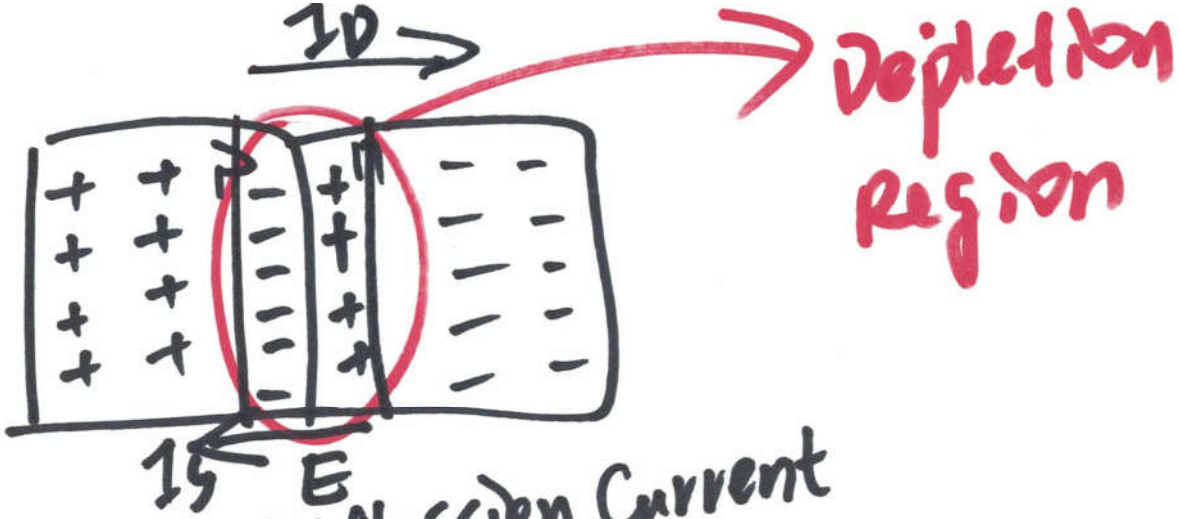


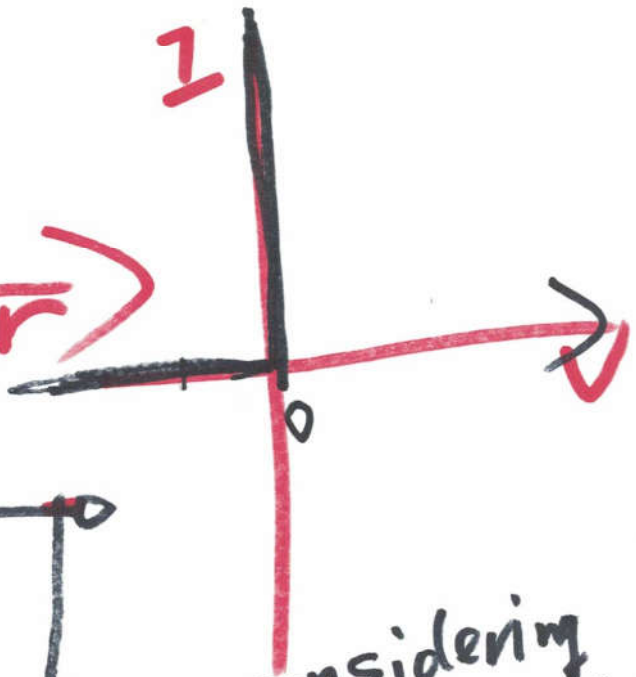
I_D : Diffussion Current

I_S : Drift Current

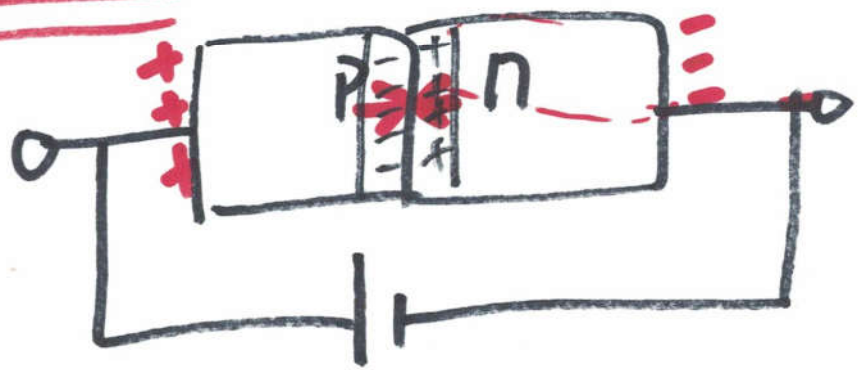
Ideal Diode

Equilibrium

narrower



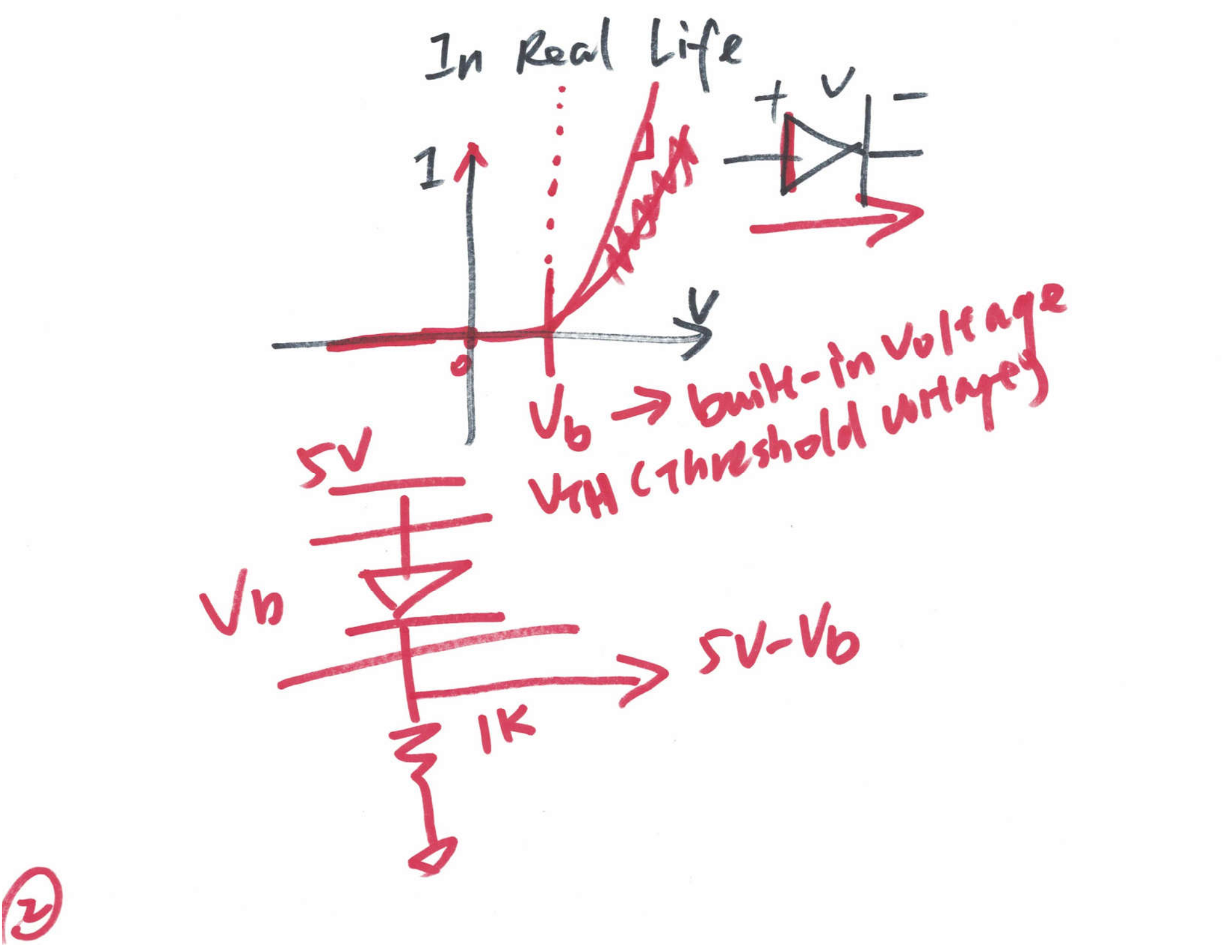
① Forward Bias



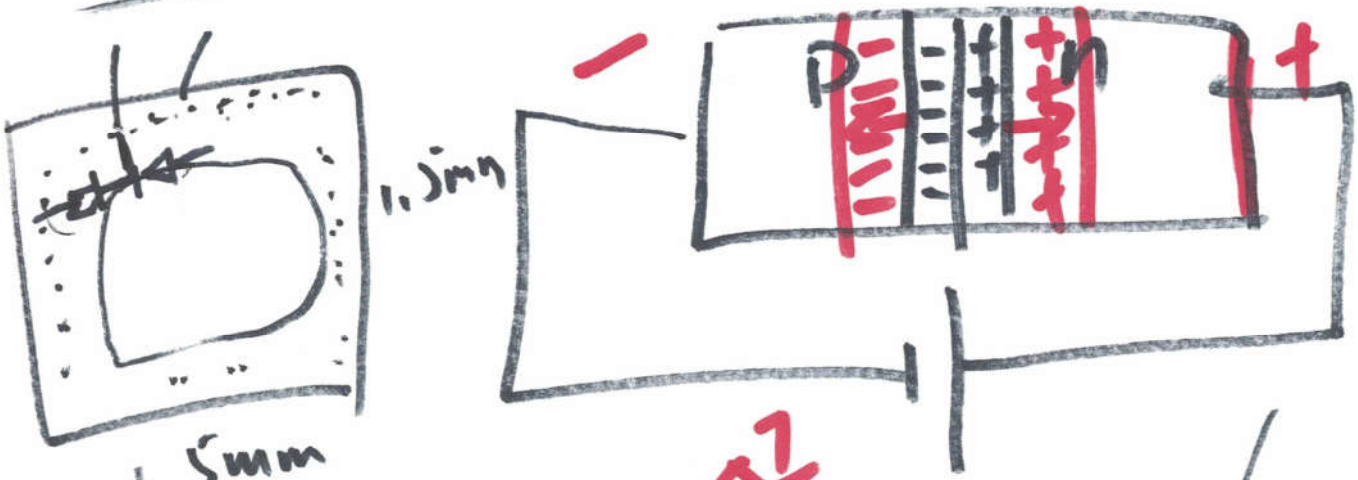
$C = \frac{\varepsilon A}{d}$

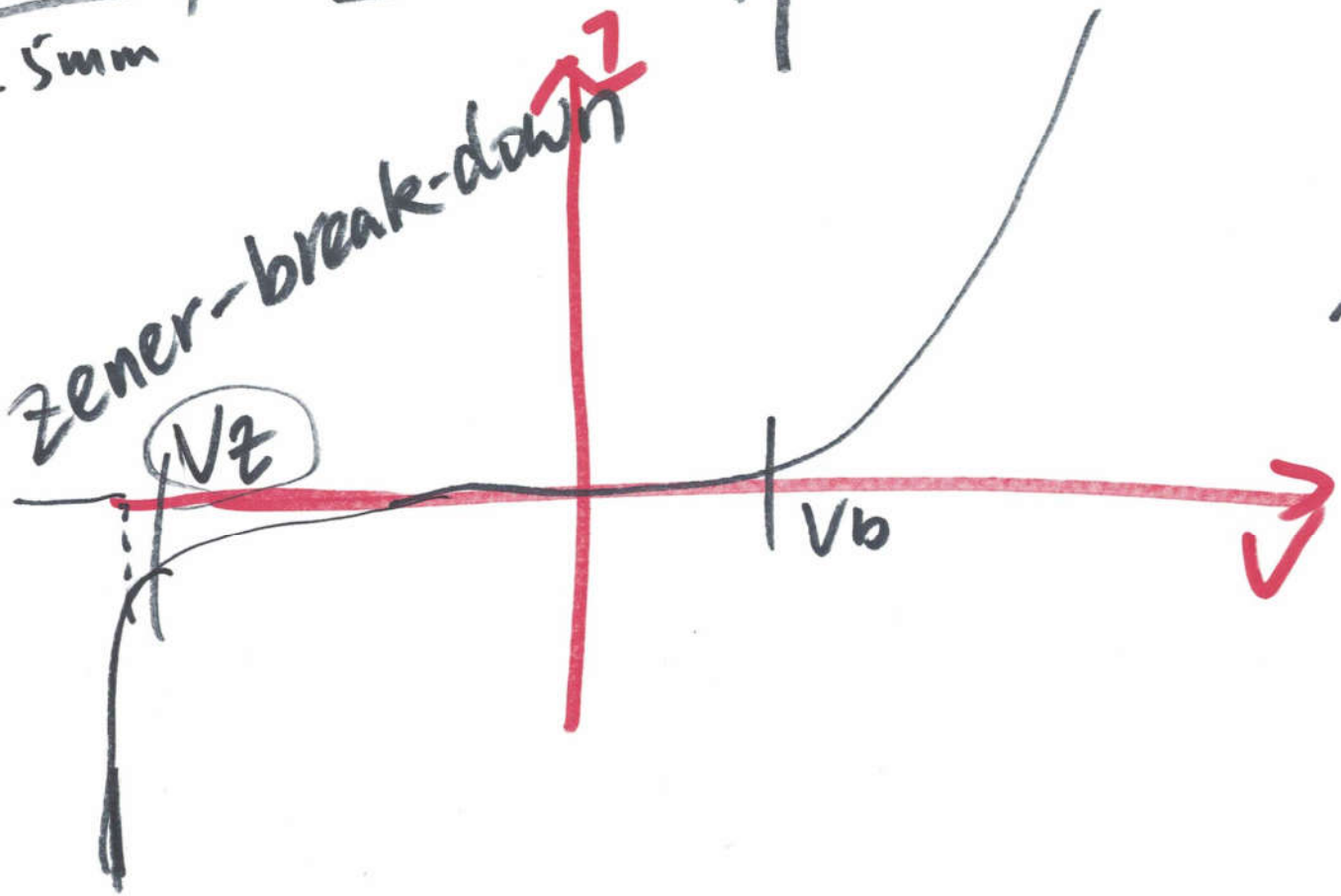
no considering the built-in voltage

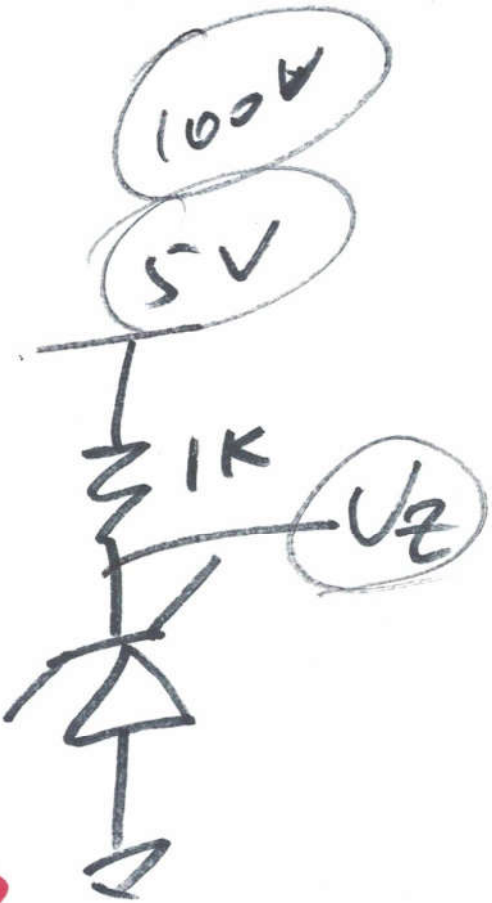
①


In Real Life
I
V
0
+
V
−
V_D → built-in voltage
V_{TH} (threshold voltage)
5V
V_D
5V-V_D
1K

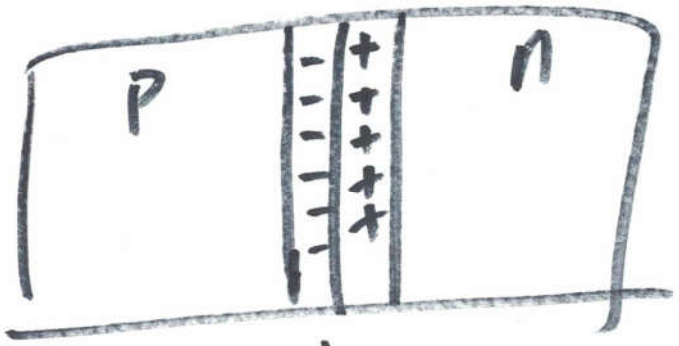
2. Reverse Bias





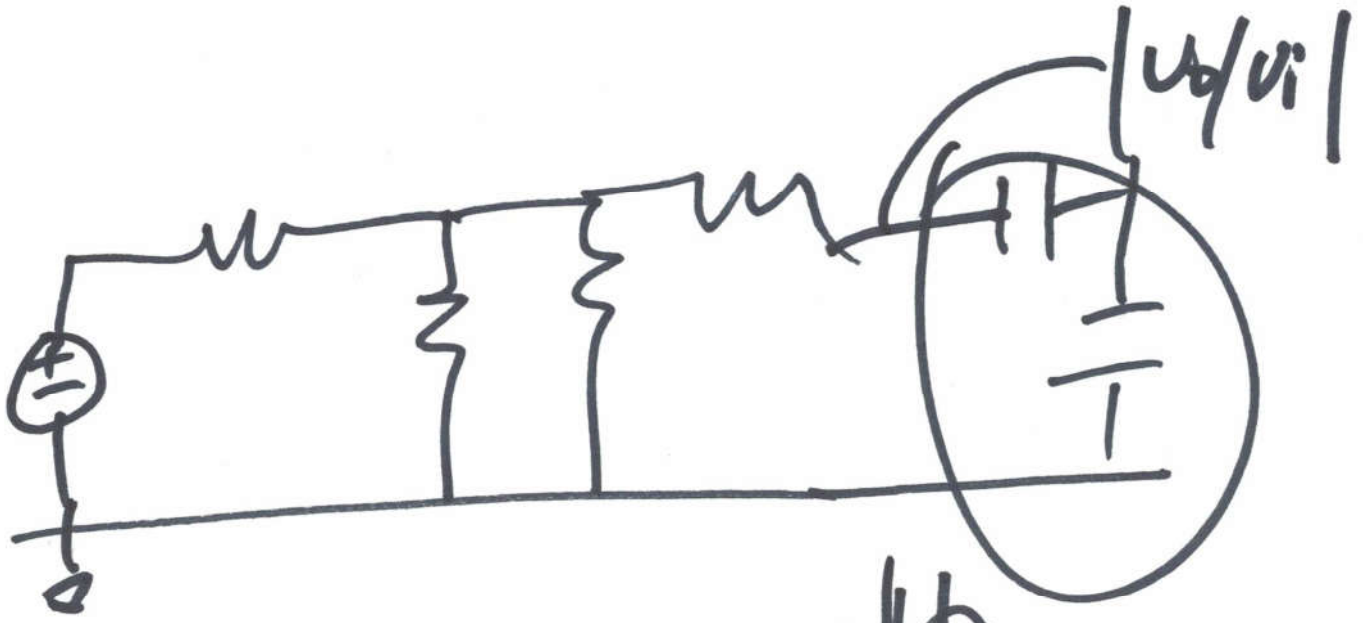


3. Heavily doped semiconductor



→ narrower.

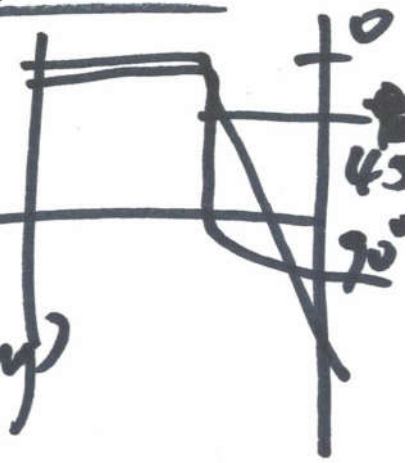
Forms a stronger E gaicker to against further diffussion.

① 

② Op Amps

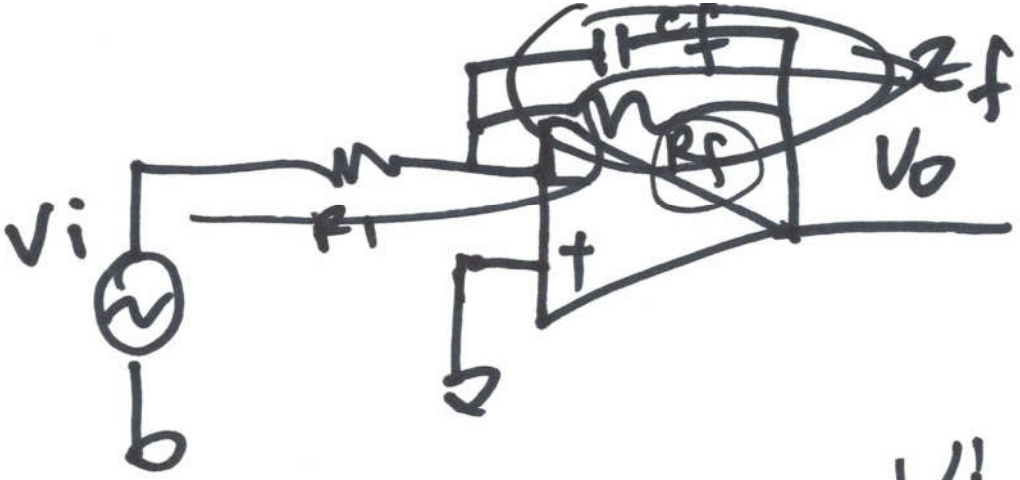
③ Resistor Colors

④ Difference Amp / Instrumentation Amp



⑤ Diodes / pn junction

⑤



$$\frac{V_i - 0}{R_1} = \frac{0 - V_o}{Z_f}$$

$$Z_f = \frac{\frac{1}{j\omega C_f} \cdot R_f}{\frac{1}{j\omega C_f} + R_f}$$

$$= \frac{R_f}{1 + j\omega R_f C_f}$$

$$\frac{V_1}{R_1} = \frac{-V_o}{\frac{R_f}{1 + j\omega R_f C_f}}$$

$$\frac{V_o}{V_i} = -\frac{R_f}{R_1} \cdot \frac{1}{1 + j\omega R_f C_f}$$

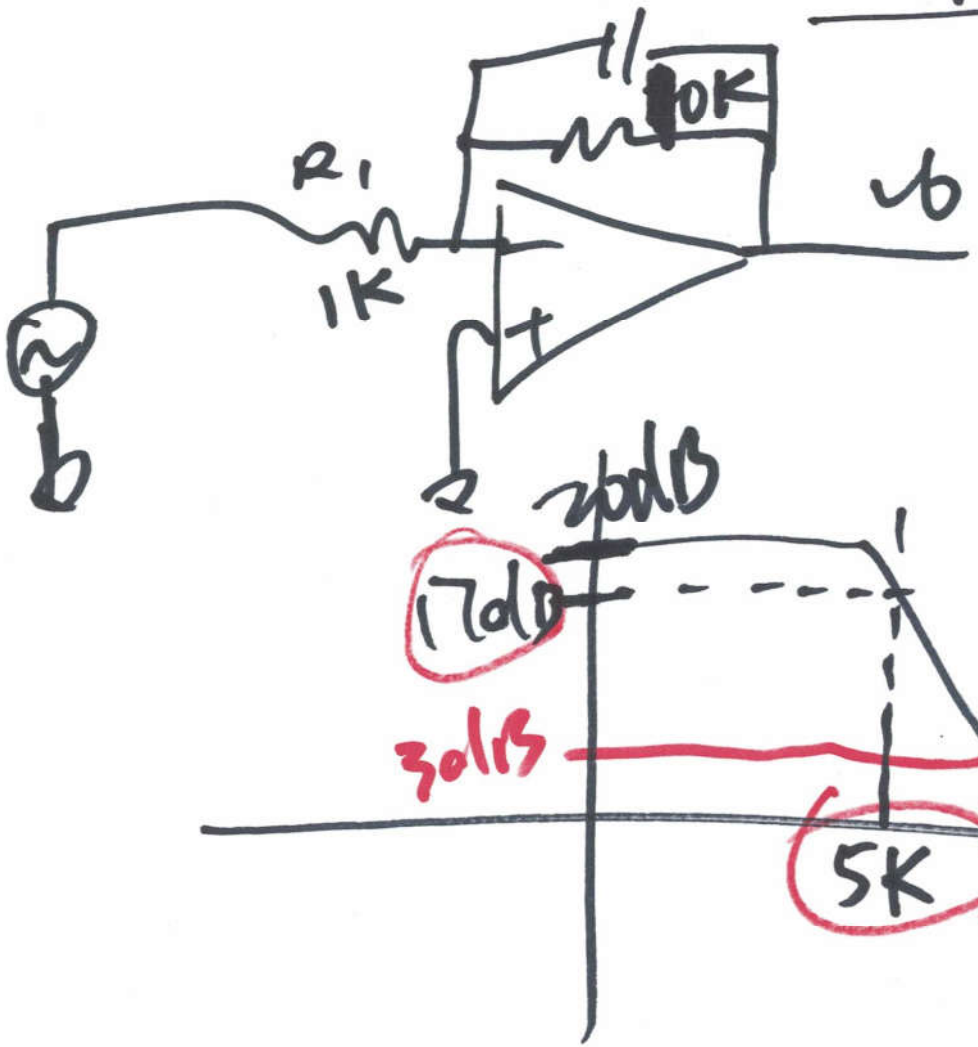
$$\left|\frac{V_o}{V_i}\right| = \frac{R_f}{R_1} \cdot \frac{1}{\sqrt{1^2 + (\omega R_f C_f)^2}}$$

$$= \frac{R_f}{R_1} \frac{1}{\sqrt{1^2 + \left(\frac{f}{f_c}\right)^2}}$$

(b)

$$20\log\left|\frac{V_o}{V_i}\right| = 20\log\left(\frac{1}{\sqrt{1+\left(\frac{f}{f_c}\right)^2}} \cdot \frac{R_f}{R_1}\right)$$

$$= \underline{20\log\frac{R_f}{R_1}} + \underline{20\log\frac{1}{\sqrt{1+\left(\frac{f}{f_c}\right)^2}}}$$



① low f : $20\log\left|\frac{V_o}{V_i}\right|$

$= 20\log 10$

$= 20\,dB$

② $f = f_c$: $20\log\left|\frac{V_o}{V_i}\right|$

$= 17\,dB$