



**OPTOSCRIBE**

Pioneering 3D photonic integrated circuits

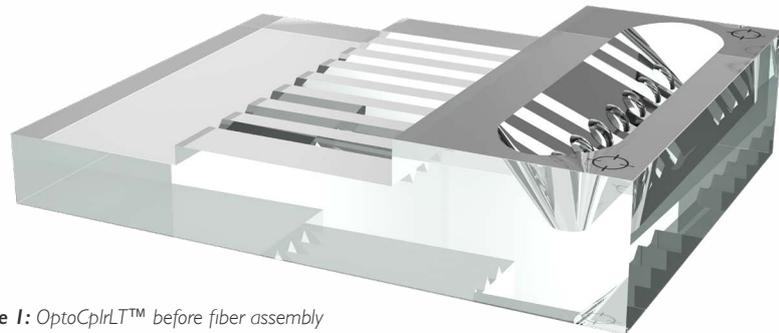
# A NOVEL SOLUTION FOR FIBER-TO-SiPh COUPLING

[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.

Transceivers using silicon photonics are already enabling 100G and 400G today, 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

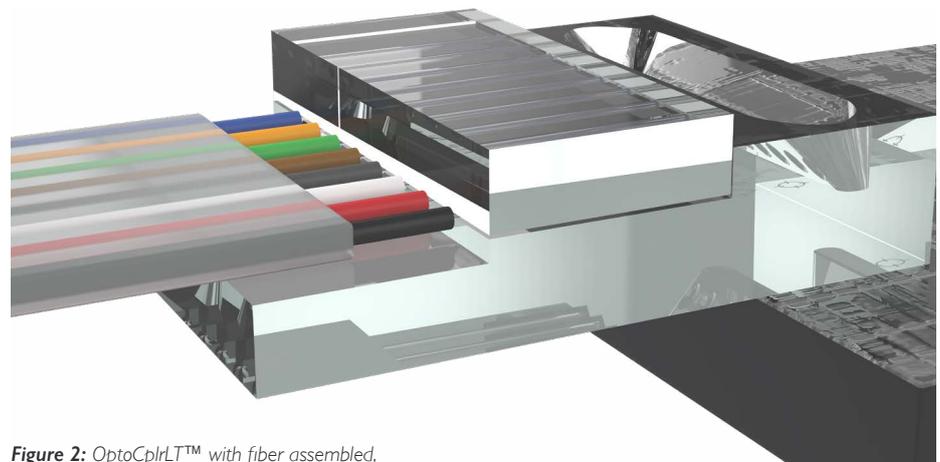
fiber arrays, Optoscribe's solution uses low-loss light turning curved mirrors, embedded in the glass, which simultaneously redirects and focuses the light for optimal coupling to and from the PIC grating couplers.

## 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 – less than 2 mm height – 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 minimising loss/performance issues.

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 assembled, coupling to SiPh grating couplers

## About Optoscribe Ltd

Formed in 2010, Optoscribe uses its innovative laser direct write technology to manufacture glass-based photonic components primarily for the telecommunications and data communications markets. Optoscribe's technology allows for 3D waveguide formation and 3D laser induced selective etching with unprecedented design freedom.

Optoscribe's Precision Fiber Alignment Structures (OptoArray™) and SiPh Advanced Coupling Solutions (OptoCplr™) are capable of solving many of the challenges with the drive for high density optical connections.

The company is located in Livingston, UK, where it has a state-of-the-art manufacturing facility.



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