

UNIC-CASS Design-to-Tapeout (Sept. 11, 2024)

Analog flow for mock tapeout and precheck steps on Efabless platform

Presented by: D-to-T mentoring team

Gabriel Maranhão



UNIC-CASS educational material

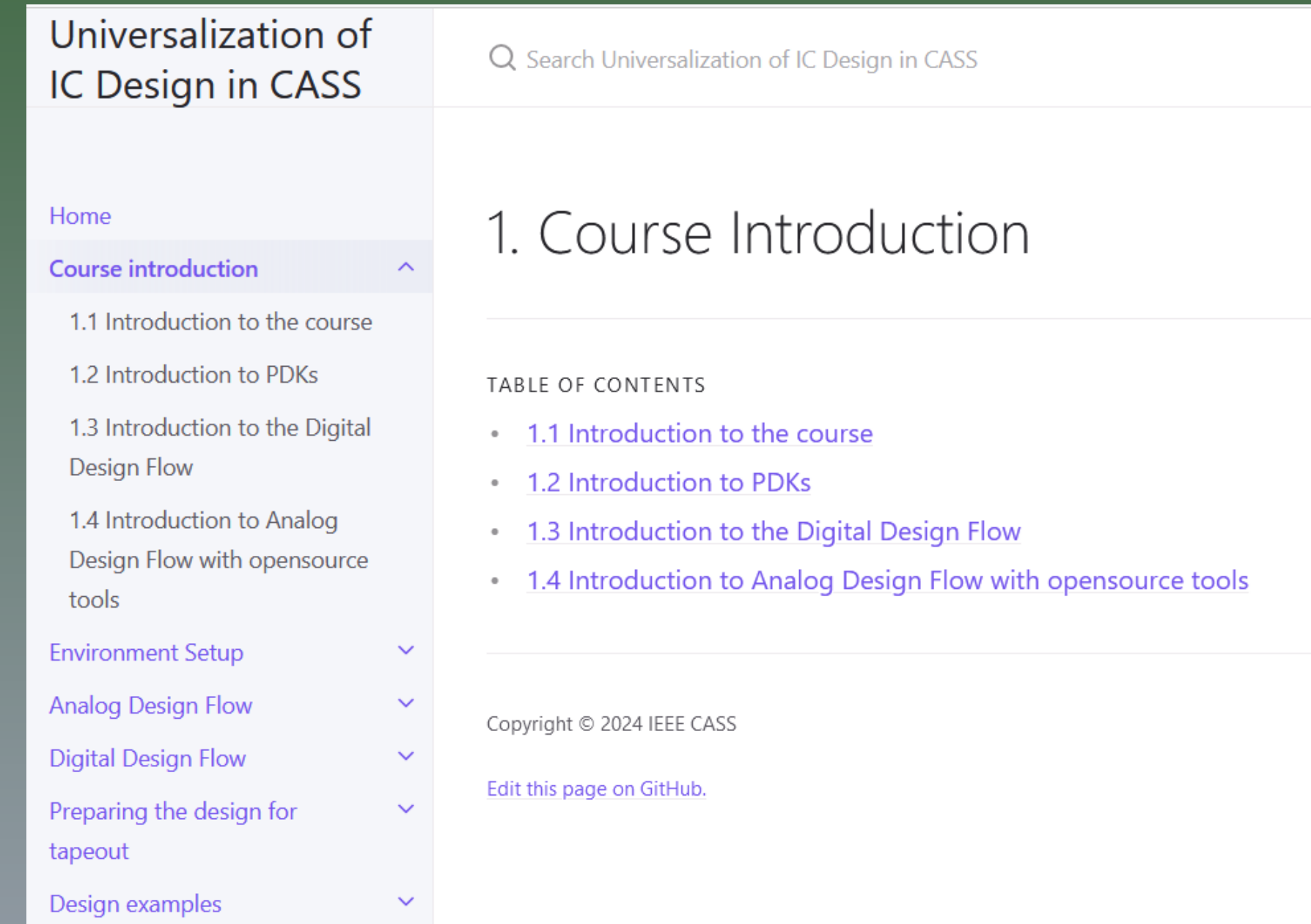


Universalization of IC Design from CASS (UNIC-CASS)

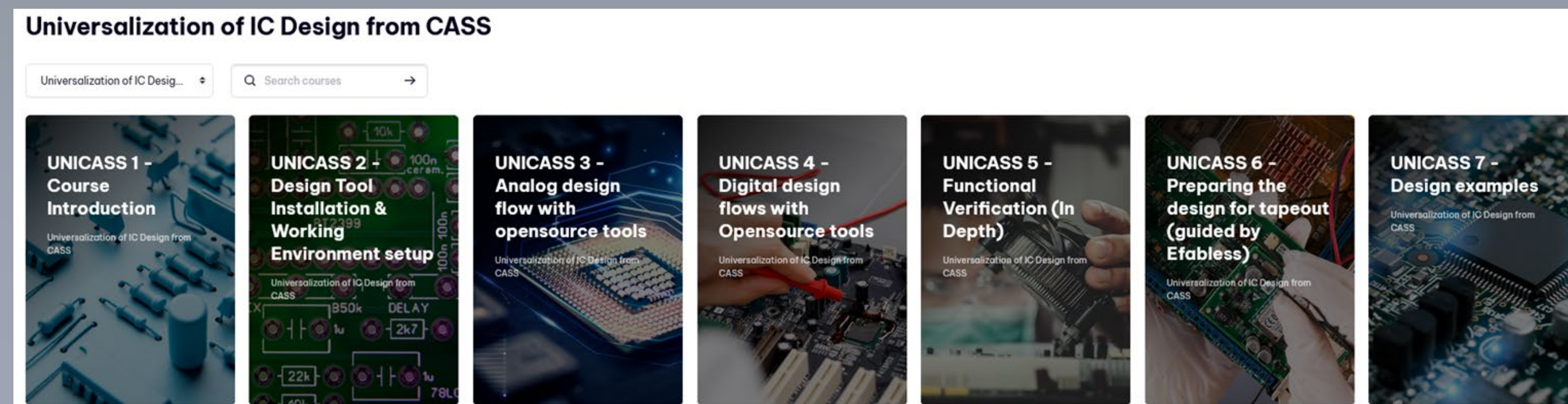
9 followers <https://ieee-cas.org/universalization-i...>

Source: <https://github.com/unic-cass/unic-cass.github.io>

- New videos made by volunteers following the lecture notes
- Lecture notes in Markdown format
 - ⇒ You can contribute by updating them
- New document theme using Just-the-docs Jekyll theme
- Latest materials in Github
- Materials in CASS-MiLe will be updated into v2.0 soon
- Add instructions for Klayout in analog design flow
 - Layout
 - DRC
 - LVS



Website: <https://unic-cass.github.io>



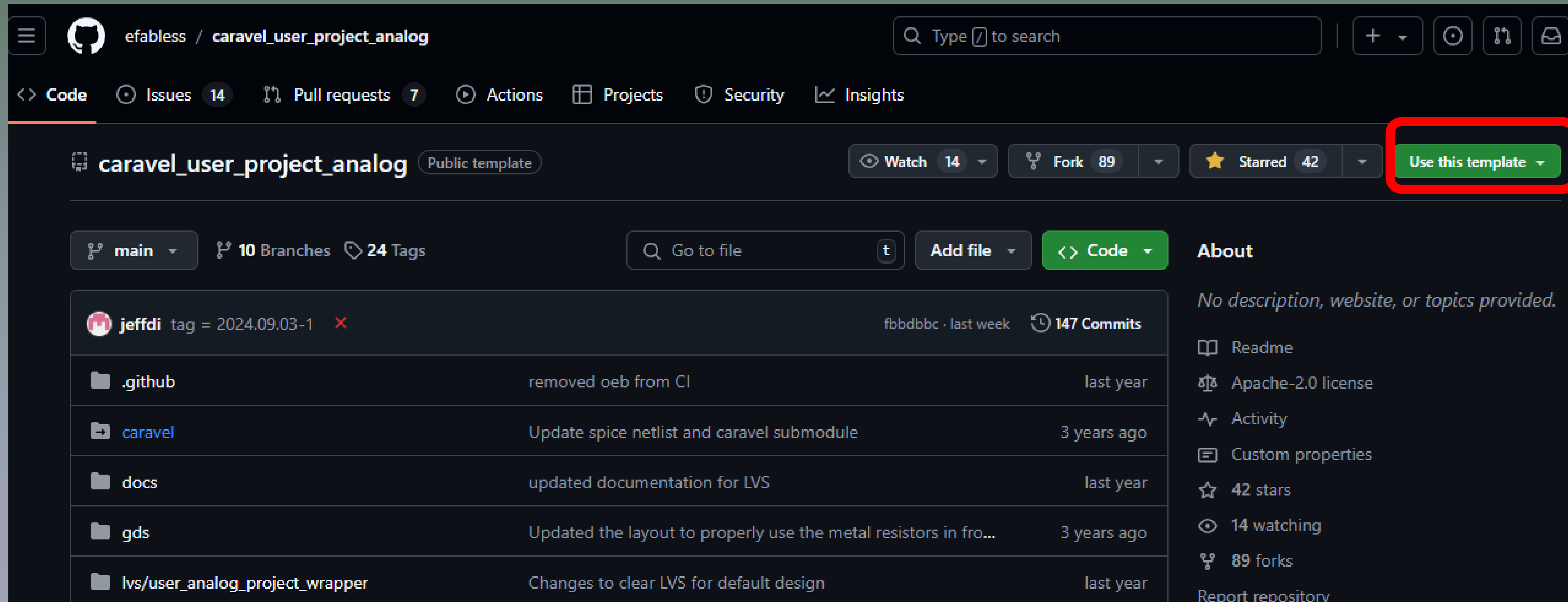
CASS-MiLe: <https://ml.ieee-cas.org>

Mock tapeout and Precheck

- ▶ First two stages that are correlated. Learn how to use the Efabless platform and to submit a project for tape-out;
- ▶ **Mock tape-out:** Is a empty or a really simple circuit/project;
- ▶ **Precheck:** A verification processes to validate the files inside the project directory;
- ▶ [Efabless YouTube Playlist to help with these steps.](#)

Creating the CARAVEL repository on github

- ▶ Click “Use this template”, create a name, make it public.
 - https://github.com/efabless/caravel_user_project_analog

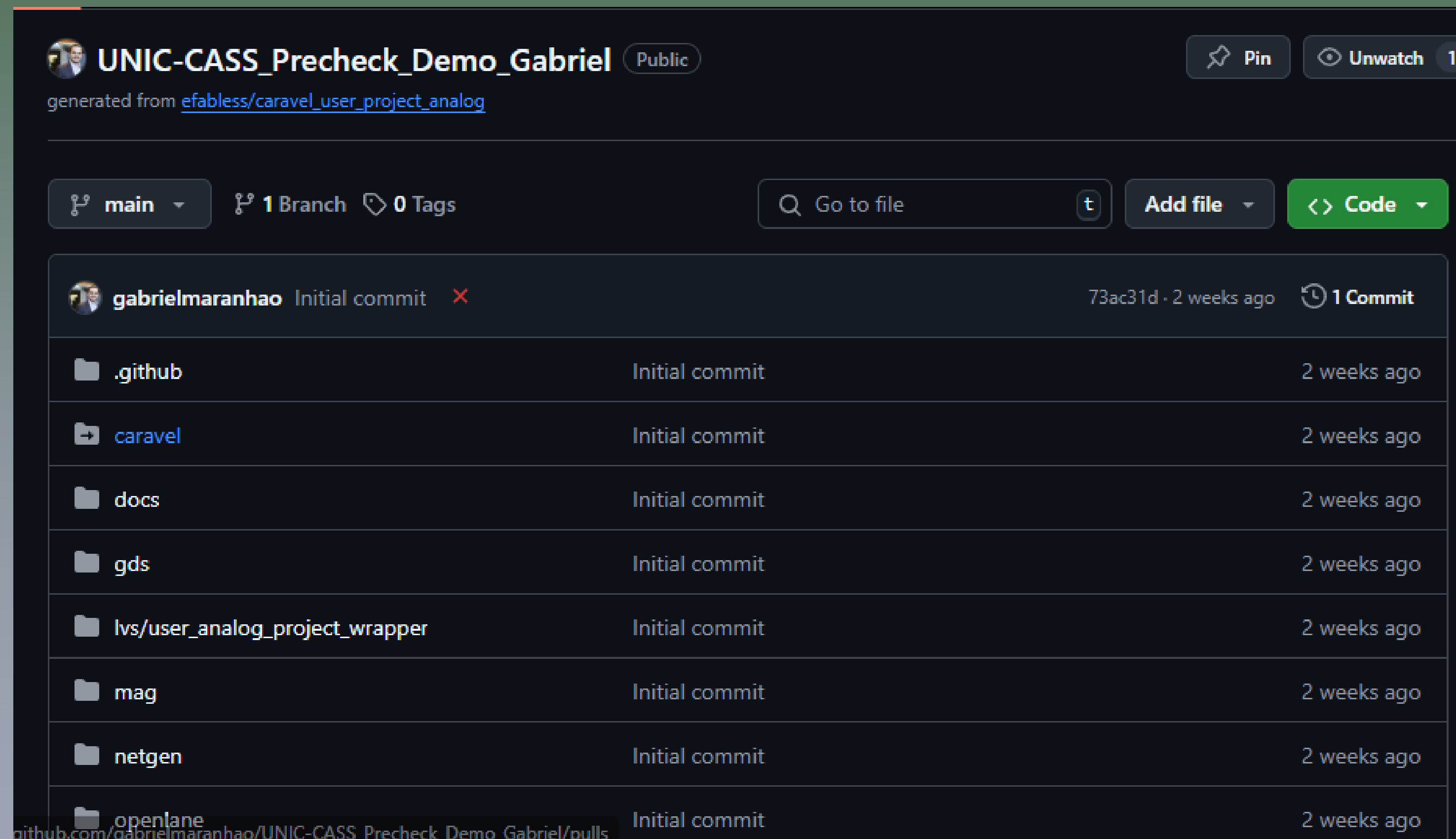


The screenshot shows the GitHub repository page for 'caravel_user_project_analog' by 'efabless'. The repository is a public template. The 'Use this template' button is highlighted with a red box. The repository has 14 watches, 89 forks, and 42 stars. The repository contains several folders: .github, caravel, docs, gds, and lvs/user_analog_project_wrapper. The repository is tagged with '2024.09.03-1' and has 147 commits.

File/Folder	Commit Message	Commit Date
.github	removed oeb from CI	last year
caravel	Update spice netlist and caravel submodule	3 years ago
docs	updated documentation for LVS	last year
gds	Updated the layout to properly use the metal resistors in fro...	3 years ago
lvs/user_analog_project_wrapper	Changes to clear LVS for default design	last year

Creating the repository on github

▶ Example:



The screenshot shows a GitHub repository page for 'UNIC-CASS_Precheck_Demo_Gabriel'. The repository is public and was generated from 'efabless/caravel_user_project_analog'. It features a 'main' branch with 1 branch and 0 tags. The repository contains several folders: '.github', 'caravel', 'docs', 'gds', 'lvs/user_analog_project_wrapper', 'mag', 'netgen', and 'openlane'. All folders were added in the initial commit by 'gabrielmaranhao' 2 weeks ago. The repository has 1 commit and a commit hash of 73ac31d.

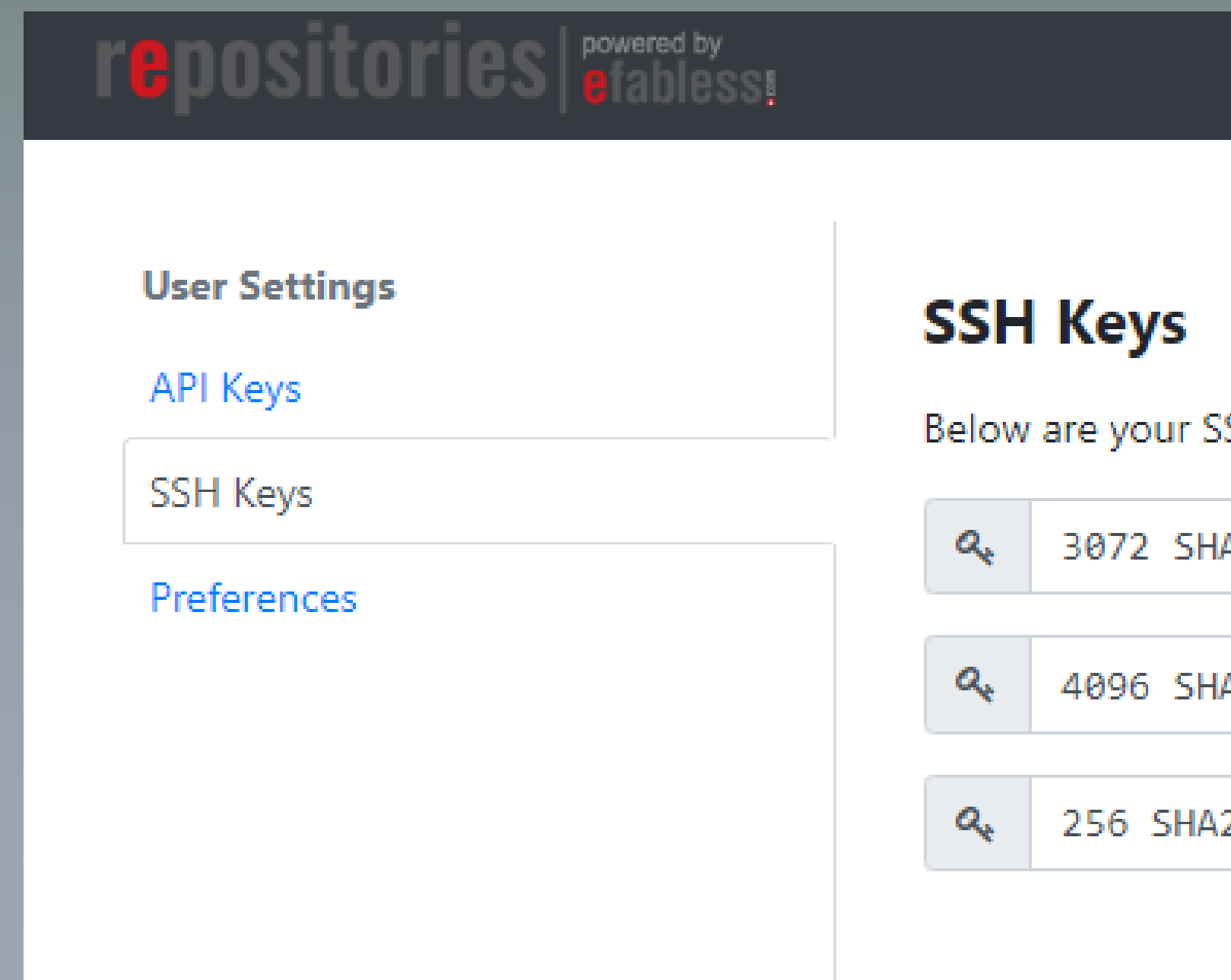
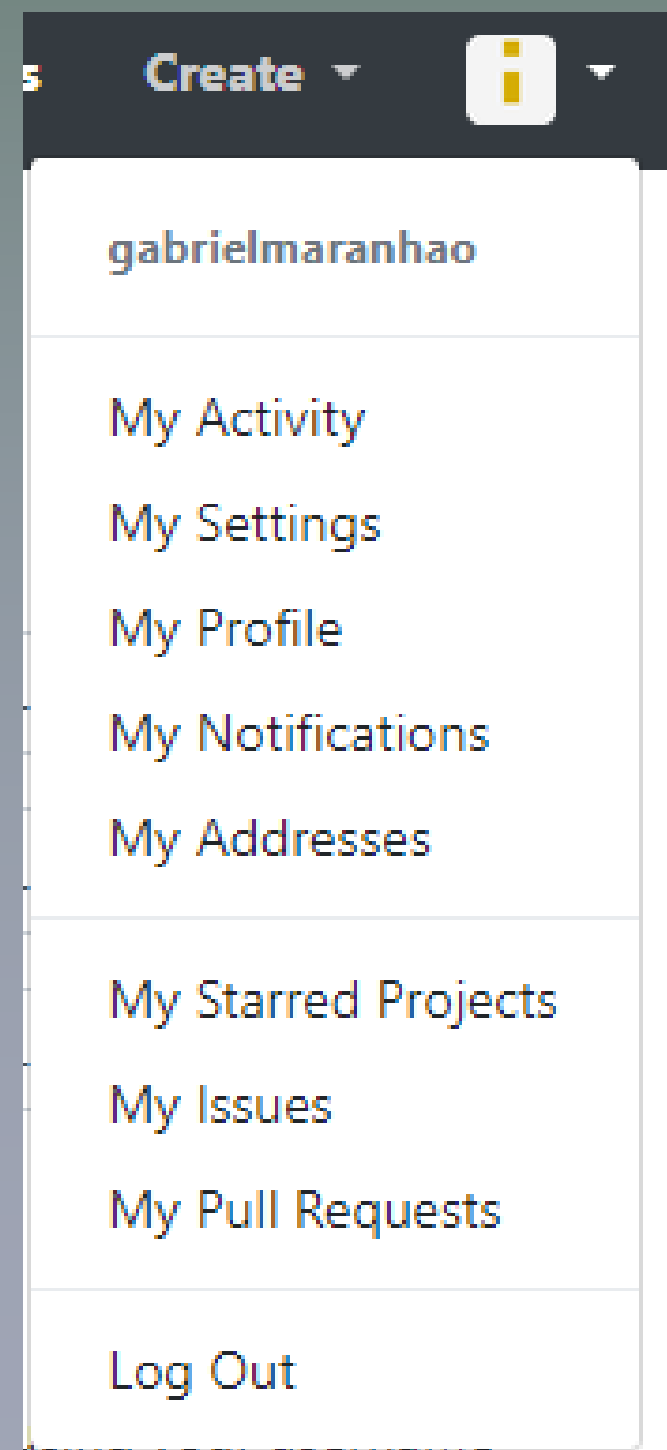
File/Folder	Commit	Time
gabrielmaranhao	Initial commit	2 weeks ago
.github	Initial commit	2 weeks ago
caravel	Initial commit	2 weeks ago
docs	Initial commit	2 weeks ago
gds	Initial commit	2 weeks ago
lvs/user_analog_project_wrapper	Initial commit	2 weeks ago
mag	Initial commit	2 weeks ago
netgen	Initial commit	2 weeks ago
openlane	Initial commit	2 weeks ago

Clone the created github repository to your local PC or JKU (IIC-TOOLS) environment

- ▶ Clone it using SSH. I recommend to have a SSH for github already created <https://github.com/settings/keys>
- ▶ `$ git clone https://github.com/....`
- ▶ Make sure to have the environment variables (PDK_ROOT= /pdk/path/sky130)

Creating the SSH on Efabless plataform

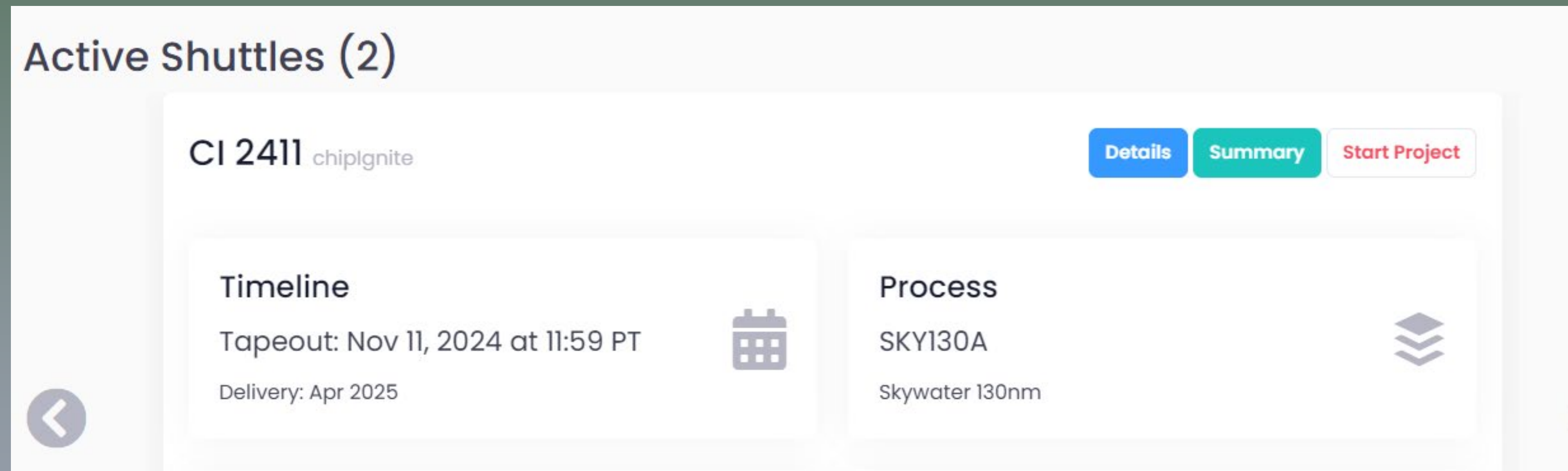
- ▶ Make sure to have a efabless profile;
- ▶ <https://repositories.efabless.com/settings> Go to Settings -> SSH Keys, follow the steps.



[Efabless video tutorial](#)

Create a project on Efabless platform

- ▶ Go to <https://platform.efabless.com/>. The shuttle for UNIC-CASS is the **CI2411** from the "Active Shuttles";



- ▶ Use the "Project Title" as the same name of the github repository (Not mandatory)

Create a project on Efabless platform

- ▶ Push your github repo to Efabless repo

Maintained by mattvenn

demo project

☆ Star 0 Unwatch 1 Members 1

To interact with this project, provide your ssh key here.

This repo is brand new!

Please note, by convention, the original / primary remote repository is called origin.

If you are starting a brand new project without a local repository, here are the suggested commands:

```
git clone ssh://git@repositories.efabless.com/mattvenn/project-test.git
cd project-test
git checkout -b main
touch README.rst
git add README.rst
git commit -m "Add README file"
git push -u origin main
```

If you already have a local Git repository, initialized with `git init`, you will need to associate your local repository with the Efabless Repository remote location. The following commands will add Efabless Repository as a remote repository and push your changes to the main branch.

```
git remote add origin ssh://git@repositories.efabless.com/mattvenn/project-test.git
git push -u origin main
```

If you already have a remote repository, for example one on GitHub, use the command below to add another remote Git repo (make sure that each repo has its unique ID, e.g. origin, ef-repo in the example below).

```
git remote add ef-repo ssh://git@repositories.efabless.com/mattvenn/project-test.git
git push -u ef-repo main
```

```
Terminal
matt-desktop:2022 [main]: git remote -v
origin https://github.com/efabless/caravel_user_project (fetch)
origin https://github.com/efabless/caravel_user_project (push)
matt-desktop:2023 [main]: git remote add ef-repo ssh://git@repositories.efabless.com/mattvenn/project-test.git
matt-desktop:2024 [main]: git remote -v
ef-repo ssh://git@repositories.efabless.com/mattvenn/project-test.git (fetch)
ef-repo ssh://git@repositories.efabless.com/mattvenn/project-test.git (push)
origin https://github.com/efabless/caravel_user_project (fetch)
origin https://github.com/efabless/caravel_user_project (push)
matt-desktop:2025 [main]: git push -u ef-repo main
Enumerating objects: 3500, done.
Counting objects: 100% (3500/3500), done.
Delta compression using up to 8 threads
Compressing objects: 100% (1487/1487), done.
Writing objects: 100% (3500/3500), 170.70 MiB | 17.43 MiB/s, done.
Total 3500 (delta 1880), reused 3495 (delta 1877)
remote: Resolving deltas: 100% (1880/1880), done.
remote: 2023-07-06 08:55:12,741 [DEBUG] flask_server: after_request
remote: 2023-07-06 08:55:12,741 [DEBUG] flask_server: after_request
To ssh://repositories.efabless.com/mattvenn/project-test.git
 * [new branch]      main -> main
Branch 'main' set up to track remote branch 'main' from 'ef-repo'.
matt-desktop:2026 [main]:
matt-desktop:2026 [main]:
```

[Check it - Efabless video tutorial](#)

Efabless platform remote Precheck

- ▶ Push all the commits, make your repo up to date;
- ▶ Go to <https://platform.efabless.com/shuttles/CI%202411> (Make sure to be logged)
- ▶ Click on "Submit" for "MPW Precheck"
- ▶ Use the commit hash of the last commit as a "Job name"
 - Command to print the last commit hash on your local repo
 - `$ git log -1 --pretty=format:@"%H"`
- ▶ Click "Submit", it takes 10min;
 - It is going to fail (**Incomplete**) if no changes were made in the repo files, is ok for now.

Local Precheck

- ▶ Go into your local repo file (make sure to have the right environment variable PDK_ROOT on this terminal);
- ▶ Push all the commits, make your repo up to date;
- ▶ Need docker and Klayout to run, see [Setup Desktop](#);
- ▶ \$ make precheck (only one time)
- ▶ \$ make run-precheck

Mock Tape-out

- ▶ Now is time to get a “Complete” on the remote precheck run;
- ▶ Important files:
 - xschem/user_analog_project_wrapper.sch (**SCHEMATIC**)
 - verilog/rtl/user_defines.v (**VERILOG**)

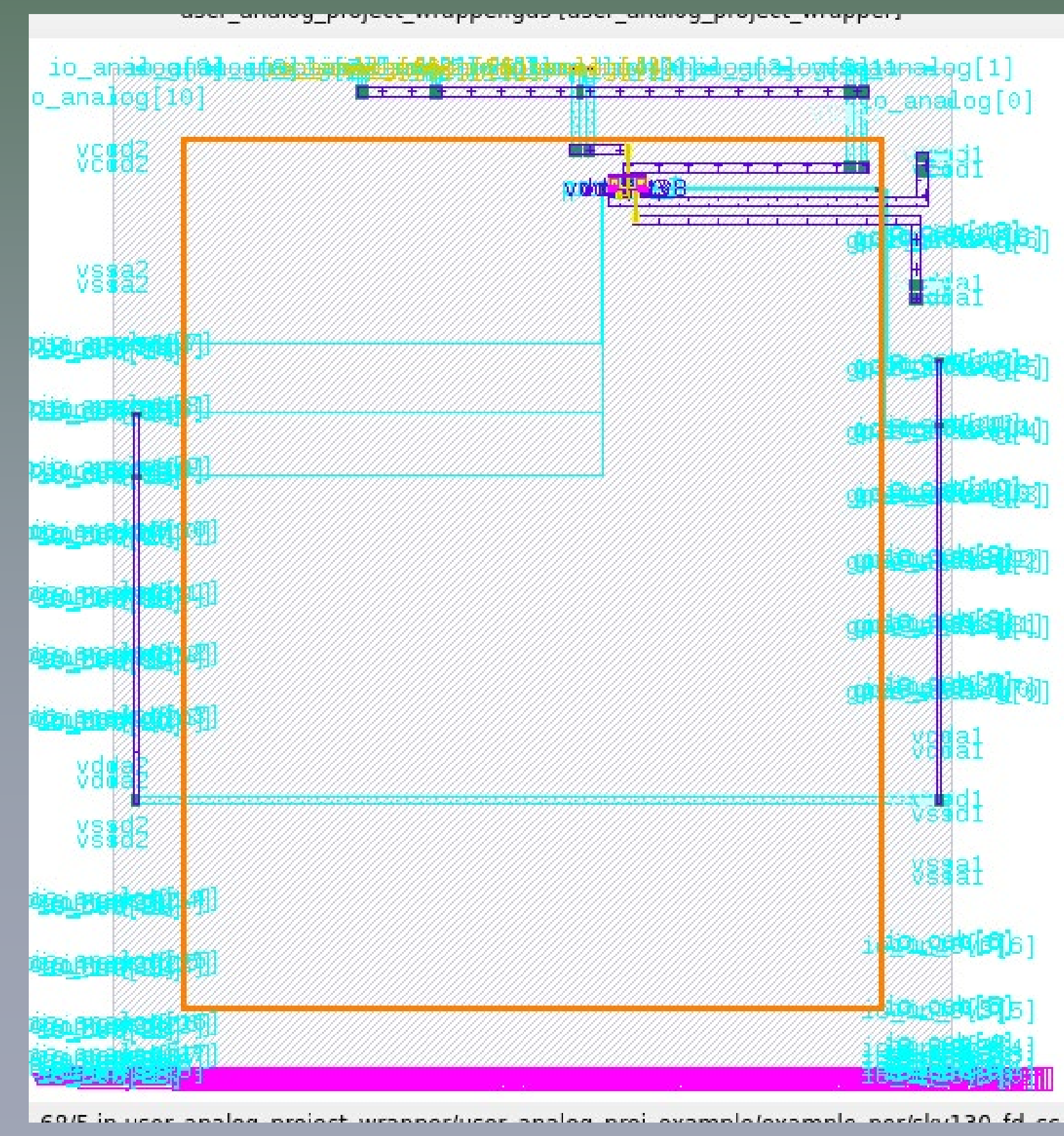
```
// deliberately erroneous placeholder value; user required to config GPIO's to other
`define GPIO_MODE_INVALID          13'hXXXXX

// Authoritive source of these MODE defs is: caravel/verilog/rtl/user_defines.v
// Useful GPIO mode values.  These match the names used in defs.h.
//
```

- gds/user_analog_project_wrapper.gds (**LAYOUT**)

Mock Tape-out

- ▶ Place your mock/simple layout inside the GDS wrapper (*user_analog_project_wrapper.gds*)
- ▶ This is your user project are
 - Don't rename the files;
 - Make sure to have a LVS clean.
- ▶ Edit the *user_defines.v* file (to fix the GPIO-Defines flag/error)
- ▶ Commit and push the updates, run precheck again
 - DRC clean
 - LVS not mandatory.



Observations

- ▶ If you created your own schematics files the LVS of the precheck will flag a LVS error.
 - If you want to have a precheck with LVS clear you need to edit the file "*user_analog_project_wrapper.sch*" and generate a new "*user_analog_project_wrapper.spice*"
- ▶ During the Local precheck, the flag "Default", appears only if either the *.gds* and the README.md was not modified from the default one.