MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Electrical Engineering

6.331 Advanced Circuit Techniques

Laboratory 2
Power Converters

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Due : Friday, April 5, 2002

Design, build, and demonstrate a switching power supply that meets the following specs. (You may choose to build either the boost or flyback topology.)

Specifications

- Output voltage: for the boost 20 V, for the flyback -10 V
- Steady state error: Zero (use an integrator in the loop).
- Output voltage ripple: $\leq$ 200 mVpp (peak-to-peak)
- Input voltage range: 8 V $\leq V_{in} \leq$ 16 V
- Input ripple current (calculated): $\leq$10 mA rms
- Output power: 5 watts
- Small signal bandwidth: $\geq$ 5 kHz
- Small signal step overshoot: $\leq$ 10%

Lab Hints

Build your converter in stages rather than attempting to construct and test the entire loop in one smoke-producing flip of the switch.

1. Build the switching section
    - use ceramic capacitors for the main filtering caps in your converter. use electrolytics only for damping legs.
    - drive the switch with a function generator (D = 0.5 or whatever)
    - start with a small input voltage (V_{in} = 0.5 V or so)
    - if the waveforms look ok, gradually increase V_{in}
    - use the function generator's symmetry control to vary D, and convince yourself that the converter is operating correctly.
2. Build the controller section
    - test the controller section using "fake" inputs

- use lab kit supplies to power controller circuitry (not V_{in} supply)
- verify proper operation before attempting to close the loop

3. Consider start-up details before closing the loop.
    - soft-start
    - current-limit
    - duty-cycle limit
4. Pray, sacrifice a token 3904, then power up the closed-loop system