



## ESL ELECTROSCIENCE

CERAMIC TAPES &  
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# R-300-A/B Resistor Series

**Tolerant to Processing and Design Variations**

**Excellent Printing Characteristics**

**Low TCR's**

**High Performance**

**Low Cost**

The ESL R-300-A and R-300-B Resistor Series are economical, high performance materials for the manufacture of hybrid circuits and resistors networks. Features of the ESL R-300-A and R-300-B Series include excellent printability and low sensitivity to processing conditions.

The dependence of resistance and TCR on blending follows the usual curves for resistor materials. Adjacent members of the Series can be blended. The R-300-A Series members can not be blended with members of the R-300-B Series.

The resistors are calibrated with ESL 9693-SA PdAg conductor terminations. Other silver-based and gold-based conductors can be used; however, TCR and resistivity shifts may be observed.

R-300-A/B 1209-G

### ESL Affiliates

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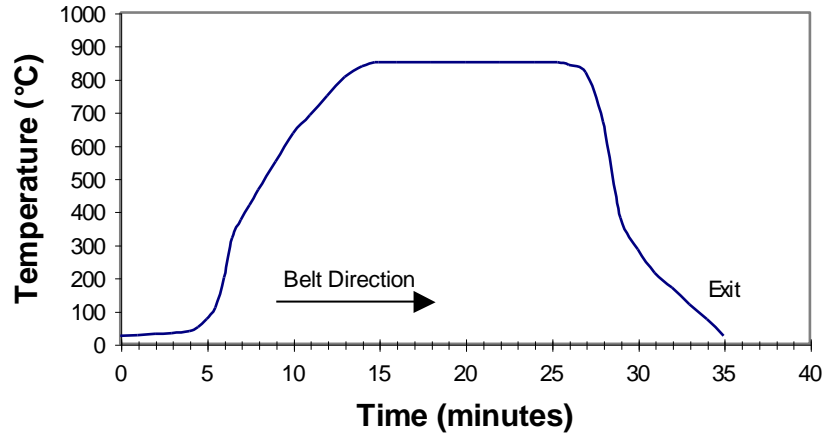
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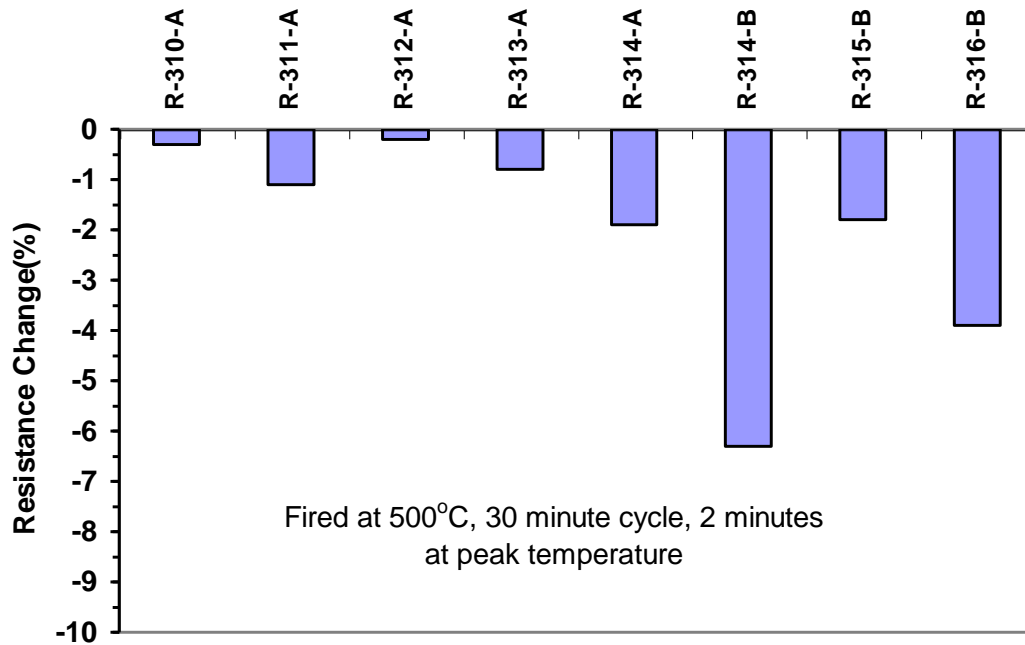
See Caution and Disclaimer on other side.

### Typical 850°C Firing Profile R-300-A/B



### EFFECT OF OVERGLAZING ON R-300-A/B RESISTORS

#### RESISTANCE CHANGE AFTER OVERGLAZING WITH G-471



R-300-A/B 1209-G

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## R-300-A/B RESISTOR SERIES

### TYPICAL RESISTOR PROPERTIES

PROPERTIES	R-310-A	R-311-A	R-312-A	R-313-A	R-314-A	R-314-B	R-315-B	R-316-B
RESISTIVITY <sup>a</sup> ( $\Omega$ /square)	1	10	100	1 k	10 k	10 k	100 k	1 M
SHIPPING SPECIFICATION (%)	$\pm 30$	$\pm 10$	$\pm 10$	$\pm 10$	$\pm 10$	$\pm 10$	$\pm 10$	$\pm 10$
COEFFICIENT OF VARIATION (%)	< 8	< 8	< 8	< 8	< 7	< 5	< 5	< 8
VISCOSITY <sup>b</sup> (Pa·s)	225 $\pm$ 25					300 $\pm$ 50		
DRIED THICKNESS ( $\mu$ m)	22.5 $\pm$ 2.5					20.0 $\pm$ 2.0		
THINNER	ESL 401							
TCR <sup>c</sup> (ppm/ $^{\circ}$ C)	50 $\pm$ 100	0 $\pm$ 100	0 $\pm$ 100	0 $\pm$ 50	0 $\pm$ 50	0 $\pm$ 100	0 $\pm$ 100	0 $\pm$ 100
STOL <sup>d</sup> (V/mm)	1.65	7.38	24.6	76.8	137	150	350	330
STD. WORKING VOLTAGE <sup>e</sup> (V/mm)	0.66	2.95	9.84	30.7	54.8	60	140	130
MAX RATED POWER <sup>f</sup> (mW/mm <sup>2</sup> )	436	871	968	944	300	360	190	17
QUAN-TECH NOISE (dB)	NA	NA	$\leq -10$	$\leq -10$	$\leq -10$	$\leq 2$	$\leq 5$	NA
LASER TRIM (% $\Delta$ R) (1000 hours at 150 $^{\circ}$ C)	NA	$\leq 0.3$	$\leq 0.3$	$\leq 0.3$	$\leq 0.3$	$\leq 0.3$	$\leq 0.4$	$\leq 0.5$
TERMINATION OF CALIBRATION	ESL 9693-SA							

The R-314-B is used as a blending member with R-315-B. For use as a 10 k $\Omega$ /sq. resistor, R-314-A is recommended.

<sup>a</sup> CALIBRATION: Resistor size used for tests; A—1.25 mm square; B—1.0 mm square at dried thickness shown.

<sup>b</sup> VISCOSITY: Brookfield RVT, ABZ Spindle, 10 rpm, 25.5 $^{\circ}$ C $\pm$ 0.5 $^{\circ}$ C.

<sup>c</sup> CTCR: -55 $^{\circ}$ C to +25 $^{\circ}$ C. HTCR: +25 $^{\circ}$ C to +125 $^{\circ}$ C.

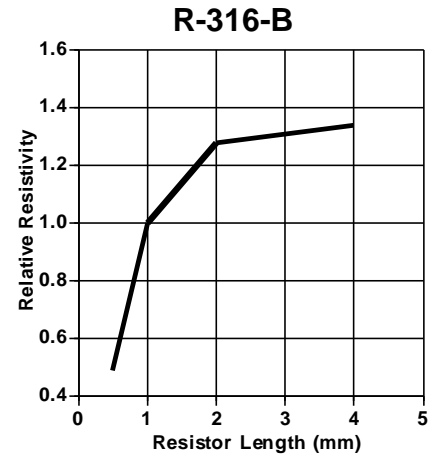
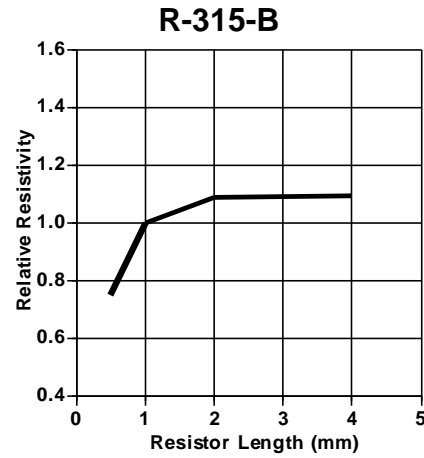
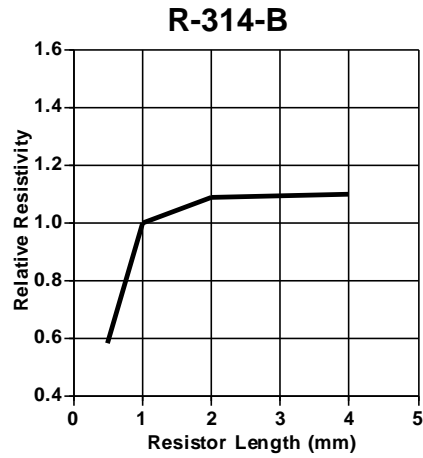
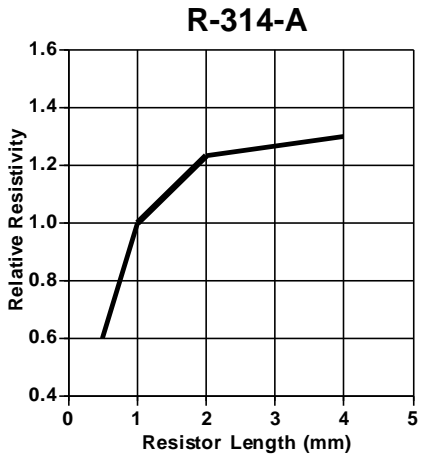
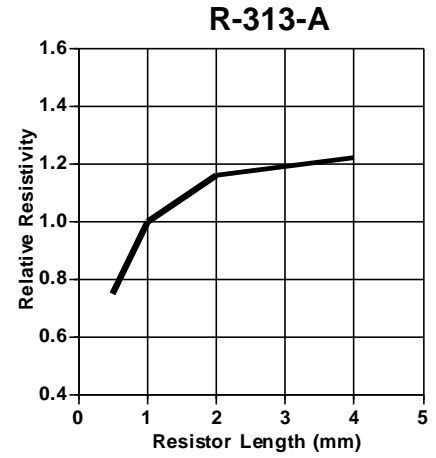
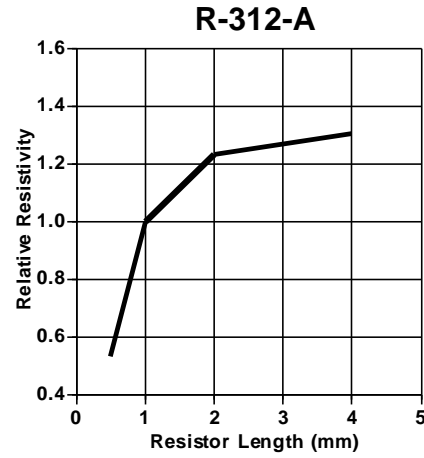
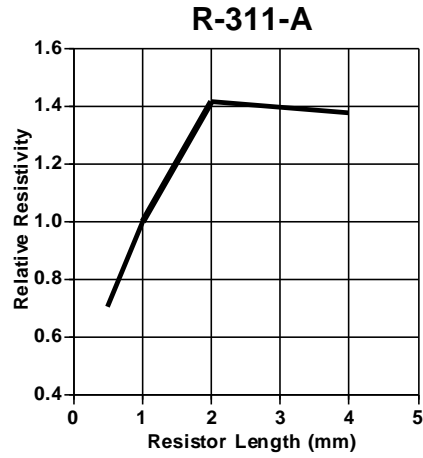
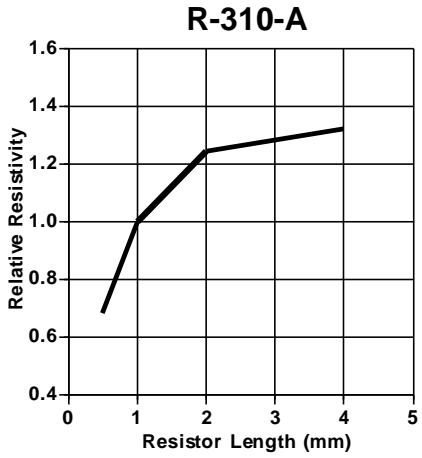
<sup>d</sup> STOL: Voltage required, 5 second duration, to induce a resistance change of  $\pm$ 0.1% at 25 $^{\circ}$ C. Resistor size as in 1.

<sup>e</sup> STANDARD WORKING VOLTAGE: 0.4 x STOL Voltage.

<sup>f</sup> MAXIMUM RATED POWER: (Standard Working Voltage)<sup>2</sup>/Resistance.

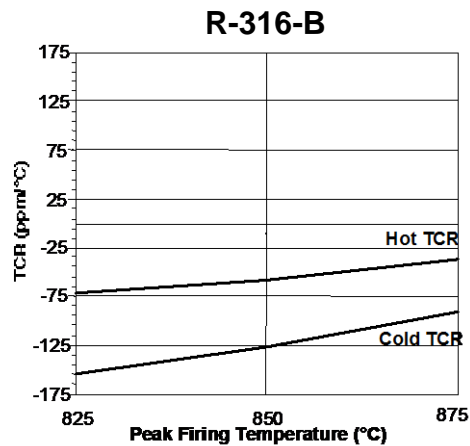
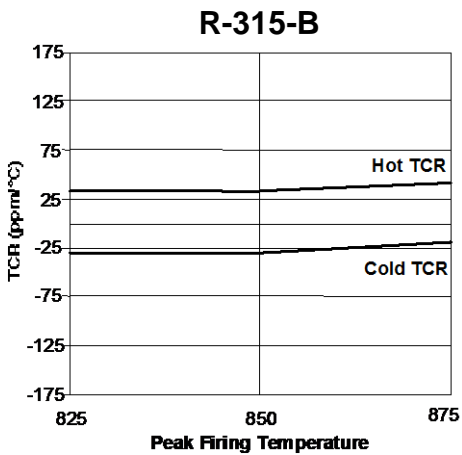
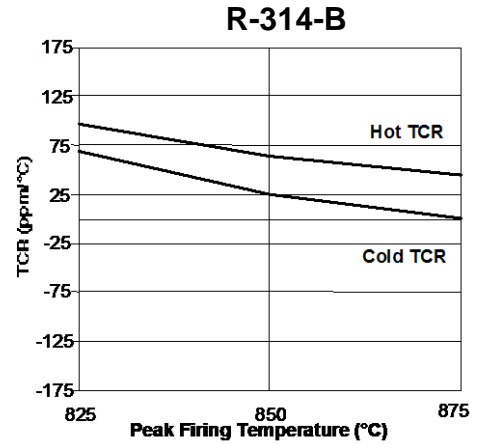
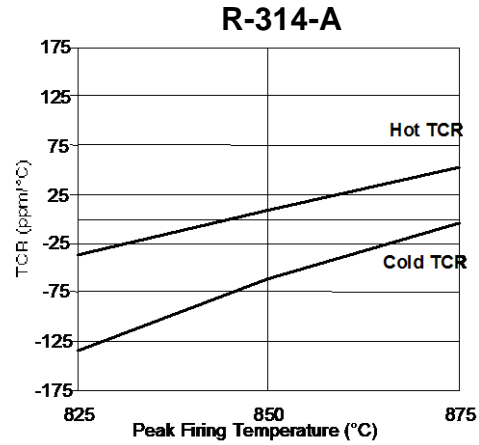
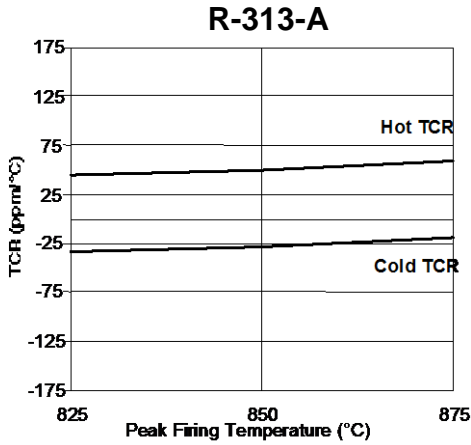
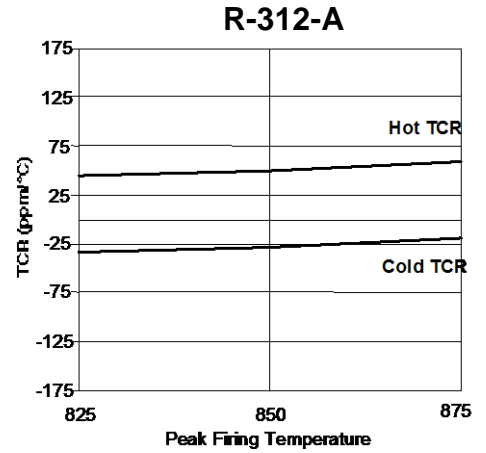
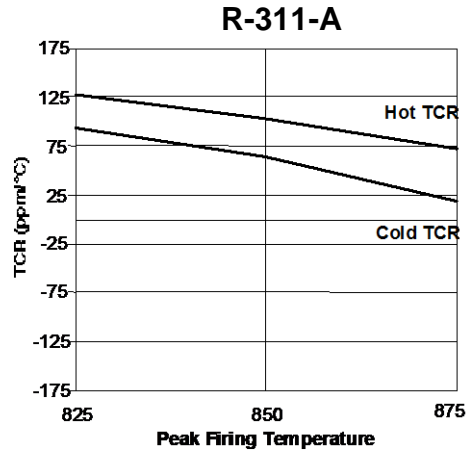
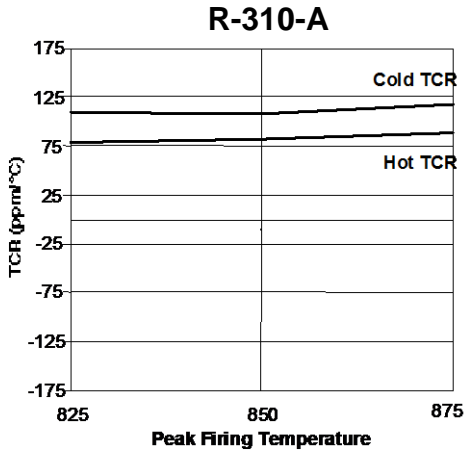
# R-300-A/B Resistor Series

## RESISTANCE VERSUS LENGTH



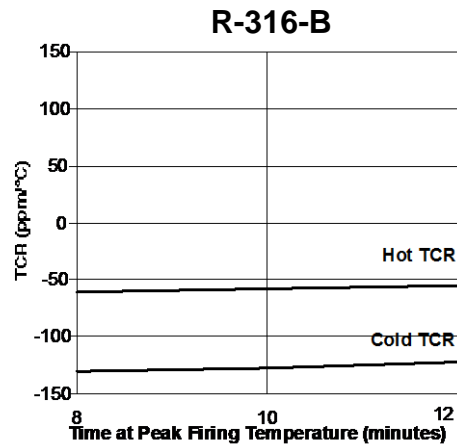
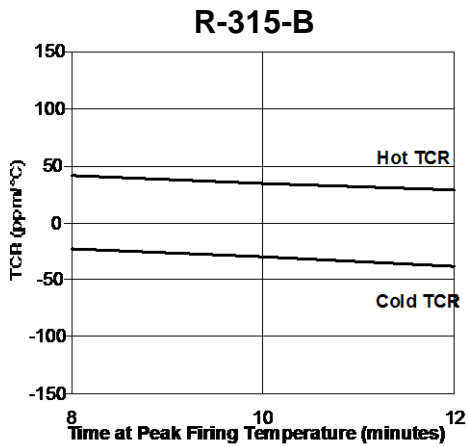
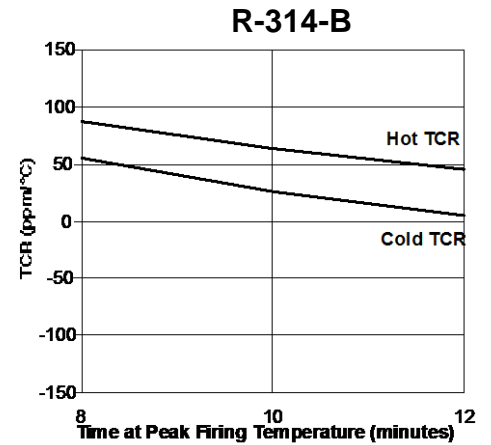
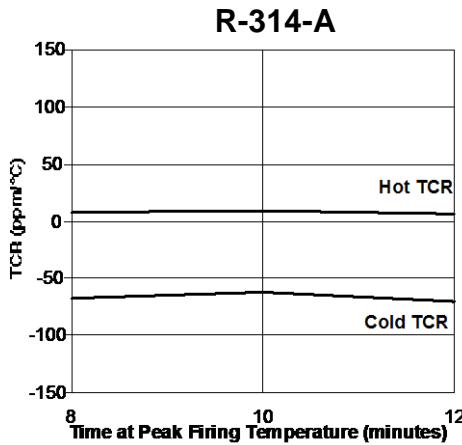
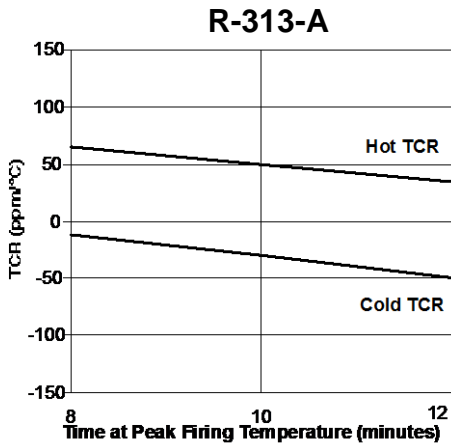
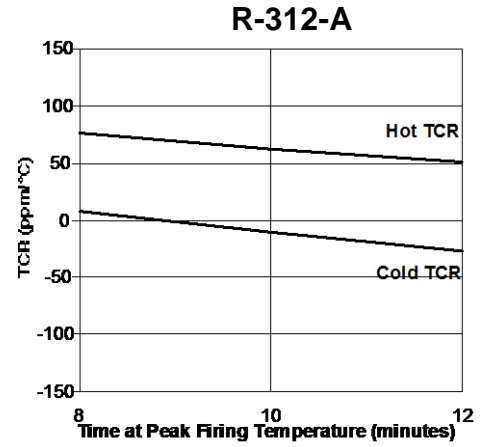
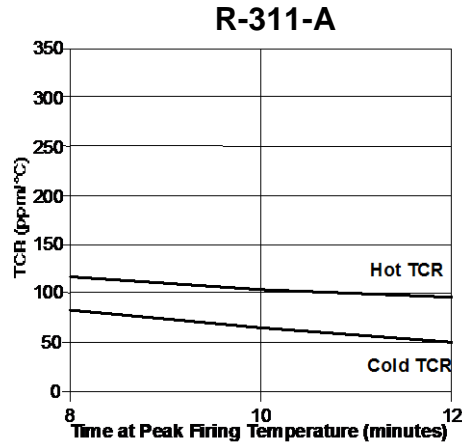
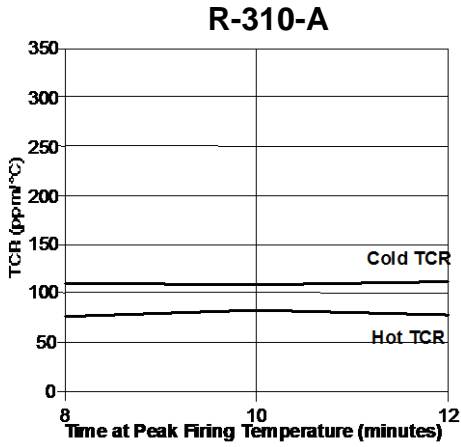
## R-300-A/B Resistor Series

### TCR VERSUS PEAK FIRING TEMPERATURE (10 minutes at peak temperature)



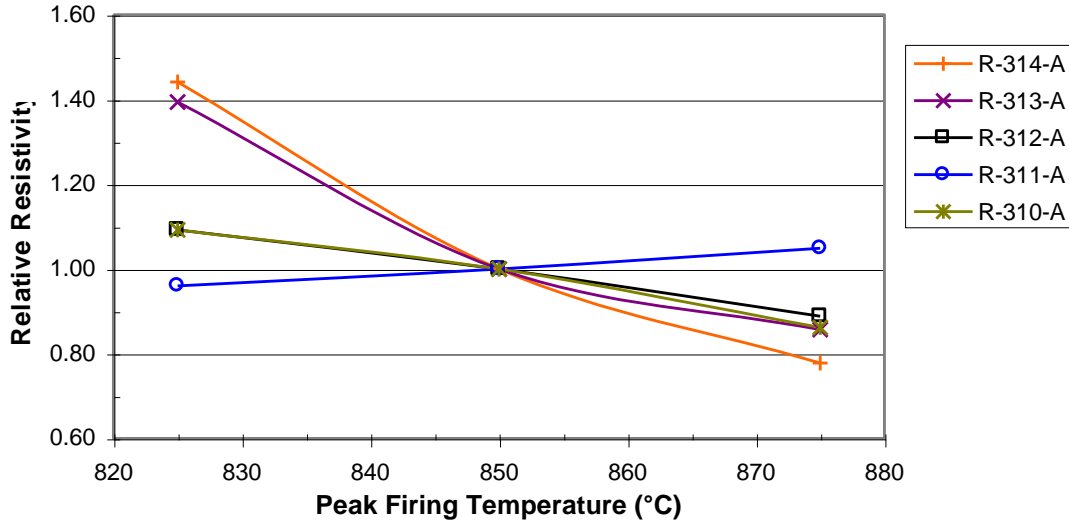
## R-300-A/B Resistor Series

### TCR VERSUS TIME AT PEAK FIRING TEMPERATURE (850°C)

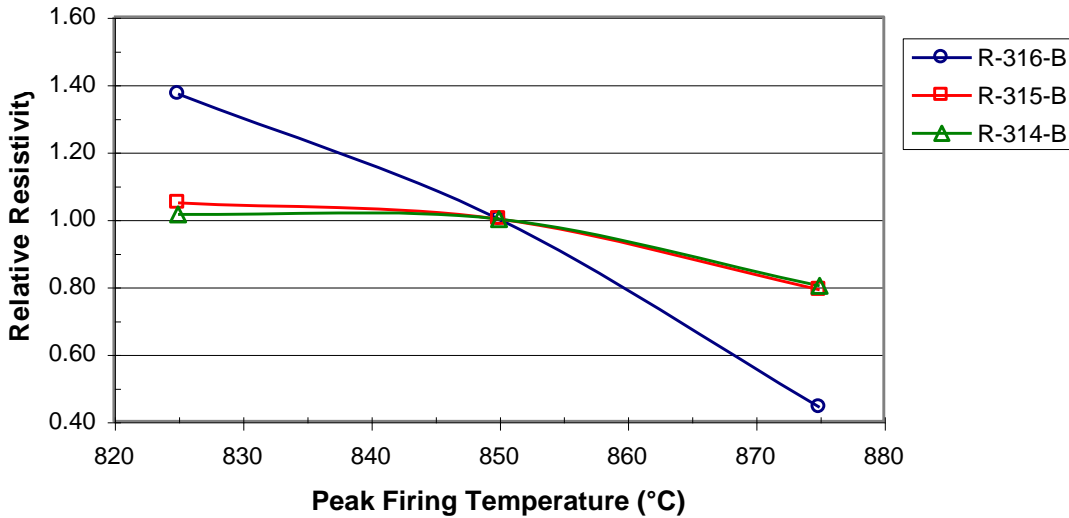


## R-300-A/B Resistor Series

### R-300-A SERIES - RELATIVE RESISTIVITY vs. PEAK FIRING TEMPERATURE



### R-300-B SERIES - RELATIVE RESISTIVITY vs. PEAK FIRING TEMPERATURE

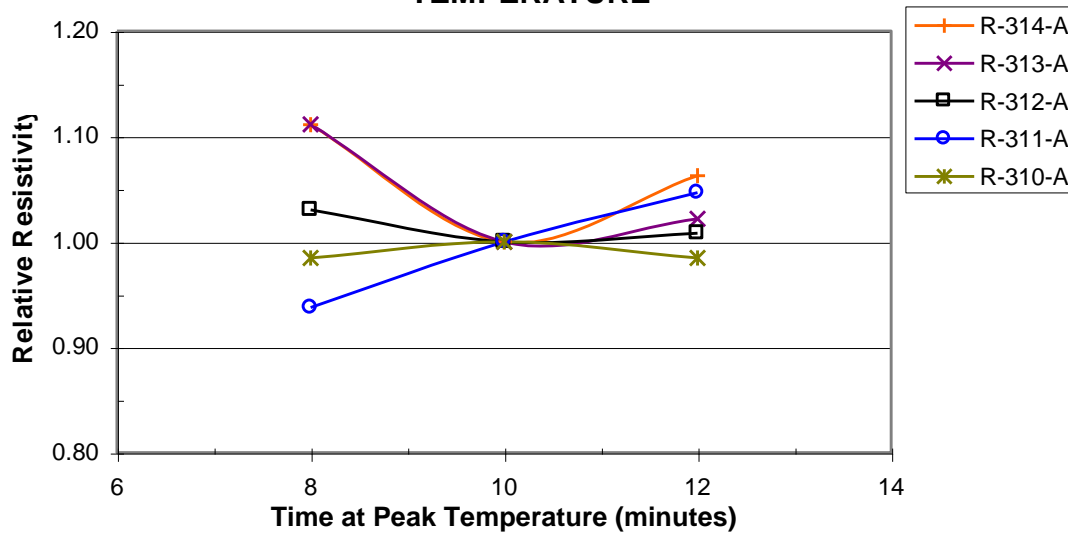


Time at peak temperature = 10 minutes.

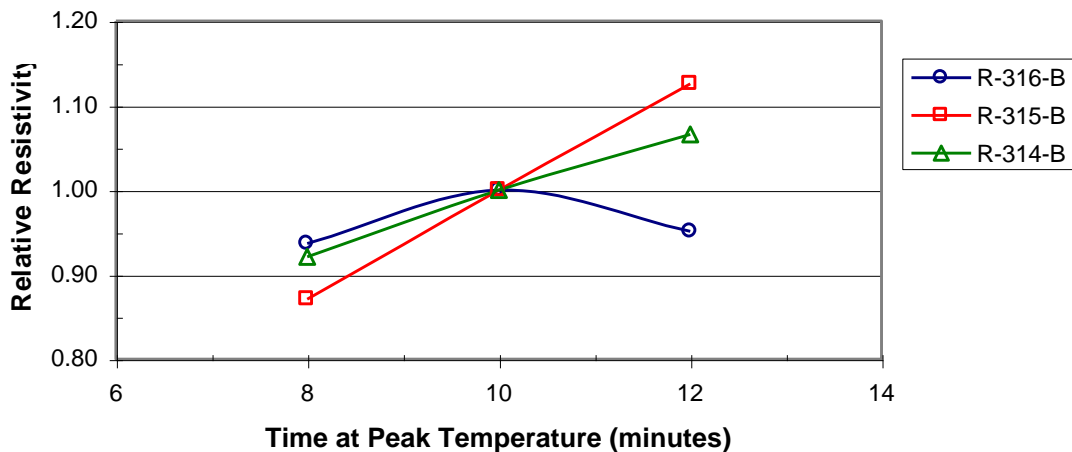
Relative Resistivity = resistivity at specified peak firing temperature/resistivity at 850°C.

## R-300-A/B Resistor Series

### R-300-A - RELATIVE RESISTIVITY vs. TIME AT PEAK TEMPERATURE



### R-300-B - RELATIVE RESISTIVITY vs. TIME AT PEAK TEMPERATURE



Peak temperature = 850°C

Relative Resistivity = resistivity at specified time at peak temperature/resistivity at 10 minutes.