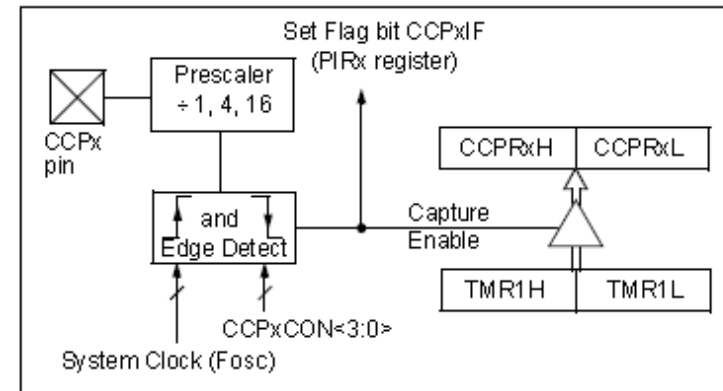


CCP Module

Capture

- In Capture mode, the CCPRxH, CCPRxL register pair captures the 16-bit value of the TMR1 register when an event occurs on pin CC
- An event is defined as one of the following and is configured by the CCP1M<3:0> bits of the CCP1C register:
 - Every falling edge
 - Every rising edge
 - Every 4th rising edge
 - Every 16th rising edge

FIGURE 11-1: CAPTURE MODE OPERATION BLOCK DIAGRAM



Uses of Capture

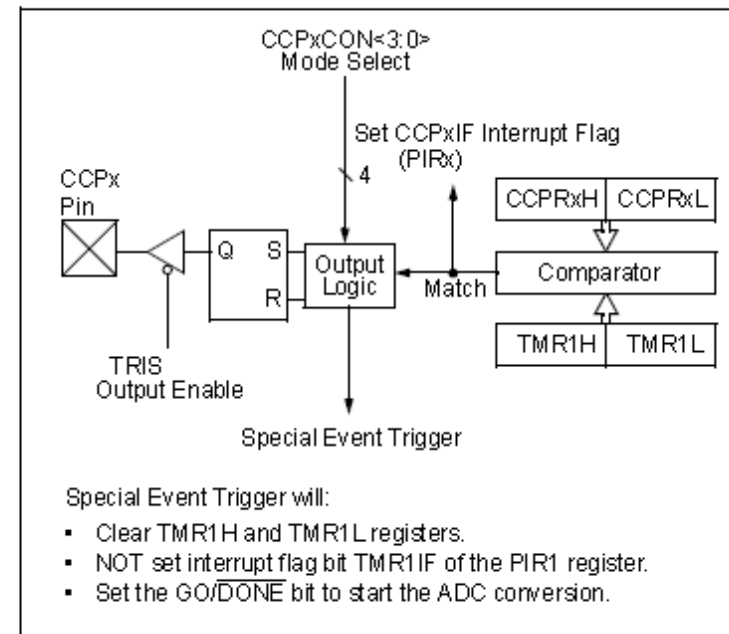
- Capabilities
 - Non-software intensive
 - Measure the period of an external square wave with or without averaging
 - Measuring Pulse width of external signals
- Applications
 - Encoder RPM output
 - Accelerometer outputs (changing duty cycle on output with change in sensed acceleration)

Compare

In Compare mode, the 16-bit CCPRx register value is constantly compared against the TMR1 register pair value. When a match occurs, the CCPx module may:

- Toggle the CCPx output
- Set the CCPx output
- Clear the CCPx output
- Generate a Special Event Trigger
- Generate a Software Interrupt

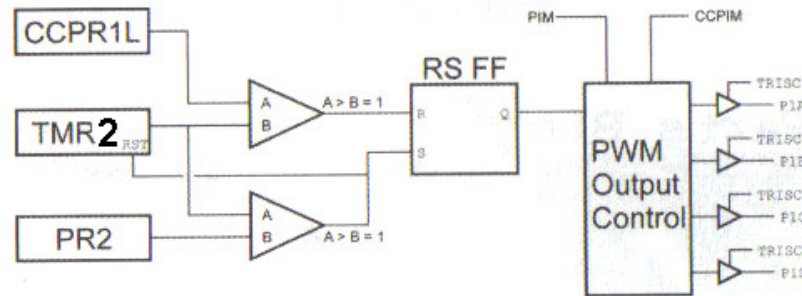
FIGURE 11-2: COMPARE MODE OPERATION BLOCK DIAGRAM



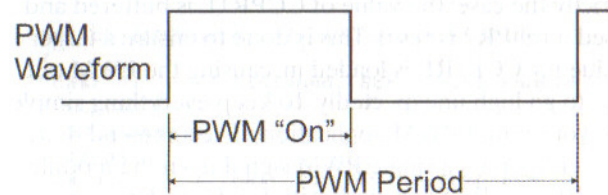
Uses of Compare

- Functions as a “stopwatch” to generate a specific output event upon compare with timer
- Can generate specific modulation formats
 - PWM, PPM, Manchester
- Can generate a “Time Tick” for an RTOS

Simplified PWM Block Diagram



PWM block diagram

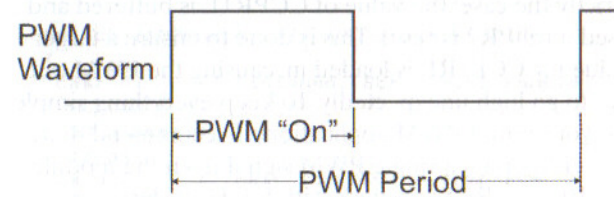
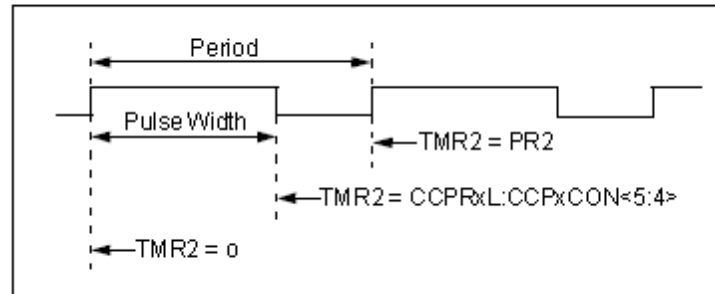


$$\text{Duty Cycle} = \frac{\text{PWM On}}{\text{PWM Period}}$$

PWM

PWM Output

FIGURE 11-4: CCP PWM OUTPUT



$$\text{Duty Cycle} = \frac{\text{PWM On}}{\text{PWM Period}}$$

PWM

Uses of PWM

- Can generate controls for motors
- Can generate through addition of a LOW PASS Filter analog signals
- Can generate tones with a buzzer
- Can work in light dimming

Unidirectional

Unidirectional Brushed DC Motor Control Using CCP

BRUSHED DC (BDC) MOTOR CONTROL CIRCUIT

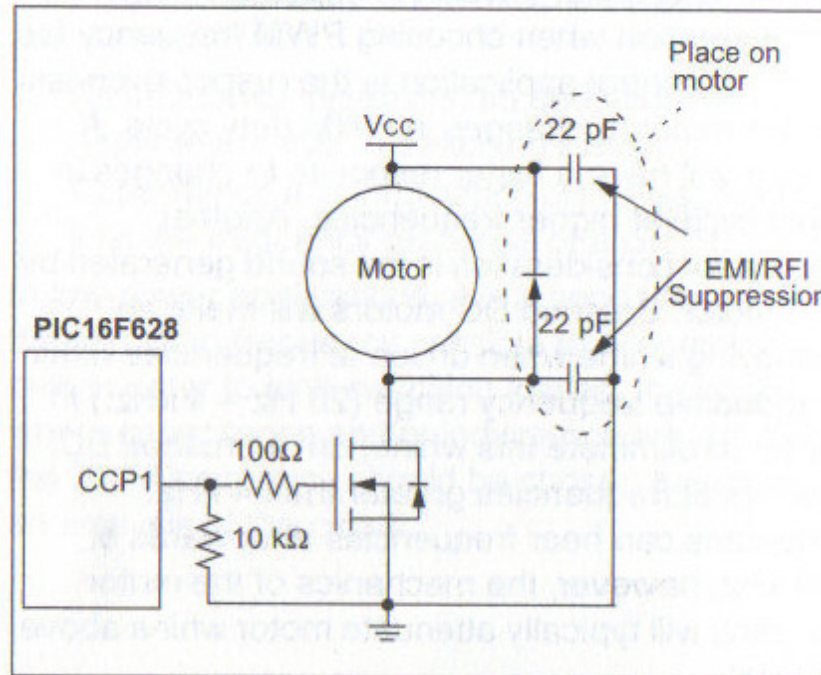
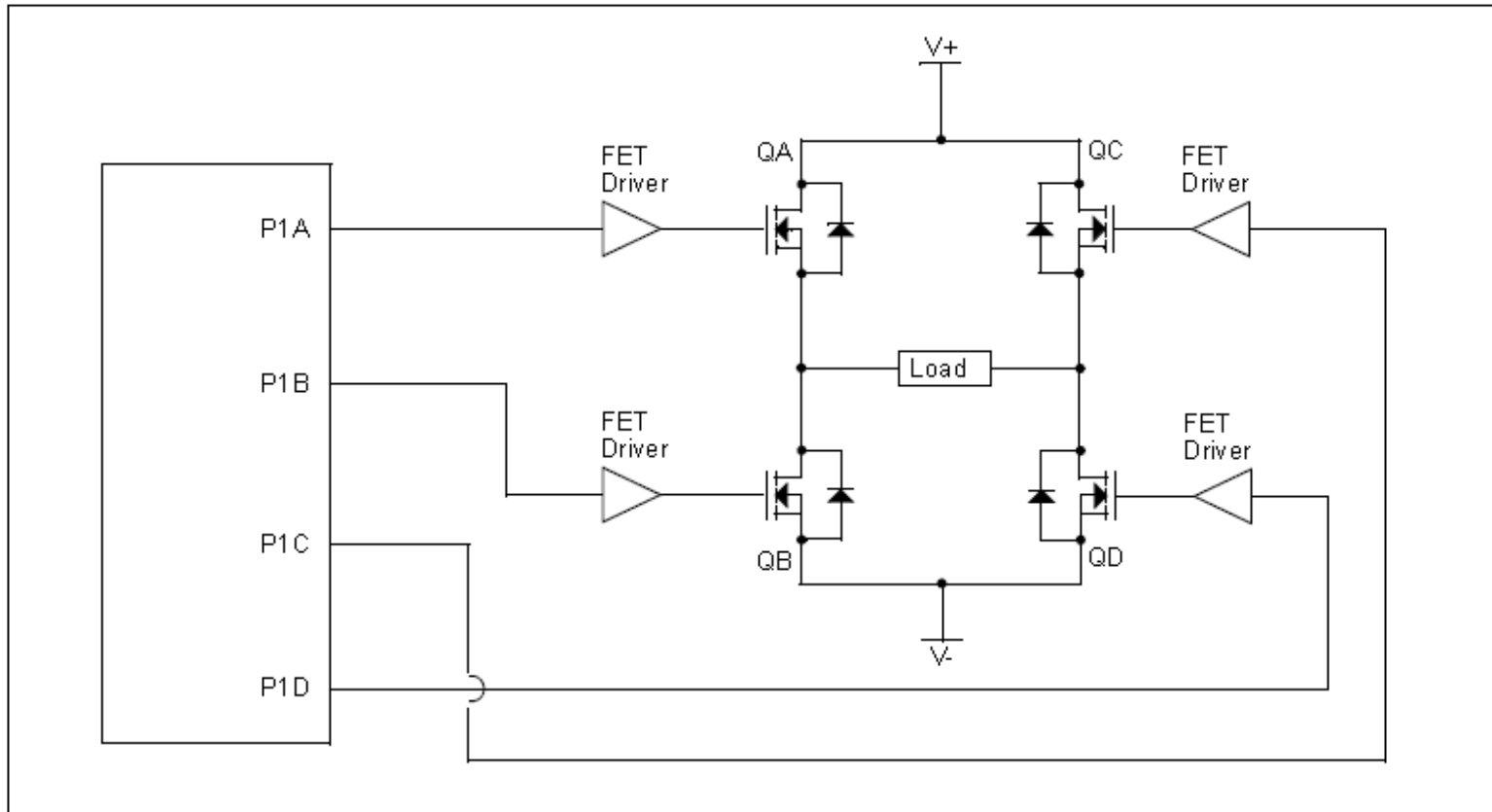
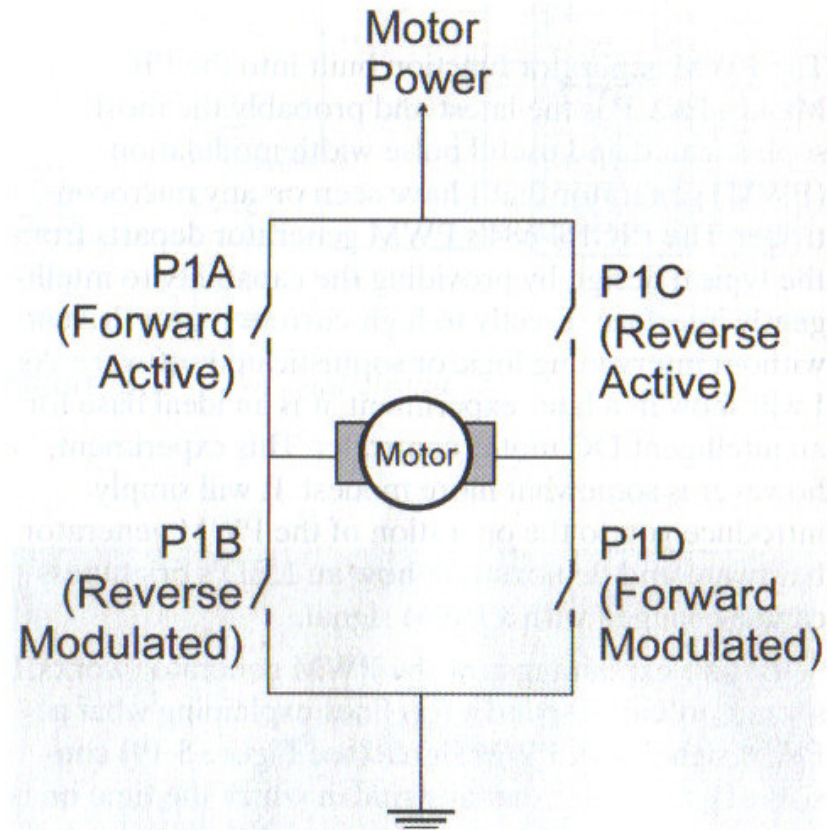


FIGURE 11-10: EXAMPLE OF FULL-BRIDGE APPLICATION



Bi-directional

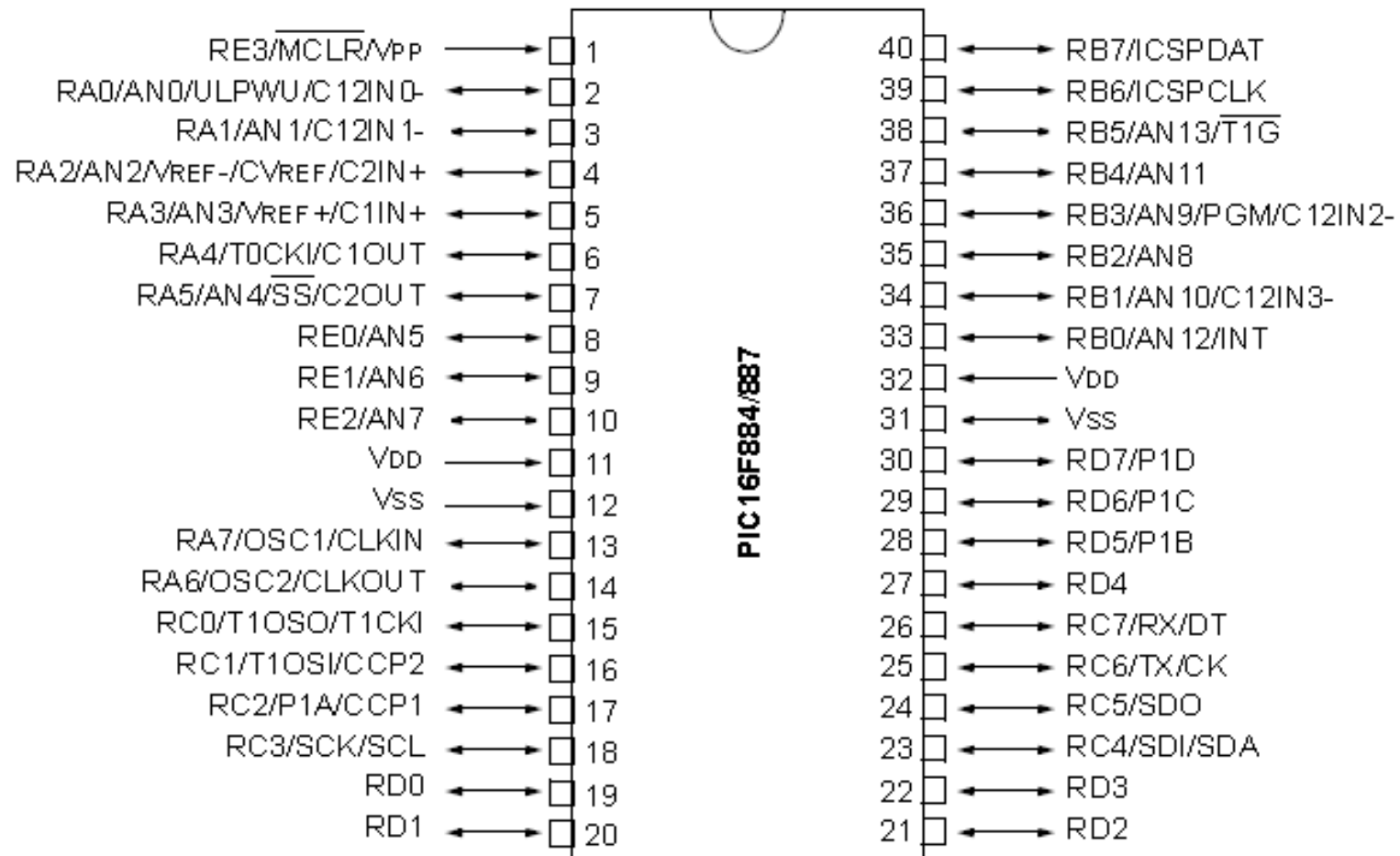


References

- Microchip's PIC MCU CCP and ECCP Tips and Tricks

Pin Diagrams – PIC16F884/887, 40-Pin PDIP

40-pin PDIP



Exercise Part 1

- Use CCP1 PWM to control the output voltage to an LED tied to RC5 (PWM) pin.
- Use ADC with pot to vary PWM output
- Disconnect PICKIT2 from DIP prototype board
- Construct circuit to existing DIP prototype board
 - 2.2K or 1K resistor to RC5 to LED anode (short pin) with LED cathode (long pin) to ground
 - Hook pot center wiper to PIC pin AN1 and two ends of the pot to +5V and GND respectively

Exercise Part 2

- Navigate to: C:\EET250\16F887\Lesson 15 CCP Peripheral and LED Dimmer\PWM
- Connect PICKIT2 to DIP prototype board
- Open PWM.mcp, select PICKIT2 as debugger, view output window to ensure PICKIT2 is ready
- Build, program, download program into prototype
- Run and verify execution—as you adjust pot from one extreme to other the LED brightness should vary.