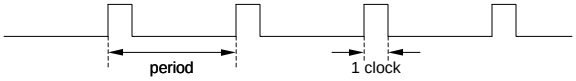
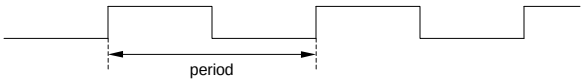
Timers

Uses

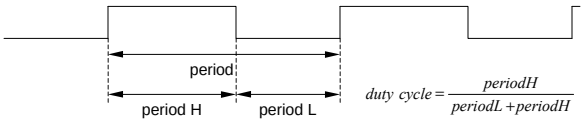
- timed interrupt
- pulse generator



- frequency generator



- pulse-width modulation (PWM)



Timer Characteristics

Size (number of bits)

for flexibility want to be able to generate both high and low frequencies

Example: clock is 20 MHz
- 8-bit counter minimum f = 78 KHz
- 16-bit counter minimum f = 305 Hz
- 24-bit counter minimum f = 1.2 Hz

can use prescaler to reduce number of counter bits

Compare Registers

vary timing by comparing Count Register with a compare register
same number of bits as Count Register
generally Count Register counts up and resets to 0 when matches value in a compare register

Additional Features

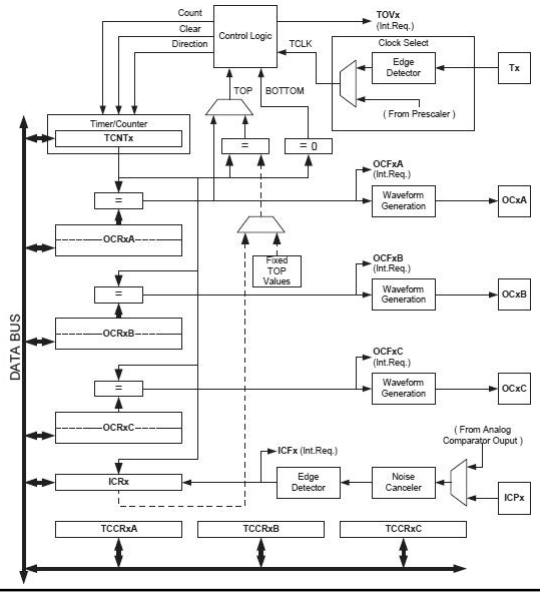
one-shot or continuous mode
generates interrupts

µC Timer Examples

Number of Timers

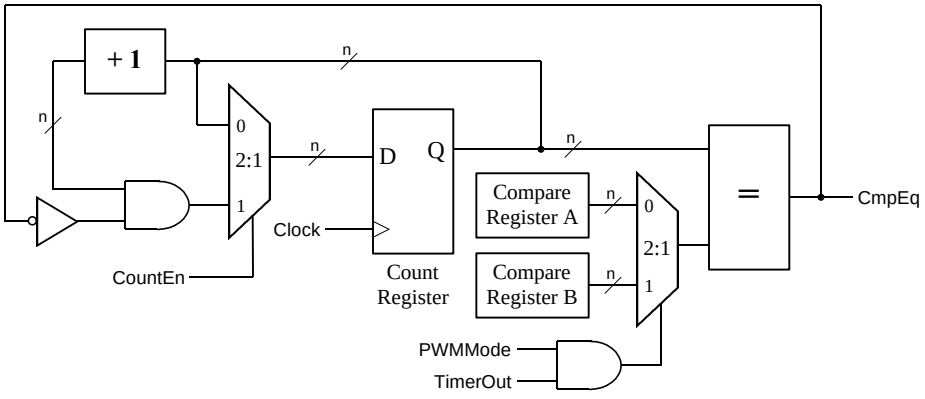
PIC10F200	1
68HC05B4	2
PIC16C55	3
ATMega64	4
AT91RM9200	6
TMS470R1A768	32

ATMega Timer

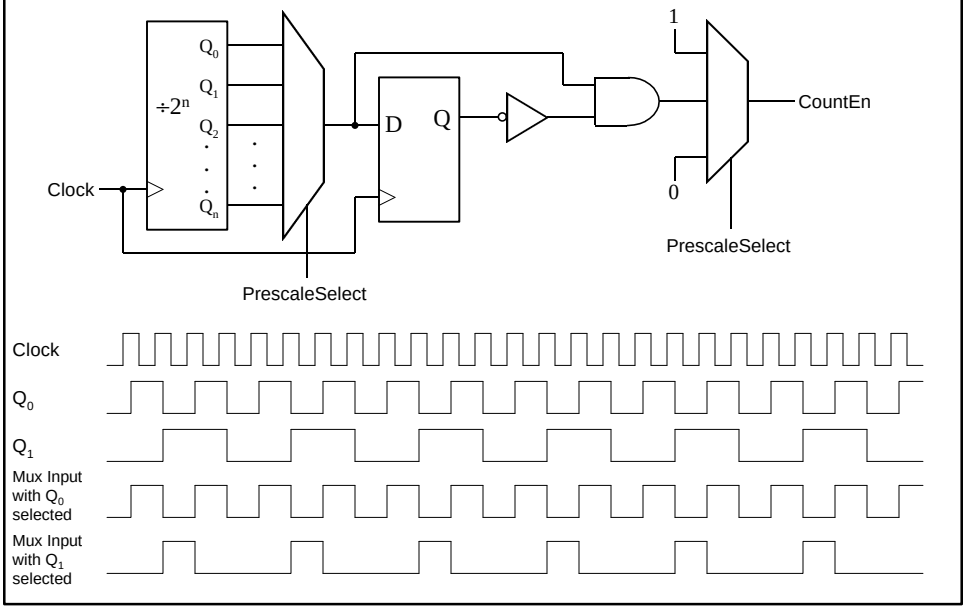


Timer Design

Basic Timer Counter

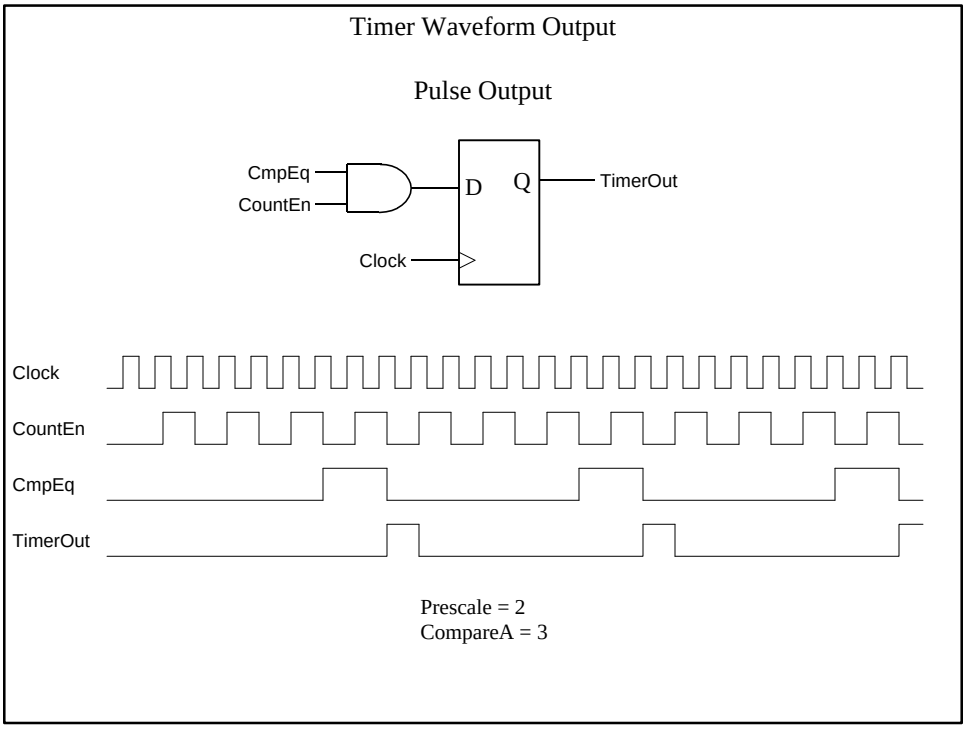


Timer Prescaler



Timer Waveform Output

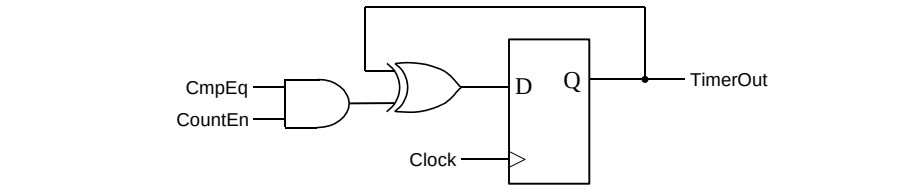
Pulse Output

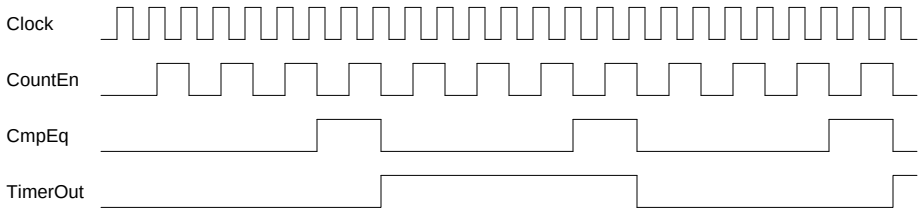


Prescale = 2
CompareA = 3

Timer Waveform Output

Square Wave Output

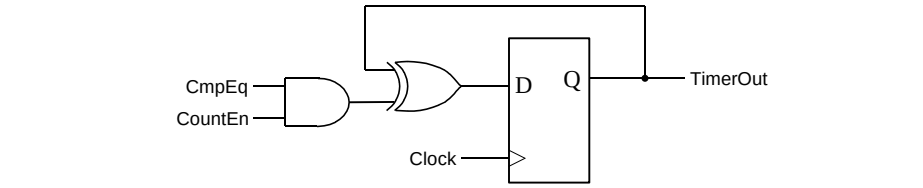


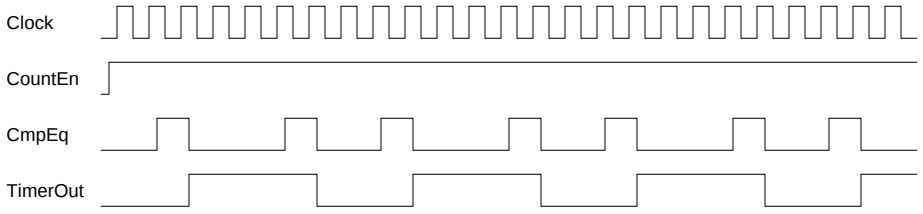


Prescale = 2
CompareA = 3

Timer Waveform Output

PWM Output

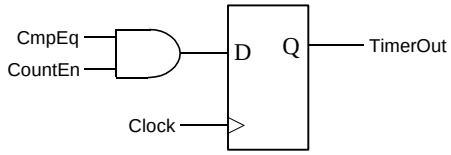




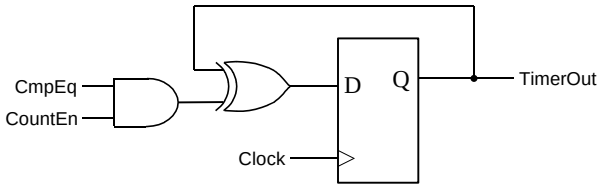
Prescale = 1
CompareA = 2
CompareB = 3

Timer Waveform Output

Pulse Output



Square Wave / PWM Output



Timer Status & Interrupts