

Chapter 6 - OpenROAD GUI

Course authors (Git file)



1 Analysing designs with the GUI



Section 1

Analysing desings with the GUI



View layout

Viewing Layout Results

The `make_gui_final` command target successively reads and loads the technology `.odb` files and the parasitics and invokes the GUI in these steps:

- Reads and loads `.odb` files.
- Loads `.spef` (parasitics).

The figure below shows the post-routed DEF for the `ibex` design.

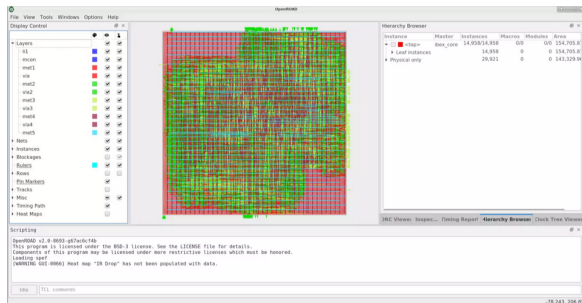


Figure 1: View layout



View objects

Visualizing Design Objects And Connectivity

Note the **Display Control** window on the LHS that shows buttons for color, visibility and selection options for various design objects: Layers, Nets, Instances, Blockages, Heatmaps, etc.

The Inspector window on the RHS allows users to inspect details of selected design objects and the timing report.

Try selectively displaying (show/hide) various design objects through the display control window and observing their impact on the display.

Figure 2: View objects



Clock tree

Tracing The Clock Tree

View the synthesized clock tree for `ibex` design:

- From the top Toolbar Click `Windows` -> `Clock Tree Viewer`



Figure 3: Clock tree



Heat maps

Using Heat Maps

From the Menu Bar, Click on **Tools** -> **Heat Maps** -> **Placement Density** to view congestion selectively on vertical and horizontal layers.

Expand **Heat Maps** -> **Placement Density** from the Display Control window available on LHS of OpenROAD GUI.

View congestion on all layers between 50-100%:

In the **Placement density** setup pop-up window, Select **Minimum** -> **50.00%** **Maximum** -> **100.00%**

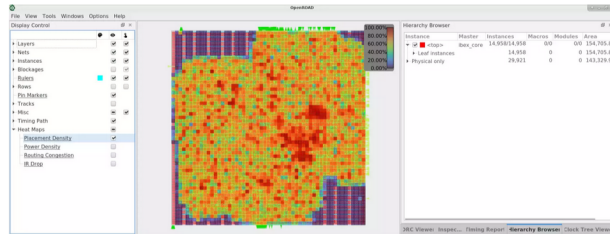


Figure 4: Heat maps



Timing report

Viewing Timing Report

Click **Timing** -> **Options** to view and traverse specific timing paths. From Toolbar, click on the **Timing** icon, View **Timing Report** window added at the right side (RHS) of GUI as shown below.

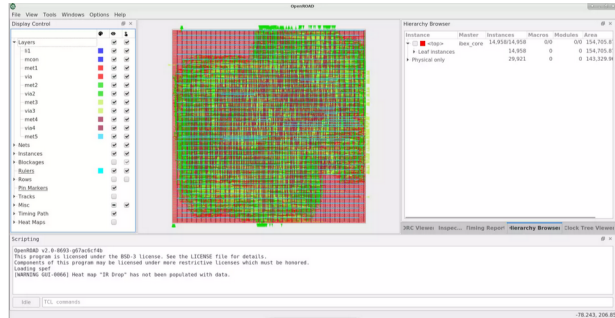


Figure 5: Timing report



Rulers (measure distances)

Using Rulers

A ruler can measure the distance between any two objects in the design or metal layer length and width to be measured, etc.

Example of how to measure the distance between VDD and VSS power grid click on:

Tools -> Ruler K



Distance between VDD and VSS layer is 11.978

Figure 6: Rulers



TCL command interface

Tcl Command Interface

Execute OpenROAD-flow-scripts Tcl commands from the GUI. Type `help` to view Tcl Commands available. In OpenROAD GUI, at the bottom, `TCL commands` executable space is available to run the commands. For example

View `design area` in the `Tcl Commands` section of the GUI:

```
report_design_area
```

Try the below timing report commands to view timing results interactively:

```
report_wns  
report_tns  
report_worst_slack
```

Figure 7: TCL interface



Area report

Area

View design area and its core utilization:

```
make gui_final
```

In the `Tcl Commands` section:

```
report_design_area
```

View the resulting area as:

```
Design area 191262 u^2 30% utilization.
```

Figure 8: Area report



Timing slack report

Timing

Users can view flow results using the command interface from the shell or the OpenROAD GUI to visualize further and debug. Learn more about the [GUI](#).

```
make gui_final
```

Use the following commands in the **Tcl Commands** section of GUI:

```
report_worst_slack  
report_tns  
report_wns
```

Note the worst slack, total negative slack and worst negative slack:

```
worst slack -0.99  
tns -1.29  
wns -0.99
```

Figure 9: Timing slack report



Power report

Power

Use the report command to view individual power components i.e. sequential, combinational, macro and power consumed by I/O pads.

In the `Tcl Commands` section:

```
report_power
```

The power output is as follows:

Group	Internal Power	Switching Power	Leakage Power	Total Power	
Sequential	5.58e-03	6.12e-04	1.67e-08	6.19e-03	19.0%
Combinational	9.23e-03	1.71e-02	4.90e-08	2.63e-02	81.0%
Macro	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.0%
Pad	0.00e+00	0.00e+00	0.00e+00	0.00e+00	0.0%
Total	1.48e-02 45.6%	1.77e-02 54.4%	6.57e-08 0.0%	3.25e-02	100.0%

Figure 10: Power report



DRC viewer

DRC Viewer

You can use the GUI to trace DRC violations and fix them.

View DRC violations post routing:

```
less ./reports/sky130hd/ibex/base/5_route_drc.rpt
```

Any DRC violations are logged in the `5_route_drc.rpt` file, which is empty otherwise.

From OpenROAD GUI, Enable the menu options `Windows -> DRC Viewer`. A `DRC viewer` window is added on the right side (RHS) of the GUI. From `DRC Viewer -> Load` navigate to `5_route_drc.rpt`

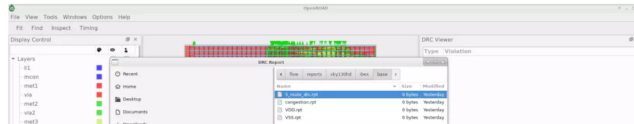


Figure 11: DRC viewer

