Lab 5
Gilbert Multiplier

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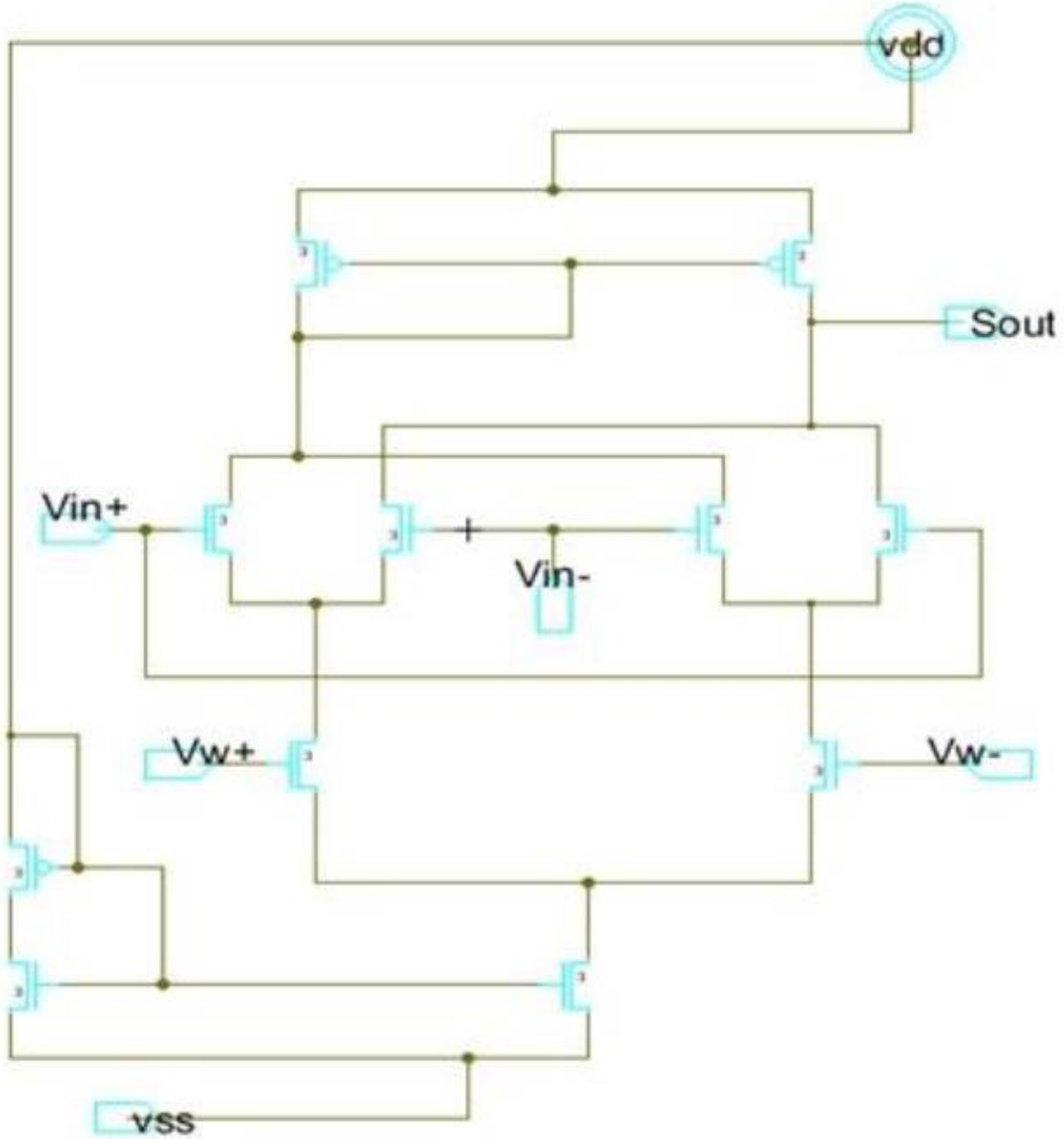
Analog Gilbert Multiplier

The synapse is an important element in artificial neural networks. The basic role of a synapse element is to multiply the input signals with stored weight values and later adapt those values through some learning algorithm.

$$Io = \sqrt{2KaKb}Vin\ Vw$$

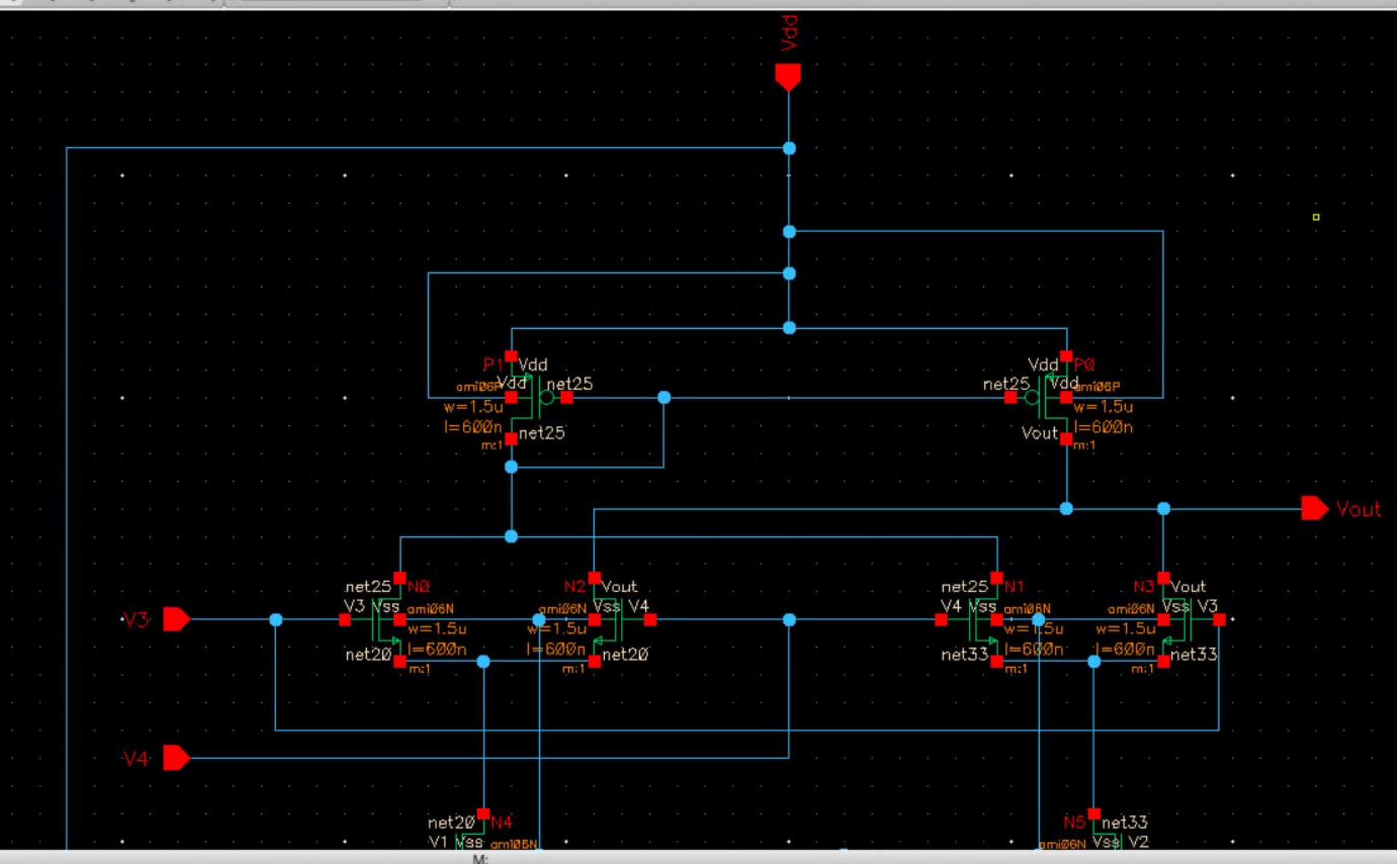
Where Ka and Kb are the transconductance of the PMOS and NMOS.

For most of the analog multipliers such as Gilbert multiplier or VGA(Variable gain amplifier-based) multiplier, the output should be current.



(a)

Patki, Mayuresh Premanand. "A Low Power and Area Efficient CMOS Implementation of Multilayer Feedforward Artificial Neural Network." (2017).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P1
Vdd
ami06P
Vdd
net25
w=1.5u
l=600n
m:1
net25
Vdd
P0
net25
Vdd
ami06P
w=1.5u
Vout
l=600n
m:1
Vout
V3
net25
N0
V3
Vss
ami06N
w=1.5u
net20
l=600n
m:1
N2
Vout
ami06N
Vss
V4
w=1.5u
l=600n
net20
m:1
net25
N1
V4
Vss
ami06N
w=1.5u
net33
l=600n
m:1
N3
Vout
ami06N
Vss
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w=1.5u
l=600n
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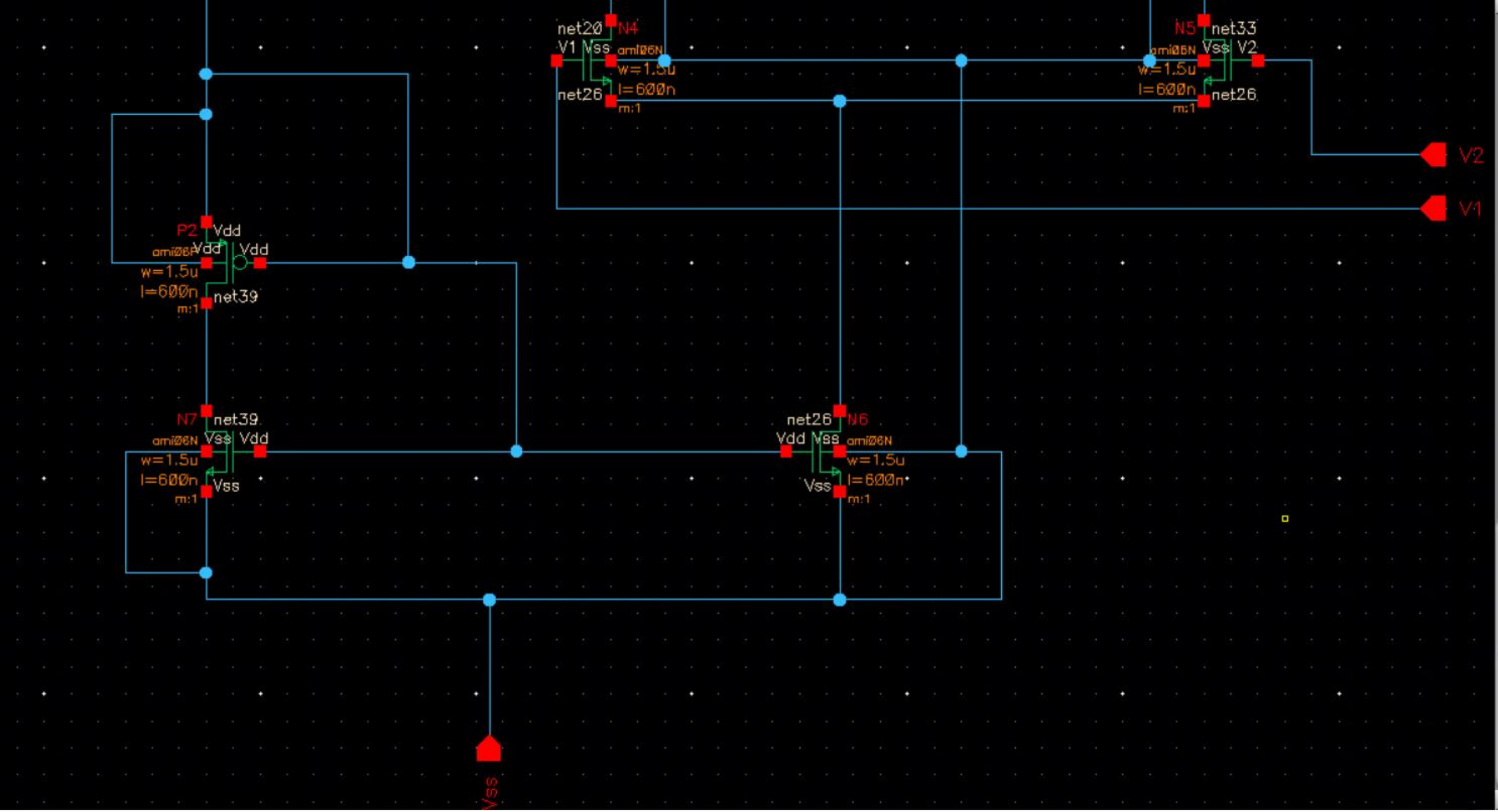
V1
Vss
ami06N
N5
net33
ami06N
Vss
V2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N4
V1
Vss
ami06N
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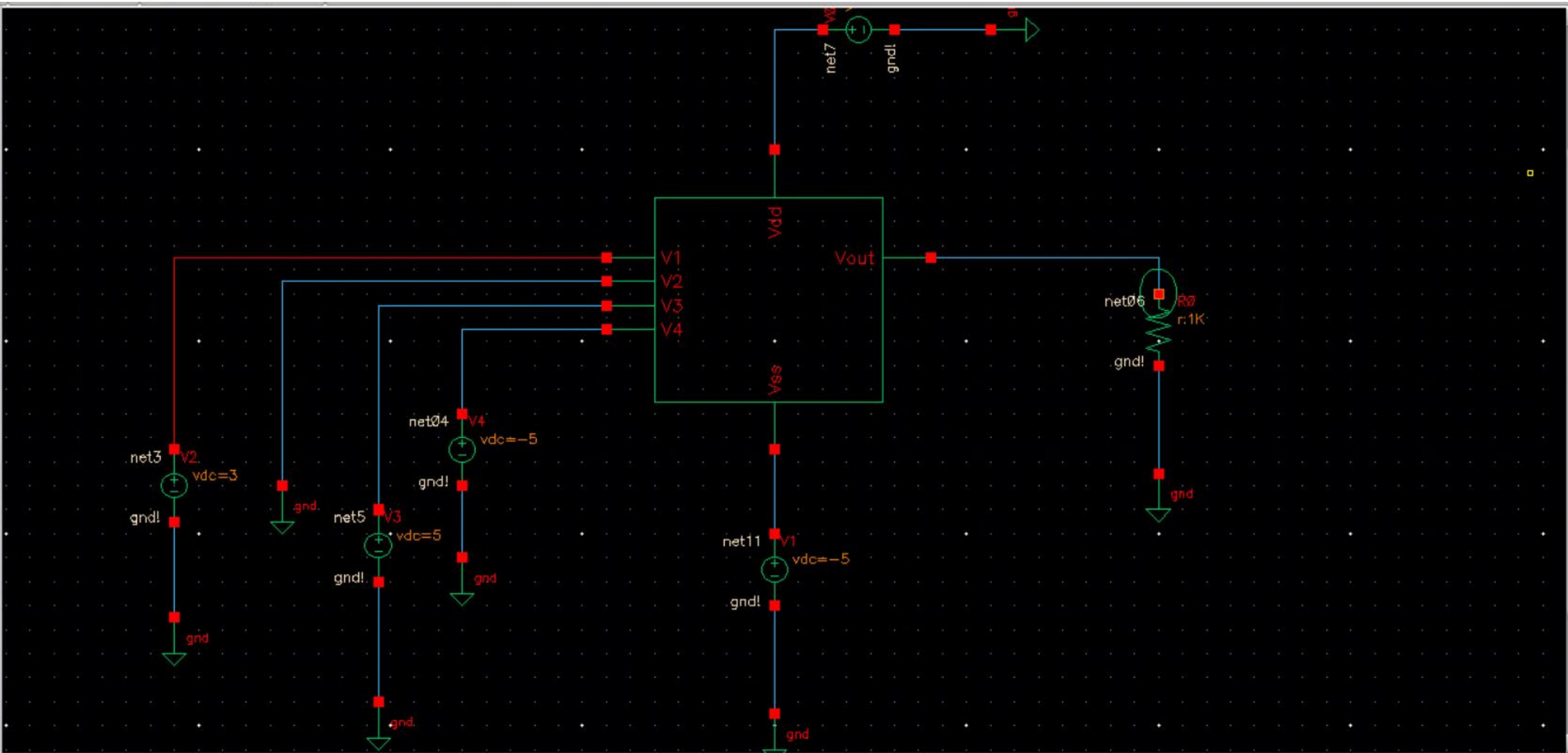
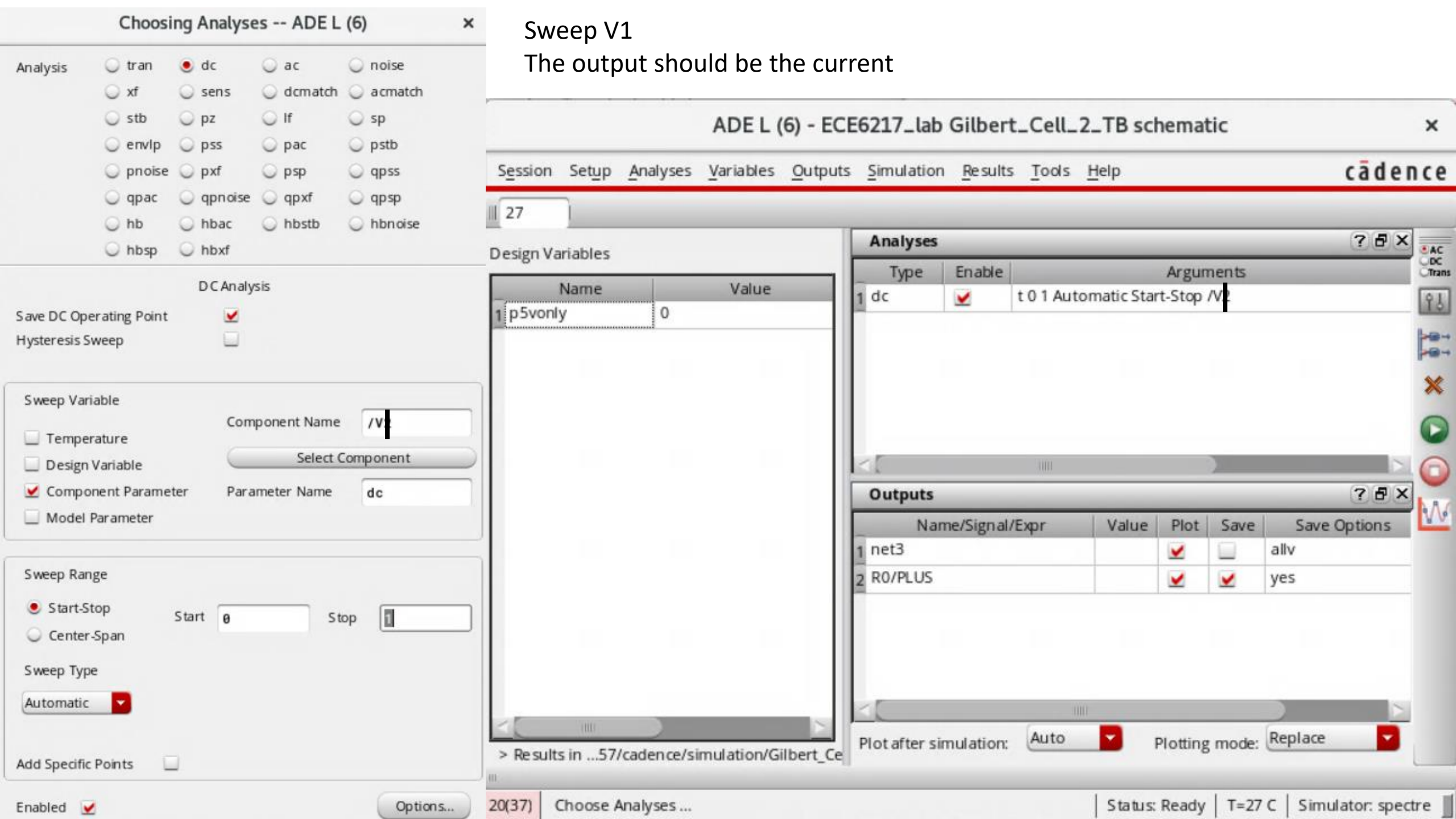
l=600n
m:1
net26
N5
net33
V2
P2
Vdd
ami06P
net39
N7
N6
V2
V1
Vss

Save as symbol and create a Testbench



Sweep V1

The output should be the current



Note that:
Gilbert Multiplier only works for small input voltage(0-1V in our case).