Photonics21 Position on Chips Act 2.0 - Powering Europe's Future with Light

Europe's Moment: Photonics as a Foundational Asset

Across Europe, light is transforming the continent's technological foundations. From lasers in manufacturing to optical fibres carrying data, photonics has become one of the engines of Europe's digital and green transition. Once niche, it now underpins strategic sectors in communications, healthcare, mobility, and defence.

The Photonics21 Market Research Study 2024 shows global photonics revenues growing by 6.8 % annually (2019–2022) – over two times faster than global GDP. European photonics revenue was €124.6 billion in 2022, about 15 % of the world market, powered by over 5,000 SMEs. Even through crises, photonics has proven a resilient and ever-growing European strength.

Yet, leadership today does not guarantee leadership tomorrow. As competitors merge electronics and photonics into hybrid chips, Europe must act now.

The next technological leap – integrated photonics – may define control over AI, quantum, and secure communication infrastructures. The semiconductor race is no longer just about transistors per wafer but in addition about bandwidth, energy-efficiency, and computational power. Integrated photonics delivers all three.

This is Europe's decisive moment. To secure sovereignty and industrial growth, integrated photonics must be a cornerstone of Chips Act 2.0.

Why Integrated Photonics Matters for Europe's Strategic Capabilities

Integrated photonics forms the bridge between electrons and photons, unlocking unprecedented speed, energy efficiency, and data capacity. It is the technology that will enable Europe to lead the next wave of computing, connectivity, and intelligent systems.

Artificial Intelligence & High-Performance Computing

AI workloads are exploding, but traditional electrical interconnects are reaching their physical limits. Integrated photonics provides terabit-per-second data links with dramatically lower energy per bit, enabling co-packaged optics on semiconductor dies. It also powers optical neural networks and photonic accelerators capable of performing AI computations at enormously increased speed. If Europe wants to lead in AI infrastructure and advanced computing, integrated photonics must be part of the chips roadmap – not a separate domain.

Defence, Security & Sovereignty

Photonics lies at the heart of modern defence technologies: lidar, secure optical communications, quantum sensors, and directed-energy systems. Integrated photonic circuits combine miniaturisation, ruggedness, and power-efficient operation, making them ideal for aeronautic, space, and autonomous systems. A resilient European defence and security ecosystem depends on sovereign capabilities in integrated photonics design, fabrication, and packaging.

Quantum & Secure Communications

Quantum photonic circuits are the foundation of some the most promising quantum computing, encryption, and networking solutions. Integration provides the compactness, stability, and reproducibility needed for large-scale deployment – and enables hybrid systems linking quantum and classical electronics. Europe's scientific lead in quantum technologies must be matched by world-leading development in photonic integration.

Sensing, Imaging & Autonomous Systems

From lidar for vehicles to spectroscopic sensors for healthcare and environment, integrated photonics enables smart, energy-efficient sensors with small form factors and low cost. These markets align directly with Europe's industrial strengths in automotive, manufacturing, and medical technology.

Key Recommendations for Chips Act 2.0

The Chips Act 2.0 arrives at a decisive inflection point for photonics and Europe's technology sovereignty. Key recommendations include:

A. Create a Photonics Integration Pillar in the Chips JU 2.0

- Establish a dedicated Integrated Photonics & Co-Integration vertical within the Chips JU 2.0.
- Fund design, foundry, packaging, testing, and hybrid photonic-electronic integration as core priorities.
- Include measurable SRIA targets: optical-channel density, energy per bit, and packaging yield.
- Support system-level Grand Challenge Projects combining photonics and electronics for strategic impact.

B. Build industry-driven Pilot Lines & Foundry Capacity

- Invest in 200 mm and 300 mm industrially driven photonic pilot lines, leveraging microelectronic and CMOS production technology.
- Use IPCEI and EC co-funding mechanisms to crowd-in private capital and accelerate investment in production ecosystems.
- Support for photonics industry to exploit and closely collaborate with Chips JU pilot lines.

C. Strengthen Supply-Chain Security

- Integrate photonics into Europe's technology monitoring frameworks (Chips Act Pillar 3).
- Establish crisis-response mechanisms and reserves for critical photonic components.

D. Ensure Governance & Stakeholder Inclusion

- Give Photonics21 a formal representation on the Chips JU Private Members Board (PMB) to represent the photonics industry.
- Include photonics experts in ECS drafting, evaluation, and project monitoring.
- Align Photonics21 roadmaps and Grand Challenge priorities with the Chips JU work programme to ensure coherence and synergy.

Photonics21 has mapped a portfolio of Grand Challenge Projects – concrete, pan-European initiatives ready for rapid deployment – such as "Lightspeed AI: Powering Europe's Next-Generation AI Infrastructure with Light", "Directed Energy Effectors and Photonic Integrated Circuits for Defence: Innovations for Sovereignty" or "Personalised Optical Digital Twin: Photonic Health Monitoring for Europe's Preventive and Precision Medicine". These projects are candidates for full or partial implementation through the Chips JU 2.0 initiative. They demonstrate how integrated photonics can strengthen Europe's competitiveness and strategic autonomy, provide a clear implementation blueprint, and should be tightly aligned with Chips JU 2.0 funding and policy instruments.