

2D/3D AOI Concepts and Possibilities



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GÖPEL electronic

Solutions quality assurance in electronic industry

- Inspection solutions
 - Automated Optical Inspection · AOI
 - Automated X-ray Inspection · AXI
 - Solder Paste Inspection · SPI
 - Industrial Vision Solutions · IBV
- Automotive Test Solutions
- Industrial Functional Test
- JTAG/Boundary Scan





2D Technologies







2D Technologies: Cameras





2D Technologies: Orthogonal inspection









2D Technologies: Angled view inspection







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2D Technologies: Illumination









Orthogonal and angled view inspection



Illumination module



Orthogonal and angled view inspection



2D Inspection methods

Orthogonal inspection







2D Inspection methods

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• Angled view inspection





2D Technology: Application examples



• Inspection of components and solder joints incl. OCR



2D Technologies



Pros

- Proven method
- Acceptable system costs

Cons

- Colour and optical appearance of components and solder joints have influence on failure detection and false call rate
- Inspection based on secondary characteristics (reflections)



3D Technologies













3D Technology: Triangulation

System concept

orthogonal camera



Projectors for structured light



3D Technology: Triangulation

Application examples



- Inspection of components and solder joints
- Different use of 3D technologies for the diverse system concepts



3D Technology: Triangulation

Pros

- Colour and optical appearance of components and solder joints have no influence on inspection
- Successful use for solder paste inspection

Cons

- Shadows and reflections caused by triangulation angle on certain components and solder joints possible
- No measurements on undercuts and in drill holes possible





🕯 Made in Germany

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System concept



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Application example: Measurement of press fit pins



Source: eve GmbH



Pros

- No shadows caused by tall components, measurement in drill holes possible
- Add-on module for existing systems

Cons

- Use for special applications (not for conventional SMD inspection)
- No inspection of the whole PCB possible









Example: Competitor 1

Orthogonal 3D AOI system camera with fringe projection, without angled view **Projectors** for structured light Illumination module

Example: Competitor 1

Pros

- Clear structure of camera module
- Optimized system for 3D measurement

Cons

• No angled view inspection







Example: Competitor 2

• 2D AOI system with angled view and integrated, orthogonal fringe projection



Example: Competitor 2

Pros

- Reduced number of system components (projectors)
- Angled view available

Cons

- Compromise concerning inspection angle and projection angle
- Reduced 3D data quality







Example: GÖPEL electronic

- 3D/2D AOI system with structured light projection and angled view
- 360 inspection and projection directions



Example: GÖPEL electronic

Pros

- Angled view available
- Optimized angle for projection and angled view
- Maximum failure detection because of
 3D measurement and angled view inspection
 in 360 directions

Cons

• ?



Application examples for 2D and 3D







Chip components



• Measurement of component position





Chip components



Measurement of height and co-planarity of component body ٠





Chip components



• Measurement of solder volume





Chip components



• Measurement of mensicus





IC components



Measurement of component position





IC components



• Measurement of height and co-planarity of component body



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IC components



• Measurement pin height (lifted lead)





IC components



• Measurement pin solder joint





IC components



• detection of short



PLCC: Inspection with **2D - orthogonal**





PLCC: Inspection with **3D**





PLCC: Inspection with **3D**





PLCC: Inspection with **3D**





PLCC: Inspection with **2D** – **angled view**













SMD connector: Inspection with **3D**







SMD connector: Inspection with **3D**





SMD connector: Inspection with $2D - angled view 0^{\circ}$







SMD connector: Inspection with **2D** – **angled view 90°**





SMD connector: Inspection with **2D** – **angled view 45°**





SMD connector: Inspection with **2D** – **angled view 20°**





Summary

- A combination of 2D inspection and 3D measurement is needed for maximum failure coverage.
- **3D technologies** minimize **influences caused by optical appearance** of components and solder joints
- **360 directions for inspection and projection** guarantee a higher failure detection on hidden solder joints and components







Thanks for your attention!

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