



High Speed Wire Bond Inspection

1 μm height resolution at scanning width of 35 mm

WHY IS OPTICAL INSPECTION OF WIRE BOND CRITICAL?

The reliability of an integrated circuit in a real application is dependent on the quality of its inter-connections and bonding, namely – wire and ball bonding. The wire bond inspection is a combination of mechanical, electrical and optical inspection. There are certain defects which cannot be identified during the mechanical and electrical inspections such as height of the wire, distances between wires, missing wires occurring during multiple bonding, over and under bonding. Apart from this, the contact methods for quality inspection lead to electrostatic/physical damage of the wires. A 2D and 3D optical inspection not only provides reliable data of the wires but also inspects the solder quality and other components in the vicinity of the wires.

WHY A STEREO LINE SCAN APPROACH IS THE RIGHT APPROACH FOR WIRE BOND INSPECTION?

Manual inspection is quite evident in the wire bond industry. Some manufacturers use visual microscopes for 2D quality inspection along with X-ray sensors or laser projection methods for 3D inspection. A stereoscopic technology views the wire bond from different angles, providing a real 3D perspective. Furthermore, a line scan approach provides new opportunities for real inline inspection of wire bonds.

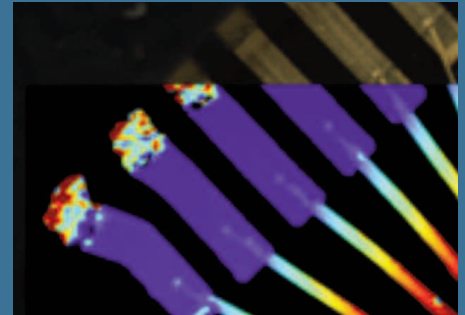
HIGHLIGHTS FROM CHROMASENS

Resolution: The 3DPIXA with an optical resolution of 5 μm in two dimensional colour imaging provides three dimensional height resolution of up to 1 μm . The high resolution being a pre-requisite for wire bonds of 1 mil, Chromasens also provides a range of cameras optimized for wire bond inspection of wires with higher thicknesses. Wire of thickness lower than 1 mil can also be tested.

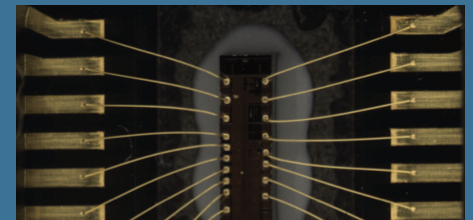
Lighting: The lighting for 3D wire bond inspection is critical due to the shape and geometry of the wires. 2D image provides a top-view of the wires which is not enough for extracting 3D data from the wire. Special lighting from Chromasens GmbH helps to achieve better 3D results.

Algorithms: Viewing the wire from different angles also leads to a parallax error. The specially designed high speed 3D algorithms form a good basis for identifying the wires within the stereo images. This results in a good correlation, required for calculating the height of wire bonds.

3D - 1 μm height resolution
2D - 5 μm optical resolution



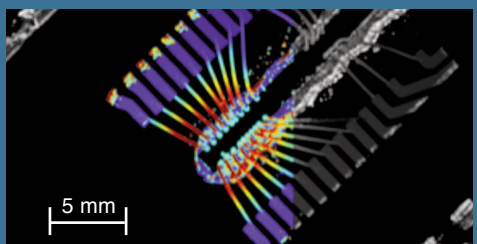
Pseudo-color representation of height map



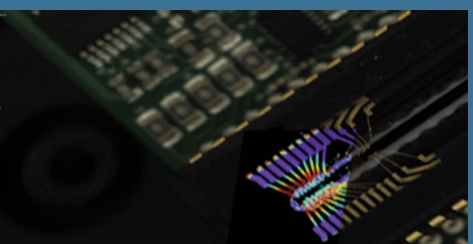
High resolution 2D image



3D point cloud of wire bonds



Grey scale images representing the height information



3D point cloud representation depicting selected regions in pseudo-color

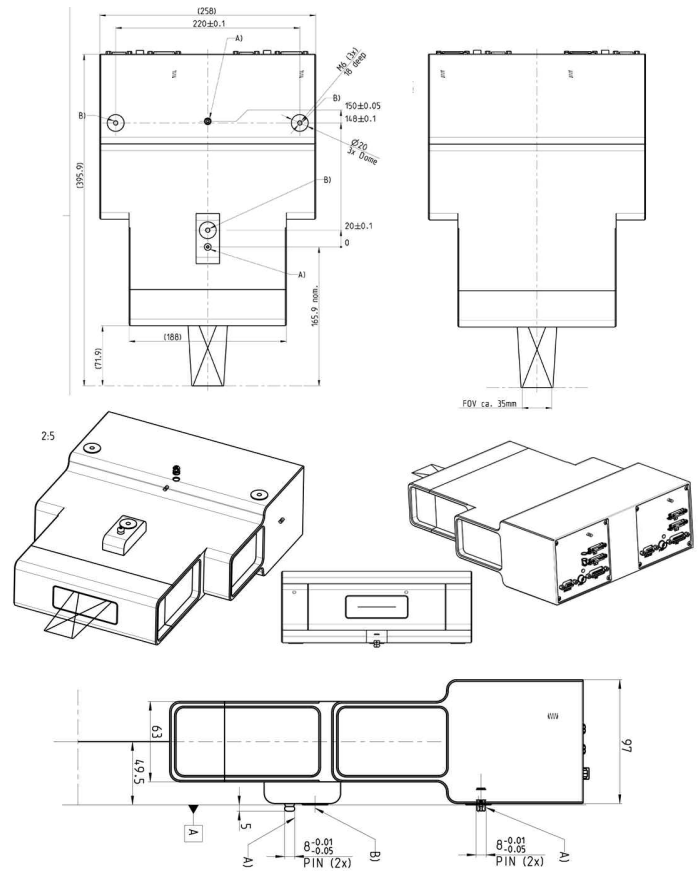
3DPIXA Stereo Line Scan Camera

PRECISION IN HIGH-RESOLUTION 3D AND COLOR

DIMENSIONS (IN MM)
OF 5 μm "D" DUAL VERSION

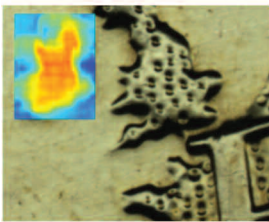
CAMERA SPECIFICATIONS

Camera	Stereo camera with lens factory calibrated
Sensor	Tri-linear CCD scan line
Number of pixels	max. 3500 (Compact) max. 7300 (Dual)
Active pixel size	10 μm x 10 μm
Line rate	up to 21,2 kHz for Compact up to 60 kHz for Dual
Interfaces	CameraLink Medium, Base Power supply External I/O RS 232
Software Chromasens 3D	API for calculating 3D data from stereo images on GPU Nvidia graphic boards
Software output	Height map 16 Bit Rectified color image 3x8 Bit 3D point cloud
Additional accessories	Corona II illumination
Supported software	LabView (National Instruments) Halcon (MVTec) MIL (Matrox)

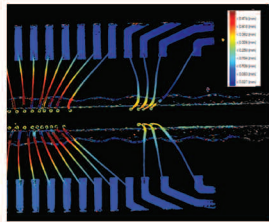


APPLICATIONS

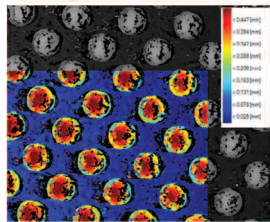
METAL SURFACES



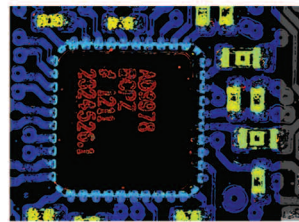
WIRE BONDS



BALL GRID ARRAY



PCB



3DPIXA CONFIGURATIONS

3DPIXA Model	Optical Resolution ($\mu\text{m}/\text{pixel}$)	FOV max (mm)	Height Resolution* (μm)	Typical Height Range* (mm)	Free Working Distance (mm)	Maximum Speed (m/s)
CP000470-						
C01-015-0040	15	40	3	2.5	99.6	0.31
C01-030-0105	30	105	6	10	173.6	0.63
D01-005-0035	5	35	1	0.7	71.9	0.1
D01-015-0105**	15	105	3	2.5	229	0.31
D01-030-0210	30	215	6	10	383.3	0.63
D01-070-0500	70	500	10	52	796.9	1.45

* height range and height resolution depend on object surface

** the model number for D01-015-0105 is CP000520

NOTE: Compact cameras are denoted with model numbers – C01. Dual cameras are denoted with model numbers – D01. Please take into consideration a tolerance of +/- 3 mm to the Free Working Distance mentioned above.