

Assignment on TWI Communication

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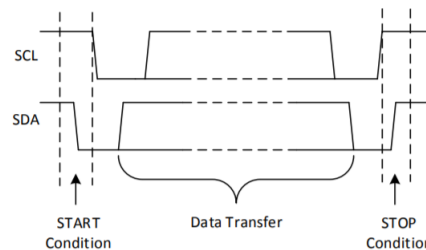
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1 Brief Introduction of the Two-Wire Interface

TWI is serial , synchronous , bidirectional , multi-master , and self-reserved communication bus. It has two wire namely SDA and SCL. SDA is serial data line and SCL is serial clock line.

1.1 Properties of TWI

- Both SDA and SCL are connected to power source with pull up resistor. So devices can force voltage of SDA, SCL to low only.
- There are 7 bit for address. So total of $2^7 = 128$ distinct addressable devices can communicate via this interface.



- Start condition is happen when SDA line goes low from high while SCL is high. SDA line going high to low while SCL is high defines STOP condition.

1.2 Sending data from master to slave

Master first send start condition followed by slave devices address and R/\tilde{W} bit which is 0 this time. Then if slave is ready to communicate then it sends acknowledge (ACK) signal. Then Master sends 8 bit data. Then slave sends ACK signal. Again master sends 8 bit data and slave reply with ACK bit. If slave unable to send ACK bit then error happens and master send stop condition and report error.

Figure 8 shows an example of writing a single byte to a slave register.

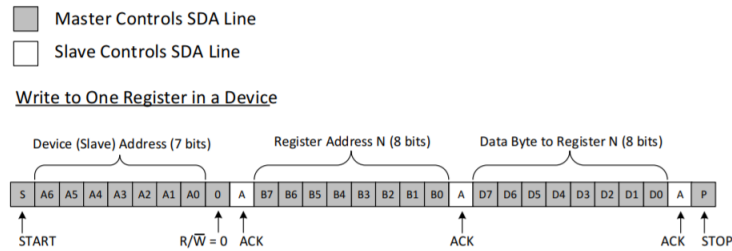


Figure 8. Example I²C Write to Slave Device's Register

1.3 Receiving data from slave to master

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Figure 9 shows an example of reading a single byte from a slave register.

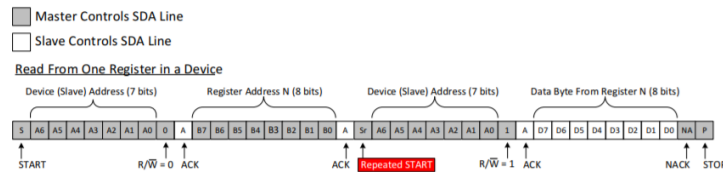


Figure 9. Example I²C Read from Slave Device's Register

Slave cannot send start condition. If slave needs to transmit data to master then master needs to start connection and make R/\bar{W} bit to 1. Master release control of sda line when data should be written by slave. Master always send clock pulse to SCL line irrespective of R/\bar{W} bit. After slave write data , then master sends NACK signal to sda line.

2 Advantages of TWI/I2C

- I2C uses only two wires whereas, SPI uses atleast 2 wires for simplex communication and 3 wires for duplex communication .
- Supports multiple master and multiple slaves. But USART works with only two devices.
- ACK/NACK confirms successful data transfer.
- TWI offers multiple master/slave support which UART does not.
- Faster than UART

3 Disadvantages of TWI/I2C

- Connection is half duplex , SPI or USART is full duplex.

- Size of data frame is only 8 bit and cannot be changed. In USART communication size of data frame can be chosen from between 8 and 9 bit.
- More complicated hardware needed to implement than SPI
- Slower transfer rate than SPI.

4 References