

## Technical Information

# 6150 Etchable Silver Conductor Paste

The thick film silver composition 6150 is designed for applications requiring narrow lines and spaces, smooth pattern edges, and high electrical conductivity. It is deposited by screen printing, fired, then patterned and etched using normal photolithographic techniques. The 6150 yields nearly pinhole-free films with one print and fire operation. It does not contain cadmium, lead, nickel, or

highly toxic organic solvents. Its key features include:

- RoHS Compliant
- High Conductivity
- Suitable for RF and Microwave
- High Adhesion
- Clean Etched Area Footprint
- High Film Density
- Compatibility with Dielectrics and Resistors

### TYPICAL FIRED FILM CHARACTERISTICS<sup>(1)</sup>

<b>Fired Thickness</b>	8-10 $\mu\text{m}$
<b>Resistivity</b>	$\leq 2.50$ Milliohms/square at 12 $\mu\text{m}$ fired thickness
<b>Adhesion<sup>(2)</sup></b>	> 24 N

(1) Typical properties are based on testing of several batches under various processing conditions. They are not intended as specification limits.

(2) The adhesion test consists of attaching 20 AWG tinned copper wire to 2mmx2mm pads, by dipping in 225°C +/-5°C solder for 5 seconds. The wires are then bent 90 degrees and pulled at constant speed, while a force gauge records the peel strength. However, this product is not recommended for directly soldering to it.

### COMPOSITION PROPERTIES

<b>Viscosity:</b>	120 $\pm$ 30 Kcps, when measured with Brookfield HBT viscometer, Spindle #14, utility cup, 10 RPM, 25°C
<b>Specific Gravity:</b>	3.6 – 4.0 g/cm <sup>3</sup>
<b>Recommended Thinner:</b>	KOARTAN A-1039

## RECOMMENDED PROCESSING PROCEDURE

**Printing:** Printing with 325 mesh stainless steel screen using 10-15  $\mu\text{m}$  emulsion and 45 degree angle is recommended. Other mesh counts, 400-325, and emulsion thicknesses, 5-25  $\mu\text{m}$ , may be used for special applications. Squeegee speeds of up to 10 inches/sec may be utilized.

Coverage is approximately 80  $\text{cm}^2/\text{g}$ , when utilizing a 325 mesh screen and a wet print thickness of about 30  $\mu\text{m}$ .

**Drying:** Wet prints should be allowed to level for 5-10 minutes prior to drying. Dry for 10-15 minutes in a convection oven or belt dryer at 125°C-150°C.

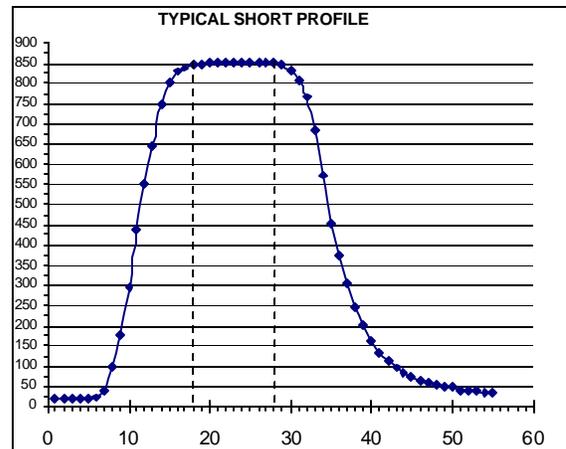
**Firing:** Firing in air using a belt furnace and a 36-60 minute profile, with 10 minutes at a peak temperature of 850°C is recommended. Air flow rates must be optimized to ensure that the products of binder burn-off discharge properly and create a fully oxidizing atmosphere in the muffle.

**Application Notes:** A fired thickness of 8-10 $\mu\text{m}$  and good photolithographic technique allow etching of 2-3 mil lines with only minor undercutting. A 325 mesh screen with thin emulsion or a 400 mesh calendared screen may be used to obtain the desired thickness and surface morphology.

The 6150 silver has excellent adhesion to 96% alumina substrate. However, at the recommended thickness, its soldered aged adhesion is limited to 9-12 N for 2mmx2mm pads. Soldering directly to 6150 is not recommended. Solder pads may be post printed using Koartan general purpose silver 6120, which typically provides greater than 26 N of pull strength after 500 hours at 150°C, or a palladium-silver paste.

The recommended steps for etching are as follows:

1. Clean fired substrates in methanol and bake at 150°C to drive off moisture.
2. Apply Shipley S1800 photoresist or equivalent at about 4000 rpm. Bake at 110°C-120°C for 1 hour.
3. Expose to UV light. Exposure time depends on source intensity, but should generally be about 30 seconds.
4. Develop using Shipley 351 developer or equivalent.
5. Rinse in distilled water and immerse in potassium iodide/iodine or especially formulated etch solution. In order to minimize undercutting, stirring or agitation of the solution is not recommended. It may, however, be heated to speed up the etching process.
6. Use Shipley 1165 or equivalent to remove photoresist from the developed pattern.



Temperature (°C) vs. Time (minutes)

**Storage and Shelf Life:** Store in tightly capped containers at room temperature. Shelf life is 6 months for unopened jars. Under ordinary conditions of storage and use the product should not require thinning. However, solvent loss during extended printing runs may be replaced by incorporating up to 0.5% of Koartan A-1039 thinner.

The information presented herein is based on data believed to be dependable and is accurate and reliable to the best of our knowledge and belief, but not guaranteed to be so. Koartan Company assumes no liability arising from the use of this product or the information provided herein. It is the responsibility of the user to verify the information and to establish the suitability of the product(s) for any particular application. Nothing herein is to be construed as recommending any practice or any product in violation of any patent or in violation of any law or regulation.