



## PS 33-651 Hot Melt Rear Silver Aluminum Conductor Lead Free

**Description:** PS 33-651 is part of a specially designed silver conductor system that does not require drying. By eliminating the drying processes of conventional pastes, Hot Melt compositions offer higher throughput rates, increased productivity and improved yields. Hot Melt pastes are solid at room temperature, but when resistively heated above their melting point, the ink will screen print similarly to a conventional thick film paste. Unlike conventional pastes, once the paste is transferred to the solar cell, the ink instantly resolidifies and is ready for the next printing sequence.

PS 33-651 is a lead and cadmium free Ag/Al conductor paste specially designed as a back contact for p+/p/n+ type silicon solar cells that utilize an aluminum BSF. The conductor is compatible with all Ferro Al 53-series lead free aluminum pastes and has excellent solderability and adhesion when using lead free solders.

A variety of configurations and process sequences can be accommodated by combinations of our product offerings.

### Typical Properties

	PS 33-651
Viscosity (Pa·s) <sup>1</sup> :	30–60
Solids Content:	78.0–81.0%
Fineness of Grind:	< 14/13 μm
Dried Thickness:	15–20 μm
Fired Thickness:	10–15 μm
Resistivity <sup>2</sup> (milliohms/square):	< 3.0
Drying Profile <sup>3</sup> :	None required
Firing <sup>3</sup>	810–940°C, < 1–3 seconds
Recommended Thinner	None; solid at room temperature

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, 65°C.

<sup>2</sup>Milliohms/sq. at 25 μm.

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

### Product Advantages:

- RoHS-compliant<sup>4</sup>
- Lead & Cadmium Free<sup>5</sup>
- Complete compatibility with Lead Free Al inks
- Excellent solderability and adhesion when using lead free solders
- Hot Melt reduces cycle times, VOCs, wafer handling/breakage & floor space

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### Processing Recommendations

**Printing:** The screen and squeegee need to be heated to temperatures of 60–65°C prior to printing. The temperature of the stage or nest used to carry the silicon wafer should also be controlled to achieve optimum results.

**Screen:** 250–325 mesh screen with a 20–25 µm emulsion thickness is recommended. Wire diameter is 20–25 µm with a mesh orientation of 45°.

**Drying:** No drying is required, as the paste instantly resolidifies after transfer to the solar cell.

**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, since the paste is solid at room temperature.

**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.

Rev. 10/07

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