

Description

The MC002967 Carbon Conductive Pen easily draws and repair conductive traces. It dispenses a conductive paint made of durable acrylic lacquer that is pigmented with conductive carbon powders. The cured traces are durable and corrosion resistant. This pen works best on smooth, flat, hard surfaces. The valve-tip opens when pressed against the drawing surface, and the flow is controlled by squeezing the barrel.

Applications and Usages

Use this pen for drawing or repairing conductive traces where high conductivity is not required.

It is used for repairing damaged traces on keyboards, game controllers, or remote controls. Repaired devices may be returned to service in only 10 minutes.

Also, it is used to create conductive traces on a variety of surfaces for prototyping, hobbies, or maker projects. It is good for making small connections in or between circuits, such as jumpers, through-holes, bridges, and links. It is great for drawing resistors and it can be used to increase the surface area of contacts by painting the area around them.

Benefits and Features

- Volume resistivity: $0.46\Omega\cdot\text{cm}$
- Creates durable, reliable, and conductive connections
- Typical trace width: 1.0mm
- Dries in minutes at room temperature
- Adheres to plastics, epoxy, copper, aluminum, ceramics, wood, and most electronic substrates
- Adheres to ABS, PLA, and other 3D printed plastics
- Superior corrosion resistance
- Toluene and xylene free
- Cost effective

Usage Parameters

Properties	Value
Handling Time	10 min
Drying Time @25°C (77°F)	24 hour
Drying Time @65°C (149°F)	30 min
Shelf Life	2 years
Typical Trace Width	1.0 mm
Theoretical Pen	$\leq 71\text{cm}^2$
Coverage ^{a)}	$\leq 11\text{in}^2$

^{a)} Idealized estimate based on a coat thickness of $25\mu\text{m}$ (1.0 mil) and 100% transfer efficiency

Temperature Ranges

Properties	Value
Constant Service Temperature	-40 to 120°C
	(-40 to 248°F)
Intermittent Temperature Limit	-50 to 125°C
	(-58 to 257°F)
Storage Temperature of Unmixed Parts ^{b)}	-5 to 40°C
	(23 to 104°F)

^{b)} The product must stay within the storage temperature limits stated.

Principal Components

Carbon Black
Acrylic Resin
Acetone

Properties of Cured MC002967^{a)}

Physical Properties	Method	Value ^{a)}	
Volume Resistivity	Method 5011.5 in MIL-STD-883H	0.46Ω*cm	2.2S/cm
Surface Resistance		Resistance ^{b)}	Conductance ^{b)}
1 coat @ 0.97 mil	Square Probe	170 Ω/sq	0.006 S
2 coats @ 1.7 mil	Square Probe	60 Ω/sq	0.017 S
3 coats @ 2.3 mil	Square Probe	50 Ω/sq	0.021 S
Magnetic Class		Diamagnetic (Non-magnetic)	
Relative Permeability		<1.0	
Physical Properties	Method	Value	
Paint Type	-	Lacquer (Thermoplastic)	
Colour	Visual	Black	
Abrasion Resistant	-	Yes	
Blister Resistant	-	Yes	
Peeling Resistant	-	Yes	
Water Resistant	-	Yes	
Mechanical Properties	Method	Value	
Adhesion ^{c)}	ASTM D3359	5B	
Pencil Hardness ^{c)}	ASTM D3363	H, Hard	

a) Values based on liquid format. Pen format values may vary slightly.

b) The units are given in Ω/sq and the corresponding conductance in Siemens (S or Ω⁻¹).

c) Tested on acrylonitrile butadiene styrene (ABS) material

Surface Resistance by Coating Thickness

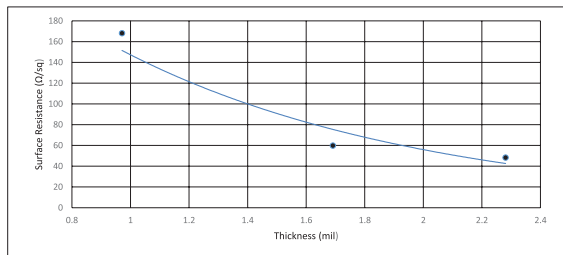


Figure 1. Carbon coating surface resistance at different thicknesses (the dots indicate typical successive coat thicknesses)

Properties of Uncured MC002967

Physical Properties	Mixture
Colour	Black
Density @25 °C (77 °F)	0.84 g/mL
Solids Percentage (wt/wt) a)	15%
Viscosity @25 °C (77 °F) b)	319 cP (368mm ² /s)
Flash Point	-17 °C (1.4 °F)
Odour	Ketone-like

- a) Percentage for liquid only (without propellant)
- b) Brookfield viscometer at 100 RPM with spindle LV S63

Compatibility

Chemical - Carbon doesn't oxidize or deteriorate under a normal environment and conditions, including marine environments as seen by the salt spray test results.

The thermoplastic acrylic resin is incompatible common paint solvents like toluene, xylene, acetone, and MEK. Further, it will not withstand chronic exposures to engine oils, fuels and other similar hydrocarbons. While this makes the coating unsuitable for solvent rich environments, it does offer great repair and rework characteristics.

Adhesion - The MC002967 coating adheres to most materials used to house printed circuit assemblies; however, it is not compatible with contaminants like water, oil, and greasy flux residues that may affect adhesion. If contamination is present, clean the surface to be coated first.

MC002967 Adherence Compatibility

Substrate	Note
Acrylonitrile Butadiene Styrene (ABS)	Chemically etches ^{a)} and adheres well to this substrate.
Polybutylene Terephthalate (PBT)	Chemically etches ^{a)} and adheres well to this substrate.
Polycarbonate	Chemically etches ^{a)} and adheres well to this substrate.
Polyvinyl Acetate (PVA)	Chemically etches ^{a)} and adheres well to this substrate.
Acrylics or Acrylic Paints	Adheres well to clean surface
Copper, Lead, Tin	Adheres well to clean surface
Epoxy, FR4 substrate	Adheres well to clean surface
Polyurethane	Adheres well to clean surface for most urethane types
Wood	Adheres well with surface preparation

^{a)} Etching is similar to sanding, except that it also softens the surface helping to meld the paint to the plastic for superior adhesion.

ATTENTION! Do not use on thin plastics or on plastics where you want to keep original surface intact. The MC002967 contains a controlled amount of solvents designed to chemically etch plastic surfaces to help adhesion by melding the acrylic coating into the plastic substrate. This prevents flaking or peeling. Using the thinner lessens the etching effects for chemically sensitive substrates.

Storage

Store between -5 and 40°C (23 and 104°F) in dry area. Store pen with the tip up after use.

Pen Application Instructions

Follow the procedure below for best results.

ATTENTION! DO NOT apply a total coating thickness of >2.0 mil (>51 µm). This will cause coating to crack.

To apply the liquid pen

1. Ensure that the surface to be coated is clean and oil-free.
2. Shake pen vigorously until the ball moves freely inside
3. Hold pen at angle and depress tip against surface
4. Draw pen across surface while gently squeezing barrel
5. Let dry 10 minutes before handling
6. For optimal conductivity, let stand 24 hours or heat cure at 65 °C for 30 minutes
7. Replace cap and store tip up after use

Carbon Conductive Pen



To cure at Room temperature

Let air dry 24 hours

To accelerate cure by heat

After flash off, put in oven or under heat lamp at 65°C for 30 min.

NOTE: Coats that are very thick require more time to dry.

ATTENTION! If heat curing, do not exceed 65 °C as this may cause surface defects due to solvents evaporating off too quickly.

Packaging

Packaging	Net Volume		Net Weight	
Pen	5mL	0.16 fl oz	4.21 g	0.14 oz

Part Number Table

Description	Part Number
Carbon Conductive Pen, 5mL, Black	MC002967

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