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---

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Renesas Electronics Corporation

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H8SX Family
BFLD Bit Field Transfer

Introduction
Shows an example of C compiler use of the BFLD instruction.

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1. Specifications

- The H8SX family microcomputer BFLD instruction performs the following processing:
  - Performs low-order alignment of the field specified by the source operand, and transfers it to 8-bit register Rd.
  - Transfers a bit field specified by the source operand to the lower bits of a specified 8-bit general register Rd.
- In this sample task, bit transfer is performed using a C-language structure, and the assembly language code generated by the C compiler is shown.

![Figure 1 BFLD Instruction Processing](image-url)
2. Functions Used

This sample task shows an example of use of the BFLD instruction by the C compiler.

3. Principles of Operation

(1) To confirm BFLD instruction operation, a 1-byte RAM area (BFTST) is divided into three as a structure. The BFTST structure is shown in figure 2.

```
<table>
<thead>
<tr>
<th>Bit no.</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>BFTST.BYTE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HFTST.BIT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2  BFTST Structure
```

(2) Table 1 shows an example of a C program that reads the M area of the BFTST structure, and the assembly language code generated by the C compiler.

Table 1  BFLD Code

<table>
<thead>
<tr>
<th>Sample C Program</th>
<th>Sample Assembly language code Generated by the C compiler</th>
</tr>
</thead>
</table>
| void main(void) | _main:
| {              | .             |
| .              | .             |
| .              | .             |
| /* Write 1 byte of data to BFTST memory */ | ; Write 1 byte of data to BFTST memory
| BFTST.BYTE = 0x74 | MOV.B #H'74:8,0_BFTST:32 |
| /* Read bits 4 to 2 */ | ; Read bits 4 to 2, bit field transfer
| readdt = BFTST.BIT.M; | BFLD #H'1C,0_BFTST:32,R0L  |
| .              | MOV.B R0L,0_readdt:32 |
| }              | .             |
4. Development Environment

4.1 Development Support Tool

The development support tools of this sample task is shown in table 2.

Table 2 Development Support Tool Versions

<table>
<thead>
<tr>
<th>Software Name</th>
<th>Version Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>CH38.EXE</td>
<td>C compiler (H8S, H8/300 series C/C++ compiler) Ver. 6.0.00.005</td>
</tr>
<tr>
<td>ASM38.EXE</td>
<td>Assembler (H8S, H8/300 series cross assembler) Ver. 6.0.01.005</td>
</tr>
<tr>
<td>OPTLNK.EXE</td>
<td>Linkage editor (optimizing linkage editor) Ver. 8.0.00.020</td>
</tr>
<tr>
<td>LBG38.EXE</td>
<td>Library configuration tool (H8S, H8/300 series C/C++ standard library generator) Ver. 2.0.00.000</td>
</tr>
</tbody>
</table>

4.2 C compiler Option Settings

C compiler option settings for this sample task are shown in table 3.

Table 3 C compiler Option Settings

<table>
<thead>
<tr>
<th>Option</th>
<th>Set Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPu</td>
<td>H8SX:24:MD</td>
</tr>
<tr>
<td>Code</td>
<td>Machinecode</td>
</tr>
<tr>
<td>OPtimize</td>
<td>1</td>
</tr>
<tr>
<td>REGParam</td>
<td>3</td>
</tr>
<tr>
<td>SPeed</td>
<td>Register, SHift, STruct, Expression</td>
</tr>
</tbody>
</table>
5. Description of Software

5.1 Modules

Modules used by this sample task are shown in table 4.

<table>
<thead>
<tr>
<th>Module Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>main</td>
<td>Main routine</td>
</tr>
<tr>
<td></td>
<td>Writes 1-byte data to BFTST.BYTE, and stores contents of BFTST.BIT.M.</td>
</tr>
</tbody>
</table>

5.2 Arguments

No arguments are used by this sample task.

5.3 Internal Registers Used

No internal registers are used by this sample task.

5.4 RAM Usage

Table 5 describes RAM usage in this sample task.

<table>
<thead>
<tr>
<th>Label</th>
<th>Size</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>BFTST</td>
<td>1 byte</td>
<td>BFLD test memory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— BFTST.BIT.H: Bits 7 to 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— BFTST.BIT.M: Bits 4 to 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>— BFTST.BIT.L: Bits 1, 0</td>
</tr>
<tr>
<td>readdt</td>
<td>1 byte</td>
<td>Stores contents of BFTST.BIT.M</td>
</tr>
</tbody>
</table>
6. Flowcharts

6.1 Main Routine

```
main
  CCR = H'80
  Disable interrupts
  BFTST.BYTE = H'74
  Write 1 byte of data
  readdt = BFTST.BIT.M
  Stores data of bits 4 to 2
```

6.2 Link Address Specifications

<table>
<thead>
<tr>
<th>Section Name</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV1</td>
<td>H'000000</td>
</tr>
<tr>
<td>P</td>
<td>H'001000</td>
</tr>
<tr>
<td>B</td>
<td>H'FEC000</td>
</tr>
</tbody>
</table>
7. Program Listing

7.1 C Program

/*****************************/
/*
/* H8SX Family
/* Application Note
/*
/* 'Bit Field LoaD'
/*
/* Function
/* : BFLD
/*
/*
/*
/*****************************/

#include    <machine.h>

/*****************************/
/* Function define */
/*****************************/
void main ( void );

/*****************************/
/* RAM define */
/*****************************/
union {                                   /* Bit Field Test Memory          */
  unsigned char BYTE;
  struct {
    unsigned char   H :3;             /* bit7-5                         */
    unsigned char   M :3;             /* bit4-2                         */
    unsigned char   L :2;             /* bit1-0                         */
  } BIT;
}BFTST;

unsigned char readdt;                    /* Store memory                     */

/*****************************/
/* Vector Address */
/*****************************/
#pragma section     V1                  /* VECTOR SECTOIN SET               */
void (*const VEC_TBL1[])(void) = {
  main                                /* 00 Reset                         */
};

#pragma entry main(sp=0xFFC000)
#pragma section                         /* P                                */
/*****************************/
/* Main Routine */
/*****************************/
void main ( void )
{
    set_ccr(0x80);                      /* Initialize CCR/Interrupt Disable */
    BFTST.BYTE = 0x74;                  /* Set H'74 --> B'01110100          */
    readdt = BFTST.BIT.M;               /* Store B'101 --> H'5              */
    while(1);
}

7.2 Assembly Language Code Generated by the C compiler

;*** File main.c    , Line 50              ; function: main
  _main:                               ; section
  00000000                      _main:
  00000000 7A0700FFC000           MOV.L       #16760320,SP
  00000006 F980                   MOV.B       #128:8,R1L
  00000008 0309                   LDC.B       R1L,CCR
  0000000A 017D487400000000       MOV.B       #116:8,@_BFTST:32
  00000012 6A3000000000F81C       BFLD        #28,@_BFTST:16,R0L
  0000001A 6AA800000000       MOV.B       R0L,@_readdt:32
  00000020                    L42:
  00000020 4000                   BRA         L42:8

;*** File main.c    , Line 57              ; section
  _BFTST:                              ; static: Dummy
  00000000                      _BFTST:
  00000000 00000001               .RES.B      1
  00000001                      _readdt:   ; static: readdt
  00000001 00000001               .RES.B      1
  _VEC_TBL1:                           ; static: VEC_TBL1
  00000000                      _VEC_TBL1:
  00000000 00000000               .DATA.L     _main
## Revision Record

<table>
<thead>
<tr>
<th>Rev.</th>
<th>Date</th>
<th>Page</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>Sep.15.04</td>
<td>—</td>
<td>First edition issued</td>
</tr>
</tbody>
</table>
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