

# Specification

(Reference)

Title: FIXED CHIP RESISTOR NETWORKS; RECTANGULAR TYPE

Style: RAC10 2D,RAC10 4D,RAC16 4D, RAC16 8D

RoHS COMPLIANCE ITEM

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**釜屋電機株式会社**  
**KAMAYA ELECTRIC CO., LTD.**

Issue Dept.: Research & Development Department Hokkaido Research Center

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## 1. Scope

1.1 This specification covers the detail requirements for fixed chip resistors networks; rectangular type, style of RAC10 2D, 10 4D, 16 4D, 16 8D.

## 1.2 Applicable documents

JIS C 5201-1: 1998, JIS C 5201-9: 2006, JIS C 5201-9-1: 2006

IEC60115-1: 1999, IEC60115-9: 2003, IEC60115-9-1: 2003

EIAJ RC-2129-2000.

## 2. Classification

Type designation shall be the following form.

(Example) 1.	RAC	16	2	D	103	J	A	TP
	1	2	3	4	5	6	7	8
	Style							
2.	RAC	16	2	D	JP	A	TP	
	1	2	3	4	5	7	8	
	Style							

1 Fixed chip resistors networks; rectangular type

2 Size

3 Number of element

4 Circuits

5 Rated resistance Example; 103 → 10kΩ, Chip jumper: JP

6 Tolerance on rated resistance

7 Terminal style

8 Packaging form 1. Scope

Style

## 3. Rating

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

Table-1

Style		Terminations style	Rated element dissipation (W)	Rated network dissipation (W)	Temperature coefficient of resistance ( $10^{-6}/^{\circ}\text{C}$ )	Rated resistance range( $\Omega$ )	Preferred number series for resistors	Tolerance on rated resistance
RAC10	2D	C	0.063	0.125	$\pm 200$	10~1.0M	E24	J( $\pm 5\%$ )
	4D							
RAC16	4D	C	0.063	0.25	$\pm 200$	10~1.0M	E24	F( $\pm 1\%$ ) J( $\pm 5\%$ )
	8D	C	0.063	0.25	$\pm 200$	10~1.0M	E24	J( $\pm 5\%$ )

Style		Limiting element voltage(V)	Isolation voltage(V)	Number of element	Circuit networks	Category temperature range( $^{\circ}\text{C}$ )
RAC10	2D	25	50	2	D (Independence type)	-55~+125
	4D			4		
RAC16	4D	50	100	4		
	8D	25	100	8		

Note. Rated current of chip jumper: 1(A)

Note. Resistance value of chip jumper: 50mΩ max.

## 3.2 Climatic category

55/125/56

Lower category temperature

-55  $^{\circ}\text{C}$

Upper category temperature

+125  $^{\circ}\text{C}$

Duration of the damp heat, steady state test

56days

## 3.3 Stability class

5%

Limits for change of resistance:

–for long-term tests  $\pm(5\%+0.1\Omega)$  Chip jumper: 50 m $\Omega$  max.  
 –for short-term tests  $\pm(1\%+0.05\Omega)$  Chip jumper: 50 m $\Omega$  max.

## 3.4 Derating

The derated values of dissipation (or current rating in case of chip jumper) at temperature in excess of 70 °C shall be as indicated by the following curve.

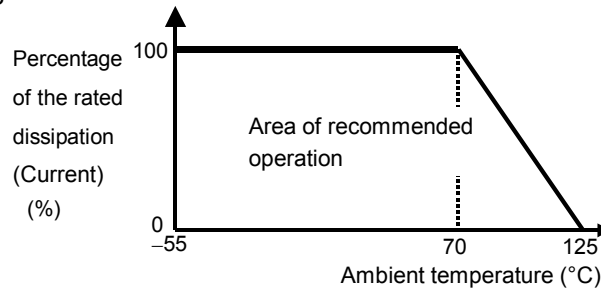


Figure-1 Derating curve

## 3.5 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 ( $\Omega$ )

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.

## 4. Packaging form

The standard packaging form shall be in accordance with Table-2.

Table-2

Symbol	Packaging form		Standard packaging quantity / units	Application
B	Bulk (loose package)		1,000 pcs.	RAC10 2D, 4D, RAC16 4D, 8D
TH	Paper taping	8mm width, 2mm pitches	10,000 pcs.	RAC10 2D, 4D
TP	Paper taping	8mm width, 4mm pitches	5,000 pcs.	RAC16 4D, 8D

## 5. Dimensions

The resistor shall be of the design and physical dimensions in accordance with below.

## 5.1 RAC10 2D

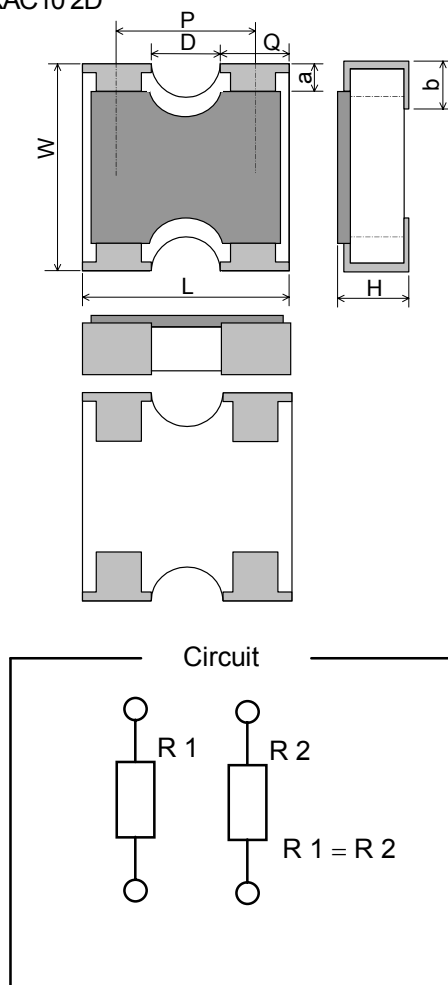


Figure-2

## 5.2 RAC10 4D

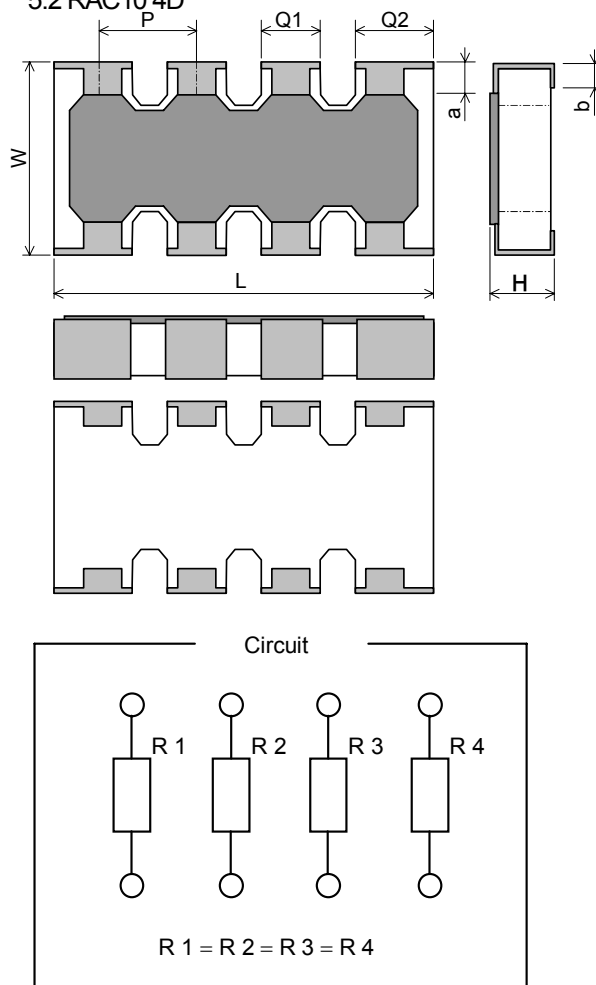


Figure-3

Table-3

Unit: mm

Style	Terminations style	Country of origin	L	W	H	Q or Q <sub>1</sub>	*Q <sub>2</sub>
RAC10 2D	C	Malaysia,	1.0±0.05	1.0±0.05	0.35±0.05	0.33±0.10	—
		China	1.0±0.1	1.0±0.1	0.35±0.10	0.34±0.05	—
RAC10 4D	C	Malaysia,	2.0±0.1	1.0±0.1	0.35±0.05	0.35±0.10	0.45±0.10
		China	2.0±0.1	1.0±0.1	0.45±0.10	0.3±0.05	0.4±0.1

Style	Country of origin	D	a	b	*P
RAC10 2D	Malaysia,	0.34±0.10	0.15±0.10	0.25 <sup>+0.05</sup> <sub>-0.10</sub>	0.65
	China		0.2±0.15	0.25±0.17	0.65
RAC10 4D	Malaysia,		0.15±0.10	0.25±0.10	0.5
	China		0.2±0.1	0.25±0.10	0.5

\*Reference

### 5.3 RAC16 4D

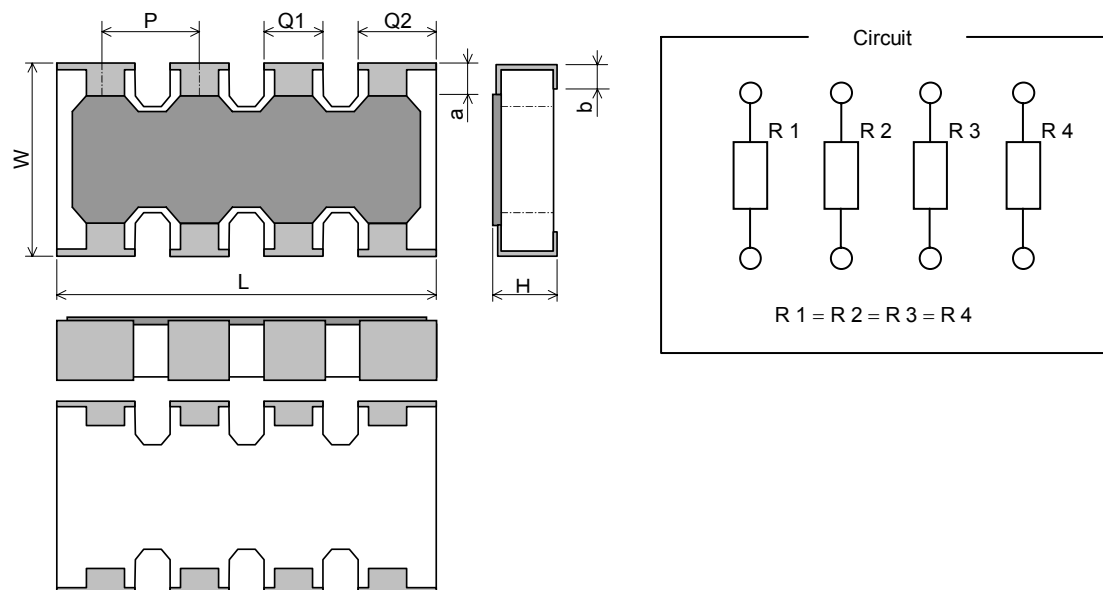


Figure-4  
 Table-4

Unit: mm

Style	Terminations style	Country of origin	L	W	H	Q <sub>1</sub>	a
RAC16 4D	C	Malaysia,	3.2±0.1	1.6±0.1	0.5±0.1	0.4±0.15	0.3±0.2
		China	3.2±0.1	1.6±0.1	0.5±0.1	0.4±0.1	0.3±0.1

Style	Country of origin	b	*Q <sub>2</sub>	*P
RAC16 4D	Malaysia,	0.25±0.15	0.6±0.15	0.8
	China	0.3±0.2	0.6±0.1	0.8

\*Reference

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#### 5.4 RAC16 8D

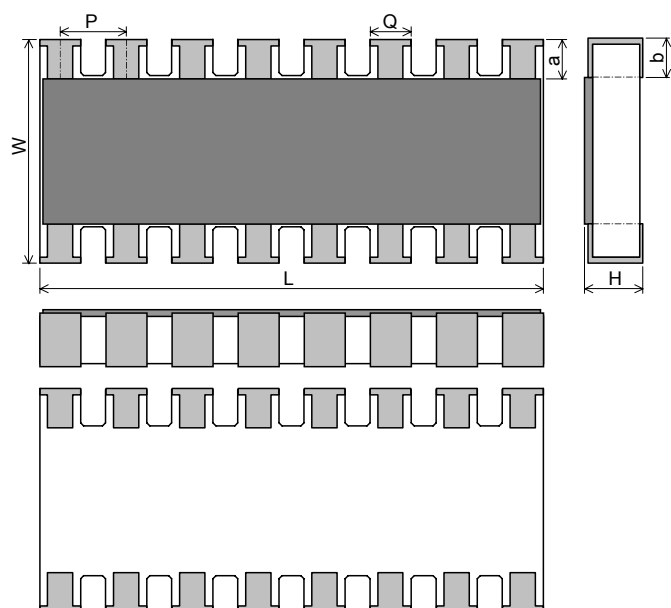


Figure-5

Table-5

Unit: mm

Style	Terminations style	Country of origin	L	W	H	Q	a
RAC168D	C	China	$3.8 \pm 0.1$	$1.6 \pm 0.1$	$0.45 \pm 0.10$	$0.3 \pm 0.1$	$0.3 \pm 0.1$

\*Reference

Style	Country of origin	b	*P
RAC168D	China	$0.3 \pm 0.1$	$0.5 \pm 0.1$

#### 5.2 Net weight (Reference)

Style	Terminations style	Net weight(mg)
RAC10 2D	C	1.1
RAC10 4D	C	2.1
RAC16 4D	C	7
RAC16 8D	C	8.3

## 6. Marking

The Rated resistance of RAC10 2D should not be marked.

### 6.1 For the resistors

The rated resistance shall be marked in 3 digits (E24) and marked on over coat side.

Marking example		Contents	Application
Malaysia	China		
123	123	$12 \times 10^3 \text{ } [\Omega] \rightarrow 12 \text{ } [\text{k}\Omega]$	RAC104D
D123	123	$12 \times 10^3 \text{ } [\Omega] \rightarrow 12 \text{ } [\text{k}\Omega]$	RAC164D
—	123	$12 \times 10^3 \text{ } [\Omega] \rightarrow 12 \text{ } [\text{k}\Omega]$	RAC168D

## 6.2 For the Jumper Chip

Marking example		Contents	Application
Malaysia	China		
□	000	JP	RAC104D
DO	000	JP	RAC164D
—	000	JP	RAC168D

## 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-6.

Table-6(1)

[illegible]

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Table-6(2)

No	Test items	Condition of test (JIS C 5201 - 1)	Performance requirements
5	Mounting  Overload (in the mounted state)    Solvent resistance of the marking	Sub-clause 4. 31 Substrate material: Epoxide woven glass Test substrate: Figure-6 Sub-clause 4. 13 The applied voltage shall be 2.5 times the rated voltage or twice the limiting element voltage, whichever is the less severe. 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 $\Delta R \leq \pm (1\%+0.05\Omega)$ Chip jumper: 50 mΩ max. Legible marking
6	Mounting   Bound strength of the end face plating   Final measurements	Sub-clause 4. 31 Substrate material: Epoxide woven glass Test substrate: Figure-7 Sub-clause 4. 33 Bent value: 3 mm Resistance  Sub-clause 4. 33. 6 Visual examination	$\Delta R \leq \pm (1\%+0.05\Omega)$ Chip jumper: 50 mΩ max. No visible damage
7	Resistance to soldering heat      Component resistance solvent	Sub-clause 4. 18 Solder temperature: 260°C±5°C Immersion time: 10s±0.5s 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. $\Delta R \leq \pm (1\%+0.05\Omega)$ Chip jumper: 50 mΩ max.  No visible damage $\Delta R \leq \pm (1\%+0.05\Omega)$ Chip jumper: 50 mΩ max.



Table 6(3)

No	Test items	Condition of test (JIS C 5201 - 1)	Performance requirements
8	<p>Mounting</p> <p>Adhesion</p> <p>Rapid change temperature</p>	<p>Sub-clause 4. 31 Substrate material: Epoxide woven glass Test substrate: Figure-6</p> <p>Sub-clause 4. 32 Force: 5 N Duration: 10s±1s Visual examination</p> <p>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</p>	<p>No visible damage</p> <p>No visible damage Δ R ≤ ±(1%+0.05Ω) Chip jumper: 50 mΩ max.</p>
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+12hourcycle) Remaining cycle</p> <p>-D.C. load</p>	<p>Sub-clause 4. 23 Sub-clause 4. 23. 2 Test temperature: +125 °C Duration: 16 h</p> <p>Sub-clause 4. 23. 3 Test method : 2 Test temperature: 55 °C [Severity(2)]</p> <p>Sub-clause 4. 23. 4 Test temperature-55 °C Duration: 2h</p> <p>Sub-clause 4. 23. 6 Test method: 2 Test temperature: 55 °C [Severity (2)] Number of cycles: 5 cycles</p> <p>Sub-clause 4. 23. 7 The applied voltage shall be the rated voltage or the limiting element voltage whichever is the smaller. Duration: 1 min. Visual examination Resistance</p>	<p>No visible damage Δ R ≤ ± ( 5%+0.1Ω) Chip jumper: 50 mΩ max.</p>

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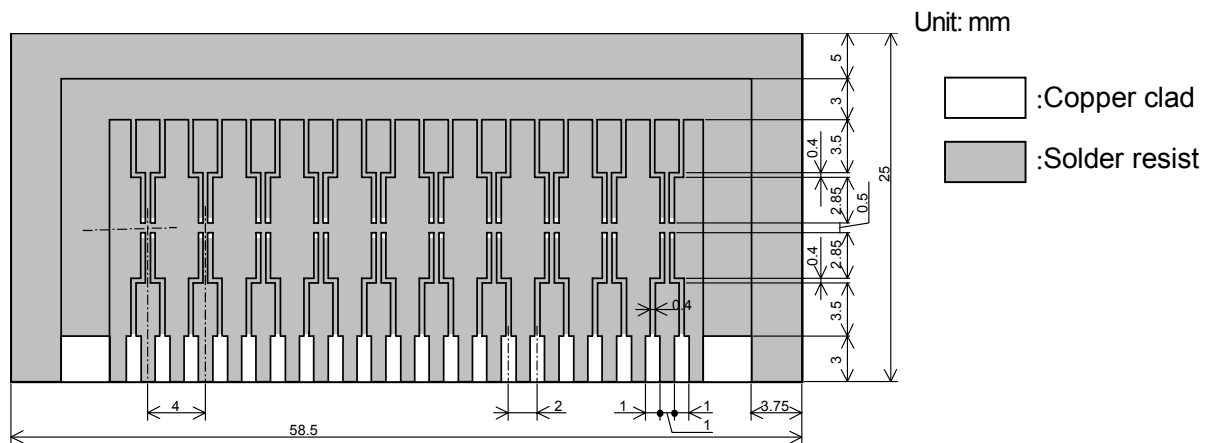
Table-6(4)

No	Test items	Condition of test (JIS C 5201 - 1)	Performance requirements
10	Mounting  Endurance at 70 °C	Sub-clause 4. 31 Substrate material: Epoxide woven glass Test substrate: Figure-6 Sub-clause 4. 25. 1 Ambient temperature: 70°C±2°C Duration: 1000 h The voltage shall be applied in cycles of 1. 5 h on and 0. 5 h off. The applied voltage shall be the rated voltage or the limiting element voltage whichever is the smaller. Examination at 48 h , 500 h and 1000 h: Visual examination Resistance	No visible damage $\Delta R \leq \pm (5\%+0.1\Omega)$ Chip jumper: 50 mΩ max.
11	Mounting  Variation of resistance with temperature	Sub-clause 4. 31 Substrate material: Epoxide woven glass Test substrate: Figure-6 Sub-clause 4. 8 -55 °C / +20 °C +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-6 Sub-clause 4. 24 Ambient temperature: 40°C±2°C Relative humidity : 93 $\pm$ 3 % a) 1st group: without voltage applied. b) 2nd group: The d. c. voltage shall be applied continuously. The voltage shall be accordance with Sub-clause 4. 24. 2 .1 b). without polarizing voltage [4. 24. 2. 1, c)] Visual examination  Resistance	No visible damage Legible marking $\Delta R \leq \pm (5\%+0.1\Omega)$ Chip jumper: 50 mΩ max.

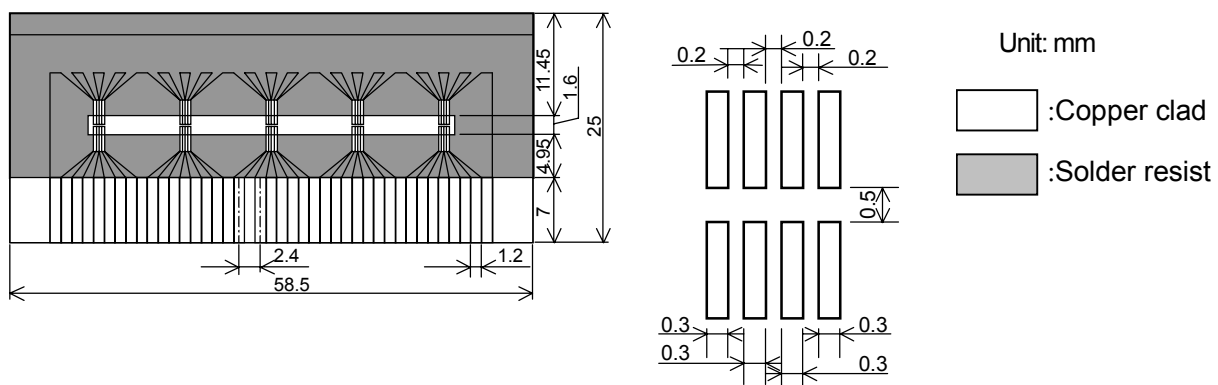
Table-6(5)

No	Test items	Condition of test (JIS C 5201 - 1)	Performance requirements
13	<p>Dimensions (detail)</p> <p>Mounting</p> <p>Endurance at upper category temperature</p>	<p>Sub-clause 4. 4. 3</p> <p>Sub-clause 4. 31</p> <p>Substrate material: Epoxide woven glass</p> <p>Test substrate: Figure-6</p> <p>Sub-clause 4. 25. 3</p> <p>Ambient temperature: 125°C±2°C</p> <p>Duration: 1000 h</p> <p>Examination at 48 h, 500 h and 1000 h:</p> <p>Visual examination</p> <p>Resistance</p>	<p>As in Sub-clause 5.1 of this specification</p> <p>No visible damage</p> <p><math>\Delta R \leq \pm (5\% + 0.1\Omega)</math></p> <p>Chip jumper: 50 mΩ max.</p>

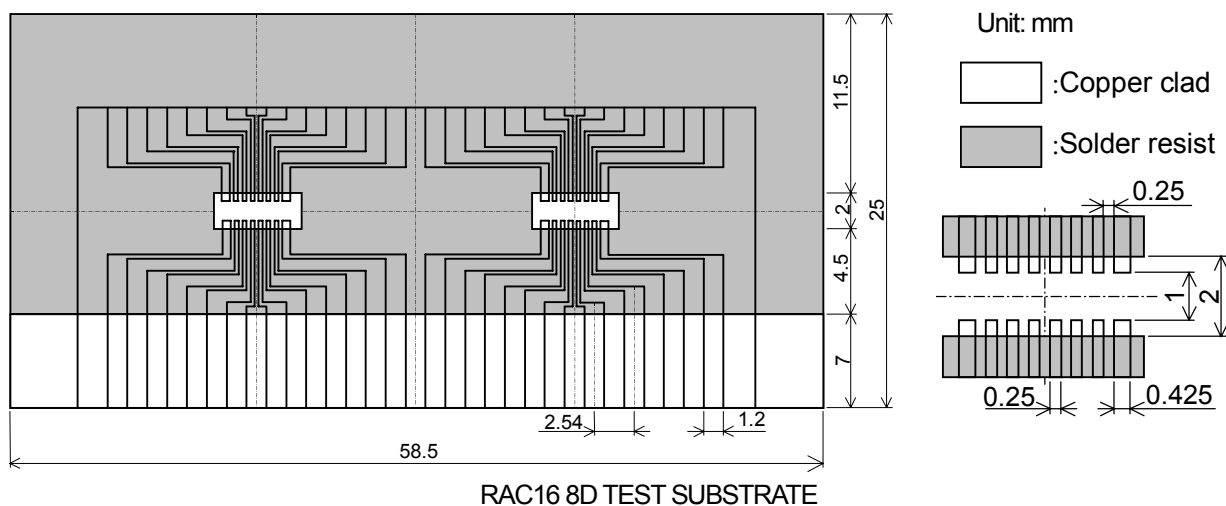
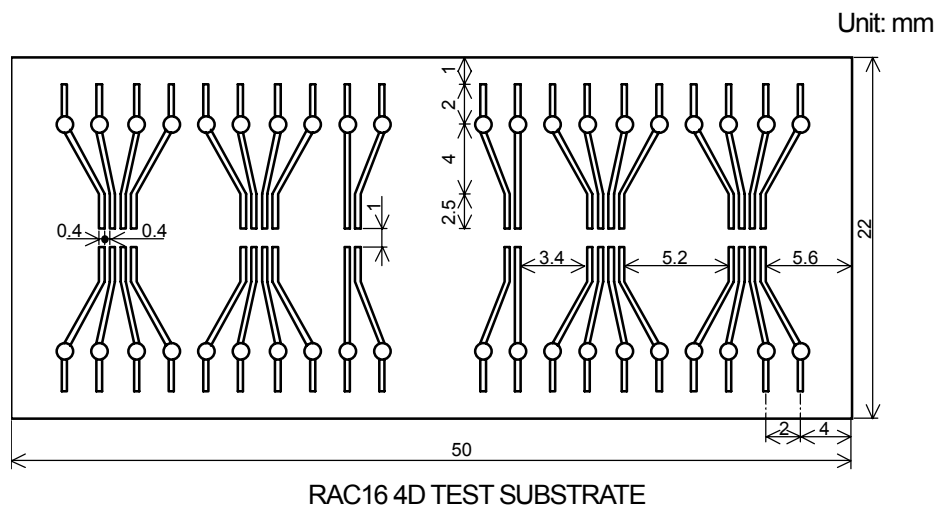
## 8. Test substrate



RAC10 2D TEST SUBSTRATE

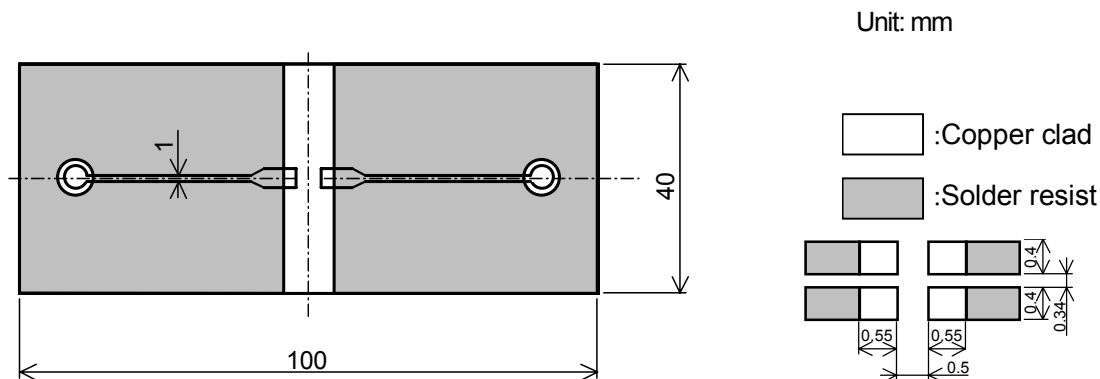


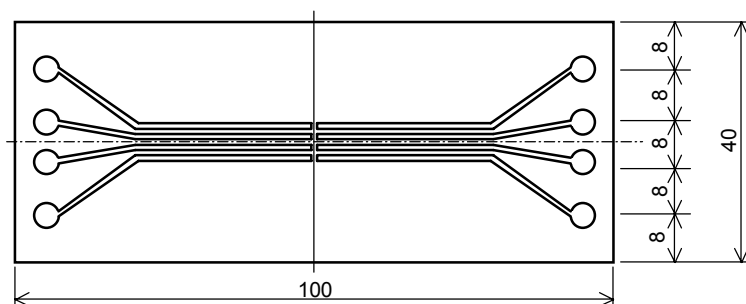
## RAC10 4D TEST SUBSTRATE



- Remark 1). Material: Epoxide woven glass  
Thickness: 1.6mm Thickness of copper clad: 0.035mm
- 2). In the case of connection by connector, the connecting terminals are gold plated.  
However, the plating is not necessary when the connection is made by soldering.

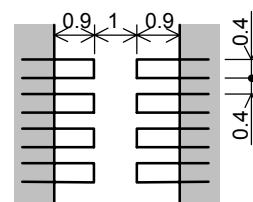
Figure-6



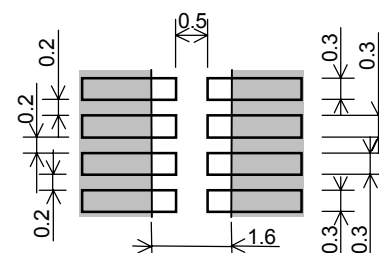


Unit: mm

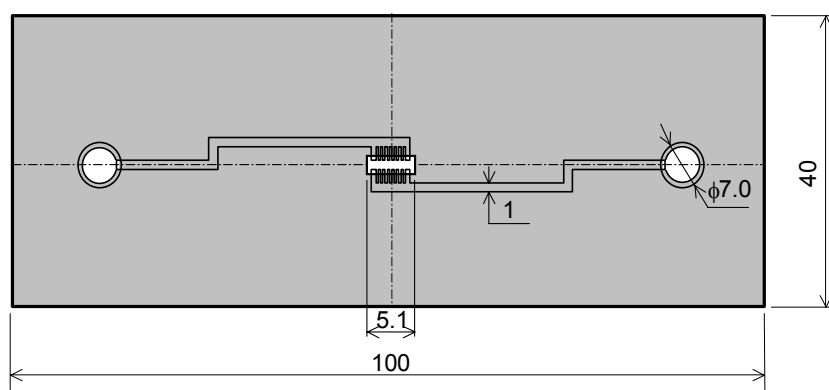
•RAC16 4D



•RAC10 4D



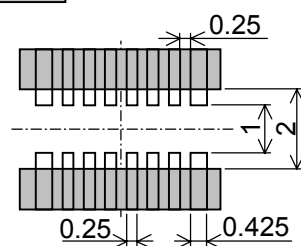
RAC10 4D, 16 4D BOUND STRENGTH OF THE END FACE PLATING TEST SUBSTRATE



Unit: mm

□ :Copper clad

■ :Solder resist



RAC16 8D TERMINAL STRENGTH TEST SUBSTRATE

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

Figure-7

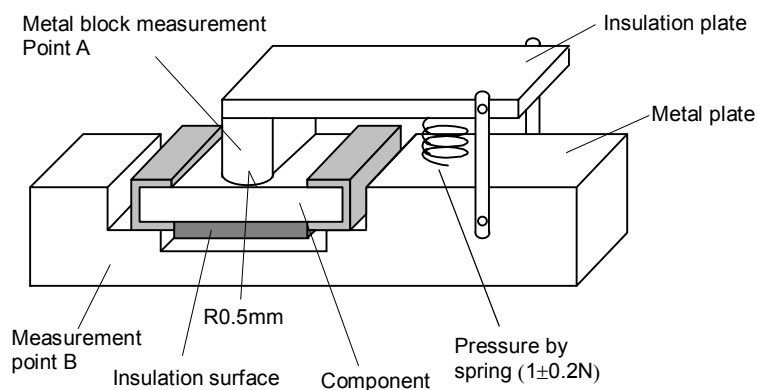


Figure-8

## 9. Taping

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

### 9.2 Taping dimensions

9.2.1 RAC10 2D, RAC10 4D (Paper taping, 8mm width, 2mm pitches)

Taping dimensions shall be in accordance with Figure-8 and Table-7.

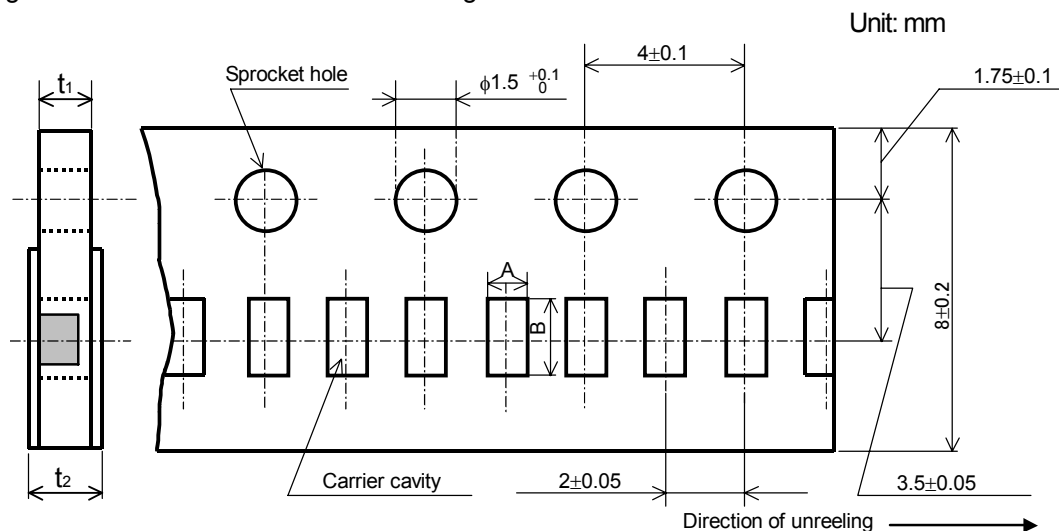


Figure-9

Table-7

Unit: mm

Style	A	B	$t_1$	$t_2$
RAC10 2D	$1.15^{+0.05}_{-0.10}$	$1.15^{+0.05}_{-0.10}$	$0.4^{+0.05}_{-0.10}$	0.5max.
RAC10 4D	$1.2 \pm 0.1$	$2.2 \pm 0.1$	$0.4 \pm 0.1$	

9.2.2 RAC16 4D, RAC16 8D (Paper taping, 8mm width, 4mm pitches)

Taping dimensions shall be in accordance with Figure-10 and Table-8.

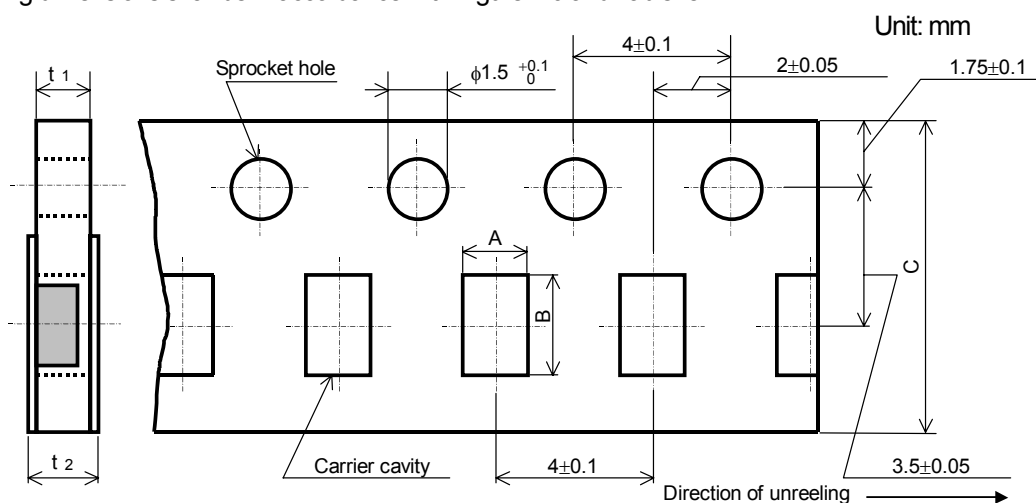


Figure-10

Table-8

Unit: mm

Style	A	B	C	$t_1$	$t_2$
RAC16 4D	$1.9 \pm 0.15$	$3.6 \pm 0.2$	$8.0 \pm 0.2$	$0.6 \pm 0.1$	0.8max.
RAC16 8D	$1.9 \pm 0.15$	$4.1 \pm 0.15$	$8.0 \pm 0.3$		

- 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  $\pm 0.2\text{mm}$ .
- 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 Figure-11.
- 6). When the tape is bent with the minimum radius for 25 mm, 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.
- 9). The direction of resistor shall be taped as Figure-12.

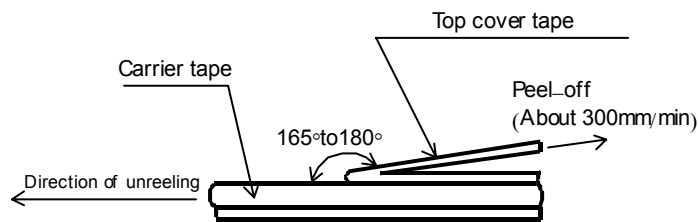


Figure-11

•RAC10 2D

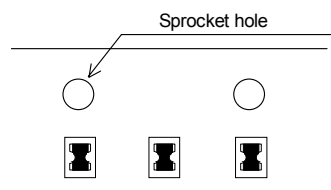


Figure-12

### 9.3 Reel dimension

Reel dimensions shall be in accordance with the following Figure-13 and Table-9.

Plastic reel (Based on EIAJ ET-7200B)

Unit: mm

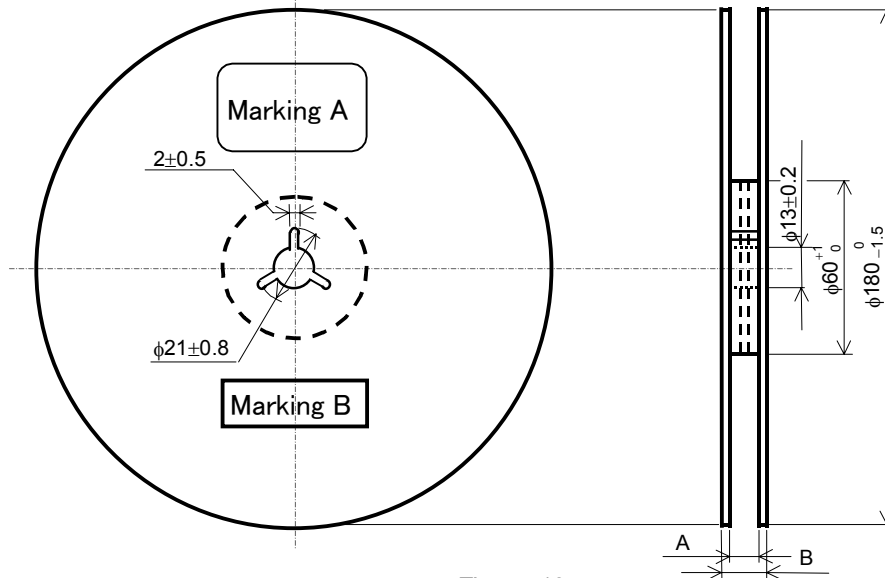


Figure-13

Table-9

Unit: mm

Style	A	B	Note
RAC10,16	9 $^{+1.0}_{0}$	11.4±1.0	Injection molding
		13±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)

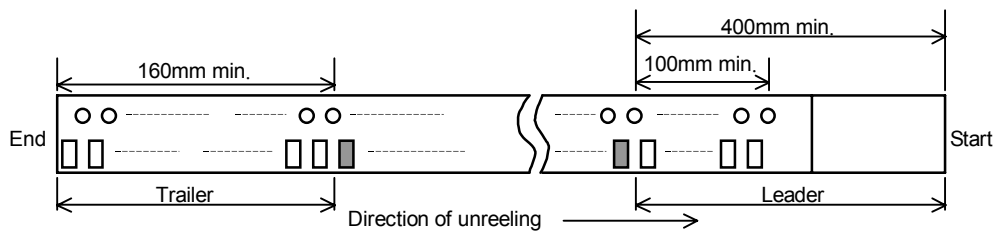


Figure-14

## 10. Marking on package

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

### 10.1 Marking A

- (1) Classification (Style, Rated resistance, Tolerance on rated resistance, Terminal style, Packaging form)
- (2) Quantity (3) Lot number (4) Manufacturer's name or trade mark (5) Others

### 10.2 Marking B (KAMAYA Control label)