

# Micromax™ 1759

## Electronic Inks and Pastes

### Series 17 Resistors

### High Reliability Hybrid Microcircuits And Precision Resistor Network 10Ω - 1MΩ/sq Silver Alloy Terminations

Micromax™ Series 1700 Resistor Compositions have been developed as part of a materials system for use in the manufacture of high reliability hybrid circuits requiring high stability, low TCR, and low process sensitivity.

### Product benefits

- Post laser trim stability of less than 0.5% average  $\Delta R$  under all standard testing conditions.
- TCRs of less than 100 ppm/°C, even with blends.
- Low sensitivity to variations in firing temperature, time at peak and resistor geometry.

### Product information

|                        |                                    |
|------------------------|------------------------------------|
| Solvent or thinner     | Micromax™ 4036                     |
| Blend member or series | 17 Resistors Series <sup>[1]</sup> |
| [1]: Blend Member B    |                                    |

### Rheological properties

|                                               |                               |
|-----------------------------------------------|-------------------------------|
| Viscosity                                     | 145 - 210 <sup>[2]</sup> Pa.s |
| [2]: HAT UC & #14 Spindle, 10rpm, 25°C ± 1 °C |                               |

### Application technique

|                                    |                             |
|------------------------------------|-----------------------------|
| Mask mesh                          | 200 <sup>[3]</sup>          |
| Mask emulsion                      | 12 - 18 μm                  |
| Drying time                        | 10 - 15 min                 |
| Drying temperature                 | 150 °C                      |
| Theoretical coverage               | 80 - 110 cm <sup>2</sup> /g |
| Recommended film thickness, dried  | 22 - 28 μm                  |
| Leveling time                      | 5 - 10 min                  |
| [3]: Screen Types: Stainless steel |                             |

### Electrical properties

|                                         |                                            |
|-----------------------------------------|--------------------------------------------|
| Surface resistivity                     | 9E8 - 1.1E9 <sup>[4]</sup> mOhm per square |
| Hot Temperature Coefficient Resistance  | -100 - 100 <sup>[5]</sup> ppm/K            |
| Cold Temperature Coefficient Resistance | -100 - 100 <sup>[6]</sup> ppm/K            |
| Short Term Overload Voltage             | 370 <sup>[7]</sup> V/mm                    |
| Standard Working Voltage                | 150 <sup>[8]</sup> V/mm                    |
| Maximum Rated Power Dissipation         | 22 <sup>[9]</sup> m/(W.mm <sup>2</sup> )   |

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Voltage Coefficient of Resistance -90<sup>[10]</sup> ppm

[4]: Typical resistor properties based on laboratory tests using recommended processing conditions: terminations : Micromax™ Palladium/Silver Conductor Composition 9308 prefired at 850 °C; substrate : 96% alumina; printing : 200-mesh stainless steel screen (18 µm emulsion thickness) to a dried thickness of 25±3 µm; firing : 60-min cycle to peak temperature of 850 °C for 10 minutes. Shipping specifications. Resistor geometry : 1.5 mm x 1.5 mm.

[5]: Temperature Coefficient of Resistance 25 to 125 °C

[6]: Temperature Coefficient of Resistance -55 to 25 °C

[7]: Short Term Overload Voltage : required (5 second duration) to induce a resistance change of 0.25% in a 1 mm x 1 mm resistor at 25 °C.

[8]: Standard working voltage : 0.4 x Short Term Overload Voltage.

[9]: Maximum Rated Power Dissipation : (Standard Working Voltage)<sup>2</sup> / Resistance

[10]: ppm/V/mm, Resistor geometry 1 mm x 1 mm laser trimmed with P-cut to 1.5x average fired value. VCR measured from 5-50 VDC.

## Storage and stability

Shelf life 6<sup>[11]</sup> months

[11]: in unopened containers, from date of shipment, at temperature <25° C

## Additional information

How to use

## Processing

### • Terminations

- Unless otherwise stated, reported properties are based on tests with Micromax™ 9308 silver/palladium conductor composition, prefired at 850 °C. Excellent results have also been obtained using other silver/palladium conductor compositions. The precious metal alloy compositions are prefired at 850 °C.

### • Substrates

- Reported properties are based on tests on 96% alumina substrates. Substrates of other compositions and from various manufactures may result in variations in performance properties.

### • Resistor geometry

- Micromax™ Series 1700 compositions are Quality Assurance tested using a 1.5 mm x 1.5 mm resistor with prefired silver/palladium Micromax™ 9308 terminations. Variations in resistor geometry will result in slight variations in resistivity and TCR.

### • Printing

- Specified properties are based on resistors printed to 25±3 µm dried print thickness. This is readily achieved using 200-mesh stainless steel screens with 15±3 µm emulsion thickness. Nylon or polyester screens may be used in some applications although a lower mesh count of 150-175 will usually be required to achieve equivalent print thickness.

### • Drying

- Prints should be allowed to level at room temperature and then

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dried.

- **Effect of variations in thickness**
  - Print thickness outside the 20-30  $\mu\text{m}$  range may result in compromised TCR and/or stability characteristics.
- **Firing**
  - Micromax™ Series 1700 resistivity and TCR specifications are based on a 60-min firing cycle with a 10-min peak at 850 °C, 20 min above 800 °C and 30 min above 600 °C.
- **Refire sensitivity**
  - 10k $\Omega$ /sq or lower resistors change very slightly on refiring. The 100k and 1M $\Omega$ /sq resistors show significant increases in resistivity on refiring; however, TCR's remain well within the  $\pm 100$  ppm/°C limits.
- **Encapsulant**
  - In general, glass encapsulation is not required. However, in applications which require mechanical protection or protection from extreme environments such as high temperature nitrogen or forming gas, Micromax™ QQ550 encapsulant fired at 500 °C is recommended. Glass encapsulation of 1 mm x 1 mm resistors terminated with silver/palladium Micromax™ 9308 shifts the resistivity of Micromax™ Series 1700 resistors by less than 1%.

## Properties

- Information in this datasheet shows anticipated typical physical properties for Micromax™ 1700 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.

## 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 Safety Data Sheet (SDS).