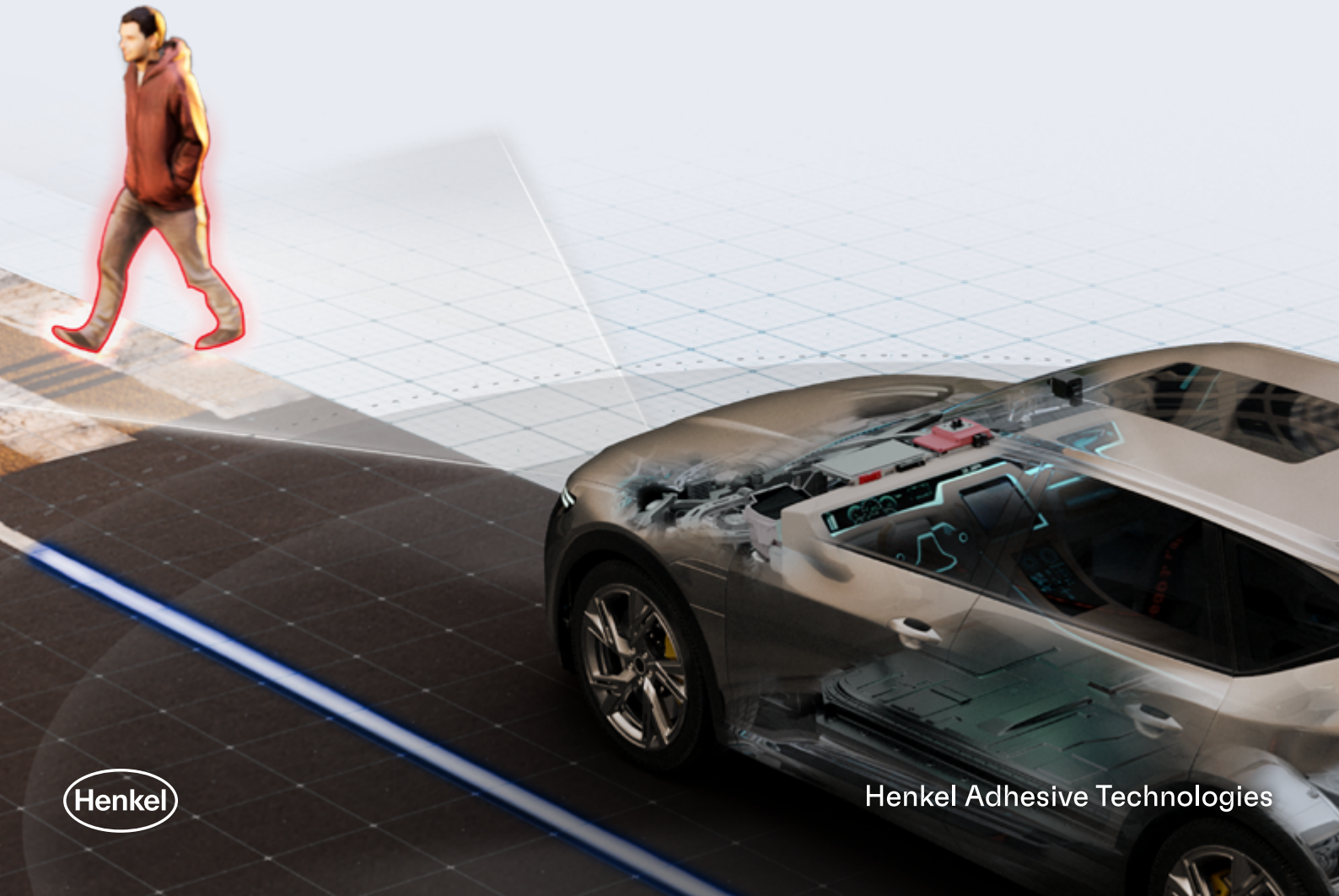
LOCTITE®
TECHNOMELT®
TEROSON®

BERGQUIST®

sonderhoff

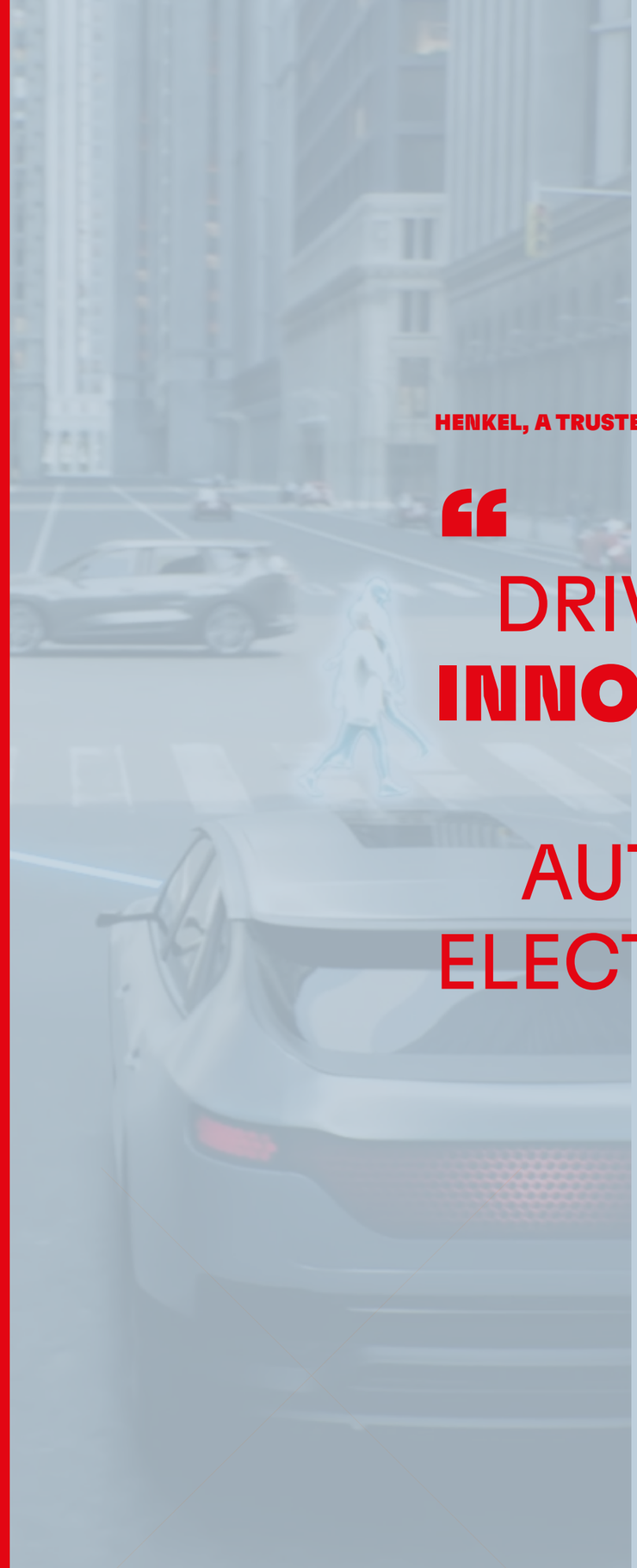
HENKEL SOLUTIONS FOR **AUTOMOTIVE ELECTRONICS** COMPONENTS



Henkel

Henkel Adhesive Technologies

CONTENT



HENKEL, A TRUSTED SOLUTIONS PARTNER

“DRIVING **INNOVATIONS** IN AUTOMOTIVE ELECTRONICS”

ADDRESSING TRENDS IN AUTOMOTIVE ELECTRONICS WITH HENKEL SOLUTIONS

Market Trends

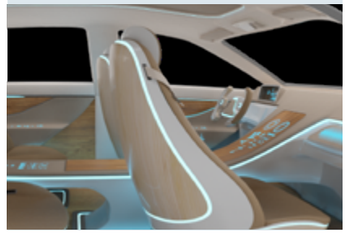
Electrification & Autonomous Driving

Evolution of E/E Architecture

Cost & Process Optimization

Sustainability

Comfort & Entertainment



Key Challenges

- Heat Generation
- Reliability, Safety Regulations
- Environmental Standards
- Manufacturing Efficiency
- Connectivity
- Passenger Comfort

HENKEL SOLUTIONS:

- PROCESS EXPERTISE
- BROAD TECHNOLOGY PORTFOLIO
- EQUIPMENT
- MODELING SIMULATION
- DEBONDING

SUSTAINABILITY *TRENDS*

PIONEER IN OFFERING **SUSTAINABLE SOLUTIONS**

CLIMATE

- **Localization:** Production and cross-regional localization initiatives reduce cradle-to-gate carbon footprint (> 50% CO_2 reduction)
- **CO_2 /energy savings:** Materials that cure with UV, RTV & low energy

CIRCULARITY

- **Bio Based Materials:** 50% biobased content
- **Enable Circularity:** Debonding solutions to reduce scrap during customer application

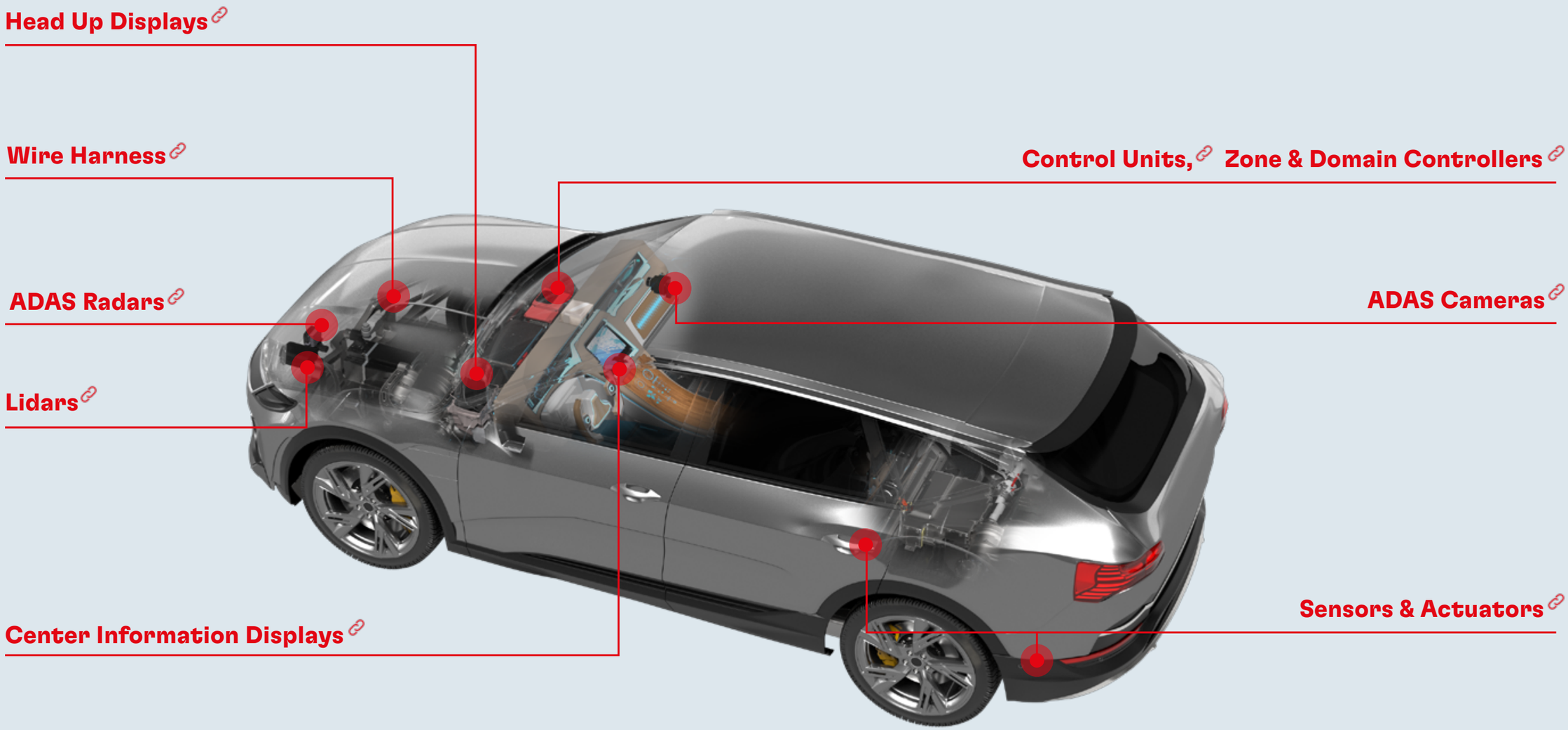
SAFETY

- **Responsible Chemistry:** CMR-free, SVHC free, REACH compliant product composition
- **Prevent Environmental Pollution:** Reduced D4-D6 in silicone, low siloxane VOC product

TRANSPARENCY

- Provide customers **data transparency about the sustainability benefits** of our solutions including the use phase

COMPREHENSIVE SOLUTIONS FOR AUTOMOTIVE ELECTRONIC COMPONENTS



Highlighted applications are selected examples; this list is not exhaustive.

ADAS CAMERAS AND LIDARS

LOCTITE® ABLESTIK NCA 01UV

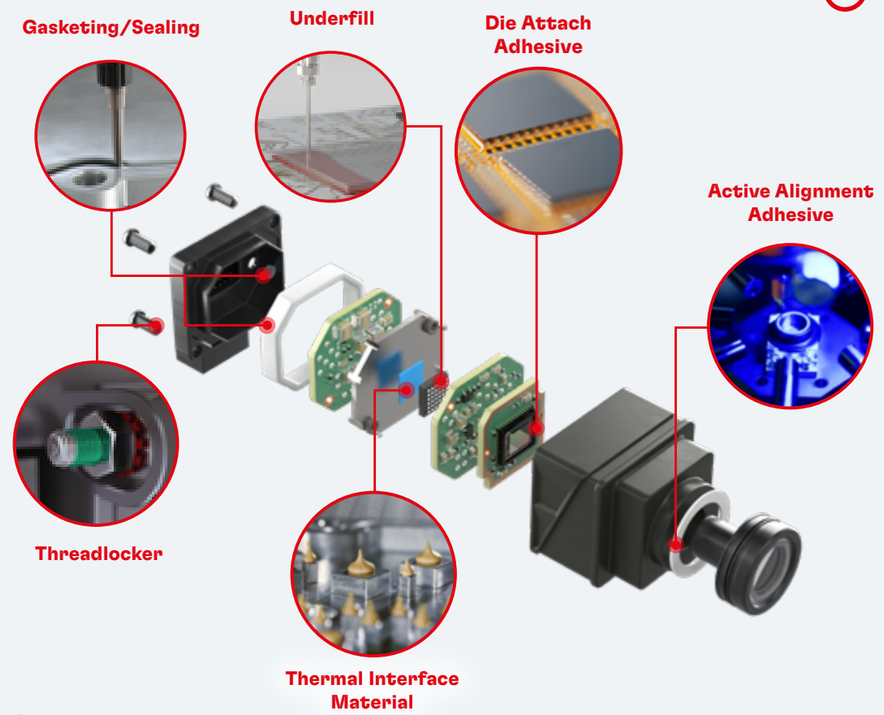
Revolutionary **1-step cure adhesive** for high resolution ADAS cameras and lidars. It allows fast process cycle since it is fully cured within 3 sec of UV LED exposure. It has a high glass transition temperature (Tg), low coefficient of thermal expansion (CTE), low and consistent shrinkage (below 1.4%), and no outgassing.

BERGQUIST LIQUI FORM TLF 4500CGEL-SF

Silicone-free, 1-component curable gel with 4.5 W/mK thermal conductivity. **Thermal interface material** optimized for optical systems passing hazing, fogging, and outgassing tests. Fast dispense and reliable vertical gap stability.

Highlighted products and applications are not exhaustive. Please refer to full product portfolio from page 28 and forward for more information.

CAMERA



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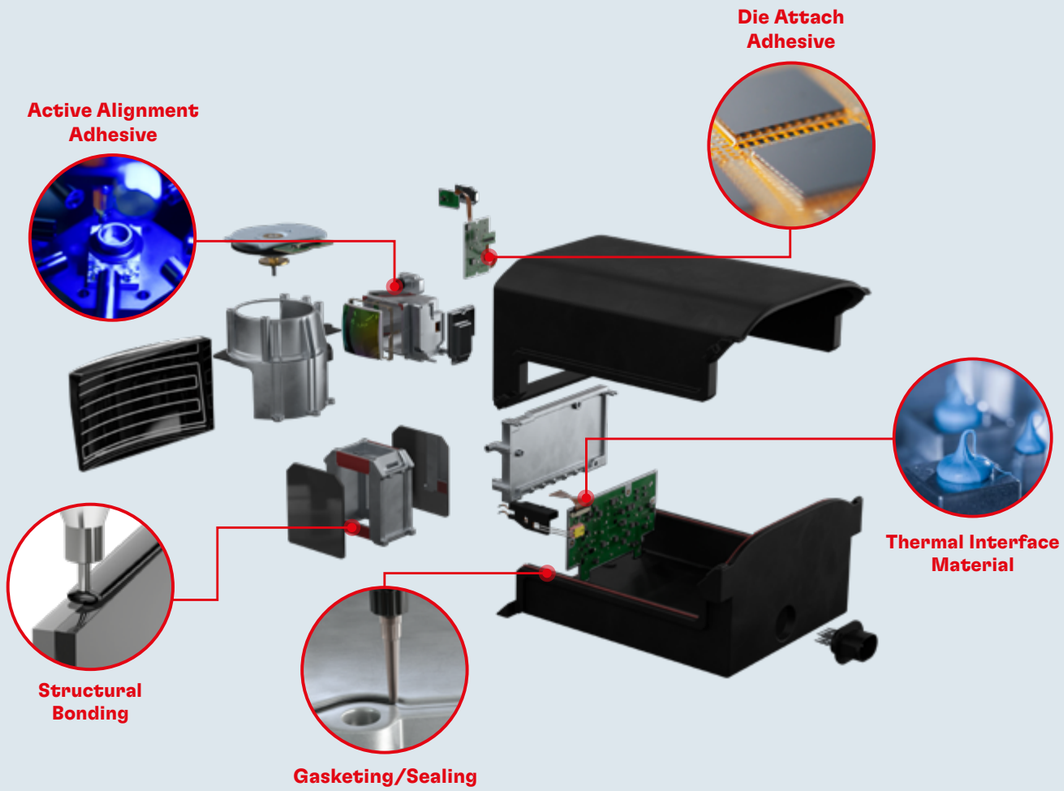
LIDAR



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ADAS RADARS

BERGQUIST GAP PAD TGP EMI 4000

Multifunctional, silicone-free, highly conformable gap pad with 4.0 W/mK thermal conductivity combined with electromagnetic nergy attenuation at frequencies up to 77GHz. **EMI protection** and **thermal management** in one product.

LOCTITE® SI 5972 FC

1-component silicone-based, formed-in-place **gasketing** material (FIPG) that enables a fast process cycle during gasketing with excellent adhesion to aluminum and most plastics.

Highlighted products and applications are not exhaustive. Please refer to full product portfolio from page 28 and forward for more information.

RADAR

Click **graphic** to interact

ADAS DOMAIN CONTROL UNIT

LOCTITE® ECCOBOND UF 1173

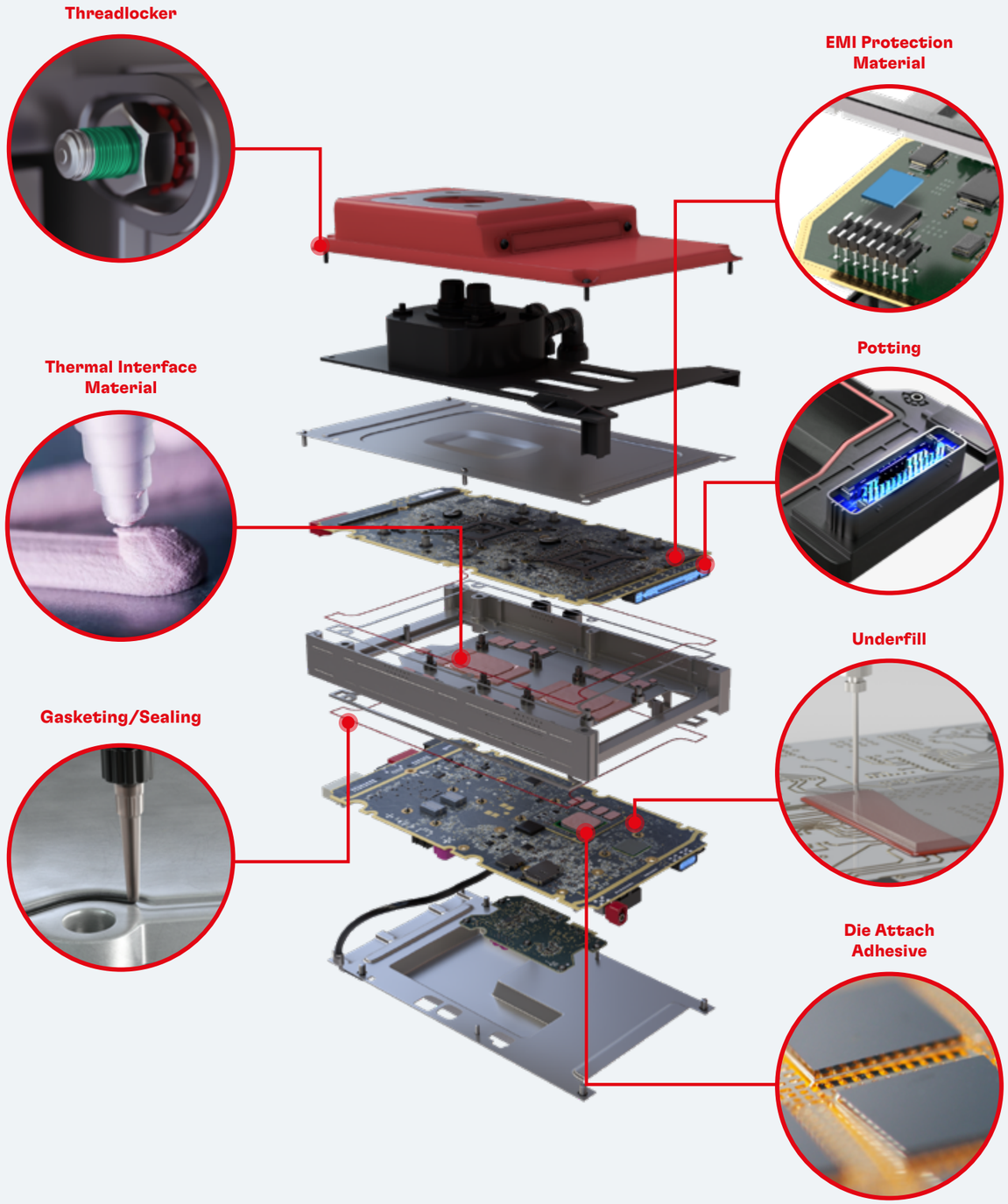
Epoxy-based full capillary board level **underfill** with a high glass transition temperature (Tg) of 159°C and low coefficient of thermal expansion (CTE) that offers uniform and void-free reinforced solder joint reliability in CSP and BGA packages at high operating temperatures, while prioritizing health and safety based on a CMR-free formulation.

BERGQUIST LIQUI FORM TLF 6500CGEL-SF

Silicone free , 1-component moisture or heat cure **thermal gel** with 6.5 W/mK thermal conductivity. Thermal interface material ideal for high-performing ADAS components and domain controllers.

Highlighted products and applications are not exhaustive. Please refer to full product portfolio from page 28 and forward for more information.

ADAS DOMAIN CONTROL UNIT



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ZONE & DOMAIN CONTROLLERS

LOCTITE® SI 5970

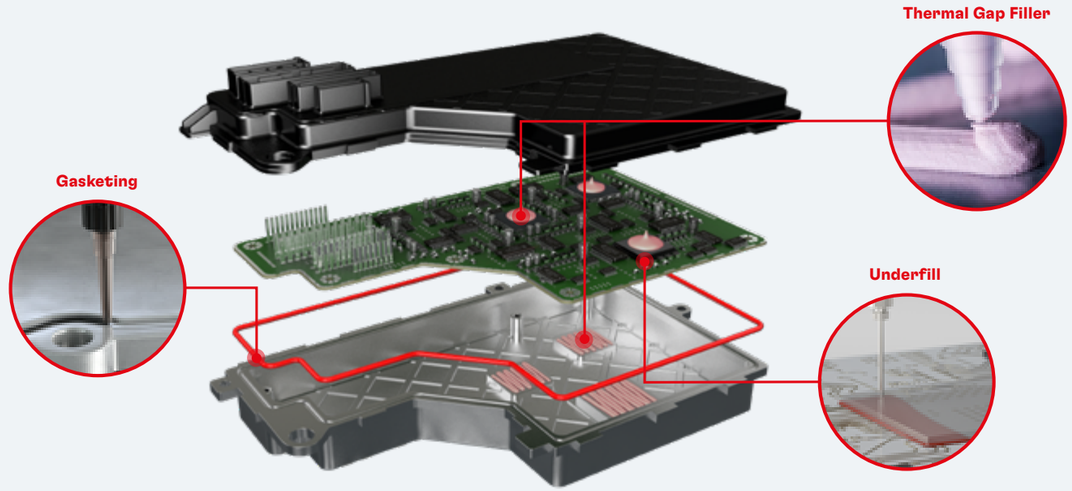
Moisture-cured, 1-part, thixotropic, alkoxy silicone flange **sealant** with great resistance to oil and joint movement, and a rapid skin-over time.

TEROSON® RB 81 VA

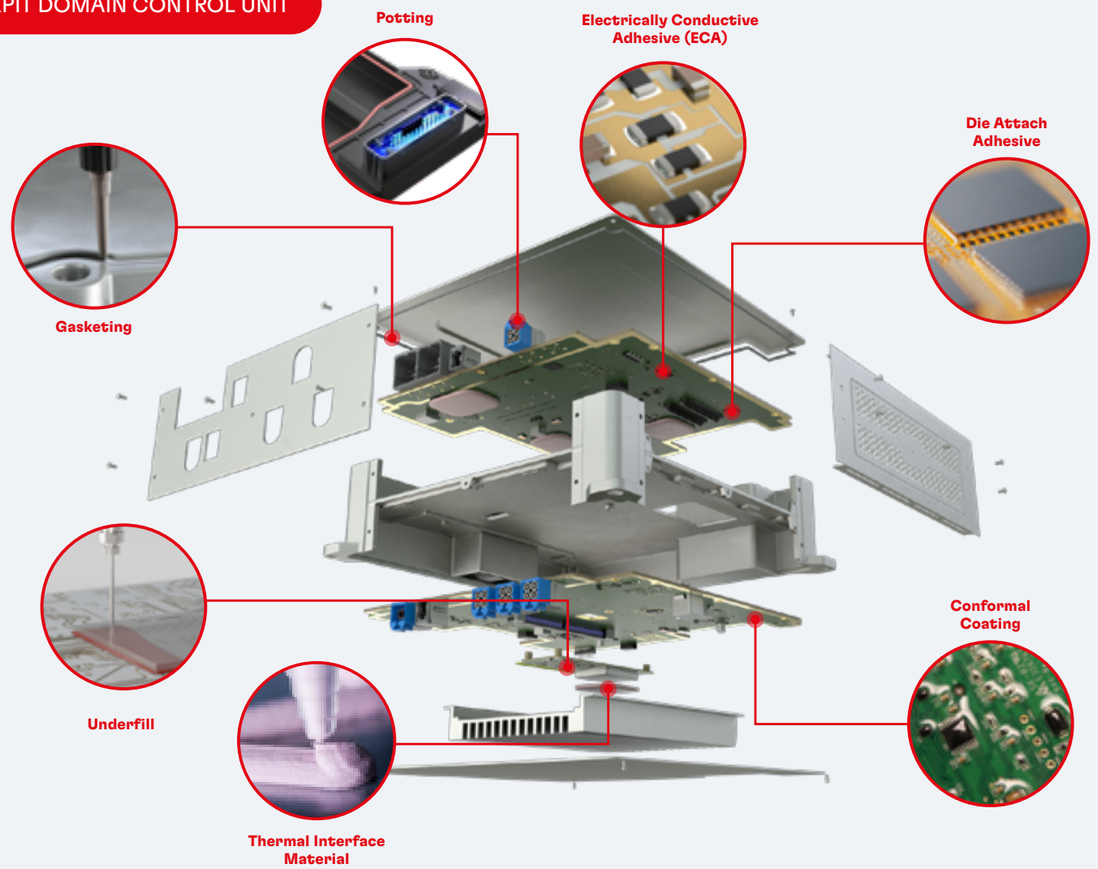
A non-corrosive, high-quality butyl rubber **adhesive sealing tape** with powerful adhesion properties for assembly work.

Highlighted products and applications are not exhaustive. Please refer to full product portfolio from page 28 and forward for more information.

ZONE CONTROLLER



COCKPIT DOMAIN CONTROL UNIT



ELECTRONIC CONTROL UNIT

BERGQUIST GAP FILLER TGF 2900LVO

2-component, silicone-based, low volatile liquid gap filling **thermal interface material** with 2.9 W/mK thermal conductivity. Suited for ultra-thin bondline applications. Offers long working time, and curing can be accelerated by heat.

LOCTITE® AA 5885

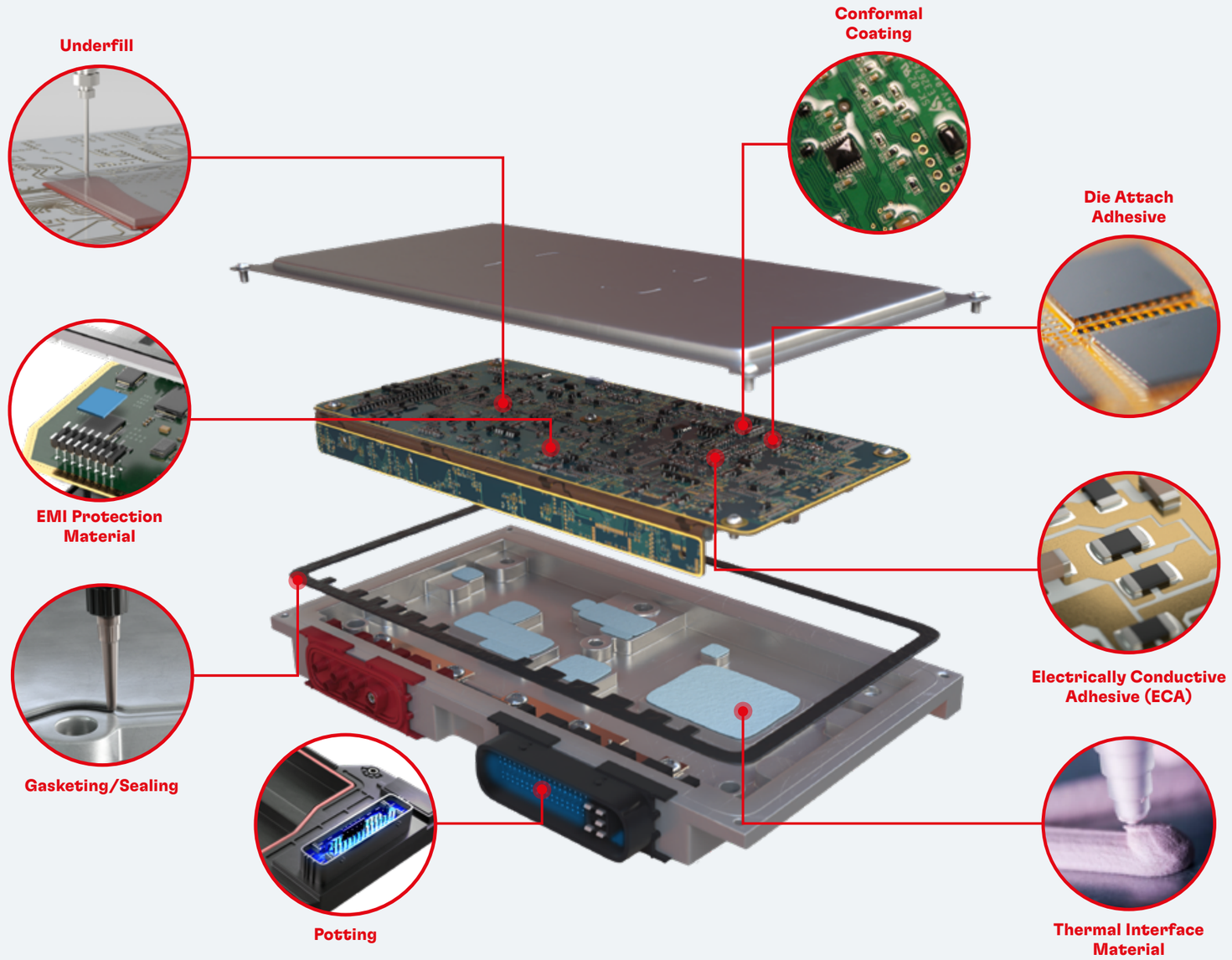
1-component polyacrylate, rapid cure-in-place (CIP) liquid **gasketing** material for high-integrity sealing of electronic control units. Maintains uniform seal across a broad range of service temperatures and offers good adhesion to aluminum and most plastics.

BERGQUIST GAP FILLER TGF 4400LVO

2-component, silicone based and low volatile next generation of liquid **thermal interface material** with 4.4 W/(mK) thermal conductivity. Offers fast and robust dispensing, allows for thin bondline thickness, can be cured at room temperature within 12 hours and allows for an extended working time.

Highlighted products and applications are not exhaustive. Please refer to full product portfolio from page 28 and forward for more information.

ELECTRONIC CONTROL UNIT



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CENTER INFORMATION DISPLAYS

LOCTITE® InvisiPrint

InvisiPrint is an ultra-thin, transparent, fluorine free **anti-fingerprint optical coating** that drastically reduces the visibility of fingerprint smudges on glass surfaces, outgassing of product reduces risk of display fogging.

LOCTITE® AA 8671 PSA AD

1-component, UV/visible light-curable, acrylic **Liquid Optically Clear Adhesive (LOCA)**. Specifically designed for optical bonding of display modules to improve optical performance and durability by filling gaps between the cover lens and TFT module. Turns into a pressure-sensitive adhesive (PSA) upon exposure to UV/visible light.

Highlighted products and applications are not exhaustive. Please refer to full product portfolio from page 28 and forward for more information.

CENTER INFORMATION DISPLAY

Click **graphic** to interact

HEAD UP DISPLAYS

LOCTITE® HHD 3597

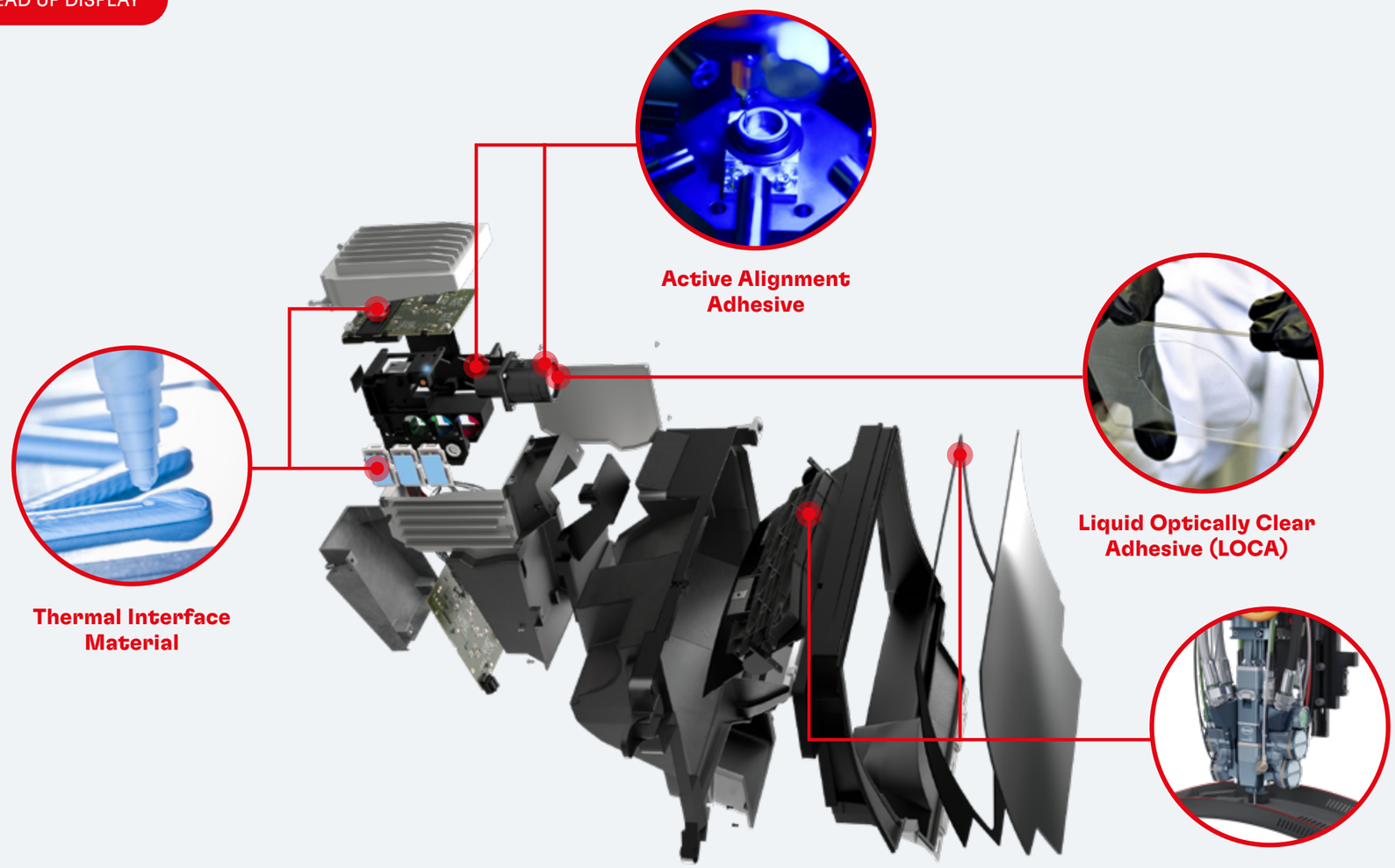
1-component polyurethane-based reactive hotmelt. A soft and flexible **structural bonding** material particularly suitable for bonding dissimilar substrates with short open time and strong adhesion strength.

LOCTITE® SI 5615

2-component silicone-based adhesive with excellent adhesion to different surfaces including glass, metal, and PC/ABS blends. A soft and flexible **structural bonding** solution that is particularly suitable for bonding substrates with different coefficients of thermal expansion (CTE).

Highlighted products and applications are not exhaustive. Please refer to full product portfolio from page 28 and forward for more information.

HEAD UP DISPLAY



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SENSORS & ACTUATORS

LOCTITE® PE 8086

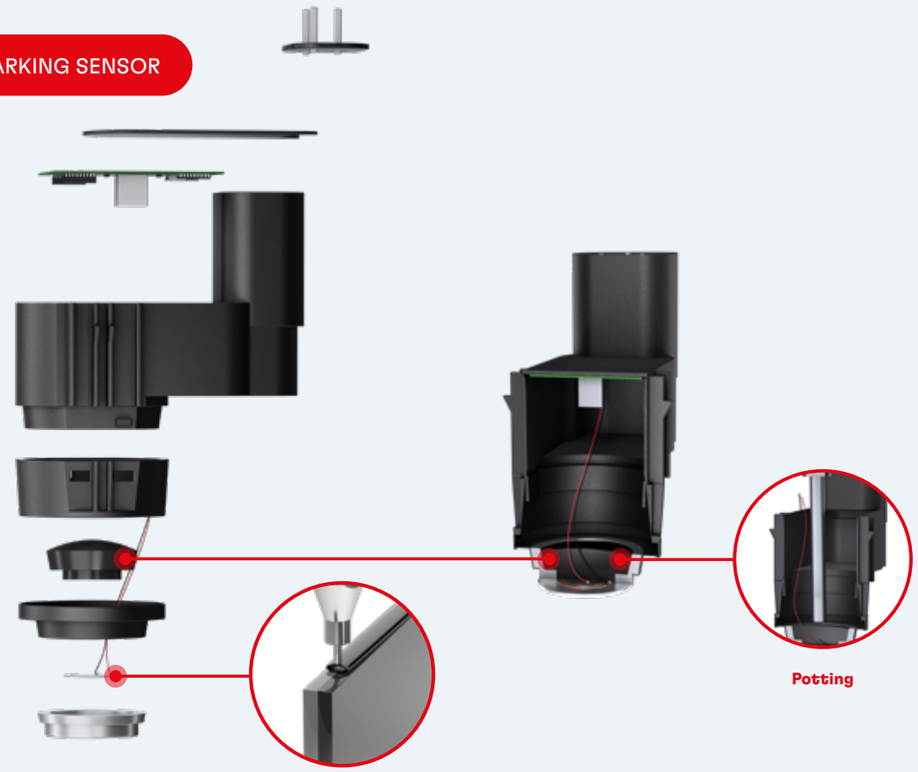
A 2-component, epoxy-based thermal **potting** resin with thermal conductivity of 1.5 W/mK and low mixed viscosity for easy processing. Heat (up to 180°C) and automatic transmission fluid (ATF) resistant, as well as electrically insulating.

TEROSON® PU U137S / U102

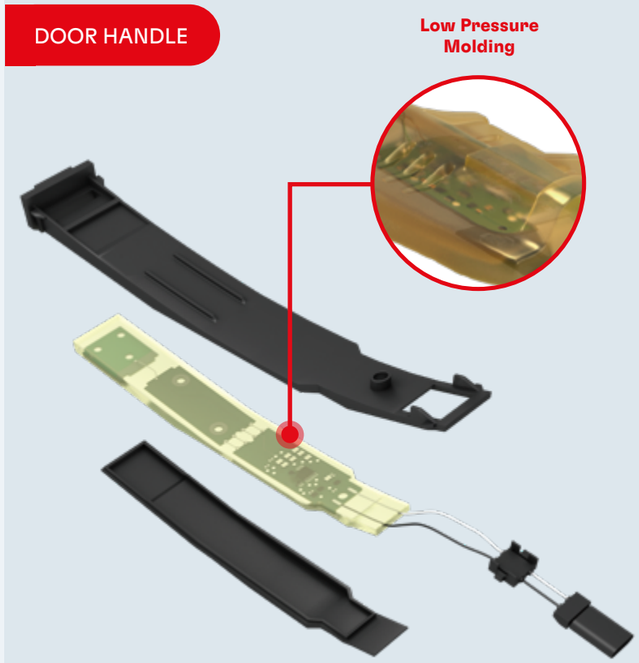
A highly flowable 2-component polyurethane-based **potting** resin with adhesion to common plastic surfaces. Encapsulates sensitive electronic components to provide electrical insulation and protection against shock and vibration.

Highlighted products and applications are not exhaustive. Please refer to full product portfolio from page 28 and forward for more information.

PARKING SENSOR

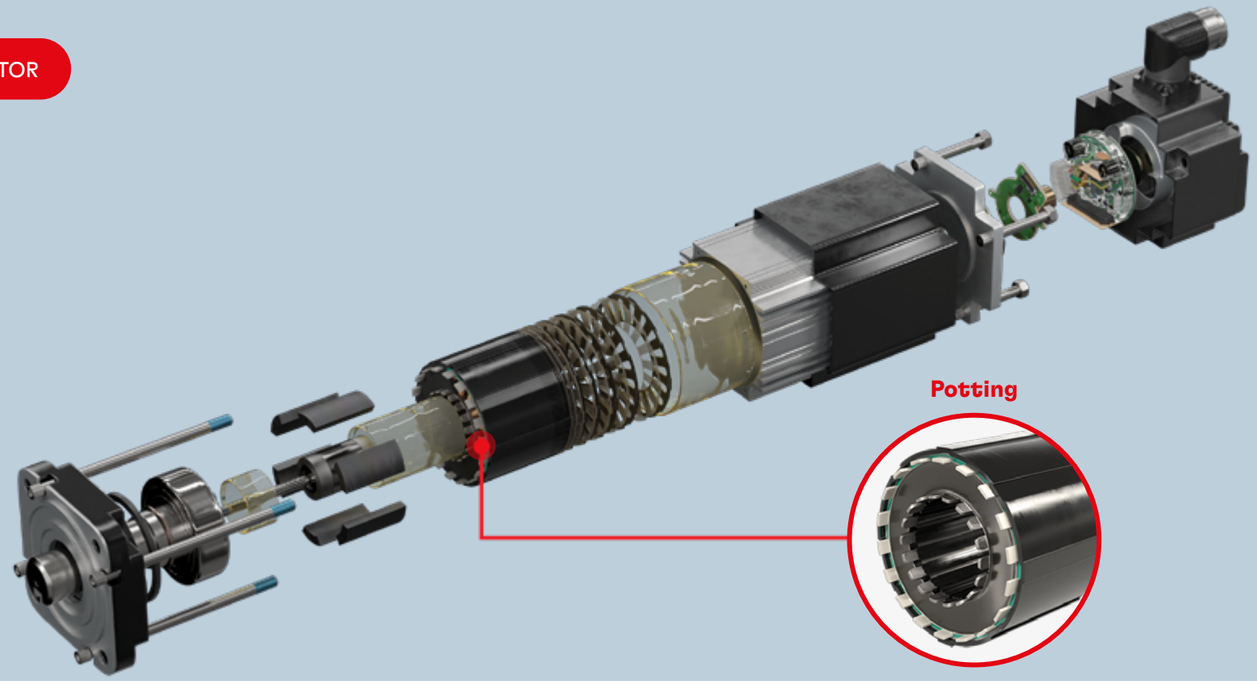


DOOR HANDLE



Structural Bonding

SERVO MOTOR



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WIRE HARNESS

LOCTITE® AA 5832

1-component, rapid UV curing, polyacrylate **potting** product. Silicone-free with excellent adhesion to most plastics and >200% elongation. Heat (up to 150°C) and automatic transmission fluid (ATF) resistant.

TECHNOMELT® PA 638 BLACK

High-performance thermoplastic polyamide for **low pressure molding**. This product can be processed at low processing pressure due to its low viscosity, allowing the encapsulation of fragile components without damage.

FERMADUR A-117-37

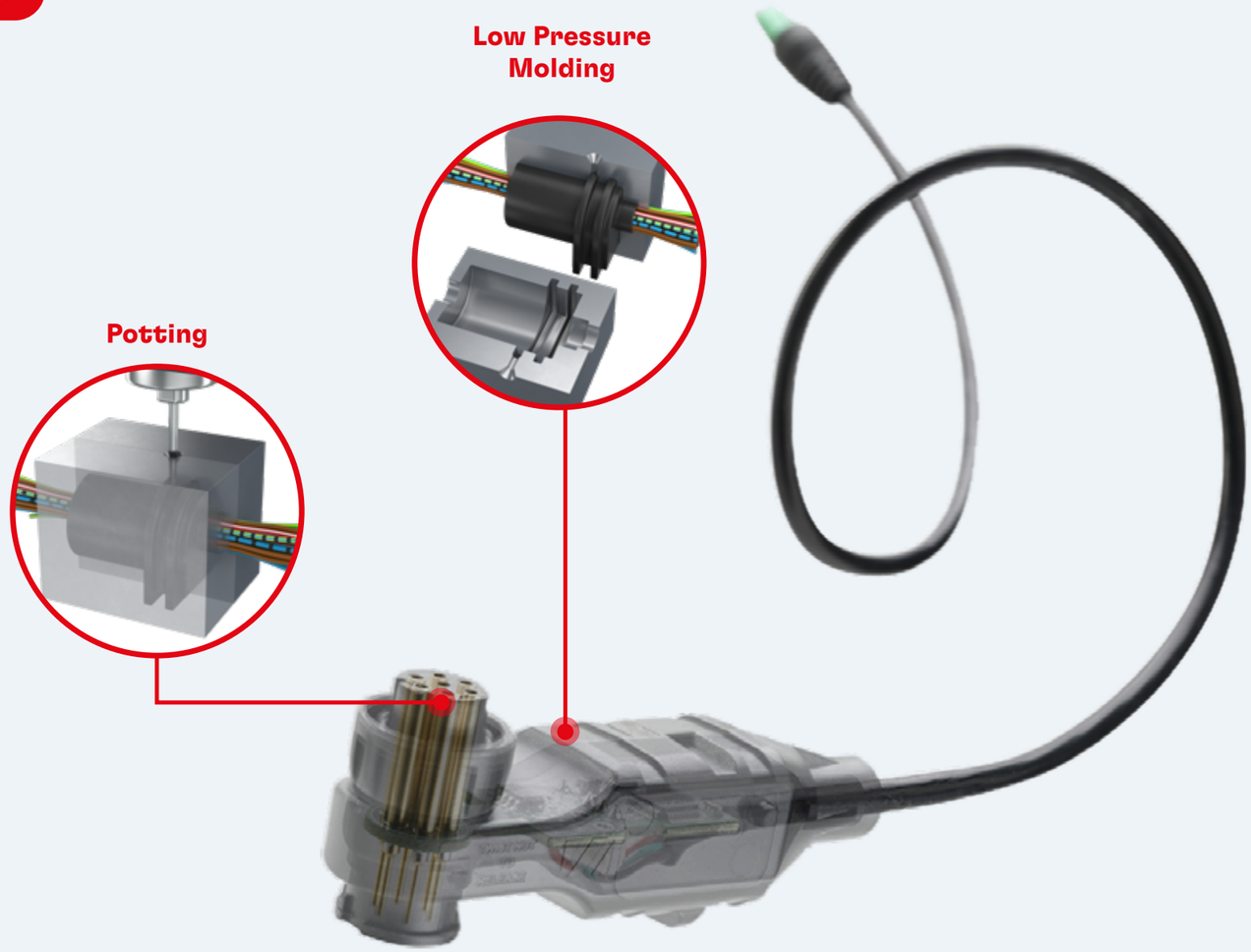
2-component, room temperature cross-linking polyurethane potting compound with a viscosity of 45,000 mPas and a hardness of 80 Shore D.

FERMADUR A-173-1-VP1

2-component, room temperature cross-linking polyurethane potting compound with a viscosity of 1,800 mPas and a hardness of 60 Shore A, e.g. for molding of cable grommets.

Highlighted products and applications are not exhaustive. Please refer to full product portfolio from page 28 and forward for more information.

WIRE HARNESS



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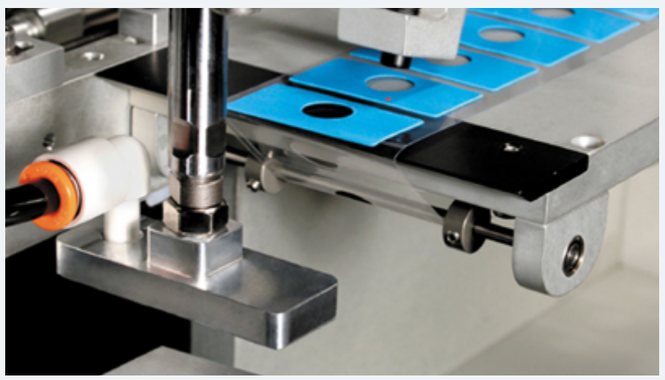
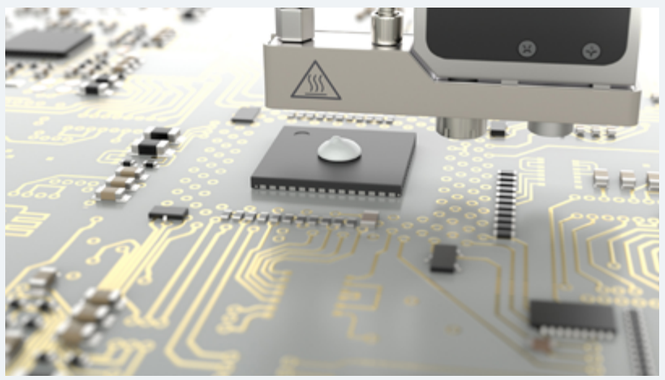
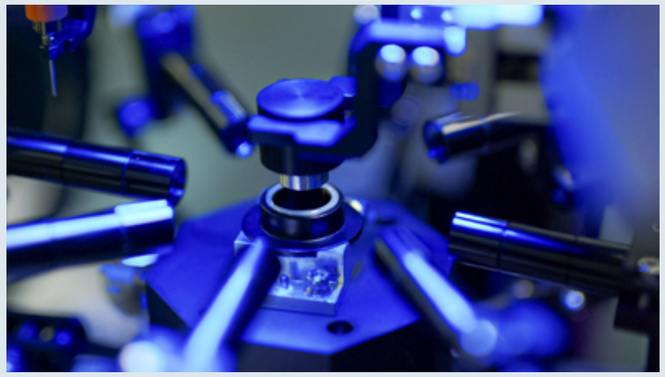
AUTOMOTIVE ELECTRONICS PORTFOLIO ACROSS APPLICATIONS

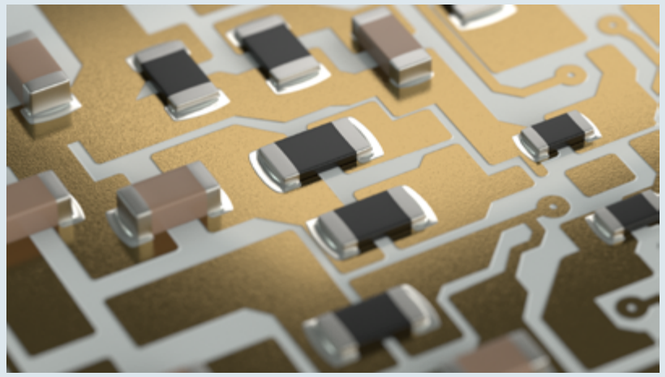
Thermal Management



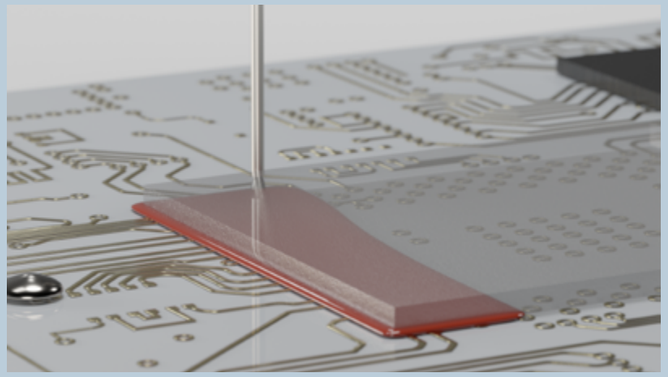


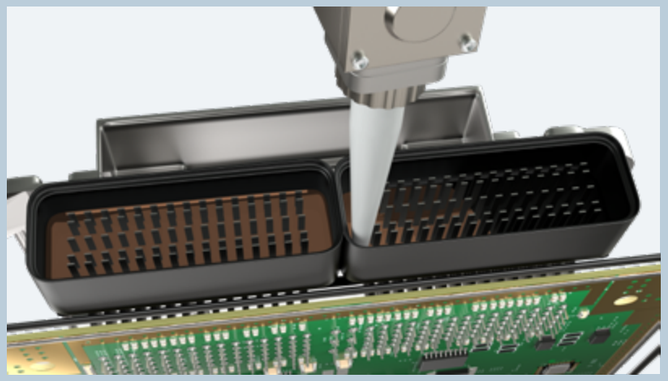
Bonding & Connecting

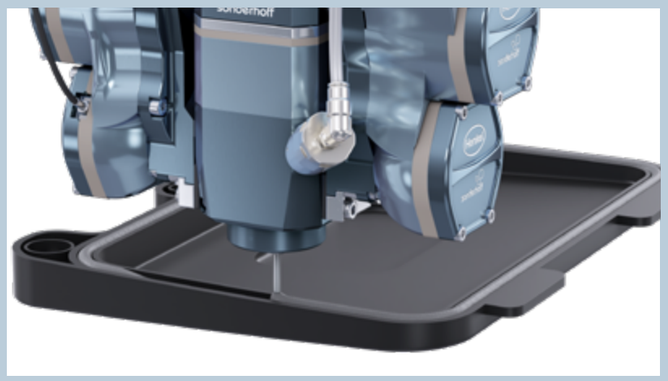




Protecting & Sealing







THERMAL MANAGEMENT SOLUTIONS

Moving Heat Away From Critical Components

As a market leader in thermal management solutions, Henkel delivers high-performance thermal interface materials (TIM) enabling highly efficient, safe, and robust heat management. Effectively dissipating heat is critical to the reliability and longevity of automotive electronic components.

We provide a broad portfolio of solutions, thermal conductivities, and filler technologies to accommodate various heat dissipation requirements and manufacturing preferences, from liquid gap fillers and curable gels, to custom die-cut GAP PAD and SIL-PAD materials.

GAP FILLERS AND CURABLE GELS

Ensure reliability with thermally conductive gap-filling liquid materials that are designed to dissipate heat away from the component.

GAP PAD MATERIALS

Simple-to-use GAP PAD products that are soft, conformable thermal pads that provide effective thermal interfaces between heat sinks and electronic devices.

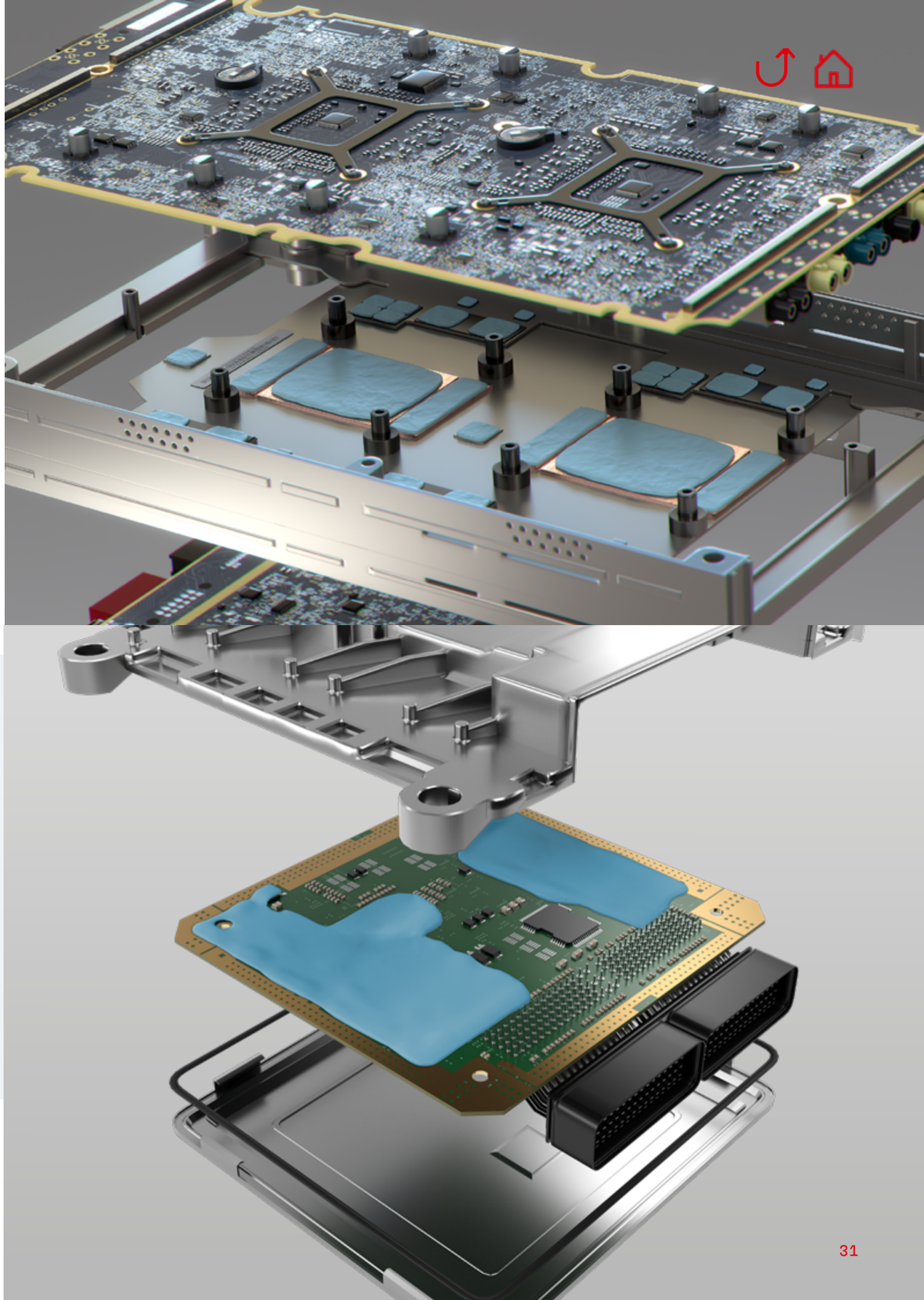
SIL-PAD MATERIALS

Improve heat dissipation in a range of electronic assemblies with minimized thermal resistance. Provide electrically insulating properties with sufficient dielectric strength to withstand high voltage.

THERMALLY CONDUCTIVE ADHESIVES

Combine bonding abilities with thermal management capabilities.

KEEPING AUTOMOTIVE ELECTRONICS COOL



THERMAL INTERFACE MATERIALS

GAP FILLERS

Product Name	Chemistry	Thermal Conductivity (W/mK)	Viscosity (mPa·s)	Dielectric Strength (kV/mm)	Volume Resistivity (Ω·m)	Shore Hardness (Shore 00)	Typical Curing Conditions
BERGQUIST GAP FILLER TGF 1000SR	Silicone	1.0	20,000	19.7	10^{11}	75	20 hr. at 25°C or 10 min. at 100°C
BERGQUIST GAP FILLER TGF 2100LVO	Silicone	2.2	15,000	8	10^{10}	80	10 hr. at 25°C or 5 min. at 100°C
BERGQUIST GAP FILLER TGF 2900LVO	Silicone	2.9	51,000	9.0	10^{11}	55	12 hr. at 25°C
BERGQUIST GAP FILLER TGF 3600	Silicone	3.6	50,000	10.8	10^{09}	35	15 hr. at 25°C or 30 min. at 100°C
BERGQUIST GAP FILLER TGF 4000LVO	Silicone	4.0	A: 800 B: 600	12	10^{10}	82	15 min. at 100°C 240 min. at 40°C 16 hr. at 25°C
BERGQUIST GAP FILLER TGF 4400LVO	Silicone	4.4	50,000	10	10^{10}	90	Room temperature and/or heat cure (refer to TDS)
BERGQUIST GAP FILLER TGF 10000	Silicone	10.4	550,000	12	10^{12}	80	Fully cured after 7 days

CURABLE GELS

Product Name	Chemistry	Thermal Conductivity (W/mK)	Viscosity (mPa·s)	Dielectric Strength (kV/mm)	Volume Resistivity (Ω·m)	Shore Hardness (Shore 00)	Typical Curing Conditions
BERGQUIST LIQUI FORM TLF 4500CGEL-SF	Silicone-free	4.5	52,000	9.8	10^{7}	50	24 hr. at 25°C, 50% RH
BERGQUIST LIQUI FORM TLF 6500CGEL-SF	Silicone-free	6.5	65,000	13.5	10^{7}	75	24 hr. at 25°C, 50% RH

The provided product and technical information should serve as a first indication for your product selection. For further details, please refer to the technical documentation on the product-specific Henkel website (click on product name) and consult a Henkel representative or the technical support group.

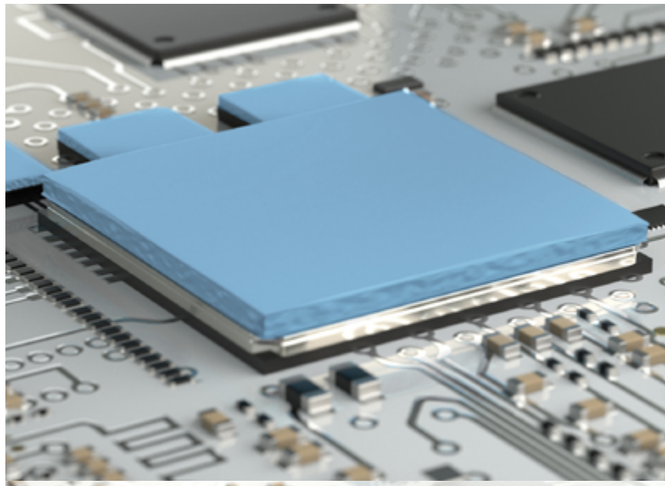
THERMAL INTERFACE MATERIALS

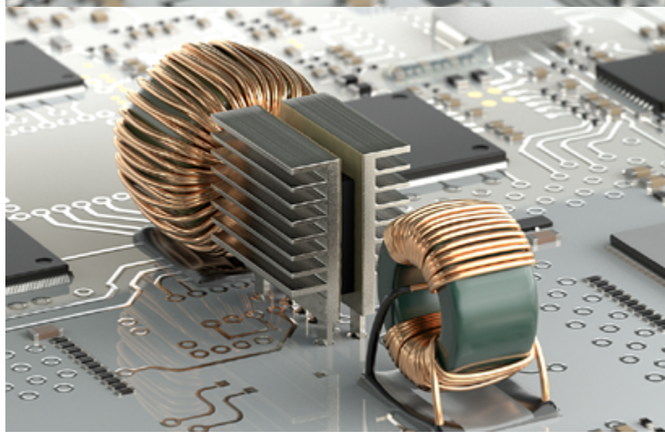
GAP PAD MATERIALS

Product Name	Chemistry	Thermal Conductivity (W/mK)	Dielectric Breakdown Voltage (V)	Volume Resistivity (Ω·m)	Shore Hardness (Shore 00)	Thickness (mm)
BERGQUIST GAP PAD TGP 1000VOUS	Silicone	1.0	6,000	10^{11}	5	0.508 – 6.350
BERGQUIST GAP PAD TGP EMI1000	Silicone	1.0	1,700	10^{10}	5	0.508 – 3.175
BERGQUIST GAP PAD TGP EMI4000	Silicone-free	4.0	1,000	10^{7}	60	0.750 – 2.000
BERGQUIST GAP PAD TGP 2000	Silicone	2.0	5,000	10^{11}	30	0.508 – 3.175
BERGQUIST GAP PAD TGP HC3000	Silicone	3.0	5,000	10^{10}	15	0.508 – 3.175
BERGQUIST GAP PAD TGP HC5000	Silicone	5.0	5,000	10^{10}	35	0.508 – 3.175
BERGQUIST GAP PAD TGP 5000	Silicone	5.0	5,000	10^{09}	35	0.508 – 3.175
BERGQUIST GAP PAD TGP 7000ULM	Silicone	7	5,000	10^{11}	75	0.5 – 3.18
BERGQUIST GAP PAD TGP 12000ULM	Silicone	12	6,200	10^{12}	68	1.0 – 4

SIL-PAD MATERIALS

Product Name	Chemistry	Thermal Conductivity (W/mK)	Dielectric Breakdown Voltage (V)	Volume Resistivity (Ω·m)	Shore Hardness (Shore A)	Thickness (mm)
BERGQUIST SIL PAD TSP K1300TAC	Silicone/ Polyimide	1.3	6,000	10^{12}	90	0.150
BERGQUIST SIL PAD TSP 1600S	Silicone	1.6	5,500	10^{10}	92	0.229
BERGQUIST SIL PAD TSP 1800ST	Silicone	1.8	3,000	10^{11}	75	0.203
BERGQUIST SIL PAD TSP 3500	Silicone	3.5	4,000	10^{11}	90	0.254 – 0.508





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THERMAL INTERFACE MATERIALS

THERMALLY CONDUCTIVE ADHESIVES

Product Name	Chemistry	Thermal Conductivity (W/mK)	Dielectric Strength (kV/mm)	Volume Resistivity (Ω·m)	Shore Hardness	Viscosity (mPa·s)	Typical Curing Conditions
LOCTITE® EA 9497	Epoxy	1.4	–	10^{15}	83 (Shore D)	Part A: 16,000 Part B: 24,000	24 hr. at 22°C followed by 30 min. at 80°C
LOCTITE® SI 5404	Silicone	1.0	17.1	10^{12}	58 (Shore A)	65,000	10 min. at 150°C or 15 min. at 130°C
BERGQUIST LIQUIBOND TLB SA2005RT	Silicone	2.0	10.8	10^{11}	65 (Shore A)	70,000	Room temperature with further improved properties at elevated temperatures
LOCTITE® ABLESTIK TE 3530	Epoxy	2.3	–	10^{13}	87 (Shore D)	60,000	30 min. at 100°C or 15 min. at 120°C or 10 min. at 150°C
BERGQUIST LIQUIBOND TLB SA3500	Silicone	3.5	10.0	10^{10}	90 (Shore A)	Part A: 45,000 Part B: 35,000	20 min. at 125°C or 10 min. at 150°C

PHASE CHANGE MATERIALS

Product Name	Chemistry	Thermal Conductivity (W/mK)	Format	Dielectric Breakdown Voltage (V)	Volume Resistivity (Ω·m)	Thickness (mm)	Phase Change Temperature (°C)	Typical Drying Conditions (At 0.051 mm thickness)
LOCTITE® EIF 5000	Hydrocarbon	0.4	Foil	2,000	10^{10}	0.0508	60	–
BERGQUIST HI FLOW THF 1500P	Hydrocarbon	1.5	Foil	5,000	10^{12}	0.114 – 0.140	55	–
BERGQUIST HI FLOW THF 1600P	Hydrocarbon	1.6	Foil	5,000	10^{12}	0.102 – 0.127	52	–
LOCTITE® TCP 7000	Hydrocarbon	3.0	Printable	–	–	–	45	30 hr. at 22°C or 22 min. at 60°C or 3 min. at 125°C
LOCTITE® TCF 4000 PXF	Hydrocarbon	3.4	Foil	–	–	0.2/0.4	45	–
LOCTITE® TCP 4000D	Hydrocarbon	3.4	Dispensable	–	–	–	45	5 hr. at 22°C
BERGQUIST HI FLOW THF 5000UT	Silicone	5.3	Foil	–	10^{10}	8, 10 & 12	45	-40°C – 150°C

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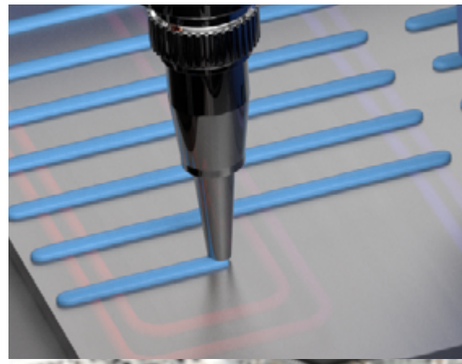
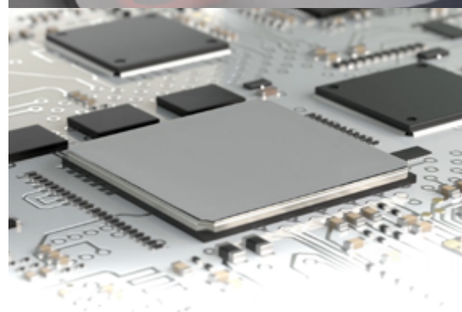


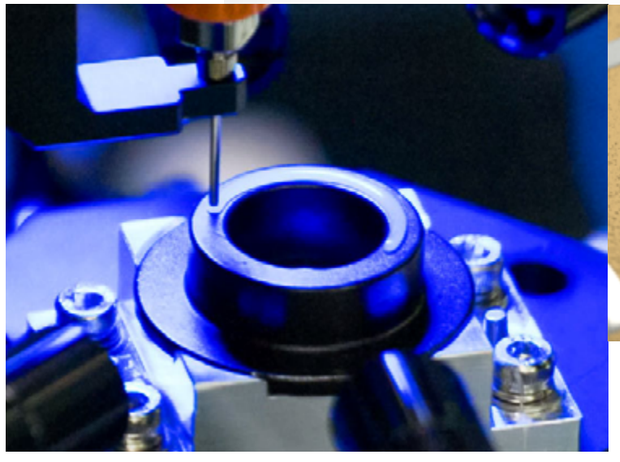


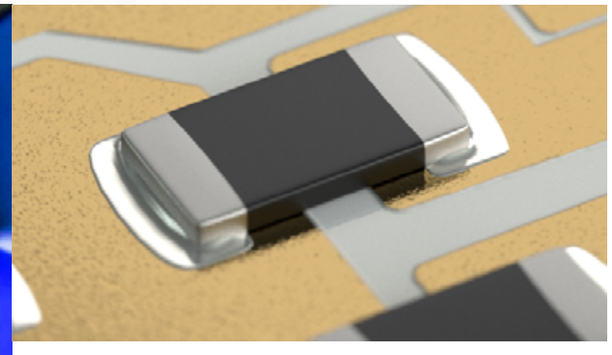
BONDING & CONNECTING SOLUTIONS

Making Strong and Reliable Bonds

Henkel's range of conductive and non-conductive adhesives for electronics offers strong interconnections for on-demand, long-term, and reliable performance. These adhesives are formulated using a variety of base chemistries, each of which is designed to provide manufacturers with choice and flexibility for varying requirements, including low-temperature curing.

Our highly reliable bonding solutions provide advantages for your process cycle in a variety of applications, from ADAS camera and lidar module assembly to optical bonding for automotive displays, and everything in between.





ACTIVE ALIGNMENT ADHESIVES

Achieve optical active alignment with advanced dual-cure adhesives designed for reliable functionality in ADAS camera and lidar modules.

ELECTRICALLY CONDUCTIVE ADHESIVES (ECA)

Improve reliability with lead-free solder alternatives ideal for SMT components, thermal, structural bonding, and EMI applications.

STRUCTURAL BONDING ADHESIVES

Provide tough, durable bonds to a wide variety of surfaces in engineering applications.

INSTANT BONDING ADHESIVES

Generate high-performance bonding of materials in seconds with a robust range of instant adhesives.

DIE ATTACH ADHESIVES

Conductive and non-conductive adhesives with excellent dispensability and high-reliability performance are designed to meet today's challenging, high-density die architectures.

RETAINING & CORE PLUG MATERIALS

Liquid threadlocker adhesives secure nuts, bolts, and threaded fasteners in place to ensure safe and reliable mechanical locking devices.

OPTICAL BONDING ADHESIVES

Liquid optically clear adhesives (LOCA) are designed for optimized lamination processes in optical bonding, enabling optical components for improved contrast ratio, impact, heat, and moisture resistance.

WHEN IT COMES TO BONDING, FAILURE IS NOT AN OPTION

BONDING & CONNECTING SOLUTIONS

ACTIVE ALIGNMENT ADHESIVES

Product Name	Chemistry	Color	Cure Shrinkage (volume %)	Tg, TMA (°C)	CTE 1 Below Tg (ppm/°C)	CTE 2 Above Tg (ppm/°C)	Viscosity (mPa·s)	Thixotropic Index	Recommended Substrates	Typical Curing Conditions
LOCTITE® 3296	Epoxy cationic	Milky white	1.4	189 (DMA)	22	–	33,700	4.3	Aluminum, FR4	3 sec. at 1,000 mW/cm² + 30 min. at 120°C
LOCTITE® ABLESTIK NCA 01UV	Epoxy cationic	Milky white	1.4	135 (DMA)	19	–	30,600	5.6	Aluminum, FR4	3 sec. at 1,000 mW/cm²
LOCTITE® 3217	Epoxy/acrylate	Amber	5.6	82	53	178	37,600	2.9	Aluminum, FR4, plastics	5 sec. at 100 mW/cm² + 30 min. at 80°C
LOCTITE® ABLESTIK NCA 2280	Epoxy/acrylate	Black	3.0	90	45	156	54,000	4.4	Aluminum, FR4, plastics	2 sec. at 100 mW/cm² + 30 min. at 80°C
LOCTITE® ABLESTIK NCA 2280LV	Epoxy/acrylate	Black	2.9	75	54	160	32,800	4.8	Aluminum, FR4, plastics	2 sec. at 200 mW/cm² + 30 min. at 80°C
LOCTITE® ECCOBOND UV 9052	Acrylate	Translucent light blue	6.0	50	49	–	6,400	6.0	Aluminum, FR4, plastics	5 sec. at 1,000 mW/cm² + RT

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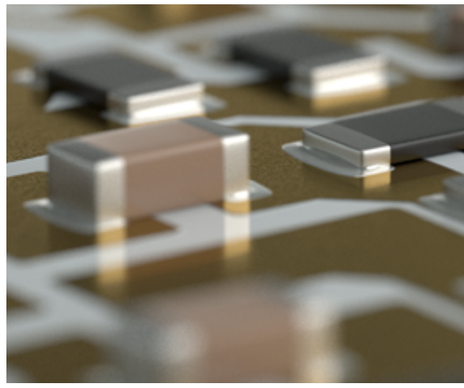
BONDING & CONNECTING SOLUTIONS

ELECTRICALLY CONDUCTIVE ADHESIVES (ECA)

Product Name	Chemistry	Filler Type	Metallization	Viscosity (mPa·s)	Thixotropic Index	Volume Resistivity (Ω·m)	Modulus at 25°C (MPa)	Tg, TMA (°C)	Typical Curing Conditions
LOCTITE® ABLESTIK CE 3103WLV	Epoxy	Silver	Non-noble	20,000	5.5	8×10^{-6}	4,500	114	10 min. at 120°C or 3 min. at 150°C
LOCTITE® ABLESTIK 84-1LMISR4	Epoxy	Silver	Noble	8,000	5.6	2×10^{-6}	3,900	120	60 min. at 175°C
LOCTITE® ABLESTIK CE 8500	Modified epoxy	Silver	Noble	130,000	1.4	2×10^{-6}	2,500	24	90 min. at 120°C or 40 min. at 150°C or 15 min. at 175°C
LOCTITE® ABLESTIK ICP 4000	Silicone	Silver	Noble	30,000	2.8	6×10^{-7}	100	-45	60 min. at 130°C or 35 min. at 140°C



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BONDING & CONNECTING SOLUTIONS

DIE ATTACH ADHESIVES

Product Name	Chemistry	Electrically Conductive	Color	Viscosity (mPa·s)	Thixotropic Index	Tg ,TMA (°C)	CTE (ppm/°C)	Modulus at 25°C (MPa)	Typical Curing Conditions
LOCTITE® ABLESTIK ABP 2030SCR	Proprietary	Yes	Silver	11,600	4.6	35	45	3,300	90 sec. at 150°C
LOCTITE® ABLESTIK ABP 2035SCR	Hybrid Chemistry	No	Red	9,830	4	118	50	1,500	2 min. at 120°C; 60 min. at 80°C
LOCTITE® ABLESTIK 8700K	Epoxy	No	White	45,000	–	165	Below Tg: 20 Above Tg: 55	4,000	60 min. at 175°C
LOCTITE® ABLESTIK XE 80100	Epoxy	No	Off-white	12,000	1.2	45	140	10,000	90 min. at 120°C or 60 min. at 150°C or 15 min. at 175°C

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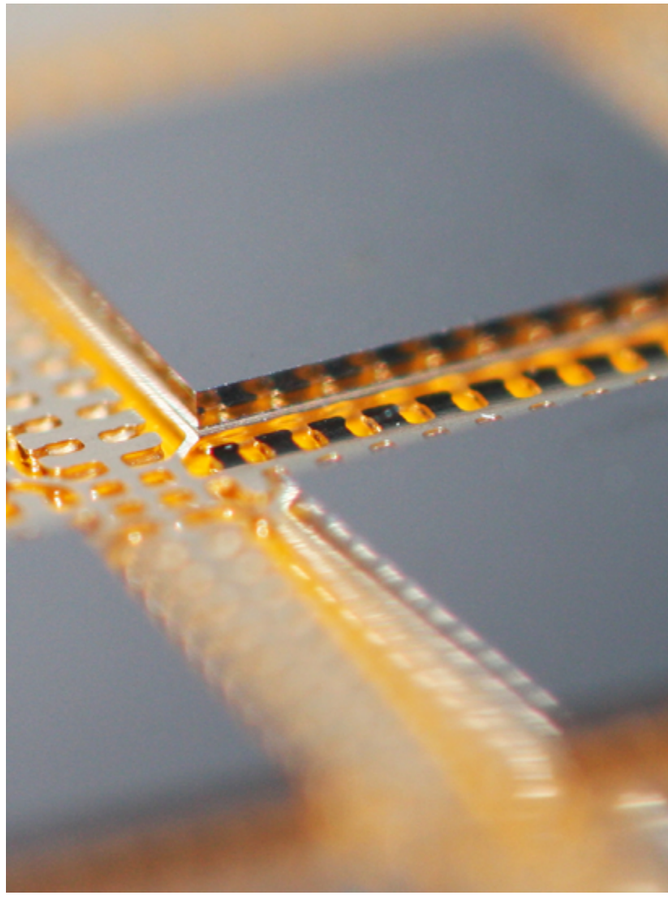
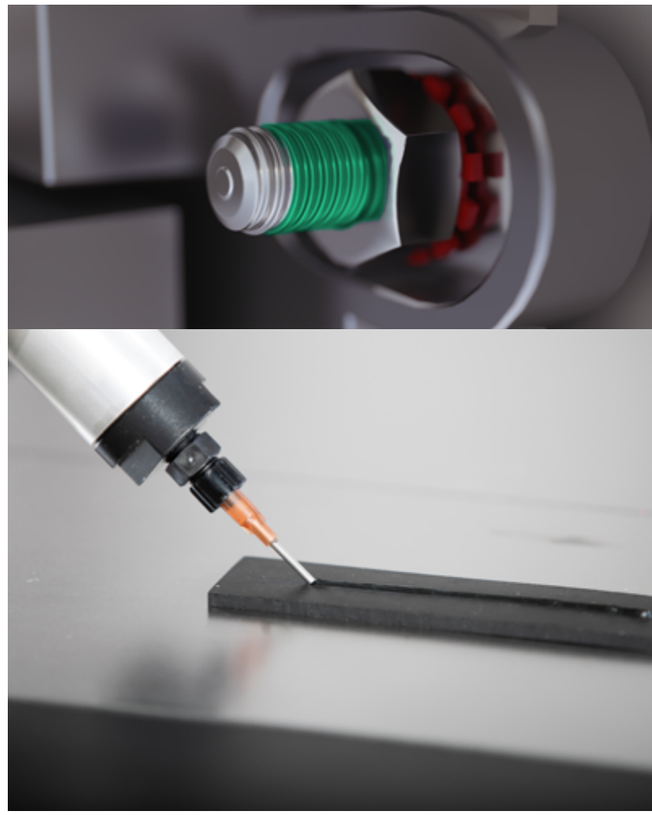


BONDING & CONNECTING SOLUTIONS

STRUCTURAL BONDING ADHESIVES

Product Name	Chemistry	Color	Components	Viscosity (mPa·s)	Typical Curing Conditions
LOCTITE® EA 9492	Epoxy	White opaque	2-component	A: 45,000 B: 27,000	24 hr. at RT.*
LOCTITE® EA 9502	Epoxy	Dark gray	1-component	17,000 – 40,000	30 min. at 120°C or 15 min. at 150°C

Product Name	Chemistry	Color	Components	Viscosity (mPa·s)	Tensile Strength (MPa)	Elongation (%)	Shore Hardness	Typical Curing Conditions
LOCTITE® AA 3494	Acrylic	Transparent	1-component	5,000 – 7,000 mPa·s	22.5	190	65 (Shore D)	UV cure 220 – 260 nm
LOCTITE® 3609	Epoxy	Red	1-component	0.16 – 2.0 Pa·s	–	–	–	90 – 120 sec. at 150°C
LOCTITE® 3621	Epoxy	Red	2-component	0.5 – 3.0 Pa·s	–	–	–	90 – 120 sec. at 150°C
LOCTITE® SI 5610	Silicone	Black	2-component	A: 20,000 mPa·s B: 10,000 – 80,000 mPa·s	1.35	210	30 – 50 (Shore A)	8 hr. at 22°C or 4 hr. at 22°C
LOCTITE® SI 5615	Silicone	Red	2-component	A: 30,000 – 100,000 B: 10,000 – 70,000	1.28	230	34 (Shore A)	7 days at RT
LOCTITE® MS 9650**	Silane-modified polymer	Black	1-component or 2-component	800,000	3.0	180	60 (Shore A)	7 days at RT
TEROSON® MS 647	Silane-modified polymer	White, Grey, Black	1-component or 2-component	800,000	2.8	300	50 (Shore A)	7 days at RT
LOCTITE® MS 650*	Silane-modified polymer	Black	1-component or 2-component	800,000	3.0	180	60 (Shore A)	7 days at RT



* Next generation of TEROSON® MS 650

** Can be accelerated with heat.

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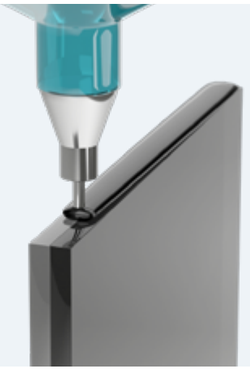
BONDING & CONNECTING SOLUTIONS

STRUCTURAL BONDING ADHESIVES

Product Name	Chemistry	Color	Components	Viscosity (mPa·s)	Tensile Strength (MPa)	Elongation (%)	Shore Hardness	Typical Curing Conditions
LOCTITE® HHD 3597	Polyurethane	Black	1-component	6,000	7.0	800	35 (Shore D)	7 days at RT
LOCTITE® UK 2043/2143	Polyurethane	Black	2-component	A: 150,000 B: 22,000	1.5	–	–	RT
LOCTITE® UK 2073/2173	Polyurethane	Black, Grey	2-component	A: 70,000 – 90,000 B: 40,000 – 80,000	3.5 – 4.5	300	60 – 70 (Shore A)	1 day at RT



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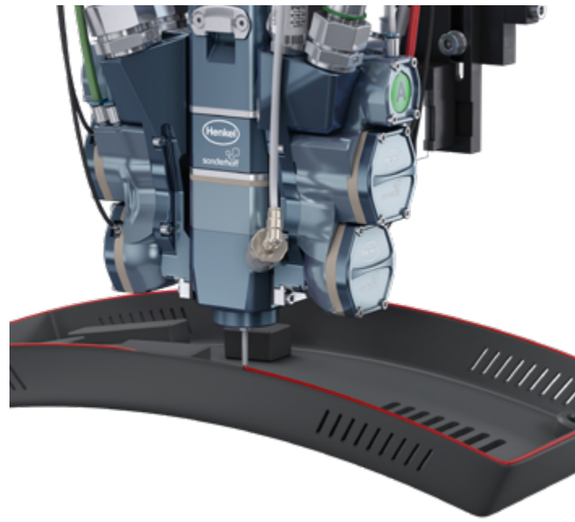
BONDING & CONNECTING SOLUTIONS

RETAINING & CORE PLUG MATERIALS

Product Name	Chemistry	Color	Viscosity (mPa·s)	Typical Curing Conditions
LOCTITE® 638	Acrylic	Green	2,000 – 3,000	7 days at RT or 4 hr. at 40°C
LOCTITE® 648	Acrylic	Green	400 – 600	7 days at RT or 8 hr. at 40°C



INSTANT BONDING ADHESIVES

Product Name	Chemistry	Color	Viscosity (mPa·s)	Typical Curing Conditions
LOCTITE® 480	Cyanoacrylate	Black	100 – 200	40 sec. at RT

OPTICAL BONDING ADHESIVES

Product Name	Chemistry	Components	Viscosity (mPa·s)	Refractive Index	Typical Curing Conditions
LOCTITE® AA 8671 PSA AD	Acrylic	1-component	10,000 – 30,000	1.48	10 sec. at 450 mW/cm²

OPTICAL COATING

Product Name	Chemistry	Components	Hardness	Water Contact Angle	Transparency	Typical Curing Conditions
LOCTITE® AF 8800++						
LOCTITE® InvisiPrint	Polysiloxane	1-component	9 H	> 77°	> 99%	Heat (Spray: 40 min. at 120°C PVD*: 20 min. at 40°C)

* Heat is optional

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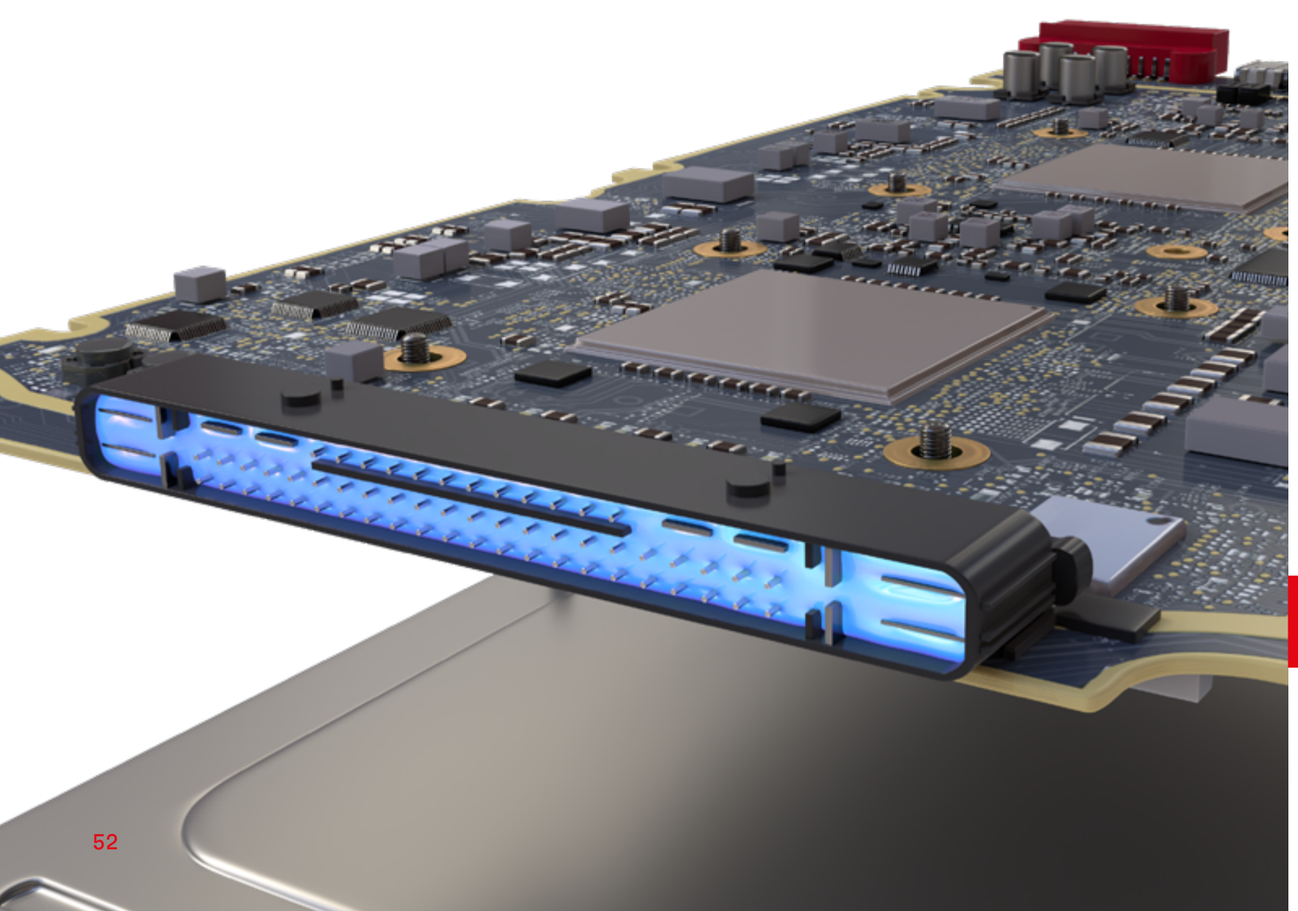
PROTECTING & SEALING SOLUTIONS

Superior Protection From Board to System Level

Protecting automotive electronics from adverse environmental conditions is essential for long-term reliable performance. Stray electromagnetic waves, thermal stresses, and harsh environmental conditions can all contribute to performance issues if not adequately addressed in the engineering and design phase.

Our protecting materials safeguard electronics at all levels, enabling automotive electronics manufacturers to meet rigorous automotive industry standards and produce highly reliable end products.



UNDERFILLS

Protect solder joints from mechanical and thermal stresses and reinforce ball grid array components (BGA, CSP, Flip Chips) to ensure reliability in harsh environmental conditions.

POTTING MATERIALS

Provide superb resistance to mechanical shock, vibration, moisture, dust, chemicals, and extreme temperature variations.

CONFORMAL COATINGS

Protect PCBs against harsh environmental conditions and chemicals while conserving weight and space.

GASKETING/SEALING MATERIALS

Reliable bonding and sealing of enclosures with resistance to high temperatures, pressure, and vibrations. Broad range of form-in-place (FIPG) and cure-in-place liquid (CIPG) gasketing and plugging materials for liquid and gas-tight seams, joints, and flanges.

LOW PRESSURE MOLDING MATERIALS

Designed to simplify the assembly processes for faster and more efficient protection of sensors, connectors, cables, and wire harness assemblies.

EMI PROTECTION MATERIALS

Thermal interface materials, gaskets, and coatings with an electromagnetic absorption or shielding feature.

PRINTED ELECTRONICS

Add versatility to electronic design, enabling electronic circuits to be printed onto thin, flexible, and lightweight substrates for improved product designs.

PROTECTION FOR LONG-LASTING, RELIABLE PERFORMANCE

PROTECTING & SEALING SOLUTIONS

CAPILLARY UNDERFILLS

Product Name	Chemistry	Reworkable	Viscosity (mPa·s)	Modulus at 25°C (MPa)	Tg, TMA (°C)	CTE (ppm/°C)	Typical CuringConditions
LOCTITE® ECCOBOND E 1172 A	Epoxy	No	17,000	10,000	135	27	6 min. at 135°C or 3 min. at 150°C or 30 min. at 100°C + 5 min. at 135°C (low stress cure)
LOCTITE® ECCOBOND E 1216M	Epoxy	No	4,000	2,970	125	35	3 min. at 165°C or 4 min. at 150°C or 10 min. at 130°C
LOCTITE® ECCOBOND FP4531	Epoxy	No	10,000	7,600	161	28	7 min. at 160°C
LOCTITE® ECCOBOND UF 1173	Epoxy	No	7,500	6,000	160	26	5 min. at 150°C

EDGE/CORNERBOND MATERIALS

Product Name	Chemistry	Reworkable	Viscosity (mPa·s)	Modulus at 25°C (MPa)	Tg, TMA (°C)	CTE (ppm/°C)	Typical Curing Conditions
LOCTITE® 3296	Epoxy	No	33,700	10,900	189 (DMA)	22	3 sec. at 1,000 mW/cm² + 30 min at 120°C
LOCTITE® ECCOBOND EO 1072	Epoxy	No	80,000	6,700	135	43	5 min. at 140 – 150°C
LOCTITE® 3705	Acrylate	No	44,000	–	77	66	80 sec. at 30 mW/cm²

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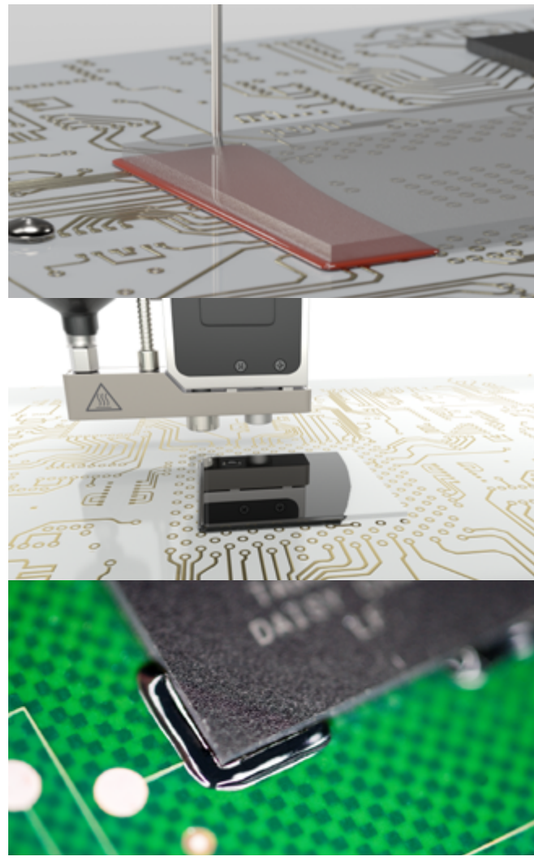
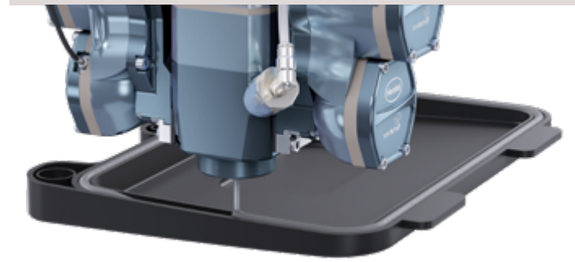


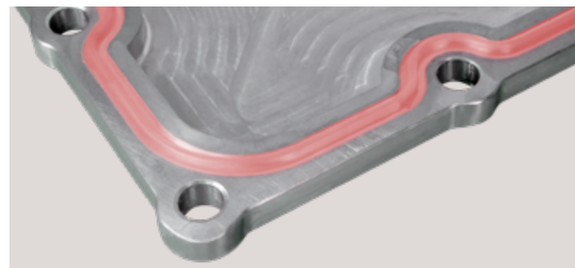
PROTECTING & SEALING SOLUTIONS

GASKETING/SEALING MATERIALS

Product Name	Chemistry	Components	Tensile Strength (MPa)	Elongation (%)	Shore Hardness (Shore A)	Typical Curing Conditions	Tack-Free Time
LOCTITE® AA 5821	Polyacrylate	1-component	1.3	175	20 – 30 (Shore A)	2 weeks at 25°C	–
LOCTITE® AA 5884	Polyacrylate	1-component	4.0	200	55 – 65	30 sec. at 270 mW/cm²	–
LOCTITE® AA 5885	Polyacrylate	1-component	3.3	300	27	60 sec. at 70 mW/cm²	–
BERGQUIST LIQUI BOND TLB 400SLT	Silicone	2-component	2.10	400	40	7 days at 25°C or 12 hr. at 50°C or 30 min. at 85°C	–
LOCTITE® SI 5039	Silicone	1-component	1.0	150	32 – 48	60 sec. at 70 mW/cm² + 72 hr. at RT	≤ 20 min.
LOCTITE® SI 5470	Silicone	1-component	0.3	163	54 (Shore 00)	60 sec. at 70 mW/cm²	15 sec.
LOCTITE® SI 5607	Silicone	2-component	1.0	80	30 – 50	7 days at 25 ± 2°C, 50 ± 5% RH	25 – 70 min.
LOCTITE® SI 5615	Silicone	2-component	1.28	230	34	7 days at RT	12 min.
LOCTITE® SI 5643	Silicone	2-component	0.3	–	–	–	–
LOCTITE® SI 5970	Silicone	1-component	1.5	200	44	21 days at RT	25 min.
LOCTITE® SI 5972 FC	Silicone	1-component	1.5	200	30 – 40	< 21 days at RT	18 min.
LOCTITE® SI 5999	Silicone	1-component	2.4	100	45 – 75	7 days at RT	≤ 30 min.
TEROSON MS 647	Silane Modified Polymer	1-component	2.8	300	50 (Shore A)	–	–
TEROSON MS 9399	Silane Modified Polymer	2-component	3	150	55 (Shore A)	–	–

Product Name	Chemistry	Color	Consistency	Density g/cm³	Solids (%)	Tack	Service Temperature (°C)
TEROSON RB 81VA	Butyl Rubber	Black	Soft, plasto-elastic	1.26	100	Very strong	-40°C – 80°C





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PROTECTING & SEALING SOLUTIONS

POTTING MATERIALS (1-COMPONENT)

Product Name	Chemistry	Color	Viscosity (mPa·s)	Shore Hardness	Typical Curing Conditions
LOCTITE® STYCAST EO 1058	Epoxy	Black	50,000	90 (Shore D)	120 min. at 140°C or 180 min. at 125°C
LOCTITE® STYCAST EO 7038	Epoxy	Black	40,000	92 (Shore D)	180 min. at 130°C or 120 min. at 140°C
LOCTITE® SI 5031	Silicone	Light yellow, translucent	5,800	28 – 40 (Shore A)	60 sec. at 70 mW/cm² + 72 hr. at RT
LOCTITE® AA 5831 M	Polyacrylate	Translucent	2,500 – 7,000	15 (Shore A)	30 sec. at 270 mW/cm² + 14 days at RT
LOCTITE® AA 5832	Polyacrylate	Amber	5,000	64 (Shore A)	< 30 sec. at 70 mW/cm² + 7 days at RT

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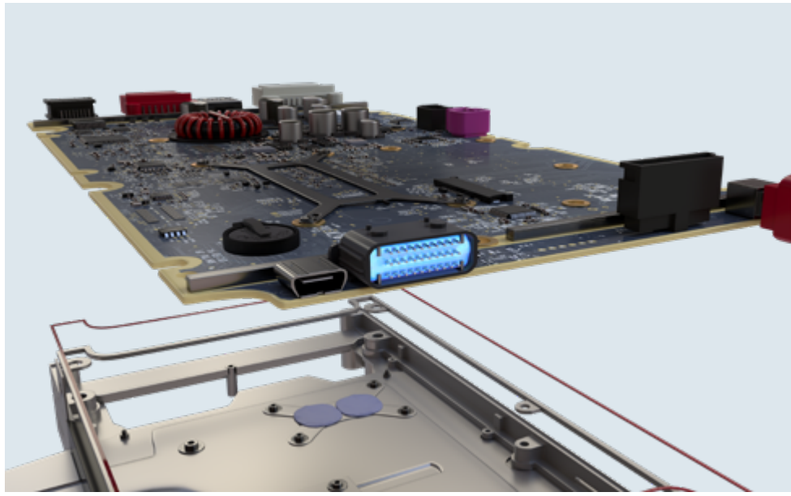

PROTECTING & SEALING SOLUTIONS

POTTING MATERIALS (2-COMPONENT)

Product Name	Chemistry	Color	Thermal Conductivity (W/mK)	Viscosity (mPa·s)	Mix Ratio by Weight	Shore Hardness	Typical Curing Conditions
LOCTITE® PE 8086	Epoxy	Gray	1.44	A: 228,000 B: 40	10:1	88 (Shore D)	60 min. at 90°C + 60 min. at 130°C
LOCTITE® SI 5643	Silicone	Yellow	1.4	A: 5,000 B: 5,000	1:01	55 – 65	80°C for 30 min. or 25°C for 24 hr.
LOCTITE® STYCAST 2651-40 W1 CAT 9*	Epoxy	Black	0.48	10,000	100:9	90 (Shore D)	24 hr. at RT†
LOCTITE® STYCAST 2750T	Epoxy	Black	0.50	6,700	100:17.5	89 (Shore D)	2 hr. at 80°C
LOCTITE® STYCAST 2850FT CAT 9*	Epoxy	Black	1.25	58,000	100:3.5	96 (Shore D)	24 hr. at RT†
LOCTITE® STYCAST E 2534 FR CAT 9	Epoxy	Blue	1.50	38,600	100:4	90 (Shore D)	24 hr. at RT†
LOCTITE® STYCAST U 2500 HTR	Polyurethane	Black	0.50	8,000	100:7.6	75 (Shore A)	4 hr. at 60°C + 2 hr. at 100°C – 120°C
TEROSON® PU U137 S / U102	Polyurethane	Pink to gray	0.30	A: 7,000 B: 100	100:13.3	30 (Shore A)	24 hr. at RT†
TEROSON® PU U333 / U102	Polyurethane	Black	0.30	A: 1,600 B: 100	100:50	30 (Shore A)	24 hr. at RT†
FERMADUR A-117-37 / B-RF	Polyurethane	Black	–	45,000	5:1	80 (Shore D)	11 min. at RT*

* Different catalysts are available to allow different final properties. Cure schedule differs depending on catalyst used.
† Can be accelerated with heat.

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PROTECTING & SEALING SOLUTIONS

LOW PRESSURE MOLDING MATERIALS

Product Name	Chemistry	Color	Shore Hardness	Application Temperature Range (°C)	Operating Temperature (°C)	Key Differentiator
TECHNOMELT® PA 638 BLACK	Polyamide	Black	90 (Shore A)	200 – 240	-40 – +130	–
TECHNOMELT® PA 641	Polyamide	Amber	92 (Shore A)	210 – 240	-40 – +125	–
TECHNOMELT® PA 646 BLACK	Polyamide	Black	92 (Shore A)	200 – 240	-40 – +130	High temperature resistant
TECHNOMELT® PA 652 N	Polyamide	Amber	77 (Shore A)	200 – 230	-40 – +100	–
TECHNOMELT® PA 653	Polyamide	Amber	77 (Shore A)	180 – 230	-40 – +100	–
TECHNOMELT® PA 657 N BLACK	Polyamide	Black	77 (Shore A)	180 – 230	-40 – +100	Best adhesion moderate resistance up to 100°C
TECHNOMELT® PA 658	Polyamide	Black	77 (Shore A)	210 – 230	-40 – +100	Hydrolysis resistant
TECHNOMELT® PA 673	Polyamide	Amber	90 (Shore A)	210 – 240	-40 – +140	–
TECHNOMELT® PA 678 BLACK	Polyamide	Black	90 (Shore A)	210 – 240	-40 – +140	–
TECHNOMELT® PA 2302 BLACK	Polyamide	Black	53 (Shore D)	220 – 240	-15 – +200	–
TECHNOMELT® PA 6208 N BLACK	Polyamide	Black	82 (ShoreA)	–	-40 – +100	Best adhesion moderate resistance up to 100°C
TECHNOMELT® PA 6344	Polyamide	Black	76 (Shore A)	210 – 250	-40 – +100	–
TECHNOMELT® PA 6771 N BLACK	Polyamide	Black	90 (Shore A)	210 – 240	-50 – +140	Hydrolysis & UV resistant
TECHNOMELT® PUR 3460	Polyurethane	Light ivory	42 (Shore D)	110 – 140	-40 – +150	High temperature resistant

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PROTECTING & SEALING SOLUTIONS

CONFORMAL COATINGS

Product Name	Chemistry	Color	Viscosity (mPa.s)	Solid Content (%)	Typical Drying Conditions
LOCTITE® STYCAST CC 8555	Urethane	Clear liquid	60	–	–
LOCTITE® STYCAST PC 40-UMF	Urethane acrylate	Clear	250	100	10 sec. at 300 – 600 mW/cm² + 2 – 3 days at RT
LOCTITE® SI 5293	Silicone	Transparent amber to yellow	400 – 800	> 85	60 sec. at 70 mW/cm² + 7 days at RT
LOCTITE® STYCAST PC 62	Acrylic	Clear	52	23 – 26	24 hr. at RT*

* Can be accelerated with heat.

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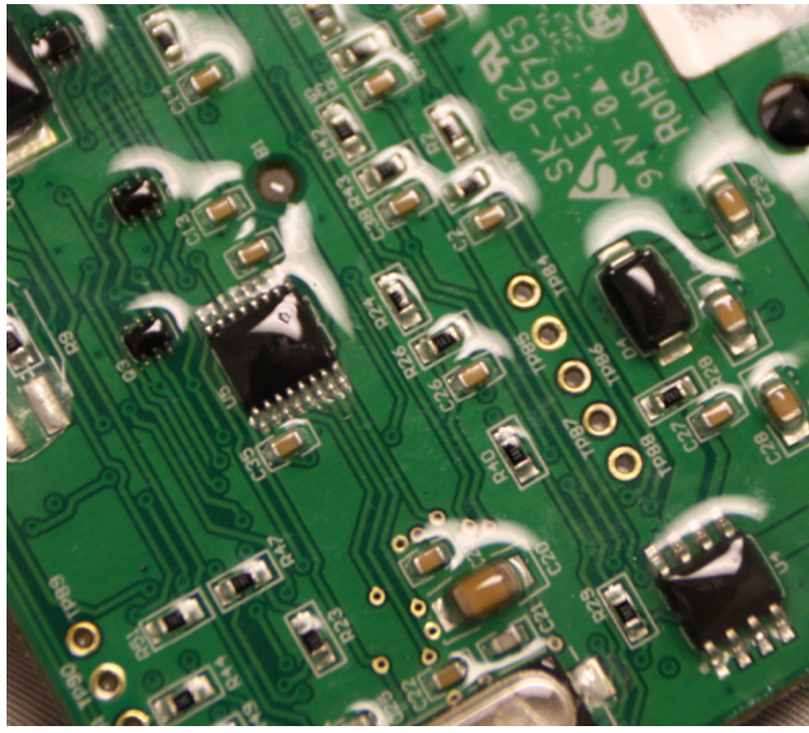

PROTECTING & SEALING SOLUTIONS

EMI PROTECTION – THERMAL INTERFACE MATERIALS

Product Name	Chemistry	Thermal Conductivity (W/mK)	Absorption (dB/cm)	Dielectric Breakdown Voltage (V)	Volume Resistivity (Ω·m)	Shore Hardness (Shore 00)	Thickness (mm)
BERGQUIST GAP PAD TGP EMI1000	Silicone	1.0	18 at 2.4 GHz 36 at 5 GHz	1,700	1×10^{10}	5	0.508 – 3.175
BERGQUIST GAP PAD TGP EMI4000	Silicone-free	4.0	86 at 18 GHz 127 at 70 GHz	1,000	4.4×10^{7}	60	0.750 – 2.000

EMI PROTECTION – GASKETS

Product Name	Chemistry	Filler	Appearance	Attenuation (dB)	Volume Resistivity (Ω·cm)	Elongation (%)	Shore Hardness (Shore A)	Typical Curing Conditions
LOCTITE® SI 5421	Silicone	Silver	Paste	90 at 1 GHz 100 at 10 GHz	0.01	40	50 – 65	1 hr. at 23 ± 2°C 50 ± 5% RH

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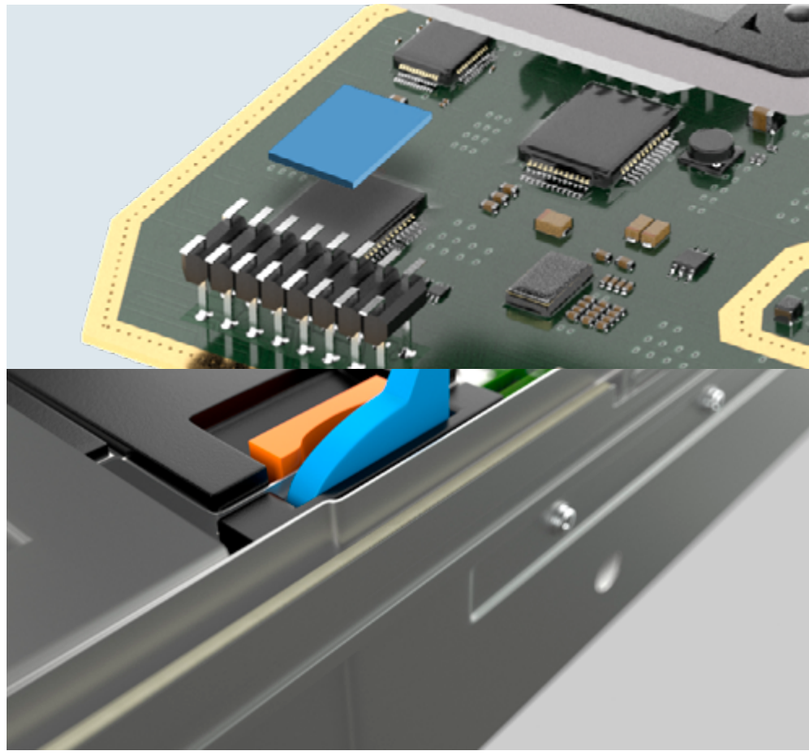
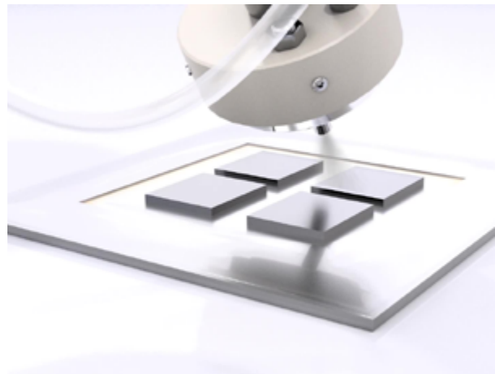


PROTECTING & SEALING SOLUTIONS

EMI PROTECTION – COATINGS

Product Name	Chemistry	Filler	Viscosity (mPa.s)	Solid Contents (%)	Attenuation (dB)	Sheet Resistance (Ω/sq)	Typical Drying Conditions
LOCTITE® EDAG 1415M E&C	Thermoplastic	Silver	375	58	60 at 1 GHz	< 0.015	30 min. at 70 – 80°C
LOCTITE® EDAG 437 E&C	Thermoplastic	Copper	4,500	64	50 – 70 at 1 GHz	< 0.5	16 hr. air dry at 60 – 71°C
LOCTITE® EDAG 440 AS E&C	Thermoplastic	Nickel	5,750	68	50 – 70 at 1 GHz	< 0.5	20 – 30 min. at 60 – 70°C
LOCTITE® EDAG 550 E&C	Acrylic	Nickel	7,500	60	60 – 65 at 1 GHz	0.9	16 hr. at RT, 20 – 30 min. at 60 – 71°C



Product Name	Chemistry	Filler	Viscosity (mPa.s)	Attenuation (dB)	Typical Curing Conditions
LOCTITE® ABLESTIK EMI 8880S	Silver Sintering	Silver	530	92 at 2.6 – 3 GHz 89 at 3 – 4 GHz	60 min. at 175°C

PRINTED ELECTRONICS

Product Name	Color	Viscosity (mPa·s)	Thixotropic Index	Sheet Resistance per 25 µm (Ω/sq)	Solid Content (%)	Adhesion on PET, Cross Hatch (ppm/°C)	Typical Drying Conditions
LOCTITE® ECI 1010 E&C	Gray	9,000	1.9	0.007	62	5B	15 min. at 120°C or 2 min. at 150°C
LOCTITE® ECI 1011 E&C	Gray	2,800	2.5	0.005	76	5B	10 min. at 150°C
LOCTITE® ECI 1501 E&C	Gray	13,000	2.0	0.025	70	5B	15 min. at 120°C
LOCTITE® ECI 8001 E&C	Black	6,500	6.0	1,700	50	5B	10 min. at 120°C

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