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R8C/10群

定时器X运行（定时器模式）

1. 概要

本资料说明了定时器X的定时器模式的使用例。

2. 前言

在本资料中说明的例子，适合以下单片机在下列条件下使用。

- 单片机 : R8C/10、R8C/11、R8C/12、R8C/13群
- 主时钟输入振荡频率 : 16MHz

和R8C/10群有相同SFR（外围控制寄存器）的其它R8C/Tiny系列，也可以使用本程序。但有时会因增加一部分功能等情况而有所改变，所以必须通过手册进行确认。在使用本应用说明时必须进行充分的评价。

3. 定时器模式的运行

- (1) 如果将计数开始标志置“1”，计数器则对计数源进行递减计数。
- (2) 下溢时，重新装入再装入寄存器的内容，然后继续计数。同时，定时器X中断请求位变为“1”。
- (3) 如果将计数开始标志清“0”，计数器则保持计数值并停止。

定时器模式运行的时序如图1所示。

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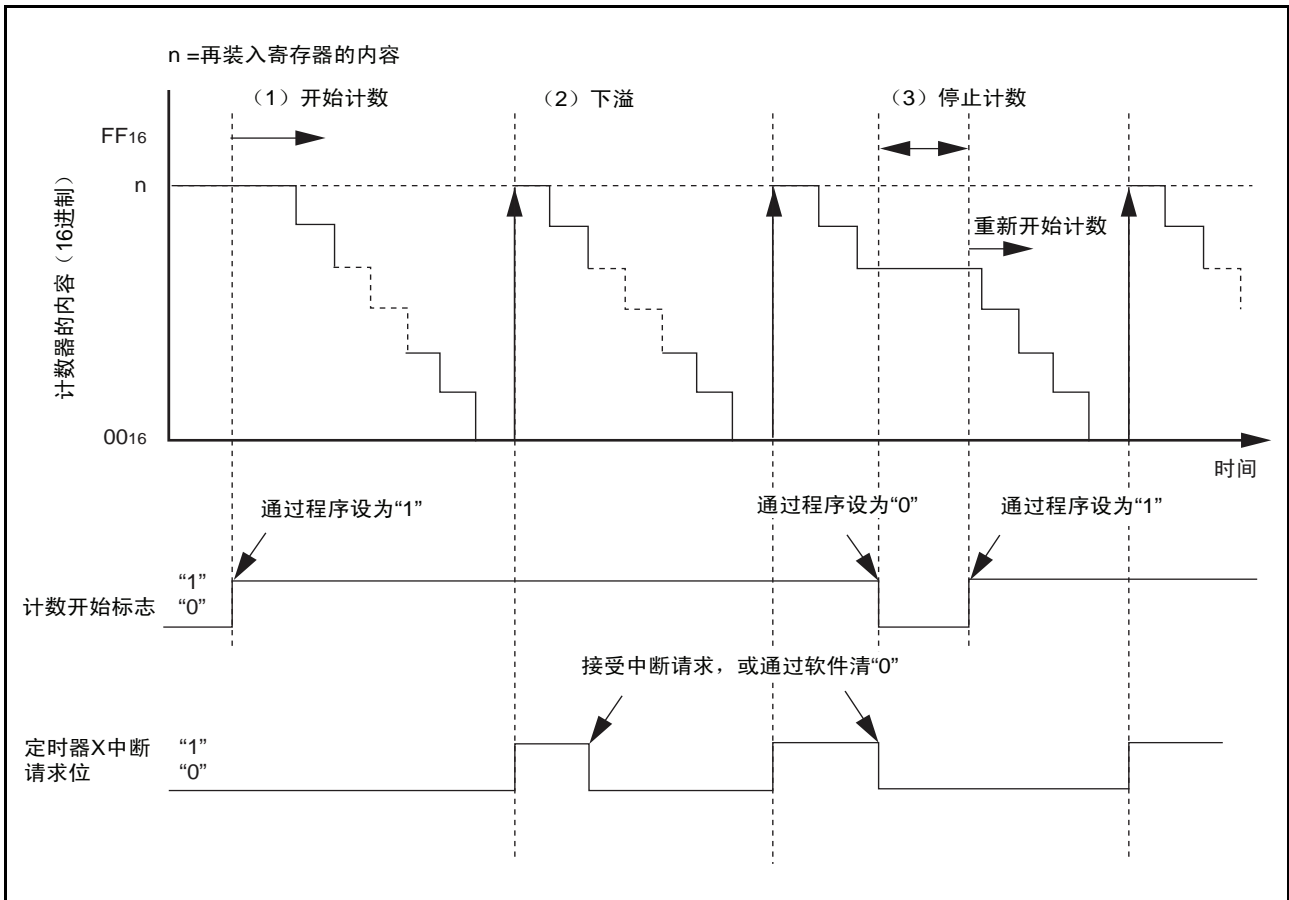


图1 定时器模式运行时序

4. 应用例

4.1 应用例的说明

(1) 定时器X每4ms产生一次下溢。

$$4\text{ms} = (1/f_1) \times (\text{预分频器} X+1) \times (\text{定时器} X+1) \\ = 62.5\text{ns} \times (255+1) \times (249+1)$$

定时器X每下溢一次，就产生一次定时器X中断请求。通过程序对定时器X中断进行250次计数，就会建立1秒的时序，并更新显示数据。

(2) LED连接到端口P11~P14，显示“L”有效电平。显示数据为0000b~1111b，并且每过1秒就加上1。使用的引脚如图2所示。

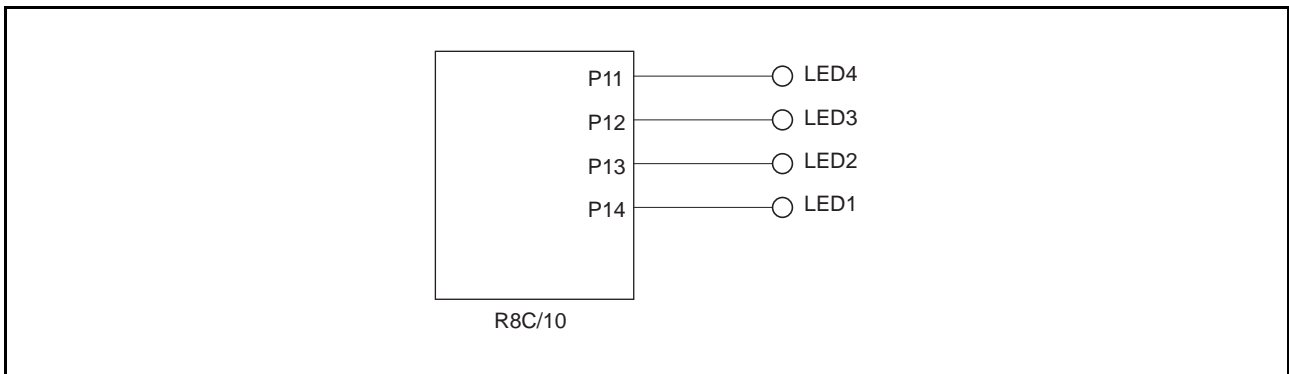


图2 使用的引脚

另外，本样本程序在SFR的位分配的情况下，有可能对不使用的功能位进行操作。这些设定值请根据用户系统的使用情况进行设定。

4.2 主要寄存器的设定

定时器计数源设定寄存器的设定

定时器计数源设定寄存器【008E₁₆地址】TCSS

定时器X计数源选择位

| b1 | b0 | 计数源 | 计数源的周期 f(XIN): 16MHz时 |
|----|----|-----------------|--------------------------|
| 0 | 0 | f ₁ | 62.5ns |
| 0 | 1 | f ₈ | 500ns |
| 1 | 0 | f ₃₂ | 2μs |
| 1 | 1 | f ₂ | 125ns |

定时器X计数源选择位

b1 b0
 0 0 : f₁
 0 1 : f₈
 1 0 : f₃₂
 1 1 : f₂

预分频器X寄存器的设定

预分频器X寄存器【008C₁₆地址】PREX

设定为255

定时器X寄存器的设定

定时器X寄存器【008D₁₆地址】TX

设定为249

定时器X模式寄存器的设定

定时器X模式寄存器【008B₁₆地址】TXMR

在定时器模式下, 必须清“0”

脉冲测定模式除外

在定时器模式下, 必须清“0”

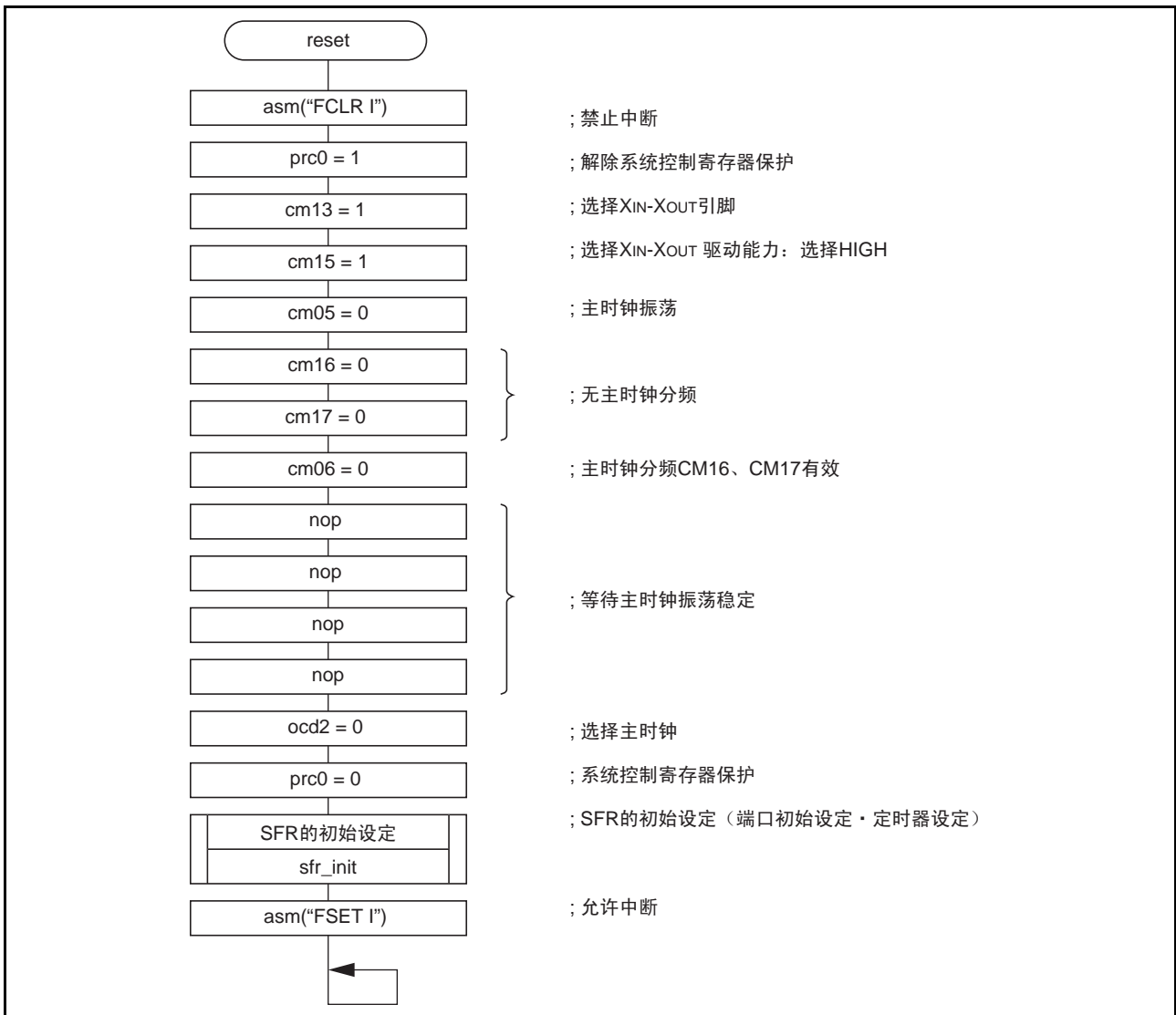
定时器模式的选择

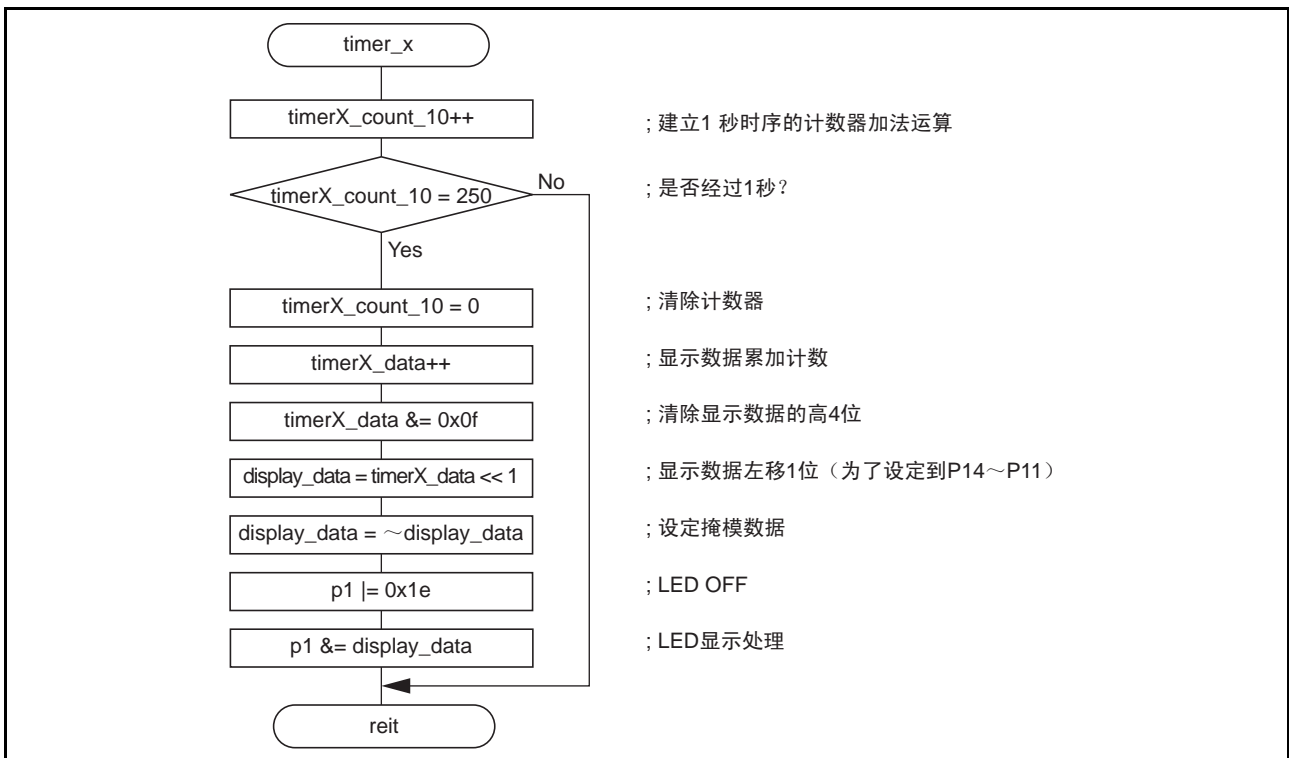
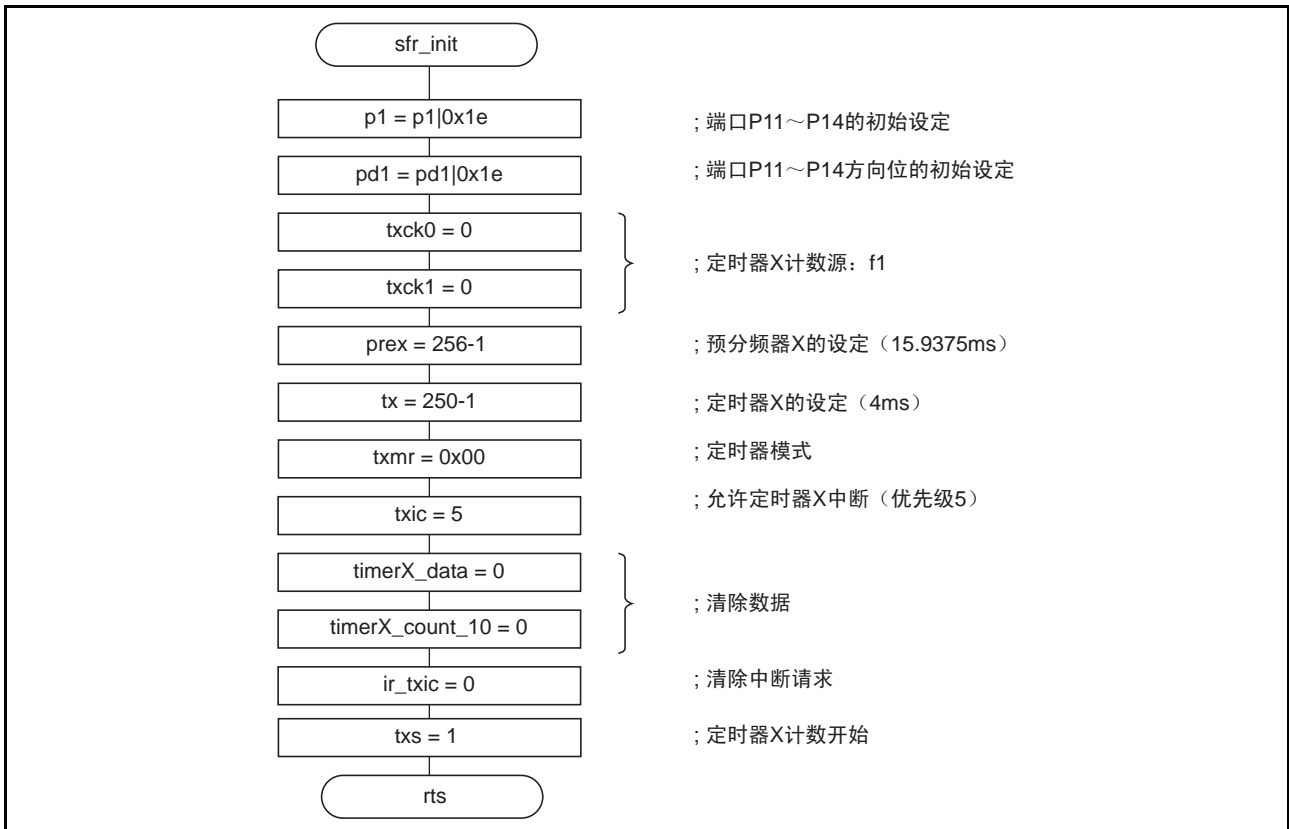
INT1/CNTR₀极性切换位

定时器X计数开始标志 计数开始时设定为“1”

在定时器模式下, 必须清“0”

4.3 流程图





5. 参考程序例

```

/*****
*
*   File Name      : main.c
*   Contents       : R8C/10 Timer X Timer Mode Test Program
*   Copyright, 2004 RENESAS TECHNOLOGY CORPORATION
*                   AND RENESAS SOLUTIONS CORPORATION, All rights reserved.
*   Version        : 1.10
*   note           : 0.01 : First version
*                   : 1.10(2004.08.23): Comment is revised
*****/
#include "sfr_r810.h" /* Definition of the R8C/10 SFR */

/* Definition of RAM area */
unsigned int timerX_data;
unsigned int timerX_count_10;

/* Declaration of function prototype */
void sfr_init(void); /* Initial setting of SFR registers */

main() {
    asm("FCLR I"); /* Interrupt disable */

    /*-----
    -Change on-chip oscillator clock to Main clock -
    -----*/
    prc0 = 1; /* Protect off */
    cm13 = 1; /* Xin Xout */
    cm15 = 1; /* XCIN-XCOUT drive capacity select bit : HIGH */
    cm05 = 0; /* Xin on */
    cm16 = 0; /* Main clock = No division mode */
    cm17 = 0;
    cm06 = 0; /* CM16 and CM17 enable */
    asm("nop"); /* Waiting for stable of oscillation */
    asm("nop");
    asm("nop");
    asm("nop");
    ocd2 = 0; /* Main clock change */
    prc0 = 0; /* Protect on */

    /*-----
    - Initialize SFR -
    -----*/
    sfr_init(); /* Initial setting of SFR registers */

    asm("FSET I"); /* Interrupt enable */

    /*-----
    - Loop of main -
    -----*/
    while(1){ /* Main processing */
        }
}

```

```

/*****
Name:          sfr_init
Parameters:    None
Returns:       None
Description:   Initial setting of SFR registers
*****/
void sfr_init(void){
    /* Setting port registers */
    p1 = p1 | 0x1e;          /* P14-P11 = H(Led 4.3.2.1) */

    /* Setting port direction registers */
    pd1 = pd1 | 0x1e;      /* P14-P11 port direction = output */

    txck0 = 0;             /* Timer X count source = f1 */
    txck1 = 0;

    /* Setting main cycle timer */
    /* 16MHz * 1/1 * 256 * 250 = 4ms */
    prex = 256-1;         /* Setting Prescaler X register */
    tx  = 250-1;          /* Setting timer X register */

    txmr = 0x00;          /* Timer X : timer mode */
    txic = 5;             /* Interrupt priority level = 5 */

    timerX_data = 0;      /* Display data initialization */
    timerX_count_10 = 0;  /* 1 second counter initialization */

    ir_txic = 0;          /* Interrupt request flag clear */
    txs = 1;              /* Timer X count start flag = start */
}

```

```

/*****
Name:          interrupt Timer X
Parameters:    None
Returns:       None
Description:    Timer X
*****/
#pragma interrupt timer_x
void timer_x(void){

    unsigned int display_data;

    timerX_count_10++;                /* 1 second counter increment */

    if ( timerX_count_10 == 250 ) {  /* 1 second have passed ? */
        timerX_count_10 = 0;        /* 1 second counter clear */
        timerX_data++;              /* Display data increment */
        timerX_data &= 0x0f;        /* Display data mask */
        display_data = timerX_data << 1; /* Display data shift */
        display_data = ~display_data; /* Display data set */
        pl |= 0x1e;                 /* LED Clear */
        pl &= display_data;         /* LED On */
    }
}

```

6. 参考文档

硬件手册

R8C/10群硬件手册

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