

# EE321 Lab - week 8 - JFET Amplifier

1st September 2005

## 1 Purpose

This experiment has several purposes:

1. To show you a different type of amplifying device: the junction field effect transistor.
2. To gain the experience of making measurements without detailed instructions.

## 2 Overview

Last week, we studied a classic transistor amplifier with the usual "4 resistor" bias circuit. We looked at the bias, and the gain with and without an emitter bypass capacitor.

This week, we will do the same, substituting a "JFET" for the "BJT", and making some minor circuit changes to accommodate it.

Tolerances of this device are poor, so you may need to tweak the design.

To give you an idea of how poor.....

|                    | min    | typ  | max    |
|--------------------|--------|------|--------|
| $I_{DSS}$          | 2 mA   | 6 mA | 9 mA   |
| $V_{TH}$           | -1 V   | -4 V | -7 V   |
| $G_m$ at $I_{DSS}$ | 1.5e-3 |      | 5.5e-3 |

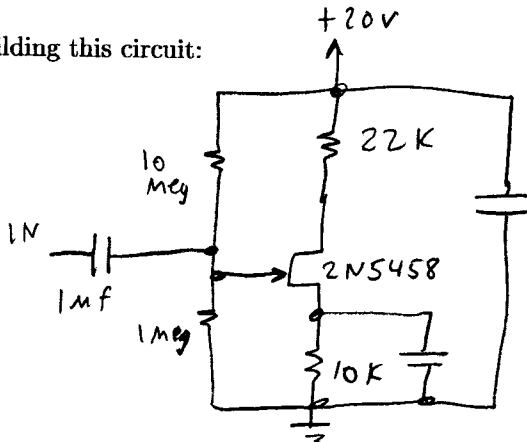
This is bad for biasing, but the value  $K$  is fairly consistent at .5e-3, so the transconductance at the current we use should be about 1e-3. FET transconductance is usually lower than BJT transconductance, so you can expect lower gain than last time.

## 3 Parts and equipment

- 2N5458 JFET
- Resistors, as per schematic, mostly the same as last time.
- Capacitors, same as last time.

## 4 Procedure

Begin by building this circuit:



Then measure it as you did last week. You can use your notes from last week as a reference. Check with the instructor when you measure the bias, then again with gain measurements.

## 5 Report

For this experiment, only a simple report is required. You should hand it in before you leave today.

### 5.1 Executive summary, on cover

Just a schematic of the circuit, with the measurements.. Operating point, and gain with and without the source bypass capacitor.

### 5.2 More detailed summary

A sentence or two on the experience.

### 5.3 Journal

The usual journal of what you did.

### 5.4 Analysis

Gain check: for  $G_m=1e-3$ , what gain do you expect? What did you get?

### 5.5 Simulation

Just include a copy of mine.

```

list
Rg1 ( dd g ) 10.Meg
Rg2 ( g 0 ) 1.Meg
Rd ( dd d ) 22.K
Rs ( s 0 ) 10.K
M1 ( d g s s ) n l= 10.u w= 10.u
Vdd ( dd 0 ) DC 20.
.model n nmos (level=1 tnom= 27. fc= 0.5 pb= 0.8 cj= 0. mj= 0.5 cjsw= 0. mjsw= 0.5 is
= 10.f rsh= 0. cgso= 0. cgdo= 0. cgbo= 0. vto=-3.5 gamma= 0. phi= 0.6 ld= 0. uo= 600.
tpg=1 kp= 0.001)
*+(* cox= 0.)
Cin ( in g ) 1.u
Vin ( in 0 ) GENERATOR
Cs ( s 0 ) 0.001
print op v(nodes) id(m1) gm(m1) vds(m1)
op
#          v(d)          v(dd)          v(g)          v(in)          v(s)          id(M1)          gm(M1)          vds(M1)
300.15    10.36          20.           1.8182        0.             4.382         438.2u         936.16u         5.9775

print ac v(nodes)
ac 1k
#Freq          v(d)          v(dd)          v(g)          v(in)          v(s)
1.K            20.596        9.3606n        1.            1.            149.u
delete cs
op
#          v(d)          v(dd)          v(g)          v(in)          v(s)          id(M1)          gm(M1)          vds(M1)
300.15    10.36          20.           1.8182        0.             4.382         438.2u         936.16u         5.9775

ac
#Freq          v(d)          v(dd)          v(g)          v(in)          v(s)
1.K            1.9877        902.49p        1.            1.            0.90349
>

```