

## Technical Data Sheet

### THICK FILM MATERIALS

Product Type: Resistors

Product Name: R 2200 Series  
(10 Ω/□ – 10 MΩ/□)



Lead Free Overglazed Air Fired Resistor Series / DPIS\*  
\* Development Product Information Sheet

#### Description

The Heraeus lead free resistor R 2200 Series, 10Ω - 10MΩ, has been developed to meet high performance on alumina.

#### Key Benefits

- To be used with post-fired plating resistant 600 °C overglaze giving mean tolerance of resistance within ± 10 %
- Compatible with lead free series of Heraeus Ag contained conductors
- Free of lead, nickel, cadmium and phthalate
- REACH<sup>6</sup> and RoHS<sup>7</sup> compliant

#### Typical Fired Resistor Properties<sup>1</sup>

Overglazed R 2200 Series <sup>2,5</sup>	R 2211 (WP14-23)	R 2221 (WP15-05)	R 2231 (WP15-23)	R 2241L (WP15-24)	R 2241H (WP15-31)	R 2251 (WP16-64)	R 2261 (WP16-68)	R 2271
Resistivity <sup>3</sup> (Ω/□) with overglaze	10 ± 10 %	100 ± 10 %	1k ± 10 %	10k ± 10 %	10k ± 10 %	100k ± 10 %	1M ± 10 %	10M ± 10 %
Temperature Coefficient of Resistance <sup>4</sup> TCR (ppm/K)	± 100	± 100	± 100	± 100	± 100	± 100	± 100	Under development
Dried Film Thickness (DFT) (µm)	25 ± 3	17 ± 3	17 ± 3	17 ± 3	17 ± 3	17 ± 3	17 ± 3	

#### Legend

##### 1) Typical properties fired

Results are based on laboratory test methods. For optimum results all materials should be fired in a profiled furnace supplied by dried, hydrocarbon-free and other contaminant-free air (PP-1).

##### 2) Processing conditions

**Termination:** Heraeus lead free silver conductor composition C8729(H), pre-fired at 850 °C;  
**Substrate:** 96 % alumina (Ceramtec, Rubalit 708S);  
**Printing:** 325 mesh stainless steel screen with 30 µm emulsion, to a dried thickness of 17 ± 3 µm;  
**Firing resistor:** 60 minute cycle (furnace entry to exit) to a peak temperature of 850 °C for 10 minutes for R2200 Series  
**Firing overglaze:** See datasheet of IP 9036 A (green).

##### 3) Shipping specifications

**Resistor geometry:** 1.25 mm x 1.25 mm  
**Post-fired resistor overglaze IP 9036 A (green) at 600 °C:**  
With double-wet-printing to a fired film thickness of 14 ± 3 µm.  
**Resistivity:** The resistances indicated are the values after separate post-firing of IP 9036A on resistors at 600 °C.

##### 4) Temperature coefficient of resistance

-55 °C to +25 °C and +25 °C to +125 °C.

##### 5) Blend breaks

A blend break exists between decades 1k (R2231) and 100k (R2251) which are not directly blendable. For blending two 10k pastes are available – R2241L (compatible with the low ohmic range of the series) and R2241H (compatible with the high ohmic range).

##### 6) REACH

REACH compliant according to the latest \*\* Annex XIV to Regulation (EC) of the European Parliament and of the council on the Registration, Evaluation, Authorisation and Restriction of Chemicals ("REACH") by European Chemicals Agency and its subsequent amendments: the material does not contain any substance listed in Annex XIV.

##### 7) RoHS

RoHS compliant according to the latest \* Directives (European Union) of Restriction of Hazardous Substances ("RoHS") and its subsequent amendments (including the exceptions related to Pb).

\* See the data sheet issue date (DD/MM/YY) as reference of validity of latest edition which is available on request.

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#### Processing

- 1) Spatulate well prior to processing.  
  
When stored in a refrigerator allow paste to come to room temperature prior to opening, to avoid condensation.
- 2) Print through a 325 mesh stainless steel screen, 30  $\mu\text{m}$  emulsion. Total screen thickness: 70 – 110  $\mu\text{m}$ .
- 3) Level at room temperature for 5 – 10 minutes.
- 4) Dry at 150 °C for 10 minutes. Dried film thickness should be  $17 \pm 3 \mu\text{m}$ .
- 5) The electrical performance given in this data sheet refers to a 60 minutes firing cycle, with a peak temperature of 850 °C for 10 minutes.

#### Thinner

HVS 100

#### Typical Properties (Pastes)

Form	Pseudoplastic paste
Viscosity	20 – 50 Pas (25 °C, D = 100/s)
Coverage	tbd $\text{cm}^2/\text{g}$ (DFT: 17 $\mu\text{m}$ )
Shelf Life	6 months from date of shipment with correct storage (in a dry, cool (5 – 25 °C) and dark place with container tightly shut).

#### Compatibility

Conductors	Ag	C 8729 (H)
	AgPd	To be determined
	AgPt	To be determined
Overglaze	IP 9036A	

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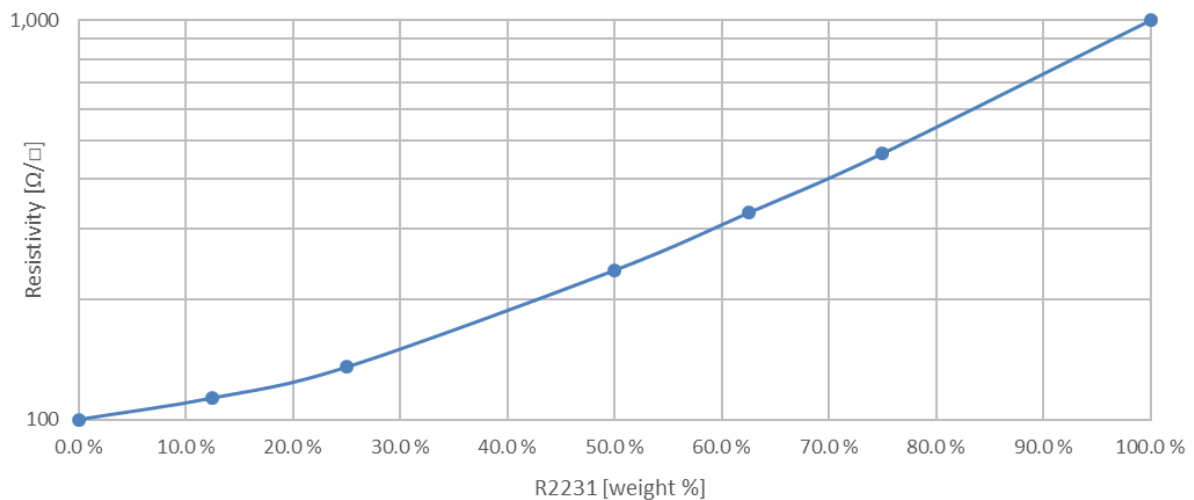
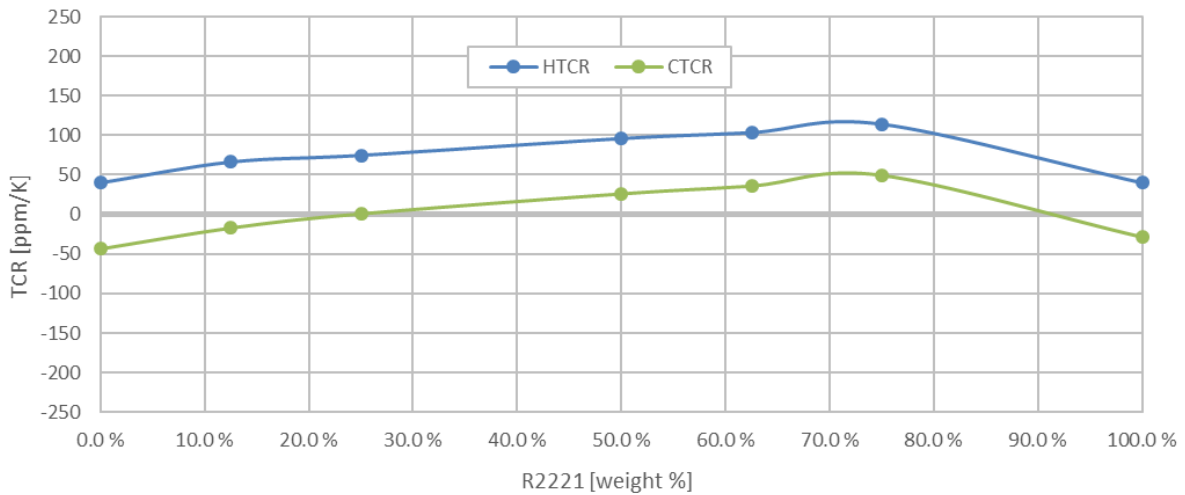
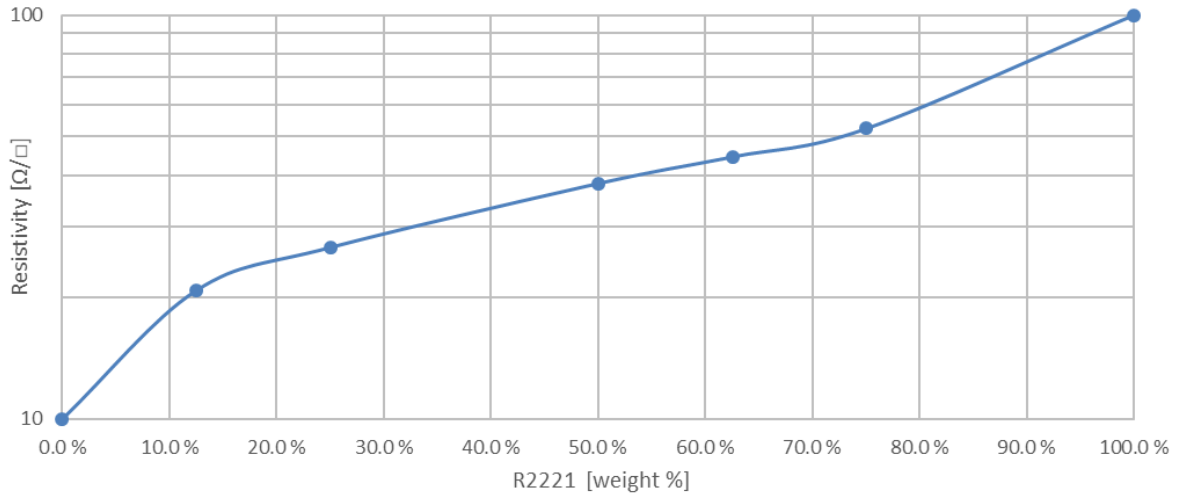


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### Annex 1: Blend Curves – Resistivity and HTCR

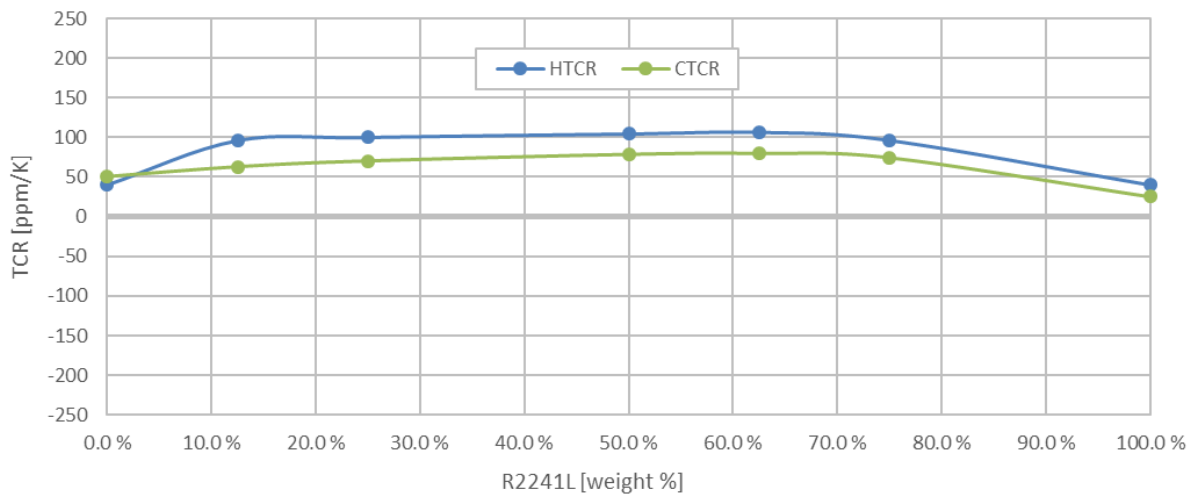
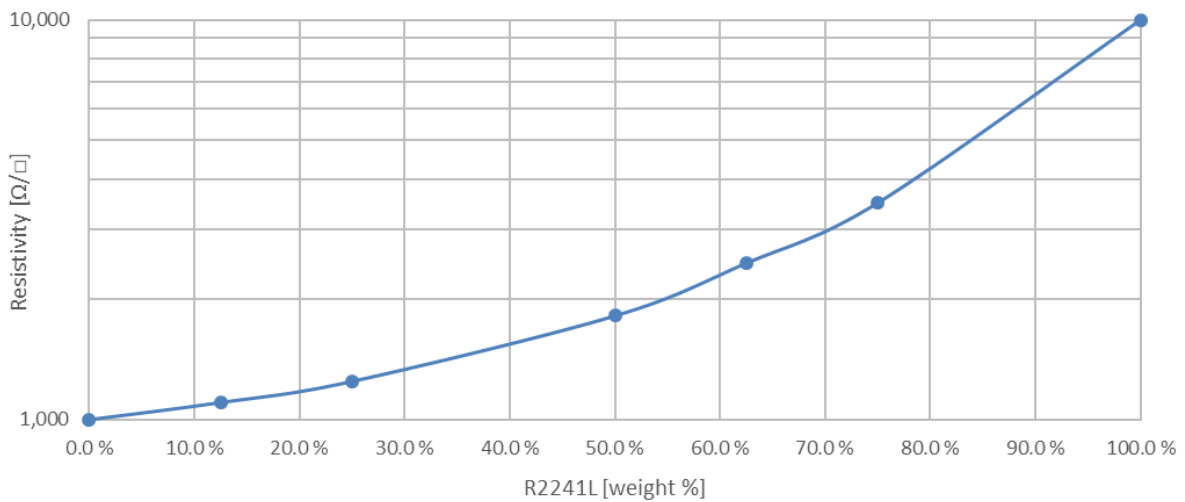
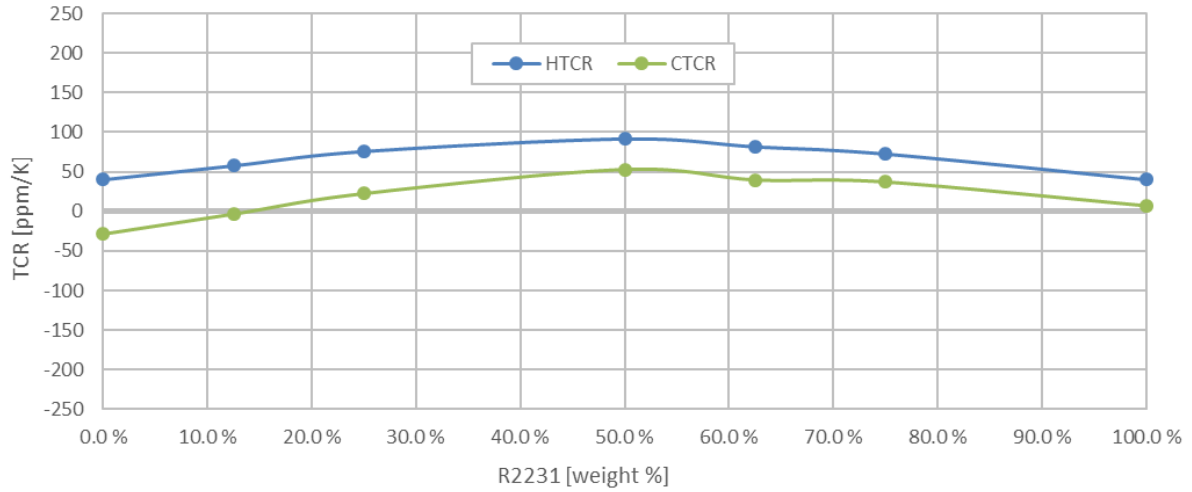
Blend curves for  $R_{\square}$  and TCR: R2211 and R2221 postfired with overglaze IP9036  
 $R_{\square}$  values calculated to a dried film thickness of 17 $\mu$ m (geometry 1.25 x 1.25mm)



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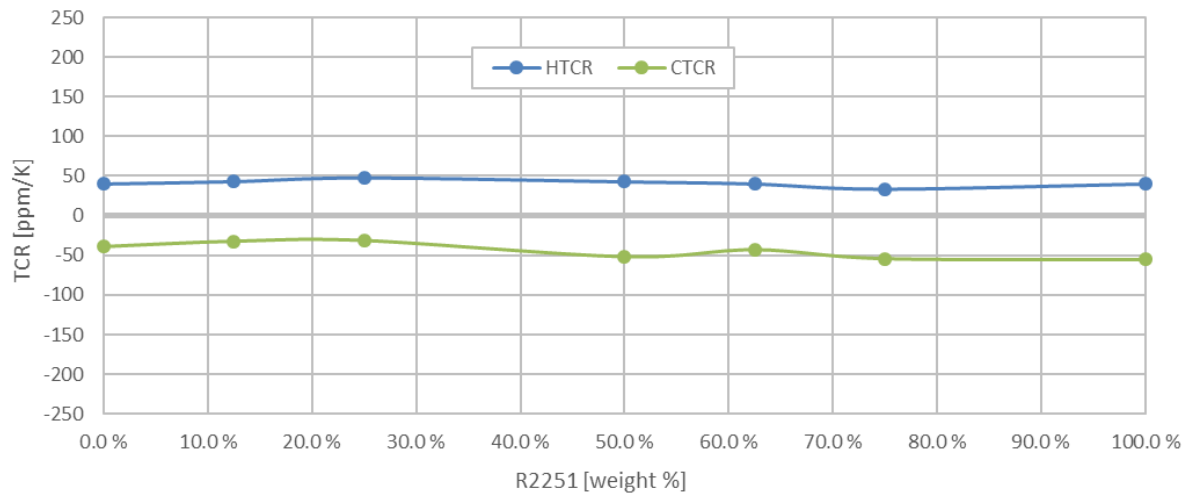
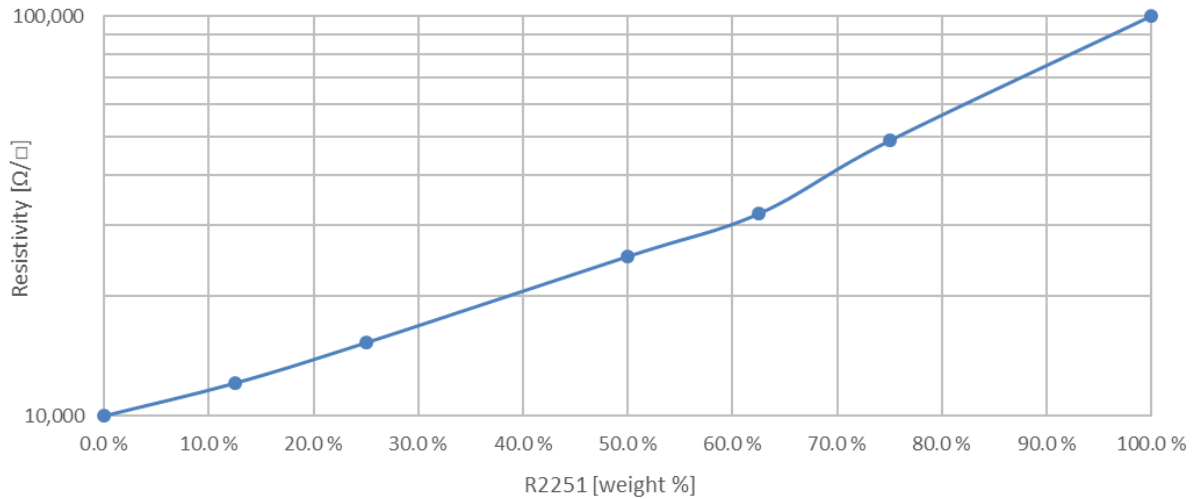


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