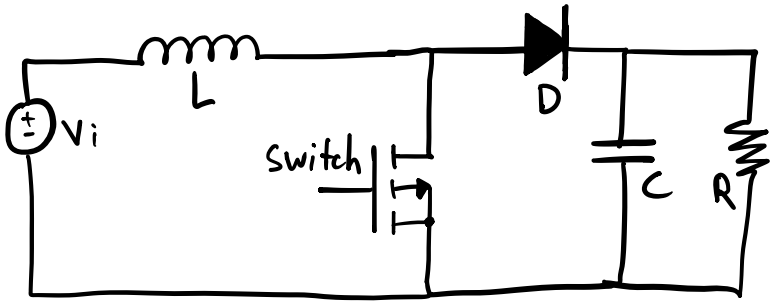
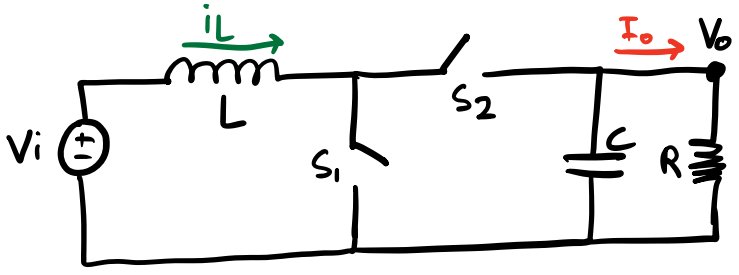
BOOST

Practical:



Ideal:



Case 1:

- Switch is ON, Short circuit through the switch so $I_o = 0$. Inductor is being charged and will hold a voltage

Case 2:

- Switch is OFF, Diode is conducting,

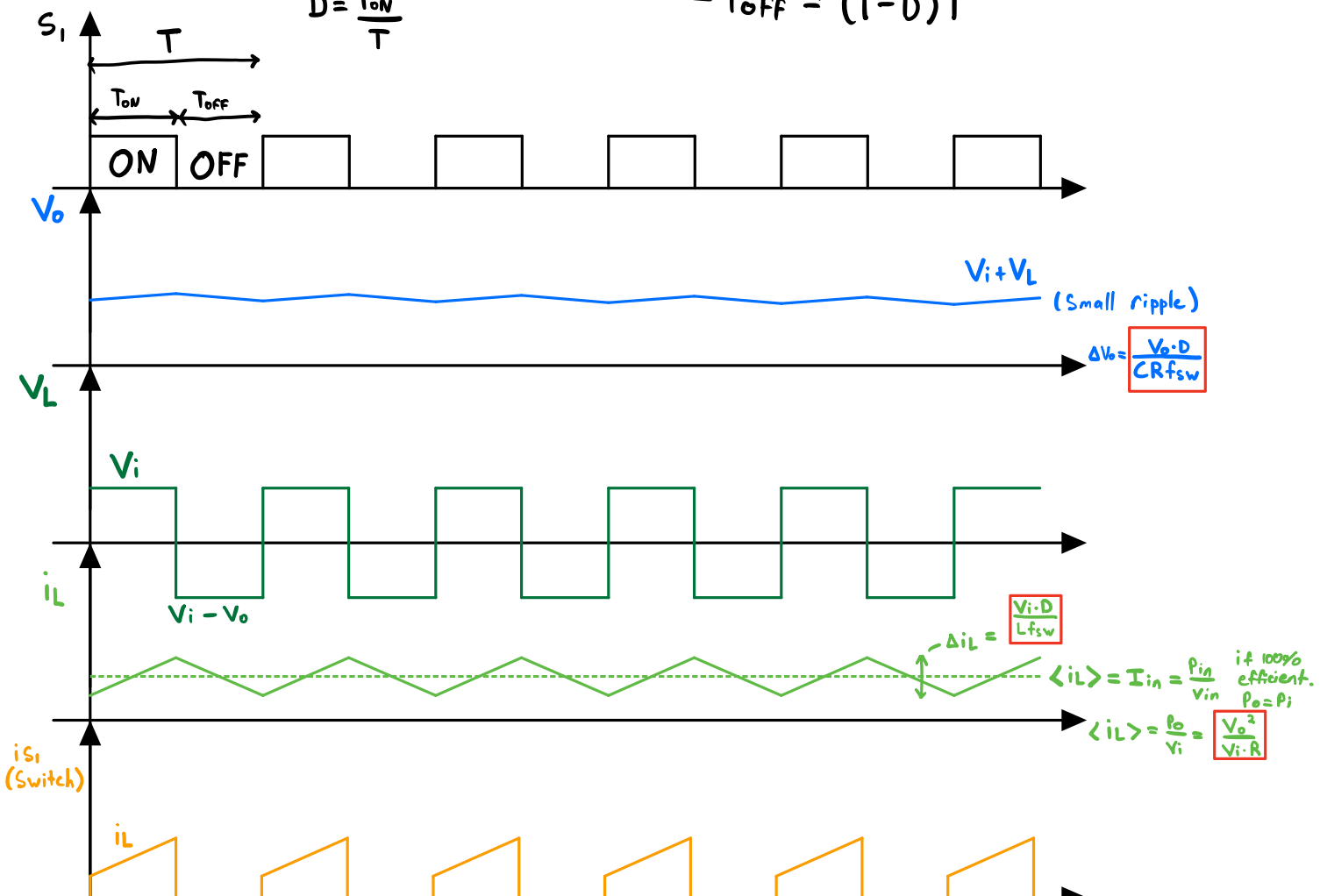
$V_o = V_i + V_L$

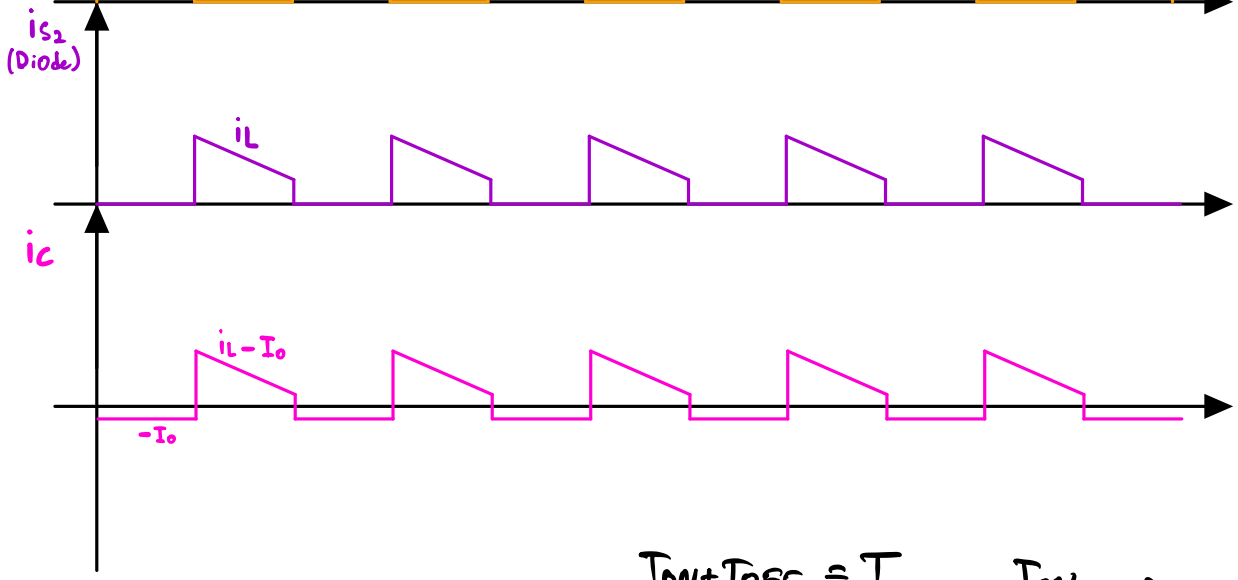
Case 3:

- Switch is ON, But diode is reverse biased. Inductor is being charged and we have a RC capacitor discharge circuit at the output

- $T_{ON} = DT$
- $T_{off} = (1-D)T$

$D = \frac{T_{ON}}{T}$





$T_{ON} + T_{OFF} = T$

$T_{OFF} = T - T_{ON}$

$\frac{T_{ON}}{T} = D$

Gain Equation:

$$V_i \cdot T_{ON} = (V_o - V_i) T_{OFF}$$

$$V_i T_{ON} = V_o T_{OFF} - V_i T_{OFF}$$

$$V_i DT = V_o (1-D)T - V_i (1-D)T$$

$$\cancel{V_i DT} = V_o T - V_o DT - V_i T + \cancel{V_i DT}$$

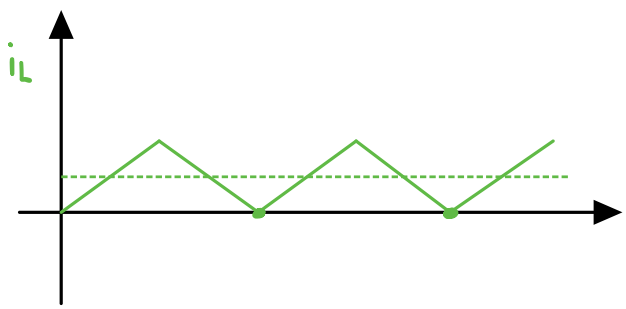
$$V_i T = V_o T - V_o DT$$

$$V_i = V_o - V_o D$$

$$V_i = V_o (1-D)$$

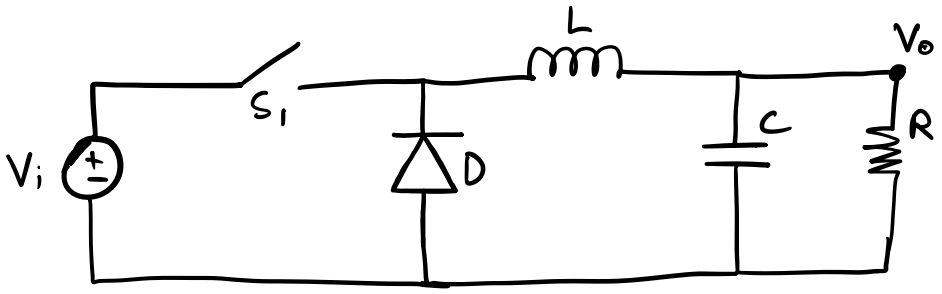
$$\frac{V_o}{V_i} = \frac{1}{(1-D)}$$

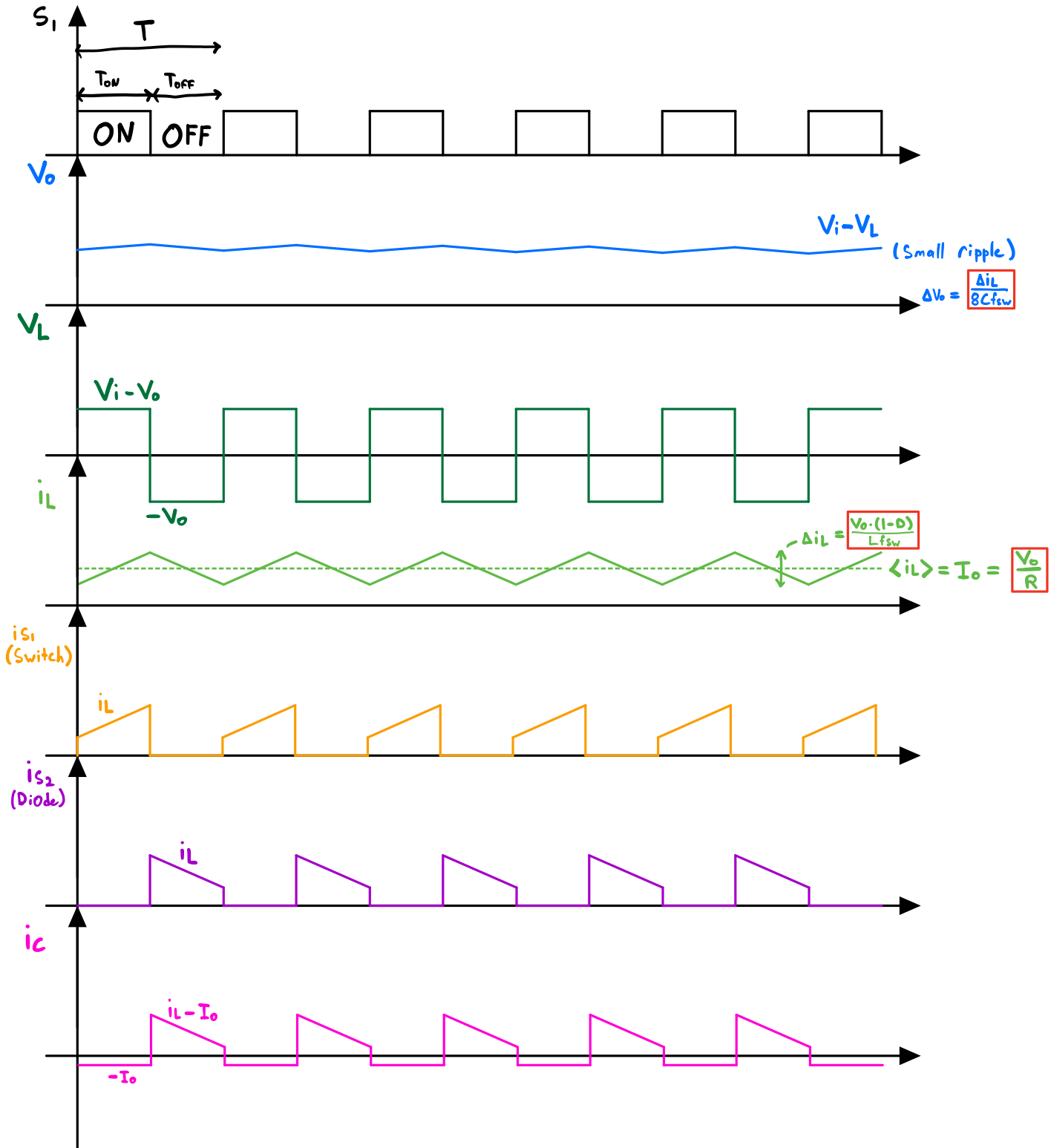
Discontinuous Conduction Mode:



Occurs when $\langle i_L \rangle = \frac{\Delta i_L}{2}$

BUCK


L
V_o
S_1
C
R
V_i
D


S_1
T
T_{ON}
T_{OFF}
ON
OFF
V_o
$V_i - V_L$
(Small ripple)
$\Delta V_o = \frac{\Delta i_L}{8Cf_{sw}}$
V_L
$V_i - V_o$
$-V_o$
i_L
$\Delta i_L = \frac{V_o \cdot (1-D)}{L f_{sw}}$
$\langle i_L \rangle = I_o = \frac{V_o}{R}$
i_{S_1} (Switch)
i_L
i_{S_2} (Diode)
i_L
i_C
$i_L - I_o$
$-I_o$

Gain Equation:

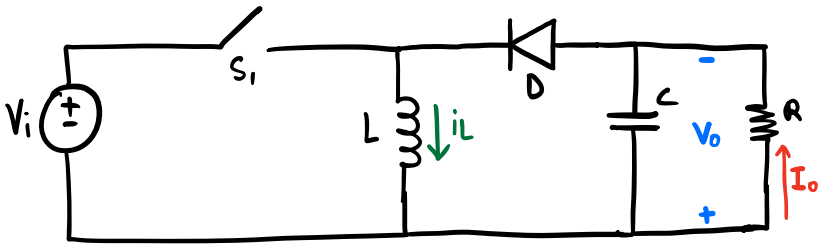
$$(V_i - V_o)DT = V_o(1-D)T$$

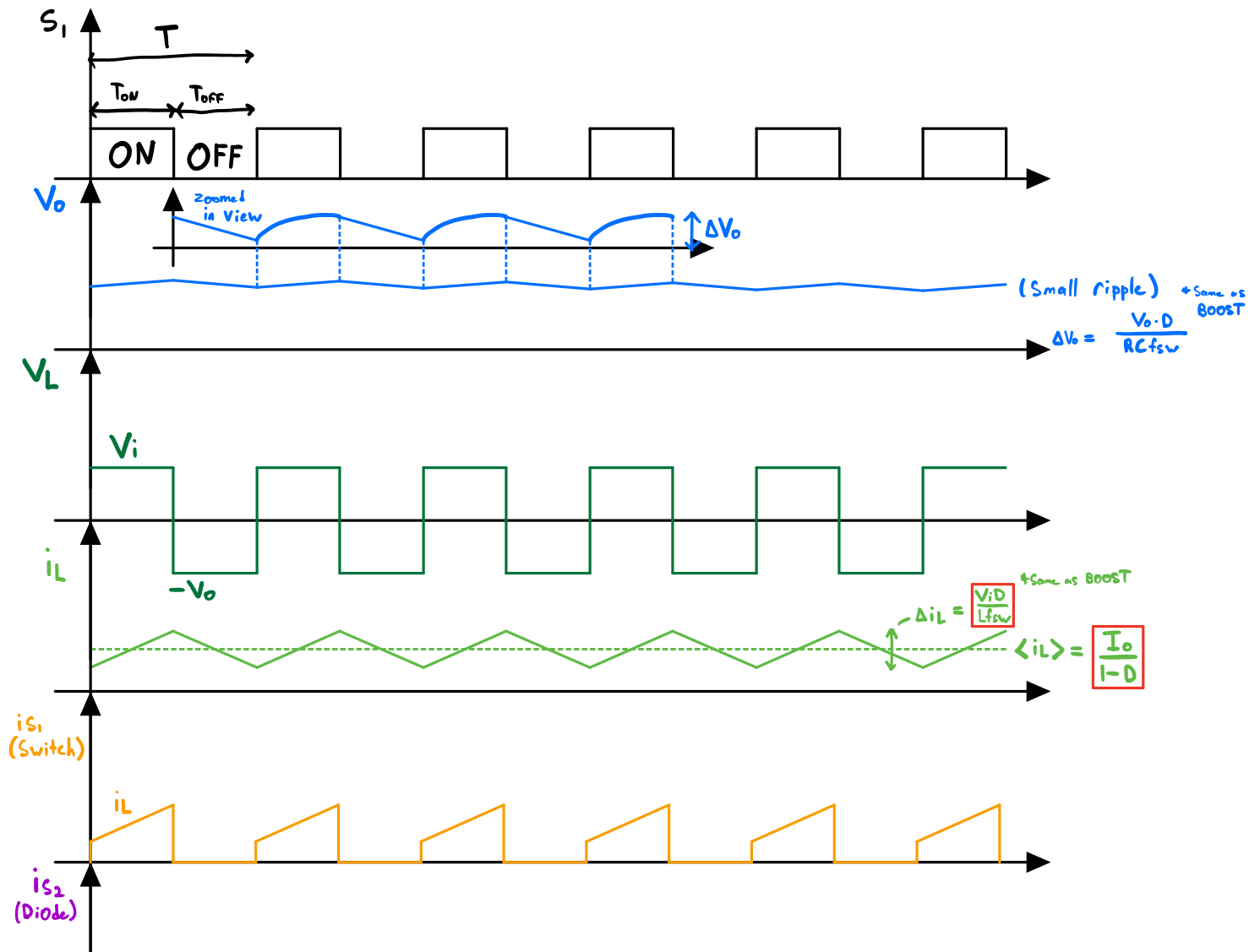
$$V_iDT - \cancel{V_oDT} = V_oT - \cancel{V_oDT}$$

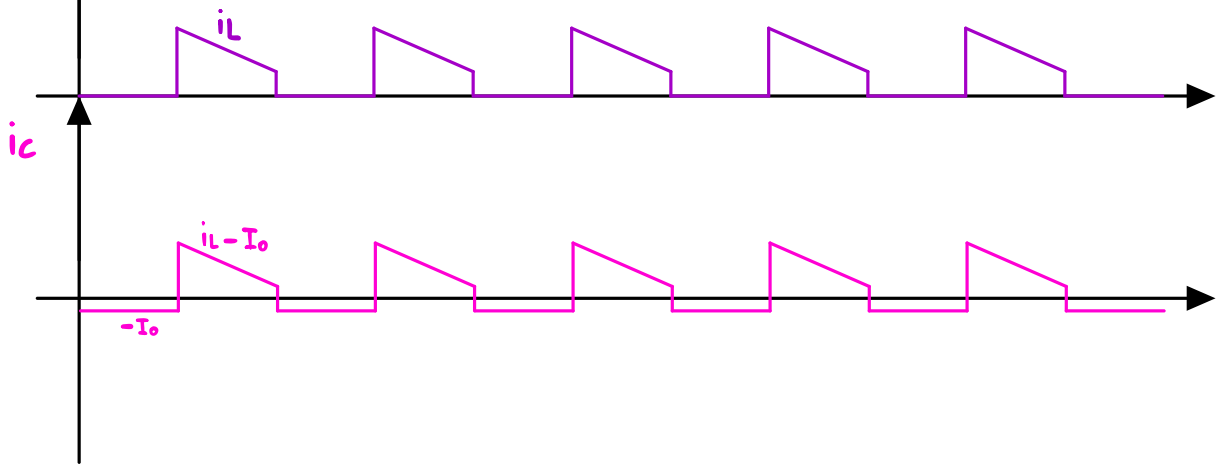
$$V_iD = V_o$$

$$\frac{V_o}{V_i} = D$$

BUCK-BOOST







Gain Equation :

$$V_i DT = V_o(1-D)T$$

$$V_i D = V_o - V_o D$$

$$V_i D = V_o(1-D)$$

$$\frac{V_o}{V_i} = \frac{D}{(1-D)}$$