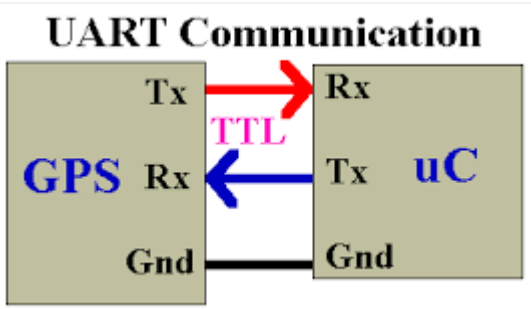
國立中正大學
National Chung Cheng University

微處理機系統與介面技術

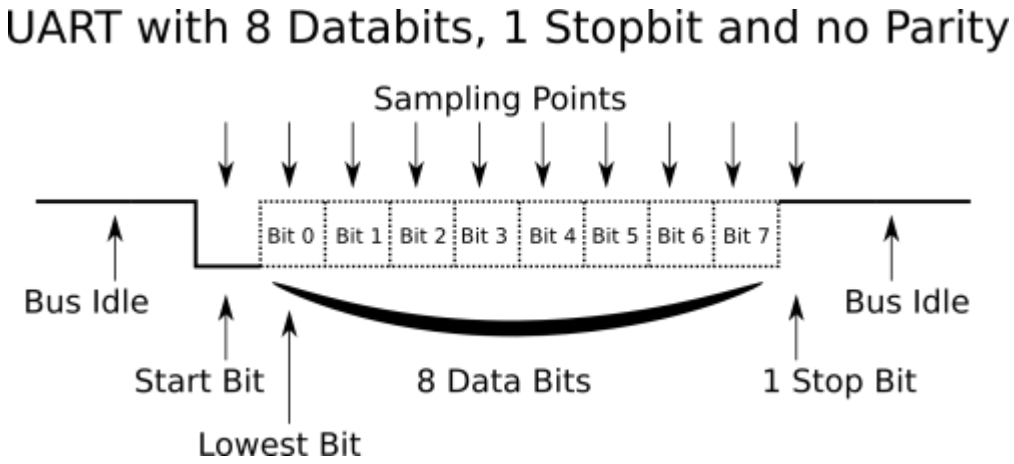
LAB 2 – UART

www.neatlab.tw
neat Laboratory
CCU@Taiwan 中正大學

UART



- Universal Asynchronous Receiver/Transmitter (UART)
- UART0
  - RX0/GPB0 : pin32
  - TX0/GPB1 : pin33
- UART1
  - RX1/GPB4 : pin19
  - TX1/GPB5 : pin20
- UART2
  - RX2/GPD14 : pin38
  - TX2/GPD15 : pin39



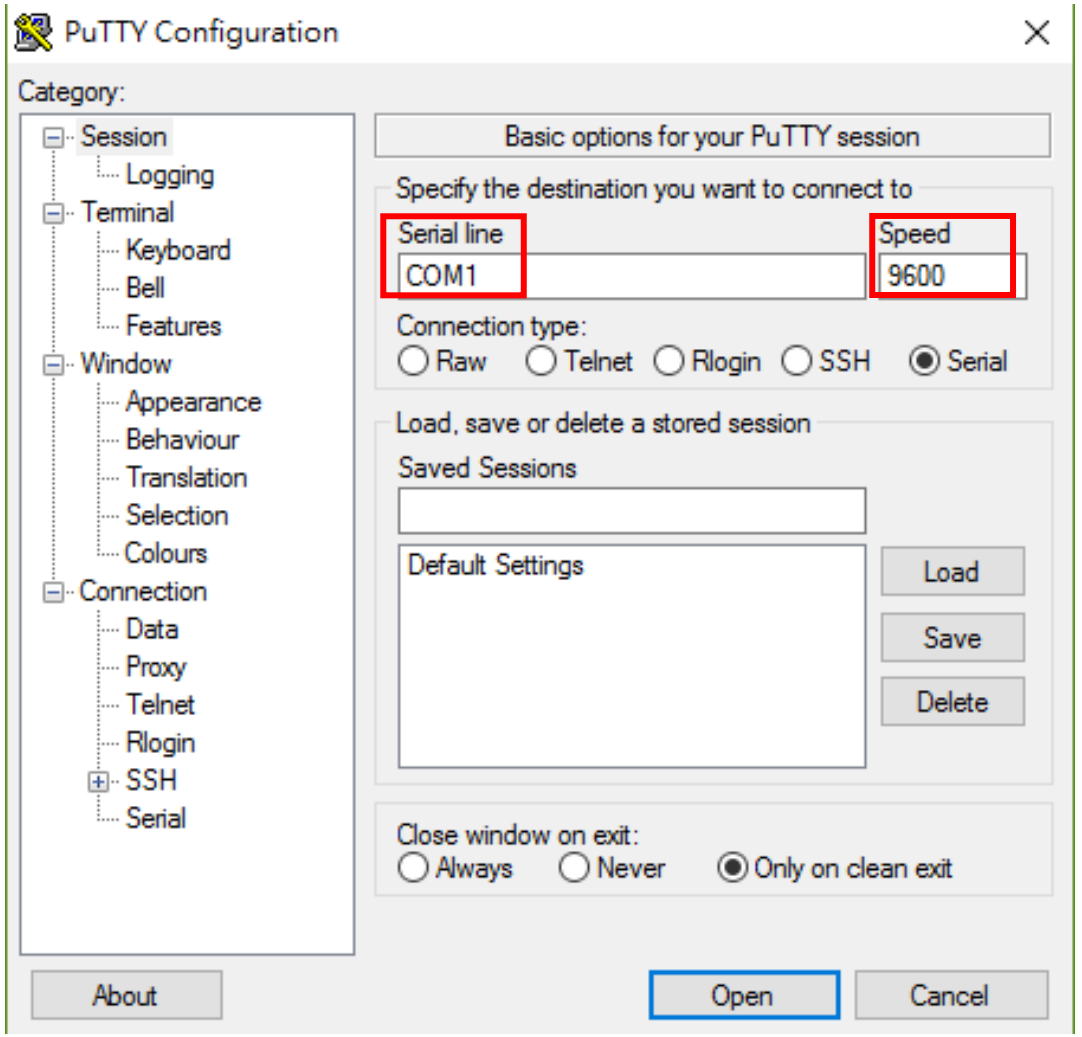
PL2303orCH340G

- 將UART訊號轉成USB訊號
- Pin
  - VCC 不要接
  - GND接到NUC140 GND
  - TxD 接到NUC140 Rx
  - RxD 接到NUC140 Tx

Putty

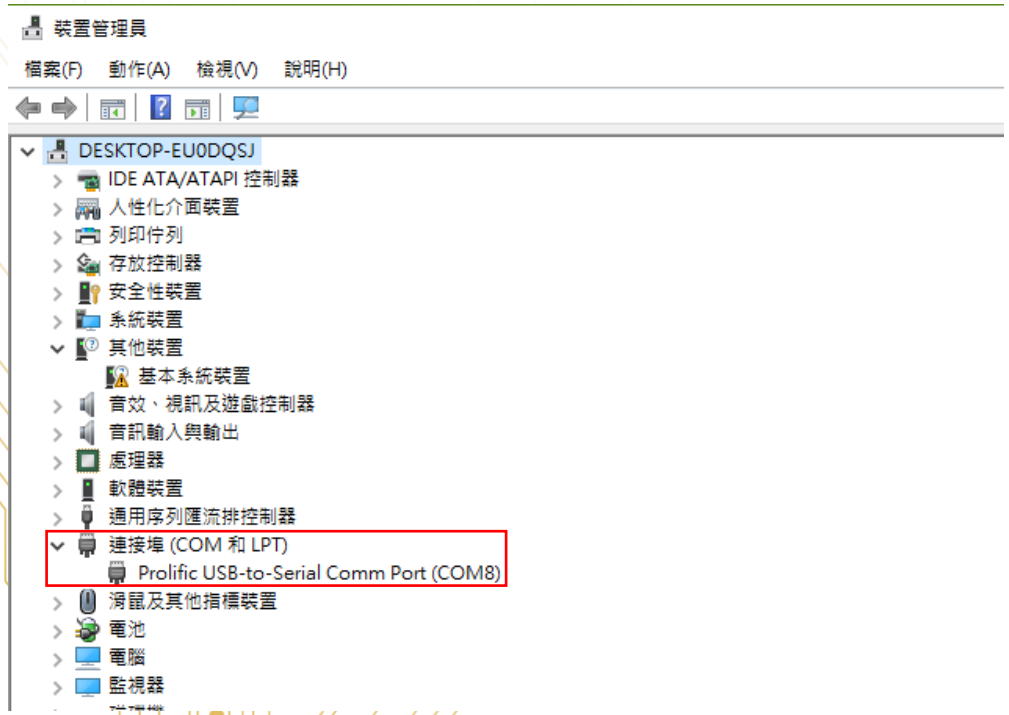
- 下載網址 http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html

- 記得選 COMPORT
- 記得改 Speed



Putty

- USB接到PC後,可以點選裝置管理員,就可以看到uart的COM port



Register Configuration

- UA_BAUD: Baud Rate Divider Register
- UA_LCR: Line Control Register
  - Word length, parity, stop bit
- UA_IER: Interrupt Enable Register
  - UART裡面有很多種中斷,請注意使用
- UA_ISR: Interrupt Status Control Register

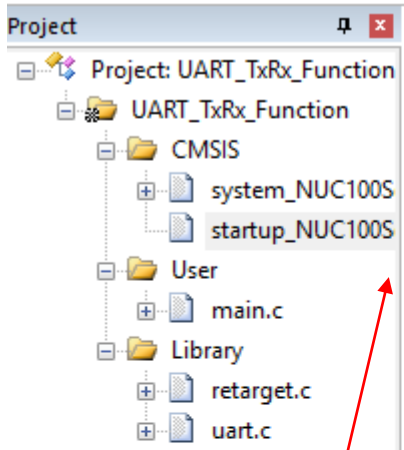
31	30	29	28	27	26	25	24
Reserved							
23	22	21	20	19	18	17	16
Reserved							
15	14	13	12	11	10	9	8
DMA_RX_EN	DMA_TX_EN	AUTO_CTS_EN	AUTO_RTS_EN	TIME_OUT_EN	Reserved		LIN_RX_BRK_IEN
7	6	5	4	3	2	1	0
Reserved	WAKE_EN	BUF_ERR_IEN	RTO_IEN	MODEM_IEN	RLS_IEN	THRE_IEN	RDA_IEN

ISR - Interrupt Service Routine

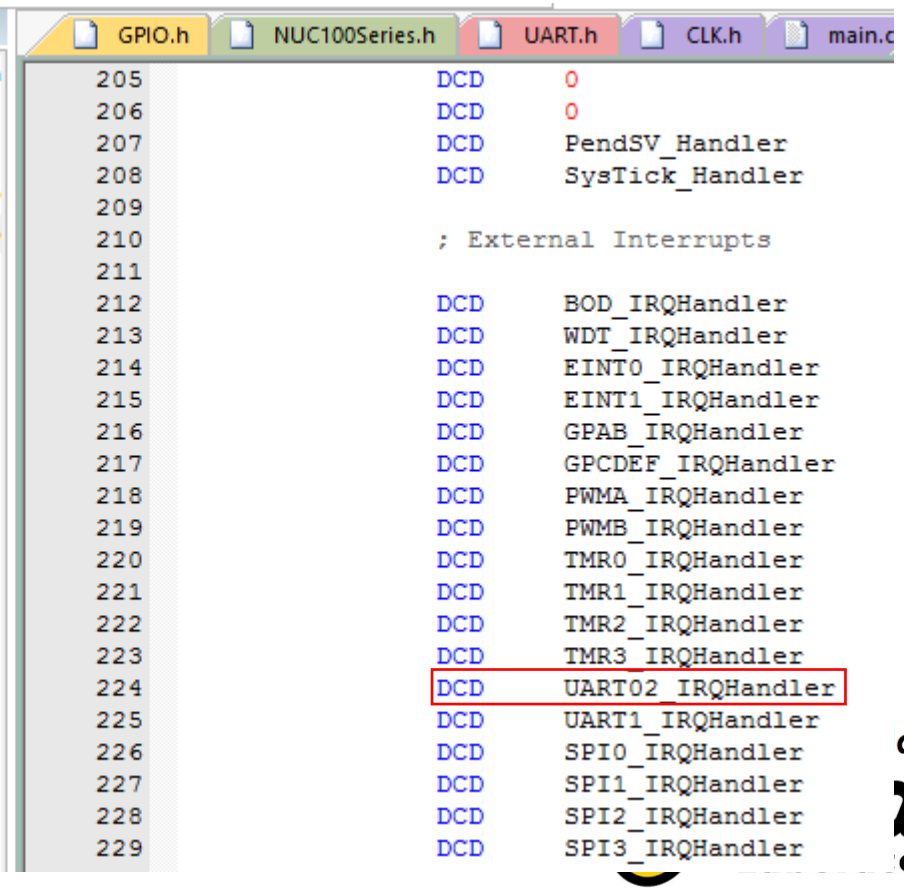
- 在MCU架構下,通常由硬體觸發,ex. 鍵盤送出一個字給MCU→觸發中斷
- Interrupt vector
- IRQ_Handler

```
/*---------------------------------------------------
/* ISR to handle UART Channel 0 interrupt event
/*---------------------------------------------------
void UART02_IRQHandler(void)
{
    UART_TEST_HANDLE();
}
```

IRQ_Handler裡面會有處理中斷的相關function



startup_NUC100Series.s裡面有處理中斷的Interrupt vector

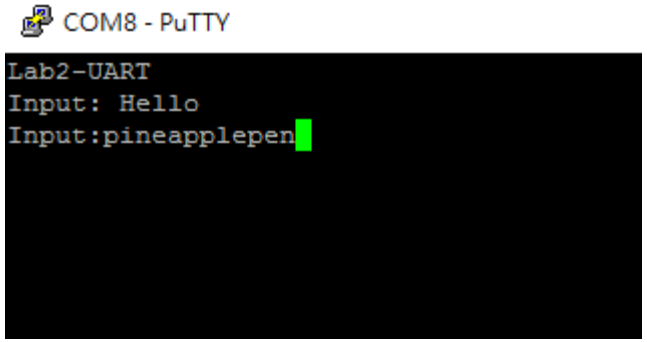


Basic

- 將鍵盤輸入的字印到putty上面
  - 注意!請輸入enter的時候再把字印出來

    ex. 輸入 “Hello” → enter → putty上面印出Hello

    中間過程請不要在putty上面印字
  - Enter’s ascii code: 0x0D



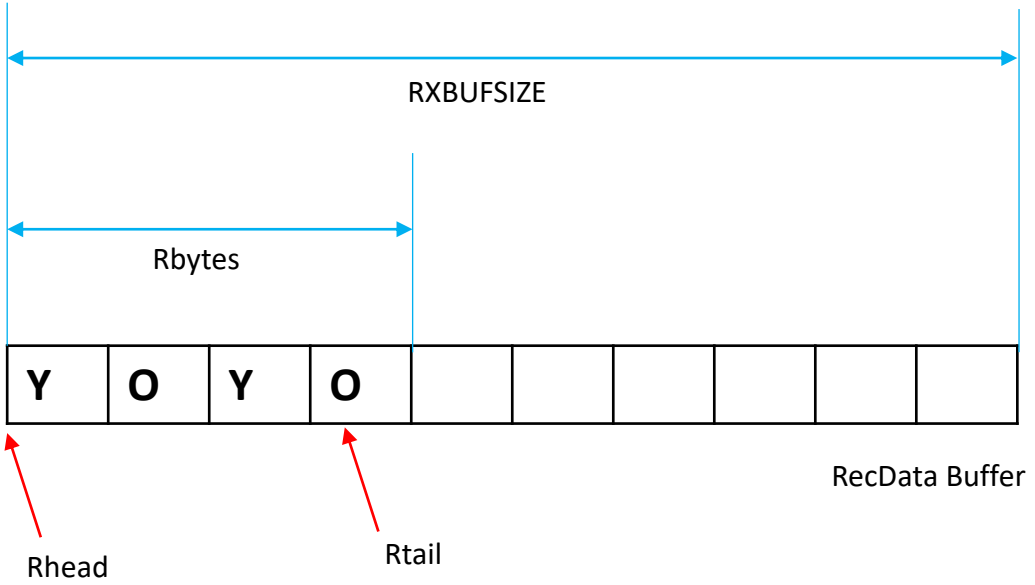
Bonus

- 輸入字串控制RGB LED
  - Keyboard input "red on" → turn on the red led
  - Keyboard input "red off" → turn off the red led
  - Keyboard input "green on" → turn on the green led
  - Keyboard input "green off" → turn off the green led
  - Keyboard input "blue on" → turn on the blue led
  - Keyboard input "blue off" → turn off the blue led

RGB LED low-active driven
by GPA12 for **blue** color
by GPA13 for **green** color
by GPA14 for **red** color

```
Input:  red on

Input:  red off

Input:  green on

Input:  green off

Input:  blue on

Input:  blue off

Input:
```

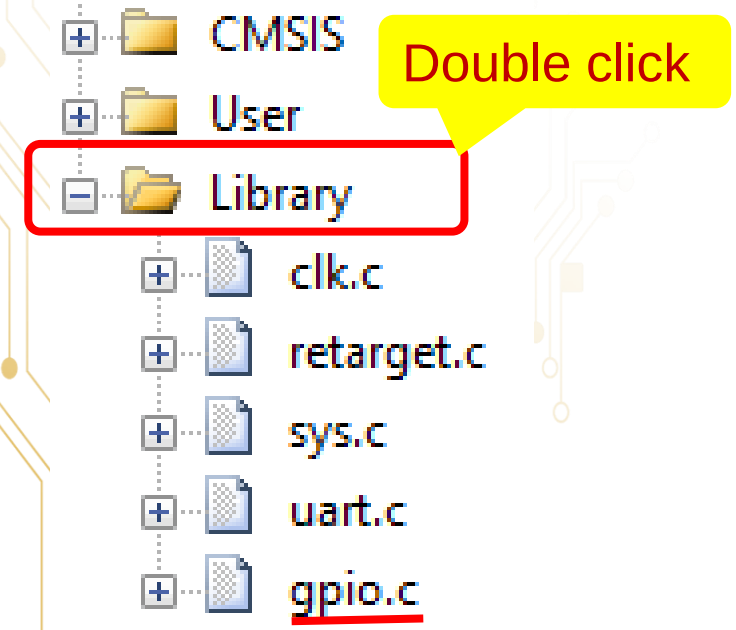
Tips

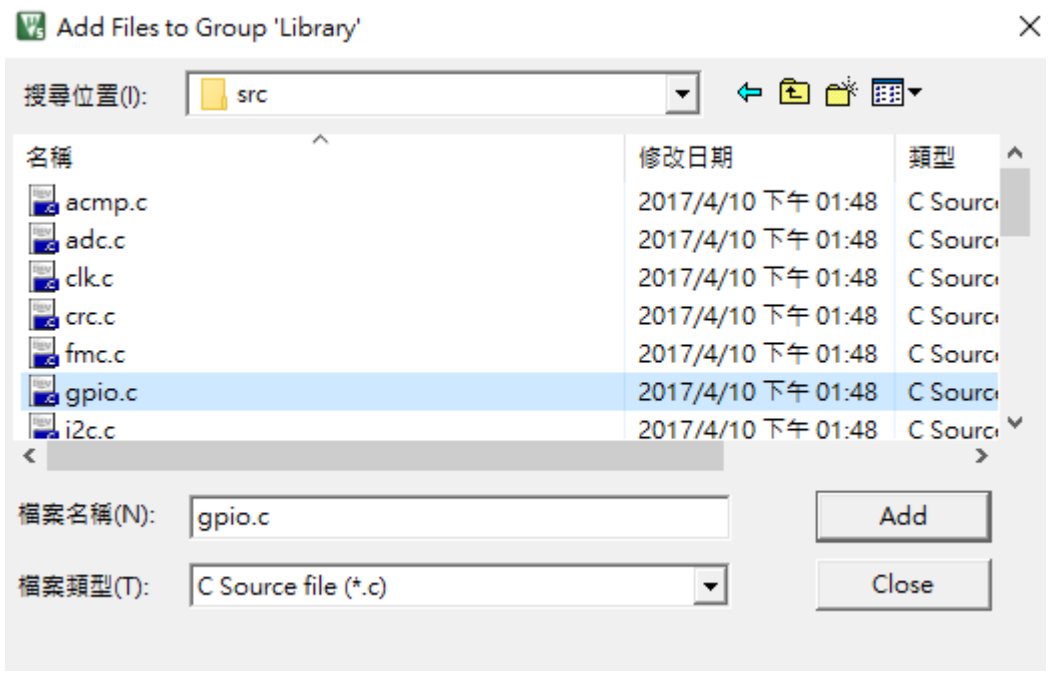


- 參考範例: UART_TxRx_Function
  - 請看懂裡面如何使用uart interrupt, 不要直接照抄
- 相關function:
  - memset, strcmp(記得include string.h)
- 請多多參考NUC140的Technical Reference Manual 裡面會清楚說明如何使用那些register
- RGB LED 記得要設定腳位為Output mode 詳見LAB1 PPT

Tips

- 要使用GPIO_SetMode function 要include GPIO.c 到Library
- GPIO.c 路徑
  NUC100_120BSP… -> Library -> StdDriver -> src





Demo

- Place: 創新大樓515 找助教 夏子聰
- Demo Time: (二)(四)下午三點~五點
- Report deadline: 10/21(五)
- Report title format: LABx_ID_Name.pdf

- Demo必須在Report deadline前完成
- Demo前須先上傳程式碼(上傳main所在的.c檔即可)

Graded

- Basic : 70%
- Bonus : 15%
- Report & Code : 15%