

**Description:** For many years, Ferro has been the leading supplier of thick film silver inks designed for making contact to the n-doped silicon front face of photovoltaic devices. Achieving good adhesion with an excellent ohmic contact to this shallow junction is critical in the production of high efficiency cells. Ferro Electronic Materials has produced a number of different formulations for this application. It has been our experience that each cell type has variations in junction depth, dopant concentration and silicon orientation. For this reason, we suggest that a manufacturer new to our product test variations of these formulations, in order to capture the sometimes subtle advantages that one of them may offer for a particular cell type. For similar reasons, our recommended firing profile is meant to be taken as a starting point only and it is absolutely essential that a matrix of profiles be tested to achieve optimum output.

3349 is a silver conductor paste, which contains phosphorous diffusion source in the formulation. It has proved to be extremely successful in firing through a wide variety of anti-reflective and passivation coatings; the versatile formula yields

a low contact resistance over a wide range of temperatures and firing conditions.

### Processing Recommendations

**Printing:** 250 – 325 mesh screen with a 20  $\mu\text{m}$  – 25  $\mu\text{m}$  emulsion thickness is recommended.

**Drying:** The ink can be dried in an Infrared or conventional dryer under wide range of conditions. Inks are typically dried in a IR dryer with set points of 250°C – 300°C in less than 20 seconds.

**Thinning:** Thinning is not recommended, since 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, dry place away from direct sunlight. Properly stored material will have a shelf life in excess of 6 months.

Typical Properties	
	3349
Viscosity (poise) <sup>1</sup> :	875 – 1175
Solids Content	77.4 – 79.7%
Fineness of Grind:	< 14 / 11 $\mu\text{m}$
Dried Thickness:	16 – 25 $\mu\text{m}$
Fired Thickness:	8 – 14 $\mu\text{m}$
Resistivity <sup>2</sup> (milliohms/square):	< 1.2
Drying Profile:	250 – 300°C, < 20 seconds
Peak Firing Temp:	680 – 750°C
Time at Peak:	1 – 20 seconds
Recommended Thinner:	0800

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. normalized to 25 $\mu\text{m}$ .

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