

## PS 33-601 Rear Silver Aluminum Conductor Lead Free

**Description:** PS 33-601 is a lead and cadmium free, silver aluminum conductor paste designed as a back contact for p+/p/n+ type silicon solar cells that use an aluminum back surface field (BSF).

The conductor is compatible with all Ferro AL 53-series lead free aluminum pastes and has excellent solderability and adhesion when used with lead free solders.

Typical Properties	
	PS 33-601
Viscosity (Pa·s) <sup>1</sup> :	70–110
Solids Content:	74.5–77.5%
Fineness of Grind:	< 18/14 μm
Dried Thickness:	15–20 μm
Fired Thickness:	10–15 μm
Resistivity <sup>2</sup> (milliohms/square):	< 2.5
Drying Profile <sup>3</sup> :	250–300°C, < 60 seconds
Firing <sup>3</sup>	810–940°C, < 1–3 seconds
Recommended Thinner	0800

All properties are target values and are not meant to represent product specifications

Notes:

<sup>1</sup>Viscosity as measured on Brookfield model HBT cone/plate viscometer; 9.6 reciprocal seconds, 1.565° cone, 25°C.

<sup>2</sup> Milliohms/sq. at 25μm.

<sup>3</sup> Recommended set points °C in infrared firing furnace.

### Product Advantages:

- RoHS compliant<sup>4</sup>
- Lead and Cadmium free<sup>5</sup>
- Complete compatibility with lead free Al inks
- Excellent solderability and adhesion when using lead free solders
- Hot Melt & conventional printing versions available

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**PS 33-601**  
**Rear Silver Aluminum Conductor**  
**Lead Free**

**Processing Recommendations**

**Printing:** It is recommended that the paste temperature be between 20–25°C prior to printing, and it is advisable to control the ambient room temperature within  $\pm 2^\circ\text{C}$  to ensure consistent printing results. The printing area should be clean and well-ventilated.

**Screen:** 200–325 mesh screen with a 20–25  $\mu\text{m}$  emulsion thickness is recommended.

**Drying:** The ink can be dried in an infrared or conventional dryer under a wide range of conditions. Inks are typically dried in an IR dryer with set points of 250–300°C in less than 60 seconds.

**Soldering:** Recommended soldering conditions (ribbons) are 290°C for 96.5Sn/3.5Ag; and 220°C for 62Sn/36Pb/2Ag.

**Firing:** An infrared fast process furnace with three or more firing zones and belt speeds of > 200 inches per minute is highly recommended, although the product may be fired in a variety of furnaces with belt speeds >120 inches per minute. Optimum firing conditions must be established by the customer based on the cell configuration, thickness, and manufacturing process. Peak set point temperatures between 810–940°C with a dwell time above 700°C ranging from >1 to 3 seconds is typical.

**Compatibility:** Ferro has tested this material according to the recommended processing conditions described here; however, it is imperative that customers evaluate the material in their manufacturing process and conditions to insure suitability for their intended use. Ferro technical personnel can help facilitate testing, and can assist with integration into customer manufacturing processes.

**Thinning:** Thinning is not recommended because the paste is supplied at the correct viscosity for application. Contact your local Ferro Representative for appropriate solvent details should thinning become necessary to replace solvent lost through evaporation.

**Paste Storage & Shelf Life:** The paste should be stored in tightly capped containers in a cool (5–30°C) dry place away from direct sunlight. When properly stored, unopened material will have a shelf life of up to 6 months.

Notes:

<sup>4</sup>Complies with EU Directives on Restriction of the use of Hazardous Substances (RoHS; 2002/95/EC) and Waste from Electrical and Electronic Equipment (WEEE; 2002/96/EC). Current exemptions allow lead contained in the glass system of thick film materials used in electronic components. In anticipation of future amendments and more stringent environmental regulations, Ferro continues to expand its range of Lead Free<sup>5</sup> materials.

<sup>5</sup>Initial product composition was certified by SGS laboratories to be below the detection level for lead and cadmium. This conductor paste is not routinely analyzed for lead and cadmium content and is not the basis for product specification or warranty.

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