Celanese
The chemistry inside innovation™

Micromax™ Fodel® QM44F

Electronic Inks and Pastes

Photoimageable Thick-Film Paste

Micromax™ Fodel® QM44F photoimageable thick-film composition is a Fodel® version of Micromax™ QM44 and the first silver compatible Fodel® dielectric. It should be used in circuits requiring small vias and precise geometries.

Product benefits

- Capable of forming 3mil diameter vias
- Compatible with silver conductors
- Low shrinkage dried to fired (45%)
- Thin, 2 print dielectric film
- Robust electrical properties

Product information

Solvent or thinner	Micromax™ 8250	
Solid content	64.5 - 66	%

Rheological properties

Viscosity	50 - 90[1]	Pa.s

[1]: 10 rpm

Application technique

Mask mesh	200	
Mask emulsion	≤13	µm
Drying time	12 - 14	min
Drying temperature	80	°C
Theoretical coverage	100 - 120[2]	cm²/g
Recommended film thickness, dried	28 - 30	µm
Recommended film thickness, fired	30 - 32[3]	µm
Leveling time	5 - 10	min

[2]: based on fired thickness of 15µm

[3]: total fired thickness

Electrical properties

Dielectric Constant	8 - 10[4]	
Dissipation Factor	≤0.5[5]	%
Insulation Resistance, DC	≥1E12	Ohm
Breakdown Voltage	≥1000	V

[4]: at 1 KHZ

[5]: wet

[6]: at 100 VDC

Micromax™ Fodel® QM44F

Electronic Inks and Pastes

[7]: at 25µm

Storage and stability

Shelf life	6[8] months

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

Additional information

How to use

Design & compatibilty

- Design
  - Although testing indicates 25mil vias can be photo imaged successfully, it is recommended to screen print larger features when possible.
- Compatibility
  - The dielectric is compatible with a full range of Ag and mixed metal conductors, including silver/palladium, silver/platinum, and gold conductors.

Processing

- Using safe lighting
  - To prevent accidental polymerization, handle Micromax™ Fodel® materials under yellow or amber "safe lights" which have no UV, violet, or blue light wavelengths. Use safe lights in all areas where parts are printed, dried, exposed, and developed. Protect parts from all sources of white light unless these sources are carefully checked to ensure that they will not cause polymerization. To determine whether while light is present in your production area, turn off all yellow lights and look for any remaining white light. (This assumes that there are no white light leaks from yellow light fixtures).
- Printing
  - Screen (stainless steel) 200 mesh
  - Wire diameter 35µm
  - Emulsion 0-13µm
  - Squeegee 80 durometer
  - Print speed 1-2"/sec.
  - The composition should be thoroughly mixed before use. This is best achieved by slow, gently, hand stirring with a clean burr-free plastic spatula for 0.5-1 minute. Care must be taken to avoid air entrapment.
  - Printing should be performed in a clean and well ventilated area. Optimum printing characteristics are generally achieved in the

Micromax™ Fodel® QM44F

Electronic Inks and Pastes

room temperature range of 20°C - 23°C. It is therefore important that the material, in its container, is at this temperature prior to commencement of printing.
    - Micromax™ Fodel® QM44F photoimageable thick-film composition may show some degree of tackiness during printing. Therefore, it is a recommended practice to print slowly. Increased snap-off will be helpful as well.
- Thinning
    - This composition is optimized for screen printing, 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 behavior of the material and its printing characteristics.
- Drying
    - Allow prints to level 5-10 min. at room temperature, then dry in a well ventilated oven for 12-14 min. at 80°C. Properly dried film shows slight tackiness when hot and none when cool. Overdried film may require longer time to expose.
- Exposure
    - Photospeed of the dielectric film is quite fast, typical exposure time is 2-3 seconds when power is at 11.0 mW/cm^2. UV light source (Hg) is peaked at 360nm. Optimum result is obtained when phototool is in contact with the film. It is advised to adjust exposure time according to intensity of the light source.
- Development
    - Film is developed in a conveyorized spray developer using 0.8% (wt.) Na2CO3 aqueous solution. To set the proper development time, a dried part (unexposed) is sent through the developer first to determine time to clear (TTC). Then the belt speed of the developer is adjusted so that exposed part is developed at 1.5xTTC. Once the part is developed and water rinsed, excess water should be removed immediately by blowing with an air gun. The preferred solution temperature should be maintained at 85°F (30°C).
    - Considering that vias will become slightly bigger after firing due to shrinkage, it is recommended to adjust the exposure/development condition such that after development, via size in slightly smaller than artwork.
- Firing
    - Fire each dielectric print separately in a well ventilated conveyor furnance, in air. A 30 minute cycle with a peak temperature of 850°C held for 10 minutes should be used.

Micromax™ Fodel® QM44F

Electronic Inks and Pastes

Properties

- Typical properties are based on laboratory data using recommended processing procedures.
- Information in this datasheet shows anticipated typical physical properties for Micromax™ Fodel® QM44F 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).

Trouble-shooting/recommendation

Problem	Indication	Solution
3mil via is not formed after development, other vias are smaller than artwork	Over exposed or under developed	Fix development time, decrease exposure time or vice versa
3mil via is formed, but larger than artwork	Under exposed or over developed	Fix development time, increase exposure time
Film washed away partially or completely	Under exposed	Increase exposure time
Film did not wash away, but none of the vias developed	Over exposed	Decrease exposure time
Film washed away partially, no vias developed	Film too thick	Adjust print thickness
Film washed away at any	Over dried	Decrease drying

Micromax™ Fodel® QM44F

Electronic Inks and Pastes

exposure time		temperature and/or length of time
Film sticks to phototool	Under dried	Increase drying time

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