Lab07 Interrupt & Timer

PIC18F4520 Datasheet

MicroChip - PIC18F4520 Datasheet

(https://ww1.microchip.com/downloads/en/DeviceDoc/39631E.pdf)

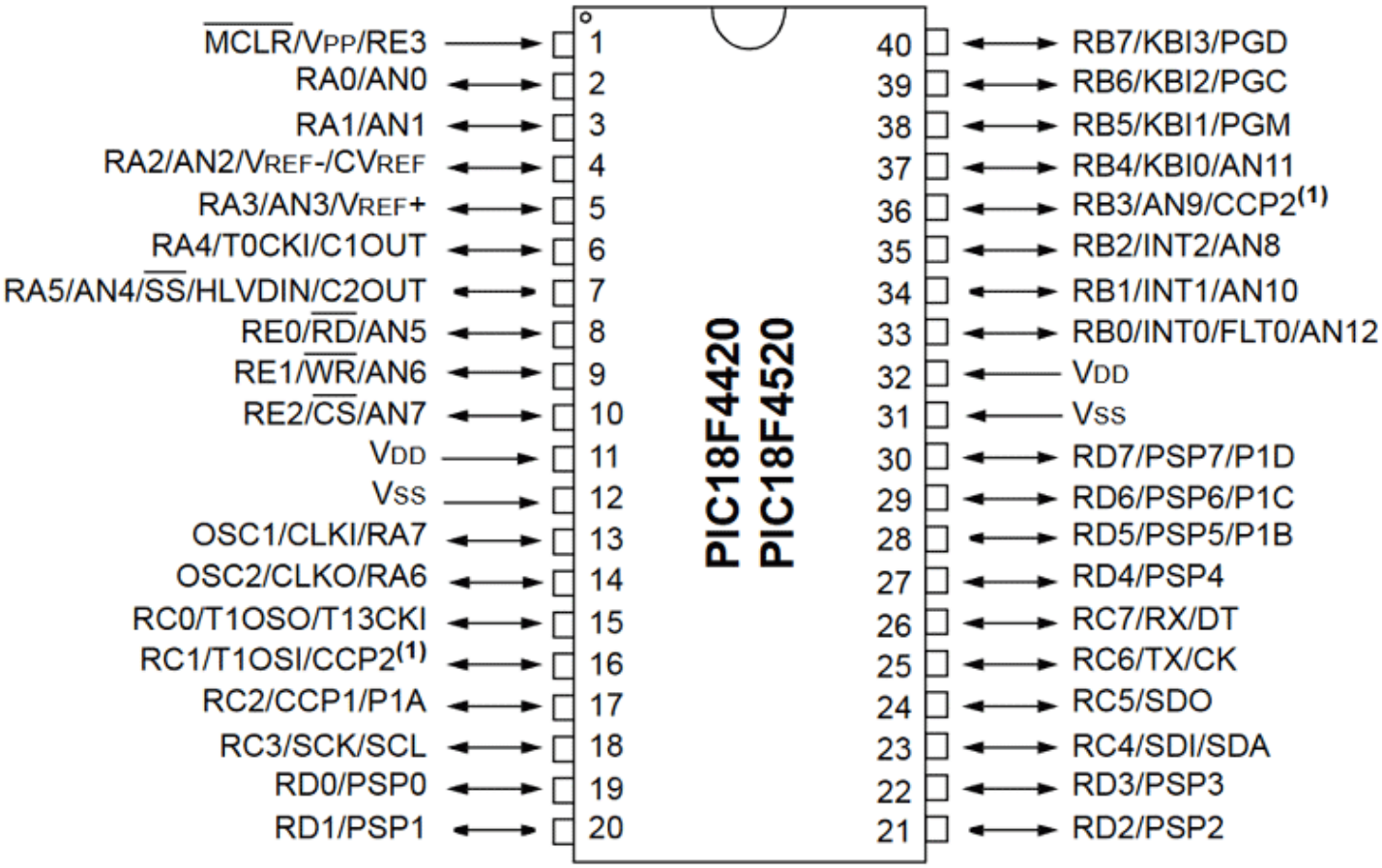
Interrupt用

Register名稱	在第幾頁	用途
RCON	第44頁	IPEN: 設定Interrupt優先度
INTCON	第95頁	GIE、INT0的[Flag bit, Enable Bit]
ADCON1	第226頁	設定數位類比

Timer用

Register名稱	在第幾頁	用途
OSCCON	第32頁	調整時脈 (可以玩看看)
T2CON	第135頁	設定Timer2的啟動、預除器後除器
PIR1	第98頁	TMR2IF、TMR1IF等
PIE1	第100頁	TMR2IE、TMR1IE等
IPR1	第102頁	TMR2IP、TMR1IP等

PIC18F4520 架構圖



Interrupt 範例程式碼

```
#include "p18f4520.inc"

; CONFIG1H
  CONFIG  OSC = INTIO67         ; Oscillator Selection bits (Internal oscilla
  CONFIG  FCMEN = OFF           ; Fail-Safe Clock Monitor Enable bit (Fail-Sa
  CONFIG  IESO = OFF            ; Internal/External Oscillator Switchover bit

; CONFIG2L
  CONFIG  PWRT = OFF            ; Power-up Timer Enable bit (PWRT disabled)
  CONFIG  BOREN = SBORDIS       ; Brown-out Reset Enable bits (Brown-out Reset
  CONFIG  BORV = 3              ; Brown Out Reset Voltage bits (Minimum setti

; CONFIG2H
  CONFIG  WDT = OFF             ; Watchdog Timer Enable bit (WDT disabled (co
  CONFIG  WDTPS = 32768         ; Watchdog Timer Postscale Select bits (1:327
```

```
; CONFIG3H
  CONFIG  CCP2MX = PORTC        ; CCP2 MUX bit (CCP2 input/output is multiple
  CONFIG  PBADEN = ON           ; PORTB A/D Enable bit (PORTB<4:0> pins are c
  CONFIG  LPT1OSC = OFF         ; Low-Power Timer1 Oscillator Enable bit (Tir
  CONFIG  MCLRE = ON            ; MCLR Pin Enable bit (MCLR pin enabled; RE3

; CONFIG4L
  CONFIG  STVREN = ON           ; Stack Full/Underflow Reset Enable bit (Stac
  CONFIG  LVP = OFF             ; Single-Supply ICSP Enable bit (Single-Suppl
  CONFIG  XINST = OFF           ; Extended Instruction Set Enable bit (Instru

; CONFIG5L
  CONFIG  CP0 = OFF             ; Code Protection bit (Block 0 (000800-001FFF
  CONFIG  CP1 = OFF             ; Code Protection bit (Block 1 (002000-003FFF
  CONFIG  CP2 = OFF             ; Code Protection bit (Block 2 (004000-005FFF
  CONFIG  CP3 = OFF             ; Code Protection bit (Block 3 (006000-007FFF

; CONFIG5H
  CONFIG  CPB = OFF             ; Boot Block Code Protection bit (Boot block
  CONFIG  CPD = OFF             ; Data EEPROM Code Protection bit (Data EEPRO

; CONFIG6L
  CONFIG  WRT0 = OFF            ; Write Protection bit (Block 0 (000800-001FF
  CONFIG  WRT1 = OFF            ; Write Protection bit (Block 1 (002000-003FF
  CONFIG  WRT2 = OFF            ; Write Protection bit (Block 2 (004000-005FF
  CONFIG  WRT3 = OFF            ; Write Protection bit (Block 3 (006000-007FF

; CONFIG6H
  CONFIG  WRTC = OFF            ; Configuration Register Write Protection bit
  CONFIG  WRTB = OFF            ; Boot Block Write Protection bit (Boot block
  CONFIG  WRTD = OFF            ; Data EEPROM Write Protection bit (Data EEPR

; CONFIG7L
  CONFIG  EBTR0 = OFF           ; Table Read Protection bit (Block 0 (000800-
  CONFIG  EBTR1 = OFF           ; Table Read Protection bit (Block 1 (002000-
  CONFIG  EBTR2 = OFF           ; Table Read Protection bit (Block 2 (004000-
  CONFIG  EBTR3 = OFF           ; Table Read Protection bit (Block 3 (006000-

; CONFIG7H
  CONFIG  EBTRB = OFF           ; Boot Block Table Read Protection bit (Boot

    L1 EQU 0x14
    L2 EQU 0x15
    org 0x00

DELAY macro num1, num2
    local LOOP1
```

```
    local LOOP2
    MOVLW num2
    MOVWF L2
    LOOP2:
        MOVLW num1
        MOVWF L1
    LOOP1:
        NOP
        NOP
        NOP
        NOP
        NOP
        NOP
        DECFSZ L1, 1
        BRA LOOP1
        DECFSZ L2, 1
        BRA LOOP2
endm

; 程式邏輯：會一直卡在main裡面做無限迴圈，按下RB0的按鈕後會觸發interrupt，跳到ISR執行
; ISR裡的內容會亮起所有在RA上的燈泡，Delay約0.5秒後熄滅。

goto Initial                    ; 避免程式一開始就會執行到ISR這一段，要跳過。
ISR:                            ; Interrupt發生時，會跳到這裡執行。
    org 0x08
    SETF LATA
    DELAY  d'350' , d'180'      ; 約500_000cycles數， 在1MHz的情況下大約會Delay0.5
    CLRF LATA
    BCF INTCON, INT0IF
    RETFIE                     ; 離開ISR，回到原本程式執行的位址，同時會將GIE設為1，允


Initial:                                ; 初始化的相關設定
    MOVLW 0x0F
    MOVWF ADCON1                ; 設定成要用數位的方式，Digitial I/O

    CLRF TRISA
    CLRF LATA
    BSF TRISB,  0
    BCF RCON, IPEN
    BCF INTCON, INT0IF          ; 先將Interrupt flag bit清空
    BSF INTCON, GIE             ; 將Global interrupt enable bit打開
    BSF INTCON, INT0IE          ; 將interrupt0 enable bit 打開 (INT0與RB0 pin腳位

main:
    bra main
end
```

Timer2 範例程式碼

```
#include "p18f4520.inc"

; CONFIG1H
  CONFIG  OSC = INTIO67         ; Oscillator Selection bits (Internal oscilla
  CONFIG  FCMEN = OFF           ; Fail-Safe Clock Monitor Enable bit (Fail-Sa
  CONFIG  IESO = OFF            ; Internal/External Oscillator Switchover bit

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  CONFIG  PWRT = OFF            ; Power-up Timer Enable bit (PWRT disabled)
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  CONFIG  CP2 = OFF             ; Code Protection bit (Block 2 (004000-005FFF
  CONFIG  CP3 = OFF             ; Code Protection bit (Block 3 (006000-007FFF

; CONFIG5H
  CONFIG  CPB = OFF             ; Boot Block Code Protection bit (Boot block
  CONFIG  CPD = OFF             ; Data EEPROM Code Protection bit (Data EEPRO

; CONFIG6L
  CONFIG  WRT0 = OFF            ; Write Protection bit (Block 0 (000800-001FF
  CONFIG  WRT1 = OFF            ; Write Protection bit (Block 1 (002000-003FF
  CONFIG  WRT2 = OFF            ; Write Protection bit (Block 2 (004000-005FF
```

```
  CONFIG  WRT3 = OFF            ; Write Protection bit (Block 3 (006000-007FF

; CONFIG6H
  CONFIG  WRTC = OFF            ; Configuration Register Write Protection bit
  CONFIG  WRTB = OFF            ; Boot Block Write Protection bit (Boot block
  CONFIG  WRTD = OFF            ; Data EEPROM Write Protection bit (Data EEPR

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  CONFIG  EBTR0 = OFF           ; Table Read Protection bit (Block 0 (000800-
  CONFIG  EBTR1 = OFF           ; Table Read Protection bit (Block 1 (002000-
  CONFIG  EBTR2 = OFF           ; Table Read Protection bit (Block 2 (004000-
  CONFIG  EBTR3 = OFF           ; Table Read Protection bit (Block 3 (006000-

; CONFIG7H
  CONFIG  EBTRB = OFF           ; Boot Block Table Read Protection bit (Boot

    org 0x00

goto Initial
ISR:
    org 0x08                ; 大致效果: 每0.5秒會進入一次interrupt
    COMF LATA               ; interrupt會開關LATA一次
    BCF PIR1, TMR2IF        ; 離開前記得把TMR2IF清空 (清空flag bit)
    RETFIE

Initial:
    MOVLW 0x0F
    MOVWF ADCON1
    CLRF TRISA
    CLRF LATA
    BSF RCON, IPEN
    BSF INTCON, GIE
    BCF PIR1, TMR2IF          ; 為了使用TIMER2，所以要設定好相關的TMR2IF、TMR2IE、
    BSF IPR1, TMR2IP
    BSF PIE1 , TMR2IE
    MOVLW b'11111111'         ; 將Prescale與Postscale都設為1:16，意思是之後每256
    MOVWF T2CON               ; 而由於TIMER本身會是以系統時脈/4所得到的時脈為主
    MOVLW D'122'              ; 因此每256 * 4 = 1024個cycles才會將TIMER2 + 1
    MOVWF PR2                 ; 若目前時脈為250khz，想要Delay 0.5秒的話，代表每經過
                              ; 因此PR2應設為 125000 / 1024 = 122.0703125， 約
    MOVLW D'00100000'
    MOVWF OSCCON              ; 記得將系統時脈調整成250kHz

main:
    bra main


end
```