

Experiments for the Lab9500

INTRODUCTION

The Lab9500 is a circuit board employing a member of the Xilinx 9500 CPLD family. The particular chip used is the XC9572XL. The trailing XL denotes a low-power technology using a 3.3 Volt power supply voltage. Besides being low power, this family is very reasonably priced. The “72” in the number indicates that this CPLD has 72 macro cells similar to the GAL macrocell.

The original PAL (AMD) from which the GAL (Lattice) evolved had two families, a 20-pin package and a 24-pin package. The larger package was considerably more expensive and never gained widespread use. The PAL had a fixed output structure that was either a combinational logic output or a flip-flop output, but not both. The registered (20-pin) PALs came in four-, six- and eight-output versions. If a flip-flop was not needed, that pin could be used as an input.

The GAL is a PAL-like structure, however, with several programmable features. A 20-pin GAL has eight so-called macrocells. These can be programmed as registered outputs, combinational outputs, or inputs. A single 20-pin GAL replaces nearly all of the various versions of the original PAL family.

Xilinx (and other vendors) take the macrocell idea further. Whereas GALs had a number of pins that were input only, any I/O pin on a CPLD can be an input or outputs. Furthermore, whereas the number of macrocells is eight or ten in the GAL, the smallest chip in the XC9500 family has thirty-six macrocells! To make use of the many more macrocells, CPLDs require packages having a large number of pins (surface mount). Since a typical design uses combinational and registered outputs that need not be brought out to the world, it is not necessary to use a package so large as to allow every macrocell an I/O pin. The 64-pin package used on the Lab9500 board permits 52 of the 72 macrocells to be brought out to I/O pins which is usually more than is necessary.

For maximum flexibility and convenience the Lab9500 has assigned specific on-board I/O to the CPLD chip. There are still about twenty-five I/O pins that are uncommitted. These are accessible via the headers surrounding the chip, or the macrocells attached to these pins can be used for internal functions.

The organization of Experiments for the Lab9500 is as follows:

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5. Chapter 4 – Some ABEL basics

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 - Experiment – 100 – Checking out the Lab9500 Board
 - Experiment – 110 – Logic Equations
 - Experiment – 120 – Binary Adder
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6. Experiments – Part II – Registered logic and State Machines - Introduction
 - Experiment – 200 – Counters
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