Silicon photonics and InP photonic integrated circuit market to grow to $48bn by 2036

The acceleration of silicon photonics adoption requires simpler, externally modulated CW lasers, notes IDTechEx.

Photonic integrated circuits (PICs) use manufacturing processes developed for the semiconductor industry to miniaturize complex optical functionality onto a chip. PICs offer significant advantages over electronic ICs. Since light travels about 3x faster than electricity, PICs can transmit data with much higher throughput. Propagation losses are also typically much smaller compared to resistance losses in electronic ICs. These attributes allow photonic waveguides to achieve up to ten times better data transfer efficiency, one hundred times higher bandwidth, and much shorter latency (0.3 times) when compared to their electronic counterparts, whilst typically saving energy too. Additionally, PICs can be integrated into modern CMOS processes and are relatively easy to combine with existing electronic systems. This enhances their versatility and effectiveness in advancing data communication technology.

In IDTechEx's report 'Silicon Photonics and Photonic Integrated Circuits 2026-2036: Technologies, Markets, and Forecasts' it is predicted that this market will rise at a compound annual growth rate (CAGR) of 21.9% to US$48bn market by 2036, since photonic integrated circuit (PIC)-based transceivers are fast-becoming essential tools in the AI revolution, where they speed up connections between nodes in data centers whilst reducing power consumption, allowing larger AI models to be trained and executed. However, unlike purely electrical integrated circuits, photonic integrated circuits require the integration of a III–V semiconductor to function as the laser, because silicon does not lase. As of 2026, the dominant material choice is indium phosphide (InP).

Indium phosphide versus silicon photonics: a false dichotomy

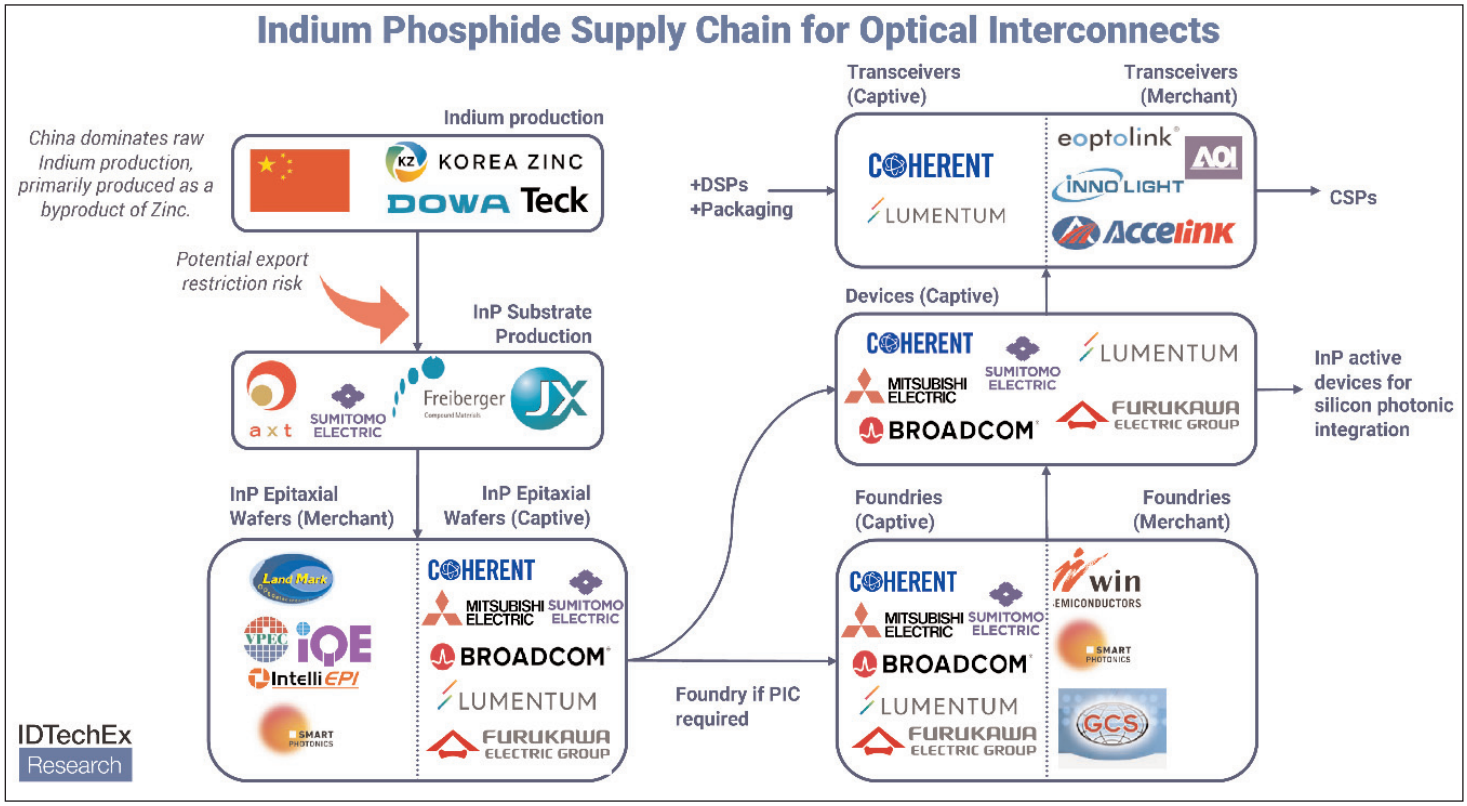
There are two main types of PICs used in optical transceivers: silicon photonic and monolithic indium phosphide. Monolithic InP builds the entire PIC — modulator, laser, photodiode, waveguides — out of InP. This avoids the complexity of bonding the InP laser to a silicon photonic chip (and the interface losses that this entails) but requires a lot of a relatively expensive and supply-constrained material from a smaller wafer that has much lower yield than silicon processes.

Silicon photonics, on the other hand, uses silicon wherever possible and only uses III–V semiconductors for the lasers and photodiodes. A key misunderstanding often associated with photonics is the split between InP and silicon photonics. As of 2026, nearly all silicon photonics devices will contain an InP laser and, as such, a shift towards greater silicon photonics adoption does not occur at the expense of demand for InP components, but it does change the nature of InP demand.

Photonics drives demand for indium phosphide

Indium is produced as a byproduct of zinc and, according to IDTechEx research, most global supply (about 70%) is concentrated in China. This regional concentration adds an additional layer of risk, since China imposed export controls on a suite of materials — including indium — in April 2025. So far, these export restrictions only amounted to the requirement for licensing rather than a full export ban. However, it indicates the precariousness of the global supply chain for photonics. Once processed, indium is then combined with phosphide to make indium phosphide (InP) substrates, a highly specialized task dominated by Sumitomo Electric, AXT, JX Nippon, and Freiberger. These wafers are then sent to epitaxy foundries where crystalline layers are grown either by metal-organic chemical vapor deposition (MOCVD) or molecular beam epitaxy (MBE) reactors.

Demand for high-quality InP substrates has skyrocketed in recent years. While producers are ramping up production, this is an emerging bottleneck in the AI hardware rollout. After this, a foundry fabricates the devices on the wafer, for example lasers or modulators, and these are either sold as discrete devices, packaged into an InP optical transceiver, or integrated



The global InP supply chain from indium production to transceiver assembly. A significant portion of supply from epitaxial growth to device manufacturing is captive. Source: IDTechEx.

into silicon photonic devices. In general, yields are much lower than for silicon devices, and the wafer sizes available are much smaller. While silicon foundries have matured the 12" wafer size, for InP 2", 3" and 4" are standard. With an increasingly supply constrained market, there have been moves to increase the wafer platform size, with IDTechEx research in 'Silicon Photonics and Photonic Integrated Circuits 2026–2036: Technologies, Markets, and Forecasts' identifying several players that are in the process of moving to 6" wafers.

InP supply mostly captive

IDTechEx research indicates that many of the leading InP players have a high degree of vertical integration. Coherent and Lumentum both control the supply from wafer to final device, be that laser module or optical transceiver. In contrast, it is common for silicon photonic circuits to be manufactured at an external foundry (such as TSMC, Tower, or GlobalFoundries) before being shipped to an outsourced assembly & test (OSAT) partner.

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The InP industry has long been for specialized low-volume and high-value telecoms applications and thus has never been driven to develop a disaggregated global ecosystem. There is also a strong amount of proprietary knowledge in InP epitaxial growth that keeps device manufacturing in-house. However, this bespoke low-volume production ecosystem is facing unprecedented high demand. Leaders Coherent and Lumentum have both reported demand drastically outstripping supply, as major players such as NVIDIA flex their leverage to secure long-term supply of InP devices.

A downstream consequence of this that IDTechEx has identified is the acceleration of silicon photonics adoption, which requires only simpler and CW (continuous wave) lasers that are externally modulated by a silicon modulator.

Rapidly moving market, and future material platforms on the horizon

IDTechEx research has tracked and benchmarked several emerging material platforms, beyond silicon and InP. These include TFLN (thin-film lithium niobate) and BTO (barium titanate oxide), which have high potential switching frequencies that are desirable for emerging PIC applications such as quantum technologies. ■

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