



Singlemode Technology



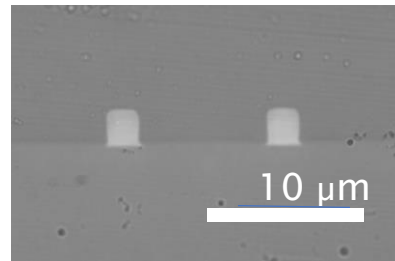
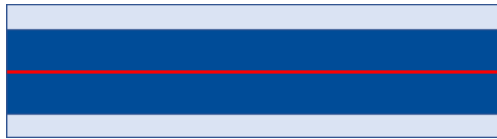
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Singlemode Technology:

Polymer Waveguides

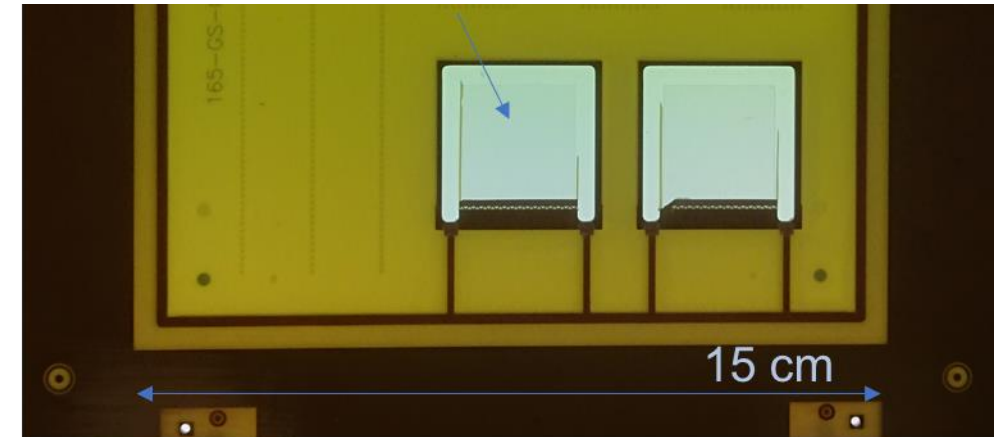
Singlemode



Core dimensions: 3 – 5 μm

- mature & robust technology
- highly customizable & versatile
- functional structures (interferometers etc)
- advanced packaging solution (PICs)

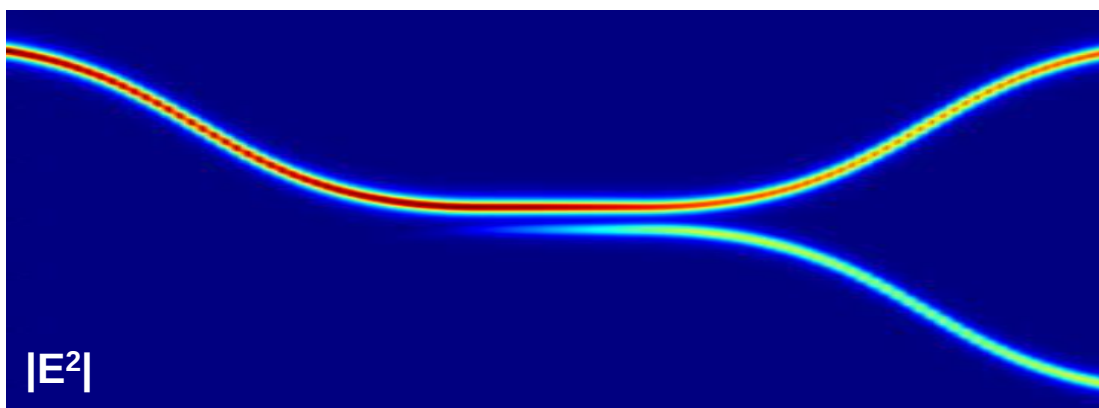
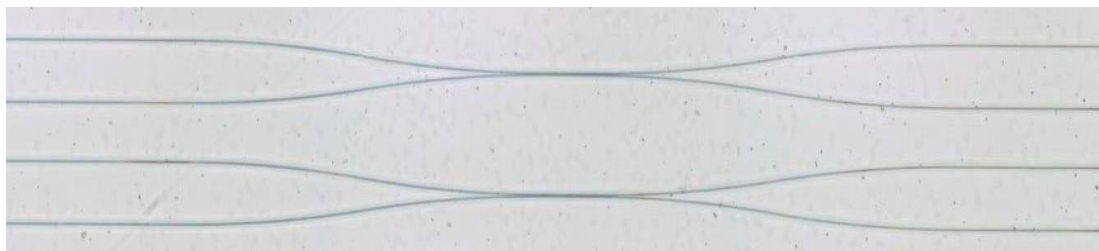
Glass Waveguides



- Low loss
- Larger dimensions

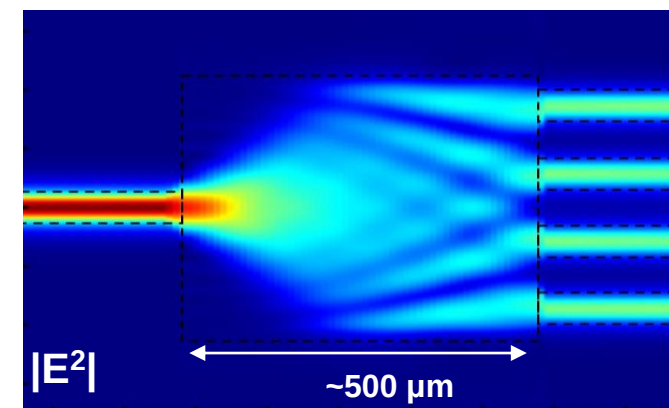
Singlemode Waveguides – Passive Devices

2x2 Directional Couplers (850 / 1310 / 1550 nm)



- Splitting or combining light – Interferometry!

Multimode Interference Couplers (MMIs) 1to3 / 1to4 / 1to5 Splitters



- Very compact 1xn splitter
- Reduced back-reflections
- Insertion loss 0.2 dB
- Channel uniformity 0.1 dB

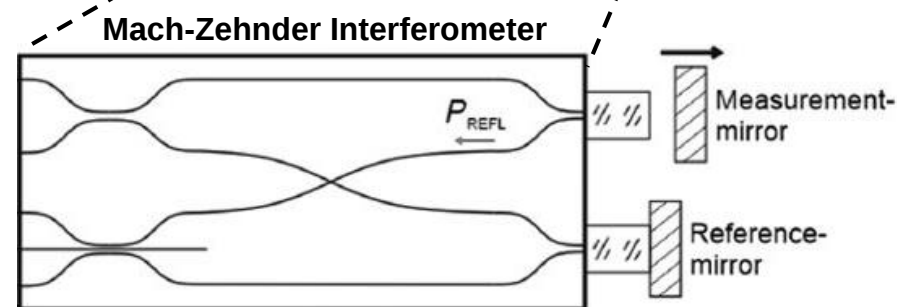
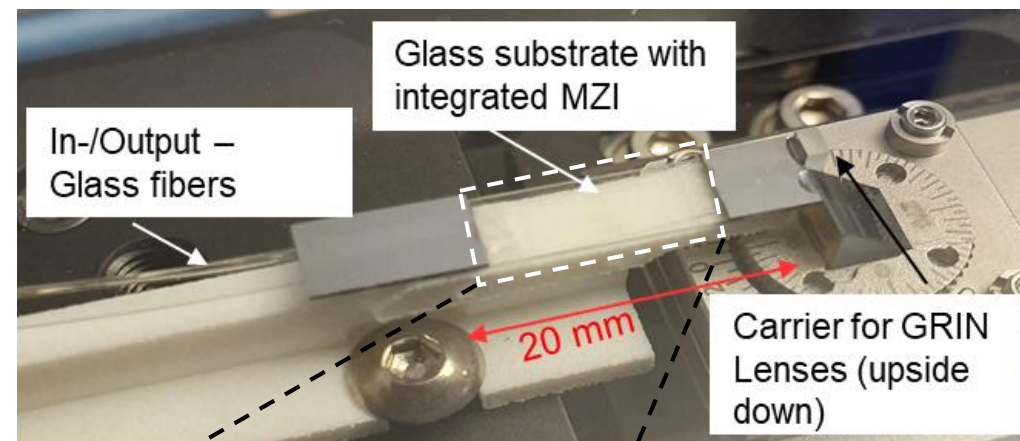
Singlemode Applications: Compact & integrated Sensors

On-chip Interferometry

Type	Wavelength	Description
MMI	1550/1310 nm	1x2, 1x4, 1x5,...
DC 2x2	850/1310/1550 nm	50:50 or other ratio
Y-Couplers	850/1310/1550 nm	low loss

- Very compact n x m splitters & combiners
- Compact & versatile sensor unit
- (LiDAR, Gas- / Fibersensing)
- **On-chip interferometry!**

Integrated interferometric sensor unit:



J. Kremmel, N. Cramer, T. Lamprecht & M. Michler, "Passive aligned assembly of an integrated optical displacement sensor based on a reflective Mach-Zehnder interferometer with a 3×3 directional coupler," Opt. Eng. 57(8), 2018

Singlemode Applications: EOCB Integration Platform for PICs with combined on-board electrical & optical Interface

Optical Fan-out

Customizable design

- Multiple parallel channels
- Fan-outs to e.g. fiber-array
- Robust singlemode waveguides
- High-power operation (> 50 mW per channel)

Optical Interface

Adiabatic coupling:

- Insertion loss < 1 dB
- Relaxed assembly
- tolerances ($\pm 2 \mu\text{m}$)

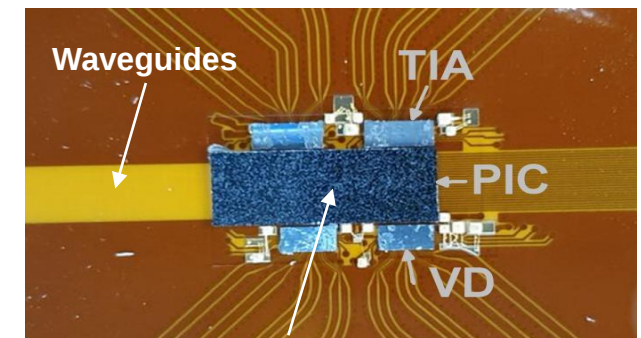
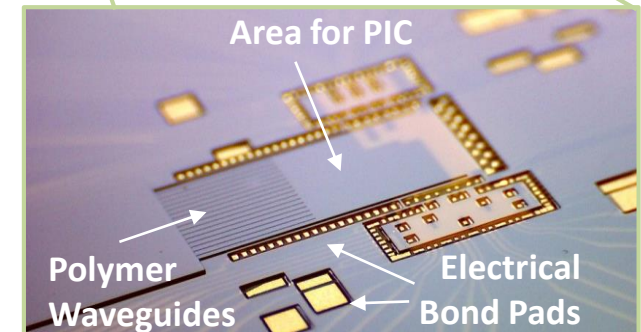
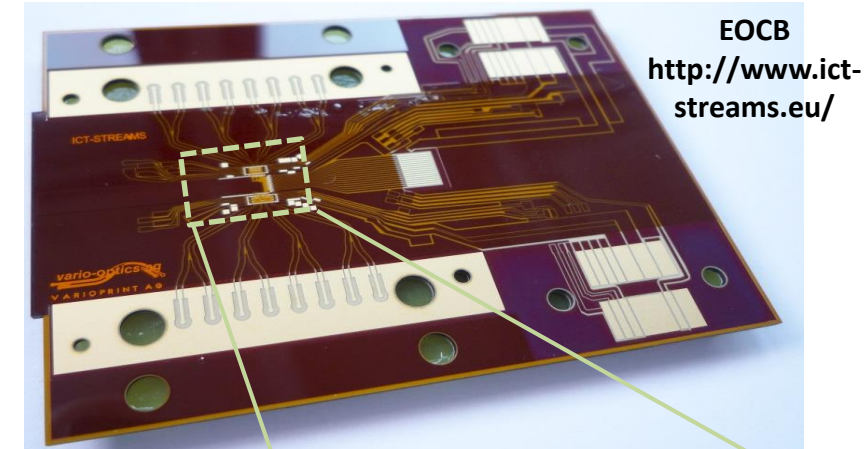
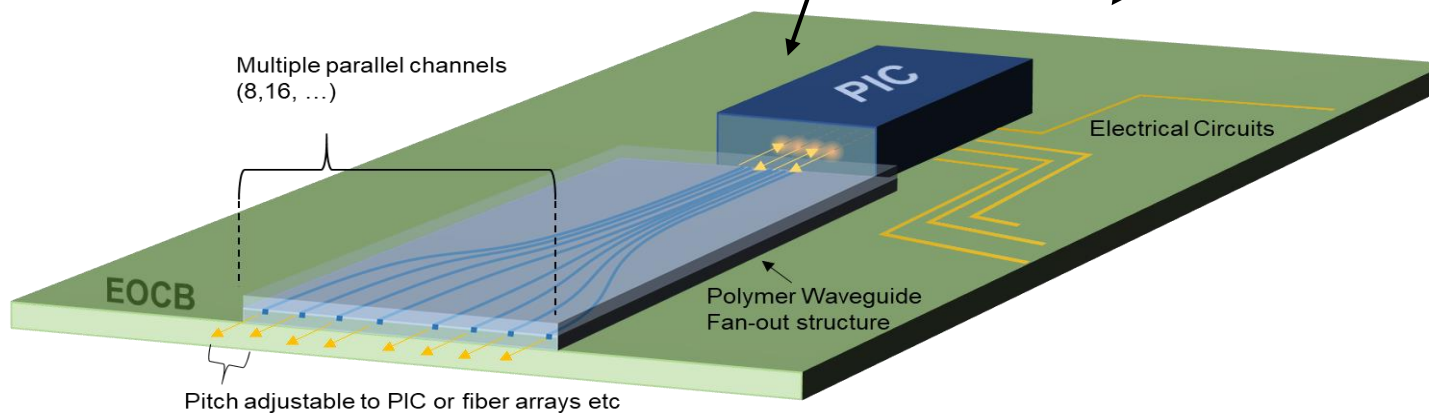
edge-coupling:

- MFD adjusted to PIC

EOCB

High-planarity; bond pads for flip-chip bonding

High-frequency electrical signal interface



Flip-chip bonded PIC



The Future is
Bright !

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