This specification is intended to be utilized in conjunction with Series 200 data sheet.

RESISTOR SPECIFICATION

RCD Series 200
Miniature Power Wirewound Resistors

RESISTORS • CAPACITORS • COILS • DELAY LINES

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RCD Series 200 Power Wirewound Resistors

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Performance ratings apply to standard Series 200 resistors, unless indicated otherwise. Consult factory for performance ratings of parts with options or are custom-designed to meet specialty requirements.

For additional information not presented in this report, request following Application Guides…

Thermal EMF (Engineering Report #R-32)
Forced Air Convection Across Power Resistors (Engineering Report #R-33)
Thermal Considerations and Temperature Rise of RCD Resistors (Engineering Report #R-35)
Power Derating Factors for Grouping Resistors (Engineering Report #R-36)
Mounting Guidelines for RCD Axial Lead Resistors & Inductors (Engineering Report #R-37)

1.0 SERIES 200 PRODUCT HISTORY

RCD's Series 200 was developed in 1985 to achieve precision performance in package sizes significantly smaller than conventional resistors. The 200 Series has been constantly improved and expanded over the years to achieve greater stability under various environmental conditions, as well as a wider range of resistance values and design options.

2.0 PRODUCT DESCRIPTION

Designed for precision power applications where space-savings is beneficial. Wide range of custom options including non-standard values, non-inductive design, high-pulse and high voltage designs, military screening, flameproof coating, low thermal emf, etc., are available (refer to Series 200 data sheet for dimensions, etc.).

2.1 Component Weight (typ):

202 0.14g
210 0.23g
232 0.75g
235 1.1g
255 2.1g
272 6.4g

3.0 DESIGN FEATURES

- Small size: compared to conventional resistors, the 200 series offer significant space savings
- Design objectives are achieved via use of high thermally- conductive materials and special processing.
- Low noise and high mechanical strength result from all-welded construction
- Excellent environmental stability

4.0 CONSTRUCTION AND MANUFACTURING PROCESS

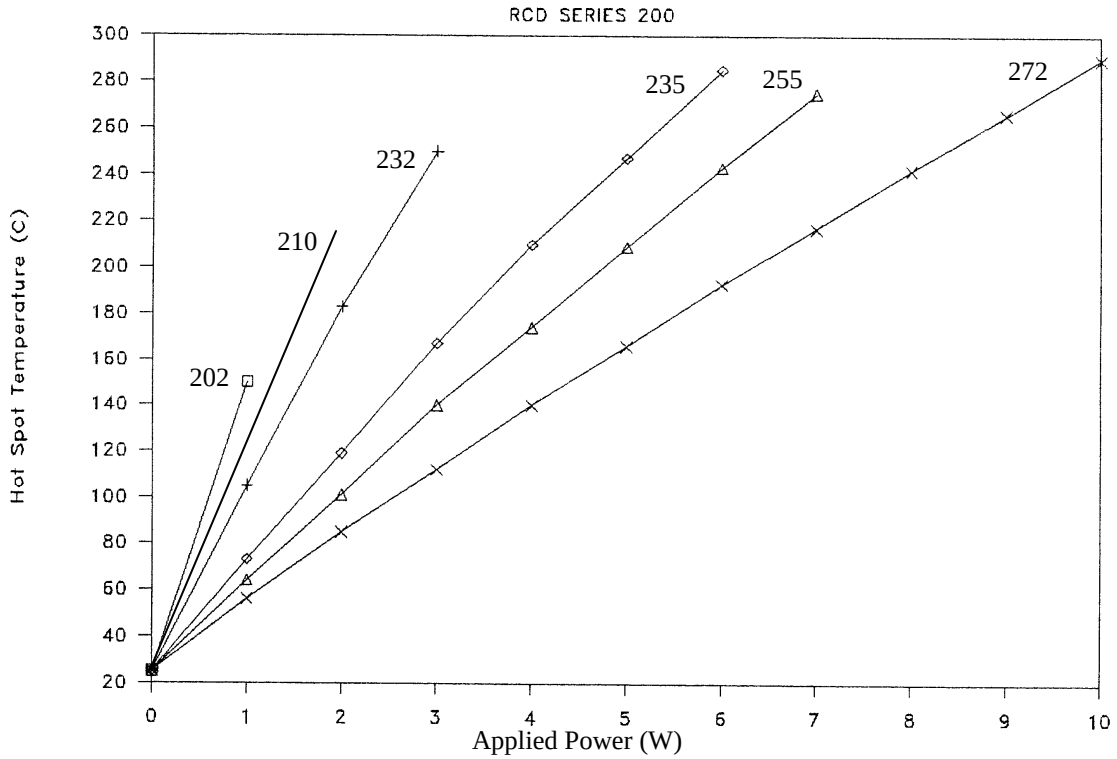
The design and construction of the 200 Series results in excellent reliability. Premium grade nickel-chromium or copper-nickel resistance wire is wound around special ceramic core and welded to end caps. Bodies are conformal coated with high-temperature/high thermal conductivity coating. All parts receive preconditioning prior to shipment to ensure excellent stability. Terminals are solder coated copper or copperweld (lead-free version available). Parts are marked with resistance value and tolerance as a minimum (custom marking is available).

5.0 QUALITY CONTROL

As part of RCD's ABZED program (ABsolute ZEro Defects), all key stages of production are monitored by Statistical Process Control (SPC), first-piece inspection, and/or a variety of in-process inspection steps to ensure optimum uniformity. Final outgoing inspection ensures six sigma quality levels. A wide range of military screening tests are available as an option fo high reliability applications.

6.0 TEMPERATURE RISE AND MOUNTING DENSITY

Power resistors especially miniature models such as series 200 are designed to run hot when subjected to full rated power levels. The temperature rise of low power resistors, particularly smaller models, depends largely on heat conduction through the leads or end terminations, which can vary significantly depending on PCB material and layout (i.e. pad size, trace area, copper thickness, air flow, etc.). It is recommended to evaluate product in actual use conditions to ensure that the proper component and PCB layout is utilized. Refer to chart below…



7.0 ELECTRICAL, ENVIRONMENTAL, AND MECHANICAL PERFORMANCE

7.1 Terminal Strength

The terminal welds shall not break when tested per MIL-STD-202 Method 211, pull test. Direct load shall be 5 pounds on 202 and 210, 10 pounds 235 through 272.

7.2 Solderability

When resistors are tested per ANSI-J-STD-002 Cat.1, the dipped surface of the lead shall be at least 95% covered with new solder coating.

7.3 Solvent Resistance

The coating and marking are resistant to industrial solvents. The speciality high temp/ high-thermal conductivity coating utilized on this series is not quite as durable as epoxy or enamel coatings and therefore care should be taken to prevent abrasion or cuts into the coating. Do not brush with hard bristles or use jet spray immediately after soaking in solvent.

7.4 Resistance Measurement

When measured at 25°C ±2C and 3/8" ±1/16" from body on each lead, the reading shallt be within the specified tolerance of the nominal value.

7.5 Temperature Coefficient

Typical TCR is 20ppm/°C for values 10ohm and above (available to 5ppm). Consult data sheet for values below 10 ohm. TC is typically measured at 25°C and 100°C but can be measured at customer-specified temperatures with prior arrangement.

7.6 Short Time Overload & Pulse Capability

Standard vs. Option P: RCD's 200 Series features improved pulse capability compared to most other resistors of equivalent size, especially in Option 'P' pulse resistant version. Parts are capable of overloads of 5 times rated power for 5 seconds. Pulse capability is dependent on a variety of factors including resistance value, waveform, repetition rate, environmental conditions, etc. The following chart is a general guide for standard 200 series, based on single or infrequent pulses. The maximum pulse capability for parts with Opt. P is 50% greater than standard ratings (increased pulse levels up to 3x standard are available on custom basis, consult factory). Ratings are based on resistors remaining within 1% of initial value.

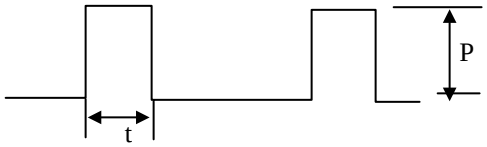
Single Pulse Application Note

a) Pulse must not exceed peak power level given in chart for given time duration, and
b) Peak voltage must not exceed the following levels (increased voltage design available):
202= 1000V, 210=1500V, 232=2000V, 235=3000V, 255=4000V, 272= 5000V
c) Ambient temperature must be 25ºC or below (if above 25ºC, derate peak wattage and voltage levels by .4%/ºC)

Multiple Pulse Application Note

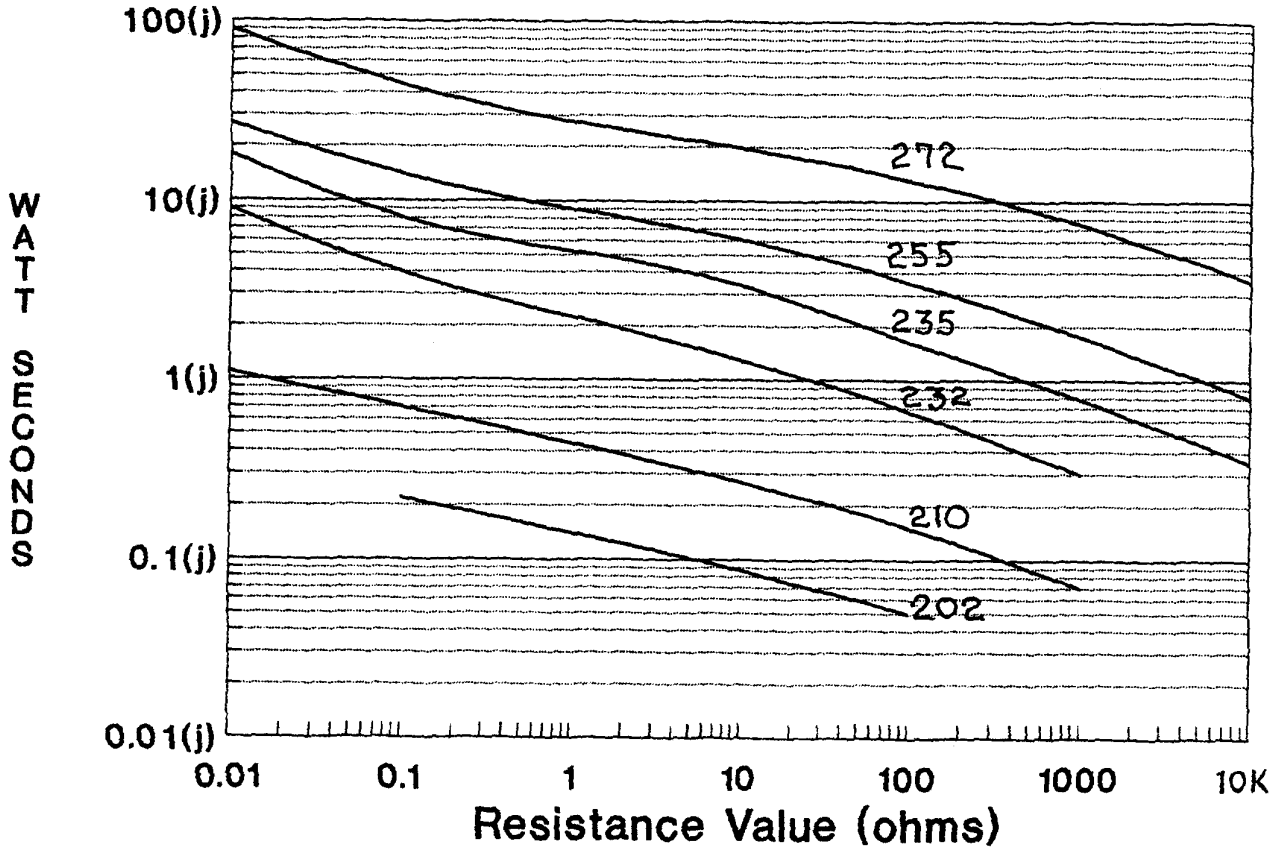
a) Must meet the criteria for a single pulse given above, and
b) Average power must not exceed the following levels at 25ºC: 202= 1W, 210=2W, 232=3W, 235=5W, 255=7W, 272= 10W

Average Power = Pt/T
P= Peak Power (Watts)
t= Pulse duration (Seconds)
T= Cycle Time



Example: Peak Power (P)= 1000W, pulse duration (t) = 10uS, cyle time =
60Hz (.01667S)... 1000W x .00001S / .01667S = .6 Watts average power.

For improved performance and reliability, a 30% safety factor is recommended (50% if parts are subjected to multiple pulses). Complete RCD's "Surge Questionnaire Form" if standard or Opt.P construction won't suffice so that we can recommend the optimum resistor for your application. Always verify selection by evaluating protoypes under worst-case conditions.



7.7 High Temperature Exposure

When subjected to 250°C for 250 hours, the resistance value shall not shift more than 2% + 0.005Ω and marking shall remain legible.

7.8 Voltage Rating

200 Series resistors have a DC or AC_{RMS} voltage rating equivalent to $(PxR)^{1/2}$, not to exceed 30V for 202, 40V 210, 60V 232, 157V 235, 210V 255, and 600V 272. Increased voltage levels are available.

7.9 Moisture Resistance

When tested per MIL-R-26 Par. 4.6.11, and MIL-STD-202 method 106, the resistance shift shall not exceed 2% + .005 ohm.

7.10 Load Life

Series 200 resistors have an indefinite life expectancy, i.e. there is no expected “burn-out” period when used within published guidelines. Stability level is within 3% % (+.005Ω) when subjected to full rated power at 25°C (cycled 1½ hours on, ½ hour off) for 2000 hours. Tightened stability levels are available via extra preconditioning.

7.11 Vibration

Under harsh conditions of shock or vibratioon, all leaded resistors should be mounted so that the body is restrained from movement, as specified by Mil-PRF-39007 par.6.5. If clamps are utilized to hold the resistor body in place, the performance of the resistor could be enhanced or retarded depending on the thermal conductivity of the material. Under normal vibration conditions, all sizes may be supported by their leads only. For improved vibration resistance, keep lead lengths as short as practical. When subjected to Vibration per MIL-STD-202 Method 201 (6 hours), the resistance value shall not shift more than 0.2% +.005Ω (resistors shall be mounted per Mil-R-26 par 4.6.15 (A).

7.12 Dielectric Withstanding Voltage

When tested per MIL-STD-202 M.311 using V-block mounting, there shall be no evidence of flashover, mechanical damage, arcing, or insulation breakdown. Dielectric rating is 300VAC for type 202 and 500VAC all others (1KV available).

7.13 Insulation Resistance

Insulation resistance shall be 1000 MegΩ Minimum when tested per method 302 of MIL-STD-202 test condition A, and prepared per MIL-R-26 Par.4.6.8.1(A) and 4.6.8.1(G)

7.14 Noise

Noise levels are extremely low, one reason why this series is often used in audio applications. Typical noise level is –38dB or better.

7.15 Operating Temperature Range

-55°C to +275°C

7.16 Power/ Voltage/Current Derating

Derate 0.4%/°C when ambient temperature exceeds 25°C (to zero at 275°C).

7.17 Flame Retardancy

Series 200 is flame retardent in accordance with UL94-V1, specify option “F” for flameproof coating in accordance with UL94-V0.

7.18 Shelf Life

Typical shelf life stability is 0.01% ΔR/year

7.19 Inductance

The inductance of RCD's 200 Series is primarily value and size dependent, typically in the range of 0.5 to 10uH for lower values and smaller sizes, 10 uH to 70uH for higher values and larger sizes. External factors such as length of leads, layout of the circuit, stray capacitance, etc., may have an impact. Low inductance design is available (specify option 'X'). Maximum inductance for Option X models (measured at 500KHz) is as follows (models with inductance levels as low as 20nH are available)…

Type	Inductance of Values ≤50 ohm	Inductance of Values >50 ohm
202X, 210X, 232X, 235X	0.2uH Max	0.37uH Max
255X	0.3uH Max	0.6uH Max
272X	0.6uH Max	1.0uH Max