ELECTRONICS LABORATORY

PART 7 EXPERIMENTS

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Contents

EXPERIMENT 7.1
EXAMINATION OF TRANSISTOR SOUND AMPLIFIERS

EXPERIMENT PROCEDURE:

1- Put Y-0016/011 module in place. Connect the circuit shown in Figure 7.1.

Note: 8R/2W resistor on the module will be used as speaker.

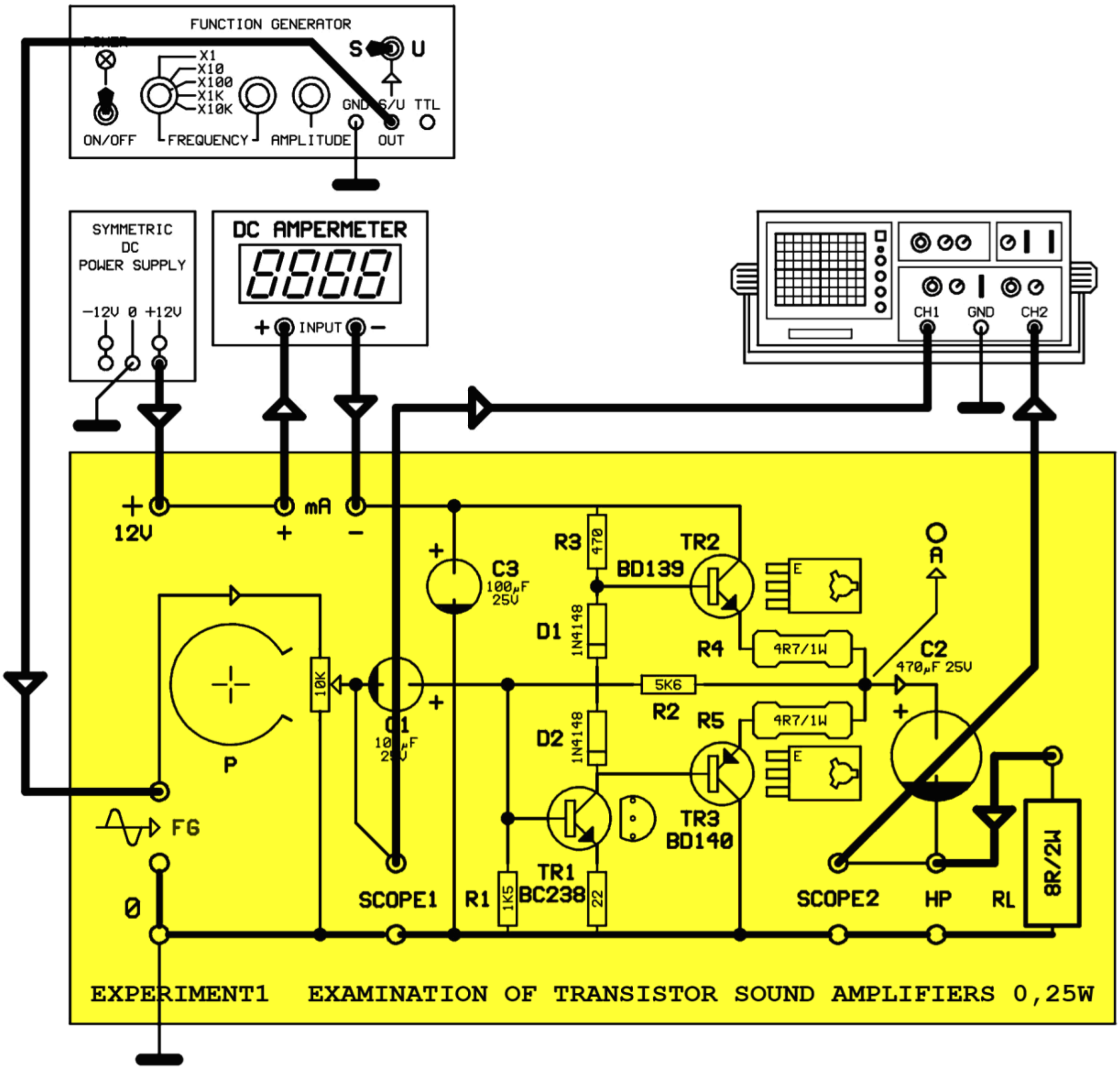


Figure 7.1

2- Adjust potantiometer P to maximum condition (**middle pin on top**). Only apply power to the function generator. Adjust the output of function generator to Scop1, sinusoidal signal with frequency 1 KHz and amplitude peak-peak **Vipp=**1Volt .Adjust potantiometer "**P**" to minimum condition (**middle pin on bottom**).

3- Power on the sound amplifier. Measure the current drawn by sound amplifier. What is this current's definition and why?

4- Adjust the P potantiometer to obtain maximum distortion-free amplitude at Scop2. Measure the current drawn by sound amplifier. What is this current and why? Evaluate the value in terms of efficieny.

5- Measure the input and output signal amplitude when the output signal have distortion-free maximum amplitude value. Evaluate the voltage gain of the sound amplifier.

Input signal peak-peak ***Vipp=****...............Volt.*
Output signal peak-peak ***Vopp=****...............Volt.*
*Voltage gain (****A****);*

$$A = 20Lg.\frac{Vo}{Vi} =$$

$$A = ...dB$$

6- Evaluate the output power of the sound amplifier (**P**).

Output signal peak-peak ***Vopp=****...............Volt.*
Maximum output voltage

$$E\,max = \frac{Vopp}{2} = ...Volt$$

*Effective output voltage (****E****);*

E=Emax.0,707=.........................Volt

*Output power (****P****);*

$$P = \frac{E^2}{Z} = \text{..............Watt}$$

Note: *Z is the speaker impedance, where we used RY load resistance in the circuit, which is RL=8Ω.*

7- For the values in table of Figure 7.2 measure and note output voltage (**Vopp**) for all steps.

Vi_{pp}=500mV CONSTANT				Vi_{pp}=500mV CONSTANT		
NUMBER	FREQUENCY	Vo_{pp} (V)		NUMBER	FREQUENCY	Vo_{pp} (V)
1	20 Hz			7	3 KHz	
2	50 Hz			8	4 KHz	
3	100 Hz			9	5 KHz	
4	500 Hz			10	10 KHz	
5	1 KHz			11	15 KHz	
6	2 KHz			12	20 KHz	

Figure 7.2

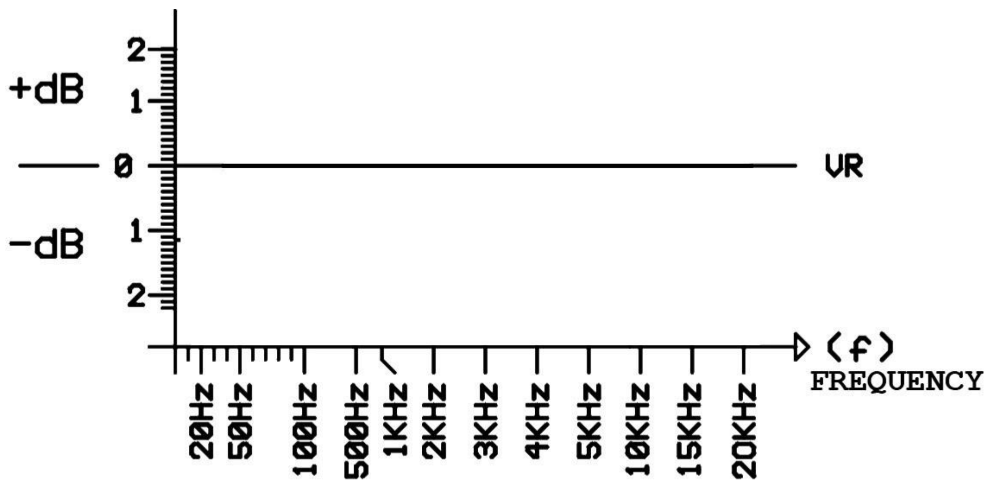
8- Based on your measurements in Figure 7.2, plot the frequency characteristic of the sound amplifier using the output voltage values.

VR→ reference voltage

At 20Hz
VR>Vopp →

$$-dB = 20Lg.\frac{VR}{Vopp} =$$

*At all other frequencies **dB=0,** so the frequency characteristics of the sound amplifier is,*



EXPERIMENT: 7.2
EXAMINATION OF INTEGRATED SOUND AMPLIFIER

EXPERIMENT PROCEDURE:

1- Put the Y-0016/011 module in place. Connect the circuit as shown in Figure 7.3.

Note: 8R/2W resistor on the module will be used as speaker.

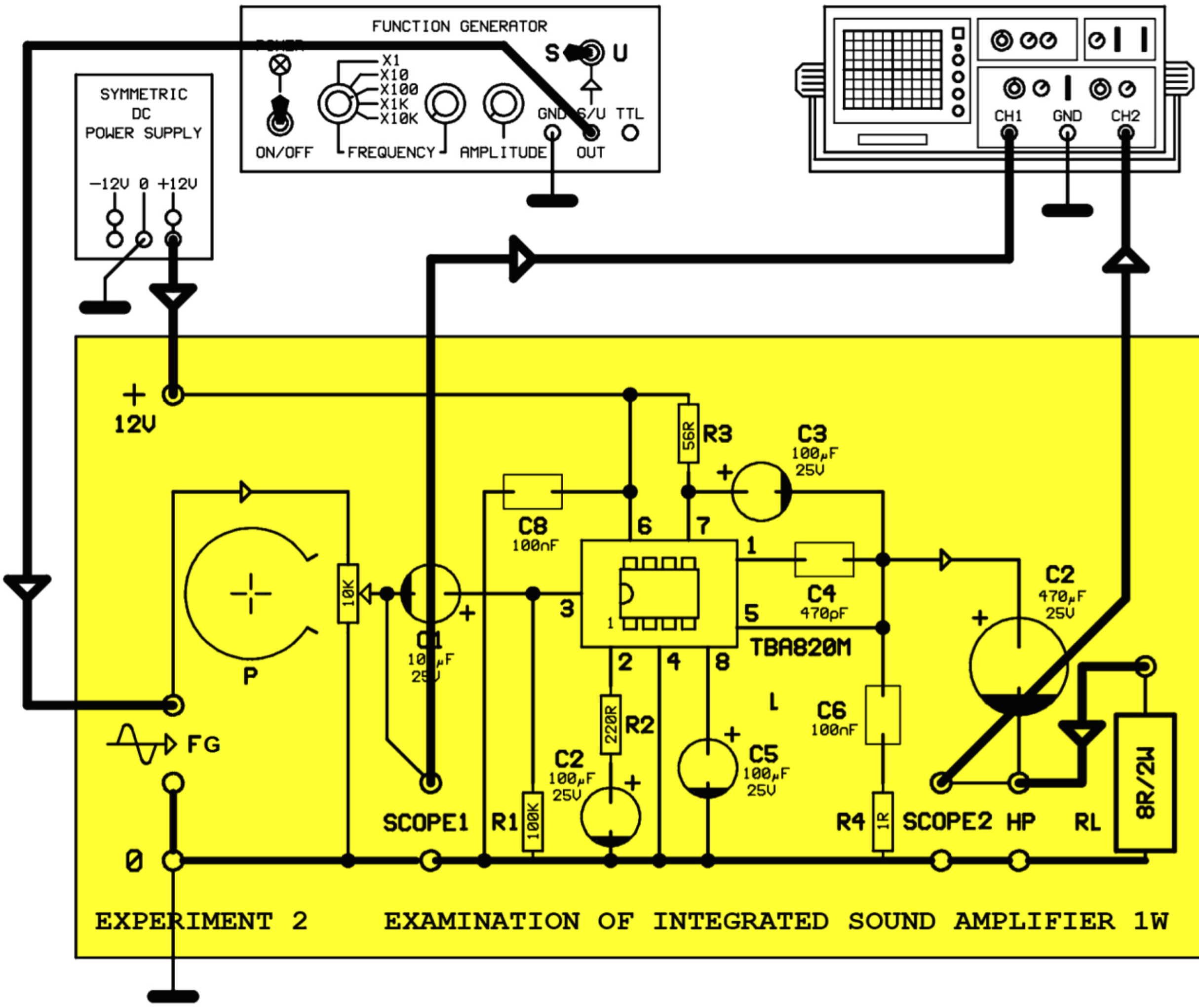


Figure 7.3

2- Adjust the "**P**" potantiometer to the maximum value (**middle pin on top**). Only power the function generator. Adjust the signal of the function generator to a 1Khz frequency **Vipp** = 1Volt peak-to-peak sinusoidal at Scope1. Adjust the "**P**" potantiometer to the minimum value (**middle pin on bottom**).

3- Power the sound amplifier. Adjust the P potantiometer and obtain maximum amplitude and no distortion at Scope2. Measure the input and output signal amplitudes when the output signal is at maximum amplitude and no distortion. Calculate the voltage gain of the sound amplifier.

Input signal voltage peak to peak is ***VIpp=***……………….*.Volt*
Output signal voltage peak to peak is ***VOpp=***…………….*Volt.*

*Voltage Gain (**A**);*

$$A = 20Lg.\frac{Vo}{Vi} =$$

A=…………..dB

4- Calculate the output power of the sound amplifier. (**P**)

Output signal voltage peak to peak is ***VOpp=***……………*Volt.*
*Maximum output voltage (**Emax**);*

$$E\,max = \frac{Vopp}{2} = ...Volt$$

*Effective output voltage (**E**);*
E=Emax x 0.707=………………………..Volt
*Output power(**P**);*

$$P = \frac{E^2}{Z} = ...$$ *Watt*

5- Measure the output voltage (**VOpp**) based on the values in tables of Figure 7.4.

Vi_{pp}=250mV CONSTANT		
NUMBER	FREQUENCY	Vo_{pp} (V)
1	20 Hz	
2	50 Hz	
3	100 Hz	
4	500 Hz	
5	1 KHz	
6	2 KHz	

Vi_{pp}=250mV CONSTANT		
NUMBER	FREQUENCY	Vo_{pp} (V)
7	3 KHz	
8	4 KHz	
9	5 KHz	
10	10 KHz	
11	15 KHz	
12	20 KHz	

Figure 7.4

6- Using the output voltages in Figure 7.4, plot the frequency characteristics of the sound amplifier between the frequency-decibel axes.

Based on the values, the reference voltage (VR) is……….Volts. dB sign is negative since at each step VR>Vopp

For : 20Hz→ $dB = 20.Lg.\frac{VR}{Vopp} =$

For: 50Hz → $dB = 20.Lg.\frac{VR}{Vopp} =$

For: 100Hz → $dB = 20.Lg.\frac{VR}{Vopp} =$

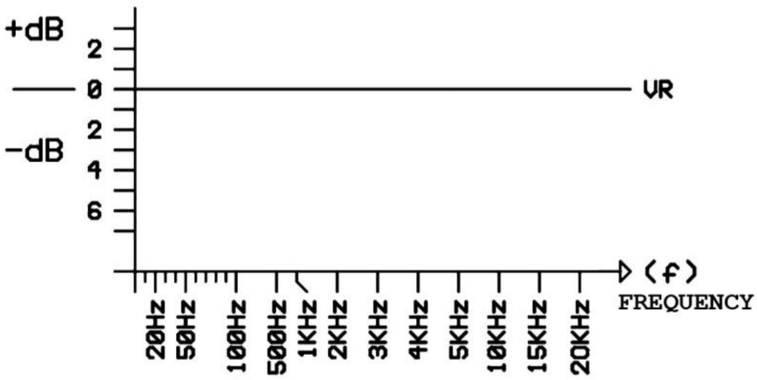
For: 5KHz → $dB = 20.Lg.\frac{VR}{Vopp} =$

For: 10KHz → $dB = 20.Lg.\frac{VR}{Vopp} =$

For: 15KHz → $dB = 20.Lg.\frac{VR}{Vopp} =$

For: 20KHz → $dB = 20.Lg.\frac{VR}{Vopp} =$

The frequency characteristics,



EXPERIMENT 7.3

EXAMINATION OF JFET'S INPUT CHARACTERISTICS

EXPERIMENTAL PROCEDURE:

Plug the Y-0016/012 module. Make the circuit connections as in Figure 7.5.

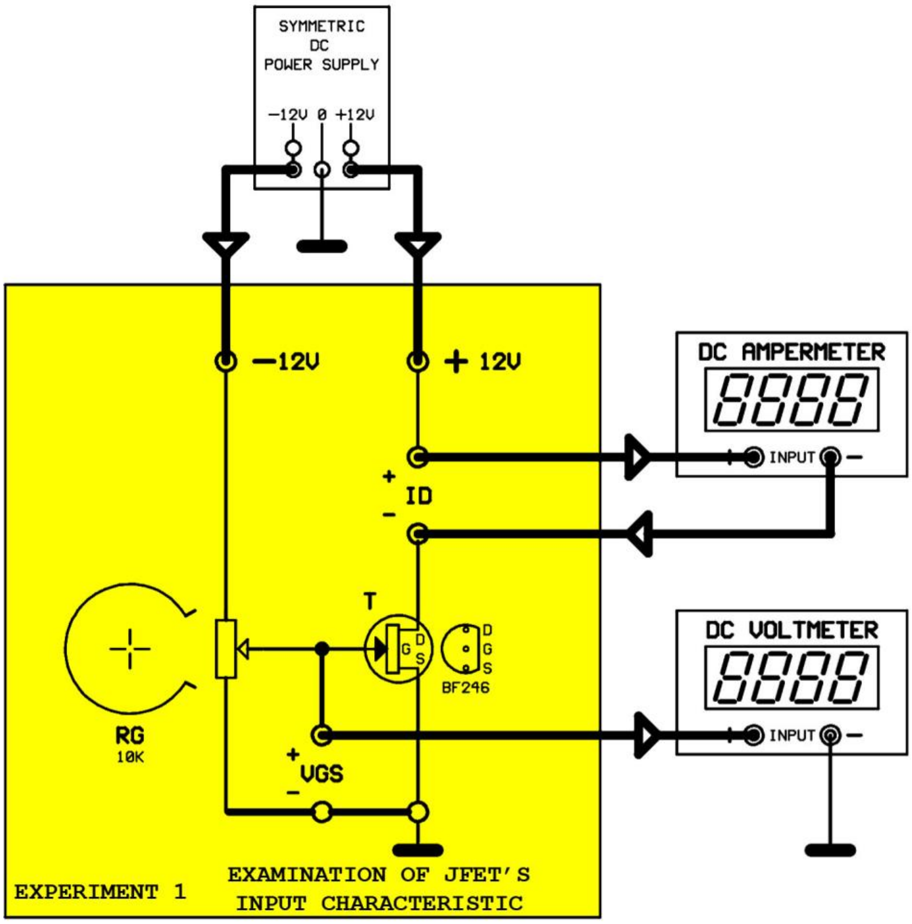


Figure 7.5

1- Type the VGS voltage to the table at Figure 7.6 with the help of RG potentiometer. Also type the ID values for each step.

V_{DS}=12V CONSTANT	
V_{GS} (VOLT)	*I_D (mA)*
0.0	
-0.5	
-1.0	
-1.5	
-2.0	
-2.5	
-3.0	
-3.5	
-4.0	

Figure *7.6*

2- Draw the VGS/ID curve using the values in Figure 7.6.

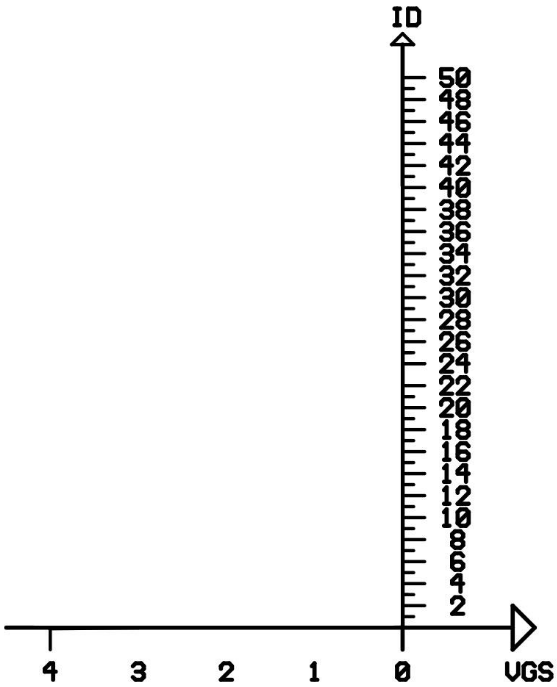


Figure 7.7

3- When the **VGS=**-3.5V or at a smaller value **ID="0"**. What is the name for this value of VGS?

EXPERIMENT: 7.4

EXAMINATION OF JFET'S OUTPUT CHARCTERISTICS

EXPERIMENTAL PROCEDURE:

Plug the Y-0016/012 module. Before making the connections, adjust the output voltage of power supply to "**0**" by rotating voltage potentiometers to left. And adjust the gate voltage to "**0**" by rotating the "**RG**" potentiometer to left.

Make the circuit connections as in Figure 7.8 and apply energy to circuit.

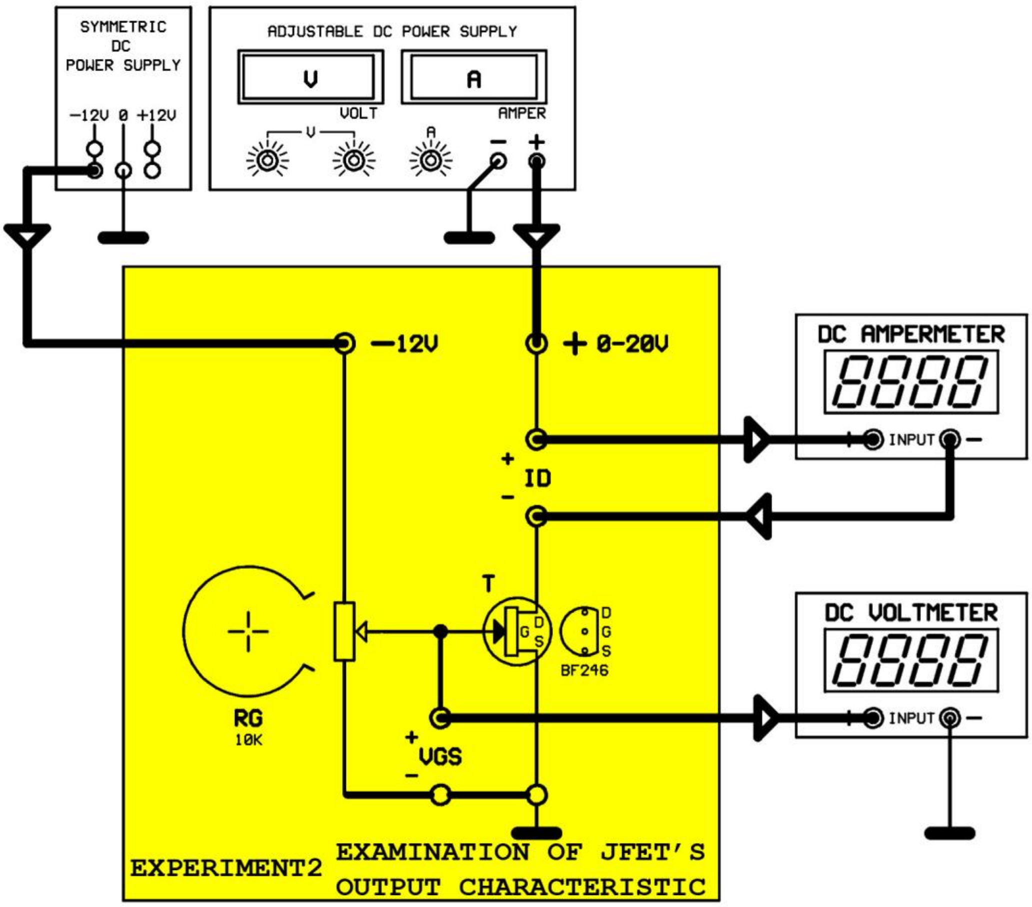


Figure 7.8

1- Set **VGS**=0 using “**RG**” potentiometer. Adjust the power supply voltage to the VDS voltage values in Figure 7.9 and make sure that **VGS=0** at each step. Type the ID values at each step to section “**A**”.

VGS=0 CONSTANT	
VDS (VOLT)	ID (mA)
1	
2	
3	
4	
5	
10	
15	
20	

A

VGS=-1 CONSTANT	
VDS (VOLT)	ID (mA)
1	
2	
3	
4	
5	
10	
15	
20	

B

VGS=-2 CONSTANT	
VDS (VOLT)	ID (mA)
1	
2	
3	
4	
5	
10	
15	
20	

C

VGS=-3 CONSTANT	
VDS (VOLT)	ID (mA)
1	
2	
3	
4	
5	
10	
15	
20	

D

VGS=-4 CONSTANT	
VDS (VOLT)	ID (mA)
1	
2	
3	
4	
5	
10	
15	
20	

E

Figure 7.9

2- Draw the change graphic between VDS/ID axes like in Figure 7.10

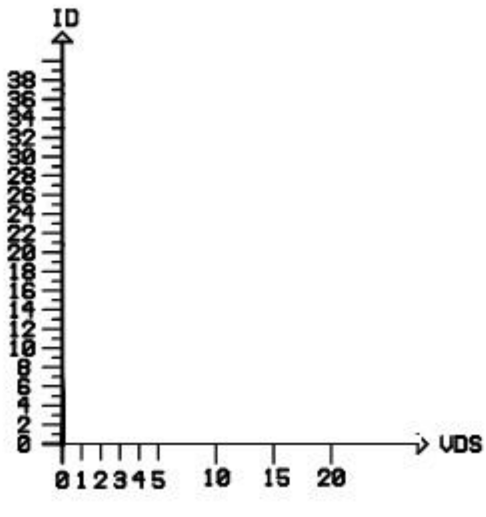


Figure 7.10

3- ID is constant even if the VDS is increased. What is the name for this value of ID?

4- Adjust the VGS voltage to–1V, -2V, -3V, -4V, respectively. Adjust the VDS voltage to the values in Figure 7.11 and type each ID value next to each VDS value.

VGS=0 CONSTANT	
VDS (VOLT)	ID (mA)
1	
2	
3	
4	
5	
10	
15	
20	

A

VGS=-1 CONSTANT	
VDS (VOLT)	ID (mA)
1	
2	
3	
4	
5	
10	
15	
20	

B

VGS=-2 CONSTANT	
VDS (VOLT)	ID (mA)
1	
2	
3	
4	
5	
10	
15	
20	

C

VGS=-3 CONSTANT	
VDS (VOLT)	ID (mA)
1	
2	
3	
4	
5	
10	
15	
20	

D

VGS=-4 CONSTANT	
VDS (VOLT)	ID (mA)
1	
2	
3	
4	
5	
10	
15	
20	

E

Figure 7.11

5- Draw change graphics between VDS/ID axes for each VGS voltage value like in Figure 7.10.

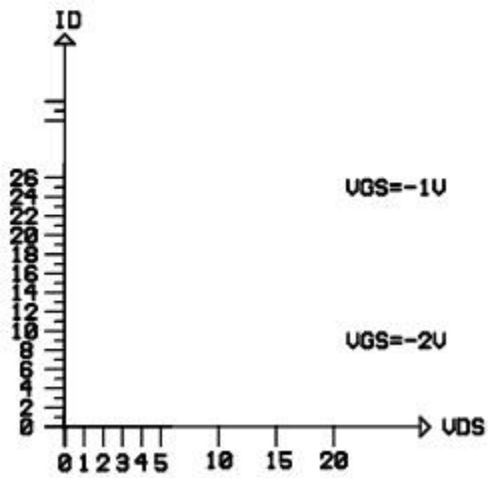


Figure 7.12

6- What is the name for these graphics?

7- Write the effect of gate bias to drain current.

8- Write the effect of VDS voltage to drain current.

EXPERIMENT: 7.5
EXAMINATION OF SOURCE GROUND CONNECTION

EXPERIMENTAL PROCEDURE:

Plug the Y-0016/012 module. Make the circuit connections as in Figure 7.13 and apply energy to circuit.

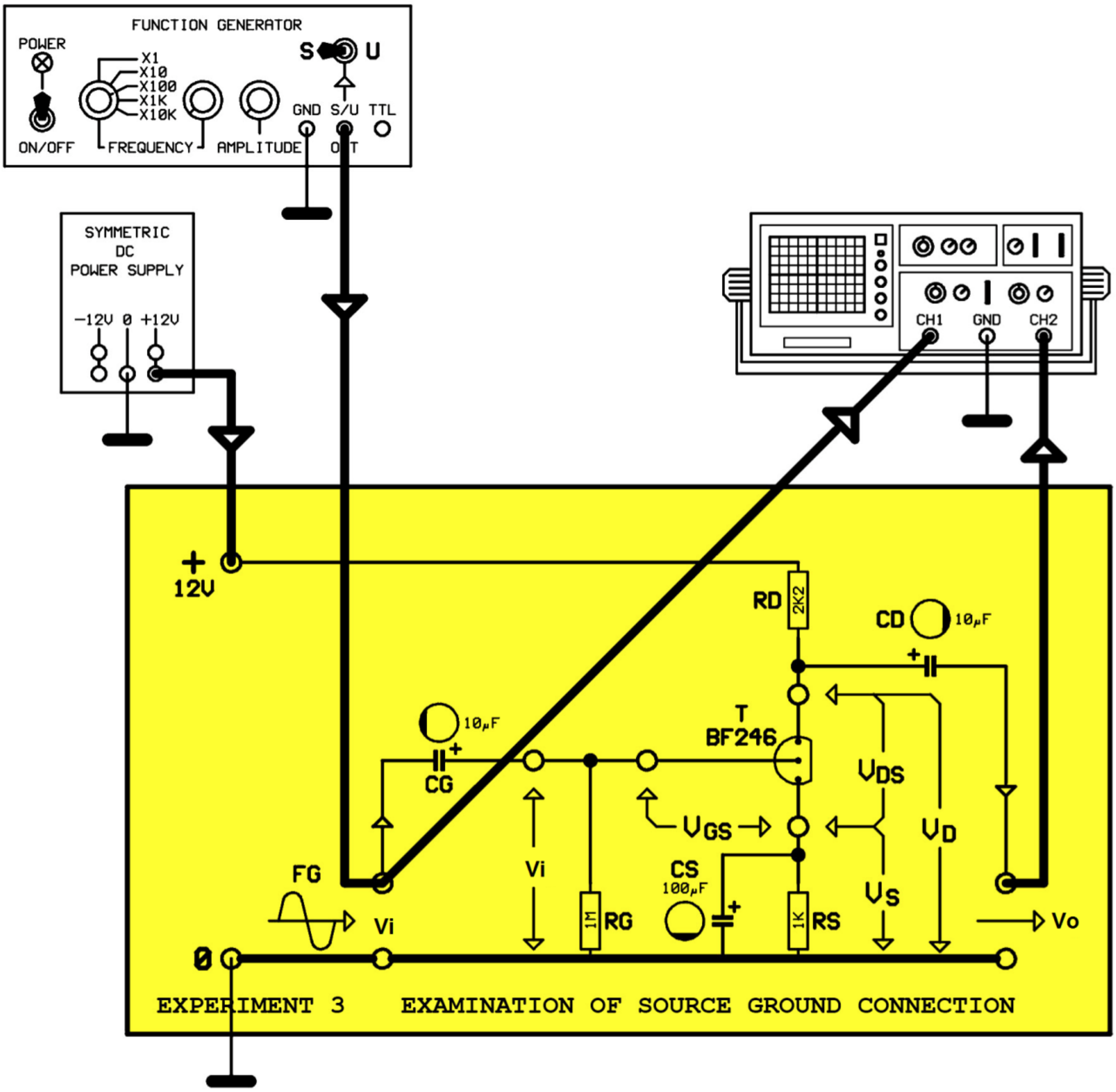


Figure 7.13

1- Disconnect the function generator from the circuit. Measure the VG, VGS, VS, VDS, VD voltages by the help of a digital voltmeter.

Vi	***:***	*................Volt*
VGS	***:***	*................Volt*
VS	***:***	*................Volt*
VDS	***:***	*................Volt*
VD	***:***	*................Volt*

2- Adjust the output of function generator to sine, frequency to 1 KHz and peak to peak amplitude to **Vpp**=100mV, and apply to FG input. What is the phase difference of input and output signal? Measure the amplitude of output signal.

……

Output signal amplitude is Vpp=…………………Volt.

3- Calculate the voltage gain of circuit.

Voltage gain:

$$A = \frac{Vout}{Vin} = ...$$

4- In which areas the source ground connection is used?