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April 1st, 2010
Renesas Electronics Corporation

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April 1, 2003

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APPLICATION NOTE**Counting the Number of Logical-1 Bits in 8-Bit Data (HCNT)****Introduction**

Counts the number of logical-1-valued bits in 8-bit data.

Target Device

H8/300H Series

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Cautions

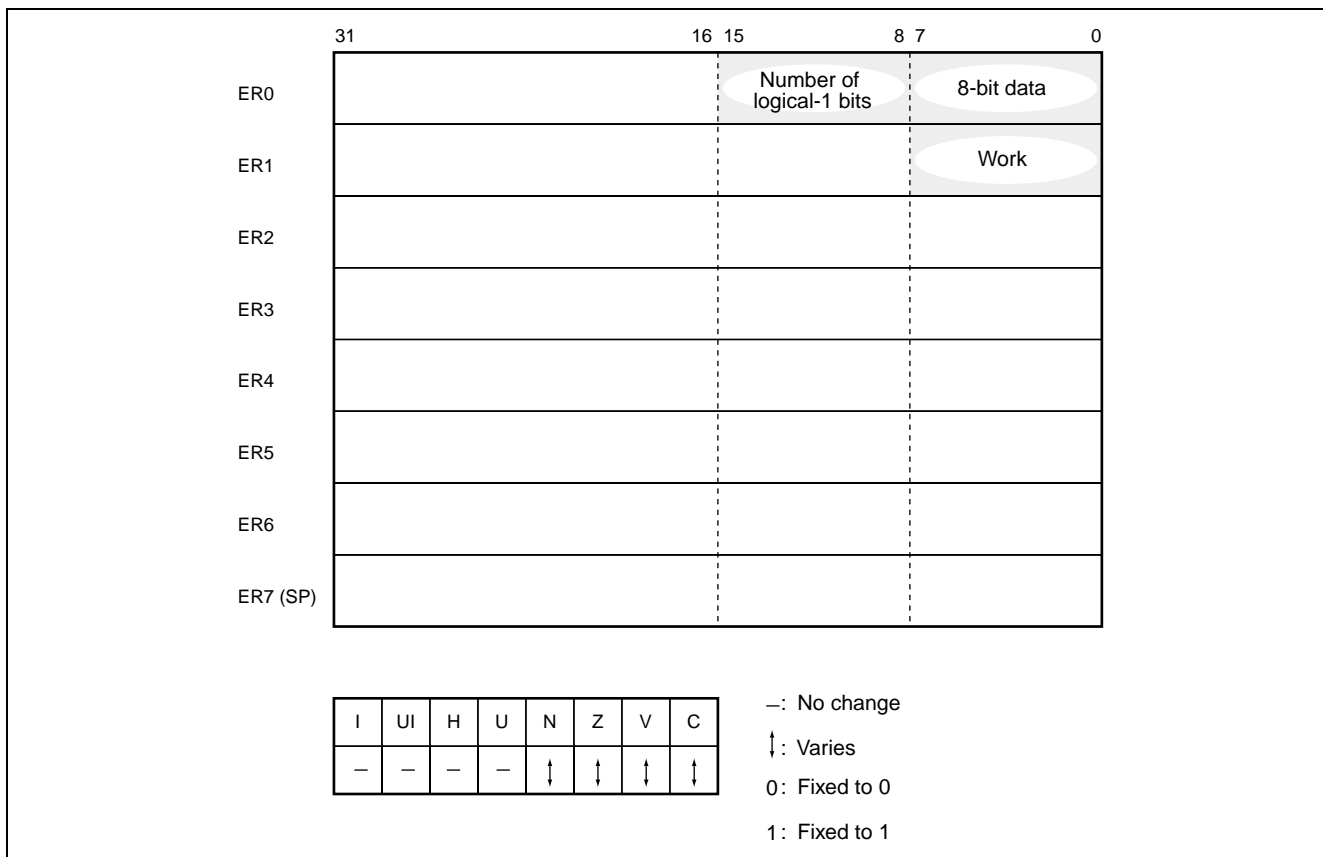
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1. Arguments

Description		Storage Location	Data Length (Bytes)
Input	8-bit data	R0L	1
Output	Number of logical-1 bits	R0H	1

2. Changes to Internal Registers and Flags



3. Programming Specifications

Program memory (bytes)	16
Data memory (bytes)	0
Stack (bytes)	0
Number of cycles	126
Re-entrant	Yes
Relocatable	Yes
Interrupts during execution	Yes

4. Note

The number of cycles given in the programming specifications is the value when the 8-bit data is H'FF.

5. Description

5.1 Description of Functions

1. The arguments are as follows:

R0L: Set the 8-bit input data.

R0H: The number of logical-1 bits in the 8-bit data is set here as the output.

2. The following figure illustrates the execution of the HNCT subroutine.

The number of logical-1 bits in the input argument is set in R0H.

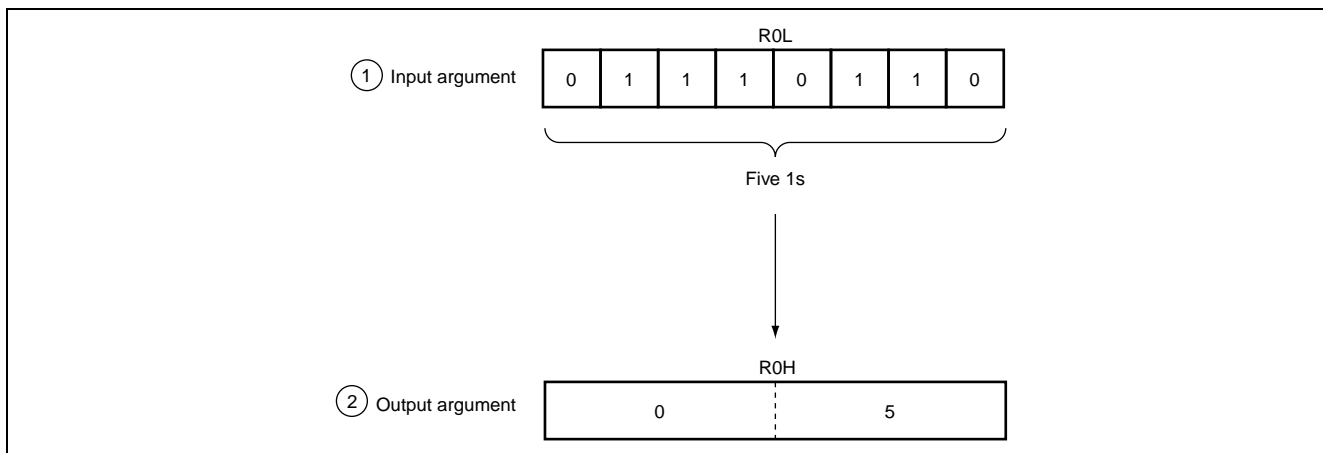


Figure 5.1 Example of HCNT Execution

5.2 Usage Note

When counting the number of logical-0 bits, take the 1's complement of R0L and then execute HCNT.

5.3 Description of Data Memory

No data memory is used by HCNT.

5.4 Example of Usage

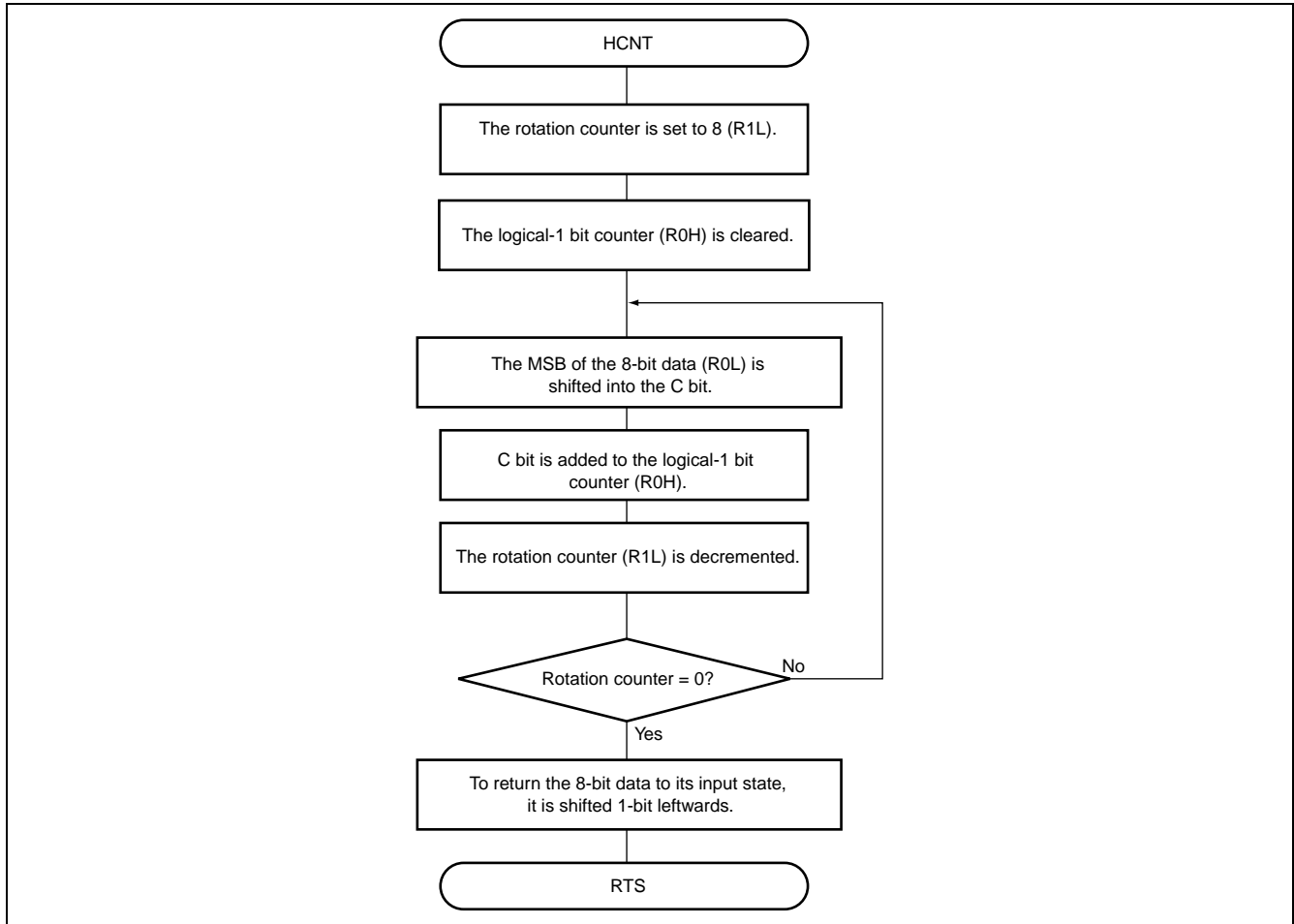
After setting the 8-bit data, call the HCNT subroutine.

WORK1	. RES. B 1	.....	Reservation of the data memory area for setting of the 8-bit data by the user program.
WORK2	. RES. B 1	.....	Reservation of the data memory area for setting of the number of logical-1 bits in the 8-bit data by the user program.
	MOV. B @WORK1, R0L	.....	Set in the 8-bit data specified in the user program as an input argument.
	.		
	.		
	.		
	JSR @HCNT	.....	Subroutine call of HCNT
	MOV. B R0H, @WORK2	.....	Transfers the number of logical-1 bits set as the output argument to the data-memory area of the user program.

5.5 Principles of Operation

1. The rotation instruction (ROTL.B) is used to shift each bit of the 8-bit data (R0L) into the C flag bit.
2. When the C flag is 1, the bit counter (R0H) is incremented; when the C flag is 0, there is no operation.
3. The two steps above are repeated until the rotation counter (R1L) reaches 0, and the number of logical-1 bits in the 8-bit data has been found.

6. Flowchart



7. Program Listing

```

1          1          ;*****
2          2          ;*
3          3          ;*      NAME      :      COUNTING OF HIGH BITS      (HCNT)      *
4          4          ;*
5          5          ;*****
6          6          ;*
7          7          ;*      ENTRY      :      R0L      (8 BIT DATA)      *
8          8          ;*      RETURNS   :      R0H      (HIGH BIT COUNTER)      *
9          9          ;*
10         10         ;*****
11         11         ;
12         12         .CPU      300HA
13         13         .SECTION A, CODE, LOCATE=H'001000
14         14         HCNT     .EQU      $      ;Entry point
15         15         001000   F920     MOV.B     #8,R1L     ;Set rotate counter
16         16         001002   1030     MOV.B     #0,R0H     ;Clear high bit counter
17         17         001004   58500004 HCNT1    ROTL.B    R0L      ;Rotate 8 bit data left
18         18         001006   1A09     BCC      HCNT2     ;Branch if C bit = 0S
19         19         00101A   46F6     INC.B    R0H      ;Increment high bit counter
20         20         00100C   1A09     HCNT2    DEC.B    R1L     ;Decrement rotate counter
21         21         00100E   46F4     BNE     HCNT1     ;Branch until rotate counter = 0
22         22         001010   5470     RTS
23         23         .END

***** TOTAL   ERRORS      0
***** TOTAL   WARNINGS   0

```

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