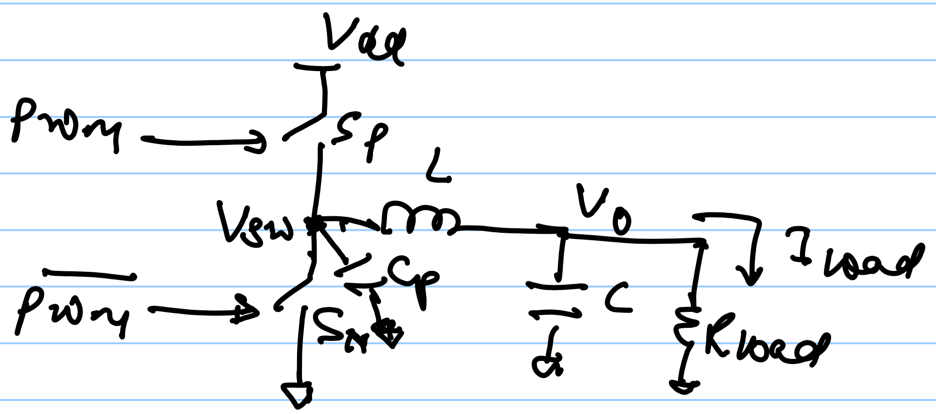
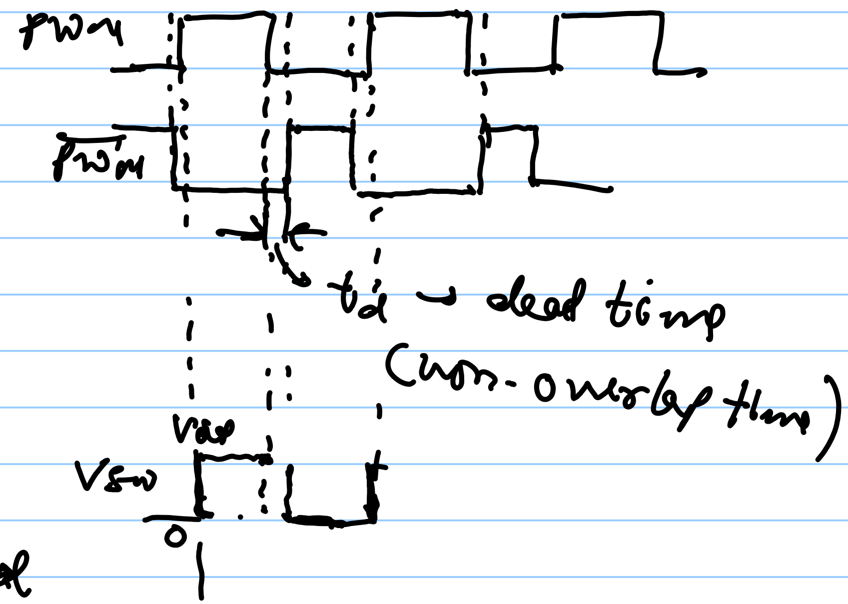
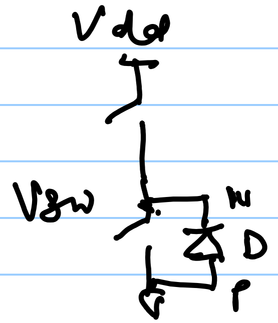
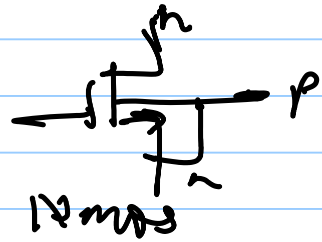
Dead time switching losses:



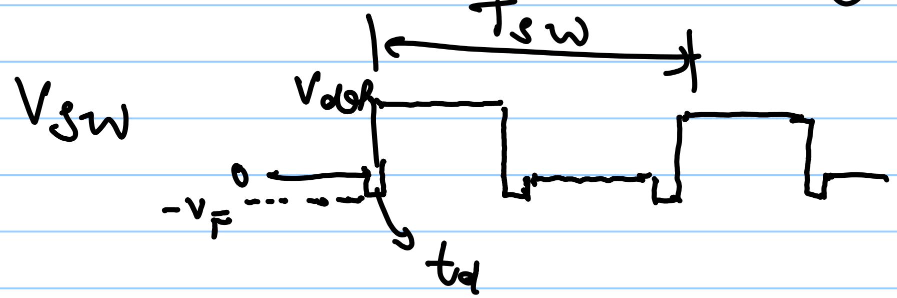


PWM & $\overline{PWM}$ are non-overlapped





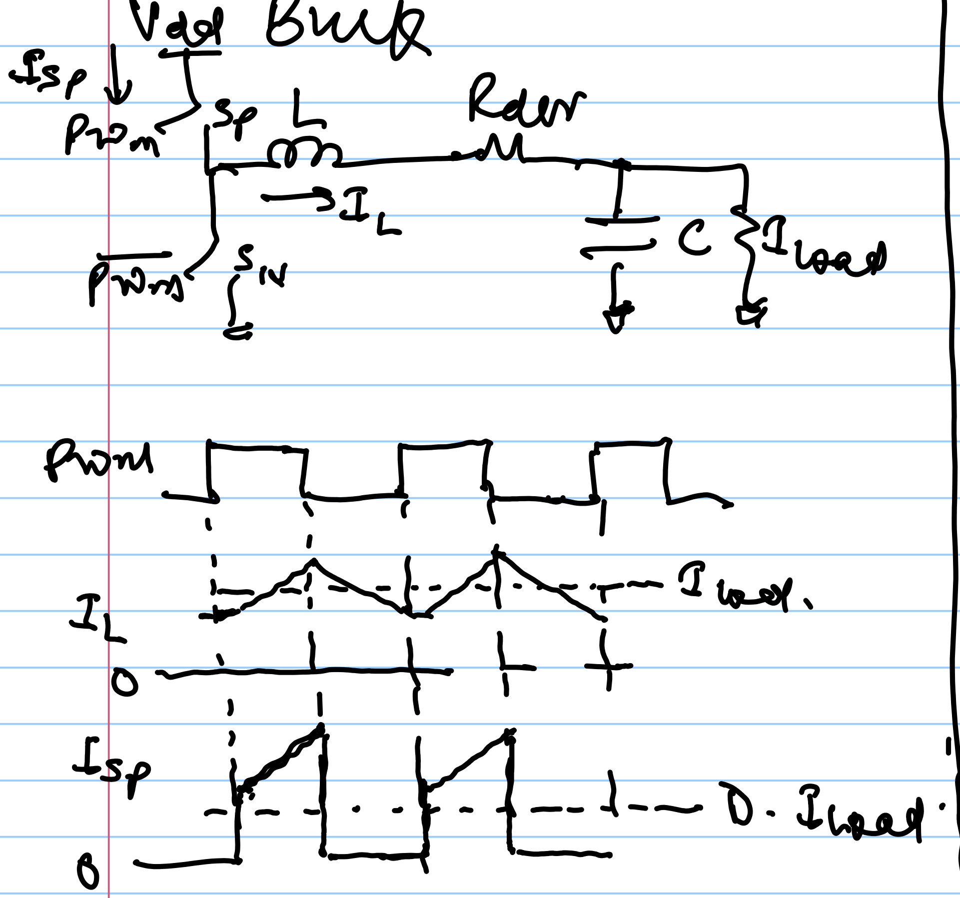
diode D is conducting during dead time



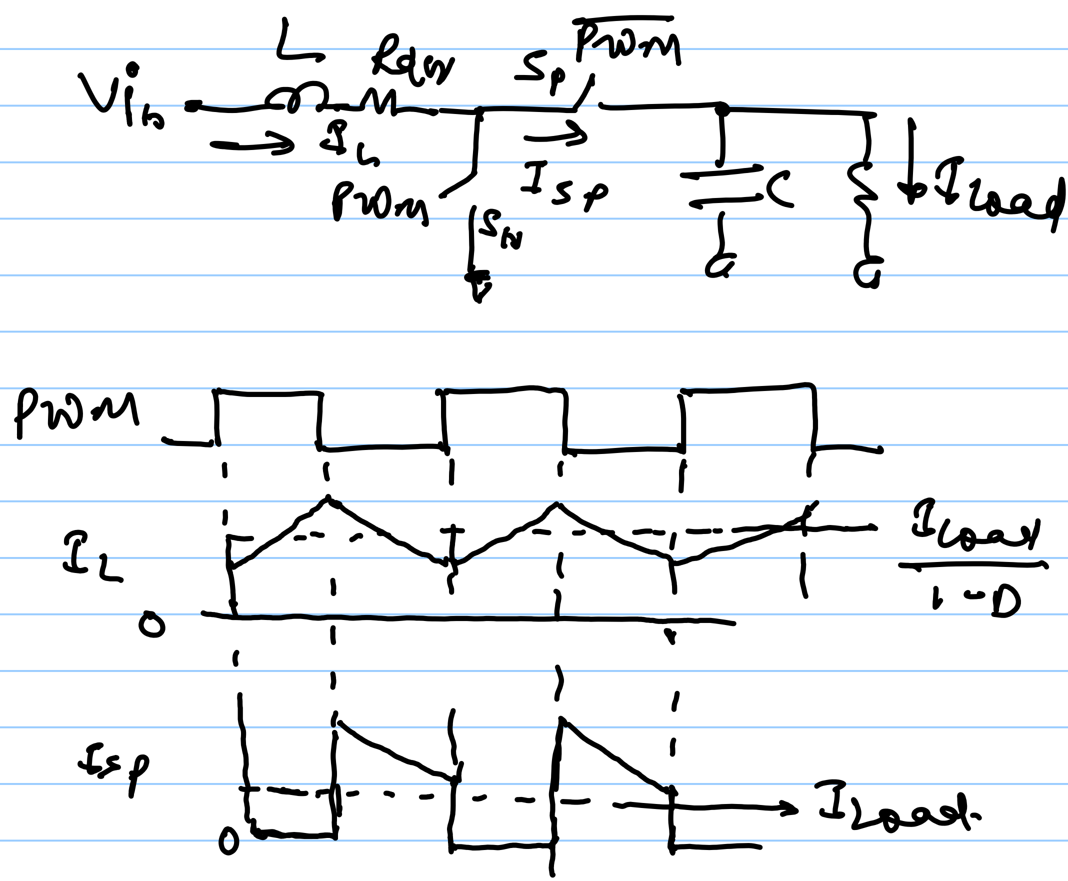
Total power consumption in diode

$$2 \times \frac{(V_F \times I_{load})\, t_d}{T_{SW}}$$

Buck

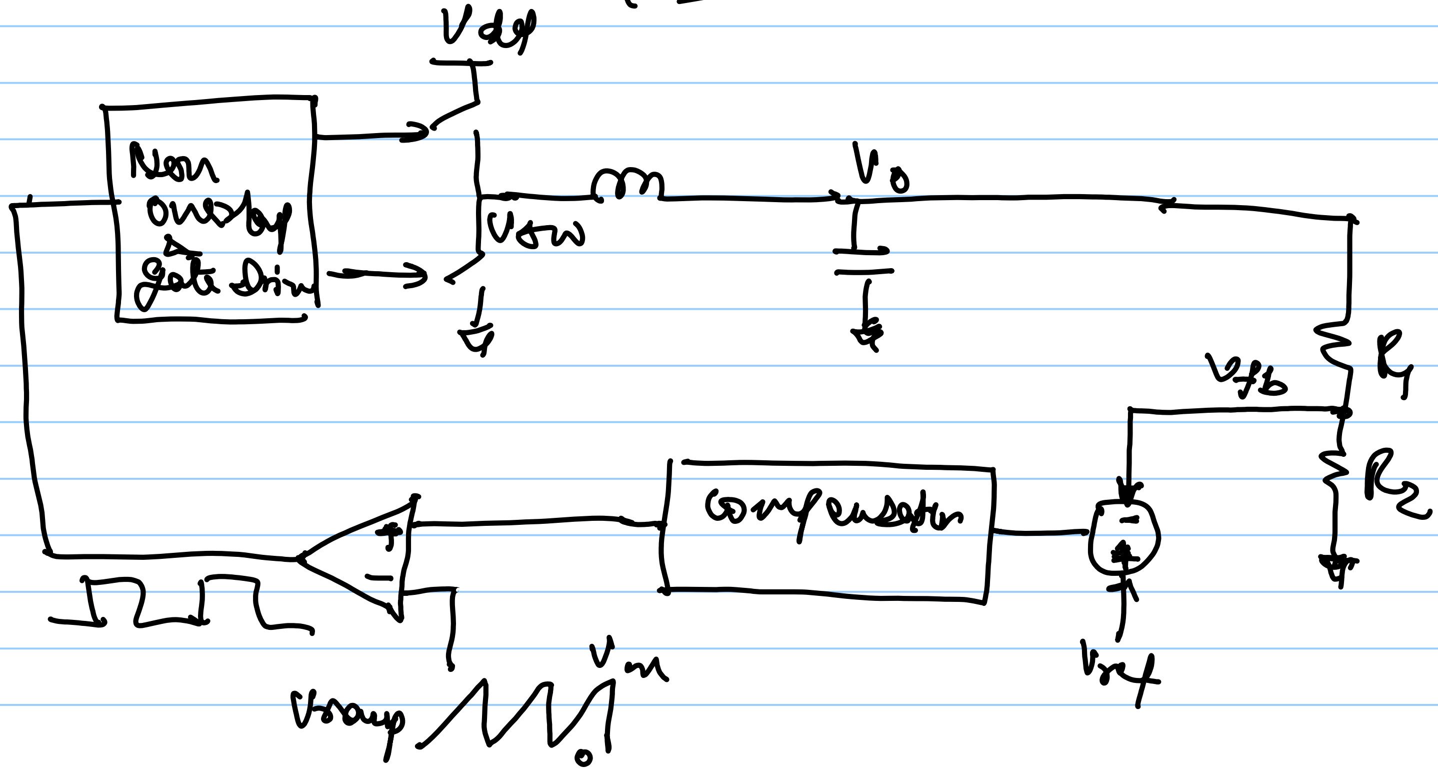

Vdd
Isp
PWM
Sp
L
Rdcr
IL
PWM
SN
C
Iload
PWM
IL
Iload.
0
Isp
D. Iload
0

Boost


Vin
L
Rdcr
Sp
PWM
IL
Isp
PWM
SN
C
Iload
PWM
IL
Iload / 1-D
0
Isp
Iload.
0

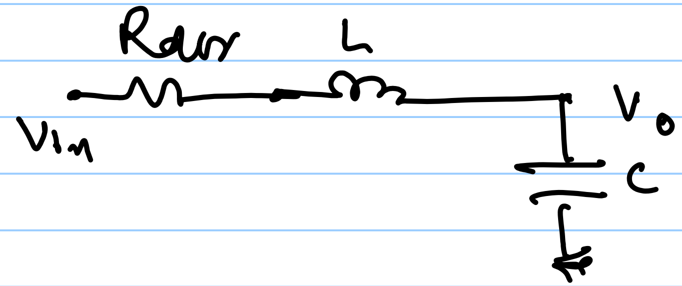
$$\frac{I_{load}}{1-D} - I_{load} = I_{load}\left(\frac{1 - 1 + D}{1-D}\right)$$

Control Technique



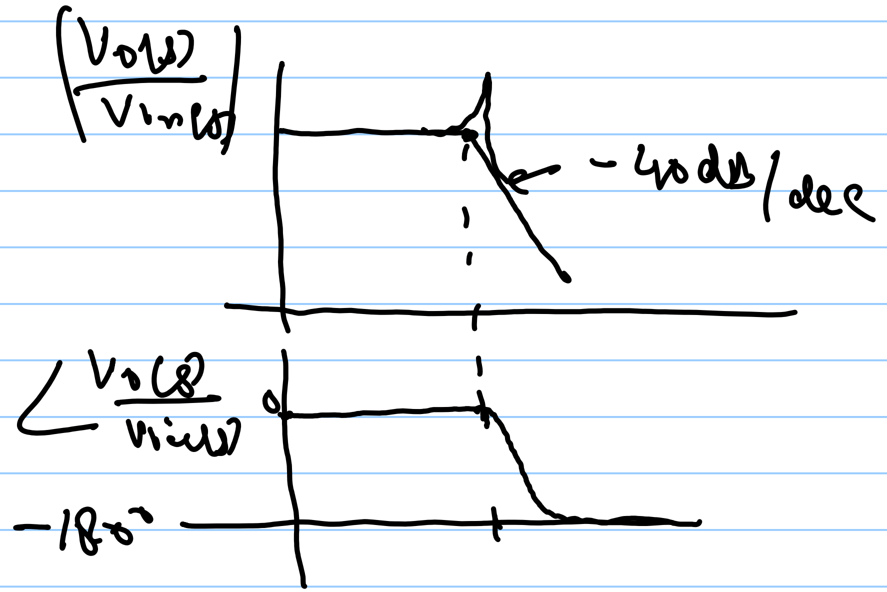
$$V_o = \left(1 + \frac{R_1}{R_2}\right) V_{ref}$$

$$= \frac{V_{ref}}{\beta}$$



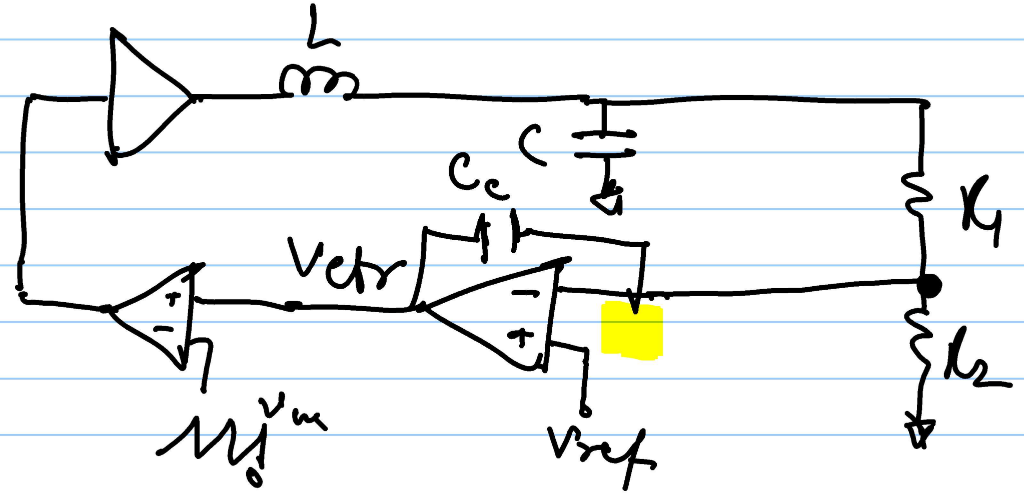
$$\frac{V_o(s)}{V_{in}} = \frac{1/LC}{s^2 + \frac{R_{dcr}}{L}s + \frac{1}{LC}}$$

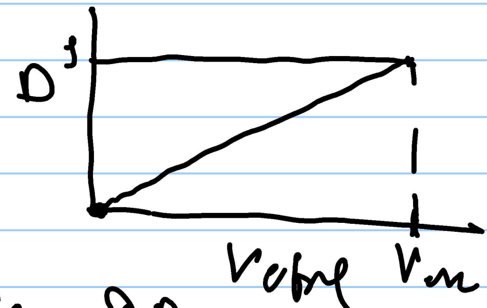
$$\omega_o = \frac{1}{\sqrt{LC}} \quad , \quad \frac{\omega_o}{Q_o} = \frac{R_{dcr}}{L}$$



Buck is inherently unstable due to LC resonance poles hence require compensation.

We can do dominant pole compensation by using an integrator.





$$gain = \frac{\partial D}{\partial V_{ctrl}} = \frac{1}{V_m}$$

chose $\frac{1}{R_1 C_c} << \frac{\omega_0}{Q_0}$