ECE 372A Fall 2015 - Lecture 13

Garrett Vanhoy

October 8, 2015





Outline

- Output Compare Module
 - Circuit
 - Modes
 - Motor Operation
- Introduction to SPI
 - Introduction
 - Circuit Configurations
 - Using SPI





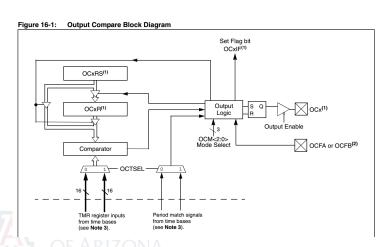
Output Compare Module

Reference Material

Section 16 in the PIC24F Family Reference Manual Section 16 in the PIC32MX Data Sheet







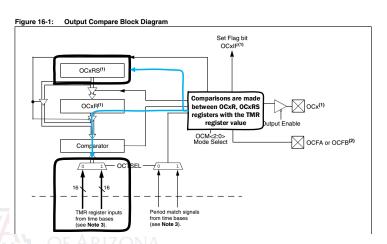
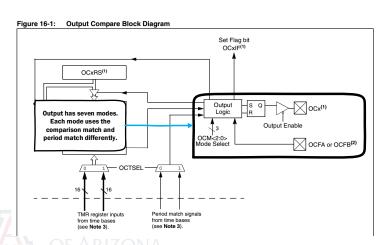


Figure 16-1: **Output Compare Block Diagram** Set Flag bit OCxIF(1) Output events are triggered when a "comparison match" or when TMRx = PRx depending on the mode. Output Logic Output Enable OCM<2:0> OCFA or OCFB(2) Mode Select Comparator TMR register inputs Period match signals from time bases from time bases (see Note 3). (see Note 3).



```
bit 2-0

OCM<2:0>: Output Compare x Mode Select bits

111 = PWM mode on OCx, Fault pin enabled
110 = PWM mode on OCx, Fault pin disabled
101 = Initialize OCx pin low, generate continuous output pulses on OCx pin
100 = Initialize OCx pin low, generate single output pulse on OCx pin
101 = Compare event toggles OCx pin
101 = Compare event toggles OCx pin
101 = Initialize OCx pin high, compare event forces OCx pin low
101 = Initialize OCx pin low, compare event forces OCx pin low
101 = Initialize OCx pin low, compare event forces OCx pin high
102 = Output compare channel is disabled
```





Output Compare Register

Other uses we will go over.

OCM<2:0>: Output Compare x Mode Select bits

111 = PWM mode on OCx, Fault pin enabled

110 = PWM mode on OCx, Fault pin disabled

101 = Initialize OCx pin low, generate continuous output pulses on OCx pin 100 = Initialize OCx pin low, generate single output pulse on OCx pin 11 = Compare event toggles OCx pin 1010 = Initialize OCx pin low, compare event forces OCx pin low 1010 = Initialize OCx pin low, compare event forces OCx pin high 1010 = Output compare channel is disabled





OC Modes

OC Modes

Single Compare Match mode (Only OCxR is involved)





OC Modes

OC Modes

- Single Compare Match mode (Only OCxR is involved)
- 2 Dual Compare Match mode (OCxR and OCxRS is involved)





OC Modes

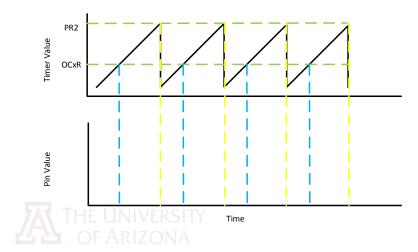
OC Modes

- Single Compare Match mode (Only OCxR is involved)
- Dual Compare Match mode (OCxR and OCxRS is involved)
- PWM mode (previously covered)

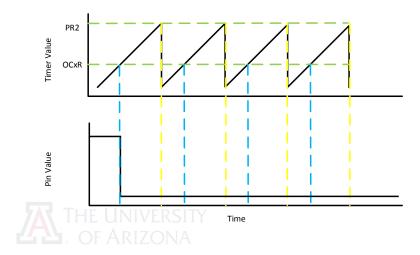




Single Compare

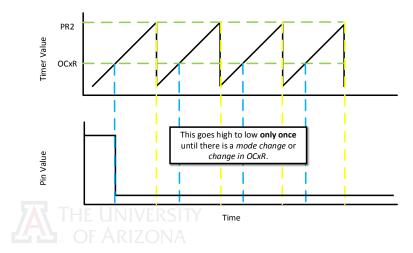


Single Compare





Single Compare





Single Compare Modes

Single Compare Modes

- From high to low
- From low to high





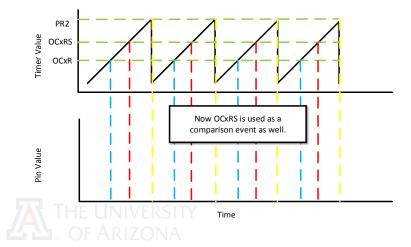
Single Compare Modes

Single Compare Modes

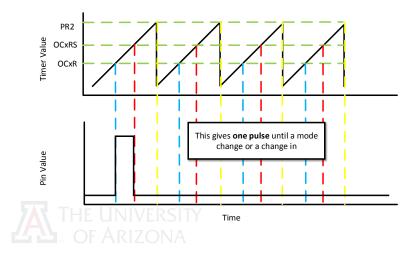
- From high to low
- From low to high
- Toggle





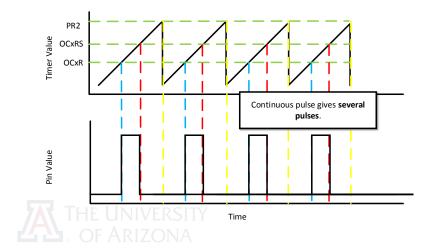


Dual Compare Single Pulse

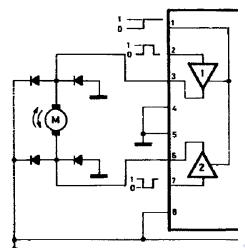




Dual Compare Single Pulse

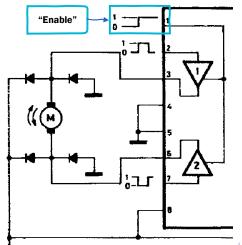


DIP16 - L:



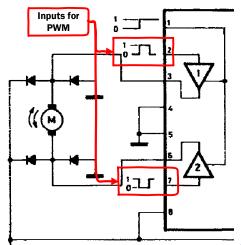


DIP16 - L:



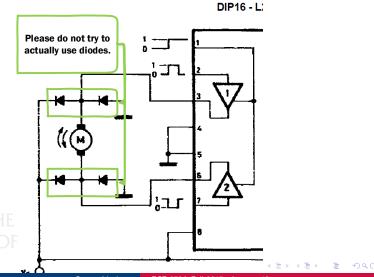


DIP16 - L:





DIP16 - L: Outputs to the motor. Depending on the difference, the motor will turn or stop.



Outline

- Output Compare Module
 - Circuit
 - Modes
 - Motor Operation
- 2 Introduction to SPI
 - Introduction
 - Circuit Configurations
 - Using SPI





Reference Material

Section 23 in the PIC32MX Family Reference Manual Section 17 in the PIC32MX Data Sheet





SPI

Introduction to SPI

Stands for Serial Peripheral Interface





SPI

Introduction to SPI

- Stands for Serial Peripheral Interface
- 2 It is a *serial*, *synchronous* protocol.





SPI

Introduction to SPI

- Stands for Serial Peripheral Interface
- It is a serial, synchronous protocol.
- It is full-duplex.





Introduction to SPI

- Stands for Serial Peripheral Interface
- 2 It is a serial, synchronous protocol.
- It is full-duplex.
- Uses a master-slave configuration





Master and Slave Devices

Master	SCLK
	MOSI
	MISO
	SS'





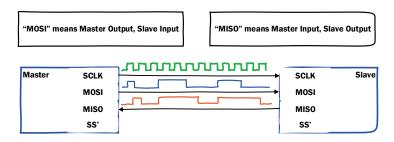


Master "sends" the clock signal.





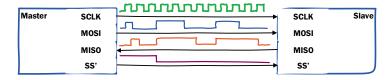








"SS" is Slave Select
When the SS is **high**, data is not valid.
In fact, unless it is low, the slave will not send data in general.

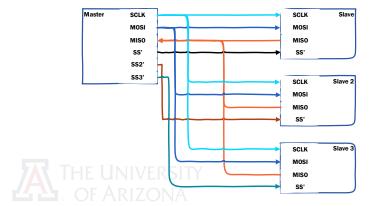






SPI Multi-Slave Configuration

Adding more slaves requires more Slave Select Wires

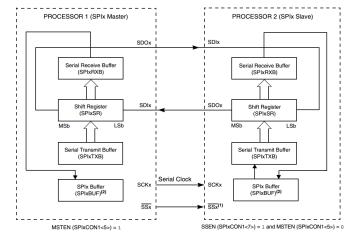






SPI Circuit

Figure 23-3: SPIx Master/Slave Connection



Demonstration

SPI Demonstration

Sending data to an accelerometer.



