

# Specification

Title: **FIXED CONDUCTIVE PATH RESISTORS**

Style: **RC1/2U**

**RoHS COMPLIANCE ITEM**

**Halogen and Antimony Free**

Product specification contained in this specification  
are subject to change at any time without notice  
If you have any questions or a Purchasing Specification for any quality  
Agreement is necessary, please contact our sales staff.



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Note: Stock conditions

Temperature: +5°C ~ +35°C

Relative humidity: 60%R.H. max.

The period of guarantee: Within 6 month from shipment by the company.

## 1. Scope

1.1 This specification covers the detail requirements for fixed conductive path resistors in compliance with the requirement] for UL1492, style of RC1/2U.

## 1.2 Applicable documents

- UL1676-1990 Discharge Path Resistors
- CSA C22.2 No.1-94 Audio, Video, and Similar Electronic Equipment
- JIS C 5201-1: 2011, JIS C 5201-2: 2014, JIS C 5201-2-1: 1998
- IEC60115-1: 2008, IEC60115-2: 2014, IEC60115-2-1: 1982

## 2. Classification

Type designation shall be the following form to be registered to UL or CSA.

(Example) 

RC	1/2U	475	K	B
1	2	3	4	5

Style

1 Carbon composition resistors

2 Rated dissipation

3 Rated resistance

475	475--> 4.7MΩ
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4 Tolerance on rated resistance

K	±10%
M	±20%

5 Packaging form

B	Bulk (loose package)
H	Horizontal forming
TB	52mm width taping box
TD	52mm width taping reel

— Series designation (Style): FIXED CONDUCTIVE PATH RESISTORS

## 3. File No.

3.1 The file number to be designated by UL shall be as follows;

File No.: E151897

3.2 The file number to be designated by CSA shall be as follows;

File No.: CA109446-1

## 4. Rating

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

Table-1

Style	Rated dissipation (W)	Rated resistance range (Ω)	Preferred number series for resistors	Tolerance on rated resistance
RC1/2U	0.5	1M~10M	E12	K(±10%)
			E6	M(±20%)

Style	Rated voltage (V)	Isolation Voltage (V)	Category temperature range (°C)	Applicable line voltage
RC1/2U	350	500	-55~+125	250 Vac max. and/or 125 Vac max.

#### 4.2 Climatic category

55/125/56

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

#### 4.3 Stability class

10%

Limits for change of resistance:  
 -for long-term tests  $\pm(10\%+0.5\Omega)$   
 -for short-term tests  $\pm(2\%+0.1\Omega)$

#### 4.4 Derating

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

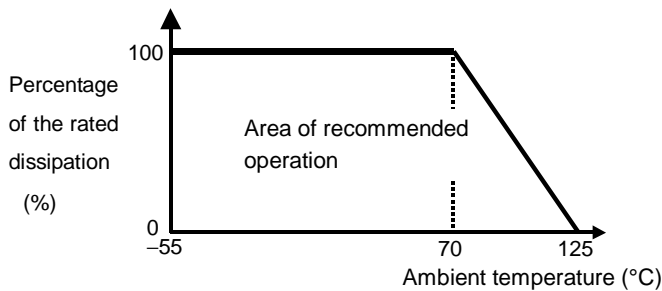


Figure-1 Derating curve

#### 5. Packaging form

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

Table-2

Symbol	Packaging form	Standard packaging quantity / units	Style
B	Bulk (Straight lead)	500 pcs.	See 6.1
H	Horizontal forming		
TB	52mm width taping box	2,000 pcs.	See 10
TD	52mm width taping reel	3,000 pcs.	

#### 6. Dimensions

##### 6.1 Straight lead type

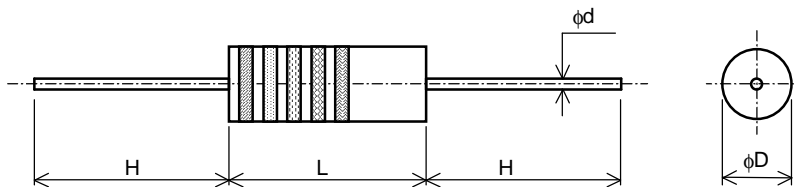


Figure-2

Table-3

Unit:mm

Style	L	$\phi D$	H	$\phi d$
RC1/2U	$9.5^{+0.8}_{-0.7}$	$3.6 \pm 0.2$	$28 \pm 3$	$0.7^{+0.07}_{-0.05}$

## 7. Marking

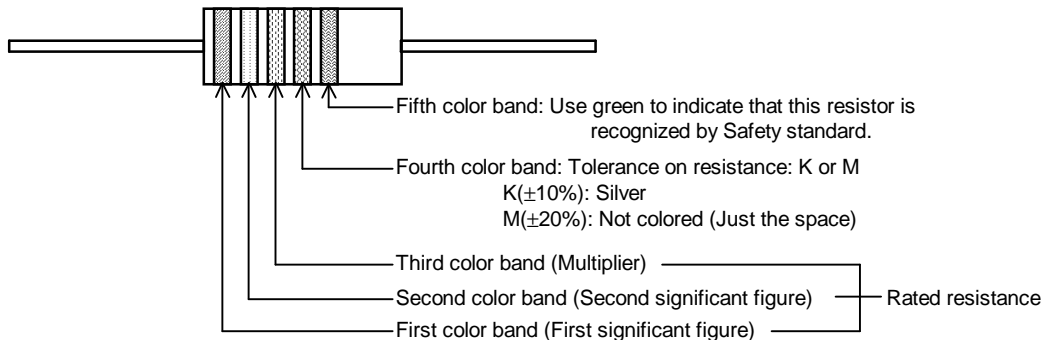
### 7.1 Marking of product

The rated resistance, tolerance on rated resistance and the other applicable mark shall be marked by five color coding on the surface of resistor.

The color coding shall be based on JIS C 5062-2008 "Marking codes for resistors and capacitors".

The tolerance on rated resistance tolerance M( $\pm 20\%$ ) shall be none color of the fourth color code.

Color	First color Band	Second color band	Third color band	Fourth color band	Fifth color band
	Rated resistance ( $\Omega$ )				
	First digit	Second digit	Multiplier	Tolerance on rated resistance	
Black	0	0	—	—	—
Brown	1	1	—	—	—
Red	2	2	—	—	—
Orange	3	3	—	—	—
Yellow	4	4	—	—	—
Green	5	5	$10^5$	—	Safety standards recognition on a resistor
Blue	6	6	$10^6$	—	—
Purple	7	7	—	—	—
Grey	8	8	—	—	—
White	9	9	—	—	—
Silver	—	—	—	$\pm 10\%$	—
—	—	—	—	$\pm 20\%$	—

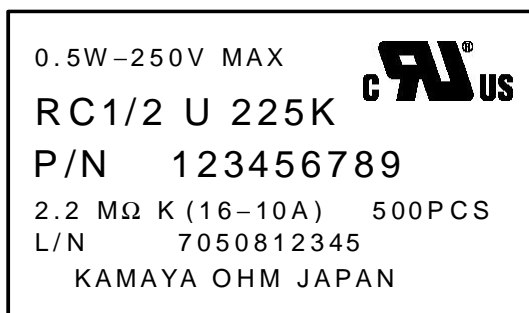


### 7.2 Marking of package

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

- 1).Rated dissipation and Applicable line voltage
- 2).Type designation
- 3).Lot No.
- 4).Quantity
- 5).Manufacturer's name or trade mark
- 6).UL recognized component mark and/or CSA component acceptance mark.
- 7).Others

Example)



## 8. Performance

8.1 The standard condition for tests shall be in accordance with Sub-clause 4.2, JIS C 5201-1: 2011.

8.2 The performance shall be satisfied in Table-4.

Table-4(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	As specified in Table-3 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: V-block method Test voltage: Alternating voltage with a peak value of 1.42 times the insulation voltage. Duration: 60 s ± 5 s	No breakdown or flash over
4	Solderability     Overload (in the mounted state)	Sub-clause 4.17 Without ageing Method: 1 (The solder bath method) Bath temperature: 235 °C ± 5 °C Immersion time: 5 s ± 0.5 s Depth immersion: A point within about 4mm from the resistor body Sub-clause 4.13 The applied voltage shall be twice the limiting element voltage. Duration: 5 s Visual examination  Resistance	Good thinning as evidenced by free flowing of the solder with wetting of the terminations.     No visible damage Legible marking $\Delta R \leq \pm (2\% + 0.1\Omega)$

Table-4(2)

No	Test items	Condition of test (JIS C 5201-1)	Performance requirements
5	Robustness of termination Tensile	Sub-clause 4.16 Sub-clause 4.16.2 The force; 10N Duration: 10 s ± 1 s	No visible damage $\Delta R \leq \pm (2\%+0.1\Omega)$
	Bending	Sub-clause 4.16.3 Method 1 Bending times: 2 times Bending force: 5N	
	Torsion	Sub-clause 4.16.4 Method A: Severity 2 (two successive Rotations of 180°) Visual examination Resistance	
	Resistance to soldering Heat	Sub-clause 4.18 Method: 1B Solvent temperature: 350 °C ± 10 °C Immersion time: 3.5 s ± 0.5 s Depth of immersion:A point within 4±0.8mm from the resistor body Visual examination Resistance	No visible damage Legible marking $\Delta R \leq \pm (3\%+0.1\Omega)$
6	Rapid change temperature	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 $\Delta R \leq \pm (2\%+0.1\Omega)$
	Vibration	Sub-clause 4.22 Frequency endurance test Frequency range: 10 Hz to 500 Hz Amplitude: 0.75 mm or acceleration 98 m/s <sup>2</sup> (whichever is the less severe) Total duration: 6 h Visual examination Resistance	No visible damage $\Delta R \leq \pm (2\%+0.1\Omega)$

Table-4(3)

No	Test items	Condition of test (JIS C 5201-1)	Performance requirements
7	Climatic sequence -Dry heat  -Damp heat, cycle (12+12hour cycle) First cycle  -Cold  -Low air pressure -Damp heat, cycle (12+12hour cycle) Remaining cycle  -D.C. load	Sub-clause 4.23 Sub-clause 4.23.2 Test temperature: + 125 °C Duration: 16 h  Sub-clause 4.23.3 Test method: 2 Test temperature: 55 °C [Severity(2)]  Sub-clause 4.23.4 Test temperature -55 °C Duration: 2h 8 kPa  Sub-clause 4.23.6 Test method: 2 Test temperature: 55 °C [Severity (2)] Number of cycles: 5 cycles  Sub-clause 4.23.7 The applied voltage shall be the limiting element voltage . Duration: 1 min. Visual examination  Resistance Insulation resistance	No visible damage Legible marking $\Delta R \leq \pm (10\%+0.5\Omega)$ $R \geq 100 M\Omega$
8	Endurance at 70 °C	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. The applied voltage shall be the limiting element voltage. Examination at 48 h, 500 h and 1000 h: Visual examination Resistance Examination at 1000 h: Insulation resistance	No visible damage $\Delta R \leq \pm (10\%+0.5\Omega)$  $R \geq 1 G\Omega$

Table-4(4)

No	Test items	Condition of test (JIS C 5201-1)	Performance requirements	
9	Variation of resistance with temperature	Sub-clause 4.8 -55 °C / +20 °C +20 °C / +125°C	At -55°C	
			Resistance range(Ω)	Temperature coefficient(%)
			R=1MΩ	+15-0(%)
			R>1MΩ	+20-0(%)
			At +125°C	
			Resistance range(Ω)	Temperature coefficient(%)
			R=1MΩ	0-10(%)
			R>1MΩ	0-15(%)
10	Damp heat, steady state	Sub-clause 4.24 Ambient temperature: 40 °C ± 2 °C Relative humidity : 93 $\pm$ <sub>3</sub> % 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). c) 3rd group: The d.c. voltage shall be applied continuously. The voltage: 20 V ± 2 V Visual examination  Resistance Insulation resistance	No visible damage Legible marking $\Delta R \leq \pm (10\%+0.5\Omega)$ $R \geq 100 M\Omega$	
11	Dimensions (detail)	Sub-clause 4.4.3	As in Table-3	
	Endurance at upper category temperature	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 Examination at 1000h: Insulation resistance	No visible damage $\Delta R \leq \pm (10\%+0.5\Omega)$  $R \geq 1 G\Omega$	

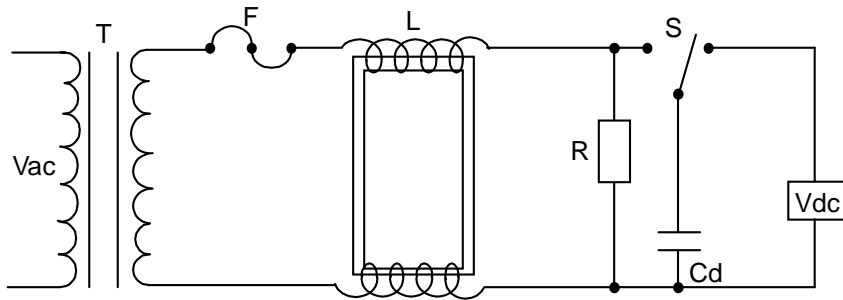


8.3 The test in accordance with UL 1676 and/or CSA C22.2 No.1-94 Paragraph18.

8.3.1 Environmental and Electrical

Table-5(1)

No	Test items	Condition of test	Performance requirements
1	DC resistance	<u>Paragraph 4.5 of JIS C 5201-1</u> Classification of test voltage : A	Within the specified tolerance of nominal resistance.
2	Humidity conditioning	<u>Paragraph 4.2 and 4.3 of UL 1676</u> <u>Paragraph 18.5.2 and 18.5.3 of CSAC22.2 No.1</u> Test conditions: Test temperature: 40±2°C Relative humidity: 90-95% Test period: 21 days(504h) After completion of the test, measure the resistance within 5min.	12MΩ max. And ΔR/R of initial resistance value for No.1 shall be within ±50%
3	Discharge	<u>Paragraph 4.4 and 4.5 of UL 1676</u> <u>Paragraph 18.5.4 and 18.5.5 of CSAC22.2 No.1</u> Test samples: Each resistor tested as described in paragraph No.2. Test cycle: Discharge of 10 times. Test circuit : Figure-3 After completion of the test, measure the resistance for 15min. to 1h.	12MΩ max. And ΔR/R of initial resistance value for No.1 shall be within ±50%
4	Dielectric Voltage-withstand	<u>Paragraph 4.6, 4.7, 4.8, 4.9 and 4.10 of UL 1676</u> <u>Paragraph 18.5.6.1, 18.5.6.2, 18.5.6.3, 18.5.6.4 and 18.5.6.5 of CSA C22.2 No.1</u> Test samples: Each resistor tested as described in paragraph No.3. Test condition: 1000Vac, 1 minute. After completion of the test, measure the resistance for 15min. to 1h.	12MΩ max. And ΔR/R of initial resistance value for No.1 shall be within ±50%
Note;* The sensitivity of the test power supply shall be able to indicate pass or failure, when it is connected to 120kΩ. * When the resistor dissipates more than rated power, it can be cooled by artificial means.			
5	Over voltage test	<u>Paragraph 5.1 and 5.2 of UL 1676</u> <u>Paragraph 18.6.1 and 18.6.2 of CSAC22.2 No.1</u> Test samples : The resistor that dissipates more than rated power during the Dielectric voltage-withstand test.(Paragraph No.4) Test conditions : ①Line voltage 125Vac; 1300Vac,4s ②Line voltage 126-250Vac; 1500Vac,4s After completion of the test, measure the resistance for 1h.	ΔR/R of initial resistance value for No.5 shall be within ±10%.
Note;* The resistor are not to be artificially cooled during the test.			
6	Pulling test	<u>Paragraph 6.1 of UL 1676</u> Pull force : 22.2N for lead wire Duration : 1 min.	No evidence of mechanical damage.
7	Torsional test	<u>Paragraph 7.1, 7.2, and 7.3 of UL 1676</u> The resistor shall be bent through an angle of 90 degrees at a point 6.4mm from the resistor body. The lead wire shall be clamped at 1.2±0.4mm. The body shall be fixed. 360 degrees about its original axis at a rate of 2-5s per 360 degrees. Torsion condition 3 times of different directions.	No evidence of mechanical damage. No damage to the resistor body.



- Vac:120Vac or 240Vac Capacity : 30A min.
- T :Optional isolation transformer for pulse blocking, having a 1 : 1 turn ration and output capability of 25A min.
- F :Fuse rated 30A, 250V
- L :Choke 3mH 0.03Ω
- S :High-voltage switch
- Cd:Dump capacitor 0.01μF
- Vdc:10kv direct-current source of power supply
- R :Resistor of test sample
- Discharge:Every 5s

Figure-3 Circuit for discharge test

9. Horizontal forming

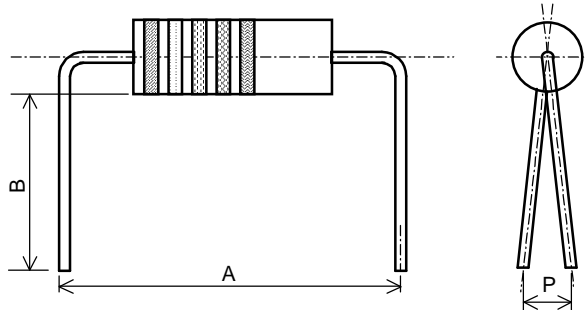


Figure-4

Table-6

Unit:mm

Style	A	B	P
RC1/2U	15.0 ± 0.5	5.0 ± 0.5	1.8max.

### 10. Taping design and dimensions

10.1 Applicable document JIS C 0806-1: 1999

10.2 Taping design and dimensions shall be in accordance with Figure-5 and Table-7.

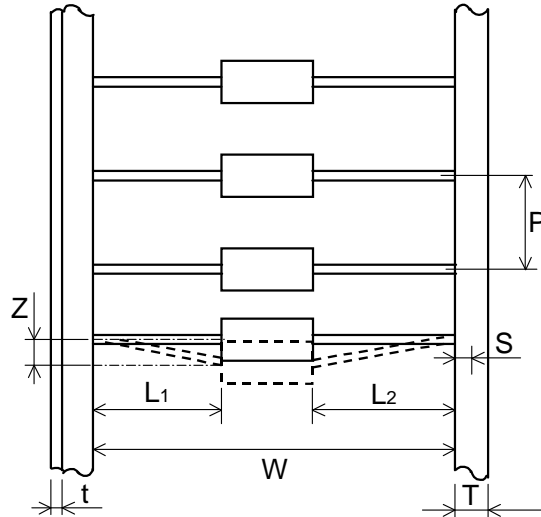


Figure-5

Table-7

Unit:mm

Style	W	P	L1-L2	Z	S	T	t
RC1/2U	52.4 <sup>+1.6</sup> <sub>-.14</sub>	5.08 ± 0.38	1.0max.	1.0max.	3.2min.	6.0 ± 0.5	0.5max.

### 10.3 Notes

10.3.1 The direction of color codes should be on unified.

10.3.2 No component shall be missed.

10.3.3 The wire leads shall be free from kinks and bends.

10.3.4 Pitches tolerance is 2mm(100±2mm) for 20 pitches.

10.3.5 The edge waving of tape shall be not more than ±1.0mm through a length of 300mm.

10.3.6 The reinforcement of the tape cutting should be reinforced by a new tape (30mm min.) in 3mm limits and insuring 1 pitch dimension as shown in Figure-6.

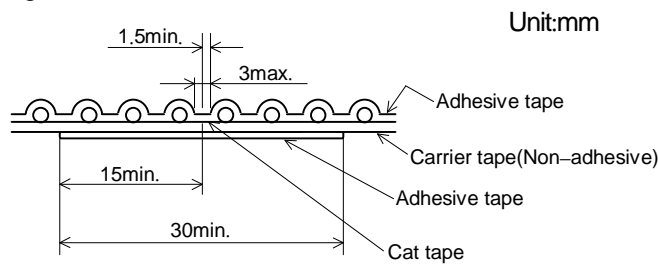


Figure-6

Unit:mm

10.2 Taped and box

The box shall be of the design and physical dimensions in accordance with Figure-7 and Table-8.  
The box of materials shall be carton.

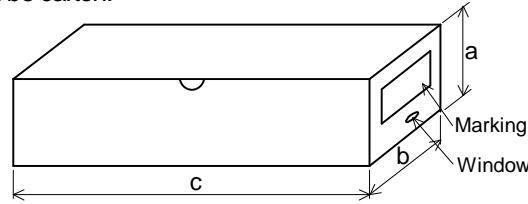


Figure-7

Table-8

Unit:mm

Style	Symbol	a	b	c
RC1/2U	TB	65 ± 5	75 ± 5	455 ± 5

10.3 Taping reel

The reel shall be of the design and physical dimensions in accordance with Figure-8 and Table-9.

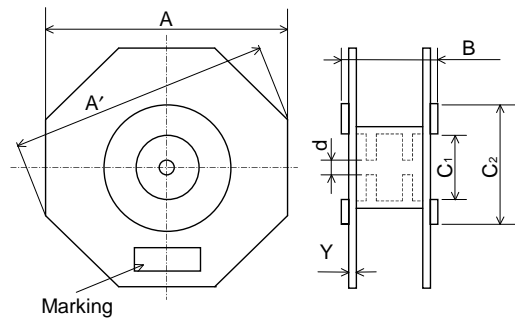


Figure-8

Table-9

Unit:mm

Style	Symbol	A	*A'	B	C <sub>1</sub>	C <sub>2</sub>	d	*Y
RC1/2U	TD	260 ± 5	280	75 ± 5	60.4 ± 1.0	78 ± 1	14.5 ± 0.5	3

\*Reference

11. Order of priority

In case it makes the difference between Safety standard (UL 1676-1990 and CSA C22.2 No.1-94) and this specification, Safety standard has priority.

12. Handling recommendations

This resistor's element is made by mixing materials of carbon conductor and other suitable materials. Lead wires are molded into the edge of resistive elements.

Following consideration is required.

12.1 Soldering

As high temp. and longtime soldering will be made on resistance value change widely, solder the resistor following conditions.

- (1)For flow soldering: Temp. of solder bath 250°C max. and immersion time 3s max.
- (2)For soldering iron: Temp. of solder iron 350°C max. and time 3s max.

12.2 Storage

Avoid places high temperature and high humidity. (Recommend: 6 months max.)

Following conditions are required for storage.

- (1) Please keep "first in-first out" based inventory control.
- (2) Store at recommended condition at 35°C max. and below 50-60%R.H.