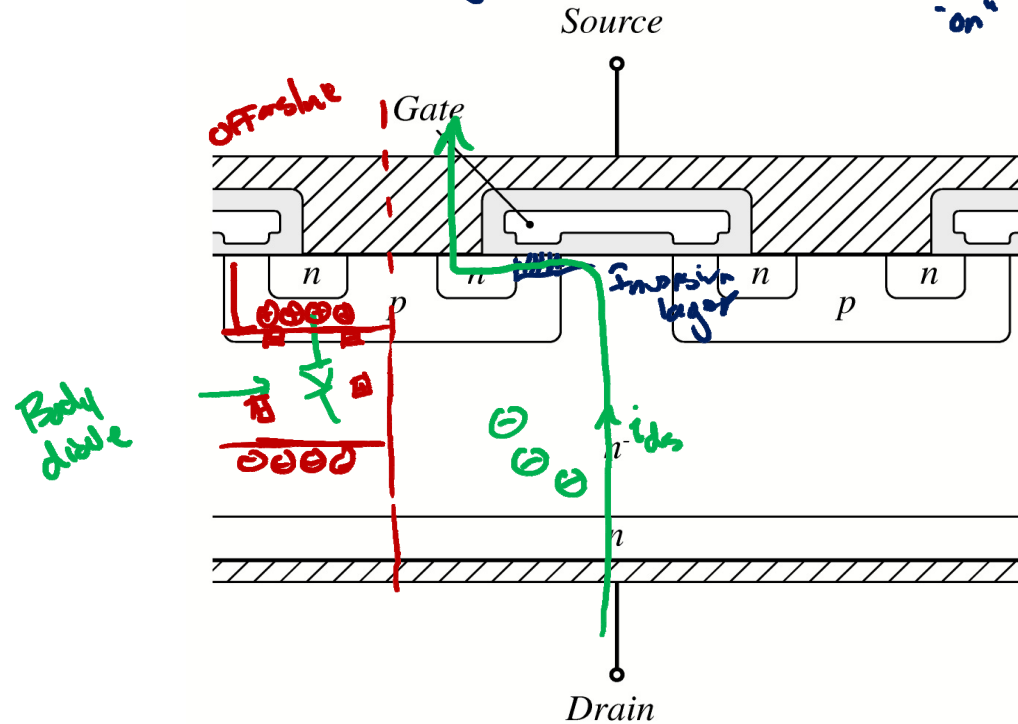
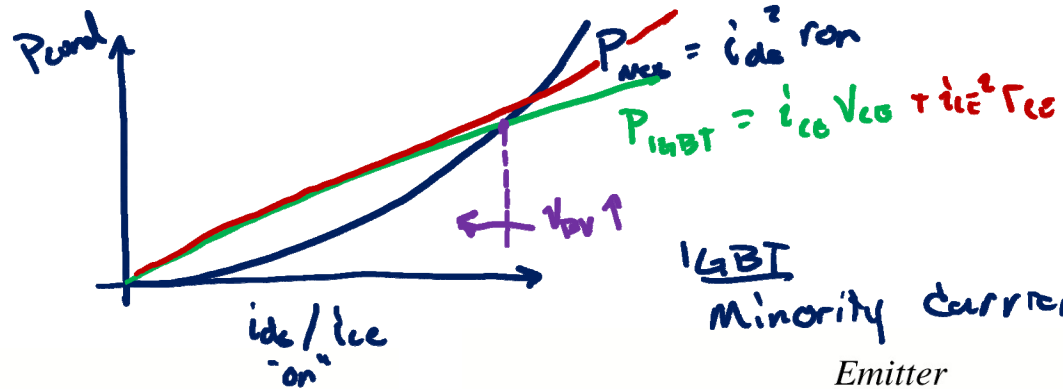
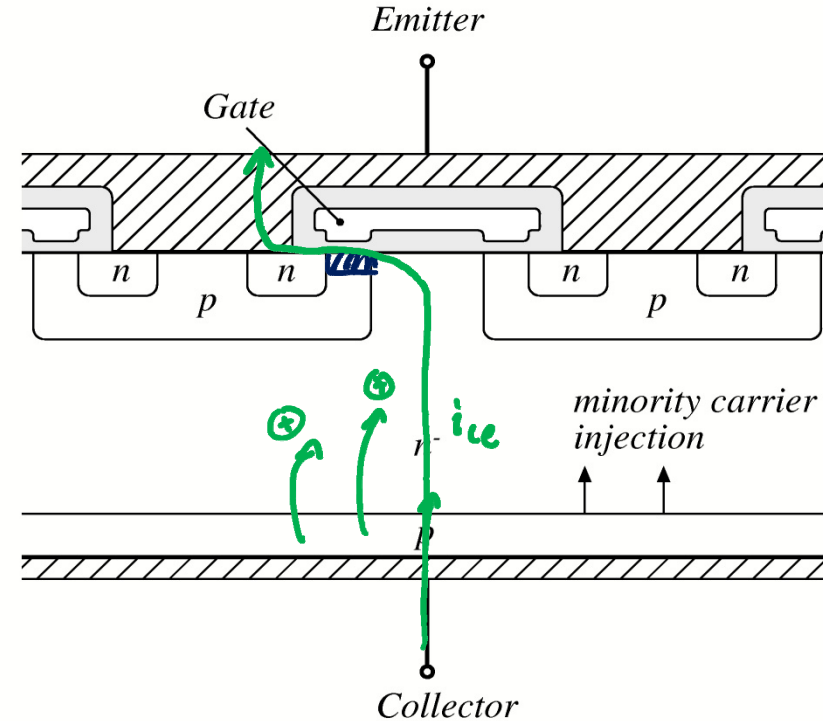


Charge Storage

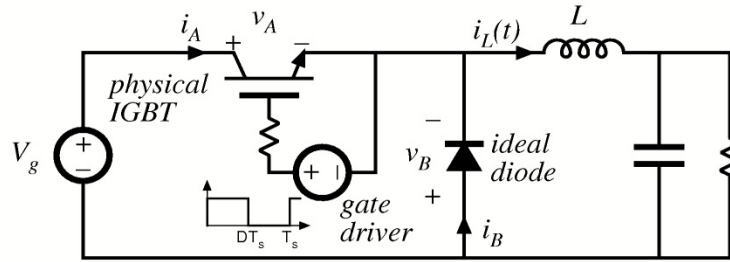


- r_{on} -vs- V_{th} fixed tradeoff
- + No minority stored charge



- stored minority charge
- + "conductivity modulation" $\rightarrow$ doping density doesn't dictate conductivity in on-state

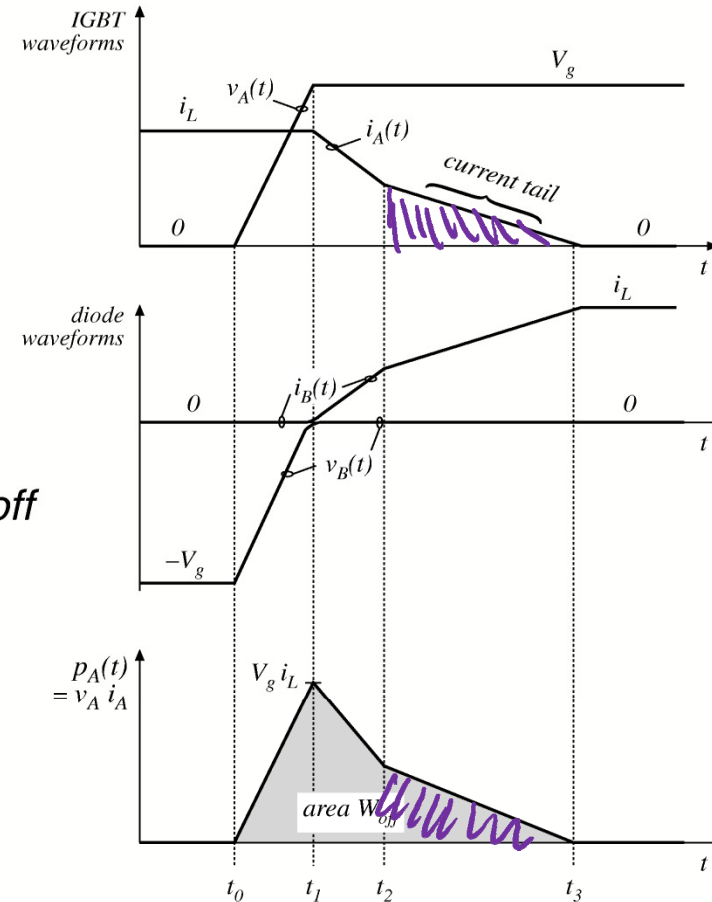
IGBT Current Tailing



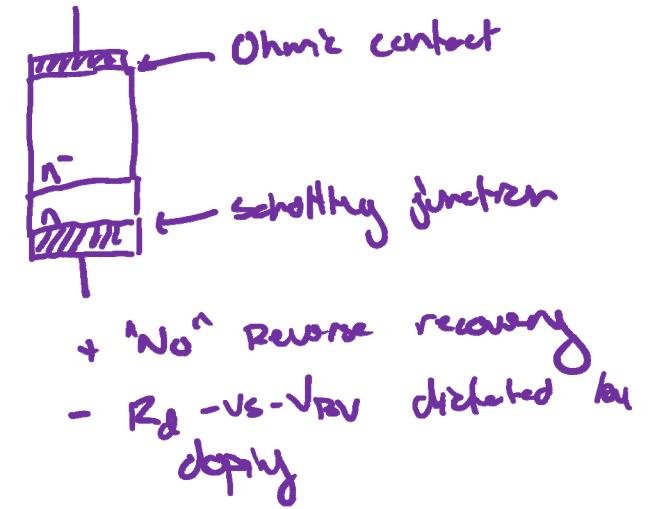
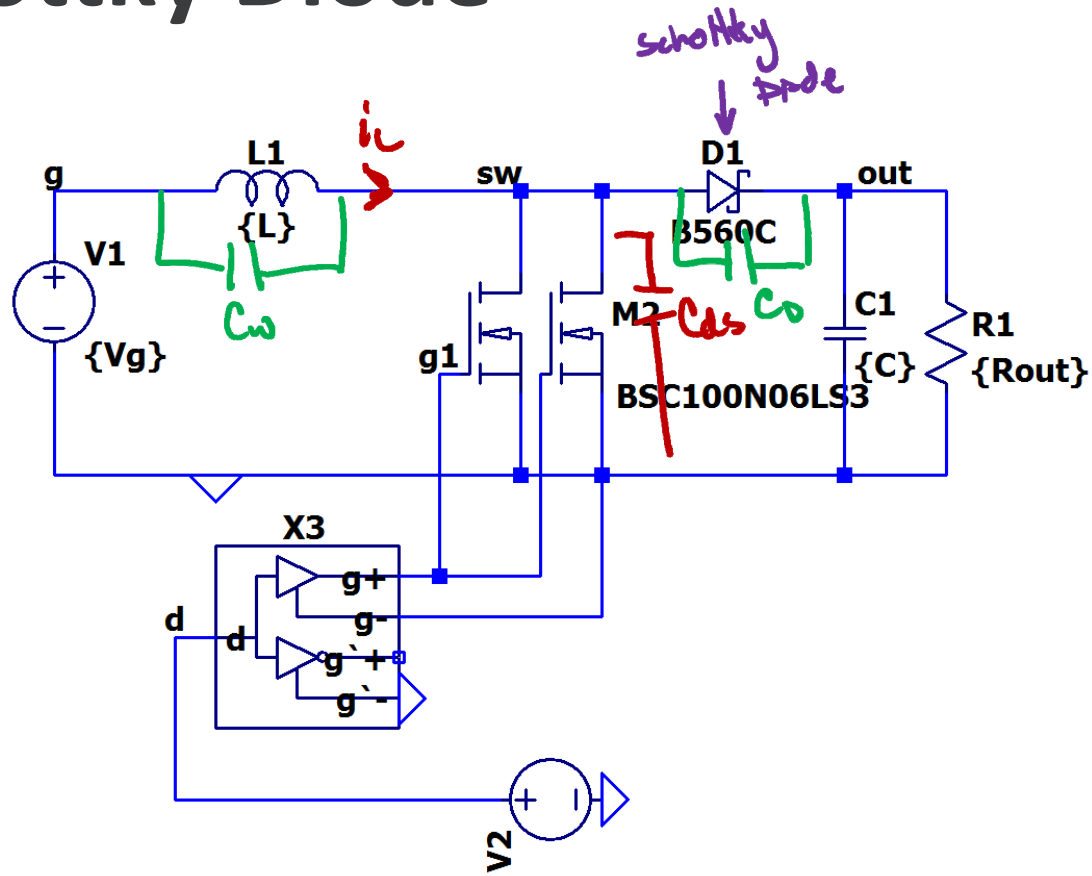
Example: buck converter with IGBT

transistor turn-off
transition

$$P_{sw} = \frac{1}{T_s} \int_{\text{switching transitions}} p_A(t) dt = (W_{on} + W_{off}) f_s$$



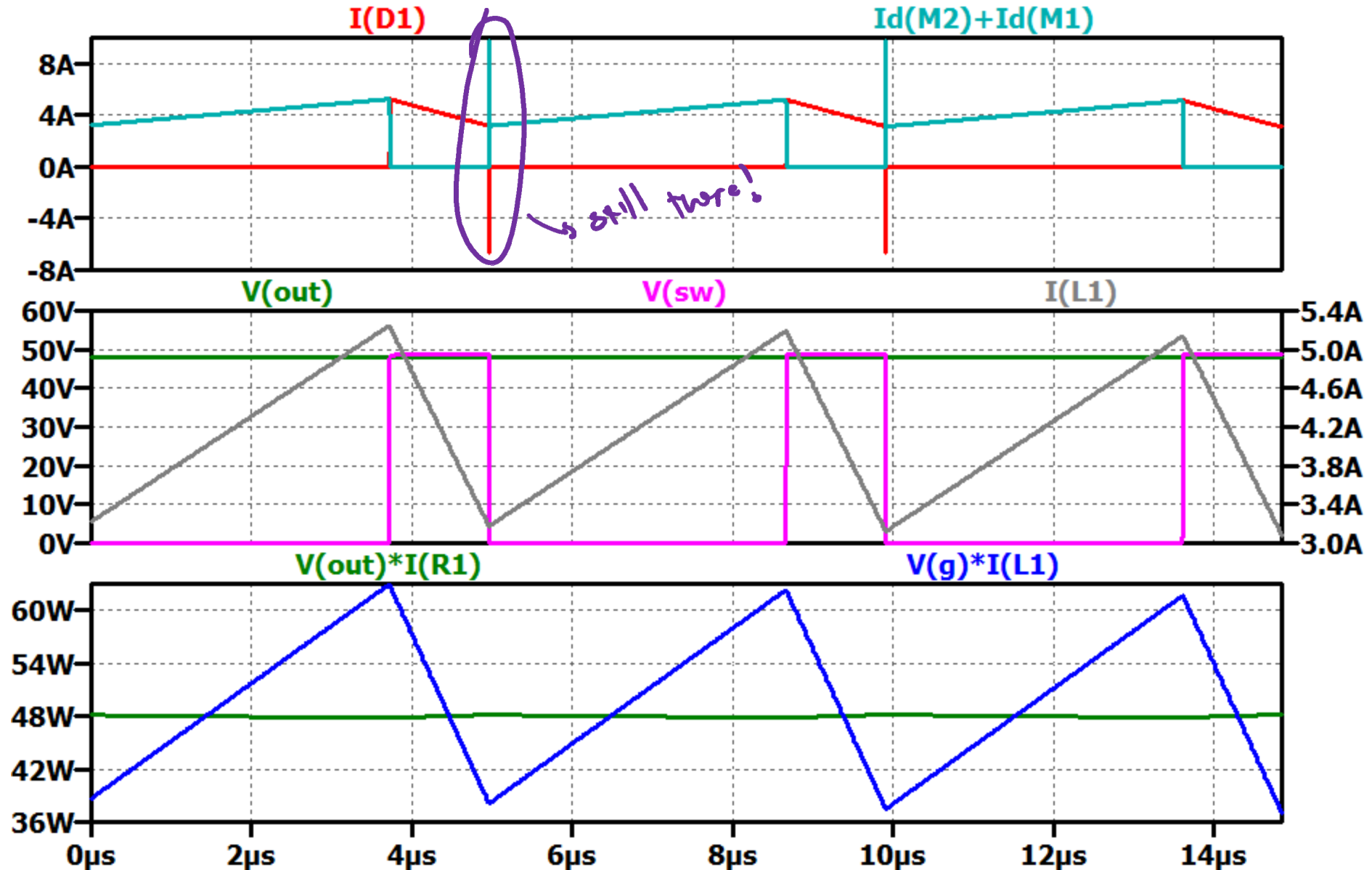
Schottky Diode



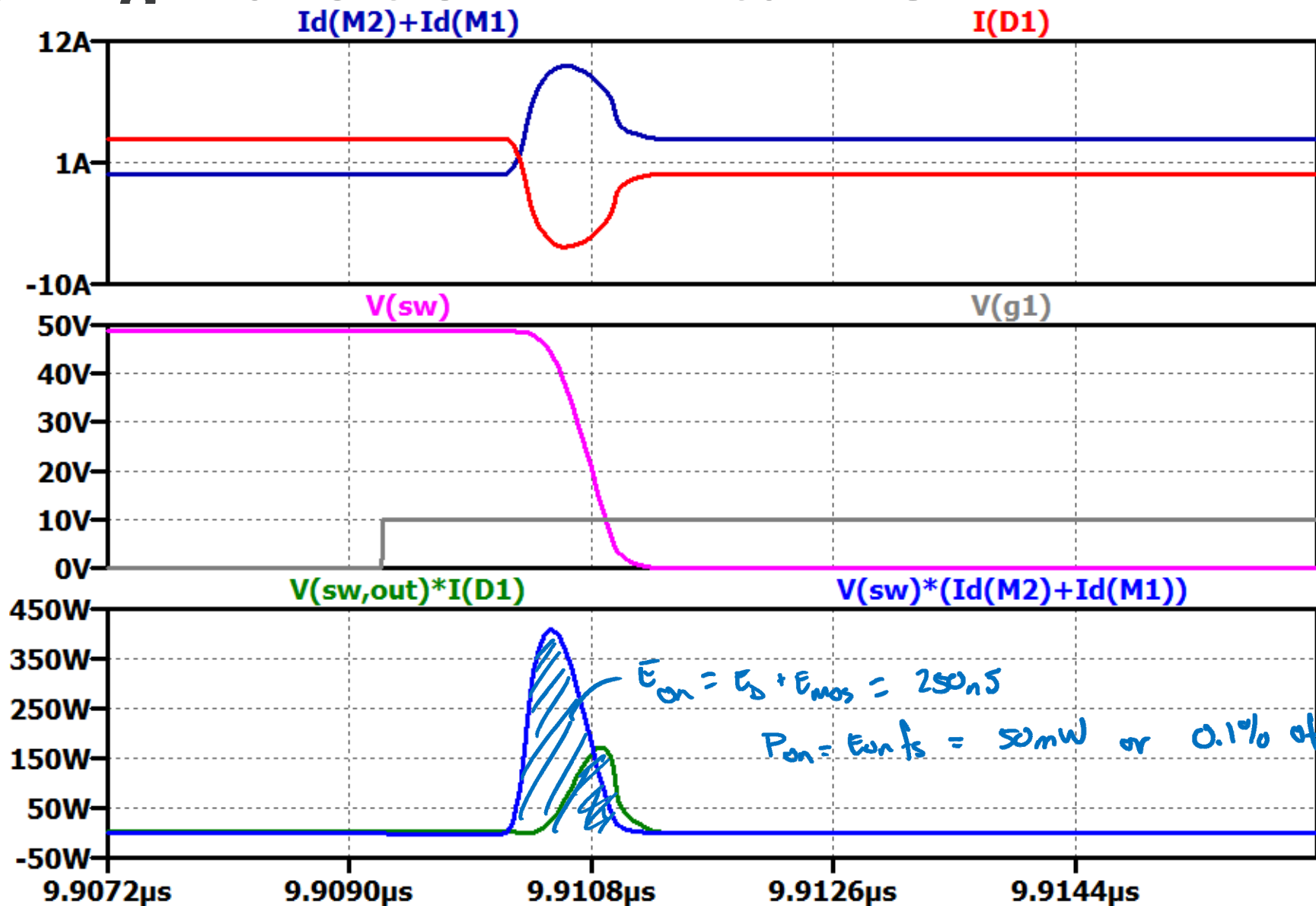
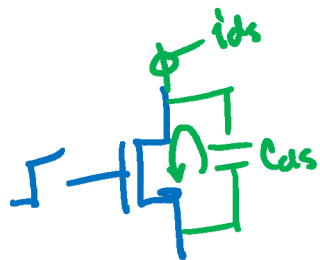
L	C_{out}	f_s	Diode	η (Sim)
22uH	22uF	202k	Si (FR)	93.9%
22uH	22uF	202k	Si Schottky	95.8%

*~ 2% increase in ?
(But were hoping for 3%)*

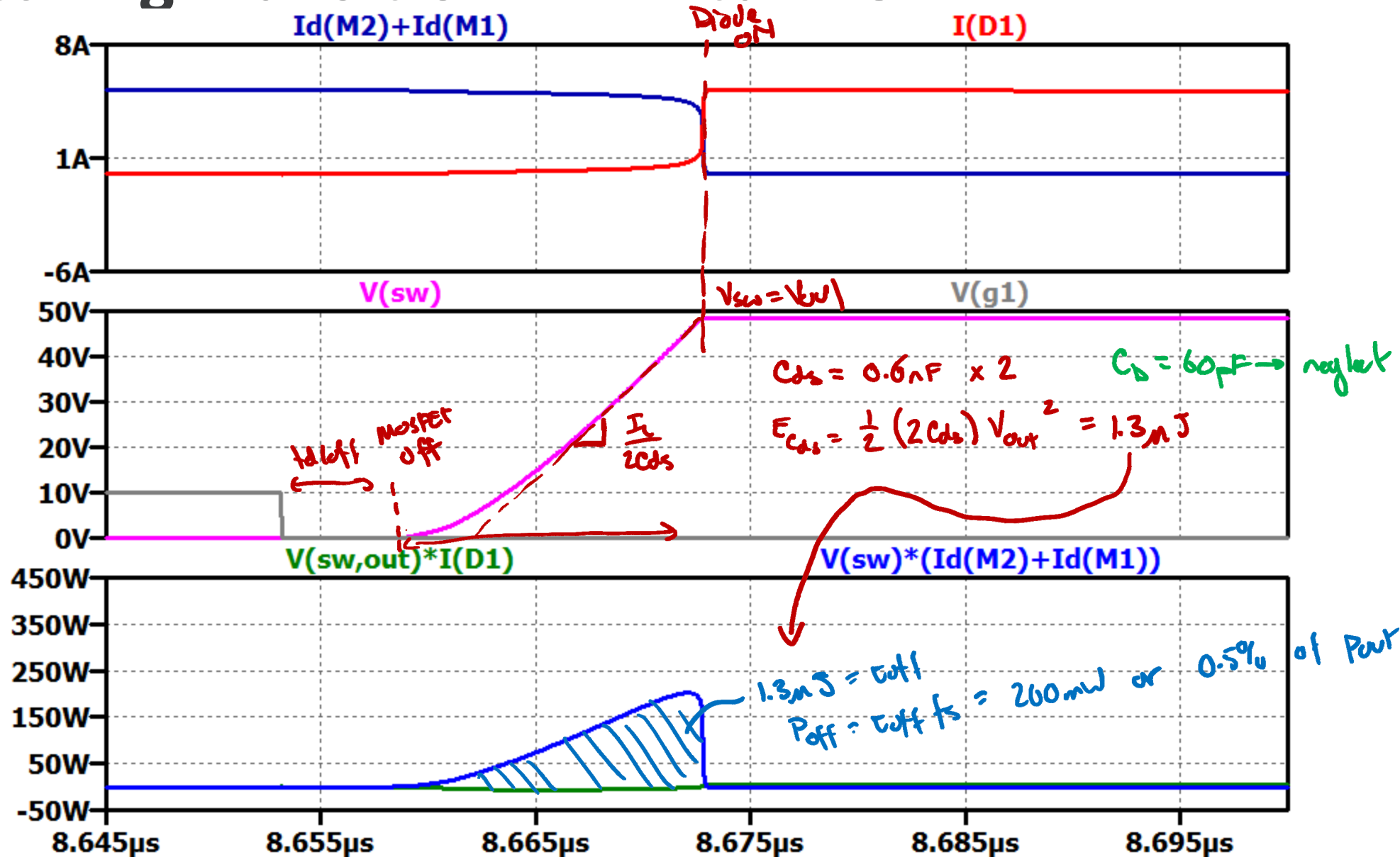
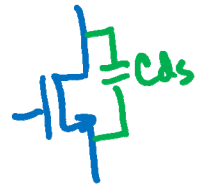
Simulation Waveforms



Switching Transition – FET turn ON



Switching Transition – FET turn OFF

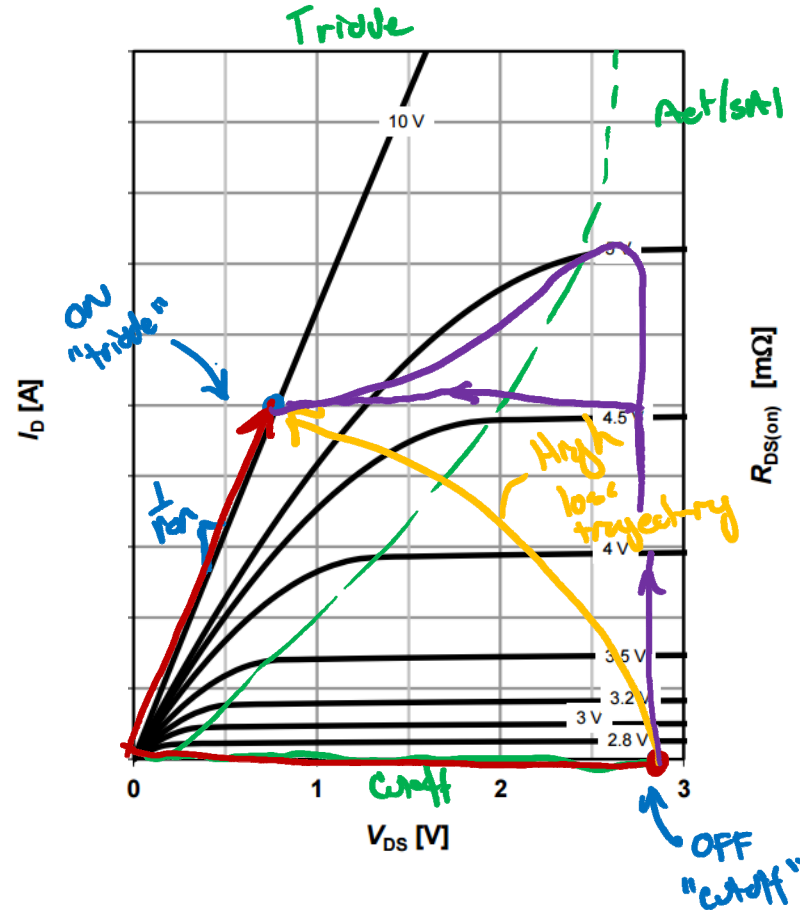


MOSFET Switching Behaviors (shytr)

5 Typ. output characteristics

$$I_D = f(V_{DS}); T_j = 25^\circ\text{C}$$

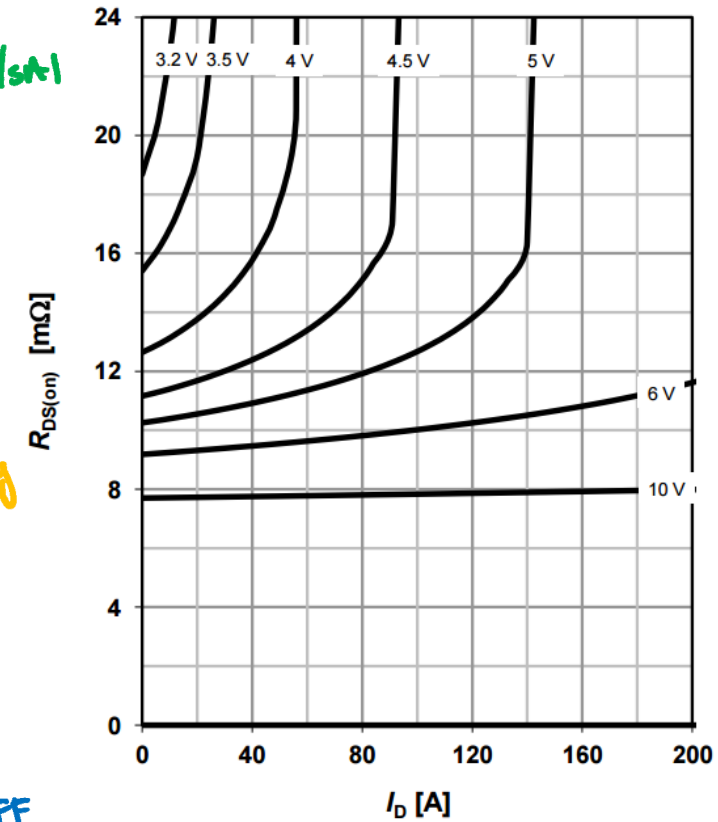
parameter: V_{GS}



6 Typ. drain-source on resistance

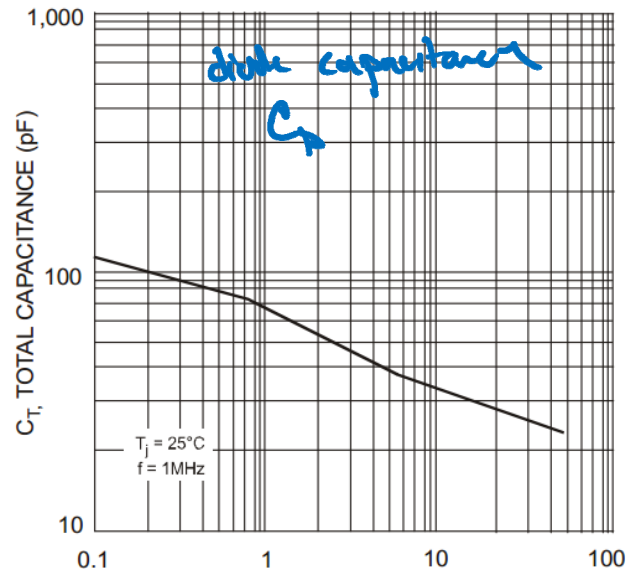
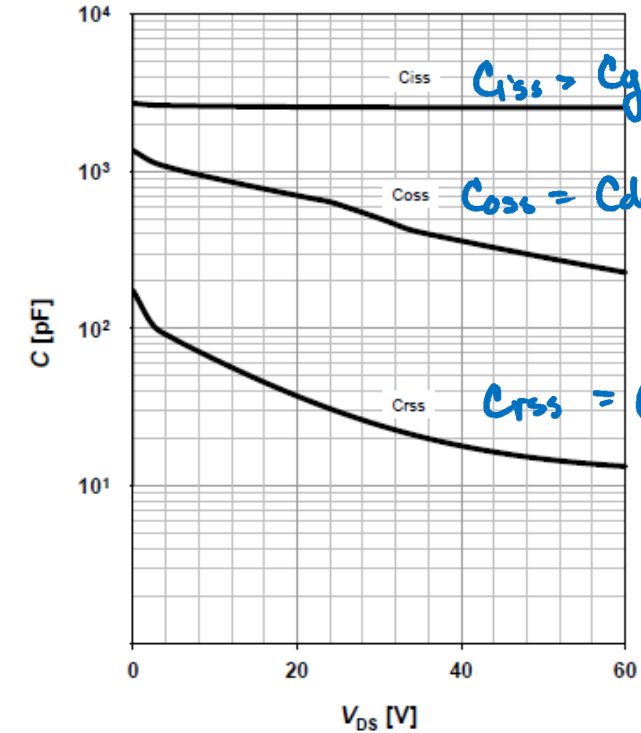
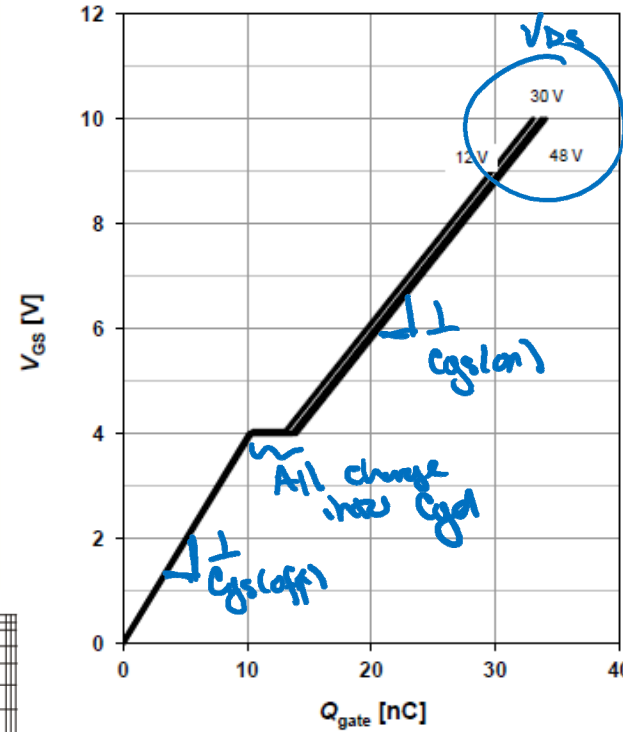
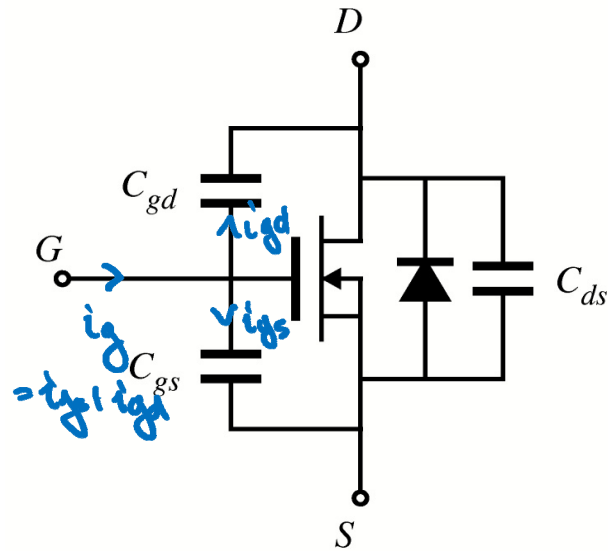
$$R_{DS(on)} = f(I_D); T_j = 25^\circ\text{C}$$

parameter: V_{GS}



MOSFET Stored Charge

Dynamic



$$Q_g = \int i_g dt$$

$$Q = CV$$

$$C = \frac{Q}{V}$$