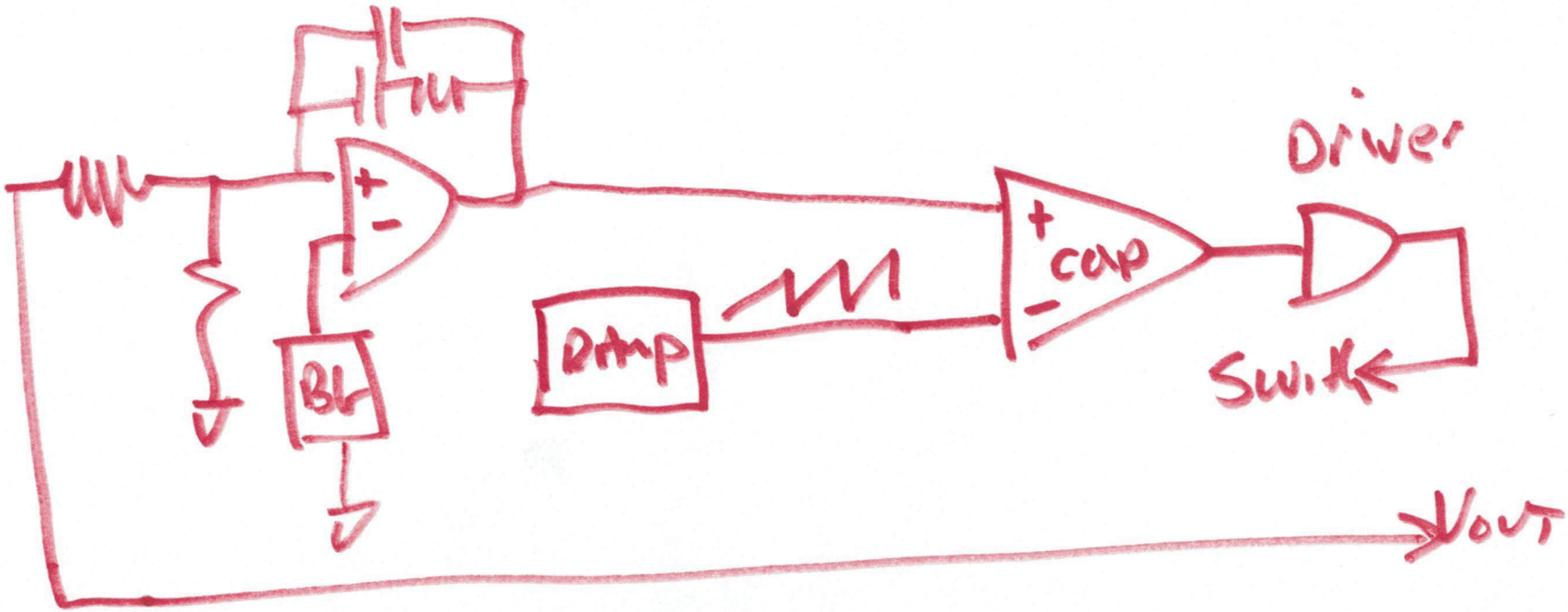
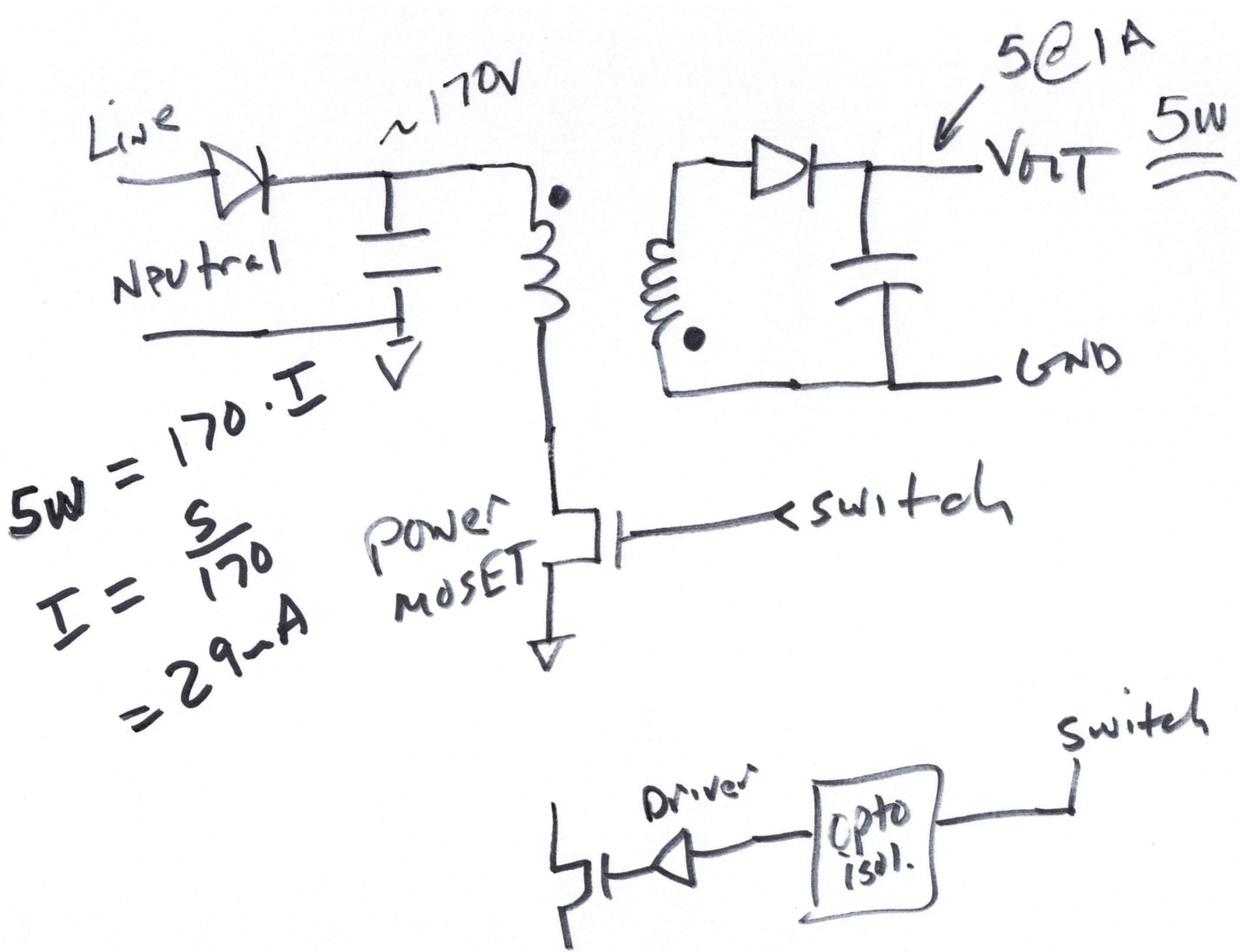
EE 442 / ECG 642.

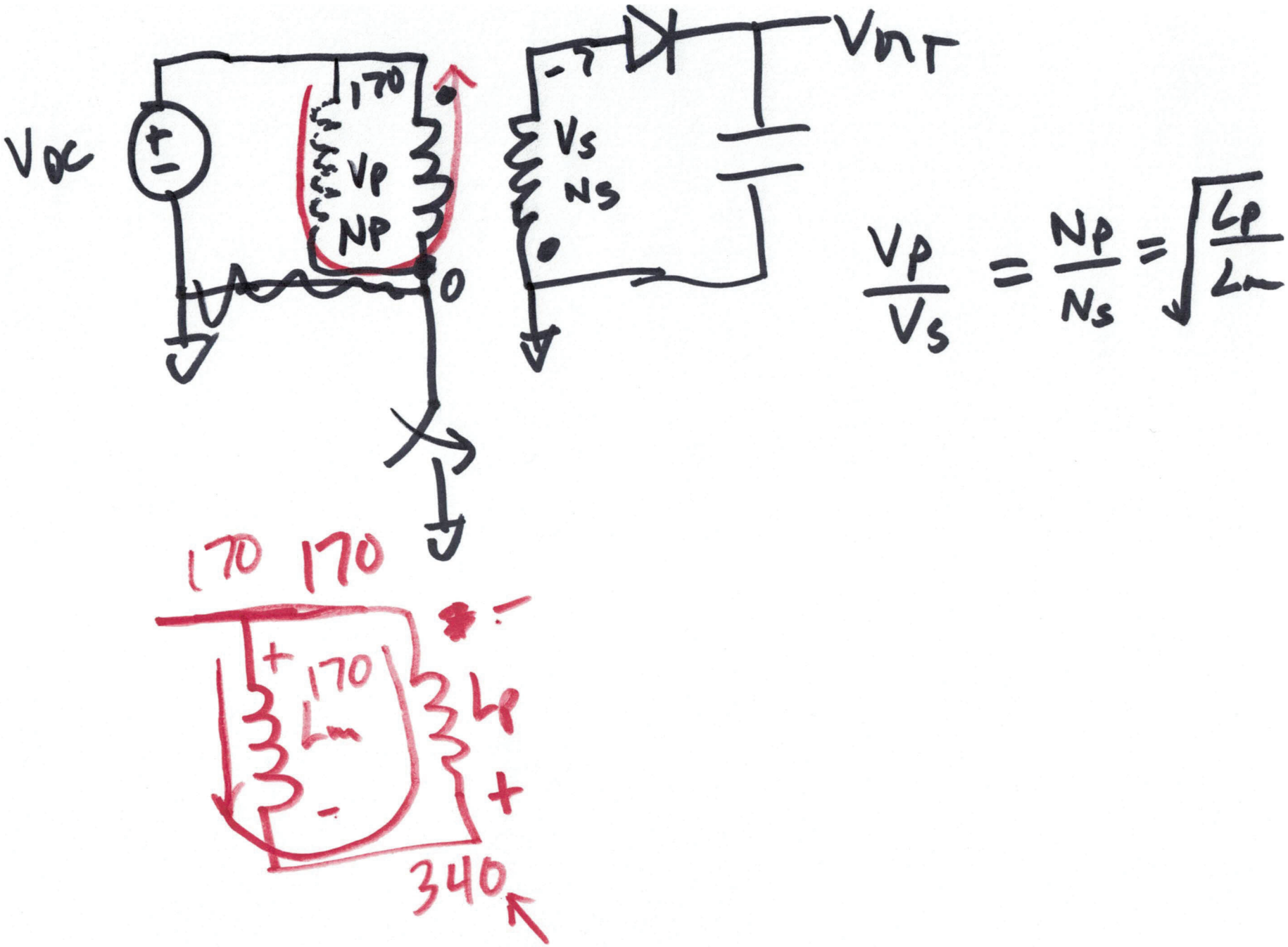
Power Electronics

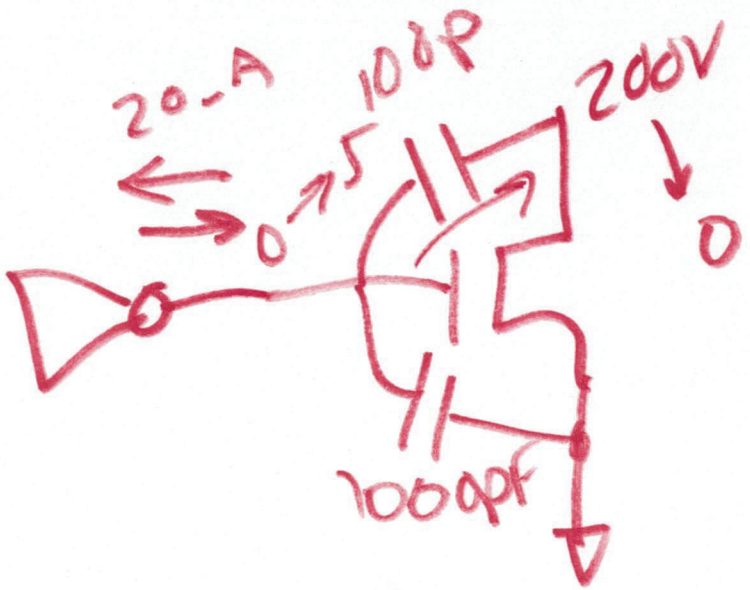
Lecture 18

NOVEMBER 2, 2022




Line
~170V
Neutral
5@1A
5W
VOUT
GND
5W = 170 · I
I = 5/170
= 29~A
power MOSET
switch
Driver
opto isol.
switch

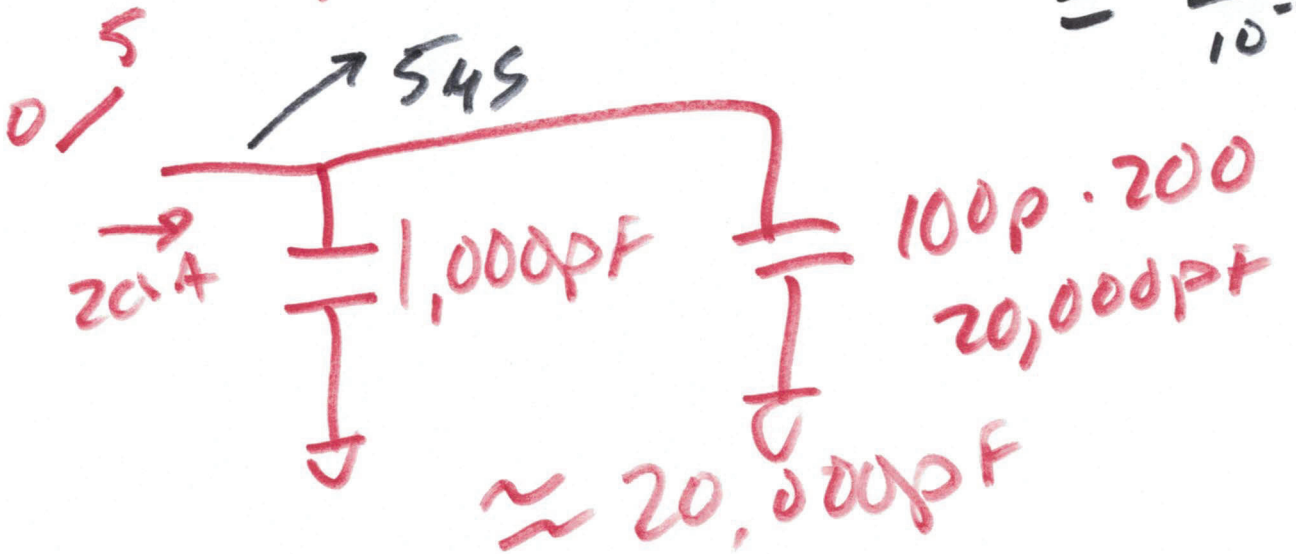

VDC
170
VP
NP
0
VOUT
VS
NS
VP / VS = NP / NS = √(LP / Lm)
170 170
170
Lm
LP
340



$$\frac{I}{C} = \frac{dV}{dT} = \frac{20\,nA}{20\,nF}$$

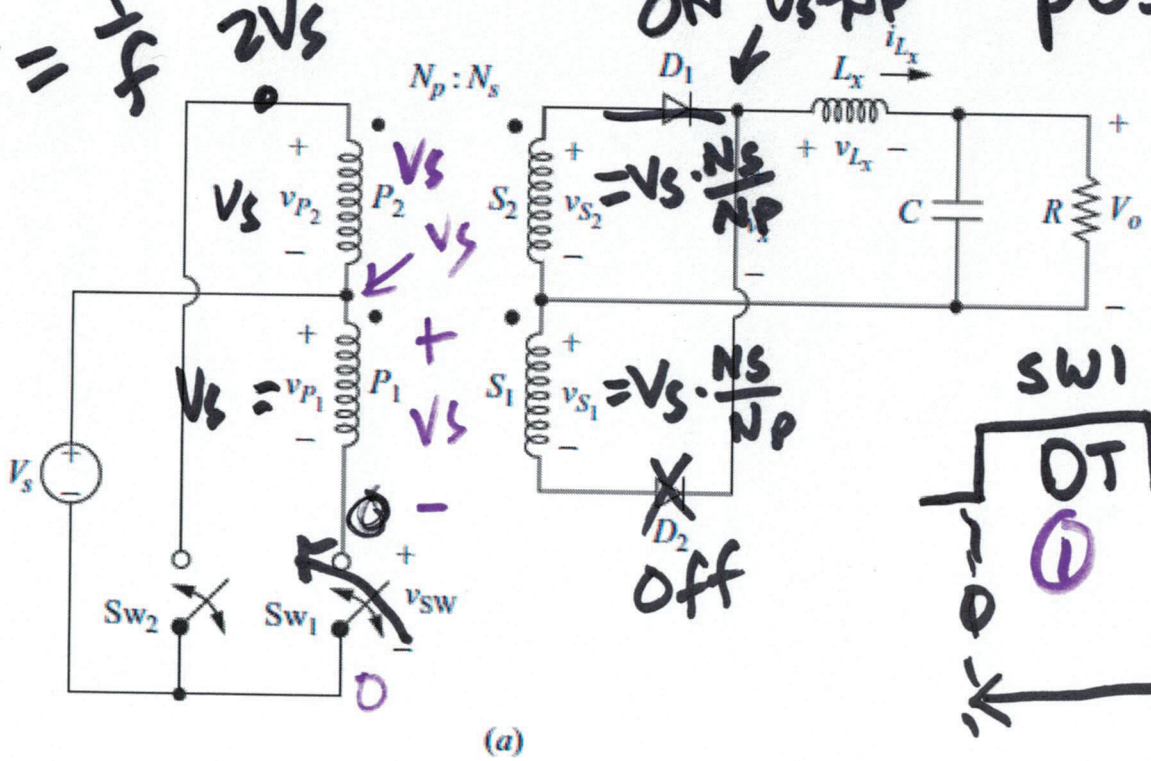
$$= \frac{10^{-3}}{10^{-7}} = \frac{1V}{4S}$$

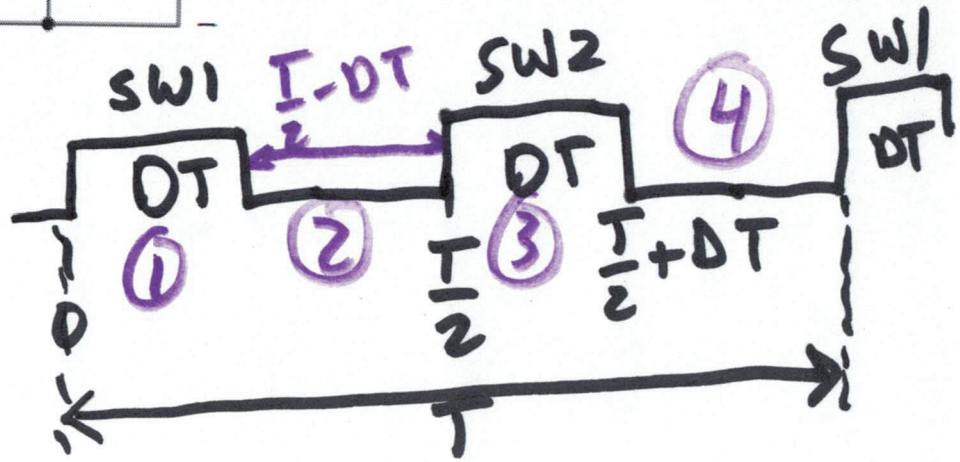
205V · 100pF



$T = \frac{1}{f}$ 2Vs

ON $V_s \frac{N_s}{N_p}$ push-pull converter



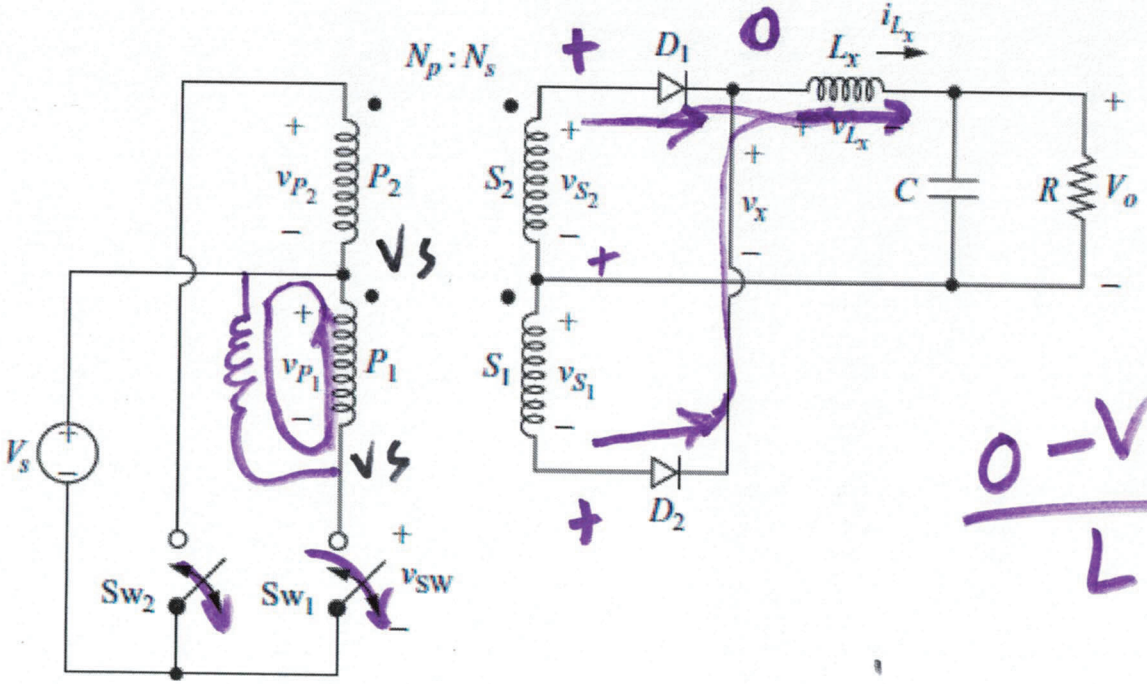


SW1 closed

$$V_{Lx} = V_s \cdot \frac{N_s}{N_p} - V_o$$

$$\frac{V_s \frac{N_s}{N_p} - V_o}{L_x} = \frac{\Delta i_{Lx}}{DT}$$

$$\Delta i_{Lx} = DT\left(\frac{V_s \frac{N_s}{N_p} - V_o}{L_x}\right)$$



(a)

$$\frac{0 - V_o}{L} = \frac{\Delta i_{Ls\,dpn}}{\frac{T}{2} - DT}$$

$$\Delta i_{Ls\,dpn} = \frac{-V_o}{L \cdot T\left(\frac{1}{2} - D\right)}$$

$$= -\frac{V_o}{L}\left(\frac{1}{2} - D\right)T$$

b)

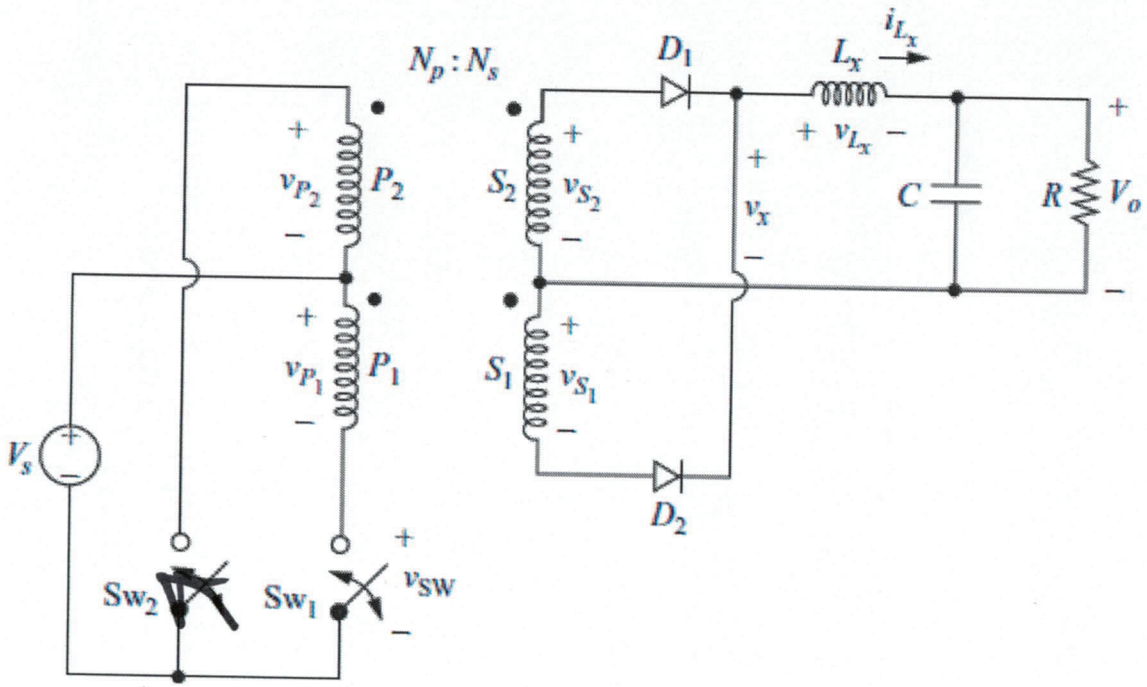
$$-\frac{V_O}{L_X}\left(\frac{1}{2}-D\right)T = DT\left(\frac{V_S\frac{N_S}{N_P}-V_O}{L_X}\right)$$

$$+\frac{V_O}{2}-DV_O = DV_S\left(\frac{N_S}{N_P}\right)-DV_O$$

$$\left(-D-\frac{1}{2}+D\right)\frac{V_O}{2} = DV_S\left(\frac{N_S}{N_P}\right)$$

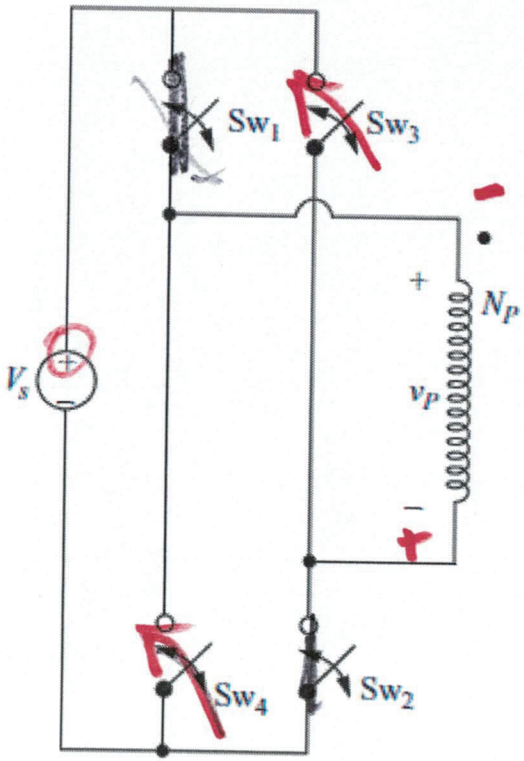
$$\frac{V_O}{2} = DV_S\left(\frac{N_S}{N_P}\right)$$

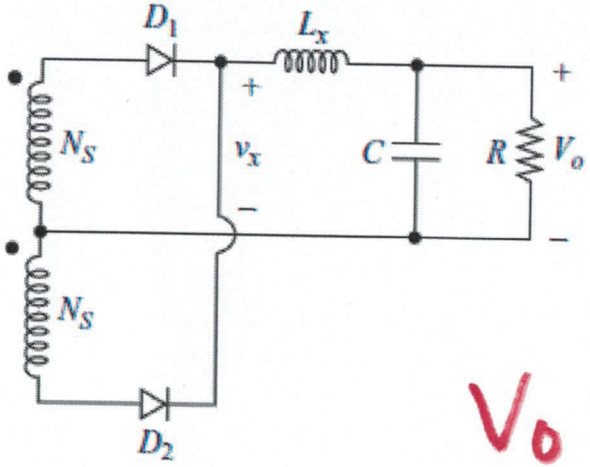
$$V_O = 2V_S\left(\frac{N_S}{N_P}\right)D$$


$N_p : N_s$
D_1
L_x
i_{L_x}
$+ \; v_{L_x} \; -$
P_2
v_{P_2}
S_2
v_{S_2}
v_x
C
R
V_o
P_1
v_{P_1}
S_1
v_{S_1}
V_s
D_2
Sw_2
Sw_1
v_{SW}

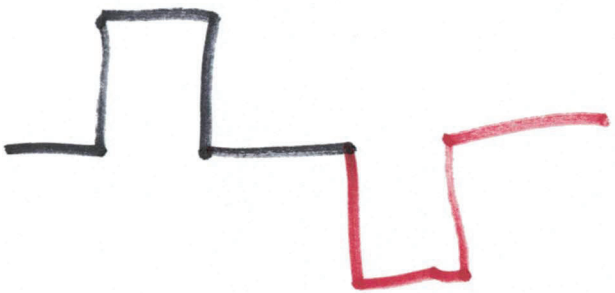
(a)

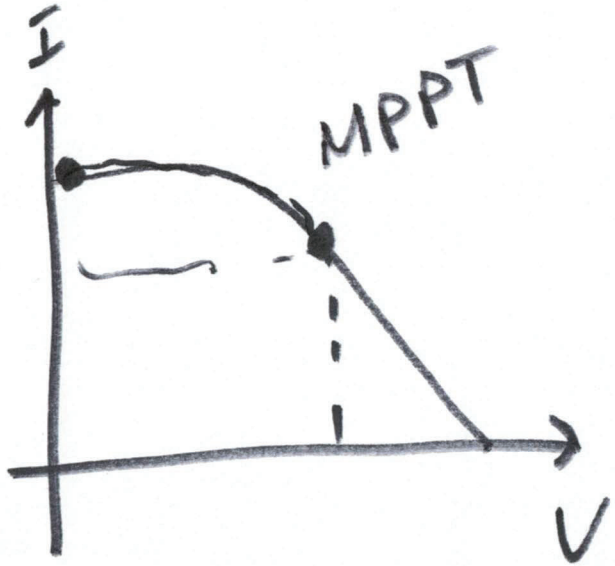
full bridge

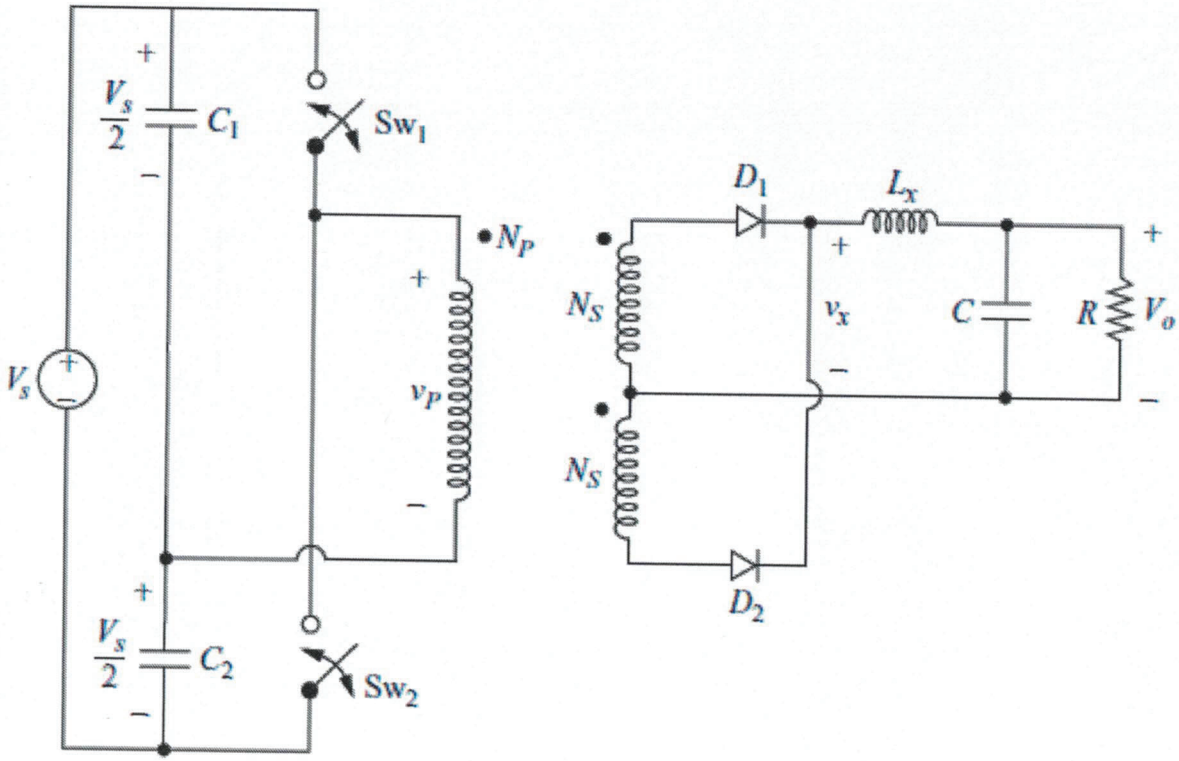




$$V_o = 2V_s \frac{N_s}{N_P} \cdot D$$






$\frac{V_s}{2}$
C_1
Sw_1
N_P
V_s
v_P
$\frac{V_s}{2}$
C_2
Sw_2
D_1
L_x
N_S
v_x
C
R
V_o
N_S
D_2