

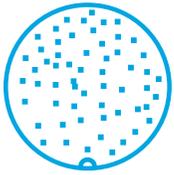
Surfscan® SP3/Ax

Unpatterned Wafer Inspection Systems



The Surfscan SP3/Ax unpatterned wafer inspection systems offer a wide choice of options to 150mm, 200mm and 300mm IC fabs manufacturing ICs at design nodes from 500nm to 2Xnm. With sensitivity enabled by a deep ultra-violet (DUV) laser source and high throughput, the Surfscan SP3/Ax system detect a wide range of critical defects and surface quality issues at a low cost of ownership, helping fabs improve chip reliability and achieve high yield. Built on the industry-proven Surfscan platform the Surfscan SP3/Ax inspectors offer production-proven performance and are easy to service, maintain and upgrade as a fab's inspection requirements evolve.

The Surfscan SP3/Ax systems incorporate several capabilities that enhance a fab's productivity and performance for the full range of 500nm and smaller design node devices. These include robust haze tolerance to extend the lifetime of test wafers, integrated SURFmonitor™ for characterizing and measuring wafer surface quality, and connectivity to SurfServer™ for centralized recipe management and health monitoring of the tool fleet.



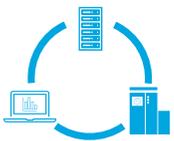
Defect Sensitivity

- Powerful DUV source, DUV-optimized optics and advanced algorithms deliver sensitivity to sub-40nm defects, including latent defects that can impact IC reliability
- Optional brightfield inspection channel detects large substrate defects, such as epi stacking faults, air pockets, and other critical defects of interest (DOIs)
- Standard darkfield and optional brightfield inspection modes run concurrently, enabling capture and classification of a wide range of yield-critical and latent defect types in a single test



Signature Detection

- Automated defect signature detection and classification drives faster identification and sourcing of defect root causes
- Integrated SURFmonitor enables process optimization and process tool qualification through the characterization of surface quality, measurement of surface roughness, and capture of ultra-fine slip lines and scratches



Production Integration

- Matching and correlation among Surfscan SP1, SP2, SP3, SP A2 and SP A3 models enhances fleet flexibility allowing fabs to mix-and-match tools based on their unique sensitivity requirements
- Surfscan SPA3 is field upgradeable to Surfscan SP3 delivering 26nm sensitivity and advanced inspection features, ensuring protecting a fab's capital investment
- Flexible configurations support the specific performance requirements of different end-users
- Compatible with SurfServer for efficient fleet and recipe management



Productivity

- Advanced stage, image computer and optics produce >100wph throughput for high sampling coverage, fast defect sourcing and effective wafer dispositioning
- Robust haze tolerance reduces test wafer cost by extending test wafer life without sacrificing performance

Automotive IC Manufacturing

Semiconductors are at the core of innovation in today's automobiles. Many mission-critical vehicle functions – including basic operation, efficiency, safety, advanced driver assistance, infotainment, and autonomous driving – are controlled and monitored by numerous automotive chips. With thousands of ICs in a modern car, chip reliability has become the top quality concern for automakers. IC manufacturers are aggressively pursuing new strategies to improve chip reliability for the automotive industry.

Chip reliability is highly correlated to random defectivity during the IC manufacturing process. This has led the automotive supply chain to pursue a Zero Defect strategy for automotive ICs. Latent defects (defects that impact chip reliability) must be found in the fab where the cost of discovery and mitigation is the lowest. The best way to reduce latent (reliability) defects is to reduce the fab's overall defectivity levels. In mature fab processes, most defects are random, contributed by process tools. A methodical defect reduction program finds and addresses defect sources, helping fabs make progress towards automotive manufacturer's Zero Defect IC requirements.

The Surfscan SP3/Ax unpatterned wafer inspection systems provide options that are critical to an automotive fab's defect reduction strategy, supporting tool monitoring applications that are the established best practice for isolating the source of random defectivity contributed by a fab's process tools. With high sensitivity and integrated automatic latent defect binning, the Surfscan SP3/Ax systems can detect, monitor and control the smallest latent defects that might otherwise escape the fab causing potential latent failures. With throughput >100wph, the Surfscan SP3/Ax range provides the inspection capacity needed for fabs to implement tool monitoring strategies that identify defect issues in the fab, well before the chips enter the automotive supply stream.

The Surfscan SP3/Ax range supports several defect reduction strategies that fabs implement in order to meet automotive manufacturers' reliability requirements:



Continuous Improvement Program (CIP)

A continuous improvement program (CIP) leverages tool monitoring / tool qualification applications to identify specific process tools causing defects. A bare wafer is inspected by the Surfscan SP3/Ax, run through a specific process tool (or chamber), then inspected again to reveal any defects added by the process tool. This strategy allows fabs to identify and address the sources of random defectivity contributed by each process tool. With a tool monitoring CIP in place, automotive fabs can set objective targets for reducing the process defects that affect reliability.



Golden Tool Work Flow

With a Golden Tool Work Flow or Automotive Work Flow (AWF), the wafers for automotive ICs only go through the best process tools in the fab. Surfscan SP3/Ax tool monitoring inspections are leveraged to determine the best process tools, and then to monitor the process tools to ensure consistent performance. By restricting AWF to the best process tools, fabs reduce the random defectivity related to reliability issues.



Dog Tool Programs

A Dog Tool Program proactively addresses the worst process tool – the dog tool – at any given process step. By methodically improving the dog tool at each process step until all tools meet a minimum standard, fabs can quickly reduce random defectivity. An effective Dog Tool Program requires a tool monitoring strategy using the Surfscan SP3/Ax to qualify each process tool at each step. The SURFmonitor module also helps identify dog tools by revealing subtle differences between process tools, or processing chambers. A Dog Tool Program increases yield and reliability, and ultimately improves an automotive fab's effective capacity and productivity.

Surfscan® SP3/Ax range

| Model | Design Node | Maximum Sensitivity | 150mm | 200mm | 300mm | SURFmonitor™ | SurfServer™ | Advanced Algos |
|----------------|--------------|---------------------|-------|-------|-------|--------------|-------------|----------------|
| Surfscan SP A2 | 6Xnm - 0.5µm | 26nm | ✓ | ✓ | — | ✓ | ✓ | ✓ |
| Surfscan SP A3 | 4Xnm - 0.5µm | 44nm | — | — | ✓ | ✓ | ✓ | ✓ |
| Surfscan SP3 | 2Xnm - 3Xnm | 23nm | — | — | ✓ | ✓ | ✓ | ✓ |



Applications



Research & Development

- Supports characterization and qualification of new processes during the development phase of IC, substrate and equipment manufacturing.
- With strong connectivity between the Surfscan SP3/Ax and KLA's eDR7xxx™ e-beam review system, development engineers have a robust solution for quickly finding, identifying and sourcing critical defects on new processes and materials.



Incoming /Outgoing Wafer Qualification

- The extended DUV sensitivity of the Surfscan SP3/Ax helps wafer manufactures to control the quality of their outgoing wafers while IC manufacturers ensure that incoming wafers meet their strict quality specifications.



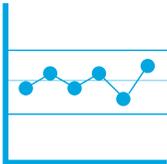
Process Tool Monitoring

- The Surfscan SP3/Ax range is used for process qualification and tool monitoring leveraging its DUV sensitivity to capture tiny blanket film defects at production speeds. This allows IC fab engineers to monitor process tools for defects that may be introduced during film deposition or CMP.
- Automatic binning of smaller defects into a latent reliability defect category, which allows fabs to separately track defects related to reliability, providing improved data for continuous process improvement programs.



Product Wafer Monitoring

- Detection of defects on deposited films on product wafers before patterning begins.
- High throughput and low cost of ownership supports the high sampling needed in automotive screening applications.



Process Uniformity Monitor

- The full-wafer, high-resolution SURFimage™ represents the variations of the wafer surface characteristics in response to changes in process chemistries or parameters, enabling process optimization and production monitoring. The images may reveal subtle differences between process tools, or processing chambers, that can help troubleshoot dog versus golden tools.

Surfscan® Platform

The industry-leading Surfscan® family of unpatterned wafer inspection systems identify defects and surface quality issues that affect the performance and reliability of semiconductor devices. Surfscan systems support 150mm, 200mm and 300mm IC, OEM, materials and substrate manufacturing for both leading-edge and larger design nodes.

Using a DUV laser source with peak power control, a novel optical architecture, a range of spot sizes and advanced algorithms, the Surfscan family delivers ultimate sensitivity to critical defects and enhanced defect classification at high throughput for bare wafers, smooth and rough films, and fragile resists and litho stacks. Surfscan tools also integrate a high resolution SURFmonitor™ module that characterizes surface quality and detects subtle defects, helping qualify processes and tools.



IC Manufacturing

- Qualification of incoming substrates
- Qualification and monitoring of materials, processes and process tools

Substrate Manufacturing

- Process development and production monitoring of advanced substrates, including prime silicon, epitaxial and SOI wafers
- Final quality control check

Equipment and Materials Manufacturing

- Process development
- Process tool qualification

KLA SUPPORT

Maintaining system productivity is an integral part of KLA's yield optimization solution. Efforts in this area include system maintenance, global supply chain management, cost reduction and obsolescence mitigation, system relocation, performance and productivity enhancements, and certified tool resale.

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KLA Corporation
 One Technology Drive
 Milpitas, CA 95035
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Printed in the USA
 Rev 1_6-8-2021