

Enhancing the Performance & Reliability of Your Electronics Designs

Innovative Thermally Conductive Silicone Solutions



IMAGINE



Heat Is the Enemy of Electronic Devices ...

The reasons why may vary from application to application. Yet, improved thermal management is increasingly critical to maintaining the long-term performance and reliability of electronics in virtually every industry.

TRANSPORTATION: From rail to road, vehicles are increasingly reliant on electronics for everything from optimized fuel consumption and safety to propulsion and braking. As this trend accelerates, it will drive demand for higher performance and more cost-effective thermal management solutions.

ADVANCED SEMICONDUCTOR PACKAGING: The trend toward smaller devices with more densely packed electronic components is converging with expanded use of flip chip and stacked die architectures. As a result, new thermal management solutions are needed to effectively dissipate heat and deliver greater device reliability.

SOLID-STATE LIGHTING: Unlike conventional light sources, the ability to manage the temperature of an LED module has a direct impact on the reliability, output quality, lifetime and system cost of the device. Moreover,

thermal management is becoming an increasingly important performance metric for the entire LED value chain, as solid-state lighting competes with conventional illumination for high-intensity and high-temperature applications.

POWER ELECTRONICS: Power supplies and controls for industry, computer servers, and solar and wind energy are all managing higher electrical loads and, with them, increasing temperatures. The trend is creating a need for improved thermal management to dissipate heat in these devices, as this translates into improved performance, reliability and lifetime. Improved thermal management also offers needed design flexibility.

CONSUMER ELECTRONICS AND TELECOMMUNICATIONS: Form factor optimization is one of the challenges facing this industry. This is in for consumer electronics, requiring compact, multi-functional thermal management solutions.



... In Dow Corning, You Have a Powerful Ally for Thermal Management

Offering an innovative and growing portfolio of thermally conductive silicone adhesives, compounds, encapsulants and dispensable pads, Dow Corning can help you identify a thermal management solution for your most sensitive electronics. Combining materials knowledge, application expertise, collaborative innovation and a global presence, we can help you meet your design goals for heat dissipation, processability and low cost of ownership.

As a class of materials, silicones from Dow Corning maintain consistently high physical, electrical and optical performance at high temperatures. Available in a broad range of viscosities, cure chemistries and delivery formats, our products can help expand design and manufacturing latitudes.

ADHESIVES

Strong Bonds That Dissipate Heat

Thermally conductive silicone adhesives from Dow Corning are suitable for bonding and sealing hybrid circuit substrates, semiconductor components, heat spreaders and other applications that demand broad design, flexible processing options and excellent thermal management.

These high-performance materials range from low-viscosity liquids to non-slump formulations and encompass two cure chemistries:

- One-part moisture-cure grades offer simple room-temperature processing to minimize costs
- One- or two-part heat-cure solutions help accelerate processing to speed time to market

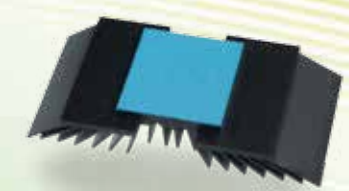
They develop no significant by-products during processing, allowing use as structural adhesives without mechanical fasteners, even in complete confinement.

Expanded design and process flexibility

Dow Corning's thermally conductive silicone adhesives enhance design flexibility by filling oddly-shaped gaps and generating large contact areas to maximize heat transfer. Similarly, they can ease manufacturing challenges when part planarity and fit tolerances cannot be tightly controlled.

The surface contact of our thermally conductive adhesives helps reduce interfacial resistance. Specific formulations even incorporate microscopic spacer beads to achieve extremely uniform bond lines, while compensating for board deviation and minor warping.

After cure, these advanced materials convert into a strong yet flexible elastomer and deliver good unprimed adhesion to a variety of common substrates including metals, ceramics and filled plastics. The highest-performing grades deliver thermal conductivity as high as 6.8 W/mK.



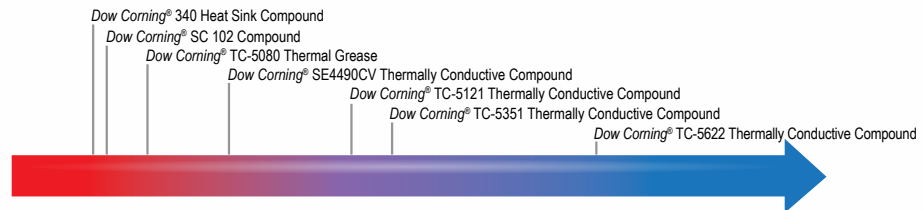
COMPOUNDS

Extending Thermal Management to the Smallest Gap

Dow Corning's thermally conductive compounds serve as a thermal bridge that draws heat away from a device's sensitive electronics and dissipates it into the ambient environment. Our broad and versatile portfolio of solutions encompasses both thermal silicone compounds and greases.

These no-cure materials share common properties, such as low thermal resistance, high thermal conductivity and the ability to achieve very thin bond line thickness. They offer relatively low cost, ease of application onto heat sinks via screen-printing and ease of re-work. They are designed to maintain their consistency at high temperatures to form a positive seal with heat sinks to ensure reliable device performance. Our thermally conductive compounds and greases are particularly suitable for applications in which heat sinks are removed and reattached later, or where the electronics assembly favors no-cure processes.

Select grades from this family of products offer thermal conductivity as high as 4.3 W/mK.

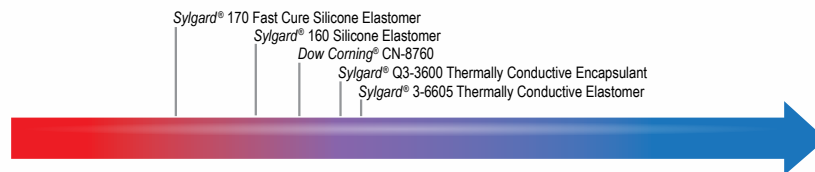


ELASTOMERS AND GELS

Managing Heat in Complex Architectures

Dow Corning's thermally conductive silicone elastomers and gels encompass an adaptable selection of products for encapsulation and potting applications. This broad family of material technologies offers versatile thermal management solutions with a variable level of hardness or stress relief to fit your electronics application need.

The low viscosity before cure of these products enables them to process easily and fully embed tall components, delicate wires and solder joints, making them particularly suitable for managing high heat in complicated electronic architectures. Plus, due to their extremely low modulus after cure, these materials offer superb stress relief.



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Next-Generation Thermal Management Materials ... Today!

Dow Corning listens closely to its customers and continuously innovates across product technologies to deliver next-generation thermal solutions when you need them – today.

From thermal greases that dissipate heat in computer and telecom applications, to dispensable thermal pads for more cost-competitive LED lighting, to adhesives for more reliable transportation electronics, Dow Corning continues to pioneer advanced solutions for your thermal management needs.

Some of our most advanced thermal management innovations include:

Dow Corning® TC-5622 Thermally Conductive Compound

Our decades of expertise in silicone technology and thermally conductive fillers enabled development of this advanced new silicone grease. In addition to delivering the highest thermal conductivity in our portfolio, *Dow Corning®* TC-5622 Thermally Conductive Compound also offers new options for reducing total systems cost for electronics applications.

Dow Corning is your source for collaborative innovation of new thermal management solutions. If you do not see what you need in our expansive product offering, call us today to discuss your application or processing challenge.

Dow Corning® Dispensable Thermal Pads

Our dispensable thermal pad solution enables you to quickly and precisely dispense or print a layer of thermally conductive silicone compound in controllable thicknesses on complex substrate shapes, helping to ensure excellent thermal management and lower cost of ownership compared to prefabricated thermal pads. Select grades offer varying levels of thermal conductivity: *Dow Corning®* TC-4015 and TC-4016 Dispensable Thermal Pads offer thermal conductivity of 1.5 W/mK, while *Dow Corning®* TC-4025 and TC-4026 Dispensable Thermal Pads offer higher 2.5 W/mK thermal conductivity. *Dow Corning®* TC-4016 and TC-4026 Dispensable Thermal Pads incorporate glass beads to offer improved control over bond line thickness.

Dow Corning® TC-2030 and TC-2035 Thermally Conductive Adhesives

These advanced materials can help inspire new designs and opportunities for effective heat management. *Dow Corning®* TC-2030 Thermally Conductive Adhesive delivers good heat transfer and excellent adhesion to copper and aluminum substrates commonly used in transportation electronics.

For electronic transmission, power and conversion modules, *Dow Corning®* TC-2035 Thermally Conductive Adhesive was designed to deliver reliable long-term bonding and efficient thermal flow. It is particularly suitable for applications that demand thin bond lines to enhance thermal conductivity. This high-performance material effectively bonds either organic or ceramic substrates to heat sinks and sustains reliable performance at temperatures reaching 200°C.

Product	Thermal Conductivity (W/mK)	Adhesive	Thin BLT TIM (<100 µm)	Gap Filler (>100 µm) Large Joint Movement and Dampening Needs	Encapsulant/Pottant	
NON-CURABLE						
Dow Corning® 340 Heat Sink Compound	Increasing TC		✓			
Dow Corning® SC 102 Compound			✓			
Dow Corning® TC-5080 Thermal Grease				✓	✓	
Dow Corning® SE4490CV Thermally Conductive Compound				✓		
Dow Corning® TC-5121 Thermally Conductive Compound				✓		
Dow Corning® TC-5351 Thermally Conductive Compound					✓	
Dow Corning® TC-5622 Thermally Conductive Compound	4.3		✓			
ONE-PART CURABLE ELASTOMER						
Dow Corning® SE 9184 White RTV Adhesive†	Increasing TC	✓	✓			
Dow Corning® 4422 Thermally Conductive Adhesive†		✓	✓	✓		
Dow Corning® 4420 Thermally Conductive Adhesive†		✓	✓	✓		
Dow Corning® 4486 Thermally Conductive Adhesive†		✓	✓			
Dow Corning® 3-6752 Thermally Conductive Adhesive		✓	✓			
Dow Corning® 3-1818 Thermally Conductive Adhesive		✓	✓			
Dow Corning® 1-4174 Thermally Conductive Adhesive*		✓	✓			
Dow Corning® 1-4173 Thermally Conductive Adhesive		✓	✓			
Dow Corning® 6523**		✓	✓			
Dow Corning® DA-6534 Adhesive**		6.8	✓	✓		
TWO-PART CURABLE ELASTOMER						
Sylgard® 170 Fast Cure Silicone Elastomer	Increasing TC				✓	
Sylgard® 170 Silicone Elastomer						✓
Sylgard® 160 Silicone Elastomer						✓
Dow Corning® CN-8760						✓
Dow Corning® Q1-9226 Thermally Conductive Adhesive		✓	✓			
Sylgard® Q3-3600 Thermally Conductive Encapsulant		✓				✓
Sylgard® 3-6605 Thermally Conductive Elastomer		✓	✓			✓
Dow Corning® 3-6753 Thermally Conductive Adhesive*		✓	✓			
Dow Corning® 3-6751 Thermally Conductive Adhesive		✓	✓			
Dow Corning® TC-4016 Dispensable Thermal Pad*					✓	
Dow Corning® TC-4015 Dispensable Thermal Pad					✓	
Dow Corning® TC-4026 Dispensable Thermal Pad*					✓	
Dow Corning® TC-4025 Dispensable Thermal Pad					✓	
Dow Corning® TC-2030 Thermally Conductive Adhesive			✓		✓	
Dow Corning® TC-2035 Thermally Conductive Adhesive		3.2	✓	✓		

* Contains glass spacer beads for Bond Line Thickness (BLT) control

** Provides electrical conductivity

† Moisture-cure product

COMPOUNDS are defined as non-curable materials. They also are commonly called greases.

GELS are defined as curable, lightly cross-linked materials with very low modulus where the hardness is on or below the Shore 00 scale.

ELASTOMERS are defined as curable materials typically with a durometer on the Shore A scale. In some cases, a very soft elastomer can have a Shore 00 durometer.

ENCAPSULANTS are defined as curable materials that deliver protective/hiding/impact protection functions. They typically have a hardness in the mid-upper Shore A range.

POTTANTS are defined as curable materials that deliver protective/extreme stress relief functions. They typically have a hardness below a low Shore A value.

ADHESIVES are defined as materials that adhere or seal. They typically have a hardness in the mid-upper Shore A range.

This list is not all-inclusive. If you do not see a product that meets your needs, please contact your Dow Corning representative.

How can we help you today?

Tell us about your performance, design and manufacturing challenges. Let us put our silicon-based materials expertise, application knowledge and processing experience to work for you.

For more information about our materials and capabilities, visit dowcorning.com.

To discuss how we could work together to meet your specific needs, email electronics@dowcorning.com or go to dowcorning.com/contactus for a contact close to your location. Dow Corning has customer service teams, science and technology centers, application support teams, sales offices, and manufacturing sites around the globe.



Images: Cover - AV13673, AV01159, AV19254, AV13369, AV16447, AV20668; Page 2 - AV20670, AV20671, AV20674; Page 3 - AV16442, AV20669, AV20673; Page 4 - AV13140, AV11085, AV16293; Page 5 - AV19454, AV15473, AV19773; Page 6 - AV20672; Back cover - AV12934

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