VLC PHOTONICS
A Hitachi Group Company

HITACHI

Scalability and Reliability Testing: **Reducing Investment Barriers**

One-stop services for

Photonics Integrated Circuits

At Industrial-grade level

EPIC Technology Meeting on
Photonics Integrated Circuits
at Ligentec - 2025
Lausanne, Switzerland

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VLC Photonics (Hitachi High-Tech)

2011
Founded in July. Spin-off from the Polytechnical University of Valencia.

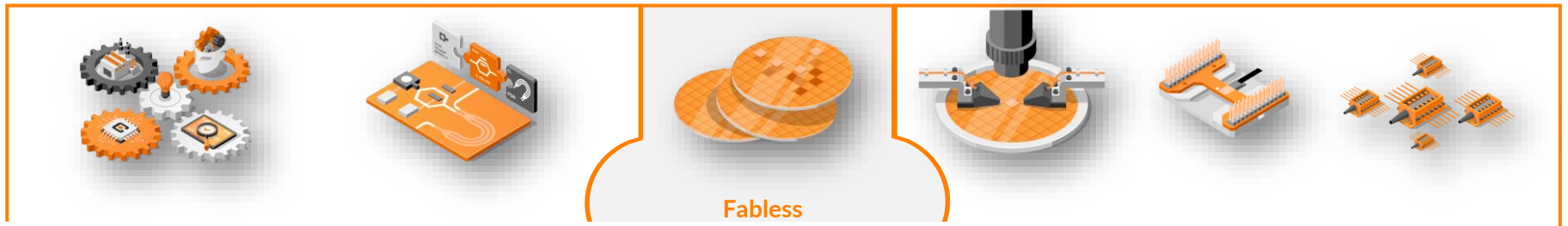
2015
+10 new members of extensive academic and industrial experience.

2020
VLC Photonics was acquired and became part of the **Hitachi High-Tech group.**

2024
Over 30 employees, 15 projects around the world.

2025
VLC offices and labs are moving to the Tactica Building.
Received the **PERTE** Chip funding

end-to-end PIC engineering service offer.



Photonics architecture
Specify circuit functionality, component requirements, material platform, techno-economic analysis.

Circuit design and layout
New building blocks, tolerance analysis, circuit simulation, opto-electrical routing-layout, design 4 test/pack, LVS and DRC

Fabless

Manufacture
Fabrication brokering, generic/custom tech., dedicated/MPW runs.

Chip/Wafer characterization
Visual inspection, component level measurements, functional design evaluation, system level measurements, test assemblies

Packaging & Test
Carrier and housing design, die-attach to carrier, optical alignment, electrical DC/RF contacts, package assembly.

- Turn-key solution or individual services for any development phase.
- Support from prototyping, to engineering and pilot production.
- Ramp-up to high-volume production with the support of Hitachi.

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Silicon Photonic IC markets evolution

A changing industry, growing +44% per year, simultaneously advancing process technologies.

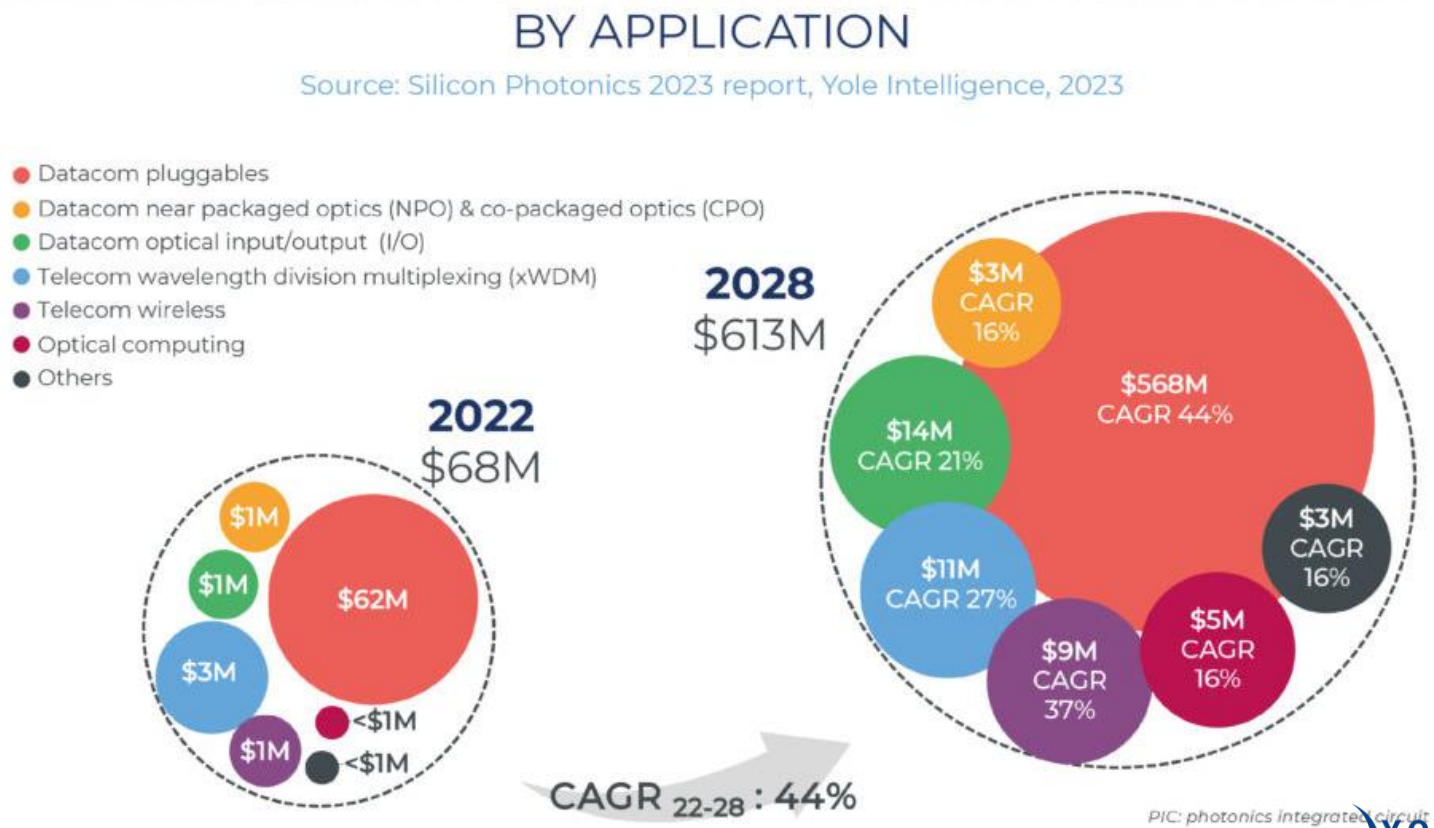
Innovative Add-on Technologies + **Emerging applications and new players**

Hybrid integrable technologies with Silicon Photonics (SiPh):

- Thin-film Lithium Niobate
- Polymers
- Graphene
- Barium Titanate (BTO)
- Silicon-Organic Hybrid
- Indium Phosphide

Exceeding adopter material limits, to enhance SiPh performance:

+ Light emission sources,
+ Above 100 GHz Modulation,
+ Energy efficiency.



2022-2028 Silicon Photonics die Forecast by Application

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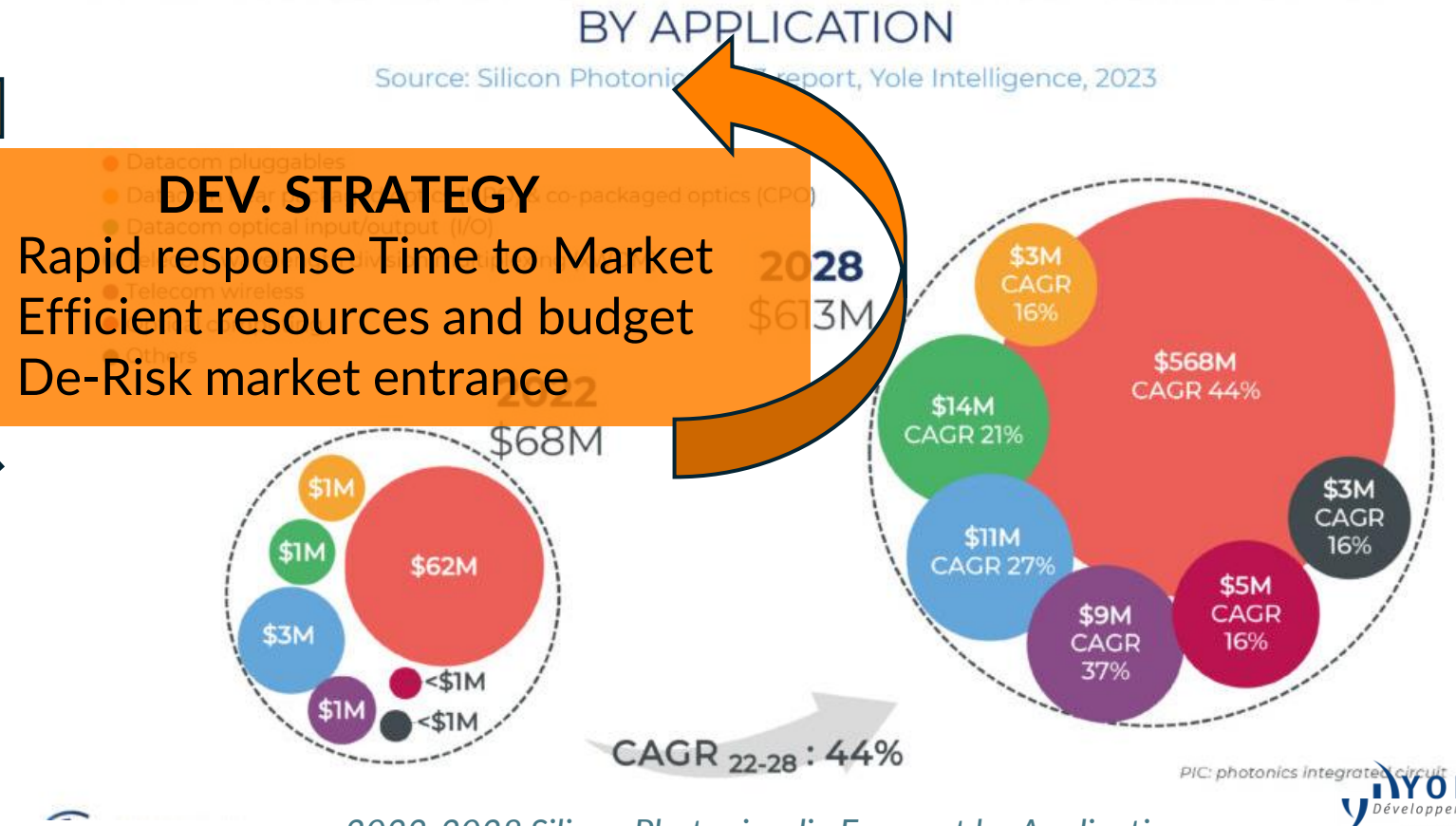
DEV. STRATEGY

- Rapid response Time to Market
- Efficient resources and budget
- De-Risk market entrance



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Main PIC Markets and Applications

Telecommunications:

- Coherent long-haul transport
- 5G / Microwave photonics

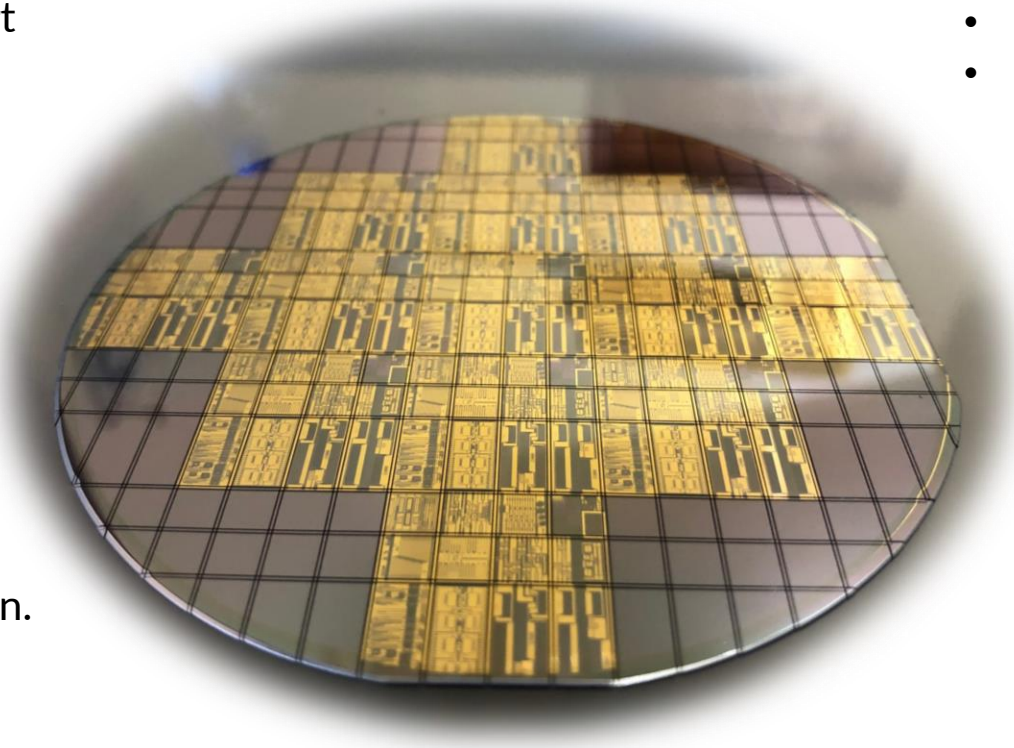
Datacom and computing:

- Datacenter transceivers
- HPC Interconnects (AI, Switches)
- Co-packaged optics (CPO)
- Linear-drive Pluggable Optics

Defense and security:

- Quantum Random Number Gen.
- Quantum Key Distribution
- Quantum computing

Silicon Photonics IC



Medical and life sciences:

- High-sensitivity label-free detection
- Optical Coherence Tomography

Sensing and measurement:

- Spectroscopy (analytics)
- Environment gas detection
- IR image projection
- Astronomical observation

Automotive and industrial:

- Fiber sensor interrogators
- Inertial sensors (Gyroscopes)
- LiDAR scanners

High Speed (signal BW and rate)

Low-latency (real-time integrity)

Parallelization (Channel/Density)

Reliable (Yield/Performance)

Scalable (Cost/Volume)

Energy efficiency

Compact (Integration/Density)

High Sensitivity and Selectivity

Non-invasiveness

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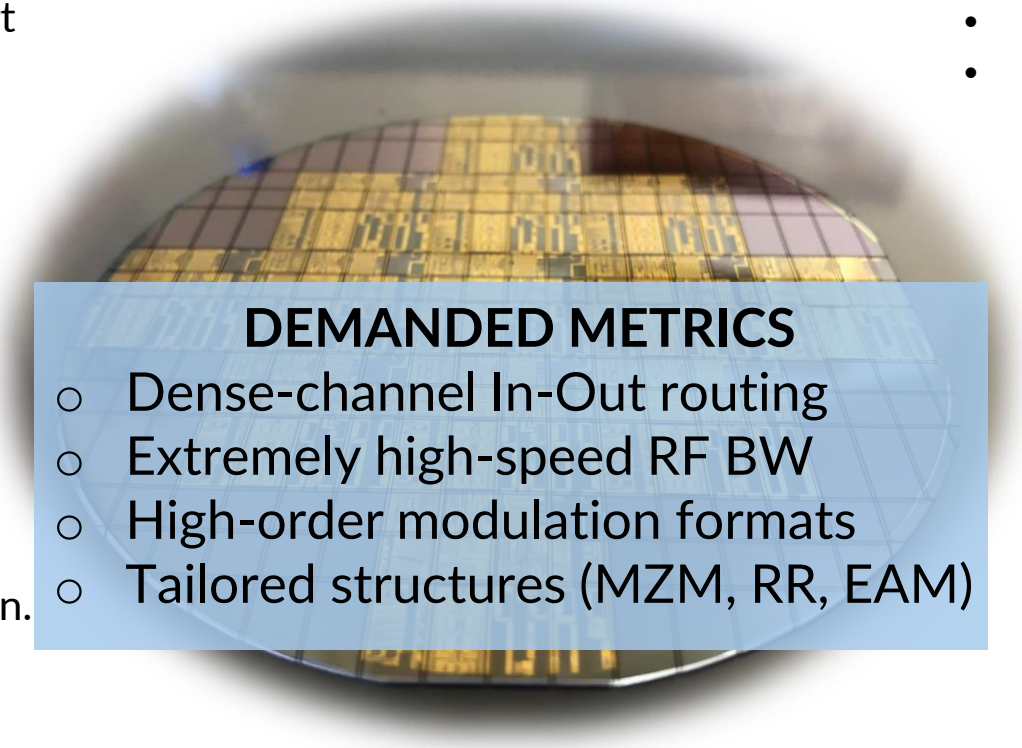

DEMANDED METRICS

- Dense-channel In-Out routing
- Extremely high-speed RF BW
- High-order modulation formats
- Tailored structures (MZM, RR, EAM)

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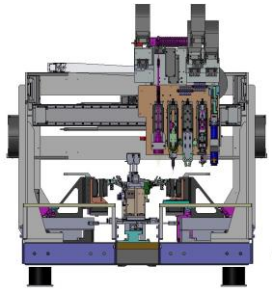
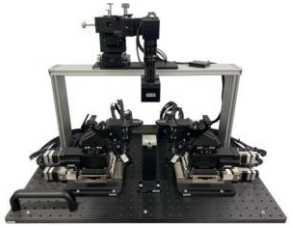
Forward-Thinking PIC Backend Semiconductor Expertise

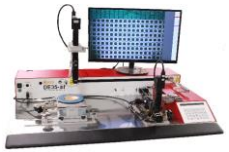
with a Front-End Development Perspectiver

1 Automation

WLT





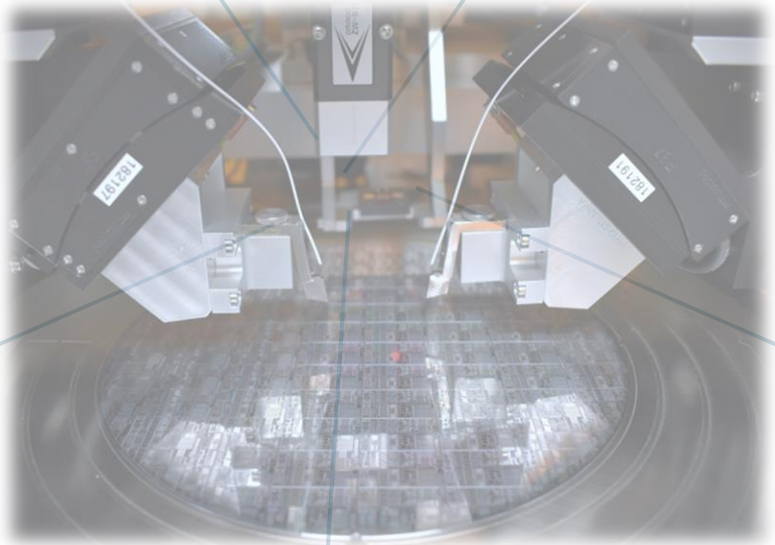


DLT / Die Sorter

2 Instrumentation

5 Test Assembly

Link Equipment + Expertise



To sort out **known good dies** (KGD)

3 High Speed RF Signal

110 GHz

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112 Gbaud

4 Reliability (Thermal)

THB/ BDH / HTOL

+ RCA Inspection:
SEM. FIB and SDX.

ISO 9001:2015

ISO-6 clean room.
Full ESD protection

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Design Flow | Simulation, Modelling, Layout + Testing

1

Photonic software modelling

Virtual Transfer Functions.
Tolerance sensitivity analysis.
Epitaxy / Implants
Transmission electrical lines

Test feedback

Parametrization

2A

Photonic Circuit Simulation

Entire system performance.
Virtual design iteration (prefab).
Link budget and integrity.

2B

Process Design Kit & Libraries

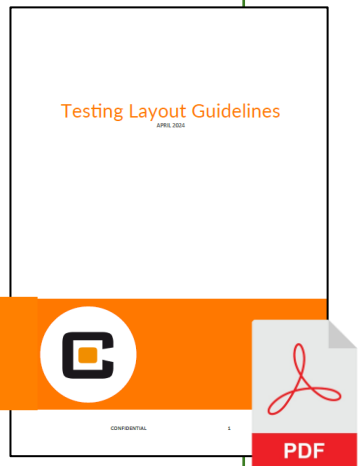
Compilation of building blocks.
Compact models - calibration.

3

Photonic circuit Layout

Routing Layout vs Schematic logic.
Parametric GDS layout.
DoE variations (cell, reticle).
Design Rule Checking (Error-Free).
In-depth layout critique review
Consider electronics & PCB

Rules & Plan



Tape-out

Manufacturing

Testing-mindset starts at the Design phase …

2C

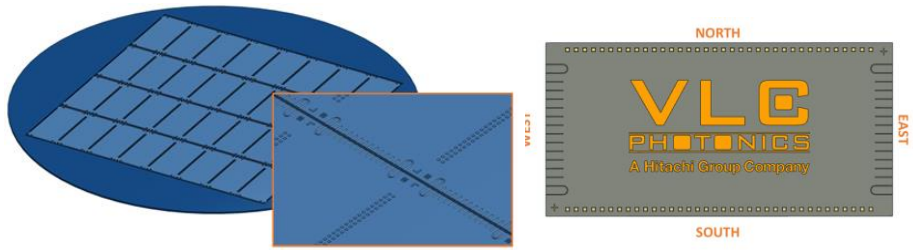
Test Campaign planification

- Equipment/instrumentation requirements, BoM.
- Electrical and optical port positions.
- Port pitch and bias configuration.
- Type and number of measurements per port.
- Design parameters and expected values.
- Measurement System Analysis (MSA) definition.
- Risk identification and agile planning

Test Desing Kits (TDKs)

- Standard specs on the layout towards test/assembly.
- Available in PDF + some EDA software / foundries.
- Compatible with VLC's test and assembly capabilities.

LUCEDA SYNOPSYS®



Trenches on Wafer for edge-coupling Testing, general conventions.

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Let's stay in touch!

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