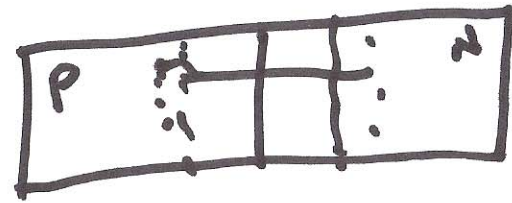
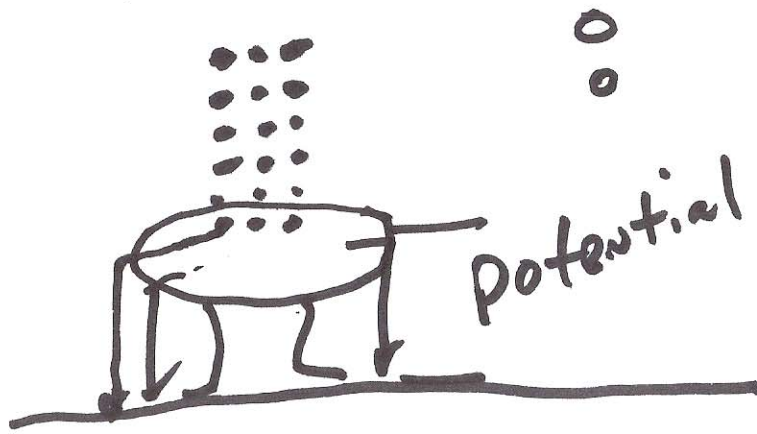
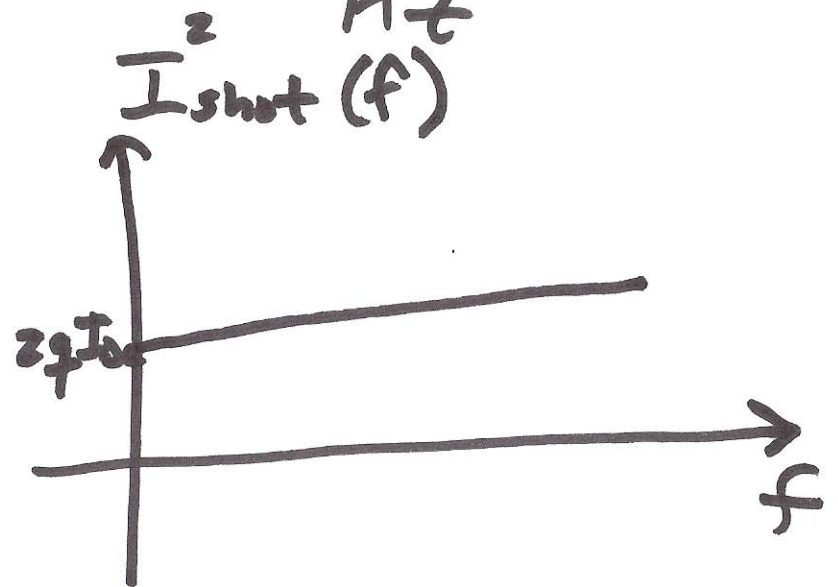
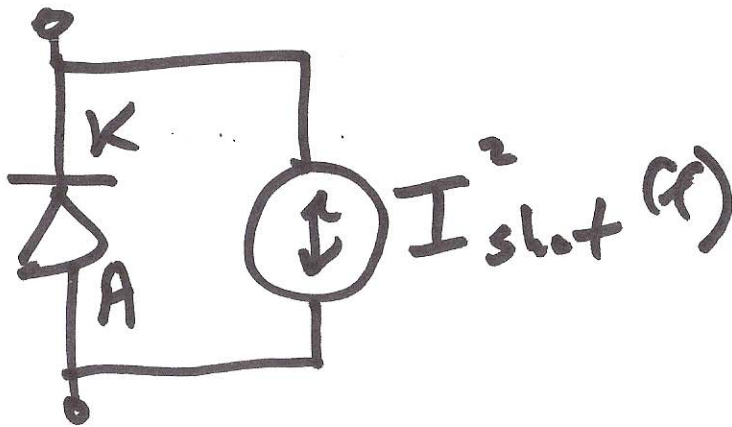


Shot noise

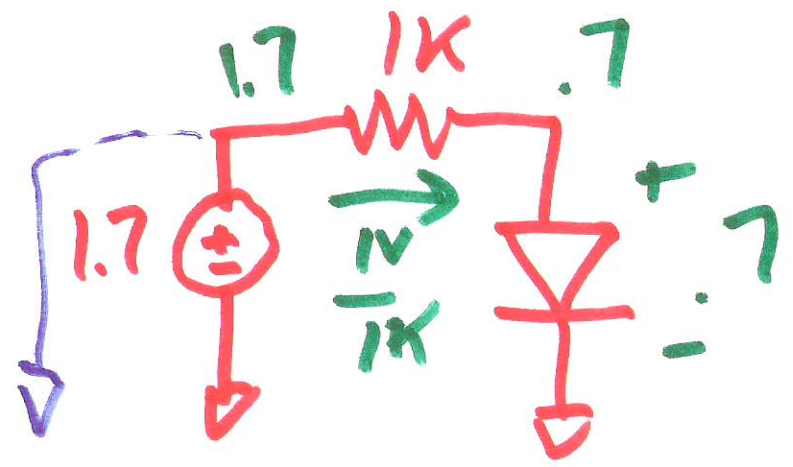


$$I_{\text{shot}}^2(f) = 2q I_{\text{DC}} \frac{\text{A}^2}{\text{Hz}}$$

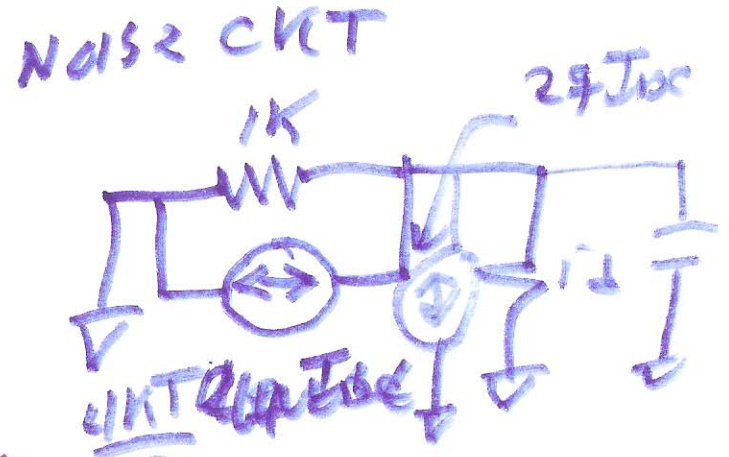


1)

EXAmple 8.12



$I_{DC} = 1\mu A$



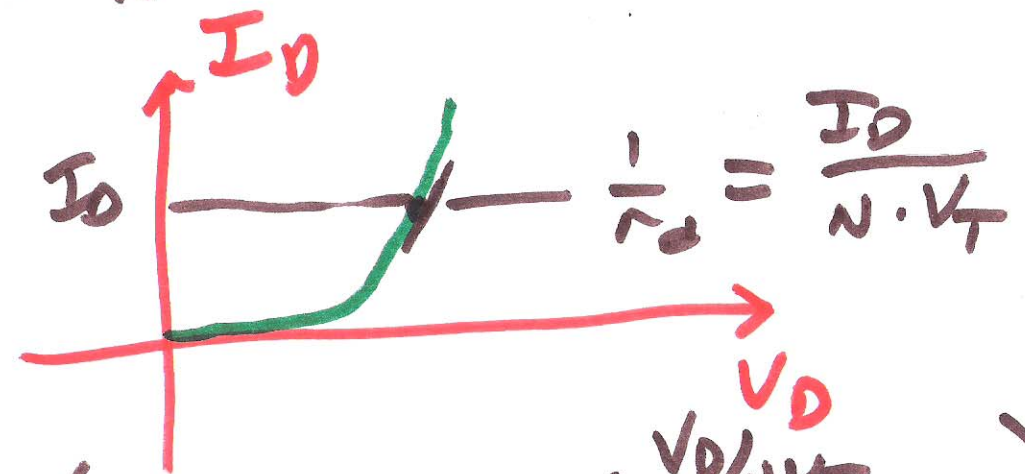
$r_d = \frac{1}{I_0} \frac{kV_T}{q}$, $C_d = \frac{2\pi \cdot I_0}{V_T}$

$\tau_T = 2ns$

$\tau_T = r_d \cdot C_d$

forward biased diode
 $N=1$

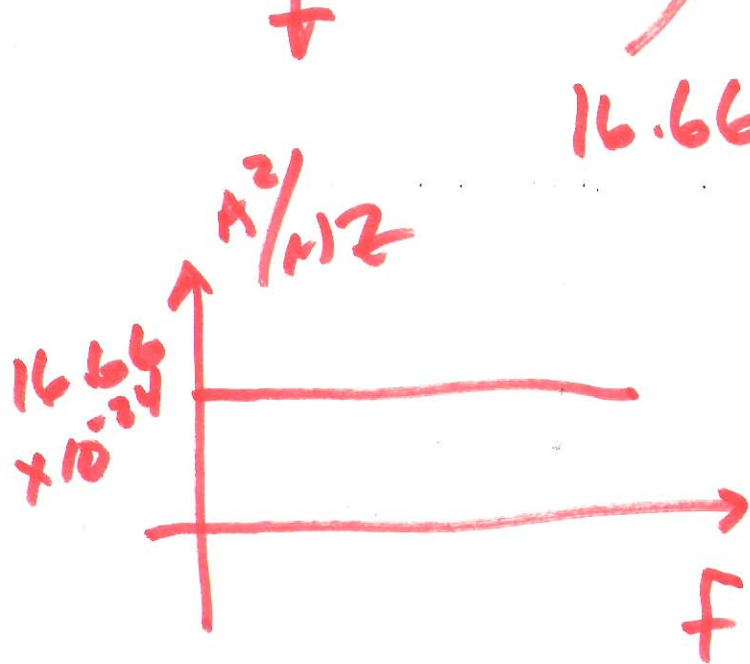
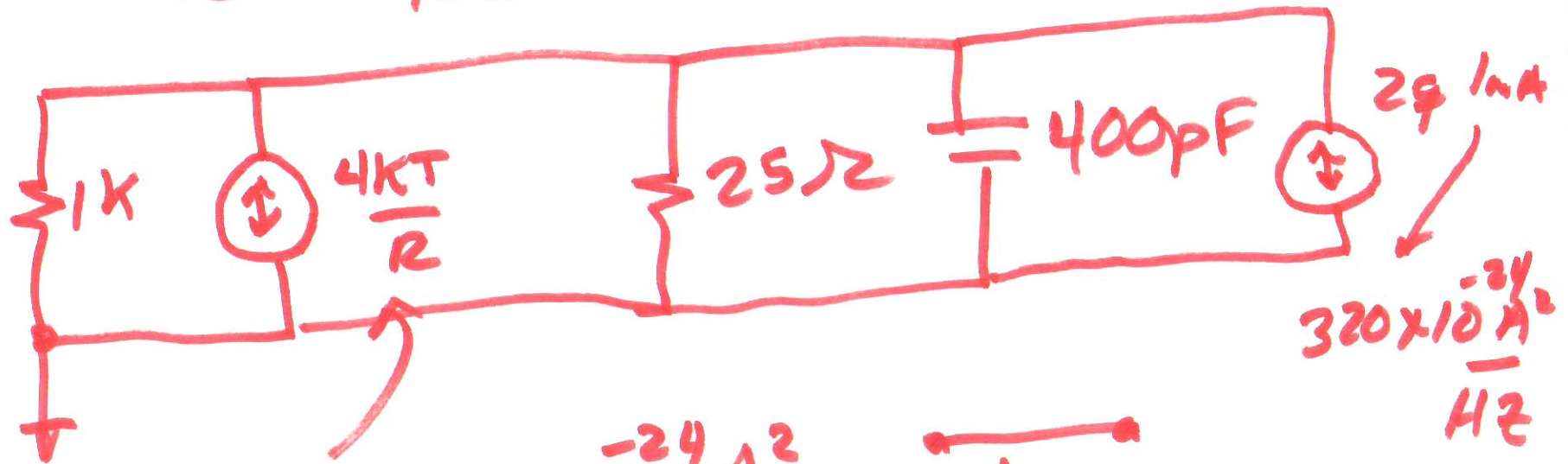
$= \frac{I_0}{qV_T} = C_d$



$V_T = \frac{kT}{q} = 26mV @ 300K$ $I_D = I_S (e^{V_D / N V_T} - 1)$

2)

$$r_d = \frac{25\text{mV}}{1\text{uA}} = 25\Omega$$

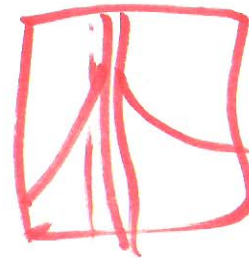


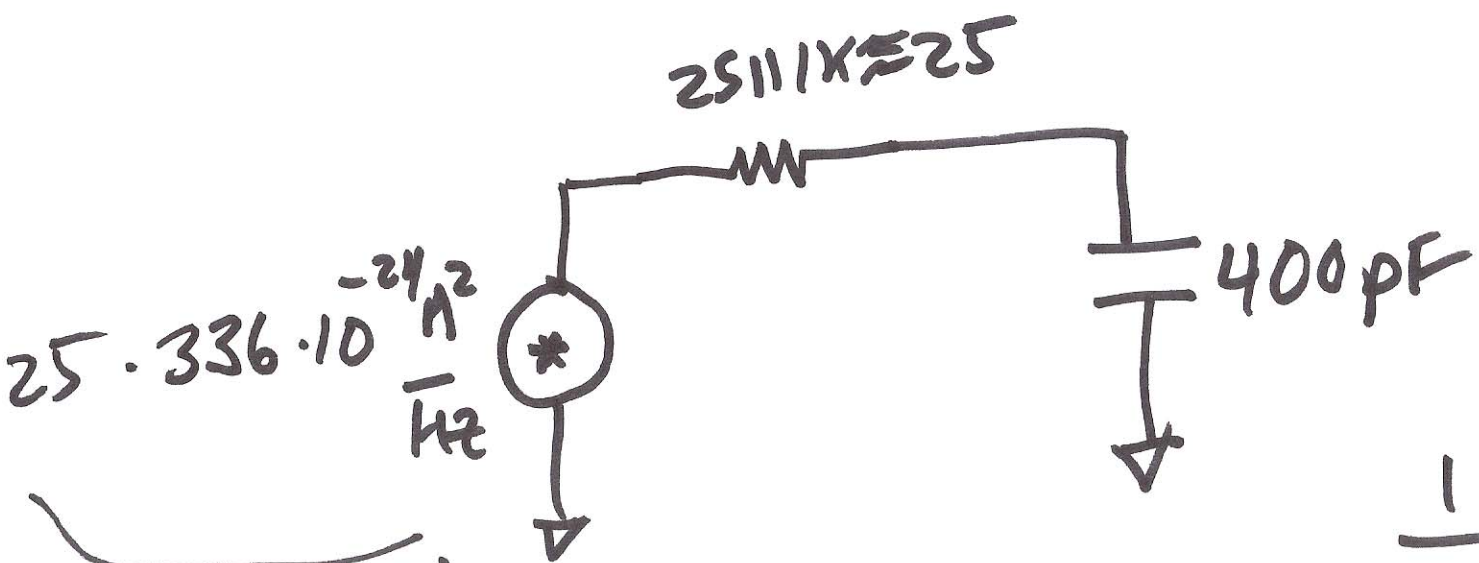
$$16.66 \times 10^{-24} \frac{\text{A}^2}{\text{Hz}}$$

$$\frac{dQ}{dt} = \frac{eA}{t}$$

$$C_D = r_d \cdot \frac{2q I_n A}{t} = 400\text{pF}$$

10ns





$$25.336 \cdot 10^{-24} \frac{\text{A}^2}{\text{Hz}}$$

$$8.4 \times 10^{-21} \frac{\text{V}^2}{\text{Hz}}$$

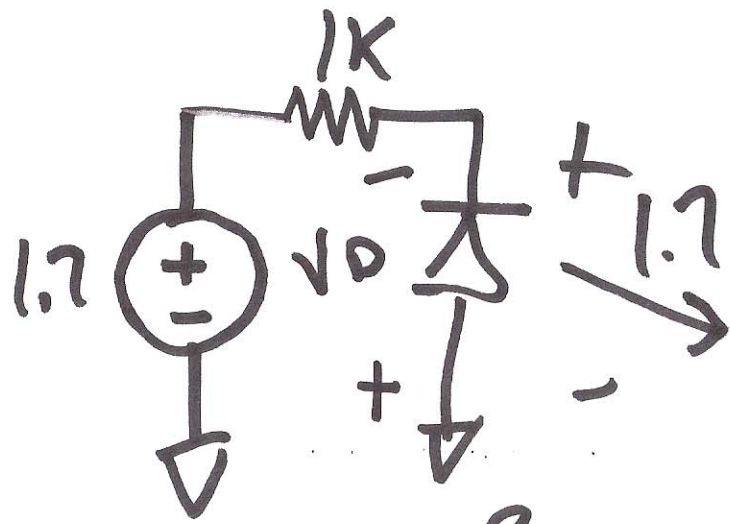
$$f_{3dB} = \frac{1}{2\pi \cdot 25 \cdot 400\text{pF}}$$

$$= 15.9 \text{ MHz}$$

$$V_{0,rms} = \sqrt{8.4 \cdot 10^{-21} \cdot 25.3 \cdot 10^6} \quad \text{NEB} = \frac{\pi}{2} \cdot f_{3dB} = 25.3 \text{ MHz}$$

$$= \underline{\underline{2.3 \mu\text{V}}}$$

4)



Ex.

8.13

$$V_D = -1.7$$

$$V_J = 1V$$

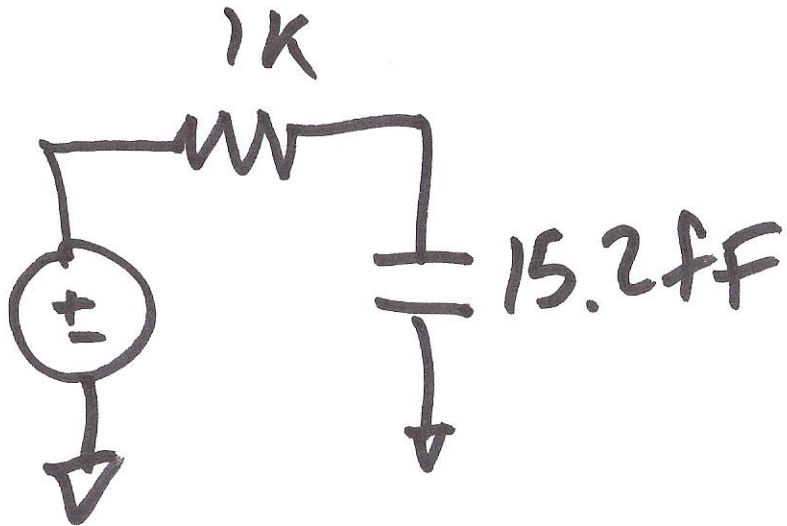
$$C_{J0} = 25 \text{ fF}$$

$$M = 1/2$$

$$C_i(V_D) = \frac{25 \text{ fF}}{\sqrt{1 + \left(\frac{V_D}{V_J}\right)}}$$

1.7

$$C_i(V_D) = \frac{C_{J0}}{\left(1 + \frac{-V_D}{V_J}\right)^M}$$

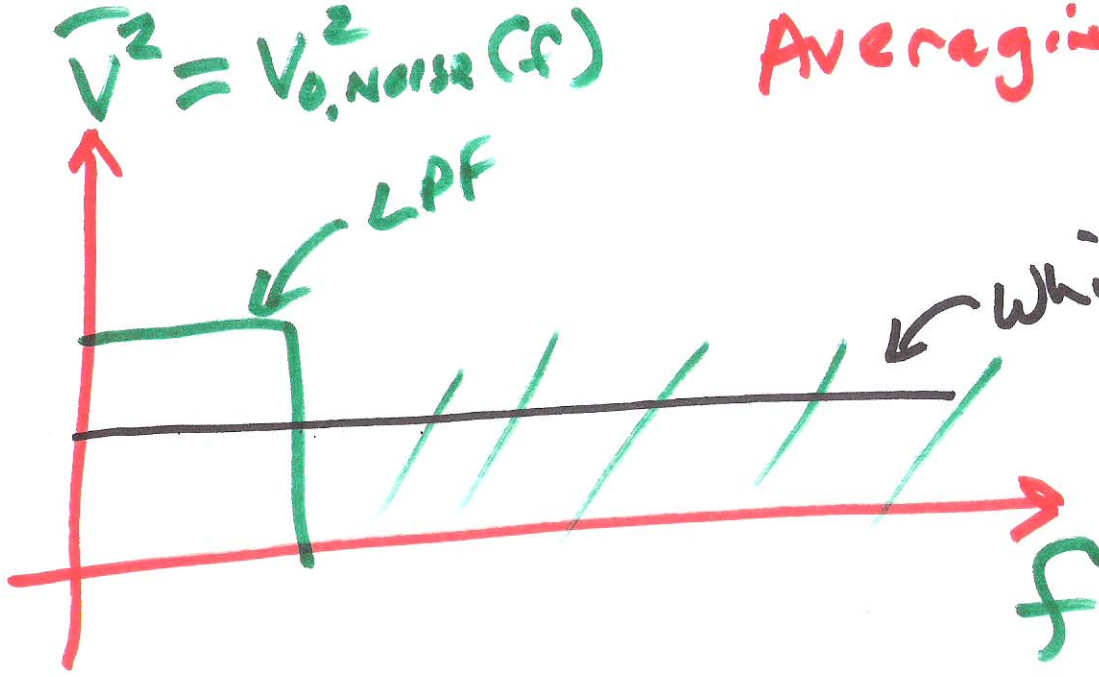


$$C_i = 15.2 \text{ fF}$$

$$V_{D, rms} = \sqrt{\frac{kT}{C}} = 52 \text{ mV}$$

5)

Averaging white noise



$$V_{0,rms}^2 = \frac{4kTRB}{K}$$

↑
of points averaged

$x_1 + x_2 + x_3 + x_4 + \dots$

Averaging



Moving Average filter

See 2nd Mixed-Signal Book!

$$V_{0,rms}^2 = \frac{2q \cdot I_{oc} \cdot B}{K}$$

6)