

EE 330 Laboratory 4

Layout of Basic Logic Gates

Spring 2024

The objective of this experiment is to explore the layout of basic circuits. A simple 2-input NOR gate will be used as an example. In this experiment, manual checking of all design rules should be used to verify no design rules are violated. In the next experiment, CAD tools will be used to do a design rule check on your layout. The design rules for this process are given in the Reference Materials section of the class WEB page in the link: [MOSIS rules pictorial \(Most basic rules in one PDF files\)](#)

Checkpoints

1. Layout of NOR gate
2. DRC results.
3. LVS results.

Part 1 Layout a 2-input NOR gate to fit into the “Layout Region” shown in Figure 1 using the TSMC 0.18 μm CMOS process using λ -based design rules. In this process, $\lambda=0.3\mu\text{m}$. The n-channel devices should have dimensions $W=3\lambda$ and $L=6\lambda$. The p-channel devices should have $W=8\lambda$ and $L=3\lambda$. The inputs A and B should be in metal 1 and the output Y should be in metal 4 and placed as shown by the blue rectangles in Figure 1. Assume the width of these metal 1 traces are all 5λ . Try to layout your circuit so that the distance d shown in the figure is small. Connect the bulk of the n-channel transistors to VSS (denoted as GND) and the bulk (i.e. the n-well) of the p-channel transistors to VDD. Verify manually that there are no design rule violations in your layout.

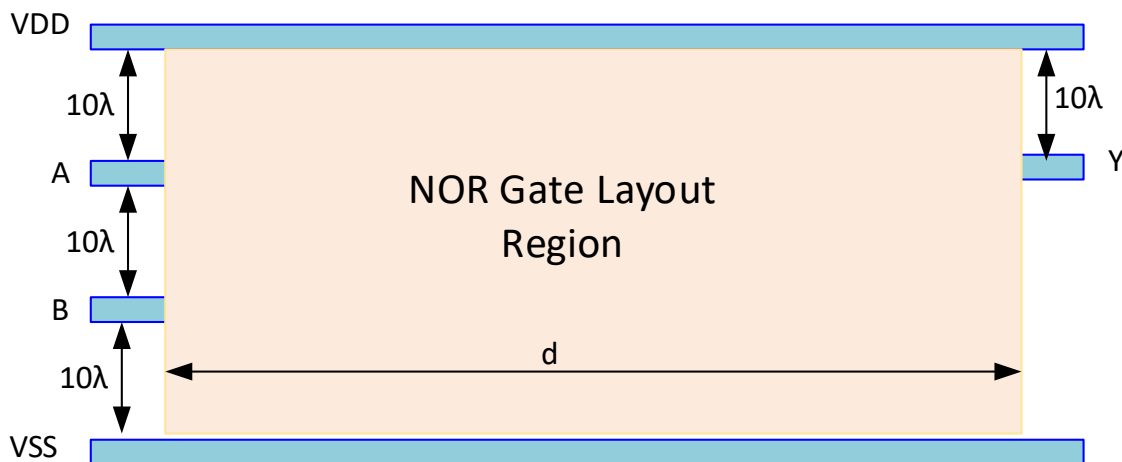


Figure 1 Layout Template for 2-input NOR Gate

Part 2 Modify your layout obtained in Part 1 to have a single design rule violation by moving one contact to Poly to violate the spacing between contact and Poly. Next week you will be asked to verify that the design checking tools catch this design rule violation.

Keyboard Shortcuts

When placing features and editing, use of the GUI in the layout editor can be a slow tedious process. There are some keyboard shortcuts that can speed up this process. Some are summarized in this section.

Useful keyboard shortcuts in schematic view:

Action	Key
Add Instance	i
Add Pin	P
Wire	w
Undo	u
Redo	shift +u
Properties	q
Rotate	r
Copy	c
Check and Save	F8
Zoom to Fit	f
Move	m
Wire Name	L

Useful keyboard shortcuts in layout view:

Action	Key
Create rectangle	r
More detail in layout	shift + f
Less detail in layout	ctrl + f
Stretch rectangle	s
Zoom to Fit	f
create ruler	k
clear all rulers	shift + k
Undo	u

Redo	shift +u
Copy	c
Properties	q