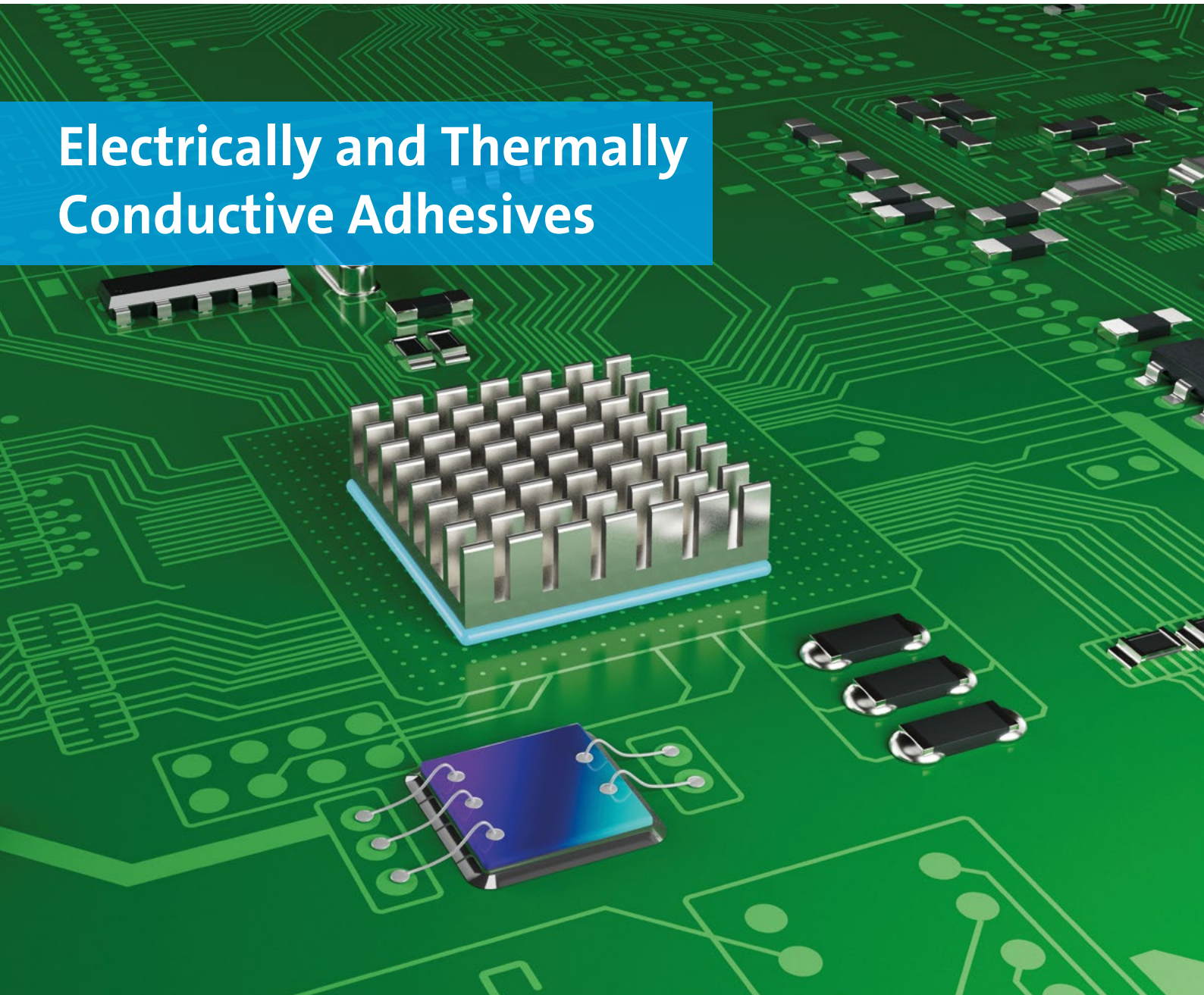


# Electrically and Thermally Conductive Adhesives

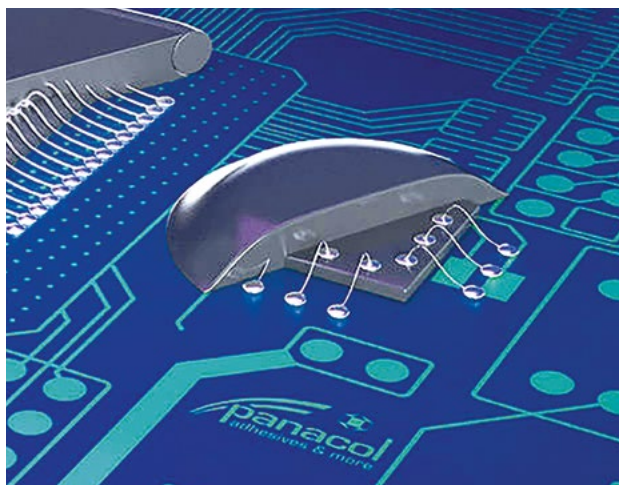


**Adhesive Bonding Instead of Soldering:  
Bonding Electrical Connections**

**Die Attach  
Sensor Bonding  
Thermal Management**

## Thermal Management

Electronic components and devices are getting smaller and more powerful, which increases their thermal load. This can shorten their lifetime and reduce their performance. In many applications, such as computer and sensor technology or the manufacture of high-performance batteries, efficient heat dissipation combined with electrical insulation is required. In addition to these properties, adhesives offer form-fit and mechanically lightweight construction.



### Benefits of adhesives compared to other processes:

Thermal dissipation with simultaneous mechanical fastening and form-fit connection of different components

- ▶ High ionic purity
- ▶ Good media resistance
- ▶ Solvent-free
- ▶ High adhesion

Panacol offers a wide range of thermally conductive adhesives: The portfolio covers 1- and 2-component adhesives with different curing conditions. The adhesives are suitable for applications at temperatures between -40 and 200°C.

Thermally conductive adhesives							
Adhesive	Typical application (areas of application)	Viscosity [mPas]	Thix-Index	Base	Curing	[W/mK] Values	Properties
<b>Elecolit® 6207</b>	Sensor bonding, potting compounds	9,000 - 12,000 (Mix)	1.4 - 1.5	2-part epoxy	RT/thermal	0.9 - 1.1	Flammability category according to UL-94: V0
<b>Elecolit® 6601</b>	Sensor bonding, potting compounds	12,000 - 20,000 LVT, Sp. 4/6 rpm	1.3 - 1.5	1-part epoxy	thermal	0.7 - 0.9	Excellent adhesion to metals, high strength
<b>Elecolit® 6603</b>	Sensor bonding, potting compounds, automotive	20,000 - 40,000 Rheometer, 10s <sup>-1</sup>	1.4 - 2.4	1-part epoxy	thermal	1.2 - 1.4	Excellent adhesion to metals, highly resistant to vibrations and temperature shock
<b>Elecolit® 6604</b>	Magnet and heat sink bonding	55,000 - 75,000 Rheometer, 10s <sup>-1</sup>	1.2 - 1.7	1-part epoxy	thermal	0.9 - 1.1	Excellent adhesion to metals
<b>Elecolit® 6607</b>	Sensor, magnet and heat sink bonding	50,000 - 65,000 Rheometer, 5s <sup>-1</sup>	1.6 - 1.7	1-part epoxy	thermal	0.8 - 1.0	Low coefficient of thermal expansion (CTE), curing from 80°C
<b>Elecolit® 6608</b>	Potting compounds, automotive	95,000 - 105,000 Rheometer, 10s <sup>-1</sup>	1.2 - 1.4	1-part epoxy	thermal	1 - 1.2	Flammability category according to UL-94: V0, High thermal resistance Tg = 140°C
<b>Elecolit® 6616</b>	Sensor, magnet and heat sink bonding	50,000 - 120,000 Rheometer, 10s <sup>-1</sup>	2 - 3	2-part epoxy	RT/thermal	0.9 - 1.1	Very high dielectric strength (> 30 kV/mm)
<b>Vitralit® E-1671 T</b>	NTC Glob Top	40,000 - 55,000 Rheometer, 10s <sup>-1</sup>	8.5 - 10	1-part epoxy	UV/thermal	0.7 - 0.9	Stable, high thermal resistance, high Tg

## Creating Electrical Connections

Miniaturization and condensed power are highly advanced and extremely relevant in electronics and electrical engineering. Precise dispensing in complex component geometry, fast curing and ultimately a form-fit and long-lasting material connection are essential. Low curing temperatures, low electrical resistance and reliable performance on flexible, temperature-sensitive substrates are in demand and do not align with classic soldering processes.



### Benefits of adhesives compared to other processes:

- ▶ Application by screen printing & jetting possible
- ▶ Fast curing (snap cure) and thermode curing (hot press) can be realized
- ▶ Flexible, mechanical & temperature-stable connection
- ▶ High ionic purity (corrosion-resistant)

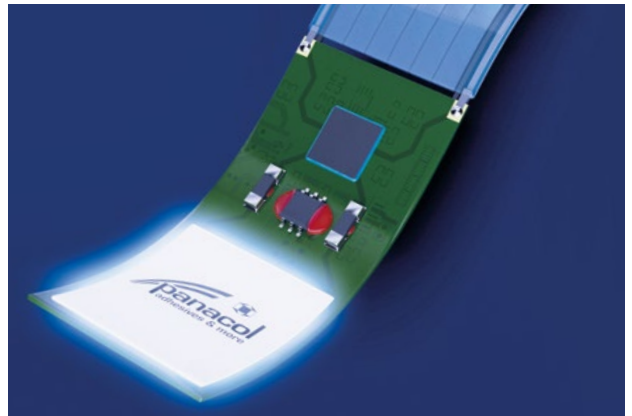
Electrically conductive adhesives from Panacol are characterized by low shrinkage, good adhesion to printed circuit boards (PCBs) and metals (copper, silver), as well as high chemical, mechanical and thermal resistance. The adhesives are suitable for applications at temperatures between -40 and 200°C.

Electrically conductive adhesives							
Adhesive	Typical application (areas of application)	Viscosity [mPas]	Base	Curing	[W/mK] Values	Volumen-resistance in $\Omega \cdot \text{cm}$	Properties
<b>Elecolit® 3025</b>	Heat-sensitive components	80,000 - 90,000 Rheometer, $10\text{s}^{-1}$	2-part epoxy	RT/thermal	> 1.6	$10^{-3}$	Curing at room temperature
<b>Elecolit® 3043</b>	Automotive sensors	1,500 - 3,500 Rheometer, $10\text{s}^{-1}$	1-part epoxy	thermal	1.8 - 2.2	$10^{-4}$	Excellent flow behavior, low viscosity
<b>Elecolit® 3647-1</b>	(Organic) photovoltaics	7,000 - 12,000 Rheometer, $10\text{s}^{-1}$	1-part epoxy	thermal	4 - 5	$10^{-4}$	Very flexible, particularly suitable for foil substrates (flex PCB, metallic foils)
<b>Elecolit® 3648</b>	(Organic) photovoltaics, die attach	10,000 - 15,000 Rheometer, $10\text{s}^{-1}$	1-part epoxy	thermal	3 - 4	$10^{-4}$	Suitable for foil substrates (flex PCB, metallic foils), curing by thermode, curing from 80°C
<b>Elecolit® 3653</b>	Powertrain, Automotive sensors	4,000 - 8,000 Rheometer, $10\text{s}^{-1}$	1-part epoxy	thermal	1.8 - 2.2	$10^{-3}$	Suitable for flexible substrates
<b>Elecolit® 3655</b>	SMD Packaging, LED die attach	5,000 - 15,000 Rheometer, $10\text{s}^{-1}$	1-part epoxy	thermal	8.5 - 9.5	$10^{-4}$	High glass transition temperature ( $T_g - 150^\circ\text{C}$ ), high ionic purity (semiconductor grade)
<b>Elecolit® 3656</b>	SMD Packaging, LED die attach	50,000 - 70,000 Rheometer, $10\text{s}^{-1}$	1-part epoxy	thermal	3.5 - 4.5	$10^{-3}$	Stable, high dimensional stability, suitable for jetting
<b>Elecolit® 3661</b>	Flexible circuit boards, die attach	20,000 - 40,000 Rheometer, $10\text{s}^{-1}$	1-part epoxy	thermal	1.8 - 2.2	$10^{-3}$	Stable, high dimensional stability
<b>Elecolit® 3662</b>	Power modules	45,000 - 55,000 Rheometer, $10\text{s}^{-1}$	1-part epoxy	thermal	5 - 6	$10^{-5}$	Very good electrical conductivity, suitable for jetting, low abrasiveness
<b>Elecolit® 323</b>	Medical devices	paste-like	2-part epoxy	thermal	3.8 - 4.2	$10^{-4}$	Biocompatible, certified according to ISO 10993-5, high ionic purity (semiconductor grade)
<b>Elecolit® 325</b>	Aerospace	paste-like	2-part epoxy	RT/thermal	2.8 - 3.2	$10^{-3}$	Minimal stringing, low volume resistance during RT curing
<b>Elecolit® 336</b>	MV-protect./discharge, electronic contacting	pastös	2-part-epoxy	RT/thermal	2.8 - 3.2	10	Good conductivity values at room temperature curing
<b>Elecolit® 342</b>	ESD protection, Contacting of heating elements	1,000 - 2,000 Rheometer, $20\text{s}^{-1}$	1-part acrylate	RT/thermal	1.8 - 2.2	$10^{-3}$	Small particle size
<b>Elecolit® 414</b>	Aerospace	6,000 - 15,000 Rheometer, $10\text{s}^{-1}$	1-part polyester	thermal	3 - 4	$10^{-4}$	Flexible, very high chemical resistance

### Die Attach

Die Attach is one of the most important processes in the assembly of microelectronic components. In this process, a semiconductor component (e.g. micro-processor) is attached to a circuit carrier (e.g. a PCB). Electrically conductive adhesives offer the advantage of combining form-fit mechanical stability, electrical contacting and thermal conductivity. This decisively optimizes the efficiency/performance and reliability of the entire component. Adjustable flow properties enable precise dispensing via screen printing or jetting.

Due to their flexibility and low curing temperatures, electrically conductive adhesives are particularly suitable for flexible and temperature-sensitive substrates (flex PCBs). Nevertheless, they exhibit high chemical, mechanical and thermal resistance (e.g. for reflow processes).



### Thermally Conductive Potting

Thermally conductive adhesives are chemically curing systems that have, in uncured condition, a low viscosity and very good flow properties. This enables precise dispensing, flow of the adhesive into cavities and gaps and good surface wetting with form-fit gap bridging, which compensates for unevenness in the surfaces of the parts to be joined. A properly selected adhesive not only ensures the dissipation of heat, but also offers high bond strength between a wide variety of materials and dissimilar substrates.



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