Introduction
This master project consists of the design of a comparator with internal offset compensation which will be used in a product being developed at Microchip.

Theory/Method/Hypothesis
The comparator consists of preamplification stages and a latch at the end of the chain of preamplification. The latch is usually a fast operation, small sized block where a rail to rail output is provided to the ADC logic, the digital signal. The purpose of preamplification chain is to amplify the minimum possible input signal up to a value that it will overpass the latch input referred offset voltage.

The gain distribution between the stages are optimized so as to have the best noise performance.

The total power consumption is minimized by certain design choices taken aiming for that.

The propagation delay is optimized using a design variation analysis tool.

The offset of the preamplification stages are cancelled out with an offset compensation circuitry.

The offset of the latch remains negligible thanks to the preamplification put in place.

The layout of one preamplification stage has been made. The floorplan and surface estimation of the complete block has been also made using the layout of the preamplification stage.

Results
The comparator is designed and verified by corner and Monte Carlo simulations that it meets the planned specifications.

However, there is still room for improvement of the noise by increasing the power consumption of the block.

The residual offset values are quite low according to simulation results such that, one can improve the noise performance by sacrificing from offset.

By leaving freedom on residual offset and power consumption, the same tool used for the optimization of the propagation delay can be used for a better noise performance design.

Finally, one could make a parasitic extraction after the completion of the layout and verify functionality with the parasites.

Conclusion/Perspectives
Thanks to this project, I took part and observed the chip development process in industry.

I learned how to design for given specifications and play with different parameters to arrive to desired output values.

References
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