

1. Scope

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

2. Part Numbering System

Example:

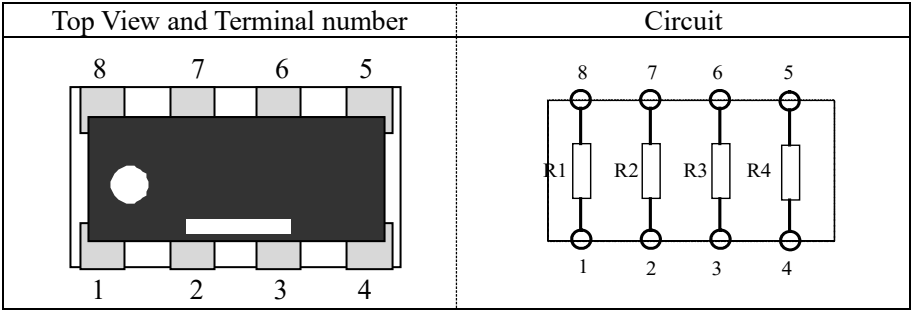
RM3216F-S001-NBXL10

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


- (1) Product Type
RM : Fixed metal film surface mount resistor networks.
- (2) Size
3216 : 3.2 x 1.6 mm
- (3) Circuit Type
F : (See para.3)
- (4) Product code;
S001~S019 : (See para.6)
- (5) Absolute temperature coefficient of resistance
N : ±10ppm/°C
- (6) Absolute tolerance on rated resistance
B : ±0.1%
- (7) Temperature coefficient of resistance tracking
X : ±1ppm/°C
- (8) Tolerance ratio on rated resistance
L : ±0.01%
- (9) Quantity per reel
10 : 1,000 pcs / reel

3. Circuit type

Circuit type code = F

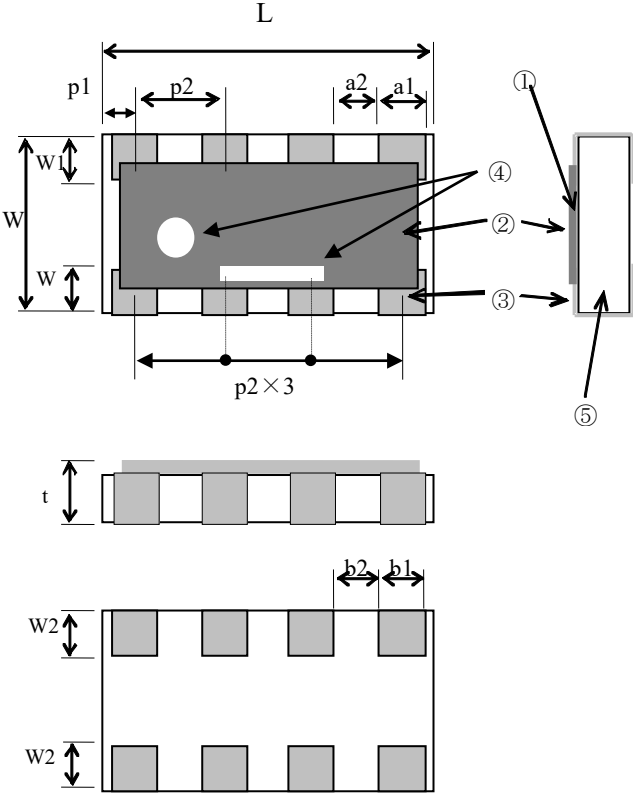


					APPD H.Hosoya	SUSUMU CO.,LTD
					2025/7/9	
					CHKD S.Negishi	
					2025/7/9	
					DRAWN M.Inoue	
					2025/7/9	TITLE: Specification for Resistor networks RM3216F series
						SPEC.NO:
						RM00-4509
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REV	CHANG.NO	NOTE.	DATE	DRAWN	APPD	



Thin Film Specialist and Innovator

4. Mechanical Specification



Code letter	Dimensions(mm)
L	3.2±0.2
W	1.6±0.2
t	0.45±0.1
a1	0.4±0.2
a2	0.4±0.2
b1	0.4±0.2
b2	0.4±0.2
p1	0.4±0.2
p2	0.8±0.1
W1	0.3±0.2
W2	0.4±0.2

Fig.1 Dimensions

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

5. Marking

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

6. Rated power, and voltage

6.1. Resistance, Tolerance and Temperature coefficient of resistance

	Rated resistance					Tolerance on rated resistance	Temperature coefficient of resistance
Absolute		R1	R1	R3	R4	±0.1% (Code: B)	±10ppm/°C (Code: N)
	RM3216F-S001-NBXL10	1kΩ	1kΩ	1kΩ	1kΩ		
	RM3216F-S002-NBXL10	2kΩ	2kΩ	2kΩ	2kΩ		
	RM3216F-S003-NBXL10	5kΩ	5kΩ	5kΩ	5kΩ		
	RM3216F-S004-NBXL10	10kΩ	10kΩ	10kΩ	10kΩ		
	RM3216F-S005-NBXL10	20kΩ	20kΩ	20kΩ	20kΩ		
	RM3216F-S006-NBXL10	50kΩ	50kΩ	50kΩ	50kΩ		
	RM3216F-S007-NBXL10	100kΩ	100kΩ	100kΩ	100kΩ		
	RM3216F-S008-NBXL10	2kΩ	1kΩ	1kΩ	2kΩ		
	RM3216F-S009-NBXL10	4kΩ	1kΩ	1kΩ	4kΩ		
	RM3216F-S010-NBXL10	5kΩ	1.25kΩ	1.25kΩ	5kΩ		
	RM3216F-S011-NBXL10	40kΩ	10kΩ	10kΩ	40kΩ		
	RM3216F-S012-NBXL10	5kΩ	1kΩ	1kΩ	5kΩ		
	RM3216F-S013-NBXL10	50kΩ	10kΩ	10kΩ	50kΩ		
	RM3216F-S014-NBXL10	9kΩ	1kΩ	1kΩ	9kΩ		
	RM3216F-S015-NBXL10	90kΩ	10kΩ	10kΩ	90kΩ		
	RM3216F-S016-NBXL10	10kΩ	1kΩ	1kΩ	10kΩ		
	RM3216F-S017-NBXL10	100kΩ	10kΩ	10kΩ	100kΩ		
	RM3216F-S018-NBXL10	50kΩ	1kΩ	1kΩ	50kΩ		
	RM3216F-S019-NBXL10	100kΩ	1kΩ	1kΩ	100kΩ		
Ratio (Tracking)	R1/R2 , R1/R3 , R1/R4 , R2/R3 , R2/R4 , R3/R4					±0.01% (Code: L)	±1ppm/°C (Code: X)

6.2. Rated power

0.0313 W / element 0.125W / 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.

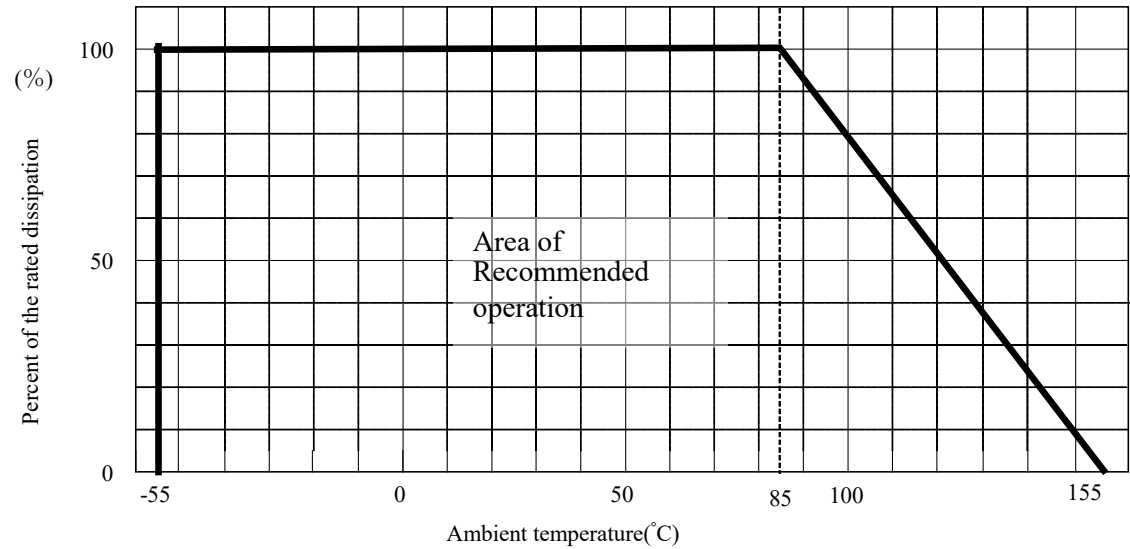


Fig. 2 Derating curve

6.3. Rated voltage

The DC or AC rms 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.

$$E = \sqrt{E \times P}$$

Where E: Rated voltage (V)
 R: Rated resistance (Ω)
 P: Rated dissipation (W)

6.4. Limiting element voltage

50 V

6.5. Maximum overload voltage

100 V

6.6. Operating temperature

Range of ambient temperature under which RM series resistors can operate continuously and normally.

- (1) Upper temperature limit : +155 °C
- (2) Lower temperature limit : -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	Refer to IEC 60115-1 (JIS C 5201-1), Sub-clause 5.6	Should be within specified tolerance (Section .6.1)	
2	Temperature characteristic of resistance	Resistance shall be measured at standard ambient conditions and at 100 °C higher than that. Refer to IEC 60115-1 (JIS C 5201-1), Sub-clause 6.2	Should be within specified tolerance (Section .6.1)	
3	Short time Overload	DC or AC rms. 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 8.1	Resistance drift:	
			Absolute	Within $\pm(0.1\%+0.01\Omega)$
			Ratio	Within $\pm0.05\%$
			No visible damage nor any arcing or sparks between the terminals	
4	Board bending test	The amount of bend: 3mm For other procedures, refer to IEC 60115-1(JIS C 5201-1), Sub-clause 9.8 & JIS C 60068-2-21 Sub-clause 8.5.1	Resistance drift:	
			Absolute	Within $\pm(0.05\%+0.01\Omega)$
			Ratio	Within $\pm0.05\%$
			No visible external appearance change	
5	Resistance to soldering heat	(1) <u>Solder bath method</u> Preheat 100~110°C 30 s. Temperature 270±5°C 10±1 s. (2) <u>Reflow soldering method</u> 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) <u>Soldering iron method</u> Soldering iron tip temperature: 350±5°C Duration 3 +1 / 0 sec. For other procedures, refer to IEC 60115-1(JIS C 5201-1), Sub-clause 11.2	Resistance drift:	
			Absolute	Within $\pm(0.05\%+0.01\Omega)$
			Ratio	Within $\pm0.05\%$
			No visible external appearance change	

TITLE:
Specification for
Resistor networks RM3216F series

SUSUMU
CO.,LTD

Thin Film Specialist and Innovator

SPEC.NO:
RM00-4509

Rev. No.
0

Table 1

No.	Item	Conditions	Specification
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 11.1	Fresh solder should cover minimum of 95% of the terminal.
7	Solvent resistance	Immersion cleaning At normal temperature: 5 min. Using Isopropyl alcohol. For other details, refer to IEC 60115-1(JIS C 5201-1), Sub-clause 11.3	Marking shall be legible. No visible external appearance change.
8	Temperature cycle	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 10.1	Resistance drift: Absolute Within ±(0.1%+0.01Ω) Ratio Within ±0.05% No visible external appearance change
9	Load life	Temperature: 85±2°C Rated DC voltage 1 hr. 30 min on, 30 min off repeated for 1000 +48/0 hrs. The applied voltage shall not exceed the limited element voltage. For other procedures, refer to IEC 60115-1(JIS C 5201-1), Sub-clause 7.1	Resistance drift: Absolute Within ±(0.1%+0.01Ω) Ratio Within ±0.05% No visible external appearance change
10	Endurance (Temperature Humidity Bias)	Temperature: 85±2°C Humidity: 85±5%RH DC voltage equivalent of 10% of rated power, 1 hr. 30 min on, 30 min off, repeated for 1000 +48/0 hrs. The applied voltage shall not exceed the limited element voltage. For other procedures, refer to IEC 60115-1(JIS C 5201-1), Sub-clause 10.5	Resistance drift: Absolute Within ±(0.1%+0.01Ω) Ratio Within ±0.05% No visible external appearance change
11	Endurance at a maximum temperature	Temperature: 155±2°C Duration: 1000 +48/0 hrs. For other procedures, refer to IEC 60115-1(JIS C 5201-1), Sub-clause 7.3	Resistance drift: Absolute Within ±(0.1%+0.01Ω) Ratio Within ±0.05% No visible external appearance change

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SUSUMU
CO.,LTD

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Thin Film Specialist and Innovator
SSM SUSUMU THIN FILM SPECIALIST AND INNOVATOR

SPEC.NO:

RM00-4509

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8. Packaging

Resistors are packaged in tape/reel.

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 JEITA 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

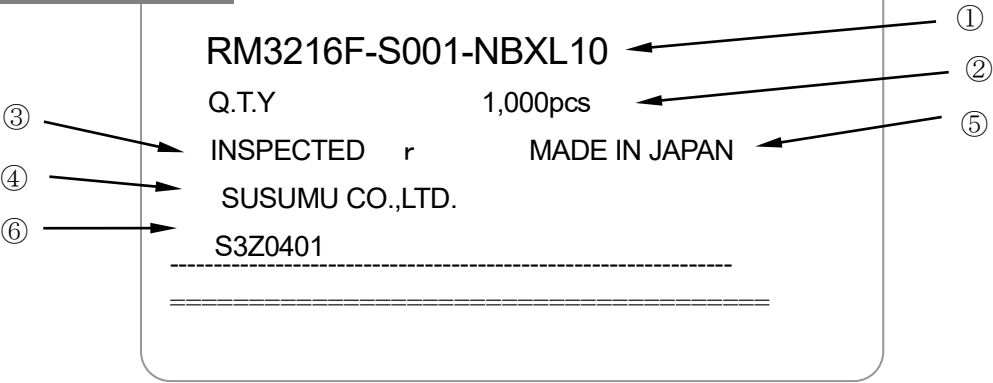
Regular quantity is 1,000 pcs/reel

8.4. Labeling

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

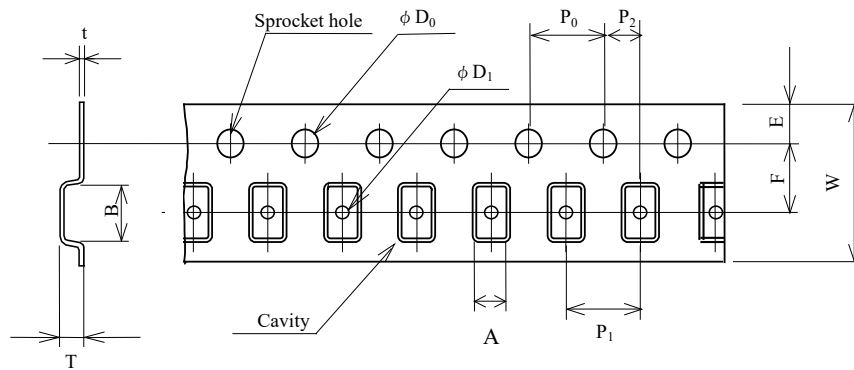
- ① Part number (See section 2)
- ② Quantity (See section 8.3)
- ③ Inspection year/month code
(Refer to JIS C 5201-1 Annex JA Table JA.5)
- ④ Manufacturer's name ("SUSUMU CO., LTD.")
- ⑤ Country of origin
- ⑥ Lot. No.

Example of the label



<p>TITLE:</p> <p>Specification for Resistor networks RM3216F series</p>	<p>SUSUMU CO.,LTD</p> <p>SSM SUSUMU Thin Film Specialist and Innovator</p>	<p>SPEC.NO:</p> <p>RM00-4509</p>	<p>Rev. No.</p> <p>0</p>
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Unit:mm



Code letter	Dimensions
A	2.0 ± 0.2
B	3.6 ± 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	1.05 ± 0.05
T	Less than 1.5
t	Less than 0.3

Fig.3 Dimensions of taping

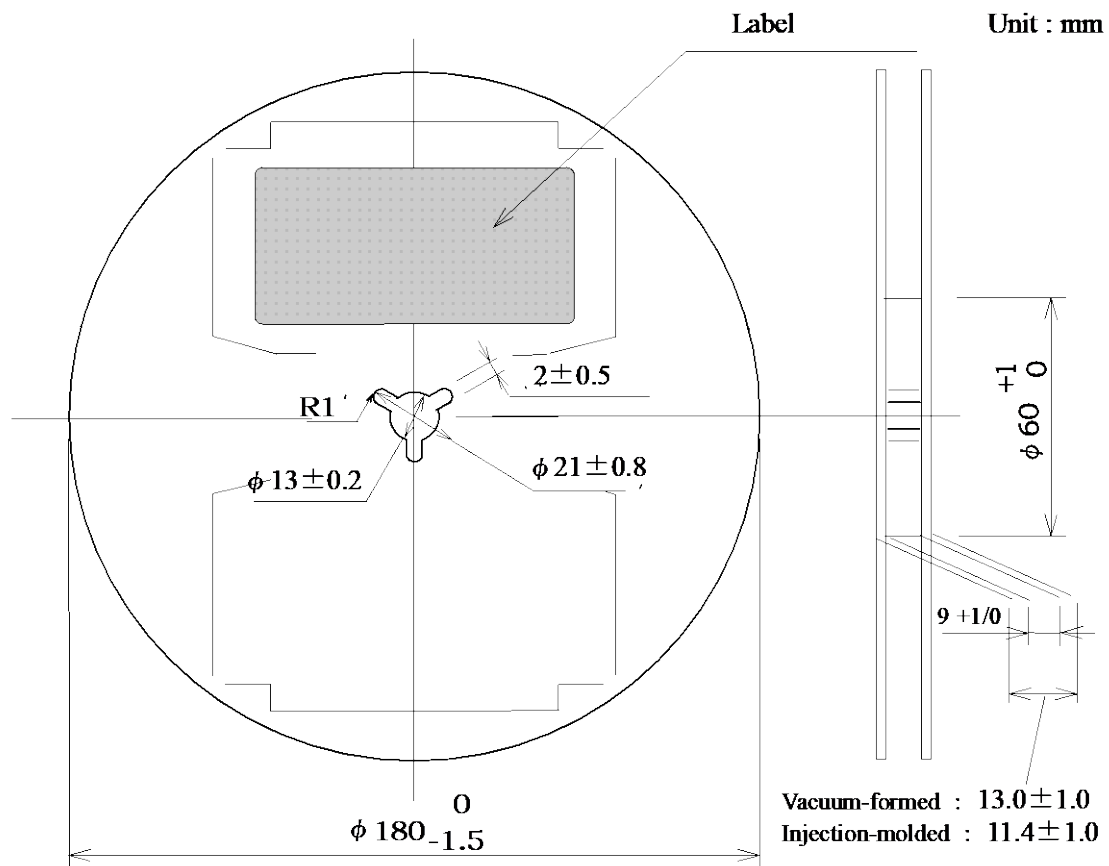


Fig. 4 Dimensions of reel

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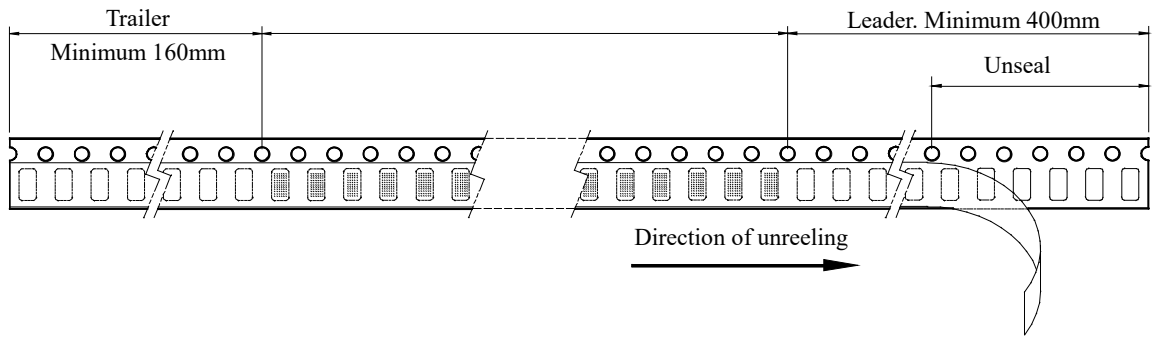


Fig. 5 Leader and trailer

Alignment of products in taping

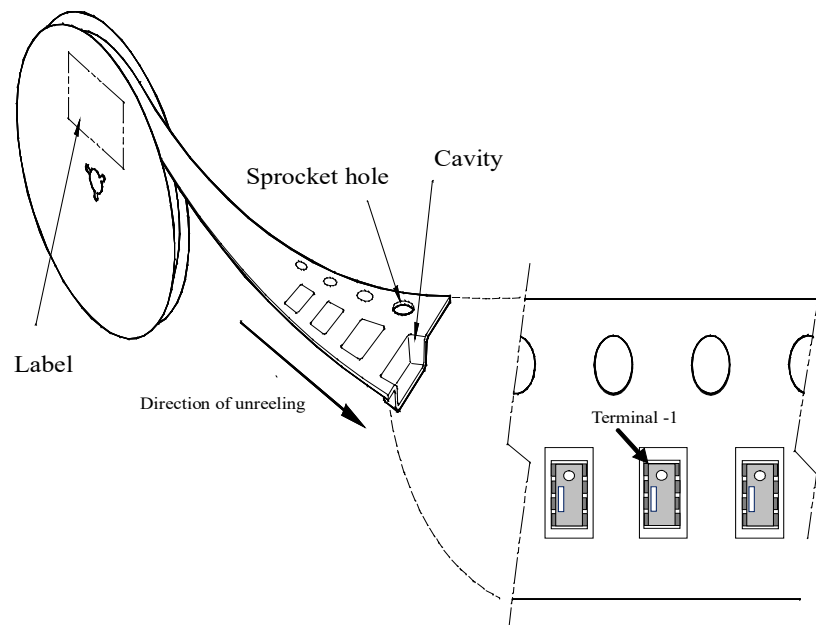


Fig. 6 Direction of chip in tape

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9. Precautions in use these resistors

9.1. Storage

- (1) The resistors shall be stored where temperature and humidity are controlled; (temperature 5°C to 35°C, humidity 45 to 85 % RH), keep humidity as low as possible.
- (2) The resistors shall not be exposed to direct sunlight.
- (3) The resistors shall be stored where no conditions that might affect solderability exists such as excess humidity, excess dust, or harmful gasses (example: hydrogen chloride, sulfurous acid gas, and hydrogen sulfide).
- (4) Resistors shall be stored in the smallest package unit and in the tape.
- (5) When resistors are stored under sealed conditions with oxygen-depleting packing material, it is rare, but depending on the environment, the gas generated by the oxygen-depleting chemical may cause resistance change.

9.2. Shelf life

- (1) The shelf life of the resistors is one year from the date they are shipped from Susumu.
- (2) Verify solderability when you use the resistors that are over the shelf life.

9.3. Caution during chip mounting

- (1) When the resistors are pick-and-placed on the PC board, try not to damage the protective coating or the surface of the products. Any damage to outer surface could affect the moisture tolerance.
- (2) When using soldering iron, the heating should be on the land. The soldering iron tip should not touch the chip resistors.
- (3) After the mounting, if the PC board is sealed or potted with resin, the board must be cleaned and dried thoroughly. If moisture or ionic contamination is sealed in, it could affect moisture tolerance.
- (4) If resin is used, the curing condition of the resin must be thoroughly evaluated beforehand. If improper curing condition is used, unnecessary resistance drift could occur.
- (5) The shape of chucking or picking devise of the mounting equipment or the pressure by chucking or grabbing device, could cause cracks or chips to the ceramic substrate if too strong. The mechanical pressure to the ceramic substrate by chucking devise should be less than 7×10^{-4} J, which is equivalent of 25g iron block falling onto the side of the standing chip resistor from the height of 2.8mm.
- (6) The adhesive that holds the resistors in position before soldering must have high insulation resistance, and tolerant to the moisture and the temperature of the soldering condition.

9.4. Using and Handling

- (1) Using the chip resistors under special environment
Performance and reliability must be fully evaluated and confirmed in advance if the chip resistors are used in special environment. Special environment can include.
 - [1] Used submerged or frequently exposed to water, saltwater, oil, acid, alkaline or solvents.
 - [2] Used in direct sunlight or exposed to heavy dust.
 - [3] Used where condensation could occur
 - [4] Used where the resistors are exposed to harmful gases (such as sea breeze, HCl, Cl₂, SO₂, H₂S, NH₃, NO_x)
 Under such conditions listed above, the protective material to the resistive body may erode gradually and moisture or ionic contamination could reach to the resistive body, which could change resistance by electrolysis or chemical corrosion.
- (2) Using the chip resistor under high temperature
When the resistors are used in high ambient temperature, the maximum power must follow the derating curve provided (Section 6.2)
- (3) Try to minimize the mechanical stress toward the edge of the substrate and surface of the protective coating.
- (4) The PC board warping or bending can be stress to the resistors mounted on the board. Handle the PC board carefully when the board is divided or inserted into the slots.
- (5) The resistors should be used within the rated power in this specification (Section 6.2) When voltage higher than the rated voltage is applied, the excess heat might damage the equipment, experience excessive resistance drift or even become open.
- (6) Even operating under rated voltage, the temperature of the resistors could be influenced by the density of the components surrounding the resistor and their heat dissipation. It is recommended to confirm temperature of the resistor and reduce the power according to the derating curve.
- (7) Observe Limiting element voltage and maximum overload voltage specified for each size (Section 6.3).
- (8) Thin film resistors are susceptible to surge voltage. If there is a possibility of large surge voltage (pulse voltage, Electrostatic discharge), it is necessary to take precautions to address the surge voltage.
- (9) Coating, sealing and embedding with resin or polymer
When mounted components are coated ,sealed with resin or polymer, or embedded into resin or polymer, the resin/polymer selection must consider heat tolerance, humidity tolerance, mechanical properties, and chemical or ion compositions. Certain resin materials may cause resistance drift during the curing process. Please get in touch with us in advance if you are using resin.

9.5. Others

Refer to JEITA 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 5201-1:2021 Fixed resistors for use in electronic equipment-Part 1: Generic specification ”

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