PCB Component Placement Inspection

Executive Summary

Optimet's ConoProbe Mark10 HD with a 50 mm focal length lens was used to inspect PCB component placement. The PCB board inspected contained both individual electronic components as well as microelectronic devices and components such as FPGAs, D/A converters, etc. The main goal of inspection relates to the height of the chip legs relative to the board surface. Optimet's collinearity feature, in contrast to triangulation technologies, allows measurements with high lateral resolution between the gaps of the Legs.

The chip features measured with repeatability better than 1 um were:

- Chip height above board surface
- Legs height above board surface
- Legs gap separation distance

All features measured at 9 kHz measurement rate.

1. Optimet's Advantages over Other Technologies:

1. Collinearity – permits a measurement between the legs in both axes. Sensors using triangulation techniques cannot measure between legs in both axes without rotating the board.
2. Both axis scans have similar performances due to circular sensor laser spot shape.
3. High lateral resolution
4. High sampling rate with no need for averaging

2. Application Description

Non-contact inspection of PCB component placement measurements using a two-axis scanner. The sensor (fig. 1) can also be integrated in vision inspection system.

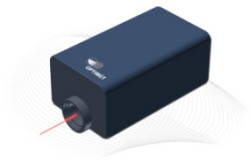


Figure 1-Conoprobe Sensor

2.1 Chip Characteristics / Features

The measured features of the chip marked in fig. 2 are:

- Chip leg heights above board surface
- Board surface height variation between legs
- Gap between chip legs
- Nominal dimensions and height of chip

Figure 2 - The measured chip

2.2 Method

Using Optimet's ConoProbe Mark10 HD with a 50 mm focal length lens (fig. 3), the interface between the chip and PCB can be measured and inspected.

Measurements Setup

Sensor Type:	ConoProbe Mark 10 HD
Lens focal length:	50 mm lens
Sample rate:	3 kHz (up to 9 kHz).
Laser power level:	45 (~0.6 mW).
Step along the line (X):	2 µm
Step between lines (Y):	2 µm
Room temp:	23°-24° C

Probe spec

Working range:	2 mm
Standoff:	40 mm
Precision:	2.5 um
Spot size:	15 um

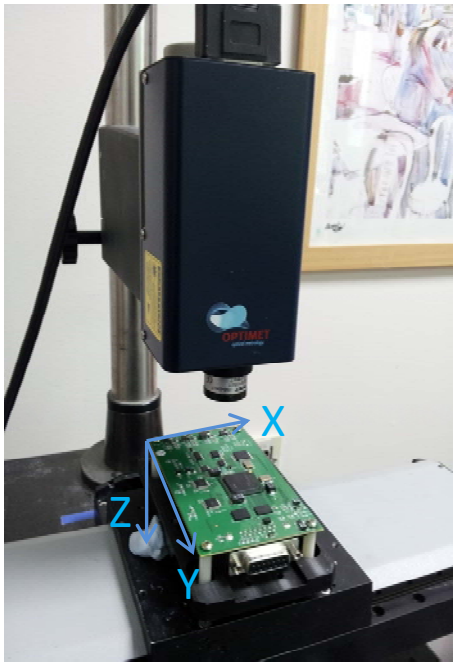


Figure 3 - Optimet's ConoProbe Mark10 HD

3. Results and Observations

Leg Height Measurements

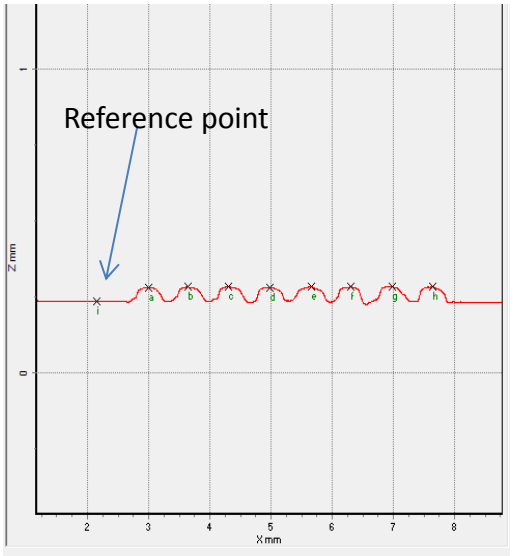


Figure 4 - MK 10 HD with a 50 mm lens

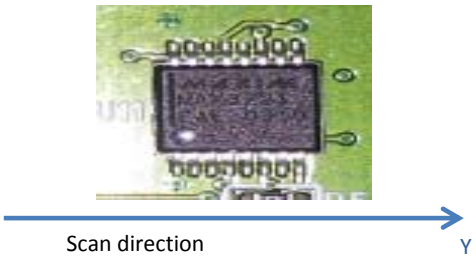
	leg height [mm]
	0.0455
	0.047
	0.0482
	0.0453
	0.0473
	0.0471
	0.0476
	0.0472
average	0.0469
std	0.00093

Under 1uM standard deviation in leg height

Table 1 - Chip leg heights

Explanation of fig. 5 and table 1:

In order to detect whether the chip was properly placed on the PCB, the leg heights above the board were measured. The point scan resulted in a standard deviation of under 1µm. This indicates that, the legs were properly placed.



Short Circuit Testing

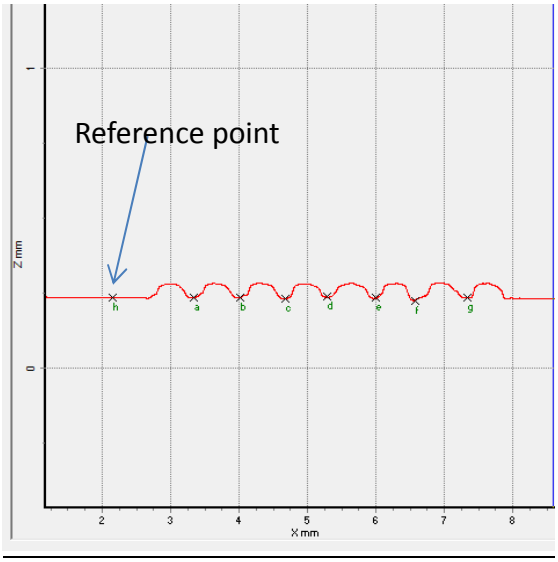


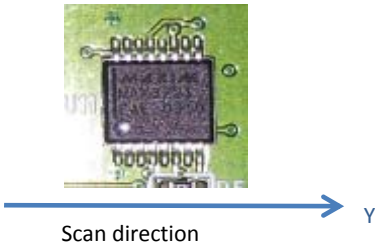
Figure 5 - MK 10 HD with 50

	Valley height [mm]
	0
	0.0012
	0.0027
	0.0035
	0.0007
	0.0084
	0.0019
average	0.002629
std	0.002599

Table 2 - Chip valley heights

Explanation of fig. 5 and table 2:

In order to detect board damages or short circuits between the legs at the board surface, the surfaces heights between the legs were measured. Due to the collinearity and lateral resolution of the sensor, measurements could be made all the way down to the board base surface and between the legs.



Chip Nominal Dimensions

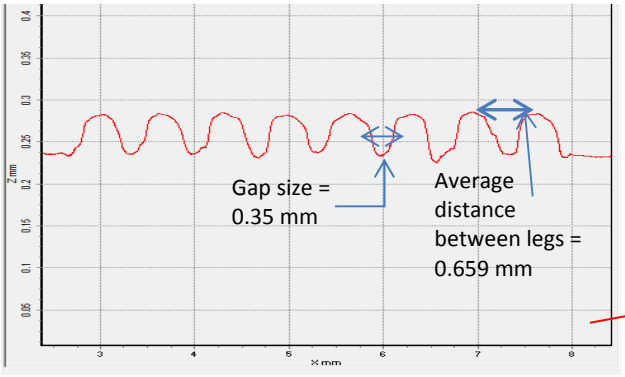
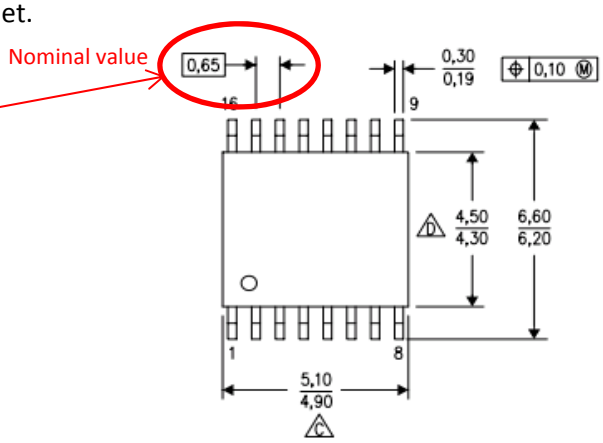
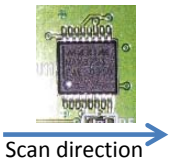


Figure 7- MK 10 HD with a 50 mm lens Y

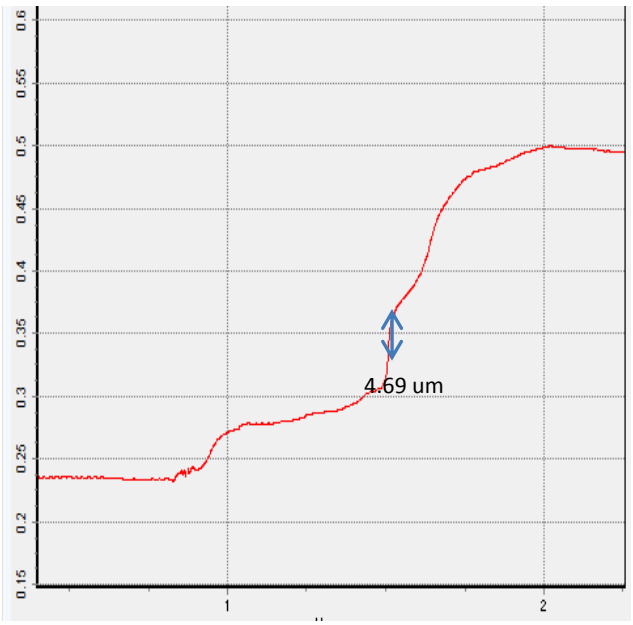
Here it can be seen that in addition to the placement inspection we can also measure the chip nominal dimensions after the placement and check that the chip was not damaged during the placement. In this case we can compare our results to the data provided in the chip datasheet.

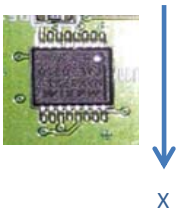




Single Leg Height

Scan of a single leg. The scan was performed along the leg, in order to indicate where on each leg the previous measurement was taken.





4. Data

Parameter	Value
Reflective/Diffusive/Transparent/Translucent	Diffusive
Working Range (mm)	2
Precision (µm)	2.5
Stand Off (mm)	40
Max. Data Rate (KHz)	9
Lateral Resolution	-
Z Resolution	-
Application Category	-