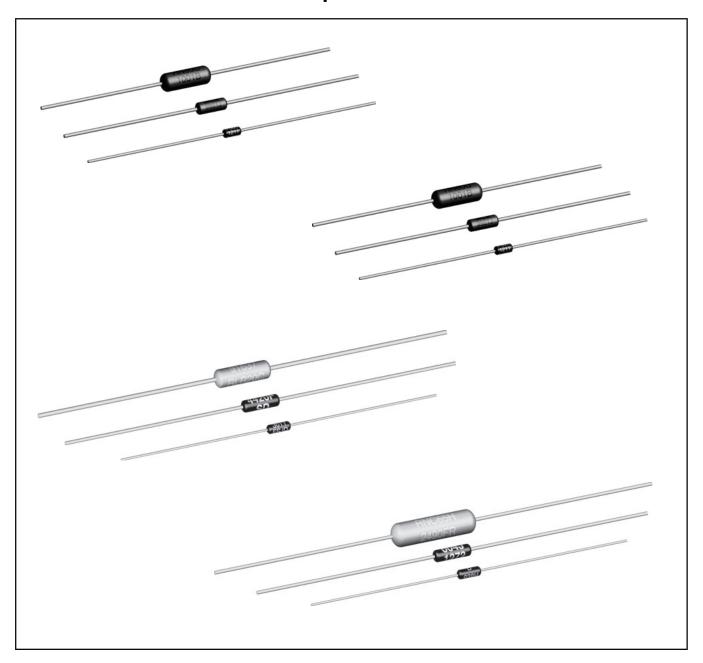


Vishay Dale

Selection Guide for Conversion of Carbon Composition Resistors



Vishay Dale believes that the information described in this publication is accurate and reliable, and much care has been taken in its preparation. However, no responsibility, financial or otherwise, is accepted for any consequences arising out of the use of this information.

This information is subject to change without notice.

Cross Reference Guide

Vishay Dale

Selection Guide for Conversion of Carbon Composition Resistors



The following cross reference guide is intended to assist in finding Vishay Dale film resistor types that are most similar to a particular Allen-Bradley carbon composition type. Direct interchangeability is not implied due to differences in technology, however, electrical characteristics typically will be met or exceeded.

CROSS-REFERENCE FOR COMMERCIAL MODELS					
CHARACTERISTICS BY WATTAGE	ALLEN BRADLEY (Carbon Comp)	GENERAL APPLICATIONS	SNUBBER	EXTENDED RANGE	
1/8 Watt					
Model	BB ± 5 %	CMF-50	RS-1/4	RNX-1/4	
Body Length	0.145"	0.150"	0.250"	0.290"	
Body Diameter	0.062"	0.065"	0.085"	0.140"	
Lead Diameter	0.015"	0.016"	0.020"	0.025"	
Resistance Range (Ohms)	2.7 - 100M	10 - 1M	1 - 3.4K	1 - 100M	
Maximum Operating Voltage	150 V	200 V		750 V	
1/4 Watt					
Model	CB ± 5 %	CMF-55	RS-1/4	RNX-1/4	
Body Length	0.250"	0.240"	0.250"	0.290"	
Body Diameter	0.090"	0.090"	0.085"	0.140"	
Lead Diameter	0.025"	0.025"	0.020"	0.025"	
Resistance Range (Ohms)	2.7 - 100M	1 - 22.1M	0.1 - 3.4K	1 - 100M	
Maximum Operating Voltage	250 V	200 V		750 V	
1/2 Watt					
Model	EB ± 5 %	CMF-20 FP 1/2P	RS-1/2	RNX-3/8	
Body Length	0.375"	0.375" 0.360"	0.312"	0.420"	
Body Diameter	0.140"	0.145" 0.138"	0.085"	0.140"	
Lead Diameter	0.033"	0.032" 0.032"	0.020"	0.025"	
Resistance Range (Ohms)	1 - 100M	1 - 10 Ω 10 - 1Μ	0.1 - 4.9K	1M - 1G	
Extended Range		1M - 8.2M			
Maximum Operating Voltage	350 V	350 V		1.5 kV	
1 Watt					
Model	GB ± 5 %	FP-69P5	RS-2B	RNX-3/4	
Body Length	0.562"	0.516"	0.562"	0.790"	
Body Diameter	0.225"	0.225"	0.187"	0.140"	
Lead Diameter	0.041"	0.032"	0.032"	0.025"	
Resistance Range (Ohms)	1 - 100M	2 - 1.5M	0.1 - 34.5K	1M - 1G	
Maximum Operating Voltage	500 V	500 V		3 kV	
2 Watt					
Model	HB ± 5 %	FP2P	RS-2C	R0X-3/4	
Body Length	0.688"	0.687"	0.500"	0.800"	
Body Diameter	0.312"	0.300"	0.218"	0.310"	
Lead Diameter	0.045"	0.045"	0.040"	0.032"	
Resistance Range (Ohms)	10 - 100M	10 - 1.5M	0.1 - 32.3K	1M - 1G	
Maximum Operating Voltage	500/750 V	500 V		5 kV	





Selection Guide for Conversion of Carbon Composition Resistors

Vishay Dale

The following cross reference guide is intended to assist in finding Vishay Dale film resistor types that are most similar to a particular Allen-Bradley carbon composition type. Direct interchangeability is not implied due to differences in technology, however, electrical characteristics typically will be met or exceeded.

Military types are also listed for reference: MIL-R-11 (RC), MIL-R-22684 (RL) and MIL-R-10509 (RN)

CHARACTERISTICS BY WATTAGE	ALLEN BRADLEY (Carbon Comp)	SUGGESTED VISHAY DALE MODELS (Film Resistor Types)	
1/8 Watt			
Model	RC05 ± 5 %	RN50	
Body Length	0.145"	0.150"	
Body Diameter	0.062"	0.065"	
Lead Diameter	0.015"	0.016"	
Resistance Range (Ohms)	2.7 - 100M	10 - 1M	
Maximum Operating Voltage	150 V	200 V	
1/4 Watt			
Model	RC07 ± 5 %	RN55	RL07
Body Length	0.250"	0.240"	0.240"
Body Diameter	0.090"	0.090"	0.090"
Lead Diameter	0.025"	0.025"	0.025"
Resistance Range (Ohms)	2.7 - 100M	1 - 22.1M	1 - 5M
Maximum Operating Voltage	250 V	250/200 V	250 V
1/2 Watt			
Model	RC20 ± 5 %	RN60	RL20
Body Length	0.375"	0.344"	0.375"
Body Diameter	0.140"	0.145"	0.145"
Lead Diameter	0.033"	0.025"	0.032"
Resistance Range (Ohms)	1 - 100M	1 - 8M	1 - 8M
Maximum Operating Voltage	350 V	350/200 V	350 V
1 Watt			
Model	RC32 ± 5 %	RN70	
Body Length	0.562"	0.562"	
Body Diameter	0.225"	0.180"	
Lead Diameter	0.041"	0.032"	
Resistance Range (Ohms)	1 - 100M	1 - 15M	
Maximum Operating Voltage	500 V	500 V	
2 Watt			
Model	RC42 ± 5 %		
Body Length	0.688"		
Body Diameter	0.312"	(SEE COMMERCI	AL OFFERINGS)
Lead Diameter	0.045"	-	,
Resistance Range (Ohms)	10 - 100M		
Maximum Operating Voltage	500/750 V		

Cross Reference Guide

Vishay Dale

Selection Guide for Conversion of Carbon Composition Resistors



The following cross reference guide is intended to assist in finding Vishay Dale film resistor types that are most similar to a particular Allen-Bradley carbon composition type. Direct interchangeability is not implied due to differences in technology, however, electrical characteristics typically will be met or exceeded.

Military types are also listed for reference: MIL-R-11 (RC), MIL-R-22684 (RL), MIL-R-39008 (RCR) and MIL-R-39017 (RLR)

CHARACTERISTICS BY WATTAGE	ALLEN BRADLEY (Carbon Comp)	GENERAL APPLICATIONS	SNUBBER
1/8 Watt			
Model	RCR05 ± 5 %	RLR05	RWR81S
Body Length	0.145"	0.150"	0.250"
Body Diameter	0.062"	0.066"	0.085"
Lead Diameter	0.015"	0.016"	0.020"
Resistance Range (Ohms)	2.7 - 100M	4.7 - 22M	0.1 - 1K
		(1.1M - 22M non QPL)	
Maximum Operating Voltage	150 V	200 V	
1/4 Watt			
Model	RCR07 ± 5 %	RLR07	RWR81S
Body Length	0.250"	0.250"	0.250"
Body Diameter	0.090"	0.090"	0.055"
Lead Diameter	0.025"	0.025"	0.020"
Resistance Range (Ohms)	2.7 - 100M	1 - 22M	0.1 - 1K
Maximum Operating Voltage	250 V	250 V	
1/2 Watt			
Model	RCR20 ± 5 %	RLR20	RWR82S
Body Length	0.375"	0.375"	0.312"
Body Diameter	0.140"	0.138"	0.085"
Lead Diameter	0.033"	0.032"	0.020"
Resistance Range (Ohms)	1 - 100M	4.3 - 3.01M	0.1 - 1.3K
Maximum Operating Voltage	350 V	350 V	
1 Watt			
Model	RCR32 ± 5 %	RLR32	RWR89S
Body Length	0.562"	0.560"	0.562"
Body Diameter	0.225"	0.190"	0.187"
Lead Diameter	0.041"	0.040"	0.032"
Resistance Range (Ohms)	1 - 100M	1 - 22M	0.1 - 4.12K
, ,		(3M - 22M non QPL)	
Maximum Operating Voltage	500 V	500 V	
2 Watt			
Model	RCR42 ± 5 %	NON QPL PARTS	RWR89S
Body Length	0.688"		0.562"
Body Diameter	0.312"	See FP2P, 10M - 1.5M	0.187"
Lead Diameter	0.045"	or	0.032"
Resistance Range (Ohms)	10 - 100M	ERL-62-1, 1M - 2.7M	0.1 - 4.12K
Maximum Operating Voltage	500/750 V	, i	

www.vishay.com

For technical questions, contact: ff2aresistors@vishay.com



Selection Guide for Conversion of Carbon Composition Resistors

Vishay Dale

COMPARISON OF RLR AND R	CR SPECIFICATIONS			
MODELS	RLR	RCR		
MILL SPECIFICATIONS	MIL-R-39017	MIL-R-39008		
GENERAL CHARACTERISTIC	S			
Type Element	Film element on insulating form	Carbon Composition (hot molded solid core or material applied as athin coating on insulation form)		
Available Tolerances	\pm 1 % in 96 values per decade \pm 2 % and \pm 5 % in 24 values per decade	± 5 % and ± 10 % in 24 values per decade		
Mil-Spec Test Criteria for Failure Rate Determination (+ 70 °C)	100 % rated power for 10 000 hours permissible change in resistance ± 4 %	50 % rated power for 10 000 hours permissble change in resistance ± 15 %		
Resistance Temperature Characteristics (Maximum TCR)	± 100 ppm/°C (350 ppm(°C, above 10M) Equivalent to: - 55 °C ± 150 °C Below 10M = ± 0.8 % ± 1.25 % Above 10M = ± 2.8 % ± 4.375 %	-55 °C ±105 °C 1K and under ±6.5 % ±5 % 1.1K - 10K ±10 % ±6 % 11K - 100K ±13 % ±7.5 % 110K - 1M ±15 % ±10 % 1.1M - 10M ±20 % ±15 % 11M and above ±25 % ±15 %		
ENVIRONMENTAL TEST (STA	ABILITY)			
Life (+ 70 %)	2000 hours at 100 % rated power: ± 2 % 1000 hours at 100 % rated power: average or ± 10 % for individual re 1000 hours at 50 % rated power:			
Power Conditioning (100 % Test)	± 0.5 %	(Test not required)		
Thermal Shock	± 0.25 %	± 4 %		
Dielectic Strength	± 0.25 %	No ∆R required		
High Temperature Exposure (+ 150 °C for 2000 hours)	± 2 %	(Test not required)		
Low Temperature Operation	± 0.25 %	± 3 %		
Moisture Resistance	± 1 %	± 10 % average or ± 15 % for individual resistor		
Short Time Overload	± 0.5 %	± 2.5 %		
Terminal Strenght	± 0.25 %	± 1 %		
Resistance to Solder Heat	± 0.25 %	± 3 %		
Shock and vibration	± 0.5 %	± 2 %		

ADVANTAGES AND DISADVANTAGES				
STYLE: CARBON COMPOSITION		STYLE: METAL FILM OXIDE		
Advantages	Disadvantages	Advantages	Disadvantages	
 Wide resistance range Good stability at 1/2 rate power Good pulse handling capability Good frequency characteristics 	 Highest TCR Poor moisture resistance Poor shelf life (15 %) High noise level High voltage coefficient (0.02 to ± 0.5 %) Becoming obsolete Very high A.S.P. 	 Better stability at full power Better operating temperature (150 °C to 175 °C) Excellent shelf life (0.1 %) Good frequency characteristics Good voltage coefficient (0.001 %/V) Best TC of R Off the shelf availability 	Limited resistance range (in some styles)	

Note

 Each board application has unique design parameters. You may wish to request samples, to insure compatibility with your specific application, for prototype or qualification builds.

Cross Reference Guide

Vishay Dale

Selection Guide for Conversion of Carbon Composition Resistors

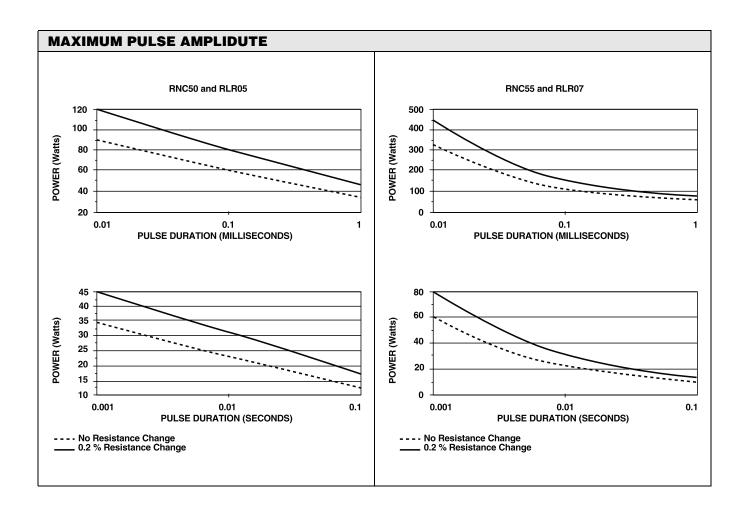


VISHAY DALE NICHROME FILM RESISTORS IN PULSED POWER APPLICATIONS

The various military specifications which provide the framework for the construction and testing of Established Reliability film resistors supply detailed requirements for the performance of these components in a wide range of operating environments. They do not, however, provide much guidance in the area of pulsed power applications. It has become very evident from the numerous questions we receive that film resistors are subjected to a wide variety of electrical pulses which are of short duration and relatively high amplitude. To answer these questions, the Vishay Dale Film Division has performed extensive testing to develop guidelines for the use of ERL and ERC resistors in short duration current pulse applications. The ERL and ERC product lines are a Vishay Dale equivalent to the RLR and RNC styles respectively.

All recommendations presented here shall apply to only the Vishay Dale ERC and ERL styles and are not applicable to any other RLR and RNC products. Numerous factors influence the response of any single resistor to a given pulsed overload so these guidelines are based on the most conservative analysis of test results from thousands of individual units.

Single Square Pulse: The following graphs depict the maximum recommended instantaneous power amplitudes for Vishay Dale RLR05, RNC50, RLR07 and RNC55 products for a single square wave form pulse. Each graph provides the maximum power a resistor will withstand without any resistance change, and a maximum power when allowing a 0.2 % resistance change for the single applied pulse.







Selection Guide for Conversion of Carbon Composition Resistors

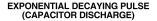
Vishay Dale

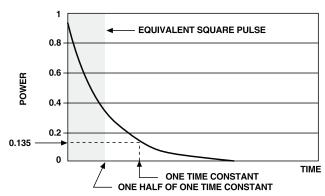
VISHAY DALE NICHROME FILM RESISTORS IN PULSED POWER APPLICATIONS

Repetitive Pulses: Any change induced by a single overload pulse can be expected to have similar cumulative effects with successive pulses. For this reason, Vishay Dale recommends that any application with repetitive pulses limit the pulse power to a value which results in no resistance change. Additionally, it is necessary to verify that the average power during any five second period of operation does not exceed the power rating of the component.

Capacitor Discharge: In the case where the pulse exhibits an exponential decay typical of the discharge of a capacitor, the suitability of a resistor can be determined by calculating an equivalent square wave pulse. For determining a resistor's tolerance to a short duration exponentially decaying power overload, a square wave with an amplitude equal to the initial voltage of that pulse and with a duration equal to one-half of the time constant of the decaying pulse will be of equivalent energy and may be substituted. The time constant is the time required for the voltage across the capacitor to have decreased to 36.8 % of it's value at the moment the discharge began. Because the power is proportional to the square of the voltage, the power will have decayed to 13.5 % of it's original value in the same time. The graph at the right depicts the power output of a discharging capacitor and an equivalent square pulse.

The time constant of a capacitive discharge can be calculated by multiplying the capacitance in Farads by the resistive load in Ohms through which to capacitor is discharged.





One half of this value will provide the proper duration for the equivalent pulse.

Equivalent pulse duration = 0.5

Resistive (Ohms)

Capacitance (Farads)

Maximum Voltage Constraints: In addition to the previous limitations which are imposed by the properties of the resistive film, the characteristics of the dielectric materials insulating the resistive elements must also be recognized. For all four Vishay Dale styles mentioned above, the potential across the component can not exceed 3000 volts without the risk of a dielectric failure in the insulating coating.

Additional Information: While the recommendations presented here are very broad, it is likely that there are applications which do not fit the ones we have provided. If you need additional information or have any questions on this subject, please use the email contact on the bottom of this datasheet.