Lab07 Interrupt & Timer

PIC18F4520 Datasheet

MicroChip - PIC18F4520 Datasheet
(https://ww1.microchip.com/downloads/en/DeviceDoc/39631E.pdf)

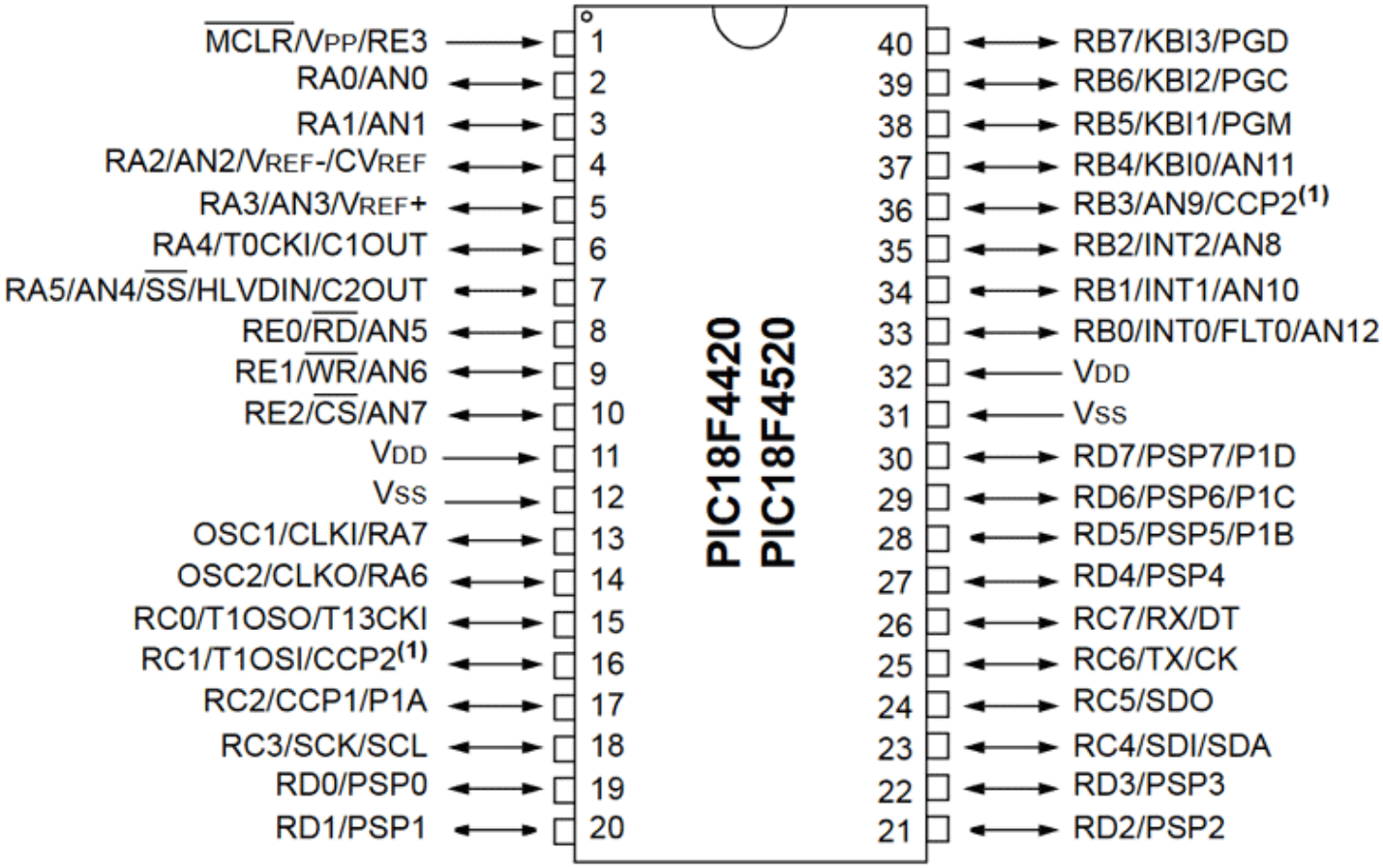
Interrupt用

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 o
  CONFIG  FCMEN = OFF           ; Fail-Safe Clock Monitor Enable bit (F
  CONFIG  IESO = OFF            ; Internal/External Oscillator Switchov

; CONFIG2L
  CONFIG  PWRT = OFF            ; Power-up Timer Enable bit (PWRT disab
  CONFIG  BOREN = SBORDIS       ; Brown-out Reset Enable bits (Brown-ou
  CONFIG  BORV = 3              ; Brown Out Reset Voltage bits (Minimur

; CONFIG2H
  CONFIG  WDT = OFF             ; Watchdog Timer Enable bit (WDT disab
  CONFIG  WDTPS = 32768         ; Watchdog Timer Postscale Select bits

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

```
22
23  ; CONFIG4L
24    CONFIG  STVREN = ON           ; Stack Full/Underflow Reset Enable bi
25    CONFIG  LVP = OFF             ; Single-Supply ICSP Enable bit (Singl
26    CONFIG  XINST = OFF           ; Extended Instruction Set Enable bit
27
28  ; CONFIG5L
29    CONFIG  CP0 = OFF             ; Code Protection bit (Block 0 (000800-
30    CONFIG  CP1 = OFF             ; Code Protection bit (Block 1 (002000-
31    CONFIG  CP2 = OFF             ; Code Protection bit (Block 2 (004000-
32    CONFIG  CP3 = OFF             ; Code Protection bit (Block 3 (006000-
33
34  ; CONFIG5H
35    CONFIG  CPB = OFF             ; Boot Block Code Protection bit (Boot
36    CONFIG  CPD = OFF             ; Data EEPROM Code Protection bit (Data
37
38  ; CONFIG6L
39    CONFIG  WRT0 = OFF            ; Write Protection bit (Block 0 (00080
40    CONFIG  WRT1 = OFF            ; Write Protection bit (Block 1 (00200
41    CONFIG  WRT2 = OFF            ; Write Protection bit (Block 2 (00400
42    CONFIG  WRT3 = OFF            ; Write Protection bit (Block 3 (00600
43
44  ; CONFIG6H
45    CONFIG  WRTC = OFF            ; Configuration Register Write Protect
46    CONFIG  WRTB = OFF            ; Boot Block Write Protection bit (Boo
47    CONFIG  WRTD = OFF            ; Data EEPROM Write Protection bit (Da
48
49  ; CONFIG7L
50    CONFIG  EBTR0 = OFF           ; Table Read Protection bit (Block 0 (
51    CONFIG  EBTR1 = OFF           ; Table Read Protection bit (Block 1 (
52    CONFIG  EBTR2 = OFF           ; Table Read Protection bit (Block 2 (
53    CONFIG  EBTR3 = OFF           ; Table Read Protection bit (Block 3 (
54
55  ; CONFIG7H
56    CONFIG  EBTRB = OFF           ; Boot Block Table Read Protection bit
57
58      L1 EQU 0x14
59      L2 EQU 0x15
60      org 0x00
61
62  DELAY macro num1, num2
63      local LOOP1
64      local LOOP2
65      MOVLW num2
66      MOVWF L2
67      LOOP2:
68          MOVLW num1
69          MOVWF L1
70      LOOP1:
71          NOP
72          NOP
73          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
; 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De
    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


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

main:
    bra main
end
```

Timer2 範例程式碼

```
#include "p18f4520.inc"

; CONFIG1H
  CONFIG  OSC = INTIO67         ; Oscillator Selection bits (Internal o
  CONFIG  FCMEN = OFF           ; Fail-Safe Clock Monitor Enable bit (F
  CONFIG  IESO = OFF            ; Internal/External Oscillator Switchov

; CONFIG2L
```

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

; CONFIG2H
  CONFIG  WDT = OFF             ; Watchdog Timer Enable bit (WDT disabl
  CONFIG  WDTPS = 32768         ; Watchdog Timer Postscale Select bits

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

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

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

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

; CONFIG6L
  CONFIG  WRT0 = OFF            ; Write Protection bit (Block 0 (000800
  CONFIG  WRT1 = OFF            ; Write Protection bit (Block 1 (002000
  CONFIG  WRT2 = OFF            ; Write Protection bit (Block 2 (004000
  CONFIG  WRT3 = OFF            ; Write Protection bit (Block 3 (006000

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

; CONFIG7L
  CONFIG  EBTR0 = OFF           ; Table Read Protection bit (Block 0 (0
  CONFIG  EBTR1 = OFF           ; Table Read Protection bit (Block 1 (0
  CONFIG  EBTR2 = OFF           ; Table Read Protection bit (Block 2 (0
  CONFIG  EBTR3 = OFF           ; Table Read Protection bit (Block 3 (0

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

    org 0x00

```

```
60  goto Initial
61  ISR:
62      org 0x08                ; 大致效果: 每0.5秒會進入一次interrupt
63      COMF LATA               ; interrupt會開關LATA一次
64      BCF PIR1, TMR2IF        ; 離開前記得把TMR2IF清空 (清空flag bit)
65      RETFIE
66
67  Initial:
68      MOVLW 0x0F
69      MOVWF ADCON1
70      CLRF TRISA
71      CLRF LATA
72      BSF RCON, IPEN
73      BSF INTCON, GIE
74      BCF PIR1, TMR2IF          ; 為了使用TIMER2，所以要設定好相關的TMR2IF、TM
75      BSF IPR1, TMR2IP
76      BSF PIE1 , TMR2IE
77      MOVLW b'11111111'         ; 將Prescale與Postscale都設為1:16，意思是之後
78      MOVWF T2CON               ; 而由於TIMER本身會是以系統時脈/4所得到的時脈為
79      MOVLW D'122'              ; 因此每256 * 4 = 1024個cycles才會將TIMER2
80      MOVWF PR2                 ; 若目前時脈為250khz，想要Delay 0.5秒的話，代表
81                                ; 因此PR2應設為 125000 / 1024 = 122.070312
82      MOVLW D'00100000'
83      MOVWF OSCCON              ; 記得將系統時脈調整成250kHz
84
85  main:
86      bra main
87
88
89  end
90
```