HIGH VOLTAGE - HIGH POWER - NON INDUCTIVE

EN ISO 9001 : 2000

EBG

RESISTORS

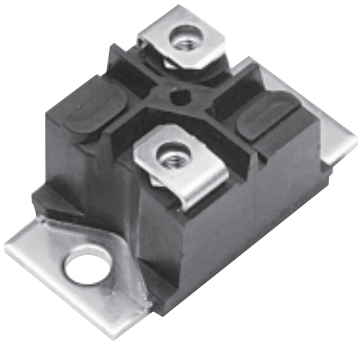
including PRODUCT LINE MTX

EBG Austria - Issue 309

About our company – An Introduction to EBG

EBG

- EBG is a leading international electronics components manufacturer, concentrating on highly specialized electronic resistive components.
- EBG has its corporate headquarters in Austria. In addition, we have operational facilities throughout Europe, USA and the Asian basin.
- Since 1977, EBG has added many quality electronic component products, and from its Austrian plant, EBG exports more than 85% of its production to its customers all over the world via Air Freight in 3 days or less.
- EBG does not produce the commodity type electronic components; rather, we concentrate in the high technology components spectrum.
- EBG`s resistive components offer such characteristics as very low and controlled temperature and voltage coefficients, high stability, high temperature operations and very tight tolerances. All products comply with applicable enviromental tests as required by European and USA military specifications.
- The EBG resistor product lines consist of an extensive variety of metal oxide products made with our exclusive METOX - FILM formulation. We offer different style options such as flats , cylindricals, dividers and networks.
- EBG is EN ISO 9001 : 2000 certified. Our customer base consists of many of the top FORTUNE 500 companies throughout the world.
- We encourage you to contact our technical staff to help assist you in your development/design of your individual resistor needs.



How to order EBG standard products:

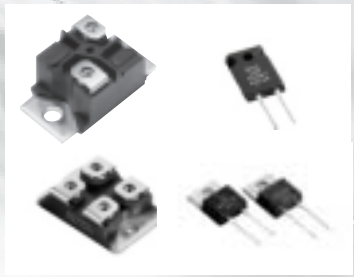
Quantity	Type	R-Value	R-Tol.	TCR
50	SGT 78	10k5	± 1%	± 25ppm
100	HXP 200-1	3k7	± 5%	± 100ppm

Catalog Overview:

EBG

High Voltage Resistors

Power Resistors



Ultra High Power Resistors

Voltage Dividers and Networks

Shunts - Current Sense Resistor

Metal Film

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

High Voltage Resistors

EBG

Series SGT Low TC • USPatent-Nr. 4,859,981

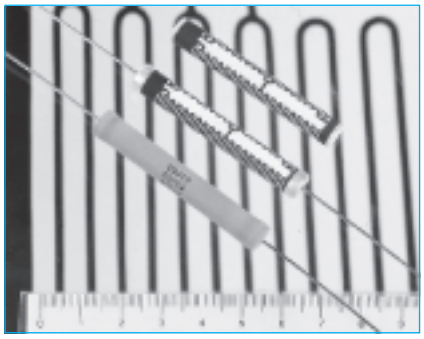
- TC of 25ppm/°C combined with Precision Tolerances (0.1%-1%), Ohmic Range (100KΩ-1GΩ)

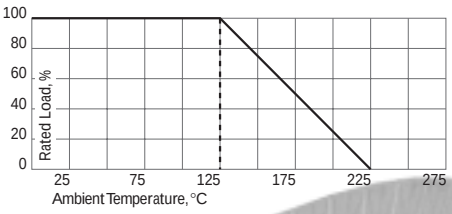
EBG is producing these models in order to meet the most stringent requirements regarding temperature coefficient in connection with high stability performance at high operating voltages. The low temperature coefficient minimizes the selfdrift generated through the warm-up due to power dissipation. The series SGT are produced with EBG's patented Non-Inductive Design. Typical applications are Medical Systems like X-Ray, Nucleus spin tomographes as well as Power Supplies or instruments. The features of the Type SGT Low TC Precision High Voltage Resistors are:

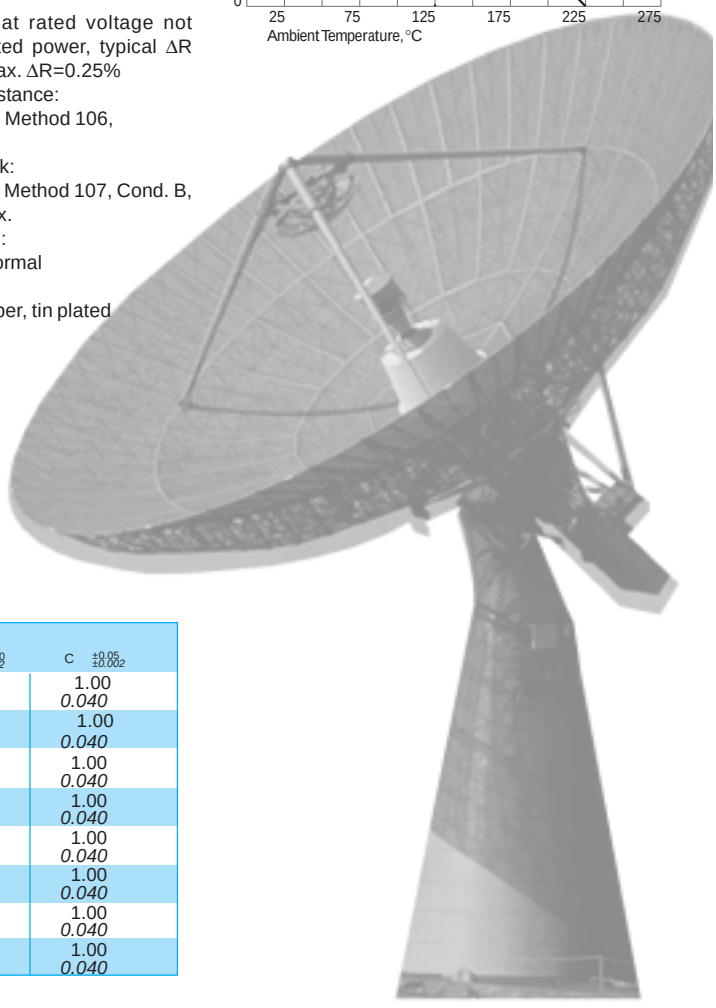
- Resistance Range from 100KΩ to 1GΩ
- Resistance Tolerance from ±0.1% to ±1.0%
- Temperature Coefficient: 25ppm/°C from -15°C to +85°C.
- Load Life Stability of 0.25% per 1,000 hours at +125°C.
- Patented NON-INDUCTIVE DESIGN
- Max. Cont. Operating Temp. of +225°C.
- Voltages up to 60% higher than the table values may be obtained in special order by adding "S" to the model designation.

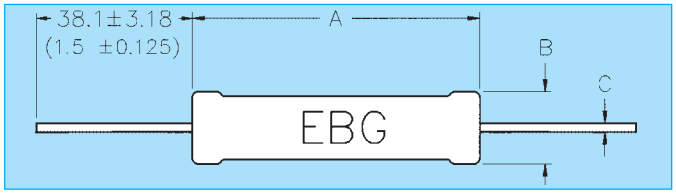
Specifications:

- Resistance Tolerance: Standard:±1% to ±10% (tolerances down to ±0.1% on special request)
- Temperature Coefficient: ±25ppm/°C referenced to 25°C, ΔR taken at -15°C and +85°C.
- Voltage Coefficient: max. -0.2ppm/V as to MIL-Std-202, Method 309, 10 KV DC max.
- Dielectric Strength: 1,000VDC
- Insulation Resistance: 10 GΩ min.
- Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times max. continuous operating voltage for 5 seconds. ΔR 0.20% max.
- Load Life: 1,000 hours at rated voltage not exceeding rated power, typical ΔR (2s)=0.1%, max. ΔR=0.25%
- Moisture Resistance: MIL–Std–202, Method 106, ΔR 0.4% max.
- Thermal Shock: MIL–Std–202, Method 107, Cond. B, ΔR 0.20% max.
- Encapsulation: Silicone Conformal
- Lead Material: O.F.H.C. Copper, tin plated









Model No.	Watt-age	Max. Cont. Oper. Volt.	MIN Ω	MIN "S" Ω	Max. (1% Tol.) Ω	Dimensions in millimeters *Dimensions in inches* A ±0.50 ±0.02	B ±0.50 ±0.02	C ±0.05 ±0.002
SGT 26	1.0	4,000	100K	40M	250M	26.90 *1.059*	8.20 *0.323*	1.00 *0.040*
SGT 32	1.25	5,000	120K	50M	300M	33.00 *1.3*	8.20 *0.323*	1.00 *0.040*
SGT 39	1.5	6,000	150K	60M	400M	39.50 *1.555*	8.20 *0.323*	1.00 *0.040*
SGT 52	2.0	10,000	200K	80M	500M	52.10 *2.051*	8.20 *0.323*	1.00 *0.040*
SGT 78	3.0	15,000	300K	120M	700M	77.70 *3.059*	8.20 *0.323*	1.00 *0.040*
SGT 103	4.0	20,000	400K	160M	1G	102.90 *4.051*	8.20 *0.323*	1.00 *0.040*
SGT 124	5.0	25,000	500K	190M	1G	123.70 *4.870*	8.20 *0.323*	1.00 *0.040*
SGT 154	6.0	30,000	600K	250M	1G	153.70 *6.051*	8.20 *0.323*	1.00 *0.040*

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

High Voltage Resistors

EBG

Series SGP/OGP • US Patent-Nr. 4,859,981

- TC of 80ppm/°C combined with Precision Tolerances (0.1%-10%) and wide Ohmic Range (100Ω-10GΩ)

EBG offers the SGP series to meet the requirements of high resistance values combined with very high voltage requirements, while utilizing EBG's patented non-inductive design complete with in-process digital trimming to exact value.

This series employs our special METOXFILM which demonstrates excellent stability while covering resistance ranges from 100Ω to 10GΩ, -all at high operating temperatures to 225°C. The power ratings and voltage ratings are for continuous opera-tion, and have all been pre-tested to these requirements for steady state performance, as well as momentary overload conditions.

A summary of the features of the SGP series are:

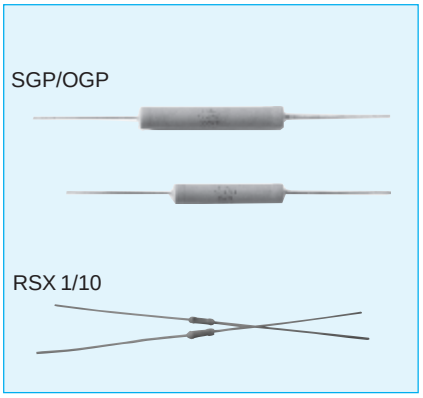
- Resistance values up to 10GΩ
- Resistance tolerance from ± 0.1% to ± 10%
- Temperature Coefficient: 80ppm/°C
- Maximum continuous Operating Voltage to 48,000 V
- Life Stability: Typical ±0.02% per 1,000 hours
- Maximum operating temp. up to +225°C

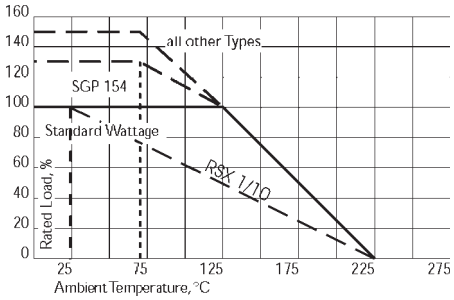
Voltages up to 60% higher than the table values may be obtained in special order by adding "S" to the model designation.

EBG's special patented (USPatent-Nr. 4,859,981) non-inductive construction offers an outstanding advantage over other techniques. The design incorporates a unique method of DIGI-TAL TRIMMING to value. Other less desirable methods include an "analog" method of abrading and removing the resistive material, frequently resulting in a weak section. EBG's patented process avoids this potential problem.

Specifications:

- Resistance Tolerance: Standard: ±1% to ±10% (±2% to ±10% above 1Gohms) (tolerances down to ±0,1% on special request)
- Temperature Coefficient: Standard ±80ppm/°C from -15°C to +105°C, referenced to +25°C
- Voltage Coefficient: see diagram
- Dielectric Strength:1,000VDC
- Insulation Resistance: 10GΩ, min.
- Overload/Overvoltage: 5 times rated power125°C with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. Overload/Overvoltage, ΔR 0.5% max.
- Load Life: 1,000 hours at 125°C and rated power, components with 1% Tol. ΔR 0.5% max., extented range ("S") ΔR=0.8% max.
- Moisture Resistance: MIL-Std-202, Method 106, ΔR 0.4% max.
- Thermal Shock: MIL-Std-202, Method 107, Cond.C, ΔR 0.25% max.
- Encapsulation: Silicone Conformal
- Lead Material: O.F.H.C. Copper tin plated.



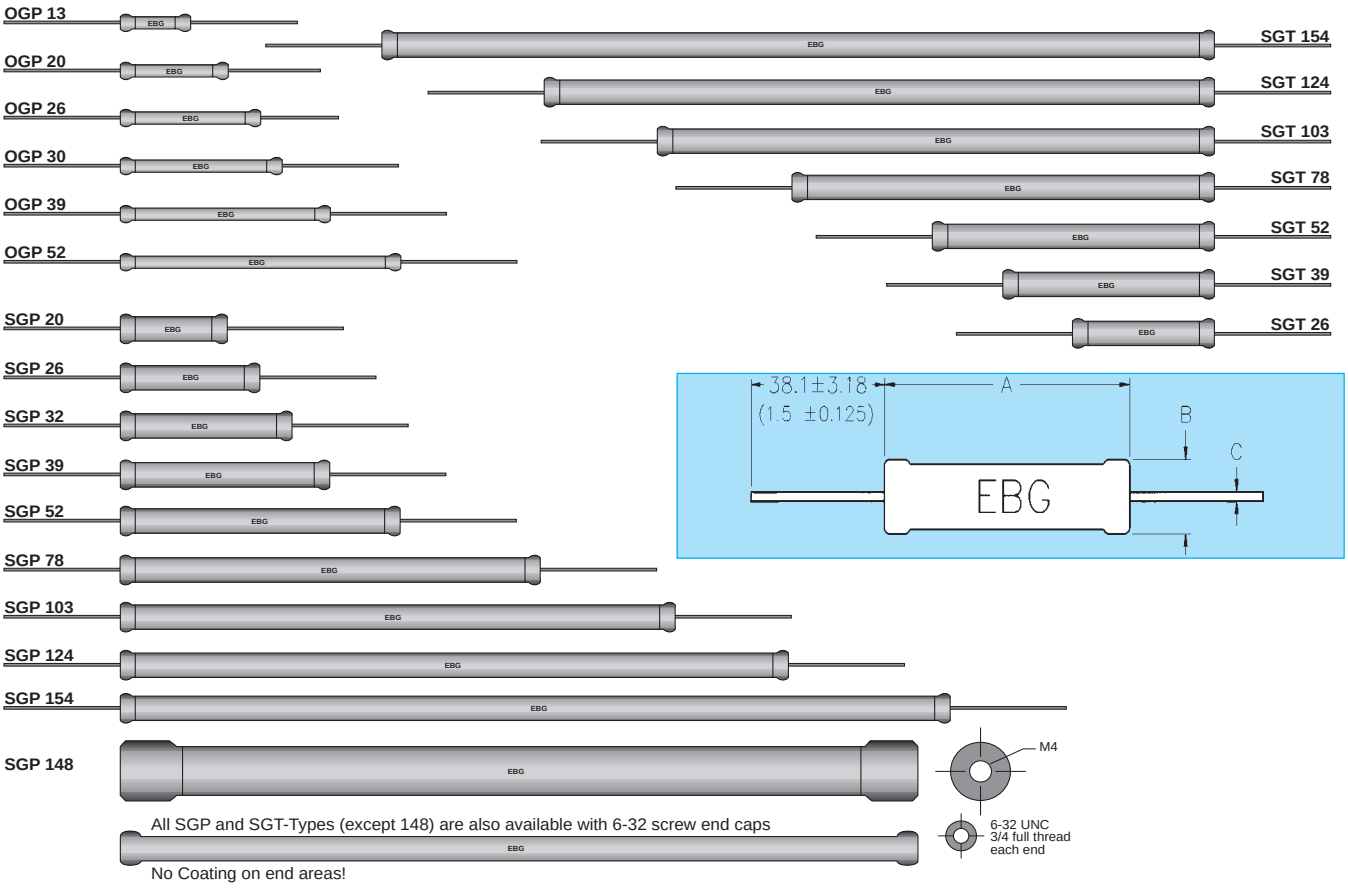


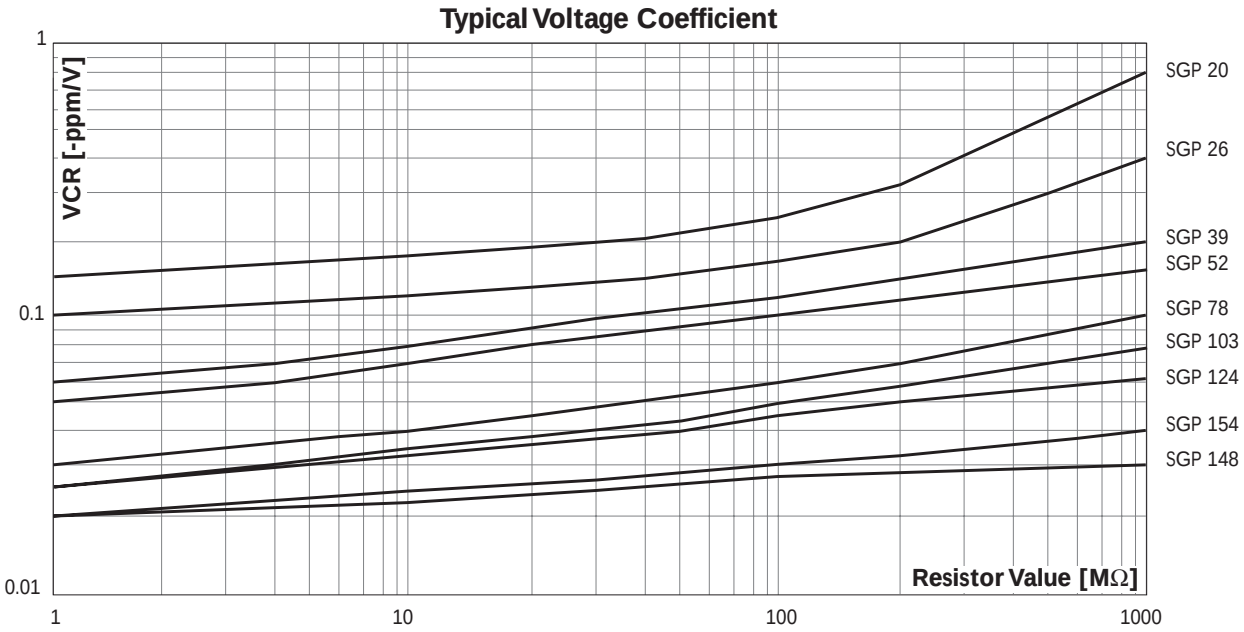
Model No.	Watt-age 25°C	Watt-age 75°C	Watt age 125°C	Max. Cont. Oper.V (kV)	Max. KV "S"	Resistance F(=1%) Min. ohmic	Resistance F(=1%) Max. values	s-Resistance Max. (2% Tol.)	Dimensions in millimeters *Dimensions in inches* A ± 0.50 *± 0.02*	B ±0.50 *±0.02*	C ± 0.05 *±0.002*
RSX1/10	0.5	0.38	0.25	0.5	0.75	100	200M	500M	6.50 *0.256*	2.00 *0.079*	0.60 *0.024*
OGP 13	1.0	1.0	0.60	1.5	2.4	100	50M	500M	13.30 *0.524*	4.20 *0.165*	0.60 *0.024*
OGP 20	1.5	1.5	1.00	2.0	3.2	200	100M	1G	19.70 *0.776*	4.20 *0.165*	0.60 *0.024*
OGP 26	1.9	1.9	1.25	4.0	6.4	300	150M	2G	26.20 *1.031*	4.20 *0.165*	0.60 *0.024*
OGP 30	2.5	2.5	1.50	5.0	8.0	500	250M	3G	32.30 *1.272*	4.20 *0.165*	0.60 *0.024*
OGP 39	3.0	3.0	2.00	6.0	9.6	700	300M	5G	39.40 *1.551*	4.20 *0.165*	0.60 *0.024*
OGP 52	3.3	3.3	2.50	10.0	12.0	400	2G	—	49.50 *1.949*	4.20 *0.165*	0.60 *0.024*
SGP 20	2.5	2.5	1.50	3.0	4.8	200	250M	1G	20.20 *0.795*	8.20 *0.323*	1.00 *0.040*
SGP 26	3.7	3.7	2.50	4.0	6.4	250	300M	1G	26.90 *1.059*	8.20 *0.323*	1.00 *0.040*
SGP 32	4.5	4.5	3.00	5.0	8.0	300	400M	1.5G	33.00 *1.3*	8.20 *0.323*	1.00 *0.040*
SGP 39	5.2	5.2	3.50	8.0	12.8	400	500M	1.5G	39.50 *1.555*	8.20 *0.323*	1.00 *0.040*
SGP 52	7.5	7.5	5.00	10.0	16.0	500	750M	2.5G	52.10 *2.051*	8.20 *0.323*	1.00 *0.040*
SGP 78	11	11	7.50	15.0	24.0	900	1G	4G	77.70 *3.059*	8.20 *0.323*	1.00 *0.040*
SGP 103	12	12	8.00	20.0	32.0	1K2	1G	2G	102.90 *4.051*	8.20 *0.323*	1.00 *0.040*
SGP 124	15	15	10.00	25.0	40.0	1K5	1G	8G	123.70 *4.870*	8.20 *0.323*	1.00 *0.040*
SGP 148	30	30	20.00	45.0	—	10K	3G	10G	148.0 *5.83*	16.0 *0.63*	– –
SGP 154	20	20	15.00	30.0	48.0	2K0	2G	10G	153.70 *6.051*	8.20 *0.323*	1.00 *0.040*

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

High Voltage Resistors – Overview

EBG





In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Power Resistors

EBG

Series SSP/OSP

- Power and High Voltage Resistors with high Maximum Temperature Operation, TC of 50ppm/°C

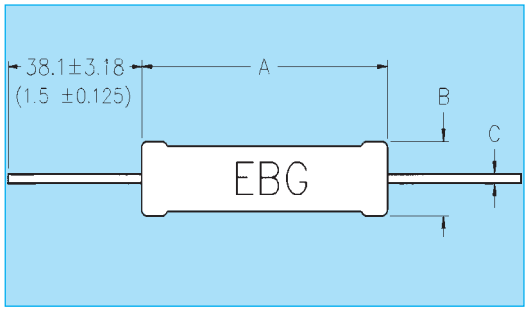
EBG offers the SSP series to meet the requirements of power ratings up to 40 Watts while at the same time offering voltage ratings up to 6,000 Volts.

These Power Film Resistors cover a wide resistance range and operation up to 275°C in axial lead construction.

A summary of the features of the SSP series are:

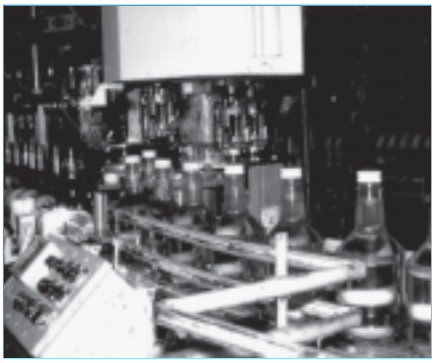
- Non-inductive Performance (EBG's patented process)
- Full power and voltage ratings (derating not required)
- Very high resistance values (see table) up to 30MΩ

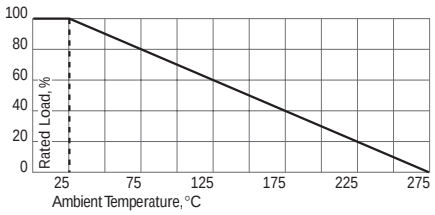
To accomplish this objective of high stability, high value, high voltage and high power in the SSP series, EBG employs a special variation of its METOXFILM formulations. These films are annealed on special ceramic bodies at temperatures above 1400°F / 800°C and become an inherent part of the surface of the ceramic, resulting in their unusual performance characteristics. As a result of EBG's unique non-inductive patented process, these resistors are ideally suited for high frequency applications, and result in less "ringing" with minimum distortion of the signals and faster settling times.



Specifications:

- Resistance Tolerance: Standard: ±1% to ±10%**
- Temperature Coefficient: for 10Ω and above 50ppm/°C. TC referenced to 25°C, ΔR taken at -15°C and +105°C.
- Dielectric Strength:1,000 V DC
- Insulation Resistance: 10GΩ, min.
- Overload/Overvoltage: 5 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds. ΔR 0.5% max. or 0.5Ω max., whichever is greater. (not valid for SSP 148!)
- Load Life: 1,000 hours at rated power, ΔR 0.5% max. or 0.5Ω max., whichever is greater.
- Thermal Shock: MIL–Std–202, Method 107, Cond. C, ΔR 0.5% max. or 0.5Ω max., whichever is greater.
- Max. Operating Temp.: +275°C
- Encapsulation: Silicone Confomal
- Lead Material: O.F.H.C. Copper, tin plated



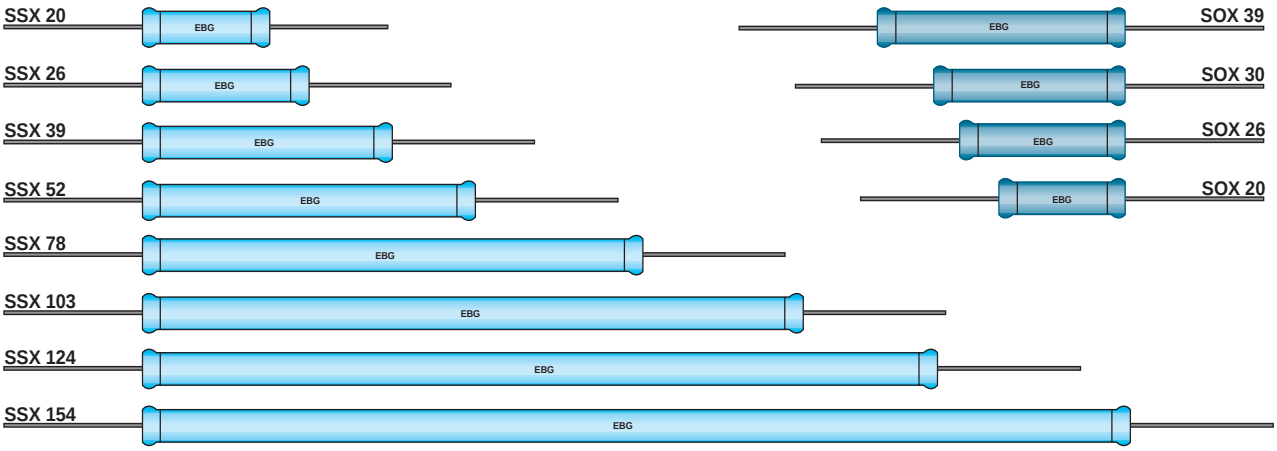


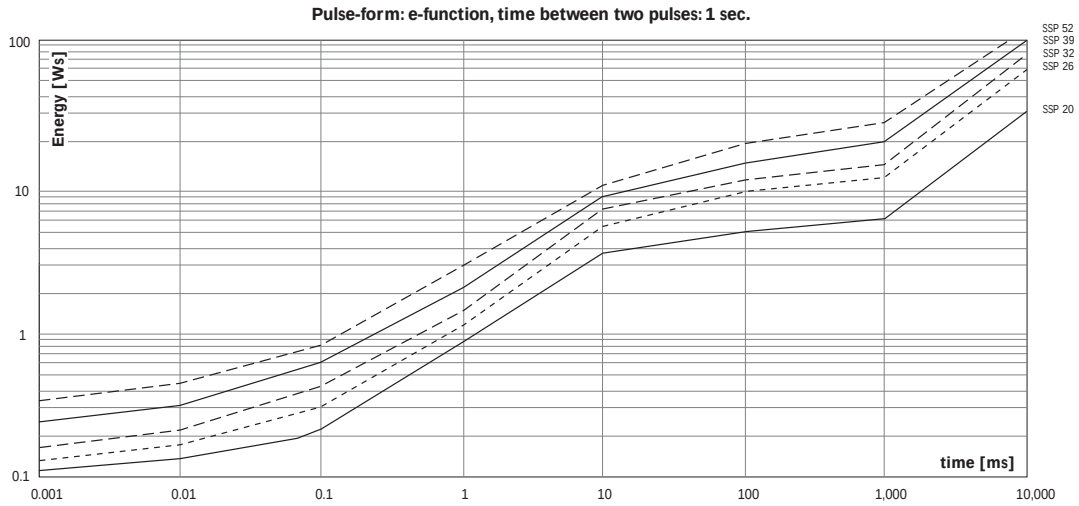
Model No.	Watt-age	Max. Voltage	Resistance Min. Ω	Resistance Max. Ω	Dimensions in millimeters (inches) A ± 0.50 ± 0.02	B ±0.50 ±0.02	C ±0.50 ±0.02
OSP 10	2.00	1,000	0.1	10M	10.90 *0.429*	4.20 *0.165*	0.60 *0.024*
OSP 13	2.40	1,000	0.1	12M	13.70 *0.539*	4.20 *0.165*	0.60 *0.031*
OSP 20	3.00	1,000	0.1	15M	19.70 *0.776*	4.20 *0.165*	0.60 *0.024*
SSP 20	4.00	800	0.1	15M	20.20 *0.795*	8.20 *0.323*	1.00 *0.040*
SSP 26	6.00	2,000	0.1	15M	26.90 *1.059*	8.20 *0.323*	1.00 *0.040*
SSP 32	8.00	4,500	0.1	20M	33.00 *1.3*	8.20 *0.323*	1.00 *0.040*
SSP 32 F*	10.00	4,500	1	10M	33.0 1.3	8.20 0.323	1.00 0.040
SSP 39	10.00	4,500	0.1	20M	39.50 *1.555*	8.20 *0.323*	1.00 *0.040*
SSP 52	12.50	6,000	0.1	30M	52.10 *2.051*	8.20 *0.323*	1.00 *0.040*
SSP 52 F*	15.00	6,000	1	30M	52.10 *2.051*	8.20 *0.323*	1.00 *0.040*
SSP 148	40.00	6,000	1	10K	148.0 *5.83*	16.0 *0.63*	– –

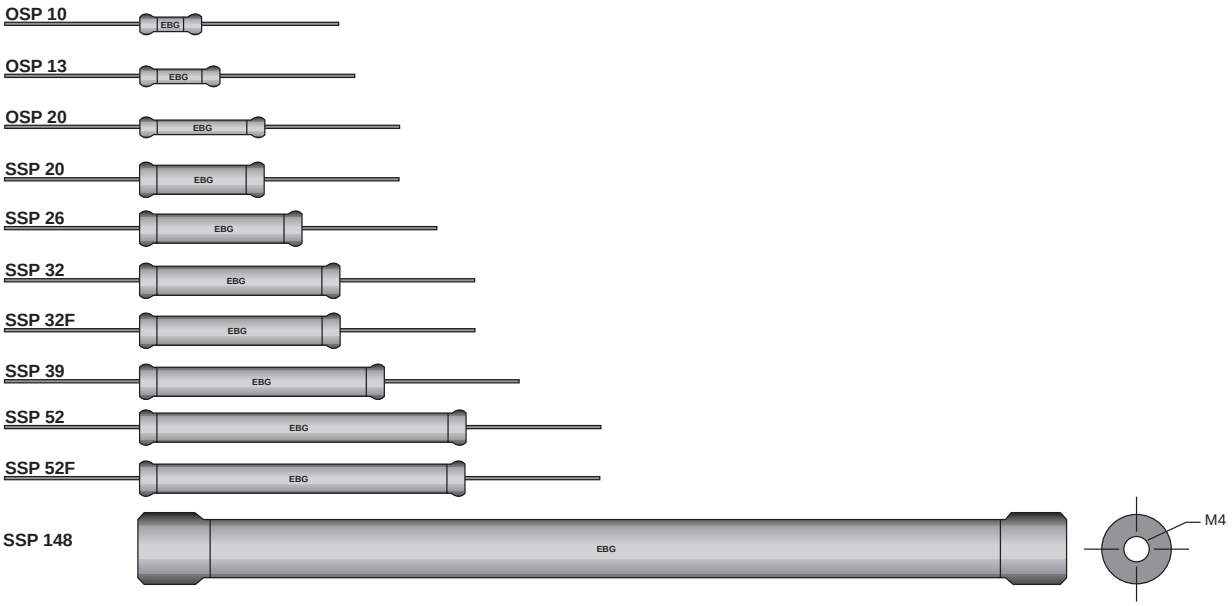
F*: enforced cooling

**Version L: resistance tolerances down to ±0,5% or ±0,1%, lower max. power (like SGP Series)

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:







In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Precision High Voltage Resistors

EBG

Precision High Voltage Resistor Series SSX/SOX

- Power and Precision High Voltage Resistors, TC of 100ppm/°C and wide Ohmic Range (300Ω-10GΩ)

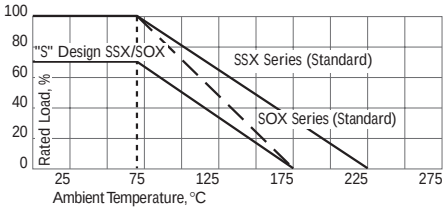
EBG offers the SSX/SOX series to meet general set of requirements at economical prices. This product is available with a silicone or epoxy coating and has a wide range of tolerances and temperature coefficients of resistance available.

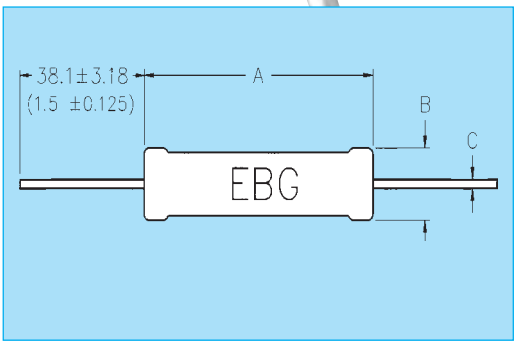
A summary of the features of the SSX/SOX series are:

- Silicone coating for ambient temperatures up to 225°C
- Epoxy coating for excellent humidity protection available under the name SOX
- Resistance tolerances offered from ±0.1% to ±10%
- Temperature coefficients: ±100ppm/°C to ±250ppm/°C
- Standard temperature coefficient: ±100ppm/°C
- Power Ratings up to 19.4 Watts
- 16 Models with Voltage Ratings from 5 KV to 60 KV
- Load Life Stability of 0.50% per 1,000 hours
- Resistance Range from 300Ω to 10GΩ.
- Full encapsulation over the entire resistor length

Specifications:

- Resistance Tolerance: ±1%, ±2%, ±5% or ±10% (tolerance to ±0.1%, ±0.25%, ±0.5% on special order)
- Temperature Coefficient: Standard 100ppm/°C referenced to 25°C, ΔR taken at 0°C and +70°C, other TCR on request.
- Load Life: 1,000 hours at rated power at 70°C, ΔR, 0.50% max.
- Thermal Shock: MIL–Std–202, Method 107, Cond. A, ΔR 0.20% max.
- Moisture Resistance: MIL-Std-202, Method 106, ΔR, 0.40 max.
- Encapsulation: Silicone or epoxy coating over the whole element
- Lead Material: O.F.H.C. Copper, tin plated





Model No.	Wattage at 70°C	Max. Cont. Oper. KV	Max. KV "S"	Resistance Min. Ω	Resistance Max. Ω	Dimensions in millimeters / Dimensions in inches A ±0.50 ±0.02	B ±0.50 ±0.02	C ±0.05 ±0.002
SOX 20	1.20	5.0	6.2	300	10G	21.30 *0.839*	8.60 *0.339*	1.00 *0.040*
SOX 26	1.60	7.5	9.4	450	10G	27.50 *1.083*	8.60 *0.339*	1.00 *0.040*
SOX 39	2.50	11.0	13.8	500	10G	40.20 *1.583*	8.60 *0.339*	1.00 *0.040*
SOX 52	3.40	16.0	20.0	400	10G	52.50 *2.067*	8.60 *0.339*	1.00 *0.040*
SOX 78	5.00	24.0	30.0	600	10G	78.70 *3.098*	8.60 *0.339*	1.00 *0.040*
SOX 103	6.50	32.0	40.0	800	10G	104.10 *4.098*	8.60 *0.339*	1.00 *0.040*
SOX 124	8.20	40.0	50.0	1M	10G	124.20 *4.890*	8.60 *0.339*	1.00 *0.040*
SOX 154	10.60	48.0	60.0	1M	10G	154.50 *6.083*	8.60 *0.339*	1.00 *0.040*
SSX 20	2.30	5.0	6.2	600	10G	20.20 *0.795*	8.20 *0.323*	1.00 *0.040*
SSX 26	3.90	7.5	9.4	600	10G	27.20 *1.071*	8.20 *0.323*	1.00 *0.040*
SSX 32	4.20	8.5	11.0	550	10G	33.00 *1.3*	8.20 *0.323*	1.00 *0.040*
SSX 39	4.60	11.0	13.8	500	10G	39.50 *1.555*	8.20 *0.323*	1.00 *0.040*
SSX 52	7.80	16.0	20.0	400	10G	52.00 *2.047*	8.20 *0.323*	1.00 *0.040*
SSX 78	11.70	24.0	30.0	600	10G	77.60 *3.055*	8.20 *0.323*	1.00 *0.040*
SSX 103	12.50	32.0	40.0	800	10G	103.20 *4.063*	8.20 *0.323*	1.00 *0.040*
SSX 124	15.50	40.0	50.0	1M	10G	123.70 4.870	8.20 0.323	1.00 0.040
SSX 154	19.40	48.0	60.0	1M	10G	153.70 6.051	8.20 0.323	1.00 0.040

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Precision High Voltage Resistors

EBG

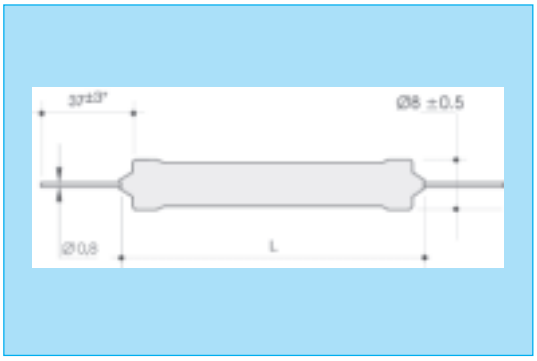
Series MTX 968

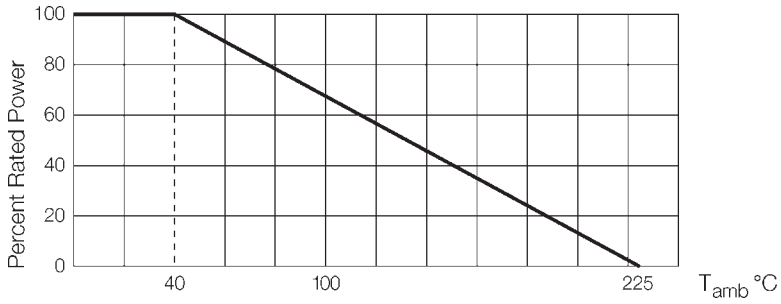
- Precision High Voltage Resistors with wide Ohmic Range (400Ω-30GΩ)

- The MTX 968 resistor series is designed for the usage in voltage dividers, medical equipment, electrostatic devices, measuring equipment, current limiting devices, where high stability, low TCR, high ohmic values and high short-term loads are required.

Specifications:

- Resistance Tolerance: ±0.1% to ±10%
- Temperature Coefficient: ±15ppm/°C to ±200ppm/°C
- Load Life: ΔR/R 0.5% max., 1000 hours at rated power
- Dielectric Strength: > 1000V (25°C, 75% relative humidity)
- Thermal Shock: ΔR/R 0.25% max.
- Moisture Resistance: ΔR/R 0.25% max.
- Operating Temperature: -55°C to +225°C
- Encapsulation: Conformal coating
- Lead Material: Gold plated copper wire





Type	P 40 °C Watt	U KVdc	Resistance Ranges Tolerance 1 – 10% TC ppm / °C 200	Tolerance 0.5 – 10% TC ppm / °C 100	Tolerance 0.25 – 10% TC ppm / °C 50	Tolerance 0.1 – 5% TC ppm / °C 25, 15	L mm
968.2	3.8	9	400 R – 10 G	400 R – 1 G	400 R – 1 G	60K – 500 M	27 ±1
968.3	5	12	500 R – 15 G	500 R – 1.5 G	500 R – 1.5 G	80K – 750 M	37 ±1
968.5	7.5	18	900 R – 20 G	900 R – 2 G	900 R – 2 G	120K – 1 G	52 ±1
968.7	10	24	1.2 K – 30 G	1.2 K – 3 G	1.2 K – 3 G	180K – 1.5 G	78 ±1.5
968.10	12.5	36	1.7 K – 30 G	1.7 K – 4 G	1.7 K – 3 G	240K – 2 G	103 ±1.5
968.12	15	42	2.6 K – 30 G	2.6 K – 5 G	2.6 K – 3 G	300K – 2 G	128 ±2
968.15	17	54	3.2 K – 30 G	3.2 K – 6 G	3.2 K – 3 G	350K – 2 G	153 ±2

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Precision High Voltage / High Power Resistors

EBG

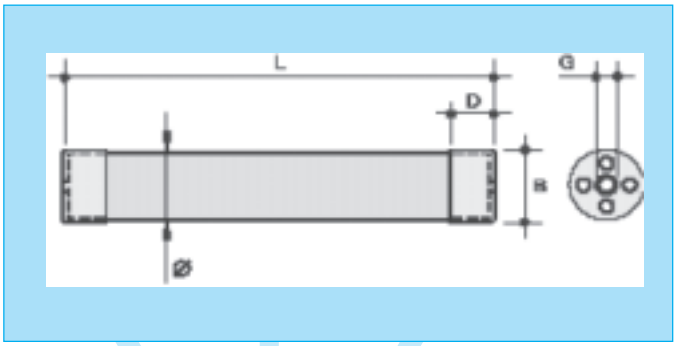
Series MTX 969

- High Power and High Voltage Resistors up to 96 kV and 105 Watts

The MTX 969 resistor series is designed for the usage in voltage dividers, medical equipment, electrostatic devices, measuring equipment, current limiting devices, where high stability, low TCR, high ohmic values and high short-term loads are required.

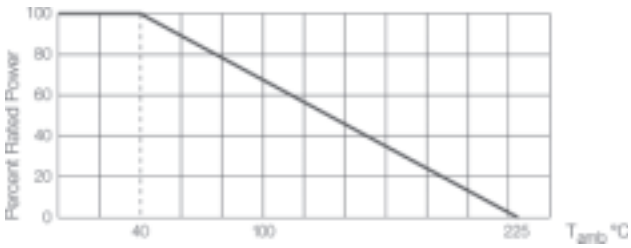
Specifications:

- Resistance Tolerance: ±0.1% to ±10%
- Temperature Coefficient: ±10ppm/°C to ±200ppm/°C
- Load Life: ΔR/R 0.5% max., 1000 hours at rated power
- Dielectric Strength: > 1000V (25°C, 75% relative humidity)
- Thermal Shock: ΔR/R 0.25% max.
- Moisture Resistance: ΔR/R 0.25% max.
- Operating Temperature: -55°C to +225°C
- Encapsulation: Conformal coating
- Lead Material: Nickel plated caps



Specifications
Dimensions (mm)

Type	L	B	Ø	D	G
969.11	81 ±1	14.5 ±0.2	13.5 ±0.5	10 ±0.2	M4
969.23	156 ±2	14.5 ±0.2	13.5 ±0.5	10 ±0.2	M4
969.54	160 ±2	31.5 ±0.2	30.5 ±0.5	18 ±0.2	M8
969.71	210 ±2.5	31.5 ±0.2	30.5 ±0.5	18 ±0.2	M8
969.105	308 ±3.5	31.5 ±0.2	30.5 ±0.5	18 ±0.2	M8



Type	P 40 °C Watt	U KVdc	Resistance Ranges Tolerance 2 – 10% TC ppm / °C 150, 20	Tolerance 0.5 – 10% TC ppm / °C 50, 100	Tolerance 0.1 – 10% TC ppm / °C 15, 25
969.11	11	24	500 R – 5 G	500 R – 1 G	50 K – 500 M
969.23	23	48	700 R – 10 G	700 R – 1 G	100 K – 1 G
969.54	54	48	2 R – 10 G	2 R – 1 G	100 K – 1 G
969.71	71	64	20 R – 15 G	20 R – 1.5 G	100 K – 1.5 G
969.105	105	96	80 R – 25 G	80 R – 2 G	100 K – 2 G

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Precision High Voltage Divider

EBG

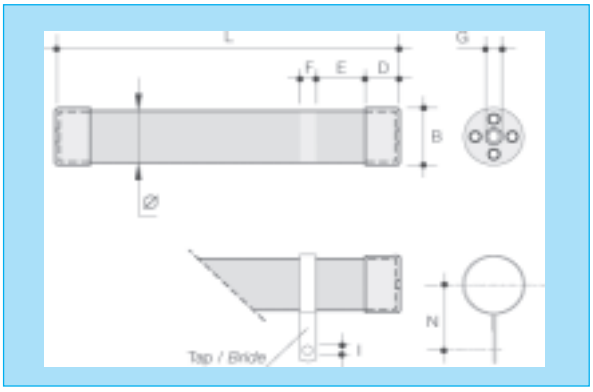
Series MTX 2000

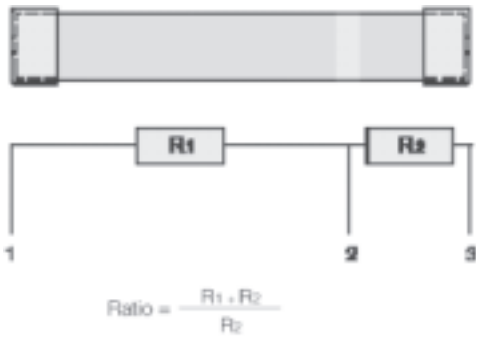
- High Power / High Voltage Dividers up to 50 Watts

The MTX 2000 series are high quality, high precision, high power, high voltage dividers for use in sophisticated resistor networks. These custom designs support a wide range of resistance values, tight voltage ratios, close tolerances, and low TCR's.

Specifications:

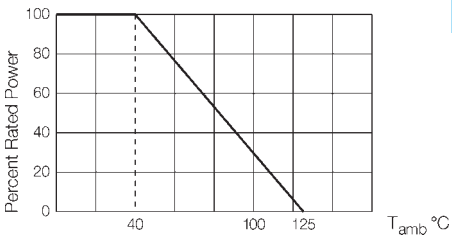
- Resistance Tolerance: ±0.1% to ±1%
- Ratio Tolerance: 0.1% to 1%
- Temperature Coefficient: ±25ppm/°C to ±50ppm/°C
- Ratio Temperature Coefficient: 10ppm/°C to 15ppm/°C
- Load Life: ΔR/R 0.15% max., 1000 hours at rated power
- Dielectric Strength: > 1000V (25°C, 75% relative humidity)
- Thermal Shock: ΔR/R 0.2% max.
- Moisture Resistance: ΔR/R 0.25% max.
- Operating Temperature: -55°C to +125°C
- Encapsulation: Conformal coating
- Lead Material: Nickel plated caps





Specifications
Dimensions (mm)

Type	L	B	Ø	D	E	F	G	I	N
2000.23	156 ±2	14.5 ±0.2	13.5 ±0.5	10 ±0.2	6.5 ±0.5	5 ±0.5	M4	3.2 ±0.2	18.5 ±0.5
2000.105	308 ±2.5	31.8 ±0.3	30.5 ±0.5	18 ±0.2	40 ±2	7 ±0.5	M8	3.2 ±0.2	31.5 ±0.5



	Pwatt 40°C	U kVDC		TK abs.	50 ppm / °C	25 ppm / °C	15 ppm / °C
				Tol. abs	1% – 0.25%	1% – 0.1%	1% – 0.1%
				TK Ratio	25 ppm / °C	15 ppm / °C	15 / 10 ppm / °C
				Tol. Ratio	0.5% - 0.25%	0.5% – 0.1%	0.5% – 0.1%
2000.23	10	40	R1 + R2 Ratio	2 M – 2 G 1 : 1000 – 1 : 20000	20 M – 1 G 1 : 1000 – 1 : 20000	20 M – 500 M 1 : 1000 – 1 : 10000	
2000.105	50	80	R1 + R2 Ratio	20 M – 3 G 1 : 1000 – 1 : 20000	20 M – 2 G 1 : 1000 – 1 : 20000	20 M – 1 G 1 : 1000 – 1 : 10000	

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

High Power Watercooled Resistor

EBG

Series MTX 969W

- High Power Watercooled Single Resistors and Voltage Dividers up to 1000 Watts!

Our resistor series 969W is designed for usage in high power applications.

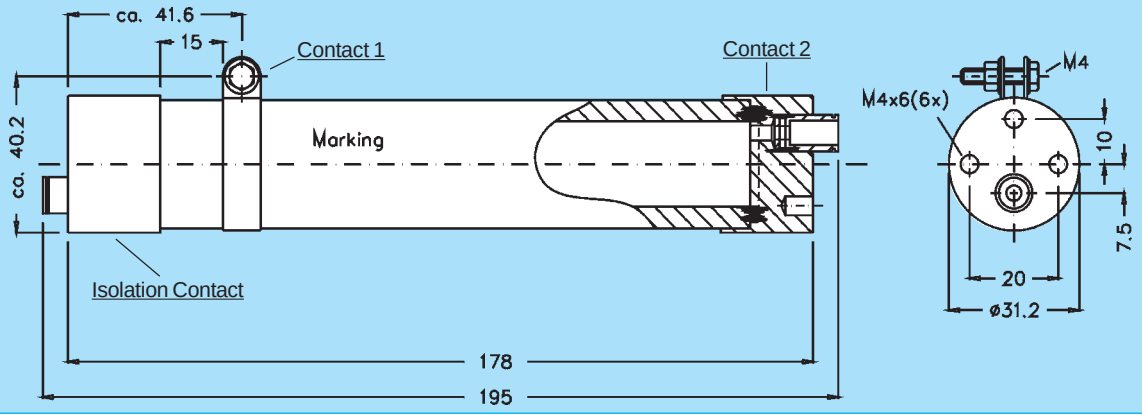
Due to the direct watercooling these resistors are good for a continuous power load up to 1,000 W (short time overload up to 2,000 W)!

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. Also voltage dividers are possible!

Specifications:

Standard Resistance Values:	1Ω to 100KΩ (Resistor between Contact 1 and Contact 2)
Standard Resistance Tolerance:	10%
Temperature Coefficient:	±100ppm/°C (measured from +25°C to +85°C)
Power Rating:	1000 W (at cooling medium temp. < 50°C, flow >7l/min.)
Voltage Rating:	7 kV DC
Isolation Voltage:	10 kV DC (between Contact 1 and Isolation Contact)
Cooling medium:	distilled Water or
	distilled Water - Clycol mixture
Connecting type of cooling medium:	6mm tube
Max. Cooling medium pressure:	10 bar
Component weight:	0.4kg
Contacts material:	CrNi (stainless)

Tolerances acc. DIN ISO 2768 (rough)



In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

High Voltage Resistors

EBG

High Voltage Flat Style Resistor Series FSX, FEX and FBX

- TC of 80ppm/°C combined with Precision Tolerances (0.5%-10%) and wide Ohmic Range (200Ω-2GΩ)

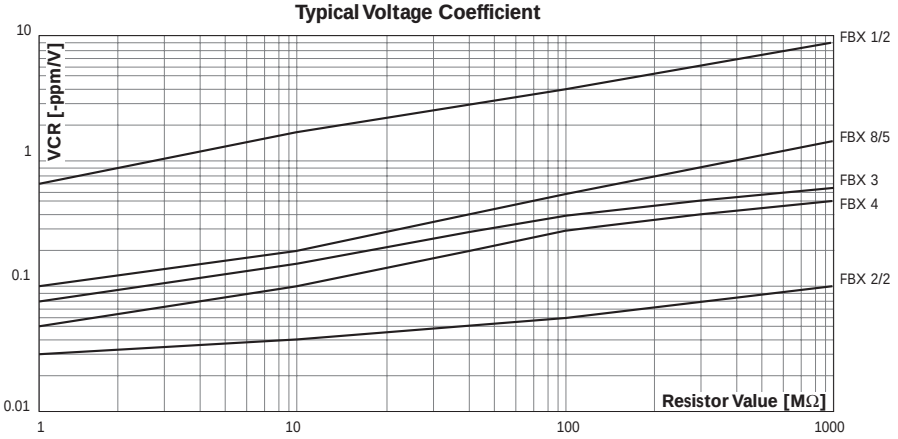
These are the low cost high voltage resistors that provide high density packaging in large volume applications.

- 3 different coatings available
  -Series FSX with conformal silicone for high temperature operation (225°C)
  -Series FEX with epoxy coat for maximal moisture protection
  -Series FBX with surface silicone print as an inexpensive alternative
- High Voltage Withstanding up to 24,000 Volts
- 6 different sizes
- Thickness max. 3mm (0.118 inch) only for High Density Packaging
- Non Inductive Design

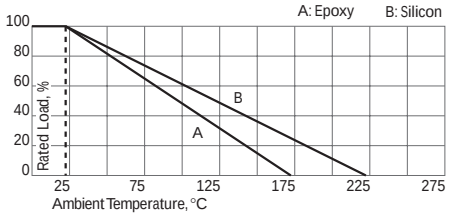
Specifications:

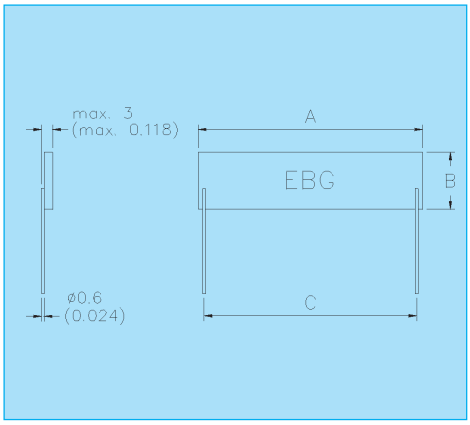
- Resistance Range: 200Ω to 2GΩ
- Resistance Tolerance: ±0.5% to ±10%
- Temp. Coefficient (up to 100MΩ): ±80 ppm/°C from -5°C to +105°C referenced to +25°C
- Max. Operating Voltage: "S" on request up to 35% higher than listed (please contact your local representative)
- Voltage Coefficient (typically): see below

Typical Voltage Coefficient



	Model No.	Wattage	Max. Continuous Oper. Volt.	Dimensions in millimeters *Dimensions in inches* A (max.) ±0.50 ±0.02	B (max.) ±0.50 ±0.02	C ±0.50 ±0.02
Series FBX with Surface Silicone Print	FBX1/2	0.50	4,000	12.90 *0.51*	3.40 *0.13*	10.20 *0.40*
	FBX5/5	0.65	6,000	17.15 0.68	3.40 0.13	15.24 0.60
	FBX8/5	1.60	8,000	25.60 *1.01*	5.30 *0.21*	22.90 *0.90*
	FBX3	3.00	12,000	38.30 *1.51*	6.60 *0.26*	35.50 *1.4*
	FBX4	4.00	15,000	51.00 *2.01*	6.60 *0.26*	48.20 *1.9*
	FBX2/2	5.00	22,000	51.00 *2.01*	12.90 *0.51*	48.20 *1,9*
Series FEX with Epoxy Protection	FEX1/4	0.25	4,000	13.80 *0.54*	5.00 *0.20*	10.20 *0.40*
	FEX5/5	0.35	7,000	19.05 *0.75*	5.08 *0.20*	15.24 *0.60*
	FEX4/5	0.80	9,000	26.10 *1.03*	6.70 *0.26*	22.90 *0.9*
	FEX3/2	1.50	13,000	38.90 *1.53*	7.90 *0.31*	35.50 *1.40*
	FEX2	2.00	17,000	51.50 *2.03*	8.10 *0.32*	48.20 *1.90*
	FEX2/2	3.00	24,000	51.50 *2.03*	14.40 *0.57*	48.20 *1.90*
Series FSX with Conformal Silicone Protection	FSX1/2	0.50	4,000	13.60 *0.54*	4.50 *0.18*	10.2 *0.40*
	FSX5/5	0.65	6,000	17.85 *0.70*	4.50 *0.18*	15.24 *0.60*
	FSX8/5	1.60	8,000	25.90 *1.02*	6.30 *0.25*	22,90 *0.90*
	FSX3	3.00	12,000	38.70 *1.52*	7.50 *0.30*	35.50 *1.40*
	FSX4	4.00	15,000	51.3 *2.02*	7.50 *0.30*	48.20 *1.90*
	FSX2/2	5.00	22,000	51.30 *2.02*	14.20 *0.56*	48,2 *1.90*





In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

High Voltage Resistors

EBG

High Voltage Flat Style Resistors Series FPX and FLX

- TC of 100ppm/°C combined with Precision Tolerances (0.5%-10%) and wide Ohmic Range

Here are the low cost power resistors that provide high density packaging in large volume applications.

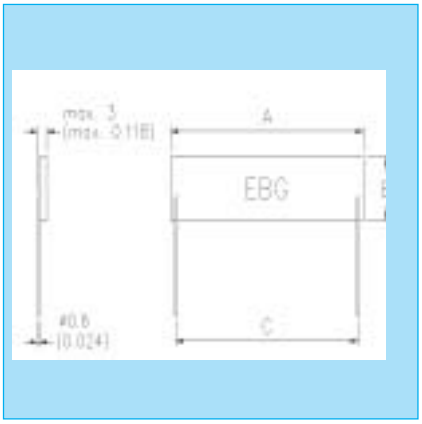
- Series FPX and FLX printed on surface with conformal black silicone for high temperature operation (225°C)
- High Voltage Withstanding up to 22,000V
- 5 different sizes
- Thickness only max. 3mm (0.118 inch) for High Density Packaging
- Non Inductive Design

Specifications:

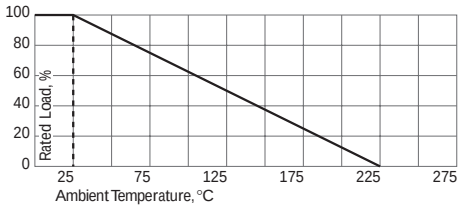
- Resistance Range:
  FPX: 200Ω to 2GΩ
  FLX: 10Ω to 1GΩ
- Resistance Tolerance:
  FPX: ±1% to 10%
  FLX: ±0.5% to 10%
- Temperature Coefficient:
  ±100 ppm/°C , measured from +25°C to 85°C
- Voltage Coefficient (typically):

Resistance Range			-ppm/V
200R	-	1M	0.1- 1.0
1M	-	100M	0.2- 3.0
100M	-	2,000M	0.5- 10.0

- Max. Operating Voltage: "S" on request up to 35% higher than listed



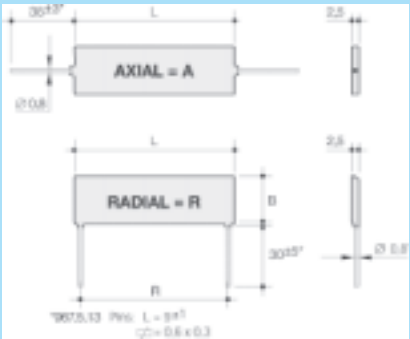
	Model No.	Watt-age	Max. Continuous Oper. Volt.	Dimensions in millimeters *Dimensions in inches* A (max.) ±0.50 ±0.02	B (max.) ±0.50 ±0.02	C ±0.50 ±0.02
Series FPX with Surface Silicone Print	FPX1/2	1.50	4,000	12.90 *0.51*	3.40 *0.13*	10.20 *0.40*
	FPX8/5	2.50	8,000	25.60 *1.01*	5.30 *0.21*	22.90 *0.90*
	FPX3	4.00	12,000	38.30 *1.51*	6.60 *0.26*	35.50 *1.40*
	FPX4	5.00	15,000	51.00 *2.01*	6.60 *0.26*	48.20 *1.90*
	FPX2/2	7.50	22,000	51.00 *2.01*	12.90 *0.51*	48.20 *1.90*
Series FLX with Conformal Silicone Protection	FLX1/2	1.50	300	12.90 *0.51*	3.40 *0.13*	10.20 *0.40*
	FLX8/5	2.50	500	25.60 *1.01*	5.30 *0.21*	22.90 *0.90*
	FLX3	4.00	800	38.30 *1.51*	6.60 *0.26*	35.50 *1.40*
	FLX4	5.00	1,000	51.00 *2.01*	6.60 *0.26*	48.20 *1.90*
	FLX2/2	7.50	1,000	51.00 *2.01*	12.90 *0.51*	48.20 *1.90*



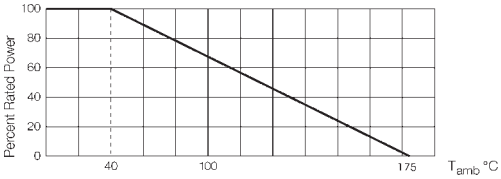
High Voltage Flat Style Resistors Series MTX 967

Specifications
Dimensions (mm)

Type	Pwatt	UkvDC	L	B	R
967.3.25	1	8	25.4	3.8	22.9
967.3.38	1.5	10	38	3.8	35.7
967.5.13	1	5	12.7	5	10.2
967.5.51	2	20	50.8	5	48.3
967.10.25	2	10	25.4	10	22.9
967.10.51	3	30	50.8	10	48.3
967.15.38	3	15	38	15	35.7
967.15.51	4.5	30	50.8	15	48.3
967.15.76	5.5	35	76.2	15	73.4
967.25.99	10	35	101.6	24	98.6



Operating Temperature	-55 to +175°C
Temperature Coefficient	±10 to ±200ppm/°C
Tolerance	±10% to ±0.1%
Insulation Resistance	> 10,000 Mohm (500 Volts, 25°C, 75% relative humidity)
Dielectric Strength	> 1000 Volts (25°C, 75% relative humidity)
Termal Shock	ΔR/R 0.2% max
Overload	ΔR/R 0.25% max 1.5 x Pnom, 5 sec (do not exceed 1.5 x Vmax)
Moisture Resistance	ΔR/R 0.25% max
Load Life	ΔR/R 0.25% max
Encapsulation	Conformal coating or glass coating
Lead Material	Tinned copper



In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Power Resistors

EBG

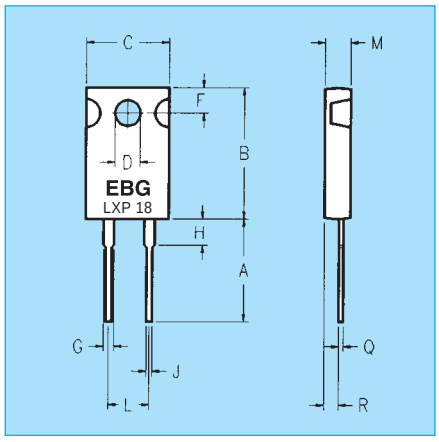
Series LXP 18 TO 220

- 18 WattThick Film Power Resistors for High Frequency and Pulse Loading Applications

EBG offers the totally encapsulated and insulated TO-220 package for low ohmic value and non-inductive design for high frequency and pulsing applications. Ideal use is for power supplies. This series is rated at 18 Watts mounted to a heat sink.

The special features include:

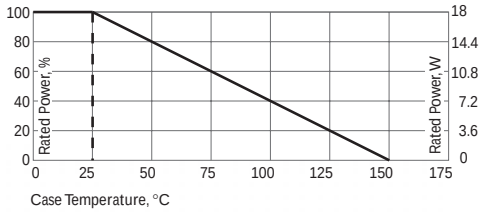
- 18 Watt power rating at 25°C case temperature
- TO-220 package configuration
- Single screw mounting simplifies attach-ment to the heat sink.
- A totally molded housing for enviromental protection.
- Non-Inductive design
- Resistor package totally insulated from heat sink.



Dim.	Millimeter Min.	Millimeter Max.	Inches Min.	Inches Max.
A	11.43	13.97	0.450	0.550
B	16.00	16.52	*0.630*	*0.650*
C	10.15	10.67	*0.400*	*0.420*
D	3.08	3.28	*0.121*	*0.129*
F	2.92	3.44	*0.115*	*0.135*
G	1.14	1.40	*0.045*	*0.055*
H	2.54	4.06	*0.100*	*0.160*
J	0.66	0.86	*0.026*	*0.034*
L	4.82	5.34	*0.190*	*0.210*
M	2.92	3.44	*0.115*	*0.135*
Q	0.40	0.60	*0.016*	*0.024*
R	1.52	2.04	*0.060*	*0.080*

Specifications:

- Resistance Range: 0.05Ω to 1MΩ other values on request
- Resistance Tolerance: ±1%, ±2%, ±5%, ±10% (0.5% on request)
- Temperature Coefficient: 10Ω and above, ±50ppm/°C, referenced to 25°C, ΔR taken at +105°C. Between 1Ω and 10Ω, ± (100ppm+0.002Ω)/°C, referenced to 25°C, ΔR taken at +105°C
- Max. Operating Voltage: 350 V
- Dielectric Strength: 1,800V AC
- Power Rating: 18 W at 25°C. Depends upon case temperature. See Derating Curve.
- Insulation Resistance: 10 GΩ min.
- Momentary Overload: 2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds, ΔR ± (0.3% + 0.001Ω) max.
- Load Life: MIL–R–39009, 2,000 hours at rated power, ΔR ±(1.0% + 0.001Ω).
- Moisture Resistance: MIL–Std–202, Method 106, ΔR ±(0.5% + 0.001Ω) max.
- Thermal Shock: MIL–Std–202, Method 107, Cond. F, ΔR ±(0.3% + 0.001Ω) max.
- Terminal Strength: MIL–Std–202, Method 211, Cond. A (Pull Test) 2.4N., ΔR ±(0.2% + 0.001Ω) max.
- Vibration, High Frequency: MIL–Std–202, Method 204, Cond. D, ΔR ±(0.2% + 0.001Ω) max.
- Lead Material: Tinned Copper
- Max. Torque: Using a screw and a compression washer mounting technique is 0.9 Nm



Derating (thermal resistance): 0.144W/°K (6.94K/W). Without a heatsink, when in free air at 25°C, the LXP18 is rated for 2.25W. Derating for temp. above 25°C is 0.018W/°K.

The case temperature is to be used for the definitiion 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.

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Power Resistors

EBG

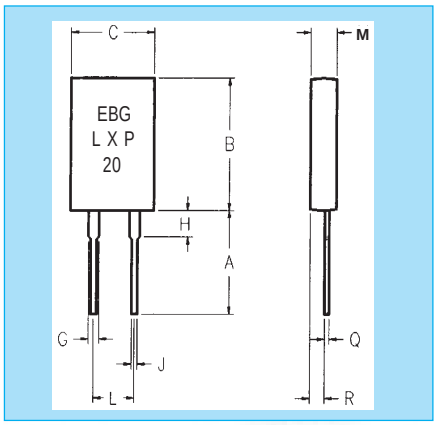
Series LXP 20 TO 220

- 20 Watt Thick Film Power Resistors for High Frequency and Pulse Loading Applications

EBG offers the totally encapsulated and insulated TO-220 package for low ohmic value and non-inductive design for high frequency and pulsing applications. Ideal use is for power supplies. This series is rated at 20 Watts mounted to a heat sink.

The special features include:

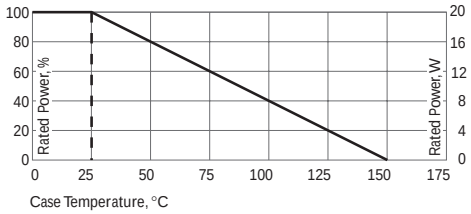
- 20 Watt power rating at 25°C case temperature
- High pulse tolerant design
- TO-220 package configuration
- Snap-on style TO-220 heat sink required
- A totally molded housing for enviromental protection.
- Non-Inductive design
- Resistor package totally insulated from heat sink.



Dim.	Millimeter Min.	Max.	Inches Min.	Max.
A	11.43	13.97	0.450	0.550
B	16.00	16.52	*0.630*	*0.650*
C	10.15	10.67	*0.400*	*0.420*
G	1.14	1.40	*0.045*	*0.055*
H	2.54	4.06	*0.100*	*0.160*
J	0.66	0.86	*0.026*	*0.034*
L	4.82	5.34	*0.190*	*0.210*
M	2.92	3.44	*0.115*	*0.135*
Q	0.40	0.60	*0.016*	*0.024*
R	1.52	2.04	*0.060*	*0.080*

Specifications:

- Resistance Range: 0.05Ω to 1MΩ other values on request
- Resistance Tolerance: ±1%, ±2%, ±5%, ±10% (0.5% on request)
- Temperature Coefficient: 10Ω and above, ±50ppm/°C, referenced to 25°C, ΔR taken at +105°C. Between 1Ω and 10Ω, ±(100ppm + 0.002Ω)/°C, referenced to 25°C, ΔR taken at +105°C
- Max. Operating Voltage: 350V
- Dielectric Strength: 1,800V AC
- Power Rating: 20W at 25°C. Depends upon case temperature. See Derating Curve.
- Insulation Resistance: 10GΩ min.
- Momentary Overload: 2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds, ΔR ± (0.3% + 0.001Ω) max.
- Load Life: MIL–R–39009, 2,000 hours at rated power, ΔR ±(1.0% + 0.001Ω).
- Moisture Resistance: MIL–Std–202, Method 106, ΔR ±(0.5% + 0.001Ω) max.
- Thermal Shock: MIL–Std–202, Method 107, Cond. F, ΔR ±(0.3% + 0.001Ω) max.
- Terminal Strength: MIL–Std–202, Method 211, Cond. A (Pull Test) 2.4N, ΔR ±(0.2% + 0.001Ω) max.
- Vibration, High Frequency: MIL–Std–202, Method 204, Cond. D, ΔR ±(0.2% + 0.001Ω) max.
- Lead Material: Tinned Copper



Derating (thermal resistance): 0.16W/°K (6.25°K/W). Without a heatsink, when in free air at 25°C, the LXP20 is rated for 3W. By using the element with a snap-on heat sink the resistor is rated for 5W. Derating for temp. above 25°C is 0.018W/°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.

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Power Resistors

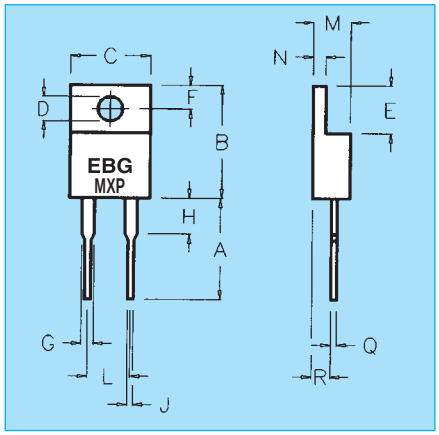
EBG

Series MXP 35 TO 220

- 35 Watt Thick Film Power Resistors for High Frequency and Pulse Loading Applications

The special performance features of the Type MXP include:

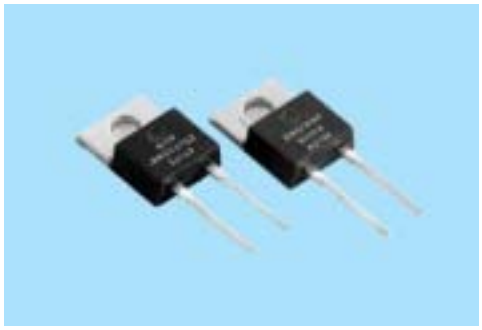
- 35 Watt power rating at 25°C
- TO-220 package configuration
- Single screw mounting simplifies attachment to heat sink
- Heat resistance to cooling plate: R_{th} < 4.28 °K/W
- A molded case for environmental protection.
- Resistor element is electrically insulated from the metal sink tab.
- Standard lead form for easier fit.

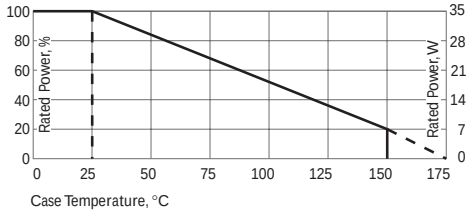


Dim.	Millimeter Min.	Max.	Inches Min.	Max.
A	12.70	14.70	*0.500*	*0.579*
B	14.50	15.00	*0.571*	*0.591*
C	9.91	10.41	*0.390*	*0.410*
D	3.55	3.75	*0.139*	*0.148*
E	5,85	6.35	*0.230*	*0.250*
F	2.85	3.05	*0.112*	*0.120*
G	1.17	1.37	*0.046*	*0.054*
H	– –	4.00	– –	*0.157*
J	0.70	0.86	*0.027*	*0.034*
L	4.83	5.33	*0.190*	*0.210*
M	4.06	4.82	*0.159*	*0.190*
N	1.20	1.40	*0.047*	*0.055*
Q	0.55	0.70	*0.022*	*0.028*
R	2.05	2.25	*0.080*	*0.089*

Specifications:

- Resistance Range: 0.05Ω to 1MΩ other values on request
- Resistance Tolerance: ±1% to ±10% (0.5% on request)
- Temperature Coefficient: 10Ω and above, ± 50ppm/°C, referenced to 25°C, ΔR taken at +105°C. Between 1Ω and 10Ω, ± (100ppm+0.002Ω)/°C, referenced to 25°C, ΔR taken at +105°C.
- Max. Operating Voltage: 350V
- Dielectric Strength: 1,800VAC
- Insulation Resistance: 10GΩ min.
- Momentary Overload: 2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds, ΔR ±(0.3% + 0.01Ω) max.
- Load Life: MIL–R–39009, 2,000 hours at rated power, ΔR ±(1.0% + 0.01Ω).
- Power Rating: Depends upon case temperature. See Derating Curve.
- Moisture Resistance: MIL–Std–202, Method 106, ΔR =(0.5% + 0.01Ω) max.
- Thermal Shock: MIL–Std–202, Method 107, Cond. F, ΔR =(0.3% + 0.01Ω) max.
- Working Temperature Range: -55°C to +175°C
- Terminal Strength: MIL–Std–202, Method 211, Cond. A (Pull Test) 2.4N, ΔR =(0.2% + 0.01Ω) max.
- Vibration, High Frequency: MIL–Std–202, Method 204, Cond. D, ΔR =(0.2% + 0.01Ω) max.
- Lead Material: Tinned Copper
- Maximum Torque: 0.9 Nm

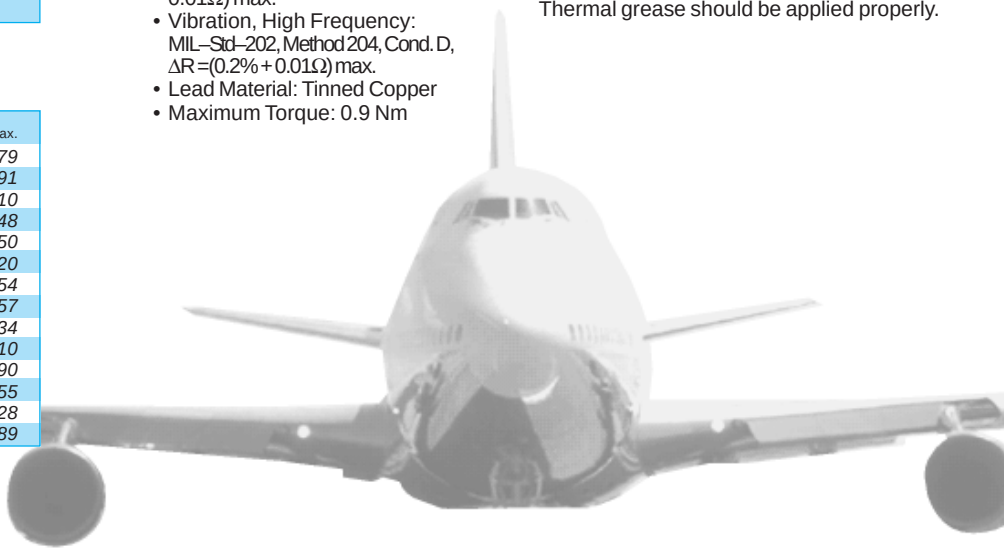




Derating (thermal resistance): 0.23W/°K (4.28°K/W)

Without a heatsink, when in free air at 25°C, the MXP is rated for 2.50W. Derating for temp. 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.



In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Power Resistors

EBG

Series MSP 35 SMD - TO 220

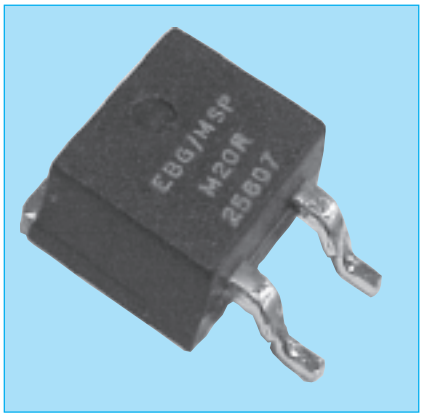
- 35 Watt Thick Film Power Resistors for Surface Mount including Metal Tab

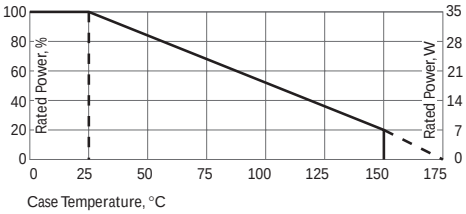
The special performance feature of the Type MSP include:

- 35 Watt power rating at 25°C
- **SMD - TO-220** package configuration
- Heat resistance to cooling plate: R_{th}< 4.28 °K/W
- A molded case for environmental protection.
- Resistor element is electrically insulated from the metal sink tab.

Specifications:

- Resistance Range: 0.1Ω to 10KΩ other values on request
- Resistance Tolerance: ±1% to ±10% (0.5% on request)
- Temperature Coefficient: 10Ω and above, ± 50ppm/°C, referenced to 25°C, DR taken at +105°C. Between 1Ω and 10Ω, ±(100ppm+0.002Ω)/°C, referenced to 25°C, DR taken at +105°C.
- Max. Operating Voltage: 350V
- Dielectric Strength: 1,800VAC
- Insulation Resistance: 10GΩ min.
- Momentary Overload: 2 times rated power with applied voltage not to exceed 1.5 times maximum continuous operating voltage for 5 seconds, DR ±(0.3% + 0.01Ω) max.
- Load Life: MIL–R–39009, 2,000 hours at rated power, DR ±(1.0% + 0.01Ω).
- Power Rating: Depends upon case temperature. See Derating Curve.
- Moisture Resistance: MIL–Std–202, Method 106, DR =(0.5% + 0.01Ω) max.
- Thermal Shock: MIL–Std–202, Method 107, Cond. F, DR =(0.3% + 0.01Ω) max.
- Working Temperature Range: -55°C to +175°C
- Terminal Strength: MIL–Std–202, Method 211, Cond. A (Pull Test) 2.4N, DR =(0.2% + 0.01Ω) max.
- Vibration, High Frequency: MIL–Std–202, Method 204, Cond. D, DR =(0.2% + 0.01Ω) max.
- Lead Material: Ni-plated copper

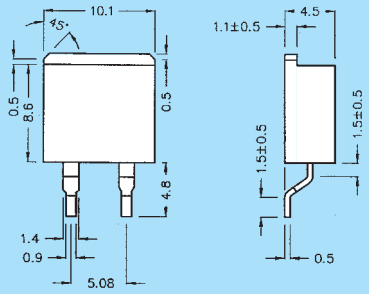




Derating (thermal resistance): 0.23W/°K (4.28°K/W)

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.

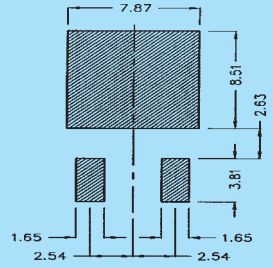
Dimensions:



Tolerances, unless noted: ±0.2mm

TO 220 style power package for SMD applications
35W power rating at 25°C case temperature

Soldering Template:



Soldering Note: During surface mount soldering the soldering temperature profile must not cause the metal tab of this device to exceed 220°C!

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

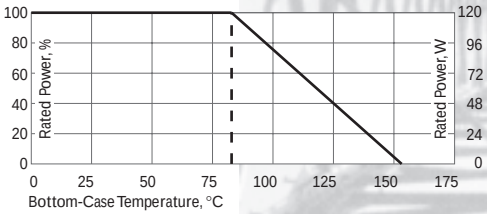
Power Resistors

EBG

Series AXP 100

- 100 Watt Power Resistor with (4) wire Terminals

This new design of the non–inductive thick film Metal Oxide Technology with the wire terminals eliminates the possibility for problems regarding creeping distance from terminal to ground. This unique design will allow you to use this element in the following areas: Variable Speed Drives; Power Supplies; Control Devices; Telecommunications; Robotics; Motor Controls and other Switching Devices.



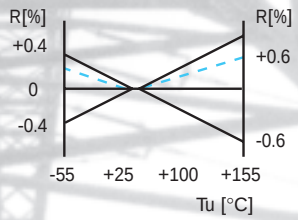
Derating (thermal resistance):
3.12W/°K (0.32°K/W).
Best results can be reached by using a thermal transfer compound with a heat conductivity of better than 1W/mK

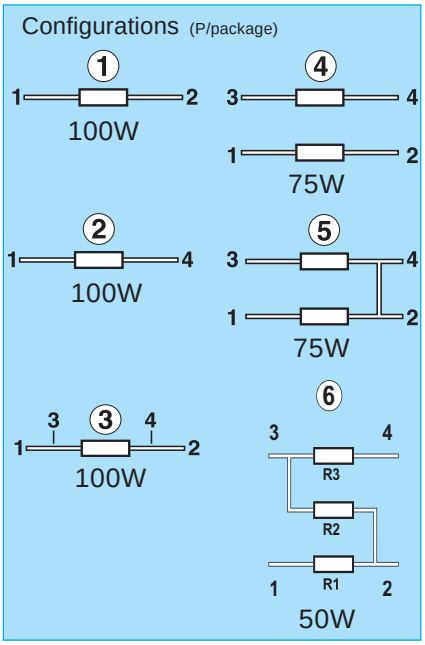
Suggested Mounting Procedure:
1) Position component and press down by hand.
2) Fix both mounting screws with 0.1 to 0.2 Nm torque.
3) Apply final torque to mounting screws of 1.0 to 1.2 Nm max.

Specifications

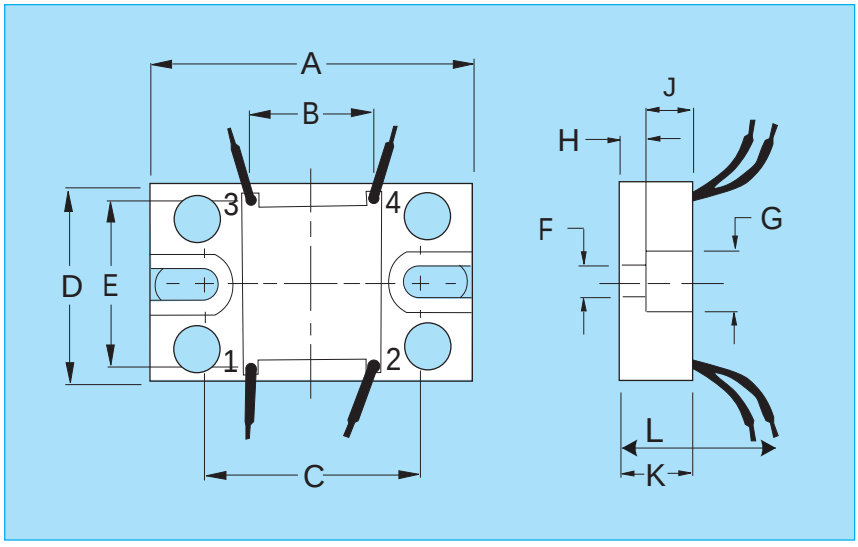
- Resistance Range:1Ω to 1MΩ
- Standard tolerance:±1% to ±10%
- Temperature coefficient:
  ±50, ±100ppm, ±250ppm (at +105°C ref. to +25°C)
- Max. Work. Voltage: 500V
  (up to 1,000V on special request)
- Power rating: at 85°C BCT
- Standard wire length: L = 100mm
  (other lenghts are available on special request)
- Electric strength: 5kV DC (3kV AC)
  higher values on request
- Max. Torque: 1.2Nm
- Working temp. range:
  - 55 up to 155 °C

Typical TCR – Curve





Version 5: ohmic value between contact 2 and 4 = 3mΩ



Dim.	Millimeters Min.	Millimeters Max.	Inches Min.	Inches Max.
A	44.8	45.2	1.764	1.779
B	16.3	17.3	0.642	0.681
C	29.7	30.1	1.169	1.185
D	26.2	26.6	1.031	1.047
E	22.0	23.0	0.866	0.906
F	4.1	4.3	0.161	0.169
G	8.0	8.4	0.315	0.331
H	4.1	4.4	0.083	0.095
J	5.8	6.2	0.307	0.323
K	10.0	10.5	0.394	0.413
L	95.0	105.0	3.740	4.134

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Power Resistors

EBG

Series GXP 120, SOT 227

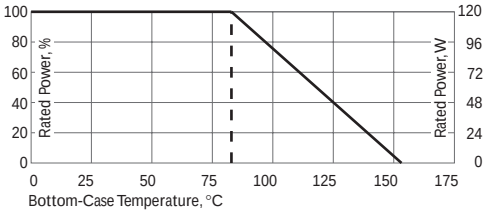
- 120 Watt Power Resistor in the “ISOTOP“ Power Device (1x120W/2x50W/3x30W acc. Configurations)

Due to a non inductive design these elements are ideally suited for high frequency and pulse load applications. By direct mounting on a heatsink significant cost advantages can be realized. The type GXP can be supplied in a 2-terminal or 4-terminal version. Even triple resistors are available. Main applications are: Variable speed Drives, Power Supplies, Control Devices, Telecom, Robotics, Motor Controls and other switching designs.

Specials and custom designed components on request.

Specifications

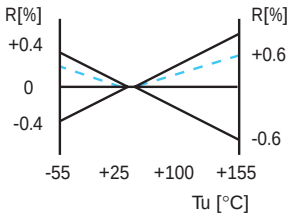
- Resistance Range: 0.1Ω to 1MΩ
- Tolerance: ±1%, 2%, 5%,10%
- Temperature coefficient: ±50, ±100ppm, ±250ppm (at +105°C ref. to +25°C)
- Max. Work.Voltage: 500V (up to 1,000V on special request)
- Power Rating at 85°C: 120W (see derating)
- Partial Discharge: up to 2,000Vrms/80 pC
- Voltage Proof: Dielectric Strength up to 4,000V DC against ground
- Protectionclass: acc. to IEC 950/CSA22.2 950/ M-89 and EN 60950.88: 2
- Heat Resistance to Cooling Plate: R_{th} <0.35 K/W
- Capacitance/Mass: 45pF
- Working Temp. Range: -55°C to +155°C
- Max. Torque for Base Plate (static): 1.5 Nm
- Max. Torque for Contacts (static): 1.3 Nm. M4 screws

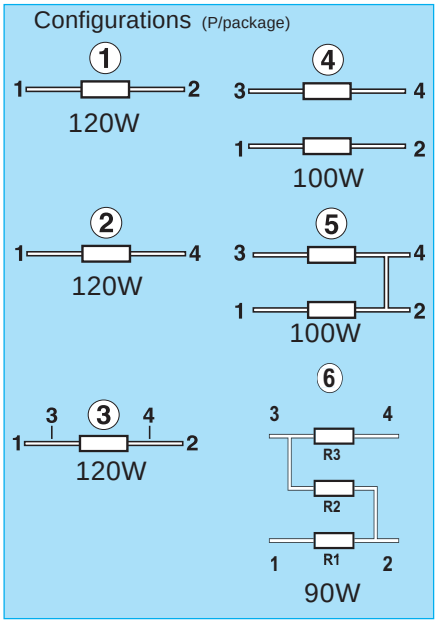


Derating (thermal resistance): 2.86W/°K (0.35°K/W).

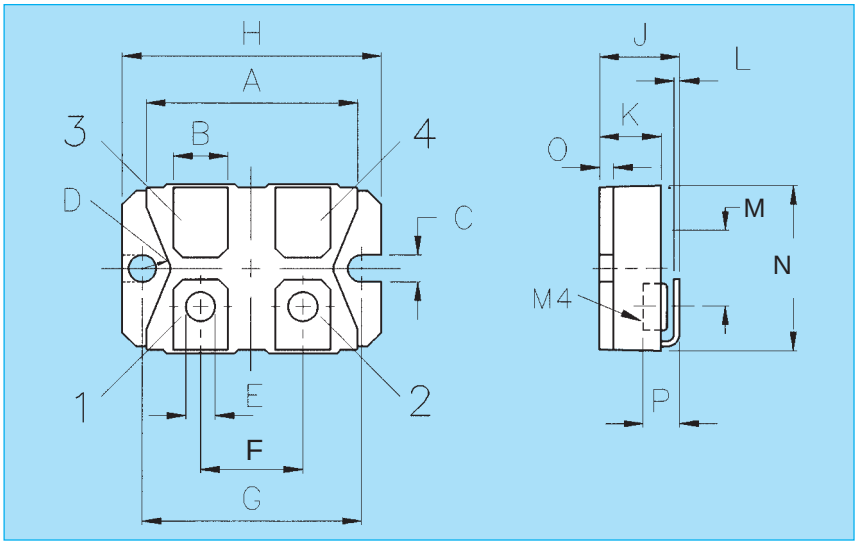
Best results can be reached by using a thermal transfer compound with a heat conductivity of better than 1W/mK

Typical TCR – Curve





Version 5: ohmic value between contact 2 and 4 = 3mΩ



Dim.	Millimeters Min.	Max.	Inches Min.	Max.
A	31.0	31.7	*1.220*	*1.249*
B	7.8	8.2	*0.307*	*0.323*
C	4.1	4.3	*0.162*	*0.169*
D	4.0	– –	*0.158*	– –
E	4.1	4.3	*0.162*	*0.169*
F	14.9	15.1	*0.587*	*0.595*
G	30.1	30.3	*1.186*	*1.193*
H	38.0	38.2	*1.497*	*1.505*
J	11.8	12.2	*0.465*	*0.481*
K	8.9	9.1	*0.351*	*0.359*
L	0.75	0.85	*0.030*	*0.033*
M	12.6	12.8	*0.496*	*0.504*
N	24.4	25.4	*0.960*	*1.001*
O	1.95	2.05	*0.077*	*0.081*
P	5.3	– –	*0.209*	– –

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Power Resistors

EBG

Series HPP 150

- Non-Inductive 150 Watt Power Resistors according to VDE 0160 and UL 94V-0

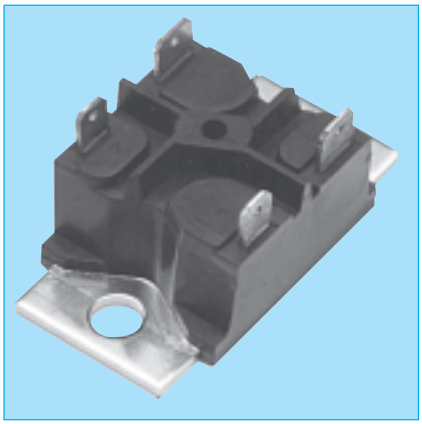
EBG's series HPP is rated at 150 Watts mounted to a heat sink. There are four configurations of resistive patterns available in the package. The increased height of the package makes this resistor ideal in applications where creeping distance must meet VDE 0160 and UL 094-0 standards.

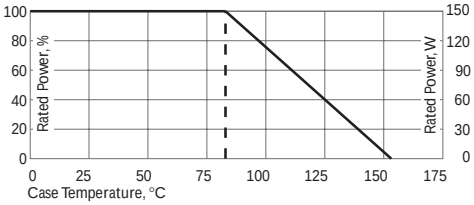
A few features of the HPP include:

- 150 Watts at 85°C
- Non-Inductive Design
- Four configurations of resistive patterns
- Up to 3 resistors in 1 package
- Easy mounting using already existing infra-structure

Specifications

- Resistance Range: 1Ω to1MΩ (other values on request)
- Tolerance: ±1%, 2%, 5%, 10%
- Temperature Coefficient: ±50ppm, ±100ppm, ±250ppm (at +105°C ref. to +25°C)
- Max. Working Voltage: 500V (up to 1,000V on special request)
- Power Rating at 85°C: 150W (others upon request)
- Voltage Proof: 5,000 VDC, 3,000 VAC
- Heat resistance to cooling plate: < 0.47 °K/W
- Capacitance/mass: 45 pF
- Working temperature range: -55°C to +155°C
- Max. torque for base plate (static):1.5 Nm

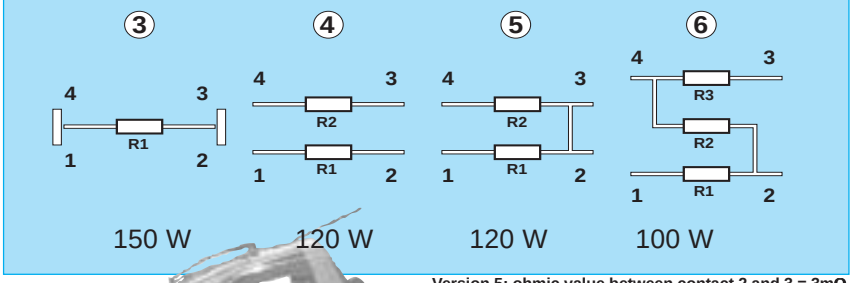




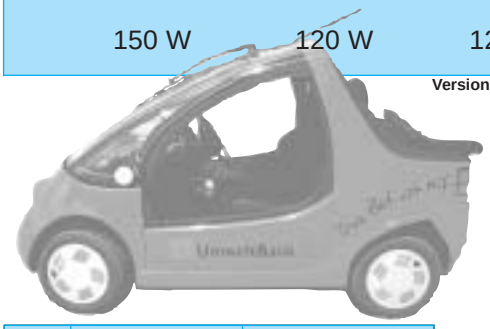
Derating (thermal resistance): 2.14W/°K (0.47°K/W).

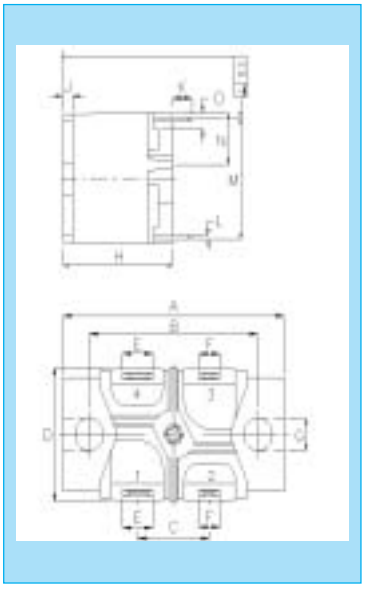
Best results can be reached by using a thermal transfer compound with a heat conductivity of better than 1W/mK

Configurations (P/package)



Version 5: ohmic value between contact 2 and 3 = 3mΩ





Dim.	Millimeter Min.	Max.	Inches Min.	Max.
A	44.7	46.5	*1.760*	*1.831*
B	34.7	35.3	*1.366*	*1.390*
C	14.8	15.2	*0.583*	*0.598*
D	– –	26.5	– –	*1.043*
E	6.2	6.4	*0.244*	*0.252*
F	4.7	4.9	*0.185*	*0.193*
G	5.9	6.1	*0.232*	*0.240*
H	20.9	21.3	*0.823*	*0.839*
J	1.9	2.1	*0.075*	*0.083*
K	3.4	4.0	*0.134*	*0.157*
L	0.77	0.83	*0.0303*	*0.0326*
M	23.0	23.4	*0.905*	*0.921*
N	9.4	9.8	*0.370*	*0.386*
O	2.9	3.1	*0.114*	*0.122*

Air distance contact to contact:

③ • Contacts 1 and 2 resp.3 and 4
without Fast-on-Plug: 9.2mm
withFast-on-Plug: 8.2mm

④ • Contacts 1 and 4 resp. 2 and 3
without Fast-on-Plug: 21.9mm
with Fast-on-Plug: 20.9mm

⑤ • Contacts 2 resp. 3 and M5 - mounting screw with washer
without Fast-on-Plug: 16.3mm
with Fast-on-Plug: 15.9mm

⑥ • Contacts 1 resp. 4 and M5 - mounting screw with washer
without Fast-on-Plug: 15.5mm
with Fast-on-Plug: 15.0mm

Creeping distance:

③ • Contacts 1 and 2 resp. 3 and 4
without Fast-on-Plug: 20.0mm
with Fast-on-Plug: 19.0mm

④ • Contacts 1 and 4 resp. 2 and 3
without Fast-on-Plug: 27.4mm
with Fast-on-Plug: 25.8mm

⑤ • Contacts 2 resp. 3 to base plate
without Fast-on-Plug: 20.2mm
with Fast-on-Plug: 19.8mm

⑥ • Contacts 1 resp. 4 to base plate
without Fast-on-Plug: 19.5mm
with Fast-on-Plug: 18.9mm

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Power Resistors

EBG

Series HPS 150

- Non-Inductive 150 Watt Power Resistor according to VDE 0160 and UL 94V-0

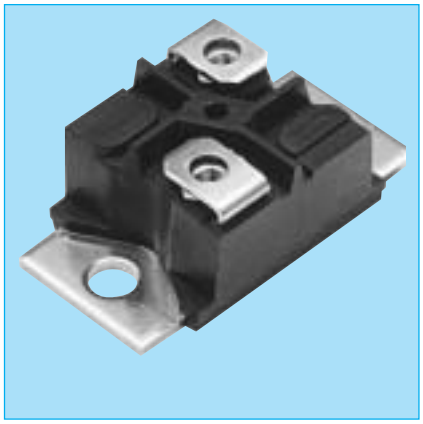
EBG's series HPS is rated at 150 Watts mounted to a heat sink. The increased height of the package makes this resistor ideal in applications where creeping distance must meet VDE 0160 and UL 094-0 standards.

A few features of the HPS include:

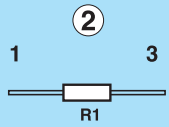
- 150 Watts at 85°C
- Non-Inductive Design
- Easy mounting using already existing infra-structure

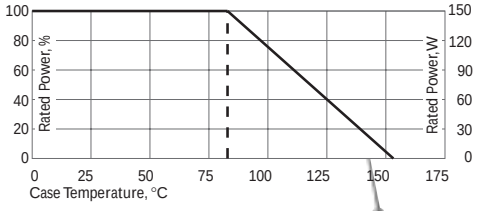
Specifications

- Resistance Range: 1Ω to 1MΩ (other values on request)
- Tolerance: ±1, 2, 5, 10%
- Temperature Coefficient: ±50ppm, ±100ppm, ±250ppm (at +105°C ref. to +25°C)
- Power Rating at 85°C: 150 W (others upon request)
- Max. Working Voltage: 500V (up to 1,000V on special request)
- Voltage Proof: 5,000 VDC, 3,000 VAC
- Heat Resistance to Cooling Plate: < 0.47 °K/W
- Capacitance/Mass: 45pF
- Working Temp. Range: -55°C to +155°C
- Max. Torque for Base Plate (static): 1.5 Nm
- Max. Torque for Contacts (static): 1.3 Nm M4 screws



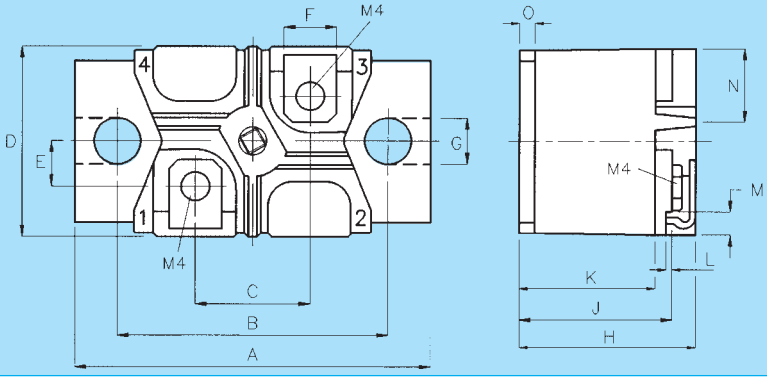
Configurations





Derating (thermal resistance): 2.14W/°K (0.47°K/W).
Best results can be reached by using a thermal transfer compound with a heat conductivity of better than 1W/mK

Dim.	Millimeter Min.	Millimeter Max.	Inches Min.	Inches Max.
A	44.7	46.5	*1.760*	*1.831*
B	34.7	35.3	*1.366*	*1.390*
C	14.8	15.2	*0.583*	*0.598*
D	– –	26.5	– –	*1.043*
E	6.25	6.45	*0.246*	*0.254*
F	7.4	7.8	*0.291*	*0.307*
G	5.9	6.1	*0.232*	*0.240*
H	20.9	21.3	*0.823*	*0.839*
J	18.0	18.4	*0.709*	*0.724*
K	16.0	16.4	*0.630*	*0.646*
L	0.77	0.83	*0.0303*	*0.0326*
M	2.9	3.1	*0.114*	*0.122*
N	9.4	9.8	*0.370*	*0.386*
O	2.9	3.1	*0.114*	*0.122*



② Air distance contact to contact:
- Contact to contact > 9.2mm
- Contact to base plate >13.2mm (with mounting screw M5 and washer)

② Creeping distance:
- Contact to base plate >17.0mm
- Contact to contact
  –> without PT-screw >22.8mm
  –> with PT-screw >20.2mm

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Power Resistors

EBG

Series HXP 200, SOT 227

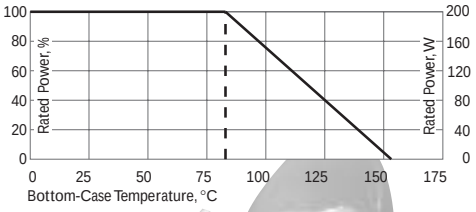
- 200 Watt Power Resistor in the “ISOTOP“ Power Device

Due to a non inductive design these elements are ideally suited for high frequency and pulse load applications. By direct mounting on a heatsink significant cost advantages can be realized. The type HXP can be supplied in a 2-terminal or 4-terminal version. Even double resistors are available. Main applications are: Variable speed Drives, Power Supplies, Control Devices, Telecom, Robotics, Motor Controls and other switching designs.

Specials and custom designed components on request.

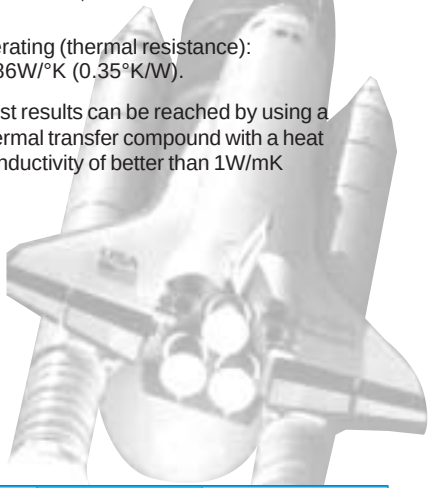
Specifications

- Resistance Range: 0.1Ω to 1MΩ
- Tolerance: ±1%, 2%, 5%,10%
- Temperature coefficient: ±50, ±100ppm, ±250ppm (at +105°C ref. to +25°C)
- Max. Work.Voltage: 500V (up to 1,000V on special request)
- Power Rating at 85°C: 200W (see derating)
- Partial Discharge: up to 2,000Vrms/80 pC
- Voltage Proof: Dielectric Strength up to 4,000V DC against ground
- Protectionclass: acc. to IEC 950/CSA22.2 950/M-89 and EN 60950.88: 2
- Heat Resistance to Cooling Plate: R_{th} <0.35 K/W
- Capacitance/Mass: 45pF
- Working Temp. Range: -55°C to +155°C
- Max. Torque for Base Plate (static): 1.5 Nm
- Max. Torque for Contacts (static): 1.3 Nm. M4 screws

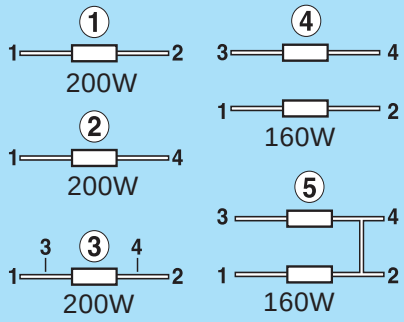


Derating (thermal resistance): 2.86W/°K (0.35°K/W).

Best results can be reached by using a thermal transfer compound with a heat conductivity of better than 1W/mK

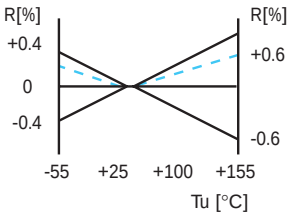


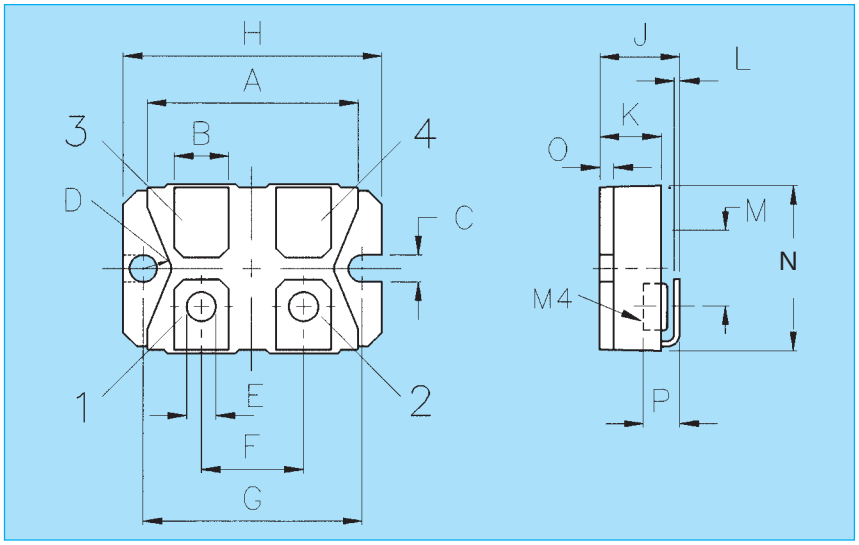
Configurations (P/package)



Version 5: ohmic value between contact 2 and 4 = 3mΩ

Typical TCR – Curve





Dim.	Millimeters Min.	Millimeters Max.	Inches Min.	Inches Max.
A	31.0	31.7	*1.220*	*1.249*
B	7.8	8.2	*0.307*	*0.323*
C	4.1	4.3	*0.162*	*0.169*
D	4.0	– –	*0.158*	– –
E	4.1	4.3	*0.162*	*0.169*
F	14.9	15.1	*0.587*	*0.595*
G	30.1	30.3	*1.186*	*1.193*
H	38.0	38.2	*1.497*	*1.505*
J	11.8	12.2	*0.465*	*0.481*
K	8.9	9.1	*0.351*	*0.359*
L	0.75	0.85	*0.030*	*0.033*
M	12.6	12.8	*0.496*	*0.504*
N	24.4	25.4	*0.960*	*1.001*
O	1.95	2.05	*0.077*	*0.081*
P	5.3	– –	*0.209*	– –

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Ultra High Power Resistors

EBG

Series UXP 300

300 Watt Power Resistor, Non Inductive Design

Mainly used as a snubber resistor to compensate the C-R peaks in traction power supplies.

General Characteristics

Electric support:

- High alumina ceramic metallized on the top side with EBG Metoxfilm placed on a solid A1 heat distribution plate for perfect connection to the main heat sink.

Encapsulation:

- Special resin filled epoxy casing with large creeping distance to mass, large air distance between the terminals and high insulation resistance (CTI 600).

Resistance Element:

- Special design for perfect current yield over the entire resistor area.

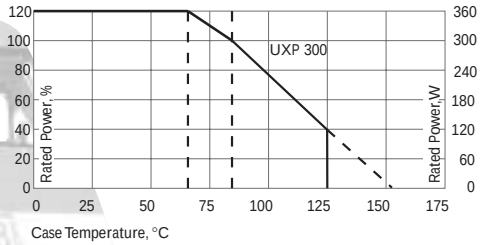
Contacts:

- Easy load connecting with M4 or M5 screws.
- Connector height (M+N) available from 25 to 42mm.
- Various sleeves for increased creeping distance up to 85mm or potted cable connections are available on special request.
- The model UXP 300 introduced on this page can be changed according to customers specification.

Please note that almost all of our UXP customers have their own custom designed drawing. Therefore please do not hesitate to discuss your special need with the local representative of EBG.

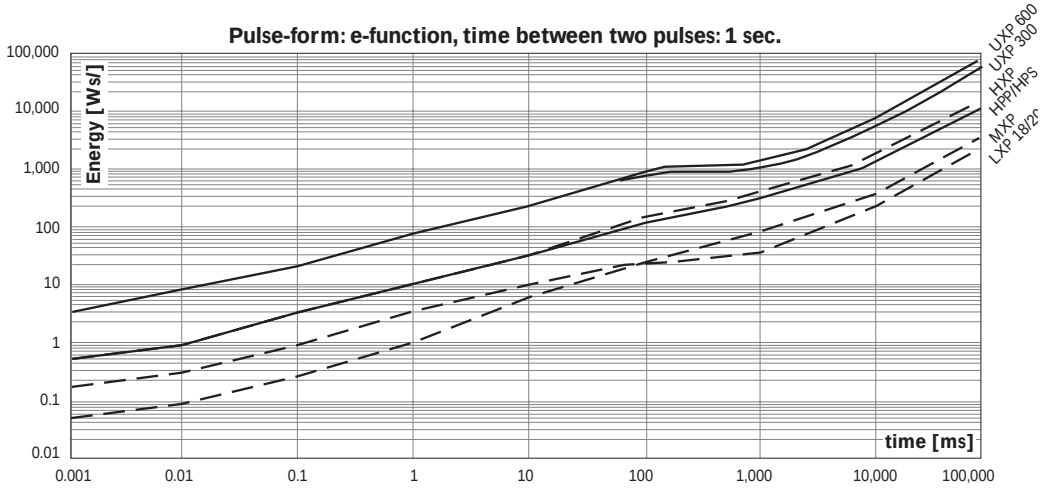
Specifications

- Resistance Values: 0.5Ω to 100KΩ
- Resistance Tolerance: ±5% to ±10%
- Temperature Coefficient: ±150ppm/°C (others upon request)
- Maximum Working Voltage: 5,000VDC; higher voltage on request, not exceeding max. power
- Short Time Overload: 1.5x rated power = 450W at 70°C for 10 sec, ΔR = 0.4% max.
- Power Rating: 300W at 85°C bottom case temperature.
- Electric Strength Voltage:6kVrms, 50Hz,1Min., up to 8,000Vrms on special request
- Single Shot Voltage: up to 12 kV Normwave (1.5/50 µsec)
- Partial Discharge: 3kVrms <10pC, up to 5kV on special request
- Insulation Resistance: 10GΩ Min. at 500V
- Creeping Distance: 42 mm Min.
- Air Distance:14 mm Minimum
- Inductance: - 80 nH
- Capacity/Mass: - 110 pF
- Capacity/Parallel: - 40 pF
- Operation Temperature: -55°C to +150°C
- Max. Torque for Contacts: 2 Nm
- Max. Torque for Mounting: 1.8 Nm
- Dimensions: please see page 26



Derating (thermal resist.) UXP 300: 4.36W/°K (0.229°K/W)
Power Rating: 300W at 85°C bottom case temp.*

*This value is only valid by using a thermal conduction to the heatsink R_{th}-cs<0.025°K/W. This value can be reached by using thermal transfer compound with a heat conductivity of 1W/mK. The flatness of the cooling plate must be better than 0.05mm overall. The roughness of the surface should not exceed 6.4µm.



In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Ultra High Power Resistors

EBG

Series UXP 600

- 600 Watt Resistor, US Patent # 5,355,281

For variable speed drivers, power supplies, control devices, robotics, motor control and other power designs, the easy mounting fixture guarantees an autocalibrated pressure to the cooling plate of about 120 to 160 N.

General Characteristics

Electric support:

- High alumina ceramic metallized with EBG ALTOX film on the bottom for better heat transfer and optimum discharge.

Encapsulation:

- Special resin filled epoxy casing with large creeping distance to mass, large air distance between the terminals and high insulation resistance (CTI 600).

Resistance Element:

- Special design for low inductance and capacitance values. The element employs our special METOXFILM which demonstrates stability while covering high wattage and pulse loading.

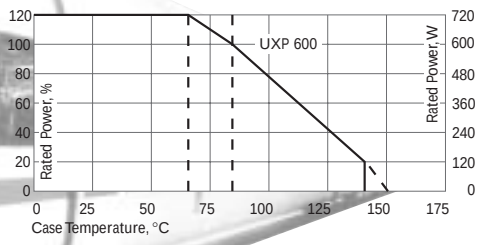
Contacts:

- Easy load connecting with M4 or M5 screws.
- Connector height (M+N) available from 25 to 42mm.
- Various sleeves for increased creeping distance up to 85mm or potted cable connections are available on special request

Materials in accordance with UL94-V0

Specifications

- Resistance Values: 0.5Ω to 100KΩ
- Resistance Tolerance: ±5% to ±10%
- Temperature Coefficient: ±150ppm/°C (others upon request)
- Maximum Working Voltage: 5,000V DC, higher voltage on request, not exceeding max. power
- Short Time Overload: 1,000W at 70°C for 10sec., ΔR = 0.4% max.
- Power Rating: 600W at 85°C Bottom case temperature.
- Peak Current: up to 1500 Amp. depending on pulse length and frequency Please ask for details
- Electric Strength Voltage:6kVrms, 50Hz,upto 12kVrms on special request.
- Single Shot Voltage: up to 12 kV Normwave (1.5/50 µsec)
- Partial Discharge:4KVrms, <10pC, up to 7kV on special request
- Insulation Resistance: 10GΩ Min. at 500V
- Creeping Distance: 42 mm Min.
- Air Distance:14 mm Minimum
- Inductance: - 80 nH
- Capacity/Mass: - 110 pF
- Capacity/Parallel: - 40 pF
- Operation Temperature: -55°C to +150°C
- Max. Torque for Contacts: 2 Nm
- Max. Torque for Mounting: 1.8 Nm

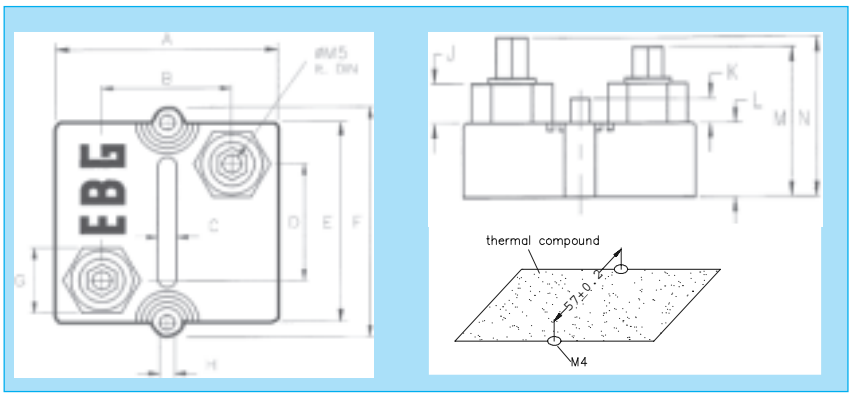


Derating (thermal resist.) UXP 600: 8.73W/°K (0.115°K/W)

Power Rating: 600W at 85°C bottom case temp.*

* This value is only valid by using a thermal conduction to the heatsink R_{th}-cs<0.025°K/W. This value can be reached by using thermal transfer compound with a heat conductivity of 1W/mK. The flatness of the cooling plate must be better than 0.05mm overall. The roughness of the surface should not exceed 6.4µm.

Test	Method	Typical Results
• Short time overload	1,000 W/10sec	0.4%
• Humidity Steady State	56days/40°C/ 95%	0.25%
• Temp. Cycling	-55/+125/5 cycles	0.20%
• Shock	40g/4,000 times	0.25%
• Vibrations	2-500Hz/10g	0.25%
• Load Life 1,000cyl	Pn 30 min. on/ 30 min off	0.40%
• Terminal Strengths f. Contacts	200N	0.05%



Dim.	Millimeter Min.	Max	Inches Min.	Max.
A	59.2	60.8	2.331	2.394
B	35.8	36.2	1.409	1.425
C	4.5	5.5	0.177	0.216
D	33.8	34.2	1.331	1.346
E	56.8	57.2	2.236	2.252
F	64.2	65.8	2.527	2.591
G	17.5	18.5	0.689	0.728
H	4.05	4.3	0.159	0.169
J	6.5	7.5	0.256	0.295
K	4.5	5.5	0.177	0.216
L	14.5	15.5	0.571	0.610
M	29.5	30.5	1.161	1.201
N	31.5	32.5	1.240	1.279

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Ultra High Power Resistors

EBG

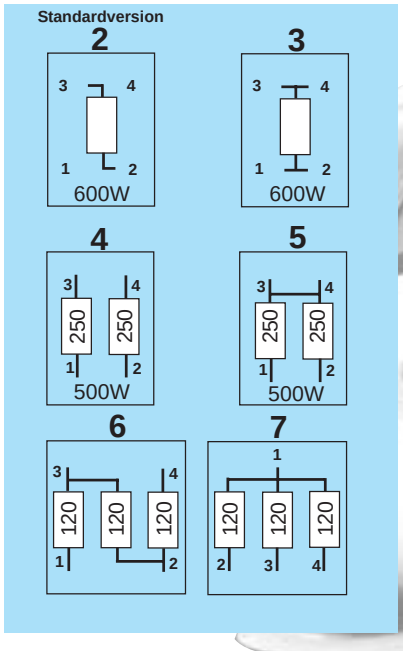
Series UPT 600

- 600 Watt Resistor, US Patent # 5,355,281

For variable speed drivers, power supplies, control devices, robotics, motor control and other power designs, the easy mounting fixture guarantees an autocalibrated pressure to the cooling plate of about 120 to 160 N.

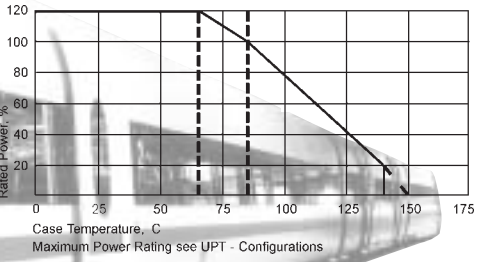
Materials in accordance with UL94-V0

Configurations: (P/package)



Specifications

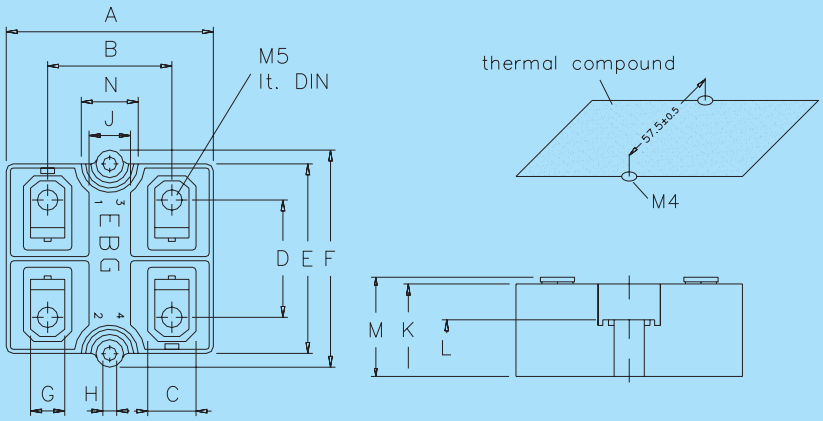
- Resistance Values: 0.5Ω to 100KΩ
- Resistance Tolerance: ±5% to ±10%, tigher tolerances are available on request, with the reduction of the max. power / pulse rating. Please ask your local representative.
- Temperature Coefficient: ±150ppm/°C (others upon request)
- Maximum Working Voltage: 5,000V DC, higher voltage on request, not exceeding max. power
- Short Time Overload: 1,000W at 70°C for 10sec., ΔR = 0.4% max.
- Power Rating: up to 600W at 85°C bottom case temperature, see configurations
- Electric Strength Voltage:6kVrms, 50Hz,upto 12kVrms or 23kV DC on special request.
- Single Shot Voltage: up to 12 kV Normwave (1.5/50 µsec)
- Partial Discharge:4KVrms, <10pC, up to 7kV on special request
- Insulation Resistance: 10GΩ Min. at 500V
- Inductance: - 80 nH
- Capacity/Mass: - 110 pF
- Capacity/Parallel: - 40 pF
- Operation Temperature: -55°C to +150°C
- Max. Torque for Contacts: 2 Nm
- Max. Torque for Mounting: 1.8 Nm



Derating (thermal resist.) UPT 600:
8.73W/°K (0.115°K/W)
Power Rating: 600W at 70°C heatsink temp.*

* This value is only valid by using a thermal conduction to the heatsink R_{th}-cs<0.025°K/W.
This value can be reached by using thermal transfer compound with a heat conductivity of 1W/mK. The flatness of the cooling plate must be better than 0.05mm overall. The roughness of the surface should not exceed 6.4µm.

Dimensions:



Dim.	Millimeter Min.	Millimeter Max.	Inches Min.	Inches Max.
A	59.2	60.8	2.331	2.394
B	35.8	36.2	1.409	1.425
C	13.5	14.5	0.531	0.571
D	33.8	34.2	1.331	1.346
E	57.0	58.0	2.244	2.283
F	64.2	65.8	2.527	2.591
G	9.5	10.5	0.374	0.413
H	4.05	4.3	0.159	0.169
J	11.5	12.5	0.453	0.492
K	24.0	25.0	0.945	0.984
L	14.5	15.5	0.571	0.610
M	25.5	26.5	1.004	1.043
N	16.0	17.0	0.630	0.669

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

High Pulse Load Resistors

Series **SWS - 2**

EBG

The SWS - 2 resistor is a low ohmic, high current pulse load resistor designed for usage as a protective resistor, where no further resistor cooling is available.

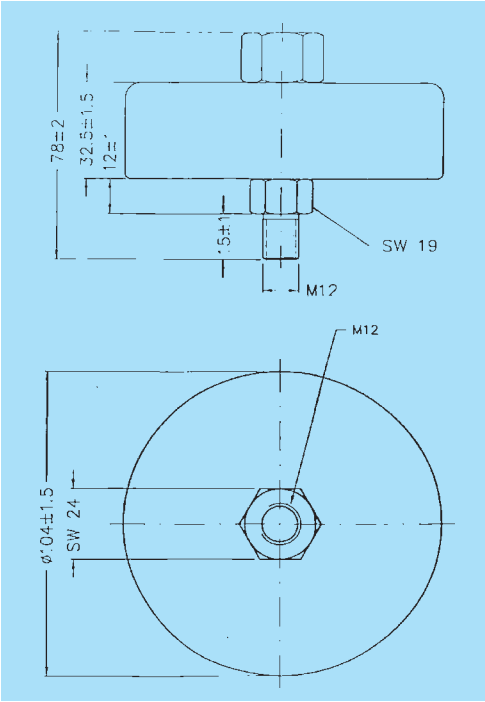
As per DIN VDE 0123:1985 the SWS-2 resistor does not need any further maintenance if the resistor gets used according to the specified technical data. For safety reasons a regular visual inspection and check of ohmic value is suggested at least every 2 years, better once a year.

Because of using stainless steel material, a long life expectancy is also part of the advantages for this resistor version.

The very easy handling of the SWS -2 will be another advantage for applications where service is requested!

Dimensions:

(For example: 100mΩ resistor)



Main electrical data

Ohmic value:	< 0.5 Ohm - others on request
Tolerance:	+/- 10 % for standard, also +/-5% available
Cont. power load:	125 Watts without additional cooling
Max. peak current:	Depending on ohmic value! For example: 3,500 Amps/100ms for a 100mΩ resistor (it is suggested to perform an ohmic and visual check after such high current pulses!)
Max. peak voltage:	350V for 100ms
Max. weight:	< 1100g
Max. mounting torque:	100Nm

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Precision Decade Voltage Dividers

EBG

Series 1776-X

- Family of Input Voltage Dividers for Multimeters and other Instruments

Series 1776 - X Precision Decade Voltage Divider's Ceramic Protected

Family of Input Voltage Dividers for Multimeters and other Instruments

EBG offers a family of Voltage Dividers for a variety of applications, including Digital Multimeters, Multi range instrumentation, and other range switching devices. This line of products utilizes the special EBG METOXFILM resulting in a family of Series 1776-X models:

A summary of the features of the 1776-X series are:

- Compact precision resistor networks
- Easy to install package
- Absolute tolerances to ±0.1, ±0.25 and ±0.5%
- Relative tolerances to 0.05, 0.10 and 0.25%
- Ratio Temperature Coefficients from 10 to 50 ppm/°C
- High stability under load <0.02%
- Excellent Shelf Life: <0.02%

Many special combinations of ratios, absolute tolerances, relative tolerances and absolute temperature coefficients of resistance are available. Consult your EBG agent or the factory direct for your special requirements.

Specifications

- Ratio Tolerance: 0.05% to 0.25%
- Absolute Tolerance: ±0.1% to ±0.5%
- Ratio Temp. Coefficient: 10ppm/°C to 50ppm/°C
- Absolute Temp. Coefficient: ±25ppm/°C to ±50ppm/°C
- Voltage Coefficient: <0.05ppm/V
- Storage Temperature: -55°C to + 165°C
- Load Life (ratio stability): <0.04%
- Shelf Life (ratio stability): <0.02% (six months)
- Number of Decades: 3 to 6
- Values of Single Resistors: 900Ω to 10MΩ

Model-Nr.	Resistance Values R1 Ω	R2 Ω	R3 Ω	R4 Ω	R5 Ω	Figure	Voltage Rating	Absolute Tol. %	Ratio Tol. %	Absol. TCppm/°C	Ratio TC ppm/°C	Vol. Coef. Ratioppm/V	Ratio Stability % Change in Ratio Load Life	Shelf Life	Over-Voltage
B169 T3	9M	900K	90K	9K	900	1	1200	0.1	0.1	30	10	0.1	0.02	0.01	0.01
B168 T3	9M	900K	90K	9K	1K	1	1200	0.1	0.1	30	10	0.1	0.02	0.01	0.01
E167 T1	9M	900K	90K	9K	900	2	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
B167 T1	9M	900K	90K	9K	900	2	1200	0.1	0.1	50	50	0.5	0.04	0.02	0.04
E166 T1	9M	900K	90K	9K	1K	2	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
B166 T1	9M	900K	90K	9K	1K	2	1200	0.1	0.1	50	50	0.5	0.04	0.02	0.04
E16 T1	9M	900K	90K	9K	900	3	1200	0.25	0.25	50	50	0.3	0.04	0.02	0.04
B16 T1	9M	900K	90K	9K	900	3	1200	0.1	0.1	50	50	0.2	0.02	0.01	0.02
A16 T1	9M	900K	90K	9K	900	3	1200	0.1	0.05	50	50	0.2	0.02	0.01	0.02
E161 T1	9M	900K	90K	9K	1K	3	1200	0.25	0.25	50	50	0.3	0.04	0.02	0.04
D161 T1	9M	900K	90K	9K	1K	3	1200	0.25	0.1	50	50	0.2	0.02	0.01	0.02
C161 T1	9M	900K	90K	9K	1K	3	1200	0.25	0.05	50	50	0.2	0.02	0.01	0.02
F37 T3	9M	900K	90K	10K	N/A	4	1200	+0-0.5	0.1	30	10	0.02	0.02	0.01	0.01
F379 T3	9M	900K	90K	10K	N/A	5	1200	+0-0.5	0.1	30	10	0.02	0.02	0.01	0.01
C15 T3	9M	900K	90K	10K	N/A	6	1200	0.25	0.05	30	10	0.02	0.02	0.01	0.01
D15 T3	9M	900K	90K	10K	N/A	6	1200	0.25	0.1	30	10	0.02	0.02	0.01	0.01
D14 T2	9.9M	90K	10K	N/A	N/A	7	1200	0.25	0.1	30	25	0.2	0.02	0.01	0.02
D14 T3	9.9M	90K	10K	N/A	N/A	7	1200	0.25	0.1	30	10	0.02	0.02	0.01	0.01
E39 T3	10M	1.111M	101.01K	10.01K	1.0001K	8	1200	0.25	0.25	30	10	0.1	0.02	0.01	0.01
B39 T3	10M	1.111M	101.01K	10.01K	1.0001K	8	1200	0.1	0.1	30	10	0.1	0.02	0.01	0.01
G39 T1	10M	1.111M	101.01K	10.01K	1.0001K	8	1200	0.5	0.5	50	50	0.5	0.04	0.02	0.04
E39 T1	10M	1.111M	101.01K	10.01K	1.0001K	8	1200	0.25	0.25	50	50	0.5	0.04	0.02	0.04
E159 T5	900K	90K	9K	900	N/A	9	750	0.25	0.25	25	25	0.4	0.02	0.01	0.02
B159 T6	900K	90K	9K	900	N/A	9	750	0.1	0.1	25	15	0.3	0.02	0.01	0.02
A159 T6	900K	90K	9K	900	N/A	9	750	0.1	0.05	25	15	0.3	0.02	0.01	0.02
G158 T5	900K	90K	9K	1K	N/A	9	750	0.25	0.25	25	25	0.4	0.02	0.01	0.02
B158 T6	900K	90K	9K	1K	N/A	9	750	0.1	0.1	25	15	0.3	0.02	0.01	0.02
A158T6	900K	90K	9K	1K	N/A	9	750	0.1	0.05	25	15	0.3	0.02	0.01	0.02

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Thick Film Precision Resistors Networks

EBG

Also Custom Designed Elements Available

The same excellent performance that characterises the other EBG metal oxide types is also inherent in the various types of multiple METOXFILM circuits. Careful attention is devoted to the individual customer`s design so as to not only comply with the requirements of resistance value, tolerance and TCR, but also power handling and stability during life, even under adverse conditions.

Most of EBG´s multiple component designs are computer generated, and therefore avoid any possibility of "hot spot" long time deterioration. In addition, trimming is accomplished in digital step fashion by computer controlled lasers, of which EBG has several from both American and European laser companies, thus permitting us to cover a wide range of requirements.

While EBG has developed a standard product line of voltage divider models as shown here, we are also well suited to develop an exact custom designed circuit for you, employing high precision, high stability, low TCR and wide resistance range coverage without sacrifice of your important requirements.

We encourage you to consult our Applications Engineering Department with your special needs.

Figure 1

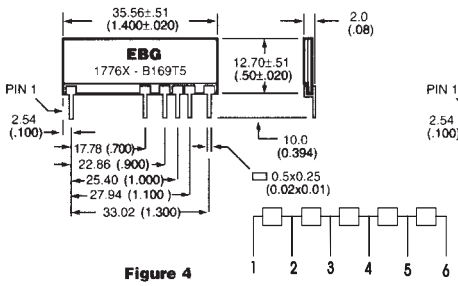


Figure 2

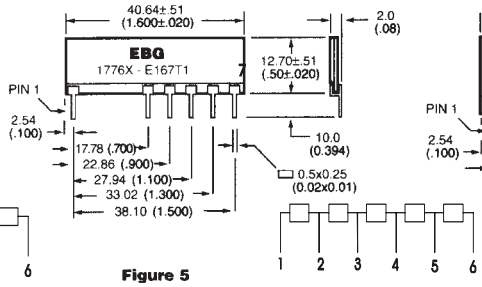


Figure 3

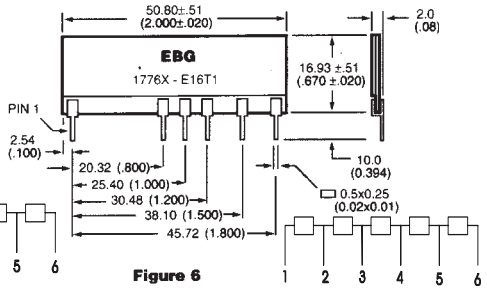


Figure 4

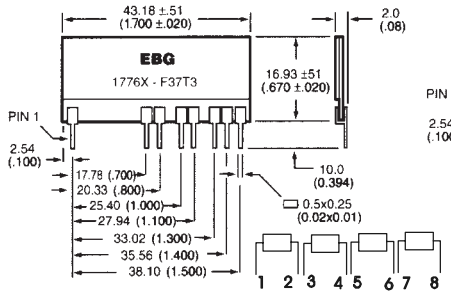


Figure 5

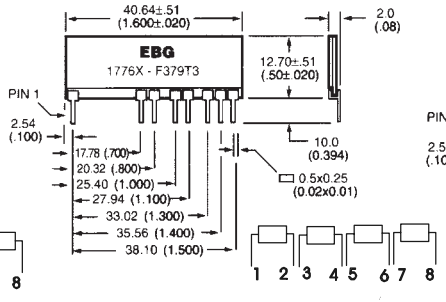


Figure 6

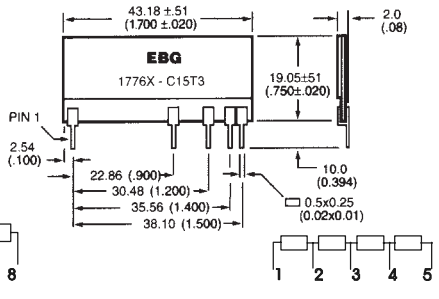


Figure 7

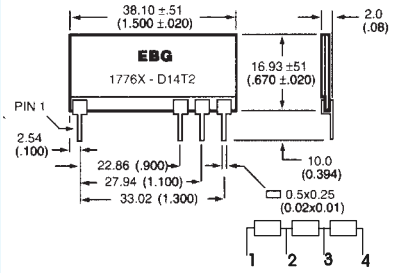


Figure 8

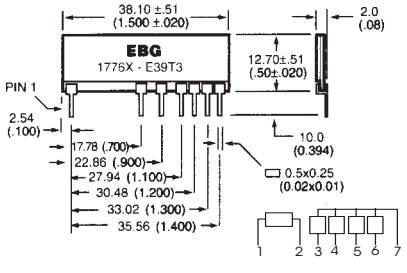
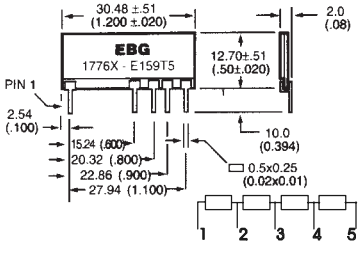


Figure 9



Dimensions in Millimeters (Inches)

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Precision High Voltage Divider

EBG

Series HVT

EBG introduces the new series of High Voltage Dividers called HVT. Available in 6 different sizes from 5 KV to 20 KV Voltage rating. In these highly reliable components EBG combines its state of the art high voltage technology with the unique METOXFILM stability.

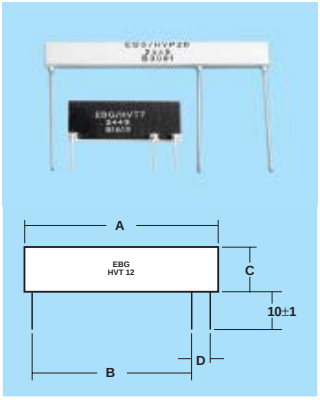
The HVT Components provide tight ratio tolerance, TCR tracking and custom designed values.

- Voltage ratings from 5KV to 20KV
- Ratio TCR 25 ppm/°C (10 ppm/°C upon request)
- Typical Voltage Coefficient 0.3 ppm/V
- Voltage Division: 1,000:1 or 100:1 (others upon request)

- Ratio = $\frac{R_1 + R_2}{R_2}$

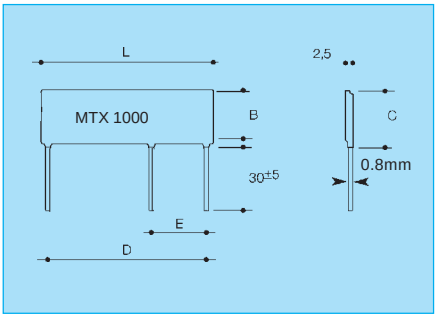
Specifications

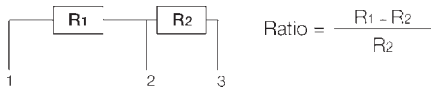
- Absolute Tolerance: ±1.0% for all resistors
- Overvoltage: 1.5 times rated voltage for 5 seconds ΔR ratio 0.5% max.
- abs TCR ± 100ppm/°C TCR measurd between +25°C and +85°C, referenced to +25°C
- Load Life: Ratio ΔR with rated voltage applied for 1,000 hours 0.4% max.
- Moisture Resistance: Mil-Std-202, Method 106, ratio ΔR 0.5% max.
- Thermal Shock: Mil-Std-202, Method 107, Cond. C, ratio ΔR 0.25% max.
- Encapsulation: Silicon conformal coating with Dielect. withstanding Voltage of 1,000V on HVT 11, 16, 21. HVT 5, 7 and 12 have a printed silicon coating
- Other Resistance Values on request. Please do not hesitate to contact our local representative.
- Lead Material: O.F.H.C. Copper tin plated: diam. 0.60 mm
- operating temp.: -55°C to 155°C



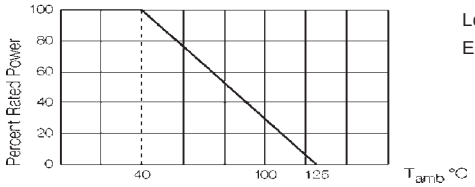
Type	Voltage [KV]	Resist. [MΩ]	Pmax	Dim. in mm ±0.4 *(inches ±0.016)* A	B	C	D
HVT 5	5 KV	100	0.3	25.4 *1.00*	18.0 *0.709*	7.62 *0.300*	5.08 *0.200*
HVT 7	7 KV	100	0.5	25.4 *1.00*	18.0 *0.709*	12.7 *0.500*	5.08 *0.200*
HVT 11	10 KV	100	1.0	38.1 *1.500*	28.0 *1.102*	26.4 *1.039*	5.08 *0.200*
HVT 12	12 KV	200	1.0	52.0 *2.047*	33.0 *1.299*	12.7 *0.500*	15.24 *0.600*
HVT 16	15 KV	200	1.5	52.0 2.047	42.0 1.654	18.0 0.709	5.08 0.200
HVT 21	20 KV	200	2.0	52.0 *2.047*	42.0 *1.654*	25.4 *1.00*	5.08 *0.200*

Series MTX 1000





Ratio = $\frac{R_1 - R_2}{R_2}$



Specifications

Dimensions (mm)

Type	Pwatt	UkvDC	L	B	C	D	E
1000.2	0.5	8	26	8	9.1	22.9	5.08
1000.3	1.2	15	38.5	13	14.2	35.6	7.62
1000.4	1.8	24	51.5	15.5	16.6	48.3	10.16
1000.5	2.4	32	77.5	15.5	16.6	73.4	10.16

Operating Temperature	-55 to +125°C	
Abs. Temperature Coefficient	50 to 15ppm/°C	depending on ohmic value
Ratio Temperature Coefficient	15 to 5ppm/°C	depending on ohmic value
Absolute Tolerance	±1% to ±0.1%	depending on ohmic value
Ratio Tolerance	1% to 0.1%	depending on ohmic value
Insulation Resistance	> 10,000 Mohm	(500 Volts, 25°C, 75% relative humidity)
Dielectric Strength	> 1000 Volts	(25°C, 75% relative humidity)
Termal Shock	ΔR/R 0.2% max	
Overload	ΔR/R 0.25% max	1.5 x Pnom, 5 sec (do not exceed 1.5 x Vmax)
Moisture Resistance	ΔR/R 0.25% max	
Load Life	ΔR/R 0.15% max	(1000 hours at rated power)
Encapsulation	Conformal coating (U) or glass coating (G)	

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Shunts

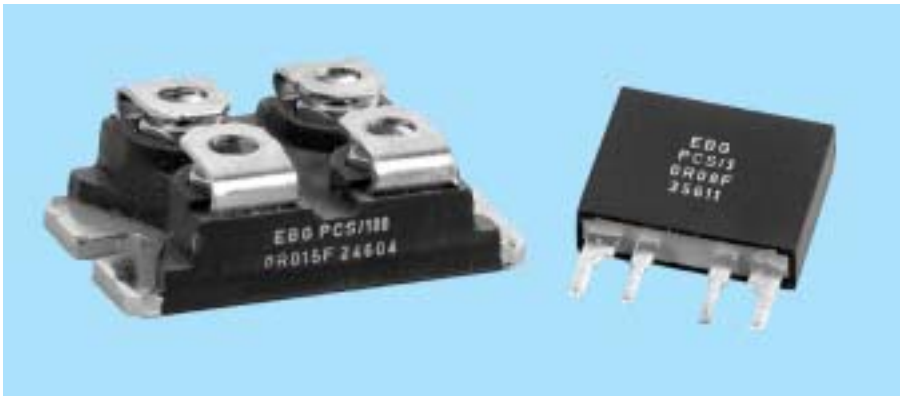
PCS – Precision Current Sense Resistors

EBG

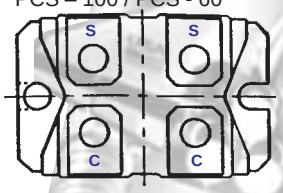
The resistor family line, PCS, utilizes EBG`s state of the art technology to provide a highly reliable resistor with a non inductive design.

This makes the PCS resistor ideal for many current monitoring and controls applications.

- Available in two different designs
- Values beginning at 0.5mΩ
- Non Inductive Design
- Four terminal Kelvin connection
- 100% QC measurement



PCS – 100 / PCS - 60

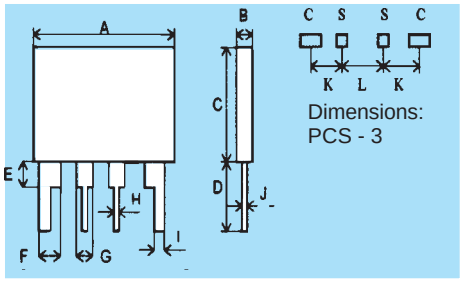


C = current connection (source)
S = voltage connection (sense)

For the Dimensions please see our type HXP in this catalogue on page 24 !

PCS – 3

- Standard Resistance Values:
  1 mΩ - 60mΩ (60mΩ – 1Ω on request)
- Resistance Tolerances: 1%, 2%, 5%
- Pulse current up to 200A / 0.5sec, depending on OHMIC value
- Temperature Coefficient:
  TC referenced to 25°C, ΔR taken at -15°C and +105°C, 60ppm/°C typically for values > 27mΩ (please ask for details)
- Power Rating: 3W at 70°C
  40Amp permanent (higher on request)
- Load Life:
  1,000 hours at rated power at +70°C, ΔR 0.2% max.
- Thermal Shock:
  Mil-Std-202, Method 107, Cond. A, ΔR 0.2% max.
- Moisture Resistance:
  Mil-Std-202, Method 106, ΔR 0.2% max.
- Terminal Material:
  Kelvin Terminals; tinned copper
- Encapsulation:
  Polyester over resistance element

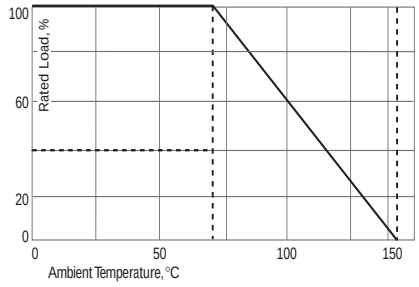


Dimensions:
PCS - 3

PCS – 3

Dim.	Millimeter	Inches
A	20.5 ±1.20	(0.807±0.008)
B	5.35 ±0.10	(0.211±0.004)
C	16.4 ±0.20	(0.646±0.008)
D	8.00 ±0.20	(0.315±0.008)
E	3.00 ±0.20	(0.118±0.008)
F	3.00	(0.118)
G	2.00	(0.079)
H	1.10	(0.043)
I	1.50	(0.059)
J	0.80	(0.031)
K	5,08	(0.2)
L	7.62	(0.3)

Power Rating Curve (for all types):



PCS - 100

- Standard Resistance Values:
  0.5mΩ – 1Ω (others on request)
- Resistance Tolerances: 1%, 2%, 5%
- Pulse current up to 500A / 0.5sec, depending on OHMIC value
- Temperature Coefficient:
  TC referenced to 25°C, ΔR taken at -15°C and +105°C, < 60ppm/°C (TC < 500ppm/°C for resistance range from 27mΩ to 49mΩ)
- Power Rating:
  100W (at 70°C case temperature)
  50Amp permanent (higher on request)
- Dielectric strength: 1000VDC
  higher value on request
- Heat Resistance: Rth = < 0.56K/W
- Protectionclass
  acc. to IEC 950/CSA22.2 950/M - 89 and EN 60950.88:2
- Working Temp. Range:
  -55°C to +155°C
- Max. Torque for Contacts:
  1.3Nm 8 (static)
- Max Torque for Base Plate:1.5 Nm (static)

PCS - 60

This resistor type is equal to the PCS-100 apart from following points:

- Power Rating:
  60W (at 70°C case temperature)
- Dielectric strength: up to 4000VDC or 2800VAC, higher values on request
- Temperature Coefficient:
  TC referenced to 25°C, ΔR taken at -15°C and +105°C, < 60ppm/°C (TC < 500ppm/°C for resistance range from 20mΩ to 49mΩ)

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Metal Film

EBG

Series UPR / UPSC

- Extreme precise radial Resistors

- • Precision Tolerances:
  ±0.1% is standard, and tolerances as close as ±0.01% are available

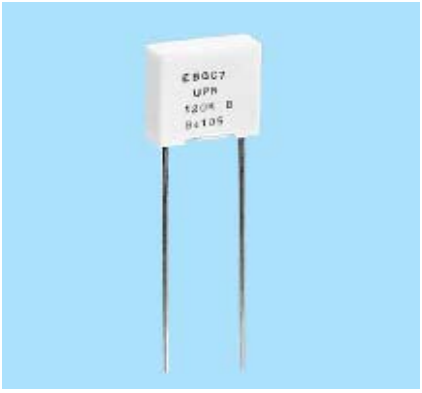
- • Low Temperature Coefficient:
  better than 3ppm/°C, 5ppm°C, 10ppm/°C or 15ppm/°C

- • Long-Term Stability:
  better than ±0.05% per 2000 hours of operation.

- • Wide Resistance Range:
  from 10 Ohms to 255 KOhms

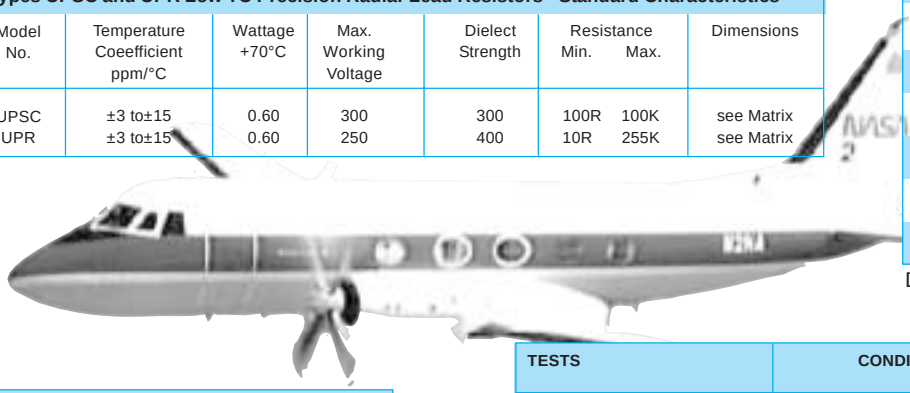
Specifications

- • Resistance Tolerance:
  ±1.0% (tolerances to ±0.01% on special order)
- • Std. Operating Temperature:
  -55°C to + 85°C
- • TC Temperature Range:
  -20°C to + 85°C
- • Overload:
  6.25 times rated power for 5 seconds at voltage not to exceed 1.5 times maximum rated working voltage, ΔR less than 0.05%
- • Load Life:
  2000 hours at + 125°C, ΔR less than 0.05%
- • Moisture Resistance:
  Mil-Std-202, Method 106, ΔR less than 0.02%
- • Thermal Shock:
  Mil-Std-202, Method 107, Cond. B, ΔR less than 0.05%
- • Isulation Resistance:
  10,000 Megohms
- • Low Temperature Operation:
  ΔR less than 0.02%
- • Dielect. Withstanding Voltage:
  ΔR less than 0.02%
- • Vibration:
  ΔR less than 0.01%
- • Shock: ΔR less than 0.02%



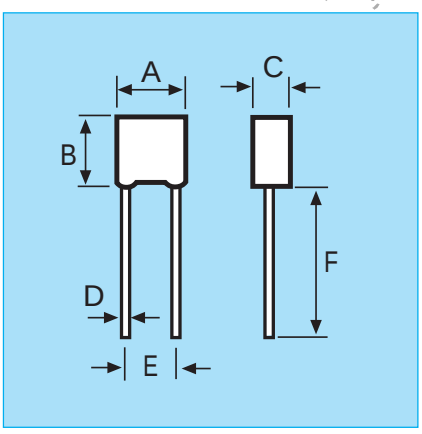
Types UPSC and UPR Low TC Precision Radial-Lead Resistors - Standard Characteristics

Model No.	Temperature Coeefficient ppm/°C	Wattage +70°C	Max. Working Voltage	Dielect Strength	Resistance Min.	Resistance Max.	Dimensions
UPSC	±3 to±15	0.60	300	300	100R	100K	see Matrix
UPR	±3 to±15	0.60	250	400	10R	255K	see Matrix



Dim.	UPSC	UPR
A	7.50±.20 (.295±.008)	10.50±.30 (.413±.012)
B	8.50±.20 (.335±.008)	9.00±.30 (.354±.012)
C	2.50±.20 (.098±.008)	4.00±.30 (.157±.012)
D	0.63±.05 (.025±.002)	0.63±.05 (.025±.002)
E	3.81±.38 (.150±.015)	7.62±.38 (.300±.015)
F	38.10±.50 (1.500±.197)	8.10±.50 (1.500±.197)

Dimensions in millimeters (inches)



TESTS	CONDITIONS	MIL-R-55182/9	TYPICAL DRIFTS
POWER CONDITIONING (108)	100 hours/rated power at + 125°C 90'/30' cycle	-	±.02% combined test
THERMAL SHOCK (107)	5 cycles -65°C/+150°C	±.05% combined tests	
SHORT TIME OVERLOAD	6.25 times rated power/5sec		
LOW TEMPERATURE STORAGE	1h stor. 45 min rated pow. at -65°C	±.05%	-
AND OPERATION	24 h stor. 45 min rated pow. at -65°C	-	±.01%
TERMINAL STRENGTH (211)	2lb pull test	±.02%	±.01%
DIELECTRIC WITHSTANDING VOLTAGE (301)	300 V ATMOSPHERIC 200 V/100.000 ft.	±.02%	±.01%
RESIST TO SOLDERING (210)	350°C/3 sec.	±.02%	±.01%
MOISTURE RESISTANCE (106)	10 days	±.05%	±.01%
SHOCK	10 shocks 100 g 6 ms sawtooth	±.01%	±.01%
VIBRATION (204)	10 to 2000 Hz. 20 g 8 hours	±.02%	±.01%
LOAD LIFE (108)	2000 hours at rated power at + 25°C, +85°C. or + 125°C	±.05%	±.05%
	10,000 hour at rated power at + 125°C	±.5%	±.2%
STORAGE LIFE	10,000 h. no load at room conditions	-	±.005%

In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Metal Film

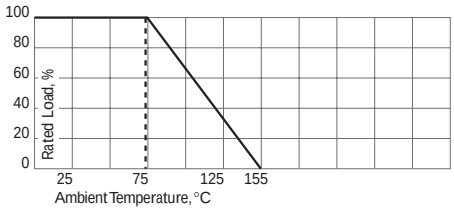
EBG

Series NE / EE

Precision Metal Film Resistors Molded Style

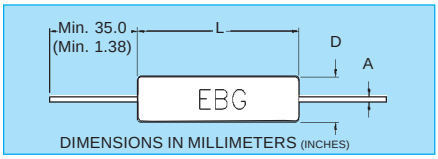
The EBG NE styles feature extremely low ranges hereto fore unavailable in the industry. As a result of a special proprietary filming method, a nickel film is employed with controlled amounts of other metals, which results in fracturial ohm availability yet with low temperature coefficient of resistance and high stability.

- Resistance Values as low as 0.05 Ohms



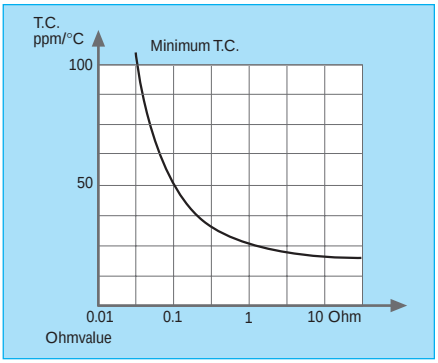
Specifications:

- Resistance Tolerance: from ± 0.05% to ± 5%
- Temperature Coefficient: according to drawing
- Operating Temperature: -55°C to + 155°C
- Isulation Resistance: 10^4 Mohm at 500 VDC



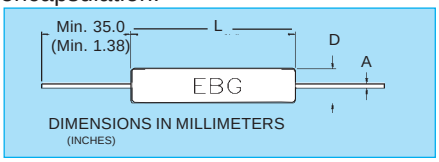
DIMENSIONS IN MILLIMETERS (INCHES)

- Noise
  less than 0.05µV/V



Model (inches) No.	Watt-age	Resistance Range Min.	Resistance Range Max.	Dimensions in millimeters L	D	A
NE 1/10	0.25	0.025R	20R	6.80±.30 *(.268±.01)*	2.50±.40 *(.098±.02)*	.60±.05 *(.024±.002)*
NE 1/8	0.50	0.1R	20R	10.00±.30 *(.394±.01)*	3.70±.40 *(.146±.02)*	.60±.05 *(.024±.002)*
NE 1/4	1.00	0.1R	20R	14.80±.30 *(.583±.01)*	5.20±.40 *(.205±.02)*	.60±.05 *(.024±.002)*
NE 1/2	1.50	0.1R	20R	18.30±.30 *(.720±.01)*	6.50±.40 *(.256±.02)*	.81±.05 *(.032±.002)*

The EBG EE styles conform dimensionally to the RN styles of MIL-R-10509 and the RNR styles of MIL-R-55182. All of the EBG styles of Metal Film Resistors offer perfomance superior to the requirements of both of these specifications. All the EE styles can be used for automatic insertion and/or encapsulation.



DIMENSIONS IN MILLIMETERS
(INCHES)

Specifications:

- Resistance Tolerance: from ± 0.02% to ± 1%
- Temperature Coefficient: from±5ppm/°C to±50ppm/°C all TCR referneced to 25°C, ΔR taken at +25°C and +85°C, other temperature ranges on request
- Elements are produced and tested in accordance with MIL-R-10509 and MIL-R-55182 as well as MIL-STD-202.

- Special Feature - Series UAR
  On request EBG does a "burn-in" to these elements for ultimate stability. Please refer to series UAR (Ultra Accurate Resistor) and ask for detailed datasheet.

Type MIL 10509	EE 1/20 RN 50	EE 1/10 RN 55	EE 1/8 RN 60	EE 1/4 RN 65	EE 1/2 RN 70
Power rating (W at 125°C)	.05	.10	.125	.25	.50
Max. working voltage (V)	200	250	300	300	350

Model No.	Watt-age 70°C	Max. Continuous Oper.Volt.	Resistance Range Min.	Resistance Range Max.
EE 1/20	.125	200	20R	600K
EE 1/10	.250	250	20R	3M
EE 1/8	.500	300	20R	5M
EE 1/4	.750	300	20R	10M
EE 1/2	1.000	350	20R	15M

Model No.	Dimensions in millimeters (inches) L	D	A
EE 1/20	390±.30 *(.154±.01)*	1.80±.40 *(.071±.02)*	.45±.05 *(.018±.002)*
EE 1/10	6.80±.30 *(.268±.01)*	2.50±.40 *(.098±.02)*	.60±.05 *(.024±.002)*
EE 1/8	10.00±.30 *(.394±.01)*	3.70±.40 *(.146±.02)*	.60±.05 *(.024±.002)*
EE 1/4	14.80±.30 *(.583±.01)*	5.20±.40 *(.205±.02)*	.60±.05 *(.024±.002)*
EE 1/2	18.30±.30 *(.720±.01)*	6.50±.40 *(.256±.02)*	.81±.05 *(.032±.002)*

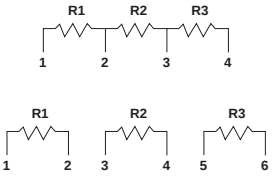
In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

Custom designed

EBG

EBG is pleased to introduce our strength in custom designed passive components. Listed below are just a few components we have created in close cooperation with our valued customers.

INX 3 x 70 up to 3 x 100 Watt
thick film resistor
with 4 or 6 terminals
any resistor value available
1Ω to 1MΩ.
Insulation voltage > 2500V
non inductive design



INX

ESP

ESP & SMG
High pulse load resistors;
different versions available
1Ω to 1MΩ as standard
easy M4 mounting and
connecting

SMG

DISC Press-Pack resistor for
extreme high continuous
power load (up to 5,000W)
High Current Pulse (up to
3,000 Amps)
Ohmic value < 1Ω

DISC-RESISTOR

GWN 1800 W - non inductive discharge
resistor for traction application.

GWN

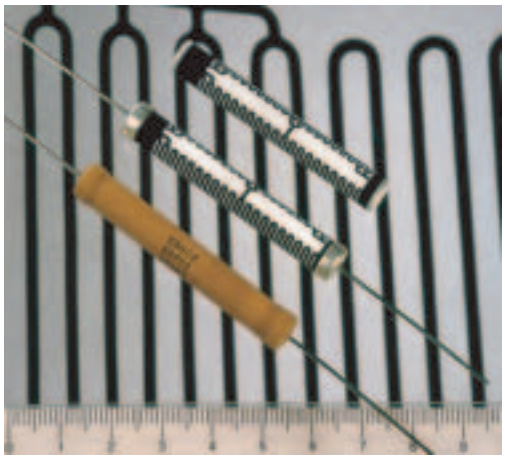
In the above spec sheet, you will find our standard product, please contact your local manufacturing representative or call us direct to find out details of other options available regarding this style:

The EBG Customer Relationship

EBG concentrates its attention on the leading edge of electronic component technology. Avoiding the mass produced commodity items with less exacting requirement, **EBG** developes highly reliable product lines to fill the creative requirements of the design and development engineer in today's fast moving world.

Our company has always welcomed the opportunity to participate in new product development for engineers with imagination and vision. If its within the scope of our knowledge of thick film technology, thin film technology, computer programming, laser isolation and processing, our engineers will work with you ... and for you to help solve your resistor needs now and in the future.

EBG is certified acc. to EN ISO 9001 : 2000



Your local EBG partner:

Corporate Headquarters
EBG Elektronische Bauelemente Gesellschaft M.B.H
A-8082 Kirchbach 384
Austria, Europe
Phone ++(3116) 2624
Fax ++ (3116) 2076
http://www.ebg.at
email: sales@ebg.at

American Headquarters
EBG LLC.
460 Spruce Street
Middletown
PA 17057
Phone ++(717) 737 9877
Fax ++ (717) 737 9664
http://www.ebgusa.com
email: sales@ebgusa.com