MISR UNIVERSITY FOR SCIENCE AND TECHNOLOGY
COLLEGE OF ENGINEERING
MECHATRONICS DEPARTMENT

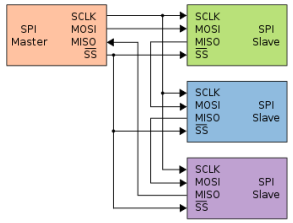
MTE 405 SENSORS AND MEASUREMENTS

Lab 7 – SPRING 2019

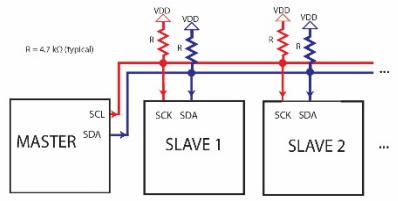
Lab 7

Goals Of The Lab

Advanced Measurements System



Serial **P**eripheral **I**nterface (SPI)

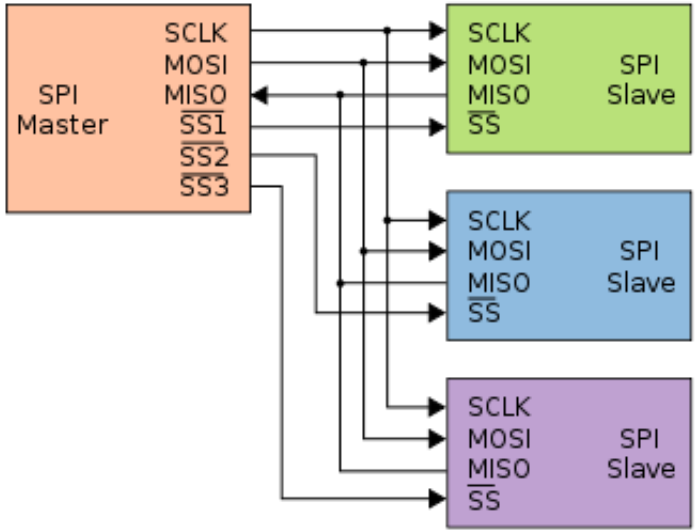


Inter-**I**ntegrated **C**ircuit (I^2C)

Lab 7

SPI

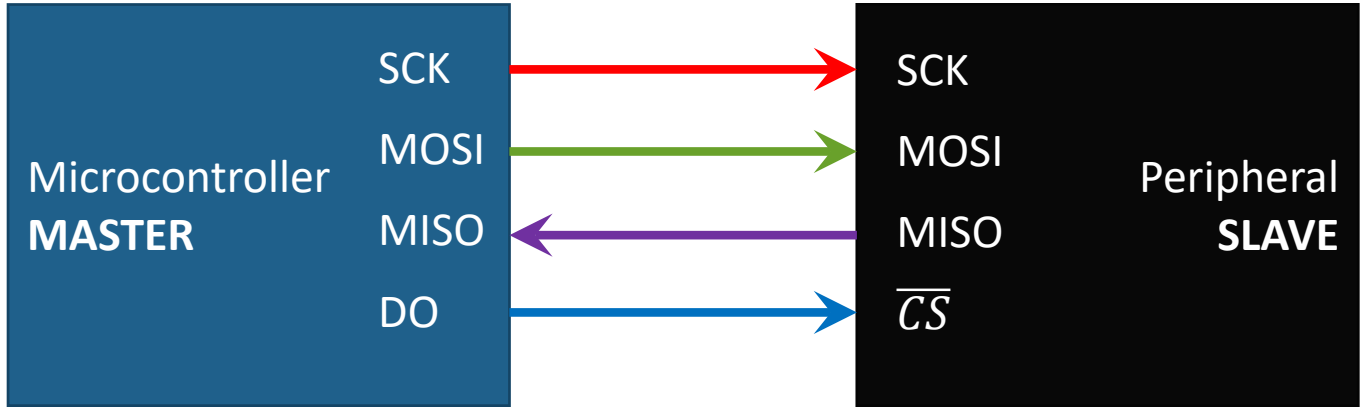
Serial **P**eripheral **I**nterface



Lab 7

SPI

- Sending data between **Microcontroller** and **peripherals**
- Dedicated **Clock bus** (*CLK or SCK*)
- Dedicated **Data bus** (*MISO and MOSI*)
- **Chip Select** (CS) for selecting peripheral



SPI

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Common peripherals

- Accelerometers
- SD cards
- IO port expander

SPI

Clock speed is higher than I2C and UART

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- Dedicated **Clock bus** (*CLK or SCK*)
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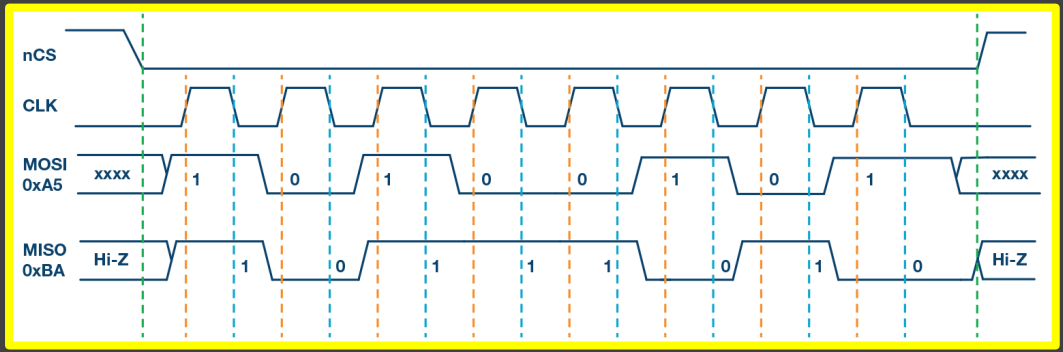

Clock is used for synchronization

CPOL : Clock polarity (when IDLE)

CPHA : Clock phase (when to shift data out)

Clock has 4 modes (assignment)

SPI

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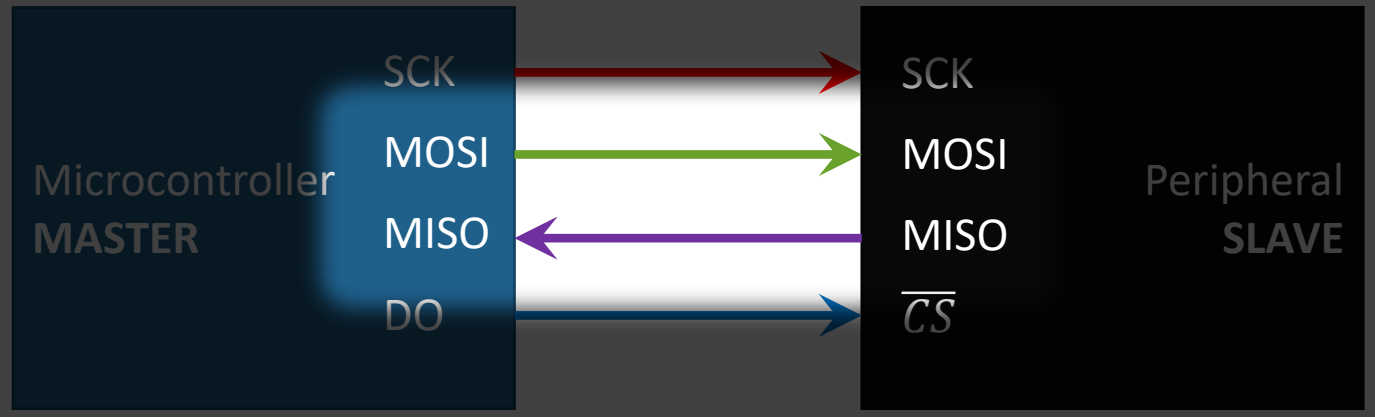

MOSI : Master Out (Micro) → Slave In (Peripheral)

MISO : Master In (Micro) ← Slave Out (Peripheral)

SPI

- Sending data between **Microcontroller** and **peripherals**
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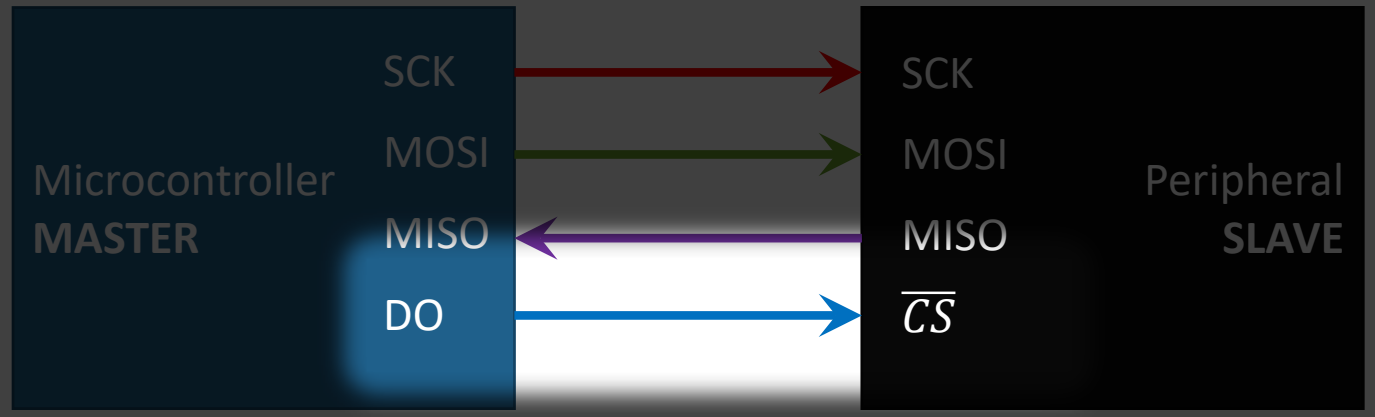

$\overline{CS}$: **Chip Select (Active Low)**

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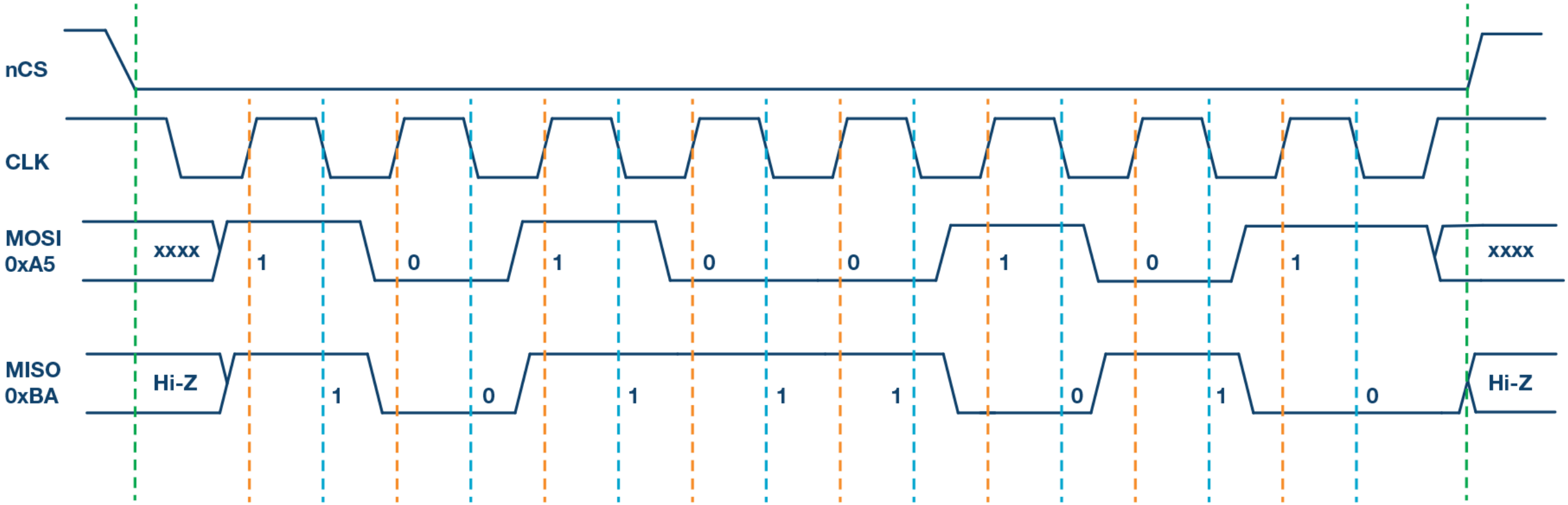
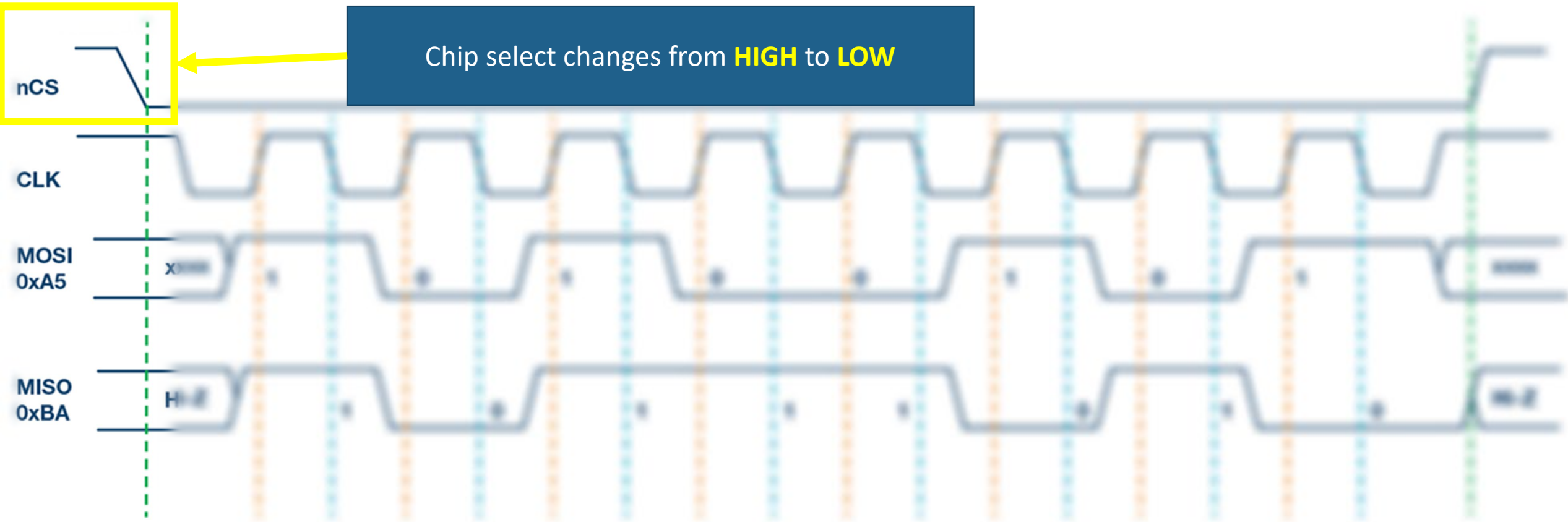
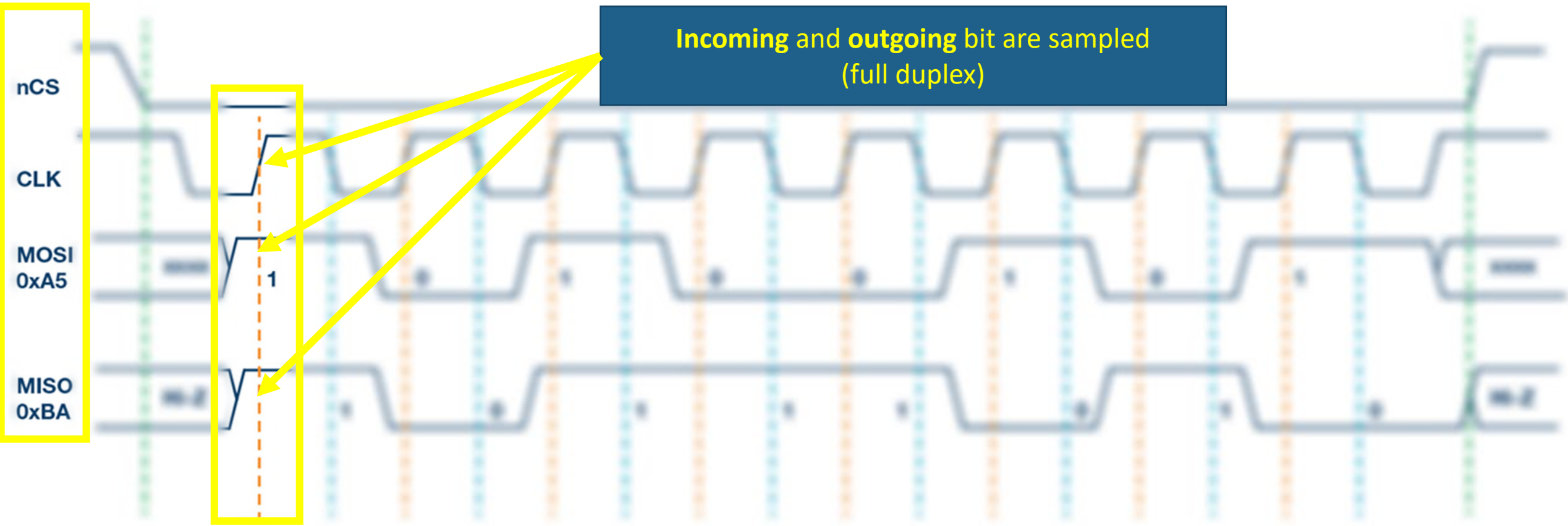
SPI Communication



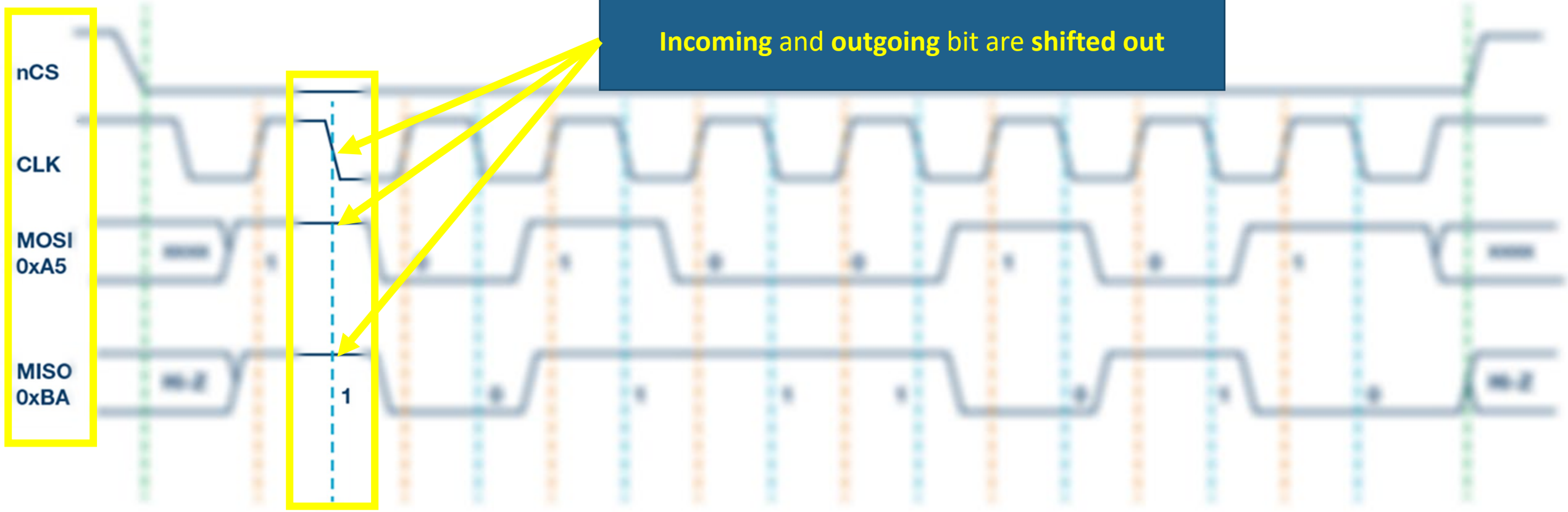
SPI Communication



SPI Communication



SPI Communication



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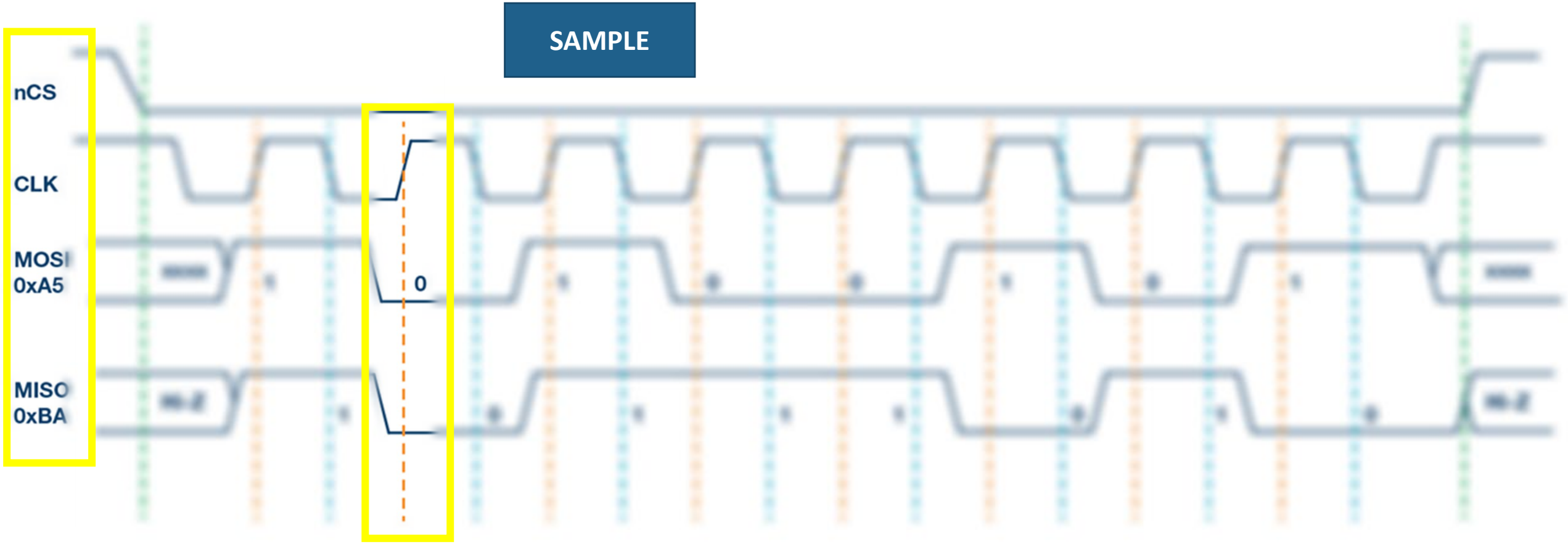
SPI Communication



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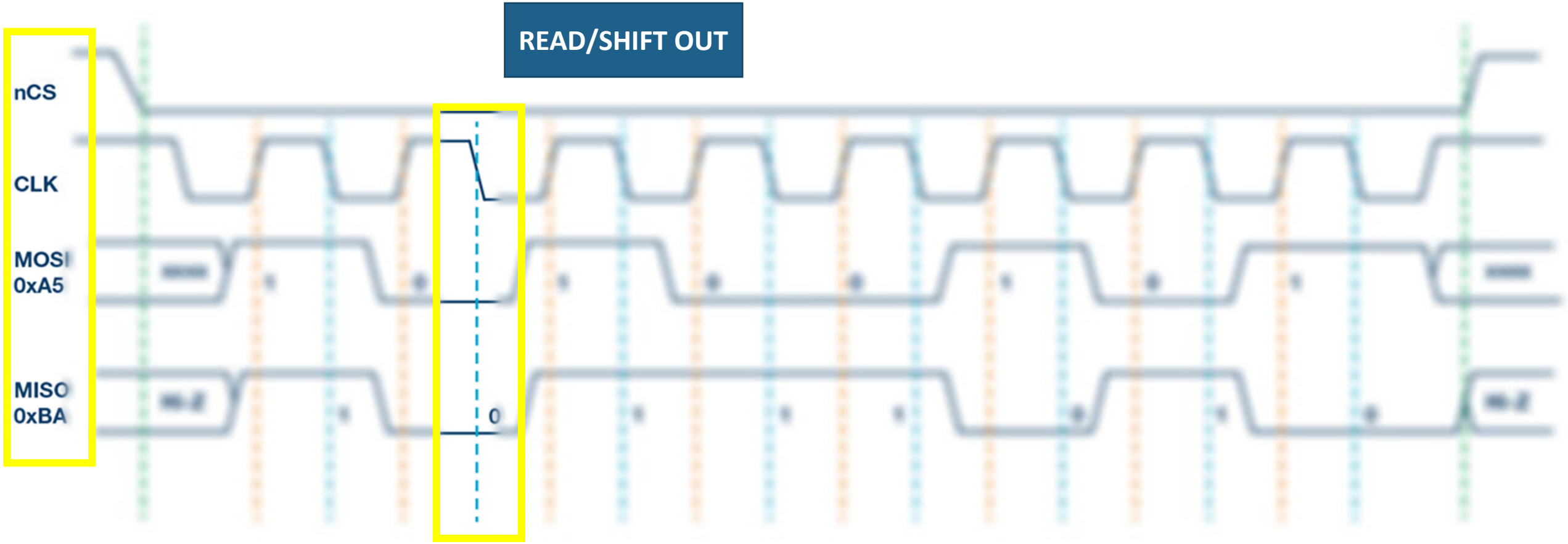
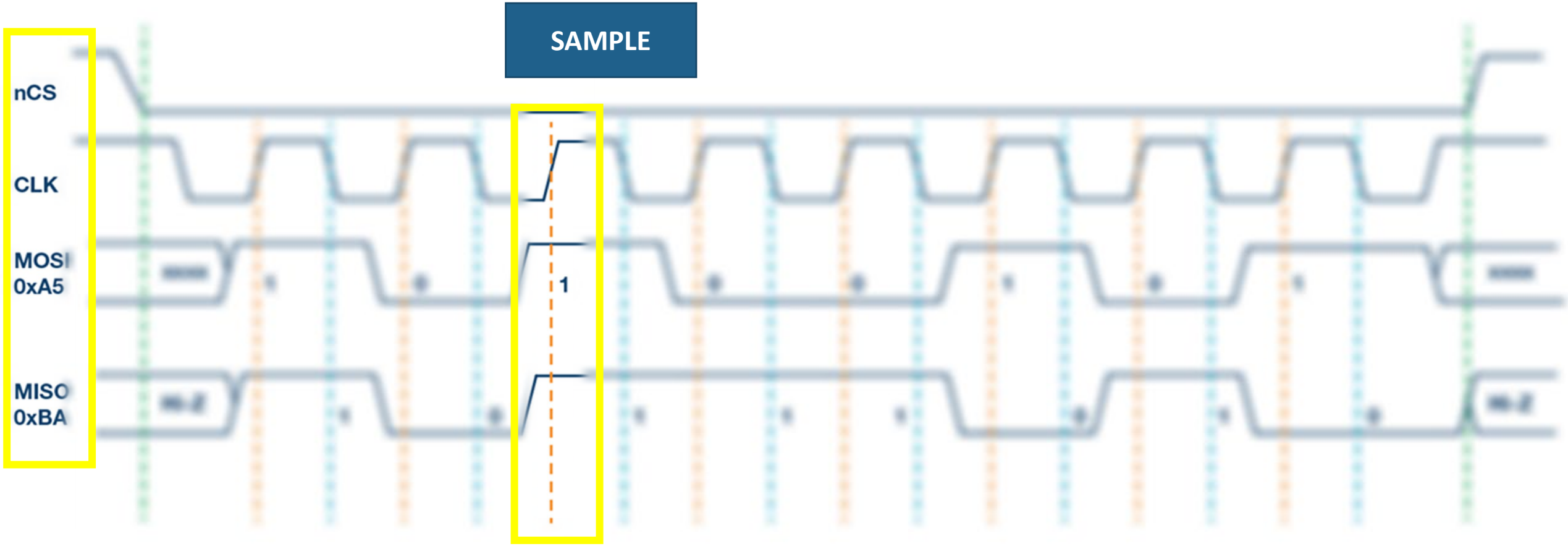
SPI Communication



SPI Communication



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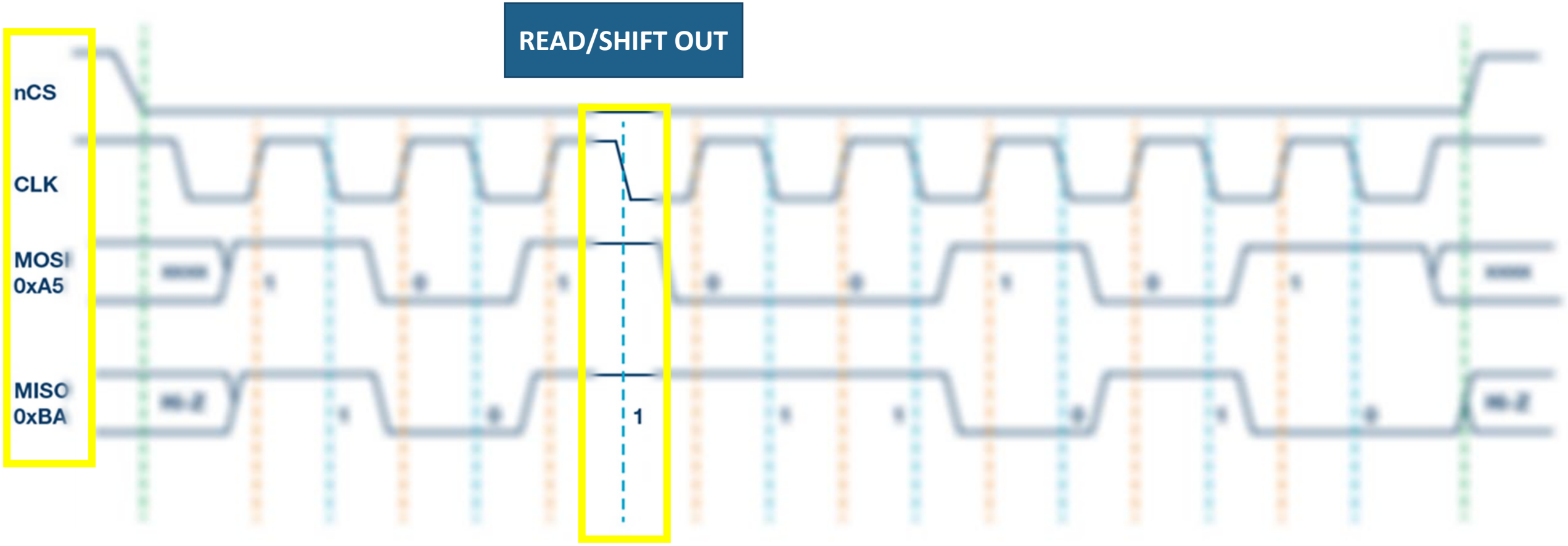
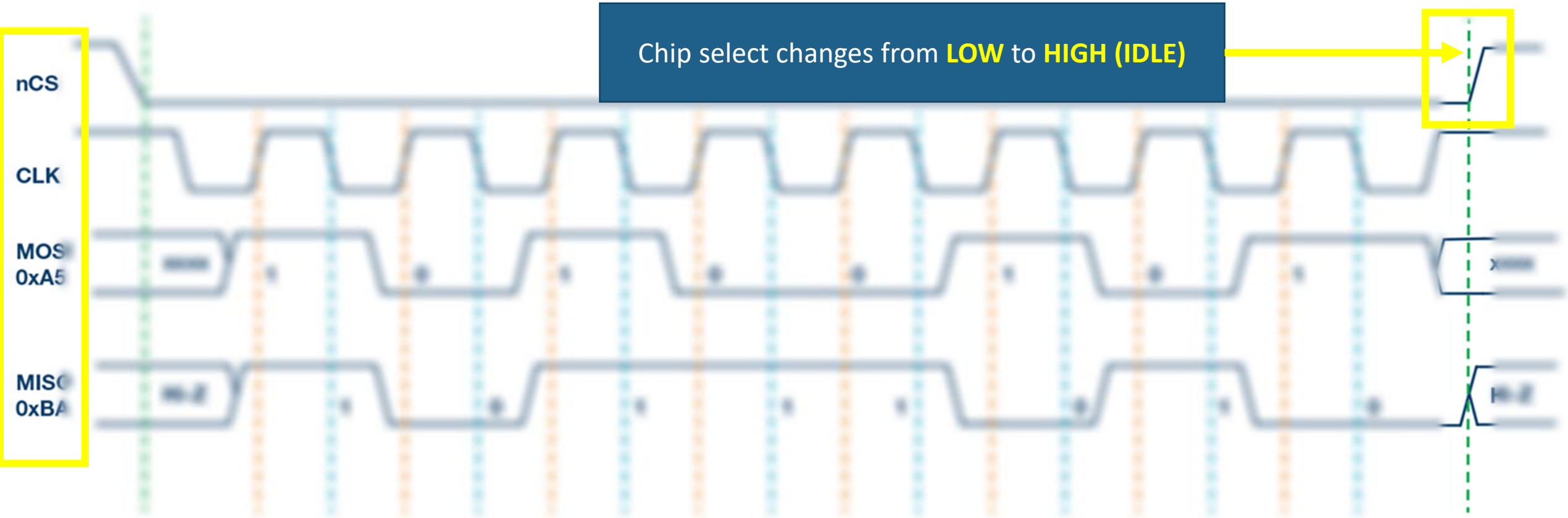
SPI Communication

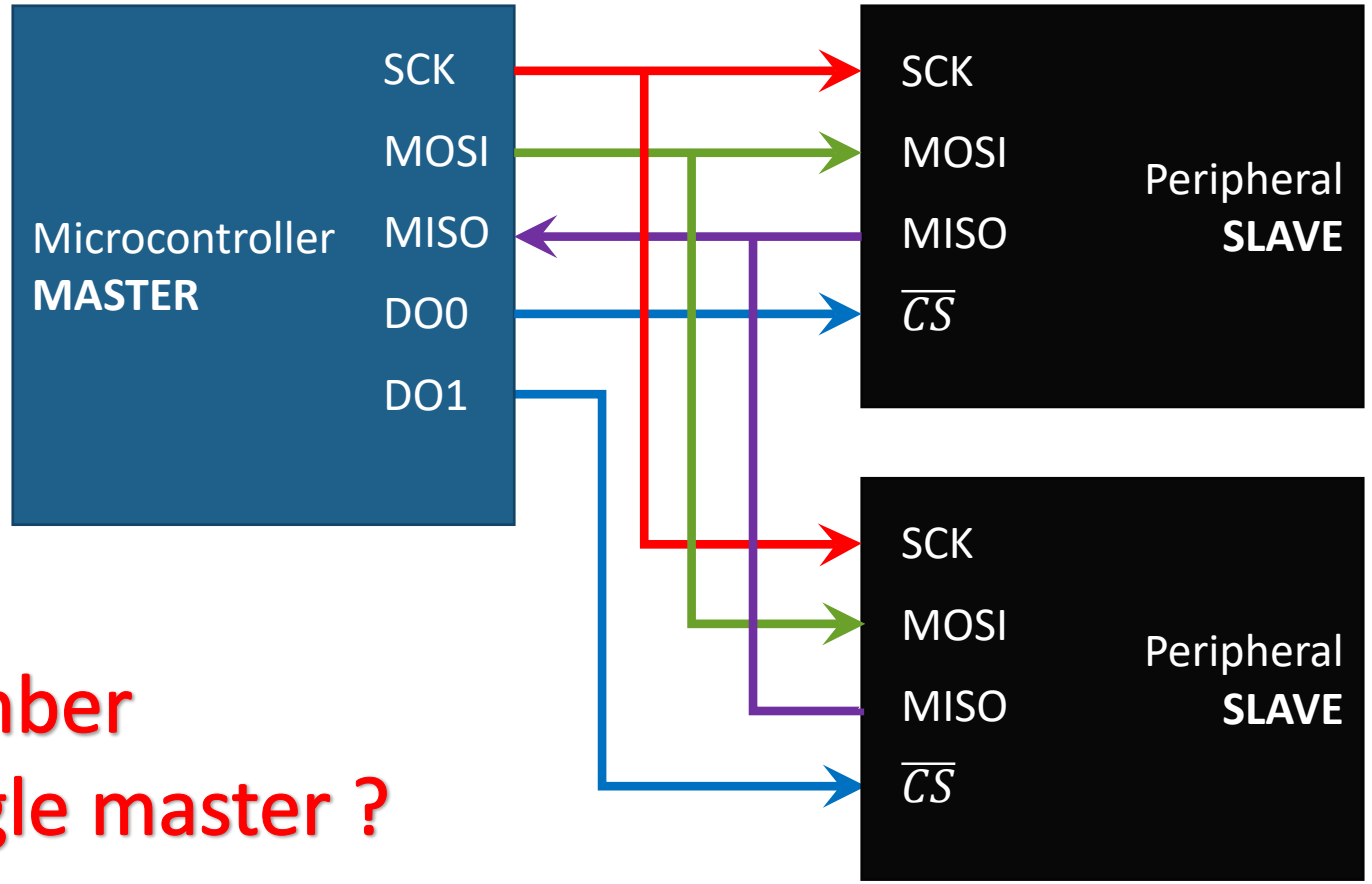


SPI Communication



SPI Multi-Slave Configuration

- Slave is selected using **Chip Select**
- Each data bus is tied together
- Dedicated **Data bus** (*MISO and MOSI*)



What is the max number of slaves connected to a single master ?

Lab 7

Exercise 1

SPI Digital Potentiometer

Libraries for exercise

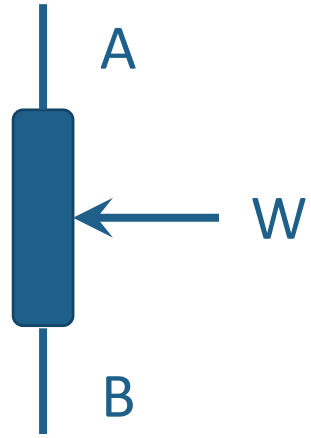
Built-in SPI library

```
#include <SPI.h>                    // SPI library
SPI.begin();                        // Initialize SPI

digitalWrite(CSPin, LOW);           // Select peripheral
SPI.transfer(byte);                 // Send Byte
digitalWrite(CSPin, HIGH);          // Deselect peripheral
```

AD5204 Digital Potentiometer

- **256** positions
- **4** channels
- 10k, 50k and 100k variants



AD5204BN**XX**

CHANNEL ADDRESS			RESISTANCE VALUE							
A2	A1	A0	D7	D6	D5	D4	D3	D2	D1	D0

0x00 - 0x03

0-255 → 0-10K

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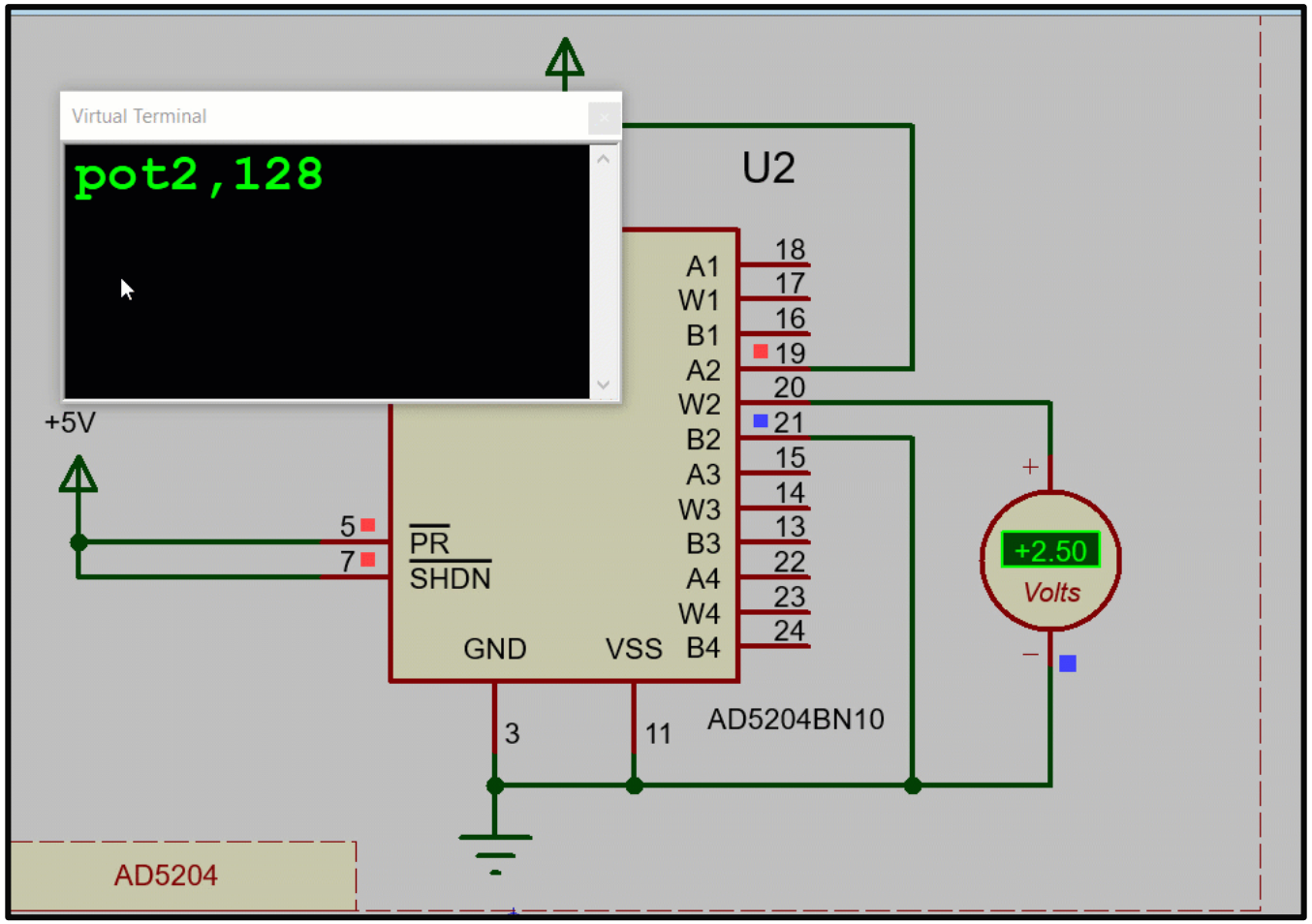
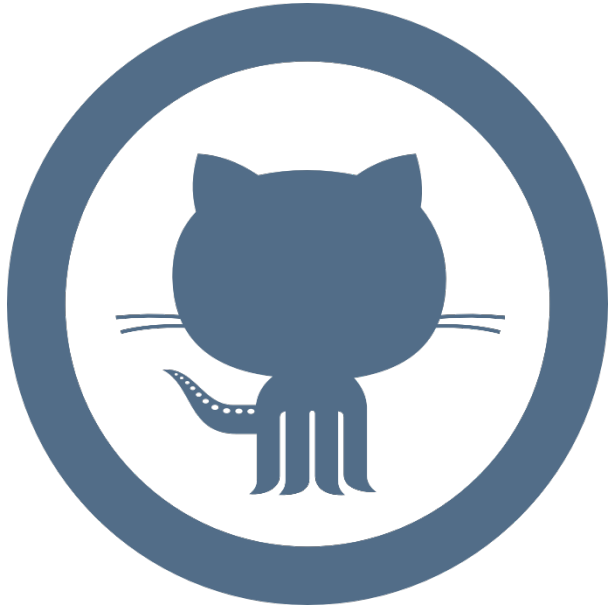
AD5204 Digital Potentiometer





Don’t forget to pull the lab update from.

http://github.com/wbadry/mte405

END OF Lab 7