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

RESISTOR SPECIFICATION

RCD Series PRM
Surface Mount Pulse Resistors

RESISTORS • CAPACITORS • COILS • DELAY LINES

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RCD Series PRM Pulse Resistors

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Performance ratings apply to standard Series PRM 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)
Recommend Reflow Soldering Profile for SM Resis & Capac (Engineering Report #R-38)
Pulse Capability Derating Factors (Engineering Report #R-42)

1.0 SERIES PRM PRODUCT HISTORY

RCD's Series PRM was developed in the 1990's to achieve precision performance in surface mount applications involving surges. It was developed from the axial-lead Series PR version and is significantly smaller than conventional resistors with similar overload capabilities. The PRM Series has been 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 surface-mount applications where pulses/surges are likely to be encountered. The PRM Series features a wide range of custom options including non-standard values, non-inductive design, increased power and/or voltage designs, military screening, flameproof construction, low thermal emf, etc., are available. Refer to Series PRM data sheet for more details about options, dimensions, etc.

2.1 Component Weight (typ):

PRM1/8	100mg
PRM1/4	185mg
PRM1/2	.7g
PRM1	2.5g

3.0 DESIGN FEATURES

- High surge capability in small package size
- High thermally- conductive ceramic core
- Low noise
- Excellent environmental stability

4.0 CONSTRUCTION AND MANUFACTURING PROCESS

The design and construction of the PRM Series results in excellent surge capability, superior to conventional film or wirewound resistors. Heavy-duty resistive element is over-molded with flame retardant thermally conductive insulation. The standard terminals are tin coated copper (RoHS-compliant) and are also available with tin-lead finish as is commonly required for military and aerospace applications. Parts are marked with resistance value and tolerance as a minimum if size permits (customized marking is also available). All parts receive preconditioning prior to shipment to ensure excellent stability. Additional stabilization and burn-in is available.

5.0 QUALITY CONTROL

As part of RCD's ABZED program (ABsolute ZEro Defects), 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 visual and electrical inspection ensures excellent quality levels. A wide range of military screening tests are available as an option for high-reliability and critical-use applications.

6.0 TEMPERATURE RISE AND MOUNTING DENSITY

Power resistors are designed to run hot when subjected to full rated power levels, particularly Option B increased-power version. The temperature rise of surface mount 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…

Temp Rise[1]
PRM1/8 200ºC/W
PRM1/4 110ºC/W
PRM1/2 65ºC/W
PRM1 40ºC/W

[1] Typical. Note: the temperature rise of surface mount resistors is highly dependent on the PC board material, termination pad geometry, and component mounting density. Temp rise is approximate and based on DIN44050 board material, single component or low mounting density, and conventional pad sizes with 2oz copper traces (trace width equal to component width). Temp rise when mounted on alumina ceramic substrate is typically 25% to 40% less

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 1 pound on PRM1/8 and PRM1/4, 2 pounds PRM1/2 and PRM1.

7.2 Solderability

When resistors are tested per ANSI-J-STD-002 Cat.1, the dipped surface of the lead shall be at least 90% covered with new solder coating. Enhanced solderability and hot solder dip finish is available. Refer to Section 7.20 concerning exposed base metal.

7.3 Solvent Resistance

The molding material and marking are resistant to industrial solvents when tested in accordance with method 215 of MIL-STD-202.

7.4 Resistance Measurement

When measured at 25°C ±2C, the reading shall be within the specified tolerance of the nominal value.

7.5 Temperature Coefficient

TCR is 100ppm/°C for values 0.2ohm and above typical (available to 20ppm), less than 0.2 ohm are 200ppm. 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

RCD's Series PRM resistors feature improved pulse capability compared to most other resistors of equivalent size. 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 PRM series, based on single or infrequent pulses. (increased pulse levels are available on custom basis, consult factory). Ratings are based on resistors remaining within 5% of initial value.

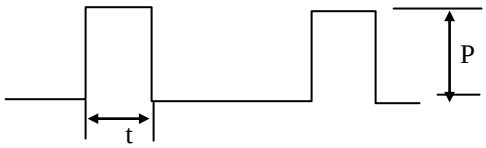
Single Pulse Application Note

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):
PRM1/8= 2000V, PRM1/4=3500V, PRM1/2=5000V, PRM1=10,000V
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: PRM1/8= 1/8W, PRM1/4=1/4W, PRM1/2=1/2W, PRM1=1W

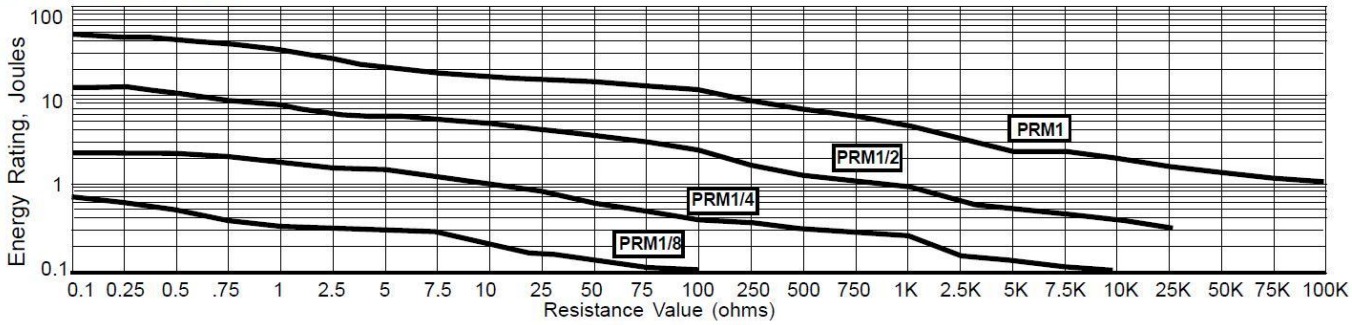
Average Power = Pt/T
P= Peak Power (Watts)
t= Pulse duration (Seconds)
T= Cycle Time



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 typically recommended, 50% if parts are subjected to multiple pulses (refer to Engr Report R- 42 for derating factors attributable to pulse width, repetition rate, temperature, altitude, humidity). If helpful, complete RCD's "Surge Questionnaire Form" if standard construction won't suffice so that we can recommend the optimum resistor for your application. Always verify selection by evaluating prototypes under worst-case conditions.

SURGE CAPABILITY



7.7 High Temperature Exposure

When subjected to 150°C for 100 hours, the resistance value shall not shift more than ± (2% + 0.05Ω) and marking shall remain legible.

7.8 Voltage Rating

PRM Series resistors have a DC or AC_{RMS} voltage rating equivalent to $(PxR)^{1/2}$, not to exceed 150V for PRM1/8, 250V PRM1/4, 350V PRM1/2, and 500V PRM1. 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% + .05) ohm.

7.10 Load Life

Series PRM 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% +.05Ω) when subjected to full rated power at 25°C (cycled 1½ hours on, ½ hour off) for 1000 hours. Tightened stability levels are available via extra preconditioning.

7.11 Vibration

Under harsh conditions of shock or vibration, resistors should be mounted so that the body is restrained from movement, as specified by Mil-PRF-39007 par.6.5. When subjected to Vibration per MIL-STD-202 Method 201 (6 hours), the resistance value shall not shift more than ± (0.5% +.05Ω).

7.12 Dielectric Withstanding Voltage

When tested per MIL-STD-202 M.311, there shall be no evidence of flashover, mechanical damage, arcing, or insulation breakdown. Dielectric rating is 500VAC (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

7.14 Noise

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

7.15 Operating Temperature Range

-55°C to +150°C (up to +275°C available)

7.16 Power/ Voltage/Current Derating

Derate 1.25%/°C when ambient temperature exceeds 25°C (to zero at 150°C).

Wattage Rating
PRM1/8 1/8W
PRM1/4 1/4W
PRM1/2 1/2W
PRM1 1W

7.17 Temperature Cycling

When tested per MIL-STD-202 method 107, 5 cycles -55/+85ºC, the resistance shift shall not exceed ± (2% + .05) ohm.

7.18 Flame Retardance

Series PRM is flame retardant in accordance with UL94-V1, specify option "F" for flameproof molding in accordance with UL94-V0.

7.19 Shelf Life

Typical shelf life stability is 0.02% ΔR/year

7.20 Inductance

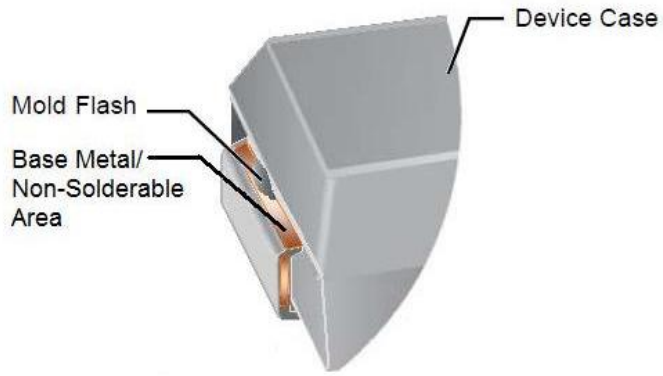
The inductance of RCD's PRM Series is dependent on resistance value and size, typically in the range of 0.5 to 20uH. External factors such as length of leads, layout of the circuit, stray capacitance, etc., may have an impact. Low inductance design is available (specify option 'X'). Maximum inductance for Option X models is as follows (models with inductance levels as low as 20nH are available)…

Type	Inductance ≤50 ohm (at 500KHz)	Inductance >50 ohm (at 500KHz)
PRM1/8X, PRM1/4X, PRM1/2X	0.2uH Max	0.37uH Max
PRM1X	0.3uH Max	0.6uH Max

7.21 High Frequency Performance

PRM resistors should not be used in circuits where their ac performance is of critical importance in operation of such circuits. Specify option X Non-inductive design for improved high-frequency performance.

7.22 Exposed Base Metal and Mold Flash



Molding Flash & Exposed Base Metal: Case molds have upper and lower halves, which allow flash, the small amount of excess molding compound that remains after the device is ejected from the mold and the device is singulated and trimmed. Interlead flash is allowed between the case and the dambar protrusion, and is away from the critical soldering areas. Non-solderable /exposed base metal is allowed on trimmed edges and non-critical soldering areas (e.g. where terminal protrudes from body) by various Military/Aerospace/Industrial specifications (such as MIL-PRF-39017, MIL-PRF-55182, EIA J-STD-002, IPC-A-610, IPC J-STD-001, etc.).

7.23 Test Data

PRM1/8

Characteristic	Test Conditions	Test Results (10pcs each)				Specification
		Value	Max.	Min.	Avg.	
HIGH TEMPERATURE	100 hrs at 150°C	1Ω 1KΩ	0.487% 0.317%	0.013% 0.028%	0.084% 0.068%	± (2% + 0.05Ω)
TEMPERATURE COEFFICIENT	25 -->100°C	1Ω 1KΩ	58ppm 15ppm	36ppm -17ppm	46ppm -9ppm	100ppm/°C
TEMPERATURE CYCLING/THERMAL SHOCK	-55→+85°C, 5 cycles	1Ω 1KΩ	0.173% 0.133%	-0.066% -0.015%	0.056% 0.049%	± (2% + 0.05Ω)
VIBRATION	10 to 55Hz 3 directions, 6 hours total	1Ω 1KΩ	0.128% 0.037%	-0.009% -0.003%	0.033% 0.016%	± (0.5% +.05Ω)
SHOCK	MIL-STD-810E, Method 516.4, Proced. IV, 26 shocks	1Ω 1KΩ	0.022% 0.019%	-0.014% -0.011%	0.016% 0.012%	± (0.5% +.05Ω)
SOLDERABILITY	Solder Dip at 230°C ±5°C for 3 sec. ±1 sec. ANSI-J-STD-002 Cat.1	1Ω 1KΩ	- -	>95% >95%	>95% >95%	95% min Opt.ER, 90% min non-ER
PULSE (5 pcs)	.32Joule pulse .022 Joule pulse	1Ω 1KΩ	0.249% 0.197%	-0.128% -0.119%	0.162% 0.148%	ΔR ±5%
MOISTURE RESISTANCE	MIL-STD-202, Method 106	1Ω 1KΩ	0.345% 0.095%	0.002% 0.001%	0.047% 0.039%	± (2% + 0.05Ω)
LOAD LIFE	MIL-STD-202, Method 108, 1000 hrs	1Ω 1KΩ	0.356% 0.231%	-0.069% -0.036%	0.216% 0.109%	± (3% + 0.05Ω)
SOLVENT RESISTANCE	MIL-STD-202 M.215	1Ω 1KΩ	- -	- -	Pass Pass	Legible marking
DIELECTRIC STRENGTH	MIL-STD-202 M.311	1Ω 1KΩ	- -	>500VAC >500VAC	>500VAC >500VAC	500V Min.
INSULATION RESISTANCE	MIL-STD-202 M.302, Cond.A	1Ω 1KΩ	- -	>1GΩ >1GΩ	>1GΩ >1GΩ	1000M Min

PRM1/4

Characteristic	Test Conditions	Test Results (10pcs each)				Specification
		Value	Max.	Min.	Avg.	
HIGH TEMPERATURE	100 hrs at 150°C	1Ω 1KΩ	.440% .349%	.002% .031%	0.067% 0.075%	± (2% + 0.05Ω)
TEMPERATURE COEFFICIENT	25 -->100°C	1Ω 1KΩ	49ppm 17ppm	26ppm 2ppm	37ppm 12ppm	100ppm/°C
TEMPERATURE CYCLING/THERMAL SHOCK	-55→+85°C, 5 cycles	1Ω 1KΩ	0.190% 0.133%	-0.069% -0.017%	0.086% 0.059%	± (2% + 0.05Ω)
VIBRATION	10 to 55Hz 3 directions, 6 hours total	1Ω 1KΩ	0.102% 0.033%	-0.007% -0.004%	0.023% 0.011%	± (0.5% +.05Ω)
SHOCK	MIL-STD-810E, Method 516.4, Proced. IV, 26 shocks	1Ω 1KΩ	0.031% 0.017%	-0.013% -0.009%	0.019% 0.011%	± (0.5% +.05Ω)
SOLDERABILITY	Solder Dip at 230°C ±5°C for 3 sec. ±1 sec. ANSI-J-STD-002 Cat.1	1Ω 1KΩ	- -	>95% >95%	>95% >95%	95% min Opt.ER, 90% min non-ER
PULSE (5 pcs)	1.7 Joule pulse .25 Joule pulse	1Ω 1KΩ	0.291% 0.186%	-0.115% -0.089%	0.185% 0.119%	ΔR ±5%
MOISTURE RESISTANCE	MIL-STD-202, Method 106	1Ω 1KΩ	0.311% 0.106%	0.002% 0.001%	0.056% 0.047%	± (2% + 0.05Ω)
LOAD LIFE	MIL-STD-202, Method 108, 1000 hrs	1Ω 1KΩ	0.299% 0.208%	-0.066% -0.038%	0.238% 0.131%	± (3% + 0.05Ω)
SOLVENT RESISTANCE	MIL-STD-202 M.215	1Ω 1KΩ	- -	- -	Pass Pass	Legible marking
DIELECTRIC STRENGTH	MIL-STD-202 M.311	1Ω 1KΩ	- -	>500VAC >500VAC	>500VAC >500VAC	500V Min.
INSULATION RESISTANCE	MIL-STD-202 M.302, Cond.A	1Ω 1KΩ	- -	>1GΩ >1GΩ	>1GΩ >1GΩ	1000M Min

PRM1/2

Characteristic	Test Conditions	Test Results (10pcs each)				Specification
		Value	Max.	Min.	Avg.	
HIGH TEMPERATURE	100 hrs at 150°C	1Ω 1KΩ	.484% .329%	.014% .032%	0.092% 0.082%	± (2% + 0.05Ω)
TEMPERATURE COEFFICIENT	25 -->100°C	1Ω 1KΩ	36ppm 16ppm	12ppm -1ppm	26ppm 11ppm	100ppm/°C
TEMPERATURE CYCLING/THERMAL SHOCK	-55→+85°C, 5 cycles	1Ω 1KΩ	0.173% 0.146%	-0.056% -0.014%	0.079% 0.039%	± (2% + 0.05Ω)
VIBRATION	10 to 55Hz 3 directions, 6 hours total	1Ω 1KΩ	0.128% 0.048%	0.010% -0.004%	0.042% 0.021%	± (0.5% +.05Ω)
SHOCK	MIL-STD-810E, Method 516.4, Proced. IV, 26 shocks	1Ω 1KΩ	0.026% 0.025%	-0.014% -0.013%	0.019% 0.018%	± (0.5% +.05Ω)
SOLDERABILITY	Solder Dip at 230°C ±5°C for 3 sec. ±1 sec. ANSI-J-STD-002 Cat.1	1Ω 1KΩ	- -	>95% >95%	>95% >95%	95% min Opt.ER, 90% min non-ER
PULSE (5 pcs)	8 Joule pulse .9 Joule pulse	1Ω 1KΩ	0.259% 0.197%	-0.147% -0.125%	0.169% 0.158%	ΔR ±5%
MOISTURE RESISTANCE	MIL-STD-202, Method 106	1Ω 1KΩ	0.304% 0.176%	0.016% 0.001%	0.052% 0.039%	± (2% + 0.05Ω)
LOAD LIFE	MIL-STD-202, Method 108, 1000 hrs	1Ω 1KΩ	0.321% 0.239%	-0.076% -0.041%	0.281% 0.142%	± (3% + 0.05Ω)
SOLVENT RESISTANCE	MIL-STD-202 M.215	1Ω 1KΩ	- -	- -	Pass Pass	Legible marking
DIELECTRIC STRENGTH	MIL-STD-202 M.311	1Ω 1KΩ	- -	>500VAC >500VAC	>500VAC >500VAC	500V Min.
INSULATION RESISTANCE	MIL-STD-202 M.302, Cond.A	1Ω 1KΩ	- -	>1GΩ >1GΩ	>1GΩ >1GΩ	1000M Min

PRM1

Characteristic	Test Conditions	Test Results (10pcs each)				Specification
		Value	Max.	Min.	Avg.	
HIGH TEMPERATURE	100 hrs at 150°C	1Ω 1KΩ	.369% .187%	.034% .002%	0.144% 0.099%	± (2% + 0.05Ω)
TEMPERATURE COEFFICIENT	25 -->100°C	1Ω 1KΩ	19ppm 16ppm	10ppm 4ppm	16ppm 11ppm	100ppm/°C
TEMPERATURE CYCLING/THERMAL SHOCK	-55→+85°C, 5 cycles	1Ω 1KΩ	0.161% 0.169%	-0.007% 0.004%	0.046% 0.055%	± (2% + 0.05Ω)
VIBRATION	10 to 55Hz 3 directions, 6 hours total	1Ω 1KΩ	0.098% 0.043%	0.011% -0.001%	0.031% 0.020%	± (0.5% +.05Ω)
SHOCK	MIL-STD-810E, Method 516.4, Proced. IV, 26 shocks	1Ω 1KΩ	0.039% 0.025%	-0.022% -0.013%	0.025% 0.009%	± (0.5% +.05Ω)
SOLDERABILITY	Solder Dip at 230°C ±5°C for 3 sec. ±1 sec. ANSI-J-STD-002 Cat.1	1Ω 1KΩ	- -	>95% >95%	>95% >95%	95% min Opt.ER, 90% min non-ER
PULSE (5 pcs)	31 Joule pulse 4.3 Joule pulse	1Ω 1KΩ	0.296% 0.157%	-0.086% -0.067%	0.144% 0.108%	ΔR ±5%
MOISTURE RESISTANCE	MIL-STD-202, Method 106	1Ω 1KΩ	0.299% 0.084%	0.006% 0.001%	0.095% 0.047%	± (2% + 0.05Ω)
LOAD LIFE	MIL-STD-202, Method 108, 1000 hrs	1Ω 1KΩ	0.489% 0.295%	0.024% -0.026%	0.298% 0.202%	± (3% + 0.05Ω)
SOLVENT RESISTANCE	MIL-STD-202 M.215	1Ω 1KΩ	- -	- -	Pass Pass	Legible marking
DIELECTRIC STRENGTH	MIL-STD-202 M.311	1Ω 1KΩ	- -	>500VAC >500VAC	>500VAC >500VAC	500V Min.
INSULATION RESISTANCE	MIL-STD-202 M.302, Cond.A	1Ω 1KΩ	- -	>1GΩ >1GΩ	>1GΩ >1GΩ	1000M Min

