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H8/300H Tiny Series

NMI Interrupt

Introduction

By turning on a switch input connected to the $\overline{\text{NMI}}$ pin, an NMI interrupt is generated, and counting-up of a 16-bit counter which is set in a two-byte variable (counter_sub) starts.

Target Device

H8/3664

Contents

1. Specifications

1. By turning on a switch input connected to the $\overline{\text{NMI}}$ pin, an NMI interrupt is generated, and counting-up of a 16-bit counter which is set in a two-byte variable (counter_sub) starts.
2. The NMI interrupt is requested by detection of the falling edge of the input to the $\overline{\text{NMI}}$ pin.
3. During NMI 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. Figure 1.1 shows an example of connection of a switch to the $\overline{\text{NMI}}$ input pin.

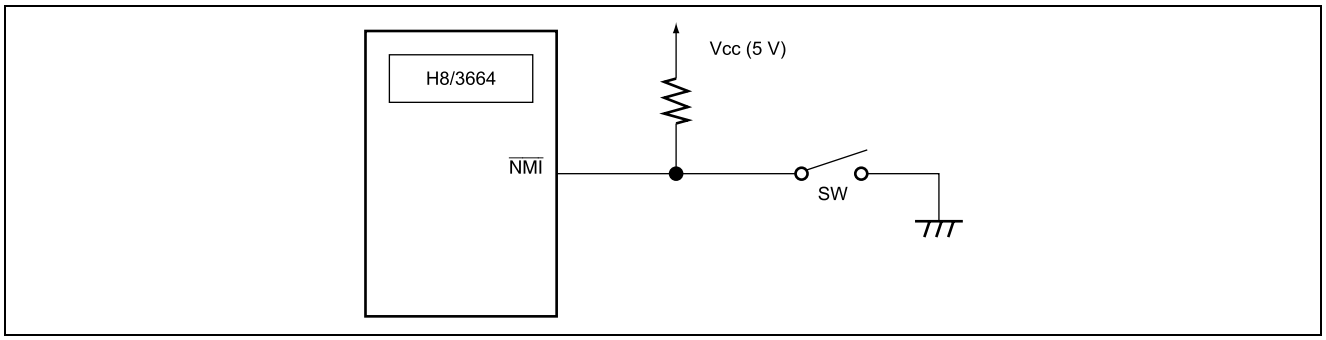


Figure 1.1 LED lighting/extinction operation

2. Description of Functions

1. In this task example, the counter is started by an NMI interrupt.
   Below, the NMI interrupt is explained.
   — The NMI interrupt is requested by an input signal to the $\overline{\text{NMI}}$ pin. Rising or falling edge sensing for the NMI interrupt can be specified using the NMIEG bit of the interrupt edge select register 1 (IEGR1).
   — An NMI interrupt request has highest priority and is always accepted regardless of the CCR I bit value.

2. Table 2.1 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
NMEG0	Sets detection edge direction for $\overline{\text{NMI}}$ pin input
PCR7	Sets P74 output pin function
PDR7	Stores data of P74 output pin
P74	Output pin for LED output

3. Description of Operations

Figure 3.1 explains the operation. Through the hardware and software processing shown in the figure, after a NMI interrupt is generated, the LED connected to the I/O port is lit and extinguished.

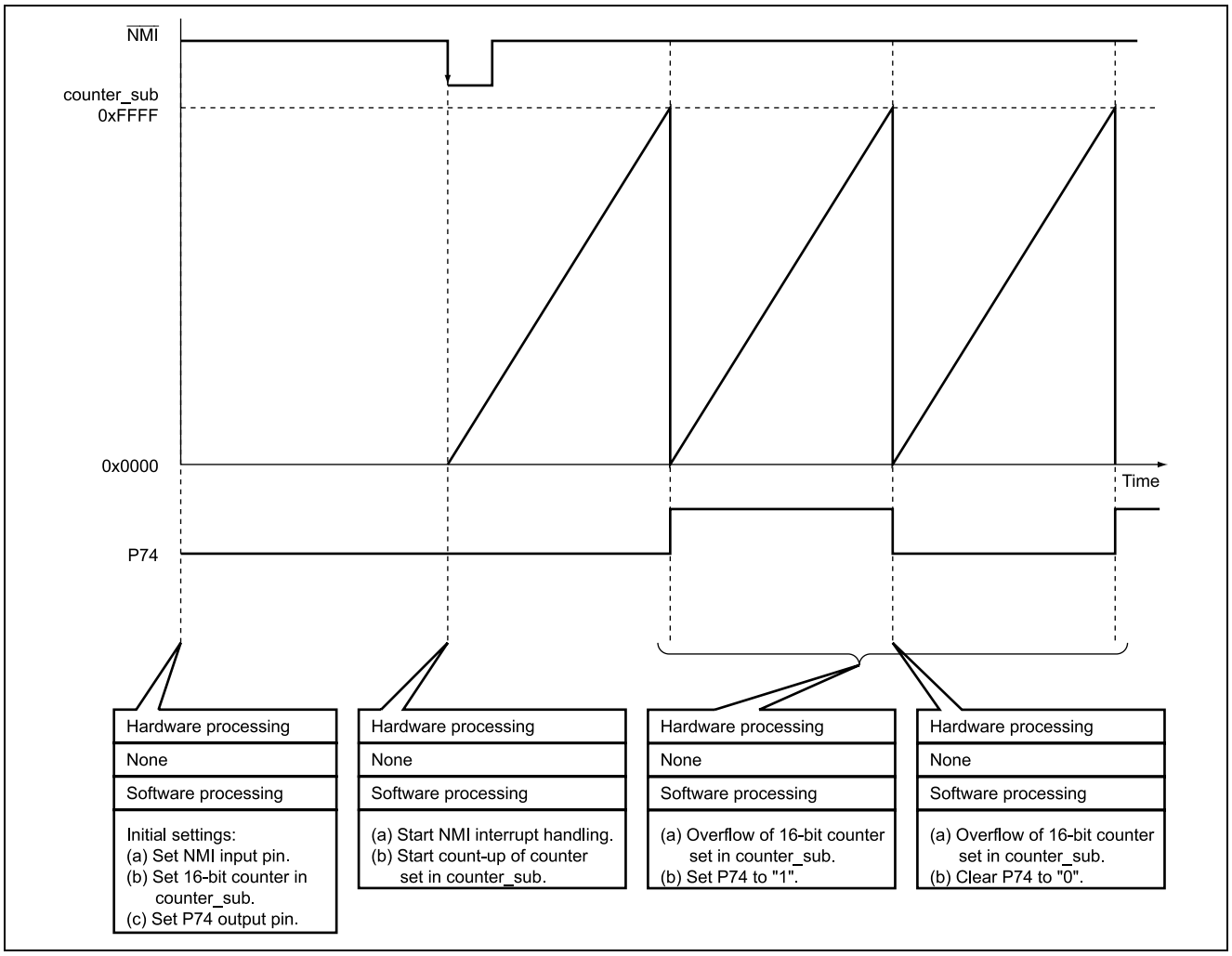


Figure 3.1 Explanation of operation to light and extinguish LED connected to the I/O port

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 NMI interrupt, sets LED output pin, increments 16-bit counter, and performs LED output
Switch on	NMI	In the NMI interrupt routine, sets SWO NF to 1

4.2 Description 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
IEGR1	NMIEG	Interrupt edge select register 2 (NMI edge select) NMIEG = 0: Detects the falling edge of the $\overline{\text{NMI}}$ pin input	H'FFF2 Bit 7	0

4.4 Description of RAM Used

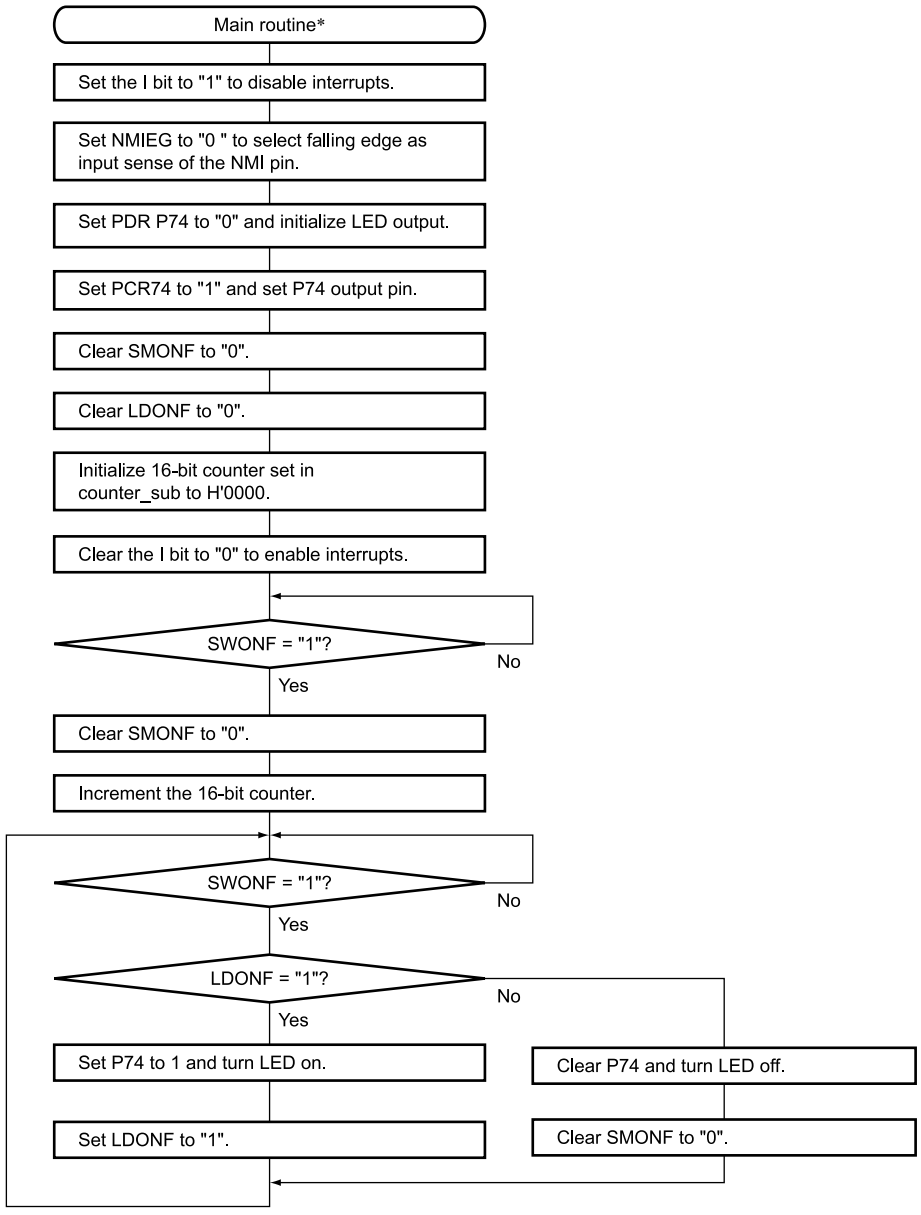
Table 4.3 describes the RAM used in this sample task.

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

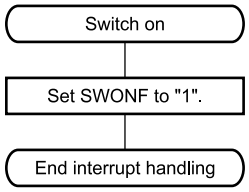
5. Flowcharts

1. Main routine



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

2. NMI 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                                                                                                                           */
/*                                                                                                                                              */
/*   'NMI Interrupt function                                                                                                                    */
/*                                                                                                                                              */
/*   Function                                                                                                                                   */
/*   : NMI                                                                                                                                      */
/*                                                                                                                                              */
/*   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   IEGR1          *(volatile unsigned char *)0xFFF2                    /* Interrupt Edge select Register1          */
#define   IEGR1_BIT      (*(struct BIT *)0xFFF2)                              /* Interrupt Edge select Register1          */
#define   NMIEG          IEGR1_BIT.b7                                         /* NMI Edge Serect                          */
#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    (NMI)
```

```
/************************************************************************************************************************/
/*   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      NMI( void );                                     /* NMI 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) = {                                   /* 0x0e - 0x0f                                */
     NMI                                                             /* 07 NMI                                     */
};

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

     NMIEG = 0;                                                      /* NMI Falling Edge Interrupt                 */

     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                       */

     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                              */
                  }
            }
}

/************************************************************************************************************************/
/*   NMI Interrupt                                                                                                      */
/************************************************************************************************************************/
void NMI( 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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