Carbon film resistors

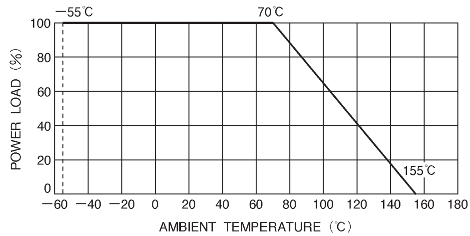
R25X (6.3 × ϕ 2.4 size: 1 / 3W)

ROHM resistors are produced using an integrated production system for parts and materials, and state of the art technology to ensure high precision productivity, and quality.
ROHM resistors are ISO-9001 certified.
The design and specifications are subject to change without prior notice. Before ordering or use, please cheak the technical specification sheets.

●Features

1) All ceramic rods are made from the same material to yield consistent quality.
2) Unique production methods provide outstanding mechanical strength characteristics.
3) Superb accuracy of axial taping for excellent high-speed automatic insertion performance.
4) Though miniaturized, the R25X retains the high pulse resistance of its predecessor chips.
5) Soft copper wire with solder plating offers superior solderability.
6) Both insulator coating and its color codes are highly resistant to solvents, and steam cleaning is no problem.
7) Highly nonflammable insulation coating (UL94V-0).

●Ratings

<table>
<tr><th colspan="2">Item</th><th colspan="2">R25X</th></tr>
<tr><td colspan="2">Rated power（70℃）</td><td colspan="2">1 / 3W（0.33W）</td></tr>
<tr><td></td><td>Power derating curve</td><td colspan="2">

Power must be derated according to the power derating curve in the accompanying figure when ambient temperature exceeds 70 °C.</td></tr>
<tr><td colspan="2">Rated voltage</td><td colspan="2">Rated voltage is equal to the lesser of the value obtained by the formula $\sqrt{\text{rated voltage x nominal resistance}}$ or maximum operating voltage.</td></tr>
<tr><td></td><td>Maximum voltage</td><td colspan="2">300V</td></tr>
<tr><td>Resistance</td><td>Resistance tolerance</td><td></td><td>J（±5℃）</td></tr>
<tr><td></td><td rowspan="6">Resistance temperature coefficient</td><td>Nominal resistance</td><td>Resistance temperature coefficient</td></tr>
<tr><td></td><td>Less than 10 Ω</td><td>0 to ＋300ppm / ℃</td></tr>
<tr><td></td><td>10 Ω to 300k Ω</td><td>0 to −400ppm / ℃</td></tr>
<tr><td></td><td>330k Ω to 910k Ω</td><td>0 to −600ppm / ℃</td></tr>
<tr><td></td><td>1M Ω to 1.3M Ω</td><td>0 to −700ppm / ℃</td></tr>
<tr><td></td><td>1.5M Ω to 3.3M Ω</td><td>0 to −1000ppm / ℃</td></tr>
<tr><td></td><td>Resistance range</td><td></td><td>0.47 Ω to 3.3M Ω</td></tr>
<tr><td></td><td>Nominal resistance</td><td colspan="2">E24 series</td></tr>
<tr><td></td><td>Maximum overload voltage</td><td colspan="2">600V</td></tr>
<tr><td></td><td>Maximum intermittent overload voltage</td><td colspan="2">750V</td></tr>
<tr><td></td><td>Operating temperature</td><td colspan="2">−55℃ to 155℃</td></tr>
<tr><td></td><td>Weight</td><td colspan="2">230mg</td></tr>
</table>

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

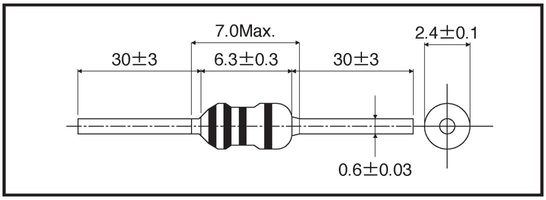
<table>
<tr><th>Characteristics</th><th>Specifications</th><th>Test method</th></tr>
<tr><td>DC resistance</td><td>DC resistance is within maximum variation from nominal DC resistance.</td><td>JIS C 5202 5.1
DC resistance value is measured at the test voltage levels specified below:
<table>
<tr><th>Nominal resistance</th><th>DC test voltage</th></tr>
<tr><td>Less than 10Ω</td><td>0.1V</td></tr>
<tr><td>10Ω to 100Ω</td><td>0.3V</td></tr>
<tr><td>100Ω to 1 kΩ</td><td>1.0V</td></tr>
<tr><td>1 kΩ to 10 kΩ</td><td>3.0V</td></tr>
<tr><td>10 kΩ to 100 kΩ</td><td>10.0V</td></tr>
<tr><td>100 kΩ to 1 MΩ</td><td>25.0V</td></tr>
<tr><td>1 MΩ and over</td><td>50.0V</td></tr>
</table></td></tr>
<tr><td>Resistance temperature characteristics</td><td>Resistance temperature characteristics fall within the range of resistance temperature c-oefficients specified in the following table.
<table>
<tr><th>Nominal resistance</th><th>(ppm / °C)</th></tr>
<tr><td>Less than 10 Ω</td><td>0 to +300</td></tr>
<tr><td>10Ω to 300kΩ</td><td>0 to −400</td></tr>
<tr><td>330kΩ to 910kΩ</td><td>0 to −500</td></tr>
<tr><td>1MΩ to 1.3MΩ</td><td>0 to −700</td></tr>
<tr><td>1.5MΩ to 3.3MΩ</td><td>0 to −1,000</td></tr>
</table></td><td>JIS C 5202 5.2
Resistance temperature coefficients are calculated according to the following formula, and are based on the resistance temperature coefficient at test temperature, and on resistance at room temperature.
$\frac{R_2-R_1}{R_1(t_2-t_1)}\times10^6$ (ppm / ℃)
R_1: Resistance at room temperature (t_1)
R_2: Resistance at room temperature + 100°C (t_2)
Test temperature sequence: Room temperature (25°C)
Room temperature + 100°C</td></tr>
<tr><td>Voltage coefficient</td><td>25ppm / V Max.</td><td>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.
$\frac{R_1-R_2}{R_2}\times\frac{10^6}{0.9\times(\text{rated voltage})}$ (ppm / V)
R_1: Resistance, as measured at rated voltage.
R_2: Measurement for resistance obtained at a voltage equal to 1 / 10 of rated voltage</td></tr>
<tr><td>Short time overload</td><td>Resistance change rate must be within ±(1%+0.05Ω), and there must be no mechanical damage.</td><td>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.</td></tr>
<tr><td>Insulation resistance</td><td>10^4MΩMin.</td><td>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.</td></tr>
<tr><td>Withstand voltage</td><td>Resistance change rate must be within ±(0.5%+0.05Ω), and there must be no line loss, overheating, or damage to the insulation.</td><td>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.</td></tr>
<tr><td>Intermittent overload (10Ω or greater)</td><td>Resistance change rate must be within ±(0.75%+0.05Ω), and there must be no mechanical damage.</td><td>JIS C 5202 5.8
AC voltage (at effective commercial frequency) 4 times greater than rated voltage (3 times greater in the case of 1 / 4W resistors) is applied 1,000 times at 25-seconds intervals, with each application lasting 1 second. Maximum intermittent overload voltage is 600V.</td></tr>
</table>

<table>
<tr><th>Characteristics</th><th>Specifications</th><th>Test method</th></tr>
<tr><td>Terminal strength</td><td>Resistance change rate must be within ±(0.5%+0.05Ω), and there must be no mechanical damage, such as broken or loose leads.</td><td>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 degrees 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.</td></tr>
<tr><td>Resistance to vibration (low frequency)</td><td>Resistance change rate must be within ±(0.5%+0.05Ω), and there must be no mechanical damage.</td><td>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.</td></tr>
<tr><td>Resistance to soldering heat</td><td>Resistance change rate must be within ±(1%+0.05Ω), and there must be no mechanical damage.</td><td>JIS C 5202 6.4
Dip leads up to 4.0±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>
<tr><th>Conditions</th><th>Temperature</th><th>Soldering time</th></tr>
<tr><td>A</td><td>350±10℃</td><td>3.5±0.5s.</td></tr>
<tr><td>B</td><td>260±5℃</td><td>10.0±1.0s.</td></tr>
</table></td></tr>
<tr><td>Solderability</td><td>At least 95% of the area exposed to the solder bath must be covered with soft, new solder.</td><td>JIS C 5202 6.5
Carry out the test in the manner prescribed in JIS C 5202 6.5.
Soldering temperature: 235±5℃
Soldering time: 5±0.5s.</td></tr>
<tr><td>Resistance to cold</td><td>Resistance change rate must match the description in the following table, and there must be no mechanical damage.
<table>
<tr><th>Nominal resistance</th><th>Resistance change rate</th></tr>
<tr><td>Less than 100 kΩ</td><td>±(2%+0.05Ω)</td></tr>
<tr><td>100 kΩ or greater</td><td>±3%</td></tr>
</table></td><td>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±3°C.</td></tr>
<tr><td>Resistance to dry heat</td><td>Resistance change rate must match the description in the following table, and there must be no mechanical damage.
<table>
<tr><th>Nominal resistance</th><th>Resistance change rate</th></tr>
<tr><td>Less than 100 kΩ</td><td>±(2%+0.05Ω)</td></tr>
<tr><td>100 kΩ or greater</td><td>±3%</td></tr>
</table></td><td>JIS C 5202 7.2
The resistor is placed without load for 1000 to 1048 continuous hours in a chamber kept at a constant 125±2°C.</td></tr>
<tr><td>Temperature cycling</td><td>Resistance change rate must be within ±(1%+0.05Ω), and there must be no mechanical damage.</td><td>JIS C 5202 7.4
The resistor is put through five temperature cycles, each cycle being as described in the following table.
<table>
<tr><th>Step</th><th>Temperature</th><th>Holding time</th></tr>
<tr><td>1</td><td>−55±3℃</td><td>30min</td></tr>
<tr><td>2</td><td>Room temperature</td><td>2 to 3min</td></tr>
<tr><td>3</td><td>155±2℃</td><td>30min</td></tr>
<tr><td>4</td><td>Room temperature</td><td>2 to 3min</td></tr>
</table></td></tr>
</table>

Characteristics	Specifications	Test method
Resistance to humidity (steady state)	Resistance change rate must match the description in the following table, and there must be no mechanical damage. Nominal resistance / Resistance change rate Less than 100 kΩ: ±(2%+0.05Ω) 100 kΩ or greater: ±3%	JIS C 5202 7.5 The resistor is placed without load for 240 continuous hours in a chamber kept at a constant 40±2°C and 90% to 95% relative humidity.
Endurance (under load in damp environment)	Resistance change rate must match the description in the following table, and there must be no mechanical damage. Nominal resistance / Resistance change rate Less than 100 kΩ: ±(2%+0.05Ω) 100 kΩ or greater: ±3%	JIS C 5202 7.9 The resistor is placed for 1000 to 1048 continuous hours in a chamber kept at a constant 40±2°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 (rated load)	Resistance change rate must match the description in the following table, and there must be no mechanical damage. Nominal resistance / Resistance change rate Less than 100 kΩ: ±(2%+0.05Ω) 100 kΩ or greater: ±3%	JIS C 5202 7.10 The resistor is placed for 1000 to 1048 continuous hours in a chamber kept at a constant 70±2°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. Solvent / Temperature of solvent / Duration Isopropyl alcohol: 20 to 25 / 60±10s Water: 55±5 / 5±0.5Min.

∗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

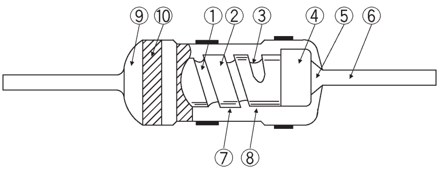


Fig.1

(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
0Ω: Copper film
Less than 10Ω: Nickel film. In addition to their high stability, these resistors are designed to cut off safely in the event of a voltage spike.
10Ω and above: Carbon film. This type of film offers superior uniformity and stability.

(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 10Ω 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

ROHM's pioneering products meet the following domestic and international standards.

- •JIS C 5202: Regulations on test methods for fixed resistors
- •JIS C 5003: Regulations on test methods for malfunction rates
- •JIS C 6402: Resistors, fixed, carbon film
- •MIL-R-11: Resistors, fixed, composition (insulated)
- •MIL-R-10509: Resistors, fixed, film (high stability)
- •MIL-R-22684: Resistors, fixed, film, insulated
- •EIA-RS-196: Fixed film resistors-precision and semi-precision
- •DIN-44052: Resistors, fixed, lacquered, cracked carbon film, high stability, with axial leads

●Pulse voltage limits

The pulse voltage rating (1) is determined by the following formula. However, if the value obtained from the formula exceeds the maximum pulse voltage (2) or the resistance-limited voltage peak value (3), the lowest value must be taken as the pulse voltage rating.

(1) Pulse voltage rating

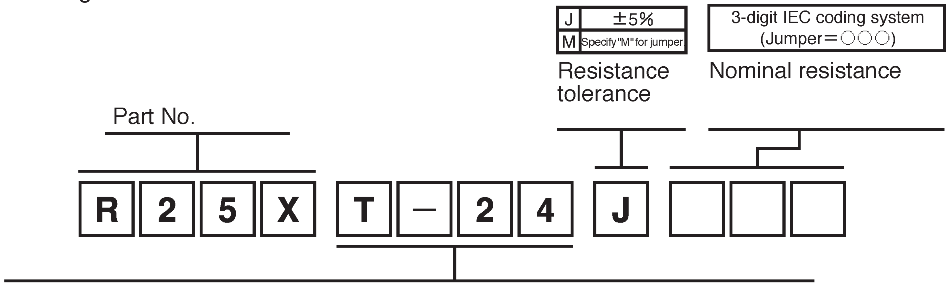
$$V_p = \sqrt{\frac{P \times R}{f \times t}}$$

P:Rated power (W) f: repetition frequency (Hz)
R: nominal resistance (Ω) t: pulse width (s)

(2) Maximum pulse voltage R20× 600V
R25× 750V

(3) Resistance-limited voltage peak
Less than 10Ω
Up to four times the rated DC voltage
10Ω or more
Up to seven times the rated DC voltage
It is assumed that the pulse width is less than 10ms.

●Product designation



Packaging specifications (carbon film resistors)

Part No.	Code	Package style	Tape inner width	Case	Standard ordering unit (pcs)	Shipped to
R25X	T-24	Axial taping	26mm	Ammo box	2000	JAPAN, KOREA
	T-29	Axial taping	52mm	Ammo box	2000	JAPAN only
	T-04	Axial taping	52mm	Ammo box	5000	EUROPE, BRAZIL, KOREA
	T-68	Axial taping	52mm	Reel	5000	USA only

●Electrical characteristics

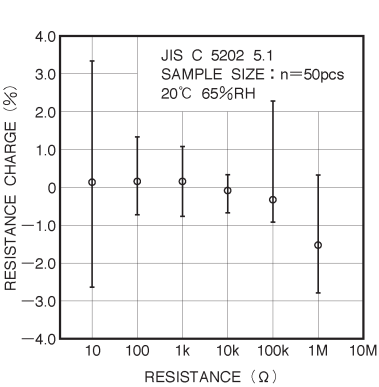


Fig.2 DC resistance

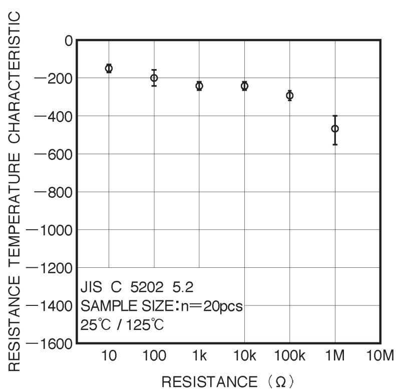


Fig.3 Resistance temperature characteristics

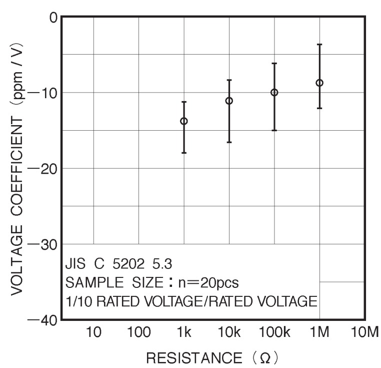


Fig.4 Voltage coefficient

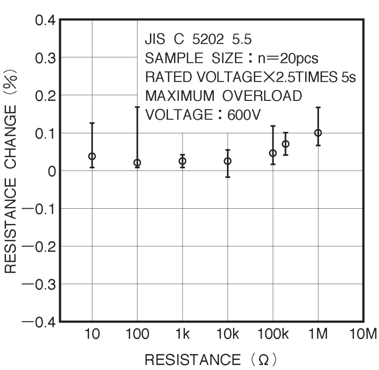


Fig.5 Short time overload

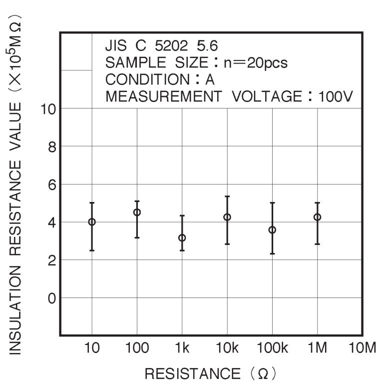


Fig.6 Insulation resistance

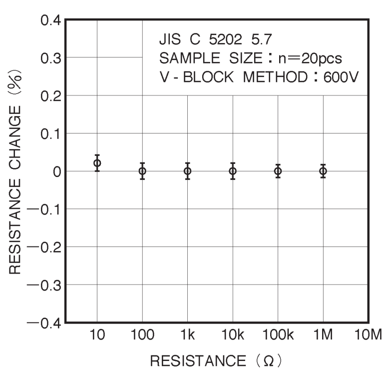


Fig.7 Withstand voltage

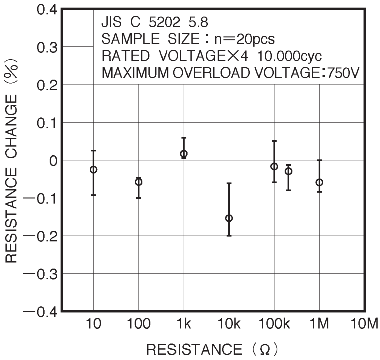


Fig.8 Intermittent overload

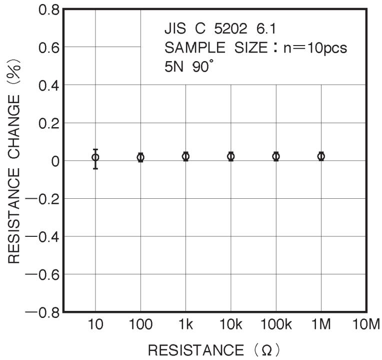


Fig.9 Terminal strength (bending)

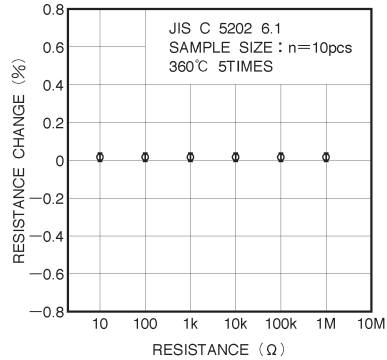


Fig.10 Terminal strength (torsional)

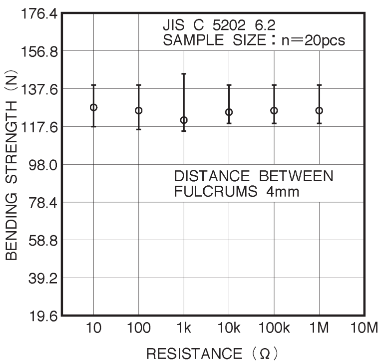


Fig.11 Bending strength

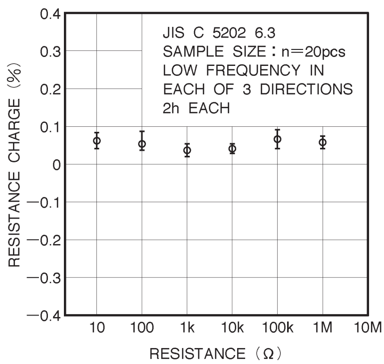


Fig.12 Resistance to vibration

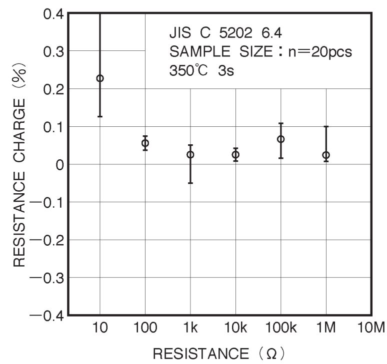


Fig.13 Resistance to soldering heat

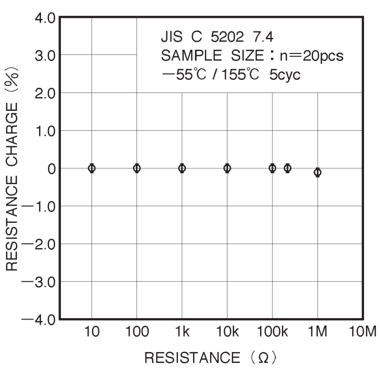


Fig.14 Temperature cycling

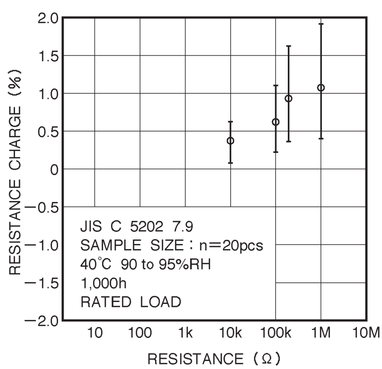


Fig.15 Endurance (underload and damp)

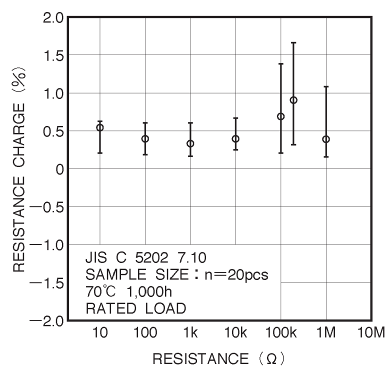


Fig.16 Endurance (rated load)