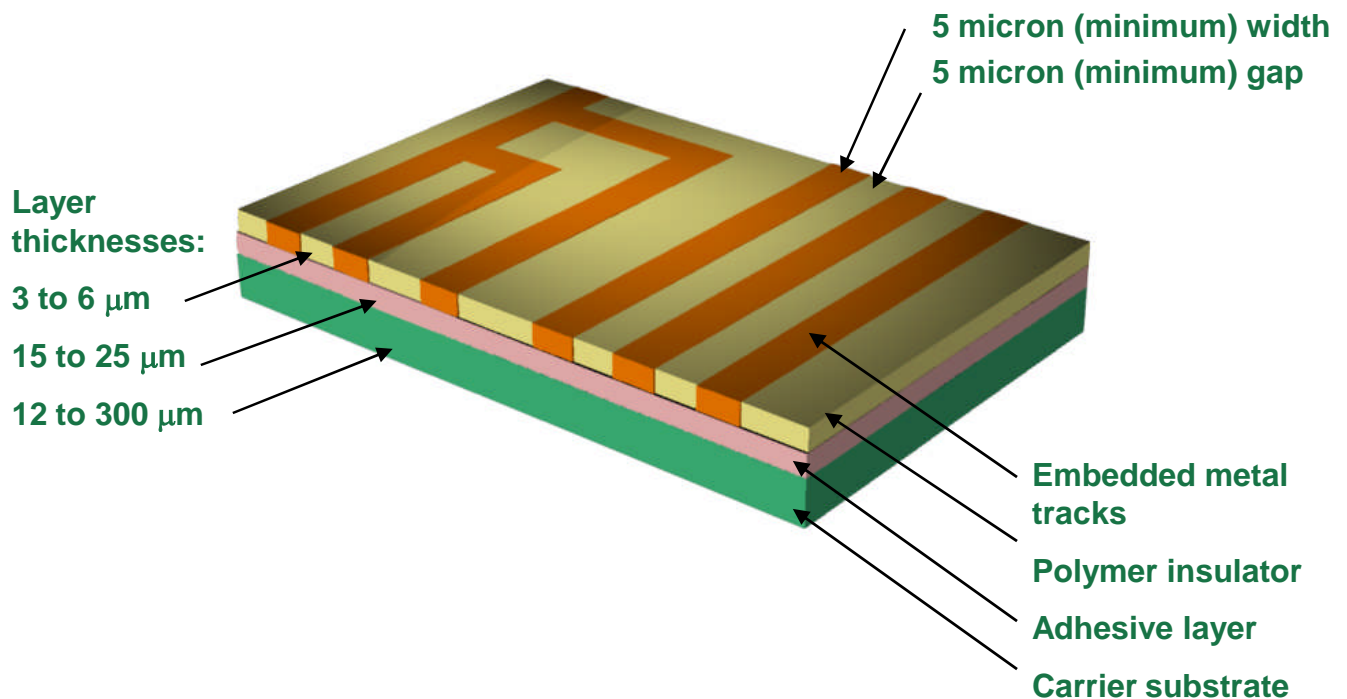




High resolution embedded circuit boards



Overview

Epigem's new flexible and rigid circuit boards offer the benefits of very small track and gap sizes at very competitive cost. We can do this by replacing conventional subtractive resist-based processes for making the board with a new, patented method based on additive plating methods.

Features

- 5 micron (minimum) width, 5 micron (minimum) gap width.
- 3 to 6 micron thick conductors (provided tracks are at least as wide as they are thick).
- Planar surface ideal for further over-coating, build up of fluid circuit layers or lamination.
- Nickel or copper metallisation
- Gold over nickel finish available
- Wide choice of carrier substrate and adhesive combinations to suit end application.

For further information, please contact;
Epigem Limited, Malmo Court, Kirkleatham Business Park, Redcar, TS10 5SQ, UK
Tel: +44 (0)1642 496300 Fax: +44 (0)1642 496301 <http://www.epigem.co.uk> info@epigem.co.uk



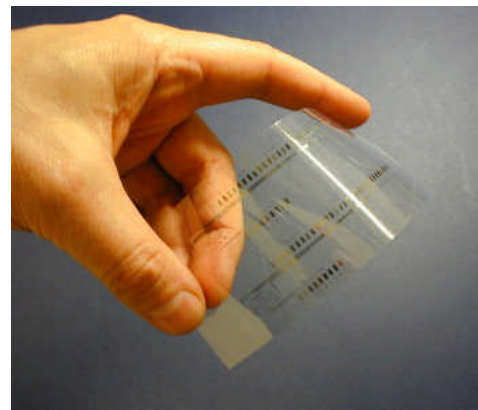


High resolution embedded circuit boards

Adhesive/carrier substrate options

Flexible carrier films that have been successfully used include:

- Polyimide (PI)
- Polyethylene Naphthlate (PEN)
- Polyethylene Terephthalate (PET)
- Polycarbonate (PC)
- Polyether Sulphone (PES)
- Polyarylate
- Paper



High transparency PEN flex board

Rigid substrates successfully used include:

- Glass
- Polymethyl methacrylate (PMMA)
- Silicon
- Polycarbonate (PC)
- Polyetheretherketone (PEEK)

Choice of adhesive depends on carrier substrate and end use requirements. Materials are available that cover continuous upper use temperatures of up to 180 °C. Short term temperatures up to 230°C are possible (when soldering onto the boards for example). Examples of adhesive materials available are:

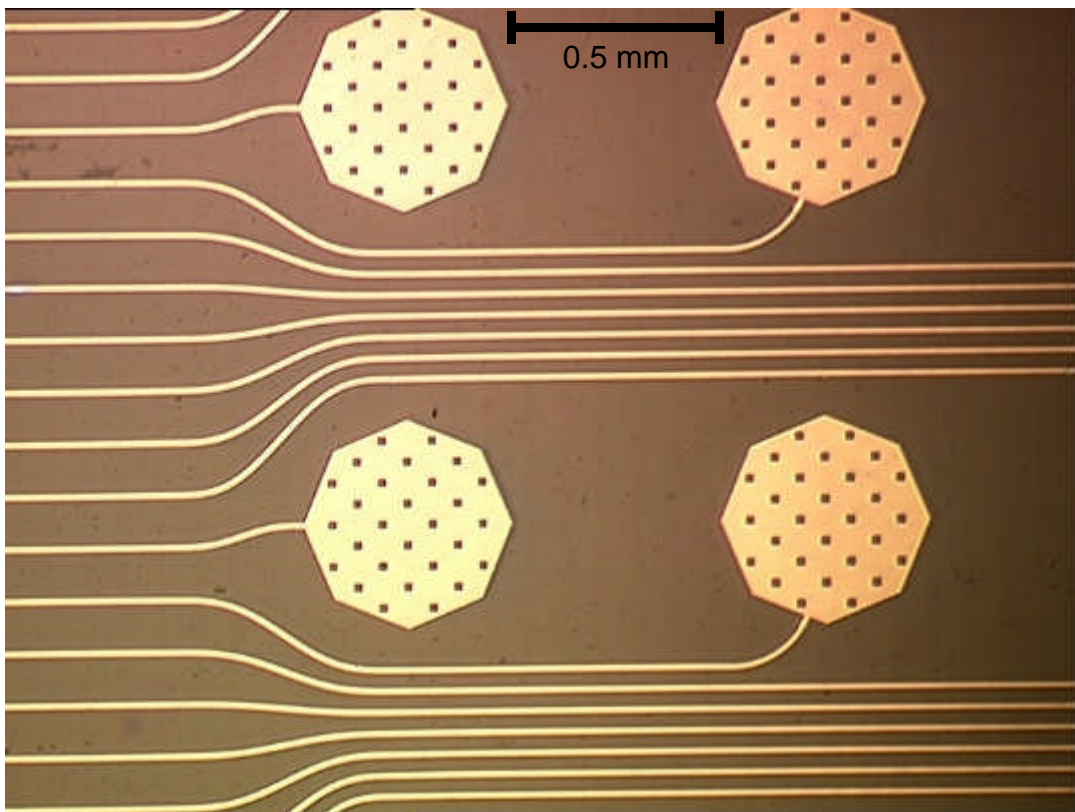
- Acrylic, epoxy or acrylate type
- UV curing, thermosetting, hot melt or pressure sensitive

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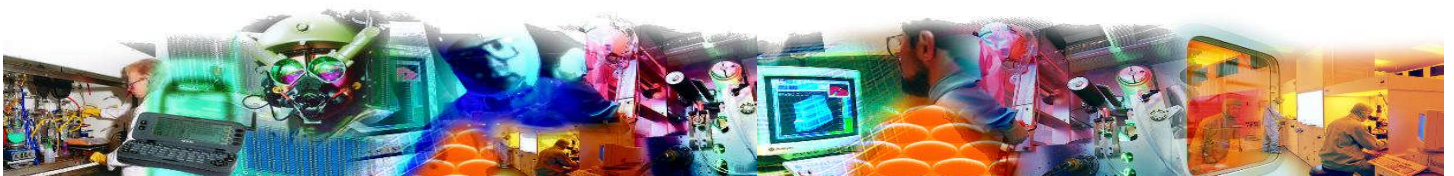


High resolution embedded circuit boards



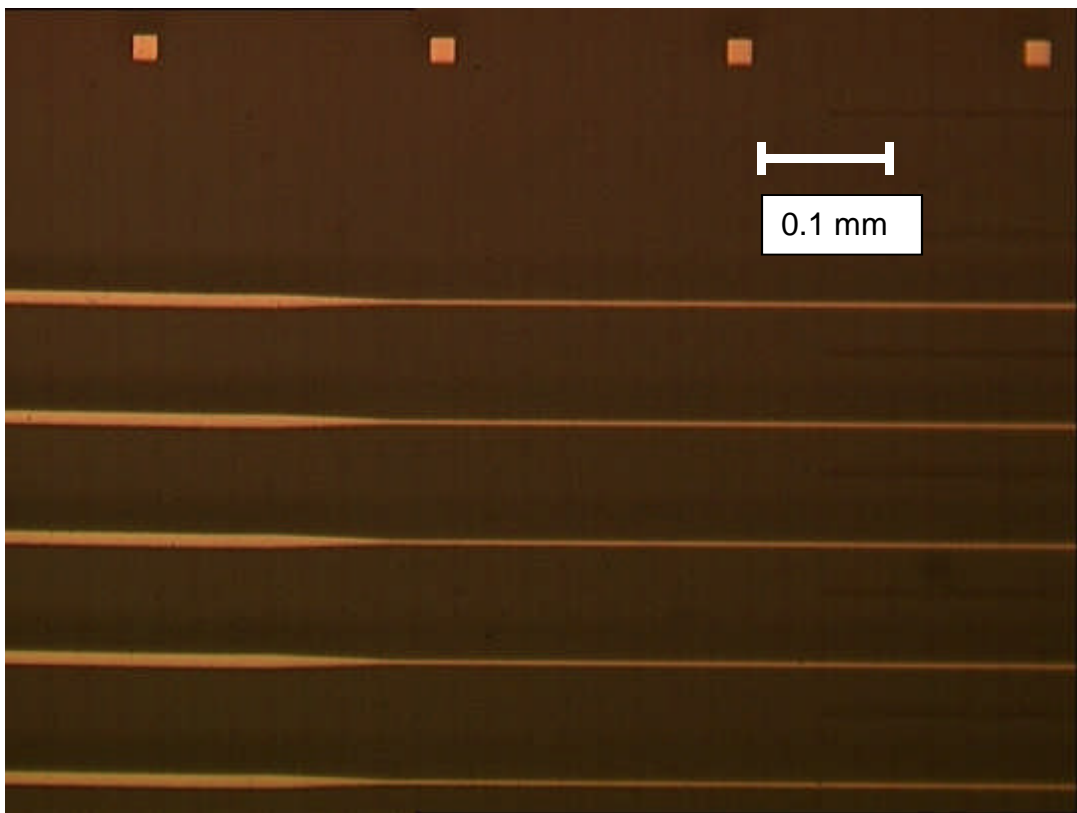
Example 1: 15 micron wide tracks on 30 micron pitch fan out to 100 micron pitch. Bond pads have 20 micron square holes cut out. Track depth is 5 micron.

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High resolution embedded circuit boards



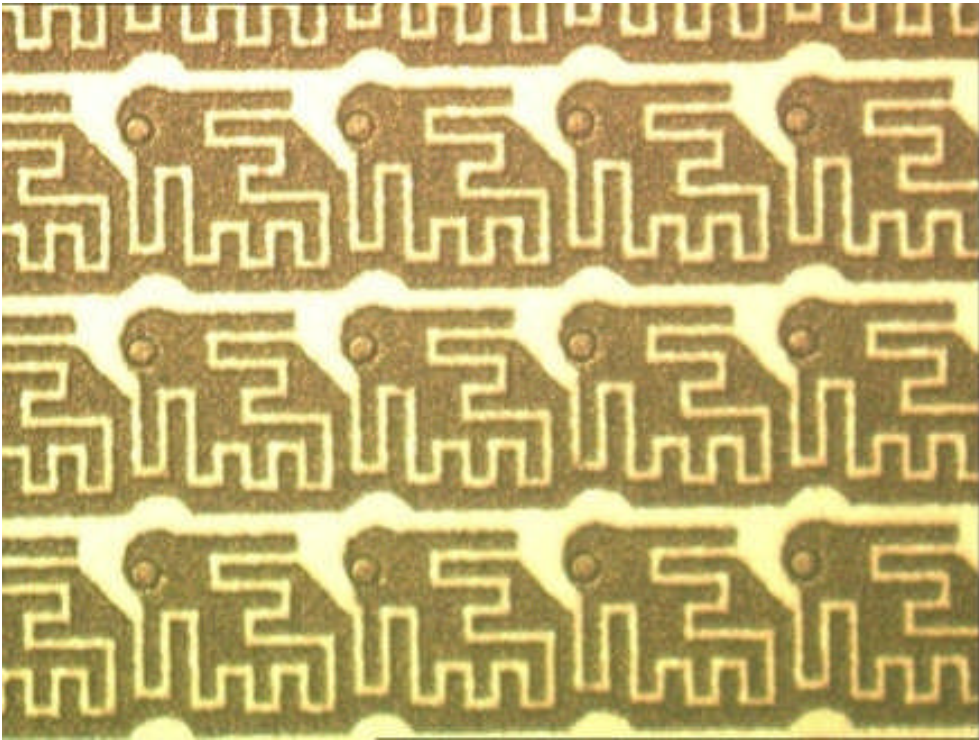
Example 2: 10 micron wide tracks on 100 micron pitch taper to 4 micron wide. Square objects in top of picture are 20 micron square. Track depth is 4 micron.

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High resolution embedded circuit boards



Example 3: Part of a sensor design with 7 micron wide minimum feature size. Nickel track thickness is 5 micron.

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High resolution embedded circuit boards

Design guidelines for electrical layer

- Size Up to 200 x 200 mm
- Metal type Ni or Cu
- Trace thickness 3 to 6 μm
- Metal surface finish (optional) Au
- Finish thickness Gold thickness = 0.06 to 0.2 μm .
- Trace width 5 μm or larger so that aspect ratio ≤ 1 .
- Gap between traces Equal to or greater than trace width
- Pad sizes Must be smaller than 1 mm or made up of 1 mm or smaller sized features to prevent lifting during plating.
- Photomasks When feature size is less than 25 μm then a chrome on glass hard photomask is required. Above this size then a flexible photomask is used.
- Yield and electrical testing The yield depends on the minimum feature size and the particular layout of the circuit pattern. Try to minimise the number and length of any very narrow tracks. Optical inspection of the board will be carried out to identify faults. Electrical test of the board is by agreement with Epigem (using Wentworth probe station) and if required the design should allow probing using either a custom wafer probe card (extra cost) or using 2 manual spring loaded probes.
- Background grid/waffle pattern A background cross-hatch grid or spacer dot pattern is recommended in areas not covered by the circuit pattern so as to ensure uniform thickness of metal during plating. Epigem can advise or add this to your design as required.
- Polymer insulator layer thickness Equal to metal thickness
- Surface flatness Peak to valley less than 0.2 μm (without gold finish, gold finish adds 2 μm above the surface of the metal traces).
- Adhesive layer thickness 10 to 25 μm depending on type
- Carrier substrate Various flex and rigid available
- Placement Electrical layer can be placed above or below a fluid circuit layer
- Number of electrical layers Single layer
- Electrical vias between layers Not available at present (under development)
- Overcoat layer Optional. Can be applied on top of electrical layer. Thickness between 0.5 μm and 100 μm .
- Solder mask layer Optional on top of outer electrical layer
- Solder mask dimensions
 - Photolithographic Thickness: 25 to 100 μm
 - Drilled/milled Minimum feature size: 25 μm .
Material: transparent epoxy. Thickness : 0.1 mm
Min feature size: 0.3 mm
Material: PEN/epoxy or PET/epoxy or photo-imagable epoxy

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