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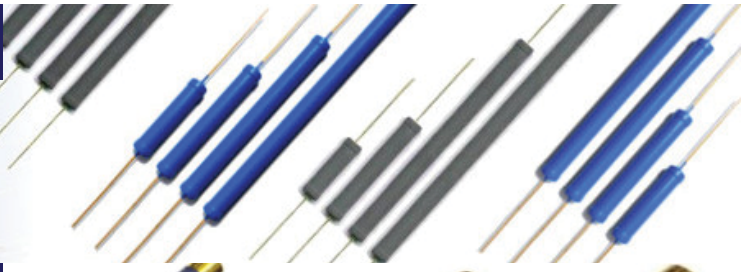
High Performance Thick Film Resistors

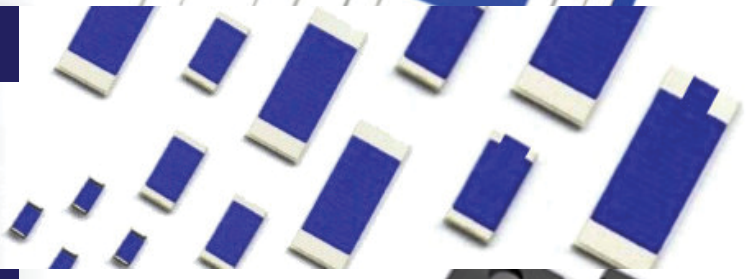
Cylindrical High Voltage Resistors



Tubular High Voltage Power Resistors

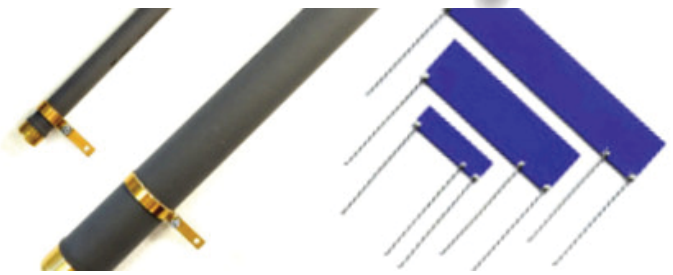
Planar High Voltage Resistors

SMD High Voltage Chip Resistors



Heat Sink Mountable Power Resistors

Precision High Voltage Dividers



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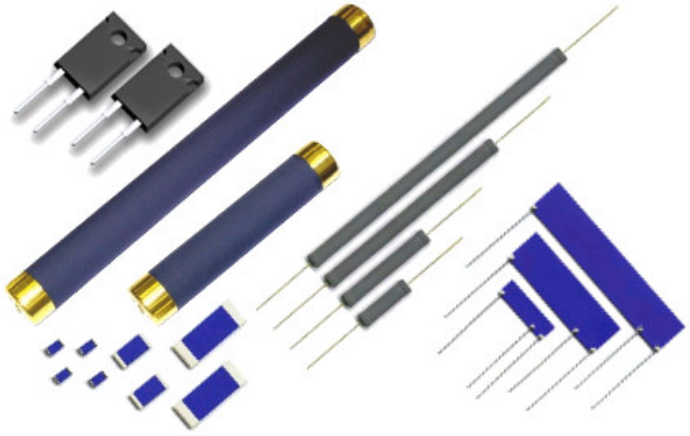
High Performance Thick Film Resistors



Nicrom Electronic

Nicrom Electronic was founded in 1993 by engineers with more than 30 years of experience in Thick Film technology. Our purpose is to design and manufacture High Voltage, High Power, High Precision and Low TC Resistors where our experience plays a leading role.

100% Swiss Made

Our products are 100% designed and manufactured in Switzerland. The development of our products begins with a careful selection of the materials to guarantee high precision and quality. Special designs and process technologies provide outstanding performances and technical solutions for our most exacting customers.

Factory

Our factory is placed in the south of Switzerland, an area with low hills and rolling countryside 25 km away from the airport of Lugano–Agno and 60 km away from Milan–Malpensa. An ideal location to take advantages of the economical and political stability of Switzerland.

Equipments

- 6 Laser Trimmers (custom built)
- 1 Firing Furnace to 1000 °C
- 8 Curing and Drying Hovens
- 4 Screen Printing Machines for cylindrical substrates
- 4 Screen Printing Machines for planar substrates
- 7 Resistance Measurements Systems to 100G /10T

Capabilities

- Resistance value to 10 TOhm
- Tolerance of 0.05% up to 10 Gohm
- Temperature Coefficients 10 ppm/°C to 10 Gig
- Fine line printing to 80 micron on 0603 chip resistors
- Printing on ultra large ceramic tubes to 1300 mm long
- Printing on Alumina, AlN and Steel substrates

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Cylindrical High Voltage Resistors

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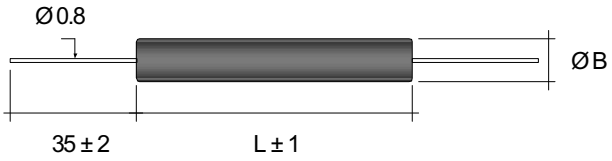
SMD High Voltage Chip Dividers

Planar High Voltage Dividers

Tubular High Voltage Dividers

High Voltage Resistors Series 400
Precision, Non-Inductive, Low TC

High Voltage Resistors Series 400 have been developed to meet the precision temperature stability requirements of high accuracy and high voltage systems, combining proprietary non-inductive resistance system and design to achieve low temperature coefficient, low voltage coefficients, high stability and increased high operating voltages.
Low TC Precision High Voltage Resistors Series 400 are designed to meet the demanding requirements of TWT power supplies, electron microscopes, X-ray systems, high resolution CRT displays and geophysical instruments.



Model	Wattage	Max. Oper. Voltage	Dimensions in millimeters ± 0.50 [Dimensions in inches ± 0.02]	
			L	B
400.2	3.80	15'000	27.00 [1.07]	8.00 [0.32]
400.3	5.00	21'000	37.00 [1.46]	8.00 [0.32]
400.5	7.50	30'000	52.00 [2.05]	8.00 [0.32]
400.7	10.00	45'000	77.00 [3.03]	8.00 [0.32]
400.10	13.50	60'000	102.00 [4.02]	8.30 [0.33]
400.12	16.00	72'000	122.00 [4.80]	8.50 [0.34]
400.15	20.00	90'000	152.00 [5.98]	8.50 [0.34]

Characteristics

Resistance Values	from 1KΩ to as high as 100GΩ on all models (to 1TΩ on request)		
Tolerances	0.05%, 0.1%, 0.25%, 0.5%, 1%, 2%, 5%, 10% (0.05% avail. to 10G, 0.25% to 100G, other on request)		
Temperature Coefficients*	5, 10, 15, 25, 50 and 100 ppm/°C (10 ppm/°C available to 10G, 25 ppm/°C to 100G, other on request)		
Operating Temperature	-55 .. +225°C	(extended temperature range to 350°C available)	
Insulation Resistance	> 10'000 MΩ	500 Volt 25 °C 75% relative humidity	
Dielectric Strength	> 1'000 Volt	25 °C 75% relative humidity	
Thermal Shock	Δ R/R < 0.1% typ., 0.20% max.	MIL Std. 202, method 107 Cond. C	IEC 68 - 2 -14
Overload	Δ R/R < 0.1% typ., 0.25% max.	1,5 x Pnom, 5 sec (do not exceed max. voltage)	
Moisture Resistance	Δ R/R < 0.1% typ., 0.25% max.	MIL Std. 202, method 106	IEC 68 - 2 - 3
Load Life	Δ R/R < 0.1% typ., 0.25% max.	1000 hours at rated power	IEC 115 - 1
Encapsulation	Silicone Conformal Coating	Core Material	Al_2O_3 (96%)
Lead Material	Gold Plated	Resistor Material	Ruthenium Oxide

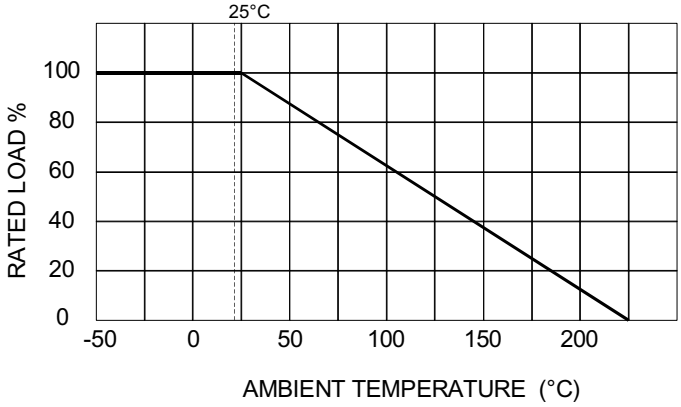
* Temperature Coefficient referenced to 25°C, ΔR taken at +125°C.

Voltage Coefficients of Resistance

Type	Resistance Range	VCR (-ppm/V)*
400.2	1K .. 500M	< 0.40
	500M .. 5G	< 0.75
400.3	1K .. 1G	< 0.20
	1G .. 10G	< 0.40
400.5	1K .. 1G5	< 0.15
	1G5 .. 15G	< 0.30
400.7	1K .. 2G5	< 0.10
	2G5 .. 25G	< 0.15
400.10	1K .. 3G	< 0.08
	3G ..30G	< 0.12
400.12	1K .. 4G	< 0.06
	4G .. 40G	< 0.10
400.15	1K .. 5G	< 0.04
	5G .. 50G	< 0.08

* typical values, contact factory for details

Derating Curve



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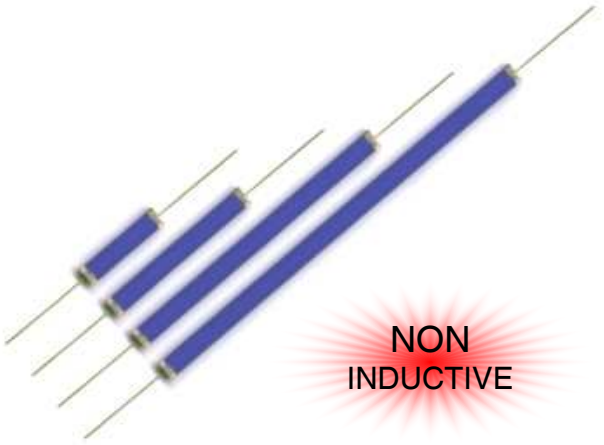
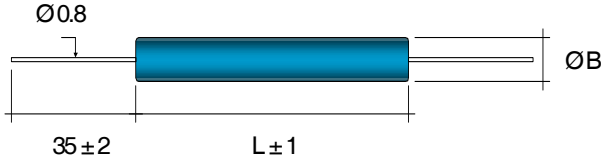
High Voltage Resistors Series 400E

Precision, Non-Inductive, Low TC, Epoxy Coating

High Voltage Resistors Series 400E have been specifically developed for use in high performance industrial high voltage systems. These precision high voltage resistors combine proprietary non-inductive resistance system and design to achieve low temperature coefficient, low voltage coefficients, high stability and increased high operating voltages.
Low TC Precision High Voltage Resistors Series 400E with high-temperature, solvent-resistant epoxy coating are intended for use in almost any environment, including oil and SF6. Typical applications are medical systems like X-ray as well as power supplies or instruments.





Model	Wattage	Max. Oper. Voltage	Dimensions in millimeters ± 0.50 [Dimensions in inches ± 0.02]	
			L	B
400.2E	3.80	15'000	27.00 [1.07]	8.00 [0.32]
400.3E	5.00	21'000	37.00 [1.46]	8.00 [0.32]
400.5E	7.50	30'000	52.00 [2.05]	8.00 [0.32]
400.7E	10.00	45'000	77.00 [3.03]	8.00 [0.32]
400.10E	13.50	60'000	102.00 [4.02]	8.00 [0.32]
400.12E	16.00	72'000	122.00 [4.80]	8.00 [0.32]
400.15E	20.00	90'000	152.00 [5.98]	8.00 [0.32]

Characteristics

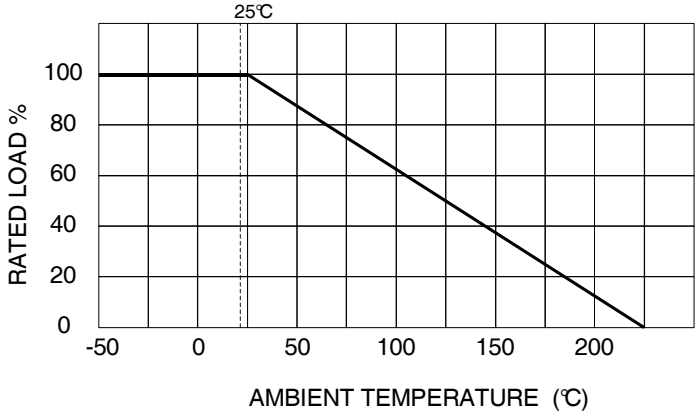
Resistance Values	from 1KΩ to as high as 100GΩ on all models (to 1TΩ on request)		
Tolerances	0.05%, 0.1%, 0.25%, 0.5%, 1%, 2%, 5%, 10% (0.05% avail. to 10G, 0.25% to 100G, other on request)		
Temperature Coefficients	5, 10, 15, 25, 50 and 100 ppm/℃ (10 ppm/℃ availab le to 10G, 25 ppm/℃ to 100G, other on request)		
Operating Temperature	-55 .. +225℃	(extended temperature range to 350℃ available)	
Insulation Resistance	> 10'000 MΩ	500 Volt 25 ℃ 75% relative humidity	
Dielectric Strength	> 1'000 Volt	25 ℃ 75% relative humidity	
Thermal Shock	Δ R/R < 0.1% typ., 0.20% max.	MIL Std. 202, method 107 Cond. C	IEC 68 - 2 -14
Overload	Δ R/R < 0.1% typ., 0.25% max.	1,5 x Pnom, 5 sec (do not exceed max. voltage)	
Moisture Resistance	Δ R/R < 0.1% typ., 0.25% max.	MIL Std. 202, method 106	IEC 68 - 2 - 3
Load Life	Δ R/R < 0.1% typ., 0.25% max.	1000 hours at rated power	IEC 115 - 1
Encapsulation	Epoxy Conformal Coating	Core Material	Al_2O_3 (96%)
Lead Material	Gold Plated	Resistor Material	Ruthenium Oxide

Voltage Coefficients of Resistance

Model	Resistance Range	VCR (-ppm/V)*
400.2E	1K .. 500M	< 0.40
	500M .. 5G	< 0.75
400.3E	1K .. 1G	< 0.20
	1G .. 10G	< 0.40
400.5E	1K .. 1G5	< 0.15
	1G5 .. 15G	< 0.30
400.7E	1K .. 2G5	< 0.10
	2G5 .. 25G	< 0.15
400.10E	1K .. 3G	< 0.08
	3G ..30G	< 0.12
400.12E	1K .. 4G	< 0.06
	4G .. 40G	< 0.10
400.15E	1K .. 5G	< 0.04
	5G .. 50G	< 0.08

* typical values, contact factory for details

Derating Curve



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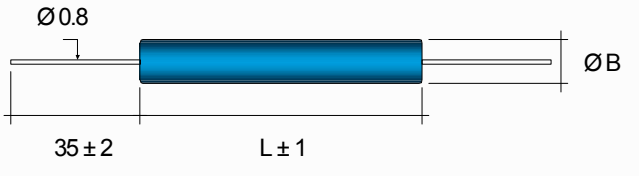
High Voltage Resistors Series 425

TC of 25 ppm/°C, Precision, Non-Inductive

High Voltage Resistors Series 425 have been developed to meet the precision temperature stability requirements of high accuracy and high voltage systems, combining proprietary non-inductive resistance system and design to achieve low temperature coefficient of 25 ppm/°C, low voltage coefficients and high stability.
Low TC Precision High Voltage Resistors Series 425 are designed to meet the demanding requirements of medical and industrial X-ray systems, power supplies or instruments.

Model	Wattage	Max. Oper. Voltage	Dimensions in millimeters ± 0.50 [Dimensions in inches ± 0.02]	
			L	B
425.2	2.00	8'000	27.00 [1.07]	8.00 [0.32]
425.3	3.00	12'000	37.00 [1.46]	8.00 [0.32]
425.4	3.50	14'000	45.00 [1.77]	8.00 [0.32]
425.5	4.00	17'000	52.00 [2.05]	8.00 [0.32]
425.7	6.00	25'000	77.00 [3.03]	8.00 [0.32]
425.10	8.00	35'000	102.00 [4.02]	8.30 [0.33]
425.12	10.00	40'000	122.00 [4.80]	8.50 [0.34]
425.15	12.00	50'000	152.00 [5.98]	8.50 [0.34]



Characteristics

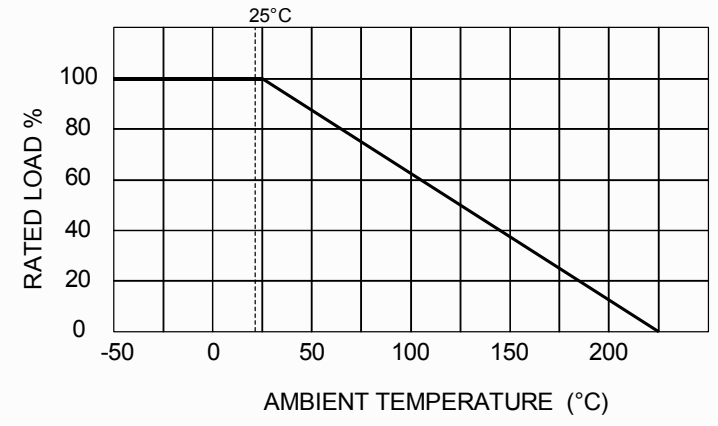
Resistance Values	from 100KΩ to as high as 1GΩ		
Tolerances	0.1%, 0.25%, 0.5%, 1%, 2%, 5%, 10%		
Temperature Coefficient	25 ppm/°C referenced to 25°C, ΔR taken at 0°C and 85°C		
Operating Temperature	-55 .. +225°C	(extended temperature range to 350°C available)	
Insulation Resistance	> 10'000 MΩ	500 Volt 25 °C 75% relative humidity	
Dielectric Strength	> 1'000 Volt	25 °C 75% relative humidity	
Thermal Shock	ΔR 0.20% max.	MIL Std. 202, method 107 Cond. B	
Overload	ΔR 0.20% max.	1,5 x Pnom, 5 sec (do not exceed max. voltage)	
Moisture Resistance	ΔR 0.40% max.	MIL Std. 202, method 106	
Load Life	ΔR 0.25% max.	1000 hours at rated power	
Encapsulation	Blue Silicone Conformal Coating	Core Material	Al_2O_3 (96%)
Lead Material	Gold Plated	Resistor Material	Ruthenium Oxide

Voltage Coefficients of Resistance

Model	Resistance Range	VCR (-ppm/V)*
425.2	100K .. 250M	< 0.20
425.3	150K .. 400M	< 0.20
425.4	170K .. 450M	< 0.20
425.5	200K .. 500M	< 0.15
425.7	300K .. 700M	< 0.10
425.10	400K .. 1G	< 0.08
425.12	500K .. 1G	< 0.06
425.15	600K .. 1G	< 0.04

* typical values, contact factory for details

Derating Curve



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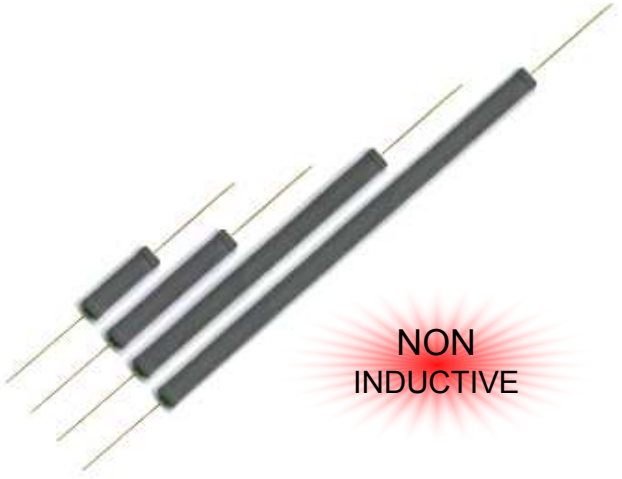
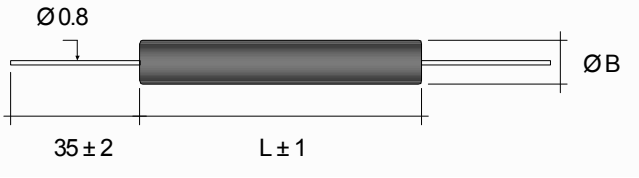
High Voltage Power Resistors Series MS400

High Power, Non-Inductive, High Temperature

High Voltage Power Resistors Series MS400 combine proprietary non-inductive resistance system, power film technology and design to achieve high stability, increased power rating to 30 Watts and high operating voltages up to 30 kV.
MS400 Power Film Resistors cover a wide resistance range from 10Ω up to 30 MΩ and operating temperatures from –55°C to +275°C. These resistors are ideally suited for high power and high frequency applications.





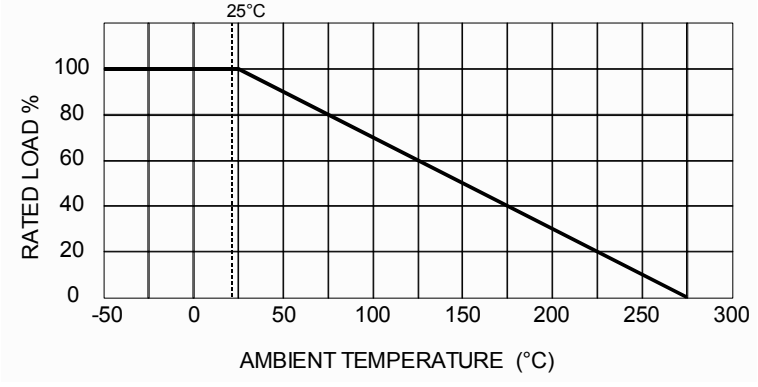
Model	Wattage Rating	Max. Voltage	Dimensions in millimeters ± 0.50 [Dimensions in inches ± 0.02]	
			L	B
MS400.2	6.00	5'000	27.00 [1.07]	8.00 [0.32]
MS400.3	8.00	7'000	37.00 [1.46]	8.00 [0.32]
MS400.4	10.00	8'000	45.00 [1.77]	8.00 [0.32]
MS400.5	12.50	10'000	52.00 [2.05]	8.00 [0.32]
MS400.7	15.00	15'000	77.00 [3.03]	8.00 [0.32]
MS400.10	20.00	20'000	102.00 [4.02]	8.30 [0.33]
MS400.12	24.00	24'000	122.00 [4.80]	8.50 [0.34]
MS400.15	30.00	30'000	152.00 [5.98]	8.50 [0.34]

Characteristics

Resistance Values	from 10Ω to as high as 30MΩ		
Tolerances	1%, 2%, 5%, 10% (other tolerances to 0.1% on request)		
Temperature Coefficients *	50 and 100 ppm/°C (other temperature coefficients to 25 ppm/°C on request)		
Operating Temperature	-55 .. +275°C	(extended temperature range to 350°C available)	
Insulation Resistance	> 10'000 MΩ	500 Volt 25 °C 75% relative humidity	
Dielectric Strength	> 1'000 Volt	25 °C 75% relative humidity	
Thermal Shock	Δ R/R < 0.5% or 0.5Ω max. whichever is greater	MIL Std. 202, method 107 Cond. C	IEC 68 - 2 -14
Overload	Δ R/R < 0.5% or 0.5Ω max. whichever is greater	5 x Pnom, 5 sec (do not exceed max. voltage)	
Moisture Resistance	Δ R/R < 0.5% or 0.5Ω max. whichever is greater	MIL Std. 202, method 106	IEC 68 - 2 - 3
Load Life	Δ R/R < 0.5% or 0.5Ω max. whichever is greater	1000 hours at rated power	IEC 115 - 1
Encapsulation	High Temp Silicone Conformal Coating	Core Material	Al_2O_3 (96%)
Lead Material	Gold Plated Copper	Resistor Material	Ruthenium Oxide

* Temperature Coefficient referenced to 25°C, ΔR taken at +105°C.

Derating Curve



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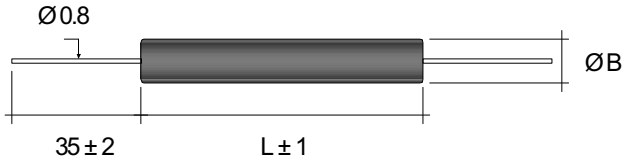
High Voltage Surge Resistors Series P400

High Pulse Energy, High Power, Non-Inductive

High Voltage Surge Resistors Series P400 combine proprietary non-inductive power film resistance system and design to achieve excellent pulse withstand performance, high stability, high power density and high operating voltages.
The new Series P400 has been developed to meet the demanding high power / high energy requirements of pulse / transient applications such as Medical Surge Protection (defibrillator cables), RC Snubber Circuits, Spark-Gap Limiters and High Voltage Power Supplies.
Series P400 is also an ideal replacement of carbon composition resistors and bulk ceramic resistors over an extended resistance range.



Model	Wattage Rating	Max. Peak Pulse Voltage	Dimensions in millimeters ± 0.50 [Dimensions in inches ± 0.02]	
			L	B
P400.2	3.80	15'000	27.00 [1.07]	8.00 [0.32]
P400.3	5.00	21'000	37.00 [1.46]	8.00 [0.32]
P400.5	7.50	30'000	52.00 [2.05]	8.00 [0.32]
P400.7	10.00	45'000	77.00 [3.03]	8.00 [0.32]
P400.10	13.50	60'000	102.00 [4.02]	8.30 [0.33]
P400.12	16.00	72'000	122.00 [4.80]	8.50 [0.34]
P400.15	20.00	90'000	152.00 [5.98]	8.50 [0.34]

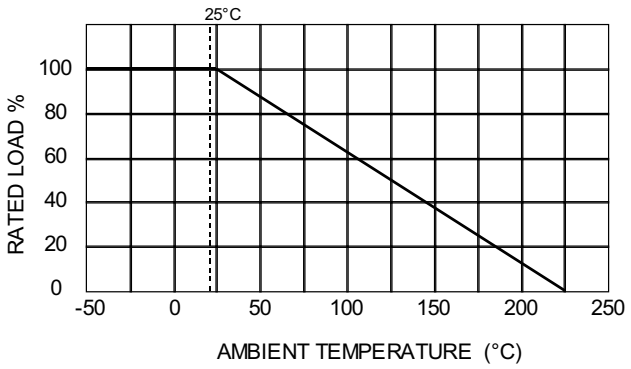
Characteristics

Resistance Values	from 1Ω to as high as 1MΩ		
Tolerances	1%, 2%, 5%, 10% (other tolerances to 0.05% on request)		
Temperature Coefficients	25, 50 and 100 ppm/°C (other temperature coefficients to 10 ppm/°C on request)		
Operating Temperature	-55 .. +225°C	(extended temperature range to 350°C available)	
Insulation Resistance	> 10'000 MΩ	500 Volt 25 °C 75% relative humidity	
Dielectric Strength	> 1'000 Volt	25 °C 75% relative humidity	
Thermal Shock	Δ R/R < 0.5% typ., 1% max.	MIL Std. 202, method 107 Cond. C	IEC 68 - 2 -14
Overload	Δ R/R < 0.5% typ., 1% max.	1.5 x Pnom, 5 sec (do not exceed max. voltage)	
Moisture Resistance	Δ R/R < 0.5% typ., 1% max.	MIL Std. 202, method 106	IEC 68 - 2 - 3
Load Life	Δ R/R < 0.5% typ., 1% max.	1000 hours at rated power	IEC 115 - 1
Continuous Working Voltage	Power Limited	= √(PxR)	
Encapsulation	Silicone Conformal Coating	Core Material	Al_2O_3 (96%)
Lead Material	Gold Plated	Resistor Material	Ruthenium Oxide

Single Pulse Energy

Type	Nominal Energy Rating (Pulse Duration 10 ms)*
P400.2	35 Joules
P400.3	55 Joules
P400.5	80 Joules
P400.7	120 Joules
P400.10	160 Joules
P400.12	200 Joules
P400.15	250 Joules

Derating Curve



*Max. Single Pulse Energy is based on a pulse duration of 10 ms.
For shorter pulses the energy rating should be decreased (see Application Notes for details). In case of repeated pulses, the average pulse power should not exceed the Nominal Power Rating.

High Voltage Resistors Series 480

General Purpose, Low Cost, Non-Inductive

NEW
Low Cost

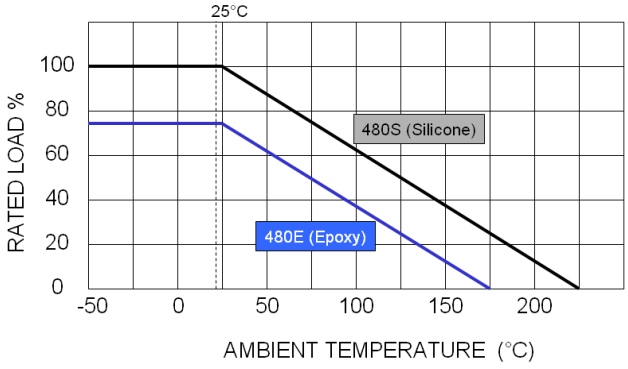
The **low cost** High Voltage Resistors Series 480 meet a general set of requirements with voltage ratings to **50 kV**. These products are available with high temperature silicone or epoxy coating and feature a wide ohmic range from 100Ω to 10GΩ, standard tolerance to **1%** and standard temperature coefficient of **80 ppm/°C**.

Model	Wattage	Max. Oper. Voltage	Dimensions in millimeters ± 0.50 [Dimensions in inches ± 0.02]	
			L	B
480.2	2.50	8'000	27.00 [1.07]	8.00 [0.32]
480.3	3.50	12'000	37.00 [1.46]	8.00 [0.32]
480.4	4.00	14'000	45.00 [1.77]	8.00 [0.32]
480.5	5.00	17'000	52.00 [2.05]	8.00 [0.32]
480.7	7.50	25'000	77.00 [3.03]	8.00 [0.32]
480.10	10.00	35'000	102.00 [4.02]	8.30 [0.33]
480.12	13.00	40'000	122.00 [4.80]	8.50 [0.34]
480.15	15.00	50'000	152.00 [5.98]	8.50 [0.34]

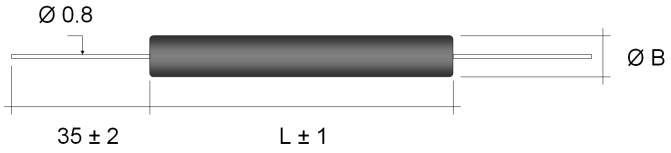
Characteristics

Resistance Values	from 100Ω to as high as 10GΩ		
Tolerances	1%, 2%, 5%, 10% (for tighter tolerances please use Series 400)		
Temperature Coefficient	80 ppm/°C referenced to 25°C, ΔR taken at 125°C (for lower TC please use Series 400 or Series 425)		
Operating Temperature	Silicone Coating: -55 .. +225°C	Epoxy Coating: -55 .. +175°C	
Insulation Resistance	> 10'000 MΩ	500 Volt 25 °C 75% relative humidity	
Dielectric Strength	> 1'000 Volt	25 °C 75% relative humidity	
Thermal Shock	ΔR 0.50% max.	MIL Std. 202, method 107 Cond. B	
Overload	ΔR 0.50% max.	1,5 x Pnom, 5 sec (do not exceed max. voltage)	
Moisture Resistance	ΔR 0.50% max.	MIL Std. 202, method 106	
Load Life	ΔR 0.50% max.	1000 hours at rated power	
Encapsulation	Silicone Coating / Epoxy Coating	Core Material	Al_2O_3 (96%)
Lead Material	Gold Plated	Resistor Material	Ruthenium Oxide

Derating Curve



Dimensions



Ordering Information

Model – Coating (S or E) - Resistance Value - Tolerance

Example:
Model 480.15, Silicone Coating, 200 MOhm, 1% tolerance
Ordering Code: 480.15-S-200M-1%

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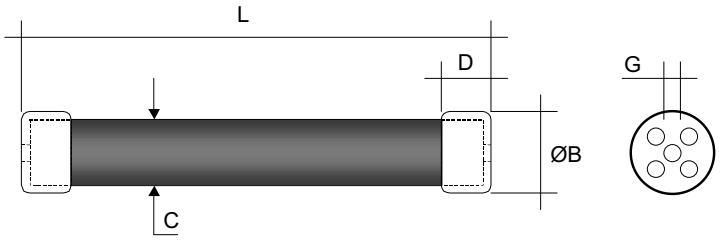
High Voltage Resistors Series 500
Precision, Non-Inductive, Low TC

High Voltage Power Resistors Series 500 combine proprietary non-inductive resistance system and design to achieve low temperature coefficient, low voltage coefficients, high stability, increased high operating voltages and high power ratings.

These Precision High Voltage Power Resistors are designed to meet the demanding requirements of TWT power supplies, electron microscopes, X-ray systems, high resolution CRT displays, geophysical instruments and power transmission lines.



Model	Wattage	Max. Operating Voltage*	Dimensions in millimeters ± 1.00 [Dimensions in inches ± 0.04]				
			L	B	C	D	G
500.10	15.00	35'000	81 ± 1 [3.19 ± 0.04]	14.00 [0.55]	13.50 [0.53]	10.00 [0.40]	M4
500.20	25.00	80'000	156 ± 1.5 [6.14 ± 0.06]	14.00 [0.55]	13.50 [0.53]	10.00 [0.40]	M4
500.50	55.00	70'000	158 ± 1.5 [6.22 ± 0.06]	31.50 [1.24]	30.50 [1.20]	17.00 [0.67]	M8
500.70	75.00	100'000	208 ± 2 [8.19 ± 0.08]	31.50 [1.24]	30.50 [1.20]	17.00 [0.67]	M8
500.100	110.00	150'000	308 ± 3 [12.12 ± 0.12]	31.50 [1.24]	30.50 [1.20]	17.00 [0.67]	M8

* DC or AC peak in dry air.

Characteristics

Resistance Values	from 1KΩ to as high as 100GΩ on all models (to 1TΩ on request)		
Tolerances	0.05%, 0.1%, 0.25%, 0.5%, 1%, 2%, 5%, 10% (0.05% avail. to 10G, 0.25% to 100G, other on request)		
Temperature Coefficients*	5, 10, 15, 25, 50 and 100 ppm/°C (10 ppm/°C available to 10G, 25 ppm/°C to 100G, other on request)		
Operating Temperature	-55 … +225°C	(extended temperature range to 350°C available)	
Insulation Resistance	> 10'000 MΩ	500 Volt 25 °C 75% relative humidity	
Dielectric Strength	> 1'000 Volt	25 °C 75% relative humidity	
Thermal Shock	Δ R/R < 0.1% typ., 0.20% max.	MIL Std. 202, method 107 Cond. C	IEC 68 - 2 -14
Overload	Δ R/R < 0.1% typ., 0.25% max.	1,5 x Pnom, 5 sec (do not exceed max. voltage)	
Moisture Resistance	Δ R/R < 0.1% typ., 0.25% max.	MIL Std. 202, method 106	IEC 68 - 2 - 3
Load Life	Δ R/R < 0.1% typ., 0.50% max.	1000 hours at rated power	IEC 115 - 1
Encapsulation	Silicone Conformal Coating	Core Material	Al_2O_3 (96%)
Lead Material	Brass Caps (lug terminations avail.)	Resistor Material	Ruthenium Oxide

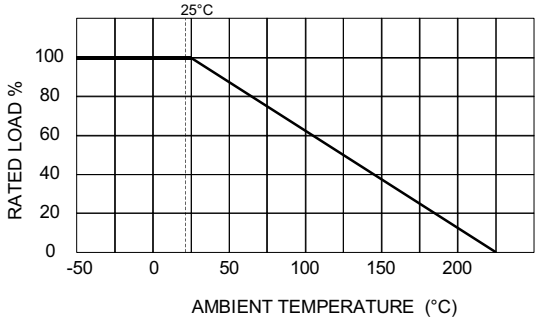
* Temperature Coefficient referenced to 25°C, ΔR taken at +125°C.

Voltage Coefficients of Resistance

Type	Resistance Range	VCR (-ppm/V)*
500.10	1K .. 1G5	< 0.09
	1G5 .. 15G	< 0.18
500.20	1K .. 3G5	< 0.04
	3G5 .. 35G	< 0.08
500.50	1K .. 2G5	< 0.04
	2G5 .. 25G	< 0.07
500.70	1K .. 3G5	< 0.03
	3G5 .. 35G	< 0.05
500.100	1K .. 6G	< 0.02
	6G .. 60G	< 0.03

* typical values, contact factory for details

Derating Curve



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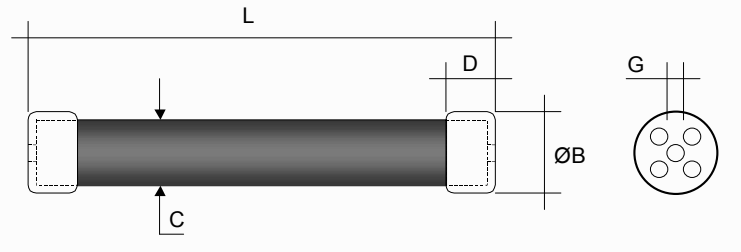
High Voltage Power Resistors Series MS500

High Power, Non-Inductive, High Temperature

High Voltage Power Resistors Series MS500 combine proprietary non-inductive resistance system, power film technology and design to achieve high stability, increased power rating and high operating voltages up to 50 kV.

MS500 Power Film Resistors cover a wide resistance range from 1 Ohm up to 10 MegOhm and operating temperatures from –55°C to +275°C. These resistors are ideally suited for high power and high frequency applications.



Model	Wattage	Max. Operating Voltage*	Dimensions in millimeters ± 1.00 [Dimensions in inches ± 0.04]				
			L	B	C	D	G
MS500.10	23.00	12'000	81 ± 1 [3.19 ± 0.04]	14.00 [0.55]	13.50 [0.53]	10.00 [0.40]	M4
MS500.20	38.00	27'000	156 ± 1.5 [6.14 ± 0.06]	14.00 [0.55]	13.50 [0.53]	10.00 [0.40]	M4
MS500.50	83.00	23'000	158 ± 1.5 [6.22 ± 0.06]	31.50 [1.24]	30.50 [1.20]	17.00 [0.67]	M8
MS500.70	113.00	33'000	208 ± 2 [8.19 ± 0.08]	31.50 [1.24]	30.50 [1.20]	17.00 [0.67]	M8
MS500.100	165.00	50'000	308 ± 3 [12.12 ± 0.12]	31.50 [1.24]	30.50 [1.20]	17.00 [0.67]	M8

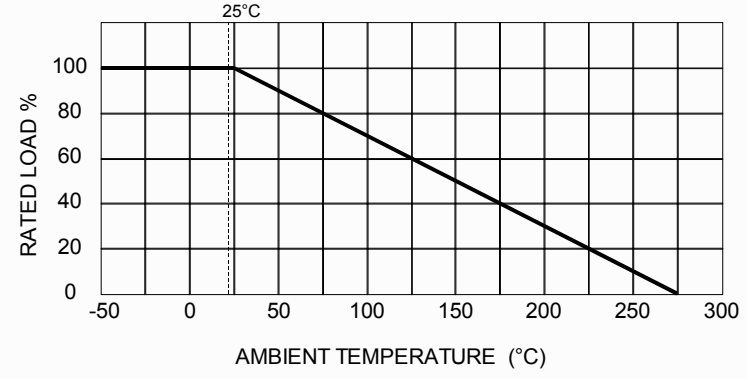
* DC or AC peak in dry air.

Characteristics

Resistance Values	from 1Ω to as high as 10MΩ		
Tolerances	1%, 2%, 5%, 10% (other tolerances to 0.05% on request)		
Temperature Coefficients*	25, 50 and 100 ppm/°C (other temperature coefficients to 10 ppm/°C on request)		
Operating Temperature	-55 .. +275°C	(extended temperature range to 350°C available)	
Insulation Resistance	> 10'000 MΩ	500 Volt 25 °C 75% relative humidity	
Dielectric Strength	> 1'000 Volt	25 °C 75% relative humidity	
Thermal Shock	Δ R/R < 0.5% typ., 1% max.	MIL Std. 202, method 107 Cond. C	IEC 68 - 2 -14
Overload	Δ R/R < 0.5% typ., 1% max.	1,5 x Pnom, 5 sec (do not exceed max. voltage)	
Moisture Resistance	Δ R/R < 0.5% typ., 1% max.	MIL Std. 202, method 106	IEC 68 - 2 - 3
Load Life	Δ R/R < 0.5% typ., 1% max.	1000 hours at rated power	IEC 115 - 1
Continuous Working Voltage	Power Limited	= √(PxR)	
Encapsulation	Silicone Conformal Coating	Core Material	Al_2O_3 (96%)
Lead Material	Brass Caps (lug terminations avail.)	Resistor Material	Ruthenium Oxide

* Temperature Coefficient referenced to 25°C, ΔR taken at +125°C.

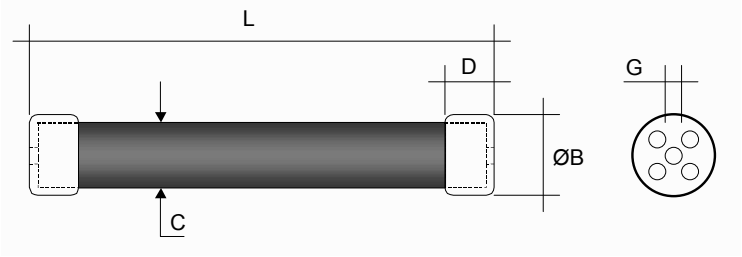
Derating Curve



High Voltage Surge Resistors Series P500

High Pulse Energy, High Power, Non-Inductive

High Voltage Surge Resistors Series P500 combine proprietary non-inductive power film resistance system and design to achieve excellent pulse withstand performance, high stability, high power density and high operating voltages. The new Series P500 has been developed to meet the demanding high power / high energy requirements of pulse / transient applications such as Medical Surge Protection (defibrillator cables), RC Snubber Circuits, Spark-Gap Limiters and High Voltage Power Supplies. Series P500 is also an ideal replacement of carbon composition resistors and bulk ceramic resistors over an extended resistance range. These resistors are ideally suited for high power and high frequency applications.



Model	Wattage	Max. Peak Pulse Voltage	Dimensions in millimeters ± 1.00 [Dimensions in inches ± 0.04]				
			L (max.)	B	C	D	G
P500.10	15.00	35'000	81 ± 1 [3.19 ± 0.04]	14.00 [0.55]	13.50 [0.53]	10.00 [0.40]	M4
P500.20	25.00	80'000	156 ± 1.5 [6.14 ± 0.06]	14.00 [0.55]	13.50 [0.53]	10.00 [0.40]	M4
P500.50	55.00	70'000	158 ± 1.5 [6.22 ± 0.06]	31.50 [1.24]	30.50 [1.20]	17.00 [0.67]	M8
P500.70	75.00	100'000	208 ± 2 [8.19 ± 0.08]	31.50 [1.24]	30.50 [1.20]	17.00 [0.67]	M8
P500.100	110.00	150'000	308 ± 3 [12.12 ± 0.12]	31.50 [1.24]	30.50 [1.20]	17.00 [0.67]	M8

Characteristics

Resistance Values	from 1Ω to as high as 1MΩ		
Tolerances	1%, 2%, 5%, 10% (other tolerances to 0.05% on request)		
Temperature Coefficients*	25, 50 and 100 ppm/°C (other temperature coefficients to 10 ppm/°C on request)		
Operating Temperature	-55 .. +225°C	(extended temperature range to 350°C available)	
Insulation Resistance	> 10'000 MΩ	500 Volt 25 °C 75% relative humidity	
Dielectric Strength	> 1'000 Volt	25 °C 75% relative humidity	
Thermal Shock	Δ R/R < 0.5% typ., 1% max.	MIL Std. 202, method 107 Cond. C	IEC 68 - 2 -14
Overload	Δ R/R < 0.5% typ., 1% max.	1,5 x Pnom, 5 sec (do not exceed max. voltage)	
Moisture Resistance	Δ R/R < 0.5% typ., 1% max.	MIL Std. 202, method 106	IEC 68 - 2 - 3
Load Life	Δ R/R < 0.5% typ., 1% max.	1000 hours at rated power	IEC 115 - 1
Continuous Working Voltage	Power Limited	= √(PxR)	
Encapsulation	Silicone Conformal Coating	Core Material	Al_2O_3 (96%)
Lead Material	Brass Caps (lug terminations avail.)	Resistor Material	Ruthenium Oxide

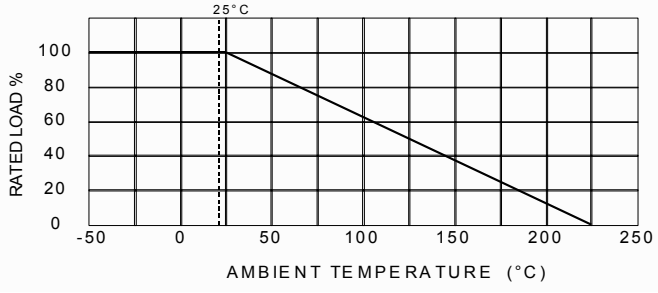
* Temperature Coefficient referenced to 25°C, ΔR taken at 125°C.

Single Pulse Energy

Type	Nominal Energy Rating (Pulse Duration 10 ms)*	
	Std. Version	-X Version
P500.10	200 Joules	400 Joules
P500.20	500 Joules	1000 Joules
P500.50	1000 Joules	2000 Joules
P500.70	1400 Joules	2800 Joules
P500.100	2200 Joules	4400 Joules

*Max. Single Pulse Energy is based on a pulse duration of 10 ms.
For shorter pulses the energy rating should be decreased (see Application Notes for details). In case of repeated pulses, the average pulse power should not exceed the Nominal Power Rating.

Derating Curve



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High Power Watercooled Resistor Series W500

High Power Watercooled Single Resistors and Voltage Dividers up to 2000 Watts!

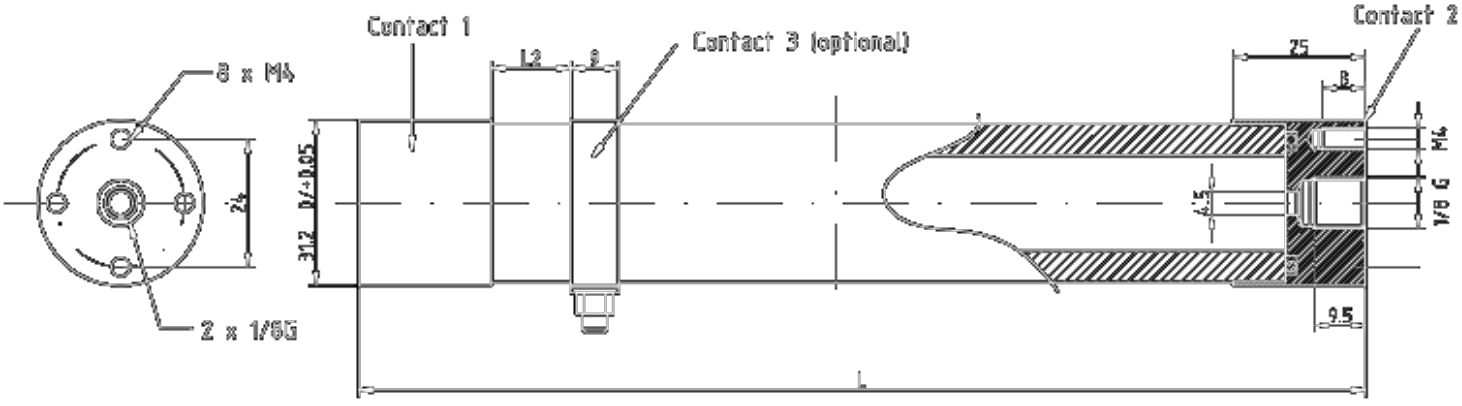
Our resistor Series W500 is designed for usage in high power applications. Due to the direct watercooling these resistors are good for a continuous power load up to 2000 W (short time overload up to 4000 W)! The easy M4 mounting, wide ohmic range, precise tolerance and temperature coefficient values as well as a high dielectric strength capability are only some of the features of this resistor series. Series W500 is available in two standard configurations, with or without isolated contact. Also voltage dividers are possible!

Model	Wattage*	Max. Peak Voltage**	Isolation Voltage*** (Optional)	Dimensions in mm ± 2.00	
				L	L2
W500.50	1000	70 kV	7 kV	178	10
W500.70	1400	100 kV	10 kV	228	15
W500.100	2000	150 kV	15 kV	328	20

* max. power at cooling medium temperature < 50°C, flow > 7 l / min.
** DC or AC peak between contacts 1 and 2, Configuration A
*** between contact 3 and isolated contact 1, Configuration B

Electrical Characteristics:

Resistance Value	0.5Ω to 10MΩ (or other special values on request)
Tolerance	± 10% (±5% or other on request)
Temperature Coefficient	± 100 ppm/°C
Cooling	Cooling medium MUST be non-conductive (e.g. distilled water or distilled water – glycol mixture)
Inductivity	50 .. 150 nH typical (depending on size and resistance value)
Cooling Medium Pressure	Max. 10 bar
Cooling Connection	1/8 G thread or Metal One-touch Fittings (optional)
Encapsulation	High Temperature Silicone Coating
Resistor Material	Ruthenium Oxide
Contact Material	CrNi (stainless)



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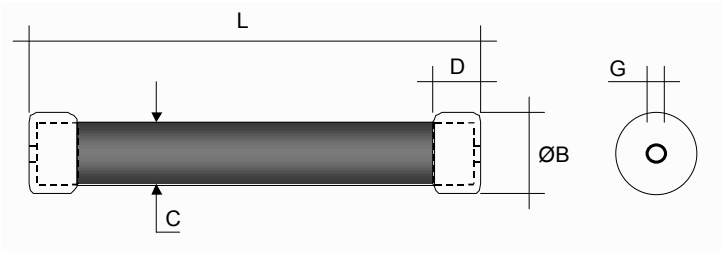
Version 24.01.2013

Ultra High Voltage Power Resistors Series 1000
Precision, Non-Inductive, Low TC

Ultra High Voltage Resistors Series 1000 combine proprietary non-inductive design with uniform voltage distribution to achieve low temperature coefficient, low voltage coefficients, high stability and increased operating voltages to 500 kV.

These Ultra High Voltage Resistors are designed to meet the demanding requirements of high voltage test systems, X-ray industrial systems, geophysical military instruments and HVDC power transmission lines.



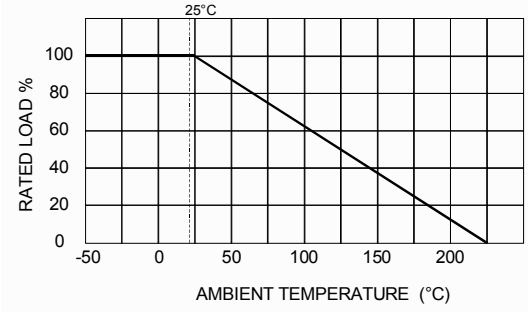
Model	Wattage	Max. Operating Voltage	Dimensions in millimeters ± 3.00 [Dimensions in inches ± 0.12]				
			L (max.)	B	C	D	G
1000.150	150	200 kV	470 [18.50]	40.00 [1.58]	38.00 [1.50]	18.00 [0.71]	M8
1000.200	200	250 kV	600 [23.62]	40.00 [1.58]	38.00 [1.50]	18.00 [0.71]	M8
1000.250	250	300 kV	800 [31.50]	50.00 [1.97]	48.00 [1.89]	18.00 [0.71]	M8
1000.280	280	300 kV	780 [30.71]	62.00 [2.44]	60.00 [2.36]	18.00 [0.71]	M8
1000.300	300	400 kV	1000 [39.37]	50.00 [1.97]	48.00 [1.89]	18.00 [0.71]	M8
1000.350	350	400 kV	1025 [40.35]	62.00 [2.44]	60.00 [2.36]	18.00 [0.71]	M8
1000.400	400	500 kV	1320 [51.97]	62.00 [2.44]	60.00 [2.36]	18.00 [0.71]	M8

Characteristics

Resistance Values	from 1KΩ to as high as 100GΩ on all models (to 1TΩ on request)		
Tolerances	0.05%, 0.1%, 0.25%, 0.5%, 1%, 2%, 5%, 10% (0.05% avail. to 10G, 0.25% to 100G, other on request)		
Temperature Coefficients *	10, 15, 25, 50 and 100 ppm/°C (10 ppm/°C available to 10G, 25 ppm/°C to 100G, other on request)		
Operating Temperature	-55 .. +225°C	(extended temperature range to 350°C available)	
Insulation Resistance	> 10'000 MΩ	500 Volt 25 °C 75% relative humidity	
Dielectric Strength	> 1'000 Volt	25 °C 75% relative humidity	
Thermal Shock	Δ R/R < 0.1% typ., 0.20% max.	MIL Std. 202, method 107 Cond. C	IEC 68 - 2 -14
Overload	Δ R/R < 0.1% typ., 0.25% max.	1,5 x Pnom, 5 sec (do not exceed max. voltage)	
Moisture Resistance	Δ R/R < 0.1% typ., 0.25% max.	MIL Std. 202, method 106	IEC 68 - 2 - 3
Load Life	Δ R/R < 0.1% typ., 0.25% max.	1000 hours at rated power	IEC 115 - 1
Encapsulation	Silicone Conformal Coating	Core Material	Al_2O_3 (96%)
Lead Material	Brass Caps (lug terminations avail.)	Resistor Material	Ruthenium Oxide
VCR	< -0.02 ppm/V for all models to 10 Gig (VCR = Voltage Coefficient of Resistance)		

* Temperature Coefficients referenced to 25°C, ΔR taken at +125°C

Derating Curve



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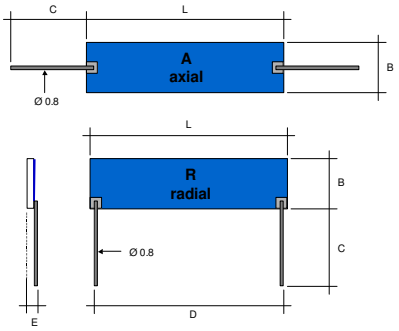
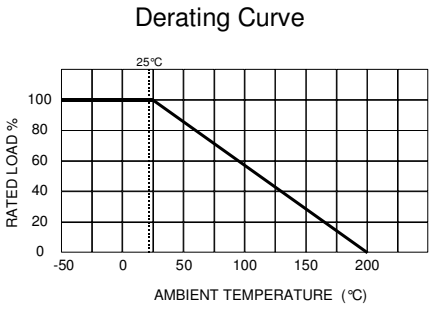
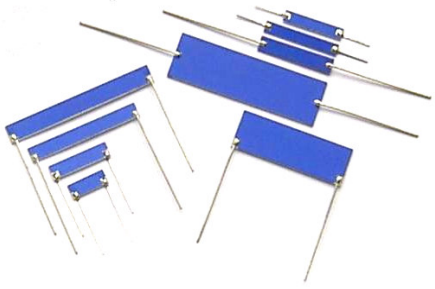
High Voltage Resistors Series 90, 100 and 200
Precision, Non-Inductive, Low TC

High Voltage Resistors Series 90, 100 and 200 combine proprietary non-inductive resistance system and design to achieve low temperature coefficient, low voltage coefficients, high stability and increased high operating voltages.

Precision High Voltage Resistors Series 90, 100 and 200 are designed to meet the demanding requirements of TWT power supplies, electron microscopes, X-ray systems, high resolution CRT displays and geophysical instruments. SMD Chip versions available on request.







Model	Wattage	Max. Continuous Oper. Voltage	Dimensions in millimeters ± 0.50 [Dimensions in inches ± 0.02] L	B	C (max.)	D	E (max.)
90.1	0.80	7'000	20.32 [0.80]	3.81 [0.15]	10.00 [0.40]	17.78 [0.70]	2.00 [0.08]
90.2	1.00	11'000	25.40 [1.00]	3.81 [0.15]	10.00 [0.40]	22.86 [0.90]	2.00 [0.08]
90.3	1.50	20'000	38.10 [1.50]	3.81 [0.15]	10.00 [0.40]	35.56 [1.40]	2.00 [0.08]
90.4	2.00	30'000	50.80 [2.00]	5.08 [0.20]	10.00 [0.40]	48.26 [1.90]	2.00 [0.08]
100.1	1.00	7'000	20.32 [0.80]	5.08 [0.20]	35.00 [1.40]	17.78 [0.70]	2.50 [0.10]
100.2	1.30	11'000	25.40 [1.00]	5.08 [0.20]	35.00 [1.40]	22.86 [0.90]	2.50 [0.10]
100.3	2.00	20'000	38.10 [1.50]	5.08 [0.20]	35.00 [1.40]	35.56 [1.40]	2.50 [0.10]
100.4	3.00	30'000	50.80 [2.00]	6.35 [0.25]	35.00 [1.40]	48.26 [1.90]	2.50 [0.10]
200.1	1.00	5'000	12.70 [0.50]	5.08 [0.20]	10.00 [0.40]	10.16 [0.40]	2.00 [0.08]
200.2	2.00	11'000	25.40 [1.00]	7.62 [0.30]	35.00 [1.40]	22.86 [0.90]	2.50 [0.10]
200.3	3.00	20'000	38.10 [1.50]	12.70 [0.50]	35.00 [1.40]	35.56 [1.40]	2.50 [0.10]
200.4	4.50	30'000	50.80 [2.00]	15.24 [0.60]	35.00 [1.40]	48.26 [1.90]	2.50 [0.10]
200.5	6.50	45'000	76.20 [3.00]	15.24 [0.60]	35.00 [1.40]	73.66 [2.90]	3.00 [0.12]
200.7	9.00	60'000	101.60 [4.00]	15.24 [0.60]	35.00 [1.40]	99.06 [3.90]	3.00 [0.12]

Characteristics

Resistance Values	from 1KΩ to as high as 100GΩ on all models (to 1TΩ on request)		
Tolerances	0.05%, 0.1%, 0.25%, 0.5%, 1%, 2%, 5%, 10% (0.05% available to 10G, 0.25% to 100G, other on request)		
Temperature Coefficients	5, 10, 15, 25, 50 and 100 ppm/°C (10 ppm/°C available to 10G, 25 ppm/°C to 100G, other on request)		
Operating Temperature	-55 .. +200°C	(extended temperature range to 350°C available)	
Insulation Resistance	> 10'000 MΩ	500 Volt 25 °C 75% relative humidity	
Dielectric Strength	> 1'000 Volt	25 °C 75% relative humidity	
Thermal Shock	Δ R/R < 0.1% typ., 0.20% max.	MIL Std. 202, method 107 Cond. C	IEC 68 - 2 -14
Overload	Δ R/R < 0.1% typ., 0.25% max.	1,5 x Pnom, 5 sec (do not exceed max. voltage)	
Moisture Resistance	Δ R/R < 0.1% typ., 0.25% max.	MIL Std. 202, method 106	IEC 68 - 2 - 3
Load Life	Δ R/R < 0.1% typ., 0.25% max.	1000 hours at rated power	IEC 115 - 1
Encapsulation	Screen Printed Silicone	Core Material	Al_2O_3 (96%)
Lead Material	Tinned Copper / SMD versions available	Resistor Material	Ruthenium Oxide

Voltage Coefficients of Resistance

Type	Resistance Range	VCR (- ppm/V)*	Type	Resistance Range	VCR (- ppm/V)*	Type	Resistance Range	VCR (- ppm/V)*
90.1	1K .. 100M 100M .. 1G	< 0.80 < 1.50	**100.2**	1K .. 250M 250M .. 3.5G	< 0.70 < 1.80	**200.3**	1K .. 1G 1G .. 10G	< 0.20 < 0.40
90.2	1K .. 150M 150M .. 1.5G	< 0.65 < 1.20	**100.3**	1K .. 400M 400M .. 5G	< 0.45 < 1.20	**200.4**	1K .. 1G 1G .. 20G	< 0.10 < 0.30
90.3	1K .. 300M 300M .. 4G	< 0.50 < 0.90	**100.4**	1K .. 600M 600M .. 10G	< 0.35 < 0.70	**200.5**	1K .. 1.5G 1.5G .. 30G	< 0.07 < 0.20
90.4	1K .. 500M 500M .. 7G	< 0.35 < 0.80	**200.1**	1K .. 250M 250M .. 3G	< 2.00 < 3.70	**200.7**	1K .. 2G 2G .. 40G	< 0.05 < 0.15
100.1	1K .. 200M 200M .. 2.5G	< 0.90 < 2.50	**200.2**	1K .. 500M 500M .. 7G	< 0.35 < 0.90	* typical values, contact factory for details		

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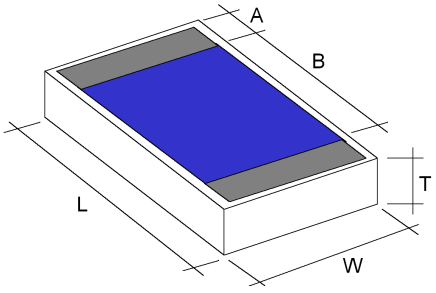
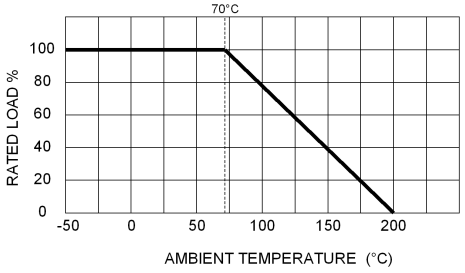
High Voltage Chip Resistors / Low Noise Chip Resistors
Series HVC

High Voltage Chip Resistors HVC Series combine proprietary Fine Line Thick Film Technology and design to achieve a new level of high voltage ratings and stability in SMD chip resistors. Nicrom's technology features a longer, high aspect ratio trace of lower resistivity film compared to traditional thick film chip resistors.

Compared to standard chip resistors Nicrom's HVC Series provides unmatched performances and design efficiency resulting in lower voltage coefficients and temperature coefficients, lower noise, tighter tolerances, higher stability, higher resistance values and higher voltage ratings. Wire bondable gold terminations and custom configurations available.



Derating Curve



Model-Size	Wattage @ 70°C	Max. Continuous Oper. Voltage	Dimensions in millimeters [Dimensions in inches] L	W	T (max.)	A	B (min.)
0603	0.10	600	1.60 ± 0.20 [0.063 ± 0.008]	0.80 ± 0.10 [0.031 ± 0.004]	0.50 [0.020]	0.25 ± 0.10 [0.010 ± 0.004]	0.80 [0.032]
1206	0.30	1'500	3.25 ± 0.20 [0.128 ± 0.008]	1.60 ± 0.20 [0.063 ± 0.008	0.70 [0.028]	0.45 ± 0.20 [0.018 ± 0.008]	1.95 [0.077]
2010	0.50	2'200	5.10 ± 0.20 [0.200 ± 0.008]	2.50 ± 0.20 [0.098 ± 0.008]	0.80 [0.032]	0.55 ± 0.20 [0.022 ± 0.008]	3.70 [0.146]
2512	1.00	3'000	6.40 ± 0.20 [0.252 ± 0.008]	3.20 ± 0.20 [0.126 ± 0.008]	0.80 [0.032	0.65 ± 0.20 [0.026 ± 0.008]	5.00 [0.200]
4020	1.50	4'000	10.16 ± 0.20 [0.400 ± 0.008]	5.08 ± 0.20 [0.200 ± 0.008]	0.80 [0.032]	1.00 ± 0.20 [0.040 ± 0.008]	7.50 [0.295]
5020	2.00	5'000	12.70 ± 0.20 [0.500 ± 0.008]	5.08 ± 0.20 [0.200 ± 0.008]	0.80 [0.032	2.00 ± 0.30 [0.079 ± 0.012]	8.00 [0.315]
8020	2.50	7'000	20.32 ± 0.20 [0.800 ± 0.008]	5.08 ± 0.20 [0.200 ± 0.008]	1.00 [0.040]	2.00 ± 0.30 [0.079 ± 0.012]	15.60 [0.615]
10020	3.00	11'000	25.40 ± 0.20 [1.000 ± 0.008]	5.08 ± 0.20 [0.200 ± 0.008]	1.00 [0.040]	2.00 ± 0.30 [0.079 ± 0.012]	20.70 [0.815]

Characteristics

Resistance Values	from 1KΩ to as high as 100GΩ on all models (to 1TΩ on request)		
Tolerances	0.05%, 0.1%, 0.25%, 0.5%, 1%, 2%, 5%, 10%, 20% (0.05% available to 10G, 0.25% to 100G on request)		
Temperature Coefficients*	5, 10, 15, 25, 50 and 100 ppm/°C (10 ppm/°C available to 10G, 25 ppm/°C to 100G on request)		
Operating Temperature	-55 … + 200°C	(extended temperature range to 350°C available)	
Insulation Resistance	> 10'000 MΩ	500 Volt 25 °C 75% relative humidity	
Dielectric Strength	> 1'000 Volt	25 °C 75% relative humidity	
Thermal Shock	Δ R/R < 0.1% typ., 0.50% max.	MIL Std. 202, method 107 Cond. C	IEC 68 - 2 -14
Overload	Δ R/R < 0.1% typ., 0.50% max.	1,5 x Pnom, 5 sec (do not exceed max. voltage)	
Moisture Resistance	Δ R/R < 0.1% typ., 0.50% max.	MIL Std. 202, method 106	IEC 68 - 2 - 3
Load Life	Δ R/R < 0.1% typ., 0.50% max.	1000 hours at rated power	IEC 115 - 1
Encapsulation	Screen Printed Silicone	Core Material	Al_2O_3 (96%)
Solder Pads Material	Silver (PdAg) / Bondable Gold / Tinned	Resistor Material	Ruthenium Oxide
Termination Style	Flip-chip single side termination (standard) or 3-sided wraparound termination available (option W)		

* Temperature Coefficient referenced to 25°C, ΔR taken at +125°C.

Voltage Coefficients of Resistance

Type	Resistance Range	VCR (- ppm/V)*
0603	1K .. 3M	< 16.00
	3M .. 30M	< 80.00
	30M .. 300M	< 150.00
1206	1K .. 10M	< 3.20
	10M .. 100M	< 15.00
	100M .. 1G	< 29.00
2010	1K .. 20M	< 1.30
	20M .. 200M	< 6.00
	200M .. 2G	< 12.00

Type	Resistance Range	VCR (- ppm/V)*
2512	1K .. 30M	< 0.80
	30M .. 300M	< 4.00
	300M .. 3G	< 7.00
4020	1K .. 30M	< 0.60
	30M .. 300M	< 3.00
	300M .. 3G	< 6.00
5020	1K .. 40M	< 0.40
	40M .. 400M	< 2.00
	400M .. 4G	< 3.60

Type	Resistance Range	VCR (- ppm/V)*
8020	1K .. 60M	< 0.30
	60M .. 600M	< 1.50
	600M .. 6G	< 2.50
10020	1K .. 80M	< 0.20
	80M .. 800M	< 1.00
	800M .. 8G	< 1.80

*Typical values. Voltage coefficient of resistance strongly depends on the resistance value, consult factory for details.

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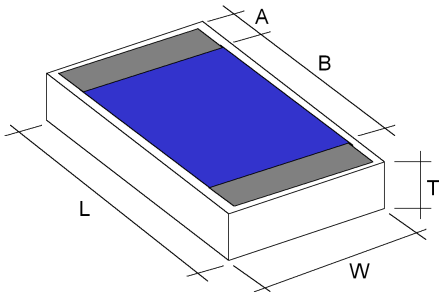
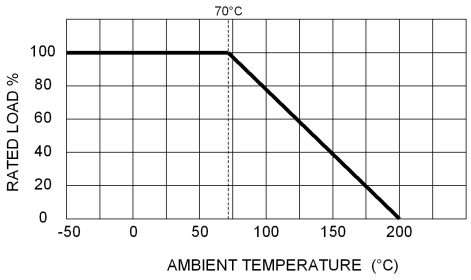
Medium Voltage Low Cost Chip Resistors
Series MVLC

Medium Voltage Chip Resistors MVLC combine proprietary Thick Film Technology and design to achieve medium / high voltage ratings in a low cost SMD solution. Nicrom's technology features a longer, medium aspect ratio trace of lower resistivity film compared to traditional thick film chip resistors.

Compared to standard chip resistors Nicrom's MVLC Series provides higher performances, lower voltage coefficients, temperature coefficients to 50 ppm/C, tighter tolerances to 0.5% and higher voltage ratings to 5'000 Volts. 3-sided wraparound terminations, wire bondable gold terminations and custom configurations available.



Derating Curve



Model-Size	Wattage @ 70°C	Max. Continuous Oper. Voltage	Dimensions in millimeters [Dimensions in inches]				
			L	W	T (max.)	A	B (min.)
1206	0.30	750	3.25 ± 0.20 [0.128 ± 0.008]	1.60 ± 0.20 [0.063 ± 0.008	0.70 [0.028]	0.45 ± 0.20 [0.018 ± 0.008]	1.95 [0.077]
2010	0.50	1100	5.10 ± 0.20 [0.200 ± 0.008]	2.50 ± 0.20 [0.098 ± 0.008]	0.80 [0.032]	0.55 ± 0.20 [0.022 ± 0.008]	3.70 [0.146]
2512	1.00	1'500	6.40 ± 0.20 [0.252 ± 0.008]	3.20 ± 0.20 [0.126 ± 0.008]	0.80 [0.032	0.65 ± 0.20 [0.026 ± 0.008]	5.00 [0.200]
4020	1.50	2'000	10.16 ± 0.20 [0.400 ± 0.008]	5.08 ± 0.20 [0.200 ± 0.008]	0.80 [0.032]	1.00 ± 0.20 [0.040 ± 0.008]	7.50 [0.295]
5020	2.00	2'500	12.70 ± 0.20 [0.500 ± 0.008]	5.08 ± 0.20 [0.200 ± 0.008]	0.80 [0.032	2.00 ± 0.30 [0.079 ± 0.012]	8.00 [0.315]
8020	2.50	3'500	20.32 ± 0.20 [0.800 ± 0.008]	5.08 ± 0.20 [0.200 ± 0.008]	1.00 [0.040]	2.00 ± 0.30 [0.079 ± 0.012]	15.60 [0.615]
10020	3.00	5'000	25.40 ± 0.20 [1.000 ± 0.008]	5.08 ± 0.20 [0.200 ± 0.008]	1.00 [0.040]	2.00 ± 0.30 [0.079 ± 0.012]	20.70 [0.815]

Characteristics

Resistance Values	from 100Ω to as high as 100MΩ on all models except 1206 max 30MΩ and 2010 max 60MΩ		
Tolerances	0.5%, 1%, 2%, 5%, 10% (for tighter tolerances please use Series HVC)		
Temperature Coefficients*	50 or 100 ppm/°C (for low temperature coefficients please use Series HVC)		
Operating Temperature	-55 … + 200°C	(extended temperature range to 350°C available)	
Insulation Resistance	> 10'000 MΩ	500 Volt 25 °C 75% relative humidity	
Dielectric Strength	> 1'000 Volt	25 °C 75% relative humidity	
Thermal Shock	Δ R/R < 0.50% typical	MIL Std. 202, method 107 Cond. C	IEC 68 - 2 -14
Overload	Δ R/R < 0.1% typical	1,5 x Pnom, 5 sec (do not exceed max. voltage)	
Moisture Resistance	Δ R/R < 0.1% typical	MIL Std. 202, method 106	IEC 68 - 2 - 3
Load Life	Δ R/R < 0.50% typical	1000 hours at rated power	IEC 115 - 1
Encapsulation	Screen Printed Silicone	Core Material	Al_2O_3 (96%)
Solder Pads Material	Silver (PdAg) / Bondable Gold / Tinned	Resistor Material	Ruthenium Oxide
Termination Style	Flip-chip single side termination (standard) or 3-sided wraparound termination available (option W)		

* Temperature Coefficient referenced to 25°C, ΔR taken at +125°C.

Voltage Coefficients of Resistance

Type	Resistance Range	VCR (- ppm/V)*
1206	100R .. 30M	< 10
2010	100R .. 60M	< 7
2512	100R .. 100M	< 5
4020	100R .. 100M	< 3
5020	100R .. 100M	< 2
8020	100R .. 100M	< 1
10020	100R .. 100M	< 1

*Typical values. VCR strongly depends on the resistance value, consult factory for details.

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High Power Film Resistors Series HTO
TO-220 Style, Non-Inductive

100 Watts
in TO-220 Style

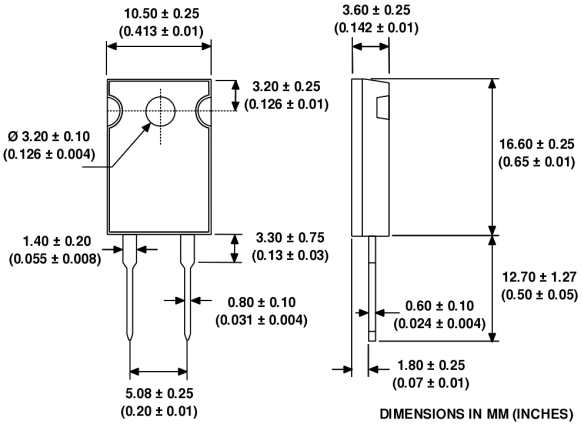
Nicrom Electronic's HTO TO-220 package resistor provides up to **100 Watts** of steady state power when properly used in today's well defined heat sink applications. These High Power non-inductive resistors are built under proprietary processes that deliver more power handling capability than other TO-220 package resistors of similar size. Standard terminal forms are provided for manual or automatic insertion.

NON INDUCTIVE

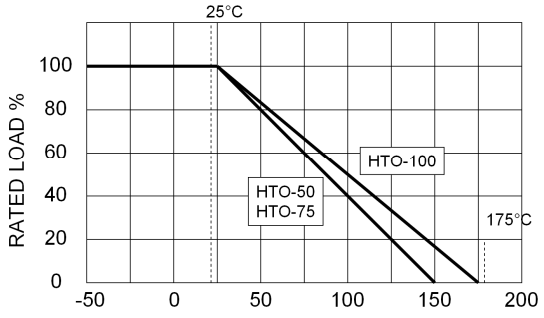
Features:
- Up to 100W Power Rating @ 25°C case temperature
- Non-inductive design
- Single Screw Mounting
- Compact TO-220 Package

Applications:
- Switching Power Supplies
- Snubbers and Motor Control
- High Frequency and Pulse Loading
- Voltage Regulation
- Automotive and Measurements

Model	Power Rating	Package Style	Resistance		Max. Voltage	Thermal Resistance R_{JC} Film (J) to Case (C)	Max. Temp. T_{MAX}
			Min.	Max.			
HTO-50	**50 Watts ***	TO-220	0.01 Ω	1 MΩ	350 V	2.50°C/Watt	150°C
HTO-75	**75 Watts ***	TO-220	0.10 Ω	100 KΩ	500 V	1.67°C/Watt	150°C
HTO-100	**100 Watts ***	TO-220	0.10 Ω	100 KΩ	500 V	1.50°C/Watt	175°C



Derating Curve



*Case temperature must be used for definition of the applied power limit. 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.

Characteristics

Tolerances	1%, 2%, 5%, 10% (0.5% and 0.25% on request)		
Temperature Coefficients**	10 Ω and above 50 ppm/°C, between 0.01 Ω and 10 Ω, 100 ppm/°C		
Operating Temperature	-55°C to Tmax.	(extended temperature range available)	
Insulation Resistance	> 10'000 MΩ	500 Volt 25 °C 75% relative humidity	
Dielectric Strength	> 1'800 VAC	25 °C 75% relative humidity	
Thermal Shock	Δ R/R ± (0.3% + 0.0005 ohm) max.	MIL Std. 202, Method 107 Cond. F	IEC 68 - 2 -14
Overload	Δ R/R ± (0.3% + 0.0005 ohm) max.	1.5 x Pnom, 5 sec (do not exceed 1.5 times max. voltage)	
Moisture Resistance	Δ R/R ± (0.5% + 0.0005 ohm) max.	MIL Std. 202, method 106	IEC 68 - 2 - 3
Load Stability	Δ R/R ± (1% + 0.0005 ohm) max.	2000 hours at rated power	
Terminal Strength	Δ R/R ± (0.2% + 0.0005 ohm) max.	MIL Std. 202, Method 211 Cond. A (Pull Test) 2.4N	
Vibration, High Frequency	Δ R/R ± (0.2% + 0.0005 ohm) max.	MIL Std. 202, Method 204 Cond. D	
Shock	Δ R/R ± (0.4% + 0.0005 ohm) max.	100G, MIL Std. 202, Method 213, Cond. I	
Encapsulation	Epoxy High Temperature Case	Core Material	Al_2O_3 (96%)
Lead Material	Tinned Copper	Resistor Material	Ruthenium Oxide
Maximum Torque	0.9 Nm	Power rating in free air	2.5 W

** Temperature Coefficient referenced to 25°C, ΔR taken at +125°C.

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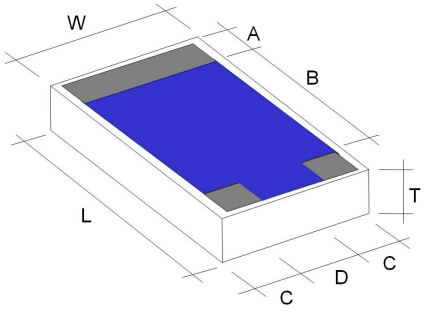
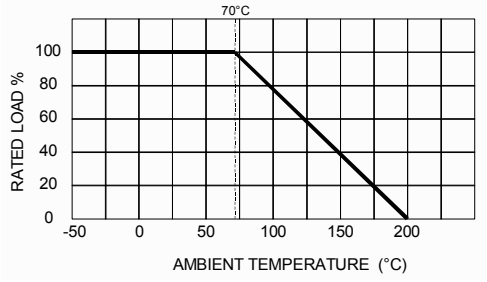
High Voltage Chip Dividers Series HVCD
Flip-chip, Precision, Low TC

High Voltage Chip Dividers HVCD Series combine proprietary Fine Line Thick Film Technology and design to achieve a new level of high voltage ratings and stability in SMD chip dividers. Nicrom's technology features a longer, high aspect ratio trace of lower resistivity film compared to traditional thick film chip dividers.

Compared to standard chip dividers Nicrom's HVCD Series provides unmatched performances and design efficiency resulting in lower voltage coefficients and temperature coefficients, lower noise, tighter tolerances, higher stability, higher resistance values and higher voltage ratings. Wire bondable gold terminations and custom configurations available.



Derating Curve



Model Size	Wattage @ 70°C	Max. Continuous Oper. Voltage	Dimensions in millimeters [Dimensions in inches] L	W	T (max.)	A	B (min.)	C	D
2512	0.50	3'000	6.40 ± 0.20 [0.252 ± 0.008]	3.20 ± 0.20 [0.126 ± 0.008]	0.80 [0.032]	0.65 ± 0.20 [0.026 ± 0.008]	5.00 [0.200]	0.65 ± 0.20 [0.026 ± 0.008]	1.90 ± 0.20 [0.075 ± 0.008]
5020	0.80	5'000	12.70 ± 0.20 [0.500 ± 0.008]	5.08 ± 0.20 [0.200 ± 0.008]	1.00 [0.040]	2.00 ± 0.30 [0.079 ± 0.012]	8.00 [0.315]	1.20 ± 0.20 [0.047 ± 0.008]	2.70 ± 0.20 [0.106 ± 0.008]
8020	1.00	7'000	20.32 ± 0.20 [0.800 ± 0.008]	5.08 ± 0.20 [0.200 ± 0.008]	1.00 [0.040]	2.00 ± 0.30 [0.079 ± 0.012]	15.60 [0.615]	1.20 ± 0.20 [0.047 ± 0.008]	2.70 ± 0.20 [0.106 ± 0.008]
10020	1.30	10'000	25.40 ± 0.20 [1.000 ± 0.008]	5.08 ± 0.20 [0.200 ± 0.008]	1.00 [0.040]	2.00 ± 0.30 [0.079 ± 0.012]	20.70 [0.815]	1.20 ± 0.20 [0.047 ± 0.008]	2.70 ± 0.20 [0.106 ± 0.008]

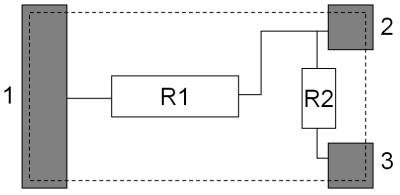
Characteristics

Resistance Values	from 1KΩ to as high as 10GΩ on all models (to 100GΩ on request)		
Ratios	From 1:100 to 1:10'000, other on request		
Absolute Tolerances	0.1%, 0.25%, 0.5%, 1%, 2%, 5%, 10% (0.1% available to 1G, 0.25% to 10G on request)		
Ratio Tolerances	0.1%, 0.25%, 0.5%, 1%, 2%, 5%		
Absolute Temperature Coefficients*	10, 15, 25, 50 and 100 ppm/°C (10 ppm/°C available to 1G, 25 ppm/°C to 10G on request)		
Ratio Temperature Coefficients*	10, 15, 25, 50 ppm/°C		
Operating Temperature	-55 … + 200°C	(extended temperature range to 350°C available)	
Insulation Resistance	> 10'000 MΩ	500 Volt 25 °C 75% relative humidity	
Dielectric Strength	> 1'000 Volt	25 °C 75% relative humidity	
Thermal Shock	Δ R/R < 0.1% typ., 0.50% max.	MIL Std. 202, method 107 Cond. C	IEC 68 - 2 -14
Overload	Δ R/R < 0.1% typ., 0.50% max.	1,5 x Pnom, 5 sec (do not exceed max. voltage)	
Moisture Resistance	Δ R/R < 0.1% typ., 0.50% max.	MIL Std. 202, method 106	IEC 68 - 2 - 3
Load Life	Δ R/R < 0.1% typ., 0.50% max.	1000 hours at rated power	IEC 115 - 1
Encapsulation	Screen Printed Silicone	Core Material	Al_2O_3 (96%)
Solder Pads Material	Silver (PdAg) / Bondable Gold / Tinned	Resistor Material	Ruthenium Oxide

Voltage Coefficients of Resistance

Type	Resistance Range	VCR (- ppm/V) **
2512	1K .. 30M	< 0.80
	30M .. 300M	< 4.00
	300M .. 3G	< 7.00
5020	1K .. 40M	< 0.40
	40M .. 400M	< 2.00
	400M .. 4G	< 3.60
8020	1K .. 60M	< 0.30
	60M .. 600M	< 1.50
	600M .. 6G	< 2.50
10020	1K .. 80M	< 0.20
	80M .. 800M	< 1.00
	800M .. 8G	< 1.80

Electrical Connections



PCB Pads

$$\text{Ratio} = \frac{R2}{R1 + R2}$$

* Temperature Coefficient referenced to 25°C, ΔR taken at +125°C.
** Typical values. Voltage coefficient of resistance strongly depends on the resistance value, consult factory for details.

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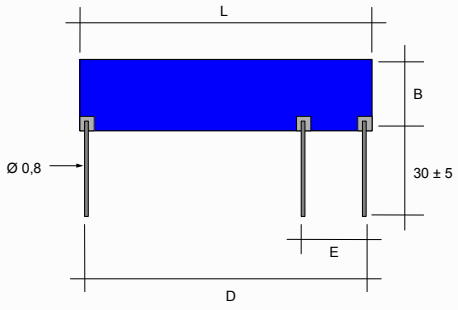
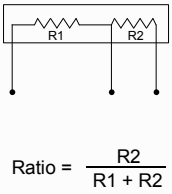
High Voltage Dividers Series 300
High Precision, Low TC

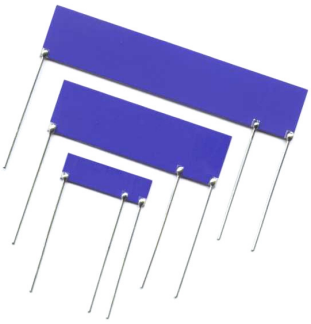
NEW !!
to 55'000 V

High Voltage Dividers Series 300 introduce Nicrom Electronic's exclusive advanced proprietary high voltage resistor technology which increases the allowable working voltage over the length of the high voltage section.
Precision High Voltage Dividers Series 300 provide tighter ratio temperature coefficients and tighter ratio tolerances than have previously been available in standard high voltage divider products.

These specifications can provide important improvements in performance in many types of advanced electronic systems, including TWT power supplies, radar systems, X-ray systems, analytical equipment and high resolution CRT displays.
Precision High Voltage Dividers Series 300 are available in a broad range of custom resistance values, voltage ratings, ratio tolerances and ratio temperature coefficients.







Model	Wattage	Max. Operating Voltage	Dimensions in millimeters ± 0.50 [Dimensions in inches ± 0.02]			
			L	B	D	E
300.0	0.50	4'000	12.7 [0.50]	5.08 [0.20]	10.16 [0.40]	2.54 [0.10]
300.1	0.75	8'000	20.32 [0.80]	5.08 [0.20]	17.78 [0.70]	5.08 [0.20]
300.2	1.00	12'000	25.4 [1.00]	7.62 [0.30]	22.86 [0.90]	5.08 [0.20]
300.3	1.50	18'000	38.1 [1.50]	12.7 [0.50]	35.56 [1.40]	7.62 [0.30]
300.4	2.50	24'000	50.8 [2.00]	15.24 [0.60]	48.26 [1.90]	10.16 [0.40]
300.5	3.50	40'000	76.2 [3.00]	15.24 [0.60]	73.66 [2.90]	10.16 [0.40]
300.7	4.50	55'000	101.6 [4.00]	15.24 [0.60]	99.06 [3.90]	10.16 [0.40]

Characteristics

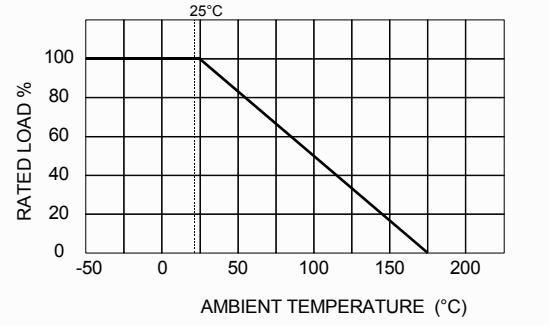
Resistance Values	from 1KΩ to as high as 100GΩ on all models	Ratios	1:100 to 1:10'000 on request
Absolute Tolerances	0.05%, 0.1%, 0.25%, 0.5%, 1%, 2%, 5%, 10% (0.05% avail. to 10G, 0.25% to 100G, other on request)		
Ratio Tolerances	0.05%, 0.1%, 0.25%, 0.5%, 1% (0.02% on request)		
Absolute TC	5, 10, 15, 25, 50 and 100 ppm/°C (10 ppm/°C available to 10G, 25 ppm/°C to 100G, other on request)		
Ratio TC	5 ppm/°C, 10 ppm/°C, 15 ppm/°C, 25 ppm/°C or 50 ppm/°C		
Operating Temperature	-55 … +175°C	(extended temperature range to 300°C available)	
Insulation Resistance	> 10'000 MΩ	500 Volt 25 °C 75% Relative humidity	
Dielectric Strength	> 1'000 Volt	25 °C 75% Relative humidity	
Thermal Schock	Δ R/R < 0.1% typ., 0.20% max.	MIL Std. 202, method 107 Cond. C	IEC 68 - 2 -14
Overload	Δ R/R < 0.1% typ., 0.25% max.	1,5 x Pnom, 5 sec (do not exceed max. voltage)	
Moisture Resistance	Δ R/R < 0.1% typ., 0.25% max.	MIL Std. 202, method 106	IEC 68 - 2 - 3
Load Life	Δ R/R < 0.05% typ., 0.25% max.	1000 hours at rated power	IEC 115 - 1
Encapsulation	Screen Printed Silicone	Substrate Material	Al_2O_3 (96%)
Lead Material	Tinned Copper	Resistor Material	Ruthenium Oxide

Voltage Coefficients of Resistance

Type	Resistance Range	VCR (-ppm/V)*
300.0	1K .. 200M 200M .. 2G	< 2.00 < 3.70
300.1	1K .. 200M 200M .. 2G	< 0.70 < 1.80
300.2	1K .. 500M 500M .. 7G	< 0.35 < 0.90
300.3	1K .. 1G 1G .. 10G	< 0.20 < 0.40
300.4	1K .. 1G 1G .. 20G	< 0.10 < 0.30
300.5	1K .. 1.5G 1.5G .. 30G	< 0.07 < 0.20
300.7	1K .. 2G 2G .. 40G	< 0.05 < 0.15

* typical values, contact factory for details

Derating Curve



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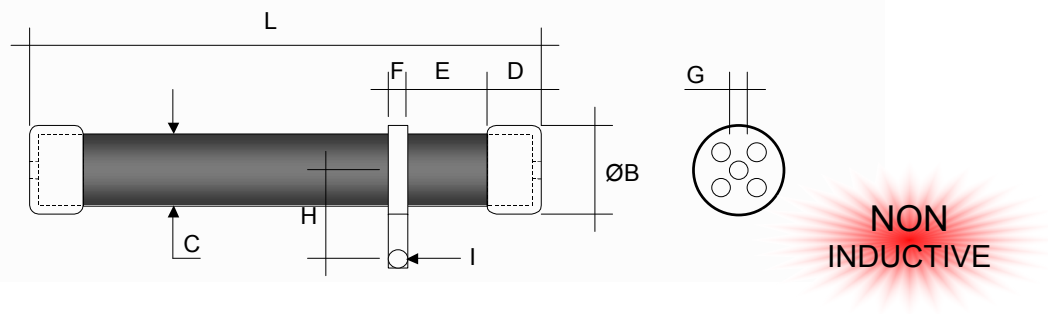
High Voltage Dividers Series 600
Precision, Non-Inductive, Low TC

High Voltage Dividers Series 600 combine proprietary non-inductive resistance system and design to achieve low ratio temperature coefficient, low voltage coefficients, tight ratio tolerances, high stability and increased high operating voltages.

These Precision High Voltage Dividers can provide important improvements in performance in many types of advanced electronic systems, including power supplies, radar systems, X-ray systems, analytical equipment and geophysical instruments.



Model	Wattage	Max. Operating Voltage	Dimensions in millimeters ± 1.00 [Dimensions in inches ± 0.04]								
			L (max.)	B	C	D	E	F	H	I	G
600.10	10.00	30'000	81.00 [3.19]	14.00 [0.55]	13.50 [0.53]	10.00 [0.40]	6.50 [0.26]	6.00 [0.24]	28.00 [1.10]	3.20 [0.26]	M4
600.20	15.00	70'000	156.00 [6.14]	14.00 [0.55]	13.50 [0.53]	10.00 [0.40]	6.50 [0.26]	6.00 [0.24]	28.00 [1.10]	3.20 [0.26]	M4
600.100	75.00	120'000	308.00 [12.12]	31.50 [1.24]	30.50 [1.20]	17.00 [0.67]	40.00 [1.58]	6.00 [0.24]	36.00 [1.42]	3.20 [0.26]	M8

Characteristics

Resistance Values	from 1KΩ to as high as 100GΩ on all models (to 1TΩ on request)		
Ratios	from 1:100 to 1:10'000, other on request		
Absolute Tolerances	0.05%, 0.1%, 0.25%, 0.5%, 1%, 2%, 5% (0.05% avail. to 10G, 0.25% to 100G, other on request)		
Ratio Tolerances	0.05%, 0.1%, 0.25%, 0.5%, 1% (other on request)		
Absolute Temp. Coeff. *	5, 10, 15, 25, 50 and 100 ppm/°C (10 ppm/°C available to 10G, 25 ppm/°C to 100G, other on request)		
Ratio Temp. Coeff. *	5, 10, 15, 25 and 50 ppm/°C		
Operating Temperature	-55 .. +175°C	(extended temperature range to 350°C available)	
Insulation Resistance	> 10'000 MΩ	500 Volt 25 °C 75% relative humidity	
Dielectric Strength	> 1'000 Volt	25 °C 75% relative humidity	
Thermal Shock	Δ R/R < 0.1% typ., 0.20% max.	MIL Std. 202, method 107 Cond. C	IEC 68 - 2 -14
Overload	Δ R/R < 0.1% typ., 0.25% max.	1,5 x Pnom, 5 sec (do not exceed max. voltage)	
Moisture Resistance	Δ R/R < 0.1% typ., 0.25% max.	MIL Std. 202, method 106	IEC 68 - 2 - 3
Load Life	Δ R/R < 0.1% typ., 0.25% max.	1000 hours at rated power	IEC 115 - 1
Encapsulation	Silicone Conformal Coating	Core Material	Al_2O_3 (96%)
Lead Material	Brass Caps (lug terminations avail.)	Resistor Material	Ruthenium Oxide

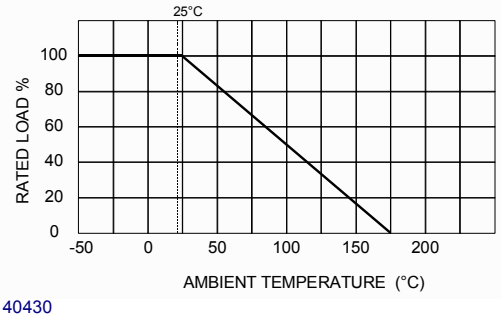
* Temperature Coefficients referenced to 25°C, ΔR taken at +125°C

Voltage Coefficients of Resistance

Type	Resistance Range	VCR (-ppm/V)*
600.10	1K .. 1G5	< 0.09
	1G5 .. 15G	< 0.18
600.20	1K .. 3G5	< 0.04
	3G5 .. 35G	< 0.08
600.100	1K .. 6G	< 0.02
	6G .. 60G	< 0.03

* typical values, contact factory for details

Derating Curve



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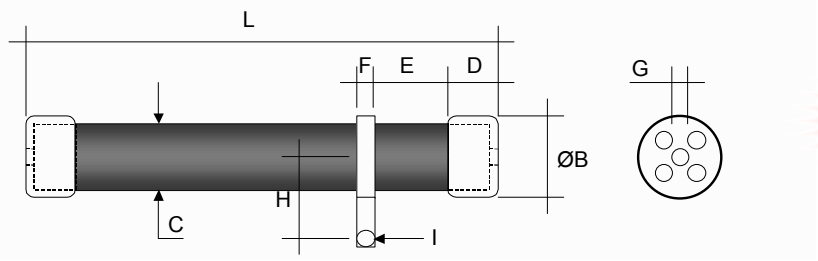
Ultra High Voltage Dividers Series 2000
Precision, Non-Inductive, Low TC

Ultra High Voltage Dividers Series 2000 combine proprietary non-inductive resistance system and design to achieve low ratio temperature coefficient, low voltage coefficients, tight ratio tolerances, high stability and increased high operating voltages.

These Precision High Voltage Dividers can provide important improvements in performance in many types of advanced electronic systems, including power supplies, radar systems, X-ray systems, analytical equipment and geophysical instruments.



NON INDUCTIVE

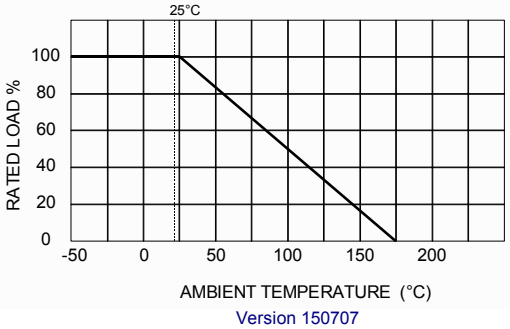
Model	Wattage	Max. Operating Voltage	Dimensions in millimeters ± 2.00 [Dimensions in inches ± 0.08]								
			L (max.)	B	C	D	E	F	H	I	G
2000.150	100.00	160'000	470 [18.50]	40.00 [1.58]	38.00 [1.50]	18.00 [0.71]	40.00 [1.58]	8.00 [0.32]	36.00 [1.42]	4.00 [0.16]	M8
2000.200	150.00	200'000	600 [23.62]	40.00 [1.58]	38.00 [1.50]	18.00 [0.71]	40.00 [1.58]	8.00 [0.32]	36.00 [1.42]	4.00 [0.16]	M8
2000.250	200.00	240'000	800 [31.50]	50.00 [1.97]	48.00 [1.89]	18.00 [0.71]	40.00 [1.58]	8.00 [0.32]	41.00 [1.62]	4.00 [0.16]	M8
2000.280	250.00	240'000	780 [30.71]	62.00 [2.44]	60.00 [2.36]	18.00 [0.71]	40.00 [1.58]	8.00 [0.32]	47.00 [1.85]	4.00 [0.16]	M8
2000.300	250.00	320'000	1000 [39.37]	50.00 [1.97]	48.00 [1.89]	18.00 [0.71]	40.00 [1.58]	8.00 [0.32]	41.00 [1.62]	4.00 [0.16]	M8
2000.350	300.00	320'000	1025 [40.35]	62.00 [2.44]	60.00 [2.36]	18.00 [0.71]	40.00 [1.58]	8.00 [0.32]	47.00 [1.85]	4.00 [0.16]	M8
2000.400	350.00	400'000	1320 [51.97]	62.00 [2.44]	60.00 [2.36]	18.00 [0.71]	40.00 [1.58]	8.00 [0.32]	47.00 [1.85]	4.00 [0.16]	M8

Characteristics

Resistance Values	from 1KΩ to as high as 100GΩ on all models (to 1TΩ on request)		
Ratios	from 1:100 to 1:10'000, other on request		
Absolute Tolerances	0.05%, 0.1%, 0.25%, 0.5%, 1%, 2%, 5% (0.05% avail. to 10G, 0.25% to 100G, other on request)		
Ratio Tolerances	0.05%, 0.1%, 0.25%, 0.5%, 1% (other on request)		
Absolute Temp. Coeff. *	10, 15, 25, 50 and 100 ppm/°C (10 ppm/°C available to 10G, 25 ppm/°C to 100G, other on request)		
Ratio Temp. Coeff. *	10, 15, 25 and 50 ppm/°C		
Operating Temperature	-55 .. +175°C	(extended temperature range to 350°C available)	
Insulation Resistance	> 10'000 MΩ	500 Volt 25 °C 75% relative humidity	
Dielectric Strength	> 1'000 Volt	25 °C 75% relative humidity	
Thermal Shock	Δ R/R < 0.1% typ., 0.20% max.	MIL Std. 202, method 107 Cond. C	IEC 68 - 2 -14
Overload	Δ R/R < 0.1% typ., 0.25% max.	1,5 x Pnom, 5 sec (do not exceed max. voltage)	
Moisture Resistance	Δ R/R < 0.1% typ., 0.25% max.	MIL Std. 202, method 106	IEC 68 - 2 - 3
Load Life	Δ R/R < 0.1% typ., 0.25% max.	1000 hours at rated power	IEC 115 - 1
Encapsulation	Silicone Conformal Coating	Core Material	Al_2O_3 (96%)
Lead Material	Brass Caps (lug terminations avail.)	Resistor Material	Ruthenium Oxide

* Temperature Coefficients referenced to 25°C, ΔR taken at +125°C

Derating Curve



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