

***OPERATING INSTRUCTIONS***

**F.E.T CHARACTERISTICS**



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## FET CHARACTERISTICS

The FETs are characterised to Jfet parameters. Like an bipolar transistor a field effect transistor is also three terminal device. Its function depends upon one type of carrier only thus it is also called as unipolar device. Unlike a bipolar transistor the FET has very high input resistance and it is voltage controlled device rather than a current controlled device in case of BJT. The characteristics of a FET is studied in following manner. The board has following features.

- \* DC regulated continuously variable power supplies for drain - source and gate - source, in which the gate - source supply provided on sockets.
- \* Three meters to take readings of gate voltage, drain - source voltage and drain current respectively. These meters are prewired in the given circuit and shown by block diagram upon panel.
- \* One fet BFW 10 or eq, fitted behind the panel with gate protection.

The parameters of FET

1. *Drain resistance,  $r_d$*  :- The drain resistance of mosfet may defined as follows,

$$r_d = \Delta V_{ds} / \Delta I_d, \quad V_{gs} \text{ at constant value...} \quad 1$$

Where  $V_{ds}$  is the drain - source supply,  $I_d$  corresponding drain current and  $V_{gs}$  is the voltage between gate - source. The  $r_d$  of such mosfet lies between 20 - 100 K ohms typically. The reciprocal of it gives admittance quantity  $Y_{os}$  in  $\mu\text{mhos}$ .

2. *Transconductance,  $g_m$*  :- It is defined as the control of gate voltage over drain current and measured by forward transconductance  $g_{fs}$  as

$$g_{fs} = \Delta I_d / \Delta V_{gs}, \quad V_{ds} \text{ at constant value...} \quad 2$$

Its typical value lies between  $10 \times 10^3$  to  $20 \times 10^3 \mu\text{mhos}$ . It is sometimes expressed in millisiemens also.

3. *Amplification factor  $\mu$*  :- It is related to  $r_d$  and  $g_{fs}$  by

$$\mu = r_d g_{fs} = \Delta V_{ds} / \Delta V_{gs}, \quad I_d \text{ at constant} \quad \dots \quad 3$$

The typical values of  $\mu$  lies between 5 to 10 for such device.

From above relations, two characteristics curves should be drawn for input and output. The experimental procedure is given on next page.

**Experiment procedure**

*Object* : (1). To measure drain current  $I_d$ , at different values of gate voltage  $V_{gs}$ . (2) To measure drain current  $I_d$ , for different values of drain - source voltage  $V_{ds}$ . To plot input / output characteristics curves and to evaluate the parameters.

1.1. Keep both supply controls at minimum position ( fully counter - clockwise ). Connect gate - source connections with gate supply  $V_{gs}$  as shown dotted lines in fig 1.

1.2. Switch on the power. Adjust drain supply,  $V_{ds}$  at 10 volt and  $V_{gs}$  at + 0.25 volt. Note the current  $I_d$ , mA at  $V_{gs} = + 0.25$  V.

1.3. Decrease  $V_{gs}$  in small steps and note corresponding drain current till  $V_{gs} = 0$ V.

1.4. Bring  $V_{DS} = 0$ V. Reverse the gate - source connections as shown in bold lines in fig 1.

Now the gate terminal is negative than source. Bring  $V_{DS} = 10$ V.

1.5. Increase gate voltage in small steps in negative direction and note the drain current for each increment of  $V_{gs}$ .

1.6. Repeat the steps at  $V_{ds} = 15$  volt. Tabulate the readings.

Exp (2).

2.1. Remain the set up as step 1.4. Keep  $V_{gs} = 0$  volt. Increase  $V_{ds}$  in small steps and note drain current with each increment of  $V_{ds}$ .

2.2. Repeat step 2.1. at -0.5, -1.00, -1.50 and -2.00 volt of  $V_{gs}$ . Tabulate the readings.

Preparation of table

Sr No	$V_{gs}$	$I_d$ mA at $V_{ds}$	Sr No	$V_{ds}$	$I_d$ mA at $V_{gs}$
01	+0.25	...	01	0.00	...
02	0.00	...	02	0.50	...
03	-0.50	...	03	1.00	...
04	-1.00	...	04	2.50	...
05	-1.50	...	05	5.00	...
06	-2.00	...	...	...	...
...	...	...			

From the table plot a graph between  $V_{gs}$  and  $I_d$  for the constant values of  $V_{ds}$ . Plot another graph between  $I_d$  and  $V_{ds}$  at constant values of  $V_{gs}$ . From the curves evaluate the parameters as given at page 1.

fet characteristics - 3.

