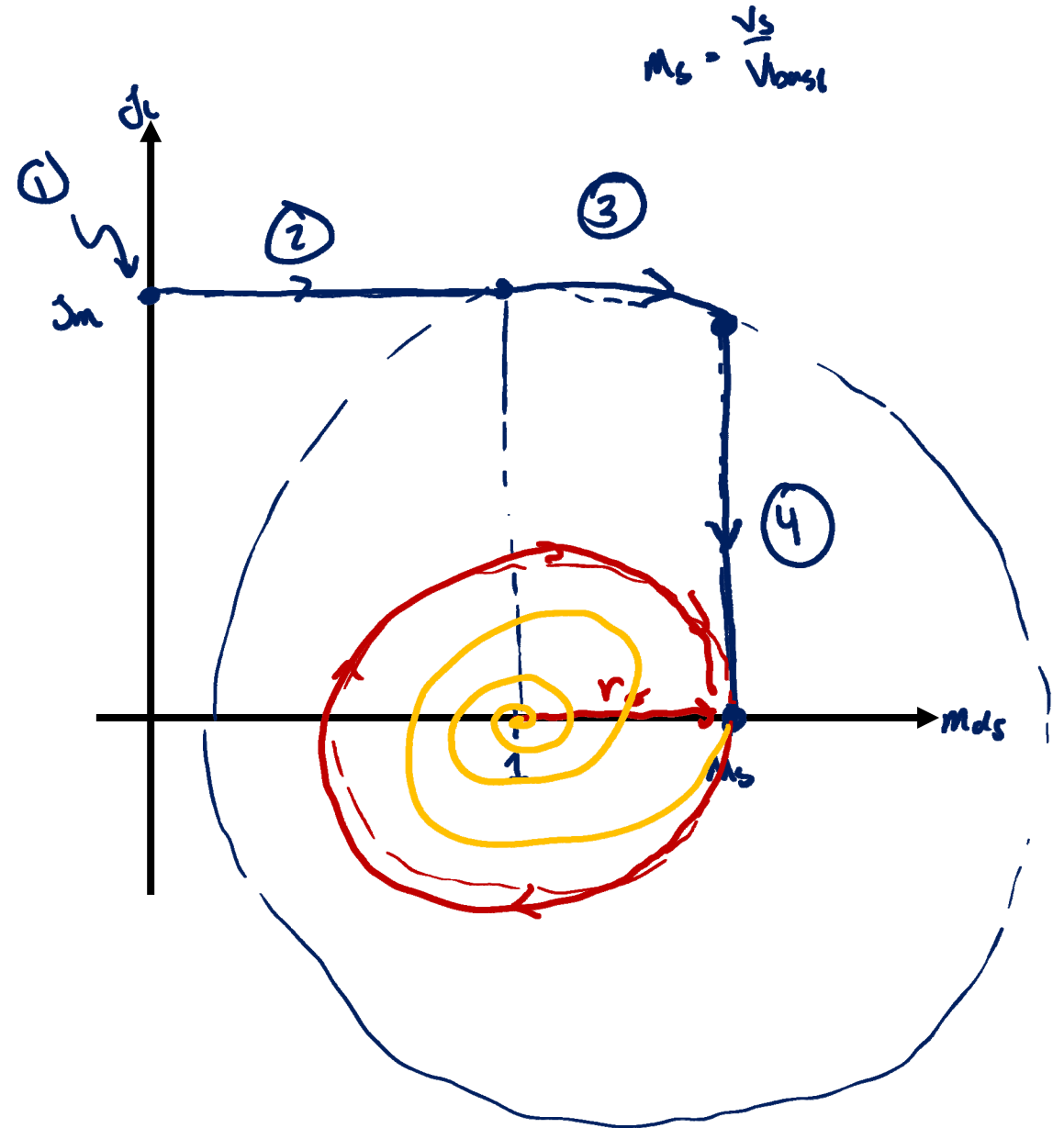
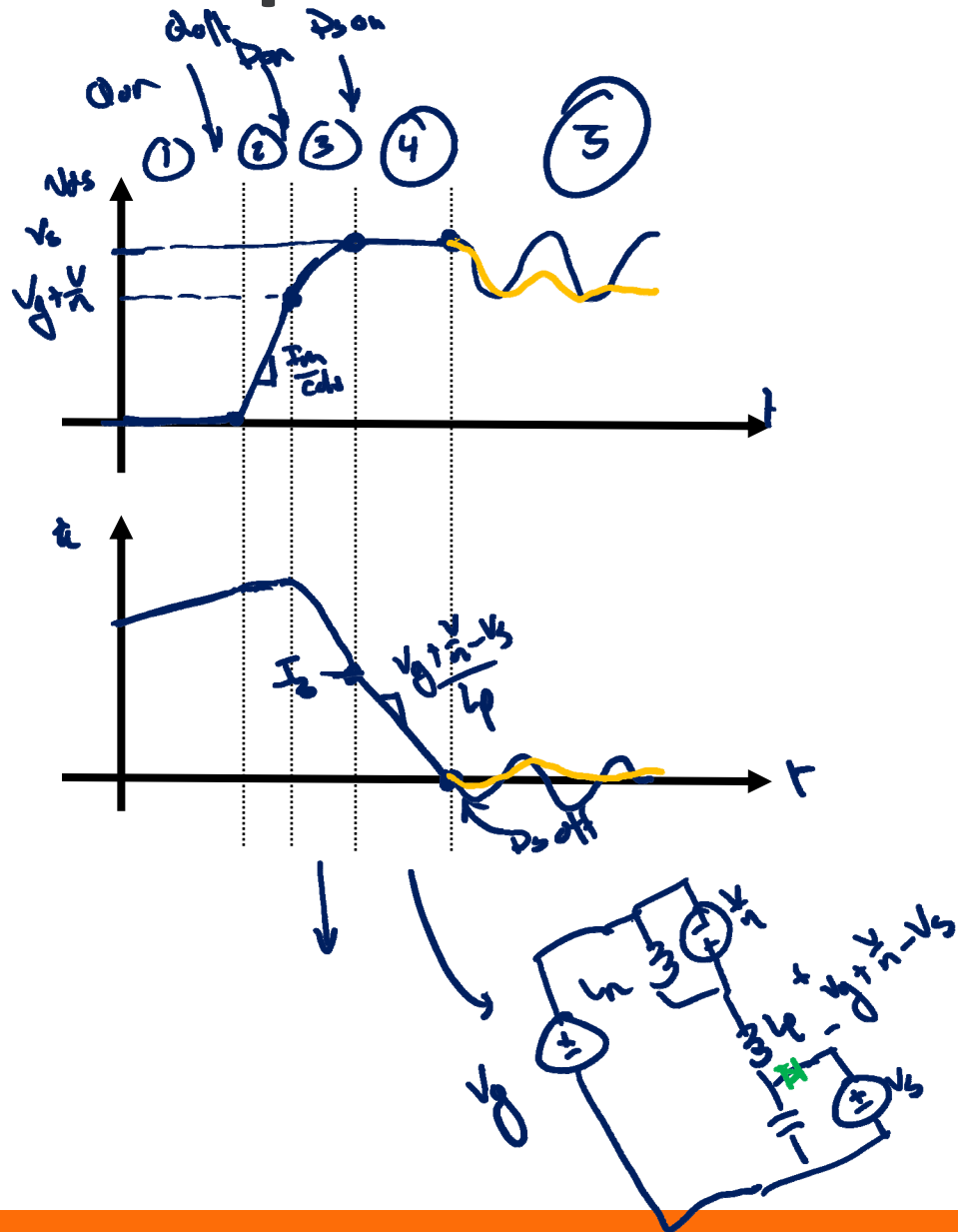


Clamped State Plane



Loss Comparison

for $V_s = 850V$

Assume ringing damps out in ⑤

$$\Delta E_d = \phi - \phi$$

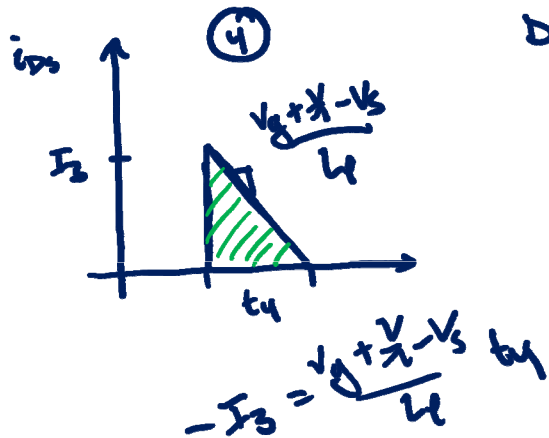
$$\Delta E_c = \frac{1}{2} C_{os} V_s^2 - \frac{1}{2} C_{os} (V_g + \frac{V}{n})^2 = 4.125 \mu J$$

$$0.125 \mu J$$

$$125 mW$$

$$E_v = (V_g + \frac{V}{n}) \underbrace{C_{os} (V_s - V_g - \frac{V}{n})}_{Q_c} = 4 \mu J$$

Q_c



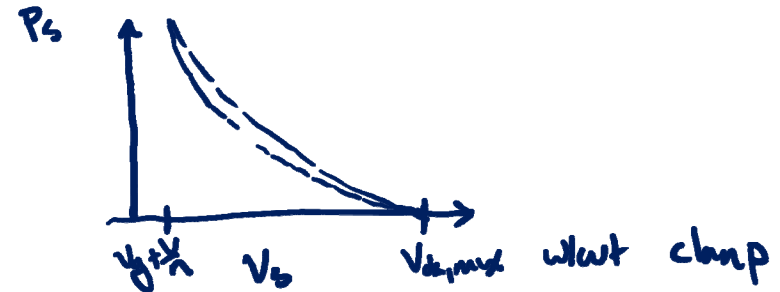
During ④ energy removed from circuit into V_s

$$E_s = V_s \int i_{DS} dt = V_s \frac{1}{2} I_3 t_4 = V_s \frac{1}{2} I_3 \left[\frac{I_3 L t}{V_s - V_g - \frac{V}{n}} \right]$$

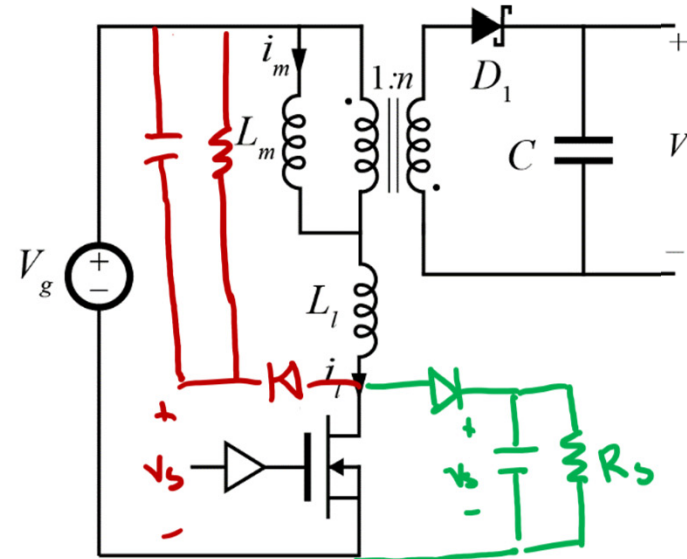
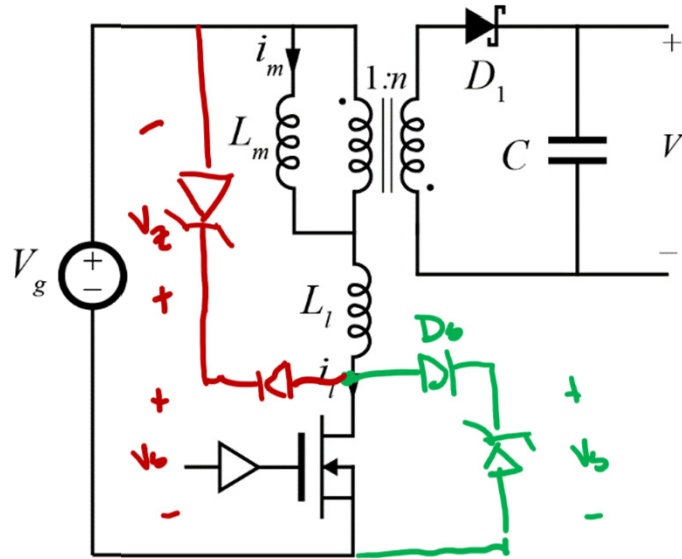
for $V_s = 850V$

$$E_s = 72 \mu J$$

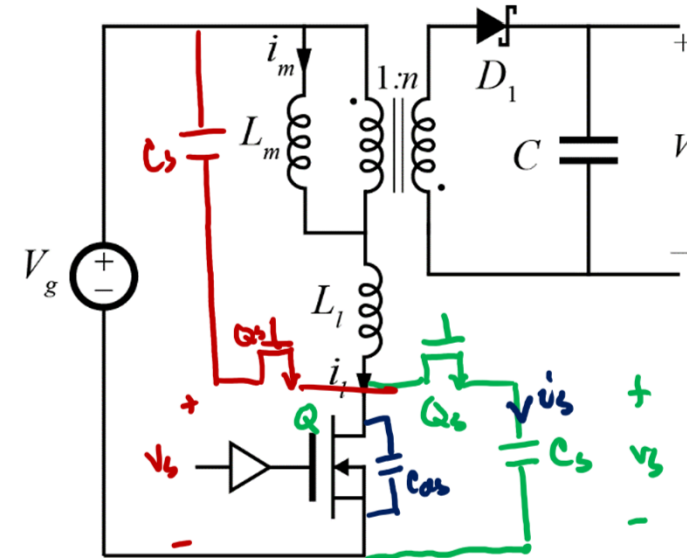
$$P_s = 72W !!$$



Clamp Implementations



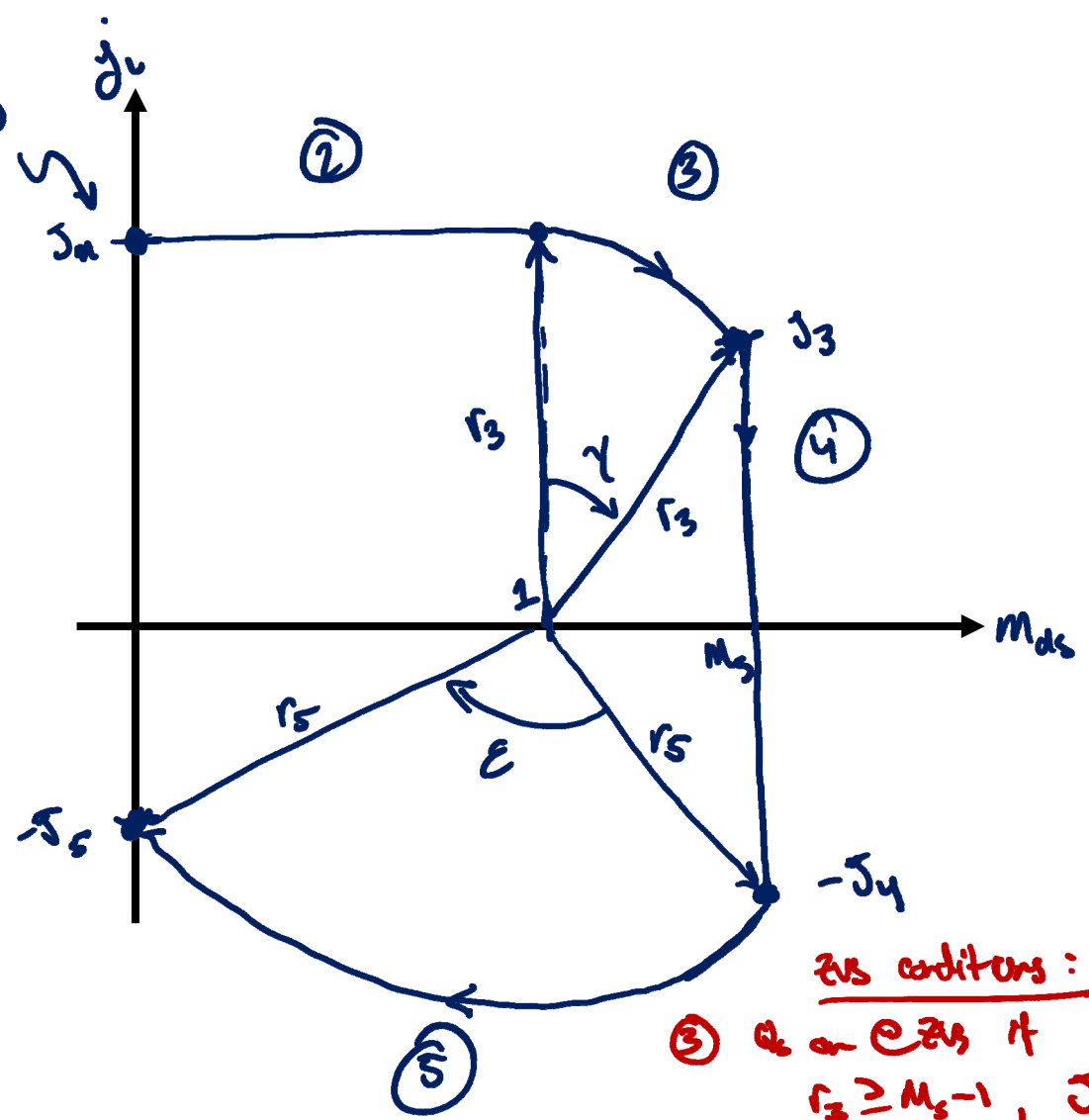
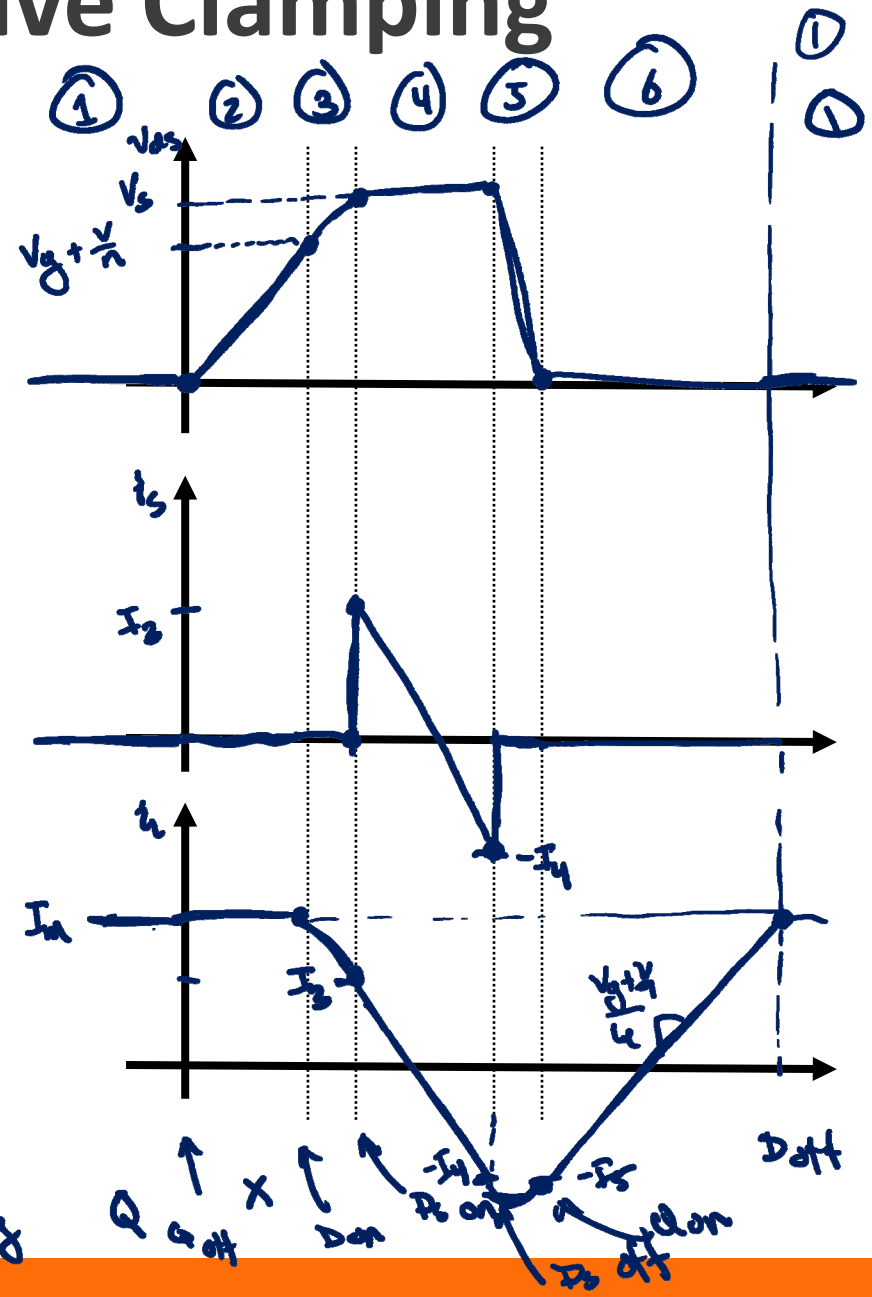
Active Clamping



Assume C_s ($\neq L_m \neq C$) are large filter elements

$$V_{Dmax} = V_g + \frac{V}{n}$$

Active Clamping



zvs conditions:

③ Q on @ zvs if $r_3 \geq m_3 - 1$, $j_m \geq m_6 - 1$

⑤ Q on @ zvs $r_5 \geq 1$
 $(m_6 - 1)^2 + j_1^2 \geq 1$

Subinterval Equivalent Circuits

