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CHAPTER 10**M68HC12 TIMER**

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OBJECTIVES

This chapter describes the M68HC12 timer system and we compare the MC68HC812A4 and MC68HC912B32 versions. The timer system in both includes a *free running counter* and eight timer channels. These channels may be configured in any combination of timer comparison channels, called *output compares*, or *input capture* channels, that capture the time when an external event occurs. There is a *real-time periodic interrupt* and a counter for external events called the *pulse accumulator*. The interrupting capabilities of the timer are covered and programming examples are given. We also describe the *pulse width modulated* waveform generator available in the MC68HC912B32.

- 10.1 Introduction
- 10.2 Basic Timer
 - Prescaler
 - Sixteen-bit Free-running TCNT Register
 - Timer Overflow Flag
 - Timer Overflow Interrupts
- 10.3 Output Compare
 - Output Compare Time Delays
 - Output Compare Interrupts
 - Output Compare Bit Operation
 - One Output Compare Controlling up to Eight Outputs
 - Very Short Duration Pulses
 - Forced Output Compares
 - Output Compare Software Check-list
- 10.4 Input Capture
 - Input Capture Software Check-list
- 10.5 Pulse Accumulator
 - Pulse Accumulator Interrupts
- 10.6 Plain and Fancy Timing
- 10.7 Real-time Interrupt
- 10.8 Timer Input and Output Electronics
- 10.9 External Interrupts Using Timer Interrupts
- 10.10 Clearing Timer Flags

Fast Timer Flag Clearing

- 10.11 MC68HC912B32 Pulse-width Modulator
 - Pulse-width Modulator Clock Control
 - Pulse-width Modulation Control Registers
 - Other Pulse-width Modulation Registers
 - Choosing Pulse-width Modulation Counter Prescaler Values

10.12 Conclusion and Chapter Summary Points

The timer features of the M68HC12 are useful in many applications. Although the programming and control of the elements seems complex, the operation of all functions is similar with similar control requirements. The common elements are:

- ! Timing is derived from the M-clock.
- ! The M-clock may be prescaled (divided) by 1, 2, 4, 8, 16 or 32.
- ! A 16-bit free running counter, TCNT, provides the basic counting functions in the system.
- ! TCNT generates a timer overflow every 65,536 clock cycles.
- ! Eight channels of output compare can set an output compare flag when the TCNT register is equal to the output compare register.
- ! Eight channels of input capture can latch the TCNT on an input signal.
- ! All timer functions set a flag to indicate when their particular event has occurred.
- ! Each timer flag can be ANDed with an interrupt enable bit to generate an interrupt when the particular event has occurred.
- ! In all events, the flag is reset by software writing a one to the flag.
- ! The MC68HC912B32 has a pulse-width modulator waveform generator.