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H8/300H Tiny Series

Address Break

Introduction

An LED connected to P11 can be turned on and then off by an address break interrupt.

Target Device

H8/300H Tiny Series H8/36014 CPU

Contents

1. Specifications

- Connect an LED to P11 as shown in Figure 1.
- The LED is off when P11 = 0, and on when P11 = 1.
- First, turn the LED on.
- Generate address break interrupt processing to turn the LED connected to P11 off.

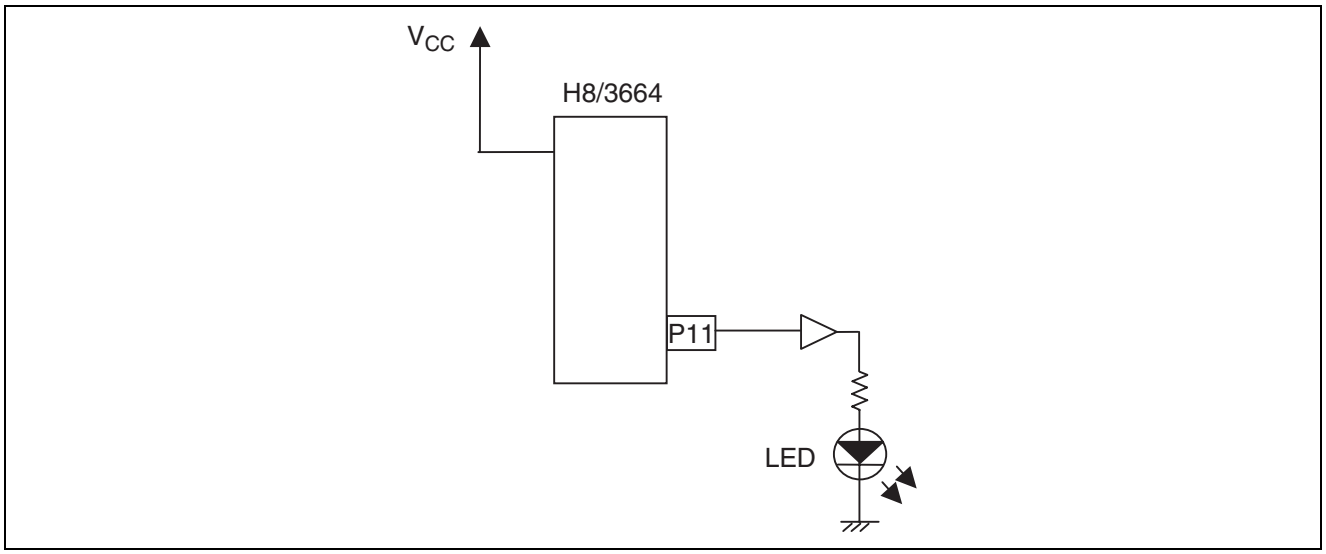


Figure 1 Example of Connecting an LED to the I/O Output Pin

2. Description of Functions

This sample task performs address break interrupt processing. Figure 2 illustrates address break interrupt processing, and is then followed by an explanation of an address break and port 1.

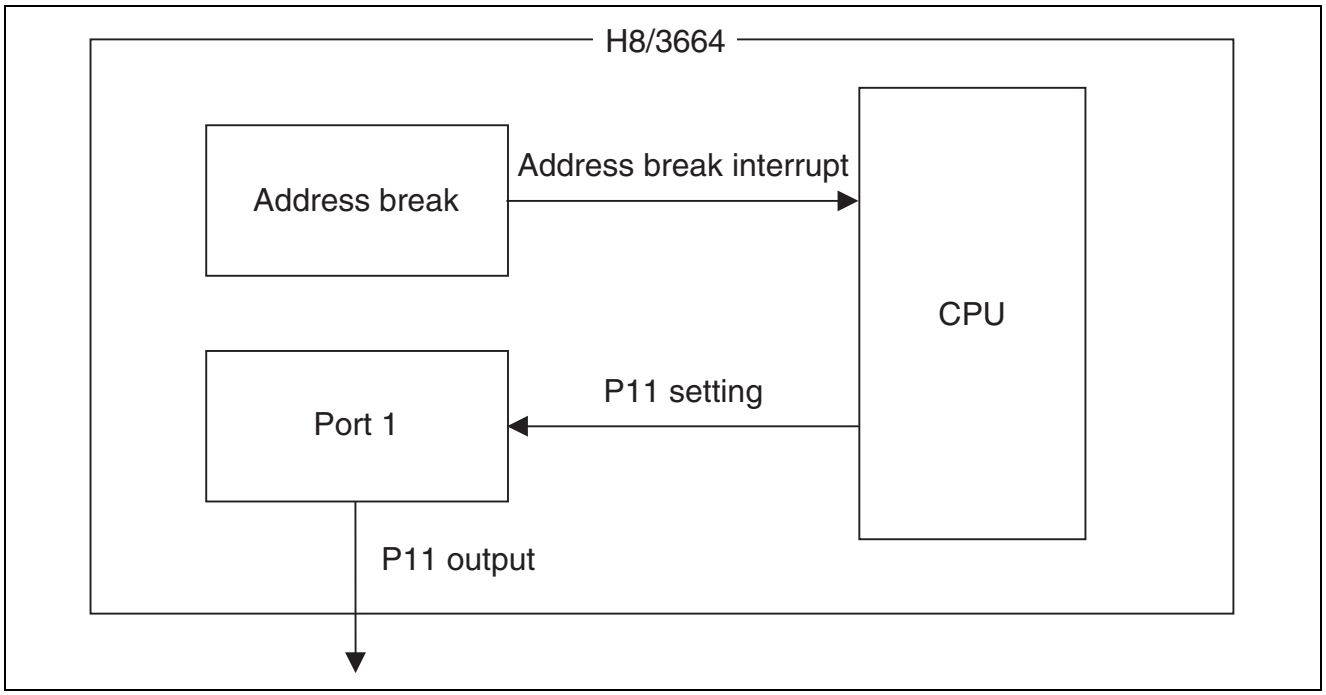


Figure 2 Address Break Interrupt Processing

1. Figure 3 illustrates an address break. Each item in the figure is explained below:
   - — Address break control register (ABRKCR)
     Sets an address break condition. In this sample task, an instruction execution cycle is set for the address break condition. The condition is satisfied after the instruction indicated by the address set in the BAR is executed.
   - — Break address register (BAR (BARH, BARL))
     Sets an address for generating an address break interrupt, using 16 bits. In this sample task, the BAR is set to H'011E. BARH is the upper eight bits and BARL is the lower eight bits.
   - — Address break interrupt request enable (ABIE)
     Enables an address break interrupt request.
   - — Address break interrupt request flag (ABIF)
     Set to 1 when the ABRKCR, BAR, and ABIE conditions are satisfied. At this time, address break interrupt processing starts.

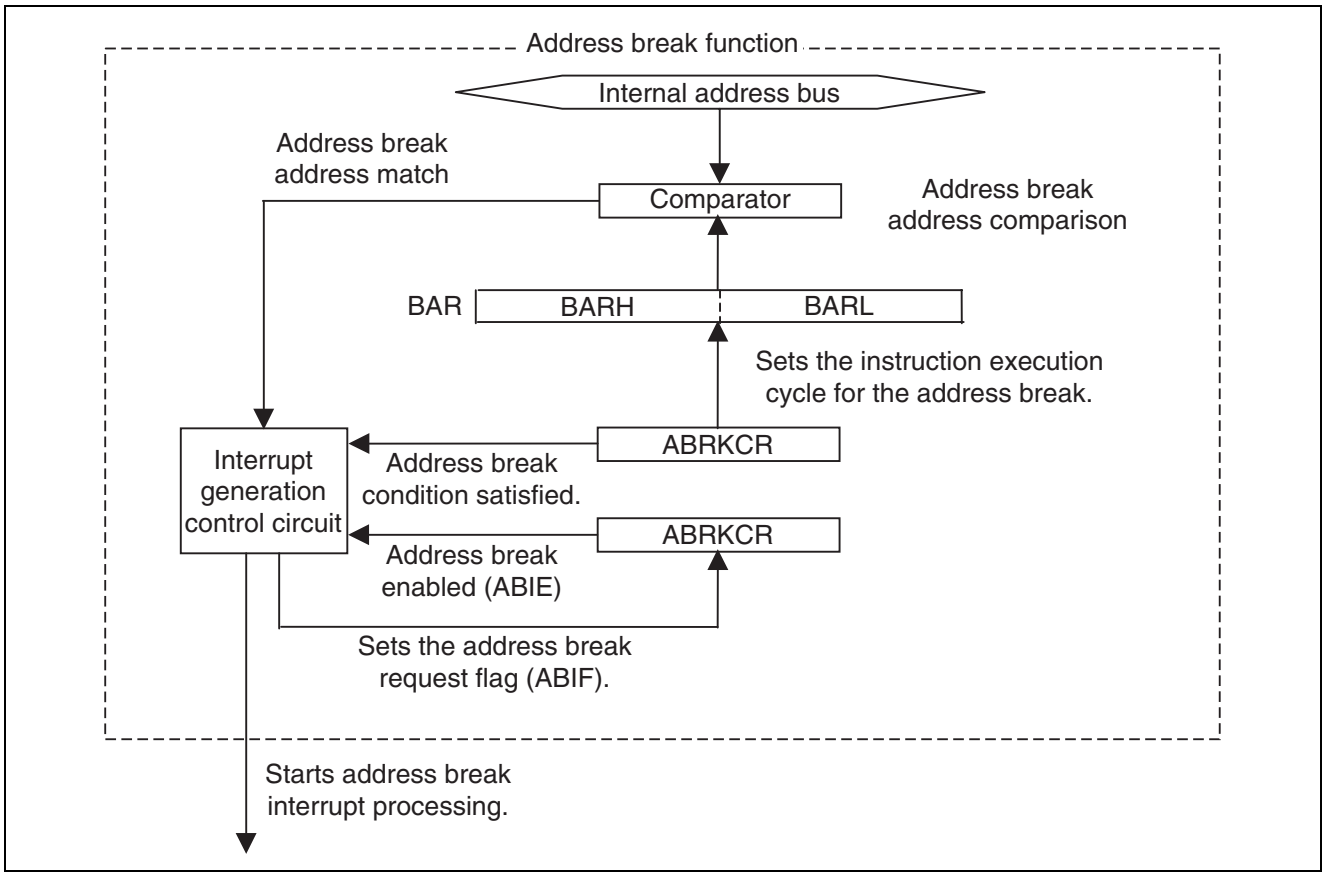


Figure 3 Address Break

2. Figure 4 shows port 1. Each item in the figure is explained below:
   — Port control register 1 (PCR1)
   Specifies, bit-by-bit, whether each of the general I/O ports of port 1 is an input or output pin.
   — Port data register 1 (PDR1)
   General I/O port register for port 1

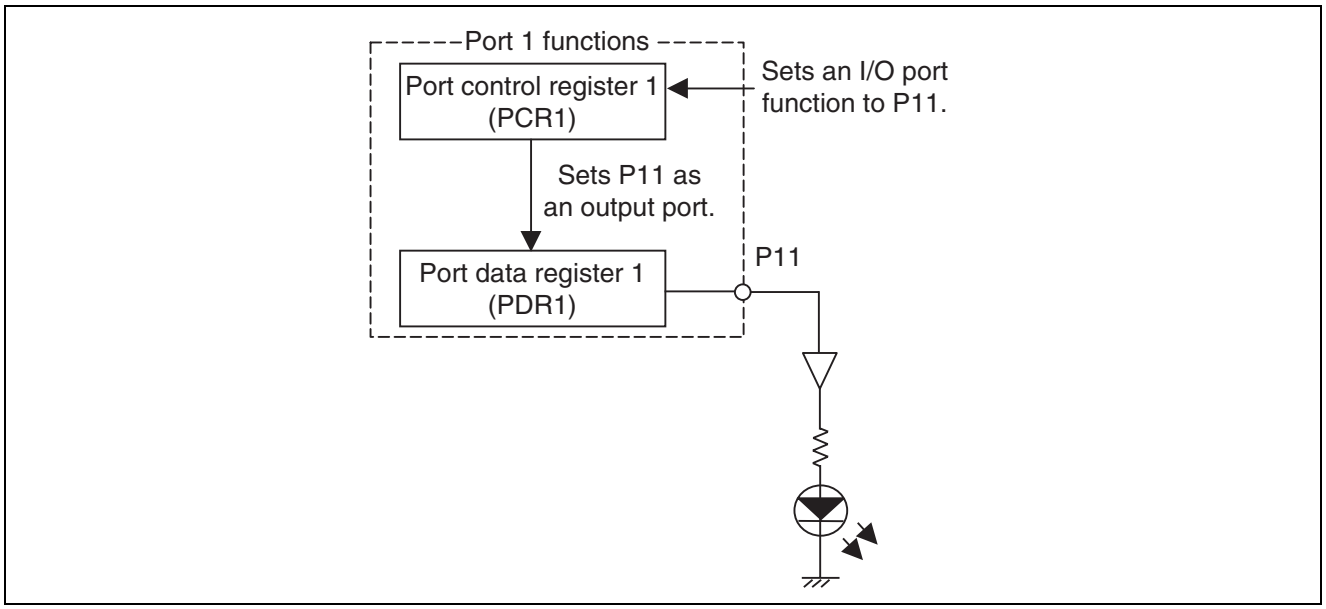


Figure 4 Port 1

3. Table 1 lists the function assignments of this sample task. Assign functions as listed in Table 1.

Table 1 Function Assignments

Function	Function assignment
ABRKCR	Sets the address break condition to an instruction execution cycle. Enables an RTE interrupt. The condition is satisfied after the instruction corresponding to the address set in the BAR is executed.
BAR (BARH, BARL)	Sets an address for generating an address break interrupt, using 16 bits. BARH is the upper eight bits while BARL is the lower eight bits.
ABIE	Enables address break interrupt processing.
ABIF	Set to 1 when the ABRKCR, BAR, and ABIE conditions are satisfied. At this time, address break interrupt processing starts.
PCR1	Sets P11 as an output port.
PDR1	Outputs the value of P11.

3. Description of Operation

Figure 5 illustrates the operations that are used. Hardware and software processing as shown in Figure 5 turn the LED connected to P11 on. Then, address break interrupt processing is generated and the LED is turned off. Address break interrupt processing is generated when the set break conditions are satisfied. This interrupt processing is not affected by the I bit of the CCR.

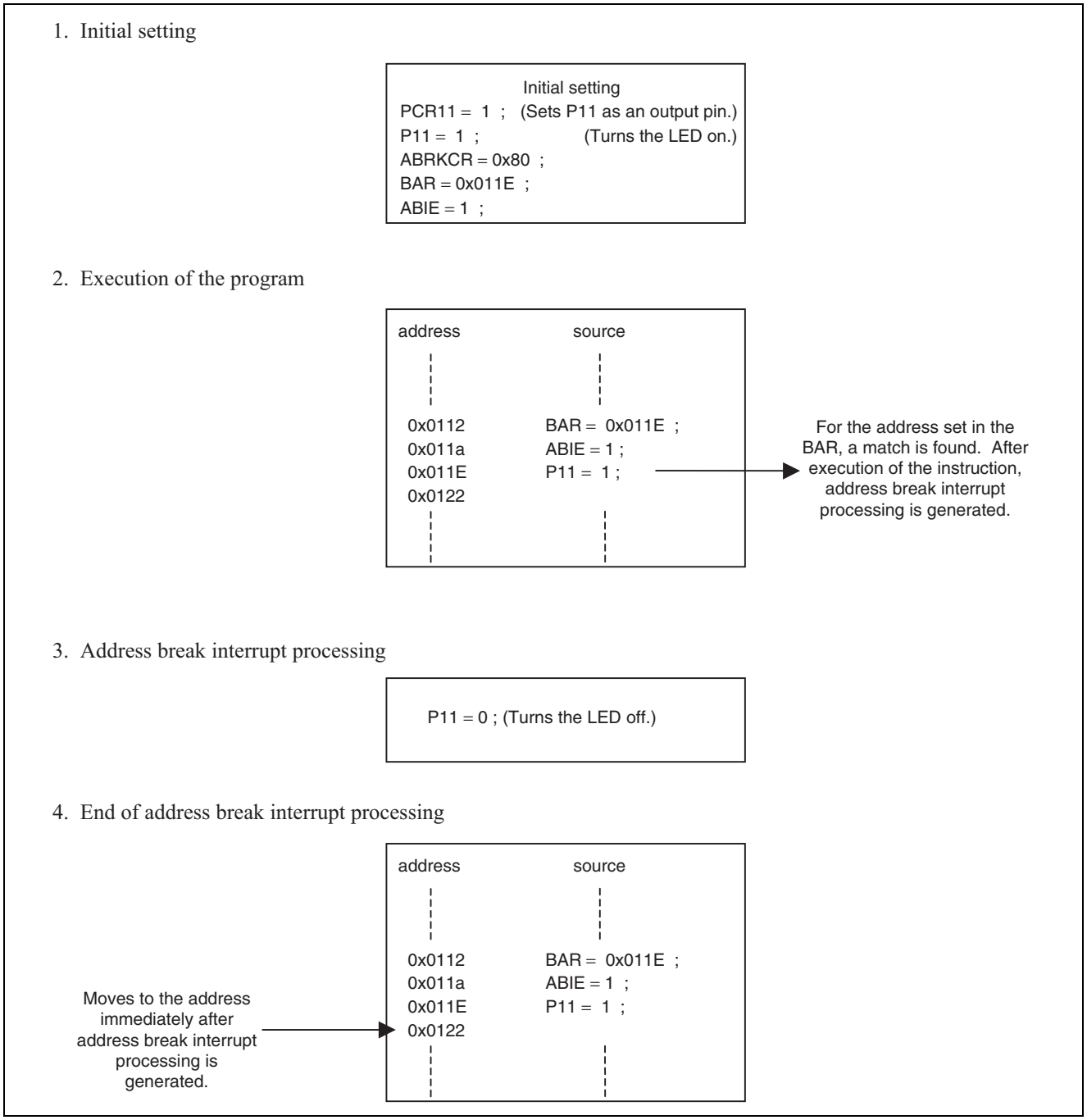


Figure 5 Operations Used

4. Description of Software

4.1 Modules

- Table 2 lists the modules used in this sample task.

Table 2 Modules

Module name	Label name	Function
Main routine	main	Sets the port 1 output function. Turns the LED on according to the setting of P11. Sets the address break condition.
Address break interrupt function	abcint	Turns the LED off according to the setting of P11.

4.2 Arguments

- No arguments are used in this sample task.

4.3 Internal Registers

- The following internal registers are used in this sample task:

— ABRKCR Address break control register Address: H'FFC8

Bit	Bit name	Setting	Function
7	RTINTE	1	RTE interrupt enable RTINTE = 0 Masks the interrupt immediately after the execution of the RTE instruction and always executes one instruction. RTINE = 1: Does not mask the interrupt.
6	CSEL1	0	Condition select 1 and 0
5	CSEL2	0	Sets the address break condition. CSEL1 = 0, ASEL = 0: Sets an instruction execution cycle.
4	ACMP2	0	Address compare 2 to 0
3	ACMP1	0	Sets the condition for comparison between the BAR and internal address bus. ACMP2 = 0, ACMP1 = 0, ACMP = 0: Performs 16-bit comparison.
2	ACMP0	0	
1	DCMP1	0	Data compare 1 and 0
0	DCMP0	0	Sets the condition for comparison between the BDR and internal data bus. DCMP1 = 0, DCMP0 = 0: Does not compare any data.

— ABRKSR Address break status register Address: H'FFC9

Bit	Bit name	Setting	Function
7	ABIF	0	Address break interrupt request flag ABIF = 1: When the condition set in the ABRKCR is satisfied ABIF = 0: Initial value, after the status of 1 is read , or when a value of 0 is written
6	ABIE	1	Specifies whether to enable an address break interrupt request. ABIE = 0: Masks the address break interrupt request. ABIE = 1: Enables the address break interrupt request.

— BAR Break address register Address: H'FFCA
(BARH Break address register H Address: H'FFCA)
(BARL Break address register L Address: H'FFCB)
Function: Sets an address for generating address break interrupt processing, using 16 bits.
Setting: H'011E

— PDR1 Port data register Address: H'FFD4

Bit	Bit name	Setting	Function
1	P11	1	Output data P11=0: P11 is low. P11=1: P11 is high.

— PCR1 Port control register 1 Address: H'FFE4

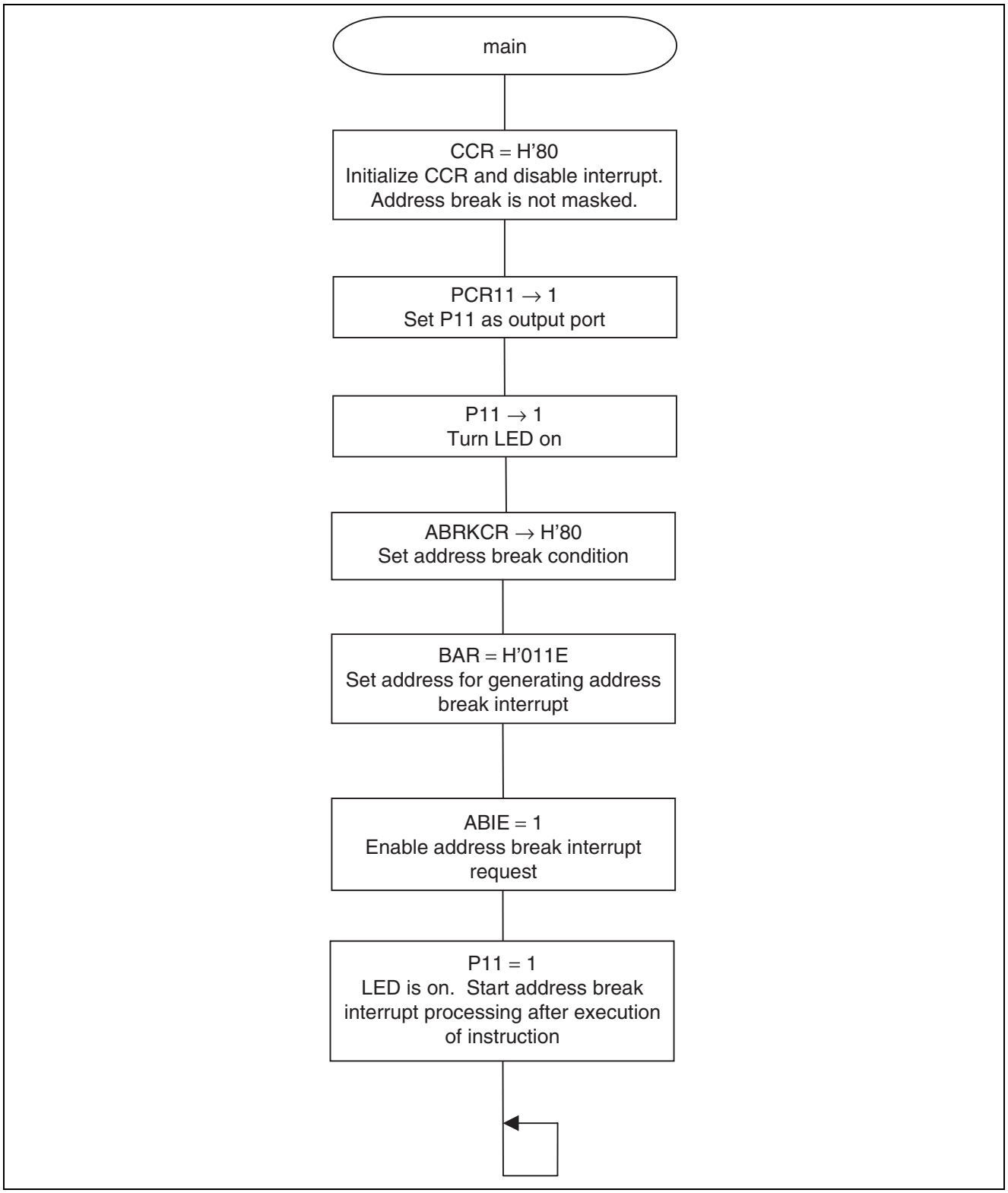
Bit	Bit name	Setting	Function
1	PCR11	1	Selects an I/O function. PCR11 = 0: Sets P11 as an input port. PCR11 = 1: Sets P11 as an output port.

4.4 RAM

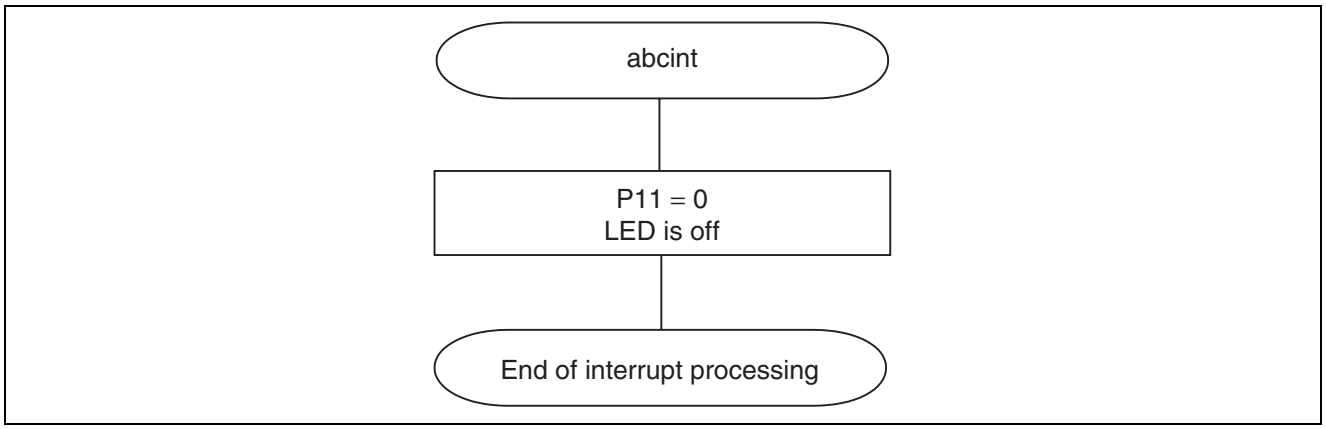
- No RAM is used in this sample task.

5. Flowchart

5.1 Main routine



5.2 Address break interrupt function



- Link Address Specifications

Section name	Address
CV1	H'0000
CV2	H'0018
P	H'0100

6. Program Listing

```
/************************************************************/
/*                                                          */
/*  H8/300HN Series -H8/3664-                               */
/*  Application Note                                        */
/*                                                          */
/*  'Address Break'                                         */
/*                                                          */
/*  External Clock : 16MHz                                  */
/*  Internal Clock : 16MHz                                  */
/*  Sub Clock      : 32.768kHz                              */
/*                                                          */
/************************************************************/

#include   <machine.h>

/************************************************************/
/*  Symbol Definition                                       */
/************************************************************/
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 ABRKCR     *(volatile unsigned char *)0xFFC8        /* Address Break Control Register   */
#define ABRKSR_BIT (*(struct BIT *)0xFFC9)                  /* Address Break Status Register    */
#define ABIE       ABRKSR_BIT.b6                            /* Address Break Interrupt Enable   */
#define BAR        *(volatile unsigned short *)0xFFCA       /* Break Address Register H         */
#define PCR1_BIT   (*(struct BIT *)0xFFE4)                  /* Port Control Register 1          */
#define PCR11      PCR1_BIT.b1                              /* Port Control Register 11         */
#define PDR1_BIT   (*(struct BIT *)0xFFD4)                  /* Port Data Register 1             */
#define P11        PDR1_BIT.b1                              /* Port 11                          */

#pragma interrupt  (abcint)
/************************************************************/
/*  Function define                                         */
/************************************************************/
void main ( void );
void abcint( void );

/************************************************************/
/*  Vector Address                                          */
/************************************************************/
#pragma section    V1                                       /* VECTOR SECTION SET               */
void (*const VEC_TBL1[])(void) = {
    main
};
```

```
#pragma section    V2                                          /* VECTOR SECTION SET              */
void (*const VEC_TBL2[])(void) = {
    abcint                                                     /* Address Break                   */
};

#pragma entry main(sp=0xFF80)
#pragma section                                                /* P                               */
/************************************************************/
/*  Main Program                                              */
/************************************************************/
void main ( void )
{
    set_ccr(0x80);                                             /* Initialize CCR/Interrupt Disable */

    PCR11 = 1;                                                 /* P11 set output port             */
    P11 = 1;                                                   /* P11 switching of High           */
    ABRKCR = 0x80;                                             /* Setup of Address Break condition */
    BAR = 0x011E;                                              /* Setup of Address Break          */
    ABIE = 1;                                                  /* Setup of Address Break Enable   */

    P11 = 1;                                                   /* P11 switching of High           */
    while(1);
}

/************************************************************/
/*  Address Break Interrupt                                   */
/************************************************************/
void abcint( void )
{
    P11 = 0;                                                   /* P11 switching of Low            */
}
```

Revision Record

Rev.	Date	Description	
		Page	Summary
1.00	Dec.20.03	—	First edition issued

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