

# Metal film resistors

## CRB20 ( $3.2 \times 1.9 \phi$ size: 1 / 5W)

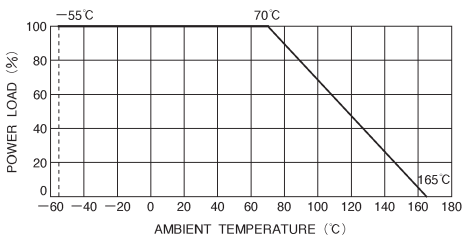
CRB20 resistors are the same size as our small carbon film resistors and are coated with a nickel–chromium film. The dielectric is applied by means of vacuum deposition, which ensures high stability and reliability. ROHM resistors have achieved ISO–9001 certification.

Design and specifications are subject to change without notice. Carefully check the specification sheet supplied with the product before using or ordering it.

### ●Features

- 1) Competitively priced for use in consumer goods.
- 2) Of the same dimensions as our small carbon film resistors. Superb space economy.
- 3) Long used by the biggest manufacturers in Europe and America. Renowned in the market for reliability.
- 4) Current noise countermeasures are not required. The noise level has been checked using a third–harmonic distortion meter (which offers greater accuracy than current noise instruments).

### ●Ratings

Item	CRB20
Rated power (70°C)	1 / 5W (0.20W)
Power derating curve	 <p>Power must be derated according to the power derating curve in the accompanying figure when ambient temperature exceeds 70°C.</p>
Rated voltage	Rated voltage is equal to the lesser of 1) the value obtained by the formula or $\sqrt{\text{rated power} \times \text{nominal resistance}}$ 2) maximum operating temperature
Maximum voltage	250V
Resistance	
Resistance tolerance	F ( $\pm 1.0\%$ )
Resistance temperature coefficient	Y ( $\pm 50 \text{ppm} / ^\circ\text{C}$ )
Resistance range	10 $\Omega$ to 1.0M $\Omega$
Nominal resistance	F: E24, E96 series
Maximum overload voltage	500V
Operating temperature	$-55^\circ\text{C}$ to $+165^\circ\text{C}$
Weight	130mg

Note: This product meets the specifications given in this specification sheet, but it is influenced by the applied voltage and ambient conditions. For this reason, if the product is to be used in equipment that must be extremely reliable, pay careful consideration to the load rate on the component when designing the equipment. In cases such as this, we recommend that you design the circuit so that the voltage on the component is no more than half of its rated value. In particular, when the component is used in AC circuits, take steps to ensure that the peak voltage applied to the component is less than the maximum operating voltage.

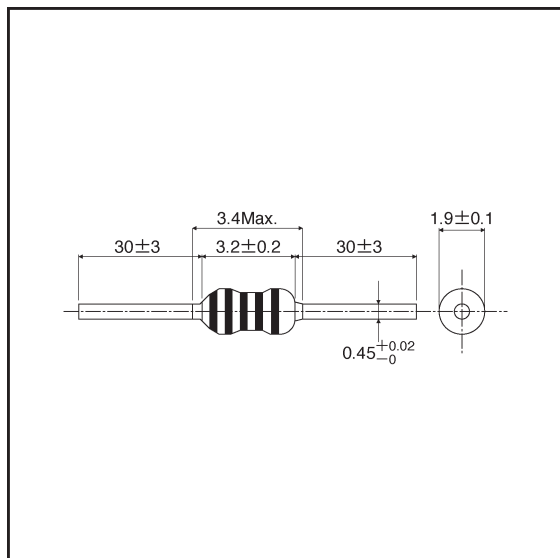
## ●Characteristics

Characteristics	Specifications	Test method														
DC resistance	DC resistance is within maximum variation from nominal DC resistance.	JIS C 5202 5.1 DC resistance value is measured at the test voltage levels specified below: <table><tr><th>Nominal resistance</th><th>DC test voltage</th></tr><tr><td>Less than 100 Ω</td><td>0.3V</td></tr><tr><td>100 Ω to 999 Ω</td><td>1.0V</td></tr><tr><td>1 kΩ to 9.999 kΩ</td><td>3.0V</td></tr><tr><td>10 kΩ to 99.999 kΩ</td><td>10.0V</td></tr><tr><td>100 kΩ to 999.999 kΩ</td><td>25.0V</td></tr><tr><td>1MΩ and over</td><td>50.0V</td></tr></table>	Nominal resistance	DC test voltage	Less than 100 Ω	0.3V	100 Ω to 999 Ω	1.0V	1 kΩ to 9.999 kΩ	3.0V	10 kΩ to 99.999 kΩ	10.0V	100 kΩ to 999.999 kΩ	25.0V	1MΩ and over	50.0V
Nominal resistance	DC test voltage															
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10 kΩ to 99.999 kΩ	10.0V															
100 kΩ to 999.999 kΩ	25.0V															
1MΩ and over	50.0V															
Resistance temperature characteristics	Resistance temperature characteristics fall within the range of resistance temperature coefficients specified in the following table. <table><tr><th>Resistance temperature coefficient code</th><th>(ppm / °C)</th></tr><tr><td>Y</td><td>±50</td></tr></table>	Resistance temperature coefficient code	(ppm / °C)	Y	±50	JIS C 5202 5.2 Resistance temperature characteristics are calculated according to the following formula, and are based on the resistance temperature coefficient at test temperature, and on resistance at room temperature. $\frac{R_2-R_1}{R_1(t_2-t_1)} \times 10^6 \text{ (ppm / } ^\circ\text{C)}$ R <sub>1</sub> : Resistance at room temperature (t <sub>1</sub> ) R <sub>2</sub> : Resistance at room temperature + 100°C (t <sub>2</sub> ) Test temperature sequence: Room temperature (25°C) Room temperature + 100°C										
Resistance temperature coefficient code	(ppm / °C)															
Y	±50															
Voltage coefficient	25ppm / V <sub>Max</sub> .	JIS C 5202 5.3 The change in resistance, as measured at rated voltage, is calculated according to the following formula, and is based on the measurement for resistance obtained at a voltage equal to 1/10 of rated voltage. $\frac{R_1-R_2}{R_2} \times \frac{10^6}{0.9 \times (\text{rated voltage})} \text{ (ppm / V)}$ R <sub>1</sub> : Resistance, as measured at rated voltage. R <sub>2</sub> : Measurement for resistance obtained at a voltage equal to 1 / 10 of rated voltage														
Short time overload	Resistance change rate must be within ±(0.5%+0.05Ω), and there must be no mechanical damage.	JIS C 5202 5.5 DC voltage or AC voltage (at effective commercial frequency) 2.5 times greater than rated voltage is applied for five seconds. Maximum overload voltage is 500V.														
Insulation resistance	10 <sup>4</sup> MΩ Min.	JIS C 5202 5.6 Place the resistor in a metal 90-degree V block such that neither end projects beyond the edges of the block, then apply a test voltage of 100V (at effective commercial frequency) for 60 seconds between the V block and the lead.														
Withstand voltage	Resistance change rate must be within ±(0.1%+0.05Ω), and there must be no line loss, overheating, or damage to the insulation.	JIS C 5202 5.7 Place the resistor in a metal 90-degree V block such that neither end projects beyond the edges of the block, then apply a test voltage of 300V (at effective commercial frequency) for 60 to 70 seconds between the V block and the lead.														
Terminal strength	Resistance change rate must be within ±(0.2%+0.05Ω), and there must be no mechanical damage, such as broken or loose leads.	JIS C 5202 6.1 Bending strength: holding the resistor steady, suspend a weight of 5N from the lead so that it hangs perpendicularly from the resistor. Rotate the resistor 90°C in one direction and return it to its original position, then rotate it again 90-degrees in the opposite direction. Torsional strength: Bend the lead 90 degrees approximately 6 mm from the resistor. After fixing the position of the bent lead, rotate it upon its original axis back and forth 360 degrees three times at a speed of approximately 5 seconds per revolution.														

Characteristics	Specifications	Test method															
Resistance to vibration (low frequency)	Resistance change rate must be within $\pm(0.2\%+0.05\Omega)$ , and there must be no mechanical damage.	JIS C 5202 6.3 Resistor is subjected to a single vibration having an amplitude of 0.8 mm (double amplitude of 1.6 mm) for two hours each in three mutually perpendicular directions for a total of six hours. Vibration frequency should be varied back and forth regularly from 10 Hz to 55 Hz and back again once every minute.															
Resistance to soldering heat	Resistance change rate must be within $\pm(0.1\%+0.05\Omega)$ , and there must be no mechanical damage.	JIS C 5202 6.4 Dip leads up to $4.0\pm 0.8$ mm from the resistor body in a solder bath in the manner described in A or B below, leave them undisturbed for three hours, then measure resistance. <table border="1"> <tr> <th>Conditions</th><th>Temperature</th><th>Soldering time</th></tr> <tr> <td>A</td><td><math>350\pm 10^{\circ}\text{C}</math></td><td><math>3.5\pm 0.5\text{s}</math></td></tr> <tr> <td>B</td><td><math>260\pm 5^{\circ}\text{C}</math></td><td><math>10.0\pm 1.0\text{s}</math></td></tr> </table>	Conditions	Temperature	Soldering time	A	$350\pm 10^{\circ}\text{C}$	$3.5\pm 0.5\text{s}$	B	$260\pm 5^{\circ}\text{C}$	$10.0\pm 1.0\text{s}$						
Conditions	Temperature	Soldering time															
A	$350\pm 10^{\circ}\text{C}$	$3.5\pm 0.5\text{s}$															
B	$260\pm 5^{\circ}\text{C}$	$10.0\pm 1.0\text{s}$															
Solderability	At least 95% of the area exposed to the solder bath must be covered with soft, new solder.	JIS C 5202 6.5 Carry out the test in the manner prescribed in JIS C 5202 6.5. Soldering temperature: $235\pm 5^{\circ}\text{C}$ Soldering time: $5\pm 0.5\text{s}$															
Resistance to cold	Resistance change rate must be within $\pm(1\%+0.05\Omega)$ , and there must be no mechanical damage.	JIS C 5202 7.1 The resistor is placed without load for 1000 to 1048 continuous hours in a chamber kept at a constant $-55\pm 3^{\circ}\text{C}$ .															
Resistance to dry heat	Resistance change rate must be within $\pm(2\%+0.05\Omega)$ , and there must be no mechanical damage.	JIS C 5202 7.2 The resistor is placed without load for 1000 to 1048 continuous hours in a chamber kept at a constant $165\pm 2^{\circ}\text{C}$ .															
Temperature cycling	Resistance change rate must be within $\pm(1\%+0.05\Omega)$ , and there must be no mechanical damage.	JIS C 5202 7.4 The resistor is put through five temperature cycles, each cycle being as described in the following table. <table border="1"> <tr> <th>Step</th><th>Temperature</th><th>Time</th></tr> <tr> <td>1</td><td><math>-55\pm 3^{\circ}\text{C}</math></td><td>30min.</td></tr> <tr> <td>2</td><td>Room temperature</td><td>10 to 15min.</td></tr> <tr> <td>3</td><td><math>165\pm 2^{\circ}\text{C}</math></td><td>30min.</td></tr> <tr> <td>4</td><td>Room temperature</td><td>10 to 15min.</td></tr> </table>	Step	Temperature	Time	1	$-55\pm 3^{\circ}\text{C}$	30min.	2	Room temperature	10 to 15min.	3	$165\pm 2^{\circ}\text{C}$	30min.	4	Room temperature	10 to 15min.
Step	Temperature	Time															
1	$-55\pm 3^{\circ}\text{C}$	30min.															
2	Room temperature	10 to 15min.															
3	$165\pm 2^{\circ}\text{C}$	30min.															
4	Room temperature	10 to 15min.															
Resistance to humidity (steady state)	Resistance change rate must be within $\pm(1\%+0.05\Omega)$ , and there must be no mechanical damage.	JIS C 5202 7.5 The resistor is placed without load for 240 continuous hours in a chamber kept at a constant $40\pm 2^{\circ}\text{C}$ and 90% to 95% relative humidity.															
Endurance (under load in damp environment)	Resistance change rate must be within $\pm(1\%+0.05\Omega)$ , and there must be no mechanical damage.	JIS C 5202 7.9 The resistor is placed for 1000 to 1048 continuous hours in a chamber kept at a constant $40\pm 2^{\circ}\text{C}$ and 90% to 95% relative humidity, where rated DC voltage is alternately applied (for 1.5 hours) and turned off (for 0.5 hours) in a continuous cycle.															
Endurance (steady state)	Resistance change rate must be within $\pm(1\%+0.05\Omega)$ , and there must be no mechanical damage.	JIS C 5202 7.10 The resistor is placed for 1000 to 1048 continuous hours in a chamber kept at a constant $70\pm 2^{\circ}\text{C}$ , where rated voltage is alternately applied (for 1.5 hours) and turned off (for 0.5 hours) in a continuous cycle.															
Resistance to solvents	Printed markings and surface of the insulation must not be noticeably damaged.	JIS C 5202 6.9 Resistor is immersed five times in solvent as specified in the following table and rubbed dry each time with absorbent cotton. <table border="1"> <tr> <th>Solvent</th><th>Temperature of solvent</th><th>Duration</th></tr> <tr> <td>Isopropyl alcohol</td><td>20 to 25</td><td><math>60\pm 10\text{s}</math>.</td></tr> <tr> <td>Water</td><td><math>55\pm 5</math></td><td><math>5\pm 0.5\text{Min.}</math></td></tr> </table>	Solvent	Temperature of solvent	Duration	Isopropyl alcohol	20 to 25	$60\pm 10\text{s}$ .	Water	$55\pm 5$	$5\pm 0.5\text{Min.}$						
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Isopropyl alcohol	20 to 25	$60\pm 10\text{s}$ .															
Water	$55\pm 5$	$5\pm 0.5\text{Min.}$															

\* The design and specifications are subject to change without prior notice. Before ordering or using, please check the latest technical specification.

### ●External dimensions (Units: mm)



### ●Structure and materials

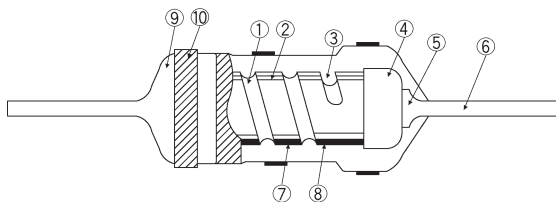


Fig.1

#### (1) Substrate: Alumina magnetic rod

Alumina is superior to regular mullite or forsterite with respect to mechanical strength, thermal conductivity, and thermal stability.

#### (2) Resistive elements

Nickel and nickel-chromium film of high uniformity and reliability.

#### (3) Cutting groove

The groove is cut to a uniform depth and width across the whole element, and there are no chips or cracks in the finished product.

#### (4) Terminals: Tin-plated copper, steel cap

This material provides a solid physical and electrical connection.

#### (5) Connections: Spot-welded

Spot welding ensures a solid, durable connection between the terminal and the terminal wire.

#### (6) Terminal wires: Solder-plated copper wire

Can be soldered effectively even after a long time.

#### (7) Protective film

For resistors of 10 ohms or more, a special inorganic material guarantees the long-term stability of the dielectric film.

#### (8) Under coating: Phenolic resin

The dielectric film is protected by a coat of high-purity phenolic resin.

#### (9) Outer coating: Epoxy resin (color: light brown)

This coating offers superior resistance to heat, the elements, and solvents, and is a good insulator. It is also very safe, meeting the UL94V-0 standard for nonflammability.

#### (10) Markings: Color coding using thermo-hardened paint

Markings offer outstanding resistance to solvents and chemicals, and do not fade.

### ●Reference standards

#### ■ JIS C 5202

Regulations on test methods for fixed resistors

#### ■ JIS C 5003

Regulations on test methods for malfunction rates

### ●Other reference standards

#### CRB20

#### ■ MIL-R-10509 RN55

Resistors, fixed, film (high stability)

#### ■ MIL-R-55182 RNR55

Resistors, fixed, film, established reliability

#### ■ MIL-R-22684 RL07

Resistors, fixed, film, insulated

#### ■ MIL-R-39017 RLR07

Resistors, fixed, film, established reliability

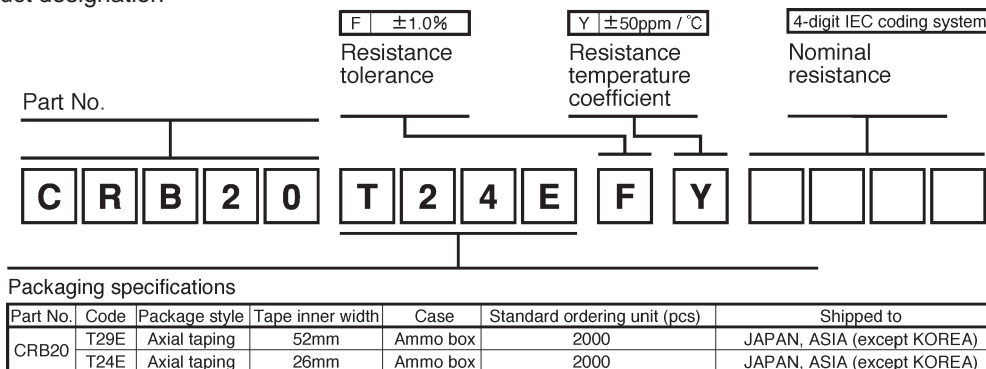
#### ■ EIA-RS-196

Fixed film resistors—precision and semi-precision

#### ■ DIN-44061-0207

Resistors, fixed, lacquered, metal film, high stability, with low temperature coefficient, with axial leads

## ●Product designation



## ●Electrical characteristics

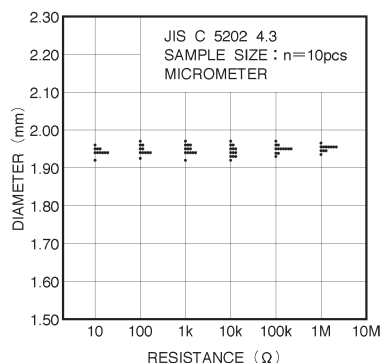


Fig.2 Dimensions (diameter)

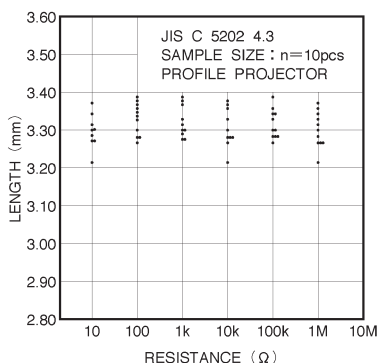


Fig.3 Dimensions (length)

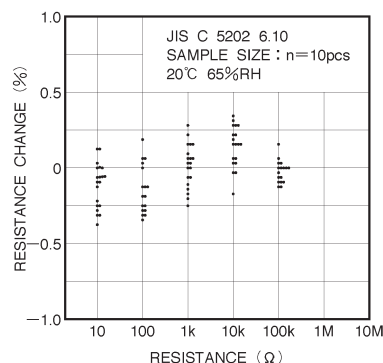


Fig.4 DC resistance

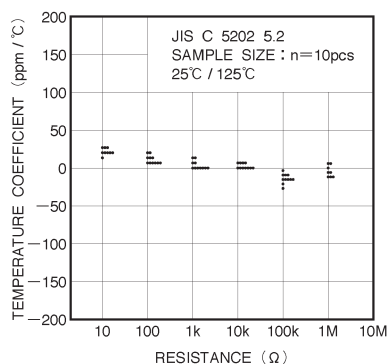


Fig.5 Resistance temperature characteristics

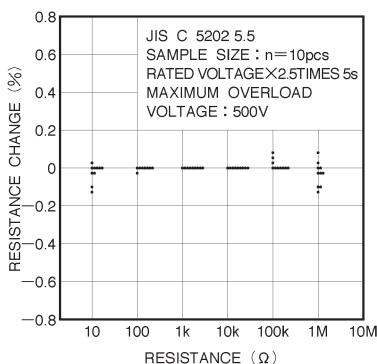


Fig.6 Short time overload

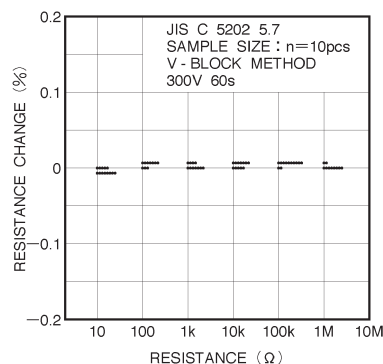


Fig.7 Withstand voltage

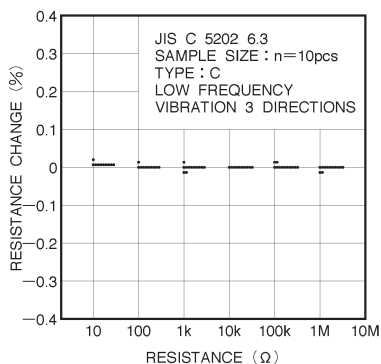


Fig.8 Resistance to vibration

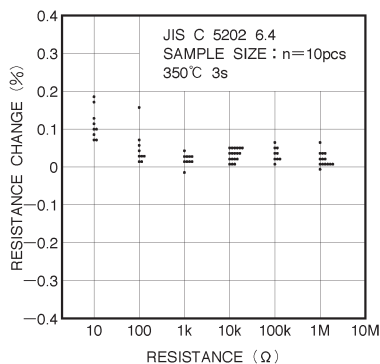


Fig.9 Resistance to soldering heat

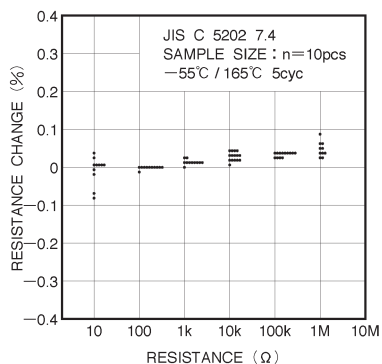


Fig.10 Temperature cycling

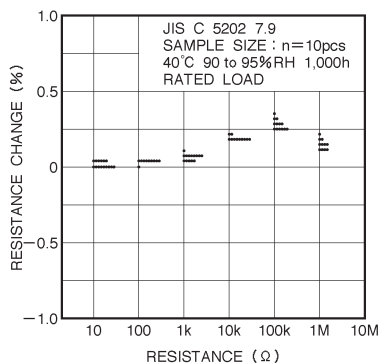


Fig.11 Endurance (under load and damp)

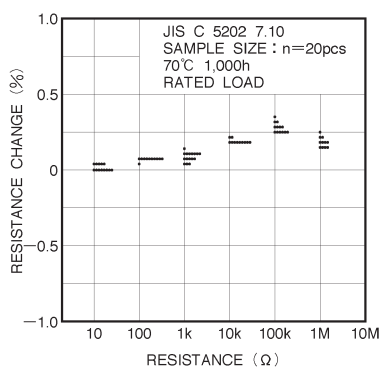


Fig.12 Endurance (rated load)