

## 7544 Group

### Timer X Operation (Pulse Width Measurement Mode)

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#### **1. Abstract**

The following article introduces and shows an application example of pulse width measurement mode of timer X.

#### **2. Introduction**

The explanation of this issue is applied to the following condition:  
Applicable MCU: 7544 Group

### 3. Contents

**Outline:** “H” level width of pulse input to P1<sub>4</sub>/CNTR<sub>0</sub> pin is counted.

**Specifications:** The “H” level width of a FG pulse input to the P1<sub>4</sub>/CNTR<sub>0</sub> pin is counted. An underflow is detected by the timer X interrupt. The completion of “H” level of input pulse is detected by the CNTR<sub>0</sub> interrupt.

Operation clock:  $f(X_{IN}) = 4.19 \text{ MHz}$ , high-speed mode

**Example:** When  $f(X_{IN}) = 4.19 \text{ MHz}$ , the count source becomes  $3.8 \mu\text{s}$  divided by 16. Measurement can be made up to 250 ms in the range of “FFF<sub>16</sub>” to “0000<sub>16</sub>”.

### 3.1 Connection of Timer and Setting of Division Ratio

Figure 1 shows the connection of timer and setting of division ratio.

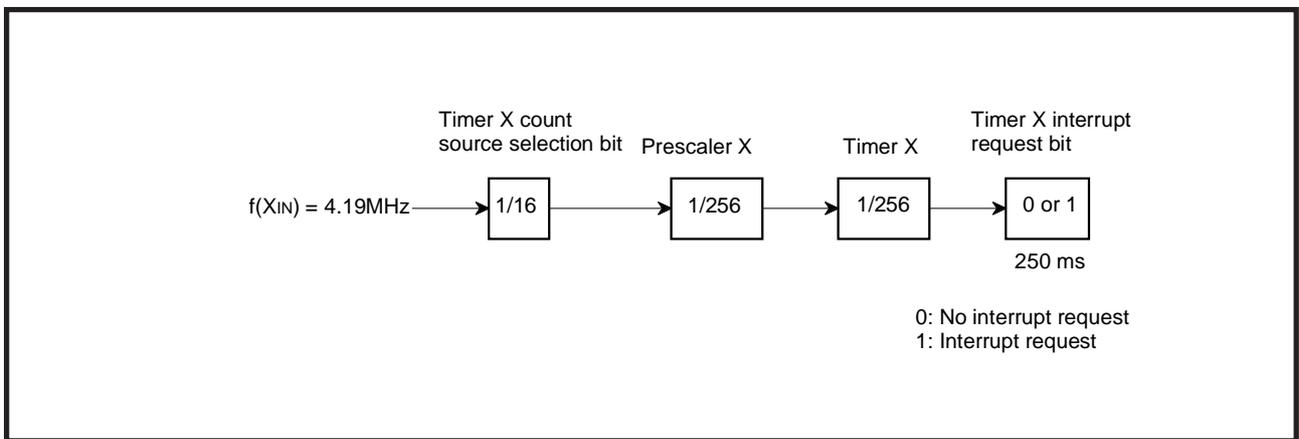


Figure 1 Connection of timer and setting of division ratio

### 3.2 Example of Control Procedure

Figure 2 shows an example of control procedure.

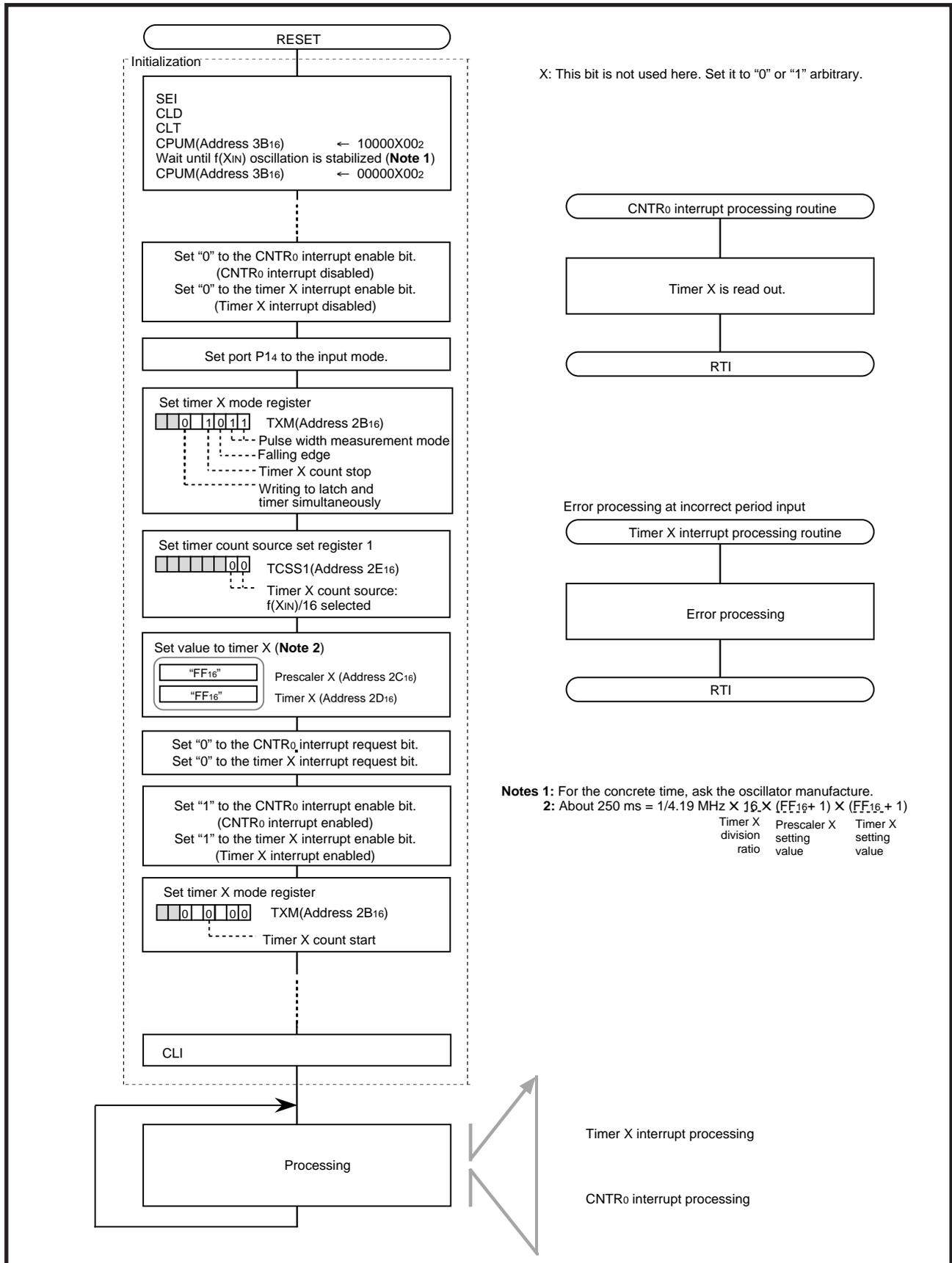


Figure 2 Example of control procedure

#### 4. Sample Programming Code

[Reset Start •• Main Routine Process]

```

RESET:
    SEI                ; Interrupt disable
    CLD
    CLT
;
    LDX #$FF          ; Set stack bottom
    TXS
;
    LDM #%10000000,CPUM ; Set CPU mode register
;
; Wait f(XIN) oscillation stabilizing time
;
    LDM #%00000000,CPUM ; Set CPU mode register
;
    LDA #0
    LDX #>RAM_top
RAM_clear:
    STA $00,X
    INX
    BNE RAM_clear
;
    CLB 5,ICON1       ; CNTR0 interrupt disable
    CLB 7,ICON1       ; TimerX interrupt disable
;
    LDM #%00000000,P1D ; set P1_4 pin input mode
;
    LDM #%00001011,TXM ; pulse width measurement mode
                        ; CNTR0 interrupt priority : falling edge
                        ; stop timer X count
;
    LDM #%00000000,TCSS1 ; select timer X count source : f(XIN)/16
;
    LDM #$FF,PREX     ; Set Prescaler X
    LDM #$FF,TX       ; Set Timer X
                        ; maximum measurement value 250ms
;
    CLB 5,IREQ1       ; clear CNTR0 interrupt request
    CLB 7,IREQ1       ; clear timer X interrupt request
    SEB 5,ICON1       ; enable CNTR0 interrupt
    SEB 7,ICON1       ; enable TimerX interrupt
;
    CLB 3,TXM         ; start timer X count
;
    CLI
;
__MAIN:
    ;
    ; process
    ;
    BRA __MAIN
;
    
```

Figure 3 Sample Programming Code (1)

**[CNTR0 Interrupt Process]**

```

__INT_cntr0:
    CLD
    CLT
    PHA
;
    SEB 3,TXM           ; stop timer X count
;
    LDA PREX
    STA RESULT+0
    LDA TX
    STA RESULT+1
;
    LDM #$FF,PREX      ; set prescaler X
    LDM #$FF,TX        ; Set TimerX initial data
;
    CLB 3,TXM          ; start timer X count
;
    PLA
    RTI
;

```

**[Timer X Interrupt Process]**

```

__INT_timerX:
    CLD
    CLT
    PHA
;
; error process
;
    PLA
    RTI
;

```

**Figure 4 Sample Programming Code (2)**

## 5. Reference

Data Sheet  
7544 Group Data sheet  
7544 Group Data sheet (QzROM Version)

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REVISION HISTORY	7544 Group Timer X Operation (Pulse Width Measurement Mode)
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		Page	Summary
1.00	Apr 01, 2003	-	First Edition issued
2.00	Nov 12, 2004	4-5	Sample Programming Code added.

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