will vary from a maximum of $I_{DSS}$ to minimum of 0.

IV) Because of two gates are at the same potential, both depletion layer widen or narrow down by an equal amount.

V) (VII) The JFET is not subject to thermal runaway when the temperature of device increases.

VI) (VIII) Since JFET has no gate current, there is no $\beta$ rating of the device.

## Important ~~parameters~~ terms of JFET.

There are following parameters of JFET.

I) Shorted gate-drain current ($I_{DSS}$)

II) pinchoff voltage ($V_P$)

III) Gate-source cutoff voltage [$V_{GS(off)}$]

I) **Shorted gate drain current ($I_{DSS}$):-** It is the drain current with short circuited gate (i.e $V_{GS} = 0V$) and drain source voltage ($V_{DS}$) is equal to pinchoff voltage. It sometimes called zero bias current.

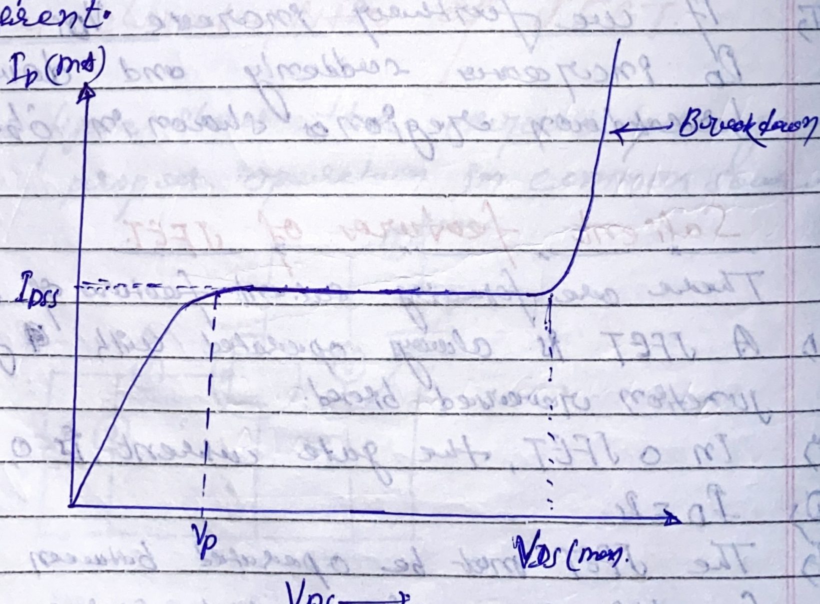


Fig: Characteristics of JFET.

II) **pinch off voltage (Vp):-** It is the minimum drain-source voltage at which the drain current becomes constant.

III) **Gate-source cut off voltage (Vgs off):-** It is the gate-source voltage at which channel is completely cut off and drain current becomes zero which is shown below.

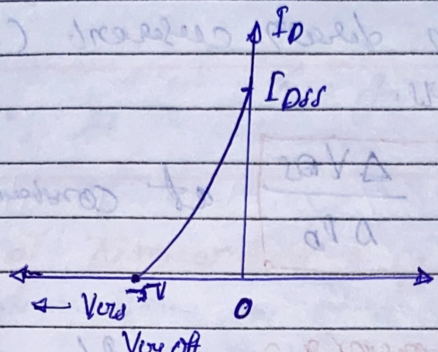


Fig: Variation of $I_D$ with $V_{GS}$.

## Expression for drain current

From transfer characteristics curve of JFET.

$$V_p = |V_{GS\,off}|$$

$$I_D = I_{DSS}\left[1 - \frac{V_{GS}}{V_{GS\,off}}\right]^2$$

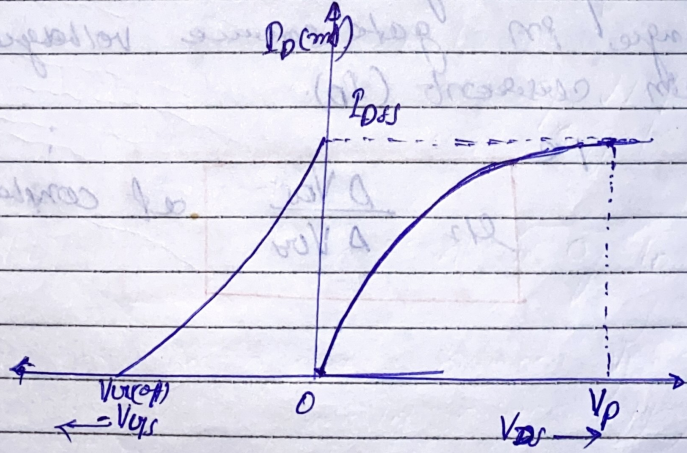


Fig: current transfer characteristics of JFET

## Parameters of JFET

There are following parameter of JFET.

i) A.c drain resistance ($r_d$)
ii) Transconductance ($g_m$)
iii) Amplification factor.

i) **A.C drain resistance ($r_d$):-** It is the ratio of change in drain source voltage ($\Delta V_{DS}$) to change in drain current ($\Delta I_D$) at constant $V_{GS}$.

i.e

$$r_d = \frac{\Delta V_{DS}}{\Delta I_D} \text{ at constant } V_{GS}$$

ii) **Transconductance ($g_m$):-** It is the ratio of change in drain current to change in gate-source voltage at constant drain-source voltage.

i.e

$$g_m = \frac{\Delta I_D}{\Delta V_{GS}} \text{ at constant } V_{DS}$$

III) **Amplification factor ($\mu$):-** It is the ratio of change in drain-source voltage to change in gate source voltage at constant drain current ($I_D$).

i.e

$$\mu = \frac{\Delta V_{DS}}{\Delta V_{GS}} \text{ at constant } I_D$$

## Relation between $\mu$, $g_m$ and $r_d$

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$$\mu = \frac{\Delta V_{DS}}{\Delta V_{GS}}$$

$$= \frac{\Delta V_{DS}}{\Delta V_{GS}} \times \frac{I_D}{I_D}$$

$$= \frac{\Delta V_{DS}}{I_D} \times \frac{I_D}{\Delta V_{GS}}$$

$$\therefore \mu = r_d \times g_m$$