NPN
Overvoltage

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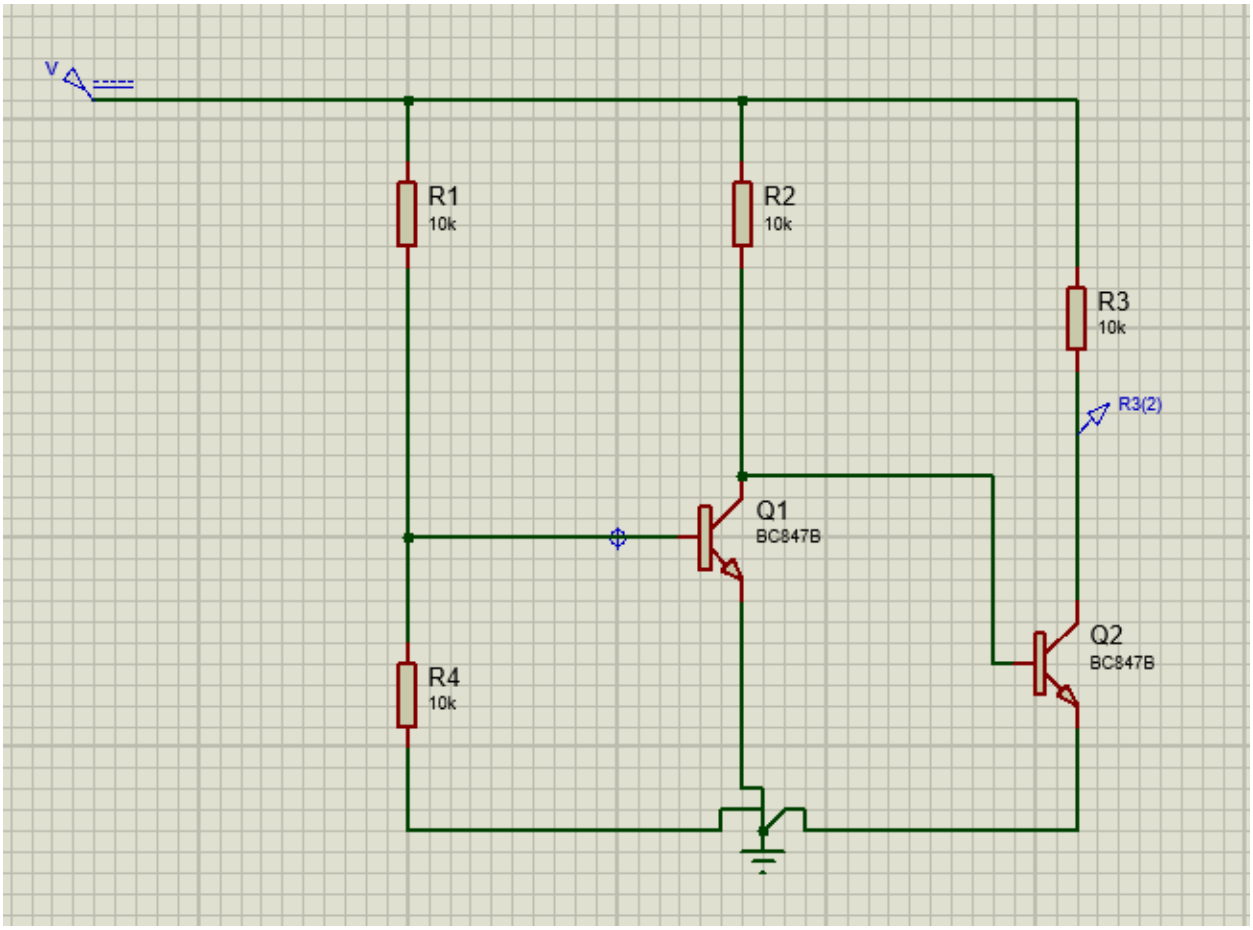

Figure 1 NPN Overvoltage Schematic

Circuit Operation Description

In the beginning, our load is the R4 resistor. When the voltage is too low, the Q1 transistor will be turned off because, to turn it on, we must give 0.7V on its base, and we made the value for R2 so small compared to R1 to make us need a high input voltage to turn Q1 on. So, in cases of low input voltage, only Q1 will be turned on, and it will act as a low-side switch because it's an NPN transistor, and everything will run smoothly until we hit the point where the voltage that is reaching Q1 is equal to or greater than 0.7V. Here, Q1 will connect the node above it to ground, which means the base of Q2 will be connected to the ground, making it turn off and act as an open circuit.

Simulation Discussion

BJT Collector (Output Branch)

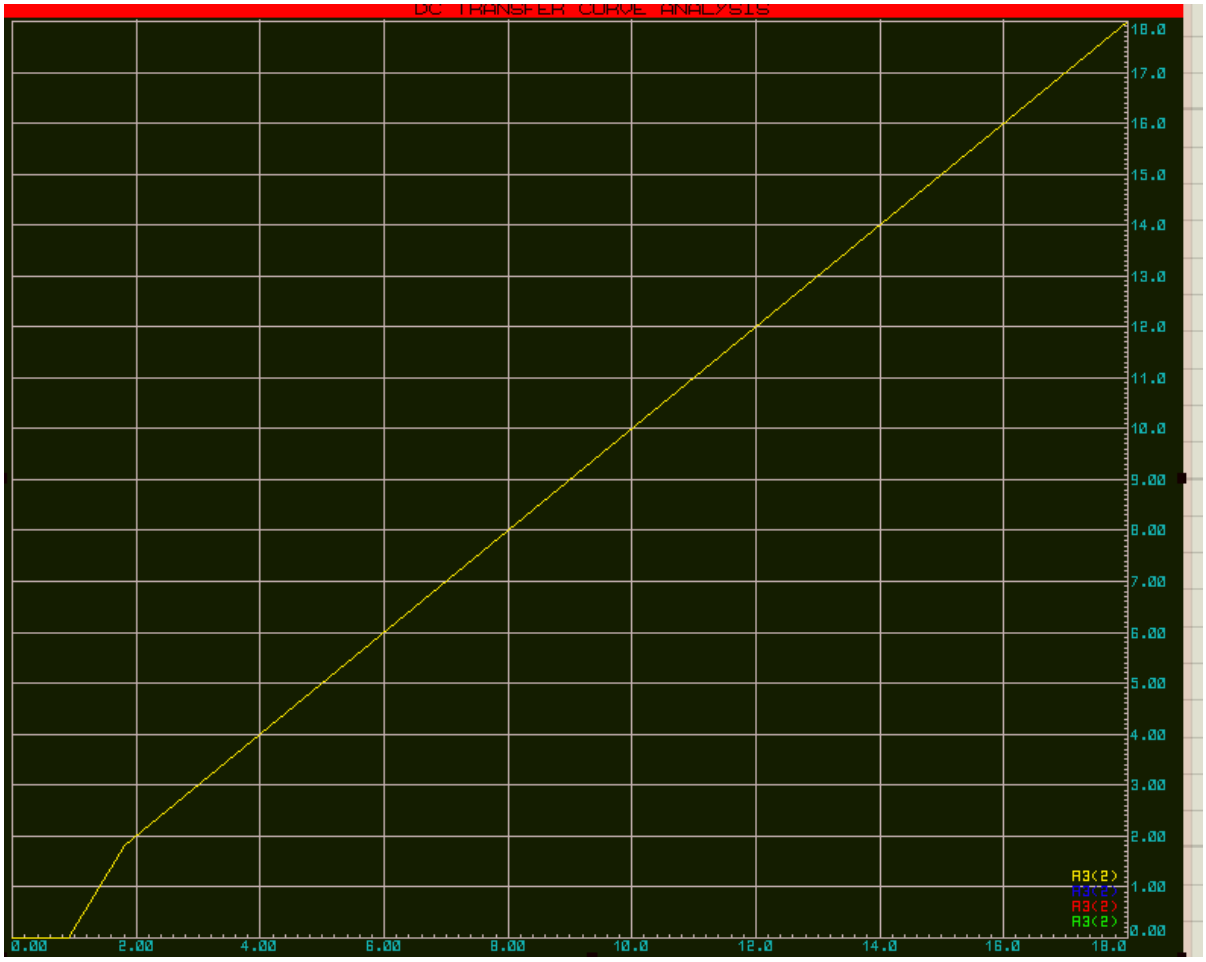

Figure 2 Output Branch Voltage

As seen in this sweep, the voltage goes from 0 to 18 volts. In the beginning, the Q1 transistor was cut off because there wasn't enough voltage on its base, so the voltage was reaching the base of Q2 and it was working as a switch, so on the Q2 collector, the voltage was zero because if it were working as a switch, the collector voltage would be approximately zero (connected to ground), but after the voltage reaches 18 or lower, Q1 will start working, and it will connect the base of Q2 to ground and it will act as an open circuit, so its collector will be floating and the branch will be open circuit and its voltage will be the same as the voltage source.

Q1 and Q2 Bases

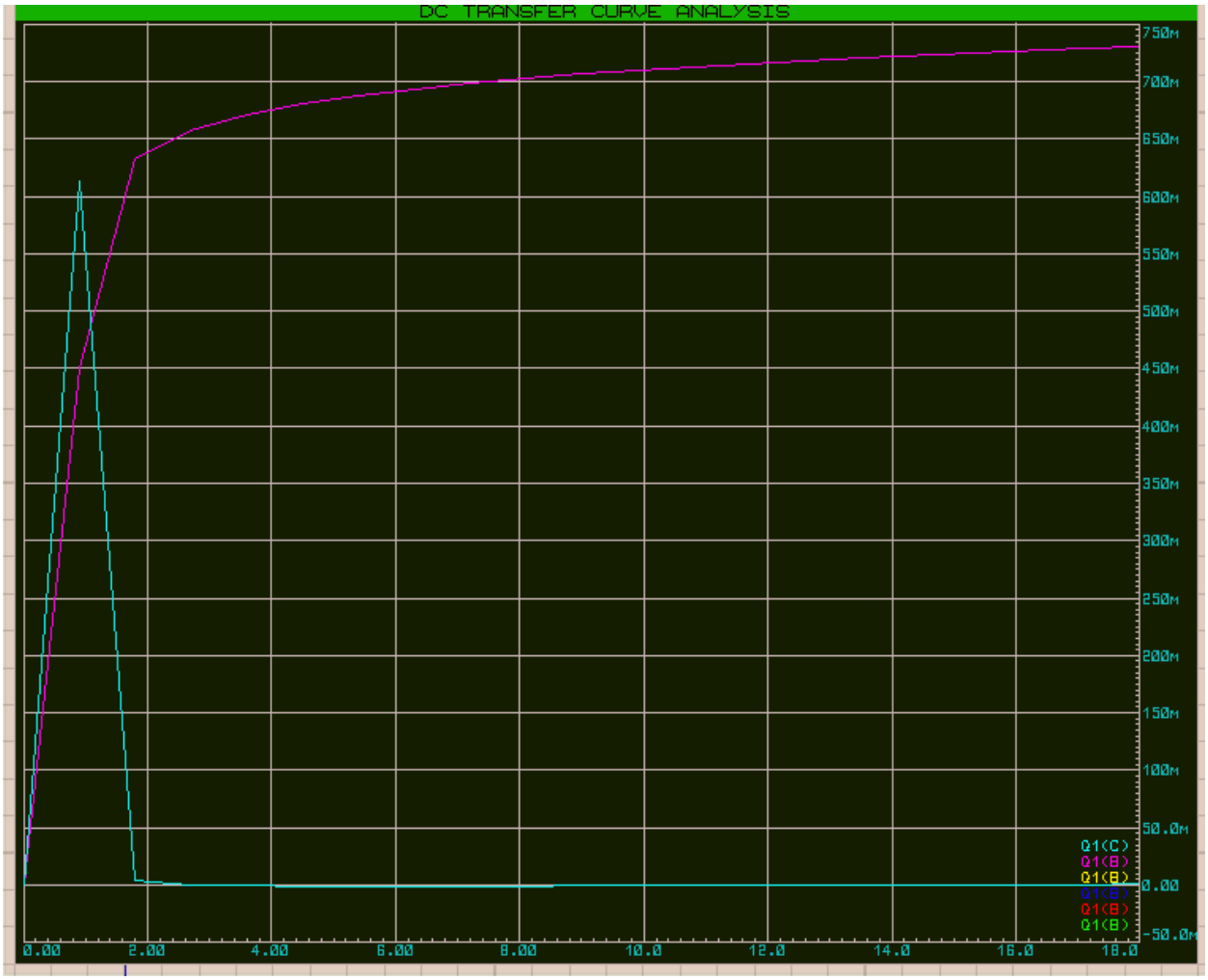

Figure 3 Q1 and Q2 Bases Voltages

There are two graphs here, the purple one is the Q1 base, and the white one is the Q2 base. Q1 is increasing gradually because the voltage from the source is increasing, and if we measure it using the voltage divider rule, we'll find the value of the Q2 base. Here, we can notice that the Q2 base gets to zero when Q1 gets 700 mV or near it because here Q1 starts working, and when it does, it connects the base of Q2 to the ground, so it gets to zero.