NEC

On-Chip Peripheral Program Example   August 1999
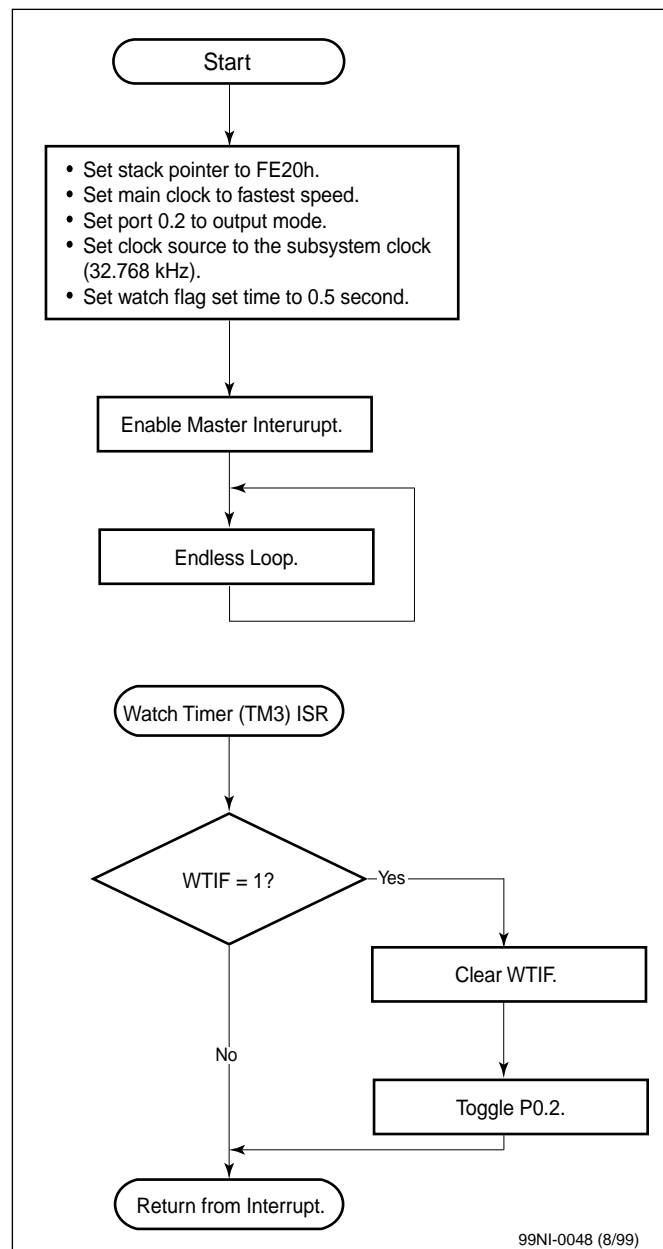
Description   The 8-bit watch timer in the μPD7805x/78005x subseries can be used in watch timer and interval timer mode at the same time, as demonstrated in this program example.

The timer generates an interrupt every 0.5 seconds, and operates from the subsystem clock. After every interrupt, port 0 bit 2 is toggled. The timer can also be operated from the main system clock.

Program Specifications

- □ Count clock frequency: 32.768 kHz (subsystem clock)
- □ Square wave frequency: 1 Hz (1 second period)
- □ Pins used in program: P02/INTP2 (port pin toggles every 0.5 seconds)

Flowchart

```
                    ┌─────────────────┐
                    │      Start       │
                    └─────────────────┘
                             │
                             ▼
        ┌──────────────────────────────────────┐
        │ • Set stack pointer to FE20h.          │
        │ • Set main clock to fastest speed.     │
        │ • Set port 0.2 to output mode.         │
        │ • Set clock source to the subsystem    │
        │   clock (32.768 kHz).                  │
        │ • Set watch flag set time to 0.5 second.│
        └──────────────────────────────────────┘
                             │
                             ▼
            ┌───────────────────────────┐
            │  Enable Master Interurupt. │
            └───────────────────────────┘
                             │
                             ▼
            ┌───────────────────────────┐
            │       Endless Loop.        │◄──┐
            └───────────────────────────┘   │
                             │               │
                             └───────────────┘


              ┌───────────────────────────┐
              │   Watch Timer (TM3) ISR    │
              └───────────────────────────┘
                             │
                             ▼
                        ◇ WTIF = 1? ◇────Yes────┐
                             │                   │
                             │ No                ▼
                             │        ┌───────────────────┐
                             │        │    Clear WTIF.     │
                             │        └───────────────────┘
                             │                   │
                             │                   ▼
                             │        ┌───────────────────┐
                             │        │    Toggle P0.2.    │
                             │        └───────────────────┘
                             │                   │
                             ◄───────────────────┘
                             ▼
              ┌───────────────────────────┐
              │   Return from Interrupt.   │
              └───────────────────────────┘
```

99NI-0048 (8/99)

Assembly Language Program

```
;********************************************************************
; Date:        06/22/1999
;
; Parameters:  - fastest CPU clock
;                (fx = 5.00 MHz; 1 CPU clock cycle = 200 ns)
;              - Subsystem clock (32.768 kHz) is watch timer clock
;              - Port 0.2 outputs 1 Hz square wave
;********************************************************************


;=======================================
;=      Specify Interrupt Vectors      =
;=======================================
Res_Vec    CSEG AT 0000h               ; Set main program start vector.
           DW      Start


           ORG     001Eh
           DW      WATCH_ISR           ; Watch timer interrupt vector


;=======================================
;=      Main Program                   =
;=======================================
MAIN       CSEG
Start:     DI                          ; Disable interrupts
           MOVW    AX, #0FE20h         ; Load SP address
           MOVW    SP, AX              ; Set Stack Pointer
           MOV     OSMS,#01h           ; Don't use scaler
           MOV     PCC, #00h           ; Main system clock at fastest setting
           CLR1    P0.2                ; Latch port 0.2 low
           CLR1    PM0.2               ; Set port 0.2 to output mode
           MOV     TCL2,#10h           ; Select counter clock to fxt = 32.768 kHz
           MOV     TMC2,#06h           ; Set TMC2 to WATCH TIMER operation enable,
                                       ; 0.5 seconds  selection
           CLR1    TMMK3               ; Unmask the watch timer interrupt mask bit
           EI                          ; Enable interrupts

Loop:      BR      $Loop               ; endless loop


;=======================================
;=        Watch timer ISR              =
;=======================================
WATCH_ISR: BF      WTIF,$Watch10       ; Watch timer overflow flag on?
           CLR1    WTIF                ; Clear Watch timer IRQ flag
           XOR     P0,#04h             ; Toggle port 0.2
Watch10:   RETI

           END
```

C Language Program

```
/********************************************************************
; Date:        06/22/1999
;
; Parameters: - fastest CPU clock
;               (fx = 5.00 MHz; 1 CPU clock cycle = 200 ns)
;             - Subsystem clock (32.768 kHz) is watch timer clock
;             - Port 0.2 outputs 1 Hz square wave
;**********************************************************************/

/* extension functions in K0/K0S compiler */

#pragma sfr  /* key word to allow SFR names in C code */
#pragma DI   /* key word for DI instruction in C code */
#pragma EI   /* key word for EI instruction in C code */

/*====================================
;=    Specify Interrupt Vectors      =
;====================================*/
#pragma interrupt INTTM3 WATCH_ISR

/*====================================
;=    Constants/Variables            =
;====================================*/
#define TRUE      1
#define FALSE     0

/*====================================
;=    Main Program                   =
;====================================*/
void main(void)
{
      OSMS = 0x01;        /* Don't use scaler */
      PCC = 0x00;         /* Main system clock at fastest setting */
      P0.2 = 0;           /* Latch port 0.2 low */
      PM0.2 = 0;          /* Set port 0.2 Output mode */
      TCL2  = 0x10;       /* Select counter clock to fxt = 32.768 kHz */
      TMC2 = 0x06;        /* Set TMC2 to WATCH TIMER operation enable,
                                 0.5 seconds selection */
      TMMK3= 0;           /* Unmask the watch timer interrupt mask bit */
      EI();               /* Enable interrupts */

      while(TRUE);        /* loop here */
 }                        /* end of function main() */

/*====================================
;     Watch timer ISR                =
;====================================*/

void WATCH_ISR(void)
{
      if(WTIF)            /* Test Watch Timer overflow flag */
      {
          WTIF = 0;       /* Clear Watch Timer IRQ flag */
          P0 ^= 0x04;     /* Toggle port 0.2 */
      }
}
```

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