13.7.2 Parameter Measurement

The MOSFET devices that will be used in this experiment are contained in the MC14007/CD4007 IC. This IC has 3 n channel and 3 p channel enhancement mode MOSFETs. The pinouts are shown in Fig. 13.18. Normally, pin 14 is required to be the most positive pin and pin 7 is required to be the most negative pin.

It is not necessary to connect pin 14 to anything for this step in the experiment. Only transistor N1 will be used. The only laboratory instruments required in this step in the procedure are the laboratory DC power supply and a DVM. Assemble the circuit shown in Fig. 13.19.
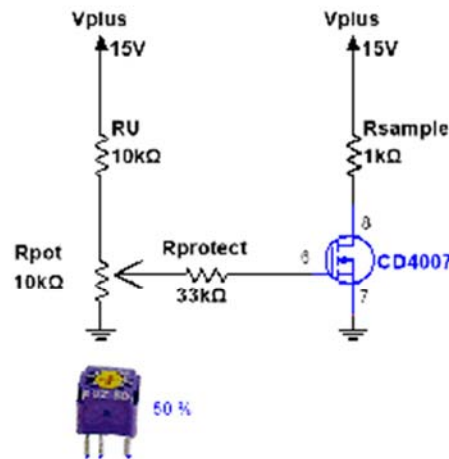

Figure 13.19: MOSFET Parameter Measurement Circuit.

Set the DC power supply voltage for 15 V. The +20 V output is connected to V_{plus} and the COMMON on the DC power supply is connected to the circuit ground. Because the resistor R_{sample} is in series with the drain of the MOSFET and has a value of 1kΩ the DC voltage measured across it is numerically equal to the drain current in mA. Adjust the pot until the DC voltage across R_{sample} is 7V. Measure the DC voltage from pin 6 to pin 7 with the DVM (this is the corresponding gate-to-source voltage). Record these voltages. Repeat for voltages across R_{sample} of 6 V, 5 V, 4 V, and 3 V. Use this set of drain current, I_D, as a function of the gate-to-source voltage, V_{GS}, to plot $\sqrt{I_D}$ versus V_{GS}. Any plotting program can be used. This should be a straight line with a slope of $\sqrt{K}$ and a y intercept of $-\sqrt{K}V_{TH}$. Include the data taken, the plot, and the measured values of K and V_{TH} in the lab report.

MOSFET　　Parameter　　Measurement　　　$R_D := 1 \ k\Omega$

Measured　　Data

　　　　　　　　　　　　　　　Voltage　　Measured　　Across　　R_D
Gate　　Voltage

$$V_G := \begin{bmatrix} 4 \\ 5 \\ 6 \\ 7 \\ 8 \end{bmatrix} \qquad V_G := V_G \cdot 1 \ V \qquad I := \begin{bmatrix} 0.37518 \\ 0.719279 \\ 1.174 \\ 1.74 \\ 2.418 \end{bmatrix} \qquad I := I \cdot \frac{1 \ V}{R_D}$$

$$\sqrt{I} \ \left(A^{\frac{1}{2}} \right)$$

$$V_G \ (V)$$
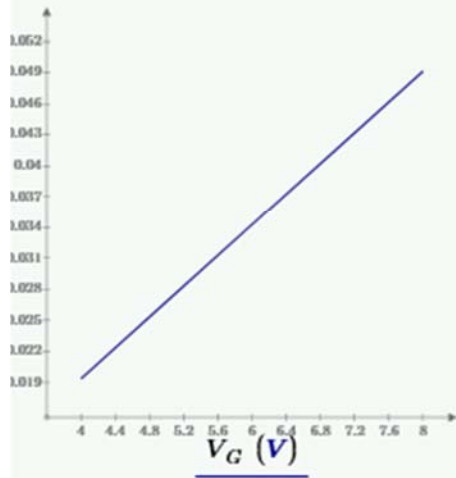
$$m := \text{slope}\left(V_G, \sqrt{I}\right) = 0.007 \ \frac{A^{\frac{1}{2}}}{V} \qquad\qquad b := \text{intercept}\left(V_G, \sqrt{I}\right) = -0.01 \ A^{\frac{1}{2}}$$

$$K := m^2 = 55.504 \ \frac{\mu A}{V^2} \qquad KP := 2 \cdot K = 0.111 \ \frac{mA}{V^2} \qquad V_{TH} := \frac{-b}{\sqrt{K}} = 1.4 \ V$$

The　　above　　was　　made　　with　　Mathcad　　Prime　　8

which　　permits　　units

#

```
%MOSpara;Matlab;
x=[4,5,6,7,8];RD=1000;I=[0.37518,0.719279,1.174,1.74,2.418]/RD;
y=sqrt(I);
plot(x,y);title('sqrt Drain Current vs VG');xlabel('VG');ylabel('sqrt(ID)');
p=polyfit(x,y,1);m=p(1,1);b=p(1,2);
K=m^2
VT=-b/sqrt(K)
KP=K*2
```
#

```
K =

   5.5504e-05


VT =

    1.4004


KP =

   1.1101e-04
```
#