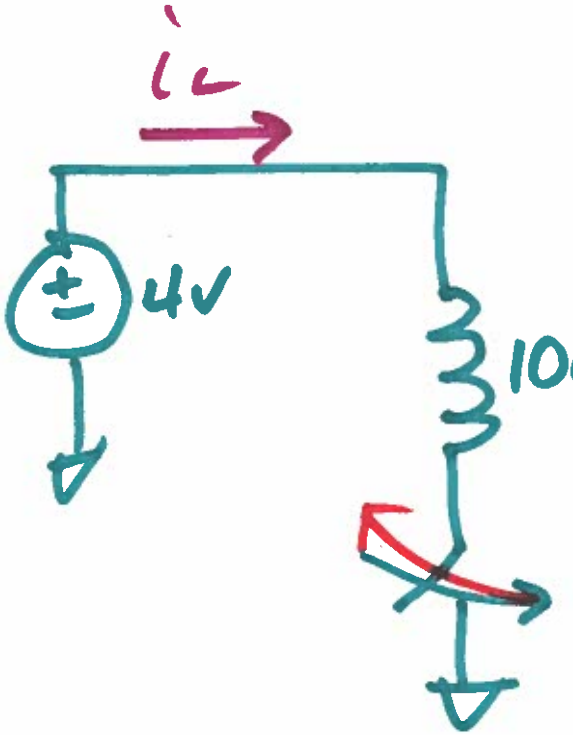
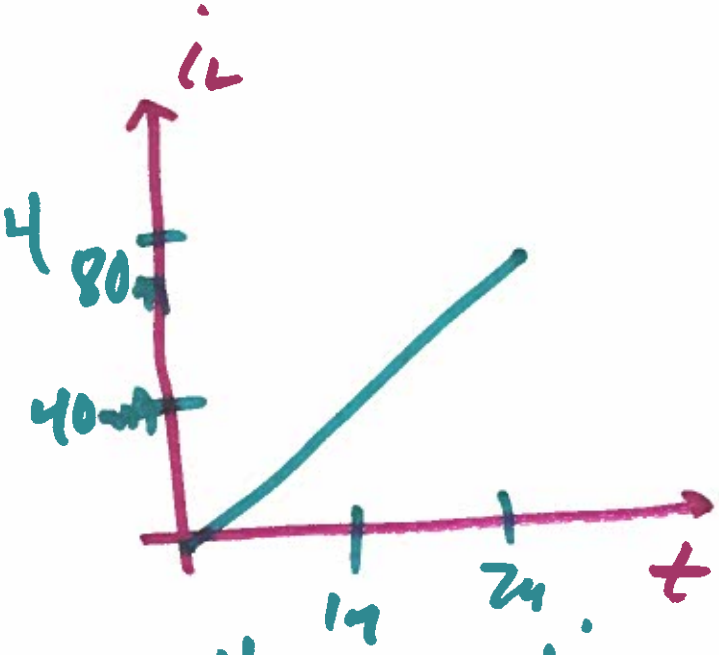
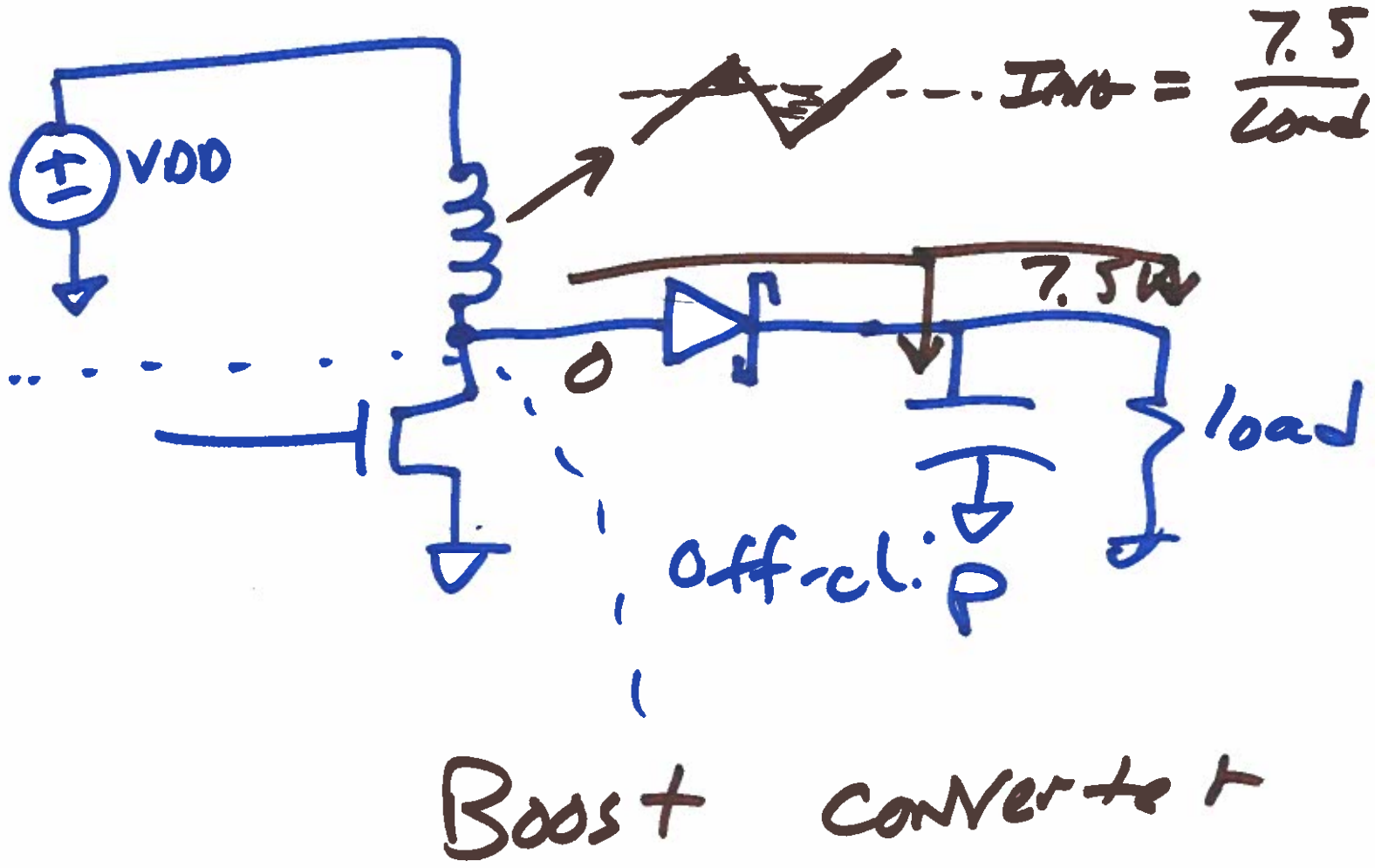
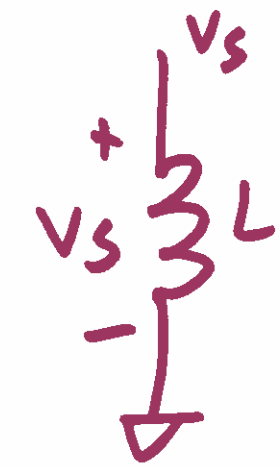
# EE421 / ECG 621
# Digital IC Design
# OCT. 16, 2019
# Lecture 14

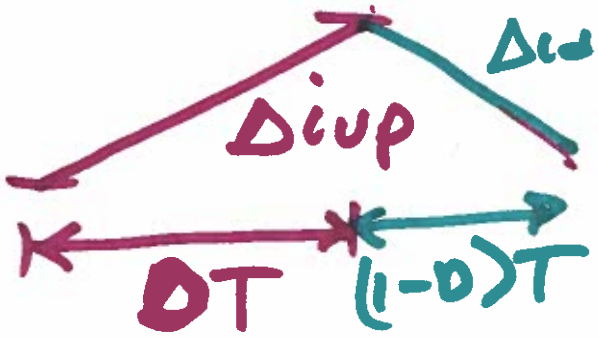



$$V = L \cdot \frac{di}{dt} \rightarrow \frac{4}{100nH} = \frac{di}{dt} = \frac{40mA}{4S}$$

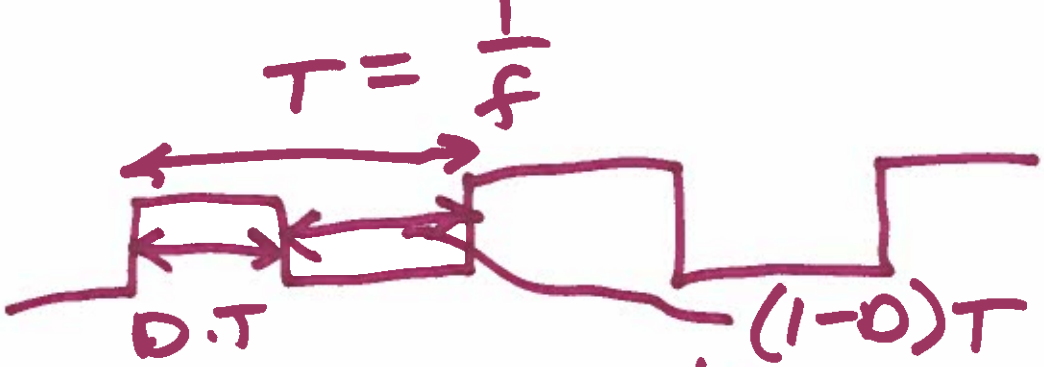

VDD
$I_{MAX} = \frac{7.5}{Load}$
7.5W
load
off-chip
Boost converter



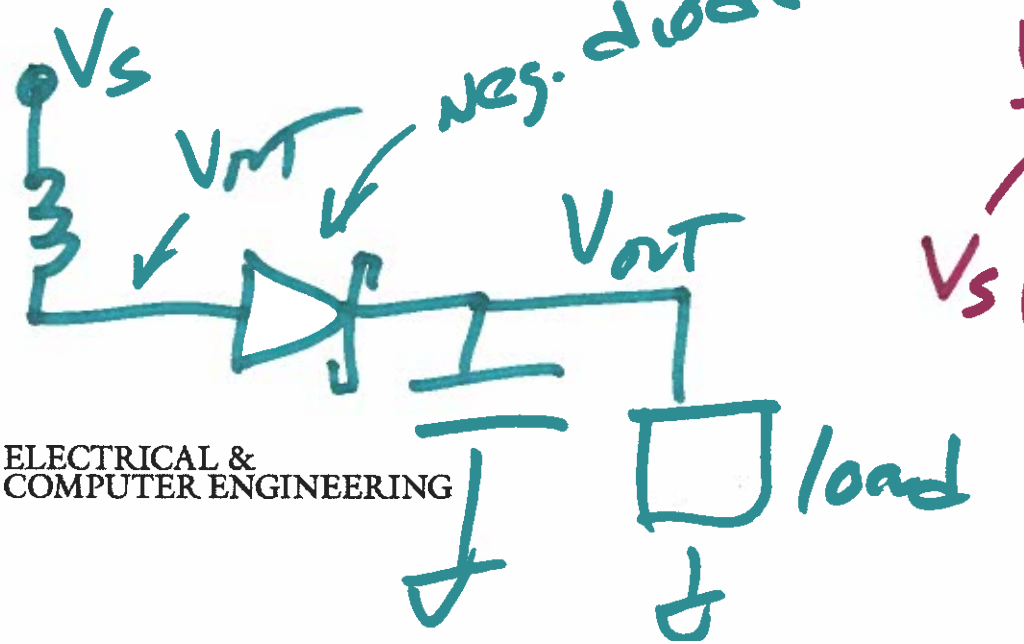

$$V = L \cdot \frac{di}{dt}$$

$$\frac{V_S}{L} = \frac{\Delta i_{up}}{D \cdot T}$$




$$\frac{V_S - V_{out}}{L} = \frac{\Delta i_{diode}}{(1-D)T}$$

D = duty cycle



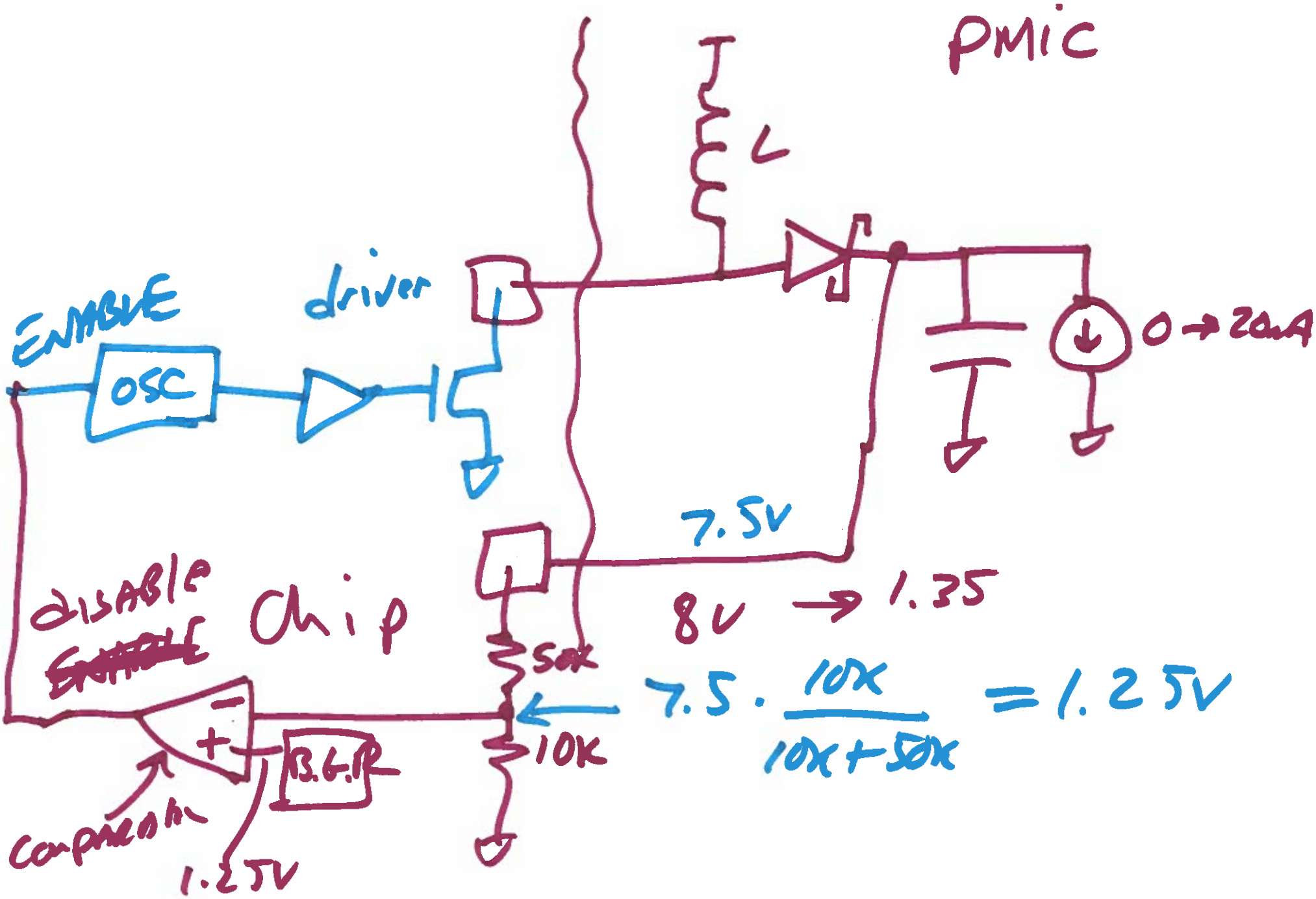

$$\frac{V_S}{L} \cdot DT = \left(\frac{V_S - V_{out}}{L} \cdot (1-D)T\right)$$

$$V_S\left(\frac{D}{L}\right)$$

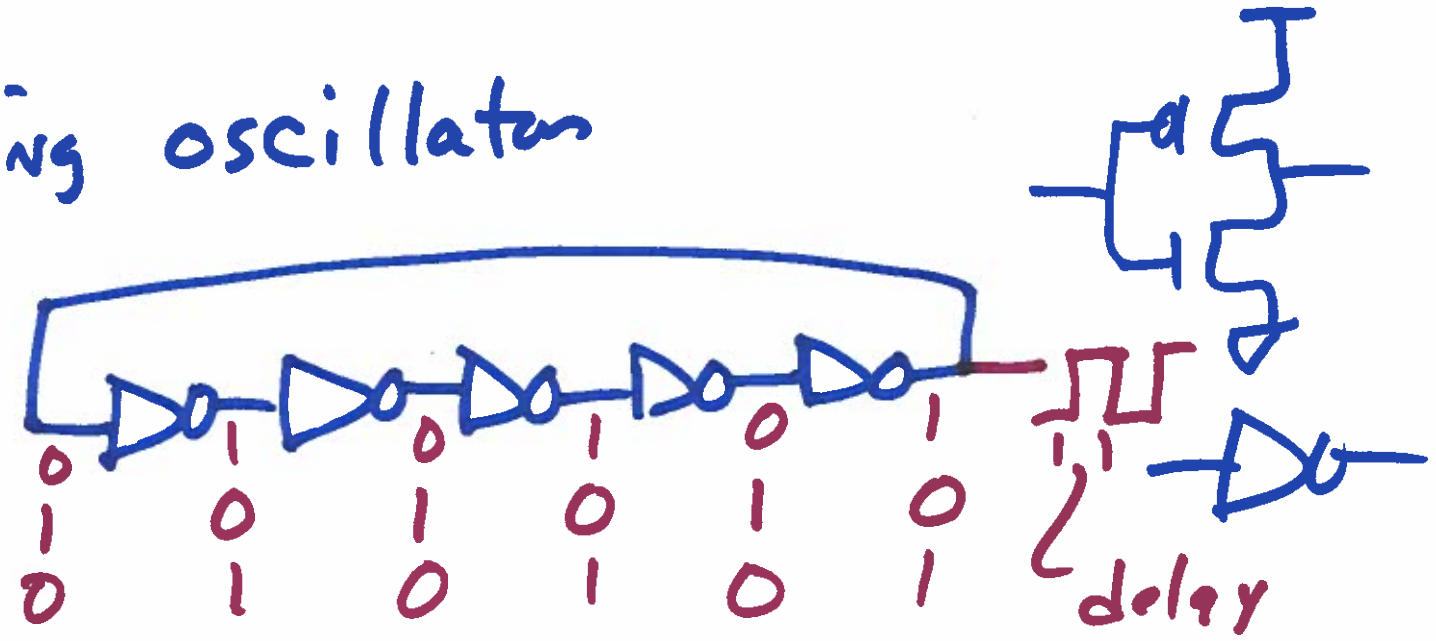
$$V_{SD} = V_S + V_{SD} + V_{OUT} - D V_{OUT}$$

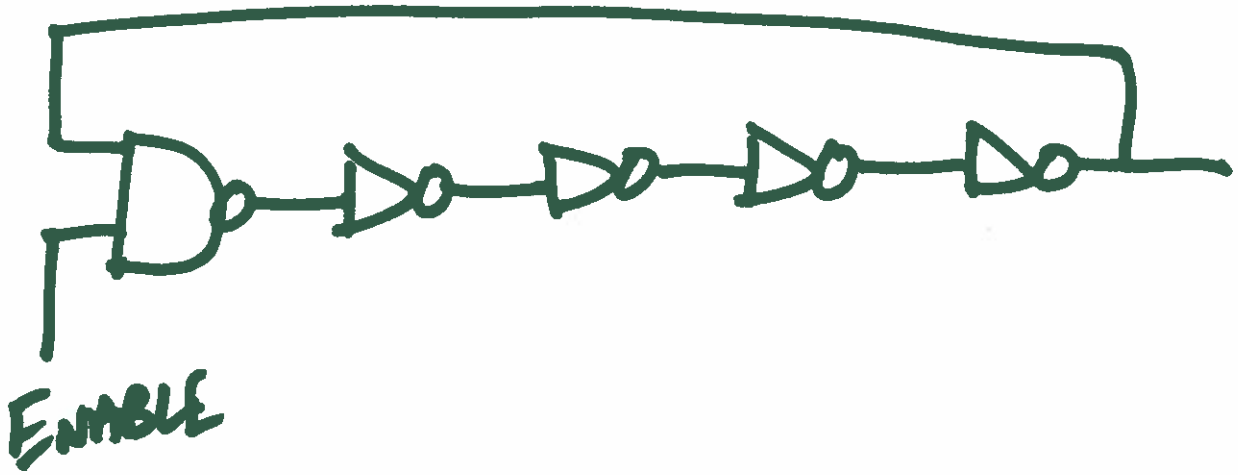
$$V_S = V_{OUT}(1 - D)$$

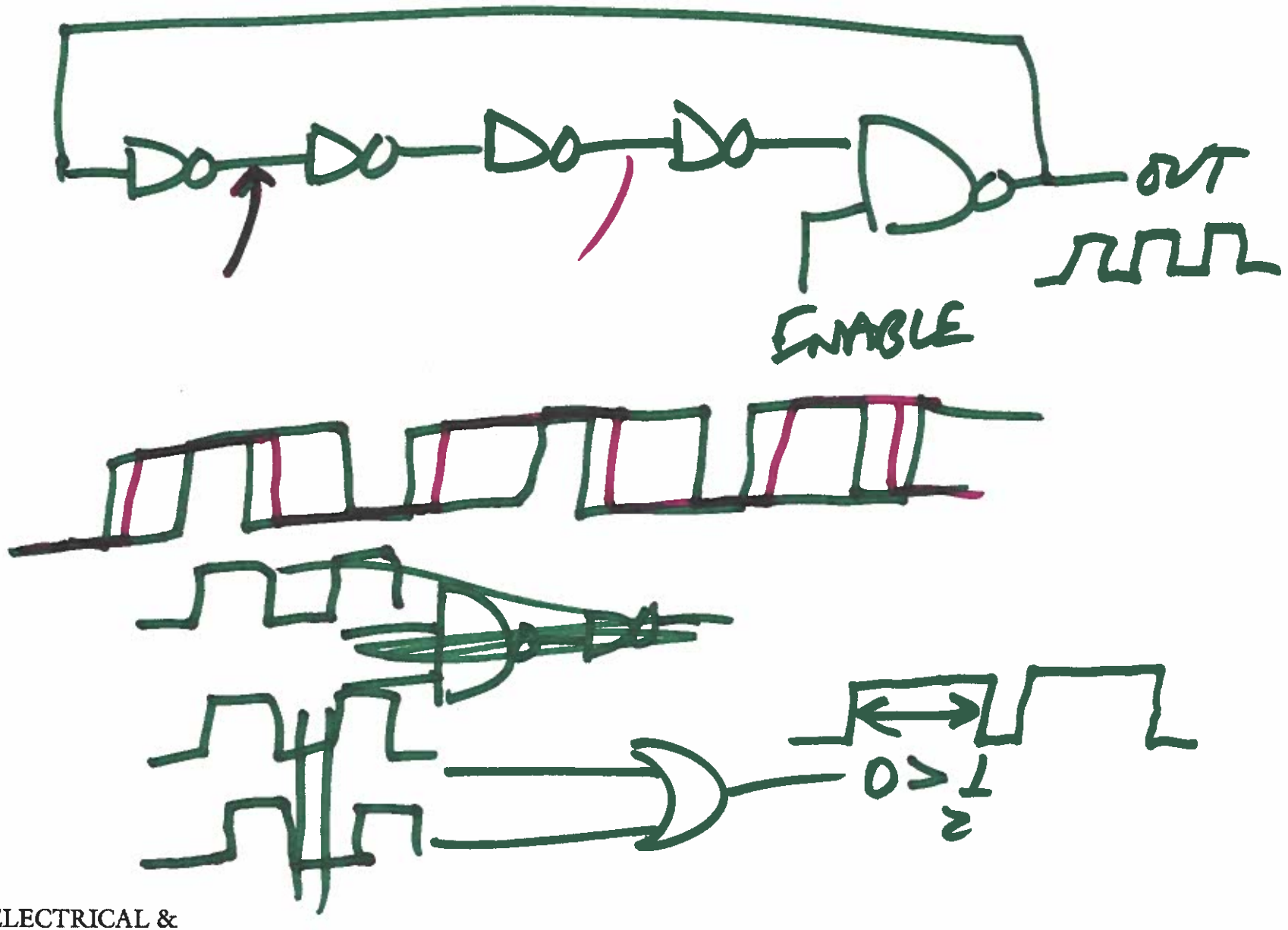
$$\boxed{V_{OUT} = \frac{V_S}{1 - D}}$$

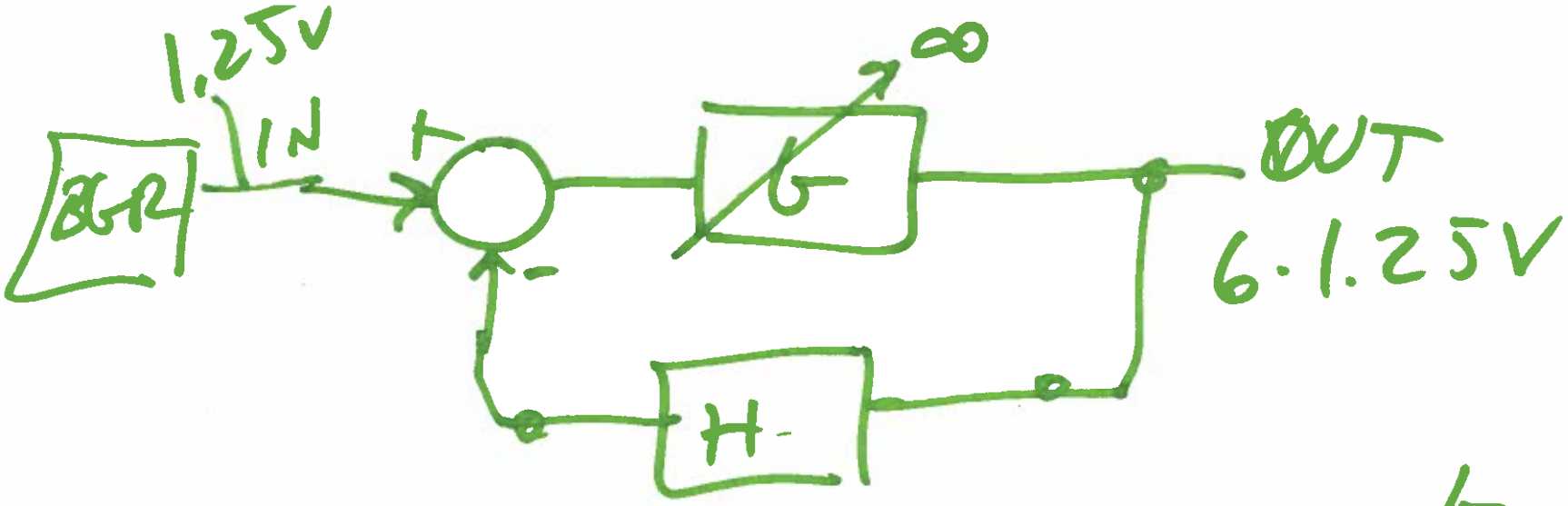

PMIC
L
ENABLE
OSC
driver
0 → 20mA
7.5V
DISABLE
Chip
8V → 1.35
50K
10K
$7.5 \cdot \frac{10K}{10K+50K} = 1.25V$
1.25V

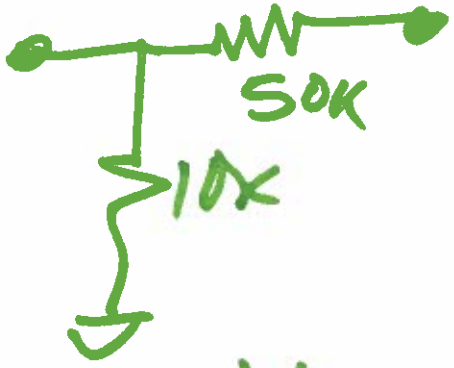
# Ring oscillator




OUT
ENABLE
0
1




$$H = \frac{1}{6}$$

$$\frac{OUT}{IN} = \frac{G}{1+GH}$$

$$= \frac{1}{\frac{1}{G}+H}$$

$$G \to \infty \quad \approx \quad \frac{1}{H}$$

$$= 6$$