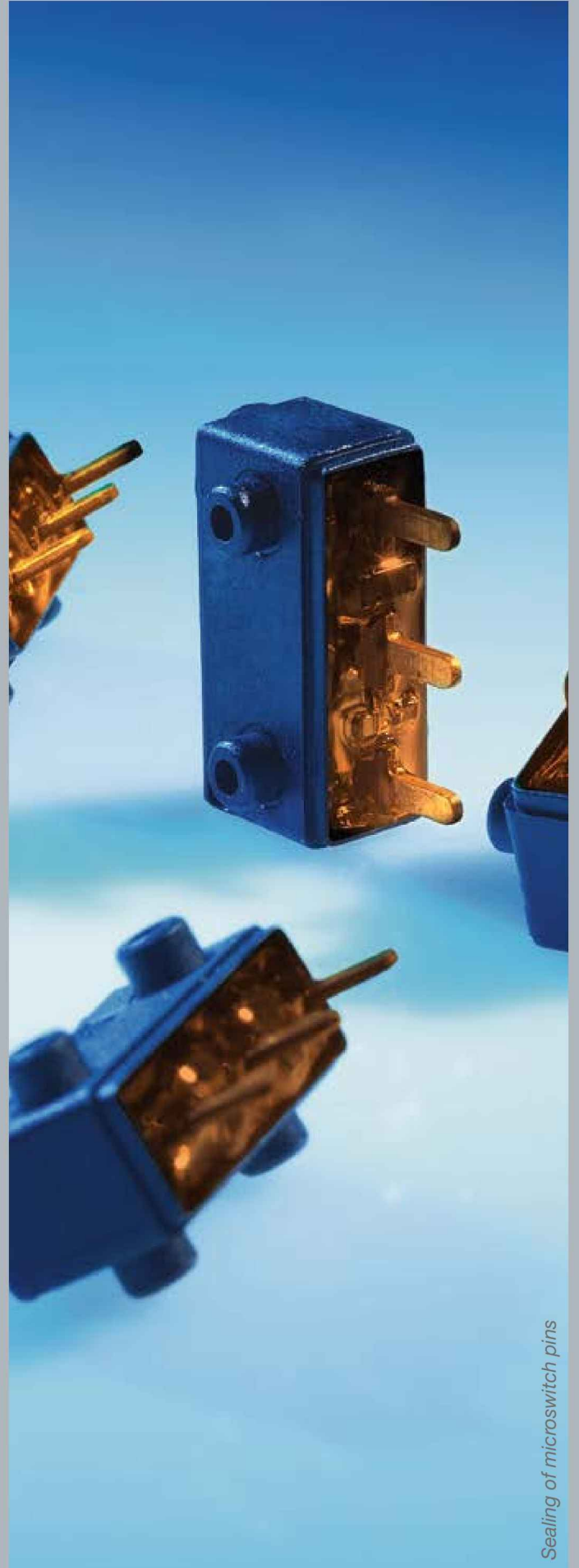


## Bonding in Electronics

Design Examples  
and Product Range



*Sealing of microswitch pins*

# Bonding and fixing

## Bonding of stator to housing



### DELO-ML DB135

- Very high impact resistance
- Excellent media 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 initial strength by light fixation; anaerobic curing of adhesive in shadowed areas



Bonding of a steel stator to an aluminum housing (© ebm-papst)

## Bonding of magnets to stator



### DELO MONOPOX

#### (various structural adhesives)

- Excellent media 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, e. g., in motors produced by the DLR (German Aerospace Center)



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

## Bonding of rotor to shaft



### DELO-ML DB133

- High impact resistance
- Excellent media resistance
- Tension-equalizing with an elongation at tear of 130 %
- Ideal for laminar bonding
- Immediate initial strength 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



### DELO MONOPOX HT2860

- High temperature stability
- Gap-filling
- Excellent media resistance (for example to oil, gasoline, brake fluid)
- Normal temperature range of use up to +220 °C
- High static and dynamic loading capacity



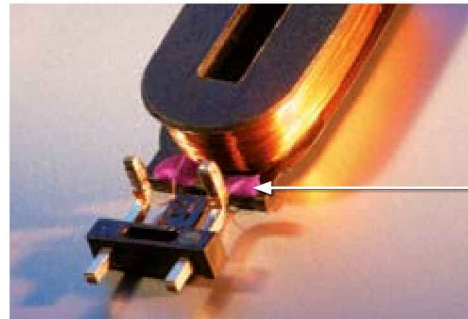
Bonding of magnets into the stator housing of an electric motor

## 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 magenta to indicate the bonding area)*

## Fixing of ferrites in coils



### DELO MONOPOX GE2710

- 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 potting



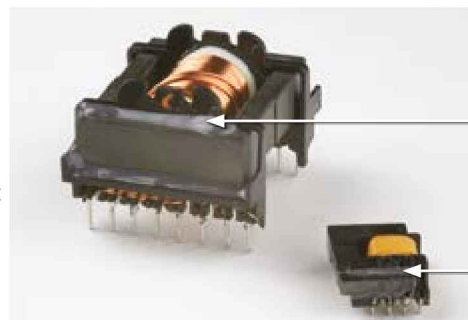
*Fixing of ferrites in coils*  
*Top: Shorter after application, the adhesive is still visible*  
*Bottom: The adhesive capillates through the windings*

## Fixing of ferrites and coil bodies



### DELO-DUOPOX FR898

- High-strength construction adhesive
- Excellent media resistance
- Quality: Good strength of the assembly during mechanical stress
- Functionality: Reduction of mechanical vibrations and associated noise development
- Multi-purpose
- Easy processing from side-by-side cartridges
- UL 94 V-0, E467212 (Yellow Card)



*Fixing of ferrites and coil bodies*

## Fixing of a diode



### DELO-CA 2153

- Good filling of gaps up to 0.2 mm
- Accelerated curing in combination with DELO-QUICK 2002 activator
- Multi-purpose for rubber, plastic and metal bondings
- 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 and fixing

## Bonding of coils

1C epoxy

40 min @ 180 °C

pasty viscosity

### DELO MONOPOX SJ2981

- Run-resistant
- 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 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

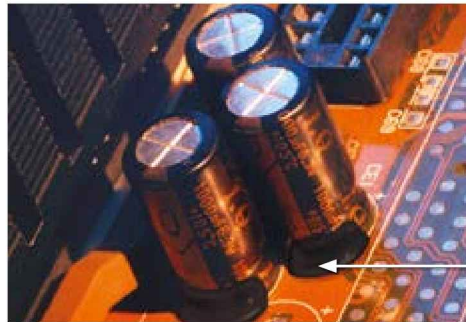
2C polyurethane

2h initial strength

pasty viscosity

### DELO-PUR 9694

- Run-resistant
- High static and dynamic loading capacity
- Functionality: Optimal vibration damping
- Multi-purpose
- Easy processing from side-by-side cartridges



*Vibration protection of soldered electronic components, for example capacitors*

## Securing of soldered contacts

1C epoxy

22s

6.3 Pa·s viscosity

### DELO KATIOBOND 45952

- 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

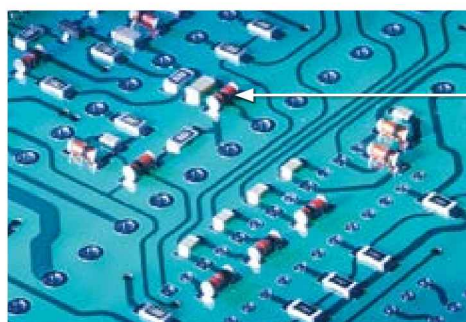
1C epoxy

20 min @ 130 °C

pasty viscosity

### DELO MONOPOX MK096

- Low outgassing
- High corrosion resistance
- Processing on standard systems: Jetting, dispensing from cartridge, screen printing
- Suitable for high-speed processes (more than 30,000 drops/h)



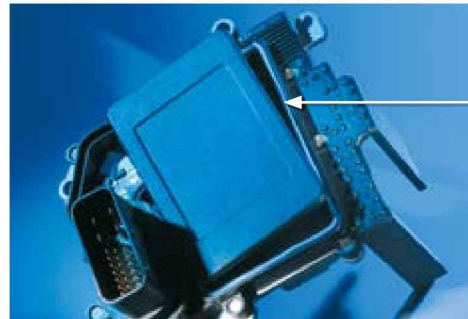
*Fixing of SMD components, especially of melfs or glass SMD components*

## Bonding of PBT cover and housing



### DELO MONOPOX GE2710

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



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

## Bonding of displays



### DELO PHOTOBOND LA4880

- Curing on demand
- Preactivated adhesive cures without further irradiation by humidity at room temperature
- Dry surface
- Highly flexible, soft
- Good peel resistance
- Initial strength after 1 – 2 minutes
- Final strength after 72 h



*Display frame bonding in the Center Information Display*

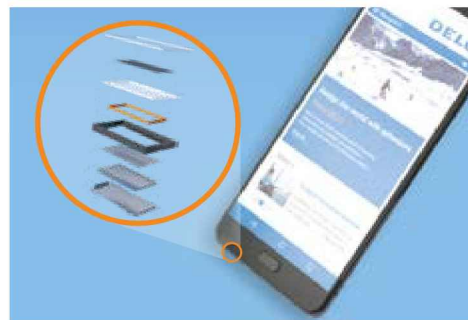


## Bonding of mini speakers



### DELO PHOTOBOND UB4086

- Temperature range of use up to +150 °C
- High temperature stability
- High impact resistance and flexibility
- Production reliability: Application control by fluorescent adhesive
- Quality: Loudspeakers bonded with DELO PHOTOBOND are characterized by excellent acoustic quality



*Bonding of mini speaker components for mobile phones*

## Bonding of automotive cameras



### DELO DUALBOND AD345, OB786

- 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 (adhesive colored magenta)*



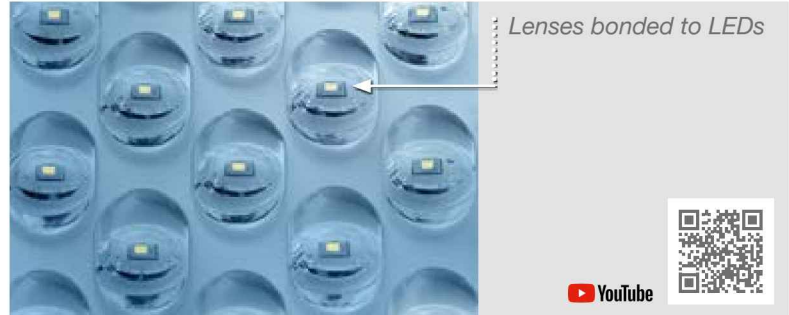
# Bonding and fixing

## Bonding of LED reflectors and lenses



### DELO KATIOBOND OB642

- 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

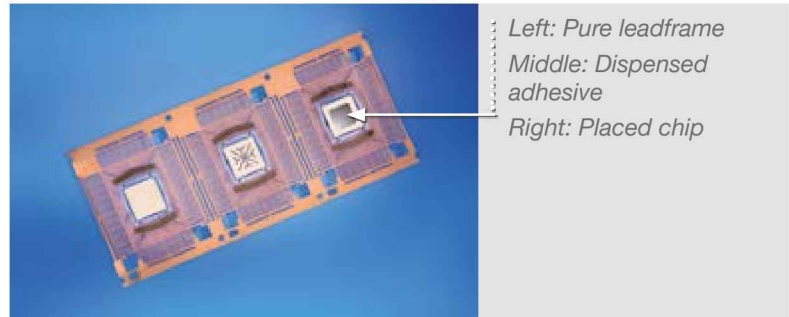


## Die attach



### DELO MONOPOX DA255

- High temperature resistance up to +260 °C
- Fast curing in seconds with a thermode (for example 6 s @ +180 °C)
- Low-tension curing
- Optimized products for many chip sizes

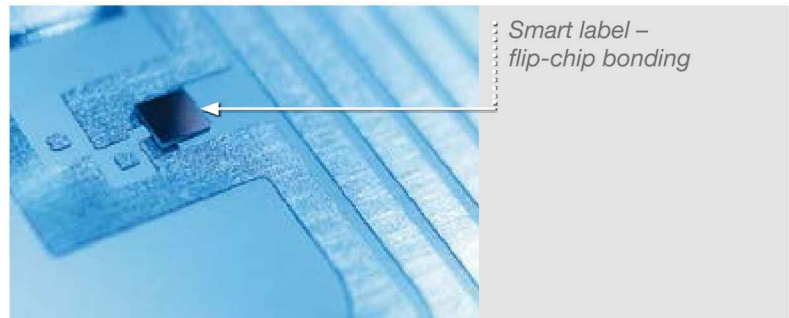


## Flip-chip bonding



### DELO MONOPOX 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 non-conductive product variants available

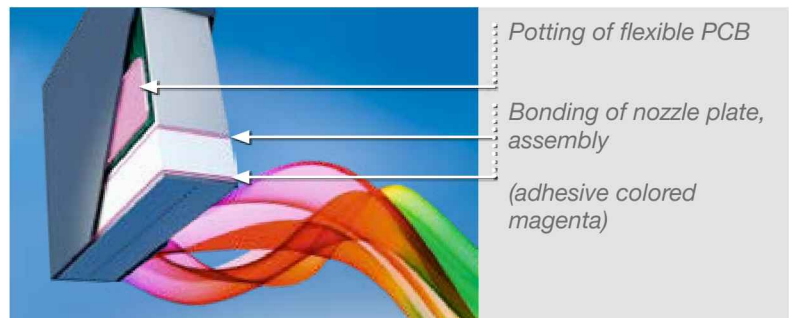


## Bonding inkjet print heads



- DELO MONOPOX GE6585 (Dam), GE6525 (Fill),
- DELO DUALBOND OB787
- DELO KATIOBOND DI6049

- Excellent media resistance (for example to aggressive inks)
- Minimization of tensions by low CTE and curing from +80 °C
- High bonding accuracy by light fixation
- Small fillers possible
- Viscosity can be set



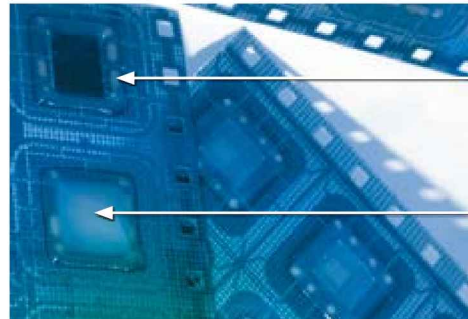
# Potting and coating

## Dam & Fill chip encapsulation



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

- High production capacity: Encapsulation of up to 40,000 modules/h (glob top; Dam & Fill: 20,000)
- Dam & Fill adhesives form a chemically homogeneous unit
- Functionality: High ion purity and strengths ensure the chip function over the entire lifetime
- Quality: Steady dispensing results even when using showerhead dispensers



*Dam & Fill smart card modules*

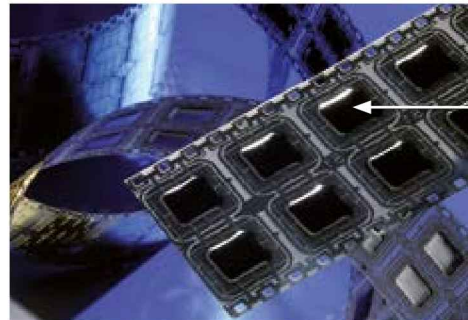
*The circumferential, high-viscous dam encloses the low-viscous fill*

## Opaque Dam & Fill chip encapsulation



### DELO DAM&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



*Black Dam & Fill chip encapsulation – absolutely opaque even in thin layers*

## Chip-on-board encapsulation on PCB



### DELO MONOPOX GE785 (Dam), GE725 (Fill)

- Excellent media resistance (for example to Diesel, oil, grease)
- Temperature range of use from -65°C to +180°C (modifications up to +250°C possible)
- 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



*Chip-on-board encapsulation*  
(© RAFI Eltec GmbH)

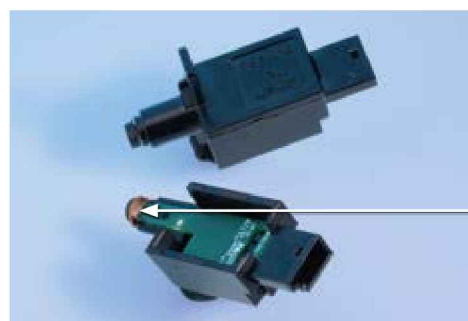


## Potting of PCBs in sensor heads



### DELO-ML DB136

- Low-viscous for good flowing into the sensor head
- Normal temperature range of use from -60°C to +180°C
- Tension-equalizing
- Immediate initial strength (after 5 s) by light fixation; anaerobic curing of adhesive in shadowed areas
- Production reliability: Application control by fluorescent adhesive



*Potting of a PCB in a copper sensor head of a temperature sensor*



# Potting and coating

## Sealing of electronic housings

1C silicone 2mm / 24h 17 Pa·s viscosity

### DELO-GUM CR3010

- 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



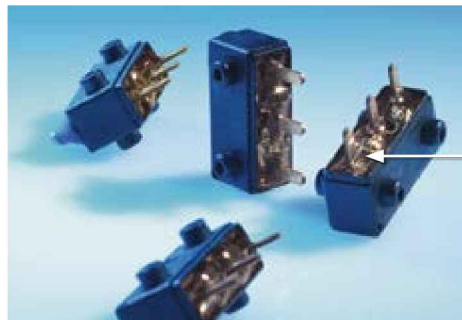
Fixing / sealing of a PCB in a housing (© viaSonic)

## Sealing of microswitch pins

mod. 1C acrylate 2 Pa·s viscosity

### DELO DUALBOND GE4910

- Excellent flow and wetting behavior
- Reliable curing in shadowed areas
- 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 within seconds
- Longer lifetime: Resistance to humidity and thermal shock



Sealing of switches, for example for the automotive industry



YouTube

## Potting of sensor PCB

2C polyurethane 1.5h initial strength 80 Pa·s viscosity

### DELO-PUR 9691

- Tough-elastic
- Flowable, suitable for small potting 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 side-by-side cartridges



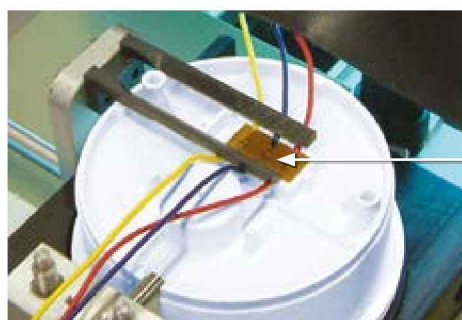
Potting of a PCB of a window hygrometer

## Potting of electronic connectors

1C epoxy 15s 1.2 Pa·s 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



Potting and sealing of soldered connection contacts in the cavity of indication instruments



## Corrosion protection of soldered contacts

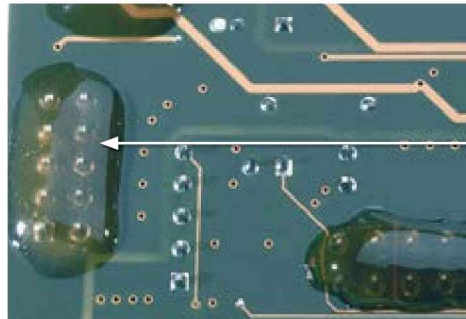
1C epoxy

UV 24 s

1.5 Pa·s viscosity

### DELO KATIOBOND KB554

- High resistance to thermal cycling test
- 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

## Potting of circuit carriers

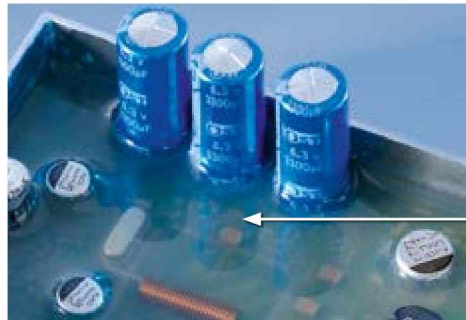
2C epoxy

A+B 5.5 h initial strength

21 Pa·s viscosity

### DELO-DUOPOX CR8021

- 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 side-by-side cartridges



Potting of electronic circuit carriers

## Potting of electronic sensor elements

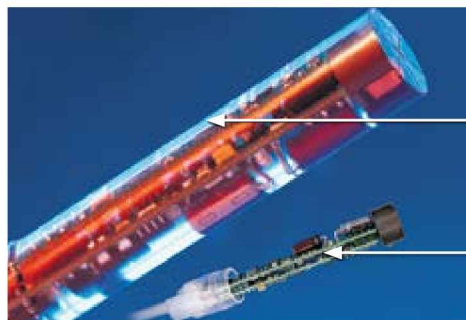
2C epoxy

A+B 8 h initial strength

1 Pa·s viscosity

### DELO-DUOPOX CR8014

- 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 potting thanks to low viscosity
- Suitable for large potting volumes



Potting of electronic elements in a safety sensor

Top: potted  
Bottom: bare

## Sensor potting

mod. 2C epoxy

A+B UV

low-viscous






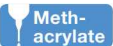





### Various DELO-DUOPOX DB adhesives

- Fast initial strength by light fixation (10 – 60 s)
- Low-viscous for good flowing around the electronic assemblies
- Low shrinkage
- Aging-resistant, permanently flexible
- Tension-equalizing
- Multi-purpose in mechanical engineering, electrical engineering and electronics



Potting of various sensors and sealing of pins (adhesive colored magenta)

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

	DELO PHOTOBOND	DELO KATIOBOND	DELO DUALBOND	DELO-ML		
<b>Basis</b>	 1C acrylate	 1C polymer	 1C epoxy	 mod. 1C epoxy	 mod. 1C acrylate	 Meth-acrylate
<b>Curing</b>	 8s UV-curing, light-curing, preactivated. Special product variants are dual-curing: light-curing and humidity-curing	 9s UV-curing, UV-/light-curing, preactivated	  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		
<b>Application areas</b>	<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>		
<b>Special features*</b>	<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> <li>▪ Bonding of opaque components by preactivation</li> </ul>	<ul style="list-style-type: none"> <li>▪ High thermal and media 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 barrier effect against water</li> <li>▪ Bonding of opaque components by preactivation</li> </ul>	<ul style="list-style-type: none"> <li>▪ Secondary curing mechanism for reliable curing in shadowed areas</li> <li>▪ Depending on the product, heat curing mandatory after light fixation</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

AAC - American Audio Components Ltd., 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, ebm-papst GmbH & Co. KG, Festo KG, Goertek Electronics Co.,

Ltd., Honeywell AG, Huawei Technologies Co., Ltd., 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...



DELO MONOPOX	DELO-DUOPOX	DELO-PUR	DELO-GUM	DELO-CA
 1C epoxy	 2C epoxy	 2C polyurethane	 1C silicone	 Cyanoacrylate
 Heat curing, depending on the product in the range from +60 to +180 °C	 5.5 h initial strength  UV	 1.5 h initial strength	 2 mm / 24 h	 30 s initial strength
At room temperature after mixing resin and hardener, for example initial strength after 5.5 h (products with fixation times from 15 min to 8 h available). Special product variants are light-fixable (light fixation in 10 s – 60 s)	At room temperature after mixing resin and hardener, for example initial strength after 1.5 h (products with fixation times from 30 min to 7 h available)	By air humidity at room temperature, for example 2 mm/24 h	By air humidity at room temperature, for example initial strength after 30 s (accelerated curing by DELO-QUICK 2002 activator)	
<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>Potting</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>Potting</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>Potting</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>Potting</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 media 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 T<sub>g</sub>, low CTE, curing at low temperatures from +60 °C)</li> </ul>	<ul style="list-style-type: none"> <li>High thermal and media 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>

## Numeric product key

<b>AC</b> = Anisotropic Conductive	<b>LA</b> = Light-Activated
<b>AD</b> = ADhesive	<b>GE</b> = General Encapsulant
<b>CR</b> = Casting Resin	<b>HT</b> = High Temperature
<b>DA</b> = Die Attach	<b>KB</b> = KATIOBOND
<b>DB</b> = Dual Bonding	<b>OB</b> = Optical Bonding
<b>DF</b> = Dam & Fill	<b>SJ</b> = Structural Joining
<b>DI</b> = Dual Initiator	<b>UB</b> = Universal Bonding
<b>FR</b> = Flame-Retardant	

## All products are

- solvent-free
- compliant with RoHS Directive 2015/863/EU



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

**DELO** Industrial Adhesives  
Headquarters

► **Germany** · Windach / Munich .....



- **China** · Shanghai
- **Japan** · Yokohama
- **Malaysia** · Kuala Lumpur
- **Singapore**
- **South Korea** · Seoul
- **Taiwan, China** · Taipei
- **Thailand** · Bangkok
- **USA** · Sudbury, MA

..... [www.DELO-adhesives.com](http://www.DELO-adhesives.com)

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ADHESIVES

DISPENSING

CURING

CONSULTING

**DELO**