Probe Station Basics

ADVANCED TECHNOLOGY FOR RESEARCH & INDUSTRY

KNOWLEDGE BASE FACT SHEET

- SCOPE: What is a Probe Station and how does it work?

The semiconductor probe station is a well-established tool for testing circuits and devices on silicon wafers, dies and open microchips – but what is it and how does it work?

Probe stations allow a user to position electrical, optical or RF probes onto a device and to then test the response of that device to an external stimulus (electrical, optical or RF). These tests can be simple such as continuity or isolation checks, or more sophisticated involving full functional tests of complex microcircuits.

A probe station can run tests on a full wafer or after it has been sawn up into individual die. Testing at a whole wafer level allows the manufacturer to test a device multiple times at different stages throughout the production process, and closely monitor fabrication to see if any defects are present. Testing on individual die prior to final packaging allows defective devices to be removed from circulation ensuring only functioning devices are packaged. Probe stations have much use throughout R&D, product development and failure analysis where engineers need a flexible yet precise tool to conduct a range of tests on different areas of a device.

What sets a good probe station apart and adds value to your testing, is its ability to precisely control where those probes are positioned on the device, how that external stimulus is applied and the environmental conditions that surround the device as the test takes place.

Basic Components

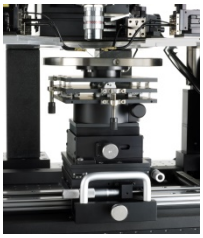
A probe station is comprised of six basic components:

- Chuck – a device for holding the wafer or die without damaging it.
- Stage – for positioning the chuck in X, Y, Z and Theta (θ).
- Manipulators – for positioning the probes on the device under test (DUT).
- Platen – for holding the manipulators and bringing the probes into contact with the device.
- Probe tips & arms – mounted onto the manipulator, they directly contact the device.
- Optics – for viewing and magnifying the device under test and probe tips.

Wafer chuck

Probe tips & arms

Manipulator



Stage & Platen

Optics

How does it work?

Probe stations hold a wafer or a die on a chuck mounted on a stage which allows the positioning of the DUT in the centre of the field of view of the microscope.

Manipulators are placed on the planar surface of the platen, and into the manipulators are inserted probe arms & tips. The probe tips must be suitable for the test programme to be carried out. The user then precisely positions the probe tips on the correct locations

within the device by adjusting the corresponding manipulator. The probes are then brought into contact with the wafer by lowering the platen; the device is now able to be tested.

For wafers with multiple devices, after the first device is tested the platen can be raised and the stage holding the wafer moved to the next device. The process of positioning the probe tips is repeated until all required devices have been tested. This process can all be done manually by an operator but if the stages and manipulators are motorised and the microscope connected to a computer vision system then the process can become semi-automatic or fully automatic. This can increase the productivity and throughput of the probe station and reduce the labour needed to run multiple tests.

Configuring your probe station

Moving on from these probe station basics there are a number of questions you should ask about your testing requirements that will allow you to specify the options you need for your probe station:

- What level of automation do you need?
- How will your test affect the probe tips selected?
- Do you need to control the temperature and local environment around your device?
- Will you need to stimulate optically or magnetically?
- What size features are you probing?
- How will you contact the device under test?