

Micromax™ S160

Electronic Inks and Pastes

10 Ω/sq - 1 MΩ/sq Resistor Compositions

Micromax™ S1X0 Series Resistor System is specially formulated for use with the Micromax™ QM44 Multilayer System.

Product benefits

- Tight TCR control.
- Low sensitivity to firing temperature and time
- Minimum length and thickness effects on resistivity and TCR
- Minimum shifts of resistivity and TCR on re-firing
- Thinner printing (20μm dried thickness)
- Compatible with Ag and Ag/Pd termination metallurgies

Product information

Blend member or series S1X0srs resistor

Application technique

Mask mesh	325
Mask emulsion	10 - 15 μm
Drying time	10 - 15 min
Drying temperature	150 °C
Recommended film thickness, dried	18 - 22 μm
Leveling time	5 - 10 min

Electrical properties

Surface resistivity	9E8 - 1.1E9 ^[1] mOhm per square
Hot Temperature Coefficient Resistance	0 - 75 ^[2] ppm/K
Cold Temperature Coefficient Resistance	-75 - 25 ^[3] ppm/K
Electrostatic discharge, 5kV	-0.3 ^[4] (avgDeltaR)(%)
Noise	15 ^[5] dB
Short Term Overload Voltage	≥630 V/mm
Standard Working Voltage	252 ^[7] V/mm
Maximum Rated Power Dissipation	45 ^[8] m/(W.mm ²)

[1]: resistor geometry 1.0 x 1.0 mm, measured on untrimmed resistors

[2]: measured on untrimmed resistors, hot TCR measured from +25 to +125°C

[3]: measured on untrimmed resistors, cold TCR measured from -55 to +25°C

[4]: 5x 5000V, measured on resistors trimmed to 1.5x its as-fired value

[5]: measured on resistors trimmed to 1.5x its as-fired value

[6]: short time overload voltage : 5 second pulse Voltage required to cause a 0.25% change in resistor trimmed to 1.5x its as - fired value, voltage/resistor length

[7]: standard working voltage : 0.4 x STOL, measured on resistors trimmed to 1.5x its as-fired value

Micromax™ S160

Electronic Inks and Pastes

[8]: maximum rated power dissipation; SWV^2 / R (ohms), measured on resistors trimmed to 1.5x its as-fired value

Storage and stability

Shelf life

6^[9] months

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

Additional information

How to use

Processing

- **Blendability**
 - Adjacent members of the Series are blendable.
- **Printing**
 - Micromax™ Series S1X0 Resistor Compositions should be thoroughly mixed before use. This is best achieved by slow, gentle, hand stirring with a clean burr-free spatula (flexible plastic) for 1-2 minutes. Care must be taken to avoid air entrapment.
 - Note : Optimum printing characteristics are generally achieved in the temperature range of 20°C - 23°C. It is therefore important that material in its container is at this temperature prior to commencement of printing.
 - Specified properties are based on resistors printed to 20±2µm dried print thickness. This is generally achieved using a 325-mesh stainless steel screen with 10-15µm emulsion thickness. Print speeds of 10 to 20 cm/s may be used. Control and reproducibility of print thickness is essential to obtain predictable, reproducible fired resistor properties.
- **Drying**
 - Allow prints to level for 5-10 minutes at room temperature in a clean, environment, followed by drying for 10-15 minutes at 150°C.
- **Firing**
 - Care must be taken to ensure that any gases/vapors from other chemicals/materials (e.g. halogenated solvents) do not enter the furnace muffle. It is also essential that the air supply to the furnace is clean, dry and free of contaminants. Air flows and extraction rates should be optimized to ensure that oxidizing conditions exist within the muffle, and that no furnace exhaust gases enter the room.
 - Micromax™ Series S1X0 series resistors should be fired on a 30 minute firing cycle to a peak temperature of 850°C held for 10 minutes. Variations in the peak firing temperature and/or the time at the peak temperature may result in variations in the final fired properties. Resistor compositions must be fired in clean air; insufficient airflow or pollution of the air in the furnace may result in

Micromax™ S160

Electronic Inks and Pastes

shifts of resistivity or TCR.

- **Encapsulant**

- Encapsulation is not required to meet published performance. For applications which require mechanical protection from extreme environments, low temperature encapsulant Micromax™ QQ550 or Micromax™ QQ600 is recommended prior to laser trimming.

- **Laser trimming**

- Trim parameters should be selected to achieve a clean laser cut (kerf) and it is recommended to cut into the substrate by 5-7µm. The preferred range of laser trim parameters are as follows: bite size 0.12 to 0.17 mils, power 0.9-1.1 watts at a frequency of 3-4 KHZ.

Properties

- Typical fired properties are based on the following :
 - Termination : Micromax™ QM22 Ag/Pb, Dried thickness of 20±2µm; Resistor geometry 1.0mm x 1.0mm
 - Firing : 30 min cycle 850°C peak for 10 minutes
 - Substrate : Micromax™ QM44. Resistance and TCR are measured on untrimmed resistors
 - STOL, SWV, MRPD, Quan-tech Noise, and ESD were measured on resistors trimmed to 1.5x its as-fired value.
- Information in this datasheet shows anticipated typical physical properties for Micromax™ S1X0srs resistor based on specific controlled experiments in our labs and are not intended to represent the product specifications, details of which are available upon request.

Micromax™ S160

Electronic Inks and Pastes

Figure 1. Typical Firing Profile

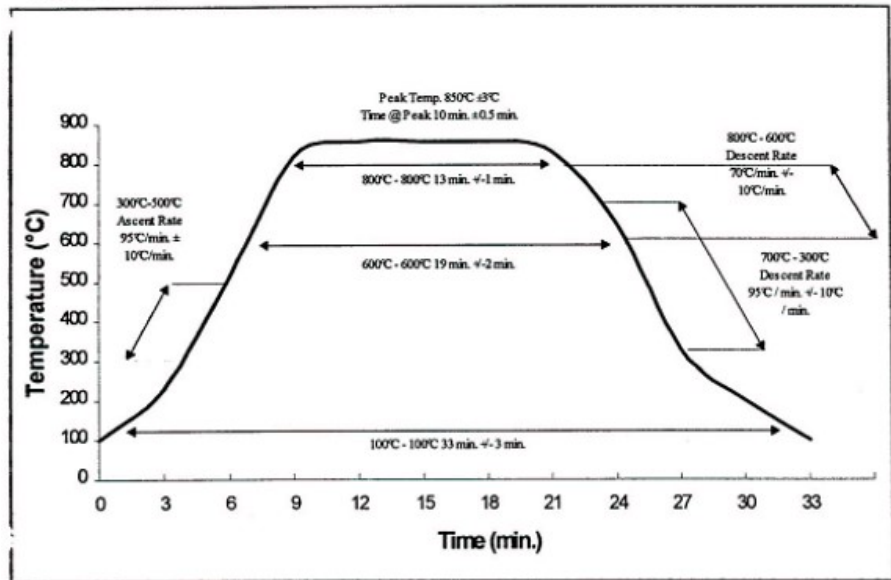


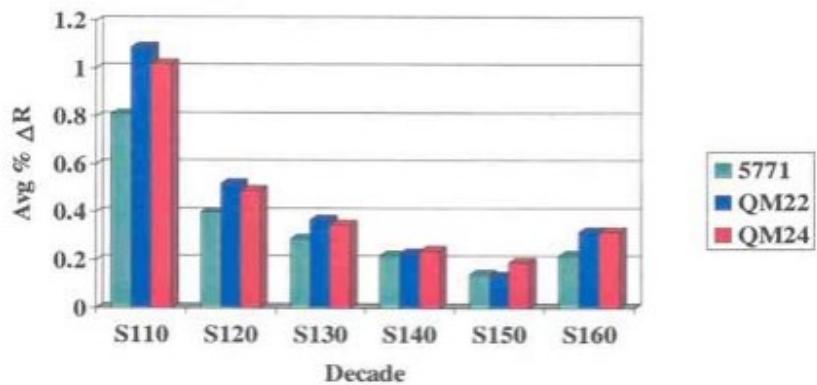
Figure 2



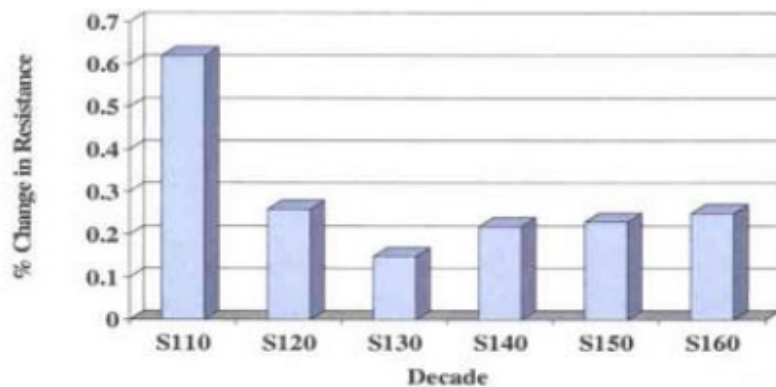
Micromax™ S160

Electronic Inks and Pastes

10K Hour Laser Trim Stability at 85C/ 85% R.H. Encapsulated 1x1mm Resistor

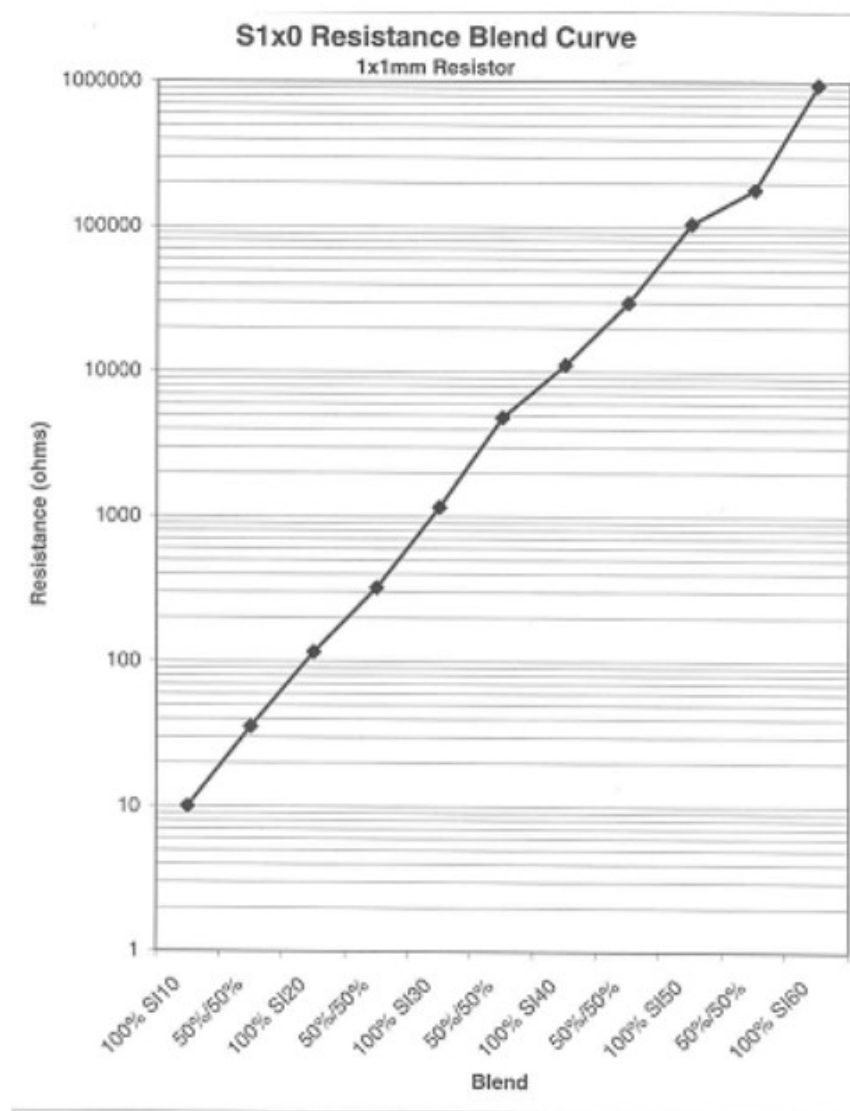


Laser Trim Stability after 1000 Thermal Cycles +150°C to -50°C (QM22 Termination)



Micromax™ S160

Electronic Inks and Pastes



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

Micromax™ S160

Electronic Inks and Pastes

Sheet (SDS).

Printed: 2023-09-21

Page: 7 of 7

Revised: 2023-07-10 Source: Celanese Materials Database

NOTICE TO USERS: Values shown are based on testing of laboratory test specimens and represent data that fall within the standard range of properties for natural material. These values alone do not represent a sufficient basis for any part design and are not intended for use in establishing maximum, minimum, or ranges of values for specification purposes. Colourants or other additives may cause significant variations in data values. Properties of moulded parts can be influenced by a wide variety of factors including, but not limited to, material selection, additives, part design, processing conditions and environmental exposure. Other than those products expressly identified as medical grade (including by MT® product designation or otherwise), Celanese's products are not intended for use in medical or dental implants. Regardless of any such product designation, any determination of the suitability of a particular material and part design for any use contemplated by the users and the manner of such use is the sole responsibility of the users, who must assure themselves that the material as subsequently processed meets the needs of their particular product or use. To the best of our knowledge, the information contained in this publication is accurate; however, we do not assume any liability whatsoever for the accuracy and completeness of such information. The information contained in this publication should not be construed as a promise or guarantee of specific properties of our products. It is the sole responsibility of the users to investigate whether any existing patents are infringed by the use of the materials mentioned in this publication. Moreover, there is a need to reduce human exposure to many materials to the lowest practical limits in view of possible adverse effects. To the extent that any hazards may have been mentioned in this publication, we neither suggest nor guarantee that such hazards are the only ones that exist. We recommend that persons intending to rely on any recommendation or to use any equipment, processing technique or material mentioned in this publication should satisfy themselves that they can meet all applicable safety and health standards. We strongly recommend that users seek and adhere to the manufacturer's current instructions for handling each material they use, and entrust the handling of such material to adequately trained personnel only. Please call the telephone numbers listed for additional technical information. Call Customer Services for the appropriate Materials Safety Data Sheets (MSDS) before attempting to process our products.

© 2023 Celanese or its affiliates. All rights reserved. Celanese®, registered C-ball design and all other trademarks identified herein with ®, TM, SM, unless otherwise noted, are trademarks of Celanese or its affiliates. Fortron is a registered trademark of Fortron Industries LLC. KEPITAL is a registered trademark of Korea Engineering Plastics Company, Ltd.