

# Conductive Compounds

Adhesives  
Sealants and Caulks  
Coatings  
Inks



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# CHO-BOND® Conductive Adhesives

**Single- and two-component epoxy and silicone adhesives, with room temperature, elevated temperature or moisture cure mechanisms.**

## Epoxies for Microelectronics

Chomerics' growing family of conductive epoxies now includes one-part, silver-filled pastes formulated for today's optoelectronic and microelectronic assembly applications.

### CHO-BOND 700 Series Adhesives for Microelectronics Packaging

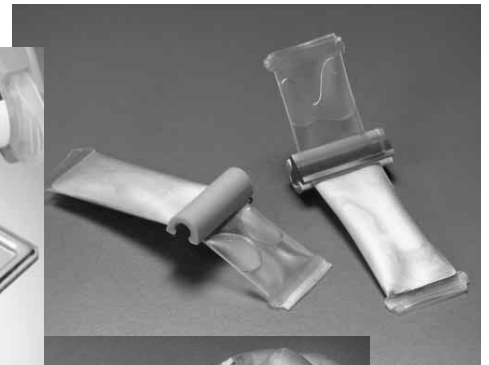
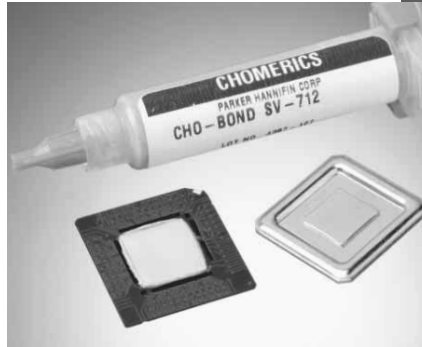
These pure silver-filled epoxy pastes are designed to meet the demanding requirements of semiconductor and microelectronics packaging. They are one-component systems with a unique combination of excellent die shear strength, low coefficients of thermal expansion, ionic purity, and high thermal and electrical conductivities. Each offers an extended working life with viscosity and thixotropy suitable for both time/pressure and positive displacement dispensing methods. Both are supplied frozen in bulk or standard syringe sizes.

- **CHO-BOND SV712** die attach adhesive has been optimized for high-speed, automated dispensing. It exhibits no resin bleedout on a variety of substrates and metallizations. Request Technical Bulletin.
- **CHO-BOND SV713** is especially well suited for temperature-sensitive, high performance applications. Request Technical Bulletin.

## Versatile Conductive Epoxies

Our two-part silver, silver-plated-copper, and silver-plated-glass filled adhesives meet the most exacting electrical bonding requirements without the high temperatures, fluxes and expensive preparatory techniques usually needed to obtain effective lead-tin solder joints. They cure at room temperature or elevated temperatures into rigid structural bonds.

Excellent adhesion is achieved to copper, bronze, cold-rolled steel, aluminum, magnesium, Kovar, nickel, ceramic, phenolic and plastic substrates. Typical uses include bonding EMI shielded vents, windows or mesh gaskets to shield permanent seams.



### CHO-BOND 500 Series Adhesive/Sealant Compounds

These pure silver-filled materials are used where tight tolerances require thin bond lines. Various cure cycles are available, and the materials are formulated for easy application by caulking gun, spatula, needle spotting, or silk screening. Their use for bonding mesh gaskets, printed circuit board repair, chip bonding, rear window defogger repair, and as low-temperature-activated flexible solders demonstrates their versatility. Request Technical Bulletin 10.

- **CHO-BOND 584-29** adhesive combines room temperature cure with low viscosity, and can be used in place of soldering or welding. It is available in easy-to-use, two-chambered CHO-PAK dispensers in 1.0, 2.5 and 10 gram sizes (see photo above). These systems eliminate waste, mistakes, and time lost weighing components. Bulk kits are also available.
- **CHO-BOND 584-208** adhesive offers exceptional ease of application for circuit board repair. It is a two-component system with a 1:1 mix ratio, and cures in 24 hours at room

temperature. With a 0.75 hour elevated cure temperature of 212°F (100°C), the material offers volume resistivity of 0.005 ohm-cm.

- **CHO-BOND 592** adhesive bonds dissimilar materials effectively. It combines long pot-life and excellent adhesion with low viscosity, a low coefficient of thermal expansion, very low thermal impedance and good thermal shock resistance. The material excels as a sealant for microwave modules and components and is useful for circuit board repair and grounding applications.

### CHO-BOND 300 Series Adhesive/Sealant Compounds

These feature large (>50 micron) silver-plated-copper particles that make them well suited for bonding poorly tolerated surfaces. Bond lines should not be thinner than 10 mils. The gritty filler bites through thin, non-conductive surfaces such as oxide layers and MIL-C-5541 Class 3 irridite. Applications include bonding and shielding of cast aluminum housings, conduit bulkhead

*continued*

**Table 1**

<b>SPECIFICATIONS AND PRODUCT CHARACTERISTICS</b> (Contact Chomerics for complete specifications and test procedures)							
<b>CHO-BOND Adhesive</b>	<b>SV712</b>	<b>SV713</b>	<b>584-29</b>	<b>584-208</b>	<b>592</b>	<b>360-20</b>	<b>360-208</b>
Binder	epoxy	epoxy	epoxy	epoxy	epoxy	epoxy	epoxy
Filler	Ag	Ag	Ag	Ag	Ag	Ag/Cu	Ag, Ag/Cu
Mix Ratio (by wgt.)	1-part	1-part	100:6.3	1:1	100:50	1:1	100:33
Consistency	thixotropic paste	thixotropic paste	thin paste	medium paste	nearly liquid	medium paste	thick paste
Specific Gravity	3.3 ±0.30	2.5 ±0.30	2.5 ±0.20	2.7 ±0.30	2.6 ±0.25	5.0 ±0.30	4.0 ±0.40
Minimum Lap Shear Strength, psi (MPa)	1100 (7.59)	1000 (6.90)	1200 (8.28)	700 (4.83)	1500 (10.35)	1600 (11.04)	1400 (9.66)
Minimum Die Shear* Strength, psi (MPa)	4800 (33.12)	4500 (31.05)	—	—	—	—	—
Maximum DC Volume Resistivity, ohm-cm	0.0004	0.0007	0.002	0.005	0.05	0.005	0.01
Use Temperature	-49 to 302°F (-45 to 150°C)	-49 to 302°F (-45 to 150°C)	-67 to 257°F (-55 to 125°C)	-80 to 210°F (-62 to 99°C)	-80 to 210°F (-62 to 99°C)	-80 to 212°F (-62 to 100°C)	-80 to 212°F (-62 to 100°C)
Elevated Temperature Cure Cycle	1hr. @257°F(125°C) or 30 min. @ 302°F (150°C)	1hr. @257°F(125°C) 30 min. @ 302°F (150°C)	15 min. @ 235°F (113°C)	45 min. @ 212°F (100°C)	30 min. @ 212°F (100°C)	2.0 hrs. @ 150°F (66°C)	45 min. @ 212°F (100°C)
Room Temperature Cure	NA	NA	24 hrs.	24 hrs.	1 wk.	24 hrs.	24 hrs.
Working Life	4 wks.	3 wks.	0.5 hr.	1.0 hr.	4.0 hrs.	1.0 hr.	1.0 hr.
Shelf Life, mos.	12**	12**	9	9	9	9	9
Coverage, in. <sup>2</sup> /lb. (cm <sup>2</sup> /g)	NA	NA	11,000 (156.1)	10,000 (141.9)	12,000 (170.3)	500 (7.1)	700 (9.9)
Recommended Thickness, in. (mm)	0.001 typ. (0.025)	0.001 typ. (0.025)	0.001 min. (0.025)	0.001 min. (0.025)	0.001 min. (0.025)	0.010 min. (0.25)	0.010 min. (0.25)
VOC, g/liter	0	0	0	0	47 (A & B)	0	0

\* Alumina die on gold \*\* at -40°F (-40°C) NA Not Applicable

passthroughs, filters, and fabricated metal cabinets. Note that these compounds should be used only when the seam will not be broken. Request Technical Bulletin 47.

- **CHO-BOND 360-20** is a low-cost, easy-to-mix adhesive/sealant with high lap shear bond strength. It fills large gaps and offers good thermal shock resistance.
- **CHO-BOND 360-208** adhesive/sealant uses a filler blend of pure silver and silver-plated-copper particles to produce superior shielding performance without requiring contact pressure, making it an ideal fillet seal. Its low flow properties make it the material of choice for vertical and overhead fillets.

**Flexible Silicone Adhesives**

With a choice of silver-plated-copper, silver-plated-aluminum or silver-plated-glass filler particles, these conductive silicones cure into gasket-like seals. When used to bond conductive silicone gaskets in place, they must be

used in thin (8-10 mil) bond lines. Metallic surfaces may require priming with the recommended CHO-BOND primer to improve adhesion.

- **CHO-BOND 1029** is a two-component adhesive cured under pressure (6 psi/0.04 MPa, min.). Bond line thickness should not exceed 8 mils. Conductivity decreases sharply at >20 mil thickness. The material possesses superior lap shear (450 psi/3.10 MPa, min.). Ideal for quick bonding of conductive elastomers, the material's cure can be accelerated to 30 minutes at 250°F (121°C). Request Technical Bulletin 32.
- **CHO-BOND 1030** is a one-component RTV silicone that cures by exposure to moderate humidity. It has twice the peel strength of other RTVs and a lap shear of 200 psi (1.38 MPa). For maximum conductivity, bond line thickness should not exceed 10 mils. Width should not exceed 0.5 in (1.27 cm) for proper curing. The material cures under nominal pressure of 1-2 psi (0.01 MPa) at temperatures not exceeding 150°F (66°C). Request Technical Bulletin 36.

- **CHO-BOND 1035** is a one-component RTV silicone adhesive/sealant that can provide both environmental sealing and EMI shielding. It is well suited for bonding commercial-grade conductive elastomer gaskets and enclosure flanges, and serves as a conductive caulking material in enclosure seams. Its silver-plated-glass filler gives the material a volume resistivity of 0.05 ohm-cm. It is non-corrosive and forms a skin within minutes. Curing occurs without pressure in the presence of moisture. Packaging choices include 2.5 oz (71 g) metal tubes and 10 oz (0.3 kg) tubes for pneumatic dispensers. Request Technical Bulletin 23.

- **CHO-BOND 1075** is used both for bonding EMI gaskets and for providing EMI shielding and environmental protection as a caulk. It is specifically recommended for bonding CHO-SEAL 1285 conductive elastomer gaskets (silver-plated-aluminum filled silicone). See "Corrosion-Resistant Sealants" on page 139. Request Technical Bulletin 35.

Table 1 continued

SPECIFICATIONS AND PRODUCT CHARACTERISTICS (Contact Chomerics for complete specifications and test procedures)						
CHO-BOND Adhesive	1029	1030	1035**	1075****	1085	1086
Binder	silicone	silicone	silicone	silicone	primer for 1029	primer for 1030, 1035, 1075
Filler	Ag/Cu	Ag/Cu	Ag/glass	Ag/Al		
Mix Ratio (by wgt.)	1.0:2.5	1-part	1-part	1-part	1-part	1-part
Consistency	thick paste	gritty paste	thin paste	medium paste	thin fluid	thin fluid
Specific Gravity	3.0 ±0.35	3.75 ±0.25	1.9 ±0.10	2.0 ±0.25	0.87 ±0.15	0.78 ±0.10
Minimum Lap Shear Strength, psi (MPa)	450 (3.11)	200 (1.38)	100 (0.69)	100 (0.69)	NA	NA
Maximum DC Volume Resistivity, ohm-cm	0.06*	0.05	0.05	0.01	NA	NA
Use Temperature	-67 to 257°F (-55 to 125°C)	-67 to 392°F (-55 to 200°C)	-67 to 392°F (-55 to 200°C)	-67 to 392°F (-55 to 200°C)	-112 to 392°F (-80 to 200°C)	-112 to 392°F (-80 to 200°C)
Elevated Temperature Cure Cycle	0.5 hr. @ 250°F (121°C)	NA	NA	NA	NA	NA
Room Temperature Cure	1 wk.***	1 wk.***	1 wk.***	1 wk.***	0.5 hr.	0.5 hr.
Working Life	2.0 hrs.	0.5 hr.	0.5 hr.	0.25 hr.	NA	NA
Shelf Life, mos.	6	6	6	6	6	6
Coverage, in. <sup>2</sup> /lb. (cm <sup>2</sup> /g)	1,800 (25.5)	1,300 (18.5)	1,500 (21.3)	1,200 (17.0)	NA	NA
Recommended Thickness, in. (mm)	0.008 max. (0.20)	0.010 max. (0.25)	0.007 min. (0.18)	0.010 max. (0.25)	0.005 min. (0.13)	0.0002 max. (0.005)
VOC, g/liter	0	0	151	0	719	740

\*Value represents DC resistance in ohms through a 0.4 sq.in. by 0.008 in. (2.58 cm<sup>2</sup> by 0.02 cm) thick sample. \*\* U.S. Patent 4,011,360 \*\*\* Cure is sufficient for handling in 24 hours. Full specification properties are developed after 1 week (168 hours). \*\*\*\* Values reflect typical properties. NA Not Applicable

Table 2 Ordering Information

PRODUCT	ORDERING PART NUMBER	UNIT/SIZE	PRODUCT	ORDERING PART NUMBER	UNIT/SIZE
CHO-BOND SV712	50-00-SV712-0000	250 gram kit kit (0.55 lb.)*	CHO-BOND 360-20	50-01-0360-0020	1 pound kit (0.5 kg)
CHO-BOND SV712	50-01-SV712-0000	1 pound kit (0.5 kg)*	CHO-BOND 360-208	50-01-0360-0208	1 pound kit (0.5 kg)
CHO-BOND SV712	50-04-SV712-0000	1 cc syringe*	CHO-BOND 360-208	50-00-0360-0208	3 ounce kit (85 g)
CHO-BOND SV712	50-17-SV712-0000	5 cc syringe*	CHO-BOND 1029	50-01-1029-0000	1 pound kit (0.5 kg)
CHO-BOND SV712	50-38-SV712-0000	10 cc syringe*	CHO-BOND 1029	50-00-1029-0000	3 ounce kit (85 g)
CHO-BOND SV713	50-00-SV713-0000	250 gram kit kit (0.55 lb.)*	CHO-BOND 1030	50-01-1030-0000	1 pound cartridge (0.5 kg)
CHO-BOND SV713	50-01-SV713-0000	1 pound kit (0.5 kg)*	CHO-BOND 1030	50-02-1030-0000	4 ounce tube (113 g)
CHO-BOND 584-29	50-10-0584-0029	1 gram CHO-PAK (0.04 oz.)	CHO-BOND 1035	51-01-1035-0000	10 ounce kit (0.3 kg)
CHO-BOND 584-29	50-02-0584-0029	2.5 gram CHO-PAK (0.1 oz.)	CHO-BOND 1035	51-00-1035-0000	2.5 ounce kit (71 g)
CHO-BOND 584-29	50-03-0584-0029	10 gram CHO-PAK (0.4 oz.)	CHO-BOND 1075	50-01-1075-0000	10 ounce kit (0.3 kg)
CHO-BOND 584-29	50-01-0584-0029	1 pound kit (0.5 kg)	CHO-BOND 1075	50-02-1075-0000	2.5 ounce kit (71 g)
CHO-BOND 584-29	50-00-0584-0029	3 ounce kit (85 g)			
CHO-BOND 584-208	50-01-0584-0208	1 pound kit (0.5 kg)	<b>Primers</b>		
CHO-BOND 584-208	50-00-0584-0208	3 ounce kit (85 g)	CHO-BOND 1085	50-01-1085-0000	1 pint (0.47 liter)
CHO-BOND 592	50-01-0592-0000	1 pound kit (0.5 kg)	CHO-BOND 1086	50-01-1086-0000	1 pint (0.47 liter)
CHO-BOND 592	50-00-0592-0000	3 ounce kit (85 g)			

\* Premixed and frozen

Note: Custom packaging can be accommodated. Please inquire.

Every shipment of Chomerics' conductive compounds is accompanied by a *Certificate of Conformance* to Chomerics specifications. Additional test reports can be obtained for a service charge. Quality control procedures conform to MIL-I-45208.

# CHO-BOND® Conductive Caulks and Sealants

**Fill cracks and large gaps with a choice of single-component non-hardening systems, or two-component curing systems.**

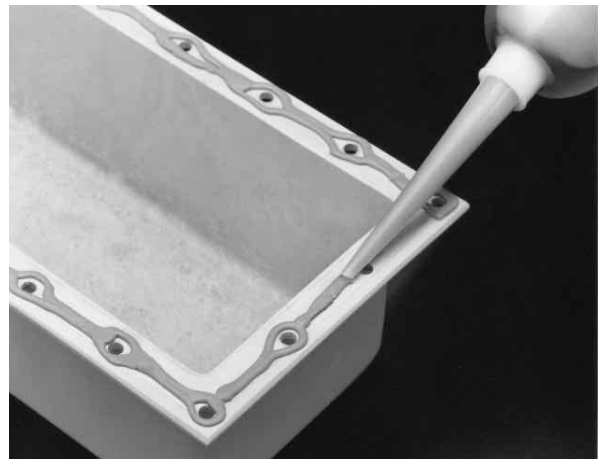
## Rigid Epoxies

Chomerics' two-component conductive epoxy caulks provide excellent adhesion to dissimilar substrates and can be used in lap or butt joint applications. They feature large (>50 micron) silver-plated-copper particles that make them well suited for sealing poorly tolerated surfaces. Bond lines should not be thinner than 10 mils. The gritty filler bites through thin, non-conductive surfaces such as oxide layers and MIL-C-5541 Class 3 irridite. Applications include bonding and shielding of cast aluminum housings, conduit bulkhead passthroughs, filters, and fabricated metal cabinets. Note that these com-

pounds should be used only when the seam will not be broken. Request Technical Bulletin 47.

- **CHO-BOND 360-20** is a low-cost, easy-to-mix adhesive/sealant with high lap shear bond strength. It fills large gaps and offers good thermal shock resistance.

- **CHO-BOND 360-208** adhesive/sealant uses a filler blend of pure silver and silver-plated-copper particles to produce superior shielding performance without requiring



contact pressure. This makes it an ideal fillet seal. Its low flow properties make it the material of choice for vertical and overhead fillets.

Table 3

### SPECIFICATIONS AND PRODUCT CHARACTERISTICS (Contact Chomerics for complete specifications and test procedures)

CHO-BOND Caulk or Sealant	360-20	360-208	1035*	1038*	1075***	4660	4669	1086
Binder	epoxy	epoxy	silicone	silicone	silicone	polyiso-butylene	polyiso-butylene	primer for 1035, 1038, 1075
Filler	Ag/Cu	Ag/Cu, Ag	Ag/glass	Ag/Cu	Ag/Al	Ag/Cu	Ag/Cu	
Mix Ratio (by wgt.)	1:1	100:33	1-part	1-part	1-part	1-part	1-part	1-part
Consistency	medium paste	thick paste	thick paste	medium paste	medium paste	gritty paste	gritty paste	thin fluid
Specific Gravity	5.0 ±0.30	4.0 ±0.40	1.9 ±0.10	3.55 ±0.35	2.0 ±0.25	2.0 ±0.30	2.0 ±0.30	0.78 ±0.10
Minimum Lap Shear Strength, psi (MPa)	1600 (11.04)	1400 (9.66)	100 (0.69)	120 (0.83)	100 (0.69)	NA	NA	NA
Maximum DC Volume Resistivity, ohm-cm	0.005	0.01	0.05	0.01	0.01	0.08	0.08	NA
Use Temperature	-80 to 212°F (-62 to 100°C)	-80 to 212°F (-62 to 100°C)	-67 to 392°F (-55 to 200°C)	-67 to 257°F (-55 to 125°C)	-67 to 392°F (-55 to 200°C)	-67 to 212°F (-55 to 100°C)	-67 to 212°F (-55 to 100°C)	-112 to 392°F (-80 to 200°C)
Elevated Temperature Cure Cycle	2.0 hrs. @ 150°F (66°C)	0.75 hrs. @ 212°F (100°C)	NA	NA	NA	NA	NA	NA
Room Temperature Cure Time	24 hrs.	24 hrs.	1 wk.**	1 wk.**	1 wk.**	1 wk.**	1 wk.**	0.5 hr.
Working Life	1.0 hr.	1.0 hr.	0.5 hr.	0.5 hr.	0.25 hr.	0.5 hr.	2.5 hrs.	N/A
Shelf Life, mos.	9	9	6	6	6	6	6	6
Coverage, in. <sup>2</sup> /lb. (cm <sup>2</sup> /g)	500 (7.1)	700 (9.9)	1500 (21.3)	750 (10.6)	1200 (17.0)	900 (12.8)	900 (12.8)	NA
Recommended Thickness, in. (mm)	0.010 min. (0.25)	0.010 min. (0.25)	0.007 min. (0.18)	0.007 min. (0.18)	0.010 min. (0.25)	0.015 min. (0.38)	0.015 min. (0.38)	0.0002 max. (0.005)
VOC, g/liter	0	0	151	117	0	323	361	740

\* U.S. Patent 4,011,360. \*\* Cure is sufficient for handling in 24 hours. Full specification properties are developed after 1 week (168 hours). \*\*\* Values shown for 1075 reflect typical properties. NA Not Applicable

## Silicones and Flexible Polyisobutylenes

These single-component, non-hardening sealants are formulated to shield or seal joints and seams that are likely to be disassembled or subject to vibration or warping. A key feature is their capacity to remaining adherent without cracking or pulling away from the surface. Metallic surfaces may require priming with CHO-BOND primer to improve adhesion of the silicone caulks.

• **CHO-BOND 1035** is an RTV\* silicone adhesive/sealant that can provide both environmental sealing and EMI shielding. It is well suited for bonding commercial-grade conductive elastomer gaskets and enclosure flanges, and serves as a conductive caulking material in enclosure seams. Its silver-plated-glass filler gives the material a volume resistivity of 0.05 ohm-cm. It is non-corrosive and forms a skin within minutes. Curing occurs without pressure in the presence of atmospheric moisture. Packaging choices include 2.5 oz (71 g) metal tubes and 10 oz (0.3 kg) tubes for pneumatic dispensers. Request Technical Bulletin **23**.

\* Room Temperature Vulcanization

• **CHO-BOND 1038** is also an RTV silicone adhesive/sealant that can provide both environmental sealing and EMI shielding. Silver-plated-copper filler gives the material a volume resistivity of 0.01 ohm-cm. It is non-corrosive and forms a skin within minutes. Curing occurs without pressure in the presence of atmospheric moisture. Request Technical Bulletin **46**.

• **CHO-BOND 1075** RTV silicone sealant is used for bonding silver-plated-aluminum filled EMI gaskets and for providing EMI shielding and environmental protection as a caulk. Its silver-plated-aluminum filler provides compatibility with CHO-SEAL 1285 conductive elastomer gaskets. Curing occurs without pressure in the presence of atmospheric moisture. Request Technical Bulletin **35**.

• **CHO-BOND 4660 and 4669** polyisobutylene sealants feature a low density that permits considerably greater coverage per pound than experienced with other conductive caulks. They are most effective when applied between metal surfaces prior to assembly, and are especially useful for grounding building conduits

and for shielding bulkhead and feed-through fittings, access panels and temporary structures.

## Corrosion-Resistant Sealants

Chomerics pioneered silver-plated-aluminum particle technology to minimize the galvanic corrosion effects of conductive elastomer gaskets. This highly conductive filler is also used in our CHO-BOND 1075 sealant, because the Ag/Al particle will provide a more compatible system for aluminum flanges.

Extensive testing conducted at Chomerics and by the USAF has shown reduced corrosion at joints while EMI shielding is maximized. Standard specifications have been developed for these Ag/Al silicone sealants. Additional testing includes: corrosion-resistance to MIL-STD-810 salt fog; long-term effects on both physical and electrical properties; paintability; lightning survivability; and NASA outgassing. Technical information is available on request.

Table 4 Ordering Information

PRODUCT	ORDERING PART NUMBER	UNIT/SIZE
CHO-BOND 360-20	50-01-0360-0020	1 pound kit (0.5 kg)
CHO-BOND 360-208	50-01-0360-0208	1 pound kit (0.5 kg)
CHO-BOND 360-208	50-00-0360-0208	3 ounce kit (85 g)
CHO-BOND 1035	51-01-1035-0000	10 ounce kit (0.3 kg)
CHO-BOND 1035	51-00-1035-0000	2.5 ounce kit (71 g)
CHO-BOND 1038	50-01-1038-0000	1 pound kit (0.5 kg)
CHO-BOND 1038	50-02-1038-0000	4 ounce kit (113 g)
CHO-BOND 1075	50-01-1075-0000	10 ounce kit (0.3 kg)
CHO-BOND 1075	50-02-1075-0000	2.5 ounce kit (71 g)
CHO-BOND 4660	51-05-4660-0000	1.5 pound cartridge (0.7 kg)
CHO-BOND 4660	51-02-4660-0000	4 ounce tube (113 g)
CHO-BOND 4669	51-05-4669-0000	1.5 pound cartridge (0.7 kg)
CHO-BOND 4669	51-02-4669-0000	4 ounce tube (113 g)
<b>Primer</b>		
CHO-BOND 1086	50-01-1086-0000	1 pint (0.47 liter)

**Note:** Custom packaging can be accommodated. Please inquire.

Every shipment of Chomerics' conductive compounds is accompanied by a *Certificate of Conformance* to Chomerics specifications. Additional test reports can be obtained for a service charge. Quality control procedures conform to MIL-I-45208.



# CHO-SHIELD® Conductive Coatings

## Epoxy Coatings

CHO-SHIELD epoxy coatings provide EMI shielding, anti-static protection, corona shielding and surface grounding in a wide range of applications.

- **CHO-SHIELD 596** coatings are two-component, silver-filled systems possessing exceptionally high conductivity and generally providing EMI shielding levels of up to 60-80 dB in the 30 MHz to 1 GHz range. They can be applied with a brush or conventional spray equipment. Both offer excellent EMI and environmental protection when applied to glass, plastic or epoxy substrates. They cure at room temperature, although optimum results are achieved with elevated temperature cure. Request Technical Bulletin **51**.

- **CHO-SHIELD 610** is a highly conductive, two-component silver-plated-copper filled epoxy coating for application to non-conductive plastic substrates, particularly those subject to hostile environmental conditions of abrasion, temperature extremes, high

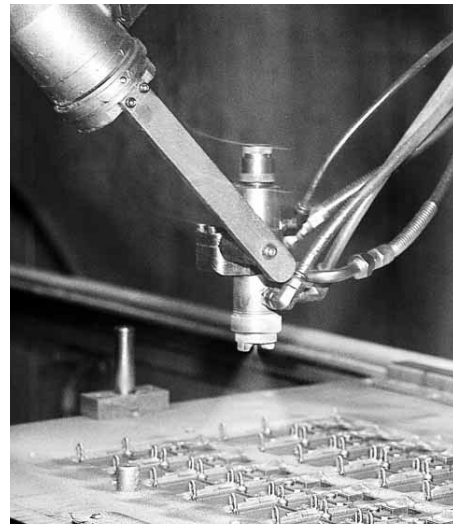
humidity, and salt fog corrosion. It dries to the touch in less than one hour, with best performance attained by using one of two accelerated cure cycles.

## Polyurethane Coating

- **CHO-SHIELD 4076** nickel-filled polyurethane is recommended for shielding an entire room. This durable coating adheres well to plaster, wood, glass, concrete, drywall and most metals. Request Technical Bulletin **29**.

## Acrylic Coatings

One-component CHO-SHIELD conductive acrylic air-dry coatings are intended for EMI shielding of non-conductive substrates. They offer a choice of filler systems that meet varying performance requirements. Silver-containing systems offer lower surface resistivity for better shielding performance. Nickel-filled systems are relatively inexpensive for providing moderate levels of EMI shielding over a wide frequency range.



- **CHO-SHIELD 2052, 2054 and 2056** silver-plated-copper filled commercial-grade coatings provide high levels of EMI shielding effectiveness, abrasion resistance and excellent adhesion on a variety of materials used for electronic enclosures. A more detailed description of these products appears below.

## CHO-SHIELD 2052, 2054 and 2056 Conductive Coatings

### Expressly Formulated for Commercial Enclosures

Developed especially for commercial applications, CHO-SHIELD 2052, 2054 and 2056 conductive coatings provide high levels of EMI shielding effectiveness and excellent adhesion on a variety of plastic substrates. These include ABS, PC-ABS, Noryl\* and PVC. Recommended applications include plastic enclosures for notebook and desktop PCs, routers, servers, medical electronics, telephone handsets, etc.

Each coating has a silver-plated-copper filler. CHO-SHIELD 2052 uses a non-aqueous, one-component acrylic resin. In CHO-SHIELD 2054, the resin is water-based acrylic/urethane that offers the advantage of low VOCs.

Owing to its filler blend of pure silver and silver-plated copper, CHO-SHIELD 2056 offers <30 mohm maximum surface resistivity at the recommended 1-mil thickness. This translates to faster cycle times with fewer mask changes and spray passes.

Extensive testing has been performed to ensure that these coatings are stable at high humidity and moderate salt fog environments. Tough and abrasion-resistant, they meet the adhesion require-

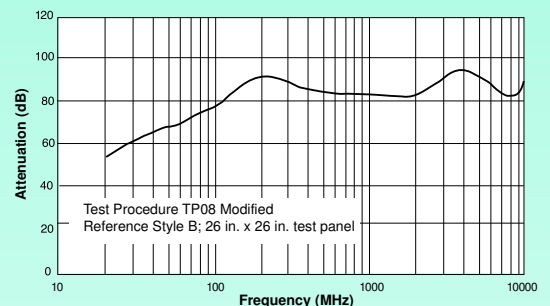


ments of UL 746-C, and are UL listed for several PC/ABS substrates.

### Application

With their excellent leveling and uniformity, these coatings are compatible with all commercially available application technologies, including high volume/low pressure (HVLP) spray systems, and conventional propeller-agitated pressure pots.

As low-settling compounds, they are ready for use after simple mixing in a paint shaker. They are supplied ready-to-spray, and don't require additional thinning, although MEK can be used.



**Figure 1** Shielding Effectiveness of CHO-SHIELD 2056 Coating

### Performance

Typical EMI shielding performance is shown in Figure 1. Testing was performed on PC panels with a film thickness of <0.001 inch (0.025 mm). Reliability testing was performed under high and low temperature, humidity, abrasion, and salt fog conditions. For reports on these tests, contact Chomerics' Applications Engineering Department. For more information, request Technical Bulletin.

\* Trademark of General Electric Co.

• **CHO-SHIELD 4900** silver-filled acrylic coating provides the highest levels of EMI shielding, as well as anti-static protection and grounding surfaces. It offers convenient fast tack and drying. Request Technical Bulletin **26**.

• **CHO-SHIELD 4914** nickel-filled coating is a low-cost choice for use on ABS, Noryl and polyester. It is *not* intended for use on polycarbonate or polystyrene substrates. It features high solvent resistance, fast tack and drying. Request Technical Bulletin **27**.

• **CHO-SHIELD 4916** nickel-filled coating dries to the touch in 30 minutes at room temperature. Effective on ABS, Noryl, polystyrene and polycarbonate, this formulation provides a surface resistivity of <1 ohm/sq. at 2 mils (0.05 mm). It is especially effective in applications requiring 40-50 dB

of EMI shielding.

### Corrosion-Resistant Conductive Flange Coatings

**CHO-SHIELD 2000 Series Coatings** provide corrosion protection for enclosure flanges that mate with EMI gaskets. They can also provide a corrosion-resistant conductive surface coating on aluminum or non-conductive composite substrates. These compounds offer excellent chemical resistance, including stability in jet fuel (JP4), hydraulic fluids and motor oil, along with high abrasion resistance even after jet fuel immersion.

With copper filler systems that are treated to remain electrically stable at elevated temperatures, 2000 Series coatings are three-part

urethane formulations. Request Technical Bulletin **30**.

• **CHO-SHIELD 2001 and 2003** coatings are equivalent except for color — 2001 coating is light brown, 2003 is dark brown. Both contain soluble chromate salts that minimize the effects of galvanic corrosion of the aluminum substrate, even in the event of a coating scratch.

• **CHO-SHIELD 2002** coating is chromate-free and intended for composite substrates or for use in repairing the 2001 coating.

Corrosion resistance has been evaluated in terms of electrical stability of the coatings and their ability to protect aluminum substrates. When tested in accordance with the conditions specified in ASTM B117 (or MIL-STD-810, Method 509.2) salt fog, no corrosion occurs on the aluminum substrate after

*continued*

**Table 5**

SPECIFICATIONS AND PRODUCT CHARACTERISTICS (Contact Chomerics for complete specifications and test procedures)													
CHO-SHIELD Coatings	596	610	4076	2052	2054	2056	4900	4914	4916	2001	2002	2003	1091
Binder	epoxy	epoxy	polyurethane	acrylic	water-based acrylic/urethane	acrylic	acrylic	acrylic	acrylic	urethane	urethane	urethane	Primer for 2001, 2002, 2003
Filler	Ag	Ag/Cu	Ni	Ag/Cu	Ag/Cu	Ag, Ag/Cu	Ag	Ni	Ni	Cu	Cu	Cu	
Mix	100:37	100:28	1-part	1-part	1-part	1-part	1-part	1-part	1-part	pre-measured kit	pre-measured kit	pre-measured kit	1-part
Consistency	medium fluid	medium fluid	medium fluid	thin fluid	thin fluid	thin fluid	thin fluid	medium fluid	heavy fluid	medium fluid	medium fluid	medium fluid	thin fluid
Specific Gravity	1.8 ±0.15	1.6 ±0.15	1.1 ±0.2 (9.2 lbs./gal.)	1.1 ±0.2 (9.2 lbs./gal.)	1.4 ±0.2 (12 lbs./gal.)	1.1 ±0.2 (9.2 lbs./gal.)	1.5 ±0.15	1.7 ±0.2 (14 lbs./gal.)	1.9 ±0.1 (15 lbs./gal.)	3.1	3.1	3.1	0.78
Suggested Spraying Viscosity #2 Zahn Cup	19-26 sec.	19-27 sec.	NA	15-20 sec.	1200-1600 cPs†	14-19 sec.	19-22 sec.	19-22 sec.	19-22 sec.	19-27 sec.	19-27 sec.	19-27 sec.	NA
Maximum Surface Resistance, ohm/sq.	0.06	0.15	0.5	0.04 @ 2 mil thickness	0.03 @ 1.5 mil thickness	< 0.03 @ 1 mil thickness	0.05	2.0	0.7	0.10	0.10	0.10	NA
Use Temperature	-85 to 257°F (-65 to 125°C)	-85 to 257°F (-65 to 125°C)	-65 to 185°F (-54 to 85°C)	-40 to 212°F (-40 to 100°C)	-40 to 167°F (-40 to 75°C)	-40 to 212°F (-40 to 100°C)	-65 to 200°F (-54 to 93°C)	-65 to 185°F (-54 to 85°C)	-65 to 185°F (-54 to 85°C)	-85 to 185°F (-65 to 85°C)	-85 to 185°F (-65 to 85°C)	-85 to 185°F (-65 to 85°C)	-67 to 180°F (-55 to 82°C)
Elevated Temperature Cure Cycle	1.0 hr. @ 250°F (121°C)	2 hrs. @ RT + 1hr. @ 150°F (66°C) + 1 hr. @ 250°F (121°C) or 2 hrs. @ RT + 4 hrs. @ 175°F (79°C)	NA	20 min. @ RT followed by 20 min. @ 140° to 167°F (60° to 75°C)	15 min. @ RT followed by 30 min. @ 150° to 185°F (65° to 85°C)	5 min. @ RT followed by 30 min. @ 140° to 160°F (60° to 71°C)	NA	NA	NA	2 hrs. @ RT followed by 30 min. @ 250°F (121°C)	2 hrs. @ RT followed by 30 min. @ 250°F (121°C)	2 hrs. @ RT followed by 30 min. @ 250°F (121°C)	NA
Room Temperature Cure Time	1 wk.	1 wk.	24 hrs.	24 hrs.	24 hrs.	24 hrs.	24 hrs.	24 hrs.	24 hrs.	1 wk.	1 wk.	1 wk.	1 hr.
Working Life	8 hrs.	8 hrs.	NA	NA	NA	NA	NA	NA	NA	2 hrs.	2 hrs.	2 hrs.	NA
Shelf Life, mos.	9	9	12	12	12	12	9 (bulk) 6 (spray)	9	12	9	9	9	15
Coverage, ft. <sup>2</sup> (m <sup>2</sup> ) @ 0.001 in. (0.025) thick*	50/lb. (10.24/kg)	453/gal. (11.1/liter)	200/gal. (4.9/liter)	194/gal. (4.8/liter)	425/gal. (10.4/liter)	192/gal. (4.7/liter)	34/lb. (6.96/kg)	225/gal. (5.5/liter)	225/gal. (5.5/liter)	40/qt. (3.5/liter)	40/qt. (3.5/liter)	40/qt. (3.5/liter)	1200/lb (245.81/kg)
Recommended Thickness, in. (mm)	0.001 min. (0.025)	0.002 min. (0.05)	0.002 min. (0.05)	0.002 min. (0.05)	0.0015 min. (0.038)	0.001 min. (0.025)	0.001 min. (0.025)	0.002 min. (0.05)	0.002 min. (0.05)	0.003 min. (0.08)	0.003 min. (0.08)	0.003 min. (0.08)	0.0001 min. (0.003)
VOC, g/liter	404	888	338 (minus water)	765	75 (minus water)	759	731 (bulk)	680	575	554	554	550	680

\* Theoretical coverage. Actual coverage will be 50-100% of this value, depending on part geometry, operator skill, etc.

† Brookfield viscosity measured at 100 rpm, spindle #3 @ 25°C, NA Not Applicable

500-hour exposure for CHO-SHIELD 2001 and 2003 coatings, and 100-hour exposure for CHO-SHIELD 2002.

**Design Issues**

Flange design and surface preparation have significant impact on the corrosion resistance offered by CHO-SHIELD 2000 Series coatings. All three coatings adhere best to MIL-C-5411, Class 3 treated aluminum (use an alkaline etching cleaner to clean the aluminum before the conversion coating step) and to most plastics and composites.

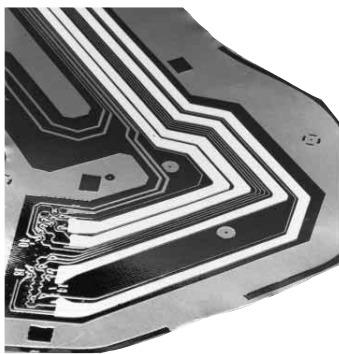
For best adhesion to aluminum, Chomerics' 1091 Primer is strongly recommended. For technical and applications information on this primer, request Technical Bulletin 31. Consult Chomerics' Applications Engineering Department concerning application to other substrates, and assistance with design and material

**Table 6 Ordering Information**

PRODUCT	ORDERING PART NUMBER	UNIT/SIZE
CHO-SHIELD 596	52-01-0596-0000	1 pound kit (0.5 kg)
CHO-SHIELD 596	52-00-0596-0000	3 ounce kit (85 g)
CHO-SHIELD 610	52-03-0610-0000	1 gallon kit (3.8 liter)
CHO-SHIELD 1091	50-00-1091-0000	1/4 pint (0.12 liter)
CHO-SHIELD 2052	52-02-2052-0000	1 quart (0.95 liter)
CHO-SHIELD 2052	52-03-2052-0000	1 gallon (3.8 liter)
CHO-SHIELD 2052	52-05-2052-0000	5 gallons (19 liter)
CHO-SHIELD 2054	52-03-2054-0000	1 gallon (3.8 liter)
CHO-SHIELD 2054	52-05-2054-0000	5 gallons (19 liter)
CHO-SHIELD 2056	52-03-2056-0000	1 gallon (3.8 liter)
CHO-SHIELD 2056	52-05-2056-0000	5 gallons (19 liter)
CHO-SHIELD 2001	52-00-2001-0000	250 grams (1/2 pint)
CHO-SHIELD 2001	52-01-2001-0000	700 grams (1 pint)
CHO-SHIELD 2001	52-04-2001-0000	1378 grams (1 quart)
CHO-SHIELD 2002	52-00-2002-0000	250 grams (1/2 pint)
CHO-SHIELD 2002	52-01-2002-0000	700 grams (1 pint)
CHO-SHIELD 2002	52-04-2002-0000	1378 grams (1 quart)
CHO-SHIELD 2003	52-00-2003-0000	250 grams (1/2 pint)
CHO-SHIELD 2003	52-01-2003-0000	700 grams (1 pint)
CHO-SHIELD 2003	52-04-2003-0000	1378 grams (1 quart)
CHO-SHIELD 4076	52-03-4076-050A	1 gal. (25 gal. min.) (3.8 liter)
CHO-SHIELD 4900	52-01-4900-0000	1 pound can (0.5 kg)
CHO-SHIELD 4900	52-02-4900-0000	6 ounce spray can (0.17 kg)
CHO-SHIELD 4900	52-03-4900-0000	1 gallon (3.8 liter)
CHO-SHIELD 4914	52-03-4914-0000	1 gallon (3.8 liter)
CHO-SHIELD 4916	52-03-4916-0000	1 gallon (3.8 liter)

**Note:** Custom packaging can be accommodated. Please inquire. Every shipment of Chomerics' conductive compounds is accompanied by a *Certificate of Conformance* to Chomerics specifications. Additional test reports can be obtained for a service charge. Quality control procedures conform to MIL-I-45208.

**CHO-FLEX® Conductive Coating and Ink**



• **CHO-FLEX 601** coating is specifically designed for EMI shielding of copper/Kapton<sup>†</sup> flexible circuit laminates and for printing circuits on Kapton film. Upon cure, this coating exhibits excellent adhesion and flexibility, thermal stability, high conductivity and superior peel strength. It can be sprayed or silkscreened, and will withstand wave solder temperatures above 500°F (260°C) without losing any of its exceptional properties.

<sup>†</sup> Trademark of DuPont Company

• **CHO-FLEX 4430** polyester ink was developed for the membrane keyboard and sensor industries. It bonds to Mylar<sup>†</sup> films, and can be creased, heat-formed or scratched without affecting its performance. Pure silver-filled CHO-FLEX 4430 ink offers surface resistivity of 0.050 ohm/square at 0.0005 inch (0.013 mm) thickness.

**Table 7 Ordering Information**

PRODUCT	ORDERING PART NUMBER	UNIT/ SIZE
CHO-FLEX 601	52-01-0601-0000	1 pound (0.5 kg)
CHO-FLEX 4430	55-01-4430-0000	1 pound (0.5 kg)

**Note:** Custom packaging can be accommodated. Please inquire. Every shipment of Chomerics' conductive compounds is accompanied by a *Certificate of Conformance* to Chomerics specifications. Additional test reports can be obtained for a service charge. Quality control procedures conform to MIL-I-45208.

**Table 8 Ordering Information**

SPECIFICATIONS AND PRODUCT CHARACTERISTICS (Contact Chomerics for complete specifications and test procedures)		
CHO-FLEX Coating or Ink	601	4430
Binder	polyurethane	polyester
Filler	Ag	Ag
Consistency	Thixotropic paste	Thixotropic paste
Typical Density	1.67	3.80
Maximum Surface Resistance, ohm/Sq.	0.06	0.08
Use Temperature	-65 to 225°F (-54 to 107°C)	-65 to 185°F (-54 to 85°C)
Cure Cycle	1.5 hrs. @ 360°F (182°C)*	0.5 hr. @ 250°F (121°C)
Shelf Life, mos.	6	9
Coverage, in <sup>2</sup> /lb. (m <sup>2</sup> /kg)**	4320 (6.13)	3000 (4.26)
VOC, g/liter	709	684

\* Flexible circuit cure cycle: 4-5 min. @ 325°F (163°C) initial cure; 90 min. @ 360°F (182°C), 400 (2.76 MPa) psi press cycle; 3-4 sec. @ 500°F (260°C) wave solder.  
 \*\* Theoretical coverage. Actual coverage will be 50-100% of this value, depending on part geometry, operator skill, etc.