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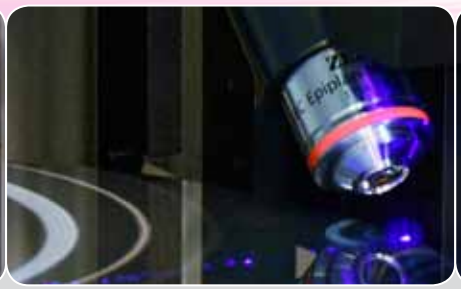
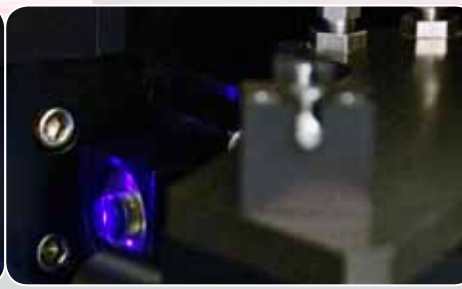
WATOM..

Wafer Topography Measurement



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KoCoS
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[ENG]

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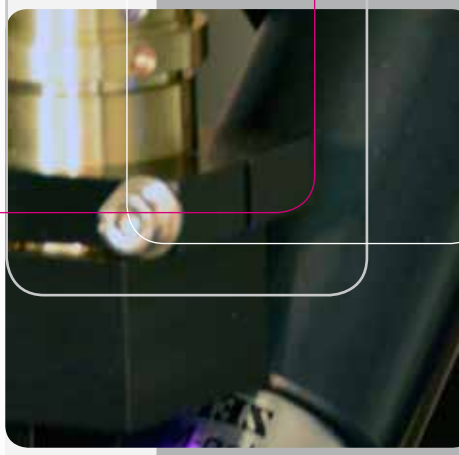
WATOM

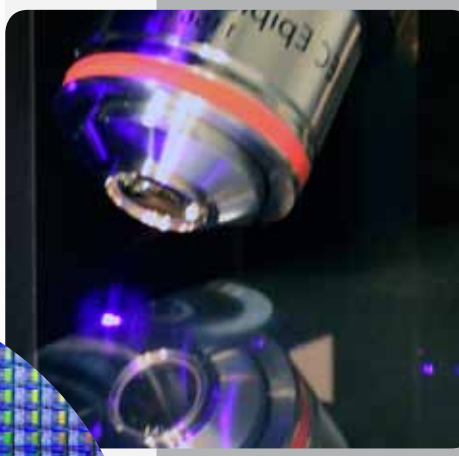
Wafer edge and notch profile measurement

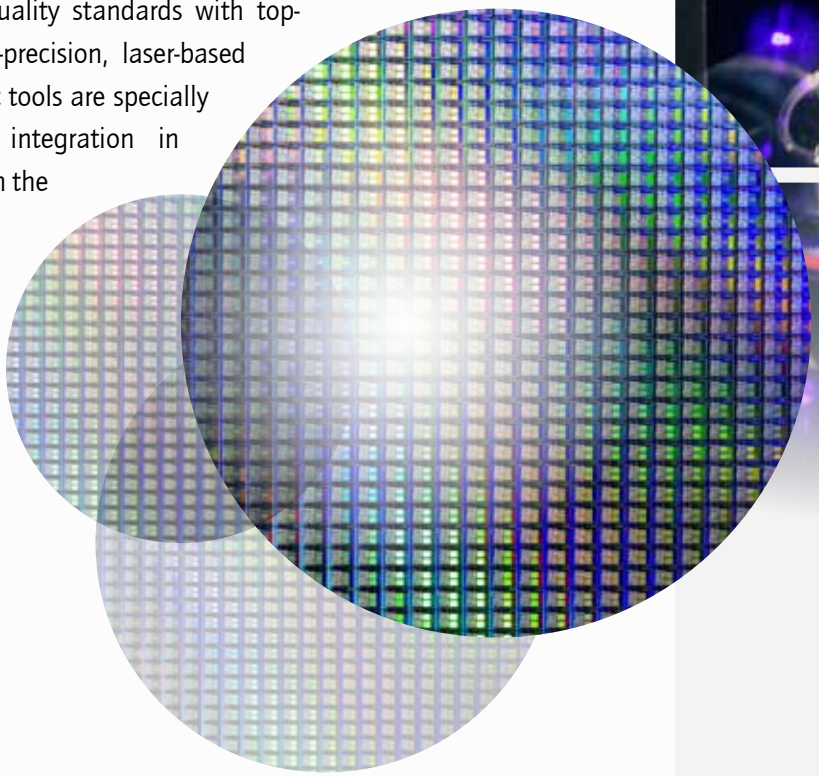
The use of smaller and smaller patterns in the semiconductor industry calls for increasingly advanced materials of extremely high quality. In response to the steady improvements in the quality of wafers, KoCoS Automation has developed WATOM, a wafer edge and notch profile measurement tool which heralds a new era of extremely precise wafer geometry measurement.

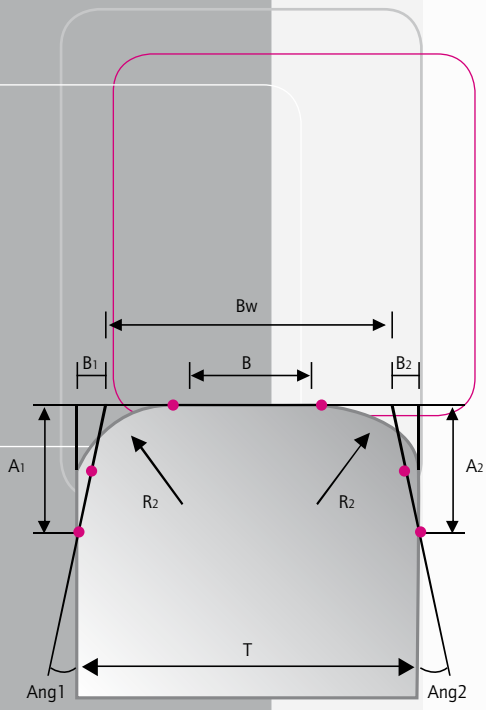
WATOM supports quality assurance throughout the wafer manufacturing process, starting at the very beginning and continuing on through to wafer reclaim.

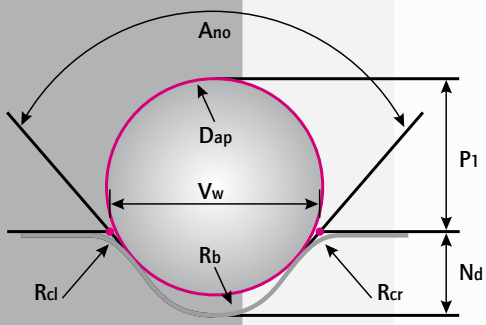
The WATOM Edge and Notch Wafer Geometry Analyser sets the worldwide benchmark for the quality assurance of geometrical measurements in semiconductor wafer manufacturing, combining the highest quality standards with top-class service. These high-precision, laser-based edge profile measurement tools are specially designed for optimum integration in manufacturing lines within the semiconductor industry.

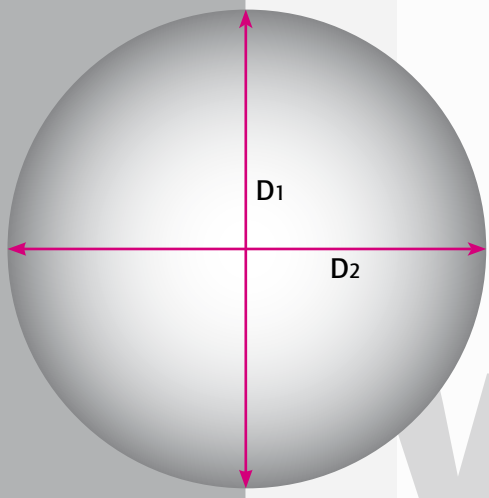












Profile measurement

The patented measurement method which uses a light-sectioning sensor can measure the profile at any point on the wafer edge, even within the notch. As well as providing a throughput of more than 50 wafers per hour with 16 measurement points, WATOM stands out from the crowd for its ability to deliver profile evaluation to KoCoS-specific criteria, SEMI M73 standard or customer-specific criteria.

Notch measurement

WATOM reliably determines the full range of typical notch measurement parameters with maximum precision, including angles, radii and notch depth.

Diameter measurement

The geometrical parameters measured by WATOM include highly precise measurements of wafer diameter exact to the µm.

WATOM.

Manual and automatic systems

Modern semiconductor manufacturing processes involve a wide range of different process automation techniques. Thanks to its modular design, WATOM can meet the specific requirements of every user, whether individual wafers are loaded manually or an automated material handling system (AMHS) is in place.

Wafer size does not present a problem either. Both the light-sectioning method and the CCD camera method can measure wafers up to 450 mm in diameter. Automatic solutions can be equipped with various numbers of load ports as required. SCARA robots provide fast wafer transport. Both vacuum and edge gripping technology are available for wafer handling.

These features ensure that WATOM systems can comply with the requirements of any class of clean room, including ISO 1 if needed. All the usual carrier ID, OHT, AGV and wafer ID solutions used in the semiconductor industry can be added as optional extras, as can additional load ports, if required.

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WATOM T

Small footprint and consistent accuracy

The latest innovation from KoCoS adds a new tool to the WATOM product family. WATOM T is a compact, inexpensive alternative for applications that have no automation requirements and provides the same quality, process reliability and measurement precision as other WATOM systems.

It is a reliable solution for space-saving integration in the production process and for sample test requirements.

WATOM T is designed to accept two wafer sizes.

Once a wafer has been placed manually on the transfer stage, it is loaded and the measurement runs automatically in accordance with all evaluation requirements. These are based on predefined recipes.

Equipped with a touch screen, this tool is easy to use for operators, experts and maintenance staff alike.

WATOM LS

The patented measurement method of WATOM LS utilizes a light-sectioning sensor to measure the profile of the wafer edge with pinpoint precision, including the profile within the notch. Using a CCD camera, pictures are taken of the laser line produced by the edge profile. Depending on the surface conditions of the wafer edge, the light-sectioning is available with a class 2 or class 3 laser system. A mathematical algorithm developed by KoCoS is then used to determine the edge profile characteristics.

WATOM CCD

WATOM CCD uses profile projection technology as an alternative to high-precision light-sectioning and provides the ideal solution for less demanding profile measurement requirements, in particular when notch edge evaluation is not required. A telecentric lens captures the profile image of the wafer edge illuminated by a telecentric light source.

Automation solutions

EFEM (Equipment Front End Module)

The fully automated handling solution EFEM is equipped with a state-of-the-art SCARA robot. The module features two load ports and has been developed to meet the very latest standards which apply to the manufacture of 300 mm wafers, including full compliance with clean room conditions of any class.

Both fully automatic load ports can accommodate common cassette types, such as FOUP, FOSB and open cassettes.

To get the wafers to a required orientation for measurement procedures, an alignment system included in the scope of delivery ensures reliable handling and high throughput.

Various identification systems for wafers and cassettes are available as options as well as an E84 interface for communication with automatic transport systems.

Automatic handling system 300

For less complex requirements in process automation, the automatic handling system for 300 mm wafers provides one or two loading stations to handle wafers from manually opened FOSB or other carriers.

A three-axis SCARA robot is used to handle the wafers by vacuum grip.

To increase throughput, a prealignment system is included so that the next wafer can be aligned while the previous wafer is being measured. Using wafer adapters, the handling system is also capable of accommodating 200 mm wafers.

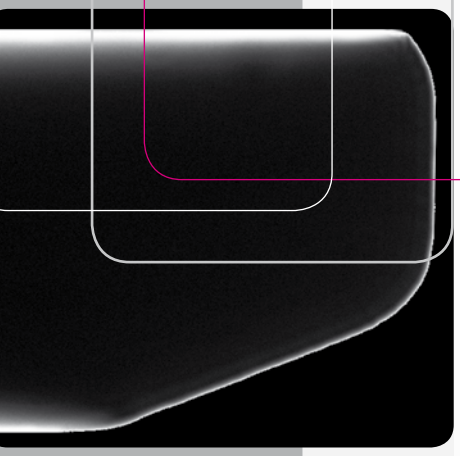
Automatic handling system 150/200

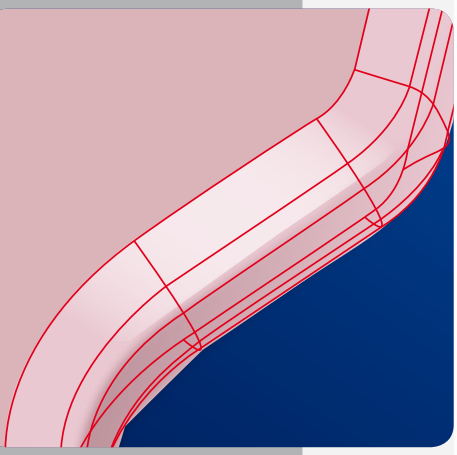
For wafers of 150 and 200 mm diameter the automatic handling system provides 4 loading stations without increasing the footprint.
A three-axis SCARA robot ensures a wide motion range and maximum axis travel with a decreased interference area.
The module is equipped with an alignment and identification system.

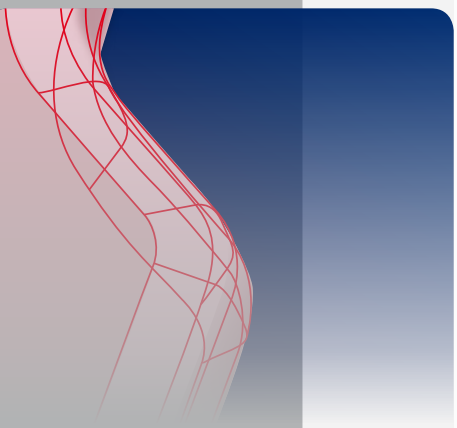
All modules can be equipped with

- OCR wafer ID readers for top or bottom reading
- Carrier ID readers (BCR, RFID reader, etc.)
- Vacuum handling systems
- Edge grip handling systems

WATOM.







Measurement and evaluation features

Large variety of materials

Using highly precise handling solutions, the WATOM product family can accommodate many substrate materials such as silicon, germanium, gallium arsenide, gallium nitride, sapphire, glass, quartz, ceramics, etc.

Three-dimensional notch edge profile

Due to the latest developments in the KoCoS light-sectioning system, evaluation of the edge profile is possible within the whole notch area. Several profile measuring points inside the notch, including the edge profile of the notch ground, the wings and the radii, allow three-dimensional notch edge control.

Various methods of evaluation and feedback

The modular WATOM software can carry out any kind of geometrical evaluation.

- Parameter-based evaluation
  - · with a highly precise KoCoS-specific evaluation method
  - · according to SEMI M73 standard
  - · with customer-specific criteria
- Template-based evaluation
  - · according to SEMI M1/M9 (T3, T4, etc.)
  - · with customer-specific template criteria

Optional evaluation modules can be provided for the calculation of any specific values, including feedback values for production equipment and the geometric parameters of grinding grooves.

Measurement of diverse edge shapes and profile types

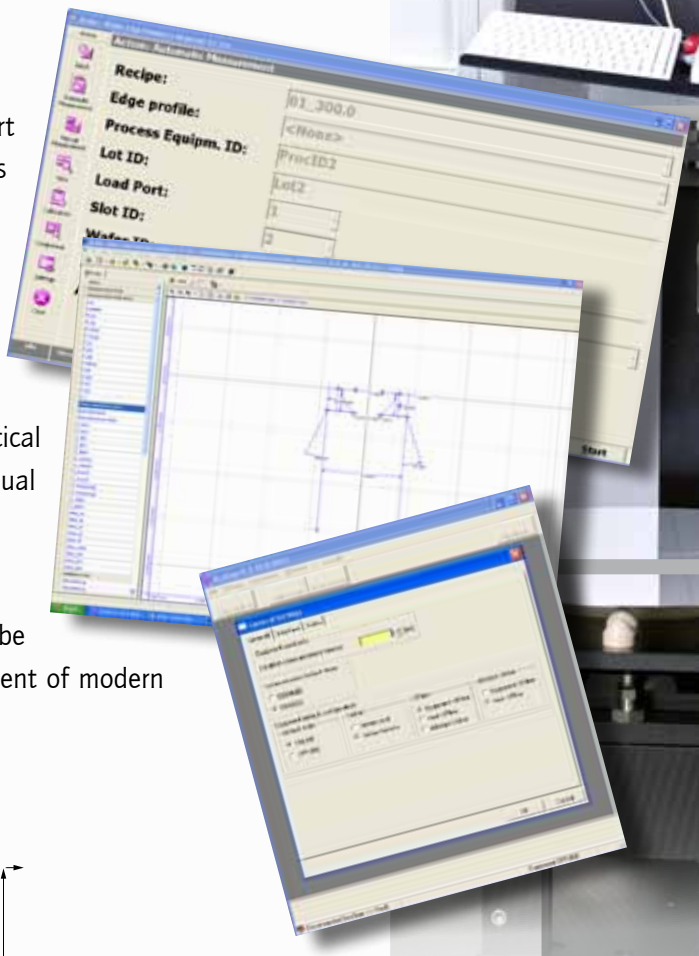
Thanks to the wide range of evaluation methods, it is possible to measure various different edge shapes.

- Round edge profiles
- Flat edge profiles
- Asymmetric edge profiles
- Combined profiles
- Bonded substrates
- SOI wafers
- Any customer-specific edge profile at any stage in production

Operation

WATOM systems rely on the WATOM software for operation, control and evaluation. This modular software, which has been specially developed by KoCoS for the specific purpose of geometrical measurement, is well structured and easy to use.

WATOM fulfills all the requirements of modern semiconductor manufacturing equipment, whether used in operator mode, expert mode or fully automatic mode.



Operator mode

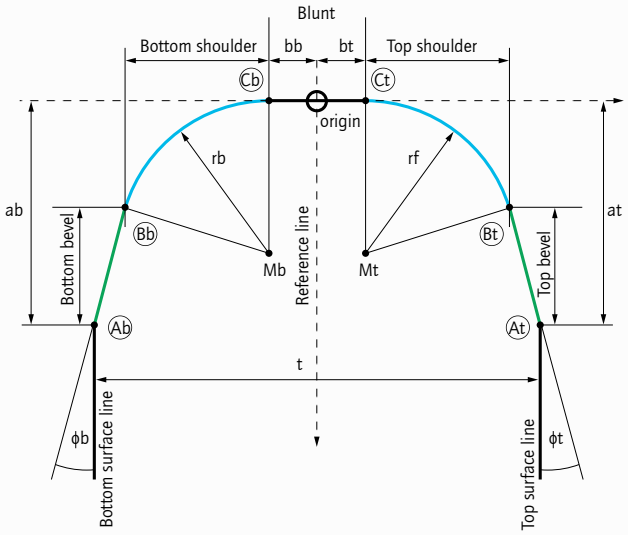
Very little input is required from the operator to start the measurement process. A pass/fail assessment is made on the basis of a comparison of the actual results with the target results pre-defined for each customer.

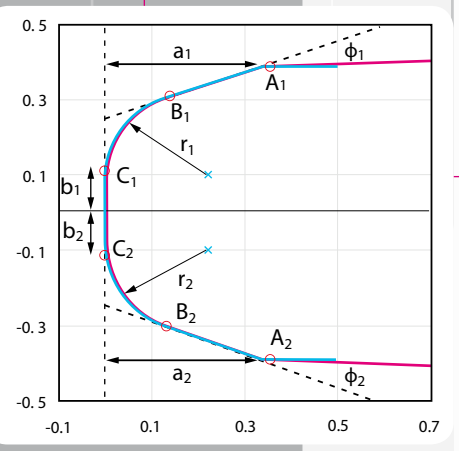
Expert mode

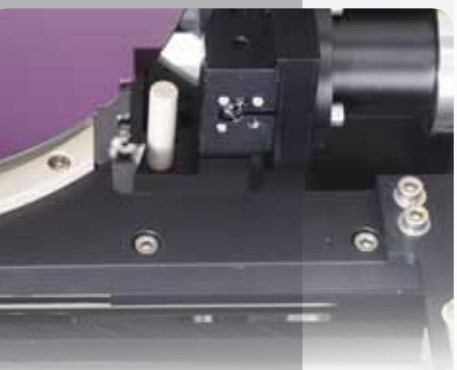
Using the expert mode, trained personnel can create measurement recipes, carry out statistical analyses and run detailed measurements of individual points.

Automatic mode

Thanks to the GEM-SECS-II interface, WATOM can be integrated quickly and easily in the host environment of modern semiconductor fabs.







System solutions for in-process wafer inspection

Know-how gained through years of experience

WATOM solutions for the in-process inspection of wafers comply with the most stringent of international manufacturing standards. They are developed on the basis of extensive know-how and many years of experience. In close contact with the semiconductor industry, KoCoS has made a significant contribution to the international test standard for wafer edge geometry.

Calibration in accordance with international standards

Quality management systems require measuring systems to be calibrated at regular intervals. WATOM can be calibrated quickly and easily. KoCoS uses calibration standards certified in accordance with international standards as well as reference wafers widely used in the industry. The use of just one calibration piece guarantees clear-cut results and minimizes the probability of calibration errors. The calibration parameters are adjusted automatically in the control software.

Low operating costs, high availability

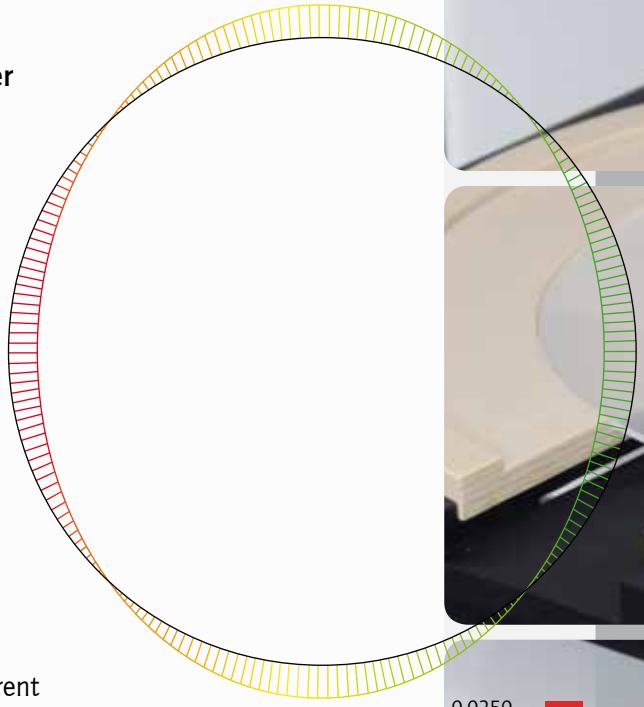
The consistent use of highly reliable components ensures a long operational life with low failure rates and modest operating costs. However, should a defect occur, all the components are easy to replace ensuring high availability.

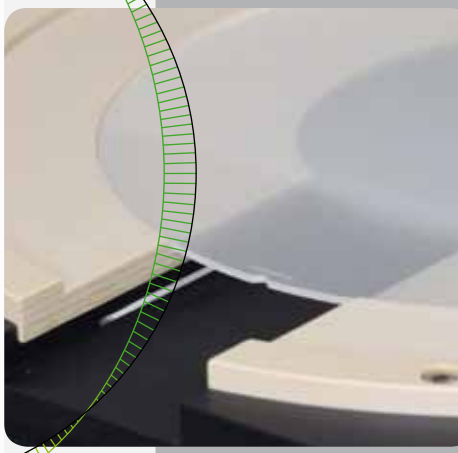
In-process inspection with WATOM

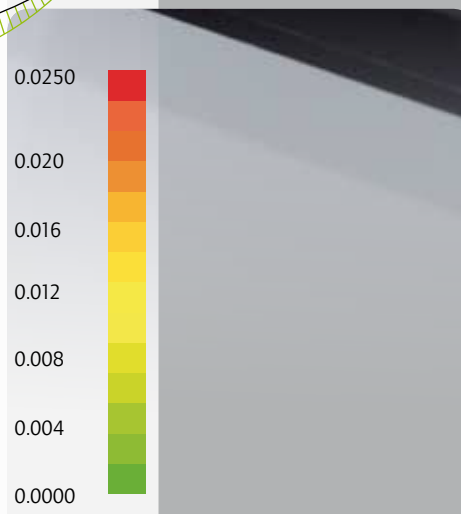
In order to fulfil the requirements of the wafer industry, in-process inspection using appropriate test systems is a must. WATOM systems provide the very best possibilities for comprehensive testing and analysis.

Edge rounding, notch shape and diameter variance

Wafer edge rounding and its inspection have a major role to play in ensuring reliable handling throughout hundreds of production processes. In order to achieve nanometer accuracy when processing wafers, the wafer edge, notch shape and diameter variance for the whole circumference must comply with exacting specifications.



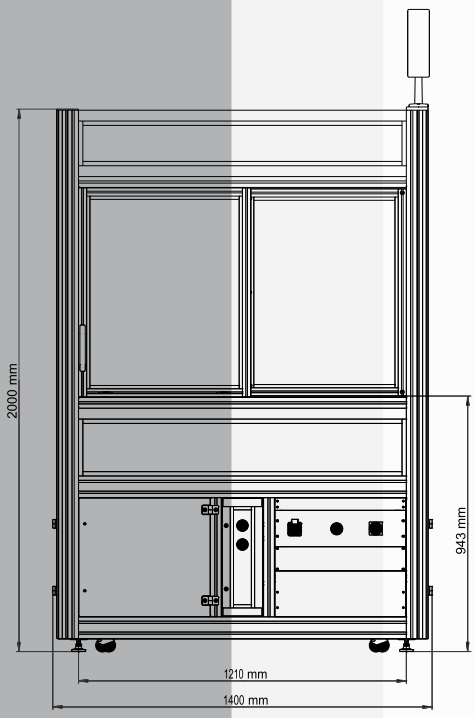


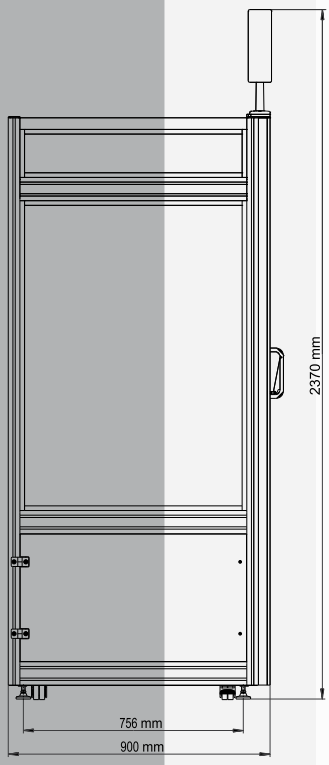


Coating and thinning processes

The manufacturing processes for various different semiconductors place further demands on wafer geometry. The rounding of the edges must be adjusted in line with the coating processes to ensure uniform coating even in the edge zone.

WATOM systems also offer optimum prerequisites for monitoring and optimising thinning processes (CMP - Chemical Mechanical Planarisation), edge trimming and related processes.





Technical data

WATOM

Throughput

50 wafers/h with 16 profile measurement points,
notch measurement and diameter measurement
MTBF: 1000 h
MTTR: 1 h

Accuracy	Accuracy	Standard deviation
Radii	± 1 µm	1 µm
Half angles	± 0.2°	0.05°
Blunt lengths	± 2 µm	1 µm
Facet lengths	± 2 µm	1 µm
Profile deformation	> 5 µm	

Facilities

Control interface	Ethernet
Input voltage	88 to 264 VAC, 47 to 63 Hz
CDA	0.6 MPa (87 psi)
Vacuum	68 kPa (9.8 psi)
Operating temperature	20 to 24°C

Order code

Order code example	WATOM LS234 (for diameter 300/450 mm with class 2 laser system)
Sensor types	LS2 (laser class 2) LS3 (laser class 3) CCD
Diameters	12 (150/200 mm) 23 (200/300 mm) 34 (300/450 mm)

Technical data

WATOM T

Throughput

50 wafers/h with 16 profile measurement points,
notch/flat and diameter measurement
MTBF: 1000 h
MTTR: < 4 h

Accuracy	Accuracy	Standard deviation
Radii	± 2 µm	1µm
Half angles	± 0.3°	0.1°
Blunt lengths	± 3 µm	2 µm
Facet lengths	± 3 µm	2 µm
Profile deformation	> 8 µm	

Facilities

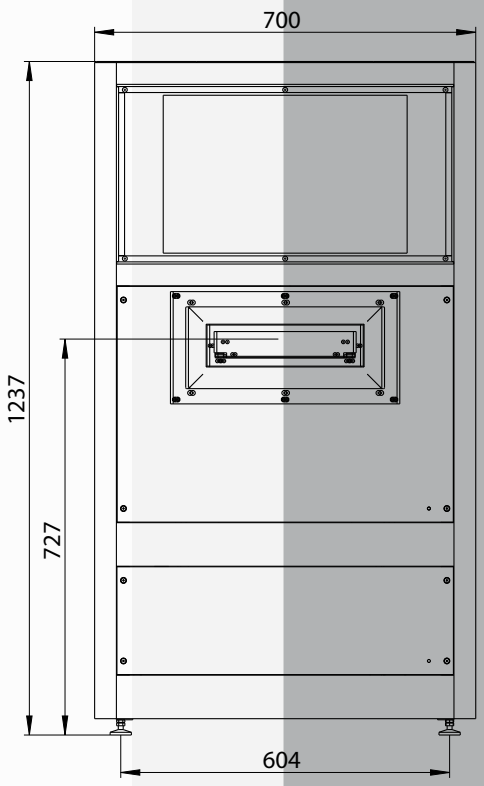
Control interface	Ethernet
Input voltage	88 to 264 VAC, 47 to 63 Hz
CDA	0.6 MPa (87 psi)
Operating temperature	20 to 24 °C

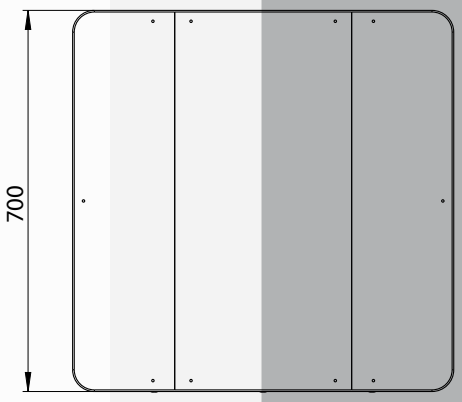
Order Code

Order code example	WATOM T 12 (for diameter 150/200 mm)
Diameters	12 (150/200 mm) 23 (200/300 mm)

Options

FFU
Console
Light tower
GEM-SECS-II Interface





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