



**OPTOSCRIBE**

Pioneering 3D photonic integrated circuits

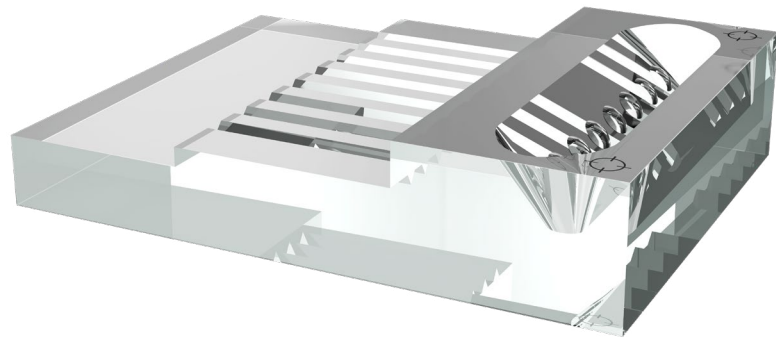
A NOVEL SOLUTION  
FOR FIBER-TO-SIPH  
COUPLING

[www.optoscribe.com](http://www.optoscribe.com)

A perfect storm of factors is driving data center operators and transceiver manufacturers to search for novel solutions that can address fiber-to-SiPh chip coupling challenges.

Today, transceivers using silicon photonics are already enabling data rates of up to 800G and the transceiver market is expected to increase significantly to ~24 million units per annum by 2025. However, fiber-to-SiPh Photonic Integrated Circuit (PIC) coupling challenges remain and need to be overcome to enable high-volume automated assembly, and to drive down costs.

The ultimate aim of silicon photonics (SiPh) has always been to leverage tried-and-tested silicon semiconductor processes in photonics to drive down costs while improving performance and achieving high volume, automated assembly.



*Figure 1: OptoCplrLT™ before fiber assembly*

### Fiber to the chip

One of the key challenges with SiPh is efficient, low-loss coupling of optical fiber to the PIC waveguides.

Fiber coupling solutions come in two forms: 'edge' coupling and 'vertical' coupling (i.e. in-plane and out-of-plane), each with their own merits. Within vertical coupling solutions, typically a grating coupler is used to couple light between the SiPh PIC and the optical fibers. However, because the grating coupler emits light perpendicular to the chip surface and there is little space inside the transceiver module, tight light bending is required for coupling.

At present, the most common way to address this challenge is to use special bend-tolerant fiber. Expensive, challenging and laborious to assemble, bent fiber assemblies have some significant limitations, particularly in the size and profile of the assembled part, determined by the minimum bend radius achievable by the fiber whilst maintaining low losses.

## Monolithic glass alternative

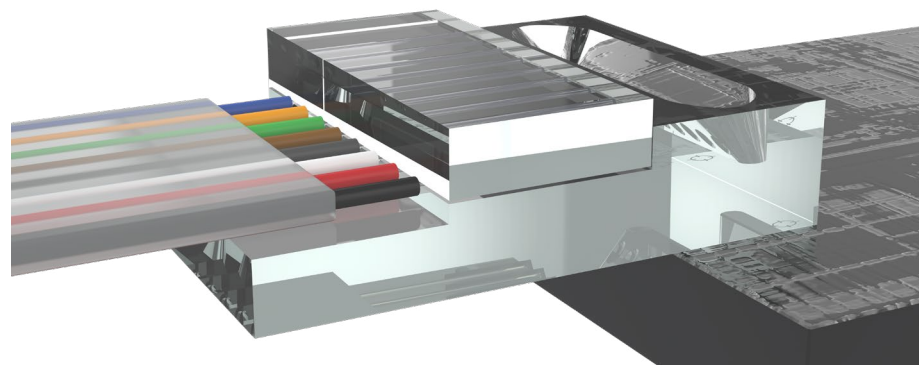
Optoscribe has an attractive alternative solution. Using a proprietary high-speed laser inscription technique, the company has produced a monolithic glass chip – OptoCplrLT™ – for low-loss coupling to SiPh grating couplers. To direct the light to or from the SiPh grating couplers, instead of using bent fiber arrays, Optoscribe's solution uses low-loss light turning curved mirrors, embedded in the glass, which simultaneously redirects and focuses the light for optimal coupling to and from the PIC grating couplers.

## Meeting industry needs

Another urgent challenge OptoCplrLT™ addresses is the footprint of the coupling device. As fiber count relentlessly increases, space inside optical transceivers is becoming a valuable commodity. Therefore, greater emphasis is being placed on compact coupling solutions. Being a low-profile interface by design – ~1 mm device height and ~1.5 mm with cap – OptoCplrLT™ allows compact interface layouts that alleviate packaging constraints.

What is more, Optoscribe's solution is compatible with industry standard materials and processes. For example, the glass chip has a coefficient of thermal expansion matched to the silicon chip, thereby minimizing loss/performance issues. Process wise, high volume methods for populating the flat fiber V-groove array enables well understood, qualified supply chains to be used.

Given SiPh transceiver packaging and integration are two of the biggest hurdles in developing more advanced commercial products, OptoCplrLT™ is a welcome new technology that can help transceiver manufacturers and data center operators meet the market's cost, performance and volume demands.



**Figure 2:** OptoCplrLT™ with fiber assembly, coupling to SiPh grating couplers

## About Optoscribe Ltd

Optoscribe designs and manufactures 3D glass-based optical components for the telecommunications and data communications markets. Using its innovative laser direct-write technology, Optoscribe's bespoke solutions address market challenges such as bandwidth, speed, density and channel count.

Optoscribe's product portfolio includes precision fiber alignment arrays, fiber-to-fiber interconnects, multicore fiber fanouts, photonic lanterns, transceiver photonic integration platforms, SiPh coupling solutions, and Optical Sub-Assemblies.

For more information, visit: [www.optoscribe.com](http://www.optoscribe.com)



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