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April 1st, 2010
Renesas Electronics Corporation

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H8/300L Series

Sorting (SORT)

Introduction

1. The software SORT sorts, on a byte-by-by basis, the data placed in the data memory into largest-to-smallest order (descending order).
2. The number of data items to be sorted can be specified within the range of 1 to 255.
3. Data to be sorted is represented as unsigned integers.

Target Device

H8/300L Series

Contents

1. Arguments

Description		Memory area	Data length (bytes)
Input	Number of data items to be sorted – 1	R0L	1
	Start address of the data to be sorted	R4	2
Output	—	—	—

2. Changes to Internal Registers and Flags

R0	R1	R2	R3	R4	R5	R6	R7
×	×	•	•	×	×	•	•

I	U	H	U	N	Z	V	C
•	•	×	•	×	×	×	×

• : No change
× : Undefined
↕ : Result

3. Specifications

Program memory (bytes)
34
Data memory (bytes)
0
Stack (bytes)
0
Clock cycle count
789482
Reentrant
Possible
Relocation
Possible
Interrupt
Possible

4. Note

The clock cycle count (789482) in the specifications is for sorting 255 bytes of data into descending order.

5. Description

5.1 Details of functions

1. The following arguments are used with the software SORT:
   R0L: Sets the number of bytes of data to be sorted – 1 as an input argument.
   R4: Sets the start address of the data to be sorted (stored in RAM).
2. The following figure illustrates the execution of the software SORT. When the input arguments are set as shown in (1), the data is sorted in descending order as shown in (2).

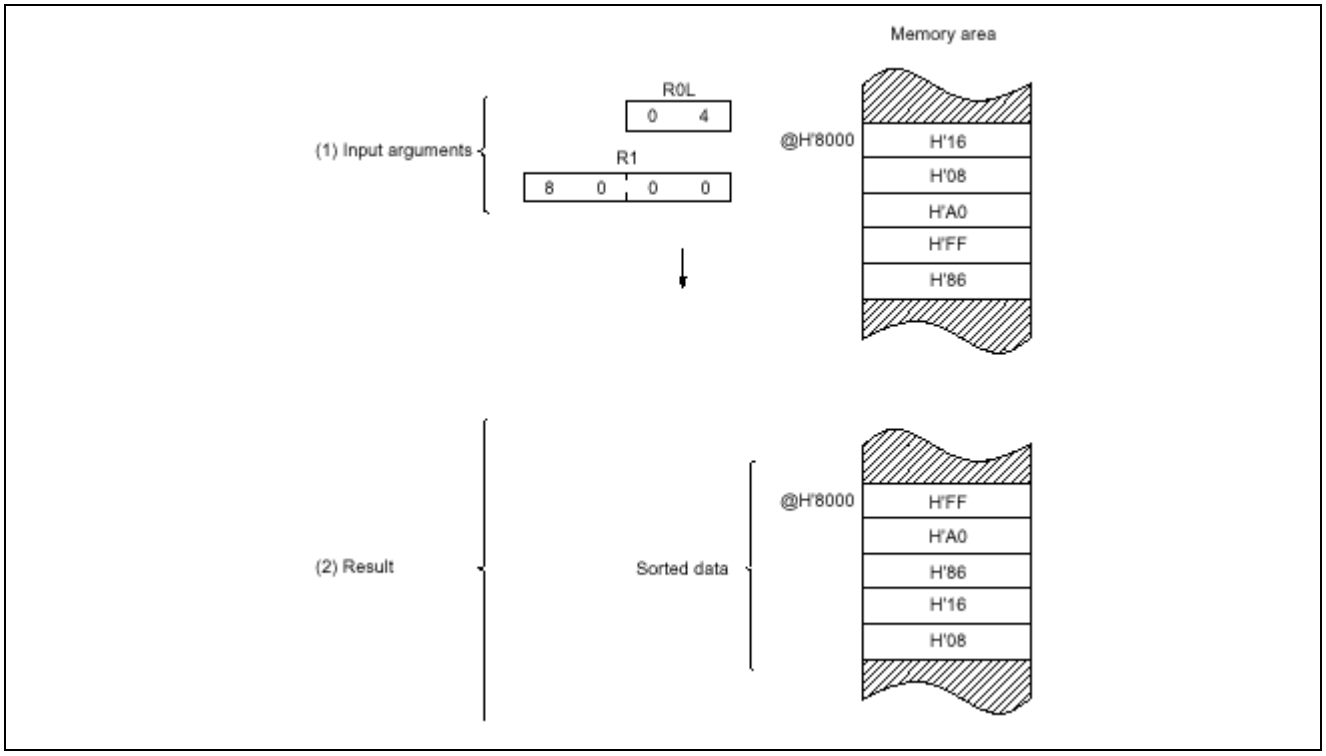


Figure 5.1 Example of Software SORT Execution

5.2 Notes on usage

1. Do not set "0" in R0L; otherwise, the software SORT will not operate normally.
2. R0L must contain the number of bytes of data to be sorted - 1.

5.3 Data memory

The software SORT uses no data memory.

5.4 Example of use

Set the input arguments in registers and call the software SORT as a subroutine.

```
WORK1    .RES. B   1             ........ Reserves a data memory area in which the
                                          user program places the number of bytes
                                          of data to be sorted.
WORK2    .RES. B   255           ........ Reserves a data memory area in which the
                                          user program places the data to be sorted.
           :
         MOV. B    @WORK1, R0L   ........ Places in the input argument the number of
                                          bytes of data to be sorted set by the user
         MOV. W    #WORK2 R4     ........ Places in R4 the start address of the data
                                          to be sorted set by the user program.
         JSR       @SORT         ........ Calls the software SORT as a subroutine.
           :
```

5.5 Operation

1. The following figure shows an example where 3 items of data are sorted into largest-to-smallest order.

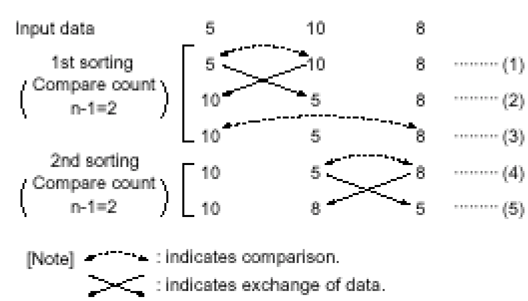
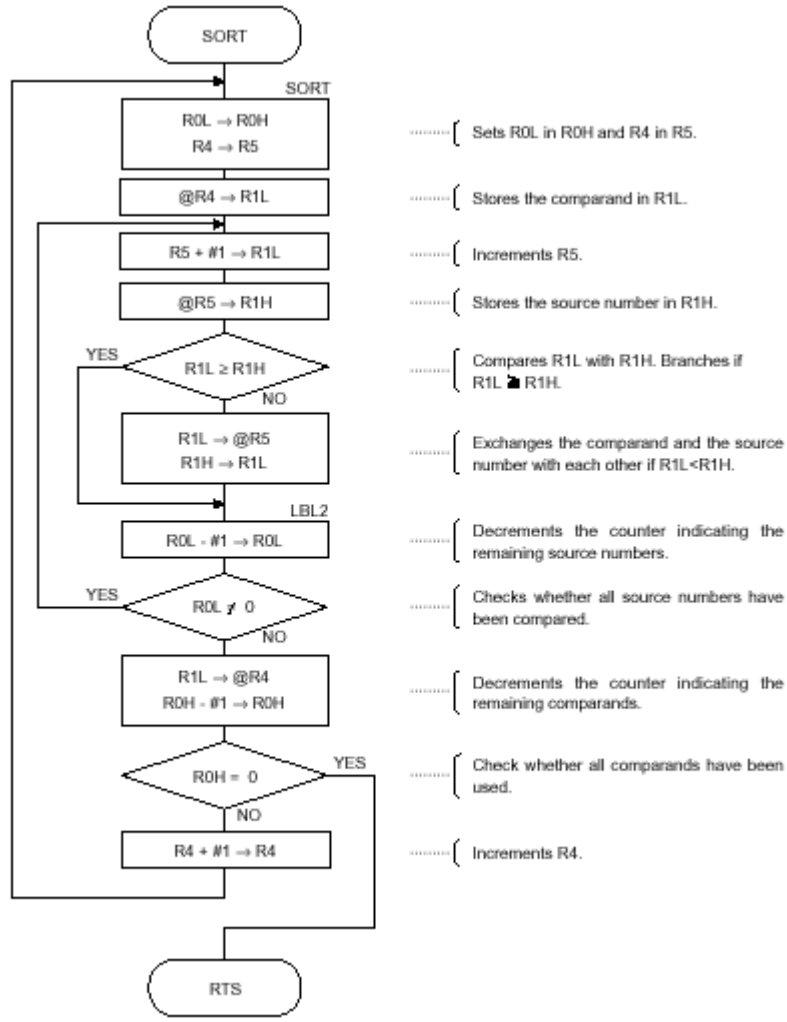


Figure 5.2 Example of Sorting

   A. The largest number of the 3 input data values is identified and placed at the far left ((1), (2) and (3) in the figure).
   B. Next, the larger of the second number from left and the last number is found and placed in the second position from left ((4) and (5) in the figure).
2. Processing by the program
   A. R4 is used as the pointer for placing the largest number. R5 is used as the pointer to the address of the memory area containing the number to be compared.
   B. The comparand is placed in R1L.
   C. The number to be compared is placed in R1H.
   D. R1H is compared with R1L. If the number to be compared is greater than the comparand (R1H > R1L), the two numbers are exchanged.
   E. Steps C and D is repeated until the counter R0L, indicating the number of remaining data items to be compared, reaches "0".
   F. When R0L reaches "0", the data stored in @R4 is the largest of the data items that have been compared in the current round of comparisons.
   G. The R0H, a counter that indicates how many data items remain for use as comparands, is decremented.

6. Flowchart


SORT
SORT
R0L → R0H
R4 → R5
Sets R0L in R0H and R4 in R5.
@R4 → R1L
Stores the comparand in R1L.
R5 + #1 → R1L
Increments R5.
@R5 → R1H
Stores the source number in R1H.
YES
R1L ≥ R1H
NO
Compares R1L with R1H. Branches if R1L ≥ R1H.
R1L → @R5
R1H → R1L
Exchanges the comparand and the source number with each other if R1L<R1H.
LBL2
R0L - #1 → R0L
Decrements the counter indicating the remaining source numbers.
YES
R0L ≠ 0
NO
Checks whether all source numbers have been compared.
R1L → @R4
R0H - #1 → R0H
Decrements the counter indicating the remaining comparands.
R0H = 0
YES
NO
Check whether all comparands have been used.
R4 + #1 → R4
Increments R4.
RTS

7. Program List

```
*** H8/300 ASSEMBLER VER 1.0B ** 08/18/92 10:26:21
PROGRAM NAME =
1                                       ;*******************************************************************************
2                                       ;*
3                                       ;*      00 - NAME               :SORTING (SORT)
4                                       ;*
5                                       ;*******************************************************************************
6                                       ;*
7                                       ;*      ENTRY                   :R0L (BYTE NUMBER)
8                                       ;*                               R4 (START ADDRESS OF DATA)
9                                       ;*
10                                      ;*      RETURN                  :NOTHING
11                                      ;*
12                                      ;*******************************************************************************
13                                      ;
14      SORT_cod C      0000                    .SECTION                SORT_code,CODE,ALIGN=2
15                                              .EXPORT                 SORT
16                                      ;
17      SORT_cod C              00000000        SORT    .EQU $                  ;Entry point
18      SORT_cod C      0000    0C80                    MOV.B   R0L,R0H         ;Set data counter
19      SORT_cod C      0002    0D45                    MOV.W   R4,R5            ;R4 -> R5
20      SORT_cod C      0004    6849                    MOV.B   @R4,R1L         ;@R4 -> data1
21      SORT_cod C      0006                    LBL1
22      SORT_cod C      0006    0B05                    ADDS.W  #1,R5           ;Increment address pointer1 (R5++)
23      SORT_cod C      0008    6851                    MOV.B   @R5,R1H         ;@R5 -> data2
24      SORT_cod C      000A    1C19                    CMP.B   R1H,R1L
25      SORT_cod C      000C    4404                    BHS     LBL2            ;Branch if C = 0
26      SORT_cod C      000E    68D9                    MOV.B   R1L,@R5         ;Store data1 @R5
27      SORT_cod C      0010    0C19                    MOV.B   R1H,R1L         ;data2 -> data1
28      SORT_cod C      0012                    LBL2
29      SORT_cod C      0012    1A00                    DEC.B   R0H             ;Decrement data counter
30      SORT_cod C      0014    46F0                    BNE     LBL1            ;Branch if Z=0
31      SORT_cod C      0016    68C9                    MOV.B   R1L,@R4         ;data1 -> @R4
32      SORT_cod C      0018    1A08                    DEC.B   R0L             ;Decrement byte number
33      SORT_cod C      001A    4704                    BEQ     EXIT            ;Branch Z=0
34      SORT_cod C      001C    0B04                    ADDS.W  #1,R4           ;Increment address pointer2 (R4++)
35      SORT_cod C      001E    40E0                    BRA     SORT            ;Branch always
36      SORT_cod C      0020                    EXIT
37      SORT_cod C      0020    5470                    RTS
38                                      ;
39                                              .END
*****TOTAL ERRORS 0
*****TOTAL WARNINGS 0
```

Revision Record

Rev.	Date	Description	
		Page	Summary
1.00	Sep.18.03	—	First edition issued

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