DuPont QS87 Series Resistors

SERIES Q-Q SIL

Technical Data Sheet

Product Description

The DuPont QS87 series resistors were designed for thick film hybrid applications and typically use high silver content termination materials. There is no blend break with this system which can provide values ranging between 1 Ohm to 100 MegOhms per square. The DuPont QS87 series members provide very good laser trim stability.

Processing

Substrates

Properties are based on tests on 96% alumina substrates. Substrates of other chemical compositions or from various manufacturers may result in variations in performance characteristics.

Terminations

Reported properties are based on tests with QS170 silver/platinum conductor composition, prefired at 850°C. Excellent results have also been obtained using DuPont QS175 silver, prefired at 850°C.

Printing

Specified properties are based on resistors printed to 25±2 µm dried print thickness. This is readily achieved using 200-mesh stainless steel screens with 15±3 µm emulsion thicknesses.

Drying

Print should be allowed to level for 5-10 minutes at room temperature and then dry for 10-15 minutes at 150°C.

Firing

Resistivity and TCR specifications are based on the recommended short firing profile with a 10 minute peak at 850°C.

Composition Properties

Test	Properties
Viscosity (Pa.s) [Brookfield HBT, UC&S 10 rpm, 25°C)	145-210
Thinner	DuPont 4036 or DuPont 8250 or DuPont 4553
Coverage (cm^2/g)	80 - 110

This table shows anticipated typical physical properties for DuPont QS87 series based on specific controlled experiments in our labs and are not intended to represent the product specifications, details of which are available upon request.

Encapsulation

In general, glass encapsulation is not required. However, for applications in need of mechanical protection or protection from extreme environments such as high temperature nitrogen or forming gas, encapsulant QQ550 fired at 500°C is recommended.

Storage and Shelf Life

Containers should be stored, tightly sealed, in a clean, stable environment at room temperature (<25°C). Shelf life of material in unopened containers is six months from date of shipment. Some settling of solids may occur and compositions should be thoroughly mixed prior to use.

Safety and Handling

For Safety and Handling information pertaining to this product, read the Material Safety Data Sheet (MSDS).

Composition Properties

	QS869	QS870	QS871	QS872	QS873	QS874	QS875	QS876
Resistivity[1,2] (Ω/sq):	1.5	3	10	100	1K	10K	100K	1M
Shipping Specification*: (%)*	± 20	± 10	± 10	± 10	± 10	± 10	± 10	± 20
Coefficient of Variation: *(CV%)*	≤ 5	≤ 5	≤ 5	≤ 5	≤ 5	≤ 5	≤ 5	≤ 5
Temperature Coefficient Of Resistance[3] (TCR) ppm/°C	0 ± 200	0 ± 100	0 ± 100	0 ± 100	0 ± 100	0 ± 100	0 ± 100	0 ± 150
Short Term Overload Voltage[4] *(STOL) V/mm*	3.5	5	9	30	75	200	355	392
Standard Working Voltage[5]:	1.4	2	4	12	30	80	142	157
(STOL) V/mm								
Maximum Rated Power Dissipation[6]: *(MRPD) mW/mm²*	727	890	865	900	560	500	170	18
Electrostatic Discharge[7]: *(ESD) %ΔR*								
2,000 Volts		-0.1	-0.1	0.1	-0.1	-0.4	-0.8	-0.6
5,000 Volts		-0.1	0.7	-0.1	-0.6	-0.5	-0.2	-0.9
Quan Tech Noise[8] *dB*		-23	-22	-19	-15	-5	-8	-

(2) Resistor geometry
R, TCR,CV: 1.5 x 1.5 mm
STOL, ESD, Noise: 1 x 1 mm laser trimmed to 1.5x fired value
(3) TCR
Cold TCR measured from –55°C to + 25°C.
Hot TCR measured from +25°C to + 125°C.
(4) STOL
Short term overload voltage required (5 second duration) to induce a permanent resistance change of <0.25%.
(5) Standard Working Voltage 0.4 x STOL
(6) Maximum Rated Power Dissipation

$$\frac{(\text{Standard Working Voltage})^2}{\text{Resistance}}$$

(7) Electrostatic Discharge measures the ΔR% after 1 pulse at specified voltage.
(8) Quan Tech Noise
Unencapsulated resistors, Equipment limitations precluded testing of 1 MΩ/sq resistor.

This table shows anticipated typical physical properties for DuPont QS87 series based on specific controlled experiments in our labs and are not intended to represent the product specifications, details of which are available upon request.

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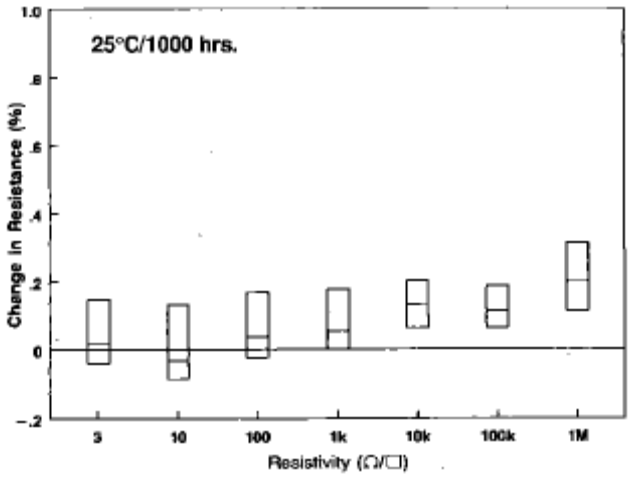
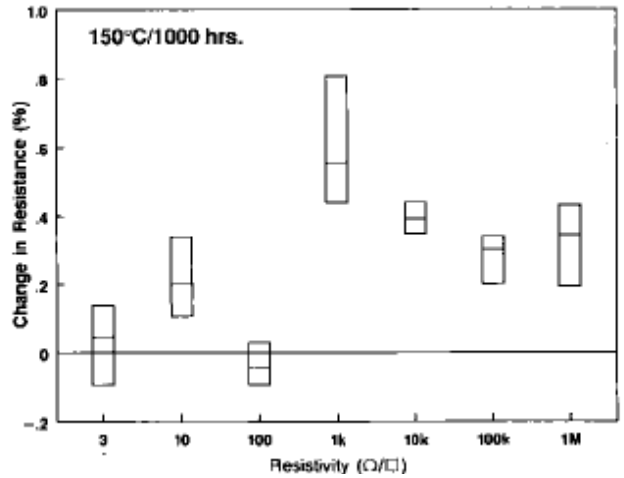
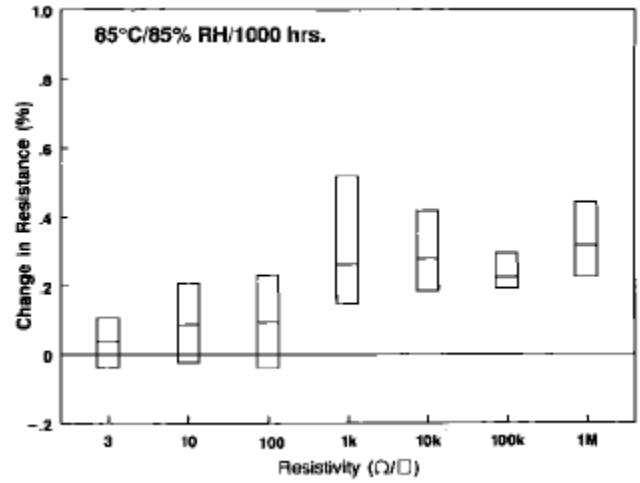
1000 Hour Laser Trim Stability
This data is based on test of 1 mm x 1 mm unencapsulated resistors terminated with DuPont QS170 silver/platinum conductor fired in the recommended short firing profile.

Environmental Stability DuPont QS87 Resistors on DuPont QS170







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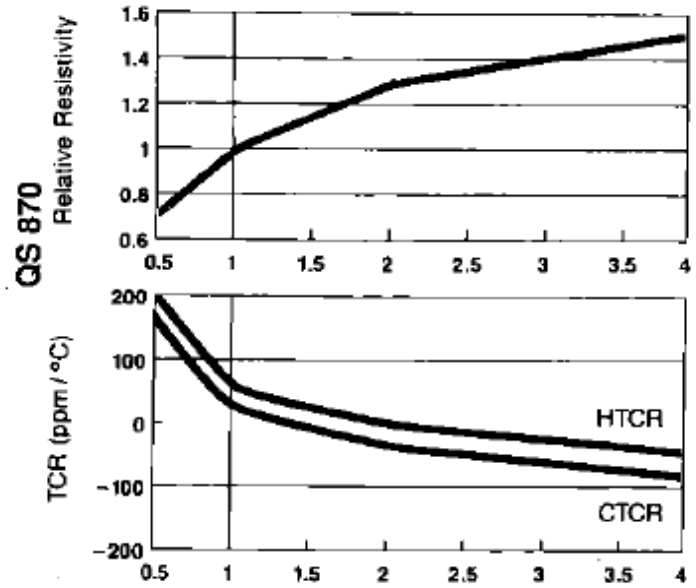
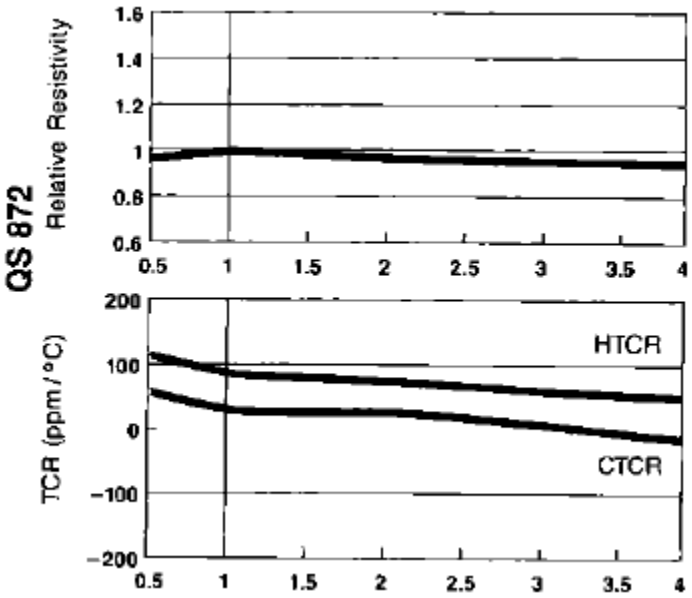
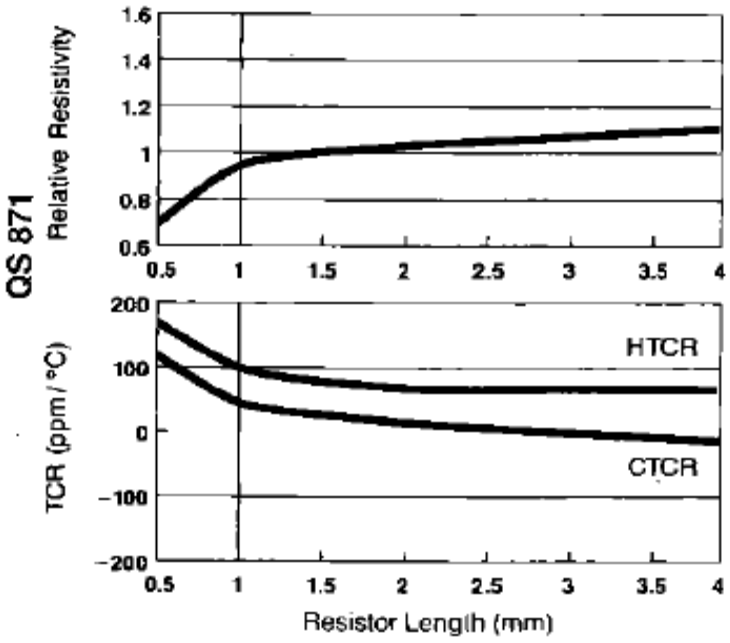
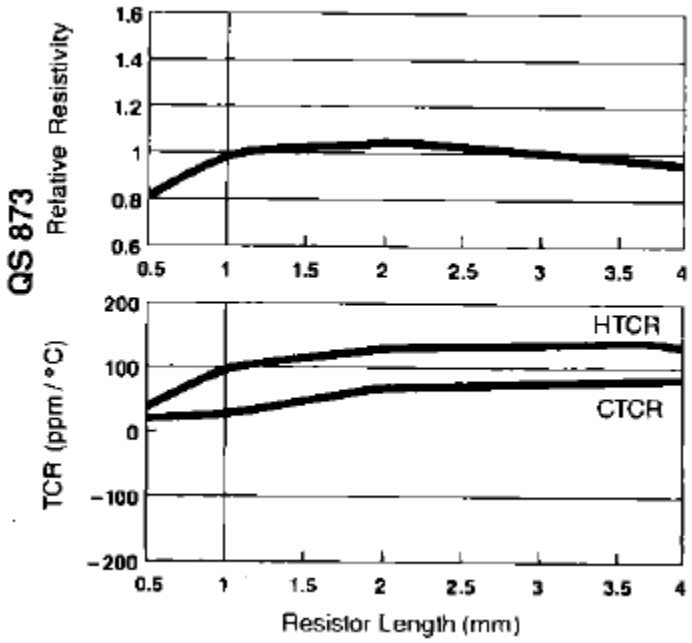
Length Effect

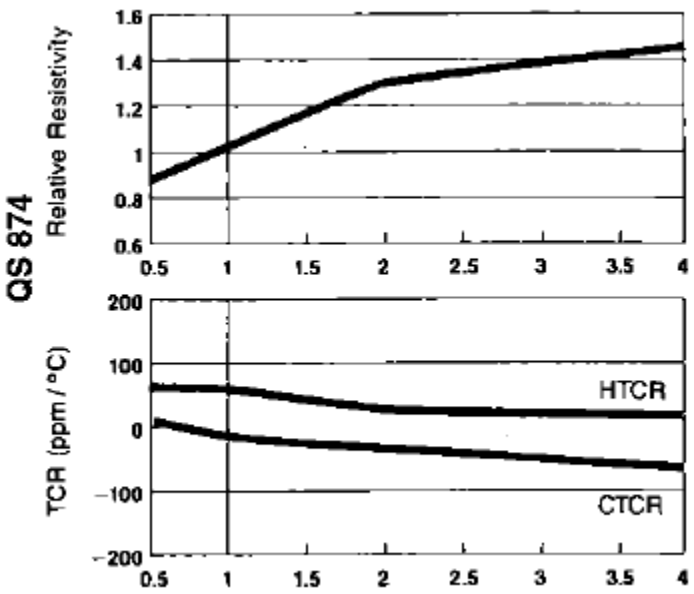


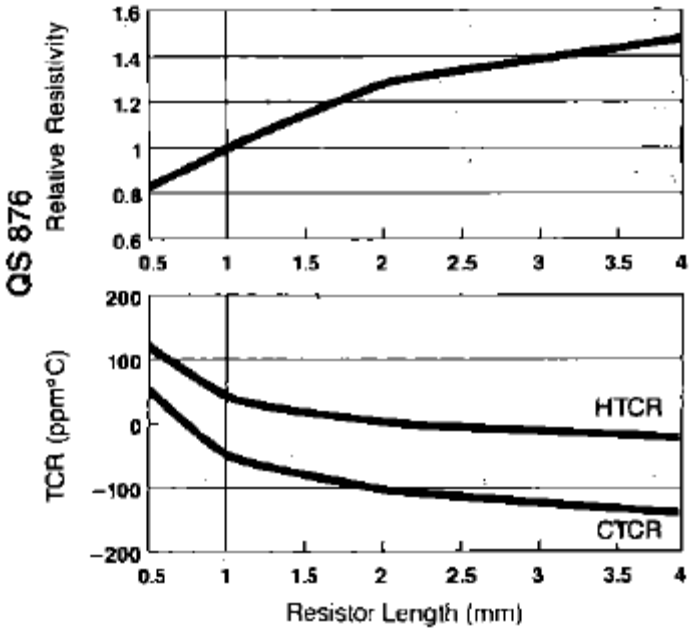


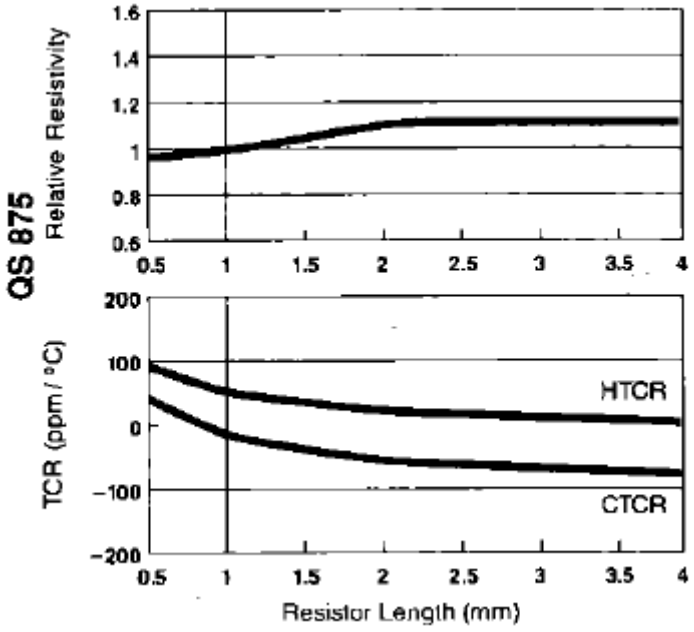




Length Effect (cont.)
This data is based on 1 mm (40 mil) wide resistors terminated with DuPont QS170 conductor. Both conductor and resistors are fired in the recommended short firing profile with a peak temperature of 850ºC.







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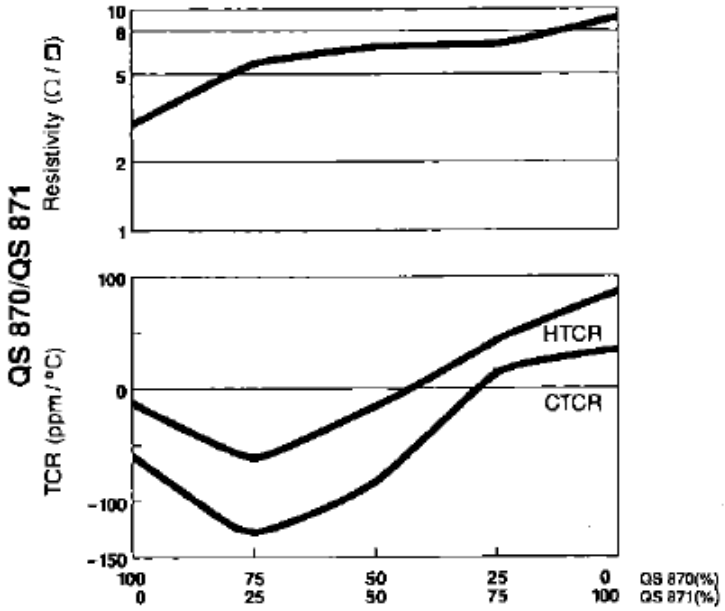
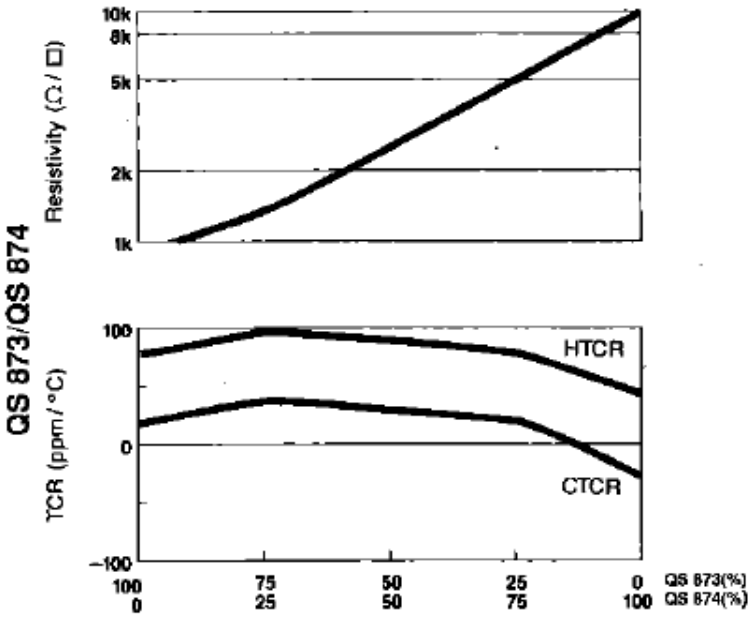
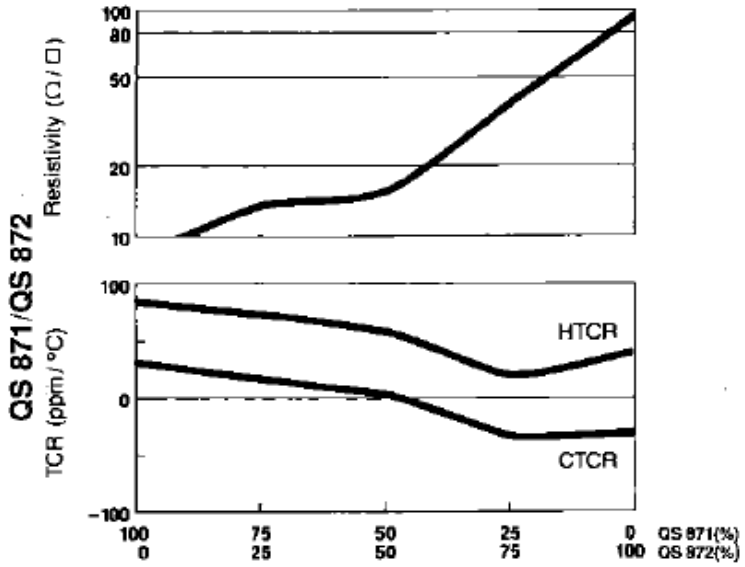
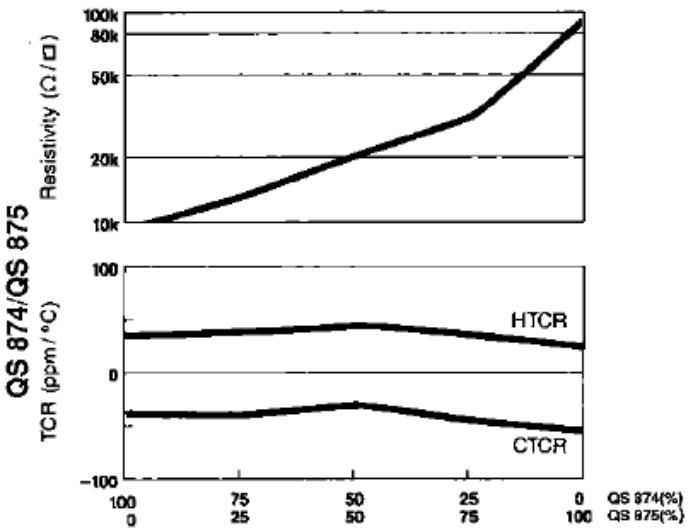
Blend Behavior

The Blend Behavior data is based on test of 1.5 mm x 1.5 mm resistors terminated with DuPont QS170 silver/platinum conductor fired in the recommended short firing profile. HTCR: +25ºC to +125ºC. CTCR: -55ºC to 25ºC.









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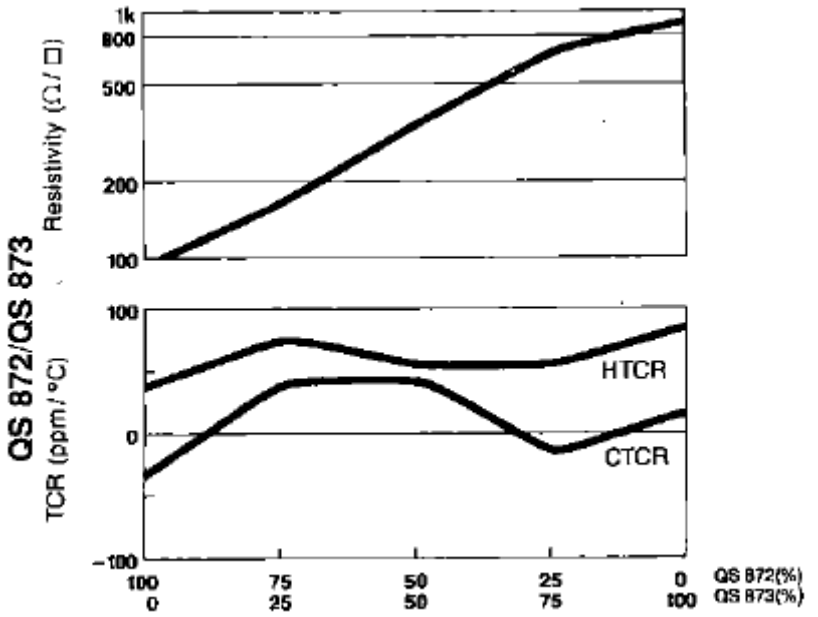
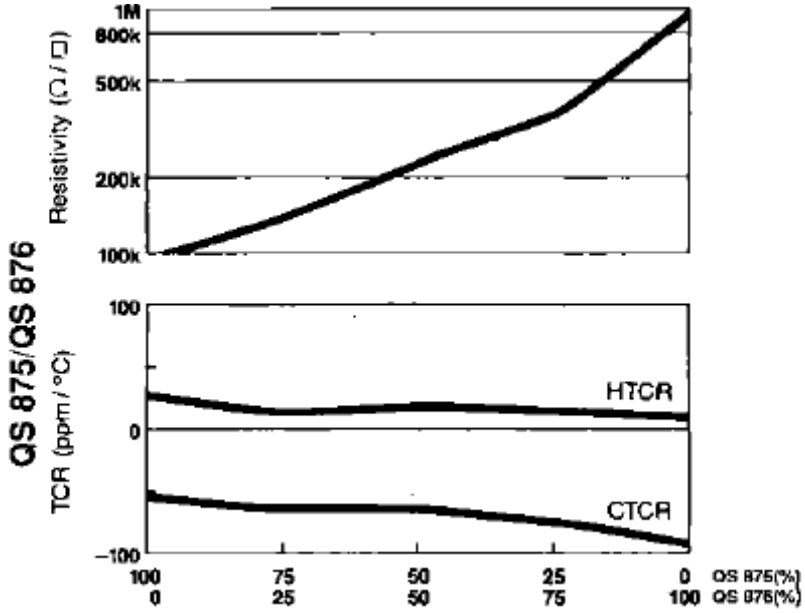
Blend Behavior (cont.)





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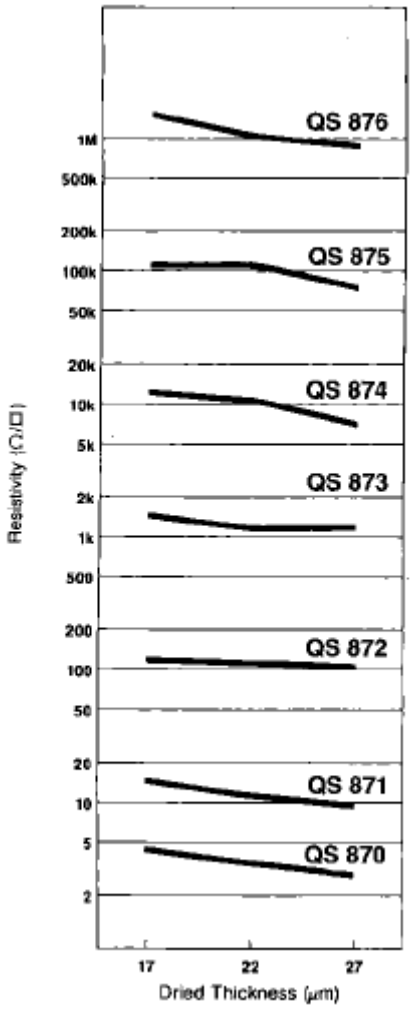
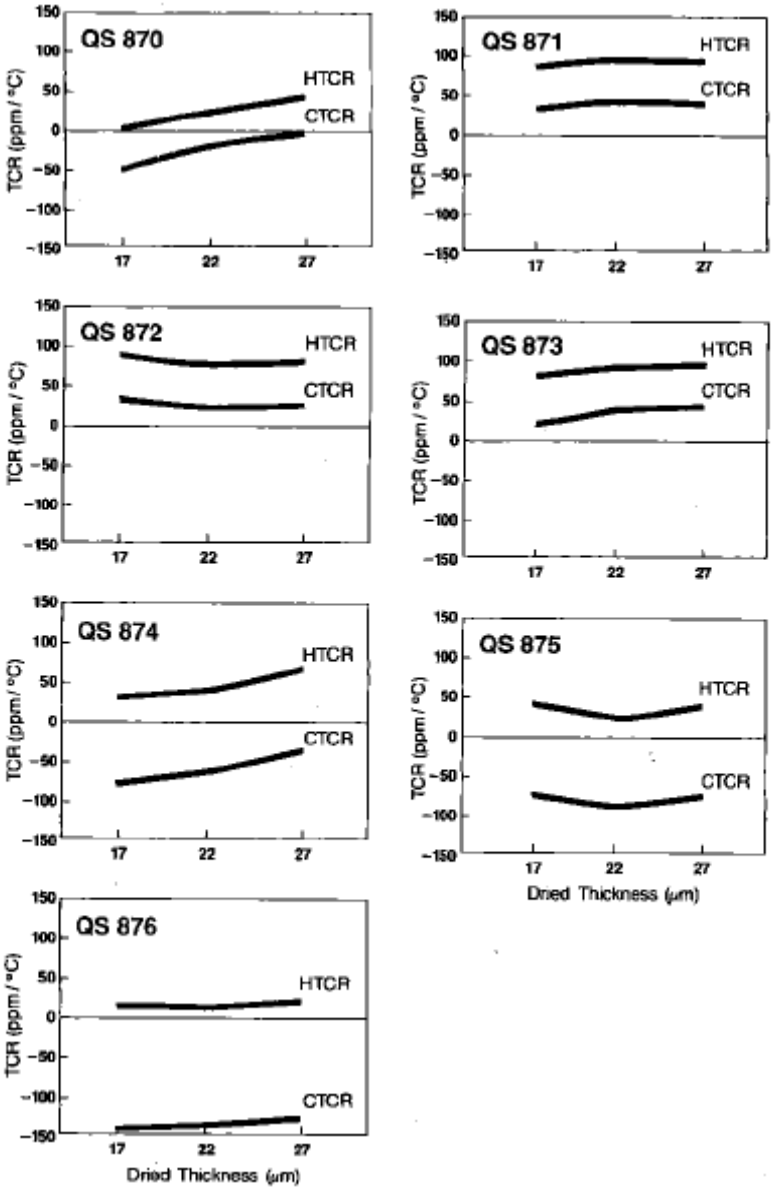
Dried Thickness Effect

Resistivity



Temperature Coefficient of Resistance



The dried thickness effect data is based on tests of 1.5 mm x 1.5 mm resistors terminated with DuPont QS170 silver/platinum conductor fired in the recommended short firing profile.

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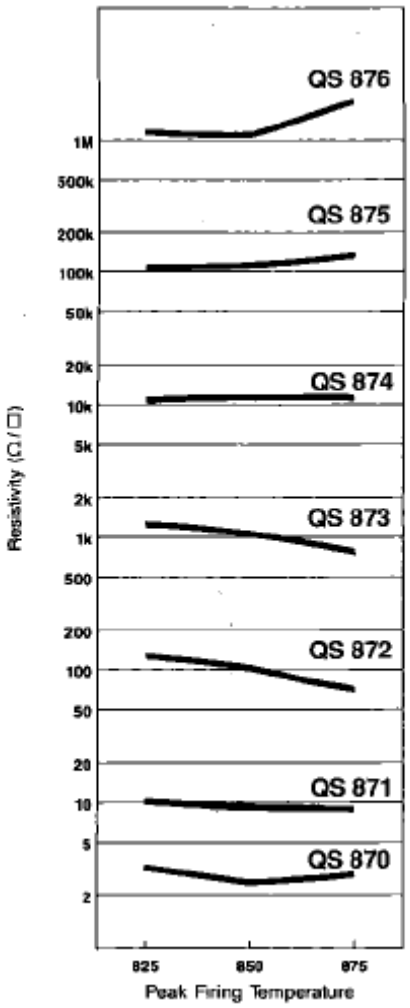
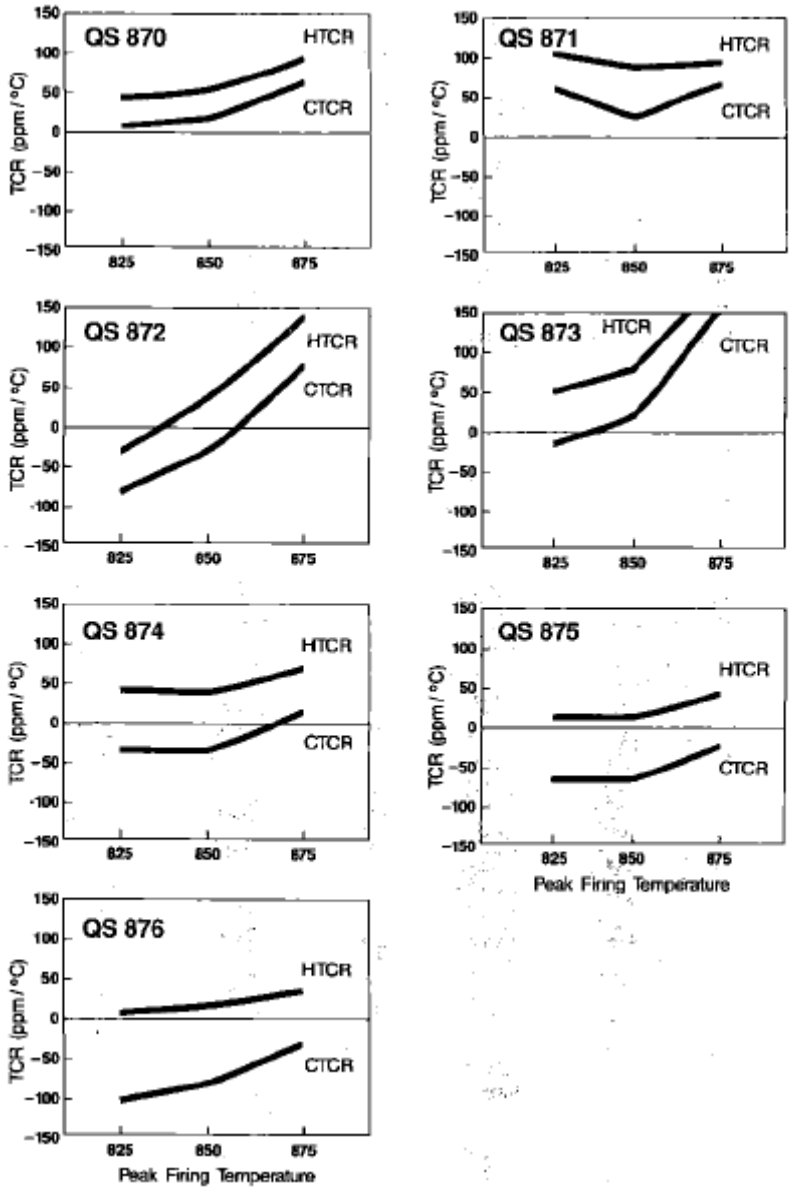
Peak Temperature Effect

Resistivity



Temperature Coefficient of Resistance



The data is based on tests of 1.5 mm x 1.5 mm resistors terminated with DuPont QS170 silver/platinum conductor fired in the recommended short firing profile. Peak temperature is held for 10 minutes and varied from 825ºC to 875ºC.

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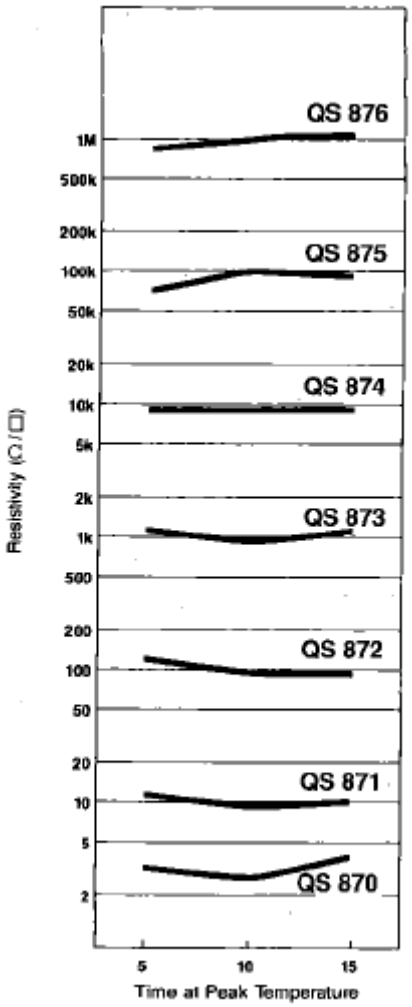
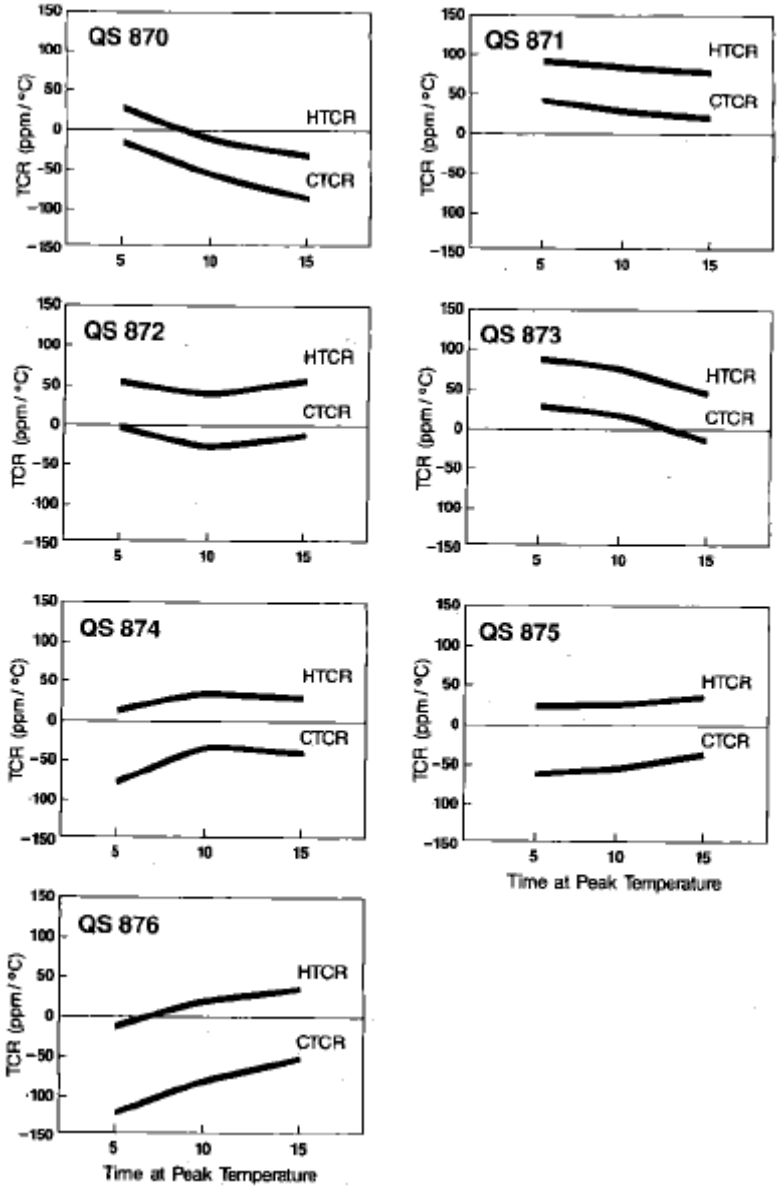
Peak Time Effect

Resistivity



Temperature Coefficient of Resistance



The data is based on tests of 1.5 mm x 1.5 mm resistors terminated with DuPont QS170 silver/platinum conductor fired in the recommended short firing profile to a peak temperature of 850ºC.

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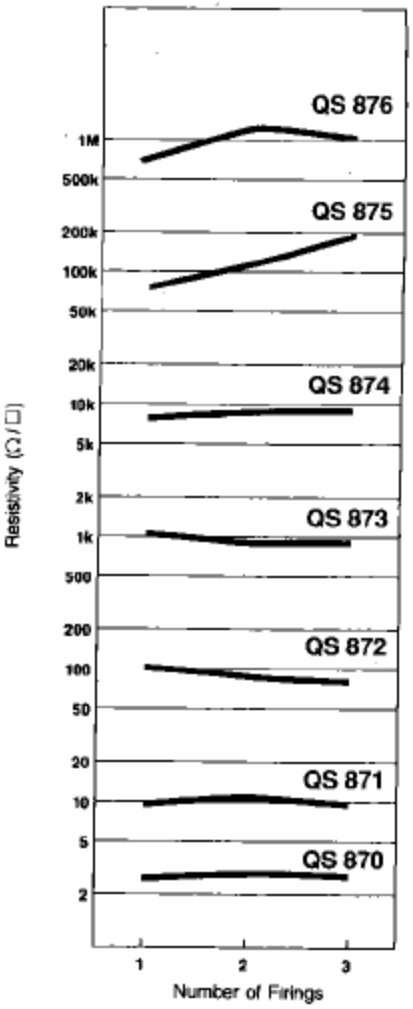
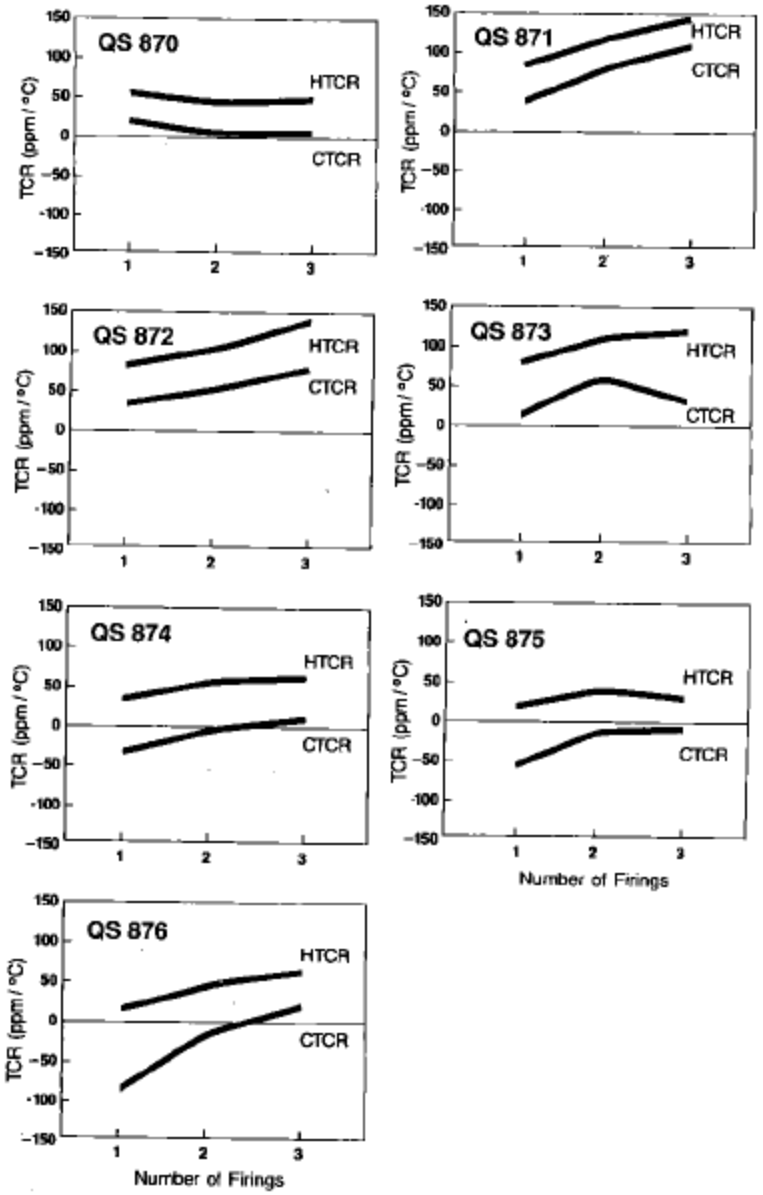
Refire Effect

Resistivity



Temperature Coefficient of Resistance



The data is based on tests of 1.5 mm x 1.5 mm resistors terminated with DuPont QS170 silver/platinum conductor fired in the recommended short firing profile. Time at peak temperature is varied from 5 to 15 minutes.

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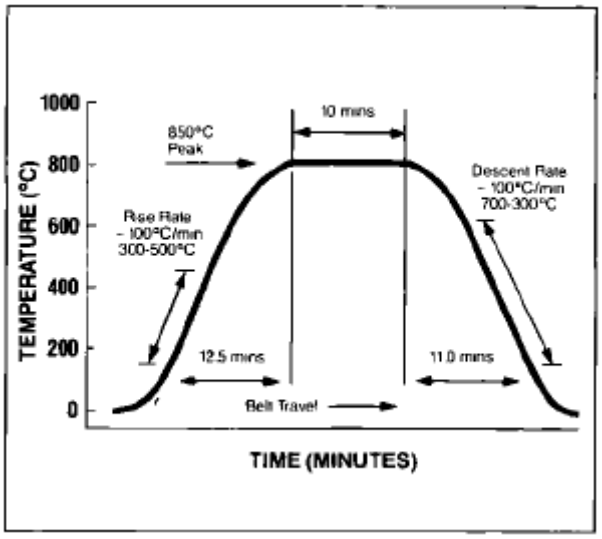
Recommended Short Firing Profile



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