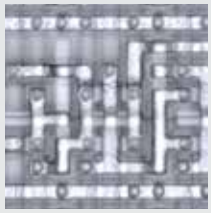
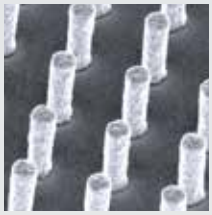
HEIDELBERG INSTRUMENTS

VPG 300 DI

THE MASKLESS DIRECT IMAGER FOR HIGH-ACCURACY AND HIGH-RESOLUTION MICROSTRUCTURES





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VPG 300 DI

THE MASKLESS DIRECT IMAGER FOR HIGH-ACCURACY AND HIGH-RESOLUTION MICROSTRUCTURES

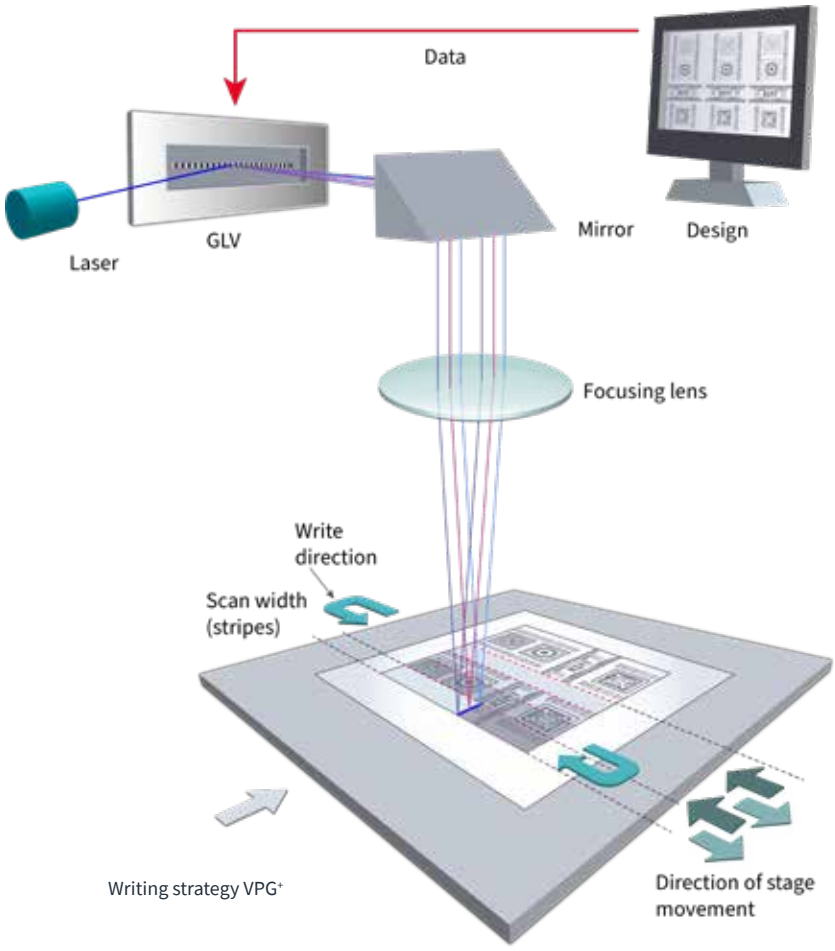
The VPG 300 DI is a Volume Pattern Generator specifically designed for direct writing high-resolution microstructures in i-line resists. It is based on the same field-proven ultra-high-speed exposure optical engine as the VPG+, with additional advanced system components like a Zerodur® stage and differential interferometer. Additionally, the VPG 300 DI offers various metrology, alignment, and wafer handling options.

HIGH-PRECISION DIRECT WRITER

The VPG 300 DI is a direct write lithography tool with outstanding imaging quality, resolution, and pattern position precision. The system is derived from the Heidelberg Instruments series of VPG+ laser writers, which are typically used for photo-mask production with the corresponding high-performance specifications and are designed to fulfil the demanding requirements of industrial environments.

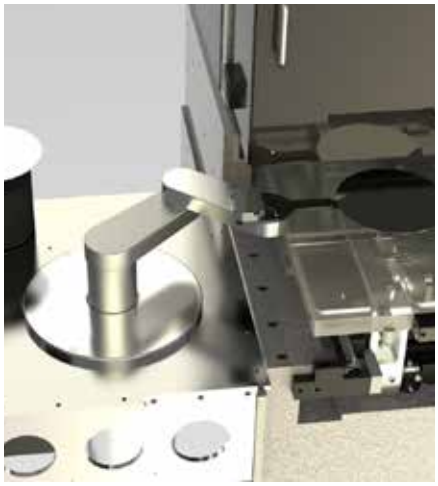
The VPG+ systems can look back on a long and successful career in mask shops all over the world. The VPG 300 DI vastly benefits from the in-depth experience that Heidelberg Instruments gained in the development and production of these high-speed production tools.

The system offers a choice of two high-resolution write modes, both capable of patterning sub-micron features with minimum features sizes down to 500 nm. Address grids below 10 nm guarantee high structure fidelity, while the data biasing during conversion corrects for target CD deviations.



Writing strategy VPG+

The system's second-layer alignment performance, the layer to layer repeatability, and the pattern position accuracy allow for the fabrication of precise multi-layer structures as well as mix-and-match applications with other tools.



Fully automatic substrate handling

THE VPG 300 DI IN A NUTSHELL

- Ultra-high-speed exposure engine
- Real-time autofocus system
- High-power DPSS laser with 355 nm wavelength
- Two write modes
- Camera system for metrology and alignment
- Closed-loop climate chamber
- Automatic loading system
- Optical edge detection
- Multiple data input formats
- User programmable interface
- Special chucks
- Labelling options
- Resolution down to 500 nm
- VIS/IR backside alignment

Application images on front page, left to right: Waveguide; CMOS personalization (courtesy of IMS Chips); Fine pitch Cu pillars chiplet connection (Courtesy of Fraunhofer IZM)

ALIGNMENT AND CALIBRATION

System features include automated alignment capabilities allowing multilayer exposures with excellent overlay accuracy and repeatability. The alignment functionality includes distortion compensation and field-by-field alignment. The 2D Stage Map Correction automatically calibrates stage positioning, improving registration of the written structures. Alignment can be achieved from the topside or the backside of the substrate.

LIGHT SOURCE AND STAGES

The VPG 300 DI operates with a high-power pulsed UV laser source with a wavelength of 355 nm. The systems is equipped with a full air-bearing Zerodur® stage with a 300 x 300 mm^2 write area.

DESIGN CONVERSION

An easy to use interface converts all standard design formats to machine data. Advanced conversion functions like flexible write grid, pattern matching data optimization, biasing, and mask layout functions are included.

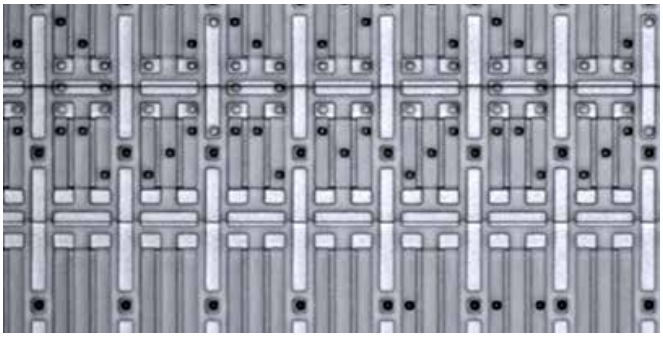
APPLICATIONS

The VPG 300 DI is designed for use in academic and industrial R&D or low-volume production. Due to its high resolution and accuracy and its ability to accurately align to previous written layers, the system can be utilized for applications where mask-based steppers are typically used. The VPG 300 DI however provides the added flexibility of a maskless writer and has no restriction in die size.

ENVIRONMENTAL CONTROL

Rigorous environmental monitoring and feedback control ensure the specified overlay accuracy: Software corrections based on precise measurements compensate for any variations in environmental parameters. An integrated metrology system enables self-calibration functions and various critical dimension measurements.

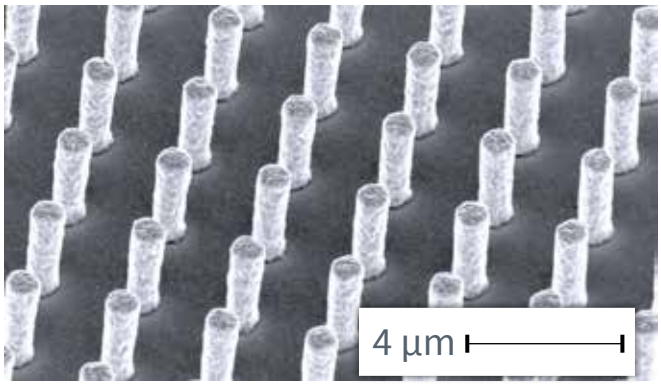
MIX-AND-MATCH APPLICATIONS



Mixed-signal gate array. Courtesy of IMS Chips

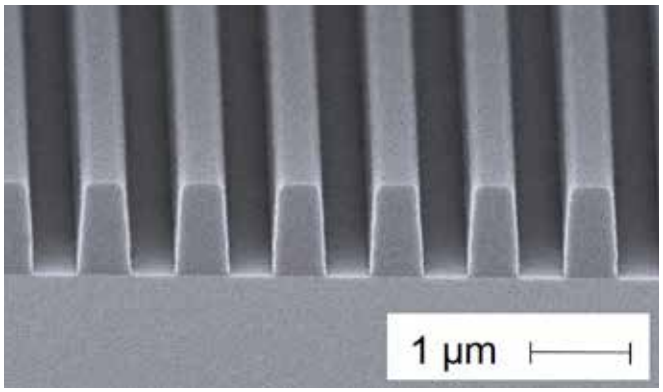
The example shows a“sea-of-gates” type mixed-signal gate array (IMS Gate Forest® technology) which allows the integration of analog and digital functionality on a single chip. The microelectronic elements on the master can be individually configured by adding the respective contacts. In a Mix-and-Match-approach, IMS Chips fabricated the CMOS masters by stepper lithography and added the personalized contacts and metallization layers with direct write laser lithography, using a VPG 400.

ADVANCED PACKAGING



Fine pitch Cu pillars chiplet connection. Courtesy of Fraunhofer IZM

HIGH-RESOLUTION STRUCTURES



Structures created with IP3250 (1 µm thickness). Courtesy of IMS Chips

VPG 300 DI

SYSTEM SPECIFICATIONS

Write mode	I	II
Writing performance		
Minimum feature size [µm]	0.5	0.8
Minimum lines and spaces [µm]	0.8	1.2
Address grid [nm]	4	8
Edge roughness [3σ, nm]	30	40
CD uniformity [3σ, nm]	50	60
2nd layer alignment (global) [nm]	100	130
Write speed [mm²/min]	340*	1020*
	*Fast mode: 680 and 2056 mm²/min with similar performance, but without specification	
Exposure time for 100 x 100 mm² area [min]	39	17
System features		
Light source	High-power DPSS laser with 355 nm	
Maximum substrate sizes	300 x 300 mm²	
Substrate thickness	0 to 12 mm (other thicknesses on request)	
Maximum exposure area	300 x 300 mm²	
Autofocus	Realtime autofocus system (optical and pneumatic)	
Autofocus compensation range	Up to 80 µm	
Flowbox	(Closed-loop) temperature controlled environmental chamber	
Alignment and metrology	Camera system and software package for metrology and alignment.	
Other features and options	Full automatic handling and prealigning of 100, 150, 200, and 300 mm wafers. Optical edge detection, topside alignment and optional IR and backside alignment. Zerodur® stage and high-resolution differential interferometer.	
System dimensions		
	System	Electronic rack
Width [mm]	2605	800
Depth [mm]	1652	650
Height [mm]	2102	1800
Weight [kg]	3550	180
Installation requirements		
Electrical	400 VAC ± 5 %, 50/60 Hz, 16A, 3 phases	
Compressed air	6 - 10 bar	

Please note: Specifications depend on individual process conditions and may vary according to equipment configuration. Write speed depends on exposure area. Design and specifications are subject to change without prior notice.

Visit product website for more information

To contact your local representative, please consult our website *heidelberg-instruments.com*

HEIDELBERG INSTRUMENTS
The power of direct writing

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