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R8C/10群

定时器X运行（脉冲输出模式）

1. 概要

本资料说明了定时器X的脉冲输出模式的使用例。脉冲输出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 脉冲输出模式的选择功能

设定项目	设定内容	
CNTR0极性切换	○	从“H”电平开始输出
		从“L”电平开始输出
P30/CNTR0引脚功能		可编程输入/输出端口
	○	脉冲输出（CNTR0输出的取反输出）

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。

目录

1. 概要	1
2. 前言	1
3. 脉冲输出模式的运行	2
4. 应用例	4
5. 参考程序例	8
6. 参考文档	10

3. 脉冲输出模式的运行

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”，计数器则对计数源进行递减计数。

从P17/INT1/CNTR0引脚输出“H”电平，从P30/CNTR0引脚输出“L”电平（CNTR0的取反信号）

(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”。并且，将INT1/CNTR0引脚和P30/CNTR0引脚的输出取反。

(3) 如果将计数开始标志清“0”，计数器则保持计数值并停止。

脉冲输出模式运行时序如图1所示。

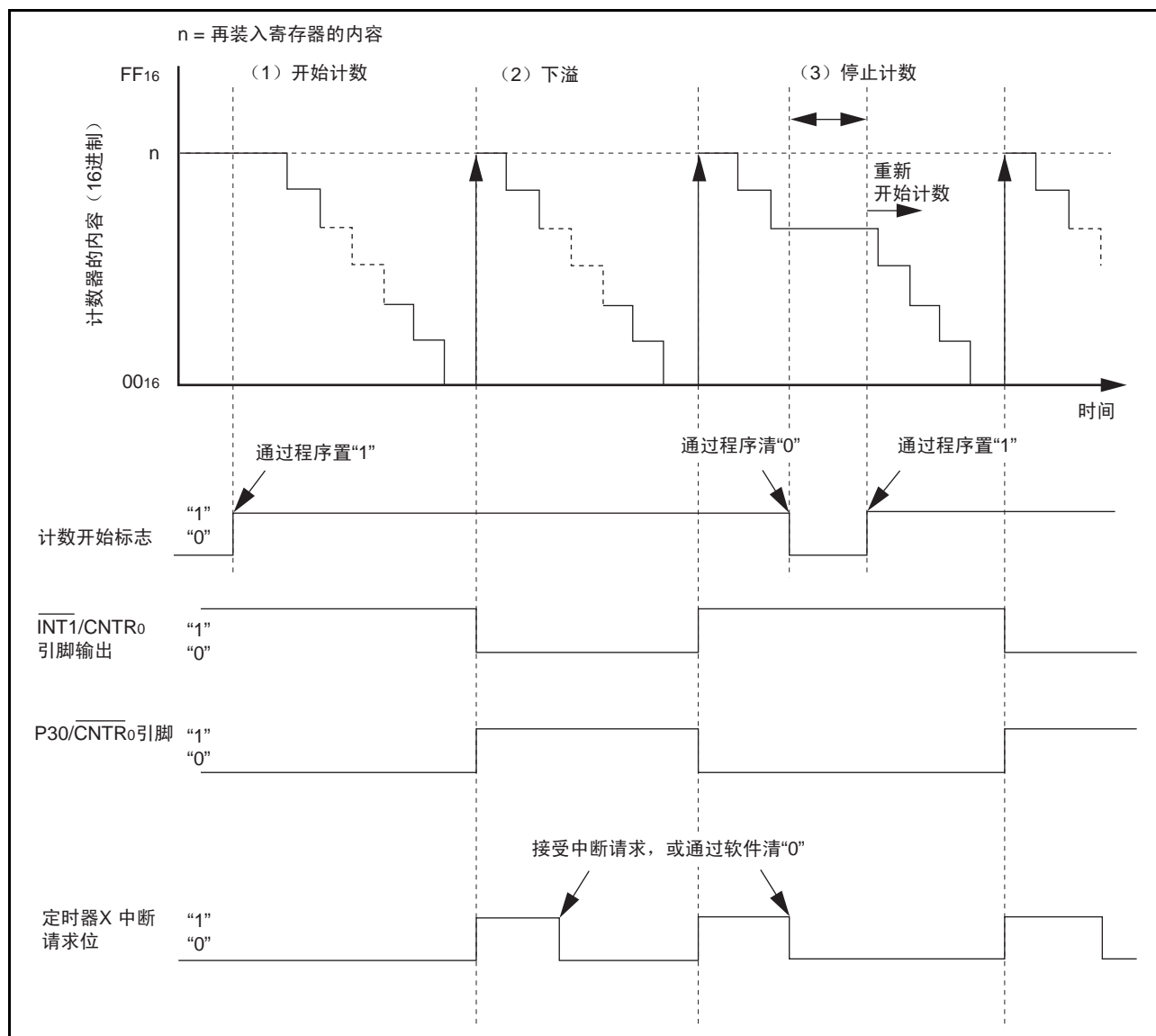


图1 脉冲输出模式运行时序

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。

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

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1。

(3) 通过定时器X的上溢时序从CNTR0引脚和CNTR0引脚输出取反的脉冲信号。CNTR0引脚从“H”电平开始输出， $\overline{\text{CNTR0}}$ 引脚从“L”电平开始输出。

使用的引脚如图2所示。

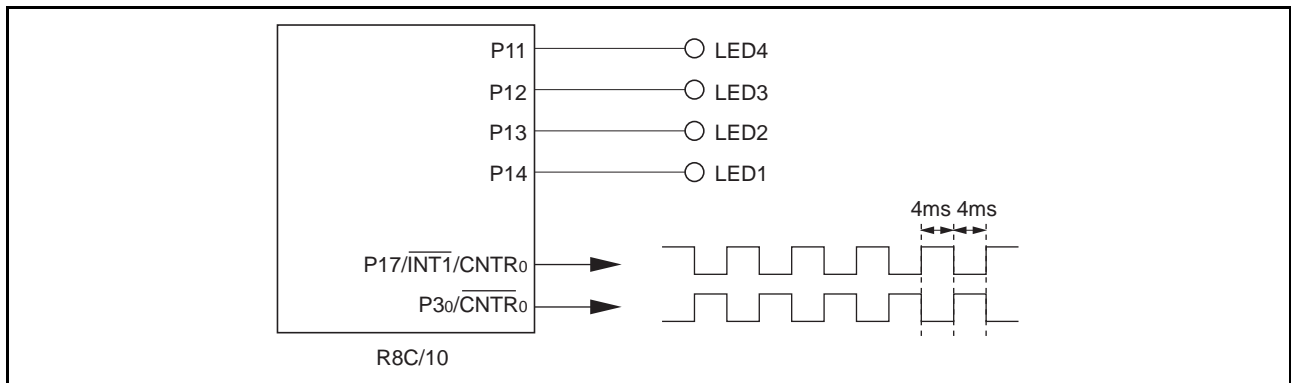
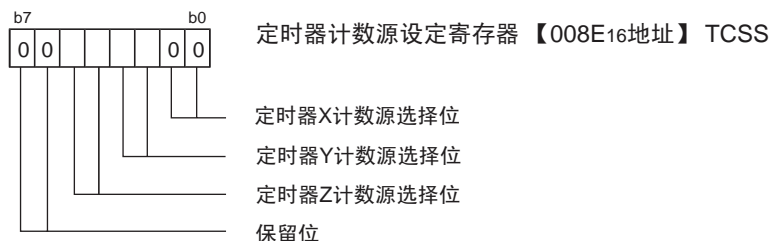


图2 使用的引脚

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

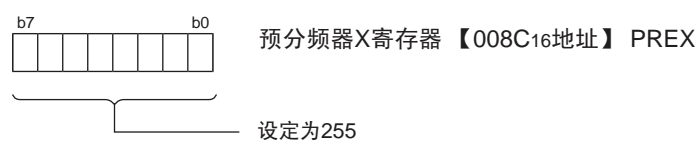


定时器X计数源选择位

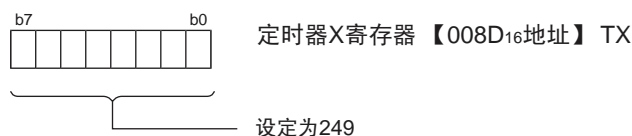
b1 b0
0 0 : f₁
0 1 : f₈
1 0 : f₃₂
1 1 : f₂

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

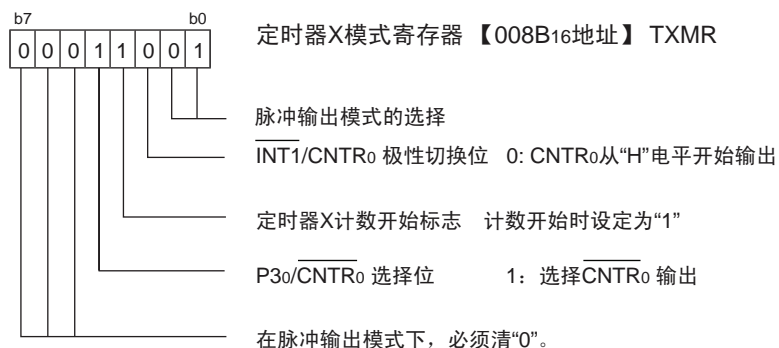
预分频器X寄存器的设定



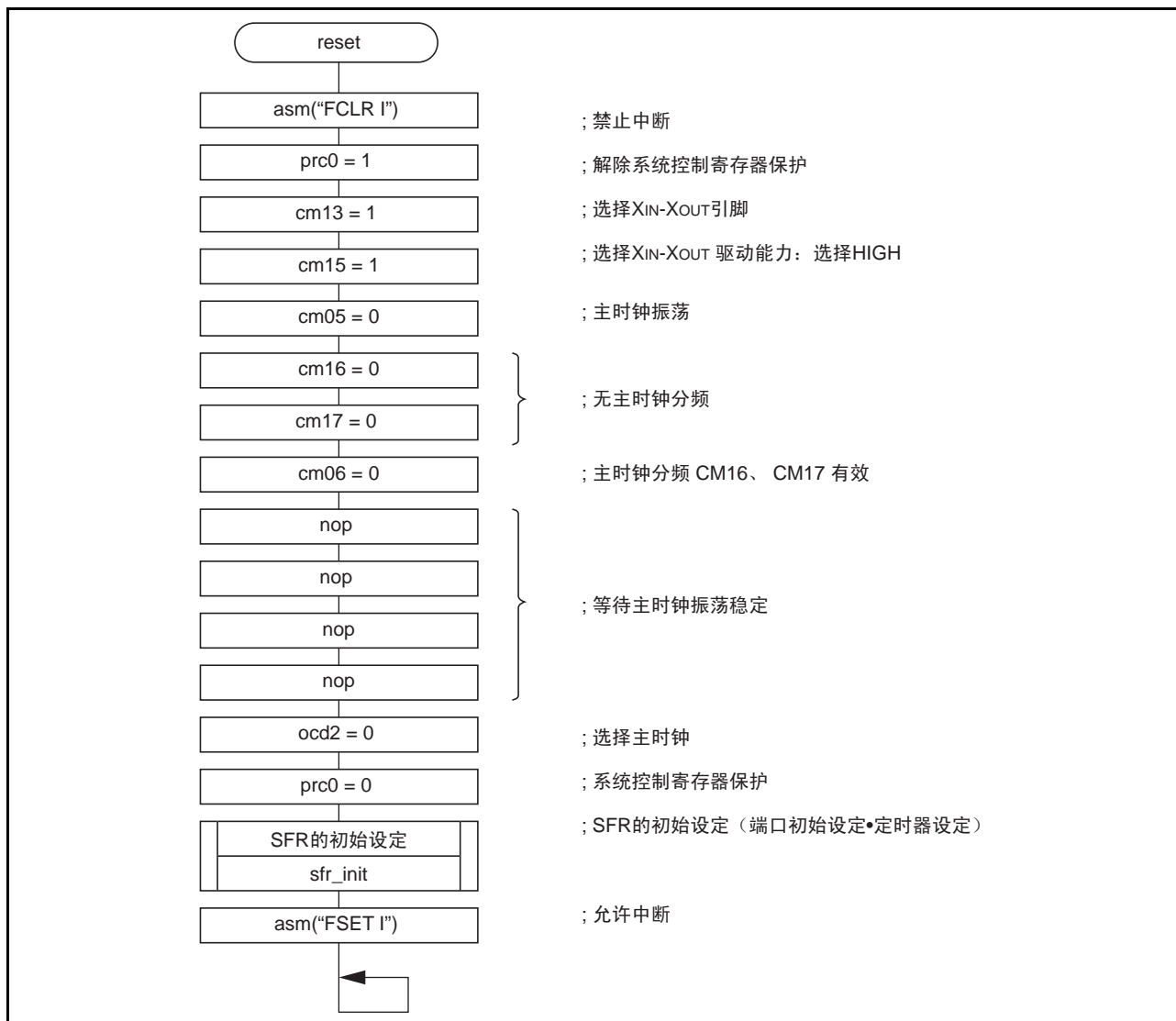
定时器X寄存器的设定

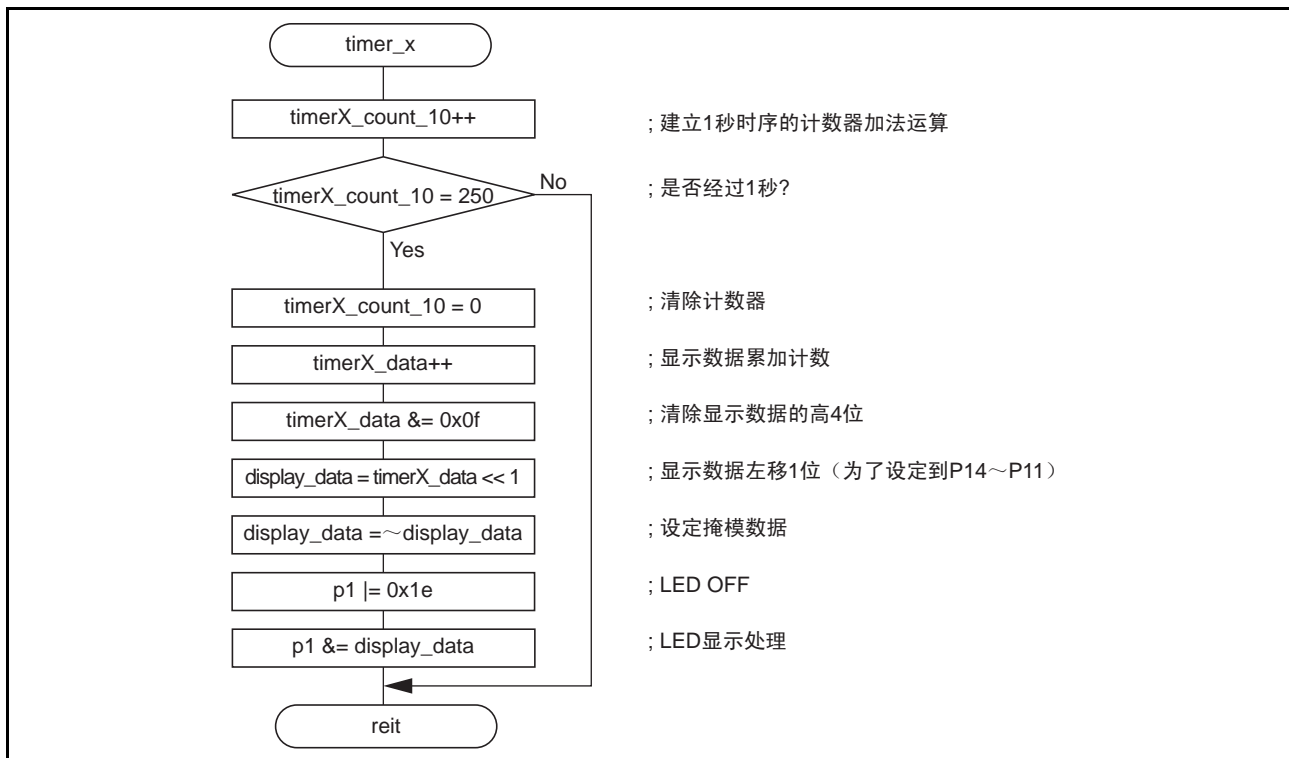
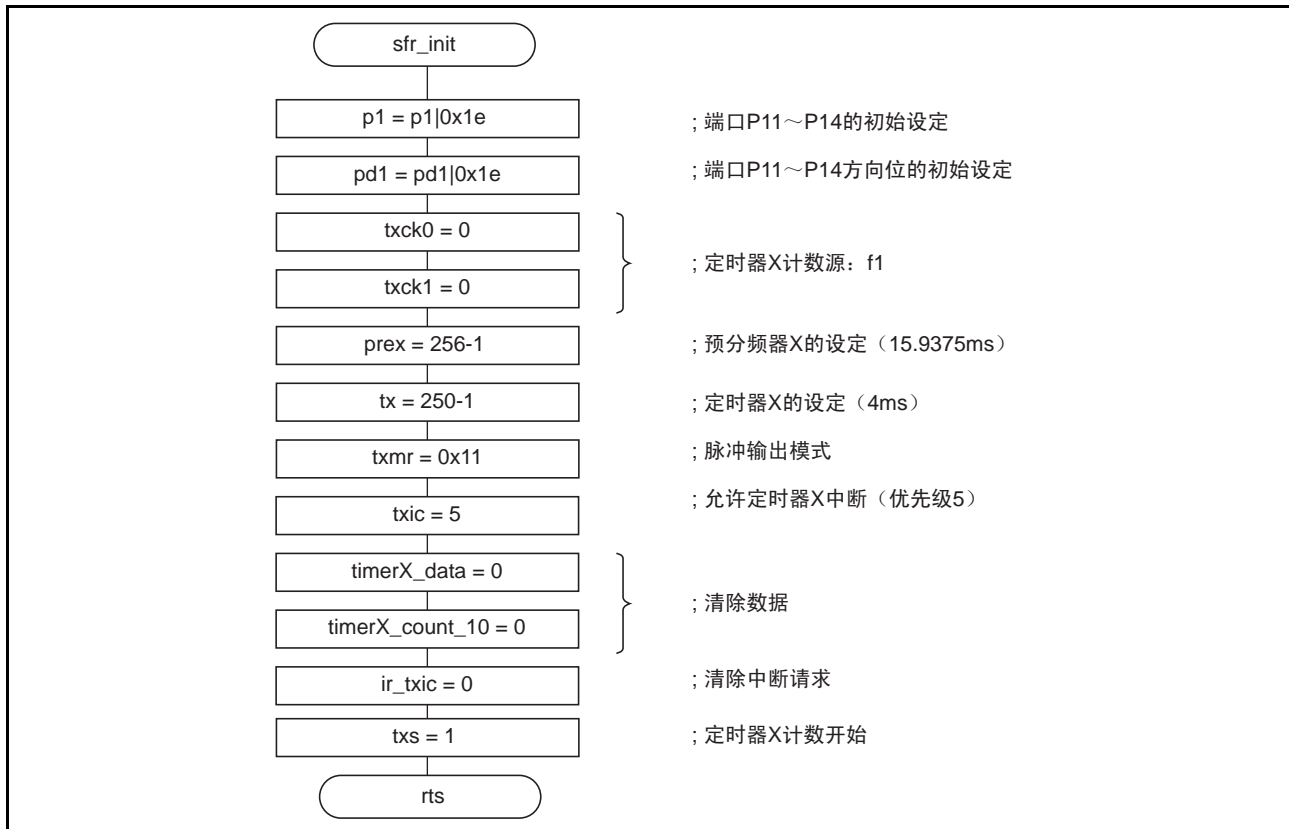


定时器X模式寄存器的设定



4.3 流程图





5. 参考程序例

```

/*****
*
*   File Name      : main.c
*   Contents       : R8C/10 Timer X Pulse output 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) */

    /* 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 = 0x11;                   /* Timer X : pulse output mode */
    txic = 5;                       /* Interrupt priority level = 5 */

    timerX_data = 0;               /* RAM clear */
    timerX_count_10 = 0;          /* RAM clear */
    ir_txic = 0;                  /* interrupt request 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 ) {
        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 */
        p1 |= 0x1e;               /* LED Clear */
        p1 &= display_data;       /* LED On */
    }
}

```

6. 参考文档

硬件手册

R8C/10群硬件手册

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