EECE 690/890
Digital Radio Hardware Design

Team 4 Assignment 2

Due: Thurs 10/22/98

Introduction

This is the second in a series of assignments designed to guide you through the tasks needed to complete the audio and digital circuit design, layout, and mechanical engineering tasks.

Attached to this assignment is an additional page giving a preview of future tasks that will need to be completed before the PDR. You are encouraged to work ahead if you can. This will ease your workload when things like tests stack up in other classes in the coming weeks.

EDA/Mechanical Design Engineer 1 Tasks

- Study the LCD hardware interface on the data sheet to determine the signals that must be carried to it from the digital circuit board, and to become familiar with any supporting circuits needed (e.g. contrast adjust pot) on that board. (Talk to team 3 if you like. They are doing something similar.)
- Study the PIC17C44 pinout and get the signal assignments from Team 3 so that you know what pins on the uC connect to which connections on the LCD.
- Draw a schematic of the circuits needed on the digital board to interface the LCD to the uC, including the connector to be used and pin assignments. (Be sure to consider EMC)
- Add connectors and cables needed to the parts list.
- Get DC voltage requirements and current consumption estimates from all teams and locate suitable voltage regulators to be used (low dropout voltage and acceptable power dissipation). You should probably check the DigiKey catalog first to see what vendors carry parts that you might want to specify.
- Decide if we want to use Nicad batteries in the mobile and if so, find a suitable charge regulator.
- Draw a schematic showing all power supply components (regulators, filter capacitors, battery, charge controller (if used), and connectors), and add these to the parts list.

Your deliverables are listed below:

- Your schematics.
- Your parts list. This should be cumulative - with any new parts specified added to the list from the previous assignment.

EDA/Mechanical Design Engineer 2 Tasks

- Study/test the handset to detemine the connections to the mic/speaker. This will not be trivial. You will need to either open the handset (which may not be possible without breaking it) or "reverse engineer" the circuit board in the base to determine which connections on the cable to the handset correspond to the the mic and which correspond to the speaker. Also you will need to determine if there is voltage applied to the mic to determine if it is an electret-condensor type. You can do this by reverse-engineering the circuit, or by hooking it up to the phone line and measuring for DC (CAUTION: The phone line contains about 50 volts and can shock you if you are standing on a good ground without shoes).
- Once this is decided, hook up the mic and speaker and make sure they work as you expect them to. This can be done by applying the required DC to the mic (through a suitable resistor) and looking at the output on the scope to check the level. Then apply a signal generator to the speaker and see how much voltage is needed for a comfortable listening level. Next, hook a moderate resistor between the signal generator and the speaker and use the voltage divider equation to estimate the speaker impedance.
- Study the ADPCM application note and design the opamp circuits needed. You should consider your own measurements of voltage and impedance levels as well as the guidelines in the app note.
- Generate a schematic of these circuits, showing the ADPCM chip as well as the connector going to the handset. Show the complete ADPCM chip pinout, but leave connections that you do not use open. These will be filled in later when we define the connections to the uC IC.
- Refine your mechanical design from assignment 1 and generate preliminary versions of any mechanical drawings needed for panel fabrication etc.

Your deliverables are listed below:

- A summary of your reverse engineering efforts and decisions regarding the handset connections, microphone type, speaker impedance, and voltage levels found.
- Your schematic of the opamp circuits designed around the ADPCM chip.
- Your mechanical drawings for panel fabrication.

Team 3 Future Assignments

The following gives an overview of the tasks remaining after task 2. We will have a "mini-design review" as part of task 3 in which your team will meet with the instructors. In this informal review, you will present your design and layout work, and we will try to find "holes" in them that may need to be addressed.

EDA/Mechanical Design Engineer 1

- Work with digital PLD and software designers to determine pin assignments on the PLD and uC, and connections to the ADPCM codec, and generate a schematic of these circuits.
- Work with your teammate to generate a complete schematic of the digital board, including connectors.
- Do initial "floorplanning" (component placement diagram for digital PC board).
- Do digital circuit board layout. (Do this on paper first! Then enter the design in the Layout program - This will help keep you flexible and allow you to try several options.)
- Check the layout against the schematic by printing each out and highlighting nets (one at a time) on each to be sure they match.

- Do a final check, in conjunction with members of other teams to be sure nothing in the design has changed! Check the layout again!
- Generate Gerber and Drill files.
- Confirm that the tools called out in the generated files are acceptable to our PC board fabricator, and if not, modify them.
- View the photoplot and drill files in a third-party Gerber viewer to be sure it was generated correctly.
- Prepare the files for sending to the fabricator. (We may need to merge both the RF and digital layouts into a single design to lower fab cost, but this can be done with cut-and paste at the end).

EDA/Mechanical Design Engineer 2

- Work with the RF team to get their schematic and layout designs.
- Work with your teammate to create a list of all IC sockets, connectors, and other special parts needed in the layout.
- Locate footprints for all the parts in the Professional version of PCBoards layout software, place the footprints on a page, and print out the page for reference.
- Create a list of all IC sockets, cables, etc. needed.
- Enter RF layout
- Check the layout against the RF team's schematic by printing each out and highlighting nets (one at a time) on each to be sure they match.

- Do a final check, in conjunction with members of other teams to be sure nothing in the design has changed! Check the layout again!
- Generate Gerber and Drill files.
- Confirm that the tools called out in the generated files are acceptable to our PC board fabricator, and if not, modify them.
- View the photoplot and drill files in a third-party Gerber viewer to be sure it was generated correctly.
- Prepare the files for sending to the fabricator. (We may need to merge both the RF and digital layouts into a single design to lower fab cost, but this can be done with cut-and paste at the end).