

UNIVERSITY OF CALIFORNIA, SANTA BARBARA

Department of Electrical and Computer Engineering

ECE 137A

WINTER 2009

Prof. Luke Theogarajan

Laboratory Assignment #2a

2a) Power Supply Buffer

2b) Proportional To Absolute Temperature (PTAT) Current Source.

Prelab due: Friday 02/06/2009 5PM in Homework Box

Lab checkout: Friday 02/20/2009

Lab report due: Tuesday 02/23/2009

Lab two will have two parts, in part one, you are designing a buffer circuit for the DC power supply you built in lab one. The second part of the lab, you will be designing a PTAT current source, which will provide the bias currents for the final lab assignment.

The regulated DC power supply that you have built from lab one has limited output current capability. As we draw more current, the voltage of the Zener regulator would drop significantly. In order to supply more output current while maintaining the same supply voltage, you need to design an output buffer stage with overload protection for the power supply. An ideal buffer circuit would take no current out of your power supply, and be able to supply large current to the load, at a constant output voltage.

Specifications

Regulated Output voltage	+/-12 V with less than 5% variation
Output Current	Able to supply ≥ 100 mA
Current Gain	> 30

Part I

Design and build an output buffer without overload protection for the power supply you built in lab one for both **positive** and **negative** outputs. **Make sure you have a load resistor at the output of the buffer to prevent any direct path to ground**, otherwise, large current can flow and destroy part of your circuit. You may choose to use bipolar transistors or MOSFETs to implement your circuit (A good set of specification sheets are needed to design the circuit). Measure the DC output voltage, and use an appropriate load resistance to draw 100mA of output current. Measure the current gain of your buffer circuit.

Prelab

Draw a schematic of your design with component values and discuss key design consideration. Answer the prelab questions. Again, you are dealing with relatively high voltage and current, you need to make sure that your circuit components have the necessary power handling capability.

Prelab questions:

1. What circuit topology gives current gain but no voltage gain?
2. Calculate the load resistance needed to draw an output current of 100 mA. What's the power

dissipation through the resistor?

3. How will the current gain change when you increase the output current?

Build the output stage that you have designed in the prelab and add it to the DC power supply you built in lab 1. Solder it neatly on the same vector board.

Questions:

4. Measure the DC output voltage and DC output current through the load resistor.

5. Measure the current gain of the output stage with a load current of 100mA. Then increase the load resistor and record how the current gain change.

You will be given a reference overload protection circuit after you finish the prelab. How does the overload protection circuit work? Build this circuit into your output buffer. Make necessary modification in your output stage to fit the overload protection circuit.

Questions:

6. Measure the DC output voltage and DC output current through the load resistor. Make sure they still meet the specifications.

Stay tuned for Part II (PTAT Current Source)