Advanced Packaging Solutions

by USHIO INC.

USHIO's "UX Series" — Providing Advanced Packaging Solutions
Page 2

USHIO's UX Series Models Featured @ SEMICON West 2013
Page 2

Large-Size Interposer Stepper UX7-3Di LIS 350 for 300-mm Wafers and 405 x 350 mm Substrates
Page 3

"UX5 Series" Stepper for Manufacturing High Resolution Print Circuit Boards
Page 5

"UDI-8001P" Direct Imaging System for Manufacturing Next-Generation FC-BGA
Page 6

"UX4 Series" Large-Area, Full-Field Projection Lithography Systems
Page 8

USHIO's High-Precision Projection Lens — Enabling Next-Generation Advanced Packaging Applications
Page 10

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USHIO's "UX Series" — Providing Advanced Packaging Solutions

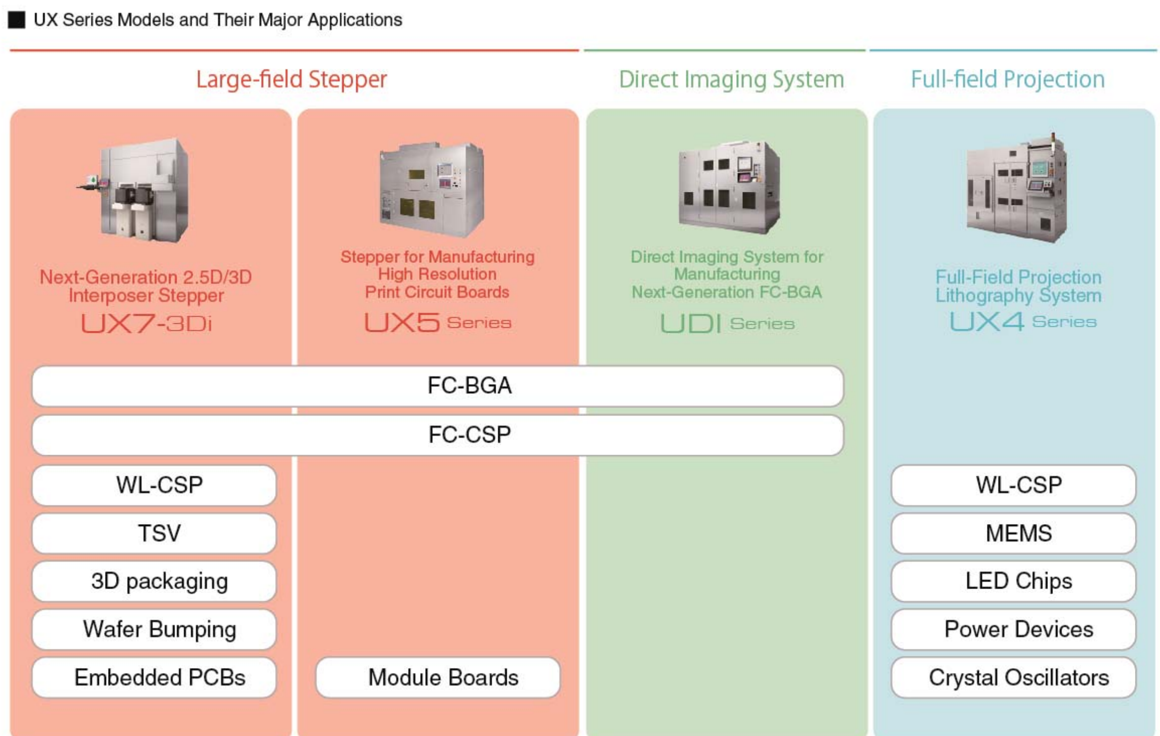
Since it was established almost 50 years ago, in 1964, USHIO INC. has been delivering UV lamps for photolithography processes, VUV lamps for surface improvement, and halogen lamps for thermal processes to the global semiconductor industry.

Starting with these light sources, USHIO has expanded its proprietary application technologies based on development of new light sources and lighting-edge technologies. It has developed, manufactured, and marketed a wide range of "UX Series" lithography systems for advanced packaging (fine-printed circuit boards), wafer-level packaging (WLP), MEMS, LEDs, and power devices, all of which are the focus of attention in the semiconductor fabrication arena. Today, more than 1,200 units of the UX Series systems are operating worldwide.

Providing reliable yet high-performance lithography tools, USHIO has made a great contribution to high-volume production and significant cost reduction in manufacturing of high-end digital products including smartphones, tablet PCs, and other mobile devices.

USHIO's UX Series Models Featured @ SEMICON West 2013

At SEMICON West 2013, we at USHIO are featuring four major UX Series models as "Advanced Packaging Solutions" that we would like to present to both our existing and potential customers.



Large-Size Interposer Stepper UX7-3Di LIS 350 for 300-mm Wafers and 405 x 350 mm Substrates

Allowing Significant Reduction of Cost for Manufacturing Large-Size Interposers for 2.5D/3D Packaging

As a world-premiere photolithography tool provider for 2.5D and 3D packaging solutions, USHIO leverages the industry's most advanced development capabilities to meet the increasingly sophisticated and divergent product requirements of the global semiconductor industry.

The UX7-3Di LIS 350 (the first unit already booked and to be delivered to a leading advanced packaging manufacturer by the end of July) allows processing of 405 x 350 mm substrates in addition to 300-mm Si wafers. Therefore, materials including glass substrates and organic substrates also can be used as interposers.

Moreover, the UX7-3Di LIS 350 has the capability to process large-size interposers at a high throughput as well as the flexibility to allow processing of substrates other than Si wafers, thus significantly reducing the cost for manufacturing interposers.

UX7-3Di LIS 350: 2.5D/3D Interposer Stepper

UX7-3Di LIS 350 Features

- Large field size: 78 x 66 mm
- Can process interposer substrates made of a variety of materials other than Si, including glass and organic materials
- Can process large substrates of up to 300-mm wafers or 405 x 350 mm substrates
- High overlay accuracy of 500 nm or less
- Innovative alignment with IR that transmits Si to allow the bottom alignment required for TSV (Through-Silicon-Via) applications indispensable to Si interposers
- High throughput of 120 wafers per hour for 300-mm wafers or 90 substrates per hour for 405 x 350 mm substrates, approx. double the throughput of conventional stepper systems

UX7-3Di LIS 350 Specifications

Resolution:	Up to 2.0 µm L/S
Wavelength:	365 nm
Overlay Accuracy:	Front <500 nm, Back <500 nm
Throughput:	300-mm wafers: 120 wph 405 x 350 mm substrate: 90 pph
Lens Field Size:	78 x 66 mm
Substrate Size:	Wafers of up to 300 mm in diameter and substrates of up to 405 x 350 mm
Substrate Transfer Method:	Wafers: Automated transfer Substrates: Manual transfer

"UX5 Series" Steppers for Manufacturing High Resolution Print Circuit Boards

The UX5 Series steppers employ mask-damage-free projection exposure and allow high overlay accuracy to be achieved by addressing expansion or contraction of substrates. The lens and alignment mechanism, light source, and substrate transfer mechanism are all modular-designed to allow future upgrades or customization of single or multiple modules. Therefore, it is not necessary to introduce a new system every time the roadmap evolves or changes, thus allowing the user to flexibly meet the required performance for efficient investment on equipment.

UX5 Series: Stepper for High Resolution Print Circuit Boards

UX5 Series Features

- Modular configuration to flexibly meet the required performance and achieve high productivity
- Automated operation that allows enhancement of the production availability by 65%
- Allows unmanned operation to further enhance product quality
- Max. 150% enhancement of the throughput compared with a contact exposure system
- Use of an ultra-low-distortion lens
- Able to meet the requirement of the roadmap for 2017 and beyond

UX5 Series Specifications

Resolution:	3.0 µm L/S
Wavelength:	365 nm
Overlay Accuracy:	±5 µm
Throughput:	120 panels/hour
Substrate Size:	Max. 510 x 610 mm

"UDI-8001P" Direct Imaging System for Manufacturing Next-Generation FC-BGAs

Direct Imaging Achieves High Resolution of 5 µm and High Throughput of 35 Seconds/Panel, Indispensable for Manufacturing of Next-Generation FC-BGAs

USHIO has succeeded in developing the ultra-fine, high-speed direct imaging (DI) system "UDI-8001P" with a resolution of 5 µm L/S and throughput of 100 panels/hour. The UDI-8001P can be used for manufacturing next-generation FC-BGA packages for computers and network equipment.

The DI systems currently used for manufacturing high-end packages such as FC-CSPs have a resolution of 10 to 15 µm L/S, an overlay accuracy of ±10 µm, and approx. 10 alignment points. The UDI-8001P achieves a much higher throughput —100 panels/hour — than conventional DI systems while offering a resolution of ±5 µm L/S, an overlay accuracy of ±5 µm, and 600 alignment points. The UDI-8001P thus allows processing of ultra-fine-pitch FC-BGA packages that could not be processed by conventional DI systems.

With the addition of the UDI-8001P to the UX5/7 stepper series for advanced packaging, USHIO provides versatile packaging solutions for the packaging industry.

USHIO has already developed and is now preparing for marketing the "UDI-8102P", with resolution of 8 µm L/S; the UDI-8102P is suitable for manufacturing FC-CSP packages.

UDI-8001P: Direct Imaging System for Manufacturing Next-Generation FC-BGAs

UDI-8001P Features

- Maskless direct imaging method
- High resolution of 5 µm L/S that allows exposure of high resolution print circuit boards
- High overlay accuracy of ±5 µm
- Ultra-high precision alignment with 600 alignment points
- High throughput of 100 pph

UDI8001P Specifications

Resolution:	5.0 µm L/S
Overlay Accuracy:	±5 µm
Throughput:	100 pph
Number of Alignment Points:	600

"UX4 Series" Large-Area, Full-Field Projection Lithography Systems

Optimum for Various Advanced Applications, including MEMS Devices, High-Brightness LEDs, Power Devices, and WL-CSPs

USHIO provides the "UX4 Series" of full-field projection exposure lithography tools for wafers of up to 300 mm in diameter to manufacture MEMS devices, high-brightness LEDs, power devices, and wafer-level packages (WL-CSPs). Use of the mask-damage-free projection exposure method as well as the capability of full-field exposure of a wafer of up to 300 mm in diameter allows great enhancement of the productivity of and significant cost reduction for manufacturing the above products.

"UX4 Series" Large-Area Full-Field Projection Lithography Systems

Model	Application	Wafer Size
UX4-MEMS FFPL200	MEMS devices	Max. 200 mm
UX4-LEDs FFPL200	High-brightness LEDs	Max. 200 mm
UX4-ECO FFPL150	Power devices	Max. 150 mm
UX4-3Di FFPL200/300	Wafer-level packages	Max. 200/300 mm

UX4 Series Common Platform: Large-Area, Full-Field Projection Lithography Systems

UX-4 Series Features

- Automated transfer of wafers up to 300 mm in diameter
- Completely non-contact so as to cause no mask damage; thus, no mask cleaning, inspection, or replacement is required
- Proprietary alignment technology that enables easy detection of low-visibility alignment marks
- Large depth of focus of 100 µm or less and special wafer chucking method allows high-precision exposure of warped or stepped substrates or thick photoresist
- Allows simultaneous projection of both sides of a wafer to enhance productivity
- Modular design of each function on a common platform allows easy future upgrades
- Optional backside alignment function to support LED wafer-level-packaging applications

UX-4 Series Specifications by Models

Model	UX4-MEMS	UX4-LEDs	UX4-ECO	UX4-3Di
Resolution:	3 µm L/S	3 µm L/S	3 µm L/S	2 µm L/S
Wavelength:	365 nm	365 nm	365 nm	365 nm
Overlay Accuracy:	±0.5 µm	±0.2 µm	±0.5 µm	±0.5 µm
Throughput:	120 wph	120 wph	120 wph	120 wph
Substrate Size:	100/150/200 mm selectable	100/150/200 mm selectable	100/150/200 mm selectable	100/150/200/300 mm selectable
Substrates:	Sapphire, GaN, Si, GaAs, SiC, and glass wafers			
Substrate Transfer Method	Automated wafer transfer on the UX4 Series platform			

Note: The specifications may slightly vary according to its application, such as for MEMS devices and high-brightness LEDs.

USHIO's High-Precision Projection Lens — Enabling Next-Generation Advanced Packaging Applications

USHIO is currently developing a large-field precision projection lens that can produce a super-high resolution of 1 μm L/S. Completion of this lens allows projection exposure of ultra-fine patterns of 1 μm L/S to meet the further requirement of finer patterns for advanced packaging.

USHIO Welcomes Demonstration Requests and Inquiries about Its UX Series Products

We at USHIO line up lithography systems using three exposure methods — step-and-repeat, direct imaging, and full-field projection exposure — to meet your application needs. To inquire about a demonstration or to request detailed information on these UX Series products, please contact:

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