



World Class Supplier of Leading Edge
Electro-Optical Circuit Boards

Highly Integrated Optics and Electronics for
Sensing and Communication Applications



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Agenda

- vario-optics
- Electro-Optical Circuit Board (EOCB) in a nutshell
- Optical Communication
- Sensing Applications
- Summary & Interaction

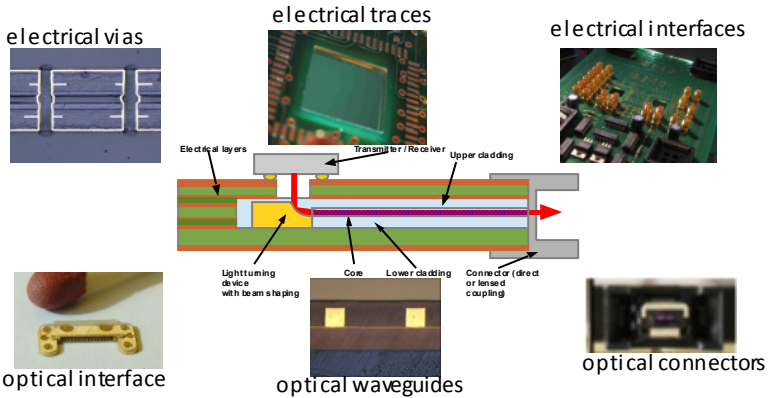
vario-optics ag

- Young SME based in Switzerland
- Unique technology solution for high-density integration of optics and electronics
- Fabrication and development
- EOCB: Electro-optical circuit board
 - Combining optical and electrical interconnects on a single board
 - Miniaturization and simplified assembly
 - Performance improvements

Agenda

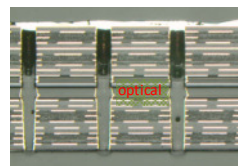
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EOCB Concept



Performance and Reliability

- Optical layer integrated into PCB (20+1)
- Large format manufacturing 305x460mm²
- Conventional (reflow) assembly process
- Polymer or glass optical waveguide layers
 - UV-curing of polymers by lithography or laser imaging
 - Ion-diffused glass singlemode waveguides for long-wavelengths
- Insertion loss down to 0.05 dB/cm (λ -dependence)
- Polymers and Glass to withstand 85°C/85%r.H. >2000h



cross-section EOCB:
20x electrical & 1x optical

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Communication Application

- Co-packaged optics: high-performance computing, routing, switching

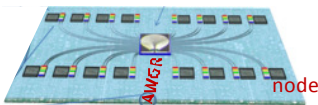


Illustration of multi-socket board with PIC's direct on EOCB
(www.ict-streams.eu; Alexoudi et. al, J. Lightwave Technol., JLT 37)

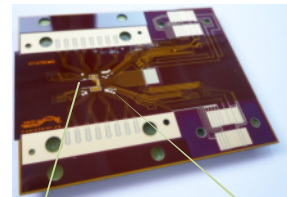
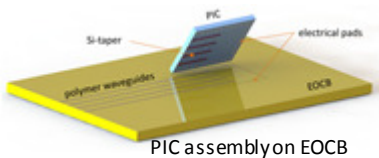


EOCB (420mm wide) with 20 electrical layers and 1 optical layer embedded

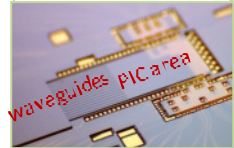
- Optical communication (WDM) on multi-socket boards
- low latency & low energy
- High level of integration
- Multi Tb/s on board communication
- Mid-board optical engines (Finisar)
- Multimode (850nm) waveguides
- Automated reflow assembly

EOCB as Host for PICs

- Photonic chip on board assembly
- EOCB as host platform
 - Optical polymer waveguides
 - High frequency electrical
 - PIC (Photonic chip) direct attach



www.ict-streams.eu



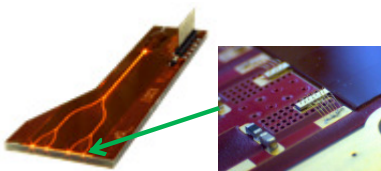
EOCB ready for adiabatic PIC direct attach (Lamprecht et. al., ECTC2018)

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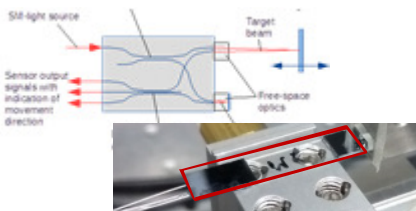
Sensing Applications

- Simplified assembly: miniaturized and cost-efficient sensor systems
- Laser source for medical application (brain trauma)
- Laser-diode direct attach
- 4 λ (NIR) mixer ($\geq 45\%$ efficiency)
- Integrated optical titration sensor
 - pH-value of a solution
- Spectral absorption



Sensing Applications

- Displacement sensor
 - high sensitivity ($\sim 1\text{nm}$) and compact
- Passively aligned fibers and lenses
 - V-groove device for mech. positioning
- Insensitive to temperature and vibration
- Integrated thermo-optical switch (embedded heater)
- low power dissipation
- High extinction ratio



TO-switch EOCS with needle probe

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EOCBs Provide ...

- High-level of integration
- High-data rate densities
- Miniaturized systems
- Novel functionality for PCB
- Novel and efficient packaging approaches

Interaction

- Offer: Approach for novel and creative solutions
 - Miniaturized optical systems
 - Replace electrical solutions with optical solutions

- Need: Advanced manufacturing and test equipment
Partners with adjacent technologies

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