

## **Experiment-5**

### **Aim:**

To implement a common source amplifier using diode connected load of gain 5 and analyse its transient and ac characteristics.

### **Tool Used:**

LTspice

### **Theory:**

When the input signal is applied at the gate terminal and source terminal, then the output voltage is amplified and obtained across the resistor at the load in the drain terminal. This is called a common source amplifier.

Common source amplifier is similar to the common-emitter follower of Bipolar Junction transistor. If we use P-channel FET, the polarity of the input voltage will be reversed.

For a Level 3 NMOS let's assume

$$V_{DD} = 1.8V$$

$$V_T = 0.4V$$

$$V_{GS} = 0.6V$$

$$K_n = 120\mu A/V^2,$$

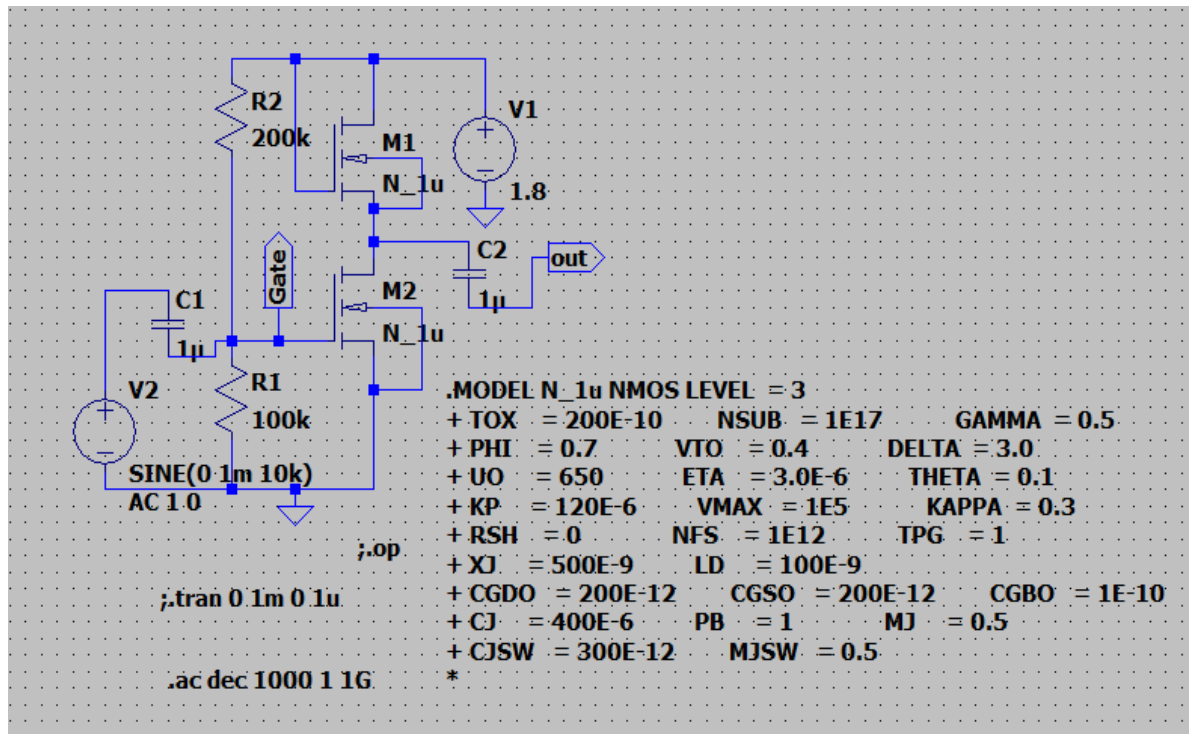
Which gives a value of  $(W/L) = (25)$  for  $1mA$   $I_D$ .

Also, for these values'  $g_m$  is attained as  $10m\Omega^{-1}$ , therefore for gain 10,  $R_D$  is taken as  $1K\Omega$ .

The value of  $V_{DS}$  should be maintained above  $(V_{GS} - V_T = 0.6 - 0.4 = 0.2V)$  for the transistor to stay in saturation region.

As for M2, the width is taken as  $250\mu m$  and the length is taken as  $10\mu m$  and for M1, the width is taken as  $50\mu m$  and the length is taken as  $50\mu m$ .

## Circuit Schematic: [ Level 3 ]



## DC Operating Point

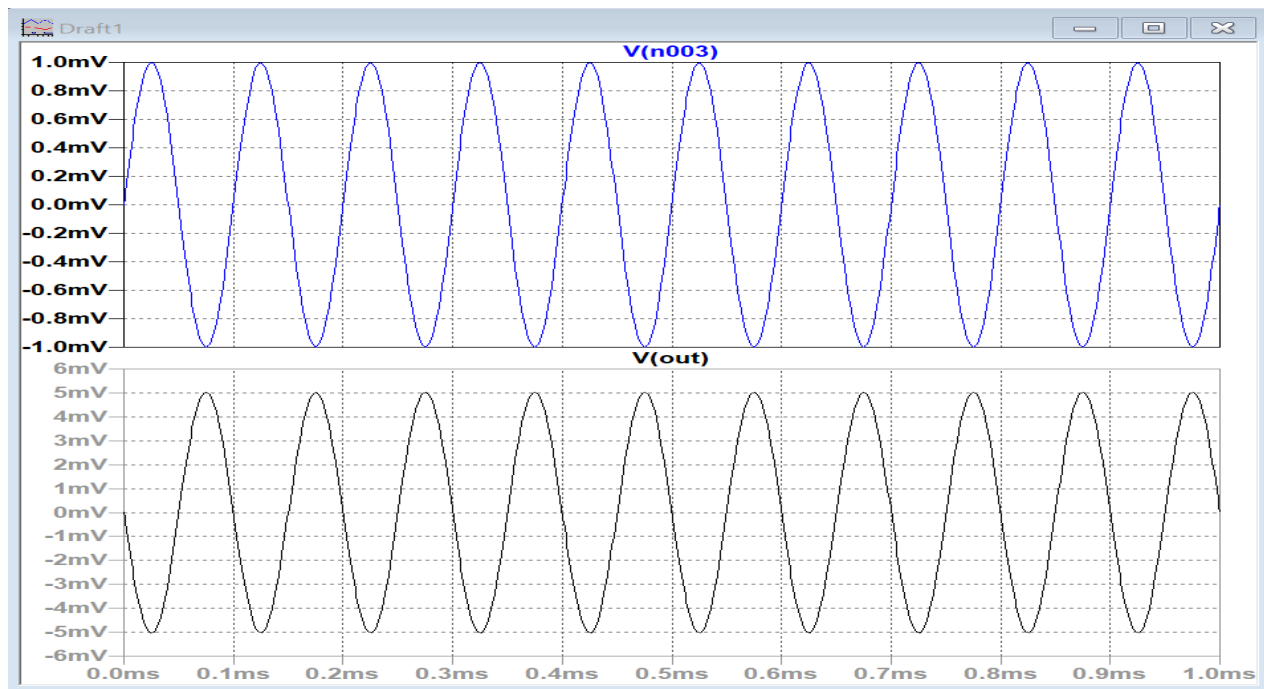
\* C:\Users\singh\Documents\Analog IC Design Lab\Lab4\common gat

--- Operating Point ---

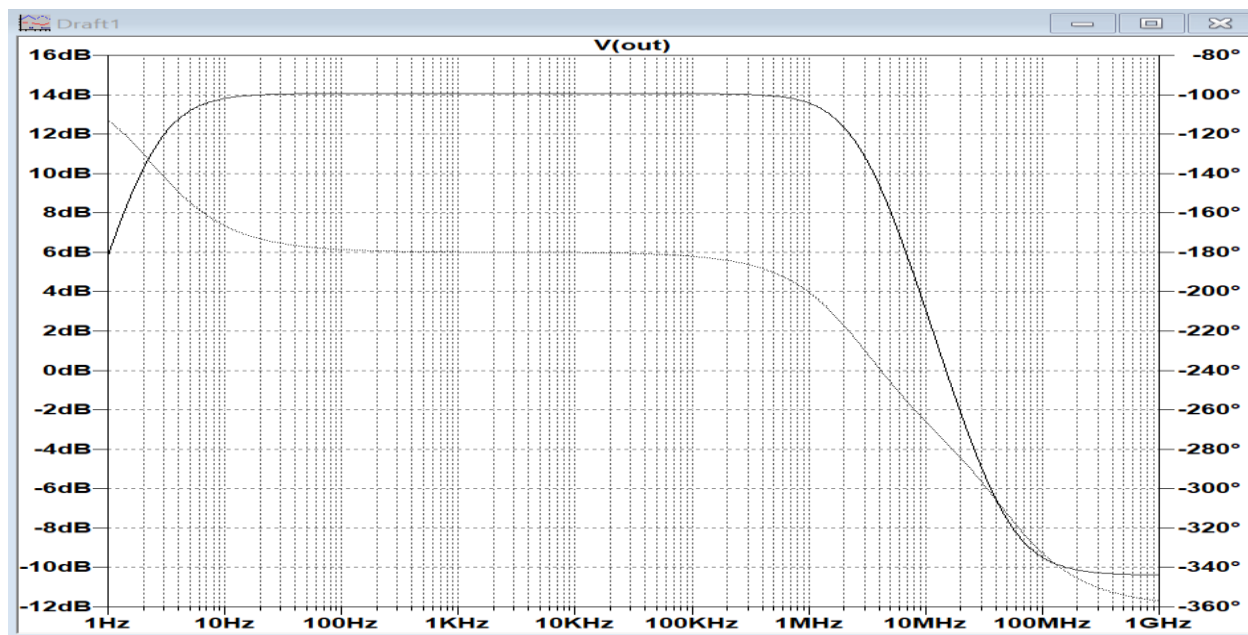
V(n001) :	1.8	voltage
V(n002) :	0.405172	voltage
V(gate) :	0.6	voltage
V(n003) :	0	voltage
V(out) :	4.05171e-007	voltage
Id(M2) :	4.62144e-005	device_current
Ig(M2) :	0	device_current
Ib(M2) :	-4.15172e-013	device_current
Is(M2) :	-4.62144e-005	device_current
Id(M1) :	4.62144e-005	device_current
Ig(M1) :	0	device_current
Ib(M1) :	-1.40483e-012	device_current
Is(M1) :	-4.62144e-005	device_current
I(C2) :	4.05171e-019	device_current
I(C1) :	-6e-019	device_current
I(R2) :	6e-006	device_current
I(R1) :	6e-006	device_current
I(V2) :	6e-019	device_current
I(V1) :	-5.22144e-005	device_current

## Output Waveforms:

### Transient Response:



### AC Analysis:



## Result:

The circuit is designed for a gain of 5 and the output is verified to be correct.

- Bandwidth is obtained to be: 3.17MHz
- Cutoff Freq: 3.17MHz, 2.36Hz