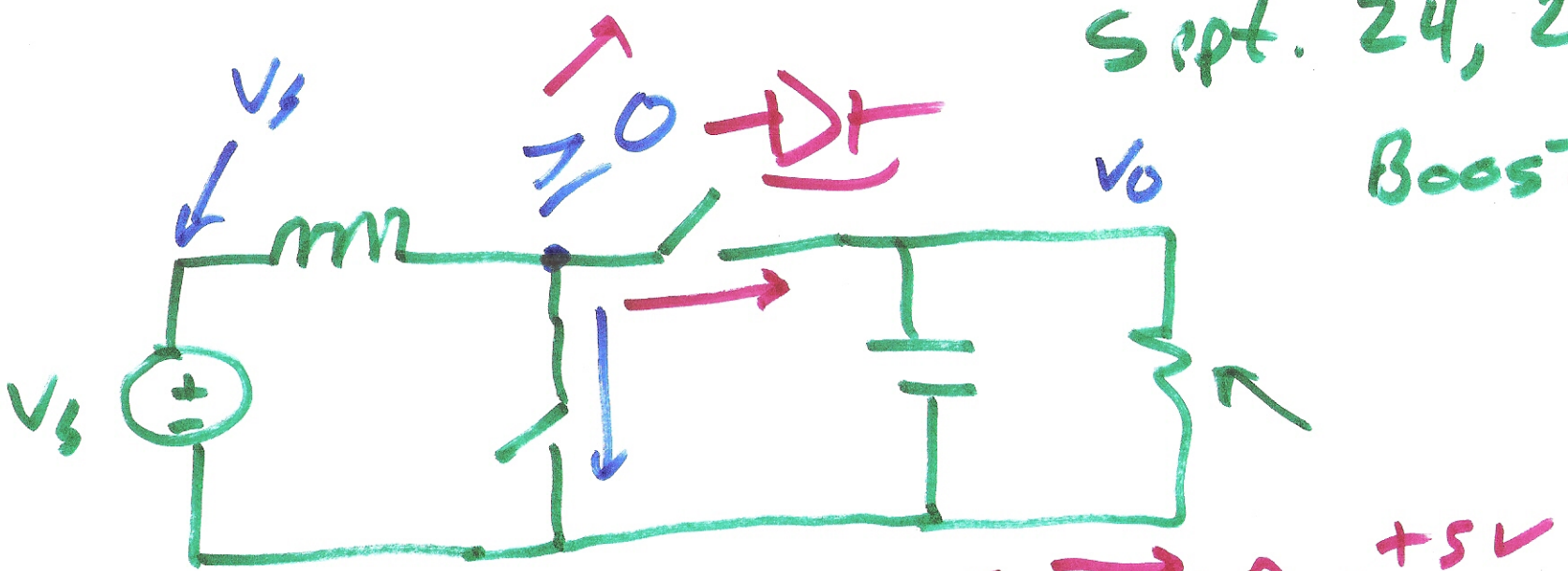
ECE 5/472 Power Electronics

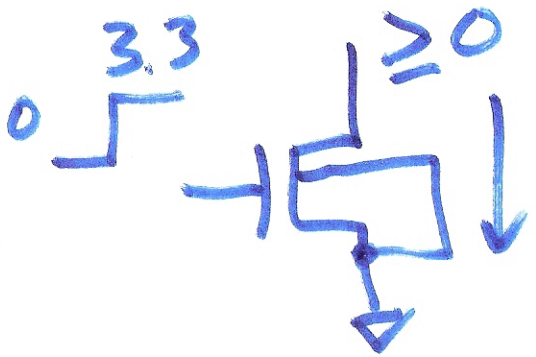
BOISE STATE UNIVERSITY

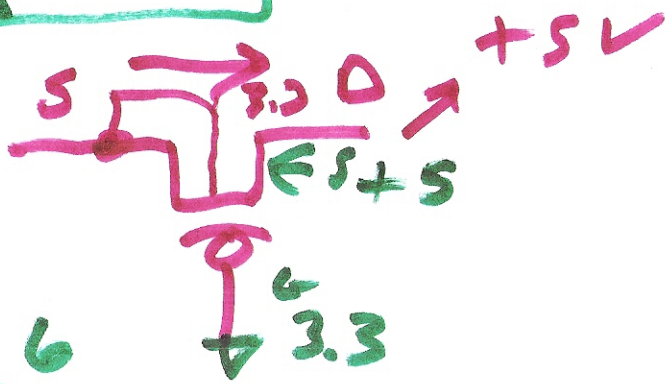
Lecture 13

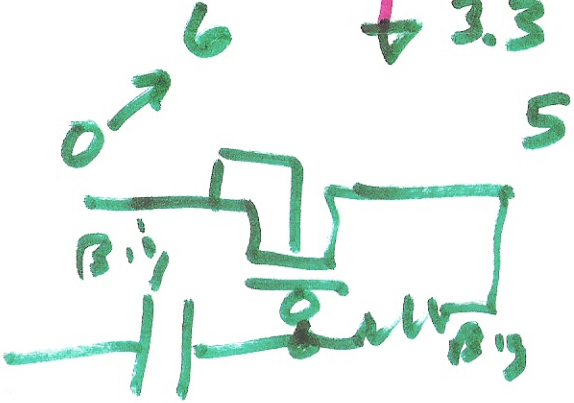
Sept. 24, 2010

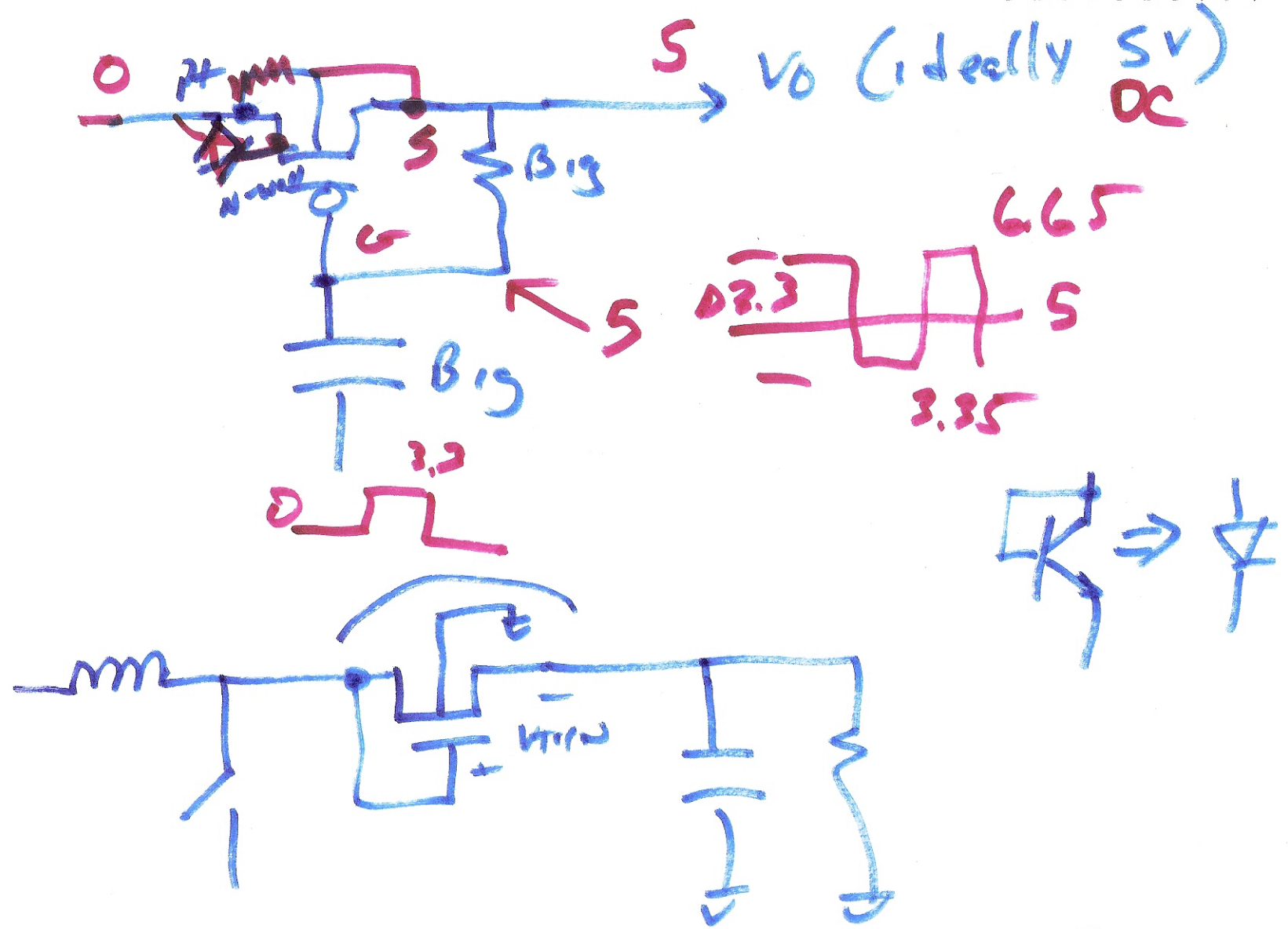
Boost











2)

study Review

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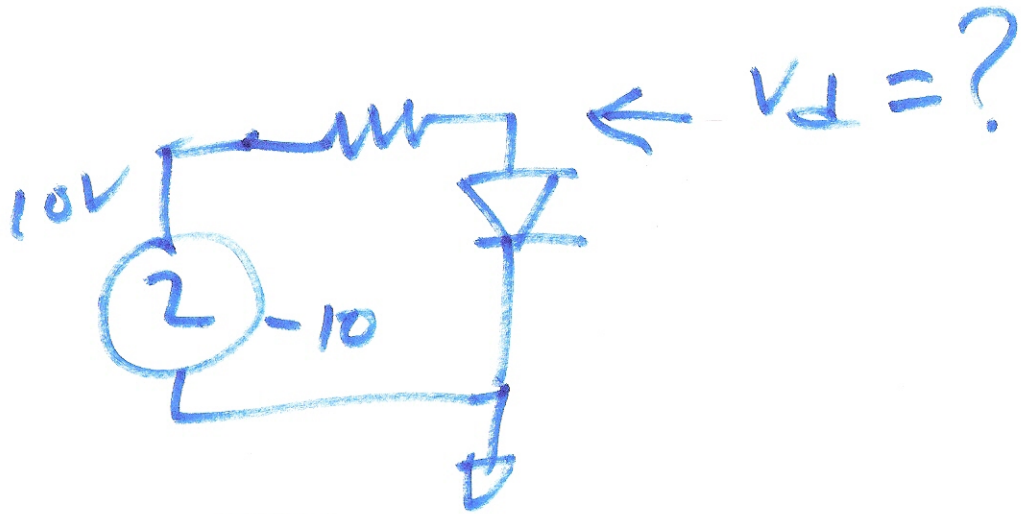
1) Know H.W. problems

2) Basic devices



MOSFETS

Diodes

LTspice questions

3) instantaneous power $p(t) = i(t) \cdot v_R(t)$

Average power $P = \frac{1}{T} \int_{t_0}^{t_0+T} p(t) \cdot dt$

3)

ELI the ICE man

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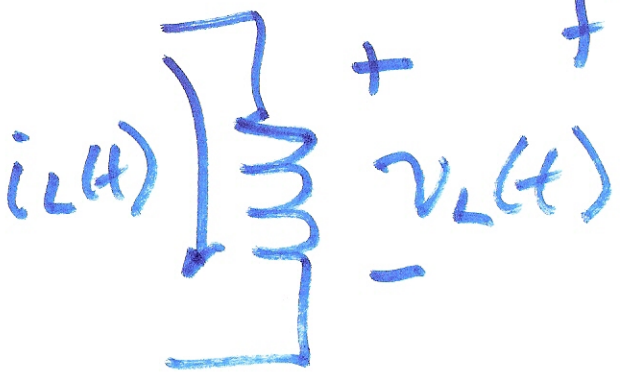
Ex. Show average power diss. by an inductor is zero. Show instantaneous power delivered to inductor is NOT zero.

use sinewave (study squarewave)

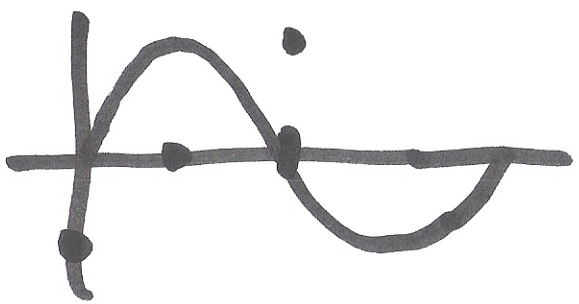
$f = \frac{1}{T}$



$v_L(t) = V_p \sin 2\pi f \cdot t$

$$i_L(t) = \frac{1}{L}\int_0^t V_p \sin 2\pi f t \, dt$$

$\int \sin x \cdot dx = -\cos x$



let $x = 2\pi f t$

$t = 0, x = 0$

$t = t, x = 2\pi f t$

$\frac{dx}{dt} = 2\pi f$

$dt = \frac{dx}{2\pi f}$

$$i_L(t) = \frac{V_p}{L} \int_0^{2\pi f t} \sin x \cdot \frac{dx}{2\pi f}$$

$$= \frac{V_p}{L \cdot 2\pi f} \cdot \left(-\cos x \Big|_0^{2\pi f t}\right.$$

$$i_L(t) = \frac{V_p}{L \cdot 2\pi f} \left(-\cos 2\pi f t + 1\right)$$

$$p(t) = v_L(t) i_L(t) = V_p \sin 2\pi f t \cdot \frac{V_p}{L 2\pi f} (1 - \cos 2\pi f t)$$

5)

$$P = \frac{1}{T}\int_0^T \frac{V_p^2}{L2\pi f}\left(\sin 2\pi ft \cdot \sin 2\pi ft - \cos 2\pi ft\right) dt$$

$$P = \frac{V_p^2}{L \cdot 2\pi}\left[\int_0^T \sin 2\pi ft \cdot dt - \int_0^T \sin 2\pi ft \cos 2\pi ft \cdot dt\right]$$

$$\frac{1}{2\pi f}\left(-\cos x\Big|_0^{2\pi}\right)$$

$$\frac{1}{2}\int_0^T \sin(4\pi ft)\, dt$$

$$\frac{1}{2\cdot 4\pi f}\left(-\cos x\Big|_0^{4\pi}\right)$$

b)

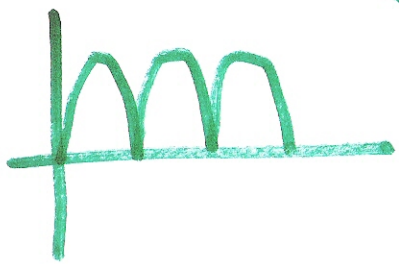
Energy stored

Study!!

$$W = \int_0^{T/2} p(t) \cdot dt \qquad 2.2$$

Study → Ex. 2-5

Effective rms



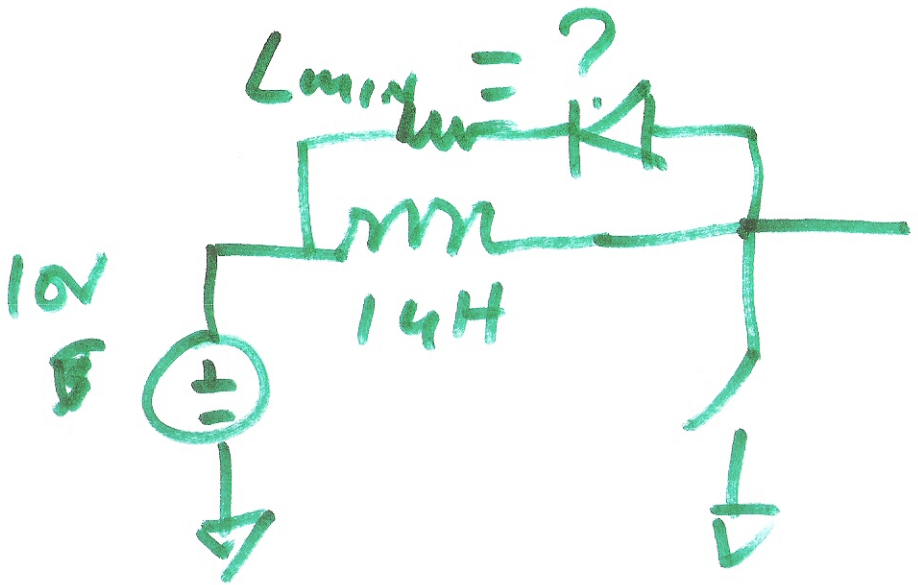
Energy Recovery.

Buck & Boost topologies and operation

det. Δi_L open
Δi_L closed

show how $V_s \cdot D = V_o$

show.



sketch i_L

know