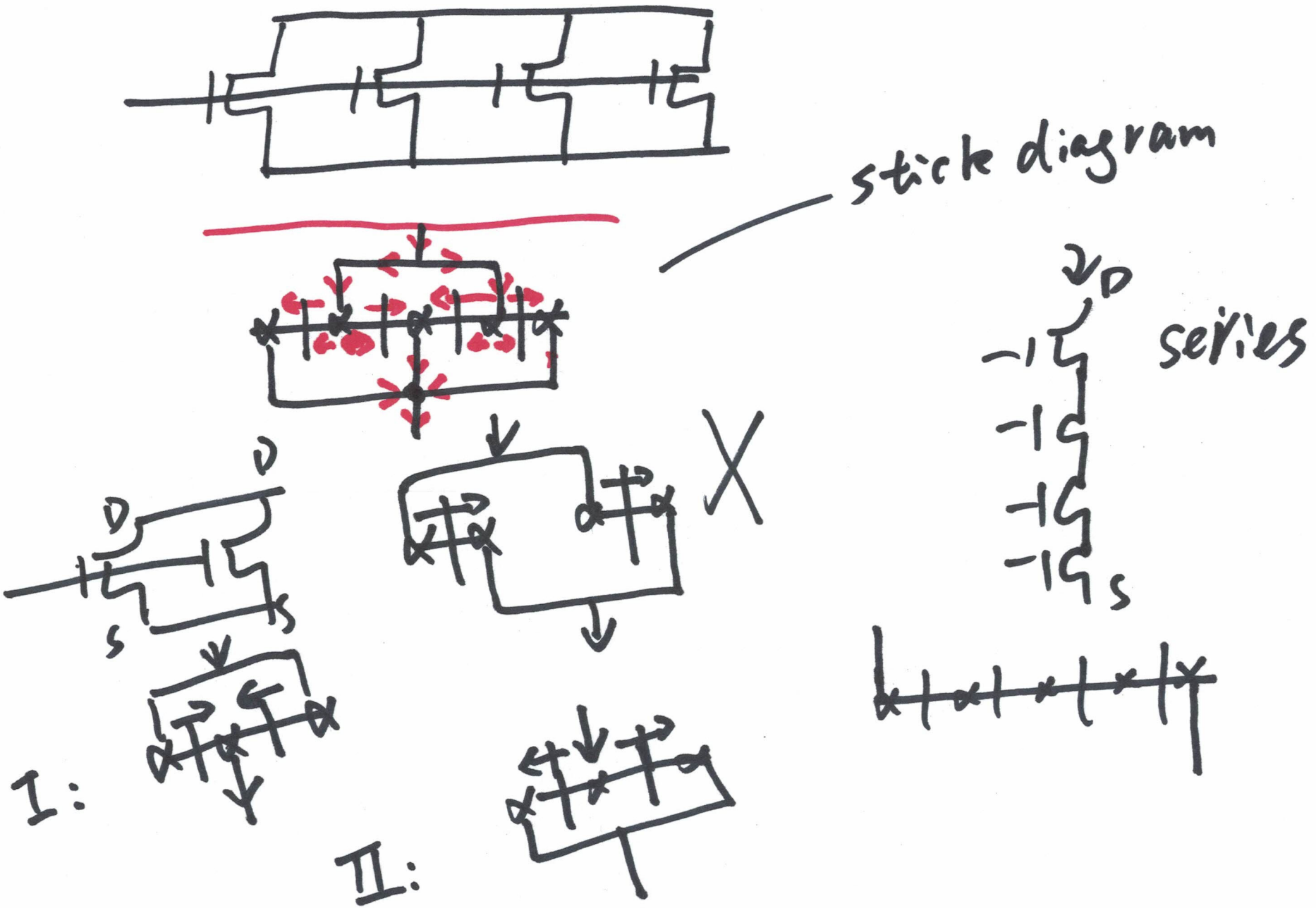
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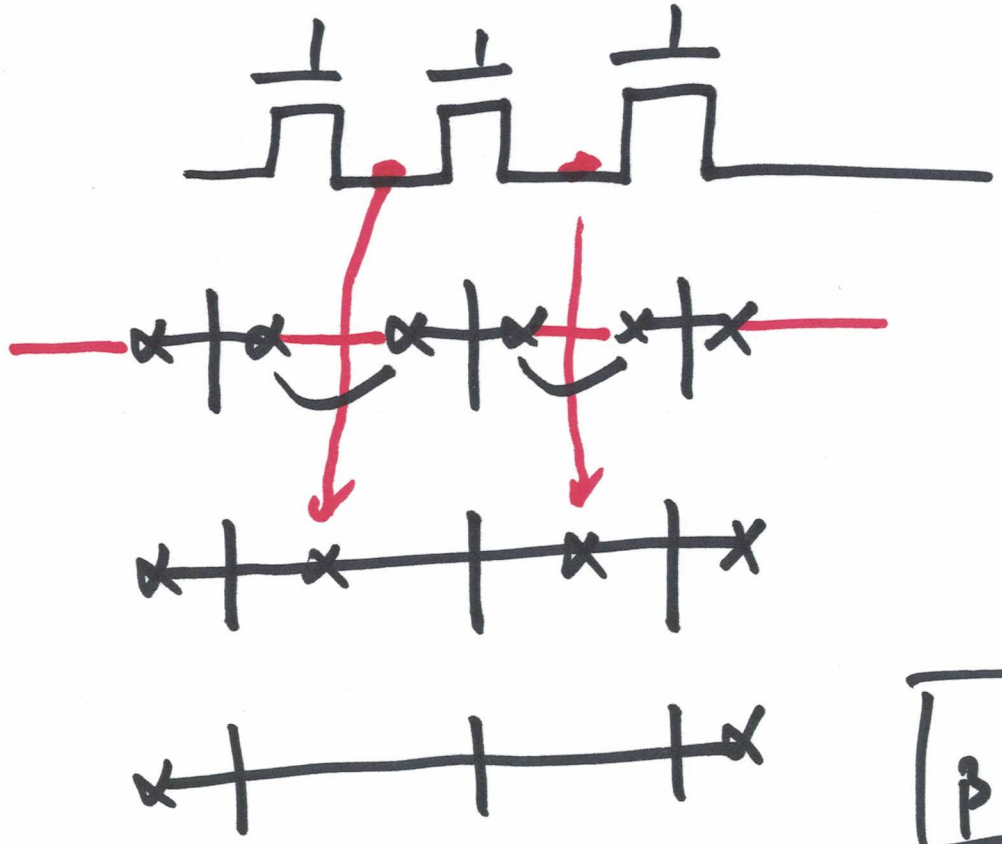
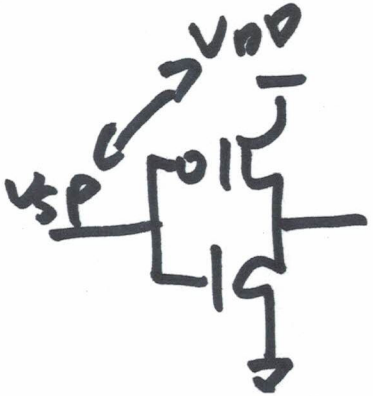
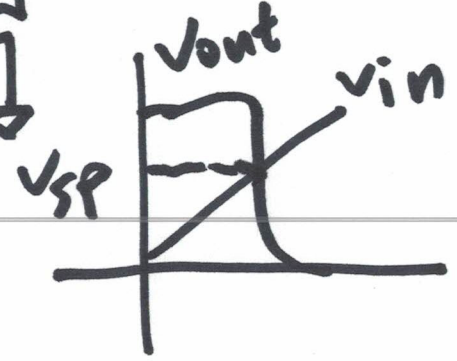


$$\beta = \frac{KP\,W}{L}$$





$$\frac{\beta_n}{2}(V_{GS} - V_{THN})^2 = \frac{\beta_p}{2}(V_{SG} - V_{THP})^2$$

$$\frac{\beta_n}{2}(V_{SP} - V_{THN})^2 = \frac{\beta_p}{2}(V_{DD} - V_{SP} - V_{THP})^2$$

$$\frac{\beta_n}{\beta_p} = \frac{(V_{DD} - V_{SP} - V_{THP})^2}{(V_{SP} - V_{THN})^2}$$

$$\sqrt{\frac{\beta_n}{\beta_p}} = \frac{V_{DD} - V_{SP} - V_{THP}}{V_{SP} - V_{THN}}$$

$$(V_{SP} - V_{THN})\sqrt{\frac{\beta_n}{\beta_p}} = V_{DD} - V_{SP} - V_{THP}$$

$$V_{SP}\left(\sqrt{\frac{\beta_n}{\beta_p}} + 1\right) = V_{THN}\sqrt{\frac{\beta_n}{\beta_p}} + V_{DD} - V_{THP}$$

$$V_{SP} = \frac{V_{THN}\sqrt{\frac{\beta_n}{\beta_p}} + V_{DD} - V_{THP}}{\sqrt{\frac{\beta_n}{\beta_p}} + 1} = 2.5V$$

$$\begin{cases} V_{DD} = 5V \\ V_{THN} = 0.8V \\ V_{THP} = 0.9V \end{cases}$$

$$\Rightarrow \sqrt{\frac{\beta_n}{\beta_p}} \approx 1$$

$$\sqrt{\frac{\beta_n}{\beta_p}} = 1 \qquad \beta_n = \beta_p$$

μ_n

$$\beta_n = \frac{K_{Pn}}{2}\frac{W}{L} \qquad \beta_p = \frac{K_{Pp}}{2}\frac{W}{L}$$

$$= 120\,\mu A/V^2 \left(\frac{W_n}{L_n}\right) = 40\,\mu A/V^2 \cdot \left(\frac{W_p}{L_p}\right)$$

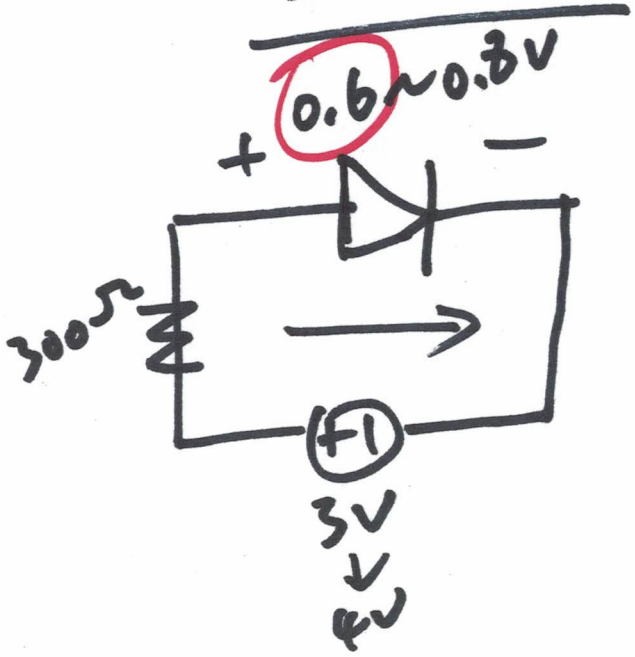
$$\frac{W_n}{L_n} = \frac{1}{3}\frac{W_p}{L_p}$$

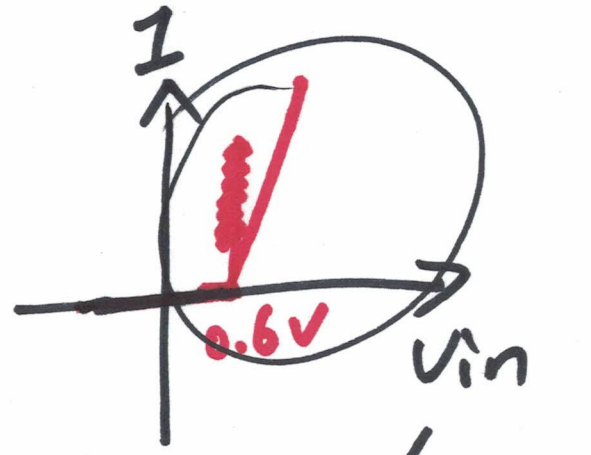
$$I_{DS} = \frac{K_{Pn}}{2}\frac{W}{L}(V_{GS} - V_{tH})^2$$

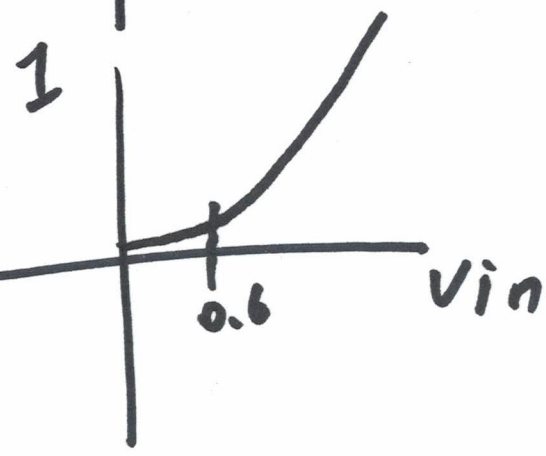
β_n

$$= \frac{\beta_n}{2}(V_{GS} - V_{tH})^2$$

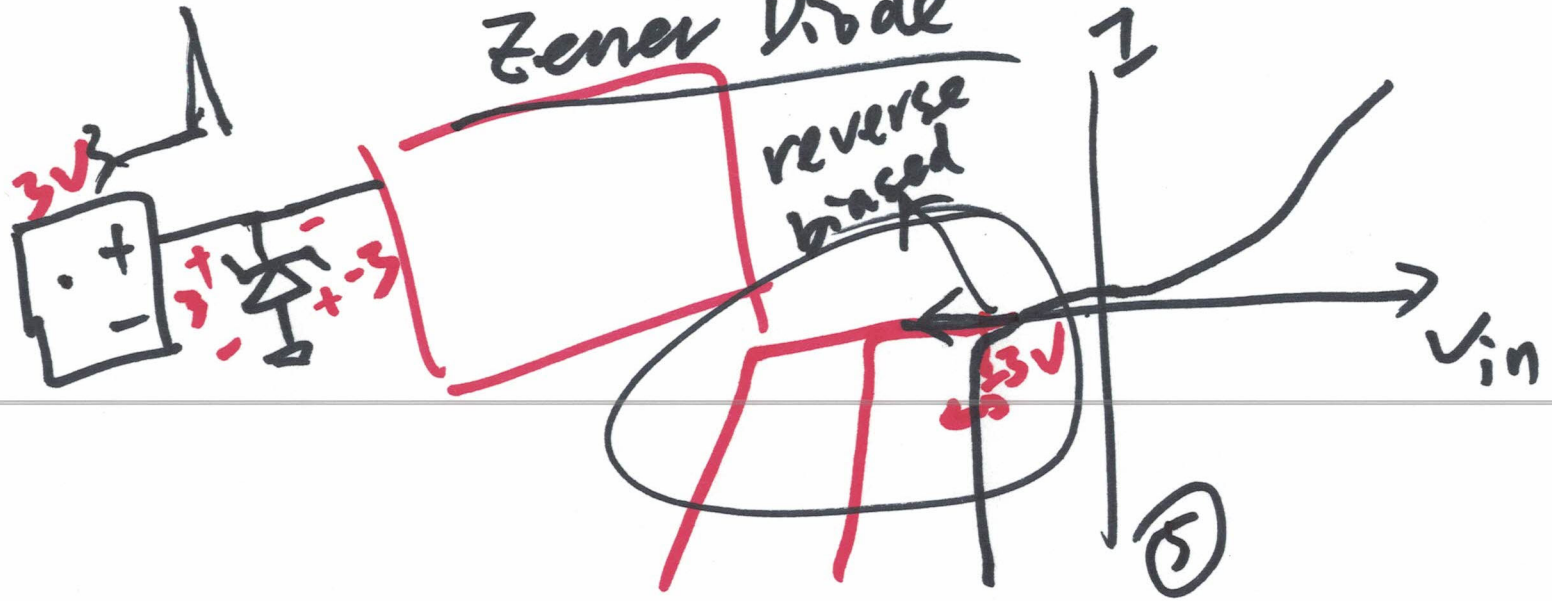
Diodes

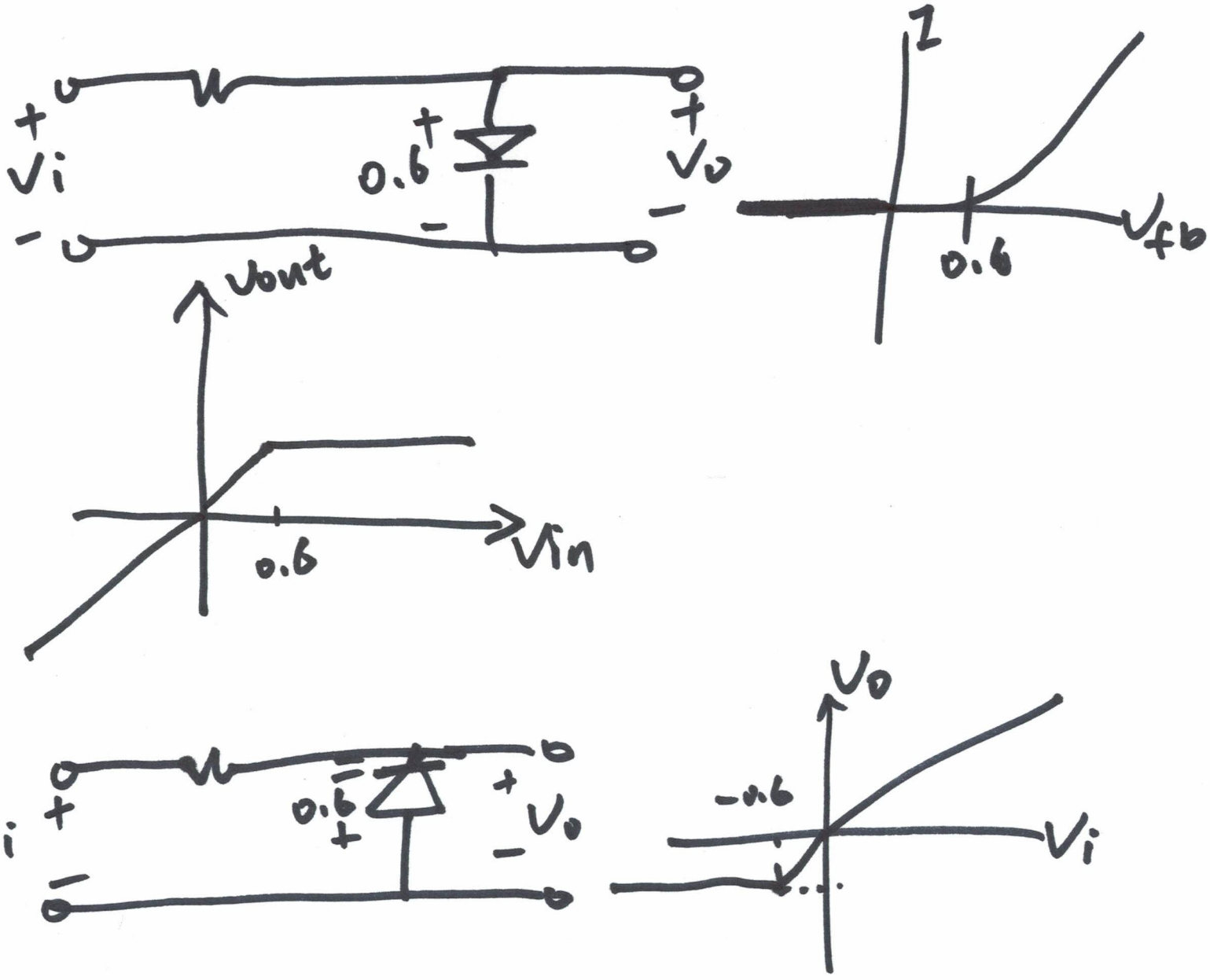






Zener Diode

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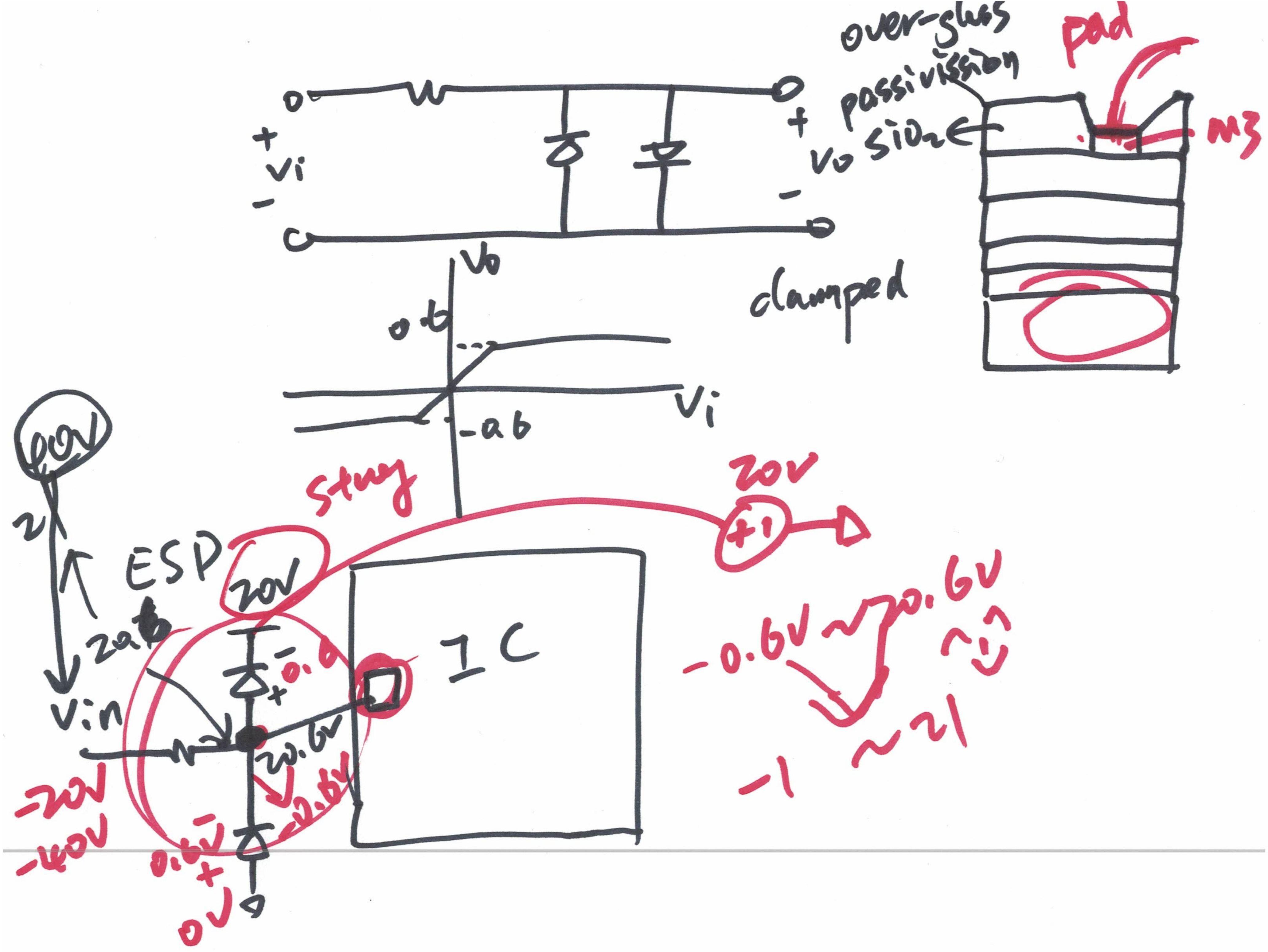

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pad
SiO_2
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Vi
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+
Vo
-
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-0.6
Vi
clamped
60V
2
ESP
20V
Stray
20V
+1
IC
Vin
20.6V
-0.6V ~ 20.6V
-1 ~ 21
-20V
-40V
0.6V
0V