



Electro-Science Laboratories, Inc.

416 East Church Road • King of Prussia, PA 19406-2625, U.S.A
610-272-8000 • Fax: 610-272-6759 • www.ElectroScience.com • Sales@ElectroScience.com

CERMET RESISTOR

3100 SERIES

The ESL 3100 Series is a ruthenium based, thick film resistor paste system designed for use on Elpor II or similar insulated steel substrates. It is intended to be fired in the range of 600°C to 650°C. These materials are aimed at low cost; broader tolerance, commercial markets, and are ideal replacements for PC boards with 5-10% tolerance chip resistors. These materials should not be considered as direct replacements for higher precision thick film cermet circuits on high alumina substrates. Typical material characteristics are shown below.

Properties	3100-0.65	3110	3111	3112	3113	3114	3115	3116
Nominal Resistivity (Ω /square) (1.25 mm x 1.25 mm resistor)	0.65*	1	10	100	1k	10k	100k	1M
Tolerance (%)	± 5	± 30	± 30	± 25	± 25	± 25	± 25	± 30
Average TCR (ppm/°C) (25°C to +125°C) and (25°C to -55°C)	≤ 1000	± 250	± 250	± 200	± 200	-50 ± 200	-50 ± 200	100 ± 200
Heat Stability 200°C, 24 hours, (% ΔR)	N/A	± 1.0	± 1.0	± 1.0	± 1.0	± 1.0	± 1.0	± 1.0

PROCESSING NOTES

BLENDING: (Stir well before using)

Most of the ESL 3100 Series pastes are blendable. ESL 3110 and 3111 may be blended with one another but not with other members of the series.

VISCOSITY:

(Brookfield RVT, ABZ Spindle, 10 rpm, 25.5°C ± 5 °C)

225 ± 25 Pa·s

RESISTIVITY: ESL 9595-A platinum silver is used for terminations. Other ESL conductors such as 9996-B (Ag) or D-593 (Ag) for low temperature firing may be used with slight resistance and TCR effects.

SUBSTRATES: Elpor II substrates are used for calibration. Other insulated steel substrates may be used although differences in fired properties may be observed.

* Tested using a nine square pattern.

3100 Series 9801-C

ESL Affiliates

Japan: ESL-Nippon Company, Ltd. • Sukegawa Bldg. • 6th floor • 3-4 Yanagibashi 1-chome • Taito-ku • Tokyo 111, Japan • Tel: (011-81)-3-3864-8521 • Fax: (011-81)-3-3864-9270
NipponSales@ESLNippon.com

China: Shanghai Agmet Electro-Science Laboratory Ltd. • Second Floor Bldg. 12A1 • #223 North Fe Te Road • Waigaoqiao Free Trade Zone • Shanghai, China
Tel: (011-86)-21-5866-0497 • Fax: (011-86)-21-5866-0497 • ShanghaiSales@ShanghaiESL.com

Europe: Agmet, Ltd. • 8 Commercial Road • Reading, Berkshire, England RG2 0QZ • Tel: (011-44)-118-987-3139 • Fax: (011-44)-118-986-7331 • Sales@ESLEurope.co.uk

See Caution and Disclaimer on other side.

PRINTING AND DRYING:

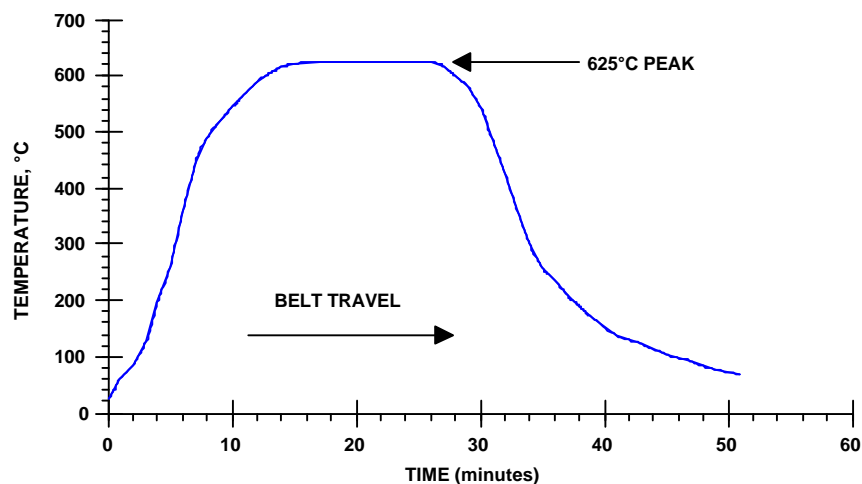
Screen Mesh, Emulsion	200 S/S, 20 μ m
Leveling Time: (25°C)	5-10 minutes
Drying Time: (125°C)	10-15 minutes
Dried Thickness:	25 \pm 3 μ m

Note: The use of a 325 mesh screen will give a thinner dried thickness. A fired thickness range of 8 to 12 micrometers will trim more rapidly than thicker films, and will resist thermal expansion-contraction mismatch (strains between the steel, enamel and resistors during laser trimming) more readily than resistor films which are 13 to 18 micrometers thick. Thinner resistor films can be volatilized by a YAG laser at lower power and thus with less danger of cutting through the 125 to 150 μ m thick enamel coating on the steel substrates. However, users should expect increases in sheet resistivity with thinner films.

FIRING:	Peak Temperature/Time:	625°C/10-12 minutes
	Clean Air Exchange:	(minimum) 1-2 times/minute
	Total Cycle Time:	45 minutes

STABILIZATION: For tolerances tighter than 5%, heat stabilization at 200°C to 450°C, prior to laser trimming has proven advantageous. Overglazing with ESL 4775 may stabilize, although firing temperature and time are critical. Expect changes of 5% to 10% due to overglazing or heat stabilization. Refiring resistors (normal profile) will cause changes (increasing with resistivity) of -5% to -30%. Use ESL 242-SB (epoxy overcoat) for post trim protection.

TYPICAL 625°C FIRING PROFILE



3100 Series 9801-C

CAUTION: Proper industrial safety precautions should be exercised in using these products. Use with adequate ventilation. Avoid prolonged contact with skin or inhalation of any vapors emitted during use or heating of these compositions. The use of safety eye goggles, gloves or hand protection creams is recommended. Wash hands or skin thoroughly with soap and water after using these products. Do not eat or smoke in areas where these materials are used. Refer to appropriate MSDS sheet.

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