Structured Electronic Design
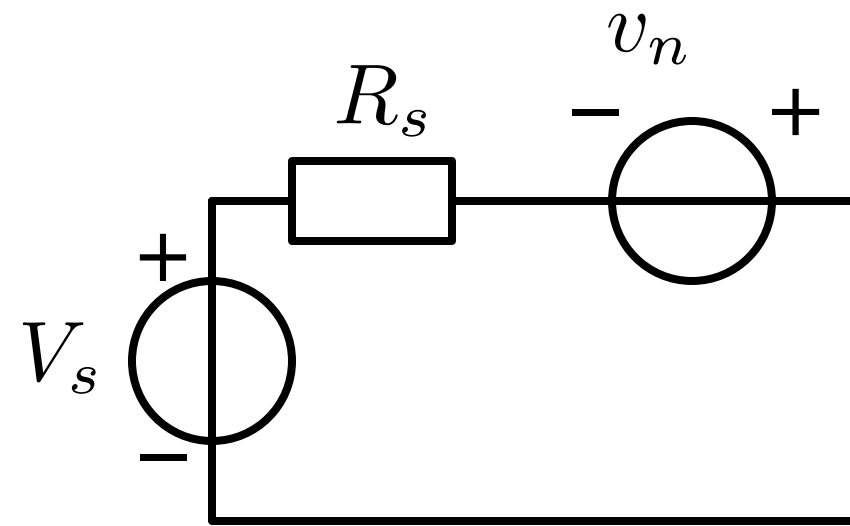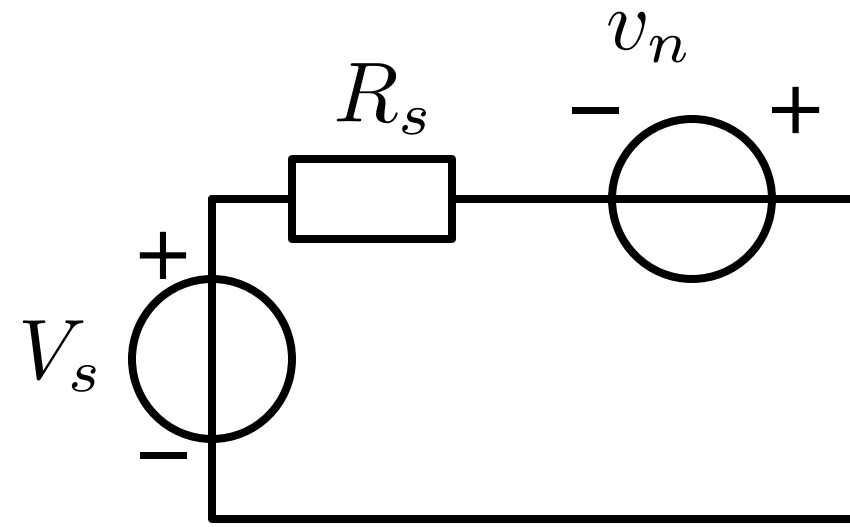
CS stage:
Noise optimization with a resistive source

Anton J.M. Montagne

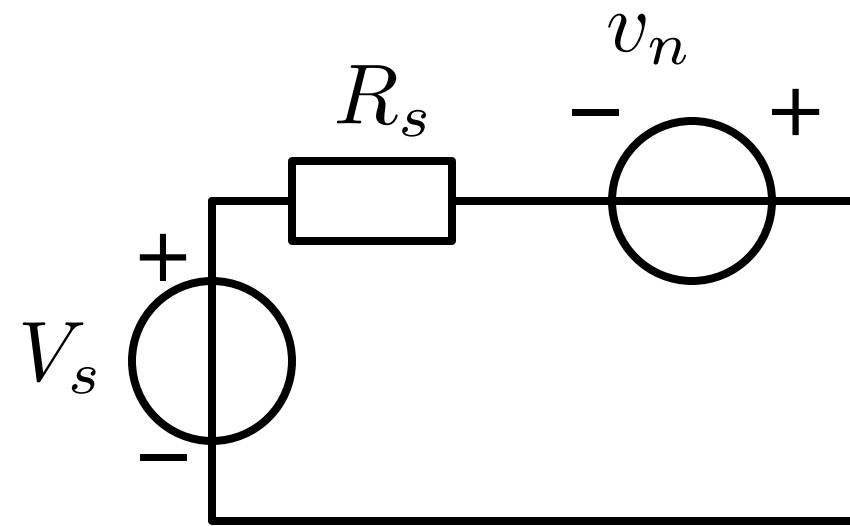# CS stage optimization noise behavior

CS stage optimization noise behavior

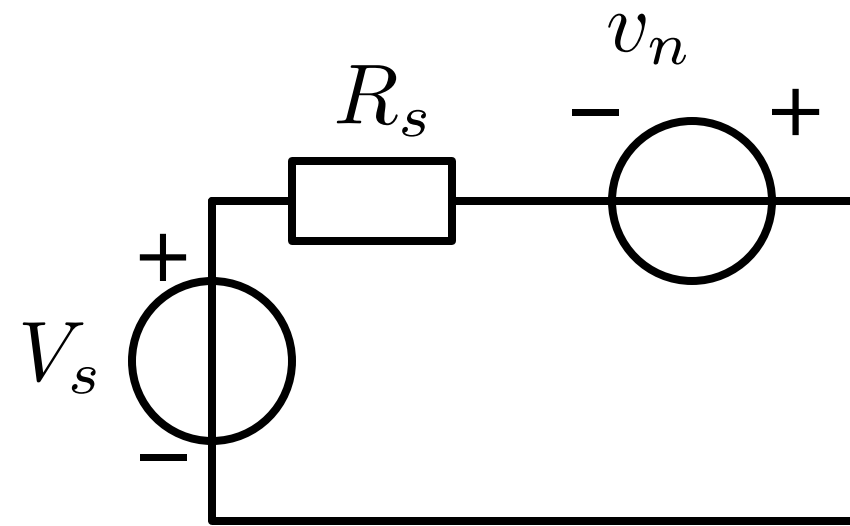v_n : total source-referred noise

CS stage optimization noise behavior

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CS stage optimization noise behavior

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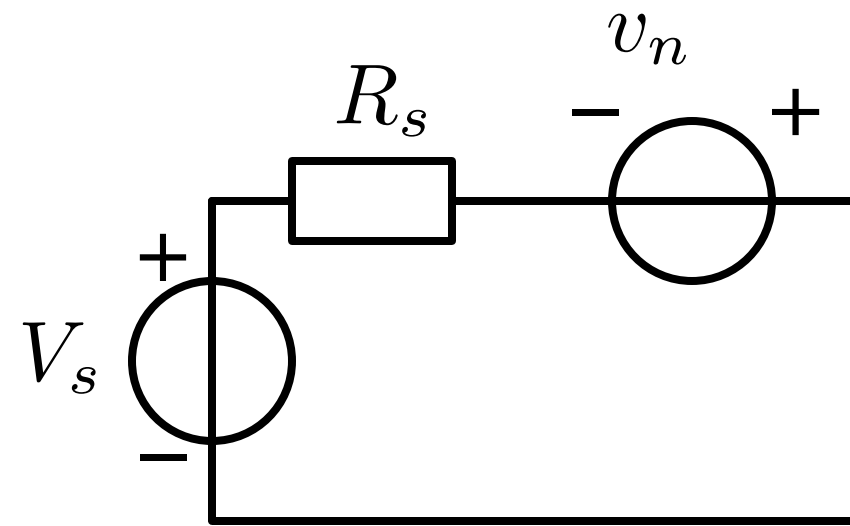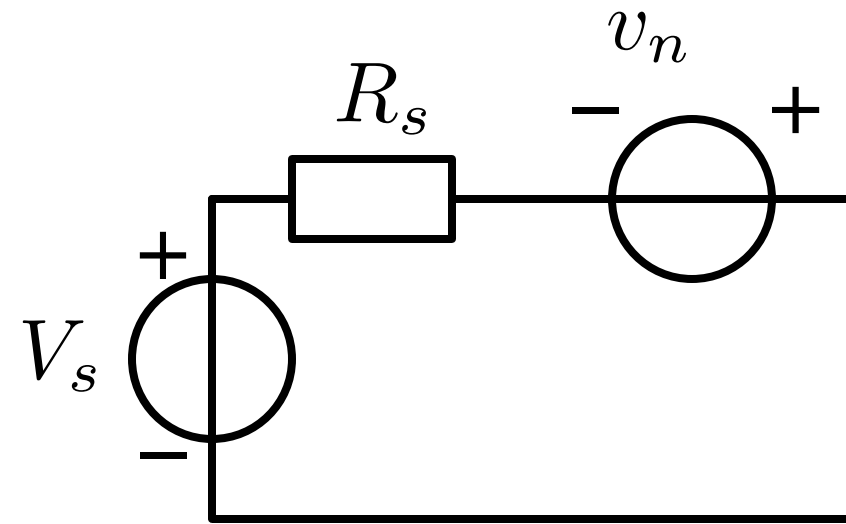
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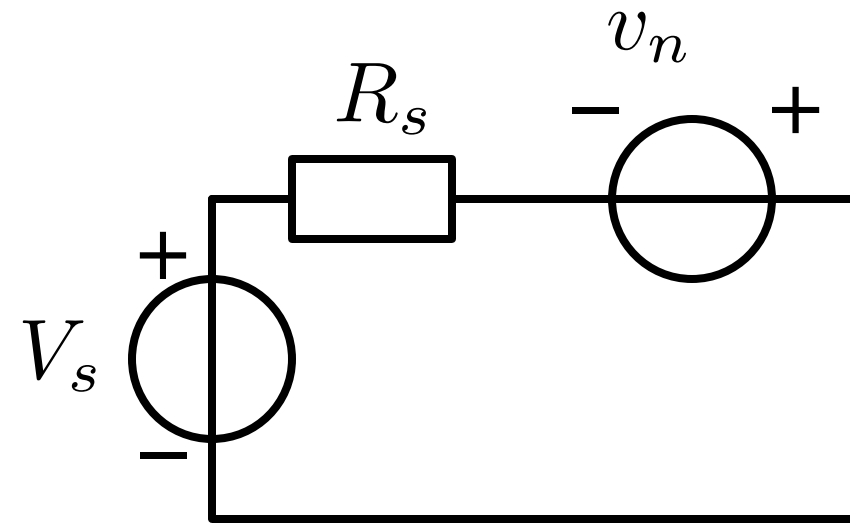v_n : total source-referred noise

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8

CS stage optimization noise behavior
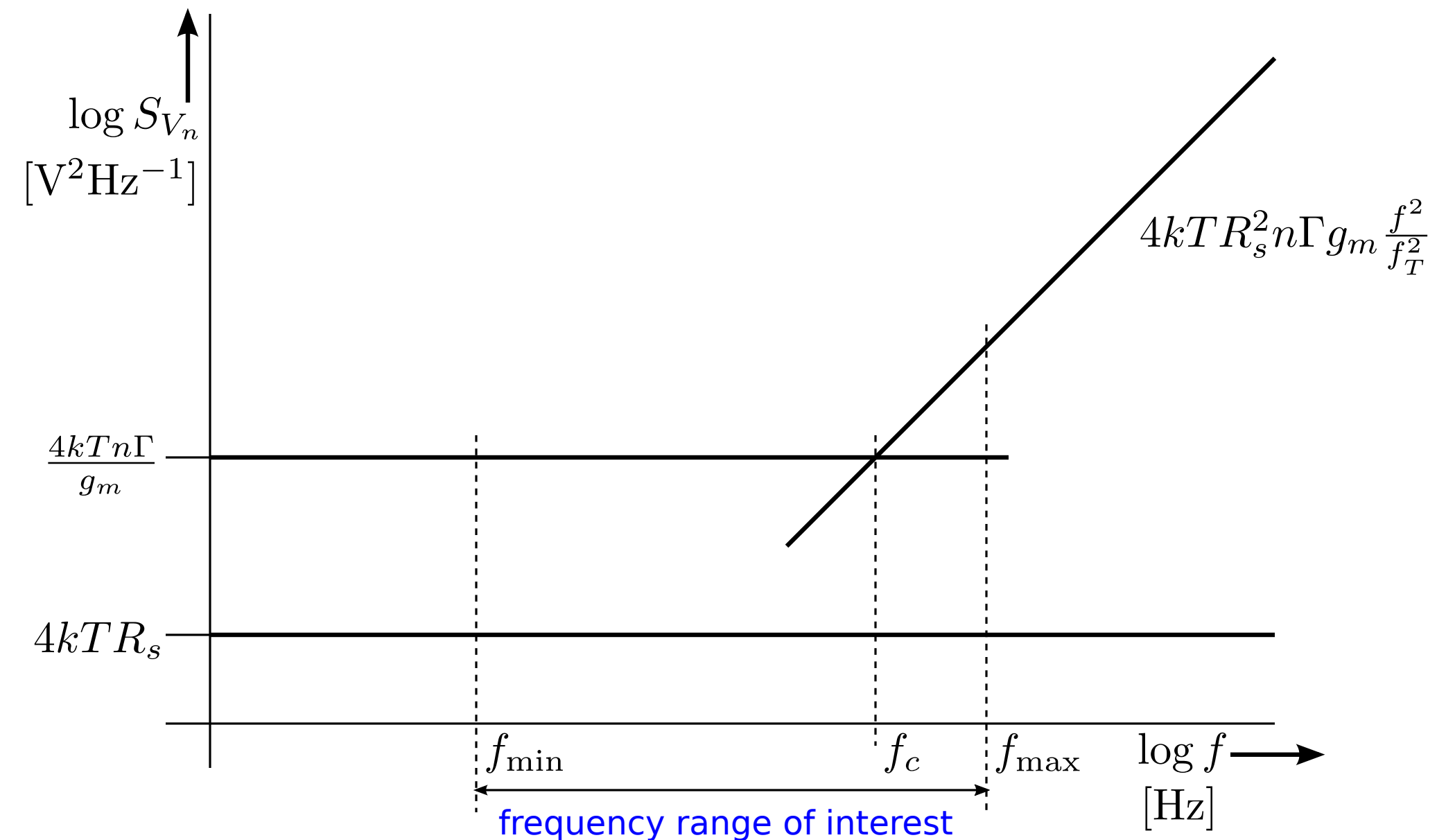
Scale the width with the current

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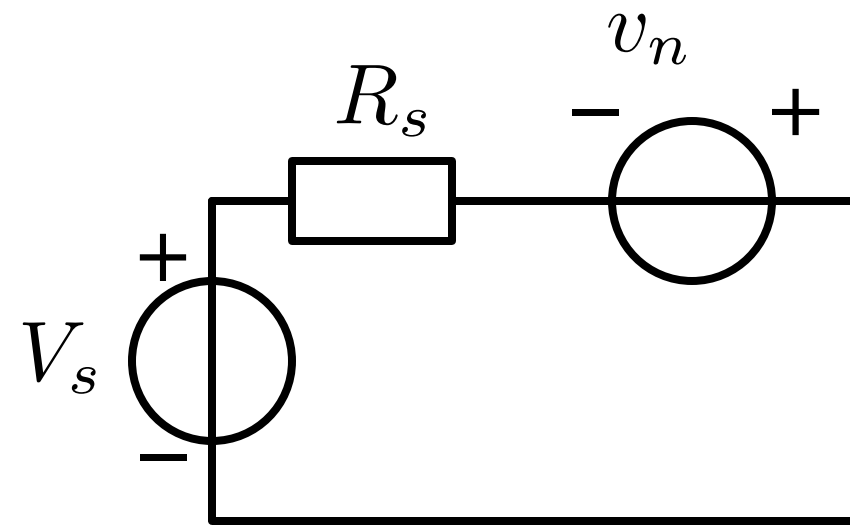
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$\log S_{V_n}$
$[\mathrm{V^2 Hz^{-1}}]$

$4kTR_s^2 n\Gamma g_m \dfrac{f^2}{f_T^2}$

$\dfrac{4kTn\Gamma}{g_m}$

$4kTR_s$

$f_{\min}$ $\quad f_c$ $\quad f_{\max}$ $\quad \log f$
$[\mathrm{Hz}]$

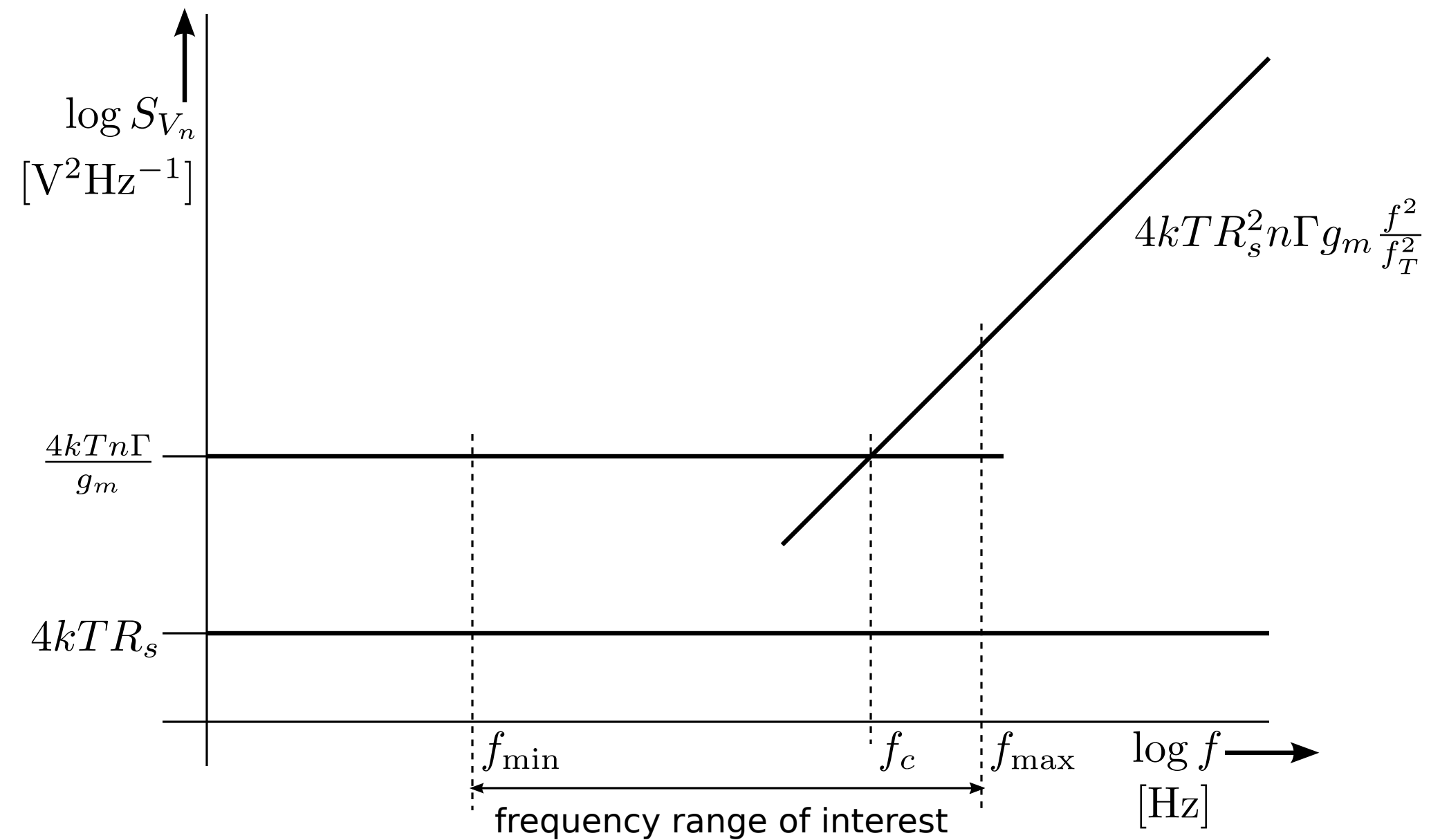frequency range of interest

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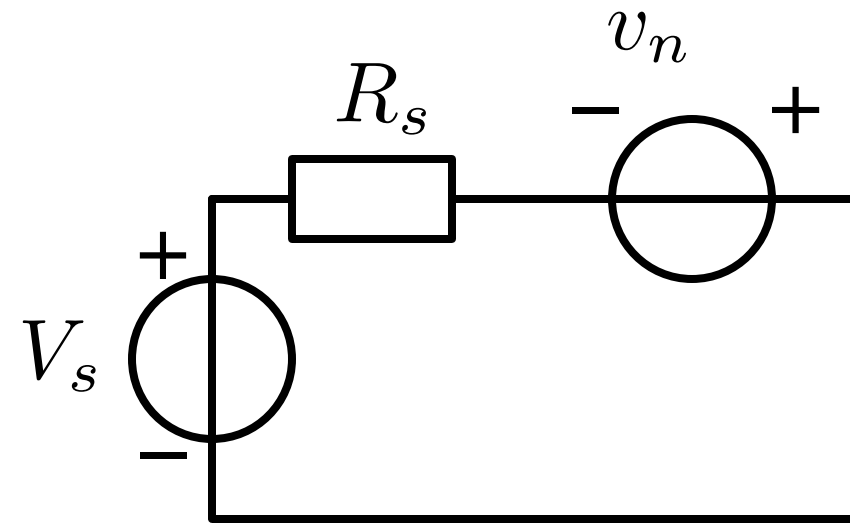
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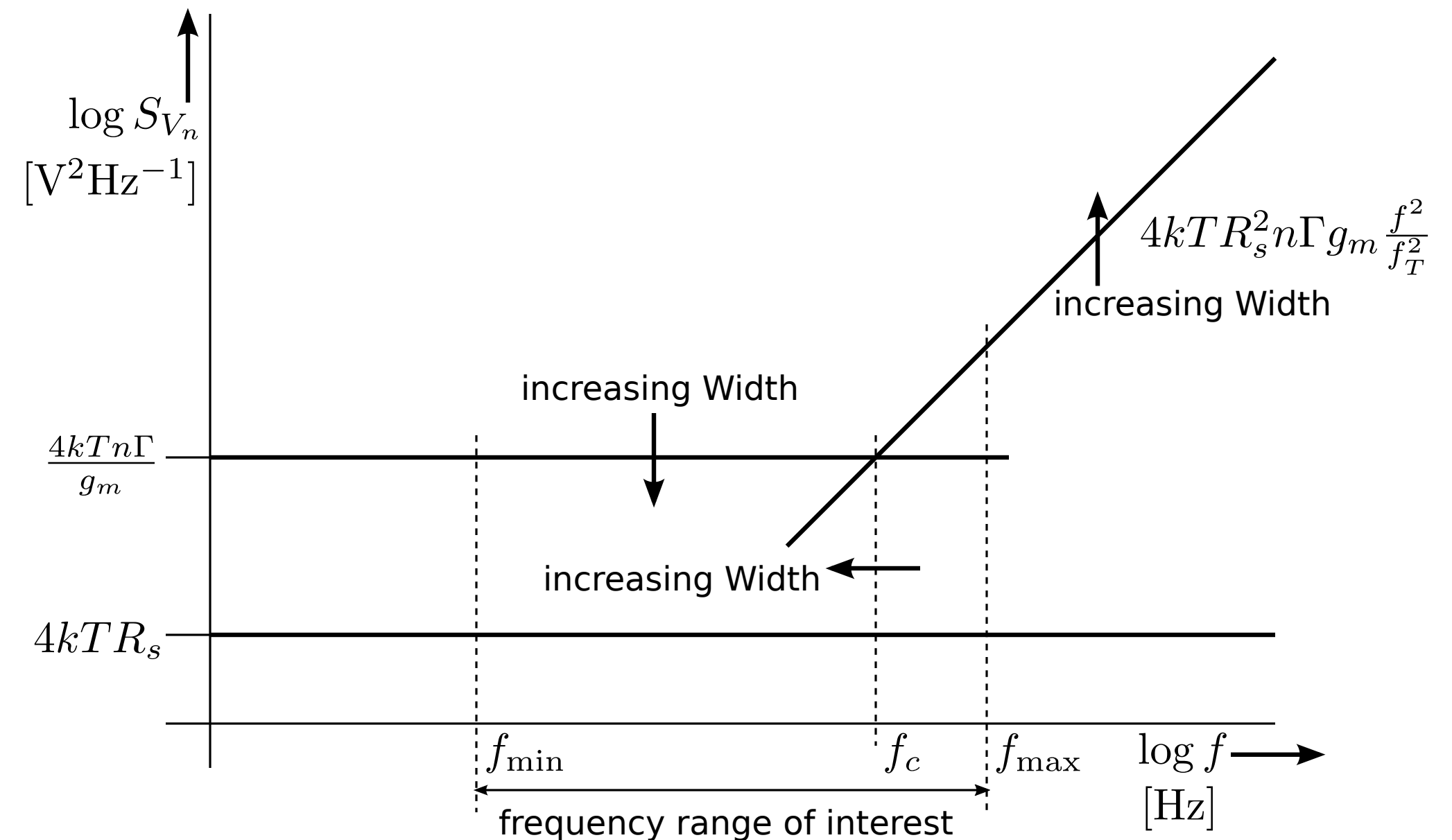
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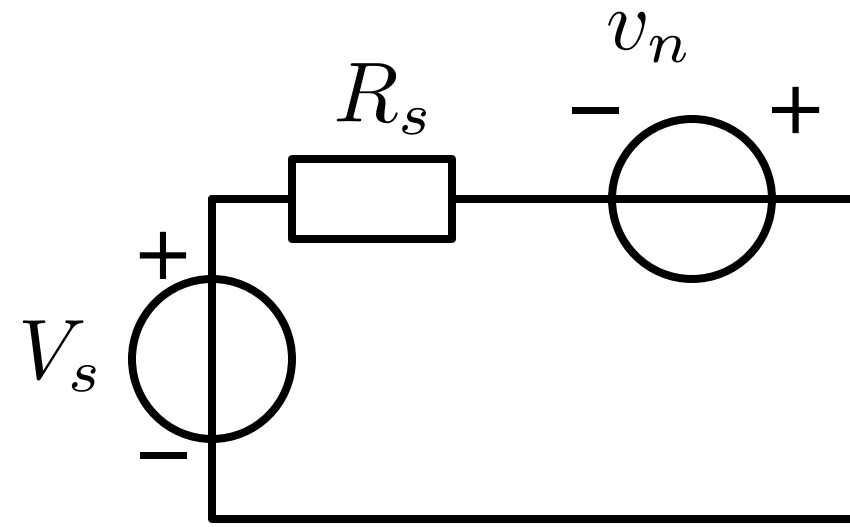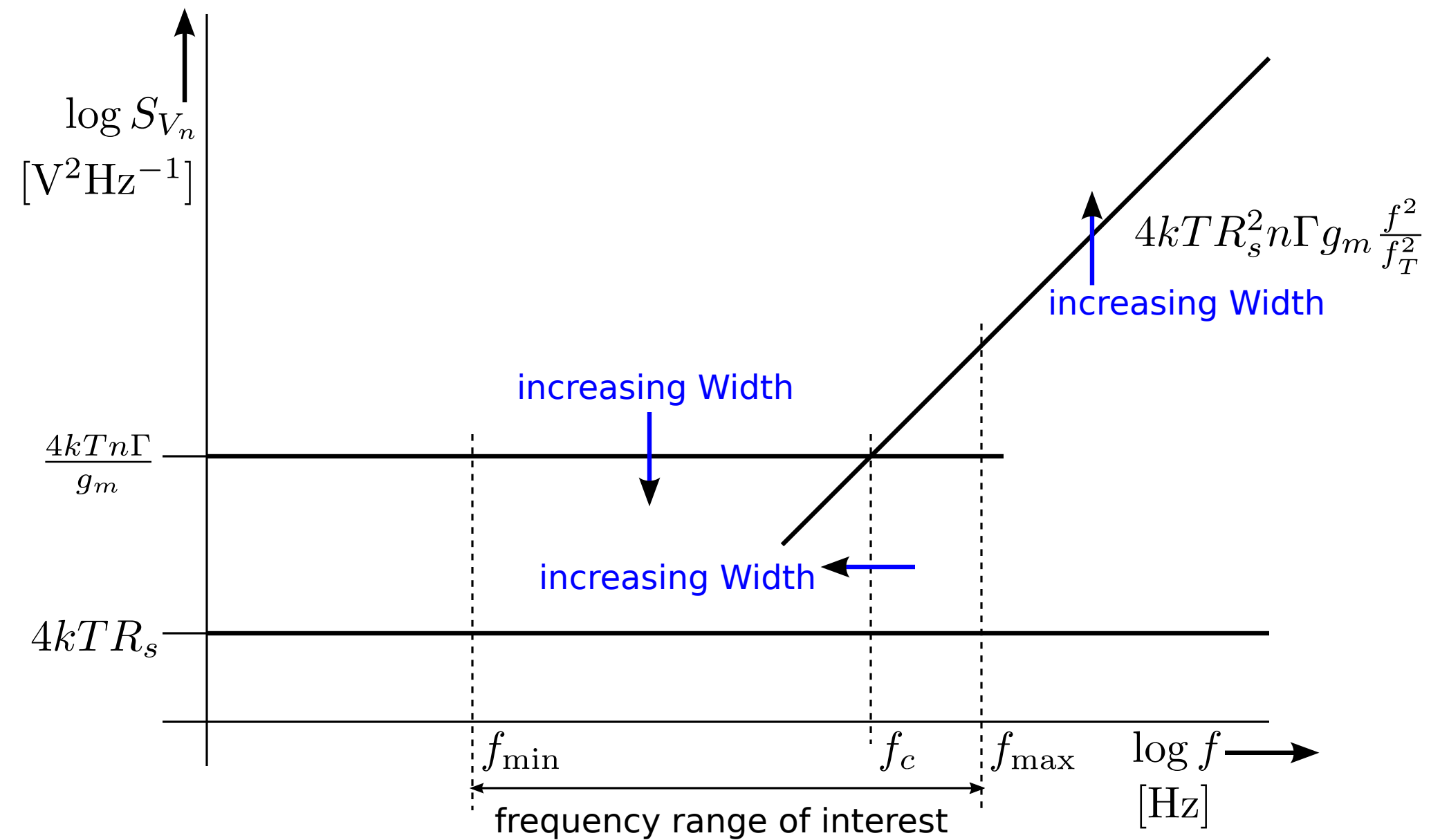
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Optimum if RMS noise has minimum

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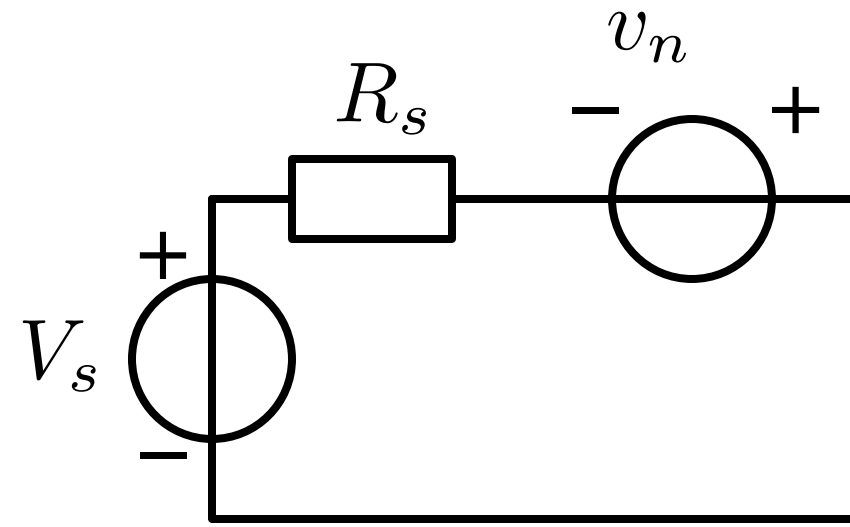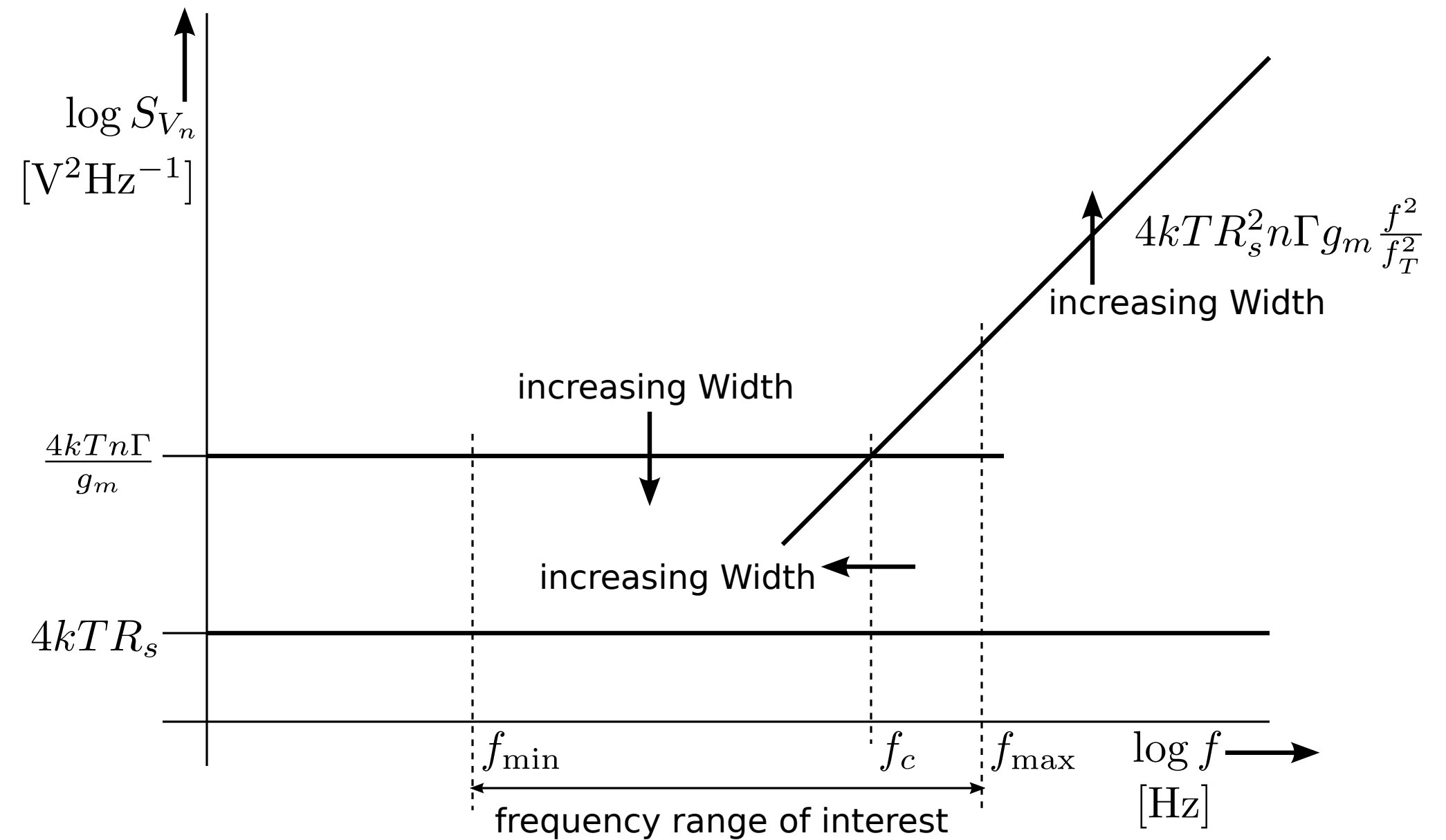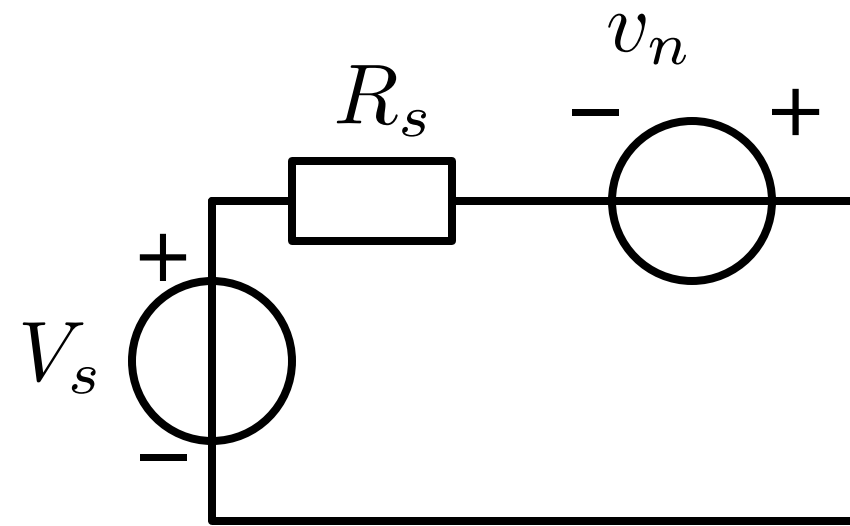$$S_{v_n} = 4kTR_s + \left| \frac{1}{g_m} + \frac{jf}{f_T}R_s \right|^2 S_{id}$$

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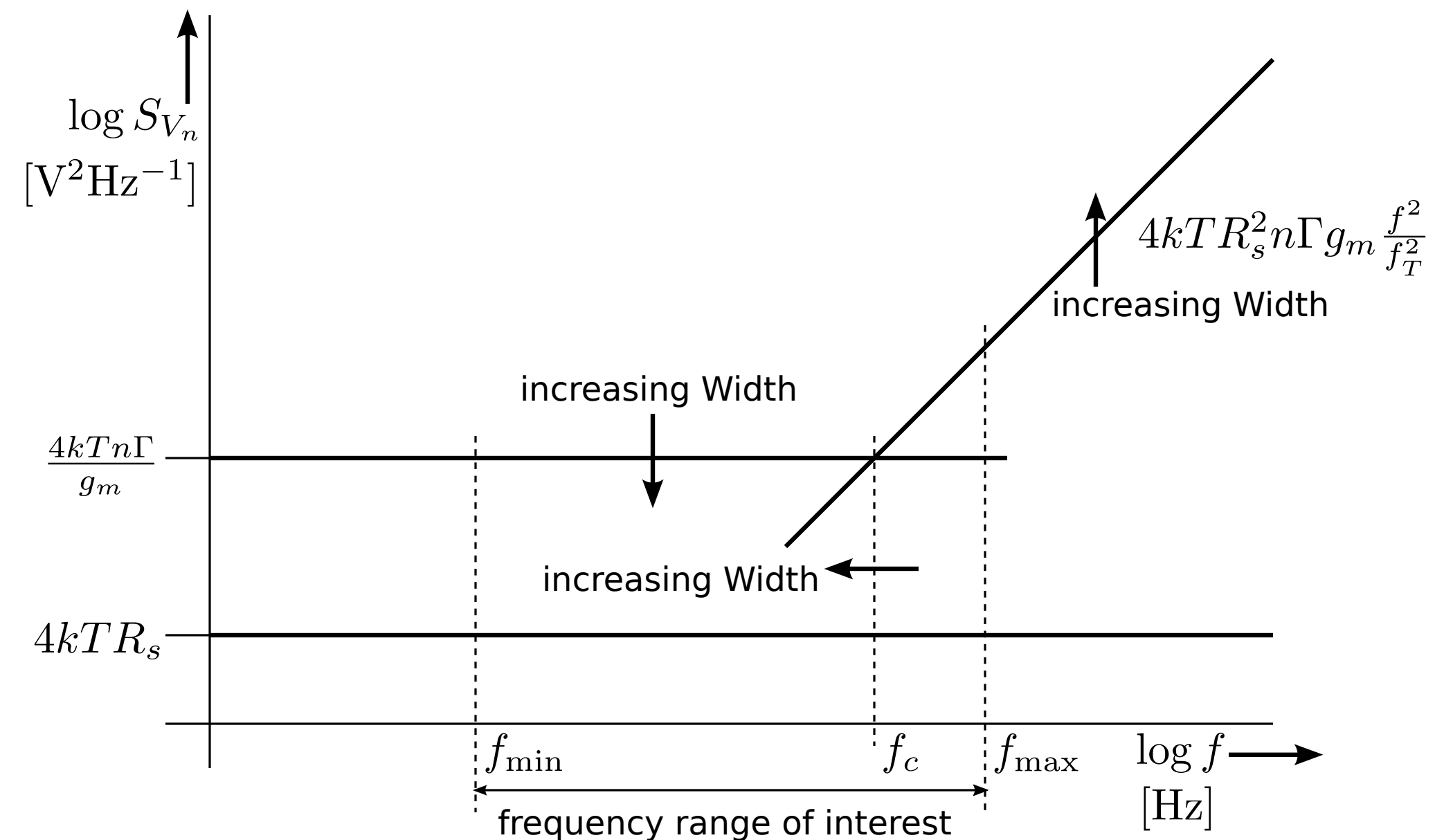
CS stage optimization noise behavior

$$\overline{v_n^2} = \int_{f_{min}}^{f_{max}} 4kT \left(R_s + \frac{n\Gamma}{g_{m_0}} \frac{W_0}{W} + \frac{f^2}{f_T^2} R_s^2 n\Gamma g_{m_0} \frac{W}{W_0} \right) df$$

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g_{m_0} small-signal transconductance at width W_0

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Book example 5.10

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SLiCAP determination of optimum width and noise figure for 600Ohm at critical inversion

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SLiCAP determination of optimum width and noise figure for 600Ohm at critical inversion

Book example 5.11

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Spice determination of optimum width and noise figure for 600Ohm at critical inversion

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Spice circuit:

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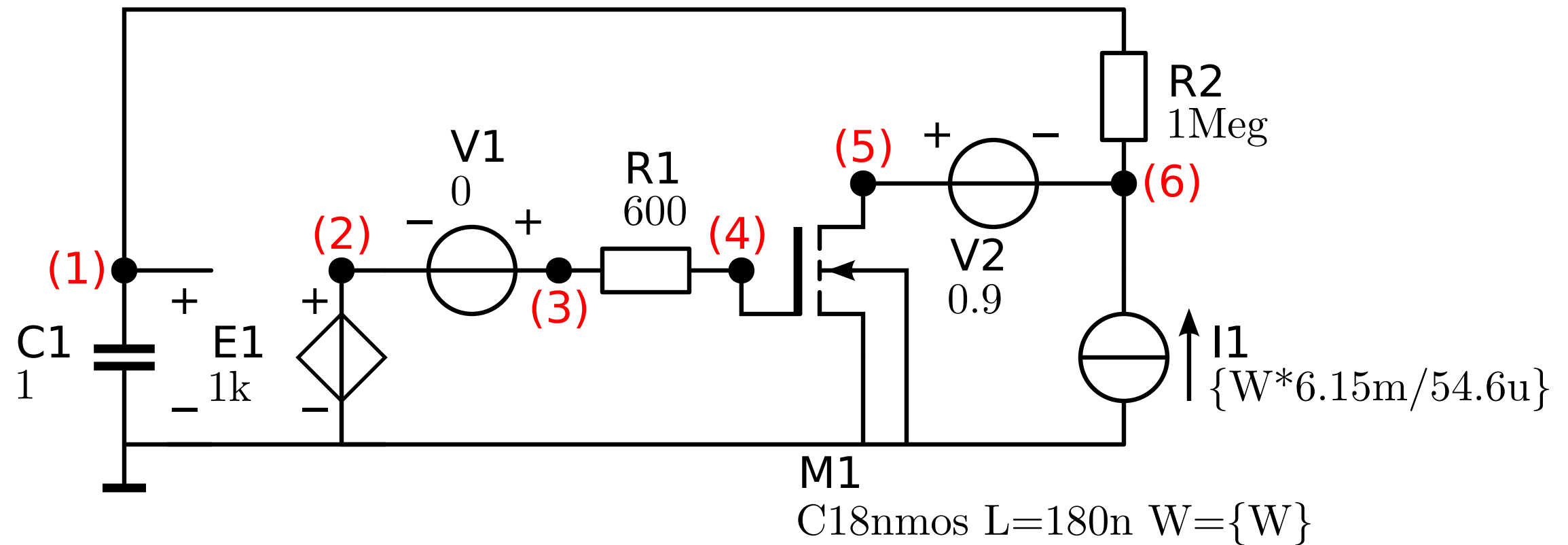Spice circuit:

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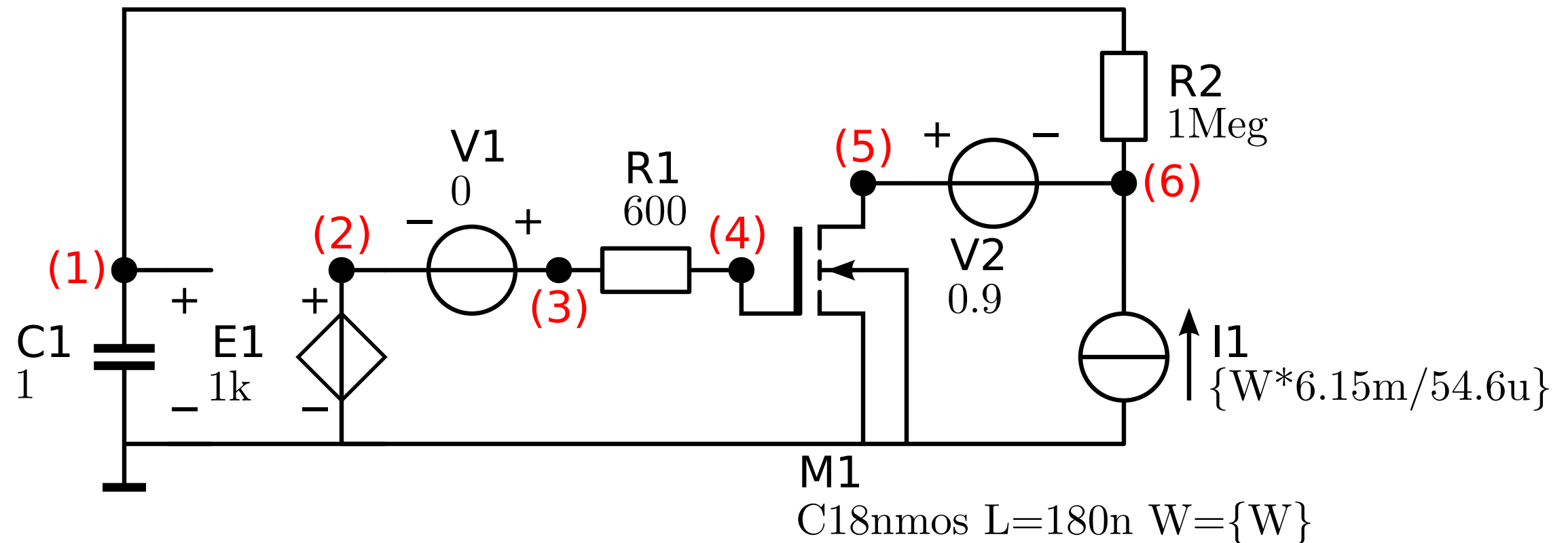
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Spice determination of optimum width and noise figure for 600Ohm at critical inversion

Spice circuit:

Results depend on library models!

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