1 Variable Voltage Divider

Build the circuits shown in Figure 1 using a 2N5485 field effect transistor. The two sources $V_{dd}$ and $V_{cont}$ are variable voltage sources.

1. Explain how the circuit constitutes a variable voltage divider.
2. Set $V_{cont} = 0$ V and measure $V_{out}$ for $V_{dd} = 1, 2, 3,$ and $4$ V.
3. Compute the equivalent resistance $R_{DS}$ (see handouts) for each of the values of $V_{cont}$.
4. Repeat measurement for $V_{out}$ for $V_{dd} = -1, -2, -3,$ and $-4$ V.
5. For which value of $V_{cont}$ the FET does not act as a resistor anymore.

![Figure 1: Circuit for part 1.](image)

2 Fast switch

Build the circuit shown in Figure 2. Use a BJT transistor 2N3725 or equivalent.

1. Use a DC voltage source to provide 5 V. Close the switch and measure $V_{CE}$, the voltage drop across the resistor and deduce $I_C$ and $I_B$.
2. Replace the resistor with a 150 $\Omega$ resistor and redo the measurement.
3. Use a function generator as voltage source instead of the DC source. Set the generator to produce square wave with amplitude of 5 V approximately.
4. Vary the frequency and describe your observations.

5. Set the frequency to $f = 100$ kHz and observe, describe and interpret the collector voltage with the help of an oscilloscope. Measure the rise and fall time of the transistor switch and conclude on the limitations/potentials of such a switch.

3 Light emitting diode

Build the circuit shown in Figure 3. Use a variable DC voltage power supply for $V$.

1. Adjust the power supply to get a voltage across the resistor $V_R = 50$ mV
2. Measure the voltage drop across the diode
3. Repeat Step (2) for $V_R = 0.1, 0.5, 1, 2, \text{ and } 5$ V
4. Plot current versus voltage for the diode
5. How much current is needed to turn the diode on.

![Circuit Diagram](image2.png)

Figure 2: Circuit for part 2.

![Circuit Diagram](image3.png)

Figure 3: Circuit for part 3.