
Stackpole Electronics — Company Profile

About Stackpole Electronics, Inc. (SEI)

In 1906 Stackpole Battery Corporation was founded in St Mary's, Pennsylvania. In 1928, the Stackpole Corporation became one of the first resistor manufacturers in North America. Over the next several decades, Stackpole became one of the leading resistor manufacturers of carbon composition resistors in the world, with facilities in St. Mary's, Farmville Virginia and subsequently, Taiwan.

In 1979, Stackpole Components and Akahane Electronics (Japan) signed an agreement whereby Akahane Electronics would supply Stackpole with metal film resistors. In 1986, Stackpole Electronics Incorporated (SEI) was formed from the resistor division of the Stackpole Corporation. Shortly thereafter, Akahane Electronics became one of the major shareholders of SEI. In September 2004 SEI Electronics Inc. formally changed its name to Stackpole Electronics, Inc.

Still privately held by the Akahane family, Stackpole has become one of the leading global manufacturers of resistive products, and one of the few companies focusing primarily on resistive technologies. With manufacturing facilities in Taiwan, China, Japan and Mexico, and sales and distribution centers in the US, Taiwan, China and Japan, Stackpole has established a truly global footprint.

Today, Stackpole's customer base is comprised of companies from every major market including consumer, medical, automotive, computer, telecom, aerospace, and industrial control and instrumentation using a very broad line of resistors, varistors, and inductors.

Our 2007 Product Catalog

Stackpole is proud to present a comprehensive offering of thick film, thin film, wirewound, current sense, precision, high voltage, metal oxide and carbon composition resistors, resistor networks and arrays, and custom high power products - in both surface mount and through-hole options for your choosing.

Stackpole remains committed to new product development and providing the broadest resistive product offering in the industry. New products for this catalog include a high power thick film resistive chip, a high voltage radial leaded series, a ceramic encased radial leaded current sense series, a high power TO-220 package resistor series, and a high voltage axial leaded metal glaze resistor series.

Need a Custom Solution?

Long recognized as a service leader in the commodity resistor market, SEI now offers the same service and responsiveness on custom resistive product solutions. With our engineering center in the US and our manufacturing facilities in Mexico and Asia, Stackpole is committed to new product development to meet the ever-changing needs of the resistor market. If you are exhausted with slow response times and exorbitant non-recoverable engineering fees from your current design partner, contact us today. When you think of **Stackpole**, think **Passive Component Solutions!** We're here to help.

Need Samples?

Stackpole is committed to providing engineering samples to prospective customers in order to assist them in completing their designs. Contact Stackpole toll free at 888-SEI-SEIS (888-734-7347), via email at marketing@seielect.com or via the web at www.seielect.com to place your sample order today.

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All information provided in this catalog is based on SEI's experience and testing programs and does not absolve customers from their responsibility to check the suitability of our products for their applications.

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Alphabetical Listing of Products

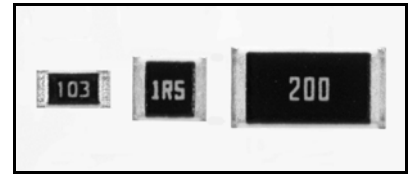
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RMC Series — General Purpose Thick Film Chip Resistors

Features

- Nickel barrier terminations standard
- Operating temp range from -65°C to +155°C
- Power derating from 100% at 70°C to zero at +155°C
- Zero ohm available (max resistance 0.05Ω)
- RoHS compliant / lead-free available (RMCF)

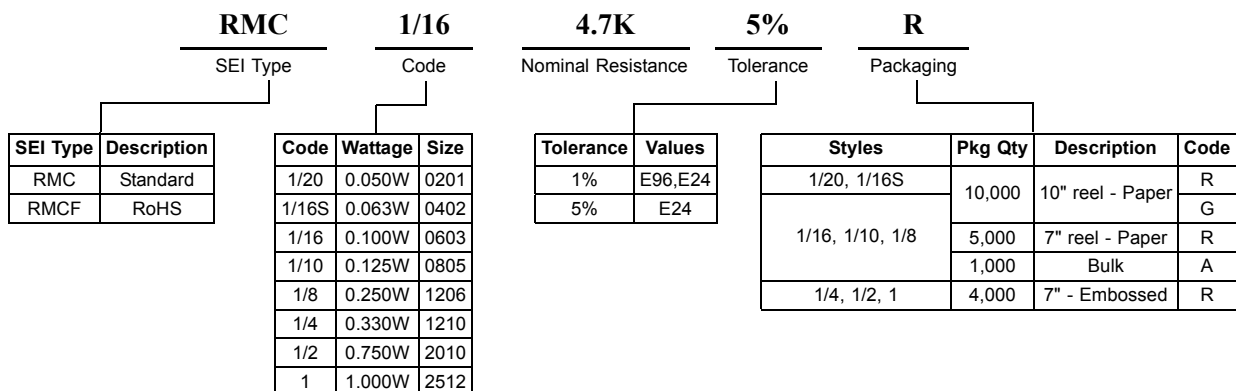


Electrical Specifications

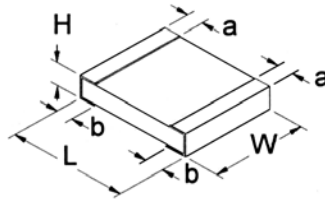
Type / Code	Package Size	Power Rating (Watts) @ 70°C	Maximum Working Voltage*	Maximum Overload Voltage	Max. Current	Resistance Temperature Coefficient	Ohmic Range and Tolerance	
							1%	5%
RMC 1/20	0201	0.05W	25	50	1 Amp	±300 ppm/°C ±200 ppm/°C	10Ω – 97.6Ω 100Ω – 1M	10Ω – 91Ω 100Ω – 10M
RMC 1/16S	0402	0.063W	50	100	1 Amp	±200 ppm/°C ±100 ppm/°C	– 1Ω – 10M	1Ω – 10M –
RMC 1/16	0603	0.1W	50	100	1 Amp	±350 ppm/°C ±200 ppm/°C ±100 ppm/°C ±350 ppm/°C	– 1Ω – 9.76Ω 10Ω – 1M 1.02M – 10M	1Ω – 9.1Ω 10Ω – 10M – 11M – 22M
RMC 1/10	0805	0.125W	150	300	2 Amp	±350 ppm/°C ±200 ppm/°C ±100 ppm/°C ±350 ppm/°C	– 0.1Ω – 0.976Ω 1.0Ω – 10M –	0.1Ω – 9.1Ω 10Ω – 10M – 11M – 22M
RMC 1/8	1206	0.25W	200	400	2 Amp	±350 ppm/°C ±200 ppm/°C ±100 ppm/°C ±350 ppm/°C	– 0.1Ω – 0.976Ω 1.0Ω – 10M –	0.1Ω – 9.1Ω 10Ω – 10M – 11M – 24M
RMC 1/4	1210	0.33W	200	400	3 Amp	±350 ppm/°C ±200 ppm/°C ±100 ppm/°C ±350 ppm/°C	– 0.1Ω – 0.976Ω 1.0Ω – 10M –	0.15Ω – 9.1Ω 10Ω – 10M – 11M – 22M
RMC 1/2	2010	0.75W	200	400	3 Amp	±350 ppm/°C ±200 ppm/°C ±100 ppm/°C ±350 ppm/°C	– 0.1Ω – 0.976Ω 1.0Ω – 10M –	0.1Ω – 9.1Ω 10Ω – 10M – 11M – 22M
RMC 1	2512	1W	200	400	3 Amp	±350 ppm/°C ±200 ppm/°C ±100 ppm/°C ±350 ppm/°C	– 0.1Ω – 0.976Ω 1.0Ω – 1M –	0.1Ω – 9.1Ω 10Ω – 10M – 11M – 22M

* Lesser of \sqrt{PR} or maximum working voltage.

How to Order



RMC Series — General Purpose Thick Film Chip Resistors



Mechanical Specifications

Type / Code	L Body Length	W Body Width	H Body Height	a Top Termination	b Bottom Termination	Units
RMC 1/20	0.024 ± 0.001 0.60 ± 0.03	0.011 ± 0.001 0.30 ± 0.03	0.009 ± 0.001 0.23 ± 0.03	0.004 ± 0.002 0.10 ± 0.05	0.006 ± 0.002 0.15 ± 0.05	inches mm
RMC 1/16S	0.039 ± 0.002 1.00 ± 0.05	0.020 ± 0.002 0.50 ± 0.05	0.014 ± 0.002 0.35 ± 0.05	0.008 ± 0.004 0.20 ± 0.10	0.010 +0.002, -0.004 0.25 +0.05, -0.10	inches mm
RMC 1/16	0.063 ± 0.004 1.60 ± 0.10	0.031 ± 0.004 0.80 ± 0.10	0.018 ± 0.004 0.45 ± 0.10	0.012 ± 0.008 0.30 ± 0.20	0.012 ± 0.008 0.30 ± 0.20	inches mm
RMC 1/10	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.004 1.25 ± 0.10	0.020 ± 0.006 0.50 ± 0.15	0.016 ± 0.008 0.40 ± 0.20	0.016 ± 0.008 0.40 ± 0.20	inches mm
RMC 1/8	0.126 ± 0.008 3.20 ± 0.20	0.063 ± 0.006 1.60 ± 0.15	0.021 ± 0.006 0.55 ± 0.15	0.020 ± 0.010 0.50 ± 0.25	0.020 ± 0.010 0.50 ± 0.25	inches mm
RMC 1/4	0.126 ± 0.008 3.20 ± 0.20	0.098 ± 0.008 2.50 ± 0.20	0.021 ± 0.006 0.55 ± 0.15	0.020 ± 0.010 0.50 ± 0.25	0.020 ± 0.010 0.50 ± 0.25	inches mm
RMC 1/2	0.197 ± 0.008 5.00 ± 0.20	0.098 ± 0.008 2.50 ± 0.20	0.021 ± 0.006 0.55 ± 0.15	0.024 ± 0.010 0.60 ± 0.25	0.024 ± 0.010 0.60 ± 0.25	inches mm
RMC 1	0.248 ± 0.008 6.30 ± 0.20	0.126 ± 0.008 3.20 ± 0.20	0.021 ± 0.006 0.55 ± 0.15	0.024 ± 0.010 0.60 ± 0.25	0.024 ± 0.010 0.60 ± 0.25	inches mm

*Lead free (RMCF) dimensions same as standard parts

Performance Characteristics

Test	Test Conditions (JIS C 5202)	Test Results
Short Time Overload	2.5x rated voltage for 5 seconds	±(2% +0.1Ω)
Dielectric Withstanding Voltage	100VAC, 1 minute	±(1% +0.05Ω)
Resistance to Soldering Heat	260°C ±5°C, for 10 sec. ±0.5 sec. (Solder Bath)	±(1% +0.05Ω)
Solderability	235°C ±5°C, for 2 sec. ±0.5 sec. (Colophonium flux)	95% coverage, minimum
Temperature Cycle	-65°C: 30 min. 25°C: 2 to 3 min. 155°C: 30 min. 25°C: 2 to 3 min. (5 Cycles)	±(1% +0.05Ω) Jumper (<0.05Ω)
Endurance (Damp load)	40°C ± 2°C, 90% RH, Rated Load 90 min. On, 30 min. Off for 1,000 hrs. -0 hrs. / +48 hrs.	±(3% +0.1Ω) Jumper (<0.05Ω)
Endurance (Rated load)	70°C ± 2°C, Rated Load 90 min. On, 30 min. Off for 1,000 hrs. -0 hrs. / +48 hrs.	±(3% +0.1Ω) Jumper (<0.05Ω)
Voltage Coefficient	1/10 rated voltage for 3 sec. max, then rated voltage for 3 sec. max.	±100 (ppm/V)
Robustness of Termination	Bend of 3mm for 5 ± 1 sec.	±(1.0% + 0.05 Ohm)

RHC Series — High Power Thick Film Chip Resistor

Features

- 2W of power
- Resistances from 0.1Ω to 1MΩ
- 1% and 5% tolerances
- TCR ±100 ppm/°C
- RoHS compliant / lead-free
- Runs significantly cooler than standard thick film 2512 chip

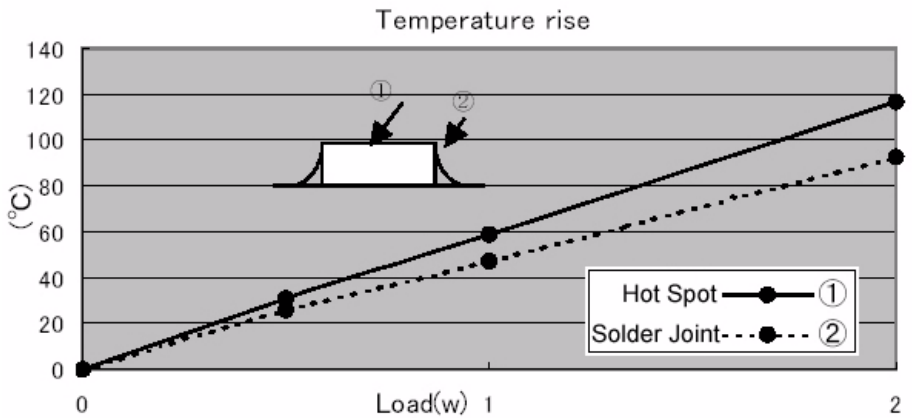


Electrical Specifications

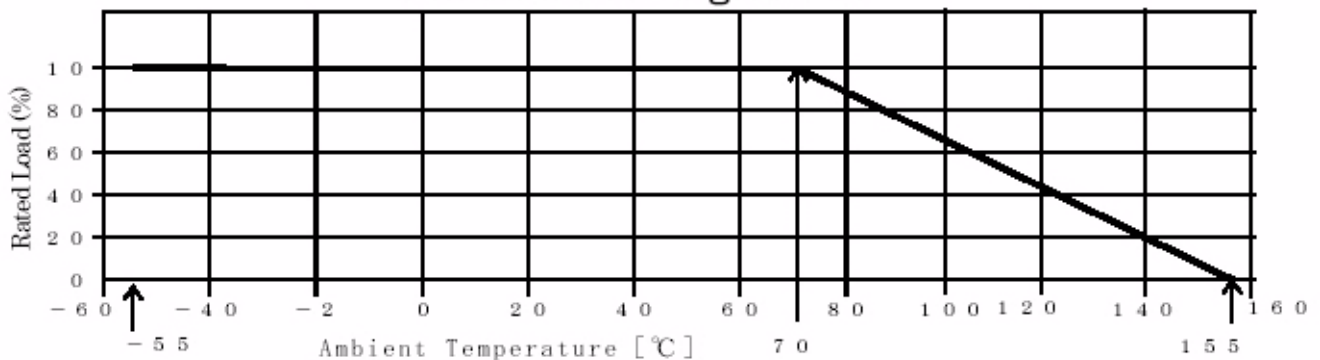
Type / Code	Package Type	Power Rating (Watts) @ 70°C	Working Voltage	Maximum Overload Voltage	Resistance Temperature Coefficient	Ohmic Range and Tolerance	
						1%	5%
RHC 2512	2512	2	200	400	±100 ppm/°C	0.1Ω - 1MΩ	0.1Ω - 1MΩ

Performance Characteristics

Test	Typical
Moisture Resistance	±1%
Load Life	±1%
Resistance to Soldering	±1%
Temperature Cycling	±1%
Thermal Shock	±1%
Short Time Overload	±1%
Insulation Resistance	≥1MΩ



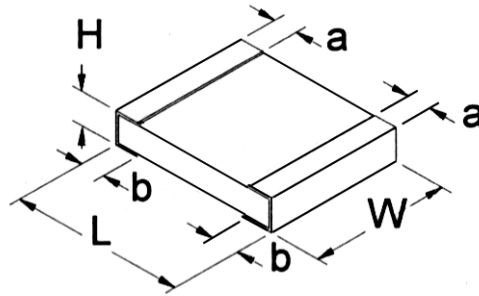
Power Derating Curve



How to Order

RHC		2512			10K		1%		R		
SEI Type		Code			Nominal Resistance		Tolerance		Packaging		
Type	Description	Code	Wattage	Size	Tolerance		Pkg Qty	Description	Code		
RHC	Standard	2512	2.000	2512	1% 5%		4,000	7" - Emboss	R		

RHC Series—High Power Thick Film Chip Resistor

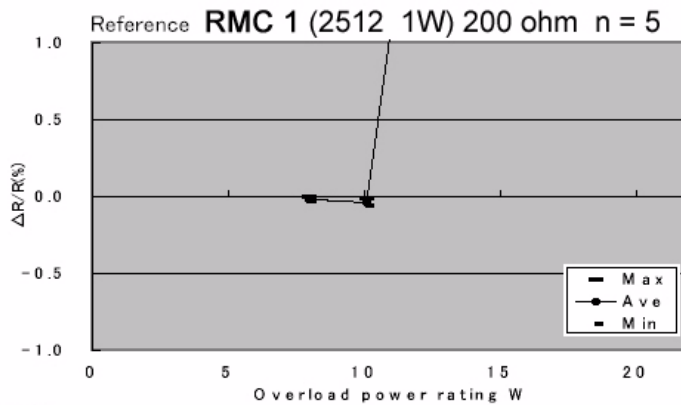
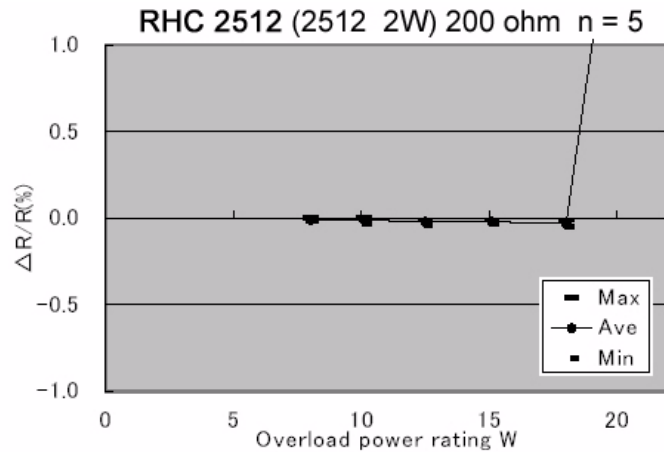
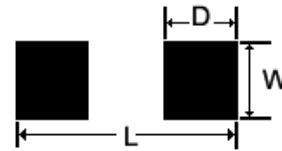


Mechanical Specifications

Type / Code	L Body Length	W Body Width	H Body Height	a Top Termination	b Bottom Termination	Units
RHC 2512	6.30 ± 0.20	3.20 ± 0.20	0.60 ± 0.10	0.7 ± 0.20	2.20 ± 0.20	mm

Solder Pad Dimensions

Type / Code	L Total Length	W Total Width	D Pad Depth	Units
RHC 2512	8.00	3.50	3.00	mm



Test condition

Voltage(Power): 2.0, 2.25, 2.5, 2.75, 3.0, 3.25 times of rated voltage. (8W, 10.1W, 12.5W, 15.1W, 18W, 21.1W)

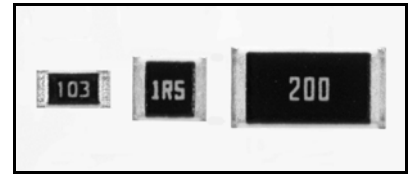
Applied time : Each voltage 5sec

As a reference test, the RMC was tested with the same rated voltage and testing substrate.

RMCS Series — Sulfur Resistant Thick Film Chip Resistors

Features

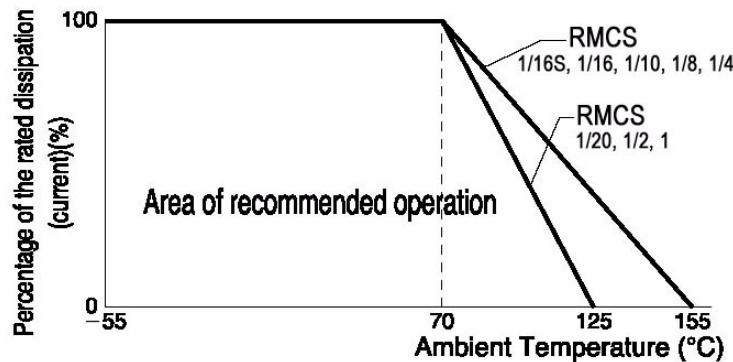
- Barrier terminations engineered to deter sulfur contamination
- Additional values available upon request
- RoHS compliant / lead-free
- Operating temp range from -55°C to +155°C (0402 - 1210 sizes)
- Zero ohm available (max resistance 0.05Ω)



Electrical Specifications

Type / Code	Package Size	Power Rating (Watts) @ 70°C	Maximum Working Voltage*	Maximum Overload Voltage	Max. Current (Jumper)	Resistance Temperature Coefficient	Ohmic Range and Tolerance	
							1%	5%
RMCS 1/20	0201	0.05W	25	50	1 Amp	±300 ppm/°C ±200 ppm/°C	10Ω – 97.6Ω 100Ω – 1M	10Ω – 91Ω 100Ω – 10M
RMCS 1/16S	0402	0.10W	50	100	1 Amp	±200 ppm/°C ±100 ppm/°C ±200 ppm/°C	10Ω – 97.6Ω 100Ω – 1M 1.02M – 10M	10Ω – 10M – –
RMCS 1/16	0603	0.10W	50	100	1 Amp	±100 ppm/°C ±200 ppm/°C	10Ω – 1M 1.02M – 6.7M	– 10Ω – 22M
RMCS 1/10	0805	0.125W	150	300	2 Amp	±100 ppm/°C ±200 ppm/°C	10Ω – 2.2M 2.21M – 10M	– 10Ω – 22M
RMCS 1/8	1206	0.25W	200	400	2 Amp	±100 ppm/°C ±200 ppm/°C	10Ω – 1M 1.02M – 10M	– 10Ω – 24M
RMCS 1/4	1210	0.25W	200	400	2 Amp	±100 ppm/°C ±200 ppm/°C	10Ω – 1M 1.02M – 10M	– 10Ω – 22M
RMCS 1/2	2010	0.50W	200	400	2 Amp	±100 ppm/°C ±200 ppm/°C	10Ω – 1M –	– 10Ω – 22M
RMCS 1	2512	1W	200	400	2 Amp	±100 ppm/°C ±200 ppm/°C	10Ω – 1M –	– 10Ω – 22M

* Lesser of \sqrt{PR} or maximum working voltage.

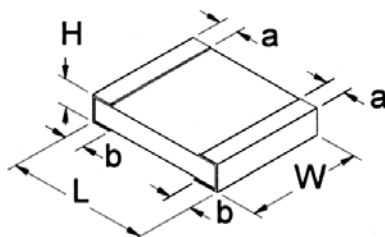


When the ambient temperature exceeds 70°C, the power (current for jumper chips) shall be derated according to this curve

How to Order

RMCS		1/16			4.7K		5%		R			
SEI Type		Code			Nominal Resistance		Tolerance		Packaging			
SEI Type	Description	Code	Wattage	Size	Tolerance	Values	Styles	Pkg Qty	Description	Code		
RMCS	Anti Sulfur	1/20	0.050W	0201	1%	E96,E24	1/20	15,000	Tape - 2mm Pitch	R		
		1/16S	0.100W	0402	5%	E24	1/16S	10,000	Paper Tape			
		1/16	0.100W	0603			1/16, 1/10, 1/8	5,000	Embossed Tape			
		1/10	0.125W	0805			1/4, 1/2, 1	4,000	Bulk			
		1/8	0.250W	1206			All	1,000	Bulk	A		
		1/4	0.250W	1210								
		1/2	0.500W	2010								
		1	1.000W	2512								

RMCS Series — Sulfur Resistant Thick Film Chip Resistors



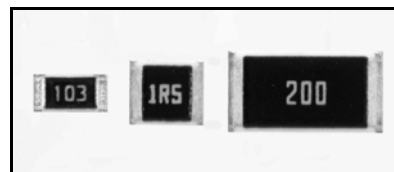
Mechanical Specifications

Type / Code	L Body Length	W Body Width	H Body Height	a Top Termination	b Bottom Termination	Units
RMCS 1/20	0.024 ± 0.001 0.60 ± 0.03	0.011 ± 0.001 0.30 ± 0.03	0.009 ± 0.001 0.23 ± 0.03	0.004 ± 0.002 0.10 ± 0.05	0.006 ± 0.002 0.15 ± 0.05	inches mm
RMCS 1/16S	0.039 ± 0.002 1.00 ± 0.05	0.020 ± 0.002 0.50 ± 0.05	0.014 ± 0.002 0.35 ± 0.05	0.008 ± 0.004 0.20 ± 0.10	0.010 +0.002, -0.004 0.25 +0.05, -0.10	inches mm
RMCS 1/16	0.063 ± 0.004 1.60 ± 0.10	0.031 ± 0.004 0.80 ± 0.10	0.018 ± 0.004 0.45 ± 0.10	0.012 ± 0.008 0.30 ± 0.20	0.012 ± 0.008 0.30 ± 0.20	inches mm
RMCS 1/10	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.004 1.25 ± 0.10	0.020 ± 0.006 0.50 ± 0.15	0.016 ± 0.008 0.40 ± 0.20	0.016 ± 0.008 0.40 ± 0.20	inches mm
RMCS 1/8	0.126 ± 0.008 3.20 ± 0.20	0.063 ± 0.006 1.60 ± 0.15	0.021 ± 0.006 0.55 ± 0.15	0.020 ± 0.010 0.50 ± 0.25	0.020 ± 0.010 0.50 ± 0.25	inches mm
RMCS 1/4	0.126 ± 0.008 3.20 ± 0.20	0.098 ± 0.008 2.50 ± 0.20	0.021 ± 0.006 0.55 ± 0.15	0.020 ± 0.010 0.50 ± 0.25	0.020 ± 0.010 0.50 ± 0.25	inches mm
RMCS 1/2	0.197 ± 0.008 5.00 ± 0.20	0.098 ± 0.008 2.50 ± 0.20	0.021 ± 0.006 0.55 ± 0.15	0.024 ± 0.010 0.60 ± 0.25	0.024 ± 0.010 0.60 ± 0.25	inches mm
RMCS 1	0.248 ± 0.008 6.30 ± 0.20	0.126 ± 0.008 3.20 ± 0.20	0.021 ± 0.006 0.55 ± 0.15	0.024 ± 0.010 0.60 ± 0.25	0.024 ± 0.010 0.60 ± 0.25	inches mm

RMCG Series — Gold Barrier Thick Film Chip Resistors

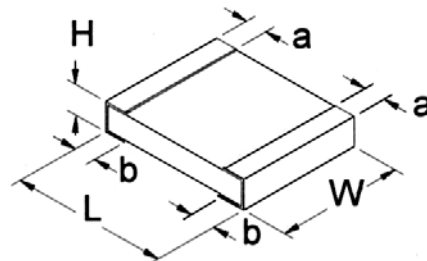
Features

- Gold terminations are completely impervious to sulfur
- Power derating from 100% at 70°C to zero at +125°C
- RoHS compliant / lead-free
- Operating temp range from -55°C to +125°C



Electrical Specifications

Type / Code	Package Size	Power Rating (Watts) @ 70°C	Maximum Working Voltage*	Maximum Overload Voltage	Resistance Temperature Coefficient	Ohmic Range
						1%, 2%, 5%
RMCG 1/16	0603	0.100W	50	100	±200 ppm/°C	10Ω – 1MΩ
RMCG 1/10	0805	0.125W	150	300		
RMCG 1/8	1206	0.250W	200	400		
RMCG 1/3	1210	0.333W	200	400		



* Lesser of \sqrt{PR} or maximum working voltage.

Mechanical Specifications

Type / Code	L Body Length	W Body Width	H Body Height	a Top Termination	b Bottom Termination	Units
RMCG 1/16	0.063 ± 0.004 1.60 ± 0.10	0.031 ± 0.004 0.80 ± 0.10	0.018 ± 0.004 0.45 ± 0.10	0.012 ± 0.008 0.30 ± 0.20	0.012 ± 0.008 0.30 ± 0.20	inches mm
RMCG 1/10	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.004 1.25 ± 0.10	0.020 ± 0.006 0.50 ± 0.15	0.016 ± 0.008 0.40 ± 0.20	0.016 ± 0.008 0.40 ± 0.20	inches mm
RMCG 1/8	0.126 ± 0.008 3.20 ± 0.20	0.063 ± 0.006 1.60 ± 0.15	0.021 ± 0.006 0.55 ± 0.15	0.020 ± 0.010 0.50 ± 0.25	0.020 ± 0.010 0.50 ± 0.25	inches mm
RMCG 1/3	0.126 ± 0.008 3.20 ± 0.20	0.098 ± 0.008 2.50 ± 0.20	0.021 ± 0.006 0.55 ± 0.15	0.020 ± 0.010 0.50 ± 0.25	0.020 ± 0.010 0.50 ± 0.25	inches mm

Performance Characteristics

Test	Test Conditions (JIS C 5202)	Test Results
Short Time Overload	2.5x rated voltage for 5 seconds	±(2% +0.1Ω)
Dielectric Withstanding Voltage	100VAC, 1 minute	±(1% +0.05Ω)
Resistance to Soldering Heat	260°C ±5°C, for 10 sec. ±0.5 sec. (Solder Bath)	±(1% +0.05Ω)
Solderability	245°C ±5°C, for 3 sec. ±0.5 sec. (Colophonium flux)	95% coverage, minimum
Temperature Cycle (5 cycles)	-55°C: 30 min. 25°C: 2 to 3 min. 125°C: 30 min. 25°C: 2 to 3 min.	±(1% +0.05Ω) Jumper (<0.05Ω)
Endurance (Damp load)	60°C ± 2°C, 90% RH, Rated Load 90 min. On, 30 min. Off, (1,000 hrs. - 0 hrs. + 48 hrs.)	±(3% +0.1Ω) Jumper (<0.05Ω)
Endurance (Rated load)	70°C ± 2°C, Rated Load 90 min. On, 30 min. Off, (1,000 hrs. - 0 hrs. + 48 hrs.)	±(3% +0.1Ω) Jumper (<0.05Ω)
Voltage Coefficient	1/10 rated voltage for 3 sec. max, then rated voltage for 3 sec. max.	±100 (ppm/V)
Robustness of Termination	Bend of 3mm for 5 ± 1 sec.	±(1.0% + 0.05 Ohm)

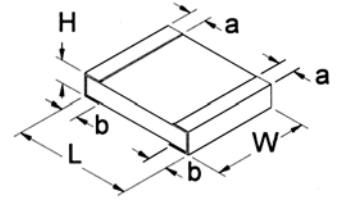
How to Order

RMCG		1/16			4.7K		5%		R			
SEI Type		Code			Nominal Resistance		Tolerance		Packaging			
SEI Type	Description	Code	Wattage	Size	Tolerance	Values	Styles	Pkg Qty	Description	Code		
RMCG	Standard	1/16	0.100W	0603	1%	E96,E24	All	5,000	7" reel - Paper	R		
		1/10	0.125W	0805	2%	E24						
		1/8	0.250W	1206	5%	E24						
		1/3	0.333W	1210								

HMC Series — High Value Thick Film Chip Resistors

Features

- R Value extension of RMC product
- Operating temperature range from -55°C to +150°C
- Power derating from 100% at 70°C to zero at 150°C
- Highly stable performance over time
- E12 values only
- Nickel barrier terminations
- RoHS compliant / lead-free



Electrical Specifications

Type / Code	Package Type	Power Rating (Watts) @ 70°C	Maximum Working Voltage*	Maximum Overload Voltage	Resistance Temperature Coefficient	Ohmic Range and Tolerance	
						10%	20%
HMC 1/16	0603	0.063W	50	100	±500 ppm/°C ±1,500 ppm/°C	47M – 1G 1.2G – 3.3G	47M – 1G 1.2G – 3.3G
HMC 1/10	0805	0.1W	75	150	±500 ppm/°C ±1,500 ppm/°C	47M – 1G 1.2G – 4.7G	47M – 1G 1.2G – 4.7G
HMC 1/8	1206	0.125W	150	300	±500 ppm/°C ±1,500 ppm/°C	47M – 1G 1.2G – 4.7G	47M – 1G 1.2G – 4.7G

* Lesser of \sqrt{PR} or maximum working voltage.

Mechanical Specifications

Type / Code	L Body Length	W Body Width	H Body Height	a Top Termination	b Bottom Termination	Units
HMC 1/16	0.063 ± 0.006	0.031 ± 0.006	0.018 ± 0.004	0.012 ± 0.008	0.012 ± 0.008	inches
	1.60 ± 0.15	0.80 ± 0.15	0.45 ± 0.10	0.30 ± 0.20	0.30 ± 0.20	mm
HMC 1/10	0.079 ± 0.008	0.049 ± 0.008	0.020 ± 0.004	0.016 ± 0.008	0.016 ± 0.008	inches
	2.00 ± 0.20	1.25 ± 0.20	0.50 ± 0.10	0.40 ± 0.20	0.40 ± 0.20	mm
HMC 1/8	0.126 +0.002/-0.008	0.063 +0.002/-0.006	0.024 ± 0.004	0.020 ± 0.010	0.020 ± 0.012	inches
	3.20 +0.05/-0.20	1.60 +0.05/-0.15	0.60 ± 0.10	0.50 ± 0.25	0.50 ± 0.30	mm

Performance Characteristics

Test	Test Conditions (JIS C 5202)	Test Results
Long Term Stability	Normal temperature & humidity for 1,000 hrs.	±0.5%
High Temperature Loading	15V _{DC} , 1.5 hr. On, 0.5 hr. Off, 1,000 hrs. 70°C	±3%
Resistance to Solder Heat	260°C ± 5°C, 10 seconds +1/-0	±1%
Short Time Overload	5 seconds at maximum overload voltage	±2%
Voltage Coefficient of Resistance	Per JIS C 5202	±0.5%/V

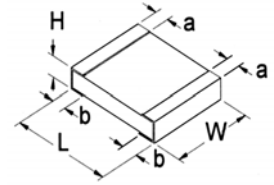
How to Order

HMC SEI Type			1/10 Code		47M Nominal Resistance		10% Tolerance		R Packaging	
Code	Wattage	Size	Tolerance	Values	Styles	Pkg Qty	Description	Code		
1/16	0.063W	0603	10%	E12	All	5,000	7" - Paper	R		
1/10	0.1W	0805	20%	E12						
1/8	0.125W	1206								

RGC Series — Semi-Precision Thick Film Chip Resistors

Features

- Precision performance
- Tolerances to $\pm 0.5\%$ and $\pm 1\%$
- Operating temperature range from -55°C to $+150^{\circ}\text{C}$
- Less sensitive to ESD discharges than comparable thin film devices
- RoHS compliant / lead-free
- Highly stable performance over time
- Power derating from 100% at 70°C to zero at 150°C
- Temperature coefficient of resistance of $\pm 50\text{ppm}/^{\circ}\text{C}$ and $\pm 100\text{ppm}/^{\circ}\text{C}$



Electrical Specifications

Type / Code	Package Type	Power Rating (Watts) @ 70°C	Maximum Working Voltage*	Maximum Overload Voltage*	Resistance Temperature Coefficient	Ohmic Range and Tolerance	
						0.5%	1%
RGC 1/16S	0402	0.063W	50	100	$\pm 50\text{ ppm}/^{\circ}\text{C}$ $\pm 100\text{ ppm}/^{\circ}\text{C}$	10 Ω – 3.24M 10 Ω – 3.24M	100 Ω – 1M 10 Ω – 3.24M
RGC 1/16	0603	0.10W	50	100	$\pm 50\text{ ppm}/^{\circ}\text{C}$ $\pm 100\text{ ppm}/^{\circ}\text{C}$	100 Ω – 3.24M 100 Ω – 3.24M	100 Ω – 3.24M 100 Ω – 3.24M
RGC 1/10	0805	0.125W	150	300	$\pm 50\text{ ppm}/^{\circ}\text{C}$ $\pm 100\text{ ppm}/^{\circ}\text{C}$	10 Ω – 3.24M –	3.32 Ω – 3.24M 3.32 Ω – 3.24M
RGC 1/8	1206	0.25W	200	400	$\pm 50\text{ ppm}/^{\circ}\text{C}$ $\pm 100\text{ ppm}/^{\circ}\text{C}$	10 Ω – 4.64M 10 Ω – 4.64M	3.32 Ω – 4.64M 3.32 Ω – 4.64M

* Lesser of $\sqrt{\text{PR}}$ or maximum working voltage.

Mechanical Specifications

Type / Code	L Body Length	W Body Width	H Body Height	a Top Termination	b Bottom Termination	Units
RGC 1/16S	0.039 \pm 0.002 1.00 \pm 0.05	0.020 \pm 0.002 0.50 \pm 0.05	0.014 \pm 0.002 0.35 \pm 0.05	0.008 \pm 0.004 0.20 \pm 0.10	0.010 +0.002/-0.004 0.25 +0.05/-0.10	inches mm
RGC 1/16	0.063 \pm 0.004 1.60 \pm 0.10	0.031 +0.006/-0.002 0.80 +0.15/-0.05	0.018 \pm 0.004 0.45 \pm 0.10	0.010 \pm 0.004 0.25 \pm 0.10	0.012 \pm 0.004 0.30 \pm 0.10	inches mm
RGC 1/10	0.079 \pm 0.004 2.00 \pm 0.10	0.050 \pm 0.004 1.25 \pm 0.10	0.024 \pm 0.004 0.60 \pm 0.10	0.016 \pm 0.008 0.40 \pm 0.20	0.016 \pm 0.008 0.40 \pm 0.20	inches mm
RGC 1/8	0.126 \pm 0.006 3.20 \pm 0.15	0.063 \pm 0.006 1.60 \pm 0.15	0.024 \pm 0.004 0.60 \pm 0.10	0.020 \pm 0.010 0.50 \pm 0.25	0.020 \pm 0.10 0.50 \pm 0.25	inches mm

Performance Characteristics

Test	Test Conditions	Test Results
Endurance @ 125°C	125°C , No load, 1,000 hrs.	$\pm 5\%$
Endurance @ 70°C	Rated Voltage, 1.5 hr. On, 0.5 hr. Off, 1,000 hrs. 70°C	$\pm 5\%$
Resistance to Soldering Heat	$260^{\circ}\text{C} \pm 5^{\circ}\text{C}$, 5 seconds +1/-0	$\pm 1\%$
Short Time Overload	2 seconds at 2.5 times rated or limiting voltage	$\pm 1\%$
Voltage Proof	100 volts AC, 60 seconds	No breakdown or flashover $R \geq 1\text{G}\Omega$

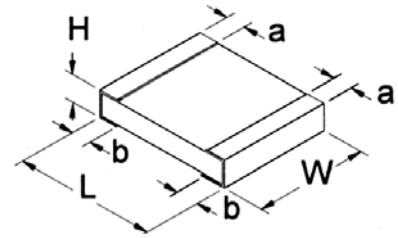
How to Order

RGC			1/16	T1	4.75K	0.5%	R			
SEI Type			Code	TCR	Nominal Resistance	Tolerance	Packaging			
Code	Wattage	Size	TCR		Tolerance	Values	Styles	Pkg Qty	Description	Code
1/16S	0.063W	0402	T1 = 100ppm		0.5%	E96	1/16S	10,000	Paper	R
1/16	0.100W	0603	T2 = 50ppm		1.0%	E96	1/16, 1/10, 1/8	5,000		
1/10	0.125W	0805								
1/8	0.250W	1206								

FCR Series — Trimmable Thick Film Chip Resistors

Features

- YAG laser user-trimmable in circuit
- Available in a variety of pre-trim tolerance ranges
- TCR of $\pm 200 \text{ ppm}/^\circ\text{C}$
- RoHS compliant / lead-free



Electrical Specifications

Type / Code	Package Type	Power Rating (Watts) @ 70°C	Maximum Working Voltage*	Maximum Overload Voltage	Resistance Temperature Coefficient	Ohmic Range and Tolerance				
						5%	10%	15%	0/-20%	0/-30%
FCR 1/16	0603	0.063W	50	100	$\pm 200 \text{ ppm}/^\circ\text{C}$	10 Ω – 1M	10 Ω – 1M	10 Ω – 1M	10 Ω – 1M	10 Ω – 1M
FCR 1/10	0805	0.1W	100	200	$\pm 200 \text{ ppm}/^\circ\text{C}$	10 Ω – 1M	10 Ω – 1M	10 Ω – 1M	10 Ω – 1M	10 Ω – 1M
FCR 1/8	1206	0.125W	200	400	$\pm 200 \text{ ppm}/^\circ\text{C}$	10 Ω – 1M	10 Ω – 1M	10 Ω – 1M	10 Ω – 1M	10 Ω – 1M
FCR 1/4	1210	0.33W	200	400	$\pm 200 \text{ ppm}/^\circ\text{C}$	10 Ω – 1M	10 Ω – 1M	10 Ω – 1M	10 Ω – 1M	10 Ω – 1M
FCR 1/2	2010	0.50W	200	400	$\pm 200 \text{ ppm}/^\circ\text{C}$	10 Ω – 1M	10 Ω – 1M	10 Ω – 1M	10 Ω – 1M	10 Ω – 1M

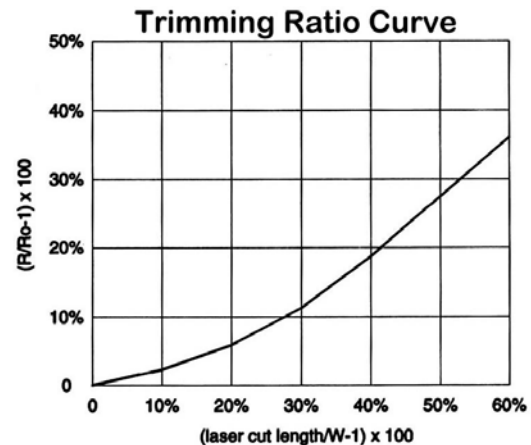
* Lesser of $\sqrt{\text{PR}}$ or maximum working voltage.

Mechanical Specifications

Type / Code	L Body Length	W Body Width	H Body Height	a Top Termination	b Bottom Termination	Units
FCR 1/16	0.063 \pm 0.006 1.60 \pm 0.15	0.031 \pm 0.006 0.80 \pm 0.15	0.018 \pm 0.004 0.45 \pm 0.10	0.012 \pm 0.008 0.30 \pm 0.20	0.012 \pm 0.008 0.30 \pm 0.20	inches mm
FCR 1/10	0.079 \pm 0.008 2.00 \pm 0.20	0.050 \pm 0.004 1.25 \pm 0.10	0.020 \pm 0.004 0.50 \pm 0.10	0.016 \pm 0.008 0.40 \pm 0.20	0.016 \pm 0.008 0.40 \pm 0.20	inches mm
FCR 1/8	0.126 \pm 0.008 3.20 \pm 0.05/-0.20	0.063 \pm 0.002/-0.006 1.60 \pm 0.05/-0.15	0.024 \pm 0.004 0.60 \pm 0.10	0.020 \pm 0.010 0.50 \pm 0.25	0.020 \pm 0.012 0.50 \pm 0.30	inches mm
FCR 1/4	0.126 \pm 0.008 3.20 \pm 0.20	0.098 \pm 0.008/-0.004 2.50 \pm 0.20/-0.10	0.024 \pm 0.004 0.60 \pm 0.10	0.020 \pm 0.010 0.50 \pm 0.25	0.0220 \pm 0.008 0.50 \pm 0.20	inches mm
FCR 1/2	0.197 \pm 0.006 5.00 \pm 0.15	0.098 \pm 0.006 2.50 \pm 0.15	0.021 \pm 0.006 0.55 \pm 0.15	0.024 \pm 0.010 0.60 \pm 0.25	0.024 \pm 0.010 0.60 \pm 0.25	inches mm

Performance Characteristics

Test	Test Results (JIS C 5202)
Load Life in Moisture	$\pm 3\%$
Temperature Cycle	$\pm 1\%$
Load Life	$\pm 3\%$
Resistance to Solder Heat	$\pm 1\%$
Terminal Adhesion	$\pm 1\%$
Short Time Overload	$\pm 2\%$
Operating Range	-55°C to +125°C



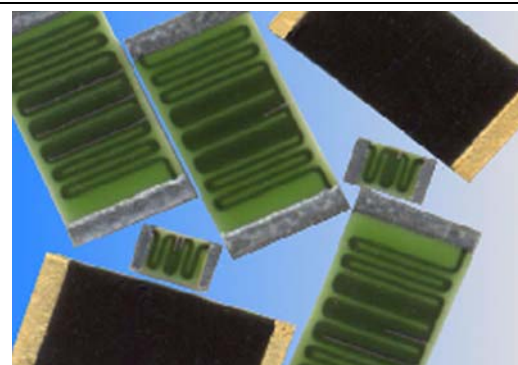
How to Order

FCR			1/10		47K		10%		R	
SEI Type			Code		Nominal Resistance		Tolerance		Packaging	
Code	Wattage	Size	Tolerance	Values	Style	Pkg Qty	Description	Code		
1/16	0.063W	0603	10%	E24	1/16, 1/10, 1/8	R	7" - Paper	5,000		
1/10	0.100W	0805	20%	E24			7" - Paper	1,000		
1/8	0.125W	1206	0/-20%	E24	1/4, 1/2	R	7" - Emboss	4,000		
1/4	0.250W	1210	0/-30%	E24						
1/2	0.500W	2010								

HVC Series — High Voltage Thick Film Chip Resistors

Features

- Voltage ratings to 40,000 volts
- Ohmic values to 10G; higher values possible
- Available with wire bondable terminations
- Tight tolerances to 0.25%
- Utilizes fine film resistor deposition technology
- Superior pulse handling capabilities
- Low TCR to 25 ppm/°C
- Low VCR to 1 ppm/volt
- Very low noise
- Ultra high stability
- Custom sizes available
- RoHS compliant / lead-free



Electrical Specifications

Type	Package Type	Power Rating (Watts) @ 70°C	Maximum Working Voltage*	Resistance Temperature Coefficient	Ohmic Range and Tolerance			
					0.5%	1%	5%	10%
HVC 0603	0603	0.06	400	±25 ppm/°C ±50 ppm/°C ±100 ppm/°C ±200 ppm/°C	–	100K – 1M 100K – 250M 10K – 250M 1K – 1G	100K – 1M 100K – 250M 10K – 250M 1K – 1G	100K – 1M 100K – 250M 10K – 250M 1K – 10G
HVC 0805	0805	0.20	750	±50 ppm/°C ±100 ppm/°C ±200 ppm/°C	–	100K – 250M 10K – 250M 1K – 1G	100K – 250M 10K – 250M 1K – 1G	100K – 250M 10K – 250M 1K – 10G
HVC 1206	1206	0.33	1,200	±25 ppm/°C ±50 ppm/°C ±100 ppm/°C ±200 ppm/°C	100K – 1M 100K – 250M 10K – 250M 1K – 250M	100K – 1M 100K – 250M 10K – 250M 1K – 1G	100K – 1M 100K – 250M 10K – 250M 1K – 1G	100K – 1M 100K – 250M 10K – 250M 1K – 10G
HVC 2010	2010	1.00	1,700	±25 ppm/°C ±50 ppm/°C ±100 ppm/°C ±200 ppm/°C	100K – 1M 100K – 250M 10K – 250M 10K – 250M	100K – 1M 100K – 250M 10K – 250M 10K – 1G	100K – 1M 100K – 250M 10K – 250M 10K – 1G	100K – 1M 100K – 250M 10K – 250M 10K – 10G
HVC 2512	2512	2.00	2,500	±25 ppm/°C ±50 ppm/°C ±100 ppm/°C ±200 ppm/°C	100K – 1M 100K – 250M 10K – 250M 10K – 250M	100K – 1M 100K – 250M 10K – 250M 10K – 1G	100K – 1M 100K – 250M 10K – 250M 10K – 1G	100K – 1M 100K – 250M 10K – 250M 10K – 10G

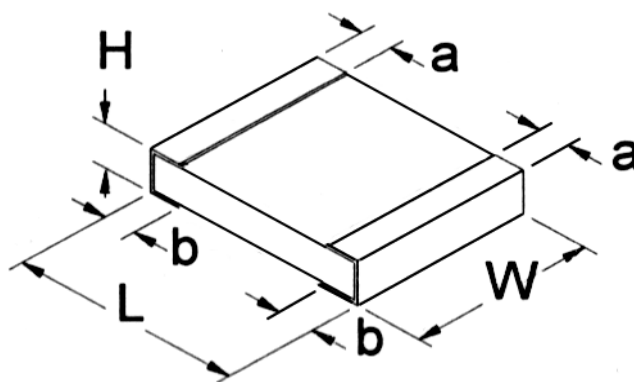
*The continuous maximum voltage applied cannot exceed the maximum power rating and is ohmic value dependent.

Note: Other case sizes and tolerances are available.

How to Order

HVC		B	1206	T2	100M	5%	R	
SEI Type	Termination		Size	TCR	Nominal Resistance	Tolerance	Packaging	
Code	Termination		TCR	Ratio Tolerance	Style	Pkg Qty	Description	Code
G	Wire bondable (gold)		T0 = 200ppm	± 0.25	0402	10,000	7" reel - Paper	R
S	Solderable single surface		T1 = 100ppm	± 0.50	0603, 0805, 1206	5,000	10" reel - Paper	G
B	Solderable (solder coated with nickel barrier)		T2 = 50ppm	± 1.00		10,000		
T	Solderable wrap-around matte tin		T9 = 25ppm	± 2.00		2010, 2512	4,000	7" reel - Emboss
Z	Solderable single surface matte tin			± 5.00				
				± 10.00				

HVC Series—High Voltage Thick Film Chip Resistors



Mechanical Specifications

Type	L Body Length	W Body Width	H Body Height	a Top Termination	b Bottom Termination	Units
HVC 0603	0.063 + 0.01/-0.005 1.60 + 0.25/-0.13	0.031 ± 0.005 0.80 ± 0.13	0.020 0.50	0.010 + 0.01/-0.005 0.25 + 0.25/-0.13	0.010 + 0.01/-0.005 0.25 + 0.25/-0.13	inches mm
HVC 0805	0.079 + 0.01/-0.005 2.00 + 0.25/-0.13	0.050 ± 0.005 1.25 ± 0.13	0.025 0.64	0.010 + 0.01/-0.005 0.25 + 0.25/-0.13	0.010 + 0.01/-0.005 0.25 + 0.25/-0.13	inches mm
HVC 1206	0.126 + 0.01/-0.005 3.20 + 0.25/-0.13	0.061 ± 0.007 1.5 ± 0.18	0.030 0.76	0.015 + 0.01/-0.005 0.38 + 0.25/-0.13	0.015 + 0.01/-0.005 0.38 + 0.25/-0.13	inches mm
HVC 2010	0.200 + 0.01/-0.005 5.08 + 0.25/-0.13	0.100 ± 0.005 2.54 ± 0.13	0.030 0.76	0.020 + 0.01/-0.005 0.51 + 0.25/-0.13	0.020 + 0.01/-0.005 0.51 + 0.25/-0.13	inches mm
HVC 2512	0.250 + 0.01/-0.005 6.35 + 0.25/-0.13	0.125 ± 0.005 3.18 ± 0.13	0.030 0.76	0.020 + 0.01/-0.005 0.51 + 0.25/-0.13	0.020 + 0.01/-0.005 0.51 + 0.25/-0.13	inches mm

Note: 0202 and 0303 case sizes available only with wire bondable terminations.

Performance Characteristics

Test	Test Method	Acceptable Parameter
Load Life	MIL-STD-202G Method 108A Test Condition D	$\Delta R = \pm 2\%$
Temperature Cycle (Thermal Shock)	MIL-STD-202G Method 107G Test Condition A	$\Delta R = \pm 0.02\%$
Resistance to Soldering Heat	IPC/EIA J-STD-002A Paragraph 4.2.4	IPC/EIA J-STD-002A Paragraph 4.2.4.4
Solderability	IPC/EIA J-STD-002A Paragraph 4.2.2	IPC/EIA J-STD-002A Paragraph 4.2.2.4.2
Short Time Overload	MIL-PRF-55342H Pg.32, Paragraph 4.8.6	MIL-PRF-55342H Pg.11, Paragraph 3.12

RVC Series — Medium Voltage Thick Film Chip Resistors

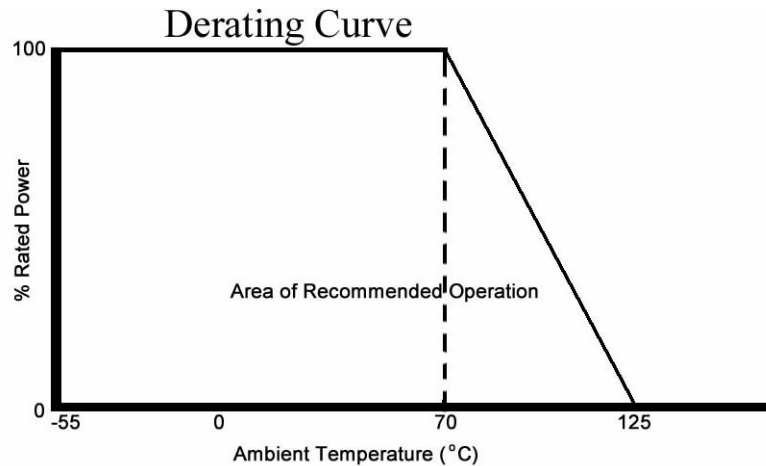
Features

- Voltage ratings 2x or more compared to standard chip resistors
- Values up to 51M
- Proportionally higher pulse power capability
- RoHS compliant / lead-free



Electrical Specifications

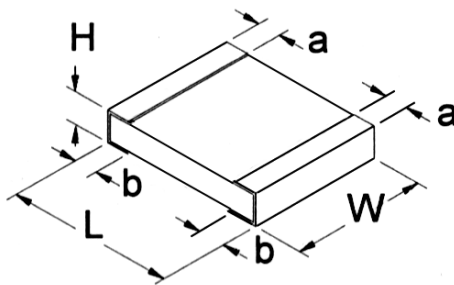
Type / Code	Power Rating (Watts) @ 70°C	Limiting Element Voltage	Isolation Voltage	Resistance Temperature Coefficient	Ohmic Range and Tolerance	
					1%	5%
RVC 0603	0.100	200V	200V	±200 ppm/°C ±100 ppm/°C	47Ω – 464Ω 470Ω – 10M	47Ω – 464Ω 470Ω – 10M
RVC 0805	0.125	300V	500V	±200 ppm/°C ±100 ppm/°C	47Ω – 97.6Ω 100Ω – 10M	47Ω – 97.6Ω 100Ω – 51M
RVC 1206	0.250	400V	500V	±200 ppm/°C ±100 ppm/°C	47Ω – 97.6Ω 100Ω – 10M	47Ω – 97.6Ω 100Ω – 51M
RVC 2010	0.500	500V	500V	±200 ppm/°C ±100 ppm/°C	47Ω – 464Ω 470Ω – 20M	47Ω – 464Ω 470Ω – 51M
RVC 2512	1.500	800V	800V	±500 ppm/°C ~ ±200 ppm/°C ±200 ppm/°C ±100 ppm/°C	47Ω – 97.6Ω 100Ω – 549Ω 560Ω – 20M	47Ω – 97.6Ω 100Ω – 549Ω 560Ω – 51M



How to Order

RVC	0805	10M	5%	R																					
SEI Type	Code	Nominal Resistance	Tolerance	Packaging																					
<table border="1"> <thead> <tr><th>Code</th></tr> </thead> <tbody> <tr><td>0603</td></tr> <tr><td>0805</td></tr> <tr><td>1206</td></tr> <tr><td>2010</td></tr> <tr><td>2512</td></tr> </tbody> </table>	Code	0603	0805	1206	2010	2512	<table border="1"> <thead> <tr><th>Tolerance</th><th>Values</th></tr> </thead> <tbody> <tr><td>1%</td><td>E24, E96</td></tr> <tr><td>5%</td><td>E24</td></tr> </tbody> </table>	Tolerance	Values	1%	E24, E96	5%	E24	<table border="1"> <thead> <tr><th>Style</th><th>Pkg Qty</th></tr> </thead> <tbody> <tr><td>0603, 0805, 1206</td><td>5,000</td></tr> <tr><td>2010, 2512</td><td>4,000</td></tr> </tbody> </table>	Style	Pkg Qty	0603, 0805, 1206	5,000	2010, 2512	4,000	<table border="1"> <thead> <tr><th>Description</th><th>Code</th></tr> </thead> <tbody> <tr><td>Tape</td><td>R</td></tr> </tbody> </table>	Description	Code	Tape	R
Code																									
0603																									
0805																									
1206																									
2010																									
2512																									
Tolerance	Values																								
1%	E24, E96																								
5%	E24																								
Style	Pkg Qty																								
0603, 0805, 1206	5,000																								
2010, 2512	4,000																								
Description	Code																								
Tape	R																								

RVC Series — Medium Voltage Thick Film Chip Resistors



Mechanical Specifications

Type / Code	L Body Length	W Body Width	H Body Height	a Top Termination	b Bottom Termination	Units
RVC 0603	0.063 ± 0.004 1.60 ± 0.10	0.031 + 0.006/-0.002 0.80 + 0.15/-0.05	0.018 ± 0.004 0.45 ± 0.10	0.012 ± 0.004 0.30 ± 0.10	0.012 ± 0.004 0.30 ± 0.10	inches mm
RVC 0805	0.079 ± 0.004 2.00 ± 0.10	0.049 ± 0.004 1.25 ± 0.10	0.021 ± 0.004 0.55 ± 0.10	0.016 ± 0.008 0.40 ± 0.20	0.016 ± 0.008 0.40 ± 0.20	inches mm
RVC 1206	0.126 ± 0.006 3.20 ± 0.15	0.063 ± 0.006 1.60 ± 0.15	0.021 ± 0.004 0.55 ± 0.10	0.020 ± 0.010 0.50 ± 0.25	0.020 ± 0.010 0.50 ± 0.25	inches mm
RVC 2010	0.197 ± 0.006 5.00 ± 0.15	0.098 ± 0.006 2.50 ± 0.15	0.021 ± 0.006 0.55 ± 0.15	0.024 ± 0.008 0.60 ± 0.20	0.024 ± 0.008 0.60 ± 0.20	inches mm
RVC 2512	0.248 ± 0.006 6.30 ± 0.15	0.126 ± 0.006 3.20 ± 0.15	0.021 ± 0.006 0.55 ± 0.15	0.024 ± 0.008 0.60 ± 0.20	0.024 ± 0.008 0.60 ± 0.20	inches mm

Climatic Category

Lower Category Temperature	-55°C
Upper Category Temperature	+125°C
Duration of the Damp heat, Steady-State Test	56 days

Performance Characteristics

Test	Test Results	Test Methods (JIS C 5201-1 : 1998)
Voltage Proof	No breakdown or flashover $R \geq 1G$ ohm	Clause 4.7 500Va.c.,60s : RVC 0805,RVC 1206, RVC 2010, RVC 2512 100Va.c.,60s : RVC 0603
Variation of Resistance with Temperature	See ratings table	Clause 4.8 Measuring temperature: +20°C/ -55°C/ +20°C/ +125°C/ +20°C
Overload	$\Delta R \leq \pm 1\% + 0.05\Omega$ No visible damage, legible markings	Clause 4.13 The applied voltage shall be 2.5 times of the rated voltage or twice of the limiting element voltage, whichever is the less severe, 2s.
Solderability	In accordance with Clause 4.17.4.5	Clause 4.17 235°C, 2s.
Resistance to Soldering Heat	$\Delta R \leq \pm 1\% + 0.05\Omega$	Clause 4.18 After immersion into the flux, the immersion into solder shall be carried out in Solder bath at 260°C for 5s.
Rapid Change of Temperature	$\Delta R \leq \pm 1\% + 0.05\Omega$ No visible damage	Clause 4.19 5 Cycles between -55°C and + 125°C.
Climatic Sequence	$\Delta R \leq \pm 5\% + 0.10\Omega$ No visible damage	Clause 4.23 Dry/Damp heat (12+12h cycle), first cycle./ Cold/Damp heat (12+12h cycle), remaining cycle./ D.C. Load
Damp Test, Steady State	$\Delta R \leq \pm 5\% + 0.10\Omega$ No visible damage, legible markings	Clause 4.24 40°C, 95% R.H., 56 days, test a) and b) of Clause 4.24.2.1
Endurance @ 70°C	$\Delta R \leq \pm 5\% + 0.10\Omega$ No visible damage	Clause 4.25.1 Rated voltage, 1.5h "ON", 05.h "OFF", 70°C, 1,000h
Endurance at the Upper Category Temperature	$\Delta R \leq \pm 5\% + 0.10\Omega$ No visible damage	Clause 4.25.3 125°C, no load, 1,000h
Adhesion	No visible damage	Clause 4.32 5N, 10s
Bend of Strength of the Face Plating	$\Delta R \leq \pm 1\% + 0.05\Omega$	Clause 4.33 Amount of bend: 3mm RVC 0603 RVC 0805 RPC 1206 Amount of bend: 1mm RVC 2010 RVC 2512

RPC Series — Pulse Withstanding Thick Film Chip Resistor

Features

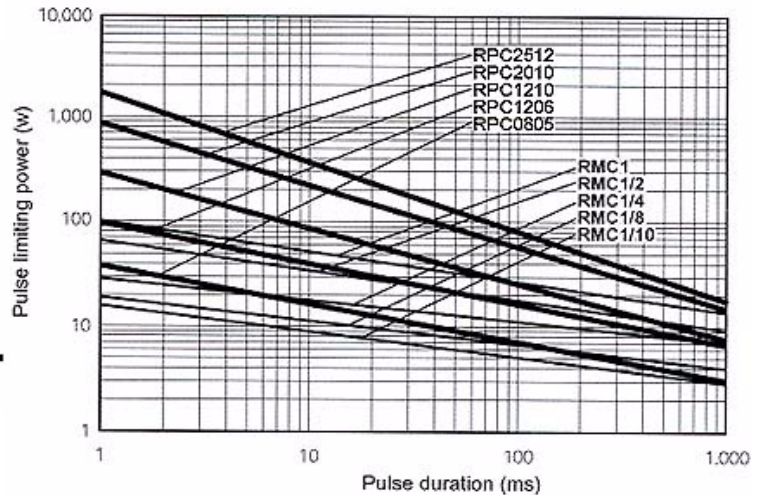
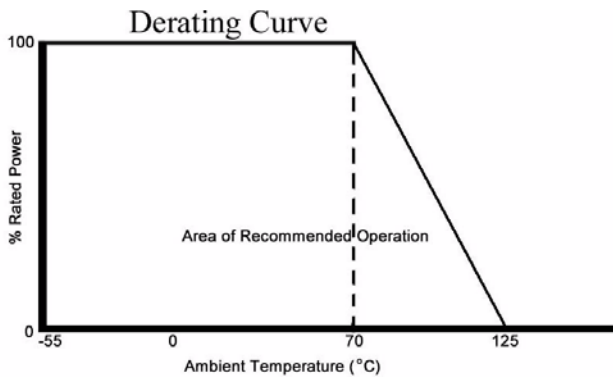
- Excellent pulse withstanding performance
- Improved working voltage
- Higher anti-surge performance compared with RMC series
- Stability class: 5%
- Broad resistance range
- RoHS compliant / lead-free available



Electrical Specifications

Type / Code	Power Rating (Watts) @ 70°C	Maximum Working Voltage	Isolation Voltage	Resistance Temperature Coefficient	Ohmic Range and Tolerance	
					5%	10%
RPC 0805	0.100	150V	500V	±200 ppm/°C	0.27Ω – 22M	0.27Ω – 22M
RPC 1206	0.125	200V	500V	±200 ppm/°C	0.27Ω – 22M	0.27Ω – 22M
RPC 1210	0.333	200V	500V	±200 ppm/°C	0.27Ω – 22M	0.27Ω – 22M
RPC 2010	0.500	200V	500V	±200 ppm/°C	0.27Ω – 22M	0.27Ω – 22M
RPC 2512	1.000	200V	500V	±200 ppm/°C	0.27Ω – 22M	0.27Ω – 22M

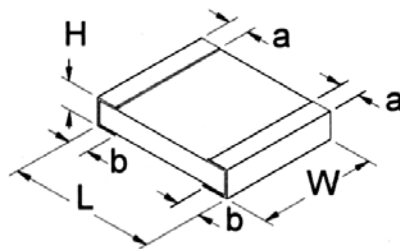
Pulse Limiting Power Curve (100Ω)



How to Order

RPC	0805	10M	5%	A
SEI Type	Code	Nominal Resistance	Tolerance	Packaging
	Code	Tolerance	Values	Styles
	0805	5%	E24	0805, 1206
	1206	10%	E24	
	1210	20%	E24	1210, 2010, 2512
	2010			
	2512			
				Pkg Qty
				10,000
				5,000
				4,000
				Description
				10" reel - Paper
				7" reel - Paper
				Code
				G
				R
				R

RPC Series — Pulse Withstanding Thick Film Chip Resistor



Mechanical Specifications

Type / Code	L Body Length	W Body Width	H Body Height	a Top Termination	b Bottom Termination	Units
RPC 0805	0.079 ± 0.004 2.00 ± 0.10	0.049 ± 0.004 1.25 ± 0.10	0.021 ± 0.004 0.55 ± 0.10	0.012 ± 0.008 0.30 ± 0.20	0.016 ± 0.008 0.40 ± 0.20	inches mm
RPC 1206	0.126 ± 0.006 3.20 ± 0.15	0.063 ± 0.006 1.60 ± 0.15	0.021 ± 0.004 0.55 ± 0.10	0.012 ± 0.008 0.30 ± 0.20	0.020 ± 0.010 0.50 ± 0.25	inches mm
RPC 1210	0.126 ± 0.006 3.20 ± 0.15	0.098 ± 0.006 2.50 ± 0.15	0.021 ± 0.006 0.55 ± 0.15	0.012 ± 0.008 0.30 ± 0.20	0.020 ± 0.010 0.50 ± 0.25	inches mm
RPC 2010	0.197 ± 0.006 5.00 ± 0.15	0.098 ± 0.006 2.50 ± 0.15	0.021 ± 0.006 0.55 ± 0.15	0.012 ± 0.008 0.30 ± 0.20	0.024 ± 0.008 0.60 ± 0.20	inches mm
RPC 2512	0.248 ± 0.006 6.30 ± 0.15	0.126 ± 0.006 3.20 ± 0.15	0.021 ± 0.006 0.55 ± 0.15	0.012 ± 0.008 0.30 ± 0.20	0.024 ± 0.008 0.60 ± 0.20	inches mm

Climatic Category

	RPC 2010 & RPC 2512	RPC 0805, RPC 1206, & RPC 1210
Lower Category Temperature	-55°C	-55°C
Upper Category Temperature	+125°C	+155°C
Duration of the Damp heat, Steady-State Test	56 days	56 days

Performance Characteristics

Test	Test Results	Test Methods (JIS C 520-1:1198)
Voltage Proof	No breakdown or flashover $R \geq 1G$ ohm	Clause 4.7 500Va.c., 60s
Variation of Resistance with Temperature	See ratings table	Clause 4.8 +20°C/ -55°C/ +20°C/ +125°C/ +20°C : RPC 2010 RPC 2512 +20°C/ -55°C/ +20°C/ +155°C/ +20°C : RPC 0805 RPC 1206 RPC 1210
Overload	$\Delta R \leq \pm 1\% + 0.05\Omega$ No visible damage, legible markings	Clause 4.13 The applied voltage shall be 2.5 times of the rated voltage or twice of the limiting element voltage, whichever is the less severe, 2s.
Solderability	In accordance with Clause 4.17.4.5	Clause 4.17 235°C, 2s.
Resistance to Soldering Heat	$\Delta R \leq \pm 1\% + 0.05\Omega$	Clause 4.18 After immersion into the flux, the immersion into solder shall be carried out in Solder bath at 260°C for 5s.
Rapid Change of Temperature	$\Delta R \leq \pm 1\% + 0.05\Omega$ No visible damage	Clause 4.19 Cycle: -55°C/ + 125°C 5 times: RPC 2010 RPC 2512 Cycle: -55°C/ +155°C 5 times: RPC 0805 RPC 1206 RPC 1210
Climatic Sequence	$\Delta R \leq \pm 5\% + 0.10\Omega$ No visible damage	Clause 4.23 Dry/Damp heat (12+12h cycle), first cycle./ Cold/Damp heat (12+12h cycle), remaining cycle./ D.C. Load
Damp Test, Steady State	$\Delta R \leq \pm 5\% + 0.10\Omega$ No visible damage, legible markings	Clause 4.24 40°C, 95% R.H., 56 days, test a) and b) of Clause 4.24.2.1
Endurance @ 70°C	$\Delta R \leq \pm 5\% + 0.10\Omega$ No visible damage	Clause 4.25.1 Rated voltage, 1.5h "ON", 05.h "OFF", 70°C, 1,000h
Endurance at the Upper Category Temperature	$\Delta R \leq \pm 5\% + 0.10\Omega$ No visible damage	Clause 4.25.3 125°C, no load, 1,000h: RPC 2010 RPC 2512 155°C, no load, 1,000h: RPC 0805 RPC 1206 RPC 1210
Adhesion	No visible damage	Clause 4.32 5N, 10s
Bend of Strength of the Face Plating	$\Delta R \leq \pm 1\% + 0.05\Omega$	Clause 4.33 Amount of bend: 3mm RPC 0805 RPC 1206 RPC 1210 Amount of bend: 1mm RPC 2010 RPC 2512

RNC Series — Precision Thin Film Chip Resistors

Features

- Precision tolerances to $\pm 0.01\%$
- TCR down to $\pm 5\text{ppm}/^\circ\text{C}$
- RoHS compliant / lead-free available (RNCF)
- Wide R-value range
- Consult factory for tighter tolerances
- 2010 and 2512 sizes now available

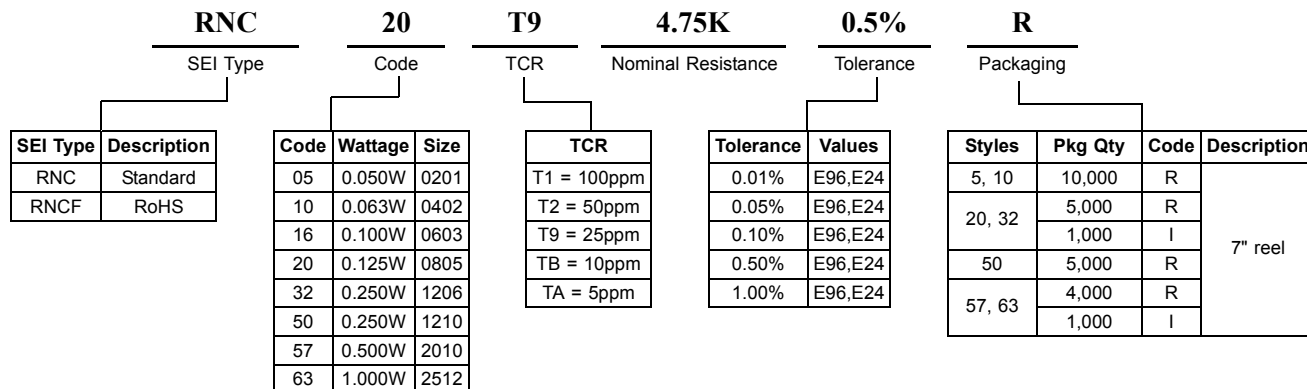


Electrical Specifications

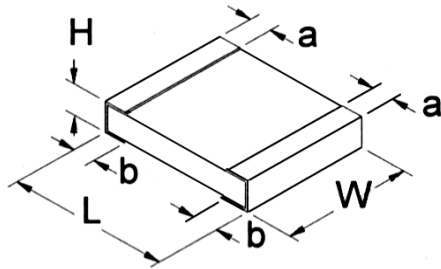
Type / Code	Package Size	Power Rating (Watts) @ 70°C	Maximum Working Voltage [*]	Maximum Overload Voltage	Resistance Temperature Coefficient	Ohmic Range and Tolerance			
						0.01%, 0.05%	0.1%	0.5%	1%
RNC 05	0201	0.050	15	30	$\pm 100\text{ ppm}/^\circ\text{C}$ $\pm 25\text{ ppm}/^\circ\text{C}$	–	–	– 33 Ω – 22K	10 Ω – 30 Ω –
RNC 10	0402	0.063	50	100	$\pm 25\text{ ppm}/^\circ\text{C}$ $\pm 10\text{ ppm}/^\circ\text{C}$	– 50 Ω – 15K	10 Ω – 100K 50 Ω – 15K	10 Ω – 100K –	–
RNC 16	0603	0.100	75	150	$\pm 50\text{ ppm}/^\circ\text{C}$ $\pm 25\text{ ppm}/^\circ\text{C}$ $\pm 10\text{ ppm}/^\circ\text{C}$	– – 50 Ω – 50K	4.7 Ω – 332K 4.7 Ω – 332K 4.7 Ω – 332K	4.7 Ω – 332K 4.7 Ω – 332K 4.7 Ω – 332K	–
RNC 20	0805	0.125	100	200	$\pm 50\text{ ppm}/^\circ\text{C}$ $\pm 25\text{ ppm}/^\circ\text{C}$ $\pm 10\text{ ppm}/^\circ\text{C}$ $\pm 5\text{ ppm}/^\circ\text{C}$	– – 50 Ω – 100K 100 Ω – 22K	4.7 Ω – 1M 4.7 Ω – 1M 4.7 Ω – 500K –	4.7 Ω – 1M 4.7 Ω – 1M 4.7 Ω – 500K –	–
RNC 32	1206	0.250	150	300	$\pm 50\text{ ppm}/^\circ\text{C}$ $\pm 25\text{ ppm}/^\circ\text{C}$ $\pm 10\text{ ppm}/^\circ\text{C}$ $\pm 5\text{ ppm}/^\circ\text{C}$	– – 50 Ω – 200K 100 Ω – 30K	4.7 Ω – 1M 4.7 Ω – 1M 4.7 Ω – 1M –	4.7 Ω – 1M 4.7 Ω – 1M 4.7 Ω – 1M –	–
RNC 50	1210	0.250	200	400	$\pm 25\text{ ppm}/^\circ\text{C}$ $\pm 10\text{ ppm}/^\circ\text{C}$	–	51.1 Ω – 2M 100 Ω – 330K	–	–
RNC 57	2010	0.500	200	400	$\pm 50\text{ ppm}/^\circ\text{C}$ $\pm 25\text{ ppm}/^\circ\text{C}$ $\pm 10\text{ ppm}/^\circ\text{C}$	–	4.7 Ω – 1M 4.7 Ω – 1M 4.7 Ω – 1M	4.7 Ω – 1M 4.7 Ω – 1M 4.7 Ω – 1M	–
RNC 63	2512	1.000	200	400	$\pm 50\text{ ppm}/^\circ\text{C}$ $\pm 25\text{ ppm}/^\circ\text{C}$ $\pm 10\text{ ppm}/^\circ\text{C}$	–	4.7 Ω – 1M 4.7 Ω – 1M 4.7 Ω – 1M	4.7 Ω – 1M 4.7 Ω – 1M 4.7 Ω – 1M	–

* Lesser of $\sqrt{\text{PR}}$ or maximum working voltage.

How to Order



RNC Series — Precision Thin Film Chip Resistors



Mechanical Specifications

Type / Code	L Body Length	W Body Width	H Body Height	a Top Termination	b Bottom Termination	Units
RNC 05	0.024 ± 0.002 0.60 ± 0.05	0.012 ± 0.002 0.30 ± 0.05	0.009 ± 0.001 0.23 ± 0.030	0.005 ± 0.002 0.12 ± 0.05	0.005 ± 0.002 0.12 ± 0.05	inches mm
RNC 10	0.039 ± 0.002 1.00 ± 0.05	0.020 ± 0.002 0.50 ± 0.05	0.014 ± 0.002 0.35 ± 0.05	0.008 ± 0.004 0.20 ± 0.10	0.010 ± 0.002 0.25 ± 0.10	inches mm
RNC 16	0.063 ± 0.008 1.60 ± 0.20	0.032 ± 0.008 0.80 ± 0.20	0.016 ± 0.004 0.40 ± 0.10	0.012 ± 0.008 0.30 ± 0.20	0.012 ± 0.008 0.30 ± 0.20	inches mm
RNC 20	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.016 ± 0.004 0.40 ± 0.10	0.016 ± 0.008 0.40 ± 0.20	0.016 ± 0.008 0.40 ± 0.20	inches mm
RNC 32	0.126 ± 0.008 3.20 ± 0.20	0.063 ± 0.008 1.60 ± 0.20	0.020 ± 0.004 0.50 ± 0.10	0.020 ± 0.012 0.50 ± 0.30	0.016 ± 0.008 0.40 ± 0.20	inches mm
RNC 50	0.126 ± 0.008 3.20 ± 0.20	0.100 ± 0.008 2.50 ± 0.20	0.024 ± 0.008 0.60 ± 0.20	0.020 ± 0.012 0.50 ± 0.30	0.016 ± 0.008 0.40 ± 0.20	inches mm
RNC 57	0.193 ± 0.006 4.90 ± 0.15	0.09 ± 0.006 2.40 ± 0.15	0.024 ± 0.004 0.60 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	0.020 ± 0.010 0.50 ± 0.25	inches mm
RNC 63	0.246 ± 0.006 6.30 ± 0.15	0.122 ± 0.006 3.10 ± 0.15	0.024 ± 0.004 0.60 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	0.020 ± 0.010 0.50 ± 0.25	inches mm

Performance Characteristics (JIS C 5202)

Test	Specification	Typical
Moisture Resistance, Thermal Shock	±(0.25% +0.05Ω)	≤0.1%
Load Life	±(0.5% +0.05Ω)	≤0.2%
Load Life in Moisture	±(0.5% +0.05Ω)	≤0.25%
Resistance to Soldering Heat	±(0.25% +0.05Ω)	≤0.05%
Solderability	min 95% coverage	≥0.95%
Terminal Strength	±(0.2% +0.05Ω)	≤0.05%
Dielectric Withstanding Voltage	±(0.25% +0.05Ω)	≤0.05%
Short Time Overload	±(0.25% +0.05Ω)	≤0.05%
Insulation Resistance	1MΩ minimum	≥1MΩ

RNCS Series — Anti-Corrosive Tantalum Nitride Replacement

Features

- Special passivation for moisture sensitive applications
- Absolute TCR's to ± 25 ppm/ $^{\circ}$ C
- Available in industry standard sizes from 0201 to 2512
- Resistance range from 25 Ω to 1M Ω
- Test proven immunity to humidity and moisture corrosion
- Absolute tolerances to 0.1%
- Ideal replacement for costly Tantalum Nitride resistors
- RoHS compliant / lead-free



The RNCS series employs a special manufacturing process to ensure high precision, ultra stable performance, and long life in the harshest environments. In moisture comparison testing the RNCS series outperformed Nichrome Chip Resistors and demonstrated the anti-corrosive claims characterized by Tantalum Nitride resistor products.

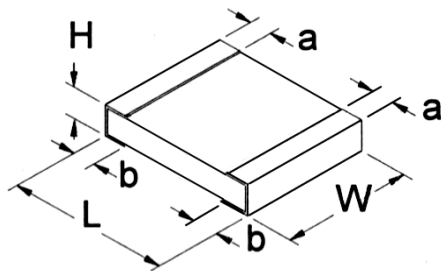
Electrical Specifications							
Type / Code	Package Size	Power Rating (Watts) @ 70 $^{\circ}$ C	Maximum Working Voltage*	Maximum Overload Voltage	Resistance Temperature Coefficient	Resistance Range	Resistance Tolerance
RNCS 10	0402	0.063W	25	50	± 50 ppm/ $^{\circ}$ C ± 25 ppm/ $^{\circ}$ C	25 Ω – 25K	$\pm 0.10\%$ $\pm 0.25\%$ $\pm 0.50\%$
RNCS 16	0603	0.100W	50	100	± 50 ppm/ $^{\circ}$ C ± 25 ppm/ $^{\circ}$ C	25 Ω – 332K	$\pm 0.10\%$ $\pm 0.25\%$ $\pm 0.50\%$
RNCS 20	0805	0.125W	100	200	± 50 ppm/ $^{\circ}$ C ± 25 ppm/ $^{\circ}$ C	25 Ω – 800K	$\pm 0.10\%$ $\pm 0.25\%$ $\pm 0.50\%$
RNCS 32	1206	0.250W	150	300	± 50 ppm/ $^{\circ}$ C ± 25 ppm/ $^{\circ}$ C	25 Ω – 1M	$\pm 0.10\%$ $\pm 0.25\%$ $\pm 0.50\%$
RNCS 57	2010	0.500W	150	300	± 50 ppm/ $^{\circ}$ C ± 25 ppm/ $^{\circ}$ C	25 Ω – 1M	$\pm 0.10\%$ $\pm 0.25\%$ $\pm 0.50\%$
RNCS 63	2512	1.000W	150	300	± 50 ppm/ $^{\circ}$ C ± 25 ppm/ $^{\circ}$ C	25 Ω – 1M	$\pm 0.10\%$ $\pm 0.25\%$ $\pm 0.50\%$

* Lesser of \sqrt{PR} or maximum working voltage.

How to Order

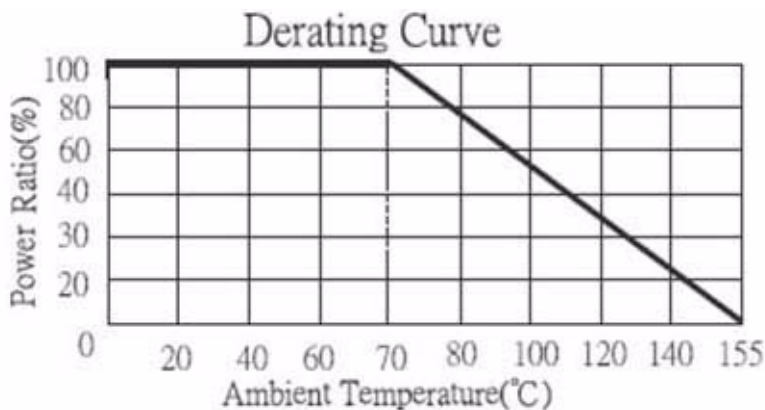
RNCS			20	T9	4.75K	0.5%	R		
SEI Type			Code	TCR	Nominal Resistance	Tolerance	Packaging		
Code	Wattage	Size	TCR	Tolerance	Values	Styles	Pkg Qty	Code	Description
10	0.063	0402	T2 = 50ppm	$\pm 0.10\%$	E96,E24	10	10,000	R	7" reel
16	0.100	0603	T9 = 25ppm	$\pm 0.25\%$	E96,E24	16, 20, 32	5,000	R	
20	0.125	0805		$\pm 0.50\%$	E96,E24		1,000	I	
32	0.250	1206				57, 63	4,000	R	
57	0.500	2010					1,000	I	
63	1.000	2512							

RNCS Series — Anti-Corrosive Tantalum Nitride Replacement



Mechanical Specifications

Type / Code	L Body Length	W Body Width	H Body Height	a Top Termination	b Bottom Termination	Units
RNCS 10	0.039 ± 0.002 1.00 ± 0.05	0.020 ± 0.002 0.50 ± 0.05	0.014 ± 0.002 0.35 ± 0.05	0.008 ± 0.004 0.20 ± 0.10	0.010 ± 0.002 0.25 ± 0.10	inches mm
RNCS 16	0.063 ± 0.008 1.60 ± 0.20	0.032 ± 0.008 0.80 ± 0.20	0.016 ± 0.004 0.40 ± 0.10	0.012 ± 0.008 0.30 ± 0.20	0.012 ± 0.008 0.30 ± 0.20	inches mm
RNCS 20	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.008 1.25 ± 0.20	0.016 ± 0.004 0.40 ± 0.10	0.016 ± 0.008 0.40 ± 0.20	0.016 ± 0.008 0.40 ± 0.20	inches mm
RNCS 32	0.126 ± 0.008 3.20 ± 0.20	0.063 ± 0.008 1.60 ± 0.20	0.020 ± 0.004 0.50 ± 0.10	0.020 ± 0.012 0.50 ± 0.30	0.016 ± 0.008 0.40 ± 0.20	inches mm
RNCS 57	0.193 ± 0.006 4.90 ± 0.15	0.09 ± 0.006 2.40 ± 0.15	0.024 ± 0.004 0.60 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	0.020 ± 0.010 0.50 ± 0.25	inches mm
RNCS 63	0.246 ± 0.006 6.30 ± 0.15	0.122 ± 0.006 3.10 ± 0.15	0.024 ± 0.004 0.60 ± 0.10	0.024 ± 0.012 0.60 ± 0.30	0.020 ± 0.010 0.50 ± 0.25	inches mm



Performance Characteristics

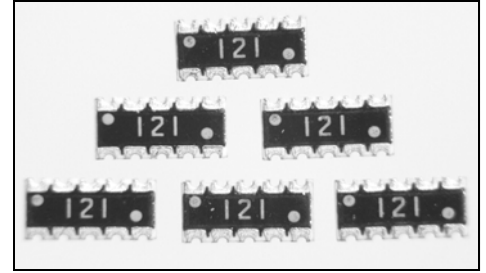
Test	Test Conditions	Test Results	
		Size 0603 / 0805 / 1206 / 2012 / 2512	Size 0402
Short Time Overload	RCWV * 2.5 or Max Overloading Voltage, 2 seconds	≤±0.02%	≤±0.1%
Thermal Shock	MIL - STD - 202F Method 107G -55°C - 125°C, 100 Cycles	≤±0.02%	≤±0.1%
Load Life	MIL - STD - 202F Method 108A RCWV, 70°C, 1.5 hours ON, 0.5 hours OFF, total 1000 - 1048 hours	≤±0.05%	≤±0.25%
Humidity (Steady State)	MIL - STD - 202F Method 103B 40°C, 90-95% RH, RCWV 1.5 hours ON, 0.5 hours OFF, total 1000 - 1048 hours	≤±0.05%	≤±0.5%
Resistance to Dry Heat	JIS - C 5202 - 7.2 1000 hours @ +125°C without load	≤±0.05%	≤±0.5%
Resistance to Soldering Heat	MIL - STD - 202F Method 210E 260 ± 5°C, 10 ± 1 second	≤±0.02%	≤±0.1%

*Storage Temperature: 25 ± 3°C; Humidity <80%RH

RAC Series—Concave Termination Chip Resistor Array

Features

- Thick film resistor element
- Zero ohm available
- Auto-placement capability
- Multiple circuit types available
- Ideal SMD substitute for leaded networks
- RoHS compliant / lead-free available (RACF)

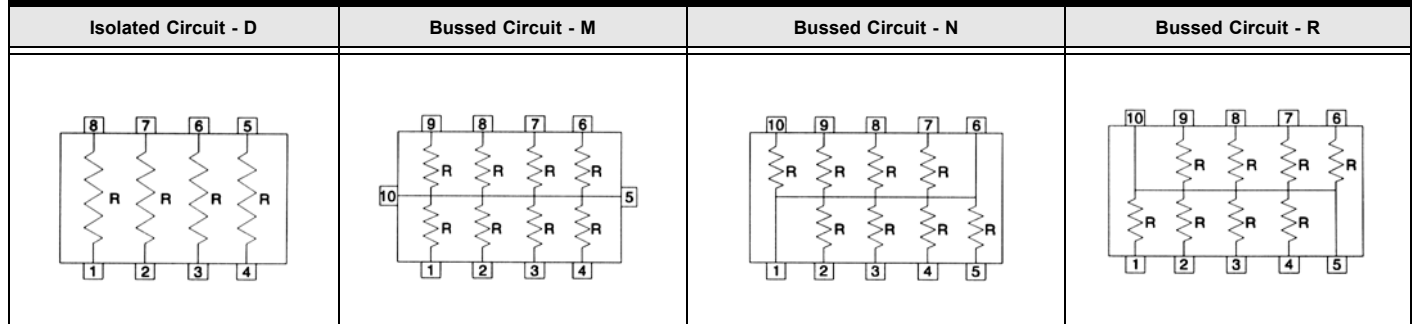


Electrical Specifications

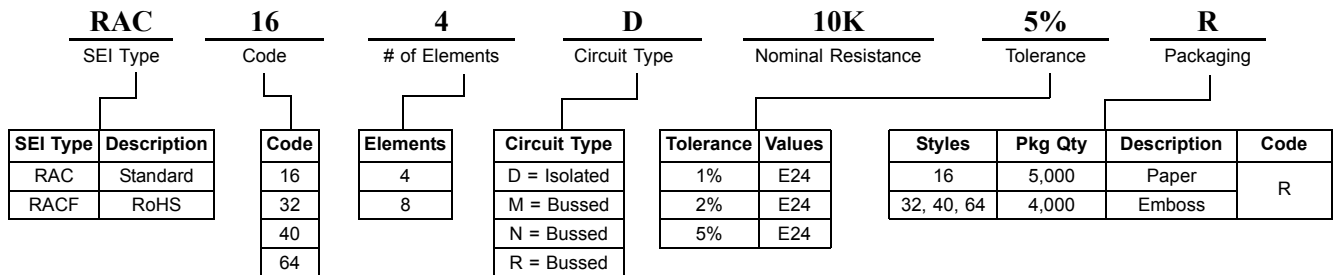
Type/Code/ # of Elements/ Circuit Type	Power Rating (per element) @ 70°C	Maximum Working Voltage*	Maximum Overload Voltage	Resistance Temperature Coefficient	Ohmic Range and Tolerance	
					1%	5%
RAC 16-4D	0.063W	50	100	±200 ppm/°C	22Ω – 1M	10Ω – 1M
RAC 32-4D	0.125W	75	150	±200 ppm/°C	22Ω – 1M	10Ω – 1M
RAC 40-8M	0.063W	25	50	±200 ppm/°C	–	22Ω – 1M
RAC 64-8N	0.063W	50	100	±200 ppm/°C	–	22Ω – 1M
RAC 64-8R	0.063W	50	100	±200 ppm/°C	–	22Ω – 1M

* Lesser of $\sqrt{\text{PR}}$ or maximum working voltage.

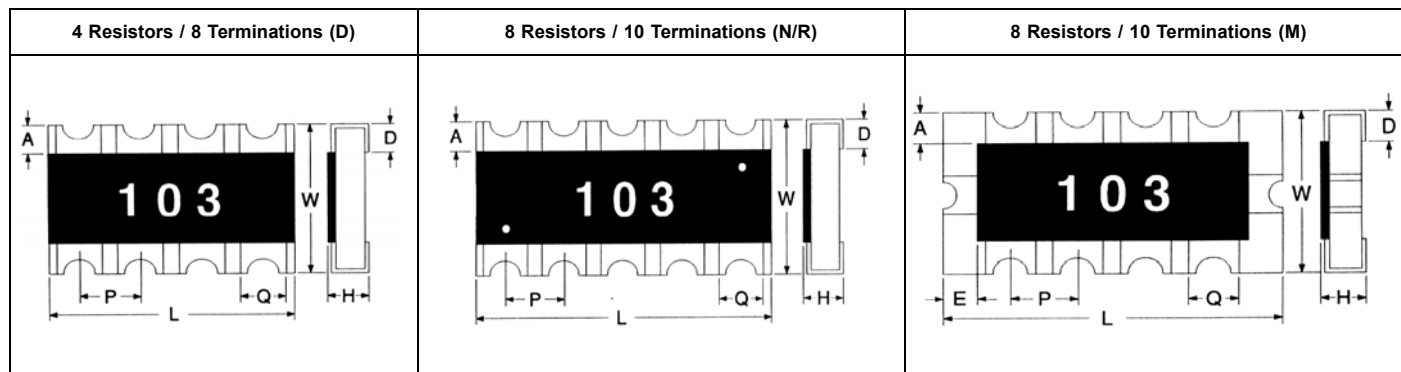
Schematics



How to Order



RAC Series — Concave Termination Chip Resistor Array



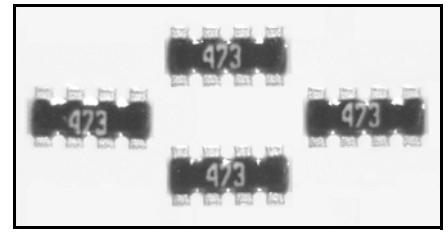
Mechanical Specifications								
inches mm								
Type/Code/ # of Elements/ Circuit Type	L Body Length	W Body Width	H Body Height	P Element Spacing	Q Termination Width	D Bottom Termination	A Top Termination	E End Termination
RAC 16-4D	0.126 ± 0.008 3.20 ± 0.20	0.063 ± 0.006 1.60 ± 0.15	0.024 ± 0.004 0.60 ± 0.10	0.031 0.80	0.016 ± 0.006 0.40 ± 0.15	0.016 ± 0.008 0.40 ± 0.20	0.012 ± 0.008 0.30 ± 0.20	-
RAC 32-4D	0.200 ± 0.008 5.08 ± 0.20	0.118 ± 0.008 3.00 ± 0.20	0.024 ± 0.004 0.60 ± 0.10	0.050 1.27	0.031 ± 0.004 0.80 ± 0.10	0.020 ± 0.008 0.50 ± 0.20	0.022 ± 0.008 0.55 ± 0.20	-
RAC 40-8M	0.157 ± 0.008 4.00 ± 0.20	0.083 ± 0.008 2.10 ± 0.20	0.024 ± 0.004 0.60 ± 0.10	0.031 0.80	0.020 ± 0.008 0.50 ± 0.20	0.016 ± 0.008 0.40 ± 0.20	0.010 ± 0.008 0.25 ± 0.20	0.012 ± 0.008 0.30 ± 0.20
RAC 64-8N	0.252 ± 0.008 6.40 ± 0.20	0.122 ± 0.008 3.10 ± 0.20	0.024 ± 0.004 0.60 ± 0.10	0.050 1.27	0.028 ± 0.008 0.70 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	0.014 ± 0.006 0.35 ± 0.15	-
RAC 64-8R	0.252 ± 0.008 6.40 ± 0.20	0.122 ± 0.008 3.10 ± 0.20	0.024 ± 0.004 0.60 ± 0.10	0.050 1.27	0.028 ± 0.008 0.70 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	0.014 ± 0.006 0.35 ± 0.15	-

Performance Characteristics	
Test	Test Results (JIS C 5202)
Load Life in Moisture	±3%
Temperature Cycle	±1%
Load Life	±3%
Resistance to Soldering Heat	±1%
Terminal Adhesion	±1%
Short Time Overload	±2%
Operating Range	-55°C to +150°C

RAV Series — Convex Termination Chip Resistor Array

Features

- Thick film resistor element
- Multiple circuit types available
- Ideal SMD substitute for leaded networks
- RoHS compliant / lead-free available (RAVF)
- Auto-placement capability
- Square corner construction
- Zero ohm jumper available
- Available without square corner, contact factory

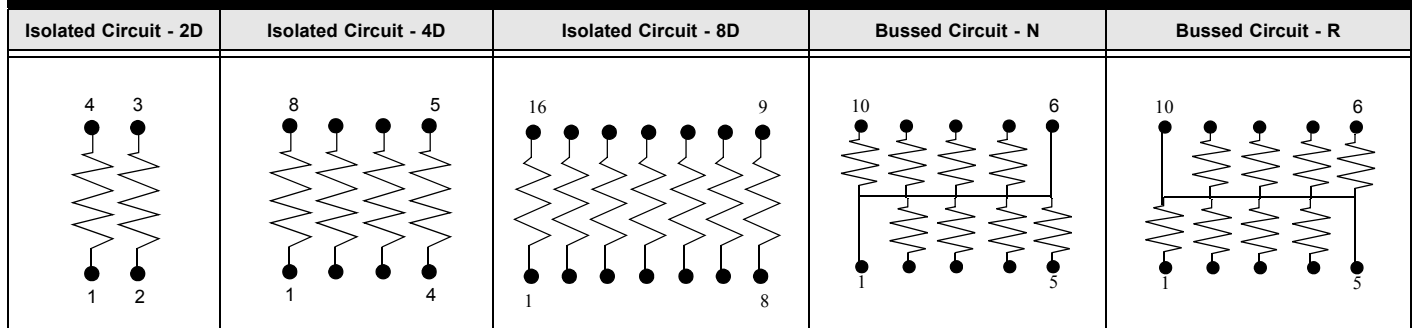


Electrical Specifications

Type / Code / # of Elements / Circuit Type	Power Rating (per element) @ 70°C	Maximum Working Voltage*	Maximum Overload Voltage	Resistance Temperature Coefficient	Ohmic Range and Tolerance	
					1%	2%, 5%
RAV 102D	0.063W	25	50	±250 ppm/°C	22Ω – 1M	10Ω – 1M
RAV 104D	0.063W	25	50	±250 ppm/°C	22Ω – 10K	10Ω – 1M
RAV 162D	0.063W	50	100	±200 ppm/°C	10Ω – 1M	10Ω – 1M
RAV 164D	0.063W	50	100	±200 ppm/°C	10Ω – 1M	10Ω – 1M
RAV 168D	0.063W	25	50	±200 ppm/°C	10Ω – 1M	10Ω – 1M
RAV 324D	0.125W	200	400	±200 ppm/°C	22Ω – 1M	10Ω – 1M
RAV 328N	0.063W	25	50	±200 ppm/°C	–	22Ω – 1M
RAV 328R	0.063W	25	50	±200 ppm/°C	–	22Ω – 1M

*Lesser of \sqrt{PR} or maximum working voltage.

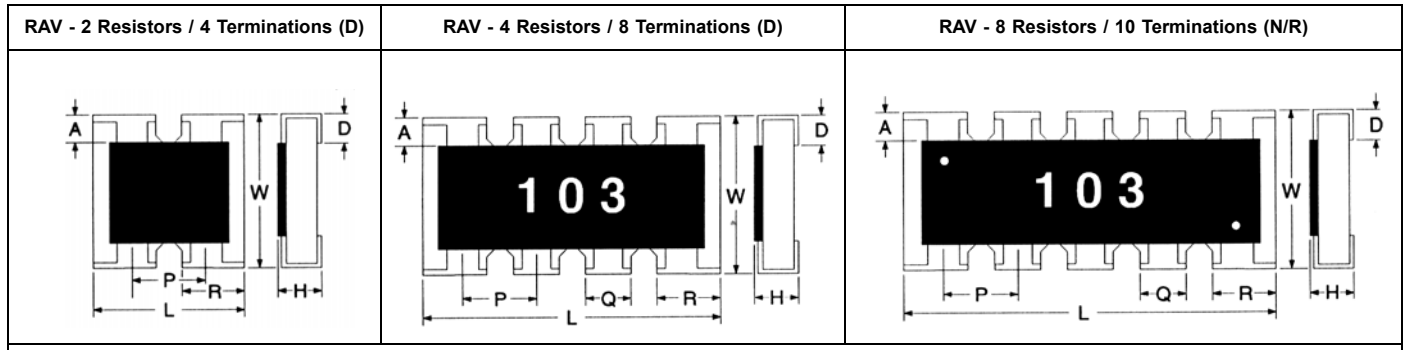
Schematics



How to Order

RAV		16	4	D	10K	5%	R
SEI Type	Code	# of Elements	Circuit Type	Nominal Resistance	Tolerance	Packaging	
RAV	10	2	D = Isolated	1%	E24	102D, 104D	10,000
RAVF	16	4	M = Bussed	2%	E24	162D, 164D, 328N, 328R	5,000
	32	8	R = Bussed	5%	E24	168D, 324D	4,000
							Reel
							Code
							R

RAV Series—Convex Termination Chip Resistor Array



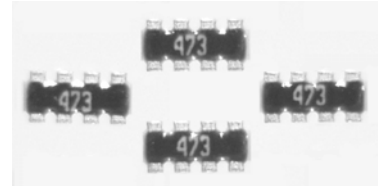
Mechanical Specifications								
	inches mm							
Type/Code/ # of Elements/ Circuit Type	L Body Length	W Body Width	H Body Height	P Element Spacing	Q Termination Width	R Termination Width	D Bottom Termination	A Top Termination
RAV 102D	0.039 ± 0.004 1.00 ± 0.10	0.039 ± 0.004 1.0 ± 0.10	0.014 ± 0.002 0.35 ± 0.05	0.026 ± 0.002 0.65 ± 0.05	—	0.013 ± 0.002 0.33 ± 0.05	0.010 ± 0.002 0.25 ± 0.05	0.006 ± 0.004 0.15 ± 0.10
RAV 104D	0.079 ± 0.008 2.00 ± 0.20	0.039 ± 0.006 1.00 ± 0.15	0.014 ± 0.004 0.35 ± 0.10	0.020 ± 0.006 0.50 ± 0.15	0.012 ± 0.006 0.30 ± 0.15	0.016 ± 0.006 0.40 ± 0.15	0.010 ± 0.004 0.25 ± 0.10	0.006 ± 0.004 0.15 ± 0.10
RAV 162D	0.063 ± 0.006 1.60 ± 0.15	0.063 ± 0.006 1.60 ± 0.15	0.020 ± 0.006 0.50 ± 0.10	0.031 ± 0.002 0.80 ± 0.05	—	0.024 ± 0.006 0.60 ± 0.15	0.010 ± 0.004 0.25 ± 0.10	0.012 ± 0.008 0.30 ± 0.20
RAV 164D	0.126 ± 0.004 3.20 ± 0.10	0.063 ± 0.004 1.60 ± 0.10	0.020 ± 0.004 0.50 ± 0.10	0.031 ± 0.002 0.80 ± 0.05	0.016 ± 0.006 0.40 ± 0.15	0.024 ± 0.006 0.60 ± 0.15	0.010 ± 0.006 0.25 ± 0.15	0.012 ± 0.008 0.30 ± 0.20
RAV 168D	0.158 ± 0.008 4.0 ± 0.20	0.063 ± 0.006 1.60 ± 0.15	0.016 ± 0.004 0.4 ± 0.10	0.020 ± 0.006 0.50 ± 0.15	0.012 ± 0.004 0.30 ± 0.10	0.016 ± 0.004 0.40 ± 0.10	0.012 ± 0.008 0.30 ± 0.20	0.012 ± 0.008 0.30 ± 0.20
RAV 324D	0.200 ± 0.008 5.08 ± 0.20	0.122 ± 0.008 3.10 ± 0.20	0.022 ± 0.004 0.55 ± 0.10	0.050 ± 0.004 1.27 ± 0.10	0.031 ± 0.008 0.80 ± 0.20	—	0.012 ± 0.008 0.30 ± 0.20	0.020 ± 0.008 0.50 ± 0.20
RAV 328N	0.126 ± 0.008 3.20 ± 0.20	0.063 ± 0.008 1.60 ± 0.20	0.020 ± 0.004 0.50 ± 0.10	0.025 ± 0.002 0.64 ± 0.05	0.013 ± 0.006 0.34 ± 0.15	0.019 ± 0.006 0.49 ± 0.15	0.010 ± 0.006 0.25 ± 0.15	0.012 ± 0.008 0.30 ± 0.20
RAV 328R	0.126 ± 0.008 3.20 ± 0.20	0.063 ± 0.008 1.60 ± 0.20	0.020 ± 0.004 0.50 ± 0.10	0.025 ± 0.002 0.64 ± 0.05	0.013 ± 0.006 0.34 ± 0.15	0.019 ± 0.006 0.49 ± 0.15	0.010 ± 0.006 0.25 ± 0.15	0.012 ± 0.008 0.30 ± 0.20

Performance Characteristics	
Test	Test Results (JIS C 5202)
Load Life in Moisture	±3%
Temperature Cycle	±1%
Load Life	±3%
Resistance to Soldering Heat	±1%
Terminal Adhesion	±1%
Short Time Overload	±2%
Operating Range	-55°C to +150°C

RAF Series — Flat Termination Chip Resistor Array

Features

- Thick film resistor element
- Ideal SMD substitute for leaded networks
- Flat termination for better solderability, reliability and lower cost
- Zero ohm jumper available
- RoHS compliant / lead-free

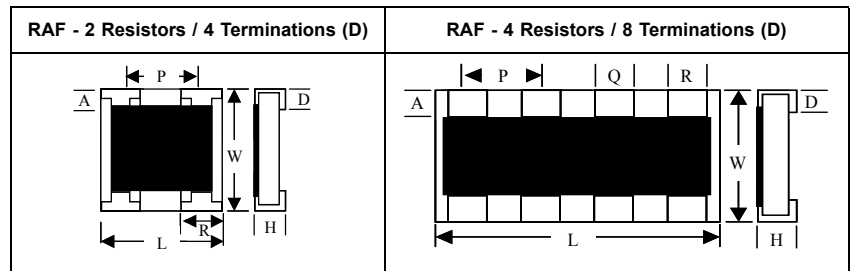
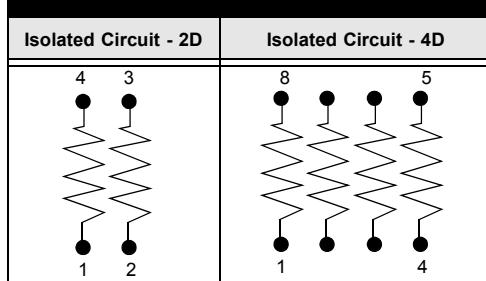


Electrical Specifications

Type / Code / # of Elements / Circuit Type	Power Rating (per element) @ 70°C	Maximum Working Voltage*	Maximum Overload Voltage	Resistance Temperature Coefficient	Ohmic Range and Tolerance	
					1%	5%
RAF 054D	0.031W	12.5	25	±200 ppm/°C	10Ω – 1M	10Ω – 1M
RAF 102D	0.063W	25	50			
RAF 104D						

*Lesser of \sqrt{PR} or maximum working voltage

Schematics



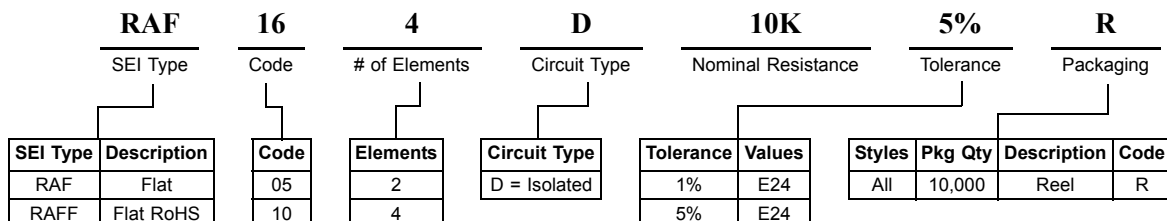
Mechanical Specifications

Type/Code/ # of Elements/ Circuit Type	L Body Length	W Body Width	H Body Height	P Element Spacing	Q Termination Width	R Termination Width	D Bottom Termination	A Top Termination
RAF 054D	0.055 ± 0.004 1.4 ± 0.10	0.024 ± 0.004 0.60 ± 0.10	0.014 ± 0.004 0.35 ± 0.10	0.016 0.40	0.008 ± 0.004 0.20 ± 0.10	0.008 ± 0.004 0.20 ± 0.10	0.006 ± 0.004 0.15 ± 0.10	0.004 ± 0.004 0.10 ± 0.10
RAF 102D	0.039 ± 0.002 1.0 ± 0.05	0.039 ± 0.004 1.0 ± 0.10	0.016 ± 0.004 0.4 ± 0.10	0.026 ± 0.002 0.65 ± 0.05	—	0.013 ± 0.004 0.33 ± 0.10	0.010 ± 0.004 0.25 ± 0.10	0.006 ± 0.004 0.15 ± 0.10
RAF 104D	0.079 ± 0.004 2.0 ± 0.10	0.039 ± 0.004 1.0 ± 0.10	0.016 ± 0.004 0.4 ± 0.10	0.020 ± 0.006 0.50 ± 0.15	0.012 ± 0.006 0.30 ± 0.15	0.012 ± 0.004 0.30 ± 0.10	0.014 ± 0.006 0.35 ± 0.15	0.009 ± 0.004 0.22 ± 0.10

Performance Characteristics

Test	Test Results (JIS C 5202)
Load Life in Moisture	±3%
Temperature Cycle	±1%
Load Life	±3%
Resistance to Soldering Heat	±1%
Terminal Adhesion	±1%
Short Time Overload	±2%
Operating Range	-55°C to +150°C

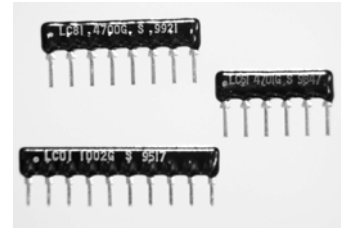
How to Order



LC Series — SIP Thick Film Resistor Networks

Features

- Standard low profile
- 6, 8, or 10 pins standard
- 3, 4, 5, 7, 9, 11, 12 and 13 pins available
- Steel leads standard
- Conformally coated
- Absolute TCR typically better than 100ppm
- TCR tracking typically better than 50ppm



Electrical Specifications

Type	Power Rating (Watts) @ 70°C	Derated to 0 Load @	Max Working Voltage*	Resistance Temperature Coefficient	Ohmic Range and Tolerance
					2%
LC	0.125W Each resistor	125°C	200	±100 ppm/°C	22Ω – 1M

* Lesser of \sqrt{PR} or maximum working voltage

Mechanical Specifications inches (mm)

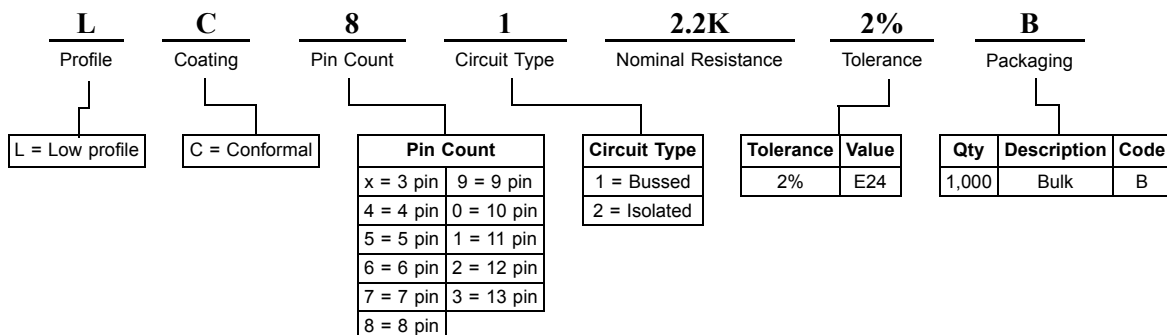
No. of Pins	"L" Max.	Low Profile – LC Series
4	0.390 (9.91)	
5	0.490 (12.45)	
6	0.590 (14.99)	
7	0.690 (17.53)	
8	0.790 (20.07)	
9	0.890 (22.61)	
10	0.990 (25.15)	
11	1.090 (27.69)	
12	1.190 (30.23)	

Performance Characteristics

Standard Configurations – Low-Profile SIP Package

Test	Test Results per MIL-R-883401 (%ΔR max.)	Single Common (Bussed) Pull-Up/Pull-Down	Discrete (Isolated) Terminator
Thermal Shock	±0.5%		
Low Temperature Operation	±0.5%		
Short Time Overload	±0.5%		
Moisture Resistance	±0.5%		
Load Life @ 70°C - 1,000 Hours	±1%		
Resistance to Soldering Heat	±0.25%		
Terminal Strength	±0.25%		
Shock (Specified Pulse)	±0.25%		
Vibration (High Frequency)	±0.25%		

How to Order



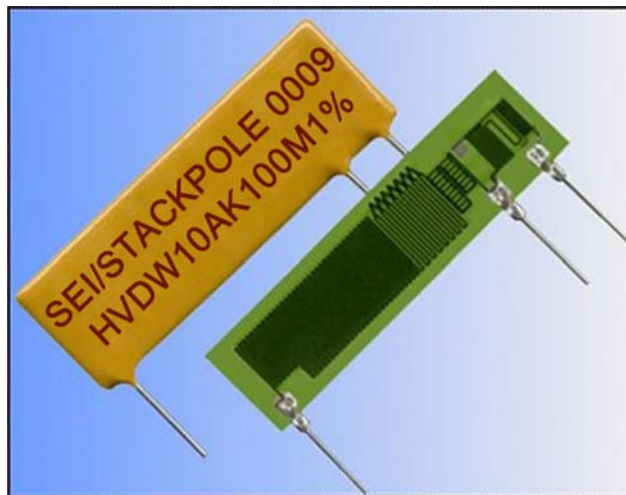
HVD Series — High Voltage Radial Leaded Plate Resistor Divider

Utilizing fine film resistor deposition technology SEI now offers a new level of stability and performance in leaded resistor dividers.

Competing product technologies have constraints due to their dependence on certain limiting composite materials. Traditional thick film products have restricted performance characteristics, while thin film offerings are confined within certain ohmic value ranges.

In addition to improving on these limitations the fine film deposition demonstrates new characteristics, such as a longer high-aspect ratio trace of lower resistivity film.

These fine film resistor dividers provide unique design efficiency, versatility, and linearity, through the combination of long line, high aspect ratio and higher conductivity film.



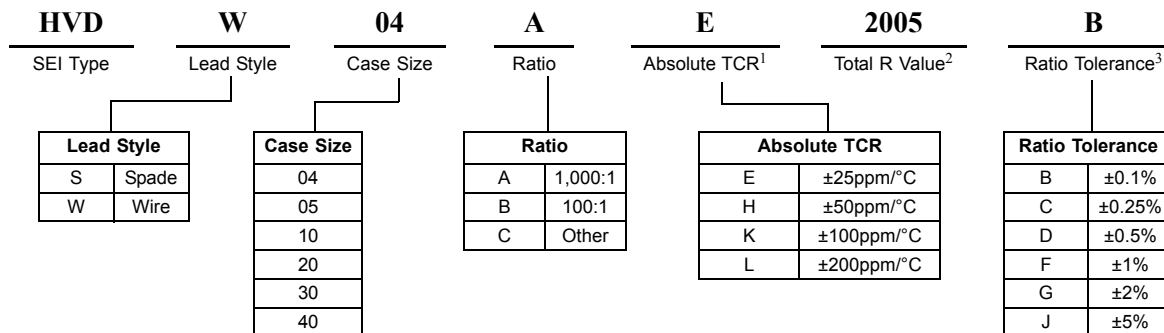
Features

- Ohmic values to 2,000G
- Voltage ratings to 40,000 volts
- Ultra high stability
- Tight tolerances to 0.1%
- Very low noise
- Low TCR to 10ppm/°C
- Low TCR tracking to 5ppm/°C
- Low VCR to 0.05ppm/volt
- Custom solutions available
- RoHS compliant / lead-free

Electrical Specifications

HVD Case Size	Power (watts) @ 25°C	Maximum Voltage Rating (kV)	Tolerance
04	0.5	4	0.1% – 1%
05	1	5	0.1% – 1%
10	1	10	0.25% – 1%
20	2	20	0.25% – 0.5%
30	3	30	0.5% – 5%
40	6	40	0.5% – 5%

How to Order



Note 1: TCR Tracking typically <25% of the Absolute TCR to a minimum of 10ppm/°C

Note 2: Express value as a four digit number, the first three numbers are the significant value and the fourth number is the number of zeros

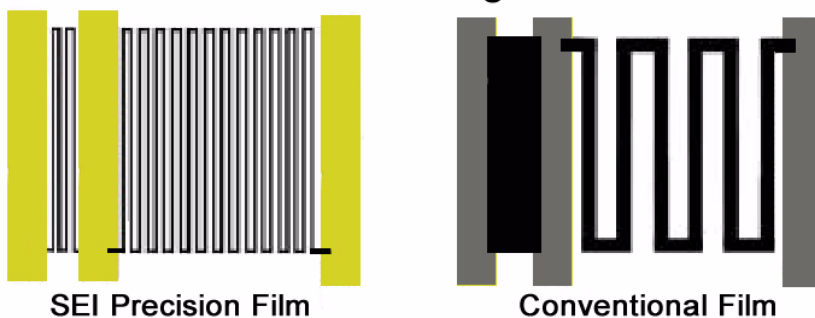
Note 3: The Absolute Tolerance is 5% unless otherwise specified

HVD Series — High Voltage Radial Leaded Plate Resistor Divider

Design Flexibility

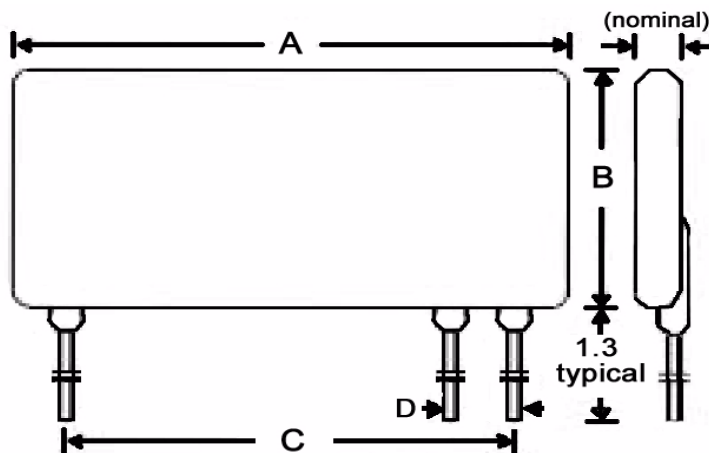
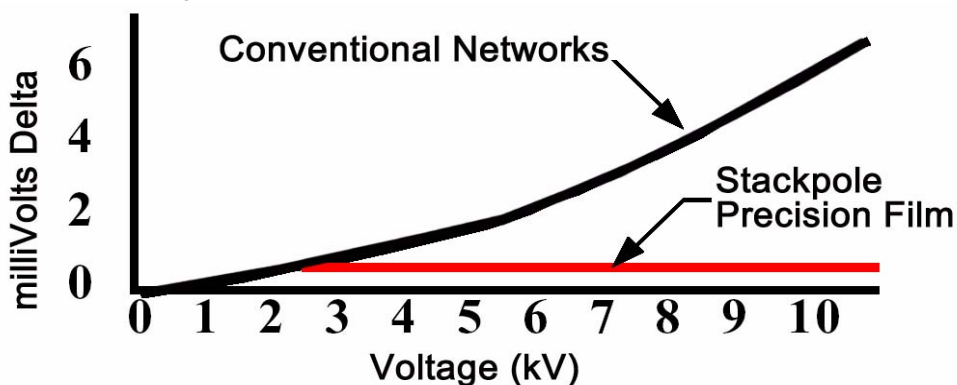
The HVD series can accommodate virtually any divider ratio due to the long serpentine pattern in the fine film manufacturing, combined with the utilization of low ohms/square thick film inks. Please contact SEI with custom design needs.

Divider Design



Excellent VCR Tracking

The VCR is virtually flat over a wide range of values.



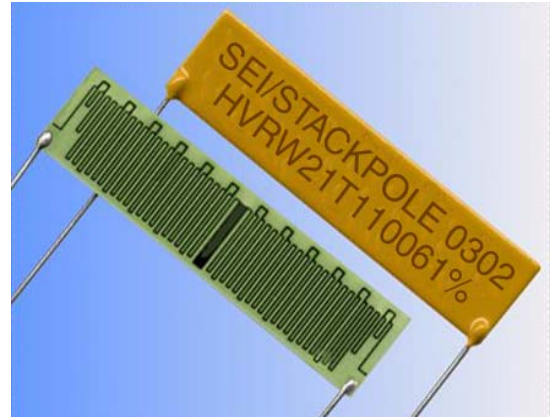
Mechanical Specifications

HVD Case Size	A	B	C	D	Units
04	0.5 +0.08/-0.03	0.375 ± 0.03	0.4	0.2	inches
	12.7 +2.032/-0.762	9.525 ± 0.762	10.16	5.08	mm
05	1.0 +0.08/-0.03	0.375 ± 0.03	0.9	0.2	inches
	25.4 +2.032/-0.762	9.525 ± 0.762	22.86	5.08	mm
10	1.5 +0.08/-0.03	0.5 ± 0.03	1.3	0.2	inches
	38.1 +2.032/-0.762	12.7 ± 0.762	33.02	5.08	mm
20	2.0 +0.08/-0.03	0.75 ± 0.03	1.9	0.2	inches
	50.8 +2.032/-0.762	19.05 ± 0.762	48.26	5.08	mm
30	3.0 +0.08/-0.03	0.75 ± 0.03	2.9	0.2	inches
	76.2 +2.032/-0.762	19.05 ± 0.762	73.66	5.08	mm
40	4.0 +0.08/-0.03	0.75 ± 0.03	3.9	0.2	inches
	101.6 +2.032/-0.762	19.05 ± 0.762	99.06	5.08	mm

HVR Series — High Voltage Radial Leaded Plate Resistors

Features

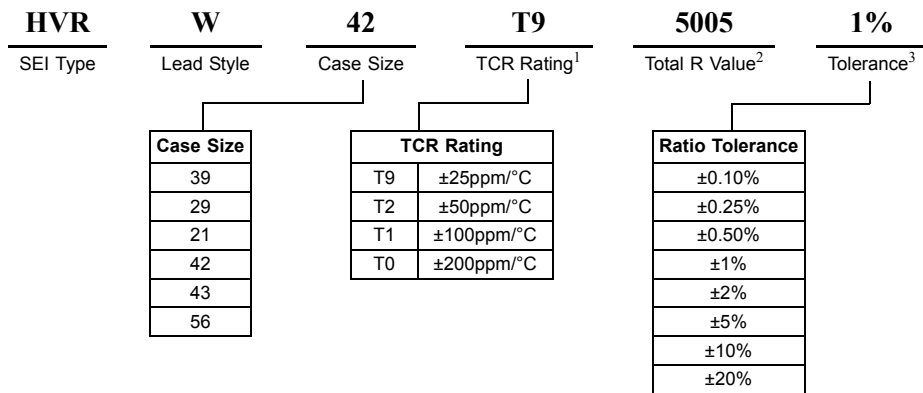
- Ohmic values to 2,000G
- Voltage ratings to 40,000 volts
- Ultra high stability
- Tight tolerances to 0.1%
- Low TCR to 10ppm/°C
- Low VCR to 0.05ppm/volt
- Very low noise
- Custom solutions available



Electrical Specifications

HVR Case Size	Power watts @ 25°C	Maximum Voltage Rating (kv)	Resistance Temperature Coefficient	Ohmic Range and Tolerance				
				0.1%	0.25% & 0.5%	1%	2%	5%, 10% & 20%
39	0.5	2	±25ppm/°C ±50ppm/°C ±100ppm/°C	<30M – 100M – –	<30M – 100M >100M – 2G –	<30M – 100M >100M – 2G >2G – 20G	<30M – 100M >100M – 2G >2G – 50G	<30M – 100M >100M – 2G >2G – 100G
29	0.5	4	±25ppm/°C ±50ppm/°C ±100ppm/°C	<30M – 100M – –	<30M – 100M >100M – 2G –	<30M – 100M >100M – 2G >2G – 20G	<30M – 100M >100M – 2G >2G – 50G	<30M – 100M >100M – 2G >2G – 100G
21	1	10	±25ppm/°C ±50ppm/°C ±100ppm/°C	<30M – 100M – –	<30M – 100M >100M – 2G –	<30M – 100M >100M – 2G >2G – 20G	<30M – 100M >100M – 2G >2G – 50G	<30M – 100M >100M – 2G >2G – 100G
42	2	20	±25ppm/°C ±50ppm/°C ±100ppm/°C	<30M – 100M – –	<30M – 100M >100M – 2G –	<30M – 100M >100M – 2G >2G – 20G	<30M – 100M >100M – 2G >2G – 50G	<30M – 100M >100M – 2G >2G – 100G
43	3	30	±25ppm/°C ±50ppm/°C ±100ppm/°C	<30M – 100M – –	<30M – 100M >100M – 2G –	<30M – 100M >100M – 2G >2G – 20G	<30M – 100M >100M – 2G >2G – 50G	<30M – 100M >100M – 2G >2G – 100G
56	6	40	±25ppm/°C ±50ppm/°C ±100ppm/°C	<30M – 100M – –	<30M – 100M >100M – 2G –	<30M – 100M >100M – 2G >2G – 20G	<30M – 100M >100M – 2G >2G – 50G	<30M – 100M >100M – 2G >2G – 100G

How to Order



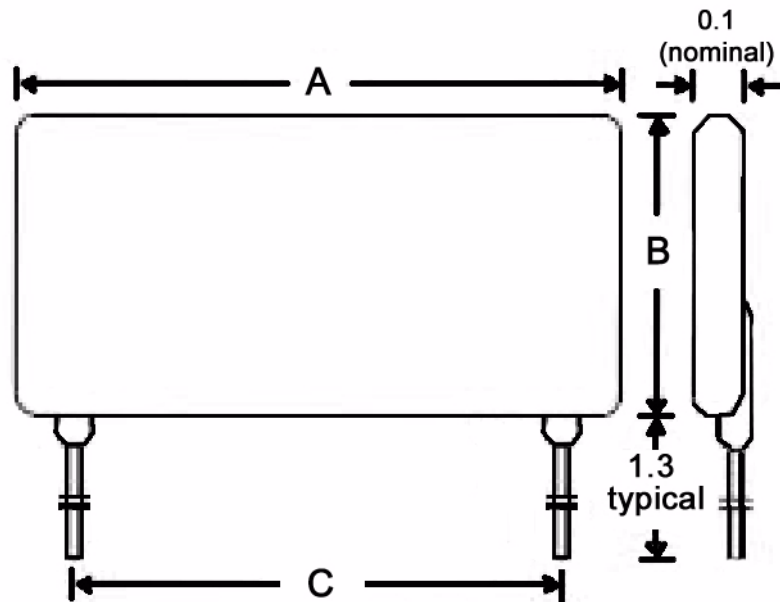
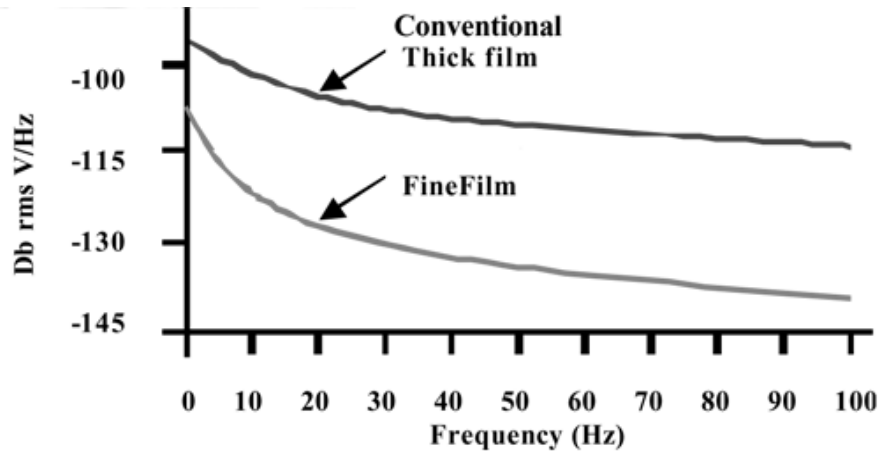
Note 1: TCR is measured from 25°C to 75°C

Note 2: Express value as a four digit number; the first three numbers are the significant value and the fourth number is the number of zeros

Note 3: Tolerance is dependent on case size and value

HVR Series — High Voltage Radial Ledged Plate Resistors

Low Noise Characteristic



Mechanical Specifications

HVR Case Size	A	B	C	Units
39	0.3 +0.08/-0.03 7.62 +2.032/-0.762	0.4 ± 0.03 10.16 ± 0.762	0.2 5.08	inches mm
29	0.5 +0.08/-0.03 12.7 +2.032/-0.762	0.375 ± 0.03 9.525 ± 0.762	0.4 10.16	inches mm
21	1.0 +0.08/-0.03 25.4 +2.032/-0.762	0.375 ± 0.03 9.525 ± 0.762	0.9 22.86	inches mm
42	2.0 +0.08/-0.03 50.8 +2.032/-0.762	0.5 ± 0.03 12.7 ± 0.762	1.9 48.26	inches mm
43	3.0 +0.08/-0.03 76.2 +2.032/-0.762	0.5 ± 0.03 12.7 ± 0.762	2.9 73.66	inches mm
56	4.0 +0.08/-0.03 101.6 +2.032/-0.762	0.75 ± 0.03 19.05 ± 0.762	3.9 99.06	inches mm

CSR/CSRN Series — Thick Film Current Sensing Resistors

Features

- 0402 to 2512 sizes available
- Power ratings to 3W
- Low inductance – less than 0.2nH typically
- RoHS compliant / lead-free (CSF)
- Non-standard resistance values available
- 2010 and 2512 sizes available with narrow terminations (CSRN)



Electrical Specifications

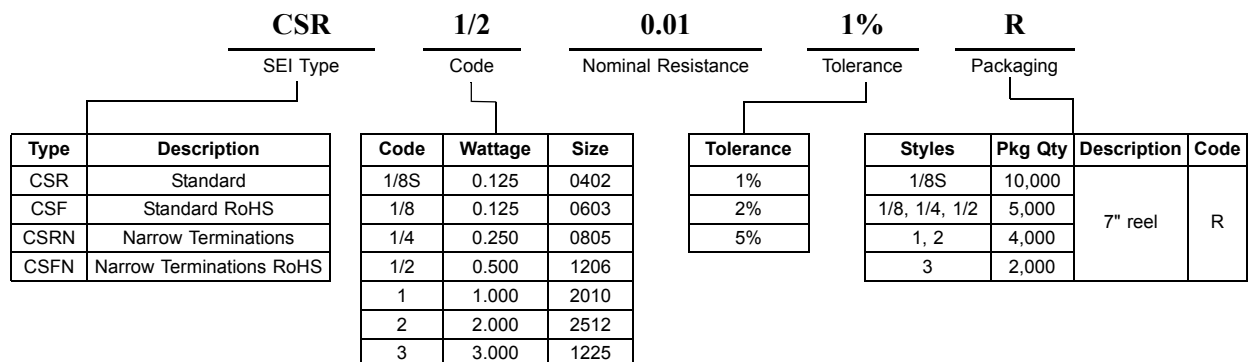
Type / Code	Package Type	Power Rating (Watts) @ 70°C	Dielectric Withstanding Voltage	Resistance Temperature Coefficient	Ohmic Range and Tolerance	
					1%	5%
CSR 1/8S	0402	0.125	200	±200 ppm/°C	0.051Ω – 1.000Ω	0.051Ω – 1.000Ω
CSR 1/8	0603	0.125	200	±300 ppm/°C	0.021Ω – 1.000Ω	0.021Ω – 1.000Ω
CSR 1/4	0805	0.250	200	±200 ppm/°C	0.021Ω – 1.000Ω	0.021Ω – 1.000Ω
CSR 1/2	1206	0.500	200	±100 ppm/°C *	0.010Ω – 1.000Ω	0.010Ω – 1.000Ω
CSR 1	2010	1.000	200	±100 ppm/°C *	0.010Ω – 1.000Ω	0.010Ω – 1.000Ω
CSRN 1	2010	1.000	200	±250 ppm/°C	0.010Ω – 1.000Ω	0.010Ω – 1.000Ω
CSR 2	2512	2.000	200	±200 ppm/°C	0.010Ω – 1.000Ω	0.010Ω – 1.000Ω
CSRN 2	2512	2.000	200	±200 ppm/°C	0.010Ω – 1.000Ω	0.010Ω – 1.000Ω
CSR 3	1225	3.000	200	±200 ppm/°C	0.005Ω – 0.200Ω	0.005Ω – 0.200Ω

* Contact factory for TCR on values below 0.05Ω

Performance Characteristics

Test	Test Specification	Typical
Moisture Resistance	±0.5%	≤0.5%
Load Life	±0.5%	≤0.5%
Leach Resistance	90 seconds min	>90 seconds
Resistance to Soldering Heat	±0.5%	≤0.25%
Solderability	min 95% coverage	≥95%
Temperature Cycling	±0.5%	≤0.5%
Thermal Shock	±0.5%	≤0.5%
Short Time Overload	±0.5%	≤0.5%
Insulation Resistance	1MΩ minimum	≥1MΩ

How to Order



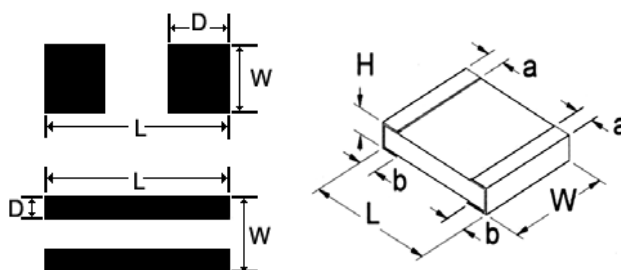
CSR/CSRN Series — Thick Film Current Sensing Resistors

Mechanical Specifications

Type / Code	L Body Length	W Body Width	H Body Height	a Top Termination	b Bottom Termination	Units
CSR 1/8S	0.039 ± 0.004 0.991 ± 0.102	0.020 ± 0.004 0.508 ± 0.102	0.014 ± 0.004 0.35 ± 0.102	0.006 ± 0.004 0.152 ± 0.102	0.006 ± 0.004 0.152 ± 0.102	inches mm
CSR 1/8	0.063 ± 0.004 1.600 ± 0.102	0.032 ± 0.004 0.813 ± 0.102	0.018 ± 0.004 0.457 ± 0.102	0.012 ± 0.008 0.305 ± 0.203	0.012 ± 0.008 0.305 ± 0.203	inches mm
CSR 1/4	0.079 ± 0.008 2.006 ± 0.203	0.049 ± 0.008 1.245 ± 0.203	0.016 ± 0.004 0.406 ± 0.102	0.016 ± 0.008 0.406 ± 0.203	0.016 ± 0.008 0.406 ± 0.203	inches mm
CSR 1/2	0.120 ± 0.006 3.048 ± 0.152	0.063 ± 0.008 1.600 ± 0.203	0.020 ± 0.006 0.508 ± 0.152	0.002 ± 0.012 0.051 ± 0.304	0.016 ± 0.010 0.406 ± 0.254	inches mm
CSR 1	0.197 ± 0.008 5.003 ± 0.203	0.100 ± 0.008 2.540 ± 0.203	0.020 ± 0.006 0.508 ± 0.152	0.067 ± 0.006 1.702 ± 0.152	0.067 ± 0.006 1.702 ± 0.152	inches mm
CSRN 1	0.197 ± 0.006 5.004 ± 0.152	0.100 ± 0.006 2.540 ± 0.152	0.024 ± 0.004 0.610 ± 0.102	0.024 ± 0.012 0.610 ± 0.305	0.020 ± 0.010 0.508 ± 0.254	inches mm
CSR 2	0.252 ± 0.008 6.401 ± 0.203	0.126 ± 0.008 3.200 ± 0.203	0.020 ± 0.006 0.508 ± 0.152	0.075 ± 0.006 1.905 ± 0.152	0.075 ± 0.006 1.905 ± 0.152	inches mm
CSRN 2	0.246 ± 0.006 6.248 ± 0.152	0.121 ± 0.006 3.073 ± 0.152	0.023 ± .004 0.584 ± 0.102	0.023 ± 0.012 0.584 ± 0.305	0.020 ± 0.010 0.508 ± 0.254	inches mm
CSR 3	0.121 ± 0.006 3.073 ± 0.152	0.246 ± 0.006 6.248 ± 0.152	0.039 ± 0.004 0.991 ± 0.102	0.023 ± 0.012 0.584 ± 0.305	0.020 ± 0.010 0.508 ± 0.254	inches mm

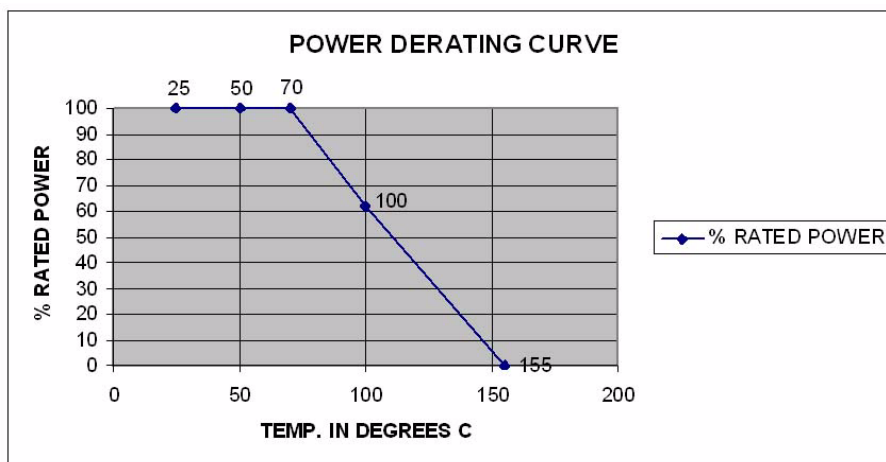
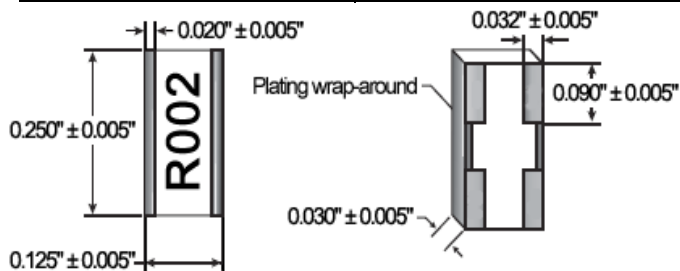
Solder Pad Dimensions

Type / Code	L Total Length	W Total Width	D Pad Depth	Units
CSR 1/8S	0.049 1.25	0.025 0.63	0.015 0.38	inches mm
CSR 1/8	0.060 1.50	0.035 0.90	0.020 0.50	inches mm
CSR 1/4	0.099 2.50	0.059 1.50	0.055 1.40	inches mm
CSR 1/2	0.158 4.00	0.079 2.00	0.071 1.80	inches mm
CSRN 1	0.250 6.35	0.145 3.68	0.055 1.40	inches mm
CSR 1	0.258 6.54	0.130 3.30	0.071 1.80	inches mm
CSR 2	0.315 8.00	0.158 4.00	0.079 2.00	inches mm
CSRN 2	0.315 8.00	0.158 4.00	0.055 1.40	inches mm
CSR 3	0.30 7.60	0.20 5.08	0.080 2.00	inches mm



CSR3 (1225)

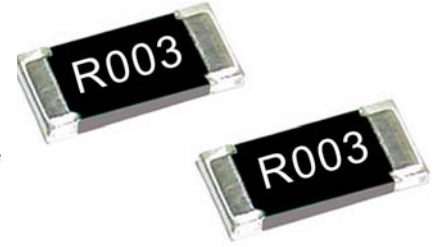
4 Terminal Bottom



CSRL / CSNL Series — Metal Foil Current Sensing Resistors

Features

- 2512 size
- 2W of power
- Low inductance – typically less than 0.1nH
- Resistances down to 0.0005 (1/2 milliΩ)
- TCR down to ±50 ppm/°C
- Current handling to 63 amps
- Non-standard resistance values available
- RoHS compliant / lead-free available



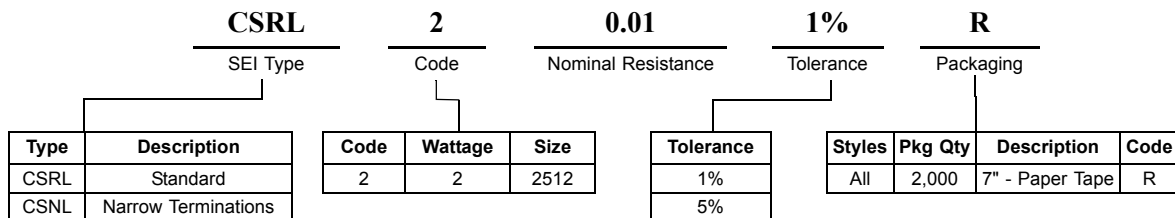
Electrical Specifications

Type / Code	Package Type	Power Rating (Watts) @ 70°C	Dielectric Withstanding Voltage	Resistance Temperature Coefficient	Ohmic Range and Tolerance	
					1%	5%
CSRL 2	2512	2	200	±50 ppm/°C	0.001Ω, 0.002Ω	0.001Ω, 0.002Ω
CSNL 2	2512	2	200	±50 ppm/°C	0.001Ω – 0.007Ω	0.001Ω – 0.007Ω

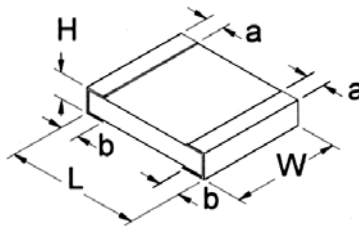
Performance Characteristics

Test	Test Specification	Typical
Moisture Resistance	±0.5%	≤0.5%
Load Life	±0.5%	≤0.5%
Leach Resistance	90 seconds min	>90 seconds
Resistance to Soldering Heat	±0.5%	≤0.25%
Solderability	min 95% coverage	≥95%
Temperature Cycling	±0.5%	≤0.5%
Thermal Shock	±0.5%	≤0.5%
Short Time Overload	±0.5%	≤0.5%
Insulation Resistance	1MΩ minimum	≥1MΩ

How to Order



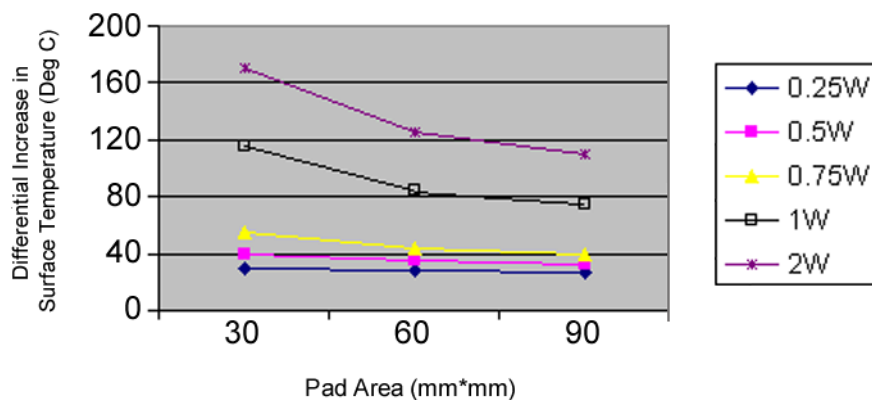
CSRL / CSNL Series — Metal Foil Current Sensing Resistors



Mechanical Specifications

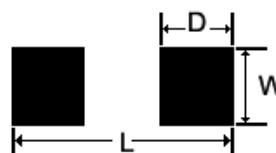
Type / Code	L Body Length	W Body Width	H Body Height	a Top Termination	b Bottom Termination	Units
CSRL 2 (2mΩ)	6.50 ± 0.33	3.20 ± 0.33	0.70 ± 0.15	1.90 ± 0.15	1.90 ± 0.15	mm
CSRL 2 (1mΩ)	6.50 ± 0.33	3.20 ± 0.33	0.80 ± 0.15	2.50 ± 2.50	2.50 ± 0.15	mm
CSNL 2 (0.5mΩ)	6.35 ± 0.25	3.18 ± 0.25	1.40 ± 0.20	1.30 ± 0.30	1.30 ± 0.30	mm
CSNL 2 (0.75mΩ)	6.35 ± 0.25	3.18 ± 0.25	1.00 ± 0.20	1.30 ± 0.30	1.30 ± 0.30	mm
CSNL 2 (1mΩ)	6.35 ± 0.25	3.18 ± 0.25	0.80 ± 0.20	1.30 ± 0.30	1.30 ± 0.30	mm
CSNL 2 (1.5mΩ)	6.35 ± 0.25	3.18 ± 0.25	0.65 ± 0.20	1.30 ± 0.30	1.30 ± 0.30	mm
CSNL 2 (2mΩ)	6.35 ± 0.25	3.18 ± 0.25	0.50 ± 0.20	1.30 ± 0.30	1.30 ± 0.30	mm
CSNL 2 (2.5mΩ)	6.35 ± 0.25	3.18 ± 0.25	1.00 ± 0.20	1.30 ± 0.30	1.30 ± 0.30	mm
CSNL 2 (3mΩ)	6.35 ± 0.25	3.18 ± 0.25	0.70 ± 0.20	1.30 ± 0.30	1.30 ± 0.30	mm
CSNL 2 (3.5mΩ)	6.35 ± 0.25	3.18 ± 0.25	0.71 ± 0.20	1.30 ± 0.30	1.30 ± 0.30	mm
CSNL 2 (4mΩ)	6.35 ± 0.25	3.18 ± 0.25	0.60 ± 0.20	1.30 ± 0.30	1.30 ± 0.30	mm
CSNL 2 (4.5mΩ)	6.35 ± 0.25	3.18 ± 0.25	0.58 ± 0.20	1.30 ± 0.30	1.30 ± 0.30	mm
CSNL 2 (5mΩ)	6.35 ± 0.25	3.18 ± 0.25	0.50 ± 0.20	1.30 ± 0.30	1.30 ± 0.30	mm
CSNL 2 (5.5mΩ)	6.35 ± 0.25	3.18 ± 0.25	0.47 ± 0.20	1.30 ± 0.30	1.30 ± 0.30	mm
CSNL 2 (6mΩ)	6.35 ± 0.25	3.18 ± 0.25	0.50 ± 0.20	1.30 ± 0.30	1.30 ± 0.30	mm
CSNL 2 (6.5mΩ)	6.35 ± 0.25	3.18 ± 0.25	0.47 ± 0.20	1.30 ± 0.30	1.30 ± 0.30	mm
CSNL 2 (7mΩ)	6.35 ± 0.25	3.18 ± 0.25	0.45 ± 0.20	1.30 ± 0.30	1.30 ± 0.30	mm
CSNL 2 (10mΩ)	6.35 ± 0.25	3.18 ± 0.25	0.80 ± 0.20	1.30 ± 0.30	1.30 ± 0.30	mm

R001



Solder Pad Dimensions

Type / Code	L Total Length	W Total Width	D Pad Depth	Units
CSRL 2	8.00	4.00	3.35	mm
CSNL 2	8.00	4.00	2.00	mm



CSRF Series — Foil on Ceramic Current Sensing Resistors

Features

- Power ratings to 2W
- Low inductance – typically less than 0.2nH
- Resistance range (0.001Ω - 0.50Ω)
- RoHS compliant / lead-free
- Non-standard resistance values available
- Current handling to 40 amps
- TCR down to ±50 ppm/°C



Electrical Specifications

Type / Code	Package Type	Power Rating (Watts) @ 70°C	Dielectric Withstanding Voltage	Resistance Temperature Coefficient*	Ohmic Range and Tolerance	
					1%	5%
CSRF 1/2	1206	0.5	200	±50 ppm/°C	0.005Ω – 0.009Ω	0.005Ω – 0.009Ω
CSRF 1	2010	1	200	±50 ppm/°C	0.001Ω – 0.500Ω	0.001Ω – 0.500Ω
CSRF 2	2512	2	200	±50 ppm/°C	0.003Ω – 0.500Ω	0.003Ω – 0.500Ω

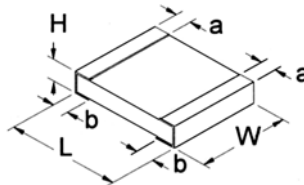
* Contact factory for values below 10Ω

Performance Characteristics

Test	Test Specification	Typical
Moisture Resistance	±0.5%	≤0.5%
Load Life	±0.5%	≤0.5%
Leach Resistance	90 seconds min	>90 seconds
Resistance to Soldering Heat	±0.5%	≤0.25%
Solderability	min 95% coverage	≥95%
Temperature Cycling	±0.5%	≤0.5%
Thermal Shock	±0.5%	≤0.5%
Short Time Overload	±0.5%	≤0.5%
Insulation Resistance	1MΩ minimum	≥1MΩ

Mechanical Specifications

Type / Code	L Body Length	W Body Width	H Body Height	a Top Termination	b Bottom Termination	Units
CSRF 1/2	0.126 ± 0.008 3.200 ± 0.200	0.063 ± 0.008 1.600 ± 0.200	0.032 ± 0.006 0.800 ± 0.150	0.020 ± 0.006 0.500 ± 0.150	0.020 ± 0.006 0.500 ± 0.150	inches mm
CSRF 1	0.197 ± 0.008 5.000 ± 0.200	0.098 ± 0.008 2.500 ± 0.200	0.032 ± 0.006 0.800 ± 0.150	0.020 ± 0.006 0.500 ± 0.150	0.039 ± 0.006 1.000 ± 0.150	inches mm
CSRF 2 (3mΩ)	0.256 ± 0.013 6.500 ± 0.330	0.126 ± 0.008 3.200 ± 0.200	0.037 ± 0.006 0.950 ± 0.150	0.075 ± 0.006 1.000 ± 0.150	0.075 ± 0.006 1.000 ± 0.150	inches mm
CSRF 2 (>3mΩ)	0.256 ± 0.013 6.500 ± 0.330	0.126 ± 0.008 3.200 ± 0.200	0.032 ± 0.006 0.800 ± 0.150	0.075 ± 0.006 1.000 ± 0.150	0.075 ± 0.006 1.000 ± 0.150	inches mm



How to Order

CSRF		2			0.01			1%		R		
SEI Type		Code			Nominal Resistance			Tolerance		Packaging		
Type	Description	Code	Wattage	Size	Tolerance			Pkg Qty	Description	Code		
CSRF	Foil / Ceramic	1/2	0.5	1206	1%			2,000	7" - Paper	R		
		1	1.0	2010	5%							
		2	2.0	2512								

MR/TMR Series—Low Resistance Value - Molded 2 and 4 Leads

Features

- Metal element resistors
- Excellent load life stability
- Inherently non-inductive
- Tinned copper leads - 10 lbs. pull
- Low temperature coefficient
- RoHS compliant / lead-free
- High power to size ratio
- Molded bodies
- Two or four terminal
- TMR - Kelvin Bridge Test
- Cut and formed product is available on select sizes; contact factory for details



Electrical Specifications

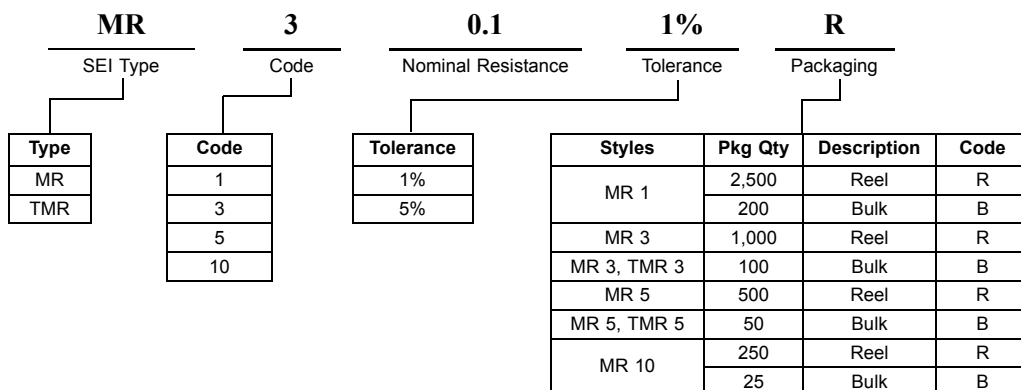
Type / Code	Power Rating (Watts) @ 70°C	Short Time Overload	Dielectric Strength	Resistance Temperature Coefficient	Ohmic Range and Tolerance
					1%, 5%
MR 1	1W	5 sec. at 5x Rated Power	500 VAC	50 - 400 ppm/°C*	0.01Ω - 0.1Ω
MR 3	3W	5 sec. at 5x Rated Power	500 VAC	50 - 400 ppm/°C*	0.005Ω - 0.2Ω
MR 5	5W	5 sec. at 5x Rated Power	500 VAC	50 - 400 ppm/°C*	0.005Ω - 0.3Ω
MR 10	10W	5 sec. at 5x Rated Power	500 VAC	50 - 400 ppm/°C*	0.01Ω - 0.5Ω
TMR 3	3W	5 sec. at 5x Rated Power	500 VAC	40 ppm/°C	0.005Ω - 0.2Ω
TMR 5	5W	5 sec. at 5x Rated Power	500 VAC	40 ppm/°C	0.005Ω - 0.3Ω

*TCR is value dependent. Please contact factory for specific data

Performance Characteristics

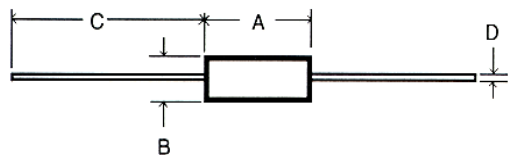
Test	Test Results
Moisture Resistance	±5%
Thermal Shock	±2%
Load Life @ 70°C - 1,000 hrs.	±5%
Resistance to Soldering Heat	±2%
Short Time Overload	±2%
Dielectric Withstanding Voltage	±2%
Operating Temperature Range	-55°C to +275°C

How to Order

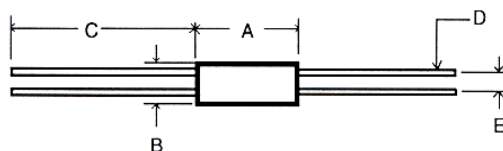


MR/TMR Series—Low Resistance Value - Molded 2 and 4 Leads

MR



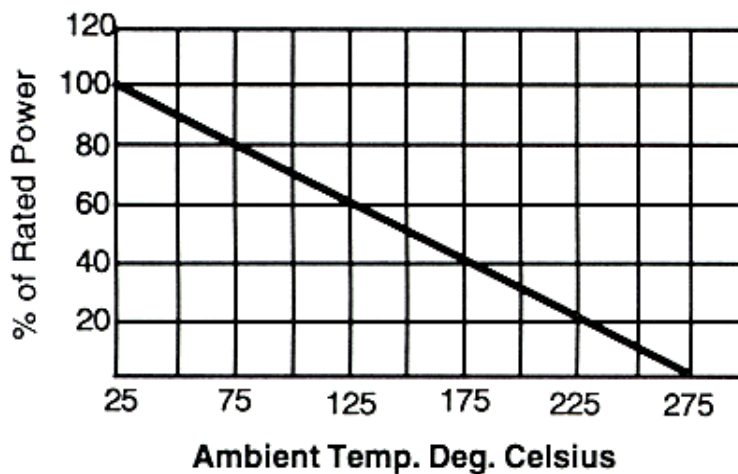
TMR



Mechanical Specifications

Type / Code	A Body Length	B Body Diameter	C Lead Length	D Lead Diameter	E Lead Spacing	Units
Tolerance	±0.015	±0.015	±0.125	±0.002	inches	inches
	±0.4	±0.4	±3.4	±0.05	mm	mm
MR 1	0.385 9.8	0.135 3.4	1.375 34.9	0.032 0.81	—	inches mm
MR 3	0.560 14.2	0.205 5.2	1.375 34.9	0.032 0.81	—	inches mm
MR 5	0.925 23.5	0.330 8.4	1.375 34.9	0.036 0.91	—	inches mm
MR 10	1.925 46.4	0.475 10.0	1.375 34.9	0.036 0.91	—	inches mm
TMR 3	0.625 15.9	0.205 5.2	1.375 34.9	0.032 0.81	0.125 3.2	inches mm
TMR 5	0.940 23.9	0.330 8.4	1.375 34.9	0.036 0.91	0.200 5.1	inches mm

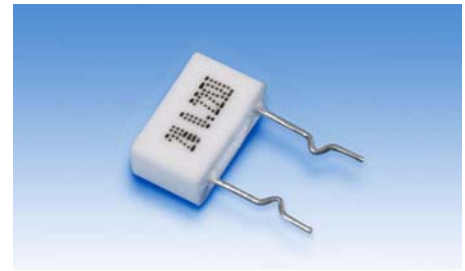
Power Derating



MPR Series — Flameproof Metal Plate Resistor

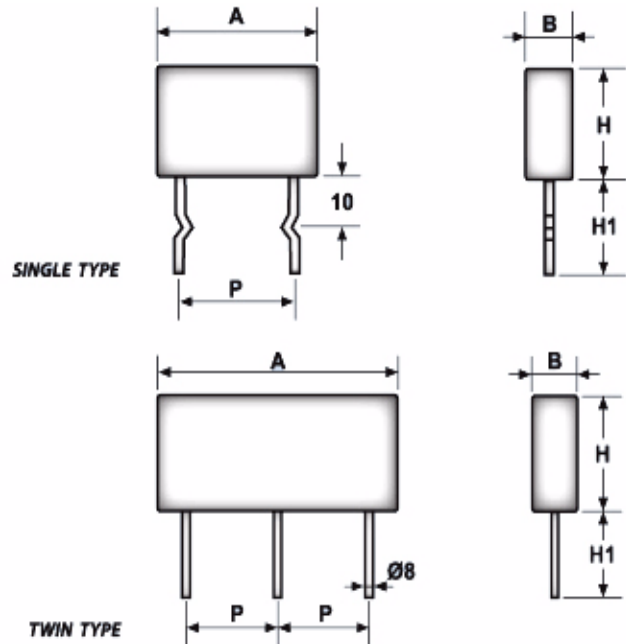
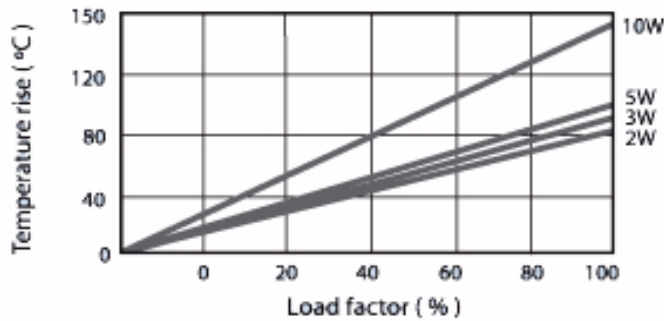
Features

- Small size with high power ratio
- Low resistance values and low inductance
- Crimped leads keep circuit board temperatures cooler
- Leadfree and RoHS compliant



Mechanical Specifications

Type	Single Type - Dimensions (mm)					Resistance	TCR (ppm/°C)
	A	B	H	H1	P	E12xJ(±5%)	
MPR 2W	14 ± 1	4 ± 0.5	9 ± 0.7	15 ± 1	9.5 ± 1	0.01 ~ 0.68	± 350
MPR 3W	14 ± 1	5 ± 0.5	13 ± 0.7	15 ± 1	9.5 ± 1	0.01 ~ 0.68	
MPR 5W	14 ± 1	5 ± 0.5	18 ± 0.7	15 ± 1	9.5 ± 1	0.01 ~ 1.0	
MPR 10W	26 ± 1	5 ± 0.5	20 ± 0.7	15 ± 1	20 ± 0.5	0.05 ~ 1.0	
Twin Type - Dimensions (mm)							
MPRT 3W (3W + 3W)	26 ± 1	5 ± 0.5	14 ± 0.7	15 ± 1	9.5 ± 0.5	0.05 ~ 0.68	± 350
MPRT 5W (5W + 5W)	26 ± 1	5 ± 0.5	17 ± 0.7	15 ± 1	9.5 ± 0.5		



How to Order

MPR		2	0.47	5%	R		
SEI Type		Code	Resistance	Tolerance	Packaging		
SEI Type	Description	Code	Wattage	Tolerance	Code	Description	Pkg Qty
MPR	Single	2	2W	5%	B	Bulk	1000
MPRT	Twin	3	3W	10%			
		5	5W				
		10	10W				

MG Series — High Voltage Metal Glaze Resistor

Features

- High voltage capability from 1600 to 3500 volts
- High resistance values up to 200M
- Inexpensive high voltage leaded resistor solution
- Tolerances as low as 1%, TC's as low as 100ppm/°C

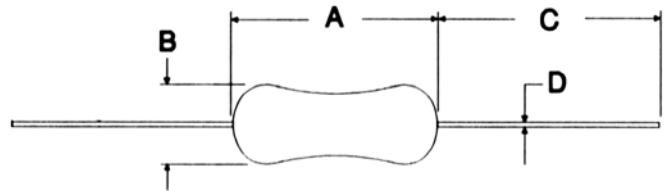
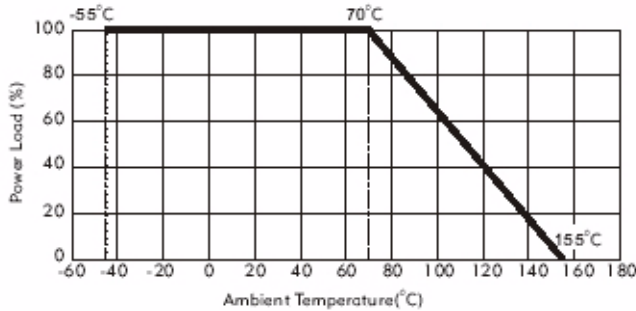


Electrical Specifications

Type / Code	Power Rating (Watts) @ 70°C	Maximum Working Voltage*	Dielectric Withstanding Voltage	Resistance Range	Resistance Tolerance	Resistance Temperature Coefficient	Operating Temperature Rating
MG 1/4	0.25	1600	600	100K - 200M	± 5% ± 1%	±200ppm/°C	-55°C - +155°C
MG 1/2	0.5	2000	600				
MG 1	1	3500	600				
MG2	2	3500	600				

Mechanical Specifications

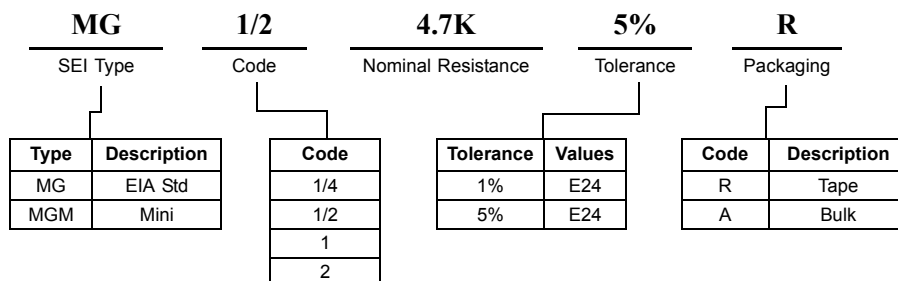
Type / Code	A Body Length	B Body Diameter	C Lead Length (Bulk)	D Lead Diameter	Units
MG 1/4	6 ± 0.3	2.4 ± 0.1	28 ± 2	0.6 ± 0.05	mm
MG 1/2	9 ± 0.5	3.3 ± 0.5	30 ± 3	0.6 ± 0.05	mm
MG 1	12 ± 2	4.5 ± 0.5	38 ± 3	0.8 ± 0.05	mm
MG 2	16 ± 2	5.5 ± 0.5	38 ± 3	0.8 ± 0.05	mm



Performance Characteristics

Test	Requirement
Short Time Overload	± (1.0% + 0.05Ω)
Moisture Resistance	± (5.0% + 0.05Ω)
Load Life	± (3.0% + 0.05Ω)
Insulation Resistance	>1,000 MΩ
Resistance to Soldering Heat	± (0.1% + 0.05Ω)
Temperature Cycling	± (0.1% + 0.05Ω)
Terminal Strength	± (0.1% + 0.05Ω)
Low Temperature Operation	± (0.1% + 0.05Ω)

How to Order



RN/RNM Series — General Purpose Metal Film Resistors

Features

- Precision metal film
- Superior electrical, TCR performances
- Flame-retardant coatings are standard
- Panasert available (selected sizes; contact factory)
- RNM (mini) an ideal choice where size constraints apply
- RoHS compliant / lead-free available (RNF/RNMF)



Electrical Specifications

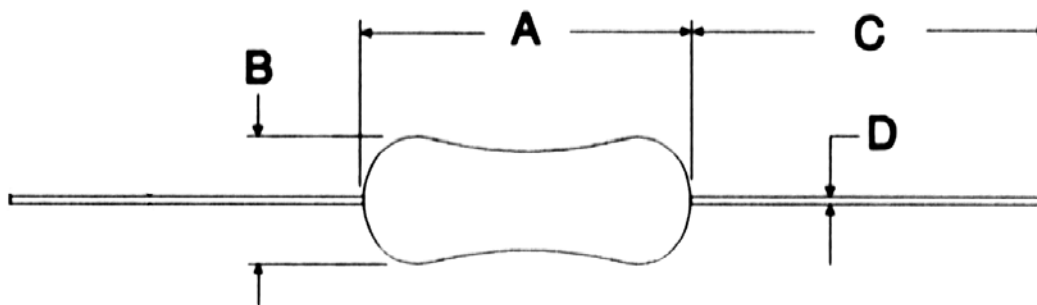
Type / Code	Power Rating (Watts) @ 70°C	Max Working Voltage*	Max Pulse Voltage	Resistance Temperature Coefficient	Ohmic Range and Tolerance				
					0.1%	0.25%	0.5%	1%	5%
RN 1/8	0.125W	200	400	±100 ppm/°C ±50 ppm/°C ±25 ppm/°C	100Ω – 100K 100Ω – 100K 100Ω – 100K	100Ω – 100K 100Ω – 100K 100Ω – 100K	10Ω – 1M 10Ω – 1M 30.1Ω – 499K	10Ω – 2.37M 10Ω – 1M 49.9Ω – 499K	1Ω – 2.2M – –
RN 1/4	0.25W	250	500	±100 ppm/°C ±50 ppm/°C ±25 ppm/°C ±10 ppm/°C	30.1Ω – 1M 30.1Ω – 1M 30.1Ω – 1M 100Ω – 100K	30.1Ω – 1M 30.1Ω – 1M 30.1Ω – 1M –	10Ω – 1M 10Ω – 1M 30.1Ω – 1M –	1Ω – 10M 1Ω – 5.11M 30.1Ω – 1M –	1Ω – 10M – – –
RN 1/2	0.5W	350	700	±100 ppm/°C ±50 ppm/°C ±25 ppm/°C	100Ω – 100K 100Ω – 100K 100Ω – 100K	100Ω – 100K 100Ω – 100K 100Ω – 100K	10Ω – 1M 10Ω – 1M 49.9Ω – 499K	1Ω – 10M 1Ω – 4.99M 49.9Ω – 499K	1Ω – 10M – –
RN 1	1W	350	700	±100 ppm/°C ±50 ppm/°C	–	–	– 10Ω – 100K	10Ω – 1M 10Ω – 1M	–
RNM 1/4	0.25W	250	500	±100 ppm/°C ±50 ppm/°C ±25 ppm/°C	100Ω – 100K 100Ω – 100K 100Ω – 100K	100Ω – 100K 100Ω – 100K 100Ω – 100K	10Ω – 1M 10Ω – 1M 30.1Ω – 499K	10Ω – 4.99M 10Ω – 1M 30.1Ω – 499K	10Ω – 2M – –
RNM 1/2	0.5W	350	700	±100 ppm/°C ±50 ppm/°C ±25 ppm/°C	30.1Ω – 1M 30.1Ω – 1M 100Ω – 294K	30.1Ω – 1M 30.1Ω – 1M 100Ω – 294K	10Ω – 1M 10Ω – 1M 49.9Ω – 1M	10Ω – 10M 1Ω – 2.15M 49.9Ω – 1M	10Ω – 2M – –

* Lesser of √PR or maximum working voltage.

How to Order

RN		1/4	T1	4.75K	1%	R			
SEI Type		Code	TCR	Nominal Resistance	Tolerance	Packaging			
Type	Description	Code	TCR	Tolerance	Values	Styles	Pkg Qty	Description	Code
RN	EIA standard	1/8	T1 = 100ppm	0.1%	E96	1/8, 1/4, RNM 1/2	5,000	Reel	R
RNM	Mini	1/4	T2 = 50ppm	0.25%	E96	RN 1/2, 1	2,500	Ammo	T
RNF	Standard RoHS	1/2	T9 = 25ppm	0.5%	E96	1/8, 1/4, 1/2	2,000		
RNMF	Mini RoHS	1	TB = 10ppm	1%	E96, E24	1	2,500	Bulk	A
				5%	E24	1/8, 1/4, 1/2	1,000		

RN/RNM Series — General Purpose Metal Film Resistors



Mechanical Specifications

Type / Code	A Body Length	B Body Diameter	C Lead Length (Bulk)	D Lead Diameter	Units
RN 1/8	0.13 ± 0.01/-0 3.2 ± 0.2/-0	0.073 ± 0.006 1.85 ± 0.20	1.10 ± 0.08 28.0 ± 2.0	0.018 ± 0.002 0.45 ± 0.05	inches mm
RN 1/4	0.24 ± 0.01 6.0 ± 0.3	0.09 ± 0.01 2.4 ± 0.2	1.10 ± 0.08 28.0 ± 2.0	0.023 ± 0.002 0.60 ± 0.05	inches mm
RN 1/2	0.33 ± 0.02 8.5 ± 0.5	0.11 ± 0.01 2.8 ± 0.3	1.10 ± 0.08 28.0 ± 2.0	0.027 ± 0.002 0.70 ± 0.05	inches mm
RNM 1/4	0.13 ± 0.01/-0 3.2 ± 0.2/-0	0.073 ± 0.006 1.85 ± 0.20	1.10 ± 0.08 28.0 ± 2.0	0.018 ± 0.002 0.45 ± 0.05	inches mm
RNM 1/2	0.24 ± 0.01 6.0 ± 0.3	0.09 ± 0.01 2.4 ± 0.2	1.10 ± 0.08 28.0 ± 2.0	0.023 ± 0.002 0.60 ± 0.05	inches mm
RN 1	0.433 ± 0.04 11.0 ± 1.0	0.177 ± 0.02 4.5 ± 0.5	1.18 ± 0.12 30 ± 3.0	0.032 ± 0.004 0.8 ± 0.1	inches mm

Performance Characteristics

Test	Standard / Method	Requirement
Biased Humidity	MIL-STD 202, Method 103	± 1.5%
Resistance to Solder Heat	MIL-STD 202, Method 210	± 0.5%
Insulation Resistance	JIS C 5202 5.6	± 0.5%
Load Life	MIL-STD 202, Method 208	± 1.0%
Terminal Strength	MIL-STD 202, Method 211	± 0.2%
Temperature Cycling	JESD22 Method JA-104	± 1.0%
Moisture Resistance	MIL-STD 202, Method 106	± 0.5%

RS / RSM Series — General Purpose Metal Oxide Resistors

Features

- Lower-cost alternative to Carbon Comps and Wirewounds
- Flameproof – meets overload test of UL #1412
- Meets solvent test of Mil Standard 202, Method 215
- Cut and formed product is available on select sizes; contact factory for details
- RSM style an ideal choice when size constraints apply
- Operating temperature range: -55°C to +155°C
- Temperature coefficient of resistance of ±200ppm
- Coating meets UL 94V-0
- Panasert lead form available; contact factory for details
- RoHS compliant / lead-free available (RSF, RSMF)



Electrical Specifications

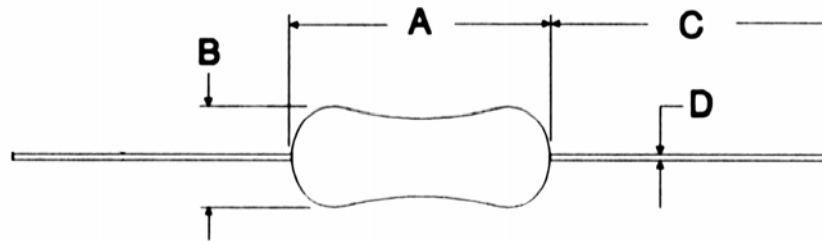
Type / Code	Power Rating (Watts) @ 70°C	Maximum Working Voltage*	Maximum Pulse Voltage	Dielectric Withstanding Voltage	Resistance Temperature Coefficient	Ohmic Range and Tolerance		
						1%	2%	5%
RS 1/2	0.5W	250	400	400	±200 ppm/°C	0.1Ω – 150K	0.1Ω – 150K	0.1Ω – 1M
RS 1	1W	350	600	500	±200 ppm/°C	0.1Ω – 100K	0.1Ω – 100K	0.1Ω – 1M
RS 2	2W	350	600	500	±200 ppm/°C	0.1Ω – 120K	0.1Ω – 120K	0.1Ω – 1M
RS 3	3W	500	800	800	±200 ppm/°C	10Ω – 4.99K	1Ω – 150K	1Ω – 150K
RS 5	5W	750	1,000	800	±200 ppm/°C	–	10Ω – 10K	1Ω – 180K
RSM 1/2	0.5W	250	400	400	±200 ppm/°C	0.1Ω – 46.4K	0.1Ω – 47K	0.1Ω – 470K
RSM 1	1W	350	600	500	±200 ppm/°C	0.1Ω – 75K	0.1Ω – 75K	0.1Ω – 470K
RSM 2	2W	350	600	500	±200 ppm/°C	0.1Ω – 100K	0.1Ω – 100K	0.1Ω – 470K
RSM 3	3W	500	800	500	±200 ppm/°C	0.1Ω – 118K	0.1Ω – 120K	0.1Ω – 470K
RSM 5	5W	750	1,000	750	±200 ppm/°C	100Ω – 4.99K	10Ω – 20K	1Ω – 150K

* Lesser of \sqrt{PR} or maximum working voltage.

How to Order

RS		1/2	0.47	5%	R			
SEI Type		Code	Nominal Resistance		Tolerance	Packaging		
Type	Description	Code	Tolerance	Values	Series	Pkg Qty	Description	Code
RS	EIA Standard	1/2	1%	E96	RS 1/2, RSM 1 RS 1, RSM 2 RS 2, RSM 3 RS 3, RSM 5	5,000 2,500 2,000 1,000 500	Tape	R
RSM	Mini	1	2%	E24				
RSF	Standard RoHS	2	5%	E24				
RSMF	Mini RoHS	3			RS 1/2, RSM 1/2, RSM 1	2,000	Ammo	T
		5			RS 1, RS 2, RSM 2, RSM 3 RS 3, RSM 5	1,000 500		
					All	1,000	Bulk	A

RS/RSM Series — General Purpose Metal Oxide Resistors



Mechanical Specifications

Type / Code	A Body Length	B Body Diameter	C Lead Length (Bulk)	D Lead Diameter	Units
RS 1/2	0.35 ± 0.04	0.12 ± 0.02	1.10 ± 0.08	0.028 ± 0.002	inches
	9.0 ± 1.0	3.0 ± 0.5	28.0 ± 2.0	0.70 ± 0.05	mm
RS 1	0.43 ± 0.04	0.16 ± 0.02	1.10 ± 0.08	0.031 ± 0.002	inches
	11.0 ± 1.0	4.0 ± 0.5	28.0 ± 2.0	0.80 ± 0.05	mm
RS 2	0.59 ± 0.04	0.22 ± 0.04	1.38 ± 0.12	0.031 ± 0.002	inches
	15.0 ± 1.0	5.5 ± 1.0	35.0 ± 3.0	0.80 ± 0.05	mm
RS 3	0.98 ± 0.08	0.34 ± 0.06	1.38 ± 0.12	0.031 ± 0.002	inches
	25 ± 2.0	8.5 ± 1.5	35.0 ± 3.0	0.80 ± 0.05	mm
RS 5	1.61 ± 0.08	0.34 ± 0.06	1.38 ± 0.12	0.031 ± 0.002	inches
	41.0 ± 2.0	8.5 ± 1.5	35.0 ± 3.0	0.80 ± 0.05	mm
RSM 1/2	0.24 ± 0.02	0.09 ± 0.01	1.10 ± 0.08	0.024 ± 0.002	inches
	6.0 ± 0.5	2.3 ± 0.2	28.0 ± 2.0	0.60 ± 0.05	mm
RSM 1	0.35 ± 0.04	0.12 ± 0.02	1.10 ± 0.08	0.028 ± 0.002	inches
	9.0 ± 1.0	3.0 ± 0.5	28.0 ± 2.0	0.70 ± 0.05	mm
RSM 2	0.43 ± 0.04	0.16 ± 0.02	1.10 ± 0.08	0.031 ± 0.002	inches
	11.0 ± 1.0	4.0 ± 0.5	28.0 ± 2.0	0.80 ± 0.05	mm
RSM 3	0.59 ± 0.04	0.22 ± 0.04	1.38 ± 0.12	0.031 ± 0.002	inches
	15.0 ± 1.0	5.5 ± 1.0	35.0 ± 3.0	0.80 ± 0.05	mm
RSM 5	0.98 ± 0.08	0.34 ± 0.06	1.38 ± 0.12	0.031 ± 0.002	inches
	25.0 ± 2.0	8.5 ± 1.5	35.0 ± 3.0	0.80 ± 0.05	mm

Performance Characteristics

Test	Standard / Method	Requirement
Biased Humidity	MIL-STD 202, Method 103	± 1.5%
Resistance to Solder Heat	MIL-STD 202, Method 103	± 0.5%
Dielectric Withstanding Voltage	MIL-STD 202, Method 103	± 0.5%
Load Life	MIL-STD 202, Method 103	± 1.0%
Terminal Strength	MIL-STD 202, Method 103	± 0.2%
Temperature Cycling	JESD22 Method JA-104	± 1.0%
Moisture Resistance	MIL-STD 202, Method 103	± 0.5%
Vibration	MIL-STD 202, Method 103	± 0.5%
Low Temperature Operation	MIL-STD 202, Method 103	± 0.5%

ASR/ASRM Series — Anti-Surge Resistors

Features

- Extended value range from 100Ω to 33M
- Excellent anti-surge characteristics
- Stable characteristics through the resistance range
- Good alternative to carbon composition resistors
- RoHS compliant / lead-free
- Applications include power supplies, CRT's and anti-surge circuits
- Cut and formed product is available on select sizes, contact factory for details



Electrical Specifications

Type / Code	Power Rating (Watts) @ 70°C	Maximum Working Voltage*	Maximum Overload Voltage	Surge Withstanding	Ohmic Range and Tolerance	
					5%	10%
ASRM 1/4	0.25W	500V	1,000V	2KV	100KΩ – 20MΩ	–
ASRM 1/2	0.50W	700V	1,000V	5KV	100Ω – 510KΩ	–
				10KV	560KΩ – 910KΩ	22MΩ – 33MΩ
ASR 1	1.00W	1,000V	1,500V	5KV	100Ω – 510KΩ	–
				10KV	560KΩ – 910KΩ	22MΩ – 33MΩ
					13MΩ – 20MΩ	

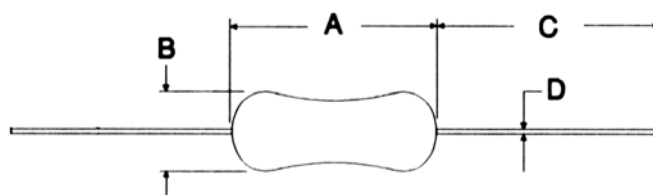
* Lesser of \sqrt{PR} or maximum working voltage

Mechanical Specifications

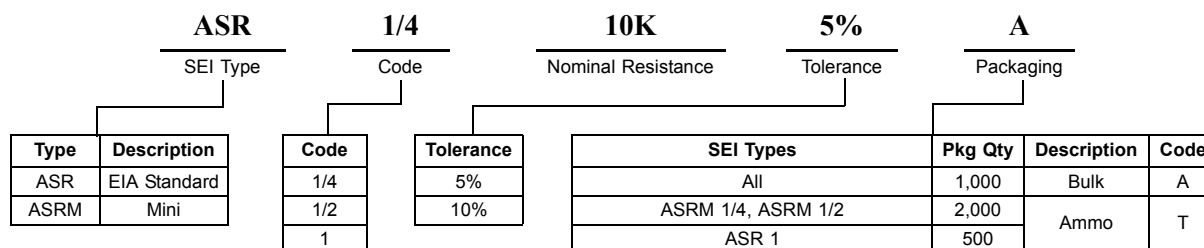
Type / Code	A Body Length	B Body Diameter	C Lead Length (Bulk)	D Lead Diameter	Units
ASRM 1/4	0.24 ± 0.01	0.09 ± 0.01	1.10 ± 0.08	0.024 ± 0.002	inches
	6.0 ± 0.3	2.3 ± 0.2	28.0 ± 2.0	0.6 ± 0.05	mm
ASRM 1/2	0.35 ± 0.03	0.12 ± 0.02	1.10 ± 0.08	0.027 ± 0.002	inches
	9.0 ± 1.0	3.0 ± 0.5	28.0 ± 2.0	0.7 ± 0.05	mm
ASR 1	0.59 ± 0.04	0.22 ± 0.02	1.38 ± 0.12	0.031 ± 0.002	inches
	15.0 ± 1.0	5.5 ± 0.5	35.0 ± 3.0	0.8 ± 0.05	mm

Performance Characteristics (JIS C 5202)

Test	Test Results
Moisture Resistance	±5%
Temperature Cycling	±1%
Load Life	±5%
Resistance to Soldering Heat	±1%
Short Time Overload	±1%
Operating Temperature Range	-55°C to +155°C
Discharge	±50%



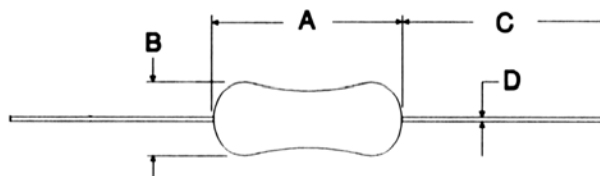
How to Order



SPR/SPRM Series — Discharge Path Resistors

Features

- UL 1676 recognized
- Excellent anti-surge characteristics
- Stable characteristics through the resistance range
- Applications include power supplies, CRT's and anti-surge circuits
- Good alternative to Carbon Composition Resistors
- Cut and formed product is available on select sizes, contact factory for details
- RoHS compliant / lead-free



Electrical Specifications

Type / Code	Power Rating (Watts) @ 70°C	Maximum Working Voltage*	Maximum Overload Voltage	Ohmic Range and Tolerance	
				5%	10%
SPRM 1/2	0.5W	700	2,000	1M – 12M	1M – 12M
SPR 1	1W	1,000	2,000	1M – 12M	1M – 12M

* Lesser of \sqrt{PR} or maximum working voltage.

Mechanical Specifications

Type / Code	A Body Length	B Body Diameter	C Lead Length (Bulk)	D Lead Diameter	Units
SPRM 1/2	0.35 ± 0.03	0.12 ± 0.02	1.10 ± 0.08	0.027 ± 0.002	inches
	9.0 ± 1.0	3.0 ± 0.5	28.0 ± 2.0	0.7 ± 0.05	mm
SPR 1	0.59 ± 0.04	0.30 ± 0.03	1.38 ± 0.12	0.031 ± 0.002	inches
	15.0 ± 1.0	7.5 ± 1.0	35.0 ± 3.0	0.8 ± 0.05	mm

Performance Characteristics (JIS C 5202)

Test	Test Results
Moisture Resistance	±5%
Temperature Cycling	±1%
Load Life	±5%
Resistance to Soldering Heat	±1%
Short Time Overload	±1%
Operating Temperature Range	-55°C ~ +155°C
Discharge	±50%

How to Order

SEI Type		Code	Nominal Resistance		Tolerance	Packaging			
Type	Description	Code	Tolerance	Values	SEI Types	Pkg Qty	Description	Code	
SPR	EIA Standard	1/2	5%	E24	SPRM 1/2, SPR 1	1,000	Bulk	A	
SPRM	Mini	1	10%	E12	SPRM 1/2	2,000	Ammo	T	
					SPR 1	500			

RSPF / RSPL Series — Flameproof Power Resistors

Features

- Flameproof design
- Compact size
- Useful in circuits where duty cycles require power resistors
- Tin-plated copper leads
- Cut and formed product is available on select sizes, contact factory for details
- RoHS compliant / lead-free

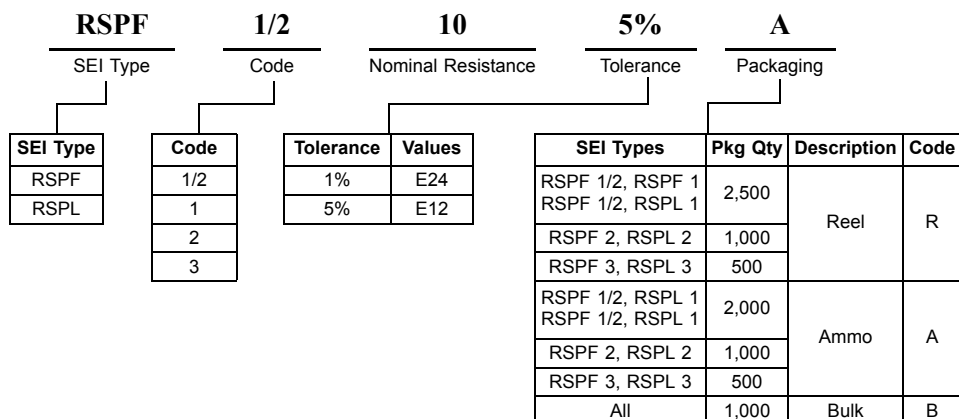


Electrical Specifications

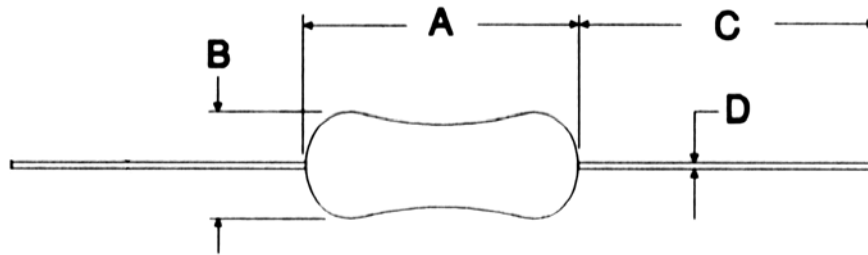
Type / Code	Power Rating (Watts) @ 70°C	Maximum Working Voltage	Maximum Pulse Voltage	Resistance Temperature Coefficient	Ohmic Range and Tolerance	
					1%	5%
RSPF 1/2	0.5W	400	800	-200 ppm/°C ~ +350ppm/°C	10Ω – 100K	2.2Ω – 1M
RSPF 1	1W	500	1,000	-200 ppm/°C ~ +350ppm/°C	10Ω – 100K	2.2Ω – 1M
RSPF 2	2W	500	1,000	-200 ppm/°C ~ +350ppm/°C	10Ω – 100K	2.2Ω – 1M
RSPF 3	3W	500	1,000	-200 ppm/°C ~ +350ppm/°C	10Ω – 100K	2.2Ω – 1M
RSPL 1/2	0.5W	√PR	√PR x 2.5	-200 ppm/°C ~ +350ppm/°C	–	0.1Ω – 2Ω
RSPL 1	1W	√PR	√PR x 2.5	-200 ppm/°C ~ +350ppm/°C	–	0.1Ω – 2Ω
RSPL 2	2W	√PR	√PR x 2.5	-200 ppm/°C ~ +350ppm/°C	–	0.1Ω – 2Ω
RSPL 3	3W	√PR	√PR x 2.5	-200 ppm/°C ~ +350ppm/°C	–	0.1Ω – 2Ω

* Lesser of √PR or maximum working voltage

How to Order



RSPF / RSPL Series — Flameproof Power Resistors



Mechanical Specifications

Type / Code	A Body Length	B Body Diameter	C Lead Length (Bulk)	D Lead Diameter	Units
RSPF / RSPL 1/2	0.24 ± 0.04 6.0 ± 0.3	0.09 ± 0.01 2.3 ± 0.2	1.10 ± 0.08 28.0 ± 2.0	0.024 ± 0.002 0.6 ± 0.05	inches mm
RSPF / RSPL 1	0.35 ± 0.02 9.0 ± 0.5	0.12 ± 0.02 3.0 ± 0.5	1.10 ± 0.08 28.0 ± 2.0	0.028 ± 0.002 0.7 ± 0.05	inches mm
RSPF / RSPL 2	0.43 ± 0.02 11.0 ± 0.5	0.16 ± 0.02 4.0 ± 0.5	1.38 ± 0.12 35.0 ± 3.0	0.031 ± 0.002 0.8 ± 0.05	inches mm
RSPF / RSPL 3	0.59 ± 0.02 15.0 ± 0.5	0.22 ± 0.02 5.5 ± 0.5	1.38 ± 0.12 35.0 ± 3.0	0.031 ± 0.002 0.8 ± 0.05	inches mm

Performance Characteristics (JIS C 5202)

Test	Test Results
Operating Temperature Range	-55°C to + 155°C
Short Time Overload	±(0.75% + 0.05Ω)
Moisture Resistance	±(5% + 0.05Ω)
Load Life @ 70°C – 1,000 hrs	±(5% + 0.05Ω)
Dielectric Withstanding Voltage	±(5% + 0.05Ω)
Resistance to Solvent	Permanent marking no physical damage or deterioration
Non-combustibility	Does not burn continuously for more than 5 seconds

FRN Series — Fusing Resistors

Features

- Coating meets UL 94V-0
- Flameproof – meets overload test of UL #1412
- Designed for constant current to provide overload protection
- Consistent performance and reliability
- Cut and formed product is available on select sizes, contact factory for details
- RoHS compliant / lead-free



Electrical Specifications

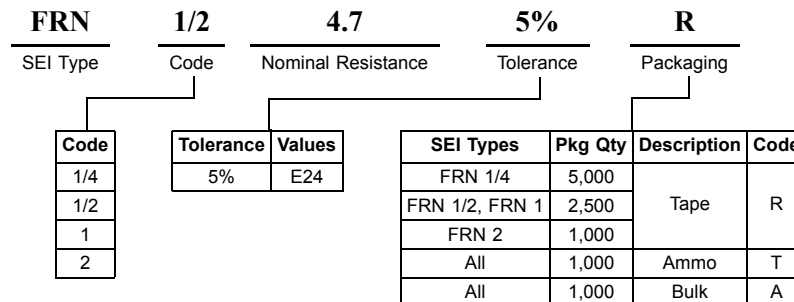
Type / Code	Power Rating (Watts) @ 70°C	Maximum Working Voltage*	Maximum Overload Voltage	Resistance Temperature Coefficient	Ohmic Range and Tolerance
					5%
FRN 1/4	0.25W	200	300	±350 ppm/°C	0.22Ω – 10K
FRN 1/2	0.5W	250	400	±350 ppm/°C	0.47Ω – 10K
FRN 1	1W	300	600	±350 ppm/°C	0.47Ω – 10K
FRN 2	2W	300	600	±350 ppm/°C	1Ω – 3K

*Lesser of \sqrt{PR} or maximum working voltage.

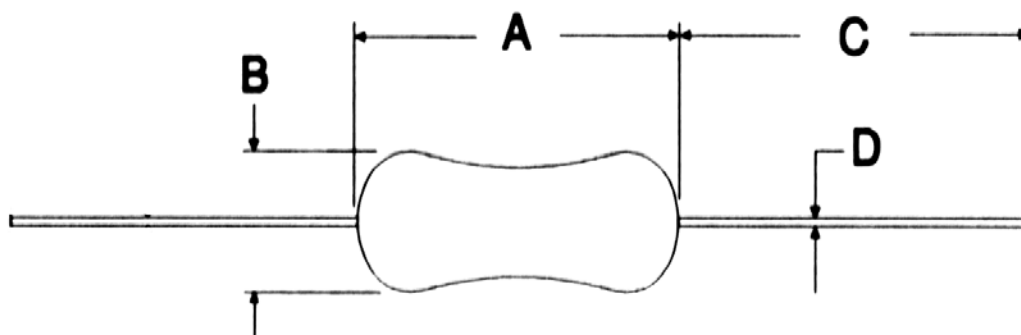
Fusing Characteristics Magnification of Power Rating

Type / Code	X25	X15	X12	Fusing Time
FRN 1/4	0.22Ω – 0.91Ω	1Ω – 4.7KΩ 2.4KΩ – 10KΩ	5.1Ω – 2.2KΩ	30 Sec. Maximum
FRN 1/2	–	0.47Ω – 2Ω 1.1KΩ – 10KΩ	2.2Ω – 1KΩ	
FRN 1	–	0.47Ω – 2Ω 1.1KΩ – 10KΩ	2.2Ω – 1KΩ	
FRN 2	–	1Ω – 3.6Ω 1.1KΩ – 3KΩ	3.9Ω – 1KΩ	

How to Order



FRN Series — Fusing Resistors



Mechanical Specifications

Type / Code	A Body Length	B Body Diameter	C Lead Length (Bulk)	D Lead Diameter	Units
FRN 1/4	0.24 ± 0.01	0.09 ± 0.01	1.10 ± 0.08	0.022 ± 0.002	inches
	6.0 ± 0.2	2.3 ± 0.2	28.0 ± 2.0	0.55 ± 0.05	mm
FRN 1/2	0.35 ± 0.02	0.11 ± 0.02	1.10 ± 0.08	0.028 ± 0.002	inches
	9.0 ± 0.5	2.8 ± 0.5	28.0 ± 2.0	0.70 ± 0.05	mm
FRN 1	0.43 ± 0.02	0.16 ± 0.02	1.10 ± 0.08	0.028 ± 0.002	inches
	11.0 ± 0.5	4.0 ± 0.5	28.0 ± 2.0	0.70 ± 0.05	mm
FRN 2	0.59 ± 0.04	0.22 ± 0.02	1.38 ± 0.12	0.031 ± 0.002	inches
	15.0 ± 1.0	5.5 ± 0.5	35.0 ± 3.0	0.80 ± 0.05	mm

Performance Characteristics

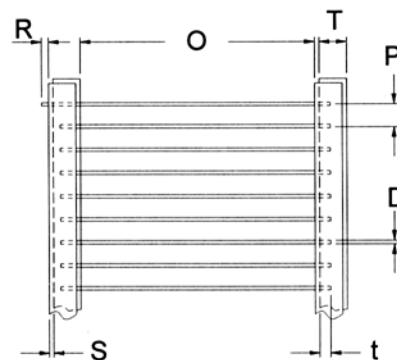
Test	Test Results
Moisture Resistance	±5.0%
Thermal Shock	±1.0%
Load Life @ 70°C – 1,000hrs	±5.0%
Resistance to Soldering Heat	±1.0%
Short Time Overload	±2.0%
Operating Temperature Range	-40°C to +155°C

JW Series — Jumper Wire

Features

- Ideal for crossovers or jumpers on circuit boards
- High current rating
- Cut and formed product is available on select sizes, contact factory for details
- RoHS compliant / lead-free

Electrical & Mechanical Specifications			
Part Number	Diameter inches mm	Gauge Reference	Maximum Current
JW 50 R	0.020 ± 0.001 0.50 ± 0.02	24	2 Amp.
JW 55 R	0.022 ± 0.001 0.55 ± 0.03	23	3 Amp.
JW 60 R	0.024 ± 0.001 0.60 ± 0.03	22	3 Amp.
JW 80 R	0.031 ± 0.001 0.80 ± 0.05	20	4 Amp.



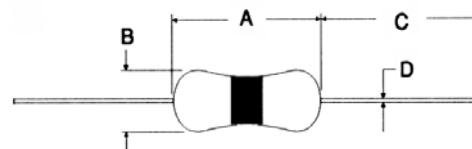
*Bulk packaging available upon request.

Packaging Specifications							
O	P	T	R	D	t	S	Units
2.047 ± 0.039 52.00 ± 1.00	0.200 ± 0.016 5.00 ± 0.40	0.236 ± 0.039 6.00 ± 1.00	0	See TYPE above	0.118 min. 3.00 min.	0.020 max. 0.50 max.	inches mm

CD Series — Zero Ohm Resistors

Features

- Ideal for crossovers or jumpers on circuit boards with auto-insertion capability
- High current rating
- Cut and formed product is available on select sizes, contact factory for details
- RoHS compliant / lead-free



Electrical Specifications				
Part Number	Current Rating (Amps) @ 70°C	Dielectric Withstanding Voltage	Marking	Resistance
CD 1/8 0 R	2A	300	Single black band	0.01Ω or less
CD 1/4 0 R	3A	500	Single black band	0.01Ω or less
CD 1/2 0 R	4A	600	Single black band	0.01Ω or less

Mechanical Specifications					
Type	A - Body Length	B - Body Diameter	C - Lead Length (Bulk)	D - Lead Diameter	Units
CD 1/8	0.12 +0.01/-0.00	0.07 ± 0.01	1.10 ± 0.08	0.018 ± 0.001	inches
	3.2 +0.2/-0.0	1.8 ± 0.2	28.0 ± 2.0	0.45 ± 0.02	mm
CD 1/4	0.24 ± 0.01	0.09 ± 0.001	1.10 ± 0.08	0.022 ± 0.001	inches
	6.0 ± 0.3	2.3 ± 0.2	28.0 ± 2.0	0.55 ± 0.03	mm
CD 1/2	0.33 +0.02/-0.00	0.11 ± 0.02	1.10 ± 0.08	0.03 ± 0.001	inches
	8.5 +0.5/-0.0	2.7 ± 0.5	28.0 ± 2.0	0.7 ± 0.05	mm

SM Series—Surface Mount Wirewound Resistors

Features

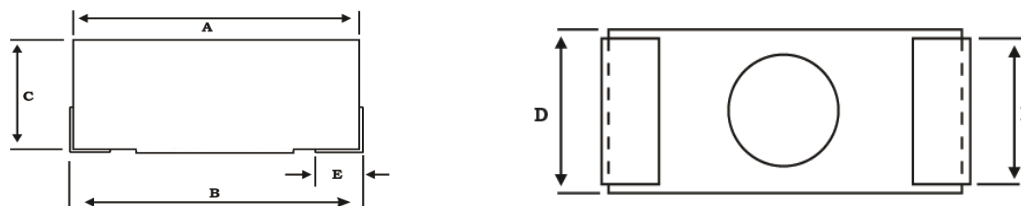
- High temperature molded encapsulation
- Flex termination for absorbing thermal expansion
- All welded construction
- Tinned copper terminals
- Available in non-inductive styles
- RoHS compliant/ lead-free



Electrical Specifications

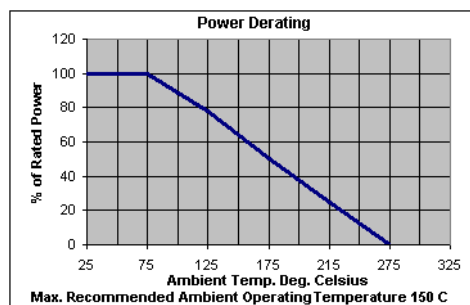
Type	Power Rating (Watts) @ 70°C	Maximum Working Voltage	Resistance Temperature Coefficient	Ohmic Range and Tolerance
				0.1%, 0.5%, 1% & 5%
SM 1	1W	25	±100 ppm/°C ± 20 ppm/°C	0.01Ω – 10Ω* 10Ω – 1K
SM 2	2W	50	±100 ppm/°C ± 20 ppm/°C	0.01Ω – 10Ω* 10Ω – 2K
SM 2A	2W	60	±100 ppm/°C	0.005Ω – 0.976Ω*
SM 3	3W	100	±100 ppm/°C ± 20 ppm/°C	0.01Ω – 10Ω* 10Ω – 3.01K

* Zero ohm available on all sizes .



Mechanical Specifications

Type	A Body Length	B Total Length	C Body Height	D Body Width	E Termination Width	F Termination Length	Units
Tolerance	±0.015	±0.032	±0.015	±0.015	±0.015	±0.015	
	±0.4	±0.81	±0.4	±0.4	±0.4	±0.4	
SM 1	0.260 6.6	0.280 7.1	0.140 3.6	0.150 3.8	0.090 2.3	0.100 2.5	inches mm
SM 2	0.410 10.4	0.435 11.1	0.180 4.6	0.240 6.1	0.100 2.5	0.115 2.9	inches mm
SM 2A	0.475 12.1	0.500 12.7	0.140 3.6	0.305 7.8	0.110 2.8	0.115 2.9	inches mm
SM 3	0.629 16.0	0.708 18.0	0.256 6.5	0.276 7.0	0.110 2.8	0.115 2.9	inches mm



Performance Characteristics

Test	Maximum Results
Load Life	1% Maximum
Short Time Overload	0.5% Maximum
Temperature Cycling	0.5% Maximum
Moisture Resistance	1% Maximum

How to Order

SM	2	1K	1%	R		
SEI Type	Code	Nominal Resistance	Tolerance	Packaging		
Code	Size	Tolerance	Series	Code	Description	Pkg Qty
1	2815	0.1%	SM 1	R	13" Reel	1,500
2	4424	0.5%	SM 2	R	13" Reel	800
2A	5031	1%	SM 2A	R	13" Reel	1,200
3	7128	5%	SM 3	R	13" Reel	750

KAL Series — Aluminum Housed Surface Mount Resistor

Features

- Aluminum housing for maximum heat dissipation
- Complete welded construction
- 10 - 50W tinned copper terminals
- Centerless ground steatite or alumina cores
- Molded epoxy body for heat transfer
- Non-inductive winding available
- 100 - 200W threaded terminals
- RoHS compliant / lead-free



Electrical Specifications

Type / Code	MIL-R-26 Ref.	Power Rating (Watts) @ 70°C		Dielectric Withstanding Voltage	Ohmic Range and Tolerance		
		Commercial	MIL		0.1%	0.5%	1% & 5%
KAL 10	RE-65	12.5W	10W	1,000 VAC 2,500 VAC	1Ω – 1K	0.05Ω – 30K	
KAL 25	RE-70	25W	20W			0.05Ω – 50K	
KAL 50	RE-75	50W	30W			0.05Ω – 150K	
KAL 100	RE-77	100W	75W		-		
KAL 250	RE-80	250W	120W		0.4Ω – 50K		
					0.6Ω – 8K		

Temperature Coefficient Standard: ±100ppm below 0.1Ω, ±50ppm from 0.1Ω - 9.9Ω, ±30ppm from 10Ω - 49Ω, & ±20ppm above 50Ω.

Power Derating



Performance Characteristics

Test	Test Conditions	Results
Short Time Overload	5x wattage rating - 5 seconds	$\Delta R \pm (0.5\% + 0.05\Omega)$ MAX
Moisture Resistance	Temp 40°C moisture 95% CDC 100V for 500 hours	$\Delta R \pm (0.5\% + 0.05\Omega)$ MAX
Load Life	Load rating (chassis is mounted) 1.5 hours on - 0.5 hours off. Repeated for 1000 hours	$\Delta R \pm (1.5\% + 0.05\Omega)$ MAX

How to Order

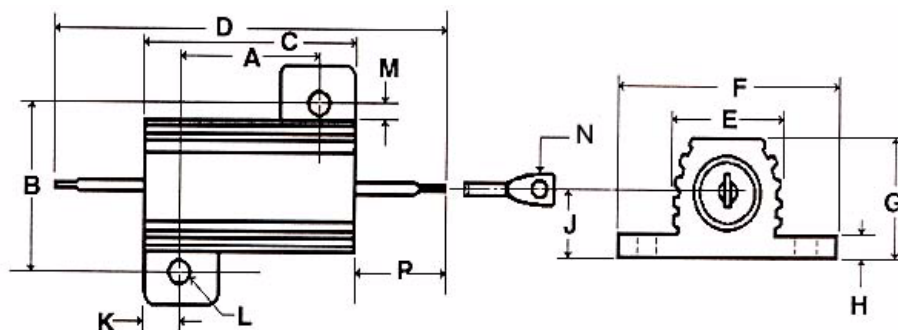
KAL		10	10K	1%	B	
SEI Type		Code	Nominal Resistance	Tolerance	Packaging	
Type	Description	Code	Tolerance	Description	Pkg Qty	Code
KAL	Standard	10	0.1%	KAL 10	20	B
NKAL	Non-Inductive	25	0.5%	KAL 25	10	B
		50	1%	KAL 50	5	B
		100	5%	KAL 100		
		250		KAL 250		

KAL Series — Aluminum Housed Surface Mount Resistor

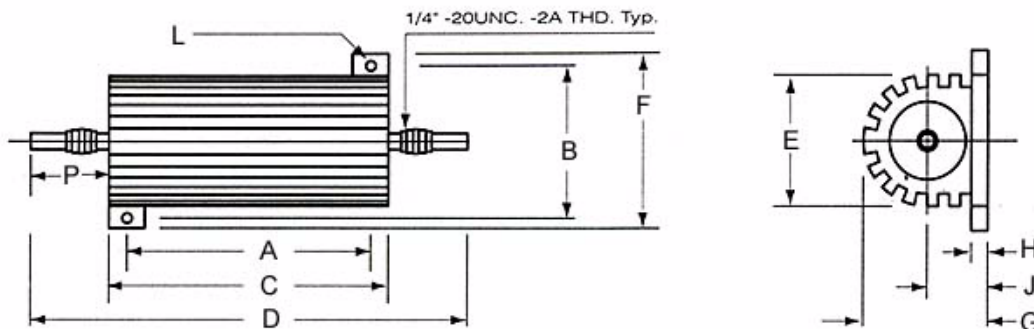
Mechanical Specifications

Type	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	Units
Tolerance	± 0.005	± 0.005	± 0.031	± 0.062	± 0.015	± 0.015	± 0.031	± 0.010	± 0.015	± 0.010	± 0.005	± 0.015	± 0.005	± 0.062	± 0.010	± 0.010	inches
	± 0.1	± 0.1	± 0.8	± 1.6	± 0.4	± 0.4	± 0.8	± 0.3	± 0.4	± 0.3	± 0.1	± 0.4	± 0.1	± 1.6	± 0.25	± 0.25	mm
KAL 10	0.562 14.3	0.625 15.9	0.750 19.0	1.375 34.9	0.420 10.7	0.800 20.3	0.390 9.9	0.075 1.9	0.190 4.8	0.093 2.4	0.093 2.4	0.102 2.6	0.086 2.2	0.312 7.9	-	-	inches mm
KAL 25	0.719 18.3	0.781 19.8	1.062 27.0	1.938 49.2	0.550 14.0	1.080 27.4	0.546 13.9	0.088 2.2	0.260 6.6	0.172 4.4	0.125 3.2	0.115 2.9	0.086 2.2	0.438 11.1	-	-	inches mm
KAL 50	1.563 39.7	0.844 21.4	1.968 50.0	2.781 70.6	0.630 16.0	1.140 29.0	0.610 15.5	0.088 2.2	0.300 7.6	0.196 5.0	0.125 3.2	0.107 2.7	0.086 2.2	0.410 10.4	-	-	inches mm
KAL 100	2.75 69.90	2.25 57.20	3.50 88.90	5.48 139.20	1.89 48.00	2.81 71.40	2.18 55.60	0.19 4.80	0.96 24.30	0.37 9.50	0.19 4.80	0.29 7.10	-	0.99 25.12	-	-	inches mm
KAL 250	3.87 98.4	2.50 63.5	4.50 114.3	7.00 177.8	2.13 54.0	3.00 76.2	2.19 55.6	0.25 6.4	0.96 24.3	0.31 7.9	0.19 4.8	0.25 6.4	-	1.25 31.8	0.87 22.2	3.00 76.20	inches mm

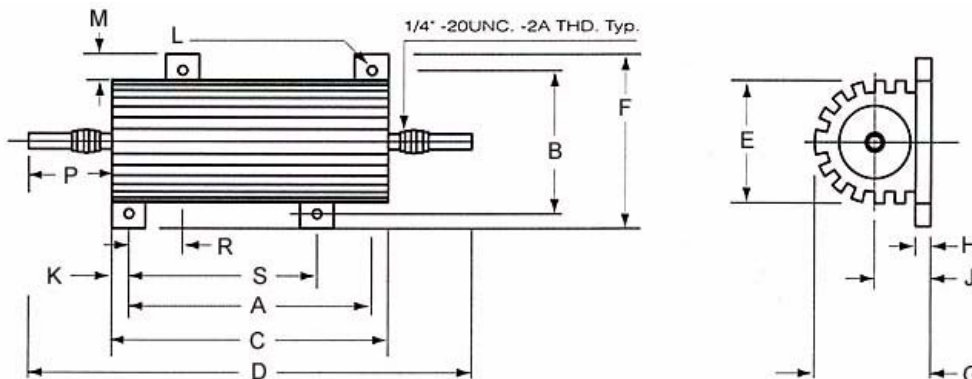
KAL 10 - 50



KAL 100



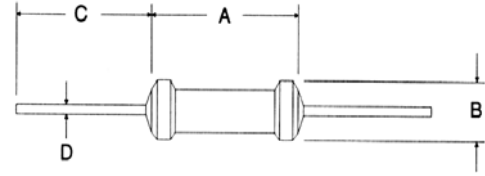
KAL 250



WRF Series — Conformal Coated Wirewound Resistor

Features

- Conformal coating
- Flameproof construction
- Temperature coefficient of resistance of $\pm 100\text{ppm}/^\circ\text{C}$
- Cut and formed product is available on select sizes; contact factory for details
- RoHS compliant / lead-free



Electrical Specifications

Type / Code	Power Rating (Watts) @ 25°C	Maximum Working Voltage	Dielectric Withstanding Voltage (RMS)	Resistance Temperature Coefficient	Ohmic Range and Tolerance
					5%
WRF 1	1W	$\sqrt{\text{PR}}$	700	$\pm 200\text{ ppm}/^\circ\text{C}$	0.1 Ω – 680 Ω
WRF 2	2W	$\sqrt{\text{PR}}$	700	$\pm 200\text{ ppm}/^\circ\text{C}$	0.1 Ω – 1.2K
WRF 3	3W	$\sqrt{\text{PR}}$	700	$\pm 200\text{ ppm}/^\circ\text{C}$	0.1 Ω – 1.2K

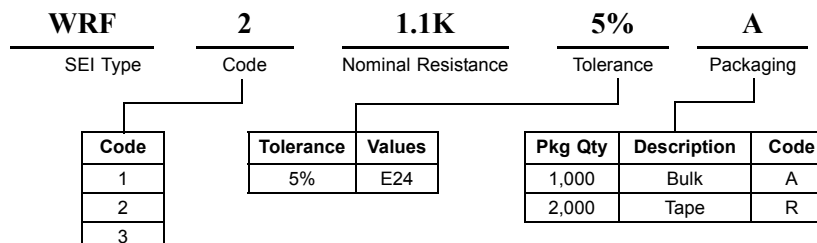
Mechanical Specifications

Type / Code	A Body Length	B Body Width	C Lead Length (Bulk)	D Lead Diameter	Units
WRF 1	0.433 max 11.0 max	0.197 max 5.0 max	1.10 \pm 0.08 28.0 \pm 2.0	0.031 \pm 0.002 0.78 \pm 0.05	inches mm
WRF 2	0.630 max 16.0 max	0.197 max 5.0 max	1.10 \pm 0.08 28.0 \pm 2.0	0.031 \pm 0.002 0.80 \pm 0.05	inches mm
WRF 3	0.630 max 16.0 max	0.197 max 5.0 max	1.10 \pm 0.12 28.0 \pm 3.0	0.031 \pm 0.002 0.80 \pm 0.05	inches mm

Performance Characteristics

Test	Test Results
Moisture Resistance	$\pm 5\%$ +0.05 Ω
Thermal Shock	$\pm 2\%$ +0.05 Ω
Load Life @ 70°C – 1,000 hrs	$\pm 5\%$ +0.05 Ω
Shock and Vibration	$\pm 1\%$ +0.05 Ω
Resistance to Soldering Heat	$\pm 2\%$ +0.05 Ω
Short Time Overload	$\pm 3\%$ +0.05 Ω
Operating Temperature Range	-55°C to +250°C

How to Order



WW/MWW Series—General Purpose and Precision Wirewound

Features

- High performance for low cost
- Excellent stability in operation
- High power to size ratio
- MWW - Completely molded construction with welded terminations tested to MIL-R-39007
- Complete welded terminations
- Tinned copper leads
- Available in non-inductive styles
- High temperature silicone coating
- RoHS compliant / lead-free

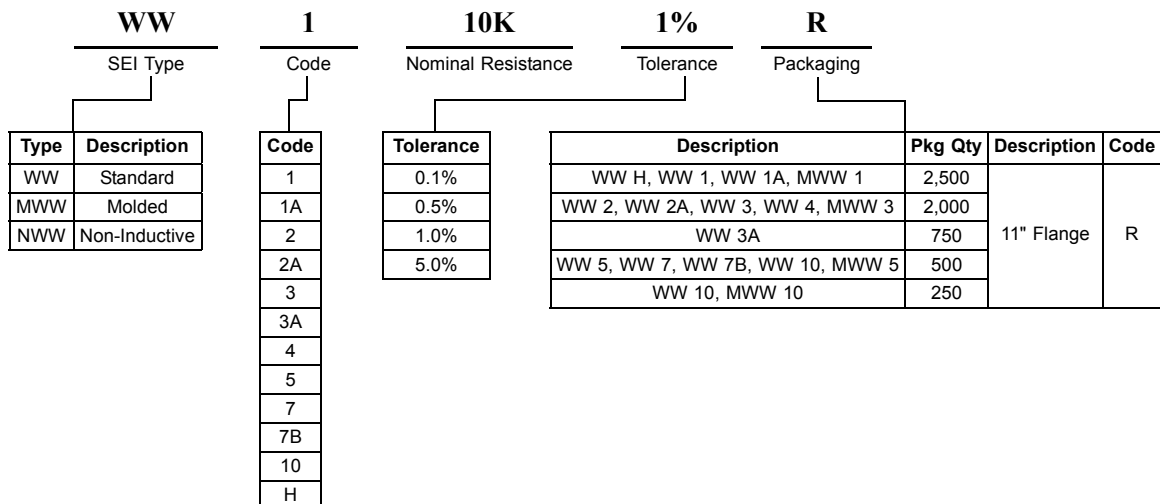


Electrical Specifications

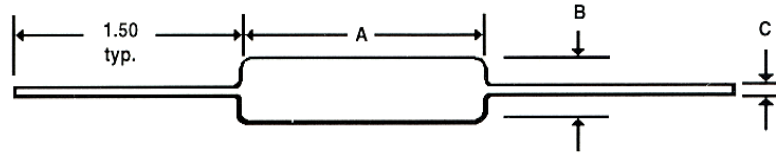
Type / Code	MIL-R-26 Ref.	Dielectric Strength	Power Rating (Watts)		Std. Resistance Range* (ohms) 0.1%, 0.5%, 1% & 5%
			@ 125°C (U)	@ 25°C (V)	
WW H	–	500	0.4W	0.6W	0.1Ω – 2K
WW 1	–	500	1.0W	1.2W	0.1Ω – 3K
WW 1A	RW-70	500	1.0W	1.5W	0.1Ω – 7K
WW 2	RW-69	1,000	1.5W	2.5W	0.1Ω – 10K
WW 2A	–	1,000	2.5W	3.0W	0.1Ω – 15K
WW 3	RW-79	1,000	3.0W	3.7W	0.1Ω – 22K
WW 3A	–	1,000	3.0W	4.0W	0.1Ω – 30K
WW 4	–	1,000	4.0W	5.0W	0.1Ω – 40K
WW 5	RW-67, RW-74	1,000	5.0W	6.0W	0.1Ω – 50K
WW 7	–	1,000	6.5W	8.5W	0.1Ω – 70K
WW 7B	–	1,000	7.0W	9.0W	0.1Ω – 100K
WW 10	RW-78	1,000	10W	13W	0.1Ω – 150K
MWW 1	RW-70	1,000	1.0W	1.5W	0.1Ω – 2K
MWW 3	RW-79	1,000	3.0W	3.75W	0.1Ω – 20K
MWW 5	RW-67, RW-74	1,000	5.0W	6.5W	0.1Ω – 40K
MWW 10	RW-68, RW-74	1,000	10.0W	13.0W	0.1Ω – 150K

*Standard TC as follows: ±90ppm below 1Ω, ±50ppm from 1 - 10Ω, & ±20ppm above 10Ω.

How to Order



WW / MWW Series — General Purpose and Precision Wirewound

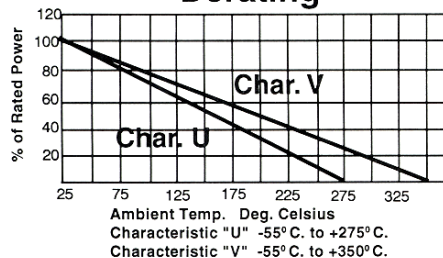


Mechanical Specifications				
Type / Code	A	B	C	Units
Tolerance	$\pm 0.062/\pm 1.6$	$\pm 0.031/\pm 0.8$	$\pm 0.002/\pm 0.05$	
WW H	0.312	0.110	0.0245	inches
	7.9	2.8	0.64	
WW 1	0.375	0.110	0.025	inches
	9.5	2.8	0.64	
WW 1A	0.420	0.110	0.025	inches
	10.7	2.8	0.64	
WW 2	0.370	0.156	0.032	inches
	9.4	4.0	0.81	
WW 2A	0.550	0.156	0.032	inches
	14.0	4.0	0.81	
WW 3	0.560	0.187	0.032	inches
	14.2	4.8	0.81	
WW 3A	0.500	0.218	0.032	inches
	12.7	5.5	0.81	
WW 4	0.700	0.270	0.036	inches
	17.8	6.9	0.91	
WW 5	0.875	0.312	0.036	inches
	22.2	7.9	0.91	
WW 7	1.000	0.312	0.036	inches
	25.4	7.9	0.91	
WW 7B	1.200	0.312	0.036	inches
	30.5	7.9	0.91	
WW 10	1.780	0.375	0.036*	inches
	45.2	9.5	0.91*	

* Available in 0.040

Mechanical Specifications				
Type / Code	A	B	C	Units
Tolerance	$\pm 0.015/\pm 0.4$	$\pm 0.015/\pm 0.4$	$\pm 0.002/\pm 0.05$	
MWW 1	0.385	0.135	0.032	inches
	9.8	3.4	0.81	
MWW 3	0.560	0.205	0.032	inches
	14.2	5.2	0.81	
MWW 5	0.925	0.330	0.036	inches
	23.5	8.4	0.91	
MWW 10	1.965	0.480	0.040	inches
	49.9	12.2	1.02	

Derating



Performance Characteristics	
Test	Results
Moisture Resistance	1% max.
Load Life	1%
Temperature Cycling	0.5%
Short Time Overload	1%

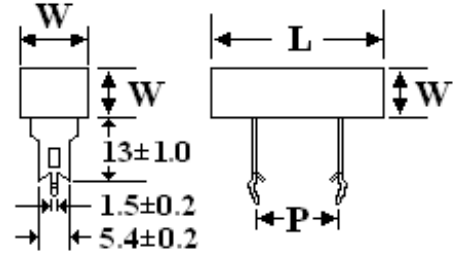
NSZ Series — Ceramic Housed Wirewound with Specialty Leads

Features

- Special lead configurations
- RoHS compliant / lead-free

See NSP data sheet for electrical and environmental specifications

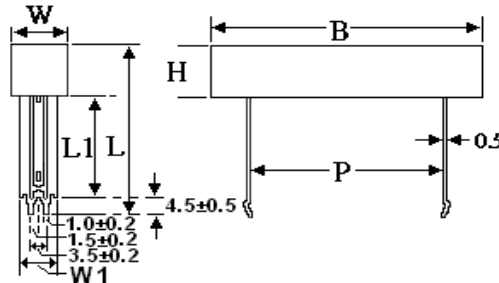
NSZ 1



NSZ 1 Specifications

Type / Code	Power Rating (Watts) @ 25°C	Maximum Working Voltage	Resistance Range Wirewound	Resistance Range Metal Oxide	L ± 1.0	W ± 1.0	P ± 1.0	Units
NSZ 1	5W	300	1.0Ω – 680Ω	680Ω – 50K	1.06 27.0	0.39 10.0	0.59 15.0	inches mm
NSZ 1	7W	350	1.0Ω – 1.0K	1.0K – 50K	1.38 35.0	0.39 10.0	0.89 22.5	inches mm
NSZ 1	10W	500	1.0Ω – 1.0K	1.0K – 50K	1.89 48.0	0.39 10.0	1.38 35.0	inches mm

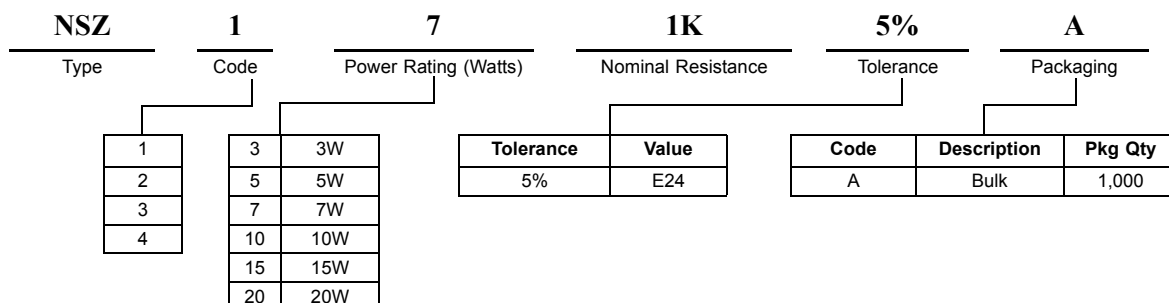
NSZ 2



NSZ 2 Specifications

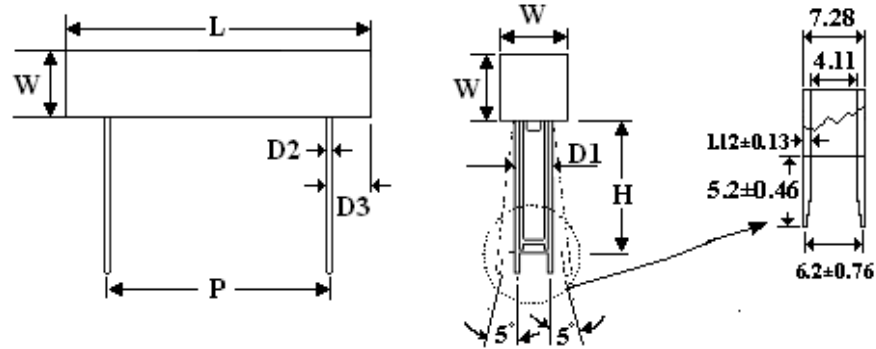
Type / Code	Power Rating (Watts) @ 25°C	B ± 1.0	H ± 0.5	W ± 0.5	W1 ± 0.1	P ± 1.0	L ± 1.0	L1	Units
NSZ 2	3W	0.98 25.0	0.39 9.8	0.39 9.8	0.29 7.3	0.49 12.5	1.55 39.3	0.98+0.08/-0.04 25+2.0/-1.0	inches mm
NSZ 2	5W	1.10 28.0	0.39 9.8	0.39 9.8	0.29 7.3	0.59 15.0	1.55 39.3	0.98+0.08/-0.04 25+2.0/-1.0	inches mm
NSZ 2	7W	1.40 35.5	0.39 9.8	0.39 9.8	0.29 7.3	0.89 22.5	1.55 39.3	0.98+0.08/-0.04 25+2.0/-1.0	inches mm
NSZ 2	10W	1.89 48.0	0.39 9.8	0.39 9.8	0.29 7.3	1.38 35.0	1.55 39.3	0.98+0.08/-0.04 25+2.0/-1.0	inches mm
NSZ 2	15W	1.89 48.0	0.47 12.0	0.47 12.0	0.29 7.3	1.28 32.5	1.54 39.0	0.98+0.08/-0.04 25+2.0/-1.0	inches mm

How to Order



NSZ Series — Ceramic Housed Wirewound with Specialty Leads

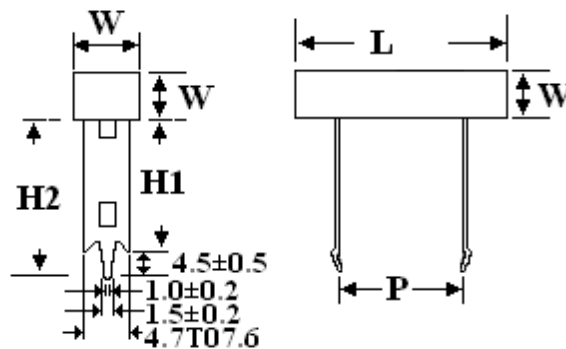
NSZ 3



NSZ 3 Specifications

Type / Code	Power Rating (Watts) @ 25°C	L +1.02/-2.03	W ±1.27	P ±1.52	H	D1 ±0.31	D2 ±0.1	D3 MIN	Units
NSZ 3	5W	1.06 27.0	0.39 10.0	0.59 15.0	0.39 10.0	0.29 7.3	0.02 0.46	0.24 6.2	inches mm
NSZ 3	7W	1.43 36.4	0.39 10.0	0.89 22.49	0.89 min 1.06 max 22.84 min 27.01 max	0.29 7.28	0.02 0.46	0.15 3.81	inches mm
NSZ 3	10W	1.89 47.97	0.39 9.82	1.38 35.03	0.89 min 1.06 max 22.84 min 27.01 max	0.29 7.28	0.02 0.46	0.15 3.81	inches mm
NSZ 3	15W	1.89 47.9	0.49 12.49	1.28 32.49	0.89 min 1.06 max 22.84 min 27.01 max	0.29 7.28	0.02 0.46	0.15 3.81	inches mm

NSZ 4



NSZ 4 Specifications

Type / Code	Power Rating (Watts) @ 25°C	Maximum Working Voltage	Resistance Range Wirewound	Resistance Range Metal Oxide	H1 ± 1.0	H2 ± 1.0	L1 MAX	P ± 1.0	W MAX	Units
NSZ 4	5W	300	0.1Ω – 680Ω	680Ω – 50K	0.98 25.0	1.18 30.0	1.06 27.0	0.59 15.0	0.39 10.0	inches mm
NSZ 4	7W	350	0.1Ω – 1.0K	1.0K – 50K	0.98 25.0	1.26 32.0	1.38 35.0	0.94 24.0	0.39 10.0	inches mm
NSZ 4	10W	500	0.1Ω – 2.0K	2.0K – 50K	0.98 25.0	1.26 32.0	1.89 48.0	1.38 35.0	0.39 10.0	inches mm
NSZ 4	15W	600	0.1Ω – 2.0K	2.0K – 50K	0.98 25.0	1.26 32.0	1.89 48.0	1.26 32.0	0.47 12.0	inches mm
NSZ 4	20W	700	0.1Ω – 2.0K	2.0K – 50K	0.98 25.0	1.26 32.0	2.56 65.0	1.77 45.0	0.47 12.0	inches mm

CB Series — Ceramic Housed Wirewound with Axial Leads

Features

- Fireproof power wirewound
- High thermal conductivity
- Different element (resistor) available: precision / ceramic & metal oxide
- Non-inductive styles available
- Body standoffs available, add "F" after CB
- High temperature silicone coating
- RoHS compliant / lead-free



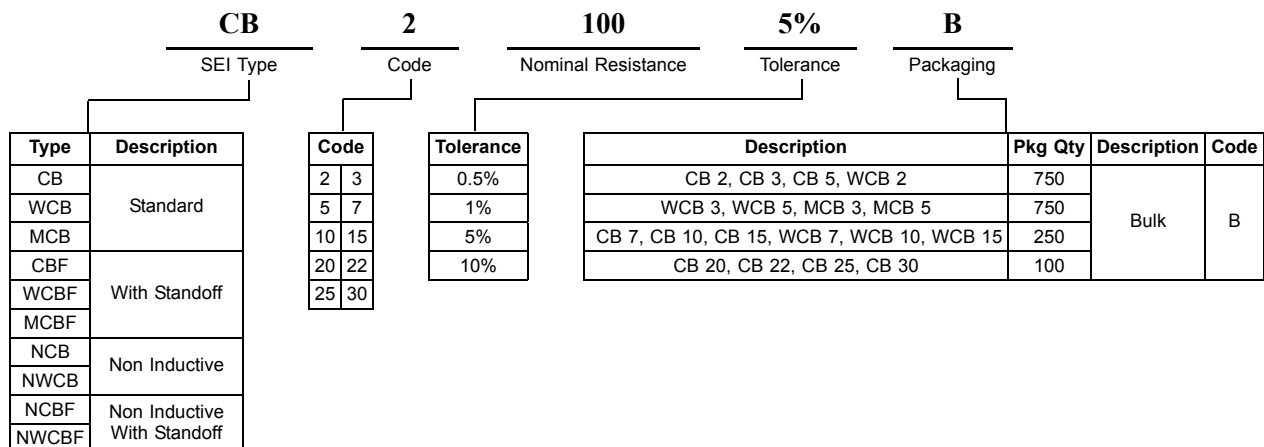
Electrical Specifications

Type / Code	Power Rating (Watts) @ 70°C	Ohmic Range and Tolerance			
		0.5%	1%	5%	10%
CB 2	2W	–	–	0.5Ω – 51Ω	0.2Ω – 51Ω
CB 3	3W	–	–	0.5Ω – 350Ω	0.1Ω – 350Ω
CB 5	5W	–	–	0.5Ω – 100Ω	0.1Ω – 100Ω
CB 7	7W	–	–	0.75Ω – 150Ω	0.15Ω – 150Ω
CB 10	10W	–	–	1.0Ω – 200Ω	0.2Ω – 200Ω
CB 15	15W	–	–	1.0Ω – 200Ω	0.2Ω – 200Ω
CB 20	20W	–	–	1.0Ω – 250Ω	0.3Ω – 250Ω
CB 22	22W	–	–	1.0Ω – 1.25K	0.3Ω – 1.25K
CB 25	25W	–	–	1.0Ω – 1.25K	0.3Ω – 1.25K
CB 30	30W	–	–	1.0Ω – 1.25K	0.3Ω – 1.25K
WCB 2	2W	1Ω – 5K	1Ω – 5K	1Ω – 5K	–
WCB 3	3W	1Ω – 10K	1Ω – 10K	1Ω – 10K	–
WCB 5	5W	1Ω – 10K	1Ω – 10K	1Ω – 10K	–
WCB 7	7W	1Ω – 15K	1Ω – 15K	1Ω – 15K	–
WCB 10	10W	1Ω – 20K	1Ω – 20K	1Ω – 20K	–
WCB 15	15W	1Ω – 20K	1Ω – 20K	1Ω – 20K	–
MCB 3	3W	–	–	100Ω – 10K	–
MCB 5	5W	–	–	100Ω – 10K	–

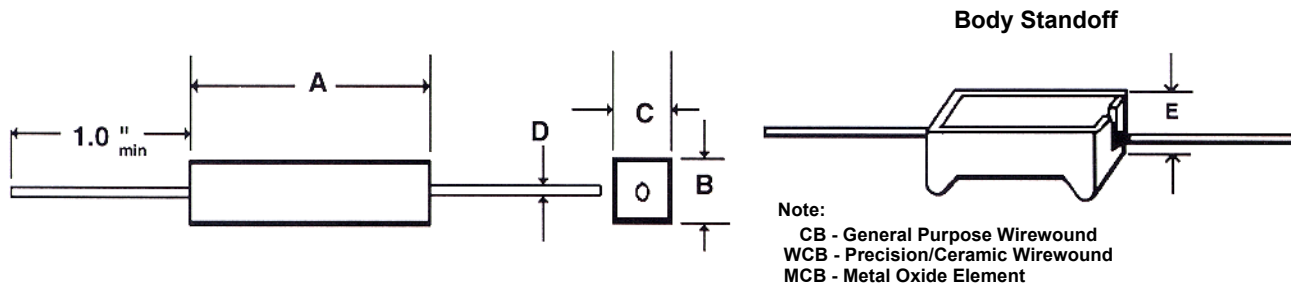
Resistance Temperature Coefficient Standard:

CB series: ±800ppm below 1Ω & ±300ppm for 1Ω and above; WCB series: ±50ppm from 1Ω to 10Ω & ±20ppm above 10Ω; MCB series: ±200ppm

How to Order



CB Series — Ceramic Housed Wirewound with Axial Leads



Mechanical Specifications

Type / Code	A	B	C	D	E	Units
Tolerance	±0.031	±0.031	±0.031	±0.002	±0.031	inches
	±0.8	±0.8	±0.8	±0.05	±0.8	mm
CB 2	0.700 17.8	0.245 6.2	0.255 6.5	0.032 0.81	0.300 7.6	inches mm
CB 3	0.875 22.2	0.312 7.9	0.312 7.9	0.036 0.91	0.375 9.5	inches mm
CB 5	0.875 22.2	0.375 9.5	0.375 9.5	0.036 0.91	0.437 11.1	inches mm
CB 7	1.400 35.6	0.375 9.5	0.375 9.5	0.036 0.91	0.500 12.7	inches mm
CB 10	1.875 47.6	0.375 9.5	0.375 9.5	0.036 0.91	0.500 12.7	inches mm
CB 15	1.875 47.6	0.500 12.7	0.500 12.7	0.036 0.91	0.625 15.9	inches mm
CB 20	2.500 63.5	0.500 12.7	0.500 12.7	0.036 0.91	0.625 15.9	inches mm
CB 22	2.500 63.5	0.500 12.7	0.500 12.7	0.036 0.91	0.625 15.9	inches mm
CB 25	2.500 63.5	0.500 12.7	0.500 12.7	0.036 0.91	0.625 15.9	inches mm
CB 30	2.500 63.5	0.625 15.9	0.625 15.9	0.036 0.91	-	inches mm
WCB 2	0.700 17.8	0.245 6.2	0.255 6.5	0.032 0.81	0.300 7.6	inches mm
WCB 3	0.875 22.2	0.312 7.9	0.312 7.9	0.032 0.81	0.375 9.5	inches mm
WCB 5	0.875 22.2	0.375 9.5	0.375 9.5	0.032 0.81	0.437 11.1	inches mm
WCB 7	1.400 35.6	0.375 9.5	0.375 9.5	0.036 0.91	0.500 12.7	inches mm
WCB 10	1.875 47.6	0.375 9.5	0.375 9.5	0.036 0.91	0.500 12.7	inches mm
WCB 15	1.875 47.6	0.500 12.7	0.500 12.7	0.036 0.91	0.625 15.9	inches mm
MCB 3	0.875 22.2	0.312 7.9	0.312 7.9	0.032 0.81	0.375 9.5	inches mm
MCB 5	0.875 22.2	0.375 9.5	0.375 9.5	0.032 0.81	0.437 11.1	inches mm

Performance Characteristics

Test	Test Results
Moisture Resistance	±5%
Thermal Shock	±2%
Load Life @ 70°C – 1,000 hrs.	±5%
Resistance to Soldering Heat	±2%
Short Time Overload	±2%
Dielectric Withstanding Voltage	±2%
Operating Temperature Range	-55°C to +275°C

LCB Series — Ceramic Housed for Current Sensing - 2 Leads

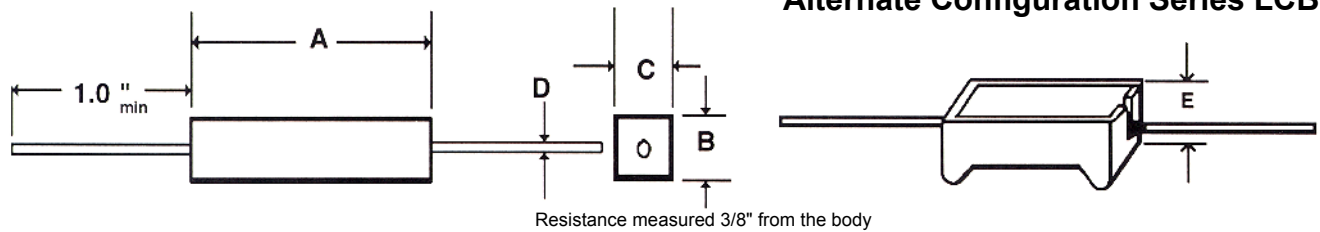
Features

- Fireproof construction
- Low temperature coefficient
- Low resistance value ceramic encased resistor
- All welded termination
- RoHS compliant / lead-free



Electrical Specifications

Type / Code	Power Rating (Watts) @ 70°C	Resistance Temperature Coefficient	Ohmic Range and Tolerance	
			1%	5%
LCB 3	3W	±40 ppm/°C	0.005Ω – .1Ω	0.005Ω – .1Ω
LCB 5	5W	±40 ppm/°C	0.005Ω – .1Ω	0.005Ω – .1Ω
LCB 7	7W	±40 ppm/°C	0.010Ω – .15Ω	0.010Ω – .15Ω
LCB 10	10W	±40 ppm/°C	0.010Ω – .2Ω	0.010Ω – .2Ω
LCB 15	15W	±40 ppm/°C	0.010Ω – .2Ω	0.010Ω – .2Ω

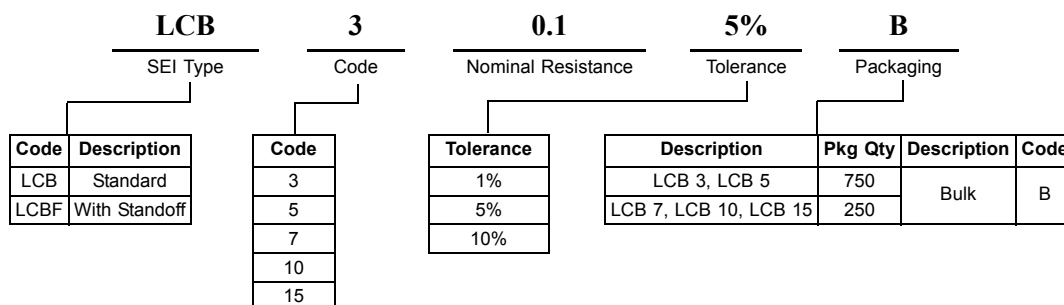


Alternate Configuration Series LCBF

Mechanical Specifications

Type	A	B	C	D	E	Units
Tolerance	±0.031	±0.031	±0.031	±0.031	±0.031	inches
	±0.8	±0.8	±0.8	±0.8	±0.8	mm
LCB 3	0.875 22.2	0.312 7.9	0.312 7.9	0.032 0.81	0.375 9.5	inches mm
LCB 5	0.875 22.2	0.375 9.5	0.375 9.5	0.032 0.81	0.437 11.1	inches mm
LCB 7	1.400 35.6	0.375 9.5	0.375 9.5	0.036 0.91	0.500 12.7	inches mm
LCB 10	1.875 47.6	0.375 9.5	0.375 9.5	0.036 0.91	0.500 12.7	inches mm
LCB 15	1.875 47.6	0.500 12.7	0.500 12.7	0.036 0.91	0.625 15.9	inches mm

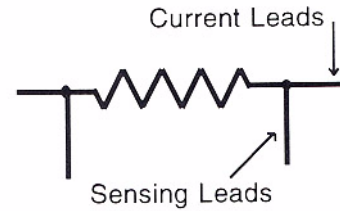
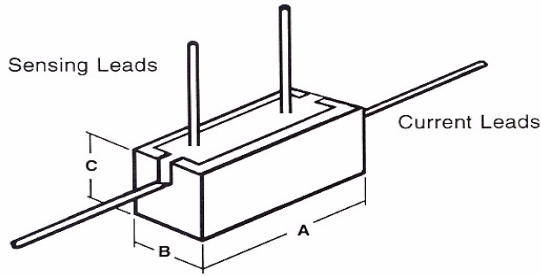
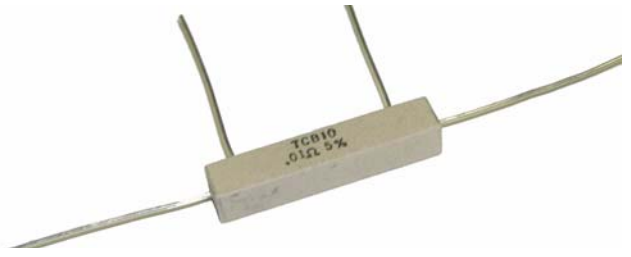
How to Order



TCB Series — Ceramic Housed for Current Sensing - 4 Leads

Features

- Four terminal construction
- Low inductance
- Low temperature coefficient
- RoHS compliant / lead-free
- Fireproof construction
- All welded termination
- Low resistance value ceramic encased resistor



Lead Diameter .036 Length 1" minimum

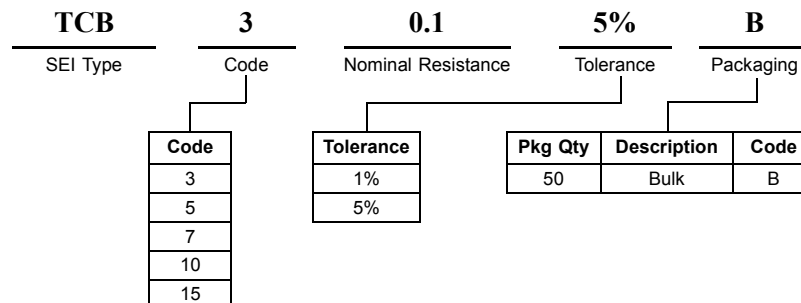
Electrical Specifications

Type / Code	Power Rating (Watts) @ 70°C	Resistance Temperature Coefficient	Ohmic Range and Tolerance	
			1%	5%
TCB 3	3W	±40 ppm/°C	0.005Ω – 0.1Ω	0.005Ω – 0.1Ω
TCB 5	5W	±40 ppm/°C	0.005Ω – 0.1Ω	0.005Ω – 0.1Ω
TCB 7	7W	±40 ppm/°C	0.01Ω – 0.15Ω	0.01Ω – 0.15Ω
TCB 10	10W	±40 ppm/°C	0.01Ω – 0.2Ω	0.01Ω – 0.2Ω
TCB 15	15W	±40 ppm/°C	0.01Ω – 0.2Ω	0.01Ω – 0.2Ω

Mechanical Specifications

Type / Code	A Body Length (max)	B Body Width	C Body Height (Bulk)	Sensing Lead Spacing	Units
Tolerance	±0.031	±0.031	±0.031	±0.062	inches
	±0.8	±0.8	±0.8	±1.6	mm
TCB 3	0.875 22.2	0.312 7.9	0.312 7.9	0.563 14.3	inches mm
TCB 5	0.875 22.2	0.375 9.5	0.375 9.5	0.563 14.3	inches mm
TCB 7	1.400 35.6	0.375 9.5	0.375 9.5	1.000 25.4	inches mm
TCB 10	1.875 47.6	0.375 9.5	0.375 9.5	1.375 34.9	inches mm
TCB 15	1.875 47.6	0.500 12.7	0.500 12.7	1.375 34.9	inches mm

How to Order



VM/MVM/LVM/WVM Series — Ceramic Housed Vertical Mount

Features

- Flameproof inorganic construction
- High temperature potting compound
- VM - Wirewound on fiberglass element
- RoHS compliant / lead-free
- MVM - Metal oxide element for higher values
- LVM - Low resistance wire or ribbon element
- WVM - Precision wirewound element



Electrical Specifications

Type / Code	Power Rating (Watts) @ 70°C	Ohmic Range and Tolerance			
		0.5%	1%	5%	10%
VM 2	2W	–	–	0.1Ω – 100Ω	0.1Ω – 100Ω
VM 3	3W	–	–	0.1Ω – 125Ω	0.1Ω – 125Ω
VM 5	5W	–	–	0.1Ω – 150Ω	0.1Ω – 150Ω
VM 7	7W	–	–	0.2Ω – 300Ω	0.2Ω – 300Ω
VM 10	10W	–	–	0.2Ω – 300Ω	0.2Ω – 300Ω
MVM 3	3W	–	–	100Ω – 1K	100Ω – 100K
MVM 5	5W	–	–	100Ω – 1K	100Ω – 100K
LVM 2	2W	–	0.01Ω – 0.1Ω	0.01Ω – 0.1Ω	0.01Ω – 0.1Ω
LVM 3	3W	–	0.01Ω – 0.1Ω	0.01Ω – 0.1Ω	0.01Ω – 0.1Ω
LVM 5	5W	–	0.01Ω – 0.1Ω	0.01Ω – 0.1Ω	0.01Ω – 0.1Ω
LVM 7	7W	–	0.02Ω – 0.15Ω	0.02Ω – 0.15Ω	0.02Ω – 0.15Ω
LVM 10	10W	–	0.02Ω – 0.15Ω	0.02Ω – 0.15Ω	0.02Ω – 0.15Ω
WVM 2	2W	0.1Ω – 2K	0.1Ω – 2K	0.1Ω – 2K	–
WVM 3	3W	0.1Ω – 5K	0.1Ω – 5K	0.1Ω – 5K	–
WVM 5	5W	0.1Ω – 5K	0.1Ω – 5K	0.1Ω – 5K	–
WVM 7	7W	0.1Ω – 8K	0.1Ω – 8K	0.1Ω – 8K	–
WVM 10	10W	0.1Ω – 8K	0.1Ω – 8K	0.1Ω – 8K	–

Resistance Temperature Coefficient Standard:

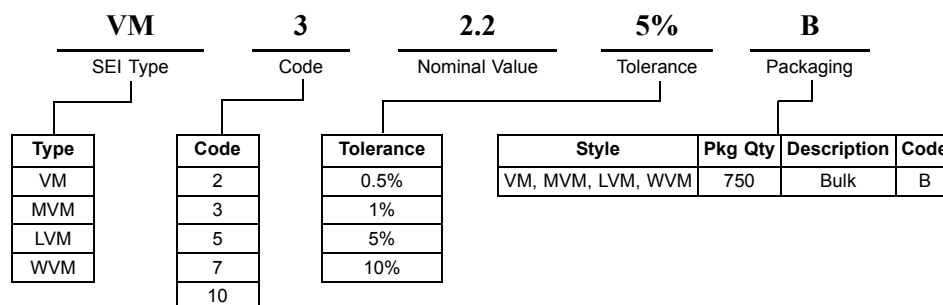
VM series: ±800ppm below 1Ω & ±400ppm at 1Ω and above

MVM series: ±200ppm

LVM series: ±50 to 400ppm depending on value

WVM series: ±90ppm below 1Ω, ±50ppm from 1Ω to 10Ω & ±20ppm above 10Ω.

How to Order



VM/MVM/LVM/WVM Series — Ceramic Housed Vertical Mount

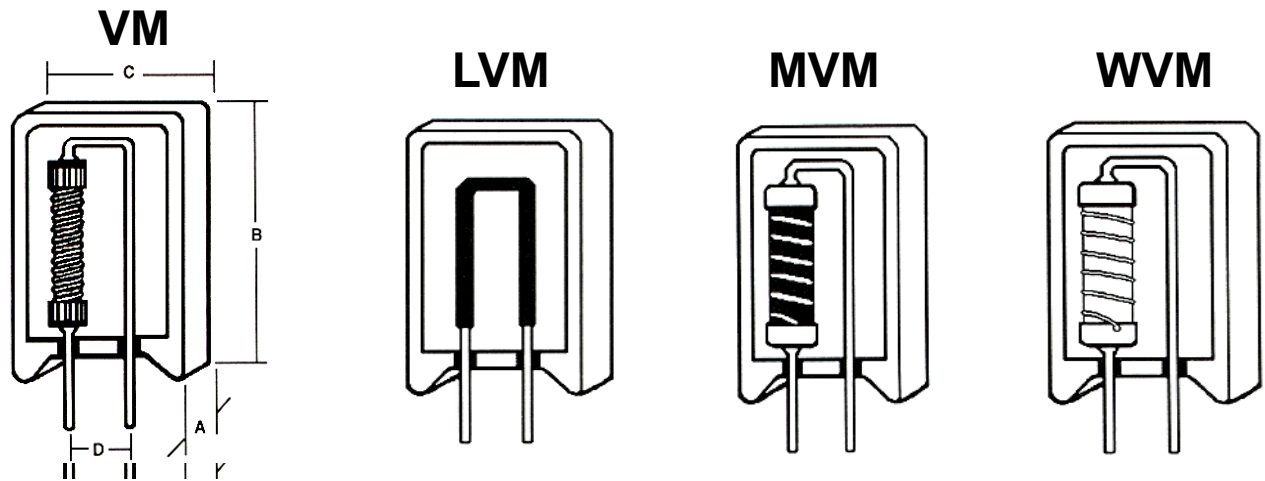
Mechanical Specifications					
Type / Code	A	B	C	D	Units
Tolerance	± 0.039	± 0.059	± 0.039	± 0.059	inches
	± 1.0	± 1.5	± 1.0	± 1.5	mm
VM 2	0.280 7.1	0.820 20.8	0.435 11.0	0.200 5.1	inches mm
VM 3	0.380 9.7	0.975 24.8	0.475 12.1	0.200 5.1	inches mm
VM 5	0.380 9.7	0.990 25.1	0.520 13.2	0.200 5.1	inches mm
VM 7	0.380 9.7	1.520 38.6	0.520 13.2	0.200 5.1	inches mm
VM 10	0.480 12.2	1.375 34.9	0.635 16.1	0.300 7.6	inches mm

*VM lead length 0.175 ± 0.032 and lead diameter 0.032

*MVM lead length 0.175 ± 0.032 and lead diameter 0.032

*LVM lead length 0.175 ± 0.032 and LVM 2 to LVM 5 lead diameter 0.032 & LVM 7 to LVM 10 lead diameter 0.036

*WVM lead length 0.175 ± 0.032 and WVM 2 to WVM 5 lead diameter 0.032 & WVM 7 to WVM 10 lead diameter 0.036



*VM 2 lead diameter is 0.032 and MVM, LVM & WVM lead diameter is 0.036

**Series VM, MVM, LVM, & WVM have the same dimensions.

Power Derating



EL/CEL Series — Commercial Power Resistors

Features

- Low cost, high performance
- Resistance range from 0.2 to 600 ohms
- Power rating: EL series = 4 watts per inch
- Power rating: CEL series = 5 watts per inch
- CEL series has a special flame retardant conformal coating
- RoHS compliant / lead-free

Applications

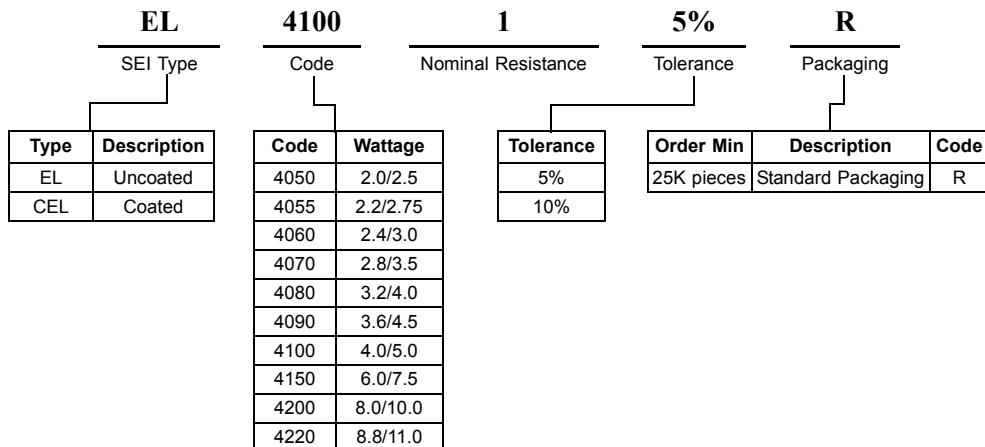
- Kitchen appliances
- Automotive devices
- Televisions and radios
- Computers
- Power supplies



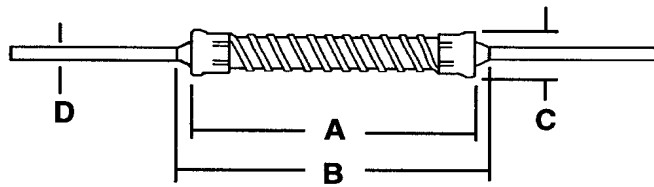
Electrical Specifications

Type / Code	Power Rating (Watts)	Resistance Temperature Coefficient EL and CEL	Ohmic Range and Tolerance	
			5%	10%
EL 4050 CEL 4050	2.0W 2.5W	±800 ppm/°C below 1Ω ±400 ppm/°C above 1Ω	0.2Ω – 100Ω	0.2Ω – 100Ω
EL 4055 CEL 4055	2.20W 2.75W	±800 ppm/°C below 1Ω ±400 ppm/°C above 1Ω	0.2Ω – 130Ω	0.2Ω – 130Ω
EL 4060 CEL 4060	2.4W 3.0W	±800 ppm/°C below 1Ω ±400 ppm/°C above 1Ω	0.22Ω – 180Ω	0.22Ω – 180Ω
EL 4070 CEL 4070	2.8W 3.5W	±800 ppm/°C below 1Ω ±400 ppm/°C above 1Ω	0.26Ω – 215Ω	0.26Ω – 215Ω
EL 4080 CEL 4080	3.2W 4.0W	±800 ppm/°C below 1Ω ±400 ppm/°C above 1Ω	0.32Ω – 255Ω	0.32Ω – 255Ω
EL 4090 CEL 4090	3.6W 4.5W	±800 ppm/°C below 1Ω ±400 ppm/°C above 1Ω	0.36Ω – 270Ω	0.36Ω – 270Ω
EL 4100 CEL 4100	4.0W 5.0W	±800 ppm/°C below 1Ω ±400 ppm/°C above 1Ω	0.4Ω – 300Ω	0.4Ω – 300Ω
EL 4150 CEL 4150	6.0W 7.5W	±800 ppm/°C below 1Ω ±400 ppm/°C above 1Ω	0.66Ω – 400Ω	0.66Ω – 400Ω
EL 4200 CEL 4200	8.0W 10.0W	±800 ppm/°C below 1Ω ±400 ppm/°C above 1Ω	0.9Ω – 500Ω	0.9Ω – 500Ω
EL 4220 CEL 4220	8.8W 11.0W	±800 ppm/°C below 1Ω ±400 ppm/°C above 1Ω	1Ω – 600Ω	1Ω – 600Ω

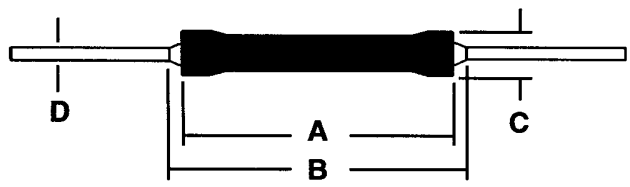
How to Order



EL/CEL Series — Commercial Power Resistors



EL Series



CEL Series

Mechanical Specifications

Dimensions

Type / Code	A	B	C	D
	(± 0.031)	(± 0.031)	(± 0.031)	(± 0.002)
EL 4050	0.500	0.562	0.140	0.036
EL 4055	0.550	0.612	0.140	0.036
EL 4060	0.600	0.662	0.140	0.036
EL 4070	0.700	0.762	0.140	0.036
EL 4080	0.800	0.862	0.140	0.036
EL 4090	0.900	0.962	0.140	0.036
EL 4100	1.000	1.062	0.140	0.036
EL 4150	1.500	1.562	0.140	0.036
EL 4200	2.000	2.062	0.140	0.036
EL 4220	2.200	2.262	0.140	0.036
CEL 4050	0.500	0.593	0.160	0.036
CEL 4055	0.550	0.643	0.160	0.036
CEL 4060	0.600	0.693	0.160	0.036
CEL 4070	0.700	0.793	0.160	0.036
CEL 4080	0.800	0.893	0.160	0.036
CEL 4090	0.900	0.993	0.160	0.036
CEL 4100	1.000	1.093	0.160	0.036
CEL 4150	1.500	1.593	0.160	0.036
CEL 4200	2.000	2.093	0.160	0.036
CEL 4220	2.500	2.293	0.160	0.036

RC Series — Carbon Composition Resistors

Features

- Non-inductive design
- Molded body for package uniformity
- Ideal for pulse-load handling characteristics
- Cut and formed product is available on select sizes; contact factory for details
- 1W now available
- RoHS compliant/ lead-free available



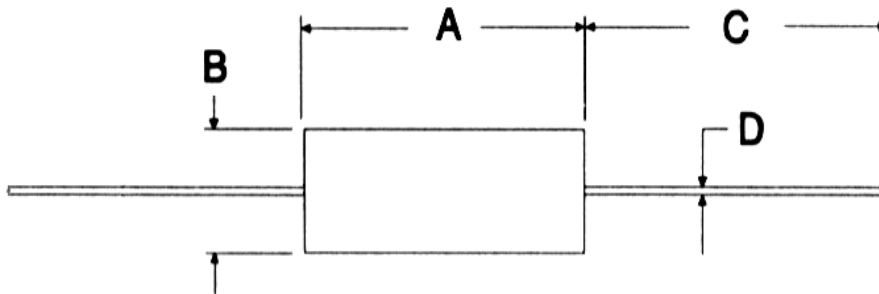
Electrical Specifications

Type / Code	Power Rating (Watts) @ 70°C	Maximum Continuous Working Voltage*	Maximum Pulse Voltage	Dielectric Withstanding Voltage	Ohmic Range and Tolerance	
					10%	5%
RC 1/4	0.25W	250	400	500	1Ω – 5.6M	1Ω – 5.6M
RC 1/2	0.5W	350	700	700	1Ω – 20M	1Ω – 20M
RC 1	1W	500	1,000	1,000	2.2Ω – 1.0M	–

* Lesser of \sqrt{PR} or maximum working voltage.

Mechanical Specifications

Type / Code	A Body Length	B Body Diameter	C Lead Length (Bulk)	D Lead Diameter	Units
RC 1/4	0.248 ± 0.028	0.094 ± 0.004	1.18 ± 0.12	0.0236 ± 0.0020	inches
	6.30 ± 0.70	2.40 ± 0.10	30.0 ± 3.0	0.60 ± 0.05	mm
RC 1/2	0.374 + 0.031/-0.028	0.142 ± 0.008	1.10 ± 0.12	0.0275 + 0.0028/-0.0020	inches
	9.50 + 0.8/-0.70	3.60 ± 0.20	28.0 ± 3.0	0.70 + 0.07/-0.05	mm
RC 1	0.56 ± 0.03	0.22 ± 0.01	1.02 ± 0.12	0.04 ± 0.002	inches
	14.3 ± 0.70	5.70 ± 0.30	26.0 ± 3.0	0.90 ± 0.05	mm



How to Order

RC	1/2	5.6M	5%	R			
SEI Type	Code	Nominal Resistance	Tolerance	Packaging			
	Code	Tolerance	Values	Style	Pkg Qty	Description	Code
	1/4	5%	E24	1/4, 1/2	5,000	Tape	R
	1/2	10%	E12	All	1,000	Bulk	A
	1						

RC Series — Carbon Composition Resistors

Resistance Temperature Characteristics

	Resistance Range	-55°C	+105°C
Maximum % resistance change from room temperature (+25°C) value	under 1K 1K to 9.1K 10K to 91K 100K to 910K 1 Mg to 10 Mg	+2.0 to +5.0 +5.0 to +9.0 +8.0 to +11.0 +10.0 to +14.0 +13.0 to +20.0	-4.0 to -2.0 -5.0 to -3.0 -7.0 to -5.0 -9.0 to -7.0 -14.0 to -9.0

Performance Characteristics (JISC 5201 - 1:1998)

Test	Test Results	Test Method
Voltage Proof	No breakdown or flashover	V-block method RC 1/4 100 VAC, 60 seconds RC 1/2 500 VAC, 60 seconds
Overload	±2% +0.05Ω No visible damage, legible markings	2.5 times the rated voltage or twice the limiting element voltage, whichever is less. Severe, 5 seconds
Termination Strength	Tensile: ±2% +0.05Ω, No visible damage Bending: ±2% +0.05Ω, No visible damage Torsion: ±2% +0.05Ω, No visible damage	10N for 5 – 10 seconds 5N, twice 180°C, two rotations
Solderability	In accordance with Clause 4.17.4.5	235°C, 5 seconds
Resistance to Soldering Heat	±3% +0.05Ω No visible damage, legible markings	After immersion into flux, the immersion into solder shall be carried out 4mm from the body at 350°C for 3.5 seconds
Temperature Shock	±2% +0.05Ω No visible damage	5 cycles between -55°C to 125°C
Climatic Sequence	±10% +0.5Ω Insulation resistance: R ≥100M ohm. No visible damage	Dry/Damp heat: 12 +12 hour cycle, first cycle Cold/Damp heat: 12 +12 hour cycle, remaining cycle D.C. load
Damp Test, Steady State	±10% +0.5Ω Insulation resistance: R ≥100M ohm. No visible damage, legible marking	40°C 95% relative humidity for 56 days, test a, b, and c of Clause 4.24.2.1
Endurance @ 70°C	±10% +0.5Ω Insulation resistance: R ≥1G ohm. No visible damage	Rated voltage, 1.5 hours On, 0.5 hours Off at 70°C, 1,000 hours
Endurance @ 125°C	±10% +0.5Ω Insulation resistance: R ≥1G ohm. No visible damage	125°C, no load, 1,000 hours
Operating Temperature Range	-55°C to + 125°C	

Reliability Test - Load Life in Moisture

Criterion (%)	Load Ratio P/Pn (%)	Total Testing Time (Hrs)	Number of Fractures (pcs)	Failure Ratio		Average Lifetime (60% reliability level) (Hrs)	
				λ	λ CL (60%)		
Δ R/R	±5	0	2.984 x 10 ⁶	6	0.201	0.244	4.098 x 10 ⁵
		20	2.990 x 10 ⁶	4	0.134	0.176	5.682 x 10 ⁵
		60	2.997 x 10 ⁶	2	0.067	0.104	9.615 x 10 ⁵
		100	2.992 x 10 ⁶	3	0.100	0.139	7.194 x 10 ⁵
		Total	1.196 x 10 ⁷	15	0.125	0.138	7.209 x 10 ⁵
	±10	Total	1.20 x 10 ⁷	0	0.0055	0.0077	1.299 x 10 ⁷

CF/CFM Series — Carbon Film Resistors

Features

- General purpose resistor ideal for commercial/industrial applications
- Flame retardant coatings standard, flameproof optional (contact factory)
- Panasert available on selected sizes (contact factory)
- Auto sequencing/insertion compatible
- CFM (mini) an ideal choice when size constraints apply
- Cut and formed product is available on select sizes; contact factory for details
- RoHS compliant / lead-free
- Standard lead wire for CF/CFM is copper plated steel, with 100% tin overplate
- 100% tin plate on copper wire is available as type CFQ/CFQM



Electrical Specifications

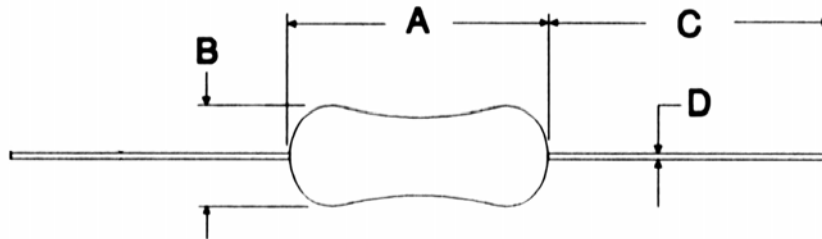
Type / Code	Power Rating (Watts) @ 70°C	Maximum Working Voltage*	Maximum Pulse Voltage	Dielectric Withstanding Voltage	Ohmic Range and Tolerance	
					2%	5%
CF 1/8	0.125W	250	500	300	10Ω – 4.7M	1Ω – 22M
CF 1/4	0.25W	350	600	500	1Ω – 4.7M	1Ω – 22M
CF 1/2	0.5W	350	700	700	10Ω – 4.7M	1Ω – 22M
CF 1	1W	500	1,000	1,000	1Ω – 10M	1Ω – 22M
CF 2	2W	500	1,000	1,000	10Ω – 1M	1Ω – 22M
CFM 1/4	0.25W	250	500	500	10Ω – 1M	1Ω – 22M
CFM 1/2	0.5W	250	500	500	10Ω – 4.7M	1Ω – 22M

* Lesser of \sqrt{PR} or maximum working voltage.

How to Order

CF		1/2		4.7K		5%		R	
SEI Type		Code		Nominal Resistance		Tolerance		Packaging	
Type	Description	Code	Tolerance	Values	SEI Types	Qty	Description	Code	
CF	EIA Standard	1/8	2%	E24	CF 1/8, CF 1/4, CF 1/2, CFM 1/4, CFM 1/2	5,000	Tape	R	
CFM	Mini	1/4	5%	E24	CF 1	2,000			
PCF	Panasert CF 1/4	1/2			CF 2	1,000	Ammo	Q	
PCFM	Panasert CFM 1/2	1			CF 1/4; CFM 1/2	2,000			
CFQ	Tin plating on copper wire	2			CF 1/8, CF 1/4, CFM 1/4, CFM 1/2	5,000			
CFQM	Tin plating on copper wire (mini)				CF 1/2	2,000			
					CF 1, CF 2	1,000		T	
					CF 1/4; CFM 1/2	5,000	Panasert	P	
					All	1,000	Bulk	A	

CF/CFM Series — Carbon Film Resistors



Mechanical Specifications

Type / Code	A Body Length	B Body Diameter	C Lead Length (Bulk)	D Lead Diameter	Units
CF 1/8	0.13 + 0.01/-0 3.2 + 0.2/-0	0.07 ± 0.01 1.8 ± 0.2	1.10 ± 0.12 28.0 ± 3.0	0.018 ± 0.002 0.45 ± 0.05	inches mm
CF 1/4	0.26 ± 0.02 6.5 ± 0.5	0.09 ± 0.01 2.3 ± 0.2	1.10 ± 0.12 28.0 ± 3.0	0.022 ± 0.002 0.56 ± 0.05	inches mm
CF 1/2	0.33 ± 0.02 8.5 ± 0.50	0.11 ± 0.02 2.7 ± 0.5	1.10 ± 0.12 28.0 ± 3.0	0.024 ± 0.002 0.60 ± 0.05	inches mm
CF 1	0.43 ± 0.04 11.0 ± 1.0	0.18 ± 0.02 4.5 ± 0.5	1.18 ± 0.12 30.0 ± 3.0	0.031 ± 0.004 0.80 ± 0.1	inches mm
CF 2	0.59 ± 0.04 15.0 ± 1.0	0.20 ± 0.02 5.0 ± 0.5	1.18 ± 0.12 30.0 ± 3.0	0.031 ± 0.004 0.80 ± 0.1	inches mm
CFM 1/4	0.13 + 0.01/-0 3.2 + 0.2/-0	0.07 ± 0.01 1.8 ± 0.2	1.10 ± 0.12 28.0 ± 3.0	0.018 ± 0.002 0.45 ± 0.05	inches mm
CFM 1/2	0.26 ± 0.02 6.5 ± 0.5	0.09 ± 0.01 2.3 ± 0.2	1.10 ± 0.12 28.0 ± 3.0	0.022 ± 0.002 0.56 ± 0.05	inches mm

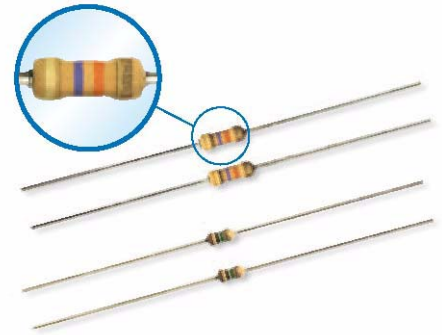
Performance Characteristics

Test	Standard / Method	Requirement
Short Time Overload	EIA-RS-172-B 3.2.6	± 0.5%
Resistance to Solder Heat	MIL-STD 202, Method 210	± 0.5%
Dielectric Withstanding Voltage	JIS C 5202 5.6	± 0.5%
Load Life	MIL-STD 202, Method 108	± 1.0%
Terminal Strength	MIL-STD 202, Method 211	± 0.2%
Moisture Resistance	MIL-STD 202, Method 106	± 0.5%

HDM Series — Moisture Resistant Carbon Film Resistors

Features

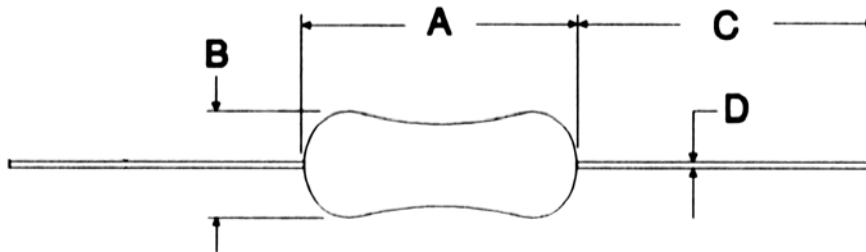
- Specialized materials, and processes and controls ensure a part that is impervious to moisture.
- Small size with high power density
- Auto sequencing / insertion capable
- Low cost replacement in many applications using metal glaze resistors
- RoHS compliant / lead-free



Electrical Specifications

Type / Code	Power Rating (Watts) @ 70°C	Maximum Working Voltage*	Maximum Pulse Voltage	Ohmic Range and Tolerance
				1%, 2%, 5%
HDM 1/4	0.25W	300	600	1Ω – 2.2M
HDM 1/2	0.5W	350	700	1Ω – 2.2M

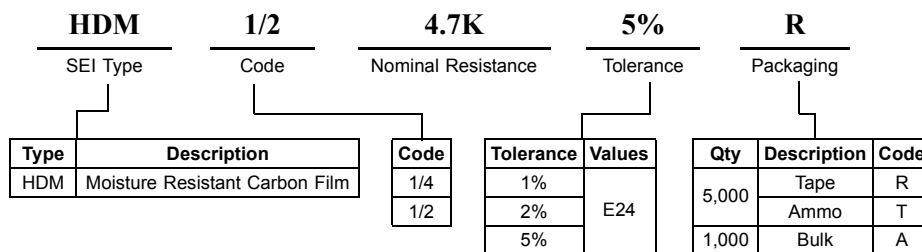
* Lesser of \sqrt{PR} or maximum working voltage.



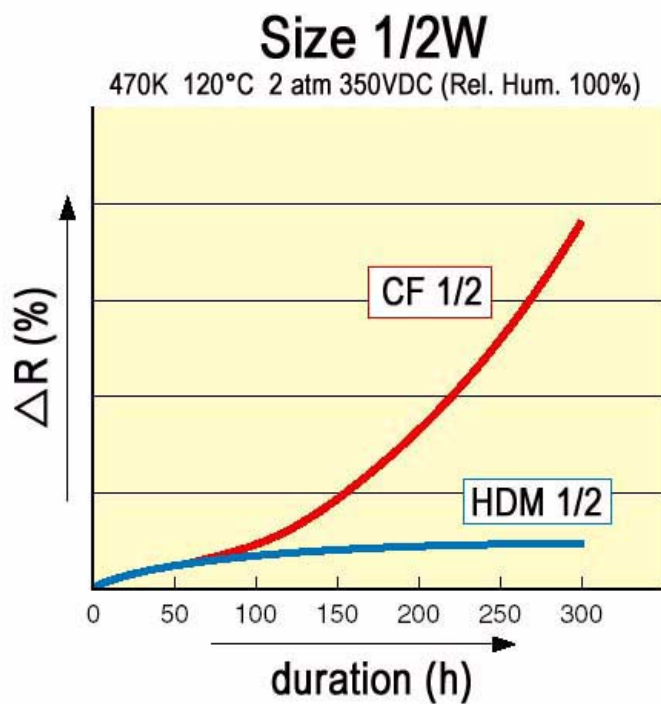
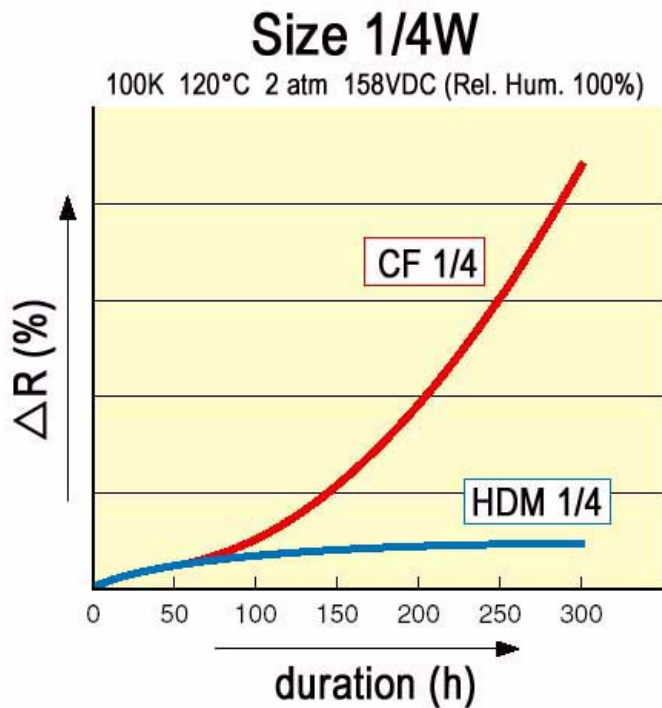
Mechanical Specifications

Type / Code	A Body Length	B Body Diameter	C Lead Length (Bulk)	D Lead Diameter	Units
HDM 1/4	0.13 + 0.01/-0	0.07 ± 0.01	1.10 ± 0.12	0.018 ± 0.002	inches
	3.20 + 0.20/-0	1.80 ± 0.20	28.00 ± 3.00	0.45 ± 0.05	mm
HDM 1/2	0.24 ± 0.02	0.09 ± 0.01	1.10 ± 0.12	0.024 ± 0.002	inches
	6.00 ± 0.30	2.40 ± 0.20	28.00 ± 3.00	0.60 ± 0.02	mm

How to Order



HDM Series — Moisture Resistant Carbon Film Resistors



Performance Characteristics

Test	Standard / Method	Requirement
High Temperature, Humidity, Pressure Bias Test	120°C, 2 atm., >98% R. H., Rated DC voltage for 100 hours	± 10%
Short Time Overload	EIA-RS-172-B 3.2.6	± 0.75%
Resistance to Solder Heat	MIL-STD 202, Method 210	± 0.5%
Dielectric Withstanding Voltage	JIS C 5202 5.6	± 0.5%
Load Life	MIL-STD 202, Method 108	± 1.0%
Temperature Cycle	JIS.C.5202.7.4	± 1.0%

HPC Series — High Power Surface Mount Resistors

The HPC series represents a breakthrough in functional design, thermal management and end-user benefits. Borrowing from long-proven techniques used in power semiconductors, the HPC series provides up to eight times more useful power than SMD power resistors currently available.

The HPC series, through superior characterization, is intended to remove the mystery of managing board level power by combining established techniques in new ways. The result is superior technology in designs options, in a cost effective package.



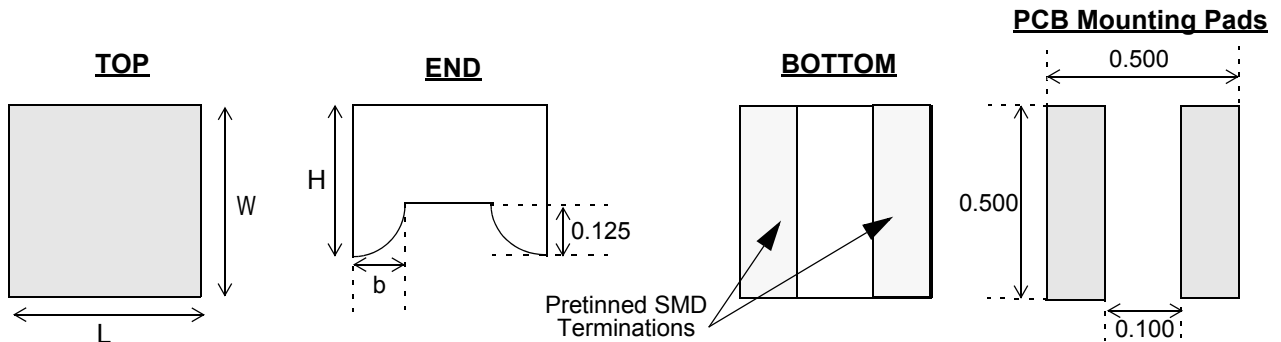
Features

- Up to 12W with no external heat sinks
- Compatible with conventional pick and place
- Only 0.5 x 0.5 PCB footprint
- Non inductive resistive element
- Up to 50W for short duration
- Patent pending
- Available in 1% and 5% tolerances
- RoHS compliant / lead-free

Electrical Specifications

Type / Code	Power Rating (Watts) @ 40°C w/400 LFM air flow	Power Rating (Watts) @ 40°C no air flow	Maximum Working Voltage	Max Overload Voltage	Dielectric Strength	Inductance	Resistance Temperature Coefficient	Ohmic Range and Tolerance
								5%
HPC 12	12W	5W	200	400	1,500	<2nH	±150 ppm/°C	0.025Ω – 250K

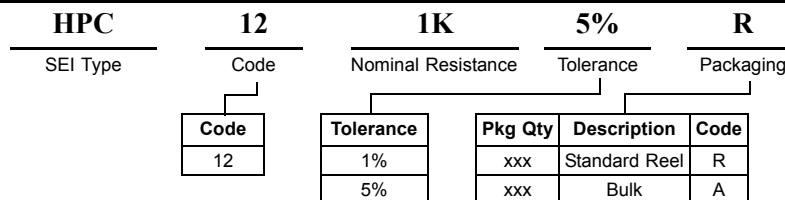
Dimensions +/- 0.010



Mechanical Specifications

Type / Code	L Body Length	W Body Width	H Body Height	b Bottom Termination	Units
HPC 12	0.480 12.18	0.500 12.69	0.400 10.15	0.110 2.79	inches mm

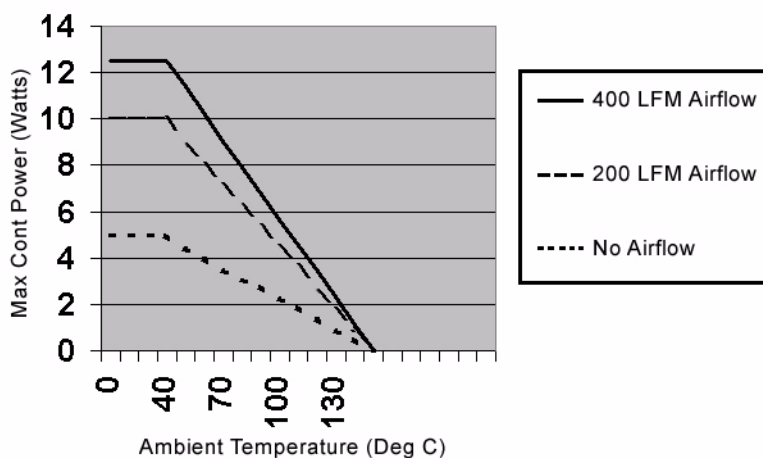
How to Order



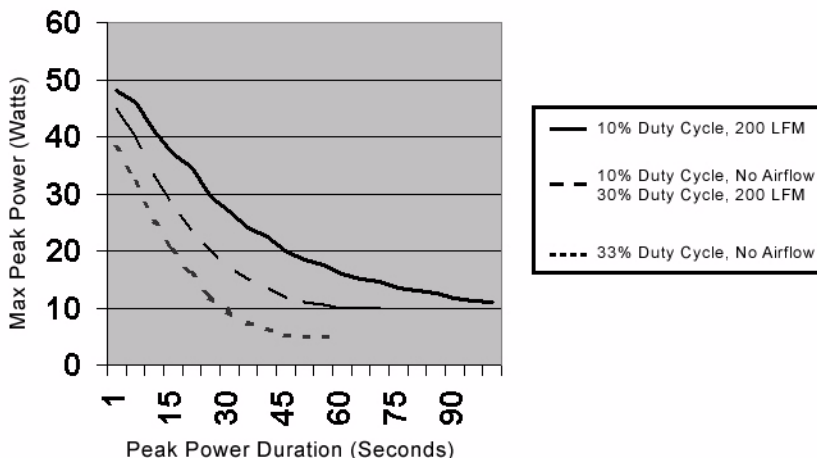
HPC Series — High Power Surface Mount Resistors

Performance Characteristics		
Test	Test Conditions (JIS C 5202)	Test Results
Short Time Overload	2.5x rated voltage for 5 seconds	$\pm(2\% +0.1\Omega)$
Dielectric Withstanding Voltage	100VAC, 1 minute	$\pm(1\% +0.05\Omega)$
Resistance to Soldering Heat	260°C $\pm 5^\circ\text{C}$, for 10 sec. ± 0.5 sec. (Solder Bath)	$\pm(1\% +0.05\Omega)$
Solderability	235°C $\pm 5^\circ\text{C}$, for 2 sec. ± 0.5 sec. (Colophonium flux)	95% coverage, minimum
Temperature Cycle	-65°C: 30 min. 25°C: 2 to 3 min. 150°C: 30 min. 25°C: 2 to 3 min. (5 Cycles)	$\pm(1\% +0.05\Omega)$ Jumper (<0.05 Ω)
Endurance (Damp load)	40°C $\pm 2^\circ\text{C}$, 90% to RH, Rated Load 90 min. On, 30 min. Off for 1,000 hrs. -0 hrs. / +48 hrs.	$\pm(3\% +0.1\Omega)$ Jumper (<0.05 Ω)
Endurance (Rated load)	70°C $\pm 2^\circ\text{C}$, 90% to RH, Rated Load 90 min. On, 30 min. Off for 1,000 hrs. -0 hrs. / +48 hrs.	$\pm(3\% +0.1\Omega)$ Jumper (<0.05 Ω)
Voltage Coefficient	1/10 rated voltage for 3 sec. max, then rated voltage for 3 sec. max.	± 100 (ppm/V)
Robustness of Termination	Bend of 3mm for 5 \pm 1 sec.	$\pm(1.0\% + 0.05 \text{ Ohm})$

HPC 12 Power Derating Curve



HPC 12 Power vs. Duration



TR Series — TO-220 Power Resistors

Features

- TO-220 style power package
- Molded case for environmental protection
- Operating temperature range -55°C - 150°C
- TR35 has single screw mounting to heat sink
- Electrically isolated and non-inductive package
- Isolated case



Electrical Specifications

Type	Power Rating (Watts) @ 25°C with Heat Sink	Maximum Working Voltage*	Resistance Temperature Coefficient	Ohmic Range and Tolerance
				1%, 2%, 5%
TR 20	20W	350V	100	0.05Ω - 10Ω 11Ω - 10KΩ
TR 35	35W		50	

Environmental Characteristics

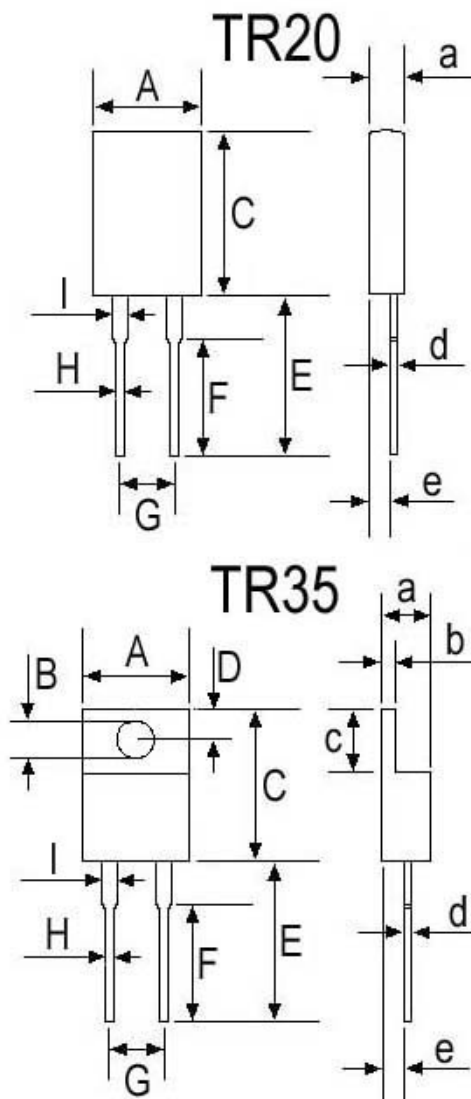
Test Item	Specification	Test Method
Short Time Overload	$\Delta R \pm (0.3\% + 0.001\Omega)$ max	2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds
Load Life	$\Delta R \pm (1.0\% + 0.001\Omega)$	MIL-R-39009, 2000 hours at rated power
Moisture Resistance	$\Delta R \pm (0.5\% + 0.001\Omega)$ max	MIL-Std-202, Method 106
Thermal Shock	$\Delta R \pm (0.3\% + 0.001\Omega)$ max	MIL-STD-202, Method 107, Condition F
Terminal Strength	$\Delta R \pm (0.2\% + 0.001\Omega)$ max	MIL-STD-202, Method 211, Condition A (Pull Test) 2.4N
Vibration, High Frequency	$\Delta R \pm (0.2\% + 0.001\Omega)$ max	MIL-STD-202, Method 204, Condition D

How to Order

TR		20		J		B			1001	
SEI Type		Code		Tolerance		Packaging			Resistance	
Code	Wattage	Code	Tolerance	Code	Description	Pkg Qty	Code	Resistance	Code	Resistance
20	20W	F	1%	B	Box	980	0R10	0.1Ω	0100	10Ω
35	35W	G	2%				4700	470Ω	101	1KΩ
		J	5%				1002	10KΩ		

TR Series — TO-220 Power Resistors

Mechanical Specifications		inches	mm
Type/Code	TR20	TR35	
A	0.40 - 0.42 10.15 - 10.67	0.39 - 0.41 9.91 - 10.41	
B	-	0.139 - 0.148 3.55 - 3.75	
C	0.63 - 0.63 16.00 - 16.52	0.571 - 0.591 14.50 - 15.00	
D	-	0.112 - 0.120 2.85 - 3.05	
E	0.45 - 0.55 11.43 - 13.97	0.500 - 0.597 12.70 - 14.70	
F	0.10 - 0.16 2.54 - 4.06	0.157 max 4.00 max	
G	0.19 - 0.21 4.82 - 5.34	0.190 - 0.210 4.83 - 5.33	
H	0.026 - 0.034 0.66 - 0.86	0.027 - 0.034 0.70 - 0.86	
I	0.045 - 0.055 1.14 - 1.40	0.046 - 0.054 1.17 - 1.37	
a	0.115 - 0.135 2.92 - 3.44	0.159 - 0.190 4.06 - 4.82	
b	-	0.047 - 0.055 1.20 - 1.40	
c	-	0.23 - 0.25 5.85 - 6.35	
d	0.016 - 0.024 0.40 - 0.60	0.022 - 0.028 0.55 - 0.70	
e	0.06 - 0.08 1.52 - 2.04	0.080 - 0.089 2.05 - 2.52	



Electrical Thermal Characteristics

	TR20	TR35
Derating (Thermal Resistance)	0.16W/K (6.25K/W) without a heat sink	0.25W/K (4.28K/W) without a heat sink
Free Air Power Rating	3W in free air at 25°C	2.5W in free air at 25°C
High Temperature Derating	Derating for temp above 25°C is 0.018W/K	Derating for temperatures above 25°C is 0.02W/K
The case temperature is to be used for the definition of the applied power limit		
The case temperature measurement must be made with a thermocouple contacting the center of the component mounted on the designed heat sink		
Thermal grease should be applied properly		

Dual Power Ratings For Resistors — Which One Is Correct?

This one definitely tops the FAQ list. Chip resistors and axial leaded resistors all seem to have various different wattage ratings depending on the manufacturer and even within the same manufacturer. This is completely illogical because intuition of the physics involved says that parts that are the same size, and are made of similar materials, will be able to handle the same power in a given application. So why all the confusion?

CHIP RESISTORS

First in the surface mount world, let's choose the 1206 size chip resistor as our example. For many years (and still today for EIA power ratings) this size resistor was considered an 1/8 watt part. These ratings were based on older design rules, and on a mindset influenced by the military. The military has traditionally been conservative in how they rate electrical components, and this case is no different. A 1206 used in an application where it will only need to handle 1/8 watt, will typically shift around .2% from its original value over the life of the part, per 1000 hours.

More recently, the CECC (a committee similar to EIA in Europe) has chosen to rate the 1206 size resistor at 1/4 watt. Similarly the 0603 size rating was increased to 1/10 from 1/16, the 0805 increased to 1/8 from 1/10, and so on. These ratings were based on the fact that certain guidelines have been established in the circuit board industry, so that the worst-case scenario is now not nearly so bad. The same 1206 from our previous example, but now used in a 1/4 watt application, will experience a typical shift of around .25 % per 1000 hours. This is clearly not much greater than the shift at the lower 1/8-watt power level, so the resistor industry has, for the most part, adopted the higher power rating as the standard.

What is confusing is that there are many designs that have originated some years ago, and thus still use the lower power rating. This should not pose a problem, since a higher power rating than required is almost always acceptable. The key to surface mount resistors and their substitutions is to compare size vs. size as long as the rated power of the part utilized is greater than or equal to that required in the application. After all, it is the physical size of the part that determines whether it will retrofit into a particular board, not the power rating.

AXIAL LEADED RESISTORS

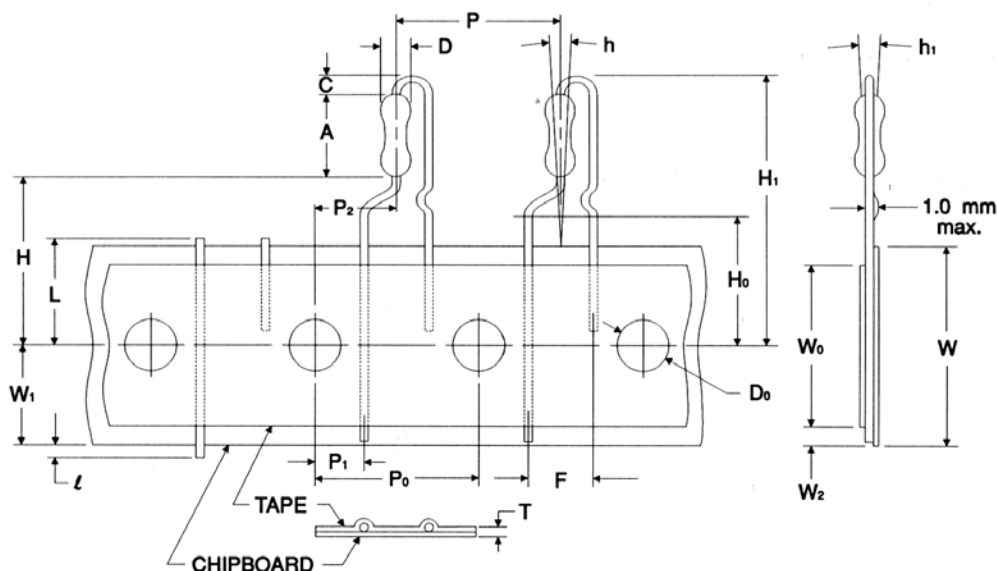
A similar argument can be made for axial leaded resistors. If physics says that parts of the same size, and relatively the same material should handle the same amount of power, then why are there 1/4 watt and 1/2 watt parts with the same dimensions?

Our surface mount discussion still holds true here. An 1/8 watt part can usually handle more power, but it is at the expense of higher ambient and board temperatures, and a more extreme resistance shift over the life of the part. Again the rule of thumb should be to try to match parts of the same dimension rather than of the same wattage.

If the application can withstand a little more heat generated and a little more resistance shift over the life of the product, then there shouldn't be any issues with using the parts at their higher power rating.

Packaging — Radial Leaded Resistors

Radial Lead Taping Specification — Pana-Sert Carbon Film & Metal Film Resistors (1/4W Body Size)



Description	Symbol	PANA-SERT	Inches mm
Resistor body diameter	D	0.090 ± 0.008 2.3 ± 0.2	
Resistor body length	A	0.256 ± 0.020 6.5 ± 0.5	
Resistor pitch ¹	P	0.500 ± 0.039 12.7 ± 1.0	
Sprocket-hole pitch ¹	P ₀	0.500 ± 0.012 12.7 ± 0.3	
Sprocket-hole center to lead center	P ₁	0.152 ± 0.028 3.85 ± 0.7	
Sprocket-hole center to resistor center ¹	P ₂	0.250 ± 0.051 6.35 ± 1.3	
Resistor lead spacing	F	0.197 ± 0.039 5.0 ± 1.0	
Resistor alignment	h	0.0 ± 0.079 [0 ± 5°] 0 ± 2.0 [0 ± 5°]	
Chipboard width ¹	W	0.709 ± 0.039/-0.020 18.0 ± 1.0/-0.5	
Hold-down tape width	W ₀	0.492 12.5 min.	
Sprocket-hole position	W ₁	0.354 ± 0.030/-0.020 0.9 ± 0.75/-0.5	

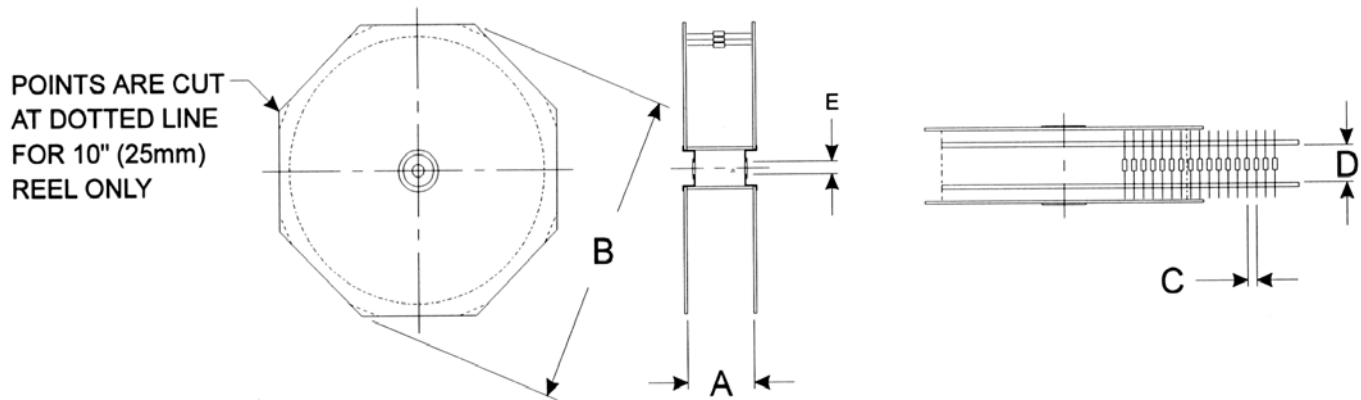
Description	Symbol	PANA-SERT	Inches mm
Hold-down tape position	W ₂	0.118 3.0 max.	
Height to bottom of resistor	H	0.748 ± 0.039 19.0 ± 0.21.0	
Height to lead clinch	H ₀	0.630 ± 0.020 16.0 ± 0.5	
Lead protrusion	l	0.079 2.0 max.	
Sprocket-hole diameter	D ₀	0.157 ± 0.012 4.0 ± 0.3	
Thickness (chipboard and tape)	T	0.028 ± 0.008 0.7 ± 0.2	
Cutout length ¹	L	0.433 11.0 max.	
Height of resistor	H ₁	1.122 28.5 max.	
Height of bending	C	0.098 ± 0.020 2.5 ± 0.5	
Resistor alignment	h ₁	0.0 ± 0.079 [0 ± 5°] 0 ± 2.0 [0 ± 5°]	

Note 1. Cumulative pitch tolerances not to exceed ±0.039 (±1.0) over 20 consecutive pitches. 2,500 pieces per reel.

Note 2. Product only available from 10Ω to 1 MΩ in 5% or 1% tolerances.

Packaging — Axial Leaded Resistors

Packaging & Identification Variations



Lead Tape Specifications: Reeled in accordance with RS-296-E

in (mm)

Series	Code	A max.	B max.	C	D	E	Tape	Class
ASR	1	99.5 (3.92)	343 (13.5)	10 (0.4)	52.4 (2.06)	14.3 (0.56)	6.35 (0.25)	I
ASRM	1/4	63.7 (2.51)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	14.3 (0.56)	6.35 (0.25)	I
	1/2	66.5 (2.62)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	14.3 (0.56)	6.35 (0.25)	I
CD	1/8	63.7 (2.51)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	14.3 (0.56)	6.35 (0.25)	I
	1/4	66.5 (2.62)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	14.3 (0.56)	6.35 (0.25)	I
	1/2	69.5 (2.74)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	14.3 (0.56)	6.35 (0.25)	I
CF	1/8	63.7 (2.51)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	14.3 (0.56)	6.35 (0.25)	I
	1/4	67.0 (2.64)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	14.3 (0.56)	6.35 (0.25)	I
	1/2	69.5 (2.74)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	14.3 (0.56)	6.35 (0.25)	I
	1	75.5 (2.97)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	14.3 (0.56)	6.35 (0.25)	I
	2	79.5 (3.13)	343 (13.5)	10 (0.4)	52.4 (2.06)	14.3 (0.56)	6.35 (0.25)	I
CFM	1/4	63.7 (2.51)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	14.3 (0.56)	6.35 (0.25)	I
	1/2	67.0 (2.64)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	14.3 (0.56)	6.35 (0.25)	I
FRN	1/4	66.5 (2.62)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	1/2	69.5 (2.74)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	1	61.5 (2.82)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	2	99.5 (3.92)	343 (13.5)	10 (0.4)	63.5 (2.50)	52.4 (2.06)	14.3 (0.56)	II
MR	1	84.1 (3.31)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	3	88.5 (3.49)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	5	97.8 (3.85)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	10	121 (4.76)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
MWW	1	90.5 (3.56)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	3	94.9 (3.74)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	5	104 (4.10)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	10	130 (5.12)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
RC	1/4	70.8 (2.79)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	1/2	70.0 (2.76)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	1	69.3 (2.73)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
RN	1/8	63.7 (2.51)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	1/4	66.5 (2.62)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	1/2	69.5 (2.74)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	1	75.5 (2.97)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
RNM	1/4	63.7 (2.51)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	1/2	66.5 (2.62)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I

Packaging—Axial Leaded Resistors

Lead Tape Specifications: Reeled in accordance with RS-296-E								in (mm)
Series	Code	A max.	B max.	C	D	E	Tape	Class
RS	1/2	69.5 (2.74)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	1	71.5 (2.82)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	2**	89.5 (3.53)	343 (13.5)	10 (0.4)	63.5 (2.50)	52.4 (2.06)	14.3 (0.56)	II
	3	99.5 (3.92)	343 (13.5)	10 (0.4)	63.5 (2.50)	52.4 (2.06)	14.3 (0.56)	II
RSM	1/2	66.5 (2.62)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	1	69.5 (2.74)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	2	71.5 (2.82)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	3	89.5 (3.53)	343 (13.5)	10 (0.4)	63.5 (2.50)	52.4 (2.06)	14.3 (0.56)	II
	5**	99.5 (3.92)	343 (13.5)	10 (0.4)	63.5 (2.50)	52.4 (2.06)	14.3 (0.56)	II
RSPF	1/2	66.5 (2.62)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	1	69.5 (2.74)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	2	71.5 (2.82)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	3	89.5 (3.53)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
RSPL	1/2	66.5 (2.62)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	1	69.5 (2.74)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	2	85.5 (3.37)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	3	89.5 (3.53)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
SPR	1/2	69.5 (2.74)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	1	99.5 (3.92)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
TMR	3	160 (6.30)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	5	168 (6.62)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
WRF	1	71.5 (2.82)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	2	76.5 (3.01)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	II
	3	76.5 (3.01)	343 (13.5)	10 (0.4)	63.5 (2.50)	52.4 (2.06)	14.3 (0.56)	II
WW	H	88.6 (3.49)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	1	90.2 (3.55)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	1A	91.4 (3.60)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	2	90.2 (3.55)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	2A	94.7 (3.73)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	3	94.7 (3.73)	343 (13.5)	5.0 (0.2)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	3A	93.4 (3.68)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	4	98.5 (3.88)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	5	103 (4.06)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	7	107 (4.21)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
	7B	111 (4.37)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I
10	126 (4.96)	343 (13.5)	10 (0.4)	52.4 (2.06)	52.4 (2.06)	14.3 (0.56)	I	

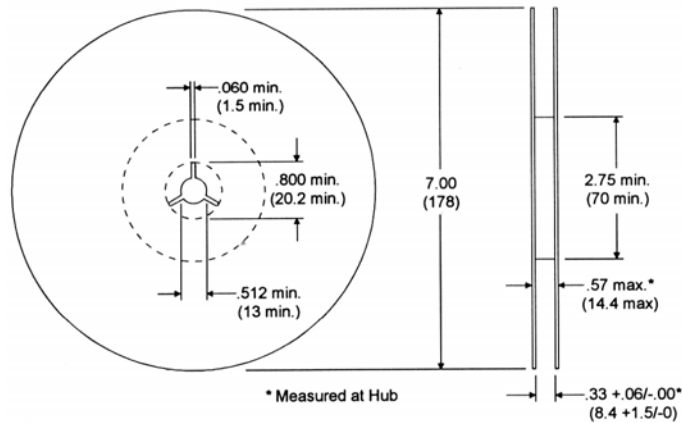
*Reference value only. The A dimension shall be governed by the overall length of the taped component. The distance between flanges shall be 0.059 inches (1.50mm) to 0.315 (8.00mm) greater than the overall component.

**Class III capable

Packaging — Chip Resistors

Chip Resistor Reel

Nominal Dimensions
Inches (mm)

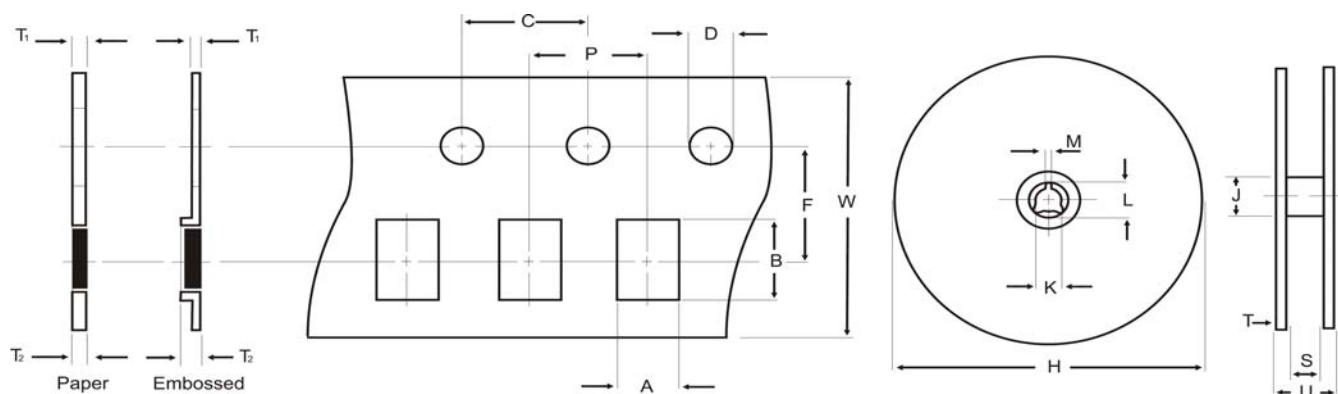


Packaging: Chips Per EIA Standard RS-481							inches mm		
A	B	C	D	E	F	G	H	J ¹	
0.16 ± 0.01 4.0 ± 0.1	0.08 ± 0.01 2.0 ± 0.1	0.16 ± 0.01 4.0 ± 0.1	0.06 + 0.01/-0 1.5 + 0.1/-0	0.04 1.0	0.069 1.75	0.20 5.0	0.138 ± 0.002 3.50 ± 0.05	0.32 ± 0.01 8.0 ± 0.1	
					K1	K2	L	M	
					RGC 1/16, RMC 1/16, RNC 16, TTF 16, CSR 1/8	0.04 max 1.1 max	-	0.04 ± 0.01 1.1 ± 0.2	0.08 ± 0.01 1.9 ± 0.2
					RGC 1/10, RMC 1/10, HMC 1/10, FCR 1/10, TTF 20, RNC 20, CSR 1/4	0.04 max 1.1 max	-	0.65 ± 0.008 1.65 ± 0.20	0.09 ± 0.01 2.4 ± 0.2
					RGC 1/8, RMC 1/8, HMC 1/8, FCR 1/8, TTF 32, RNC 32, CSR 1/2	0.04 max 1.1 max	0.09 max 2.4 max	0.08 ± 0.01 2.0 ± 0.1	0.138 ± 0.002 3.50 ± 0.05
					RMC 1/4, FCR 1/4	-	0.09 max 2.4 max	0.11 ± 0.01 2.8 ± 0.2	0.14 ± 0.01 3.6 ± 0.2
					RMC 1/2, CSR 1	-	0.09 max 2.4 max	0.11 ± 0.01 2.8 ± 0.2	0.21 ± 0.01 5.3 ± 0.2
					RMC 1, CSR 2	-	0.09 max 2.4 max	0.15 ± 0.01 3.8 ± 0.2	0.26 ± 0.01 6.6 ± 0.2
Notes:	1. Dimensions are 0.47 ± 0.01 (12.0 ± 0.1) for 1/2 and 1 Watt. 2. 5,000 per (7") reel — 1/16, 1/10, & 1/8 Watt. 4,000 per (7") reel — 1/4, 1/2 & 1 Watt. Available Options — 10,000 piece (13") reels. 3. Embossed taping standard 4,000 per (7") reel on 1/4, 1/2 & 1 Watt. 4. Paper taping available 4,000 per (7") reel on RMC 1/4 Watt.								

Packaging: RMC 1/16S, RGC 1/16S, RNC 10, and RMC 1/20 Chips (2mm Pitch)					inches mm	
A	B	C	D	E	F	G
0.026 + 0.004/-0.002 0.65 + 0.10/-0.05	0.045 + 0.004/-0.002 1.15 + 0.10/-0.05	0.315 ± 0.008 8.00 ± 0.20	0.138 ± 0.002 3.50 ± 0.05	0.69 ± 0.004 1.75 ± 0.10		
			J	K	L	
0.079 ± 0.002 2.00 ± 0.05	0.039 ± 0.002 1.00 ± 0.05	0.059 + 0.004/-0.000 1.50 + 0.10/-0.00	0.016 + 0.002/-0.000 0.40 + 0.05/0.00	0.020 max 0.50 max		
Standard Tape Packaging 2 mm Pitch – 10,000 per reel Reel diameter – 7.0 (178) Reel width – 0.315 (8.0)						

Packaging — Chip Resistors

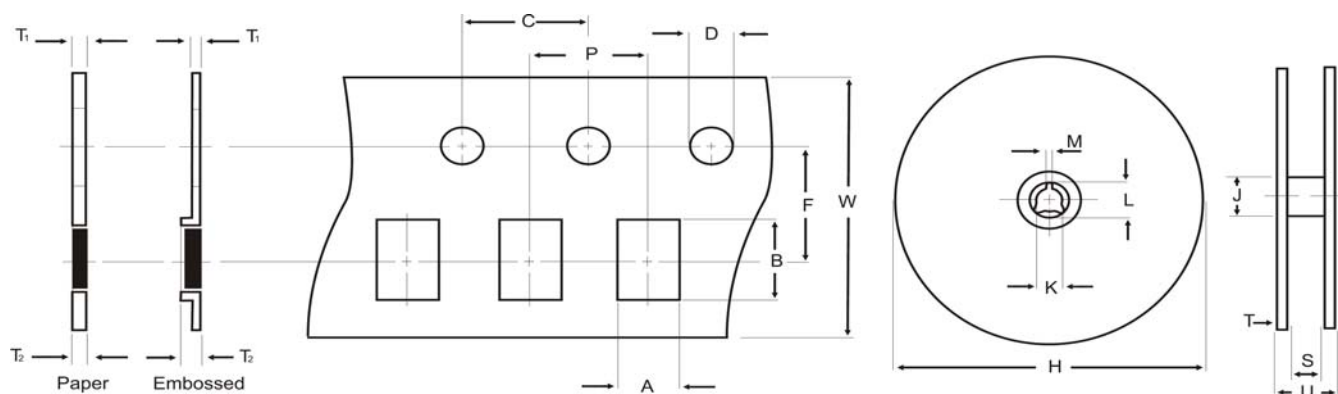
PACKING SPECIFICATIONS: Inch (mm)



FEATURES	RAV/ RAF 10-2D	RAV/ RAF 10-4D	RAV 16-2D	RAV 16-4D & 32-8	RAV 32-4D
A - Pocket Width	.046±.004 (1.17±0.10)	.051±.008 (1.30±0.20)	.071±.004 (1.80±0.10)	.079±.008 (2.00±0.20)	.134±.004 (3.40±0.10)
B - Pocket Length	.046±.004 (1.17±0.10)	.091 ±.008 (2.30±0.20)	.071±.004 (1.80±0.10)	.142±.008 (3.60±0.20)	.220±.004 (5.60±0.10)
P - Pocket Spacing	.079±.002 (2.00±0.05)	.079±.002 (2.00±0.05)	.157±.004 (4.00±0.10)	.157±.004 (4.00±0.10)	.157±.004 (4.00±0.10)
C - Pin Spacing	.157±.004 (4.00±0.10)	.157±.004 (4.00±0.10)	.157±.004 (4.00±0.10)	.157±.004 (4.00±0.10)	.157±.004 (4.00±0.10)
D - Pin Diameter	.06+.004/-0 (1.5+0.1/-0)	.06+.004/-0 (1.5+0.1/-0)	.06+.004/-0 (1.5+0.1/-0)	.06+.004/-0 (1.5+0.1/-0)	.06+.004/-0 (1.5+0.1/-0)
F - Pin-Pocket C/L	.138±.002 (3.50±0.05)	.138±.002 (3.50±0.05)	.138±.002 (3.50±0.05)	.138±.002 (3.50±0.05)	.217±.002 (5.50±0.05)
W - Strip Width	.315±.008 (8.00±0.20)	.315±.008 (8.00±0.20)	.315±.008 (8.00±0.20)	.315±.008 (8.00±0.20)	.472±.008 (12.00±0.20)
T1 - Strip Thickness	.04 max. (1.0 max.)	.04 max. (1.0 max.)	.02 max. (0.5 max.)	.04 max. (1.0 max.)	.010±.002 (0.25±0.05)
T2 - Total Thickness	.06 max. (1.4 max.)	.06 max. (1.4 max.)	.04 max. (1.0 max.)	.06 max. (1.4 max.)	.043 max. (1.10 max.)
Material Pieces/Reel	Paper 10,000	Paper 10,000	Paper 5,000	Paper 5,000	Embossed 4,000
H - Reel Diameter	7.00±.08 (178.0±2.0)	7.00±.08 (178.0±2.0)	7.00±.08 (178.0±2.0)	7.00±.08 (178.0±2.0)	7.1+0/- .12 (180+0/-3.0)
J - Hub Diameter	2.0 (50) approx.	2.0 (50) approx.	2.0 (50) approx.	2.0 (50) approx.	2.4±.04/-0 (60±1.0/-0)
K - Hole Diameter	.51±.04 (13.0±1.0)	.51±.04 (13.0±1.0)	.51±.04 (13.0±1.0)	.51±.04 (13.0±1.0)	.51±.01 (13.0±0.2)
L - Key Diameter	.83±.04 (21.0±1.0)	.83±.04 (21.0±1.0)	.83±.04 (21.0±1.0)	.83±.04 (21.0±1.0)	.83±.03 (21.0±0.8)
M - Key Width	.08±.04 (2.0±1.0)	.08±.04 (2.0±1.0)	.08±.04 (2.0±1.0)	.08±.04 (2.0±1.0)	.08±.02 (2.0±0.5)
S - Reel Inside Width	.53±.08 (13.5±2.0)	.53±.08 (13.5±2.0)	.53±.08 (13.5±2.0)	.53±.08 (13.5±2.0)	.35±.01 (9.0±0.3)
T - Side Thickness	.03±.01 (0.8±0.2)	.03±.01 (0.8±0.2)	.03±.01 (0.8±0.2)	.03±.01 (0.8±0.2)	-
U - Reel Outside Width	-	-	-	-	.45±.04 (11.4±1.0)

Packaging — Chip Resistors

PACKING SPECIFICATIONS: Inch (mm)



FEATURES	RAC 16-4D	RAC 32-4D	RAC 40-8M	RAC 64-8N/R
A - Pocket Width	0.079±0.008 (2.00±0.20)	0.138±0.004 (3.50±0.10)	0.098±0.004 (2.50±0.10)	0.138±0.004 (3.50±0.10)
B - Pocket Length	0.142±0.008 (3.60±0.20)	0.224±0.004 (5.70±0.10)	0.173±0.004 (4.40±0.10)	0.266±0.004 (6.75±0.10)
P - Pocket Spacing	0.157±0.004 (4.00±0.010)	0.157±0.004 (4.00±0.10)	0.157±0.004 (4.00±0.10)	0.157±0.004 (4.00±0.10)
C - Pin Spacing	0.157±0.004 (4.00±0.10)	0.157±0.004 (4.00±0.10)	0.157±0.004 (4.00±0.10)	0.157±0.004 (4.00±0.10)
D - Pin Diameter	0.06±0.004/-0 (1.5±0.1/-0)	0.06±0.004/-0 (1.+0.1/-0)	0.06±0.004/-0 (1.5±0.1/-0)	0.06±0.004/-0 (1.5±0.1/-0)
F - Pin-to-Pocket Center	0.138±0.002 (3.50±0.05)	0.217±0.002 (5.50±0.05)	0.217±0.002 (5.50±0.05)	0.217±0.002 (5.50±0.05)
W - Strip Width	0.315±0.008 (8.00±0.20)	0.472±0.008 (12.00±0.20)	0.472±0.008 (12.00±0.20)	0.472±0.008 (12.00±0.20)
T1 - Strip Thickness	0.02 max. (0.5 max.)	0.010±0.002 (0.25±0.05)	0.010±0.002 (0.25±0.05)	0.010±0.002 (0.25±0.05)
T2 - Total Thickness	0.04 max. (1.0 max.)	0.043 max. (1.10 max.)	0.043 max. (1.10 max.)	0.043 max. (1.10 max.)
Material Pieces/Reel	Paper 5,000	Embossed 4,000	Embossed 4,000	Embossed 4,000
H - Reel Diameter	7.00±0.08 (178.0±2.0)	7.09+0/-0.12 (180.0+0/-3.0)	7.09+0/-0.12 (180.0+0/-3.0)	7.09+0/-0.12 (180.0+0/-3.0)
J - Hub Diameter	2.0 (50) approx.	2.4+0.04/-0 (60+1.0/-0)	2.4+0.04/-0 (60+1.0/-0)	2.4+0.04/-0 (60+1.0/-0)
K - Hole Diameter	0.51±0.04 (13.0±1.0)	0.51±0.01 (13.0±0.2)	0.51±0.01 (13.0±0.2)	0.51±0.01 (13.0±0.2)
L - Key Diameter	0.83±0.04 (21.0±1.0)	0.83±0.03 (21.0±0.8)	0.83±0.03 (21.0±0.8)	0.83±0.03 (21.0±0.8)
M - Key Width	0.08±0.04 (2.0±1.0)	0.08±0.02 (2.0±0.5)	0.08±0.02 (2.0±0.5)	0.08±0.02 (2.0±0.5)
S - Reel Inside Width	0.53±0.08 (13.5±2.0)	0.35±0.01 (9.0±0.3)	0.35±0.01 (9.0±0.3)	0.35±0.01 (9.0±0.3)
T - Reel Side Thickness	0.03±0.01 (0.8±0.2)	-	-	-
U - Reel Outside Width	-	0.45±0.04 (11.4±1.0)	0.45±0.04 (11.4±1.0)	0.45±0.04 (11.4±1.0)

Part Marking Instructions — Chip Resistors



1% Marking

The nominal resistance is marked on the surface of the overcoating with the use of 4 digit markings. 0201 and 0402 are not marked



5% Marking

The nominal resistance is marked on the surface of the overcoating with the use of 3 digit markings. 0201 and 0402 are not marked

For shared E24/ E96 values, 1% tolerance product may be marked with three digit marking instead of the standard four digit marking for all other E96 values. All E24 values available in 1% tolerance are also marked with three digit marking.

Marking Instructions for 0603 1% Chip Resistors (Per EIA-J)

A two-digit number is assigned to each standard R-Value (E96) as shown in the chart below

This is followed by one alpha character which is used as a multiplier. Each letter from "Y" – "F" represents a specific multiplier as follows:

Y = 0.1	B = 100	E = 100,000
X = 1	C = 1,000	F = 1,000,000
A = 10	D = 10,000	

EXAMPLE:

Chip Marking	Explanation	Value
01B	01 means 10.0 and B = 100	10.0 x 100 = 1 K ohm
25C	25 means 17.8 and C = 1,000	17.8 x 1,000 = 17.8 K ohm
93D	93 means 90.9 and D = 10,000	90.9 x 10,000 = 909 K ohm

E96											
1%	#	1%	#	1%	#	1%	#	1%	#	1%	#
10.0	01	14.7	17	21.5	33	31.6	49	46.4	65	68.1	81
10.2	02	15.0	18	22.1	34	32.4	50	47.5	66	69.8	82
10.5	03	15.4	19	22.6	35	33.2	51	48.7	67	71.5	83
10.7	04	15.8	20	23.2	36	34.0	52	49.9	68	73.2	84
11.0	05	16.2	21	23.7	37	34.8	53	51.1	69	75.0	85
11.3	06	16.5	22	24.3	38	35.7	54	52.3	70	76.8	86
11.5	07	16.9	23	24.9	39	36.5	55	53.6	71	78.7	87
11.8	08	17.4	24	25.5	40	37.4	56	54.9	72	80.6	88
12.1	09	17.8	25	26.1	41	38.3	57	56.2	73	82.5	89
12.4	10	18.2	26	26.7	42	39.2	58	57.6	74	84.5	90
12.7	11	18.7	27	27.4	43	40.2	59	59.0	75	86.6	91
13.0	12	19.1	28	28.0	44	41.2	60	60.4	76	88.7	92
13.3	13	19.6	29	28.7	45	42.2	61	61.9	77	90.9	93
13.7	14	20.0	30	29.4	46	43.2	62	63.4	78	93.1	94
14.0	15	20.5	31	30.1	47	44.2	63	64.9	79	95.3	95
14.3	16	21.0	32	30.9	48	45.3	64	66.5	80	97.6	96

General Product Information

Temperature Coefficient Codes

SEI TC Code	MIL TC Code	Industry Std TC Code	Temperature Coefficient
T0	N/A	T0	±200ppm/°C
T1	D	T1	±100ppm/°C
T2	C	T2	±50ppm/°C
T9	E	T9	±25ppm/°C
TD	N/A	T10	±15ppm/°C
TB	N/A	T13	±10ppm/°C
TA	N/A	T16	±5ppm/°C

Tolerance Codes

Resistance Values

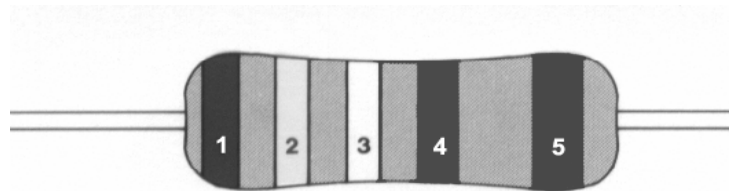
SEI/MIL Reference	Tolerance	SEI Standard for Nominal Values & Tolerances	
		Series	Tolerance
K	±10%	E12	±10%
J	±5%	E24	±5%, ±2%
G	±2%	E96	±1%
F	±1%	E192	±0.5%, ±0.25%, ±0.1%
D	±0.5%	Note: Non-standard R values are available. Consult factory for minimum order quantities.	
C	±0.25%		
B	±0.1%		

Component Flammability

Product Type	Polymer Type	IEC 695-2-2	UL94V Rating	Total Polymer Mass	Oxygen Index
Carbon Films					
CF 1/8 (CFM 1/4)	Epoxy	*	N/A	3 mg	N/A
CF 1/4 (CFM 1/2)	Epoxy	*	N/A	15 mg	N/A
CF 1/2	Epoxy	*	N/A	30 mg	N/A
Metal Films					
RN 1/8 (RNM 1/4)	Epoxy	*	N/A	3 mg	N/A
RN 1/4 (RNM 1/2)	Epoxy	*	N/A	15 mg	N/A
RN 1/2	Epoxy	*	N/A	30 mg	N/A
Metal Oxides					
RSM 1/2	Silicone	*	94V-0	20 mg	46 – 48%
RSM 1 (RS 1/2)	Silicone	*	94V-0	30 mg	46 – 48%
RSM 2 (RS 1)	Silicone	*	94V-0	50 mg	46 – 48%
RSM 3 (RS 2)	Silicone	*	94V-0	130 mg	46 – 48%
RSM 5 (RS 3)	Silicone	*	94V-0	500 mg	46 – 48%
RS 5	Silicone	*	94V-0	400 mg	46 – 48%
Chip Resistors					
RMC Series	Boro-Silicated Acid Lead Glass	*	94V-0	N/A	N/A
Resistor Networks					
LC5X	Epoxy	*	94V-0	70 mg	N/A
LC6X	Epoxy	*	94V-0	80 mg	N/A
LC7X	Epoxy	*	94V-0	90 mg	N/A
LC8X	Epoxy	*	94V-0	110 mg	N/A
LC9X	Epoxy	*	94V-0	120 mg	N/A
LC0X	Epoxy	*	94V-0	140 mg	N/A
Chip Networks					
RAC Series	Boro-Silicated Acid Lead Glass	*	94V-0	N/A	N/A
RAV Series	Boro-Silicated Acid Lead Glass	*	94V-0	N/A	N/A

* Meets specification

Standard Color Codes



Standard Color Code			
Band Color	Nominal	Multiplier	Tolerance (%)
Black	0	1	—
Brown	1	10	1
Red	2	100	2
Orange	3	1K	—
Yellow	4	10K	—
Green	5	100K	0.5
Blue	6	1,000K	0.25
Violet	7	—	—
Gray	8	—	—
White	9	0.001	—
Silver	—	0.01	10
Gold	—	0.1	5

Color Band Description		
Band	Precision	General Purpose
	Have three significant-figure bands, a multiplier band and a tolerance band. Tolerances 1% or less	Have two significant-figure bands, a multiplier band and a tolerance band. Tolerances 2% or greater
1st Band	Nominal	Nominal
2nd Band	Nominal	Nominal
3rd Band	Nominal	Multiplier
4th Band	Multiplier	Tolerance
5th Band	Tolerance	

Resistor Glossary

Resistor Glossary	
Term	Definition
Ambient temperature	The ambient temperature is the temperature in the immediate environment of the resistor.
Carbon-composition	Resistor with the resistance element formed by molding a body of carbon powder mixed with a phenolic binder.
Carbon-film	Resistor whose resistance element is carbon film deposited on a ceramic core.
Climate category	Indicates the lowest and the highest ambient temperature at which the resistors may be operated continuously.
Color-band or color code	Method of indicating value and tolerance on axial leaded resistors whose body is too small for legible alphanumeric marking.
Critical resistance	The critical resistance (R_{crit}) is the resistance that can be calculated from the rated dissipation P_v occurring under operating voltage V_{max} . A resistor of critical resistance will exhibit the largest drift in a style, because it is the highest value that may carry the full rated power load.
Current noise	Random low frequency electrostatic noise arising from current fluctuations in parallel with the resistor.
Current sensor	A resistive device employed to sense levels of changes in current.
Derating	The power load capability of a resistor is limited by its permissible element temperature. Since the rated power dissipation is referenced to a specific ambient temperature, higher ambient temperatures require a reduced permissible load, i.e., a derating. The derating curve indicates the permissible power load as a function of the ambient temperature.
Dielectric strength (dielectric withstanding voltage)	The ultimate breakdown voltage of the dielectric or insulation of the resistor when the voltage is applied between the case and all terminals tied together. Dielectric strength is usually specified at sea level and simulated at high altitude air pressures.
DIP	Dual-in-line package resistor network.
Drift	The change of a resistance value from its initial value during a specified period of time under specified operating conditions.
E-series	Method of deriving nominal resistance values required for each tolerance level. The series E24 is comprised of 24 values per decade and applies to 2% and 5% tolerances. The series E96 applies to 1% tolerance and E192 applies to .1%, .25%, and .5%.
Failure rate	The failure rate indicates the statistically established maximum rate of failures at a level of confidence of 60%. The figures are derived from certified results of standard endurance tests after 1000 hours duration at the rated dissipation.
Film temperature	The temperature of the resistive film is considered in discussions about power rating and pulse load capability. The film temperature determines the drift and stability of the resistor. For resistors that feature hot spots in the resistive film, the higher temperature of the hot spot is to be considered. Since most resistors are covered with lacquer or protective coating, only the surface temperature can be measured on the outside. However, the surface temperature is almost as high as the film temperature.
Fixed resistors	Resistors whose value is set in the manufacturing process.
Insulation resistance	The DC resistance measured between all terminals connected together and the case, exterior insulation, or external hardware.
Kelvin connection	Four-terminal connection required in low-resistance measurements to eliminate the effects of contact resistance and lead resistance, as well as the effects of lead temperature, providing accurate measurements. Invented by Lord Kelvin in the 19th Century.

Resistor Glossary

Resistor Glossary	
Term	Definition
Maximum working voltage	The maximum voltage stress (DC or rms) that may be applied to the resistor (resistance element). A function of the materials used, the required performance, and the physical dimensions.
Metal oxide	Resistor whose resistance element is a thick film ruthenium oxide paste deposited on a cylindrical ceramic core by means of dipping or spiral-coating.
Operating voltage	The limiting element voltage V_{max} is the maximum voltage that may be applied continuously to the resistor, provided its resistance value is equal to or higher than the critical resistance. The limit applies to DC voltages and to AC rms voltage of undistorted sinusoidal shape.
Power rating	Maximum power in still air that will limit the resistor internal hot-spot temperature to a satisfactory level. Power ratings must be reduced as the temperature rises, so derating curves or charts are published. These parameters are application-dependent.
Pulse load capability	The pulse load capability of a resistor is its ability to withstand transient loads that considerably exceed the rated dissipation with its peak value.
Resistance temperature characteristic (coefficient)	The magnitude of change in resistance due to temperature, expressed in percent or degree centigrade or parts-per-million per degree centigrade (PPM/C). If the resistance changes are linear over the specified temperature range, the parameter is known as the temperature "coefficient." This assumption of linearity is usually made in order to ease calculations.
Resistance tolerance	The permissible deviation of the manufactured resistance value (express in percent) from the specified nominal resistance value at standard or stated environmental conditions.
Resistor	A device that converts electrical energy to thermal energy according to Ohm's Law.
Shunt	A resistive device employed to divert most of the current in an electric circuit.
SIP	Single-in-line package resistor network.
SMD	Surface mount devices. Chips and chip arrays are examples.
Solderability	Property of the termination to accept new solder in a soldering process.
Stability	Ability of a resistor to maintain its initial resistance value of extended periods of time when subjected to any combination of electrical stresses and environmental conditions.
Temperature rise	Thermal resistance that impedes the dissipation of heat from the resistor.
Thick-film	Resistor whose resistance element consists of a ruthenium oxide (also called cermet) screen printed onto a ceramic substrate and fired at a high temperature.
Thin-film	Resistor whose resistance element (typically nickel-chromium on a ceramic core or substrate) is created typically by vacuum deposition or sputtering.
Variable resistors	Resistors whose value can be adjusted (trimmed) by the user, typically by means of a dial.
Voltage coefficient	A resistor has a voltage coefficient if measurements of resistance with different voltages yield different results. The voltage coefficient is the quotient of the relative difference in resistance and the difference of measuring voltage.
Wirewound	Resistor whose resistance element consists of a wire (nickel-chromium, copper-nickel, or gold-platinum) wound around a bobbin or core.
Zero-ohm resistors	Jumpers that are manufactured into resistor bodies for ease of insertion by the user.

Resistor Codes

Standard Resistance Values for the 10 to 100 Decade

(also usable in decade multiples or sub-multiples)

Resistance Tolerance (%)																								
E192	E96	E24	E12	E6	E192	E96	E24	E12	E6	E192	E96	E24	E12	E6	E192	E96	E24	E12	E6	E192	E96	E24	E12	E6
0.1%	—	—	—	—	0.1%	—	—	—	—	0.1%	—	—	—	—	0.1%	—	—	—	—	0.1%	—	—	—	—
0.25%	1%	2%	10%	20%	0.25%	1%	2%	10%	20%	0.25%	1%	2%	10%	20%	0.25%	1%	2%	10%	20%	0.25%	1%	2%	10%	20%
0.5%	—	5%	—	—	0.5%	—	5%	—	—	0.5%	—	5%	—	—	0.5%	—	5%	—	—	0.5%	—	5%	—	—
10.0	10.0	10	10	10	15.8	15.8	—	—	—	24.9	24.9	—	—	—	39.2	39.2	39	39	—	62.6	—	—	—	—
10.1	—	—	—	—	16.0	—	16	—	—	25.2	—	—	—	—	39.7	—	—	—	—	63.4	63.4	—	—	—
10.2	10.2	—	—	—	16.2	16.2	—	—	—	25.5	25.5	—	—	—	40.2	40.2	—	—	—	64.2	—	—	—	—
10.4	—	—	—	—	16.4	—	—	—	—	25.8	—	—	—	—	40.7	—	—	—	—	64.9	64.9	—	—	—
10.5	10.5	—	—	—	16.5	16.5	—	—	—	26.1	26.1	—	—	—	41.2	41.2	—	—	—	65.7	—	—	—	—
10.6	—	—	—	—	16.7	—	—	—	—	26.4	—	—	—	—	41.7	—	—	—	—	66.5	66.5	—	—	—
10.7	10.7	—	—	—	16.9	16.9	—	—	—	26.7	26.7	—	—	—	42.2	42.2	—	—	—	67.3	—	—	—	—
10.9	—	—	—	—	17.2	—	—	—	—	27.1	—	27	27	—	42.7	—	—	—	—	68.1	68.1	68	68	68
11.0	11.0	11	—	—	17.4	17.4	—	—	—	27.4	27.4	—	—	—	43.2	43.2	43	—	—	69.0	—	—	—	—
11.1	—	—	—	—	17.6	—	—	—	—	27.7	—	—	—	—	43.7	—	—	—	—	69.8	69.8	—	—	—
11.3	11.3	—	—	—	17.8	17.8	—	—	—	28.0	28.0	—	—	—	44.2	44.2	—	—	—	70.6	—	—	—	—
11.4	—	—	—	—	18.0	—	18	18	—	28.4	—	—	—	—	44.8	—	—	—	—	71.5	71.5	—	—	—
11.5	11.5	—	—	—	18.2	18.2	—	—	—	28.7	28.7	—	—	—	45.3	45.3	—	—	—	72.3	—	—	—	—
11.7	—	—	—	—	18.4	—	—	—	—	29.1	—	—	—	—	45.9	—	—	—	—	73.2	73.2	—	—	—
11.8	11.8	—	—	—	18.7	18.7	—	—	—	29.4	29.4	—	—	—	46.4	46.4	—	—	—	74.1	—	—	—	—
12.0	—	12	12	—	18.9	—	—	—	—	29.8	—	—	—	—	47.0	—	47	47	47	75.0	75.0	75	—	—
12.1	12.1	—	—	—	19.1	19.1	—	—	—	30.1	30.1	30	—	—	47.5	47.5	—	—	—	75.9	—	—	—	—
12.3	—	—	—	—	19.3	—	—	—	—	30.5	—	—	—	—	48.1	—	—	—	—	76.8	76.8	—	—	—
12.4	12.4	—	—	—	19.6	19.6	—	—	—	30.9	30.9	—	—	—	48.7	48.7	—	—	—	77.7	—	—	—	—
12.6	—	—	—	—	19.8	—	—	—	—	31.2	—	—	—	—	49.3	—	—	—	—	78.7	78.7	—	—	—
12.7	12.7	—	—	—	20.0	20.0	20	—	—	31.6	31.6	—	—	—	49.9	49.9	—	—	—	79.6	—	—	—	—
12.9	—	—	—	—	20.3	—	—	—	—	32.0	—	—	—	—	50.5	—	—	—	—	80.6	80.6	—	—	—
13.0	13.0	13	—	—	20.5	20.5	20	—	—	32.4	32.4	—	—	—	51.1	51.1	51	—	—	81.6	—	—	—	—
13.2	—	—	—	—	20.8	—	—	—	—	32.8	—	—	—	—	51.7	—	—	—	—	82.5	82.5	82	82	—
13.3	13.3	—	—	—	21.0	21.0	—	—	—	33.2	33.2	33	33	33	52.3	52.3	—	—	—	83.5	—	—	—	—
13.5	—	—	—	—	21.3	—	—	—	—	33.6	—	—	—	—	53.0	—	—	—	—	84.5	84.5	—	—	—
13.7	13.7	—	—	—	21.5	21.5	—	—	—	34.0	34.0	—	—	—	53.6	53.6	—	—	—	85.6	—	—	—	—
13.8	—	—	—	—	21.8	—	—	—	—	34.4	—	—	—	—	54.2	—	—	—	—	86.6	86.6	—	—	—
14.0	14.0	—	—	—	22.1	22.1	22	22	22	34.8	34.8	—	—	—	54.9	54.9	—	—	—	87.6	—	—	—	—
14.2	—	—	—	—	22.3	—	—	—	—	35.2	—	—	—	—	55.6	—	—	—	—	88.7	88.7	—	—	—
14.3	14.3	—	—	—	22.6	22.6	—	—	—	35.7	35.7	—	—	—	56.2	56.2	56	56	—	89.8	—	—	—	—
14.5	—	—	—	—	22.9	—	—	—	—	36.1	—	36	—	—	56.9	—	—	—	—	90.9	90.9	91	—	—
14.7	14.7	—	—	—	23.2	23.2	—	—	—	36.5	36.5	—	—	—	57.6	57.6	—	—	—	92.0	—	—	—	—
14.9	—	—	—	—	23.4	—	—	—	—	37.0	—	—	—	—	58.3	—	—	—	—	93.1	93.1	—	—	—
15.0	15.0	15	15	15	23.7	23.7	—	—	—	37.4	37.4	—	—	—	59.0	59.0	—	—	—	94.2	—	—	—	—
15.2	—	—	—	—	24.0	—	24	—	—	37.9	—	—	—	—	59.7	—	—	—	—	95.3	95.3	—	—	—
15.4	15.4	—	—	—	24.3	24.3	—	—	—	38.3	38.3	—	—	—	60.4	60.4	—	—	—	96.5	—	—	—	—
15.6	—	—	—	—	24.6	—	—	—	—	38.8	—	—	—	—	61.2	—	—	—	—	97.6	97.6	—	—	—
															61.9	61.9	62	—	—	98.8	—	—	—	—