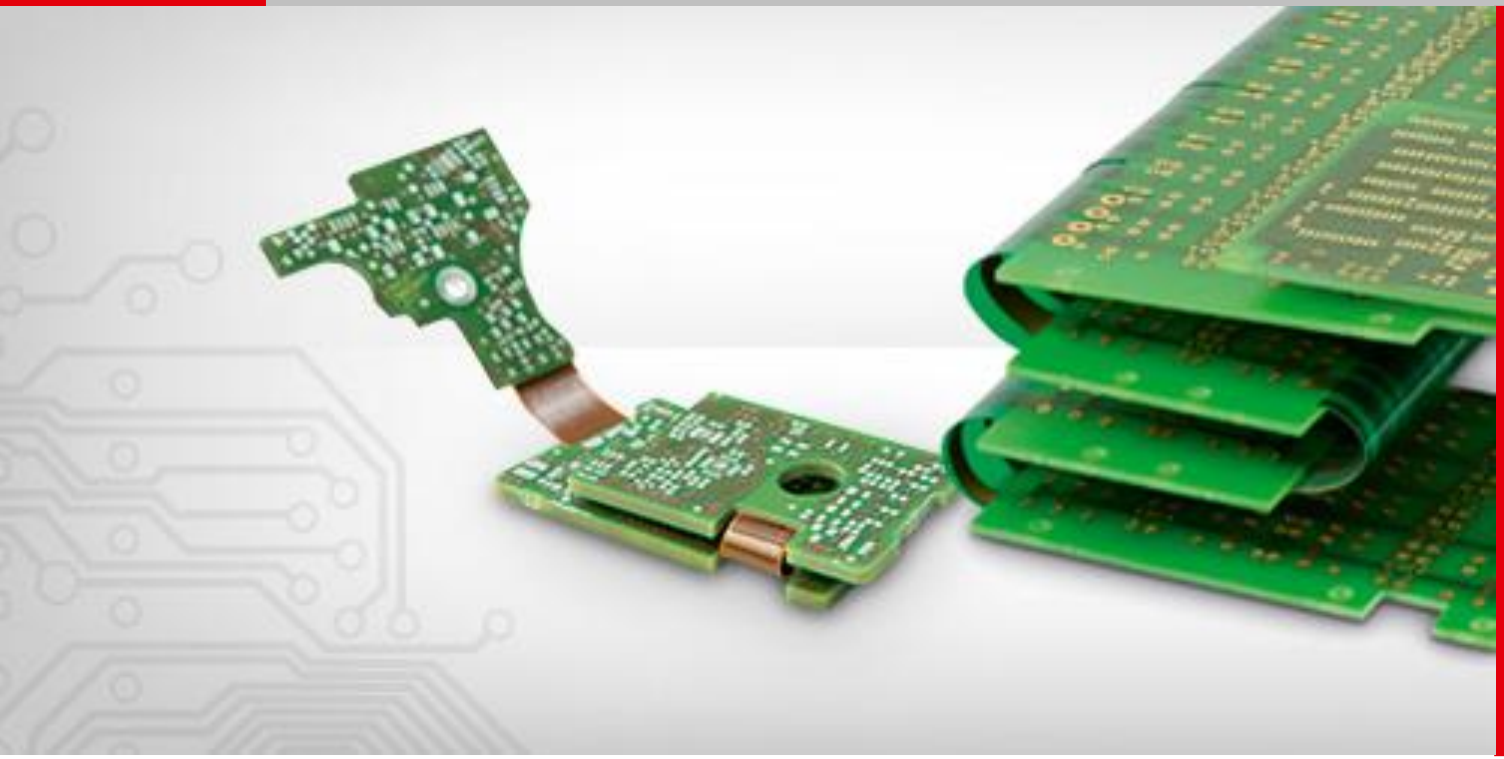
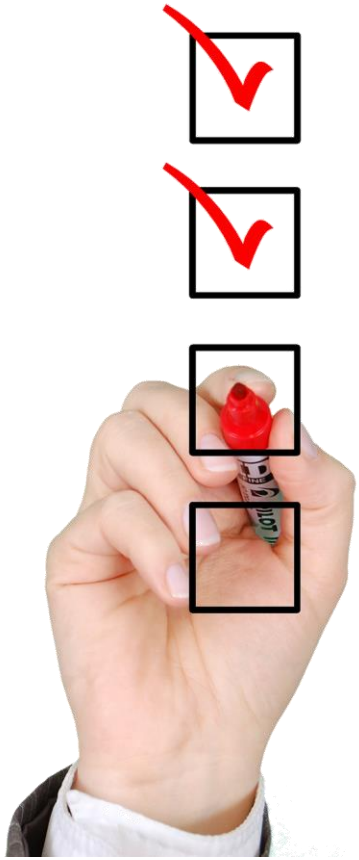
Flex-rigid Design – thorough checkup (Part II)



Andreas Schilpp

Agenda

- **Case 1: Interface Adapter**
- **Case 2: Insulation Foil**
- **Case 3: µBGA 0.5mm and Flex-Rigid**



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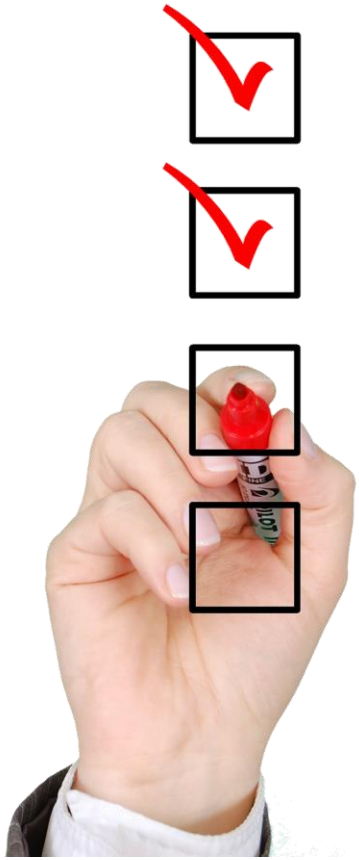
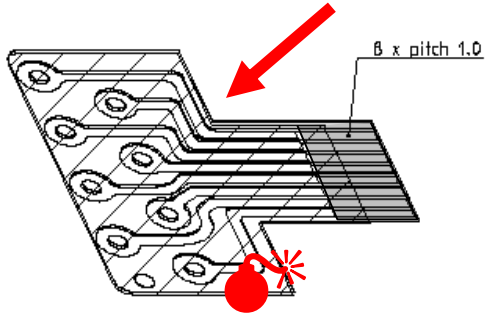


Interface Adapter | Initial Situation and Challenge

Simple cable harness replacement



- **THT to ZIF connector**
  - **Flex 1 layer, stiffener for ZIF contact**

Issues:

1. **Cost: Manual bonding of the stiffener for ZIF- contact at the end of PCB production**
2. **Quality: Packaging is difficult for everyone (bulk goods!)**
3. **Cost: Manual handling, manual assembly and manual soldering of one plug-in connector by customer**
4. **Quality: Flex cracks at connector pin after some bendings!**
5. **Quality: The mechanical design is not suitable for plastics respectively flex foils (notch effect)**

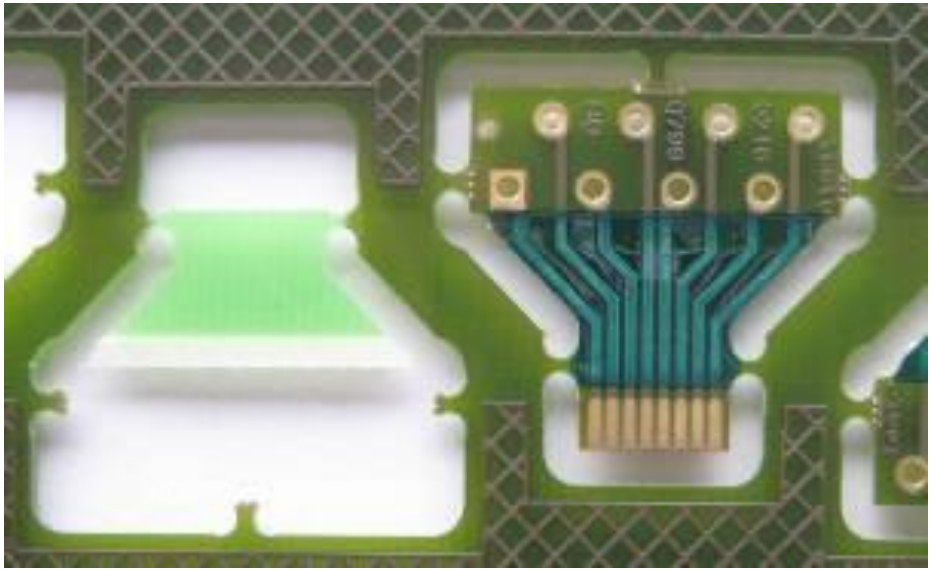
Interface Adapter | Solution

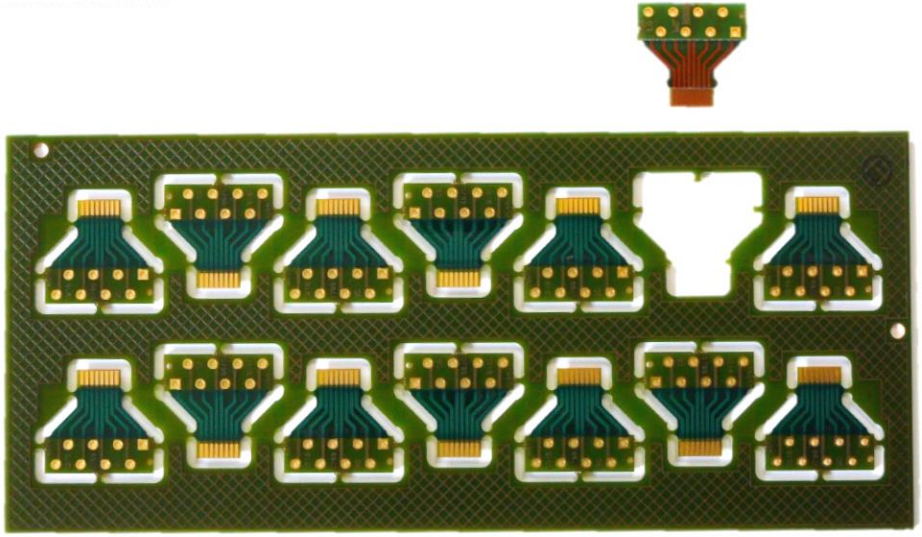
Fundamentally changed approach:

- **Flex-Rigid 1F-1Ri**
  - ZIF contact by precise depth milling
  - Perfect stability and perfect soldering with Plated Through Holes (PTH)
  - Production and packaging in an array
  - Thus automated assembly and soldering possible
  - Less notch effect by improved shape
  - Lower price compared to pure Flex with stiffener!

NEVER use Flex for THT components!

➔ **ALWAYS use Flex-Rigid**





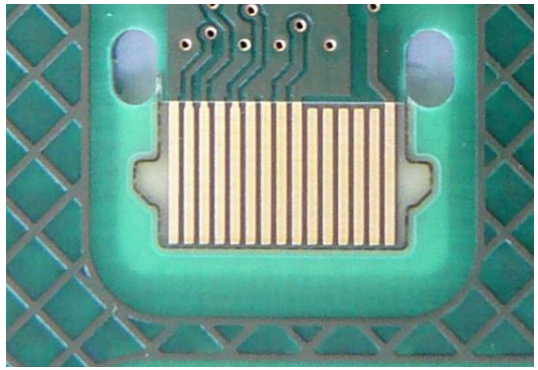
Interface Adapter | Options

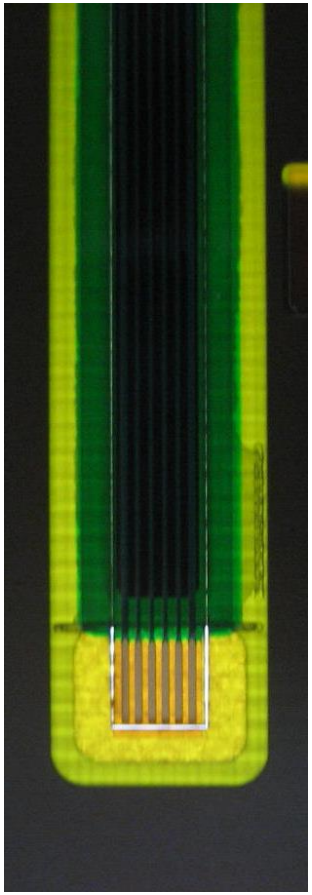
Flex-Rigid 1F-xRi

- Laser cutting of the ZIF contact is today´s standard at WE
- Snap-in hooks as protection against loss of contact (shock, vibration)
- Special design for improved handling

- Opportunity for mounting termination resistors or capacitors very near to the connector and wiring on the second layer of the rigid part

- SMT connector instead of THT enables automated assembly





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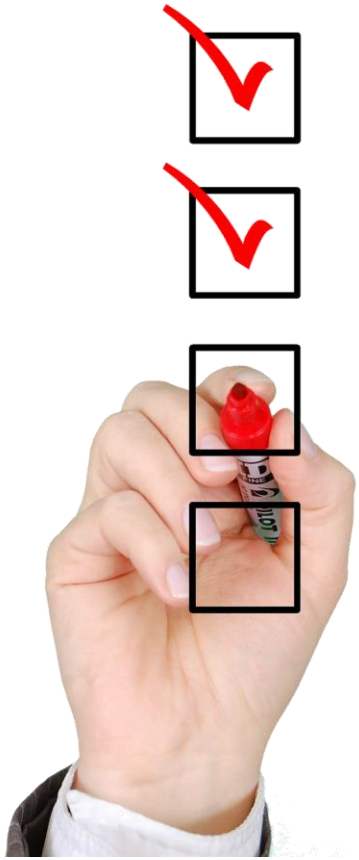
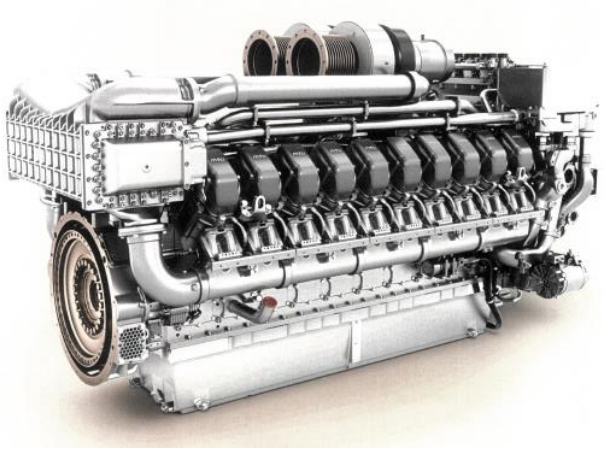
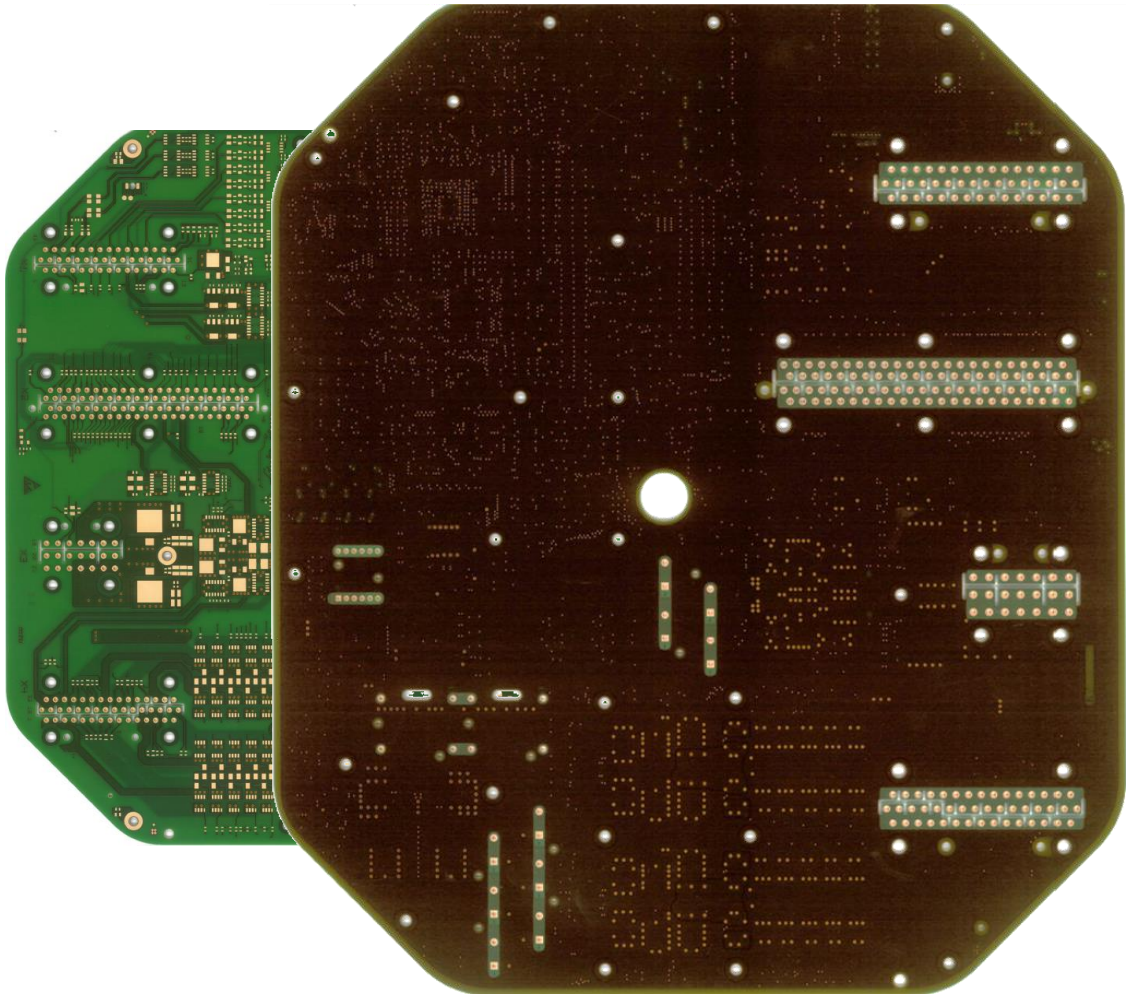


Insulation Foil | Initial Situation and Challenge

Engine Control Unit

- PCB fixed with screws on a ripped heatsink housing
- Requirements:
  - Very good insulation with low thermal resistance at the same time
  - Also secure tenting of vias
  - High abrasion resistance to withstand shock and vibration without damage





Insulation Foil | Solution

- Coverlay foil is common in Flex-Rigid
- Transferring the idea of Coverlay from flexible to rigid areas

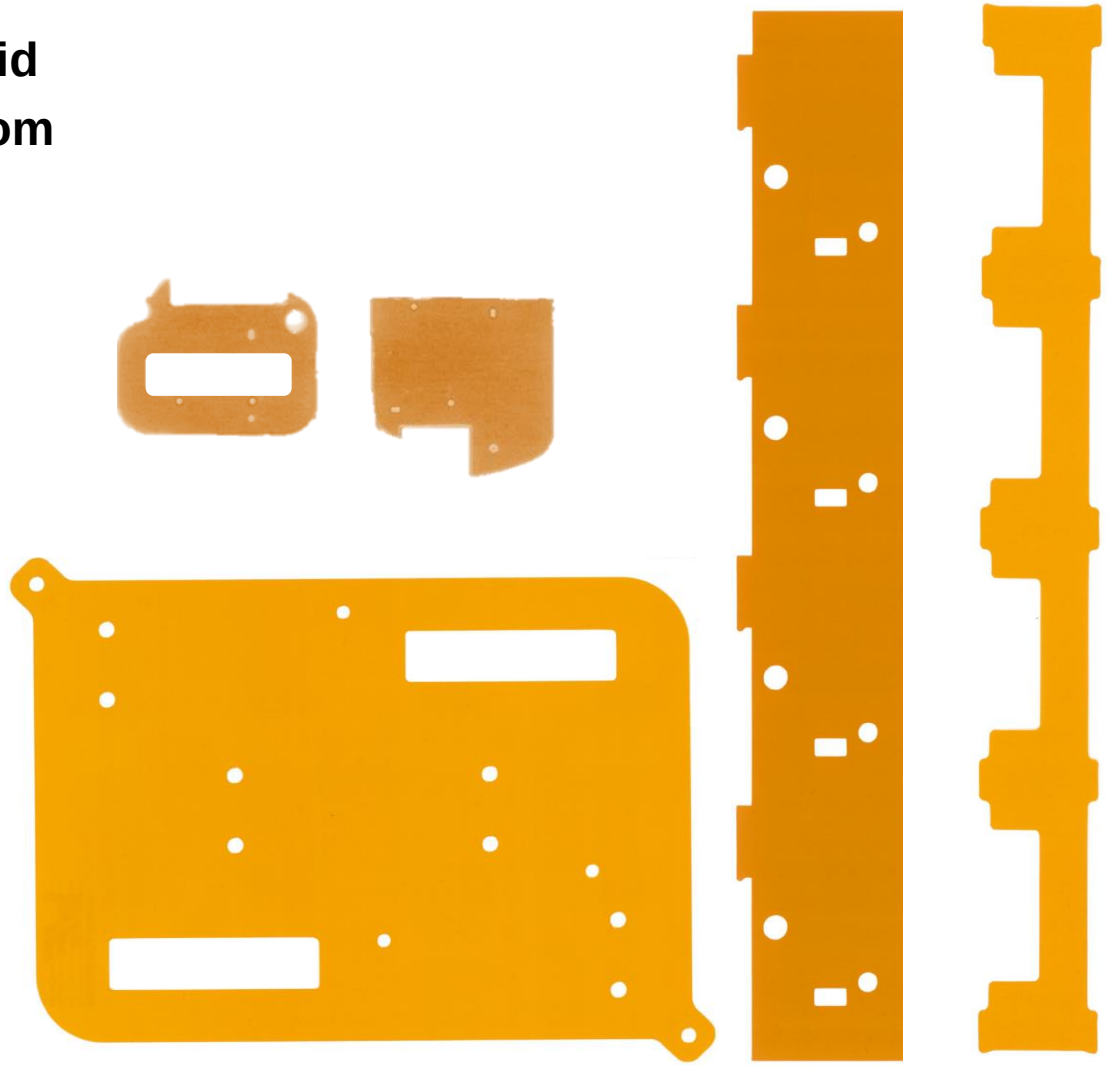
  – Polyimide 25µm thick as a standard, option with 50µm thickness

  – Dielectric strength: ≥ 6KV/mil

  – Possible on metal and on soldermask

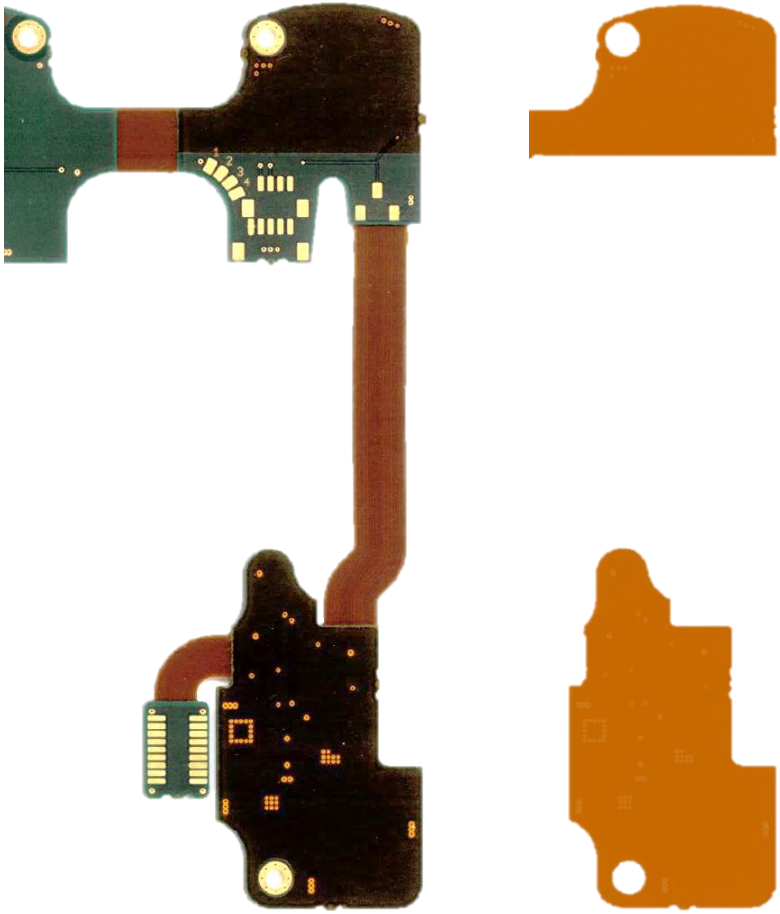
  – Cutting, registration, fixing on the finished PCB (final process)

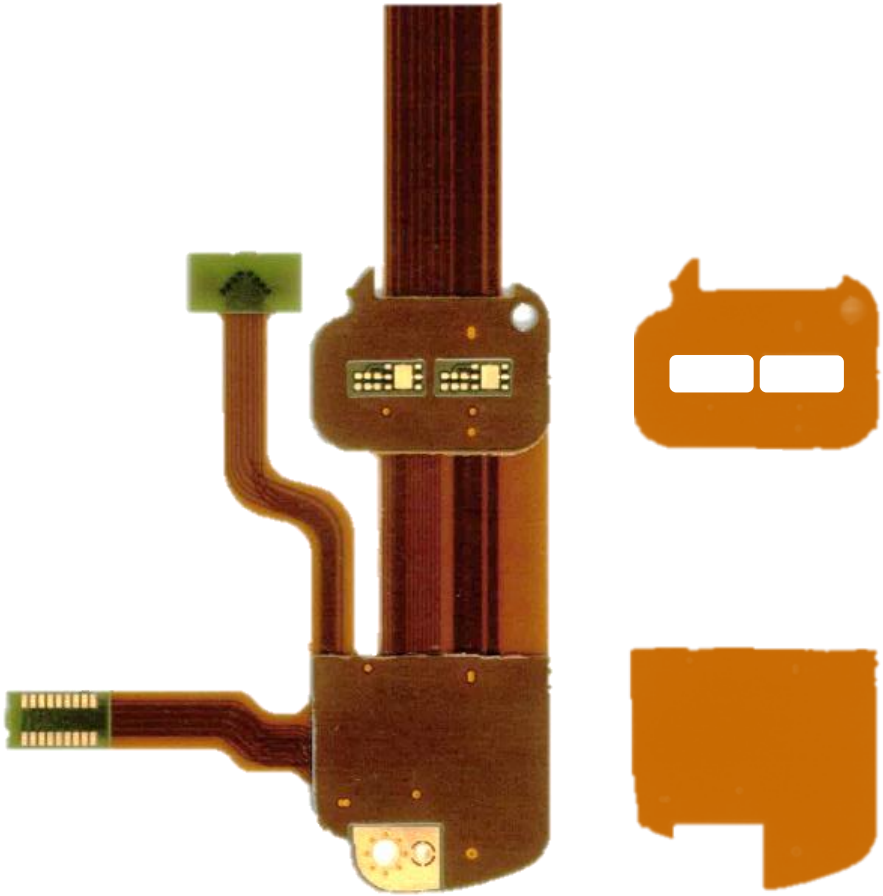
  – Vacuum lamination: Bubble-free, strong bonding



Insulation Foil | Solution

Examples with rigid-flex – GND contacts and some components free

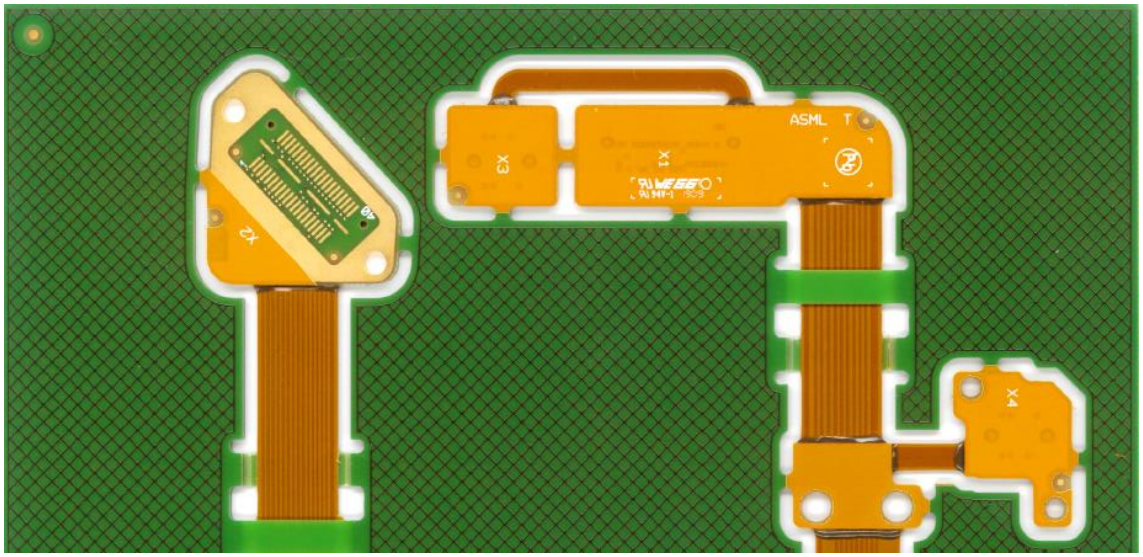


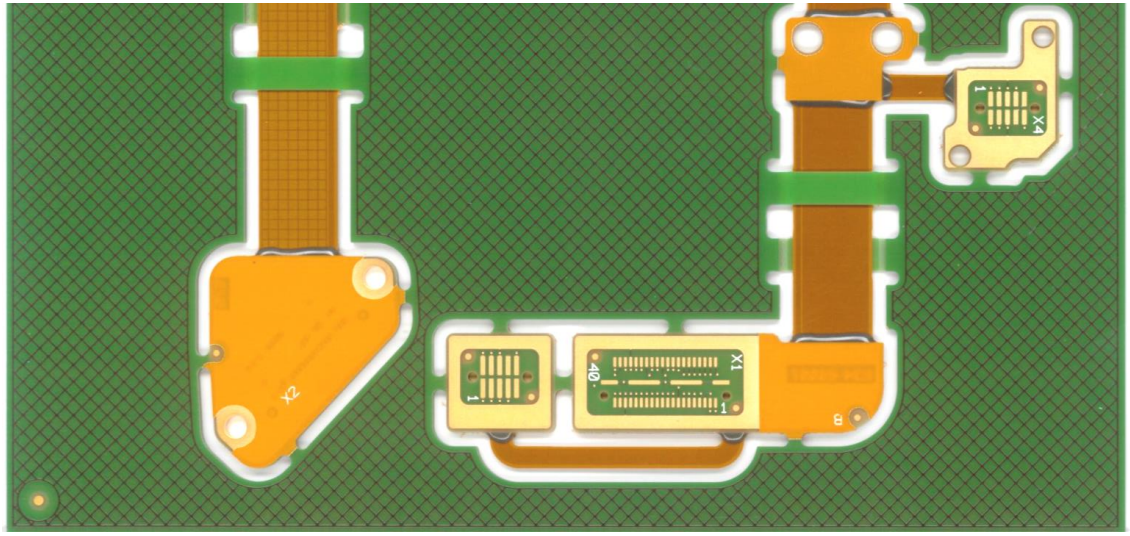


Insulation Foil | Solution

More examples

- **Very sensitive design**
- **no soldermask under coverlay**
- **Many areas isolated from the chassis**

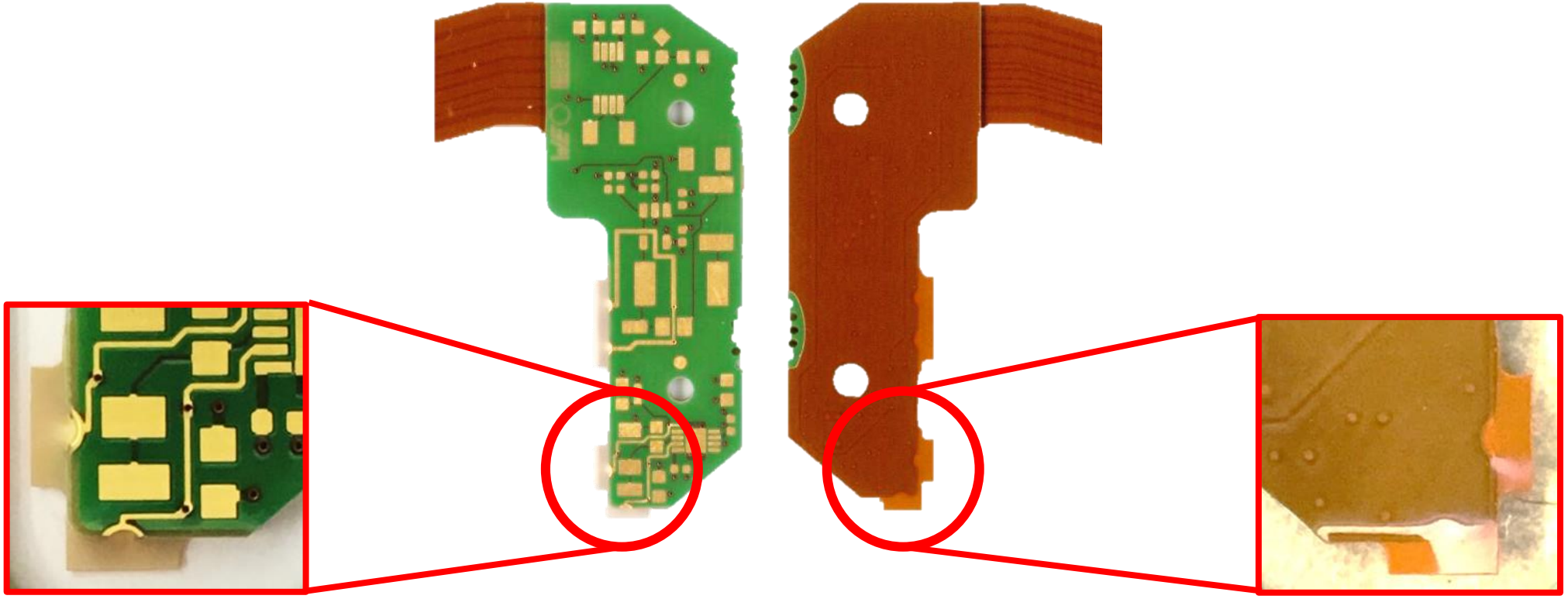




Insulation Foil | Solution

More examples

- **Insulation from the chassis**
- **Tenting of Edge plating or Half plated holes**



Call for more Examples | Success Stories

You apply flex-rigid designs or have just started ?
Maybe you are facing a number of challenges to tackle? Either in terms of:

- Material and layer structure
- Design and space requirements
- Delivery panel and processing
- Module interfaces
- Performance in the application
- Cost reasons

We will be glad to assist!

Also we are sure that you have already mastered similar or even greater challenges!

- Would you like to share these successes with us?
- Which of your application could be of general interest and are we allowed to present this at a webinar?

Please give us a hint now in the question window, we will then contact you.

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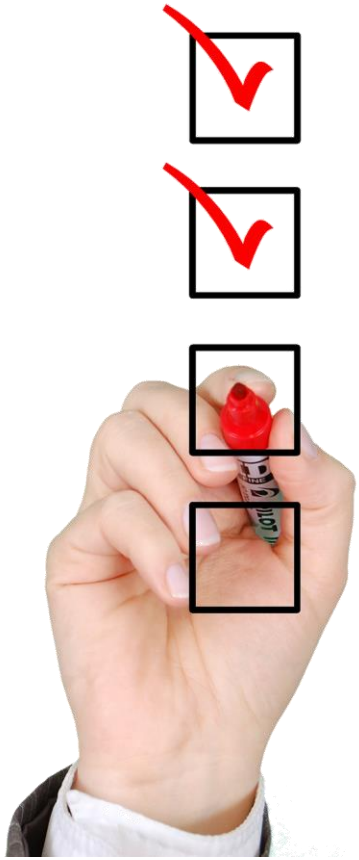
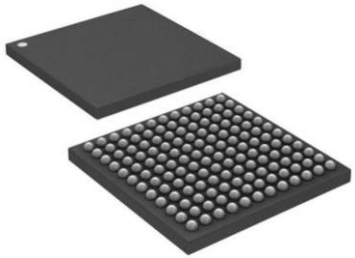
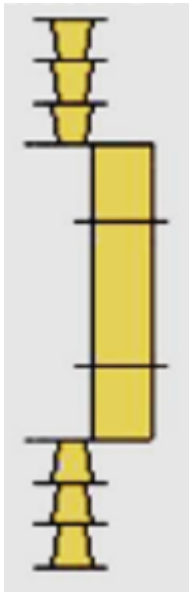
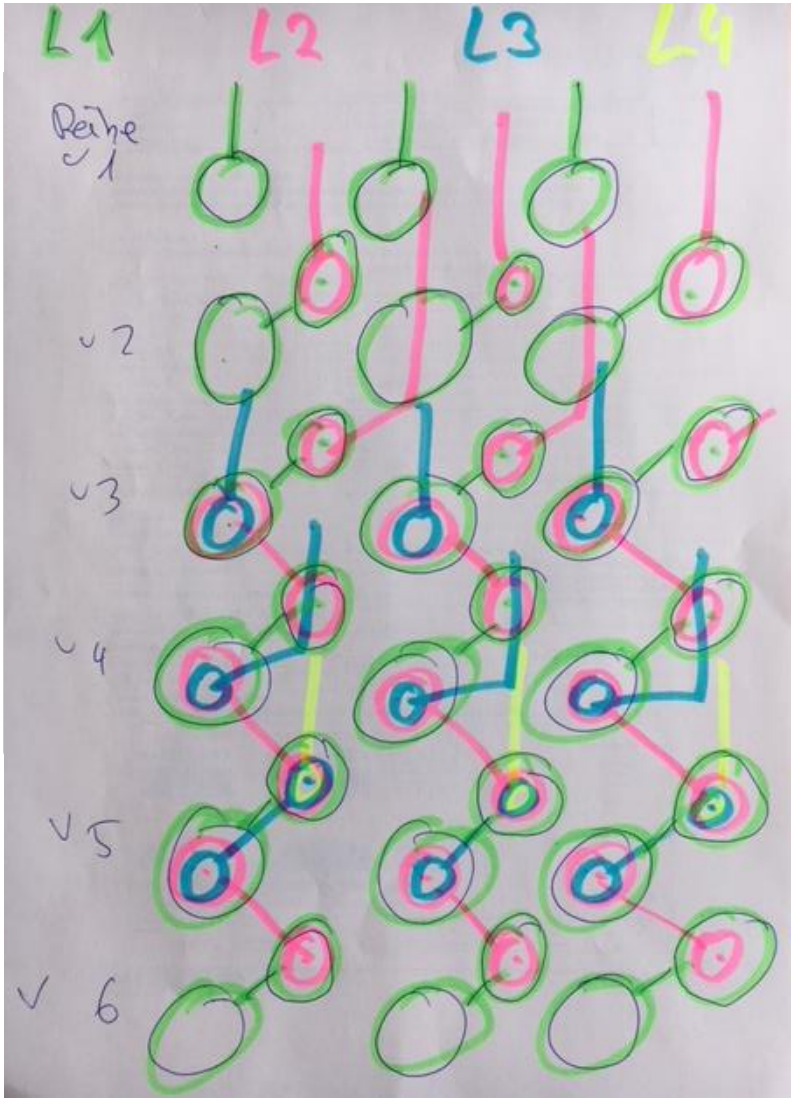


µBGA Pitch 0,5mm | Initial Situation and Challenge

Customer inquiry: µBGA full array 13x13 on a high complexity Flex-Rigid



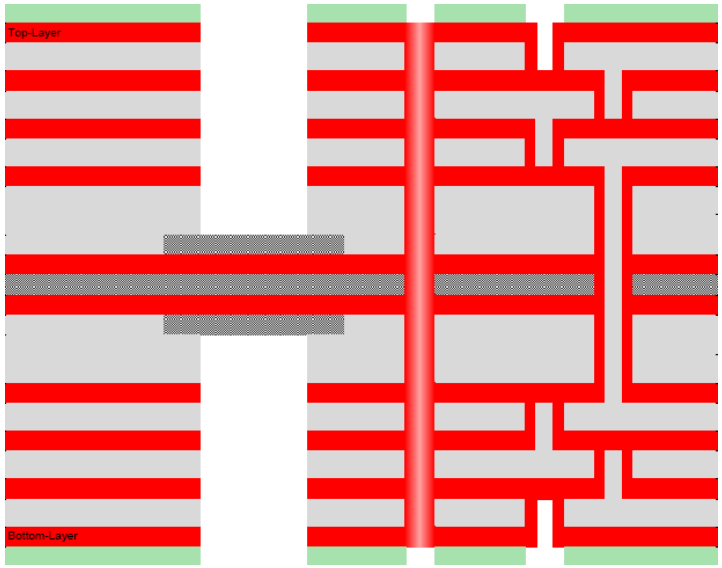




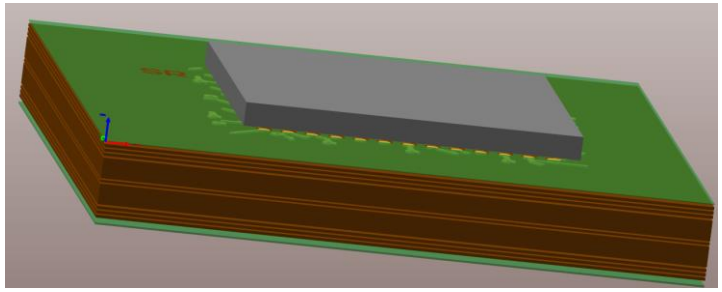
- **Approach 4Ri-2F-4Ri + HDI 3+4b+3**
  - Idea of stacked microvias
  - Requires 2x copper filling:
    Limits the smallest clearances on L2/L3 and L8/L9
  - Buried via with offset to microvias
- **Design set:**
  - Microvia Pad 275µm
  - Microvia-in-µBGA-Pad on TOP layer
  - line / space: 75µm / 75µm
  - controlled impedance not required

µBGA Pitch 0,5mm (13x13) | Solution

Solution proposed by WE TP and negotiated with the customer:



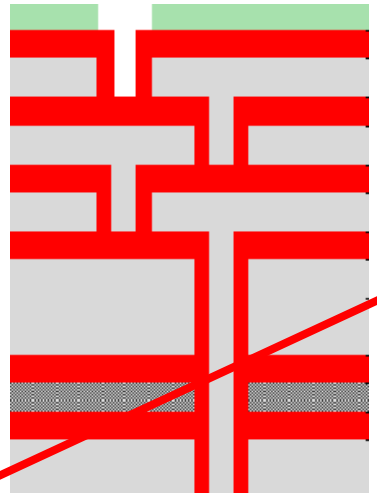
- **Flex-Rigid 4Ri-2F-4Ri + HDI 3+4b+3** ✓
  - Microvias staggered, not stacked
  - No copper filling required:
    Larger smallest clearances possible
  - Buried via with offset to microvias ✓

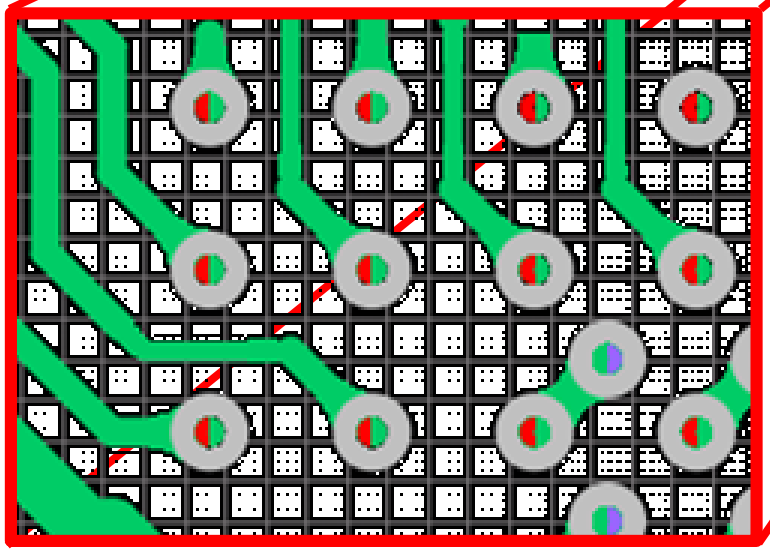


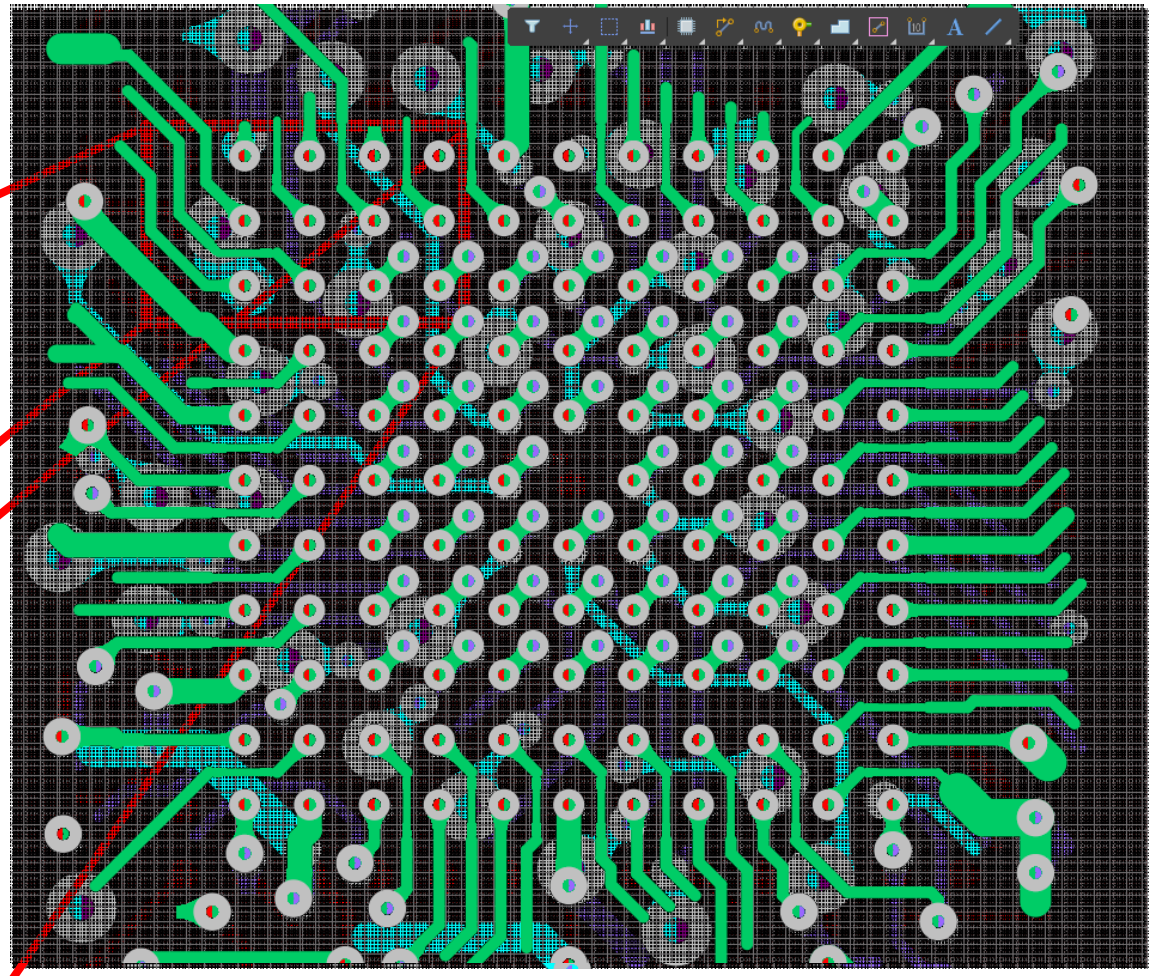
- **Design set for µBGA area only:**
  - Microvia Pad 250µm ↓
  - µBGA-Pad 240µm ↓
  - Soldermask clearance 50µm
  - Microvia-in-pad
  - line / space: 70µm / 90µm (layers with plating!)

µBGA Pitch 0,5mm (13x13) | Solution

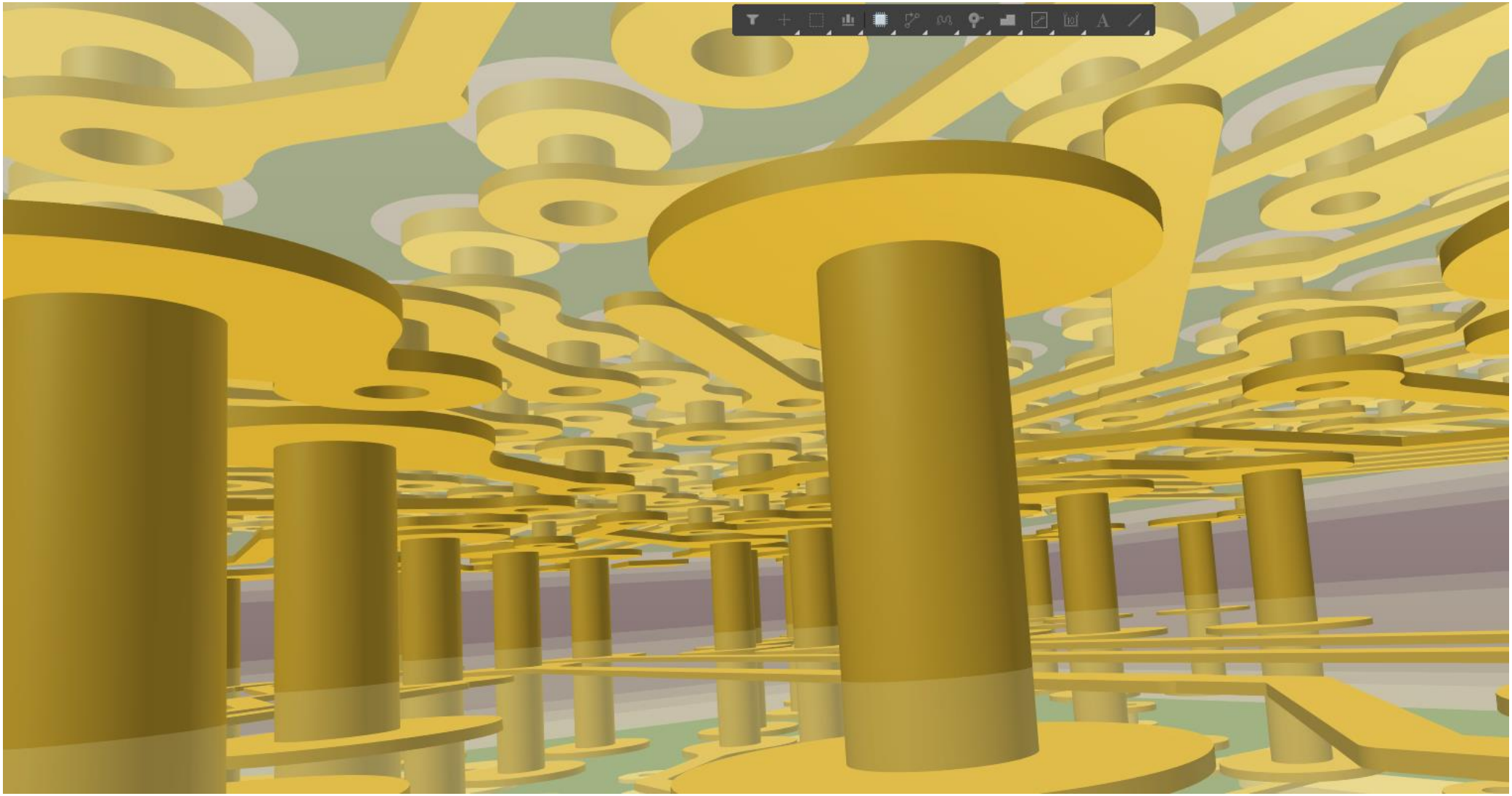
TOP
Layer 2
Layer 3
Layer 4







µBGA Pitch 0,5mm (13x13) | Solution



Thank you very much for your attention!

What Applications do you have?

Where we can support you?