

### Free-running Timer Output on Match Condition

The Free-running Timer (FRT) in the H8/500 family is a 16-bit up-counter which provides rectangular waveform generation, input pulse width measurement and external clock period measurement. With the two independent comparators on each Timer channel, two separate waveforms can be generated. Besides the rectangular waveform, the Timer can also provide square waveform by using the clear on match condition. This is used to clear the up-counter when its value matches the Compare register.

As soon as a match occurs, two situations will take place. One is software related and the other one is hardware related. As far as the software is concerned, it is the output compare flag (OCFA or OCFB, depending on which comparators) of the Timer Control/Status register (TCSR) that is to be set. As for the hardware case, if the output enable bit (OEA or OEB) in the Timer control register (TCR) is set to 1, the result is indicated by the output compare pin (FTOA or FTOB) with the logic level selected by the output level bit (OLVLA or OLVLB).

By toggling the output level on the FTOA or FTOB and clearing of the Timer counter after each match, the waveform obtained on the output pin thus becomes the square wave. The OCFA or OCFB flag must also be cleared in order for the next match condition to occur. However, care must be taken to clear this output compare flag. Otherwise the timer will have its corresponding interrupt, OCIEA or OCIEB (if enabled), continuously generated, or result in erroneous operation. Some of the hints in performing this clear will be discussed as follow.

For the C coding, an "if" statement should be used to take care of the reading of the OCFA flag before writing a zero to it.

```
IF (*TCSR1 & 0X04) {  
    *TCSR1 = 0X01;  
}  
ELSE {  
    *TCSR1 = 0X05;  
}
```

This code is to switch the logic level (0x01) to low if previously set to 1, or switch it to logic high (0x05) if it was zero. Some users may not care about the output level and therefore do not set OEA. It is still recommended to include the "if" statement to read the TCSR and write a zero to that OCFA bit. The counter is simultaneously cleared with the byte 0x05 or 0x01.

For the Assembly coding, a "BTST" instruction should be used so that the OCFA flag will be properly cleared by this read/write/modify instruction.

```
FLAG: BTST.B    5,TCSR  
      BEQ      FLAG  
      BTST.B    2,TCSR  
      BEQ      HIGH  
LOW:  MOV.B    #H'05,TCSR  
HIGH: MOV.B    #H'01,TCSR
```

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