



MJB4

Manual Mask Aligner

The Cost-Effective Solution
for Research and Production



MJB4

Quality Meets Innovation

The MJB4 Mask Aligner from SUSS MicroTec is the perfect system for laboratories and small volume production. Easy to use and compact in size, the SUSS MJB4 represents an economical, highly flexible and efficient mask aligner solution for all kinds of R&D applications. It offers an excellent platform for researchers to develop new processes and technologies on a highly versatile, state-of-the-art mask aligner platform.

Equipped with a reliable, high precision alignment and high resolution printing capability in the submicron range the MJB4 demonstrates a performance unsurpassed by any other comparable machine.

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Features and benefits

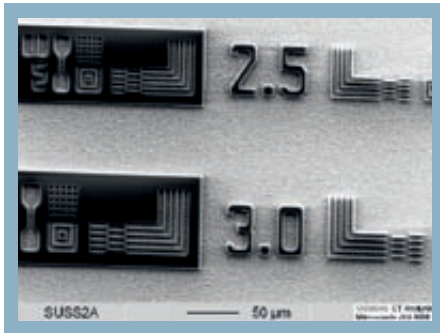
- + Fast and highly accurate alignment with SUSS Singlefield or Splitfield Microscope
- + HR Optics enables high resolution prints down to 0.5 μ m
- + Combined SUSS Broadband Optics (UV250/300/400) allows for fast switching between different wavelengths
- + Wafer and substrate handling up to 100mm
- + Upgradable with a UV-Nano Imprint Lithography (NIL) toolkit



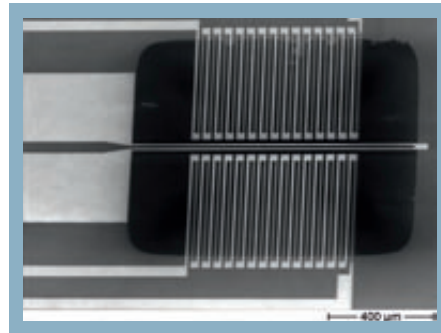
The MJB4 Supports Your Favorite Application

The MJB4 Mask Aligner is widely used in many lithography applications, e.g. MEMS, optoelectronics, power devices, medical devices and many more. The MJB4 offers customized solutions for handling standard and non-standard substrates, like fragile compound semiconductors, glass, foils, as well as warped

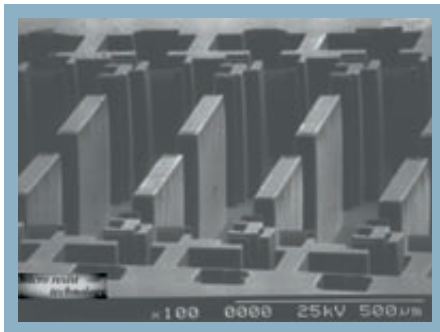
and perforated substrates. A variety of chucks and mask holders are available as an option that can be easily adapted to the process required. In addition the MJB4 can be upgraded with a UV-NIL toolkit that enables imprinting of sub 50nm geometries.



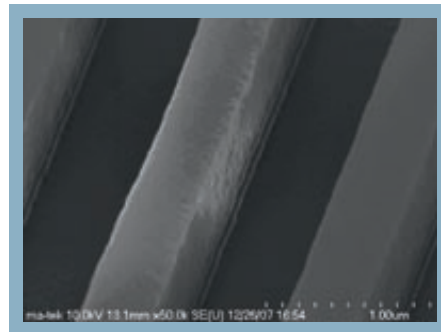
2.5 and 3µm lines and spaces pattern.
Printed in DNR-L-300-D1 resist on
2" sapphire/GaN wafers



Microfluidics device
Courtesy: IMSAS, Bremen



Structures with steep sidewalls
manufactured in 100 to 200µm thick
SU8 resist. Courtesy: mrt, Berlin



Reliable submicron patterning with
MJB4 diffraction reducing optics. 0.6µm
resolution at 0.8µm resist thickness.



Piezo motor for MEMS applications
Courtesy: IMT, University of Neuchatel

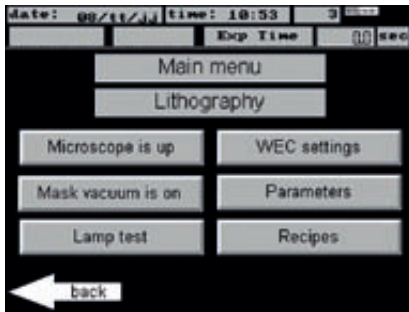


UV-NIL: 50nm, 70nm lines and spaces
imprinted with MJB4 Mask Aligner.
Courtesy: IHT, TU Braunschweig



MJB4: Your Gateway to the R&D World

The MJB4 is the next generation version of the successful MJB3 and has set industry standards specifically for its outstanding performance, ergonomic design and easy operation. With more than 2000 machines installed since its release in 1969 the MJB-series from SUSS MicroTec can be found in virtually every microelectronic laboratory, where high resolution photolithography is an essential requirement.

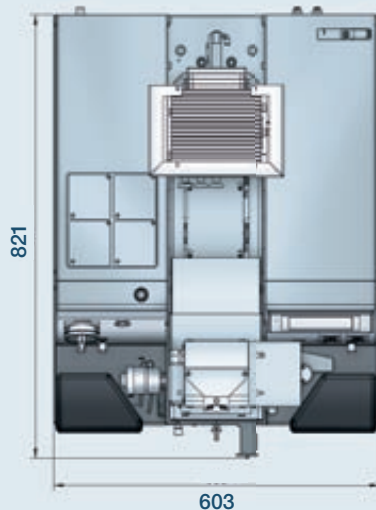


Easy and Quick Changeover Between Different Wafer Sizes and Options

The MJB4 allows for extremely quick changeover between different wafer sizes. Only chuck and maskholder need to be exchanged, which are easily accessible to the operator. Trained operators can do the wafer size changeover in less than 5 minutes.

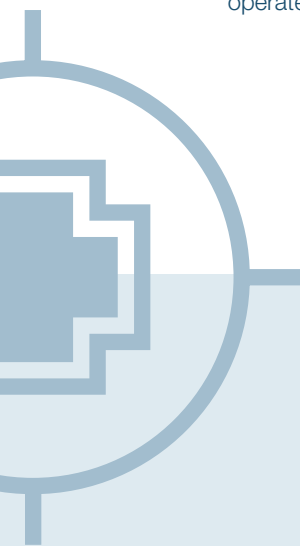
Easy Software / Minimum Operator Training

With its ergonomic operation and its elegant, touch panel based user interface the MJB4 is very easy to operate and only requires minimum operator training.



Small Footprint

In the MJB4 maximum functionality is packaged into minimal space. With a footprint of less than 0.5m² the MJB4 requires only minimum cleanroom space.

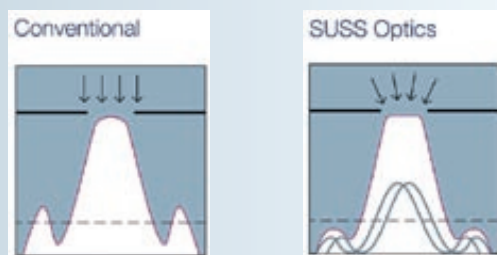


Exposure System

Diffraction Reducing Exposure Optics

All SUSS Mask Aligners use well established diffraction reducing illumination optics designed to compensate diffraction effects in contact and proximity lithography. In a SUSS MicroTec Mask Aligner, the photomask is not just simply illuminated with a plane wave, but with an annular spectrum of planar waves to reduce higher diffraction orders. The diffraction reducing exposure optics from SUSS MicroTec significantly improves resolution and sidewall profiles.

SUSS Diffraction Reducing Exposure Optics are available for the spectral ranges UV400, UV300 and UV250 and are able to significantly improve resolution and sidewall profiles.



Strong diffraction effects from parallel illumination (graphics left) vs. SUSS Diffraction Reducing Optics (graphics right). SUSS MicroTec is the only semiconductor equipment supplier offering diffraction reducing optical setups.

Dedicated Optics Solutions

The MJB4 is a full-field exposure system capable of exposing wafers and substrates up to 100mm as well as pieces.

Standard Optics

SUSS MicroTec offers optimized solutions for dedicated spectral ranges such as UV250, UV300 and UV400 to address different resolution requirements. All optics deliver optimum light uniformity of < 3%.

Combined Broadband Optics

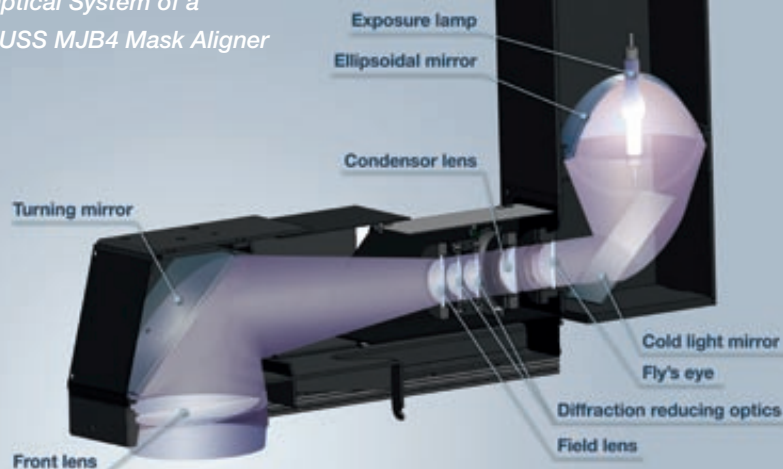
The combined SUSS Broadband Optics allows you to easily switch between different applications and wavelengths without mechanical changeover. This unique optics has been designed for UV250, UV300 and UV400 and offers broadband spectra based on only one UV lamp.

MO Exposure Optics

The SUSS MO Exposure Optics is an illumination concept based on high-tech microlens arrays and combines highest uniformity with flexible illumination shaping. The exchangeable Illumination Filter Plates allow for a quick and easy changeover between different optics types thereby enabling highest process flexibility.

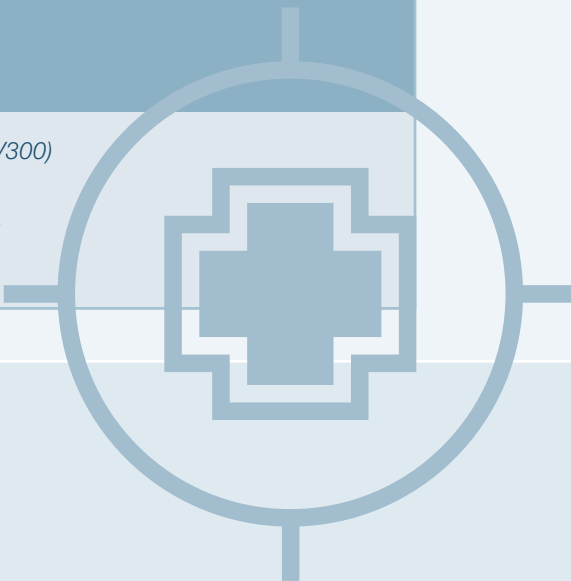


Optical System of a SUSS MJB4 Mask Aligner



MJB4 Resolution			
Exposure Mode	UV400	UV300	UV250
Vacuum Contact	< 0.8 μm	< 0.6 μm	< 0.5 μm
Hard Contact	1.0 μm	< 1.0 μm	–
Soft Contact	2.0 μm	< 2.0 μm	–
Gap Exposure	> 3.0 μm		

Line, space resolution achieved in 1 μm thick resist AZ 4110 (UV400, UV300) and 0.5 μm thick resist (UV6, UV250) respectively. Achievable resolution depends on wafer size, wafer flatness, resist type, clean room condition and therefore, might vary for different processes.



Printing Modes

The MJB4 is capable of handling several exposure sequences:

Soft Contact

In soft contact mode the wafer is brought into contact with the mask and is fixed onto the chuck with vacuum. In this exposure mode the MJB4 can achieve a resolution of 2.0 μm .

Hard Contact

In hard contact mode the wafer is brought in direct contact with the mask, while positive nitrogen pressure is used to press the substrate against the mask. In hard contact mode a resolution in the 1 micron range is possible.

Vacuum Contact for High Precision

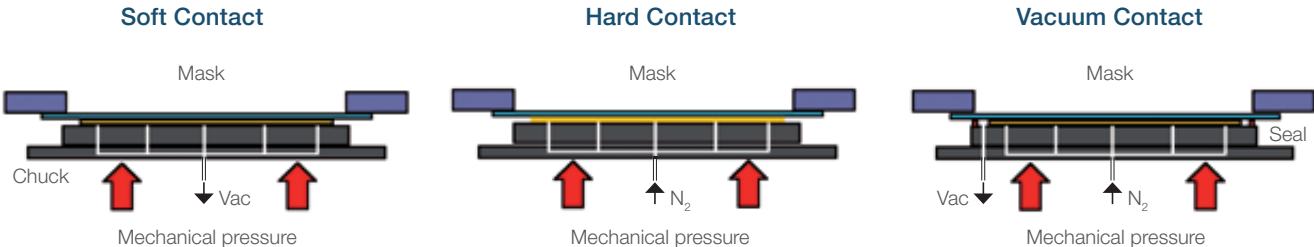
In this mode, a vacuum is drawn between mask and substrate during exposure. This results in a high resolution of < 0.8 μm .

Soft Vacuum Contact

For brittle or fragile substrates a soft vacuum contact exposure can be performed. The soft vacuum contact exposure mode reduces the vacuum impact to the substrate which leads to a high resolution not achievable in soft or hard contact.

Proximity Printing

Although the MJB4 is not considered to be a proximity exposure system, the proximity printing mode allows exposure at a pre-set gap of up to 50 μm after initial wafer to mask leveling. This reduces mask damages, especially for larger feature sizes.



Singlefield Microscope

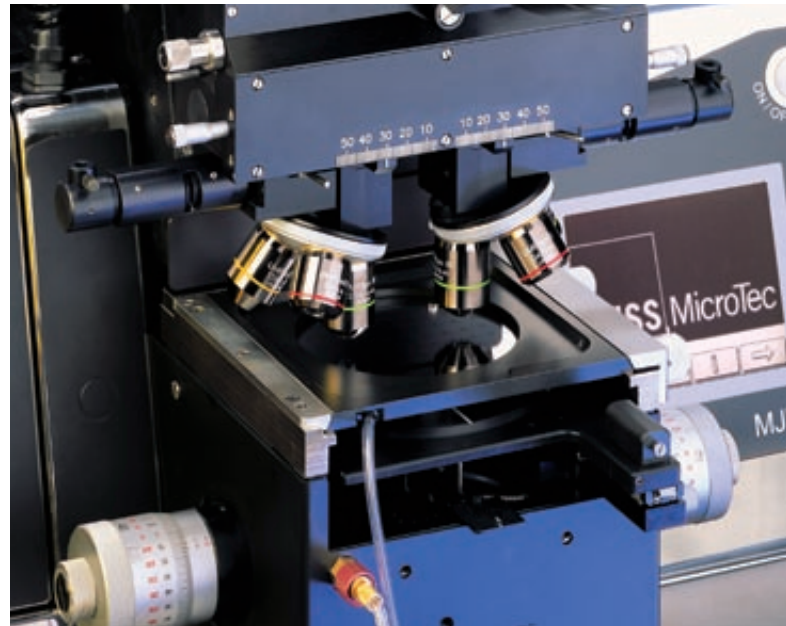
The solution for alignment of small wafers/substrates.

Splitfield Microscope with Eye-Pieces

Offers the operator a larger field of view, and an easy, simultaneous alignment of mask and wafer also at the wafer edge.

Video Microscope

System with eye-pieces and CCD camera system. Combined with the Splitfield Microscope it offers highest alignment accuracy and enables a precise alignment check.



Alignment Methods

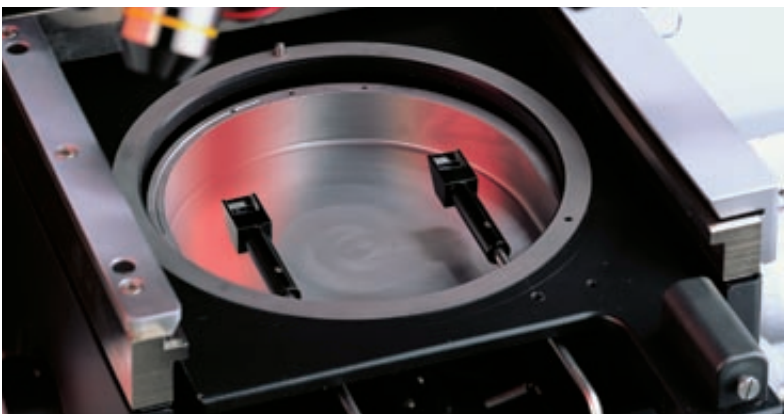
Top Side Alignment (TSA)

The MJB4 can be equipped with a manual Top Side Alignment System. It reliably achieves an alignment accuracy of $1\mu\text{m}$.

Infrared Alignment (IR) allows the handling of IR-transparent materials such as GaAs, InP, Silicon or adhesives, as used for thin wafer handling or encapsulation applications.

The dedicated solution for backside or buried layers feature alignment with an accuracy of up to $2\mu\text{m}$ (process dependant).

The IR alignment system of the MJB4 allows the handling of IR-transparent materials such as GaAs or InP.



Microscope Manipulator

For fast microscope scanning of mask and wafer a microscope manipulator is standard. It is equipped with precise pneumatic brakes, vibration-, shift- and backlash-free positioning. The large travel range enables highly precise flat alignment of 4" wafers and substrates.

For the Suss Splitfield microscope a rotation adjustment in the range of $\pm 4^\circ$ is normal. Coarse and fine focus can be done with a conveniently combined control.

SUSS IR Alignment System

- + Infrared light source to be positioned manually
- + Special IR chucks available
- + Dedicated IR objectives
- + Singlefield (M500) or Splitfield (M604) video microscopes for wavelengths from 400 to 1200nm



The UV-NIL toolkit for SUSS Mask Aligners enables patterning of sub-50nm geometries

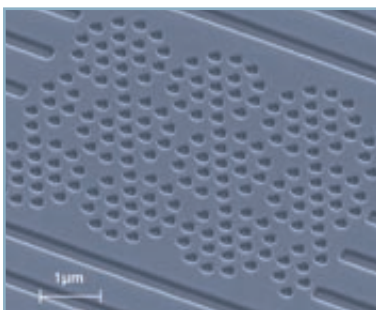
Innovation through Nano Imprint Lithography

The capabilities of the MJB4 can be enhanced with a tooling for single sided imprint UV-NIL (Nano Imprint Lithography), enabling imprint structures with features at the nano-scale level. The UV-NIL kit can be field upgraded with very limited effort, offering a straight forward upgrade path for customers to enter the nano world.

UV-NIL is a low-cost production technology that is based on UV-curing. It has been developed as a cost-effective alternative to high-resolution e-beam lithography to print sub-50nm geometries. UV-NIL solutions may be the enabling technique for next generation semiconductors, MOEMS, BioMems, LED, NEMS and optoelectronic technology.

Features and benefits

- + UV-NIL toolset can be easily upgraded on SUSS MJB4 Mask Aligners
- + Variable stamp and substrate sizes allow highest process flexibility
- + Easy and fast switching between UV-lithography and nano imprint lithography
- + Highest leveling precision and residual layer uniformity



160nm wide holes positioned in concentric rings as used for photonic crystals



SUSS MicroTec logo printed in Amonil MMS4 on a SUSS Mask Aligner



UV-NIL: 50nm, 70nm, 100nm lines and spaces imprinted with MJB4.
Courtesy: IHT, TU Braunschweig

TECHNICAL DATA	
MASK AND WAFER / SUBSTRATE	
Wafer size	1" up to 100 mm / 4" (round)
Max. substrate size	100 x 100 mm
Min. pieces	5 x 5 mm
Wafer thickness	up to 4 mm
Mask size	standard 2" x 2" up to 5" x 5" (SEMI)
Mask thickness	up to 4.8 mm / 190 mil
EXPOSURE MODES	
Contact:	soft, hard, vacuum, soft vacuum
Vacuum contact adjustable to	200 mbar abs
Gap exposure, adjustable gap	10 – 50 µm
Flood exposure, split exposure	
Lamp control modes:	constant power, constant intensity
EXPOSURE OPTICS	
RESOLUTION	
Wavelength range	UV400: 350 – 450 nm (g, h, i-line) UV 300: 280 – 350 nm UV 250: 240 – 260 nm UV 250 / 300 / 400: 240 – 450 nm
Exposure source	CPC: Constant Power Controller for Lamps Hg 200 W and Hg 350 W CIC1200: Constant Intensity Controller for Lamps Hg 200 W, Hg 350 W and HgXE 500 W (Deep UV)
Light uniformity	≤ 3%
ALIGNMENT METHODS	
Top Side Alignment (TSA) accuracy	< 0.5 µm (with SUSS recommended wafer targets)
Transmitted Infrared Alignment (IR) accuracy	2 µm depending on process conditions and wafer/substrate material
Alignment gap	10 – 50 µm
ALIGNMENT STAGE	
MA movement range	X: ± 5 mm Y: ± 5 mm Theta: ± 5°
Mechanical resolution	X, Y: 0.1 µm Theta: 4 x 10 ⁻⁵
TOPSIDE MICROSCOPE	
Movement range	X: ± 40 mm Y: + 30 – 50 mm Theta: ± 4°
UTILITIES	
Vacuum	< – 0.8 bar < 200 hPa abs
Compressed air	5.5 bar (81 psi)
Nitrogen	> 1.5 bar (22 psi)
POWER REQUIREMENTS	
Power voltage	AC 230 V ± 10 %
Frequency	50 – 60 Hz
PHYSICAL DIMENSIONS	
Width x Depth	605 x 810 mm = 0.5 m ²
Height	660 mm
Weight	up to 130 kg (290 kg with Antivibration Table)
Operator safety and ergonomics	CE-mark, others on request Sound pressure level: < 70 db (A) UV radiation emissions (315 – 400 nm): < 0.2 mW / cm ²

Data, design and specification of custom built machines depend on individual process conditions and can vary on materials, targets and tools. Not all specifications may be valid simultaneously. Illustrations in this brochure are not legally binding. SUSS MicroTec reserves the right to change machine specifications without prior notice.



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Serving Our Customers

With more than 8,000 systems installed worldwide, **SUSS MicroTec** belongs to the leading suppliers of process and equipment solutions for microstructuring in the semiconductor industry. Our commitment to superior performance and cost-effective solutions has made us a technology leader as well as a reliable partner for R&D and manufacturing.

Throughout the world dedicated and highly trained service teams support our customers with routine maintenance, training and field upgrades. Our service record is what we are continuously acknowledged for with customer satisfaction awards – we are there for you!

Visit www.suss.com/locations for your nearest SUSS representative or contact us:

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