Hardware Project

Assigned: Friday, Nov. 3

Due: Friday, Dec. 1

Project Description:

Design a 8086 microprocessor board using Orcad Capture and Layout. Draw the schematic using Capture, export the necessary files for Layout and design the board using Layout. You will be required to submit the schematic and the board layouts. Your report should include the block diagram of the whole system, describe the necessary decoding details, describe the chips used in the project and their programming details (give example code fragments to setup various chips along with their port addresses) and describe the pin-outs of all headers used to connect other devices/ boards to your microprocessor board. A portion of your grade will depend on the write-up. Your write-up should be a technical document, that can be used by others to use your board. Think of the write-up as the only documentation customers of your product (microprocessor board) are going to get. They should be able to understand your design and should be able to do either of the following:

- Design a similar board using information in your document, or
- Use you microprocessor board for designing a system. They should be able to understand the interface, the specifications and the programming aspects of your board to do this.

Assume that they have access to the data sheets, so don't just blindly reproduce information from the data sheets. You can point the user to the relevant data sheet for more information that is not directly related to your board, e.g. all possible programming modes of the 8279, 8255 etc. Your write-up should have a section for each of the major design blocks. Examples would be a section for the 8255, one for 8279, one for 8259, a section for the 8086 and it's associated bus logic, one for the decoding section and so on. Remember this is not a two page lab write-up. Include the full schematic, reference the schematic as required in your write-up and include the Bill of Materials report from the schematic tool. Include the layout, one figure per board layer, the drill layer and the silkscreen..

As you are going to do this project as a team, appoint a point of contact per team to communicate project updates or problems to me or the TAs. Nobody is a team leader and you are all welcome to ask questions regarding any specific problems you might encounter. You should cooperate with each other and meet the deadlines you have set for various design components. Divide the work equally among the team members. All of you should participate in the write-up process. You have to write the sections pertaining to the design blocks that you are assigned. Decide a common write-up format before hand so that integration of various subsections does not require major formatting edits.

Breakup of points:

Design Schematic and Board Layout: 70%
Documentation: 30%

Project Details:

Your design should include the following:

- 8086 in minimum mode and it's associated bus buffering/demultiplexing logic. NMI should be connected to a push-button switch with appropriate timing logic. The data bus, address bus and all control signals should be connected to headers after buffering and demultiplexing for external access to design expansion boards.
- 256KB of CMOS flash composed of 128K x 8 28F010 CMOS Flash Memory, decoded into two banks, highest address FFFFFH.
- 128KB of SRAM composed of 32K x 8 CY7C199 Static SRAM, decoded into two banks, lowest address 00000H.
- 8284 Clock Generator along with crystal and reset subcircuits
- 3 8255 chips, decoded at the following addresses (all in hex), all port connections should be pulled to headers for external access.
  PPI 1: Port addresses FFFF (control register), FFFD, FFFB, FFF9
  PPI 2: Port addresses FFFE (control register), FFFC, FFFA, FFF8
  PPI 3: Port addresses 3FD6 (control register), 3FD4, 3FD2, 3FD0
- 1 8259 decoded at FFCA (command) and FFC8 (data). IR0 connected to a push button switch with necessary circuits, IR1 connected to 8253 counter 2 output, IR2 connected to the 8279 IRQ output and IR3 connected to the 16550 INTR output. All other IR lines connected to headers for external access.
- 1 8253 decoded at FFDE (command), FFDC, FFDA, FFD8, with all counter 1 and counter 3 pins connected to headers. Counter 2 output connected to IR1 of the 8259, gate and clock connected to header.
- 1 8279 decoded at FFEA (command) and FFE8 (data) which will be operated in the decoded mode. Connect 22 push button switches arranged with three rows and eight columns. Last row will have two less switches. In your layout arrange these 22 keys as well as the reset and NMI keys to form a 6x4 keyboard matrix layout. Also connect 4 common-anode 7-seg LEDs to the 8279.
- 1 16550 UART decoded at FFF0-FFF7. The clock input to the UART should be PCLK from the 8284 and the INTR output should be connected to IR3 of the 8279. Make the connections for serial port using a MAX 235 line driver/receiver and a DSUB-9 connector.
- 1 common-anode 7-seg LED connected to a 74374 latch decoded at FFA0 and 8 LEDs connected to a 74374 latch decoded at FFA1.
- 8 DIP switches connected to a 74244 decoded at FFA2.
- Other misc. components that are required for the above circuits e.g. resistor packs, caps, etc.

Submission:
Detailed instructions on what and how to submit will be provided closer to the submission deadline. You will be required to provide regular updates of your progress every week.

Project Updates:
Any updates to the description will be minor and will be discussed in class and posted along with this document.