FLYING PROBE TESTING EMBRACES INDUSTRY 4.0

It is now three decades since Seica's Flying probe platform was introduced. Seica has fully embraced the concept of Industry 4.0 developing solutions now also promoted by Canavisia to monitor and collect information from machines and industrial plants.

This is to enable the optimisation of manufacturing processes as well as maintenance and energy management.

This article describes the development of the latest high resolution and high frequency solutions of our Seica's flying probe platform.

The traditional Seica V8 Next> Series flying prober has many features and test techniques required for the traditional original equipment manufacturer (OEM) and contract manufacturer (CM).

Features like in-circuit testing (ICT), AOI inspection, boundary scan, on-board-programming (OBP), LED testing and power up functional testing are a 'must have' for the traditional market.

Combining these features with a true doubled-sided and vertical board testing flying probe architecture, 100% of the standard OEM and CM market can capitalise on the standard features.

However a customer may be hard pressed and challenged to fully test one of their products, such as a probe card, interface card, or substrate without advanced features seen in one of Seica's latest innovations: the Pilot V8 XL (extra-large), Pilot V8 XL/HR (extra-large & high resolution) and the Pilot V8 HF Next> (high frequency).

Starting with the basics and the mechanical designs associated with probe cards and their construction, the very first constraint a user may notice is the size of the cards themselves.

Traditional flying probe test area sizes can be a limiting factor, so much so, the probe cards don't even fit in the test area.

To accommodate this market requirement, Seica developed a flying prober, named the Pilot V8 XL Next>, to accommodate boards with sizes up to 810 cm x 675 cm (31.88 x 26.5 inches).

Don't forget weight!

However, the area of the board may not be the only limiting factor, as board thickness and weight are also a concern. Board construction easily exceeds 50 layers in most cases, and the boards will not meet traditional thicknesses of 0.093-inch to 0.125-inch.

The Seica 'XL' structure can accommodate up to a standard of 7 mm0" (7 mm0.276") with options for even larger thickness.

Let's not forget about weight! One benefit of Seica's architecture is the vertical nature of mounting the unit under test. If this was a horizontal flying probe system and as the board size/span increases, the weight would increase in a corresponding fashion resulting in bow and deflection of the UUT.

The vertical architecture of the Pilot V8 Next> Series of testers reduces significantly the bow and deflection, allowing for faster speed and

FIGURE 1: ABOVE: THE PILOT V8-NX-HR

accuracy of the probing needles on the very small test points.

The vertical architecture does not require the use of bottom side flying probe supports, or expensive jigs and shuttles that ultimately could inhibit test area for bottom side testing. With the enhanced vertical clamping design, probe cards that exceed 15 pounds have been tested in this configuration.

Now that the basics of the mechanical architecture has been touched upon let's spend a moment on CAD data and software. As mentioned previously the physical size of these probe and interface cards are not only large in some cases but their CAD data and component counts can be extensive.

With very large CAD files and component counts exceeding 10,000 parts, the flying probe provider needs to have the latest personal computers and robust upfront easy to use CAD processing software.

When processing any probe card files, it is generally a necessity to have the latest personal computer hardware and software to even start the program generation which Seica has done.

Probe tips leave no marks

Seica focused its attention to the high resolution requirements to test standard probe cards and MLO (Multi-Layer Organic) probe cards after accomplishing the proper mechanical and software architecture.

The MLO is a special interface dedicated to contact and test silicon wafers and through the HR test on MLO with 2 HR probes, the 100% coverage is guaranteed. Seica introduced the Pilot V8 XL/HR, which is a solution that combines the demand for large test areas up to 800 cm x 650 cm (31.5 x 25.6 inches). and HR capabilities.

The 12.2 Mpx motorised camera focus with a lens resolution of 0.9 µm/pixel allows automating the autofocus procedure by learning from the software the heights of each component.

On TOP side, special probe tips of 15 µm leave no witness marks on the PCBs or scrub marks on the substrates.

Not only are these specialised tools being used to test probe cards, but also interposers and the very delicate and precise gold and precious metal regions on the most complex and expensive semiconductor boards.

With the architecture, software, and precision targeting system has been accomplished, Seica

moved in the direction of 'high frequency' testing and environmental product validation.

Eliminating oven and chamber costs

The company has developed unique probe pins that allowed testing up to 5.0 GHz. To target the IoT market, along with advances in cellular products, the new expanding infrastructure of the 5G market, and the almost unlimited demand and need for more cellular bandwidth, Seica developed the Pilot V8 HF Next> which has been deployed in locations worldwide.

This allows for a single investment in a Pilot V8 Next Series that can be fitted with proprietary HF probes, which allows our customers to do production testing, but also product validation. Product validation is to 'prove out' the capability of the OEM's end product before they initiate NPI or full scale production.

Along the same lines for product validation, Seica has integrated an environmental unit in the test area that floods the area and resulting unit under test with a temperature range from 0 – 70 degrees Celsius.

This can be very helpful in giving the OEM customer confidence that their product is meeting specifications using a very quick method to test and diagnose the product in environmental conditions without the big investment of ovens and chambers while simultaneously allowing for the test engineer to probe the board under the established environment.

For semiconductor probe cards and even backplane network boards, there has been the need to test them several times during the production process.

Failure analysis by the customers has determined that for critical signals and certain nets, board impedances have varied due to the inherent customer manufacturing processes.

As a result, customers want to exercise the UUT under certain environmental constraints to see if the signal integrity has been altered. In other scenarios, the customer would like to test the UUT in its bare board 'unloaded' component state, checking nets as well as opens and shorts, then send the board to the assembly phase where components are installed. Then return the UUT to the same test system and measures the same specified and critical signal nets for comparison from the previous step.

These techniques and processes are not 'standard', and in most cases, require unique probe pins for loaded board testing, pins for substrate and wafer probing, and software algorithms that have been specifically designed and innovated for these purposes.

FIGURE 2: BELOW: THE PILOT V8-NX-XL