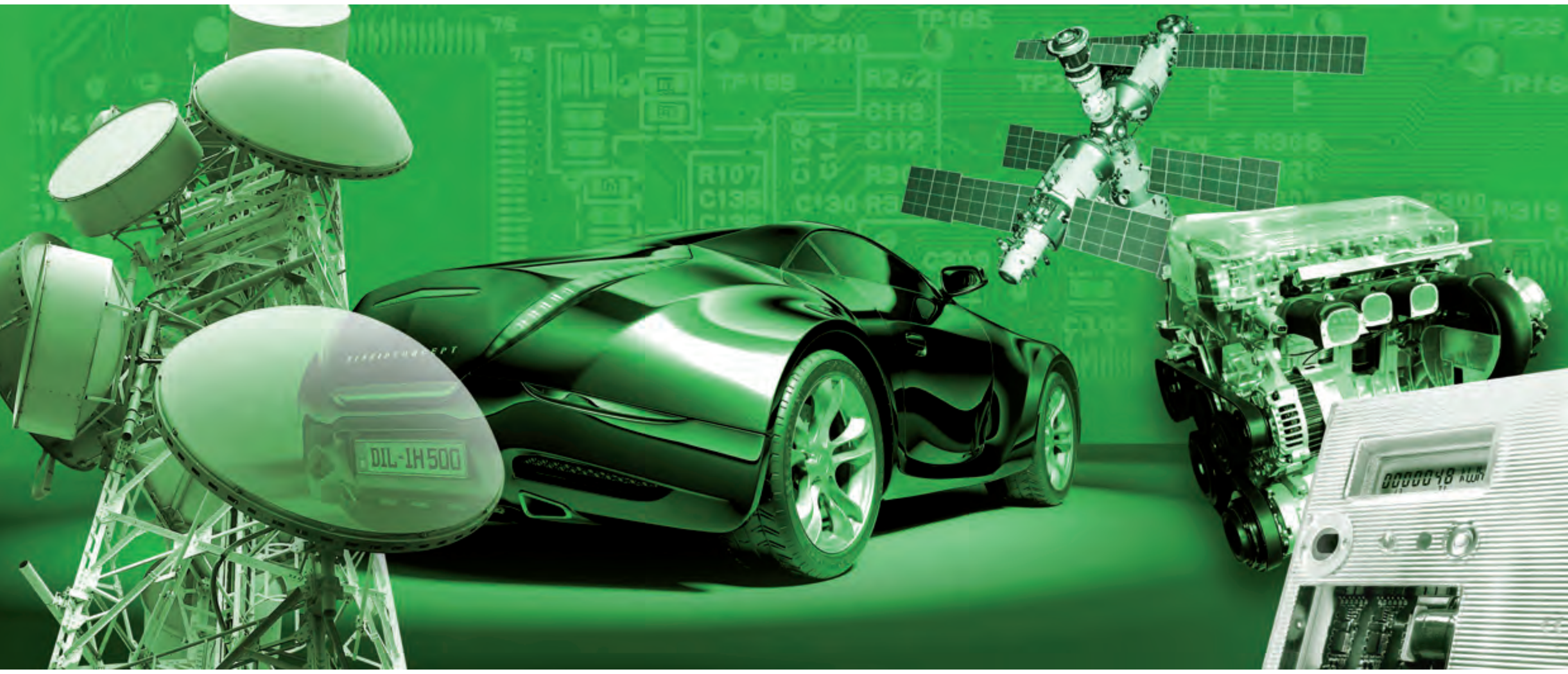
ULTIMATE PERFORMANCE WHERE IT'S LEAST EXPECTED – IN EVERY DETAIL



LOW-OHMIC PRECISION AND POWER RESISTORS

ISABELLENHÜTTE

Innovation by Tradition

ISABELLENHÜTTE HEUSLER GMBH & CO. KG

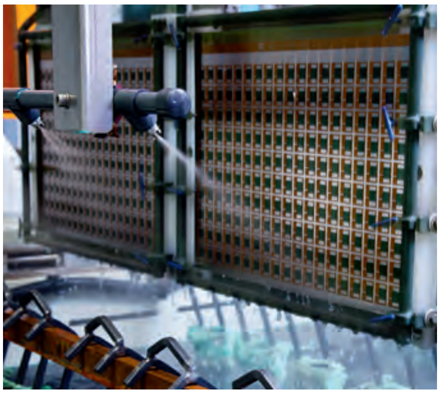
Our company is one of the world's leading manufacturers of electrical resistance and thermoelectric alloys for temperature measurement and a well known manufacturer of passive components for the automotive, electrical and electronics industries. Precision measurement systems from Isabellenhütte set the industry benchmark for current, voltage and temperature measurement in cars and trucks, hybrid and electric vehicles, as well as in industrial and renewable energy generating systems.

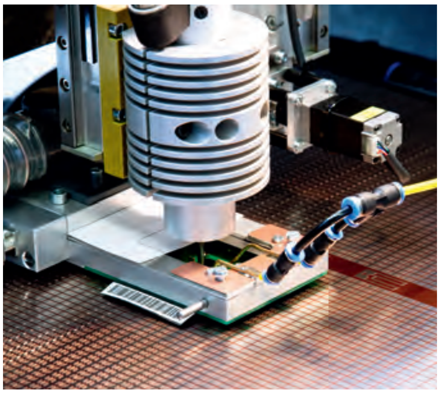
As a globally renowned specialist and technology leader, our innovative products consistently redefine the state of the art while showcasing Isabellenhütte's technical and innovative capabilities. Our success is driven by the continuous development of innovative products, new technologies and sophisticated manufacturing processes. In addition, we concentrate on a wide range of production steps and proprietary technologies in-house. This ranges from the production of alloys as well as forming and separating to coating and stranding for both standard and customer-specific requirements.

Innovation by Tradition

From standard modules to customised solutions – our resistance materials and low-ohmic resistors are developed and manufactured to the highest quality standards.

As specialists in current measurement, we're the technology leader across a wide range of sectors // Temperature coefficient, long-term stability, load capacity and inductance are all key factors in our products.





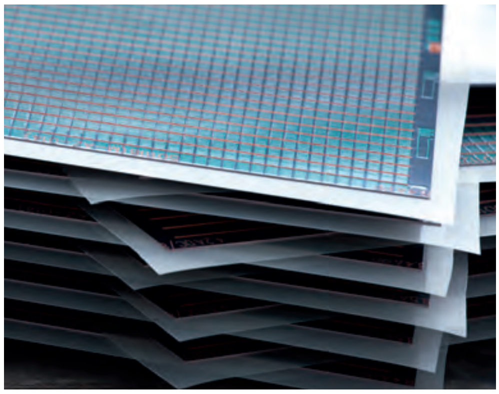
PRECISION FROM WITHIN

We're the ideal partner for precision measurement where space is at a premium. Our advanced shunt technology is specifically designed for this type of application. Backed by outstanding expertise and decades of experience, our precision resistors are manufactured to the very highest quality standards. Whether you require standard modules or high power resistors, our products meet the highest requirements in terms of temperature coefficient (TCR), thermal EMF, long-term stability, inductance and load capacity. What's more, they comply with RoHS directives and AEC-Q200 standards. In some cases, they're also qualified for use in space.

> "Our modular design system enables us to create customised solutions for current, voltage and temperature measurement applications in time and affordably."

THE BASICS OF CURRENT SENSING

When we introduced our ISA-PLAN® and ISA-WELD® technologies, Isabellenhütte set totally new standards for low-ohmic resistors and became the global benchmark in this field. Our physically optimised current sensors ("shunts") provide a range of unique benefits. In contrast to competing products, ISA-PLAN® and ISA-WELD® retain their specified tolerances under all conditions, i.e. over the entire temperature range, under full power load and throughout the entire operating life cycle.



Production panels made from pressed and laminated substrate and resistance material

The following equation generally applies to the voltage measured on a resistor:

$$\mathbf{U = R^{*} I} \qquad + U_{th} + U_{ind} + U_{iext} + \ldots$$

U_{th}	*Thermal EMF*
U_{ind}	*Induced voltage*
U_{iext}	*Voltage drop on leads*

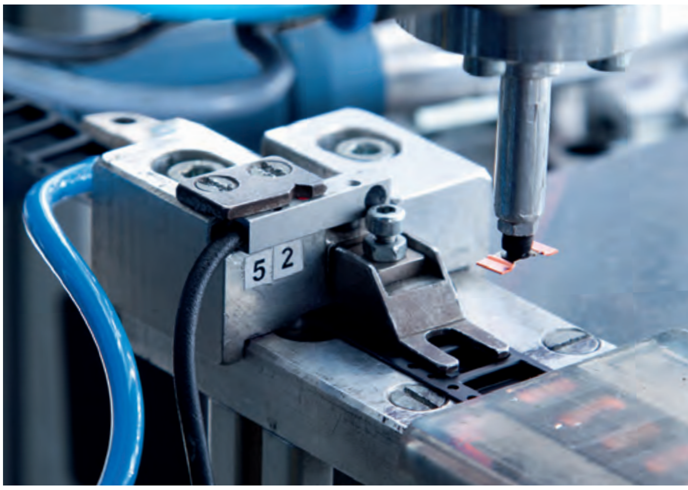
Since the voltage drop in low-ohmic resistors is correspondingly small, error voltages not produced by a current flow can completely distort the measured result. For this reason, it is essential that the product developer and layout designer understand the causes and minimise their influence through careful layout design and, in particular, by selecting appropriate components and materials.

The real resistance value is typically dependent on parameters such as temperature, time, voltage, frequency, etc.

$$\mathbf{R = R\,(T, t, P, Hz, U, A, \mu, p \ldots)}$$

Some of these characteristics are influenced not only by the choice of material but also by the design of the component and the production process. Isabellenhütte products are physically optimised to ensure the effects described above are reduced as far as possible. Our resistors are made using one of two basic production technologies: ISA-PLAN® (etched-foil resistors) and ISA-WELD® (resistors made from electron-beam welded composites, e.g. Cu-MANGANIN®-Cu).

Etching technology process of ISA-PLAN® resistors



Components are comprehensively tested, measured and calibrated before packing in standard tapes and reels

WE'RE PIONEERS FOR A GOOD REASON

LONG-TERM STABILITY

Long-term stability is an extremely important characteristic for a sensor. Even after many years of service, it is essential that users can rely on the original calibration. Resistance materials must therefore be stable against corrosion and invulnerable to any metallurgical change in structure or state.

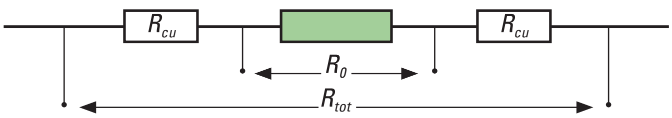
Our MANGANIN®, NOVENTIN®, ISAOHM® and ZERANIN® alloys have a homogenous mixed crystal structure, which makes them the ideal material for these applications. The alloys are carefully annealed and stabilised and are therefore supplied in their thermodynamic ground state. As a result, they all have resistance stability ratings in the range of ppm per annum. Which is why our alloys have proved themselves for over 100 years in reference resistors worldwide.

TEMPERATURE DEPENDENCE

The temperature dependence of our resistors is mainly determined by the precision resistance alloys MANGANIN®, NOVENTIN®, ISAOHM® and ZERANIN®. In many cases, however, low-ohmic resistors suffer from significant influences of the termination, which is why the sense voltage should be measured via two additional contacts located directly on the resistance material. The examples (right) show that poor layout and/or construction can result in major inaccuracies in both resistance value and temperature coefficients (TCR).

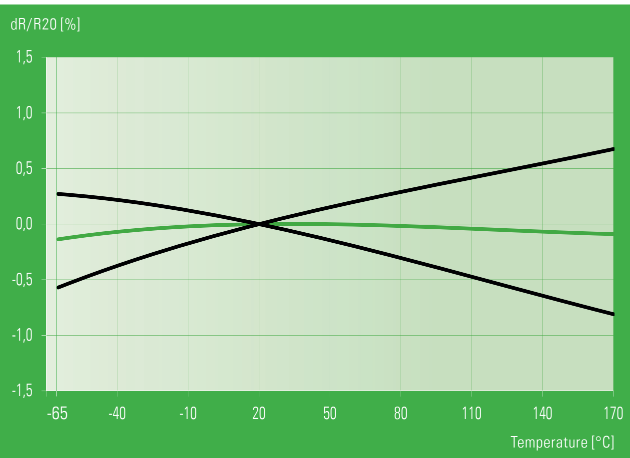
The 10 mm copper leads on a 10 mOhm conventional 2-terminal resistor already create 24 % of the total resistance while increasing the temperature coefficient from 10 ppm/K to almost 1000 ppm/K. The additional resistance on the leads could be offset by calibration, but the effect on the temperature coefficient would still remain the same. It is therefore incorrect to specify the temperature coefficient of the resistance material, a practice that is common on many data sheets.

The second example shows that poor layout design for the sense voltage connection can distort both the resistance value and the temperature coefficient by more than 100 %. In our resistors made from electron-beam welded composites (Cu-MANGANIN®-Cu), the lead resistance is extremely low. The same applies to our SMx, VMx and VLx series, thanks to the copper substrates used in these products. With the right combination of layout, soldering and resistor, it is possible to implement an optimum four-terminal configuration in which the rated resistance and temperature coefficient of the component remains valid in the application.



Total resistance	$R_0 + 2^* R_{cu}$
Four-terminal resistor	R_0

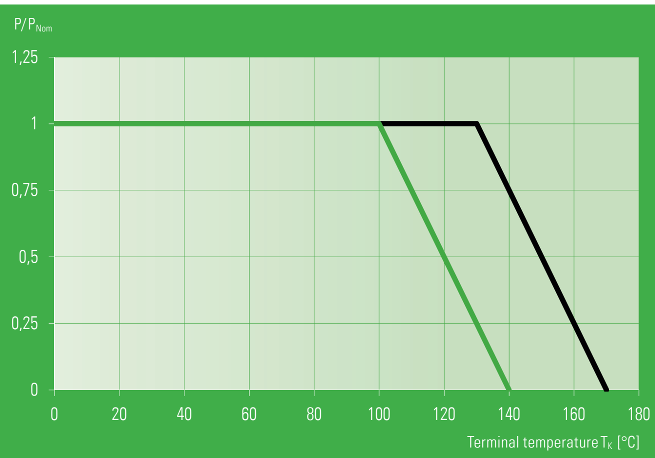
Examples:	
Cu wire 0.3 mm, 10 mm length	$R_{cu} = 2.4\ mOhm$
Cu wire 4 mm*0.2 mm*35 µm	$R_{cu} = 10\ mOhm$



Temperature dependence: MANGANIN® // 50 ppm/K

— Upper/lower limit

— Typical temperature dependence of a resistor



Power derating curve (0.5 mOhm)

— Stability 1.0 %

— Stability 0.5 %

HIGH LOAD CAPACITY

Due to the fact that the thermal conductivity of resistance materials is relatively low compared with copper and the resistor foil thickness is low, in the region of 20 to 150 µm, it is not possible to conduct the heat out of the resistor via the resistance material into the terminals.

For this reason, the resistance foil on our ISA-PLAN® resistors is bonded to a metal substrate with good thermal conductivity (copper or aluminium) using a thin adhesive that is also thermally conductive. This enables effective discharge of dissipated heat via the substrate and terminals. The result is a relatively very low internal heat resistance, typically in the region of 10 to 30 K/W.

Our resistors can therefore be used at their full rated power up to a very high terminal temperature, i.e. the derating point on the power derating curve is very high compared with other products. At the same time, the maximum temperature in the resistance material is kept low, thereby significantly improving long-term stability under load and the TCR-dependent reversible resistance change.

LOWER INDUCTANCE

Since in many applications it is necessary to not only measure but also control switch-mode currents, the inductance of the shunt or measurement circuit is of great importance.

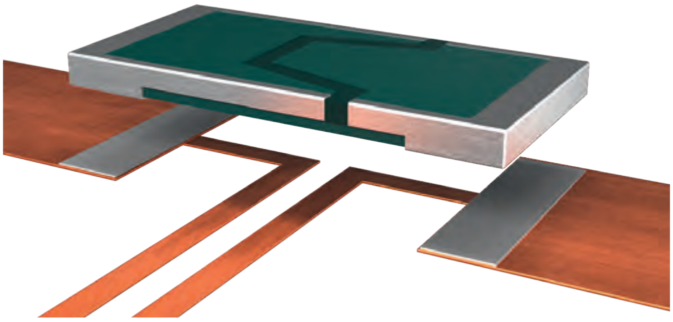
To reduce inductance, our SMD resistors have a flat design, with or without closely adjacent meanders. Performance is further improved by the diamagnetic characteristics of all our precision alloys mentioned above, as well as the metal substrate and four-terminal connection.

However, since the sensing leads and the resistor form an antenna structure in which voltages are induced by the magnetic field generated by the current flow as well as other external magnetic fields, it is especially important to ensure that the area enclosed by the leads is as small as possible. We therefore recommend the use of closely adjacent leads or even a strip-line arrangement, i.e. where the two lines are routed to the amplifier on two separate layers congruently one above the other.

SURFACE MOUNT ASSEMBLY (ISA-PLAN®)

Product series: *VMx*

Sizes: *0805 / 1206 / 2010 / 2512*



Features

- Up to 4 watts permanent power at +70 °C
- Very high pulse power rating
- Very good long-term stability
- Standard solder pad size
- Mounting: reflow and infrared soldering
- AEC-Q 200 qualified

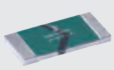
Technical data

Resistance values	*5 mOhm to 1 Ohm*
Tolerance	*1 %, 5 %*
Temperature coefficient	*<20 ppm/K (+20 °C to +60 °C)*
Applicable temperature range	*-65 °C to +170 °C*
Power rating	*up to 4 W*
Internal heat resistance	*<25 K/W*
Insulation voltage	*200 V*
Inductance	*<2 nH*
Stability (nominal load) deviation T_K = Terminal temperature	*<0.5 % after 2000 h (T_K = +65 °C)* *<0.7 % after 2000 h (T_K = +95 °C)*

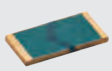
Advantages/user benefits

- 4-terminal connection on pc-board
- Tin/copper plated terminals for optimum soldering points
- Extremely low internal heat resistance
- Extremely low TCR for all resistance values
- Negligible thermal EMF against copper (< 1 µV/K)
- Very good long-term stability under full load

VMI / 0805

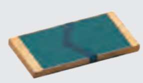


VMK / 1206



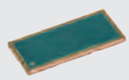
VMK-NA / 1206

VMP / 2010



VMP-NA / 2010

VMS / 2512

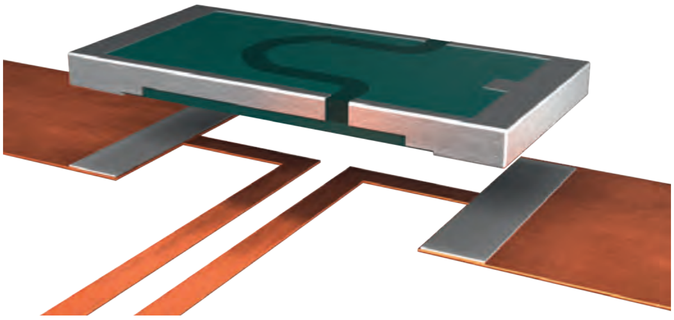


GMP / 2010

SURFACE MOUNT ASSEMBLY (ISA-PLAN®)

Product series: *CMx*

Sizes: *1206 / 2010 / 2512*



Features

- Up to 2.5 watts permanent power at +70 °C
- High pulse power rating
- Good long-term stability
- Standard solder pads
- Mounting: reflow and infrared soldering
- AEC-Q 200 qualified

Technical data

Resistance values	*10 to 250 mOhm*
Tolerance	*1 %, 5 %*
Temperature coefficient	*<75 ppm/K (+20 °C to +60 °C)*
Applicable temperature range	*-65 °C to +170 °C*
Power rating	*up to 2.5 W*
Internal heat resistance	*<35 K/W*
Insulation voltage	*200 V*
Inductance	*<3 nH*
Stability (nominal load) deviation T_K = Terminal temperature	*<1.0 % after 2000 h (T_K = +100 °C)*

Advantages/user benefits

- 4-terminal connection on pc-board
- Tin/copper plated terminals for optimum soldering points
- Extremely low internal heat resistance
- Virtually unaffected by ambient temperature in range -65 to +170 °C due to low TCR
- Negligible thermal EMF against copper (< 1 µV/K)
- Very good long-term stability under full load

CMK / 1206

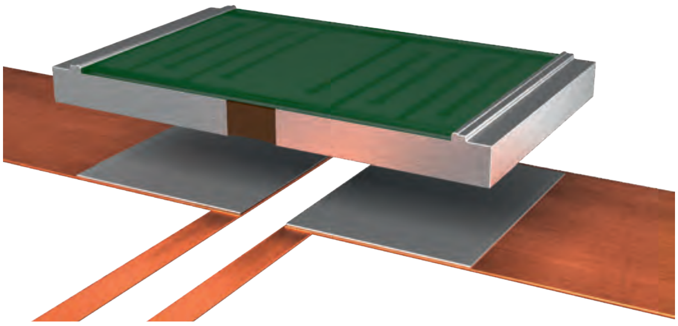
CMP / 2010

CMS / 2512

SURFACE MOUNT ASSEMBLY (ISA-PLAN®)

Product series: *SMx*

Sizes: *1206 / 2010 / 2512 / 2817*



Features

- Up to 7 watts permanent power at +70 °C
- Very high pulse power rating
- Very good long-term stability under full load
- Mounting: reflow and infrared soldering
- AEC-Q 200 qualified

Technical data

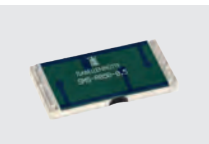
Resistance values	*4 mOhm to 4 Ohm*
Tolerance	*0.5 %, 1 %, 5 %*
Temperature coefficient	*<50 ppm/K (+20 °C to +60 °C)*
Applicable temperature range	*-65 °C to +170 °C*
Power rating	*up to 7 W*
Internal heat resistance	*from 13 K/W*
Insulation voltage	*200 V*
Inductance	*<3 nH*
Stability (nominal load) deviation T_K = Terminal temperature	*<0.5 % after 2000 h (T_K = +75 °C)* *<1.0 % after 2000 h (T_K = +105 °C)*

Advantages/user benefits

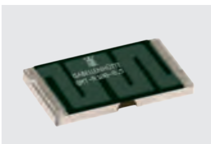
- 4-terminal connection on pc-board
- Tin/copper plated terminals for optimum soldering points
- Extremely low internal heat resistance
- Extremely low TCR for all resistance values
- Nominal power at high temperature

SMK / 1206

SMP / 2010



SMS / 2512

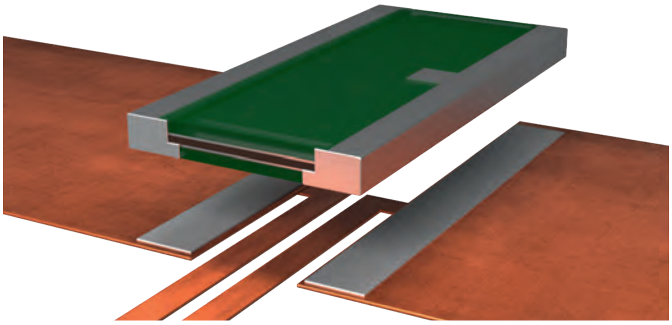


SMT / 2817

SURFACE MOUNT ASSEMBLY (ISA-PLAN®)

Product series: *VLx*

Sizes: *0612 / 1020*



Features

- Up to 2 watts permanent power at +130 °C
- High pulse power rating
- Good long-term stability under full load
- Mounting: reflow and infrared soldering
- AEC-Q200 qualified

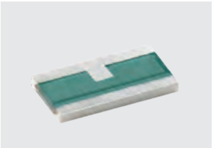
Technical data

Resistance values	*1 to 39 mOhm*
Tolerance	*1 %, 5 %*
Temperature coefficient	*<50 ppm/K (+20 °C to +60 °C)*
Applicable temperature range	*-65 °C to +170 °C*
Power rating	*up to 2 W*
Internal heat resistance	*<20 K/W*
Insulation voltage	*200 V*
Inductance	*<1 nH*
Stability (nominal load) deviation T_K = Terminal temperature	*<0.5 % after 2000 h (T_K = +100 °C)* *<0.7 % after 2000 h (T_K = +130 °C)*

Advantages/user benefits

- 4-terminal connection on pc-board
- Tin/copper plated terminals for optimum soldering points
- Extremely low internal heat resistance
- Virtually unaffected by ambient temperature in range -65 to +170 °C due to low TCR
- Negligible thermal EMF against copper (< 1 µV/K)
- Large soldering and terminal surface
- High mechanical strength of solder joint

VLK / 0612



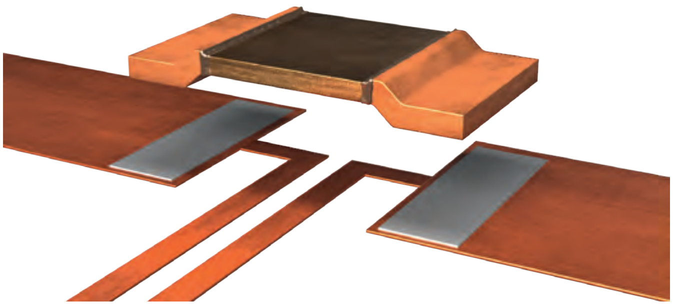
VLP / 1020

SURFACE MOUNT ASSEMBLY (ISA-WELD®)

SMD resistors for high current applications

Product series: *BVx*

Sizes: *1213 / 2512 / 3920 / 5930*



Features

- Up to 15 watts permanent power at +70 °C
- Very low resistance values
- Very good long-term stability
- Standard solder pad size
- Made from electron-beam welded composite material
- AEC-Q 200 qualified

Technical data

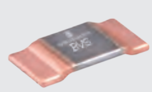
Resistance values	*0.1 to 6.8 mOhm*
Tolerance	*1 %, 5 %*
Temperature coefficient	*<50 ppm/K (+20 °C to +60 °C)*
Applicable temperature range	*-65 °C to +170 °C*
Power rating	*up to 15 W*
Internal heat resistance	*from 3 K/W*
Insulation voltage	*100 V*
Inductance	*<0.5 nH*
Stability (nominal load) deviation T_K = Terminal temperature	*<0.5 % after 2000 h (T_K = +90 °C)* *<1.0 % after 2000 h (T_K = +120 °C)*

Advantages/user benefits

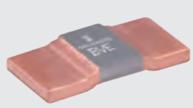
- 4-terminal connection on pc-board
- Suitable for soldering temperatures up to +350 °C/30 secs
- High power rating

BVF / 1213

BVT / 2512



BVS / 3920



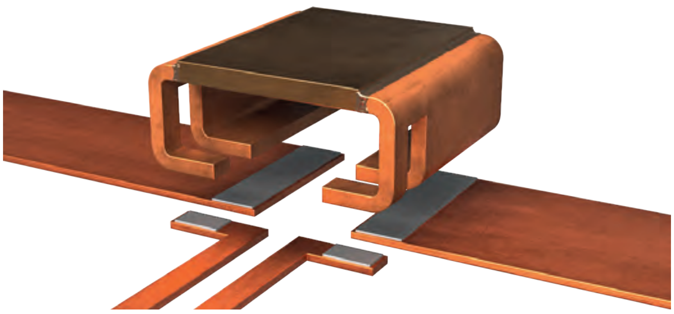
BVE / 5930

SURFACE MOUNT ASSEMBLY (ISA-WELD®)

SMD resistors for high current applications

Product series: *BVx*

Sizes: *1216 / 2725 / 3812 / 3820 / 4026*



Features

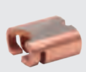
- Up to 12 watts permanent power at +70 °C
- Very low resistance values
- Very good long-term stability
- Made from electron-beam welded composite material
- AEC-Q200 qualified

Technical data

Resistance values	*0.2 to 25 mOhm*
Tolerance	*1 %, 2 %, 3 %, 5 %*
Temperature coefficient	*from 20 ppm/K (+20 °C to +60 °C)*
Applicable temperature range	*-65 °C to +170 °C*
Power rating	*up to 12 W*
Internal heat resistance	*from 3 K/W*
Insulation voltage	*100 V*
Inductance	*<3 nH*
Stability (nominal load) deviation T_K = Terminal temperature	*<0.5 % after 2000 h (T_K = +90 °C)* *<1 % after 2000 h (T_K = +120 °C)*

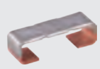
Advantages/user benefits

- 4-terminal design
- Suitable for soldering temperatures up to +350 °C/30 secs
- High power rating
- Ideal for mounting on DCB/IMS substrate



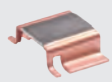
BVN / 1216

BVB / 2725

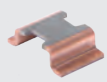


BRS / 3812

BVH / 3820



BVR / 4026

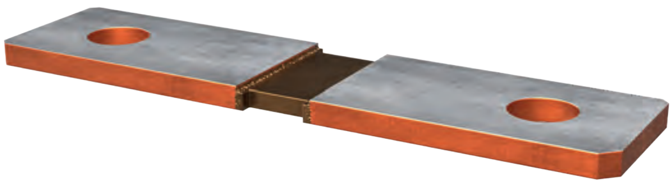


BVZ / 4026

BUS BAR MOUNTING

Bus bar components in composite material for high current applications

Product types: ***BAC / BAS / BKW / BVM-F / BVD / KVM***



Features

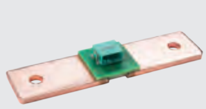
- Up to 30 watts permanent power
- Low resistance current sensors
- Very good long-term stability
- Bus bar mounting
- Made from electron-beam welded composite material
- AEC-Q 200 qualified (BAS, KVM), further parts in preparation

Technical data

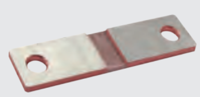
Resistance values	*0.035 to 0.5 mOhm*
Tolerance	*5 %*
Temperature coefficient	*from 20 ppm/K (+20 °C to +60 °C)*
Applicable temperature range	*-55 °C to +170 °C*
Power rating	*up to 30 W*
Continuous current	*up to 350 A*
Pulse energy	*200 J*
Internal heat resistance	*<0.2 K/W*
Inductance	*from 1 nH*
Stability (nominal load) deviation T_K = Terminal temperature	*<0.5 % after 2000 h (T_K = +105 °C)* *<1 % after 2000 h (T_K = +140 °C)*

Advantages/user benefits

- Suitable for soldering temperatures up to +350 °C/30 secs
- High permanent and pulse power rating
- Solderable and weldable

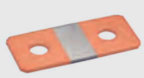


BAC
8420 (metric)

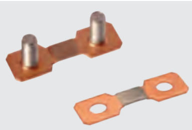


BAS
8420 (metric)

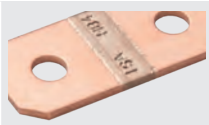
BKW
2919 (metric)



BVM-F
3516 (metric)



BVD
3512 (metric)



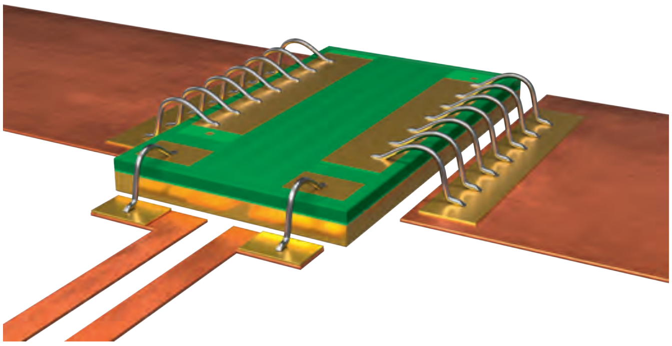
KVM
3516 (metric)

HYBRID MOUNTING

Bondable resistors for high power applications

Product series: ***PMH / PMH-D / PLU***

Sizes: *2512 / 2439*



Features

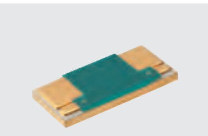
- Up to 5 watts permanent power
- Very good heat dissipation
- Mounting: soldering or adhesive bonding on substrate
- Bondable contacts
- AEC-Q 200 qualified (PMH-D, PLU)

Technical data

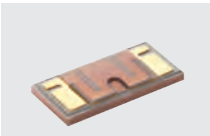
Resistance values	*1 to 80 mOhm*
Tolerance	*0.5 %, 1 %, 5 %*
Temperature coefficient	*<30 ppm/K (+20 °C to +60 °C)*
Applicable temperature range	*-65 °C to +170 °C*
Power rating	*up to 5 W*
Internal heat resistance	*from 4 K/W*
Insulation voltage	*100 V*
Inductance	*<2 nH*
Stability (nominal load) deviation T_K = Terminal temperature	*<0.5 % after 2000 h (T_K = +120 °C)* *<1 % after 2000 h (T_K = +150 °C)*

Advantages/user benefits

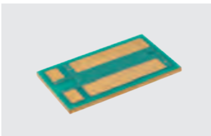
- 4-terminal connection
- Direct DBC/IMS solder mounting
- Ni-plated/Au-plated bond pads
- High load capacity
- Extremely low internal heat resistance
- Bondable resistor



PMH-D / 2512



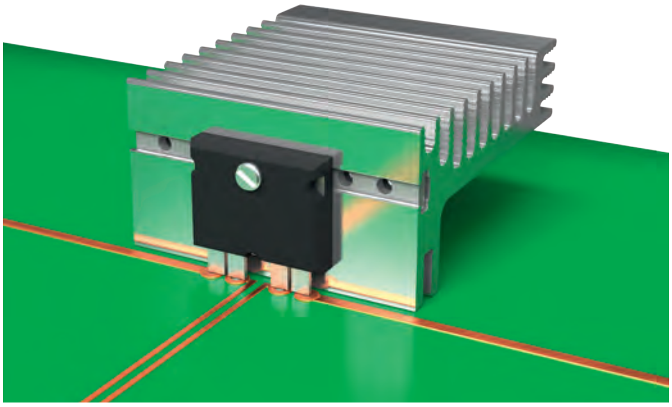
PMH / 2512



PLU / 2439

PCB AND HEAT SINK MOUNTING

Product types: ***PBH/PBV***



Features

- Up to 10 watts permanent power
- Very low resistance values
- Very good long-term stability
- Very high pulse power rating
- Low self-heating

Technical data

Resistance values	*0.5 mOhm to 100 Ohm*
Tolerance	*0.5 %, 1 %, 5 %*
Temperature coefficient	*<30 ppm/K (+20 °C to +60 °C)*
Applicable temperature range	*-55 °C to +125 °C*
Power rating	*up to 10 W*
Internal heat resistance	*from 3 K/W*
Insulation voltage	*<500 V*
Inductance	*from 10 nH*
Stability (nominal load) deviation T_K = Terminal temperature	*<0.5 % after 2000 h (T_K = +70 °C)**

**with heat sink*

Advantages/user benefits

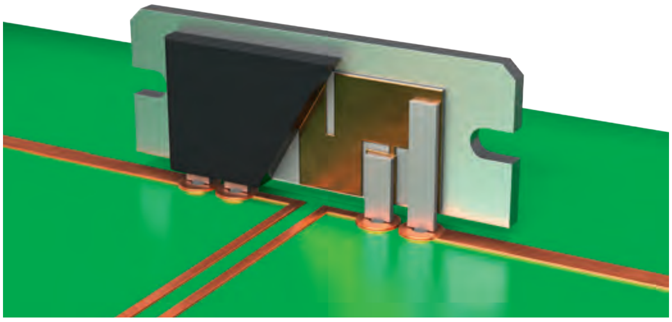
- 4-terminal connection (PBV)
- Suitable for soldering temperatures up to +350 °C/30 secs
- Heat sink mounting possible

PBH / TO-247 (ähnlich)

PBV / 2317 (metrisch)

PCB AND HEAT SINK MOUNTING

Product types: *A-H/AZ-H*



Features

- Up to 10 watts permanent power
- Very low resistance values
- Very good long-term stability
- Very high pulse power rating
- Low self-heating

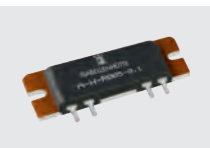
Technical data

Resistance values	*1 mOhm to 100 Ohm*
Tolerance	*0.1 %, 1 %*
Temperature coefficient	*from 3 ppm/K (+20 °C to +60 °C)*
Applicable temperature range	*-55 °C to +140 °C*
Power rating	*up to 10 W*
Internal heat resistance	*<3 K/W / 15 K/W*
Insulation voltage	*500 V AC/DC*
Inductance	*<10 nH*
Stability (nominal load) deviation T_K = base plate	*<0.1 % after 2000 h (T_K = +80 °C)** *<0.2 % after 2000 h (T_K = +95°C)**

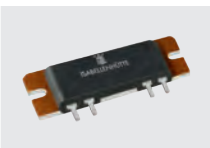
**with heat sink*

Advantages/user benefits

- 4-terminal connection
- Suitable for soldering temperatures up to +350 °C/30 secs
- Heat sink mounting possible
- Available from 3 ppm/K (AZ-H)



A-H

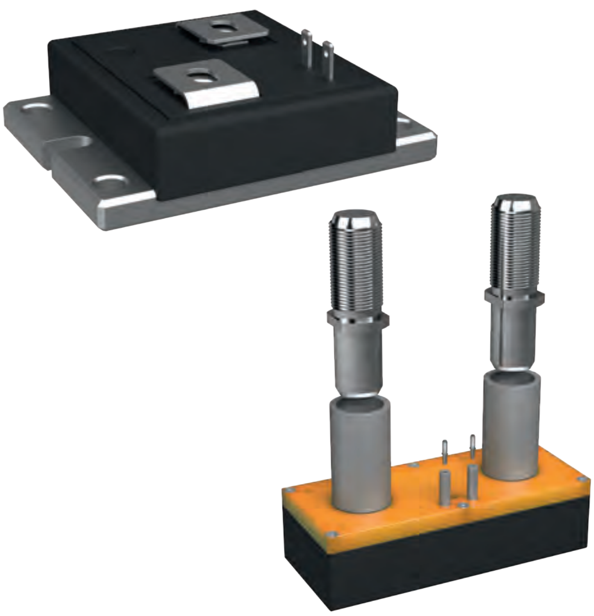


AZ-H

HEAT SINK MOUNTING

High precision calibration resistors for laboratory applications

Product types: ***RUG-Z / IKL (plug-in)***



Features

- Up to 250 watts permanent power (RUG-Z)
- Insulation voltage 500 V AC
- For highest currents and precision
- High pulse power rating up to 50 J (RUG-Z)
- Extremely low TCR

Advantages/user benefits

- 4-terminal connection
- Optimised heat dissipation
- DAkkS calibration possible

Technical data RUG-Z

Resistance values	*0.5 mOhm to 100 Ohm*
Tolerance	*0.1 %, 1 %*
Temperature coefficient	*from 1 ppm/K*
Applicable temperature range	*-55 °C to +110 °C*
Power rating	*up to 250 W*
Internal heat resistance	*<0.1 K/W*
Insulation voltage	*500 V AC*
Inductance	*<10 nH*
Stability (nominal load) deviation T_K = Terminal temperature	*<0.2 % after 2000 h* *(T_K = +85 °C)*

Technical data IKL

Resistance values	*5 µOhm to 6 mOhm*
Tolerance	*0.01 %, 0.1 %*
Temperature coefficient	*from 10 ppm/K*
Applicable temperature range	*0 to +80 °C*
Power rating	*up to 20 W*
Internal heat resistance	from *1 K/W*
Insulation voltage	*>200 V AC/DC*
Stability	*<0.05*

RUG-Z

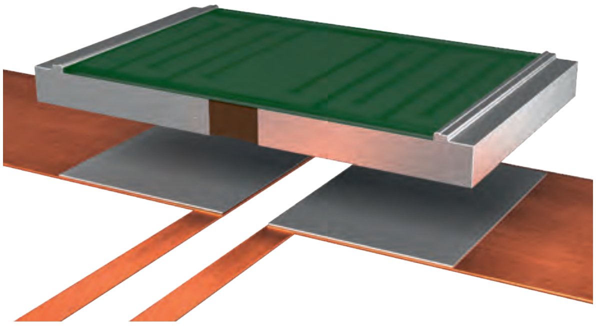
IKL

ESCC
European Space Components Coordination

AVIATION & AEROSPACE

Product types: ***SMP/SMS/SMT/SMV***

Sizes: *2010 / 2512 / 2817 / 4723*



Features

- ESCC 4001/027 for aerospace applications
- ESCC 4001/028 for aerospace applications
- Customer-specific qualification

Quality

- SnPb tinning of the contacts
- Certificate according to TS 16949 / ISO 9001
- 100 % control
- Clearly retraceable due to gapless documentation
- Date code labeling

Solderability

- Processable in all common soldering processes (Reflow-, IR-soldering
- ISA-WELD® processable up to +350 °C (1 min.)
- ISA-PLAN® processable up to +260 °C (peak)

Value range

- E6/E12/decadic values, depending on the type
- Further values on demand

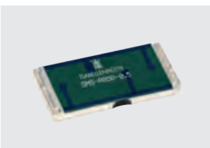
Technical data SMP / SMS / SMT

Resistance values	*4 mOhm to 2 Ohm*
Tolerance	*0.5 %, 1 %*
Temperature coefficient	*<50 ppm/K*
Applicable temperature range	*-55 °C to +170 °C*
Power rating	*1 / 2 / 3 W*
Internal heat resistance	*from 13 K/W*
Insulation voltage	*200 V*
Inductance	*<3 nH*
Stability (nominal load) deviation	*<0.2 % after 2000 h*
T_K = Terminal temperature	*(T_K = +120 °C)*

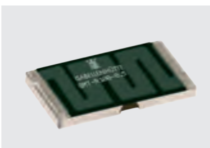
Technical data SMV

Resistance values	*3,3 mOhm to 1 Ohm*
Tolerance	*0.5 %, 1 %*
Temperature coefficient	*<30 ppm/K*
Applicable temperature range	*-55 °C to +140 °C*
Power rating	*3 W*
Internal heat resistance	*<20 K/W*
Insulation voltage	*1,000 V*
Inductance	*<10 nH*
Stability (nominal load) deviation	*<0.2 % after 2000 h*
T_K = Terminal temperature	*(T_K = +80 °C)*

SMP / 2010



SMS / 2512



SMT / 2817

SMV / 4723

INDUSTRIAL

- Drive technology
- Frequency converters
- Digital energy meters
- UPS USV Uninterruptible power supply
- Solar
- Wind
- Power modules

AUTOMOTIVE (AEC-Q200 QUALIFIED)

- Diesel and petrol direct injection systems
- Electric power steering
- Vehicle lighting systems
- Climate control
- Electric parking brake systems

HYBRID AND ELECTRIC VEHICLES

- Batteries
- H_2 / O_2 Fuel cells
- Electric vehicles

COMPUTERS

MEDICAL ENGINEERING

ELECTRICAL ENGINEERING

DOMESTIC APPLIANCES

MEASUREMENT SYSTEMS

LABORATORY

AEROSPACE

ORDERING CODES

ISA-PLAN®

VMS – R010 – 1.0

Type / Resistance value / Tolerance

ISA-WELD®

BVT – I – R003 – 1.0

Type / Material code letter / Resistance value / Tolerance

ISA-PLAN®
is a special manufacturing process in which resistance elements are etched from the precision resistance alloys MANGANIN® and ZERANIN® and then electrically insulated and mounted on a metal substrate with good heat-conducting properties. The planar structure and optimised current-density distribution enable low temperature coefficients (TCR), low-inductance designs, very low internal heat resistance and therefore a high load capacity.

ISA-WELD®
is a patented process for the manufacture of advanced high-performance resistors. The resistors are made from solid electron-beam welded composite materials incorporating one of our resistance alloys, e.g. MANGANIN®, ZERANIN® or ISAOHM®. They can be stamped or bent to suit almost any shape or application. ISA-WELD® resistors are used in high-current applications in the automotive industry, battery charging technology, drive technology and electronic energy meters.

MANGANIN®
is a resistance alloy developed by Isabellenhütte which is made from copper, manganese and nickel. MANGANIN® has been used in precision resistors worldwide for over 100 years; it has a moderate specific resistivity, a very low temperature coefficient (TCR) and a low thermal EMF against copper.

ZERANIN®
was developed as a low-ohmic alternative to MANGANIN®. This copper-manganese-tin alloy has an even better temperature coefficient (TCR) but slightly lower specific resistivity. It is therefore ideal for very low-ohmic resistors with extremely high precision characteristics.

ISAOHM®
is another resistance alloy developed by Isabellenhütte, this time made from nickel and chrome with traces of aluminium, silicon, manganese and iron. ISAOHM® is a very versatile material thanks to its particularly high specific resistivity, low temperature coefficient (TCR) and low thermal EMF against copper. It is mainly used in wire form for the production of high-ohmic, ultra-stable resistors and potentiometers as used in the automotive and consumer electronics industries as well as testing and automatic control equipment.

NOVENTIN®
With its high specific electrical resistance, the newly developed NOVENTIN® closes the gap between MANGANIN® and ISAOHM®. NOVENTIN® stands out particularly due to a small temperature coefficient of the electrical resistance with a parabolic behaviour of the R(T) curve, a high long-term stability of the electrical resistance, an extremely low thermoelectric power against copper and a good workability. Due to these features, NOVENTIN® is excellently suitable for the production of precision, standard and shunt resistors.

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PROVIDED BY

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Innovation by Tradition

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