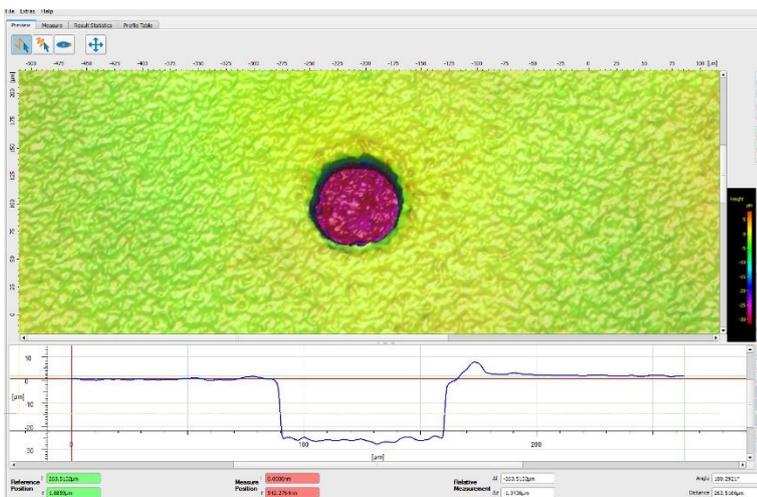
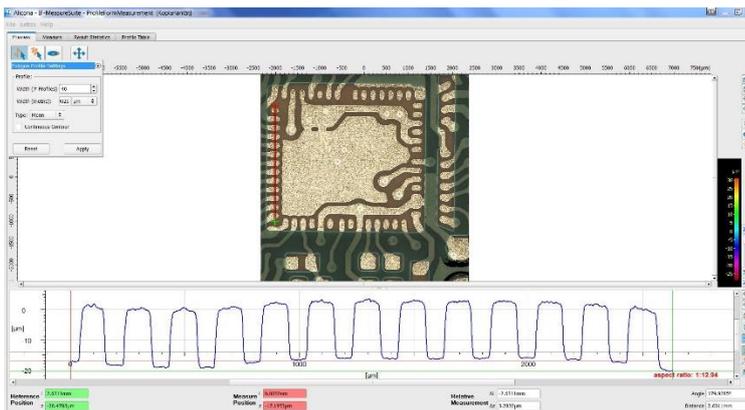


# Optical Metrology User Case Study: Reliable quality assurance of printed circuit boards



Bruker alicona

Bruker Alicona is a leading global supplier of optical metrology solutions based on the principle of Focus Variation.

Focus Variation works on the basis of moving a focal plane over a surface and collecting robust 3D data which can then be used to measure geometric form and surface finish from a single optical sensor.

Measurement processes can be fully automated and provide GD&T measurement capabilities across all industrial & medical sectors.

The systems are in use in Industry, Industrial Research, Universities and production facilities globally.

## Reliable quality assurance of printed circuit boards

Optiprint is a supplier of highly innovative printed circuit boards for use in medical engineering, the automotive and sensor industries, and space engineering. When the company was probing the market for a non-contact, areal surface measurement system, Bruker Alicona's 3D measurement systems attracted its attention. Optiprint now relies on InfiniteFocusSL in the quality assurance of printed circuit boards. The solution by Bruker Alicona allows Optiprint to measure form and roughness of complex, miniaturized component surfaces with just one system.

Today's printed circuit boards are carriers for simple to highly complex circuits. For 30 years now, Optiprint in Berneck (Eastern Switzerland) has been producing highly innovative solutions for circuit boards. New high-performance materials and more efficient ways of assembly, such as the Chip-on-Board technology, are becoming increasingly relevant. In light of these challenges, Optiprint was in need of a system for areal topography and flatness measurement of milled pockets. *"Alicona's 3D measurement system have allowed us to optimize our processes significantly and take major steps in securing the quality leadership of our products "*, quality manager Simon Hütter explains. Bruker Alicona 3D measurement solutions have made it possible to ensure flawless chip bonding (attaching of the chips) and wire bonding (attaching wires to connect chip and circuit board carrier).

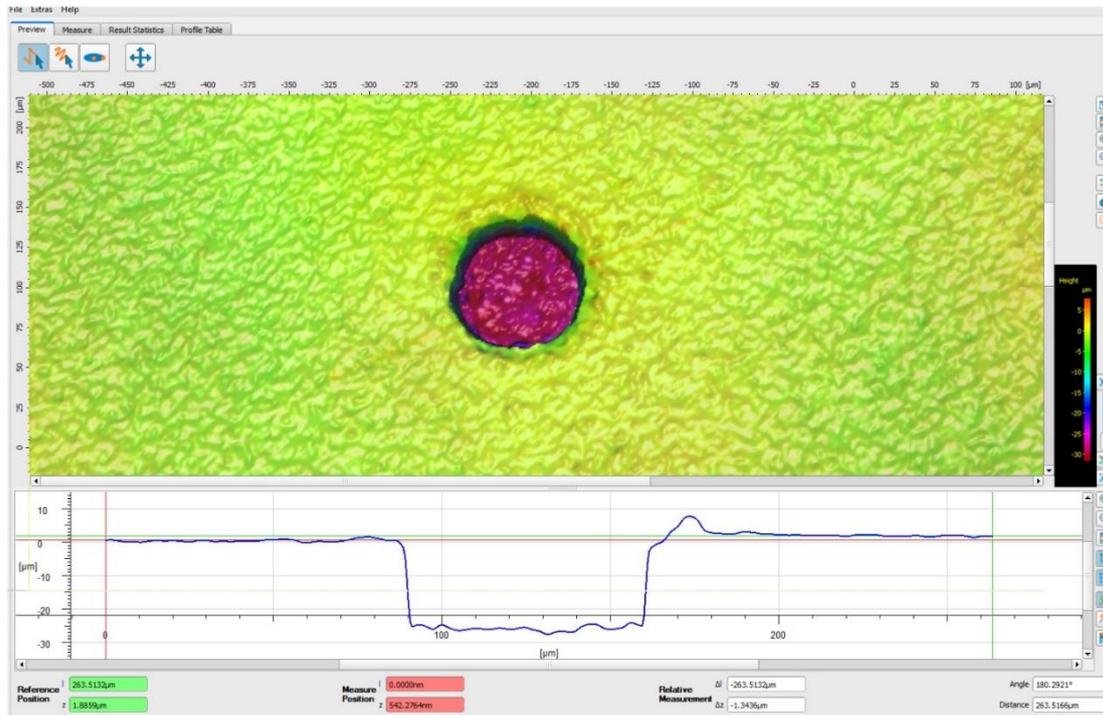
## Microvias: optical 3D measurement of diameter and depth

Optiprint's quality assurance puts great emphasis on providing printed circuit boards that are well-suited to further processing by customers. In order to ensure proper electrical bonding (interconnecting) of multi-layered circuit boards, it is vital that the microvias have been drilled according to pre-defined depth and diameter parameters.

Bruker Alicona allows Optiprint to verify diameter and height step of the microvias to confirm that the correct layers have been bonded.

Another type of measurement of laser-drilled microvias is checking for traces of powder. Traces of powder form at the outer edge of drill holes when molten material lumps together. With optimized laser parameters for the different materials these bulges are minimized. To identify bulges, roughness measurement is performed to evaluate the planarity at the transition of the surface to the microvia.

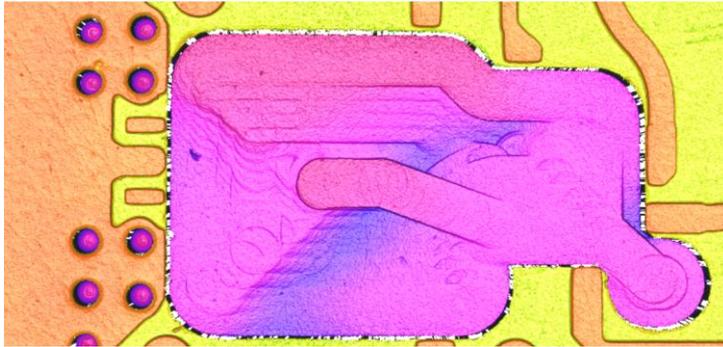
In addition to the measurement of depth, diameter, and planarity, microvia bottoms also need to be examined. The most critical fault to check for here is residual insulating material, as this can impede the electrical conductivity of the entire circuit board. It is therefore essential to verify that this area of the microvia is clean before further processing. Optiprint accomplishes this with Bruker Alicona's high-resolution true-color 3D visualization systems.



*Profile measurement of the microvia to identify traces of powder*

## Chip pockets: Area based measurement of shape and flatness

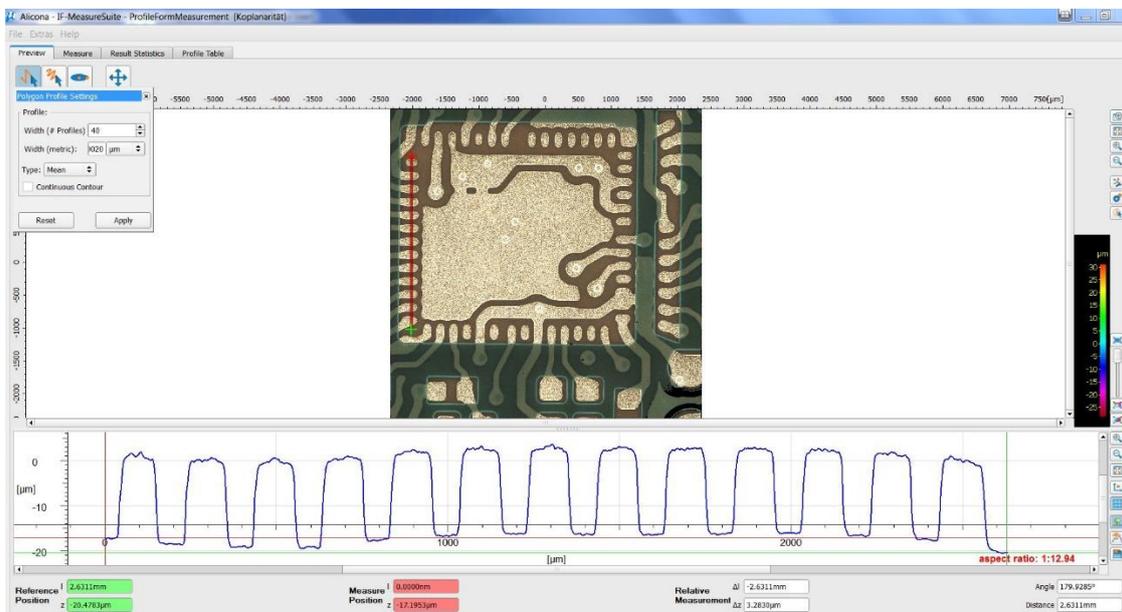
As the next step of the production process, milled pockets, also referred to as chip pockets, are milled into the circuit board to make room for the chips the end customer will later attach to the circuit board. Attaching the chips to the milled pockets is also called Chip-on-Board technology. For the silicon chips to remain in place securely, the milled pockets must have the correct shape and be flat. Thanks to roughness measurement with Alicona, Optiprint has managed to gain a better understanding of the interaction between surface properties and assembly process. This has resulted in a much more efficient manufacturing process. In order to ensure proper surface quality and, consequently, flawless attaching, Optiprint measures the height steps as well as shape and flatness of the chip pockets. *"Only when we started using areal roughness measurement, we mastered the process for milled pockets,"* says Hütter.



*3D visualization of the chip pocket before surface finish. The visualization has helped to optimize the Chip-on-Board technology. Optiprint has managed to gain a better understanding of the interaction between surface properties and assembly process*

## 3D profile form measurement of bondpads

Another step in the manufacturing process is the electrical bonding (interconnecting) of the Chips on Board. The electrical interconnecting of chips with the circuit board with using the bond wires is also called wire bonding. Bondpads must be free of faults such as roughness and dirt, as these weaken the bond interconnection. Bruker Alicona's 3D profile measurement system enables Optiprint to verify the form and co-planarity of contact pads on the printed circuit board and ensure perfect conditions for wire bonding.



*3D measurement of shape and co-planarity of contact pads to ensure perfect conditions for wire bonding*

The following parameters of multi-layer circuit boards can be measured and documented precisely with 3D measurement systems by Bruker Alicona:

- Depth and diameter of microvias
- Areal roughness at the transition of surface to drill hole
- Areal roughness and flatness at the bottom of microvias
- Areal topography and roughness of milled pockets (chip pockets)
- 3D profile form of bondpads
- Analysis and rating of quality characteristics

*"Our customers use printed circuit boards by Optiprint to manufacture products of the highest quality. Alicona's customized 3D measurement solutions play a key role in enabling us to provide our customers with the exceptional quality they need. Their systems contribute significantly to our company's success. We can only recommend Alicona to everyone."*

Simon Hütter, Quality Manager

## Summary:

It can be clearly seen that Optical 3D metrology can offer a solution to the measurement of features on PCB's.

In a simple to use package, and not requiring any metrology knowledge to operate users can easily scan a surface and measure the features requires.

## Equipment Available

These measurements can be made using one of the 2 products shown below from Bruker Alicona. The InfiniteFocusSL will measure up to 50 x 50mm, the InfiniteFocusG5 plus will measure up to 200 x 200mm.



InfiniteFocusSL system with 50x50mm XY stage and fitted with rotation device. Info at <https://bit.ly/3sZS43H>

InfiniteFocusG5 plus system with 200 x 200mm XY stage and fitted with rotation device. Info at <https://bit.ly/2TF9ctH>

