ELEC 4609 IC DESIGN TERM PROJECT 2017 OVERVIEW

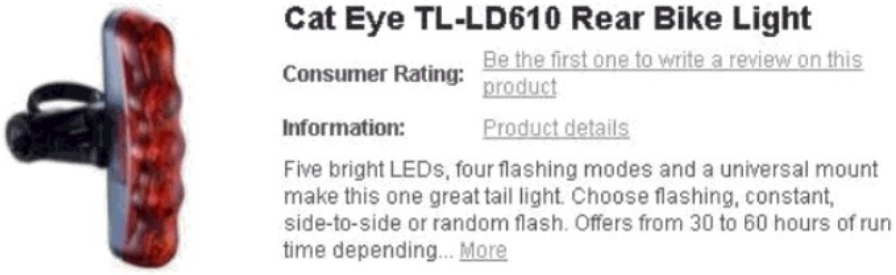
The most important component of ELEC4609 is the term design project. This project provides a chance for you to design a complete CMOS integrated circuit at Medium Scale Integration (MSI) complexity. We will attempt to fabricate your design right here at Carleton and return a finished silicon chip for you to test at the end of term. Fourth-year IC design courses are common in ECE undergraduate programs around the world, but the chance to have your design fabricated is extremely rare.

For the design to be successful it is extremely important that you make full use of the CAD tools introduced in Lab 1 to guide the design process and verify your work. In order to provide time for us to fabricate your design, we will need to have the complete design data (the layout file) by February 14. This will require many hours of work on your part through January and February. It is very important to start the work early and keep at it. As you gain experience with the CAD tools you will find that the work becomes much easier. You will also almost certainly think of ways to improve and simplify your design as you proceeed. After mid-February, the lab workload in the course will be quite modest.

It is much easier to handle the project workload if you work with a partner. I will try and accommodate those who wish to work on their own, but with a large number of students in the class it may be difficult to find space on the chip for solo projects.

Suggested projects are:

1. **Pseudorandom bike tail light controller using dynamic logic**



The goal of this project is to design a chip that will make an LED flash in an apparently random pattern, for use in a bicycle taillight (the idea is that a random flashing light is more likely to be noticed by motorists). With dynamic logic, this design can be accomplished using relatively few transistors. This “baseline” project is recommended for most groups.

2. **Pseudorandom bike tail light controller using static logic**

It is also possible to implement the bike taillight using “conventional” static CMOS logic. This uses many more transistors (and hence more area), but is much more robust and therefore more likely to work. I would like to see one or two groups try this approach. They can have more layout space than the standard project.

3. **Operational amplifier**

For those who have taken ELEC3509 and are very interested in analog and RF ICs, designing your own CMOS op amp makes a good project. The layout of the op amp is simple compared to the digital projects, but more work is required in SPICE simulation.

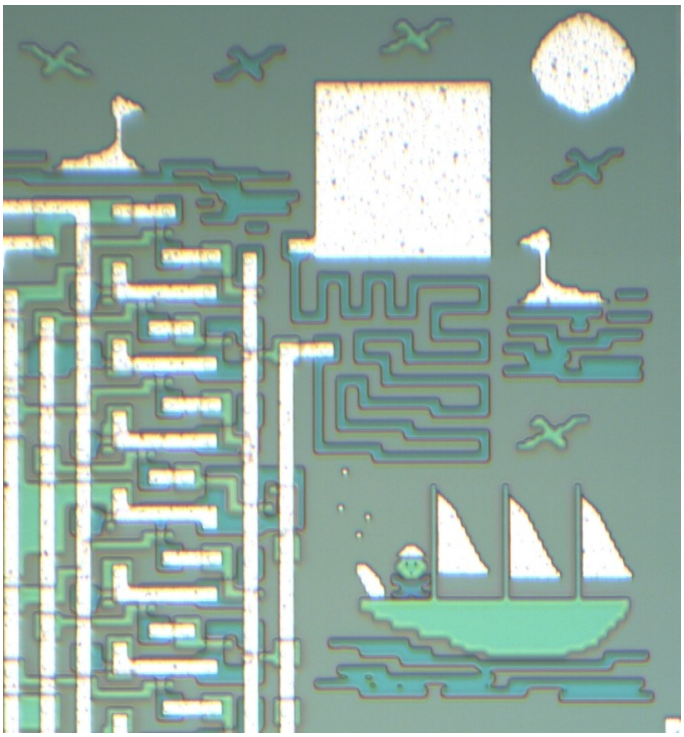
4. **3-bit counter using dynamic logic**

This is a good alternative digital project and has been quite popular in previous years. It involves roughly the same amount of work as the bike light controller. I'd like to see a few groups try this.

You may also suggest your own project, but it is important not to be too ambitious, since you only have six weeks to complete the design. Projects containing more than approximately a hundred transistors are not reasonable. Projects can have no more than six electrical connections to the outside (including power, ground and clock).

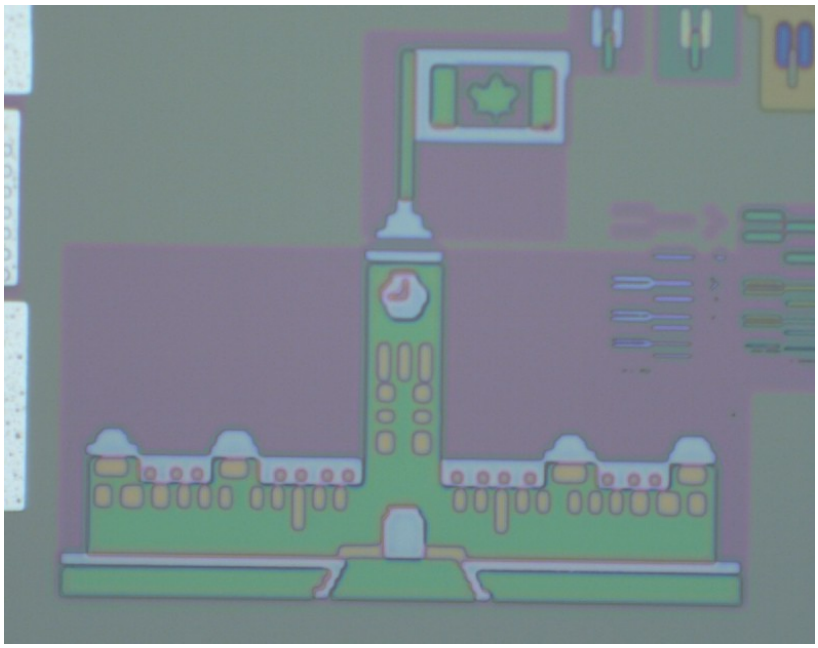
Micro-Art

Whatever project project you decide to try, you are encouraged to add some micro-art to your layout. Micro-art is a long-standing tradition amongst professional IC designers. The best micro-art will receive the annual Carleton coffee cup award! Some examples from previous years follow.



Pirates of the Caribbean, by Kim Dudeck

T-Rex, by Paulyn Mulles



Parliament buildings, by Samantha Trifoli