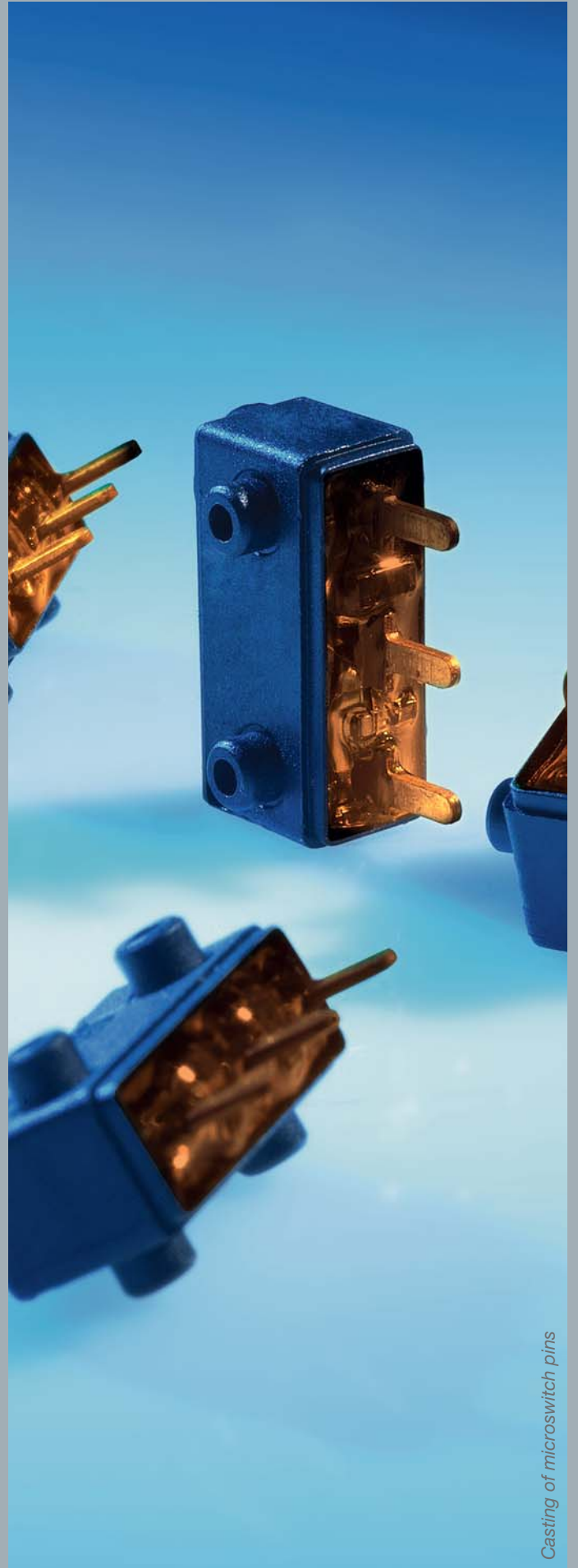


## Bonding in Electronics

Design Examples  
and Product Range



# Bonding and fixing

## Bonding of stator to housing



### DELO-ML DB135

- Very high impact resistance
- Excellent chemical resistance (for example to oil, gasoline, Diesel)
- Normal temperature range of use up to +180 °C
- Tension-equalizing: High-strength bonding of metals with dissimilar coefficients of expansion
- Immediate firmness to touch by light fixation; anaerobic curing of adhesive in shadowed areas



Bonding of a steel stator to an aluminum housing  
Figures: EBM-Papst

## Bonding of magnets to stator



### DELOMONOPOX AD295

- Excellent chemical resistance
- Very high temperature stability
- High static and dynamic loading capacity even at elevated temperatures
- Ideal for bonding metals, temperature-resistant plastics, ferrite and ceramic
- Is used in all motors produced by the DLR (German Aerospace Center)



Magnets bonded to a stator of space motors (figure: DLR) for the ISS International Space Station (figure: NASA)

## Bonding of rotor to shaft



### DELO-ML DB133

- High impact resistance
- Excellent chemical resistance
- Tension-equalizing with an elongation at tear of 130 %
- Ideal for laminar bonding
- Immediate firmness to touch by light fixation; anaerobic curing of adhesive in shadowed areas



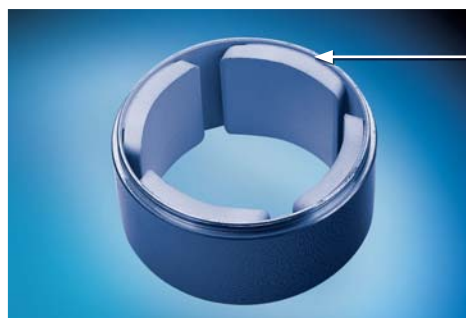
High-strength bonding of a rotor package to a shaft

## Bonding of magnets into stator housing



### DELOMONOPOX AD289

- High impact resistance
- Gap-filling
- Excellent chemical resistance (for example to oil, gasoline, brake fluid)
- Normal temperature range of use up to +200 °C
- High static and dynamic loading capacity



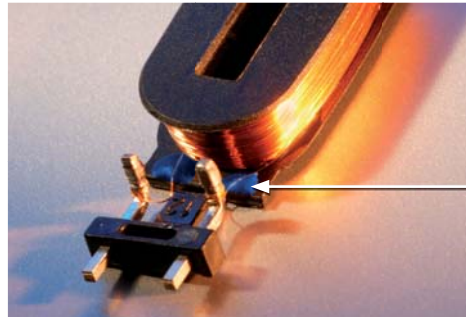
Bonding of magnets into the stator housing of an electric motor

## Fixing of coil wires



### DELO-PHOTOBOND 4497

- Dry surface
- Tension-equalizing with an elongation at tear of 200 %
- Functionality: Additional mechanical protection, for example during vibration or subsequent molding



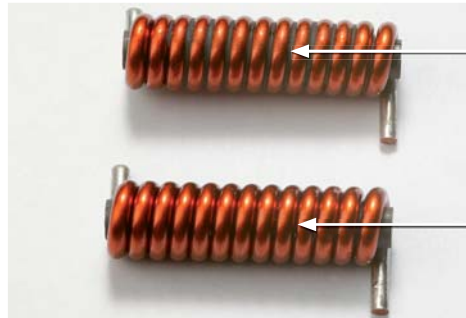
Fixing of coil wires of coil carriers (adhesive colored blue to indicate the bonding area)

## Fixing of ferrites in coils



### DELOMONOPOX 6093

- Excellent flow behavior: Adhesive capillates through the windings
- Outstanding adhesion to lacquered coil wire and ferrite
- Process reliability: Reliable fixing for further processing during the assembly process
- Also suitable for casting



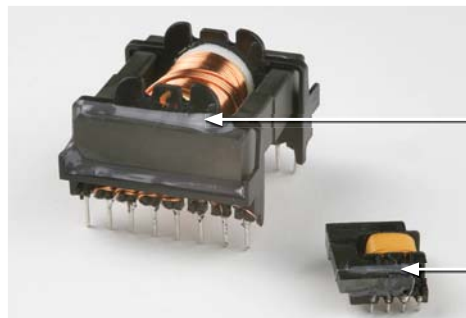
Fixing of ferrites in coils  
Top: Shorter after application, the adhesive is still visible  
Bottom: The adhesive capillates through the windings

## Fixing of ferrites and coil bodies



### DELO-DUOPOX AD895

- High-strength construction adhesive
- Excellent chemical resistance
- Quality: Good strength of the assembly during mechanical stress
- Functionality: Reduction of mechanical vibrations and the associated noise development
- Multi-purpose
- Easy processing from DELO-AUTOMIX cartridges



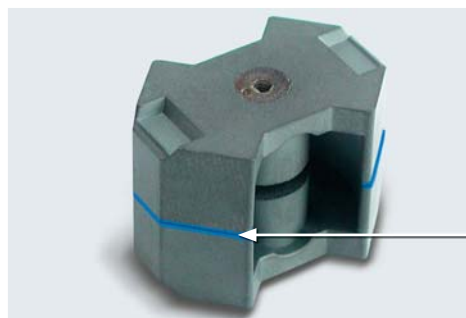
Fixing of ferrites and coil bodies

## Bonding of ferrites



### DELO-ML 5327

- Temperature range of use from -60 °C to +200 °C
- Accelerated firmness to touch in less than 20 s with DELO-QUICK activator
- High strength: Component failure in mechanical test
- Functionality: Excellent vibration resistance and damping



Fast and reliable bonding of ferrite cores (adhesive colored blue to indicate the bonding area)

# Bonding and fixing

## Bonding of coils

1C epoxy

15 min @ 180 °C

pasty viscosity

### DELOMONOPOX AD297

- Run-resistant
- Tough-hard
- Normal temperature range of use up to +200 °C
- Good strength on laminated copper foil and aramid foil
- High stability and strength even upon high magnetic forces



Bonding of coils for CERN high current transformers  
Top: Adhesive between the copper windings and the foil  
Bottom: Fixture of the coil body on the aluminum cooling plate

## Vibration protection on PCBs

2C polyurethane

2h firm to touch

pasty viscosity

### DELO-PUR 9694

- Run-resistant
- High static and dynamic loading capacity
- Functionality: Optimal vibration damping
- Multi-purpose
- Easy processing from DELO-AUTOMIX cartridges
- Authorization by Germanischer Lloyd



Vibration protection of soldered electronic components, for example capacitors

## Securing of soldered contacts

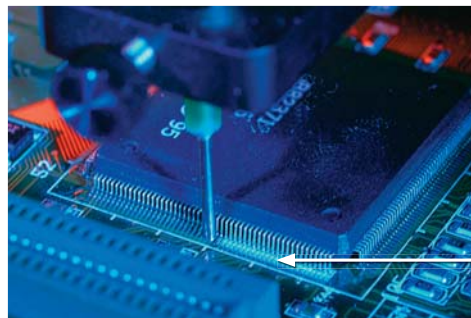
1C epoxy

22s

32 Pas viscosity

### DELO-KATIOBOND 45952

- High peel resistance
- High corrosion resistance
- Perfect solution: Preactivation enables bonding of opaque components
- Production reliability: Application control by fluorescent adhesive
- Prolonged lifetime: Reliable protection from desoldering and shocks



Securing of soldered contacts of electronic components, such as CSP or QFP

## Fixing of SMD components

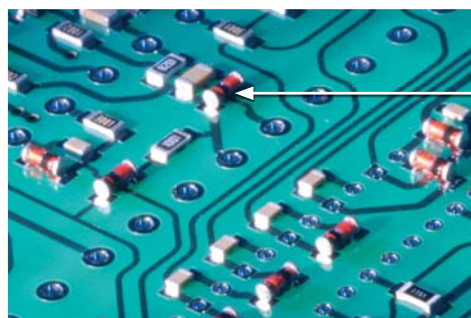
1C epoxy

15 min @ 140 °C

pasty viscosity

### DELOMONOPOX MK096

- High wet strength
- Low outgassing
- High corrosion resistance
- Processing on standard systems, for example from Camalot or Asymtek: Jetting, dispensing from cartridge, stencil printing
- Suitable for high-speed processes (more than 30,000 drops/h)



Fixing of SMD components, especially of melfs or glass SMD components



## Bonding of PBT cover and housing

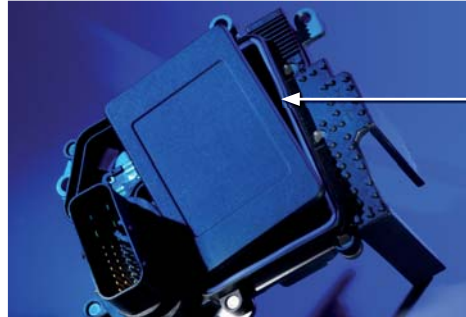
1C epoxy

30 min @ 130 °C

40 Pas viscosity

### DELOMONOPOX 6093

- Good chemical resistance (for example to oil, gasoline)
- Excellent vibration resistance
- Very high resistance to elevated temperatures and temperature cycling
- Multi-purpose for various plastics (such as ABS, PA, PBT)



Bonding of the cover to the housing of an automotive control unit

## Fixing of a diode

Cyano-acrylate

30 s firm to touch

20 Pas viscosity

### DELO-CA AD294

- Good filling of gaps up to 0.3 mm
- Accelerated curing in combination with DELO-QUICK 2002 activator
- Good adhesion to the nickel-plated surface
- Production reliability: Steady viscosity enables constant production parameters



Fast fixing of a diode in the housing of an optical converter

## Bonding of miniloudspeakers

1C acrylate

12 s

58 Pas viscosity

### DELO-PHOTOBOND SD496

- High impact resistance and flexibility
- Excellent resistance to humidity and temperature
- Multi-purpose for various materials (such as metal, ferrite, certain plastics)
- Production reliability: Application control by fluorescent adhesive
- Quality: Loudspeakers bonded with DELO-PHOTOBOND are characterized by excellent acoustic quality



Bonding of miniloudspeaker components for mobile phones

## Bonding of automotive cameras

mod. 1C epoxy

30 min @ 130 °C

30 Pas viscosity

### DELO-DUALBOND AD345

- Good resistance to temperature, climatic changes, humidity and in salt spray test
- Production capacity: Short cycle times by light fixation in less than 1 s
- Optimized process flow: Heat curing at only +80 °C allows the use of temperature-sensitive materials and ensures the maintenance of the adjusted optical system
- Process reliability: Steady, low shrinkage delivers high yield



Bonding of automotive camera modules for camera-based driver assistance systems

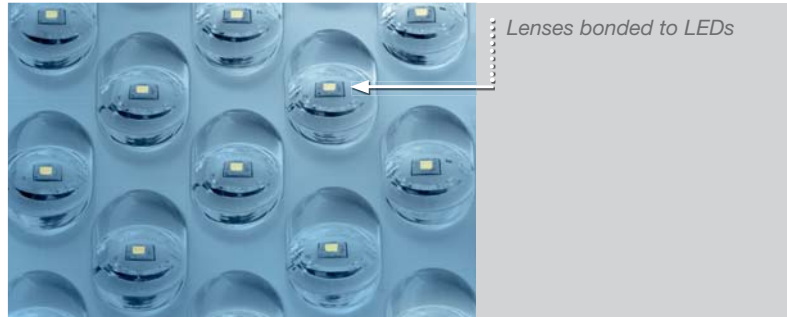
# Bonding and fixing

## Bonding of LED reflectors and lenses

1C epoxy 9s 9Pas viscosity

### DELO-KATIOBOND AD640

- Optically clear
- High yellowing resistance
- High temperature stability
- Low outgassing
- Suitable for reflow processes
- High reliability: For example for the use in headlights, flash lenses and backlighting applications

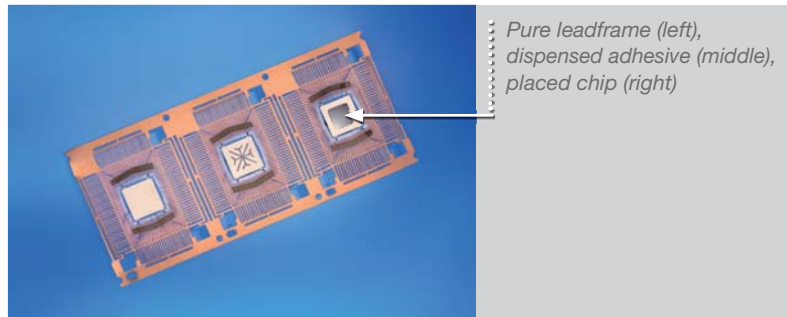


## Die attach

1C epoxy 2 min @ 175 °C 39Pas viscosity

### DELOMONOPOX DA375

- Good electrical and thermal properties
- High temperature resistance up to +260 °C, for lead-free soldering processes
- Fast curing in seconds with a thermode (for example 8 s @ +150 °C)
- Low-tension curing
- Products tested according to JEDEC MSL for reasonably priced storage
- Optimized products for many chip sizes

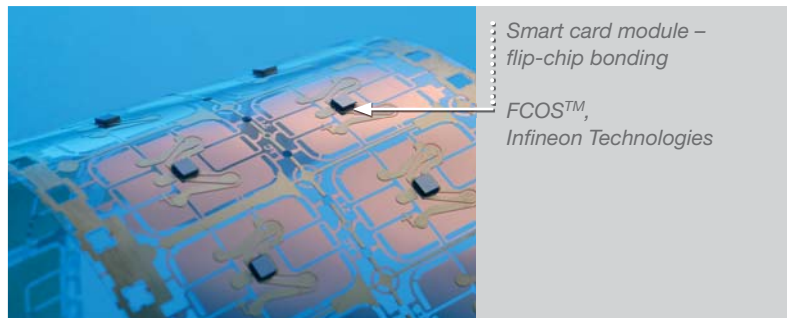


## Flip-chip bonding

1C epoxy 3 min @ 150 °C 32Pas viscosity

### DELOMONOPOX AC268

- Good humidity resistance
- High ion purity, high corrosion resistance
- Fast curing in seconds with a thermode (for example 6 s @ +180 °C)
- Multi-purpose (for example on PET, paper, FR4, PI, Cu, Al, Ag, Au)
- Anisotropic conductive and non-conductive product variants available

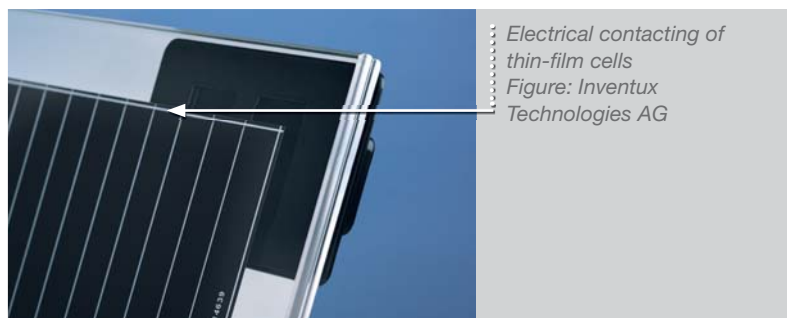


## Contacting of thin-film cells

1C epoxy 10 min @ 150 °C 60Pas viscosity

### DELOMONOPOX IC VE 19436

- Excellent electrical conductivity
- Tension-equalizing
- Outstanding adhesion to materials used in photovoltaics
- No flux material application, therefore no contamination compared to solder
- Fast curing with a thermode in less than 10 s (convection oven: 10 min @ +150 °C)
- Product variants available for flexible and rigid thin-film cells



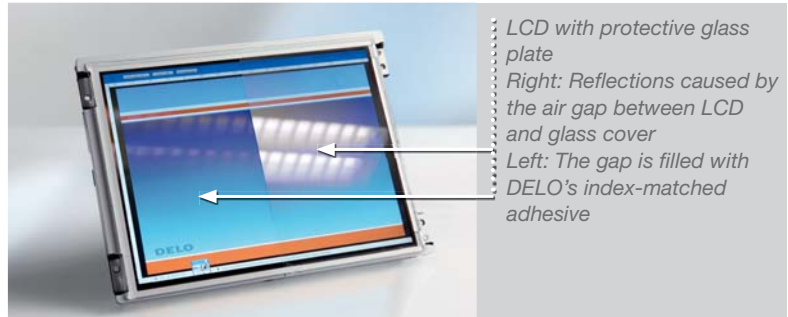
# Casting and coating

## Bonding of touch panel displays



### DELO-DUALBOND (various products)

- High transparency
- Tension-equalizing
- Low shrinkage
- Secondary curing mechanism for shadowed areas, for example under black print on the glass cover
- Quality: Increased ruggedness, impact and vibration resistance of touch panel and display

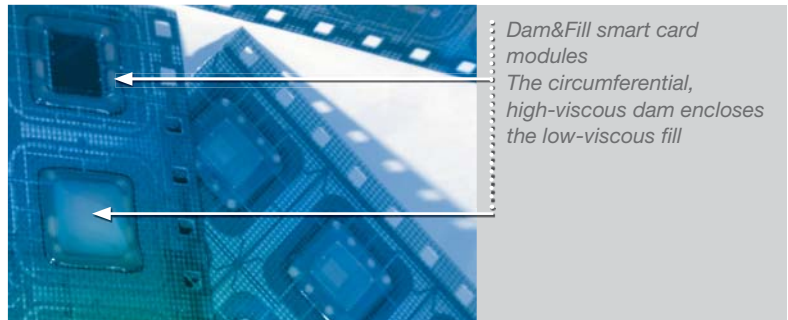


## Dam&Fill chip encapsulation



### DELO-KATIOBOND DF698 (Dam), 4670 (Fill)

- High production capacity: Encapsulation of up to 30,000 modules/h (glob top; Dam&Fill: 15,000)
- Dam&Fill adhesives for a chemically homogeneous unit
- Functionality: High ion purity ensures the chip function over the entire lifetime
- Quality: Steady dispensing results even when using showerhead dispensers

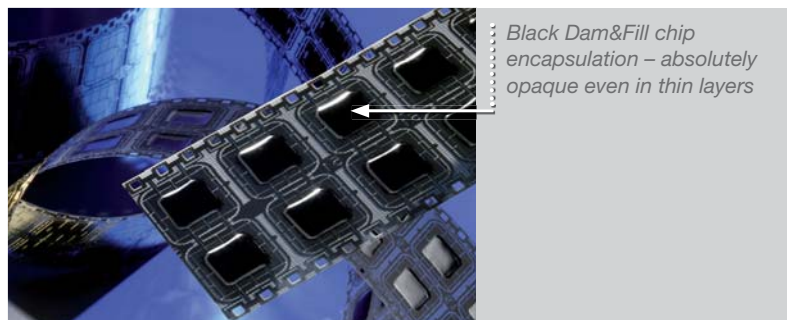


## Opaque Dam&Fill chip encapsulation



### DELO-Dam&Fill DF580 (Dam), DF570 (Fill)

- Production capacity: Short cycle times thanks to very fast curing
- Absolutely opaque even in thin layers; very high mechanical protection effect → Protection of the chip from unauthorized views, chip removal and copying

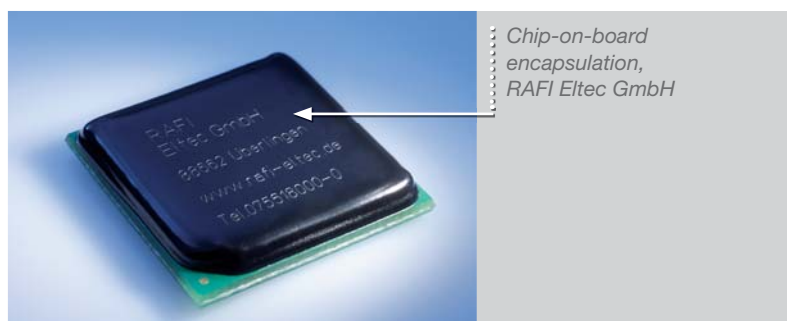


## Chip-on-board encapsulation on PCB



### DELOMONOPOX GE785 (Dam), GE725 (Fill)

- Excellent chemical resistance (for example to Diesel, oil, grease)
- Temperature range of use from -65 °C to +180 °C
- Resistance to lead-free soldering
- Universal adhesion to standard substrates (such as FR4, PA, PPS)
- Variable curing parameters: Fast curing or low curing temperature possible
- Increased functionality and prolonged lifetime: Very high humidity resistance



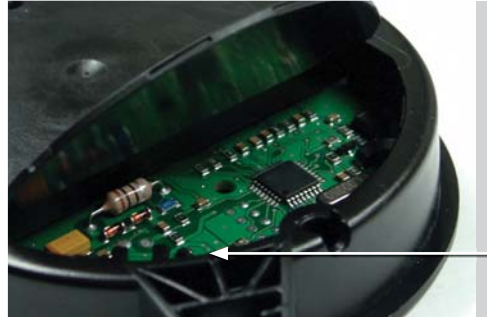
# Casting and coating

## Sealing of electronic housings

1C silicone 2 mm / 24 h 17 Pas viscosity

### DELO-GUM SI480

- Neutral crosslinking
- High flexibility from  $-50^{\circ}\text{C}$  to  $+180^{\circ}\text{C}$
- Tension-equalizing
- Low water absorption
- High corrosion resistance
- Excellent for microelectronic applications



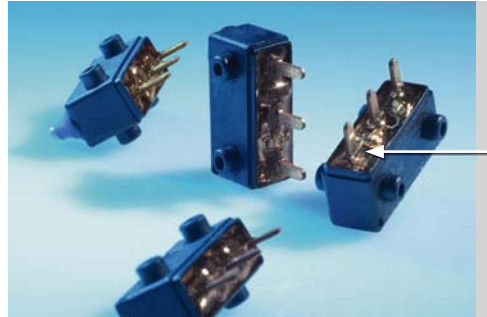
*Fixing / sealing of a PCB in a housing*

## Casting of microswitch pins

1C acrylate 8 s 1.6 Pas viscosity

### DELO-PHOTOBOND AD413

- Excellent flow and wetting behavior
- Tension-equalizing
- High flexibility even at low temperatures (down to  $-40^{\circ}\text{C}$ )
- Very good adhesion to metal and plastic
- Production capacity: Short cycle times thanks to very fast curing in seconds
- Prolonged lifetime: Resistance to humid warmth and shocks



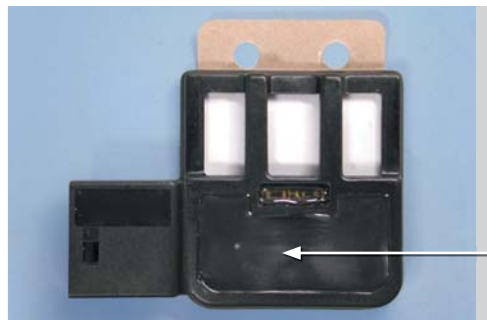
*Casting of switches, for example for the automotive industry*

## Casting of sensor PCB

2C polyurethane 1.5 h firm to touch 80 Pas viscosity

### DELO-PUR 9691

- Tough-elastic
- Flowable, suitable for small casting applications
- Normal temperature range of use from  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$
- High static and dynamic loading capacity
- Easy processing from DELO-AUTOMIX cartridges



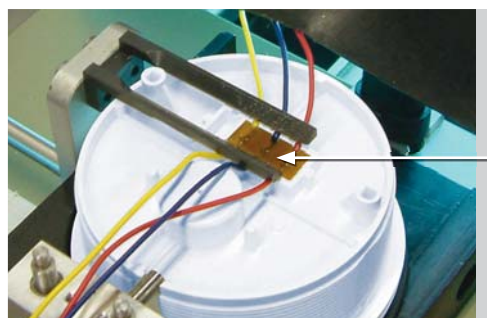
*Casting of a PCB of a window hygrometer*

## Casting of electronic connectors

1C epoxy 15 s 1.2 Pas viscosity

### DELO-KATIOBOND 4552

- High glass transition temperature  $T_G$
- Good flow behavior
- Production capacity: Short cycle times thanks to very fast curing in seconds
- Suitable for rigid bonding and sealing



*Casting and sealing of soldered connection contacts in the cavity of indication instruments*



## Corrosion protection of soldered contacts

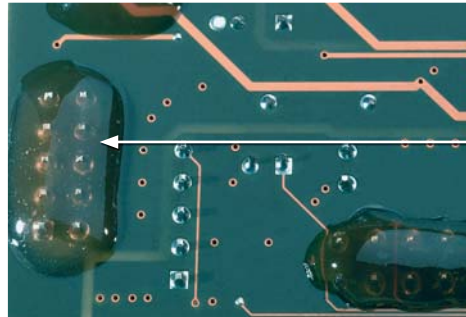
1C epoxy

24 s

1.5 Pas viscosity

### DELO-KATIOBOND KB554

- High resistance to temperature cycling
- High corrosion resistance
- Production reliability: Application control by fluorescent adhesive
- Increased operational reliability and prolonged lifetime: Excellent wetting of the soldered contact



Corrosion protection of soldered contacts, for example on PCBs

## Casting of circuit carriers

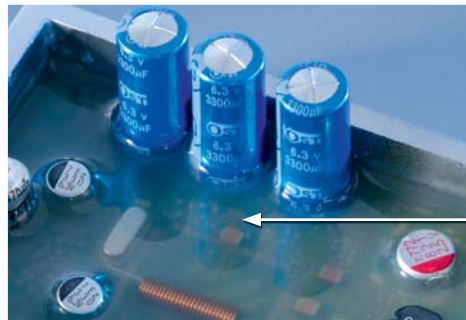
2C epoxy

5.5 h firm to touch

21 Pas viscosity

### DELO-DUOPOX AD821

- Good flow behavior
- Low shrinkage
- Aging-resistant, permanently flexible
- Low water absorption
- High creep resistance and dielectric strength
- Multi-purpose in mechanical engineering, electrical engineering and electronics
- Easy processing from DELO-AUTOMIX cartridges



Casting of electronic circuit carriers

## Casting of electronic sensor elements

2C epoxy

7.5 h firm to touch

1 Pas viscosity

### DELO-DUOPOX CR804

- Low-viscous for good flowing around the electronic assemblies
- Normal temperature range of use from  $-40^{\circ}\text{C}$  to  $+140^{\circ}\text{C}$
- Tension-equalizing
- Aging-resistant, permanently flexible
- Bubble-free casting thanks to low viscosity
- Suitable for large casting volumes



Casting of electronic elements in a safety sensor  
Top: cast  
Bottom: bare

## Casting of PCBs in sensor heads

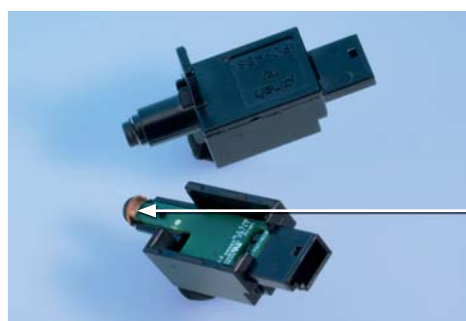
Meth-acrylate

2

1.2 Pas viscosity




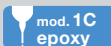







### DELO-ML DB136

- Low-viscous for good flowing into the sensor head
- Normal temperature range of use from  $-60^{\circ}\text{C}$  to  $+180^{\circ}\text{C}$
- Tension-equalizing
- Immediate firmness to touch (after 5 s) by light fixation; anaerobic curing of adhesive in shadowed areas
- Production reliability: Application control by fluorescent adhesive



Casting of a PCB in a copper sensor head of a temperature sensor

# DELO's adhesives for the electronics industry at a glance

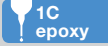





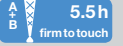



	DELO-PHOTOBOND	DELO-KATIOBOND	DELO-DUALBOND	DELO-ML
Basis	 1C acrylate	 1C epoxy	 1C acrylate  mod. 1C epoxy	 Meth-acrylate
Curing	 8 s UV-curing, light-curing, for example within 8 s	 9 s UV-curing, UV-/light-curing, light-activated, for example within 9 s	  Dual-curing: light-curing and heat- or humidity-curing depending on the product	 2-4 min  Anaerobic-curing, for example in 2 – 4 min (accelerated curing by DELO-QUICK activator). Special product variants are dual-curing: anaerobic-curing and light- or UV-curing
Application areas	<ul style="list-style-type: none"> <li>▪ Automotive</li> <li>▪ Mobile phones</li> <li>▪ Displays</li> <li>▪ Optoelectronics</li> <li>▪ Smart labels</li> <li>▪ Printed circuit boards</li> </ul>	<ul style="list-style-type: none"> <li>▪ Automotive</li> <li>▪ Mobile phones</li> <li>▪ Displays</li> <li>▪ Optoelectronics</li> <li>▪ Organic electronics</li> <li>▪ Smart cards</li> <li>▪ Printed circuit boards</li> </ul>	<ul style="list-style-type: none"> <li>▪ Automotive</li> <li>▪ Mobile phones</li> <li>▪ Displays</li> <li>▪ Optoelectronics</li> <li>▪ Photovoltaics</li> <li>▪ Printed circuit boards</li> </ul>	<ul style="list-style-type: none"> <li>▪ Automotive</li> <li>▪ Electric motors</li> <li>▪ Magnet bonding</li> </ul>
Special features *)	<ul style="list-style-type: none"> <li>▪ Extremely fast curing</li> <li>▪ High equalization of tensions</li> <li>▪ High peel resistance</li> <li>▪ High optical clearness and UV resistance</li> <li>▪ Universally good adhesion</li> </ul>	<ul style="list-style-type: none"> <li>▪ High thermal and chemical resistance</li> <li>▪ Low outgassing</li> <li>▪ Optically clear and yellowing-resistant even at elevated temperatures</li> <li>▪ High ion purity</li> <li>▪ Low corrosion potential</li> <li>▪ High water barrier effect</li> </ul>	<ul style="list-style-type: none"> <li>▪ Secondary curing mechanism for reliable curing in shadowed areas</li> <li>▪ Otherwise like the corresponding basic product group</li> </ul>	<ul style="list-style-type: none"> <li>▪ Anaerobic- and light-curing, one-component adhesives</li> <li>▪ Excellent adhesion to metal</li> <li>▪ Good adhesion even to certain plastics</li> <li>▪ Tension-equalizing and impact-resistant</li> </ul>

\*) The strong points show in which areas the product groups are particularly efficient. Depending on the product, these strong points may differ.

## Satisfied customers

ABM Greiffenberger Antriebstechnik GmbH, Amphenol-Tuchel Electronics GmbH, Barun Electronics Co., Ltd., BSH Bosch und Siemens Hausgeräte GmbH, ContiTemic microelectronic GmbH, Daimler AG, DLR Deutsche Forschungsanstalt für Luft- und Raumfahrt, Festo KG, Goertek Electronics Co., Ltd., Honeywell AG, Infineon

Technologies AG, Knowles Electronics Austria GmbH, Leopold Kostal GmbH & Co. KG, Preh GmbH, Robert Bosch GmbH, Siemens AG A&D MC, TRW Airbag Systems GmbH, Tyco Electronics AMP GmbH, ZF Electronics GmbH, Zollner Elektronik AG, and many more...

DELOMONOPOX	DELO-DUOPOX	DELO-PUR	DELO-GUM	DELO-CA
				
 <p>Heat curing, for example 30 min at +130 °C</p>	 <p>At room temperature after mixing resin and hardener, for example firm to touch after 5.5 h (products with fixing times from 15 min to 8 h available)</p>	 <p>At room temperature after mixing resin and hardener, for example firm to touch after 1.5 h (products with fixing times from 30 min to 7 h available)</p>	 <p>By air humidity at room temperature, for example 2 mm / 24 h</p>	 <p>By air humidity at room temperature, for example firm to touch after 30 s (accelerated curing by DELO-QUICK 2002 activator)</p>
<ul style="list-style-type: none"> <li>Automotive</li> <li>Electric motors</li> <li>Magnet bonding</li> <li>Smart labels</li> <li>Smart cards</li> <li>Printed circuit boards</li> <li>Microelectronic packaging</li> <li>Casting</li> </ul>	<ul style="list-style-type: none"> <li>Automotive</li> <li>Electric motors</li> <li>Tool and plant construction</li> <li>Printed circuit boards</li> <li>Casting</li> </ul>	<ul style="list-style-type: none"> <li>Automotive</li> <li>Electric motors</li> <li>Tool and plant construction</li> <li>Printed circuit boards</li> <li>Casting</li> </ul>	<ul style="list-style-type: none"> <li>Automotive</li> <li>Electric motors</li> <li>Tool and plant construction</li> <li>Printed circuit boards</li> <li>Casting</li> </ul>	<ul style="list-style-type: none"> <li>Automotive</li> <li>Tool and plant construction</li> <li>Printed circuit boards</li> </ul>
<ul style="list-style-type: none"> <li>High thermal and chemical resistance</li> <li>High strength even at elevated temperatures</li> <li>Good adhesion to many metals and plastics</li> <li>Wide property variety (for example high <math>T_G</math>, low CTE, curing at low temperatures from +80 °C)</li> </ul>	<ul style="list-style-type: none"> <li>High thermal and chemical resistance</li> <li>High shear strength on metal and certain plastics</li> <li>Partly excellent peel resistance on smooth surfaces</li> <li>Products with dissimilar curing speeds available</li> </ul>	<ul style="list-style-type: none"> <li>High strength and good elasticity</li> <li>High peel resistance</li> <li>Products with dissimilar curing speeds available</li> </ul>	<ul style="list-style-type: none"> <li>Permanently flexible</li> <li>Very good aging resistance</li> <li>Very wide temperature range of use</li> </ul>	<ul style="list-style-type: none"> <li>Especially for fast fixing of components</li> <li>Universal adhesion to metals, ceramic, many plastics and elastomers</li> </ul>

**All products are**

- solvent-free
- compliant with RoHS Directive 2002/95/EC



Many products are halogen-free according to or by the criteria of IEC 61249-2-21. Details can be found in the specific technical data sheet.





# CONTACT

## Headquarters

### DELO Industrial Adhesives

- ▶ Germany  
DELO-Allee 1  
86949 Windach/Munich  
Phone +49 8193 9900-0  
info@DELO.de  
www.DELO.de

### DELO Industrial Adhesives

- ▶ USA  
144 North Road Suite 2650  
Sudbury/Boston, MA 01776  
Phone +1 978 254 5275  
info@DELO.us  
www.DELO.us

### DELO Industrial Adhesives

- ▶ Singapore  
German Centre Singapore #02-66/67  
25 International Business Park  
Singapore 609916  
Phone +65 6560 0236  
info@DELO.com.sg  
www.DELO.com.sg

### DELO Industrial Adhesives

- ▶ China/Shanghai  
Office 628, 6/F, German Center  
88 Keyuan Rd., Zhangjiang Hi-tech Park  
201203 Shanghai, P. R. China  
Phone +86 21 2898 6563  
info@DELO.cn  
www.DELO.cn

### DELO Industrial Adhesives

- ▶ Taiwan  
Office 824, 5F, Pacific Business Building  
No. 285, Sec 4 Zhongxiao East Road  
106 Taipei  
Phone +886 2 6639 8248  
info@DELO.com.tw  
www.DELO.com.tw

The data and information provided are based on tests performed under laboratory conditions. Reliable information about the behavior of the product under practical conditions and its suitability for a specific purpose cannot be concluded from this. It is the user's responsibility to test the suitability of the product for the intended purpose by considering all specific requirements. Type, physical and chemical properties of the materials to be processed with the product, as well as all actual influences occurring during transport, storage, processing and use, may cause deviations in the behavior of the product compared to its behavior under laboratory conditions. All data provided are typical average values or uniquely determined parameters measured under laboratory conditions. The data and information provided are therefore no guarantee for specific product properties or the suitability of the product for a specific purpose. Verbal ancillary agreements are deemed not to exist.

© DELO – This brochure including any and all parts is protected by copyright. Any use not expressly permitted by the Urheberrechtsgesetz (German Copyright Act) shall require DELO's written consent. This shall apply without limitation to reproductions, duplications, disseminations, adaptations, translations and microfilms as well as to the recording, processing, duplication and/or dissemination by electronic means.

03/14

Adhesives

Dispensing

Curing

Consulting

**DELO**