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April 1st, 2010
Renesas Electronics Corporation

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SH7000 Series

Block Transfer (4 Bytes Not Aligned)

Label: MOVE

Functions Used: MOV.B Instruction
Post-Increment Register Indirect Addressing
Register Indirect Addressing with Displacement

Contents

1. Function

Transfers a block of data. The start addresses for the block data source and destination areas, and the number of bytes to be transferred, are specified by the user.

2. Arguments

Description		Storage Location	Data Length (Bytes)
Input	Number of transfer bytes	R0	4
	Start address of transfer data source area	R1	4
	Start address of transfer data destination area	R2	4
Output	—	—	—

3. Internal Register Changes and Flag Changes

	(Before Execution) → (After Execution)
R0	Number of transfer bytes → Change
R1	Start address of transfer data destination area → Change
R2	Start address of transfer data source area → Change
R3	Work
R4	
R5	
R6	
R7	
R8	
R9	
R10	
R11	
R12	
R13	
R14	
R15	(SP)

T bit | * |

— : No change
* : Change
0 : Fixed 0
1 : Fixed 1

4. Programming Specifications

Program memory (bytes)
142
Data memory (bytes)
0
Stack (bytes)
4
Number of states
429
Reentrant
Yes
Relocation
Yes
Intermediate interrupt
Yes

5. Notes

The number of states indicated in the programming specifications is the value when the number of transfer bytes is 100.

6. Description

(1) Function

Details of the arguments are as follows.

R0: As the input argument, set the number of transfer bytes (defined by user). Note that hardware limitations apply.
R1: As the input argument, set the start address of transfer data destination area (defined by user).
R2: As the input argument, set the start address of transfer data source area (defined by user).

Figure 1 shows a software MOVE execution example.

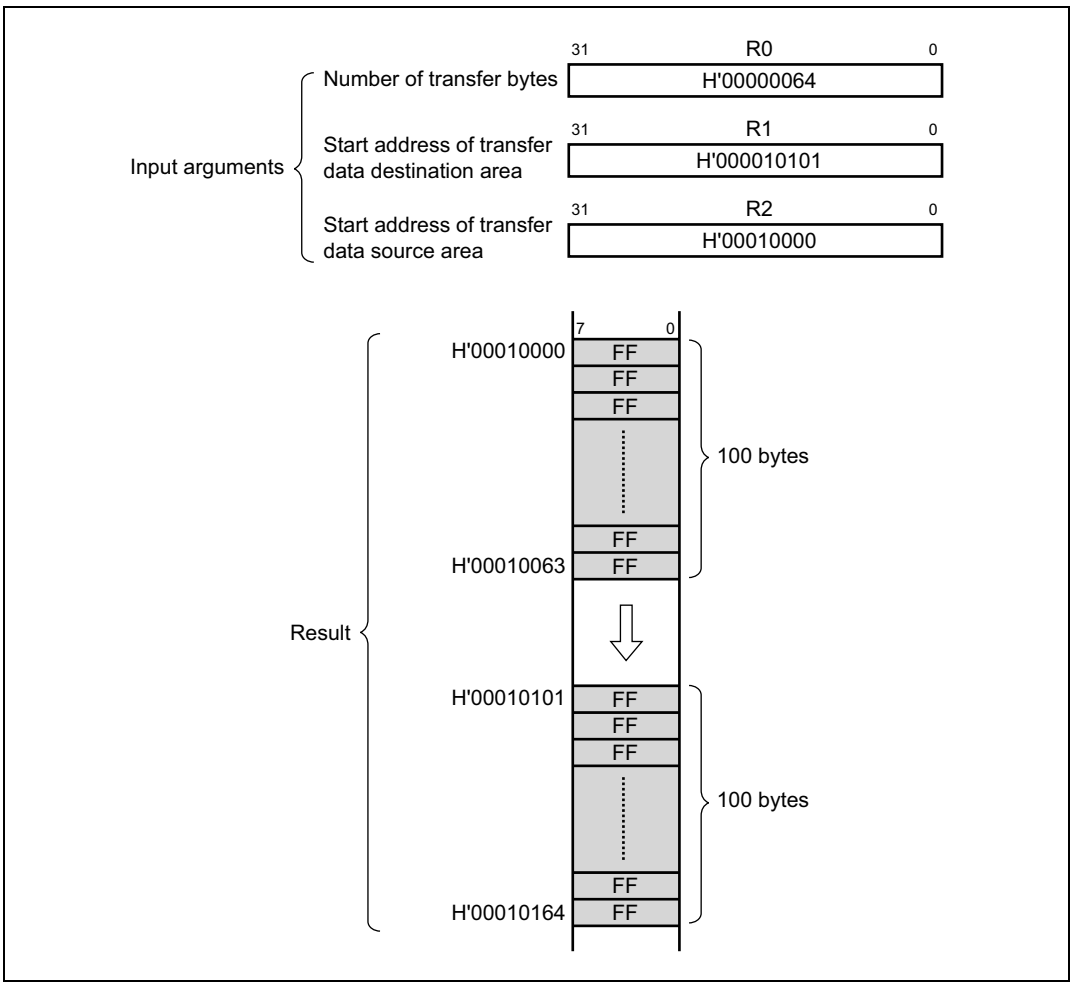


Figure 1 Software MOVE Execution Example

(2) Usage Notes

(a) The input arguments should be set so that the transfer data source area and transfer data destination area do not overlap. If the two areas overlap, as shown in figure 2, the data in the source area will be destroyed.

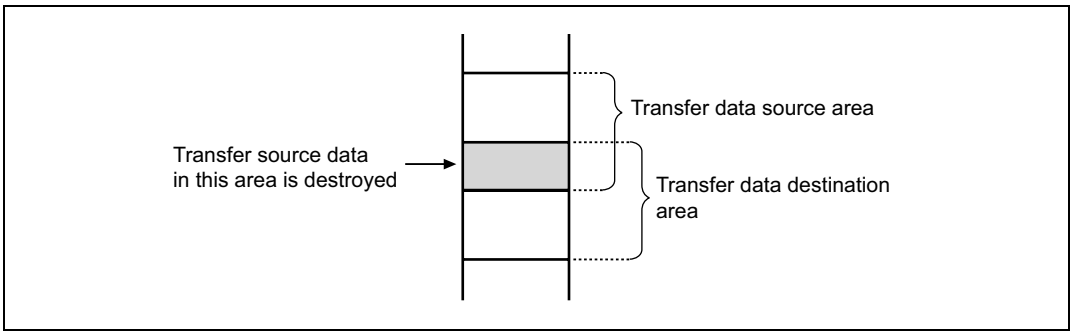


Figure 2 Block Transfer with Overlapping Data

(b) The contents of R0, R1, and R2, which set the number of transfer bytes, the start address of the transfer data destination area, and the start address of the transfer data source area, are changed using the software MOVE instruction. If the values for the number of transfer bytes, the start address of the transfer data destination area, and the start address of the transfer data source area will be needed after the software MOVE instruction is executed, they should be saved beforehand.

(3) RAM Used

No RAM is used by the software MOVE instruction.

(4) Usage Example

After the start address of the transfer data destination area, the start address of the transfer data source area, and the number of transfer bytes have been set in the input arguments, the software MOVE instruction is executed by a subroutine call.

```
          MOV.L   DATA1,R0     ... Sets number of transfer bytes in input argument (R0)
          MOV.L   DATA2,R1     ... Sets start address of transfer data destination area in input argument (R1)
          BSR     MOVE         ... Subroutine call to software MOVE
          MOV.L   DATA3,R2     ... Sets start address of transfer data source area in input argument (R2)
                .
                .
                .
                .
        .align    4
DATA1   .data.l   H'00000064
DATA2   .data.l   H'00010101
DATA3   .data.1   H'00010000
```

(5) Operating Principle

(a) Since the transfer source and transfer destination addresses are both user-defined (4 bytes not aligned), data is transferred from the source to the destination one byte at a time.

(b) Post-increment register indirect addressing (@R2+) is used to specify the transfer source address, which is then automatically incremented by 1 after each byte is transferred. Register indirect addressing with displacement is used to specify the transfer destination address. The displacement is 0 to 15, so it is necessary to increment the transfer destination address by 16 after each 15 bytes is transferred. No other increment processing is needed.

(c) A value equal to the start address of the transfer data source area (R2) plus the number of transfer bytes is set in R3. After the setting is made, R0, which was previously set to the number of data bytes, is used as workspace for the data transfer. After the transfer source data is transferred to R0, it is determined whether or not R2 is less than or equal to R3. If this condition is met (R2 ≤ R3), the data in R0 is data from the transfer source area and it is transferred to the transfer destination. If the condition is not met (R2 > R3), the data in R0 is data from outside the transfer source area and the transfer terminates.

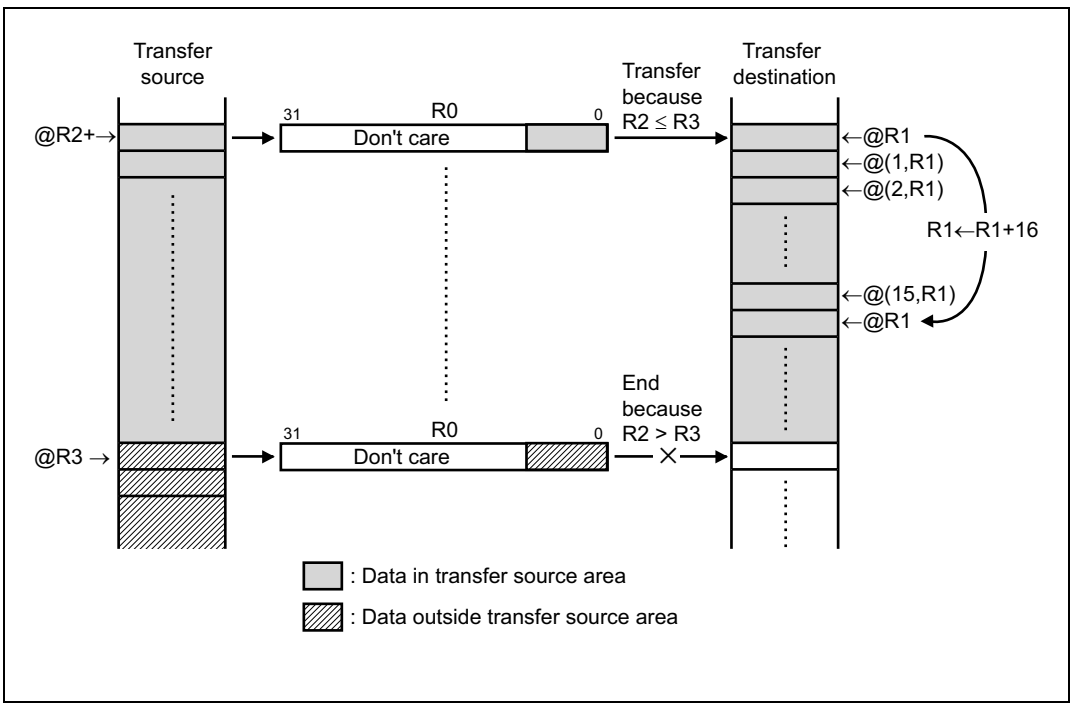
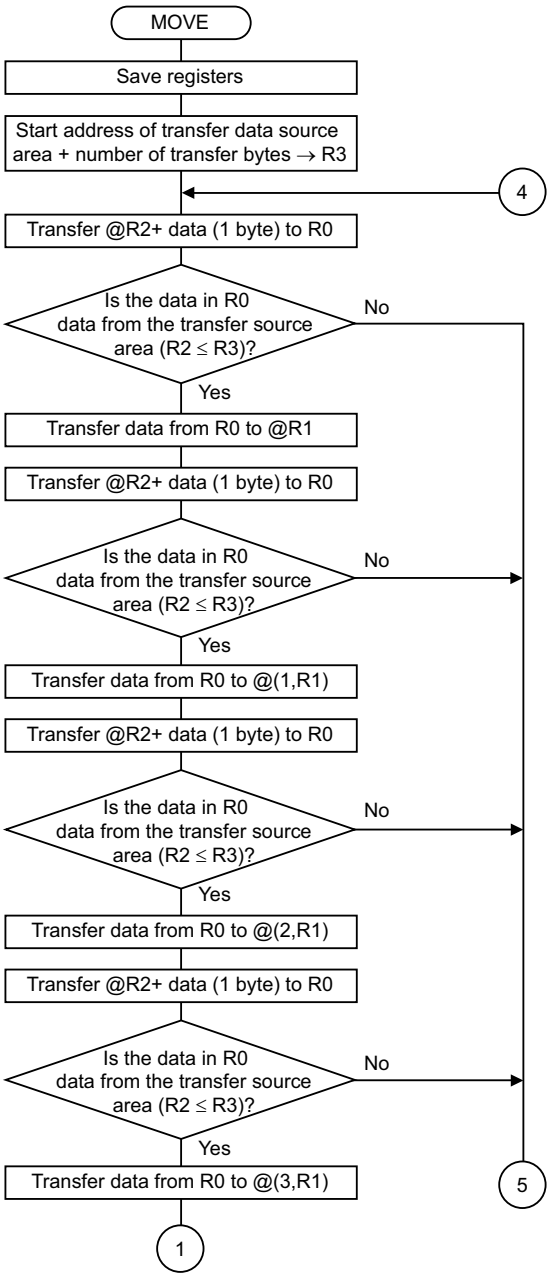
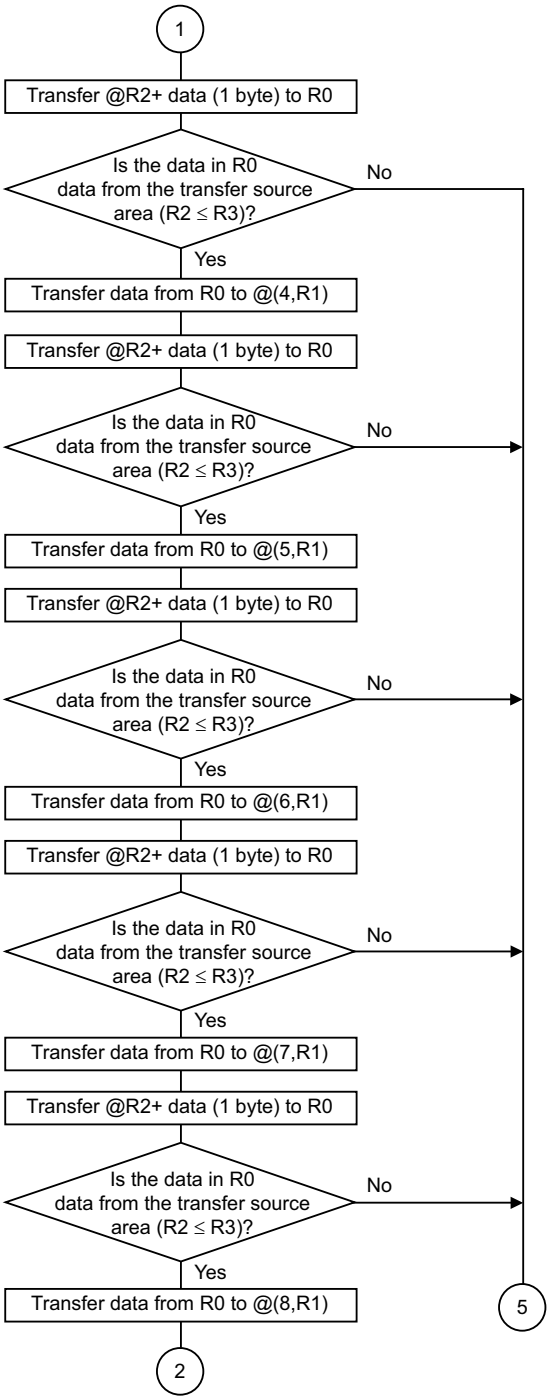
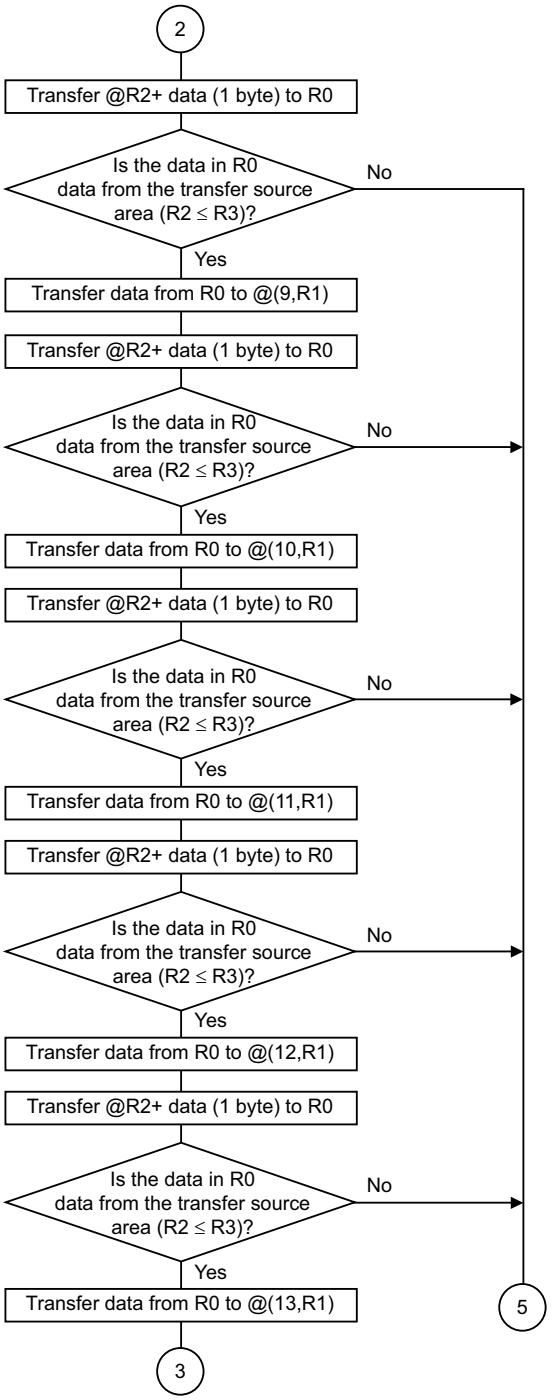


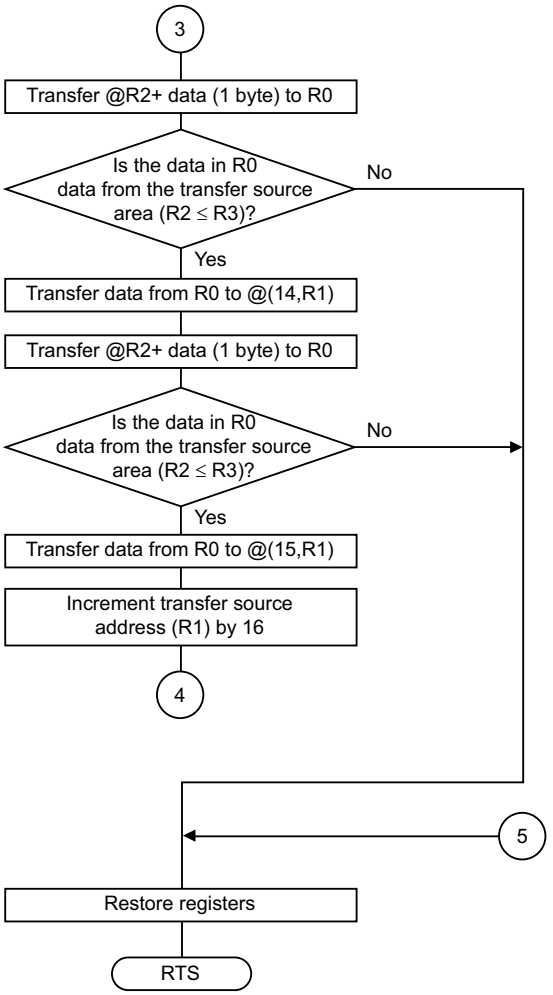
Figure 3 Data Transfer Method

7. Flowchart


MOVE
Save registers
Start address of transfer data source area + number of transfer bytes → R3
4
Transfer @R2+ data (1 byte) to R0
Is the data in R0 data from the transfer source area (R2 ≤ R3)?
No
Yes
Transfer data from R0 to @R1
Transfer @R2+ data (1 byte) to R0
Is the data in R0 data from the transfer source area (R2 ≤ R3)?
No
Yes
Transfer data from R0 to @(1,R1)
Transfer @R2+ data (1 byte) to R0
Is the data in R0 data from the transfer source area (R2 ≤ R3)?
No
Yes
Transfer data from R0 to @(2,R1)
Transfer @R2+ data (1 byte) to R0
Is the data in R0 data from the transfer source area (R2 ≤ R3)?
No
Yes
Transfer data from R0 to @(3,R1)
1
5


1
Transfer @R2+ data (1 byte) to R0
Is the data in R0 data from the transfer source area (R2 ≤ R3)?
No
Yes
Transfer data from R0 to @(4,R1)
Transfer @R2+ data (1 byte) to R0
Is the data in R0 data from the transfer source area (R2 ≤ R3)?
No
Yes
Transfer data from R0 to @(5,R1)
Transfer @R2+ data (1 byte) to R0
Is the data in R0 data from the transfer source area (R2 ≤ R3)?
No
Yes
Transfer data from R0 to @(6,R1)
Transfer @R2+ data (1 byte) to R0
Is the data in R0 data from the transfer source area (R2 ≤ R3)?
No
Yes
Transfer data from R0 to @(7,R1)
Transfer @R2+ data (1 byte) to R0
Is the data in R0 data from the transfer source area (R2 ≤ R3)?
No
Yes
Transfer data from R0 to @(8,R1)
2
5


2
Transfer @R2+ data (1 byte) to R0
Is the data in R0 data from the transfer source area (R2 ≤ R3)?
No
Yes
Transfer data from R0 to @(9,R1)
Transfer @R2+ data (1 byte) to R0
Is the data in R0 data from the transfer source area (R2 ≤ R3)?
No
Yes
Transfer data from R0 to @(10,R1)
Transfer @R2+ data (1 byte) to R0
Is the data in R0 data from the transfer source area (R2 ≤ R3)?
No
Yes
Transfer data from R0 to @(11,R1)
Transfer @R2+ data (1 byte) to R0
Is the data in R0 data from the transfer source area (R2 ≤ R3)?
No
Yes
Transfer data from R0 to @(12,R1)
Transfer @R2+ data (1 byte) to R0
Is the data in R0 data from the transfer source area (R2 ≤ R3)?
No
Yes
Transfer data from R0 to @(13,R1)
3
5


3
Transfer @R2+ data (1 byte) to R0
Is the data in R0 data from the transfer source area (R2 ≤ R3)?
No
Yes
Transfer data from R0 to @(14,R1)
Transfer @R2+ data (1 byte) to R0
Is the data in R0 data from the transfer source area (R2 ≤ R3)?
No
Yes
Transfer data from R0 to @(15,R1)
Increment transfer source address (R1) by 16
4
5
Restore registers
RTS

8. Program Listing

```
 1                          1   ;*************************************************************
 2                          2   ;*                                                           *
 3                          3   ;*       NAME ; MOVING MEMORY BLOKS (MOVE)                   *
 4                          4   ;*                                                           *
 5                          5   ;*************************************************************
 6                          6   ;*                                                           *
 7                          7   ;*      ENTRY : R0   (NUMBER OF TRANSFER)                    *
 8                          8   ;*              R1   (DESTINATION ADDRESS)                   *
 9                          9   ;*              R2   (SOURCE ADDRESS)                        *
10                         10   ;*    RETURNS : NOTHING                                      *
11                         11   ;*                                                           *
12                         12   ;*************************************************************
13 00001000                13           .SECTION A,CODE,LOCATE=H'1000
14           00001000      14   MOVE    .EQU    $               ; Entry point
15 00001000 2F36           15           MOV.L   R3,@-R15        ; Escape register
16 00001002 6323           16           MOV     R2,R3           ;
17 00001004 330C           17           ADD     R0,R3           ;
18 00001006                18   MOVE1                           ;
19 00001006 6024           19           MOV.B   @R2+,R0         ; Load source data
20 00001008 3322           20           CMP/HS  R2,R3           ; R2 <= R3 ?
21 0000100A 8B3E           21           BF      MOVE_END        ; No
22 0000100C 2100           22           MOV.B   R0,@R1          ; Yes -> Store source data
23 0000100E                23   MOVE2                           ;
24 0000100E 6024           24           MOV.B   @R2+,R0         ; Load source data
25 00001010 3322           25           CMP/HS  R2,R3           ; R2 <= R3 ?
26 00001012 8B3A           26           BF      MOVE_END        ; No
27 00001014 8011           27           MOV.B   R0,@(1,R1)      ; Yes -> Store source data
28 00001016                28   MOVE3                           ;
29 00001016 6024           29           MOV.B   @R2+,R0         ; Load source data
30 00001018 3322           30           CMP/HS  R2,R3           ; R2 <= R3 ?
31 0000101A 8B36           31           BF      MOVE_END        ; No
32 0000101C 8012           32           MOV.B   R0,@(2,R1)      ; Yes -> Store source data
33 0000101E                33   MOVE4                           ;
34 0000101E 6024           34           MOV.B   @R2+,R0         ; Load source data
35 00001020 3322           35           CMP/HS  R2,R3           ; R2 <= R3 ?
36 00001022 8B32           36           BF      MOVE_END        ; No
37 00001024 8013           37           MOV.B   R0,@(3,R1)      ; Yes -> Store source data
38 00001026                38   MOVE5                           ;
39 00001026 6024           39           MOV.B   @R2+,R0         ; Load source data
40 00001028 3322           40           CMP/HS  R2,R3           ; R2 <= R3 ?
41 0000102A 8B2E           41           BF      MOVE_END        ; No
42 0000102C 8014           42           MOV.B   R0,@(4,R1)      ; Yes -> Store source data
43 0000102E                43   MOVE6                           ;
44 0000102E 6024           44           MOV.B   @R2+,R0         ; Load source data
45 00001030 3322           45           CMP/HS  R2,R3           ; R2 <= R3 ?
46 00001032 8B2A           46           BF      MOVE_END        ; No
47 00001034 8015           47           MOV.B   R0,@(5,R1)      ; Yes -> Store source data
48 00001036                48   MOVE7                           ;
49 00001036 6024           49           MOV.B   @R2+,R0         ; Load source data
```

```
 50 00001038 3322          50          CMP/HS  R2,R3           ; R2 <= R3 ?
 51 0000103A 8B26          51          BF      MOVE_END        ; No
 52 0000103C 8016          52          MOV.B   R0,@(6,R1)      ; Yes -> Store source data
 53 0000103E               53   MOVE8                          ;
 54 0000103E 6024          54          MOV.B   @R2+,R0         ; Load source data
 55 00001040 3322          55          CMP/HS  R2,R3           ; R2 <= R3 ?
 56 00001042 8B22          56          BF      MOVE_END        ; No
 57 00001044 8017          57          MOV.B   R0,@(7,R1)      ; Yes -> Store source data
 58 00001046               58   MOVE9                          ;
 59 00001046 6024          59          MOV.B   @R2+,R0         ; Load source data
 60 00001048 3322          60          CMP/HS  R2,R3           ; R2 <= R3 ?
 61 0000104A 8B22          61          BF      MOVE_END        ; No
 62 0000104C 8018          62          MOV.B   R0,@(8,R1)      ; Yes -> Store source data
 63 0000104E               63   MOVE10                         ;
 64 0000104E 6024          64          MOV.B   @R2+,R0         ; Load source data
 65 00001050 3322          65          CMP/HS  R2,R3           ; R2 <= R3 ?
 66 00001052 8B1A          66          BF      MOVE_END        ; No
 67 00001054 8019          67          MOV.B   R0,@(9,R1)      ; Yes -> Store source data
 68 00001056               68   MOVE11                         ;
 69 00001056 6024          69          MOV.B   @R2+,R0         ; Load source data
 70 00001058 3322          70          CMP/HS  R2,R3           ; R2 <= R3 ?
 71 0000105A 8B16          71          BF      MOVE_END        ; No
 72 0000105C 801A          72          MOV.B   R0,@(10,R1)     ; Yes -> Store source data
 73 0000105E               73   MOVE12                         ;
 74 0000105E 6024          74          MOV.B   @R2+,R0         ; Load source data
 75 00001060 3322          75          CMP/HS  R2,R3           ; R2 <= R3 ?
 76 00001062 8B12          76          BF      MOVE_END        ; No
 77 00001064 801B          77          MOV.B   R0,@(11,R1)     ; Yes -> Store source data
 78 00001066               78   MOVE13                         ;
 79 00001066 6024          79          MOV.B   @R2+,R0         ; Load source data
 80 00001068 3322          80          CMP/HS  R2,R3           ; R2 <= R3 ?
 81 0000106A 8B0E          81          BF      MOVE_END        ; No
 82 0000106C 801C          82          MOV.B   R0,@(12,R1)     ; Yes -> Store source data
 83 0000106E               83   MOVE14                         ;
 84 0000106E 6024          84          MOV.B   @R2+,R0         ; Load source data
 85 00001070 3322          85          CMP/HS  R2,R3           ; R2 <= R3 ?
 86 00001072 8B0A          86          BF      MOVE_END        ; No
 87 00001074 801D          87          MOV.B   R0,@(13,R1)     ; Yes -> Store source data
 88 00001076               88   MOVE15                         ;
 89 00001076 6024          89          MOV.B   @R2+,R0         ; Load source data
 90 00001078 3322          90          CMP/HS  R2,R3           ; R2 <= R3 ?
 91 0000107A 8B06          91          BF      MOVE_END        ; No
 92 0000107C 801E          92          MOV.B   R0,@(14,R1)     ; Yes -> Store source data
 93 0000107E               93   MOVE16                         ;
 94 0000107E 6024          94          MOV.B   @R2+,R0         ; Load source data
 95 00001080 3322          95          CMP/HS  R2,R3           ; R2 <= R3 ?
 96 00001082 8B02          96          BF      MOVE_END        ; No
 97 00001084 801F          97          MOV.B   R0,@(13,R1)     ; Yes -> Store source data
 98                        98                                  ;
 99 00001086 AFBE          99          BRA     MOVE1           ;
100 00001088 7110         100          ADD     #D'16,R1        ; R1 <- R1 + 16
```

```
101 0000108A             101   MOVE_END                    ;
102 0000108A 000B        102           RTS                 ;
103 0000108C 63F6        103           MOV.L   @R15+,R3    ; Return register
104                      104           .END
*****TOTAL ERRORS    0
*****TOTAL WARNINGS  0
```

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