



**MASARYK
UNIVERSITY**
Czech Republic

PV198 – One-chip Controllers

I2C

NXPCUP

1. International competition with autonomous cars.
2. FI Team:

Write email to 492926 to register (until 28.10.)

You will get a task to solve

Recruitment until 12.12. – we will pick the top students

Content

1. What is I2C
2. What is it used for
3. How does it work
4. FRDM-K66F I2C
5. Accelerometer & Magnetometer
6. Application



What is I2C

- **I2C** – Inter-Integrated **C**ircuit
- Invented in 1982 by Philips Semiconductor (now NXP Semiconductors)



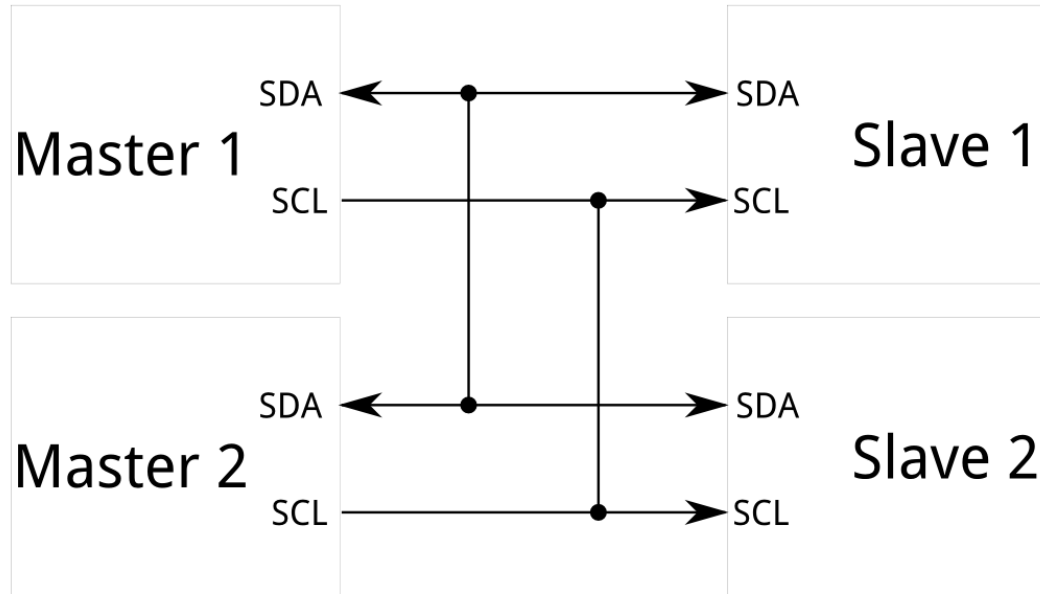
What is it used for

- Intra-board communication
- Peripherals
- Sensors

How does it work

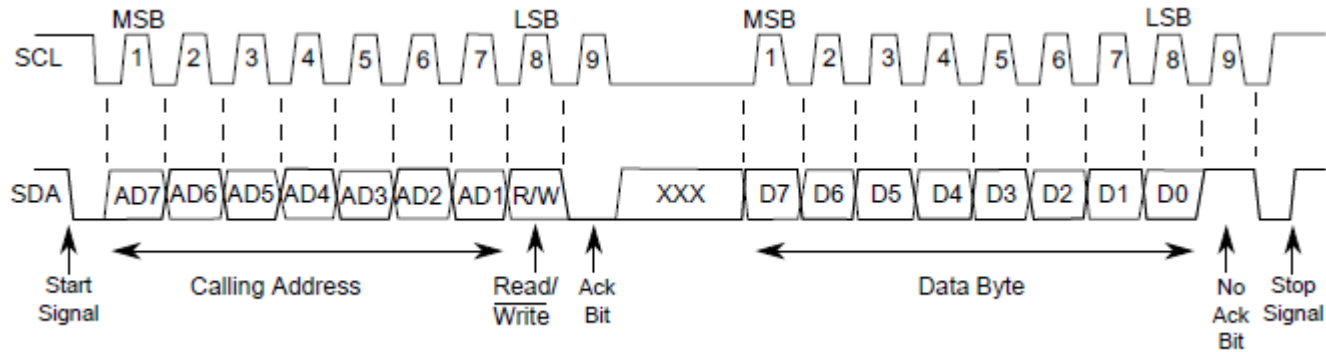
- 2 wires (Clock – SCL, Data – SDA) – pulled high
- Multi-master & multi-slave
- 100 kbit/s – 5 Mbit/s
- 7-bit addressing / 10-bit addressing
- Synchronous
- Half-duplex

How does it work – Scheme



<https://learn.sparkfun.com/tutorials/i2c/all>

How does it work – Message



K66 Sub-Family Reference Manual, Figure 58-2.

FRDM-K66F I2C

- 4 I2C modules
- Address match wakeup in low power modes
- SMBus support
- Methods to use:
 - BOARD_I2C_Receive
 - BOARD_I2C_Send

Accelerometer & Magnetometer

- FXOS8700CQ – [link](#)
- 3-axis, linear accelerometer + 3-axis, magnetometer combined into a single package

Accelerometer & Magnetometer

- Connected to I2C bus and 2 GPIO signals

Table 6. Accelerometer and magnetometer signals connection

FXOS8700CQ	K66F Connection
SCL	PTD8/LLWU_P24/I2C0_SCL/LPUART0_RX/FB_A16
SDA	PTD9/I2C0_SDA/LPUART0_TX/FB_A17
INT1	PTC17/CAN1_TX/UART3_TX/ENET0_1588_TMR1/FB_CS4/FB_TSIZE0/FB_BE31_24_BLS7_0/SDRAM_DQM3
INT2	PTC13/UART4_CTS/FTM_CLKIN1/FB_AD26/SDRAM_D26/TPM_CLKIN1

Freedom FRDM-K66F Development Platform User's Guide, Table 6.

Application – Template

- *startInitialization* (check sensor ID, wake-up)
- *setupOrientationDetection* (enable detection, interrupts, etc.) – Homework
- *finishInitialization* (setup frequency, activate sensor)

Application

- Create an application that reads accelerometer output data registers

Study the datasheet!

- Print register values into console
- Trap: Check configuration of pins and peripherals

Bonus:

- Calculate tilt angle from received values

Homework

- Create an application that detects orientation of the board (the same way as mobile phones do)
- Use the feature of the sensor – do not calculate it in the MCU from XYZ register values
- Use interrupt from sensor
- Print current orientation into console when orientation of the board changes

Homework

- Write your code into method ***setupOrientationDetection()***
- [Link to Application note: AN4068](#)