Celanese
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Micromax™ 2021

Electronic Inks and Pastes

2000 Resistor Series

The Micromax™ 2000srs resistor compositions are intended to be applied to ceramic substrates by screen printing and fired in air to form resistors in hybrid microcircuits. The series offers versatility to the designer with improved TCR tracking between resistors of different size and value, and a choice of termination materials. Stability is outstanding either with or without encapsulation. To the manufacturer, Micromax™ 2000srs offers broad processing latitude.

Product benefits

- Excellent laser post-trim stability, encapsulated or unencapsulated
- HTCR's less than 50 ppm
- Small length and thickness effects on resistivity and TCR
- Small shifts of resistivity and TCR on refiring
- Compatible with Ag/Pt or Ag/Pd terminations
- Excellent noise characteristics

Product information

Solvent or thinner	Micromax™ 4553
Blend member or series	2000 Resistor Series[1]

[1]: Blend Series B

Rheological properties

Viscosity	140 - 220[2]	Pa.s

[2]: Brookfield HAT, UC&SP [SC4-14/6RI], 10 rpm, 25 °C ± 0.2 °C

Application technique

Mask mesh	325[3]	
Mask emulsion	10 - 15	µm
Drying time	10 - 15	min
Drying temperature	150 - 170	°C
Theoretical coverage	136	cm^2/g
Shrinkage, dried	45	%
Shrinkage, fired	40	%

[3]: Screen Types: Stainless steel

Electrical properties

Surface resistivity	90000 - 110000[4]	mOhm per square
Hot Temperature Coefficient Resistance	0 - 50[5]	ppm/K
Cold Temperature Coefficient Resistance	≥[6]-75	ppm/K
Electrostatic discharge, 5kV	≤0.1[7]	(avgDeltaR)(%)

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Noise	-32[8]	dB
Short Term Overload Voltage	28[9]	V/mm
Standard Working Voltage	11[10]	V/mm
Maximum Rated Power Dissipation	870[11]	m/(W.mm^2)

[4]: Product release specifications (Resistivity and Temperature Coefficient of Resistance are routinely tested for Q.A. release). Test conditions described below in footnote 1. Sheet resistance values are normalized to 20 µm dried thickness.

[5]: TCR measured in the ranges 25°C to 125°C

[6]: TCR measured in the ranges -55°C to 25°C

[7]: ESD measured on 1 mm x 1 mm resistor trimmed to 1.5x fired value with a single plunge cut @1x5kv pulse

[8]: Quan-Tech noise measured on untrimmed resistors

[9]: Short term overload voltage: voltage required in a 5 second duration to induce a resistance change at 25°C of 0.25% in a 1mm x 1mm resistor trimmed to 1.5x fired value with a single plunge cut

[10]: Standard working voltage = 0.4 x short term overload voltage

[11]: Maximum rated power dissipation = (standard working voltage)^2 / resistance

Storage and stability

Shelf life	6[12]	months

[12]: in unopened containers, from date of shipment, at room temperature (<25°C)

Additional information

How to use

Processing

- Terminations
  - The reported properties are based on tests using Micromax™ 7484 Ag/Pd conductor compositions as the termination material, prefired at 850°C. Use of different terminating material may cause a shift of resistance and TCR values from those stated.
- Blendability
  - Two parallel low ends to Micromax™ 2000 Series are offered. These cannot be interchanged. Therefore the following members are bendable together A) Micromax™ 2004R/ 2009/ 2019/ 2031/ 2041/ 2051/ 2061/ 2071 or B) Micromax™ 2004/ 2011/ 2015/ 2021/2031 2041/ 2051/ 2061. Only adjacent members are bendable.
- Substrates
  - Properties are based on tests on 96% alumina substrates. Substrates of other compositions and from various manufacturers may result in variations in performance properties, as may different lots of substrates, and any subsequent processing of substrates (e.g. laser scribing or drilling) prior to printing. It is the responsibility of users to determine the effects of any of the above available in their particular situations.
- Printing
  - 325 mesh stainless steel screen with 10-15 µm emulsion. Print

speeds of 10-20 cm/s may be used. Control and reproducibility of print thickness are essential to obtain predictable, reproducible fired resistor properties.
    - The composition should be thoroughly mixed before use. This is best achieved by slow, gently, hand stirring with a clean burr-free spatula (flexible plastic) for 0.5 - 1 minute. Care must be taken to avoid air entrapment. Printing should be performed in a clean and well ventilated-area.
    - Note : The optimum printing characteristics are generally achieved in the room temperature range of 20°C - 23°C.
- Drying
    - Allow prints to level at room temperature, then dry in air in a well-ventilated oven or conveyor dryer .
- Firing
    - Fire in a well-ventilated belt, conveyor furnace. Air flows and extraction rates should be optimized to ensure that oxidizing conditions exist within the muffle, and that no exhaust gases enter the room. Variation in the peak firing temperature and or time at the peak temperature may result in variations in the final fired properties.
    - Resistors compositions must be fired in clean dry air. Insufficient airflow or pollution of the air in the furnace may result in shifts in resistivity and TCR.
- Encapsulant
    - In applications which require mechanical protection from extreme environments, low temperature encapsulant Micromax™ QQ550 or LF161 are recommended to be screen printed over the resistor and fired, prior to laser trimming.
- Laser trimming
    - To ensure long term stability of the resistors and to achieve maximum trimming accuracy, it is necessary to optimize resistor geometry, cut geometry and trimming parameters. Parameters should be selected that achieve a clean laser cut (kerf). The preferred range of laser trim parameters are as follows: bite size 0.10 to 0.30 mils, power 1 - 3.0W at a frequency of 5Hz.

Properties

- Information in this datasheeet shows anticipated typical physical properties for Micromax™ 2000 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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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).