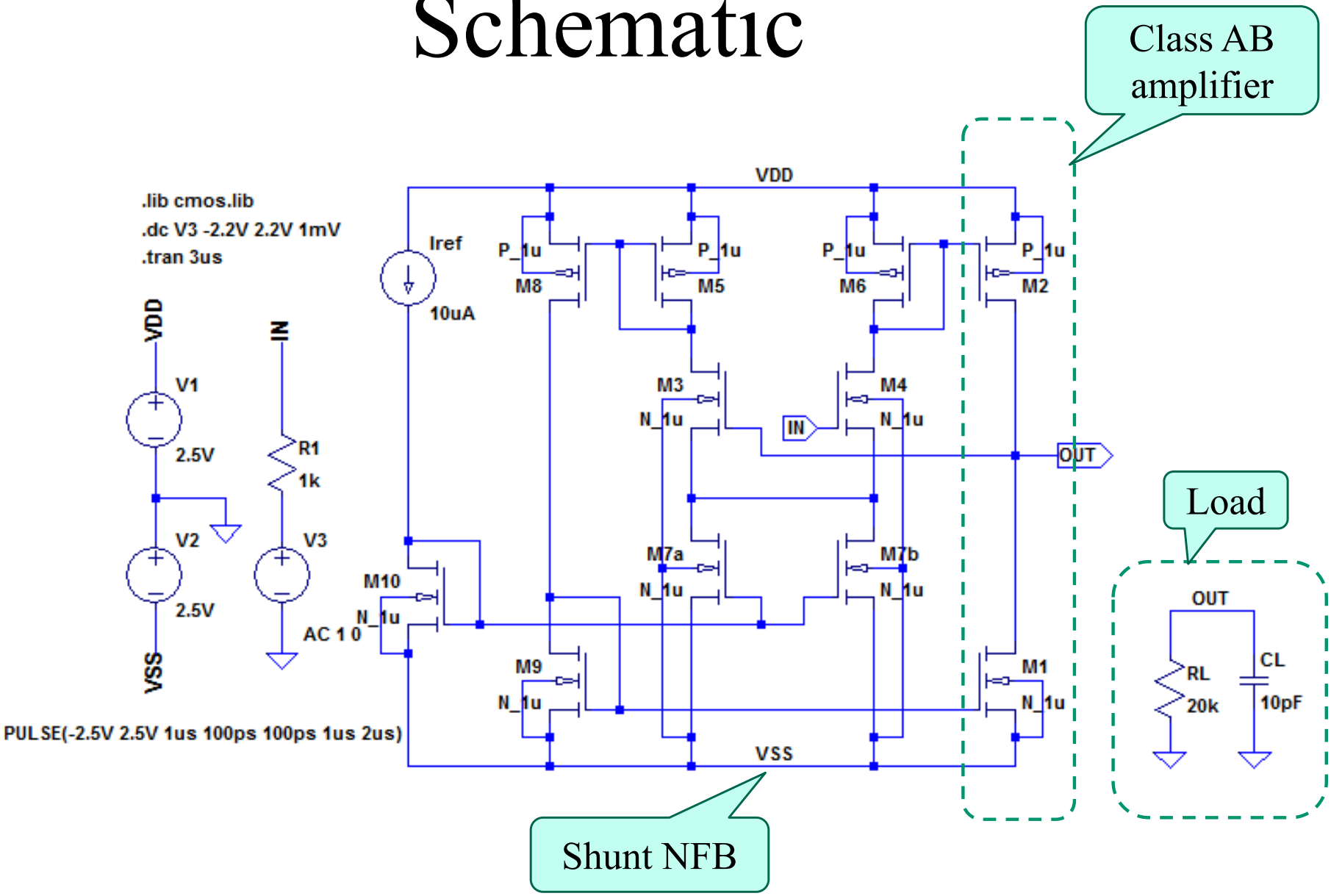
Lab. 14

CHARACTERIZATION OF OUTPUT BUFFER

1. Output swing

- Carry out the DC analysis of the class-AB buffer shown in the next slide. Use 20 kΩ load resistor (RL).
- Observe the output voltage swing and the output current swing for the input voltage swept from -2.2V to 2.2V.

Schematic


Class AB amplifier
.lib cmos.lib
.dc V3 -2.2V 2.2V 1mV
.tran 3us
VDD
V1
2.5V
V2
2.5V
VSS
IN
R1
1k
V3
AC 1 0
PULSE(-2.5V 2.5V 1us 100ps 100ps 1us 2us)
Iref
10uA
VDD
P_1u
M8
M5
M6
M2
M3
N_1u
M4
IN
OUT
M7a
M7b
M10
M9
M1
VSS
Load
RL
20k
CL
10pF
Shunt NFB

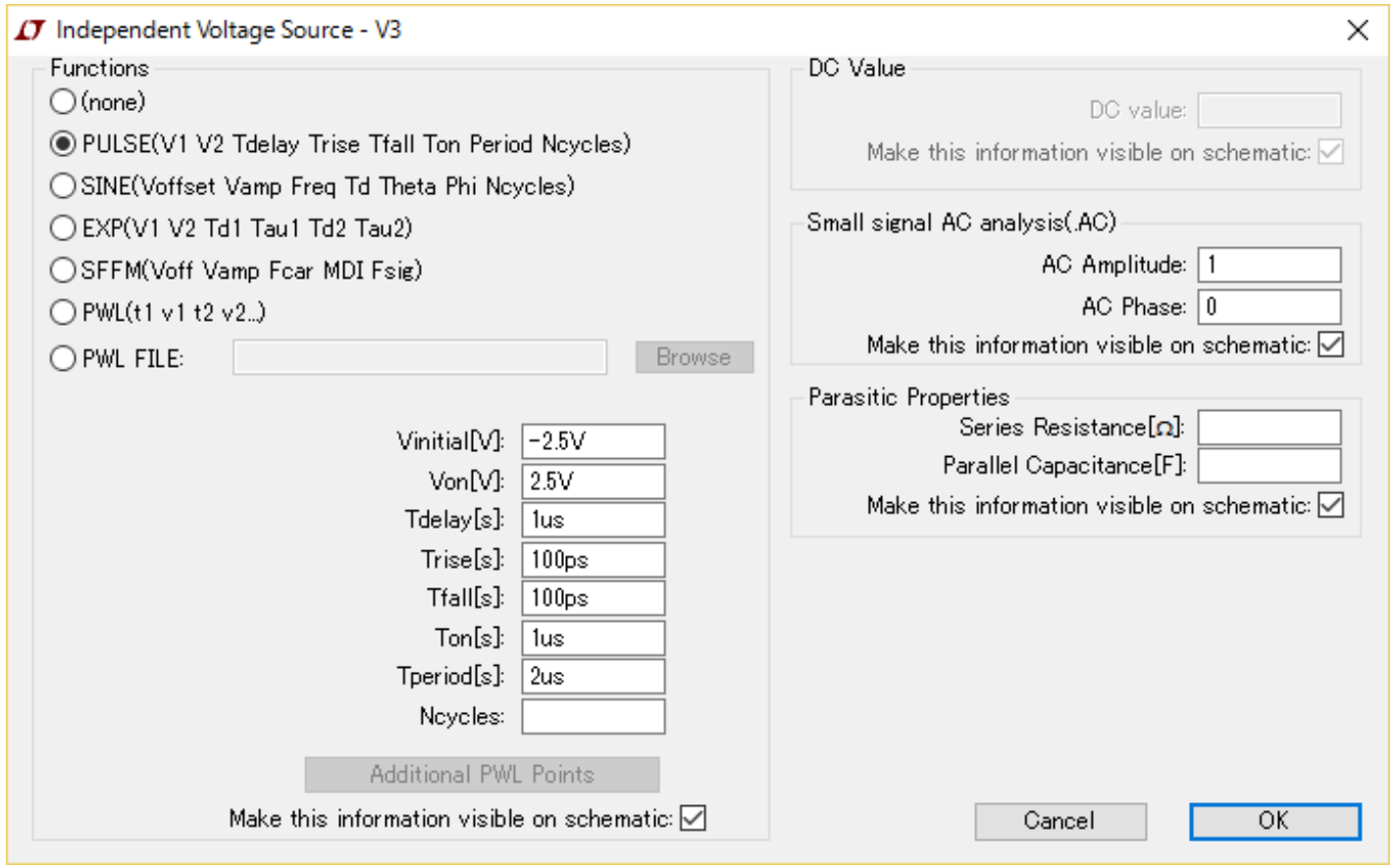
Parameters

MOSFET	L(m)	W(m)	M	AD, AS(m^2)	PD, PS(m)	W/L
M1, M9	2u	14u	8	42p	20u	56
M2, M8	2u	10u	33	30p	16u	165
M3, M4	2u	13u	16	39p	19u	104
M5,M6	2u	10u	3	30p	16u	15
M7a, M7b	2u	10u	1	30p	16u	5
M10	2u	10u	2	30p	16u	10

2. Transient response

- Carry out the step response analysis. Remove 20 kΩ load resistor (RL) and put in the load capacitance of 10pF.
- Observe the output voltage and SR = dV(out)/d(time), and measure the value of slew rate at V(out) = 0V.

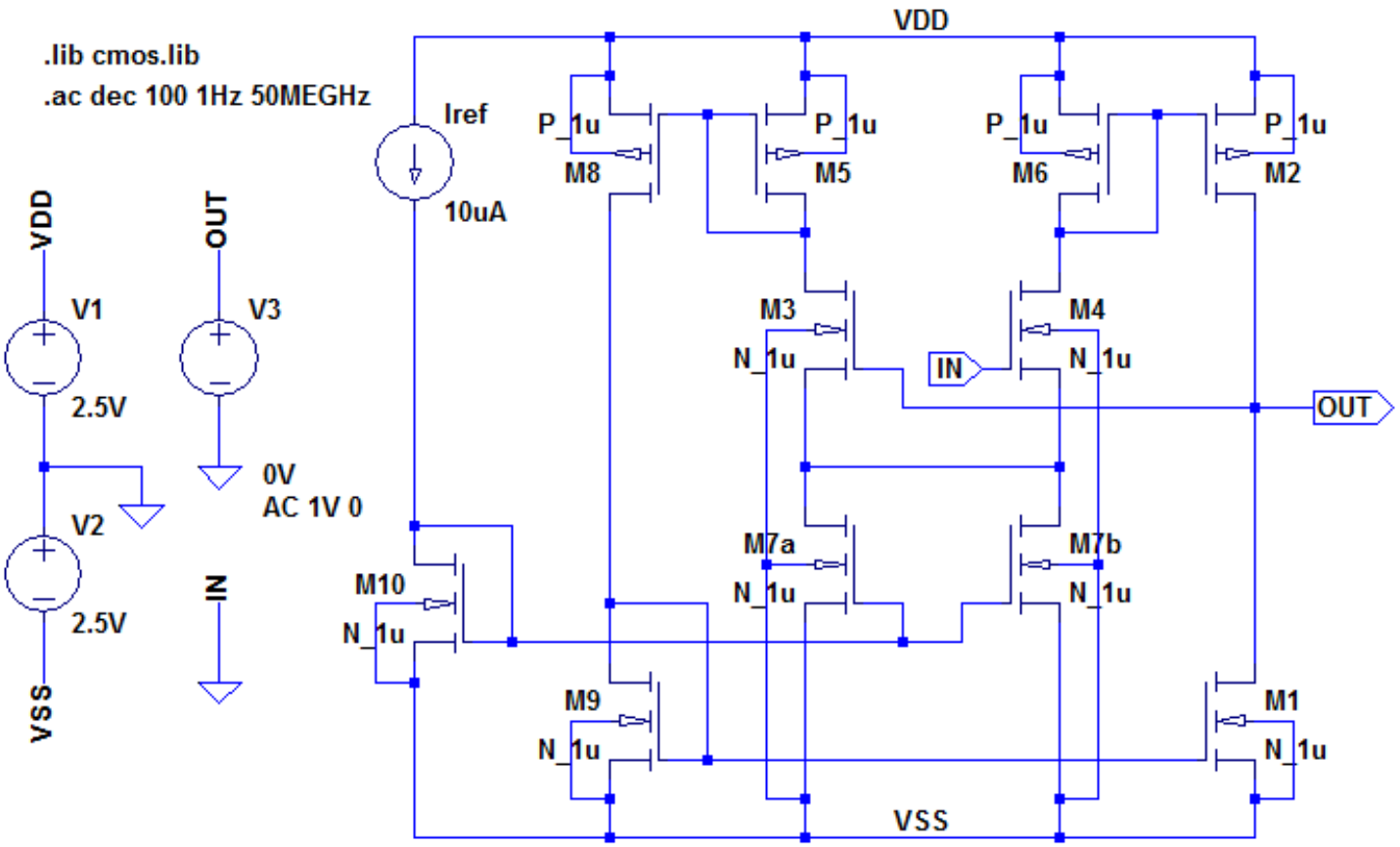
Setting of the input pulse



3. Output resistance

- Draw up the schematic to measure the output resistance and run the AC analysis for the frequency range of 1Hz - 50MEGHz.
  - Output resistance is defined as a small-signal resistance of the output node when the input signal amplitude is zero.
- Plot the output resistance V(out)/(-I(V3)) and read out the value at 1kHz.

Schematic


.lib cmos.lib
.ac dec 100 1Hz 50MEGHz
VDD
V1
2.5V
V2
2.5V
VSS
OUT
V3
0V
AC 1V 0
IN
Iref
10uA
VDD
P_1u
M8
P_1u
M5
P_1u
M6
P_1u
M2
M3
N_1u
M4
N_1u
IN
OUT
M7a
N_1u
M7b
N_1u
M10
N_1u
M9
N_1u
M1
N_1u
VSS