مرکز آموزش نیـــرا سیستم

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I2C (Inter-Integrated Circuit)

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Introduction

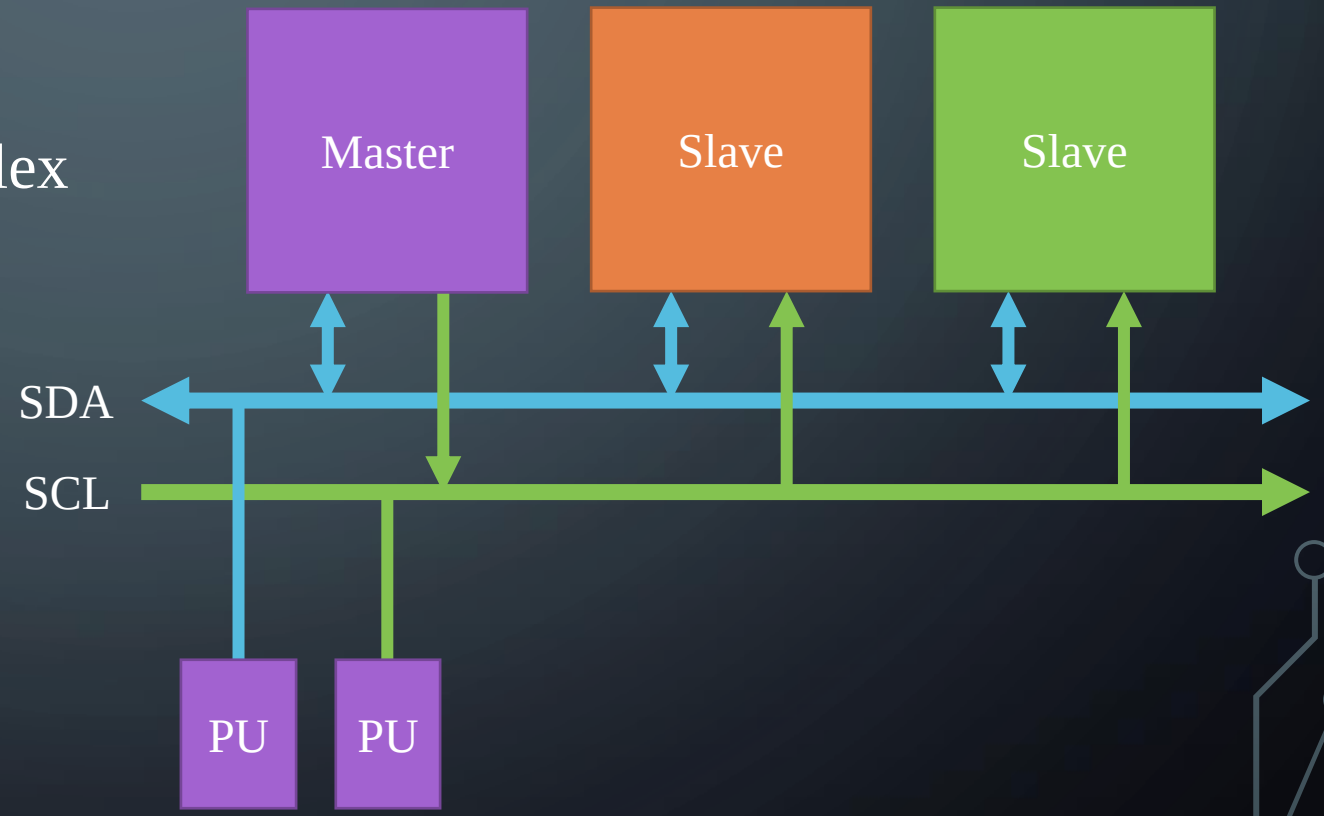
- The I2C (Inter-Integrated Circuit) interface is a widely used serial communication protocol that allows multiple devices to communicate with each other using a two-wire bus.
- It is a master-slave protocol, meaning that one device (master) controls the communication, while other devices (slaves) respond to the master's commands.
- The I2C protocol was developed by Philips (now NXP) and is commonly used in various electronic applications.

Applications

- **Sensor Networks**
  - Many sensors, such as accelerometers, gyroscopes, temperature sensors, and magnetometers, use I2C to communicate with microcontrollers.
- **Memory Devices**
  - I2C is often used to connect EEPROMs (Electrically Erasable Programmable Read-Only Memory) and other memory devices to store and retrieve data.
- **Real-Time Clocks (RTCs)**
  - RTCs, used for keeping track of time in embedded systems, frequently utilize I2C for communication.
- **LCD Displays**
  - Some LCD displays and controllers can be interfaced using the I2C protocol.
- **Interfacing with other Microcontrollers and Peripherals**
  - I2C is commonly used for communication between microcontrollers and other peripherals, providing an efficient way to exchange data.

Properties

- Connection Type: Serial
- Communication Type: Half-Duplex
- Data Type: Byte
- Synchronize: Sync
- Channel Type: Copper Wire
- Voltage State: TTL
- Bit Order: MSB First



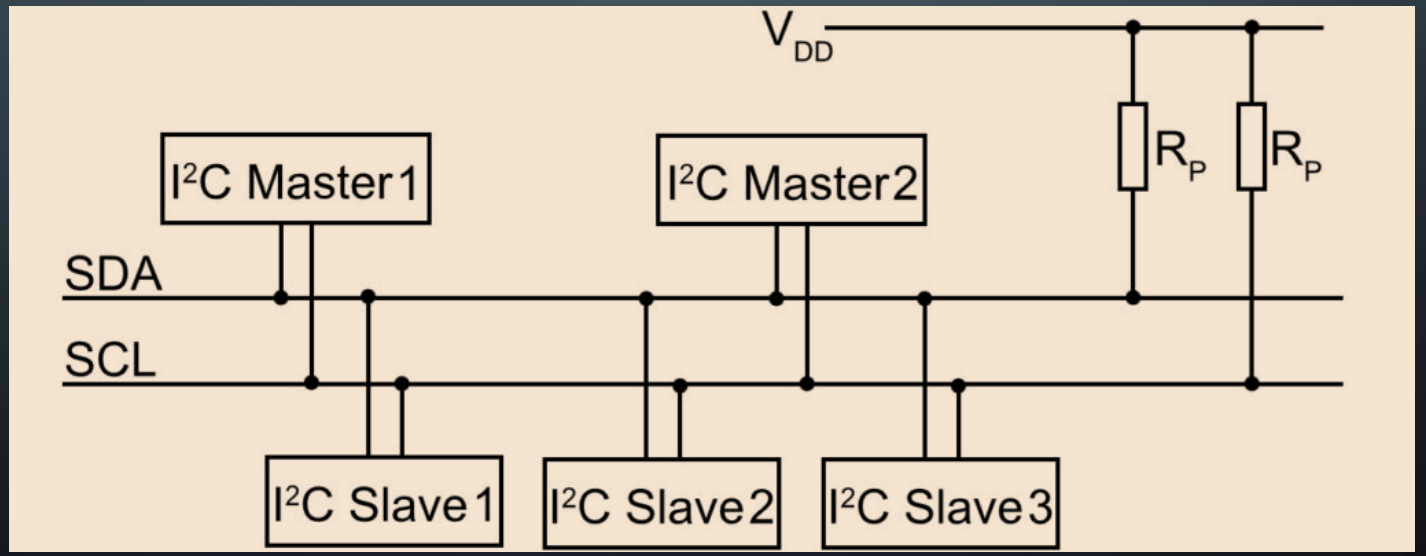
Registers

- **I2C_CR1 (Control Register 1)**
  - Configures the I2C mode, clock speed, and other parameters.
- **I2C_CR2 (Control Register 2)**
  - Configures the I2C peripheral's own address and enables various interrupts.
- **I2C_DR (Data Register)**
  - Contains the data to be transmitted or received.
- **I2C_SR1 (Status Register 1) and I2C_SR2 (Status Register 2)**
  - Indicate the status of the I2C communication, including flags for start and stop conditions, data transfer, and acknowledgment.
- **I2C_CCR (Clock Control Register)**
  - Configures the clock control in fast mode.

Settings

- 7 or 10-Bit Device Address
- 8 or 16-Bit Memory Address
- Clock Speed: Normal (100-125Khz), Fast (400Khz)

Default:
7-Bit Device Address
8-Bit Memory Address
Clock 125Khz



Write Byte(s)

1. Send Start bit
2. Send Device Address | Write
3. Send Memory Address (8-Bit or 16-Bit)
4. Send Byte(s)
5. Send Stop bit

- Write: 0
- Read: 1

Read Byte(s)

1. Send Start bit
2. Send Device Address | Write
3. Send Memory Address

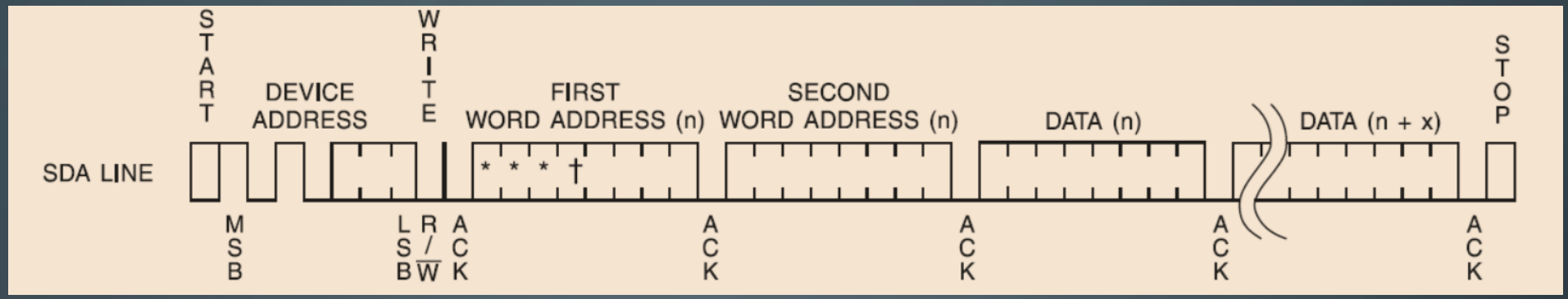
Dummy Write

4. Send Start bit
5. Send Device Address | Read
6. Read Byte(s), Send Ack
7. Read Last Byte, Send NACK
8. Send Stop Bit

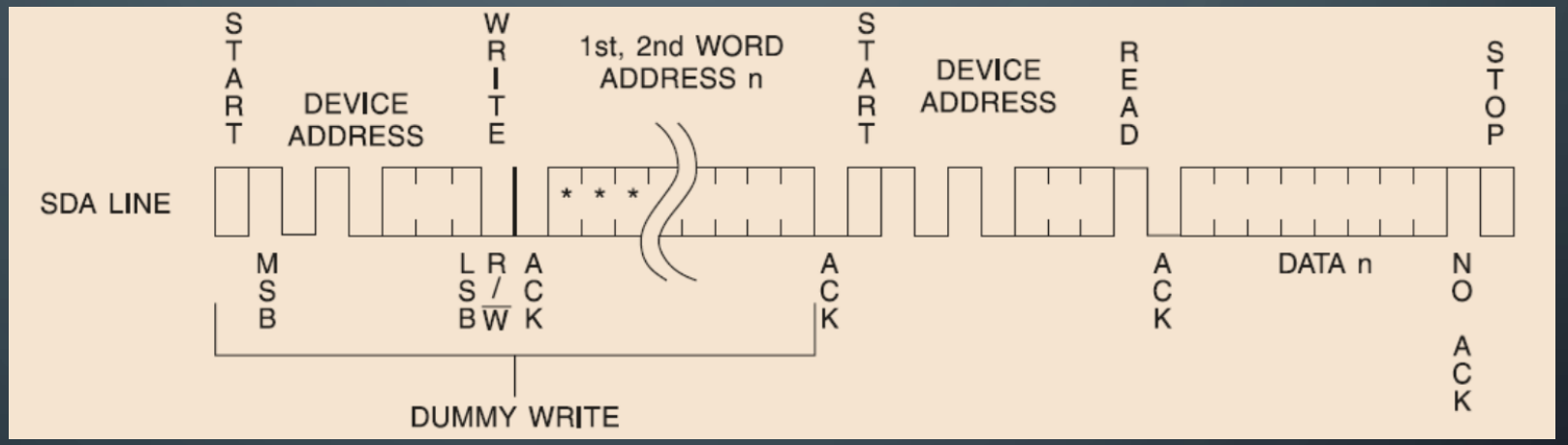
Current Read

Random Read

Write



Read Byte



Read Bytes