Photonic Chip

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With the continuous development of integrated circuits, the traditional electronic integrated circuits in terms of bandwidth and energy consumption are gradually approaching the limit. With the continuous increase in the integration of electronic circuits, metal wires become increasingly thin, and the spacing between the wires is shrinking, which on the one hand makes the resistance of the wire and its ohmic loss is increasing, making the system energy consumption increase. On the other hand, it will cause the capacitance between the metal wires, causing the crosstalk between the wires to increase, affecting the chip's high-frequency performance.

While electronic integrated chips use current signals as the carrier of information, photonic chips use higher frequency light waves as the carrier of information. Compared to electronic integrated circuits or electrical interconnects, photonic integrated circuits with optical interconnects exhibit lower transmission loss, wider transmission bandwidth, smaller time delays, and greater immunity to electromagnetic interference. In addition, optical interconnects can increase the communication capacity within the transmission medium by using various multiplexing methods like wavelength division multiplexing WDM. Therefore, on-chip optical interconnects based on integrated optical circuits are considered promising technology to overcome the bottleneck problems associated with electronic transmission. Photonic chip is a chip design with highly matched optical computing architecture and artificial intelligence algorithms, which has the potential to be widely used in key artificial intelligence fields such as autonomous driving, security monitoring, voice recognition, image recognition, medical diagnosis, gaming, virtual reality, industrial IoT, enterprise-class servers and data centers.

The brain-like photonic chip can simulate the human brain's computing by carrying information through photons to process data under the neural network architecture of the simulated brain, enabling the chip to achieve high-speed parallel and low-power computing like the human brain. Photonic chip based on micro and nanophotonic integration combined with optical computing-based neural network data processing system is the key to coping with future low power consumption, high speed, wide bandwidth, and large data volume information processing capability.

High-speed data processing and transmission constitute the two pillars of modern computing systems, and photonic chips will provide an important connection platform for information and transmission and computing, which can significantly reduce the cost, complexity, and power loss required to connect information. With the continuous development of silicon-based photonics and semiconductor processing technologies, photonic and electronic hybrid integrated optoelectronic chips can further enhance device performance and reduce costs to meet the growing need for high-bandwidth interconnections.

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