

EEO 352 Fall 2023 - Assignment 7 – Field Effect Transistors (FETs) - ABET

Please document each step with snapshots of the built circuit, plots, pictures and your observations.
Please include this page.

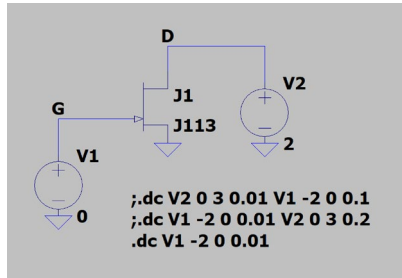


Fig.1

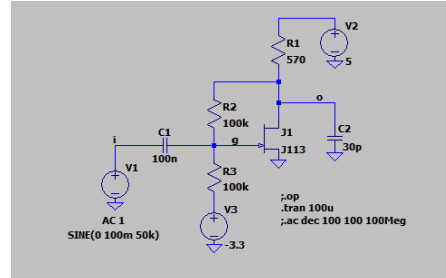


Fig.2

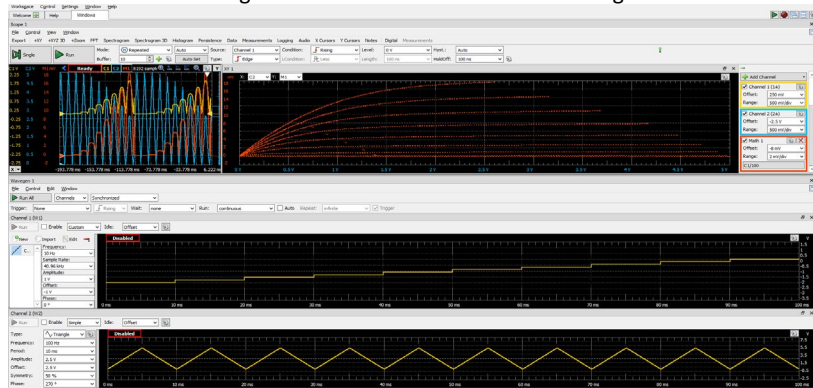


Fig.3

1) Using the n-channel JFET J113 (pick from njf) as in Fig1 simulate and plot the following (25pts):

- Drain current I_d vs V_{ds} (range 0V to 3V) with parametric V_{gs} (-2V to 0V in 100mV steps)
- Drain current I_d vs V_{gs} (range -2V to 0V) with parametric V_{ds} (0V to 3V in 200mV steps)
- Drain current I_d vs V_{gs} (range -2V to 0V) at $V_{ds}=2V$, and extrapolate the V_{gs} at $I_d=5mA$
- Derivative ($d(.)$) of the drain current I_d vs V_{gs} (range -2V to 0V) at $V_{ds}=2V$, and extrapolate the transconductance at $I_d=5mA$

Note1: the 30pF capacitor emulates the oscilloscope capacitive load (i.e. not required in experimental)

2) Using the n-channel JFET J113, one 570Ω resistor at the drain, and one 100kΩ and one 47kΩ to bias the gate, design the amplifier in Fig.2 and simulate and plot the following (25pts):

- Simulate the response to 50kHz 100mV sinusoidal signal (plot in separate panes) and extrapolate gain
- Frequency response, extrapolating the gain and -3dB bandwidth without and with the 30pF load

3) Using the n-channel JFET J113 and one 100Ω resistor at the drain, build and plot (75pts) (ABET PI-71,PI-72,PI-73):

- Drain current I_d vs V_{ds} (range 0V to 3V) with parametric V_{gs} (see example in Fig.3)
 - Drain current I_d vs V_{gs} (range -2V to 0V) for $V_{ds}>2V$, and extract the V_{gs} and the g_m at $I_d=5mA$
 - Explain how the tools operating on voltages allow measuring currents and plotting the desired curves
- Hint1: search for “Semiconductor Curve Tracer With the Analog Discovery 2”
Hint2: for (b) use W1 Triangle Amp=1V, Off=-1V at Gate

4) Build and measure the amplifier in Fig.2 and plot the following (75pts):

- Measure the response to 50kHz 100mV sinusoidal signal and extract gain
- Frequency response, extracting the gain and the -3dB bandwidth