



MA/BA8 GEN3₊

MANUAL MASK/BOND ALIGNER
FOR INDUSTRIAL RESEARCH AND PRODUCTION

INNOVATIVE EXCELLENCE

The third generation MA/BA8 Mask and Bond Aligner represents the latest development of SUSS MicroTec's manual aligner platform for industrial research and operator assisted production. The MA/BA8 Gen3 is the new benchmark in full-field lithography for MEMS, Advanced Packaging, 3D-Integration and Compound Semiconductor markets. In addition, it supports emerging processes like micro & nanoimprint, bond alignment, UV-bonding, selective plasma activation as well as wafer level microlens imprinting and assembly.

Because of their ability to easily process all kinds of wafer and substrate materials, manual aligners are increasingly used in production environments. With the new MA/BA8 Gen3,

SUSS MicroTec addresses the growing demand for tighter process control coupled with high yield.

The MA/BA8 Gen3 has been designed to enable quick and effective development of new technologies and products. Research organizations will benefit from the enhanced capabilities of this machine as it allows them to develop their processes with industry standard equipment.

Processes developed on the MA/BA8 Gen3 can be quickly transferred onto SUSS MicroTec's automated mask aligner platform for high volume production. Both platforms are based on the same SUSS technology.

FEATURES AND BENEFITS

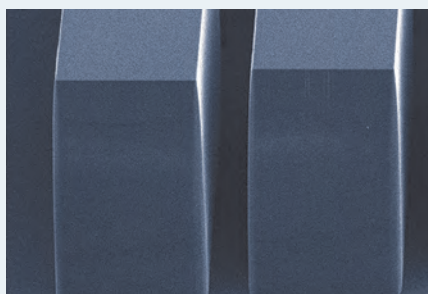
- + High resolution (HR) optics allows patterning of structures below 0.5 μm
- + Operator assisted and auto alignment permits down to 0.25 μm alignment accuracy
- + Advanced automatic functions for maximum process control
- + Process compatibility with automatic equipment
- + Optimized splitfield microscope with direct viewing and/or LCD flat screen options
- + Easy conversion to bond align mode
- + Micro & nanoimprint lithography retrofit kit
- + Microlens imprinting toolset
- + Selective plasma tool set
- + Allows utilization of tool sets from the previous MA/BA6 and MA/BA8 platform



BREAKING TECHNOLOGY BOUNDARIES

An unmatched alignment precision coupled with high resolution and maximum light uniformity makes the MA/BA8 Gen3 the tool of choice for a variety of applications,

ranging from MEMS, opto-electronics and 3D Packaging to micro-optics and nanotechnology.



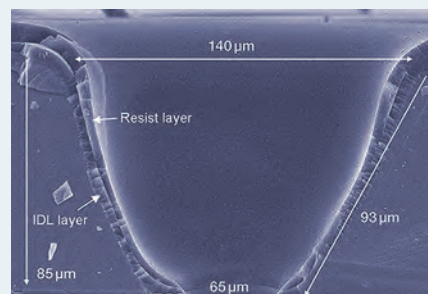
MEMS

Printed in 500µm SU8 structures
Courtesy: mrt, Berlin



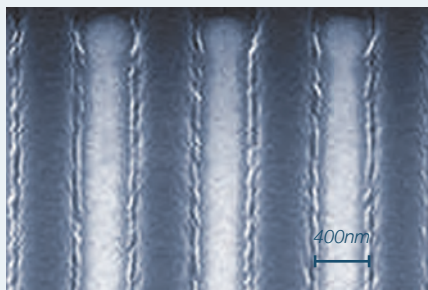
UV LIGA

Micro mechanical watch components
Courtesy: Mimotec



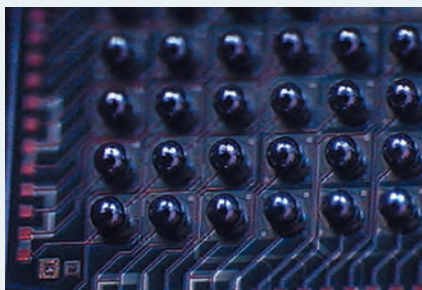
CMOS Image Sensor Packaging, TSV Lithography

Via top and bottom opening
Courtesy: Schott, IZM



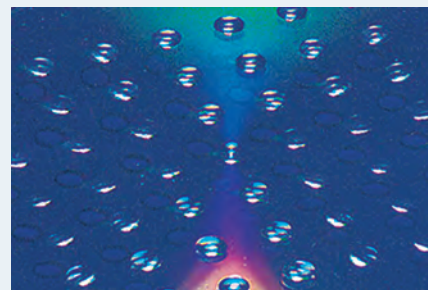
Submicron Patterning

350nm thick resist AZ6612
400nm lines and spaces
Printed with SUSS UV400 HR Optics
Courtesy: FH Voralberg



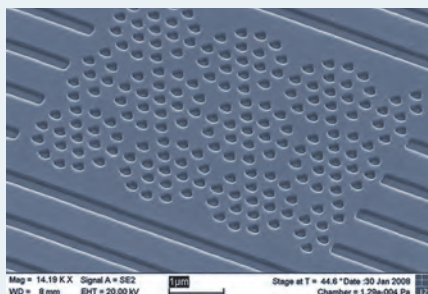
Wafer Level CSP

Redistribution layer
Courtesy: Fraunhofer IZM



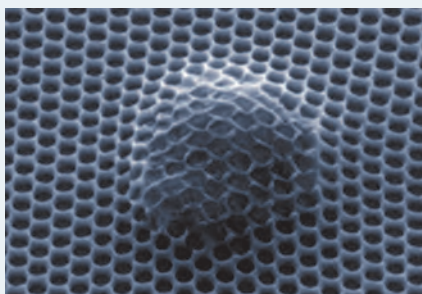
Microlens Imprint Lithography (SMILE)

Microlens array for WLC (lens dimensions:
30µm thick, 1600µm diameter)
Courtesy: SMO



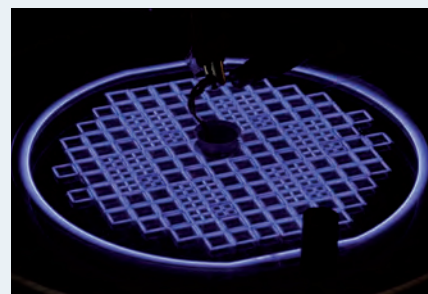
UV Nanoimprint Lithography

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



Substrate Conformal Imprint Lithography (SCIL)

Large area nanoimprint lithography with soft stamp technology
Courtesy: Philips Research



SELECT

Selective plasma activation on a 4" wafer
Courtesy: Fraunhofer IST

CONNECTING INDUSTRIAL RESEARCH AND PRODUCTION



Innovation, high device performance, cost efficiency and short time-to-market are key drivers of product development and research at the beginning of the 21st century.

With the new generation of the MA/BA8 Gen3 SUSS MicroTec has developed an innovative, state-of-the-art manual aligner solution that offers high process flexibility including submicron alignment and optimized thick resist lithography, UV micro- and nanoimprinting, microlens imprinting and assembly, UV bonding, SELECT and enhanced bond alignment.

Designed for R&D, pilot line and production environments, the MA/BA8 Gen3 enables production-friendly research. It allows easy and cost effective process transfer from laboratory to production. Key components such as optics, alignment system and graphical user interface perfectly match with the SUSS production aligner platform.

INDUSTRY NEEDS RESEARCH – RESEARCH NEEDS EQUIPMENT

The quality of our future lifestyle depends on investments we make in research today. In order to stay in the race, novel technologies and products are in development that later will be produced in large volumes. With their enabling technology, manual mask aligners from SUSS MicroTec contribute to research and development,

thereby helping us to shape the future.

Fully automated mask aligners from SUSS MicroTec are found in virtually all major advanced packaging, MEMS and compound semiconductor production environments where high yield and cost effective manufacturing are essential requirements.

TARGET MARKETS

MEMS

The MA/BA8 Gen3 with its high intensity exposure optics is a very efficient exposure tool for thick resist MEMS applications.

Innovative features or toolsets like infrared alignment system (transmission and reflective),

Bond Alignment, selective plasma activation or the capability to handle small substrates make the MA/BA8 Gen3 an enabling lithography tool for the development and low volume production of MEMS devices.



RESEARCH

A quick changeover between options such as Lithography for thin and thick resists, micro- and nanoimprint, UV Bonding, Bond Alignment, Direct Bonding and Selective Plasma Treatment make the MA/BA8 Gen3 the perfect tool for the variety of applica-

tions in research. The tool can be equipped as needed from a low cost manual tool for basic studies up to a highly automated tool with automatic alignment for industrial research.



IMPRINT

The MA/BA8 Gen3 enables with its different options for micro- and nanoimprint to have the right solution from low to high resolution and from small up to large area imprint. The UV-NIL option will allow you to print highest resolu-

tion on small substrates. For full wafer imprint up to 8" either SMILE, a micro imprint using soft stamps, or the unique SCIL nanoimprint technique for highest resolution is the optimal choice.





HIGHLY INTEGRATED FUNCTIONALITY

The MA/BA8 Gen3 is a highly versatile system for R&D and operator-assisted production. In addition it allows easy and fast upgrades to complementary technologies.

The MA/BA8 Gen3 offers you up to five system solutions in one single tool:

- + Full-field Photo Lithography
- + Bond Alignment: alignment of two substrates for subsequent substrate bonding
- + UV-Imprinting: UV-NIL, SCIL and SMILE
- + UV-Bonding: Wafer level assembly of devices with UV curable material
- + Selective Plasma Activation for partial surface activation and bond preparation

SUPERIOR ALIGNMENT

Highly precise alignment plays a significant role throughout the whole MEMS and semiconductor manufacturing process. The MA/BA8 Gen3 offers a variety of different alignment systems tailored to your specific process requirements. Depending on the alignment mode and alignment conditions, alignment precisions down to $0.25\mu\text{m}$ (under special conditions) can be achieved.

MA/BA8 GEN3 RESOLUTION

EXPOSURE MODE	UV400	UV300	UV250
Vacuum Contact	$1.5\mu\text{m}$	$0.5\mu\text{m}$	$0.4\mu\text{m}$
Hard Contact	$2.0\mu\text{m}$	$1.0\mu\text{m}$	-
Soft Contact	$3.0\mu\text{m}$	$2.0\mu\text{m}$	-
Proximity (20 μm)	$3.5\mu\text{m}$	$2.5\mu\text{m}$	-

Achievable resolution depends on optics type, wafer size, wafer flatness, resist type, clean room class and therefore, might vary for different processes. ($1\mu\text{m}$ thick resist, lines & spaces)

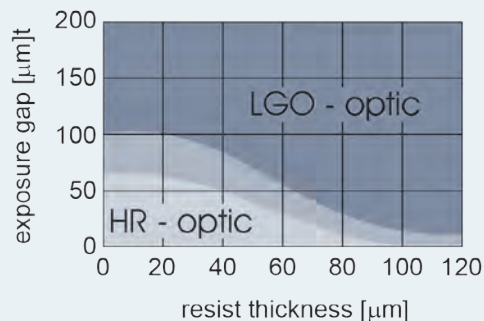
EXCELLENT UV UNIFORMITY

	MEAN INTENSITY	WAFER SIZE		
		8"	6"	< 4"
i-line*	$40\text{mW}/\text{cm}^2$	3.5 %	3.0 %	2.0 %
Broadband**	$60\text{mW}/\text{cm}^2$	3.5 %	3.0 %	2.0 %
* measured with 365nm probe				
** measured with broadband probe				



DEDICATED OPTICS SOLUTIONS

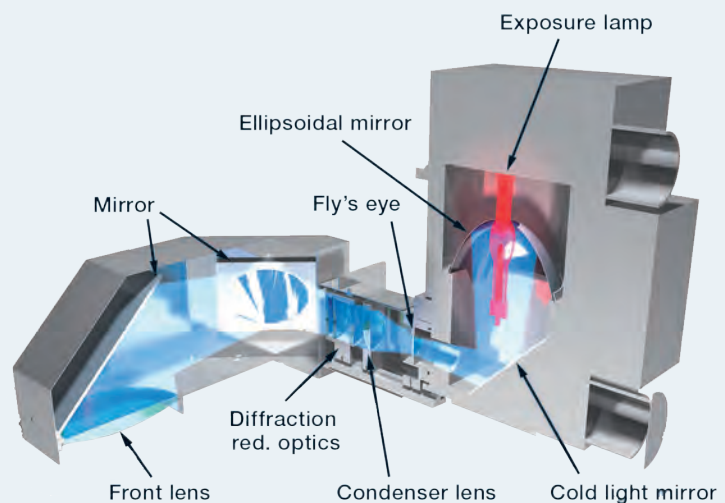
The MA/BA8 Gen3 is a full-field exposure system capable of exposing wafers and substrates from pieces up to 200mm. SUSS MicroTec offers optimized solutions for dedicated spectral ranges such as UV250, UV300 and UV400 to address different resolution requirements. All optics deliver optimum light uniformity of 3.5% depending on the application the user can choose between a High Resolution (HR) and a Large exposure Gap Optics (LGO). The high resolution optics have been optimized for small exposure gaps or contact exposure to achieve highest lines and spaces resolution. The SUSS LGO optics have been designed for large exposure gaps typically used for high topography (3D) and thick resist applications.

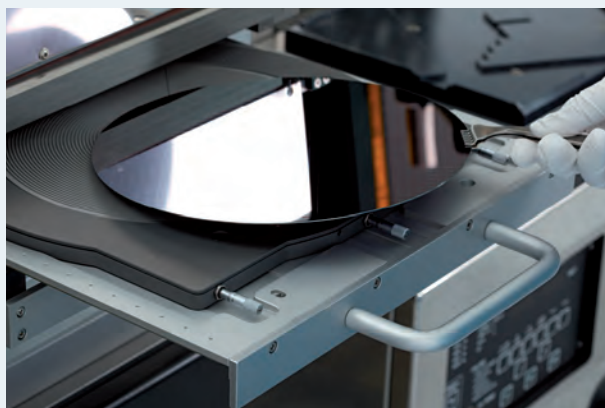


STANDARD DIFFRACTION REDUCING EXPOSURE OPTICS

All SUSS Mask Aligners can be equipped with a variety of optical configurations designed to compensate diffraction effects. SUSS Mask Aligners perform exposure not only by one parallel beam, but by several slightly inclined beams to reduce the peak intensity of the secondary diffraction images produced by interference effects.

Diffraction reducing exposure optics from SUSS MicroTec significantly improve resolution and sidewall profiles.





TOP SIDE MICROSCOPE OPTIONS

SPLITFIELD MICROSCOPE WITH EYE-PIECES

Offers the operator a larger field of view, a higher depth of focus and a colored image.

VIDEO MICROSCOPE

The microscope with attached CCD cameras present the alignment on a LCD screen for easy and fast operation.

SPLITFIELD / VIDEO MICROSCOPE

System with eye-pieces and CCD camera. It combines the advantages of both microscope options in one system. The splitfield microscope offers the operator a larger field of view, a higher depth of focus and a colored image.

ALIGNMENT METHODS

TOP SIDE ALIGNMENT (TSA)

The MA/BA8 Gen3 can be equipped with either a manual or motorized top side alignment system. It can reliably achieve an alignment accuracy down to $0.25\mu\text{m}$ (under special conditions) supported by assisted or auto alignment.

BOTTOM SIDE ALIGNMENT (BSA)

allows to pattern the top side of the wafer with features accurately aligned to the bottom side. The MA/BA8 Gen3 BSA system offers an alignment accuracy of $< 1\mu\text{m}$.

INFRARED ALIGNMENT (IR)

allows the handling of opaque, yet IR-transparent materials such as GaAs, InP, Silicon or adhesives. These are used for thin wafer handling or encapsulation applications.



ALIGNMENT MODES

MANUAL ALIGNMENT

is based on a manual or motorized alignment stage that can be precisely operated either via micrometer screws or joystick by the operator.

ASSISTED ALIGNMENT

represents the latest development for operator assisted, semi-automated alignment. During manual alignment the COGNEX® based pattern recognition software continuously measures the achieved accuracy and reports it to the operator. With its sub pixel resolution the system supports highest alignment precision, prevents misalignment and maximizes yield.

AUTO ALIGNMENT

is based on a motorized alignment stage. The COGNEX® based pattern recognition software automatically recognizes wafer target locations and controls the movement of the alignment stage.

Coupled with SUSS MicroTec's DirectAlign® accuracies down to 0.25µm can be achieved.

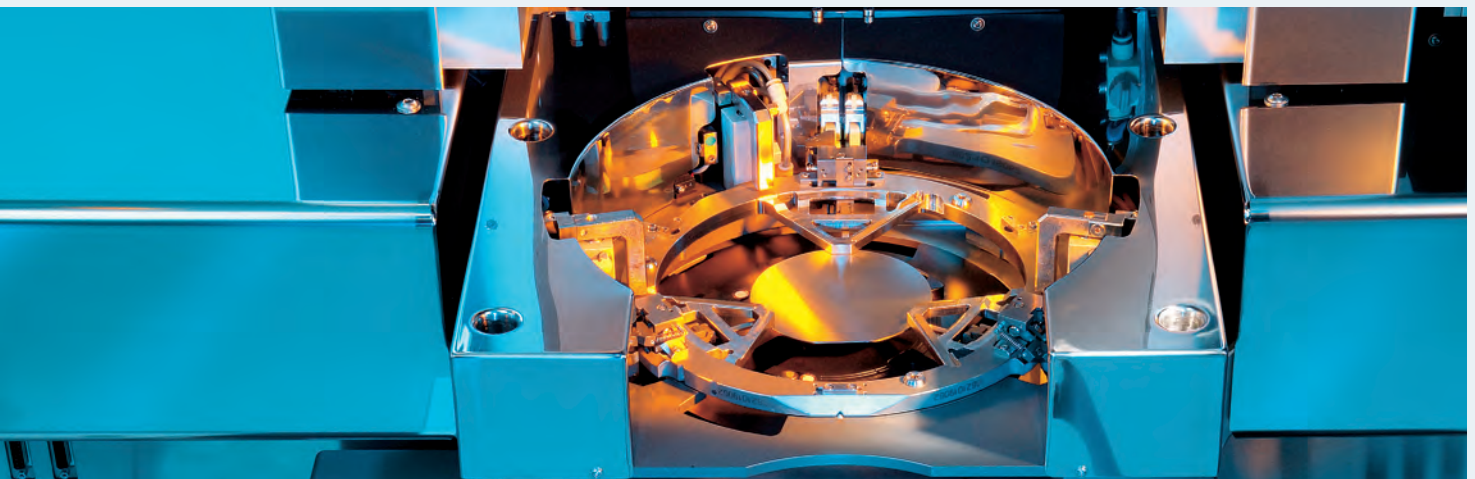
Auto Alignment enables highest repeatability of process results coupled with optimized throughput and minimum operator intervention.

BOND ALIGNMENT

The MA/BA8 Gen3 can be configured as mask and bond aligner combination or as a bond aligner only. The BA8 Gen3 aligns and clamps wafers in fixtures to maintain the position during manual transfer to a SUSS Wafer Bonder. The innovative system meets customer's needs for high precision, flexibility and repeatability, as well as low cost of ownership. In case of direct bonding processes, the wafers can be prebonded in the aligner as well. For low temperature direct bonding applications the BA8 Gen3 can be upgraded with a plasma activation toolkit for patterned and full wafer surface activation (SELECT).

The highly rigid and stable alignment stage of the BA8 Gen3 in combination with assisted and auto alignment options ensures reliable and accurate alignment of substrates. The proven, patented SUSS MicroTec wedge error compensation system guarantees highest possible planarity between wafers.

The BA8 Gen3 accommodates even most demanding alignment processes in MEMS and LED production and growth markets like 3D integration.



TECHNICAL DATA

MASK AND WAFER / SUBSTRATE

Wafer Size	1" to 200mm
Max. Substrate Size	200 x 200mm
Min. Pieces	5 x 5mm
Wafer Thickness	max. 10mm
Mask Size	standard 2" x 2" up to 9" x 9" (SEMI)

EXPOSURE MODES

Contact	soft, hard, vacuum
Proximity	exposure gap 1– 300mm
Gap Setting Accuracy	1µm
Vacuum Contact	adjustable to -80kPa
Modes	constant power, constant dose
Options	flood exposure, split exposure

EXPOSURE OPTICS

Resolution	see page 6
Wavelength Range	UV400 350–450nm UV300 280–350nm UV250 240–260nm
Exposure Source	Hg lamps 350–1000W (optional 5000W)
Intensity Uniformity	< 3.5 % (200mm)

ALIGNMENT METHODS

Top Side Alignment (TSA)	accuracy < 0.5µm (with assisted alignment and SUSS MicroTec recommended wafer targets)
Bottom Side Alignment (BSA)	accuracy < 1.0µm
TSA Focus Range	1– 400µm (AL400 – motorized focus and image capturing)
Accuracy Bond Aligner	2µm

ALIGNMENT STAGE

MA Movement Range	X: ± 5mm Y: ± 5mm θ: ± 5°
BA Movement Range	X: ± 3mm Y: ± 3mm θ: ± 3°
Resolution	0.1µm

TOPSIDE MICROSCOPE (TSA)

Movement Range	X: 33 – 202mm Y: +18, –100mm θ: ± 5°
----------------	--

BOTTOMSIDE MICROSCOPE (BSA)

Movement Range	X: 20 – 210mm Y: ±22mm focus: 6mm
----------------	---

GRAPHICAL USER INTERFACE

Windows XP
Unlimited Storage of Recipes
Remote Access Available

UTILITIES

Vacuum	< –0.8kPa
Compressed Air	0.6 - 0.8MPa
Nitrogen	> 0.5MPa

POWER REQUIREMENTS

Power	voltage AC 230V ±10 % frequency 50–60Hz
-------	--

PHYSICAL DIMENSIONS

Width x Depth	1350 x 1000mm = 1.35m²
Height	1803mm
Weight	~ 750kg

OPERATOR SAFETY AND ERGONOMICS

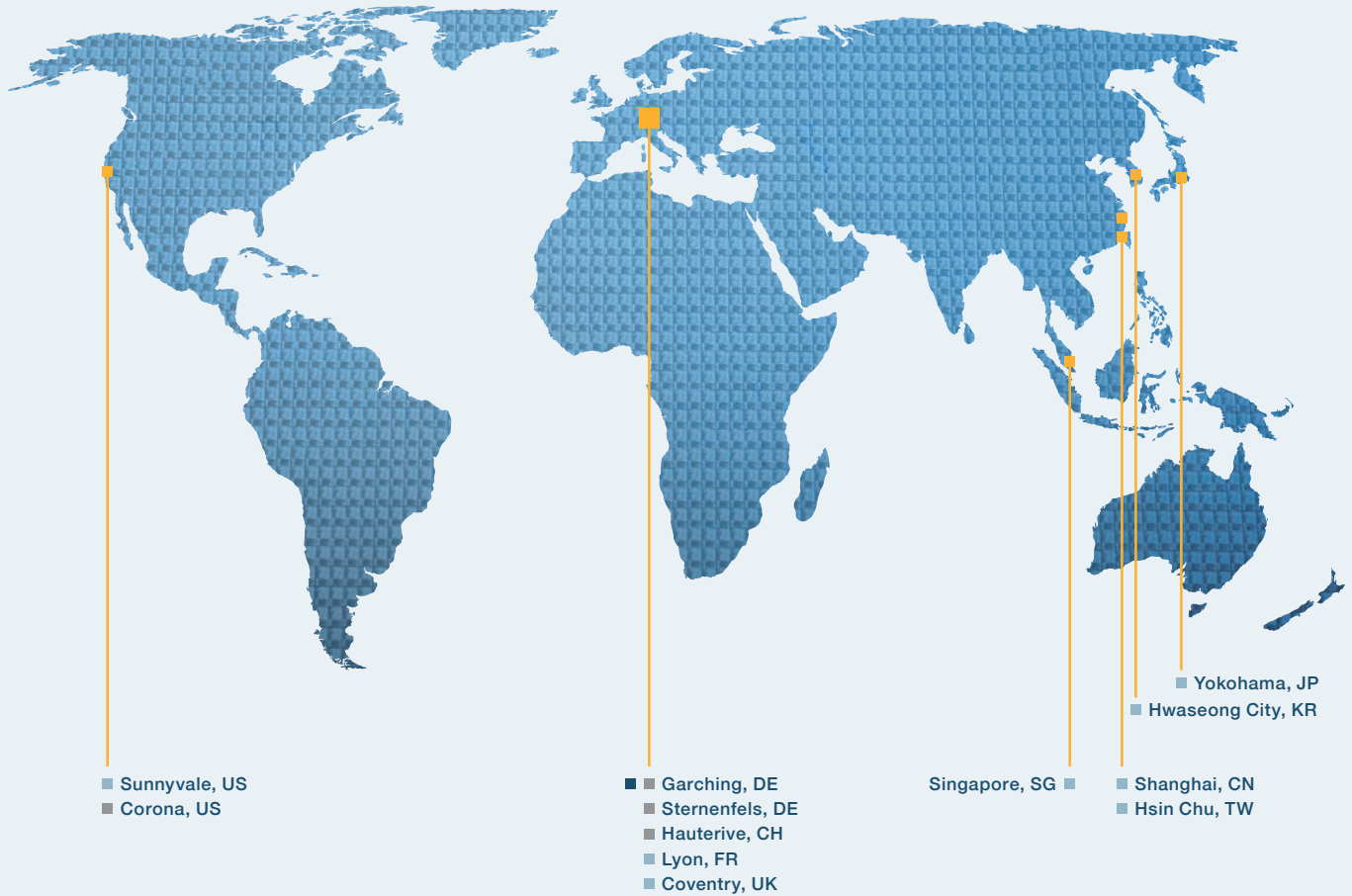
SEMI S2 Certificate
SEMI S8 Certificate
EMC
CE Compliant

Data, design and specification of custom built machines depend on individual process conditions and can vary according to equipment configurations. 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.

NORTH AMERICA

EUROPE

ASIA



- Headquarters
- Production
- Sales

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

SÜSS MicroTec AG | Phone: +49 89 32007-0 | info@suss.com

www.SUSS.com