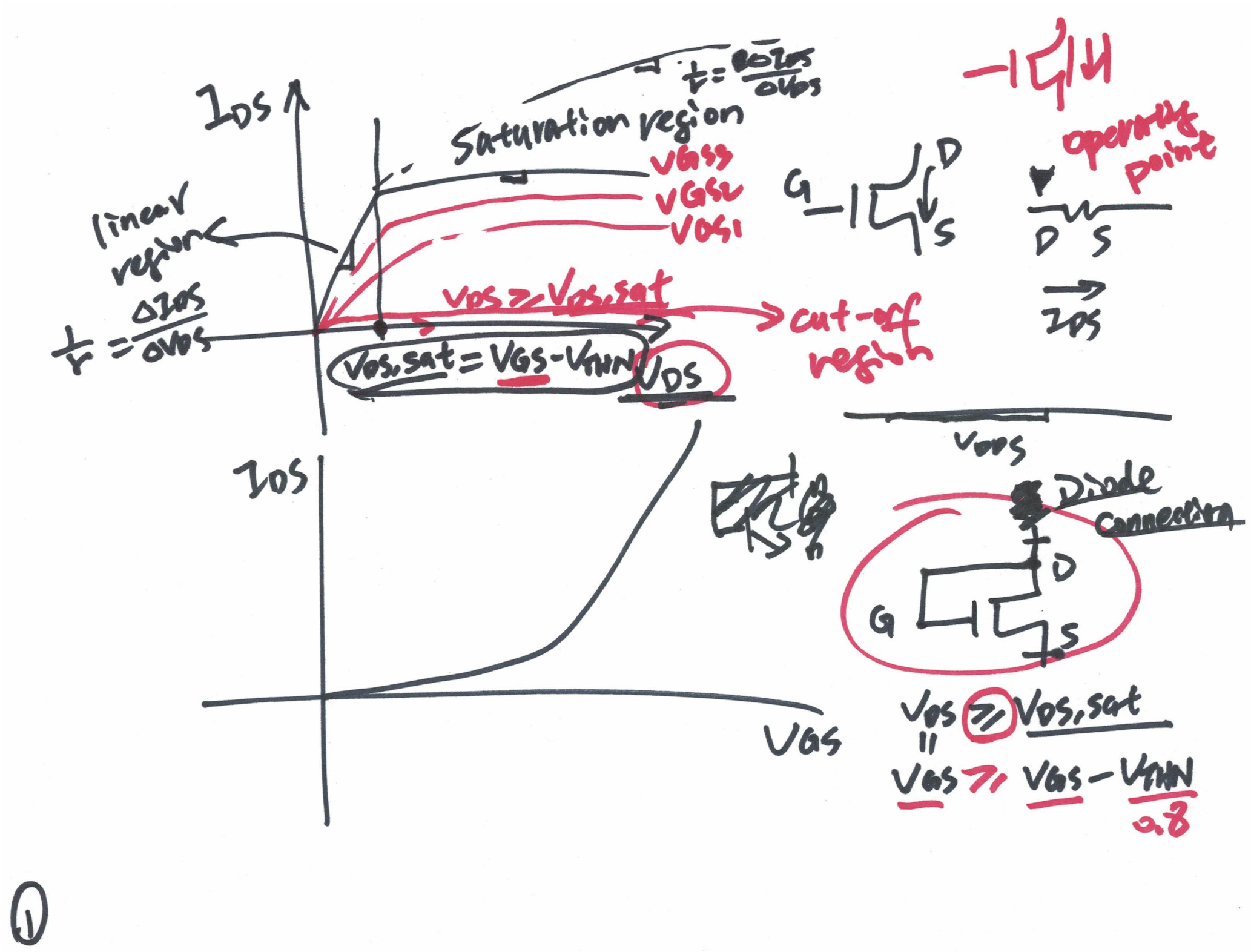
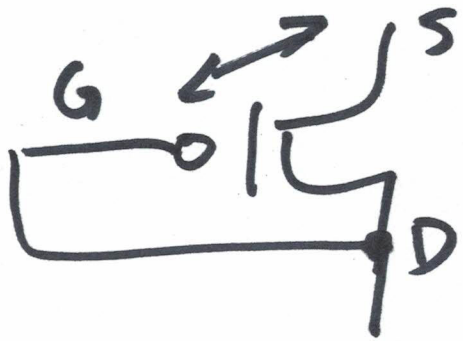

I_{DS}
Saturation region
$\frac{1}{r} = \frac{\partial I_{DS}}{\partial V_{DS}}$
V_{GS3}
V_{GS2}
V_{GS1}
linear region
$\frac{1}{r} = \frac{\partial I_{DS}}{\partial V_{DS}}$
$V_{DS} \geq V_{DS,sat}$
cut-off region
$V_{DS,sat} = V_{GS} - V_{THN}$
V_{DS}
I_{DS}
V_{GS}
G
D
S
operating point
I_{DS}
V_{DS}
Diode connected
G
D
S
$V_{DS} = V_{DS,sat}$
$V_{DS} \geq V_{GS} - V_{THN}$



$V_{SG} \geq V_{THP}$

0.9V

$KP \cdot \frac{W}{L} = \beta_n$

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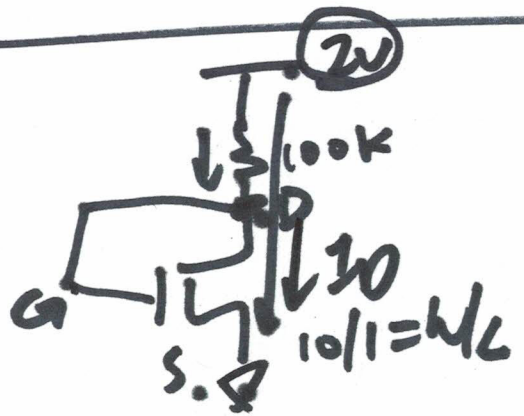
square Law Equation



Find I_{DS}?

$$I_{DS} = \frac{KP_n}{2} \frac{W}{L} (V_{GS} - V_{THN})^2$$

$KP_n = 120\,\mu A/V^2$

↑ Saturation

$$\begin{cases} I_{DS} = \frac{KP_n}{2} \frac{W}{L} (V_{GS} - V_{THN})^2 \\ I_{DS} = I_R = \frac{2V - V_{GS}}{100K} \end{cases}$$

$$\frac{120\mu A/V^2}{2}\cdot\frac{10}{1}(V_{GS}-0.8)^2=\frac{2-V_{GS}}{100K}$$

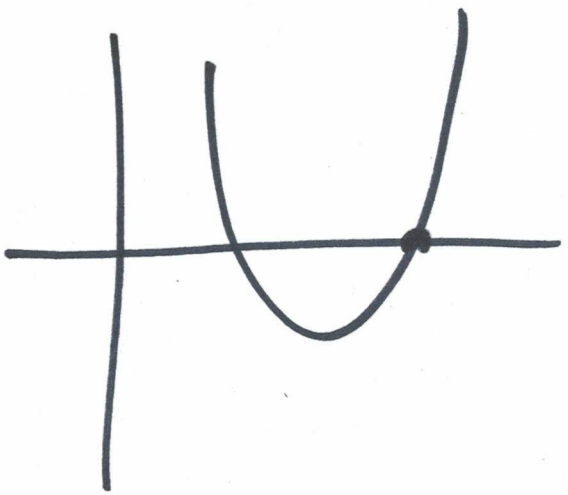
$$60\,A/V^2(V_{GS}-0.8)^2=2-V_{GS}$$

$$60V_{GS}^2-96V_{GS}+60\times0.64=2-V_{GS}$$

$$60V_{GS}^2-95V_{GS}+38.4-2=0$$

$$60V_{GS}^2-95V_{GS}+36.4=0$$

$V_{GS}=$ { 0.933 V ; 0.65 V (X) }



$I_{DS}=10.14mA$

(2)

$$V_{GS} = \sqrt{\frac{2I_{DS}}{\beta_n}} + V_{TUN}$$