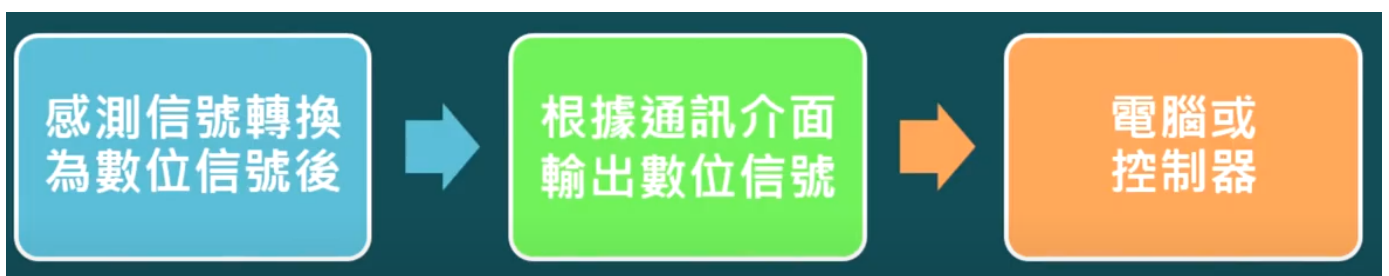


# 通訊介面

- 通訊介面
  - 通訊介面概念
  - UART
  - I2C
  - SPI

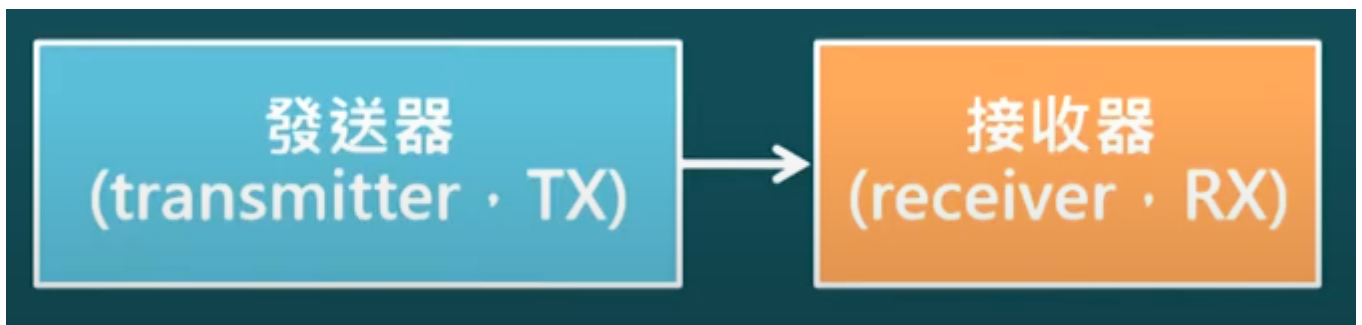
## 通訊介面概念



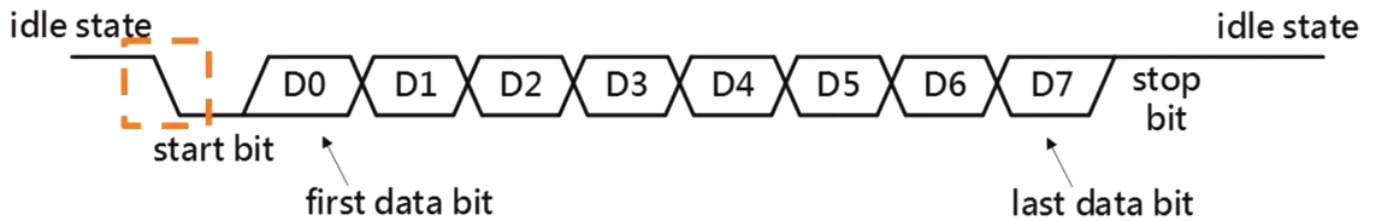
通訊介面就是能夠將數位訊號轉換成一定格式，以至接受端可以正確接收到

## UART

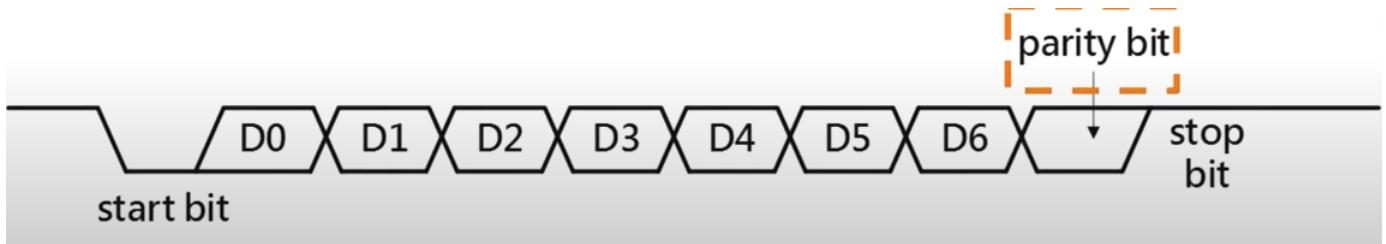
1. 通用非同步接收發送(UART, universal asynchronous receiver/transmitter)：用來做串列通訊(serial communication)的標準，常見的RS-232及RS-485都屬於UART的通訊標準之一。
2. 串列通訊(serial communication)的標準也是目前高速數位傳輸的標準做法，目前以一條線傳送多組資料。
3. 其中asynchronous指在發送器和接受器之間沒有線來傳送時脈訊號(clock signal)



4. 因為沒有時脈訊號，所以發送端和接受端都要知道訊號的位元率(bit rate)，否則無法正確接收訊號。



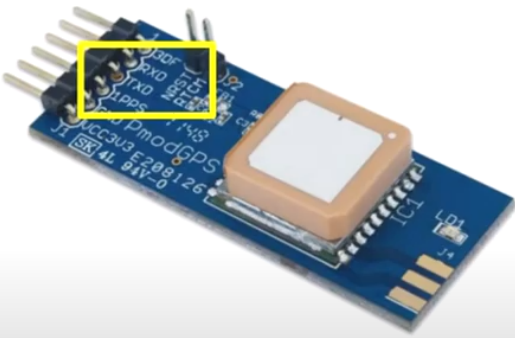
5. 錯誤檢查：parity check可設為even(偶同位)或odd(奇同位)。例如：D0-D6為0101001。若設為偶同位，則parity bit設為0，使得全部傳輸的bit為1的數目為偶數。也可以設為none，如此將不傳送parity bit。



## 使用UART 傳輸信號的 GPS接收器

### Overview

The PmodGPS can add satellite positioning accuracy to any embedded system. The PmodGPS features a GlobalTop FGPMMPA6H GPS antenna module that utilizes the MediaTek GPS MT3329.



The PmodGPS.

Features include:

- Ultra-sensitive GPS module (-165 dBm)
- Add 3m 2D satellite positioning accuracy to any embedded system
- Low power consumption
- Up to 10Hz update rate
- NMEA (default) and RTCM protocols available
- Small PCB size for flexible designs 2.0 in × 0.8 in (5.0 cm × 2.0 cm)
- 6-pin Pmod connector with UART interface
- Library and example code available in [resource center](#)

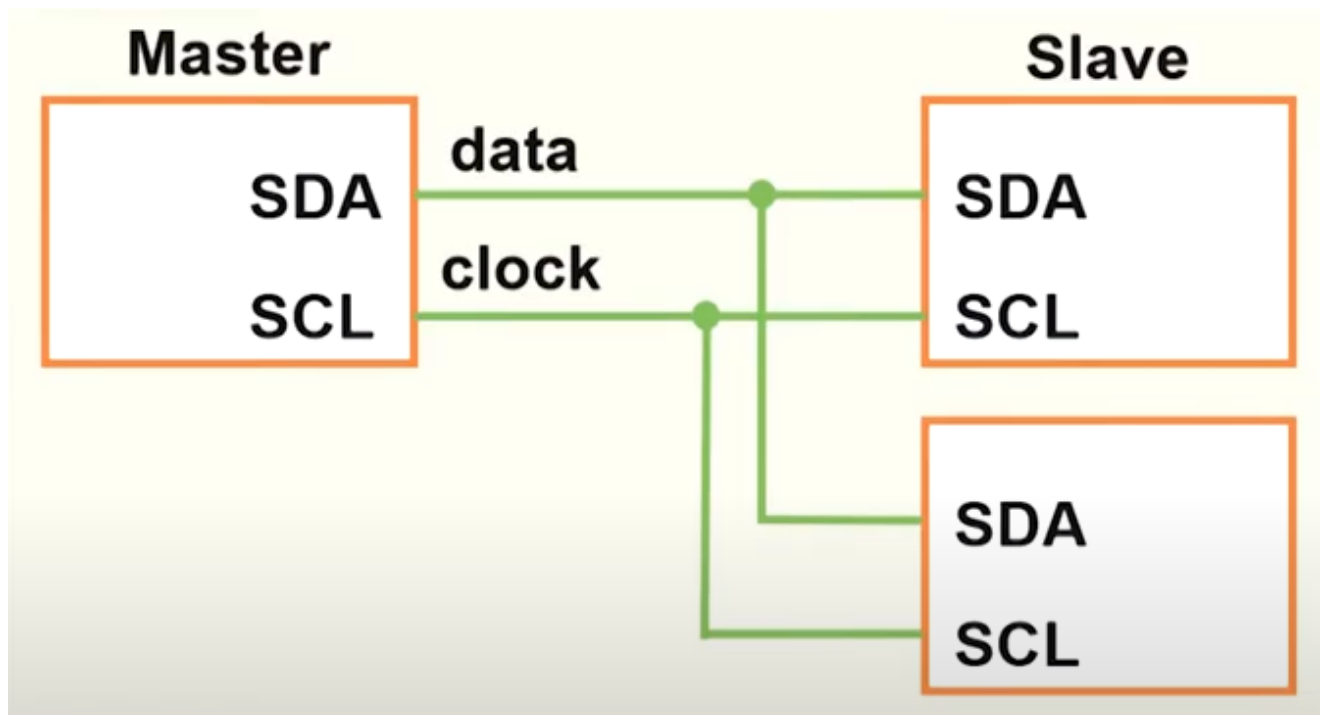
## I2C

1. I<sup>2</sup>C = Inter IC
2. I<sup>2</sup>C是串列通訊的標準，由Philips半導體公司(現為NXP)於1982年所發展出來的
3. 有兩條訊號線：一條SDA傳遞資料(Data)，另一條SCL傳遞時脈(clock)
4. 雙向訊號傳輸
5. 同步通訊

## 6. 傳輸速度

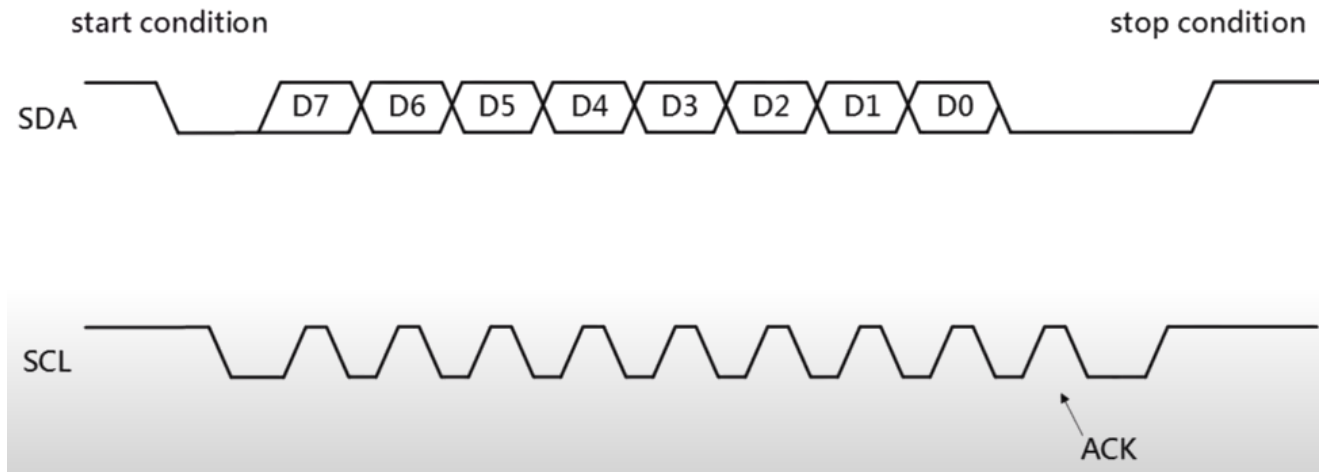
Mode	Speed
Standard mode	100 kbps
Fast mode	400 kbps
Fast model plus	1000 kbps
High-speed mode	3400 kbps
Ultra-fast mode	5000 kbps

7.



可以有一個或多個主端及從屬端，經由SDA選擇data要傳輸給哪一個slave

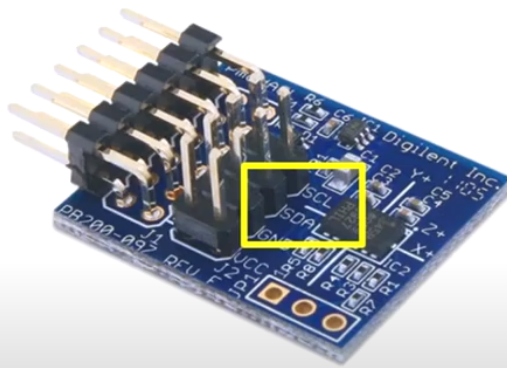
## 8. Signaling waveform



### 使用I<sup>2</sup>C 傳輸信號 的三軸加 速規

#### Overview

The Digilent PmodACL is a 3-axis digital accelerometer module powered by the [Analog Devices® ADXL345](#)



The PmodACL.

Features include:

- 3-axis,  $\pm 2/4/8/16g$  accelerometer
- User-selectable resolution
- Activity/inactivity monitoring
- Single/double-tap and free-fall detection
- Small PCB size for flexible designs 1.0 in  $\times$  0.8 in (2.5 cm  $\times$  2.0 cm)
- 12-pin Pmod connector with SPI interface and 2 $\times$ 4-pin I<sup>2</sup>C interface
- Follows Digilent Pmod Interface Specification Type 2A
- Library and example code available in [resource center](#)

## SPI

### 1. Serial Peripheral Interface

2. SPI是串列通訊的標準，由Motorola半導體(現為Freescale)所發展出來的

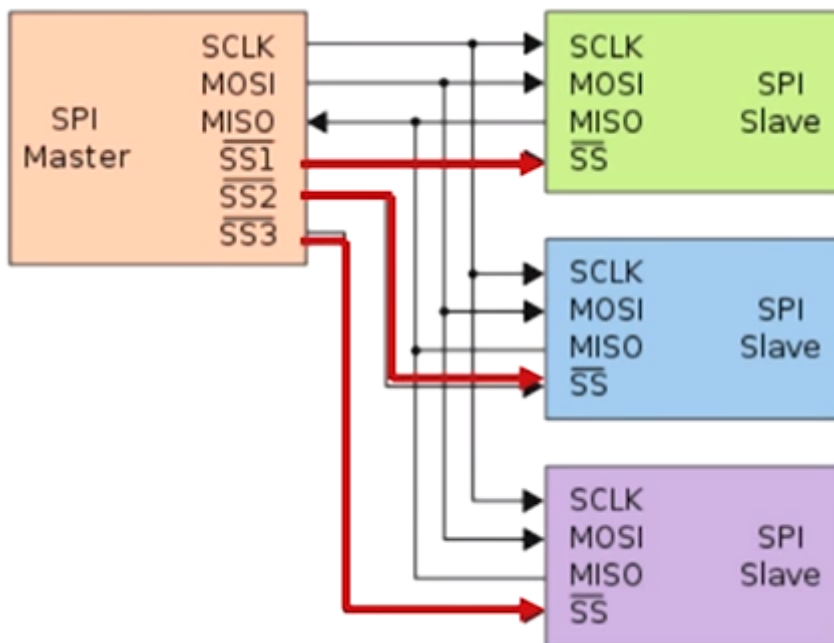
### 3. 雙向訊號傳輸

4. 有4條訊號線：2條傳遞資料(data)，可以同時收發訊號，一條傳遞時脈(clock)，另一條作從屬端的選擇(slave select)



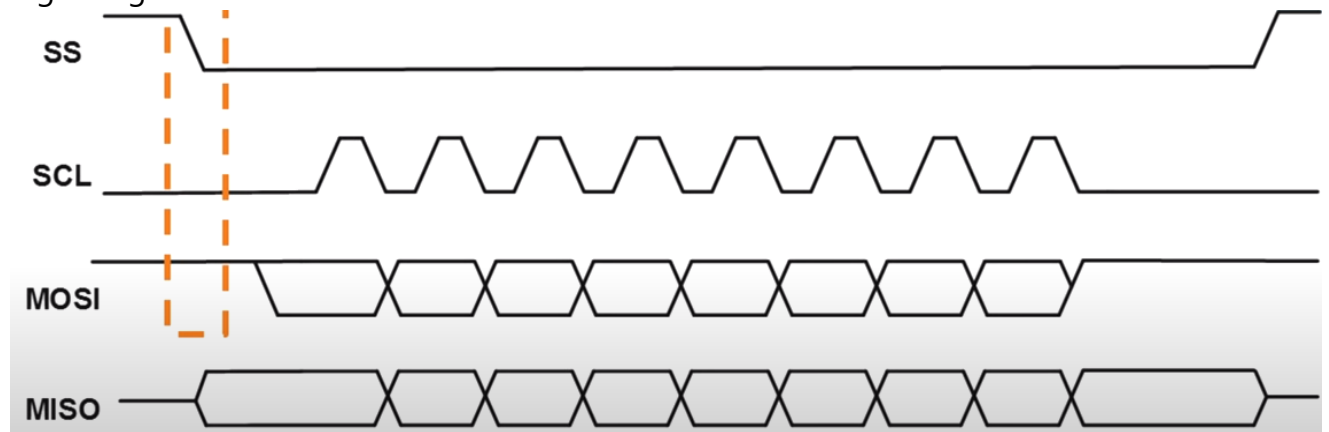
MOSI : Master Out Slave In

5.



SS從高電位->低電位，slave端就知道要接受訊號

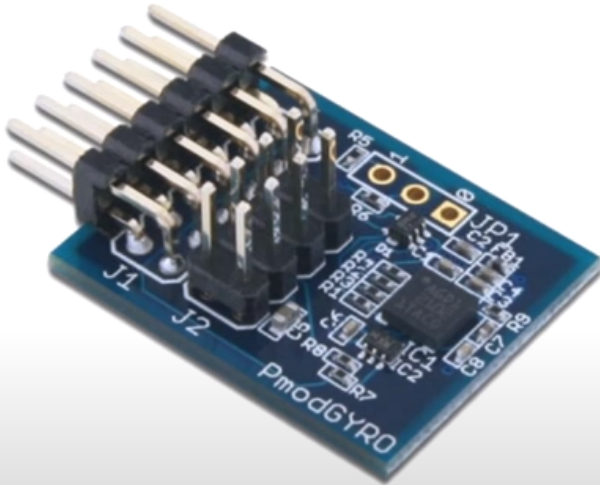
6. Signaling waveform



可以在serial clock設定，可以在低電位切到高電位的時候去讀訊號，也可以在高電位切到低電位去讀訊號

## Overview

The PmodGYRO is a 3-axis gyroscope powered by the **STMicroelectronics L3G4200D**. By communicating with the chip through SPI or I<sup>2</sup>C, users may configure the module to report angular momentum at a resolution of up to 2000 dps at an output rate up to 800Hz.



The PmodGYRO.

### Features include:

- 3-axis MEMS digital gyroscope with high shock survivability
- Get angular momentum data with user selectable resolution (250/500/2000dps)
- Two customizable interrupt pins
- User configurable signal filtering
- Power-down and Sleep modes
- Small PCB size for flexible designs 1.0 in × 0.8 in (2.5 cm × 2.0 cm)
- 12-pin Pmod connector with **SPI interface** and additional I<sup>2</sup>C interface
- Library and example code available in [resource center](#)