Design Project 2

ELECENG 2EI4

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Ideal Switches

A switch is an ON or OFF mechanism. An ideal switch has no resistance or no voltage drop when it is in the ON state, and the current only travels in one direction. In the OFF state, it should have infinite resistance or no current. This would allow it to have no power loss in both states.

Switch Non-Idealities

- When the switch is in the ON state, there will be voltage drop by VDR.
- When the switch is in the OFF state, there will be some leakage of current which will also lead to a non-zero voltage.
- There is a restricted range of operating voltage that has strict maximum and minimum values
- There is a maximum current rating that is permitted to pass before errors occur
- The switch correctly operates in only one direction

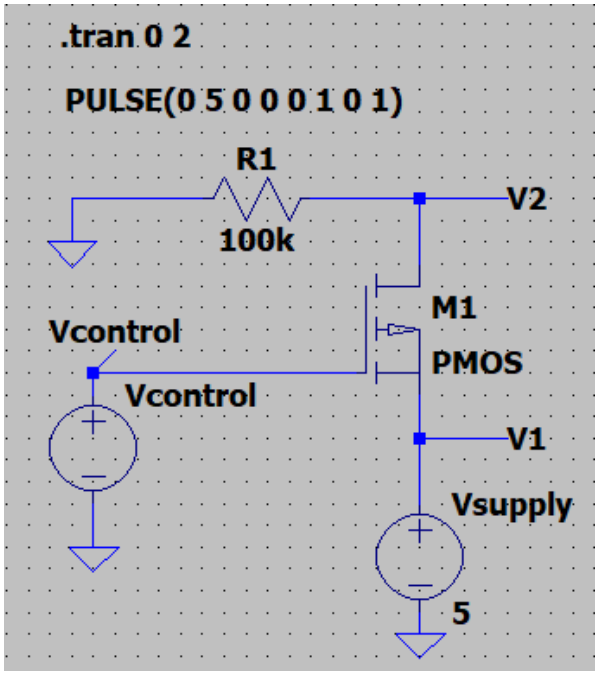
Test Plan

1. In this first experiment, Vcontrol = 0V, Supply = 5V, and v1 = 5V. We would have to determine the rON from VDR by dividing voltage difference by current.
2. In this second experiment, Vcontrol = 5V, Supply = 5V, and v1 (measured over the 100k resistor) = 5V. We would have to determine the leakage current by finding v2 and dividing by the resistance.

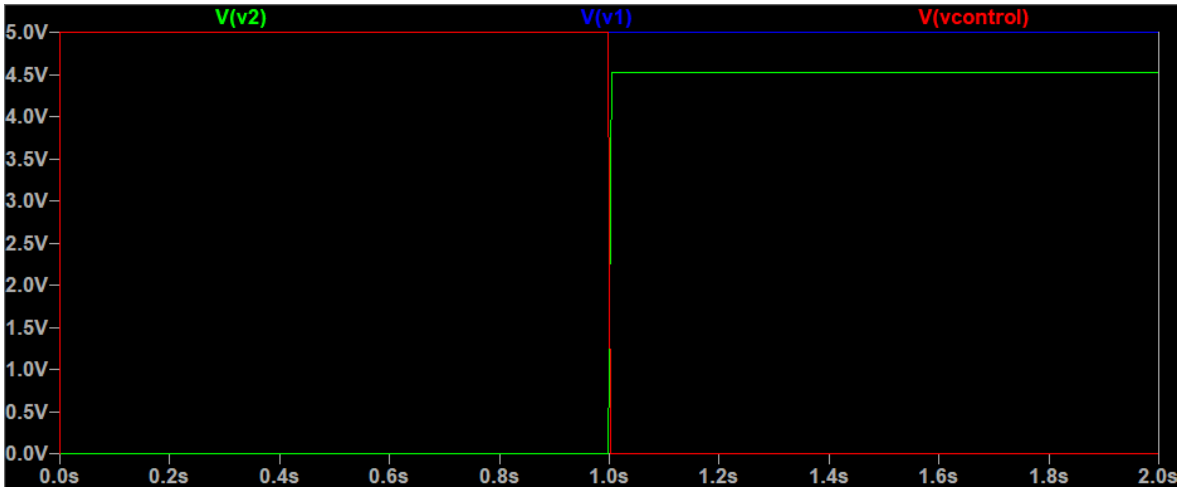
These tests would have to be repeated for both directions.

Switch Type 1

I.



II.

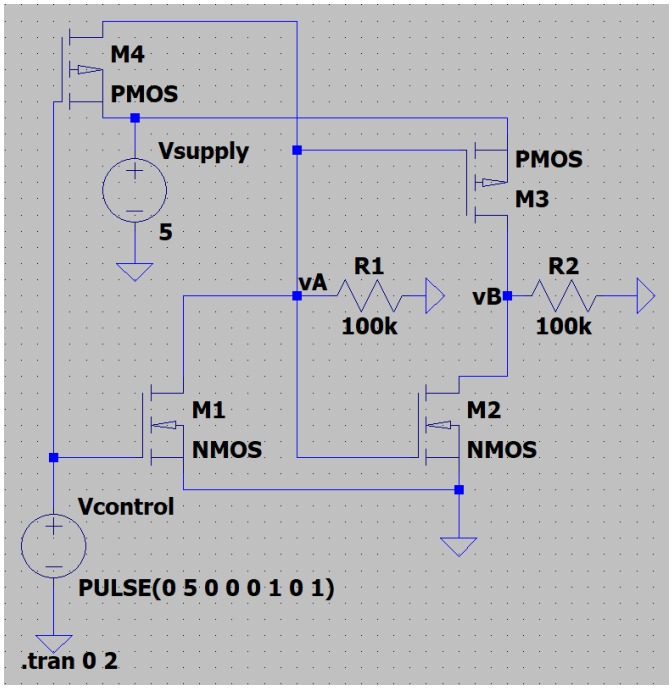


III. In theory, when the Vcontrol is equal 0V, V1 should be equal to V2, but the V1 and V2 are not exactly equal to one another in this circuit, which is not ideal, but it is very close to one another as they are only 0.5V off. This error is due to the fact that there is voltage loss from the MOSFET.

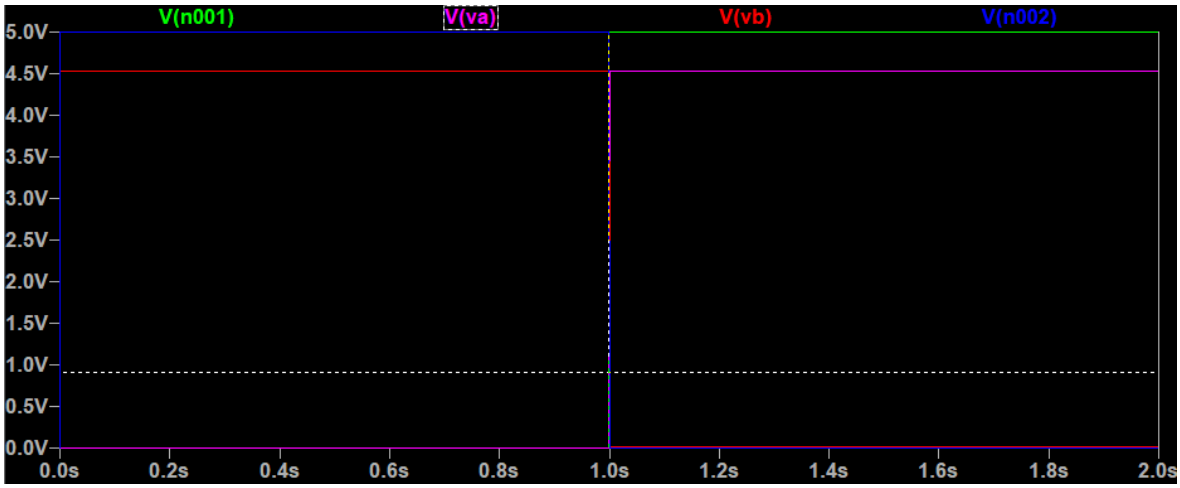
IV. Compared to the design for the second switch, this design had a much lower number of parts needed. This ensured that the circuit is much simpler and would also cost less.

Switch Type 2

I.



II.



III. In theory, when Vcontrol (n002) is equal to 0V, then v1 (n001) should be equal to vA and when Vcontrol is equal to 5V, then v1 should be equal to vB. But in this design, there is a slight difference of 0.5V between vB and v1 as well as vA and v1. This is due to voltage loss from the MOSFET as well as the resistance.

IV. Due to the fact that this circuit had many more components compared to the first switch that was designed, this one is much more complex and would mean that it would cost much more to build.