

## **Non-magnetic Chip Resistors and Chip Capacitors Chip Resistors for High Temperature Applications**

The special technological aspects of these components produced by BREL International are the materials of the contact areas, which contains no Nickel, so they are non-magnetic. The contact areas are made by noble metal alloys based on Pt-Ag and Pt-Pd-Ag, available as thickfilm pastes, which are applied by roller-coating or dipping processes onto the wrap-around areas of the chip components and fired in the range of 850°C.

By appropriate choice of materials and the coating and firing process, for these components the standard SMD soldering processes can be used. Additionally these resistors and capacitors are also suited for contact processes using silver-based conductive glue with silver as the contact material, as there can arise no formation of unstable diffusion layers between tin and silver.

The main applications of these non-magnetic components are medical electronics in the field of magnetic-resonance (MRI) and computer tomography (CT), where electronic circuits are located in high magnetic fields. The contact-technique of conductive gluing is used mainly in applications where soldering techniques can not be applied for technical reasons, like the usage of temperature sensitive components which would be affected by high soldering temperatures, or the usage of unpackaged semiconductors on the same board.

An additional advantage of thickfilm chip resistors with Pt-Ag or Pt-Pd-Ag contacts is suitability for applications at higher temperatures than the normal maximum temperature of 155°C. These resistors contain no organic material and no tin or tin-lead layers, and the firing temperatures for the resistive and conductive layers are in the temperature range of 850°C. Due to these reasons such resistors will have no substantial change of their properties and stability up to the range of 300°C. The limit for the highest application temperature is given mainly by the solder or material for the connection to the PCB or ceramic carrier, as the temperature difference between the highest application temperature and the melting or deterioration point of the contact material should be at least in the range of 30°C.



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In contrast to thickfilm chip resistors the corresponding ceramic chip capacitors are not suited for high temperature applications, because the thin inner layers of conductive and isolating materials can not withstand the expansion problems caused by high temperatures.

When using standard soldering techniques there exists a difference in the appearance of the solder-joint between such non-magnetic contacts and normally tinned contacts. Because Pt-Ag or Pd-Pt-Ag contacts do not have the same affinity to the tin of the solder-bath or printed reflow-tin as the galvanic tin-coated chip component, the soldering process does not result in an equal form of solder-meniscus. Nevertheless, the solder joints will have an equal mechanical strength as the tin-coated components.

The following product groups with the described properties are available from BREL International:

Series	Description	Value Range	Sizes
CHR	Chip Resistors in the standard range	1R0Ω to 10MΩ	0402 to 1206
CHS	Chip Resistors in the high value range	10MΩ to 1T0Ω	0402 to 4020
CHM	Precision Chip Resistors in the high value range	100KΩ to 10TΩ	0805 to 2512
CRB	Trimmable Chip Resistors	1R0Ω to 10MΩ	0603 to 1216
TPS	PTC-Temperature sensors	1R0Ω to 100KΩ	0402 to 1210
TNS	NTC-Temperature sensors	100RΩ to 100MΩ	0402 to 1210
MLCC-V	Ceramic Chip Capacitors	0.47pF to 3.3μF	0402 to 2225

The chip resistors in the high value range (CHS/CHM-series) are produced with these non-magnetic contacts for a technological reason. For the deposition of a tin-layer onto the resistor contacts it is necessary that the resistor-layer be protected by a glass-layer to avoid the deposition of the tin onto the resistor surface. Unfortunately, this glass-layer is creating diffusion-processes into the resistor-layer and at high values, mainly in the giga-ohm range, this diffusion process changes the resistor in an unpredictable way and it can not be applied in the high resistance range.

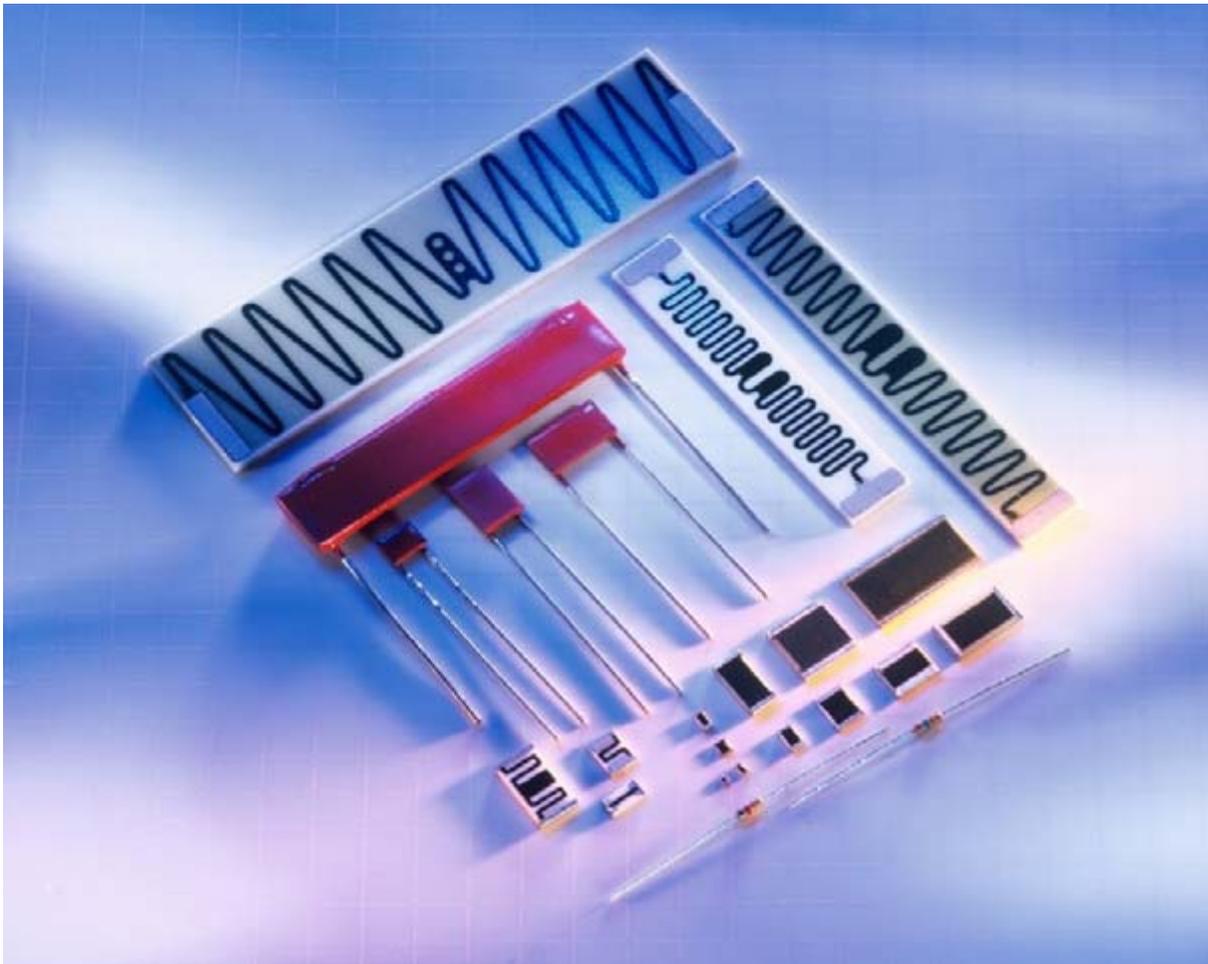


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Besides the chip resistors there are some additional series of leaded resistors in the BREL International program that have non-magnetic properties, as the copper-wire leads are soldered onto non-magnetic contact areas. These components are radial leaded, high value, and high voltage resistors in the resistance range up to 10 Tera-ohm and in voltages up to 30kV, and leaded temperature sensors in the same range as the chip-sensors. Due to the flexible production structure at BREL International it is possible to also produce custom specified resistor products with non-magnetic properties.



Chip resistors and leaded resistors in different sizes with non-magnetic features are suitable for applications in strong magnetic fields.



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