To: Ｄｉｇｉ-Ｋｅｙ

Issue No. : EZJ08022901

Date of Issue : February 29.2008

Classification : ■ New ☐ Changed ☐

PRODUCT SPECIFICATION FOR APPROVAL

Product Description : MULTILAYER VARISTOR , CHIP TYPE

Product Part Number : ＥＺＪＰ０Ｖ０８０ＭＡ
ＥＺＪＰ０Ｖ０８０ＫＡ
ＥＺＪＰ０Ｖ０８０ＧＡ

Customers Part Number :

Country of Origin : Japan

Applications : Consumer Type Electric Equipment

※If you approve this specification, please fill in and sign the below and return 1copy to us.

Approval No :

Approval Date :

Excecuted by :

(signature)

Title :

Dept. :

Prepared by : Engineering Section

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Authorized by : Y.Sakaguti
Title : Manager of Engineering

If there is a question, please ask the engineering section about it directly.

CLASSIFICATION	SPECIFICATIONS	No. 151S-EZJ-KPB357E
SUBJECT	Multilayer Varistor,Chip Type EIA:0402size Individual Specification EZJP0V080□A	PAGE 1 of 1 DATE 28 Feb, 2008

1. Scope

This specification applies to Multilayer Varistor,Chip Type EZJP series,size 0402(EIA).

2. Style and Dimensions

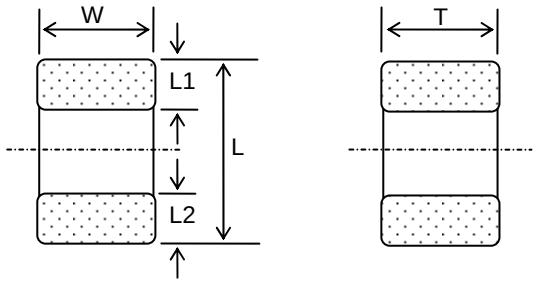


Table 1

Symbol	Dimensions(mm)
L	1.00 +/- 0.05
W	0.50 +/- 0.05
T	0.50 +/- 0.05
L1,L2	0.2 +/- 0.1

3. Operating Temperature Range / Storage Temperature Range

- 40 to 85 ºC

4. Explanation of Part Numbers

E Z J Product Code　P Series Code　0　V　0 8 0　M　A Design Code　(Ex.)

Size Code
Table 2

Code	Size
0	EIA:0402

Packaging Styles
Table 3

Code	Packaging Styles	
V	ϕ180Reel Paper Taping	
	EIA:0402 size	10,000pcs./reel

Varistor Voltage
The first digits are significant figures and the third one denotes the number of zeros following.

Capacitance Code
Table 4

Code	Capacitance
M	680 pFmax.
K	330 pFmax.
G	100 pFmax.

5. Part Number and Individual Specification

Part Number	Maximum Allowable Voltage	Varistor Voltage at 1mA	Capacitance at 1MHz	Clamping Voltage at 8/20us,1A	Maximum Peak Current at 8/20us
EZJP0V080MA	DC 5.6 V	6.8 ~ 10.2 V	680 pFmax.	18 Vmax.	20 A
EZJP0V080KA	DC 5.6 V	6.8 ~ 10.2 V	330 pFmax.	19 Vmax.	15 A
EZJP0V080GA	DC 5.6 V	6.8 ~ 10.2 V	100 pFmax.	20 Vmax.	3 A

Note ;

Panasonic Electronic Devices Co., Ltd.	APPROVAL	CHECK	DESIGN
	Y.Sakaguti	T.Kawamura	Y.Sasaki

CLASSIFICATION	SPECIFICATIONS	No. 151S-EZJ-KPG357E
SUBJECT	Multilayer Varistor , Chip Type Common Specification(EZJP Series)	PAGE 1 of 5
		DATE 28 Feb,2008

1. Information

1- 1.Applicable laws and regulations

(1) Any ozone-depleting substances listed in the Montreal Protocol are not used in the manufacturing processes for parts and materials used in this product.
(2) PBB and PBDE are intentionally excluded from materials used in this product.
(3) All the materials used in this product are registered materials under the Law Concerning Examination and Regulation of Manufacture and Handling of Chemical Substances.
(4) This product complies with the RoHS, DIRECTIVE 2002/95/EC on the Restriction of the use of certain Hazardous Substances in electrical and electronic equipment.
(5) This product is exported with export procedures under export related laws and regulations such as the Foreign Exchange and Foreign Trade Law.

1- 2.Limitation in Applications

This product was designed and manufactured for general-purpose electronic equipment such as household, office, information & communication equipment. When the following applications, which are required higher reliability and safety because the trouble or malfunction of this product may threaten the lives and/or properties, are examined, separate specifications suitable for the application should be exchanged.

・Aerospace / Aircraft equipment, Warning / Antitheft equipment, Medical equipment, Transport equipment (Motor vehicles, Trains, Ship and Vessel), Highly public information processing equipment, Others equivalent to the above.

1- 3.Production factory

(1) Panasonic Electronic Devices Hokkaido Co., Ltd.
(2) Panasonic Electronic Devices (Tianjin) Co., Ltd. (PEDTJ)

2. Scope

2- 1.This specification applies common specification to multilayer varistor/chip type .If there is a difference between this common specification and any individual specifications, priority shall be given to the individual specifications.

2- 2.This product shall be used for general-purpose electronic equipment such as audiovisual, household, office, information & communication equipment.

Unreasonable applications may accelerate performance deterioration or short/open circuits as failure modes affecting the life end.Adequate safety shall be ensured especially for product design required a high level of safety with the following considerations.

1)Previously examine how a single trouble in this product affects the end product.
2)Design a protection circuit as Failsafe-design to avoid unsafe system resulting from a single trouble with this product.

Whenever a doubt about safety arises from this product, immediately inform us for technical consultation without fail, please.

2-3.This specification is a part of contract documents pertaining to the trade made by and between your company and Matsushita Electric Industrial Co., Ltd.

2-4.The change of product specification for approval and the change influenced performance, quality and environment is determined on prior consultation.

3. Part Number Code

1	2	3	4	5	6	7	8	9	10	11	12
E	Z	J	P	0	V	0	8	0	M	A	
(1)			(2)	(3)	(4)	(5)			(6)	(7)	(8)

3- 1.Common Code (1)

EZJ : Multilayer Varistor , Chip Type

3- 2.Series Code(2)

P:EZJP series

Note ;

3- 3.Size Code(3)
0:0402(EIA) 1:0603(EIA)

3- 4.Packaging Styles Code(4)
Shown in Individual Specification.

3- 5.Varistor voltage (5)
The first two digits are significant figures and third one denotes the number of zeros following.

3- 6.Capacitance Code (6)
A:3 pF R:20 pF D:27pF E:47 pF W:56 pF F:68 pF G:100 pF H:150 pF
J:220 pF K:330 pF M:680 pF
※ 3 pF or less are displayed a top 2 figures using 10 or 11 figures.
For example 2.0 pF : 20 1.5 pF : 15

3- 7.Design Code (7)
A specific code shall be given for identification as individual specification or design ranking if necessary.

3- 8.Special Code(8)
A specific code shall be given for identification as individual specification or design ranking if necessary.

None	Capacitance Tolerance : max.
B	Capacitance Tolerance : +/- 0.10 pF
C	Capacitance Tolerance : +/- 0.25 pF
D	Capacitance Tolerance : +/- 0.50 pF
K	Capacitance Tolerance : +/- 10 %
M	Capacitance Tolerance : +/- 20 %

4. Operating Temperature Range / Storage Temperature Range
Shown in Individual Specification.

5. Test
Unless otherwise specified, all tests and measurements shall be made at a temperature of 15 to 35℃ and at a relative humidity of 45 to 75%.
If results obtained are doubted, a further test should be carried out at a temperature of 20 +/- 2℃ and a relative humidity of 60 to 70%.

6. Structure
The structure shall be in a monolithic form as shown in Fig.1.

Fig.1

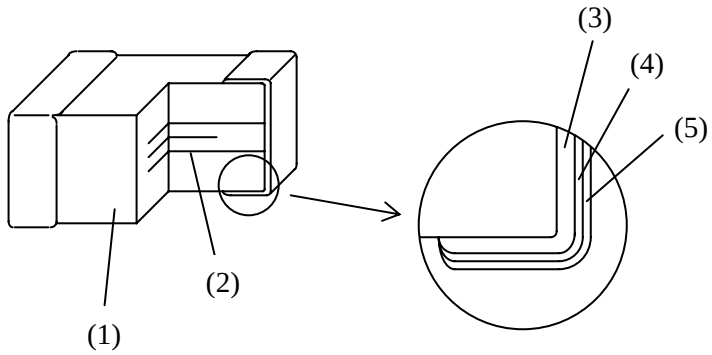
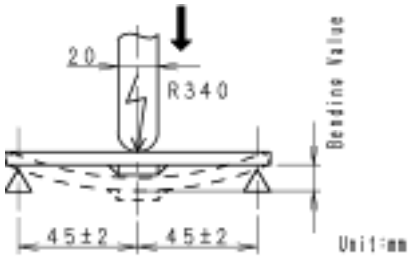


Table 1

No.	Name	
(1)	Semiconductive Ceramics	
(2)	Internal Electrode (Pd)	
(3)	Terminal Electrode	Substrate Electrode (Ag)
(4)		Intermediate Electrode (Ni)
(5)		External Electrode (Sn)

Note ;

Table 2

No	Contents		Performance	Test Method
1	Appearance		There shall be no defects which affect the life and use.	With a magnifying glass (3 times).
2	Dimensions		Shown in Individual Specification.	With slide calipers and a micrometer.
3	Maximum allowable voltage		Shown in Individual Specification.	The maximum DC voltage that can be applied continuously in the specified operating temperature.
4	Varistor voltage		Shown in Individual Specification.	The voltage between two terminals with the specified measuring current CmA DC applied is called Vc or Vc mA. The measurement shall be made as fast as possible to avoid heat affection.
5	Capacitance		Shown in Individual Specification.	Measuring Frequency: 1 MHz +/-10 %; Measuring Voltage: 1.0 +/-0.5 Vrms Our Measurement instrument is shown in the Table 3
6	Clamping voltage		Shown in Individual Specification.	The maximum voltage between two terminals with the specified impulse current(8/20 us).
7	Maximum peak current		Shown in Individual Specification.	The maximum current at less than +/-10 % of varistor voltage change when impulse current(8/20 us) is applied two times continuously with the interval of 5 minutes.
8	Maximum ESD		Shown in Individual Specification.	The maximum ESD within the varistor voltage change of +/-30 % when impressing 10 times of ESD(five times of positive-negative for each polarity) which is based on IEC61000-4-2.
9	Bending strength	Appearance	There shall be no cracks and other mechanical damage.	After soldering capacitor on the substrate 1 mm of bending shall be applied for 5 seconds. Bending speed : 1 mm/s (shown in Fig. 2) 
10	Solderability		More than 75 % of the soldered area of both terminal electrodes shall be covered with fresh solder.	Solder temperature : 230+/-5 °C Dipping period : 4+/-1 s Dip the specimen in solder so that both terminal electrodes are completely submerged. Use solder H63A(JIS-Z-3282). For the flux use rosin (JIS-K-5902) of ethanol solution of a concentration of about 25% by weight. Use tweezers for the holder to dip the specimen.

(continue)

Note ;

Table 2

<table>
<tr><th>No</th><th colspan="2">Contents</th><th>Performance</th><th>Test Method</th></tr>
<tr><td rowspan="2">11</td><td rowspan="2">Resistance to solder heat</td><td>Appear-ance</td><td>There shall be no cracks and other mechanical damage.</td><td rowspan="2">Solder temperature : 270+/-5 °C
Dipping period : 3 +/-0.5 s
Dipping position : Up to the positioin in which both terminal hides completely.
<table><tr><th>Order</th><th>Temperature(°C)</th><th>Period (S)</th></tr><tr><td>1</td><td>80 to 100</td><td>120 to 180</td></tr><tr><td>2</td><td>150 to 200</td><td>120 to 180</td></tr></table>
Use solder H63A(JIS-Z-3282). For the flux use rosin (JIS-K-5902) of ethanol solution of a concentration of about 25 % by weight.
Use tweezers for the holder to dip the specimen.</td></tr>
<tr><td>Varistor voltage</td><td>dVc/Vc : Within +/- 10.0 %</td></tr>
<tr><td rowspan="2">12</td><td rowspan="2">Tempera-ture cycle</td><td>Appear-ance</td><td>There shall be no cracks and other mechanical damage.</td><td rowspan="2">Solder the specimen to the testing jig shown in Fig.1. Condition the specimen to each temperature from step 1 to 4 in this order for the period shown in the table below.
Regarding this conditioning as one cycle, perform 5 cycles continuously.
<table><tr><th>Step</th><th>Temperature (°C)</th><th>Period (min.)</th></tr><tr><td>1</td><td>Minimum operation temperature +/- 3</td><td>30 +/-3</td></tr><tr><td>2</td><td>Room temperature</td><td>3 max.</td></tr><tr><td>3</td><td>Maximum operation temperature +/-5</td><td>30 +/-3</td></tr><tr><td>4</td><td>Room temperature</td><td>3 max.</td></tr></table></td></tr>
<tr><td>Varistor voltage</td><td>dVc/Vc : Within +/- 10.0 %</td></tr>
<tr><td rowspan="2">13</td><td rowspan="2">Damp Heat Laod

(Moisture Resistant Loading)</td><td>Appear-ance</td><td>There shall be no cracks and other mechanical damage.</td><td rowspan="2">The specimen shall be subjected to specified conditions and then stored at room temperature and normal humidity for 1 to 2 hours.
Thereafter,the change of V shall be measured.
Test temperature : 40 +/-2 °C
Relative humidity : 90 to 95 %
Laod : Maximum allowable voltage
Test period : 500 +24/0 h</td></tr>
<tr><td>Varistor voltage</td><td>dVc/Vc : Within +/- 10.0 %</td></tr>
<tr><td rowspan="2">14</td><td rowspan="2">High Tem-perature Laod

(High Tem-perature Resistant Loading)</td><td>Appear-ance</td><td>There shall be no cracks and other mechanical damage.</td><td rowspan="2">The specimen shall be subjected to specified conditions and then stored at room temperature and normal humidity for 1 to 2 hours.
Thereafter,the change of V shall be measured.
Test temperature : 125 +/-3 °C
Laod : Maximum allowable voltage
Test period : 1000 +24/0 h</td></tr>
<tr><td>Varistor voltage</td><td>dVc/Vc : Within +/- 10.0 %</td></tr>
</table>

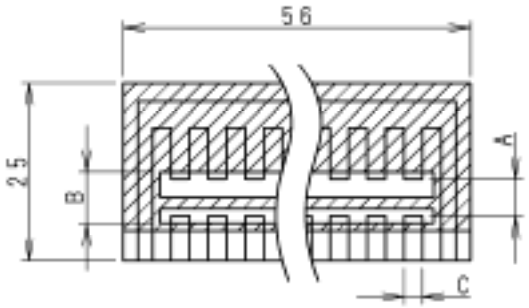
Note ;

When uncertainty occurs in the weather resistance characteristic tests (temperature cycle, moisture resistance, moisture resistant loading, high temperature resistant loading), the same tests shall be performed for the capacitor itself.

Table 3

	Our Measurement instrument
Measuring Instrument	4278A 1kHz/1MHz Capacitance Meter (Agilent Technologies)
Measuring mode	Parallel Mode
Recommended measuring jig	16034E Test Fixture (Agilent Technologies)

Fig. 1 Testing jig



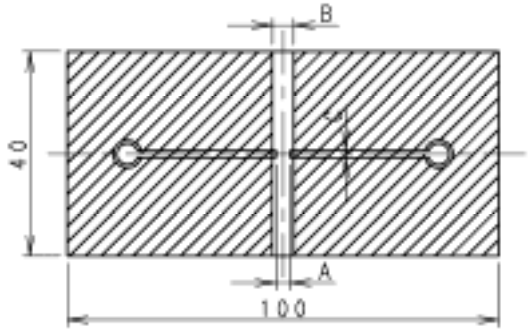
Material : Glass epoxy board
Thickness : 1.6mm
:Copper foil (0.035mm thick)
:Solder resist

Table 4

Size (EIA)	A	B	C
0402	0.5	1.5	0.6
0603	1.0	3.0	1.2

Unit : mm

Fig. 2 Testing jig



Material : Glass epoxy board
:Copper foil (0.035mm thick)
:Solder resist

Table 5

Type (EIA)	A	B	C	Board Thickness
0402	0.5	1.5	0.6	0.6
0603	1.0	3.0	1.2	1.6

Unit : mm

Note ;

1. Precautions for Use

The Multilayer Varistors (hereafter refereed to as “The Varistors”) are intended for general purpose applications as countermeasures against ESD and noise that can occur in consumer electronics (audio/visual, home, office, information & communication) equipment.
The Varistors may fail in a short circuit mode or in an open-circuit mode, when subjected to severe conditions of electrical, environmental and/or mechanical stress beyond the specified “Ratings” and “Conditions” in the catalog.
If it is used especially in the short state, there is a afraid that a circuit board may be damaged by fire by generation of heat by short current.
For products which require high safety levels, please carefully consider how a single malfunction can affect your product. Please examine a protection means to intercept short current.
The Varistors may fail in a short circuit mode in an open-circuit mode when subjected to severe conditions of electrical, environmental and/or mechanical stress beyond the specified “Rating and specified “Conditions” in the Specifications, resulting in burn out, flaming or glowing in the worst case.

2. Operating Conditions and Circuit Design

2- 1.Circuit Design

2-1-1. Operating Temperature and Storage Temperature

The specified “Operating Temperature Range” in the Specifications is the absolute maximum and minimum temperature rating. Every circuit mounting a Varistor shall be operated within the specified “Operating Temperature Range”. The Varistors mounted on PCB shall be stored without operating within the specified “Storage Temperature Range” in the Specifications.

2-1-2. Design of Voltage Application

The Varistors shall not be operated exceeding the specified “Maximum Allowable Voltage” in the Specification.
If the Varistors are operated beyond the specified Maximum allowable voltage, it may cause a short circuit and/or damage due to thermal run away.
If high frequency voltage or fast rising pulse voltage is applied continuously even within the “Rated Voltage”, contact our engineering section before use. Such continuous application affects the life of the Varistors.

2-1-3. Self-heating

The surface temperature of the Varistors shall be under the specified Maximum Operating Temperature in the Specifications including the temperature rise caused by self-heating. Check the temperature rise of the Varistor in your circuit.

2-1-4. Environmental Restrictions

The Varistors shall not be operated and / or stored under the following environmental conditions.

(1) Environmental conditions
   (a) Under direct exposure to water or salt water.
   (b) Under conditions where water can condense and/or dew can form.
   (c) Under conditions containing corrosive gases such as hydrogen sulfide, sulfurous acid, chlorine and ammonia.

(2) Mechanical conditions
   Under severe conditions of vibration or impact beyond the specified conditions in the Specifications.

Note ;

2- 2.Design of Printed Circuit Board

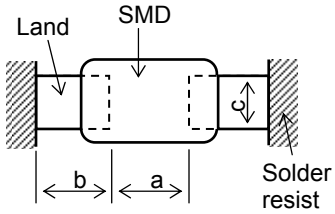
2-2-1. Selection of Printed Circuit Board

When the Varistors are mounted and soldered on an Aluminum Substrate, the substrate has influences on Varistor's reliabilities against "Temperature Cycles" and "Heat shock" because of difference in thermal expansion coefficient between them. Confirm that the actual board used does not deteriorate the characteristics of the Varistors.

2-2-2. Design of Land Pattern

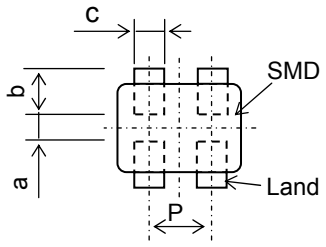
(1) Recommended land dimensions are shown below for proper amount of solder to prevent cracking at the time of excessive stress to the Varistors due to increased amount of solder.

{ Recommended land dimensions (Ex.) }



Unit : mm

Size Code (EIA)	Component Dimension L	W	T	a	b	c
0[0402]	1.0	0.5	0.5	0.4 to 0.5	0.4 to 0.5	0.4 to 0.5
1[0603]	1.6	0.8	0.8	0.8 to 1.0	0.6 to 0.8	0.6 to 0.8
2[0805]	2.0	1.25	0.6 to 1.25	0.8 to 1.2	0.8 to 1.0	0.8 to 1.0

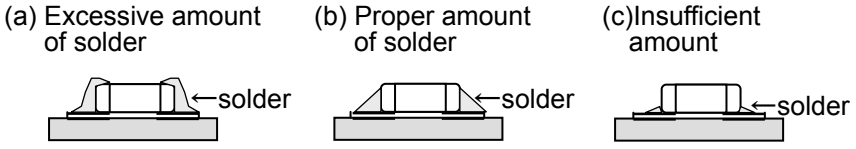


Unit : mm

Size Code	Component Dimension L	W	T	a	b	c	P
S (0504 2 array)	1.37	1.0	0.6	0.3 to 0.4	0.45 to 0.55	0.3 to 0.4	0.54 to 0.74

(2) The size of lands shall be designed to have equal spacing between the right and left sides. If the amount of solder on the right land is different from that on the left land, the component may be cracked by stress since the side with a larger amount of solder solidifies later during cooling.

Recommended Amount of Solder



2-2-3. Utilizatoin of Solder Resist

The applications of Solder resist are effective to prevent solder bridges and to control amounts of solder on PC boards.

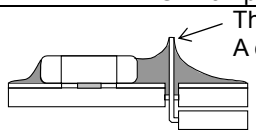
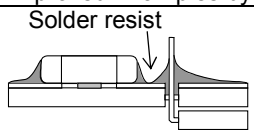
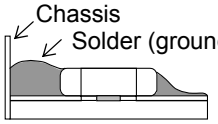
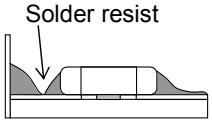
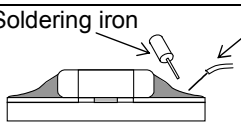
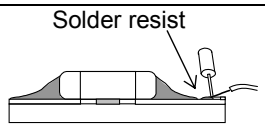
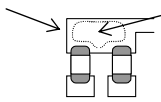
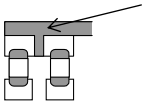
(1) Solder resist shall be utilized to equalize the amounts of solder on both sides.

(2) Solder resist shall be used to divide the pattern for the following cases;

- ·Components are arranged closely.
- ·The Varistor is mounted near a component with lead wires.
- ·The Varistor is placed near a chassis.

See the table below.

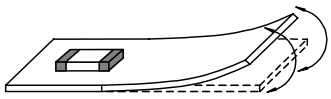
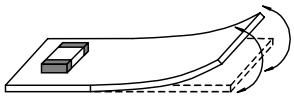
NG Examples and Recommended Examples

	NG Examples	Improved Examples by pattern division
Mixed mounting with a component with lead wires		
Arrangement near chassis		
Retrofitting of Component with lead wires		
Lateral arrangement		

2-2-4. Component Layout

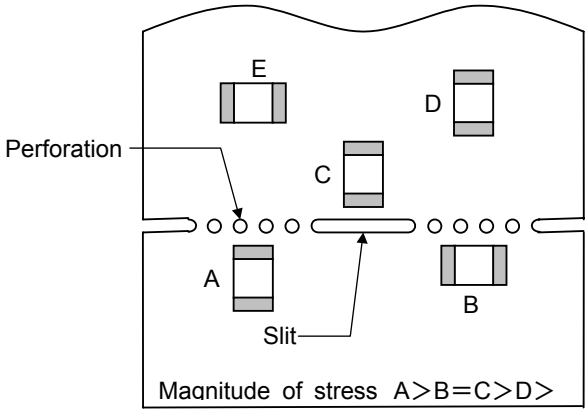
The Varistors / components shall be placed on the PC board so as to have both electrodes subjected to uniform stresses, or to position the component electrodes at right angles to the grid glove or bending line. This should be done to avoid cracking the Varistors from bending the PC board after or during placing/mounting on the PC board.

(1) To minimize mechanical stress caused by warp or bending of a PC board, please follow the recommended Varistor layout below.

	NG Example	Recommended Example
Warp of Circuit board		

(2) The following layout is for your reference since mechanical stress near the dividing/breaking position of a PC board varies depending on the mounting position of the Varistors.

(3) The magnitude of mechanical stress applied to the Varistors when the circuit board is divided is in the order of push back < slit < V-groove < perforation.
Also take into account the layout of the Varistors and the dividing/breaking method.



2-2-5. Mounting Density and Spaces

If components are arranged in too narrow spaces, the components are affected by Solder bridges and Solder balls. Each space between components should be carefully determined.

Note ;

3. Precautions for Assembly

3- 1.Storage

(1) The Varistors before mounting on PCB shall be stored between 5 - 40°C and 20 - 70% RH, not under severe conditions of high temperature and humidity.

(2) If stored in a place that is humid, dusty, or contains corrosive gasses (hydrogen sulfide, sulfurous acid, hydrogen chloride and ammonia, etc.), the solderability of terminal electrodes may deteriorate.
In addition, storage in a place subjected to heating and/or exposed to direct sunlight will cause deformed tapes and reels. This may also lead to components sticking to tapes. Both of which can result in mounting problems.

(3) Do not store components longer than 6 months. Check the solderability of products that have been stored for more than 6 months before use.

3- 2.Adhesives for Mounting

(1) The amount and viscosity of an adhesive for mounting shall be such that the adhesive shall not flow off on the land during it's curing.

(2) If the amount of adhesive is insufficient for mounting, the Varistor may fall after or during soldering.

(3) If the adhesive is too low in its viscosity, the Varistors may be out of alignment after or during soldering.

(4) Adhesives for mounting can be cured by ultraviolet or infrared radiation. In order to prevent the terminal electrodes of the Varistors from oxidizing, the curing shall be dune at conditions of 160℃ max., for 2 minutes max.

(5) If curing is insufficient, the Varistor may fall after or during soldering. Also insulation resistance between terminal electrodes may deteriorate due to moisture absorption. In order to prevent these problems, the curing conditions shall be sufficiently examined.

3- 3.Chip Mounting Consideration

(1) When mounting the Varistors/components on a PC board, the Varistor bodies shall be free from excessive impact loads such as mechanical impact or stress due to the positioning, pushing force and displacement of vacuum nozzles during mounting.

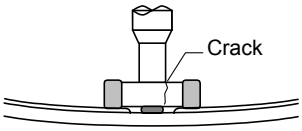
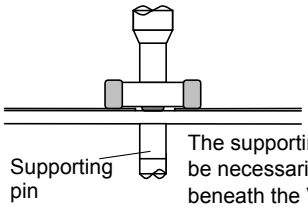
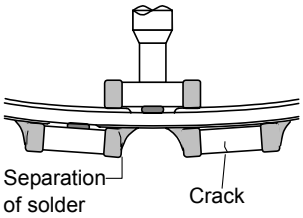
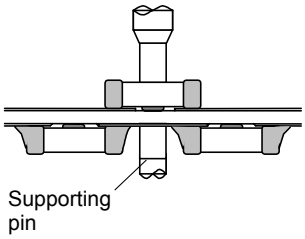
(2) Maintenance and inspection of the Chip Mounter must be performed regularly.

(3) If the bottom dead center of the vacuum nozzle is too low, the Varistor is cracked by an excessive force during mounting.
The following precautions and recommendations are for your reference in use.

(a) Set and adjust the bottom dead center of the vacuum nozzles to the upper surface of the PC board after correcting the warp of the PC board.

(b) Set the pushing force of the vacuum nozzle during mounting to 1 to 3 N in static load.

(c) For double surface mounting, apply a supporting pin on the rear surface of the PC board to suppress the bending of the PC board in order to minimize the impact of the vacuum nozzles. Typical examples are shown in the following table.

	NG Examples	Improved Examples by pattern division
Single surface mounting		
Double surface mounting		

(d) Adjust the vacuum nozzles so that their bottom dead center at the time of mounting is not too low.

Note ;

(4) The closing dimensions of the positioning chucks shall be controlled. Maintenance and replacement of positioning chucks shall be performed regularly to prevent chipping or cracking of the Varistors caused by mechanical impact during positioning due to worn positioning chucks.
(5) Maximum stroke of the nozzle shall be adjusted so that the maximum bending of PC board does not exceed 0.5mm at 90mm span. The PC board shall be supported by an adequate number of supporting pins.

3- 4.Selection of Soldering Flux

Soldering flux may seriously affect the performance of the Varistors. The following shall be confirmed before use.
(1) The soldering flux should have a halogen based content of 0.1 wt. % (converted to chlorine) or below.
Do not use soldering flux with strong acid.
(2) When applying water-soluble soldering flux, wash the Varistors sufficiently because the soldering flux residue on the surface of PC boards may deteriorate the insulation resistance on the Varistors' surface.

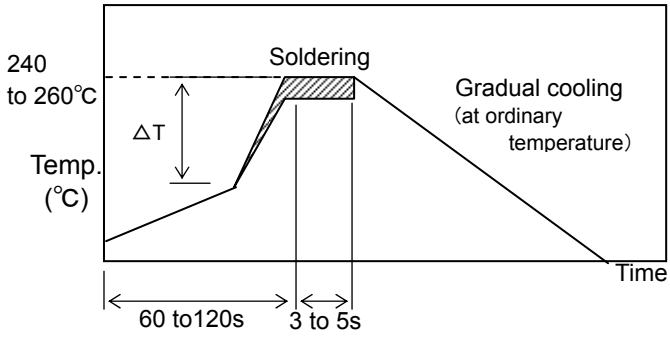
3- 5.Soldering

3-5-1. Flow soldering

In the flow soldering process, abnormal and large thermal and mechanical stresses, caused by "Temperature Gradient" between the mounted Varistors and melted solder in a soldering bath, may be applied directly to the Varistors, resulting in failure and damage of the Varistors,
It is therefore essential that soldering process be controlled following these recommended conditions.

(1) Application of Soldering flux:
The soldering flux shall be applied to the mounted Varistors thinly and uniformly by foaming method.
(2) Preheating:
The mounted Varistors/Components shall be preheated sufficiently so that the "Temperature Gradient" between the Varistors/Components and the melted solder shall be 150℃ max.
(3) Immersion into Soldering Bath:
The Varistors shall be immersed into a soldering bath of 240 to 260℃ for 3 to 5 seconds.
(4) Gradual Cooling:
The Varistors shall be cooled gradually to room ambient temperature.
(5) Flux Cleaning:
When the Varistors are immersed into a cleaning solvent, confirm that the surface temperature of the devices does not exceed 100℃.
(6) Performing flow soldering once under the conditions shown in the figure below [Recommended profile of Flow soldering (Ex)] will not cause any problems.
However, pay attention to the possible warp and bending of the PC board.

Recommended profile of Flow soldering [Ex.]



〈Allowable temperature difference ΔT〉

Size	Temp. Tol.
0603	ΔT ≦ 150 °C

3-5-2. Reflow soldering

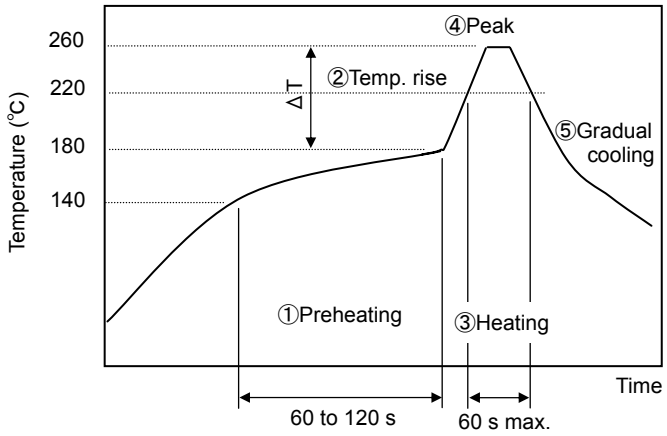
In reflow soldering, the mounted Varistors/Components are generally heated and soldered by a thermal conduction system such as an "Infrared radiation and hot blast soldering system" or a "Vapor Phase Soldering System (VPS)".
Large temperature gradients such as a rapid heating and cooling in the process may cause electrical failures and mechanical damages of the devices.
It is essential that the soldering process shall be controlled by the following recommended conditions and precautions.

Note ;

	Temperature	Period or Speed
①Preheating	140 to 180 ℃	60 to 120 s
②Temp. rise	Preheating temp. to Peak temp.	2 to 5 ℃/s
③Heating	220 ℃max.	60 s max.
④Peak	260 ℃max.	10 s max.
⑤Gradual cooling	Peak temp. to 140 ℃	1 to 4 ℃/s

When the Varistors are immersed into a cleaning solvent, confirm that the surface temperature of the devices does not exceed 100℃.
Performing reflow soldering twice under the conditions shown in the figure above [Recommended profile of Reflow soldering (EX)] will not cause any problems. However, pay attention to the possible warp and bending of the PC board.

Recommended profile of Reflow soldering (Ex.)



〈 Allowable temperature difference ΔT〉

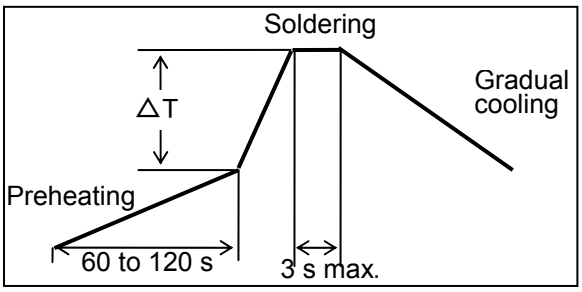
Size	Temp. Tol.
0402 to 0805 0504	ΔT≦ 150 °C

3-5-3. Hand soldering

When hand soldering Varistors, a large temperature gradient between the preheated Varistors and the tip of the soldering iron may cause electrical failure and mechanical damage such as cracking or breaking of the devices. Soldering shall be carefully controlled and performed such that the temperature gradient is kept at a minimum with the following recommended conditions:

(1) Condition 1 (with preheating)
  (a) Soldering :
    ϕ1.0mm Thread eutectic solder with soldering flux* in the core.
    *Rosin-based and non-activated flux is recommended.
  (b) Preheating:
    The Varistors shall be preheated so that “Temperature Gradient” between the devices and the tip of soldering iron is 150℃ or below.
  (c) Temperature of Iron tip: 300℃ max.
    (The required amount of solder shall be melted in advance on the soldering tip.)
  (d) Gradual Cooling:
    After soldering, the Varistors shall be cooled gradually at room ambient temperature.

Recommended profile of Hand Soldering [Ex.]



〈Allowable temperature difference ΔT〉

Size	Temp. Tol.
0402 to 0805	ΔT≦ 150 °C

Note ;

(2) Condition 2 (without preheating)

Hand soldering can be performed without preheating, by following the conditions below:

(a) Soldering iron tip shall never directly touch the ceramic dielectrics and terminal electrodes of the Varistors.

(b) The lands are sufficiently preheated with a soldering iron tip before sliding the soldering iron tip to the terminal electrode of the Varistor for soldering.

Conditions of Hand soldering without preheating

	Condition
Chip size	0402 to 0805
Temperature of soldering iron	270 °C Max.
Wattage	20W Max.
Shape of soldering iron tip	ϕ3mm Max.
Soldering time with soldering iron	3s Max.

3- 6.Post Soldering Cleaning

3-6-1. Cleaning solvent

Soldering flux residue may remain on the PC board if cleaned with an inappropriate solvent. This may deteriorate the electrical characteristics and reliability of the Varistors.

3-6-2. Cleaning conditions

Inappropriate cleaning conditions such as insufficient cleaning or excessive cleaning may impair the electrical characteristics and reliability of the Varistors.

(1) Insufficient cleaning can lead to:

(a) The halogen substance in the residues of the soldering flux to cause the metal of terminal electrodes to corrode.

(b) The halogen substance in the residue of the soldering flux on the surface of the Varistors may change resistance values.

(c) Water-soluble soldering flux may have more remarkable tendencies of (a) and (b) above compared to those of rosin soldering flux.

(2) Excessive cleaning can lead to:

(a) Overuse of ultrasonic cleaning may deteriorate the strength of the terminal electrodes or cause cracking in the solder and/or ceramic bodies of the Varistors due to vibration of the PC boards.

Please follow these conditions for Ultrasonic cleaning:

Ultrasonic wave output: 20 W/L max.
Ultrasonic wave frequency: 40 kHz max.
Ultrasonic wave cleaning time: 5 min. max.

3-6-3. Contamination of Cleaning solvent

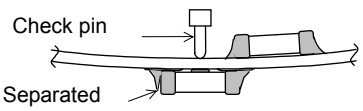
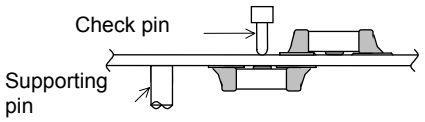
Cleaning with contaminated cleaning solvent may cause the same results as insufficient cleaning due to the high density of liberated halogen.

3- 7.Inspection Process

When mounted PC boards are inspected with measuring terminal pins, abnormal and excess mechanical stress shall not be applied to the PC board or mounted components, to prevent failure or damage to the devices.

(1) Mounted PC boards shall be supported by an adequate number of supporting pins with bend settings of 90 mm span 0.5mm max.

(2) Confirm that the measuring pins have the right tip shape, are equal in height and are set in the correct positions. The following figures are for your reference to avoid bending the PC board.

	NG Example	Recommended Example
Bending of PC board		

Note ;

3- 8.Protective Coating

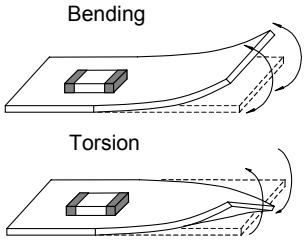
When the surface of a PC board on which the Varistors have been mounted is coated with resin to protect against moisture and dust, make sure that there is no quality deterioration of the Varistors due to protective coating application in actual settings.

(1) Do not use coating materials which produce pyrolysis or reaction gas affecting varistor components

(2) In resin curing, big stress is applied on varistors by thermal expansion or contraction of resin, which may cause cracks

3- 9.Dividing/Breaking of PC Boards

(1) Abnormal and excessive mechanical stress such as bending or torsion shown below can cause cracking in the Varistors.



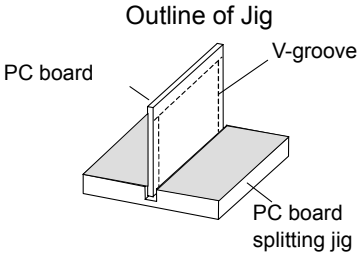
(2) Dividing/Breaking of the PC boards shall be done carefully at moderate speed by using a jig or apparatus to prevent the Varistors on the boards from mechanical damage.

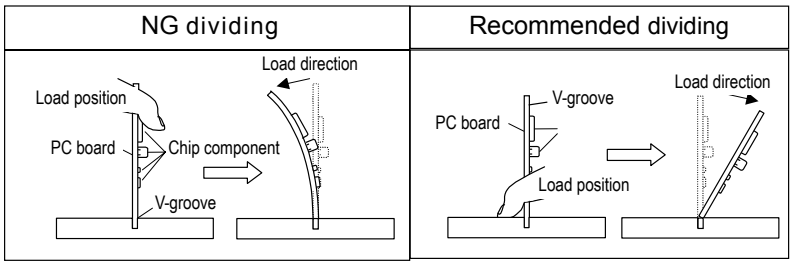
(3) Examples of PCB dividing/breaking jig

The outline of PC board breaking jig is shown below.

It is recommended when dividing or breaking PC boards that they are held near the jig where no bending will occur, this way there will be no compressive stress applied to the components or Varistors on the PC board.

Do not hold the PC board at a position which is far away from the jig, tensile stress to the Varistors may cause them to crack.



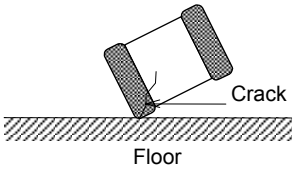


3- 10.Mechanical Impact

(1) The Varistors shall be free from any excessive mechanical impact.

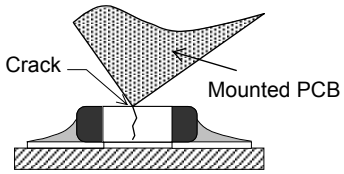
The Varistor body is made of ceramics and may be damaged or cracked if dropped.

Never use a Varistor which has been dropped; their quality may be impaired and failure rate increased.



(2) When handling PC boards with Varistors mounted on them, do not allow the Varistors to collide with another PC board.

When mounted PC boards are handled or stored in a stacked state, impact between the corner of a PC board and the Varistor may cause damage or cracking and can deteriorate the withstand voltage and insulation resistance of the Varistor.



4. Other

The various precautions described above are typical.

For special mounting conditions, please contact us.

Note ;

CLASSFICATION	SPECIFICATIONS	No. 151S-EZJ-SCV002E
SUBJECT	Multilayer Varistor, Chip Type Taped and Reeled Packaging Specifications	PAGE 1 of 5 DATE 5 June, 2006

1. Scope
This specification applies to taped and reeled packing for Multilayer varistors,chip type.

2. Applicable Standards
EIAJ (Electric Industries Association of Japan) Standard EIAJ RC-1009B
JIS (Japanese Industrial Standard) Standard JIS C 0806

3. Packing Specification
3- 1.Structure and Dimensions
Paper taping packaging is carried out according the following diagram
1) Carrier tape : Shown in Fig. 5.
2) Reel : Shown in Fig. 6.
3) Packaging : We shall pack suitably in order prevent damage during transportation or storage.

3- 2.Packing Quantity

Size (EIA)	Thickness of Capacitor(mm)	Carrier-Tape		Quantity (pcs./reel)	
		Material	Taping Pitch	ϕ180mm Reel	
				Packaging Code	Quantity
0402	0.50 +/- 0.05	Paper Taping	2 mm	V	10,000
0603	0.8 +/- 0.1	Paper Taping	4 mm	V	4,000
0805	0.8 +/- 0.2	Paper Taping	4 mm	V	5,000
	1.25 +/- 0.20	Embossed Tap.	4 mm	Y	2,000
				F	3,000

Explanation of Part Numbers (Example)

EZJZ 1 **V** 270 G A

Packaging Code

3- 3.Marking on the Reel
The following items are described in the side of a reel in English at least.
1) Part Number
2) Quantity
3) Lot Number
4) Place of origin

Note ;

Panasonic Electronic Devices Co., Ltd.	APPROVAL	CHECK	DESIGN
	Y.Sakaguti	T.Kawamura	Y.Sasaki

3- 4.Structure of Taping

1) The direction of winding of taping on the reel shall be in accordance with the following diagram.

Fig. 1 Paper Taping

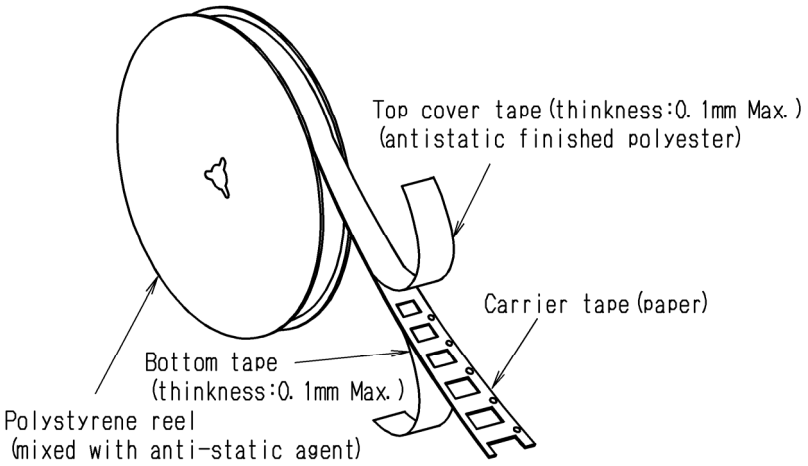
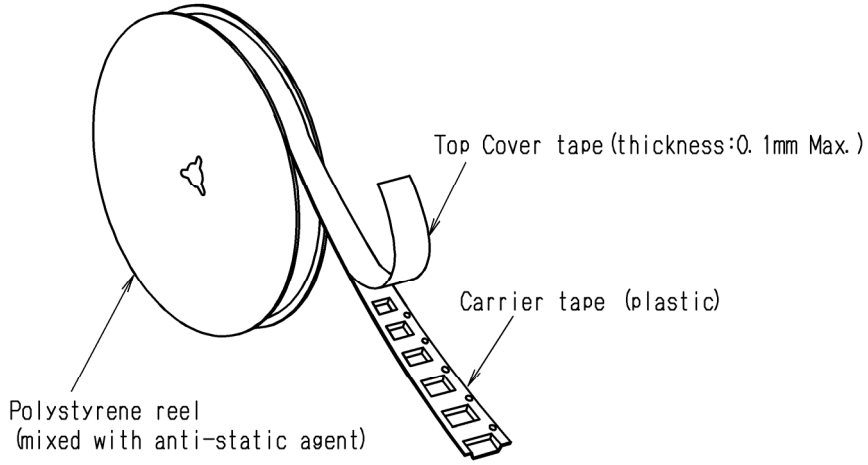
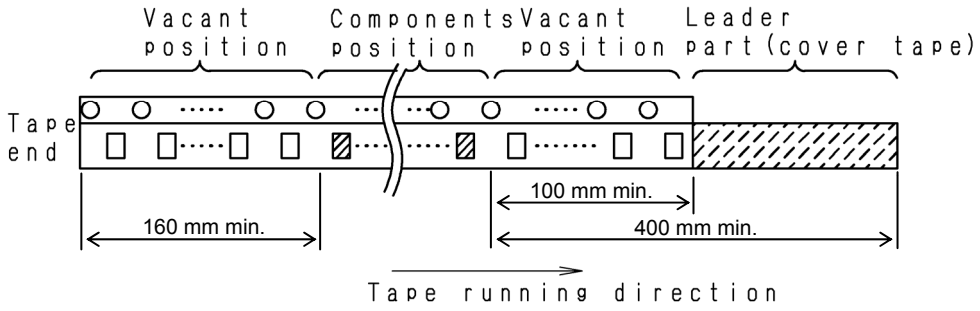


Fig. 2 Embossed Taping



2) The specification of the leader and empty portion shall be in accordance with the following diagram.

Fig. 3 Leader Part and Taped End



Note ;

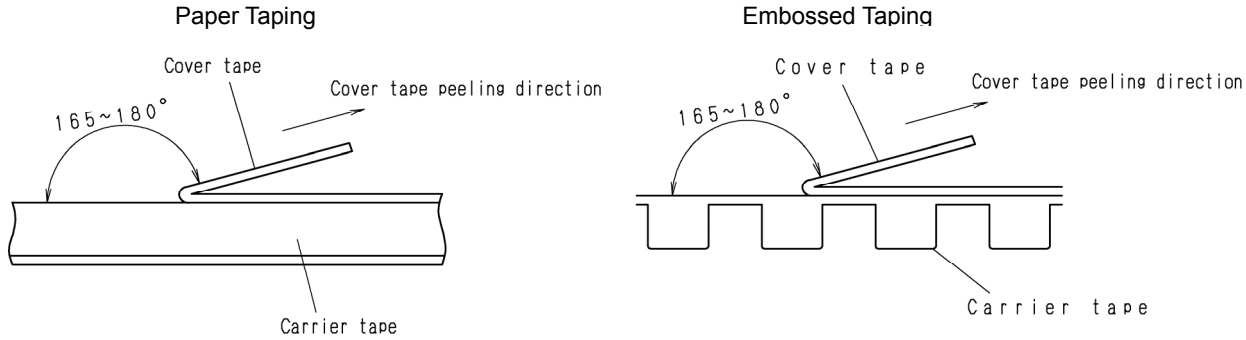
4. Efficiency

4- 1.Breakage strength of the tape : 10N or more.

4- 2.Peel strength of the cover tape (refer to the Fig. 4).

1) Peel angle : 165 to 180 degree from the tape adhesive face.
2) Peel velocity : 300 mm per min.
3) Peel strength : 0.1 to 0.7 N

Fig. 4 Peel strength of the cover tape



4- 3.Barrs on tape

There shall be no barrs preventing suction when products are taken out.

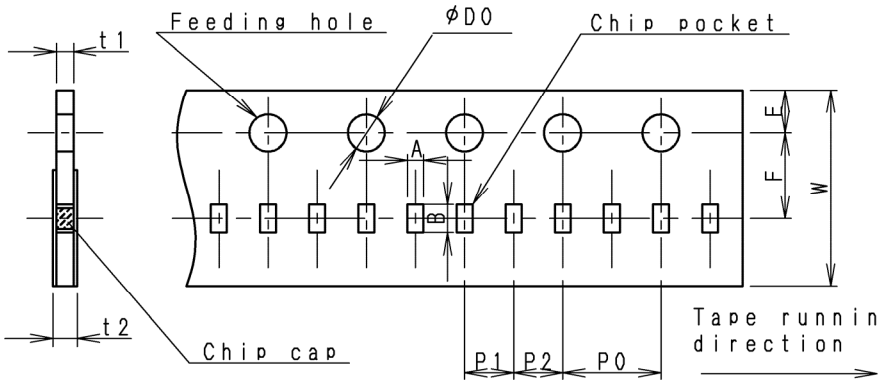
4- 4.Missing of products

The missing of products shall be 0.1 % or less per reel and there shall be no continuous missing of products.

4- 5.Adherence to the tape

Products shall not be stuck to the cover tape or bottom tape.

Fig. 5 Carrier Tape Dimension



Code	Dimension
W	8.0 +/- 0.2
F	3.50 +/- 0.05
E	1.75 +/- 0.10
P_1	2.00 +/- 0.05
P_2	2.00 +/- 0.05
P_0	4.00 +/- 0.05
D_0	ϕ1.5 +0.1/-0
t_1	0.7 max.
t_2	1.0 max.

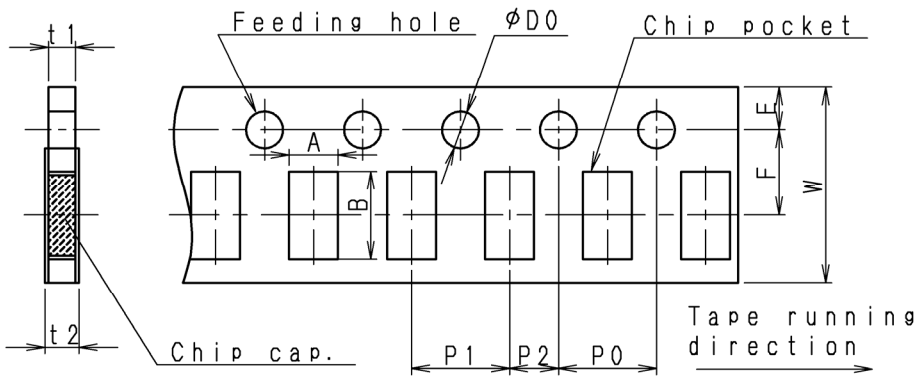
Unit : mm

Code \ Size	0402
A	0.62 +/- 0.05
B	1.12 +/- 0.05

Unit : mm

Note ;

(b) 0603,0805 size : 4mm taping pitch for Paper taping.



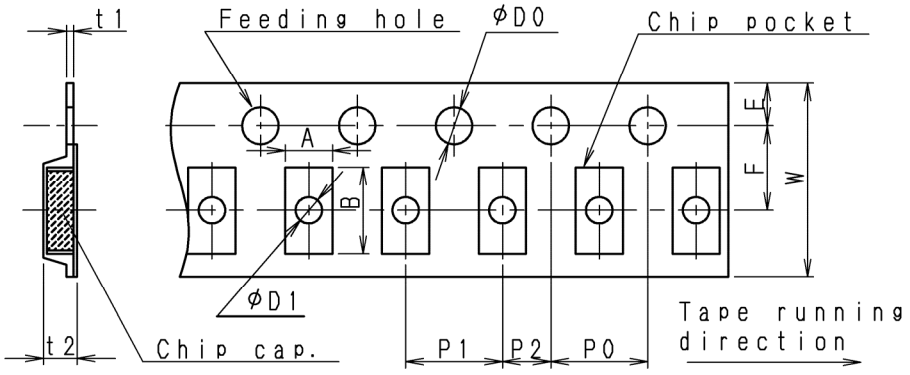
Code	Dimension
W	8.0 +/- 0.2
F	3.50 +/- 0.05
E	1.75 +/- 0.10
P_1	4.0 +/- 0.1
P_2	2.00 +/- 0.05
P_0	4.0 +/- 0.1
D_0	ϕ1.5 +0.1/-0
t_1	1.1 max.
t_2	1.4 max.

Unit : mm

Code \ Size	0603	0805
A	1.0 +/- 0.1	1.65 +/- 0.20
B	1.8 +/- 0.1	2.4 +/- 0.2

Unit : mm

(c) 0805 size : 4mm taping pitch for Embossed taping.



Code	Dimension
W	8.0 +/- 0.2
F	3.50 +/- 0.05
E	1.75 +/- 0.10
P_1	4.0 +/- 0.1
P_2	2.00 +/- 0.05
P_0	4.0 +/- 0.1
D_0	ϕ1.5 +0.1/-0
D_1	ϕ1.1+/- 0.1
t_1	0.6 max.
t_2	2.5 max.

Unit : mm

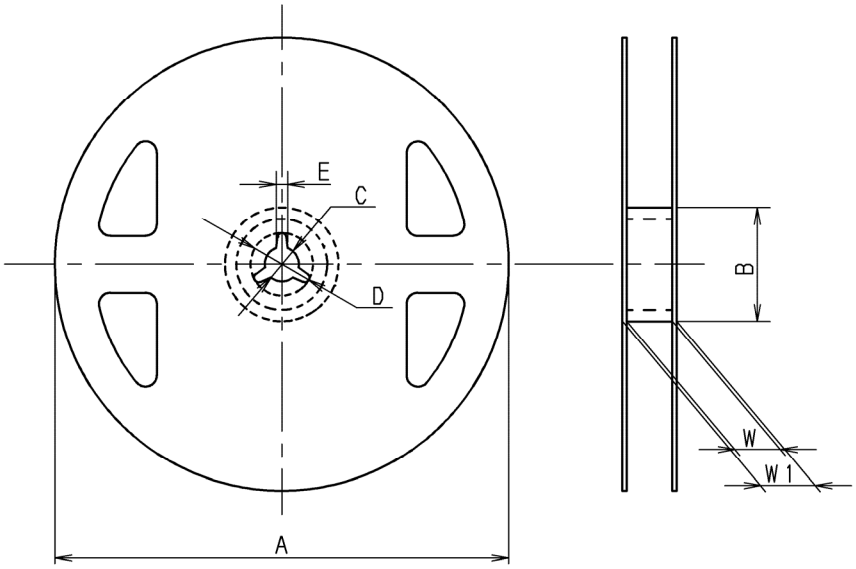
Code \ Size	0805
A	1.55 +/- 0.20
B	2.35 +/- 0.20

Unit : mm

Note ;

Fig. 6 Reel Dimension

(a) Φ180mm Reel (Standard Reel)



Code	Dimension
A	ϕ 180 +0/-3.0
B	ϕ 60.0 +/- 0.5
C	13.0 +/- 0.5
D	21.0 +/- 0.8
E	2.0 +/- 0.5
W	9.0 +/- 0.3
W_1	11.4 +/- 0.1

Unit : mm

Note ;