Thick Film Chip Array Resistor

Chip array resistors are general passive component which is useful for Voltage Drop, current controlling in circuit and surface mounting is available.
Samsung electro-mechanics manufactures various types of resistors, from single chip type resistors to more complex array type resistors.
That is, chip array resistors have several resistor elements integrated as a single chip component. Chip array resistors are effective in reducing SMD surface area and costs.

There are two types of chip array resistors. RP(Convex type) expresses the dipping type resistors and RN(Concave type) expresses the through hole type resistors. Production is increasing with demand for small size & light weight of set product. We provide ultra-small, high-reliability, high-stability resistors.
We have obtained ISO-9002/QS-9000 and ISO-14001 certification.

General Features

- Reducing SMD surface area (40% reduced).
- Reducing SMD costs (75% reduced).
- Both flow and reflow soldering are applicable.
- Convex & concave type.

Applications

- For semiconductor devices.
- For computers & digital circuits.
- For Printer & CD-ROM.

Part Numbering

RP	164P	J	100	CS
❶	❷	❸	❹	❺

❶ CODE DESIGNATION

RP(Convex type) : This code expresses the dipping type Resistor that is produced by Samsung Electro-Mechanics CO.LTD.

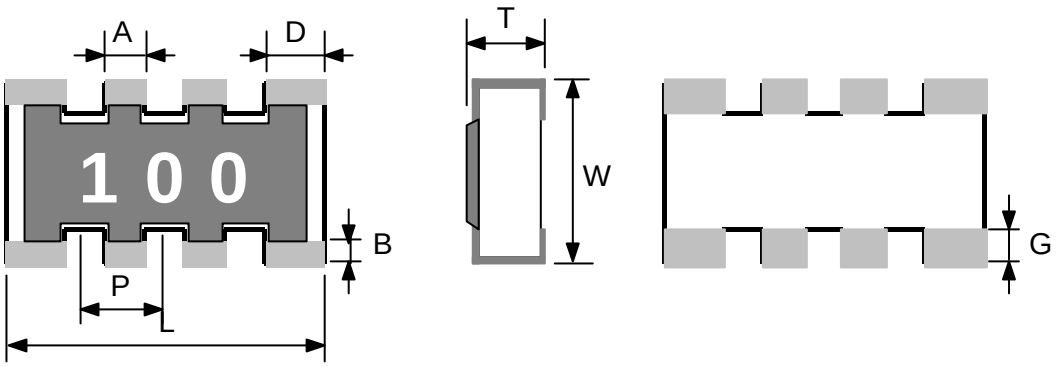
RN(Concave type) : This code expresses the through hole type Resistor that is produced by Samsung Electro-Mechanics CO.LTD.

❷ DIMENSION

Left 2 digits are dimension of the resistor, and right 2 digits are number of resistor.<Fig 1>

Ex) 104P = 1005type X 4pcs, 164P = 1608type X 4pcs

<Fig 1>



[Unit : ㎜]

Item	L	W	T	A	D	B	G	P
RP102P	1.00±0.10	1.00±0.10	0.35±0.10	0.33±0.15	-	0.20±0.10	0.25±0.10	0.65±0.10
RP104P	2.00±0.10	1.00±0.10	0.35±0.10	0.30±0.15	0.40±0.15	0.15±0.10	0.25±0.15	0.50±0.15
RP164P	3.20±0.10	1.60±0.10	0.50±0.10	0.40±0.15	0.60±0.15	0.30±0.15	0.30±0.15	0.80±0.15

❸ RESISTANCE TOLERANCE

The Resistance Tolerance is expressed as 1 digit alphabet by EIAJ standard. <Table 2>

<Table 2>

Item	F	G	J
Tolerance (%)	± 1	± 2	± 5
Producing Series	E-96, E-24	E-96, E-24	E-24
Type	RP164P, RN164P		RP & RN Series

❹ NOMINAL RESISTANCE VALUE

The Nominal Resistance Value is expressed as 3 or 4 digits by EIAJ standard. <Table 3>

<Table 3>

Item	Contents
Only number	First 2 or 3 digits : Resistance value Last 1 digit : Exponential number of 10.
Number & alphabet "R"	Read alphabet "R" as decimal point.
Example	1) 101 : 10 × 10^1 = 10 × 10 = 100Ω 2) 7R5 : 7 . 5 = 7.5Ω
Type	RP & RN Series

In case of JUMPER(0 ohm), '000' is marked on the resistor.

※ RP102P,RN102P,RN104P type : No marking

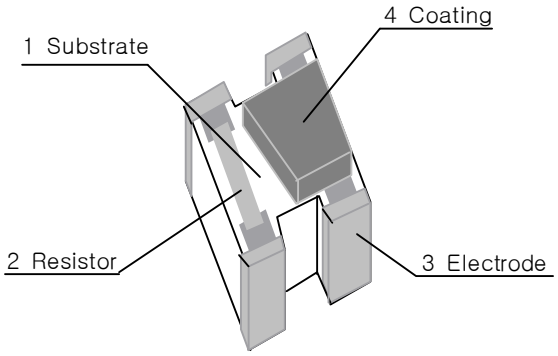
❺ PACKAGING CODE

The Packaging Code is expressed as 2 digits alphabet. <Table 4>

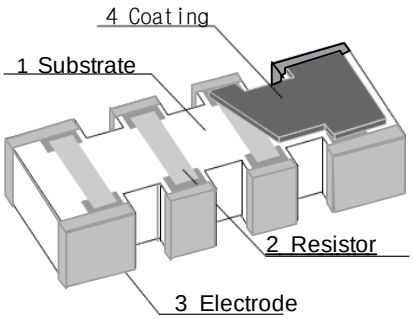
<Table 4>

Packaging Code	Description	Type	Dimension	Packaging Q'ty
C S	7" REEL PACKAGING	RP	102P, 104P	10,000 PCS
			164P	5,000 PCS
		RN	162P, 164P	5,000 PCS
A S	13" REEL PACKAGING	RP	102P, 104P	40,000 PCS
			164P	20,000 PCS
		RN	162P, 164P	20,000 PCS

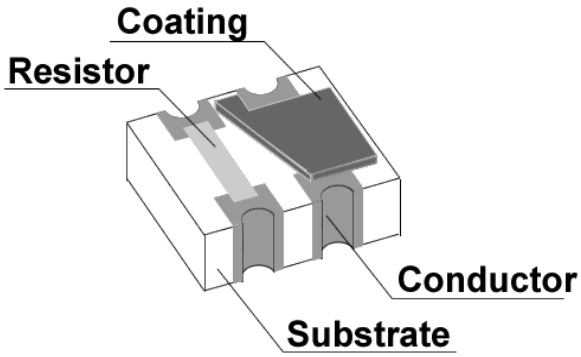
STRUCTURE



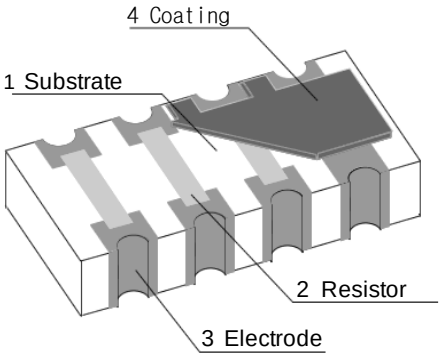
RP102P



RP104P&164P

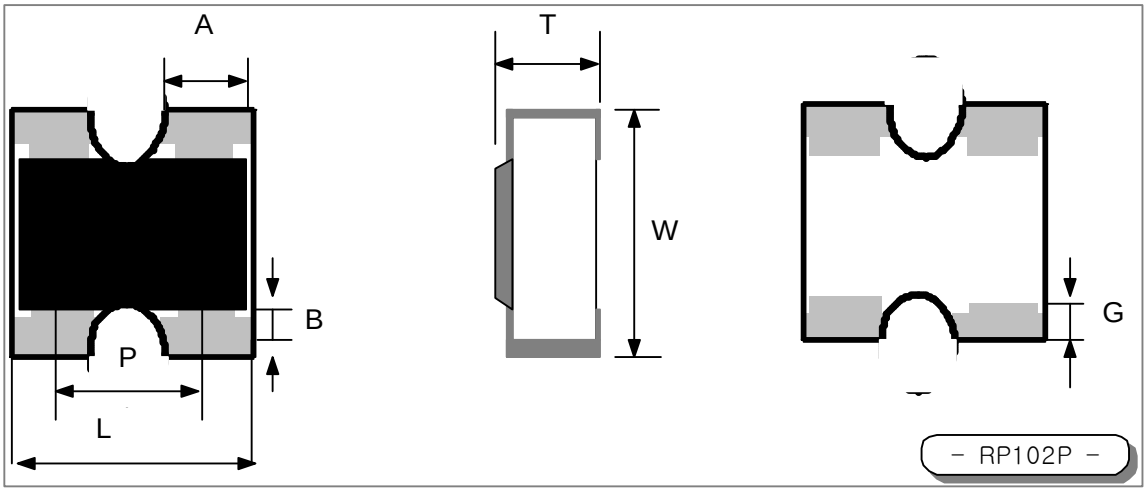


RN162P



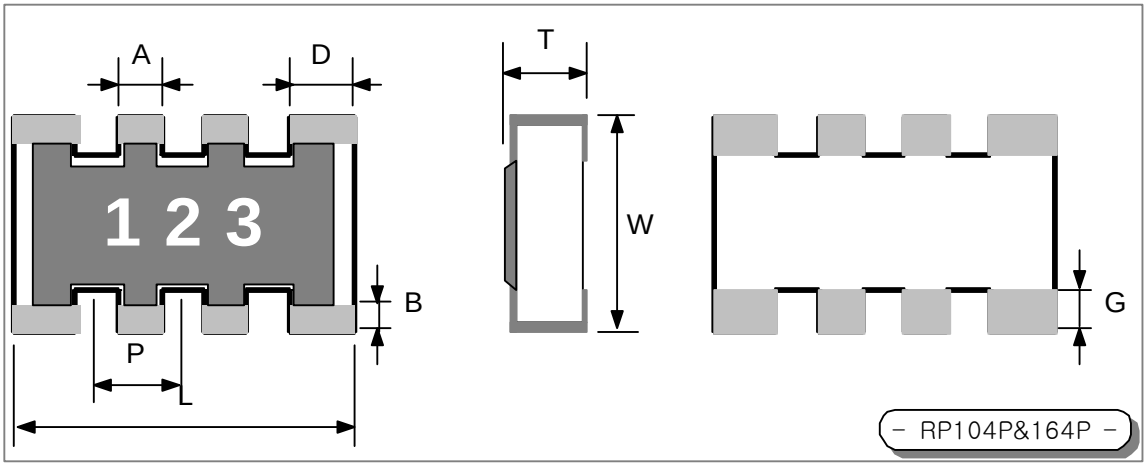
RN164P

DIMENSION



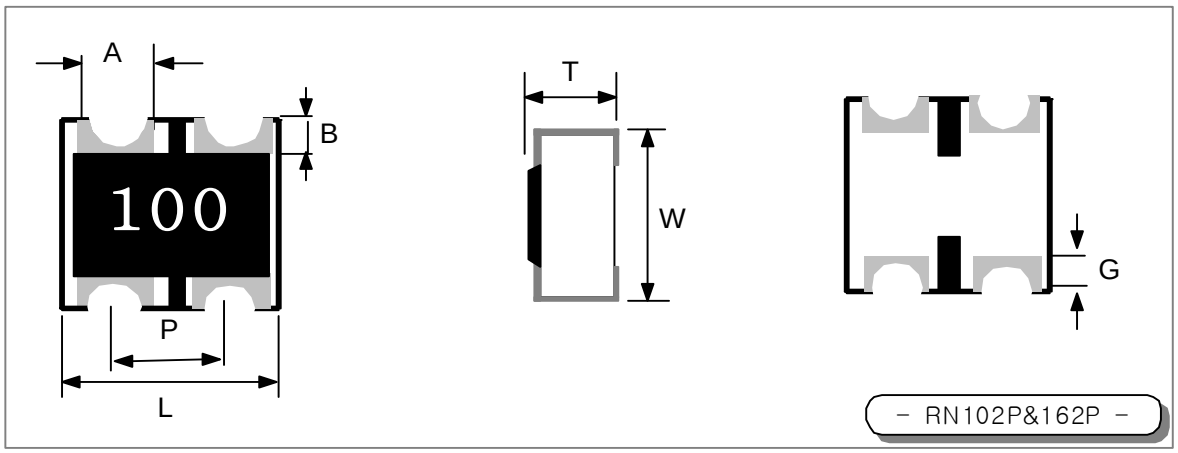
[Unit : ㎜]

Item	L	W	T	A	B	G	P
RP102P	1.00±0.10	1.00±0.10	0.35±0.10	0.33±0.15	0.20±0.10	0.25±0.10	0.65±0.10



[Unit : ㎜]

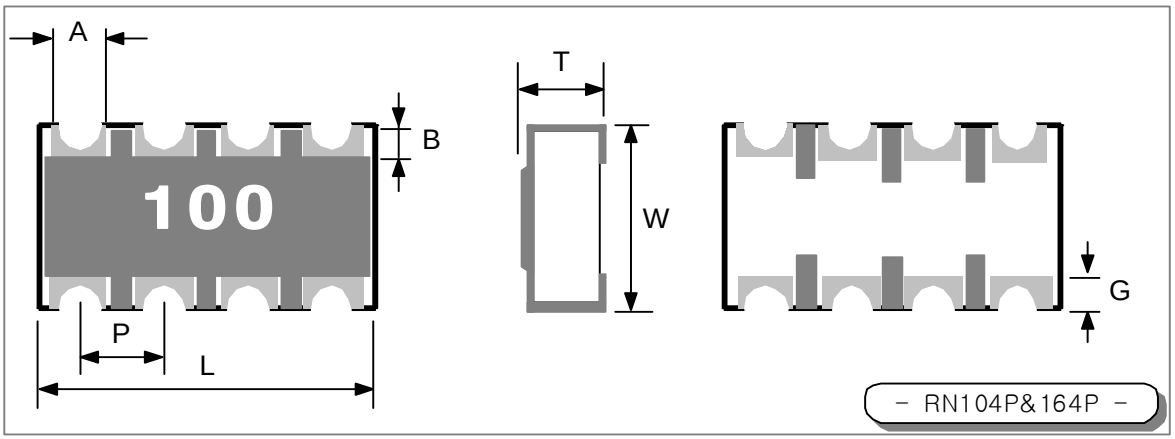
Item	L	W	T	A	D	B	G	P
RP104P	2.00±0.10	1.00±0.10	0.35±0.10	0.30±0.15	0.40±0.15	0.15±0.10	0.25±0.15	0.50±0.15
RP164P	3.20±0.10	1.60±0.10	0.50±0.10	0.40±0.15	0.60±0.15	0.30±0.15	0.30±0.15	0.80±0.15



- RN102P&162P -

[Unit : ㎜]

Item	L	W	T	A	B	G	P
RN102P	1.00±0.10	1.00±0.10	0.35±0.10	0.30±0.10	0.15±0.10	0.25±0.15	0.50±0.10
RN162P	1.60±0.10	1.60±0.10	0.60±0.10	0.45±0.10	0.30±0.15	0.40±0.15	0.80±0.10



- RN104P&164P -

[Unit : ㎜]

Item	L	W	T	A	B	G	P
RN104P	2.00±0.10	1.00±0.10	0.40±0.10	0.30±0.10	0.15±0.10	0.25±0.10	0.50±0.10
RN164P	3.20±0.10	1.60±0.10	0.60±0.10	0.45±0.10	0.30±0.15	0.40±0.15	0.80±0.10

CHARACTERISTIC LINE UP

● RESISTANCE RANGE

The Resistance Range that we produce depends on the Dimension and the Resistance Tolerance of the resistor. <Table 15>

<Table 15>

Tolerance	Range	Type	Dimension
F	22Ω ~ 1MΩ	RP	164P
		RN	164P
G	10Ω ~ 1MΩ	RP	164P
		RN	164P
J	3Ω ~ 1MΩ	RP	102P, 104P&164P
		RN	162P, 164P
Jumper	50 mΩ MAX	RP	102P, 104P&164P
		RN	162P, 164P

● RATED POWER

The Rated Power is classified by the dimension of the resistor. <Table 16>

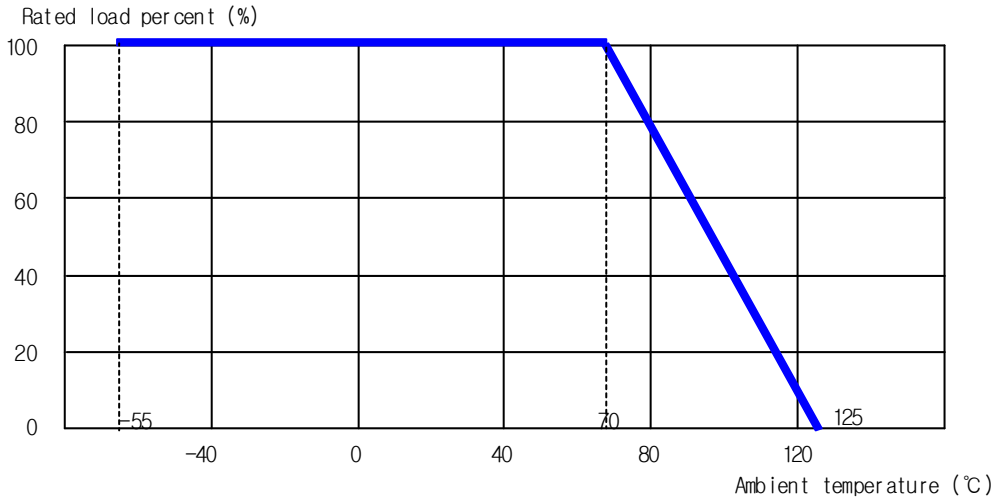
<Table 16>

Item	Range	Type
Rated power	1/16 W (0.063 W)	All
Working Volt.(Max.)	25 V	102P,104P
	50 V	162P,164P
STOL, IOL Volt.(Max.)	50 V	102P,104P
	100 V	162P,164P

※ STOL : Short Time OverLoad
IOL : Intermittent OverLoad

※ The rated power is specified as continuous full loading power at the ambient temperature of 70±2℃. In case of the temperature exceeding 70±2℃, the power should be derated in accordance to <Fig 12>.

<Fig 12>



▶ Working Temperature

- 55℃ ~ + 125 ℃

▶ Rated Voltage

The Rated Voltage should follow the equation below.
When the rated voltage exceeds the maximum working voltage shown <Table 6>, the rated voltage should be the maximum working voltage.

E = (DCV or Root Mean-Square)

E : Rated Voltage (V)
P : Rated Power (W)
R : Resistance Value (Ω)

RELIABILITY TEST CONDITION

Jumper's reliability test data are only applied to General type resistor.

● ELECTRICAL CHARACTERISTIC

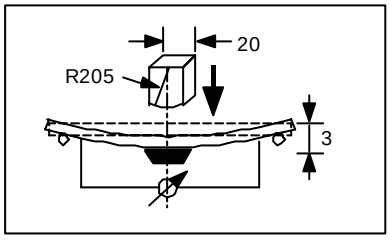
The electrical characteristic test should satisfy the test method, procedure, and standard.
If there is no special comment, each test is performed at standard conditions.
(temperature 20℃, humidity 65%RH, pressure 1023mbar)

<table>
<tr><th rowspan="2">item</th><th colspan="2">Permissible deviation</th><th rowspan="2">Test method</th></tr>
<tr><th>Resistor</th><th>Jumper</th></tr>
<tr><td>DC resistance</td><td>DC resistance value should be within the specified resistance tolerance.</td><td>50mΩ Maximum</td><td>・ Standard : JIS C 5201-1 4.5
・ Test voltage : <Table 8>
・ Applying time : within 5 seconds.
・ Test board : <Fig 11>
<Table 8>
<table><tr><th>Range (Ω)</th><th>Voltage (V)</th></tr><tr><td>3 ≤ R < 100</td><td>0.3</td></tr><tr><td>100 ≤ R < 1K</td><td>1.0</td></tr><tr><td>1K ≤ R < 10K</td><td>3.0</td></tr><tr><td>10K ≤ R < 100K</td><td>10</td></tr><tr><td>100K ≤ R < 1M</td><td>25</td></tr></table></td></tr>
<tr><td>Temperature Coefficient of Resistance</td><td><table><tr><th>Type</th><th>ppm/℃</th></tr><tr><td>102P,104P</td><td>±250</td></tr><tr><td>162P,164P</td><td>±200</td></tr></table></td><td>-</td><td>・ Standard : JIS C 5201-1 4.8
・ Temp. : 20℃ → -55℃ → 20℃ → 125℃ → 20℃
・ Test board : <Fig 11>
・ Calculation : TCR(ppm/℃) = $\frac{R-R_0}{R_0}\times\frac{1}{T-T_0}\times 10^6$
T_0 : 20 ± 2℃
R_0 : Resistance at T_0 (Ω)
T : Test temperature (-55, 125℃)
R : Resistance at T (Ω)</td></tr>
<tr><td>Short time overload (STOL)</td><td>1. No mechanical damage
2. ⊿R should be within ±(1%+0.1Ω)</td><td>50mΩ Maximum</td><td>・ Standard : JIS C 5201-1 4.13
・ Test voltage : 2.5 times of rated voltage Max. surge current at the Jumper.
・ Applying time : 5 seconds
・ Test board : <Fig 11></td></tr>
<tr><td>Intermittent overload (IOL)</td><td>1. No mechanical damage
2. ⊿R should be within ±(3%+0.1Ω)</td><td>50mΩ Maximum</td><td>・ Standard : JIS C 5201-1 4.13
・ Test voltage : 2.5 times of rated voltage Max. surge current at the Jumper.
・ Test method : 1 sec ON, 25 sec OFF 10,000^{+400}cycles
・ Test board : <Fig 11></td></tr>
</table>

item	Permissible deviation		Test method
	Resistor	Jumper	
Withstanding voltage	· No mechanical damage, short circuit, or disconnection.	Same as left	· Standard : JIS C 5201-1 4.7 · Test voltage : AC 100V · Applying time : 60 +10/-0 seconds · Test board : <Fig 13>
Insulation resistance	· Should have more than 1,000MΩ	Same as left	· Standard : JIS C 5201- 4.7 · Test voltage : DC 100V, · Applying time : 60 seconds · Test pressure : 1.0±0.2 N · Test board : <Fig 13>
Noise	· Noise standard <Table 10> Range (Ω) / dB Max. 0 ≤ R < 100 / -10 100 ≤ R < 1K / 0 1K ≤ R < 100K / 15 100K ≤ R < 1M / 20	-	· Measure equipment : QUAN-TECH NOISE METER (MODEL 315C)

● MECHANICAL CHARACTERISTIC

The mechanical characteristic test should satisfy the test method, procedure, and standard.
If there is no special comment, each test is performed at standard conditions.
(temperature 20℃, humidity 65%RH, pressure 1023mbar)

item	Permissible deviation		Test method
	Resistor	Jumper	
Solderability	· New solder coated more than 95% of termination	Same as left	· Standard : JIS C 5201-1 4.17 · Test temperature : 245 ± 5℃ · Test time : 3 ± 0.5 sec (dipping both side)
Bending strength	1. No mechanical damage 2. ⊿R should be within ±(0.5%+0.05Ω)	Same as left	· Standard : JIS C 5201-1 4.33 · Test board : <Fig 12> · Test speed : 100mm/min · Test procedure : press until 3mm, then keep 5 seconds <Fig 14> <Fig 14> 

item	Permissible deviation		Test method
	Resistor	Jumper	
Termination strength	· No mechanical damage, or sign of disconnection	Same as left	· Standard : JIS C 5201-1 4.16 · Test time : applying pressure for 5 seconds · Test tension : 0603,1005,1608 - 3N (300g · f) Others (500g · f)
Withstanding soldering heat	1. No mechanical damage 2. ⊿R should be within ±(1%+0.05Ω)	50mΩ Maximum	· Standard : JIS C 5201-1 4.18 · Temperature : 260 ± 5℃ · Test time : 10 ± 1second (both side dipping) · Test procedure : measures after 24 hours
Vibration	1. No mechanical damage 2. ⊿R should be within ±(1%+0.05Ω)	50mΩ Maximum	· Standard : JIS C 5201-1 4.22 · Test amplitude : 1.5mm · Test procedure : frequency 10Hz - 55Hz - 10Hz each 2 hours in x, y, z direction.

● ENVIRONMENTAL CHARACTERISTIC

The Environmental characteristic test should satisfy the test method, procedure, and standard.
If there is no special comment, Each test performs in standard state.
(temperature 20℃, humidity 65%RH, pressure 1023mbar)

item	Permissible deviation		Test method
	Resistor	Jumper	
Temperature cycle	1. No mechanical damage 2. ⊿R should be within ±(1%+0.1Ω)	50mΩ Maximum	· Standard : JIS C 5201-1 4.19 · Test procedure : <Table 11> · Measure : after 100 cycles of procedure · Test board : <Fig 11> <Table 11>
Moisture resistance life	1. No mechanical damage 2. ⊿R should be within <Table 12> <Table 12>	50mΩ Maximum	· Standard : JIS C 5201-1 4.14 · Test condition : temp 40 ± 2℃, humid 90 ~ 95%RH · Test voltage : rated voltage · Test time : repeat 90min ON, 30min OFF during 1000^{+48} hours · Test board : <Fig 11>

<Table 11>

item	1	2	3	4
temp(℃)	-55±2	5~35	125±2	5~35
time(min)	30	15	30	15

<Table 12>

Range(Ω)	⊿R MAX
3 ≤ R < 1M	±(3%+0.1Ω)

item	Permissible deviation		Test method
	Resistor	Jumper	
Low temperature exposure	1. No mechanical damage 2. ⊿R should be within ±(3%+0.1Ω)	50mΩ Maximum	· Standard : JIS C 5201-1 4.23 · Test temperature : -55 ± 2℃ · Test time : 1000^{+48} hours (without load) · Measure : after 1 hour · Test board : <Fig 11>
High temperature exposure	1. No mechanical damage 2. ⊿R should be within ±(3%+0.1Ω)	50mΩ Maximum	· Standard : JIS C 5201-1 4.23 · Test temperature : 125 ± 2℃ · Test time : 1000^{+48} hours (without load) · Measure : after 1 hour · Test board : <Fig 11>
Load life	1. No mechanical damage 2. ⊿R should be within <Table 13> <Table 13> Range(Ω) / ⊿R MAX 3 ≤ R < 10 / ±5% 10 ≤ R < 1M / ±(3%+0.1Ω)	50mΩ Maximum	· Standard : JIS C 5201-1 4.25 · Test temperature : 70 ± 2℃ · Test voltage : rated voltage · Test time : repeat 90min ON, 30min OFF during 1000^{+48} hours · Test board : <Fig 11>.

● TEST BOARD AND SPECIFICATION

▶ Soldering (for lead free type)

▷ The resistor should be fixed on PCB(printed circuit board) for testing.

- Soldering specification : JIS C 5201-1 4.18
  - * Soldering method : Flow type(Dipping type), Reflow type
  - * Solder : Sn -3.0Ag -0.5Cu
  - * FLUX : ROSIN 25WT% (JIS K 5902), IPA 75WT% (JIS K 5901)

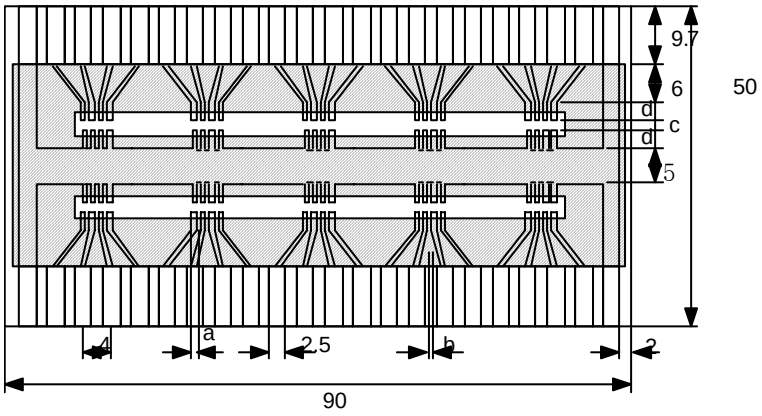
- Flow soldering condition
  - * FLUX dipping time : 5～10 sec
  - * Pre-treatment : None
  - * Soldering temp : 260℃ ±5℃
  - * Soldering time : 10±1 sec

▶ Test board

▷ Test board

<Table 9>, <Fig 8> are dimensions of test board for 104P&164P.

<Fig 8>



<Table 9>

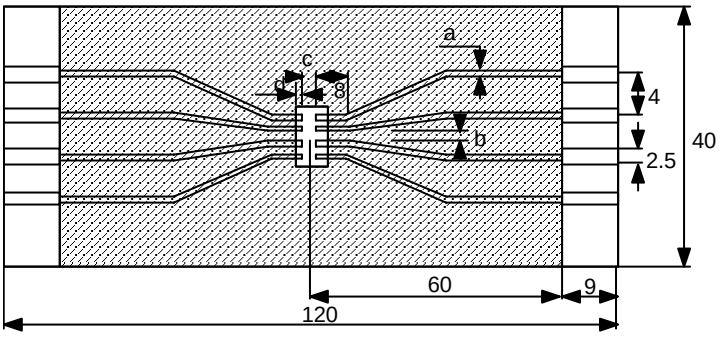
item	a	b	c	d
104P	0.4	0.2	0.5	0.3
164P	0.5	0.3	0.9	0.65

* Board material :
epoxy JIS C 6484
* pattern material :
pure copper JIS C 6484

▷ Bending Test Board

<Table 10>, <Fig 9> are dimensions of bending test board for 104P&164P.

<Fig 9>



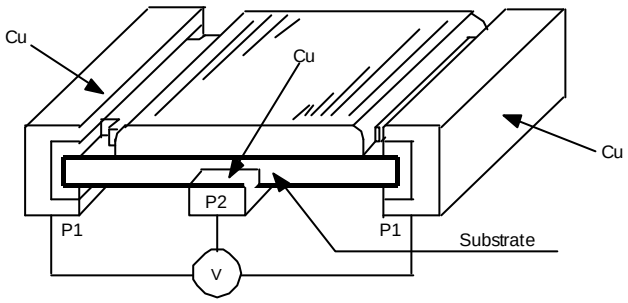
<Table 10>

item	a	b	c	d
104P	0.4	0.2	0.5	0.3
164P	0.5	0.3	0.9	0.65

* Board material :
epoxy JIS C 6484
* pattern material :
pure copper JIS C 6484

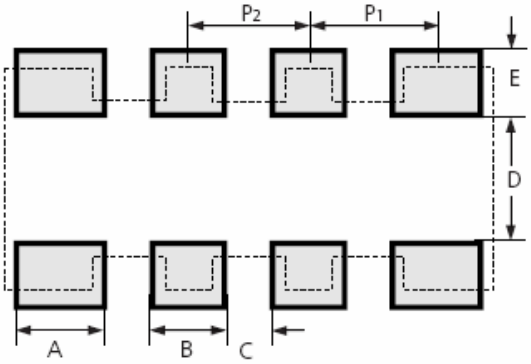
▶ Sketch of Withstanding voltage and Insulation resistance

<Fig 10>



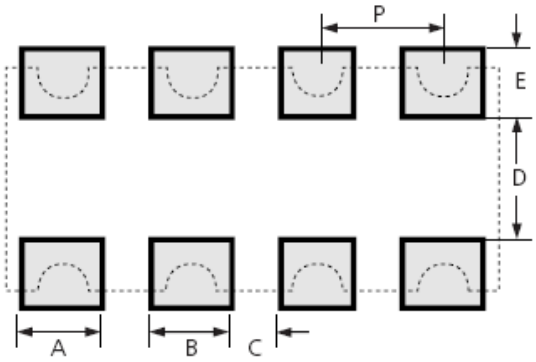
▶ Land pattern design

• Convex type



Type	A	B	C	D	E	P1	P2
102P	0.4	0.4	0.25	0.5	0.5	0.65	-
104P	0.4	0.3	0.2	0.5	0.5	0.55	0.5
164P	0.7	0.5	0.3	0.9	0.8	0.9	0.8

• Concave type



Type	A	B	C	D	E	P
102P	0.3	0.3	0.2	0.5	0.4	0.5
104P	0.3	0.3	0.2	0.5	0.4	0.5
162P	0.5	0.3	0.4	0.8	0.8	0.8
164P	0.5	0.3	0.4	0.8	0.8	0.8

PACKAGING

● PACKAGING METHOD

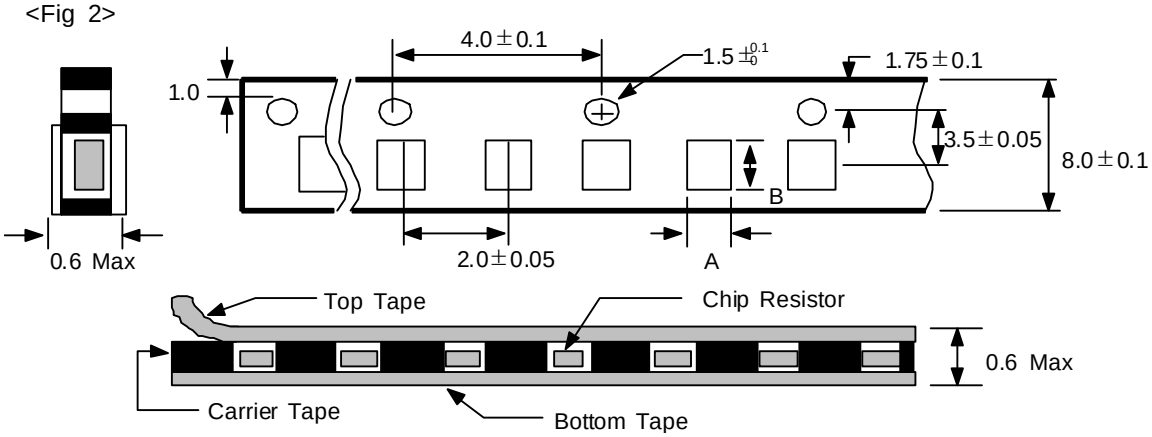
Packaging protects the resistor from damage during the shipping or storage.

● REEL TYPE PACKAGING SPECIFICATION

The packaging specification is based on the EIAJ RC-1009.

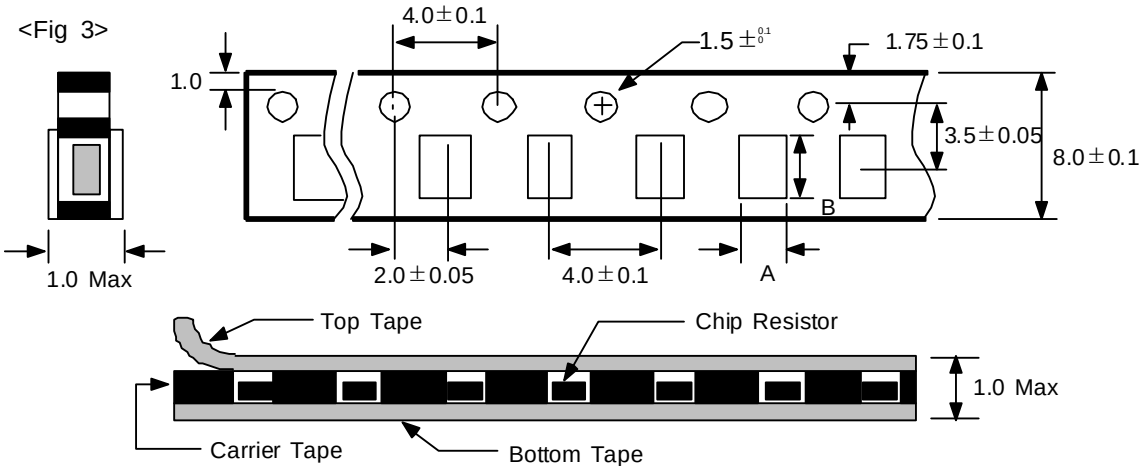
<Fig 2> is tape dimension For RP102P,RN102P, RP104P type. <Table 5> is for pocket sizes, A and B.

<Fig 2>



<Fig 3> is tape dimension For RN162P, RP&RN164P type.<Table 5> is for pocket sizes, A and B.

<Fig 3>



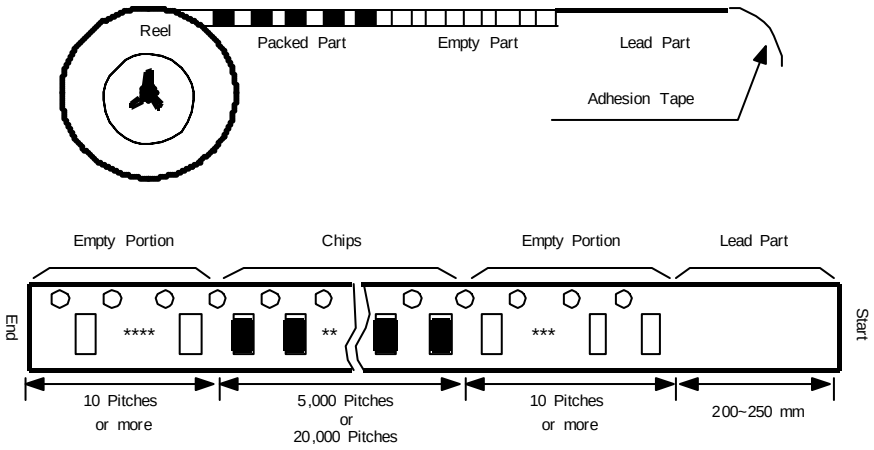
<Table 5>

Dimension / Symbol	RP			RN	
	102P	104P	164P	162P	164P
A	1.17±0.10	1.20±0.10	2.00±0.20	1.90±0.20	2.00±0.20
B	1.17±0.10	2.20±0.10	3.60±0.20	1.00±0.20	3.60±0.20

● TAPING METHOD

There are empty holes at both start part and end part of carrier tape. <Fig 4>

<Fig 4>



Note

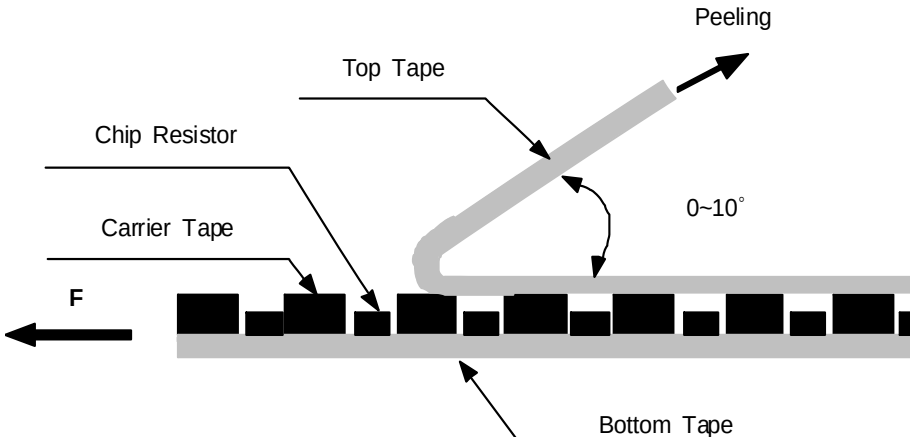
① The resistor should move in the pocket freely.

② The resistor should not adhere to the top or bottom tape.

③ There should be no vacant pocket.

④ Peeling strength of the top tape should be within 5gf and 80gf. <Fig 5>

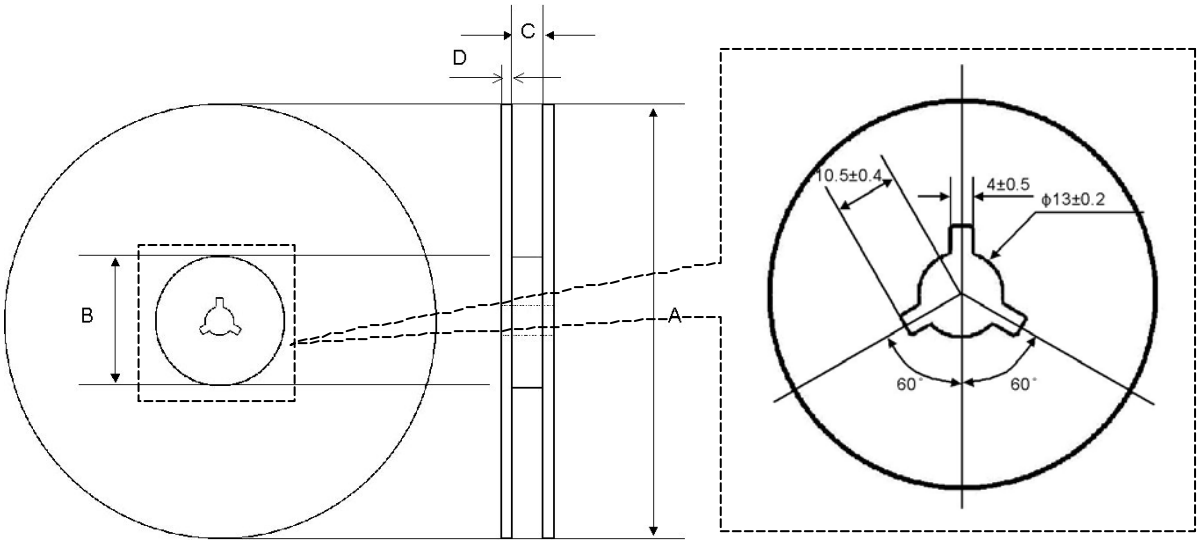
<Fig 5>



● REEL DIMENSION

The Reel dimension is classified by the diameter of Reel. <Fig 6> <Table 6>

<Fig 6>



<Table 6> [Unit : mm]

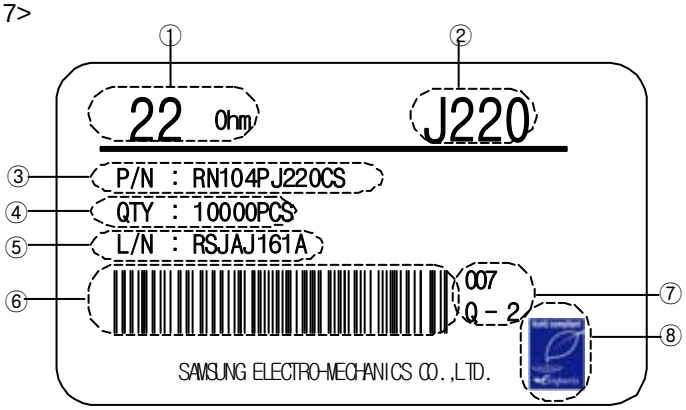
Packaging Code	Type	Dimension	Diameter	A	B	C	D
C S	RP	102P	7"	180	Φ 60	9.0 ± 0.5	1.2 ± 0.2
		104&164P	7"	180	Φ 60	9.0 ± 0.5	1.2 ± 0.2
	RN	162P	7"	180	Φ 60	9.0 ± 0.5	1.2 ± 0.2
		164P	7"	180	Φ 60	9.0 ± 0.5	1.2 ± 0.2
E S	RP	104&164P	10"	258	Φ 80	9.0 ± 0.5	2.2 ± 0.2
	RN	164P	10"	258	Φ 80	9.0 ± 0.5	2.2 ± 0.2
F S	RP	102P	13"	330	Φ 80	9.0 ± 0.5	2.2 ± 0.2
		104&164P	13"	330	Φ 80	9.0 ± 0.5	2.2 ± 0.2
	RN	164P	13"	330	Φ 80	9.0 ± 0.5	2.2 ± 0.2
A S	RP	102P	13"	330	Φ 80	9.0 ± 0.5	2.2 ± 0.2
		104&164P	13"	330	Φ 80	9.0 ± 0.5	2.2 ± 0.2
	RN	162P	13"	330	Φ 80	9.0 ± 0.5	2.2 ± 0.2
		164P	13"	330	Φ 80	9.0 ± 0.5	2.2 ± 0.2

● LABELING

▶ Reel type Label

The reel type label includes following contents as <Fig 7>.

<Fig 7>



① Resistance Value
② Tolerance, Marking
③ Part Number
④ Quantity
⑤ LOT Number
⑥ Bar - Code
⑦ Serial Number
⑧ RoHS logo

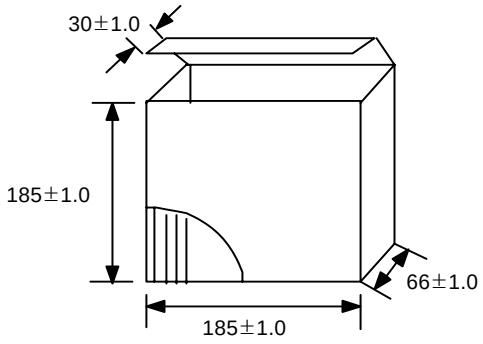
● BOX PACKAGING METHOD

① The reel type packaging is packaged twice by paper box, inner box and outer box.
② The packaging should protect the resistor from damaging during shipping by vehicle, ship, airplane and etc.
③ The information of contents is marked on both inner and outer box.

※ For other packaging methods, please contact us.

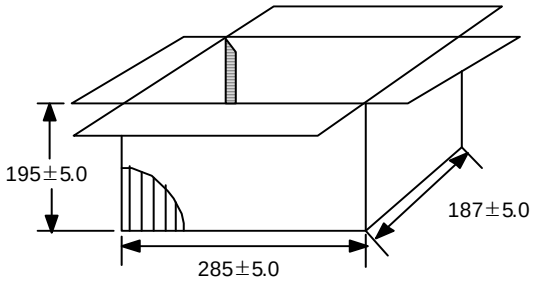
● BOX DIMENSION FOR REEL TYPE

① Max 50,000 pcs (5 EA × 7")



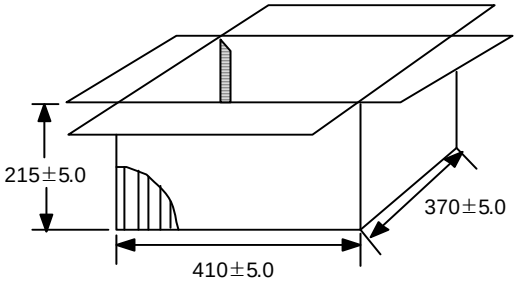
(Unit : mm)

② Max 200,000 pcs (20 EA × 7")



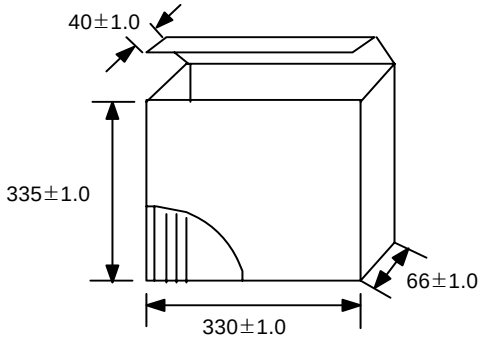
(Unit : mm)

③ Max 600,000 pcs (60 EA ×7")



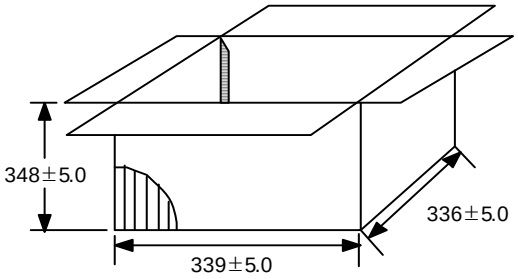
(Unit : mm)

④Max 160,000 pcs (4 EA × 13")



(Unit : mm)

⑤Max 800,000 pcs (20 EA ×13")



(Unit : mm)

APPLICATION MANUAL

● APPLICATIONS

Chip resistors are designed for general electronic devices such as home appliances, computer, mobile communications, digital circuit, etc.

If you require our products with high reliability-performing at more than 125C or below -55C for medical equipments, aircraft, high speed machines, military usage, and items that can affect human life or if you need to use in specific conditions (corrosive gas atmosphere), please contact us beforehand.

▶ **Normal Operation temperature ranges(℃) as follows.**

- 1608, 2012, 3216(general, precision) : -55℃ ~ + 155℃
- Others (rectangular, array, trimmable) : -55℃ ~ + 125℃

▶ Although resistor body is coated, sharp excessive impact should be avoided to prevent damages and adverse effects on characteristics(resistor value, open circuited, T.C.R.).

● STORAGE

To maintain proper quality of chip components, the following precautions are required for storage environment, method and period.

▶ **Storage Environment**

- Chip components may be deformed, if the temperature of packaged components exceeds 40℃.
- Do not store where the soldering properties can be deteriorated by harmful gas such as sulphurous gas, chlorine gas, etc.
- Bulk packed chip components should be used as soon as the seal is opened, thus preventing the solderability from deteriorating.
- The remaining unused chips should be put in the original bag and sealed again or store in a desiccator containing a desiccating agent.

▶ **Storage Time Period**

- Stored chip components should be used within 6 months after receiving the components. If 6 months or more have elapsed, please check the solderability before actually using.

● MOUNTING

Proper nozzle height must be given attention so as not to give excessive pressure on the chip during mounting on the PCB.

(Excessive pressure may cause exterior damage, change in resistance, circuit open, etc.)

● SOLDERING

Our products have Ag electrodes protected by double layer.

▶ **1st Ni Coating**

- This prevents Ag electrode from leaching and enhance the bonding with Sn

▶ **2nd Sn Coating**

- This is made of Sn 100% with melting point 232℃ to prevent it from melting when solder cream melts, and to enhance the bonding.
- Commercial solder creams are made of Sn-3.0Ag-0.5Cu with melting point 217℃.

● CLEANING

If rosin flux is used, cleaning usually is unnecessary. When strongly activated flux is used, chlorine in the flux may dissolve into some types of cleaning fluids, thereby affecting the chip capacitors.

This means that the cleaning fluid must be carefully selected, and should always be new.

● CAUTION FOR CHIP RESISTOR SEPERATION FROM PCB

Chip resistor installation on PCB is similar phenomenon as chocolate chip on top of cake.

PCB has enough flexibility on outer force but Chip resistor can be defected without any bending.

(By chip resistor use of Ceramic, solder, metal)

Therefore, when separate from Chip resistor on PCB, be ware of any crack of chip

● OTHERS

▶ **Manual work**

Manual soldering can pose a great risk of creating thermal cracks in chip resistors.

The hot soldering iron tip comes into direct contact with the end terminations, an operator's carelessness may cause the tip of the soldering iron to come into direct contact with the ceramic body of the resistor.

Therefore the soldering iron must be handled carefully, and close attention must be paid to the selection of the soldering iron tip and to temperature control of the tip.

▶ **Do not use more than rated voltage.(check the contents on the file)**

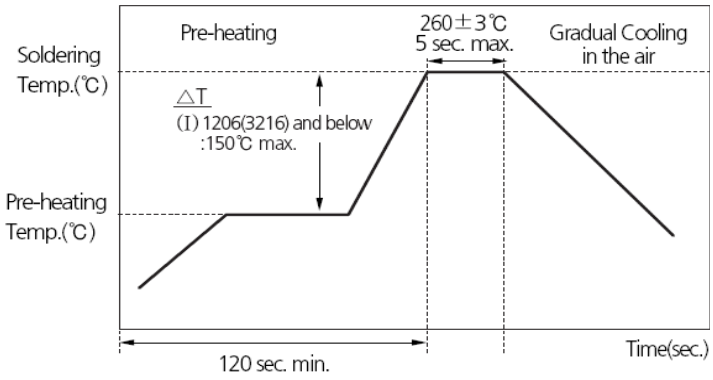
NOTICE

● RECOMMENDED USAGE OF THE RESISTOR

▶ Flow Soldering

After mounting the resistor to PCB with paste, dip the PCB into solder bath. <Fig 15>

<Fig 15>



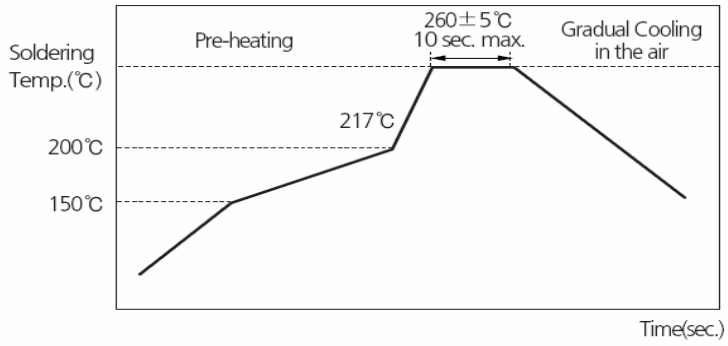
< Flow Soldering>

▶ Reflow Soldering

After printing solder creams on PCB, place the resistor on the solder cream.

Then heat the PCB. <Fig 16>

<Fig 16>



< Reflow Soldering>

● CAUTION

▶ Storage condition

Please make sure to keep the storage conditions.

* Temperature : 5℃～40℃, * Humidity : 20%RH ～ 70%RH

▶ Damage control

Please handle with care to prevent damaging the resistor.

Specially, the excessive nozzle height of SMD or the extreme pressure with tweezers.

▶ Leaching prevention

It is important to keep the soldering conditions to prevent Ag leaching in Flow soldering.