Altera UP2 Expansion Board (AEB)
System Block Diagram

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Summary

This project is to build an Altera UP2 Education Kit expansion board (AEB) that will make it a more useful test bench for complex designs. The expansion board will include an on board A/D, D/A, LCD screen, and a keyboard interface. The board layout will be designed using the Spectra for Orcad software and sent to a PCB manufacturer to be printed. The AEB will be designed and packaged for use in university laboratories. After thorough testing and analysis a datasheet will be compiled to accompany the AEB.

Background

The Altera University Program UP2 Kit is designed to help universities teach digital logic design. The package provides an Altera MAX7128S Programmable Logic Device (MAX) and an Altera FLEX 10K70 PLD (FLEX) interfaced with a pair of dual 7-segment displays, 16 LED's, three DIP switches, and 4 push-buttons. The UP2 kit will be the base of which the AEB expands upon.

The MAX7128S has 128 macrocells. Each macrocell has a programmable-AND/fixed-OR array and a configurable register with independently-programmable clock, clock enable, clear, and preset functions. With a capacity of 2,500 gates and a simple architecture, the EPM7128S device is ideal for introductory designs as well as larger combinatorial and sequential logic functions.

The FLEX 10K70 PLD has 3,744 logic elements (LEs) and nine embedded array blocks (EABs). Each LE consists of a four-input LUT, a programmable flipflop, and dedicated signal paths for carry-and-cascade functions. Each EAB provides 2,048 bits of memory which can be used to create RAM, ROM, or first-in first-out (FIFO) functions. EABs can also implement logic functions, such as multipliers, microcontrollers, state machines, and digital signal processing (DSP) functions. With 70,000 typical gates, the EPF10K70 device is ideal for intermediate to advanced digital design courses, including computer architecture, communications, and DSP applications.

The following is a listing of existing features and features that are intended to be included in the expansion

UP2 Board Description

· Altera EPF10k70 (FLEX)
· Altera EPM7128S (MAX)
· 2 dual 7-segment displays
· 4 push-buttons
· 16 LED's
· 3 8-bit DIP switches
· PS2 and VGA ports

Desired AEB features

· 4 line Liquid Crystal Display (LCD)
· Quad 7-segment display
· Keypad
· Additional push-button and DIP switches
· On-board A/D and D/A for each chip
· EPROM/RAM for each chip
· LED array

Figure 1 shows the current UP2 board layout and Figure 2 shows the preliminary layout of the AEB. The expansion board will be tied to the UP2 via the expansion headers.
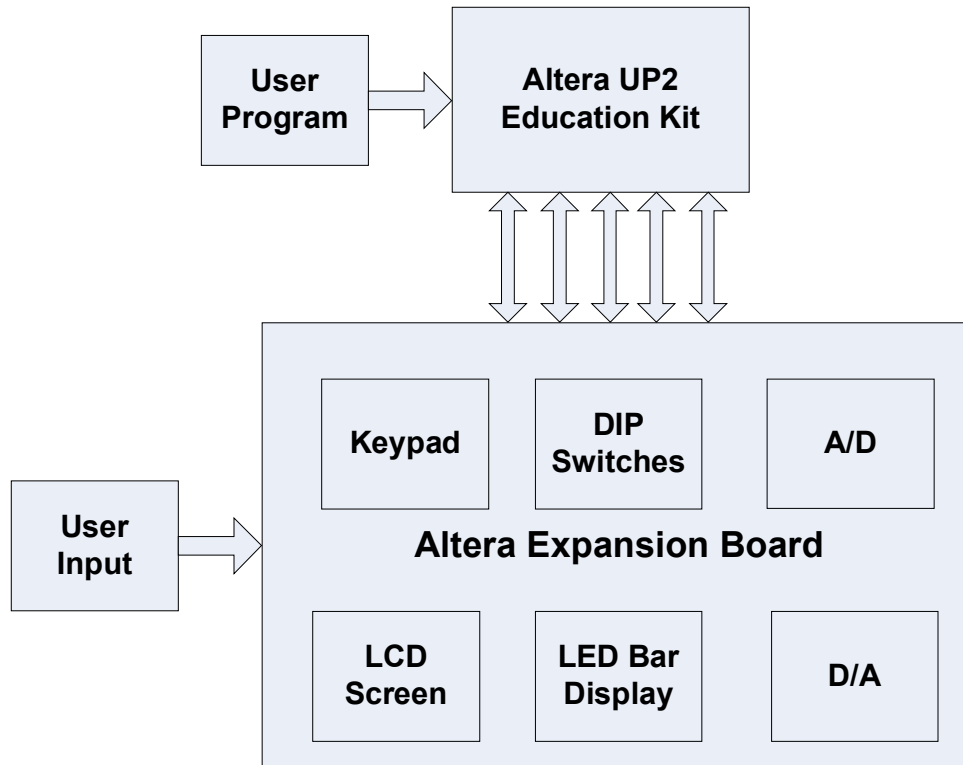
Figure 1 – UP2 Board Layout
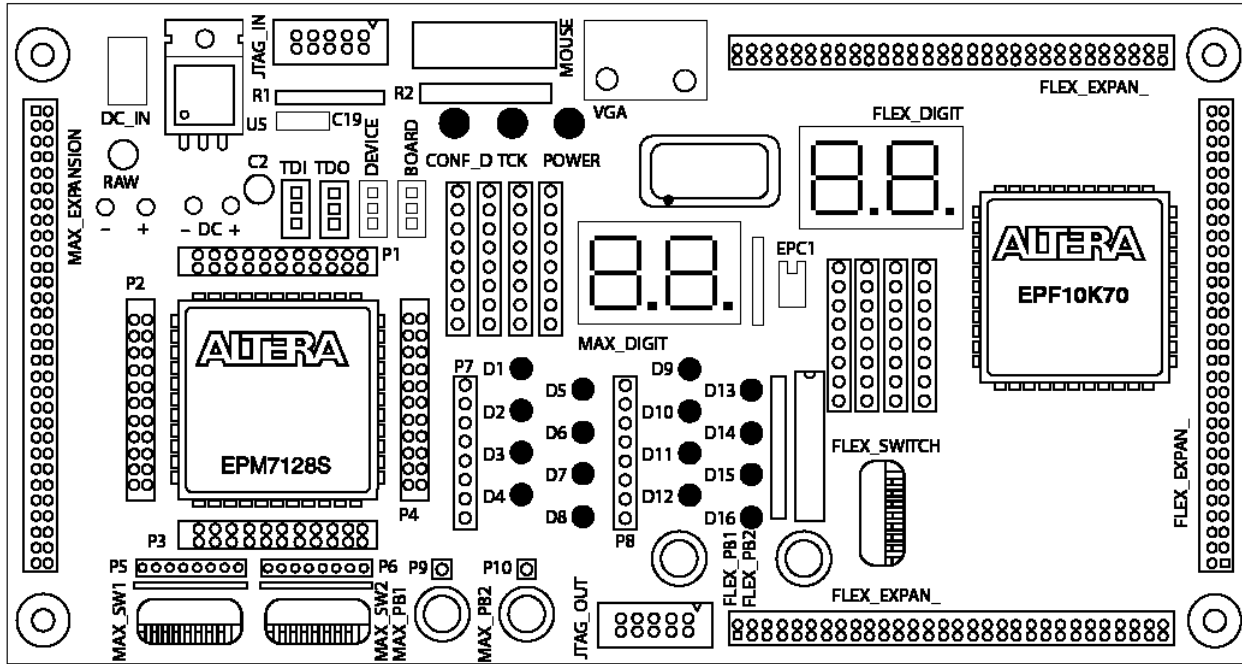
Figure 2
Altera Expansion Board PCB Layout
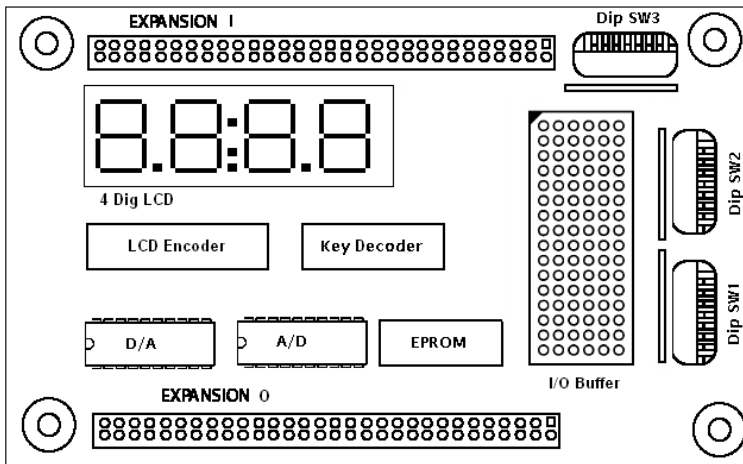
The overall system block diagram is shown in Figure 3.

Figure 3
Altera Expansion Board System Block Diagram

A/D and D/A Converters

The A/D and D/A converters will allow for the Altera chips to sample and output analog signals. This feature will make it possible for the user to test more complex designs than with the UP2 kit alone.

Keypad

The keypad will be a common alphanumeric keypad with numbers 0 through 9 and letters A through F. This will make it easier for the user to test and debug programs that use alpha-numeric inputs.

Displays

A 4 line character LCD display and a 4-digit LCD display will be added to the expansion board. The 4-digit display will be an onboard device while the LCD screen will be mounted off of the board to save space.

Dip Switches

The DIP switches will allow inputs to be set that are meant to be set and held. This will be just an added convenience for the user.

Schedule

Order Parts by	Dec. 6th
Design Board	2 Weeks
--Send to manufacturer--	
Assembly	2 Weeks
Testing and Analysis	3 Weeks
Re-evaluate design	1-2 Weeks

Bibliography

University Program UP2 Education Kit User Guide. Altera Corporation. Version 3.1.
      December 2004.

Parts List

- Altera UP2 Education Kit
- A/D, ADS5413
- D/A, TLC7528C
- Keypad/Encoder
- 4 Digit LCD, LCD_S401C52TR
- LCD Decoder, ICM7211