# SiC Wafer Manufacturing Solution

From Wafer to Package –
Complete Grinding Excellence

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# 01 Company Overview

## Complete Grinding Solutions —
## From Wafer Surface to Edge Perfection

### Company Overview

| | |
|---|---|
| **Company Name** | NTS Co., LTD |
| **Founded** | 2002 |
| **Headquarters** | Incheon, South Korea |
| **Business Field** | Precision Equipment Manufacturer for Semiconductor Manufacturing |
| **Core Products** | Edge Grinder, Strip Grinder, Wafer Grinder etc. |
| **Main Applications** | SiC, Si, GaN, Sapphire, Glass, and Advanced Packaging (HBM, FO-PLP, SiP) |
| **Employees** | 60 (including China Branch) |
| **Certifications** | ISO 9001, ISO 14001 |
| **Subsidiary** | NTS China @Suzhou, Jiangsu Province |
| **Homepage** | www.nts-semi.com |
| **Contact** | +82 32 814 2340 |

### Core Patents & Proprietary Technologies

| | |
|---|---|
| **Dressing System** | Structure and method for dressing of grinding wheel |
| **In-situ Measuring System** | Real-time thickness measurement during multi-wafer grinding |
| **High-Pressure Coolant System** | High-pressure coolant system ensuring efficient heat removal and surface stability during grinding |
| **Block Transfer Robot System** | BTR system provides fully automated wafer / block handling between NTS grinding, lapping and polishing for batch process |

# 02 Representative Products

NTS integrates patented precision technologies across its product lineup — delivering superior surface quality, stability, and productivity from wafer to SiP Package.

## EDGE GRINDER

NFE-Series

Ø300mm Compatible

## WAFER GRINDER

NFG-Series

Ø300mm Compatible

## STRIP GRINDER

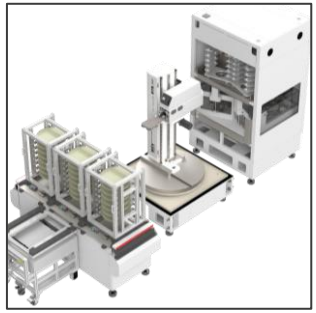
NFGS-Series

Dual-axis (Coarse / Fine)
Index table grinder

## LAPPING / POLISHING

NFL/P-Series

Ø150mm Compatible



## AUTOMATION

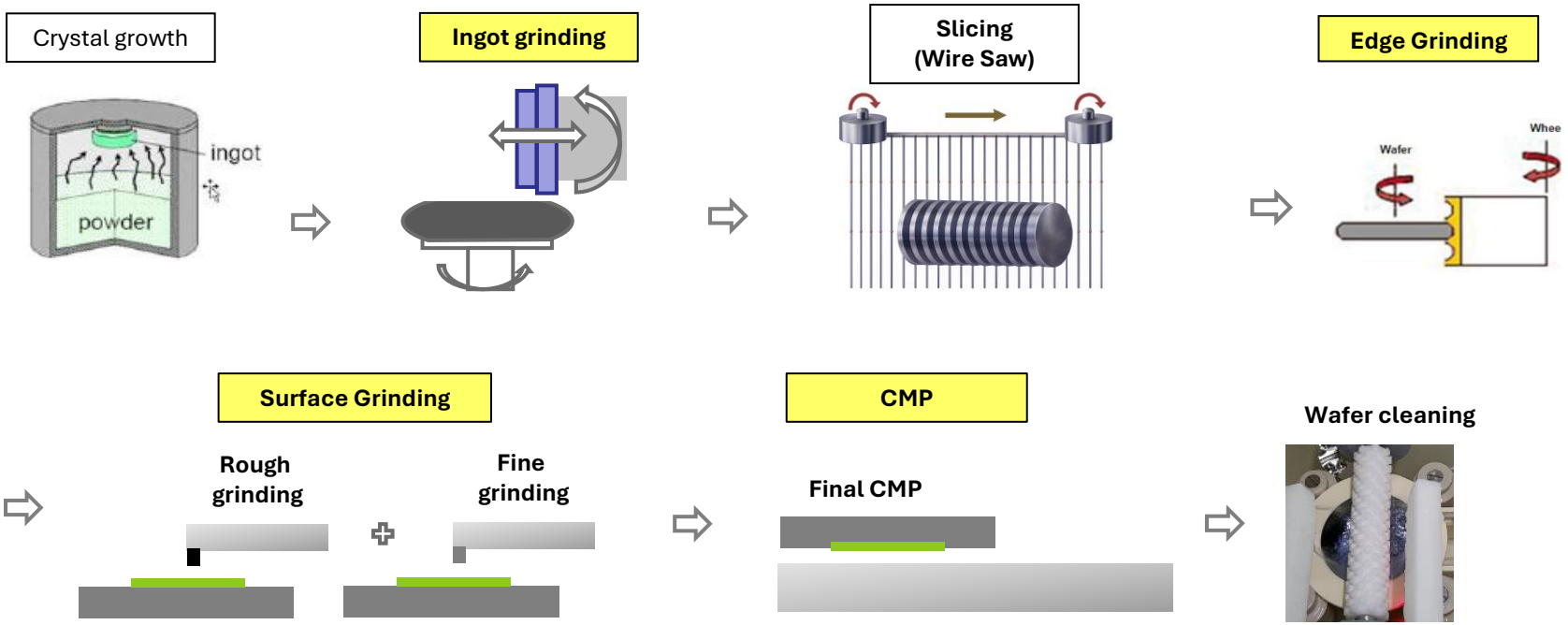
BTR-Series

Block Transfer Robot
Ø200mm Compatible

# 03 SiC Wafer Manufacturing Process

## Process Overview

1. All grinding processes performed to produce wafers after SiC crystal growth (Boule).
2. The ***Ingot Grinder*** performs top surface grinding of the Boule, outer diameter grinding, orientation measurement, and subsequent Flat or Notch machining.
3. The ***Edge Grinder*** performs chamfering of individual wafers after slicing and separation.
4. The ***Surface Grinder*** grinds the top and bottom surfaces to meet wafer specifications such as thickness and TTV.
5. The ***CMP*** polishes the remaining micro-scratches after grinding.





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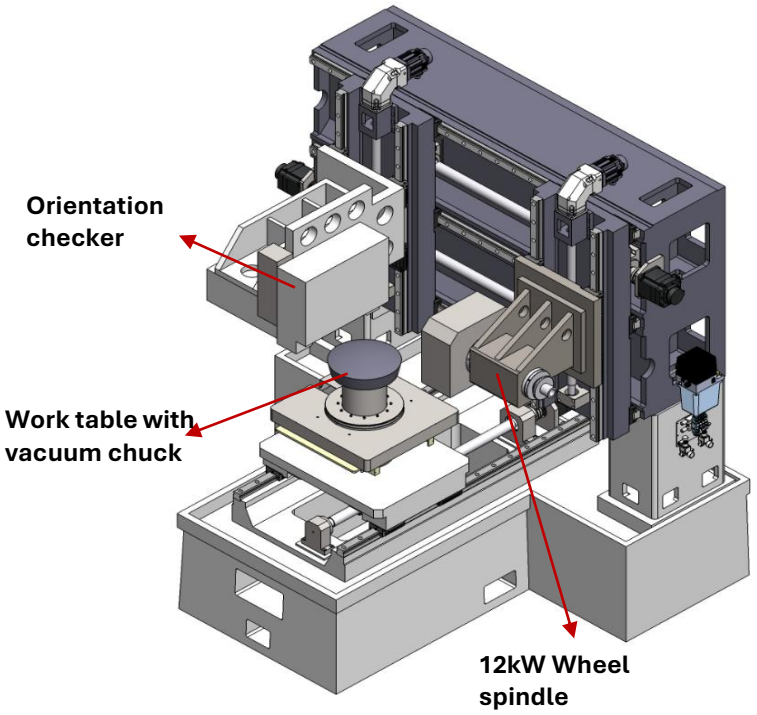
# 04 Ingot Grinder [NFIG-1200]

## INGOT GRINDER NFIG-Series




*A next-generation SiC Ingot Grinder engineered for ultra-high precision, full CNC automation, and true one-stop grinding performance—minimizing operator dependency while maximizing process stability.*

| Equipment Specification | | |
|---|---|---|
| Material | | SiC, Sapphire Ingot |
| Applicable | Boule Size | Max. Ø200 * 50mmT |
| | Grinding Wheel Size | Ø300 |
| | Coolant | water-soluble cutting water(Recycle) |
| Main body | Main Frame | Cast iron base +Steel welding frame |
| Grinding spindle | Spindle Type | Built-in spindle |
| | Spindle Speed | MAX 4000 rpm |
| | Spindle Drive Motor | 12kW |
| Work spindle | Spindle Type | High rigid spindle |
| | Spindle Speed | 10 – 200 rpm(CW & CCW) |
| | Chucking Method | Vacuum |
| Accuracy | X/Y/Z Positioning Accuracy | 0.002/300 mm |
| | Work Table Runout | ≤ 0.002 mm |
| | Grinding Flatness | ≤ 0.002 mm |
| | Top face Roughness | Ra ≤ 0.2 mm |
| Software | Recipe | Select for Product Recipe |
| Control system | Controller | PC + PLC(CNC) |
| | Monitor | Touch screen |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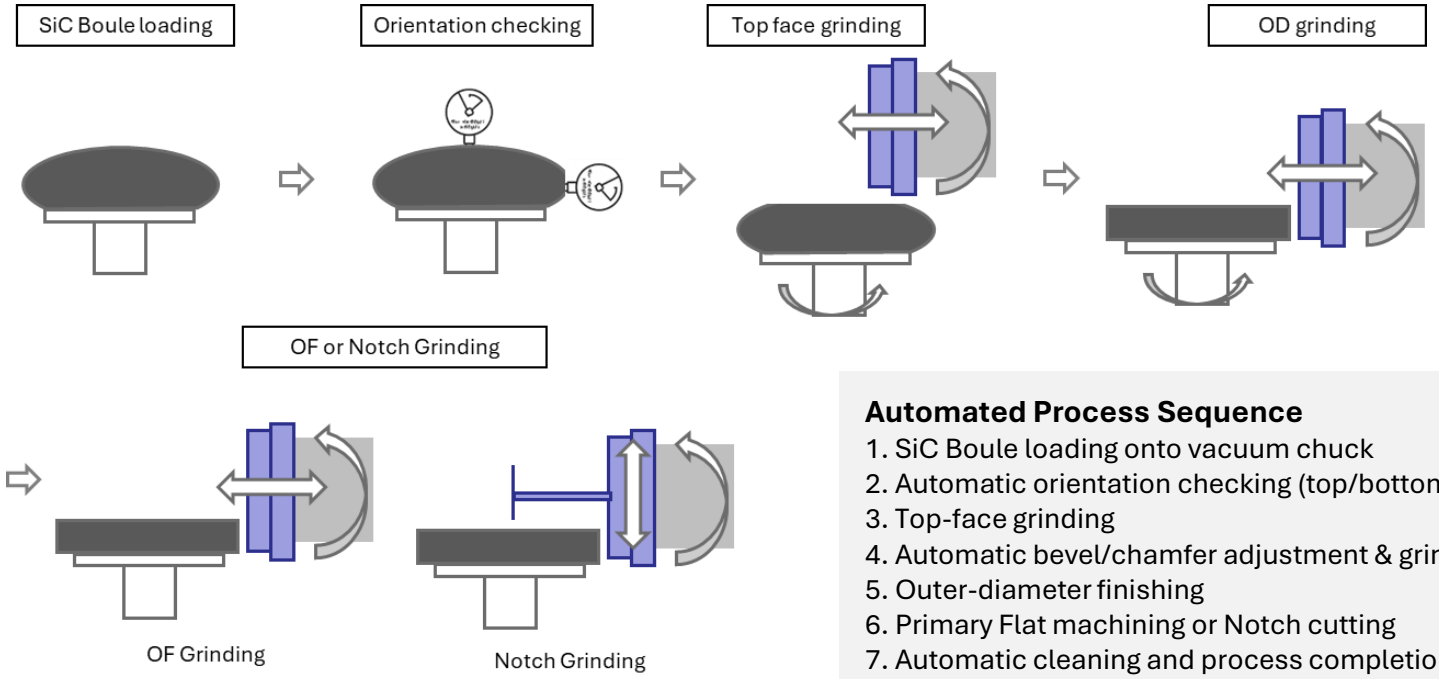
# 05 Features

Once the SiC Boule is loaded, the NTS Ingot Grinder performs all processes—orientation checking, top-face grinding, bevel/chamfering, OD finishing, and Flat/Notch cutting—fully automatically in a single cycle, delivering stable accuracy and highly repeatable results.




**Automated Process Sequence**

1. SiC Boule loading onto vacuum chuck
2. Automatic orientation checking (top/bottom/angle detection)
3. Top-face grinding
4. Automatic bevel/chamfer adjustment & grinding (Option)
5. Outer-diameter finishing
6. Primary Flat machining or Notch cutting
7. Automatic cleaning and process completion

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# 06 Edge Grinder [NFEG-2200]

## EDGE GRINDER

NFEG-Series

*A fully automated 6–8" Edge Grinder engineered for high-speed precision grinding, and non-contact CCD alignment—delivering flexible Flat/Notch machining and fast wafer size changeover with minimal operator involvement.*

| Equipment Specification | | |
|---|---|---|
| Wafer | Size | Ø6”, Ø8” wafer |
| | Shape | Notch & Flat |
| Main Grinding (Peripheral) | Wheel diameter | Ø200 mm |
| | Max. RPM | 5,000rpm |
| | Spindle driving | Built in system |
| | Motion (Work axis) | Θ-Axis , Z-Axis , X-Axis Y-Axis Moving |
| Notch Grinding | Wheel diameter | Ø1.8~2.4 mm |
| | Max. RPM | 100,000rpm |
| | Spindle bearing | Air bearing system |
| Wafer Loading unloading | No. of cassettes | 4 cassettes (std.) |
| | W.T.R | Θ-Axis , R-Axis , Z-Axis |
| Aligner Unit | Centering accuracy | ±50um |
| | Alignment resolution | 1um |
| | Centering | high precision CCD Sensor |
| Thickness Measuring Unit | Measuring Range | 1mm (Non-contact type) |
| | Resolution | 1um |
| Grinding table Revolution Axis | Driving system | AC Servo system |
| | Resolution | 0.001° |
| Grinding table Linear Axis | Driving system | Servo motor and ball screw |
| | Resolution | 1um |
| Transfer Unit | Conveying system | Suction conveying system |
| | Vacuum | Ejector |
| Cleaning unit | Cleaning system | Spin & Air blow |
| | Driving system | AC Servo system |
| | Max. RPM | 1,500 RPM |
| Machine size | Machine Dimensions | W2200 x L1610 x H2000 |
| | Machine Weight | 3,500kg |


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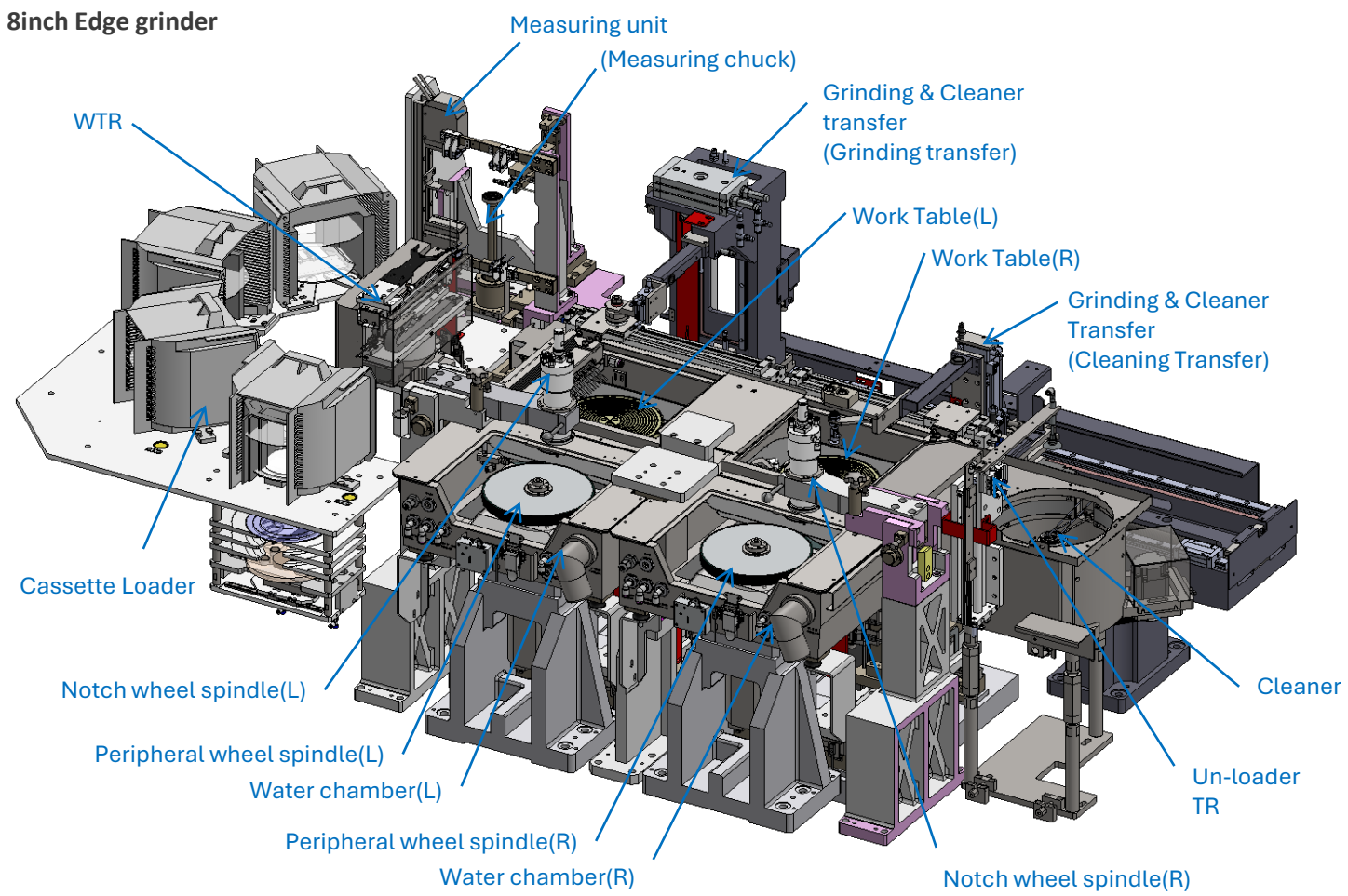
# 07 Edge Grinder [NFEG-2200]





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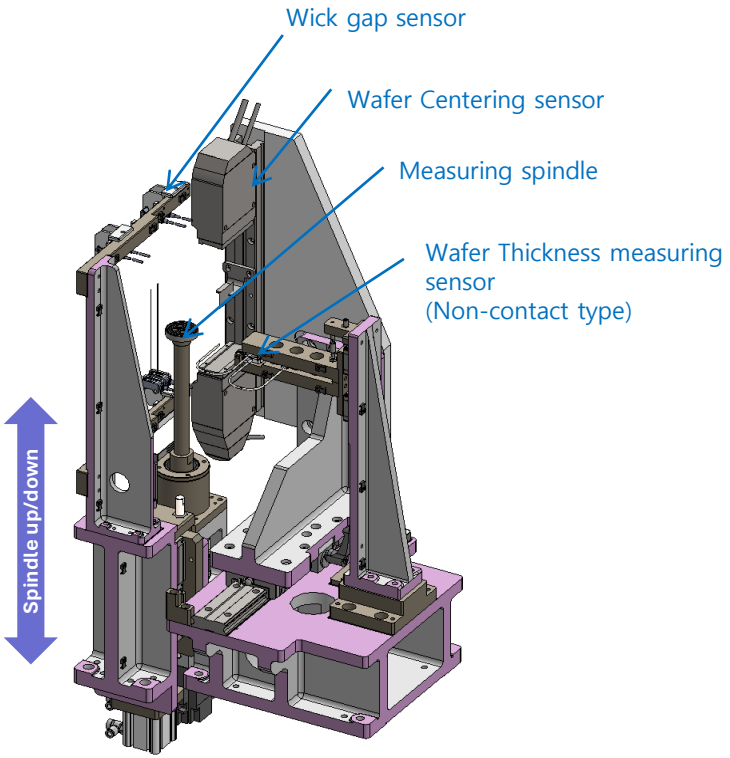
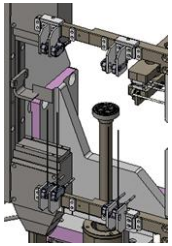
# 08 Features

Equipped with a 4-point wick gap sensor, motorized measuring spindle, high-precision CCD centering sensor, and a non-contact capacitive thickness sensor, the system delivers fast, accurate alignment and reliable thickness measurement with micron-level resolution.

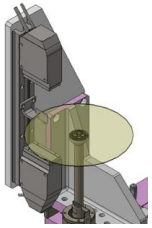


Pre-centering alignment

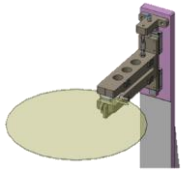
**Wick Gap Sensor**
Quantity: 4 ea
Used for pre-centering alignment before the centering sensor

**Measuring Spindle**
Equipped with spindle up/down cylinder
Rotation motor: 200 W



Wafer Centering Sensor

**Wafer Centering Sensor**
High-precision CCD (Non-contact type)
Measurement range: 0.3–30 mm
Centering accuracy: ±50 μm



Wafer Thickness Sensor

**Wafer Thickness Sensor**
Capacitive displacement sensor (Non-contact type)
Measurement range: 1 mm
Resolution: 1 μm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# 09 Wafer Grinder [NFG-5200] _ 2Axis / Auto Loading

## SURFACE GRINDER NFG-Series

*A high-precision Surface Grinder engineered for hard and brittle materials such as SiC, GaN, and Sapphire—delivering ultra-flat surfaces, sub-micron thickness uniformity, and fully automated grinding control with minimal operator involvement.*

| Equipment Specification | | | |
|---|---|---|---|
| Wafer size | | mm | Ø6”, Ø8” |
| Grinding Method (Z1 / Z2 Axis) | | - | In-feed grinding<br>With wafer rotation |
| Grinding wheel | | - | Ø300 Diamond wheel (Z1, Z2) |
| Wheel spindle | | | 12 kw Air bearing spindle / 4000RPM Max. |
| Work table | | | 750w / 400RPM Max. |
| Grinding Process (Accuracy) | Thickness Variation within one wafer | ㎛ | Ø4”, Ø6”, Ø8”,<br>Less than 2 ( < 2㎛, TV9, EE 5mm)<br>( 2 Axis grinding only ) |
| | Target Thickness Variation | ㎛ | Ø4”, Ø6”, Ø8”,<br>Less than 2 ( <± 2㎛ )<br>(Based on the mean value) |
| | Finished surface roughness | ㎛ | Ry is less than 0.05<br>(Ry value is the data after Z2) |
| Cleaning & Dry Process | Method | - | Rotary Air Atomizing Nozzles<br>with Air knife |
| | Particle | - | None<br>(on visual inspection) |
| Machine dimension (W x D x H) | | mm | 1,300(W) x 2,950(L) x 1,800(H) |
| Machine weight | | kg | Approx. 5,000 |


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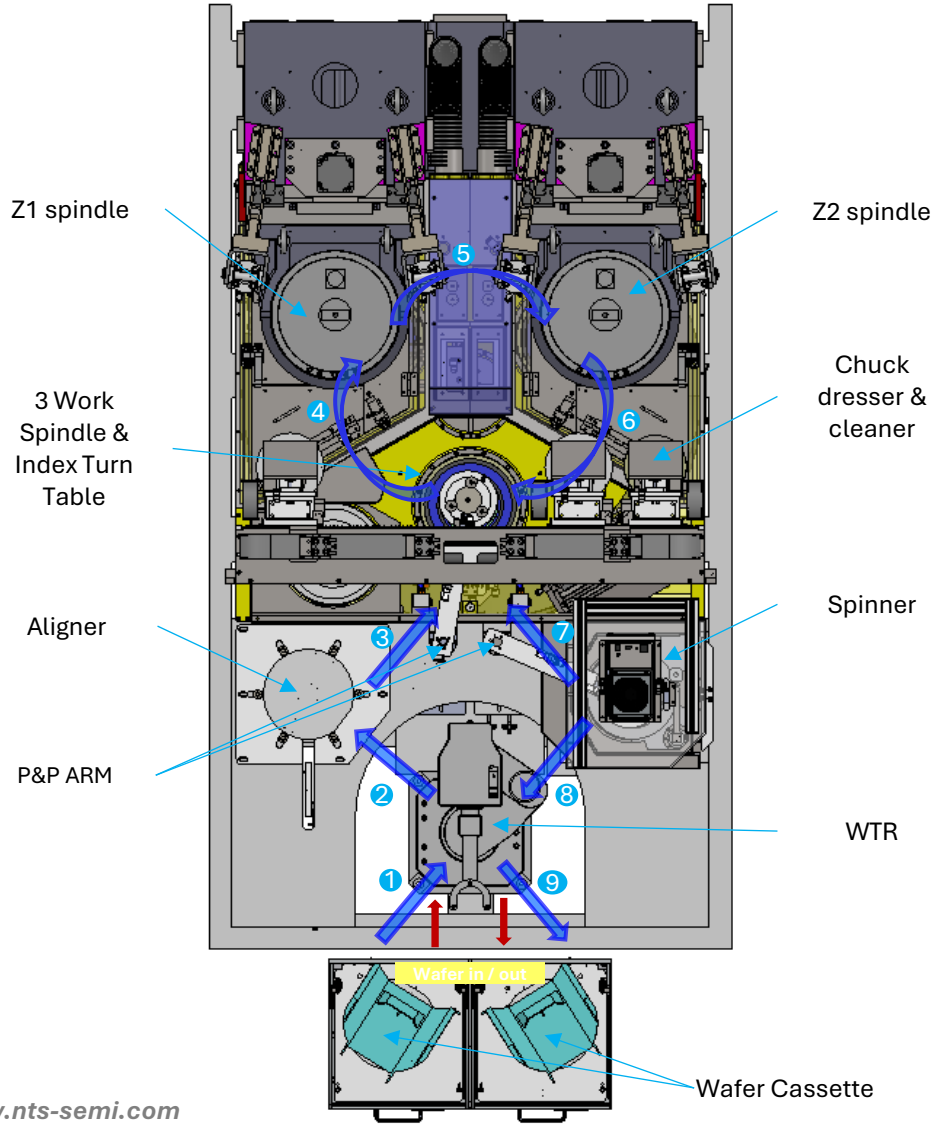
# 10 Wafer Grinder [NFG-5200]




## + 2 AXIS INDEX GRINDER Operation flow

1. The WTR robot pick a wafer from the cassette
2. WTR robot transports the wafer to aligner
3. After aligning wafer, Wafer loading P&P arm pick wafer to work spindle chuck table that has been completed cleaning by dressing unit
4. Work spindle move to Z1 grinding zone. The wafer proceed to Z1 for rough grinding
5. Work spindle move to Z2 grinding zone. The wafer proceed to Z2 for fine grinding
6. Work spindle move to ready grinding zone.
7. Wafer un-loading P&P arm pick wafer to SRD(Spin Rinse Dryer)
8. WTR robot transports the wafer to Cassette
9. The three-part work spindle rotates and continues grinding on the two-axis at the same time.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# 11 Wafer Grinder [NFG-5200] _ 2Axis / Auto Loading

## SURFACE GRINDER NSG-Series

*A compact single-axis Surface Grinder designed for manual loading—offering simple operation, flexible process capability, and reliable precision grinding for hard and brittle wafers.*

| Equipment Specification | | |
|---|---|---|
| Wafer | | SiC, Sapphire, Si wafer |
| Applicable | Wafer size | Max. Ø8" |
| | Grinding wheel size | Ø300 |
| | Coolant | DIW |
| Main body | Main frame | Steel welding frame + Cast ion |
| | Inner shield cover | PVC (Ivory) |
| Grinding spindle | Spindle type | Built-in spindle(Air bearing) |
| | Spindle speed | MAX 4000 rpm |
| | Spindle drive motor | 12kW |
| Work spindle | Spindle type | High precision spindle |
| | Spindle speed | 10 – 400 rpm(CW & CCW) |
| | Spindle drive motor | 0.75 kW, 3 Phase AC Servo motor |
| | Chucking method | Porous ceramic chuck |
| Cleaning unit | Cleaning type | Brush cleaning |
| | Dry method | Air blow & spinning |
| Software | Recipe | Select for Product Recipe |
| Control system | Controller | PC |
| | Monitor | Touch screen |
| Utility | Supply Power | 3PHASE AC220V 50/60Hz |
| | Air | 0.5~0.6 Mpa(CDA) Ø16 Air Hose |
| | DIW | 0.1 - 0.3 Mpa |
| | PCW | City water or tap water |
| | Machine dimensions | W790xL1900xH1,800 |
| | Machine Weight | 2000kg |


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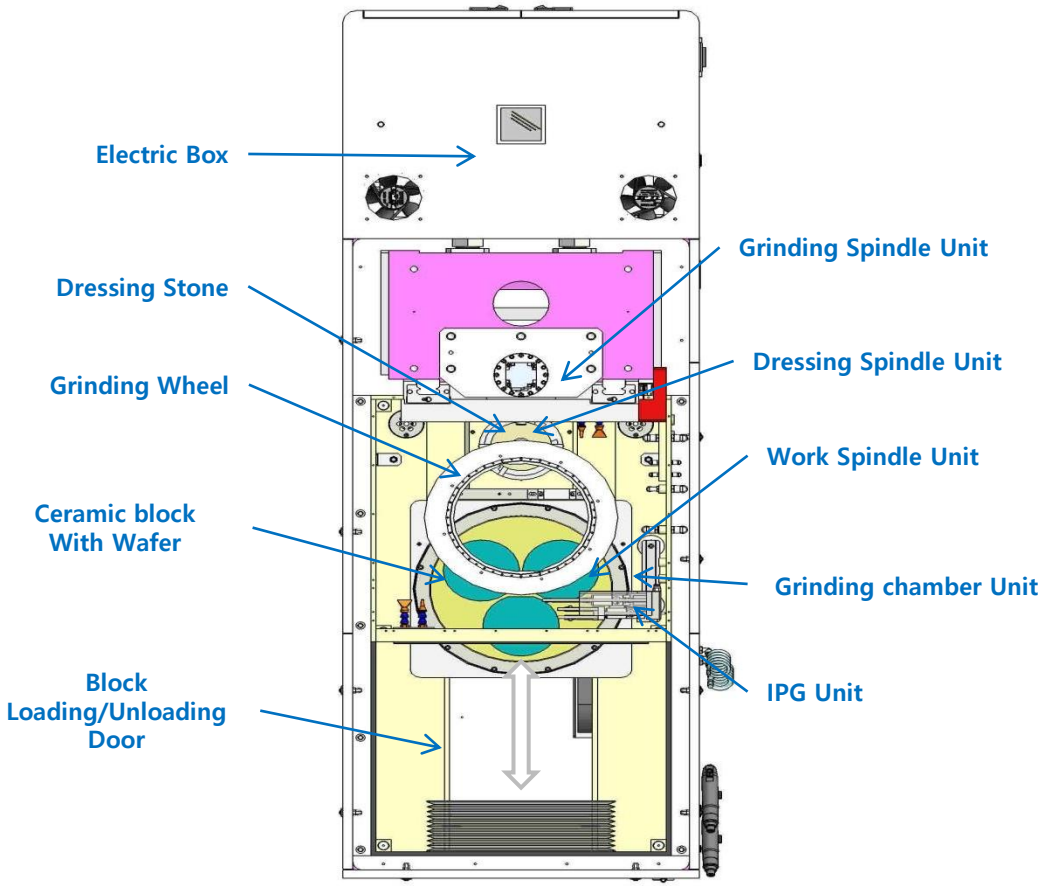
# 12 Wafer Grinder [NFG-5200]




Ceramic block Loading

⇩

Block move to chamber

⇩

Grinding spindle down

⇩

Grinding

⇩

Wheel dressing while grinding

⇩

Thickness measuring while grinding

⇩

Complete the process (reach the set thickness)

⇩

Ceramic block Loading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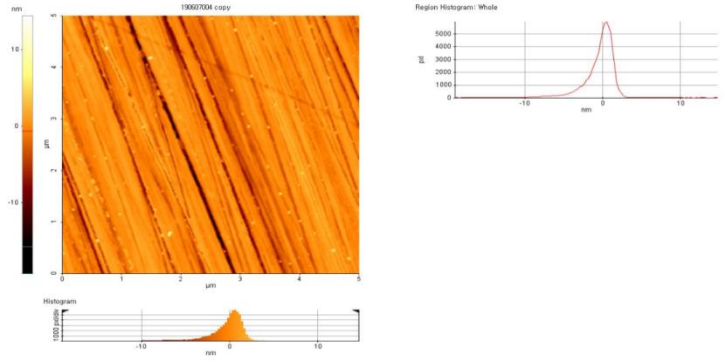
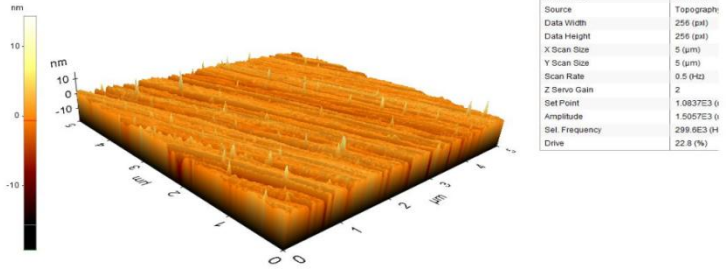
# 13 Wafer Grinder [NFG-5200]

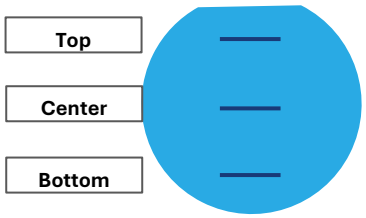
## Fine grinding Roughness Data (ø6” SiC wafer)

·**Measuring instrument** : AFM(PSIA XE150) · **Result** : Ra Avg.1.303nm





**AFM Measuring Point**




**Top**

Statistics

| Region | Min(nm) | Max(nm) | Mid(nm) | Mean(nm) | Rpv(nm) | Rq(nm) | Ra(nm) | Rz(nm) | Rsk | Rku |
|---|---|---|---|---|---|---|---|---|---|---|
| Whole | -19.294 | 14.418 | -2.438 | -0.658 | 33.712 | 2.104 | 1.428 | 31.342 | 2.258 | 12.543 |

**Center**

Statistics

| Region | Min(nm) | Max(nm) | Mid(nm) | Mean(nm) | Rpv(nm) | Rq(nm) | Ra(nm) | Rz(nm) | Rsk | Rku |
|---|---|---|---|---|---|---|---|---|---|---|
| Whole | -10.267 | 19.062 | 4.398 | 0.010 | 29.329 | 1.53 | 1.109 | 26.179 | 1.104 | 7.746 |

**Bottom**

Statistics

| Region | Min(nm) | Max(nm) | Mid(nm) | Mean(nm) | Rpv(nm) | Rq(nm) | Ra(nm) | Rz(nm) | Rsk | Rku |
|---|---|---|---|---|---|---|---|---|---|---|
| Whole | -51.257 | 8.767 | -21.245 | -0.489 | 60.024 | 2.204 | 1.372 | 56.143 | 5.865 | 90.414 |

**Ra Agv. : 1.303nm**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# 14 CMP[NFC-2024] _ Auto Loading

## CMP

NFC-Series

*A fully automated CMP system engineered for cassette-to-cassette operation, uniform pressure polishing, and advanced cleaning and conditioning—delivering stable process control, superior surface quality, and high-throughput performance for modern wafer fabrication.*

| Equipment Specification | | |
|---|---|---|
| Wafer | | Si, SiC Wafer |
| Applicable | Wafer size | Ø6” , Ø8” |
| Main body | Main frame | High Rigid Cast Iron Platform |
| | Inner shield cover | PVC (Ivory) |
| EFEM | Cassette | 4-wafer cassette |
| WTR | EFEM WTR | Vacuum Grip |
| | Process WTR | Centering Grip, Dual Arm, Flip |
| Platen | Driving | Servo Motor |
| | Material | SUS304 |
| | Spindle | Precision Ball bearing Spindle |
| L/UL unit | Material | Ivory PVC |
| | Grip Type | Clamping |
| Press plate | Driving | Individual Motor Driving |
| Cleaner | Nozzle | Water |
| Wafer | Moving | Robot Handler |
| Cleaner | Brush Material | PVA |
| | Spin Max RPM | Max3000 |
| Control system | Controller | PC+PLC |
| | Operation Panel | Programmable Touch Screen |
| Utility | Supply Power | 3PHASE AC220V 50/60Hz |
| | Air | 0.5~0.6 Mpa(CDA) |
| | DIW | 0.1 - 0.3 Mpa |
| | Machine dimensions | W2850xL4200xH2275 |
| | Machine Weight | 16000kg |
| | Clean Room | 1000 Class |


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# 15 CMP[NFC-2024] _ Auto Loading

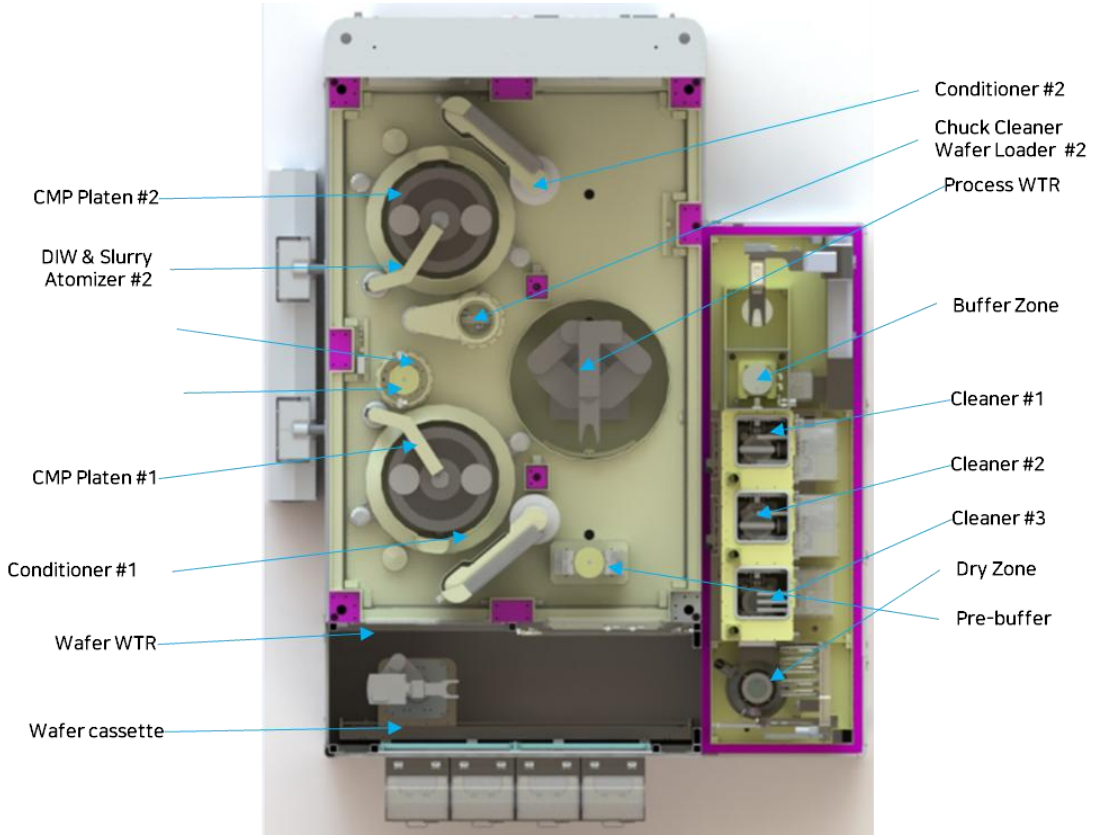
**Fully Automated Cassette-to-Cassette System**
Complete wafer loading/unloading automation maximizes throughput, with seamless transfer and alignment from loader to unloader.

**High-Performance Polishing Platform**
A single pressure head provides precise control and stability, while the membrane-type wafer carrier ensures uniform pressure distribution across the wafer surface.

**4-Step Wafer Cleaning System**
Continuous chemical and PVA brush cleaning followed by a multi-stage sequence:
2-step chemical + PVA → 1-step chemical → SRD drying.

**Precision Pad Conditioning & Head Cleaning**
A dedicated pad conditioning unit maintains pad lifetime and surface quality; the automatic head-cleaning system prevents cross-contamination and supports long-term process stability.

**Temperature & Slurry Control Design**
Internal platen cooling enables precise process temperature management, and anti-corrosion coatings on all slurry-contact components ensure maximum durability.





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# 16 CMP[NSC-1024] _ Manual Loading

## CMP

NSC-Series

*A compact semi-automatic 1-platen CMP system designed for manual loading—offering simple operation, stable polishing performance, and flexible process capability for R&D and small-batch production environments.*

| Equipment Specification | | |
|---|---|---|
| Wafer | | Si, SiC Wafer |
| Applicable | Wafer size | Ø8” x 1pcs |
| Main body | Main frame | High Rigid Cast Iron |
| | Inner shield cover | PVC (Ivory) |
| Platen | Driving | Servo Motor |
| | Material | SUS304 |
| | Spindle | Precision ball bearing Spindle |
| Loader | Material | Ivory PVC |
| | DI spray | Intermittent(Recipe) |
| Press plate | Driving | Individual Motor Driving |
| | Head | Membrane carrier |
| Pad dressing | Brush Material | Nylon |
| | RPM | Max. 100 |
| Control system | Controller | PC+PLC |
| | Operation Panel | Programmable Touch Screen |
| Thickness variation within on wafer | | Less than 2.5um |
| Thickness variation between wafers | | Less than 2.5um |
| Processing time | Ø8” SiC Ra<1nm | 10min |
| | Ø8” SiC Ra<0.2nm | 20min |

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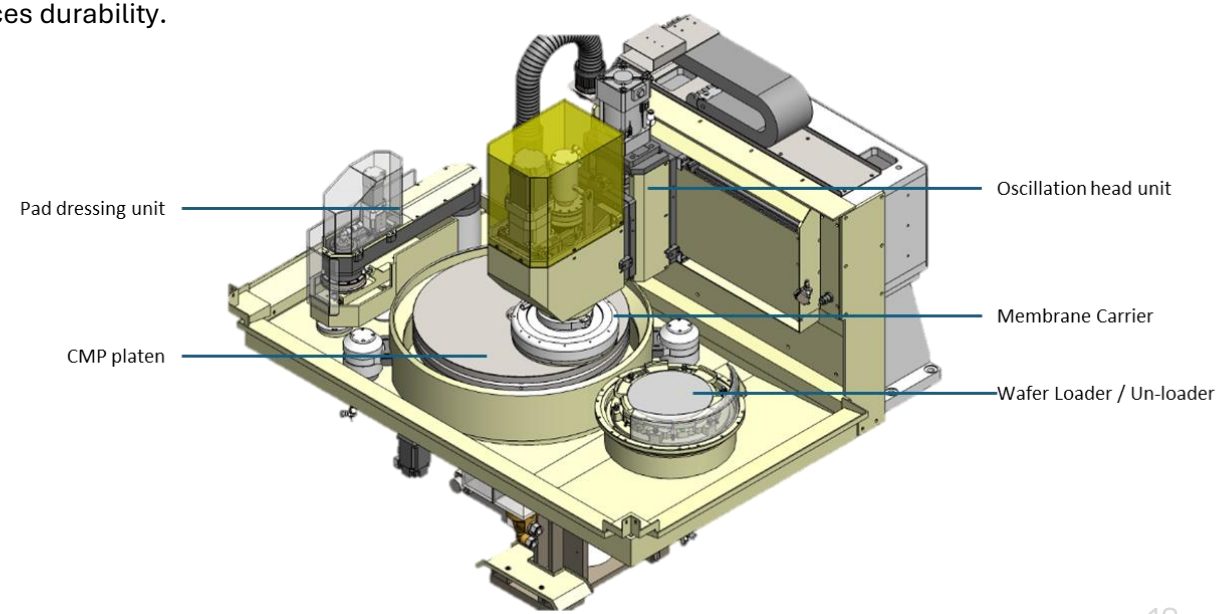
# 17 CMP[NFC-2024] _ Auto Loading

**Semi-Automatic Wafer Handling**
Wafer is placed on the loader and automatically picked up by the polishing head, transferred to the platen, and returned after processing.

**High-Precision Polishing Platform**
Single pressure head with membrane-type wafer carrier provides uniform pressure distribution and stable surface quality.

**Pad Conditioning & Head Cleaning**
Dedicated pad conditioning unit maintains pad performance, while the automatic head rinse system supports long, stable operation.

**Temperature & Slurry Management**
Integrated platen cooling ensures precise temperature control, and anti-corrosion coating on slurry-contact parts enhances durability.




CMP Platen & Membrane Carrier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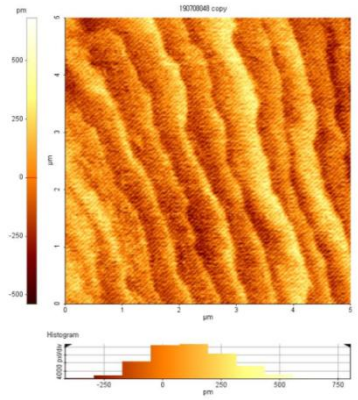
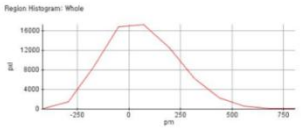
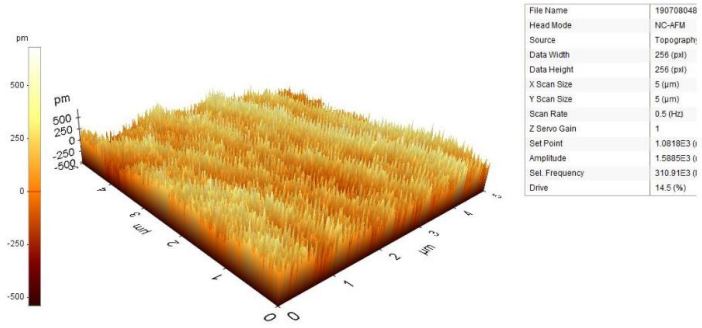
# 18 CMP[NFC-2024] _ Auto Loading

## CMP Roughness Date ((ø6” SiC wafer)

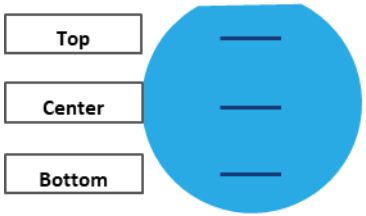
·**Measuring instrument** : AFM(PSIA XE150) · **Result** : Ra Avg.0.146nm







**AFM Measuring Point**




**Top**

Statistics

| Region | Min(pm) | Max(pm) | Mid(pm) | Mean(pm) | Rpv(pm) | Rq(pm) | Ra(pm) | Rz(pm) | Rsk | Rku |
|---|---|---|---|---|---|---|---|---|---|---|
| Whole | -837.689 | 782.188 | -27.751 | -1.232 | 1619.877 | 215.659 | 174.870 | 1465.444 | -0.015 | 2.675 |

**Center**

Statistics

| Region | Min(pm) | Max(pm) | Mid(pm) | Mean(pm) | Rpv(pm) | Rq(pm) | Ra(pm) | Rz(pm) | Rsk | Rku |
|---|---|---|---|---|---|---|---|---|---|---|
| Whole | -539.548 | 680.693 | 70.572 | 0.000 | 1220.242 | 169.346 | 136.987 | 1168.352 | -0.342 | 2.856 |

**Bottom**

Statistics

| Region | Min(pm) | Max(pm) | Mid(pm) | Mean(pm) | Rpv(pm) | Rq(pm) | Ra(pm) | Rz(pm) | Rsk | Rku |
|---|---|---|---|---|---|---|---|---|---|---|
| Whole | -742.319 | 624.244 | -59.037 | 0.000 | 1366.563 | 161.158 | 128.227 | 1219.120 | -0.036 | 2.984 |

**Ra Agv. : 0.146nm**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From Wafer to Package –
Complete Grinding Excellence