Technical Data Sheet

# DOWSIL™ TC-2035 CV Adhesive

DOWSIL™ TC-2035 CV Adhesive is a two-part heat cure silicone thermally conductive adhesive with low bond line thickness and low volatile content (D4-D10) < 0.01%.

## Features & Benefits

- High thermal conductivity
- Primerless Adhesion to selected substrates
- Low bond line thickness
- Stable performance at high temperature (up to 200°C)
- Excellent thermal performance at various BLT
- Mechanical reliability – maintain stable elastomeric properties after accelerated aging test
- Adhesive reliability – adhesion stable or improves after accelerated aging test
- Excellent dielectric properties
- Low volatile content (D4-D10) < 100 ppm (0.01%)

## Composition

- Two-part adhesive

## Applications

- Designed to provide long term bonding and efficient thermal flow, especially where low bond line thickness is required to enhance thermal conductivity
- Typical applications include: bonding organic and ceramic substrates (i.e. PCB, HDI, DBC) to heat sinks for transmission modules, power modules and conversion modules
- Automotive applications: ADAS (Advanced Driver Assistance Systems), ECU assembly, power electronics, converter/inverter, OBC

## Typical Properties

Specification Writers: These values are not intended for use in preparing specifications.

| Test | Property | Unit | Result |
|---|---|---|---|
| CTM[1] 0176 B | One or Two-part | | Two |
| CTM 0176 B | Color: Part A | | White |
| | Color: Part B | | Reddish brown |
| CTM 0022 B | Density: Part A | g/cm$^3$ | 3.0 |
| CTM 0022 B | Density: Part B | g/cm$^3$ | 3.0 |
| | Mix Ratio (Weight or Volume) | | 1 to 1 |

1. CTM: Corporate Test Method, copies of CTMs are available upon request.





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## Typical Properties (Cont.)

| Test | Property | Unit | Result |
|---|---|---|---|
| | Heat Cure Time at 115°C | minutes | 15 |
| | Pot Life at 25°C | hours | 3.5 |
| CTM 0793 | Hardness Shore D | | 33 |
| CTM 1094 C | Viscosity at 1 (1/s) (Part A) | Pa.s | 350 |
| CTM 1094 C | Viscosity at 1 (1/s) (Part B) | Pa.s | 290 |
| CTM 1094 N | Viscosity at 1 (1/s) (Mixed) | Pa.s | 345 |
| CTM 1393 | Minimum Bond-line Thickness | µm | ≤ 95 |
| CTM 0137 | Tensile Strength | MPa | 3.7 |
| CTM 0137 | Elongation | % | 50 |
| CTM 0243 A | Adhesion – Lap Shear (Al - Anodized A5052P)<br>Failure Mode, Cohesive | MPa<br>% | 2.9<br>≥ 90 |
| CTM 0114 | Dielectric Strength at 1 mm | kV/mm | 22 |
| CTM 1163 | Thermal Conductivity by Transient Method | W/m.K | 3.3 |
| DIN[2] 51007 | Heat Capacity, Volumetric<br>At 25°C | <br>$MJ/m^3.K$ | <br>2.63 |
| | Heat Capacity<br>At 25°C | <br>J/g.K | <br>0.88 |
| ASTM[3] E 831 | Linear CTE (by TMA -50 to 200°C) | ppm/K | 93.6 |

2. DIN: Deutsche Industrie Norm.
3. ASTM: American Society for Testing and Materials.

## Description

The heat-cure, thermally conductive adhesives produce no by-products in the cure process, allowing their use in deep section and complete confinement. These adhesives will develop good, primerless adhesion to a variety of common substrates including metals, ceramics, epoxy laminate boards, reactive materials and filled plastics. Electronic system assemblies are continually designed to deliver higher performance. Especially in the area of consumer devices, there is also a continual trend towards smaller, more compact designs. In combination these factors typically mean that more heat is generated in the device. Thermal management of electronic system assemblies is a primary concern of design engineers. A cooler device allows for more efficient operation and better reliability over the life of the device. As such, thermally conductive compounds play an integral role here. Thermally conductive materials act as the ambient via a heat transfer media (i.e. heat sink). These materials have properties such as low thermal resistance, high thermal conductivity, and can achieve thin Bond Line Thicknesses (BLTs) which can help to improve the transfer of heat away from the device.

## Substrate Testing

To ensure maximum bond strength for adhesives on a particular substrate, 100 percent cohesive failure of the adhesive in a lap shear or similar adhesive strength test is needed. This ensures compatibility of the adhesive with the substrate being considered. Also, this test can be used to determine minimum cure time or to detect the presence of surface contaminants such as mold release agents, oils, greases and oxide films.

## Mixing and De-airing

Two-part materials should be mixed in the proper ratio either by weight or volume. The presence of light-colored streaks or marbling indicates inadequate mixing. Automated airless dispense equipment can be used to reduce or avoid the need to de-air. If de-airing is required to reduce voids in the cured elastomer, consider a vacuum de-air schedule of > 8 inches Hg (or a residual pressure of 10–0 mm of Hg) for 10 minutes or until bubbling subsides.

## Processing/Curing

Addition-cure silicones should be cured at 100°C (212°F) or above. The cure rate is rapidly accelerated with heat (see heat-cure times in Typical Properties table). For thicker sections, a pre-cure at 70°C (158°F) may be necessary to reduce voids in the elastomer. Length of precure will depend on section thickness and confinement of adhesive. It is recommended that 30 minutes at 70°C (158°F) be used as a starting point for determining necessary pre-cure time. Addition-curing materials contain all the ingredients needed for cure with no byproducts from the cure mechanism. Deep-section or confined cures are possible. Cure progresses evenly throughout the material. These products generally have long working times.

## Pot Life and Cure Rate

Cure reaction begins with the mixing process. Initially, cure is evidenced by a gradual increase in viscosity, followed by gelation and conversion to its final state. Pot life is defined as the time required for viscosity to double after Parts A and B (base and curing agent) are mixed.

## Adhesion

Dow silicone adhesives are specially formulated to provide unprimed adhesion to many reactive metals, ceramics and glass, as well as to selected laminates, resins and plastics. However, good adhesion cannot be expected on non-reactive metal substrates or on reactive plastic surfaces such as teflon, polyethylene or polypropylene. Special surface treatments such as chemical etching or plasma treatment can sometimes provide a reactive surface and promote adhesion to these types of substrates. Dow primers can be used to increase the chemical activity on difficult substrates. For best results, the primer should be applied in a very thin, uniform coating and then wiped off after application. After application, primers should be thoroughly cured prior to application of the silicone elastomer. Poor adhesion can be experienced on plastic or rubber substrates that are highly plasticized, since the mobile plasticizers act as release agents. Small-scale laboratory evaluation of all substrates is recommended before production trials are made. In general, increasing the cure temperature and/or cure time will improve the ultimate adhesion.

## Useful Temperature Ranges

For most uses, silicone adhesives should be operational over a temperature range of -45 to 200°C (-49 to 392°F) for long periods of time. However, at both the low and high temperature ends of the spectrum, behavior of the materials and performance in particular applications can become more complex and require additional considerations. For low temperature performance, thermal cycling to conditions such as -55°C (-67°F) may be possible for most products, but performance should be verified for your parts or assemblies. Factors that may influence performance are configuration and stress sensitivity of components, cooling rates and hold times, and prior temperature history. At the high temperature end, the durability of the cured silicone elastomer is time and temperature dependent. As expected, the higher the temperature, the shorter the time the material will remain useable.

## Solvent Exposure

In general, the product is resistance to minimal or intermittent solvent exposure, however best practice is to avoid solvent exposure altogether.

## Handling Precautions

PRODUCT SAFETY INFORMATION REQUIRED FOR SAFE USE IS NOT INCLUDED IN THIS DOCUMENT. BEFORE HANDLING, READ PRODUCT AND SAFETY DATA SHEETS AND CONTAINER LABELS FOR SAFE USE, PHYSICAL AND HEALTH HAZARD INFORMATION. THE SAFETY DATA SHEET IS AVAILABLE ON THE DOW WEBSITE AT DOW.COM, OR FROM YOUR DOW SALES APPLICATION ENGINEER, OR DISTRIBUTOR, OR BY CALLING DOW CUSTOMER SERVICE.

## Usable Life and Storage

DOWSIL™ TC-2035 CV Adhesive has a 12 months shelf life from the date of production when stored at or below 35°C in its' original, unopened packaging. The product should be stored in its original packaging with the cover tightly attached to avoid any contamination. Store in accordance with any special instructions listed on the product label. The product should be used by the indicated Exp. Date found on the label.

## Limitations

This product is neither tested nor represented as suitable for medical or pharmaceutical uses.

## Health and Environmental Information

To support customers in their product safety needs, Dow has an extensive Product Stewardship organization and a team of product safety and regulatory compliance specialists available in each area.

For further information, please see our website, dow.com or consult your local Dow representative.

## Disposal Considerations

Dispose in accordance with all local, state (provincial) and federal regulations. Empty containers may contain hazardous residues. This material and its container must be disposed in a safe and legal manner.

It is the user's responsibility to verify that treatment and disposal procedures comply with local, state (provincial) and federal regulations. Contact your Dow Technical Representative for more information.

## Product Stewardship

Dow has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis for our product stewardship philosophy by which we assess the safety, health, and environmental information on our products and then take appropriate steps to protect employee and public health and our environment. The success of our product stewardship program rests with each and every individual involved with Dow products - from the initial concept and research, to manufacture, use, sale, disposal, and recycle of each product.

## Customer Notice

Dow strongly encourages its customers to review both their manufacturing processes and their applications of Dow products from the standpoint of human health and environmental quality to ensure that Dow products are not used in ways for which they are not intended or tested. Dow personnel are available to answer your questions and to provide reasonable technical support. Dow product literature, including safety data sheets, should be consulted prior to use of Dow products. Current safety data sheets are available from Dow.

## How Can We Help You Today?

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

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

To discuss how we could work together to address your specific needs, go to **dow.com** for a contact close to your location. Dow has customer service teams, science and technology centers, application support teams, sales offices, and manufacturing sites around the globe.

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