GSI™

SigmaClean®300

WaferMark®

Product Overview

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TM

WaferMark® SigmaClean®

GSI invented wafer marking processes over 20 years ago.

Over 1000 wafer marking systems installed and in production

We continually innovate marking solutions for new substrate materials, larger wafer diameters, and factory automation.

Product Area	Market Share
WaferMark® – Silicon Supplier	90%
WaferMark® – Fabs	85%

Leadership position . . .

We are the premier supplier of wafer identification marking systems throughout the world.

Industry "Firsts"

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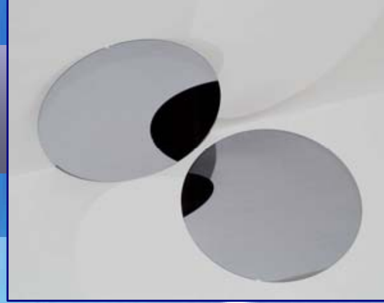
WaferMark® SigmaClean® 300

Wafer Identification Marking - Clean room environment



Application Focus:

- GSI proprietary, ultra-stable Sigma® 100 diode-pumped Nd:YLF Laser
- Patented SuperSoftMark® capability
- Standard spot size 50µm
- Flat field focusing optics
- Laser stabilization and closed-loop power control
- Data Logging Function stores laser performance

Standard Features - *Laser*

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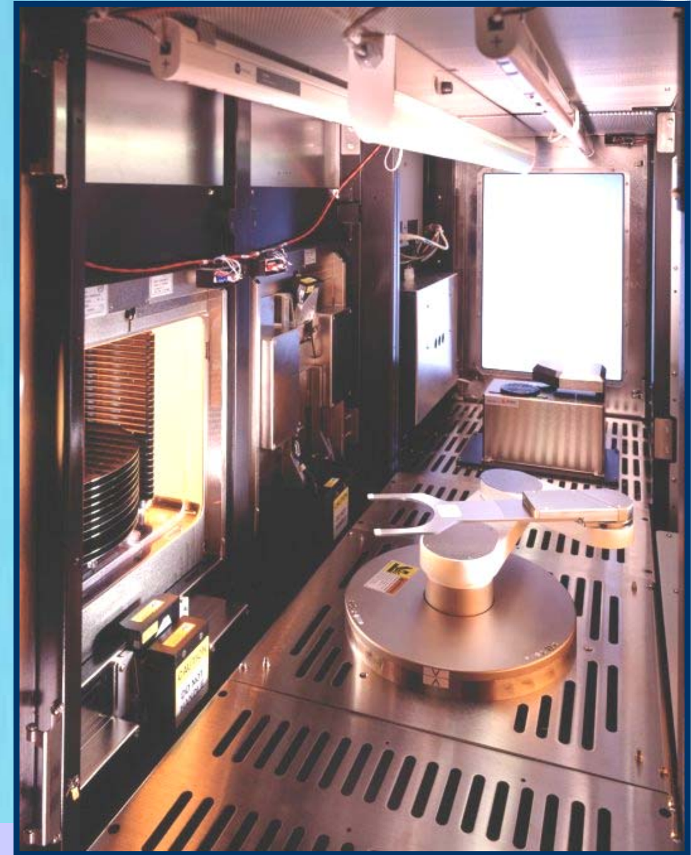
WaferMark® SigmaClean® 300

Wafer Identification Marking - Clean room environment

Standard Configuration:

- Windows XP Operating system
- 2 FOUP Load Ports
- System diagnostic indicators displayed on front panel
- Emergency stop buttons, system key switch and lock out
- Class I clean room compatible stainless steel enclosure
- ESD Ion Grid located inside work enclosure
- Single end effector vacuum robot
- Mark position accuracy of +/-125µm



System Features

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WaferMark® SigmaClean®300

Wafer Identification Marking - Clean room environment

Certified to Safety Guidelines

SEMI Safety Guidelines, S1-0701, S2-0200 and S8-1000

Center for Devices and Radiological Health (CDRH) Class I

European Radiation Safety of Laser Products, IEC 825

CE compliance configuration available

Integrated Light Tower w/Audio Alarm:

User programmable status indicator lights and alarm

Standard Features - *Safety*

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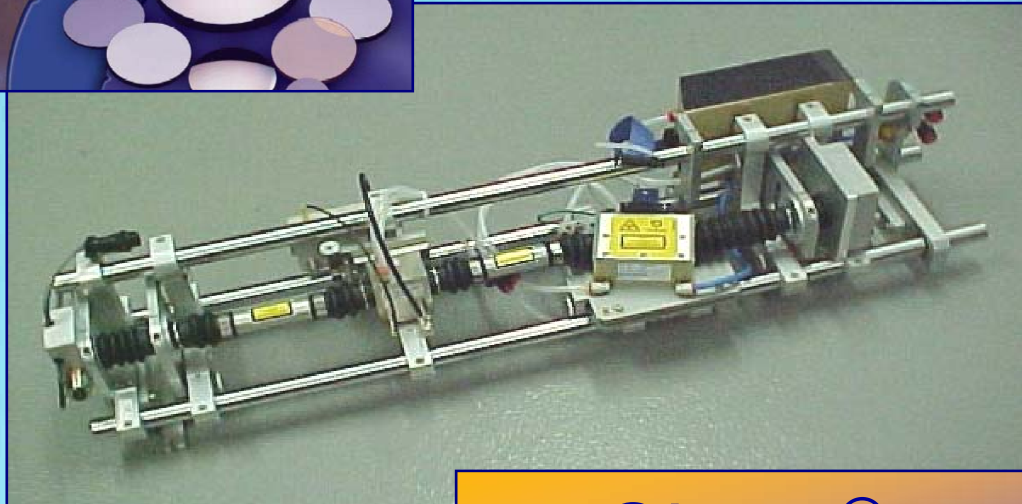

Sigma® 100 Series Lasers

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Sigma®100 Series Lasers

Introduced in 1996.

Designed and manufactured by GSIG specifically for dot matrix wafer identification marking.

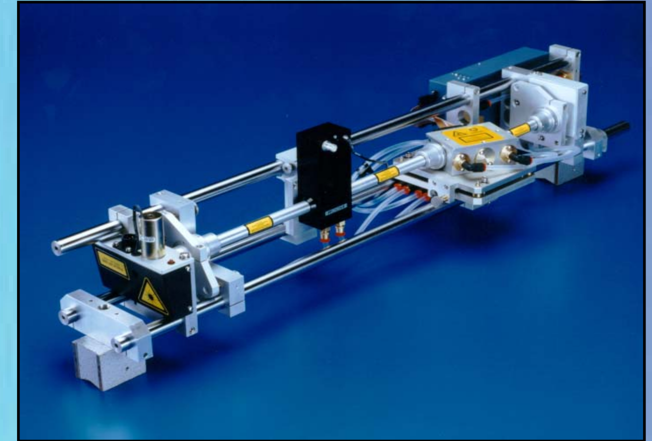
The critical requirement for generating uniform dots is precise pulse to pulse stability combined with sufficient power.

The Sigma®100A pulse to pulse stability is < 0.5% @1Khz

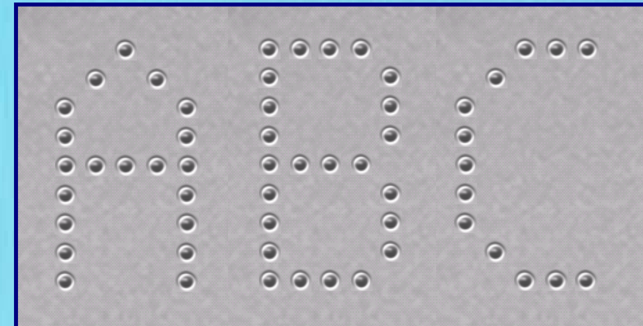
Unsurpassed precision in an industrial laser package.

Sigma series laser are only available on GSIG WaferMark® systems.

Specifications



Sigma®100 Diode Laser



Pulse to Pulse Uniformity

Critical application requirement

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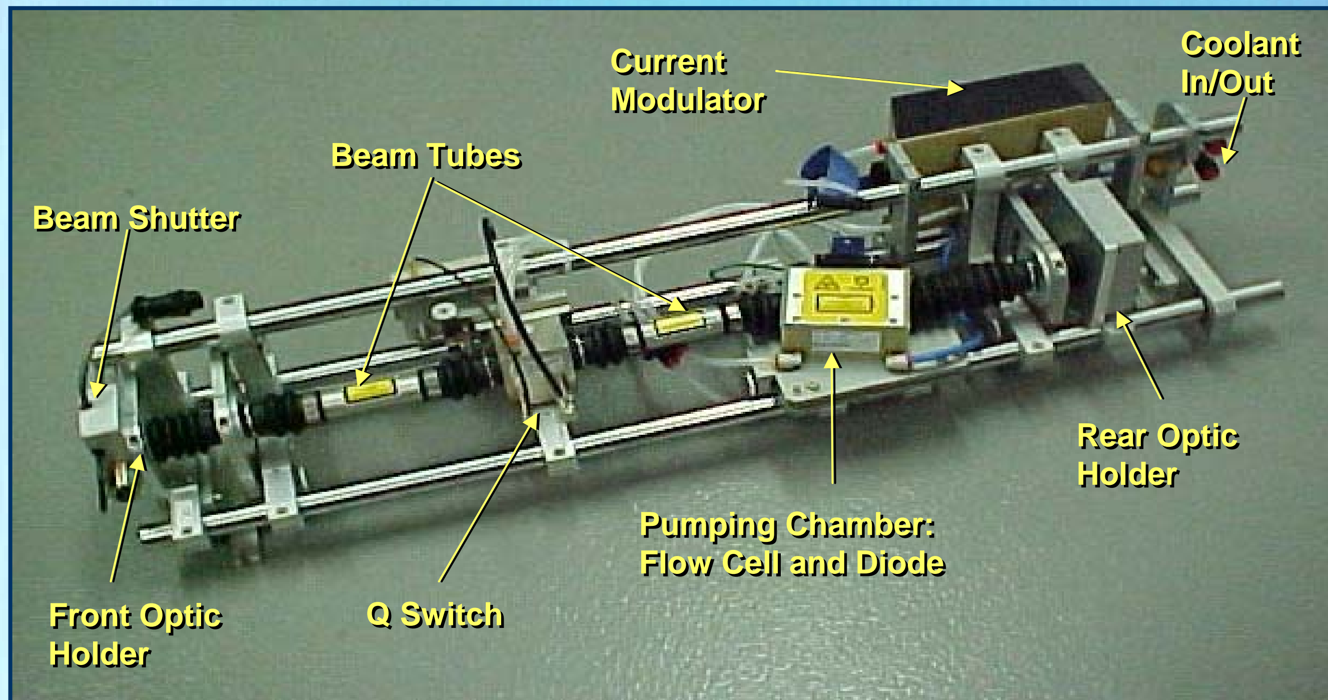
Sigma Series Lasers…..

….. Designed for production environment



All laser rail subcomponents and optics can be replaced in the field by GSI service engineers.

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Sigma Series Lasers

Laser Control

Stability monitoring and feed back

Laser performance data logging

Integrated rack mounted controller

Modules designed for integration into WaferMark® system, small footprint, no external chiller or power supply

Water Chiller

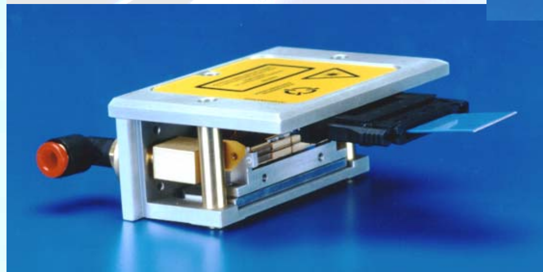
No external water required

Water temperature <± .5° C

18° - 25° C operating temperature

Efficient single phase power

Low Maintenance – Change water filter twice a year.



Diode Module

Laser Diode Module designed for easy field replacement.

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PC and Operating System

15 inch monitor

WaferMark® PC System Configuration	
Operating System:	WindowsXP SP4
CPU:	Pentium IV - 2.8 GHz
RAM:	512 MB
Hard Disk Drive:	80 GB 7200 RPM
Floppy Drive:	3.5", 1.44 MB
CD Drive:	RW 52x32x52
BackPlane:	4 ISA, 6 PCI, 1 PCI/ISA
Network Card:	Dual LAN
USB Ports	4 (at rear of PC)

4 USB ports

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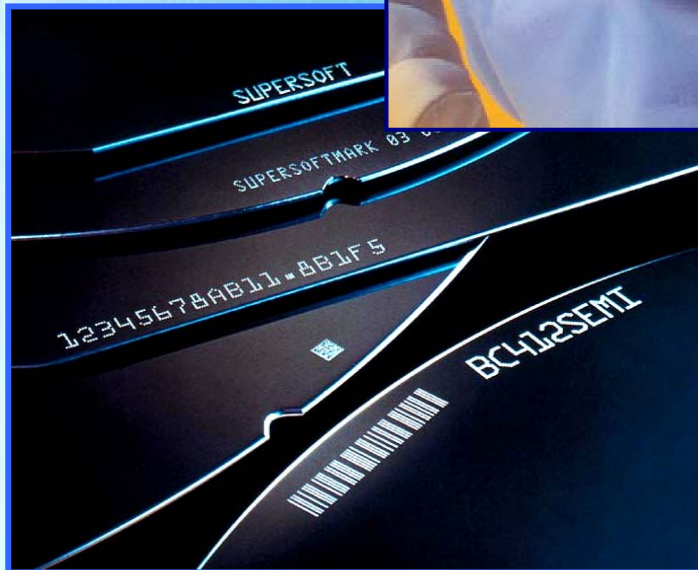

Applications Focus

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Debris Free SoftMark®

Wafer Identification Marking - Clean room environment

The SigmaClean® systems are designed to place a permanent identification marks on silicon wafers to allow for tracking through the manufacturing cycle.

The GSIG patented SoftMark® process was developed to meet the requirements of marking polished wafer in a clean room environment.

The GSI SoftMark® marking process has become the industry standard for wafer identification marking.

WaferMark® SigmaClean®

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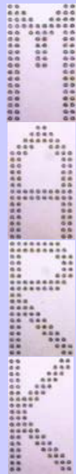
Marking Modes

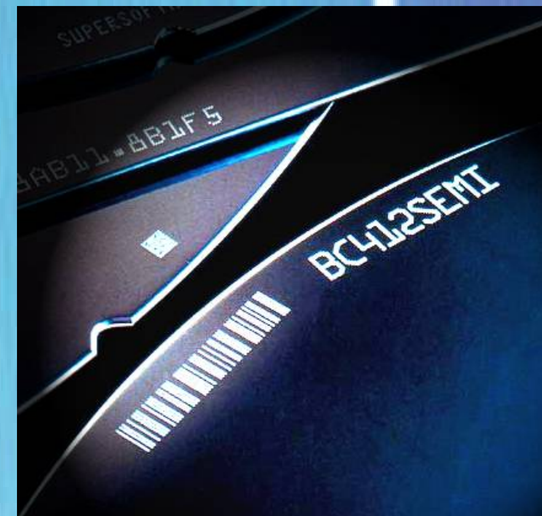


SEMI Standard Fonts

Semi Standard fonts and sizes , M12, M13 and T7 are pre-programmed for simple mark/job setup.

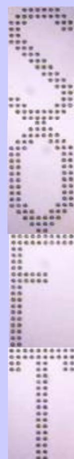
Custom size fonts can be easily generated - programming not required.

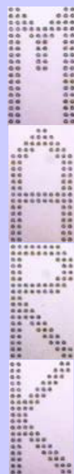
T7 Rectangular 2D Matrix



Bar Code

Marking Modes

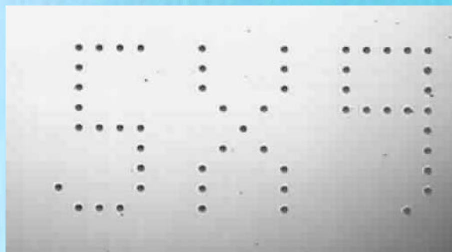




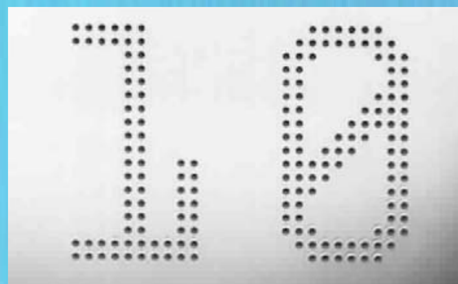
Marking Fonts Supported:

9x17 Single Density Dot Matrix (DM9X17V3)	Standard
10x18 Double Density Dot Matrix (DMDSMI62)	Standard
5x9 SEMI-OCR (DMSEMI60 or DM5X9S3)	Standard
T1-93 SEMI Specification BC-412 Bar Code (BBC412A2)	Standard
T2-0298 2D Data Matrix	Standard

Checksum function is user selectable



5x9 Single Density Dot Matrix

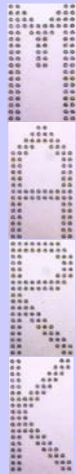


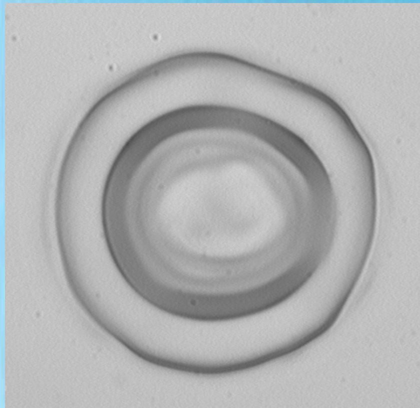
10x18 Double Density Dot Matrix

SEMI Standard Marking Mode

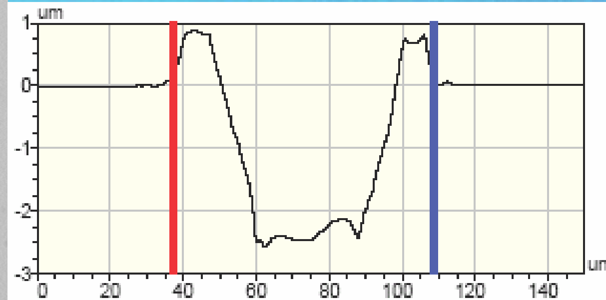
Debris Free SoftMark®

Wafer Identification Marking - Clean room environment



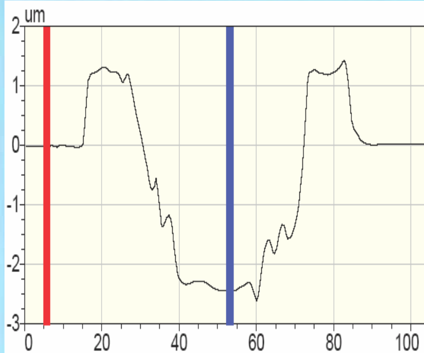


X Profile



Dot Diameter: 71.35 um

Y Profile



Dot Depth: 2.44 um

SoftMark® Process – Single Pass

Dot Depth	2.6 depth ± 0.4 µm
Dot Diameter	70 µm spot ± 10% ,
Dot Roundness	major to minor axis ≤ 1.1

Standard Single Pass Mark

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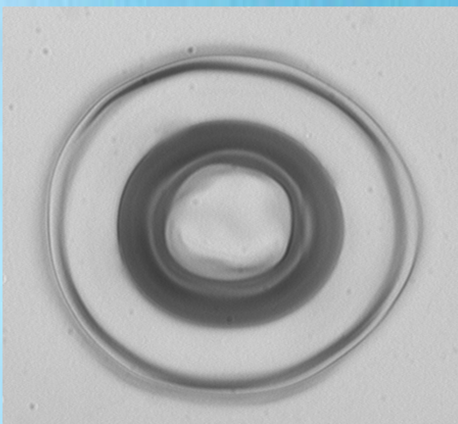
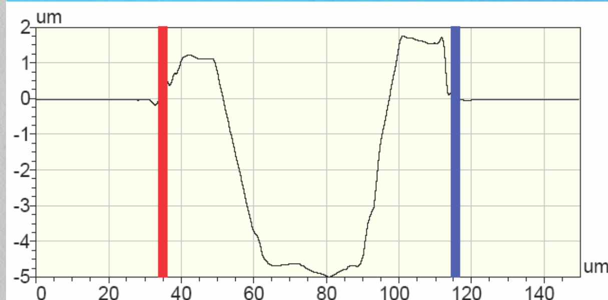
Debris Free "Soft" Marking

Wafer Identification Marking Fab - Clean room environment

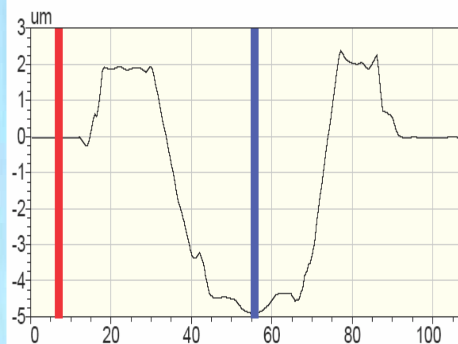


X Profile



Dot Diameter: 80.60 um

Y Profile



Dot Depth: 4.99 um

SoftMark® Process – Double Pass

Dot Depth	5.5 depth ± 0.7 μm
Dot Diameter	78 μm spot ± 10% ,
Dot Roundness	major to minor axis ≤ 1.2

Standard Double Pass Mark

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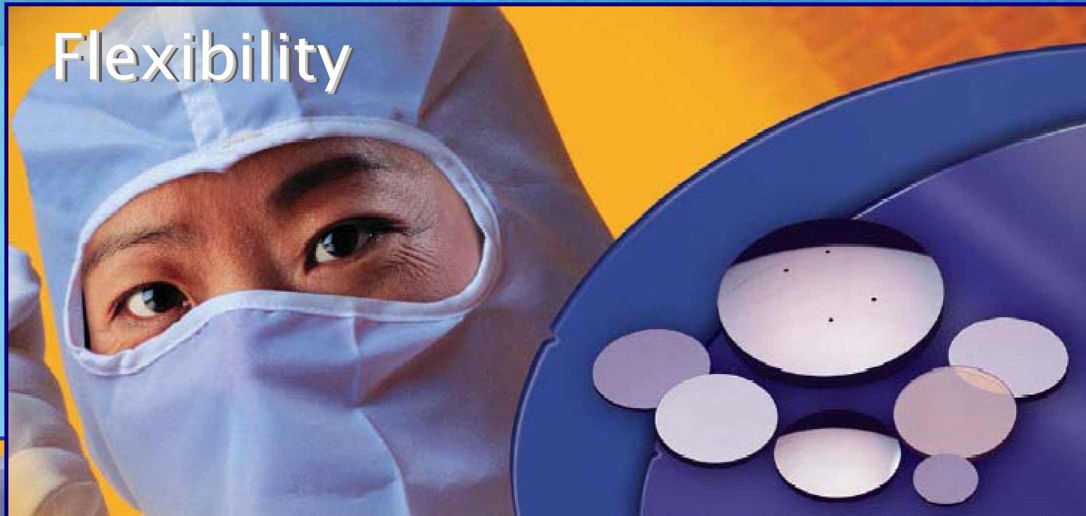

System Options

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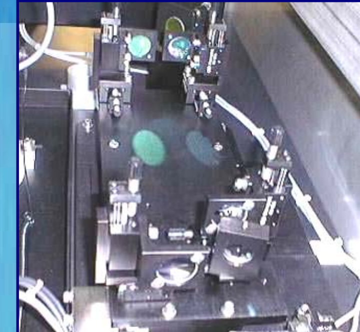
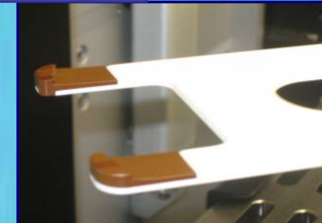
WaferMark® SigmaClean® 300

Wafer Identification Marking - Clean room environment

- Wafer Edge Handling System
- Wafertrace® Vision Options
- Dual Spot Option
- Load Port Configuration Options
    - Cassette Bar Code Reader 300mm
    - RFID, OHT , Smart TAG, RGV/AGV sensor
    - Light Curtain and Barrier
- FA Software
- UPS – Computer Electronics
- Hand Held Bar Code Reader
- Seismic Tie Down Kit





System Options

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WaferTrace® Vision Options

Mark Verification Camera:
Located inside EFEM and positioned to read ID mark on the wafer top side.

Mark Verification Option:

The wafer is marked on the top side and before the wafer is returned to the cassette the mark is tested for legibility and correct content.

Local log file is updated with pass/fail results.

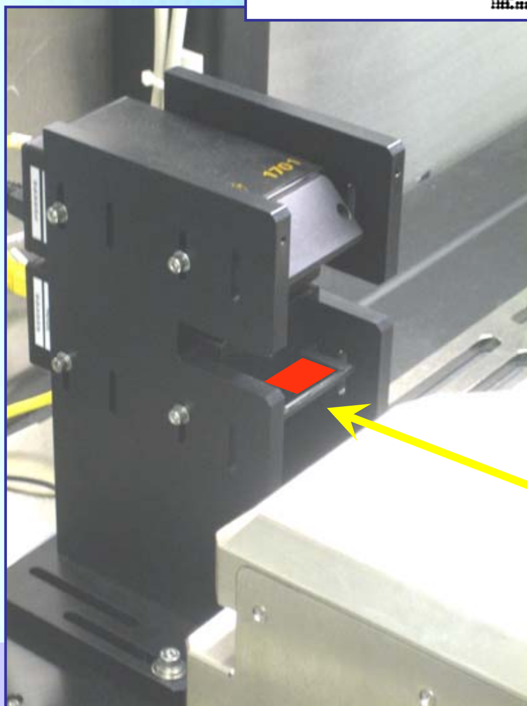
Error message displayed and alarm is sounded on bad read

Results can also be uploaded to host in conjunction with FA software option.

Mark Verification

WaferTrace® Vision Options

DY4962G4CGF3



Read and Scribe Option:

A pre-existing mark string is read from the bottom side of the wafer and laser marked on the front side of the wafer.

The mark read may also be uploaded to the host for "mark approval" before new mark is generated.

Read and Scribe Camera Location:
Positioned to read ID mark on the wafer bottom side.

Read and Scribe

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FOUP Bar Code Reader

Keyence Readers

Cassette Bar Code Reader:

Fixed bar code readers mounted on each load port.

Designed to read input from bar code labels located at bottom of FOUP per SEMI standard guidelines for location of FOUP barcode.

Information may be uploaded to host in conjunction with SECSII/GEM for host automated WIP management

Carrier ID for FOUP:

WaferMark® obtains Carrier ID from bar code on the carrier. WaferMark® Cimetrix FA supports Keyence Bar Code Readers. The bar code reader is treated just like ID devices, but write is not allowed.

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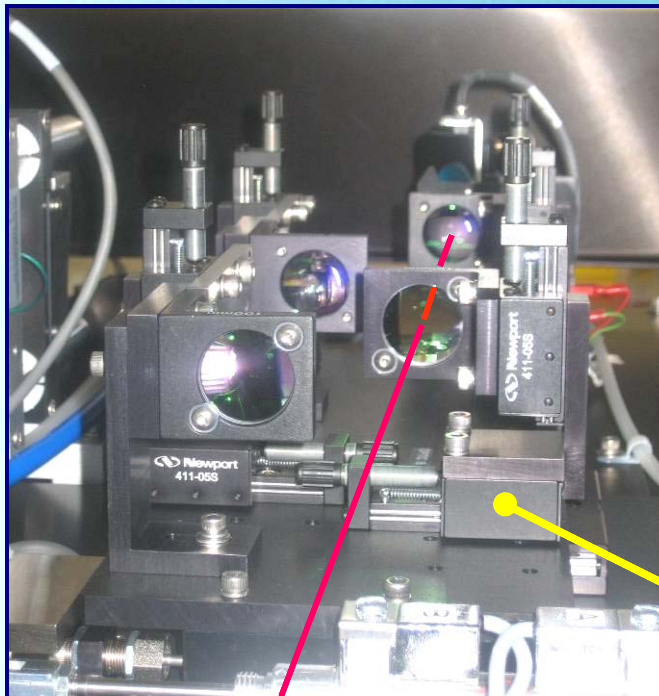
Dual Spot Optics

Dual Spot Option:

Optics shuttle allows user to select one of two optical configurations, 50µm or 70µm

Spot size is programmable with each job file.

Spot size cannot change within single job or lot.



Dual Spot Optics Shuttle:
Vacuum solenoid driven, programmable stage moves the 50µm or 70µm optics into place.

SigmaClean® Dual Spot Option

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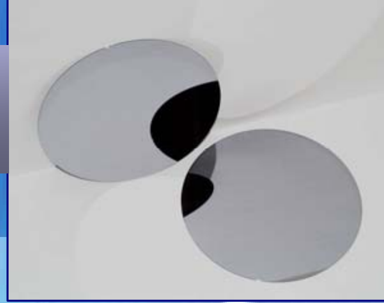
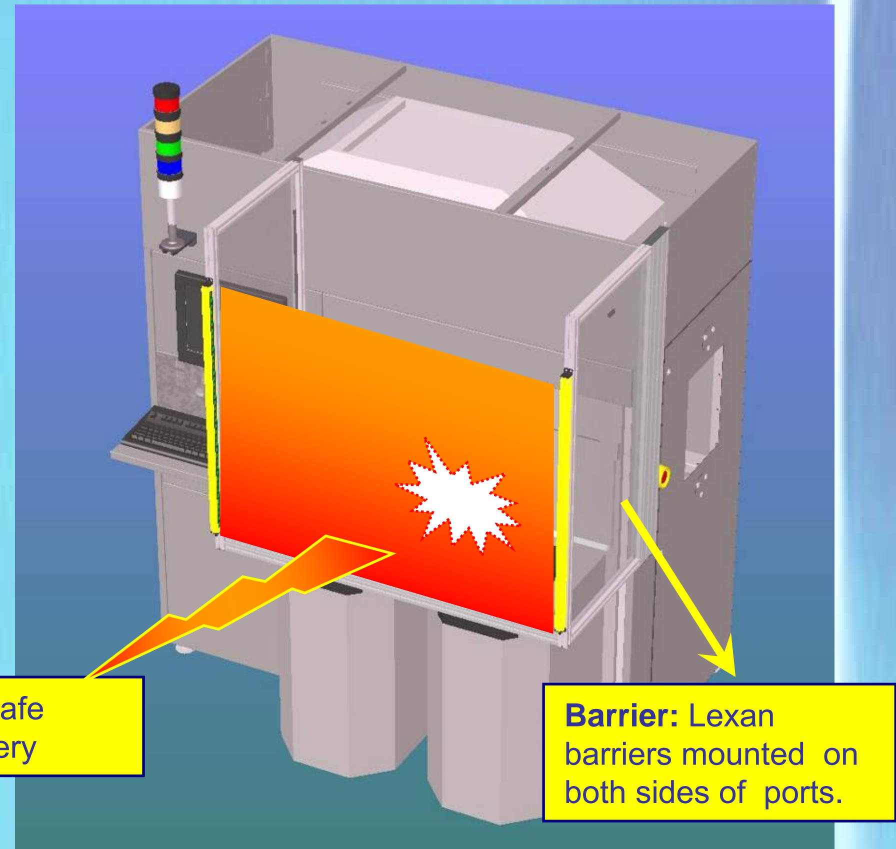
Light Curtin and Barrier



Barrier:
Static dissipative Lexan barriers mounted on left and right of Load Port doors to minimize accidental obstruction or injury at FOUP carrier load ports.

Light Curtain:
Light curtain protects the operator from injury during OHT delivery to the system. If the light curtain beam is broken, the OHT system will pause until the obstruction is removed.



Light Curtain: Exit/Entry safe guarding during OHT delivery

Barrier: Lexan barriers mounted on both sides of ports.

SigmaClean®300 Light Curtain and Barrier

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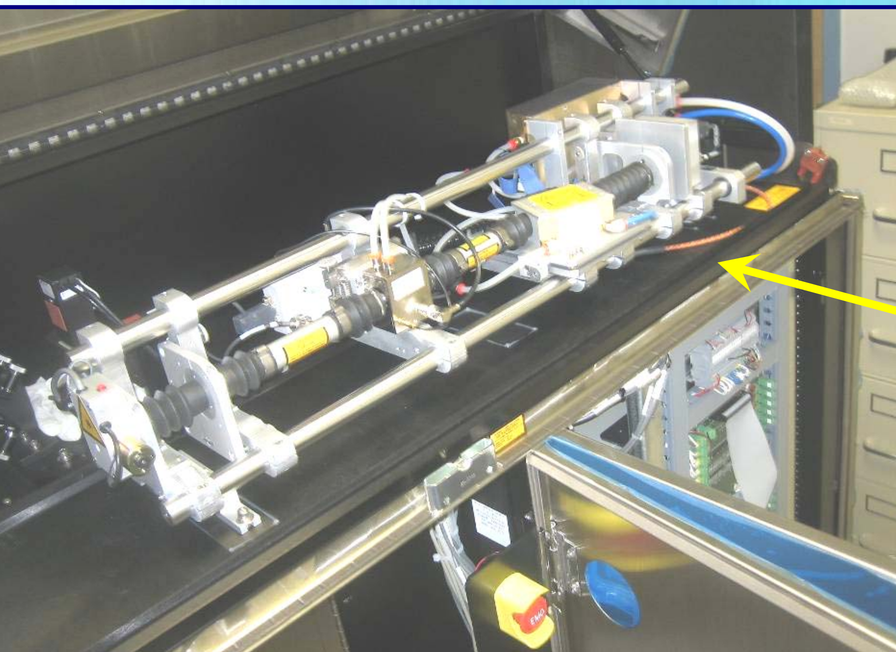
Leak Detector

Leak Detector:

A water rope located in tray below laser will shut down the system when liquid is detested, preventing potential electrical damage or safety risk.



Leak Detector Option: Positioned to sense any leakage from laser cavity

Leak Detector

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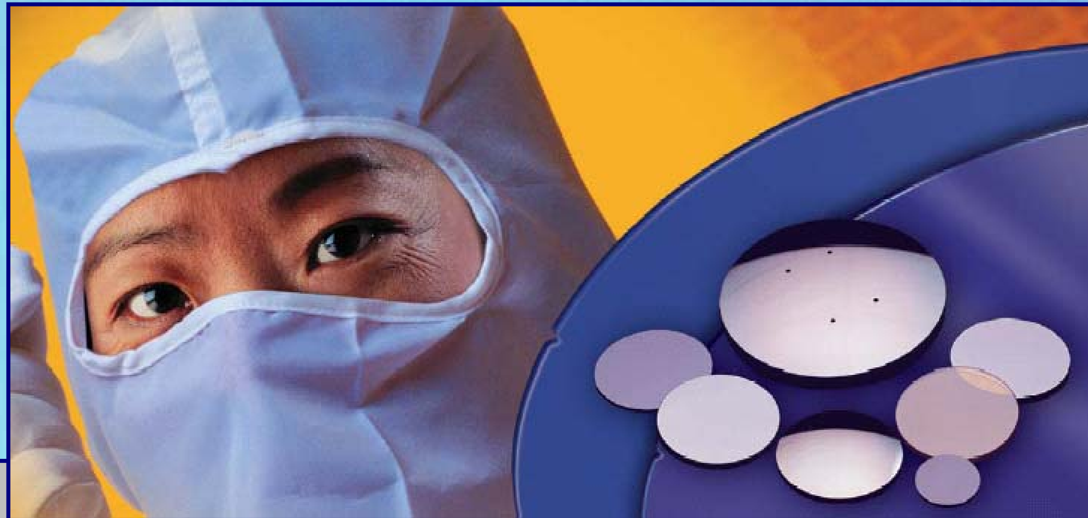

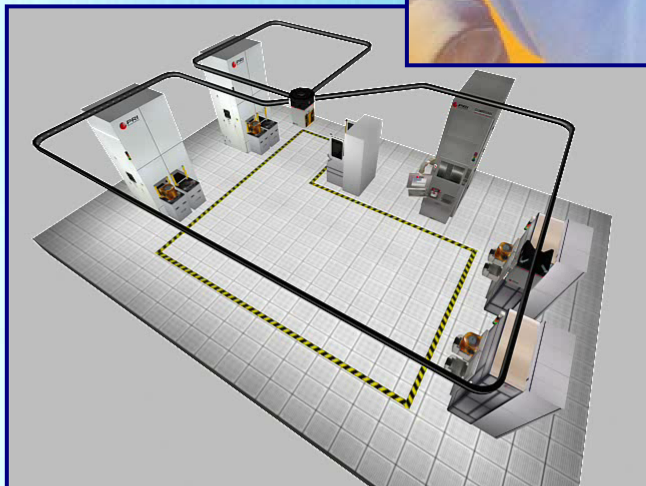

Factory Automation

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300mm Factory Automation

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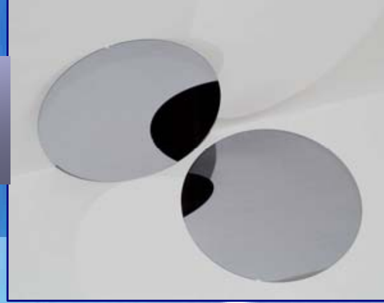

Configurable for operation with several hardware interface option including RFID, Cassette Bar Code readers, Smart Tag, OHT interface and RGV/AGV interfaces.

Provides connection to the host computer and allows remote operation and monitoring.

The FA software is Cimetrix based and includes a Cimetrix license.

Test and verification using GSI scenarios based on CCS Envoy.

Test log supplied

HSMS protocol

300mm FA Semi Compliance -*SigmaClean*®

Specification	Description
E116	Eq. Performance Tracking
E39	Object Services
E40	Process Job Management
E87	Carrier Management Standard (CMS)
E90	Substrate Tracking
E94	Control Job Management
E84	Enhanced Carrier Handoff I/0 interface
E99	Carrier ID Read/Write

SEMI compliant Factory Automation

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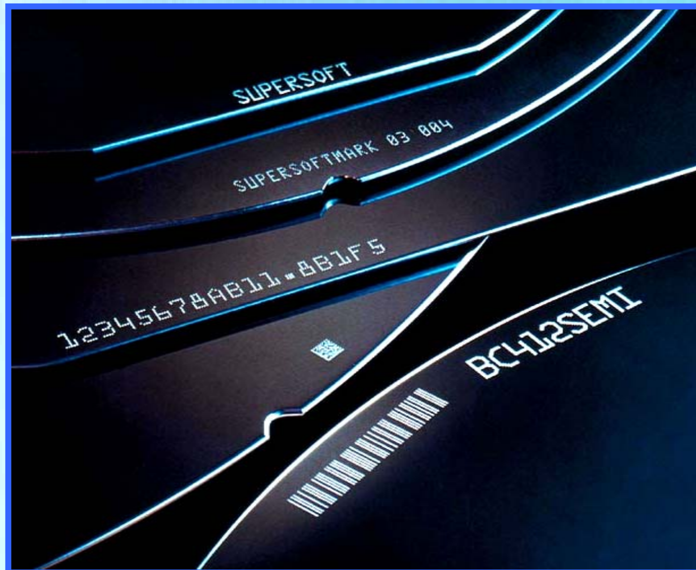

Thank You

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WaferMark® "*firsts*"

1979 - production laser wafer marking system	***WaferMark® 345™***
1984 - debris-free wafer marking technique	***SoftMark™***
1984 - in-cleanroom wafer marking system	***WaferMark® II™***
1988 - automatic 200mm wafer marking system	***WaferMark® 200HS***
1990 - debris-free wafer marking technique readable throughout processing	***SuperSoftMark™***
1990 - class 1 clean room compatible system	***WaferMark® SC™ (SuperClean®)***
1992 - process 200mm wafers	***WaferMark® III***
1992 - III-V compound laser wafer marking system	***WaferMark ® III-V***
1993 - practical 200mm wafer hard-marking system	***WaferMark® DSC™***

Continued next slide >

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WaferMark® "*firsts*"

(continued)

return

1995 - 300mm hard marking system	***WaferMark® DSC300***
1995 - diode laser SuperSoftMark™ system	***WaferMark® SigmaClean™***
1996 - hard marking diode laser system @ 300mm	***WaferMark® SigmaDSC™***
1997 - 300 mm SuperSoftMark™ system with integrated mini-environment	***WaferMark® SigmaXC***
1998 - 300mm edge handling and wafer flipper	***WaferMark® SigmaClean™***
1999 - backside die marking and CSP system	***WH4100 Die Mark System***
2000 - 300 mm mini-environment	***WaferMark® SigmaClean™ FOUP***
2001 – Read and scribe mark for 300 mm	***WaferMark® R&S™***

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WaferMark® SigmaClean ®

return

Laser Specifications - SigmaClean™

Category	*Characteristic*	*Specification*
Performance	Wavelength	1053 nm
	Maximum Average Power	**2.0 watts**
	Maximum Pulse Energy	2.0 mJ at 1 kHz
	Ambient Temperature Range	15°-28°C
	Output Pulse Energy	0.5 – 2.0 mJ, adjustable
	Pulse Duration	80 - 120 ns
	Energy Set-Point Accuracy	± 0.002 mJ
	Pulse-to-Pulse Energy Stability	**less than 0.5% at 1 kHz**
	Beam Mode	TEM_{00}, Axis ratio 1 ± 0.2
	Repetition Rate	0 – 1 kHz
	Warm-up Time	< 10 minutes
Physical Dimensions/ Weight	Laser Head (length x width x height)	93cm x 25cm x 20cm
	Control	48.26 cm (19”) rack mount, 13.33 cm (5.25”) high
	Chiller	48.26 cm (19”) rack mount, 28.6 cm (11.25”) high
	Laser Head, Control and Chiller	77.1 kg

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