



TRƯỜNG ĐẠI HỌC BÁCH KHOA HÀ NỘI
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KỸ THUẬT VI XỬ LÝ BẮM XUNG PWM

Nhóm trợ giảng K58

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NỘI DUNG

- **Giới thiệu PWM**
- **PWM với PIC 16F877a**
- **Ví dụ**

GIỚI THIỆU PWM

- Là phương pháp điều chế dựa trên sự thay đổi độ rộng của chuỗi xung vuông [1].
- Duty cycle: Là tỷ lệ % thời gian xung ở mức CAO trong 1 chu kỳ.

$$\text{Duty cycle} = \text{Turn ON time} / (\text{Turn ON time} + \text{Turn OFF time})$$

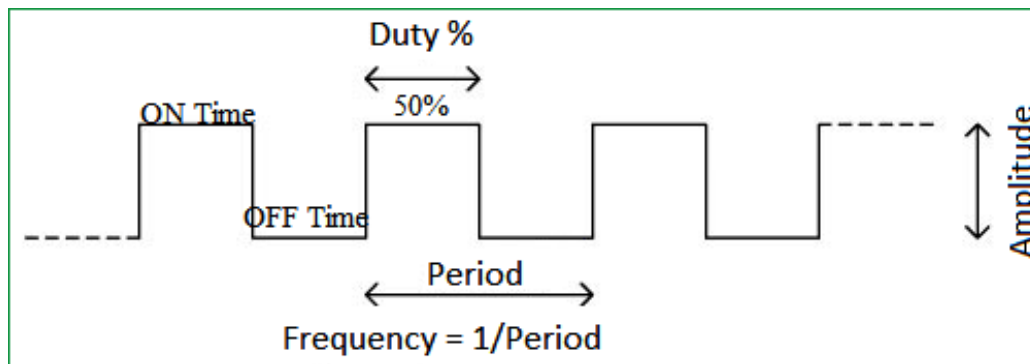
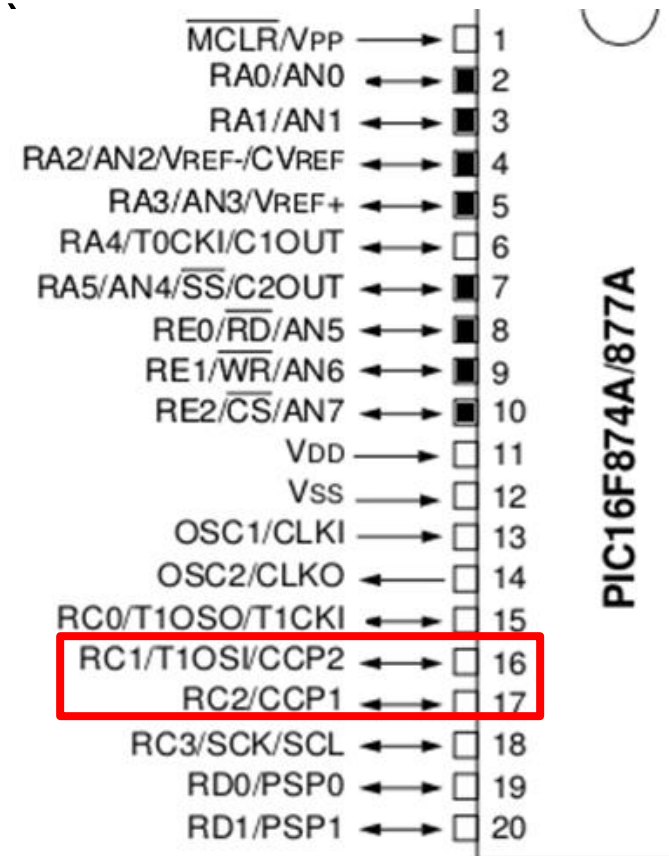


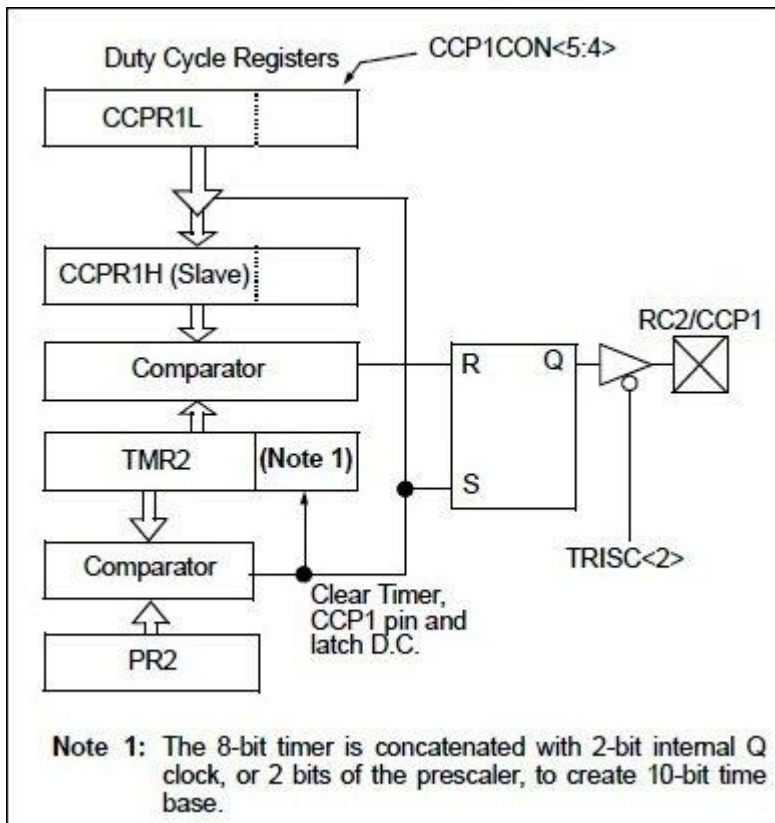
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PWM VỚI PIC 16F877A

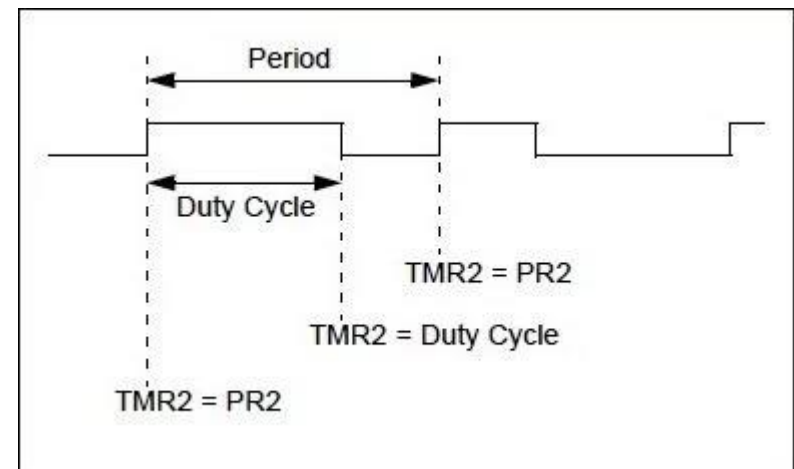
- Sử dụng module CCP (Compare Capture PWM)
- Độ phân giải: 10 bit (0 - 1023)
 - 0 \Leftrightarrow duty cycle = 0%
 - 1023 \Leftrightarrow duty cycle = 100%
- 2 module: CCP1 & CCP2
- Các thanh ghi cần thiết
 - CCP1CON (CCP1 control Register)
 - T2CON (Timer 2 Control Register)
 - PR2 (Timer 2 modules Period Register)
 - CCPR1L (CCP Register 1 Low)



PWM VỚI PIC 16F877A



Timer 2 Block Diagram



PWM output

PWM VỚI PIC 16F877A

- Các bước:

Set PWM period

- PR2 register

Set PWM duty cycle

- CCPR1L register
- CCP1CON<5:4> bits

Make CCP1: output

- TRISC<2> bit cleared

Set TMR2 prescale
& enable Timer2

- T2CON

PWM VỚI PIC 16F877A

- 2 bước quan trọng nhất:

PWM_Init()

- Khởi tạo các thanh ghi (register)

PWM_Duty()

- Đặt giá trị duty cycle

PWM VỚI PIC 16F877A

```
PWM_Initialize()
{
    PR2 = (_XTAL_FREQ/(PWM_freq*4*TMR2PRESCALE)) - 1; //Setting the PR2 formulae using Datasheet
    CCP1M3 = 1; CCP1M2 = 1; //Configure the CCP1 module
    T2CKPS0 = 1; T2CKPS1 = 0; TMR2ON = 1; //Configure the Timer module
    TRISC2 = 0; // make port pin on C as output
}
```

CCP1CON REGISTER/CCP2CON REGISTER (ADDRESS 17h/1Dh)

U-0	U-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0
—	—	CCPxX	CCPxY	CCPxM3	CCPxM2	CCPxM1	CCPxM0
bit 7							
							bit 0

bit 3-0

CCPxM3:CCPxM0: CCPx Mode Select bits

- 0000 = Capture/Compare/PWM disabled (resets CCPx module)
- 0100 = Capture mode, every falling edge
- 0101 = Capture mode, every rising edge
- 0110 = Capture mode, every 4th rising edge
- 0111 = Capture mode, every 16th rising edge
- 1000 = Compare mode, set output on match (CCPxIF bit is set)
- 1001 = Compare mode, clear output on match (CCPxIF bit is set)
- 1010 = Compare mode, generate software interrupt on match (CCPxIF bit is set, CCPx pin is unaffected)
- 1011 = Compare mode, trigger special event (CCPxIF bit is set, CCPx pin is unaffected); CCP1 resets TMR1; CCP2 resets TMR1 and starts an A/D conversion (if A/D module is enabled)
- 11xx = PWM mode

T2CON: TIMER2 CONTROL REGISTER (ADDRESS 12h)

U-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0	R/W-0
—	TOUTPS3	TOUTPS2	TOUTPS1	TOUTPS0	TMR2ON	T2CKPS1	T2CKPS0

bit 7

bit 0

bit 1-0

T2CKPS1:T2CKPS0: Timer2 Clock Prescale Select bits

- 00 = Prescaler is 1
- 01 = Prescaler is 4
- 1x = Prescaler is 16

PWM VỚI PIC 16F877A

$$\text{PWM Period} = [(PR2) + 1] * 4 * TOSC * (\text{TMR2 Prescale Value})$$

$$PR2 = (\text{Period} / (4 * TOSC * \text{TMR2 Prescale})) - 1$$

Mà:

$$\text{Period} = (1/\text{PWM_freq})$$

$$TOSC = (1/_XTAL_FREQ)$$

$$PR2 = (_XTAL_FREQ / (\text{PWM_freq} * 4 * \text{TMR2PRESCALE})) - 1;$$

VÍ DỤ

**CẢM ƠN CÁC BẠN ĐÃ
THEO DÕI !**