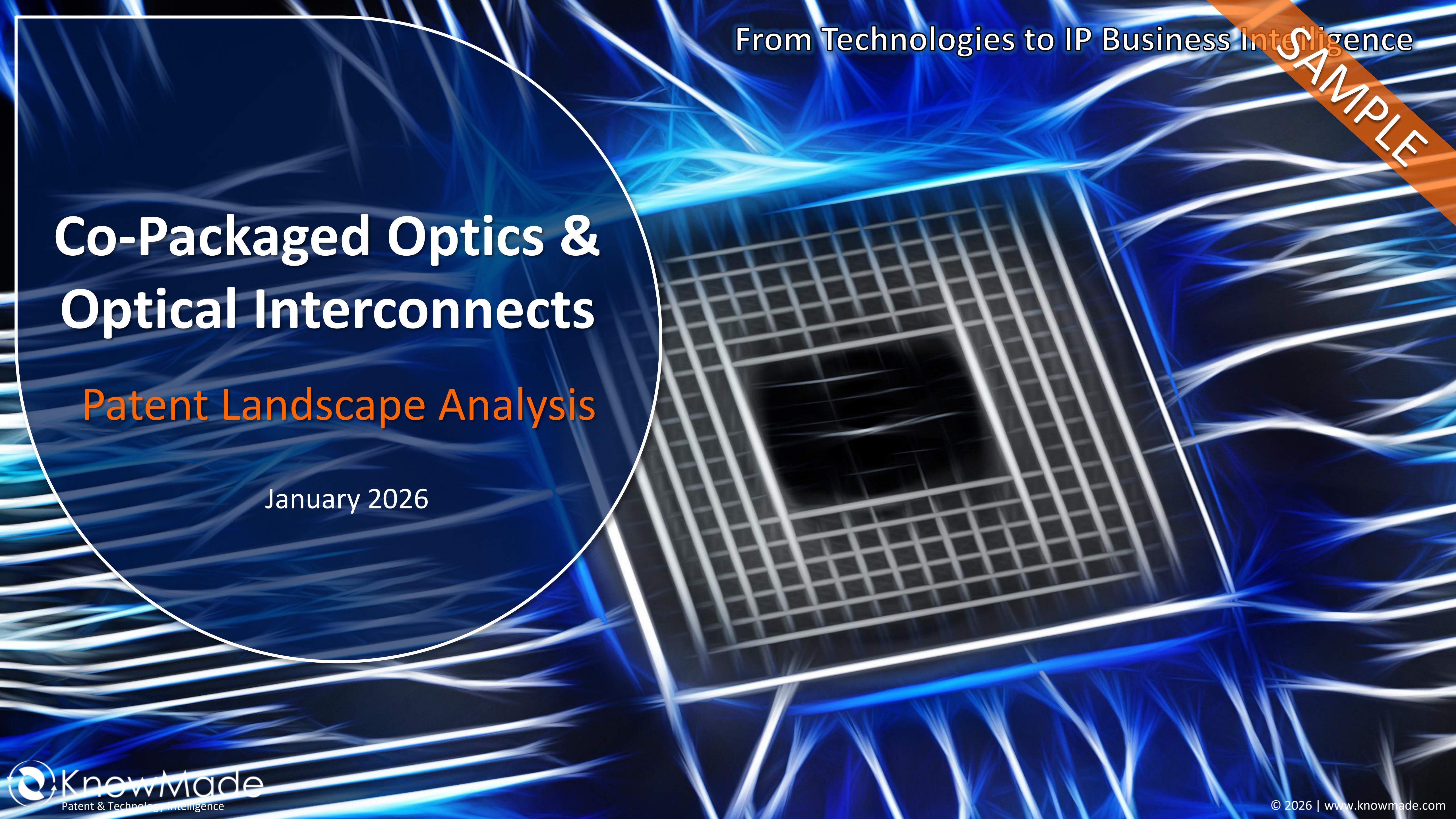

From Technologies to IP Business Intelligence

Co-Packaged Optics & Optical Interconnects

Patent Landscape Analysis

January 2026

KnowMade
Patent & Technology Intelligence

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ONE-HOUR PRESENTATION

The author of the report is available to address any questions you may have.

A **one-hour online presentation** of the report is included with your purchase. This session offers the opportunity for a direct interaction with the author, including a presentation of the results and a dedicated Q&A session.

Feel free to contact the author to schedule a meeting.

Contact us

KnowMade

KNOWMADE is a technology intelligence and IP strategy consulting company specializing in the analysis of patents and scientific publications. We assist innovative companies, investors, and research organizations in understanding the competitive landscape, anticipating technological trends, identifying opportunities and risks, improving their R&D, and shaping effective IP strategies. Our highly qualified analysts transform patent information and scientific literature into actionable insights to support decision-making in R&D, innovation, investment, and intellectual property.

MAIN PATENT ASSIGNEES MENTIONED IN THIS REPORT

Intel, TSMC, Huawei, Broadcom, Cisco, Lightmatter, Avicena, Celestial AI, Rockley Photonics, Ayar Labs, Ranovus, Samsung Group, NVIDIA, Teramount, ZTE, Resonac, Marvell, Nokia, Oracle, Micron, Senko Group, VTT, Alphabet, Accelink Technologies, Ruijie Networks, Eliyan, Mitsubishi Electric, LIPAC, RTX Corporation, HP - Hewlett Packard Development, UnilC (Tsinghua Unigroup), Yangzhou Xinli Integrated Circuit, Juniper, Suzhou Singularity Photon Intelligent Technology, Huagong Tech, NCAP, CEA, ASTAR, Sumitomo Electric, JCET Group, Apple, GlobalFoundries, ASE Group, Nubis communications, Amkor Technology, Lightelligence, Zhejiang Lingxin Optoelectronics Technology, Corning, Zhongshan Meisu Technology, Nano Photonics, Guangbenwei Technology, Wuxi institute of interconnect technology, Li Hong Electronic, Yongjiang Laboratory, SMIC, Tsinghua University, Sky Semiconductor, Elphic, Lightip Technologie, NTT - Nippon Telegraph & Telephone, Innolux, Shanghai Xizhi Technology, United Test and Assembly Center, University College Cork, Lumentum, Hanyang University, Furukawa Electric, Raytek, Hangzhou Guangzhiyuan Technology, Dongguan Luxshare Technology, PICadvanced, SPIL, Wuhan Optics Valley Information Optoelectronics Innovation Center, MACOM Technology Solutions, Ciena, MaxLinear, AIP - Advanced Integrated Photonics, Lyte AI, Browave, Xunyun Electronic Technology, Xperi/Adeia, HKUST - Hong Kong University of Science And Technology, ITRI - Industrial Technology Research Institute

INTRODUCTION

Context and objectives of the report

Artificial intelligence (AI) is fundamentally reshaping industries, driving massive increases in data generation and intensifying the demand for energy-efficient computing. As data volumes grow, hardware innovation has become critical, particularly in rethinking data center infrastructure to support accelerated computation, reduced power consumption, improved performance, and lower latency.

Silicon photonics has emerged as a transformative technology at the heart of this shift, replacing traditional copper interconnects with light-based data transmission. Among the most promising advances is **Co-Packaged Optics (CPO)**, an innovative packaging technology that integrates optical components directly within or near electronic devices for greater efficiency and scalability.

While silicon photonics is currently best known for its use in pluggable optical transceiver modules, now commercially available at speeds up to 800 Gbps, industry trends are moving toward tighter integration of optics with ASICs and other electronic chips. This evolution is giving rise to a new paradigm: **direct optical I/O**, where optical interfaces are embedded directly onto electronic packages to drastically shorten data paths and eliminate high-loss, power-hungry electrical traces. One key step in this direction is the use of **on-board optics (OBO)**, where optical engines are positioned around the ASIC package to support bandwidths of up to 1.6 Tbps. Building on OBO, emerging technologies like **CPO** and **optical I/O** take integration further by minimizing the length of electrical interconnects, significantly improving power efficiency (to the level of picojoules per bit), thermal management, and bandwidth (scaling to 3.2 Tbps and beyond).

CPO achieves these gains by placing optics adjacent to the ASIC, connected via ultra-short electrical traces or integrated optical waveguides. This close coupling is especially beneficial for high-throughput, latency-sensitive applications such as:

- **Hyperscale data centers**
- **High-performance computing (HPC)**
- **Artificial intelligence and machine learning (AI/ML)**

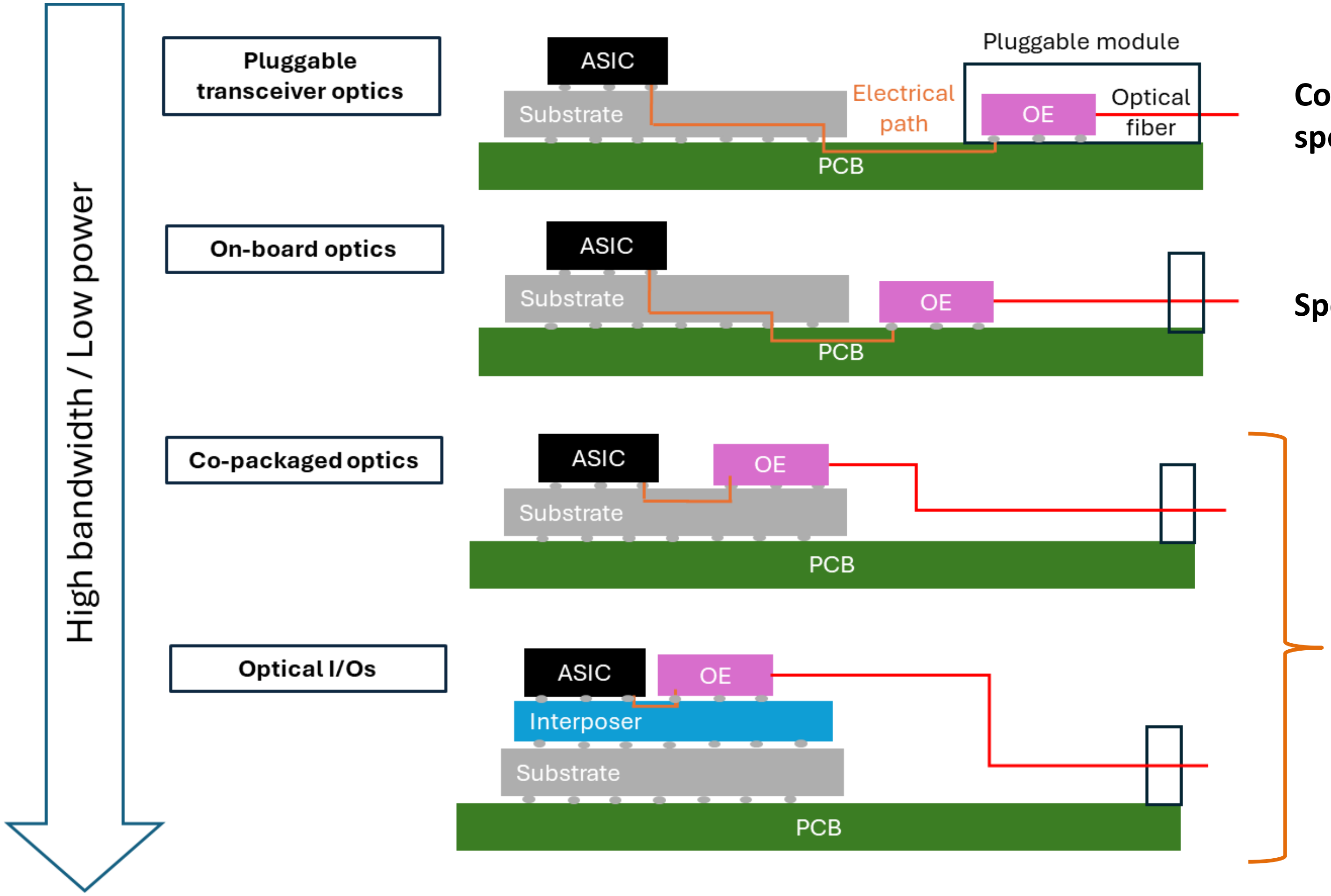
Accordingly, CPO development is focused on two primary opto-electronic integration domains:

- **Networking performance**, via CPO-enabled Ethernet switches (using an ASIC switch)
- **Computing performance**, through CPO-based interconnects for XPUs (using an ASIC processor)

There are multiple technical pathways to integrate photonic and electronic components, each presenting unique advantages and engineering challenges. This report leverages patent data analysis on CPO and optical interconnects to uncover key technological trends and identify the leading intellectual property (IP) contributors shaping this rapidly evolving landscape.

INTRODUCTION

Co-integration of optics and electronics



Commercially available at speeds up to 800 Gbps

Speeds up to 1.6 Tbps

This report

Advanced packaging

Scaling to 3.2 Tbps and beyond

CPO integrates optics directly alongside the ASIC on a single substrate interface, enabling maximum integration, minimal signal loss, higher bandwidth and reduced power consumption. On the other hand, CPO complexifies integration triggering an innovation momentum in advanced packaging that can be analyzed in the IP landscape.

INTRODUCTION

Scope of the report

We have selected and analyzed more than **4,000 patents and patent applications** published worldwide from 2010 to June 2025, representing more than **1,300 patent families** (inventions) relevant to the scope of this report.

The patent search strategy has been implemented using advanced search equations in the patent database and by a cautious patent selection performed by the analyst to get the most out of the corpus.

More details are available in METHODOLOGY part.

Inventions related to **Co-packaged optics & Optical interconnects** have been selected as follows:

Included

Patents clearly focused on co-packaged optics (CPO) for networking performance and computing performance: Core inventions

- Co-integration on the same substrate of PIC + EIC, or PIC + interposer + ASIC, CPO with Switch, or CPO with XPU

Patents that are not directly focused on co-packaged optics (CPO) but are related to it: Complementary inventions

- CPO application inferred form the description or from the company products and communications.
- Component level: PIC, photonic components, optical interconnects, optical/glass interposers, optical connectors, pluggable light sources, etc.

Excluded

Other optics/electronics co-integration

- On-board optics (OBO), near-package optics, pluggable optical transceiver modules (QSFP), etc.

Co-packaged optics (CPO) for other applications than networking performance and computing performance

- Imaging applications, optical sensors, etc.

INTRODUCTION

Reading guide: find the right information in the report

Report sections ↓

Your concern →

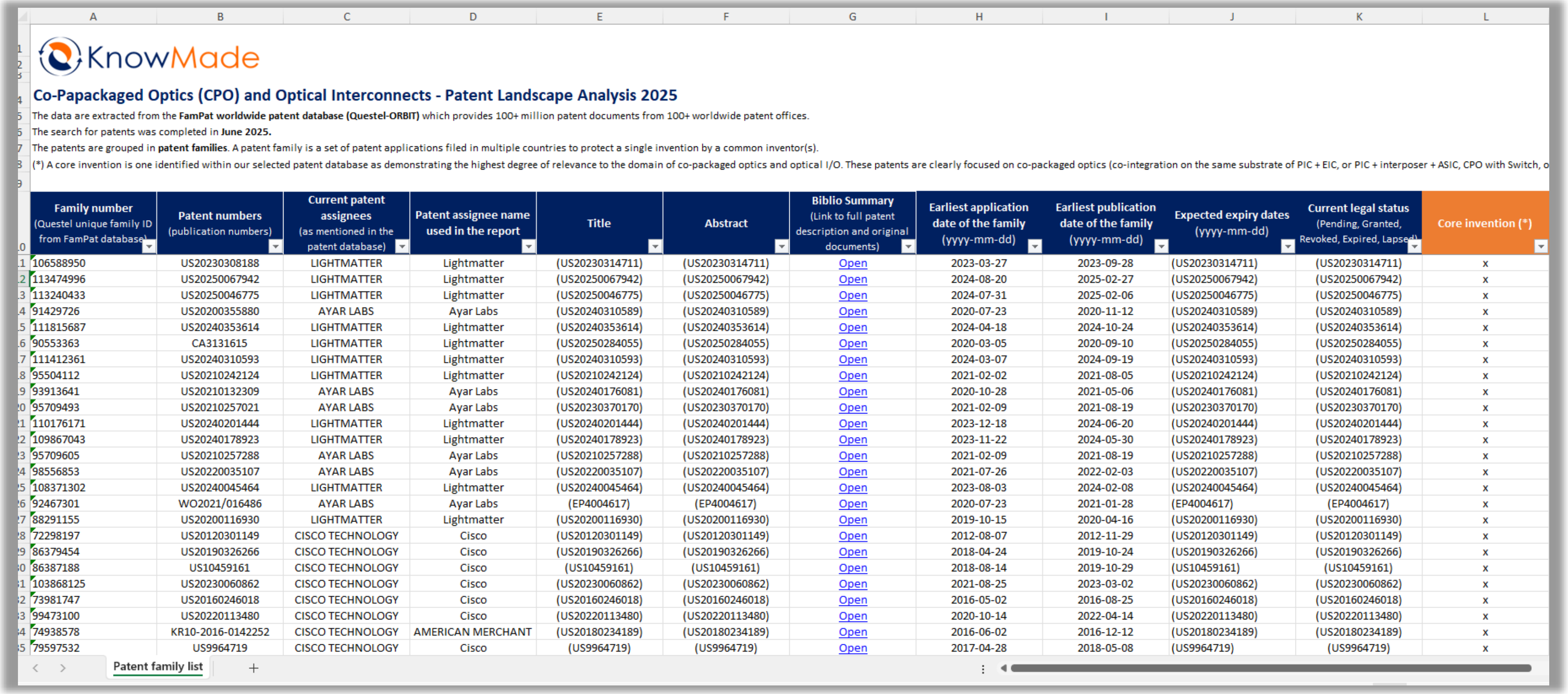
Information you get ↘

Report sections	**TECHNOLOGY** *For R&D teams, engineers, scientists*	**IP** *For IP teams, patent attorneys*	**MARKET** *For executives, business developers*	**PLAYER** *Zoom in a competitor / partner*
PATENT LANDSCAPE OVERVIEW • **Ranking of players** (enforceability, current activity, geo/tech coverage, prior-art contribution, etc.) • **Patent filings dynamics per player** • **IP collaborations** (co-filings, IPR transfers) • **Patent litigation/oppositions**	Innovators	Main patent owners IP risks/opportunities	Ecosystem (competitors, newcomers, partners, clients) Main trends IP vs Market	IP position vs Market position Player relationships (collaborations/ dependencies)
SEGMENTS ANALYSIS • **Patent filings dynamics per segment** • **IP leaders per segment** (enforceability, current activity, blocking potential) • **Key patents per segment** • **Recent patenting activity per segment**	Technology trends Technology mapping	Blocking players IP risks/opportunities in each segment (FTO, litigation, licensing)	Benchmarking Markets of interest Future developments	IP position and level of investment in each segment Key IP developments
IP PROFILE OF KEY PLAYERS • **Patent portfolio summary** (portfolio size, IP activity evolution, patents legal status, geo/tech coverage, strengths/weaknesses, etc.) • **Key patents** • **Recent patenting activity**	Current R&D activities Technology roadmap	Blocking patents Geo/Tech coverage Link between patents and products	Future products Potential partners Potential targets	R&D investment level Key inventions Current IP activities Strengths / Weaknesses

INTRODUCTION

Excel database

With this report, an **Excel file** is provided that includes all **1,387 patent families** (inventions) selected and analyzed in this study. This **useful patent database** allows for **multi-criteria searching** and includes patent publication numbers, **hyperlinks to an updated online database** (original documents, legal status, etc.), priority date, title, abstract, patent assignees, etc.



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Co-Papackaged Optics (CPO) and Optical Interconnects - Patent Landscape Analysis 2025

The data are extracted from the **FamPat worldwide patent database (Questel-ORBIT)** which provides 100+ million patent documents from 100+ worldwide patent offices.

The search for patents was completed in **June 2025.**

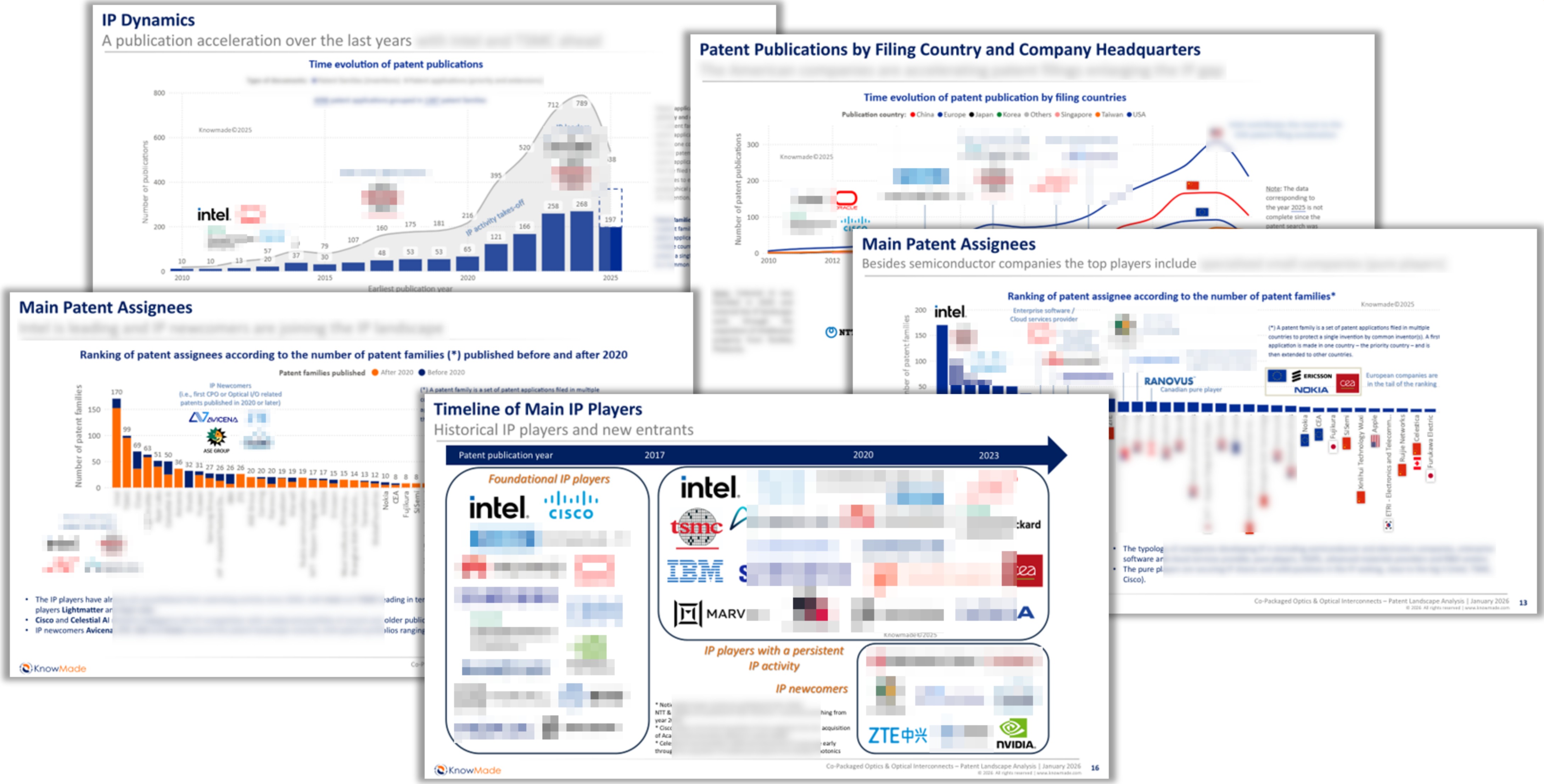
The patents are grouped in **patent families**. A patent family is a set of patent applications filed in multiple countries to protect a single invention by a common inventor(s).

(*) A core invention is one identified within our selected patent database as demonstrating the highest degree of relevance to the domain of co-packaged optics and optical I/O. These patents are clearly focused on co-packaged optics (co-integration on the same substrate of PIC + EIC, or PIC + interposer + ASIC, CPO with Switch, o

Family number (Questel unique family ID from FamPat database)	Patent numbers (publication numbers)	Current patent assignees (as mentioned in the patent database)	Patent assignee name used in the report	Title	Abstract	Biblio Summary (Link to full patent description and original documents)	Earliest application date of the family (yyyy-mm-dd)	Earliest publication date of the family (yyyy-mm-dd)	Expected expiry dates (yyyy-mm-dd)	Current legal status (Pending, Granted, Revoked, Expired, Lapsed)	Core invention (*)
106588950	US20230308188	LIGHTMATTER	Lightmatter	(US20230314711)	(US20230314711)	Open	2023-03-27	2023-09-28	(US20230314711)	(US20230314711)	x
113474996	US20250067942	LIGHTMATTER	Lightmatter	(US20250067942)	(US20250067942)	Open	2024-08-20	2025-02-27	(US20250067942)	(US20250067942)	x
113240433	US20250046775	LIGHTMATTER	Lightmatter	(US20250046775)	(US20250046775)	Open	2024-07-31	2025-02-06	(US20250046775)	(US20250046775)	x
91429726	US20200355880	AYAR LABS	Ayar Labs	(US20240310589)	(US20240310589)	Open	2020-07-23	2020-11-12	(US20240310589)	(US20240310589)	x
111815687	US20240353614	LIGHTMATTER	Lightmatter	(US20240353614)	(US20240353614)	Open	2024-04-18	2024-10-24	(US20240353614)	(US20240353614)	x
90553363	CA3131615	LIGHTMATTER	Lightmatter	(US20250284055)	(US20250284055)	Open	2020-03-05	2020-09-10	(US20250284055)	(US20250284055)	x
111412361	US20240310593	LIGHTMATTER	Lightmatter	(US20240310593)	(US20240310593)	Open	2024-03-07	2024-09-19	(US20240310593)	(US20240310593)	x
95504112	US20210242124	LIGHTMATTER	Lightmatter	(US20210242124)	(US20210242124)	Open	2021-02-02	2021-08-05	(US20210242124)	(US20210242124)	x
93913641	US20210132309	AYAR LABS	Ayar Labs	(US20240176081)	(US20240176081)	Open	2020-10-28	2021-05-06	(US20240176081)	(US20240176081)	x
95709493	US20210257021	AYAR LABS	Ayar Labs	(US20230370170)	(US20230370170)	Open	2021-02-09	2021-08-19	(US20230370170)	(US20230370170)	x
110176171	US20240201444	LIGHTMATTER	Lightmatter	(US20240201444)	(US20240201444)	Open	2023-12-18	2024-06-20	(US20240201444)	(US20240201444)	x
109867043	US20240178923	LIGHTMATTER	Lightmatter	(US20240178923)	(US20240178923)	Open	2023-11-22	2024-05-30	(US20240178923)	(US20240178923)	x
95709605	US20210257288	AYAR LABS	Ayar Labs	(US20210257288)	(US20210257288)	Open	2021-02-09	2021-08-19	(US20210257288)	(US20210257288)	x
98556853	US20220035107	AYAR LABS	Ayar Labs	(US20220035107)	(US20220035107)	Open	2021-07-26	2022-02-03	(US20220035107)	(US20220035107)	x
108371302	US20240045464	LIGHTMATTER	Lightmatter	(US20240045464)	(US20240045464)	Open	2023-08-03	2024-02-08	(US20240045464)	(US20240045464)	x
92467301	WO2021/016486	AYAR LABS	Ayar Labs	(EP4004617)	(EP4004617)	Open	2020-07-23	2021-01-28	(EP4004617)	(EP4004617)	x
88291155	US20200116930	LIGHTMATTER	Lightmatter	(US20200116930)	(US20200116930)	Open	2019-10-15	2020-04-16	(US20200116930)	(US20200116930)	x
72298197	US20120301149	CISCO TECHNOLOGY	Cisco	(US20120301149)	(US20120301149)	Open	2012-08-07	2012-11-29	(US20120301149)	(US20120301149)	x
86379454	US20190326266	CISCO TECHNOLOGY	Cisco	(US20190326266)	(US20190326266)	Open	2018-04-24	2019-10-24	(US20190326266)	(US20190326266)	x
86387188	US10459161	CISCO TECHNOLOGY	Cisco	(US10459161)	(US10459161)	Open	2018-08-14	2019-10-29	(US10459161)	(US10459161)	x
103868125	US20230060862	CISCO TECHNOLOGY	Cisco	(US20230060862)	(US20230060862)	Open	2021-08-25	2023-03-02	(US20230060862)	(US20230060862)	x
73981747	US20160246018	CISCO TECHNOLOGY	Cisco	(US20160246018)	(US20160246018)	Open	2016-05-02	2016-08-25	(US20160246018)	(US20160246018)	x
99473100	US20220113480	CISCO TECHNOLOGY	Cisco	(US20220113480)	(US20220113480)	Open	2020-10-14	2022-04-14	(US20220113480)	(US20220113480)	x
74938578	KR10-2016-0142252	CISCO TECHNOLOGY	AMERICAN MERCHANT	(US20180234189)	(US20180234189)	Open	2016-06-02	2016-12-12	(US20180234189)	(US20180234189)	x
79597532	US9964719	CISCO TECHNOLOGY	Cisco	(US9964719)	(US9964719)	Open	2017-04-28	2018-05-08	(US9964719)	(US9964719)	x

PATENT LANDSCAPE OVERVIEW

General trends, main patent assignees and new entrants



IP Dynamics

A publication acceleration over the last years

Time evolution of patent publications

Patent Publications by Filing Country and Company Headquarters

Time evolution of patent publication by filing countries

Note: The data corresponding to the year 2025 is not complete since the patent search was

Main Patent Assignees

Besides semiconductor companies the top players include

Ranking of patent assignee according to the number of patent families*

(*) A patent family is a set of patent applications filed in multiple countries to protect a single invention by common inventor(s). A first application is made in one country – the priority country – and is then extended to other countries.

European companies are in the tail of the ranking

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Main Patent Assignees

Ranking of patent assignees according to the number of patent families (*) published before and after 2020

(*) A patent family is a set of patent applications filed in multiple

Timeline of Main IP Players

Historical IP players and new entrants

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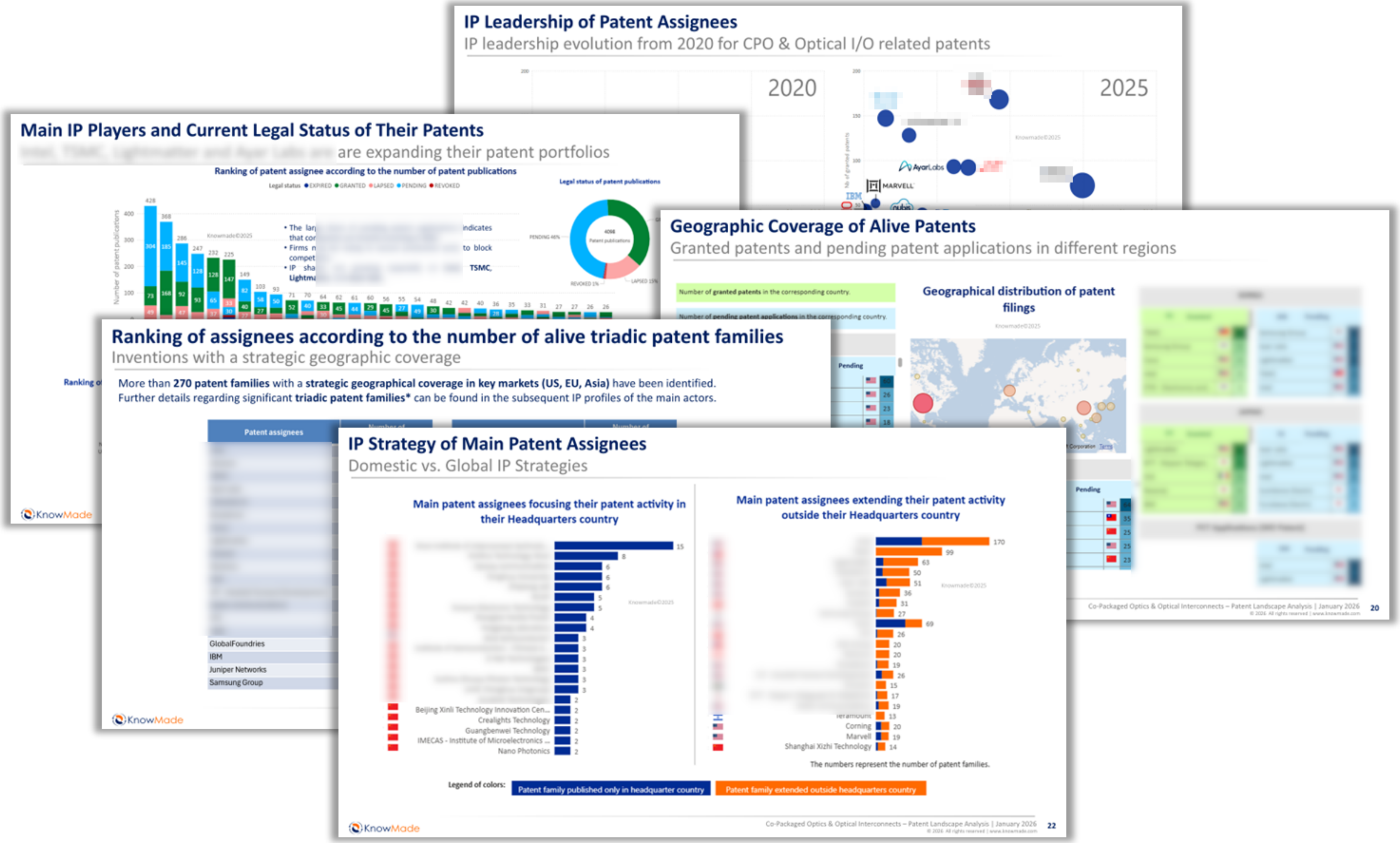
PATENT LANDSCAPE OVERVIEW

IP leaders, IP strategies, and key patents



IP Leadership of Patent Assignees

IP leadership evolution from 2020 for CPO & Optical I/O related patents

Main IP Players and Current Legal Status of Their Patents

are expanding their patent portfolios

Ranking of patent assignee according to the number of patent publications

Legal status of patent publications

- The lar… indicates that co…
- Firms … to block compet…
- IP sha… TSMC, Lightma…

Geographic Coverage of Alive Patents

Granted patents and pending patent applications in different regions

Number of **granted patents** in the corresponding country.

Number of **pending patent applications** in the corresponding country.

Geographical distribution of patent filings

Ranking of assignees according to the number of alive triadic patent families

Inventions with a strategic geographic coverage

More than **270 patent families** with a **strategic geographical coverage in key markets (US, EU, Asia)** have been identified. Further details regarding significant **triadic patent families*** can be found in the subsequent IP profiles of the main actors.

Patent assignees
GlobalFoundries
IBM
Juniper Networks
Samsung Group

IP Strategy of Main Patent Assignees

Domestic vs. Global IP Strategies

Main patent assignees focusing their patent activity in their Headquarters country

Main patent assignees extending their patent activity outside their Headquarters country

The numbers represent the number of patent families.

Legend of colors: Patent family published only in headquarter country | Patent family extended outside headquarters country

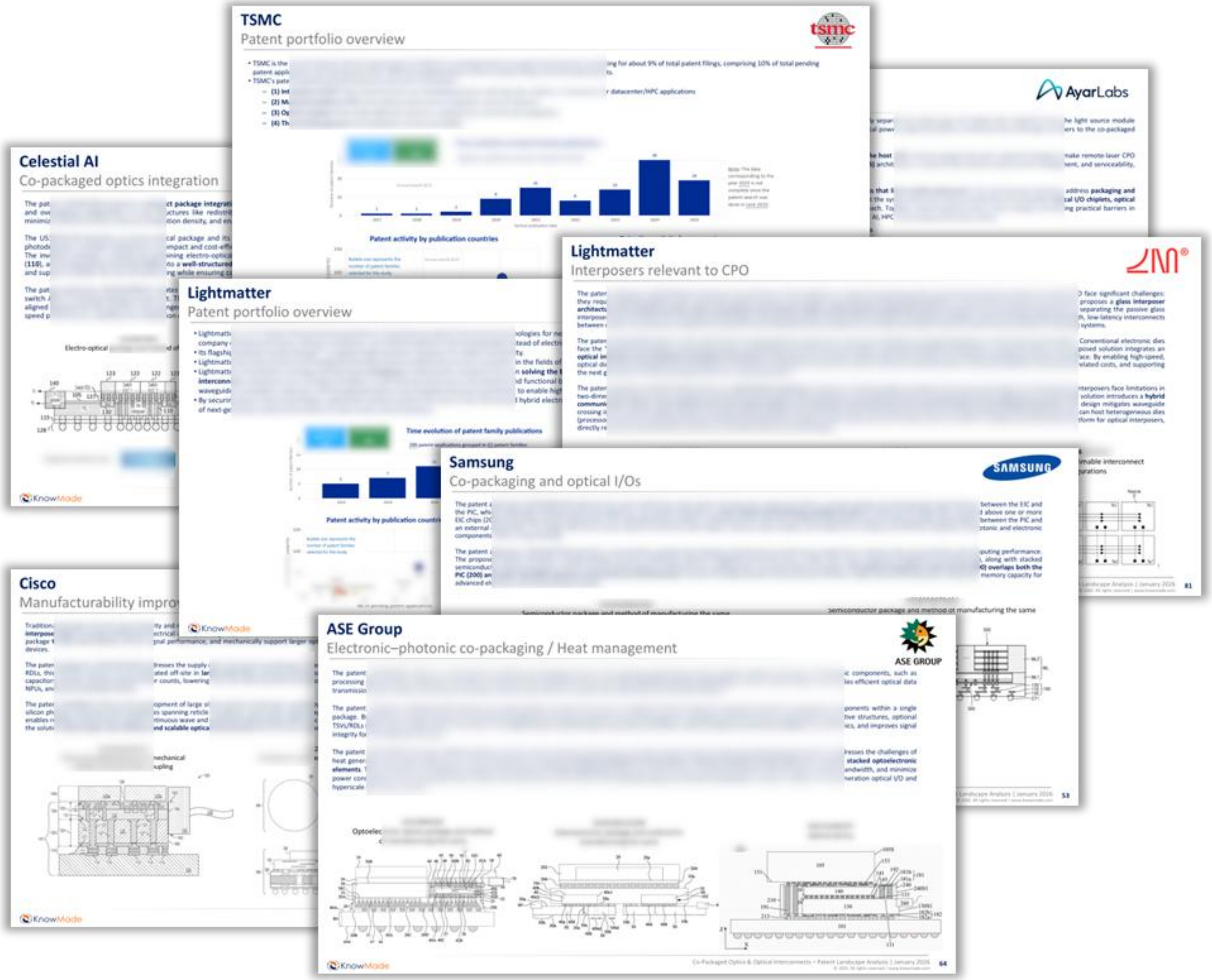
IP PROFILE OF PLAYERS

IP portfolio summary, IP strategy, and notable patents

A focus on **a selection of IP players and newcomers** is provided in a dedicated section. For each player, the **CPO & Optical I/O patent portfolio** is analyzed to provide an overview of its **level of IP activity**, **geographical coverage**, **strengths**, **potential for reinforcement**, and to highlight **notable patents.**

intel
tsmc
CISCO
SAMSUNG
BROADCOM
AVAGO TECHNOLOGIES
ASE GROUP
AyarLabs
celestial AI
AVICENA

IP profile



TSMC
Patent portfolio overview

Celestial AI
Co-packaged optics integration

AyarLabs

Lightmatter
Patent portfolio overview

Lightmatter
Interposers relevant to CPO

Samsung
Co-packaging and optical I/Os

Cisco
Manufacturability impro

ASE Group
Electronic–photonic co-packaging / Heat management

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Co-Packaged Optics and Optical Interconnects

Patent Landscape Analysis – January 2026

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BIC or SWIFT code: CCBPFRPPMAR
IBAN: : FR76 1460 7003 6360 6214 5695 139

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3.4 In the event of termination of the contract, or of misconduct, during the contract, the Seller will have the right to invoice at the stage in progress, and to take legal action for damages.

4. LIABILITIES

4.1 The Buyer or any other individual or legal person acting on its behalf, being a business user buying the Products for its business activities, shall be solely responsible for choosing the Products and for the use and interpretations he makes of the documents it purchases, of the results he obtains, and of the advice and acts it deduces thereof.

4.2 The Seller shall only be liable for (i) direct and (ii) foreseeable pecuniary loss, caused by the Products or arising from a material breach of this agreement

4.3 In no event shall the Seller be liable for:

a) damages of any kind, including without limitation, incidental or consequential damages (including, but not limited to, damages for loss of profits, business interruption and loss of programs or information) arising out of the use of or inability to use the Seller's website or the Products, or any information provided on the website, or in the Products;

b) any claim attributable to errors, omissions or other inaccuracies in the Product or interpretations thereof.

4.4 All the information contained in the Products has been obtained from sources believed to be reliable. The Seller does not warrant the accuracy, completeness adequacy or reliability of such information, which cannot be guaranteed to be free from errors.

4.5 All the Products that the Seller sells may, upon prior notice to the Buyer from time to time be modified by or substituted with similar Products meeting the needs of the Buyer. This modification shall not lead to the liability of the Seller, provided that the Seller ensures the substituted Product is similar to the Product initially ordered.

4.6 In the case where, after inspection, it is acknowledged that the Products contain defects, the Seller undertakes to replace the defective products as far as the supplies allow and without indemnities or compensation of any kind for labor costs, delays, loss caused or any other reason. The replacement is guaranteed for a maximum of two months starting from the delivery date. Any replacement is excluded for any event as set out in article 5 below.

4.7 The deadlines that the Seller is asked to state for the mailing of the Products are given for information only and are not guaranteed. If such deadlines are not met, it shall not lead to any damages or cancellation of the orders, except for non-acceptable delays exceeding [4] months from the stated deadline, without information from the Seller. In such case only, the Buyer shall be entitled to ask for a reimbursement of its first down payment to the exclusion of any further damages.

4.8 The Seller does not make any warranties, express or implied, including, without limitation, those of saleability and fitness for a particular purpose, with respect to the Products. Although the Seller shall take reasonable steps to screen Products for infection of viruses, worms, Trojan horses or other codes containing contaminating or destructive properties before making the Products available, the Seller cannot guarantee that any Product will be free from infection.

5. FORCE MAJEURE

The Seller shall not be liable for any delay in performance directly or indirectly caused by or resulting from acts of nature, fire, flood, accident, riot, war, government intervention, embargoes, strikes, labor difficulties, equipment failure, late deliveries by suppliers or other difficulties which are beyond the control, and not the fault of the Seller.

6. PROTECTION OF THE SELLER'S IPR

6.1 All the IPR attached to the Products are and remain the property of the Seller and are protected under French and international copyright law and conventions.

6.2 The Buyer agreed not to disclose, copy, reproduce, redistribute, resell or publish the Product, or any part of it to any other party other than employees of its company. The Buyer shall have the right to use the Products solely for its own internal information purposes. In particular, the Buyer shall therefore not use the Product for purposes such as:

- Information storage and retrieval systems;
- Recordings and re-transmittals over any network (including any local area network);
- use in any timesharing, service bureau, bulletin board or similar arrangement or public display;
- Posting any Product to any other online service (including bulletin boards or the Internet);
- Licensing, leasing, selling, offering for sale or assigning the Product.

6.3 The Buyer shall be solely responsible towards the Seller of all infringements of this obligation, whether this infringement comes from its employees or any person to whom the Buyer has sent the Products and shall personally take care of any related proceedings, and the Buyer shall bear related financial consequences in their entirety.

6.4 The Buyer shall define within its company point of contact for the needs of the contract. This person will be the recipient of each new report in PDF format. This person shall also be responsible for respect of the copyrights and will guaranty that the Products are not disseminated out of the company.

7. TERMINATION

7.1 If the Buyer cancels the order in whole or in part or postpones the date of mailing, the Buyer shall indemnify the Seller for the entire costs that have been incurred as at the date of notification by the Buyer of such delay or cancellation. This may also apply for any other direct or indirect consequential loss that may be borne by the Seller, following this decision.

7.2 In the event of breach by one Party under these conditions or the order, the non-breaching Party may send a notification to the other by recorded delivery letter upon which, after a period of thirty (30) days without solving the problem, the non-breaching Party shall be entitled to terminate all the pending orders, without being liable for any compensation.

8. MISCELLANEOUS

All the provisions of these Terms and Conditions are for the benefit of the Seller itself, but also for its licensors, employees and agents. Each of them is entitled to assert and enforce those provisions against the Buyer.

Any notices under these Terms and Conditions shall be given in writing. They shall be effective upon receipt by the other Party.

The Seller may, from time to time, update these Terms and Conditions and the Buyer, is deemed to have accepted the latest version of these terms and conditions, provided they have been communicated to him in due time.

9. GOVERNING LAW AND JURISDICTION

9.1 Any dispute arising out or linked to these Terms and Conditions or to any contract (orders) entered into in application of these Terms and Conditions shall be settled by the French Commercial Courts of Grasse, which shall have exclusive jurisdiction upon such issues.

9.2 French law shall govern the relation between the Buyer and the Seller, in accordance with these Terms and Conditions.

KNOWMADE

Patent and Technology Intelligence

KnowMade
Patent & Technology Intelligence

KNOWMADE PURPOSE

Turning **patent** and **scientific data** into **actionable insights** to support **decision-making** in **R&D**, **innovation**, **investment**, and **intellectual property**.

Competitive landscape | Technology trends | Opportunities / Risks | R&D and IP strategy

Patent your inventions
Assert your patents
and defend your position
Evaluate the IP risks

Understand, anticipate and evaluate the competitive landscape and current technology developments

Improve your R&D
and innovation strategy
Identify and get access
to external innovation

Prior art search
Freedom-to-operate analysis
Patent invalidation
Evidence of use

Patent landscape
Monitoring service
Patent portfolio analysis
Patent valuation

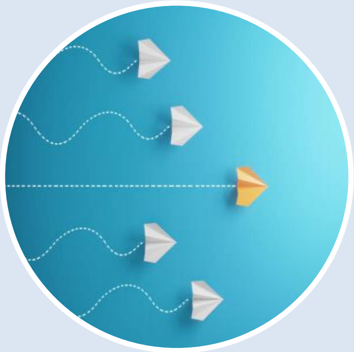
Technology scouting
Scientific literature analysis
Technology review

WHAT INFORMATION CAN YOU GET ?

INTELLECTUAL PROPERTY

For IP teams,
patent attorneys

- Risks and opportunities (FTO, litigations, licensing)
- Key patents
- Link between patents and products



TECHNOLOGY

For R&D teams,
engineers, scientists

- R&D activities
- Technological roadmap
- Position on the supply chain

MARKET

For executives,
business developers

- Identify competitors
- Compare IP with market position
- Evaluate the level of investment
- Future products & target markets

KNOWMADE OFFER

CUSTOM SERVICES

(Tailor-made analysis)

To meet your needs and budget/lead time constraints

- ➢ Specific and dedicated report.
- ➢ Prior-art search, literature review, patent landscape, freedom-to-operate, patent valuation, IP due diligence, technology scouting, monitoring service, etc.

Format
- PDF file with analyses.
- Excel file with data.
- Access to the analyst.

REPORTS

(multi-client product)

To understand the competitive landscape and explore the emerging ecosystems and new technologies

- ➢ Stand alone report
- ➢ Patent landscape.
- ➢ Overview on IP dynamics, trends and players.
- ➢ Competitor, technology and strategy analysis.
- ➢ Benchmark of patent portfolios.
- ➢ Key IP players & key patents.

Format
- PDF file with analyses.
- Excel file with patent data.

MONITORS

(multi-client product)

To track the latest R&D developments and IP activities, and to be sensitive to weak signals

- ➢ Annual subscription
- ➢ Patent monitoring service.
- ➢ Quarterly updated patent data and technology trends.
- ➢ Current R&D and IP activities.
- ➢ Early detect weak signals, opportunities and risks.
- ➢ Open discussion with analyst.

Format
- PDF file with analyses.
- Excel file with patent data.
- Direct access to the analyst.

INSIGHTS

(free article & webinar)

To get unique information about industry and technology

- ➢ Analyst point of view about industry news (product release, M&A, start-up, fund-raising, etc.) from a patent perspective.

Format
- Knowmade website

MAIN FIELDS OF EXPERTISE

SEMICONDUCTORS

- Materials & Substrates
- Power electronics
- RF & Wireless datacom
- MEMS, Sensing & Imaging
- Photonics, Lighting & Display
- Memory
- Packaging

HEALTHCARE

- New therapeutic tools
- Medical diagnostics
- Medical devices and imaging
- Drug discovery and delivery

ENERGY

- Batteries
- Fuel-cells
- Solar PV
- Power management

AGRI-FOOD

- Food processing & formulation
- Vegan food
- Next-gen packaging
- Microbiology

SEMICONDUCTORS
Expertise

SEMICONDUCTORS
from materials and devices to circuits, packaging and modules/systems

Power electronics

- ➢ Wide bandgap semiconductors
- ➢ Power devices and IC
- ➢ Power modules
- ➢ Power applications

RF & Wireless communications

- ➢ RF substrate & epiwafers
- ➢ RF devices (SAW, BAW, PA/LNA, etc.), RFIC, MMIC
- ➢ RF front-end module, RF packaging
- ➢ MIMO, beamforming, carrier aggregation
- ➢ 5G & 6G networks, Radar, mm-waves, microwaves, THz

MEMS, Sensing & Imaging

- ➢ MEMS sensors and actuators
- ➢ 3D imaging and sensing (ToF, CIS, thermal imaging, LiDAR, imaging Radar, event-based camera, etc.)
- ➢ AI/ML, sensor data fusion

Memory

- ➢ SRAM, DRAM, flash
- ➢ 3D-stacked memories
- ➢ Emerging non-volatile memories (MRAM, PCM, RRAM, etc.)
- ➢ Embedded NVM

Photonics, Lighting & Display

- ➢ Optoelectronics & optical components (LED, OLED, laser, optical transceivers, waveguides, metasurfaces, etc.)
- ➢ Photonic crystal, photonic IC, silicon photonics
- ➢ Optical communications, AR/VR, quantum

Advanced packaging

- ➢ Fan-Out WLP/PLP, 2.5D/3D IC
- ➢ SiP, SoC, Chiplets
- ➢ TSV, µbumps, interposer, interconnect bridge, hybrid bonding

Materials & Substrates

- ➢ Compound semiconductors
- ➢ Engineered substrates
- ➢ Epiwafers

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Patent & Technology Intelligence

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