Non-Destructive TSV Inspection System SP8000S

SPIROX LTS®

Spirox Laser Tomography Scan

Non-Destructive: A powerful alternative to SEM for TSV defect inspection measures TSV depth and diameter per via, with fast zone-based IPQC for quantified wafer-level data.

- Exclusive optical scanning technology with patented non-destructive defect inspection enables real-time analysis without making physical cross sections.
- AI-assisted precision inspection of TSV side walls ensures accurate defect detection, supporting both blind and through vias.
- Individual via TSV depth and diameter measurement, combined with fast zone-based IPQC sampling, delivers rapid, quantified wafer-level insight for confident die qualification and classification.

Features

- **TSV Inner Wall Defect Inspection:** Defects like striations, scallops, and cracks can damage the insulation layer and cause leakage currents.
- **Defect Data Collection and AI Database:** Systematically collect and organize defect datasets; leverage AI to build an intelligent database that enables quantitative analysis, optimizes process parameters, and improves yield and manufacturing efficiency.
- **From Individual TSV Geometry to Full-Wafer Statistics:** Fast IPQC sampling enables data-driven die qualification.

Advantages

- **Non-Destructive Inspection:** Non-linear optical inspection and patented SpiroxLTS® technology enables precise, quantitative defect evaluation without sample destruction.
- **Quick Sample Inspection:** SP8000S offers a faster and more efficient inspection process compared to traditional cross-sectional scanning electron microscopy (SEM).
- **Per-Via TSV Measurement & Fast IPQC:** Delivers rapid, quantified wafer-level insights by measuring individual TSV depth and diameter, while enabling zone-based IPQC sampling for efficient die qualification and classification.

Benefits

- **Improving Efficiency and Yield:** Online automated inspection with big data collection reduces SEM sampling, accelerates process optimization, and significantly improves product quality and yield.

• Multi-Mode Automatic Inspection with Flexibility

- ROI (Region of Interest) inspection modes
- Script scanning workflow
- Coordinate-based inspection mode
- Random inspection mode

• AI-Assisted Detection for TSV Defect Identification

• Intuitive User Interface

• Automated Loading and Unloading

3D Imaging Comparison of TSV Quality

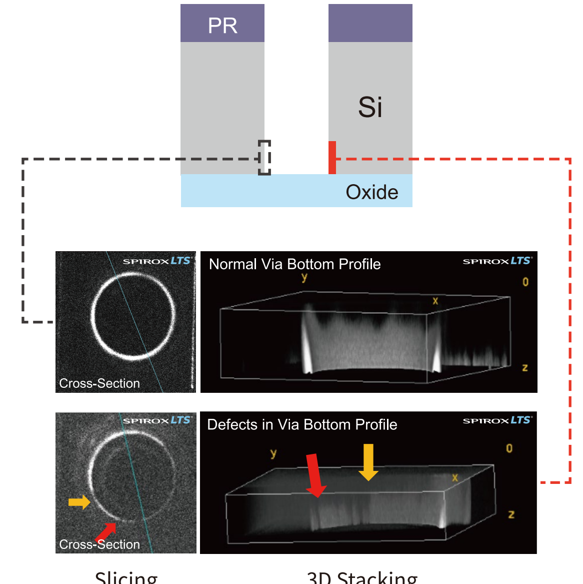
Hole Diameter	Normal	Abnormal
Via Top		
Via Bottom		

- **Reducing Production Costs:** Reducing defect rates and rework times, thus lowering material waste and production costs.
- **Enhancing Process Optimization:** Using AI analysis to continuously optimize processes, improving stability and performance.
- **Increasing Market Competitiveness:** Enhancing product reliability and consistency, attracting more customers and collaboration opportunities.
- **Data-Driven Decision Making:** Providing precise data analysis to optimize process parameters, enabling quick response to market changes and customer demands.

Capturing TSV Striation Cross-Section and 3D Imaging

PR Top
Si Top
Si Bottom
PR
Si
Oxide
3D Stacking

Bottom TSV Striation Cross-Section & 3D Imaging



Specification

Model Number	SP8000S	Applicable Sample Size	12"/ 8" Wafers
Model Name	Non-Destructive TSV Inspection System	Load / Unload	Automated Loading and Unloading
Key Optical Technology	SpiroxLTS® Nonlinear Optical Inspection	Objective Magnification	20x / 40x

Application & Inspection Items

Non-Destructive TSV In-Line Inspection System (IPQC)

Designed for non-destructive quality inspection of TSV structures on function wafers. It is applied for sampling inspection during the mass production stage to monitor process stability in real time, improving overall yield and efficiency. The system features real-time inspection of via wall defects and detection of TSV bottom oxide residue.

- **Fast Measurement of TSV Full-Wafer Depth Uniformity (AWU) (+Opt.001 or 002)**
  FOV Multi-via Depth Measurement: Unaffected by surrounding metal layers and routing; utilizes pattern-based zone sampling; independent of sidewall profile and bottom flatness.
- **Inline TSV Inner Wall Defect Inspection**
  Detect abnormalities along the via wall, such as sidewall erosion, recesses, cracks, spikes, or striations, enabling early identification of defect trends to prevent downstream process issues.
- **TSV Bottom Residue Inspection (Function Wafer)**
  Designed for the metallization stage, this function detects oxide or other residues at the via bottom, helping ensure plating uniformity, bonding quality, and preventing open circuits or high resistance.

Stability Verification for TSV Etching Equipment

Designed to verify the stability of TSV etching equipment, enabling non-destructive measurement of TSV depth and real-time inspection of via wall defects.

- **Non-Destructive TSV Depth Measurement (+Opt.001 or 002)**
  Accurately measures TSV depth on non-metalized structures through high-speed scanning to evaluate etching rates.
- **Real-Time TSV Inner Wall Inspection (+Opt.001 or 002)**
  Detect via wall defects such as sidewall erosion, recesses, cracks, spikes, or striations.

FOV/Measurement Time	Point Scanning: FOV 400 μm x 400 μm ; 3.5 seconds / frame ; 100 frames ≒ 6 minutes		
Measurement Mode	Micro-area imaging, zone-based automatic measurement, and coordinate-based measurement; user-defined scanning sequences are also available.		
Measurement Resolution	Image Minimum Resolution 0.5 μm	Motion Resolution	X-Y axis Motion Resolution 0.1 μm Z axis Motion Resolution 0.1 μm
Air Supply	■ CDA (FAC→System) ; 0.6-0.7 Mpa ; Pipe Diameter Φ 6 mm ■ CDA (FAC→System) ; 0.6-0.7 Mpa ; Pipe Diameter Φ 8 mm		
Electrical Specification	220V 60Hz AC 3500W		
Dimensions/Weight	Length 2.795 m x Width 1.830 m x Height 1.900 m Weight 2750 kg		
Options	■ Opt. 001: Transmissive Single Optical Path ■ Opt. NLR: Remove Automatic Loader/Unloader	■ Opt. 002: Transmissive Dual Optical Path	

Inspection Image

TSV Sidewall Inspection

No Defect (Clear and Smooth Image)

With Defect (Discontinuous Image)

TSV Bottom Oxide Residue Detection

Oxide Present

No Oxide Present

TSV Via Depth (CD=5 μm)
Measurement Example:
Statistical data of the 9 shots for the whole wafer

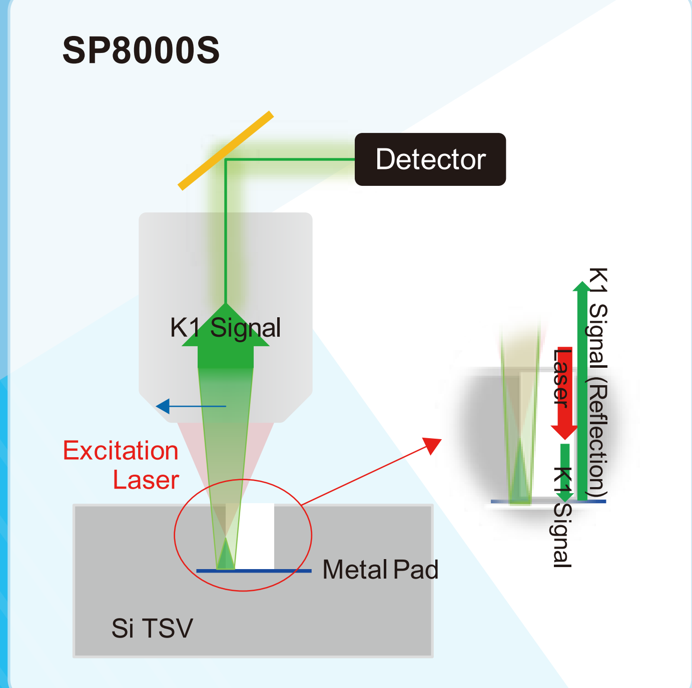
Total Statistics	
Avg.	12.77 μm
StDev.	0.61 μm
CV	4.81%
Max	14.63 μm
Min.	11.25 μm
Max - Min.	3.38 μm

Single-Via 3D Stacking

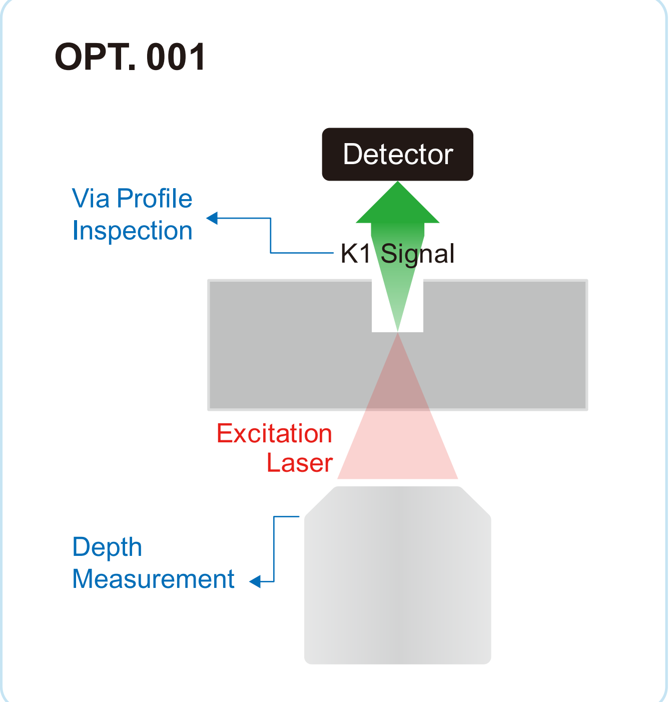
Multi-Via 3D Imaging

Optical Path Architecture

SP8000S



OPT. 001



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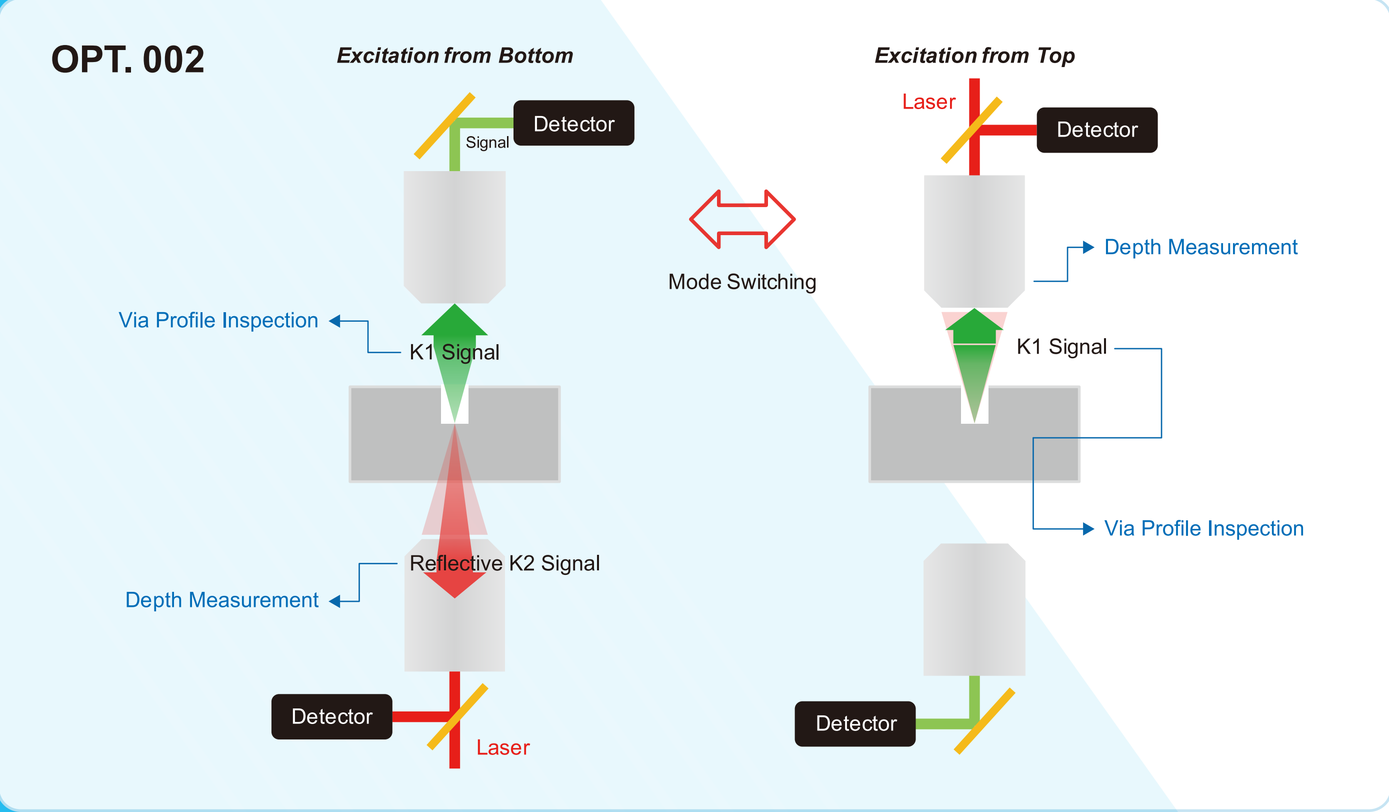

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