



Canon

CANON INDUSTRIAL PRODUCTS

ENABLING A WORLD OF INNOVATIONS

Advancing Day By Day

In 2020, Canon is celebrating the 50th anniversary since the 1970 launch of the Projection Print Camera or PPC-1. Originally referred to as a “semiconductor printing device”, the PPC-1 was Japan’s first semiconductor lithography system and signaled Canon’s full-scale entry into the semiconductor lithography equipment business.



Canon Projection Print Camera (PPC-1)

As we celebrate the 50th anniversary of our lithography equipment business, Canon will continue to improve and refine our lithography systems to contribute to the further development of society.

Canon’s exposure equipment history begins with advancements in camera lens technology. Utilizing technology originally developed for camera lenses during the mid-1960’s, Canon developed high-resolution lenses for photomask manufacturing. To further that technology and overall business expansion plans, we began developing semiconductor lithography equipment for wafer fabrication and in 1970 and entered the semiconductor lithography equipment business with the introduction of the “PPC-1”, a first in Japan.

Canon also produced the world’s first lithography system that offered less than 1 micrometer resolution with the launch of Fine Pattern Aligner (FPA) platform and the FPA-141F in 1975. In 2010, the FPA-141F was recognized by the Center of the History of Japanese Industrial Technology as an Essential Historical Material for Science and Technology.



Canon FPA-1200NZ2C Nanoimprint Lithography System



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CANON INDUSTRIAL PRODUCTS ENABLING A WORLD OF INNOVATIONS

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Canon Lithography Systems

Canon Photolithography equipment is designed to help provide exceptional quality, performance, and cost of ownership for your wafer imaging applications.

Canon FPA (Fine Pattern Aligner) Series i-line and Deep Ultraviolet (DUV) lithography systems are used in the fabrication and heterogeneous integration of high-tech devices including integrated circuits, hard disk read/write heads, microelectromechanical systems (MEMS) devices, image sensors, displays, power devices and light emitting diodes (LED).

LITHOGRAPHY PRODUCTS & TARGET APPLICATIONS

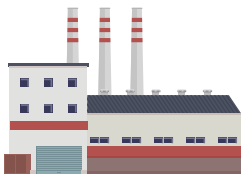
Lithography Products	Technology	Resolution	Lens Red. Field Size [mm]	Substrate Options	MRAM	Logic & MPU/GPU	3D-NAND & DRAM	HDD & SCM	Power & Automotive	Waveguide and RF	Advanced Packaging	Optics & Photonics	MEMS, Sensors & IoT	Image Sensors	5G and Data Centers	Wearables	AR/VR & Display	LED, MicroLED	OLED, MicroOLED
FPA-3030i5+	i-line (365 nm) Stepper	≤ 350 nm	5:1 22 x 22 mm	≤ 200 mm	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	
FPA-3030iWa	i-line (365 nm) Stepper	≤ 0.8 μm	2:1 52 x 52 mm	≤ 200 mm	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
FPA-3030EX6	KrF (248 nm) Stepper	≤ 150 nm	5:1 22 x 22 mm	≤ 200 mm	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	
FPA-5520iV	i-line (365 nm) Stepper	≤ 1.0 μm ≤ 0.8 μm*	2:1 52 x 34 mm	300 mm	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FPA-5550iZ2	i-line (365 nm) Stepper	≤ 280 nm (2/3 Ann.)	4:1 26 x 33 mm	200 mm 300 mm	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FPA-5510iX	i-line (365 nm) Stepper	≤ 0.5 μm	2:1 50 x 50 mm	300 mm			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FPA-6300ES6a	KrF (248 nm) Scanner	≤ 90 nm (2/3 Ann.)	4:1 26 x 33 mm	200 mm 300 mm	✓	✓	✓	✓	✓	✓					✓	✓	✓		
FPA-6300ESW	KrF (248 nm) Scanner	≤ 130 nm	3.125:1 33 x 42.2 mm	200 mm 300 mm			✓	✓	✓	✓	✓			✓	✓	✓	✓		



Compatible with application

* = Options Required

All options may not be available on all models. Contact Canon for details.



Industrial Manufacturing



High-Tech Manufacturing



Sensors and IoT



PC and Mobile



Display and AR/VR



Automotive



Medical



Green Home



Wearables



FPA-3030i5+ FEATURES

- Resolution ≤ 350 nm
- Lens Reduction 5:1
- Substrate handling capability: 50, 75, 100, 150, 200 mm
- FPA-3030i5+ Steppers leverage and extend proven Canon FPA-3000 Stepper designs
- Canon Built-In Metrology (CANOMAP)

KEY OPTIONS

- Through Silicon Alignment (TSA) Scope
- Die-by-Die Overlay Compensation (EAGA)
- Multi-Wafer Size Handling Kit
 - 75 & 100 mm, 100 & 150 mm, 150 & 200 mm
- Warped/Bonded/Transparent Wafer Handling
- Pellicle Particle Checker
- PC Remote Console
- GEM-compliant online software



Multi-Wafer Size Handling Kits allow quick changeover between two wafer sizes
75 ↔ 100 mm, 100 ↔ 150 mm, 150 ↔ 200 mm

High-Resolution i-line Stepper for ≤ 200 mm Wafer Fabrication

FPA-3030i5+ [30i5+] Steppers deliver performance and flexibility required for manufacturing and R&D environments and support a variety of substrates including GaAs, GaN and transparent sapphire and SiC wafers.

The 30i5+ is able to support a range of wafer sizes for innovative Internet-of-Things (IoT), 5G, automotive, power and Micro-electromechanical Systems (MEMS) applications and can be configured to process wafers from 50 mm (2") to 200 mm (8") in diameter. 30i5+ systems can also be configured to handle two different wafer sizes with the Multi-Wafer Handling Kit option.

The resolution, overlay, productivity and available options of the 30i5+ make it a cost-effective solution for challenging ≤ 200 mm wafer processes.



Through-Silicon Alignment Option enables measurement of back-side alignment targets through full-thickness silicon wafers.

SPECIFICATIONS

Technology	i-line Stepper (365 nm)
Resolution	≤ 350 nm
Throughput	≥ 105 wph (200 mm)
Single Machine Overlay	≤ 40 nm (Front) ≤ 500 nm (Back)*
Numerical Aperture	0.45 – 0.63
Lens Reduction Ratio	5:1
Exposure Field	22 x 22 mm
Substrate Size Options	50, 75, 100, 125, 150, 200 mm
Dimensions (W x D x H)	1.9 x 2.6 x 2.45 m

* = Option Required

FPA-3030iWa Wide-Field i-line Stepper for IoT Device Applications

NEW

Wide-Field i-line Stepper for ≤ 200 mm Wafer Fabrication

FPA-3030iWa [30iWa] Steppers deliver performance and flexibility required for manufacturing and R&D environments and support a variety of substrates including GaAs, GaN and transparent sapphire and SiC wafers.

The 30iWa features a 52 mm x 52 mm wide-field projection lens with a variable numerical aperture (NA) ranging from 0.16 to 0.24, delivering a large depth of focus (DOF) and is designed to enable high-precision imaging over large topography or through thick resist.

The field size, depth of focus, productivity and available options of the 30iWa make it a cost-effective solution for challenging ≤ 200 mm wafer processes for innovative Internet-of-Things (IoT) applications.

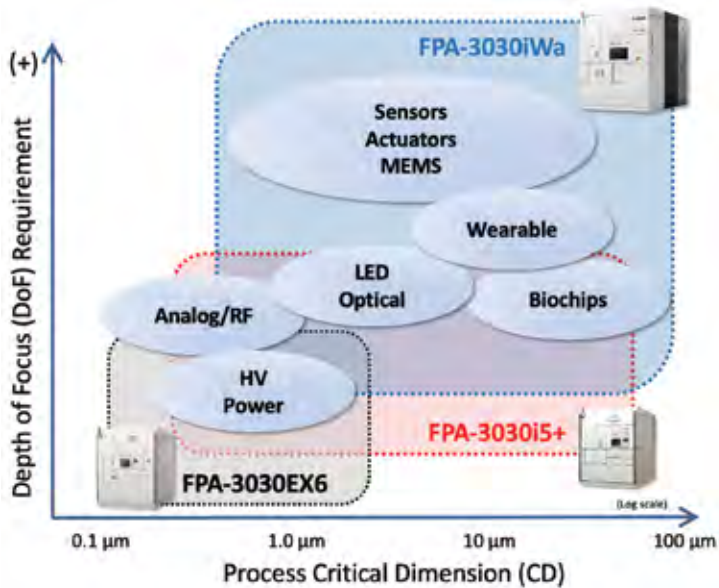


FPA-3030iWa FEATURES

- Resolution $\leq 0.8 \mu\text{m}$
- Lens Reduction 2:1
- Wide Field 52 x 52 mm
- Substrate handling capability: 50, 75, 100, 125, 150, 200 mm
- FPA-3030iWa Steppers leverage and extend proven Canon FPA-3000 Stepper designs
- Canon Built-In Metrology (CANOMAP)

KEY OPTIONS

- Through Silicon Alignment (TSA) Scope
- Die-by-Die Overlay Compensation (EAGA)
- Multi-Wafer Size Handling Kit
 - 75 & 100 mm, 100 & 150 mm, 150 & 200 mm
- Warped/Bonded/Transparent Wafer Handling
- Pellicle Particle Checker
- PC Remote Console
- GEM-compliant online software

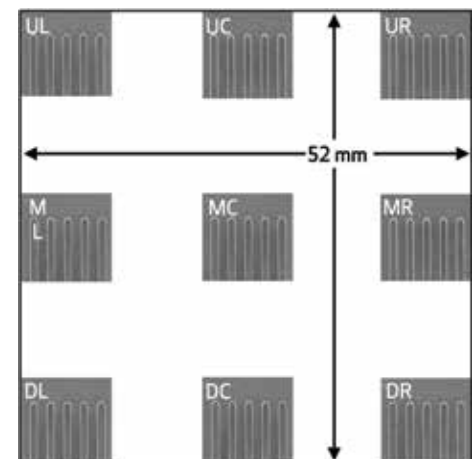


FPA-3030 Series steppers support processes requiring high-resolution and large DoF

SPECIFICATIONS

Technology	i-line Stepper (365 nm)
Resolution	$\leq 0.8 \mu\text{m}$
Throughput	≥ 125 wph
Single Machine Overlay	≤ 100 nm (Front) ≤ 500 nm (Back)*
Numerical Aperture	0.16 - 0.24
Lens Reduction Ratio	2:1
Exposure Field	52 x 52 mm
Substrate Size Options	50, 75, 100, 125, 150, 200 mm
Dimensions (W x D x H)	1.9 x 2.6 x 2.45 m

* = Option Required



FPA-3030iWa Steppers feature a large exposure field and $0.8 \mu\text{m}$ resolution capability.



High-Resolution KrF Stepper for Aggressive ≤ 200 mm Wafer Fabrication

FPA-3030EX6 [30EX6] Deep UV (DUV) Steppers provide a low cost alternative to Scanners for customers seeking high-resolution imaging. The EX6 can also be configured to handle different substrate materials, sizes and thicknesses required for fabricating advanced analog, sensor, RF and power devices as well as emerging Internet-of-Things (IoT) applications with special wafer requirements.

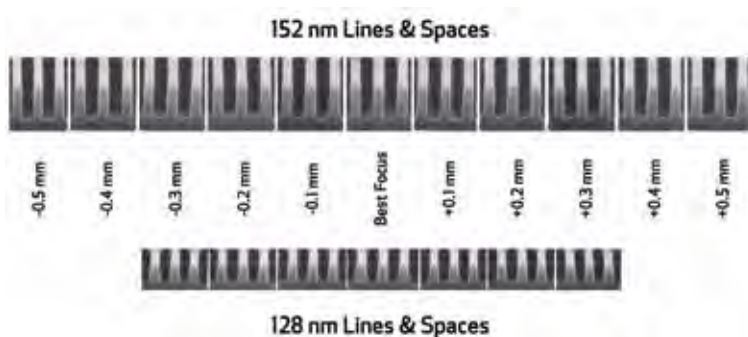
FPA-3030EX6 Steppers offer the highest level of performance among KrF (Krypton Fluoride) Excimer Laser Steppers and are designed to be a long-term solution for growing industry demands.

FPA-3030EX6 FEATURES

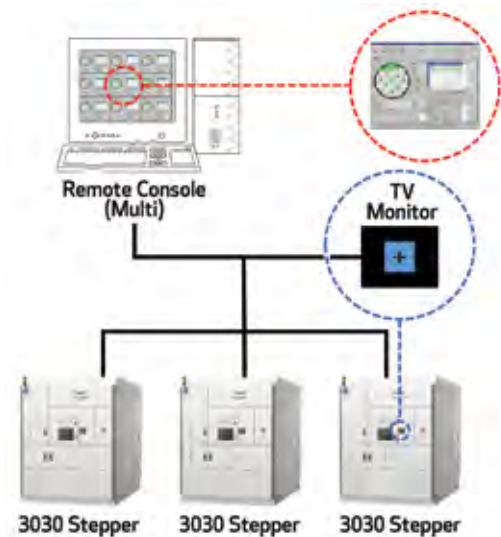
- 248 nm exposure wavelength Stepper
- Resolution ≤ 150 nm
- Single Machine Overlay ≤ 25 nm
- Substrate handling capability: 50, 75, 100, 125, 150, 200 mm
- e-Console Software supports advanced automation and remote operation functions
- Canon Built-In Metrology (CANOMAP)

KEY OPTIONS

- Through Silicon Alignment (TSA) Scope
- Die-by-Die Overlay Compensation (EAGA)
- Multi-Wafer Size Handling Kit
 - 75 & 100 mm, 100 & 150 mm, 150 & 200 mm
- Warped/Bonded/Transparent Wafer Handling
- Pellicle Particle Checker
- PC Remote Console
- GEM-compliant online software



FPA-3030EX6 DUV (KrF, 248 nm) Steppers provide cost-efficient high-resolution imaging on ≤ 200 mm substrates for sensor, power and IoT applications.



e-Console Software supports Remote Console control and troubleshooting of fleets of tools from remote locations.

SPECIFICATIONS

Technology	KrF Stepper (248 nm)
Resolution	≤ 150 nm
Throughput	≥ 121 wph (200 mm)
Single Machine Overlay	≤ 25 nm
Numerical Aperture	0.50 – 0.65
Lens Reduction Ratio	5:1
Exposure Field	22 x 22 mm
Substrate Size Options	50, 75, 100, 125, 150, 200 mm
Dimensions (W x D x H)	1.9 x 3.0 x 2.45 m

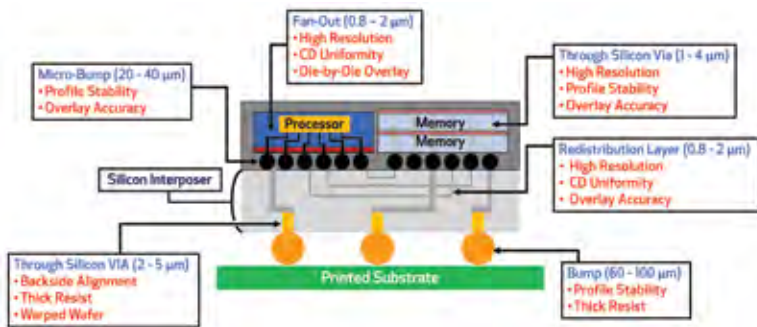
FPA-5520iV i-line Stepper for Advanced Packaging & Photonics Applications

High-Resolution, Wide-Field i-line Stepper for FOWLP & Photonics Fabrication

FPA-5520iV [20iV] Steppers address next-generation Fan Out Wafer Level Packaging [FOWLP] challenges as demand for cost effective back-end high-resolution processes increases.

Available options supporting future FOWLP processes include the High-Resolution (HR) Option that equips the 20iV with a projection lens designed with a maximum Numerical Aperture (NA) of 0.24. The 20iV-HR can provide 0.8 μm resolution patterning for high-density VIA and Redistribution Layer (RDL) processes.

20iV warpage compensation and die-by-die overlay options also support fabrication of multi-die Fan-Out packages by compensating for the substrate distortion and die-shift that is common in FOWLP processes.



FPA-5520iV Steppers support a variety of Advanced Packaging process requirements including patterning of deep etching and plating masks.



FPA-5520iV FEATURES

- Resolution $\leq 0.8 \mu\text{m}^*$
- Lens Reduction 2:1
- Wide Field 52 x 34 mm
- 20iV Steppers offer a wide exposure field, while balancing resolution and Depth of Focus (DoF) for thin and thick, positive and negative resist processes
- Canon Built-In Metrology (CANOMAP)

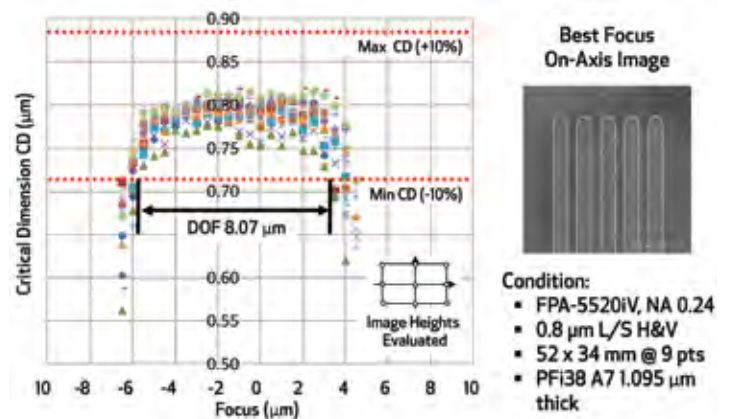
KEY OPTIONS

- Through Silicon Alignment (TSA)
- Die-by-Die Overlay Compensation (EAGA)
- Warped Wafer Vacuum Assist (WVA)
- Bonded/Transparent Wafer Handling
- Resist Outgas Exhaust System
- Front-to-Back Overlay Metrology (DMAP)
- Pellicle Particle Checker
- GEM-compliant online software

SPECIFICATIONS

Technology	i-line Stepper (365 nm)
Resolution	$\leq 1 \mu\text{m}$ (0.8 μm^*)
Throughput	≥ 160 wph (300 mm)
Single Machine Overlay	≤ 150 nm (Front) ≤ 500 nm (Back)*
Numerical Aperture	0.15 - 0.18 (- 0.24)*
Lens Reduction Ratio	2:1
Exposure Field	52 x 34 mm
Substrate Size Options	300 mm
Dimensions (W x D x H)	2.3 x 3.34 x 2.7 m

* = Option Required



Canon FPA-5520iV HR Option provides sufficient Depth of Focus (DoF) to support 0.8 μm RDL and VIA processes.



High-Productivity and High-Overlay Accuracy i-line Stepper for Low-CoO Fabrication

FPA-5550iZ2 [50iZ2] i-line Steppers offer a low cost Mix-&-Match lithography solution for advanced Logic, Memory and CMOS Image Sensor (CIS) fabrication. 50iZ2 Steppers also support growing demand for Internet-of-Things (IoT) device fabrication on both 200 and 300 mm wafers.

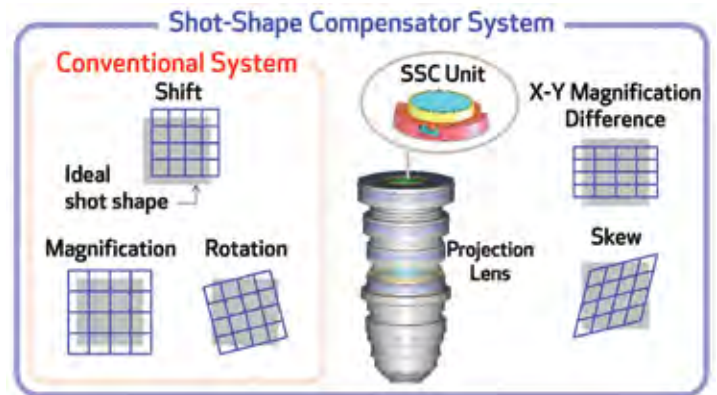
The 50iZ2 offers a balance between productivity and alignment accuracy. Throughput upgrades include calibration, alignment, exposure & wafer transfer sequence optimization, and reduced wafer lot exchange times. Overlay matching can also be improved through shot-specific intra-field compensation.

FPA-5550iZ2 FEATURES

- Throughput ≥ 230 wafers per hour* for 200 or 300 mm wafers
- Shot-Shape Compensator (SSC) Unit improves overlay matching accuracy by adjusting intra-field magnification and skew of each shot
- Canon Built-In Metrology (CANOMAP)

KEY OPTIONS

- Off-Axis Scope 2 (OAS2) Infrared (IR) Alignment scope for Color Filter (CF) & Backside Illuminated (BSI) applications
- Oxygen Concentration Control System (OCCS)
- Reticle Thermal Expansion Compensation (RTEC)
- Die-by-Die Overlay Compensation (EAGA)
- 200, 300 mm wafer handling
- Pellicle Particle Checker
- GEM-compliant online software



Shot-Shape Compensator (SSC) Unit compensates for intra-field X & Y magnification and skew differences of each shot to improve overlay matching and yield.

	No Compensation	w/ EAGA Compensation	w/EAGA & SSC Compensation
Overlay Error 3σ [nm]			
X	99.1	37.0	22.7
Y	93.4	42.5	19.5

FPA-5550iZ2 Steppers can improve overlay matching in Backside Illumination processes using the optional Enhanced AGA (EAGA) and Shot Shape Compensator (SSC) functions.

SPECIFICATIONS

Technology	i-line Stepper (365 nm)
Resolution	≤ 280 nm (2/3 Ann.)
Throughput	≥ 230 wph* (300 mm)
Single Machine Overlay	≤ 15 nm
Mix and Match Overlay	≤ 20 nm*
Numerical Aperture	0.45 – 0.57
Lens Reduction Ratio	4:1
Exposure Field	26 x 33 mm
Substrate Size Options	200, 300 mm
Dimensions (W x D x H)	2.3 x 3.66 x 3.0 m

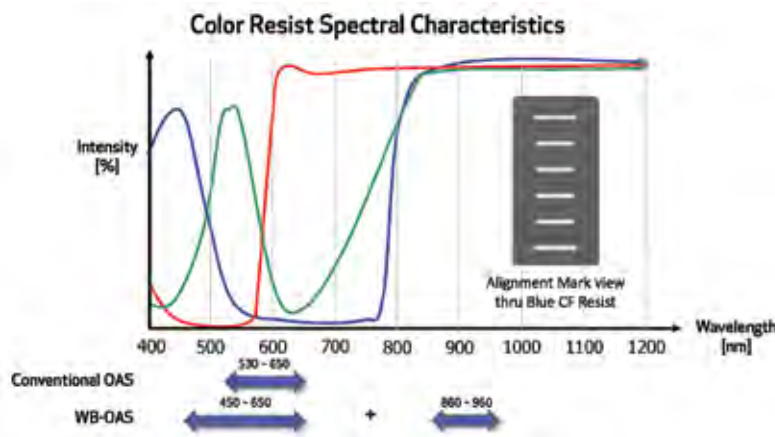
* = Option Required

FPA-5510iX i-line Stepper for CF, CIS & FPGA Applications

Wide-Field, High-Resolution i-line Stepper for Large Device Fabrication

FPA-5510iX [10iX] Steppers provide high-resolution imaging across a large exposure area and compatibility with a range of advanced functions. 10iX Steppers offer a large 50 x 50 mm exposure field allowing users to improve imaging performance and productivity by helping to avoid stitching of adjacent shots to expand field size.

Originally designed for Color Filter (CF) fabrication, the 10iX can be extended to provide high-resolution patterning for production of full-field CMOS Image Sensors (CIS), Field Programmable Gate Arrays (FPGA), Advanced Packaging, display and other large device applications.



The Wide Band Off-Axis Scope (WB-OAS) can provide infrared wavelength alignment light enabling measurement through silicon and red, blue and green color filter resists.

FPA-5510iX FEATURES

- Exposure Field 50 x 50 mm (max Φ 70.7 mm)
 - X max = 52 mm
 - Y max = 56 mm
- Stepper Alignment Options enable overlay process optimization for Color Filter (CF) and Backside Illuminated (BSI) Processes
- Canon Built-In Metrology (CANOMAP)

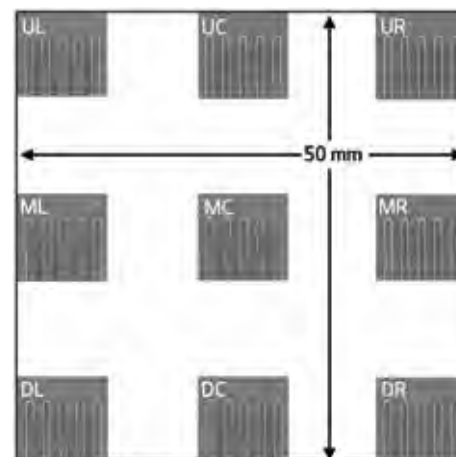
KEY OPTIONS

- Wide Band Off-Axis Scope (WB-OAS)
- Oxygen Concentration Control System (OCCS)
- Die-by-Die Overlay Compensation (EAGA)
- Resist Outgas Exhaust System
- Pellicle Particle Checker
- PC Remote Console
- GEM-compliant online software

SPECIFICATIONS

Technology	i-line Stepper (365 nm)
Resolution	≤ 500 nm
Throughput	≥ 145 wph (300 mm)
Single Machine Overlay	≤ 50 nm
Numerical Aperture	0.28 - 0.37
Lens Reduction Ratio	2:1
Exposure Field	50 x 50 mm
Substrate Size Options	300 mm
Dimensions (W x D x H)	2.3 x 3.34 x 2.7 m

* = Option Required



FPA-5510iX Steppers feature a large exposure field and 500 nm resolution capability.



High-Resolution, High-Productivity KrF Scanner for 200 & 300 mm Wafer Fabrication

The FPA-6300ES6a [ES6a] is a DUV Scanner that offers scalability to support next-generation semiconductor manufacturing. The ES6a is an all-in-one solution providing high throughput, high alignment accuracy and fine resolution for both 200 and 300 mm wafer processes.

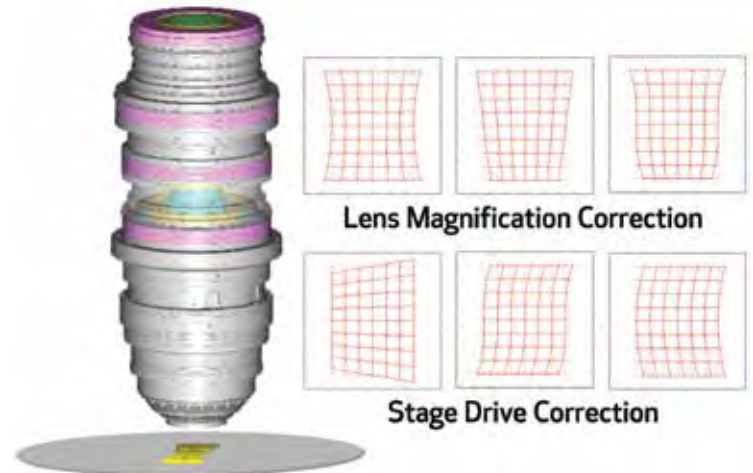
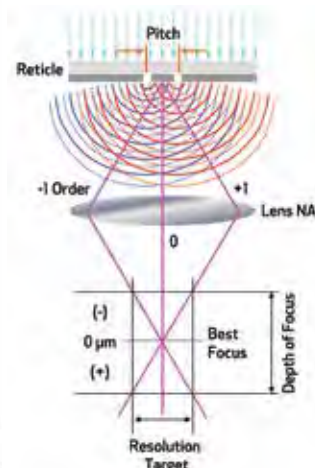
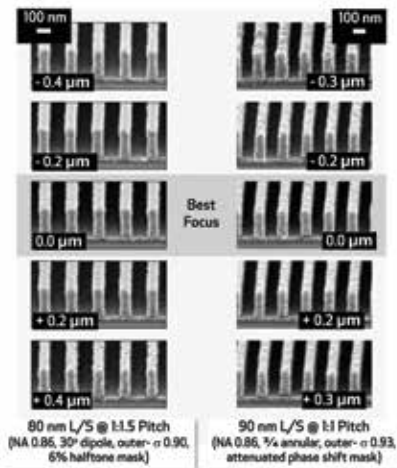
ES6a Scanners help reduce total cost of ownership by continuously upgrading the reliable and extendable single stage 6300 platform.

FPA-6300ES6a FEATURES

- Resolution ≤ 90 nm (2/3 Ann.)
- High-Throughput Mode:
 - Throughput ≥ 260 wafers per hour*
- High-Overlay Mode:
 - Mix-&-Match Overlay (MMO) ≤ 5 nm*
 - Single Machine Overlay (SMO) ≤ 3 nm*
- Advanced stage, alignment scope and precise temperature help control improve overlay accuracy
- Canon Built-In Metrology (CANOMAP)

KEY OPTIONS

- Wide Band Off-Axis Scope (WB-OAS)
- Shot-Shape High-Order Correction (SSHOC)
- Each Shot High-Order Correction (ESHOC)
- Focus Accuracy Improvement (F-MAP)
- Advanced Flexible Illumination System (AFIS)
- 200, 300 mm wafer handling
- Pellicle Particle Checker
- GEM-compliant online software



The Shot-Shape High-Order Correction (SSHOC) option can improve overlay matching by actively controlling lens magnification and stage position during scan exposure.

SPECIFICATIONS

Technology	KrF Scanner (248 nm)
Resolution	≤ 90 nm (2/3 Ann.)
Throughput	≥ 260 wph* (300 mm)
Single Machine Overlay	≤ 3 nm*
Mix and Match Overlay	≤ 5 nm*
Numerical Aperture	0.50 – 0.86
Lens Reduction Ratio	4:1
Exposure Field	26 x 33 mm
Substrate Size Options	200, 300 mm
Dimensions (W x D x H)	2.3 x 5.2 x 2.9 m

* = Option Required

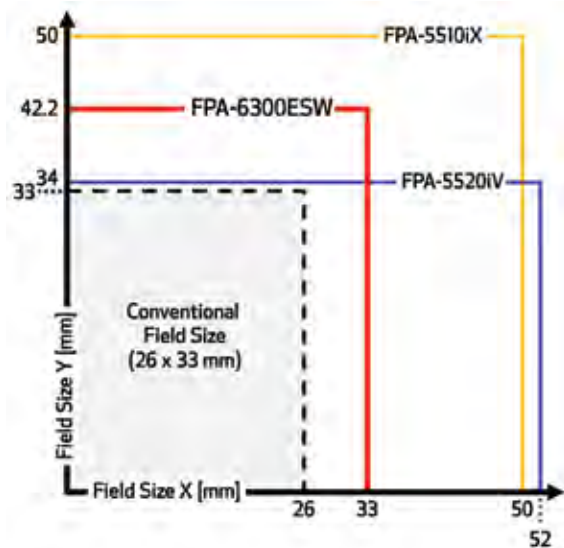
FPA-6300ES6a provides a large depth of focus for processes requiring resolution below 90 nm.

FPA-6300ESW KrF Scanner for Full-Size CIS & FPGA Applications

Wide-Field KrF Scanner for Single-Exposure Large Device Fabrication

FPA-6300ESW [ESW] wide-field DUV Scanners are capable of 130 nm resolution across a large exposure area. The ESW adopts a unique 3.125X reduction projection lens to yield a large 33 x 42.2 mm field size for large device fabrication without stitching.

Originally designed to support CMOS Image Sensor and color filter production on 300 mm wafers, the ESW can be configured to support 200 or 300 mm wafer processes including Sensor, Advanced Packaging and Display manufacturing.



FPA-6300ESW Scanners are Canon's highest resolution, large-field lithography systems supporting production of large sensors, displays and packages without shot stitching.

FPA-6300ESW FEATURES

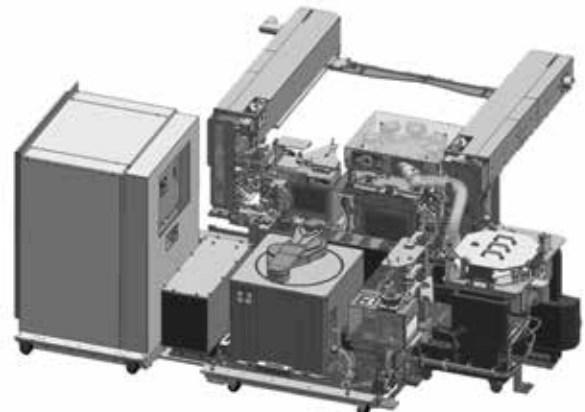
- Lens Reduction 3.125:1
- Expanded field size from 26 x 33 mm to 33 x 42.2 mm
- Flexible alignment solutions including alignment through multi-color RGB photo resist
- Proven FPA-6300 Platform
- Canon Built-In Metrology (CANOMAP)

KEY OPTIONS

- CD Uniformity Improvement
- Wide Band Off-Axis Scope (WB-OAS)
- Die-by-Die Overlay Compensation (EAGA)
- Advanced Flexible Illumination System (AFIS)
- 200, 300 mm wafer handling
- Standard Mechanical Interface Over Head Transport Kit (SMIF-OHT)
- Focus Spot Automatic Chuck Cleaning
- Pellicle Particle Checker
- PC Remote Console
- GEM-compliant online software

SPECIFICATIONS

Technology	KrF Scanner (248 nm)
Resolution	≤ 130 nm
Throughput	≥ 210 wph (300 mm)
Single Machine Overlay	≤ 9 nm
Numerical Aperture	0.45 – 0.70
Lens Reduction Ratio	3.125:1
Exposure Field	33 x 42.2 mm
Substrate Size Options	200, 300 mm
Dimensions (W x D x H)	2.3 x 5.2 x 2.9 m



FPA-6300 Scanners and FPA-5550 Steppers can be configured for 200 mm or 300 mm processes.

Canon CPO Equipment Sales Program

Canon Product Optimization (CPO) Program

The CPO equipment program extends mature product lifetimes to give customers access to cost-effective, high-quality used lithography equipment that is refurbished and guaranteed* by Canon U.S.A.

All lithography systems in the CPO program are sourced through the Canon global network of companies and all CPO systems are refurbished by Canon service professionals using Canon standardized test methodology and tooling which can lead to shorter delivery and installation times.

Interested in Price and Lead Times?

Contact Us at semi-info@cusa.canon.com

ALL-INCLUSIVE REFURBISHED EQUIPMENT PROGRAM

- Lithography systems customized to meet customer process requirements
- Configuration with optional equipment available*
- Software Licenses included
- Operation and maintenance training
- Application engineering support
- Limited warranty
- Financing options available

CPO EQUIPMENT PROGRAM BENEFITS

- Low-cost alternative to new equipment
- Equipment performance demonstrated, certified and guaranteed prior to shipment and during installation
- Authorized factory master software and firmware with software patches applied
- Electrical safety certified and retrofit for factory Field Change Orders related to safety, performance and usability
- Canon experience with specific wafer sizes and materials, resist conditions and focus, overlay and productivity challenges*

CURRENT CPO SUPPORTED MODELS

- FPA-3000i5+, FPA-5500 Series i-line Steppers
- FPA-3000EX5, FPA-3000EX6 KrF Steppers
- FPA-5000, FPA-6000 Series KrF Scanners

AVAILABLE EQUIPMENT OPTIONS*

- Configuration for specific wafer sizes and materials
- Transparent Wafer Handling
- Multi-Wafer Size Handling*
- Through-Silicon Alignment (TSA)*
- Pellicle Particle Checker
- Reticle Bar code reader



*Limitations and additional fees may apply. Please contact Canon Industrial Products for details

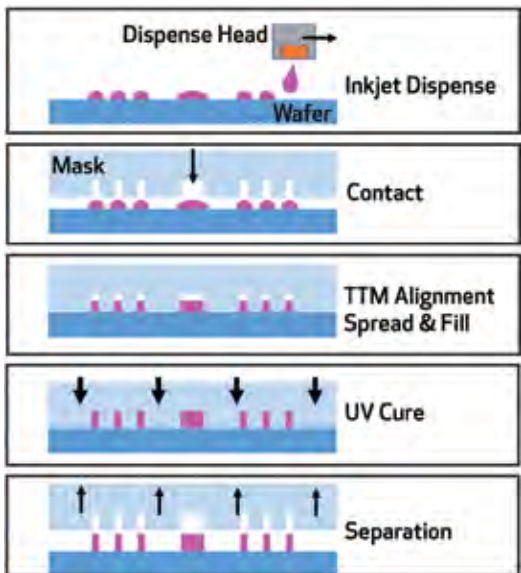
Next-Generation Lithography Solutions

Canon began conducting research into nanoimprint technology in 2004 with a goal of developing sub-20 nm resolution processes. Nanoimprint is a non-optical lithography technology that uses an etched mask to physically create patterns on substrates, offering high-resolution, design flexibility and low overall process costs.

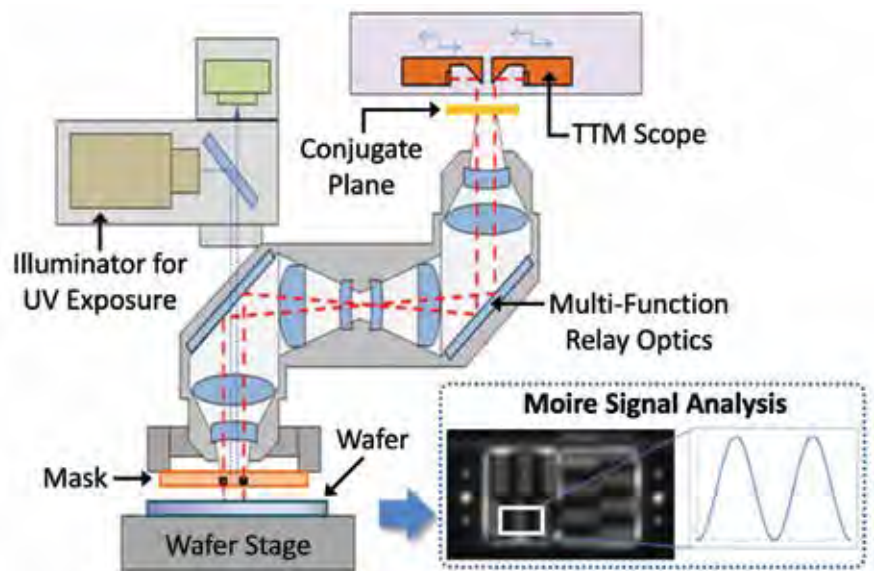
In 2009, Canon initiated development of next-generation semiconductor lithography systems employing nanoimprint technology and in 2014 welcomed Canon Nanotechnologies as a Canon group company.

Based on Canon Nanotechnologies Jet & Flash Imprint Lithography (J-FIL) technology, Canon has developed the FPA-1200NZ2C [NZ2C] NIL cluster system for semiconductor wafer mass production of circuit patterns as small as 10 nm.

Canon has also developed the FPA-1100NR2 [NR2] Nanoimprint Lithography (NIL) system that is the world's first mass-production equipment designed for nanoimprint mask replication. NR2 Mask Replication Systems duplicate lithography masks utilizing low cost NIL technology and contribute to overall NIL process cost-of-ownership.



Canon Jet & Flash Imprint Lithography (J-FIL)
Nanoimprint Process



Through-The-Mask (TTM) Scope enables real-time
measurement of positional deviations between mask and wafer



Canon ANELVA Physical Vapor Deposition (PVD), Etch Systems and Components

Canon U.S.A. provides sales, marketing, service and engineering support for products manufactured by Canon ANELVA Corporation. Canon ANELVA develops and manufactures Physical Vapor Deposition (PVD) and etching equipment for use in semiconductor, storage media and display production lines.

ANELVA PRODUCTS TARGET APPLICATIONS

ANELVA Product	Technology/ Environment	Key Features and Options	Process	Substrate Options	MRAM	Logic & MPU/GPU	3D-NAND & DRAM	HDD & SCM	Power & Automotive	Waveguide & RF	Advanced Packaging	Optics & Photonics	MEMS, Sensors & IoT	AV/VR & Display	LED, MicroLED
BC7000	Permanent Wafer Bonding	Room Temp., Low Pressure	Atomic Diffusion Bonding	100 mm 150 mm					✓	✓	✓	✓	✓		✓
NC7900	UHV PVD Cluster HVM	Oblique & Multi-Cathode	Planar & Perpendicular MTJ	300 mm	✓										
NC8000	Ion Beam Etching Cluster HVM	Optimized Ion Source Optical Endpoint Control	Planar & Perpendicular MTJ	300 mm	✓										
EC7800	UHV PVD Cluster R&D & Small Scale	Oblique & Multi-Cathode	Planar & Perpendicular MTJ	300 mm	✓										
EC8000	Dry Etch Cluster R&D	Integrated Dry Etch & CVD	Planar & Perpendicular MTJ	300 mm	✓										
FC7100	UHV PVD Cluster HVM	Damage-less Deposition	Planar Metal Gate	300 mm		✓	✓								
IC7500	UHV PVD Cluster HVM	Reactive PVD & High-Stress Materials	Metal Interconnect	300 mm	✓	✓	✓								
IC7400	PVD Cluster HVM	Low-Temp Damage-less Deposition	Under Bump Metallization (UBM)	300 mm	✓	✓	✓				✓				
EL3400	Vertical Inline PVD HVM	Single or Dual-Side Deposition, Multiple Target	Barrier & Copper Seed layer	650 x 650 300 mm x 4	✓	✓	✓				✓			✓	
HC7100	UHV PVD Cluster HVM	Oblique and Multi-Cathode	TMR & GMR MR Sensors	200 mm				✓	✓	✓		✓	✓		✓
ML3000	Inline PVD System	High-Vacuum Quality High-Temp Heating/Cooling	Magnetic Media Next Gen Media	1,800 disks per hour				✓	✓	✓		✓	✓		✓
HC7300	PVD System HVM	Integrate PVD, Milling, Insulation, Hard Bias & Cap	Magnetic Head	200 mm				✓	✓	✓		✓	✓		✓
EB1000	Compact PVD R&D & Small Scale	3 Cathodes, High-Temp Co-Sputtering	General Purpose PVD	≤ 100 mm					✓	✓		✓	✓		✓
EB1100	High-Performance PVD R&D & Small Scale	4 Cathodes, High-Temp Co-Sputtering	General Purpose PVD	≤ 220 mm					✓	✓		✓	✓		✓
EC7000	Compact PVD Cluster R&D & Small Scale	4 Cathodes, 2 Chambers Load Lock and Transfer	High-Flexibility & Productivity PVD	≤ 220 mm					✓	✓		✓	✓		✓
EC7400	Compact PVD Cluster R&D & Small Scale	4 Cathodes Space Saving Design	Electronic Components	≤ 200 mm					✓	✓		✓	✓		✓
EC3000	Batch PVD System HVM	4 Cathodes Rotary Deposition	ITO Film & Metal Electrode	≤ 200 mm					✓	✓		✓	✓		✓
EC8100	Tray Transport PVD HVM	3 PVD Chambers Damage-Less Deposition	ITO Film & Metal Electrode	≤ 200 mm					✓	✓		✓	✓		✓
EL3200	Horizontal Inline PVD HVM	3 Cathodes, Top, Bottom or Dual-Side Deposition	Printed Circuit Board	300 x 450 mm	✓	✓	✓				✓			✓	
EC7200	Annealing System R&D & HVM	Electron Bombardment High-Temperature Vacuum Anneal	SiC Power Device Activation	≤ 150 mm					✓						
X-Ray Source	Microfocus X-Ray R&D & HVM	High-Power, High-Speed & High-Resolution	Radioscopy X-Ray CT	NA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Vacuum Components	Components R&D & HVM	Pumps, Gauges, leak detectors, spectrometers, electron gun	Low-Vacuum UHV	NA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

✓ Compatible with application



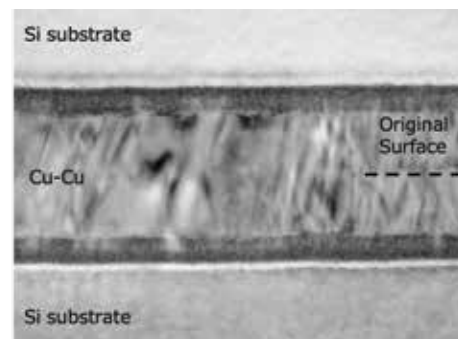
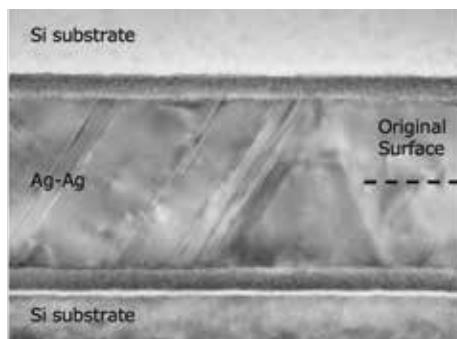
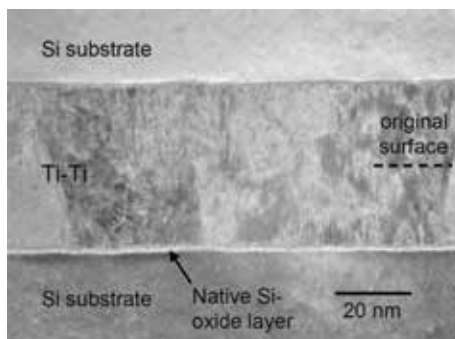
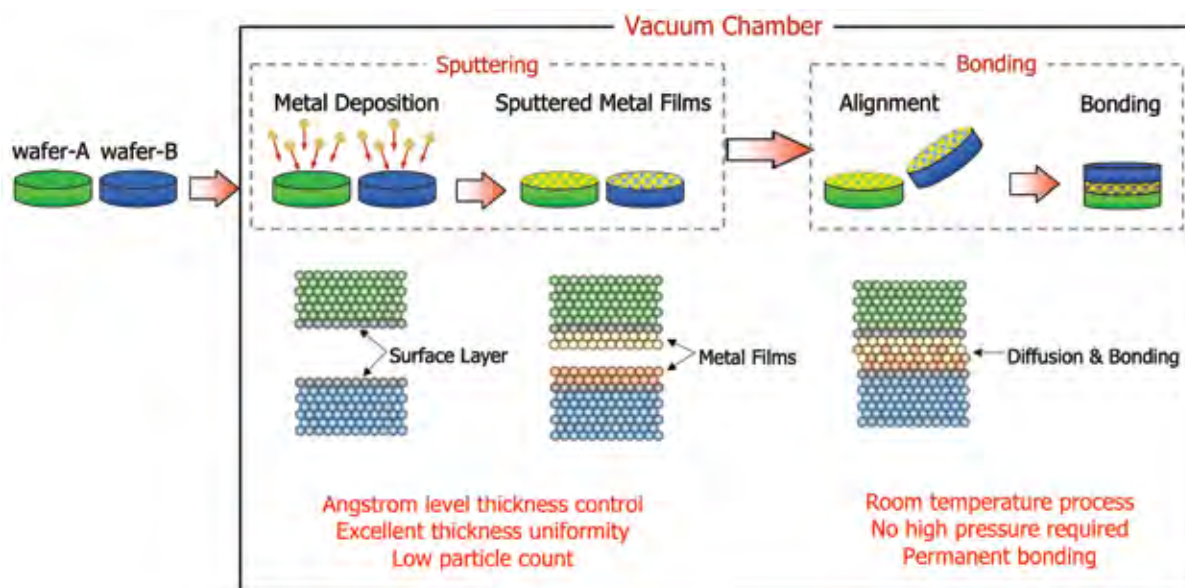
Next-Generation Wafer Bonding Solutions

BC7000 Atomic Diffusion Bonding equipment is based on Canon ANELVA's long experience with ultra high vacuum and thin film deposition technologies. It offers ultra high vacuum in-situ processes of wafer transfer, film deposition, bonding and bonded wafer collection with automatic operation and is capable of handling 100 mm (4") and 150 mm (6").

Mirror polished wafers of any materials can be bonded at room temperature without pressure by optimization of metal and thickness of deposited film at the bonding interface.

BC7000 FEATURES

- Bonding at room temperature
- No pressure during bonding
- High bonding strength
- Bonding of any similar or dissimilar materials
- High throughput



Canon ANELVA develops and manufactures reliable Physical Vapor Deposition (PVD) and Ion Beam Etching (IBE) and Dry Etching equipment to provide nanometer level processing required for a large scale integration of semiconductor devices including Magnetic Random Access Memory (MRAM).



NC7900

Ultra-High Vacuum (UHV) PVD cluster tool for 300 mm MRAM high-volume manufacturing.

Features:

- Compatible with planar and perpendicular Magnetic Tunnel Junction (MTJ) formation
- High throughput (≥ 25 wph for perpendicular MTJ)
- Oblique and multi-cathode PVD chambers with extensive module line up such as heating, cooling, and pre-cleaning
- Fine interface control with ultra-thin multi-layers



NC8000

Ion Beam Etching (IBE) cluster tool for 300 mm MRAM high-volume manufacturing.

Features:

- Enhanced ion beam source
- High etching performance with high productivity
- Clampless holder with 2-axis revolution and stage angle
- Optical end point detection system for precise etching depth control



EC7800

Ultra-High Vacuum (UHV) PVD cluster tool for 300 mm R&D and small scale MRAM production.

Features:

- Low pressure remote Pplasma sputtering technology delivering ultrathin multilayer stacks
- An order of magnitude lower pressure discharge (0.02 Pa) than conventional PVD processes
- Excellent film thickness uniformity ($< \pm 1\%$)
- Smooth and low resistance films
- Provides high Magneto-Resistance (MR) ratio with excellent distribution
- Oblique and multi-cathode PVD chambers with extensive module line up such as heating, cooling, and pre-cleaning



EC8000

Dry etching cluster tool for 300 mm MRAM R&D.

Features:

- Integrated processing –MTJ dry etching and protective film Chemical Vapor Deposition (CVD)
- Low-damage process with CH_3OH gas
- Enables micro-patterning with less shorts (high yield)
- Capable of retaining a high Magneto-Resistance (MR) ratio even after etching
- Easy maintenance and flexible equipment configuration



FC7100

Ultra-High Vacuum (UHV) PVD cluster tool provides planar metal gate deposition for 300 mm high-volume manufacturing.

Features:

- Suitable for planar metal gate deposition
- Precise control of film thickness (~ 0.1 nm)
- Excellent thickness uniformity ($1\sigma < 1\%$)
- Film composition control
- Small size cathode for low material cost



IC7500

Ultra-High Vacuum (UHV) PVD cluster tool for metal interconnect fabrication in 300 mm high-volume manufacturing of semiconductor memory.

Features:

- Excellent uniformity and low particles even for reactive PVD processes and high stress materials
- High productivity to reduce production cost
- High Throughput (80 wph)
- Uptime > 90% (Failure time < 1%)
- Cathode magnet position change through recipe facilitates easy optimization



IC7400

PVD cluster tool for Under Bump Metallization (UBM) processes in 300 mm high-volume memory packaging.

Features:

- Stress control
- Low temperature deposition
- Damage-less deposition
- Improved adhesion
- Easy to customize hardware



EL3400

Panel PVD System for Advance Packaging applications including barrier and Copper seed deposition.

Features:

- Vertical linear transport system
- Compatible with various substrates (Si, glass, organic, ...)
- Large deposition area (\square 650 mm x 2 panels, Φ 300 mm x 8 wafers, \square 300 mm x 8 panels)
- Moisture control
- Plasma surface activation for superior adhesion
- Single side or double side deposition
- Multiple targets for multilayer deposition

Canon ANELVA Storage and Hard Disk Drive Manufacturing Equipment

Canon ANELVA commands a large market share of the PVD equipment used for production of high density magnetic heads and disks for use in PCs and servers. Using proprietary technology and know-how, Canon ANELVA intends to continue our technology leadership in the evolution of hard disk drives and innovative storage media.



HC7100

200 mm PVD cluster tool production of MagnetoResistive (MR) magnetic sensors.

Features:

- Compatible with Tunnel Magneto-Resistance (TMR) and Giant Magneto-Resistance (GMR) processes
- An order of magnitude lower pressure discharge (0.02 Pa) than conventional PVD processes
- Excellent film thickness uniformity ($< \pm 1\%$)
- Smooth and low resistance films
- Provides high Magneto-Resistance (MR) ratio with excellent distribution
- Oblique and multi-cathode PVD chambers with extensive module line up such as heating, cooling, and pre-cleaning



ML3000

Inline PVD tool for R&D & mass production of next generation Hard Disk Drive (HDD) magnetic media.

Features:

- High productivity (up to 1,800 disks/hr) with a 90 m² footprint
- Over 10 days of continuous operation is possible
- Emphasis on vacuum ($\sim 10^{-6}$ Pa) quality to improve magnetic characteristics of media
- High temperature heating and cooling units for the development of next generation thermally assisted magnetic recording media



HC7300

PVD tool for Hard Disk Drive (HDD) magnetic head production.

Features:

- Effectively consolidates magnetic head production processes – milling → insulator → hard bias → cap layer
- Module lineup enables optimum shape required by read element (IBE, anisotropic deposition, isotropic deposition, RIE, etc...)
- Excellent deposition characteristic and high productivity

Canon ANELVA Electronic Device Manufacturing Equipment

Canon ANELVA's versatile device lineup supports next generation technology development and manufacturing of thin film devices such as Light Emitting Diodes (LEDs), CMOS Image Sensors, Compound Semiconductors, Piezoelectric Devices, and Power Devices.



EB1000

Compact and flexible PVD system for ≤ 100 mm general purpose R&D applications.

Features:

- Three $\Phi 2$ " compact cathodes
- Various deposition geometries (offset rotation, static) by tray transport
- Supports substrates up to $\Phi 100$ mm
- High temperature (800 °C) substrate heating (option)
- Load lock chamber (option)
- Ternary co-sputtering (option)
- Auto-pumping and manual transportation/deposition operation
- Space saving design (standard footprint W 1.8 m x D 1.1 m x H 1.55 m)



EB1100

High-performance PVD system for ≤ 220 mm R&D and small scale production.

Features:

- Fully automated operation
- Supports up to four $\Phi 4$ " cathodes
- Supports substrates up to $\Phi 220$ mm
- Various deposition geometries (offset rotation, static) by tray transport
- High temperature (800 °C) substrate heating (option)
- Space saving unit body design (standard footprint W 1.45 m x D 1.6 m x H 1.85 m)
- Co-sputtering (option)



EC7000 SERIES

Compact PVD cluster system for ≤ 220 mm R&D and small scale production of LEDs, Compound Semiconductors, and Power Devices.

Features:

- Equipped with load lock stocker chamber and transfer chamber
- Supports up to two sputtering chambers
- Fully automated operation
- Supports up to four $\Phi 4$ " cathodes
- Supports substrates up to $\Phi 220$ mm
- Various deposition geometries (offset rotation, static) by tray transport
- High temperature (800 °C) substrate heating (option)
- Space saving unit body design (standard footprint W 1.45 m x D 2.3 m x H 1.85 m)
- Co-sputtering (option)



EC7400

Compact cluster tool for ≤ 200 mm production of electronic components such as SAW Filters, TC-SAW Filters, Piezoelectric Devices, and Power Devices.

Features:

- Fully automated operation
- Able to accommodate a variety of process modules according to requirements
- High target utilization
- Substrate size up to $\Phi 200$ mm
- Up to four $\Phi 7.1$ " cathodes
- Space saving design



EL3000 SERIES

Batch type PVD system for LED production.

Features:

- Ideal for Indium Tin Oxide (ITO) transparent conductive film deposition, metal electrode film deposition, etc.
- Rotary deposition facilitates batch processing of multiple wafers and good uniformity
- Fully automated operation
- Supports substrates up to Φ 200 mm
- Tray transport (50 Φ 2" wafers/batch)
- Supports up to four Φ 7.1" or Φ 12.5" cathodes
- High target utilization to help reduce cost
- Customizable configuration according to application and production volume



EC8100

Tray Transport PVD cluster system for small wafer and LED production.

Features:

- Ideal for Indium Tin Oxide (ITO) transparent conductive film deposition, metal electrode film deposition, etc.
- Long distance sputtering
- Excellent uniformity over large area
- Multiple wafers deposition per batch (four Φ 8", eight Φ 6", etc.)
- High target utilization
- Fully automated operation
- Up to three sputtering chambers



EL3200

Horizontal linear transport PVD system for production of electronic components such as Sensor Devices.

Features:

- Configurable for single side or dual-side deposition according to production volume
- Supports laminated films by using up to 3 (single side) cathodes
- Can accommodate up to 25 trays in the stocker chamber
- Pre-heating chamber (Option)
- 300 mm x 450 mm effective deposition area



EC7200

Electron Bombardment vacuum annealing tool for SiC power device activation in \leq 150 mm R&D and mass production.

Features:

- High temperature (up to 1850 °C) process for implant activation
- In situ carbon capping for low surface roughness
- Clean vacuum
- Cluster tool configuration that supports up to three annealing chambers
- Substrate size up to Φ 6"
- Excellent repeatability (sheet resistance uniformity \pm 4.9% @ 1,000 runs)
- High electrical activation, low sheet resistance, reduction of diode leakage current, and low surface roughness

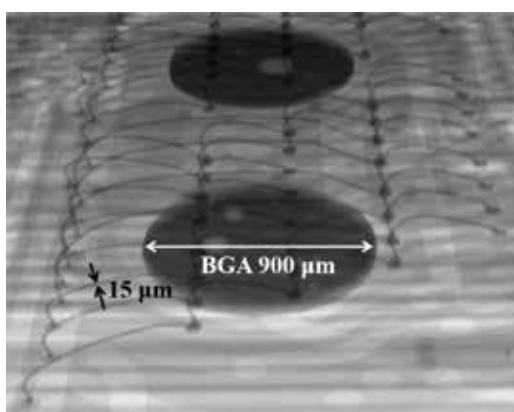
G-311, G-511 Series Micro-Focus X-ray Source

Emerging applications in healthcare, automobile electrification and autonomous driving demand high-reliability operation which increases quality requirements for computer chips and chip packages. X-ray non-destructive inspection, combined with high-speed and high-magnification inspection is one method for helping to ensure all critical electronic components meet quality specifications.

The Canon ANELVA X-ray source supports X-ray high-speed non-destructive testing of all parts and features a sealed tube with a transmissive target on a diamond window. Transmissive target systems offer advantages over X-ray sources having a sealed tube with a reflective target by providing high-power X-ray with no anode degradation and a long shelf life.

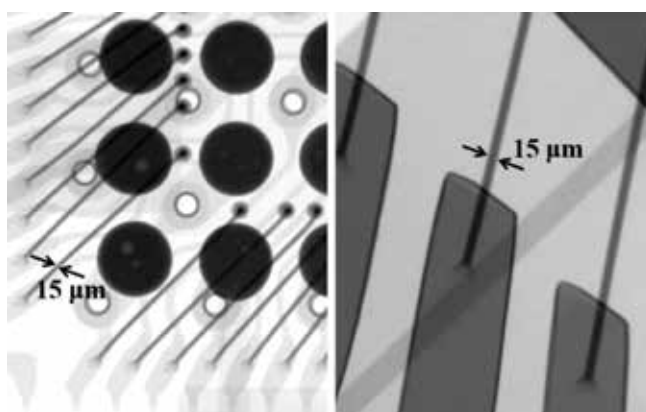
The technologies employed in our newly developed X-ray source include X-ray tube design implementations:

1. Simultaneous high power X-ray with high resolution and high magnification
2. Reduced system downtime for automated X-ray inspection systems
3. Reduced X-ray dose utilizing pulsed X-ray emission mode for protection of sensitive electronic devices



100 kV, 100 μA

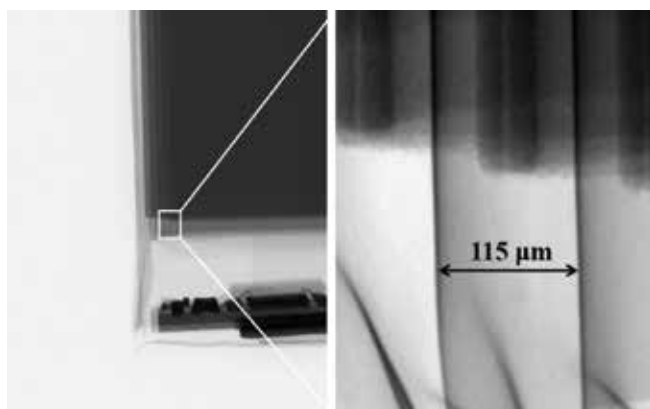
Figure 1: Ball Grid Array (BGA) on Flash Memory Chip



100 kV, 100 μA, (150 x)

100 kV, 100 μA (300 x)

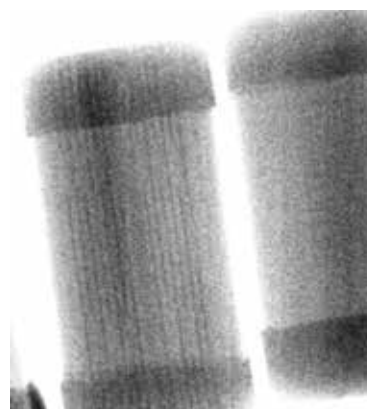
Figure 2: BGA and Wire Bond



110 kV, 90 μA, (7.5 x)

110 kV, 90 μA, (450 x)

Figure 3: Lithium Ion Battery



60 kV, 60 μA, (64 x)

Figure 4: Multi-layer Ceramic Capacitor

Thin-Film manufacturers and R&D facilities use Canon ANELVA vacuum component parts in systems incorporating vacuum technology. Canon ANELVA vacuum technology contributes to stable operation of equipment and measuring instruments.



QUADRUPOLE MASS SPECTROMETERS

Versatile instruments used to monitor process gases and analyze residual, inorganic and desorbed gases.

Available Products:

- Compact gas analysis system, D-series (M-101/201/400GA-D Series)
- Process gas monitor (M-080QA-HPM)
- Transducer type spectrometer (M-070QA-TDF, M-101QA-TDF, M-101/201QA-TDM)
- High speed and high sensitivity spectrometer (M-401QA-MU/G)



VACUUM PUMPS

Canon ANELVA offers a wide range of vacuum pumps from low-vacuum to ultra-high-vacuum applications and high efficiency cryopumps.

Available Products:

- Ion pumps/noble pumps
- Excel pumps
- Titanium sublimation pump/tie-back pumps
- Combination pumps
- Cryopumps
- Cryogenic traps
- Air cooled freezer module
- Foreline traps
- Screw type dry pumps
- Roots type dry pump



VACUUM GAUGES AND CONTROLLERS

Canon ANELVA offers a diverse lineup of gauges to meet a variety of application requirements.

Available Products:

- Cold Cathode Gauge (M-370CG)
- Cold Cathode Pirani Gauge (M-361CP)
- Capacitance Diaphragm Gauge (M-342DG)
- Pirani Gauge (M-350PG)
- Corrosion-resistant Pirani Gauge (M-351PG)
- Ion Gauge (M-311HG)
- Crystal Ion Gauge (M-336MX)
- Crystal Gauge (M-320XG)
- Wide Range Ionization Vacuum Gauges (M-431HG, M-833HG)
- Ionization Vacuum Gauge (M-723HG, M-823HG, M-923HG)
- Thermocouple Vacuum Gauge (M-012DM)
- Miniature Gauge (MG-2, MG-2M, MG-2F, MG-2/WF)
- Vacuum Gauge (Shultz, B-A, Nude Ion, Pirani, Thermocouple)



LEAK DETECTORS

Canon ANELVA helium leak detectors support a variety of quality control applications requiring high sealing performance.

Features:

- Used by customers in a variety of industries
- Compact, lightweight, and portable design
- Various models available to choose from
- Simple operation
- High sensitivity, stability, and response
- Uses a tungsten filament to help enable long term high-sensitivity measurement

Canon Optomechatronics Products

Canon Optomechatronic Products blend optics, analytics, motion control technology to enable advanced and automated processes. Canon has been developing industrial components with precision and accuracy using optical technology developed and accumulated for over half a century.



OPTOELECTRONICS

Canon Optoelectronics integrate optical and electronic technologies with precise fabrication to produce a line of products for advanced R&D and production.

Available Products:

- Digital Laser Scanner System
- Optical Digital Laser Rotary Encoder
- Interpolator Board
- Laser Doppler Velocity Sensor
- Custom Design Encoders



GM-1000 Series Digital Galvano Motors support beam diameters between 5 and 30mm.

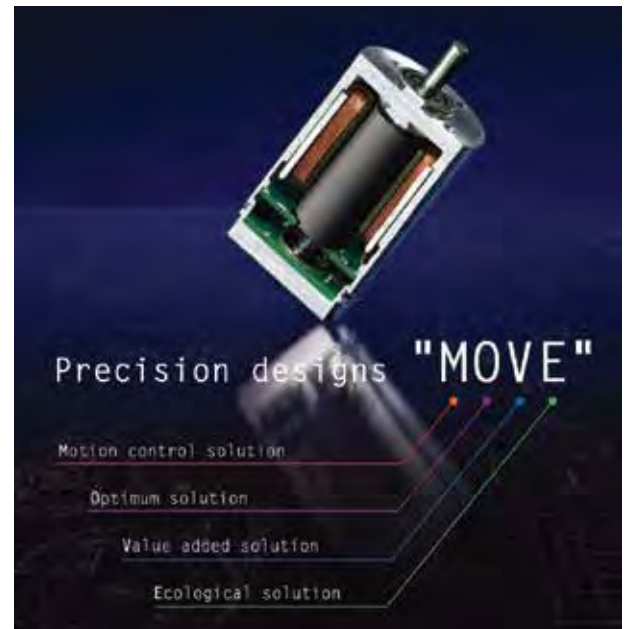


MOTION CONTROL PRODUCTS

Canon's DC Micro-Motors can be found in robotic systems, semiconductor process equipment, sporting equipment, ATMs, medical devices and pumps.

Available Products:

- Brushless Motors
- Coreless Motors
- Iron Core Motors
- Actuator Units



Options such as gear units and encoders can be added to Canon motors. Speed, reduction rate and other parameters can be customized to fit your exact requirements.



3-D MACHINE VISION SYSTEM (RV-SERIES)

RV-Series 3-D Machine Vision Systems are designed to work with robotic arm systems as an “eye” for three-dimensional recognition of the position and orientation of objects and to instruct the robotic system how to approach and pick up individual parts.

Features:

- 3-Dimensional, Image Recognition of Target Parts
- Simple and Easy Preparation with CAD data and Image File
- One-time Measurement of 3-D Pose
- Position and Orientation: 6 Degrees of Freedom



Canon's 3-D Machine Vision System was developed in response to the manufacturing industry need for a solution for 3D robotic random bin picking.



*Image simulated

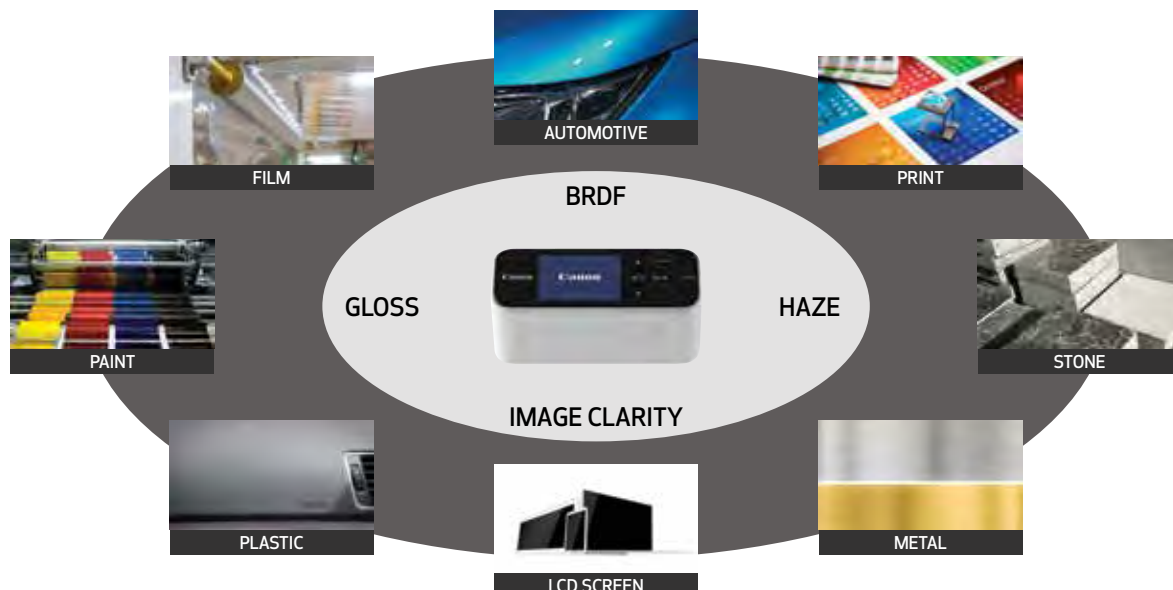
SURFACE REFLECTANCE ANALYZER

Canon's RA-532H Surface Reflectance Analyzer is a portable measuring device to evaluate surface conditions of objects including standard compliant Gloss, Haze, Image Clarity and 2-D BRDF measurements.

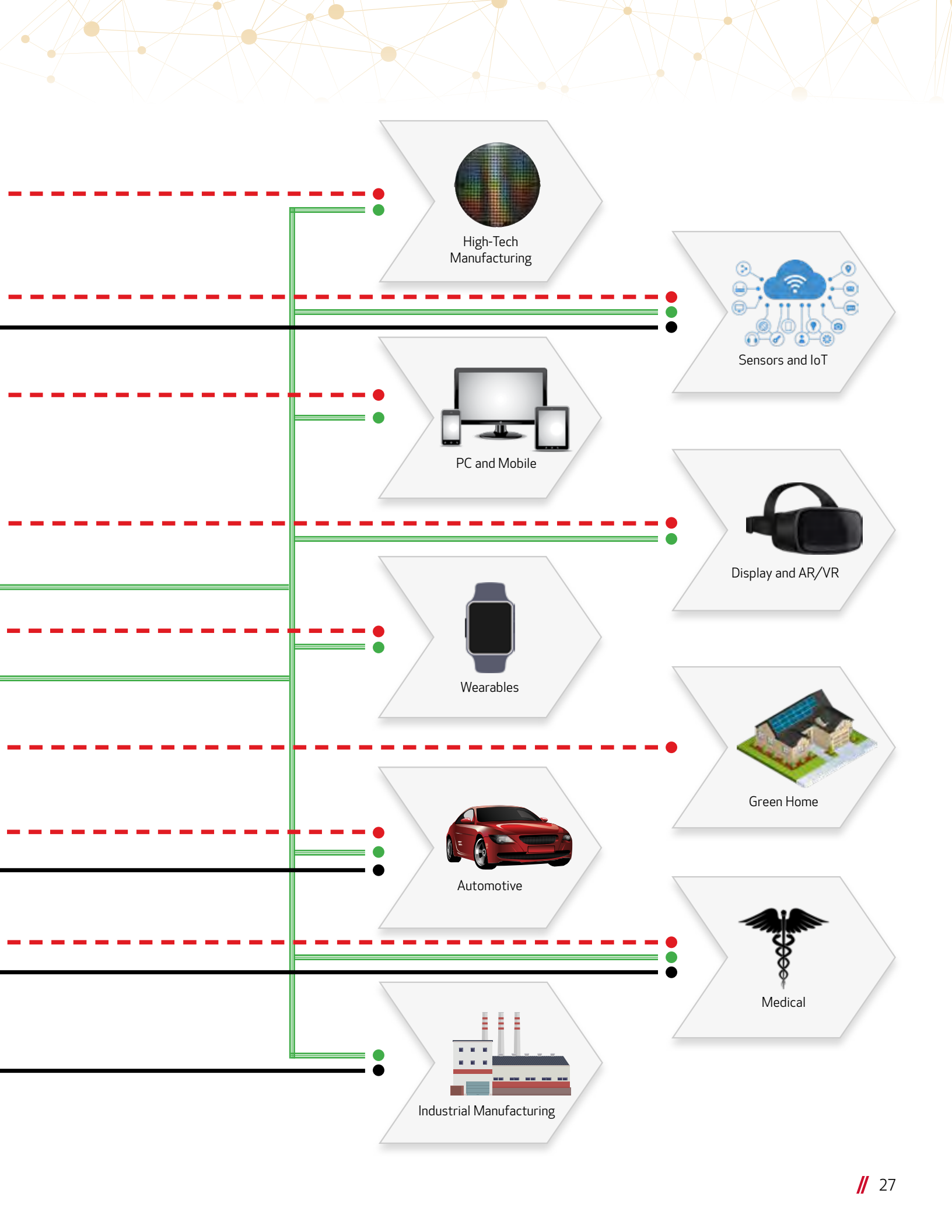
Features:

- Single analysis for 4 surface conditions: Gloss, Haze, Image Clarity, and Bidirectional Reflectance Distribution Function (BRDF)
- 2-D BRDF measurement in the palm of your hand
- Outputs the angular distribution of incident reflected light intensity
- Monitoring camera function displays measurement area results

Industries With a Need for Surface Appearance Quality Measurement







High-Tech
Manufacturing

Sensors and IoT

PC and Mobile

Display and AR/VR

Wearables

Green Home

Automotive

Medical

Industrial Manufacturing



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