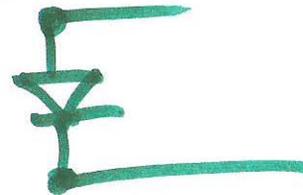
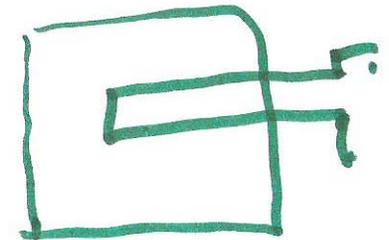
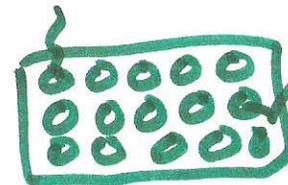


Sept. 29, 2011

Lecture 12

Talk about projects
Focal Plane Array (FPA)

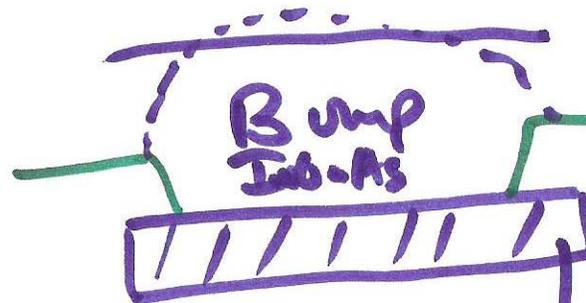
TOP view



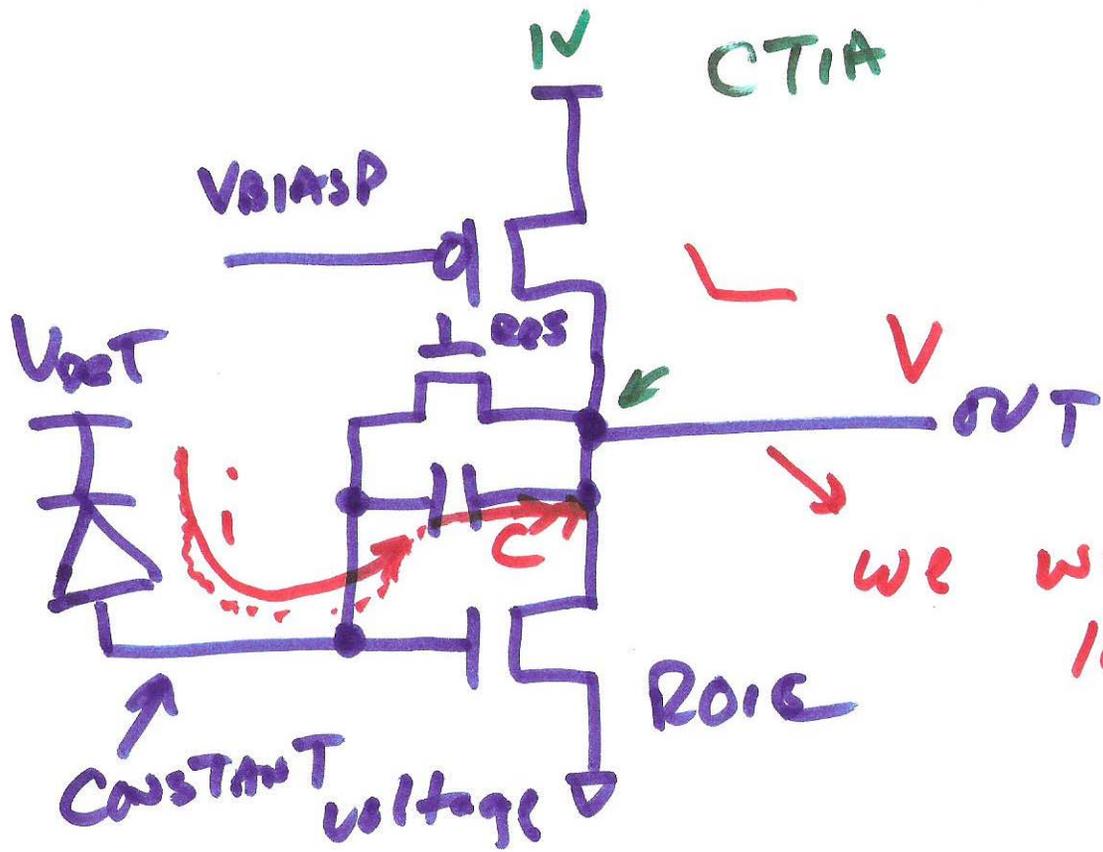
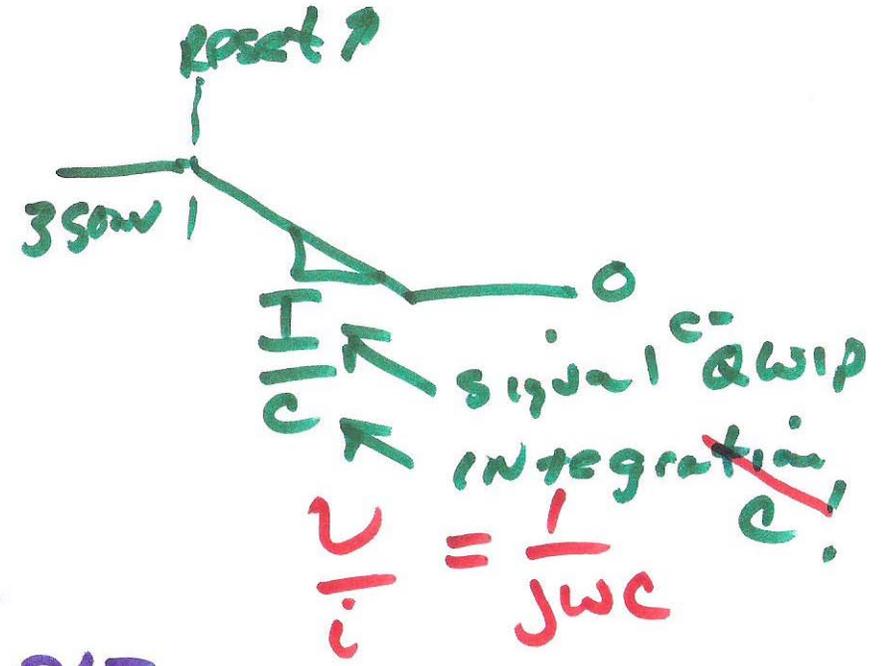
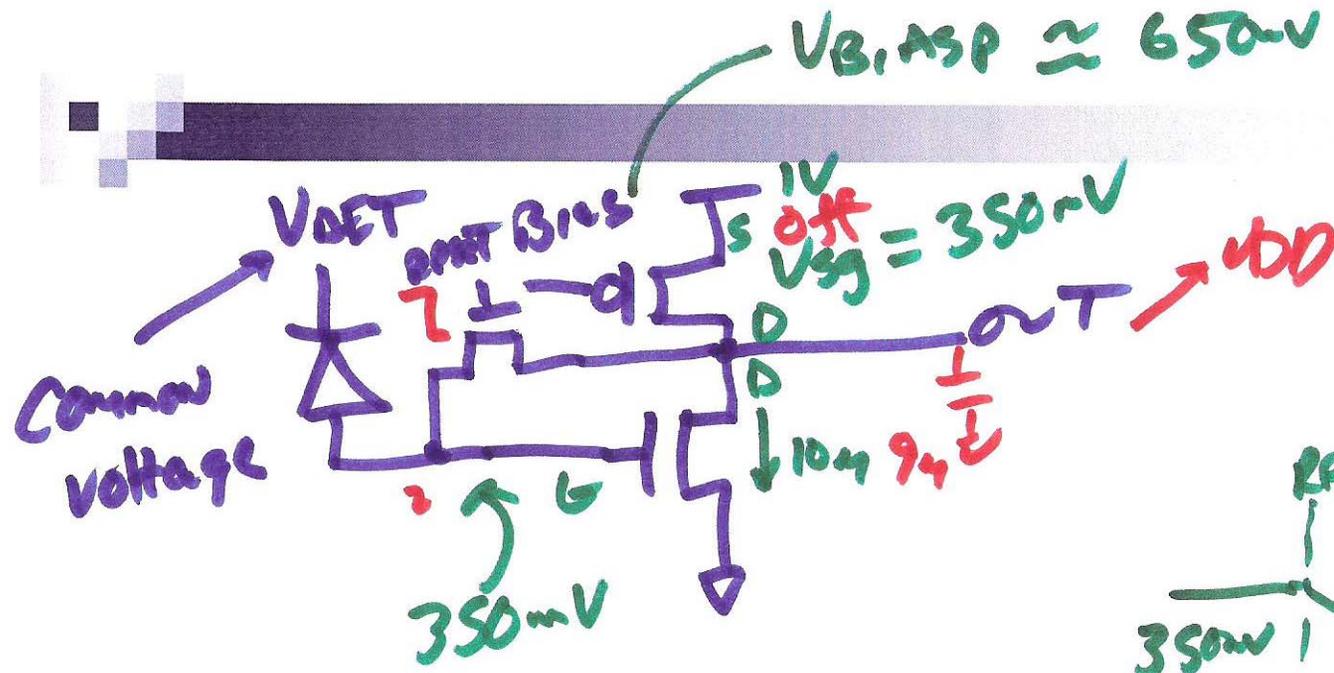
hybrid imager

Bottom view

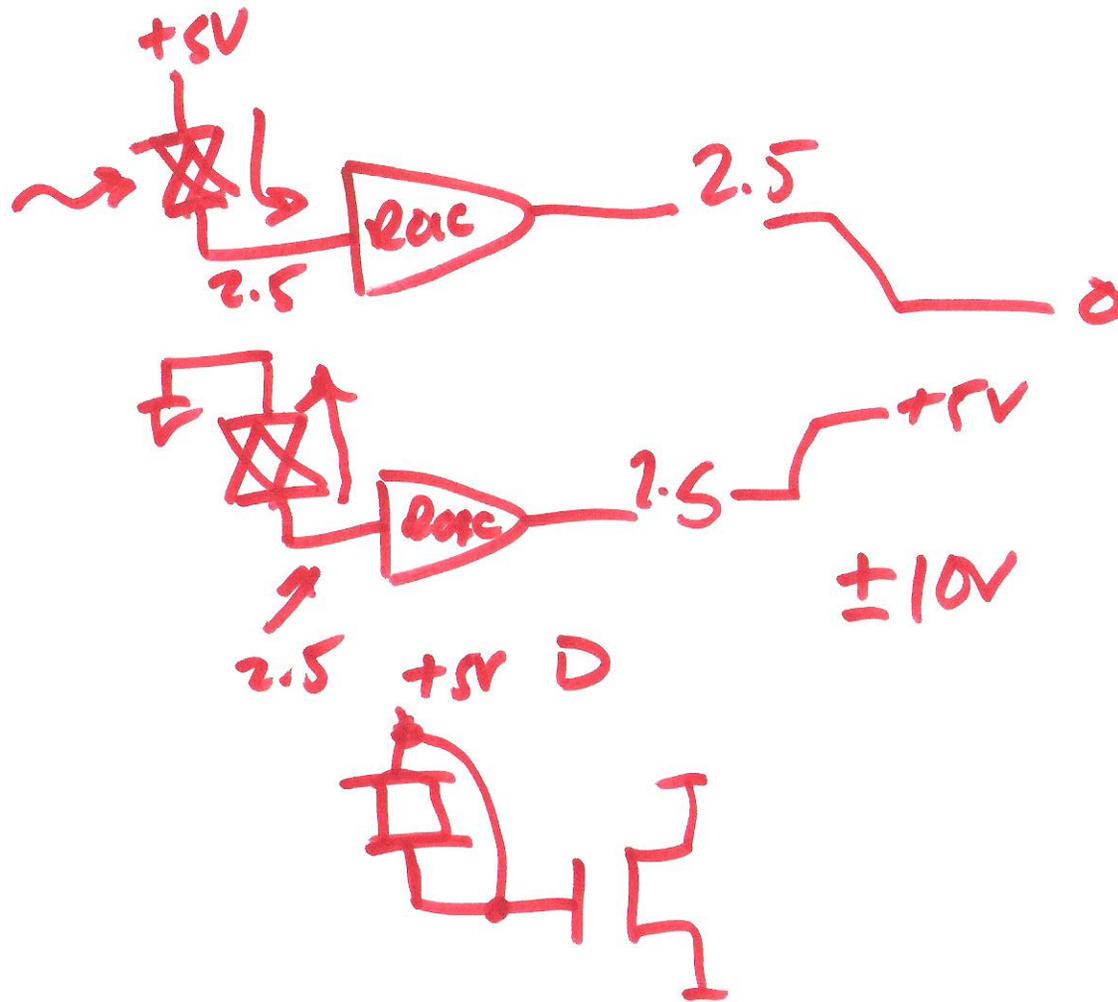
Si
 $\lambda < 1\mu m$



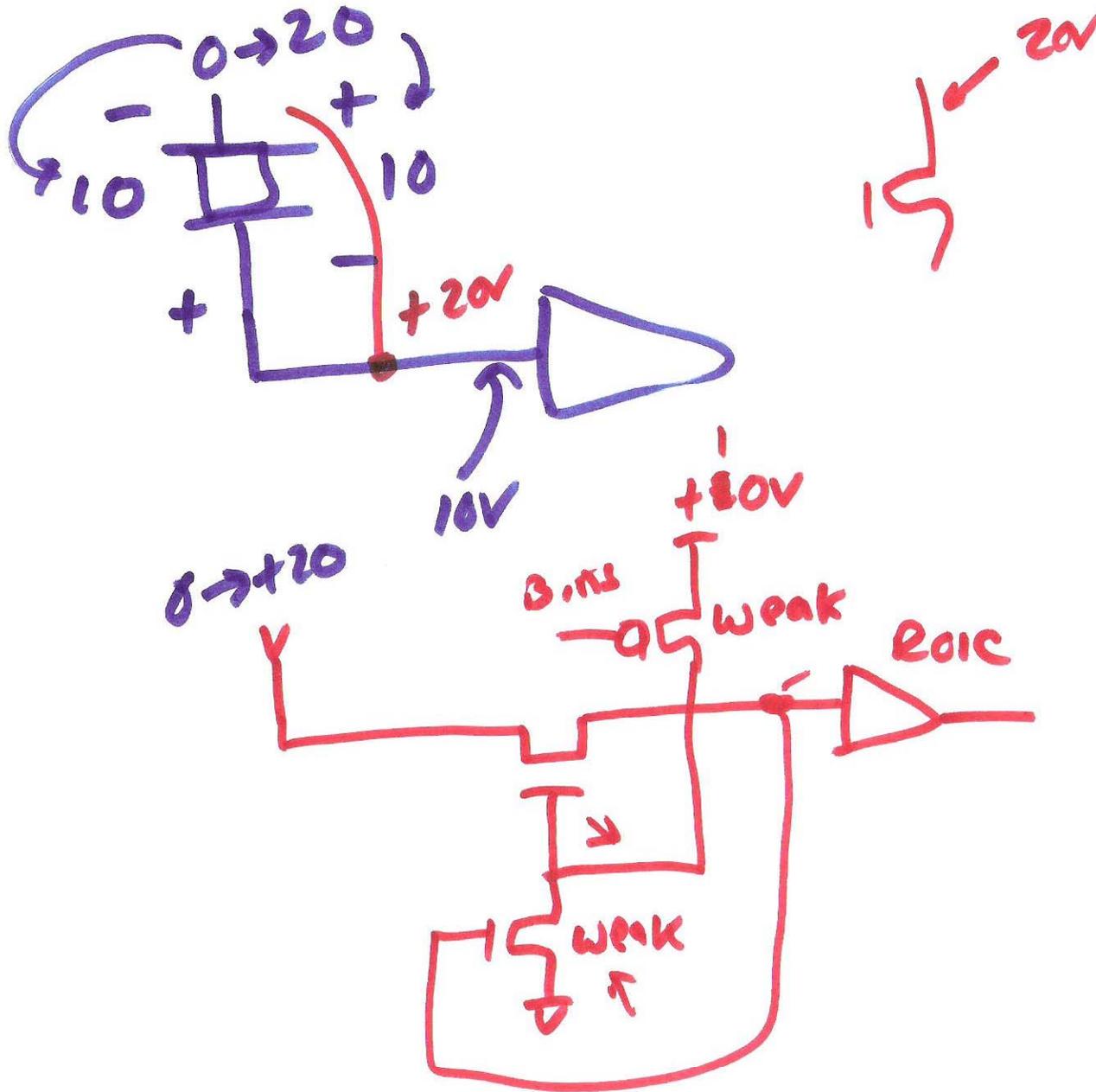
CMOS
TOP of die
Readout ROIC
Integrate circuit



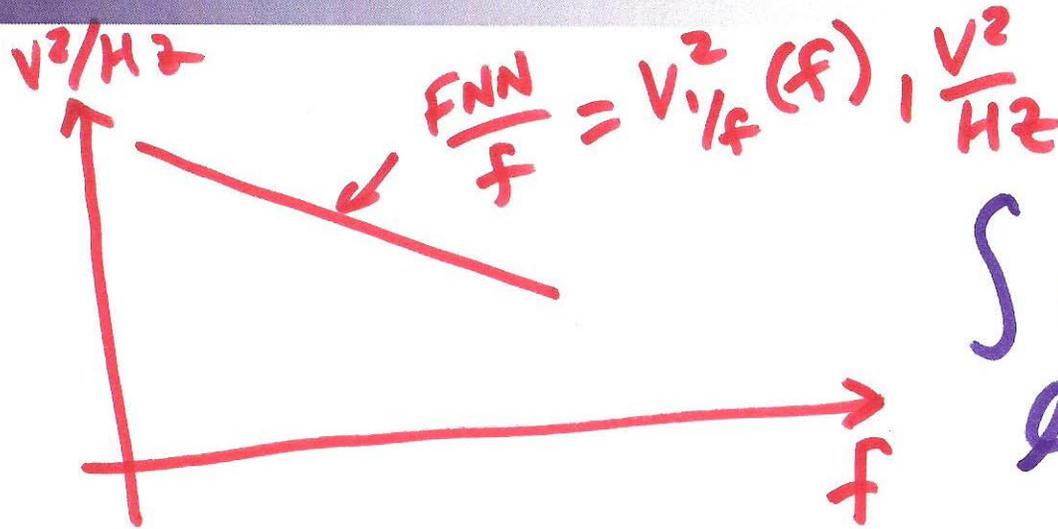
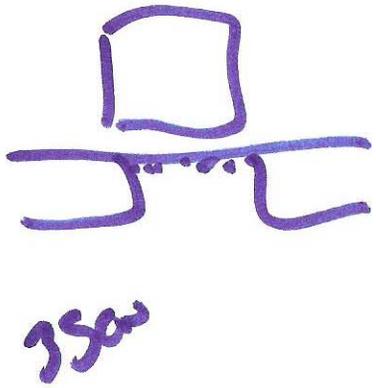
2)



4)



5)



$$\int \frac{1}{\text{cabin}} \cdot d\text{cabin}$$

ln cabin

$$V_{RMS}^2 = \int_{f_L}^{f_H} \frac{FNN}{f} \cdot df = FNN \cdot \ln f \Big|_{f_L}^{f_H}$$

$$FNN (\ln f_H - \ln f_L)$$

$$FNN \ln \frac{f_H}{f_L}$$

$f_H \rightarrow 100 \text{ GHz}$

$f_L = 10^{-10}$ once every 320 years

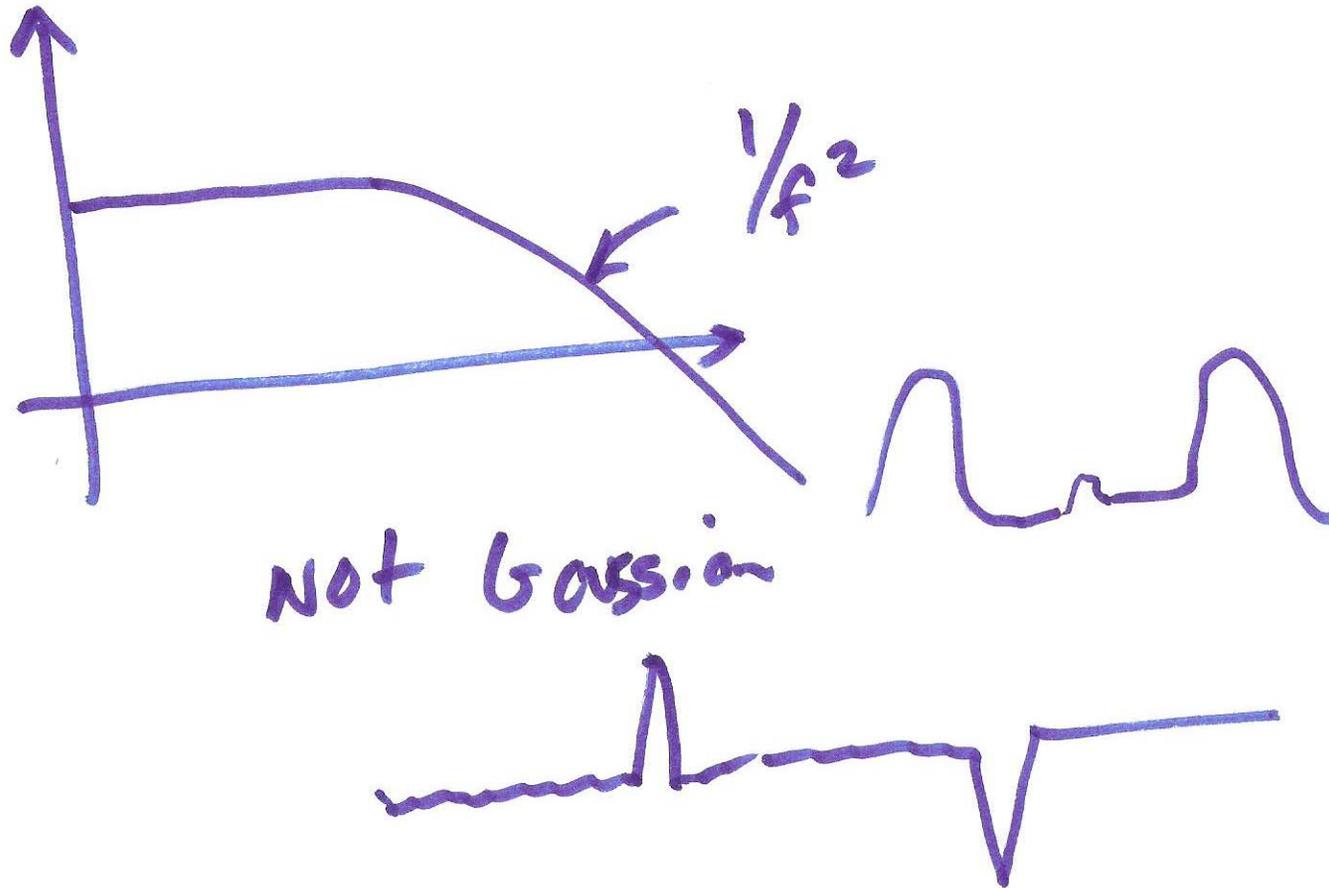
$V_{RMS} = 7 \cdot \sqrt{FNN}$

$\ln 10^{21} \approx 49$

$V_{RMS}^2 = 49 \cdot FNN$

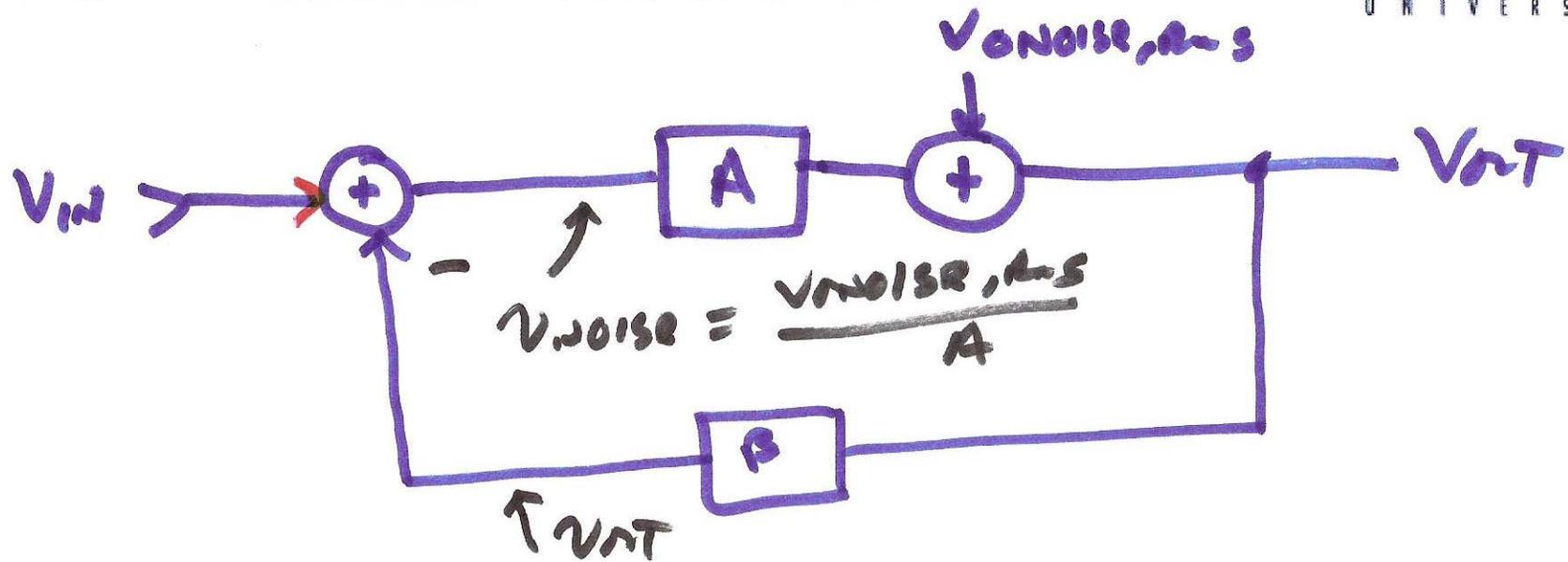
6)

RTS (Popcorn)



7)

NOISE & feedback



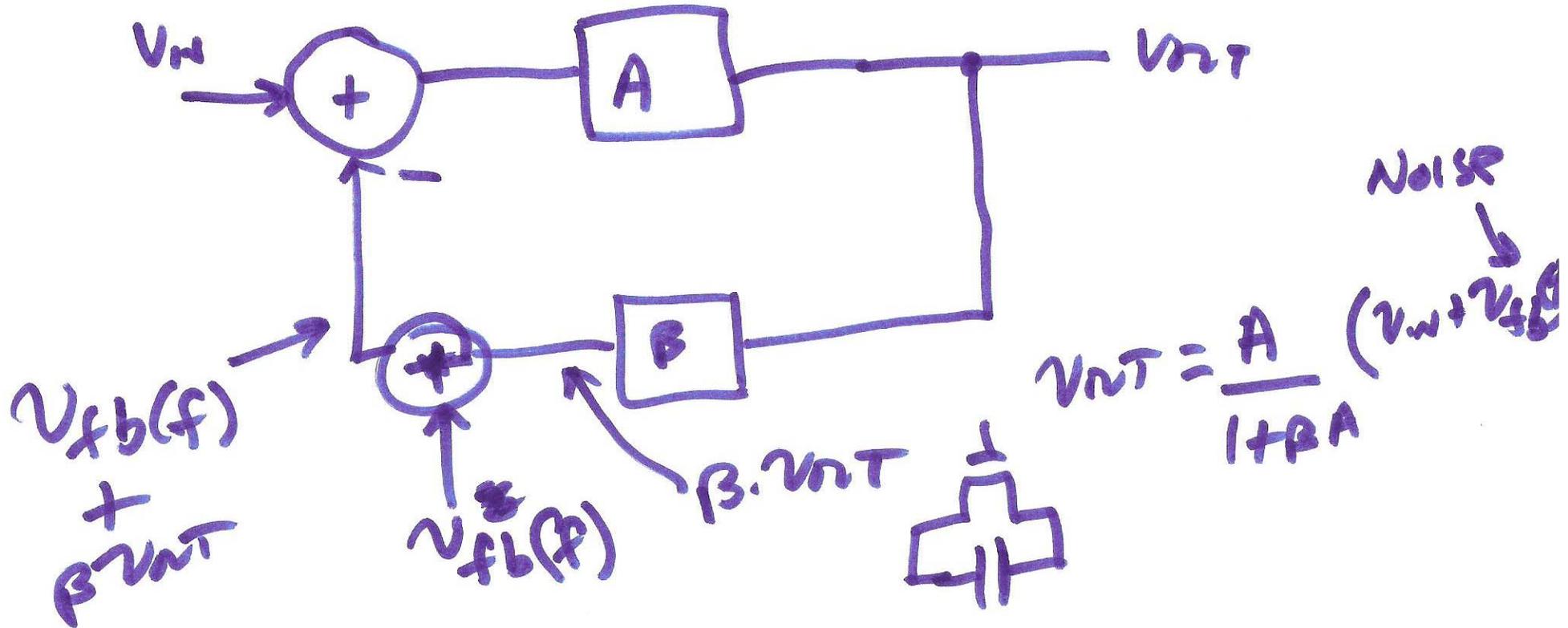
$$v_{noise} = \frac{V_{noise,rms}}{A}$$

$$(V_{in} - \beta V_{out}) A + V_{noise,rms} = V_{out}$$

$$\frac{A V_{in} + V_{noise,rms}}{1 + A \beta} = V_{out} \quad A_{CL} = \frac{1}{\beta}$$

$$\frac{A}{1 + \beta A} (V_{in} + v_{noise}) = V_{out} = \frac{1}{\frac{1}{A} + \beta} (V_{in} + v_{noise})$$

8)



NOISE \downarrow

$$V_{out} = \frac{A}{1 + \beta A} (V_m + V_{fb}(f))$$

$$[V_m - (V_{fb}(f) + \beta V_{out})] \cdot A = V_{out}$$

$$A V_m - A \cdot V_{fb}(f) - \beta A V_{out} = V_{out}$$

9)