

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

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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.

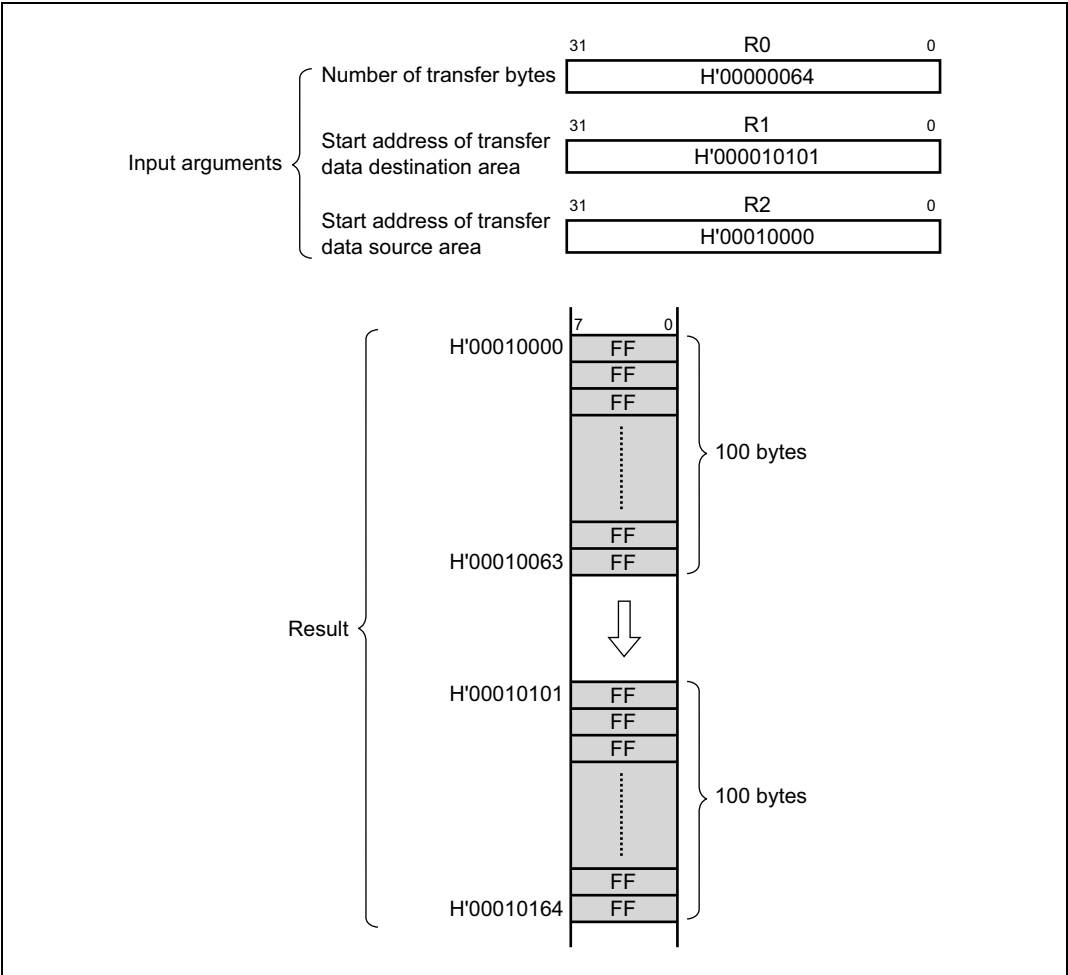


Figure 1 Software MOVE Execution Example

(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.

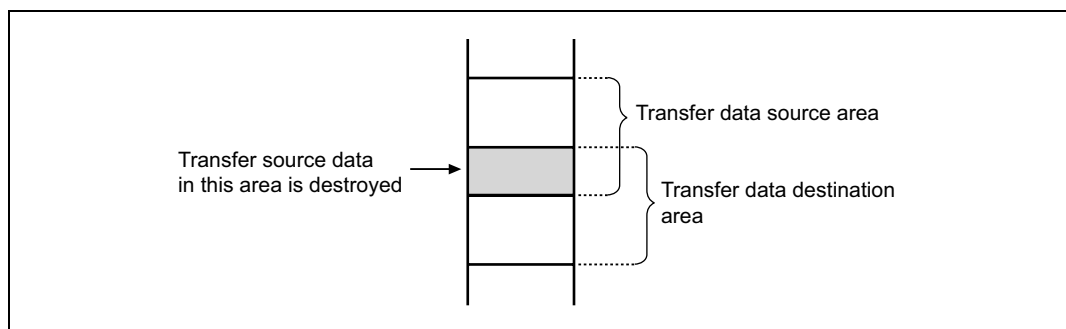


Figure 2 Block Transfer with Overlapping Data

- (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.1 H'00000064
DATA2 .data.1 H'00010101
DATA3 .data.1 H'00010000

```

(5) Operating Principle

- 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.
- 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.
- 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 ($R2 \leq R3$), 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.

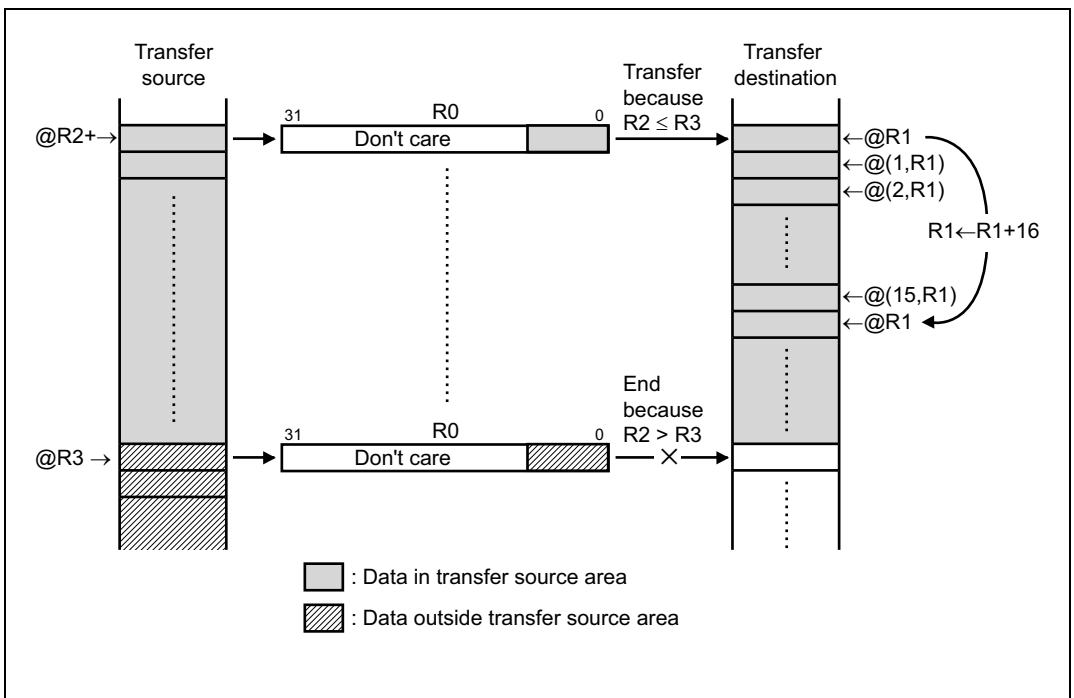
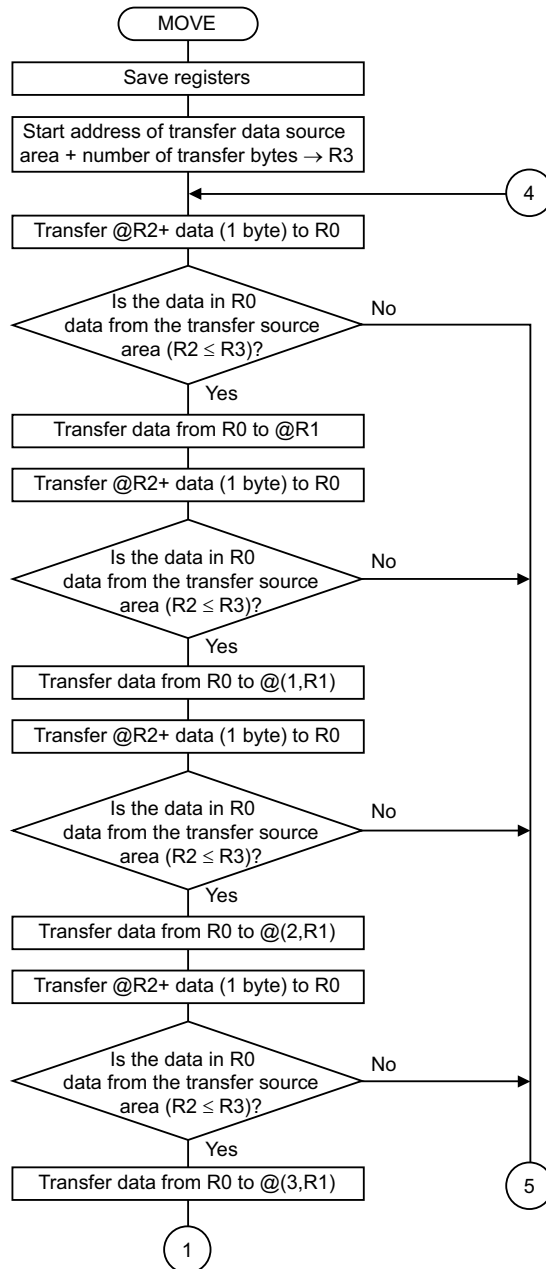
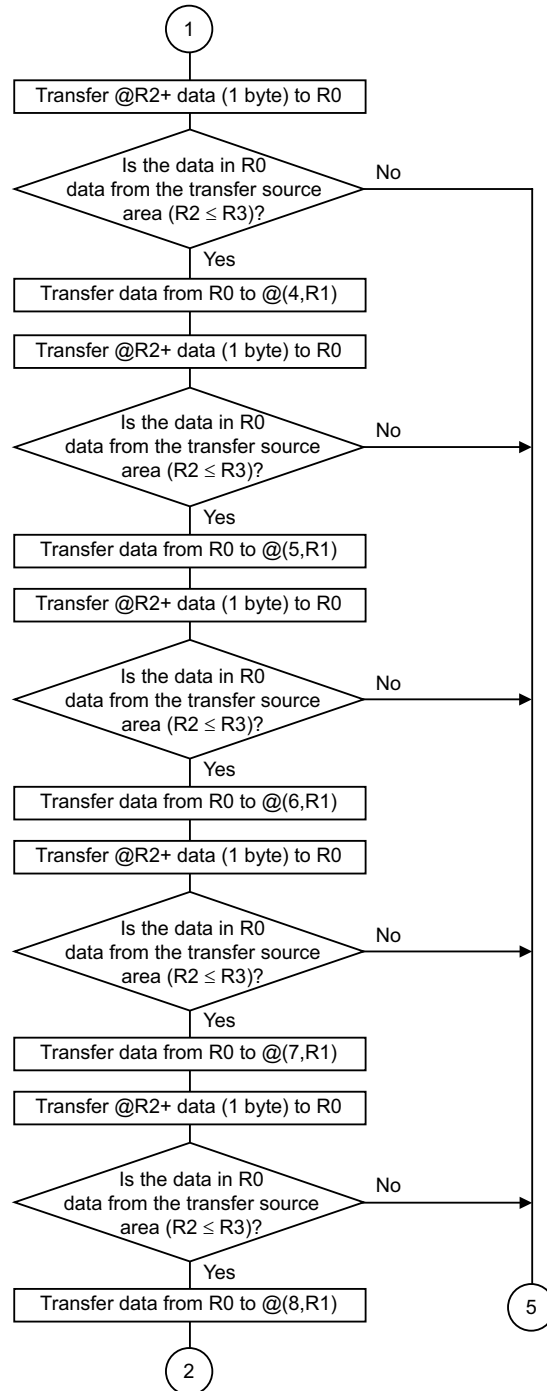
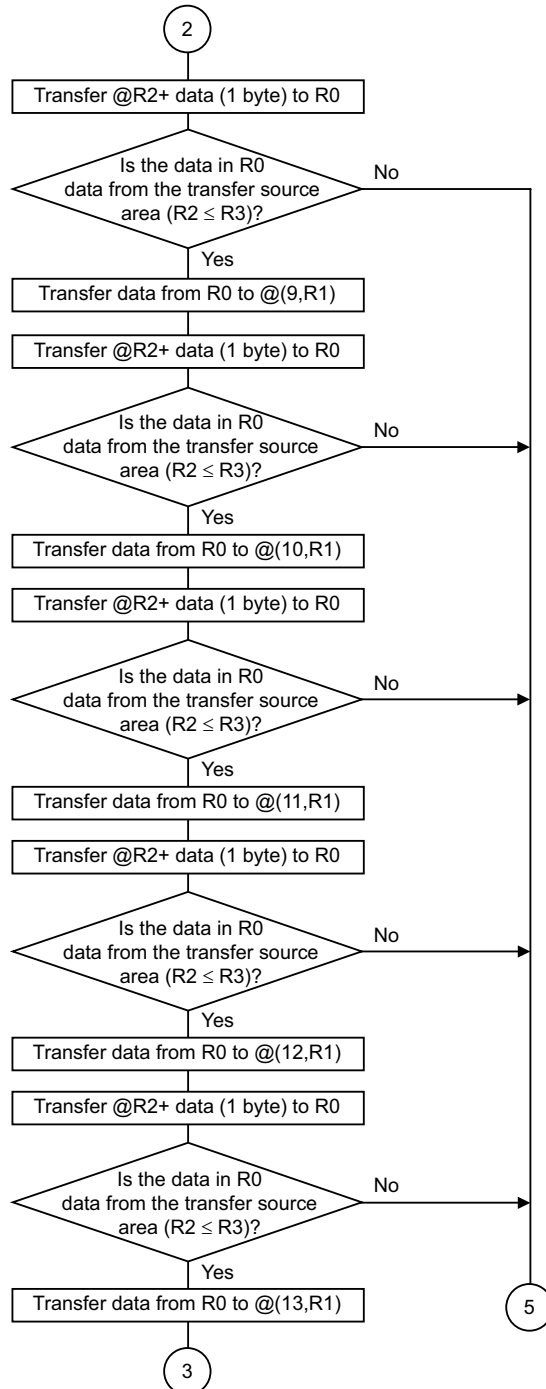


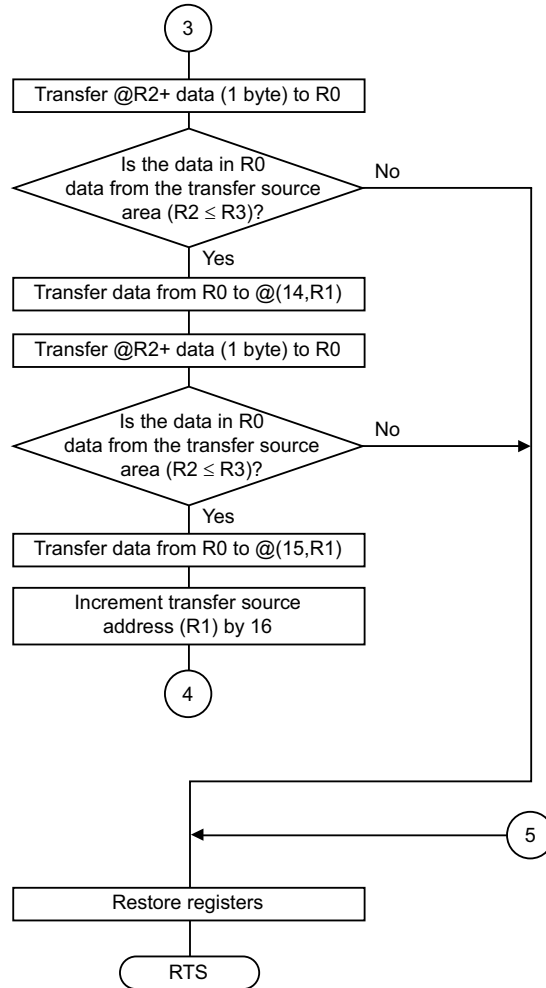
Figure 3 Data Transfer Method

7. Flowchart









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     13     .SECTION A,CODE,LOCATE=H'1000
14     14     MOVE .EQU $      ; Entry point
15     15     MOV.L R3,@-R15    ; Escape register
16     16     MOV R2,R3
17     17     ADD R0,R3
18     18     MOVE1
19     19     MOV.B @R2+,R0      ; Load source data
20     20     CMP/HS R2,R3      ; R2 <= R3 ?
21     21     BF MOVE_END      ; No
22     22     MOV.B R0,@R1      ; Yes -> Store source data
23     23     MOVE2
24     24     MOV.B @R2+,R0      ; Load source data
25     25     CMP/HS R2,R3      ; R2 <= R3 ?
26     26     BF MOVE_END      ; No
27     27     MOV.B R0,@(1,R1)   ; Yes -> Store source data
28     28     MOVE3
29     29     MOV.B @R2+,R0      ; Load source data
30     30     CMP/HS R2,R3      ; R2 <= R3 ?
31     31     BF MOVE_END      ; No
32     32     MOV.B R0,@(2,R1)   ; Yes -> Store source data
33     33     MOVE4
34     34     MOV.B @R2+,R0      ; Load source data
35     35     CMP/HS R2,R3      ; R2 <= R3 ?
36     36     BF MOVE_END      ; No
37     37     MOV.B R0,@(3,R1)   ; Yes -> Store source data
38     38     MOVE5
39     39     MOV.B @R2+,R0      ; Load source data
40     40     CMP/HS R2,R3      ; R2 <= R3 ?
41     41     BF MOVE_END      ; No
42     42     MOV.B R0,@(4,R1)   ; Yes -> Store source data
43     43     MOVE6
44     44     MOV.B @R2+,R0      ; Load source data
45     45     CMP/HS R2,R3      ; R2 <= R3 ?
46     46     BF MOVE_END      ; No
47     47     MOV.B R0,@(5,R1)   ; Yes -> Store source data
48     48     MOVE7
49     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,@(15,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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