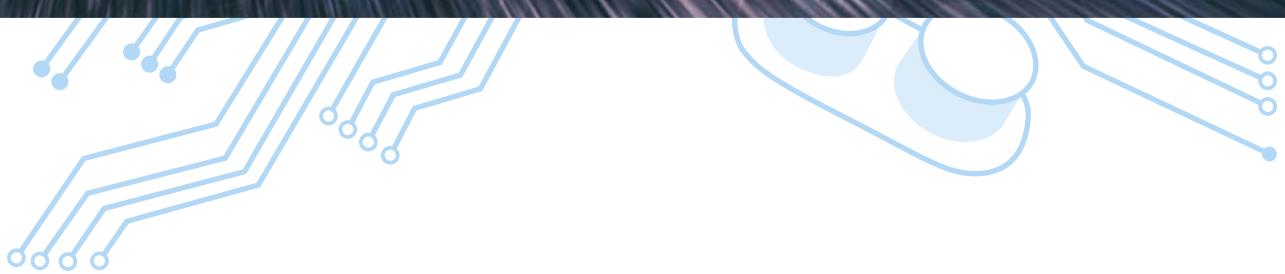


Protection of Electronic Devices in Automotive Industry



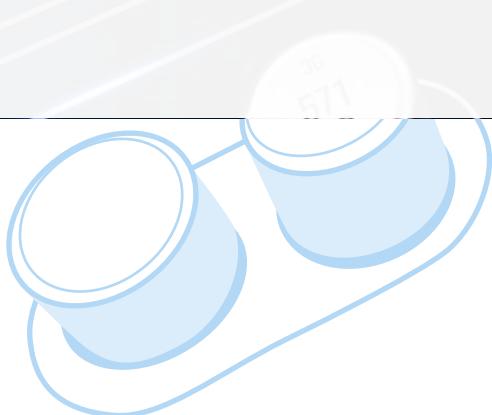
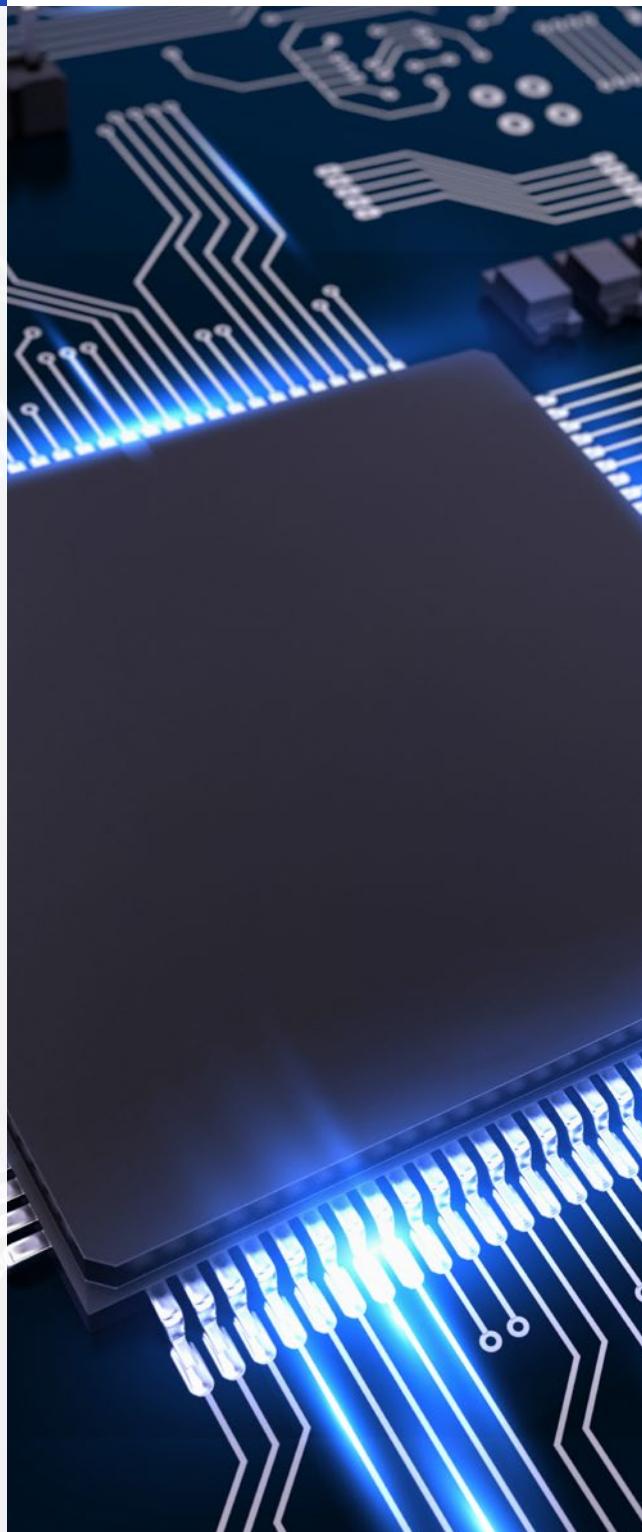
New technologies and the demand for improved productivity levels have a direct impact on todays` markets and materials used. Electronic devices are often very sensitive and require protection against humidity, chemical agents, mechanical impact, temperature changes, UV-Radiation, dust and dirt.

ELANTAS Europe's portfolio includes conformal coatings, potting & encapsulation materials as well as adhesives for circuit boards, sensors and other electronic components. Materials cover almost all chemistries including epoxy, polyurethane, silicones, acrylics and polyolefines and mixed hybrids.

We are deemed to provide excellent quality and performance of our products based on our extensive technical expertise. Challenging customer demands and extensive testing facilities support us in developing our products and supplying comprehensive support.

Throughout our processes we implement sustainability policies to protect the environment, health, and safety. All of our products are RoHS-compliant.

The demand of automotive electronics depends very much on the area of use. To offer best solutions we directed our portfolio into the main categories Automotive Interior, Automotive Exterior and the Engine Compartment.



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ELANTAS is as global as the automotive industry. With a worldwide network of production facilities, we can supply customers locally wherever they are. Our local expertise is backed by a worldwide network of R&D, application, and testing laboratories.

Our customer support is no less global. We have a worldwide Key Account Management System in place to ensure that you get full service across all locations. Wherever you need us, we're close by, with local contacts familiar with local conditions.

This extensive international presence gives us the flexibility and resilience needed to serve global automotive manufacturers.

At the same time, as a manufacturer with facilities across the globe, we place great emphasis on consistent and standardized production. We are certified according to DIN EN ISO 9001, DIN EN ISO 14001. Some of our sites are certified according to IATF 16949.



Worldwide Locations

ELANTAS GmbH
Wesel – Germany

ELANTAS Europe GmbH
Hamburg – Germany

ELANTAS Europe S.r.l.
Ascoli Piceno, Collecchio, Quattordio – Italy

ELANTAS PDG, Inc.
St. Louis, Olean – U.S.A.

ELANTAS Isolantes
Elétricos do Brasil Ltda.
Cerquilho – Brazil

ELANTAS Beck India Ltd.
Ankleshwar, Pune – India

ELANTAS Zhuhai Co. Ltd.
Zhuhai – P.R. China

ELANTAS Tongling Co. Ltd.
Tongling – P.R. China

ELANTAS Malaysia Sdn. Bhd.
Kapar – Malaysia

We adhere to the following industry standards:

- + IATF 16949
- + GS 95011-5 and other OEM approvals
- + IEC 60664-3
- + IPC-CC-830-B
- + IEC 61086 A
- + UL 94
- + UL 746E

The Automotive Interior

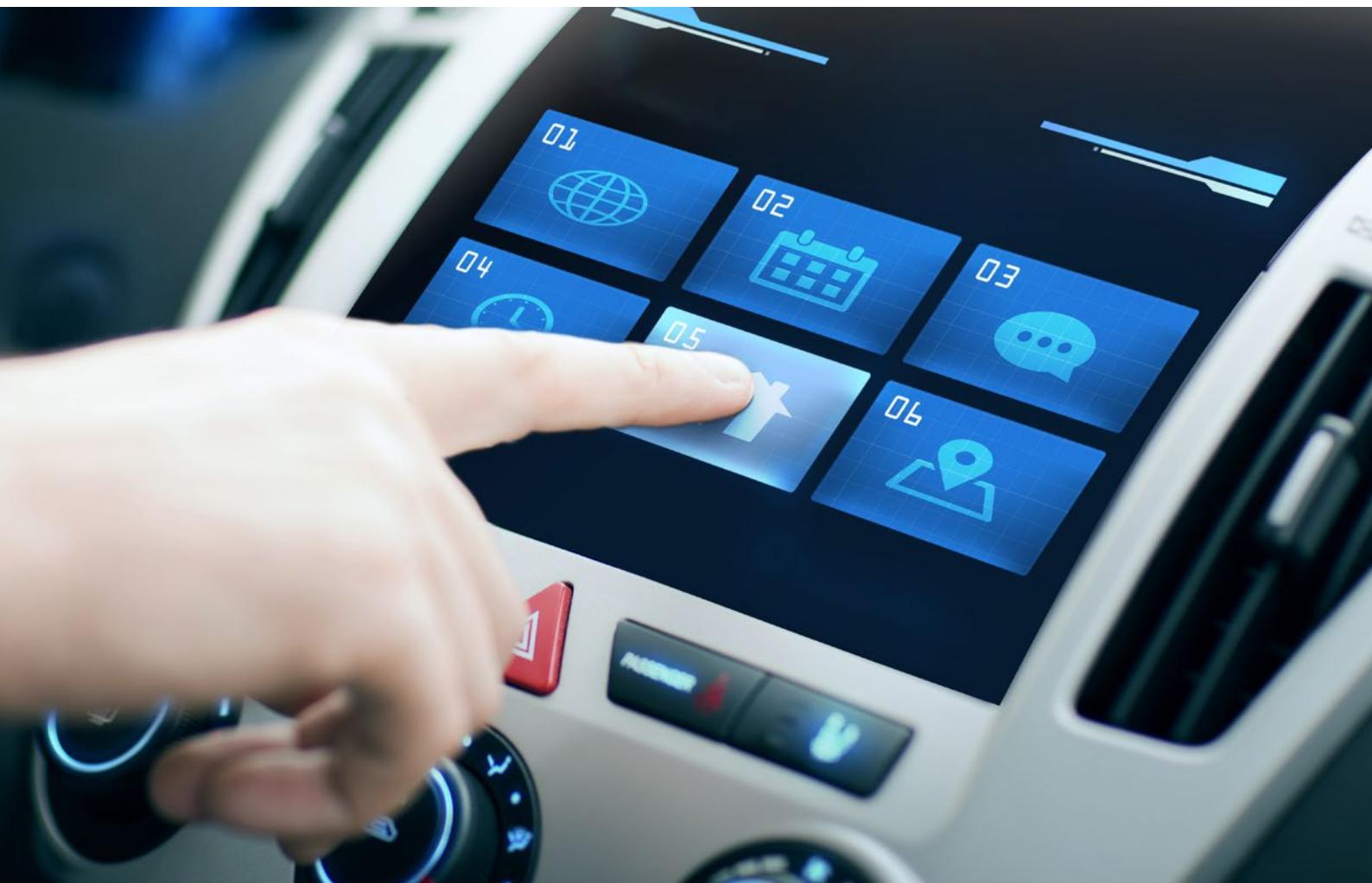
Materials up to 105 °C

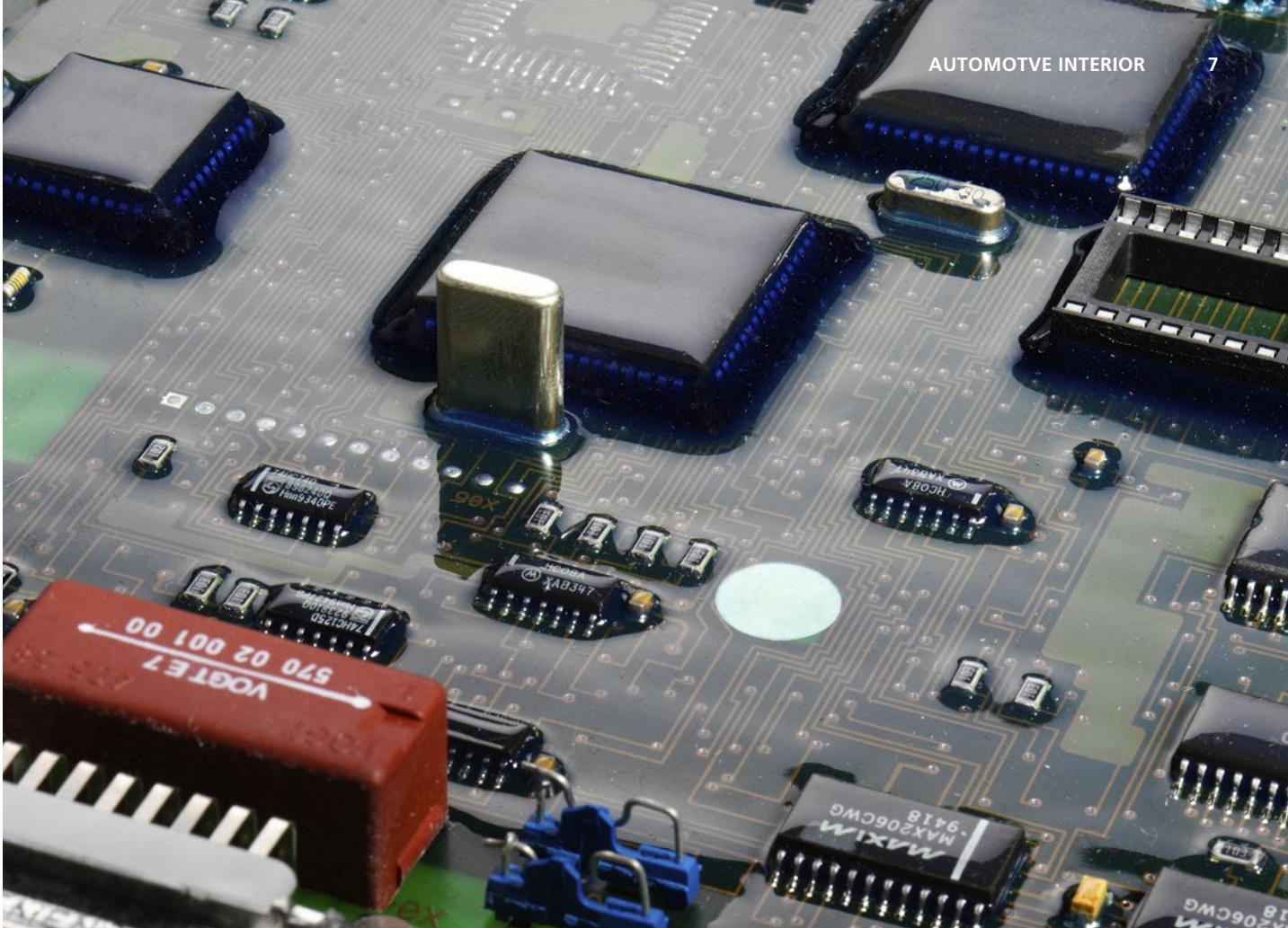
Today's automotive interiors are packed with electronic devices used to visualize, communicate, and entertain. Electronics control motors that perform multiple functions, while sensors detect the temperature and position at various points, and monitor the status of doors and seatbelts. These devices are expected to work flawlessly.

All these electronics need protection from shock, vibration, moisture and temperature, and that's where we come in.

Our products have the characteristics needed for the challenging environment of the passenger compartment:

- Protection against shock and vibration
- Safety class and no-hazardous materials available
- Environmental stability against temperature extremes, rapid temperature changes and UV radiation
- Protection against humidity and condensation
- Protection from oil, grease, water and acids in soft drinks
- No health risk from the use of the chemical product





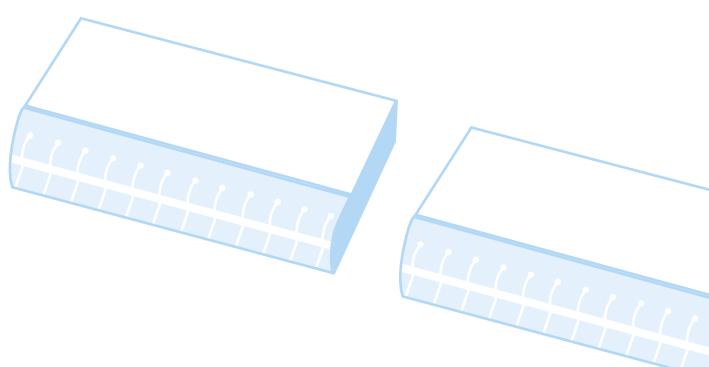
We offer a wide range of conformal coatings (thin and thick film), potting compounds, glues and adhesives, and materials for optical bonding. Materials range from hard elastomers to soft gels, and include innovative combined chemistries.

Examples for applications in the automotive interior where our products are in use:

- Seat Control
- Battery Package
- Mirror Servo
- Window Lifters
- Multimedia Electronics
- High Frequency Devices (WLAN, RADAR, Drive by Wire)
- Touchscreen Displays
- Head Up Displays
- Amplifiers
- Navigation Devices
- Center Console Instrumentation
- Door Closing Electronics

⊕ CHARACTERISTICS

- ⊕ Moisture and Liquid Media Protection
- ⊕ Low Odor Material
- ⊕ Flexible at Low Temperature





The Automotive Exterior

Materials up to 125 °C and Exposed
to the Elements

The outer skin of a car is its interface to the world. It takes in information and relays it to the driver, and sends information out to other drivers. This involves many electronic devices, which all have to stand up to harsh environmental effects. Temperatures vary widely and put mechanical strain on components, solar radiation, water and wind are ubiquitous. Cooling is creating condensation and exposure to moisture. Saltwater from winter roads and detergent from car wash sites seep into slots, and dust and dirt are ever-present.

Our products enable electronics devices to cope challenges such as:

- Temperature variations
- UV-radiation
- Rain, snow, dust
- Salt water
- Chemicals typical for roads and cars

Each application requires specific protection properties. We address them with a wide range of conformal coatings (thin and thick film), potting compounds, glues and adhesives. Materials range from hard elastomers to soft gels, and include innovative combined chemistries and applications.

Examples for applications in the automotive exterior where our products are in use:

- Tire Vibration and Rotation Sensors
- Distance Sensors (e.g. LIDAR)
- Cameras
- Antennas
- Door Locking Systems
- Tire Pressure Sensors
- Parking Sensors
- Exterior Mirror Control Electronics
- Sunroofs
- Drive-in Assistance Electronics (e.g. ABS, ESR)
- Rotary Angle Sensors

⊕ CHARACTERISTICS

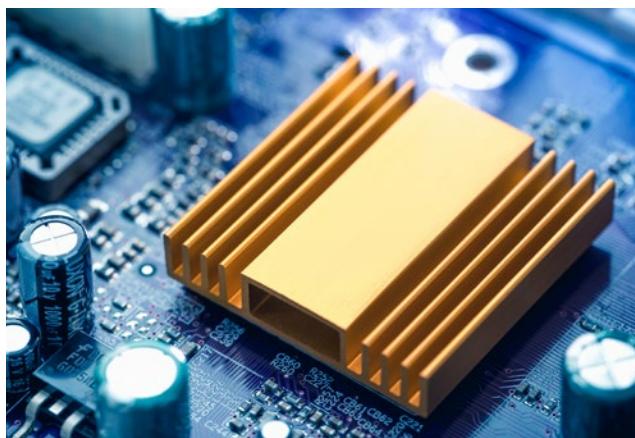
- ⊕ Thermal Flexibility
- ⊕ Protection Against UV Radiation
- ⊕ Salt Spray Resistance
- ⊕ Resistance to High Humidity and Temperature Variations (e.g. "Toyota Test")

The Engine Compartment

Materials above 150 °C

A combustion engine is a hot piece of machinery, providing extremely high temperatures. These temperatures are not limited to the engine - thermal conductivity brings heat stress to the vital electronic components in the engine compartment. For their part, electric vehicles create significant heat when electrical power is converted from AC/DC or DC/AC or discharged.

Consequently, engine compartment electronics require specific protection against thermal stress.



All these devices have electrical contacts and components that need to be sealed and protected. We provide conformal coatings (thin and thick film), potting compounds, glues and adhesives, from hard elastomers to soft gels, including innovative combined chemistries, to meet the following requirements:

- Thermal conductivity
- Resistance to automotive liquids
- Balanced combination of mechanical rigidity and flexibility to withstand high shock and vibrations
- Temperature compatibility from -60 °C to +250 °C
- Good adhesion



Examples for applications in the engine compartment where our products are in use:

- IGBT
- Gearbox Control System
- Control Unit
- Pump and Valve Controls
- Coolant Control Systems
- Exhaust Control Systems (NOx Control Electronics)
- Electric Motor Power Control and Supply Units
- Temperature, Vibration, and Liquid Pressure Sensors



CHARACTERISTICS

- + Shock & Vibration Protection
- + Automotive Liquid Resistance
- + Moisture & Liquid Media Protection
- + Extreme Temperature Flexibility

ELANTAS Product Solutions

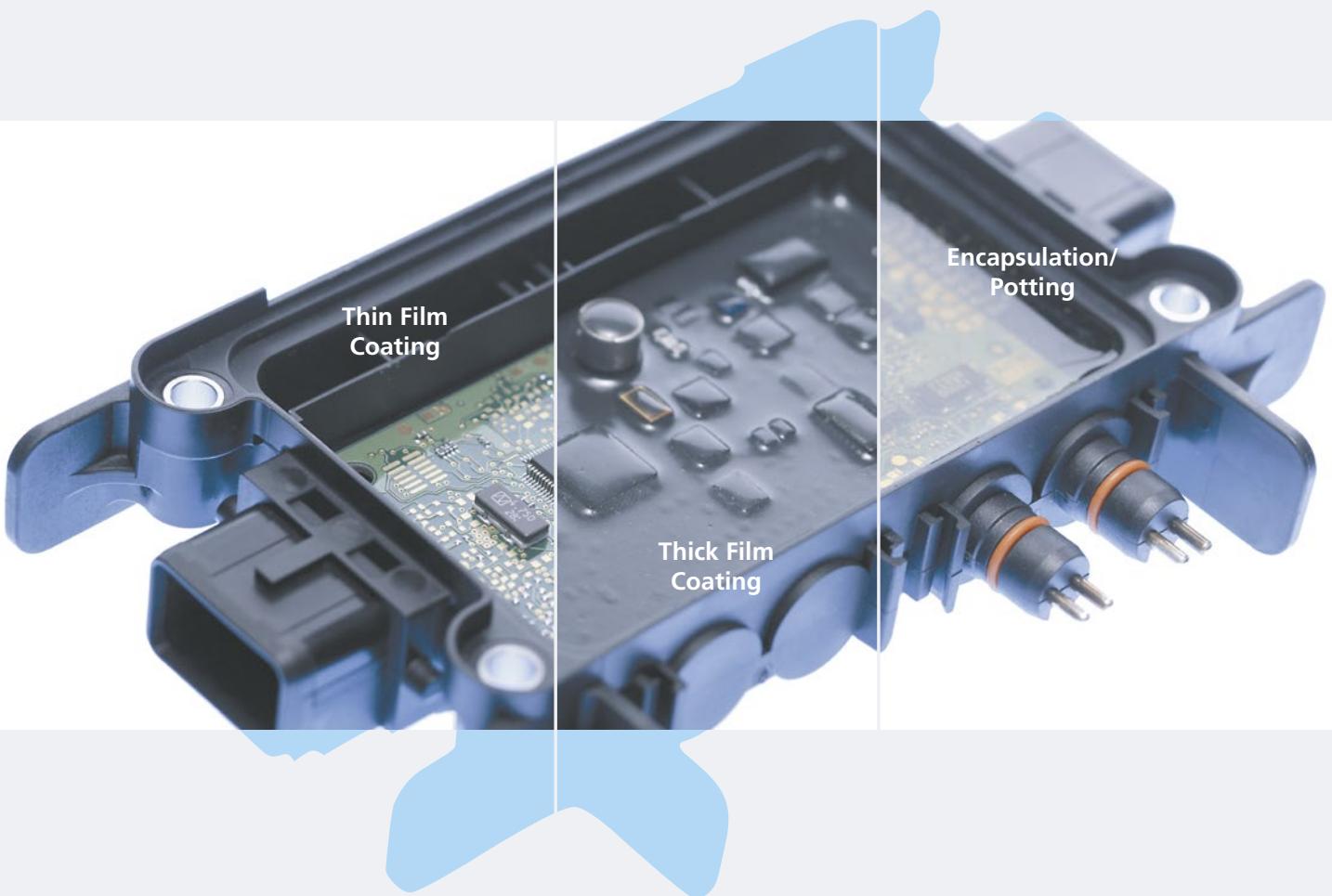
for the Automotive Industry

Product Series	Description	Hardness (Shore)	Viscosity (mPas)	Tg (°C)
Bectron® PL 4122 series	Alkyd urethane varnish, excellent edge coverage, aromatic free	Medium hard	50 – 500	+35
Bectron® PL 11 series	Acrylic varnish, aromatic free	Medium hard	30 – 50	+20
Bectron® SDC series	Silicone varnish, moisture cure, aromatic-free	A 15 – A 25	150 – 350	< -50
Bectron® SC series	Silicone coating, moisture cure, 100 % material	A 15 – A 25	450 – 1,300	< -50
Bectron® PT series	Acrylic-urethane coating, UV- and moisture cure, 100 % material	A 40 – A 75	100 – 125,000	~ -20
Bectron® PL 56 series	Epoxide coating, UV and thermal, 100 % material	A to D	250 – 400	~ -20
Bectron® AR series	Single component, polyurethane, moisture cure, 100 % material	A 65 – A 80	2,400 – 80,000	~ +10
Bectron® PK series	Single component, polyurethane, thermal cure, 100 % material	A 35 – D 70	1,150 – 9,500	-50 to +5
Bectron® MR series	Single component, polyolefin, extremly hydrophobic and dielectric properties, excellent high frequency behavior, no safety classification, 100 % material	A 10 – A 75	500 – 6,000	-40 to -25
Bectron® PU series	Two component, polyurethane, room temperature and thermal cure, wide variation of mechanical properties	A 35 – D 80	310 – 4,800	-50 to +10
Bectron® PB series	Two component, polybutadiene polyurethane, extremly dielectric and mechanical properties, excellent high frequency behavior	A 30 – A 80	900 – 15,000	-60 to -40
Bectron® EP series	Two component, epoxide, room temperature and thermal cure	D 80 – D 90	2,700 – 6,000	+70 to +120
Bectron® SK series	Two component, silicone resin, instant and thermal cure	A 35 – A 75	990 – 7,500	< -50
Bectron® SG series	Two component, silicone gel, instant and thermal cure	Soft Gel	250 – 10,500	< -50
Bectron® SG 77 series	Single component, silicone gel, UV curing	Soft Gel	800 – 1,700	< -50
Bectron® SA series	Single component, silicon adhesive, thermal and moisture cure	A 15 – A 70	3,200 – paste	< -50
ELAN-Glue® series	Single component, acrylic and epoxide adhesives, UV, thermal and moisture cure, 100 % material	A 40 – D 65	700 – paste	+10 to +70

Benefit	Typical Application	INTERIOR (-40 to +105 °C)	EXTERIOR (-40 to +125 °C)	ENGINE COMPARTMENT (-40 to +150 °C)
Combining hardness and flexibility, good chemical and thermal resistance	Universal Automotive and Industrial, conformal coating, moisture protection	✓	✓	(✓)
Easy application, repairable	Moisture protection	✓	(✓)	-
Easy to handle, soft, thermal resistant	Thick film coating, dip coating process, moisture protection	✓	✓	✓
VOC-free, soft, thermal resistant, safety class free	Thick film coating, encapsulation, moisture protection	✓	✓	✓
VOC-free, flexible, high process frequency	Thick film coating, dam and fill, moisture protection	✓	(✓)	-
VOC-free, flexible and durable, good chemical resistance, high process frequency	Thin film coating, thick film coating, chemical protection	✓	✓	(✓)
VOC-free, low halogen content, cure at room temperature, excellent adhesion	Thick film coating, adhesive, glue	✓	(✓)	-
VOC-free, easy handling, fast cure, safety class free	Thick film coating, encapsulation and potting of electronic components, dam and fill	✓	✓	(✓)
VOC-free, high water resistance, resistance against acids and bases, easy application, reworkable, safety class free	Encapsulation and potting of electronic components and sensors, high frequency application, antenna, water protection	✓	✓	(✓)
Best combination between mechanical flexibility and chemical resistance	Encapsulation and potting of electronic components	✓	✓	(✓)
Flexible even at extremely low temperatures, excellent shock absorption, good adhesion	Encapsulation and potting of electronic components, sensors and antenna, high frequency application	✓	✓	(✓)
High mechanical strength, excellent chemical resistance, good thermal conductivity, good adhesion	Encapsulation and potting of small components, water protection, chemical protection	✓	✓	✓
Flexible even at low temperatures, high temperature resistance	Encapsulation and potting of electronic components and sensors	✓	✓	✓
High voltage and high temperature resistance	Insulation materials, AC/DC converters, IGBT	✓	✓	✓
Flexible, good adhesion, easy to process, Mura effect-free	Optical bonding	✓	✓	✓
Low halogen content, excellent mechanical damping	Fixing of electronic components, anti-vibration protection	✓	✓	✓
Low halogen content, storable at 20°C, excellent adhesion	Fixing of electronic components	✓	✓	(✓)

✓ highly recommended (✓) depending on product and application - not recommended

Different Ways to Protect Electronic Devices



Typical Application Areas for Bectron® Products



Technical Expertise and Broad Capabilities



In-House Raw Material Production

We process the bulk of our raw materials ourselves, in-house. This gives us full control throughout the development and manufacturing chain.

Crucially for our customers, this makes us a more reliable partner. Because we make our own raw materials, we are more independent from variations in supply. This means that we can deliver consistent quality, in the required quantity, at the required time.

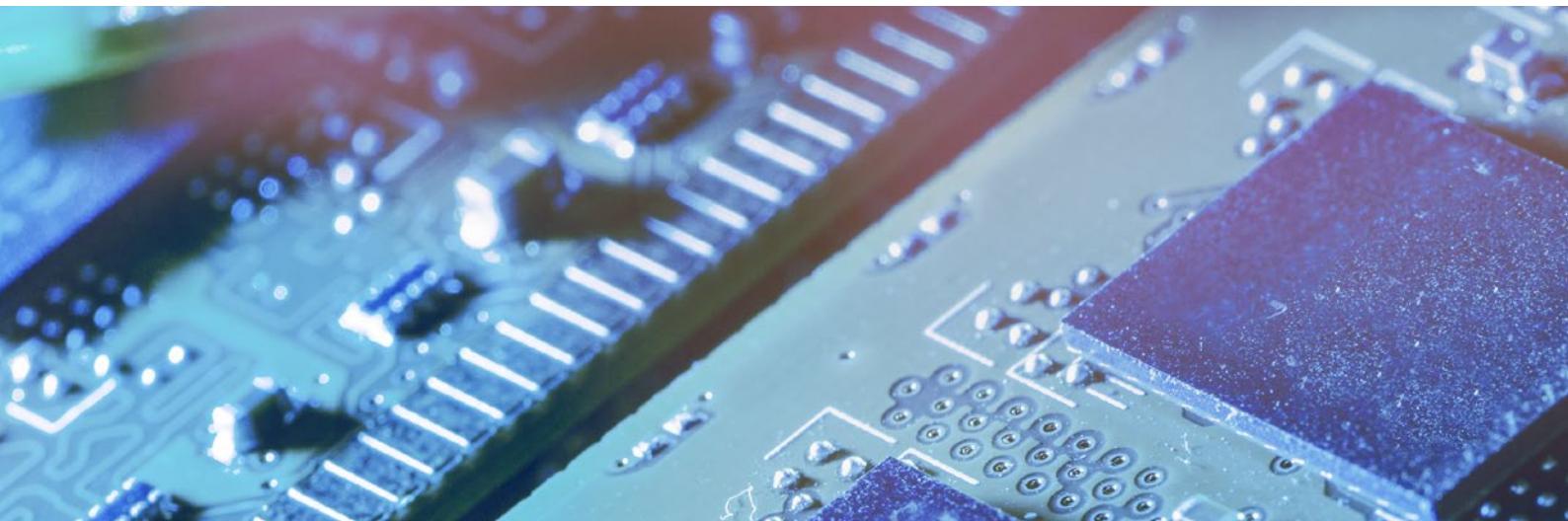
Furthermore, the resulting backward integrated synthesis of many different types of chemistries gives us the edge in innovation. We start product development higher upstream, for higher-performance solutions.

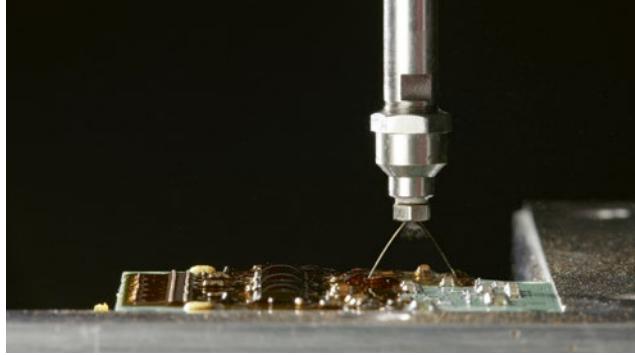
State-of-the-Art Research Laboratories

Our product innovations build on a state-of-the-art laboratory infrastructure and an extensive knowledge of a full range of chemistries. Our researchers combine a deep understanding of acrylics, epoxides, polyurethanes, silicones, and melting resins with expertise in chemistry, engineering, design, and processing.

This enables us to develop solutions that combine different chemical properties. It allows us to make customized solutions for specific customer needs, as market requirements grow.

We are aware of our environmental responsibility, and our product development focuses on environmental solutions.





Application Laboratories

The knowledge how to use our material is an important value-add that we provide. We have deep technical expertise in the application of conformal coatings, pottings and glues. Our application laboratories feature industrial, state-of-the-art UV-curing furnaces, thermal curing, dispensing, and automated lacquering and coating equipment, so that we can test and refine the performance of our products under conditions of actual use.

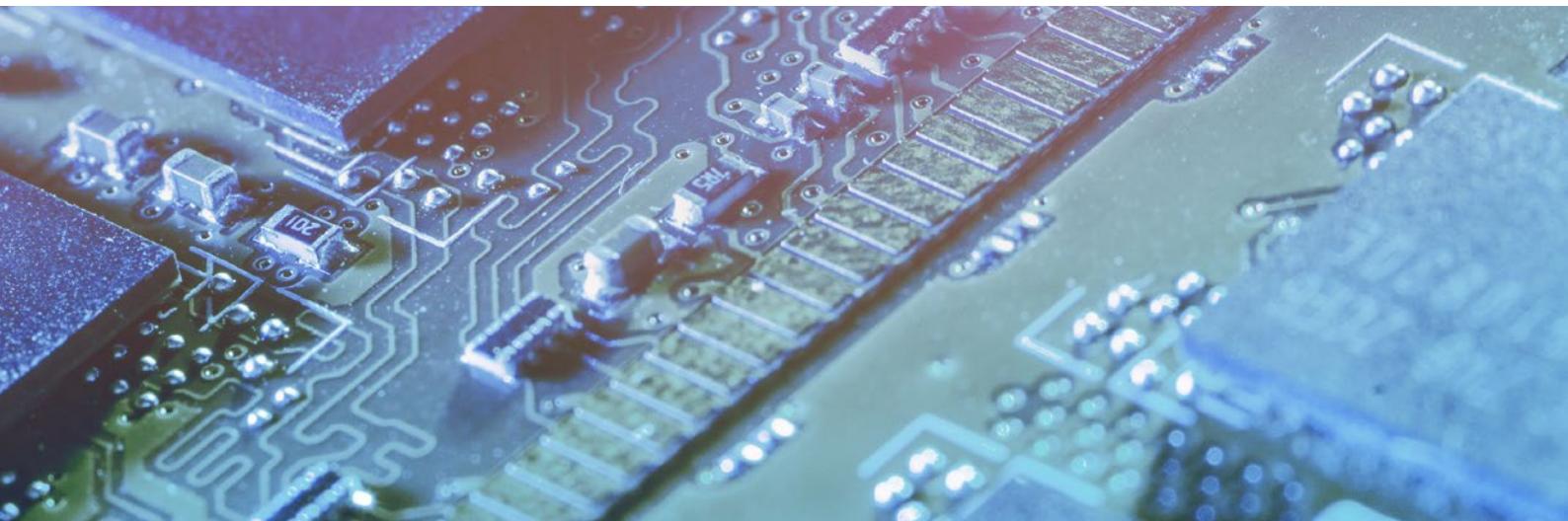
This lets customers know that our products will fit into their production lines without issues. To make sure of it, we provide extensive support in material selection, as well as technical backup to ensure the proper operation of production equipment. Our training in application methods helps customers get the most out of our solutions. We are also supporting customers in applying our materials on their test printed circuit boards.

Quality Testing Laboratories

ELANTAS quality testing laboratories perform a wide range of chemical, mechanical, thermal and electrical tests, on low and high voltage specimens. Our test labs replicate the conditions under which our products will be used, during production as well as later during use. We don't just test our products, we also test devices that use our products, for thermal shock, physical properties, dimensional variation, adhesion, resistance to humidity, resistance against fluids and all other relevant criteria including extended chemical analysis. Our labs do long-term testing such as SIR, climate, thermal shock and salt spray tests.



ELANTAS Europe is a member of, and active contributor to, international standardization committees (ISO, IEC).





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