

Heptagon Wafer-Level Offerings for Emerging Applications

2024-11

HEPTAGON

CONTENTS

- **Company Overview**
- **Foundry Service and Typical Applications**
- **Added Value to Customers**
 - Benefits of Wafer-Level Optics (WLO) Technology
 - How WLO Technology Enables Your Applications
 - Ensuring the Performance and Reliability of Our Products
 - Work with Us – From Design to Mass Production
- **Summary**

Focuslight Overview

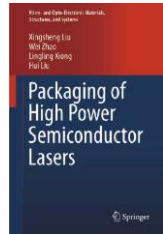
- Founded in 2007 by Dr. Victor X. Liu, headquartered in Xi'an, China.
- A fast-growing company that develops and manufactures:
 - **High-power diode laser components and materials** (Photon Generation)
 - **Laser optics components** (Photon Control)
 - **Photonics module and system solutions** (Application Solutions) focusing on optical communication, automotive, pan-semiconductor, and medical and health applications.
- A **global photonics foundry** offering process development and manufacturing services to the global photonics community.
- Publicly listed in the Shanghai Stock Exchange (Ticker Symbol: 688167).



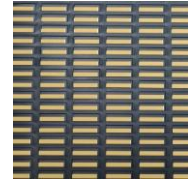
Milestones



2007
Founding of Focuslight



2013
World's first monograph on packaging of HPDL published



2017
Technology breakthrough of gold-tin film deposition



2018
UV-L750 Ultraviolet Line Laser System won Prism Award



2017

Acquisition of LIMO;
Started providing photon control and photonics application solutions



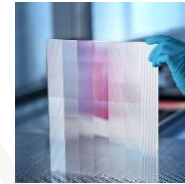
2018

Dongguan delivery and high-volume manufacturing center officially in operation



2019

Automotive LiDAR transmitter project awarded from international Tier 1



2019

Production of micro-optics on world's largest glass wafer (300 x 300 mm²)



2023

Line Beam LiDAR Transmitter Module awarded nomination from European Tier 1



2019

Global branding identity upgrade

IPO

2021

Successful IPO at Shanghai Stock Market



2024

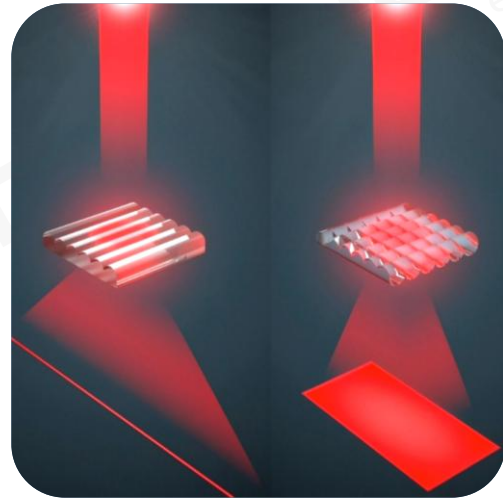
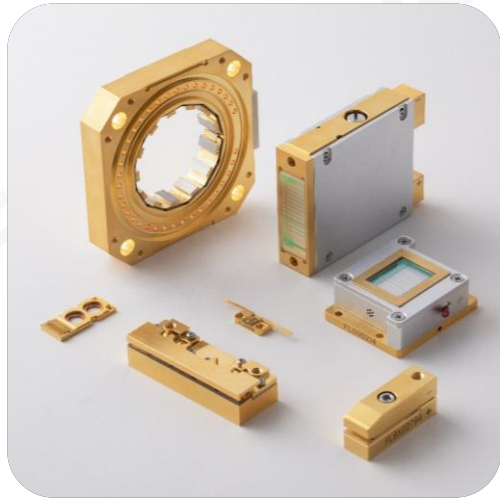
Acquisition of SUSS MicroOptics



2024

Acquisition of ams OSRAM's optical component assets;
Adopt Heptagon brand for global photonics foundry services

Products and Businesses



Photon
Generation



Photon
Control

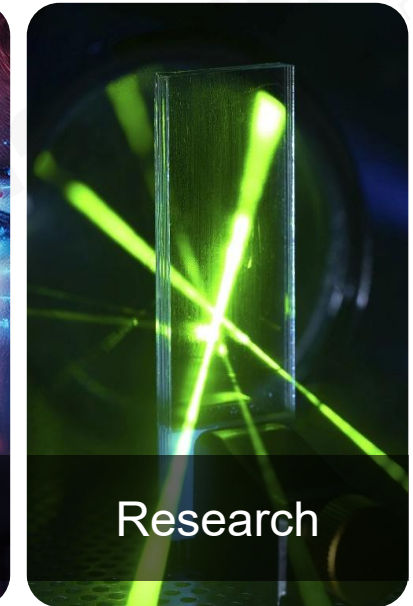
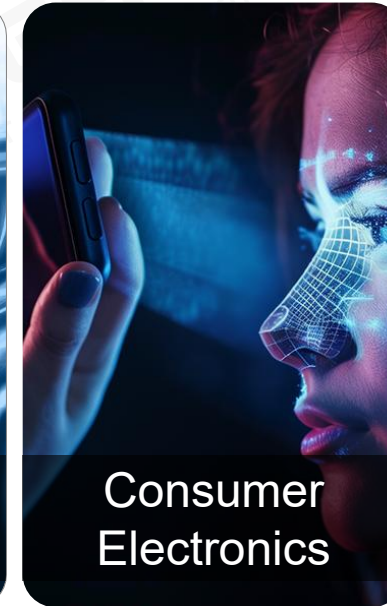
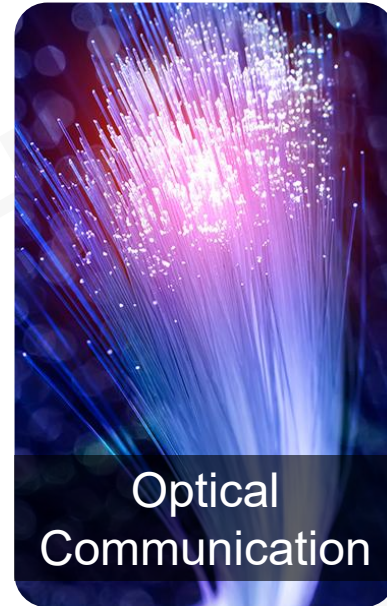
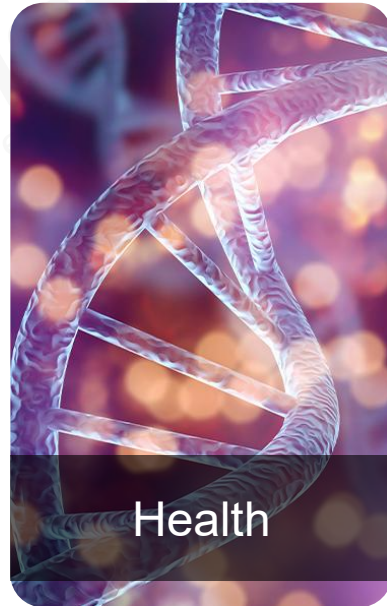
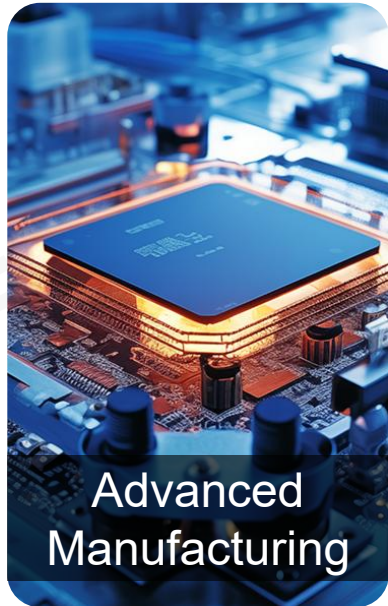


Photonics
Application
Solutions



Global
Photonics
Foundry

Markets



Be the global trusted photonics solution provider
through innovation, manufacturing excellence and fast response

Focuslight Global Operations System

Leverage the strengths and capabilities of each location to **cater to specific customer demands** and **optimize operational efficiency**.

Through centralized decision-making, integrated operations, and lean management, a **high-efficiency, low-cost global operations system** is established.



Neuchâtel, Switzerland
Operation Center



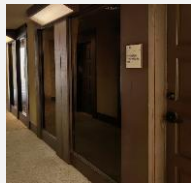
Dortmund, Germany
Operation Center



Xi'an, China
Focuslight HQ, Operation Center



Haining, China
Hefei, China
Operation Center
(being constructed)



Silicon Valley, USA
Innovation Lab



Zurich, Switzerland
R&D Office



Ang Mo Kio (AMK), Singapore
Operation Center
Business Center

Other Southeast Asian regions
(to be decided)
Photonics Foundry



Shaoguan, China
Operation Center



Dongguan, China
Operation Center

Heptagon is Back as a Focuslight Brand

FOCUSLIGHT Never stop exploring | CN | Product Search | Search | Webshop |  | 

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[← Return](#) Focuslight Technologies Inc. Completes Acquisition of ams OSRAM's Optical Component Assets, Further Strengthening Its Global Competitiveness in Optics Solutions
Time: 2024-09-02

 [Download](#)

Xi'an, China, September 2nd, 2024 – – Focuslight Technologies Inc. (Shanghai Stock Exchange: 688167), a global provider of high-power diode lasers and materials, laser optics and photonics modules and system solutions, **today announces the successful acquisition of optical component assets from ams OSRAM AG**. This marks another strategic move and milestone following Focuslight's acquisitions of LIMO GmbH in 2017 and SUSS MicroOptics SA (now as Focuslight Switzerland SA) in January 2024, providing a strong foundation on its commitment to expanding its capabilities and footprint in the global photonics market.

News source: <https://focuslight.com/news-events/newslist/focuslight-technologies-inc-completes-acquisition-of-ams-osrams-optical-component-assets-further-strengthening-its-global-competitiveness-in-optics-solutions/>

Focuslight also plans a full integration of the acquired assets into its existing business structure. The company will reorganize and integrate certain assets into its Automotive Business Unit to strengthen its capabilities in serving global automotive customers. A **Strategic Growth Division** will be established to house the R&D teams and equipment related to consumer electronics, disposable medical solutions, and other emerging applications. All products associated with these assets will be unified under the **Focuslight** brand.

Meanwhile, a **Global Photonics Foundry Business Unit** will be established serving as a global center for photonics industry process development and manufacturing services under the historic **Heptagon** brand, which was originally founded in 1993 and will now continue its legacy of innovation, quality, and high-volume manufacturing under Focuslight's global operations, transforming its customer's ideas and designs into industry-powering photonics solutions.

Story of Heptagon

Initially founded in 1993, Heptagon was a prominent brand in the micro-optics industry, known for its advanced optical packaging and wafer-level micro-optical modules, as well as high-volume manufacturing powering consumer electronics applications.

Now, under the frame of Focuslight global operations, Heptagon will continue to be the official brand name of your Global Photonics Foundry Services.

Visit www.hptg.com for more information

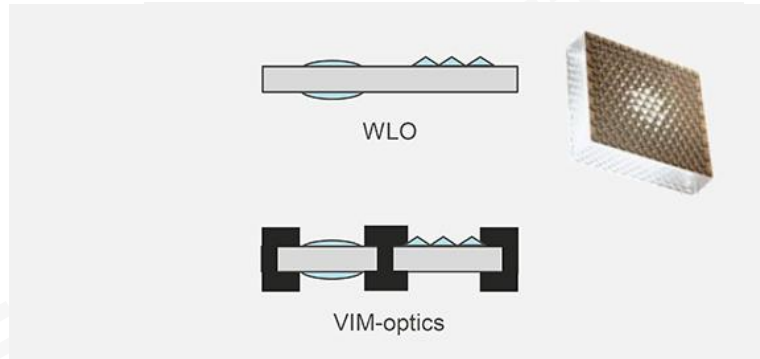
- 2024 The Heptagon brand is restored after acquisition by Focuslight for its global photonics foundry services
- 2017 Acquired by ams
- 2016 2 billion units shipped
- 2015 Entry into 3D and IoT
- 2014 Entry into wearables
- 2013 1 billion (1,000,000,000) units shipped
- 2010 First light WLO solution for leading smartphone OEM
- 2007 Imaging WLO high-volume manufacturing in Singapore
- 2006 First wafer-level CMOS micro-optics solution to leading handset OEM
- 2002 First wafer-level micro-optics solution
- 1993 The company Heptagon was founded

HEPTAGON

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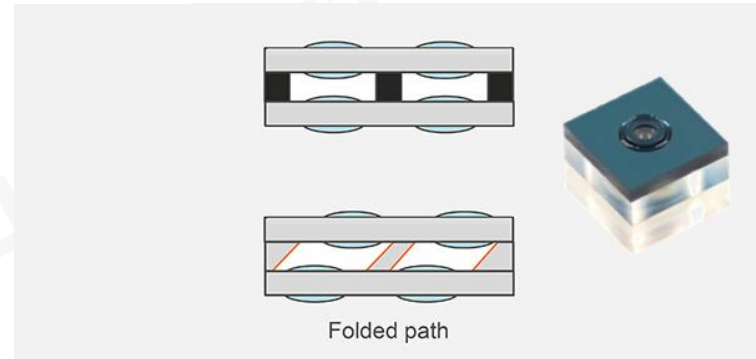
Global Photonics Foundry Services



Wafer Level Optics

Imprinted optics from mm to nm scale

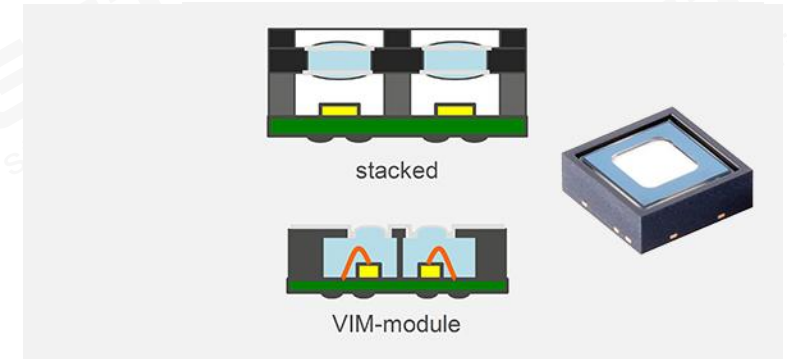
- Diffractive and refractive optics
- Micro lens arrays (MLAs)
- Diffusers



Wafer Level Stacking

From imprinted optics from mm to nm scale

- Imaging lenses
- Projector lenses



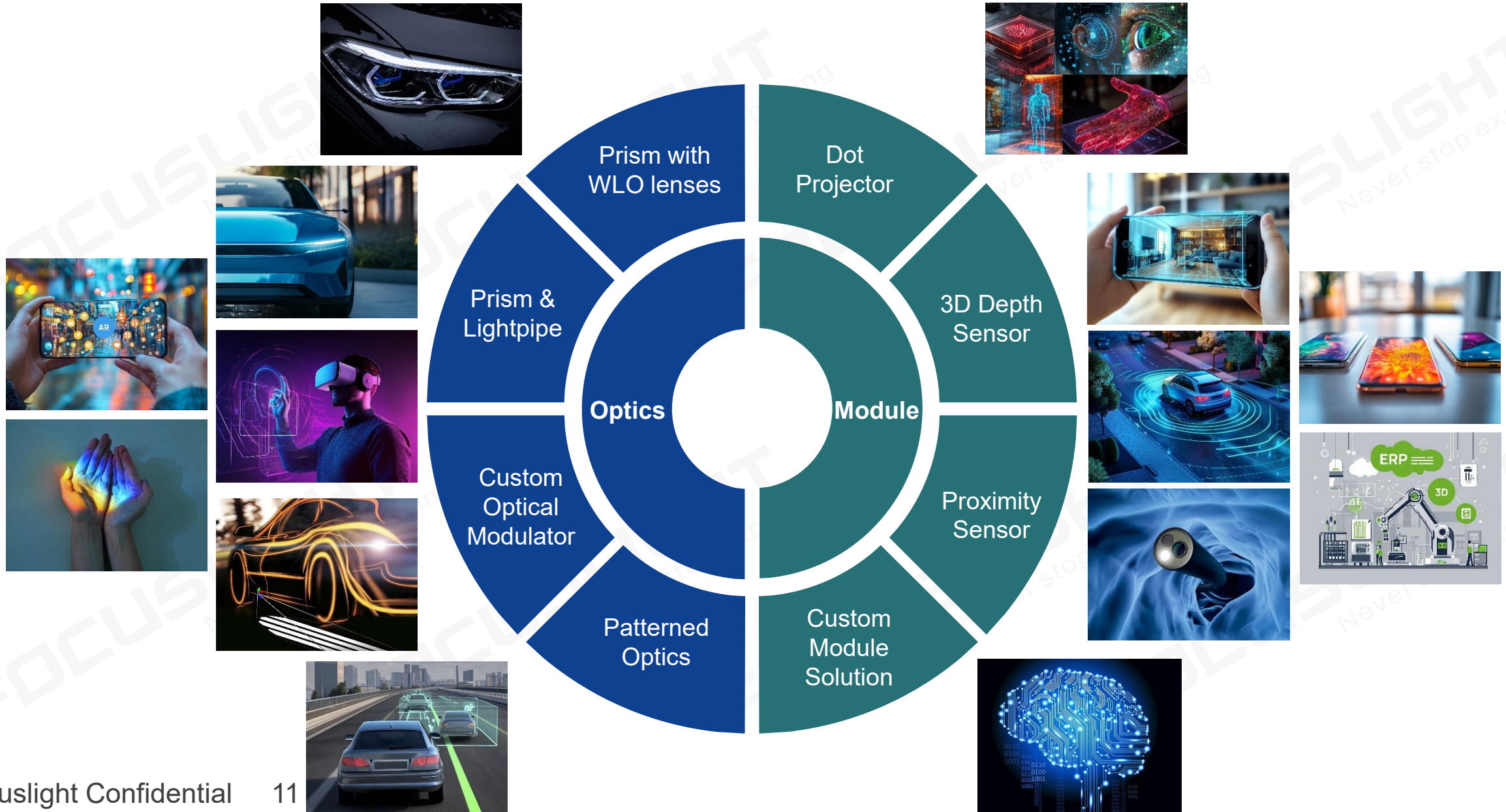
Wafer Level Integration

From imprinted optics from mm to nm scale

- Optical sensor and illumination modules

With the Heptagon legacy of know-how in **wafer-level technologies**, **excellent design, development**, and **mass production capabilities** of micro-optics based solutions, the foundry will be a global hub for photonics process development and manufacturing to the global photonics community, offering manufacturing facilities worldwide based on customer needs.

Wide Application Spectrum of Solutions



Typical Application and Products

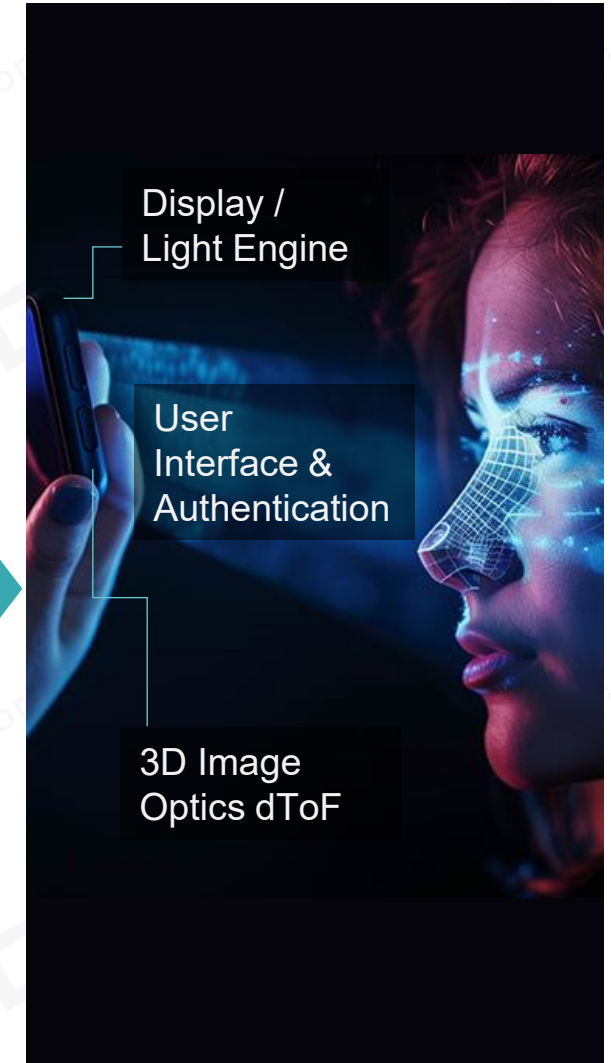
Consumer Electronics



Optical Sensing, Empowering AR/VR and AI to See

- Multi-aperture wafer-level optical lens for AR-Light Engine
- Micro-optics Modules for Vis & NiR solutions, addressing mm to infinity performance, multiple FoV options including ultra-wide
- Wafer level stacking that is fully reflowable as per SMT IC's, allowing for high volume manufacturing
- Leading thermal performance, ensuring simple thermal design

- Face ID, Under-Display Face ID
- Multi-Zone 3D sensor solutions, including dToF, Proximity sensor optics
- Complex Micro Dot Projectors Optics for multiple consumer applications
- Leading thermal performance, ensuring simple thermal design



Typical Application and Products

Automotive, Robotics, Medical



In-Cabin Sensing



Endoscopy

Tailored Diffusor Micro-Optics

Irregular Micro Lens Arrays for flood illuminators with various FOIs

Pattern-Generating Micro-Optics

MLA-based Projected Lighting System MLA-based dot projectors

Pattern from a single illuminator

Pattern from a pair of illuminator

Imaging and Projection Micro-Optics

WLO lens & camera integration for chip-on-tip medical endoscopes



Decorative Lighting



Home / Service Robotics

HEPTAGON

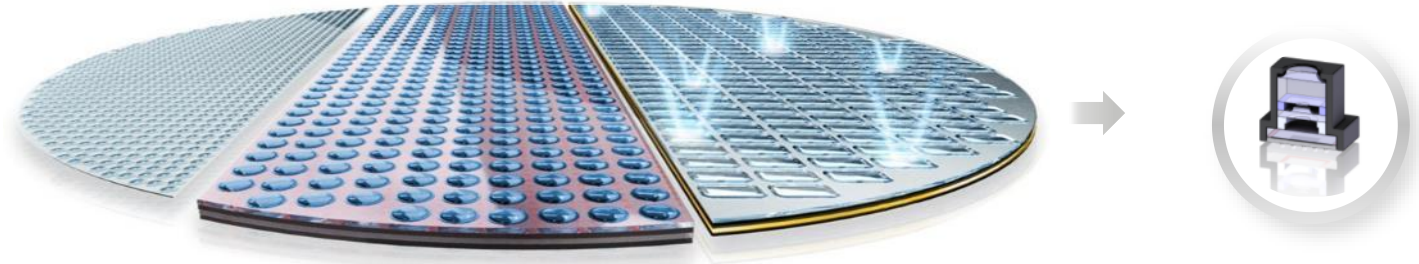
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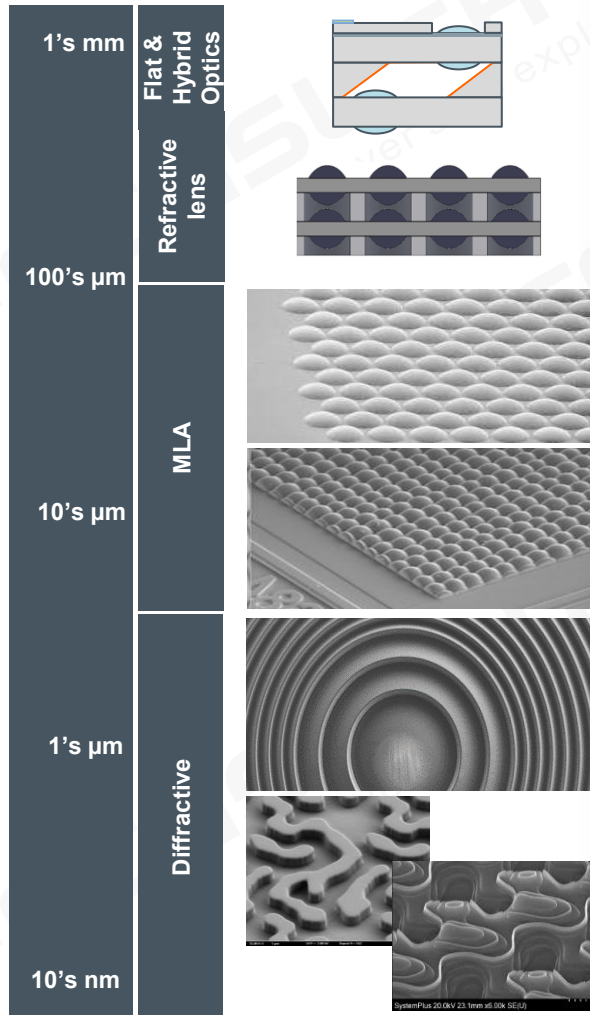
Wafer Level Optics – Common Technology Base

Design for Manufacturing by In-House Wafer Level Optics & Stacking Technology

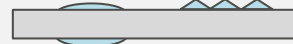
Wafer-Level Optics, Electronics, Packaging, Integration, Testing and Processing



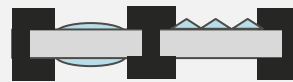
Wafer-level imprinted optics from mm down to nm-scale



WLO
(Wafer Level Optics)



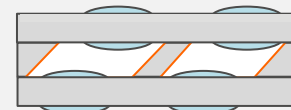
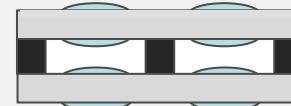
WLO



VIM-optics

Diffractive & refractive optics, MLAs, diffusers

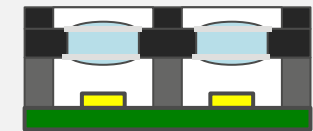
WLS
(Wafer Level Stacking)



Folded path

Imaging lenses, projector lenses

WLI
(Wafer Level Integration)



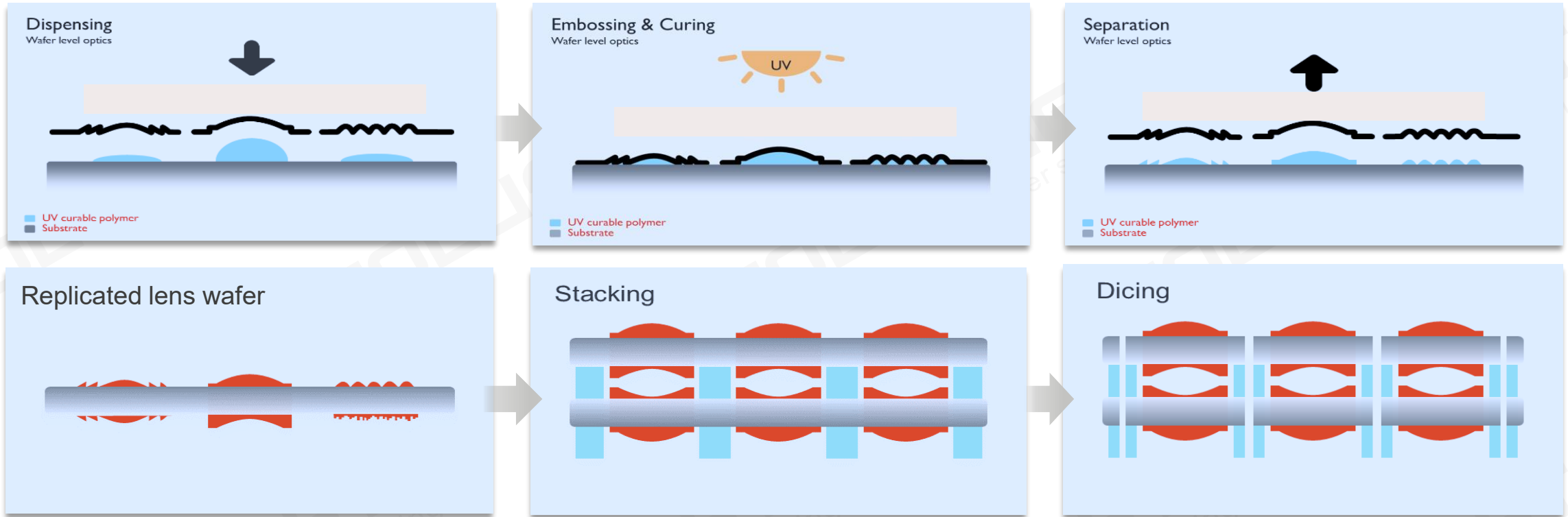
stacked



VIM-module

Optical sensor & illumination modules

Wafer Level Optics – Basic Manufacturing Process



WLO Competitive Advantages:

- Full wafer-scale process for high volume mass production
- UV curing, Low temperature, low pressure process
- Conformal, microfluidic filling for micro/nano structures
- Conformal reproduction of features less than 1 μ m
- Reflowable optical material with high thermal performance

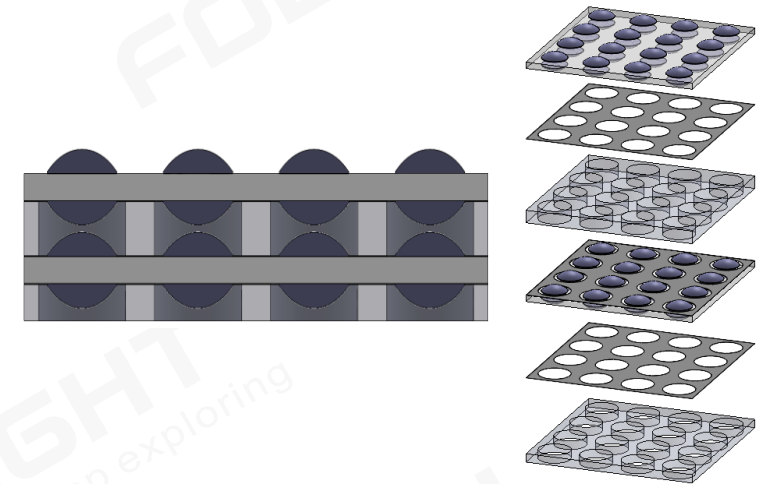
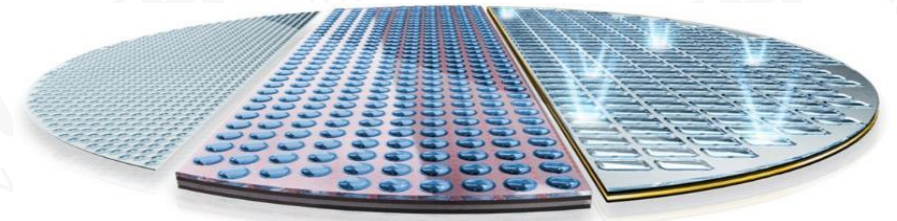
Unique Advantages for High Performance u-Camera:

- Full Solution reflowability, no Compromise of Function, Fit, Cosmetics
- No barrels, mounts, highly compact, highly integrated optical solutions
- Miniaturization (mm²) flexibility, advanced capabilities, performance
- Concepts to ensure quality mass production volume solutions
- Active Alignment to sensor delivering μ WLO+Image Sensor Modules

Reflowable WLO-lens systems enable smallest footprint for μ camera devices and integration

Benefits – Wafer-Level Optics and Stacking

- **Wafer-Level Optics (WLO)** is an extremely high-precise fabrication technology for micro-optics at large volume
 - ✓ Wafer-scale process rapidly scalable for mass production
 - ✓ Tends to be profitable at high volume (MP >100 wafers per production) due to relatively high master & tooling cost
- **Wafer-Level Stacking (WLS)** enables high-performance and highly integrated micro-optical system products
 - ✓ Micron-level precision stacking of multiple optics wafers using leading-edge mask aligners
 - ✓ Wafer-scale bonding using rigid spacers and materials with excellent thermal and mechanical stability
 - ✓ Economic wafer-scale integration of added functions such as apertures, coatings, spectral filters, a.o.



- WLO & WLS benefits can be leveraged best in high-volume markets such as Consumer Electronics, AR/VR & Automotive
- Committed to providing reliable, high-performance WLO products and superior development services to our customers

Benefits – Wafer-Level Integration

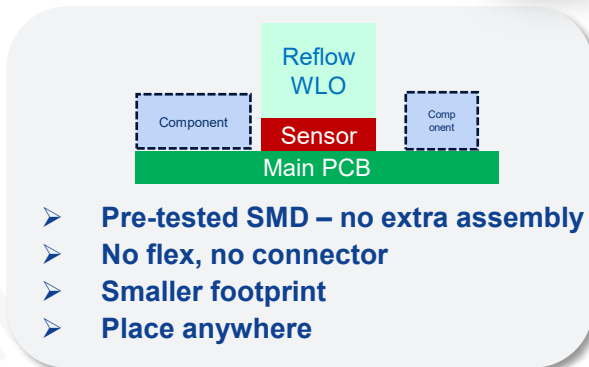
Better usage of real estate, more design freedom, simpler assembly

Complete reflowable camera solutions for miniature CSP sensors:

- ✓ Integrated optical filters
- ✓ Anti-reflection technology
- ✓ Ultra-thin light sealing - no barrels or mounts

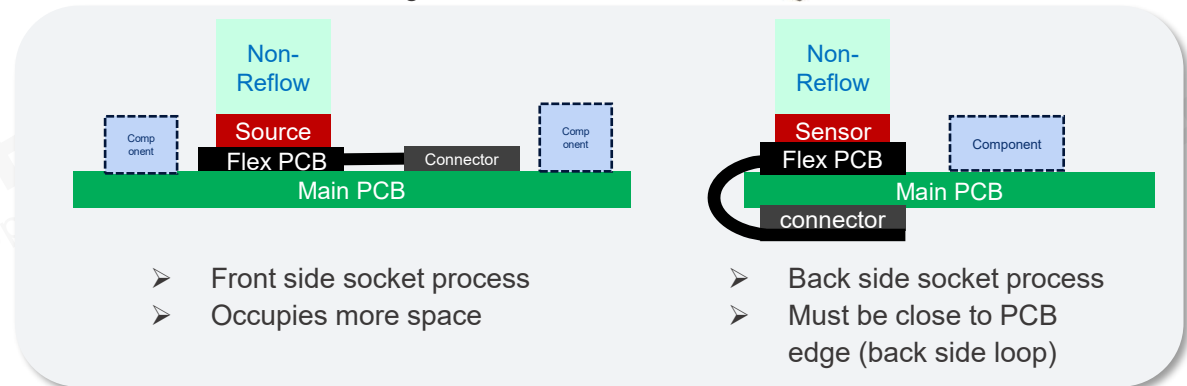
WLO Reflowable Module

- Use as SMD
- No extra assembly, less real estate
- More design freedom



Non-Reflowable Module

- Extra assembly post-reflow
- More real estate: flex & connector must be accommodated
- Less design freedom

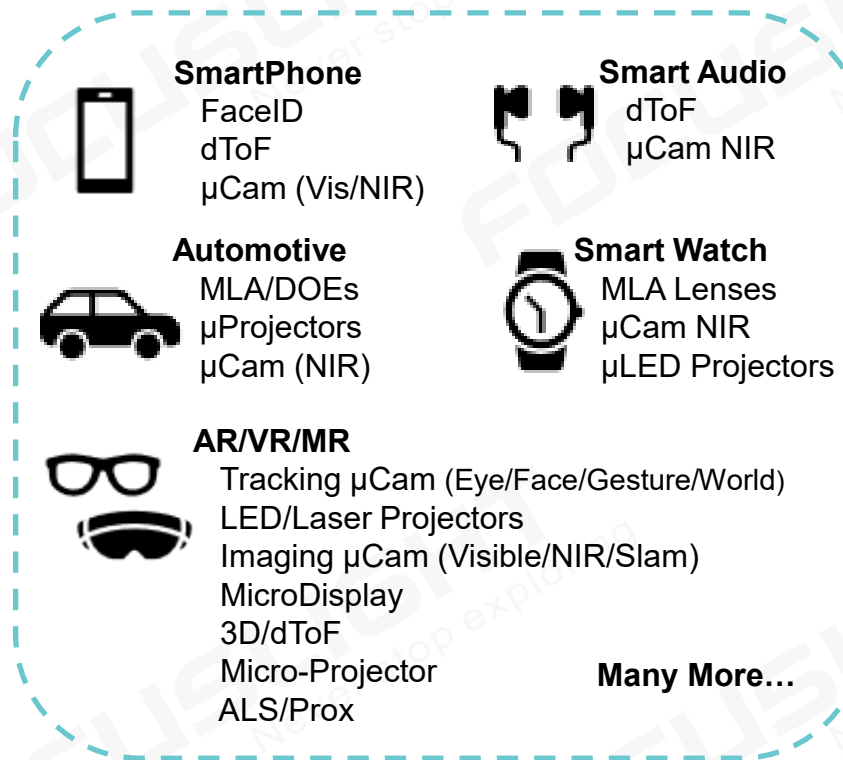


Reflowable WLO-lens systems enable smallest footprint sizes for micro-camera devices and their integration

How WLO Technology Enables Your Applications

Developing Customized Wafer-Level Optics Solutions for our Customers

Customer Concepts, Requirements...
Target application Spec Sharing



Optical Component
System Level Solutions

Optics Solution Provider

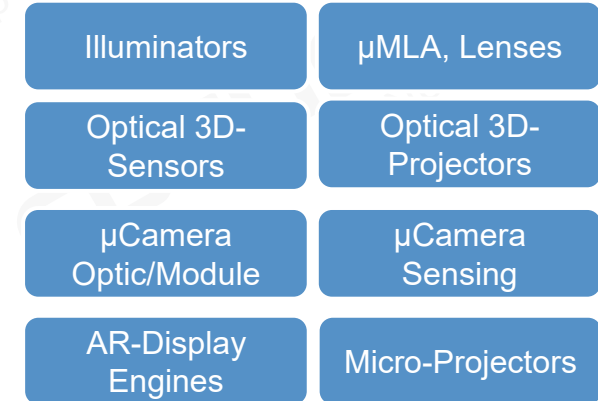
“From concept idea to mass production solution”

Feasibility Study,
Product Design,
POC-Sampling
Validation,
Product Development,
Qualification,
Mass Production



Delivering the Optic or Module to Customer,
Semicon or indeed ISP partner

Final Solutions
Module or Application Level



USP for WLO, WLS, WLI

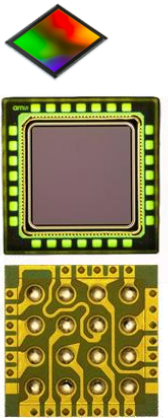
- Outstanding Performance
- Micro Size
- Reflowability
- High Volume Manufacturing

Wafer-Level Optics solutions are generally **customer and application specific**, due to specific targets as well as specific semiconductor light source, μ-display and light detector components

Example: Micro-Camera Modules Empowered via WLO Imaging


Enabling Performance, Flexibility, fully Reflowable Micro-Camera for multi-vision applications

Global-Shutter Sensor Technology



- ✓ **High QE:** Vis and NIR applications
- ✓ **Global Shutter:** no motion blur
- ✓ **Low Power:** low power enabling consumer
- ✓ **Small Footprint:** CSP for SMT volume Production

Wafer Level Optics Technology

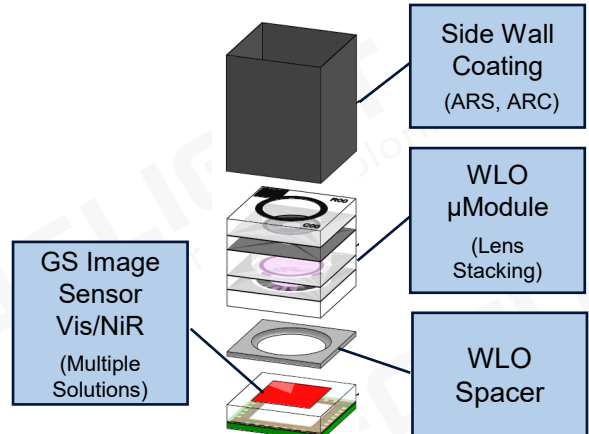


- ✓ **Reflowable materials,** excellent thermal stability
- ✓ **Wafer-scale:** rapidly scaleable to high volume
- ✓ **Micron-precision stacking,** proven up to 3 wafers
- ✓ **Highly integrated:** filters, apertures, ARC,

Reflowable Micro-Camera Module Solutions

Target Applications

- ✓ **AV/VR/MR**
 - Eye-Tracking μ Cam
 - Gesture Tracking μ Cam
 - World Tracking μ Cam
 - Ai Assistance μ Cam
- ✓ **Consumer Spectral Response**
 - Gesture Tracking μ Cam
 - World Tracking μ Cam
 - Ai multispectral Assistance μ Cam
- ✓ **Service Robotics Spectral Response**
 - World Tracking μ Cam
 - Ai Assistance μ Cam



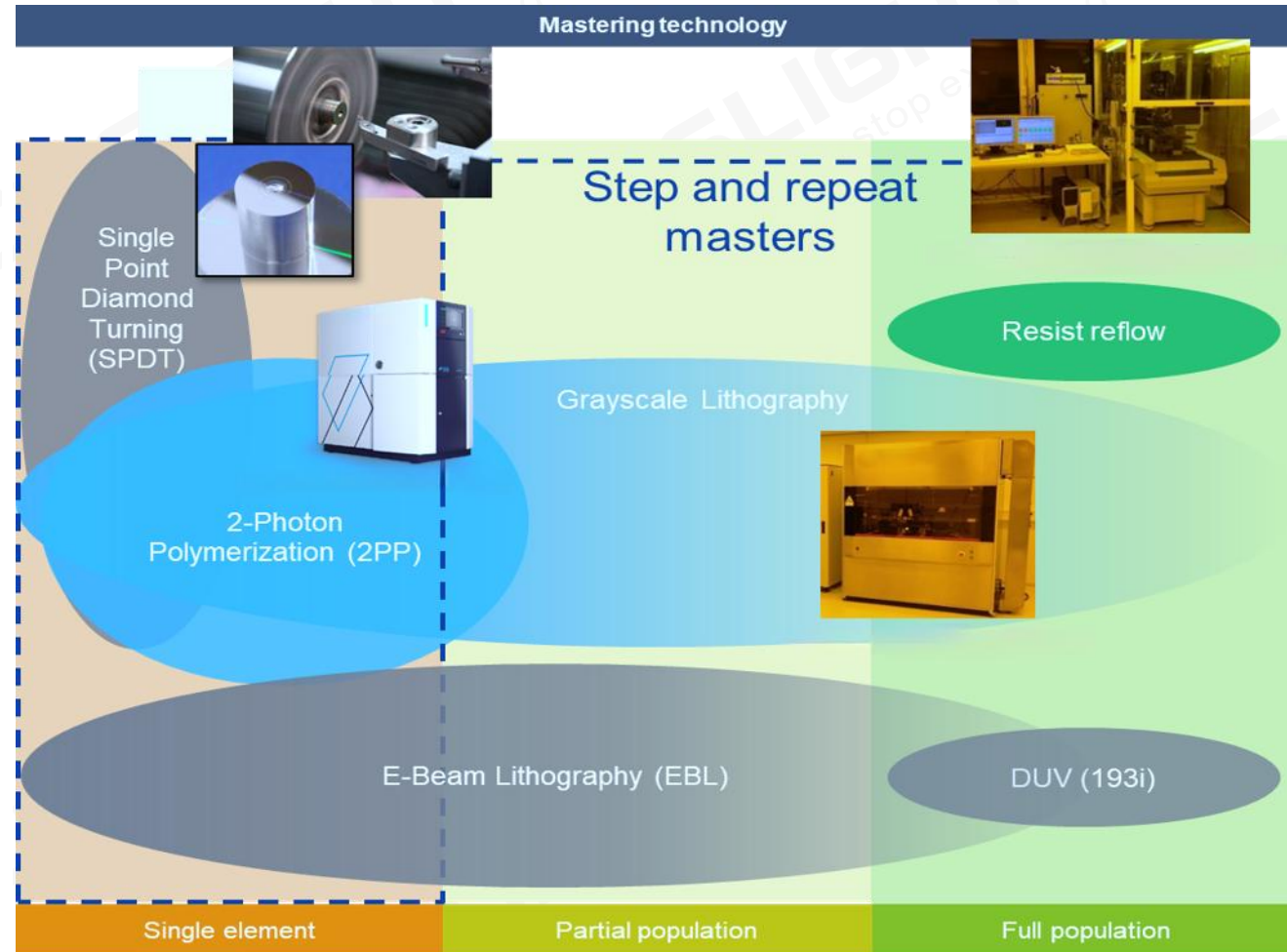
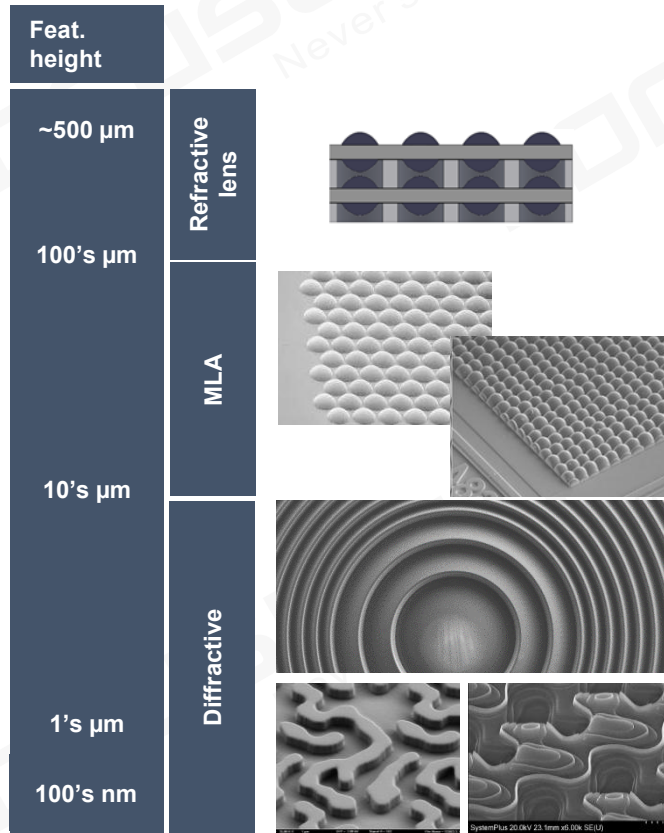
Extremely compact NIR-Camera module

- Customizable for various NIR-bands (e.g. 850nm, 940nm) with integrated bandpass filter, additional colour filters
- ✓ **Flexible in application use case**
 - Same design can be set up for infinite or finite / close-up working distance [~25mm...infinity]
- ✓ **Easy overall system integration**
 - Re-flowable CSP-camera module can be processed similar to SMD

Reflowable WLO-lens systems enable smallest footprint for micro-camera devices with full integration, allowing simplicity to market, ease of manufacturing capabilities (SMT reflow) and costs...

Our Mastering Capabilities – All Starts from Here

Our R&D Lab and Equipment



Ensuring the Optical Performance of Products

Metrology Capabilities



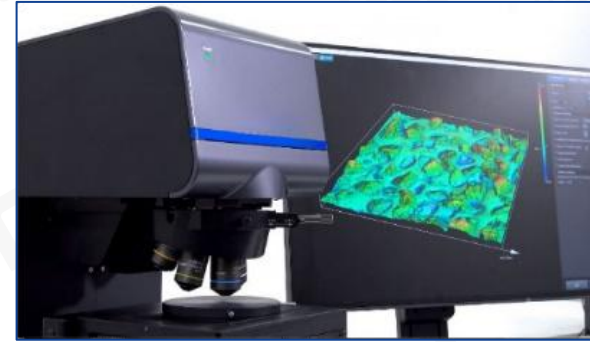
Coordinate Measuring Machine



Contour Measuring Instrument



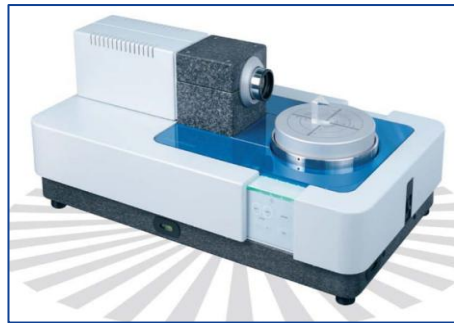
White Light Interferometer



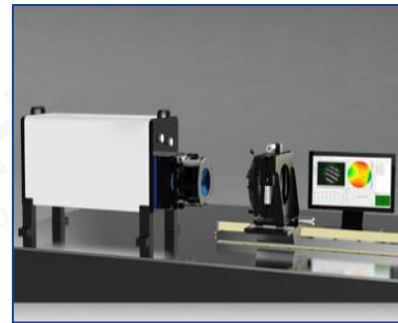
Confocal Microscope



SEM



Precision Goniometer



Large-diameter horizontal planar & cylindrical interferometer



Full Size Measuring Instrument



Off-Center Measuring Instrument



Ion-miller



3D Optical Profiler

Ensuring the Product Reliability



Temperature Shock Chamber x3

Temp. range: -55~150°C
Thermal shock (Switching time≤1min) : <30s



Thermal Cycling Chamber x3

Temp. range: -55~150°C
Heating/freezing rate: ≤15°C/min



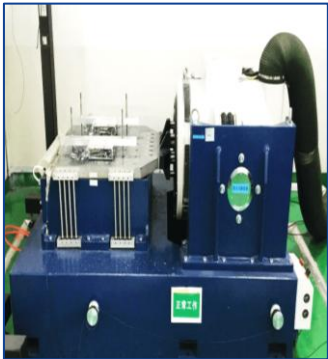
High / Low Temperature & High Humidity Chamber x5

Temp. range: -55~150°C
R.H. range: 20~98% RH



High-pressure boiling testing chamber x1

Temp. range: 100~132°C
R.H. range: 100% R.H.
Pressure: <5atm



Vibration table x1

10000kgf max force; 2~2500Hz frequency, 2m/s max speed



Salt Spray Test device x1

According to ISO 9227:2017



Xenon lamp aging tester x1

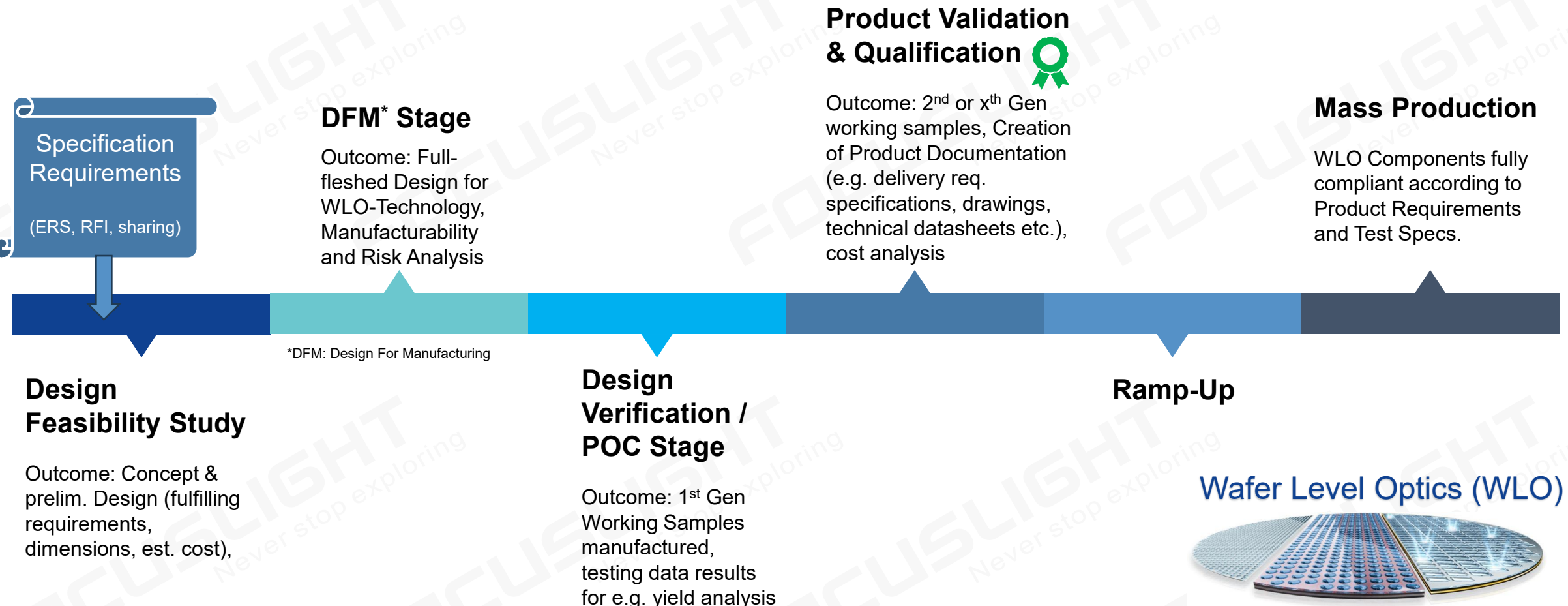
According to DIN 75220



Reflow Oven x1

Work with Us – From Concept to Mass Production

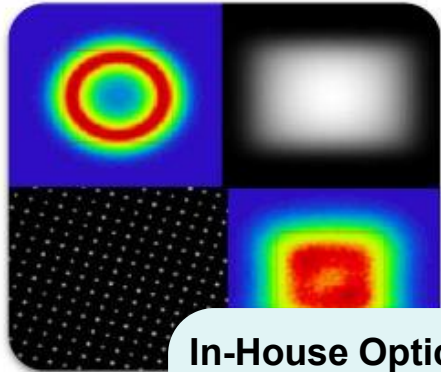
Value Chain for Customer-Specific Micro-Optics Solutions



In-House Skills and Capabilities, Delivering Concepts, Design using DFM Development Cycle and Testing
Ensuring high volume manufacturing, with reliability delivering proven Quality

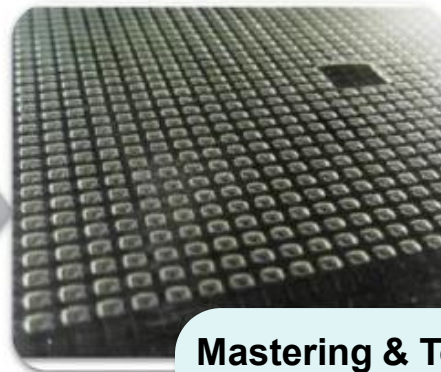
Work with Us – From Concept to Mass Production

Full-Scale Capabilities for the Whole Process



In-House Optical & Mechanical Design

- Location: Switzerland
- Ray trace and wave optics
- Full CAD capacity
- Physics simulation
- Single-Element to Full System Designs



Mastering & Tooling

- Master in-house and 3rd party
- Tooling: in-house
- Locations: Singapore and Switzerland
- Wide range of micro- and nano-structures possible



In-House Wafer Rep., Stacking and BE Process

- Location: Singapore
- Epoxy on glass, multiple materials options available
- Capacity for high volume production of micro-optics



In-House Optical & Final Testing

- Location: Singapore
- High UPH
- Wafer level, unit level, and module level testing with standard and customized systems

In-House Vertically Integrated Capability: Design, Development, Manufacturing, Reliability and Optical Test

Business Models

1

Based on the available technical capabilities, we provide our **product portfolio** (standard, customizable) or pure custom **Focuslight designs**.

The customer can then integrate these **Focuslight products** into their application solutions.



FOCUSLIGHT
Never stop exploring

2

Based on the available technical capabilities, we cooperate with the customer, provide our **foundry service** to convert **customer's designs** into mass produced products.

These products will then be the **customer's own products**.



HEPTAGON
A FOCUSLIGHT BRAND

Both business models (products and foundry service) share the same technology base, yet they power the customer's business in different ways.

Summary



- **30+ Years of Optical Design & Simulation + Volume Production Expertise**
- **Advanced & Unique Wafer-level-Technologies to Provide Various Optical Solutions**
- **Reliable, Stable Quality + High Precision Products for Various Applications**
- **Fast Response + Customized Service Available**



Your committed and reliable long-term partner in photonics application solutions

THANK YOU



www.focuslight.com

www.hptg.com

