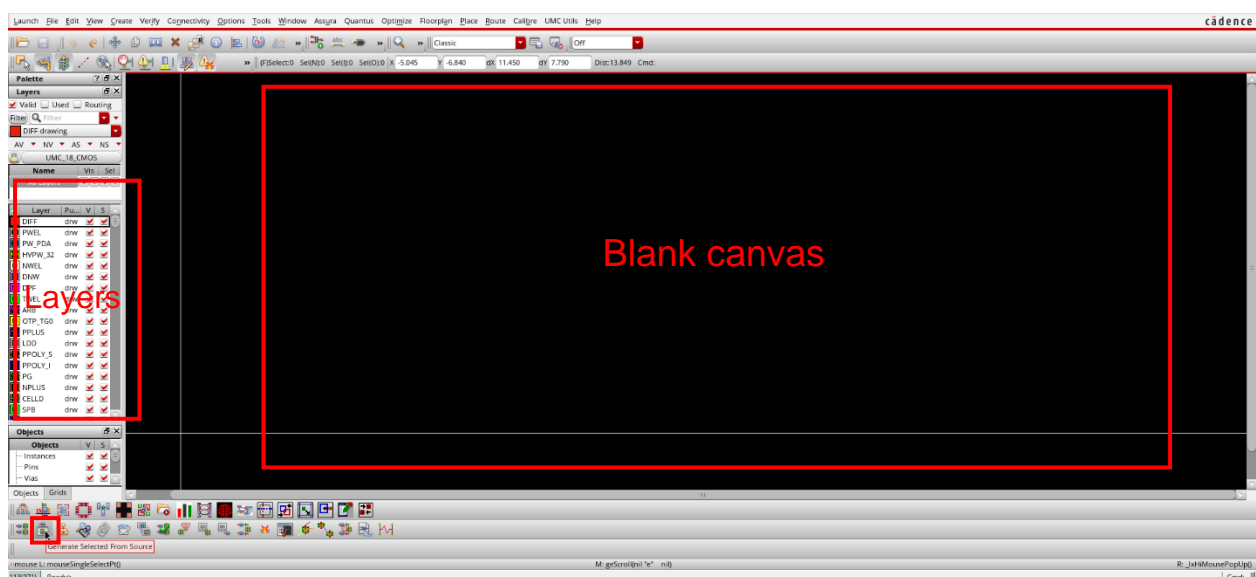


PRACTICAL EXERCISE SESSION No. 6 - Appendix

Instantiating the MOSFETs

To add a device from schematic into the layout window,

- Go to the schematic and click on the MOSFET that you would like to add to the layout.
- In the layout window, on the bottom left corner click on the “**Generate selected from Source**” button as shown below:

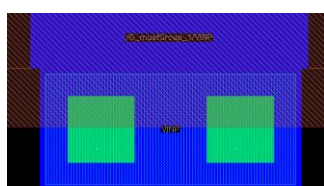
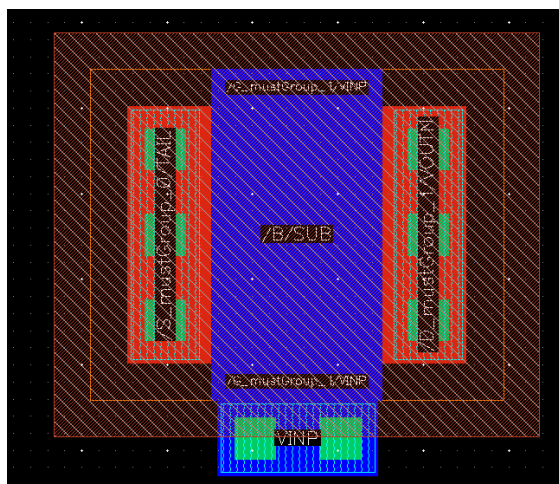


When you hover the mouse inside the layout window, the device will be available. Click on the point where you would like to place the device and the instantiation is complete.

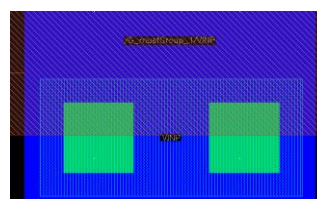
Adding Contacts to the MOSFETs

By default, the instantiated MOS will have Source and Drain connections available through ME1. However, we need to add a poly-to-metal contact in order to provide electrical contact to the Gate of the MOSFET. Press “o” and choose **M1_POLY** from the dropdown as shown below. You can change the number of rows or columns of contacts needed based on the dimension of the Poly itself. Make sure that you use more than one row/column if applicable. Once chosen, place this contact on the Poly of the instantiated MOSFET.

Once you add the contact, to avoid any design rule violation, we need to fill the poly in the open spaces next to the contact (refer to the image below).



Before filling the open space by drawing a poly rectangle



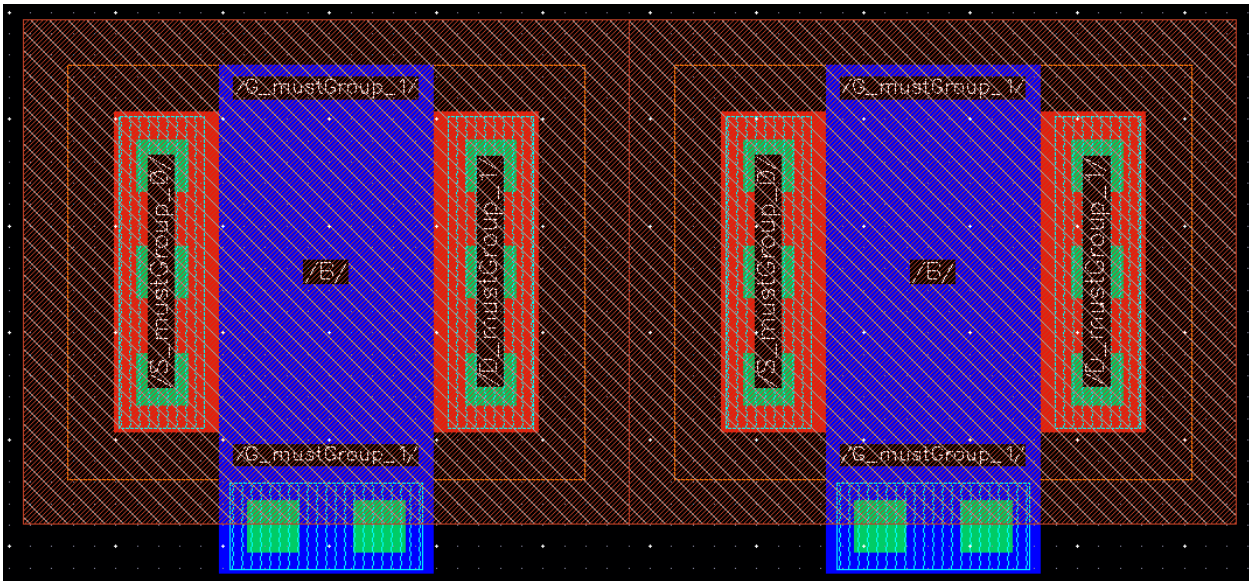
After filling the open space by drawing a poly rectangle

To draw a poly rectangle, click on PO1 in the layer palette (this selects the poly layer) and then press “R”. Fill the poly rectangle so that you do not have any openings. Use the zoom shortcut “z” to be precise.

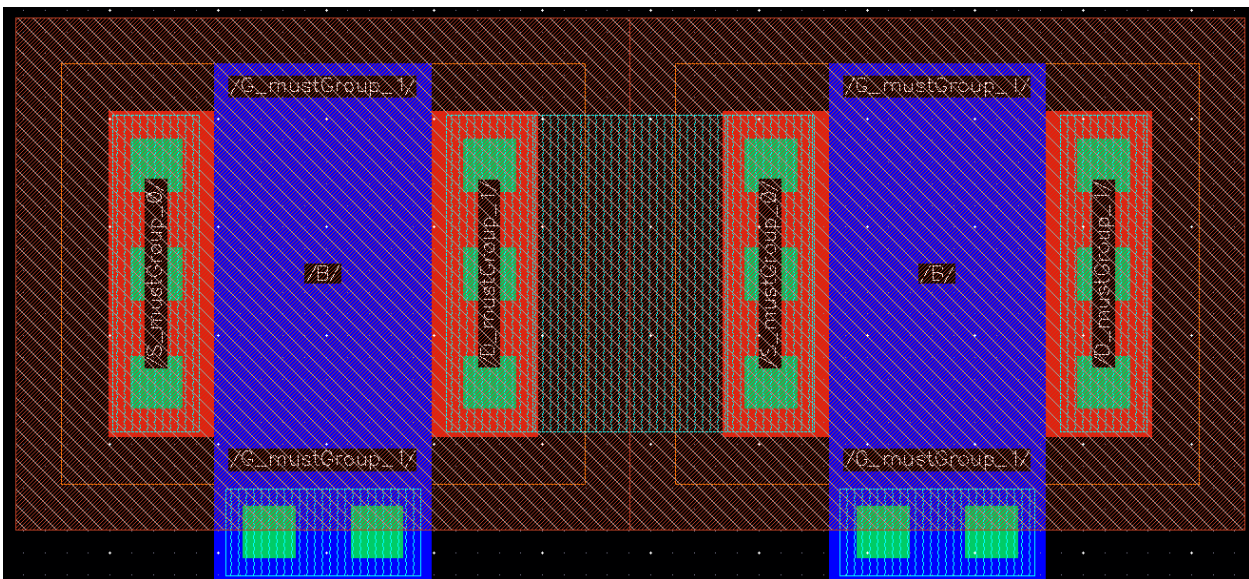
Similarly, instantiate the second MOSFET of the diff-pair and place them side by side. (Alternatively, you can select the whole structure that you have created and use the copy command to make a copy for the other diff-pair MOSFET).

Routing the NETs

Once the diff-pair MOSFETs are placed next to each other (as shown below), we need to make the connection between the source of the two MOSFETs (which is the net “TAIL” in the schematic). Note that you can choose any of the terminals as Source/Drain in the layout.



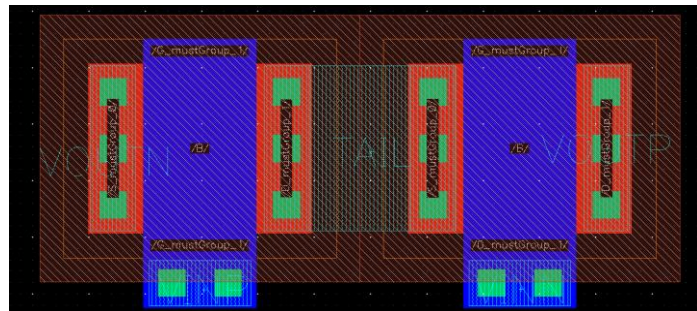
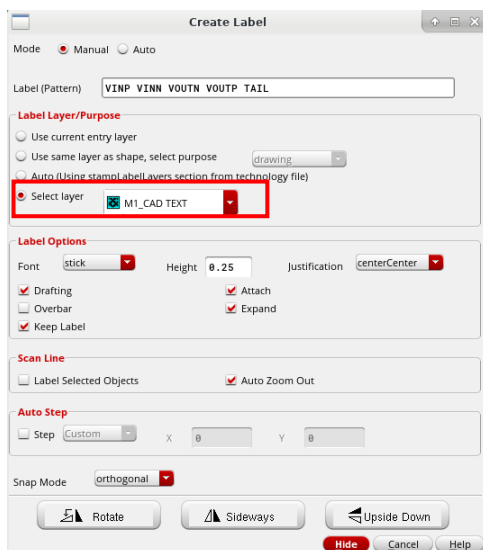
Draw a ME1 rectangle (by selecting the ME1 layer from the Layers Palette and then pressing “R”) as shown below between the two adjacent source terminals of the MOSFETs, to create the “TAIL” connection/terminal.



Creating Terminals on the Layout:

Finally, we need to place the terminal names matching the Pin names on the schematic for the tool to identify the nets. To do this, press “L” and based on the metal layer on which you want to place this, choose the suitable layer under the “Select Layer” option. For example, in our case, you could place the labels “VINP”, “VINN”, “VOUT”, “IBIAS”, all in the ME1 layer

since all the contacts are available in ME1. So, we choose the M1_CAD_TEXT option in the “Select Layer” and type the label names that we need. Refer to the image below to see the same.



Press Hide and place the labels one by one (as they appear) on the corresponding positions as shown above. This will complete all the pins except for the substrate connection (“SUB” terminal in the schematic). This begs the question; how do we connect the substrate (P-sub for NMOS devices) electrically? Where is the substrate in the layout window?

Creating Substrate connection in the Layout:

The most important thing to be noticed is that all the NMOS devices are placed on a common P-substrate. In the layout window, the black background corresponds to this P-substrate. You can place the P-substrate to metal contact anywhere on the black background. However, the farther away you place the contact from a MOSFET, the weaker the substrate connection near the MOSFET is going to be tied to that potential. We will place a common substrate connection surrounding the NMOS current mirror and differential pair. Again, press “o” to bring up the contacts menu and choose “M1_PDIF” and add as many columns/rows as possible since the connections to the substrate need to offer very low resistance. Press hide and place the contact next to the MOSFETS. Route metal on top of the contact and connect the metal with the source terminal of NMOS, which is “VSS” pin in the design.