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CERMET RESISTOR SYSTEM

3900 SERIES

The 3900 Series is a ruthenium-based resistor system for use in hybrid micro-electronic circuits and discrete components. It is used for the most demanding telecommunications, aerospace and medical applications and combines high performance, low cost, and ease of processing. The resistors exhibit good voltage and thermal stability.

The 3900 Series has the following characteristics:

- Wide range of resistivities: $0.1\Omega/sq$. to $1 M\Omega/sq$.
- Temperature Coefficient of Resistance (TCR): less than 50 ppm/°C for the 100 Ω, 1 kΩ, and 10 kΩ resistivity ranges.
- TCR tracking within 10 ppm/°C when the same size and termination are used with an individual resistivity.
- Low sensitivity of TCR and resistivity to printing and firing cycles.
- Good power load stability, up to 1000 mW/mm² (650 W/in²) with or without overglaze as long as hot spot temperatures are limited to 150°C. Heat stabilization may be used to permit stable operation at significantly higher power loading.
- Excellent stability after laser trimming.
- Specially blended intermediate resistor values are available on request.
- All members of the 3900 Series are cofirable.

ESL Affiliates

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³⁹⁰⁰⁻J Series 0206-New

PASTE DATA

RHEOLOGY:

Thixotropic, screen printable paste

PROCESSING

SCREEN MESH/EMULSION:		200/12.5 μm
LEVELING TIME: (25°C)		5-10 minutes
DRYING AT 125°C:		10-15 minutes
FIRING TEMPERATURE:		850°C
	TIME AT PEAK:	10-12 minutes
	FIRING CYCLE:	60 minutes
SUBSTRATE OF CALIBRATION:		96% alumina*

* - NOTE: Beryllia substrates may also be used but resistivity and TCR changes will occur. Similarly, small shifts in resistivity and TCR may occur with 99% alumina substrates or substrates containing substantial amounts of calcium and barium silicates.

Stabilization: If required, post-fire stabilization, such as overglazing with 4770-BCG (fired at 500°C-525°C) and/or 240-SB (modified silicone resin, cured at 200°C-250°C), may be used. For high precision applications, or tight tolerance resistors the following procedure may be used: overglaze with 4770-BCG, trim to 1% of nominal value, anneal at 200°C for 24 hours before fine trimming to the desired tolerance. Laser cuts may be protected with a low temperature polymer coating such as 240-SB.

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 eve goggles, gloves or hand protection creams is recommended. Wash hands or skin thoroughly with scap and water after using these products. Do not eat or smoke in areas where these materials are used. Refer to appropriate MSDS sheet.

DISCLAIMER: The product information and recommendations contained herein are based on data obtained by tests we believe to be accurate, but the accuracy and completeness thereof is not guaranteed. No warranty is expressed or implied regarding the accuracy of these data, the results obtained from the use hereof, or that any such use will not infringe any patent. Electro-Science assumes no liability for any injury, loss, or damage, direct or consequential arising out of its use by others. This information is furnished upon the condition that the person receiving it shall make their own tests to determine the suitability thereof for their particular use, before using it. User assumes all risk and liability whatsoever in connection with their intended use. Electro-Science's only obligation shall be to replace such quantity of the product proved defective.

PROPERTIES	3900-0.1OHM	3910	3911	3912	3913	3914	3915	3916	
Resistivity (Ω /square) ^a	0.1	1	10	100	1 k	10 k	100 k	1 M	
Tolerance (%)	±50	±30	±10	±10	±10	±10	±10	±10	
Viscosity (Pa•s) ^b	300±25 225±25								
Dried Thickness (µm)	22.5±2.5								
Thinner	ESL 401								
Average TCR (ppm/°C) ^c	75±75	50±100	0±100	0±50	0±50	0±50	0±100	-100±100	
STOL (V/mm) ^d	-	-	8.07	24.6	70.9	64.0	128	-	
Std. Working Voltage (V/mm) ^e	-	-	3.22	9.84	28.3	25.6	51.2	-	
Max Rated Power (mW/mm ²) ^f	-	-	974	970	1001	60.6	27.0	-	
Quan-Tech Noise (dB)	N/A	N/A	N/A	≤-10	≤-10	≤+10	≤+25	≤+35	
Average VCR (ppm/V/cm)	-	-	-	-	-	≤-100	≤100	≤-450	
Laser Trim Stability (%∆R)	-	-	±0.3%	±0.3%	±0.3%	±0.3%	±0.3%	±0.3%	
(1,000 hours at 150°C)									
Termination Conductor	8835-1B 9635-B								
Shelf Life (25°C)	6 months								

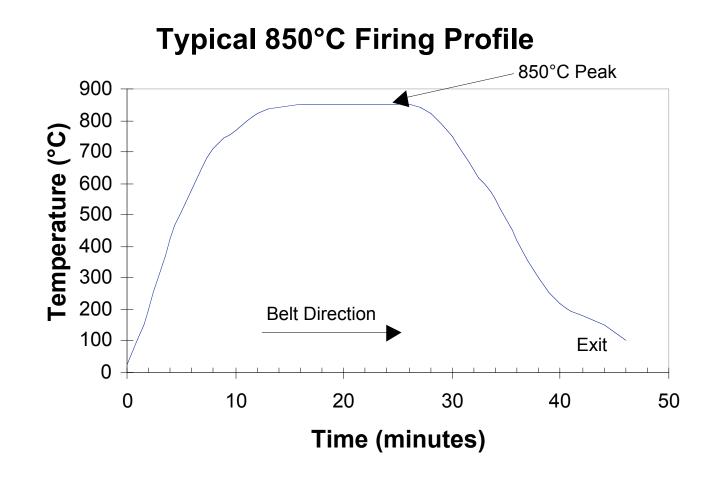
^a CALIBRATION: Resistor size: 1.25 mm x 1.25 mm.

^b VISCOSITY: Brookfield RVT, ABZ Spindle, 10 rpm, 25.5°C±0.5°C.

^c CTCR: -55[°]C to +25[°]C. HTCR: +25[°]C to +125[°]C. Resistor size measured for TCR: 3900-0.1 OHM & 3910 - 20 mm x 2 mm; all others - 1.25 mm x 1.25 mm.

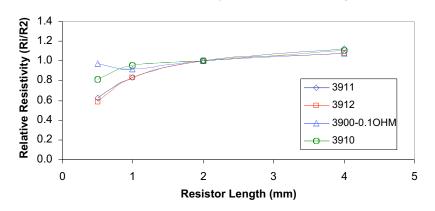
^d STOL: Voltage required, 5 second duration, to induce a resistance change of ±0.1% at 25°C.

^e STANDARD WORKING VOLTAGE: 0.4 x STOL Voltage. ^f MAXIMUM RATED POWER: (Standard Working Voltage)²/Resistance.



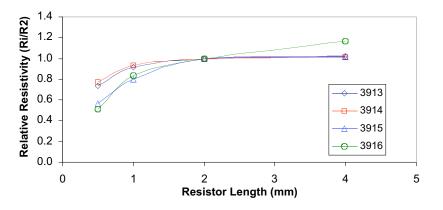
3900 Series 9807-B

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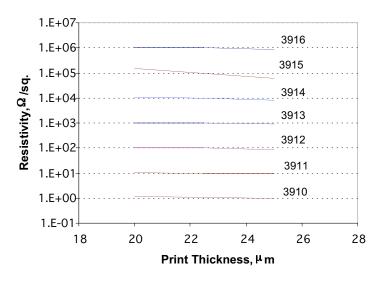


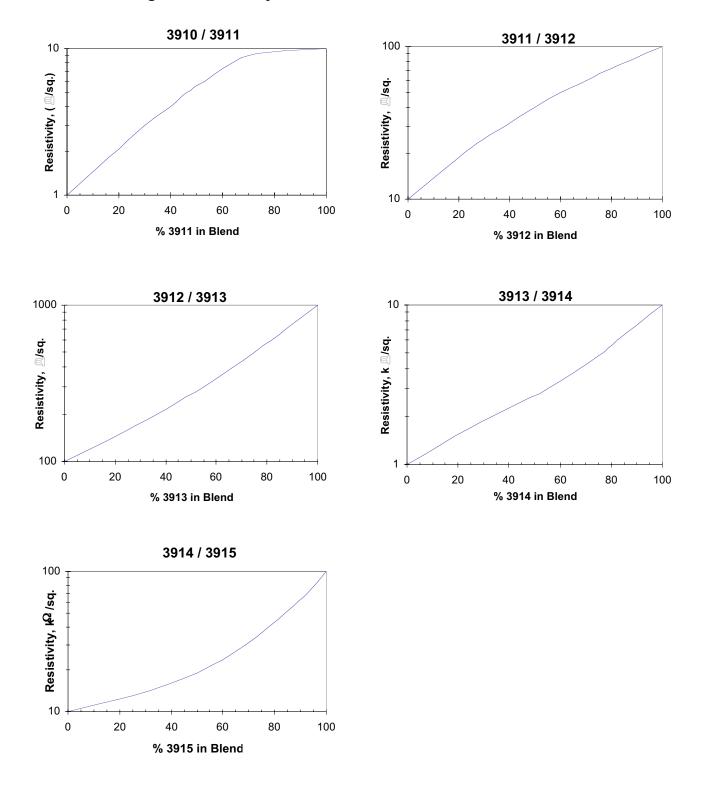
3900-Series Resistivity vs Resistor Length



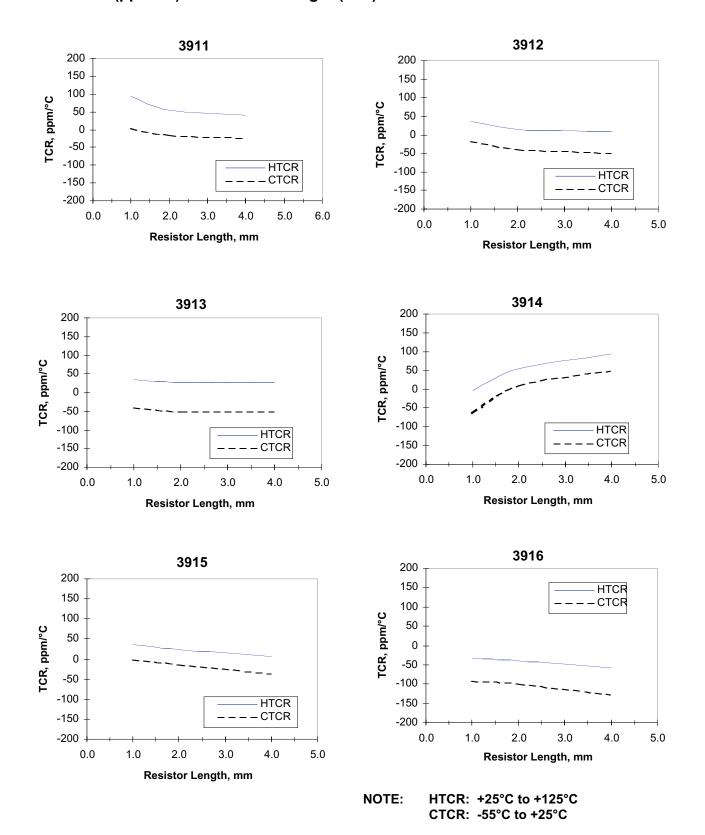


3900 Series Resistivity vs. Print Thickness





Blending Curves for Adjacent Members of the 3900 Series Resistors



TCR (ppm/°C) vs. Resistor Length (mm) for the 3900 Series Resistors