1. Scope

This specification applies to fixed metal film surface mount resistor networks [High precision and reliability]

2. Type Designation

Example:

RM 2012 A – 102 / 102 – P W X L 10

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10)

(1) Product Type
RM : Fixed metal film surface mount resistor networks.

(2) Size
2012 : 2.0 x 1.25 mm

(3) Circuit Type
A : See para.3.
B : See para.3.

(4) Rated resistance of R1
102 : Example : 102 = 10×10^2 = 1 kΩ

(5) Rated resistance of R2
102 : Same as para.(4)

(6) Absolute temperature coefficient of resistance
N : ±10ppm/°C
P : ±25ppm/°C

(7) Absolute tolerance on rated resistance
W : ±0.05%
B : ±0.1%
C : ±0.25%
D : ±0.5%

(8) Temperature coefficient of resistance tracking
X : ±1ppm/°C
W : ±2ppm/°C
V : ±5ppm/°C

(9) Tolerance ratio on rated resistance
L : ±0.01%
P : ±0.02%
W : ±0.05%
B : ±0.1%

(10) Quantity per reel
05 : 500 pieces / reel
10 : 1,000 pieces / reel
50 : 5,000 pieces / reel

REV	CHANG.NO NOTE.	DATE	DRAWN	APPD
		/ /		
4	8.4. Label is changed.	/ /		
3	2 .Type Designation is changed.	2018/8 /10	H.Hosoya	H.Hosoya
2	3. Circuit type is changed.	16/5/31	Hosomi	Hosoya
1	2 .Type Designation is changed.	11/5/25	Takagisi	Hosoya
0	First edition	05/ 5/27	Komatsu	mori

APPD H. Hosoya 2018/8/11
CHKD H. Tanaka 2018/8/11
DRAWN M.Nakazaki 2018/8/10

SSM SUSUMU Thin Film Specialist and Innovator

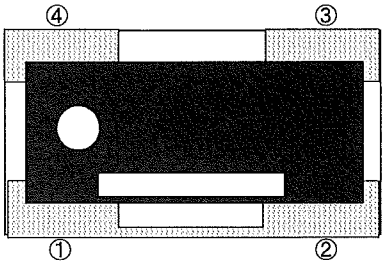
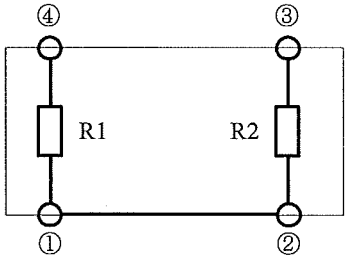
SUSUMU CO.,LTD

TITLE: Specification for Resistor networks RM2012

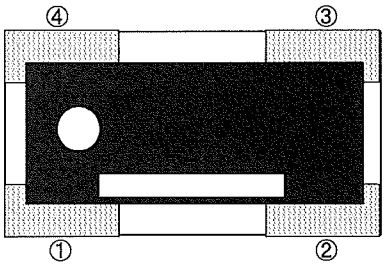
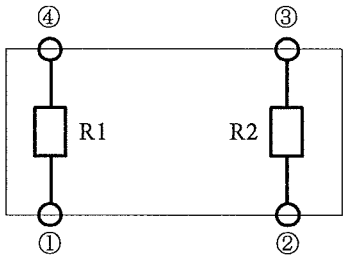
SPEC.NO: RM00-4019

3. Circuit type

Circuit type code = A

Top View and Terminal number	Circuit
	

Circuit type code = B

Top View and Terminal number	Circuit
	

4. Physical Dimensions and Construction

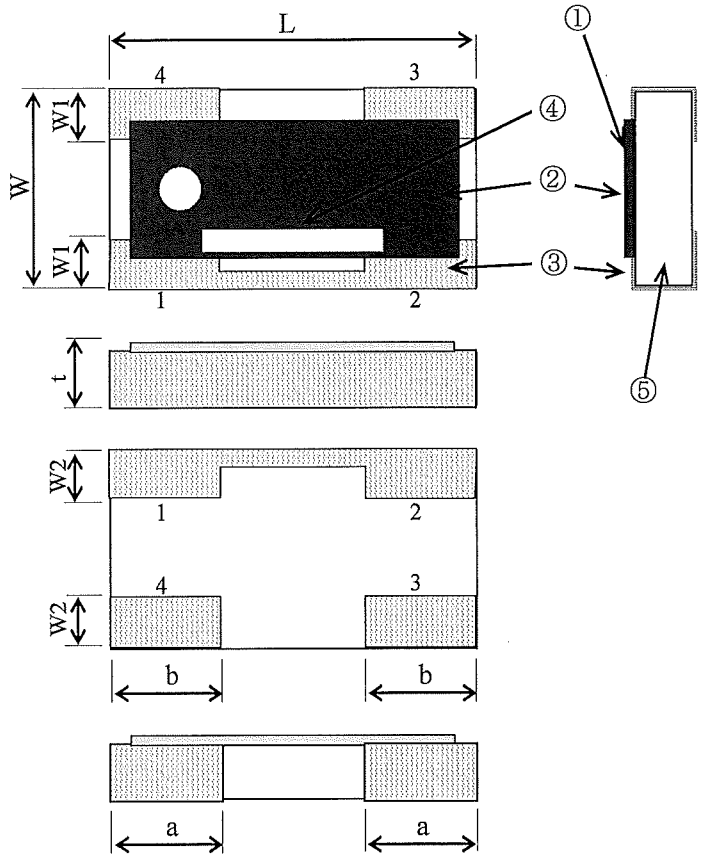


Fig.1-1 Dimensions (Circuit type : A)

Code letter	Dimensions(mm)
L	2.0±0.2
W	1.25±0.2
t	0.45±0.1
a	0.5±0.2
b	0.6±0.2
W1	0.4±0.2
W2	0.35±0.2

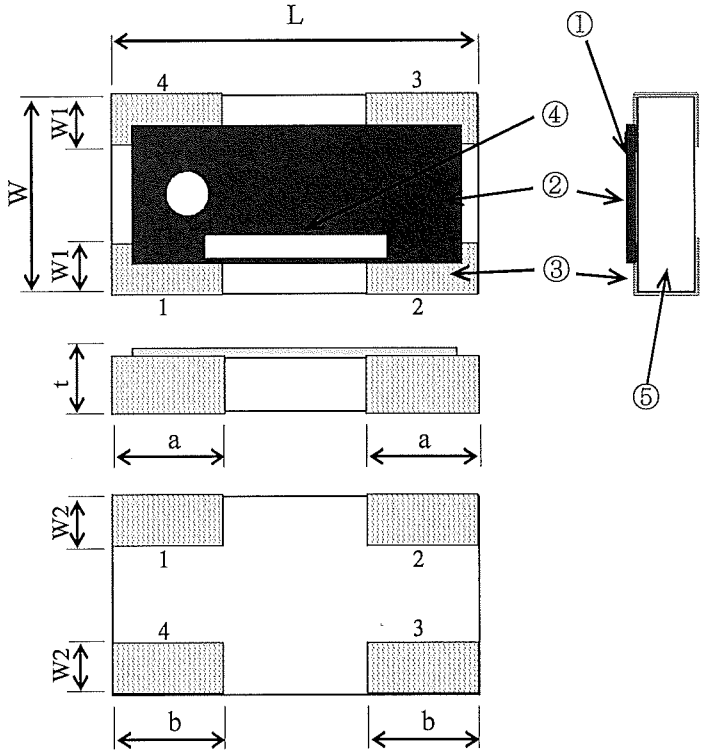


Fig.1-2 Dimensions (Circuit type : B)

① Resistive element
Chrome alloy thin film resistive element
② Protective coat
Inorganic coating & Resin coating
③ Electrode
Tin plating
④ Marking
⑤ Substrate
Alumina ceramic

5. Marking

Dot and bar mark is marked on the protect coating. (See para.4.)

6. Ratings

6.1. Ratings

Rated Resistance

Rated resistance range	Tolerance on rated Absolute resistance
100Ω ≦R＜2kΩ	±0.1%(B) ±0.25%(C) ±0.5%(D)
2k≦R≦100kΩ	±0.05%(W) ±0.1%(B) ±0.25%(C) ±0.5%(D)

Ratio (Tracking)	Tolerance on Ratio
Ratio＝1	±0.01%(L) ±0.02%(P) ±0.05%(W) ±0.1%(B)
1＜Ratio≦10	±0.02%(P) ±0.05%(W) ±0.1%(B)
10＜Ratio≦100	±0.05%(W) ±0.1%(B)

Temperature coefficient of resistance

Rated resistance range	Temperature coefficient of resistance [Absolute]
100Ω ≦R＜300Ω	±25ppm/℃(P)
300Ω ≦R≦100kΩ	±10ppm/℃(N) ±25ppm/℃(P)

Ratio (Tracking)	Temperature coefficient of resistance [Ratio]
Ratio＝1	±1ppm/℃(X) ±5ppm/℃(V)
1＜Ratio≦3	±2ppm/℃(W) ±5ppm/℃(V)
3＜Ratio≦100	±5ppm/℃(V)

Definition of the Ratio

Tolerance on rated resistance ratio:

$$\left(\frac{MEASURED.RESISTANCE.RATIO..R2/R1}{RATED.RESISTANCE.RATIO - R2/R1} - 1\right) \times 100(\%)$$

Tracking of Temperature Coefficient of Resistance(T.C.R.) :

(T.C.R. of R2) − (T.C.R. of R1)

The combination of the standard resistance value

Ratio	R1	R2	Ratio	R1	R2	Ratio	R1	R2
1 : 1	1kΩ	1kΩ	1 : 5	1kΩ	5kΩ	1 :20	1kΩ	20kΩ
	10kΩ	10kΩ		2kΩ	10kΩ		2kΩ	40kΩ
	100kΩ	100kΩ		10kΩ	50kΩ		5kΩ	100kΩ
1 : 2	1kΩ	2kΩ	1: :6	1kΩ	6kΩ	1 : 25	1kΩ	25kΩ
	10kΩ	20kΩ		10kΩ	60kΩ		2kΩ	50kΩ
1 : 3	1kΩ	3kΩ	1 : 9	1kΩ	9kΩ	1 : 50	1kΩ	50kΩ
	10kΩ	30kΩ		10kΩ	90kΩ		2kΩ	100kΩ
1 : 4	1kΩ	4kΩ	1 : 10	1kΩ	10kΩ	1 : 100	1kΩ	100kΩ
	10kΩ	40kΩ		2kΩ	20kΩ			
				10kΩ	100kΩ			

It is possible with the combination except for this as well that we make it corresponding to the requirement.

6.2. 8Rated dissipation

0.05 W / element 0.1 W / package

Rated dissipation is based on continuous full load operation at rated ambient temperature of 85°C.

For resistors operated at ambient temperature in excess of 85°C, the maximum load shall be derated in accordance with the following curve.

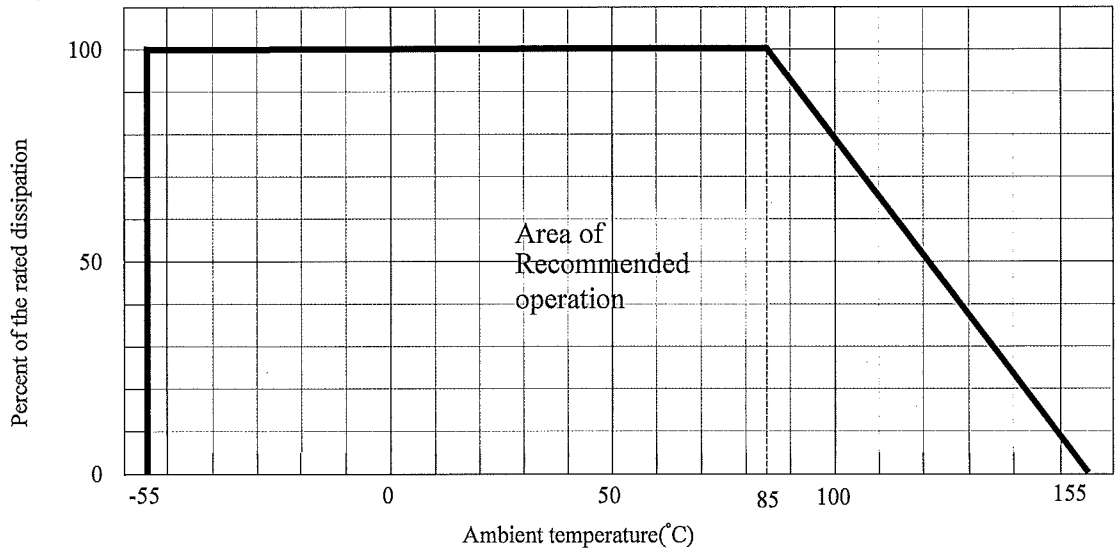


Fig. 2 Derating curve

6.3. Rated voltage

The d.c. or a.c. r.m.s voltage shall be calculated from the following expression.

When the rated voltage exceeds the limiting element voltage, the limiting element voltage shall be the rated voltage.

$E=\sqrt{R\times P}$ Where E: Rated voltage (V)
R: Rated resistance (Ω)
P: Rated dissipation (W)

6.4. Limiting element voltage

25 V

6.5. Maximum overload voltage

50 V

6.6. Category temperature range

Range of ambient temperature for witch a resistor has been designed to operate continuously, defined by the temperature limits of its appropriate category.

(1) Upper category temperature : +155 °C

(2) Lower category temperature : -55 °C

7. Performance

See Table 1.

The test method shall be as specified in IEC 60115-1 or JIS C 5201-1.

Table 1

No.	Item	Conditions	Specification
1	Resistance and tolerance	Refer to IEC 60115-1 (JIS C 5201-1), Sub-clause 4.5.	Not exceed the specified tolerance on rated resistance in para.6.1.
2	Temperature characteristic of resistance	Resistance shall be measured under standard atmospheric conditions. When the temperature reaches and is maintained at 100 ˚C higher than the temperature of standard atmospheric conditions, resistance shall be measured again. Refer to IEC 60115-1 (JIS C 5201-1), Sub-clause 4.8.	Not exceed the specified temperature coefficient of resistance in para.6.1.
3	Overload	A d.c. or a.c. r.m.s. voltage of 2.5 times the rated voltage shall be applied for 5 sec. For other procedures, refer to IEC 60115-1(JIS C 5201-1), Sub-clause 4.13.	Change in resistance Absolute ±(0.1%+0.01 Ω) Ratio ±0.05% Without damage by flash over (spark, arcing), burning or breakdown etc.
4	Substrate bending test	Pressurizing jig: Fig.12 in IEC 60115-1(JIS C 5201-1), Sub-clause 4.33. The amount of bend: 3mm Test board A shall be used. For other procedures, refer to IEC 60115-1(JIS C 5201-1), Sub-clause 4.33.	Change in resistance Absolute ±(0.05%+0.01 Ω) Ratio ±0.05% Without mechanical damage such as breaks.
5	Resistance to soldering heat	(1) Solder bath method Preheat 100～110˚C 30 s. Temperature 270±5˚C 10±1 s. (2) Reflow soldering method Peak temperature 260±5˚C 10 sec. or less Temperature 220˚C over 60 s. max. Limited reflow times: two times. The temperature shall be board surface temperature. (3) Soldering iron method Bit temperature 350±5˚C Time 3 +1／0 s. For other procedures, refer to IEC 60115-1(JIS C 5201-1), Sub-clause 4.18.	Change in resistance Absolute ±(0.05%+0.01 Ω) Ratio ±0.05% Without mechanical damage.
6	Solderability	Temperature of solder 235±5˚C (Solder alloy: Sn-37Pb) 245±5˚C (Solder alloy: Sn-3Ag-0.5Cu) Duration of immersion 2±0.5 s. For other procedures, refer to IEC 60115-1(JIS C 5201-1), Sub-clause 4.17.	A new uniform coating of solder shall cover minimum of 95% of the surface being immersed.
7	Solvent resistance	Immersion cleaning At normal temperature : 300 s. Using Isopropyl alcohol.	Without distinct damage in appearance.

Table 1

No.	Item	Conditions	Specification
8	Rapid change of temperature	The resistor shall be subjected to 5 continuous cycles, each as shown in the figure below. 1) −55±3°C : 30 min 2) Standard atmospheric conditions : 2～3 min 3) +125±2°C : 30 min 4) Standard atmospheric conditions : 2～3 min For other procedures, refer to IEC 60115-1(JIS C 5201-1), Sub-clause 4.19.	Change in resistance Absolute ±(0.1%+0.01 Ω) Ratio ±0.05% Without mechanical damage such as breaks and distinct damage in appearance.
9	Endurance (Rated load)	Temperature: 85±2°C Subjected to a voltage cycle consisting of rated d.c. voltage application of 1 hr 30 min and rest of 30 min repeatedly for 1000 +48/0 hrs. For other procedures, refer to IEC 60115-1(JIS C 5201-1), Sub-clause 4.25.	Change in resistance Absolute ±(0.1%+0.01 Ω) Ratio ±0.05% Without mechanical damage in appearance.
10	Endurance (Temperature Humidity Bias)	Temperature: 85±2°C Humidity: 85±5%RH Subjected to a voltage cycle consisting of 10% rated d.c. voltage application of 1 hr 30 min and rest of 30 min repeatedly for 1000 +48/0 hrs. For other procedures, refer to IEC 60115-1(JIS C 5201-1), Sub-clause 4.37.	Change in resistance Absolute ±(0.1%+0.01 Ω) Ratio ±0.05% Without mechanical damage in appearance.
11	Endurance at upper category temperature	The specimen shall be placed in the test chamber at 155±2°C with no load for 1000 +48/0 hrs. For other procedures, refer to IEC 60115-1(JIS C 5201-1), Sub-clause 4.25.3.	Change in resistance Absolute ±(0.1%+0.01 Ω) Ratio ±0.05% Without mechanical damage in appearance.

8. Packaging

Resistors shall be in Taping.

8.1. Material and Dimensions

8.1.1. Tape

Using plastic embossed tape. See Fig.3.

8.1.2. Reel

Using plastic reel. See Fig.4. Refer to EIAJ ET-7200C

8.2. Specification of taping

Refer to clause 8.1 and IEC 60286-3 (JIS C 0806-3).

8.3. Quantity per reel

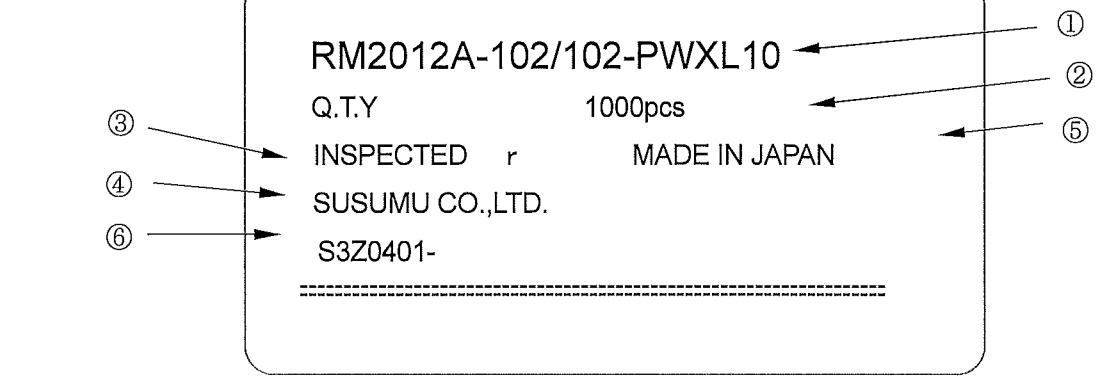
Regular quantity is 500, 1000, or 5000 piece per reel.

8.4. Label

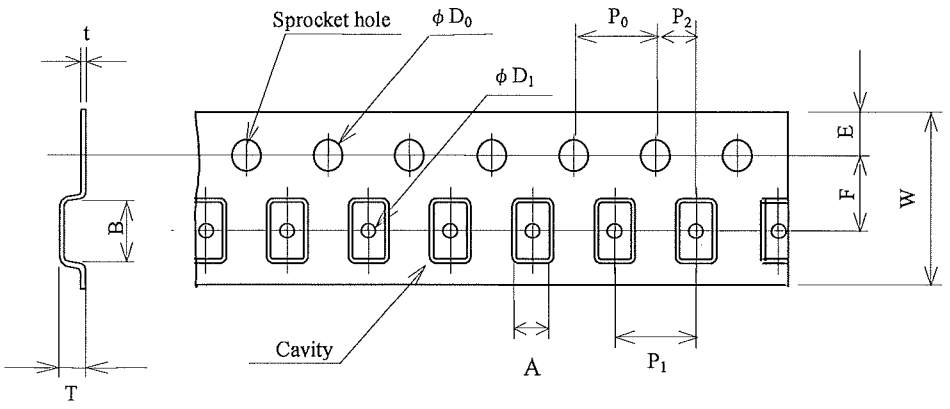
The label indicated following items shall be marked on single side of the reel.

① Type designation (See Para. 2)
② Quantity
③ Inspection date code
(Month and year are marked. Refer to JIS C 5201-1 Annex JA TableJA.5-1)
④ Manufacturer's name ("SUSUMU CO., LTD.")
⑤ Country of origin
⑥ Lot. No.

Example of the label



Unit:mm



Code letter	Dimensions
A	1.6±0.2
B	2.4±0.2
W	8.0±0.3
F	3.5±0.05
E	1.75±0.1
P_0	4.0±0.1
P_1	4.0±0.1
P_2	2.0±0.05
D_0	1.55±0.05
D_1	---
T	Less than 1.5
t	Less than 0.3

Fig.3 Dimensions of taping

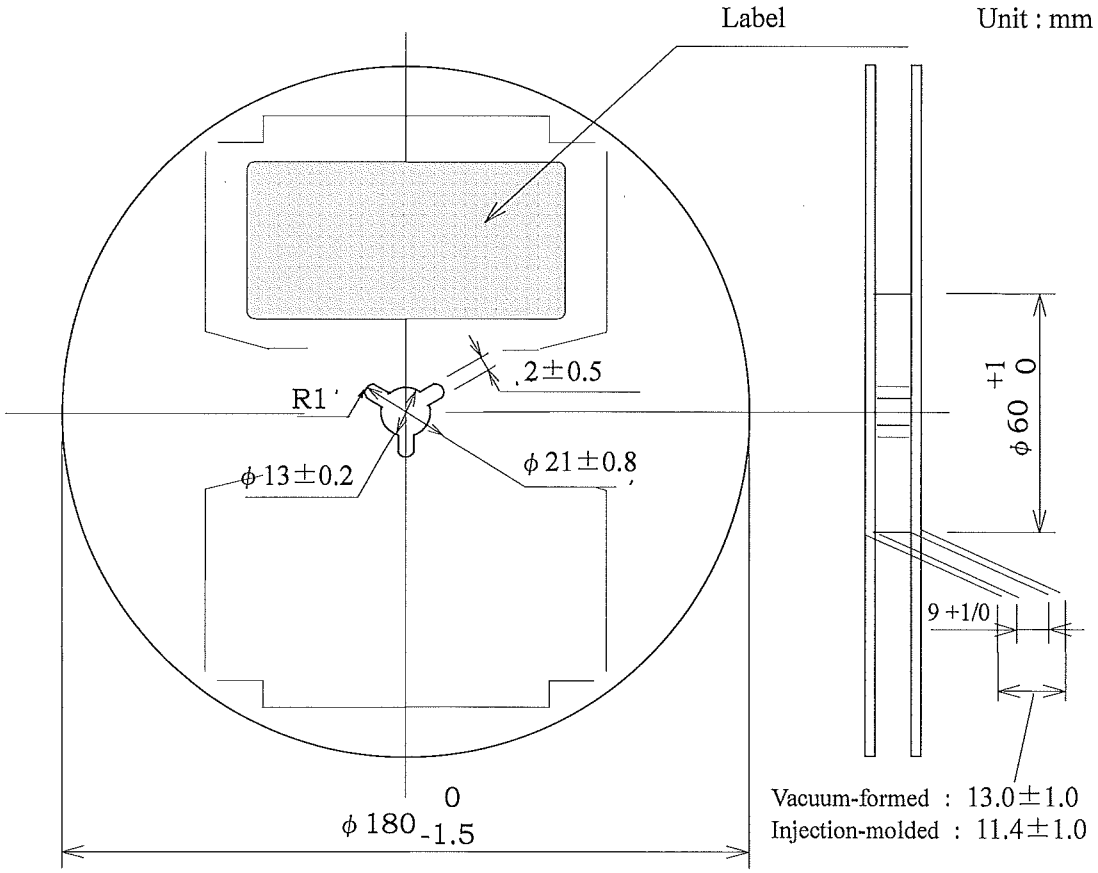


Fig. 4 Dimensions of reel

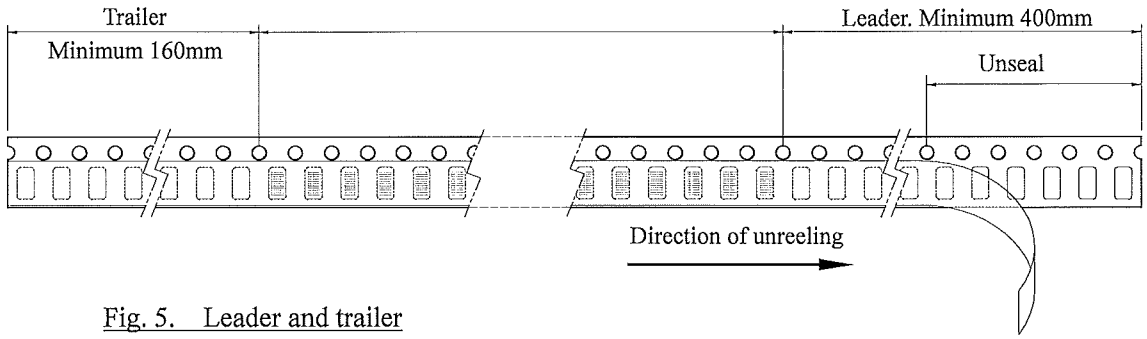


Fig. 5. Leader and trailer

Alignment of products in taping

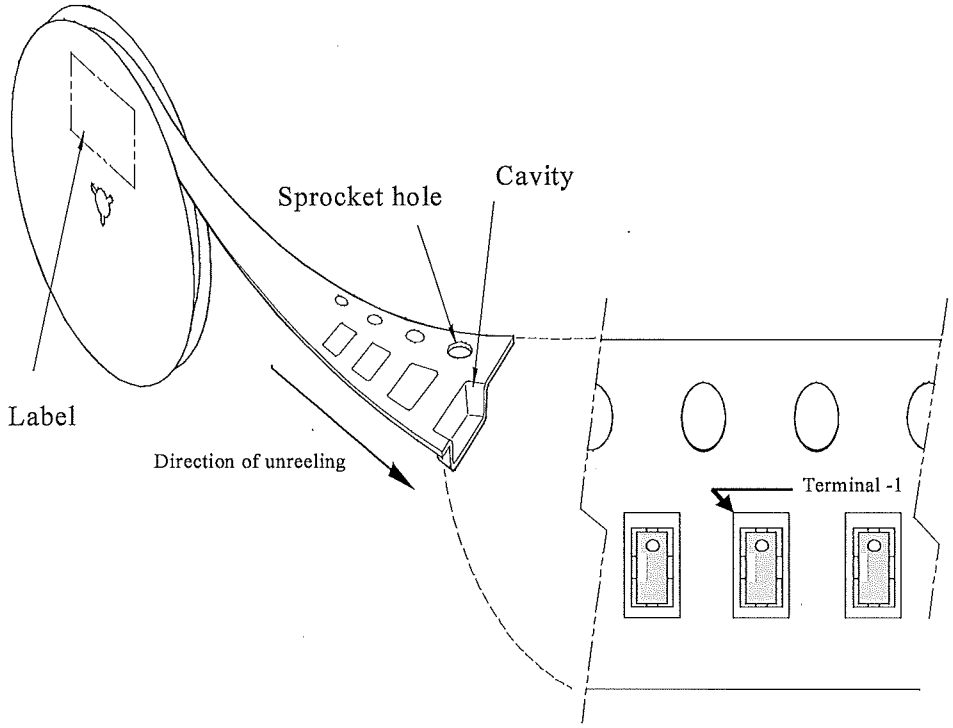


Fig. 6. Direction of chip in tape

9. Precautions in use

9.1. Storage

(1) Resistor shall be stored in a room where temperature and humidity must be controlled.
(temperature 5 to 35 deg C, humidity 45 to 85 % RH) However humidity, keep it low, as it is possible.

(2) Resistor shall be stored as direct sunshine doesn't hit on it.

(3) Resistor shall be stored with no moisture, dust, a material that will make solderbility inferior, and a harmful gas (hydrogen chloride, sulfurous acid gas, and hydrogen sulfide).

(4) Resistor shall be stored with keeping the minimum package unit with uncivilized sealed (Keep the state of the taping).

9.2. Time limit to storage

(1) The storage time limit of the product is reckoned on the day when the product was shipped by our company and made within one year.

(2) Confirm solderbility beforehand when you use the one that the time limit was passed.

9.3. Chip mounting

(1) When chip are mounted on the PC board, the protection coat of resistors must not be scratched. If it will be scratched, it will make performance for moisture inferior.

(2) In case that resistor will be soldered by soldering iron, heating shall be done on the land, and soldering iron must not hit on the resistor itself.

(3) In case that resin coating or resin seal will be made for a PC board after chip mounting, do washing and drying it enough before coating or sealing. If ion bear or moisture will be sealed in resin coating, it will make performance for moisture inferior sometimes.
For resinous use, it is necessary to set up enough the curing conditions. As it get improper for the condition, change of a resistance value are large and are a case.

(4) When resin coating will be used, it is necessary to confirm a curing condition and so on fully in advance and to set it up. When a curing condition becomes inappropriate, a change in the resistance value may grow big.

(5) According to shape, material, and pressure of clamping in chip mounting machine, there is the case that crack will be appeared on resistor. Control a shock energy for clamping resistor under 7×10^{-4} J.
With a shock energy around clamping that says here, it is suited to a potential energy, in case that iron block of 25g is dropped naturally to the resistor placed on iron plate for the height of 2.8mm.

(6) The glue to fix a resistor on the PC board around chip mounting, it is needed high insulation resistance and great performance or moisture. And it is needed that these characteristics are not inferior in using temperature range and a hot spot temperature to be acting.

9.4. Using and Handling

(1) Use under the special environment
Performance and reliability are fully researched in advance, and it must be confirmed when a use part under the special environment is used with the special environment. There is the following thing in the special environment.
[1] Water, salt water, oil, the inside of acid, alkali, the liquid such as an organic solvent or the place where it reaches it
[2] The place where direct sunlight hits it, an exposure in the open air, the inside of the dust
[3] The condensation
[4] The place where harmful gas (in such cases as the sea breeze, HCl, Cl_2, SO_2, H_2S, NH_3, NO_X) is abundant
Water or ion quality sometimes reaches even a resistance body and an electrode by the protection material of the resistor being eroded gradually under the above environment. Then, investigation confirmation is necessary because resistance value may change due to the chemical reaction such as electrolysis.

(2) Use under the high temperature environment
When components are used under the high temperature environment, load electric power must be reduced based on the reduction curve prescribed in every kind.

(3) Protect the edge and protection coat of resistors from mechanical stress.

(4) Handle with care when PC board is divided or fixed on support body, because bending of PC board after chip mounting will make mechanical stress for resistors.

(5) Resistors shall be used within rated range shown in specification.
Especially, if voltage more than specified value will be loaded to resistor, there is a case it will make damage for machine because of temperature rise depending on generation of heat, and increase resistance value or breaks.

(6) In case that resistor is loaded a rated voltage, it is necessary to confirm temperature of a resistor and to reduce a load power according to load reduction curve, because a temperature rise of a resistor depends on influence of heat from mounting density and neighboring element.

(7) Observe Limiting element voltage and maximum overload voltage specified in each specification.

(8) If there is a possibility that a large voltage (pulse voltage, shock voltage) charge to resistor, It is necessary that operating condition shall be set up before use, because performance of thin film resistor is affected by a large shock voltage.

9.5. Others

Refer to EIAJ RCR-2121B – Technical Report if Japan Electronics and Information Technology Industries Association "Guideline of notabilia for Fixed resistor for use in electronic equipment (Safety Application Guide for fixed resistors for use in electronic equipment)"

10. Normative reference

JIS C 5201-1:2011 Fixed resistors for use in electronic equipment-Part 1: Generic specification "