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TIMER1 MODULE

Timer1 Module Data Sheet Errata

Clarifications/Corrections to the Data Sheet:

In the Device data sheets listed below, the following clarifications and corrections should be noted. Any silicon issues related to the Timer1 Module will be reported in a separate silicon errata. Please check the Microchip web site for any existing issues.

Device	Data Sheet	Device	Data Sheet	Device	Data Sheet	Device	Data Sheet
PIC12F609	DS41302	PIC16F716	DS41206	PIC18F2321	DS39689	PIC18F6585	DS30491
PIC12HV609		PIC16F737	DS30498	PIC18F4321		PIC18F6680	
PIC12F615		PIC16F747		PIC18F2331	DS39616	PIC18F8585	
PIC12HV615		PIC16F767		PIC18F2431		PIC18F8680	
PIC12F617				PIC18F4331		PIC18F24J10	
PIC12F629	DS41190	PIC16F777	DS41249	PIC18F4431	DS30485	PIC18F25J10	DS39682
PIC12F675		PIC16F785		PIC18F2439		PIC18F44J10	
PIC12F635	DS41232	PIC16HV785	DS39598	PIC18F2539	DS30485	PIC18F45J10	DS39774
PIC16F636		PIC16F818		PIC18F4439		PIC18F63J11	
PIC16F639		PIC16F819		PIC18F4539		PIC18F64J11	
PIC12F683	DS41211	PIC16F870	DS30569	PIC18F2455	DS39632	PIC18F65J11	DS39774
PIC14000	DS40122	PIC16F871		PIC18F2550		PIC18F83J11	
PIC16C62A	DS30234	PIC16F872	DS30221	PIC18F4455	DS39637	PIC18F84J11	DS39770
PIC16C63		PIC16F873	DS30292	PIC18F4550		PIC18F85J11	
PIC16C64A		PIC16F874		PIC18F2480		PIC18F63J90	
PIC16C65A		PIC16F876		PIC18F4480	PIC18F64J90		
PIC16C66		PIC16F877		PIC18F4580	PIC18F65J90		
PIC16C67		PIC16F873A	PIC18F2510	DS39636	PIC18F83J90		
PIC16C62B		DS35008	PIC16F874A		PIC18F2610	PIC18F84J90	
PIC16C72A	PIC16F876A		PIC18F4510	PIC18F85J90			
PIC16C63A	DS30605	PIC16F877A	DS41291	PIC18F4610	DS39631	PIC18F65J10	DS39663
PIC16C65B		PIC16F882		PIC18F2520		PIC18F66J10	
PIC16C73B		PIC16F883		PIC18F2585		PIC18F66J15	
PIC16C74B	PIC16F884	PIC18F2680	DS39625	PIC18F67J10			
PIC16C72	PIC16F886	PIC18F4585		PIC18F85J10			
PIC16C73A	DS30390	PIC16F887	DS41250	PIC18F4680	DS39626	PIC18F85J15	
PIC16C74A		PIC16F913		PIC18F2620		PIC18F86J10	
PIC16C76		PIC16F914		PIC18F4620		PIC18F85J15	
PIC16C77	DS41124	PIC16F916	DS41250			PIC18F87J10	
PIC16C745		PIC16F917					
PIC16C765		PIC16F946					

TIMER1 MODULE

Device	Data Sheet	Device	Data Sheet	Device	Data Sheet	Device	Data Sheet
PIC16C773	DS30275	PIC17C42A	DS30412	PIC18F4685	DS39761	PIC18F65J50	DS39775
PIC16C774		PIC17C43		PIC18F6390	DS39629	PIC18F66J50	
PIC16C923	DS30444	PIC17C44	PIC18F6490	PIC18F66J55			
PIC16C924		PIC17C752	PIC18F8390	PIC18F67J50			
PIC16C925	DS39544	PIC17C756A	DS30289	PIC18F8490	PIC18F85J50		
PIC16C926		PIC17C762		PIC18F6520	PIC18F85J55		
PIC16F72	DS39597	PIC17C766	DS39026	PIC18F6620	PIC18F87J50	DS39778	
PIC16F73	DS30325	PIC18C242		PIC18F6720	DS39609		PIC18F66J11
PIC16F74		PIC18C252		PIC18F8520			PIC18F66J16
PIC16F76		PIC18C442		PIC18F8620			PIC18F67J11
PIC16F77		PIC18C452	PIC18F8720	PIC18F86J11			
PIC16F87	DS30487	PIC18C601	DS39541	PIC18F6525	PIC18F86J16	DS39762	
PIC16F88		PIC18C801		PIC18F6621	PIC18F87J11		
PIC16F610	DS41288	PIC18C658	DS30475	PIC18F8525	PIC18F66J60		
PIC16HV610		PIC18C858		PIC18F8621	PIC18F66J65		
PIC16F616		PIC18F242	DS39564	PIC18F6527	PIC18F67J60		
PIC16HV616	PIC18F252	PIC18F6622		PIC18F86J60			
PIC16F627A	DS40044	PIC18F442		PIC18F6627	PIC18F86J65		
PIC16F628A		PIC18F452		PIC18F6722	PIC18F87J60		
PIC16F648A		PIC18F248	PIC18F8527	PIC18F96J60			
PIC16F630	DS40039	PIC18F258	DS41159	PIC18F8622	PIC18F96J65		
PICF676		PIC18F458		PIC18F8627	PIC18F97J60		
PIC16F631	DS41262	PIC18F1220	DS39605	PIC18F8722			
PIC16F677		PIC18F1320	DS39758				
PIC16F685		PIC18F1230					
PIC16F687		PIC18F1330	DS39599				
PIC16F689		PIC18F2220					
PIC16F690		PIC18F2330					
PIC16F684	DS41202	PIC18F4220					
PIC16F688	DS41203	PIC18F4320					

TIMER1 MODULE

1. Asynchronous Counter

When Timer1 is started or updated, the timer needs to see a falling edge from the external clock source before a rising edge can increment the counter. If writes to TMR1H and TMR1L are not completed while the external clock pulse is still high, Timer1 will miss counting the first clock pulse after the update.

When using an external crystal, the pulse width from rising to falling edge is temperature dependent and may decrease with temperature. As a result, the timer may require an additional oscillation to overflow.

Code examples are given for the affected devices:

- PIC12/14/16/17 devices – Example 1 and Example 2
- PIC18 devices – Example 3

Both examples include code to wait for Timer1 to increment twice between the `RTCisr` and `Update` labels.

In PIC18 devices, it is not possible to reliably update Timer1 in a *low-priority* interrupt. A high-priority interrupt could occur at any time and unexpectedly delay the TMR1 update.

PIC18 devices also include Timer3 which is functionally identical to Timer1.

Work around

Switching Timer1 to the main system oscillator after reloading, the timer ensures the timer will see a falling edge before switching back to the external clock source.

Due to the time from Timer1 overflow to the reload being application specific, wait for the timer to increment before beginning the reload sequence. This ensures the timer does not miss a rising edge during reload. The timing of the clock source changing is critical and is detailed in Example 1 and Example 2.

EXAMPLE 1: PIC12/14/16/17 CODE EXAMPLE FOR 1 SECOND OVERFLOW PERIOD WITH 32.786 KHZ OSCILLATOR

```
BTFSC    TMR1L,0
GOTO     $-1
BTFSS    TMR1L,0
GOTO     $-1           ;Timer has just incremented, 31 µs before next rising edge to
                       ;complete reload

Update:

    BCF    T1CON,TMR1CS ;Select system clock for Timer1
    BSF    TMR1H,7      ;Timer1 high byte 0x80
    BCF    T1CON,TMR1ON ;Timer1 off
    BSF    T1CON,TMR1C  ;Select external crystal
    BSF    T1CON,TMR1ON ;Timer1 on

Critical Timing of code sequence for instructions following last write to TMR1L or TMR1H.
```

TIMER1 MODULE

EXAMPLE 2: PIC12/14/16/17 CODE EXAMPLE FOR OVERFLOW PERIODS OTHER THAN 1 SECOND OR USING AN OSCILLATOR OTHER THAN 32.768 KHZ

```
BTFSCL    TMR1L, 0
GOTO     $-1
BTFSCL    TMR1L, 0
GOTO     $-1                ;Timer has just incremented, 31µs before next rising
                        ;edge to complete reload.

BCF      T1CON, TMR1CS      ;Select system clock for Timer1.
MOVWF    TMR1, W           ;Sample low byte of Timer1 before increments.
ADDWFB   TMR1_Reload_lo, F ;Add reload value for low byte
BTFSCL   STATUS, C         ;if this generates a carry then
INCF     TMR1_Reload_hi, F ;modify the reload value for the high byte.

MOVWF    TMR1_Reload_hi, W ;Reload Timer1 high byte.
MOVWF    TMR1H

MOVWF    TMR1_Reload_lo, W ;Reload Timer1 low byte.
MOVWF    TMR1L

BCF      T1CON, TMR1ON     ;Timer1 off.
BSF      T1CON, TMR1CS     ;Select external crystal.
BSF      T1CON, TMR1ON     ;Timer1 on.
```

Critical Timing of code sequence for instructions.

EXAMPLE 3: PIC18 HIGH-PRIORITY INTERRUPT SERVICE ROUTINE

```
HIntVector code 0x0008      ; (3-4Tcy), fixed interrupt latency
goto HighISR              ; (3Tcy) jump to high priority ISR code

code                      ; unprotected code space

HighISR:
  btfss PIR1,TMR1IF       ; (1Tcy) TMR1 overflow?
  goto NextISR            ; (2Tcy) No, check another interrupt source

; Insert the next 4 lines of code when TMR1 can not
; be reliably updated before clock pulse goes low
RTCSir:
  btfsc TMR1L,0           ; wait for TMR1L<0> to become clear
  bra $-2                 ; may already be clear (loops for 0 to 30.5us)
  btfss TMR1L,0           ; wait for TMR1L<0> to become set
  bra $-2                 ; (loops for 30.5us)

; If TMR1 update can be completed before clock pulse
; goes low, start update here
Update:
  bsf TMR1H,7             ; reload for next 1 second overflow
  bcf PIR1,TMR1IF        ; clear flag
  incf Seconds,F         ; record second
  retfie FAST

NextISR:                  ; Another interrupt source...
  ....                   ; code for other interrupts, if needed

retfieFAST
```

REVISION HISTORY

Rev A Document (7/2007)

Initial release of this errata.

Rev B Document (03/2010)

Added PIC12F617 device to the Clarifications/
Corrections to the Data Sheet section.

TIMER1 MODULE

NOTES:

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
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