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April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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H8/300H Tiny Series

TRAP Interrupt

Introduction

By using a TRAP instruction, a TRAP interrupt handling is performed.

Target Device

H8/3664

Contents

1. Specifications

1. By using a TRAP instruction, a TRAP interrupt handling is performed.
2. A TRAP interrupt is generated by executing a TRAP instruction.
3 .During TRAP interrupt handling, counting-up of the 16-bit counter value set in counter_sub starts.
4. Each time the 16-bit counter set in counter_sub overflows, an LED is lit or extinguished.
5. The LED is assumed to be connected to the P74 output pin of port 7.
6. A TRAP instruction is described using the embedded functions.

2. Description of Functions

1. In this task example, the counter is started by a TRAP interrupt.
   Below, the TRAP interrupt is explained.
   - The TRAP interrupts are initiated by executing a TRAP instruction.
   - A TRAP instruction generates vector addresses whose vector numbers are 0 to 3 that are specified by the instruction code.
   - Four vector addresses corresponding to TRAP#0 to TRAP#3 are assigned for TRAP interrupts.
   - An exception handling by a TRAP instruction is always accepted during program execution state regardless of the interrupt mask bit (I) in the condition code register (CCR).

2. Table 1 indicates function allocations in this task example.
   The function allocations indicated in Table 2.1, and operations to light and extinguish the LED connected to the I/O port are performed.

Table 2.1 Function Allocation

Function	Function allocation
PCR7	Sets P74 output pin function
PDR7	Stores data of P74 output pin
P74	Output pin for LED output

3. Description of Operations

Figure 1 explains the operation. Through the hardware and software processing shown in the figure, after a TRAP interrupt is generated, the LED connected to the I/O port is lit and extinguished.

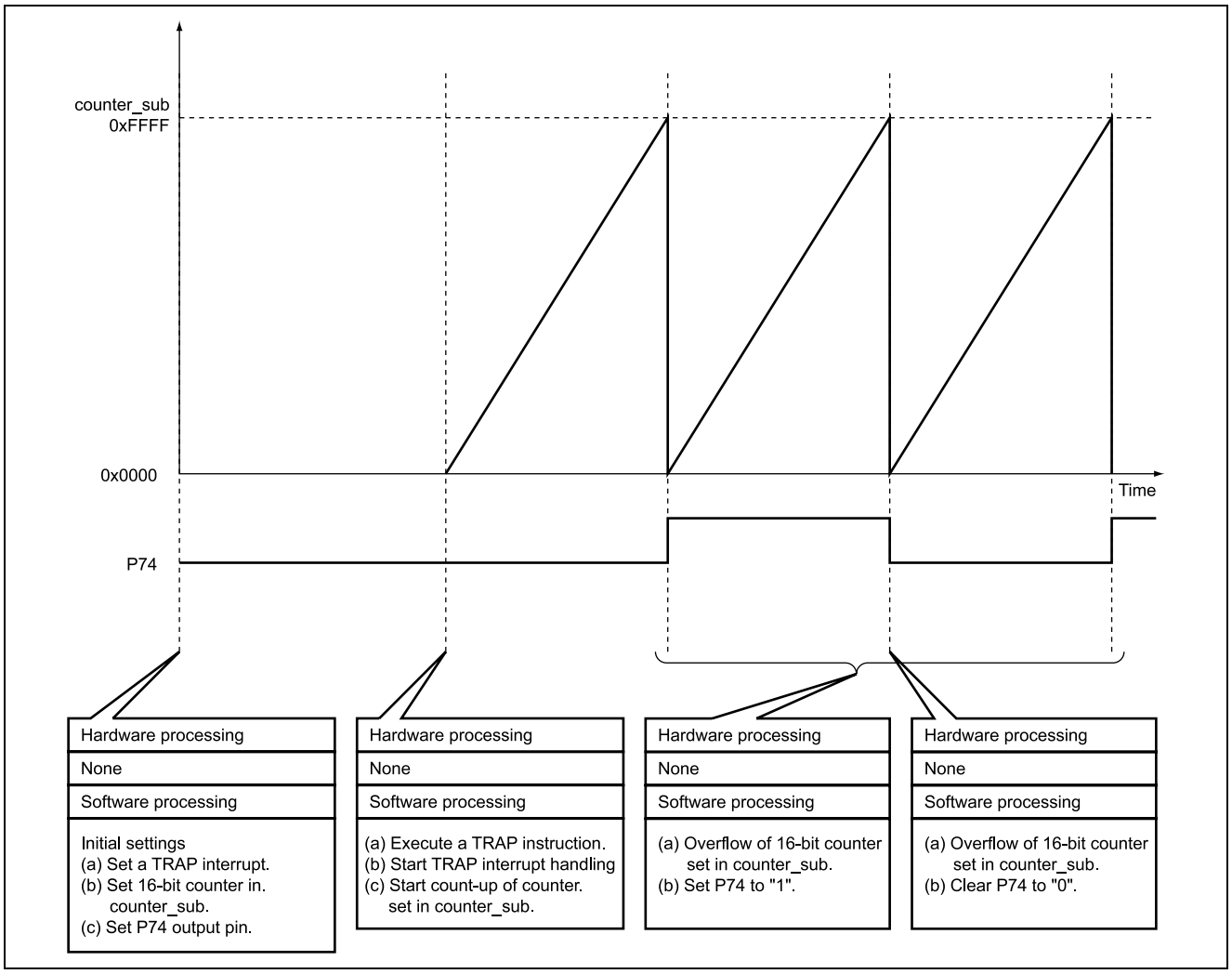


Figure 3.1 Explanation of operation to light and extinguish LED connected to the I/O port

4. Description of software

4.1 Description of Modules

Table 4.1 explains the modules in this task example.

Table 4.1 Description of Modules

Module name	Label name	Function
Main routine	main	Sets direction of input edge for TRAP interrupt, sets LED output pin, increments 16-bit counter, and performs LED output
Switch on	TRAP	In the TRAP interrupt routine, sets SWO NF to 1

4.2 escription of Arguments

This sample task uses no arguments.

4.3 Description of Internal Registers

The internal registers used in this sample task are described in table 4.2.

Table 4.2 Description of Internal Registers

Register	Name	Function	Address	Setting
PDR7	P74	Port data register 7 (port data register 74) P74=0: The pin P74 output level is low P74=1: The pin P74 output level is high	H'FFDA Bit 4	0
PCR7	PCR74	Port control register 7 (port control register 74) PCR74=1: The I/O pin P74 functions as an output pin	H'FFEA Bit 4	1

4.4 Description of RAM Used

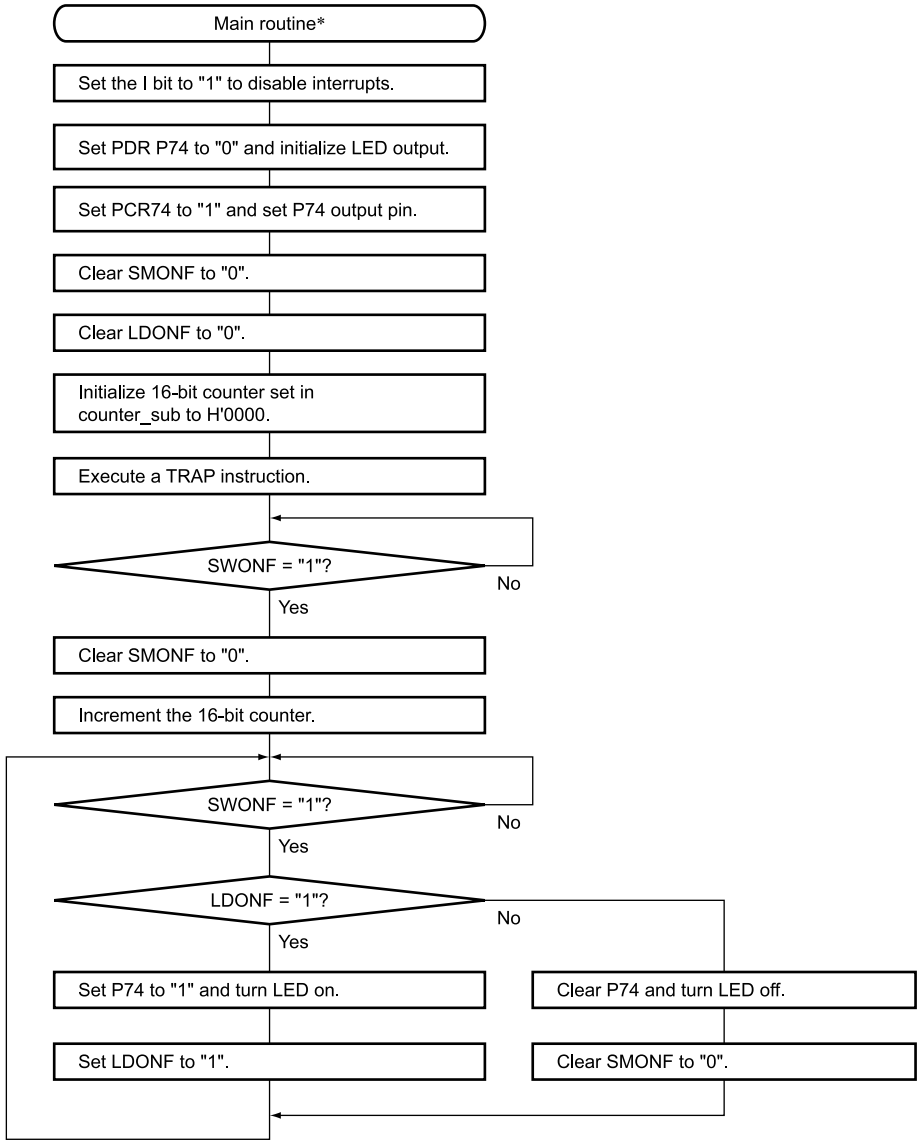
Table 4.3 describes the RAM used in this sample task.

Table 4.3 Description of RAM

Label Name		Function	Address	Used in
Counter_sub		16-bit up-counter which lights and extinguishes the LED each time overflow occurs	H'FB80	Main routine
USRF	SWONF	Flag to judge whether switch input is on or off	H'FB82 Bit 0	Main routine Switch on
	LDONF	Flag to judge whether LED is on or off	H'FB82 Bit 1	Main routine

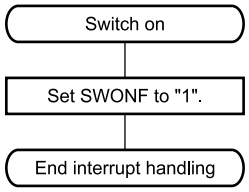
5. Flowcharts

1. Main routine



Note: * In this example, the stack pointer is set using INIT.SRC (assembly language).

2. TRAP interrupt handling routine



6. Program Listing

INIT.SRC (Program listing)

```
        .EXPORT   _INIT
        .IMPORT   _main
    ;
        .SECTION  P,CODE
    _INIT:
        MOV.W     #H'FF80,R7
        LDC.B     #B'10000000,CCR
        JMP       @_main
    ;
        .END
```

```
/************************************************************************************************************************/
/*                                                                                                                      */
/*   H8/300H Tiny Series -H8/3664-                                                                                      */
/*   Application Note                                                                                                   */
/*                                                                                                                      */
/*   'TRAP Interrupt function                                                                                           */
/*                                                                                                                      */
/*   Function                                                                                                           */
/*   : TRAP                                                                                                             */
/*                                                                                                                      */
/*   External Clock : 16MHz                                                                                             */
/*   Internal Clock : 16MHz                                                                                             */
/*   Sub Clock      : 32.768kHz                                                                                         */
/*                                                                                                                      */
/************************************************************************************************************************/

#include    <C:\ch38\include\machine.h>

/************************************************************************************************************************/
/*   Symbol Defnition                                                                                                   */
/************************************************************************************************************************/
struct BIT {
     unsigned char   b7:1;    /* bit7 */
     unsigned char   b6:1;    /* bit6 */
     unsigned char   b5:1;    /* bit5 */
     unsigned char   b4:1;    /* bit4 */
     unsigned char   b3:1;    /* bit3 */
     unsigned char   b2:1;    /* bit2 */
     unsigned char   b1:1;    /* bit1 */
     unsigned char   b0:1;    /* bit0 */
};

#define   PCR7          *(volatile unsigned char *)0xFFEA                  /* Port Control Register 7                */
#define   PCR7_BIT  (*(struct BIT *)0xFFEA)                                /* Port Control Register 7                */
#define   PCR74          PCR7_BIT.b4                                       /* Port Control Register Bit 4            */
#define   PDR7      *(volatile unsigned char *)0xFFDA                      /* Port Data Register 7                   */
#define   PDR7_BIT  (*(struct BIT *)0xFFDA)                                /* Port Data Register 7                   */
#define   P74       PDR7_BIT.b4                                            /* Port Data Register Bit 4               */

#pragma        interrupt    (TRAP_0)
```

```
/************************************************************************************************************************/
/*   RAM define                                                                                                         */
/************************************************************************************************************************/
unsigned int   counter_sub;                                          /* 16 Bit Up Counter                       */
unsigned char  USRF;                                                 /* User Flag Erea                          */
#define        USRF_BIT    (*(struct BIT *)&USRF)
#define        SWONF         USRF_BIT.b0                             /* Swich ON/OFF Judgment Flag              */
#define        LDONF         USRF_BIT.b1                             /* LED ON/OFF Judgment Flag                */

extern void _INITSCT();

/************************************************************************************************************************/
/*   Function definition                                                                                                */
/************************************************************************************************************************/
extern    void      INIT( void );                                    /* SP Set                                  */
extern    void      TRAP_0( void );                                  /* TRAP0 Interrupt Routine                 */
void main           ( void );
/************************************************************************************************************************/
/*   Vector Address                                                                                                     */
/************************************************************************************************************************/
#pragma section     V1                                               /* VECTOR SECTOIN SET                      */
void (*const VEC_TBL1[])(void) = {
/* 0x00 - 0x0f */
     INIT                                                            /* 00 Reset                                */
};

#pragma section     V2                                               /* VECTOR SECTOIN SET                      */
void (*const VEC_TBL2[])(void) = {
/* 0x10 - 0x11 */
     TRAP_0                                                          /* 08 TRAP0                                */
};

#pragma section                                                      /* P                                       */
/************************************************************************************************************************/
/*   Main Program                                                                                                       */
/************************************************************************************************************************/
void main ( void )
{
     _INITSCT();

     set_imask_ccr(1);                                               /* Interrupt Disable                       */

     P74 = 0;                                                        /* Port74 "0" Output                       */

     PCR74 = 1;                                                      /* Port74 Output                           */

     SWONF = 0;                                                      /* Swich ON/OFF Judgment Flag Clear        */

     LDONF = 0;                                                      /* LED ON/OFF Judgment Flag Clear          */

     counter_sub = 0x0000;                                           /* 16 Bit Counter Clear                    */

     set_imask_ccr(0);                                               /* Interrupt Enable                        */

     trapa(0);

     while(SWONF != 1){                                              /* SWONF = 1 ?                             */
          ;
     }
```

```
      SWONF = 0;                                                    /* Clear SWONF                          */

      while(1){
           do{
                counter_sub++;                                      /* Increment 16bit Counter              */
           }while(counter_sub != 0x0000);                           /* 16bit Counter = H'0000 ?             */

           if(LDONF == 1){                                          /* LDONF = 1 ?                          */
                P74 = 0;                                            /* Turn Off LED                         */
                LDONF = 0;                                          /* Clear LDONF                          */
           }
                else{
                     P74 = 1;                                       /* Turn On LED                          */
                     LDONF = 1;                                     /* Set LDONF                            */
                }
           }
}

/************************************************************************************************************************/
/*   TRAP0 Interrupt                                                                                                    */
/************************************************************************************************************************/
void TRAP_0( void )
{
     SWONF = 1;                                                     /* Set SWONF to 1                       */

}
```

Link address specifications

Section Name	Address
CV1	H'0000
CV2	H'0016
P	H'0100

Revision Record

		Description	
Rev.	Date	Page	Summary
1.00	Sep.29.03	—	First edition issued

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