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Zeta-20

3D Optical Profiler



KLA-Tencor pioneered the science of multi -mode metrology, packing five powerful techniques into one compact opti cal package.

ZDot

KLA-Tencor's proprietary 3D imaging technology combines innovative optics with powerful software algorithms to produce great results on a variety of surfaces

ZX5 &ZX100

Vertical Scanning Interferometer optics enables wide-area measurements with a high Z resolution

ZIC



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> Convert any standard objective into a shearing interferometer to provide very high Z resolution images

ZFT

ZSI

reflectance measurements



Developed in 2007, the revolutionary Confocal Grid Structured Illumination (CGSI) is the powerful technology in all Zeta Optical Profilers ... but in a Zeta, it's called a ZDot[™].

Evolution of Confocal Optical profiling technology

1957 Principle of Confocal Microscopy Marvin Minsky

1978 Laser Scanning Process Thomas and Christoph Cremer

2007 - Present CGSI

James Xu and Ken Lee









Micro Lens

IC Structure

Gold Bump on IC

Crystalline Si for Solar Cells

Laser Ablation on Si with Film MEMS Device



Zeta's unique interference contrast technique provides enhanced & quantitative images of subnanometer-level roughness

Integrated broad-band reflectometer for thin film thickness and surface



Microfluidic Structure

Nitride-coated Si Pyramids

Hardware Options



Imaging Options

Image parameters such as field of view (FOV) and lateral resolution are determined by the combination of camera, coupler and objective choices. A variety of color and black & white cameras, designed specially for the Zeta system, are available; a popular option for research labs is the 2.8 MPix software programmable multi-resolution color CCD camera. Combined with an extensive suite of objectives and coupling lenses, the flexibility of configuring the Zeta optics means that the same tool can be used to image an FOV as small as 45x35µm all the way up to 9.5x7.5mm. Broadband white light or 405nm monochromati c high-brightness LED light sources are available. Surfaces can be imaged in brightfield, darkfield or differential image contrast modes. ZDot technology eliminates the need for expensive objecti ves by using standard objecti ves.



Transmitted Illumination

High-brightness LEDs are used to illuminate transparent samples for through transmissive imaging.

Advanced Hardware Options

The KLA-Tencor Optical Profi ers can be easily upgraded to meet your measurement requirements. Shown below are some applicati on-specifi c hardware confi gurati ons.



Comprehensive Set of Objectives

Standard, Long, Ultra-long, Immersion and Refractive Index Corrected

Stage & Sample Handling Options

The Zeta-20 can be equipped with a manual or a motorized XY stage. It can be configured to accept samples as large as 14"x7". Specialty stages include ti p-ti lt stages (coarse and fine adjustment) and motorized piezo Theta 360 degree stages. Chuck opti ons include manual rotary, tilt, vacuum, square and circular glass opti ons for transmitt ed illuminati on (backlight for transparent substrates), and special apparatus for wire, magneti c and solar applicati ons.





Microneedles for Drug Delivery Bump for WLCSP

2µm RDL for FOWLP

Laser-ablated thin film surface

SiC Wafer Edge Defect Profile

Feature on Currency Note





Diamond-Scribe

Precision diamond tipped scribe to mark features of interest for further analysis on AFM, SEM or other tools.



280mm Extended Z Range



Chamfer/Edge Inspection

PSS – Patterned Sapphire Substrate

VCSEL Device

Software Options



Simple Scan Setup

Fastest Time to Usable Data

Preparing samples and equipment for data acquisition should be fast. The ease of use and automation features of a Zeta3D[™] enables the user to have the fastest "time to usable data."

Image Acquisition Options include:

- Automatic illumination control
- Auto-focus
- Software-selectable field of view •
- Auto-sequence for multiple sites
- Time-delay acquisition •
- Multiple-layered acquisition (up to 8 layers)
- Wide-area stitching •
- Pattern recognition for automatic detection and scanning
- High dynamic range (HDR) for surfaces with high contrast variation
- User manager with password-protected recipe access





Automatic Optical Inspection (AOI)

Simple & Effective Analysis Report



Communicating Results

Advanced functionality allows for easy reporting – from exporting data to run in your favorite image processor, or simply taking a screenshot to drop into a presentation. Advanced options include:

- Custom report format
- Offline analysis license
- Additional analysis
- package ZMorf



Firing Pin Mark on a Casing

FOWLP Bump over Passivation RGB Pixels Inside a Smartphone

Patterned Sapphire Substrate

Contact Line on a Solar Cell

Laser Dicing on an LED Wafer

2D Infinite True Color View



Image Analysis Software Included, With Options

Zeta3D comes with a comprehensive software package, offering a complete suite of analysis functions and recipes. Some of the highlights are:

- Roughness analysis based
 - on ISO standards
- 2D and 3D roughness
- 2D and 3D step height analysis
- Single & multiple cross
 - section analysis
- Automatic feature detection
- CD measurement of detected features
- Bow and shape measurement
- Automated defect inspection (optional)
- Texture analysis (optional)
- Contact line analysis
- Film spectrometry (optional)

- Compatibility with thirdparty packages - MATLAB, SPIP



Deep Trench in PDMS

Isolation Trench on Solar Cell

Application Solutions

Zeta Instruments creates turnkey metrology solutions for a variety of applications. We combine multi-mode optics, advanced electronics and data analysis algorithms to create "one-button" production-ready packages.



High-Brightness LED (PSS)

Application Suite:

- Film Thickness
- CD Measurements
- Dry Etch PSS Height
- Wet Etch PSS Height • Defect Inspection
- Defect Review
- 3D Imaging of Defects



Wet Etch Flat-Top PSS



Dry Etch Large-Size PSS Cone





AOI Defect Inspection





Extreme OD (XOD)

Application Suite:

- Wafer Chamfer Shape
- Wafer Chamfer Roughness







Application Suite:

- Bare Wafer Texture
- Edge Inspection •
- Nitride Wafer Texture
- Film Thickness
- Contact Line Height •
- Edge Trench Depth



CMP Pad Conditioner

Asphalt Surface

Microfluidic Flow Separator Read/Write Head

Eye of a Fly

MEMS Device





- Side Wall Shape
- Top Edge Defect Mapping
- Side Wall Defect Mapping
- Defect Review
- 3D Imaging of Defects
- Diamond Scribe Marking

3D Profile Review







Performance

Z Resolution	0.1nm ¹
Z Repeatability (Step Height)	< 0.5% ²
Z Accuracy (Step Height)	< 0.75% ³
RMS Repeatability (Roughness)	0.05nm⁴

Objectives & Imaging

Objective Options	1.25X - 150X Normal Objectives
	Long Working Distance Objectives, Ultra Long Working Distance Objectives
	Through Transmissive Objectives, Liquid Immersion Objectives
	Vertical Scanning Interferometry Objectives
FOV	From 9µmx7µm up to 18mmx14mm (objective dependent)
Turret Options	From 1-position up to 6-position Manual
	6-position Automated
Camera	Color CCD camera, Software Controlled, Variable Image Size
	From 640x480 pixels up to 1920x1440 pixels (larger pixel formats also available for custom applications)
Total Magnification	5500 times optical/66000 times digital

Optics & Illumination

ZDot (Confocal Grid Structured Illumination), True Color, Standard
ZFT (Thin Film Spectrometer), Option
ZIC (Interference Contrast Imaging), Option
ZX5/100 (Vertical Scanning Interferometer), Option
ZSI (Shearing Interferometer), Option
Triple Optical Path for Multi-Mode Optics
Dual Ultra Bright LED, White, Standard
Dual Ultra Bright LED, Blue, Option
Bright Field, Standard
Polarized Light, Option
Through Transmissive (Bottom), Option
Dark Field, Option
Multiple Angle Side Illumination, Option

Scan Range & Speed

Z Scan Range	Up to 25mm in a single scan
Z Scan Speed	> 150µm/sec

1. As measured with the ZSI interferometer on a nominal 12nm VLSI step height standard.

2. As measuserd on a nominal 8um step height. Standard deviation of 10 repeated measurements.

3. As measured on a nominal 8um step height. Average of 10 repeated measurements.

4. As meassured with the ZSI interferometer on a nominal 5 angstrom roughness surface. Standard deviation of 10 repeated measurements.

Stage & Sample Dimensions

z Scan Stage	40mm Standard, Closed loop with optical feedback control, 13nm resolution
	240mm Extended Option, Closed loop with optical feedback control, 13 nm resolution
	200µm Ultra High Precision Piezo Stage Option, 0.1nm resolution
XY Stage Options	Manual XY Stage: Up to 175mm x 350mm
	Motorized XY Stage: Up to 180mm x 200mm
Tip/Tilt Options	Precision & Coarse Tip/Tilt stage options up to 20° of tilt
	"CM" Option for disk and wafer edge measurements
	"Swivel Head" Option for tilting optical head around large samples
Sample Chuck	360° rotary chuck with vacuum connection
	Glass chuck for through transmissive imaging (backlight)
	Custom chucks and fixtures for specific applications
Sample Weight	Up to 15Kg, depending on XY stage selected
	>15Kg Option available for specific applications
Sample Size	XY Size : Up to 350mm depending on XY Stage
	Z Size: 125mm, Standard; 350mm with Extended Z-Stage Option (Custom extended staging options available)

Data Acquisition & Display

	64-bit Windows 7
PC -	Multi-core Intel i7
	16GB RAM / 1 TB HDD
	3D Accelerator Card with 250MB VRAM
Display	270nm oxide film standard



Software Feature Set

Zeta3D	The comprehensive Zeta3Dsoftware package is a fully integrated data acquisition, analysis and reporting package. Step height, roughness, profile and area analysis based on ISO standards are all included in the Zeta3D software package.
Advanced Applications	CD - Critical Dimension, Feature detection, Multi-surface, Film thickness, HDR - high dynamic range, Bow/Warp Mapping, Wafer Edge Profile, AOI - Defect Inspection
External Applications & Controls	ZMorf, MATLAB, SPIP, TCP/IP, SECS/GEM
Automation Suite	Auto-illumination, Autofocus, Auto sequence, Auto deskew, Pattern recoginition, Auto-stitching

Calibration

Zeta Calibration Reference	Includes 4 reference step heights for Z Calibration: • Nominal 8, 25, 50 and 100 μm • Varying Pitch patterns for XY Calibration • Patterns for Optical Resolution Testing
Zeta Film Reference	270nm oxide film standard
NIST Traceable Standards	Application specific Step Height and Film Thickness standards

Vibration Isolation

Vibration Isolation	Vibration dampening feet included with system
	Optional active vibration isolation modules avaiable for high noise environments

Warranty

Comprehensive Warranty	1 year
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Capabilities of Zeta3D ${}^{\rm \scriptscriptstyle M}$ systems will depend on the configuration purchased.

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