Briefings

LIONIX INTERNATIONAL

Multi Project Wafer Runs Overview manual

Introduction.

To enable you a low cost and easy access to our photonic integrated circuit technology, we offer regular scheduled Multi Project Wafer (MPW) runs in the TriPleX™ technology. This Photonic Integration platform is suitable for components for telecom/datacom in the infrared (1550nm) region, as well as in life science applications in the visible range (400 700nm).

This manual helps you understand the different offers and options. It will answer questions like:

- **Is an MPW the preferred route for me?**
- **Which MPW do I need to choice**
- **What assembly options are there**

To MPW or not to MPW?

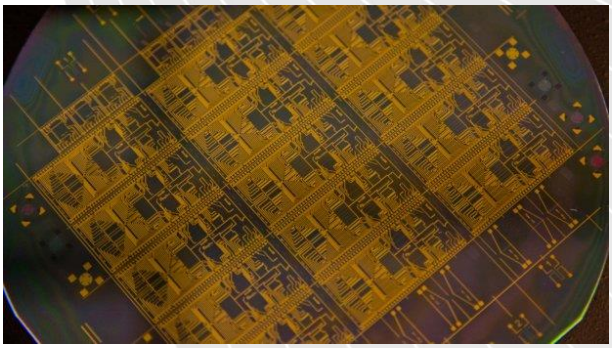
We offer photonic integrated modules based on silicon-nitride Photonic IC in a vertically integrated fashion. This means that if you have a product idea, in which you want to use the advantages of photonic integration, we can support you both in the (product) design, manufacturing of the IC and the assembly and packaging into the module for your product. In this route we offer dedicated manufacturing runs where we can optimize our technology for use in your application.

So where does the MPW come in?

The MPW is a great fit when you:

- Have an idea in research phase
- Are exploring integrated photonics' possibilities
- Just need a few chips for your design
- Are choosing what technology fits your application
- Are looking for lowest entry costs

Our offer you the MPW include a set of standard and validated building block, easily accessible via a software tool. So you can start designing your chip rapidly and bring your idea to live in a photonic IC.



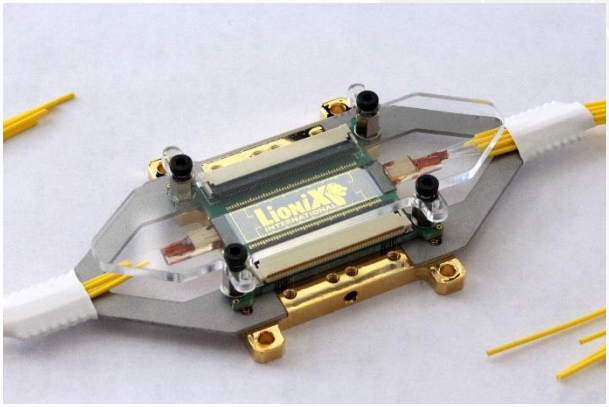
Multi Project Wafer

In addition to the PIC manufacturing we provide the following services enabling you for an easy access to the state-of-the-art photonic technology:

- Training on design tools
- Special offer for simulation tools and mask layout software
- Design kit
- Design support

In addition we offer post processing upon request:

- Etching trenches for fluidic applications
- Etching trenches next to waveguides for heat localization
- Packaging (in particular fiber chip coupling)
- Glass bonding and fluidic connection
- Polishing

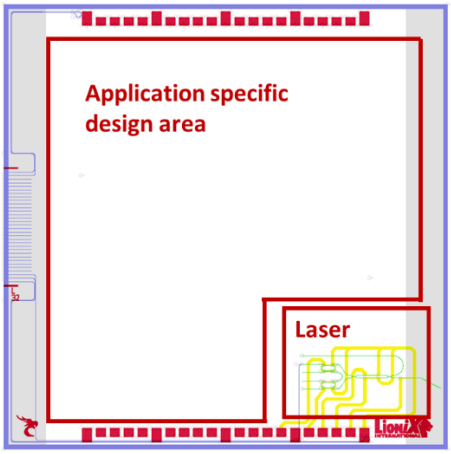


MPW Technology – 1550 nm

The TriPleX™ waveguides offered within the infrared MPW are designed for single polarization (TE) applications to operate at the telecom wavelength (1.55 µm). The waveguide however is also transparent for lower wavelengths. The TriPleX™ technology has applications from 405nm to 2.35µm. In addition, these waveguides show a low propagation loss (< 0.5 dB/cm @ 1.55µm). The high contrast waveguide allows bend radii of 125 micron, which makes large scale integration (VLSI) on chip possible. The coupling to and from a fiber from this high contrast waveguide is optimized by the addition of spot size converters , which expand the mode profile to the size of a standard telecom fiber, allowing low loss fiber chip coupling.

PDK and building blocks

The MPW offering includes a process design kit (PDK) containing validated and specified building blocks. This building blocks are a good start to a design and allow the user to create many new functionalities.



Tunable laser building block

Now our MPW offering has been extended with a tunable laser building block. The building block provides the user with a narrow linewidth source with specifications given in the table below. As with all other building blocks offered in our PDK, it allows the user to easily connect the items together and create a customized or application specific design.

	Wavelength tuning range	On-chip power	Linewidth
Tunable laser building block	C-band	>1 mW	< 100 kHz

Hybrid assembly

By offering the tunable laser building block, the MPW user can get access not only to our well known low-loss waveguide platform TriPleX™. Also our unique hybrid assembly method of attaching InP gain section to our PICs become now easily available for designers using the PDK.

MPW Technology – Visible

For the visible (400-700 nm) the MPW is offered through an EU H2020 funded pilot-line project called *PiX4life*. This project will mature a state of the art silicon nitride (SiN) photonics pilot line for life science applications in the visible range and pave the way to make it accessible as an enabler for product development by a broad range of industrial customers. See *www.pix4life.eu* for more information including the planning.

MPW participation process

If you want to participate on one of the MPWs, please follow the guidelines on our website to secure your spot.

TriPleX technology overview

In the last years the proprietary TriPleX™ waveguide technology of LioniX International has matured and has become one of the three main integrated optical platforms (next to InP and SOI). TriPleX™ structures are realized with CMOS compatible fabrication equipment and the materials used are based on chemical endproducts of LPCVD processes, resulting in very reproducible material properties, allowing design by geometry. The basic concept of a TriPleX™ waveguide consists of a multilayer stack of stochiometric silicon nitride and silicon oxide. These materials have an opposite stress when deposited on a silicon wafer, in which nitride is tensile and oxide is compressive, and stacking them in a multilayer results in a macroscopically low stress layer stack.

Specifications MPW NIR

The TriPleX™ waveguides offered within the MPW Nir are designed to operate at the telecom wavelength (1.55 µm) with a high modal birefringence. In addition, these waveguides show a low propagation loss. The waveguide geometry is chosen such that compact structures can be realized using a moderately-high index contrast furthermore the coupling to and from commercially available optical fibers is optimized by the integration of spot size converters.

Our chips drive your business

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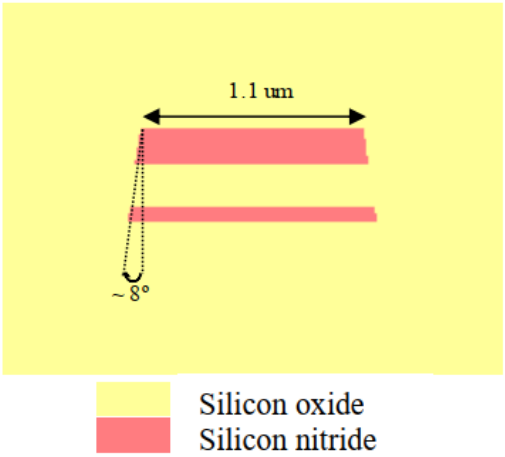

The waveguides consist of a “double-stripe” shown in TriPleX™ BB using layers of Si3N4 with a high refractive index. Furthermore, the cladding and core region consist of SiO2. The complete waveguide is realized on 100 mm silicon wafers with 8 µm thermal oxide. By tuning the aspect ratio of the box-shape the birefringence can be tailored and minimized.
The optical indices of the single-mode TriPleX™ waveguides are summarized in the following table for TE polarization only. TM polarization can also propagate but with much larger propagation loss and bending loss and is therefore not supported:

Optical Property @ λ = 1.55 µm	**TE_{00}**
Effective index of the mode	1.530 ± 0.005
Group index of the mode (indication)	~ 1.77
Channel birefringence of a straight waveguide	> 10^{-2}
Straight waveguide loss	≤ 0.5 dB/cm

Table 1. Effective indices of TriPleXTM ADS waveguide. Specs are given at a wavelength of 1.55 µm and a waveguide width of 1.1 µm.

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