DATA SHEET

Manual, Semiautomatic, and Fully Automatic Die and Wafer Inspection

SemiProbe wafer inspection system (WIS) examines, locates and identifies defects created during wafer manufacturing, probing, bumping, dicing or general handling. This provides microelectronic device manufacturers with accurate, timely quality assurance and process information. The WIS has single sided and double sided wafer mapping capabilities and can improve efficiency, reduce manufacturing costs, increase yields and shorten time to market.

All WIS systems are designed based on SemiProbe's patented adaptive architecture. Unlike traditional inspection systems, all foundation modules – bases, stages, chucks, microscope mounts, microscope movements, optics, manipulators and more - are interchangeable, which makes the WIS the consummate solution for many different applications and budgets. This unique modular design enables customers to acquire inspection capabilities that precisely match their requirements.

More importantly, as the environment or inspection conditions change, the WIS can easily be field- upgraded to meet new demands. With this design philosophy, WIS customers have time and cost savings over traditional inspection systems because they do not need to invest in a new platform when wafer size, levels of automation, or inspection requirements change.

All SemiProbe semiautomatic and fully automatic systems operate on the powerful PILOT control software suite, designed employing the same adaptive architecture philosophy as the WIS hardware. PILOT is modular, intuitive and easy to learn. Additional control modules for added

INSPECTION ON:

- MEMS
- Optical Components
- Double sided devices
- Photovoltaics
- All Microelectronic devices
- Discretes

DEFECT INSPECTION FOR:

- Probe Mark
- Inking Verification
- Residual Films
- Through Silicon VIA
- Bump
- Passivation

- Saw
- Pattern
- Incomplete Etch
- Resist
- Large Scale Contamination
- Scratches, Cracks and Chips

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features and accessories can be implemented without changes to the core control software. Common functions such as 2 point alignment are wizard-based for easy operation - even for the occasional user. For setup or occasional users, the software can be bypassed and total control moved to a local joystick.

This powerful client/server-based software allows users to quickly and easily communicate with the inspection system. Full driver libraries are available for LabView, C++, and Visual Basic to accommodate manual or automatics inspection applications. Communications may be made using RS-232, GPIB or TCP/IP enabling the system to be either a controller or a slave in an integrated solution.

A complete line of accessories is available for WIS including inkers, CCTV systems and much more.

INSPECTION APPLICATIONS

The SemiProbe WIS macro defect inspection systems offer a range of options and capabilities for detecting process damage, contamination, or flaws in the circuit pattern. And the WIS is field upgradable to add new capabilities as your needs change, including next generation process requirements. Defect size to be detected is based upon the optical system selected. Some of the defects the WIS can identify include:

Probe Mark Defects: Failure of a device in test can be due to poor, nonexistent, or excessive probe contact. Missing or excessive probe contact can cause a bad die to pass or a good die to fail.

Inking Verification: While many process lines exclusively rely on wafer maps, others still ink bad die as insurance so they do not make it into the final packaging operation.

Physical Defects: Missing or damaged components can be easily identified prior to expensive secondary operations. These physical defects can be identified and classified visually or automatically using our pattern recognition program.

Backside Defect Inspection: With many devices, processing is currently being done on both sides of the wafer. The WIS is capable of backside inspection through stretch frame for singulated die on frame. On single sided product, backside inspection can help determine if damage has been caused by contamination or material handling. This is sometimes done prior to lithography to prevent focus or exposure problems and minimize stress points and hot spots that can precipitate wafer breakage and device failure.

Through-Silicon VIA (TSV) TSV: technology stacks two or more chips vertically. Vias through the silicon substrates replace edge wiring to create an electrical connection between the circuit elements on each chip. TSV dramatically increases the functionality of the device in a very small footprint and at a reduced cost. Inspection of the TSVs are critical for ensuring the performance of the 3D ICs and the profitability of the overall manufacturing process. A small 3% via failure across the entire wafer can potentially return a 0% yield. Because of the sheer number of vias and the potential for damage, physical testing is not appropriate. The WIS has unique capabilities for testing TSVs.

Bump Inspection: Prior to bonding, it is important for device manufacturers using advanced packaging technologies to ensure that all bumps are present and properly shaped, positioned and sized to meet planarity specifications.

Saw & Edge Inspection: Saw damage to devices and edge defects can be identified prior to expensive packaging operations using the WIS.

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WIS Manual Inspection with automated stage

The WIS offers 3 levels of system automation to meet your specific needs. The simplest system is the WIS manually loaded/semiautomatic run/manually inspected. The operator manually loads the devices for test and performs an alignment using the PILOT control software wizard. Wafer ID information is manually recorded in the system. The operator manually inspects the die for defects as the machine steps across a wafer map at programmable variable speed. When a defect is discovered, the operator stops scanning and indicates that the die is bad. Fault reasons may be recorded in the wafer map and a color assigned to each failure mode, providing an easy-to-view graphical representation of the results indicating the failure modes identified.

This WIS enables the operator to test wafers, diced die on stretch frame or singulated die in a waffle pack. It is ideally suited for double sided testing of singulated die on stretch frame. In this mode, the PILOT control software enables the operator to start with backside inspection. All defective die are marked on the wafer map. When the wafer is moved to the front side for inspection, identified bad die on the back are already indicated as bad die. If inking is being done, bad die indicated during backside inspection will be automatically inked as the system steps to that die on the front side inspection. Optical packages may be selected to provide the magnification and field of view required for the inspection.

WIS Semiautomatic (SA) inspection systems

Semiautomatic systems can be loaded with full wafers, diced wafers on stretch frame, fragments, or die in a waffle pack. With the SA version, the operator presses a start button and the system completes an automatic 2-point alignment, scans the wafer and generates a unique wafer map for that part. The specific coordinates of each die are recorded in the wafer map. The system then steps thru the wafer map inspecting each die using the pattern recognition system. The engineer doing the inspection setup tells the system what the die are supposed to look like and assigns a comparison percentage. Any nonconforming die are recorded on the wafer map. Inking can be done if desired.

Because of variances in the stretch frame film, automated systems are difficult to use doing back side inspection. The WIS is unique in its ability to test broken or partial wafers. With more devices being fabricated on thin wafers, the probability of wafer breakage increases. The operator can generate a unique map and inspect these broken fragments saving many of the devices on the broken wafer.

WIS Fully Automatic (FA) inspection systems

Fully Automatic systems must be configured either for wafers or stretch frame. However, stretch frames may be used for diced wafers, fragments, thinned wafers, or full wafers if they are first mounted onto stretch frame. Once initiated, the system loads the wafer or frame, completes a 2-point alignment, steps the wafer, inspects each die and bins them appropriately. When a wafer or frame is finished, it is returned to the cassette and the next wafer or frame is loaded without operator intervention.

This system is ideal for high volume high throughput operation. The test engineer is able to set the parameters for die binning as well as teach the system the image of the die to be tested. Communications with a test floor network will enable QC process managers to see real time results.

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OPTIONS & ACCESSORIES

Optics	Suitable for Stereo Zoom, Compound, A-Zoom or Zoom tube optical packages based upon the level of magnification and field of view required.
Vibration Isolation	Because inspection is often done at high magnification and because high speed operation generates vibration, a vibration isolation system is often required. Both tabletop and table vibration isolation are available.
Signal Tower	To indicate the status of the system, a signal tower can be installed. Software controls the parameters for light signal indications. In larger operations, it helps the floor manager at a glance see that all systems are in operation.
Software - SemiProbe PILOT WIS	SemiProbe PILOT WIS software is a graphic-based control system that uses wizards for initiating and controlling the inspection station while minimizing operator error and speeding time to data. The powerful PILOT wafer map program provides the ability to record device positional data, lot and wafer ID, pass/fail, failure mode and do so in a graphical presentation that can show an entire wafer or a small enlarged section. Wafer map data is easily exported to other equipment in a variety of formats.
Inking Option	The WIS uses Xandex industry standard inkers and cartridges. The inker control box is designed to control 2 inkers so that the system can ink a predetermined number of die behind while traveling in either direction.

UNIQUE SEMIPROBE CAPABILITIES

Probe & Inspect with the same system

Because the WIS series is based on the Probe System for Life(PS4L) patented adaptive, modular architecture, it is easy to add modules that allow simultaneous probing and inspection capabilities with a single system.

What is the difference between a Probe Station and a Wafer Inspection Station?

While there are many similarities and common components, the probe station has additional capabilities not needed on the inspection station. The biggest difference - Inspection stations do not have Z stages. Z movement is not required because the inspection process doesn't contact and break contact with probes. Platens for manipulators are also not required so a much simpler platen for inkers is utilized.

Remote Inspection

Today, many semiconductor companies have separate manufacturing and test facilities or partners in remote locations. The PILOT WIS software, configured with the integral TCP/IP network interface, can provide accurate, timely virtual inspection. The WIS will scan a wafer, recording pictures of every die. The pictures can then be sent to another location where they can be loaded along with a map of the wafer, inspected and binned accordingly. The maps are then returned to the production site where the wafers can then be inked based on the binned wafer map. This capability eliminates the need to send wafers and inspection equipment to a remote location while facilitating the use of offsite labor for inspection, resulting in substantial time, scheduling and cost savings.

276 E. Allen Street, Winooski, VT 05404
P: 802-860-7000
F: 802-419-3149
info@semiprobe.com
www.semiprobe.com

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