EE 236 Electronic Devices Lab
Lab No. 0

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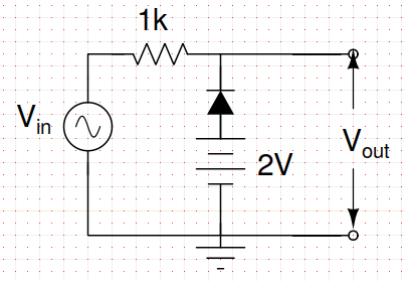
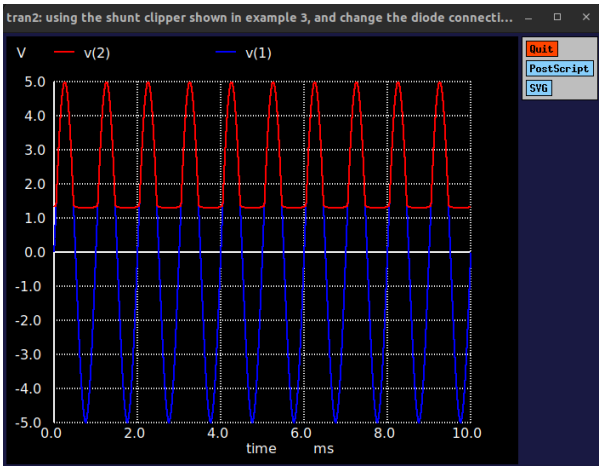
04^{th} August, 2024

NgSpice Portion

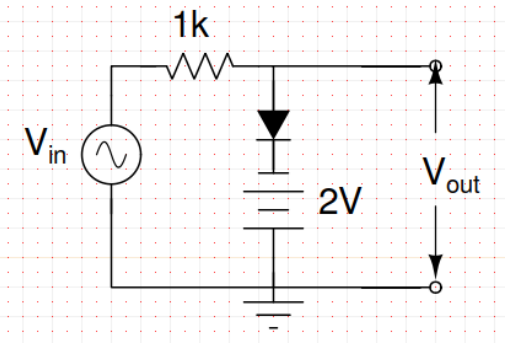
1 Shunt Clipper

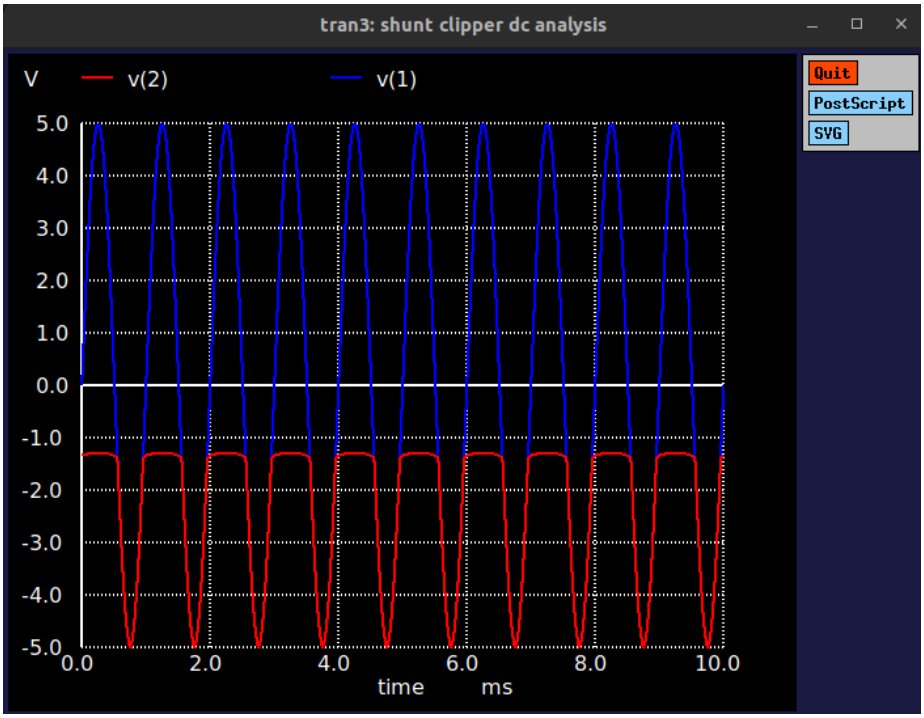
1.1 Shunt Clipper with only Diode Polarity Reversed



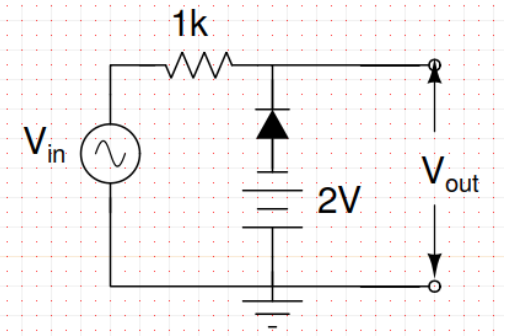


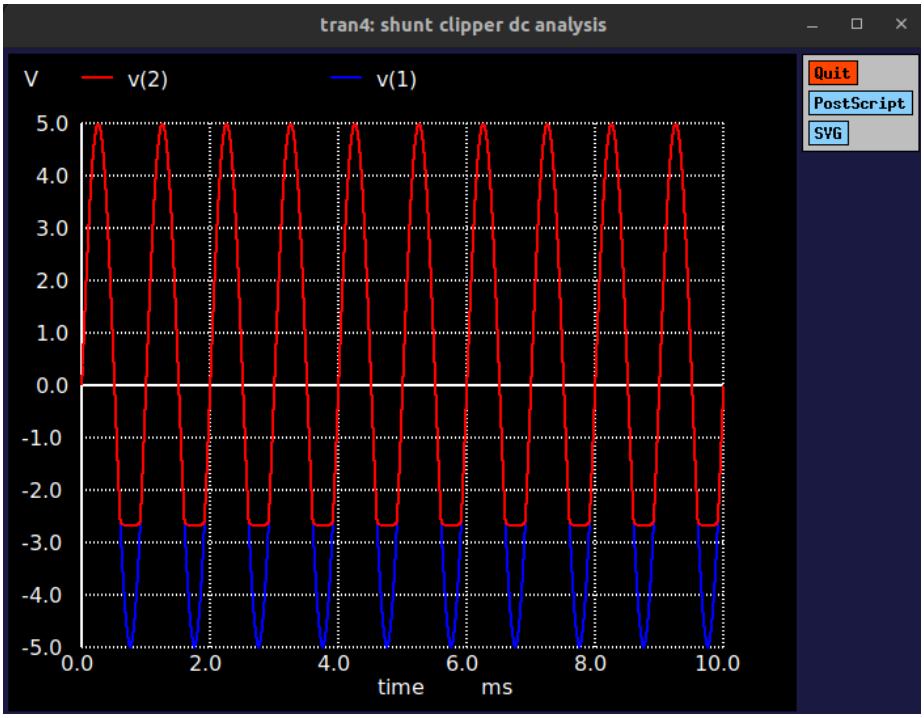
1.2 Shunt Clipper with only Voltage Source Reversed



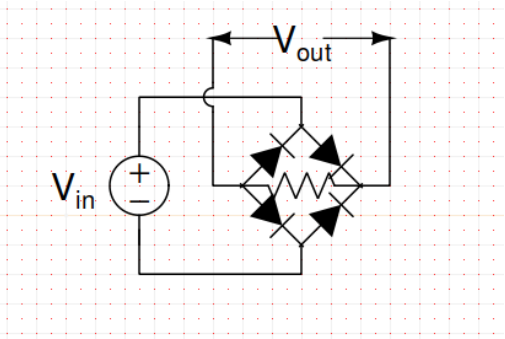


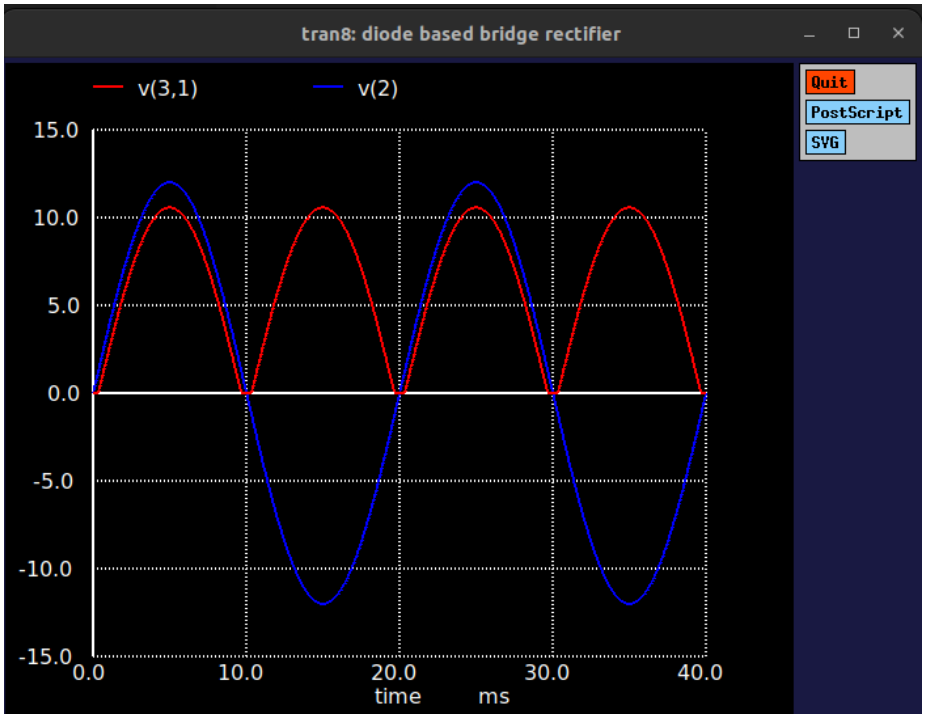
1.3 Shunt Clipper with both Diode polarity and Voltage Source Reversed





1.4 Bridge Rectifier using Diode





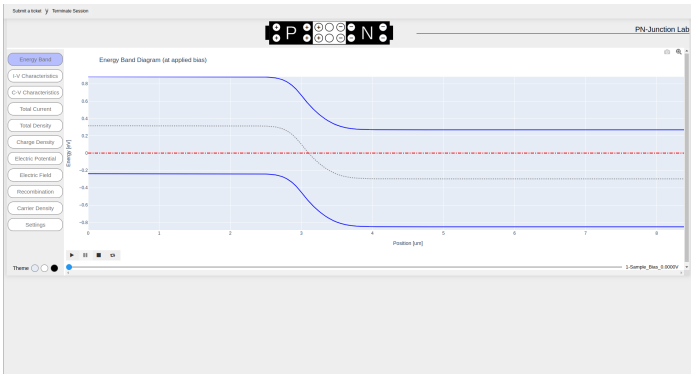
NanoHUB Portion

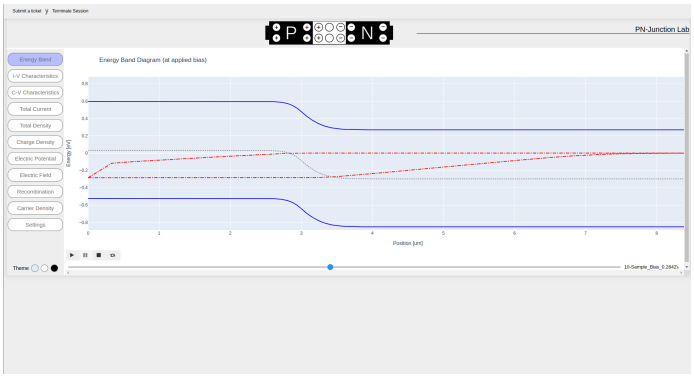
2 Analyze Energy Band Diagram, Electric Field, Charge Density & Total Density

2.1 Aim of the Experiment

Use NanoHub software to analyze the total density, charge density, energy bands and electric field graphs of the diode.

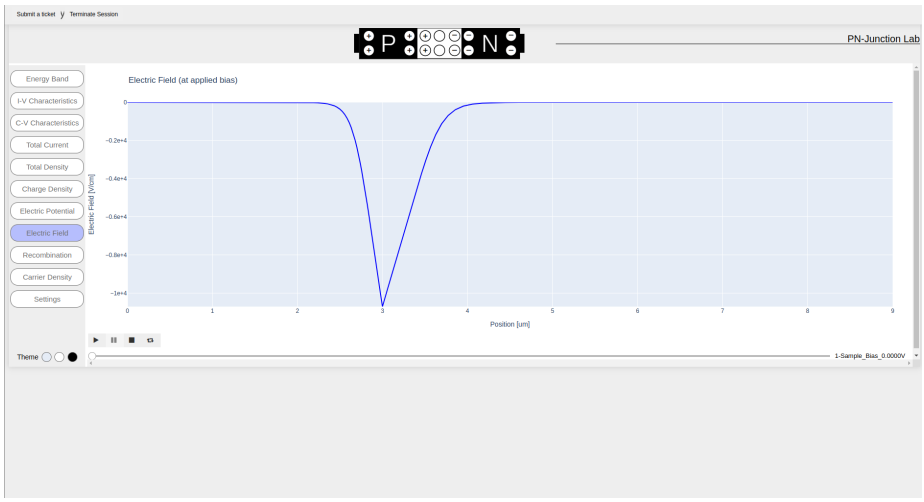
2.2 Energy Band Diagram

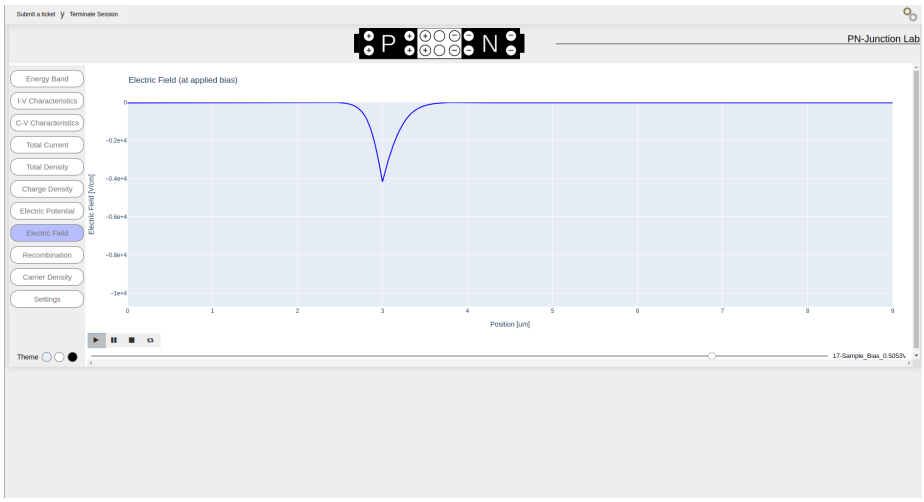




In forward bias, the conduction and valence bands move closer together, which leads to reduction in the band-gap. In reverse bias, the bands move further apart, which leads to increase in the band-gap. This band bending indicates Electric potential across the junction.

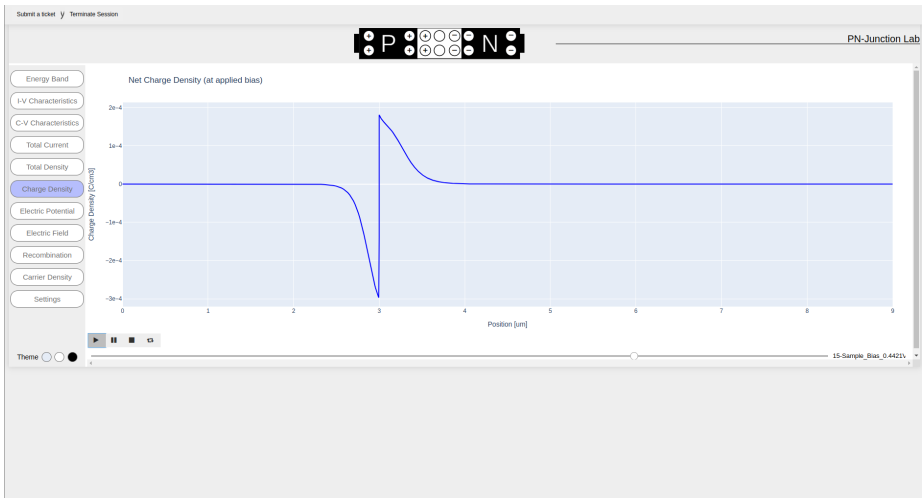
2.3 Energy Field

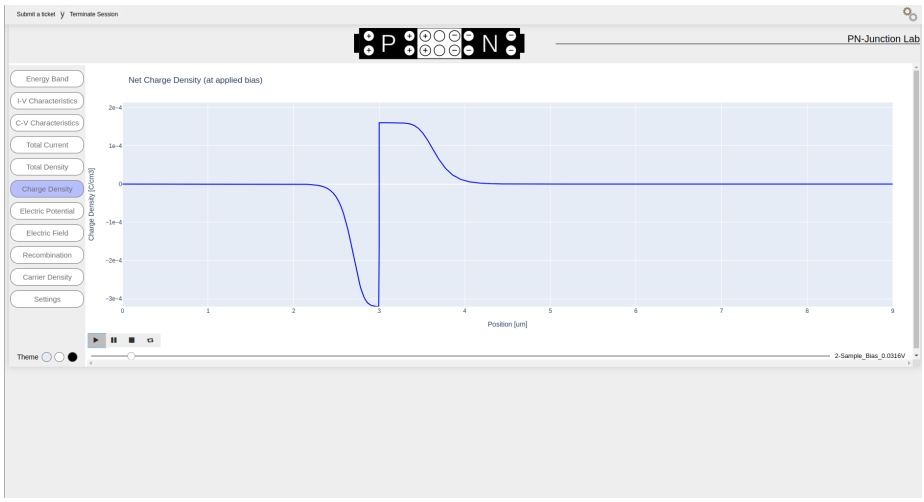




Change in applied voltage leads to change in electric field. In case of forward bias, the electric field decreases, allowing easy flow of current. In reverse bias, the electric field increases, which prevents carrier flow and widens the depletion region.

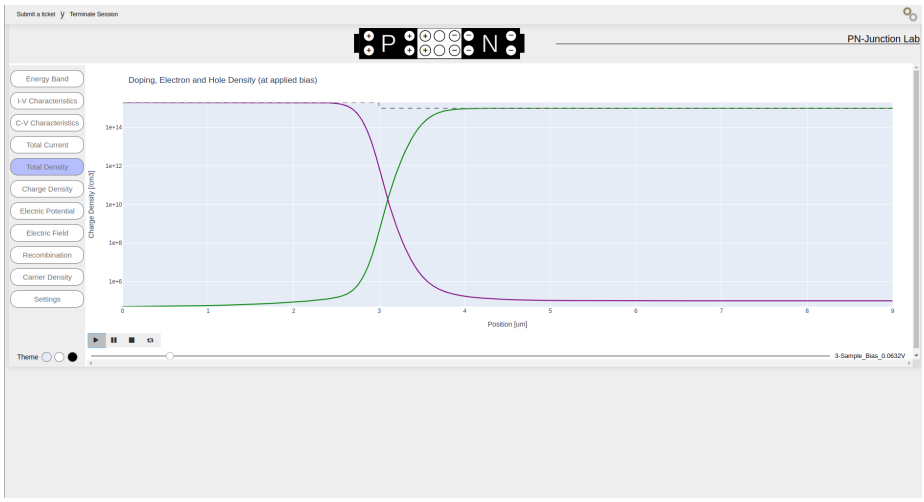
2.4 Charge Density

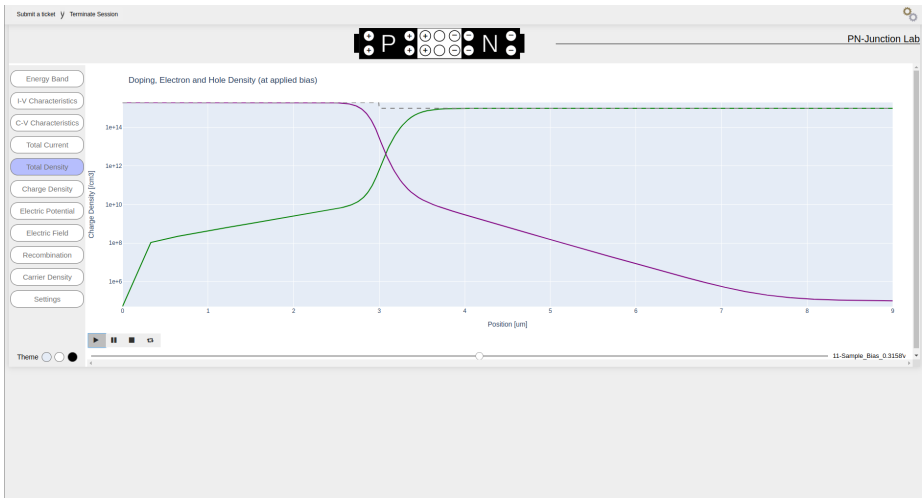




The charge density distribution shows the electrons' and holes' concentration. In forward bias, the combining carriers increase the charge density near the junction. In reverse bias, exopanding depletion region, decreases charge density near the junction.

2.5 Total Density





The plot shows overall concentration of charge carriers. Under forward bias, enhanced recombination leads to increase in the total density of carriers near the junction. In reverse bias, the extending depletion region leads to decrease in the total density of carriers near the junction.