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LSI Application Notes Excerption

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About This Manual

■ Configuration of This Manual

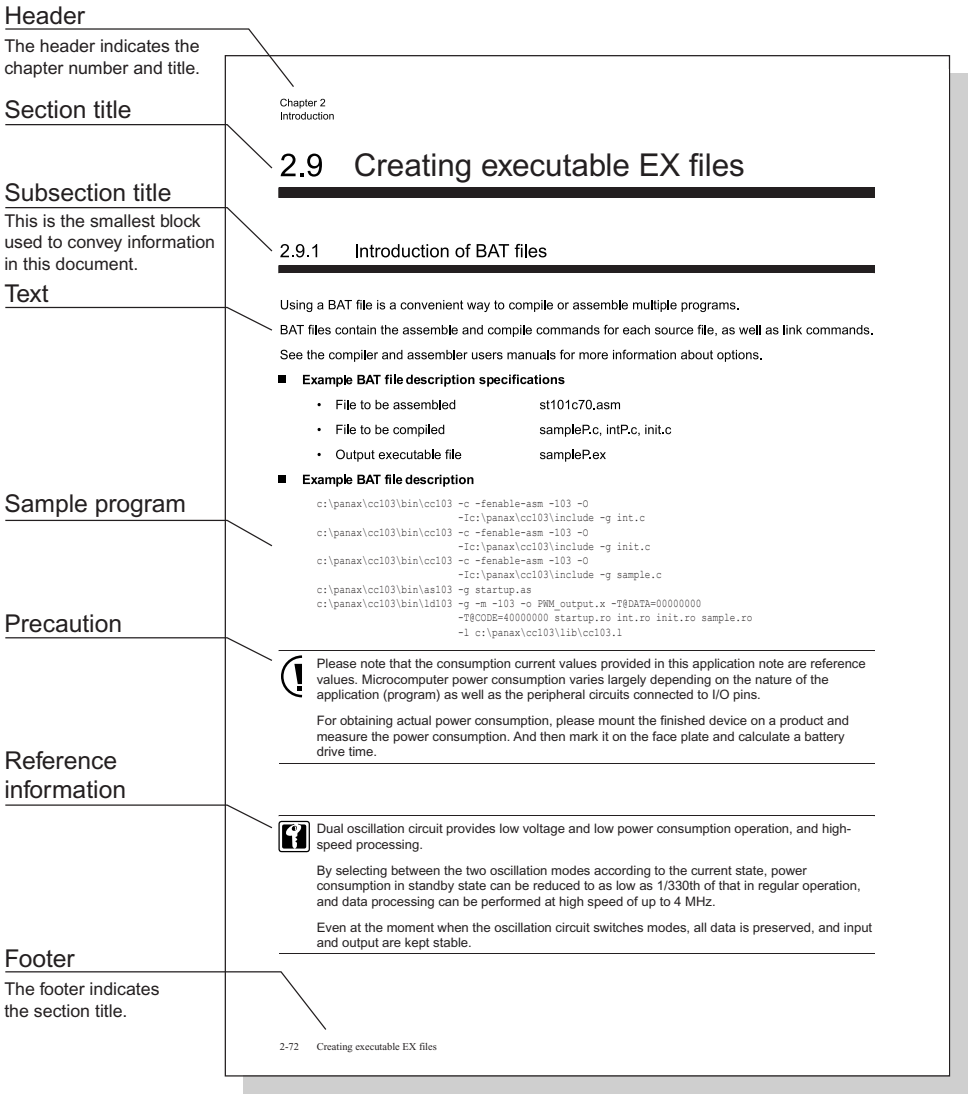
This LSI application note consists of the following sections.

- Overview: This section presents a brief description of this LSI's overview and features as information useful for selecting and using a microcomputer.
- Introduction: This section describes a sample program that implements this LSI's basic functions.
- Microcomputer Basics: This section provides a brief description of the settings and sample programs for peripheral LSI functions that are not addressed in the Introduction section.
- Appendix: The appendix provides circuit diagrams of evaluation boards that can be used to verify the proper operation of the sample programs described in this manual.

■ This document's format

This manual mainly consists of titles, text, sample programs, precautions, and reference information.

The page layout and definition of these elements are shown below.



Format used for sample program explanations

The sample programs included in the Introduction, Microcomputer Basics are explained in the following order of headings. Unnecessary headings may be omitted depending on their sample program.

- Specification
- Hardware allocation list
- Register description
- Flowchart
- Example program

The following oscillation frequencies this documentís sample programs use: fosc = 10 MHz, fx = 32.768 kHz.

More information

Program CDs and evaluation boards for use with the programs described in this document are available. Contact your Panasonic sales representative or access the following URL.

http://panasonic.co.jp/semicon/e-micom/inquiry

Evaluation boards are sold through Panasonic sales offices.

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3.6 8-bit timer operation

3.6.1 Counting rising edges using the event count

■ Overview

This program uses Timer 1 to count the rising edges of the external signal input from the TM1IO input pin with a binary counter.

When the external input signal is detected 5 times, an interrupt is generated and LED connected to P44 flashes. The setting stored in the base register determines the number of rising edge detections that is counted until an interrupt is generated.

■ Hardware allocation list

Source frequency	fosc (10 MHz)	
Ports used	Port 3 (P31)	Event input pin
Timers used	Timer 1	Event count timer
Count clock source	TIM0IO input	
Interrupts used	Timer 1 interrupt	LED connected to P44 flashes
Interrupt level	0	
Interrupt source	Binary counter underflow	

■ Register description

Group 4 Interrupt Control Register (G4ICR: 0x00008910)

bp	Flag name	Description
15	—	—
14-12	G4LV2 G4LV1 G4LV0	Group 4 interrupt priority level Set a level from 6 to 0.
11-10	—	—
9	G4IE1	Timer 1 underflow interrupt enable flag 0: Disabled 1: Enabled
8	G4IE0	Timer 0 underflow interrupt enable flag 0: Disabled 1: Enabled
7-6	—	—
5	G4IR1	Timer 1 underflow interrupt request flag 0: No interrupt request 1: Interrupt request
4	G4IR0	Timer 0 underflow interrupt request flag 0: No interrupt request 1: Interrupt request
3-2	—	—
1	G4ID1	Timer 1 underflow interrupt detection flag 0: No interrupt detected 1: Interrupt detected
0	G4ID0	Timer 0 underflow interrupt detection flag 0: No interrupt detected 1: Interrupt detected

Timer 1 Base Register (TM1BR: 0x0000A149)

bp	Flag name	Description
7 6 5 4 3 2 1 0	TM1BR7 TM1BR6 TM1BR5 TM1BR4 TM1BR3 TM1BR2 TM1BR1 TM1BR0	Timer 1 Base Register

Timer 1 Binary Counter (TM1BC: 0x0000A151)

bp	Flag name	Description
7 6 5 4 3 2 1 0	TM1BC7 TM1BC6 TM1BC5 TM1BC4 TM1BC3 TM1BC2 TM1BC1 TM1BC0	Timer 1 binary counter

Timer 1 Mode Register (TM1MD: 0x0000A141)

bp	Flag name	Description
7	TM1CNE	Timer operation enable 0: Operation disabled 1: Operation enabled
6	TM1LDE	Timer initialization 0: Normal operation 1: Initialization TM1BR value is loaded into TM1BC. Timer pulse output 1 is reset to low level.
5-3	—	—
2-0	TM1CK2 TM1CK1 TM1CK0	Count source selection 000: IOCLK 001: IOCLK/8 010: IOCLK/32 011: Cascading with Timer 0 100: Timer 0 underflow 101: Setting not available 110: Timer 2 underflow 111: TM1IO pin input

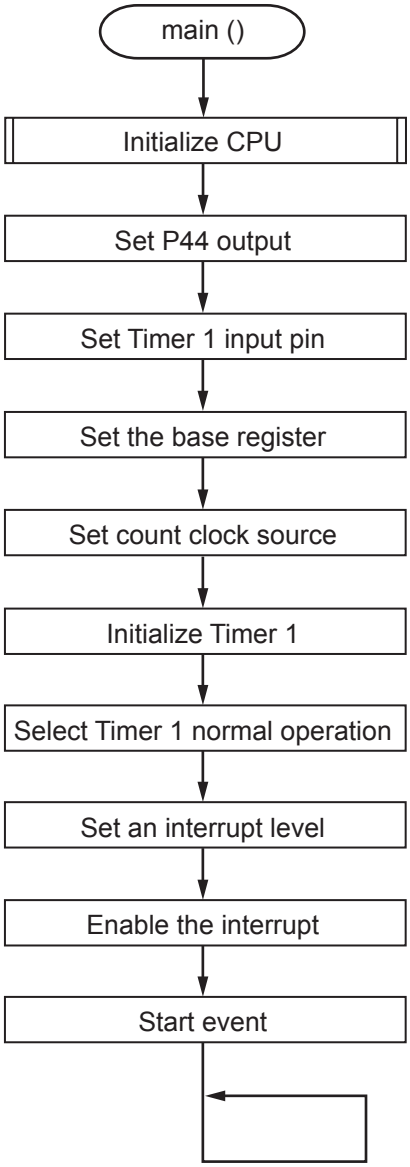
Port 3 I/O Control Register (P3DIR: 0x0000A023)

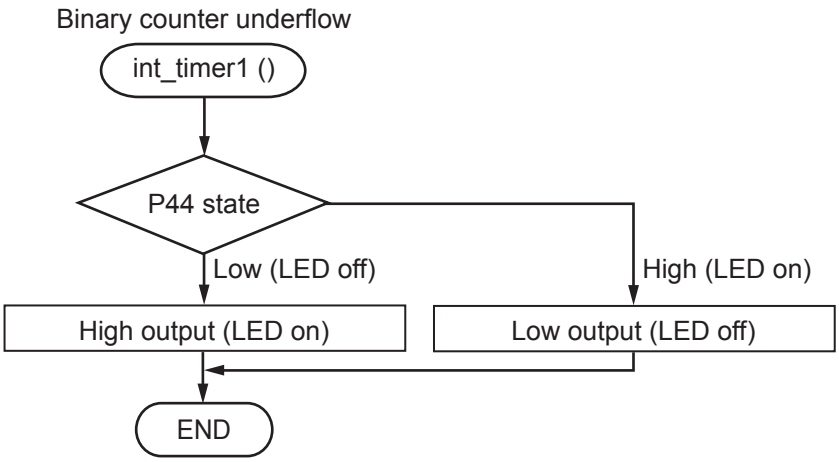
bp	Flag name	Description
7	—	—
6-0	P36D P35D P34D P33D P32D P31D P30D	P36 to P30 I/O control 0: Input mode 1: Output mode

Port 3 Output Mode Register (P3MD: 0x0000A033)

bp	Flag name	Description
7-4	—	—
3	P33M	Switching outputs 0: I/O port 1: TM3IO
2	P32M	Switching outputs 0: I/O port 1: TM2IO
1	P31M	Switching outputs 0: I/O port 1: TM1IO
0	P30M	Switching outputs 0: I/O port 1: TM0IO

■ Flowchart


main ()
Initialize CPU
Set P44 output
Set Timer 1 input pin
Set the base register
Set count clock source
Initialize Timer 1
Select Timer 1 normal operation
Set an interrupt level
Enable the interrupt
Start event


Binary counter underflow
int_timer1 ()
P44 state
Low (LED off)
High (LED on)
High output (LED on)
Low output (LED off)
END

■ Example program

```
/************************************************************************/
/*  CHECK Program for The count of the rising edge                      */
/*  which used event count operation(8-bit)                             */
/************************************************************************/
/*  Setting of Main Peripheral                                          */
/*  Port 0 : Unused                                                     */
/*  Port 1 : Unused                                                     */
/*  Port 2 : Unused                                                     */
/*  Port 3 : Used as Timer 1 input                                      */
/*  Port 4 : Used as output port                                        */
/*  Port 5 : Unused                                                     */
/*  Port 6 : Unused                                                     */
/*  Port 7 : Unused                                                     */
/*  Port 8 : Unused                                                     */
/*  Timer 0 : Unused                                                    */
/*  Timer 1 : Used as Event count operation                             */
/*  Timer 2 : Unused                                                    */
/*  Timer 3 : Unused                                                    */
/*  Timer 8 : Unused                                                    */
/*  Timer 11 : Unused                                                   */
/*  3-phase PWM output : Unused                                         */
/*  Serial interface communication 2 : Unused                           */
/*  10-bit A/D converters : Unused                                      */
/*                                                                      */
/*  Interrupt : External interrupt   Unused                             */
/*                                                                      */
/*      2004/09     Rev 0.1                                             */
/************************************************************************/
#include "sr103s92.h"
#include "int.h"

/***************************/
/*  Declaration of function */
/***************************/
void main(void);
void initialize(void);


/*-----------------------------------------------
    After the assembler boot processing is completed
    control is shifted to this main routine.
-----------------------------------------------*/
void main(void)
{
    initialize();                   /* Initial Job */

    TM1MD  = 0x00;                  /* Stop the counter */

/*-----------------------------------------------
    P4 setting
-----------------------------------------------*/
    P4OUT = 0x00;                   /* Set P44 Low(VSS level) */
    P4DIR = 0x10;                   /* Set P44 output */

/*-----------------------------------------------
    P3 setting
-----------------------------------------------*/
    P3MD  = 0x02;                   /* Set TM1IO port */
    P3DIR = 0x00;                   /* Set P31 input */

/*-----------------------------------------------
    Event count timer setting
-----------------------------------------------*/
    TM1BR  = 0x04;                  /* Set the base register */
    TM1MD  = TM1MD | 0x07;          /* Select the clock source to TMIN1 pin input */
    TM1MD  = TM1MD | 0x40;          /* Initial timer */
    TM1MD  = TM1MD & 0xBF;          /* Set normal operation */

    G4ICR = 0x0200;                 /* Set an interrupt level */
                                    /* Enable the interrupt */
    asm ("    or    0x0F00,PSW\n"); /* Enable the interrupt, Interrupt level 7 */
```

```
    asm ("    nop\n");
    asm ("    nop\n");

    TM1MD  = TM1MD | 0x80;          /* Start the counter */

    while(1){
    }
}

/*-----------------------------------------------
    Operation initial setting
-----------------------------------------------*/
void initialize(void)
{
    asm ("    and    0xF0FF,PSW\n");    /* Disable all maskable interrupts */
    asm ("    nop\n");
    asm ("    nop\n");

    CPUM   = 0x0000;                    /* Set normal mode */
}

/*-----------------------------------------------
    Timer 1 underflow
-----------------------------------------------*/
void int_timer1(void)
{
    if(P4OUT & 0x10){
        P4OUT = 0x00;                   /* Set P44 Low(VSS level) */
    }
    else{
        P4OUT = 0x10;                   /* Set P44 High(VDD level) */
    }
}
```

Inquiries

If you have questions regarding technical information on this manual, please visit the following URL.

User Support Team

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URL: http://panasonic.co.jp/semicon/e-micom/inquiry

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