

Specification

(Reference)

Title: FIXED THICK FILM CHIP RESISTORS;
RECTANGULAR TYPE AND LOW OHM

Style: RLC10, 16, 20, 32, 35, 50, 63

RoHS COMPLIANCE ITEM

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1. Scope

1.1 This specification covers the detail requirements for fixed thick film chip resistors; rectangular type and low ohm, style of RLC10, 16, 20, 32, 35, 50, 63.

1.2 Applicable documents

- JIS C 5201-1: 1998, JIS C 5201-8: 1998, JIS C 5201-8-1: 1998
- IEC60115-1: 1999, IEC60115-8: 1989 Amendment 1: 1992, IEC60115-8-1: 1989
- EIAJ RC-2134B-2002

2. Classification

Type designation shall be the following form.

(Example)

RLC	20	K	R470	J	TP
1	2	3	4	5	6

Style

1 Fixed thick film chip resistors; rectangular type and low ohm Style

2 Size

3 Temperature coefficient of resistance

K	$\pm 100 \times 10^{-6} / ^\circ\text{C}$
-(Dash)	Standard

4 Rated resistance Rated resistance and symbol shall be in accordance with Sub-clause 3.2.

5 Tolerance on rated resistance

6 Packaging form

3. Rating

3.1 The ratings shall be in accordance with Table-1.

Table-1(1)

Style	Rated dissipation (W)	Rated current range (A)	Temperature coefficient of resistance ($10^{-6} / ^\circ\text{C}$)		Rated resistance range (Ω)	Tolerance on rated resistance
RLC10	0.125	0.11~1.11	K	± 100	3.6~10	F($\pm 1\%$), J($\pm 5\%$)
			-(Standard)	0~+200	0.47~3.3	F($\pm 1\%$), G($\pm 2\%$), J($\pm 5\%$)
				0~+300	0.24~0.43	F($\pm 1\%$), J($\pm 5\%$)
RLC16	0.25	0.14~1.58	K	± 100	3.6~10	F($\pm 1\%$), J($\pm 5\%$)
			-(Standard)	0~+200	0.47~3.3	F($\pm 1\%$)
				0~+250	0.2~0.43	G($\pm 2\%$)
RLC20	0.33	0.15~2.56	K	± 100	3.6~10	F($\pm 1\%$), J($\pm 5\%$)
			-(Standard)	0~+200	0.47~3.3	F($\pm 1\%$)
				0~+250	0.2~0.43	G($\pm 2\%$)
RLC32	0.5	0.18~3.16	K	± 100	0.05~0.18	J($\pm 5\%$)
			-(Standard)	0~+200	0.2~0.43	F($\pm 1\%$)
				0~+250	0.05~0.18	G($\pm 2\%$)
RLC35	0.66	0.44~3.63	K	± 100	0.47~3.3	F($\pm 1\%$)
			-(Standard)	0~+200	0.2~0.43	G($\pm 2\%$)
				0~+250	0.05~0.18	J($\pm 5\%$)

Table-1(2)

Style	Rated dissipation (W)	Rated current range (A)	Temperature coefficient of resistance (10 ⁻⁶ /°C)		Rated resistance range(Ω)	Tolerance on rated resistance
RLC50	0.75	0.47~3.87	K	±100	0.47~3.3	F(±1%) G(±2%) J(±5%)
			-(Standard)	0~+200	0.2~0.43	
				0~+250	0.05~0.18	
RLC63	1.0	0.55~4.47	K	±100	0.47~3.3	F(±1%) G(±2%) J(±5%)
			-(Standard)	0~+200	0.2~0.43	
				0~+250	0.05~0.18	

Style	Limiting element voltage(V)	Isolation voltage (V)	Category temperature range (°C)
RLC10	1.11	100	-55~+125
RLC16	1.41		
RLC20	1.58	500	
RLC32	1.81		
RLC35	1.47		
RLC50	1.56		
RLC63	1.82		

3.2 Rated resistance

The rated resistance shall be in accordance with Table-2

Table-2

Rated resistance [mΩ]	Symbol	Rated resistance [mΩ]	Symbol	Rated resistance [Ω]	Symbol
50	R050	250	R250	1.1	1R10
51	R051	270	R270	1.2	1R20
56	R056	300	R300	1.3	1R30
60	R060	330	R330	1.5	1R50
62	R062	360	R360	1.6	1R60
65	R065	390	R390	1.8	1R80
68	R068	400	R400	2.0	2R00
70	R070	430	R430	2.2	2R20
75	R075	470	R470	2.4	2R40
80	R080	500	R500	2.7	2R70
82	R082	510	R510	3.0	3R00
90	R090	560	R560	3.3	3R30
91	R091	600	R600	3.6	3R60
100	R100	620	R620	3.9	3R90
110	R110	650	R650	4.3	4R30
120	R120	680	R680	4.7	4R70
130	R130	700	R700	5.1	5R10
150	R150	750	R750	5.6	5R60
160	R160	800	R800	6.2	6R20
180	R180	820	R820	6.8	6R80
200	R200	900	R900	7.5	7R50
220	R220	910	R910	8.2	8R20
240	R240	1000	1R00	9.1	9R10
				10	100

3.3 Climatic category

55/125/56

Lower category temperature -55 °C
Upper category temperature +125 °C
Duration of the damp heat, steady state test 56days

3.4 Stability class

5%

Limits for change of resistance:
-for long-term tests ±5%
-for short-term tests ±1%

3.5 Derating

The derated values of dissipation at temperature in excess of 70 °C shall be as indicated by the following curve.

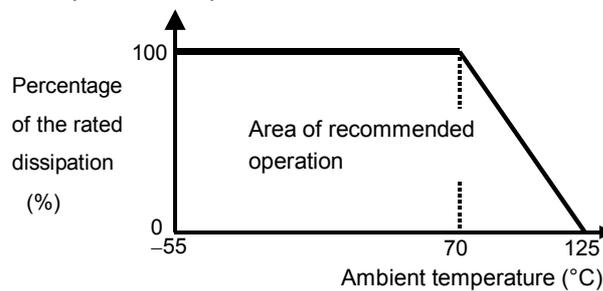


Figure-1 Derating curve

3.6 Rated voltage

d.c. or a.c. r.m.s. voltage calculated from the square root of the product of the rated resistance and the rated dissipation.

$$E = \sqrt{P \cdot R}$$

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

Limiting element voltage can only be applied to resistors when the resistance value is equal to or higher than the critical resistance value.

At high value of resistance, the rated voltage may not be applicable.

3.7 Rated current

The rated current calculated from the square root of the quotient of the rated resistance and the rated dissipation.

$$I = \sqrt{P / R}$$

I: Rated current (A)
P: Rated dissipation (W)
R: Rated resistance (Ω)

The rated current shall be corresponding to rated voltage.

4. Packaging form

The standard packaging form shall be in accordance with Table-3.

Table-3

Symbol	Packaging form		Standard packaging quantity / units	Application
B	Bulk (loose package)		1,000 pcs.	RLC10, 16, 20, 32, 35, 50, 63
TH	Paper taping	8mm width, 2mm pitches	10,000 pcs.	RLC10
TP	Paper taping	8mm width, 4mm pitches	5,000 pcs.	RLC16, 20, 32
TE	Embossed taping	8mm width, 4mm pitches	4,000 pcs.	RLC35
		12mm width, 4mm pitches		RLC50, 63

5. Dimensions

5.1 The resistor shall be of the design and physical dimensions in accordance with Figure-2 and Table-4.

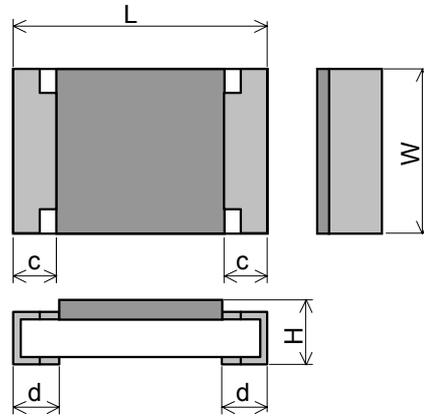


Figure-2

Table-4

Unit: mm

Style	L	W	H	c	d
RLC10	1.0 ± 0.05	0.5 ± 0.05	0.35 ± 0.05	0.2 ± 0.1	0.25 ^{+0.05} / _{-0.10}
RLC16	1.6 ± 0.1	0.8 ^{0.15} / _{-0.05}	0.45 ± 0.1	0.3 ± 0.1	0.3 ± 0.1
RLC20	2.0 ± 0.15	1.25 ± 0.10	0.6 ± 0.1	0.4 ± 0.2	0.4 ± 0.2
RLC32	3.1 ± 0.2	1.6 ± 0.15	0.6 ± 0.1	0.5 ± 0.25	0.3 ^{+0.2} / _{-0.1}
RLC35	3.1 ± 0.2	2.5 ± 0.15	0.6 ± 0.15	0.5 ± 0.25	0.3 ^{+0.2} / _{-0.1}
RLC50	5.0 ± 0.2	2.5 ± 0.15	0.6 ± 0.15	0.6 ± 0.2	0.6 ± 0.2
RLC63	6.3 ± 0.2	3.2 ± 0.15	0.6 ± 0.15	0.6 ± 0.2	0.6 ± 0.2

5.2 Net weight (Reference)

Style	Net weight (mg)
RLC10	0.6
RLC16	2
RLC20	5
RLC32	9
RLC35	16
RLC50	25
RLC63	40

6. Marking

The rated resistance shall be marked in 4 characters consisting of 3 figures and a letter or 3 figures and marked on over coat side.

The rated resistance shall be accordance with sub-clause 3.2.

The Rated resistance of RLC10 and RLC16 should not be marked.

(Example) "R050" → 0.05 [Ω]

"100" → 10 [Ω]

7. Performance

7.1 The standard condition for tests shall be in accordance with Sub-clause 4.2, JIS C 5201-1: 1998.

7.2 The performance shall be satisfied in Table-5.

Table- 5(1)

No.	Test items	Condition of test (JIS C 5201-1)	Performance requirements
1	Visual examination	Sub-clause 4.4.1 Checked by visual examination.	As in 4.4.1 The marking shall be legible, as checked by visual examination.
2	Dimension Resistance	Sub-clause 4.4.2 Sub-clause 4.5 Measurement current: 10(mA) Note: The measuring apparatus corresponding to Digital multimeter of TR6878 for Advantest Corp..	As specified in Table-4 of this specification. As in 4.5.2 The resistance value shall correspond with the rated resistance taking into account the specified tolerance.
3	Voltage proof	Sub-clause 4.7 Method: 4.6.1.4(See Figure-5) Test voltage: Alternating voltage with a peak value of 1.42 times the insulation voltage. Duration: 60 s±5 s Insulation resistance Test voltage: Insulation voltage Duration: 1 min.	No breakdown or flash over R ≥ 1 GΩ
4	Solderability	Sub-clause 4.17 Without aging Flux: The resistors shall be immersed in a non-activated soldering flux for 2 s. Bath temperature: 235 °C±5 °C Immersion time: 2 s±0.5 s	As in 4.17.4.5 The terminations shall be covered with a smooth and bright solder coating.
5	Mounting Overload (in the mounted state) Solvent resistance of the marking	Sub-clause 4.31 Substrate material: Epoxide woven glass Test substrate: Figure-3 Sub-clause 4.13 The applied voltage shall be 2.5 times the rated voltage or the current corresponding to. Duration: 2 s Visual examination Resistance Sub-clause 4.30 Solvent: 2-propanol Solvent temperature: 23 °C±5 °C Method 1 Rubbing material: cotton wool Without recovery	No visible damage ΔR ≤ ±1% Legible marking

Table-5(2)

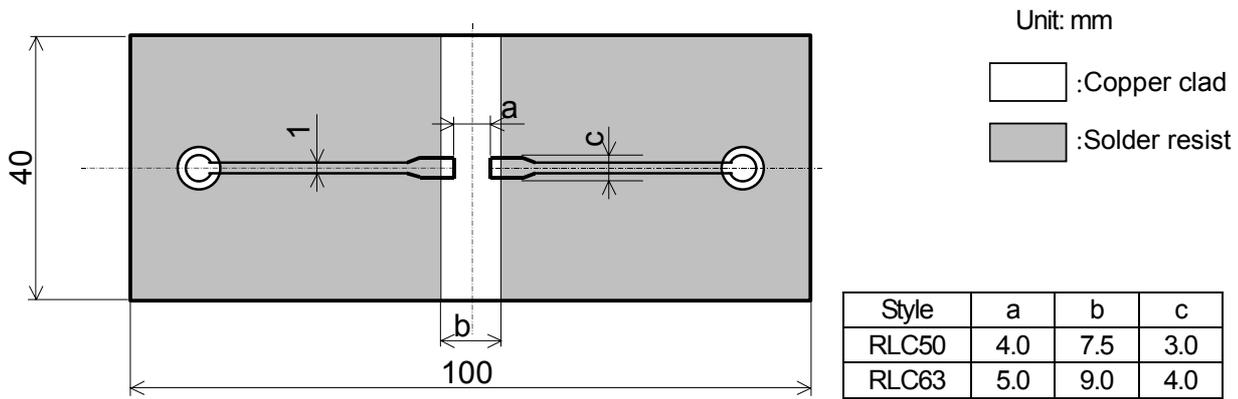
No	Test items	Condition of test (JIS C 5201-1)	Performance requirements
6	Mounting Bound strength of the end face plating Final measurements	Sub-clause 4.31 Substrate material: Epoxide woven glass Test substrate: Figure-4 Sub-clause 4.33 Bent value: 3 mm (3225 size max.) 1 mm (5025 size min.) Resistance Sub-clause 4.33.6 Visual examination	$\Delta R \leq \pm 1\%$ No visible damage
7	Resistance to soldering heat Component resistance solvent	Sub-clause 4.18 Solder temperature: 260 °C±5 °C Immersion time: 10 s±0.5 s Visual examination Resistance Sub-clause 4.29 Solvent: 2-propanol Solvent temperature: 23 °C±5 °C Method 2 Recovery: 48 h Visual examination Resistance	As in 4.18.3.4 No sign of damage such as cracks. $\Delta R \leq \pm 1\%$ No visible damage $\Delta R \leq \pm 1\%$
8	Mounting Adhesion Rapid change temperature	Sub-clause 4.31 Substrate material: Epoxide woven glass Test substrate: Figure-3 Sub-clause 4.32 Force: 5 N Duration: 10 s±1 s Visual examination Sub-clause 4.19 Lower category temperature: -55 °C Upper category temperature: +125 °C Duration of exposure at each temperature: 30 min. Number of cycles: 5 cycles. Visual examination Resistance	No visible damage No visible damage $\Delta R \leq \pm 1\%$

Table-5(3)

No	Test items	Condition of test (JIS C 5201-1)	Performance requirements
9	<p>Climatic sequence</p> <p>-Dry heat</p> <p>-Damp heat, cycle (12+12hour cycle) First cycle</p> <p>-Cold</p> <p>-Damp heat, cycle (12+12hour cycle) Remaining cycle</p> <p>-D.C. load</p>	<p>Sub-clause 4.23</p> <p>Sub-clause 4.23.2</p> <p>Test temperature: +125 °C</p> <p>Duration: 16 h</p> <p>Sub-clause 4.23.3</p> <p>Test method: 2</p> <p>Test temperature: 55 °C</p> <p>[Severity(2)]</p> <p>Sub-clause 4.23.4</p> <p>Test temperature -55 °C</p> <p>Duration: 2h</p> <p>Sub-clause 4.23.6</p> <p>Test method: 2</p> <p>Test temperature: 55 °C</p> <p>[Severity (2)]</p> <p>Number of cycles: 5 cycles</p> <p>Sub-clause 4.23.7</p> <p>The applied current shall be the rated current.</p> <p>Duration: 1 min.</p> <p>Visual examination</p> <p>Resistance</p>	<p>No visible damage</p> <p>$\Delta R \leq \pm 5 \%$</p>
10	<p>Mounting</p> <p>Endurance at 70 °C</p>	<p>Sub-clause 4.31</p> <p>Substrate material: Epoxide woven glass</p> <p>Test substrate: Figure-3</p> <p>Sub-clause 4.25.1</p> <p>Ambient temperature: 70 °C±2 °C</p> <p>Duration: 1000 h</p> <p>The current shall be applied in cycles of 1.5 h on and 0.5 h.</p> <p>The applied current shall be the rated current</p> <p>Examination at 48 h, 500 h and 1000 h:</p> <p>Visual examination</p> <p>Resistance</p>	<p>No visible damage</p> <p>$\Delta R \leq \pm 5 \%$</p>

Table-5(4)

No	Test items	Condition of test (JIS C 5201-1)	Performance requirements
11	Mounting Variation of resistance with temperature	Sub-clause 4.31 Substrate material: Epoxide woven glass Test substrate: Figure-3 Sub-clause 4.8 +20 °C / +125 °C	As in Table-1
12	Mounting Damp heat, steady state	Sub-clause 4.31 Substrate material: Epoxide woven glass Test substrate: Figure-3 Sub-clause 4.24 Ambient temperature: 40 °C±2 °C Relative humidity: 93 \pm ₃ % Without current applied. Visual examination Resistance	No visible damage Legible marking $\Delta R \leq \pm 5\%$
13	Dimensions (detail) Mounting Endurance at upper category temperature	Sub-clause 4.4.3 Sub-clause 4.31 Substrate material: Epoxide woven glass Test substrate: Figure-3 Sub-clause 4.25.3 Ambient temperature: 125 °C±2 °C Duration: 1000 h Examination at 48 h, 500 h and 1000 h: Visual examination Resistance	As in Table-4 No visible damage $\Delta R \leq \pm 5\%$



Remark 1). Material: Epoxide woven glass
 Thickness: 1.6mm Thickness of copper clad: 0.035mm

Figure-4 RLC50, 63 BOUND STRENGTH OF THE END FACE PLATING TEST SUBSTRATE

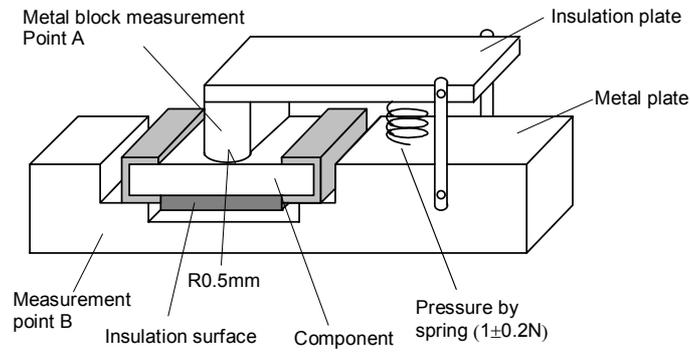


Figure-5

9. Taping

9.1 Applicable documents JIS C 0806-3: 1999, EIAJ ET-7200B: 2003

9.2 Taping dimensions

9.2.1 Paper taping (8mm width, 2mm pitches)

Taping dimensions shall be in accordance with Figure-6 and Table-6.

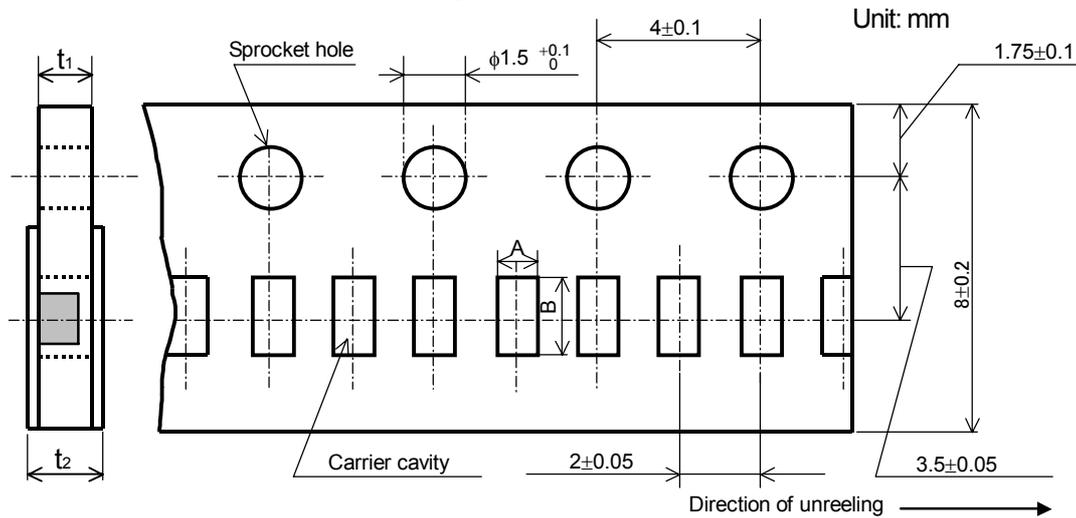


Figure-6

Table-6

Unit: mm

Style	A	B	t ₁	t ₂
RLC10	0.65 ^{+0.05} / _{-0.10}	1.15 ^{+0.05} / _{-0.10}	0.4 ± 0.05	0.5max.

9.2.2 Paper taping (8mm width, 4mm pitches)

Taping dimensions shall be in accordance with Figure-7 and Table-7.

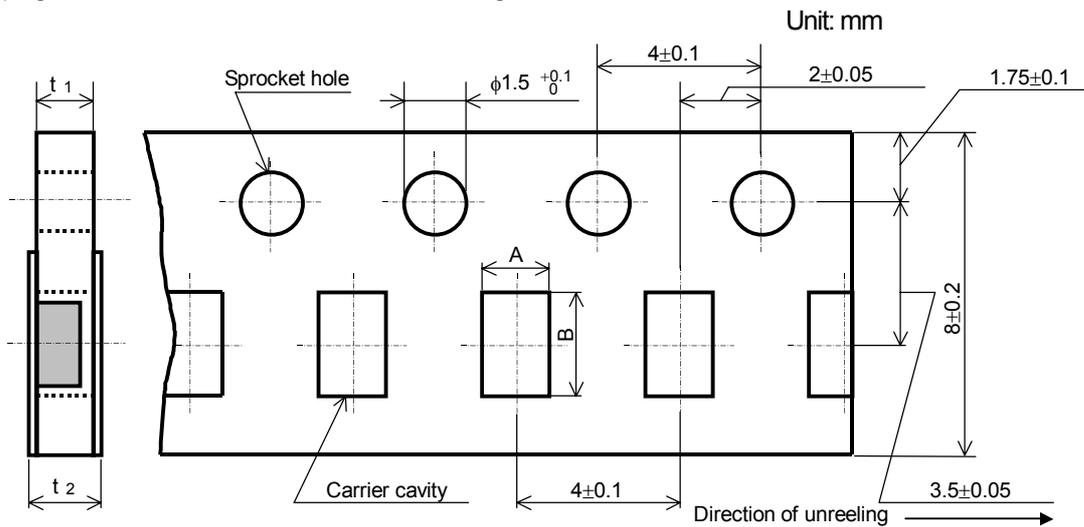


Figure-7

Table-7

Unit: mm

Style	A	B	t ₁	t ₂
RLC16	1.15±0.15	1.9 ± 0.2	0.8 ± 0.1	0.8max.
RLC20	1.65±0.15	2.5 ± 0.2		1.0max.
RLC32	2.00±0.15	3.6 ± 0.2		

9.2.3 Embossed tapping dimensions shall be in accordance with Figure-8 and Table-8.

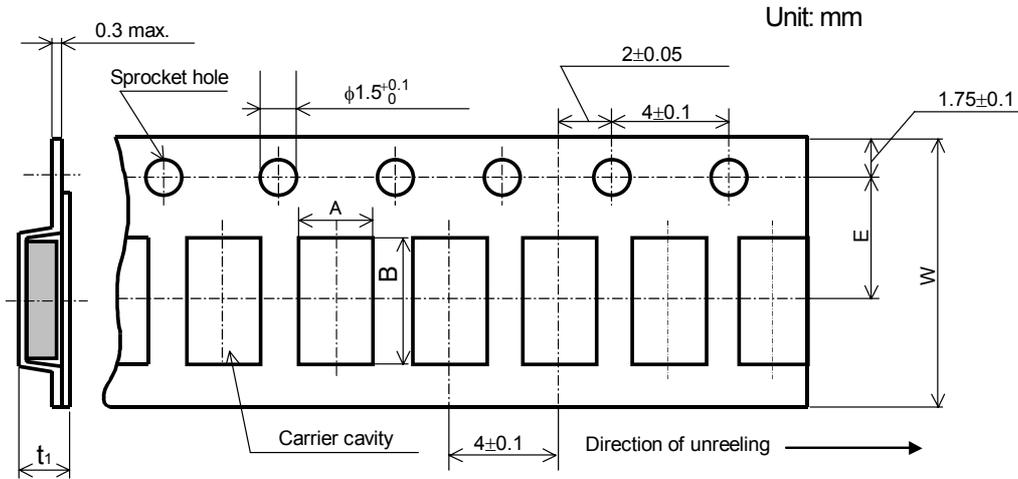


Figure-8

Table-8

Unit: mm

Style	A	B	W	E	t_1
RLC35	2.85 ± 0.2	3.5 ± 0.2	8 ± 0.3	3.5 ± 0.05	1.0 ± 0.2
RLC50	3.1 ± 0.2	5.5 ± 0.2	12 ± 0.3	5.5 ± 0.05	1.1 ± 0.15
RLC63	3.6 ± 0.2	6.9 ± 0.2			

- 1). The cover tapes shall not cover the sprocket holes.
- 2). Tapes in adjacent layers shall not stick together in the packing.
- 3). Components shall not stick to the carrier tape or to the cover tape.
- 4). Pitch tolerance over any 10 pitches ± 0.2 mm.
- 5). The peel strength of the top cover tape shall be within 0.1N to 0.5N on the test method as shown in the following RLC10, 16, 20, 32: Figure-9, RLC35, 50, 63: Figure-10.
- 6). When the tape is bent with the minimum radius for (RLC10, 16, 20, 32, 35: 25mm, RLC50, 63: 30mm) the tape shall not be damaged and the components shall maintain their position and orientation in the tape.
- 7). In no case shall there be two or more consecutive components missing.
The maximum number of missing components shall be one or 0.1%, whichever is greater.
- 8). The resistors shall be faced to upward at the over coating side in the carrier cavity.

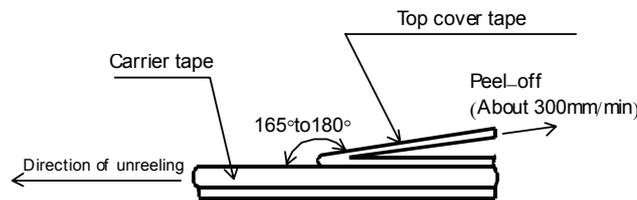


Figure-9

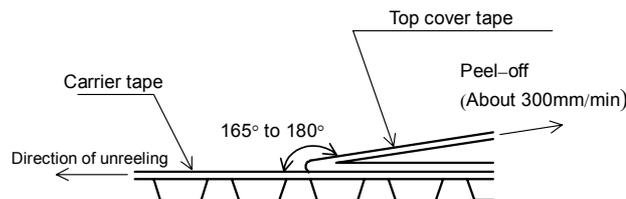


Figure-10

9.3 Reel dimension

Reel dimensions shall be in accordance with the following Figure-11 and Table-9.
Plastic reel (Based on EIAJ ET-7200B)

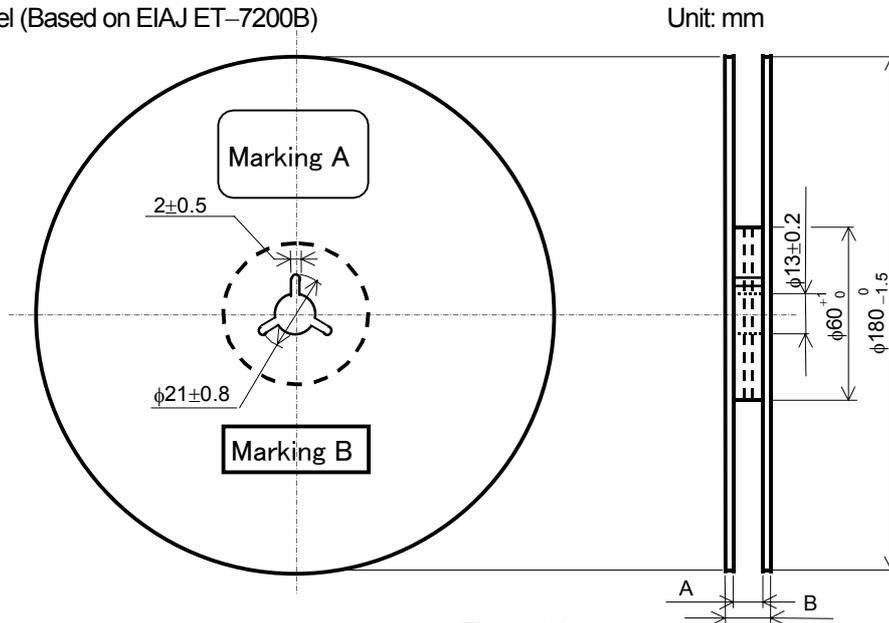


Figure-11

Table-9

Unit: mm

Style	A	B	Note
RLC10, 16, 20, 32, 35	9 ^{+1.0} ₀	11.4±1.0	Injection molding
		13±1.0	Vacuum forming
RLC50, 63	13 ^{+1.0} ₀	17±1.0	Vacuum forming

Note: Marking label shall be marked on a place of Marking A or two place of marking A and B.

9.4 Leader and trailer tape.

(Example)

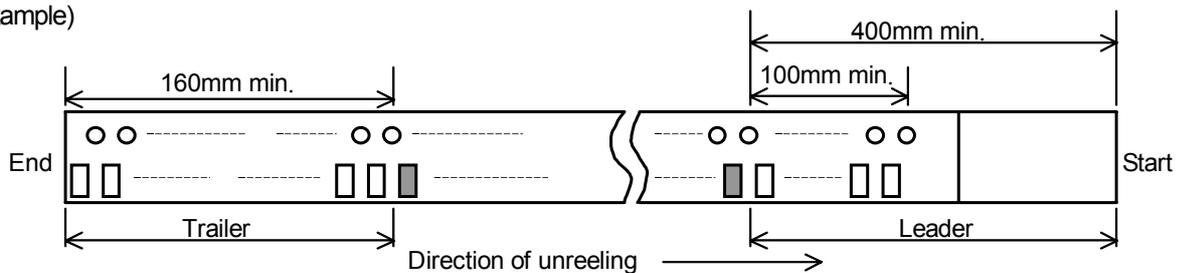


Figure-12

10. Marking on package

The label of a minimum package shall be legibly marked with follows.

10.1 Marking A

(1) Classification

(Style, Temperature coefficient of resistance, Rated resistance, Tolerance on rated resistance, Packaging form)

(2) Quantity (3) Lot number (4) Manufacturer's name or trade mark (5) Others

10.2 Marking B (KAMAYA control label)