

Title: EmPowerSoc flow for Active Power Estimation of SOC

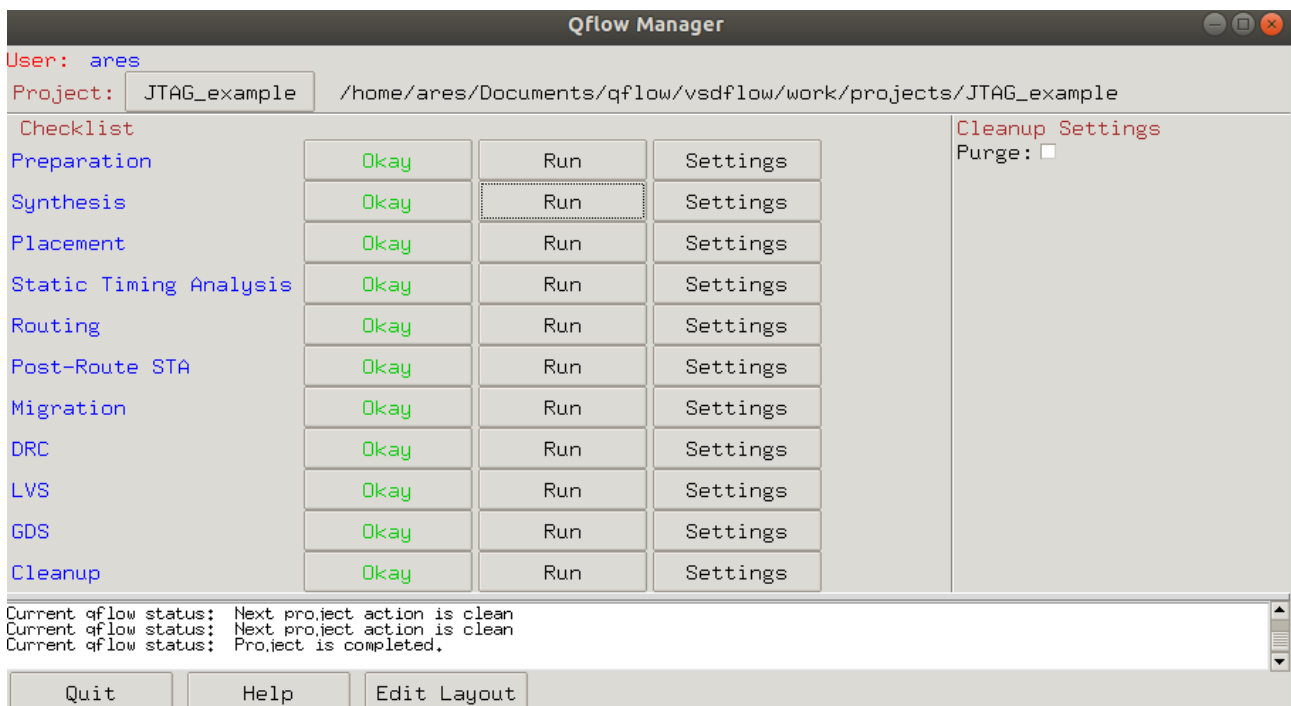
EmPowerSoC is an open-source EDA tool for power estimation of SoC. It has been developed alongside the existing Qflow open-source tool chain which is currently being used for implementation of RTL to GDSII flow.

The development work was carried out by Mr. Akshat Jain, Mr. Nimesh Shahdadpuri , Mr. Sagar Yadav and Mr. Naveen Dugar, bonafide students at NSUT under the guidance of Dr. Kunwar Singh, Assistant Professor, Department of ECE, Netaji Subhas University of Technology.

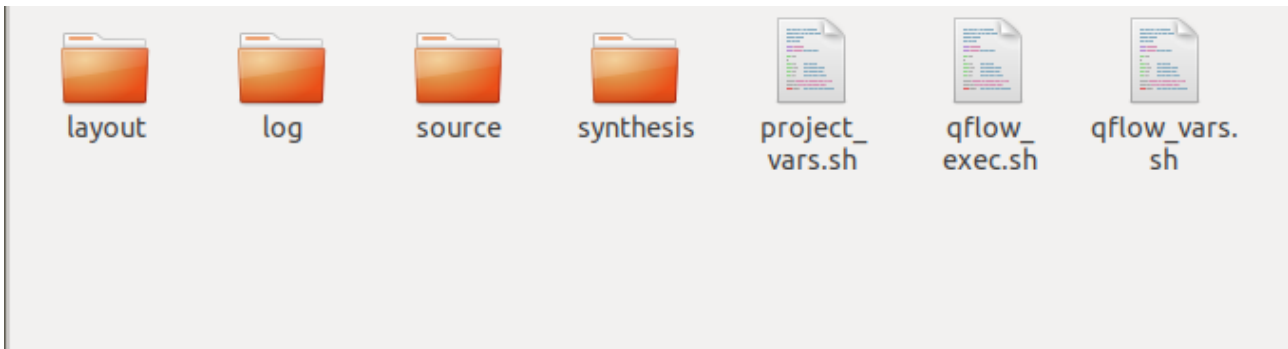
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- ➔ Download the provided example source code verilog files for Jtag.
- ➔ Make project directory “**JTAG_Example**” and “**source**” directory inside JTAG_Example. Paste the JTAG verilog files inside source folder. Use the following commands-
 - mkdir JTAG_Example
 - cd JTAG_Example
 - mkdir source
 - mv <source_location> ./source/tap_top.v
 - mv <source_location> ./source/tap_defines.v
- ➔ In the **JTAG_Example** directory, open the qflow gui using terminal window and run the RTL2GDS flow by selecting required parameters.



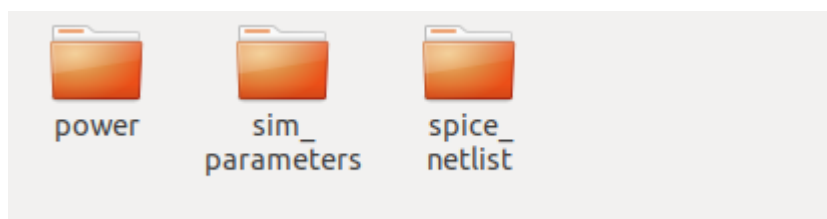
- ➔ After completion of RTL2GDS, these below mentioned folders should be created in the project directory.



- ➔ Now, inside the project directory Jtag_example, right click and select open in terminal. Run the command “empower” in terminal to start EmPowerSoc.

- ➔ EmPowerSoc directory will be created in your project directory. It will contain 3 sub directories-

- ➔ Power – Contains the calculated power values.
- ➔ Spice Netlist - Contains the spice netlists for all the standard cells
- ➔ Sim_Parameters – Contains the saved project simulation parameters which can be loaded directly in the future.



- ➔ In the GUI, by changing tabs you can switch between Standby Power estimation and Active Power estimation.

The screenshot displays the EmPowerSOC GUI window titled "EmPowerSOC : tap_top". It features a menu bar with "File" and "Help". Below the menu bar are two tabs: "Active Power Consumption" and "Standby Power Consumption". A blue arrow points to the "Standby Power Consumption" tab, indicating the current active view. The "Active Power Consumption" tab contains a dropdown menu labeled "tms_pad_i" and a radio button labeled "Pulse". Below the "Pulse" radio button are input fields for "Initial Value [V]", "Pulsed Value", "Delay", "Rise Time", "Fall Time", "Pulse Width", and "Period", followed by an "Add Pulse" button. Below these is a radio button labeled "DC Input" and an input field for "Value [V]", followed by an "Add Input" button. The "Standby Power Consumption" tab contains a dropdown menu labeled "tdo_pad_o", an input field for "Value", and an "Add Load" button. Below these are input fields for "Supply Value [V]", "Stop Time", and "Time Step Size", followed by an "Add Model file" button. At the bottom of the window are two large orange buttons: "Review Simulation Parameters" and "Run Simulation".

➔ Apply input pulses to all the required ports and add DC inputs wherever required.

EmPowerSOC : tap_top

File Help

Active Power Consumption Standby Power Consumption

tms_pad_i tdo_pad_o

☒ Pulse ☐ DC Input

Initial Value [V] Pulsed Value Delay 0p Rise Time 10p Fall Time 10p Pulse Width 1n Period 2n

Add Pulse

Value

Add Load

Supply Value [V] Stop Time Time Step Size

Add Model file

Add Input

Value [V]

Review Simulation Parameters Run Simulation

- ➔ Specify the load capacitances for the output nodes. And add the Supply Value, simulation time and time step for simulation.

The screenshot shows the 'EmPowerSOC : tap_top' application window. It has a menu bar with 'File' and 'Help'. Below the menu bar are two tabs: 'Active Power Consumption' (selected) and 'Standby Power Consumption'. The 'Active Power Consumption' tab is divided into two main sections. The left section is for 'tms_pad_i' and has a radio button for 'Pulse' (selected) and a radio button for 'DC Input'. Under 'Pulse', there are input fields for 'Initial Value [V]', 'Pulsed Value', 'Delay', 'Rise Time', 'Fall Time', 'Pulse Width', and 'Period', each with an 'Add Pulse' button. Under 'DC Input', there is a 'Value [V]' field and an 'Add Input' button. The right section is for 'tdo_pad_o' and has a 'Value' field with '10pf' and an 'Add Load' button. Below these are fields for 'Supply Value [V]' (1.8), 'Stop Time', and 'Time Step Size' (10p). At the bottom right, there is an 'Add Model file' button and a text field containing the path 'z:/Documents/qflow/vsdfow/work/scripts/SampleLib.mod'. At the very bottom of the window are two large orange buttons: 'Review Simulation Paramenters' and 'Run Simulation'. Two blue arrows point upwards: one from the 'Add Model file' button to the 'Add Load' button, and another from the bottom of the window to the 'Add Model file' button.

- ➔ Add the model file for NMOS and PMOS. We have provided a sample model file for reference.

Note: If you want to use your own model parameters, kindly ensure the library name and model name are same as the one in sample model file provided.

➔ Review the simulation parameters. Make any changes if necessary.

EmPowerSOC : tap_top

File Help

Active Power Consumption Standby Power Consumption

tms_pad_i tdo_pad_o

☒ Pulse

Initial Value [V]

Pulsed Value

Delay 0p

Rise Time 10p

Fall Time 10p

Pulse Width 1n

Period 2n

Add Pulse

☐ DC Input

Value [V]

Add Input

Value 10pf

Add Load

Supply Value [V] 1.8

Stop Time 40n

Time Step Size 10p

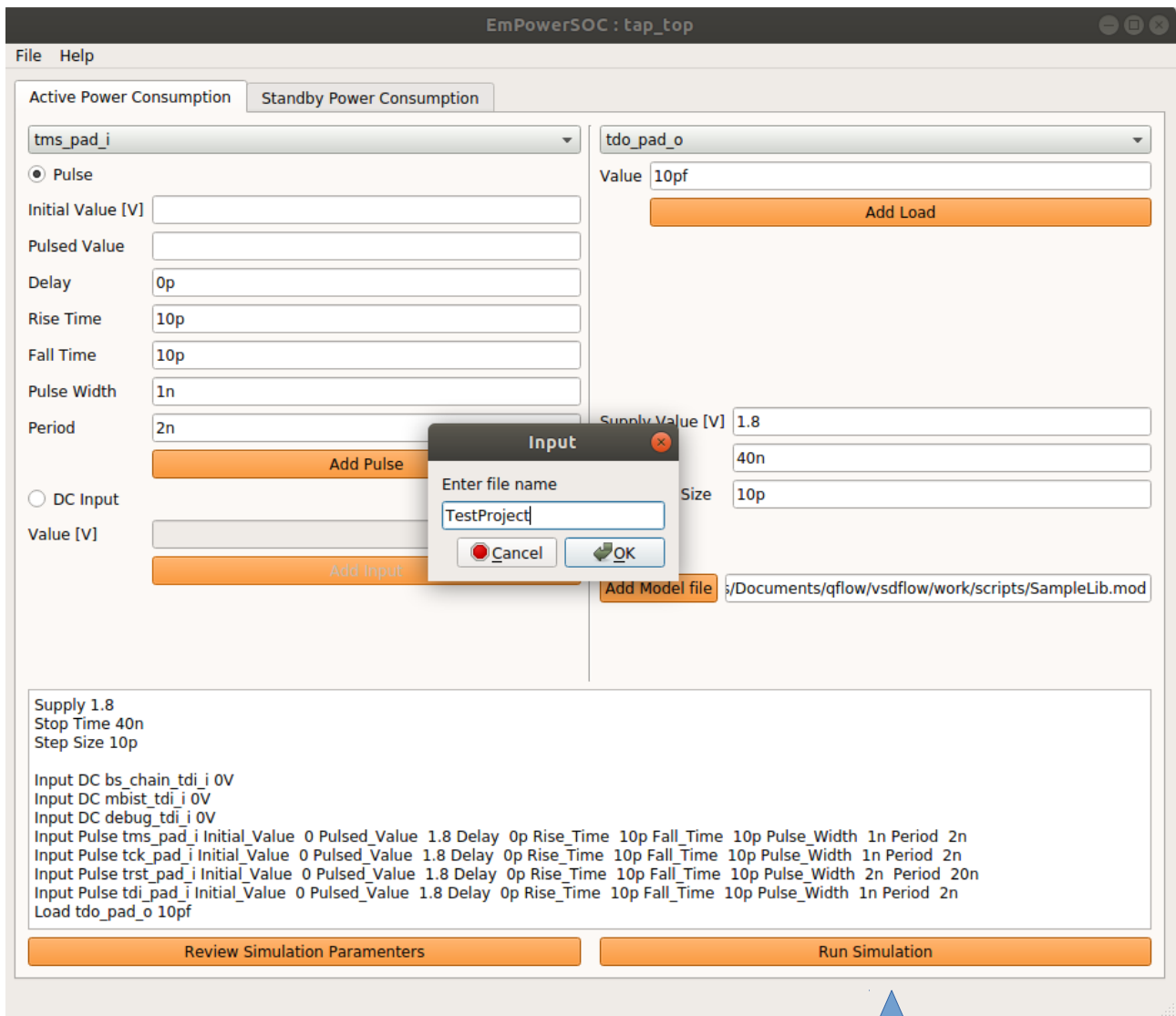
Add Model file s:/Documents/qflow/vsdfow/work/scripts/SampleLib.mod

Supply 1.8
Stop Time 40n
Step Size 10p

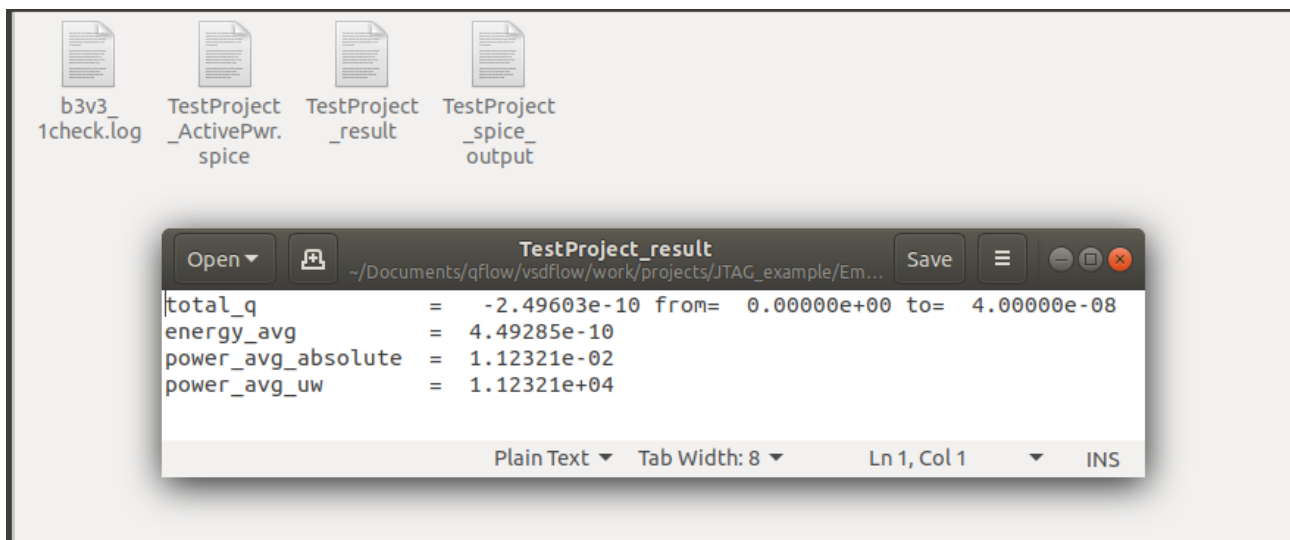
Input DC bs_chain_tdi_i 0V
Input DC mbist_tdi_i 0V
Input DC debug_tdi_i 0V
Input Pulse tms_pad_i Initial_Value 0 Pulsed_Value 1.8 Delay 0p Rise_Time 10p Fall_Time 10p Pulse_Width 1n Period 2n
Input Pulse tck_pad_i Initial_Value 0 Pulsed_Value 1.8 Delay 0p Rise_Time 10p Fall_Time 10p Pulse_Width 1n Period 2n
Input Pulse trst_pad_i Initial_Value 0 Pulsed_Value 1.8 Delay 0p Rise_Time 10p Fall_Time 10p Pulse_Width 2n Period 20n
Input Pulse tdi_pad_i Initial_Value 0 Pulsed_Value 1.8 Delay 0p Rise_Time 10p Fall_Time 10p Pulse_Width 1n Period 2n
Load tdo_pad_o 10pf

Review Simulation Parameters Run Simulation

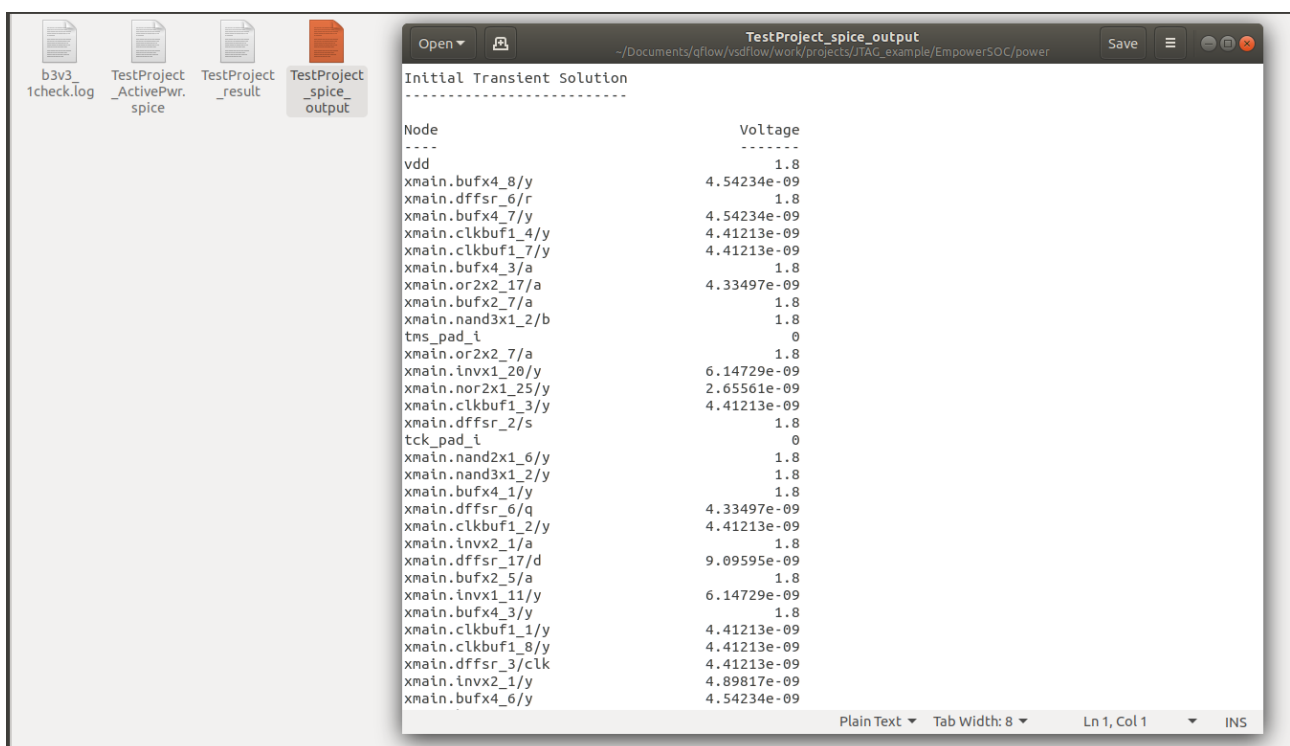
- ➔ Finally, run the simulator. You will be asked to provide a name for your project in order to save it.



- The Estimated Power will be saved as a text file TestProject_result in the EmpowerSoc>Power directory.



- The complete ngspice output will also be saved.



- ➔ In future, you can load these parameters directly into the tool by going into File>Open, and then selecting the simulation parameters file for that project.

