Micromax™ 7499R

Electronic Inks and Pastes

100mΩ/sq - 300mΩ/sq Surge Protection Resistors

Micromax™ 7400R Series resistor composition are intended to be applied to ceramic substrates by screen printing and fired in a conveyor furnace in an air (oxidising) atmosphere, to form specific resistive elements. Micromax™ 7400R series resistors have been developed for applications where high voltage pulses must be dissipated. These materials have low resistivity and are intended for use in serpentine patterns.

Product benefits

- Outstanding stability to high voltage pulses
- Small changes in resistivity after encapsulation
- Thin, dense fired films
- Compatible 850 °C firing encapsulant, suitable for laser trimming
- Suitable for encapsulation with low temperature overglaze
- Qualified at 20µm dried thickness
- Excellent stability after storage at 150 °C and 85 °C/85% rel humidity
- Lead, Cadmium, Phthalate, Nickel oxide free*

* Lead, Cadmium, Phthalate and Nickel oxide 'free' as used herein means that lead, cadmium, phthalate and nickel oxide are not intentional ingredients in and are not intentionally added to the referenced product. Trace amount however may be present.

Product information

Solvent or thinner	Micromax™ 4553
Blend member or series	7400R Series

Rheological properties

Viscosity	120 - 250[1]	Pa.s

[1]: Brookfield HBT, UC&SP, SC4-14/6R, 10 rpm, 25 °C ± 0.2 °C

Application technique

Mask mesh	325	
Mask emulsion	8 - 12	µm
Drying time	10 - 15	min
Drying temperature	150	°C
Theoretical coverage	90 - 110[2]	cm^2/g
Recommended film thickness, dried	17 - 23	µm
Shrinkage, dried	42[3]	%
Shrinkage, fired	43[3]	%
Leveling time	5 - 10	min

[2]: based on dried thickness of 20µm

[3]: for guidance only

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Electrical properties

Surface resistivity	800 - 1200[4]	mOhm per square
Hot Temperature Coefficient Resistance	-25 - 25[5]	ppm/K
Cold Temperature Coefficient Resistance	25 - 75[6]	ppm/K

[4]: resistivity values are normalized to 20µm dried thickness

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

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

Storage and stability

Shelf life	6[7]	months

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

Additional information

How to use

Processing

- Terminations
  - Micromax™ 7400R Series resistors can be used with a wide range of terminations. The reported properties are based on tests using Micromax™ QM21R Pd/Ag conductor composition as the termination material, pre-fired at 850°C.
- Substrates
  - Substrates of different compositions and from various manufacturers may result in variations in performance properties.
- Printing
  - The composition should be thoroughly mixed before use. This is best achieved by slow, gentle hand stirring with a clean burr-free spatula (flexible plastic or stainless steel) for about 1-2 minutes. Care must be taken to avoid air entrapment. Printing should be performed in a well ventilated area.
  - Note : Optimum printing characteristics are generally achieved in the room temperature range of 20°C - 23°C. It is therefore important that the material, in its container, is at the temperature prior to commencement of printing. Class 10,000 printing area is recommended for building complex hybrids and multilayer circuits, otherwise severe yield losses could occur.
- Thinning
  - Micromax™ 7400R composition is optimized for screen printing and thinning is not normally required. Use the Micromax™ recommended thinner for slight adjustments to viscosity or to replace evaporation losses. The use of too much thinner or the use of a non recommended thinner may affect the rheological behaviour of the material and its printing characteristics.

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- Drying
  - Allow prints to level for 5-10 minutes at room temperature, then dry for 10-15 minutes at 150°C.
  - Dry in a well ventilated oven or conveyor dryer.
- Firing
  - 850°C peak held for 10 minutes on 30 minute cycle in an air atmosphere.
  - Fire in well ventilated belt, conveyor furnace or static 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.
- Encapsulant
  - Encapsulant composition Micromax™ 7401 has been specifically designed for compatibility with Micromax™ 7400R Series resistors and is recommended to obtain optimum pulse stability. Micromax™ 7401 is fired at peak temperature of 850°C using a 30 minute firing profile. Low temperature (500°C) firing encapsulant Micromax™ QQ550 or Micromax™ QQ620 (620°C) can also be used.
- Laser trimming
  - Micromax™ 7400R Series resistors can be trimmed successfully using a wide range of trimming conditions. When trimming through Micromax™ 7401 encapsulant relatively high power should be used. The following range of trim parameters have been used on production type YAG laser: bite size 4-5µm, pulse frequency 4-5kHz; average power 4.0-5.0W, giving trim speeds of up to 25 mm/s.

Properties

Typical Fired Properties*[1]

Test	Properties
Resistance change after encapsulation Micromax™ 7401 (850°C firing) (%)	< 5
Resistance change after encapsulation Micromax™ QQ550 (500°C firing) (%)	< 0.1
Resistance change after pulse test*[2] Micromax™ 7401 encapsulant (%)	< 0.1
Resistance change after pulse test*[2] Micromax™ QQ550 encapsulant (%)	< 0.1

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Resistance of test parts (Ω)	200
Pulse peak voltage (kV)	3.2
Time to half peak voltage (µs)	575
Pulse energy (Joules)	21
Resistance change after 1000 hours storage*3 150°C (%)	0.03
Resistance change after 1000 hours storage*3 85°C/85% RH (%)	-0.01

*1 Typical resistor properties based on laboratory tests using procedures as follows :
• Pattern : 200 square serpentine with 0.9mm line width and 0.6mm spaces; Corners on pattern reinforced with Micromax™ QM21R conductor
• Printing : 325 mesh stainless steel screen, 8-12µm emulsion thickness to a dried resistor thickness of 20±3µm
• Firing : 30 minutes profile with a peak temperature of 850°C hold for 10 minutes
• Substrate : All tests performed on 96% alumina
• Termination : Micromax™ QM21R Pb/Ag conductor
*2 Resistors encapsulated at a fired encapsulant thickness of 10-12mm. Test equipment : Haefely P6T pulse tester with nominal 10/700ms pulse setting. Resistance shift recorded after 10 pulses with 30 seconds between each pulse, at the pulse voltage indicated.
*3 Resistors protected with Micromax™ 7401 encapsulant.

Information in this datasheet shows anticipated typical physical properties for Micromax™ 7400R 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.

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).

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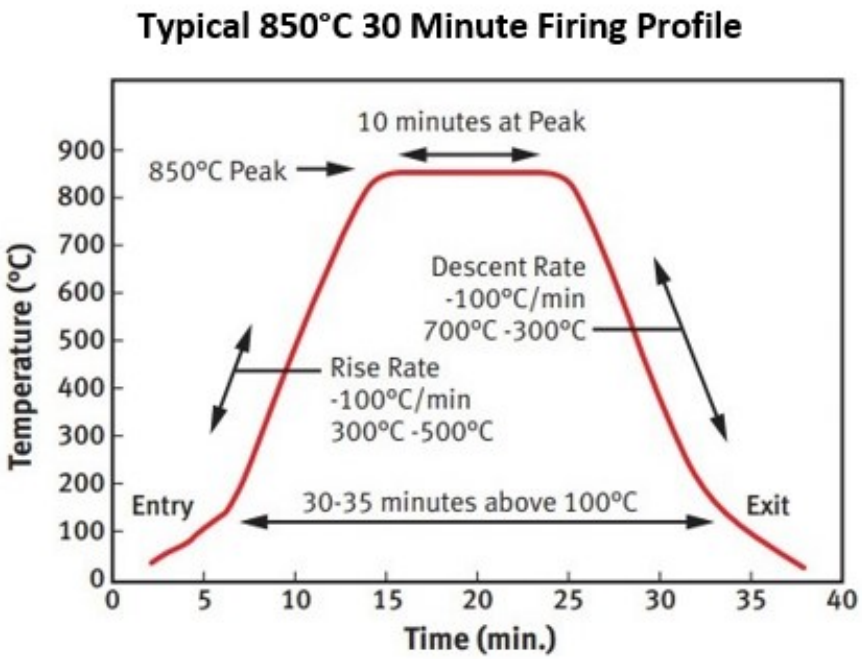

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