VIBRANTZ TECHNOLOGIES™

Heater on steel materials

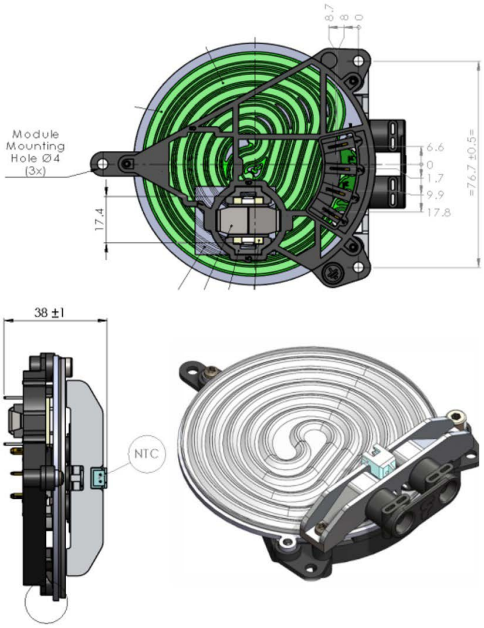
Materials and engineered products

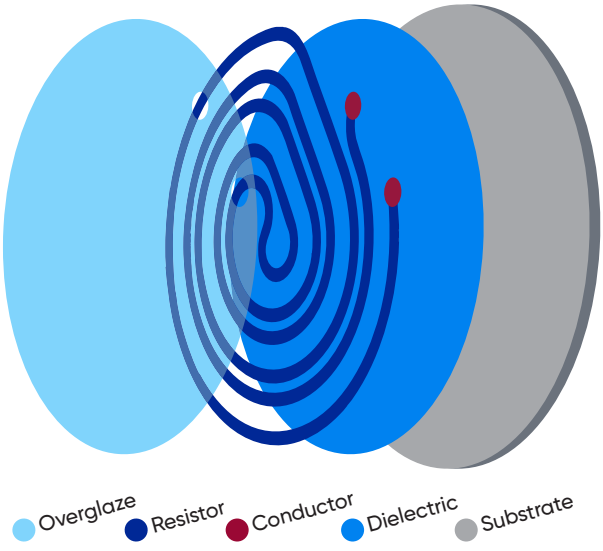
Contents

Heater on steel (HOS)

Innovative paste solutions for modern applications

Rising expectations for energy efficiency, design flexibility, instant heating and durability mean original equipment manufacturers (OEMs) and fabricators need flexible solutions without compromising performance. Vibrantz's HOS paste systems offer heater element customization for steel substrates and unlock greater opportunities in the automotive and home appliance sectors.





Product groups

Our product line features flexible and durable paste systems designed for exceptional performance in a range of industries, including:

- **Dielectric pastes:** Ensure strong insulation and thermal stability on steel substrates
- **Resistance pastes:** Optimize uniform heat distribution and control performance
- **Termination pastes:** High-conductivity pastes that support secure and reliable electrical connections

Applications

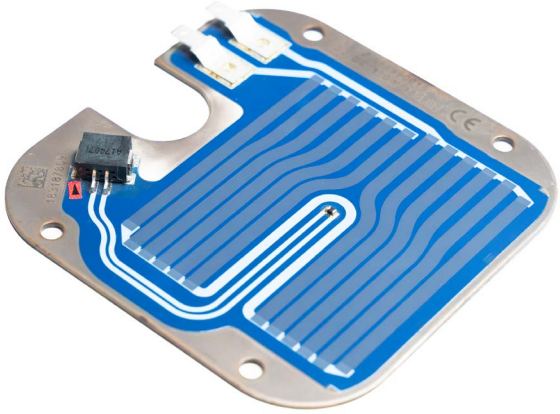
We design with unrivaled precision, delivering durable products that drive excellence across industries.

- **Automotive:** Cabin heaters and battery heaters for electric vehicles (EVs)
- **Home appliances and industrial cooking equipment:** Precision contact heating elements
- **Water and gas systems:** Efficient flow through heaters
- **Small and large-scale electrical appliances:** Thick film steamers for steam generation in household appliances (like irons) and industrial systems

High performance in action

Vibrantz revolutionizes automotive battery heating for OEM with steel-based system

A leading automotive OEM partnered with us to design a compact, energy-efficient heater for its EV batteries. Our innovative steel-based system met the stringent requirements and delivered outstanding results. By optimizing thermal management, we enabled the OEM to enhance the overall driving experience. This improvement brought several key benefits, including:



- **Extended EV battery life**
- **Reduced charging times**
- **Improved passenger safety**

Product list

Product	4916	4924	4931	4940	G485-1
Material #	1424817	1433471	1149018	1438841	1424812
Application	Dielectric on 304 steel	Dielectric on 430 steel standard	Dielectric on 430 steel less bending	Dielectric on 430 steel low bending	Overglaze
Firing temperature, °C	850 °C	850 °C	850 °C	850 °C	600 °C
Fired thickness, µm	> 70	> 80	> 80	> 90	10 to 15
Breakdown voltage, VAC	≥ 1500	≥ 1800	≥ 1800	≥ 1800	≥ 1500
Color	Blue	Blue	Blue	Green	Green

All dielectric materials can be used as overglaze post fire at 850 °C

Resistor	29106	29206	29109	29115	29215	29515	29130	29230
Material #	1149132	1149182	1149181	1426435	1149139	1149141	1149137	1149140
Metallurgy	Ag/Pd	Ag/Pd	Ag/Pd	Ag/Pd	Ag/Pd	Ag/Pd	Ag	Ag
Resistivity, mΩ/sq	100	200	100	100	200	500	100	200
Tolerance, %	± 10	± 10	± 10	± 10	± 10	± 10	± 10	± 10
TCR, ppm/°C	600	600	900	1500	1500	1500	3320	3320
Dry thickness µm	20 - 22	20 - 22	20 - 22	20 - 22	20 - 22	20 - 22	20 - 22	20 - 22

Resistor	59109	59115 35 mOhm	59115	59117	59215	59515
Material #	1440805	1439642	1437942	1443598	1437945	1439581
Metallurgy	Ag/Pd	Ag/Pd	Ag/Pd	Ag/Pd	Ag/Pd	Ag/Pd
Resistivity, mΩ/sq	100	35	100	100	200	500
Tolerance, %	± 10	± 10	± 10	± 10	± 10	± 10
TCR, ppm/°C	900	1500	1500	1700	1500	1500
Dry thickness, µm	20 - 22	20 - 22	20 - 22	20 - 22	20 - 22	20 - 22

Conductor	9912-G	9512-G	9695-G
Material #	1437203	1149049	1149069
Metallurgy	Ag	Ag/Pt	Ag/Pd
Firing temperature, °C	850	850	850
Initial adhesion, kg	≥ 7	≥ 7	≥ 7
Aged adhesion, kg	≥6	≥6	≥6
Aged adhesion Details, hrs, °C	48 hrs, 150 °C	48 hrs, 150 °C	48 hrs, 150 °C

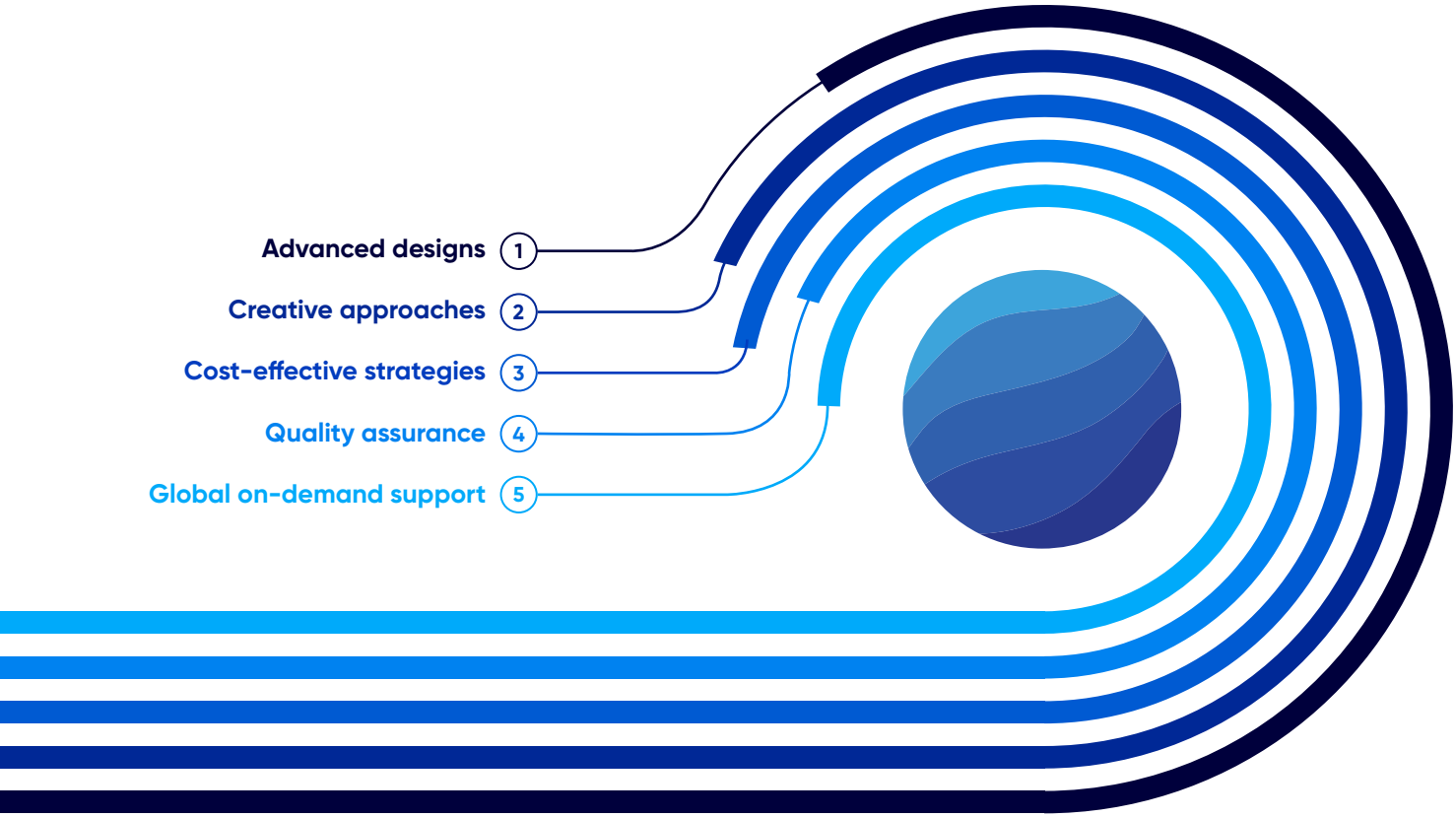
Resistor	10 500R (N401)	1 3500R (N412)	1 3700R (N414)
Material #	1436100	1438970	1438969
Metallurgy	Ag/Ru	Ag/Ru	Ag/Ru
Firing temperature, °C	10	1	10
Tolerance, %	± 10	± 10	± 10
TCR, ppm/°C	500	3500	3700
Dry thickness, µm	20 - 22	20 - 22	20 - 22

Why choose Vibrantz's electronic materials solutions?

By utilizing our advanced paste systems, manufacturers benefit from:

- **Customization:** Tailored solutions designed to meet specific application requirements
- **Efficiency:** Decreased energy consumption and lower operational costs
- **Durability:** Excellent resistance to wear, corrosion and temperature fluctuations

Partner and align with our industry experts to deliver innovative heating solutions that are shaping the future of advanced electronic materials.



Discover our other applications

Vibrantz has a 300-year combined legacy of innovation in advanced materials, color solutions and performance coatings. Our core competencies in particle engineering, color technology and glass and ceramic science have made us a supplier of choice.

Our Electronic Materials products are part of the Advanced Materials business unit. We are a premier manufacturer of specialty chemicals minerals and chemical additives for myriad applications worldwide. We offer a full range of engineered electronic materials and custom designed products for hybrid circuits, microelectronics, packaging, multilayer chip components and other devices.

Contact us to learn how we elevate the everyday.

Custom material systems

We collaborate with our customers to develop tailored electronic component formulations and systems designed to achieve precise performance objectives.

Toll manufacturing and custom processing

Our extensive manufacturing capabilities ensure flexibility to deliver quality products in diverse quantities and formulations. We provide custom contract manufacturing, joint development and toll processing services.

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