

- **Logistics**
- **Memory-Mapped I/O interfaces:**
  - Buzzer (Lab 5)
  - LCD (Lab 6)
- **Demo**
- **Hardware handout**

- **Next Lecture:** 9. Juni 2016
- Until then: extra time to work on your labs
- **Late labs:** You may turn them in late with a 35% penalty per day.
- **Lab time average:** Lab 1: 4.5 hrs, Lab 2: ~10 hrs

# Lab 5 I/O: Buzzer



- Produces a tone when driven at a given frequency.
- You will drive that pin from the MIPSfpga system.



## Connecting the Buzzer to MIPSfpga system:

- **Step 1.** Build underlying hardware for driving the buzzer pin at a specified frequency (will need a counter)
- **Step 2.** Memory-map the buzzer input so that a user can specify the desired frequency
- **Step 3.** Connect the buzzer physically to the Nexys4 DDR board (.xdc file)



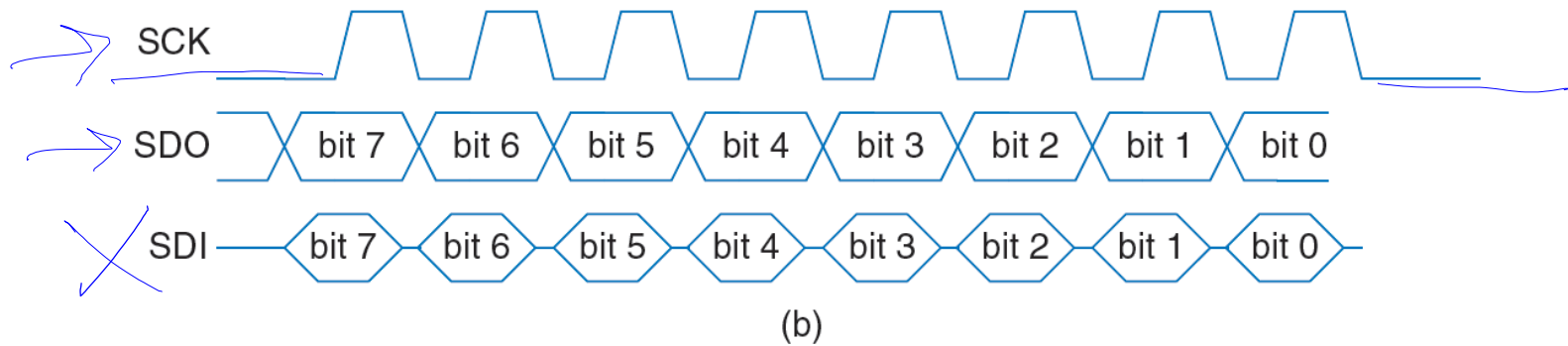
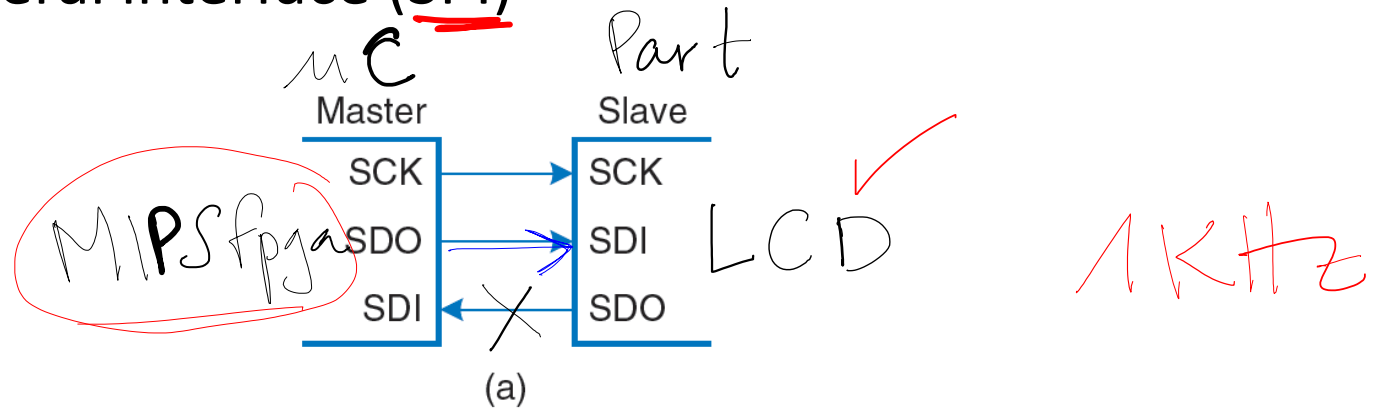
# Lab 6 I/O: SPI LCD



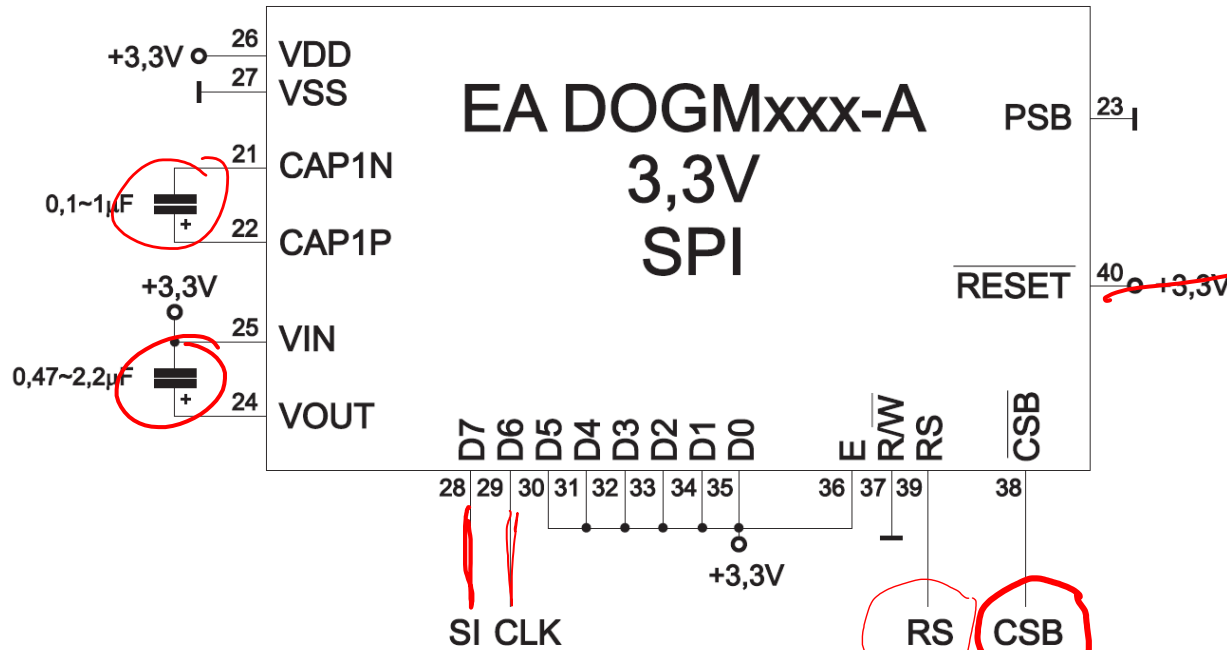
- Drive a Liquid Crystal Display (LCD) using its SPI interface.
- Create an SPI Interface on MIPSfpga



- Serial peripheral interface (SPI)



# LCD SPI Interface



MIPSppp  
Reset  
Signal

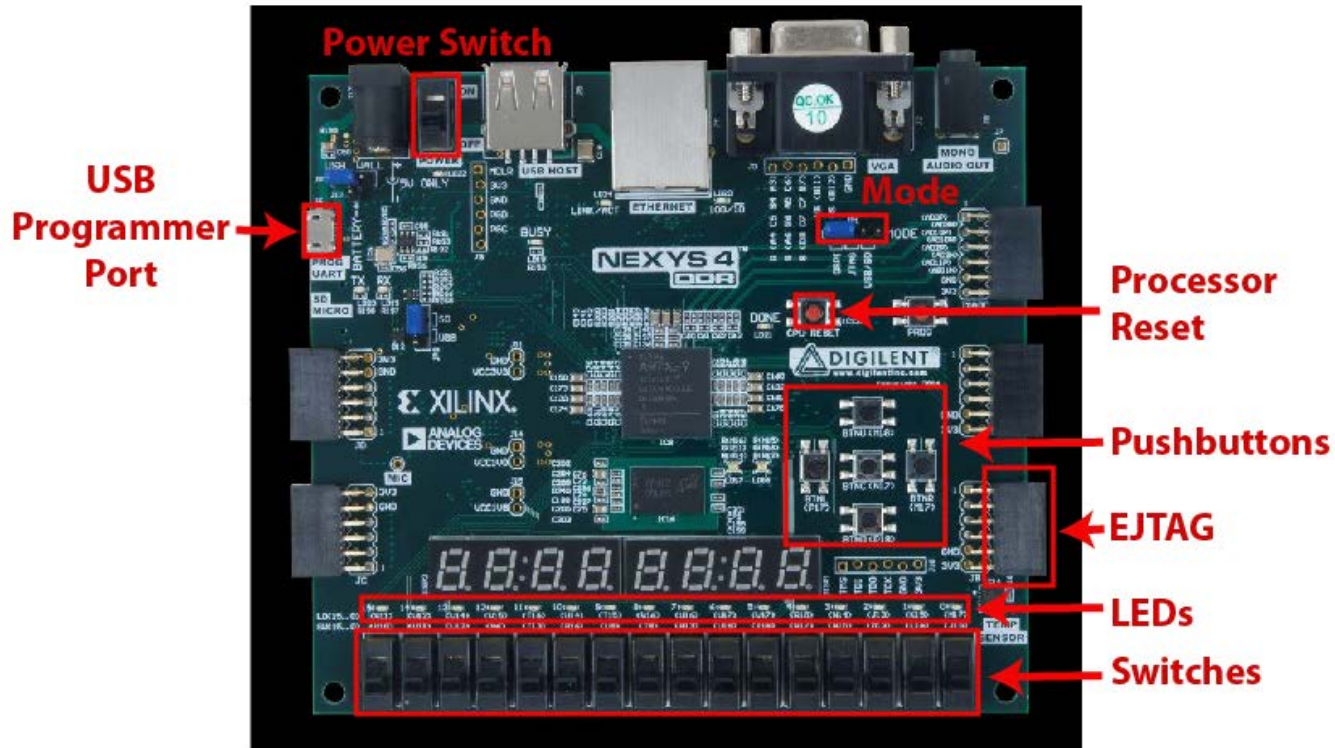
SDI SCK

Command / Data

# Demo



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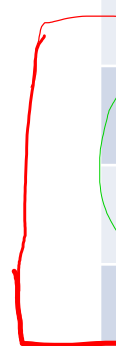


# Parts List



Name	Quantity
Bus Blaster probe	1
Buzzer	1
LCD 1x8	1
Breadboard	1
Jumper wires (male-female)	3
Jumper wires (male-male)	25
Capacitors (1 uF)	3

Lab 5



Lab 6

