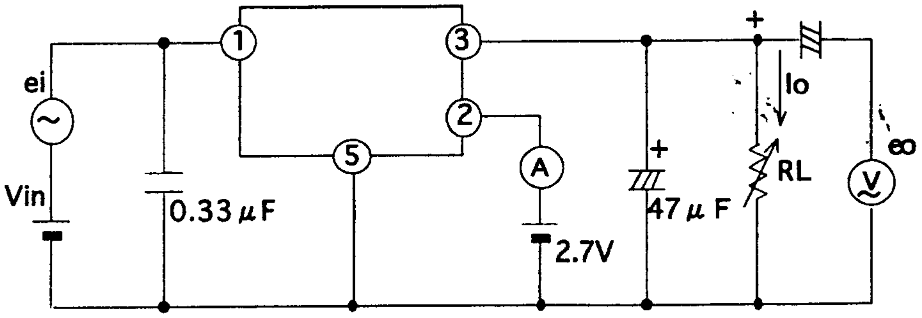
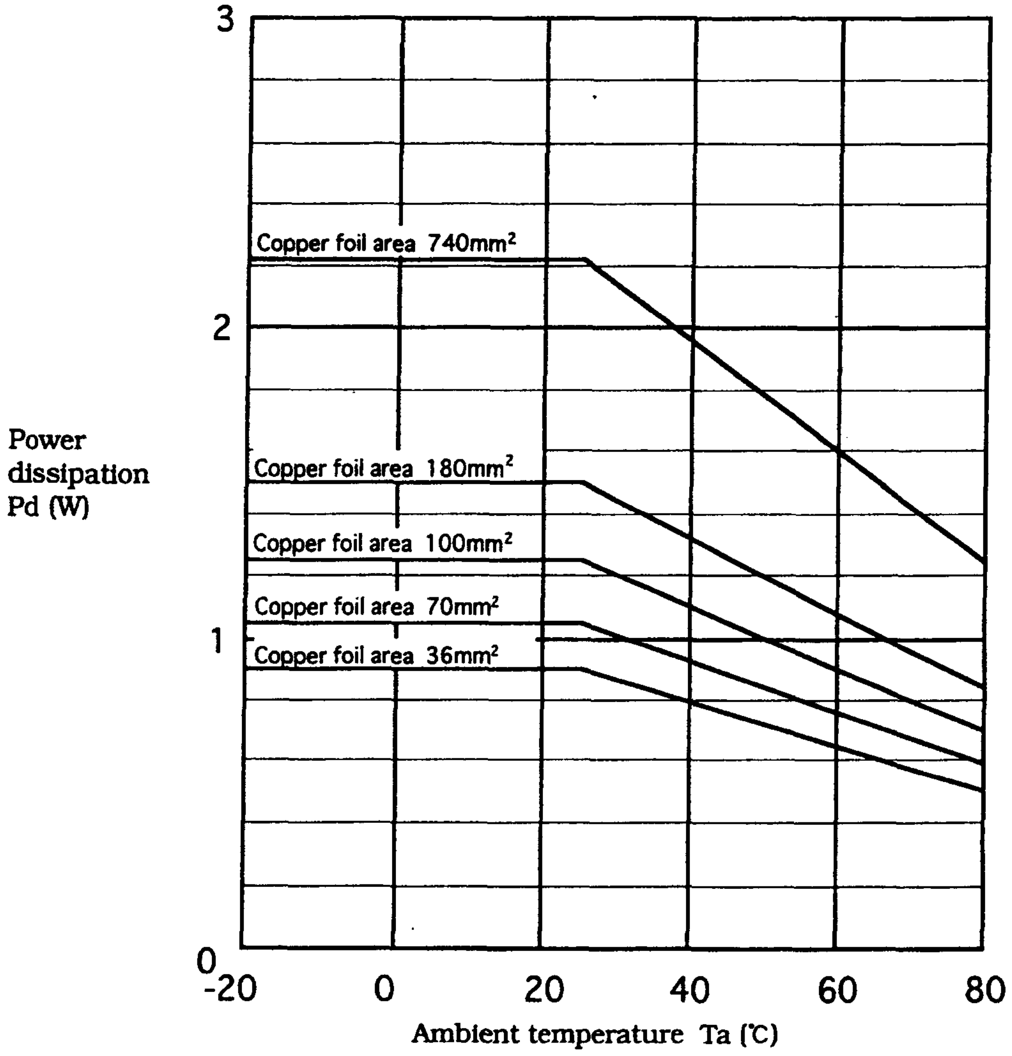


Fig. 3 Standard measuring circuit of critical rate of ripple rejection

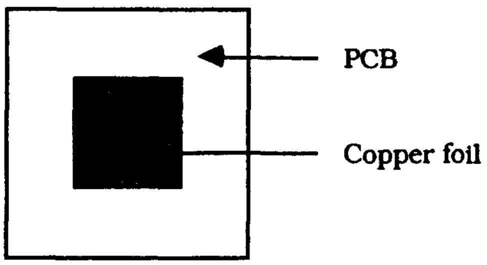
f=120Hz sine wave
ei(rms)=0.5V
Vin=Vo(TYP)+1V
Io=0.3A
RR=20 log {ei(rms)/eo(rms)}



3.4 Pd - Ta rating (Typical value)



Mounting PCB



Material : Glass-cloth epoxy resin
Size : 50 × 50 × 1.6mm
Thickness of copper : 35 μm

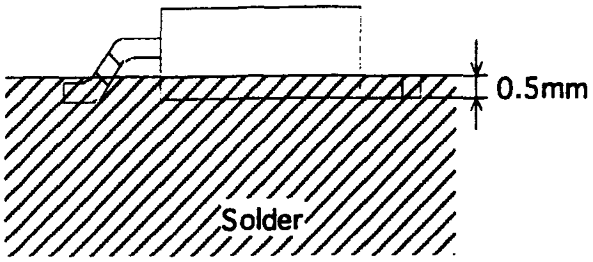
4. Reliability

The reliability of products shall satisfy items listed below.

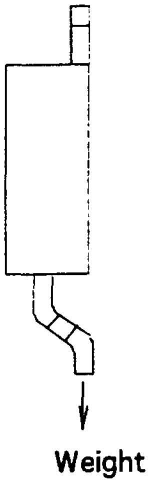
Confidence level : 90%
LTPD : 10%/20%

Test Items	Test Conditions	Failure Judgement Criteria	Samples (n) / Defective(C)
Temperature cycling	1 cycle -40℃ to +150℃ (30min) (30min) 20 cycles test	Vo<L×0.8 Vo>U×1.2 RegL>U×1.2 RegI>U×1.2 RR<L×0.8 Vi-o>U×1.2 *4 U: Upper specification limit L: Lower specification limit	n=22, C=0
Humidity (Steady State)	+60℃,90%RH, 1000h		n=22, C=0
Damp Heat cyclic	1 cycle : -20℃ to 70℃ (2h) (2h) Transfer time between high and low temp. is 1h. 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	Ta=25℃, Pd=0.8W, 1000h		n=22, C=0
Mechanical shock	15km/s^2, 0.5ms 3 times/ ±X, ±Y, ±Z		n=11, C=0
Vibration (Variable frequency)	200m/s^2 100 to 2000 to 100Hz/4 min 4 times/ X, Y, Z direction		n=11, C=0
Electrostatic discharge	±250V, 200pF, 0Ω Between GND and each terminal/ 3 times		n=11, C=0
Soldering heat	260℃, 10 s, Dip up to 0.5mm from resin portion *1		n=11, C=0
Robustness of Termination (Tensile test)	Weight: 10N 10 s/ each terminal *2	Failure if it has breakdown and loosened pin. *5	n=11, C=0
Robustness of Termination (Bending test)	Weight: 2.5N 0° ~90° ~0° ~-90° ~0° each terminal *3		n=11, C=0
Solderability	230±5℃, 5±0.5 s Use rogin flux *1	Failure if solder shall not be adhere at the area of 95% or more dipped portion. *6	n=11, C=0

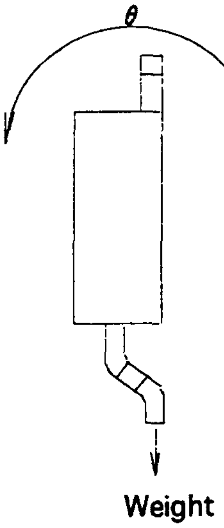
*1 Soldering area is shown below.



*2 Terminal tensile direction is shown below.



*3 Terminal bending direction is shown below.



*4 Applied to PQ030EZ01Z and PQ033EZ01Z.

*5 Except for the bending of terminal.

*6 Except for the portion within 0.5mm from the interface between the heat sink and the resin portion, and the side surface of heat sink.

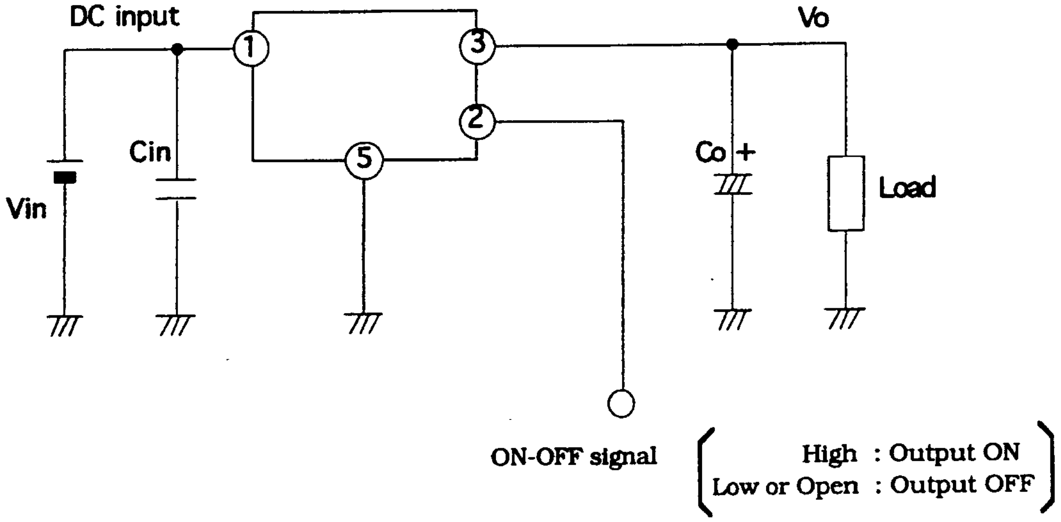
5. Outgoing inspection

TABLE II-A single sampling plans for normal inspection 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 Unreadable marking	0.1	Depend on the specification
Minor defect	Appearance Dimensions	0.4	

6. Supplement

6.1 Example of application



6.2 Packing specifications (PQ***EZ01ZP)

6.2.1 Packing conditions

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

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

The reel shall be made of polystyrene. Dimensions are shown 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 from 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 : 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

One reel shall contain 3000 pcs.

REFERENCE

6.2.4 Indication

(1) Reel

The reel shall be pasted label with following information.

* 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 condition

Taped products shall be stored at the temperature lower than 5 to 30℃ and the humidities lower than 70%RH. If taped products aren't used longer than for 10days, Please rewind the tape pulled out and storage.

6.2.6 Others

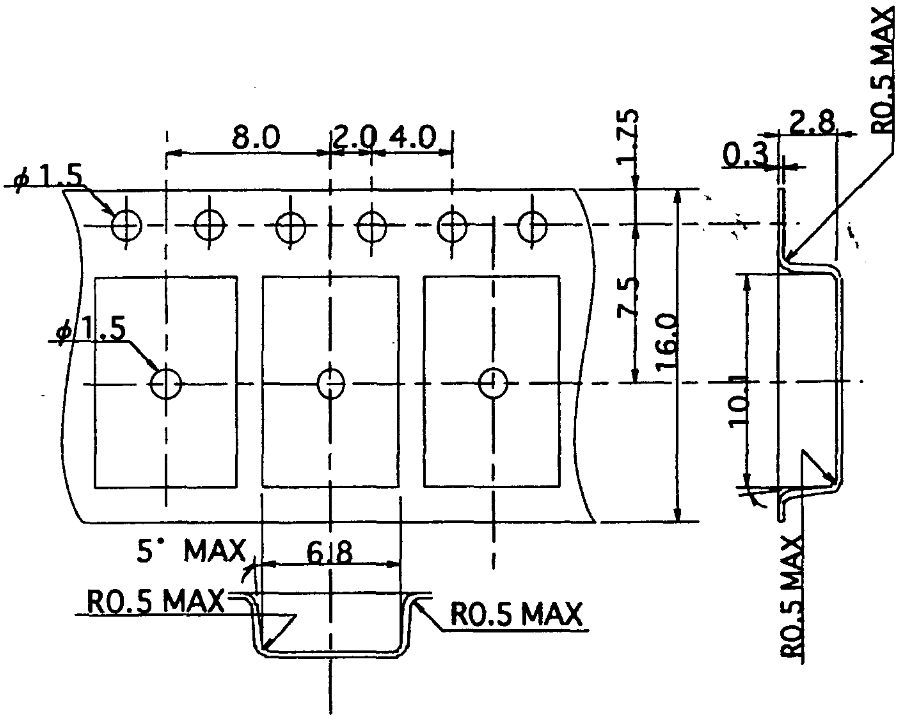
(1) joint of tape

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

(2) The way to repair taped failure devices

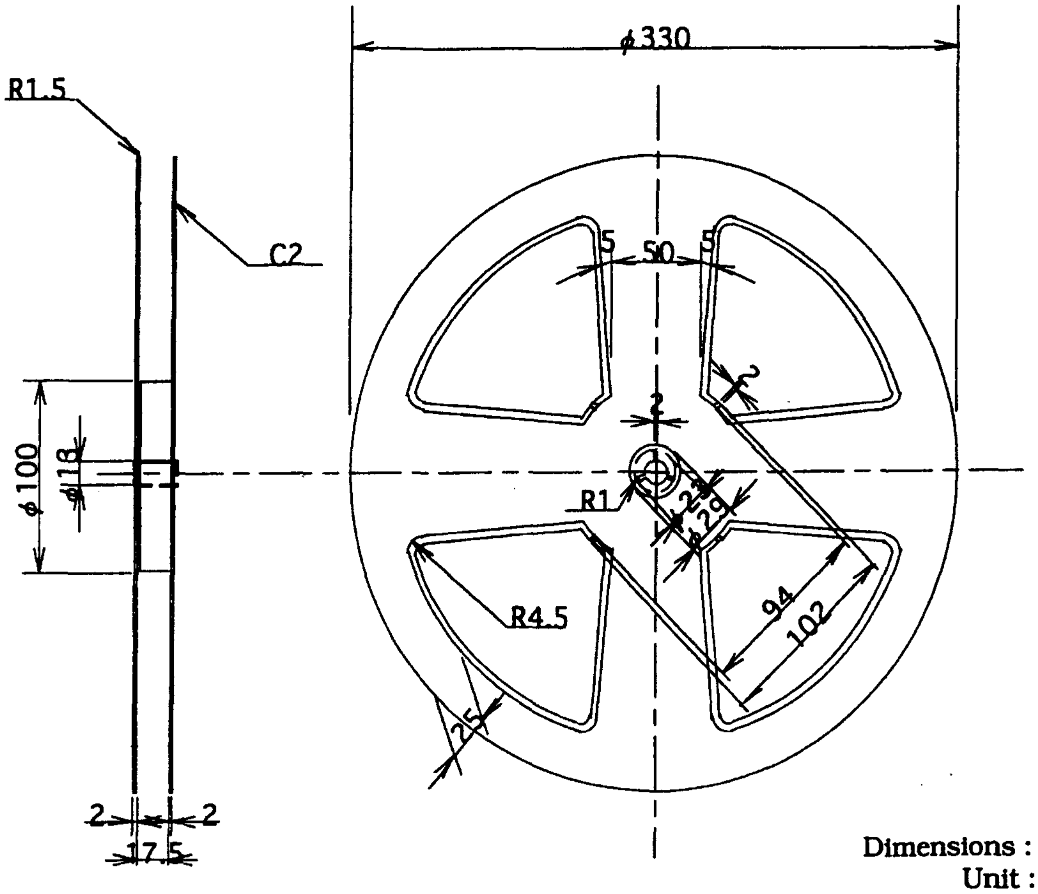
The way to repair taped failure devices cut a bottom of carrier tape with a cutter, and after replacing to good devices, the cutting portion shall be sealed with adhesive tape.

Fig. A Tape structure and Dimensions



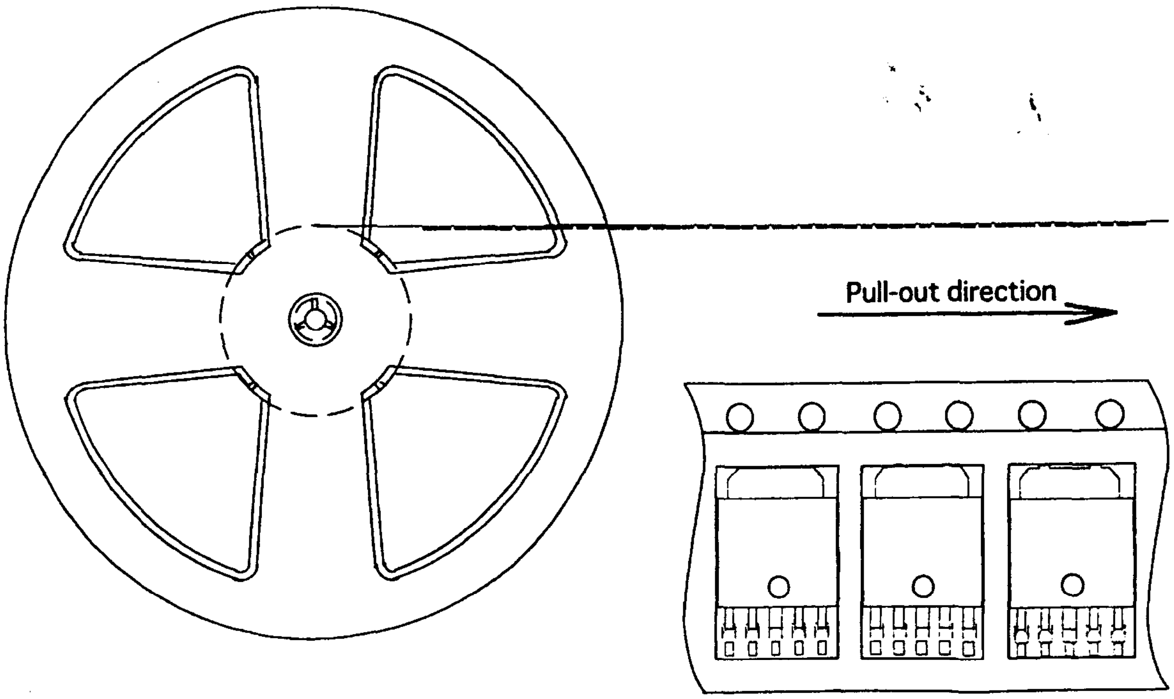
Dimensions : TYP. value
Unit : mm

Fig. B Reel structure and Dimensions



Dimensions : TYP. value
Unit : mm

Fig. C Direction of product insertion



6.3 Sleeve packaging (PQ***EZ01ZZ)

6.3.1 Packing conditions

(1) Sleeve structure and Dimensions (Refer to Fig. D)

The sleeve shall be made of high inpuct polethylene
(Plastics with preventing static electricity).
Dimensions are shown Fig. D.

(2) The packing case shall be made of corrugated cardboard.
Dimensions are shown Fig. F.

(3) Stopper structure

The stopper shall be made of styrene butadiene rubber.

6.3.2 Packaging method and quantity

(1) Packaging method

Max. 75pcs. of products shall be packaged in a sleeve and both of sleeve edges shall be fixed by stoppers. Fix the packing case by kraft tape.

(2) Quantity (Refer to Fig. E)

One package shall contain 3000pcs./package.

6.3.3 Indication

(1) Packing case

The packing case shall be marked with following information.

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

REFERENCE

Fig. D

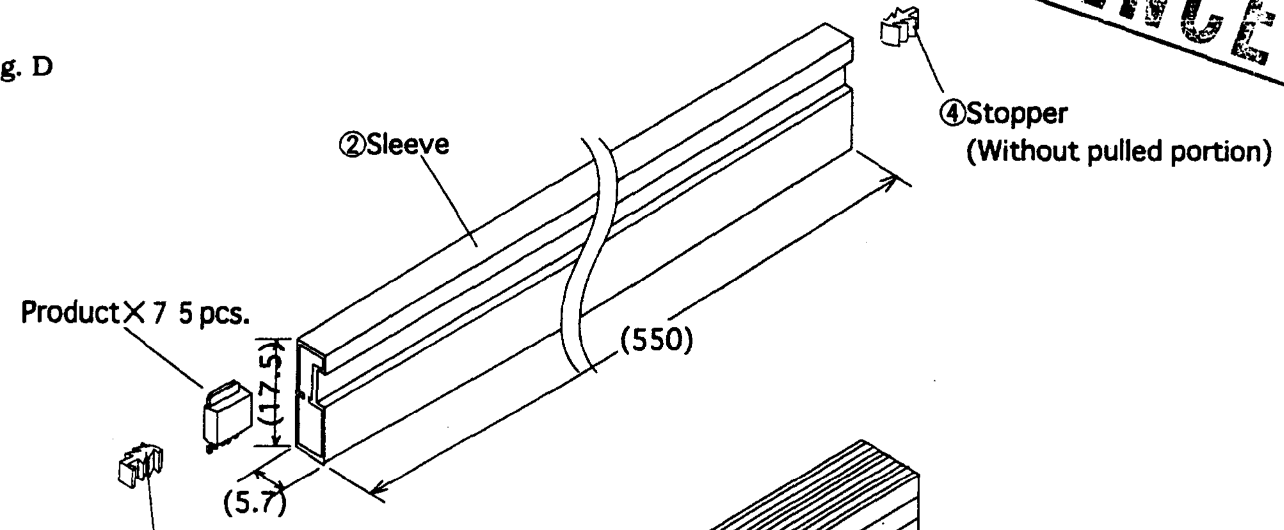


Fig. E

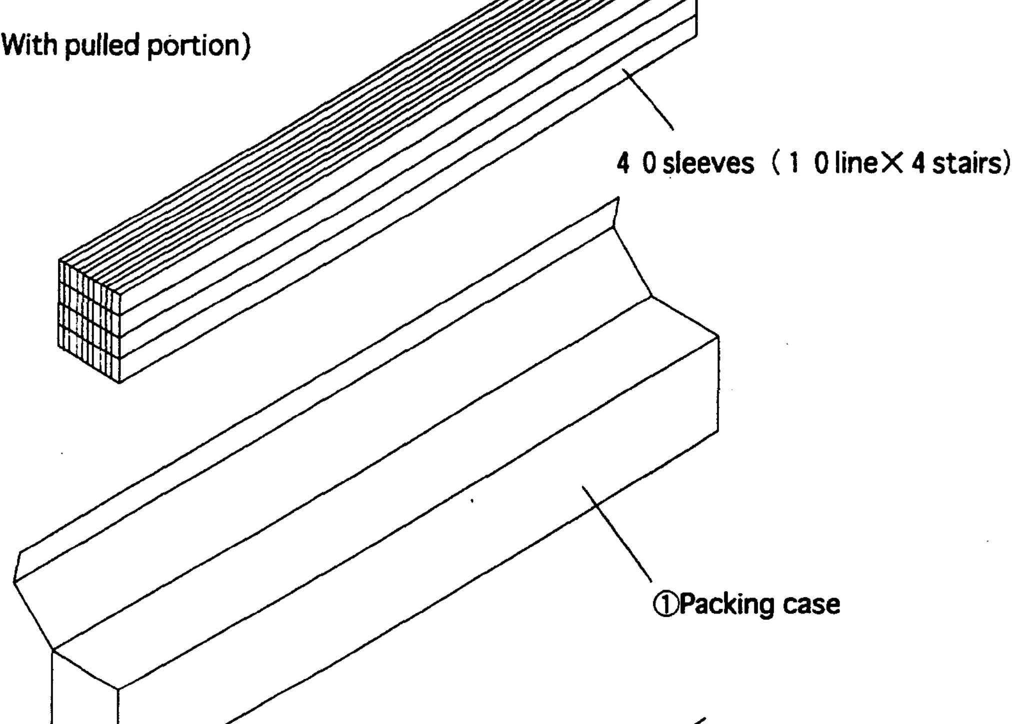
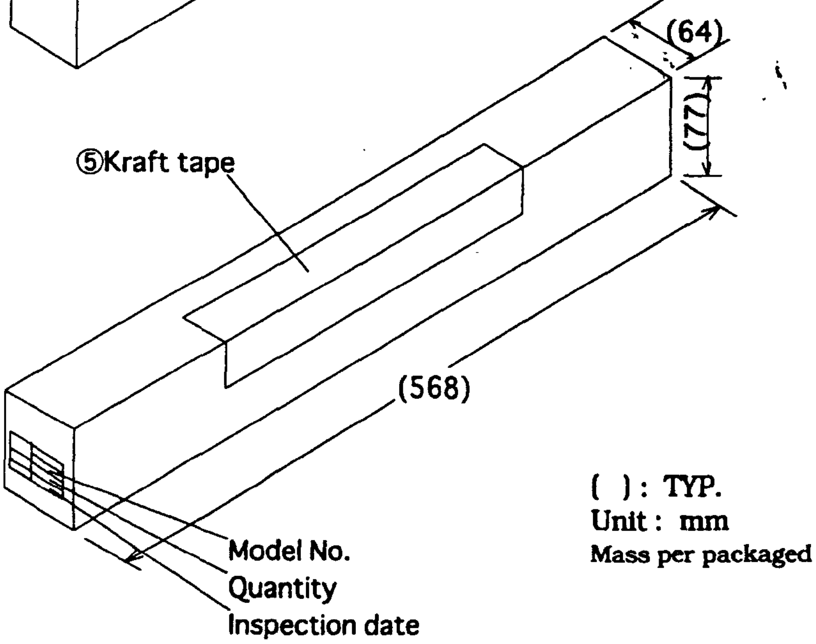


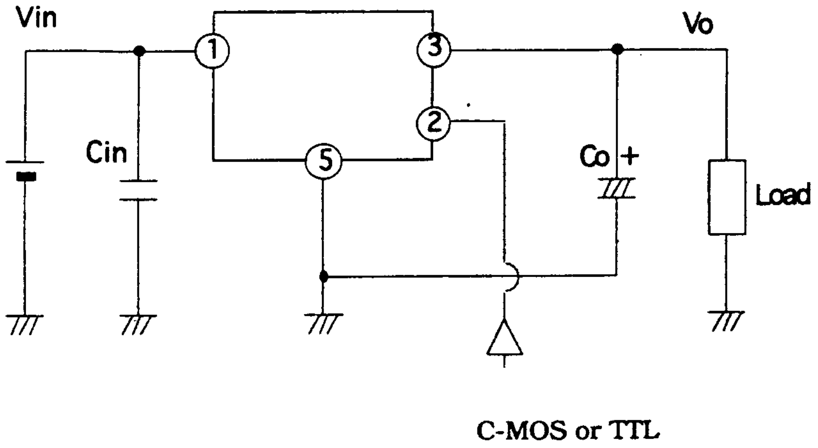
Fig. F



( ) : TYP.
Unit : mm
Mass per packaged case : 1.6kg TYP

7. Notes

7.1 External connection



(1) Please perform shortest wiring for connection between Cin, Co 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) The input terminal for ON/OFF output control ; ② 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 ; ① 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.

7.2 Thermal protection design

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

$$Pd=Io\times(Vin-Vo)+Vin\times Iq$$

If the maximum operating temperature and Pd (MAX.) 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 gives an unfavorable influence to the normal operation and reliability of the device. In the case of no passage within 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 10MΩ or more) from the commercial power supply. Also the solder dip basin must be grounded.

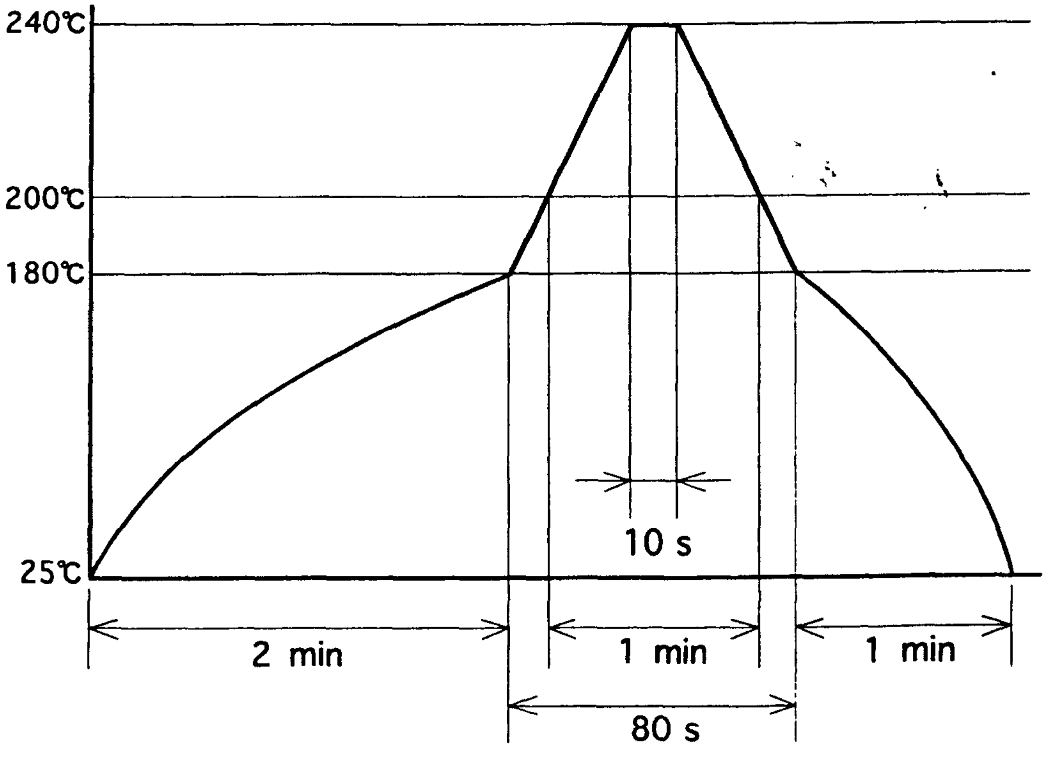
7.4 Soldering

(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 become at the device which is the room temperature.

(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 sloping when soldering-reflow is 4℃/s or less.



(2) Dip soldering

We recommend that solder dip should be 260℃ or less (Solder temp.) within 10s and 1 time only. Please obey the note items below concerning solder reflow.

(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., it is recommended that only one hand soldering should be done at 260℃ or less of soldering iron edge temperature, for 10s 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.

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 For 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

In case 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.