

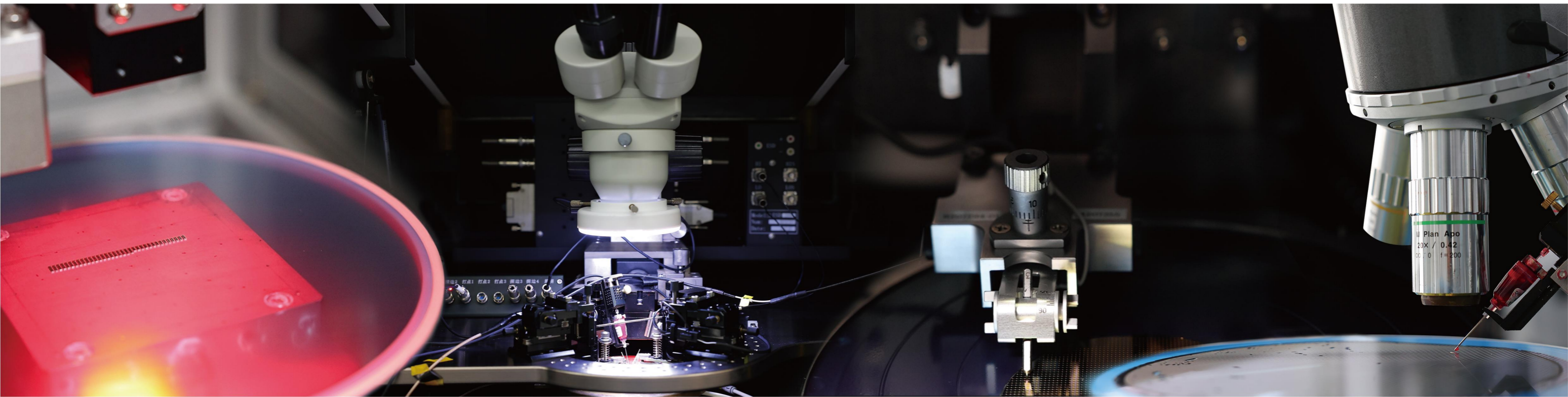


**Product Series**

- Silicon Microlens
- Fused Silica Microlens
- Silicon Capacitor & IPD







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# INTRODUCTION

Suzhou Suna Optoelectronics Co., Ltd. was established in 2014. SUNA is a company specializing in wafer/chips of micro-optics and opto-electronics. We provide complete and innovative solutions in transceivers, Lidar, temperature sensing, infrared thermometry and intelligent electric appliance. Several tens of millions of silicon/fused silica microlenses, silicon capacitors, silicon submounts, photodiodes have been shipped worldwide.



Capacity per year

**10,000** wafer

**100** Million die

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**5000** m<sup>2</sup> Ultra cleanroom

**300** sets+ Semiconductor equipment

**200** + Employees including Ph.D. and master degree 40+

**8/6** -inch R&D and mass production facility



# FACILITY AND EQUIPMENT

Automated Production Line

High Precision Equipment

Production Standardization

## All process in house

- LITHO
- ETCH
- METAL
- FILM
- CMP
- DICING
- SORTING
- TEST
- RELIABILITY



 **SUNA**



# 2


# MARKET

The shipment of silicon microlens exceeds **80 million**



**130+** optical transceiver customers from all over the world





**Microlens**  
Silicon Microlens  
Fused Silica Microlens

**Application**  
Transceivers  
Infrared thermometry  
Lidar  
WSS



**Silicon Capacitor & IPD**

**Application**  
Transceivers  
High performance IC  
RF Amplifier  
Lidar

### ► Customer Values

1. High performance and quality: shipment over 80 million pcs.
2. Assured delivery: all process in house, huge equipment investment to ensure continuous improvement of production capacity.
3. Low cost: low NRE fee (for microlens < \$ 5,000), reasonable price.
4. Short lead-time (for microlens): standard product 1-7 days, customized product 6-8weeks.
5. Quick response: quick response to customer needs, 7×24 services.
6. Flexibility: large or small quantity, standard or customized products supported.
7. One-stop service: optical simulation design and customer application environment testing capability.

Successfully developed **300 products**, 100 of which have been mass-produced.

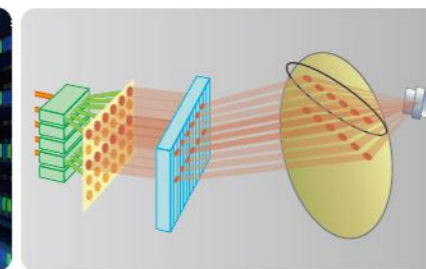
Services for all types of customers  
**130+ Customers**

Since establishment, SUNA has continuously maintained a high growth rate of **100% in annual sales**

### ► Application



Transceivers



WSS



Temperature sensing



Intelligent electric appliance



Infrared thermometry



Lidar



# 3

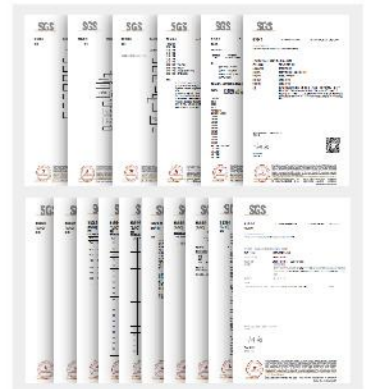
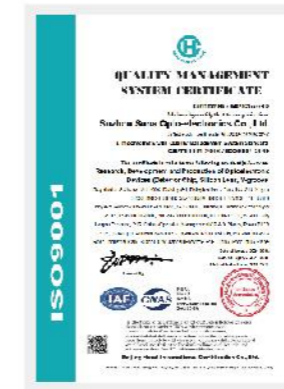
# ACHIEVEMENT

## ► Intellectual Property

85 patents have been authorized.



## ► Management System Certificate



## ► Industry Position

- **SUNA is the leading company for microlens .**
- **50% market share in the field of optical communication in the world .**



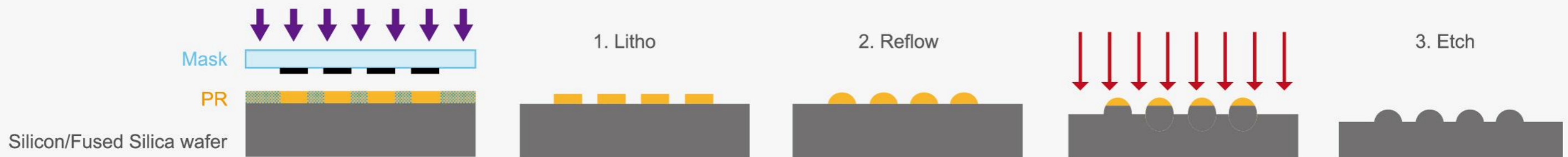
# 4

# PROCESS FLOW CHART

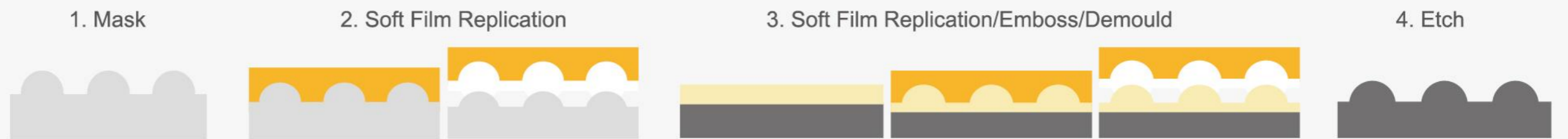


## ► Front-end

### Process route 1: Reflow + etch



### Process route 2: Nanoimprint + etch



## ► Back-end



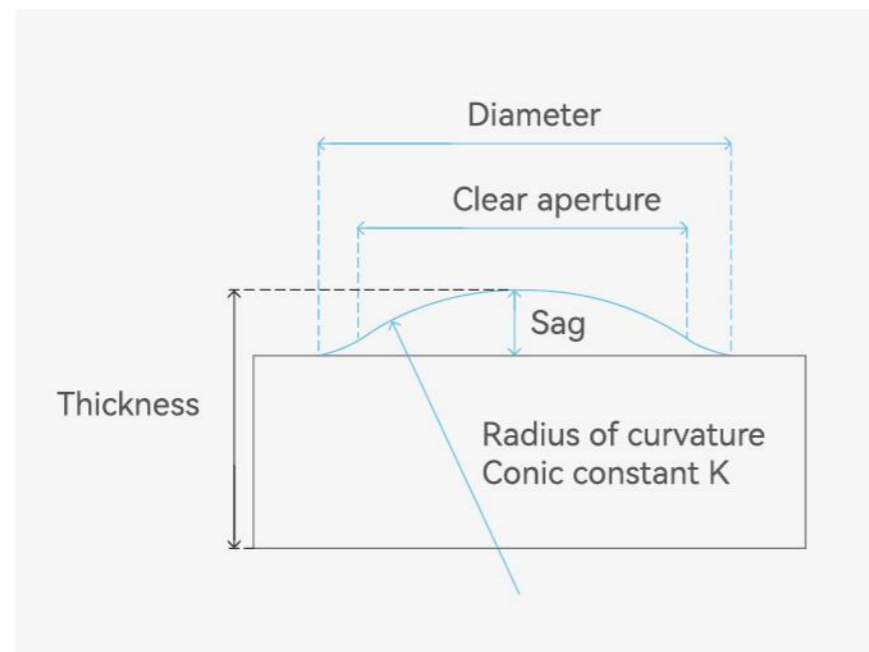


# CORE PRODUCT

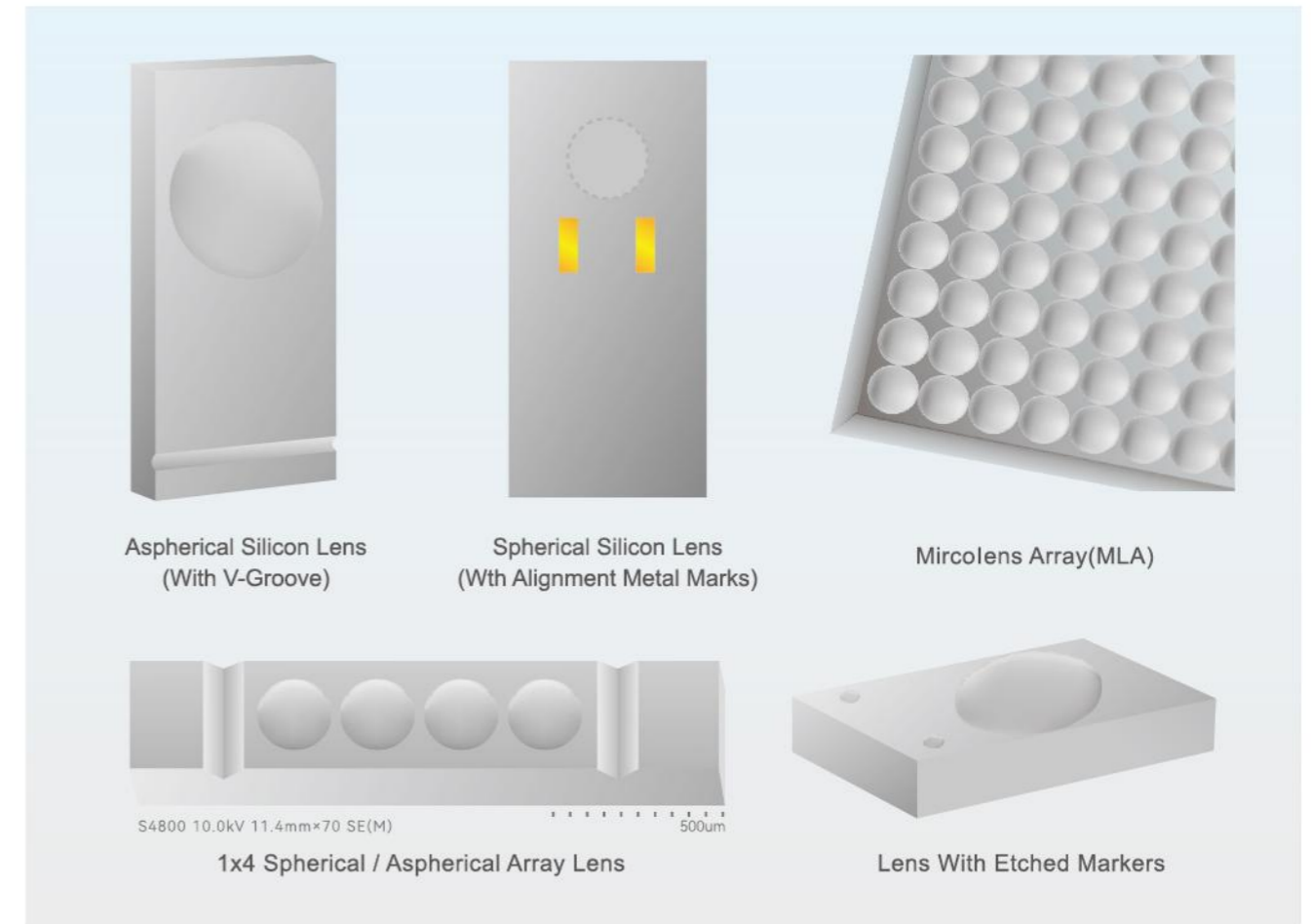
## Silicon Microlens

### ► Typical parameters

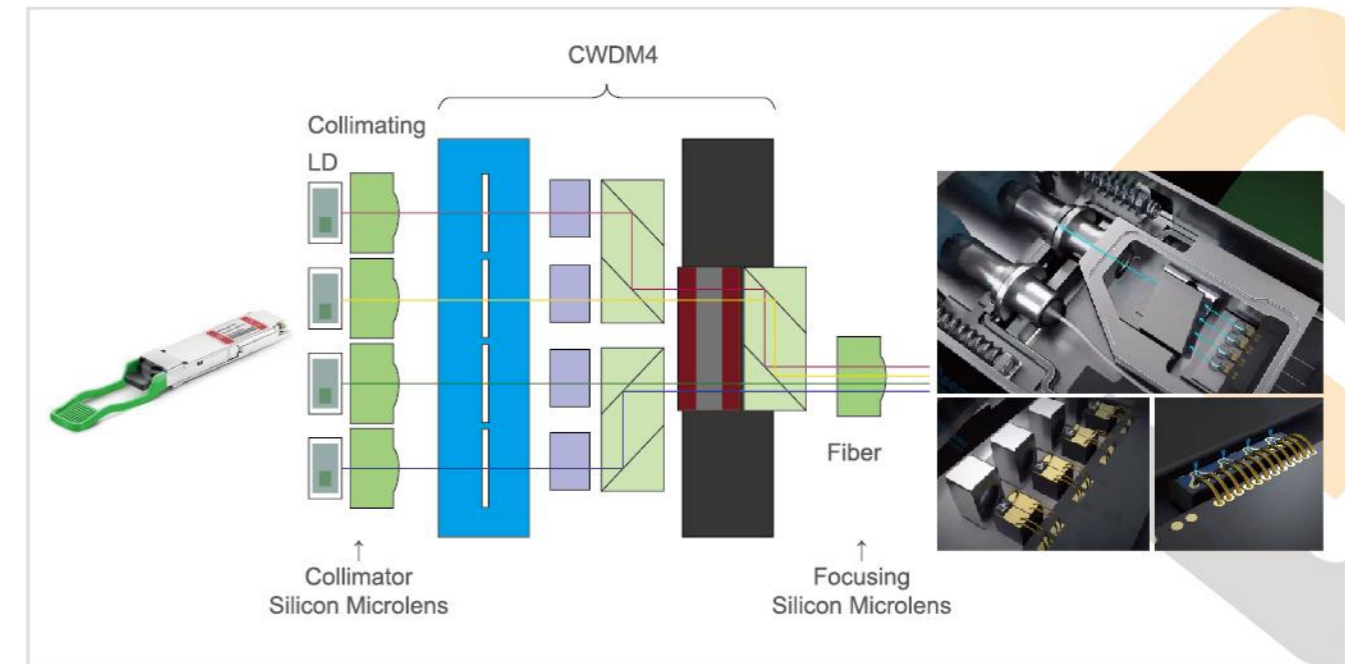
Parameters	Process capabilities
SPD	$\leq 25\text{nm}$ ( $\text{sag} \leq 60\mu\text{m}$ ) $\leq 150\text{nm}$ ( $60 < \text{sag} \leq 100\mu\text{m}$ ) $\leq 300\text{nm}$ ( $100 < \text{sag} \leq 230\mu\text{m}$ )
AR Coating	1260~1620nm R<0.3%; 8~14 $\mu\text{m}$ , $T_{\text{avg}} > 85\%$ ; Customization available.
Roc tolerance (Array to array )	300~9000/ $\pm 3\%$
Roc tolerance (In Array )	300~9000/ $\pm 2\%$
Surface roughness	< 5nm
Conic	-12~0
Chip Size Tolerance	$\pm 10\mu\text{m}$
Verticality	$\pm 1.5^\circ$
Thickness tolerance	$\pm 20\mu\text{m}$
Pitch accuracy	$\pm 1\mu\text{m}$ ( $\pm 0.25\mu\text{m}$ )
Lens position to edge	$\pm 5\mu\text{m}$ for x/y axis and $\pm 10\mu\text{m}$ for y/x axis
Channel Qty	Customized



### ► Typical products



### Typical optical path diagram

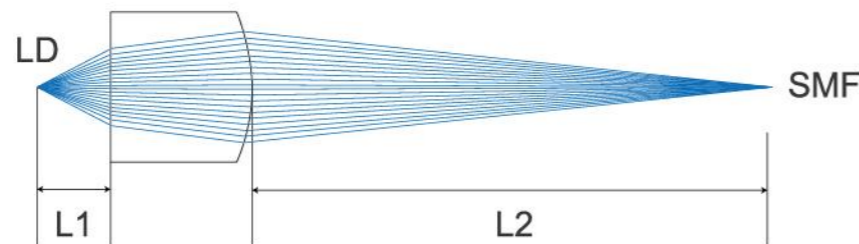




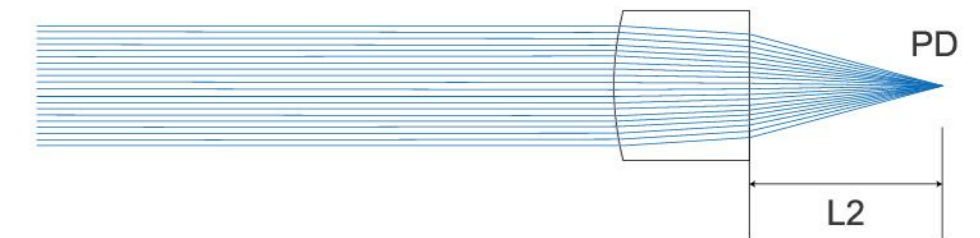
## ► Standard Silicon microlens

Type	PN	Pitch / $\mu\text{m}$	Material	Roc /mm	Conic	Thickness /mm	CA /mm	EFL/mm (@1310nm)	Wave length /nm	TX	RX	L1/mm	L2/mm	Length /mm	Coupling efficiency /%
Coupling Lens	SiL090		Silicon	0.83	-2.7	0.5	0.5	0.331	1310	LD NA =0.5	SMF	0.26	1.87	2.63	81.3
	SiL022	750	Silicon	1.21	0	0.38	0.5	0.483	1310	SMF	PD( $\phi \geq 16\mu\text{m}$ )	0.97	0.87	2.22	99.2
	SiL020	750	Silicon	1.9	0	0.5	0.6	0.759	1310	SMF	PD( $\phi \geq 16\mu\text{m}$ )	1.44	1.45	3.39	98.8
Collimator Lens	SiL148	-	Silicon	1.0	-4.335	0.5	0.5	0.399	1310	LD NA =0.5	-	0.26	-	-	-
	SiL039	-	Silicon	1.1	-4.15	0.5	0.5	0.439	1310	LD NA =0.5	-	0.30	-	-	-
	SiL102	-	Silicon	1.24	-3.7	0.5	0.5	0.495	1310	LD NA =0.5	-	0.35	-	-	-
	SiL056	-	Silicon	4.0	0	0.5	0.5	1.598	1310	SMF	-	1.44	-	-	-
	SiL003	750	Silicon	4.0	0	1.0	0.6	1.598	1310	SMF	-	1.30	-	-	-
	SiL042	-	Silicon	4.955	0	0.5	0.5	1.979	1310	SMF	-	1.83	-	-	-
Focusing Lens	SiL056	-	Silicon	4.0	0	0.5	0.5	1.598	1310	Collimated beam	PD	-	1.44	-	-
	SiL003	-	Silicon	4.0	0	1.0	0.6	1.598	1310	Collimated beam	PD	-	1.30	-	-
	SiL042	-	Silicon	4.955	0	0.5	0.5	1.979	1310	Collimated beam	PD	-	1.83	-	-

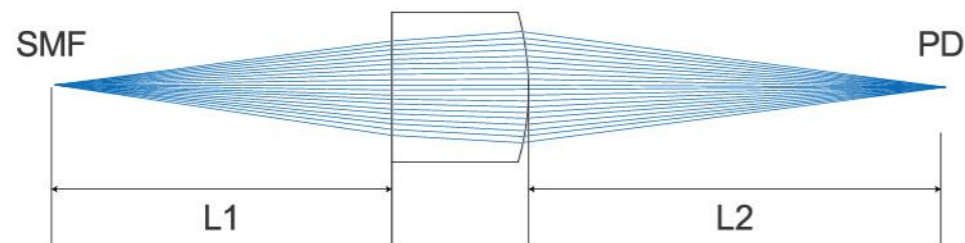
Coupling Lens:  
LD→Single Mode Fiber



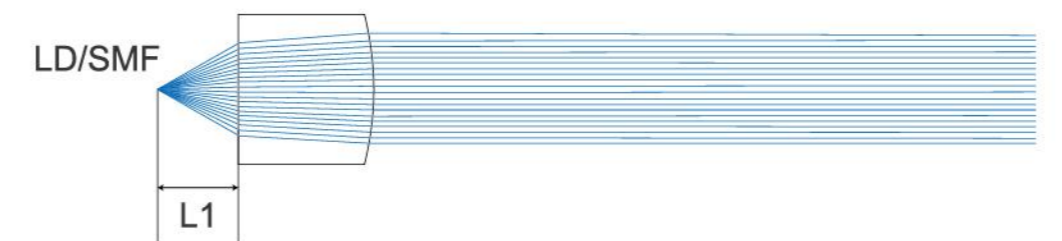
Focusing Lens:



Coupling Lens:  
SMF→PD



Collimator Lens:



Besides above standard products for all customers, we have more than 300 customized products for specific customers.

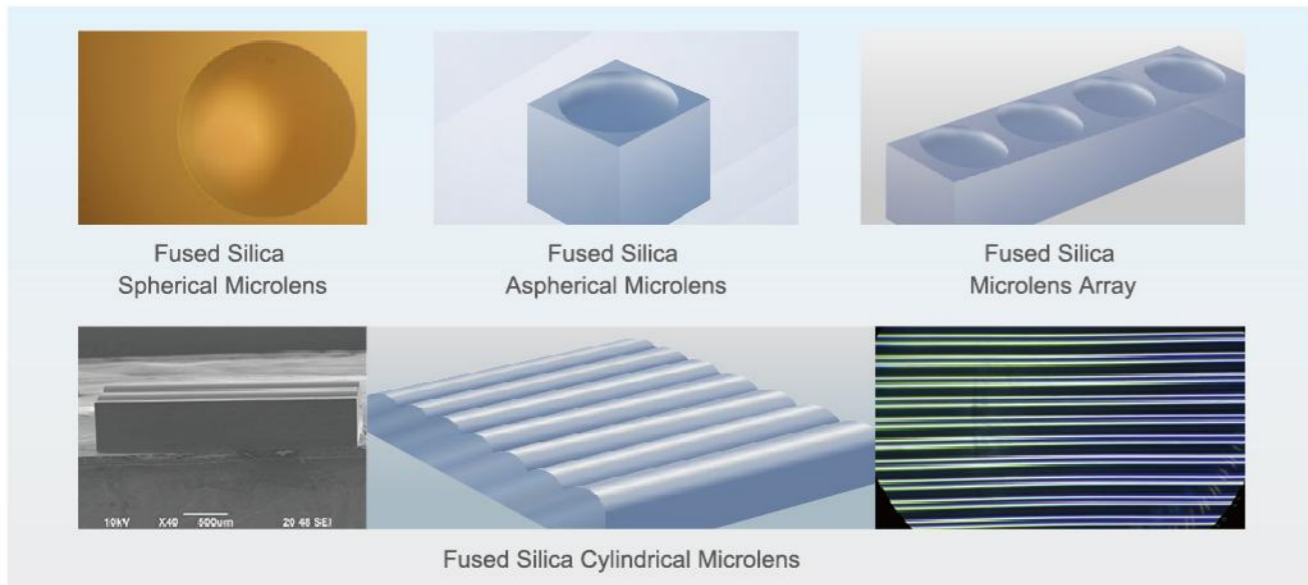


PRODUCT 2

# Fused Silica Series

## Product Introduction

Fused Silica Microlens

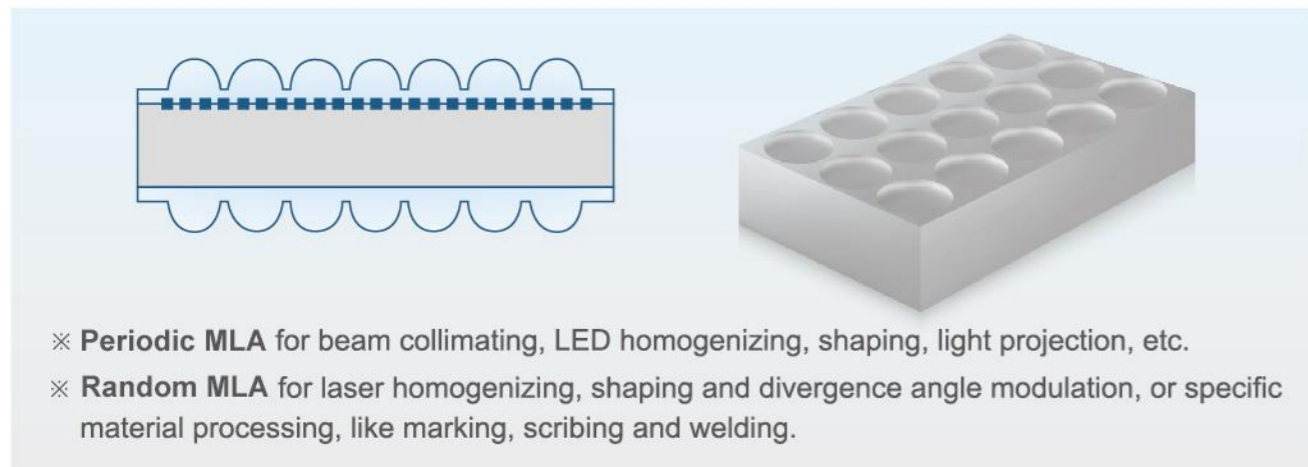


PRODUCT 3

# MLA

## Product Introduction

Microlens Array - MLA

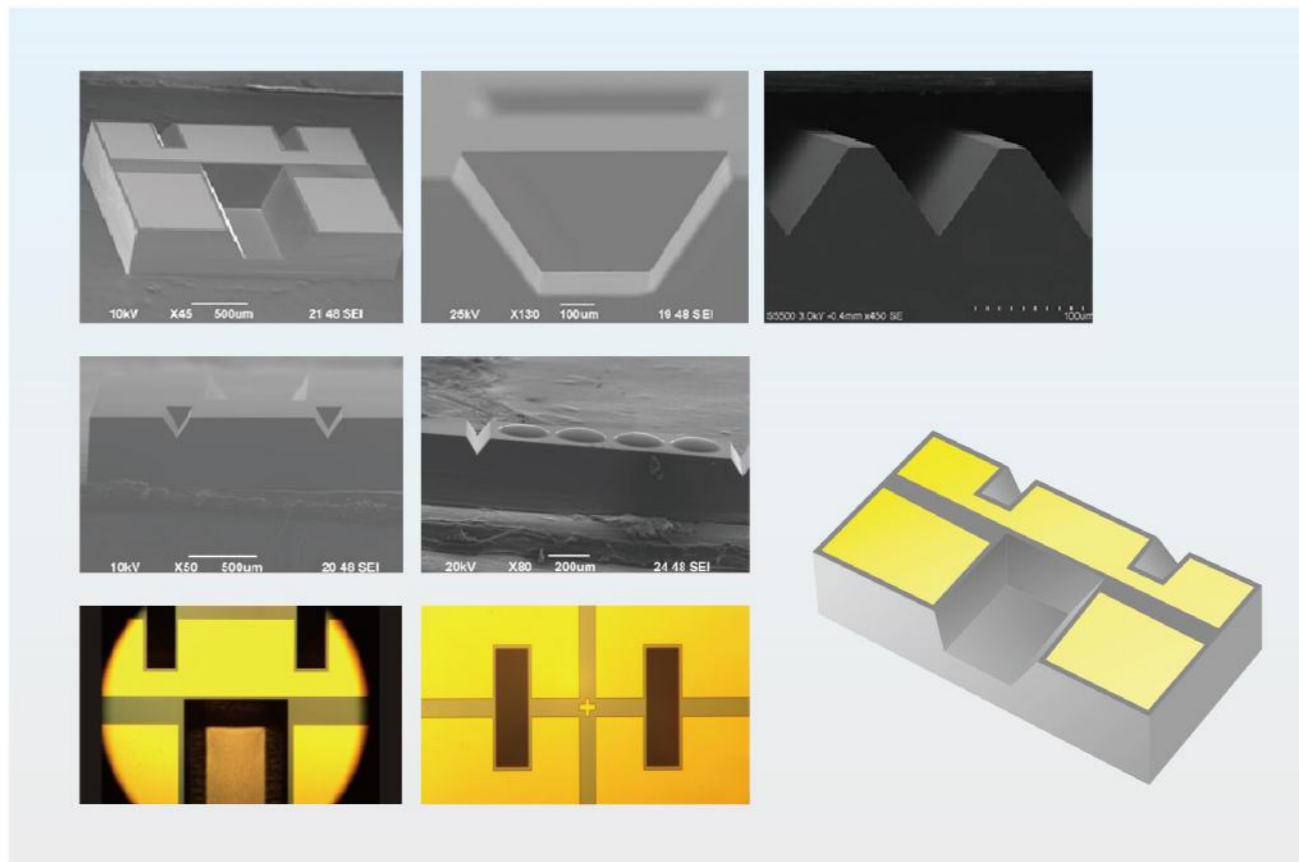


PRODUCT 4

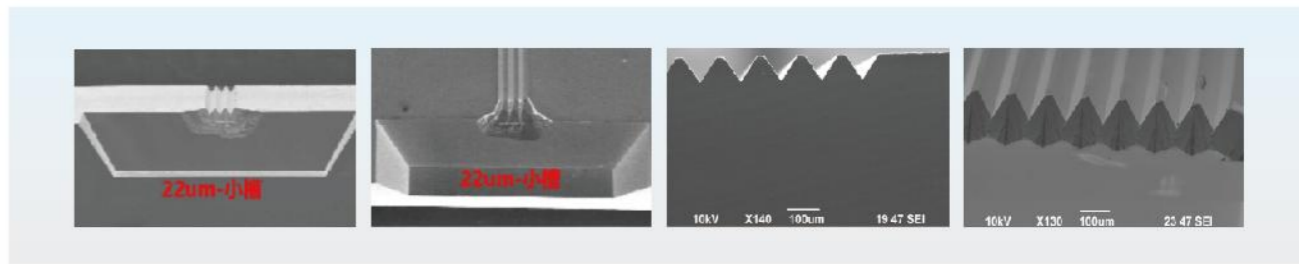
# Silicon Submount

## Product Introduction

1. Silicon V-groove Submount



2. Silicon Cascade-groove Submount

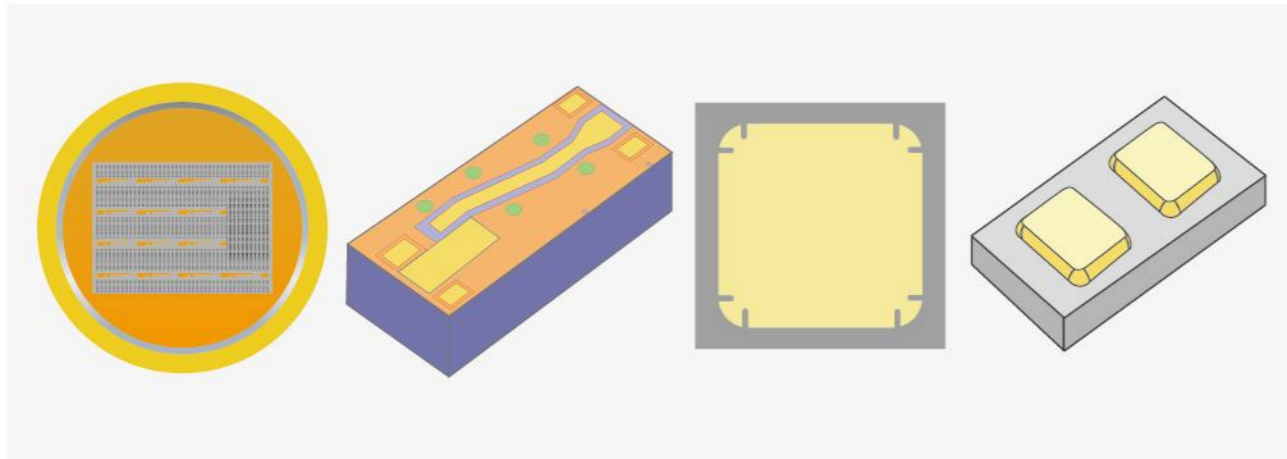




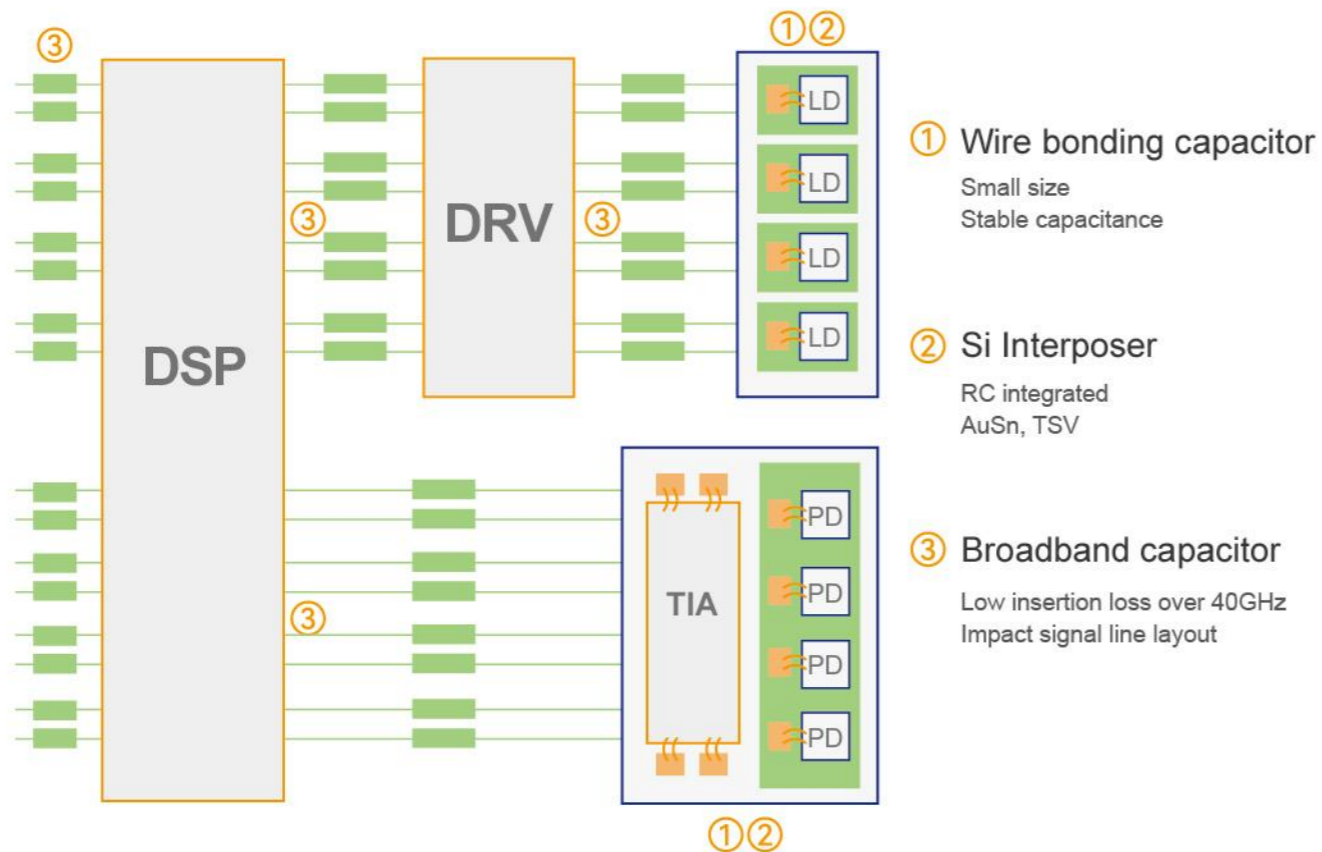
# Silicon Capacitor & IPD

## Product Introduction

Silicon Capacitor & IPD

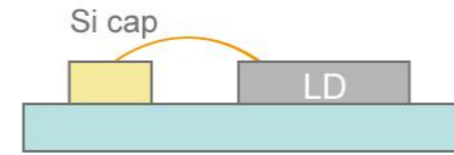


## Application: Transceivers

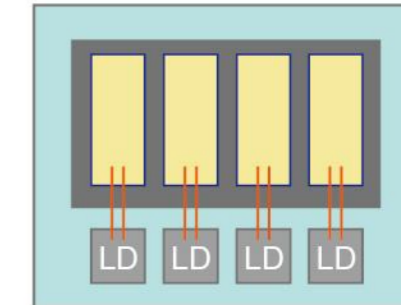


## Application: LIDAR

Si cap

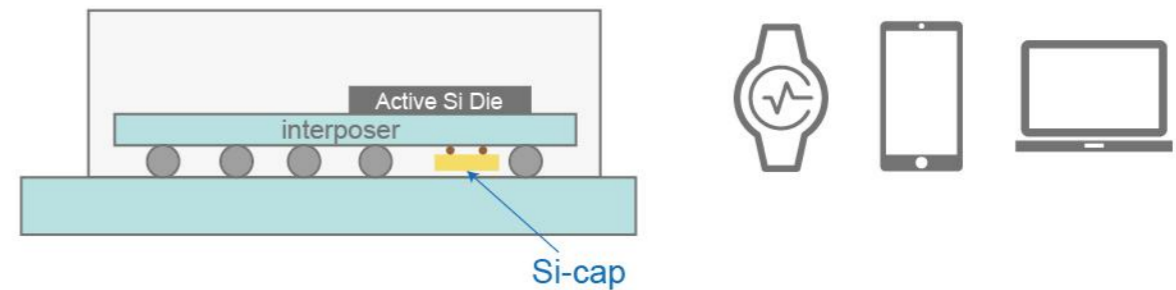


Cap array



※ With the upgrade of ADAS level, the regulation of eye safety requires higher output power and narrower pulse width, achieving longer detection distance and higher resolution.

## Application: High performance IC



### Silicon cap advantages

- high capacitance density (above  $1\mu\text{F}/\text{mm}^2$ )
- Ultra low ESR@SRF
- Ultra low ESL
- Ultra thin thickness (less than 100um)

※ Noise suppression over wider frequency range to realize PDN optimization for high performance IC



*Thanks for giving us sufficient trust and valuable opportunities for a long time.*

*Quality, delivery and price are the criteria for customers to inspect our products.*

*Efforts to create value for customers and long-term cooperation are our core values.*



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