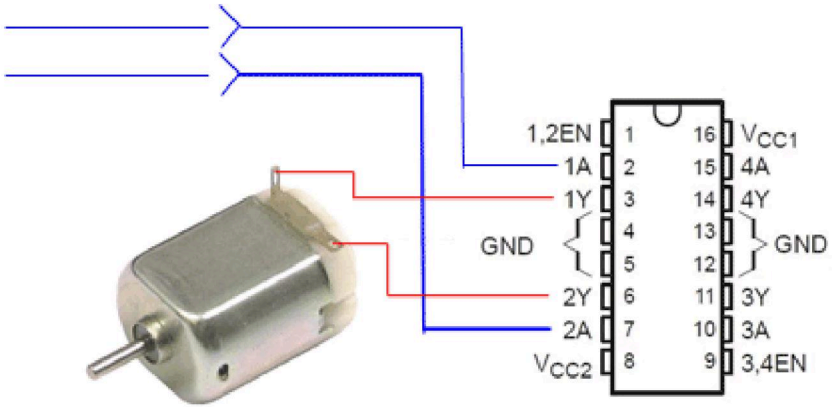
PWM 18F



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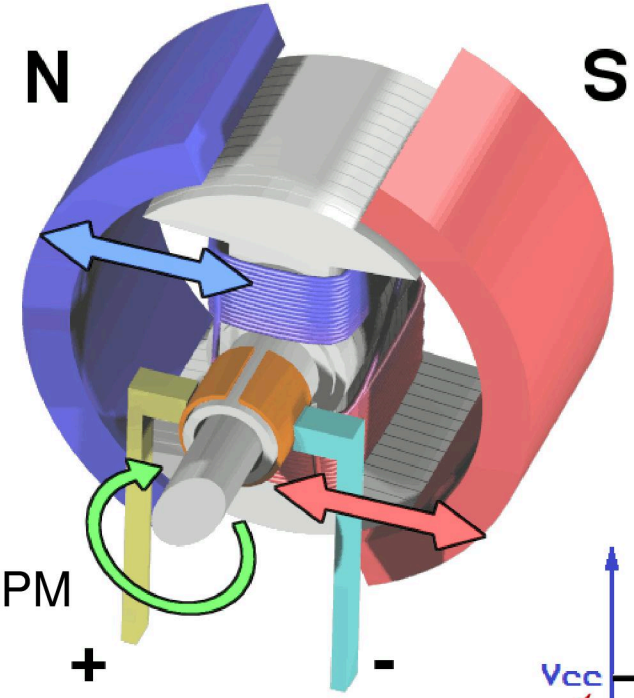
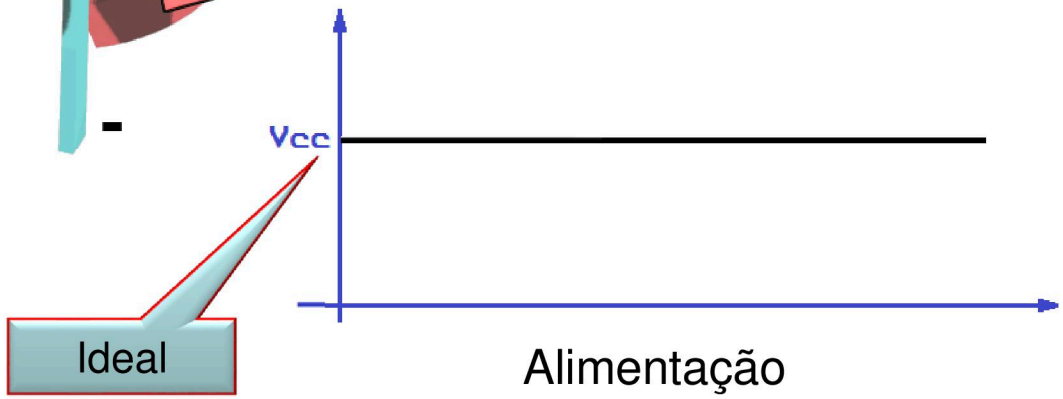
Características



Rotação em RPM



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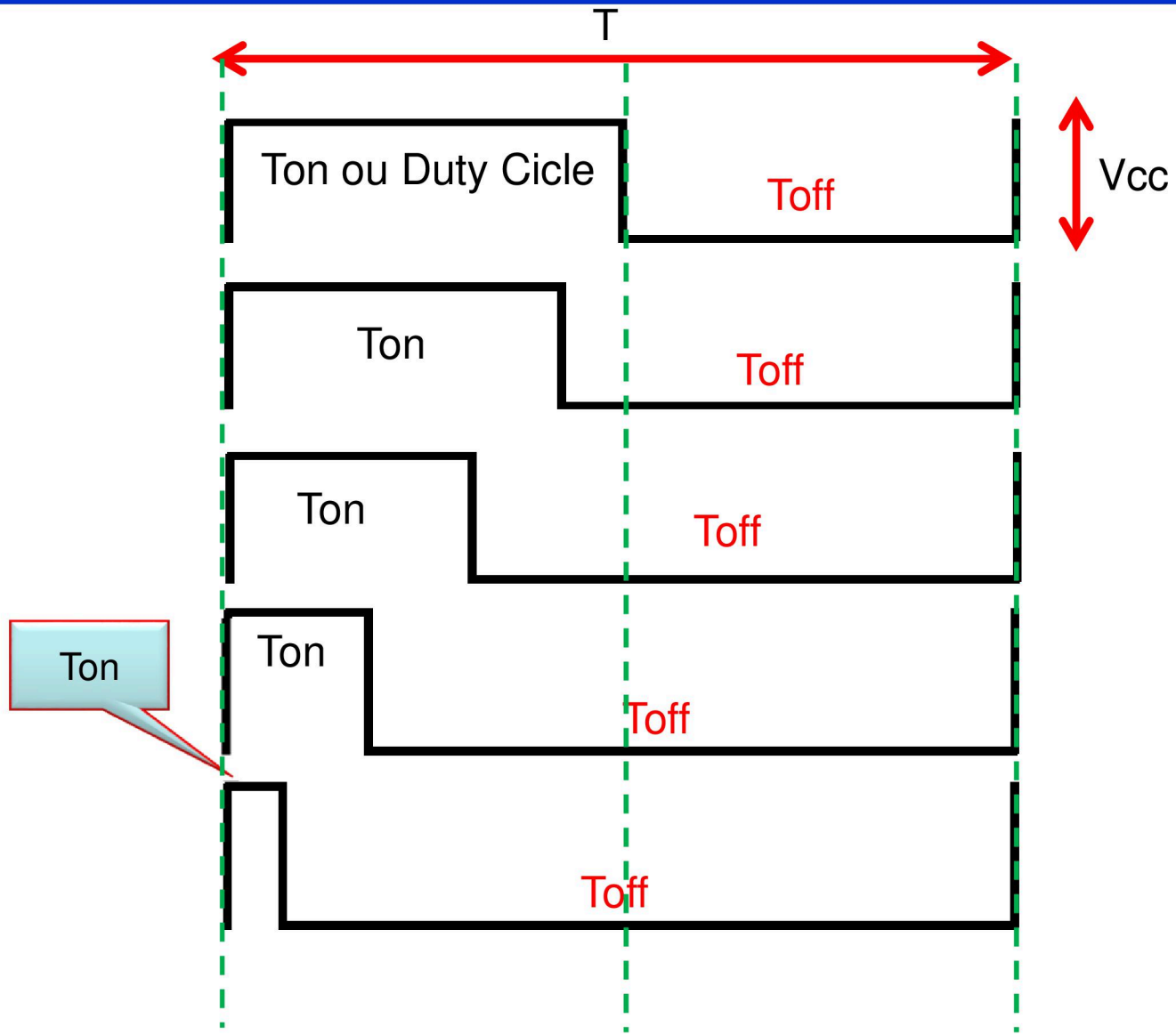
Intervalando...



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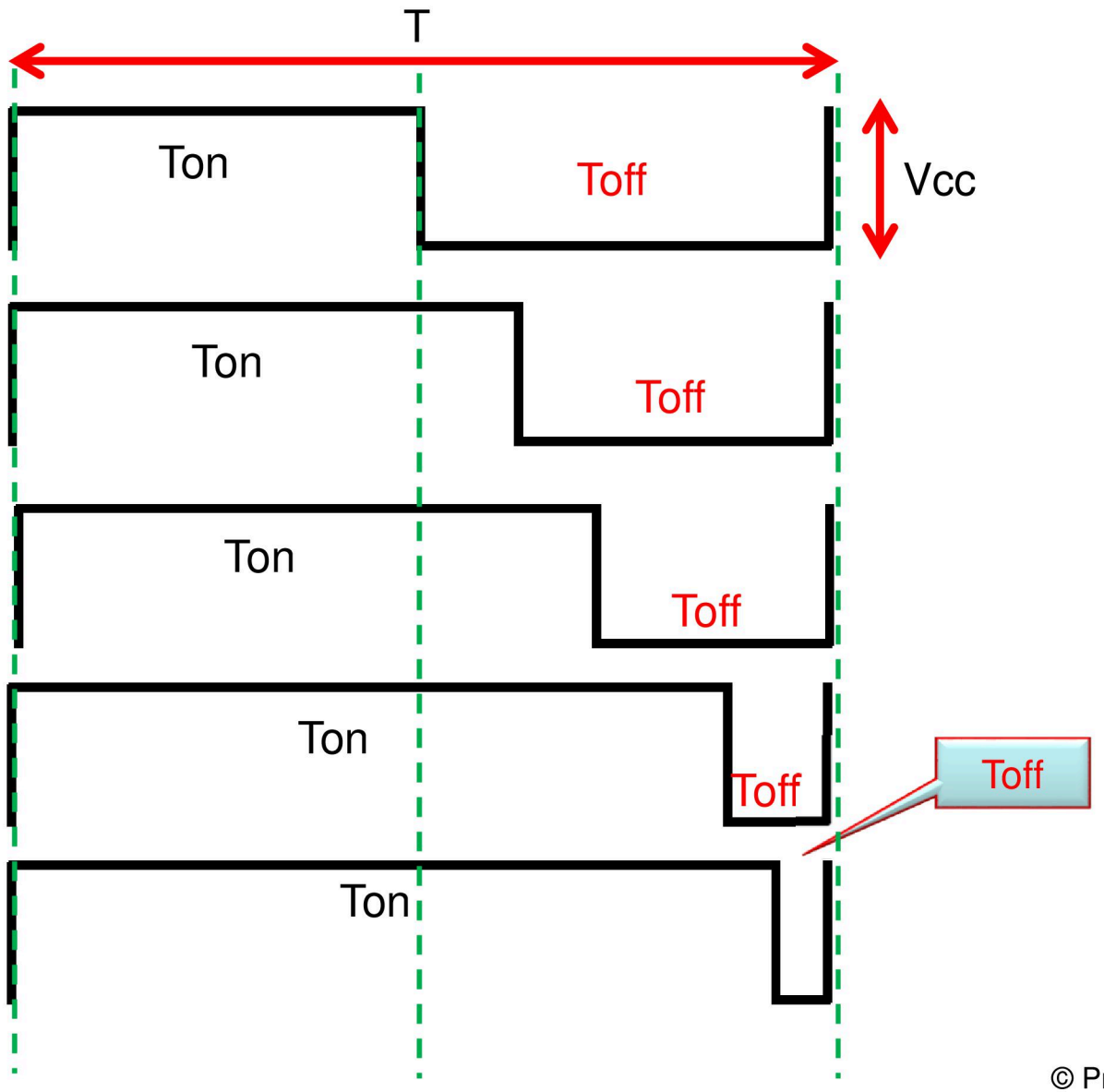
ou...



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Características

Gerador de PWM Interno que usa o Timer2

Deve ser informado nos fuse bits

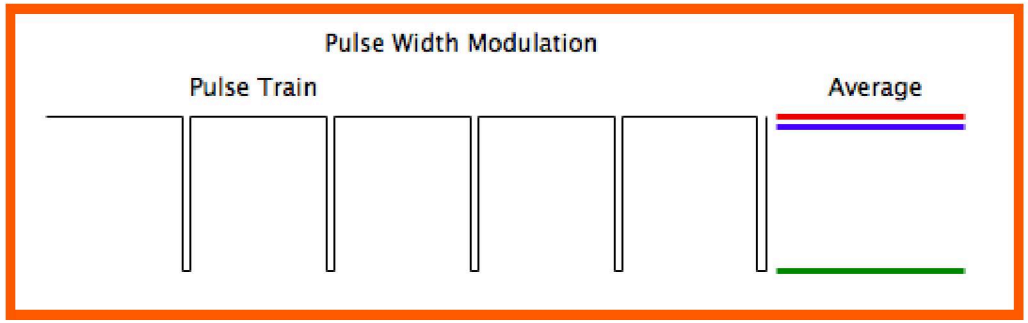
Capture/Compare/PWM

Capture/Compare/PWM

Capture/Compare/PWM

PIC18F4455
PIC18F4550

Pin	Lado	Sinal
1	Esquerda	MCLR/VPP/RE3
2	Esquerda	RA0/AN0
3	Esquerda	RA1/AN1
4	Esquerda	RA2/AN2/VREF-/CVREF
5	Esquerda	RA3/AN3/VREF+
6	Esquerda	RA4/T0CKI/C1OUT/RCV
7	Esquerda	RA5/AN4/SS/HLVDIN/C2OUT
8	Esquerda	RE0/AN5/CK1SPP
9	Esquerda	RE1/AN6/CK2SPP
10	Esquerda	RE2/AN7/OESPP
11	Esquerda	VDD
12	Esquerda	VSS
13	Esquerda	OSC1/CLKI
14	Esquerda	OSC2/CLKO/RA6
15	Esquerda	RC0/T1OSO/T13CKI
16	Esquerda	RC1/T1OSI/CCP2(1)/UOE
17	Esquerda	RC2/CCP1/P1A
18	Esquerda	VUSB
19	Esquerda	RD0/SPP0
20	Esquerda	RD1/SPP1
21	Direita	RD2/SPP2
22	Direita	RD3/SPP3
23	Direita	RC4/D-/VM
24	Direita	RC5/D+/VP
25	Direita	RC6/TX/CK
26	Direita	RC7/RX/DT/SDO
27	Direita	RD4/SPP4
28	Direita	RD5/SPP5/P1B
29	Direita	RD6/SPP6/P1C
30	Direita	RD7/SPP7/P1D
31	Direita	VSS
32	Direita	VDD
33	Direita	RB0/AN12/INT0/FLT0/SDI/SDA
34	Direita	RB1/AN10/INT1/SCK/SCL
35	Direita	RB2/AN8/INT2/VMO
36	Direita	RB3/AN9/CCP2(1)/VPO
37	Direita	RB4/AN11/KBI0/CSSPP
38	Direita	RB5/KBI1/PGM
39	Direita	RB6/KBI2/PGC
40	Direita	RB7/KBI3/PGD



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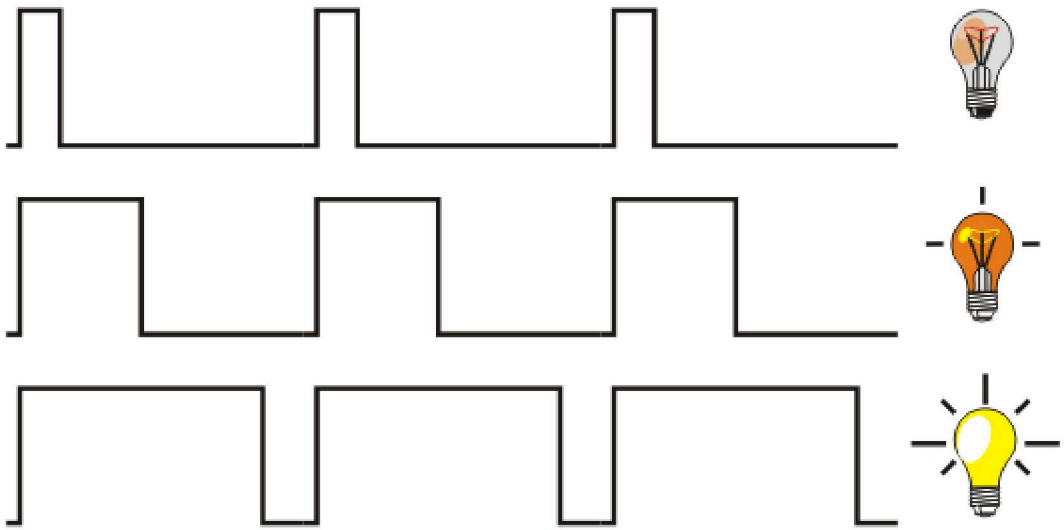
Exemplo

- Motor com 1000 RPM ➲ 16.7 RPS ou 16.7 Hz
- Ou seja, T = 0,06 S
- Duty Cycle T_{on} = 0,03 S e T_{off} = 0,03 S 50%



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Registros envolvidos

- CCPxCON
  - (x = 1 ou 2)
- CCPRxL
  - Faz o controle do Duty Cycle do canal (x = 1 ou 2)
- CCPRxH
- T2CON
  - Utilizado para definir o período, e é comum aos canais de PWM
- PR2
  - Registro de 8 bit para definir prescaler do Duty Cycle
- TRISB e TRISC
  - RC2 (CCP1) ou RC1e RB3 (CCP2)

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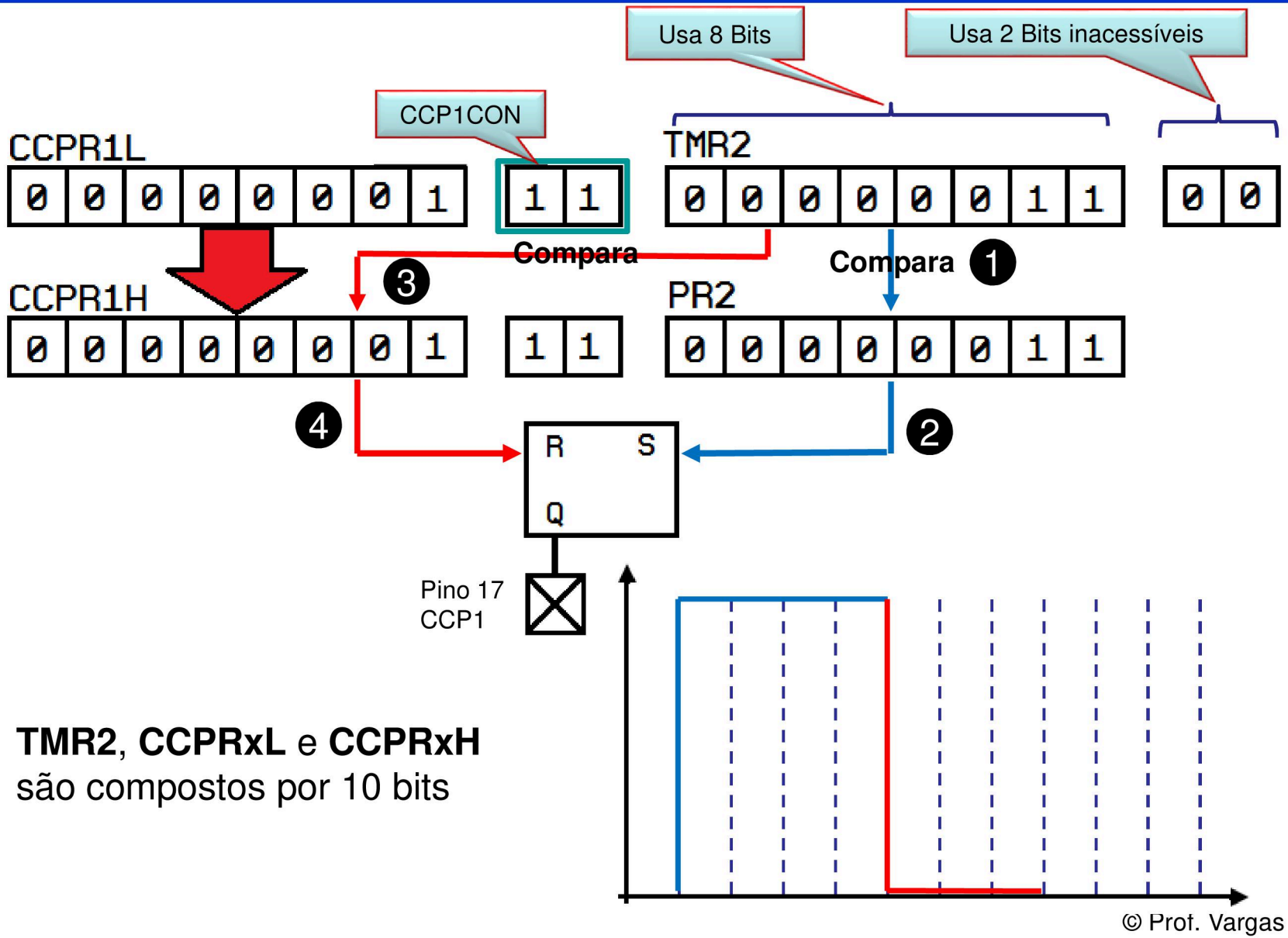
Execução



TMR2, **CCPRxL** e **CCPRxH** são compostos por 10 bits

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Registros

8 Bits mais significativos

CCPR1L	DC1B9	DC1B8	DC1B7	DC1B6	DC1B5	DC1B4	DC1B3	DC1B2

CCP1CON	P1M1(3)	P1M0(3)	DC1B1	DC1B0	CCP1M3	CCP1M2	CCP1M1	CCP1M0

2 bits menos significativos

Configura Modo PWM

bit 3-0 **CCPxM3:CCPxM0**: CCPx Module Mode Select bits

0000 = Capture/Compare/PWM disabled (resets CCPx module)
0001 = Reserved
0010 = Compare mode: toggle output on match (CCPxIF bit is set)
0011 = Reserved
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: initialize CCPx pin low; on compare match, force CCPx pin high (CCPxIF bit is set)
1001 = Compare mode: initialize CCPx pin high; on compare match, force CCPx pin low (CCPxIF bit is set)
1010 = Compare mode: generate software interrupt on compare match (CCPxIF bit is set, CCPx pin reflects I/O state)
1011 = Compare mode: trigger special event, reset timer, start A/D conversion on CCPx match (CCPxIF bit is set)
11xx = PWM mode

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Registros

T2CON	—	T2OUTPS3	T2OUTPS2	T2OUTPS1	T2OUTPS0	TMR2ON	T2CKPS1	T2CKPS0

Liga Timer2

Prescaler Timer2

bit 1-0 **T2CKPS1:T2CKPS0**: Timer2 Clock Prescale Select bits

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

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Cálculo de PR2 e TMR2

$$T_{PWM} = [PR2 + 1] \times \frac{4}{f_{osc}} \times TMR2_{prescaler}$$

ou

$$f_{PWM} = \frac{1}{[PR2 + 1] \times \frac{4}{f_{osc}} \times TMR2_{prescaler}}$$

Que isolando PR2:

$$PR2 = \frac{f_{osc}}{f_{PWM} \times 4 \times TMR2_{prescaler}} - 1$$

PR2 é o prescaler do Duty Cycle. Arredonde para o valor mais próximo entre **0 e 255**
TMR2 é **1**, **4** ou **16**

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Cálculo de Duty Cycle Ratio

$$Duty\ Cycle\ Ratio = \frac{CCPR1L{:}CCP1CON < 5{:}4 >}{4 \times\ (PR2 + 1)}$$

- Duty Cycle Ratio = PWM Duty Cycle
- CCPR1L = 8 bits parte alta do Duty Cycle
- CCP1CON<5:4> = 2 bits parte baixa do Duty Cycle
- PR2 = Define período do PWM

$$CCPR1L{:}CCP1CON < 5{:}4 >= \frac{\%DC_{PWM} \times f_{osc}}{100 \times TMR2_{prescaler} \times f_{PWM}}$$

Escolha o prescaler para o Timer2 em CCPR1L:CCP1CON<5:4> de forma que valor de TMR2 permaneça entre `0` e `1023`

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Prática

- Frequência desejada de PWM = 4KHz e 50% de Duty Cycle
- Calcula-se PR2:

$$PR2 = \frac{f_{osc}}{f_{PWM} \times 4 \times TMR2_{prescaler}} - 1 = \frac{8 \times 10^6}{4.000 \times 4 \times 4} - 1 = 123$$

- O prescaler **4** foi escolhido entre **1**, **4** e **16**
- Cálculo de Duty Cycle

$$CCPR1L{:}CCP1CON < 5{:}4 >= \frac{\%DC_{PWM} \times f_{osc}}{100 \times TMR2_{prescaler} \times f_{PWM}}$$

$$CCPR1L{:}CCP1CON < 5{:}4 >= \frac{50 \times 8 \times 10^6}{100 \times 4 \times 4.000} = 250$$

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Cuidados

CCP2 MUX bit

Enabled

PORTB A/D

Disabled

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