Elkem
A Bluestar Company

Silicones

Delivering your potential

Bluesil

CAF

Accelerate your transportation revolution

with Electronic Silicone Solutions

www.silicones.elkem.com

Protect your Electric vehicle's components with Electronic Silicone Solutions

Why choose Elkem Silicones?

Elkem Silicones is a complete integrated global silicones manufacturers with more than 60 years of silicone expertise. Thanks to its worldwide upstream and downstream operations, Elkem Silicones offers a comprehensive range of silicone technologies in support of diverse specialty markets including paper release, healthcare, moldmaking, automotive, aerospace, personal care and Electronics.

Our worldwide quality focus

Since 1944, we have continuously developed new technologies. We at Elkem Silicones apply our Quality Policy in line with the ISO 9001 standard, linked to a management system based on strong continuous Improvement programs.

Lean manufacturing tools and methodologies are deployed through our EBS initiative (Elkem Business System) to enhance our product lines. Our worldwide operating centers - headquarters, laboratories, sales & development processes and manufacturing sites - are all ISO 9001 certified and specialist product ranges also comply with specific industry standards, such as the EN/AS 9100 for aerospace components.

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We create agile innovation

Since 1944, we have continuously developed new technologies, processes and solutions to address our customers' needs. In a changing environment, we question the status quo, we generate new ideas and constantly progress, in close cooperation with our customers.

A worldwide network to deliver our customers' potential because we care

Our upstream and downstream production units, working closely with the worldwide sales network of our subsidiaries, agents and distributors, enhance our understanding of markets and enable us to satisfy the current and future needs of Elkem Silicones customers.

We offer technical support to serve demanding markets

Our dedicated teams support you from product approval to after-sales technical services, including prototype production.

With very high-performance facilities and unique know-how, our teams can validate technical solutions in the laboratory to cover all industrial applications that require bonding, sealing or potting. We test on-site performance in conjunction with your teams to define and determine the optimal solution for your processes, and to obtain your final approval.

Before ramping up to industrial-scale production, limited prototype series can be produced in-house by our technical laboratories, with access to a robot manufacturing application. Our technicians provide services on-demand to customers to assist and advice them throughout the production phase.

As a conclusion, at Elkem Silicones, we are more than just high quality silicone products. From technical support to customized formulations with quality, regulatory and supply chain services, Elkem Silicones has the people in place when and where you need them.

Why silicones for Electric Vehicle applications?

The main challenge for H&EV automakers is to ensure that the electrical and electronic parts in these new-generation vehicles are efficient, reliable and safe.

Silicones play an essential role in producing high-performance H&EV since they are used in a wide range of solutions for the assembly, integrity and protection of critical parts in these new vehicles. Our product line including Elastomers Silicones Adhesives (ESA range) for potting and encapsulating, CAF range for sealing and bonding and several foams products for lightweight applications are increasingly used in the protection of battery modules and in Automotive electronics (sensors, PCT heater, IGBT, etc...) as a result of their high performance physical properties and their stability across a wide range of extreme conditions.

The first challenge is to manage the heat of the battery modules which is the heart of the electric vehicle. The temperature affects the performance, reliability, safety, life and the cost of batteries in HEVs, PHEVs and EVs. Elkem Silicones develops customized solutions according to the design of the battey pack and the cells used in these modules. We are providing two options for that, depending on the design of the battery pack and the cells used (cylindrical, pouch or prismatic):

- thermal insulation of the cell to avoid the overheat propagation to the other cells ; thermal insulation of the battery pack to limit the impact of cold environment on the temperature of the battery.
- in opposite, thermally conductive materials can be used to evacuate the heat from the cell. Discover our Silicones range, including adhesives, gap filler, encapsulant and gels.

This thermal management issue is not only for battery but also for other parts like electronic control unit, charger, converters or electric motors.

Other challenges for OEM (original equipment manufacturer) and OES (original equipment supplier) are the protection and the assembly (sealing and bonding) of Electric vehicles components. Elkem Silicones provide many technologies for these functions as Adhesives (ESA range) for bonding applications, Gels (ESA range) for Electronics potting, foams (RTFoam range) & CAF (RTV-1) for sealing and gasketing and conformal coating products.

All these products can be dispensed by automatic equipment.

Most common applications in EV

Key benefits for Electronics Silicones Solutions:

Excellent ageing stability (long term thermal & chemical stability)

Heat management From thermal insulation to conduction performance

Excellent electrical insulation

Weight reduction, specifically when using silicone foams

Flexible rheological properties for easy processing

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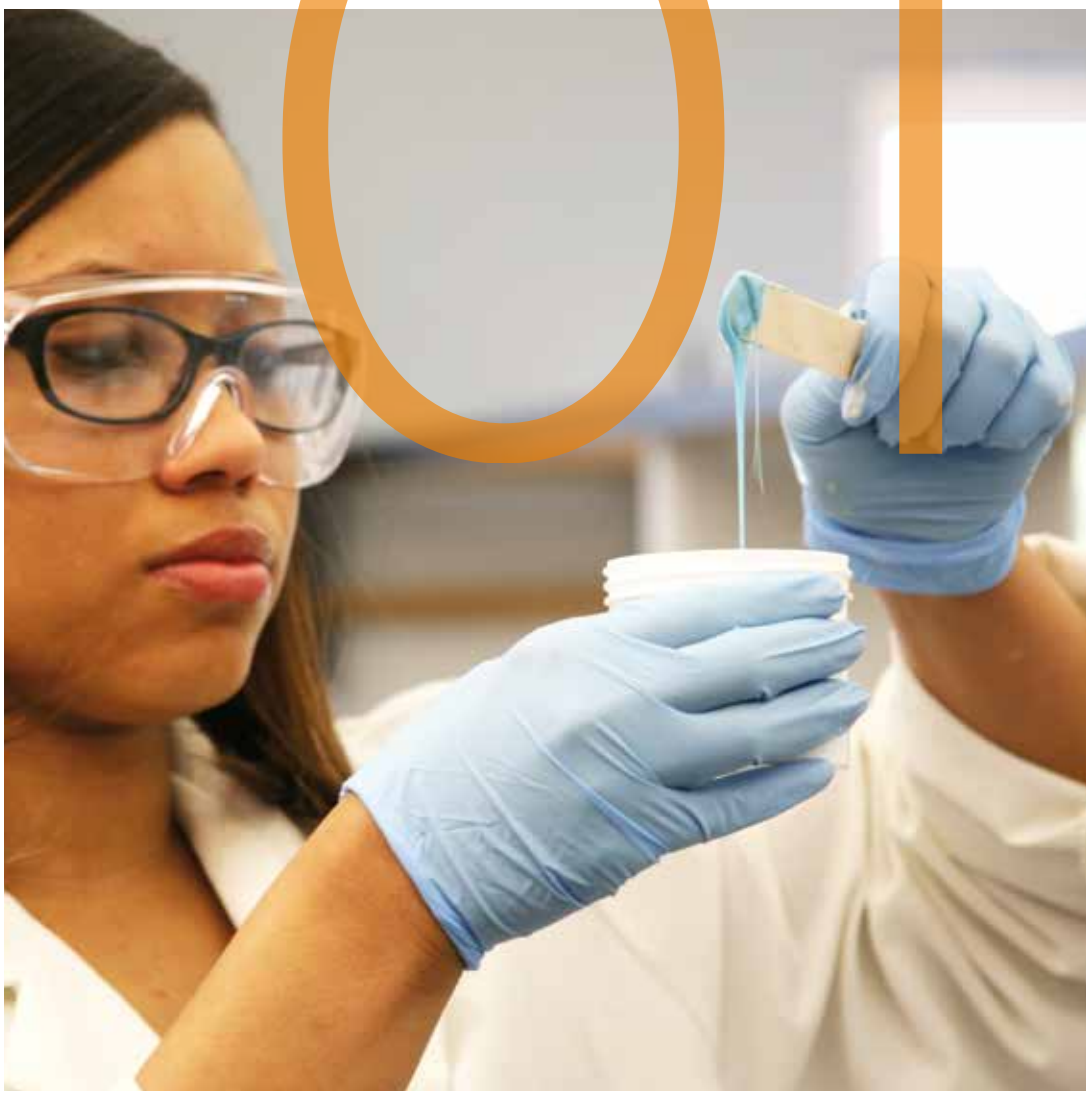
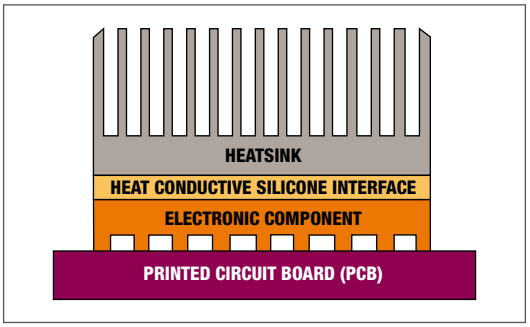


Thermally conductive
materials for
heat management

Thermally conductive silicones

The management of the heat is a major challenge in electric vehicles components, like in batteries or electronic control units. One option is to dissipate the heat from electronic components.
For that purpose, Elkem Silicones provides a wide range of thermal interface materials with several technologies:

- thermally conductive silicone adhesives
- thermally conductive silicone gap filler
- thermally conductive silicone gels and encapsulants.



Bluesil™ ESA Properties

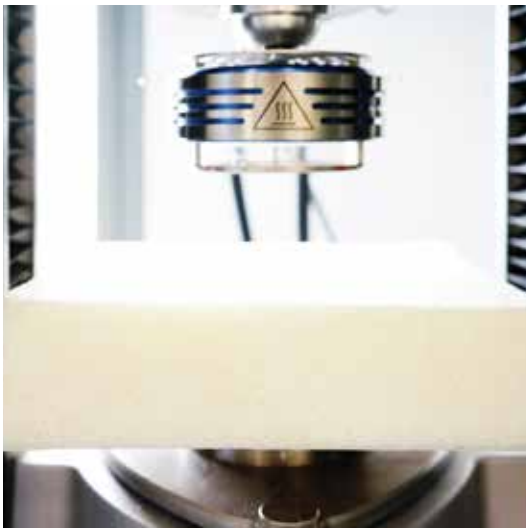
Products	Application	Description	Color	Ratio	Viscosity (mPa.s)	Shore A Hardness	Thermal conductivity (W/m.K)
ESA 7721 A&B	Adhesive	Adhesive	Blue	1:1	A: 225 000 B: 115 000	69	1,00
ESA 7712 A&B	Potting	Adhesive potting	Grey	1:1	A: 56 000 B: 43 000	24	1,50
ESA 7752 A&B	Gap filler	Gap filler	Grey	1:1	A: 140 000 B: 80 000	88	2,00
ESA 6721 A&B	Potting	Encapsulant	White	1:1	A: 7 400 B: 12000	32 Sh00	1,02
ESA 6742 A&B	Gap filler	Gap filler	White	1:1	A: 107 000 B: 97 000	68 Sh00	1,83

When higher values of thermal conductivity are targeted by our customers, we develop customized products.
This allows us to optimize the material in front of the technical requirements for our customer.
Products with very low content of volatiles siloxanes (D3-D10) are available on request.
Gap filler grades are also available with glass beads on request.

Bluesil™ ESA Applications

	Applications							
	Battery pack							
Products	Bonding battery pack to cooling plate	Heat dissipation between cells	Heat dissipation from the cells to heat sink	Power control unit	Convertor, invertor	Electric motor	Electronic control unit	PTC heater
ESA 7721 A&B	•	•		•	•			•
ESA 7712 A&B		•				•	•	
ESA 7752 A&B		•		•	•			
ESA 6721 A&B		•	•		•	•	•	
ESA 6742 A&B		•	•	•	•		•	

Lightweight Silicone Solutions for EV



Bluesil™ RT Foam Technology for flexible solutions

In which case using RT Foams

- A compression gasket is required
- An “environmental seal” is required (sealing against ambient air, splashed water, dust, moisture)
- A cost effective sealing solution is required (compared to preformed gaskets / foam tapes)
- Fast-cure is demanded (room-temp / low/short heat)
- Low sealing force / low modulus is needed
- High tolerance gaps exist
- Component sound and vibration requires dampening
- Gasket installation demands automation (robotic dispensing)
- A excellent temperature insulation with a very low thermal conductivity coefficient

Silicone foam is a spongy material that provides the performance benefits of standard silicone but with added flexibility, suppleness and lightweight.

Processing

- Both RT Foam parts is directly dispensed onto the surface or groove to be sealed.
- Once the components are mixed, a foaming agent is formed.
- The dispensed foam gasket expands in its liquid stage and cures to a foamed solid within 5 min to 4 hours at room temperature.
- Provides a low modulus integrated compression seal with the fine cell-structure.

Benefits

Elkem Silicones foam range is specially designed for Sealing, Gasketing and thermal insulation application.

More information on the foam video

Compression properties

Fire resistance

02

For the management of the heat, the silicone foam with a very low thermal conductivity coefficient, is another option to insulate cells to avoid the overheat propagation to the other cells. Foams can be used also as a gasketing for the sealing of the battery pack. On top the low density of these materials do not impact the weight and consequently the energy consumption.

Bluesil™ RT Foam properties

Products	Application	Description	Color	Ratio	Viscosity (mPa.s)	Density	Pot life	Curing conditions	Thermal conductivity (W/m.K)	Max service Temp. (°C)
RTF 3210	Potting	Thermal insulation	Beige	1:1	A: 6000 B: 2500	0,13	1 min	2 hours at RT	<0,03	275°C
RTF 3242	Potting	Flowable foam, V0 on 10 mm thick	Dark grey	1:1	A: 15 000 B: 15 000	0,25	2-8 min	15 to 30 min at RT		250°C
RTF 3243	FIPFG	Thixotropic, Heat Curing, V0 on 10 mm thick	Black	1:1	A: 110 000 B: 80 000	0,3	2-5 min	4 hours at RT		250°C
RTF 3244	FIPFG	Thixotropic, RT curing, V0 on 10 mm thick	Black	1:1	A: 20 000 B: 10 000	0,25	1-3 min	10 to 30 min at RT		275°C
RTF 3234	Potting	Thixotropic, RT curing, V0 on 10 mm thick	White	1:1	A: 20 000 B: 10 000	0,25	1-3 min	10 to 30 min at RT		275°C
RTF 3345	Insulation	Thermally Resistant Foam	Rust	10:1	A:60 000 B: 60	0,3	3-5 min	10 to 30 min at RT	0,10	275°C (500H 250°C)

The foaming is based on H_2 generation with a addition curing type, but Syntatic foams are also available on request.

Bluesil™ RT Foam application

	Applications				
Products	**Frame sealing of battery pack**	**Assembly PCU, ECU**	**Cell insulation**	**Potting**	**Gap filling**
RTF 3210			•		
RTF 3242				•	•
RTF 3243	•	•			
RTF 3244	•	•			
RTF 3234			•	•	
RTF 3345			•	•	

Potting and encapsulating materials for your sensitive Electronics

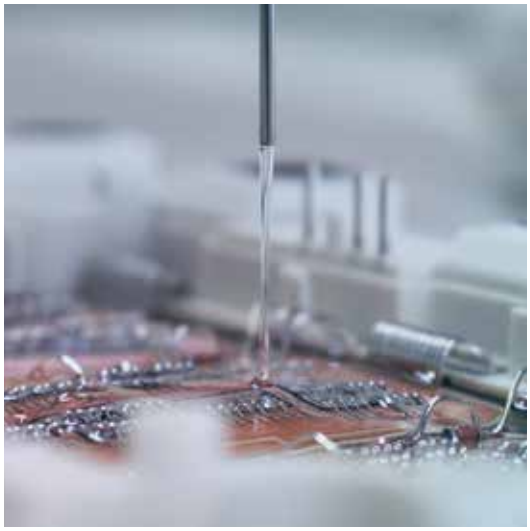
Protection of Sensitive Components

The protection of critical parts is a key challenge in electric vehicle applications.

There is a growing need to protect sensitive components against environmental factors, such as dust and moisture, as well as fluids, heat, and fire exposure. Silicones are the materials of choice for potting and encapsulating sensitive Electronics like sensors, actuators, central processing units (CPUs), printed circuit board, as they are the first line of defense against outside aggression. Elkem Silicones offers a wide range of technologies for potting and encapsulating as:

- Gels: thanks to the low modulus, these materials can protect against external influences and transmission of mechanical stress
- Elastomers: with high mechanical performances, high thermal resistance and fire resistance (UL certification).

For Power Electronics devices, like IGBT (insulated gate bipolar transistor), we developed special grade of gel with increased temperature performance expected for higher power density due to miniaturization of the devices. These specific grades can sustain high service temperature conditions: high temperature > 200°C during a long period of time (5 000 hours even 9 000 hours).



Bluesil™ ESA Gels Properties

Products	Application	Description	Color	Ratio	Viscosity (mPa.s)	Penetration (1/10mm)	Pot life	Curing conditions	Thermal conductivity (W/m.K)
ESA 6024 A&B	Potting	Self-adhesive (tacky), high damping, low extractibles	Blue	1:1	1 300	280	90 min	24h at 23°C or 90min at 80°C	0,15
ESA 6020 A&B	Potting	Self-adhesive (tacky), high damping, low extractibles	Clear	1:1	1 300	280	90 min	24h at 23°C or 90min at 80°C	0,15
ESA 6025 A&B	Potting	Self-adhesive (tacky), high damping, low extractibles	Blue	1:1	1 300	280	20 min	4h at 23°C or 90min at 80°C	0,15
ESA 6110 A&B	Potting	Optically clear, shock absorption, tacky	Optically clear	1:1	1 200	250	50 min	3h at 23°C	0,15
ESA 6110 QC A&B	Potting	Optically clear, shock absorption, tacky	Optically clear	1:1	1 200	250	5 min	30 min at 23°C	0,15
ESA 6016 A&B	Potting	Inherent tack, high damping, low extractible	Clear	1:1	460	130	>6h	24h at 23°C or 60min at 70°C	0,19
ESA 6120 QC A&B	Potting	Low viscosity, thermal resistance	Clear	1:1	200	270	20 min	30 min at 120°C	0,15
ESA 6000 HT A&B	Potting	Thermal resistance, Less tacky	Clear	1:1	1 300	50 Sh00	50 min	90 min at 80°C	0,15
ESA 6115 QC A&B	Potting	Inherent tack, high damping	Clear	1:1	1 200	130	20 min	Clear	0,15
ESA 6010 A&B	Potting	Inherent tack, high viscosity	Clear	1:1	60 000	170	120 min	60 min at 120°C	0,18

Bluesil™ ESA RTV-2 properties

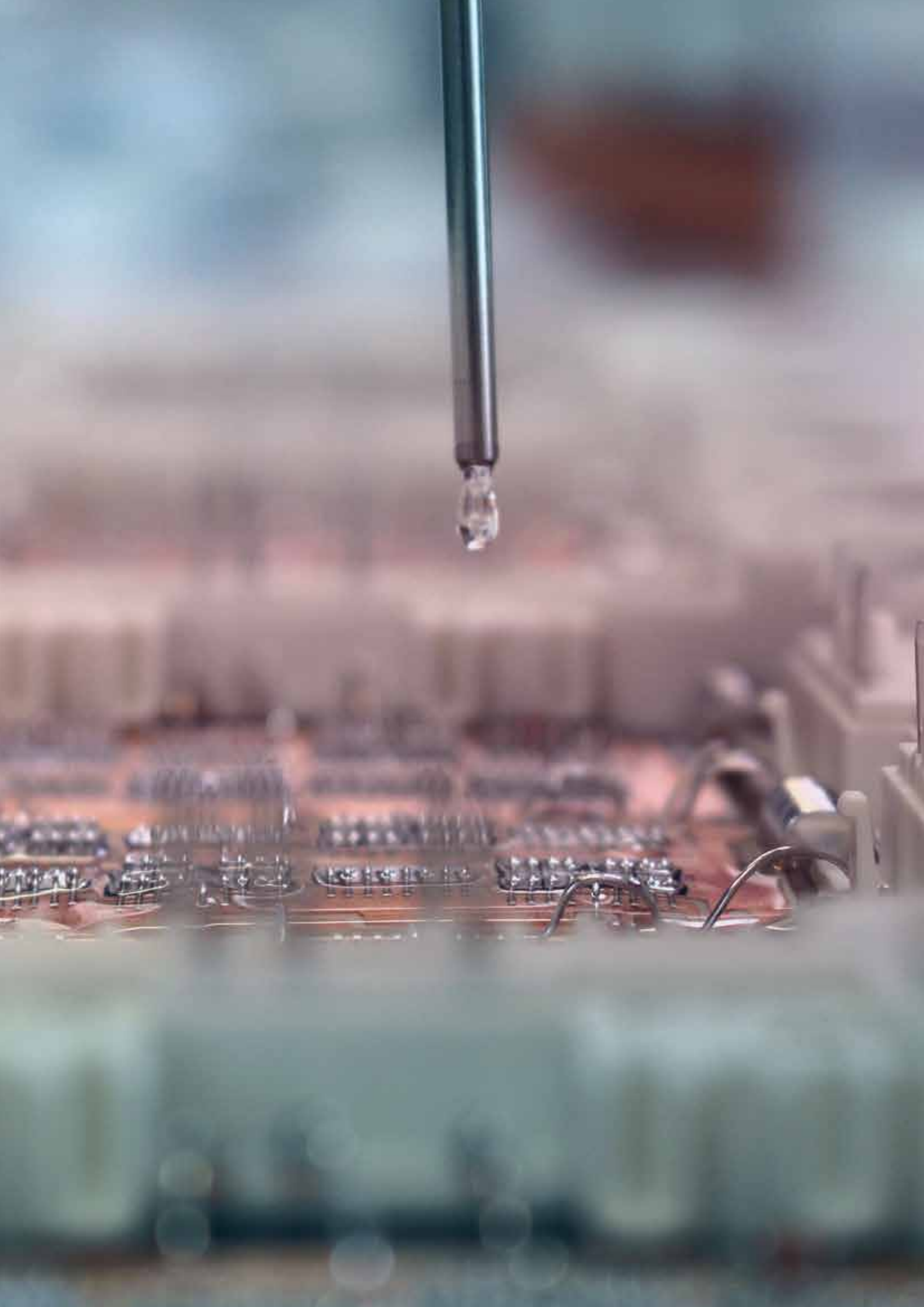
Products	Application	Description	Color	Ratio	Viscosity (mPa.s)	Shore A Hardness	Tensile strength (Mpa)	Elongation at break (%)	Pot life
ESA 7242	Potting	UL94 V0	Dark grey	1:1	2 600	50	2,9	140	60 min
ESA 7242 QC	Potting	UL94 V0	Black	1:1	3 000	53	2,5	135	8 min
ESA 7246	Potting	Optically clear, Pourable	Optically clear	10:1	3 750	48	6,9	120	80 min
ESA 7250	Potting	Optically clear UL94 HB	Optically clear	10:1	4 000	52	6,2	115	4 h
ESA 7247	Potting	Self adhesion	Dark grey	1:1	5 700	53	2,5	114	76 min
ESA 7255 50	Potting	Optically clear, adhesion on plastic, metal	Transparent	10:1	2 000	30	2,1		8 h
ESA 7256	Potting	Clear, low temperature curing	Clear to Light Straw	10:1	4 200	43	6,9	119	3 h
ESA 7258	Potting	High durometer	Dark grey	1:1	910	67	2,7	44	5 h
ESA 7262	Potting	Fire resistance	Black	1:1	3 500	50			2h

Max service Temperature (°C)	Shelf life	Dielectric Strength (IEC 60243), kV/mm	Dielectric constant at 1 kHz (IEC 60250)	Dielectric dissipation factor at 1 kHz (IEC 60250)	Volume resistivity (IEC 60093), .cm
150	12 months	9,6	6,4	0,0005	2,7x10^16
150	12 months	9,6	6,4	0,0005	2,7x10^16
150	12 months	9,6	6,4	0,0005	2,7x10^16
150	12 months		6,3	0,002	2,1x10^14
	12 months		6,3	0,002	2,1x10^14
150	12 months				
150	12 months	9,5	6,6	0,002	1,5x10^16
225	12 months		8,8	0,0003	7,6x10^14
150	12 months	9,5	4,1	0,0003	3,1x10^15
	12 months				

Curing conditions	Thermal conductivity (W/m.K)	Max service Temperature (°C)	Shelf life	Dielectric Strength (IEC 60243), kV/mm,	Dielectric constant at 1 kHz (IEC 60250)	Dielectric constant at 1 kHz (IEC 60250)	Volume resistivity (IEC 60093), .cm
30min at 150°C	0,43	250	12 months	18,6	3,05 at 100KHz	0,004 at 100KHz	8,24x10^14
30min at 150°C	0,43	250	12 months	16,5	2,95 at 100KHz	0,001 at 100KHz	7.1x10^14
10 min at 115°C	0,18		12 months	15,6			
1h at 150°C	0,16	200	24 months	16,5	2,7	0,003	1x10^15
30 min at 115°C	0,43	250	6 months	20	2,95 at 100KHz	0,001 at 100KHz	7,1x10^14
1h at 150°C	0,16	200	12 months	20,3			
35 min at 100°C	0,18	200	12 months	20,3	2,72 at 100KHz	0,0009 at 100KHz	1,03x10^16
90 min at 100°C	0,41	200	12 months	18,4	3,17 at 100KHz	0,002 at 100KHz	7,42x10^14
20h at 23°C	0,64	200	6 months	17,0	3,2	0,005	8x10^13

Bluesil™ ESA Applications

	Applications					
Products	Junction box	IGBT	Sensors	CPU	PCB	Connectors
ESA 6024 A&B	•		•	•		•
ESA 6020 A&B	•		•	•		•
ESA 6025 A&B	•		•	•		•
ESA 6110 A&B	•		•			
ESA 6110 QC A&B			•			
ESA 6016 A&B	•		•	•		•
ESA 6120 QC A&B	•		•			
ESA 6000 HT A&B		•				
ESA 6115 QC A&B	•					•
ESA 6010 A&B	•		•	•		
ESA 7242	•		•	•		•
ESA 7242 QC	•		•	•		•
ESA 7246	•				•	
ESA 7250	•				•	
ESA 7247	•		•	•		•
ESA 7255 50	•				•	
ESA 7256	•				•	•
ESA 7258	•		•	•		•
ESA 7262	•		•	•		•



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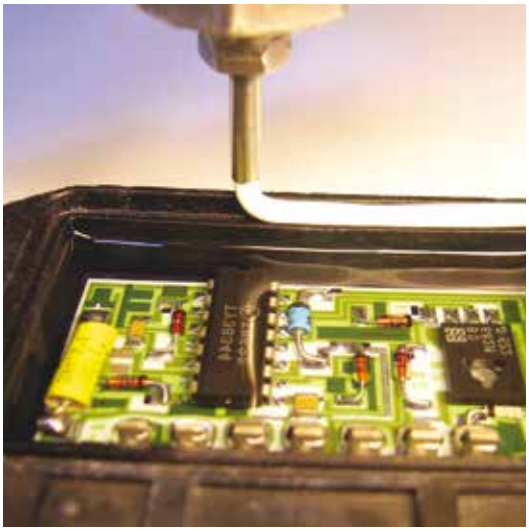
Discover our
Adhesive solutions



Adhesive Silicones solutions Bluesil™ ESA & CAF for Sealing & Bonding

Silicones materials are widely used in electronic applications for bonding components and sealing against environmental contaminants as they can maintain their physical and electrical properties over a wide range of temperature, moisture and other harsh environments.

Elkem Silicones offers a range of silicones adhesives with CAF® RTV-1 and Bluesil™ ESA RTV-2 which provide self-adhesion to many metals, ceramic, glass and plastics. These solutions are excellent candidates for assembly applications on or near to sensitive electrical and electronic components as they do not release any corrosive by products.

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Bluesil™ ESA & CAF® Properties

Type	Products	Application	Description	Color	Ratio	Viscosity (mPa.s)	Shore A Hardness	Tensile strength (Mpa)	Elongation at break (%)
RTV2	ESA 7244	Adhesive	Adhesion metal, plastic, silk screening	Blue	1:1	60 000	50	5,5	200
RTV2	ESA 7241	Adhesive	Adhesion metal, plastic, silk screening	Ivory	1:1	60 000	50	5,5	200
RTV2	ESA 7230	Adhesive	Transparent, adhesion	Translucent	10:1	40 000	31	3,2	260
RTV2	ESA 8352	Adhesive	PC, RT, Adhesive	Black	10:1	90 000	50	2,7	250
CAF	CAF 530	Adhesive	Neutral alcoxy curing, thixotropic, primerless	Black, White	1 component	Thixotropic	34	3,5	450
CAF	CAF 520	Adhesive	Neutral alcoxy curing, thixotropic, primerless	Trans, White	1 component	Thixotropic	15	1,1	500
CAF	CAF 2 Fluid	Adhesive	Neutral flowable, self-adhesive	Translucent	1 component	30 000	18	0,7	250

Bluesil™ ESA & CAF® Applications

	Applications				
Products	**ECU housing**	**Connector sealing**	**PTC or Sheath heater**	**Vibration damping**	**Adhesive potting**
ESA 7244		•	•		•
ESA 7241		•	•		•
ESA 7230		•			•
ESA 8352	•	•			
CAF 530	•			•	
CAF 520	•			•	
CAF 2 Fluid					•

Pot life	Curing conditions	Thermal conductivity (W/m.K)	Max service Temperature (°C)	Shelf life	Dielectric Strength (IEC 60243), kV/mm	Dielectric constant at 1 kHz (IEC 60250)	Dielectric dissipation factor at 1 kHz (IEC 60250)	Volume resistivity (IEC 60093), .cm
>16h	10 min at 150°C	0,34	200	12 months	16,1	2,9 at 100KHz	0,003	1,5x10^15
>16h	10 min at 150°C	0,34	200	12 months	19	2,9 at 100KHz	0,003	1,5x10^15
>16h	10 min at 150°C	0,17	200	12 months	19	2,9 at 100KHz	0,003	1,5x10^15
15-20min	RT	0,34	220	12 months				
15 min	8h for 2mm RT	0,30	185	12 months				
7 min	7h for 2mm RT	0,30	150	12 months				
12 min	16h for 2mm RT	0,20	250	10 months				

Our dedicated team of experts for sealing, bonding and protective sensitive electronics applications, are focused on customer needs, providing unique silicone solutions including products and services. Ease your business hassles with Elkem Silicones, using some of our services:

Elkem
A Bluestar Company

Silicones

Delivering your potential

Elkem Silicones

Elkem Silicones is one of the world's leading fully integrated silicone manufacturers with applications and research laboratories, production sites and sales offices located around the globe.

At Elkem Silicones, we're more than just high quality silicone products and associated services. We are a team of professionals located around the globe ready to provide you with the service and performance you deserve with a personal touch.

From technical support to customized formulations and regulatory support, Elkem Silicones has the people in place when and where you need them, committed to help you deliver your potential. Because we care!

For detailed commercial contacts please visit our website: www.silicones.elkem.com

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