

X-ray CT Image = Microscope Image = Conductivity Test ?

# CONSISTENCY CHECK

Feb.12, 2021

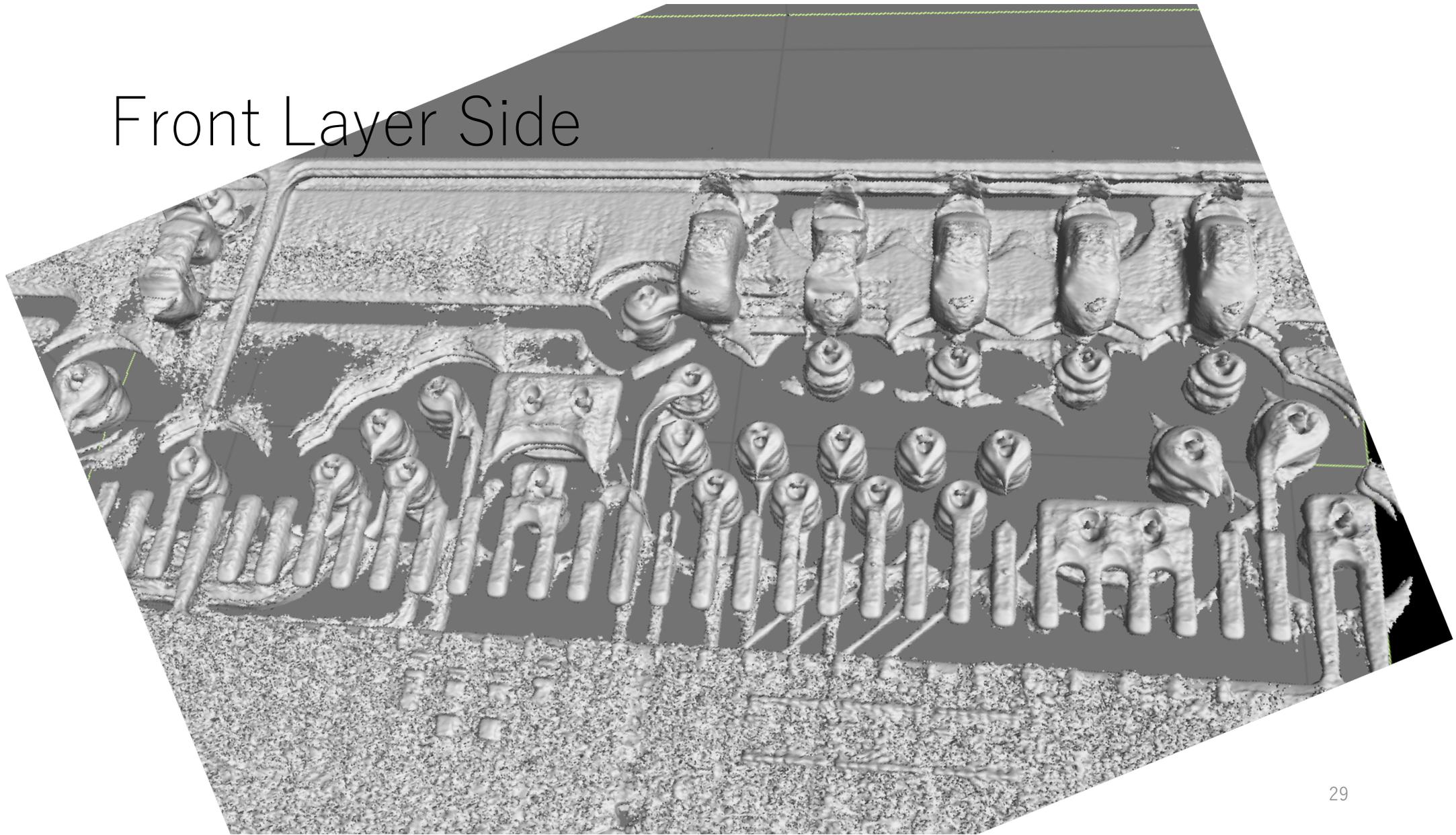
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Daisuke Yanagawa, Itaru Nakagawa

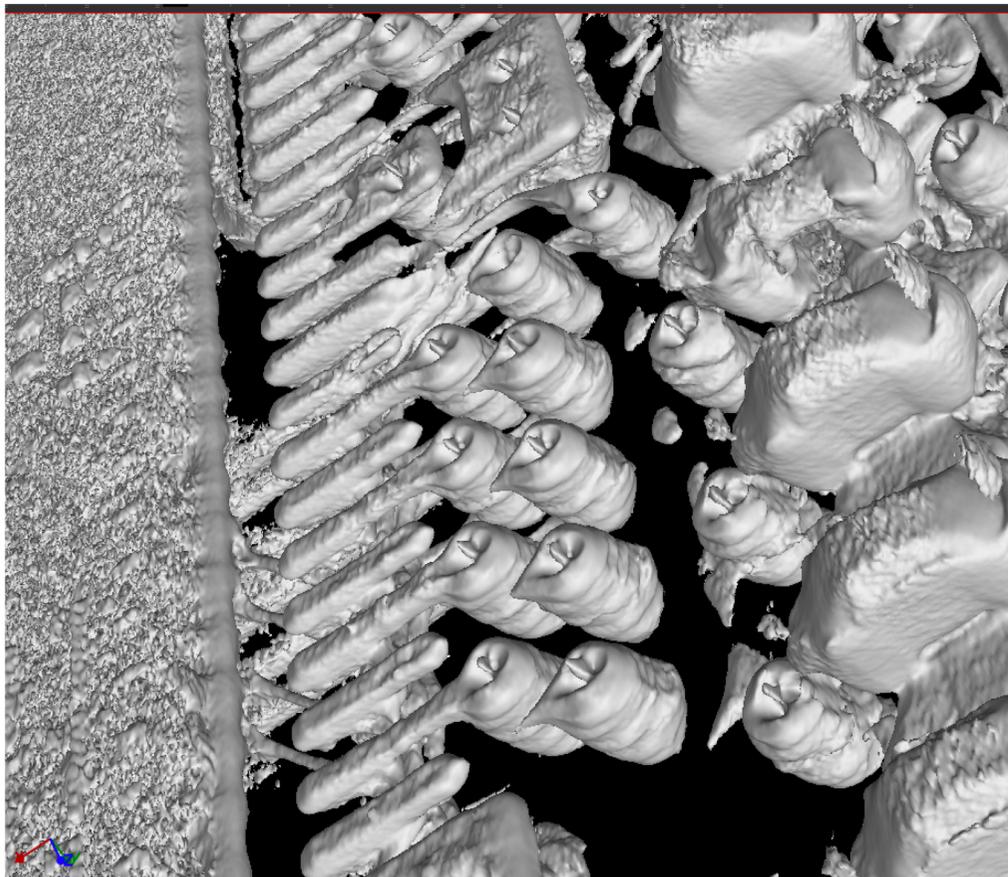
# Table of Contents

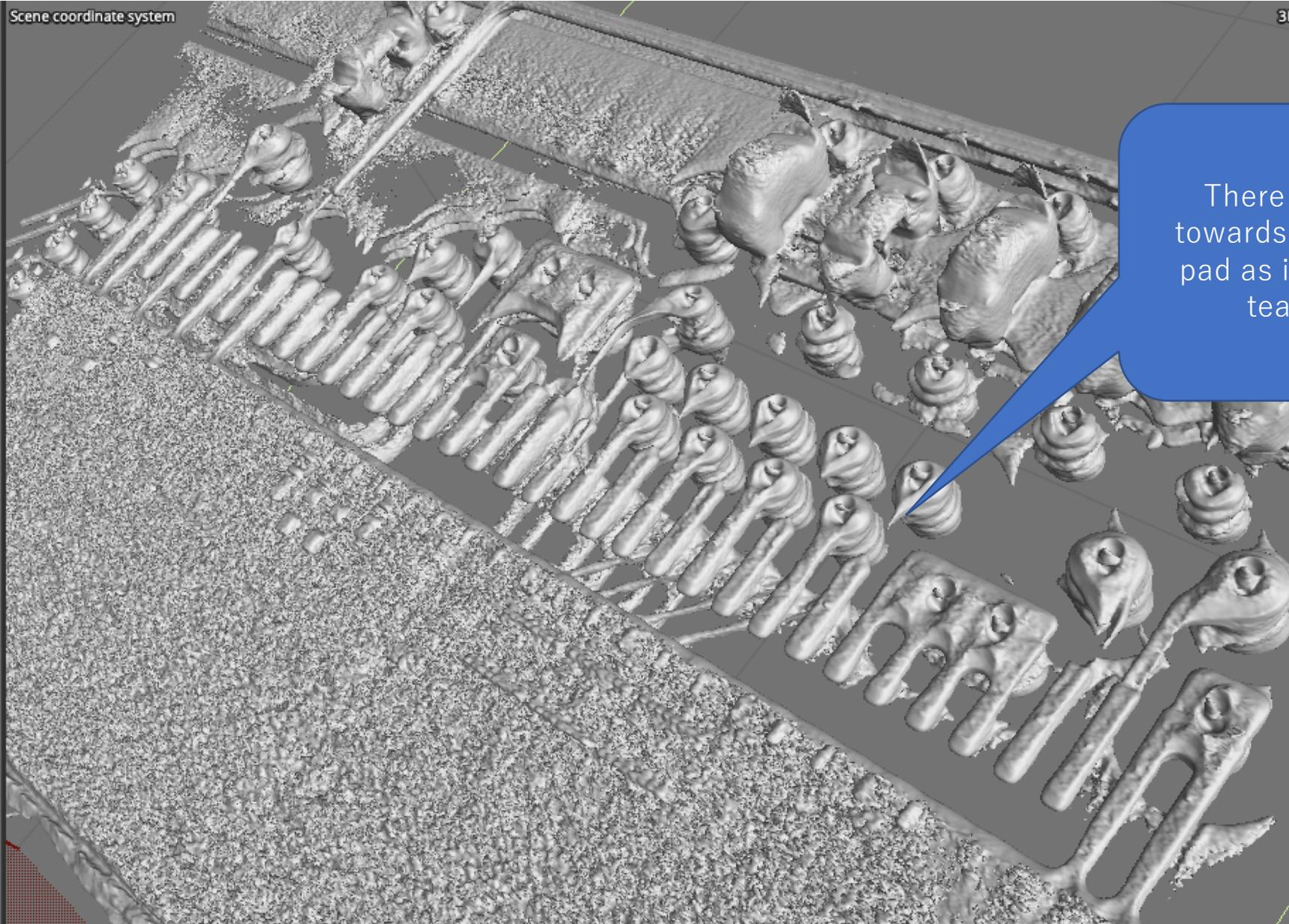
- The X-ray image indicated possible line open in the path between thru hole and bonding pads, and these opens appear almost every other lines.
- This is contradict to what was observed in Taiwan.
- The consistency check was made between different observation methods of the line open.
  1. X-ray CT scan image
  2. Microscope observation of the HDI surface layer
  3. Conductivity check with a multimeter

# Front Layer Side

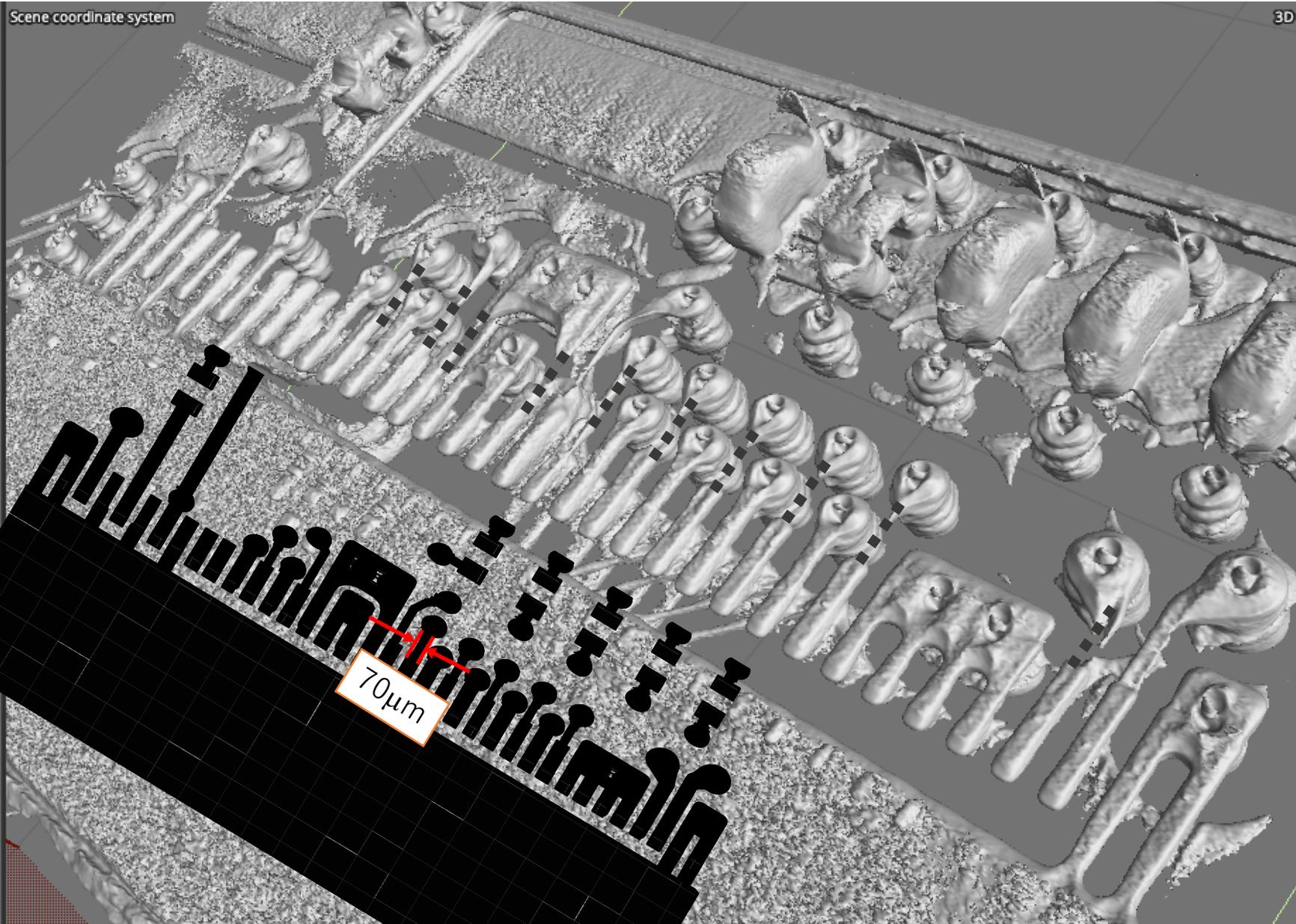


# Front Layer Side

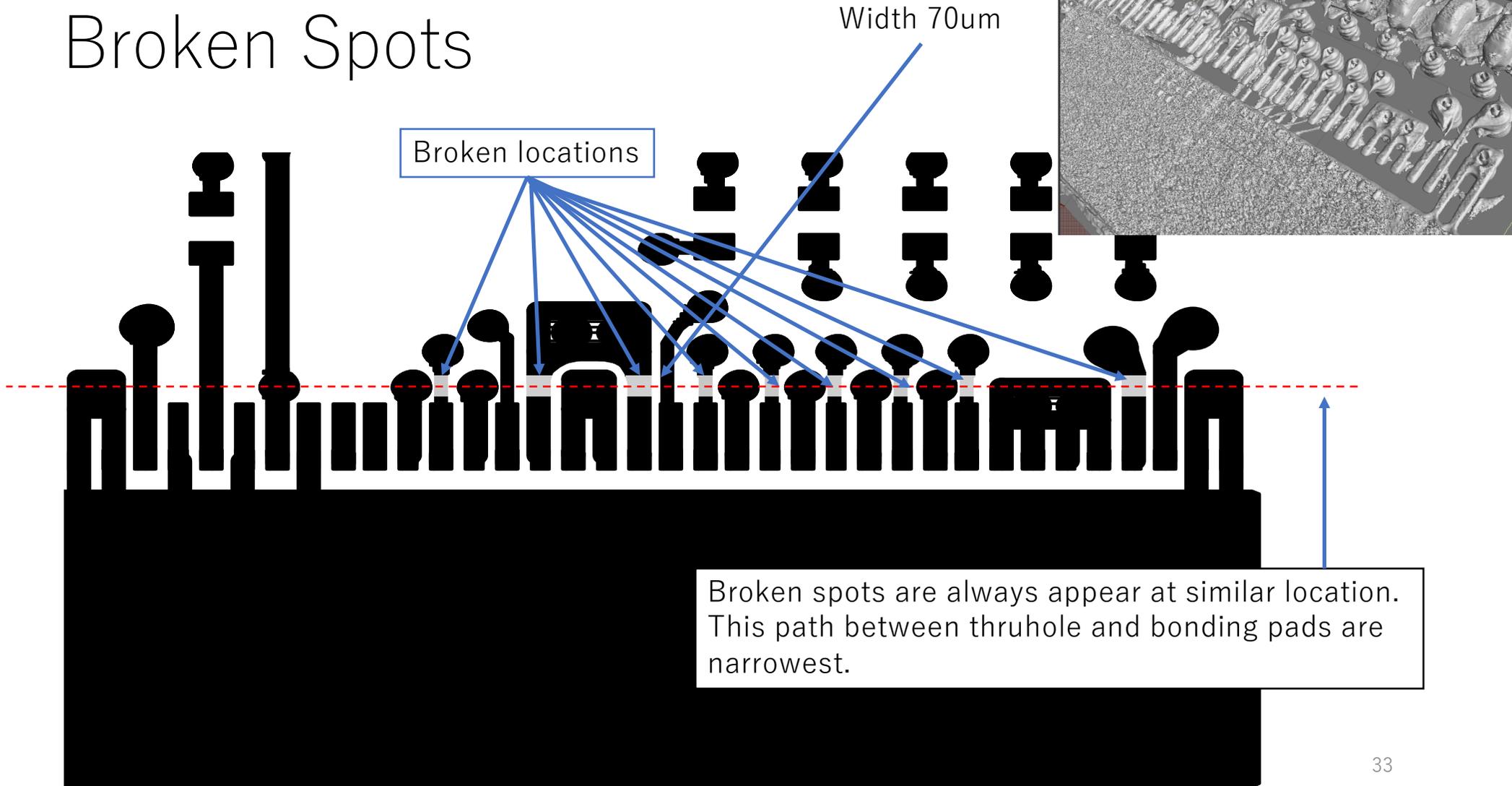


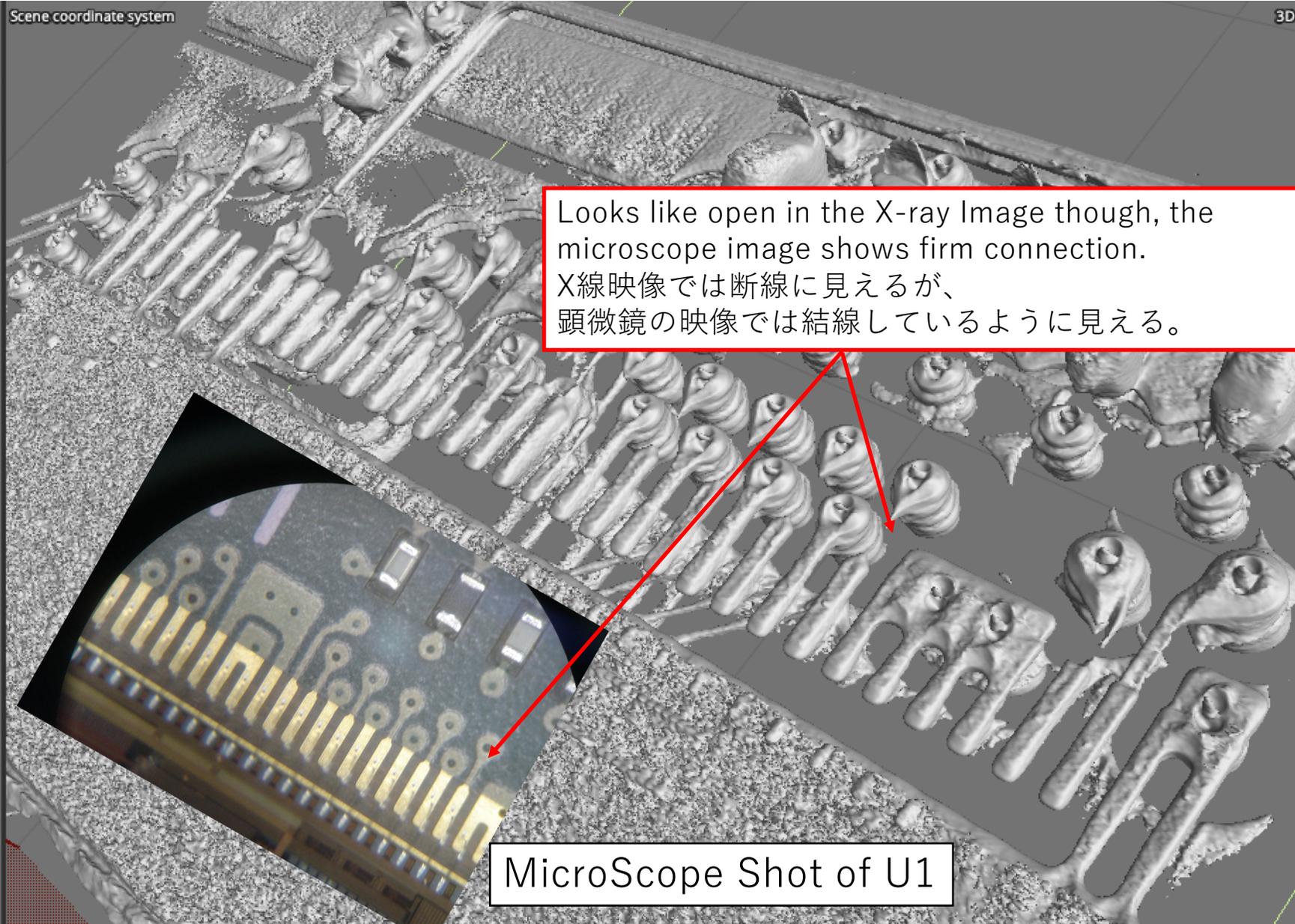


There are traces towards the bonding pad as if the path is torn off.



# Broken Spots

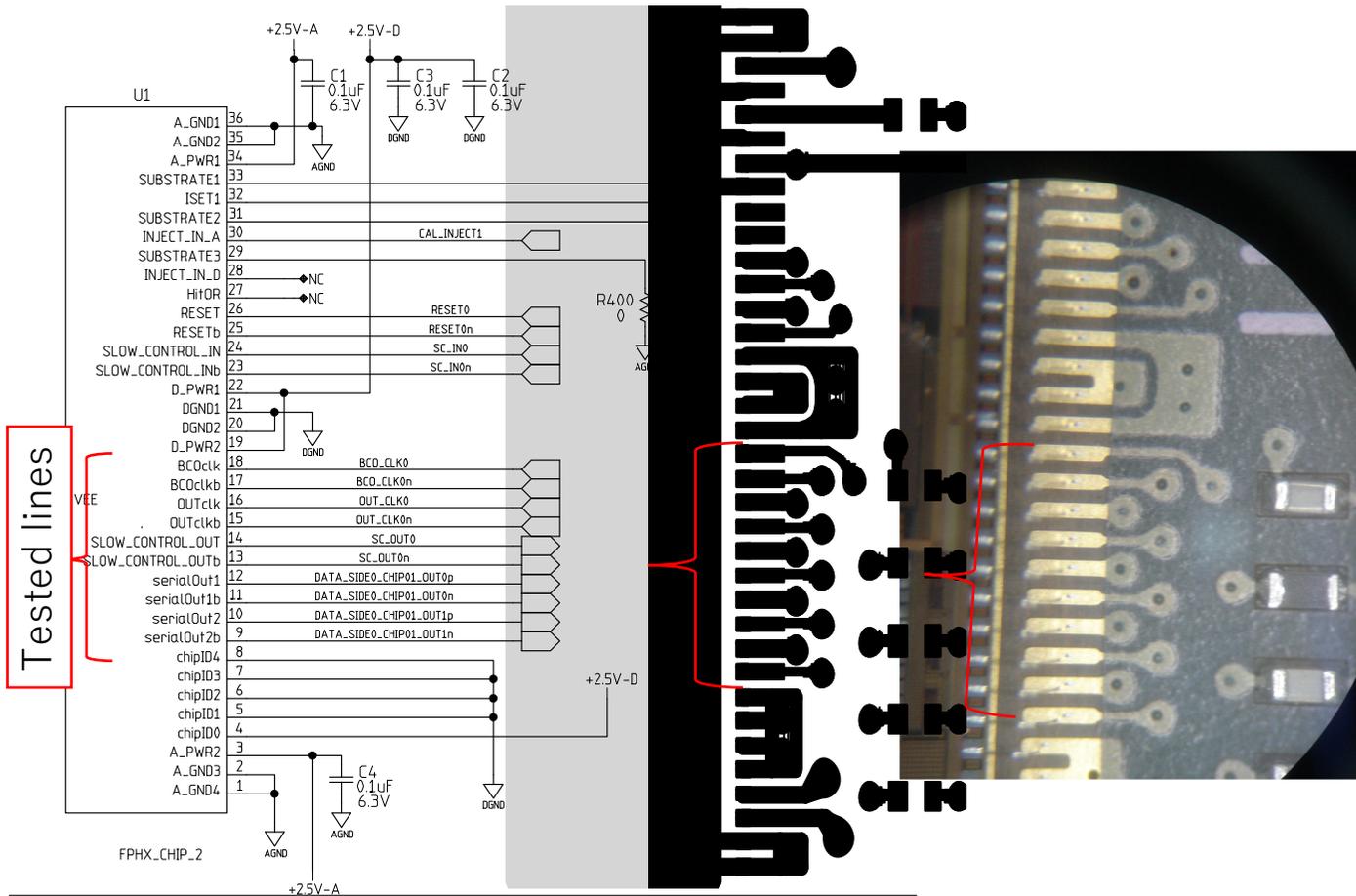




Looks like open in the X-ray Image though, the microscope image shows firm connection.  
X線映像では断線に見えるが、顕微鏡の映像では結線しているように見える。

MicroScope Shot of U1

# Conductivity Test

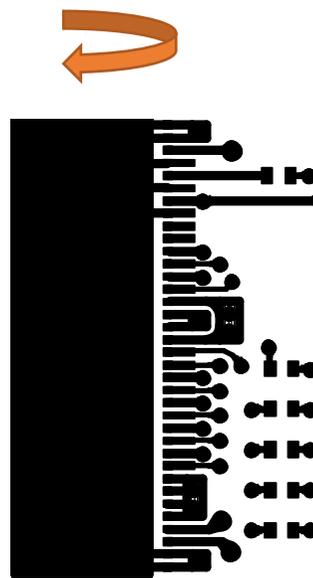


Only outclk line is open as measured in Taiwan

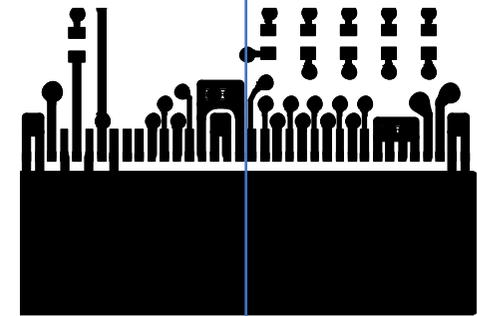
Channel	Xray	Micro-Scope	Voltmeter
BCOclk	○	○	○
BCOclkb	✗	○	○
OUTClk	○	○	✗
OUTClkb	✗	○	○
SC_OUT	○	○	○
SC_OUTb	✗	○	○
SerialOut1	○	○	○
SerialOut1b	✗	○	○
SerialOut2	○	○	○
SerialOut2b	✗	○	○

# Rotation of CT-Scanning

The reconstructed image can be different if we let the chip spin this orientation.



This is the orientation of the rotation



# Conclusion

- The conductivity of the X-ray image is not consistent with neither the micro-scope image of the front layer nor conductivity test with a multimeter.
- The cause is not known. The resolution  $\sim 10\mu\text{m}$  is unlikely cause because the line width of  $70\mu\text{m}$  should be sufficient.
- If we trust the microscope image and the multimeter measurements, then the candidate of the open line is at the thruhole and the crack is expected to be less than  $20\sim 30\mu\text{m}$ .
- We should move on to the destructive measurement to observe the crack as originally planned.
- Simultaneously, we'll take another X-ray CT-scan image for a production HDI before the assembly.