

Meridian WaferScan and WS-DP

Non-destructive Optical Fault Isolation

Full-wafer electrical fault localization for process control and design debug of advanced devices under production test conditions.

Overview

The Thermo Scientific™ Meridian™ WaferScan and WS-DP Systems are designed to perform backside Photon Emission and Laser Scanning Microscopy analysis on IC devices stimulated by static bias or dynamic ATE test conditions.

With time-to-yield being critical to profitability, it is too costly for device designers and manufacturers to wait until after dicing and packaging to identify the source of electrical faults. The Meridian WaferScan and WS-DP Systems enable faster defect localization by using production testers, load boards and probe cards to conduct Dynamic Optical Fault Isolation on wafers before dicing and packaging.

Meridian WaferScan and WS-DP Systems are used in semiconductor FA labs worldwide for:

- Identifying systematic process, design or integration issues.
- Isolating root cause of random electrical failures.
- Circuit timing analysis for speed path testing and design debug.

Key benefits

Best-in-class, high-sensitivity, low-noise, low-voltage Photon Emission detection with Broadband DBX or InGaAs camera systems

Multi-wavelength Laser Scanning Microscope for Scan Chain analysis, frequency mapping, transistor probing and isolation of faults

Patented, industry-proven, high-NA “Point & Click” Solid Immersion Lens (SIL)



Figure 1. Meridian WaferScan System (top); Meridian WS-DP System (bottom).

All diagnostic options from the Meridian Optical Fault Isolation (OFI) product line are available for the Meridian WaferScan and WS-DP Systems:

Optical Fault Isolation (OFI) analysis options on Meridian WaferScan and WS-DP Systems

Technique	Application Use Cases
Photon Emission PEM	Isolate transistor faults; leakage
Static Laser Stimulation OBIRCH	Identify physical defects such as metal shorts
Dynamic Laser Stimulation SDL / LADA	Locate parametric failures; Design and timing debug
Laser Voltage Imaging LVI	Transistor frequency mapping; Scan Chain debug
Laser Voltage Probing LVP	Transistor waveform generation and rise time measurement
Laser Voltage Tracer LVT	Asynchronous noise isolation
Solid Immersion Lens imaging SIL	High-resolution wafer Imaging and GDS / schematic overlay

Photon Emission

Photon Emission Microscopy (PEM) collects small amounts of light generated by IC device activity or certain electrical faults. Meridian WaferScan and WS-DP Systems offer a range of infrared detector systems capable of analyzing emissions across a broad spectrum of wavelengths and operating voltages, as well as a suite of software analysis tools, including centroid identification, background subtraction and multi-tile mosaic.

DBX Broadband Photon Emission option

- Ultimate sensitivity, low-noise broadband emission system for low-Vdd applications
- Five selectable filter positions per lens
- Thermal Emission selectivity and proprietary pulsing mode
- Liquid nitrogen cooling and autofill system; 77K operating temperature
- 1k x 1k detector array
- 18 um pixel pitch
- 16-bit electronics
- Patented noise reduction technology with light-blocking baffles
- Photon Emission detection at Vdd <0.4 V
- Illumination @ 1200 nm SLED for navigation

InGaAs Photon Emission options

- LN2-cooled 1k x 1k InGaAs
- LN2-cooled 640 x 640 InGaAs
- TEC-cooled 640 x 512 InGaAs
- All InGaAs systems are upgradable to DBX Broadband emission

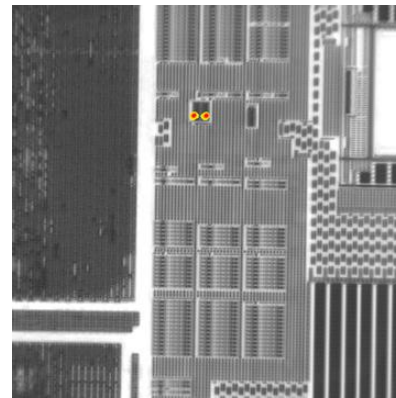


Figure 2. Photon Emission overlay onto optical image of device.

Laser Voltage Imaging and Probing

Meridian WaferScan and WS-DP Systems' LVx options cover a broad operating range to visualize transistor activity across a field-of-view in the frequency domain, quickly acquire functional waveforms and diagnose Scan Chain failures.

LVI/LVP specifications

- Wavelengths: 1320 nm and/or 1154 nm for full-thickness wafer samples
- Bandwidth ≤100 kHz – 9 GHz
- Low-Frequency, Standard and High-Bandwidth detector options

Phase LVI option

- Bandwidth ≤100 kHz - 600 MHz
- 15-degree phase angle resolution
- 16-color mapping

Laser Voltage Tracer (LVT) option

- Two gates: Signal and Baseline
- Maximum bandwidth: 450 MHz
- Minimum gate width: 555.5 ps
- Dwell time: 1/3 BW

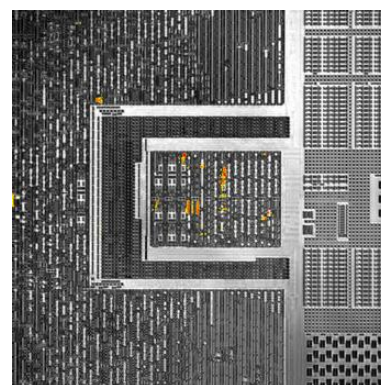


Figure 3. Laser Voltage Imaging maps device frequencies.

FDx Dynamic Laser Stimulation and Static Laser Stimulation (OBIRCH)

The Fault Diagnostic (FDx) module on Meridian WaferScan and WS-DP Systems provides a suite of techniques to isolate electrical, IDDQ and parametric failures in active areas as well as in device metallization.

SLS specifications

- 1320 nm and 1154 nm wavelength options
- Forced Voltage and Forced Current modes
- $\leq 1\%$ bias accuracy
- 3 pA detectability
- Active Probe noise reduction technology

DLS specifications

- 1320 nm and 1154 nm wavelength options, 1064 nm wavelength option for LADA
- Latch: 2ns
- Tester input: -5V to +5V
- Pass/Fail metering

Solid Immersion Lenses

Meridian WaferScan and WS-DP Systems incorporate state-of-the-art, high-Numerical Aperature (NA) optics compatible with full-thickness wafer samples to provide industry-leading resolution for imaging and analysis.

- ≤ 260 nm line/space resolution @ 1320 nm
- ≤ 240 nm line/space resolution @ 1154 nm
- ≤ 260 nm line/space resolution @ 1064 nm

Device Under Test (DUT)

- Compatible with a wide range of samples, including:
 - 300 mm wafer
 - 200 mm wafer
 - Wafer fragments
 - Wafer pieces
 - Singulated Die
 - Packaged Parts

ATE Tester Docking

The Meridian WaferScan and WS-DP Systems' docking architecture and customized interface isolate vibrational noise to enable high-speed dynamic testing using production test setups. A 1:1 signal connection from test head to probe maximizes test flexibility. The systems support vertical, round, DP (Direct Probe) and cantilevered probe card setups. Manual probing setups with micro-manipulators and an overhead microscope are also supported as an option.

- Compatible with all commercially available ATE testers, as well as customizable solutions
- 9.5", 12", 18" round probe cards
- Direct probe load boards
- 440 mm and 300 mm probe cards
- Probe arrays of <100 to >10,000 pins
- 20 lbs vacuum force for wafer stability
- Die-to-die stepping for good die/bad die analysis
- +/- 5 degrees of platen rotation
- 16 μ m platen theta resolution
- 1 μ m microscope stage accuracy in XYZ
- 5 μ m wafer stage accuracy in XY

