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R8C/10群

定时器X运行（事件计数器模式）

1. 概要

本资料说明了定时器X事件计数器模式的使用例。事件计数器模式的选择功能如表1所示。在此，对选择了表1所示的○符号后内容时的运行进行说明。

表1 事件计数器模式的选择功能

设定项目	设定内容	
CNTRo极性切换	○	上升沿计数（上升沿中断）
		下降沿计数（下降沿中断）

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）的其它的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。

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3. 事件计数器模式的运行

对选择了表1所示的○符号后内容时的运行进行说明。

- (1) 如果将计数开始标志置“1”，计数器则对输入到CNTR0引脚的外部信号的上升沿进行递减计数。并且，每次输入外部信号都产生INT1中断。
- (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。

事件计数器模式运行时序如图1所示。

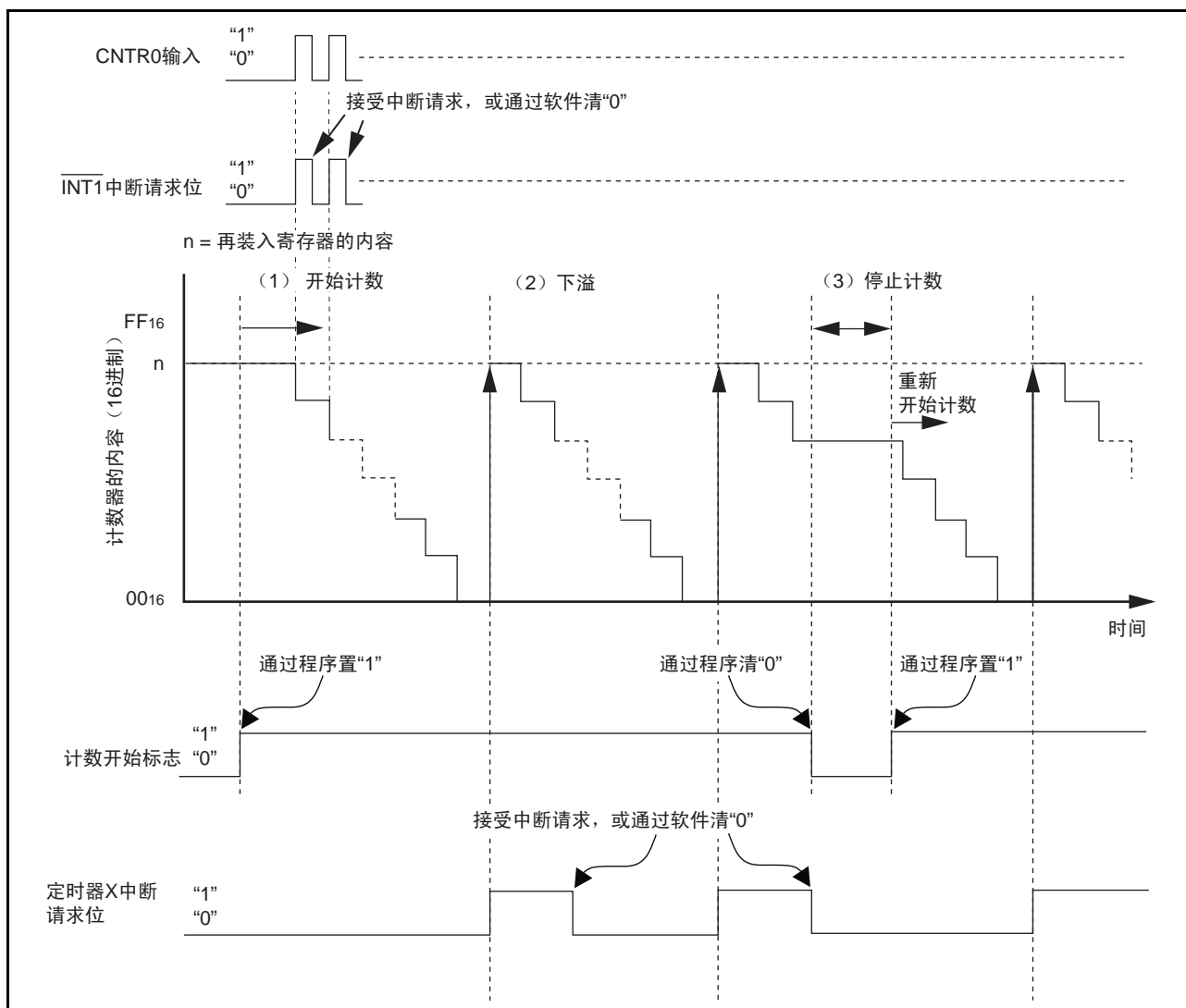


图1 事件计数器模式运行时序

4. 应用例

4.1 应用例的说明

(1) 假设向 CNTR0 引脚输入 12.5μs 周期的脉冲，定时器 X 每 80ms 产生一次下溢。

$$\begin{aligned} 80\text{ms} &= \text{CNTR0 输入脉冲周期} \times (\text{预分频器 } X+1) \times (\text{定时器 } X+1) \\ &= 12.5\mu\text{s} \times (255 + 1) \times (24 + 1) \end{aligned}$$

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 25 次计数，就会建立 2 秒的时序，并更新显示数据。

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

(3) 每次 INT1 中断产生，就通过程序将端口 P30 的输出取反。

使用的引脚如图 2 所示。

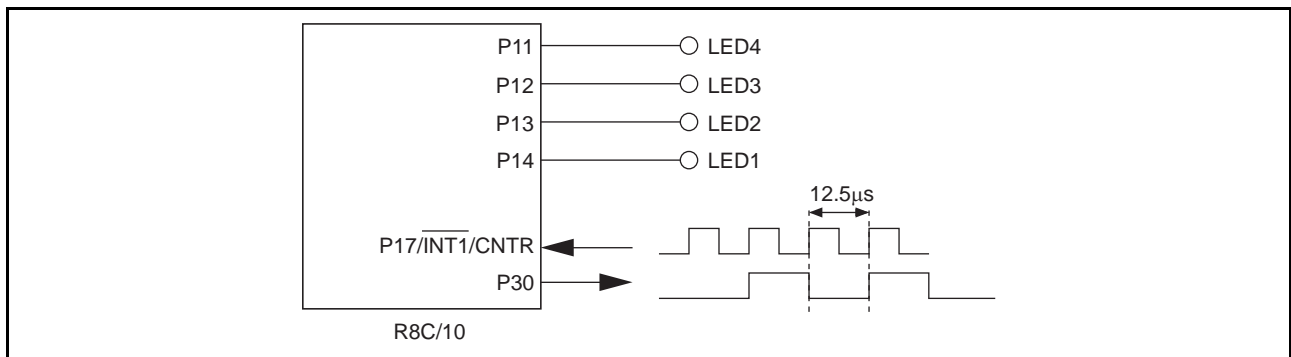
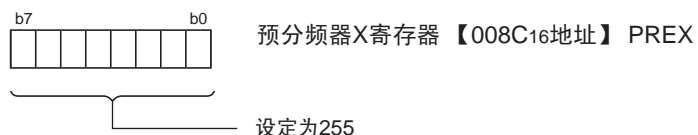


图 2 使用的引脚

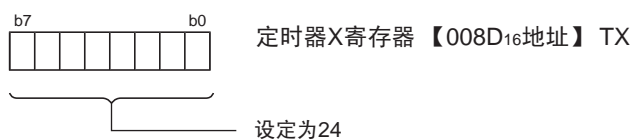
另外，本样本程序在 SFR 的位分配的情况下，有可能对不使用的功能位进行操作。这些设定值请根据用户系统的使用情况进行设定。

4.2 主要寄存器的设定

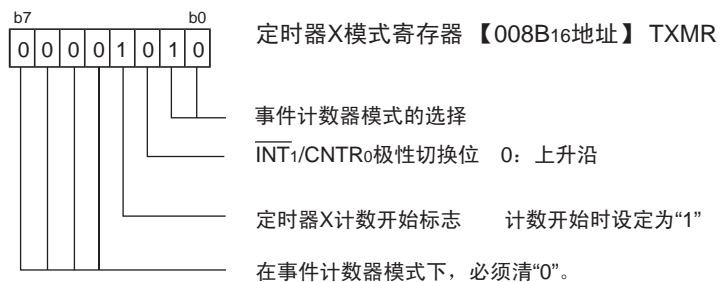
预分频器X寄存器的设定



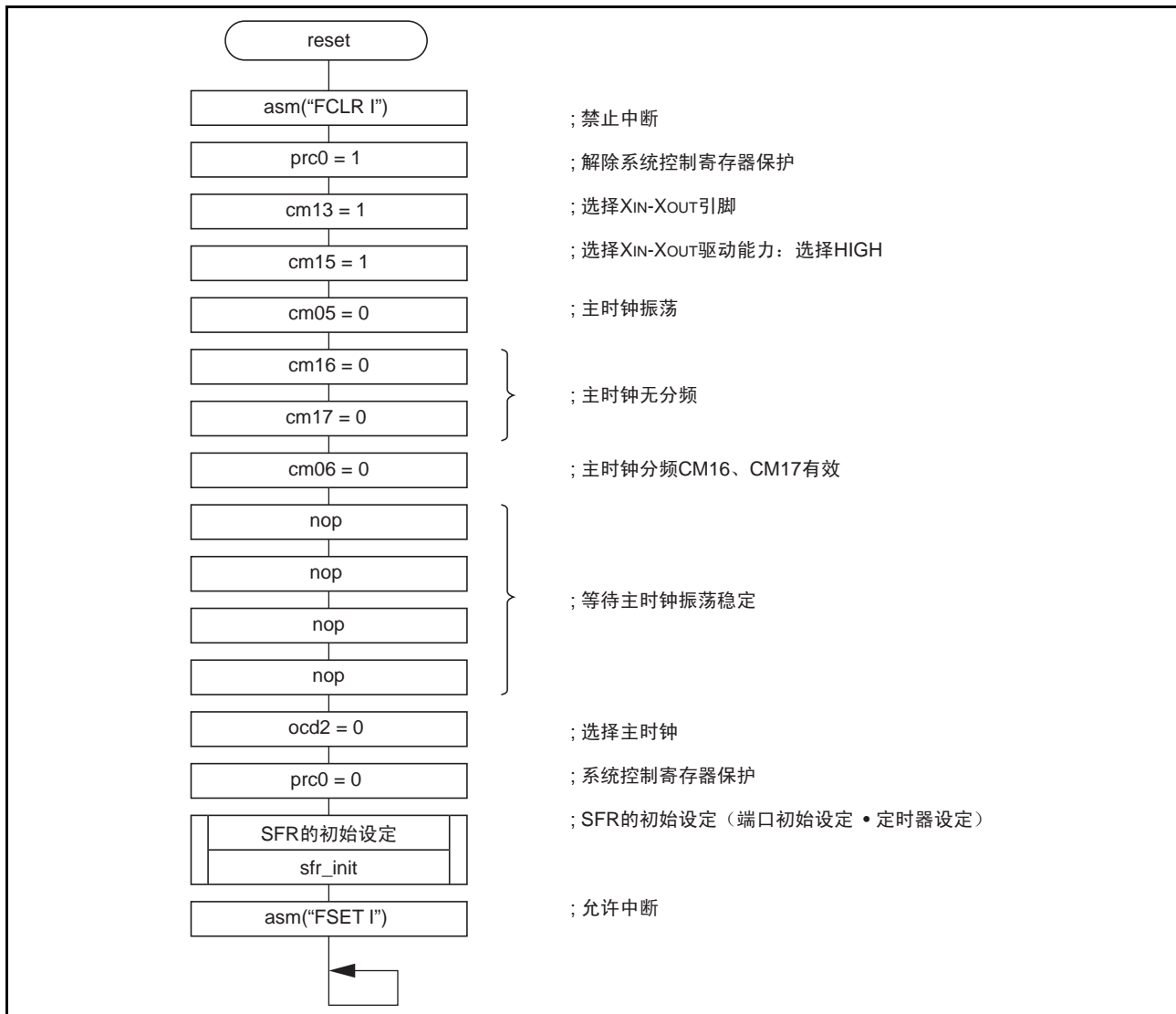
定时器X寄存器的设定

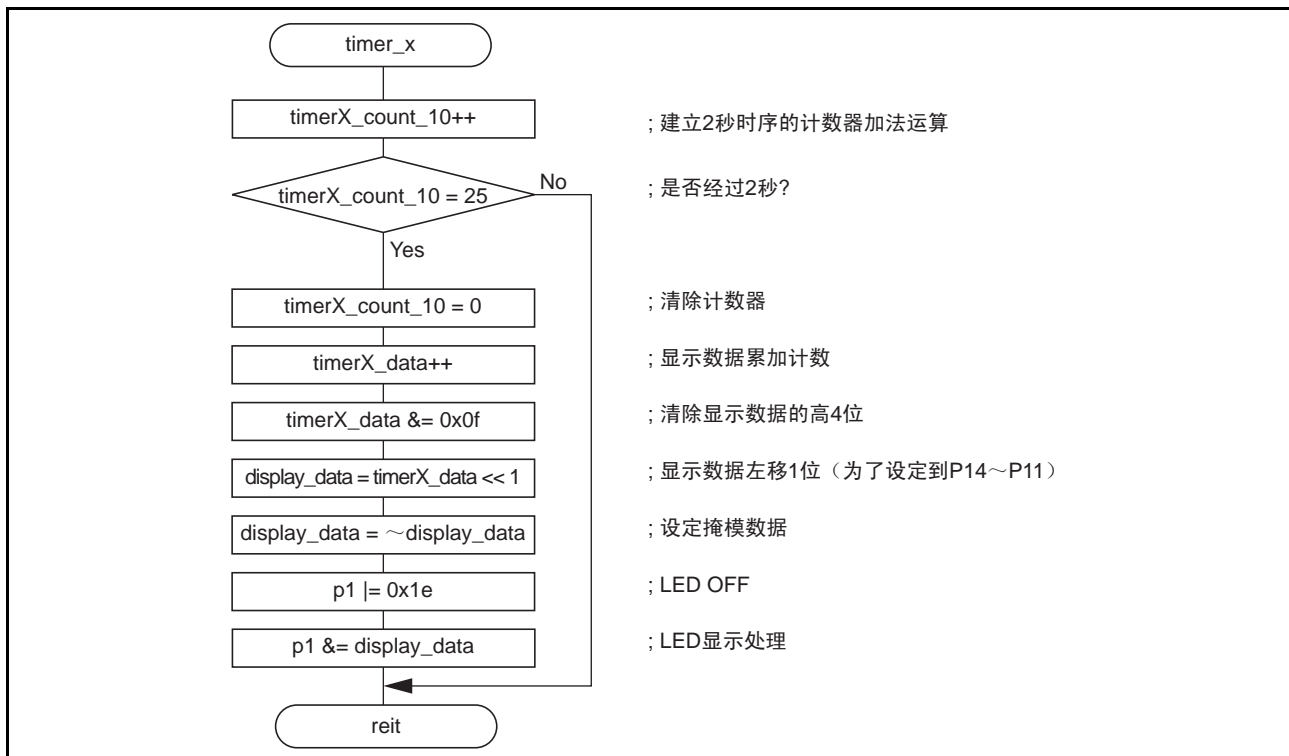
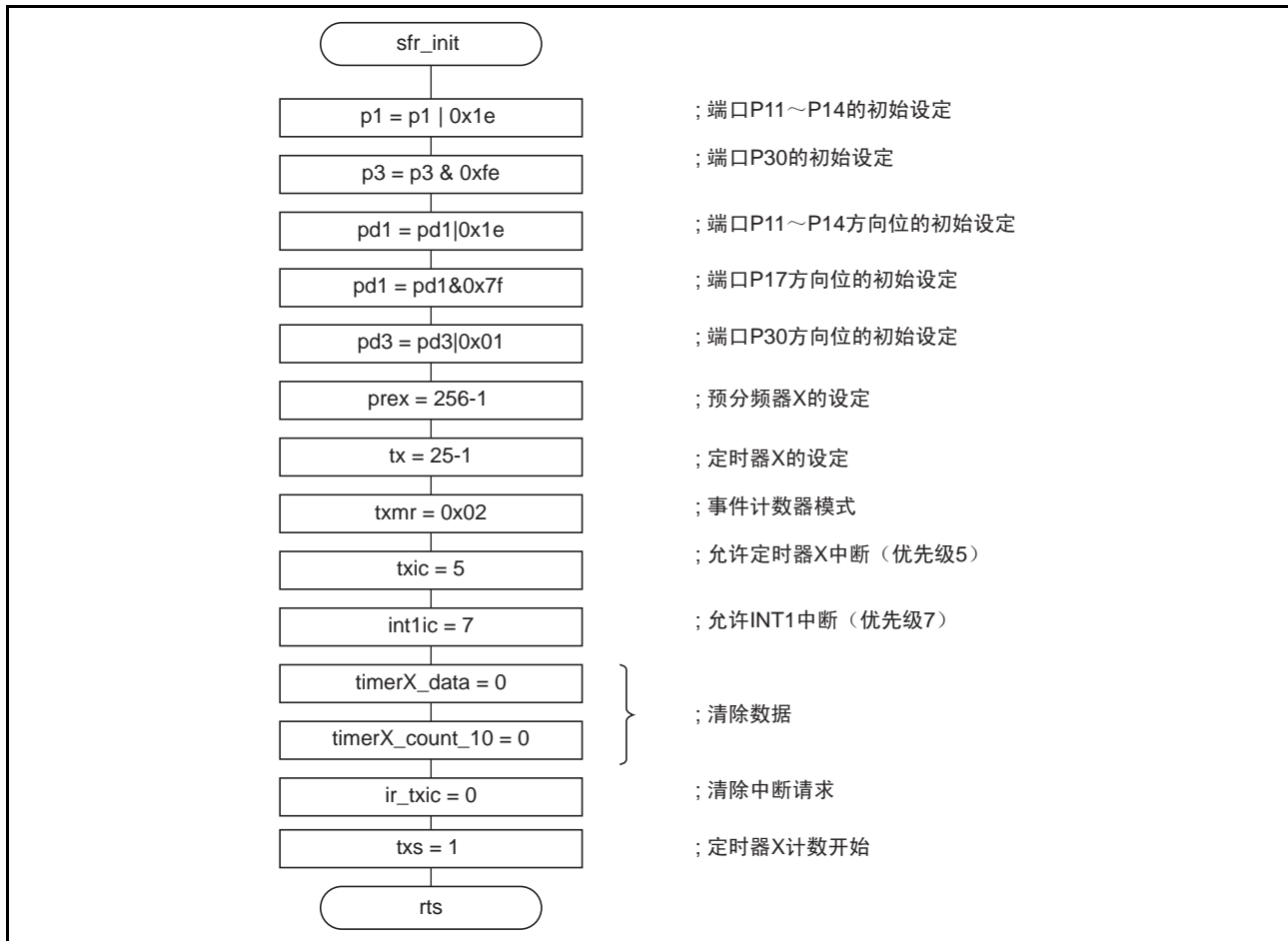


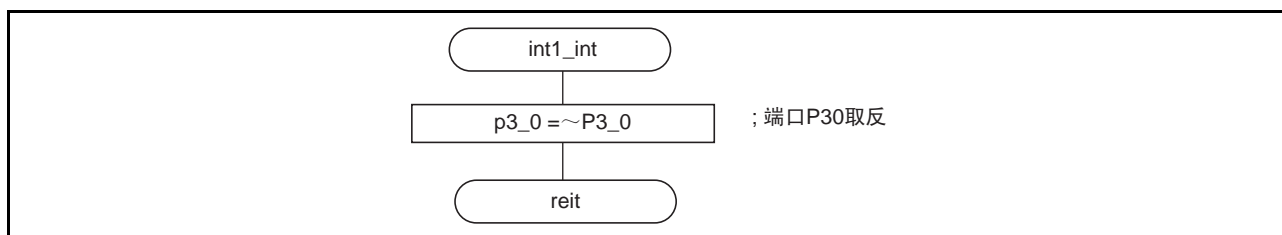
定时器X模式寄存器的设定



4.3 流程图







5. 参考程序例

```

/*****
*
*   File Name       : main.c
*   Contents        : R8C/10 Timer X Event counter 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 */
    cml3 = 1;                  /* Xin Xout */
    cml5 = 1;                  /* XCIN-XCOUT drive capacity select bit : HIGH */
    cm05 = 0;                  /* Xin on */
    cml6 = 0;                  /* Main clock = No division mode */
    cml7 = 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) */
    p3 = p3 & 0xfe;          /* P30 = L */

    /* Setting port direction registers */
    pd1 = pd1 | 0x1e;        /* P14-P11 port direction = output */
    pd1 = pd1 & 0x7f;        /* P17 port direction = input */
    pd3 = pd3 | 0x01;        /* P30 port direction = output */

    /* Setting main cycle timer */
    /* 12.5us * 1 * 256 * 25 = 80ms */
    prex = 256-1;            /* Setting Prescaler X register */
    tx  = 25-1;              /* Setting timer X register */

    txmr = 0x02;             /* Timer X : event counter mode */
    txic = 5;                /* Interrupt priority level = 5 */
    intlic = 7;              /* Interrupt priority level = 7 */

    timerX_data = 0;         /* Display data initialization */
    timerX_count_10 = 0;     /* 2 seconds 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++;                /* 2 seconds counter increment */

    if ( timerX_count_10 == 25 ) {    /* 2 seconds have passed ? */
        timerX_count_10 = 0;         /* 2 seconds 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 */
        p1 |= 0x1e;                  /* LED Clear */
        p1 &= display_data;          /* LED On */
    }
}
/*****
Name:          interrupt INT1
Parameters:    None
Returns:       None
Description:    INT1
*****/
#pragma interrupt int1_int
void int1_int(void){
    p3_0 = ~p3_0;
}

```

6. 参考文档

硬件手册

R8C/10群硬件手册

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