

Laboratory Report 5, JFET curves and attenuators

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Introduction:

In this lab, the focus will be on the JFET transistor and we going to measure the JFET curves. There will be 3 circuits in which we are going to gather data from and put them in a tabular format and graph them.

Results

A1)

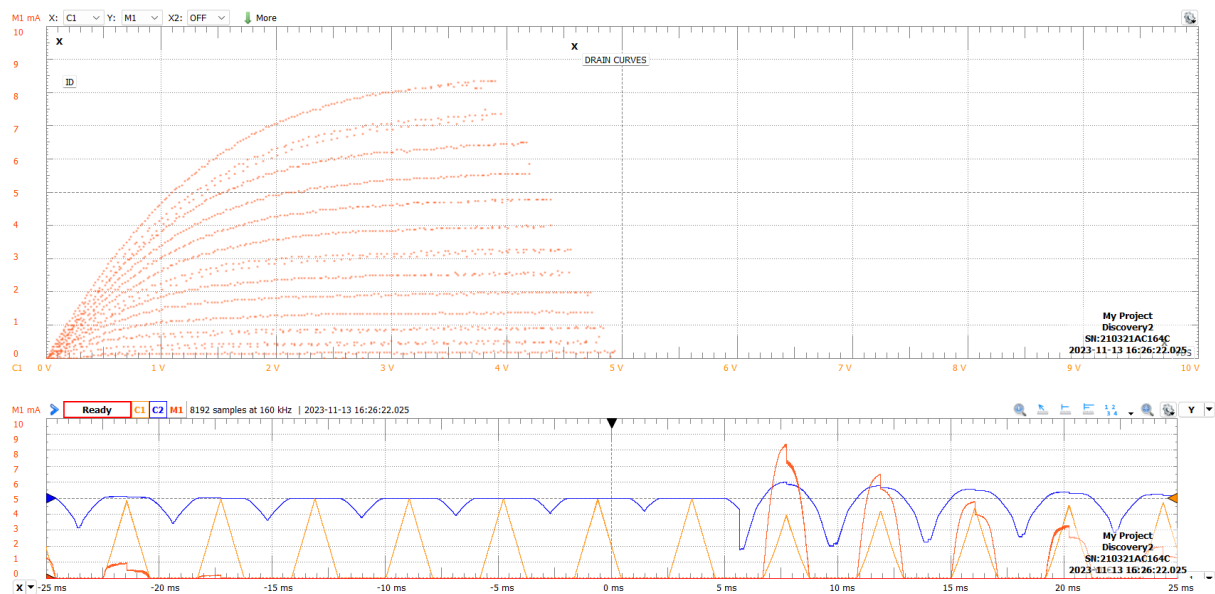


Figure 1 Both graphs are for part 1 of the experiment.

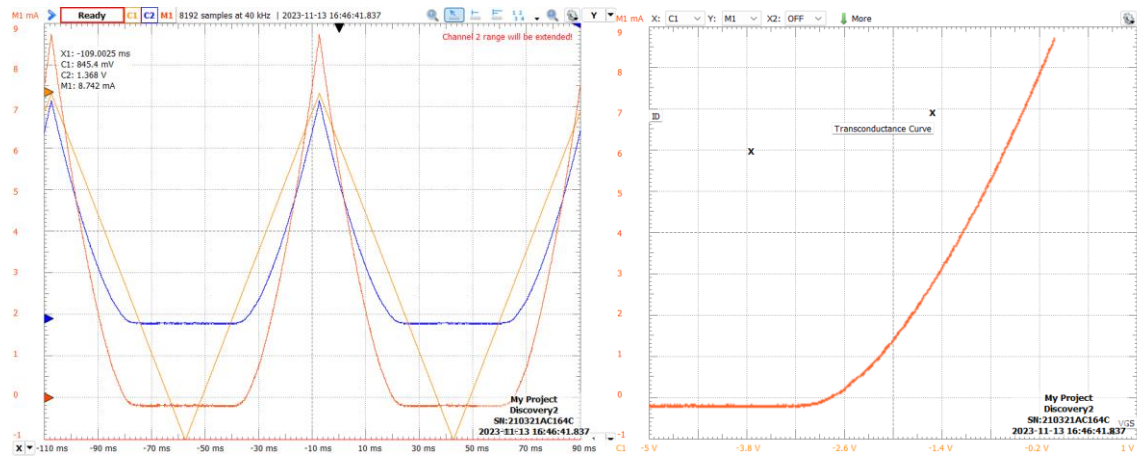
$$I_{DSS} = 8.45\text{mA}$$

$$V_p = 4\text{V}$$

$$r_{ds(on)} = V_p / 2I_{DSS}$$

$$r_{ds(on)} = 470.6\Omega$$

A2)



Graphs for the Transconductance curve

The I_{DSS} for the transconductance is **8.6mA** which is a slight difference compared to last value.

$$G_m = 8.6\text{mA}/5\text{V} = 1.72$$

$$V_{GS(off)} = -2I_{DSS}/G_{m0} = -0.01\text{V}$$

$$V_p = -V_{GS(off)} = 0.01\text{V}$$

$$R_{DS(on)} = 0.01\text{V}/2(8.6\text{mA}) = 0.58\Omega$$

JFET voltage-controlled resistor.

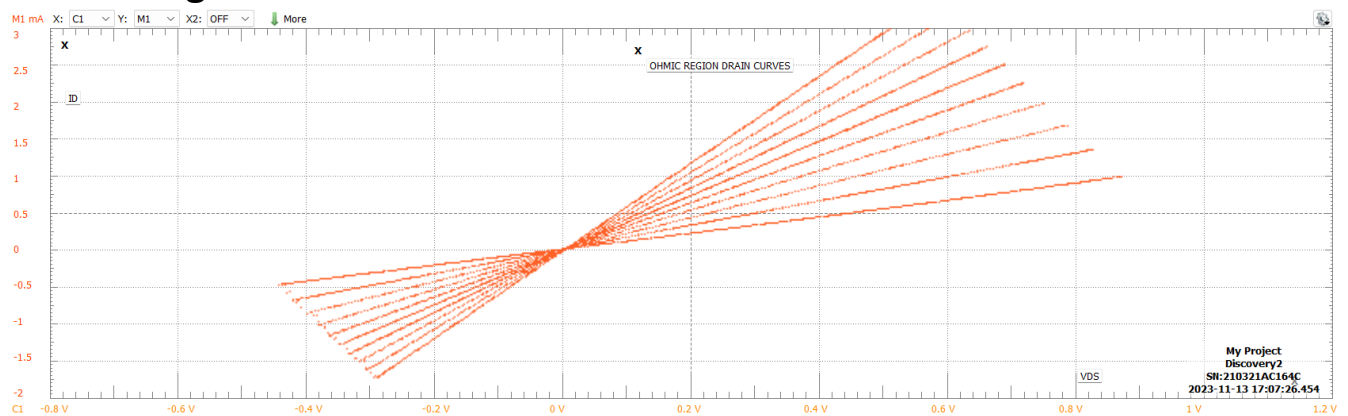
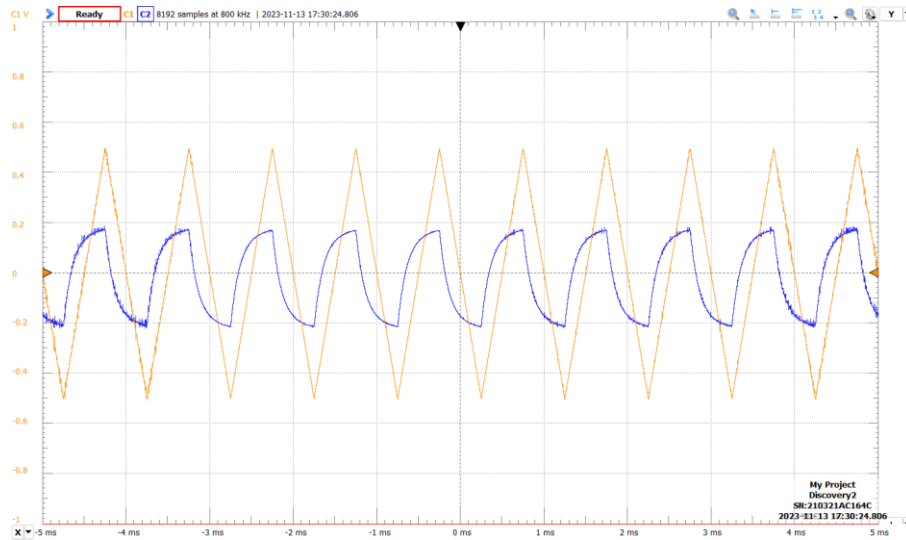


Figure 2 Graph for the JFET voltage controlled resistor

JFET CONTROLLED ATTENUATOR:



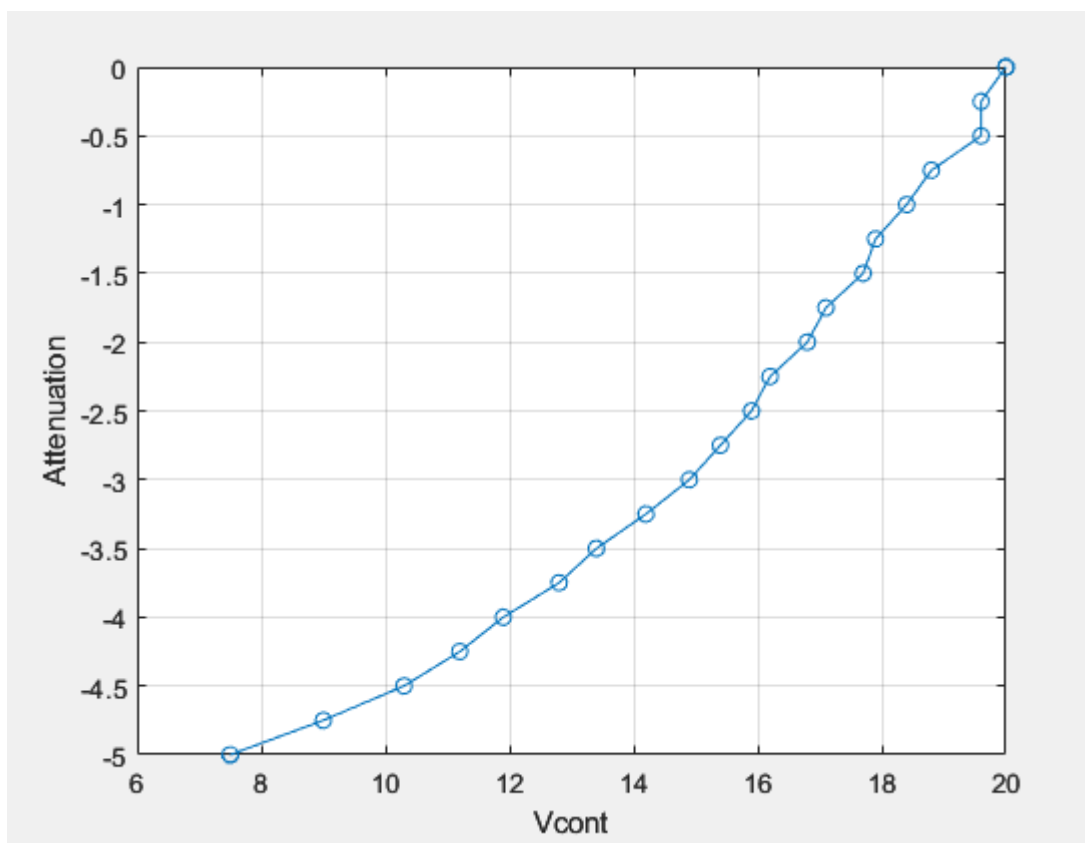
Voltage(V)	Input(V)	Output(V)	Attenuation α	Attenuation (dB)
-5	1	0.42	0.42	7.5
-4.75	1	0.355	0.355	9
-4.5	1	0.305	0.305	10.3
-4.25	1	0.275	0.275	11.2
-4	1	0.255	0.255	11.9
-3.75	1	0.230	0.230	12.8
-3.5	1	0.215	0.215	13.4
-3.25	1	0.195	0.195	14.2
-3	1	0.18	0.18	14.9
-2.75	1	0.17	0.17	15.4
-2.5	1	0.16	0.16	15.9
-2.25	1	0.155	0.155	16.2
-2	1	0.145	0.145	16.8
-1.75	1	0.140	0.140	17.1
-1.5	1	0.130	0.130	17.7
-1.25	1	0.128	0.128	17.9
-1	1	0.120	0.120	18.4
-0.75	1	0.115	0.115	18.8
-0.5	1	0.105	0.105	19.6
-0.25	1	0.105	0.105	19.6
0	1	0.1	0.1	20

Input = 1V

Output = 420mV

Attenuation α = output/input

In dB = $-20\log(\alpha)$



Conclusion

In conclusion I was able to successfully complete the lab and collecting all the results and displaying them in tabular and graphical formats. I was also able to understand the processes of the JFET transistor.

Problem

a)

Lab 5 problem ↓

(a) $I_D = \frac{I_{DSS}}{V_p^2} [2(V_{GS} + V_p)V_{DS} - V_{DS}^2]$

Differentiate in terms of V_{DS}

$$\frac{\partial I_D}{\partial V_{DS}} = \frac{I_{DSS}}{V_p^2} \cdot [2(V_{GS} + V_p) - 2V_{DS}]$$

equation 3 ↓

$r_{DS} = \frac{r_{DS(on)}}{1 + V_{GS}/V_p}$

$r_{DS} \approx \frac{2I_{DSS}}{V_p^2} \cdot (V_{GS} + V_p)$

$$r_{DS} \approx \frac{1}{r_{DS(on)}} \cdot (V_{GS} + V_p)$$
$$r_{DS} \approx \frac{r_{DS(on)}}{1 + \frac{V_{GS}}{V_p}}$$

b)

