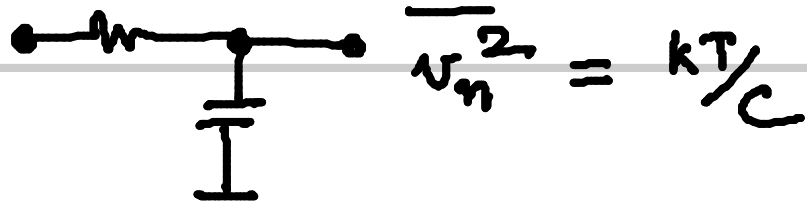


$$\frac{kT}{C}$$



A/D converter 16 bits
full scale = 1 Volt

$$LSB = \frac{1 \text{ Volt}}{2^{16}}$$

$$\text{Max noise voltage} = \frac{1 \text{ V}}{2^{16} \times 2}$$

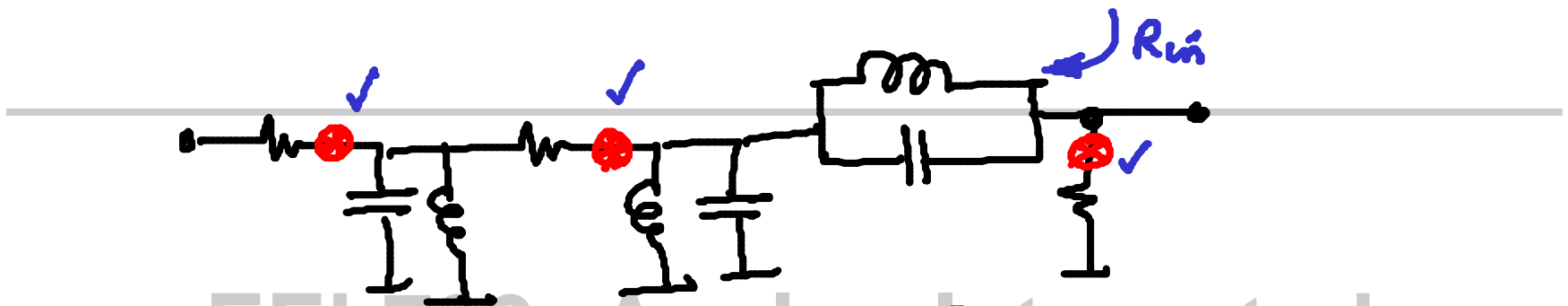
$$\sqrt{\frac{kT}{C}} < \frac{1}{2^{17}}$$

$$kT @ 27C = 25 \text{ mV} \times 1.6 \times 10^{-19} \text{ Coulomb}$$

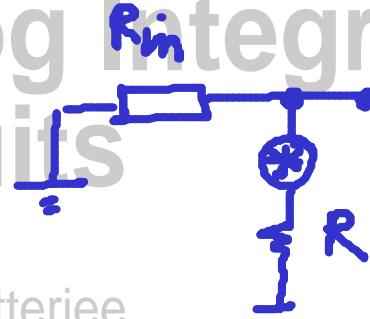
$$C > 71 \text{ pF}$$

→ 3 volts instead of 1 V

→ $C_{min} \downarrow 9x$



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Mean sq noise voltage at output

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"Output referred noise" → straightforward

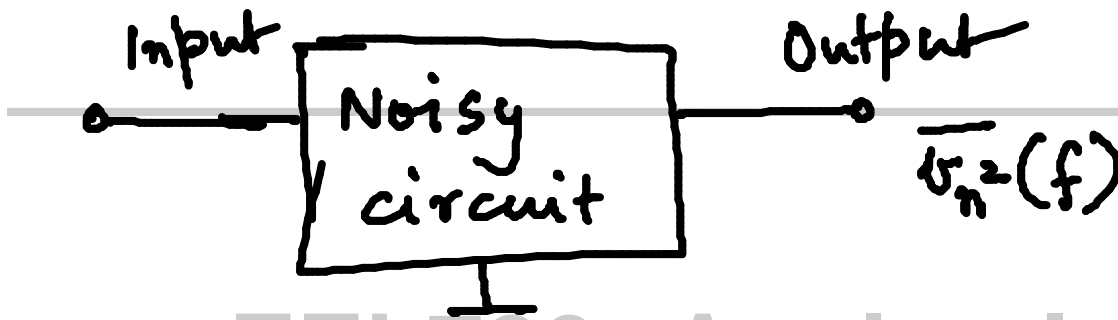
"Input referred noise"

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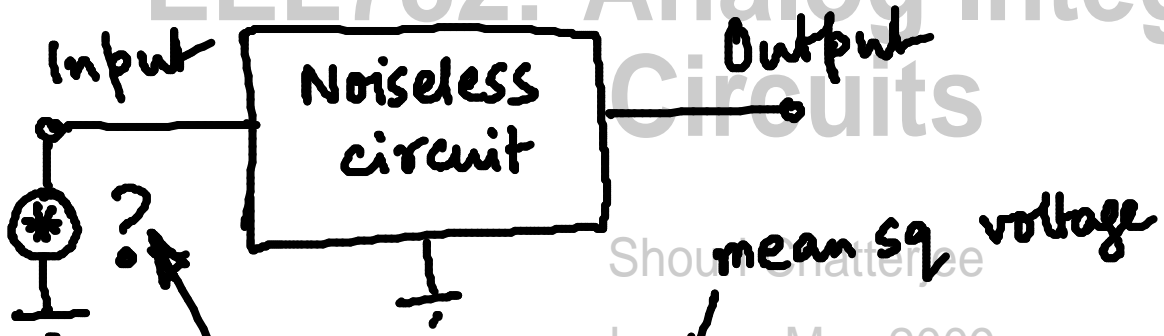
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"Input referred noise" = mean sq voltage

mean sq voltage

$$\frac{\text{Output referred noise}}{H(f) \hat{H}(f)}$$

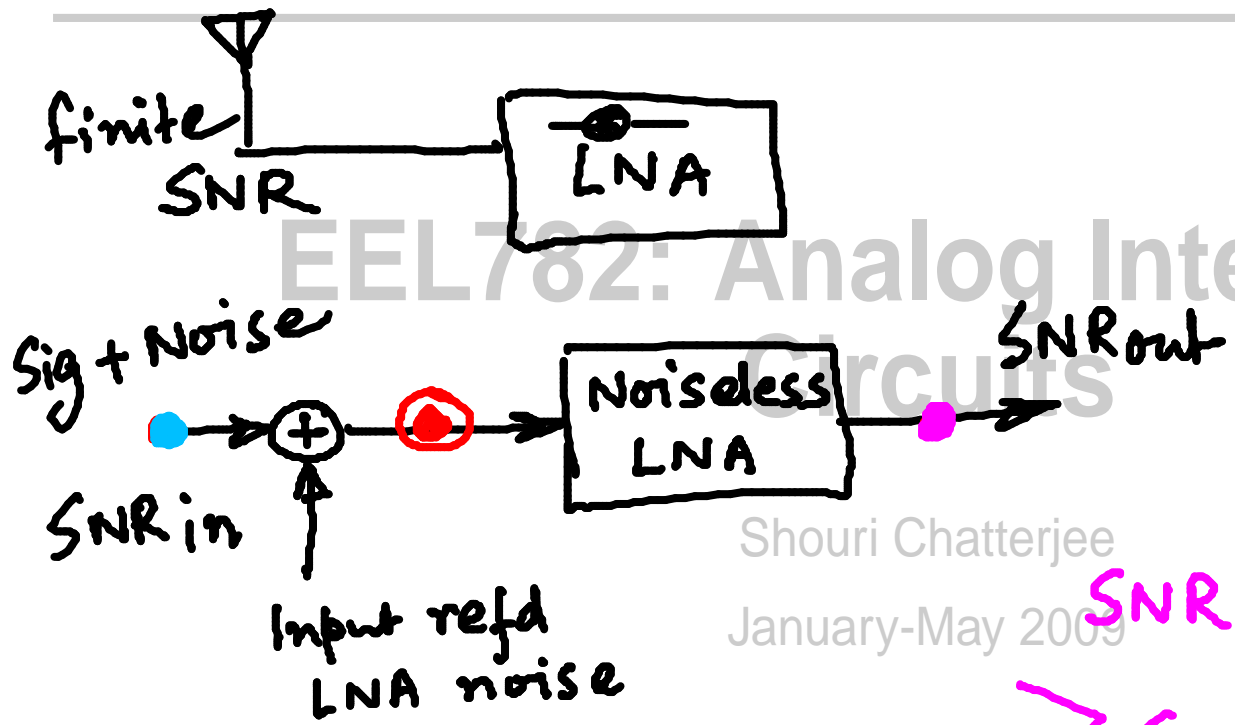
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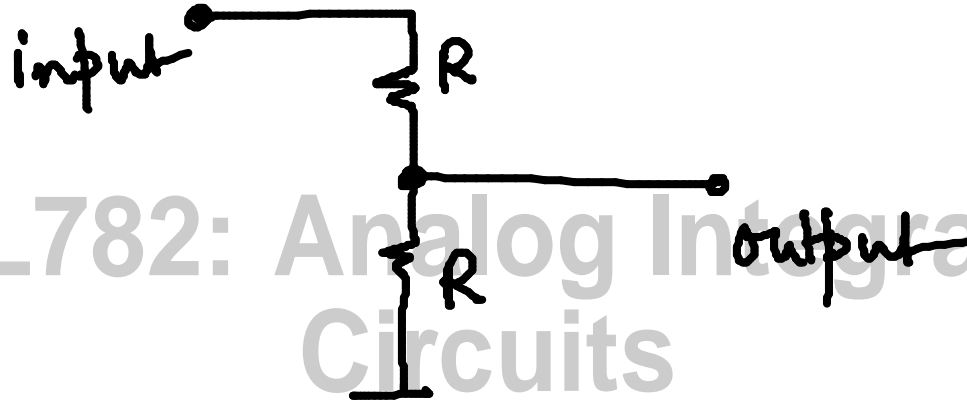


SNR @ input of system

SNR @ output of system

$$NF = \frac{SNR_{in}}{SNR_{out}} \text{ (dB)}$$





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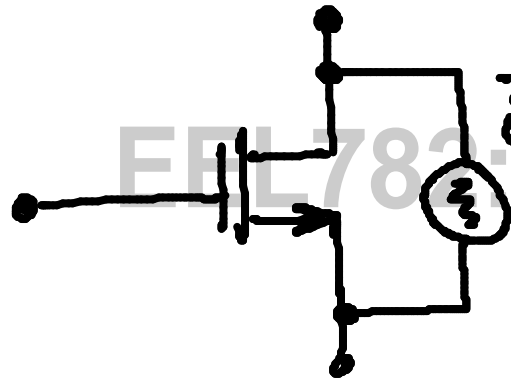
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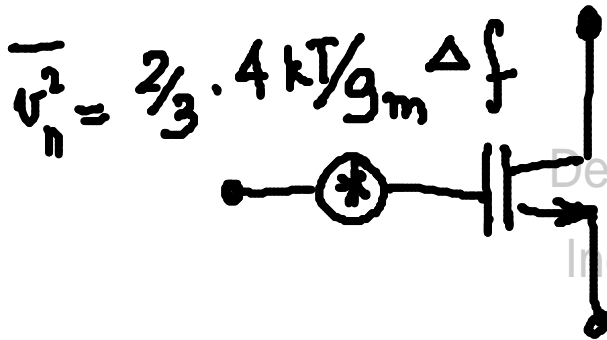


MOSFET \rightarrow lossy \rightarrow noisy

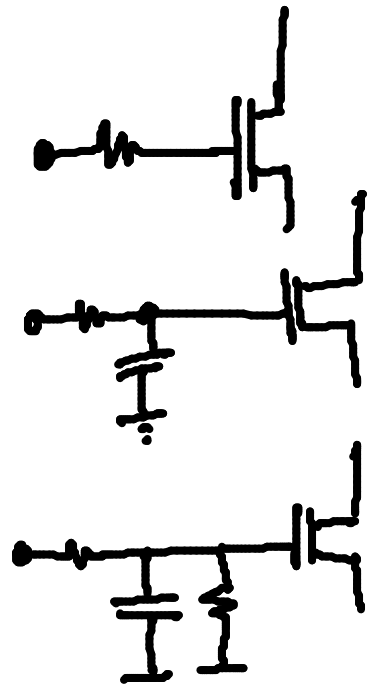
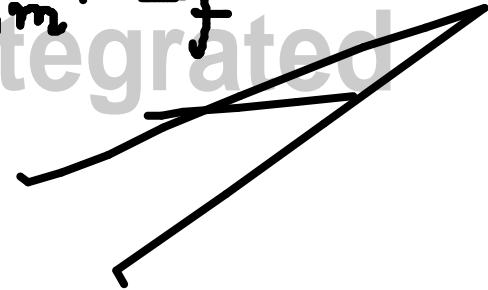


$$\overline{v_{n^2}} = \frac{2}{3} \cdot 4kTg_m \cdot \Delta f$$

Model in
Strong inv, sat



$$\overline{v_{n^2}} = \frac{2}{3} \cdot 4kT/g_m \cdot \Delta f$$



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