

# Microcontrollers

## *Questions for final examination*

Questions are divided into following main topics:

1. Architectural Overview and CPU
2. Memory Configuration
3. Instruction Set and Addressing Modes
4. Stack and Subroutines
5. Interrupt Process
6. System Clock Generator
7. Peripherals

### 1. Architectural Overview and CPU

- 1) Draw a block diagram of microcontroller's standard architecture (family MSP430)
- 2) How many special and universal registers are in the CPU? Describe the purpose for all of them!
- 3) Define differences between unsigned and signed numbers!
- 4) What are flags in status register? Describe them!

### 2. Memory Configuration

- 1) Describe differences between von Neumann and Harvard architectures!
- 2) Describe differences between FLASH and RAM memory!
- 3) Describe memory model of MSP430G2231!

### 3. Instruction Set and Addressing Modes

- 1) What does abbreviations RISC and CISC mean?
- 2) How many instructions are recognized by MSP430 core?
- 3) Describe differences between basic and emulated instructions?
- 4) How many addressing modes are recognized by MSP430 core?
- 5) Instruction set of MSP430 core can be divided into three formats. Describe them!
- 6) What does orthogonality of instruction set mean?

### 4. Stack and Subroutines

- 1) What is a subroutine and when we need to use it in application?
- 2) What is stack and stack pointer?
- 3) Describe program flow with subroutine and cooperation with stack and stack pointer!
- 4) Describe operation of instructions CALL and RET!

## 5. Interrupt Process

- 1) What is interrupt from the general point of view?
- 2) Describe differences between polling and interrupting!
- 3) Define following terms: interrupt source, interrupt request, interrupt priority and interrupt service routine!
- 4) Define following terms: interrupt vector and vector table!
- 5) What does mean maskable and non-maskable interrupts?
- 6) Describe program flow when program is driven by interrupt!

## 6. System Clock Generator – Basic Clock Modul

- 1) Provide an overview of basic clock modul!
- 2) Describe signals generated by basic clock modul!
- 3) Describe an internal digitally controlled oscillator (DCO)!

## 7. Peripherals

- 1) Write the key features of the 16-bit Timer\_A module!
- 2) Briefly describe Up Mode, Continuous Mode and Up/Down Mode of the 16-bit Timer\_A module!
- 3) Briefly describe Capture Mode and Compare Mode of the 16-bit Timer\_A module!
- 4) Describe interrupt vectors associated with the 16-bit Timer\_A module!
- 5) Write the key features of the Universal Serial Interface (USI) module!
- 6) Briefly describe Serial Peripheral Interface (SPI) mode of USI:
  - a. connection between two microcontrollers based on SPI
  - b. signals and protocol used by SPI
  - c. differences between master and slave mode
  - d. SPI interrupts
- 7) Briefly describe I2C mode of USI:
  - a. connection between two microcontrollers based on SPI
  - b. signals and protocol used by SPI
  - c. differences between master and slave mode
  - d. SPI interrupts
- 8) Write the key features of the 10-bit analog-to-digital converter module ADC10:
  - a. conversion modes
  - b. ADC10 interrupts

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