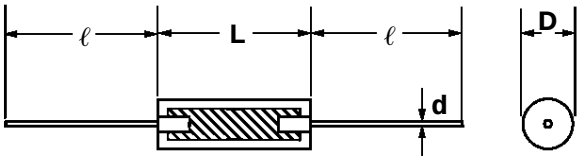
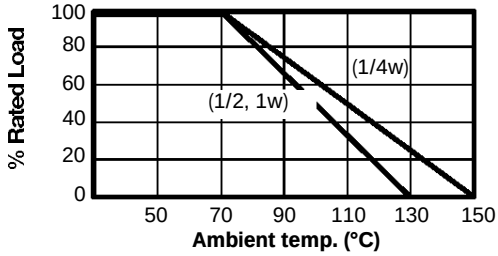
Carbon Composition Resistors

Dimensions



Derating Curve



Ratings and Dimensions

Type	Rated Power (W)	Dimensions in mm				Max. Rated Voltage (v)	Max. Overload Voltage (v)	Resistance range(Ω)	Resistance Tolerance (%)
		L	D	ℓ	d				
RC1/4G	0.25	6.3±0.7	2.4±0.1	30±3.0	$\pm^{0.6}_{0.02}$	250	400	2.2Ω 22MΩ	±5/±10
RC1/2G	0.5	$9.5^{+0.8}_{-0.7}$	3.6±0.2	25±1.0	$\pm^{0.7}_{0.02}$	350	700	2.2Ω 22MΩ	±5/±10
*RC100G	1	14.3±0.7	5.7±0.3	30±3.0	$\pm^{.92}_{0.02}$	500	1000	2.2Ω 22MΩ	±10

*Detail 1W Carbon Composition Specifications on Page K32.

Specification Limit and Performance

Test procedures, sequence of test, etc., refer to MIL-STD 202D and JIS-C-5202.

Mechanical Characteristics

Items \ Spec. & Performance		MIL - R - 11F SPEC.LIMIT					
				Spec. Limit		Performance	
		RC07	RC20	$RC_{1/4}$	$RC_{1/2}$	$RC_{1/4}$	$RC_{1/2}$
Terminal strength	Pull	2.27kg		1kg	2.5kg	5kg and over	7kg and over
		No damage, ± (1% + 0.05Ω)		No damage			
	Bending	Twist No damage ± (1% + 0.05Ω)		0.5kg	1kg	No damage	
				No damage			
Vibration		High frequency no damage, ± (2% + 0.05Ω)		No damage ± (1% + 0.05 Ω)		± 0.5%	
Resistance to soldering heat		350°C		300°C	350°C	± 1.5%	
		± (3% + 0.05Ω)		± 3%			
Solderability		232°C, 3 sec.		230°C, 3 sec.		95% and over	
		95% and over		75% and over			

Part Numbering System

RC	1/4G	103	J	T	XX
Type	**Rated Power W**	**Normal Resistance**	**Resistance Tolerance**	**Packaging**	**Lead Forming**
RC	1/4G = 1/4W 1/2G = 1/2W 100G = 1W	5% 3 Digits e.g. 2R2 = 2.2～ e.g. 102 = 1K～	J = ± 5% K = ± 10%	B Bulk T Tape & Reel TB Tape Box A Ammo	See Pages K53-56

Electrical Characteristics

Items \ Spec. & Performance		MIL-R-11F SPEC-LIMIT		Spec. Limit		Performance	
		RC07	RC20	RC1/4	RC1/2	RC1/4	RC1/2
Resistance temperature characteristics	R range	at -55°C (%)	at -105°C (%)	at -55°C (%)	at 100°C (%)	at -55°C (%)	at 100°C (%)
	1kΩ and under	± 6.5	± 5	+ 6.5 to 0	+1 to -5	+3.5 to +4.5	-3.0 to -4.0
	1.1kΩ to 10kΩ	± 10	± 6	+ 10 to 0	0 to -6	+4.5 to +5.5	-4.0 to -5.0
	11kΩ to 100kΩ	± 13	± 7.5	+ 13 to 0	0 to -7.5	+9.0 to +10	-5.0 to -6.0
	110kΩ to 1MΩ	± 15	± 10	+ 15 to 0	0 to -10	+10 to +11	-6.0 to -7.0
	1.1MΩ to 10MΩ	± 20	± 15	+ 20 to 0	0 to -10		
	11MΩ and over	± 25		+ 20 to 0	0 to -15		
Voltage coefficient		± 0.035 % / v	± 0.02 % / v	± 0.05 % / v	± 0.035% / v	- 0.02 % and under	
Short time overload		± 2.5%				± 0.7%	± 0.5%
Insulation resistance		100V	500V	100V	500V	10,000MΩ and over	
		1,000MΩ and over					
Dielectric withstanding voltage		325V	450V	300V	500V	700V	No breakdown & No damage
		No breakdown & No damage					

Environmental Characteristics

Items \ Spec. & Performance	MIL-R-11F SPEC-LIMIT		Spec. Limit		Performance	
	RC07	RC20	RC1/4	RC1/2	RC1/4	RC1/2
Temperature cycling	± 4%		± 2%		± 0.5%	
Humidity (Steady state)			± 3%		± 1.0%	
Damp heat (Long term)	X 10% Max.15%		± 5%	± 8%	± 1.0%	
Load life	X 6% Max.10%		± 6%	± 8%	± 3.0%	

Reliability Test (Damp Heat)

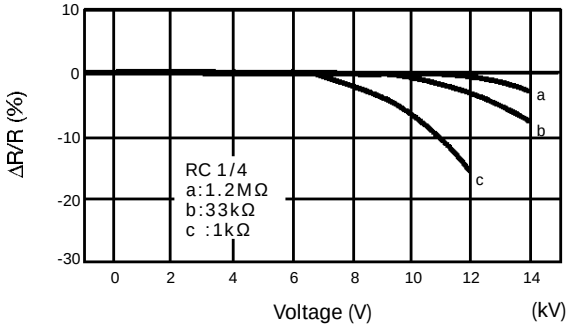
Samples: RC1/4, RC1/2 100Ω, 1kΩ, 10KΩ, 100kΩ, J, n = 150PCS. Each Total 2,400PCS.
Condition: 5,000 Hrs. operating at interval rated load at 40°C, 95%RH.

Failure rate level determination (%)		P/P$_N$ (%)	Component hour T (Hrs)	Number of failure r (P.C.S.)	Failure rate (% / 1,000Hr)		MTTF$_{CL}$(60%) (Hrs)
					λ	λ $_{CL}$(60%)	
ΔR/R	± 5	0	2.984×10^6	6	0.201	0.244	4.098×10^5
		20	2.990×10^6	4	0.134	0.176	5.682×10^5
		60	2.997×10^6	2	0.067	0.104	9.615×10^5
		100	2.992×10^6	3	0.100	0.139	7.194×10^5
		Total	1.196×10^7	15	0.125	0.138	7.209×10^5
	± 10	Total	1.20×10^7	0	0.0055	0.0077	1.299×10^7

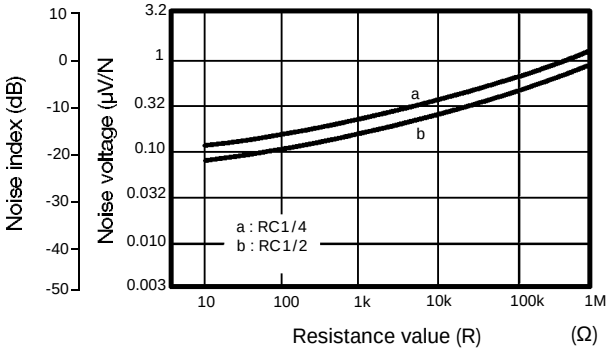
Typical Characteristics (Average value)

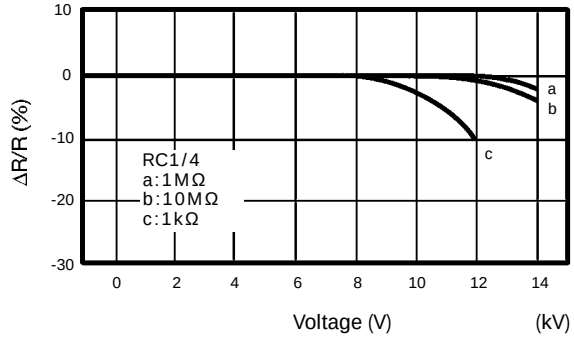
Pulse Characteristic

2000PF discharge pulse, 100 times

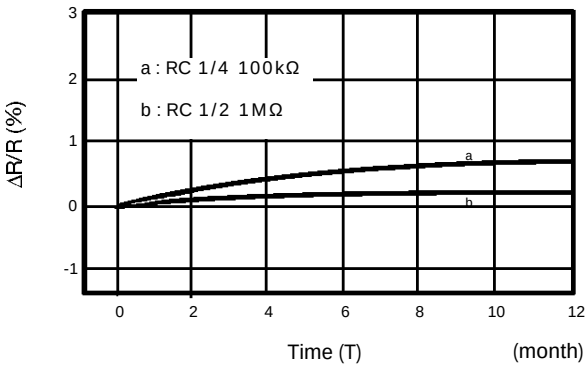


Current Noise



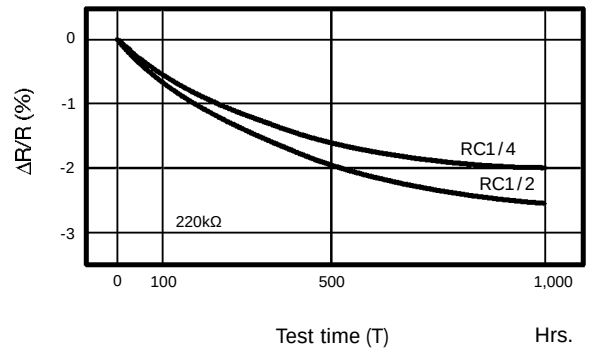


Aging Drift

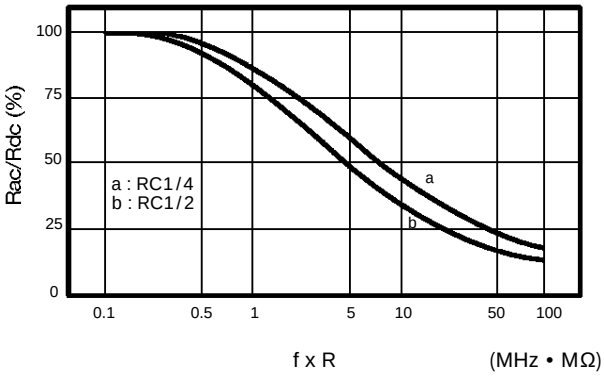


Load Life

At 70°C, Interval, Rated Load



High Frequency Characteristic



1 Watt

DC Resistance

DC resistance value must be within the specified tolerance.

DC resistance value measured at the test voltage specified below:

Nominal Resistance	DC test voltage
99Ω and lower	0.5V to 1V
10Ω to 999Ω	2.5V to 3V
1,000Ω to 9,999Ω	8V to 10V
10,000Ω to 99,999Ω	24V to 30V
100,000Ω and higher	80V to 100V

Resistance Temperature Characteristics

Nominal Resistance	Test Temp. @ -55°C	Test Temp. @ 100°C
1.0KΩ and under	6.5 to -3%	5 to 4%
1.1KΩ to 10KΩ	10 to -3%	6 to 5%
11KΩ to 100KΩ	13 to -3%	7.5 to 6%
110KΩ to 1MΩ	15 to -3%	10 to 7%
1.1MΩ to 10MΩ	20 to -3%	10 to 7%
11MΩ and over	25 to -3%	10 to 7%

$$\frac{R2 - R1}{R1} \times 100(\%)$$

R1: Resistance value at reference temp.
R2: Resistance value at test temp.

Sequence of temp: -25°C, -15°C, -55°C, 25°C, 60°C, 100°C

Voltage Coefficient (Application for 1KΩ min.)

A total resistance change of 2% maximum or chart below.

Rated Power	Coefficient Voltage
1 Watt	-.0.020%/V

Instantaneous change in resistance per volt based on:

$$\frac{R - r}{r} \times \frac{100}{0.9 \times RCWV} \quad (\% / V)$$

Dielectric Withstanding Voltage

No evidence of flashover, mechanical damage, arcing or insulation breakdown.

Resistors shall be clamped in the trough of a 90° metallic V-block and shall be tested at AC potential respectively specified in the above list for 5 seconds.

Insulation Resistance

10,000MΩ Min.

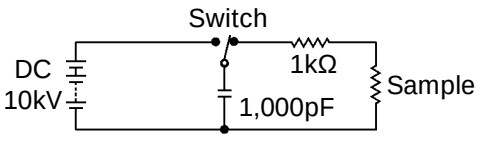
Resistors shall be clamped in the trough of a 90° metallic V-block and shall be measured at DC 100V for 1/4W and DC 500V for 1/2W and 1W.

1 Watt

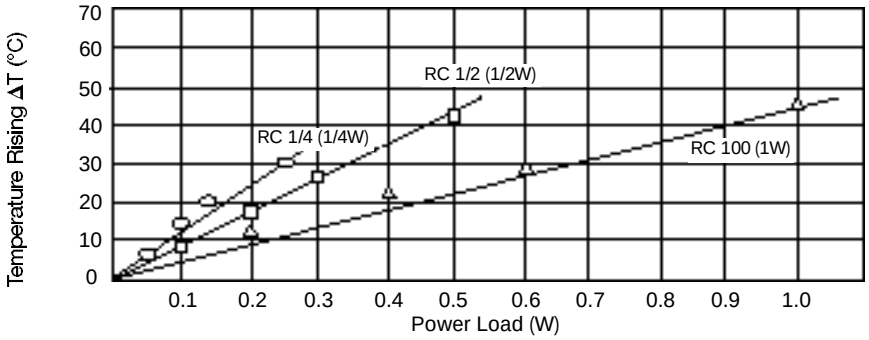
<table>
<tr><td>Temperature Cycling</td><td>±4% Max. with no evidence of mechanical damage.</td><td>Resistance change after continuous five cycles for duty cycle specified below.
<table>
<tr><th>Step</th><th>Temperature</th><th>Time (minute)</th></tr>
<tr><td>1</td><td>-55°C</td><td>30</td></tr>
<tr><td>2</td><td>25°C</td><td>10 to 15</td></tr>
<tr><td>3</td><td>85°C</td><td>30</td></tr>
<tr><td>4</td><td>25°C</td><td>10 to 15</td></tr>
</table></td></tr>
<tr><td>Humidity (Steady State)</td><td>±10% Max. with no evidence of arcing, burning, or charring.</td><td>Permanent resistance change after the application of a potential of 2.5 times RCWV, or the maximum overload voltage respectively specified in the above list, whichever is less for 5 seconds.</td></tr>
<tr><td>Short Time Overload</td><td>±(2.5% + 0.05Ω) Max. with no evidence of arcing, burning, or charring.</td><td>Permanent resistance change after the application of a potential of 2.5 time RCWV, or the maximum overload voltage respectively specified in the above list, whichever is less for 5 seconds.</td></tr>
<tr><td>Load Life in Humidity</td><td>±20% Max. with no evidence of mechanical damage.</td><td>500 hours exposure in a humidity test chamber controlled at 40° ± 2°C and 90 to 95 relative humidity.</td></tr>
<tr><td>Load Life</td><td>Resistance Change
<table>
<tr><td>Average</td><td>± 6%</td></tr>
<tr><td>Max.</td><td>± 10%</td></tr>
</table></td><td>Permanent resistance change after 1,000 hours operating at RCWV, or max. RCWV, whichever is less with a duty cycle of 1.5 hours “ON”, 0.5 hours “OFF” at 70° ± 2°C ambient.</td></tr>
<tr><td>Terminal Strength</td><td>± (1% + 0.05Ω) Max. with no evidence of mechanical damage.</td><td>Direct load:
Resistance to a 2.5 kgf (25N) direct load for 5 seconds in the direction of the longitudinal axis of the terminal leads.

Twist test:
Terminal leads shall be bent through 90° at a point of 6.35mm from the body of the resistor and shall be rotated through 360° about the original axis of the bent terminal in alternating direction for a total of 3 rotations.</td></tr>
</table>

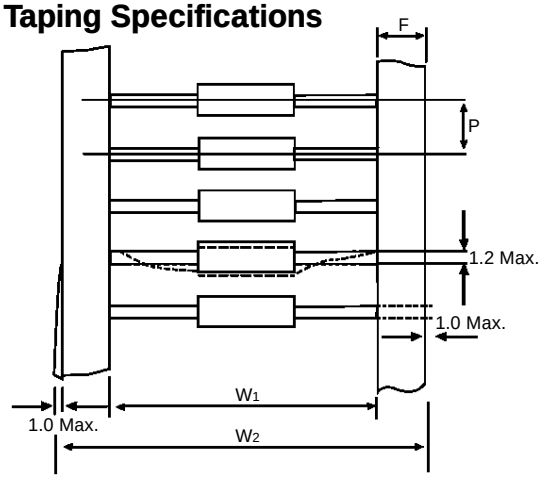
1 Watt

Resistance to Soldering Heat	± (3% + 0.05Ω) Max. with no evidence of mechanical damage.	Permanent resistance change when leads immersed 4.0 ± 0.8 mm from the body in 350° ± 10°C, solder for 3 ± 0.5 seconds.
Vibration	± (1% + 0.05Ω) Max. with no evidence of mechanical, electrical damage and electrical discontinuity.	A single vibration having an amplitude for 1.6 mm. for 2 hours in each X, Y, Z, direction. One minute between 10 and 55 Hz.
Low Temperature Operation	± 3% Max. with no evidence of mechanical damage.	Resistor shall be placed in a cold chamber at room temperature, the temperature shall be gradually decreased to -65 +10/-5°C. After 1 hour of stabilization at this temperature, RCWV or maximum RCWV, whichever less shall be applied for 45 minutes. Return to room temperature. Resistance change measured 24 hours after the test.
Solderability	95% coverage Min.	Test temperature of solder: 230 ± 5°C, Dwell time in solder: 3 ± 0.5 seconds.
Resistance to Solvents	No deterioration of color code paints.	Color code paints must resist the solvent test per MIL-STD-202 Method 215
Overload Test	± 10% Max. with no evidence of mechanical damage.	In room temperature, 1350V AC in 1 second or 1000V AC in 1 minute shall be applied.
High Voltage Pulse	± 50% Max. with no evidence of mechanical damage.	The resistors are subjected to 50 discharges at a maximum rate of 12 per minute, from a 1000 pF capacitor charged to 10kV, in test circuit as shown below. 

Hot-Spot Temperature Due to Rate of Power Dissipation



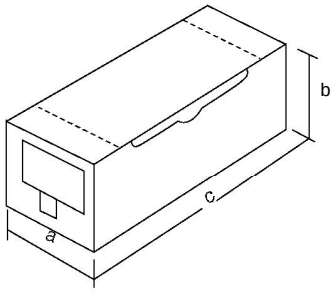
Taping Specifications



Part No.	Taping Dimensions (mm)				
	P	50XP	W_1	W_2	F
RC 1/4	5±0.5	254±2	52±1	66 Max.	6±1
RC 1/2	5±0.5	254±2	52±1	66 Max.	6±1

Tape & Box (Suffix TB)

Series	Quantity (per box)	Box		
		a	b	c
RC 1/4	2,000	70	55	260
RC 1/2	1,000	70	55	260



Tape & Reel (Suffix T)

Series	Quantity (per reel)	Reel		
		AA	B	BB
RC 1/4	5,000	80	343	315
RC 1/2	5,000	80	343	315