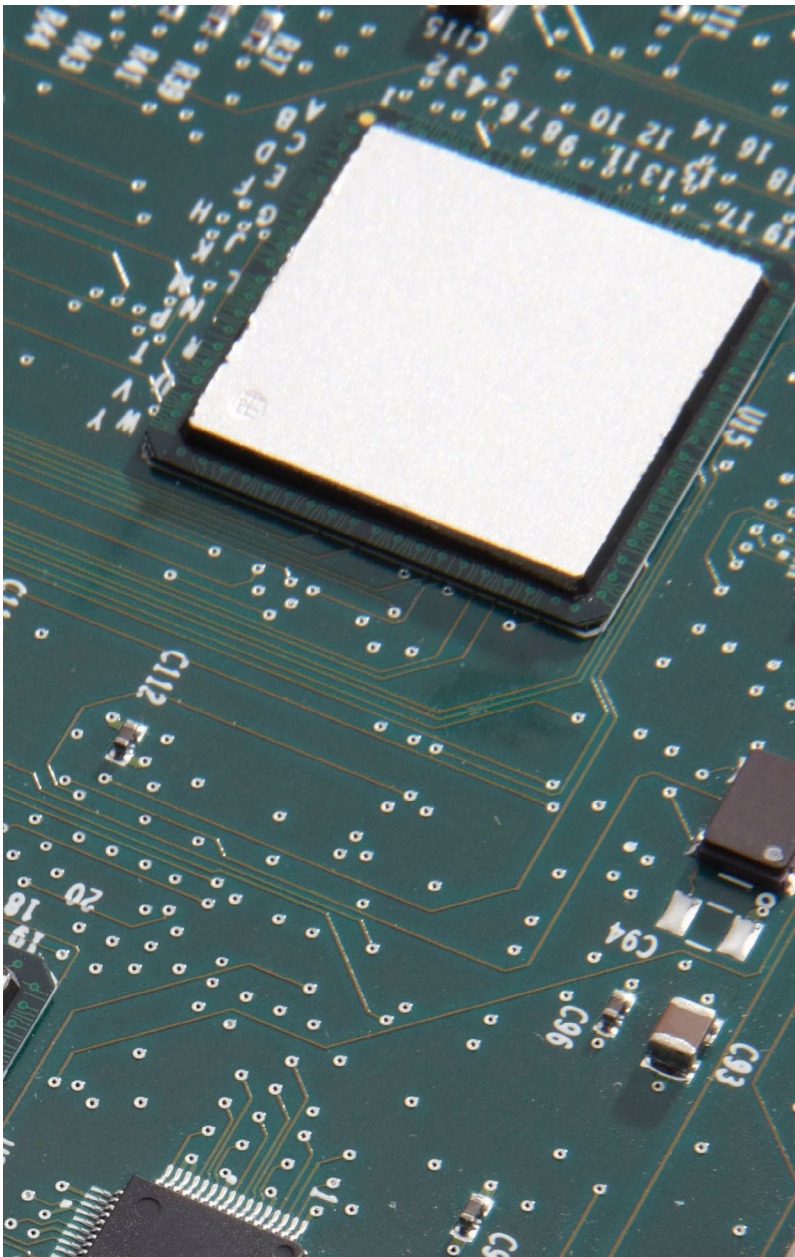
CHO-SHIELD® 604

Highly Electrically Conductive Silver Polyurethane EMI Coating for Semiconductor Packages

Parker Chomerics CHO-SHIELD 604 is a highly conductive, advanced coating developed for high volume, precise spray applications on circuit boards and semiconductor packages. Combined with innovative technologies and packaging designs, CHO-SHIELD 604 can provide board level or package level EMI shielding of electrical components.

Applied correctly, CHO-SHIELD 604 can replace stamped metal cans, saving valuable board space and reducing the overall cost of board level EMI shielding. The CHO-SHIELD 604 specially formulated flexible polymer system provides tenacious adhesion and good environmental stability.





Product Features

- One component
- Designed for high volume spray application
- Exceptional working life at room temperature. Cures only when heated, i.e., greater than 125°C (257°F).
- Silver flake filler
- Excellent conductivity and EMI shielding of components
- Polyurethane coating
- Flexible coating which provides great adhesion to a variety of substrates
- Environmentally stable, Heat [100 hrs @ 150°C (302°F)], Humidity (85% R.H.), Thermal-cycling [85°C (185°F)/85% R.H.]
- Withstands wave solder temperatures in excess of 262°C (500°F)

Typical Applications

- Laptop computers, tablets, and e-readers
- Smart phones
- Drones
- Audio devices such as microphones and headsets
- Navigation devices and other portable electronics

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CHO-SHIELD® 604 Product Information

Typical Properties	Typical Values	Test Method	
Polymer	Polyurethane	N/A	
Filler	Silver	N/A	
Mix Ratio (A/B by weight)	1-part	N/A	
Color	Silver	N/A	(Q)
Spray Viscosity	19 to 25 seconds	Zahn Cup Number 2	(Q)
Surface Resistance at 0.001 inches (25 µm, 1 mil)	0.010 ohms/square	CEPS-0002	(Q/C)
Shielding Effectiveness	70 dB (see graphs below)	CHO-TM-TP11*	(Q)
Recommended Dry Film Thickness	.001" (25 µm)	N/A	
Wet Density	1.2	ASTM D792	(Q/C)
Continuous Use Temperature	-40 to 150°C (-40 to 302°F)	N/A	(Q)
Pot Life	Unlimited	N/A	(Q)
Drying Time - Room Temperature Tack Free	None	N/A	
Drying Time - Room Temperature Full Dry**	None	N/A	
Drying Time - Elevated Temperature Full Dry	Cure Cycle Option 1: 0.25 hr @ 21°C (70°F), followed by 0.25 hr @ 150°C (302°F) Cure Cycle Option 2: 0.25 hr @ 21°C (70°F), followed by 0.5 hr @ 125°C (257°F)	N/A	
Calculated VOC	767 g /L	Calculated	
Theoretical Coverage at Recommended Dry Film Thickness	0.034 ft^2/gram 0.0032 m^2/gram 159 ft^2/gallon	N/A	
Shelf Life, unopened, from date of manufacture	9 months	N/A	(Q)
Storage Conditions	70°F/21°C +/- 9°F/5°C	N/A	

Notes: N/A – Not Applicable, (Q/C) - Qualification and Conformance Test, (Q) - Qualification Test, the above properties are based on Cure Cycle 1.
* Parker Chomerics Test Method CHO-TM-TP20 which is based on ASTM D4935 and Parker Chomerics Test Methods CHO-TM-TP07, CHO-TM-TP11, and CHO-TM-TP27 which are based on IEEE Standard 299. All test methods are available upon request from Parker Chomerics.

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CHO-SHIELD® 604 Shielding Effectiveness

Figure 1 - Typical Shielding Effectiveness

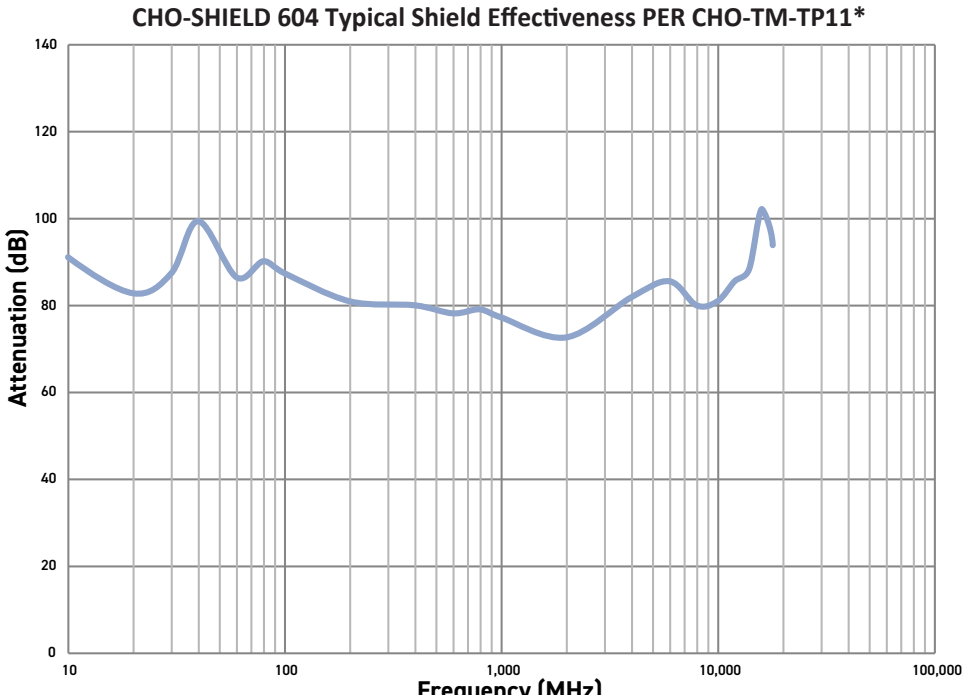
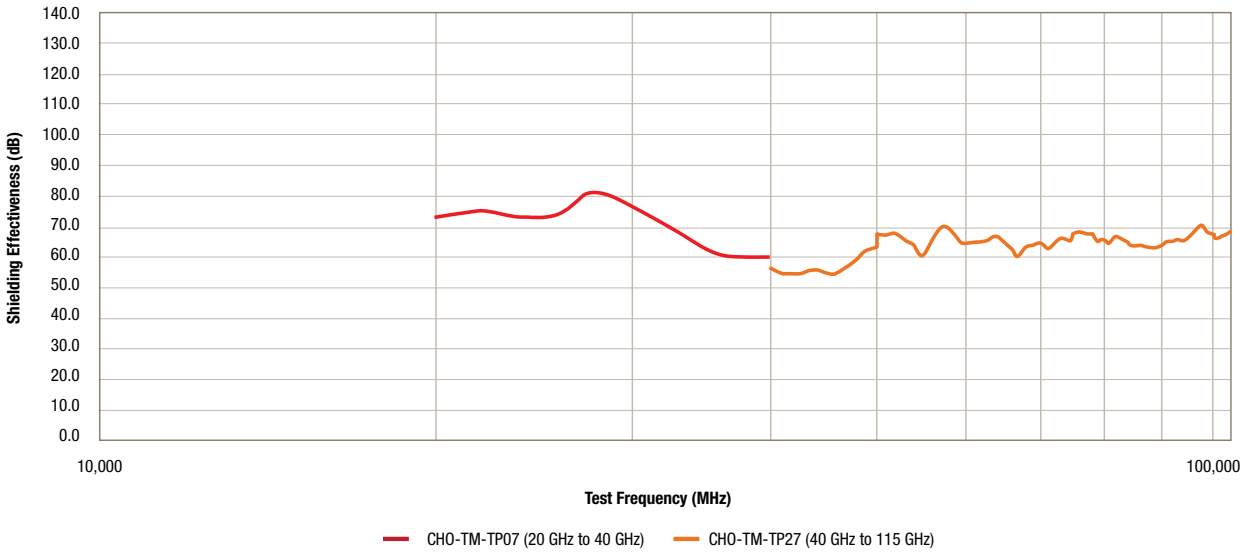


Figure 2 - CHO-SHIELD 604 Typical Shielding Effectiveness per CHO-TM-TP07 and CHO-TM-TP27



A Note on Test Methods Used

Figure 1 illustrates traditional shielding effectiveness test data from 30 MHz to 18 GHz using the CHO-TM-TP11 test method. This method used a 26 inch (660.4 mm) square test sample size, mounted on a 24 inch square (609.6 mm) aperture on the shielded room wall.

Two new test methods are used for testing the frequency range from 20 GHz to 110 GHz. Test methods CHO-TM-TP07 (20 GHz to 40 GHz) and CHO-TM-TP27 (40 GHz to 115 GHz) were developed to be able to use the same test sample throughout the wide frequency range.

Figure 2 illustrates the new test data using a 5.25 inch diameter (133.4 mm) test sample size over the frequency range from 20 GHz to 110 GHz. This smaller test sample size is required to cover such a wide frequency range.

Further information on the testing can be found by downloading the referenced test methods, available from parker.com/chomerics, or upon request from Parker Chomerics Application Engineering.

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CHO-SHIELD® 604 Application Information

Recommended Preparation

Clean the substrate: The substrate surface should be clean, dry and free of oils, release agents, dirt, and lint.

Mix the material well by placing the can on a paint shaker for 3 to 4 minutes or mix by hand with a large spatula until all solids are in a homogeneous suspension. Check that no unmixed material remains on the bottom or the sides of the container.

Optional: Strain the material to reduce or eliminate the potential for clogging the spray nozzle. The paint can be strained through a coarse mesh (1000 micron) flat strainer into a pressure pot for spray.

All metal fillers should be transferred, although a small amount of filler clusters might be collected in the strainer.

Optional thinning: Standard thinning can be accomplished with MEK (methyl ethyl ketone) solvent. During humid days (relative humidity >50% and temperature >30°C/85°F), use n-Butyl alcohol and add up to 8 fluid ounces per gallon of paint to eliminate blushing (a white tint on the drying surface).

Fluid Delivery System

Low Volume Manufacturing - Spray

Use a standard HVLP spray gun with approximately 20 to 40 psi (138 to 276 kPa) atomizing air.

A fluid nozzle with a minimum orifice diameter of 0.040 inch (1.016 mm) is recommended.

To obtain maximum adhesion and conductivity, dry spraying should be avoided. Adjust the spray pressure to achieve a proper wet film when applying the conductive coating.

Moderate Volume Manufacturing - Spray Gun and Pressure Vessel with Agitation

Use a pressure pot (15 psi, 103 kPa, typical) with large diameter, paddle type agitator at low mixing speed to keep the metal fillers in uniform suspension. Conventional spray equipment such as HVLP (High Volume, Low Pressure) or DeVilbiss EGA 503 with propeller agitator pressure pots may be used for spray application with approximately 20 to 50 psi (138 to 345 kPa) atomizing air. Use lowest pressure possible. Re-circulation of the paint from the mixing pot through the spray gun and back via a pump delivery system is recommended for greater filler uniformity.

High Volume Manufacturing - Robotic Spray Systems

For large volume, precise spray applications, a robotic spray system with constant fluid recirculation should be used to keep conductive particles from separating and settling in the lines. Both ultrasonic and HVLP spray heads may be used to apply the conductive coating. Important factors to consider when determining spray head type are part geometry, masking requirements, overspray tolerance, paint transfer efficiency, and manufacturing cycle time. A fluid nozzle with an orifice diameter of 0.020 to 0.040 inch (0.508 to 1.016 mm) is recommended.

Nominal Dry Film Thickness

A nominal dry film thickness of 0.001 inches (25 µm, 1 mil) is recommended to obtain >70 dB shielding effectiveness from 70 MHz to 18 GHz. However, a thinner or thicker coat may be acceptable depending on the shielding requirements of the device being protected. Allow material to dry 10 to 20 minutes at room temperature between coats to avoid solvent entrapment.

Drying Conditions

Dry at room temperature for 10 to 20 minutes.

Continue drying for 15 minutes at 150°C ± 2°C (302°F ± 5°F) for 0.001 inches (25 µm, 1 mil) thickness.

Dry longer if thicker film, shorter if thinner film, to achieve desired conductivity.

Clean-up

The spray system, including spray gun, mixing pot, and containers can be cleaned with MEK or Acetone (VOC exempt solvent). Masks can be power washed with Challenge 485S barrier coat.

Storage and Handling

CHO-SHIELD 604 should be stored at 10°C to 30°C (50°F to 86°F) and has a 9 month shelf life from the date of manufacturing in the original sealed container. CHO-SHIELD 604 is a flammable liquid. Please consult the material safety data sheet for proper handling procedures before use.

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CHO-SHIELD® 604 Ordering Information

Product	Weight (grams)	Packaging	Part Number	Primer
CHO-SHIELD 604	290	315 ml Aluminum Bottle	52-01-0604-0000	Not Required

The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current product catalog and in any other materials provided from Parker or its subsidiaries or authorized distributors.



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