

# Micromax™ CF021

## Electronic Inks and Pastes

### Buried Resistors

The Micromax™ CF Series buried resistors are designed to be co-processed with the Micromax™ GreenTape™ 951 low temperature co-fired ceramic system as an integral component of the fired tape structure. The series is comprised of four members ranging from 10Ω to 10kΩ per square. Adjacent members are blendable to achieve intermediate values. Due to the nature of the buried resistor applications, conventional laser trimming techniques are not applicable. The buried resistors should be positioned symmetrically within the stacked tape layers.

### Product information

|                        |                |
|------------------------|----------------|
| Solvent or thinner     | Micromax™ 8250 |
| Blend member or series | CF srs         |

### Rheological properties

|                                           |                              |
|-------------------------------------------|------------------------------|
| Viscosity                                 | 90 - 160 <sup>[1]</sup> Pa.s |
| [1]: Brookfield HAT, UC&SP, 10 rpm, 25 °C |                              |

### Application technique

|                      |                              |
|----------------------|------------------------------|
| Drying time          | 10 min                       |
| Drying temperature   | 80 - 120 °C                  |
| Theoretical coverage | 100 - 120 cm <sup>2</sup> /g |

### Electrical properties

|                                         |                                               |
|-----------------------------------------|-----------------------------------------------|
| Surface resistivity                     | 80000 - 120000 <sup>[2]</sup> mOhm per square |
| Hot Temperature Coefficient Resistance  | -200 - 200 <sup>[3]</sup> ppm/K               |
| Cold Temperature Coefficient Resistance | -200 - 200 <sup>[4]</sup> ppm/K               |
| Electrostatic discharge, 5kV            | -0.01 <sup>[5]</sup> (avgDeltaR)(%)           |
| Noise                                   | -40 - -35 dB                                  |
| Short Term Overload Voltage             | 17 - 18 V/mm                                  |

[2]: resistor values are quoted as nominal decade values in ohms per square (ohms/sq)

[3]: from +25 to +125 °C for Hot TCR

[4]: from -55 to +25 °C for Cold TCR

[5]: 1 pulse at 5kV

### Storage and stability

|                                                                           |                         |
|---------------------------------------------------------------------------|-------------------------|
| Shelf life                                                                | 6 <sup>[6]</sup> months |
| [6]: in unopened containers, from date of shipment, at temperature <25 °C |                         |

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### Additional information

How to use

### Processing

- **Terminations**

- The reported paste properties are based on tests using the Micromax™ 6142D silver conductor composition as the resistor termination material.

- **Printing**

- The resistor compositions should be thoroughly mixed prior to use. This is best achieved by slow, gentle hand stirring using a clean, burr-free spatula (flexible plastic or stainless steel) for 1-2 minutes. Care should be taken to avoid air entrapment. Printing should be performed in a clean, well-ventilated area where the room temperature is 20-23 °C. For optimum control and print reproducibility, the paste materials should be stored within this temperature range prior to use. Control of print thickness is essential to obtain predictable and reproducible fired resistor properties.

- **Thinning**

- The compositions are optimized for screen printing and thinning is not normally required. Use the recommended Micromax™ thinners to make slight viscosity adjustments or replace solvent losses due to evaporation. The use of too much thinner or non-recommended thinners may affect the materials' rheological and printing properties.

- **Drying**

- Allow wet prints to level at room temperature; then dry in a well-ventilated oven or conveyor dryer for 10 minutes at 80-120 °C.

- **Firing**

- Fire in a well ventilated belt or static furnace at the recommended Micromax™ GreenTape™ 951 850 °C profile. Air flows and extraction rates should be optimized to ensure that oxidizing conditions exist and no exhaust gases enter the room. Insufficient airflow or a polluted atmosphere within the furnace may result in shifts in resistivity or TCR values. Refer to the Micromax™ GreenTape™ 951 data sheet for the recommended firing profiles. Profile variations may be necessary to accommodate the size of the laminates to be cofired.

### Properties

Typical Fired Properties\*1\*2

| Test | Properties |
|------|------------|
|------|------------|

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|                               |           |
|-------------------------------|-----------|
| $\Delta R$ after 1 refire (%) | 0 to -1   |
| $\Delta R$ after 2 refire (%) | 0 to -1   |
| $\Delta R$ after 3 refire (%) | 0 to -2   |
| CTCR and HTCR w/3x refires    | $\pm 200$ |

\*1 The above data were obtained using Micromax™ 6142D termination (11 to 14 $\mu$ m dried thickness), with a 20 $\mu$ m dried resistor thickness and a resistor geometry of 1mm x 1mm. Resistors are positioned symmetrically in the layer stack.

\*2 The values quoted are for untrimmed resistors.

### General

Performance will depend to a large degree on care exercised in screen printing. Scrupulous care should be taken to keep the composition, printing screens and other tools free of metal contamination. Dust, lint and other particulate matter may also contribute to poor yields.

### 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).