ECE 4101/5101/6090, Fall 2004: Lab 1

An Application of an Embedded System: Inside a your Evaluation Board

General Information

Your lab team must have an SKP626 board to perform this lab during your lab session.

Learning Objectives

This lab will familiarize you with an embedded system. We will look at the packaging and computer organization technology used today. You will examine your evaluation board and identify the parts, and learn how they can work together to form a complete computer system.

Prelab Assignment

Visit the class web site or the CD that came with the evaluation board. Based on what you read, answer the following questions:

1. How much RAM does the board have?
2. How much of that can you use (user RAM)?
3. How much Flash memory does the board have?
4. Is there any other memory on the board?

Visit the class web site to see an example of how a printed circuit board is manufactured. Based on what you read, answer the following questions:

5. What is the first MANUFACTURING step that is likely done for this board production (hint: There is not a picture of it, and it is implied!)
6. What is done first: hand/manual placement of parts or robotic placement of parts?
7. Can manufacturing of this board be done completely manually? Why or why not?

Turn the answers to these questions with the rest of the lab.

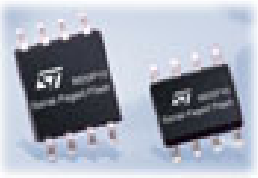
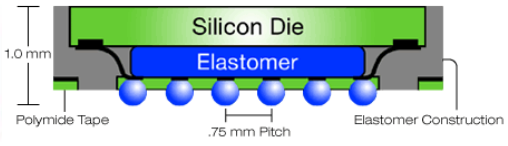
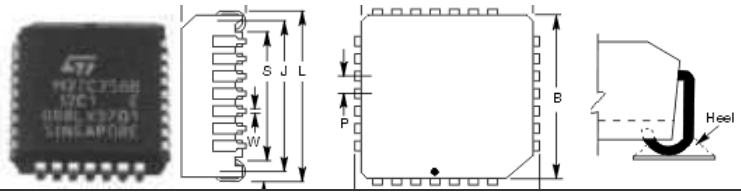
Laboratory Assignments

Embedded systems are nothing more than a computer system that has been shrunk to a very small size. A computer system is characterized by several components:

1. Input device (i.e. keyboard, mouse, scanner, disk)
2. Output device (i.e. Monitor, printer, disk)
3. Processing unit and control unit (typically a single unit called a Central Processing Unit - CPU)
4. Memory (i.e. Random Access Memory, Read-Only Memory - RAM, ROM)

The main characteristic of an embedded system is that the entire computer system carries out one specific function, which is not typically changed. An automobile computer, a PlayStation console, or a network hub box are examples of embedded systems. A PC is not.

One important aspect of product development is to use electrical components that are small, so that together, all of the components take up a small space. There are several packaging technologies available that an engineer can use to create electronic devices. Some are suitable for inexpensive toys but not miniature consumer products, and some are suitable for miniature consumer products inexpensive toys. An example of these technologies is shown below. These packages have metal leads that are the conductive wire that connect electricity from the outside world to the silicon inside the package. Leads between packages are connected with small copper traces on a printed circuit board (PCB), and the package leads are soldered to the PCB.

Technology	**Picture**
Dual In-line Package (DIP) Older technology, requires the metal leads to go through a hole in the printed circuit board. Other parts, like LEDs, can also have leads that go through the board.	 
Dual Flat Pack (DFP) - A fairly recent technology, metal leads solder to the surface of the printed circuit board.	 
Quad Flat Pack (QFP) - like the Dual Flat Pack, except here are metal leads are on four sides.	
Ball Grid Array (BGA) - The connections to the component are on the bottom of the chip, and have balls of solder to the collections	 
J-Lead - The connections on the component are like a QFP part, but the wire LEDs are curled under the part.	

Resistors, inductors, and capacitors are small "block" parts with metal on the ends.

Engineers may design products that use several of these packaging technologies. They will do this to take advantage of lower costs of some packing options, or take advantage of higher densities of other options.

Lab Procedure

Complete this lab and turn it in to the instructor at the start of class on the due date. Use the template provided on the website.

Prelab Questions

Answer the prelab questions posed above.

Lab Questions

Examine your evaluation board:

1. List all of the input devices you see on the board.
2. List all of the output devices you see on the board.
3. How many BGA parts do you see on the board?
4. How many QFP parts do you see on the board with at least eight leads?
5. How many DFP parts do you see on the board with at least eight leads?
6. How many DIP and through-hole parts do you see on the board?
7. Point out what you think is the microprocessor (CPU) on the board.
8. How do you think you would be able to load and test a new software build with this board?
9. What other test/debug interfaces do you see on the board? What tools would you use?