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Subject Area	Sensors (Studienarbeit)
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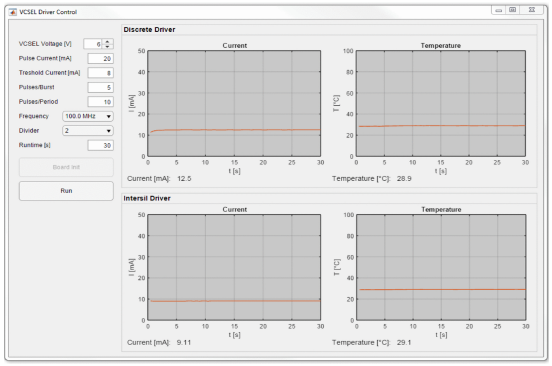
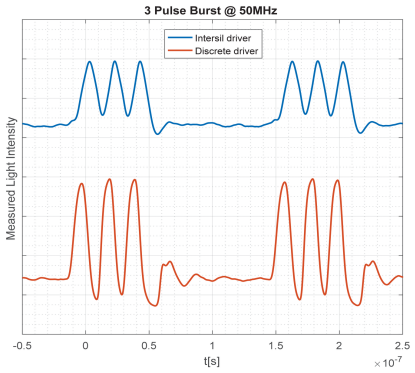
High Speed VCSEL Driver and Optical Receiver

Evaluation Board



Matlab GUI for parameter control and measurement visualization

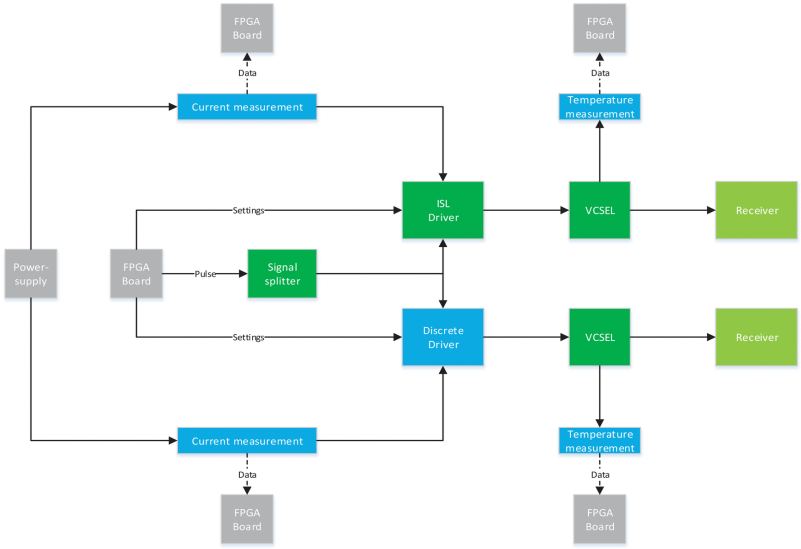


Measured light intensity of both VCSEL paths

Introduction: One of the market segments Heptagon is working on are optical time-of-flight systems: By sending out a light pulse and measuring the time until the reflected pulse reaches again the system one can calculate the distance to the object in the light path. At the moment, such systems are working with pulse widths of ten to fifty nanoseconds resulting in a distance resolution below cm. To further improve the overall system performance the reduction of the pulse widths is a key aspect for optimization. By using so-called VCSELs – a special type of tiny semiconductor lasers with superb performance – light pulses can be shortened to the ns range. In order to extract most efficiently maximal power out of these devices, dedicated driving circuitries need to be available that provide instantaneously high driving currents to the VCSEL.

Objective: To study the performance of VCSEL in time-of-flight systems, a printed circuit board (PCB) was developed which allows to measure the effects of different burst modes. The PCB contains two different paths each with one VCSEL. The main part of this semester work was to develop and to simulate a discrete driver circuit for the first VCSEL. The second VCSEL is driven by a commercial driver chip for comparison.To have the ability to compare the two VCSEL paths, temperature and current measurements were developed. All values are then sent to a PC and are displayed by a Matlab graphical user interface (GUI). The pulse frequency, burst modes and the currents through the VCSELs can also be set in matlab.

Result: Both drivers manage to generate clean pulses down to 10ns pulse-width. When the pulses get shorter they both struggle to shut down the pulse current fast enough so there is always light emitted during burst time, just the intensity varies. The pulse lengths are limited by the PCB design and could probably get shorter in an integrated design since the simulations look much more promising.



Blockdiagram of the PCB: First VCSEL path with discrete driver and second path with intersil driver