

Communication Protocols

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Communication Protocols I

- Introduction
- UART
- SPI
- I²C

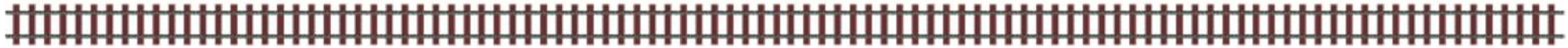
Introduction

- What do mean by Communication?
- **Mode of Communications**
- Type of Communications
- Why Protocols?

Introduction

Modes of Communication

- Simplex



- Half Duplex



- Duplex



UART



Serial Peripheral Interface

- Introduction
- Interface
- Hardware Configurations
- Data Transmission
 - Data Validity

SPI

Introduction

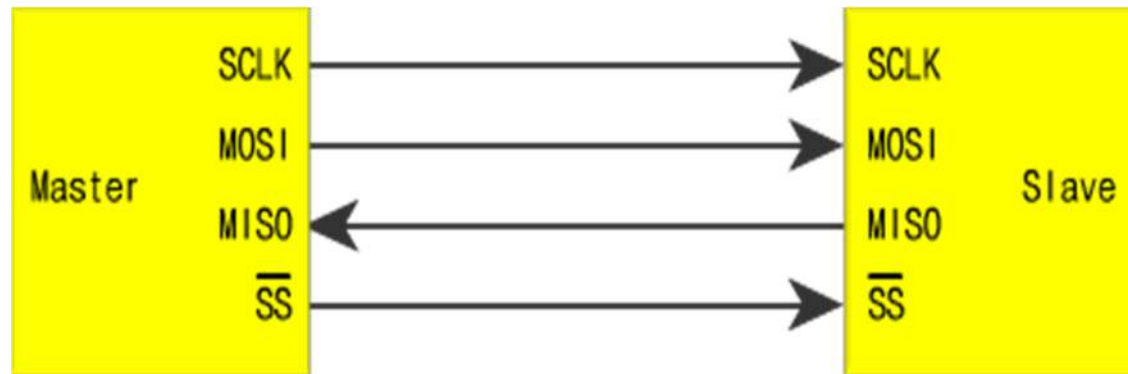
- Synchronous
- Full Duplex
- Master / Slave

SPI Interface

- SCLK
- MOSI
- MISO
- nSS

SPI

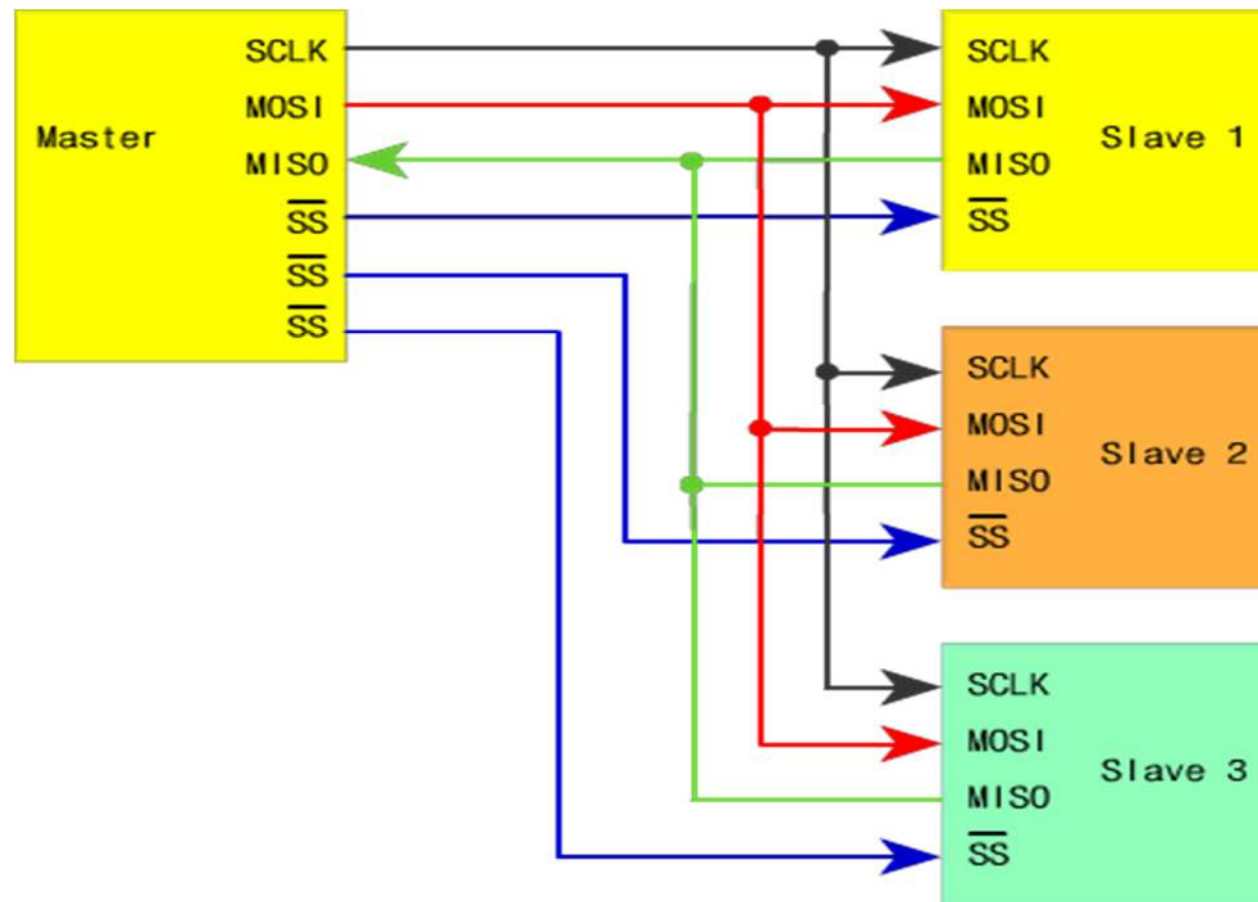
Hardware Configuration



Single Master and Single Slave

SPI

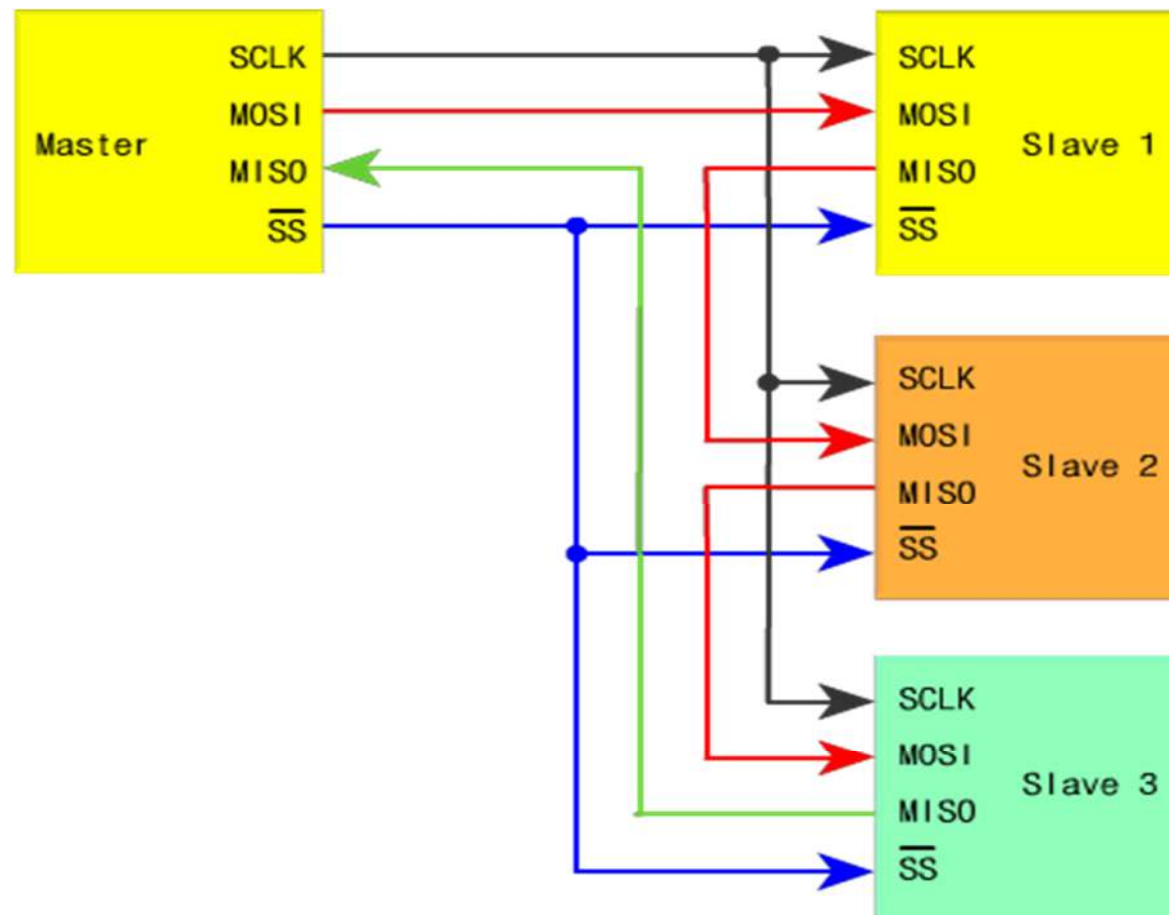
Hardware Configuration



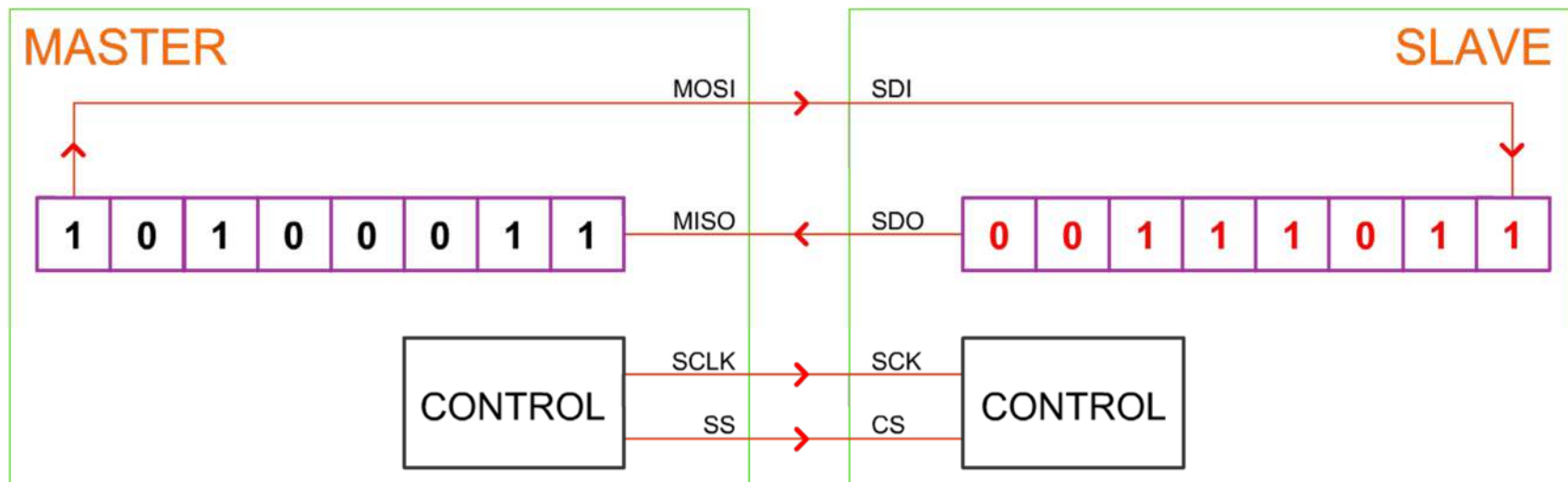
Single Master and three Slaves

SPI

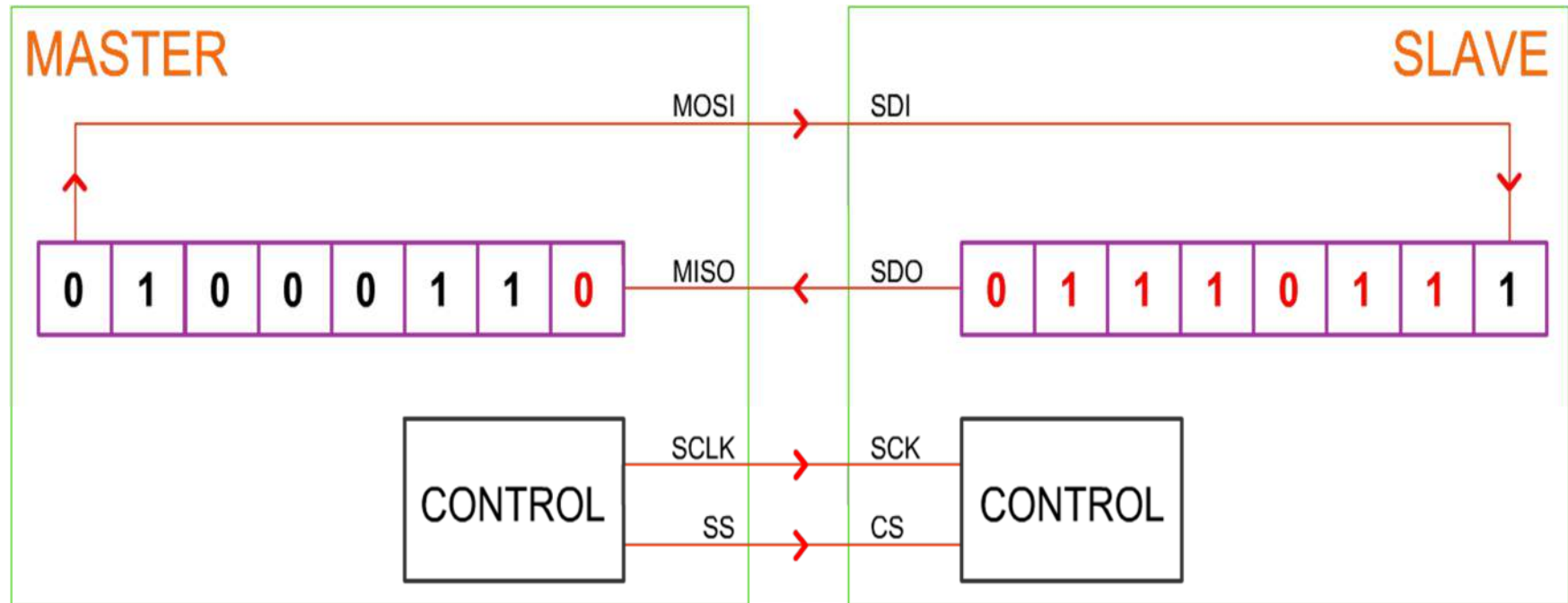
Hardware Configuration



SPI Data Transmission



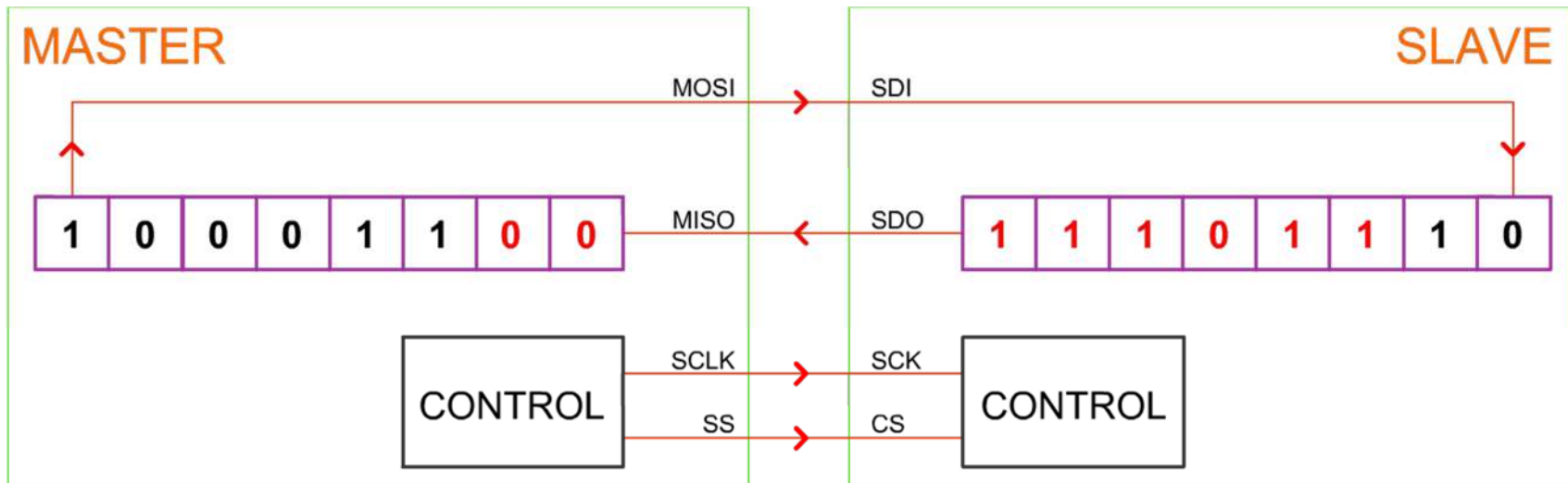
SPI Data Transmission



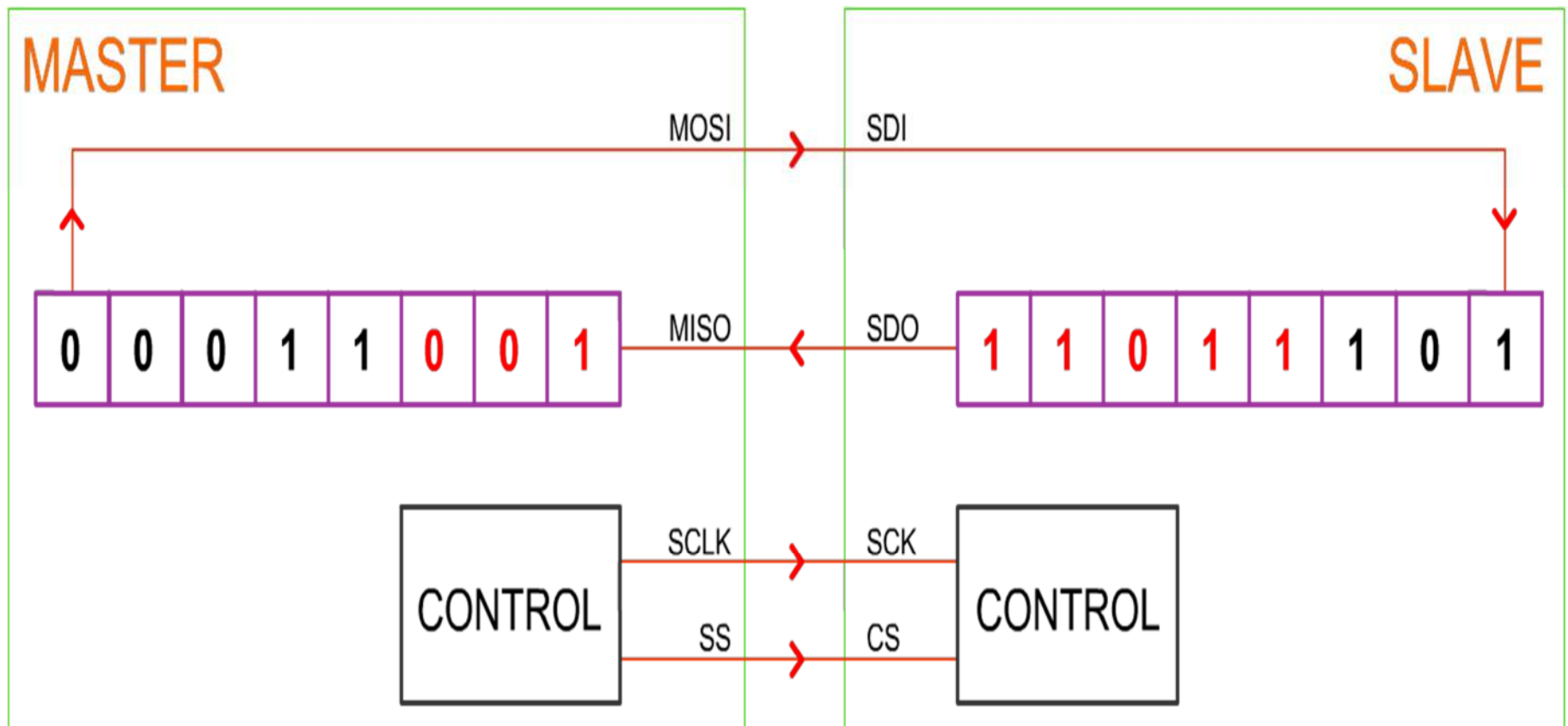
SPI

Data Transmission

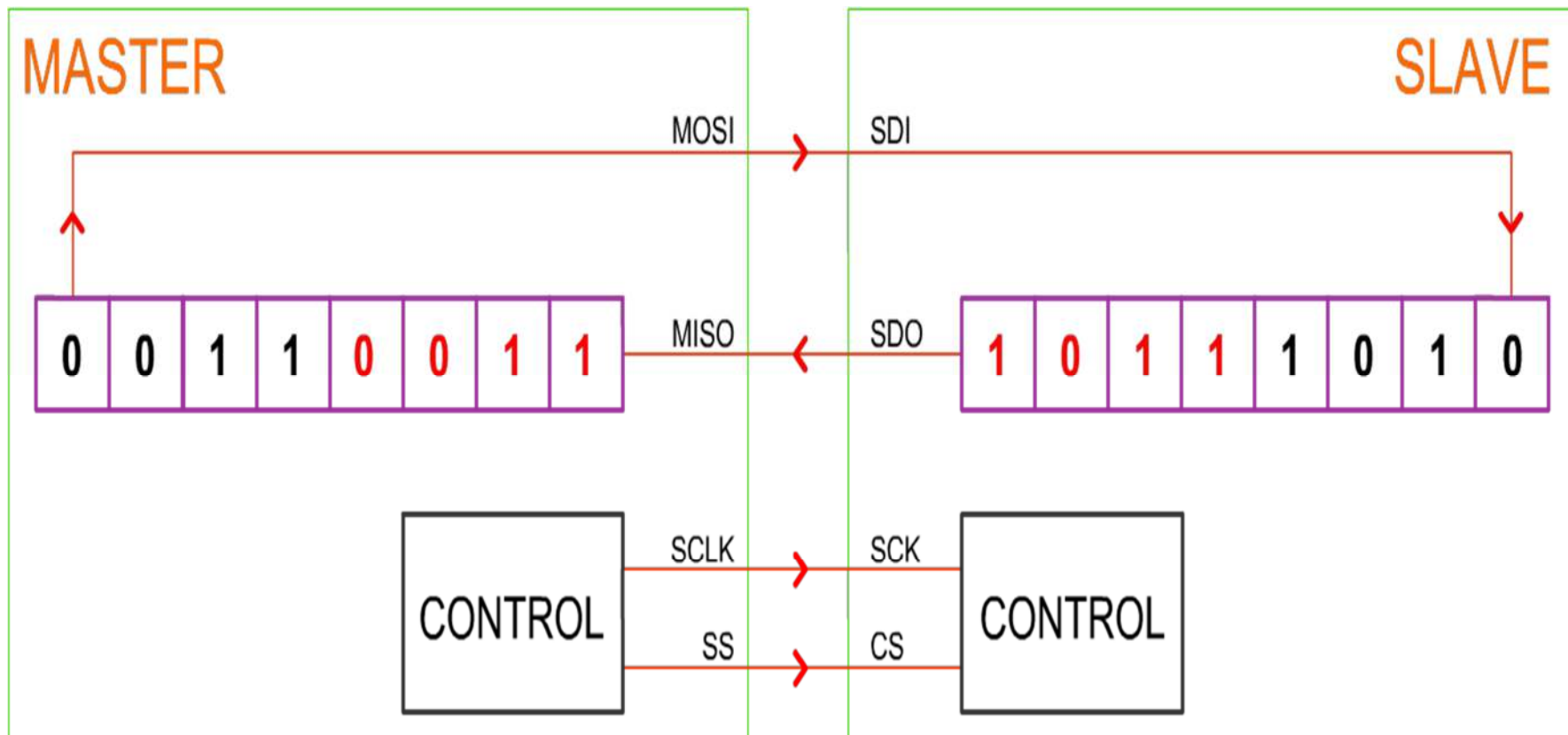
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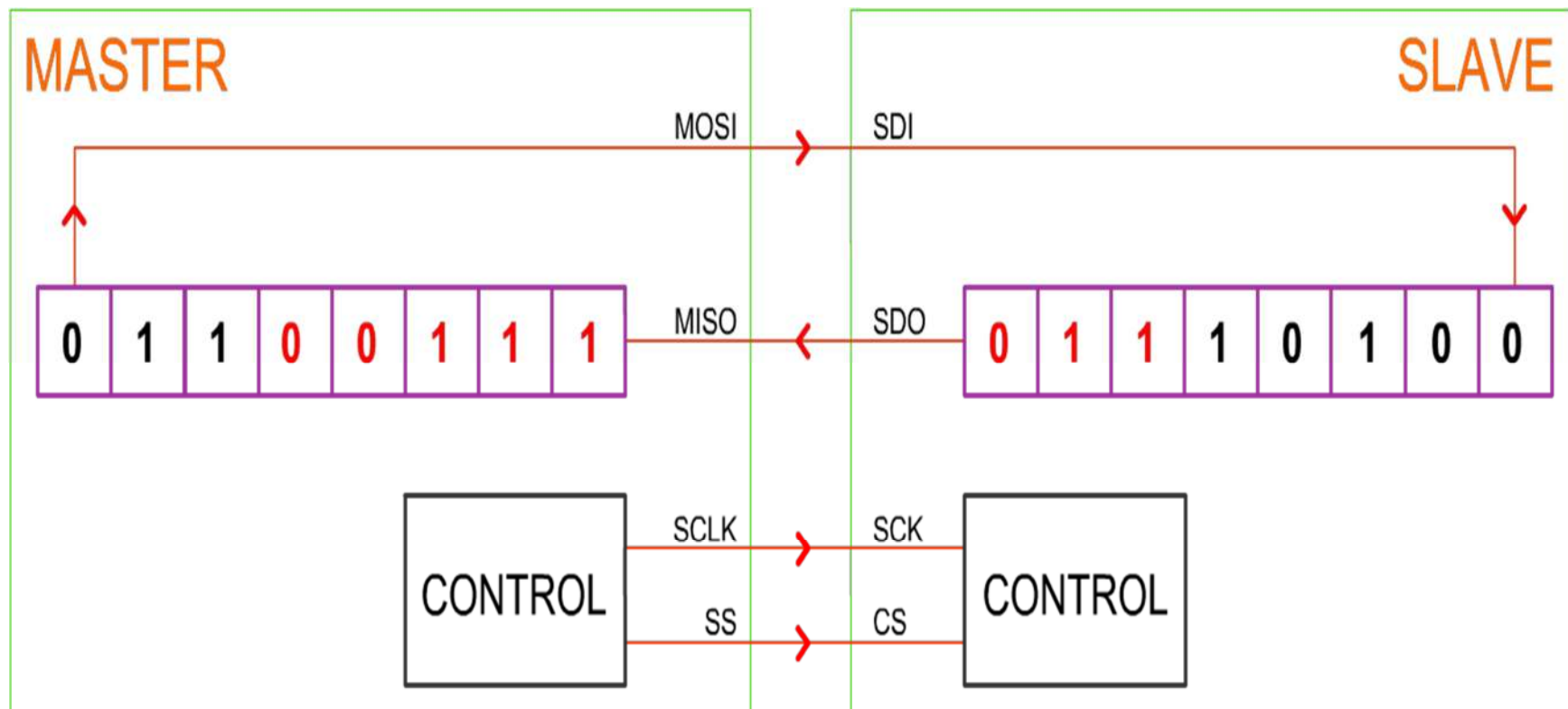
SPI Data Transmission



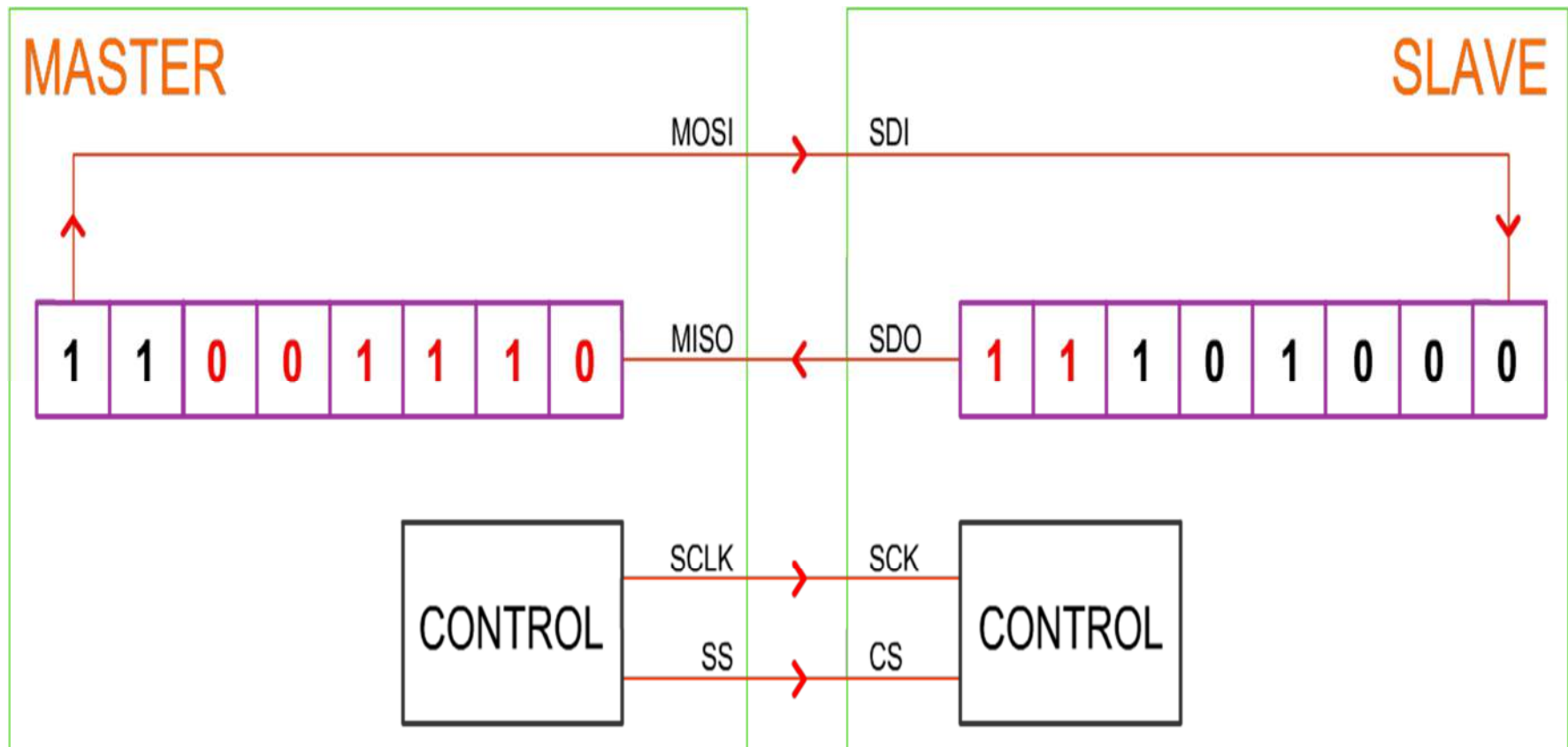
SPI Data Transmission



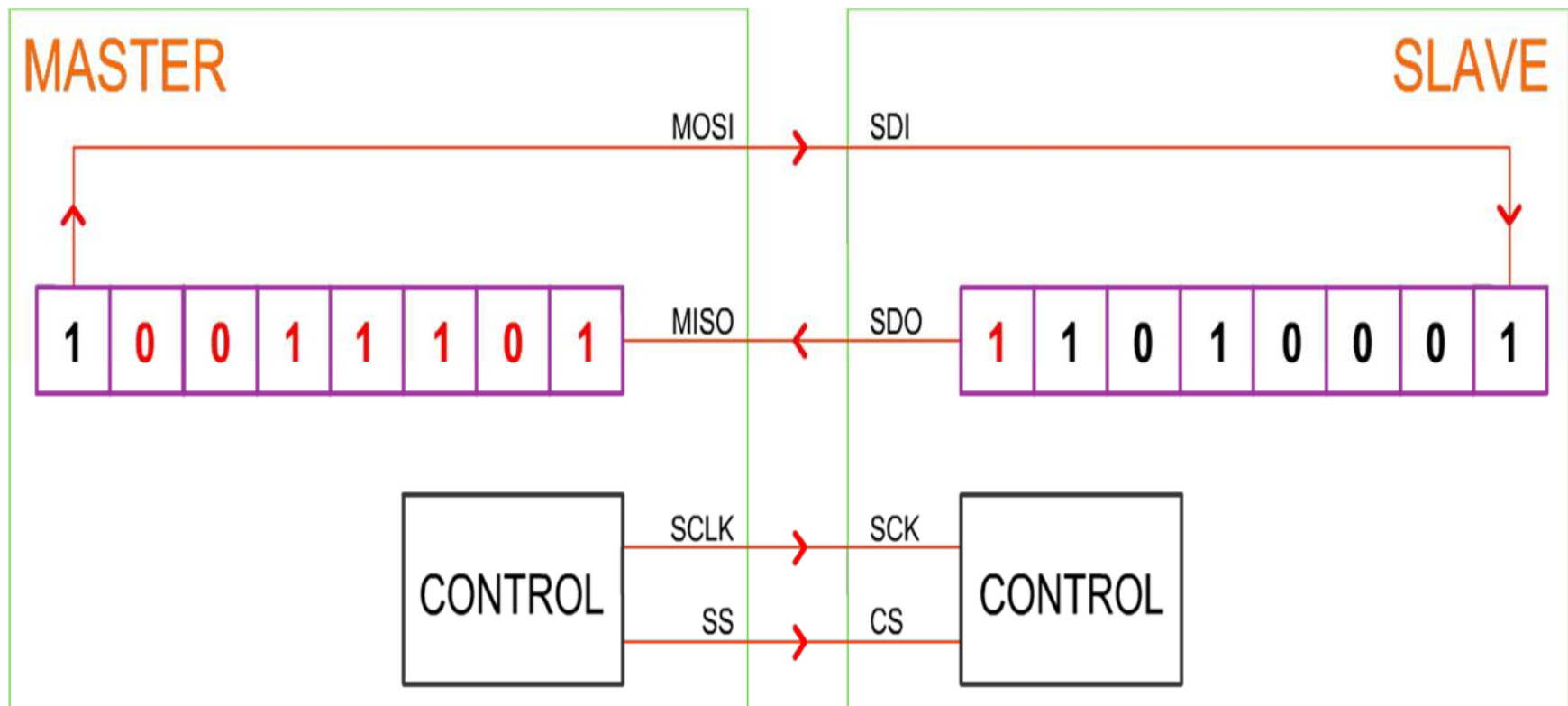
SPI Data Transmission



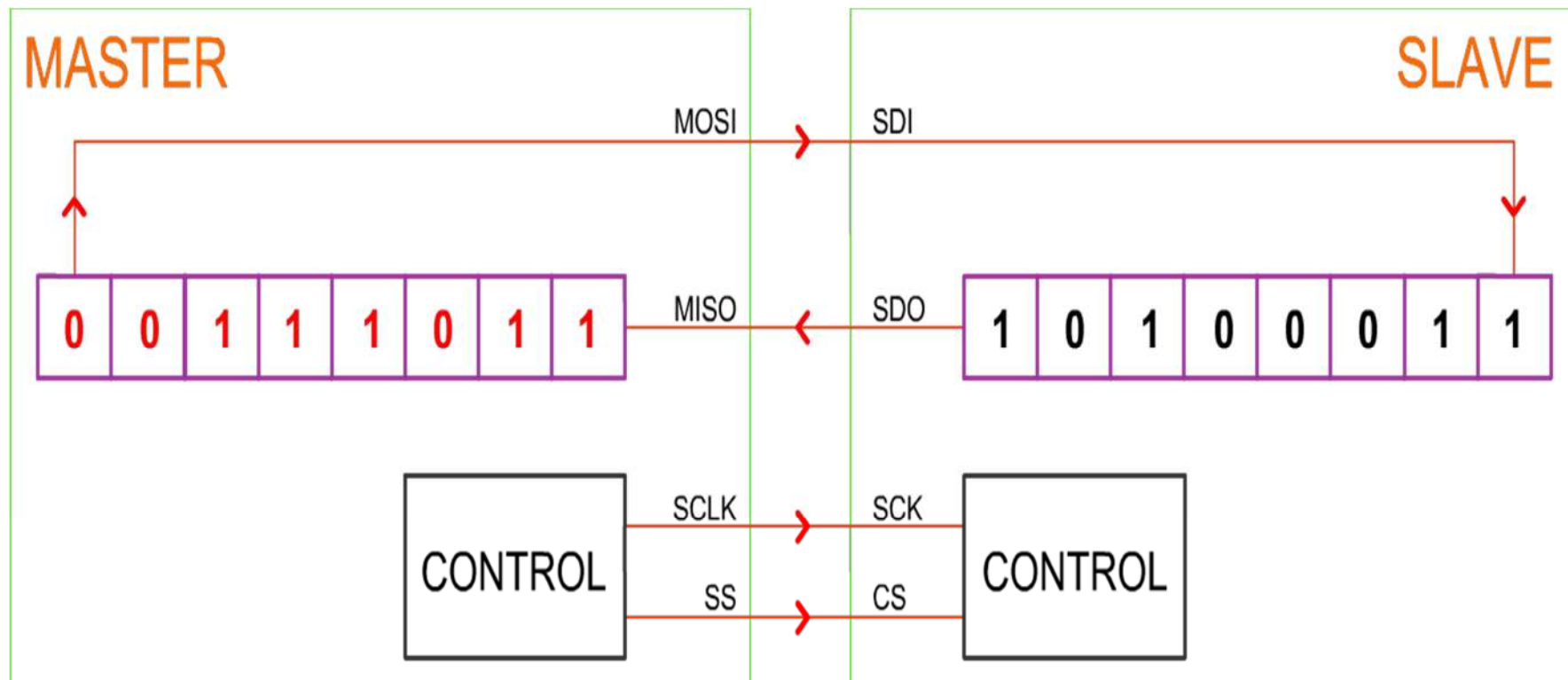
SPI Data Transmission



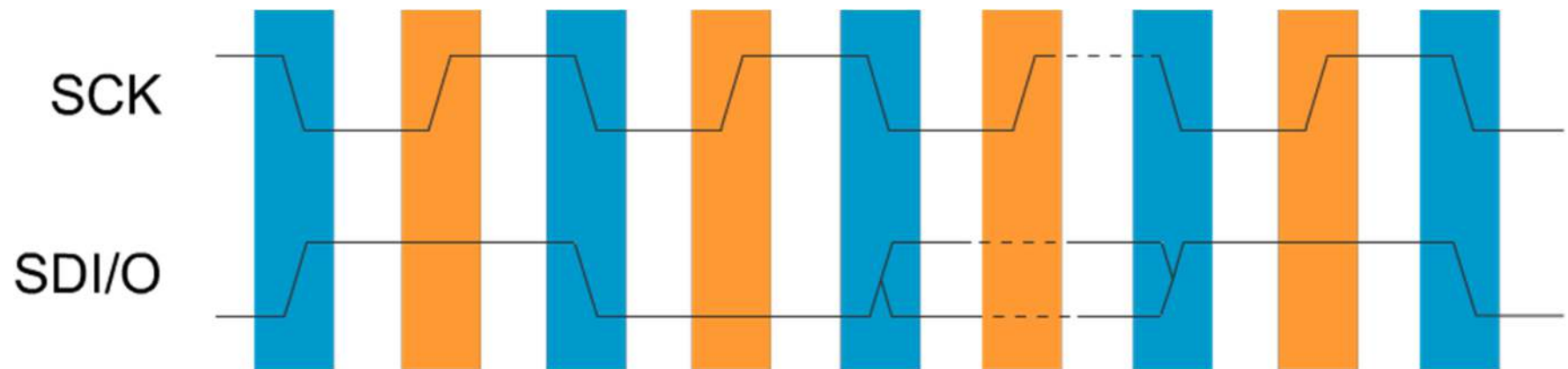
SPI Data Transmission



SPI Data Transmission



SPI Data Validity



 Data Change

 Data Read

Inter Integrated Circuits

- Introduction
- Bus Features
- The Protocol
- Bus Speeds

I²C

Introduction

- Synchronous
- Half Duplex
- Multi Master / Slave

I²C

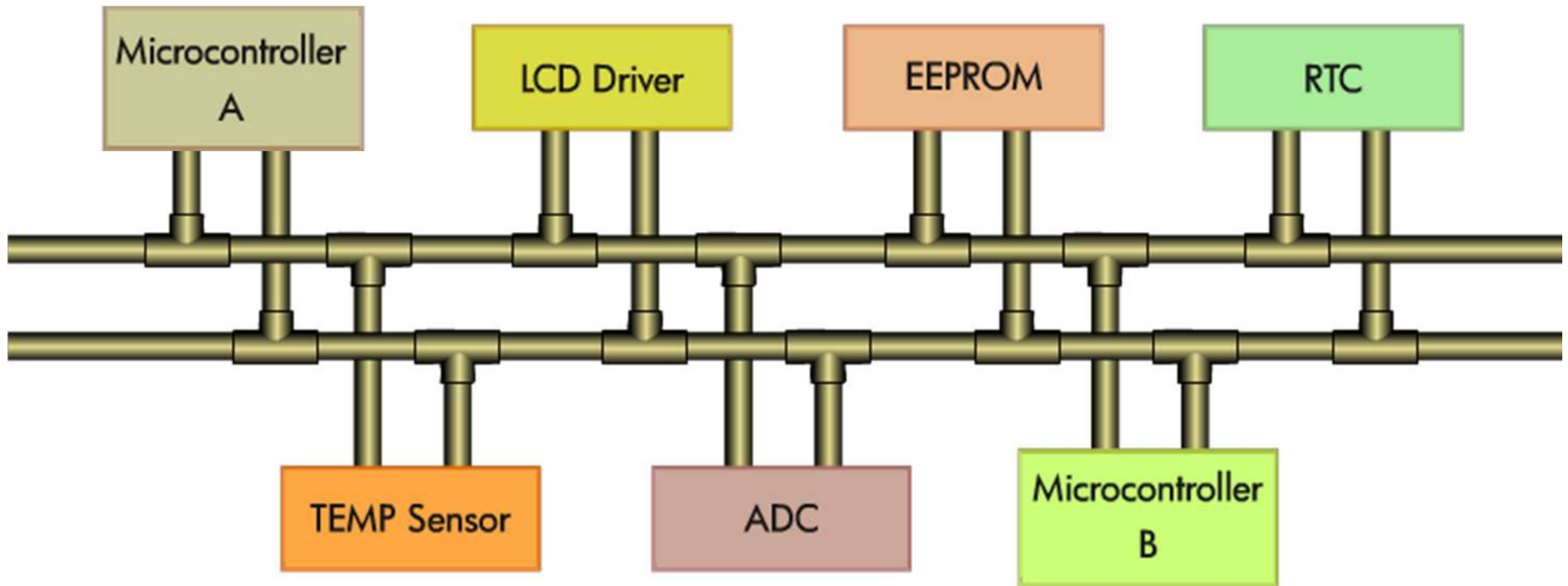
Bus Features

- Two Line Interface
- Software Addressable
- Multi Master with CD
- Serial, 8 bit Oriented, Bidirectional with 4 Modes
- On Chip Filtering

I²C Protocol

- Example
- Signals
- A Complete Data Transfer

I²C Example

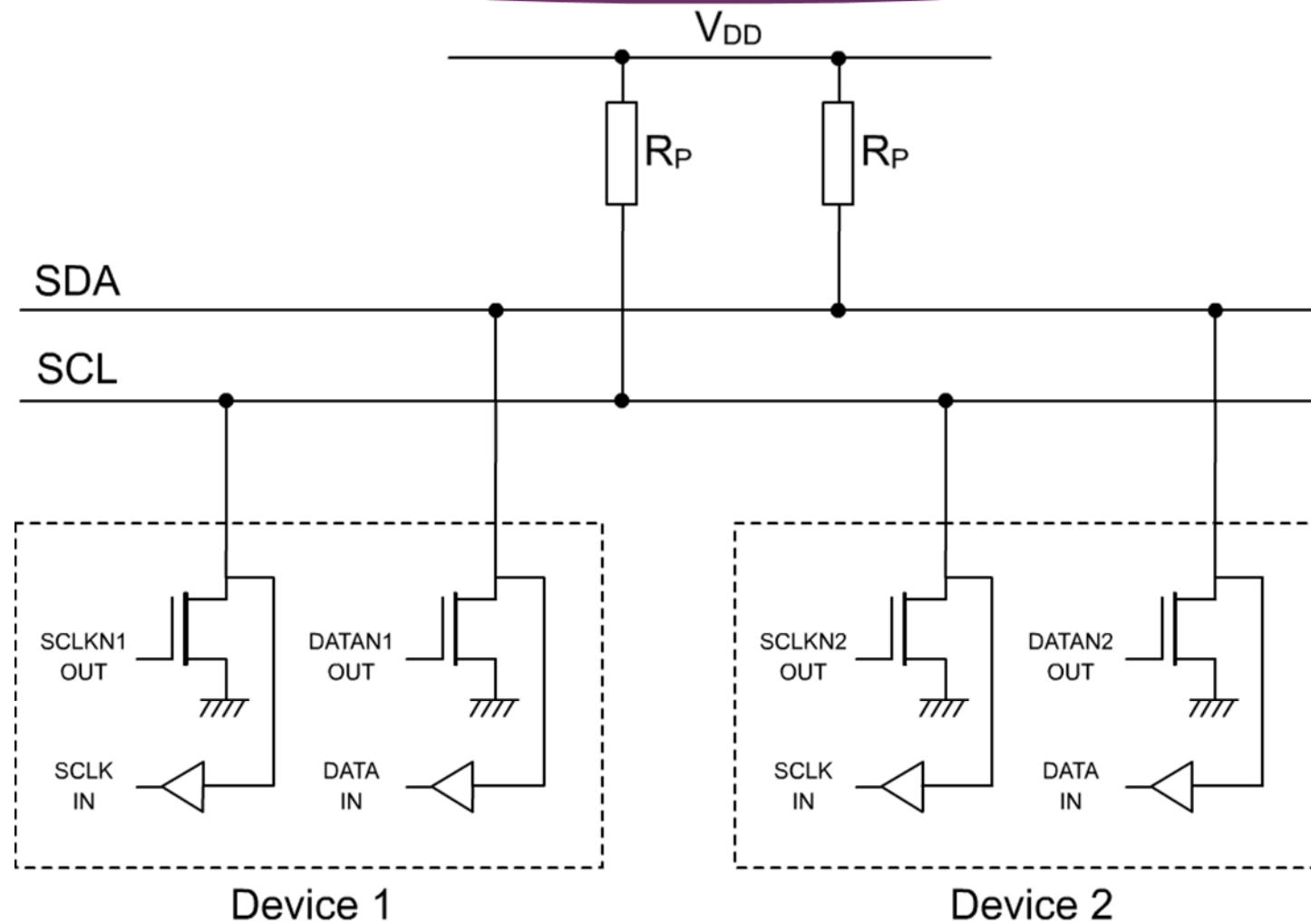


I²C Signals

- Two-wired Interface
 - SDA
 - SCL
- Wired-AND
- Conditions and Data Validity
- Transmission

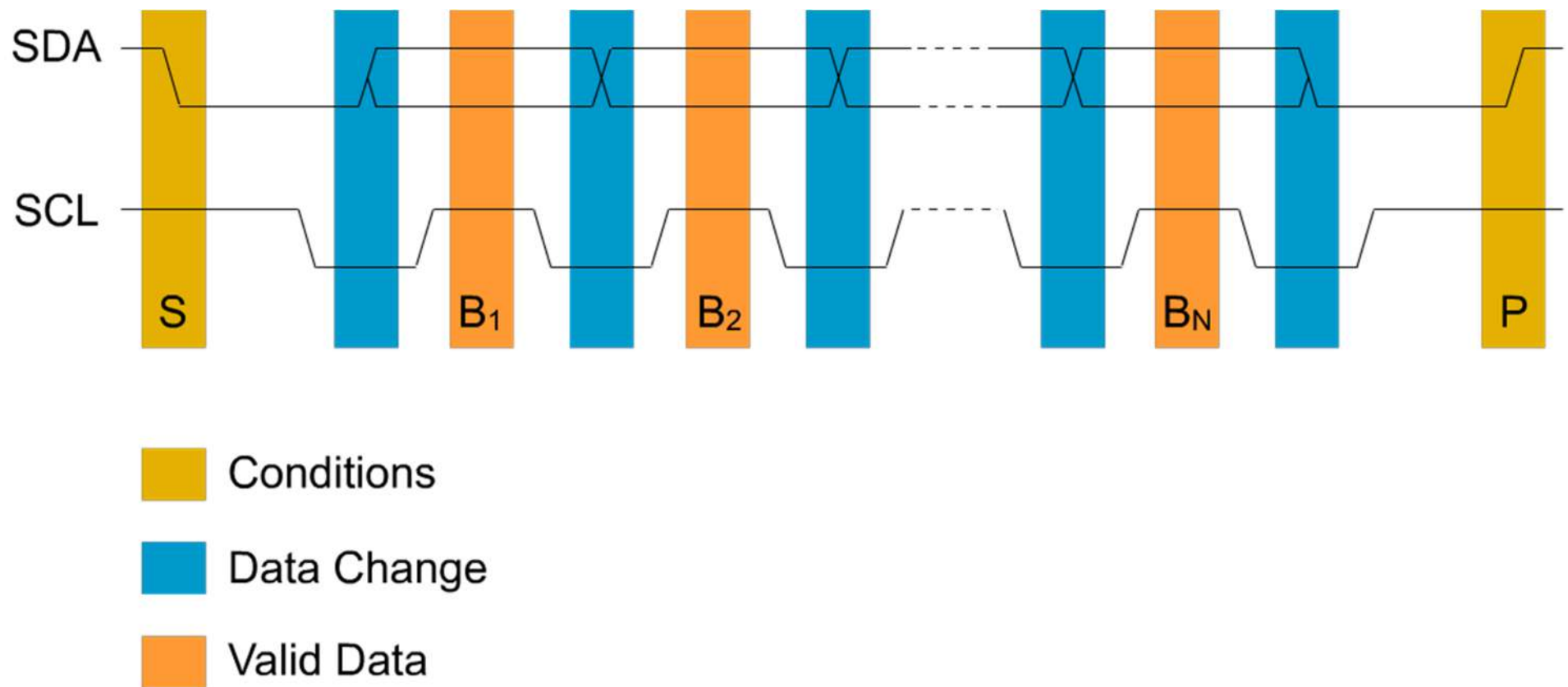
I²C

Signals - Wired-AND



I²C

Signals - Conditions and Data Validity



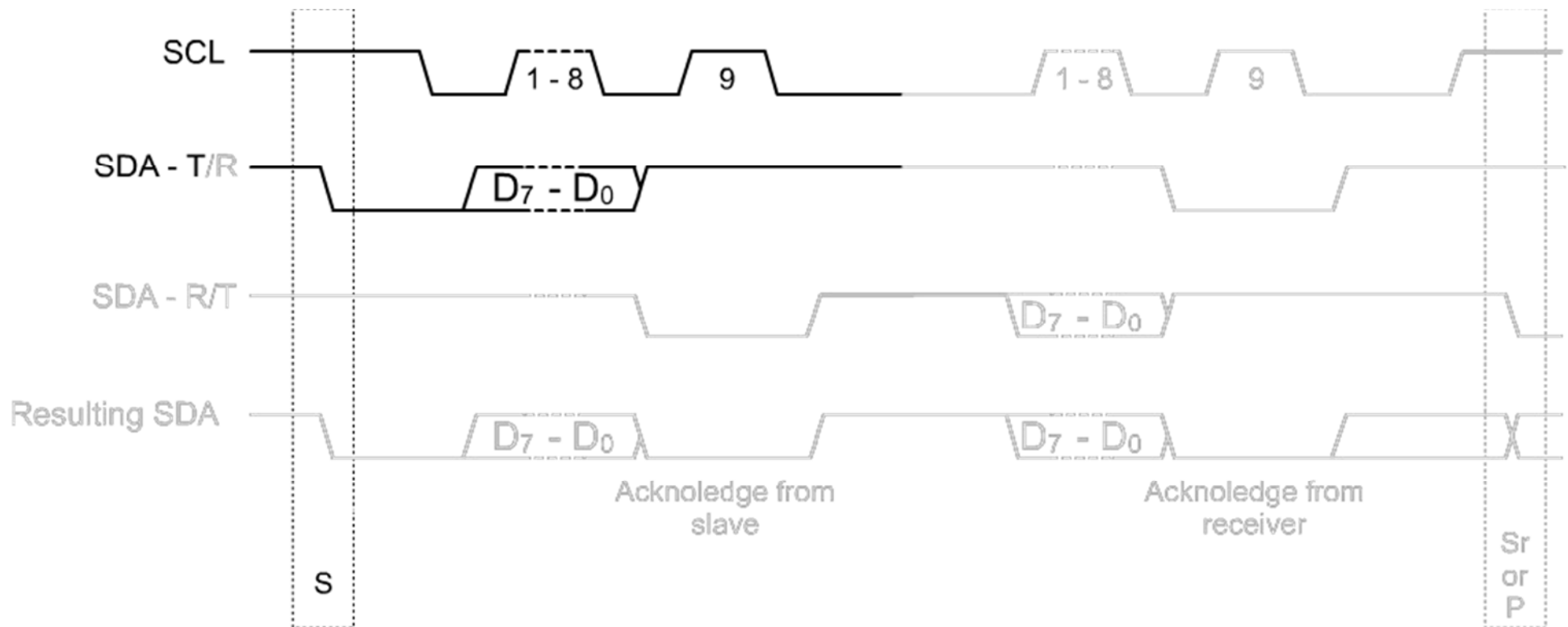
I²C

Signals - Transmission

- Data on SDA
- Clocking on SCL
- Clock Synchronization
- Data Arbitration

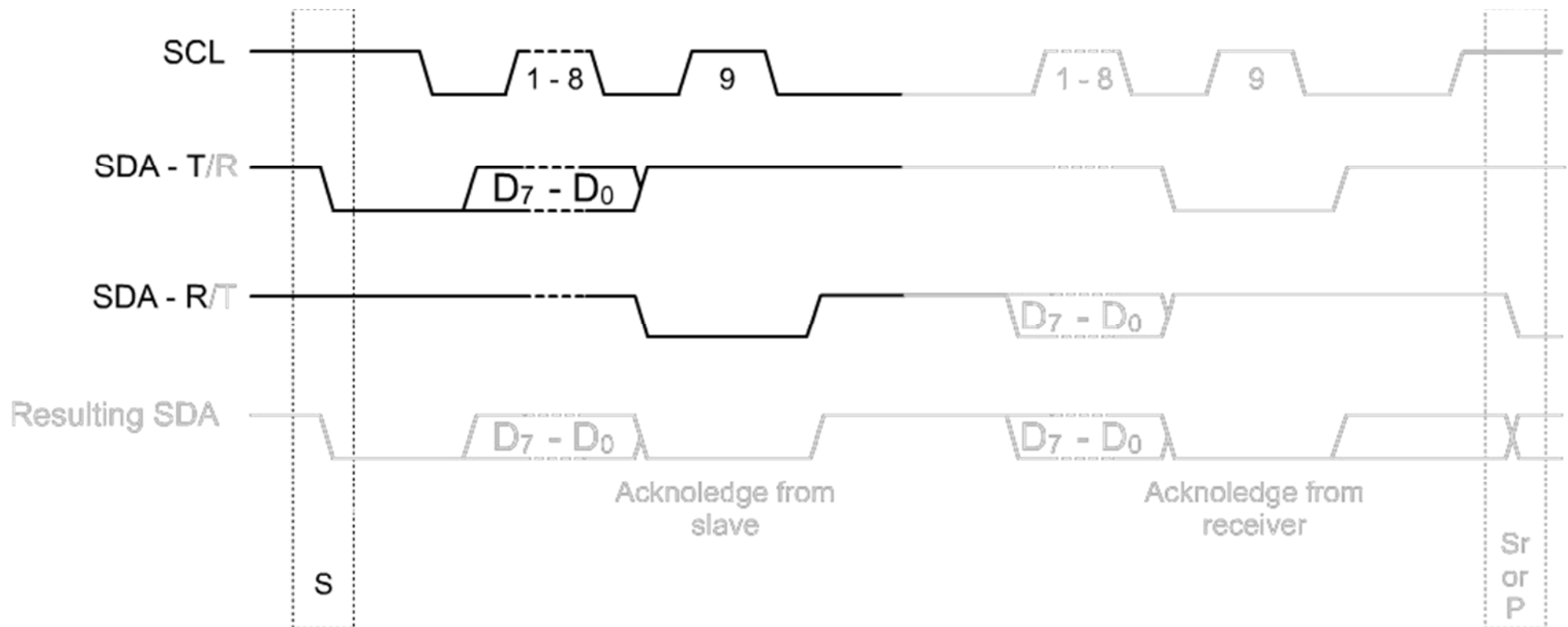
I²C

Signals - Data on SDA



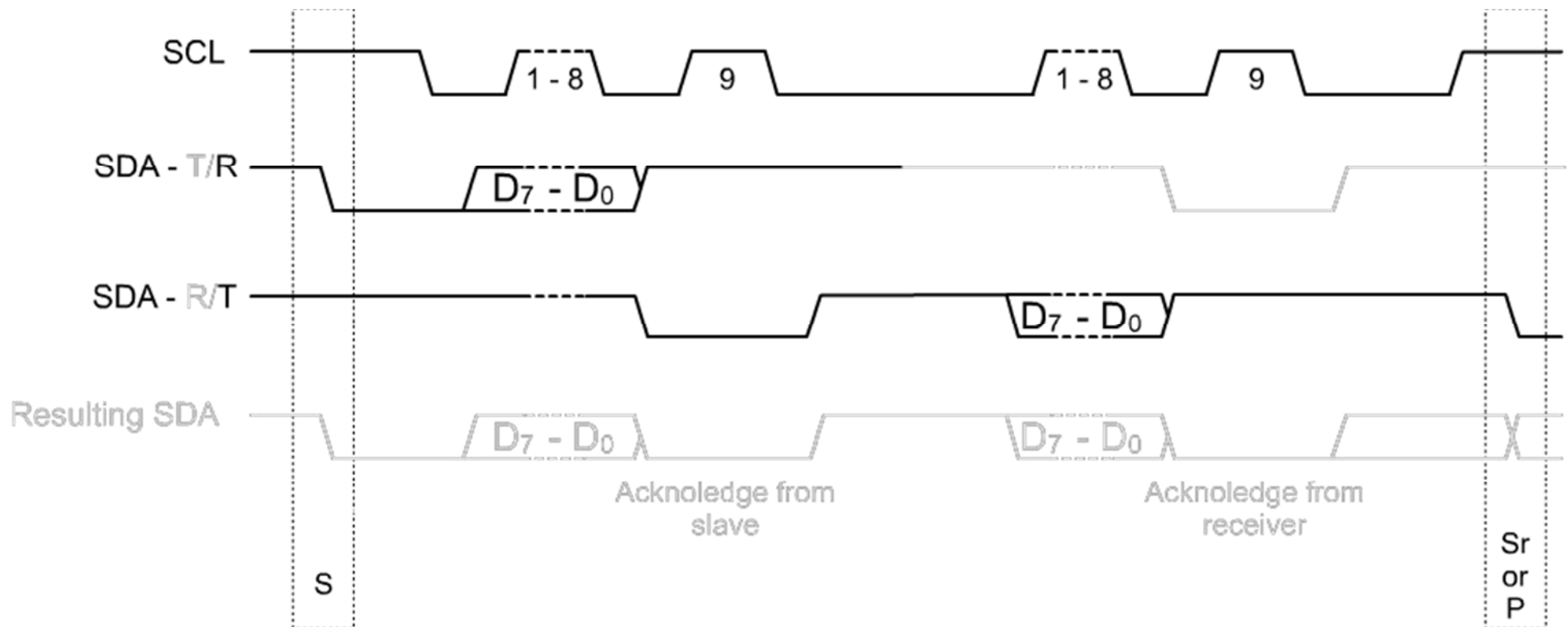
I²C

Signals - Data on SDA



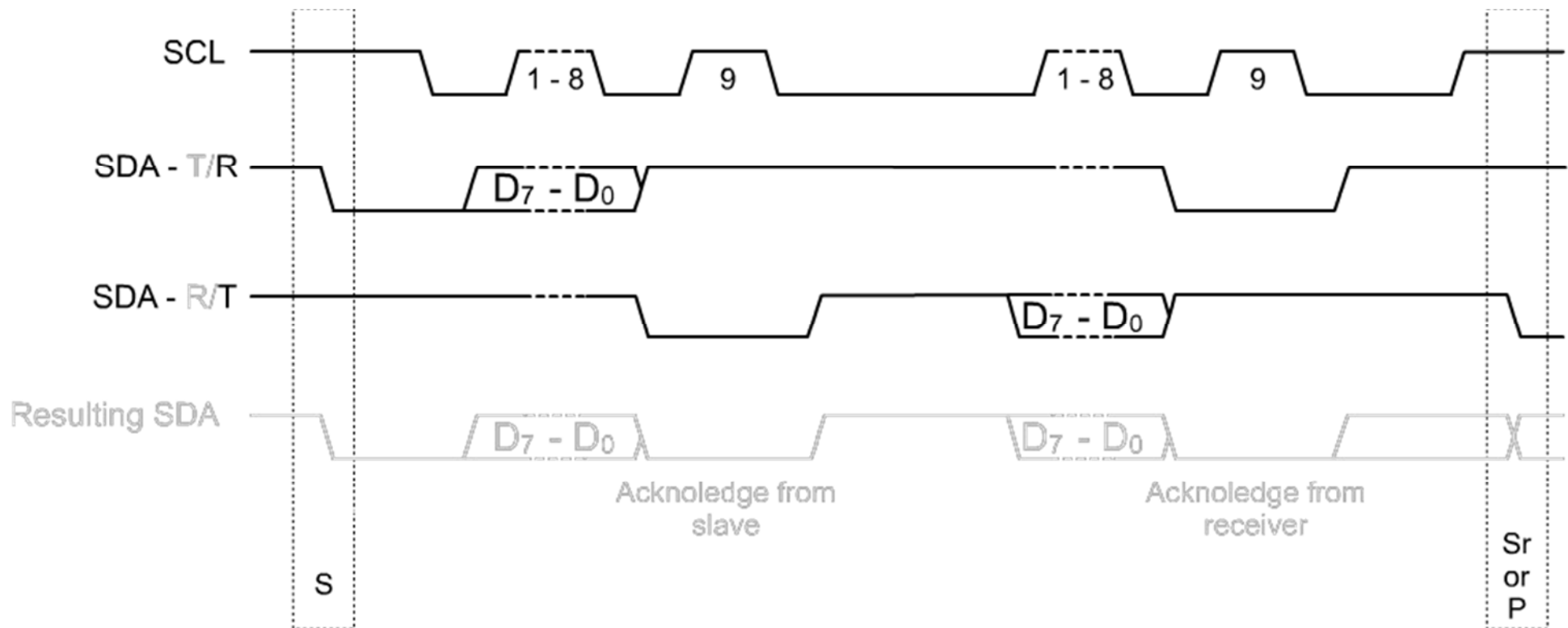
I²C

Signals - Data on SDA



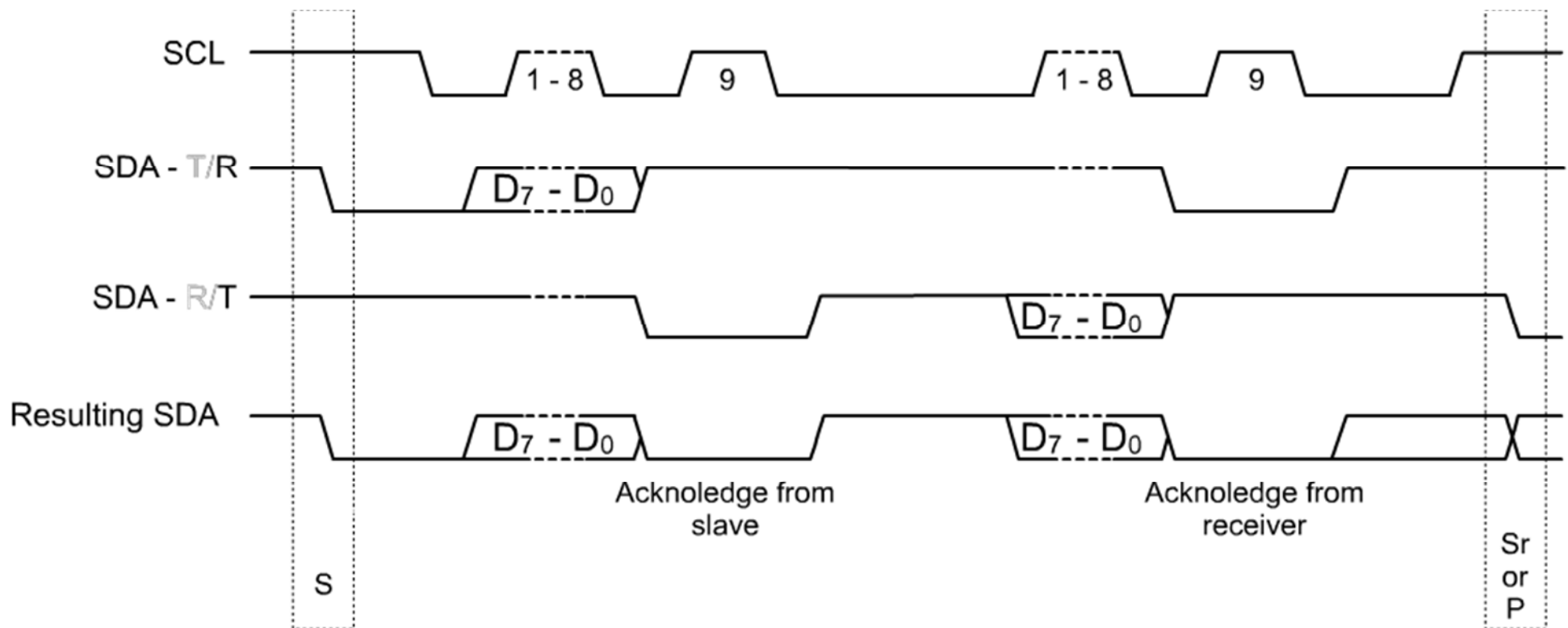
I²C

Signals - Data on SDA



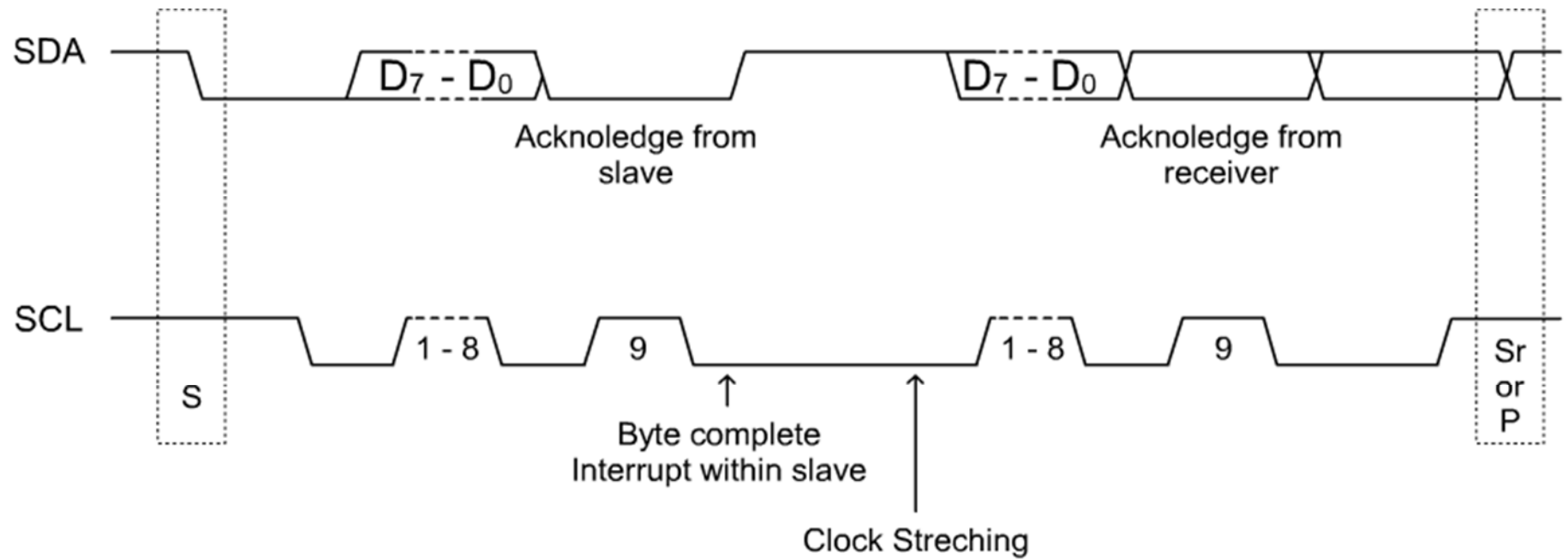
I²C

Signals - Data on SDA



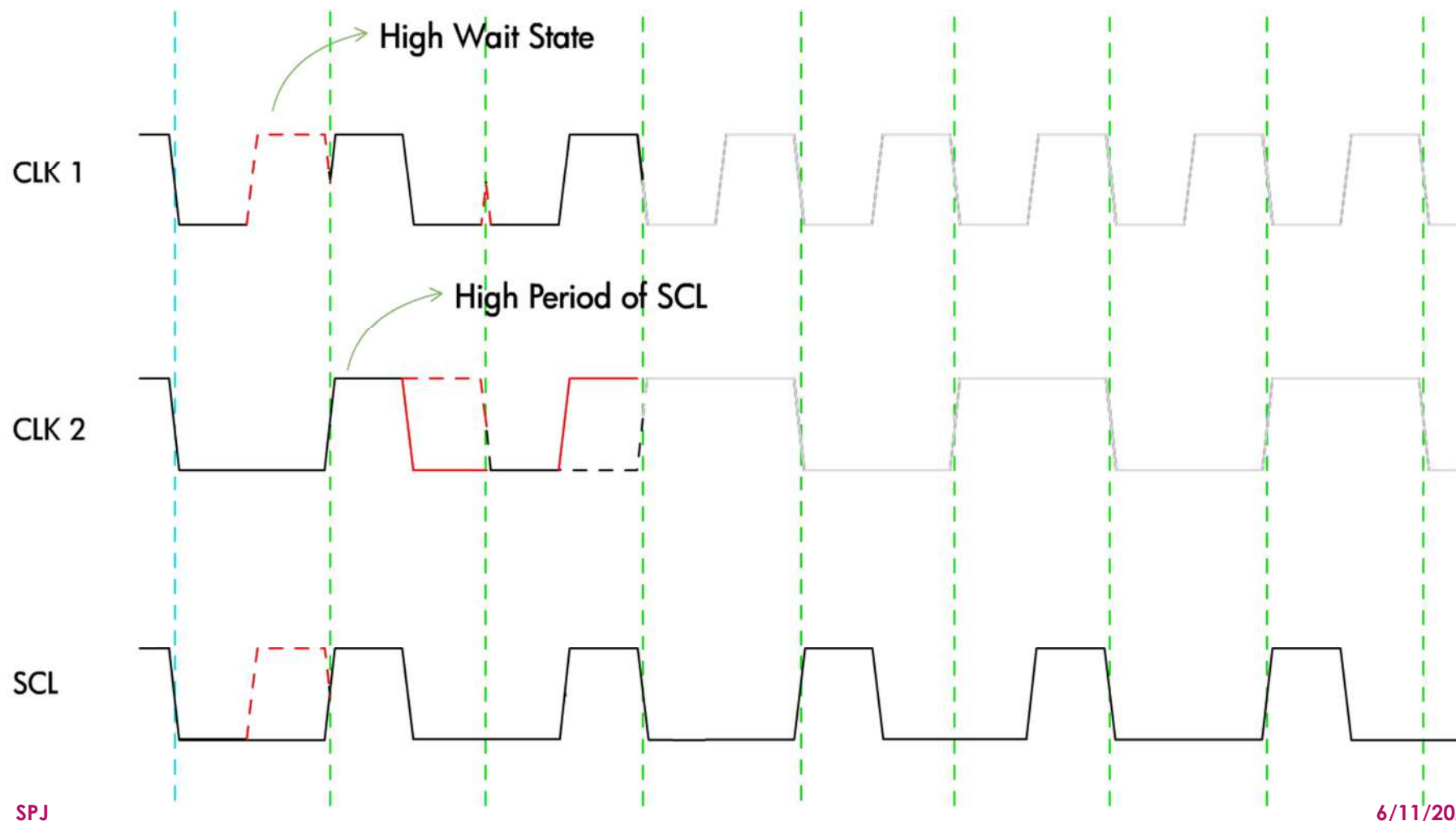
I²C

Signals - Clocking on SCL



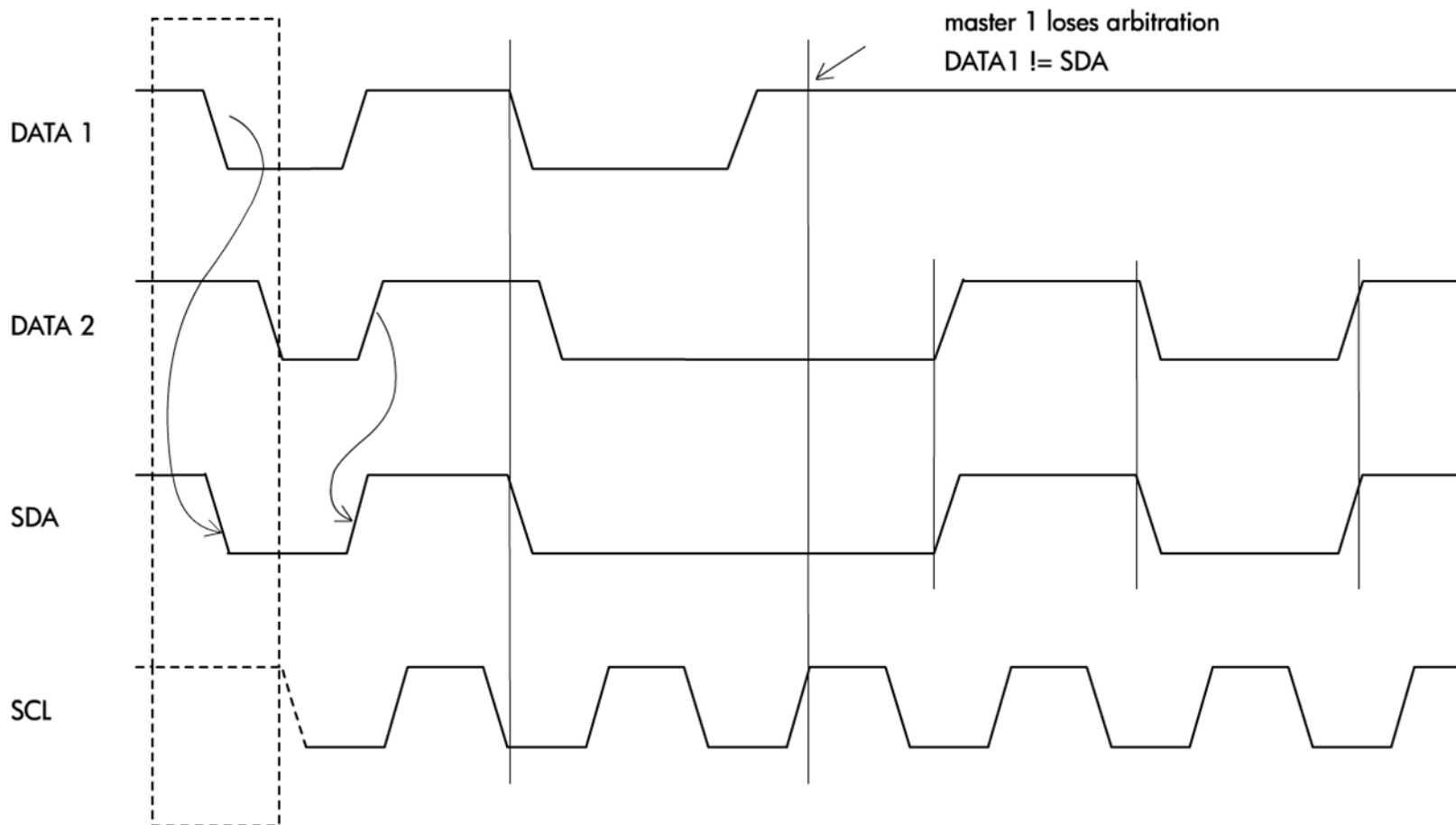
I²C

Signals - Clock Synchronization



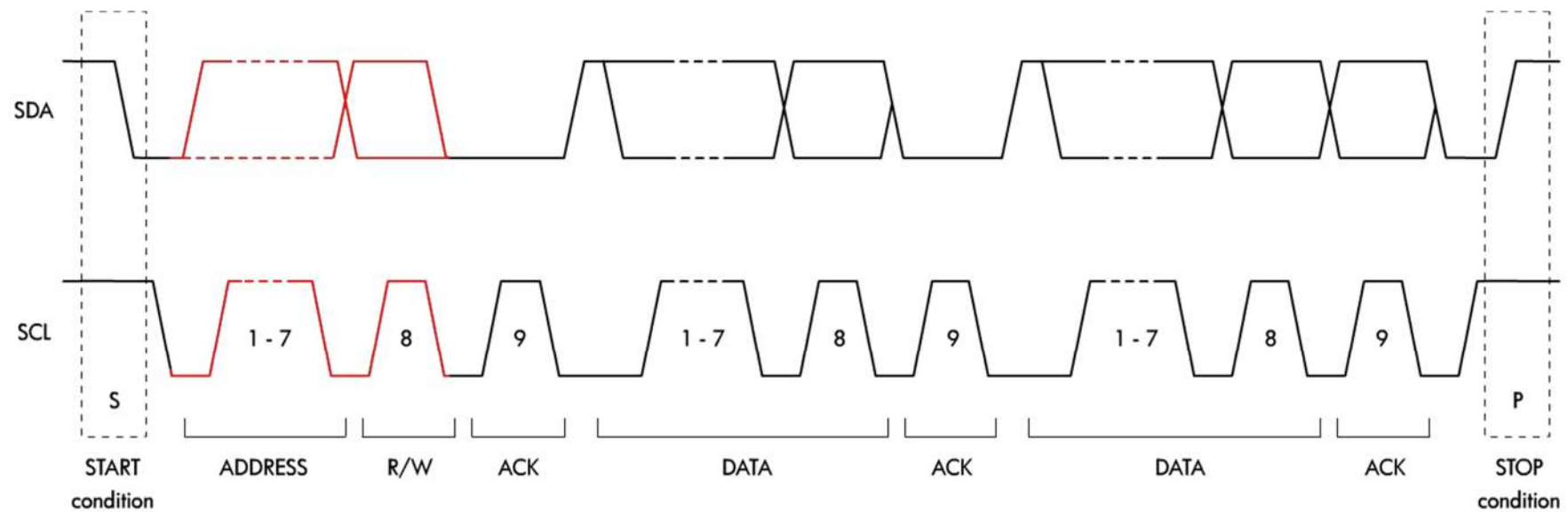
I²C

Signals - Data Arbitration



I²C

A Complete Data Transfer



I²C

Bus Speeds

- Bidirectional Bus
 - Standard Mode - 100 Kbit/s
 - Fast Mode - 400 Kbits/s
 - Fast Mode Plus - 1 Mbits/s
 - High Speed Mode - 3.4 Mbits/s
- Unidirectional Bus
 - Ultra Fast Mode - 5 Mbits/s
 - Uses Push-Pull Drivers (No Pullups)