

PV198 - Serial Peripheral Interface

One-chip Controllers

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Embedded communication buses

SPI principles

SPI in FRDM-K66F

Temperature & Pressure sensor

Application

Homework

Intro

- Switch the branch to *Week_06!*
- Discussion of HW5

Embedded communication buses

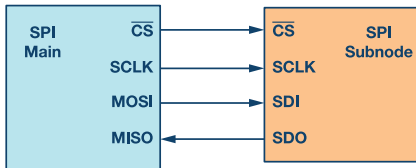
- **SPI – Serial Peripheral Interface**
- I²C – Inter-Integrated Circuit
- UART – Universal asynchronous receiver / transmitter
- CAN – Controller Area Network
- 1-Wire
- RS-485
- RS-232

What is SPI used for?

- Intra-board communication
- Peripherals
- Sensors

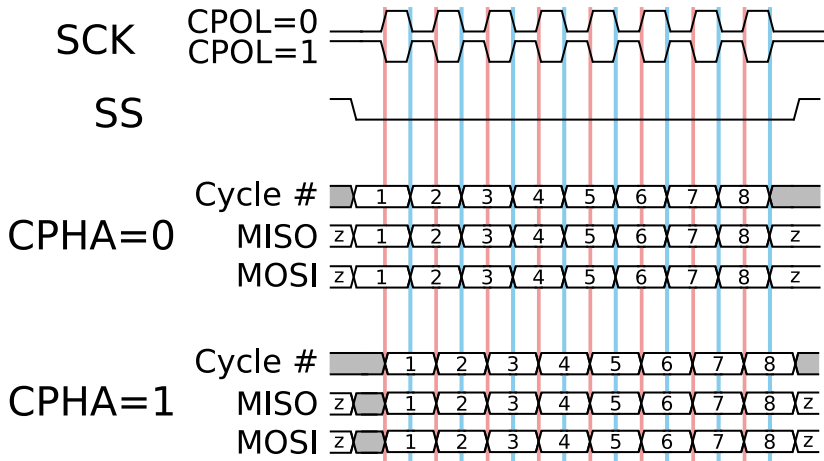
SPI

- 4 wires:
 1. Chip Select
 2. Clock
 3. Master Out Slave In
 4. Master In Slave Out
- Single-master, multi-slave bus
- *Chip Select* selects slave for communication
- Synchronous
- Full-duplex
- Possibility to use only 3 wires (only 1 data wire)



Source: <https://analog.com>

Timing



Source: https://upload.wikimedia.org/wikipedia/commons/b/b6/SPI_timing_diagram.svg

FRDM-K66F SPI

- 3 SPI modules
- Master & Slave support
- Interrupts
- DMA supports
- Programmable frame size (4 to 16 bits)
- 6 peripheral Chip Selects

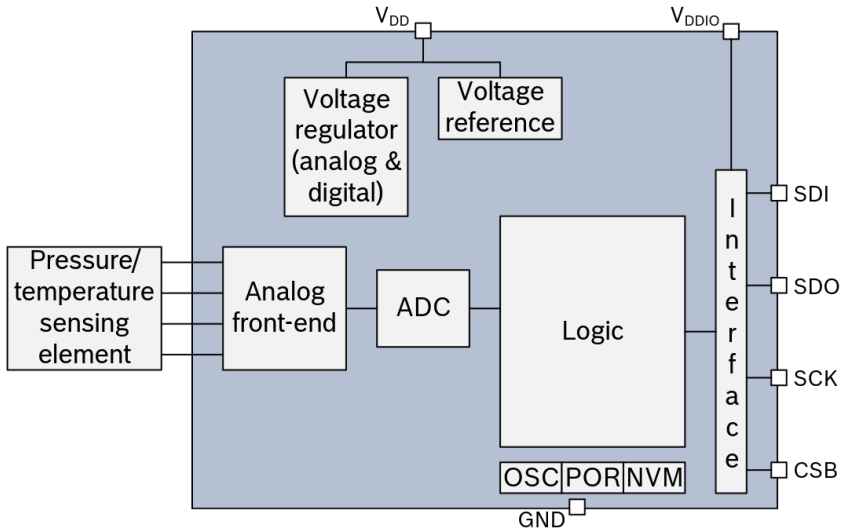
Bosch BMP280

- Datasheet
- Digital interfaces:
 1. I2C (up to 3.4 MHz)
 2. **SPI** (3 and 4 wire, up to 10 MHz)
- Pressure resolution 0.16 Pa
- Temperature resolution 0.01 °C

Warning

Holding any interface pin at a logical high level when V_{DDIO} is switched off can **permanently damage** the device by excessive current flow through the ESD protection diodes!

BMP280 block diagram



Source: BMP280 datasheet

BMP280 SPI

Study the [datasheet](#)!

- 3.3 Measurement flow
- 4.2 Memory map
- 5.3 SPI interface
 - 5.3.1 SPI write
 - 5.3.2 SPI read

Application

- Create an application that reads temperature from BMP280 sensor
- Print temperature into console

Wiring

BMP280	FRDM-K66P	
VCC	4	P3V3
GND	14	GND
SCL	12	PTC5
SDA	7	PTC6
CSB	4	PTC4
SDO	11	PTC7

See [FRDM-K66F Development Platform User's Guide](#), p. 23.

Step-by-step guide

1. Download template from study materials in IS
2. Look at `main` function implementation, pins routing & peripherals (DSPI driver)
3. Implement HW-specific functions in `sensor.c`
 - `spi_reg_write`
 - `spi_reg_read`

Homework – communication with BMP280 over SPI

- Update the application to print pressure as well as temperature.
- Uncompressed value of the pressure has to appear in the output (like with temperature).

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