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Renesas Electronics Corporation

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H8/300H Tiny Series

Sorting (SORT)

Introduction

Sorts the data (unsigned, 16 bits) in a data table into largest-to-smallest order. The maximum number of data items is 65535.

Target Device

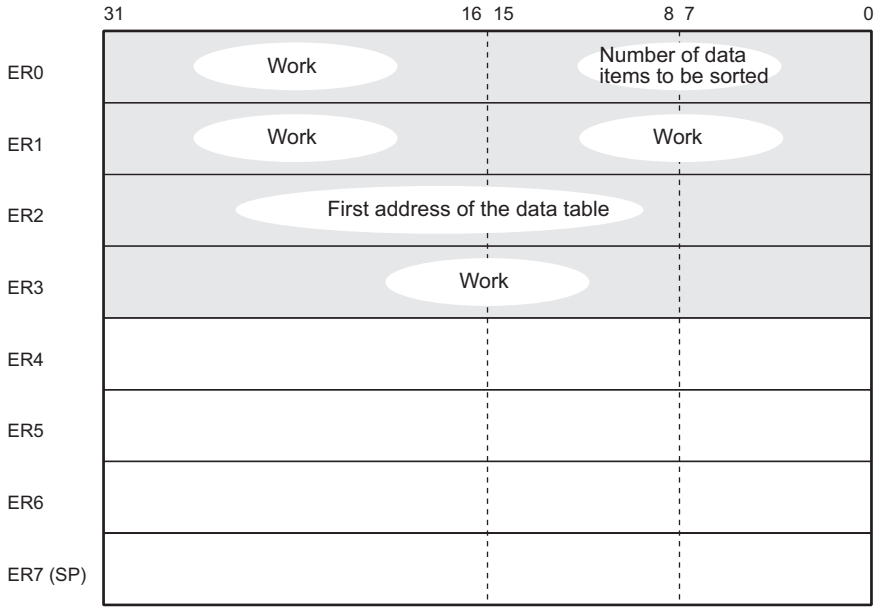
H8/300H Tiny Series

Contents

1. Arguments

Contents		Storage Location	Data Length (Bytes)
Input	Number of data items to be sorted	R0	2
	First address of the data table	ER2	4
Output	—	—	—

2. Changes to Internal Registers and Flags



I	UI	H	U	N	Z	V	C
—	—	0	—	0	1	0	0

—: No change
↕: Varies
0: Fixed to 0
1: Fixed to 1

3. Programming Specifications

Program memory (bytes)
32
Data memory (bytes)
0
Stack (bytes)
0
Number of cycles
404
Re-entrant
Yes
Relocatable
Yes
Interrupts during execution
Yes

4. Note

The number of cycles in the programming specifications is the value for the sorting of 5 words of data from smallest-to-largest into largest-to-smallest order.

5. Description

5.1 Description of Functions

1. The arguments are as follows.
   R0: Set the number of data items to be sorted.
   ER2: Set the first address of the data table.
2. The following figure illustrates the execution of the SORT subroutine. When the input arguments are set as shown, the subroutine sorts the data in the table into largest-to-smallest order.

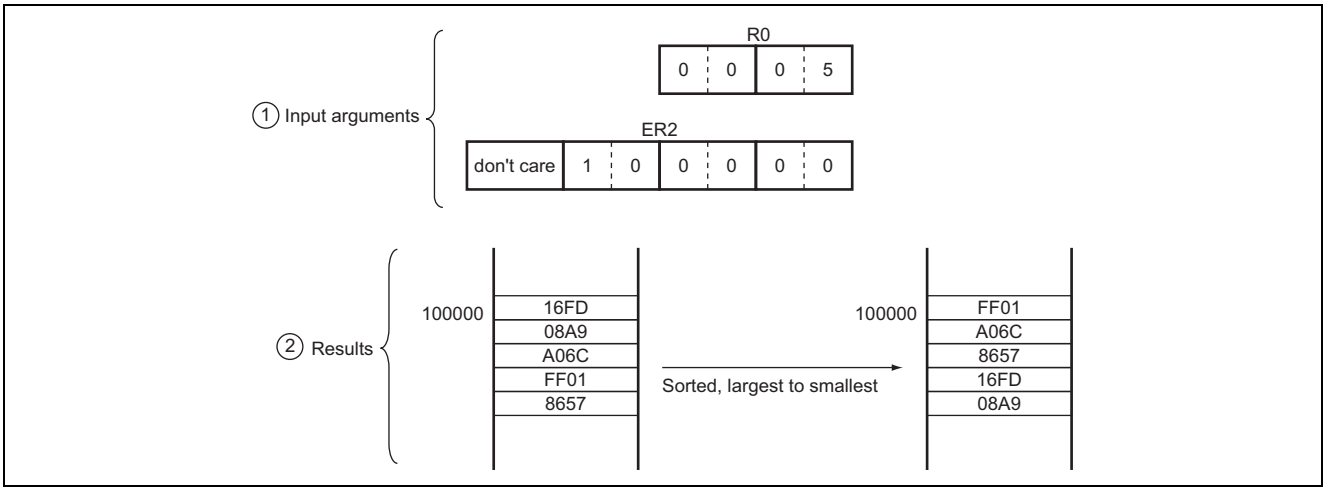


Figure 1 Example of SORT Execution

5.2 Description of Data Memory

No data memory is used by SORT.

5.3 Example of Usage

After setting the first address of the data table and the number of data items to be sorted, call the SORT subroutine.

```
WORK1   . RES. W 1          ..... Reservation of the data memory area for setting of the number of data items for soting by the
                                  user program.
WORK2   . RES. L 1          ..... Reservation of the data memory area for setting of first address of the data table by the user
                                  program.
        MOV. W @WORK1, R0   ..... Sets, as an input argument, the number of data items for soting specified by the user program.

        MOV. L @WORK2, ER2  ..... Sets, as an input argument, the first address of the data table specified by the user program.

        JSR    @SORT        ..... Subroutine call of SORT.
          .
          .
          .
```

5.4 Principles of Operation

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

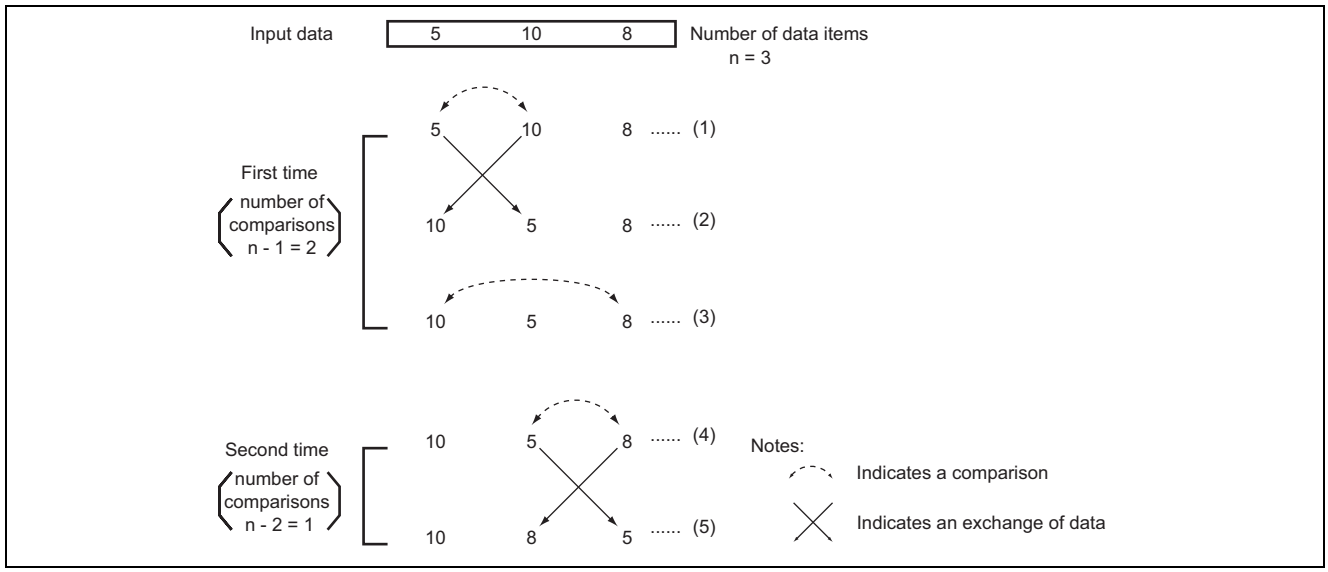
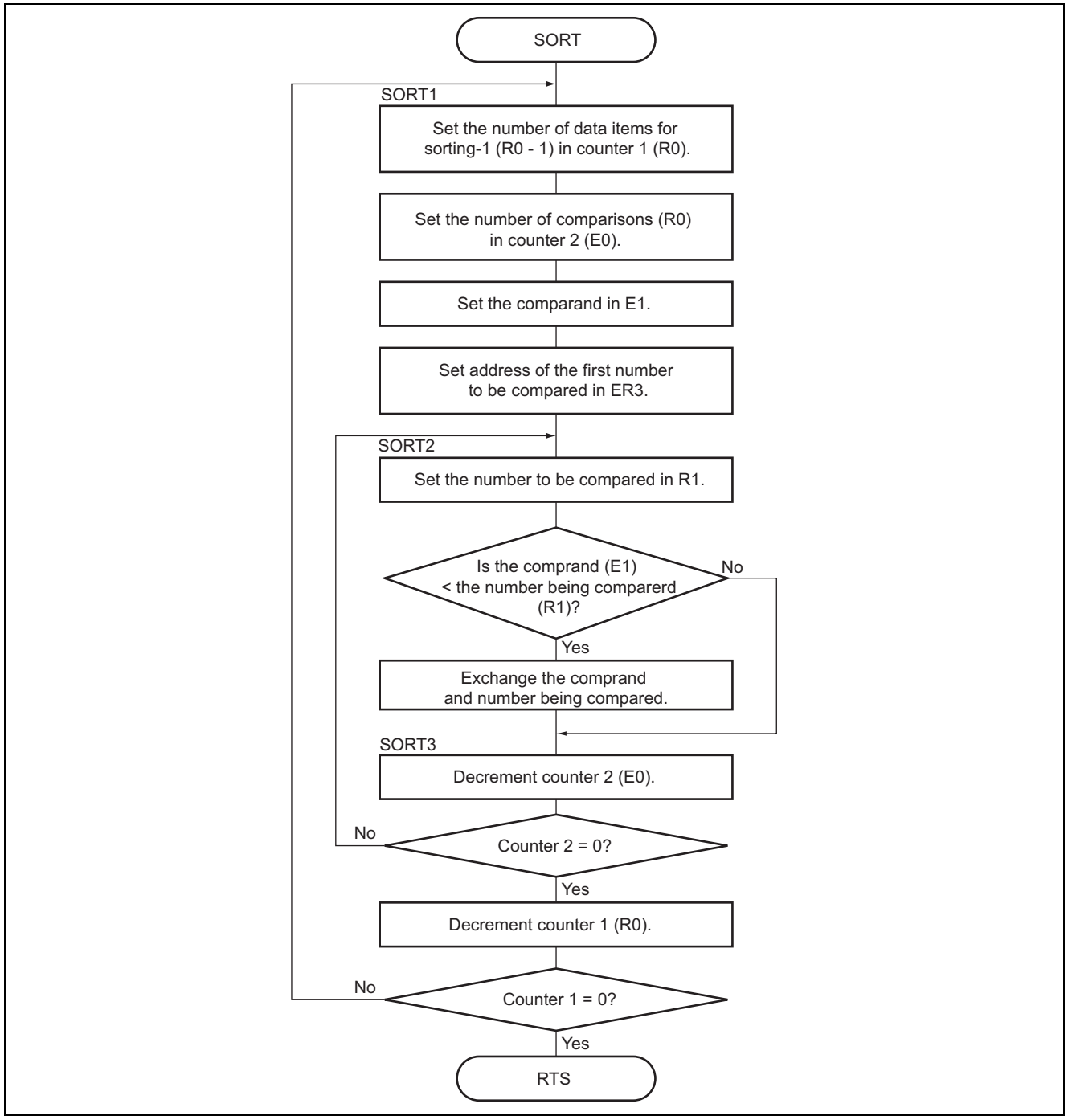


Figure 2 Example of Sorting

1) The largest number of the 3 input data values is identified and placed at the far left ((1), (2) and (3) in the figure).
2) 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. Method of Processing by the Program
   1) The comparand (reference data) is set in E1 and the number to be compared with it is set in R1; the comparison is then carried out. Since the comparand is supposed to be the larger of the two, the data are exchanged whenever the number being compared is the larger.
   2) ER3 is used as a pointer to the address of the number to be compared. Post-increment register indirect addressing is used to load these numbers, so that the pointer is incremented to the address of the next number to be compared.
   3) E0 counts the number of comparisons that remain to be done. E0 is decremented after each comparison, and the process is repeated until E0 reaches 0.
   4) ER2 indicates the address where the maximum value in the current round of comparisons is stored. Post-increment register indirect addressing is used to increment ER2 to the address of the next comparand.
   5) R0 is used as a counter that indicates how many data items remain for use as comparands. Each time a maximum value is identified, R0 is decremented and this process is repeated until R0 reaches 0.

6. Flowchart


SORT
SORT1
Set the number of data items for sorting-1 (R0 - 1) in counter 1 (R0).
Set the number of comparisons (R0) in counter 2 (E0).
Set the comparand in E1.
Set address of the first number to be compared in ER3.
SORT2
Set the number to be compared in R1.
Is the comprand (E1) < the number being comparerd (R1)?
No
Yes
Exchange the comprand and number being compared.
SORT3
Decrement counter 2 (E0).
No
Counter 2 = 0?
Yes
Decrement counter 1 (R0).
No
Counter 1 = 0?
Yes
RTS

7. Program Listing

```
 1                                1    ;*********************************************************************
 2                                2    ;*                                                                   *
 3                                3    ;*        NAME     :    SORTING   (SORT)                            *
 4                                4    ;*                                                                   *
 5                                5    ;*********************************************************************
 6                                6    ;*                                                                   *
 7                                7    ;*        ENTRY:       R0          (NUMBER OF DATA FOR SORTING)       *
 8                                8    ;*                     ER2         (START ADDRESS OF DATA FOR SORTING) *
 9                                9    ;*        RETURNS:     ER0         NOTHING                            *
10                               10    ;*                                                                   *
11                               11    ;*********************************************************************
12                               12    ;
13                               13              .CPU          300HA
14    001000                     14              .SECTION A,CODE,LOCATE=H'001000
15             00001000          15    SORT      .EQU          $           ;Entry point
16    001000   1B50              16              DEC.W         #1,R0       ;Set loop1 counter
17    001002   0D08              17    SORT1     MOV.W         R0,E0       ;Set loop2 counter
18    001004   6929              18              MOV.W         @ER2,E1     ;Load base data
19    001006   0FA3              19              MOV.L         ER2,ER3     ;Set first compare-data address
20    001008   0B83              20              ADDS          #2,ER3      ;
21    00100A   6D31              21    SORT2     MOV.W         @ER3+,R1    ;Load compare data
22    00100C   1D19              22              CMP.W         R1,E1       ;
23    00100E   58400008          23              BCC           SORT3       ;Branch if base data > compare data
24    001012   6DB9              24              MOV.W         E1,@-ER3    ;Exchange the data
25    001014   69A1              25              MOV.W         R1,@ER2     ;
26    001016   0D19              26              MOV.W         R1,E1       ;
27    001018   0B83              27              ADDS          #2,ER3      ;
28    00101A   1B58              28    SORT3     DEC.W         #1,E0       ;
29    00101C   46EC              29              BNE           SORT2       ;
30    00101E   0B82              30              ADDS          #2,ER2      ;
31    001020   1B50              31              DEC.W         #1,R0       ;
32    001022   46DE              32              BNE           SORT1       ;
33    001024   5470              33              RTS
34                               34              .END
***** TOTAL    ERRORS      0
***** TOTAL    WARNINGS    0
```

Note: The program listing included in this application note assumes compilation under the option for the advanced mode of H8/300H CPU. If you use this sample program with an H8/300H Tiny Series product, make the following change to the program code:

.CPU 300HA → .CPU 300HN

Revision Record

Rev.	Date	Description	
		Page	Summary
2.00	Feb.28.06	—	Format has been changed from Hitachi version to Renesas version.

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