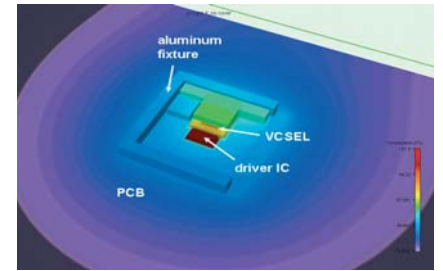


## TADDI – Temperature-Aware Design for Driver Integration

### Temperature Analysis of Optoelectronic Transmitter Modules.



#### Motivation

Thermal issues in the design of optoelectronic transmitter packages are becoming critical due to higher operation speed (up to 10 Gb/s per channel) and thus higher power dissipation, more compact assemblies and harsh environment application areas. In this project, a methodology for temperature-aware transmitter package design is developed. Using this approach, design guidelines for integration of driver IC's into packages are derived and a new driver IC for flip-chip assembly onto a silicon bench is designed.

#### Description

Thermal analyses of multichannel optoelectronic transmitter modules have been investigated. In a first step, thermal simulations of assemblies combining VCSELs (Vertical Cavity Surface Emitting Lasers) and driver ICs (Integrated Circuits) were validated with temperature measurements. Studying different designs, the contribution of separate parts of the module to heat removal have been quantified.

#### Results

As expected, the continuous metallic midlayer of the board and the through vias underneath the IC as the principal heat conductors remove the heat substantially. When through vias were omitted the junctions of the IC reached temperatures far beyond 100°C for operation at room temperature. It also has been found, that heat removal of a flip chip design with underfill is equally efficient as for a wire bonded chip. However, if the wire bonded chip is in contact to metal plating and through vias, heat removal is better compared to an equivalent flip-chip design. Based on experimental and numerical analyses, a compact model to estimate the temperature of a wire bonded chip on board has been developed. The compact model consists of a spreadsheet program that computes the temperature distribution of the assembly. The simplicity and accuracy of the program allow the engineer to quickly implement changes during the design phase where improvements are easily realized.

#### Project TADDI

**Industry Partners:**  
HELIX AG, Zürich  
www.helix.ch

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18 months  
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**Budget**  
CHF 231'900.- (CTI 105'500.-)

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