## Photonic Integrated Circuits: Trends and Developments

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Market forecasts



Technology assessment



Market sizing



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Company profiling



## Agenda

- What are future applications for PICs?
- Total PIC Forecasts
- PIC Transceivers for AI
- PIC Material Benchmarks and Forecasts
- Conclusion



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## **Key Current & Future Photonic Integrated Circuits Applications**





## **Total PIC Market Data Table**

Note: that values here include the value of the device the PIC is integrated in, not just the value of the PIC.



#### Photonic Integrated Circuit Technology Market Share



#### **Photonic Integrated Circuit Technology Market**



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#### Why do AI models need high-performance transceivers?





## **Integrated Photonic Transceivers**



#### A 10Gbps optical transceiver

#### **Classic Optical Transceiver**

- Bulky Transmitter and Receiver Optical Sub-Assemblies
- Large distance between chip and transmitter higher latency
- Single wavelength lower bandwidth



## Photonic Integrated Circuit Optical Transceiver

- Compact Transmitter and Receiver optical subassemblies
- Very short distance between chip and transmitter – lower latency
- MUX supporting Wave-Division Multiplexing higher bandwidth

A 100Gbps Silicon Photonic optical transceiver showing the transmission PIC (white boxes)



## **PIC Material Platforms Benchmarked**





## **PIC Material Platforms Benchmarked (Visualized)**

- SOI performs strongly
- Monolithic InP is a good all-round platform but suffers from losses
- SiN offers lower losses and is less mature
- Electro-Optical Polymer on Insulator good efficiency and modulation but immature as platform
- BTO is the modulation king
- TFLN has potential



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## **Photonic Integrated Circuit Market (Materials)**



PIC Technology Market (Disaggregated by

- Hybrid SOI and III-V optical transceivers account for the majority of devices that use PIC technology.
- **TFLN's** superior performance for modulation will give it applications in 3.2T+ transceivers, either as a modulator with SiN/SOI or as a monolithic material
- Monolithic InP devices take a small proportion of the market, but the material suffers issues with losses in larger chips.
- **BTO** is set to have applications within Quantum systems, and beyond 2034, it may have applications in transceivers for ultra-high transmission speeds (6.4T+)
- **Polymer and Rare-Earth** PICs do not show significant advantages over TFLN for most applications



## **Summary**

- Transceivers for AI to be a significant area of growth for PICs
- New materials such as TFLN to offer opportunities for high-speed transceivers
- 5G, Quantum, LiDAR, and Sensors are all future growth markets
- CPO (and more) may significantly improve future transceiver speeds



All content in this presentation is sourced from IDTechEx's report 'Silicon Photonics and Photonic Integrated Circuits 2024-2034' available at: www.IDTechEx.com/PIC



Quantum Computing 2024



Advanced Semiconductor Packaging 2024



Co-Packaged Optics 2024 (Coming Fall 2024)



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Slide 13

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