

214455 : Programming Skill Development Lab

Name : Swapnil Ajit Chhahre

Division : SE-10

Roll no. : 23213

Batch : E-10

Assignment - 4

Write a note on Timer 0, 1, 2 and 3

Ans i) Timer 0

i) Timer control registers

- TOCON is Timer 0 control register

- TOCON is an 8 bit register with following bits :

1) TMR0ON

2) T08BIT

3) T0CS

4) T0SE

5) PSA

6) TOPS2

7) TOPS1

8) TOPS0

} Prescaler select bits

ii) Timer registers

- Timer 0 uses a 16 bit register represented by TMR0H (Timer 0 higher byte) as higher byte register and TMR0L (Timer 0 lower byte) as lower byte register



### iii) Timer interrupt flag

- The interrupt flag bit for Timer 0 is TMR0IF which is a part of INTCON (interrupt control) register

### iv) Delay calculations

- Crystal frequency =  $X$
- Timer frequency =  $t = \frac{X}{4}$ ,  $t$ /Prescaler in case prescale ON
- Timer delay period =  $T = \frac{1}{t}$
- Count =  $FFFFH - (TMROH \cdot TMROL) + 1 = C$
- Time delay =  $D = C \times T$
- Time delay of half cycle =  $2 \times D$

### 2) Timer 1

#### i) Timer control registers

- T1CON is Timer 1 control register
- T1CON is an 8 bit register with following bits

- 1) RD16
  - 2) NOT used
  - 3) TICKPS1
  - 4) TICKPS0
  - 5) T1OSCEN
  - 6) T1SYNC
  - 7) TMR1CS
  - 8) TMR1ON
- } Prescaler select bits

## ii) Timer registers

- Timer 1 uses a 16 bit register which is split into two bytes, referred as TMR1L (Timer 1 low byte) and TMR1H (Timer 1 high byte)
- Timer 1 can be programmed in 16 bit mode only

## iii) Timer interrupt flag

- The interrupt flag bit for Timer 1 is TMR1IF which is a part of PIR1 register

## iv) Delay calculations

a) Crystal frequency =  $X$

b) Timer frequency =  $t = \frac{X}{4}$

=  $t / \text{prescaler value}$ , when prescale value  $> 1$

c) Timer period =  $T = \frac{1}{t}$

d) count =  $C = \text{FFFFH} - (\text{TMR1H} \cdot \text{TMR1L}) + 1$

e) Time delay =  $D = T \times C$

f) Time delay of half cycle =  $2 \times D$



### 3) Timer 2

#### i) Timer control register

- T2CON is Timer2 ~~register~~ control register
- T2CON is 8 bit register
- T2CON contains following 8 bits

i) Not used

ii) TOUTPS3

iii) TOUTPS2

iv) TOUTPS1

v) TOUTPS0

vi) TMR2ON

vii) T2CKPS1

viii) T2CKPS0

} Postscale select bits

} Prescale select bits

#### ii) Timer registers

- The 8 bit register of Timer2 is called TMR2
- Timer2 also has an 8 bit register called ~~period~~ period register (PR2).
- The value of PR2 can be set to a fixed value and Timer2 then increments till the same value in PR2

#### iii) Timer interrupt flag

- The interrupt flag bit of Timer2 is TMR2IF which is part of PIR1

#### iv) Delay calculations

a) Crystal frequency =  $X$

b) Timer frequency =  $\frac{X}{4} = f$

c) Timer ~~frequency~~ period =  $\frac{\text{Postscale value} \times \text{Prescale value}}{f} = T$

d) Count =  $C = \text{TMR2H} = \text{PR2}$

e) Time delay =  $C \times T = D$

f) Time delay of half cycle =  $2 \times D$

#### 4) Timer 3

i) Timer control register

- T3CON is timer3 control register

- T3CON is 8 bit register with following bits -

i) RD16

ii) T3CCP2

iii) T3CCP1

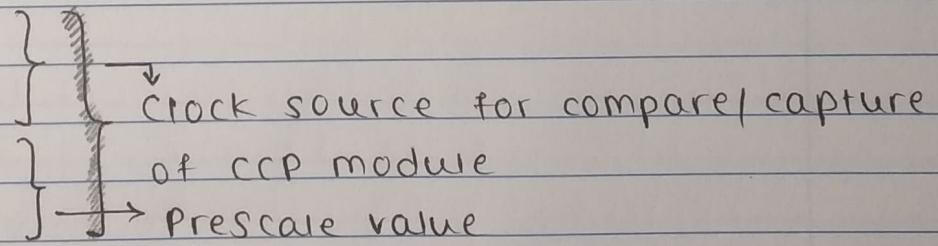
iv) T3CKPS1

v) T3CKPS0

vi) T3SYNC

vii) TMR3CS

viii) TMR3ON



#### ii) Timer registers

- Timer3 is 16 bit register split as TMR3L (Timer3 low byte) and TMR3H (Timer3 high byte)



iii) Timer interrupt flag

- The interrupt flag bit of timer 3 is called TMR3IF which is part of PIR2 register

iv) Delay calculations

a) Crystal frequency =  $X$

b) Timer frequency =  $\frac{X}{4}$

c) Timer period =  $\frac{1}{f} \times \text{prescale value} = T$

d) Count =  $C = \text{FFFFH} - (\text{TMR3H} \cdot \text{TMR3L}) + 1$

e) Timer delay =  $C \times T = D$

f) Timer delay for half cycle =  $2 \times D$