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# Packaging

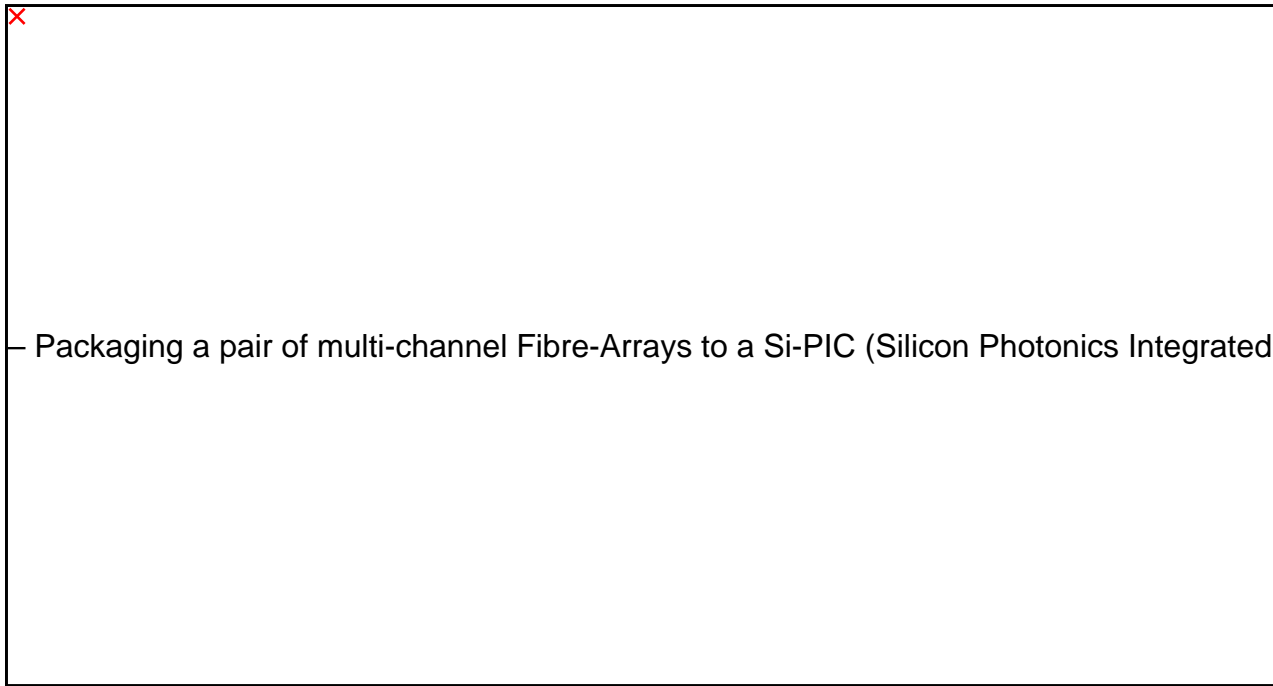


Photographs from the Photonic Packaging Lab at the Tyndall National Institute

The Photonics Packaging and Integration Group is led by Peter O'Brien. The group was established in 2009, has 15 fulltime researchers and 2 PhD students. The group has grown rapidly and formed a large number of international collaborations with both industry and academia, and is recognized for its ability to convert research results generated in the laboratory to commercialization. The group has also formed collaborations with numerous Photonic Integrated Circuit (PIC) initiatives in Europe and the US, including ePIXfab, Europractice and JePPIX, where they support advanced assembly and packaging requirements for users of these MPW services. They have also prepared the world's first set of packaging design rules and collaborated with Phoenix and Luceda Photonics to incorporate these into their software design kits.

The group has established an impressive range of packaging capabilities including; fiber optical packaging

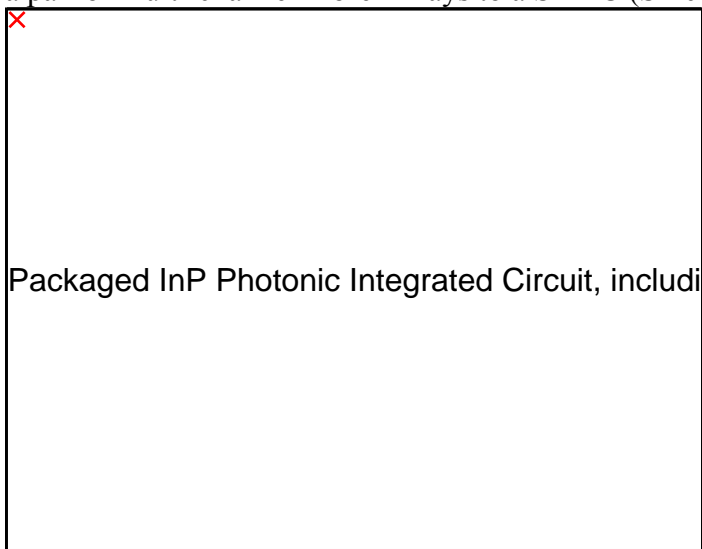
(Newport auto align & Nanosystec laser welder), micro optical assembly (Nanosytec nano-glue), semi- and fully-automatic flip- chip bonding with submicron precision (2 Finetech and new system approved for purchase with €1M budget), micro solder deposition using jetting technology (Pactech), ball and ribbon wire-bonding (3 systems), polymer embossing system (Jenaoptik), x-ray microscope inspection (Nordson), ultrasonic microscope (Sonoscan), environmental test chambers (multiple Heraeus systems), and wide range of optical and electron microscope systems for package analysis. These capabilities are supported by advanced design, including; optical (Lumerical and Zemax), electrical (HFSS and ADS), thermal (ANSYS and Comsol) and mechanical design (Solidworks). These capabilities have enabled the group to delivery full packaging solutions to many companies and academic researchers. Critically, the group supports multiple industrial sectors, with particularly strong collaborations in the areas of communications, medical devices and sensors.



– Packaging a pair of multi-channel Fibre-Arrays to a Si-PIC (Silicon Photonics Integrated

Circuit) Packaging

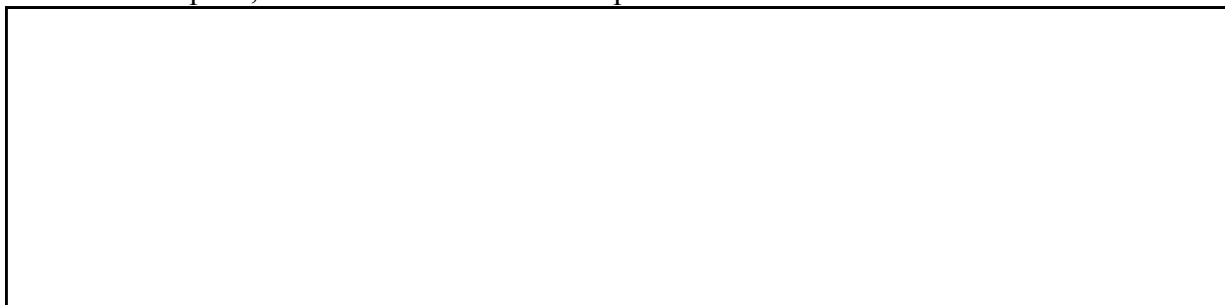
a pair of multi-channel Fibre-Arrays to a Si-PIC (Silicon Photonics Integrated Circuit)

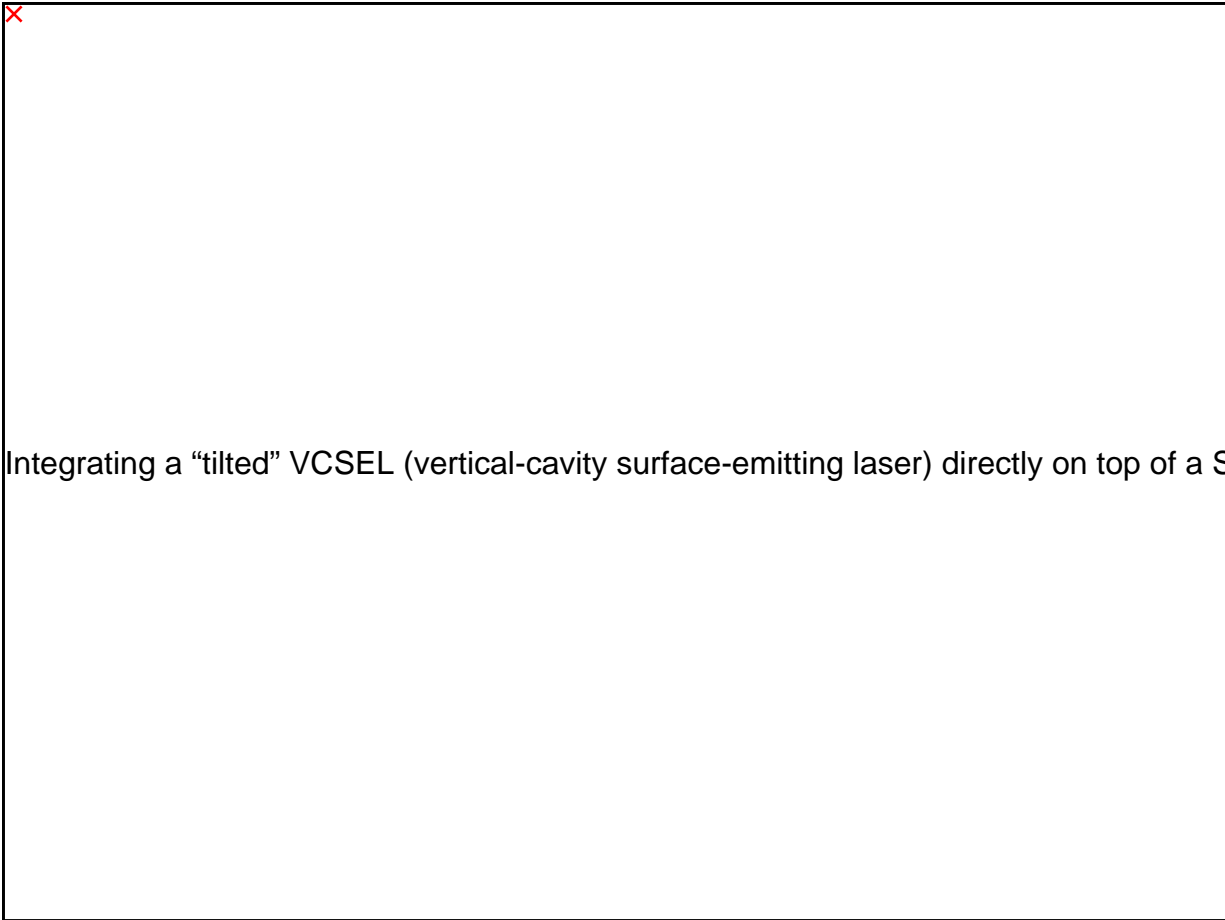


Packaged InP Photonic Integrated Circuit, includi

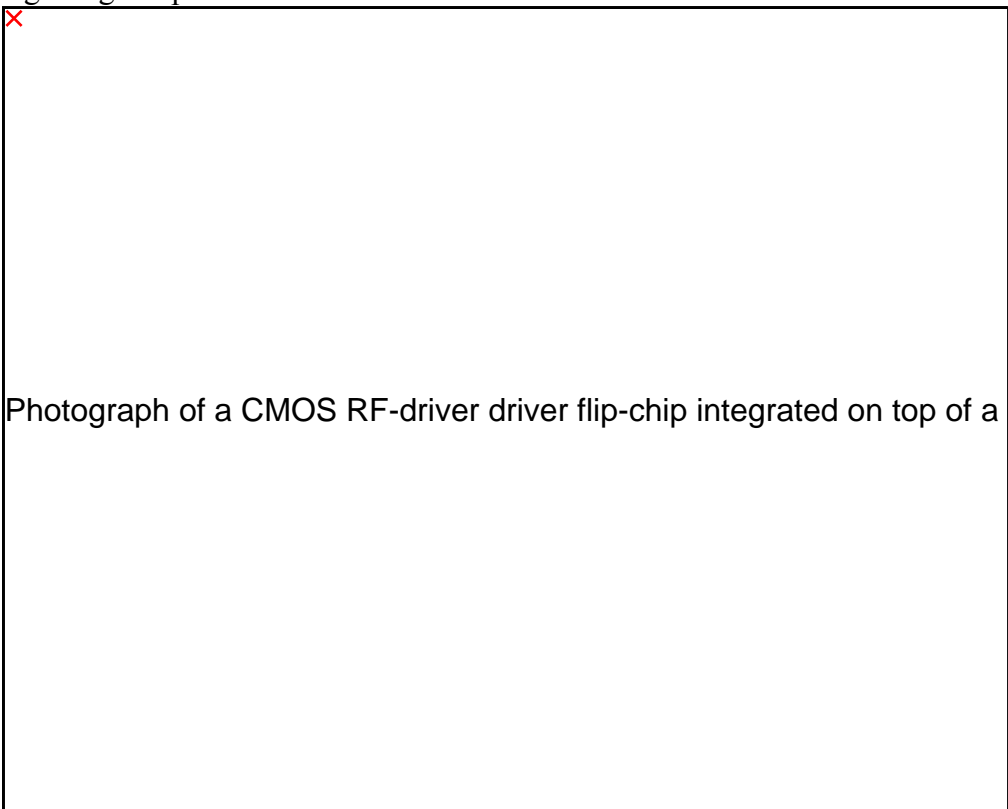
Packaged InP Photonic Integrated Circuit, including

welded fiber optics, control electronics and temperature controller





Integrating a “tilted” VCSEL (vertical-cavity surface-emitting laser) directly on top of a Si-PIC, for low-loss insertion into a grating-coupler structure



Photograph of a CMOS RF-driver driver flip-chip integrated on top of a Si-PIC, and wire-bonded to a PCB with SMT front-end electronics.

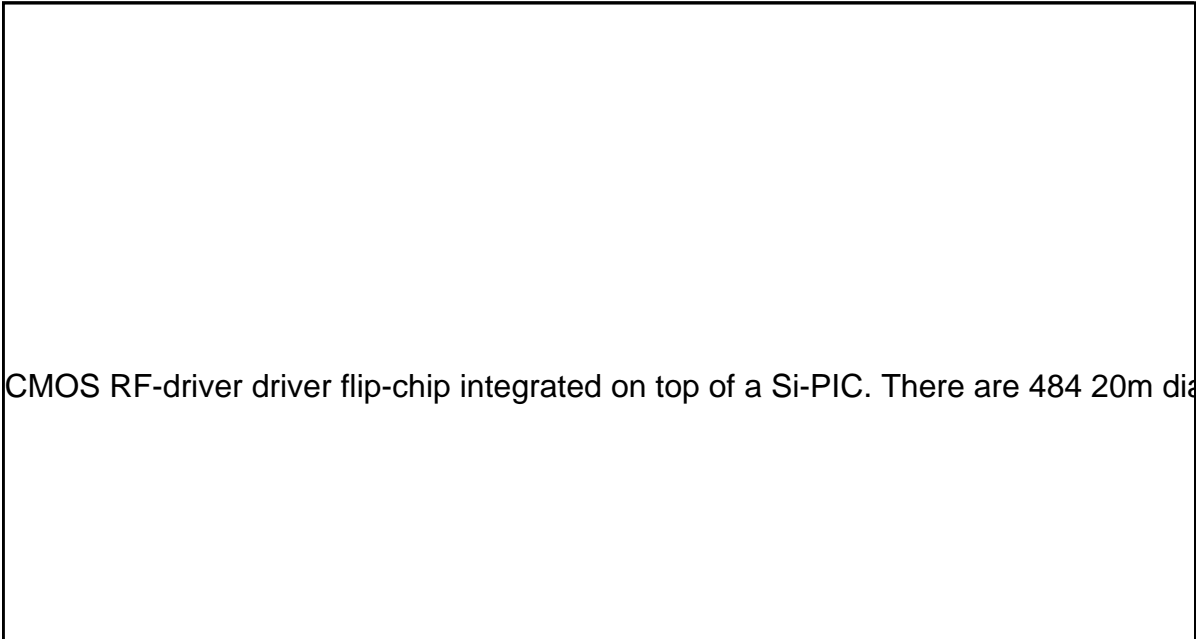
Photograph of a CMOS RF-driver driver flip-chip integrated on top of a Si-PIC, and wire-bonded to a PCB with SMT front-end electronics.



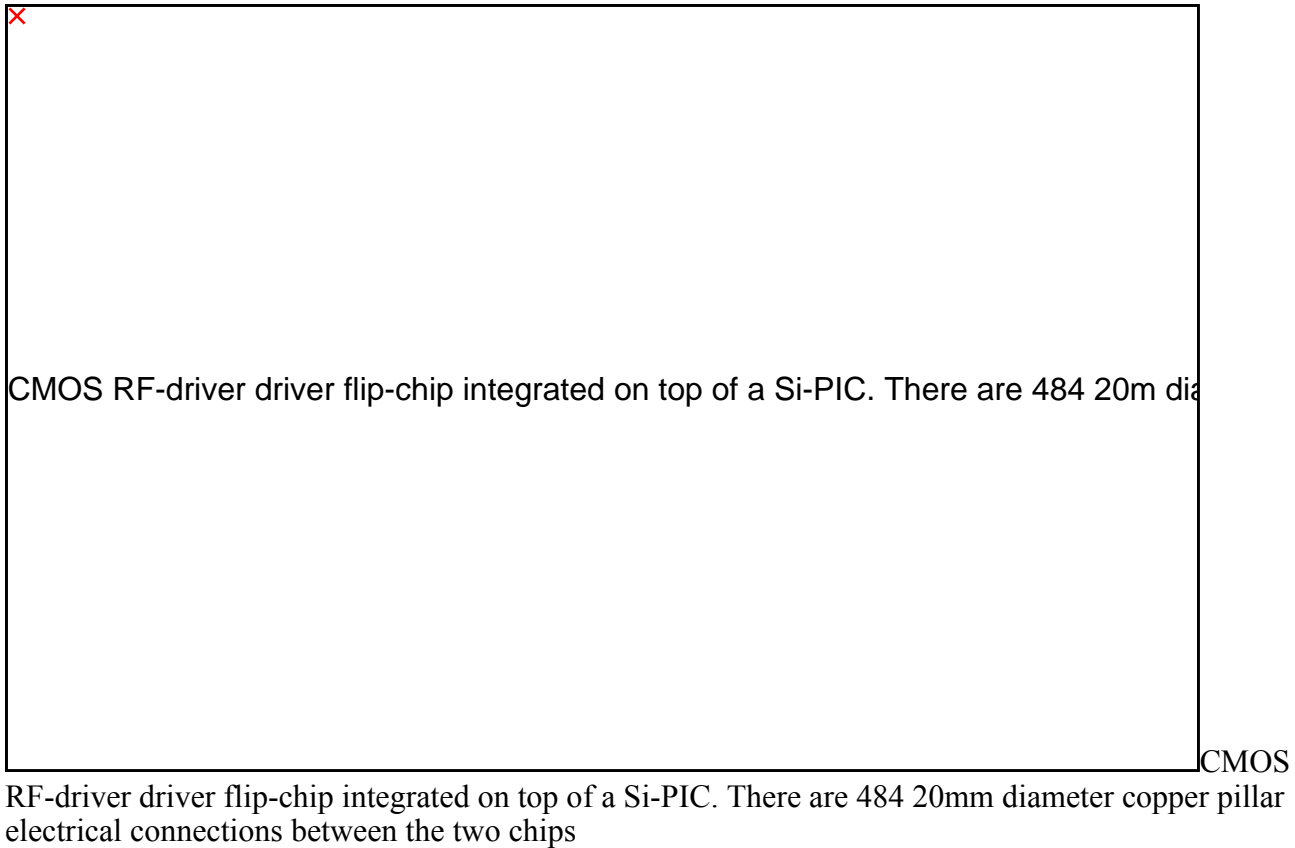


Optical and Thermal image of fully-packaged ONU (optical network unit) for a NG-

Optical and Thermal image of fully-packaged ONU (optical network unit) for a NG-PON (next generation passive optical network), showing the elevated temperature of the Si-PIC and flip-chip integrated RF-driver during operation



CMOS RF-driver driver flip-chip integrated on top of a Si-PIC. There are 484 20m dia



[The IPIC Team - Peter O'Brien](#) from [Standpoint Media](#) on [Vimeo](#).

## Contact

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## Related Publications

- [Meeting the Electrical, Optical, and Thermal Design Challenges of Photonic-Packaging](#)  
**IEEE Journal of Selected Topics in Quantum Electronics** volume **22** issue **6** pages **409 to 417**  
(2016)  
Authors: Jun Su Lee, Lee Carroll, Carmelo Scarcella, Nicola Pavarelli, Sylvie Menezo, Stephane Bernabe, Enrico Temporiti, Peter O'Brien
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- [Packaging of Silicon Photonic Devices](#)

**Topics in Applied Physics** pages **217 to 236** (2016)

Authors: Peter O'Brien, Lee Carrol, Cormac Eason, Jun Su Lee

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- [Flip-chip integration of tilted VCSELs onto a silicon photonic integrated circuit](#)

**Optics Express** volume **24** issue **15** page **16258** (2016)

Authors: Huihui Lu, Jun Su Lee, Yan Zhao, Carmelo Scarcella, Paolo Cardile, Aidan Daly, Markus Ortsiefer, Lee Carroll, Peter O'Brien

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- [Hybrid Integration of the Wavelength-Tunable Laser With a Silicon Photonic Integrated Circuit](#)

**Journal of Lightwave Technology** volume **31** issue **24** pages **3934 to 3942** (2013)

Authors: Bradley Snyder, Brian Corbett, Peter O'Brien