

Introduction to Structured VLSI Design

EITF35

LAB 3

Simple ALU

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Introduction

- ❑ Arithmetic Logic Unit (ALU) is the fundamental building block of the CPU in a computer.
 - “Heart” of a processor
 - Each processor needs at least one ALU
- ❑ ALU is a digital circuit that performs:
 - Arithmetic operations (Add, Sub, . . .)
 - Logical operations (AND, OR, NOT)



Objective

- ❑ The purpose of Lab3 is to design a simple ALU to perform the following functions:
 - Addition
 - Subtraction
 - Mod 3

- ❑ It should support:
 - Sign/unsigned operations
 - Overflow detection



Inputs/Outputs of ALU

➤ Inputs:

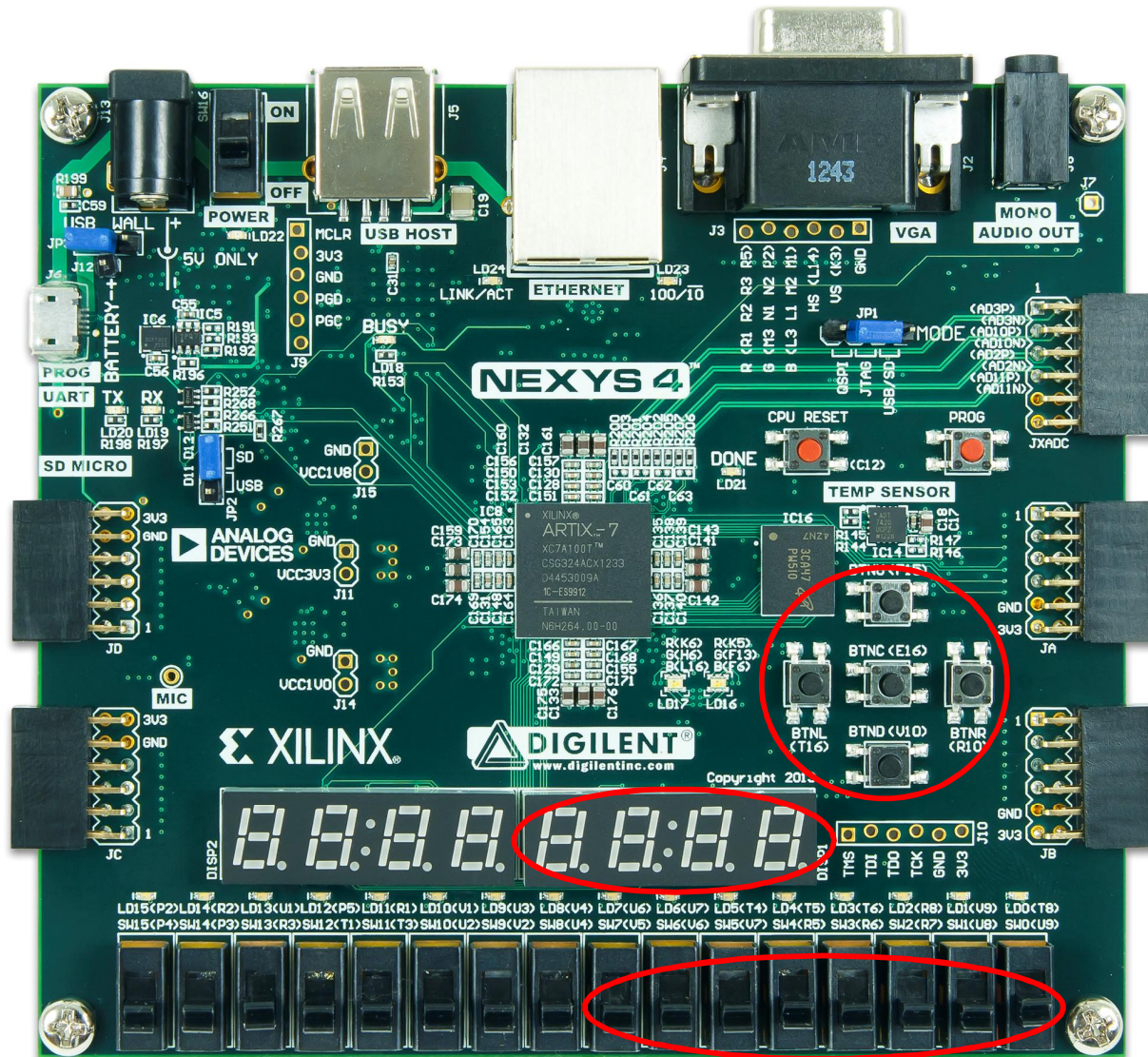
- 8 bits for operands
 - DIP Switches (SW7..SW0)
- 3 bits for control
 - Push buttons (BTN0, BTN2, BTN3)
- 50 MHz Clock

➤ Outputs:

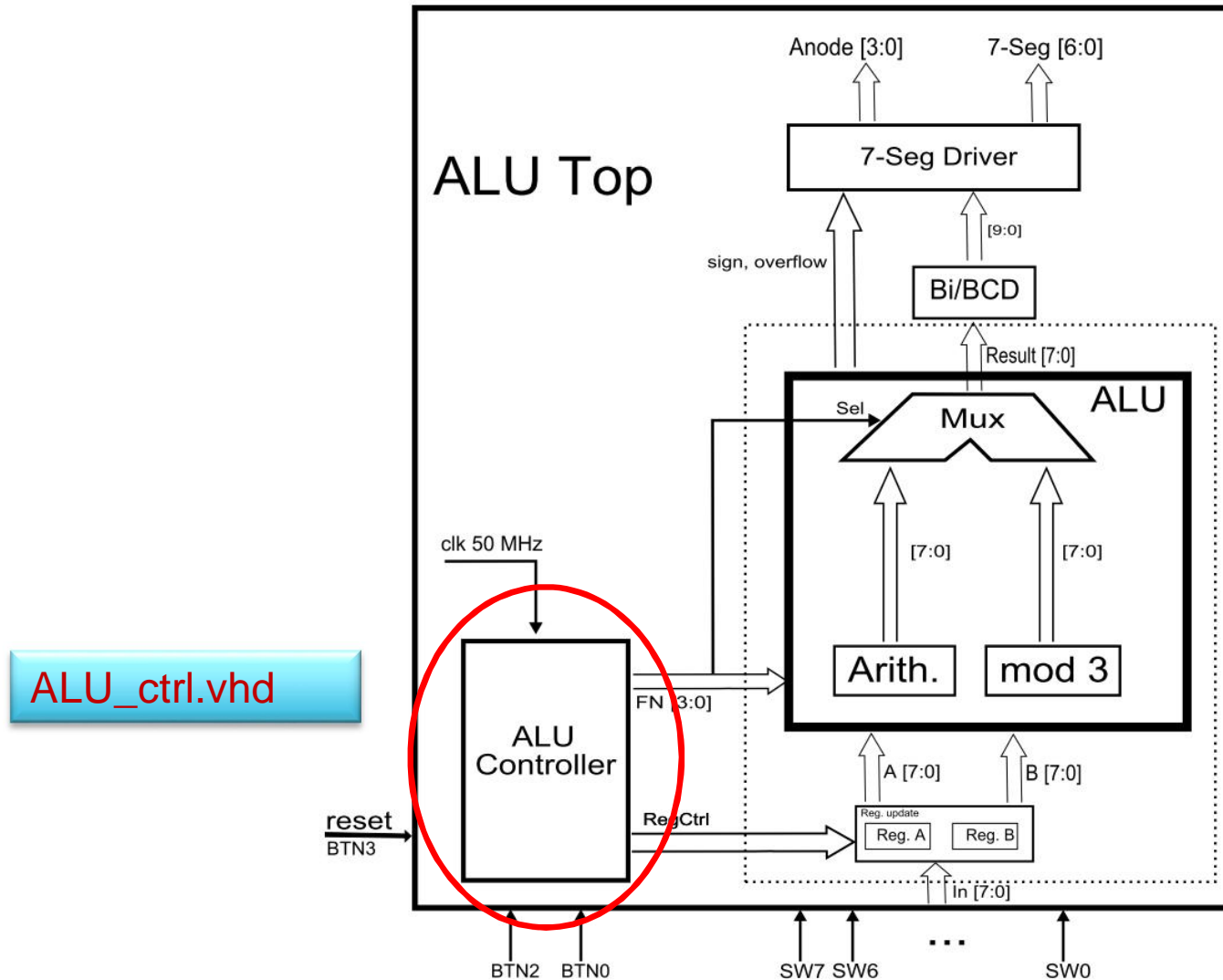
- 7-segment display



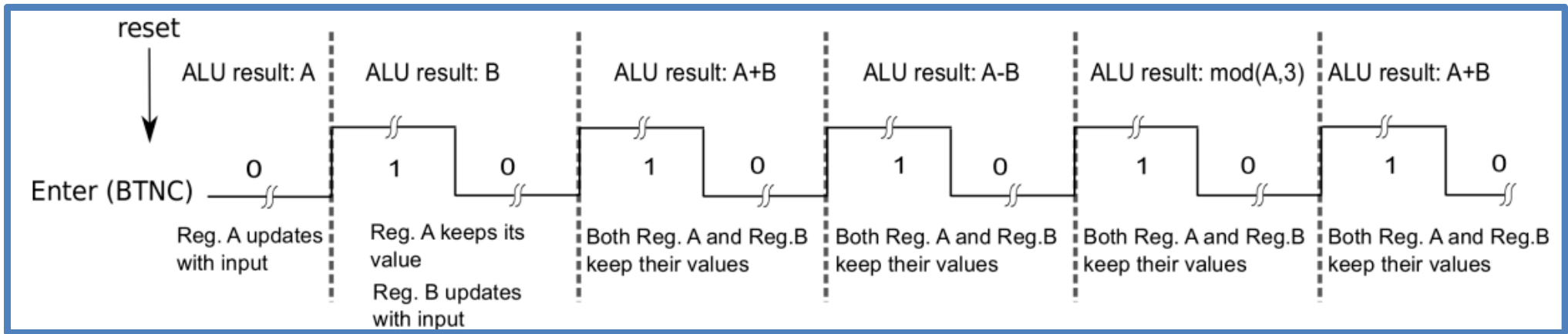
Inputs/Outputs of ALU



ALU Architecture



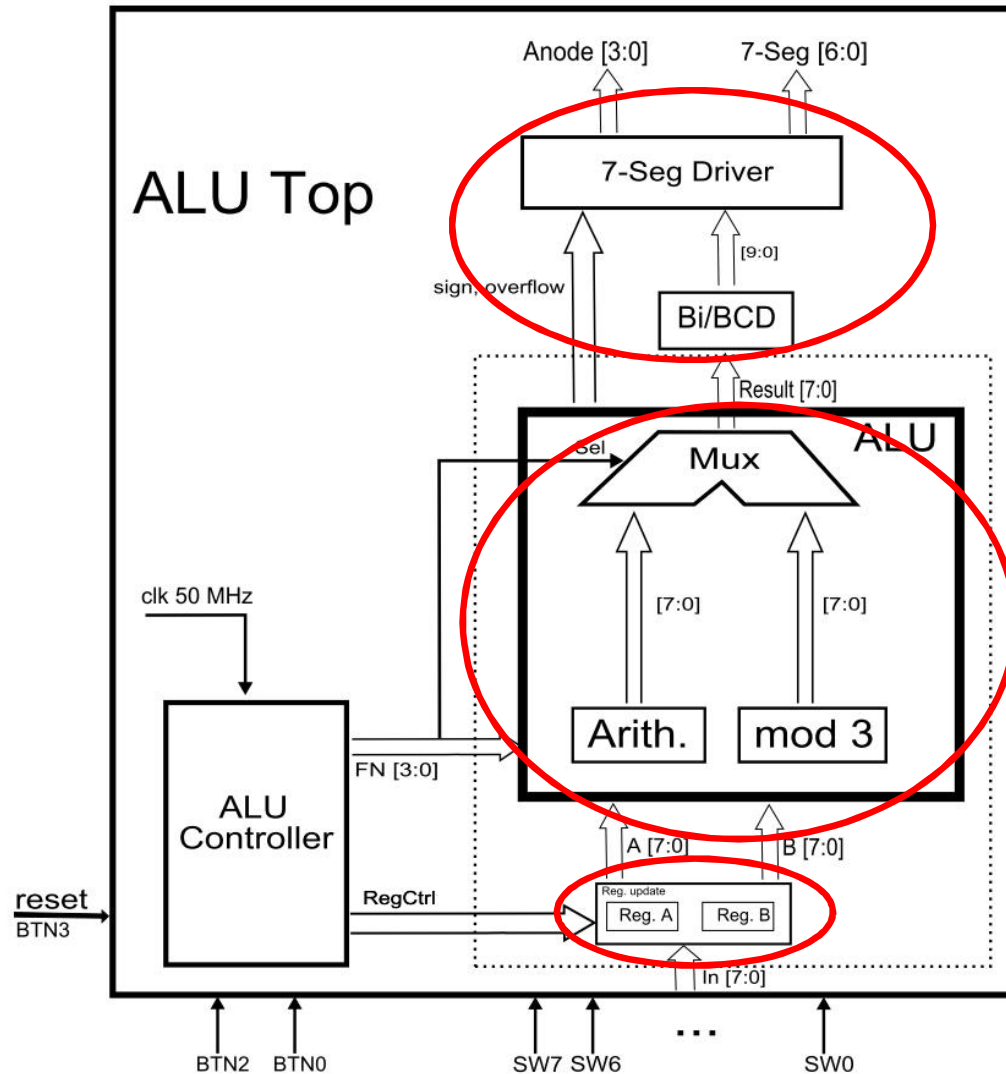
ALU Controller



FN [3 : 0]	Operation
0000	Input A
0001	Input B
0010	Unsigned (A + B)
0011	Unsigned (A - B)
0100	Unsigned (A) mod 3
1010	Signed (A + B)
1011	Signed (A - B)
1100	Signed (A) mod 3



ALU Architecture



Similar Blocks in Lab 2
`binary2BCD.vhd`
`seven_seg_driver.vhd`

To do Arithmetic Operations
`ALU.vhd`

Separate Seq. & Comb. Logic
`regUpdate.vhd`



Lab Preparation

- ❑ Read the lab manual carefully to understand all the details and requirements.
- ❑ Draw a reasonably detailed FSM for ALU controller.
- ❑ Try to design a hardware-friendly algorithms for:
 - Modulo-3 operation
 - Binary to BCD conversion



Some Notes

- Think about each block and its functionality before coding!
- Start early!
- Do the simulation as much as possible for your design

