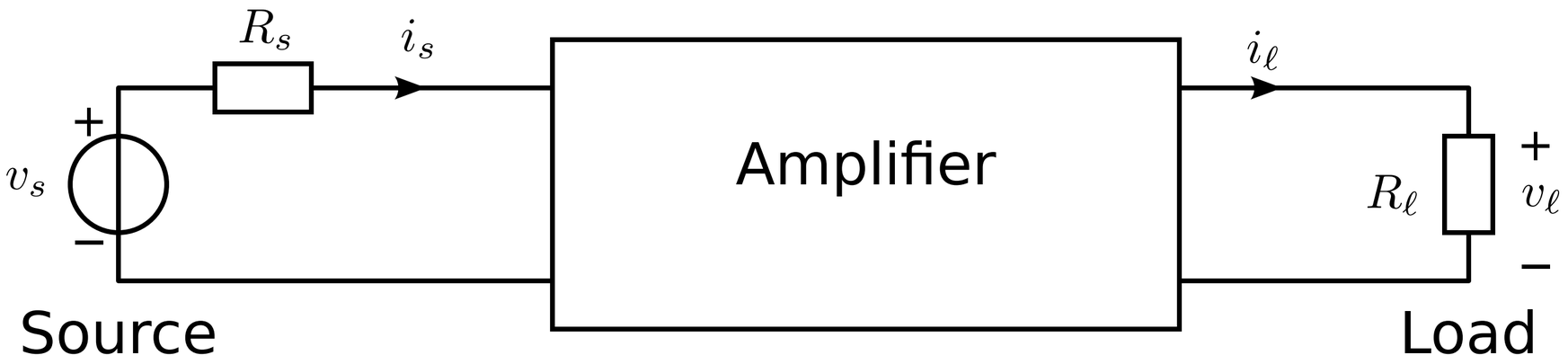
Structured Electronic Design

Principle of amplification
and
a formal approach to biasing

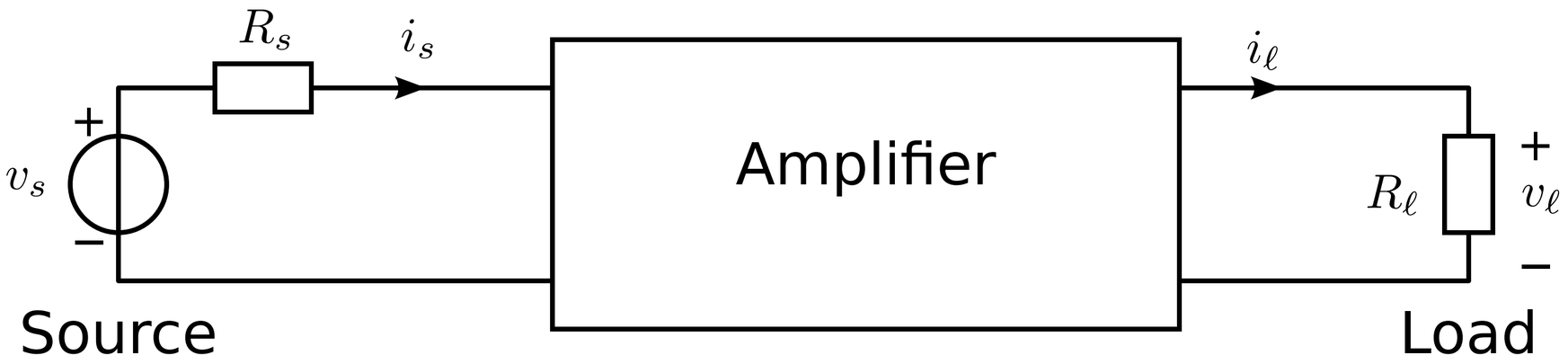
Anton J.M. Montagne

Amplification and biasing



Amplification and biasing

Signal values at the load should have a unique correspondence with those of the source



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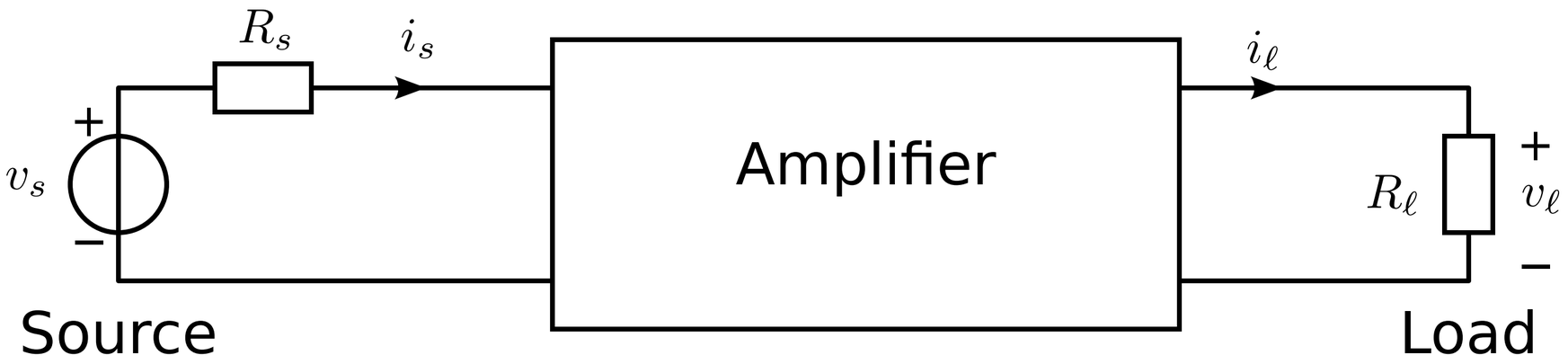

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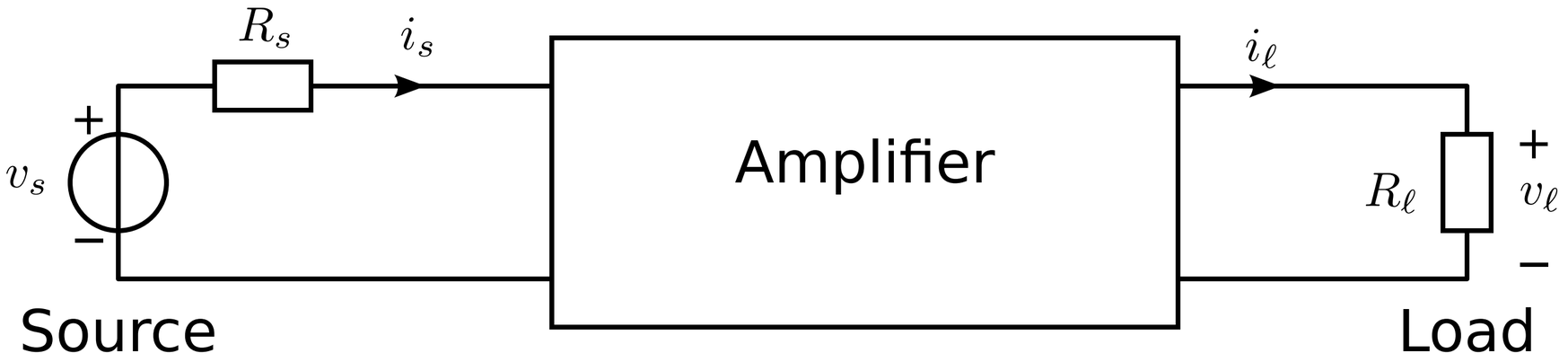

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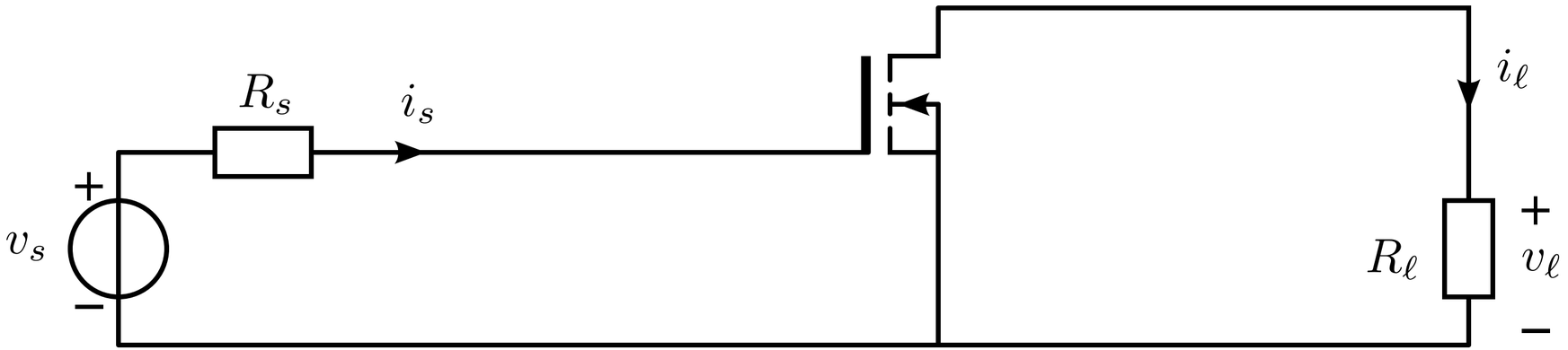

Amplification and biasing

Device equations: $I_{DS} = f\left(V_{DS}, V_{GS}\right)$

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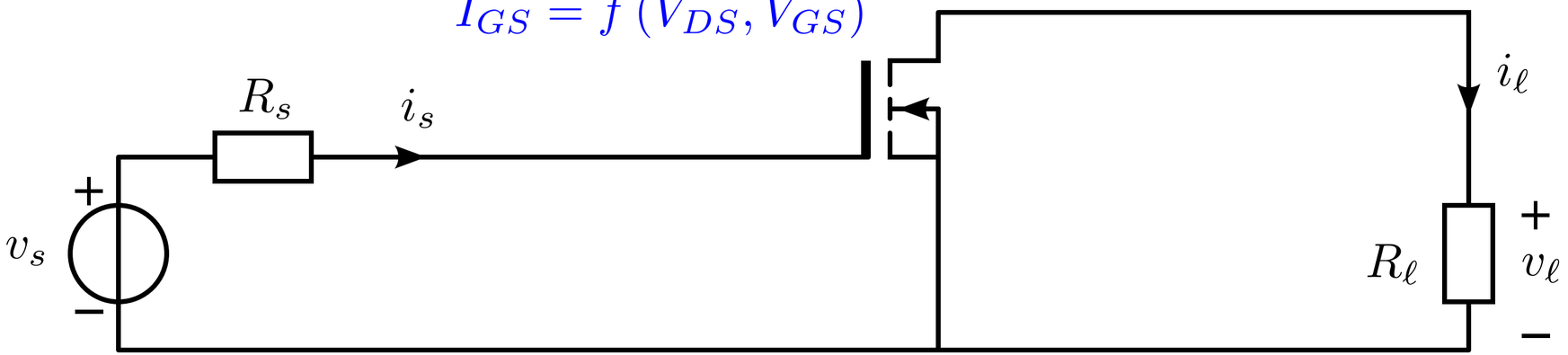

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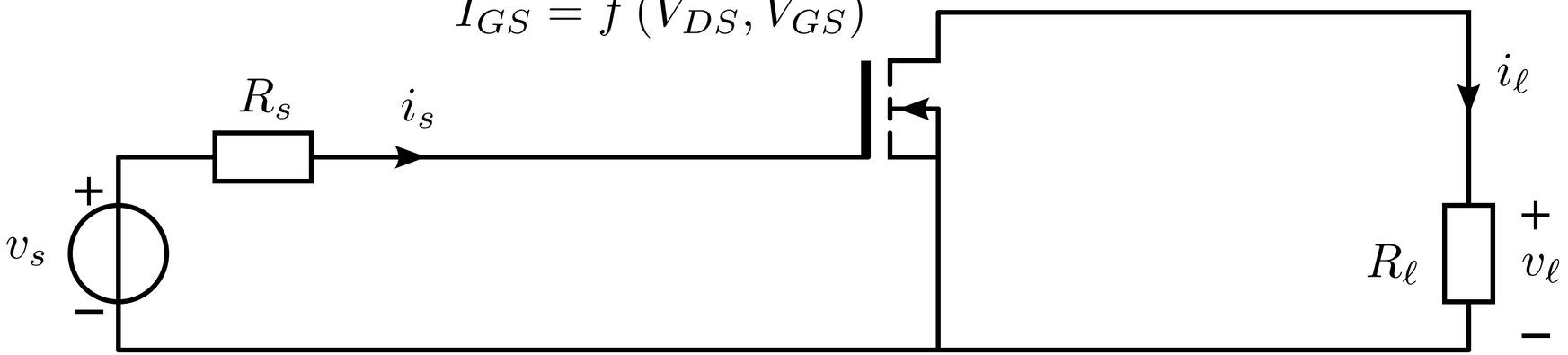

Only drain current if:

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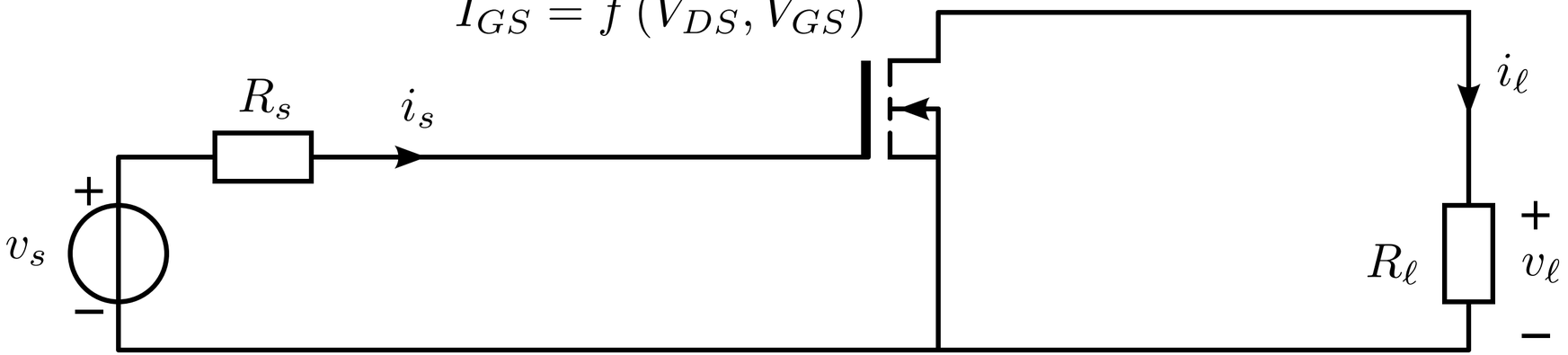

Only drain current if:

nonzero drain-source voltage

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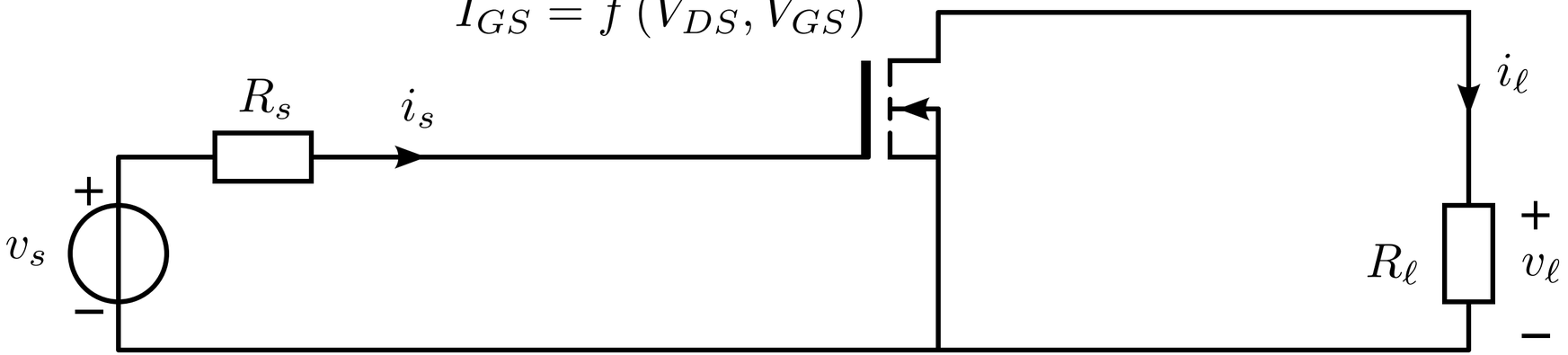

Only drain current if:

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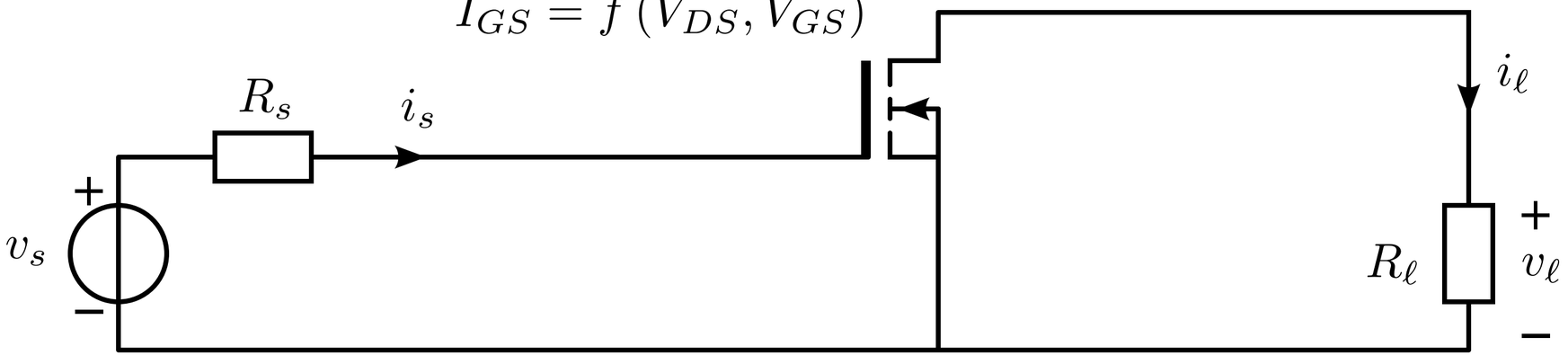

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Amplification and biasing

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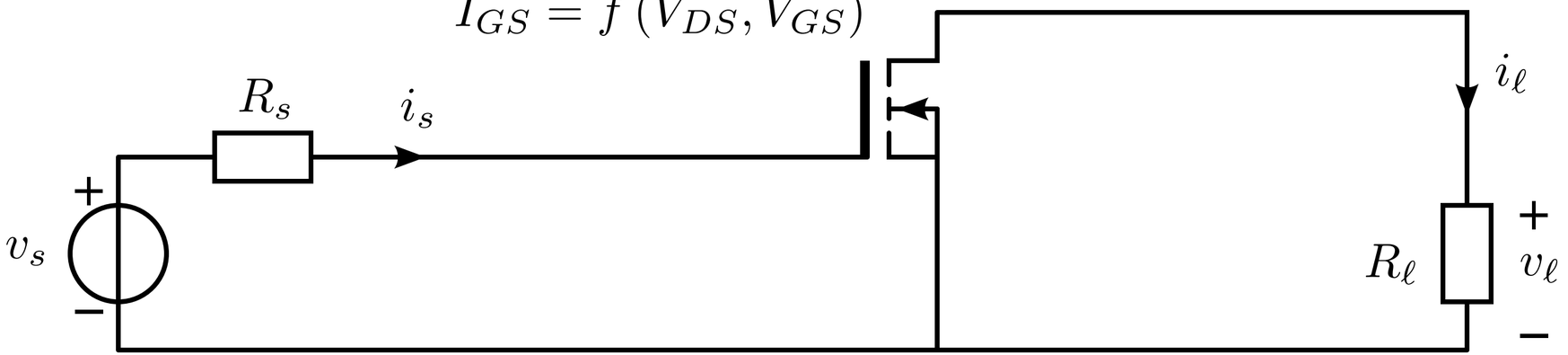

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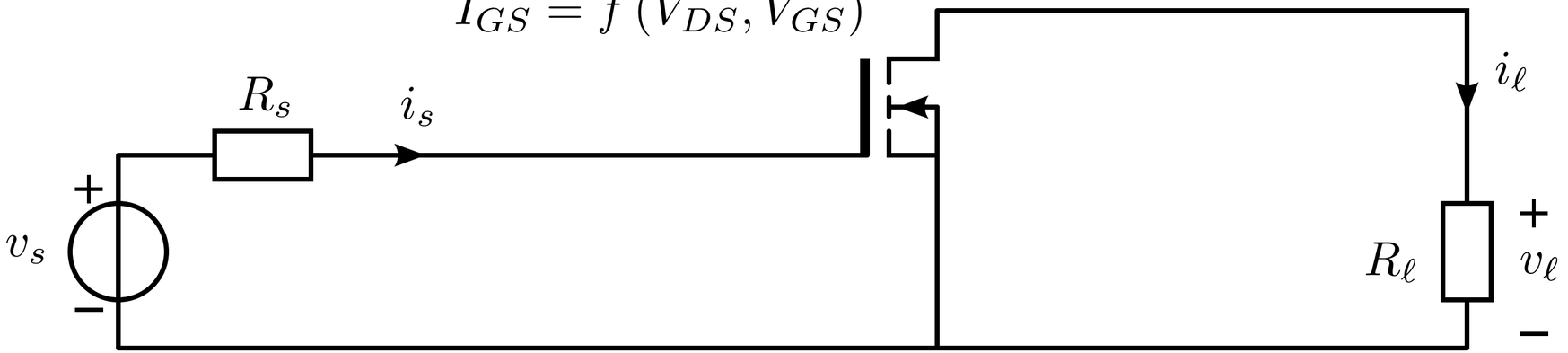

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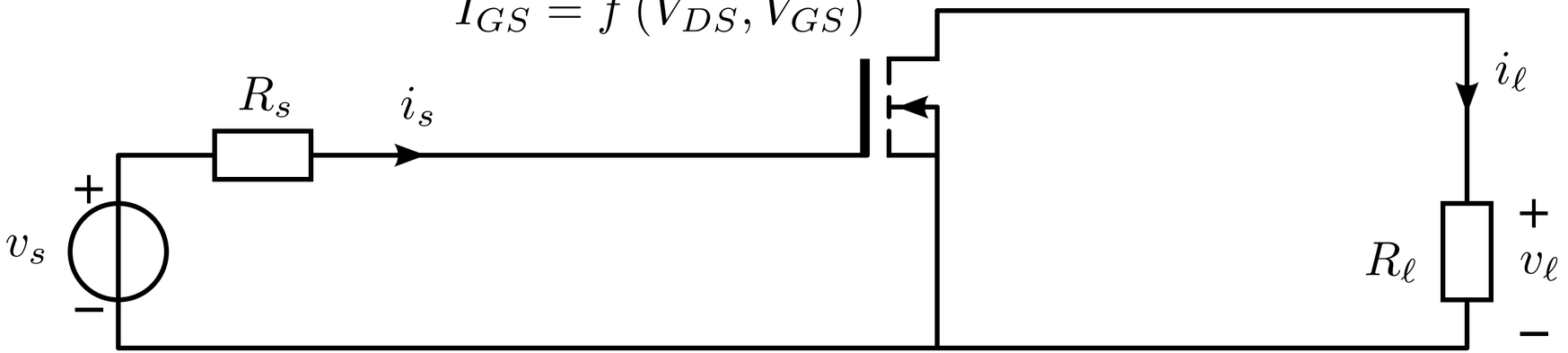

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Amplification and biasing

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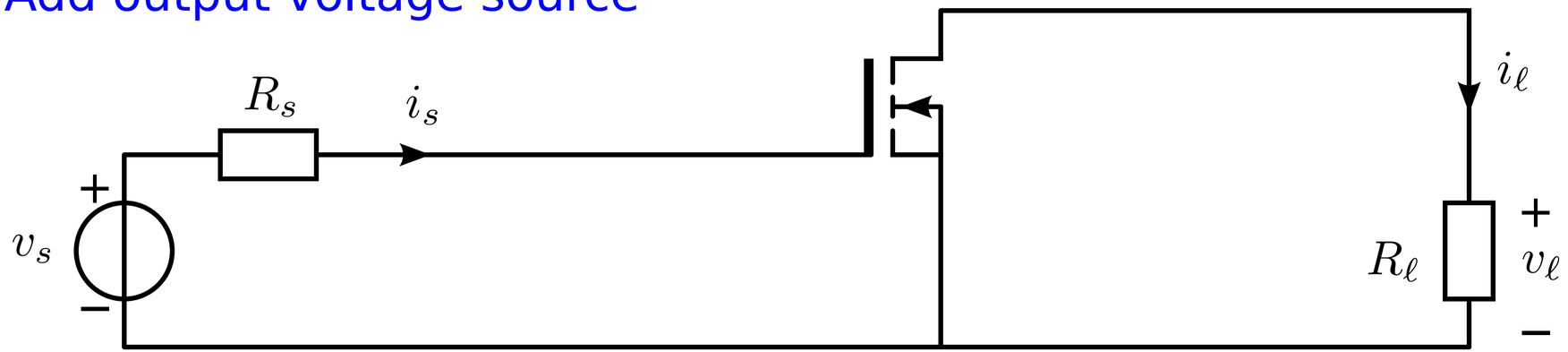

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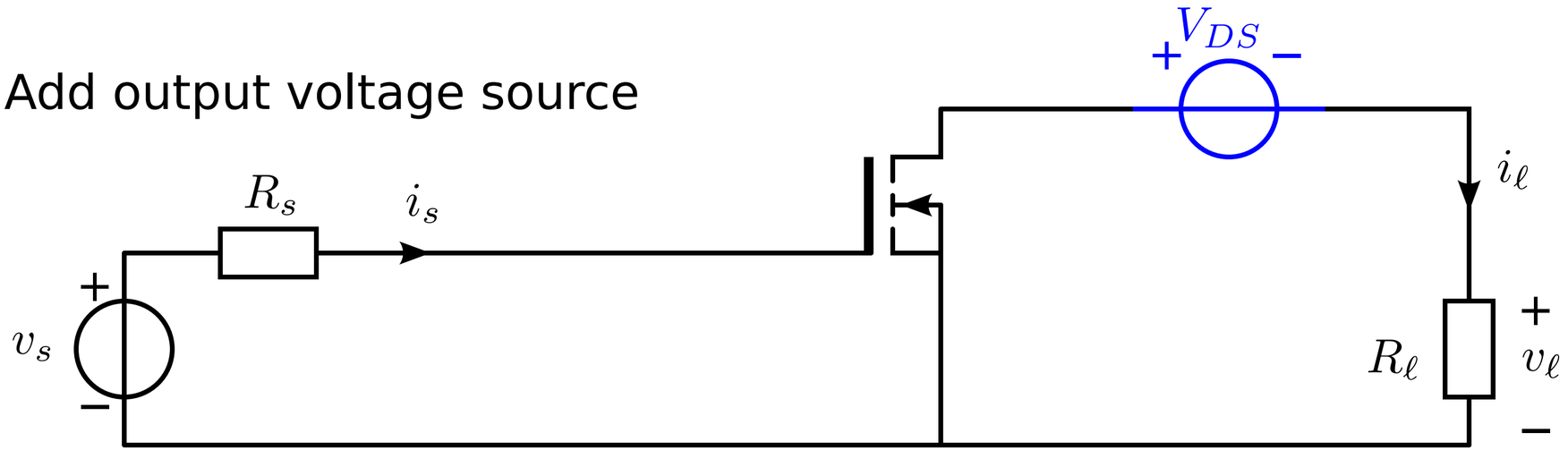

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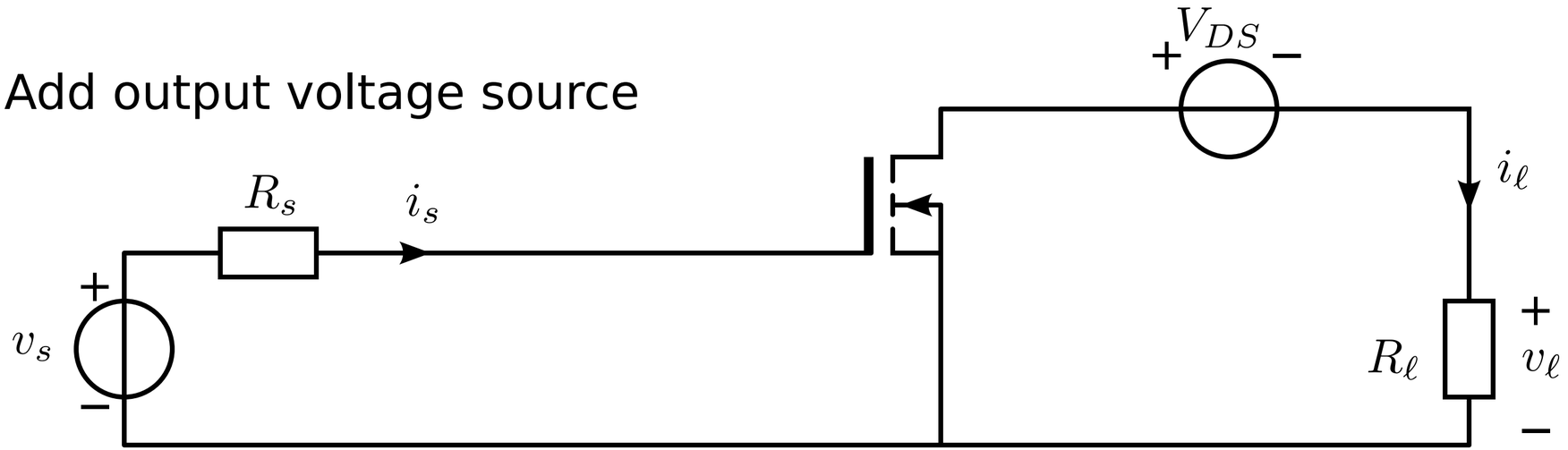

Load signal if the source voltage exceeds the threshold voltage

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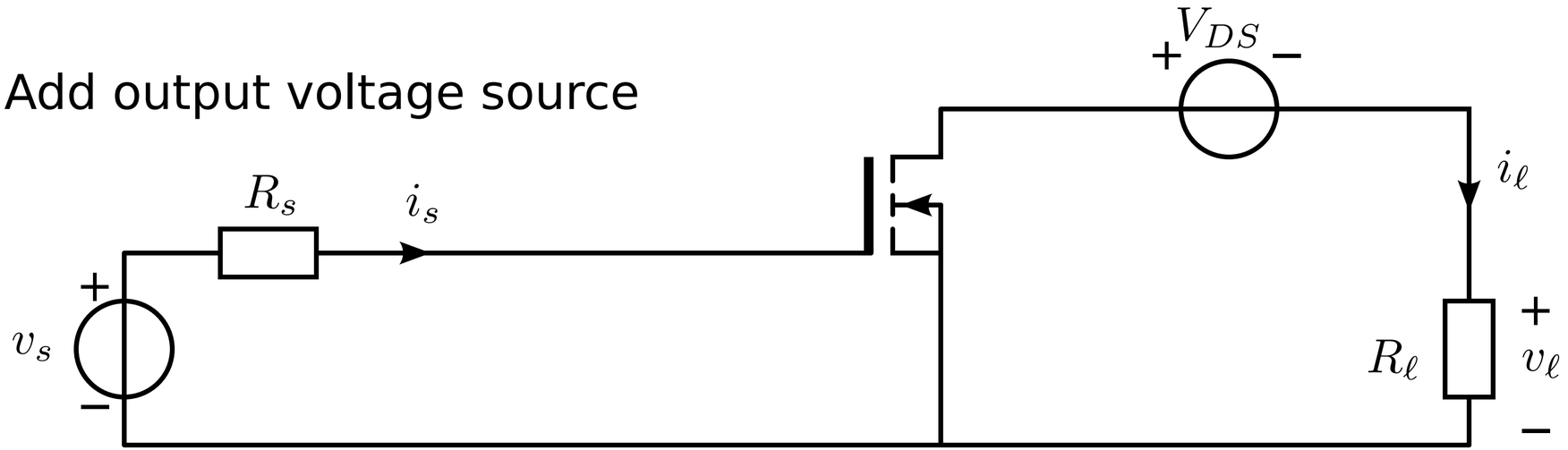

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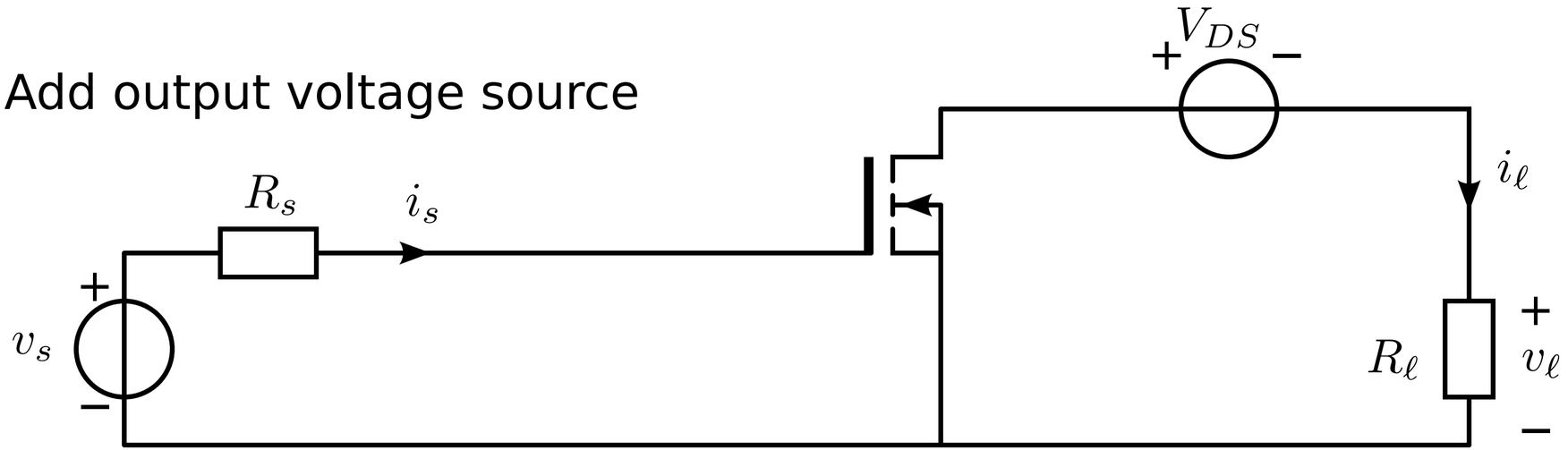

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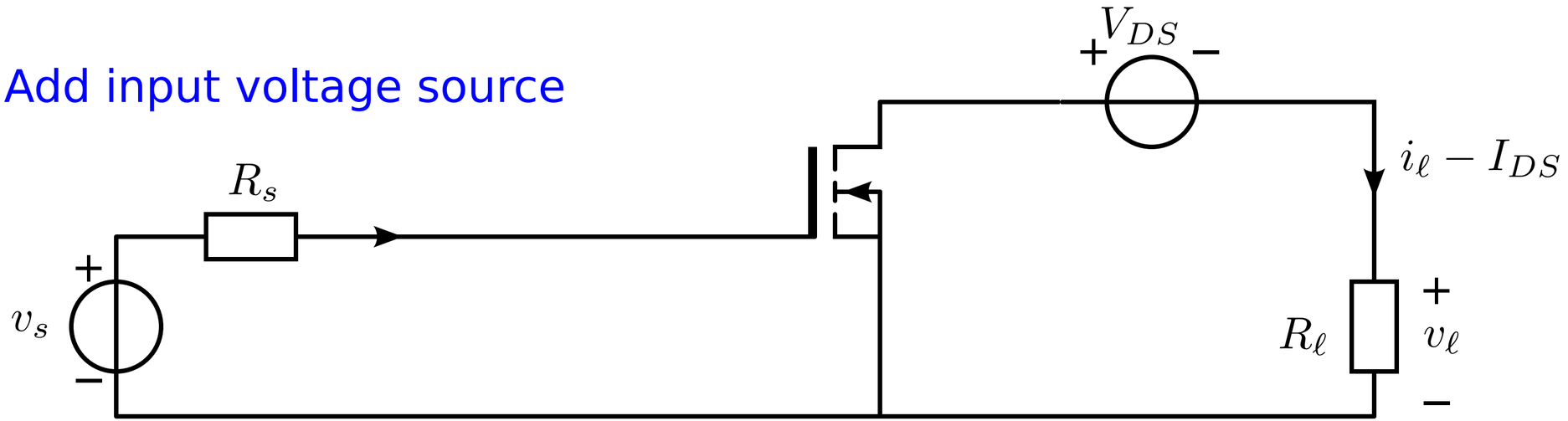

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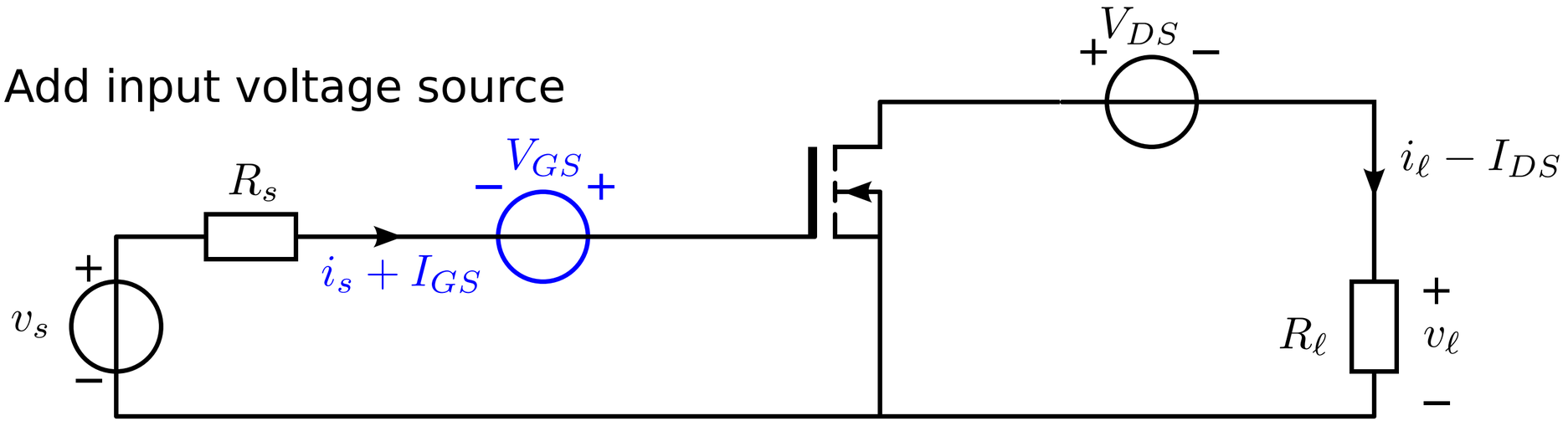

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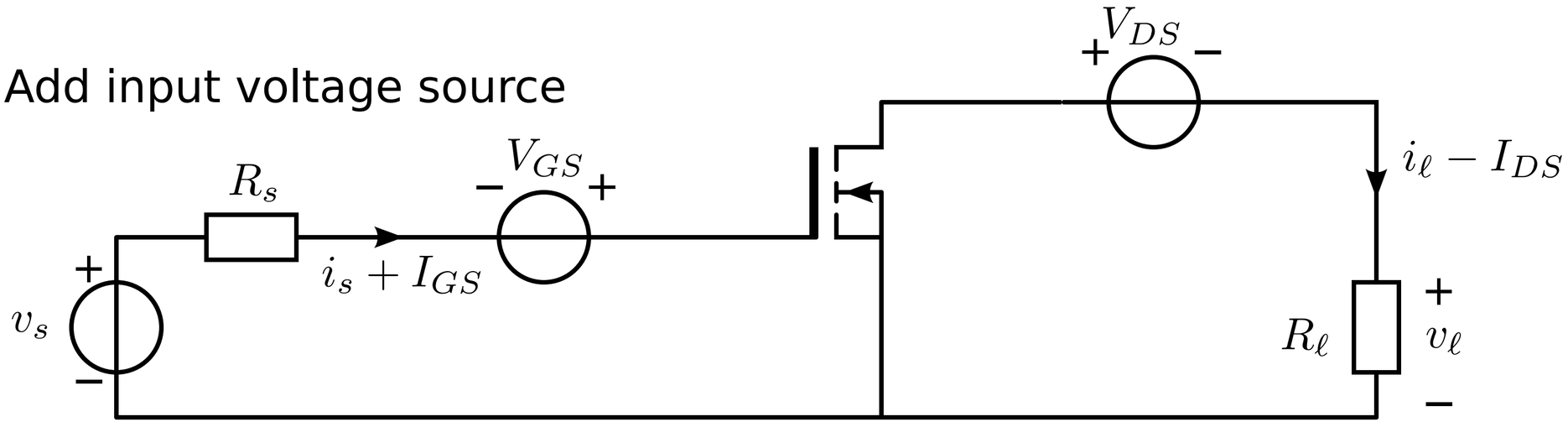

Load signal for all values of the source signal if:

$V_{GS} + v_s > V_{th}$ (threshold voltage)

Amplification and biasing

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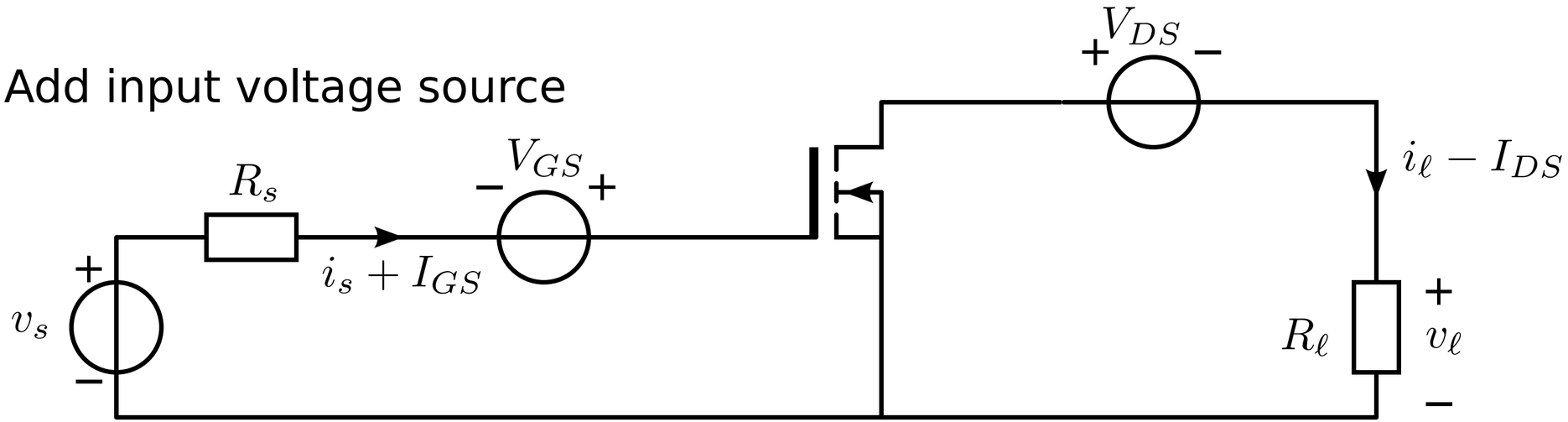

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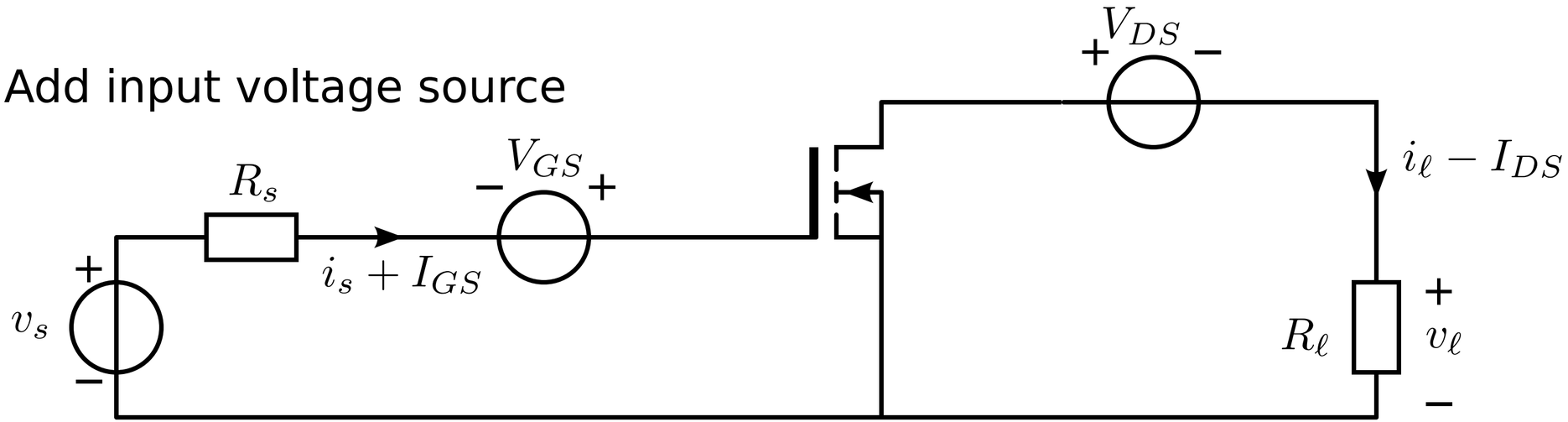

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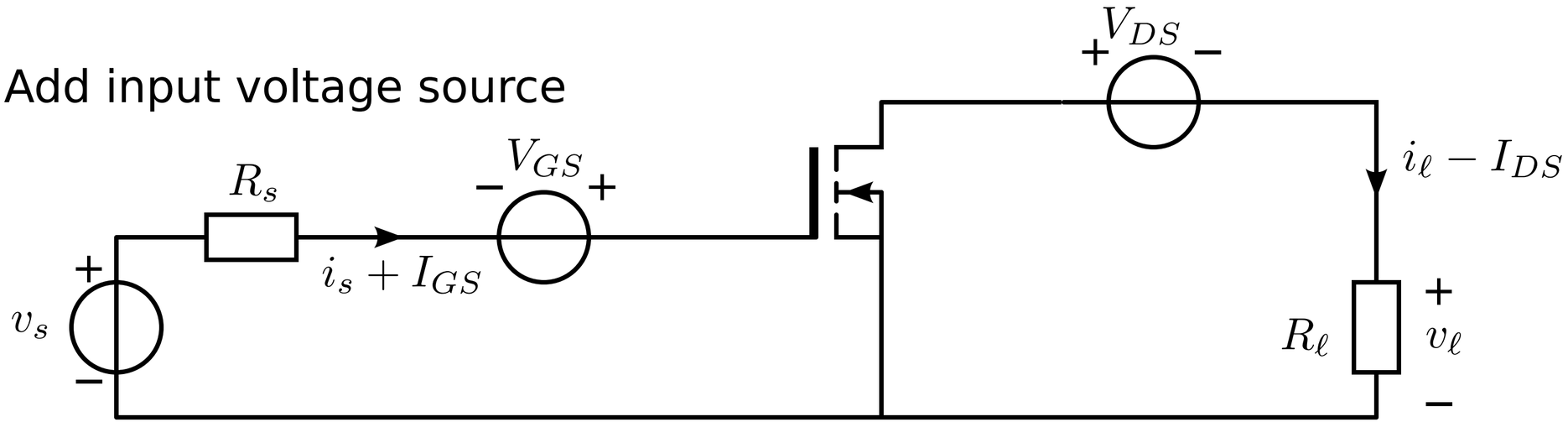

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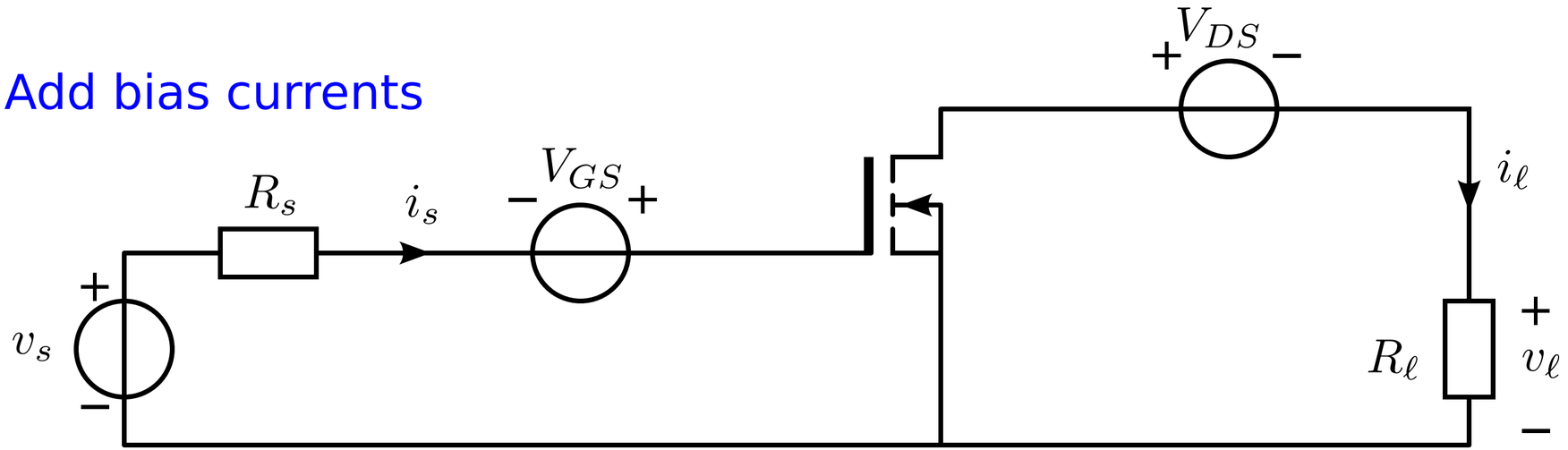

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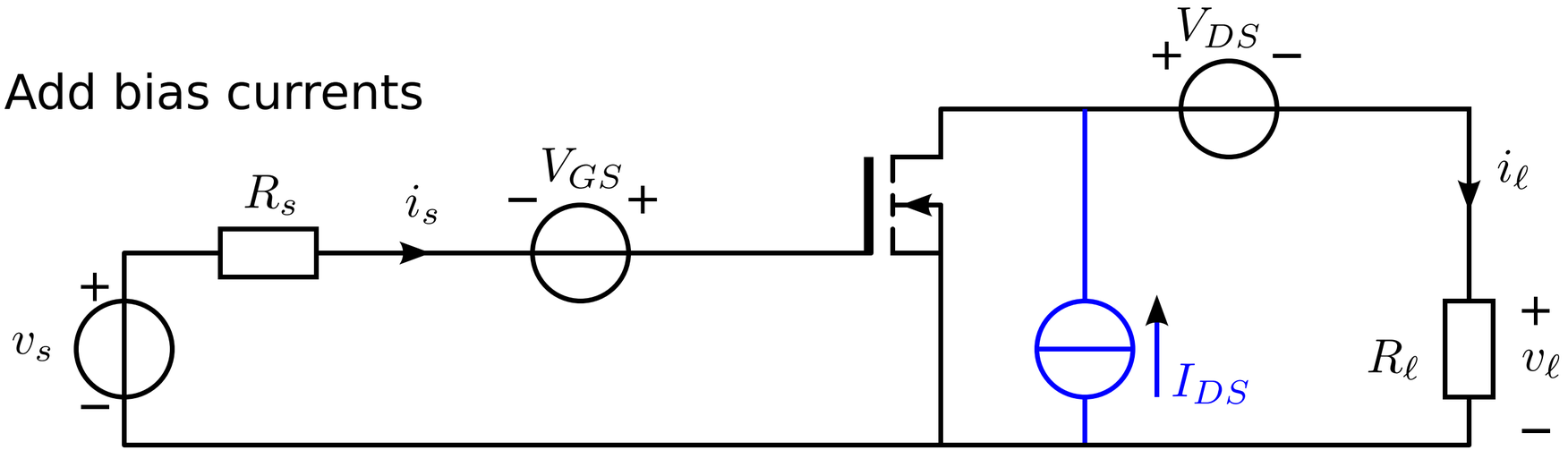

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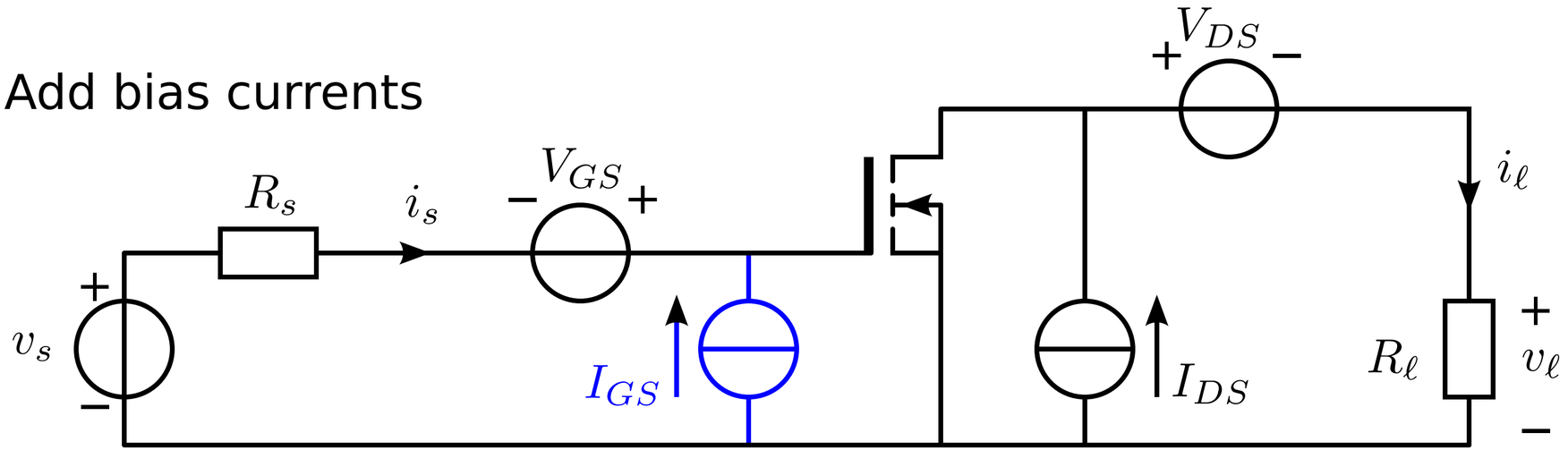

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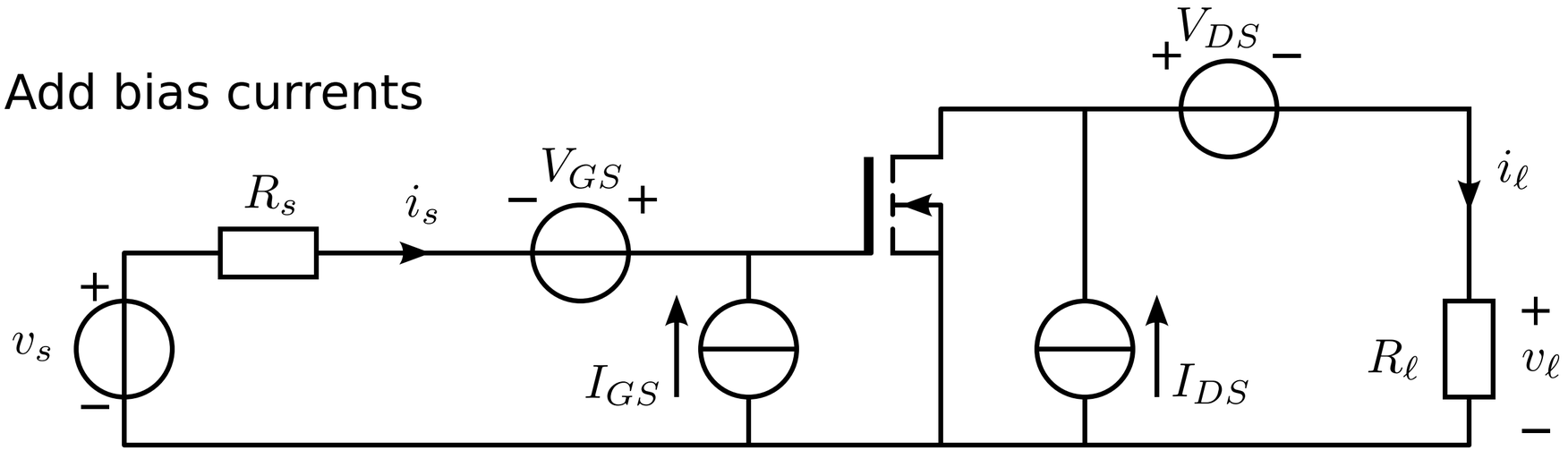

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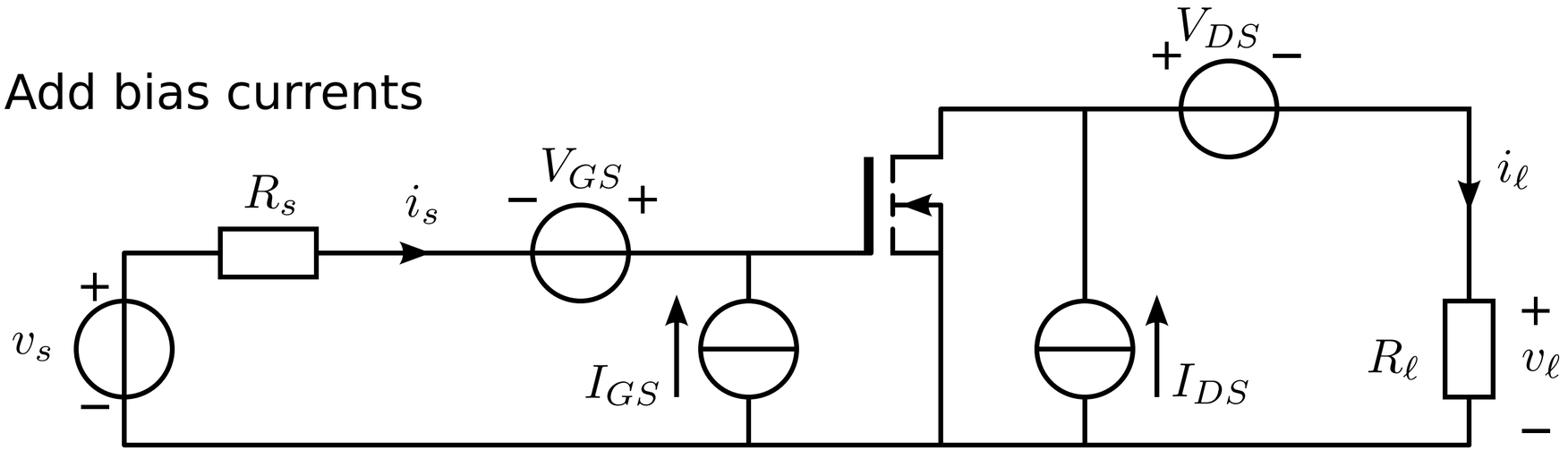

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(v_s, v_ℓ), (v_s, i_ℓ), (i_s, v_ℓ), (i_s, i_ℓ) characteristics pass through the origin

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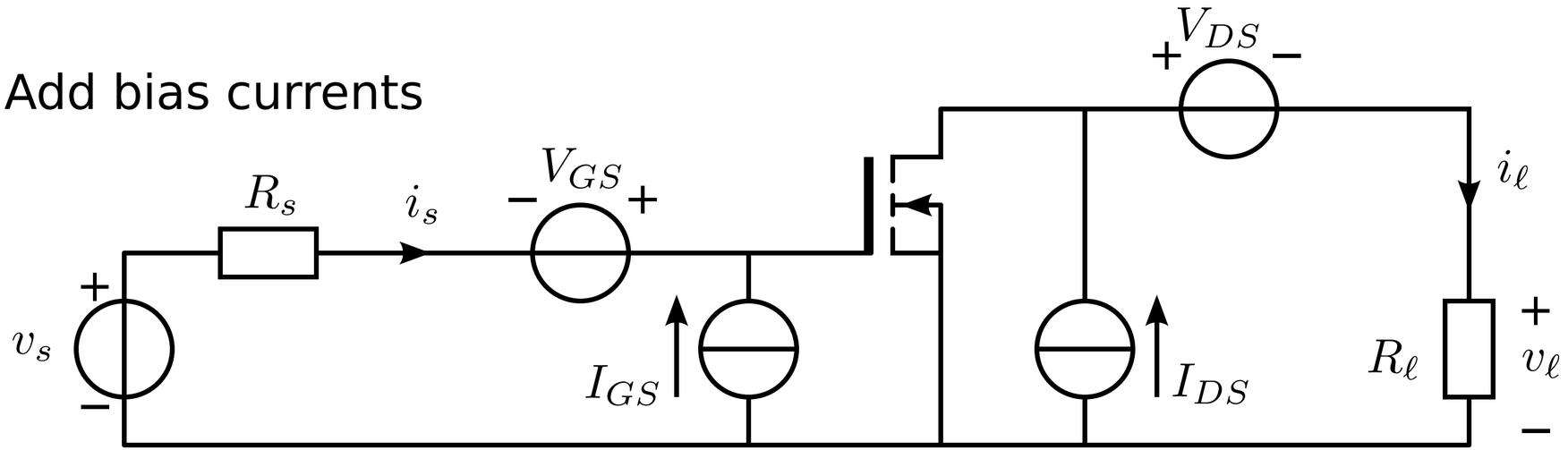

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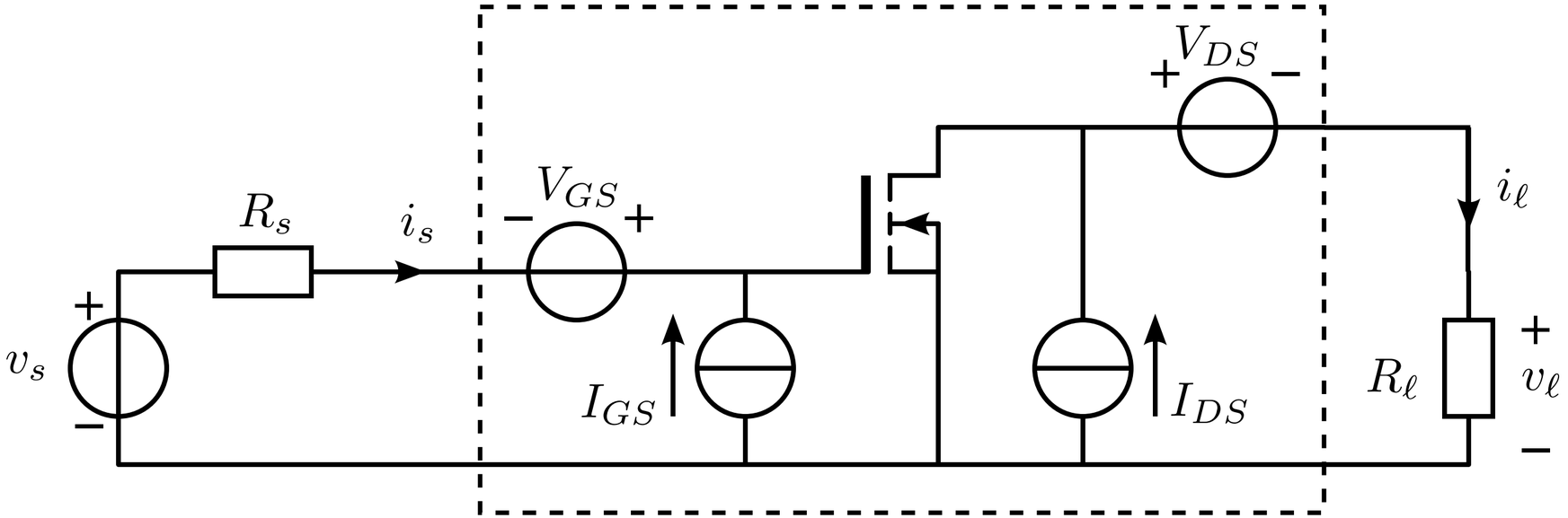
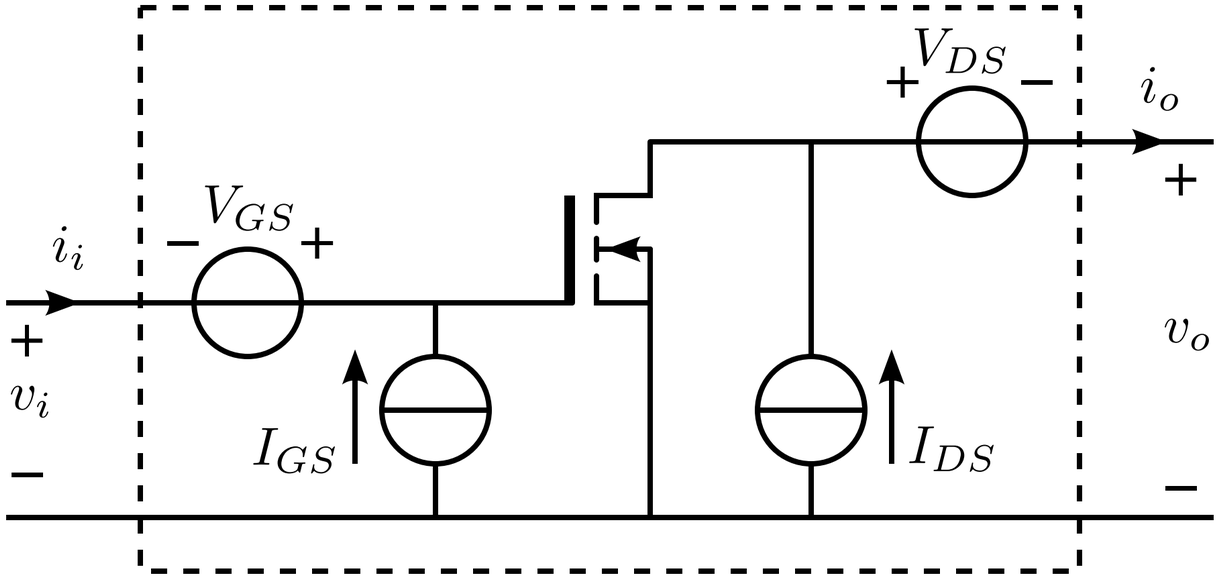


Biased amplifier stage

Amplification and biasing



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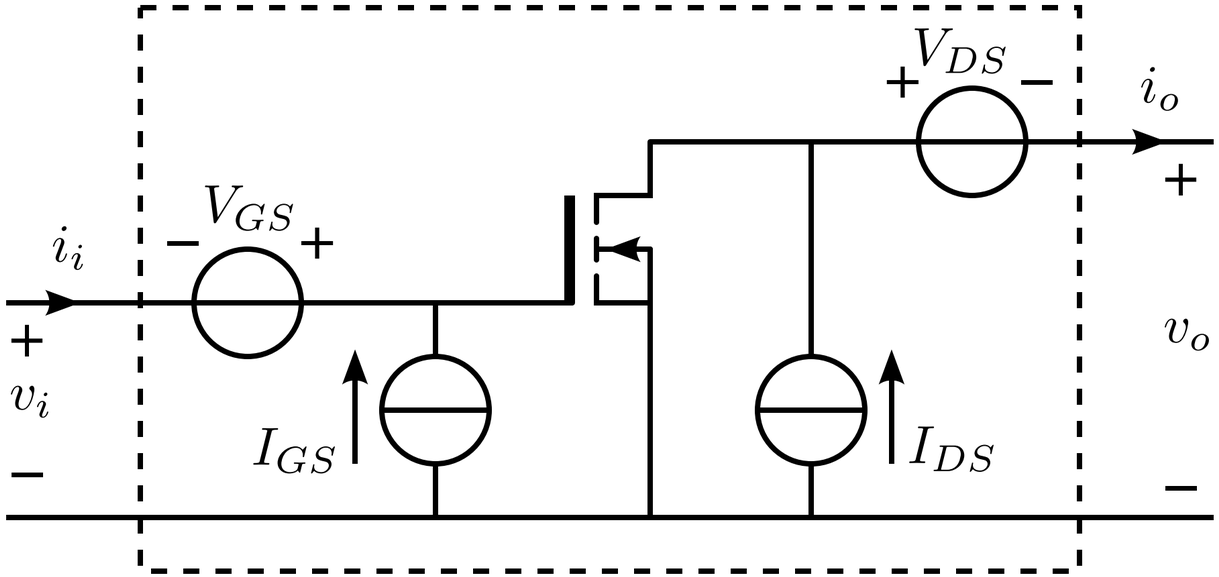
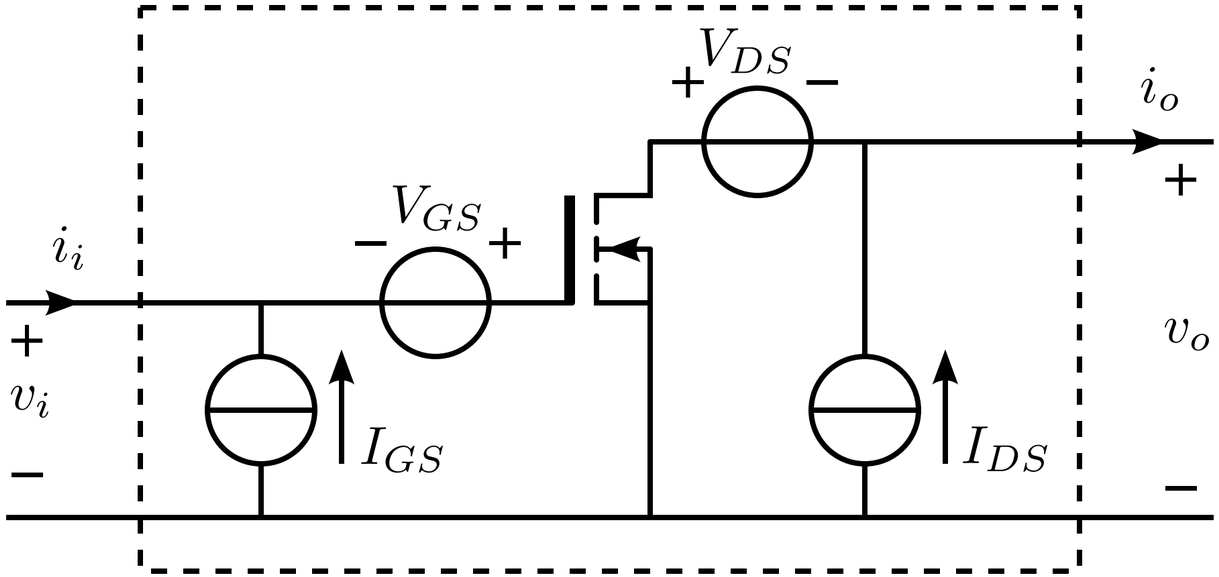


Biased amplifier stage

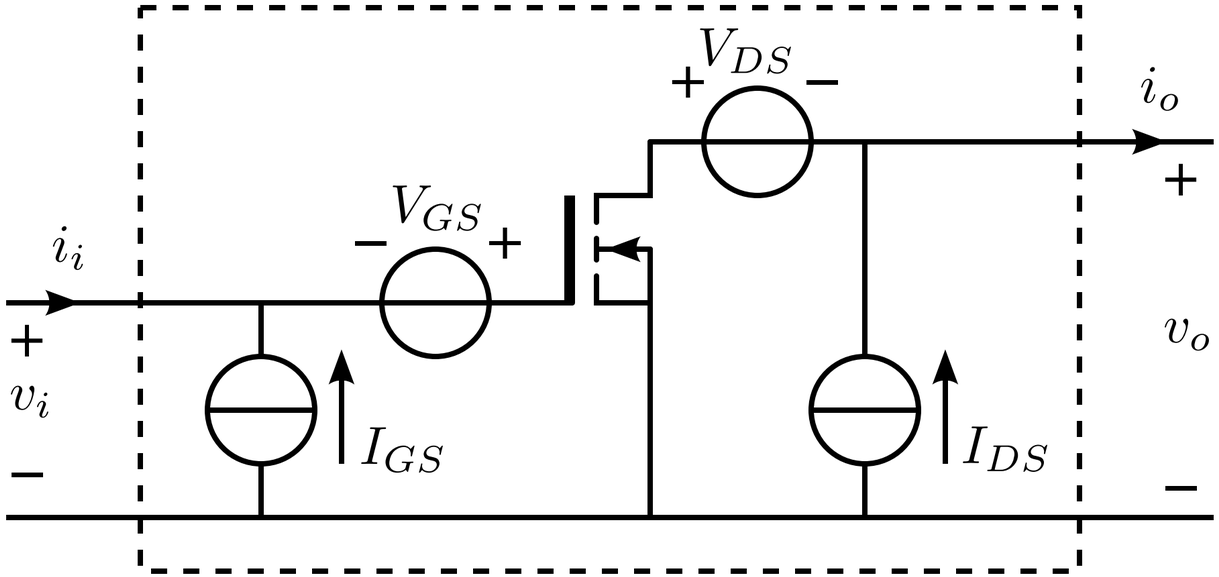
Bias power delivered by I_{GS} and I_{DS}

Amplification and biasing



Biased amplifier stage, alternative arrangement

Amplification and biasing



Biased amplifier stage, alternative arrangement

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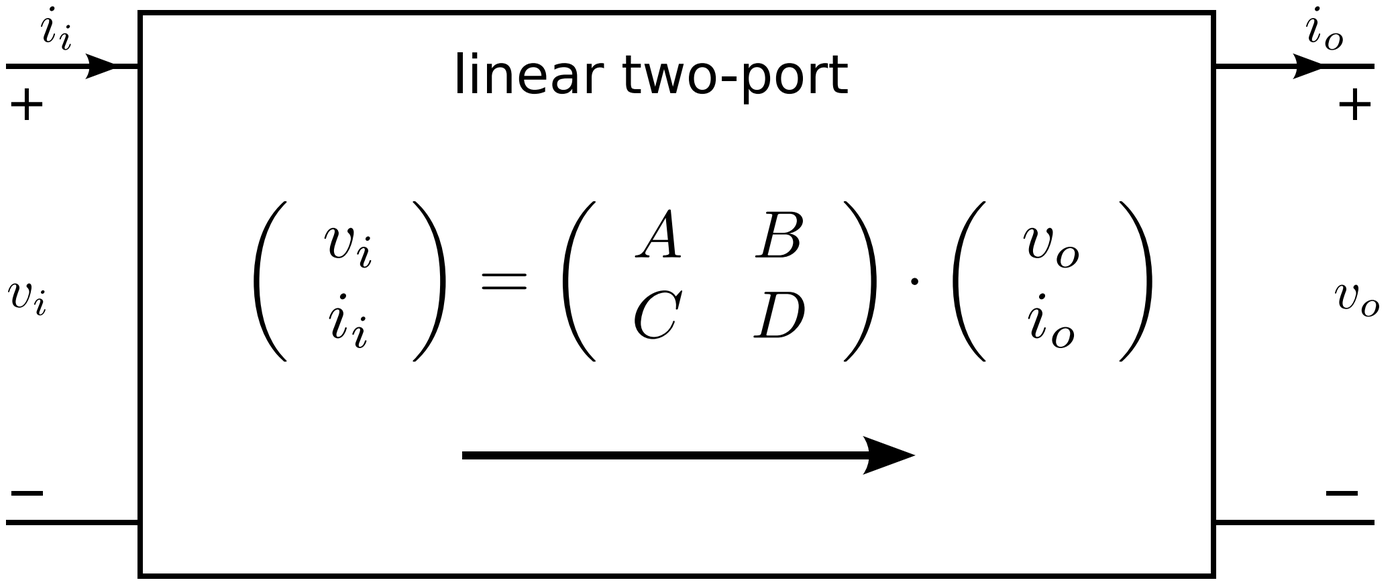
Linearization in the operating point:



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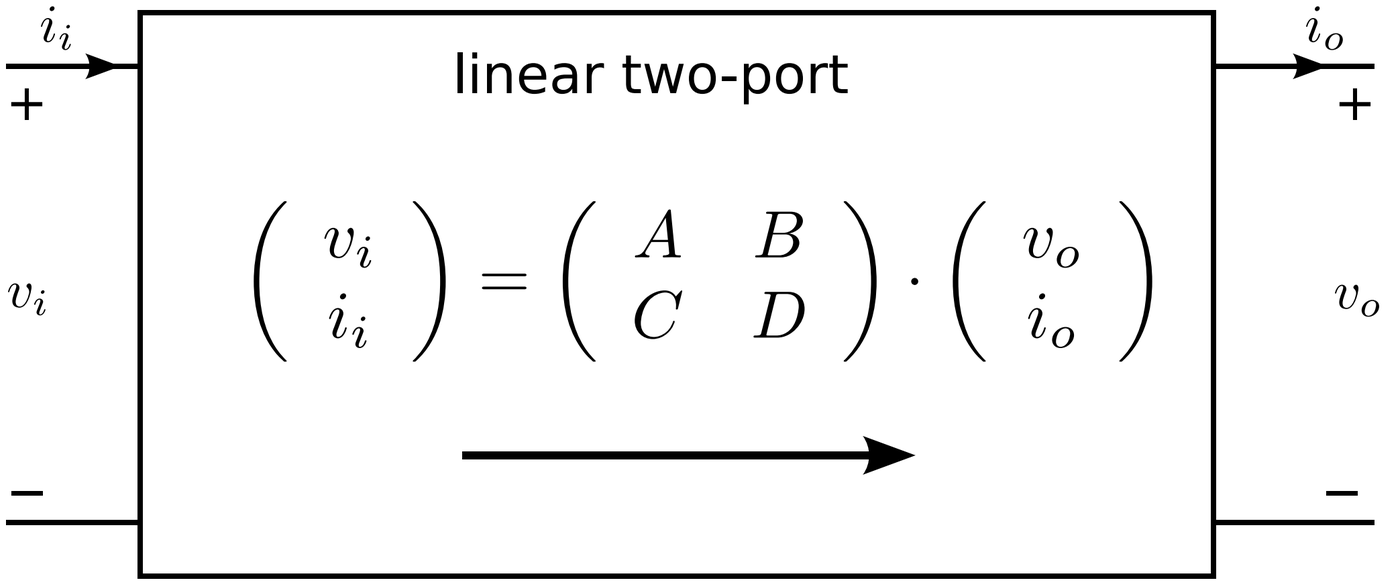

Maximum available power gain of a unilateral linear resistive two-port:

Amplification and biasing

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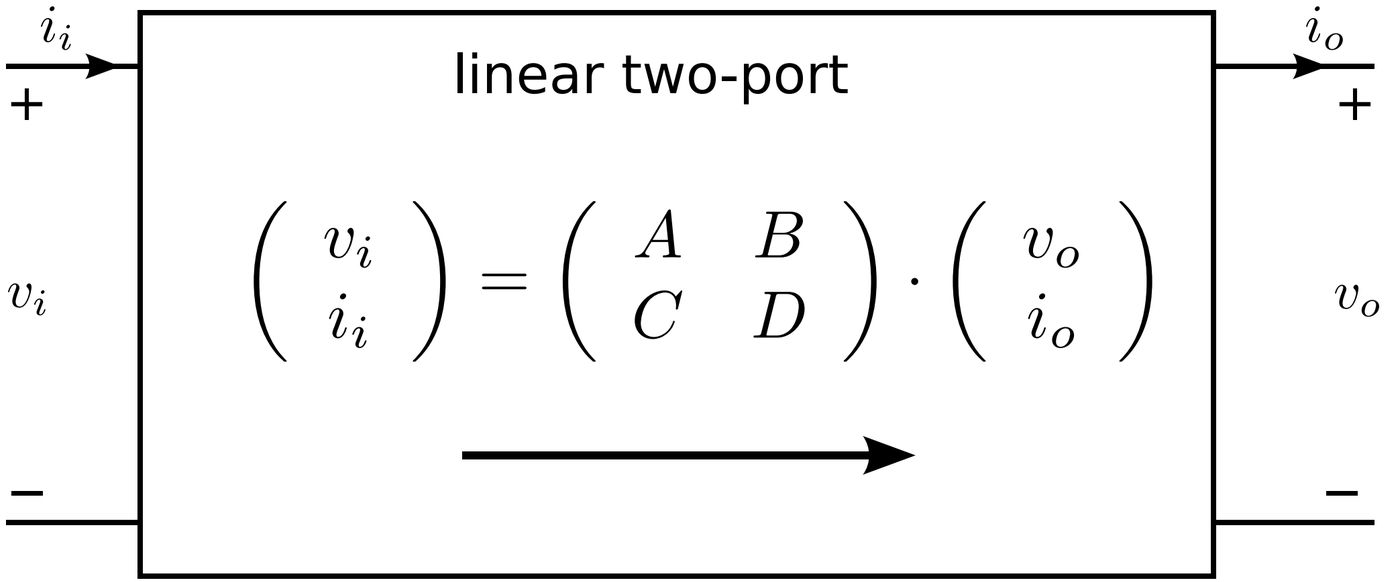

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Amplification and biasing

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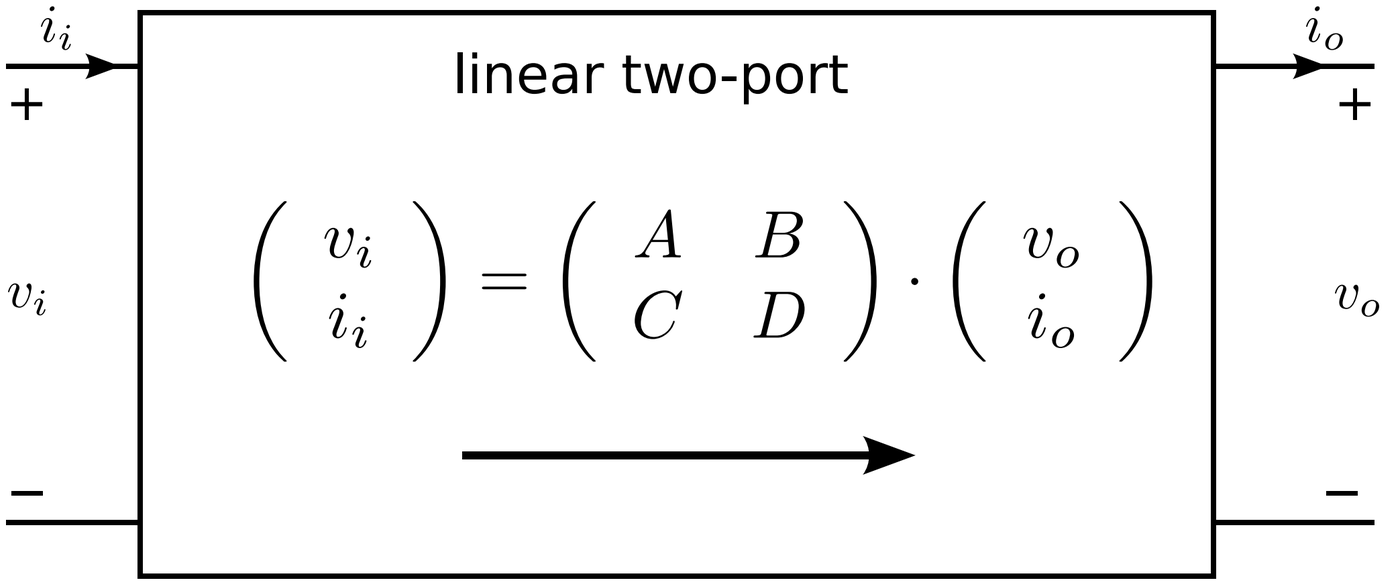

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