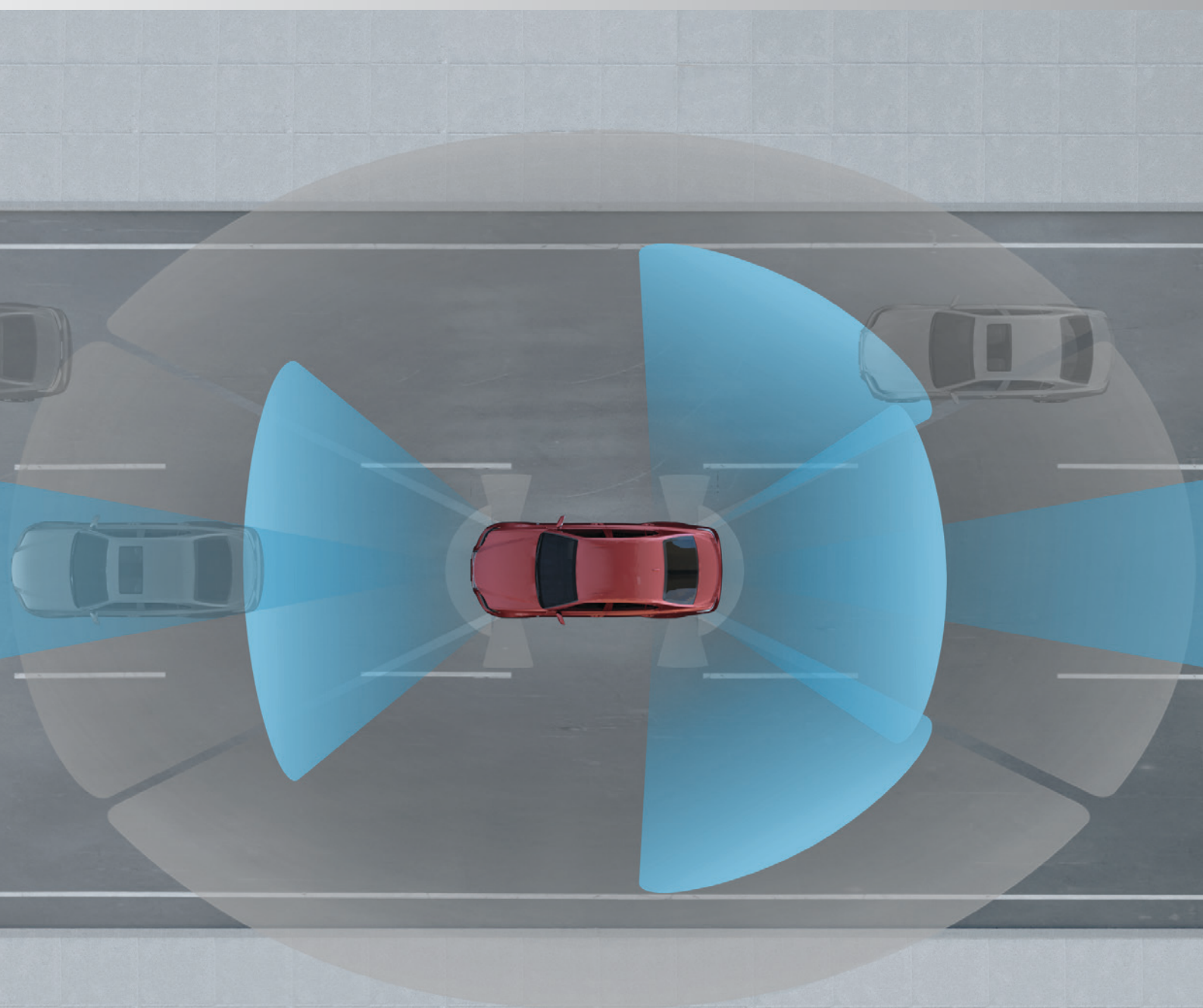


MATERIALS FOR AUTOMOTIVE RADARS

BONDING, CONNECTING, PROTECTING AND THERMAL SOLUTIONS



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MATERIALS FOR ADAS RADARS

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INTRODUCTION

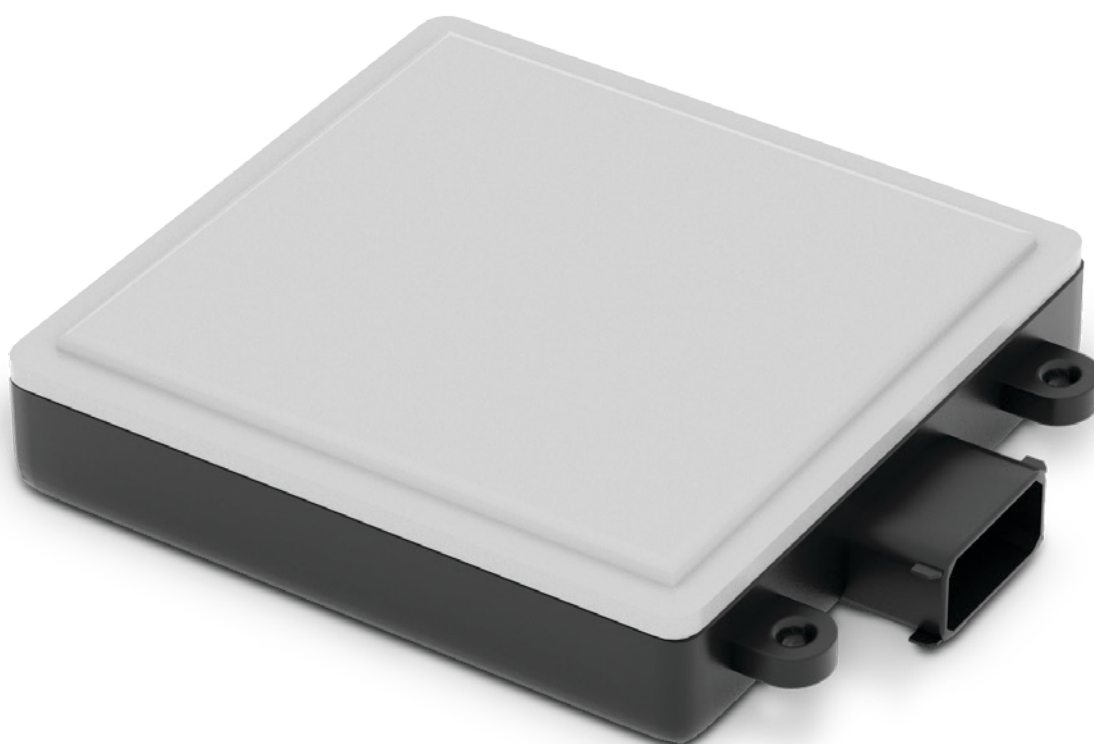
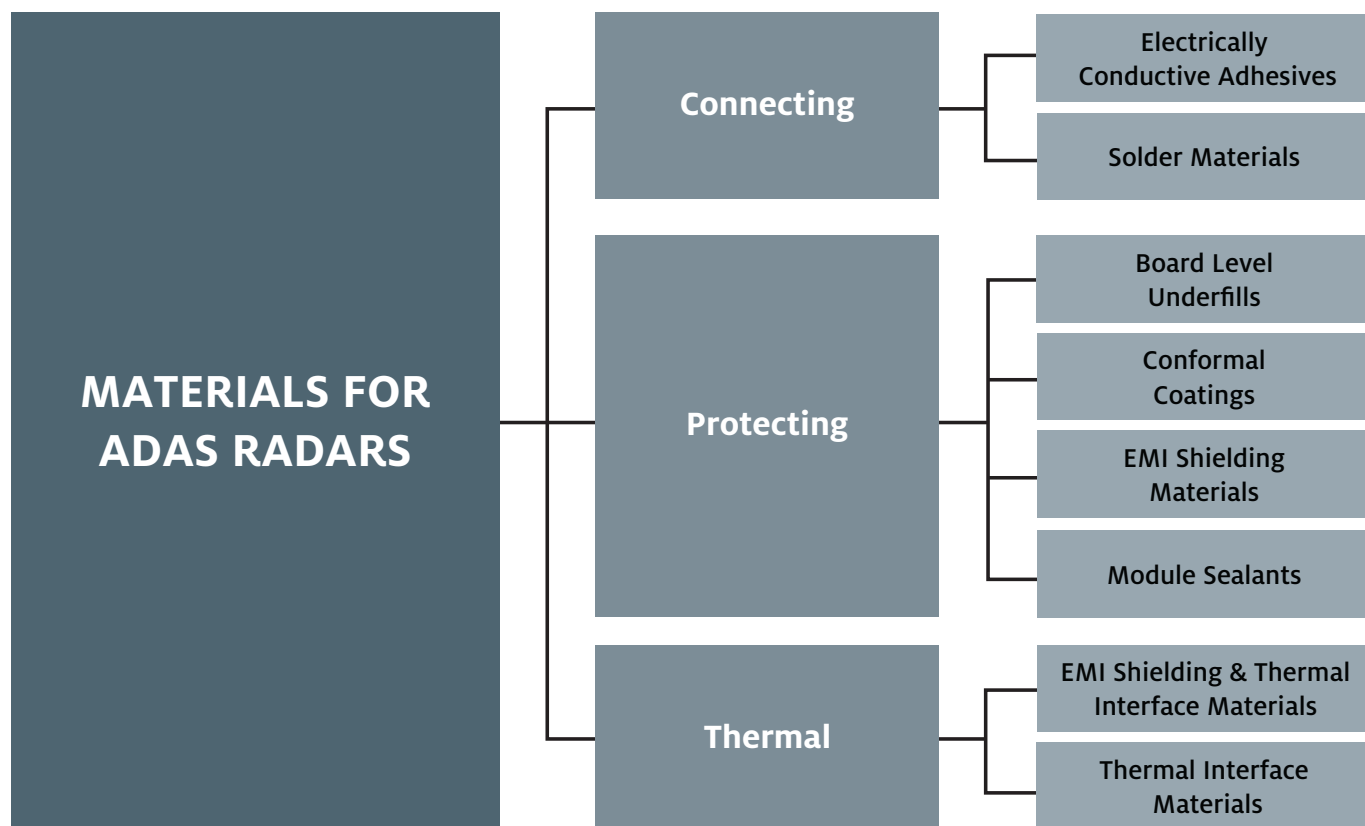
ADAS: DRIVING NEXT-GENERATION AUTOMOTIVE SAFETY

The growth of Advanced Driver Assistance Systems (ADAS) is unprecedented. What were once considered high-end luxuries are now becoming common, optional – sometimes even standard – features on today's mid- and upper-range vehicles. Working in isolation or collaborating to deliver notifications, warnings, and interventional actions to enhance driver safety, camera and radar sensor technologies are critical to ADAS advancement. While camera technology is the go-to sensor for visual object detection, radar offers more complete and exacting information as it measures an object's speed and distance from the vehicle. With this data, features like adaptive cruise control, emergency braking and rear collision warnings offer real-time alerts that greatly improve driver, passenger and pedestrian safety. Ultimately, the radar's functional reliability depends on the integrity of its components and this reality is driving radar designers and manufacturers toward Henkel electronic material solutions.

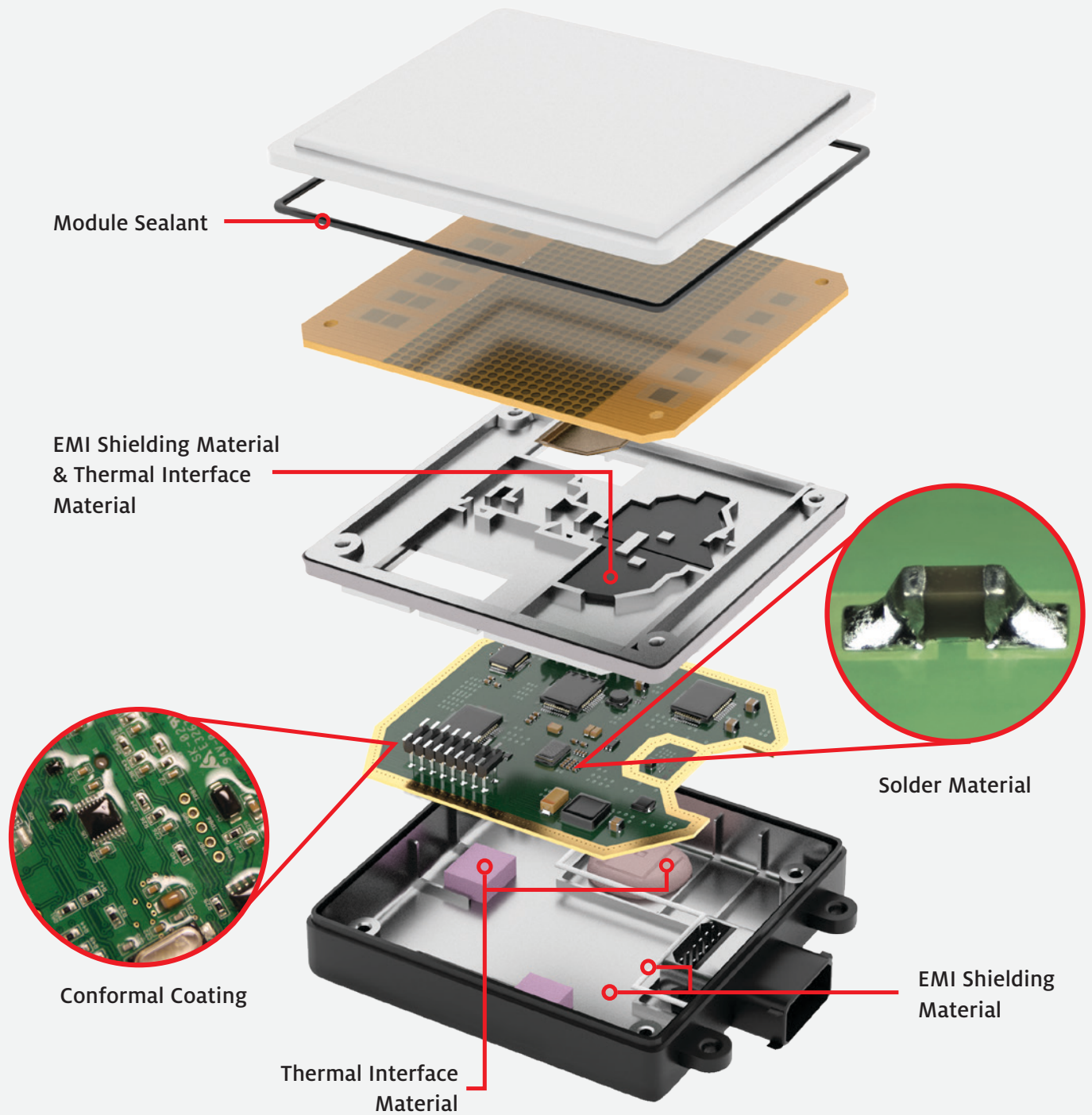
REAL-TIME NOTIFICATION DEMANDS CAPABLE MATERIALS

Today's automotive radar systems provide critical information for accident avoidance. Continuous sensing of a vehicle's distance from an object through measurement of the object's position and velocity, gives drivers a real-time view for informed decision-making and collision prevention. The reliability of the electronics within radars – including chips, components and interconnects – is essential to long-term, dependable functionality, making Henkel's advanced materials fundamental to radar performance. Connecting materials such as solders provide robust interconnection of components to the printed circuit board (PCB). And, as radars become smaller and more compact while packing more powerful function, high performance thermal management solutions, along with PCB and component protection are essential.

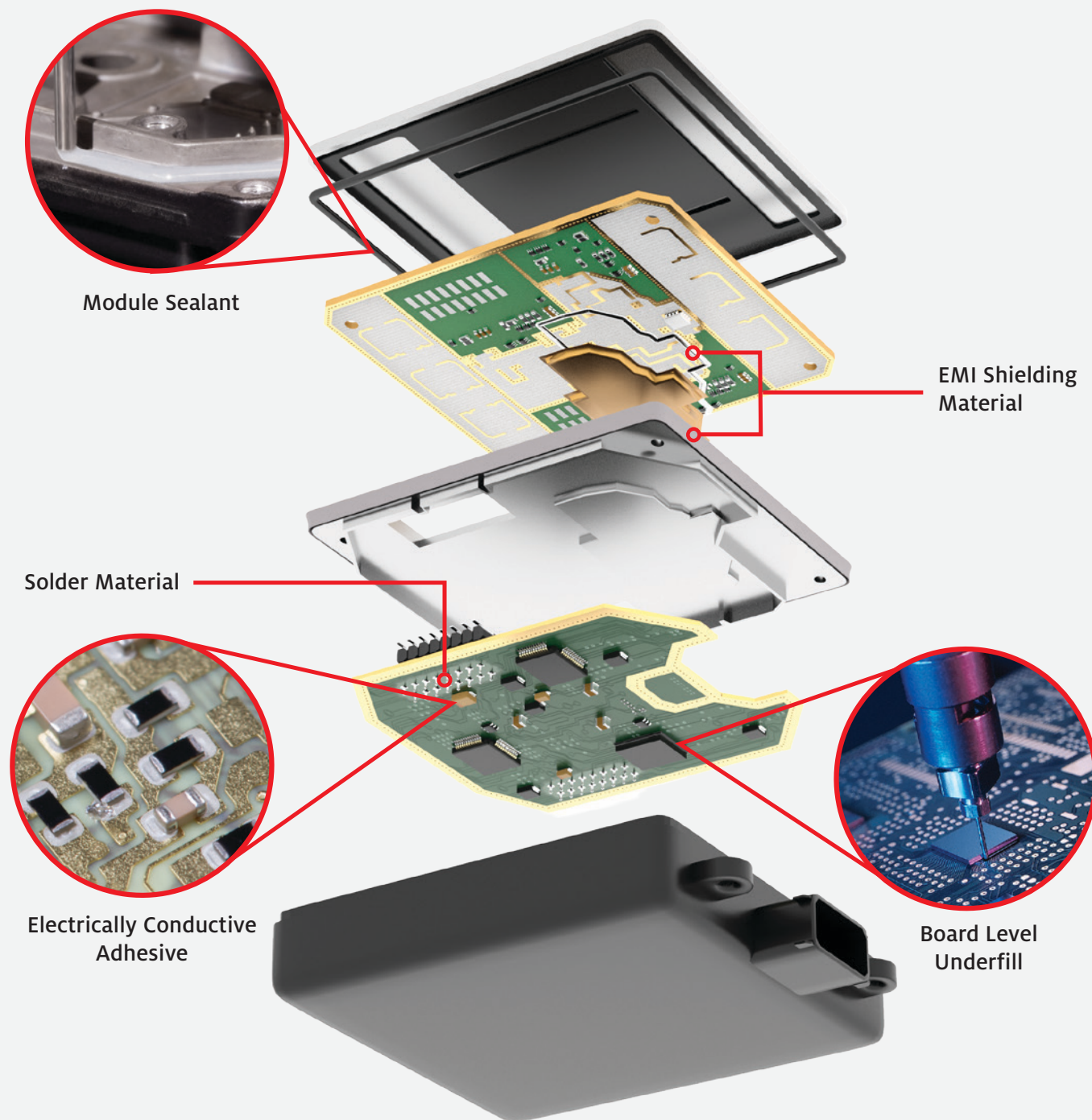




ADAS RADAR SOLUTIONS



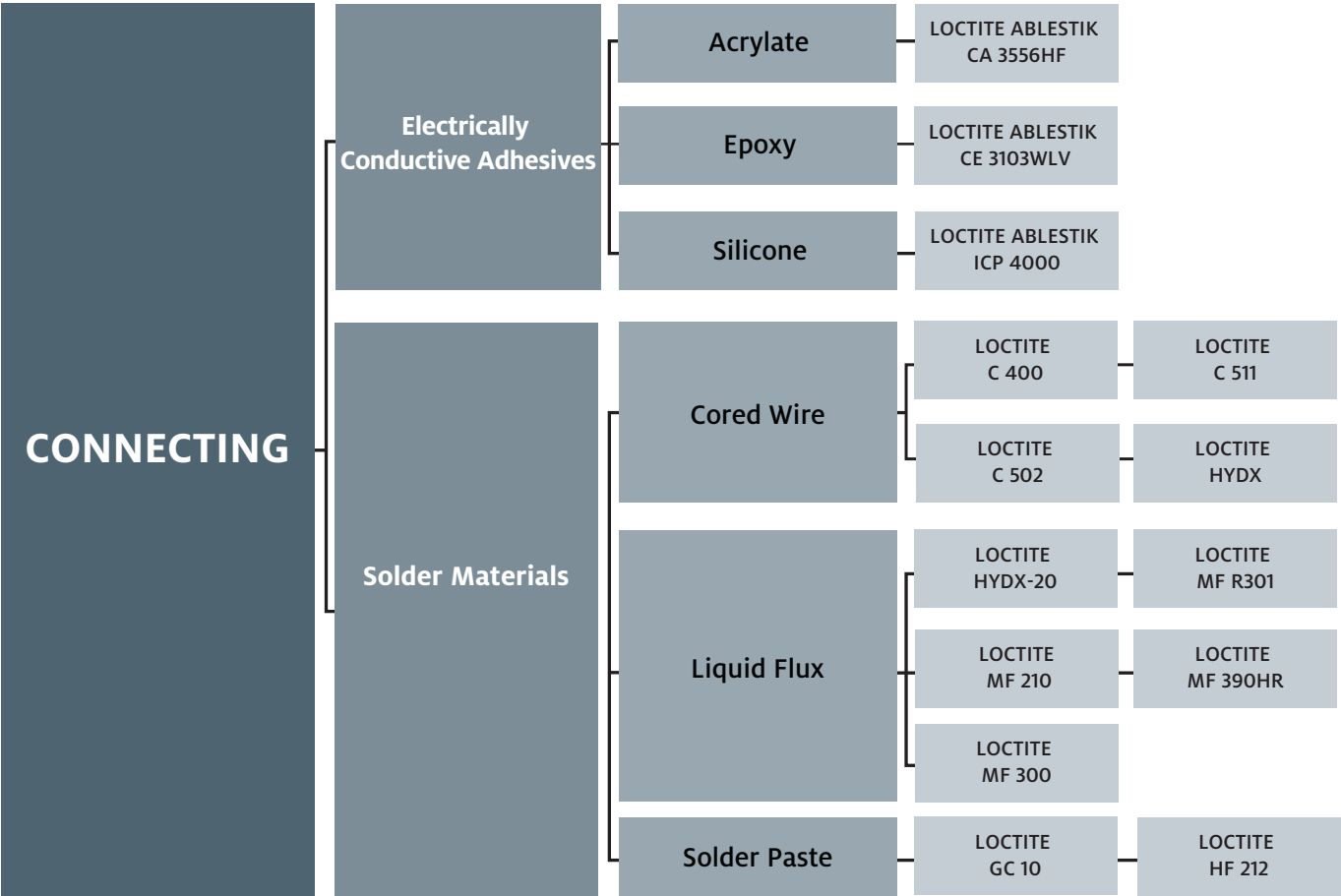
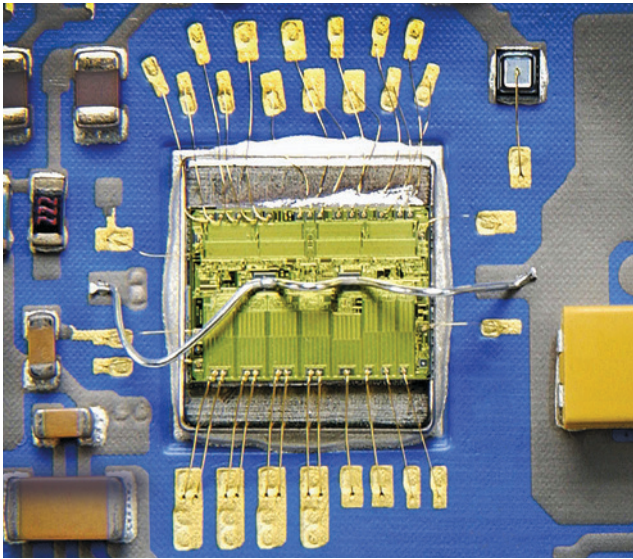
ADAS RADAR SOLUTIONS



CONNECTING MATERIALS FOR ADAS CAMERAS

CONNECTING FUNCTIONALITY

Joining all of the components of a radar system for collaborative operation and high reliability is the job of Henkel’s portfolio of advanced connecting materials. Electrical interconnection at the board level is facilitated through high-reliability, lead-free, halogen-free solder formulations and a wide range of electrically conductive adhesives, an area where Henkel’s expertise spans decades. Our scientists and engineering teams developing materials understand the reliability requirements, application-specific considerations, processability objectives and manufacturing demands to advise on the best solutions for optimal results, which is why the world’s top automotive electronics manufacturers choose Henkel. When seconds count, reliable connections matter.



CONNECTING MATERIALS FOR ADAS RADARS

ELECTRICALLY CONDUCTIVE ADHESIVES

Product Name	Description	Key Attributes	Volume Resistivity (Ω•cm)	Glass Transition Temperature, T _g (°C)	Coefficient of Thermal Expansion, CTE (ppm/°C)		Modulus at 25°C (MPa)	Recommended Cure
					Below T _g	Above T _g		
Acrylate								
LOCTITE ABLESTIK CA 3556HF	Acrylate electrically conductive adhesive	<ul style="list-style-type: none">• One component• Fast, low-temperature cure• Excellent flexibility• Good adhesion• Low contact resistance	2.5 × 10 ⁻³	-30	95	278	650	2 min. at 110°C
Epoxy								
LOCTITE ABLESTIK CE 3103WLV	Epoxy electrically conductive adhesive	<ul style="list-style-type: none">• Pb-free alternative to solder• Low-temperature cure• Stable contact resistance	8 × 10 ⁻⁴	114	45	225	4,500	10 min. at 120°C
Silicone								
LOCTITE ABLESTIK ICP 4000	Silicone electrically conductive adhesive	<ul style="list-style-type: none">• One component• High flexibility• Excellent electrical conductivity• High-temperature performance• Pb-free alternative to solder• High electrical current carrying capability• Low-temperature cure• Outstanding elongation performance• Low outgassing	6 × 10 ⁻⁵	-45	N/A	330	101	1 hr. at 130°C

SOLDER MATERIALS

Cored Wire

Product Name	Description	Key Attributes	Approximate Flux Content (% by Weight)	Diameter Range (mm)	Pb-Free Alloy	SnPb Alloy	IPC J-STE-004B Classification
Halogen-Free, No-Clean							
LOCTITE C 400	Cored solder wire	<ul style="list-style-type: none"> Clear residue Increased flux content for improved wetting on challenging surfaces Award-winning multiple flux core technology that ensures consistent distribution of flux throughout the solder wire Suitable for manual and robotic soldering 	2.2	0.38 – 1.63	<ul style="list-style-type: none"> 90iSC 99C SAC305 SAC387 	<ul style="list-style-type: none"> Sn60 Sn62 Sn63 	ROLO
Halide-Free, No-Clean							
LOCTITE C 502	Cored solder wire	<ul style="list-style-type: none"> Clear residue Good wetting on difficult substrates Medium activity flux 	2.7	0.25 – 1.63	<ul style="list-style-type: none"> SAC387 SAC305 99C 	<ul style="list-style-type: none"> Sn60 Sn62 Sn63 	ROM1
LOCTITE C 511	Cored solder wire	<ul style="list-style-type: none"> Amber residue Good wetting on difficult substrates Heat stable Medium activity flux 	2.7	0.38 – 1.63	<ul style="list-style-type: none"> SAC387 SAC305 99C 	<ul style="list-style-type: none"> Sn60 Sn62 Sn63 	ROM1
Halide-Containing, Water Wash							
LOCTITE HYDX	Cored solder wire	<ul style="list-style-type: none"> High activity flux Excellent wetting on difficult substrates 	2.0	0.38 – 1.63	<ul style="list-style-type: none"> 99C SAC305 SAC387 	<ul style="list-style-type: none"> Sn60 Sn62 Sn63 	ORH1



Liquid Flux

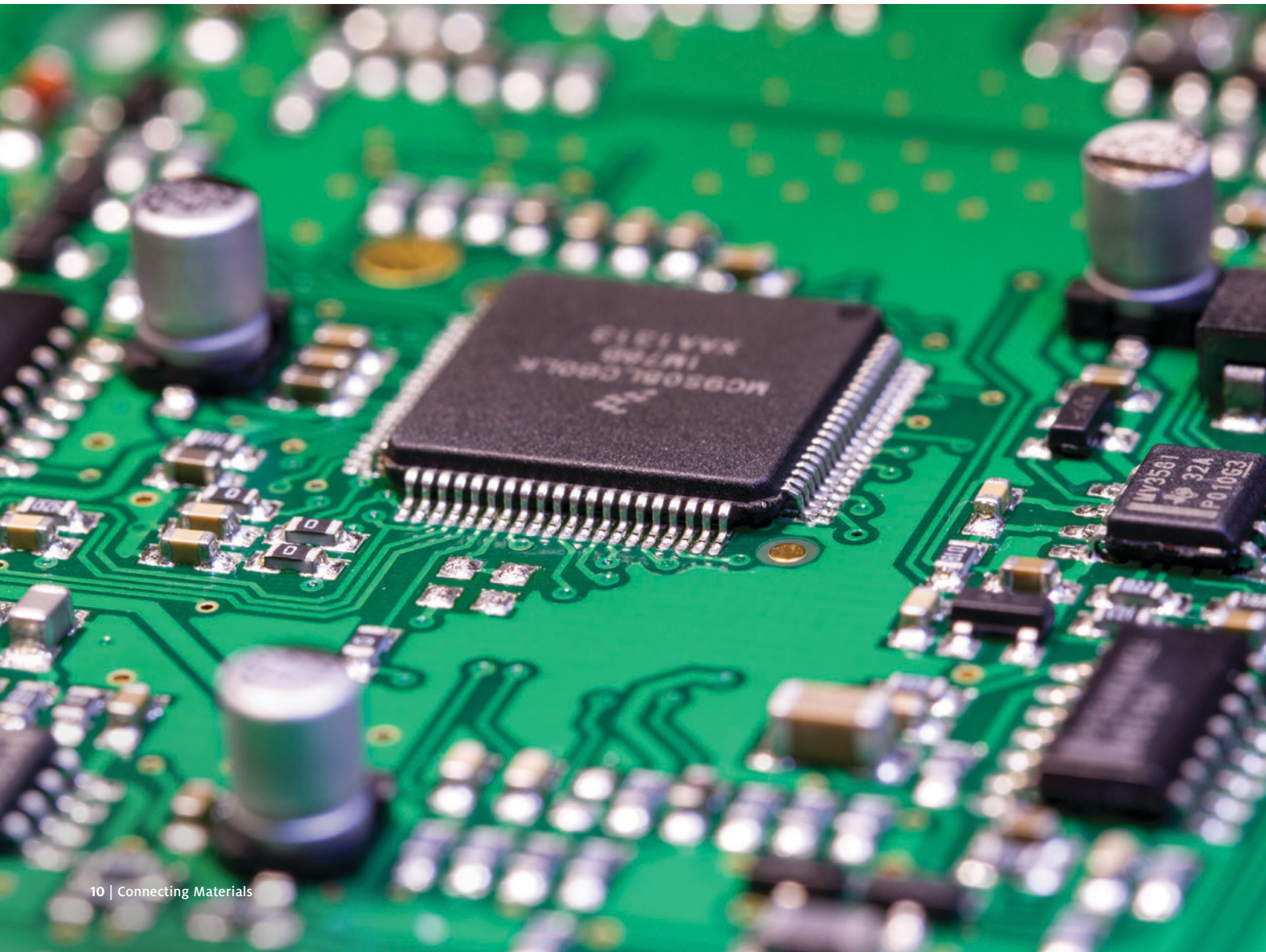
Product Name	Description	Key Attributes	Solid Content (% by Weight)	Acid Value (mg KOH/g)	Application	IPC J-STE-004B Classification
Halide-Containing, Water Wash						
LOCTITE HYDX-20	Liquid Flux	<ul style="list-style-type: none"> Highly water soluble Residues designed to be cleaned with deionized water Solders onto copper, brass, nickel and mild steel efficiently Compatible with Pb-free and SnPb wave solder processes 	20	24	Spray/Foam	ORH1
Halide-Free, No-Clean						
LOCTITE MF 210	Liquid flux	<ul style="list-style-type: none"> Resin-free flux designed to solder onto surfaces known to have poor solderability Recommended for applications where high throughput is required Compatible with Pb-free and SnPb wave solder processes 	2.9	22.5	Spray/Foam	ORMO
LOCTITE MF R301	Liquid flux	<ul style="list-style-type: none"> Higher solids flux for better wetting on surfaces known to have reduced solderability Minimizes bridging on complex geometries Fully Pb-free and dual wave compatible Solvent-based flux may be thinned with isopropyl alcohol (IPA) Compatible with Pb-free and SnPb wave solder processes 	6.0	40	Spray/Foam	ROMO
Halogen-Free, VOC-Free, No-Clean						
LOCTITE MF 300	Liquid flux	<ul style="list-style-type: none"> General-purpose, resin-free, water-based flux with special formulation designed to minimize solder balling Compatible with Pb-free and SnPb wave solder processes 	4.6	37	Spray/Foam	ORMO
Halogen-Free, No-Clean						
LOCTITE MF 390HR	Liquid flux	<ul style="list-style-type: none"> Exceptional through-hole fill Recommended for automotive applications and general electrical soldering applications Compatible with Pb-free and SnPb wave solder processes 	6.0	20 – 25	Spray/Foam	ROLO

CONNECTING MATERIALS FOR ADAS RADARS

SOLDER MATERIALS – CONTINUED

Solder Paste

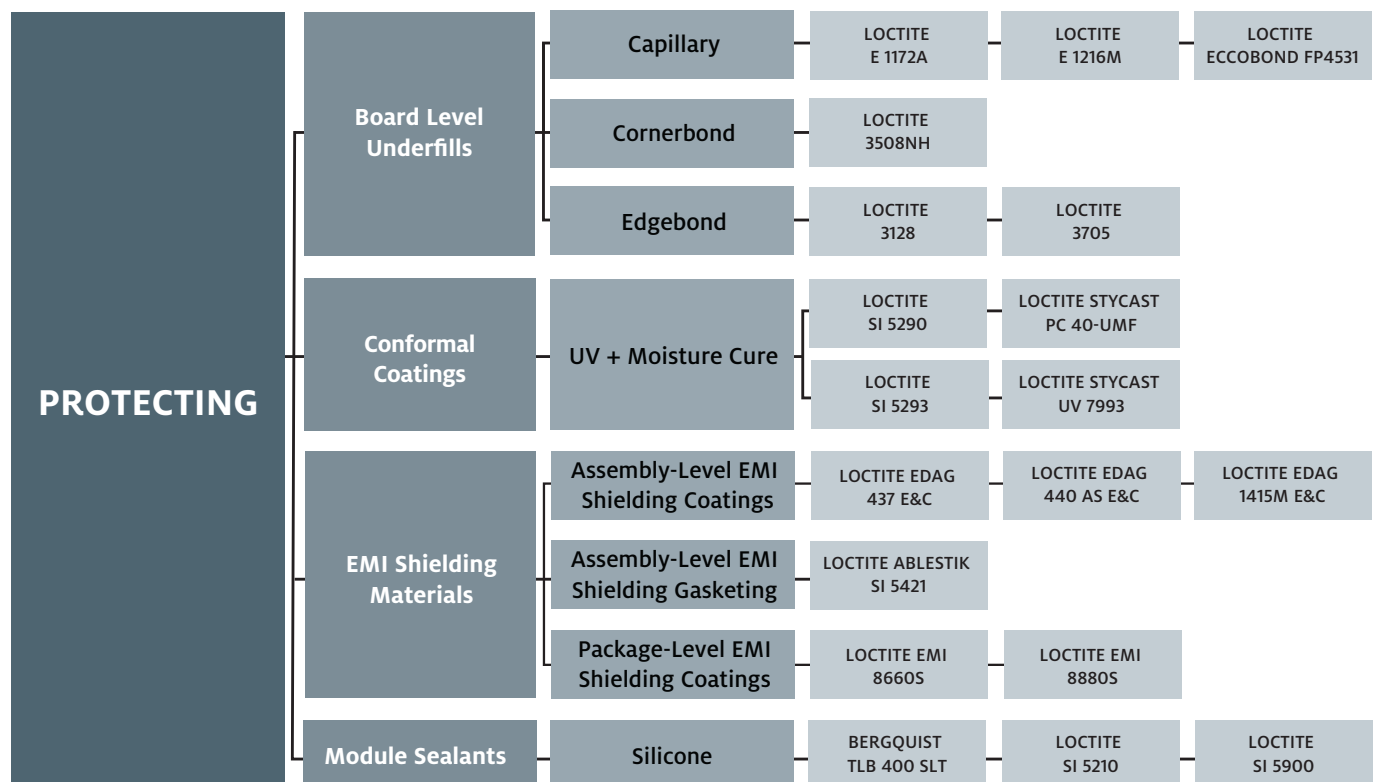
Product Name	Description	Key Attributes	Alloy	Particle Size Distribution	IPC J-STE-004B Classification	Optimal Shelf Life	Reflow Atmosphere
Temperature Stable, Halogen-Free, No-Clean							
LOCTITE GC 10	Pb-free, solder paste	<ul style="list-style-type: none">• RoHS-compliant• Excellent resistance to high humidity• Industry leader in paste transfer efficiency• Improved stability at different storage and operating temperatures• Extended stencil life up to 72 hr.• Extended abandon time up to 24 hr.• Suitable for high-density, small to large boards	<ul style="list-style-type: none">• SAC305	<ul style="list-style-type: none">• Type 3• Type 4• Type 4.5 (4A)• Type 5	ROLO	1 year at 26.5° C	Designed for air; suitable with nitrogen
Halogen-Free, No-Clean							
LOCTITE HF 212	Pb-free, solder paste	<ul style="list-style-type: none">• High tack• Low voiding• RoHS-compliant• Excellent fine pitch coalescence• Designed for medium to large boards	<ul style="list-style-type: none">• 90iSC• SAC0307• SAC305• SAC387	<ul style="list-style-type: none">• Type 3• Type 4• Type 4.5 (4A)• Type 5	ROLO	6 months at 0° C – 10° C	Air and nitrogen



PROTECTING MATERIALS FOR ADAS RADARS

A FULL RANGE OF PROTECTION

Building the radar module with high-performance electronic interconnect materials is just the start. Protecting radar systems from adverse environmental conditions and external interference is equally essential to lasting, dependable performance. Henkel's award-winning protection materials can be found throughout modern-day automotive radar systems, and for good reason. Our conformal coating solutions protect the PCB from moisture and chemical contaminants, which are plentiful in an automotive environment. Once the PCBs are populated with high-value components like micro-BGAs, the fine-pitch solder connections need to be protected from vibration and shock. Market-leading LOCTITE underfill formulations deliver added solder joint reliability to defend against stress, while Henkel module sealants keep contaminants out of the enclosure. Likewise, innovative Henkel EMI shielding solutions in multiple formats offer vital radio-frequency interference protection at all levels – from the chip to the board to the mid-frame – and effectively isolate the antennae and logic features of the radar system from each other.

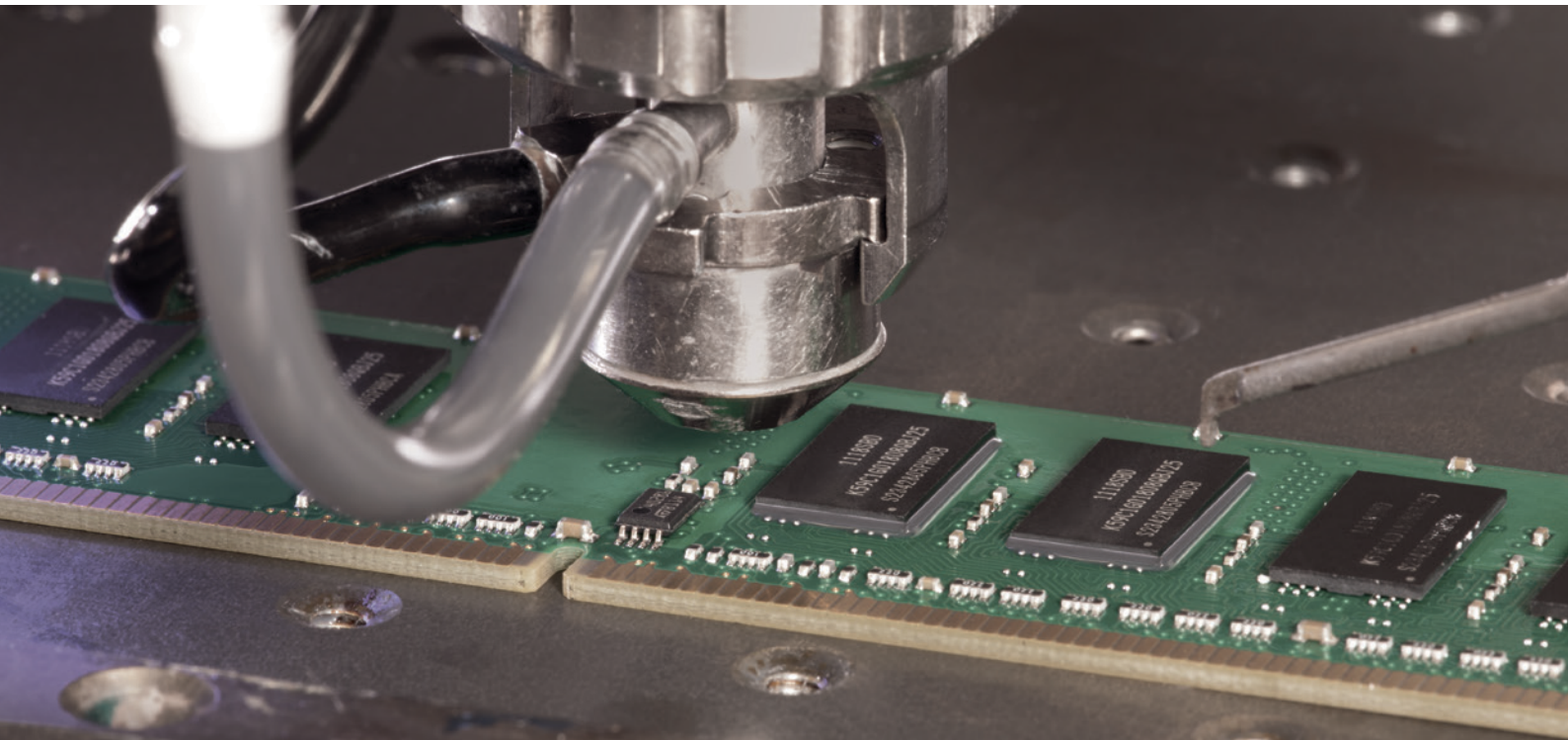


PROTECTING MATERIALS FOR ADAS RADARS

BOARD LEVEL UNDERFILLS

Capillary Underfills

Product Name	Description	Key Attributes	Modulus at 25°C (MPa)	Glass Transition Temperature, T _g (°C)	Coefficient of Thermal Expansion, CTE (ppm/°C)		Pot Life	Recommended Cure
					Below T _g	Above T _g		
LOCTITE ECCOBOND E 1172 A	Non-reworkable, capillary flow, epoxy underfill	<ul style="list-style-type: none">• Snap curable• Fast cure at low temperatures• One component• Non-anhydride curing chemistry• Void-free	10,000	135	27	85	48 hr. at 25°C	6 min. at 135°C
LOCTITE E 1216M	Non-reworkable capillary flow underfill	<ul style="list-style-type: none">• Snap or inline cure• Fast, void-free underfill of area array devices• Excellent stability during shipping, storage and use• Excellent adhesion and strength• Non-anhydride curing chemistry	2,970	125	35	131	5 days at 25°C	3 min. at 165°C
LOCTITE ECCOBOND FP4531	Capillary flow underfill	<ul style="list-style-type: none">• Snap curable• Fast flow• High adhesion strength• Proven workability at high temperatures• Qualified in automotive reliability conditions	7,600	161	28	104	24 hr. at 25°C	7 min. at 160°C



Cornerbond & Edgebond Underfills

Product Name	Description	Key Attributes	Viscosity at 25°C (cP)	Glass Transition Temperature, T _g (°C)	Coefficient of Thermal Expansion, CTE (ppm/°C)		Pot Life	Recommended Cure
					Below T _g	Above T _g		
Cornerbond								
LOCTITE 3508NH	Reworkable epoxy underfill	<ul style="list-style-type: none">• One component• Reflow curable• Eliminates post-reflow dispense and cure steps• Reworkable• Halogen-free	70,000	118	65	175	30 days at 25°C	Cure during Pb-free solder reflow profile at 245°C
Edgebond								
LOCTITE 3128	Epoxy underfill	<ul style="list-style-type: none">• One component• Low temperature cure• Excellent adhesion to a wide range of materials	22,000	45	40	130	3 weeks at 25°C	20 min. at 80°C bondline temperature
LOCTITE 3705	Acrylate underfill	<ul style="list-style-type: none">• One component• Thixotropic• Medium viscosity• Fast UV cure• No post cure required• Good adhesion to a variety of substrates	44,000	-39 (T _g 1) 77 (T _g 2)	66	151	30 days at 25°C	80 sec. at 30 mW/cm²

CONFORMAL COATINGS

Product Name	Description	Key Attributes	Viscosity at 25°C (cP)	Operating Temperature (°C)	Volume Resistivity (Ω•cm)	Color	Recommended Cure
UV + Moisture Cure							
LOCTITE SI 5290	Silicone conformal coating	<ul style="list-style-type: none"> One component Designed for severe temperature environments and high-reliability automotive applications Solvent-free 	100 – 350	-53 – 200	2 × 10 ¹⁴	Transparent amber to yellow	20 – 40 sec. at 70 mW/cm ² + 72 hr. at 50% relative humidity
LOCTITE SI 5293	Silicone conformal coating	<ul style="list-style-type: none"> One component Exhibits positive fluorescence under UV light Repairable Solvent-free Designed for severe temperature environments and high-reliability automotive applications 	400 – 800	-40 – 200	1 × 10 ¹⁴	Transparent amber to yellow	20 – 40 sec. per side at 70 mW/cm ² + 72 hr. at 50% relative humidity
LOCTITE STYCAST PC 40-UMF	Urethane acrylate conformal coating	<ul style="list-style-type: none"> One component VOC-free Conforms to IPC-CC-830 requirements 	250	-40 – 135	3.5 × 10 ¹⁶	Clear	10 sec. at 300 – 600 mW/cm ² + 2 – 3 days at atmospheric moisture
LOCTITE STYCAST UV 7993	Urethane conformal coating	<ul style="list-style-type: none"> One component Solvent-free Good moisture resistance Excellent chemical resistance 	120	-40 – 130	2.2 × 10 ¹⁶	Translucent yellow	5 sec. at 400 – 700 mW/cm ² + 100 hr. at 50% relative humidity

PROTECTING MATERIALS FOR ADAS RADARS

EMI SHIELDING MATERIALS

Assembly-Level EMI Shielding Coatings

Product Name	Description	Key Attributes	Attenuation	Sheet Resistance ($\Omega/\text{sq}/25\text{ }\mu\text{m}$)	Surfaces	Coverage at $10\text{ }\mu\text{m}$ (m^2/kg)	Recommended Cure
LOCTITE EDAG 437 E&C	Cu-filled, thermoplastic EMI shielding coating	<ul style="list-style-type: none">Burnish resistantExcellent environmental resistanceStable electrical properties after heat cyclingExcellent shielding against radiated electromagnetic interference (EMI) and protection against electrostatic discharge (ESD)Room temperature cure	50 – 70 dB at 50 μm	< 0.5	Plastic	23	30 min. at 25°C
LOCTITE EDAG 440 AS E&C	Ni-filled, thermoplastic EMI shielding coating	<ul style="list-style-type: none">Excellent shielding against radiated electromagnetic interference (EMI)Protection against electrostatic discharge (ESD)Stable in difficult environmental conditions such as high humidity or heatRoom temperature or heat cure	50 – 70 dB at 50 μm	< 0.5	Plastic	17	20 min. at 70°C
LOCTITE EDAG 1415M E&C	Ag-filled, thermoplastic EMI shielding coating	<ul style="list-style-type: none">Excellent shielding against radiated electromagnetic interference (EMI)Maintains low resistance after exposure to heat, cold, humidity and salt sprayAir drying system that requires no primer or top coatRoom temperature or heat cure	60 dB at 25 μm	< 0.015	Plastic	9	30 min. at 70°C

Assembly-Level EMI Shielding Gasketing

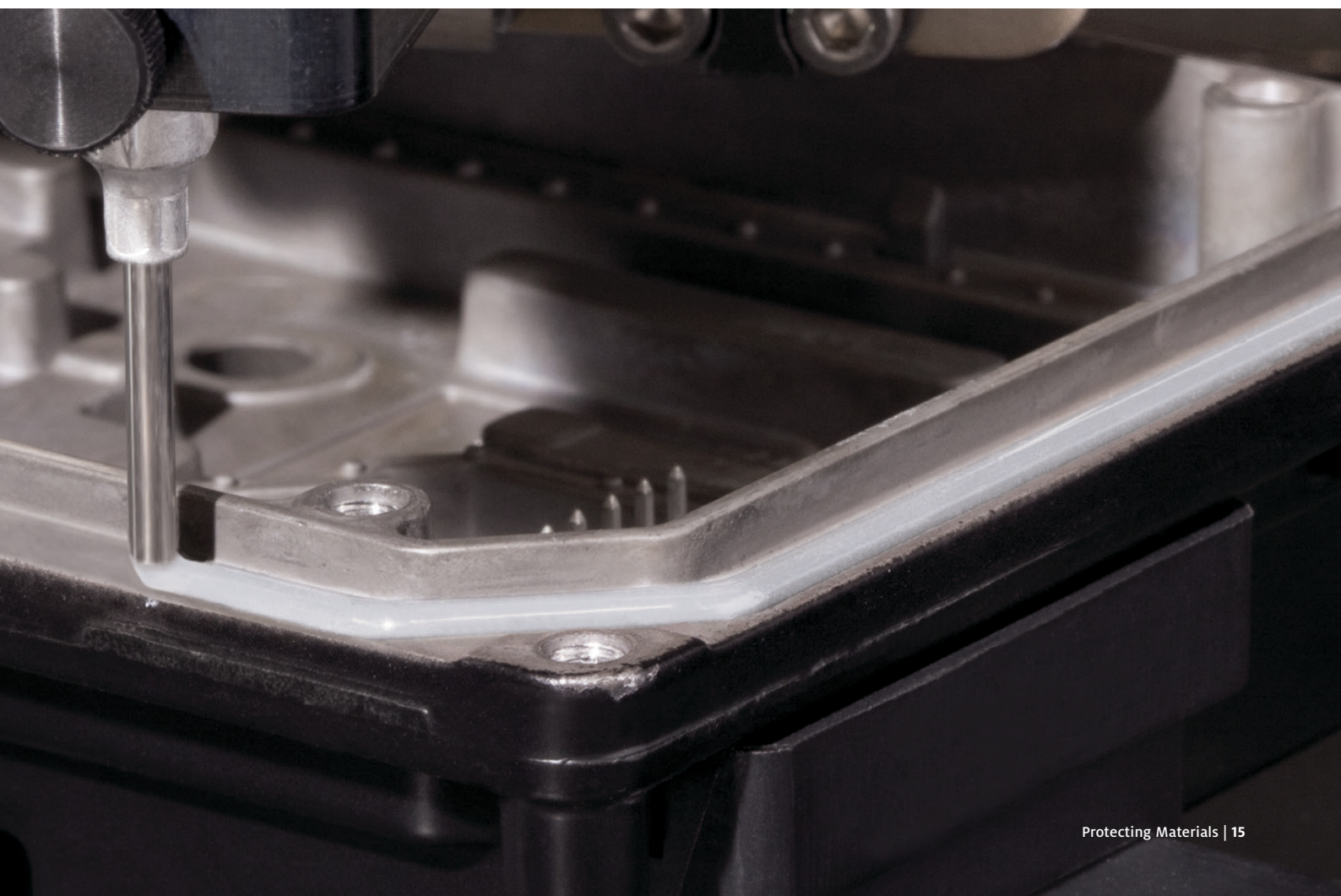
Product Name	Description	Key Attributes	Attenuation	Shore A Hardness	Volume Resistivity ($\Omega\cdot\text{cm}$)	Tensile Lap Show Strength, N/m^2 (TLSS)	Recommended Cure
LOCTITE SI 5421	Ag-filled, silicone gasketing material	<ul style="list-style-type: none">Room temperature cureLow stressHigh flexibility	<ul style="list-style-type: none">80 dB at 10 MHz110 dB at 100 MHz100 dB at 10 GHz	50 – 65	< 1×10^{-2}	0.7	24 hr. at 25°C

Package-Level EMI Shielding Coatings

Product Name	Description	Key Attributes	Attenuation	Volume Resistivity ($\Omega\cdot\text{cm}$)	Surfaces	Coating Thickness (μm)	Recommended Cure
LOCTITE ABLESTIK EMI 8660S	Package-level, conformal EMI shielding coating	<ul style="list-style-type: none">Thinly spray-coated material provides uniform coverage on top and sidewalls of packageExcellent adhesion to mold compoundExcellent EMI shielding performance at > 100 MHz	90 dB at 3 μm	1.5×10^{-5}	<ul style="list-style-type: none">Epoxy mold compoundCopper	3 – 5	1 hr. at 175°C in air
LOCTITE ABLESTIK EMI 8880S	Package-level, conformal EMI shielding coating	<ul style="list-style-type: none">Thinly spray-coated material provides uniform coverage on top and sidewalls of packageExcellent adhesion to mold compoundExcellent EMI shielding performance at > 10 MHz	90 dB at 3 μm	7.9×10^{-6}	<ul style="list-style-type: none">Epoxy mold compoundCopper	3 – 5	1 hr. at 175°C in air

MODULE SEALANTS

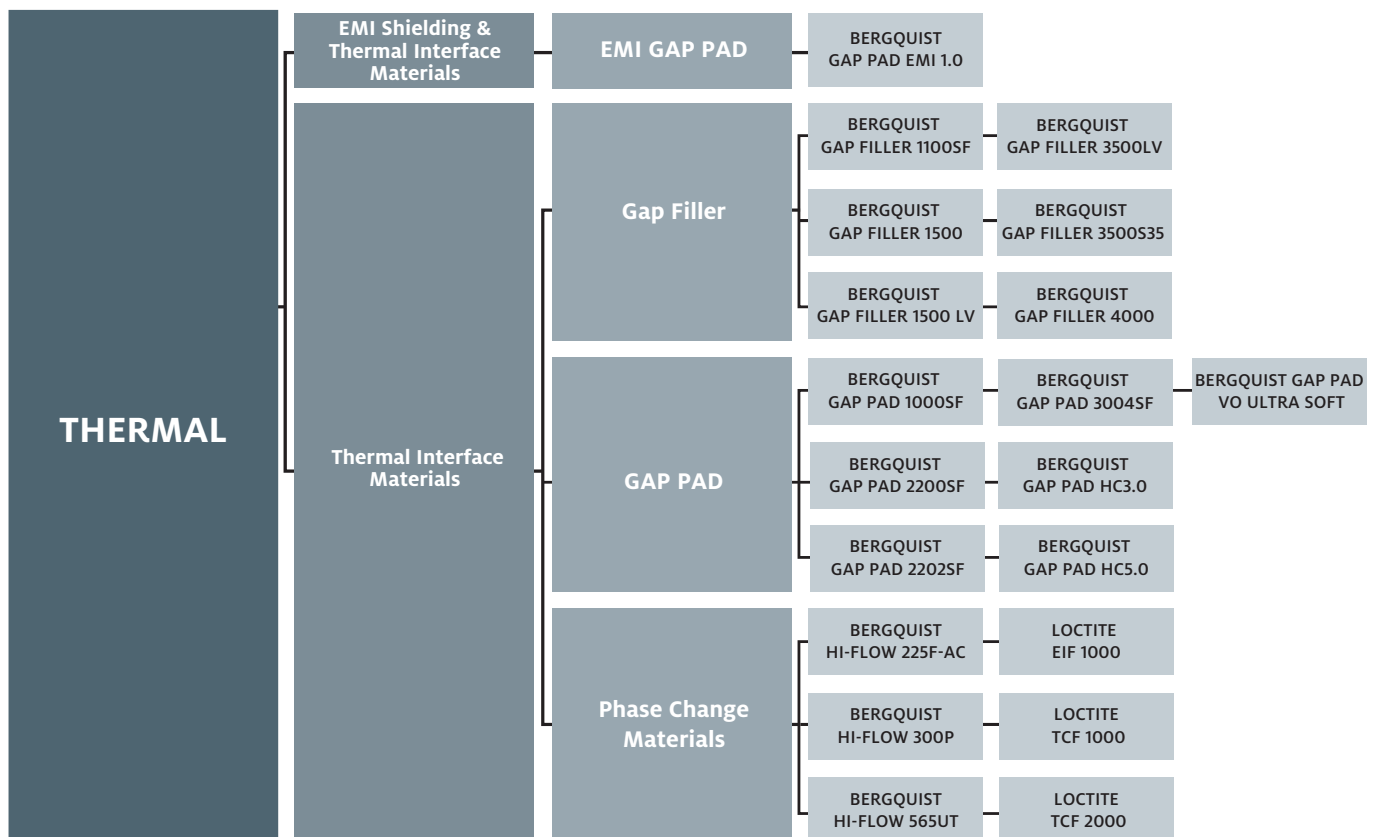
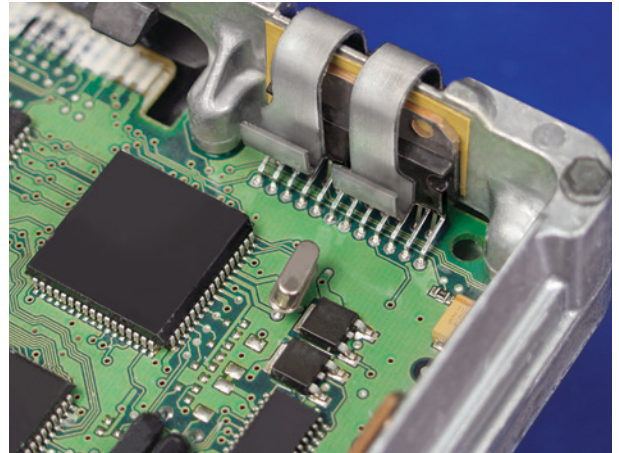
Product Name	Description	Key Attributes	Shore A Hardness	Tensile Strength (MPa)	Recommended Cure
BERGQUIST TLB 400 SLT	High performance, two-part, silicone adhesive sealant with an adaptable cure profile	<ul style="list-style-type: none"> • Fast and adaptable cure (at room or elevated temperatures) • Strong and elastic bond • Thixotropic – designed for automated dispensing as form-in-place gasket (FIPG) • Room temperature storage • Self-fixturing time of 12 hr. at 25°C 	40	2.1	7 days at 25°C
LOCTITE SI 5210	One component silicone sealant and adhesive paste	<ul style="list-style-type: none"> • An ultra-fast curing, non-corrosive, thixotropic room temperature vulcanizing (RTV) silicone designed for potting, selective sealing, vibration dampening and repair/rework applications on circuit boards • Effective for automotive electronics applications or other harsh environments • Tack free time of ≤ 5 min. at 22°C and 50% relative humidity 	48	2.8	7 days at 22°C and 50% relative humidity
LOCTITE SI 5900	One component silicone sealant and adhesive paste	<ul style="list-style-type: none"> • Excellent resistance to automotive engine oils • Ability to withstand high joint movement • Excellent adhesion to a wide variety of plastic substrates, as well as glass, ceramics and metals • Thixotropic paste • Tack free time of 7 – 24 min. at 25°C and 50% relative humidity 	31 – 46	≥ 1.7	7 days at 25°C and 50% relative humidity



THERMAL MATERIALS FOR ADAS RADARS

RADARS THAT KEEP THEIR COOL

The ability to offer driver assistance for collision avoidance, pedestrian detection, blind spot notification and, in some cases, even initiate emergency braking make radar systems very cool, safety-enhancing technology. Keeping them cool is imperative. As radar technology has become more compact and powerful, components have diminished in size, yet expanded in function. And, with this dynamic, increased heat generation is the result. In fact, thermal management is one of the most essential pieces of the reliability puzzle. If parts overheat, they don't function. Henkel's BERGQUIST brand thermal interface materials are the undisputed market leader for effective thermal management solutions. Our award-winning, low-stress gap filling thermal interface materials are enabling high-performance function of digital signal (DSP) and microcontroller (MCU) processors, as well as providing thermal relief from heat generation at the mid-frame. High conformity GAP PADs and automated, throughput-enhancing liquid form-in-place gap fillers effectively absorb and dissipate heat so radars can keep their cool.



EMI SHIELDING AND THERMAL INTERFACE MATERIALS

Product Name	Description	Key Attributes	Thermal Conductivity (W/m•K)	Modulus at 25°C (kPa)	EMI Absorption at 2.4 GHz (dB/cm)	Thickness (mm)	Flammability Rating
BERGQUIST GAP PAD EMI 1.0	Thermally conductive, conformable EMI absorbing material	<ul style="list-style-type: none"> • Electromagnetic interference (EMI) absorbing • Fiberglass reinforced for puncture, shear and tear resistance • Electrically isolating 	1	69	-2.8	0.508 – 3.175	UL 94 V-0

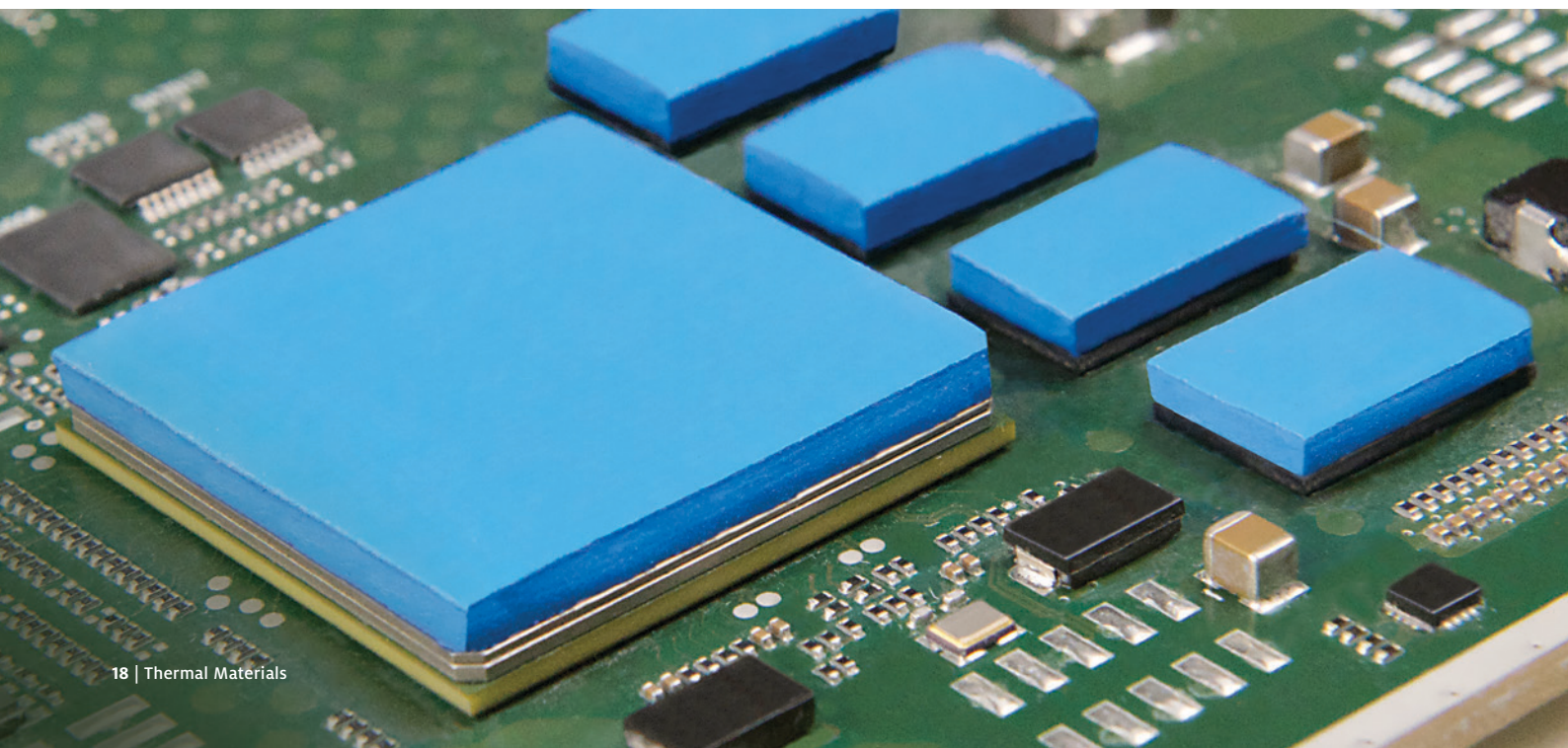
GAP FILLER

Product Name	Description	Key Attributes	Thermal Conductivity (W/m•K)	Viscosity at 25°C (cP)	Dielectric Strength (V/25 µm)	Flammability Rating	Recommended Cure
BERGQUIST GAP FILLER 1100SF	Silicone-free, thermally conductive liquid gap filling material	<ul style="list-style-type: none"> • No silicone outgassing or extraction • Ultra-conforming material designed for fragile and low-stress applications • Ambient and accelerated cure schedules • 100% solids – no cure by-products 	1.1	450,000	400	UL 94 V-0	24 hr. at 25°C
BERGQUIST GAP FILLER 1500	Thermally conductive liquid gap filling material	<ul style="list-style-type: none"> • Optimized shear thinning characteristics for ease of dispensing • Excellent slump resistance • Ultra-conforming with excellent wet-out for low-stress interface applications • 100% solids – no cure by-products • Excellent low- and high-temperature mechanical and chemical stability • Ambient and accelerated cure schedules 	1.8	25,000	400	UL 94 V-0	5 hr. at 25°C
BERGQUIST GAP FILLER 1500 LV	Thermally conductive liquid gap filling material	<ul style="list-style-type: none"> • Low volatility for silicone sensitive applications • Ultra-conforming with excellent wet-out • 100% solids – no cure by-products • Excellent low- and high-temperature, chemical and mechanical stability • Ambient or accelerated cure schedules 	1.8	20,000	400	UL 94 V-0	8 hr. at 25°C
BERGQUIST GAP FILLER 3500LV	Thermally conductive liquid gap filling material	<ul style="list-style-type: none"> • Low volatility for outgassing sensitive applications • Ultra-conforming with excellent wet-out for low-stress interfaces on applications • 100% solids – no cure by-products • Ambient or accelerated cure schedules 	3.5	45,000	275	UL 94 V-0	24 hr. at 25°C
BERGQUIST GAP FILLER 3500S35	Thermally conductive liquid gap filling material	<ul style="list-style-type: none"> • High thermal performance • Thixotropic nature makes it easy to dispense • Ultra-conforming material designed for fragile and low-stress applications • Ambient or accelerated cure schedules 	3.6	150,000	275	UL 94 V-0	15 hr. at 25°C
BERGQUIST GAP FILLER 4000	Thermally conductive liquid gap filling material	<ul style="list-style-type: none"> • High thermal performance • Extended working time for manufacturing flexibility • Ultra-conforming with excellent wet-out • 100% solids – no cure by-products • Excellent low- and high-temperature, chemical and mechanical stability • Ambient or accelerated cure schedules 	4.0	50,000	450	UL 94 V-0	24 hr. at 25°C

THERMAL MATERIALS FOR ADAS RADARS

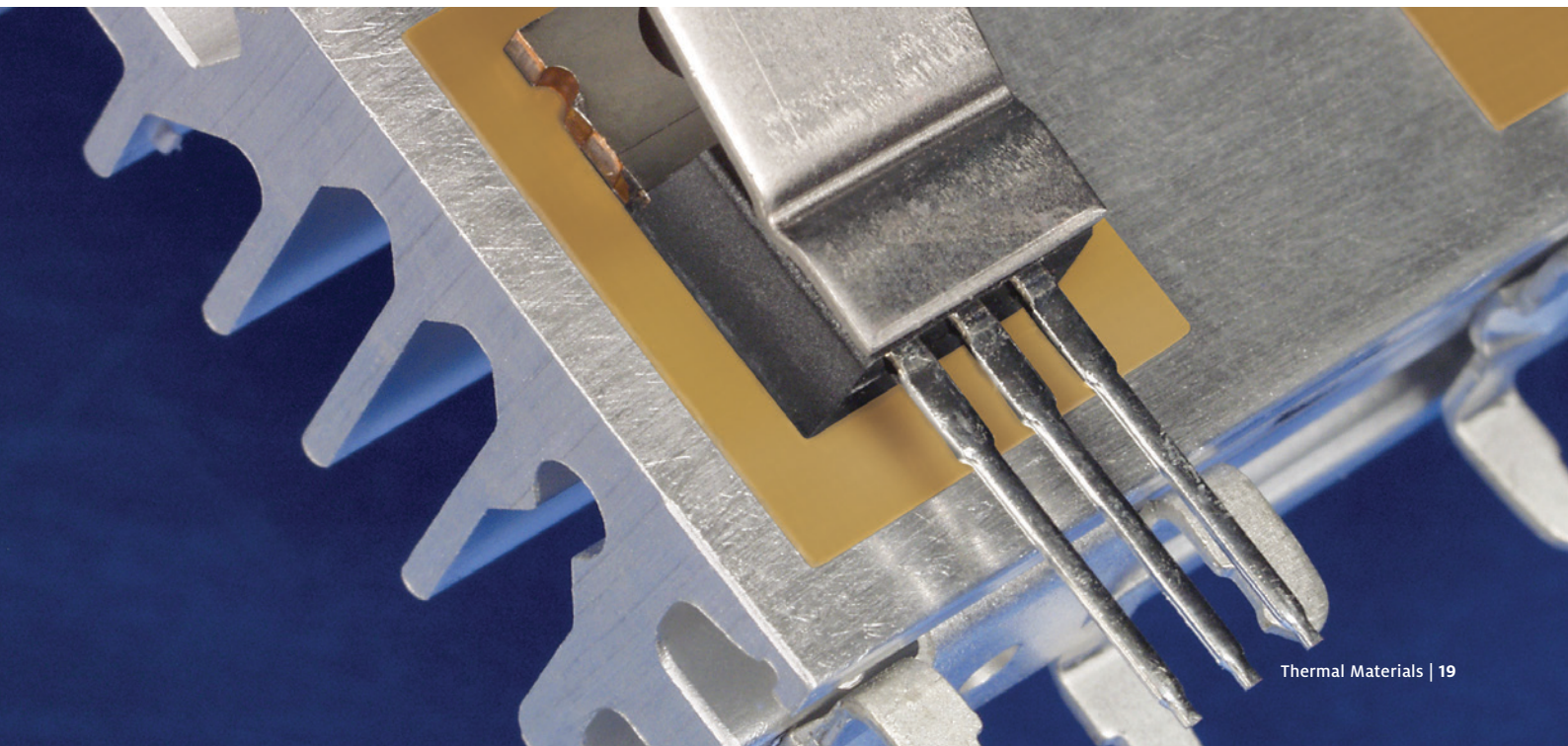
GAP PAD

Product Name	Description	Key Attributes	Thermal Conductivity (W/m•K)	Modulus at 25°C (kPa)	Dielectric Breakdown Voltage	Thickness (mm)	Flammability Rating
BERGQUIST GAP PAD 1000SF	Silicone-free, thermally conductive gap filling material	<ul style="list-style-type: none"> No silicone outgassing No silicone extraction Reduced tack on one side to aid in application assembly Electrically isolating 	0.9	234	6,000 V at 250 µm	• 0.254 – 3.175	UL 94 V-1
BERGQUIST GAP PAD 2200SF	Silicone-free, thermally conductive gap filling material	<ul style="list-style-type: none"> Medium compliance with easy handling Electrically isolating 	2	228	5,000 V at 250 µm	• 0.254 – 3.175	UL 94 V-0
BERGQUIST GAP PAD 2202SF	Silicone-free, high performance, thermally conductive gap filling material	<ul style="list-style-type: none"> Minimal compression set 12.7 µm film provides tack-free surface Tacky side allows for ease of handling and placement 	2	1,500	5,000 V at 250 µm	• 0.254 – 3.175	UL 94 V-0
BERGQUIST GAP PAD 3004SF	Silicone-free, high performance, thermally conductive gap filling material	<ul style="list-style-type: none"> Excellent thermal performance 6.4 µm polyethylene terephthalate (PET) provides easy disassembly, leaving no residue Tacky side allows for ease of handling and placement 	3	2,450	6,000 V at 250 µm	• 0.254 – 3.175	UL 94 V-0
BERGQUIST GAP PAD HC3.0	Thermally conductive gap filling material	<ul style="list-style-type: none"> High-compliance, low compression stress Fiberglass reinforced for shear and tear resistance Low modulus 	3	110	5,000 V at 500 µm	• 0.508 – 3.175	UL 94 V-0
BERGQUIST GAP PAD HC5.0	Thermally conductive gap filling material	<ul style="list-style-type: none"> Highly conformable Exceptional thermal performance High-compliance, low compression stress Fiberglass reinforced for shear and tear resistance Low modulus 	5	121	5,000 V at 500 µm	• 0.508 – 3.175	UL 94 V-0
BERGQUIST GAP PAD VO ULTRA SOFT	Thermally conductive gap filling material	<ul style="list-style-type: none"> Highly conformable, low hardness “Gel-like” modulus Decreased strain Puncture, shear and tear resistant Electrically isolating 	1	55	6,000 V at 500 µm	• 0.508 – 6.350	UL 94 V-0



PHASE CHANGE MATERIALS

Product Name	Description	Key Attributes	Thermal Conductivity (W/m•K)	Phase Change Temperature (°C)	Dielectric Strength (V/25 µm)	Thickness (mm)	Flammability Rating
Aluminum Carrier							
BERGQUIST HI-FLOW 225F-AC	Phase change thermal interface material	<ul style="list-style-type: none"> • Low thermal impedance • Can be manually or automatically applied to the surfaces of room-temperature heat sinks • Foil reinforced, adhesive coated • Soft phase change compound 	1	55	N/A	• 0.102	UL 94 V-0
LOCTITE TCF 1000	Non-insulating, phase change thermal interface material	<ul style="list-style-type: none"> • Low thermal impedance • Coated on aluminum foil • Used between any non-isolated heat dissipating component and a heat sink or chassis 	1	60	N/A	• 0.06 – 0.2	None
LOCTITE TCF 2000	Non-insulating, phase change thermal interface material	<ul style="list-style-type: none"> • Used between any non-isolated heat dissipating component and a heat sink or chassis • High thermal conductivity 	3	51	N/A	• 0.076	UL 94 V-0
Polyimide Carrier							
LOCTITE EIF 1000	High-performance, phase change thermal interface material	<ul style="list-style-type: none"> • High dielectric strength • Excellent cut-through resistance 	0.45	60	> 5,000	• 0.05 – 0.2	UL 94 V-0
BERGQUIST HI-FLOW 300P	High-performance, phase change thermal interface material	<ul style="list-style-type: none"> • Field-proven polyimide film • Excellent dielectric performance • Excellent cut-through resistance • Outstanding thermal performance in an insulated pad 	1.6	55	5,000	• 0.102 – 0.127	UL 94 V-0
No Carrier							
BERGQUIST HI-FLOW 565UT	High-performance, phase change thermal interface material	<ul style="list-style-type: none"> • Very low thermal impedance • High thermal conductivity • Naturally tacky • Tabulated for ease of assembly 	3	52	N/A	• 0.127 • 0.254	UL 94 V-0



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