Park NX-Wafer

Industry's Leading Automated AFM for In-line Metrology Solutions

Park
SYSTEMS

Park NX-Wafer is the leading-edge atomic force microscope (AFM) developed for seamless integration into semiconductor fabrication environments. Leveraging Park Systems' proven AFM technology, it delivers advanced measurement capabilities to semiconductor manufacturing, with full compliance with SEMI standards and complete automation features. NX-Wafer has been widely adopted by major semiconductor manufacturers worldwide. Its proven legacy demonstrates the system's reliability and effectiveness in semiconductor metrology.

Park NX-Wafer

Key Features

Semiconductor Fab Integrability

- Fully automated operation through XEA software with an intuitive UI
- SECS/GEM communication for fab host integration
- Automated wafer handling and probe exchange
- Full compatibility according to SEMI standards

High-Precision AFM Technology

- Minimized out-of-plane motion through a decoupled XY and Z scanner architecture
- Precise orthogonality and positioning via dual-servo XY control
- True Non-contact™ mode preserves tip shape and extends tip lifetime

Versatile Applications

- Comprehensive 3D nano-metrology
- CMP metrology with long-range profiling
- High-aspect-ratio structure metrology
- High-throughput Cu pad measurement
- Automatic defect review

Park NX-Wafer
Semiconductor Fab Integrability

Fully Automated Operation

NX-Wafer enables fully automated operation from wafer handling to measurement and analysis. It automatically receives a recipe from a host, performs end-to-end automation by selecting the appropriate tip, scanning multiple target areas, analyzing the data, and generating reports.

OPERATION VIDEO

01 **Wafer Loading**

02 **Auto Probe Exchange**

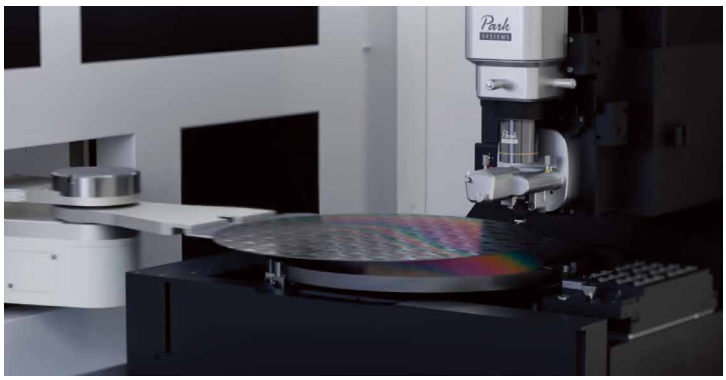
03 **Wafer Alignment and Move to Target**

04 **Tip Approach**

05 **Measurement and Analysis**

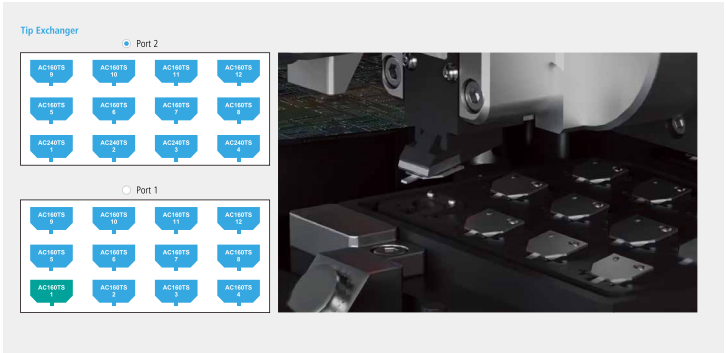
Automated Wafer Handling Capability

Wafer transfer is performed automatically by an equipment front end module (EFEM). It uses robotic mechanisms, sensors, and algorithms to ensure precise alignment and reliable handling of various materials, including warped wafers. The N2 purge load port is available as an option.



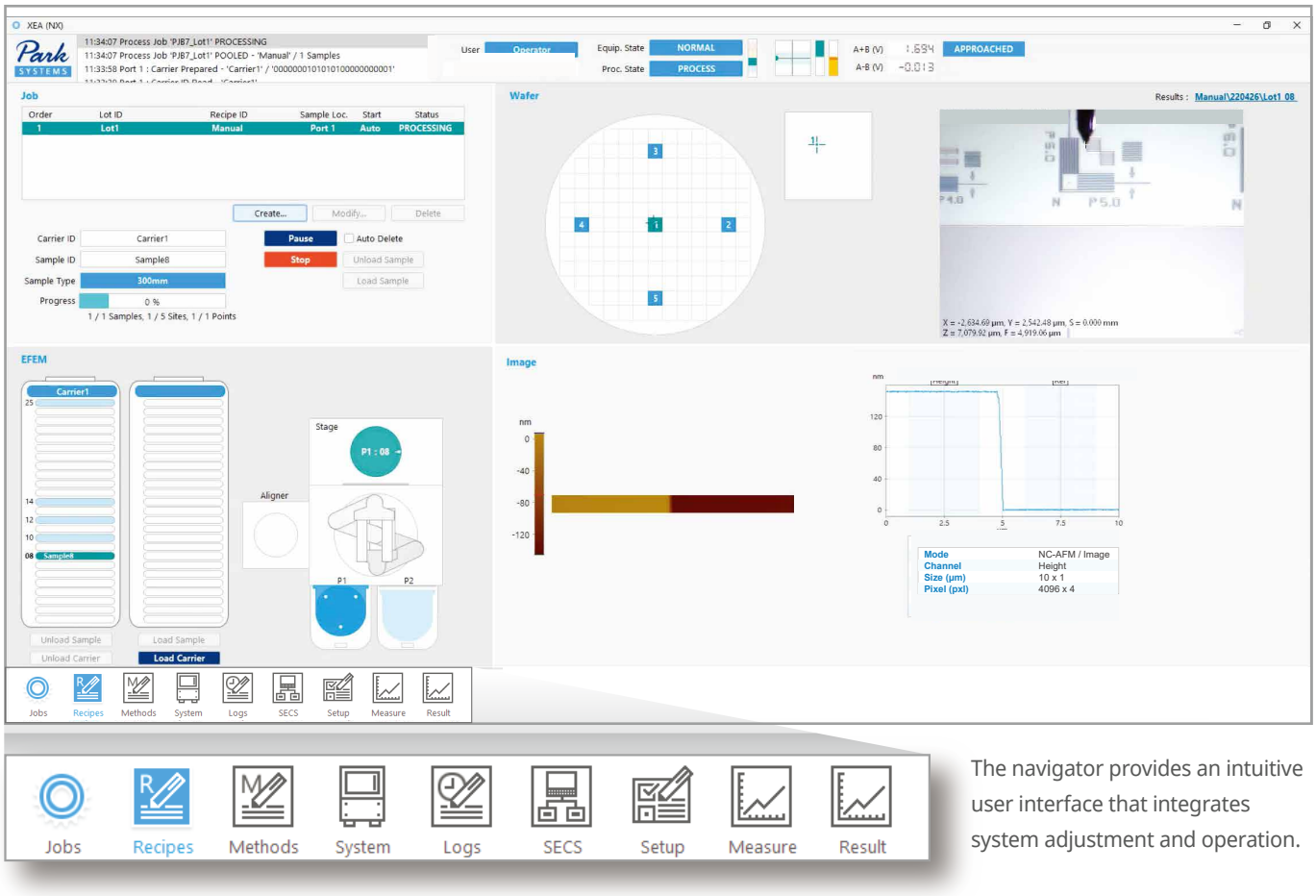
Automatic Probe Exchange

The automatic tip exchanger seamlessly replaces the probe when a threshold is exceeded. It can store up to 24 pre-mounted probes (12 probes per cassette).



Easy-to-Use Operation Software XEA

XEA offers practical features such as easy copy/paste of recipes, specialized editing modes, and real-time recipe updates. With built-in functions providing comprehensive system operation—including parameter adjustment, database management, and maintenance—the interface remains straightforward and user-friendly.



The navigator provides an intuitive user interface that integrates system adjustment and operation.

Fab Host Communication via SECS/GEM Protocol

The system enables Fab host communication via the SECS/GEM protocol, ensuring full compliance with SEMI standards, including E30, E40, E87, E90, E94, and E84 PI/O for AMHS integration.

Fab Compatibility According to SEMI Standards

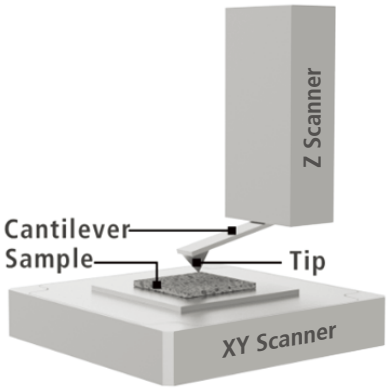
NX-Wafer ensures optimal compatibility with cleanroom environments in semiconductor fabs. The system achieves ISO Cleanliness Class 1 (≤10 particles/m³ ≥ 0.1 µm and ≤2 particles/m³ ≥ 0.2 µm) and minimizes particle contamination along the wafer movement path through its engineered fan filter unit and ventilation system, while maintaining efficient noise shielding. Additional chemical filters are available as options to effectively block airborne molecular contamination (AMC), which can adversely affect sensitive samples. Furthermore, the system is equipped with advanced monitoring capabilities that can detect and alert users to potential fire hazards or voltage sags.

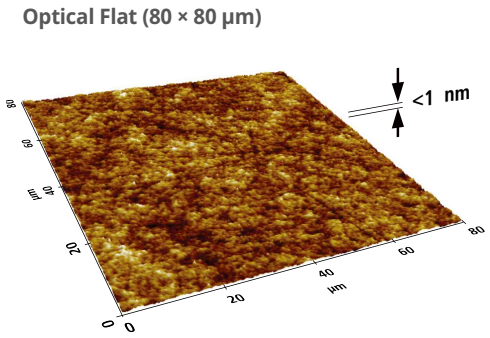
Park NX-Wafer

Park High-Precision AFM Technology

Decoupled XY and Z Scanner System

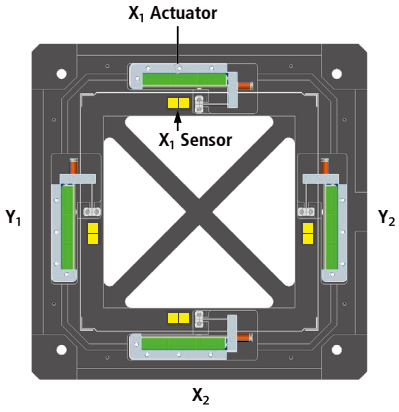
The separated flexure-guided 2D XY scanner and 1D Z scanner system minimizes out-of-plane motion by eliminating crosstalk between horizontal and vertical motion. The independent Z scanner enables precise, linear, and fast dynamic performance.

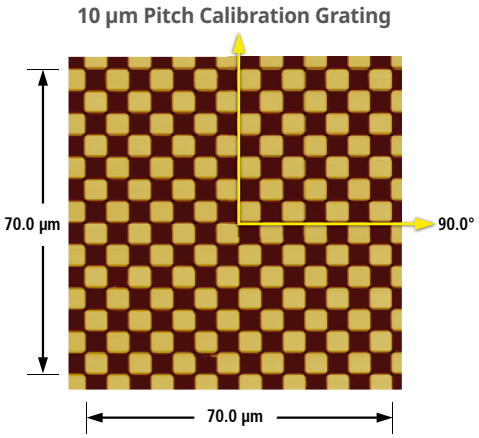




Orthogonal Scan for XY Scanner

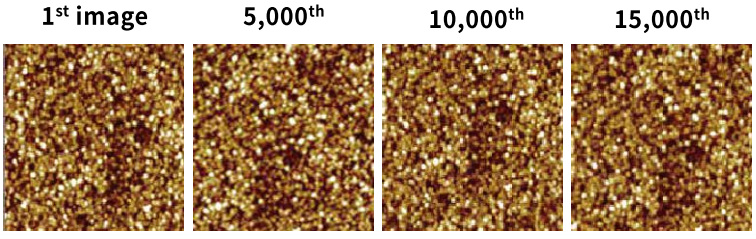
The XY scanner features a dual-servo architecture with two pairs of actuators and position sensors mounted on opposite sides of each axis, providing precise orthogonality and accurate positioning across the entire scan area.



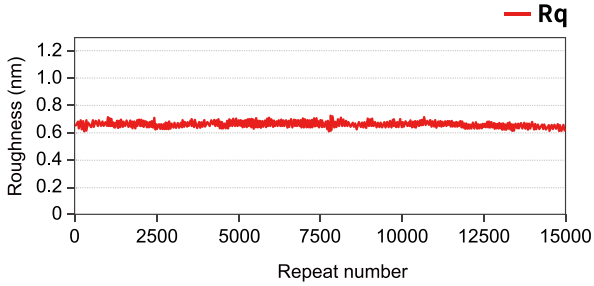


True Non-Contact™ Mode

True Non-contact™ mode, a proprietary technology offered by Park Systems, obtains topography by detecting the attractive van der Waals force between the tip and sample surface. The key advantage of True Non-contact mode is the prevention of tip wear and sample damage, ensuring consistent results with superior data reliability. This also reduces the total cost of ownership by extending tip life. The system also supports contact mode and tapping mode when required.



(500 nm × 500 nm)



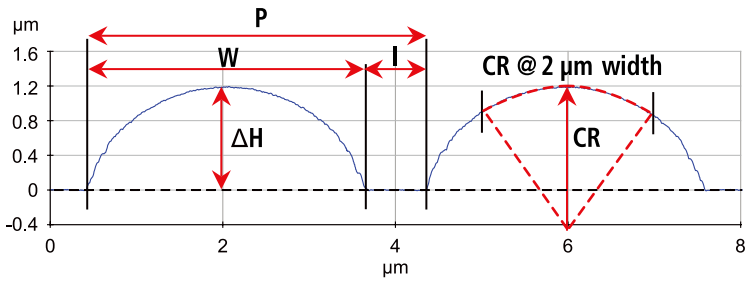
Repeat	1st	5000th	10000th	15000th	Avg.	1σ (%)
Rq (nm)	0.669	0.674	0.685	0.642	0.662	0.011 (1.72%)

Park NX-Wafer
Versatile Applications

Comprehensive 3D Nano-Metrology

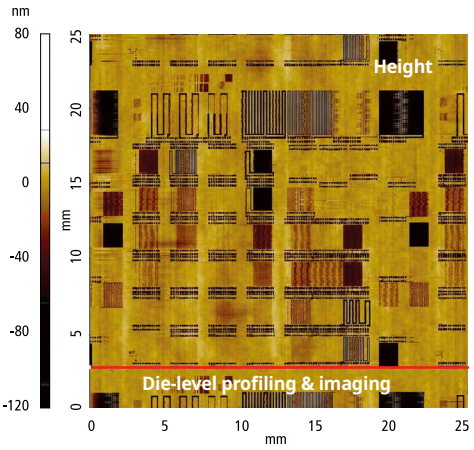
Park AFM accurately measures challenging patterns such as micro-lenses that are difficult to characterize with optical metrology tools, while providing comprehensive analytical capabilities including measurements of width, interval, pitch, height, and radius of curvature.

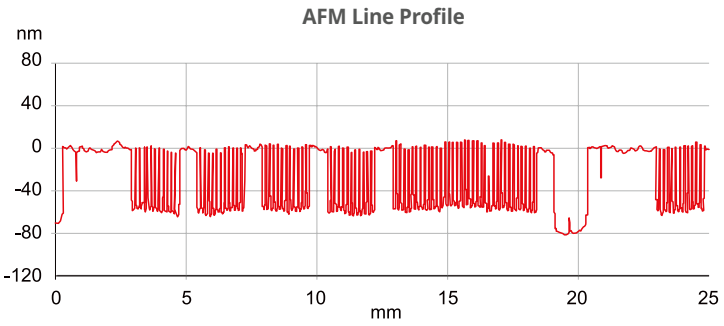
Scan Size: 9 μm × 9 μm



CMP Metrology with Long Range Profiling

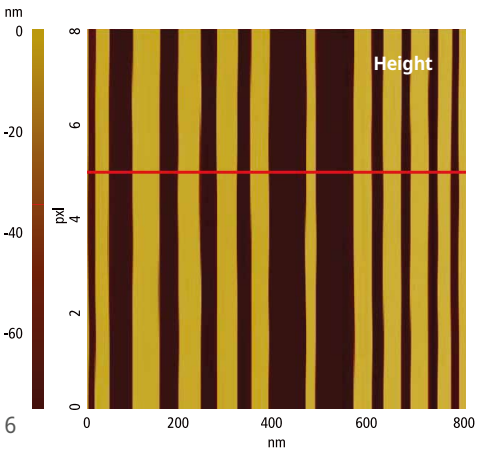
Combining NX-Wafer with a sliding stage provides a long range profiling capability for CMP metrology. Due to the unique sliding stage design of Park's automated AFM, the combined system provides very flat profiling and enables unprecedented CMP metrology of both local and global planarity measurements including dishing, erosion, and edge-over-erosion (EOE).

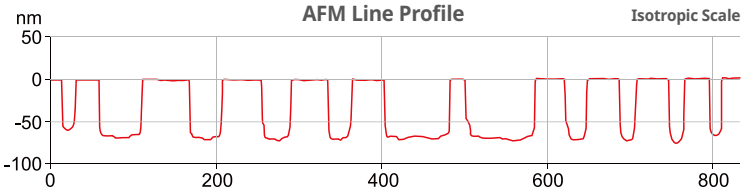




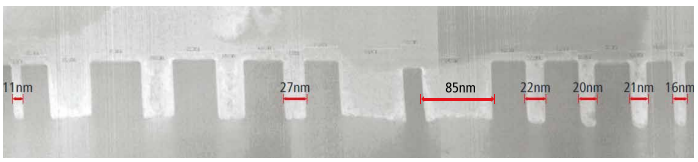
High Aspect Ratio Structure Metrology

Park AFM technology can measure high aspect ratio and nanometer-scale trenches in advanced semiconductor processes. Narrow trench mode (NTM) is optimized for nanometer-scale trench measurements. The data below show excellent NTM measurement results for nanometer-scale trenches with various aspect ratios. Specialized tips are available for specific requirements.





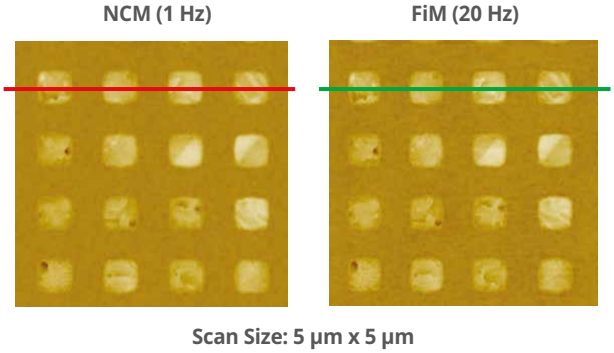
TEM Result



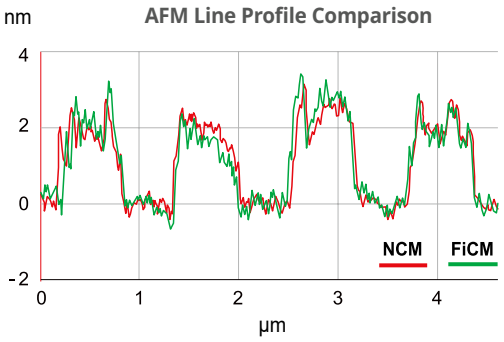
(Trench Width 11 ~ 85 nm, Trench Depth 60 ~ 70 nm)

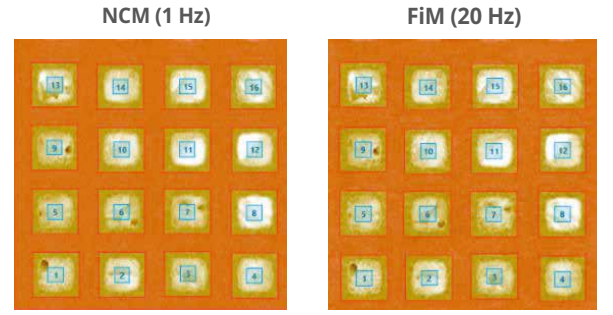
High-Throughput Measurement for Cu Pad

Park's fast imaging mode (FiM) provides reliable data for Cu pad measurements with high throughput. The Cu pad data from the fast imaging mode delivers line profiles and height values equivalent to those obtained in True Non-contact™ mode. The proprietary analysis algorithm can analyze each Cu pad regardless of pad shape or array arrangement.

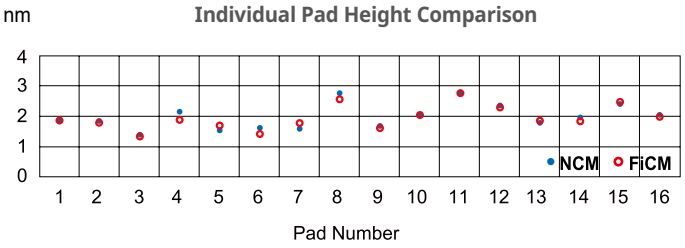


Scan Size: 5 μm x 5 μm





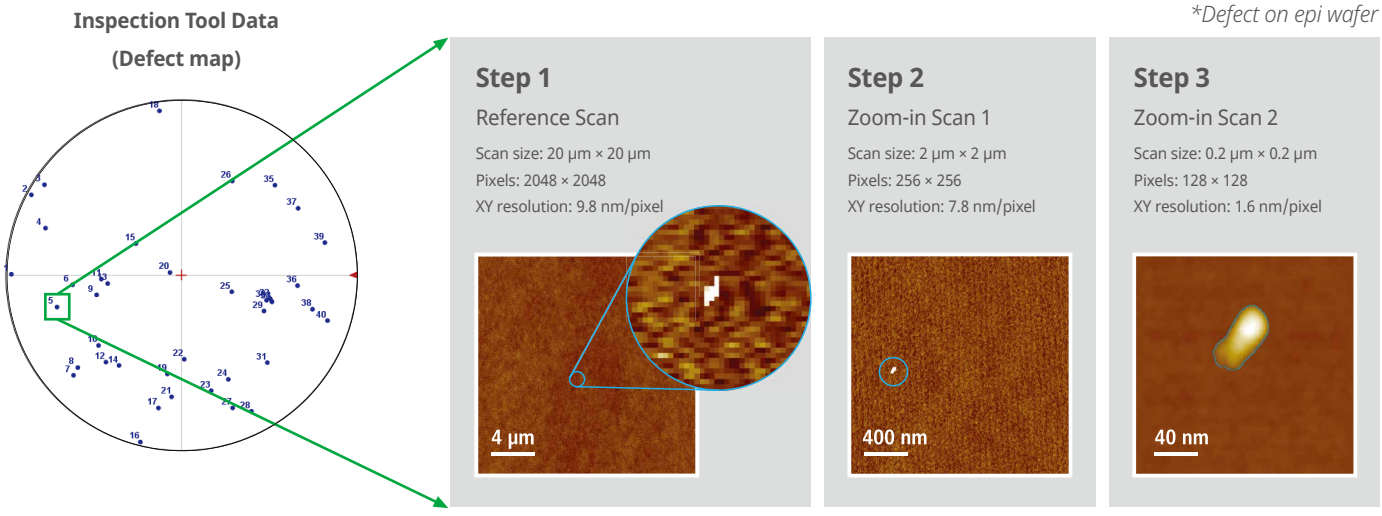
Scan Size: 5 μm x 5 μm



Automatic Defect Review (ADR)

The ADR function provides further analysis of defects detected by conventional defect inspection tools. The defects are automatically scanned by AFM once inspection tool data with defect coordinates is uploaded. Defect types and profiles are automatically analyzed in detail using zoom-in scan data.

**Defect on epi wafer*



Park NX-Wafer

Technical Specifications

AFM Modes

- True Non-contact™ Mode
- Tapping Mode
- Contact Mode
- Fast imaging Mode (FiM) **
- Narrow Trench Mode (NTM) **

Scanner

- Dual-servo XY scanner (100 µm × 100 µm)
- Flexure-guided Z scanner (15 µm or 30 µm) *

Long Range Sliding Stage

- Up to 50 mm *

On-Axis Optics

- Direct on-axis vision of sample surface and cantilever
- Field of view: 840 µm × 630 µm (w/ 10× objective lens)
- CCD: 5 M pixels

Automatic Tip Excahnger

- 24 pre-mounted probes (12 probes per cassette)

Sample Handling Capability **

- 200 mm system: 150 mm, 200 mm wafer
- 300 mm system: 200 mm, 300 mm wafer

Dimension and Weight (Approx.)

- 200 mm system: 2,763 mm × 1,245 mm × 2,242 mm (2,510 kg)
- 300 mm system: 3,854 mm × 1,582 mm × 2,228 mm (3,995 kg)

Required Environment

- Room Temperature (Stand By): 10 °C ~ 40 °C
- Room Temperature (Operating): 18 °C ~ 24 °C
- Humidity: 30% to 60% (not condensing)
- Floor Vibration Level: VC-D (6.25 µm/sec)
- Acoustic Noise: Below 65 dB
- Pneumatics: CDA 0.7 MPa, Vacuum -80 kPa
- Power Supply Rating: 208 ~ 240 V, 1 Phase, 50/60 Hz
- Ground Resistance: Below 1 Ω

** Requires additional options*

*** Consult with Park Systems*

Park SYSTEMS
www.parksystems.com