Applications

Interconnection of components for integration in electronic foil systems:
- Inexpensive screen-printing process for chip assembly
- High density fine-line technology for chip assembly
- High frequency impedance controlled wiring with high precision requirements

The Fraunhofer EMFT Offering

Fraunhofer EMFT provides an extensive portfolio of process modules for developing foil-based interconnections systems. These include for example:
- Multilayer screen printing
- Photolithographic patterning of thin film metallization
- Fabrication of electroplated conductors with semiadditive processing
- Multilayer wiring technology
- Double-side wiring technology
- Electrical and mechanical foil-to-foil assembly

These modules can be combined at will, depending on the requirements of the application in question. Parameters such as structural precision can be individually tailored to the customer requirements.

Advantages

- Fast and flexible realization of innovative ideas with flexible circuit carriers on foil — from feasibility studies to prototypes close to production
- Expert support provided by highly qualified and experienced personnel throughout the whole development process — from circuit design through small batch production all the way to technology transfer for industrial manufacturing
Technology

Standard substrates include 50 µm thin PET, PEN and polyimide films. The use of other foil materials and thicknesses is possible as well. The width of the foils to be processed is up to 305 mm, the area available for design is appr. 300 x 300 mm. The design parameters apply as listed here.

Foil materials

- Polyimid, PEN, PET and customer-specific materials
- Foil width 305 mm
- Foil length 5 - 100 m, typical length for R&D projects is ca. 15 m

Photolithography

- Maskless or mask-based approach
- VHDI-area 300 x 33 mm
- Step distance 300 mm

Process module 1: Roll-to-roll copper thin film

- Thin layer Copper with 
  \( d \approx 0.5 \mu m \) (typ.)
- Resistance \( \approx 43 m\Omega/Square \)
- Cr as adhesive promoter
- Structuring with lithography and wet-chemical etching

Process module 2: Roll-to-roll e-plating copper

- Thick layer copper with \( d < 10 \mu m \)
- Resistance (5 µm) \( \approx 4 m\Omega/Square \)
- Resistance (10 µm) \( \approx 2 m\Omega/Square \)
- Cr as adhesive promoter
- Patterning with lithography and wet-chemical etching

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<th>Relaxed</th>
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<tr>
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Process module 3: MEMS - gold

- Foil processing with MEMS-Technology on 150 mm handling wafer
- Au- thin film \( d \approx 150 nm \)
- Resistance \( \approx 400 m\Omega/Square \)
- Resistance dependent on the process control
- No adhesives between foil and gold

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Laser processing

- Maskless patterning of single layers
- Laser drilling of foils
- Cutting of device contours

Lamination

- Application of e.g. protective foils to the whole surface

Test und Characterization

- Visual control, optical inspection
- Testing of electrical parameters
- Degradation tests of humidity and temperature impact
- Measurement of HF-characteristics up to max. 100 GHz customer interface
- Further tests on request

Process module 4: Roll-to-roll screen printing

- Structured application of functional materials 5 - 25 µm thick

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<td>Long line</td>
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* depending on the material

3 Controlling bio chips on foil substrate, manufactured by roll-to-roll process
4 Keypad on foil substrate, manufactured from a single part in a roll-to-roll process