DETERMINING IDSS AND VP OF A JFET

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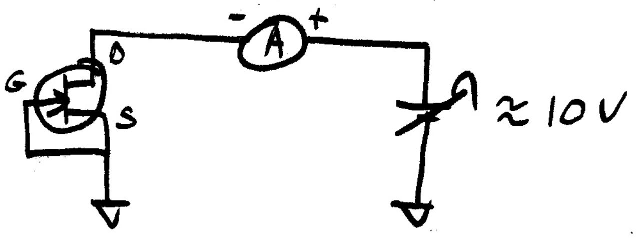
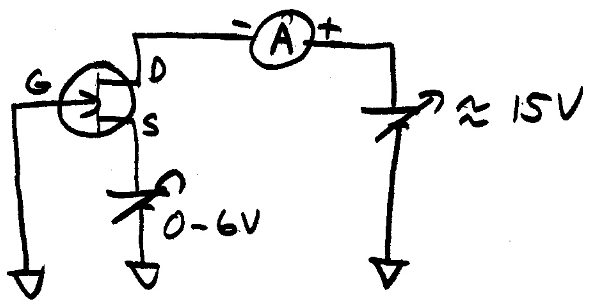
THE METHOD SHOWN IS FOR AN N-CHANNEL FET. SIMPLY REVERSE POLARITIES FOR A P-CHANNEL FET.

① MEASURE IDSS USING THE FOLLOWING CIRCUIT



READ THE CURRENT ON THE AMMETER — THIS IS IDSS. IF THE APPLIED VOLTAGE IS INCREASED BY SEVERAL VOLTS THE AMMETER SHOULD INCREASE BY ONLY A SMALL AMOUNT — PERAAPS ≈ 100 μA.

② CONNECT THE FOLLOWING CIRCUIT



ADJUST THE 0-6 VOLT SUPPLY UNTIL THE AMMETER READS 1/4 IDSS. MEASURE THE VOLTAGE OF THE 0-6 VOLT SUPPLY AND MULTIPLY BY -2. THIS IS ROUGHLY VP.

VP IS HARD TO DIRECTLY MEASURE SINCE THE DRAIN CURRENT NEVER REACHES EXACTLY ZERO AND IT IS A BIT SUBJECTIVE AS TO WHERE THE CURRENT IS PRACTICALLY ZERO. THE METHOD USED HERE USES TWO EASY MEASUREMENTS AND PROJECTS WHERE VP IS WITH OUR STANDARD MODEL. THUS, THIS METHOD PRODUCES A VP THAT SHOULD GIVE ACCURATE RESULTS WITH OUR MODEL. HERE IS THE DERIVATION.

$$I_D = I_{DSS}\left(1 - \frac{V_{GS}}{V_P}\right)^2$$

$$K\cancel{I_{DSS}} = \cancel{I_{DSS}}\,(1 - V_{GS}/V_P)^2$$

$$K = \frac{I_D \;@\; V_{GS} < 0}{I_{DSS} \;@\; V_{GS} = 0}$$

$$K = 1 - 2V_{GS}/V_P + V_{GS}^2/V_P^2$$

$$KV_P^2 = V_P^2 - 2V_{GS}V_P + V_{GS}^2$$

$$(1-K)V_P^2 - 2V_{GS}V_P + V_{GS}^2 = 0$$

$$V_P = \frac{2V_{GS} \pm \sqrt{4V_{GS}^2 - 4(1-K)V_{GS}^2}}{2(1-K)}$$

WHICH REDUCES TO

$$\boxed{V_P = V_{GS}\left[\frac{1+\sqrt{K}}{1-K}\right]}$$

IF $K = 0.25$ THEN $V_P = 2V_{GS}$ THAT MAKES $I_D = I_{DSS}/4$

WILL WORK FOR ANY GOOD VALUE OF K, BUT $K = 0.25$ IS EASY