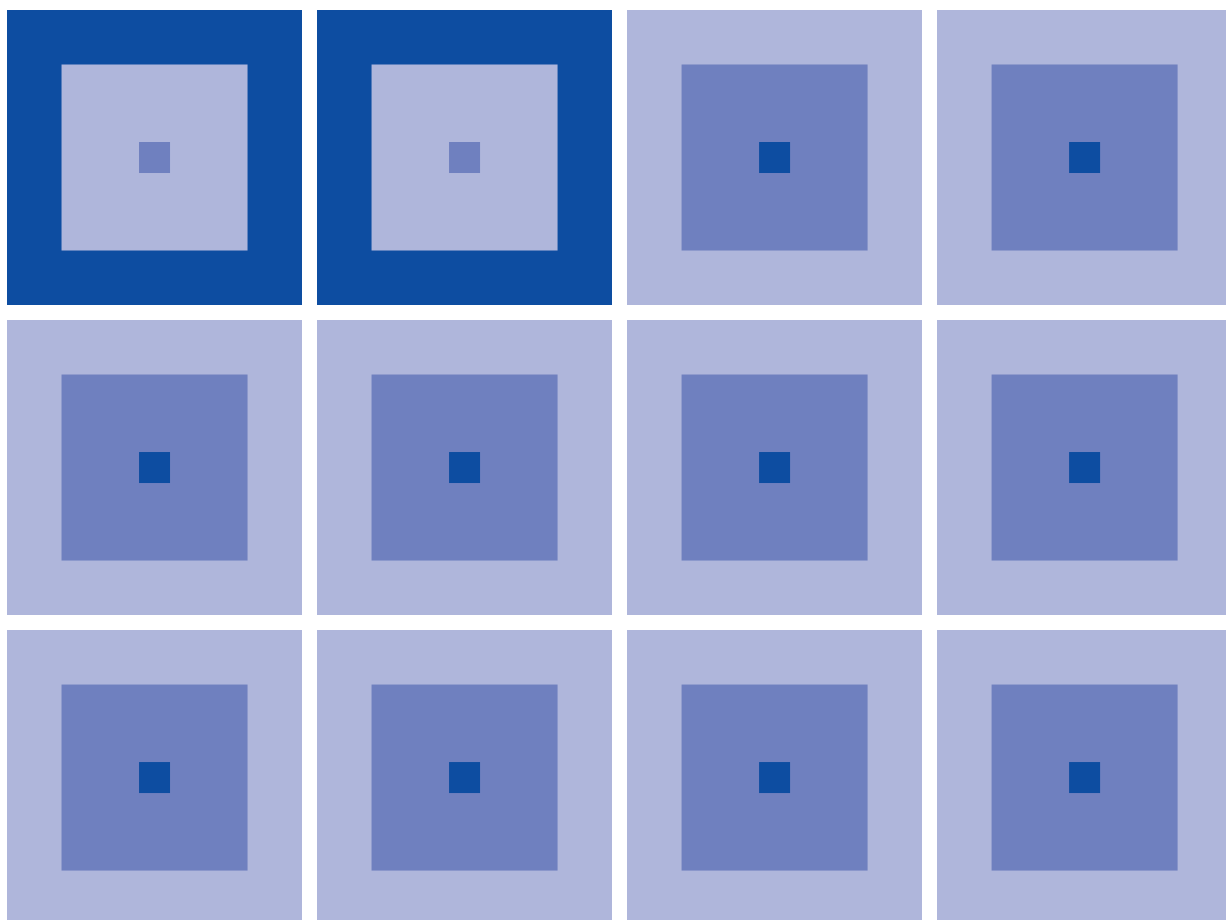


CMOS 4-BIT SINGLE CHIP MICROCOMPUTER

S5U1C60N08D Manual

(Development Software Tool for S1C60N08)



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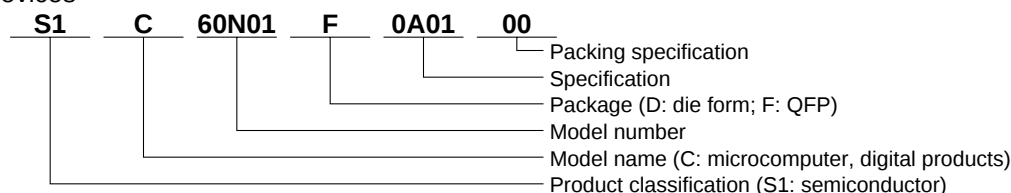
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The information of the product number change

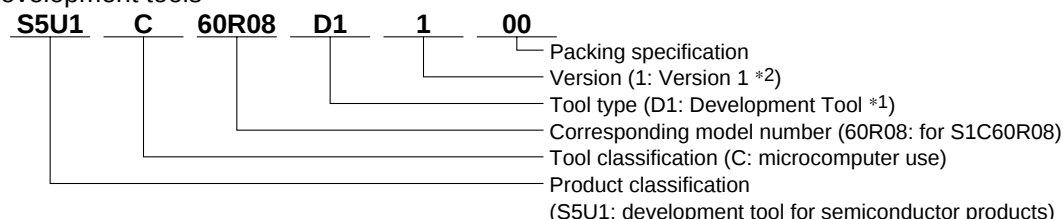
Starting April 1, 2001, the product number will be changed as listed below. To order from April 1, 2001 please use the new product number. For further information, please contact Epson sales representative.

Configuration of product number

Devices



Development tools



*1: For details about tool types, see the tables below. (In some manuals, tool types are represented by one digit.)

*2: Actual versions are not written in the manuals.

Comparison table between new and previous number

S1C60 Family processors

Previous No.	New No.
E0C6001	S1C60N01
E0C6002	S1C60N02
E0C6003	S1C60N03
E0C6004	S1C60N04
E0C6005	S1C60N05
E0C6006	S1C60N06
E0C6007	S1C60N07
E0C6008	S1C60N08
E0C6009	S1C60N09
E0C6011	S1C60N11
E0C6013	S1C60N13
E0C6014	S1C60140
E0C60R08	S1C60R08

S1C62 Family processors

Previous No.	New No.
E0C621A	S1C621A0
E0C6215	S1C62150
E0C621C	S1C621C0
E0C6S27	S1C6S2N7
E0C6S37	S1C6S3N7
E0C623A	S1C6N3A0
E0C623E	S1C6N3E0
E0C6S32	S1C6S3N2
E0C6233	S1C62N33
E0C6235	S1C62N35
E0C623B	S1C6N3B0
E0C6244	S1C62440
E0C624A	S1C624A0
E0C6S46	S1C6S460

Previous No.	New No.
E0C6247	S1C62470
E0C6248	S1C62480
E0C6S48	S1C6S480
E0C624C	S1C624C0
E0C6251	S1C62N51
E0C6256	S1C62560
E0C6292	S1C62920
E0C6262	S1C62N62
E0C6266	S1C62660
E0C6274	S1C62740
E0C6281	S1C62N81
E0C6282	S1C62N82
E0C62M2	S1C62M20
E0C62T3	S1C62T30

Comparison table between new and previous number of development tools

Development tools for the S1C60/62 Family

Previous No.	New No.
ASM62	S5U1C62000A
DEV6001	S5U1C60N01D
DEV6002	S5U1C60N02D
DEV6003	S5U1C60N03D
DEV6004	S5U1C60N04D
DEV6005	S5U1C60N05D
DEV6006	S5U1C60N06D
DEV6007	S5U1C60N07D
DEV6008	S5U1C60N08D
DEV6009	S5U1C60N09D
DEV6011	S5U1C60N11D
DEV60R08	S5U1C60R08D
DEV621A	S5U1C621A0D
DEV621C	S5U1C621C0D
DEV623B	S5U1C623B0D
DEV6244	S5U1C62440D
DEV624A	S5U1C624A0D
DEV624C	S5U1C624C0D
DEV6248	S5U1C62480D
DEV6247	S5U1C62470D

Previous No.	New No.
DEV6262	S5U1C62620D
DEV6266	S5U1C62660D
DEV6274	S5U1C62740D
DEV6292	S5U1C62920D
DEV62M2	S5U1C62M20D
DEV6233	S5U1C62N33D
DEV6235	S5U1C62N35D
DEV6251	S5U1C62N51D
DEV6256	S5U1C62560D
DEV6281	S5U1C62N81D
DEV6282	S5U1C62N82D
DEV6S27	S5U1C6S2N7D
DEV6S32	S5U1C6S3N2D
DEV6S37	S5U1C6S3N7D
EVA6008	S5U1C60N08E
EVA6011	S5U1C60N11E
EVA621AR	S5U1C621A0E2
EVA621C	S5U1C621C0E
EVA6237	S5U1C62N37E
EVA623A	S5U1C623A0E

Previous No.	New No.
EVA623B	S5U1C623B0E
EVA623E	S5U1C623E0E
EVA6247	S5U1C62470E
EVA6248	S5U1C62480E
EVA6251R	S5U1C62N51E1
EVA6256	S5U1C62N56E
EVA6262	S5U1C62620E
EVA6266	S5U1C62660E
EVA6274	S5U1C62740E
EVA6281	S5U1C62N81E
EVA6282	S5U1C62N82E
EVA62M1	S5U1C62M10E
EVA62T3	S5U1C62T30E
EVA6S27	S5U1C6S2N7E
EVA6S32R	S5U1C6S3N2E2
ICE62R	S5U1C62000H
KIT6003	S5U1C60N03K
KIT6004	S5U1C60N04K
KIT6007	S5U1C60N07K

PREFACE

This manual mainly explains the outline of the development support tool for the 4-bit Single Chip Micro-computer S1C60N08.

Refer to the "S1C62 Family Development Tool Reference Manual" for the details (common to all models) of each development support tool. Manuals for hardware development tools are separate, so you should also refer to the below manuals.

<i>Development tools</i>	☞ S1C62 Family Development Tool Reference Manual S5U1C60N08E Manual (Evaluation Board for S1C60N08) S5U1C62000H Manual (S1C60/62 Family In-Circuit Emulator)
<i>Device (S1C60N08)</i>	☞ S1C60N08/60R08 Technical Manual
<i>Instructions</i>	☞ S1C6200/6200A Core CPU Manual

* In this manual, "ICE" and "evaluation board" indicate S5U1C62000H and S5U1C60N08E, respectively.

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1 COMPOSITION OF DEVELOPMENT SUPPORT TOOL

Here we will explain the composition of the software for the development support tools, developmental environment and how to generate the execution disk.

1.1 Configuration of S5U1C60N08D

The below software are included in the product of the S1C60N08 development support tool S5U1C60N08D.

- | | |
|--|--|
| 1. Cross Assembler ASM6008 | Cross assembler for program preparation |
| 2. Function Option Generator FOG6008 | Function option data preparation program |
| 3. Segment Option Generator SOG6008 | Segment option data preparation program |
| 4. ICE Control Software ICS6008 | ICE control program |
| 5. Mask Data Checker MDC6008 | Mask data preparation program |

1.2 Developmental Environment

The software product of the development support tool S5U1C60N08D operates on the following host systems:

- IBM PC/AT (at least PC-DOS Ver. 2.0)

When developing the S1C60N08, the above-mentioned host computer, editor, P-ROM writer, printer, etc. must be prepared by the user in addition to the development tool which is normally supported by Seiko Epson.

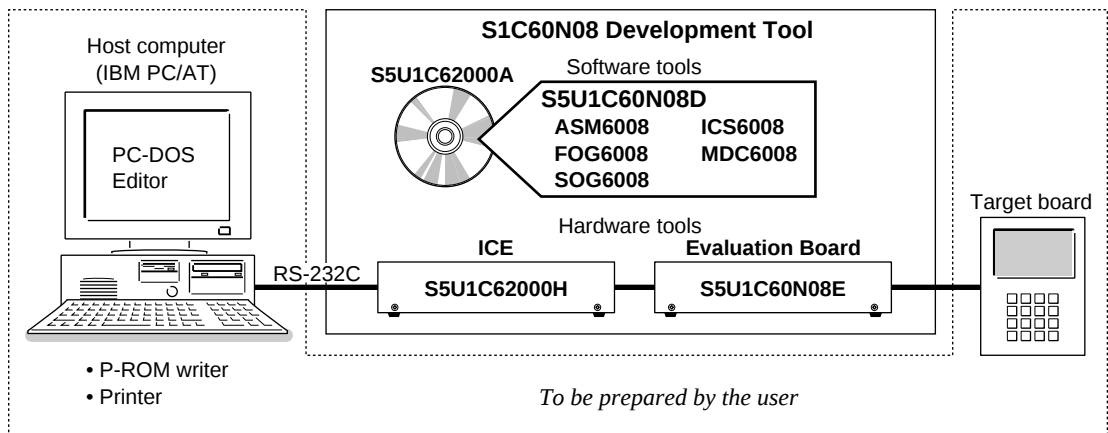


Fig. 1.2.1 System configuration

Note The S5U1C60N08D system requires a host computer with a RAM capacity of about 140K bytes. Since the ICE (S5U1C62000H) is connected to the host computer with a RS-232C serial interface, adapter board for asynchronous communication will be required depending on the host computer used.

1.3 Development Flow

Figure 1.3.1 shows the development flow through the S5U1C60N08D.

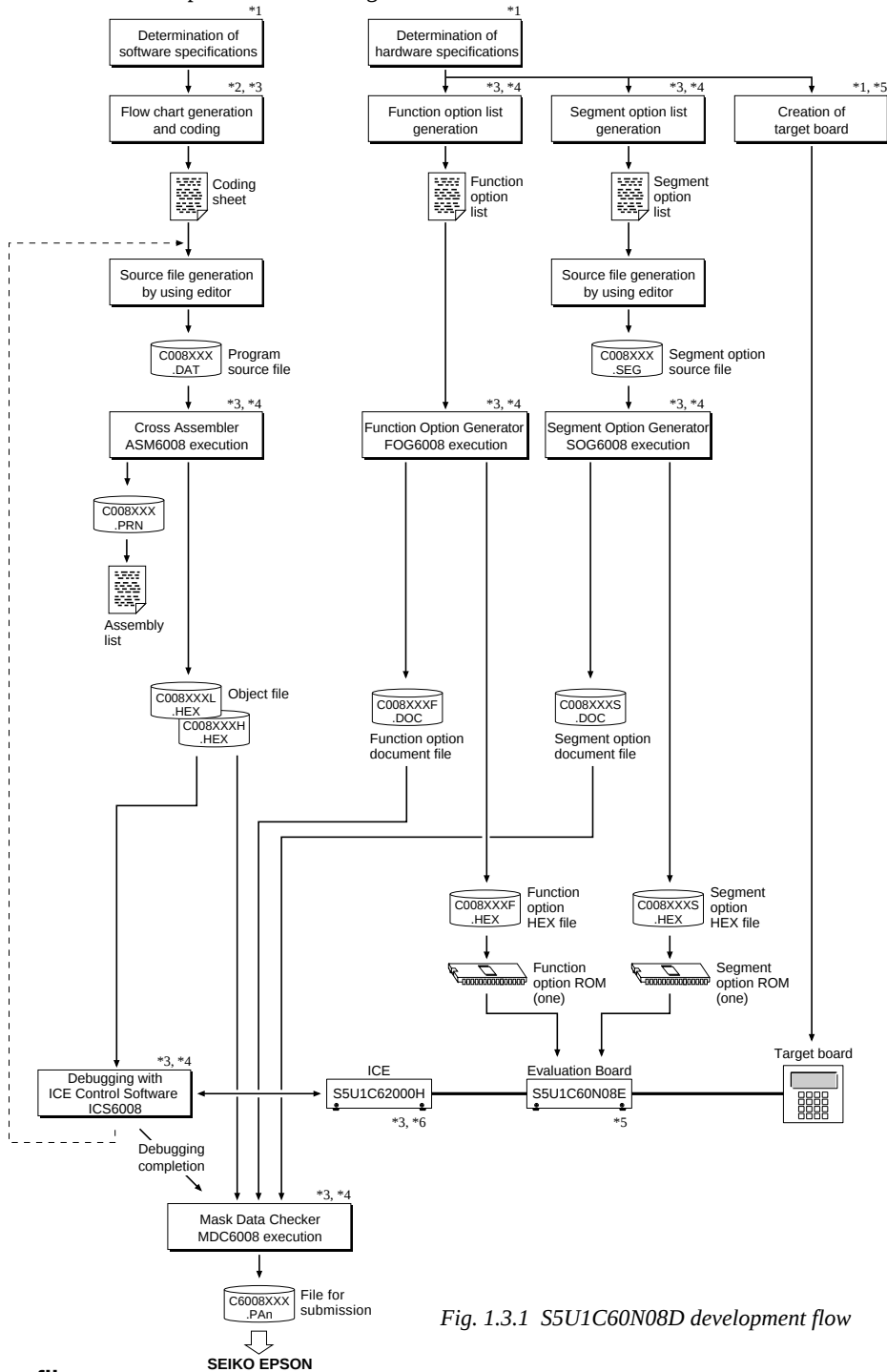


Fig. 1.3.1 S5U1C60N08D development flow

Concerning file names

All the input-output file name for the each development support tool commonly use "C008XXX". In principle each file should be produced in this manner. Seiko Epson will designate the "XXX" for each customer.

Reference Manual

- | | |
|---|-------------------------------------|
| *1 S1C60N08/60R08 Technical Manual | *4 S5U1C60N08D Manual (this manual) |
| *2 S1C6200/6200A Core CPU Manual | *5 S5U1C60N08E Manual |
| *3 S1C62 Family Development Tool Reference Manual | *6 S5U1C62000H Manual |

1.4 Installation

The S5U1C60N08D tools are included on the CD-ROM of the S5U1C62000A (S1C60/62 Family Assembler Package), and they can be installed in your hard disk using the installer (Setup.exe) on the CD-ROM. Refer to the "S5U1C62000A Manual" for how to install the S5U1C60N08D tools.

2 CROSS ASSEMBLER ASM6008

2.1 ASM6008 Outline

The ASM6008 cross assembler is an assembler program for generating the machine code used by the S1C60N08 4-bit, single-chip microcomputers. The Cross Assembler ASM6008 will assemble the program source files which have been input by the user's editor and will generate an object file in Intel-Hex format and assembly list file. In this assembler, program modularization has been made possible through macro definition functions and programming independent of the ROM page structure has been made possible through the auto page set function. In addition, consideration has also been given to precise error checks for program capacity (ROM capacity) overflows, undefined codes and the like, and for debugging of such things as label tables for assembly list files and cross reference table supplements.

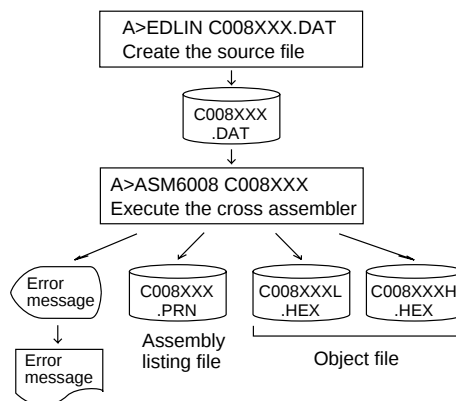


Fig. 2.1.1 ASM6008 execution flow

The format of the source file and its operating method are same as for the S1C62 Family. Refer to the "S1C62 Family Development Tool Reference Manual" for details.

2.2 S1C60N08 Restrictions

Note the following when generating a program by the S1C60N08:

■ ROM area

The capacity of the S1C60N08 ROM is 4k steps (0000H to 0FFFH). Therefore, the specification range of the memory setting pseudo-instructions and PSET instruction is restricted.

Memory configuration:

Bank: Only bank 0, Page: 16 pages (0 to 0FH), each 256 steps

Significant specification range:

ORG	pseudo-instruction:	0000H to 0FFFH
PAGE	pseudo-instruction:	00H to 0FH
BANK	pseudo-instruction:	Only 0H
PSET	instruction:	00H to 0FH

■ RAM area

The capacity of the S1C60N08 RAM is 832 words (000H to 3FFH, 4 bits / word). However, note the following points when programming.

- (1) When 040H–06FH has been specified as the segment data memory through the mask option, 240H–2CFH and 2D1H–2DFH become unused areas. Memory access is invalid when this unused area is specified.
- (2) When 240H–26FH has been specified as the segment data memory through the mask option, 270H–2CFH and 2D1H–2DFH become unused areas. Memory access is invalid when this unused area is specified.
- (3) Since RAM is set for up to 4 pages, only the subordinate 2 bits of the page section of the index register which specifies address are effective. (The 2 superordinate bits are ignored.)

Example: LD A, 04H
LD XP, A
LD X, 9FH

49FH is loaded into the IX register, but an unused area has been specified so that the memory accessible with the IX register (MX) is invalid.

■ Undefined codes

The SLP instruction has not been defined in the S1C60N08 instruction sets.

2.3 ASM6008 Quick Reference

■ Starting command and input/output files

Execution file: ASM6008.EXE

_ indicates a blank.

☐ indicates the Return key.

A parameter enclosed by [] can be omitted.

Starting command: ASM6008_ [drive-name:] source-file-name [.shp]_ [-N]☐

Option:

- .shp Specifies the file I/O drives.
- s Specifies the drive from which the source file is to be input. (A–P, @)
- h Specifies the drive to which the object file is to be output. (A–P, @, Z)
- p Specifies the drive to which the assembly listing file is to be output. (A–P, @, Z)
- @: Current drive, Z: File is not generated
- N The code (FFH) in the undefined area of program memory is not created.

Input file: C008XXX.DAT (Source file)

Output file:

- C008XXXL.HEX (Object file, low-order)
- C008XXXH.HEX (Object file, high-order)
- C008XXX.PRN (Assembly listing file)

■ Display example

```

*** E0C6008 CROSS ASSEMBLER. --- Ver 1.00 ***

EEEEEEEEEE PPPPPPPP SSSSSSS 00000000 NNN NNN
EEEEEEEEEE PPPPPPPP SSS SSSS 000 000 NNNN NNN
EEE PPP PPP SSS SSS 000 000 NNNNN NNN
EEE PPP PPP SSS 000 000 NNNNN NNN
EEEEEEEEEE PPPPPPPP SSSSSS 000 000 NNN NNN
EEEEEEEEEE PPPPPPPP SSSS 000 000 NNN NNNNN
EEE PPP SSS SSS 000 000 NNN NNNNN
EEE PPP SSS SSS 000 000 NNN NNN
EEEEEEEEEE PPP SSSS SSS 000 000 NNN NNN
EEEEEEEEEE PPP SSSSSS 00000000 NNN NN

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SOURCE FILE NAME IS " C008XXX.DAT "

THIS SOFTWARE MAKES NEXT FILES.

C008XXXH.HEX ... HIGH BYTE OBJECT FILE.
C008XXXL.HEX ... LOW BYTE OBJECT FILE.
C008XXX.PRN ... ASSEMBLY LIST FILE.

DO YOU NEED AUTO PAGE SET? (Y/N) Y ... (1)
DO YOU NEED CROSS REFERENCE TABLE? (Y/N) Y ... (2)

```

When ASM6008 is started, the start-up message is displayed.

At (1), select whether or not the auto-page-set function will be used.

Use Y ☐

Not use N ☐

If the assembly listing file output is specified, message (2) is displayed. At this stage, cross-reference table generation may be selected.

Generating Y ☐

Not generating N ☐

When the above operation is completed, ASM6008 assembles the source file.

To suspend execution, press the "CTRL" and "C" keys together at stage (1) or (2).

■ Operators

Arithmetic operators		Logical operators	
+a	Monadic positive	a_AND_b	Logical product
-a	Monadic negative	a_OR_b	Logical sum
a+b	Addition	a_XOR_b	Exclusive logical sum
a-b	Subtraction	NOT_a	Logical negation
a*b	Multiplication	Relational operators	
a/b	Division	a_EQ_b	True when a is equal to b
a_MOD_b	Remainder of a/b	a_NE_b	True when a is not equal to b
a_SHL_b	Shifts a b bits to the left	a_LT_b	True when a is less than b
a_SHR_b	Shifts a b bits to the right	a_LE_b	True when a is less than or equal to b
HIGH_a	Separates the high-order eight bits from a	a_GT_b	True when a is greater than b
LOW_a	Separates the low-order eight bits from a	a_GE_b	True when a is greater than or equal to b

■ Pseudo-instructions

Pseudo-instruction		Meaning	Example of Use		
EQU	(Equation)	To allocate data to label	ABC	EQU	9
			BCD	EQU	ABC+1
SET	(Set)	To allocate data to label (data can be changed)	ABC	SET	0001H
			ABC	SET	0002H
DW	(Define Word)	To define ROM data	ABC	DW	'AB'
			BCD	DW	0FFBH
ORG	(Origin)	To define location counter		ORG	100H
				ORG	256
PAGE	(Page)	To define boundary of page		PAGE	1H
				PAGE	3
SECTION	(Section)	To define boundary of section		SECTION	
END	(End)	To terminate assembly		END	
MACRO	(Macro)	To define macro	CHECK	MACRO	DATA
			LOCAL	LOOP	
LOCAL	(Local)	To make local specification of label during macro definition	LOOP	CP	MX, DATA
				JP	NZ, LOOP
				ENDM	
ENDM	(End Macro)	To end macro definition		CHECK	1

■ Error messages

Error message	Explanation
S (Syntax Error)	An unrecoverable syntax error was encountered.
U (Undefined Error)	The label or symbol of the operand has not been defined.
M (Missing Label)	The label field has been omitted.
O (Operand Error)	A syntax error was encountered in the operand, or the operand could not be evaluated.
P (Phase Error)	The same label or symbol was defined more than once.
R (Range Error)	- The location counter value exceeded the upper limit of the program memory, or a location exceeding the upper limit was specified. - A value greater than that which the number of significant digits of the operand will accommodate was specified.
! (Warning)	Memory areas overlapped because of a "PAGE" or "ORG" pseudo-instruction or both.
FILE NAME ERROR	The source file name was longer than 8 characters.
FILE NOT PRESENT	The specified source file was not found.
DIRECTORY FULL	No space was left in the directory of the specified disk.
FATAL DISK WRITE ERROR	The file could not be written to the disk.
LABEL TABLE OVERFLOW	The number of defined labels and symbols exceeded the label table capacity (4000).
CROSS REFERENCE TABLE OVERFLOW	The label/symbol reference count exceeded the cross-reference table capacity (only when the cross-reference table is generated).

3 FUNCTION OPTION GENERATOR FOG6008

3.1 FOG6008 Outline

With the 4-bit single-chip S1C60N08 microcomputers, the customer may select 19 hardware options. By modifying the mask patterns of the S1C60N08 according to the selected options, the system can be customized to meet the specifications of the target system.

The Function Option Generator FOG6008 is a software tool for generating data files used to generate mask patterns. It enables the customer to interactively select and specify pertinent items for each hardware option. From the data file created with FOG6008, the S1C60N08 mask pattern is automatically generated by a general purpose computer.

The HEX file for the evaluation board (S5U1C60N08E) hardware option ROM is simultaneously generated with the data file.

 The operating method is same as for the S1C62 Family. Refer to the "S1C62 Family Development Tool Reference Manual" for details.

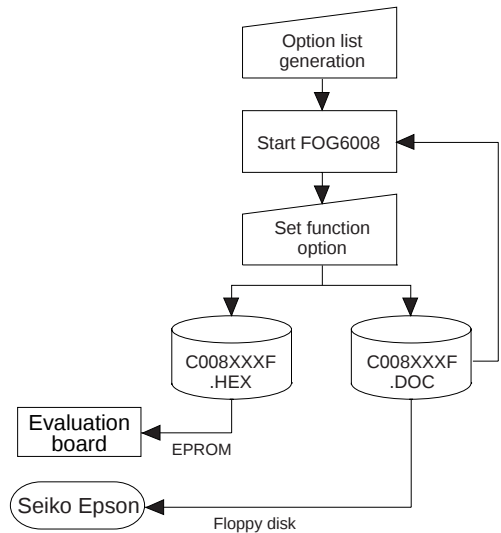


Fig. 3.1.1 FOG6008 execution flow

Note: When creating option files, please make a function option file (C008xxxF.DOC) before making a segment option file (C008xxxS.DOC).

3.2 S1C60N08 Option List

Multiple specifications are available in each option item as indicated in the Option List. Using "3.3 Option Specifications and Selection Message" as reference, select the specifications that meet the target system. Be sure to record the specifications for unused ports too, according to the instructions provided.

1. DEVICE TYPE

- DEVICE TYPE ☐ 1. E0C6008 (Normal Type <S1C60N08>)
☐ 2. E0C60L08 (Low Power Type <S1C60L08>)
☐ 3. E0C60A08 (Twin Clock Type <S1C60A08>)
- CLOCK TYPE (for evaluation board).. ☐ 1. 32 kHz ☐ 2. 38 kHz

2. OSC3 SYSTEM CLOCK (only for E0C60A08)

- ☐ 1. CR ☐ 2. Ceramic

3. MULTIPLE KEY ENTRY RESET

- COMBINATION ☐ 1. Not Use
☐ 2. Use K00, K01
☐ 3. Use K00, K01, K02
☐ 4. Use K00, K01, K02, K03
- TIME AUTHORIZE ☐ 1. Use ☐ 2. Not Use

4. WATCHDOG TIMER

- ☐ 1. Use ☐ 2. Not Use

5. INPUT INTERRUPT NOISE REJECTOR

- K00–K03 ☐ 1. Use ☐ 2. Not Use
- K10 ☐ 1. Use ☐ 2. Not Use
- K20–K23 ☐ 1. Use ☐ 2. Not Use

6. INPUT PORT PULL DOWN RESISTOR

- | | | |
|-------------|---|---|
| • K00 | ☐ 1. With Resistor | ☐ 2. Gate Direct |
| • K01 | ☐ 1. With Resistor | ☐ 2. Gate Direct |
| • K02 | ☐ 1. With Resistor | ☐ 2. Gate Direct |
| • K03 | ☐ 1. With Resistor | ☐ 2. Gate Direct |
| • K10 | ☐ 1. With Resistor | ☐ 2. Gate Direct |
| • K20 | ☐ 1. With Resistor | ☐ 2. Gate Direct |
| • K21 | ☐ 1. With Resistor | ☐ 2. Gate Direct |
| • K22 | ☐ 1. With Resistor | ☐ 2. Gate Direct |
| • K23 | ☐ 1. With Resistor | ☐ 2. Gate Direct |

7. OUTPUT PORT SPECIFICATION (R00–R03)

- | | | |
|-------------|---|---|
| • R00 | ☐ 1. Complementary | ☐ 2. Pch-OpenDrain |
| • R01 | ☐ 1. Complementary | ☐ 2. Pch-OpenDrain |
| • R02 | ☐ 1. Complementary | ☐ 2. Pch-OpenDrain |
| • R03 | ☐ 1. Complementary | ☐ 2. Pch-OpenDrain |

8. R10 SPECIFICATION

- | | | |
|------------------------------|---|---|
| • OUTPUT SPECIFICATION | ☐ 1. Complementary | ☐ 2. Pch-OpenDrain |
| • OUTPUT TYPE | ☐ 1. DC Output | ☐ 2. Buzzer Output |

9. R11 SPECIFICATION

- | | | |
|------------------------------|---|---|
| • OUTPUT SPECIFICATION | ☐ 1. Complementary | ☐ 2. Pch-OpenDrain |
| • OUTPUT TYPE | ☐ 1. DC Output | ☐ 2. SIO Flag |

10. R12 SPECIFICATION

- | | | |
|------------------------------|---|---|
| • OUTPUT SPECIFICATION | ☐ 1. Complementary | ☐ 2. Pch-OpenDrain |
| • OUTPUT TYPE | ☐ 1. DC Output | |
| | ☐ 2. FOUT 32768 or 38400 [Hz] | |
| | ☐ 3. FOUT 16384 or 19200 [Hz] | |
| | ☐ 4. FOUT 8192 or 9600 [Hz] | |
| | ☐ 5. FOUT 4096 or 4800 [Hz] | |
| | ☐ 6. FOUT 2048 or 2400 [Hz] | |
| | ☐ 7. FOUT 1024 or 1200 [Hz] | |
| | ☐ 8. FOUT 512 or 600 [Hz] | |
| | ☐ 9. FOUT 256 or 300 [Hz] | |

11. R13 SPECIFICATION

- | | | |
|------------------------------|--|---|
| • OUTPUT SPECIFICATION | ☐ 1. Complementary | ☐ 2. Pch-OpenDrain |
| • OUTPUT TYPE | ☐ 1. DC Output | |
| | ☐ 2. Buzzer Inverted Output (R13 Control) | |
| | ☐ 3. Buzzer Inverted Output (R10 Control) | |

12. I/O PORT SPECIFICATION

- | | | |
|-------------|---|---|
| • P00 | ☐ 1. Complementary | ☐ 2. Pch-OpenDrain |
| • P01 | ☐ 1. Complementary | ☐ 2. Pch-OpenDrain |
| • P02 | ☐ 1. Complementary | ☐ 2. Pch-OpenDrain |
| • P03 | ☐ 1. Complementary | ☐ 2. Pch-OpenDrain |
| • P10 | ☐ 1. Complementary | ☐ 2. Pch-OpenDrain |
| • P11 | ☐ 1. Complementary | ☐ 2. Pch-OpenDrain |
| • P12 | ☐ 1. Complementary | ☐ 2. Pch-OpenDrain |
| • P13 | ☐ 1. Complementary | ☐ 2. Pch-OpenDrain |

13. SIN PULL DOWN RESISTOR

- | | |
|---|---|
| ☐ 1. With Resistor | ☐ 2. Gate Direct |
|---|---|

14. SOUT SPECIFICATION

- | | |
|---|---|
| ☐ 1. Complementary | ☐ 2. Pch-OpenDrain |
|---|---|

15. SCLK SPECIFICATION

- PULL DOWN RESISTOR ☐ 1. With Resistor ☐ 2. Gate Direct
- OUTPUT SPECIFICATION ☐ 1. Complementary ☐ 2. Pch-OpenDrain
- LOGIC ☐ 1. Positive ☐ 2. Negative

16. SIO DATA PERMUTATION

- ☐ 1. MSB First ☐ 2. LSB First

17. EVENT COUNTER NOISE REJECTOR

- ☐ 1. 2048 or 2400 [Hz] ☐ 2. 256 or 300 [Hz]

18. LCD SPECIFICATION

• BIAS SELECTION

- S1C60N08 ☐ 1. 1/3 Bias, Regulator Used, LCD 3 V
☐ 2. 1/3 Bias, Regulator Not Used, LCD 3 V
☐ 3. 1/2 Bias, Regulator Not Used, LCD 3 V
☐ 4. 1/3 Bias, Regulator Not Used, LCD 4.5 V
- S1C60L08 ☐ 1. 1/3 Bias, Regulator Used, LCD 3 V
☐ 2. 1/2 Bias, Regulator Not Used, LCD 3 V
☐ 3. 1/3 Bias, Regulator Not Used, LCD 4.5 V
- S1C60A08 ☐ 1. 1/3 Bias, Regulator Used, LCD 3 V
☐ 2. 1/3 Bias, Regulator Not Used, LCD 3 V
☐ 3. 1/2 Bias, Regulator Not Used, LCD 3 V
☐ 4. 1/3 Bias, Regulator Not Used, LCD 4.5 V

- DUTY SELECTION ☐ 1. 1/4 Duty
☐ 2. 1/3 Duty
☐ 3. 1/2 Duty

19. SEGMENT MEMORY ADDRESS

- ☐ 1. 0 Page (040–06F)
☐ 2. 2 Page (240–26F)

3.3 Option Specifications and Selection Message

Screen that can be selected as function options set on the S1C60N08 are shown below, and their specifications are also described.

1 Device type

```
*** OPTION NO.1 ***
--- DEVICE TYPE ---
      DEVICE TYPE
                1. E0C6008
                2. E0C60L08
                3. E0C60A08

PLEASE SELECT NO.(1) ? 3 ☐

      DEVICE TYPE      3. E0C60A08  SELECTED
```

Select the chip specification.

E0C6008 (S1C60N08), E0C60L08 (S1C60L08) and E0C60A08 (S1C60A08) denote 3 V power source voltage specification, LOW POWER specification for 1.5 V power source voltage, and TWIN CLOCK specification, respectively. When E0C6008 or E0C60L08 is selected, OSC3 oscillation circuit is fixed at CR oscillation. However, it can not be used.

Crystal selection for evaluation board

```
--- CLOCK TYPE ---
      CLOCK TYPE
                1. 32KHZ
                2. 38KHZ

PLEASE SELECT NO.(1) ? 1 ☐

      CLOCK TYPE      1. 32KHZ  SELECTED
```

Select the OSC1 clock frequency (crystal) for the evaluation board.

Either 32.768 kHz or 38.4 kHz can be selected.

2 OSC3 system clock

```
*** OPTION NO.2 ***
--- OSC3 SYSTEM CLOCK ---
      OSC3 SYSTEM CLOCK
                1. CR
                2. CERAMIC

PLEASE SELECT NO.(1) ? 1 ☐

      OSC3 SYSTEM CLOCK      1. CR  SELECTED
```

Select an oscillator type for the OSC3 oscillation circuit.

To minimize external components, CR oscillation circuit would be suitable; to obtain a stable oscillation frequency, ceramic oscillation circuit would be suitable. When CR oscillation circuit is selected, only a resistor is needed as an external component since a capacitor is built-in.

On the other hand, when ceramic oscillation circuit is selected, a ceramic oscillator, a gate capacitor and a drain capacitor are needed as external components. When ceramic oscillation circuit is selected, the oscillation frequency is fixed at 500 kHz; when CR oscillation circuit is selected, it may be adjusted to a certain extent depending on the external resistor.

* The above selection is only possible with 60A08.

3 Multiple key entry reset

```
*** OPTION NO.3 ***
--- MULTIPLE KEY ENTRY RESET ---
      COMBINATION
                1. NOT USE
                2. USE K00, K01
                3. USE K00, K01, K02
                4. USE K00, K01, K02, K03

PLEASE SELECT NO.(1) ? 2 ☐

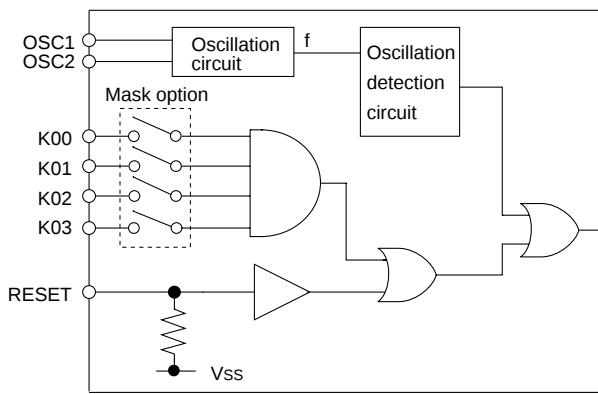
      TIME AUTHORIZE
                1. USE
                2. NOT USE

PLEASE SELECT NO.(1) ? 1 ☐

      COMBINATION      2. USE K00, K01  SELECTED
      AUTHORIZE        1. USE    SELECTED
```

The reset function when K00 through K03 are entered and the time authorize circuit are configured.

When "NOT USE" is set for the combination, the reset function is not activated even if K00 through K03 are entered. When "USE K00, K01" is set, the system is reset immediately the K00 and K01 inputs go high at the same time. Similarly, the system is reset as soon as the K00 through K02 inputs or the K00 through K03 inputs go high. When "USE" is set for the time authorize circuit, a simultaneous high input time is authorized. The system is reset when a signal is input for more than 1 to 3 sec.



If the time authorize circuit is not used, the system is reset when a high signal is input for more than 6 msec.

* If "NOT USE" is set for the combination, the time authorize selection is required.

The system reset circuit is shown in Figure 3.3.1.

Fig. 3.3.1 System reset circuit

4 Watchdog timer

```
*** OPTION NO.4 ***
--- WATCHDOG TIMER ---
      WATCHDOG TIMER
                        1. USE
                        2. NOT USE

PLEASE SELECT NO.(1) ? 1 ☒

      WATCHDOG TIMER    1. USE    SELECTED
```

Select whether the watchdog timer built-in to detect CPU runaways will be used or not.

When the watchdog timer is not reset by the program within 3 to 4 second cycles, the CPU is initially reset.

5 Input interrupt noise rejector

```
*** OPTION NO.5 ***
--- I/P INTERRUPT NOISE REJECTOR ---
      K00-K03
                        1. USE
                        2. NOT USE

PLEASE SELECT NO.(1) ? 1 ☒

      K10
                        1. USE
                        2. NOT USE

PLEASE SELECT NO.(1) ? 1 ☒

      K20-K23
                        1. USE
                        2. NOT USE

PLEASE SELECT NO.(1) ? 1 ☒

      K00-K03    1. USE    SELECTED
      K10        1. USE    SELECTED
      K20-K23    1. USE    SELECTED
```

Select whether noise rejector will be supplemented to the input interruptor of K00–K03, K10 and K20–K23.

When "USE" is selected, the entry signal will pass the noise rejector, and occurrence of interrupt errors due to noise or chattering can be avoided. Note, however, that because the noise rejector performs entry signal sampling at 4 kHz, "NOT USE" should be selected when high speed response is required.

6 Input port pull down resistor

```

*** OPTION NO.6 ***
--- I/P PORT PULL DOWN RESISTOR ---
    K00
        1. WITH RESISTOR
        2. GATE DIRECT

PLEASE SELECT NO.(1) ? 1 ☐

        :
        (Selection for K01-K03 and K10)
        :

PLEASE SELECT NO.(1) ? 1 ☐

    K20
        1. WITH RESISTOR
        2. GATE DIRECT

PLEASE SELECT NO.(1) ? 2 ☐

        :
        (Selection for K21-K23)
        :

PLEASE SELECT NO.(1) ? 2 ☐

    K00  1. WITH RESISTOR  SELECTED
    K01  1. WITH RESISTOR  SELECTED
    K02  1. WITH RESISTOR  SELECTED
    K03  1. WITH RESISTOR  SELECTED
    K10  1. WITH RESISTOR  SELECTED
    K20  2. GATE DIRECT   SELECTED
    K21  2. GATE DIRECT   SELECTED
    K22  2. GATE DIRECT   SELECTED
    K23  2. GATE DIRECT   SELECTED

```

Select whether input ports (K00–K03, K10 and K20–K23) will each be supplemented with pull down resistors or not. When "GATE DIRECT" is selected, see to it that entry floating state does not occur. Select "WITH RESISTOR" pull down resistor for unused ports.

Moreover, the input port status is changed from high level (VDD) to low (VSS) with pull down resistors, a delay of approximately 1 msec in waveform rise time will occur depending on the pull down resistor and entry load time constant. Because of this, when input reading is to be conducted, ensure the appropriate wait time with the program.

The configuration of the pull down resistor circuit is shown in Figure 3.3.2.

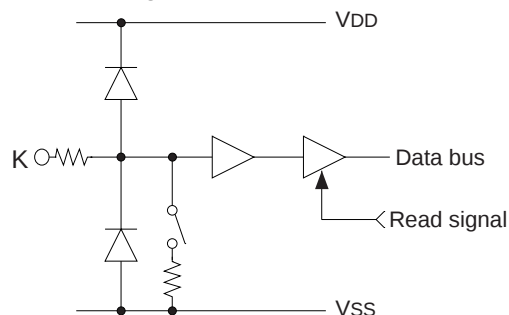


Fig. 3.3.2 Configuration of pull down resistor

7 Output port output specification (R00–R03)

```

*** OPTION NO.7 ***
--- O/P OUTPUT SPEC. (R00-R03) ---
    R00
        1. COMPLEMENTARY
        2. P-CH OPEN DRAIN

PLEASE SELECT NO.(1) ? 1 ☐

    R01
        1. COMPLEMENTARY
        2. P-CH OPEN DRAIN

PLEASE SELECT NO.(1) ? 1 ☐

    R02
        1. COMPLEMENTARY
        2. P-CH OPEN DRAIN

PLEASE SELECT NO.(1) ? 2 ☐

    R03
        1. COMPLEMENTARY
        2. P-CH OPEN DRAIN

PLEASE SELECT NO.(1) ? 2 ☐

    R00  1. COMPLEMENTARY  SELECTED
    R01  1. COMPLEMENTARY  SELECTED
    R02  2. P-CH OPEN DRAIN SELECTED
    R03  2. P-CH OPEN DRAIN SELECTED

```

Select the output specification for the output ports (R00–R03).

Either complementary output or Pch open drain output may be selected.

When output port is to be used on key matrix configuration, select Pch open drain output.

For unused output ports, select complementary output.

The output circuit configuration is shown in Figure 3.3.3.

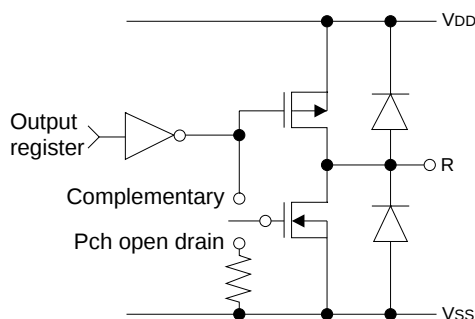


Fig. 3.3.3 Configuration of output circuit

8 R10 specification

```

*** OPTION NO.8 ***
--- R10 SPECIFICATION ---
      OUTPUT SPECIFICATION
                                1. COMPLEMENTARY
                                2. P-CH OPEN DRAIN

PLEASE SELECT NO.(1) ? 1 ☒

      OUTPUT TYPE
                                1. DC OUTPUT
                                2. BUZZER OUTPUT

PLEASE SELECT NO.(1) ? 2 ☒

OUTPUT SPECIFICATION 1. COMPLEMENTARY  SELECTED
OUTPUT TYPE          2. BUZZER          SELECTED

```

Select the output specification for the R10 terminal.

Either complementary output or Pch open drain output may be selected.

When DC output is selected, R10 becomes a regular output port. When buzzer output is selected, by writing "1" to the R10 register, buzzer drive (oscillation output) signal is output from the R10 terminal.

* When DC output is selected, the R13 terminal output type (see Option 11, "R13 specification") selection is limited to DC output only.

The circuit configuration is the same as those of the output ports R00–R03 (Figure 3.3.3). Refer to Figure 3.3.6 for the buzzer output waveform.

9 R11 specification

```

*** OPTION NO.9 ***
--- R11 SPECIFICATION ---
      OUTPUT SPECIFICATION
                                1. COMPLEMENTARY
                                2. P-CH OPEN DRAIN

PLEASE SELECT NO.(1) ? 1 ☒

      OUTPUT TYPE
                                1. DC OUTPUT
                                2. SIO FLAG

PLEASE SELECT NO.(1) ? 2 ☒

OUTPUT SPECIFICATION 1. COMPLEMENTARY  SELECTED
OUTPUT TYPE          2. SIO FLAG       SELECTED

```

Select the output specification for the R11 terminal.

Either complementary output or Pch open drain output may be selected.

When DC output is selected, R11 becomes a regular output port. When SIO flag is selected, a signal indicating the SIO operation status (RUN/STOP) is generated from the R11 terminal.

The circuit configuration is the same as those of the output ports R00–R03 (Figure 3.3.3).

10 R12 specification

```

*** OPTION NO.10 ***
--- R12 SPECIFICATION ---
      OUTPUT SPECIFICATION
                                1. COMPLEMENTARY
                                2. P-CH OPEN DRAIN

PLEASE SELECT NO.(1) ? 1 ☒

      OUTPUT TYPE
                                1. DC OUTPUT
                                2. FOUT 32768 OR 38400 HZ
                                3. FOUT 16384 OR 19200 HZ
                                4. FOUT 8192 OR 9600 HZ
                                5. FOUT 4096 OR 4800 HZ
                                6. FOUT 2048 OR 2400 HZ
                                7. FOUT 1024 OR 1200 HZ
                                8. FOUT 512 OR 600 HZ
                                9. FOUT 256 OR 300 HZ

PLEASE SELECT NO.(1) ? 2 ☒

OUTPUT SPECIFICATION 1. COMPLEMENTARY  SELECTED
OUTPUT TYPE          2. FOUT 32768 OR 38400 HZ  SELECTED

```

Select the output specification for the R12 terminal.

Either complementary output or Pch open drain output may be selected.

When DC output is selected, R12 becomes a regular output port. When FOUT is selected, clock with frequency selected from the R12 terminal is generated by writing "1" to the R12 register.

- When DC output is selected
When the R12 register is set to "1", the R12 terminal output goes high (VDD), and goes low (VSS) when set to "0".
Output waveform is shown in Figure 3.3.4.



Fig. 3.3.4 Output waveform at DC output selection

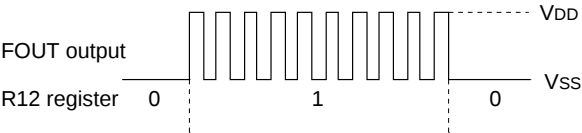


Fig. 3.3.5 Output waveform at R12 FOUT output selection

- When FOUT output is selected
When FOUT bit (R12 register) is set to "1", 50% duty and VDD–VSS amplitude square wave is generated at the specified frequency. When set to "0", the FOUT terminal goes low (VSS).
A FOUT frequency may be selected from among 8 types, ranging from 256 or 300 Hz to 32,768 or 38,400 Hz.
FOUT output is normally utilized to provide clock to other devices but since hazard occurs at the square wave breaks, great caution must be observed when using it.
Output waveform is shown in Figure 3.3.5.

11 R13 specification

*** OPTION NO.11 ***
--- R13 SPECIFICATION ---
 OUTPUT SPECIFICATION
 1. COMPLEMENTARY
 2. P-CH OPEN DRAIN

PLEASE SELECT NO.(1) ? 1☐

 OUTPUT TYPE
 1. DC OUTPUT
 2. BUZZER INVERTED O/P(R13)
 3. BUZZER INVERTED O/P(R10)

PLEASE SELECT NO.(1) ? 2☐

OUTPUT SPECIFICATION 1. COMPLEMENTARY SELECTED
OUTPUT TYPE 2. BUZZER INVERTED O/P(R13) SELECTED

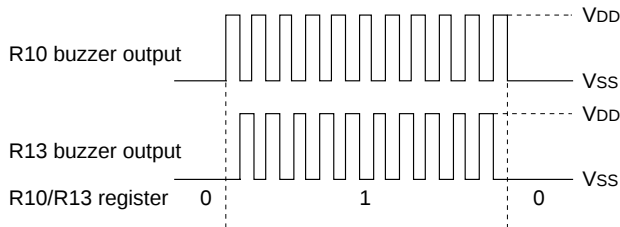


Fig. 3.3.6 Buzzer output waveform

- Select the output specification for the R13 terminal.
- Either complementary output or Pch open drain output may be selected.
- When DC output is selected, R13 becomes a regular output port. When "BUZZER INVERTED OUTPUT" is selected, inverted waveform of the R10 buzzer output is generated from the R13 terminal. The R13 and R10 control bits become buzzer inverted output when "1" is written to the R13 and R10 registers, respectively.
- * The buzzer inverted output may not be selected when the R10 output type (see Option 8, "R10 specification") is not set to buzzer. Moreover, at this point, when the R10 output type is reselected after selecting buzzer inverted output, the R10 output type is fixed at buzzer output.
- Buzzer output waveform is shown in Figure 3.3.6.

12 I/O port specification

```

*** OPTION NO.12 ***
--- I/O PORT SPECIFICATION ---
P00
    1. COMPLEMENTARY
    2. P-CH OPEN DRAIN
PLEASE SELECT NO.(1) ? 1☐

P01
    1. COMPLEMENTARY
    2. P-CH OPEN DRAIN
PLEASE SELECT NO.(1) ? 1☐

P02
    1. COMPLEMENTARY
    2. P-CH OPEN DRAIN
PLEASE SELECT NO.(1) ? 2☐

P03
    1. COMPLEMENTARY
    2. P-CH OPEN DRAIN
PLEASE SELECT NO.(1) ? 1☐

P10
    1. COMPLEMENTARY
    2. P-CH OPEN DRAIN
PLEASE SELECT NO.(1) ? 2☐

P11
    1. COMPLEMENTARY
    2. P-CH OPEN DRAIN
PLEASE SELECT NO.(1) ? 2☐

P12
    1. COMPLEMENTARY
    2. P-CH OPEN DRAIN
PLEASE SELECT NO.(1) ? 2☐

P13
    1. COMPLEMENTARY
    2. P-CH OPEN DRAIN
PLEASE SELECT NO.(1) ? 2☐

P00  1. COMPLEMENTARY  SELECTED
P01  1. COMPLEMENTARY  SELECTED
P02  1. COMPLEMENTARY  SELECTED
P03  1. COMPLEMENTARY  SELECTED
P10  2. P-CH OPEN DRAIN SELECTED
P11  2. P-CH OPEN DRAIN SELECTED
P12  2. P-CH OPEN DRAIN SELECTED
P13  2. P-CH OPEN DRAIN SELECTED

```

Select the output specification when the I/O ports (P00–P03 and P10–P13) are in output mode. Either complementary output or Pch open drain output may be selected.

The circuit configuration of the output driver is the same as those of the output ports R00–R03 (Figure 3.3.3).

Select complementary output for unused ports.

The I/O ports can control the input/output direction according to the IOC bit (2EEH•D0 and 2FEH•D0); at "1" and "0" settings, it is set to output port and input port, respectively.

The pull down resistor of this port is turned on by the read signal and is normally turned off to minimize leak current.

Because of this, when the port is set for input, take care that a floating state does not occur in the terminal.

The I/O port circuit configuration is shown in Figure 3.3.7.

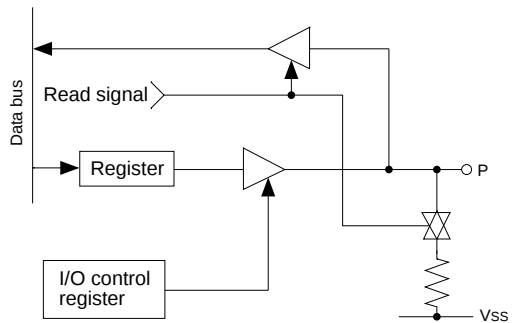


Fig. 3.3.7 Circuit configuration of I/O port

13 SIN pull down resistor

```

*** OPTION NO.13 ***
--- SIN PULL DOWN RESISTOR ---
    SIN PULL DOWN RESISTOR
        1. WITH RESISTOR
        2. GATE DIRECT
PLEASE SELECT NO.(1) ? 1☐

SIN PULL DOWN RESISTOR  1. WITH RESISTOR  SELECTED

```

Select whether pull down resistor will be supplemented to the SIN terminal (SIO data input terminal). When "GATE DIRECT" is selected, take care that input floating state does not occur. Select "WITH RESISTOR" if the SIN terminal will not be used.

14 SOUT specification

```

*** OPTION NO.14 ***
--- SOUT SPECIFICATION ---
    SOUT SPECIFICATION
        1. COMPLEMENTARY
        2. P-CH OPEN DRAIN

PLEASE SELECT NO.(1) ? 1☐

SOUT SPECIFICATION    1. COMPLEMENTARY    SELECTED

```

Select the output specification for the SOUT terminal.

Either complementary output or Pch open drain output may be selected.

Select complementary output if the SOUT terminal will not be used.

15 SCLK specification

```

*** OPTION NO.15 ***
--- SCLK SPECIFICATION ---
    SCLK PULL DOWN RESISTOR
        1. WITH RESISTOR
        2. GATE DIRECT

PLEASE SELECT NO.(1) ? 1☐

    OUTPUT SPECIFICATION
        1. COMPLEMENTARY
        2. P-CH OPEN DRAIN

PLEASE SELECT NO.(1) ? 1☐

    LOGIC
        1. POSITIVE
        2. NEGATIVE

PLEASE SELECT NO.(1) ? 1☐

SCLK PULL DOWN RESISTOR  1. WITH RESISTOR    SELECTED
OUTPUT SPECIFICATION    1. COMPLEMENTARY    SELECTED
LOGIC                   1. POSITIVE          SELECTED

```

Select the pull down resistor, output specification and logic for the SCLK terminal (input/output terminal of the SIO synchronous clock).

Pull down resistor is only available when the clock mode is set at external clock mode.

Select with pull down resistor, complementary output, and positive logic if the SCLK terminal will not be used.

The SCLK timing chart is shown in Figure 3.3.8.

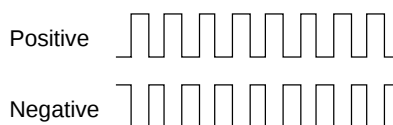


Fig. 3.3.8 SCLK timing chart

16 SIO data permutation

```

*** OPTION NO.16 ***
--- SIO DATA PERMUTATION ---
    SIO DATA PERMUTATION
        1. MSB FIRST
        2. LSB FIRST

PLEASE SELECT NO.(1) ? 1☐

SIO DATA PERMUTATION  1. MSB FIRST    SELECTED

```

Select whether the SIO input/output (SIN or SOUT) data bit permutation will be MSB first or LSB first.

Select one suitable for your programming needs.

Input/output data permutation is shown in Figure 3.3.9.

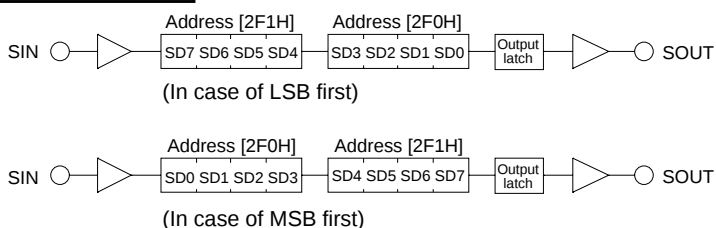


Fig. 3.3.9 Input/output data permutation

17 Event counter noise rejector

```

*** OPTION NO.17 ***
--- EVENT COUNTER NOISE REJECTOR ---
    EVENT COUNTER NOISE REJECTOR
        1. 2048 OR 2400 HZ
        2. 256 OR 300 HZ

PLEASE SELECT NO.(1) ? 1☐

EVENT COUNTER NOISE REJECTOR  1. 2048 OR 2400 HZ    SELECTED

```

The system is equipped with built-in noise rejector to prevent operational errors by the event counter caused by noise and chattering in the K02 and K03 terminals.

Either 2,048 (or 2,400) Hz or 256 (or 300) Hz may be selected as the sampling frequency.

Select one suitable for the input signal.

18 LCD specification

```

*** OPTION NO.18 ***
--- LCD SPECIFICATION ---
    BIAS SELECTION
        1. 1/3 B USE REGUL. LCD 3V
        2. 1/3 B NOT USE REGUL. LCD 3V
        3. 1/2 B NOT USE REGUL. LCD 3V
        4. 1/3 B NOT USE REGUL. LCD 4.5V

PLEASE SELECT NO.(1) ? 1 ☐

    DUTY SELECTION
        1. 1/4 DUTY
        2. 1/3 DUTY
        3. 1/2 DUTY

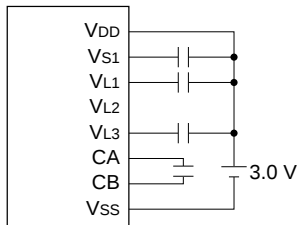
PLEASE SELECT NO.(1) ? 1 ☐

BIAS SELECTION    1. 1/3 B USE REGUL. LCD 3V    SELECTED
DUTY SELECTION    1. 1/4 DUTY    SELECTED
  
```

Table 3.3.1 Common duty selection standard

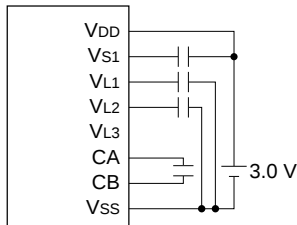
Number of segments	Common duty
1-96	1/2
97-144	1/3
145-192	1/4

4.5 V LCD panel
1/4, 1/3 or 1/2 duty, 1/3 bias



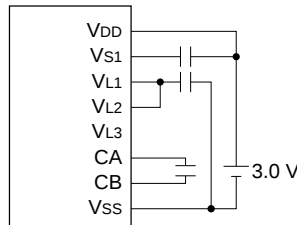
Note: VL2 is shorred to Vss inside the IC

3 V LCD panel
1/4, 1/3 or 1/2 duty, 1/3 bias

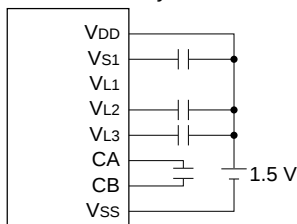


Note: VL3 is shorred to Vss inside the IC

3 V LCD panel
1/4, 1/3 or 1/2 duty, 1/2 bias

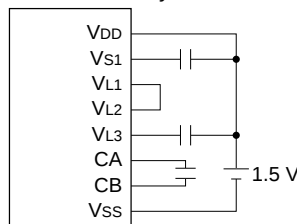


4.5 V LCD panel
1/4, 1/3 or 1/2 duty, 1/3 bias



Note: VL1 is shorred to Vss inside the IC

3 V LCD panel
1/4, 1/3 or 1/2 duty, 1/2 bias



Select the common duty and bias.
When "1/3 B USE REGULATOR LCD 3V" is selected, the internal regulator is used. The internal regulator will generate VL1 (-1.05 V).
When "1/3 B NOT USE REGULATOR LCD 3V" is selected, the internal regulator is not used.
For the LCD drive bias, either 1/3 bias or 1/2 bias can be selected.
See Figure 3.3.10 for the external elements according to the bias to be selected.
When 1/2 duty is selected, up to 96 segments of LCD panel can be driven with 2 COM terminals and 48 SEG terminals. When 1/3 duty is selected, up to 144 segments can be driven with 3 COM terminals, and when 1/4 duty is selected, up to 192 segments with 4 COM terminals.
When 1/2 duty is selected, the COM0 and COM1 terminals are effective for COM output and the COM2 and COM3 terminals always output an off signal. When 1/3 duty is selected, the COM0 to COM2 terminals are effective and the COM3 terminal always outputs an off signal.
For drive duty selection, refer to Table 3.3.1. Figures 3.3.11 and 3.3.12 show the drive waveforms of 1/3 bias driving and 1/2 bias driving, respectively.

Fig. 3.3.10
External elements for LCD power supply circuit

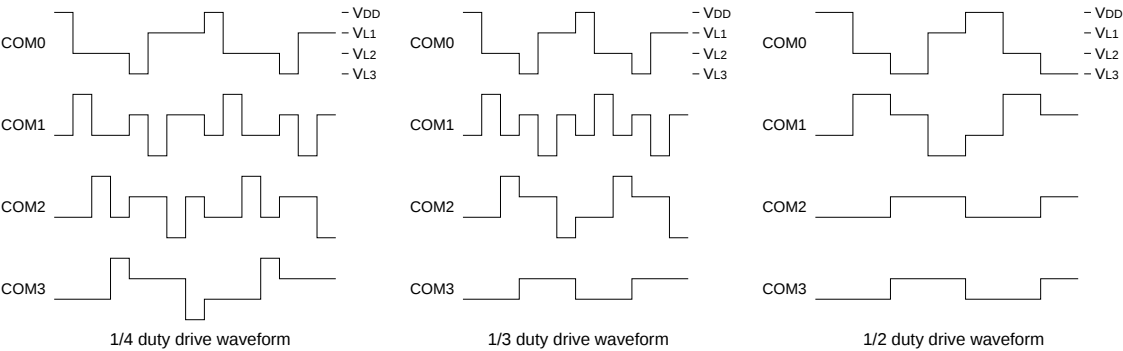


Fig. 3.3.11 Drive waveform of COM terminals (1/3 bias)

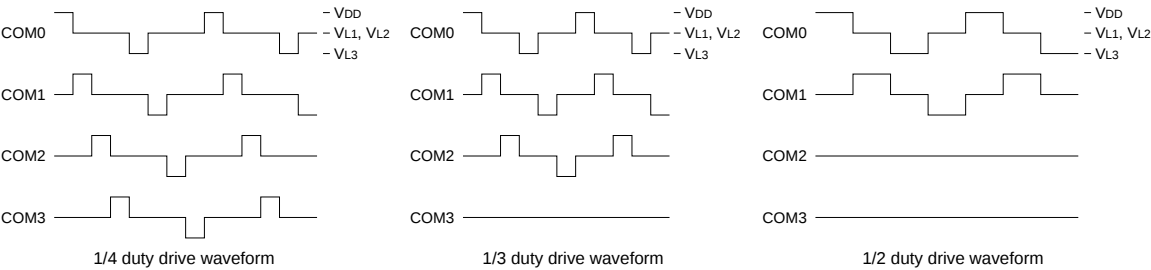


Fig. 3.3.12 Drive waveform of COM terminals (1/2 bias)

19 Segment memory address

```
*** OPTION NO.19 ***
--- SEGMENT MEMORY ADDRESS ---
    SEGMENT MEMORY ADDRESS
        1. 0 PAGE(040-06F)
        2. 2 PAGE(240-26F)

PLEASE SELECT NO.(1) ? 1[ ]

SEGMENT MEMORY ADDRESS 1. 0 PAGE(040-06F)  SELECTED
```

Select the segment memory area.
When "0 PAGE" is selected, the segment memory area is allocated to "040H-06FH" and R/W access utilizing this RAM area becomes available.
When "2 PAGE" is selected, the segment memory area is allocated to "0C0H-0EFH" and becomes a write-only area.

3.4 FOG6008 Quick Reference

■ Starting command and input/output files

Execution file: FOG6008.EXE

Starting command: FOG6008 ☐

☐ indicates the Return key.

Input file: C008XXXF.DOC (Function option document file, when modifying)

Output file: C008XXXF.DOC (Function option document file)
C008XXXF.HEX (Function option HEX file)

■ Display example

```

*** E0C6008 FUNCTION OPTION GENERATOR. --- Ver 2.20 ***

EEEEEEEEEE PPPPPPPP SSSSSSS 00000000 NNN NNN
EEEEEEEEEE PPPPPPPPP SSS SSSS 000 000 NNNN NNN
EEE PPP PPP SSS SSS 000 000 NNNNN NNN
EEE PPP PPP SSS 000 000 NNNNNN NNN
EEEEEEEEEE PPPPPPPPP SSSSSS 000 000 NNN NNN NNN
EEEEEEEEEE PPPPPPPPP SSSS 000 000 NNN NNNNNN
EEE PPP SSS 000 000 NNN NNNNN
EEE PPP SSS SSS 000 000 NNN NNNN
EEEEEEEEEE PPP SSS SSS 000 000 NNN NNN
EEEEEEEEEE PPP SSSSSS 00000000 NNN NN

(C) COPYRIGHT 1997 SEIKO EPSON CORP.

THIS SOFTWARE MAKES NEXT FILES.

C008XXXF.HEX ... FUNCTION OPTION HEX FILE.
C008XXXF.DOC ... FUNCTION OPTION DOCUMENT FILE.

STRIKE ANY KEY.
```

Start-up message

When FOG6008 is started, the start-up message is displayed.

For "STRIKE ANY KEY.", press any key to advance the program execution.

To suspend execution, press the "CTRL" and "C" keys together: the sequence returns to the DOS command level.

```

*** E0C6008 USER'S OPTION SETTING. --- Ver 2.20 ***

CURRENT DATE IS 99/03/01
PLEASE INPUT NEW DATE : ☐
```

Date input

Enter the 2-digit year, month, and day of the month by delimiting them with a slash ("/").

When not modifying the date, press the RETURN key "☐" to continue.

```

*** OPERATION SELECT MENU ***

1. INPUT NEW FILE
2. EDIT FILE
3. RETURN TO DOS

PLEASE SELECT NO.?
```

Operation selection menu

Enter a number from 1 to 3 to select a subsequent operation.

1. To set new function options.
2. To modify the document file.
3. To terminate FOG6008.

Setting new function options

Select "1" on the operation selection menu.

- (1) Enter the file name.
- (2) Enter the customer's company name.
- (3) Enter any comment.

(Within 50 characters x 10 lines)

Next, start function option setting from option No. 1.

```

*** OPERATION SELECT MENU ***

1. INPUT NEW FILE
2. EDIT FILE
3. RETURN TO DOS

PLEASE SELECT NO.? 1☐
PLEASE INPUT FILE NAME? C0080A0☐ ..(1)
PLEASE INPUT USER'S NAME? SEIKO EPSON CORP.☐ ..(2)
PLEASE INPUT ANY COMMENT
(ONE LINE IS 50 CHR)? FUJIMI PLANT☐ ..(3)
? 281 FUJIMI SUWA-GUN NAGANO-KEN 399-0293 JAPAN☐
? TEL 0266-61-1211☐
? FAX 0266-61-1273☐
? ☐

PLEASE INPUT FILE NAME? C0080A0☐
EXISTS OVERWRITE(Y/N)? N☐
PLEASE INPUT FILE NAME? C0080B0☐
PLEASE INPUT USER'S NAME?
```

In case a function option document file with the same name as the file name specified in the current drive exists, the user is asked whether overwriting is desired. Enter "Y" or "N" accordingly.

```

*** OPERATION SELECT MENU ***

    1. INPUT NEW FILE
    2. EDIT FILE
    3. RETURN TO DOS

PLEASE SELECT NO.? 2[ ]

*** SOURCE FILE(S) ***

C0080A0          C0080B0          C0080C0          .. (1)

PLEASE INPUT FILE NAME? C0080A0[ ]          .. (2)
PLEASE INPUT USER'S NAME? [ ]              .. (3)
PLEASE INPUT ANY COMMENT
(ONE LINE IS 50 CHR)? [ ]                  .. (4)
PLEASE INPUT EDIT NO.? 4[ ]                .. (5)
:
(Modifying function option settings)
:
PLEASE INPUT EDIT NO.? E[ ]

```

In step (1), if no modifiable source exists, the following message is displayed and the sequence returns to the operation selection menu.

```

*** SOURCE FILE(S) ***

FUNCTION OPTION DOCUMENT FILE IS NOT FOUND.

```

In step (2), if the function option document file is not in the current drive, the following message is displayed, prompting entry of other file name.

```

PLEASE INPUT FILE NAME? C0080N0[ ]
FUNCTION OPTION DOCUMENT FILE IS NOT FOUND.
PLEASE INPUT FILE NAME?

```

```

*** OPTION NO.2 ***
--- OSC3 SYSTEM CLOCK ---
    OSC3 SYSTEM CLOCK
        1. CR
        2. CERAMIC

PLEASE SELECT NO.(1) ? 1[ ]

OSC3 SYSTEM CLOCK    1. CR  SELECTED

```

```

END OF OPTION SETTING.
DO YOU MAKE HEX FILE (Y/N) ? Y[ ]          .. (1)

*** OPTION EPROM SELECT MENU ***

    1. 27C64
    2. 27C128
    3. 27C256
    4. 27C512

PLEASE SELECT NO.? 2[ ]                    .. (2)

    2. 27C128    SELECTED

MAKING FILE(S) IS COMPLETED.

*** OPERATION SELECT MENU ***

    1. INPUT NEW FILE
    2. EDIT FILE
    3. RETURN TO DOS

PLEASE SELECT NO.?

```

Modifying function option settings

Select "2" on the operation selection menu.

- (1) Will display the files on the current drive.
- (2) Enter the file name.
- (3) Enter the customer's company name.
- (4) Enter any comment.

Previously entered data can be used by pressing the RETURN key "[]" at (3) and (4).

- (5) Enter the number of the function option to be modified. When selection of one option is complete, the system prompts entry of another function option number. Repeat selection until all options to be modified are selected.

Enter "E[]" to end option setting. Then, move to the confirmation procedure for HEX file generation.

Option selection

The selections for each option correspond one to one to the option list. Enter the selection number. The value in parentheses () indicates the default value, and is set when only the RETURN key "[]" is pressed.

In return, the confirmation is displayed.

When you wish to modify previously set function options in the new setting process, enter "B[]" to return 1 step back to the previous function option setting operation.

EPROM selection

When setting function options setting is completed, the following message is output to ask the operator whether to generate the HEX file.

- (1) When debugging the program with the evaluation board, HEX file is needed, so enter "Y[]". If "N[]" is entered, no HEX file is generated and only document file is generated.
- (2) For the option ROM selection menu displayed when "Y[]" is entered in Step (1), select the EPROM to be used for setting evaluation board options.

When a series of operations are complete, the sequence returns to the operation selection menu.

3.5 Sample File

```

* E0C6008 FUNCTION OPTION DOCUMENT V 2.20
*
* FILE NAME      C0080A0F.DOC
* USER'S NAME    SEIKO EPSON CORP.
* INPUT DATE     1998/10/26
*
* COMMENT        ETT PLANT
*                NO.287 NANKING E.ROAD, SEC.3, TAIPEI, TAIWAN, R.O.C.
*                TEL 2717-7360
*                FAX 2717-7377
*
*
* OPTION NO.1
* < DEVICE TYPE >
*   DEVICE TYPE      E0C60A08 ----- SELECTED
* OPT0101 03
*
* < CLOCK TYPE >
*   CLOCK TYPE       32KHZ ----- SELECTED
* OPT0102 01
*
* OPTION NO.2
* < OSC3 SYSTEM CLOCK >
*   OSC3 SYSTEM CLOCK CERAMIC ----- SELECTED
* OPT0201 02
*
* OPTION NO.3
* < MULTIPLE KEY ENTRY RESET >
*   COMBINATION      USE K00,K01,K02,K03 ----- SELECTED
*   AUTHORIZE        USE ----- SELECTED
* OPT0301 04
* OPT0302 01
*
* OPTION NO.4
* < WATCHDOG TIMER >
*   WATCHDOG TIMER   USE ----- SELECTED
* OPT0401 01
*
* OPTION NO.5
* < I/P INTERRUPT NOISE REJECTOR >
*   K00-K03          USE ----- SELECTED
*   K10              USE ----- SELECTED
*   K20-K23          USE ----- SELECTED
* OPT0501 01
* OPT0502 01
* OPT0503 01
*
* OPTION NO.6
* < I/P PORT PULL DOWN RESISTOR >
*   K00              WITH RESISTOR ----- SELECTED
*   K01              WITH RESISTOR ----- SELECTED
*   K02              WITH RESISTOR ----- SELECTED
*   K03              WITH RESISTOR ----- SELECTED
*   K10              WITH RESISTOR ----- SELECTED
*   K20              WITH RESISTOR ----- SELECTED
*   K21              WITH RESISTOR ----- SELECTED
*   K22              WITH RESISTOR ----- SELECTED
*   K23              WITH RESISTOR ----- SELECTED
* OPT0601 01
* OPT0602 01
* OPT0603 01
* OPT0604 01
* OPT0605 01
* OPT0606 01
* OPT0607 01
* OPT0608 01
* OPT0609 01
*
* OPTION NO.7

```

3 FUNCTION OPTION GENERATOR FOG6008

```

* < O/P PORT SPEC. (R00-R03) >
*   R00      COMPLEMENTARY ----- SELECTED
*   R01      COMPLEMENTARY ----- SELECTED
*   R02      COMPLEMENTARY ----- SELECTED
*   R03      COMPLEMENTARY ----- SELECTED
OPT0701 01
OPT0702 01
OPT0703 01
OPT0704 01
*
* OPTION NO.8
* < R10 SPECIFICATION >
*   OUTPUT SPECIFICATION COMPLEMENTARY ----- SELECTED
*   OUTPUT TYPE          DC OUTPUT ----- SELECTED
OPT0801 01
OPT0802 01
*
* OPTION NO.9
* < R11 SPECIFICATION >
*   OUTPUT SPECIFICATION COMPLEMENTARY ----- SELECTED
*   OUTPUT TYPE          DC OUTPUT ----- SELECTED
OPT0901 01
OPT0902 01
*
* OPTION NO.10
* < R12 SPECIFICATION >
*   OUTPUT SPECIFICATION COMPLEMENTARY ----- SELECTED
*   OUTPUT TYPE          DC OUTPUT ----- SELECTED
OPT1001 01
OPT1002 01
*
* OPTION NO.11
* < R13 SPECIFICATION >
*   OUTPUT SPECIFICATION COMPLEMENTARY ----- SELECTED
*   OUTPUT TYPE          DC OUTPUT ----- SELECTED
OPT1101 01
OPT1102 01
*
* OPTION NO.12
* < I/O PORT SPECIFICATION >
*   P00      COMPLEMENTARY ----- SELECTED
*   P01      COMPLEMENTARY ----- SELECTED
*   P02      COMPLEMENTARY ----- SELECTED
*   P03      COMPLEMENTARY ----- SELECTED
*   P10      COMPLEMENTARY ----- SELECTED
*   P11      COMPLEMENTARY ----- SELECTED
*   P12      COMPLEMENTARY ----- SELECTED
*   P13      COMPLEMENTARY ----- SELECTED
OPT1201 01
OPT1202 01
OPT1203 01
OPT1204 01
OPT1205 01
OPT1206 01
OPT1207 01
OPT1208 01
*
* OPTION NO.13
* < SIN PULL DOWN RESISTOR >
*   SIN PULL DOWN RESISTOR WITH RESISTOR ----- SELECTED
OPT1301 01
*
* OPTION NO.14
* < SOUT SPECIFICATION >
*   SOUT SPECIFICATION COMPLEMENTARY ----- SELECTED
OPT1401 01
*
* OPTION NO.15
* < SCLK SPECIFICATION >
*   SCLK PULL DOWN RESISTORWITH RESISTOR ----- SELECTED
*   OUTPUT SPECIFICATION COMPLEMENTARY ----- SELECTED
*   LOGIC                POSITIVE ----- SELECTED

```

```

OPT1501 01
OPT1502 01
OPT1503 01
*
* OPTION NO.16
* < SIO DATA PERMUTATION >
*   SIO DATA PERMUTATION    MSB FIRST  -----  SELECTED
OPT1601 01
*
* OPTION NO.17
* < EVENT COUNTER NOISE REJECTOR >
*   EVENT COUNTER NOISE REJECTOR2048 OR 2400 HZ  -----  SELECTED
OPT1701 01
*
* OPTION NO.18
* < LCD SPECIFICATION >
*   BIAS SELECTION           1/3 B USE REGULATOR LCD 3V  ----  SELECTED
*   DUTY SELECTION           1/4 DUTY  -----  SELECTED
OPT1801 08
OPT1802 01
*
* OPTION NO.19
* < SEGMENT MEMORY ADDRESS >
*   SEGMENT MEMORY ADDRESS 2 PAGE (240-26F)  -----  SELECTED
OPT1901 02
*
*
*
* SEIKO EPSON'S AREA
*
*
*
* OPTION NO.20
OPT2001 01
*
* OPTION NO.21
OPT2101 01
*
* OPTION NO.22
OPT2201 01
OPT2202 01
OPT2203 01
OPT2204 01
OPT2205 01
OPT2206 01
OPT2207 01
OPT2208 01
*
* OPTION NO.23
OPT2301 01
OPT2302 01
OPT2303 01
OPT2304 01
OPT2305 01
OPT2306 01
OPT2307 01
OPT2308 01
*
* OPTION NO.24
OPT2401 01
*
* OPTION NO.25
OPT2501 01
*
* OPTION NO.26
OPT2601 01
*
* OPTION NO.27
OPT2701 01
OPT2702 01
\\END

```

Note End mark "~~¥~~END" may be used instead of "\\END" depending on the PC used. (The code of \ and ¥ is 5CH.)

4 SEGMENT OPTION GENERATOR SOG6008

4.1 SOG6008 Outline

With the 4-bit single-chip S1C60N08 microcomputers, the customer may select the LCD segment options. By modifying the mask patterns of the S1C60N08 according to the selected options, the system can be customized to meet the specifications of the target system.

The Segment Option Generator SOG6008 is a software tool for generating data file used to generate mask patterns. From the data file created with SOG6008, the S1C60N08 mask pattern is automatically generated by a general purpose computer.

The HEX file for the evaluation board (S5U1C60N08E) segment option ROM is simultaneously generated with the data file.

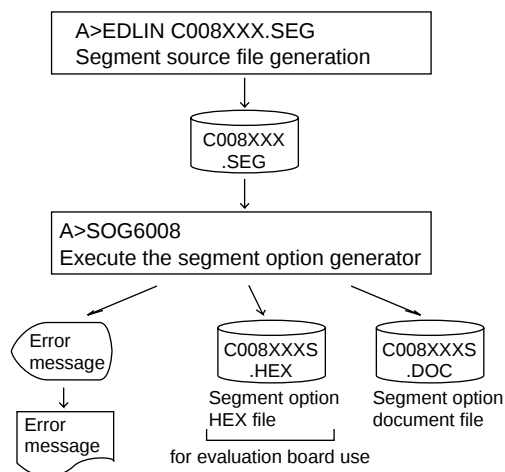


Fig. 4.1.1 SOG6008 execution flow

 The operating method is same as for the S1C62 Family. Refer to the "S1C62 Family Development Tool Reference Manual" for details.

4.2 Option List

TERMINAL NAME	ADDRESS												OUTPUT SPECIFICATION	
	COM0			COM1			COM2			COM3				
	H	L	D	H	L	D	H	L	D	H	L	D		
SEG0													SEG output	
SEG1													DC output ☐ C ☐ P	
SEG2													SEG output	
SEG3													DC output ☐ C ☐ P	
SEG4													SEG output	
SEG5													DC output ☐ C ☐ P	
SEG6													SEG output	
SEG7													DC output ☐ C ☐ P	
SEG8													SEG output	
SEG9													DC output ☐ C ☐ P	
SEG10													SEG output	
SEG11													DC output ☐ C ☐ P	
SEG12													SEG output	
SEG13													DC output ☐ C ☐ P	
SEG14													SEG output	
SEG15													DC output ☐ C ☐ P	
SEG16													SEG output	
SEG17													DC output ☐ C ☐ P	
SEG18													SEG output	
SEG19													DC output ☐ C ☐ P	
SEG20													SEG output	
SEG21													DC output ☐ C ☐ P	
SEG22													SEG output	
SEG23													DC output ☐ C ☐ P	
SEG24													SEG output	
SEG25													DC output ☐ C ☐ P	
SEG26													SEG output	
SEG27													DC output ☐ C ☐ P	
SEG28													SEG output	
SEG29													DC output ☐ C ☐ P	
SEG30													SEG output	
SEG31													DC output ☐ C ☐ P	
SEG32													SEG output	
SEG33													DC output ☐ C ☐ P	
SEG34													SEG output	
SEG35													DC output ☐ C ☐ P	
SEG36													SEG output	
SEG37													DC output ☐ C ☐ P	
SEG38													SEG output	
SEG39													DC output ☐ C ☐ P	
SEG40													SEG output	
SEG41													DC output ☐ C ☐ P	
SEG42													SEG output	
SEG43													DC output ☐ C ☐ P	
SEG44													SEG output	
SEG45													DC output ☐ C ☐ P	
SEG46													SEG output	
SEG47													DC output ☐ C ☐ P	

Legend: <ADDRESS>

H: High order address (4–6)

L: Low order address (0–F)

D: Data bit (0–3)

<OUTPUT SPECIFICATION>

C: Complementary output

P: Pch open drain output

Note: 1. Even if there are unused areas, set "---" (hyphens) such that there are no blank columns.
 2. When DC output is selected, the display memory of the COM0 column becomes effective.

4.3 Segment Ports Output Specifications

For the output specification of the segment output ports SEG0–SEG47 segment output and DC output can be selected in units of two terminals. When used for liquid crystal panel drives, select segment output; when used as regular output port, select DC output. When DC output is selected, either complementary output or Pch open drain output may further be selected.

However, for segment output ports that will not be used, select segment output.

Refer to the "S1C62 Family Development Tool Reference Manual (Segment Option Generator)" for the segment option source file creation.

■ When segment output is selected

The segment output port has a segment decoder built-in, and the data bit of the optional address in the segment memory area (040H–06FH or 240H–26FH) can be allocated to the optional segment. With this, up to 192 segments (144 segments when 1/3 duty is selected or 96 segments when 1/2 duty is selected) of liquid crystal panel could be driven.

The segment memory may be allocated only one segment and multiple setting is not possible.

The allocated segment displays when the bit for this segment memory is set to "1", and goes out when bit is set to "0".

Segment allocation is set to H for high address (4–6), to L for low address (0–F), and to D for data bit (0–3) and are recorded in their respective column in the option list. For segment ports that will not be used, write "---" (hyphen) in the H, L, and D columns of COM0–COM3.

Examples

- When 1/4 duty is selected

0	601	600	632	603	S
1	612	611	610	623	S

- When 1/3 duty is selected

0	601	600	632	---	S
1	612	611	610	---	S

- When 1/2 duty is selected

0	601	600	---	---	S
1	612	611	---	---	S

■ When DC output is selected

The DC output can be selected in units of two terminals and up to 48 terminals may be allocated for DC output. Also, either complementary output or Pch open drain output is likewise selected in units of two terminals. When the bit for the selected segment memory is set to "1", the segment output port goes high (VDD), and goes low (Vss) when set to "0". Segment allocation is the same as when segment output is selected but for the while the segment memory allocated to COM1–COM3 becomes ineffective. Write three hyphens ("---") in the COM1–COM3 columns in the option list.

Example

- When complementary output is set to SEG16 and SEG17, and Pch open drain output is set to SEG18 and SEG19.

16	6E0	---	---	---	C
17	6F0	---	---	---	C
18	6E1	---	---	---	P
19	6F1	---	---	---	P

Refer to the SOG section of the "S1C62 Family Development Tool Reference Manual" for details of segment option source file.

Note: If you select "1/3 bias, internal regulator used, LCD 3 V" in LCD specification, do not select "DC output" in the SOG file, because it is not allowance.

4.4 SOG6008 Quick Reference

■ Starting command and input/output files

Execution file: SOG6008.EXE

_ indicates a blank.

Starting command: SOG6008_ [-H] ☐

☐ indicates the Return key.

A parameter enclosed by [] can be omitted.

Option: -H: Specifies the segment option document file for input file of SOG6008.

Input file: C008XXX.SEG (Segment option source file)
C008XXXS.DOC (Segment option document file, when -H option use)

Output file: C008XXXS.DOC (Segment option document file)
C008XXXS.HEX (Segment option HEX file)

■ Display example

```
*** E0C6008 SEGMENT OPTION GENERATOR. --- Ver 1.00 ***
EEEEEEEEEE PPPPPPPP SSSSSSS 00000000 NNN NNN
EEEEEEEEEE PPPPPPPP SSS SSSS 000 000 NNNN NNN
EEE PPP PPP SSS SSS 000 000 NNNNN NNN
EEE PPP PPP SSS SSS 000 000 NNNNN NNN
EEEEEEEEEE PPPPPPPP SSSSSSS 000 000 NNN NNN
EEEEEEEEEE PPPPPPPP SSSS 000 000 NNN NNN
EEE PPP SSS SSS 000 000 NNN NNN
EEE PPP SSS SSS 000 000 NNN NNN
EEEEEEEEEE PPP SSSS SSS 000 000 NNN NNN
EEEEEEEEEE PPP SSSSSS 00000000 NNN NN

(C) COPYRIGHT 1997 SEIKO EPSON CORP.

SEGMENT OPTION SOURCE FILE NAME IS " C008XXX.SEG "

THIS SOFTWARE MAKES NEXT FILES.

C008XXXS.HEX ... SEGMENT OPTION HEX FILE.
C008XXXS.DOC ... SEGMENT OPTION DOCUMENT FILE.

STRIKE ANY KEY.
```

Start-up message

When SOG6008 is started, the start-up message is displayed.

For "STRIKE ANY KEY.", press any key to advance the program execution.

To suspend execution, press the "CTRL" and "C" keys together: the sequence returns to the DOS command level.

```
*** E0C6008 USER'S OPTION SETTING. --- Ver 1.00 ***
CURRENT DATE IS 99/03/01
PLEASE INPUT NEW DATE : ☐
```

```
*** SOURCE FILE(S) ***
C0080A0 C0080B0 C0080C0 ..(1)
PLEASE INPUT SEGMENT OPTION FILE NAME? C0080A0☐ ..(2)
PLEASE INPUT USER'S NAME? SEIKO EPSON CORP.☐ ..(3)
PLEASE INPUT ANY COMMENT
(ONE LINE IS 50 CHR)? FUJIMI PLANT☐ ..(4)
? 281 FUJIMI SUWA-GUN NAGANO-KEN 399-0293 JAPAN☐
? TEL 0266-61-1211☐
? FAX 0266-61-1273☐
? ☐
```

```
*** SOURCE FILE(S) ***
SEGMENT OPTION SOURCE FILE IS NOT FOUND. ..(5) -H option not use
*** SOURCE FILE(S) ***
SEGMENT OPTION DOCUMENT FILE IS NOT FOUND. ..(6) -H option use
```

```
PLEASE INPUT SEGMENT OPTION SOURCE FILE NAME? C0080N0☐
SEGMENT OPTION SOURCE FILE IS NOT FOUND. ..(7) -H option not use
PLEASE INPUT SEGMENT OPTION DOCUMENT FILE NAME? C0080N0☐
SEGMENT OPTION DOCUMENT FILE IS NOT FOUND. ..(8) -H option use
```

Note: The SOG6008 refers C008xxxF.DOC files, so C008xxxF.DOC and C008xxx.SEG files (both "xxx" must be the same) must be prepared in the same directory before invoking the SOG6008 without the -H option.

```
"USE LCD VOLTAGE REGULATOR" SELECTED OK(Y/N)? ..(9)
"NO USE LCD VOLTAGE REGULATOR" SELECTED OK(Y/N)?..(10)
```

The SOG6008 displays an inquiring message.

(9) is displayed if "USE REGULATOR" has been selected for Option 18 (LCD specification) in the C008xxxF.DOC. (10) is displayed if "NOT USE REGULATOR" has been selected.

Enter "Y ☐

If it is not correct, enter "N ☐

```

END OF OPTION SETTING.
DO YOU MAKE HEX FILE (Y/N) ? Y
.. (1)

*** OPTION EPROM SELECT MENU ***

1. 27C64
2. 27C128
3. 27C256
4. 27C512

PLEASE SELECT NO.? 2
.. (2)

2. 27C128   SELECTED

MAKING FILE IS COMPLETED.

```

EPROM selection

When selecting file is completed, the following message is output to ask the operator whether to generate the HEX file.

- (1) When debugging the program with the evaluation board, HEX file is needed, so enter "Y". If "N" is entered, no HEX file is generated and only document file is generated.
- (2) For the option ROM selection menu displayed when "Y" is entered in Step (1), select the EPROM to be used for setting evaluation board options.

When a series of operations are complete, the SOG6008 generates files. If no error is committed while setting segment options, "MAKING FILE IS COMPLETED" will be displayed and the SOG6008 program will be terminated.

■ Error messages

Error message	Explanation
S (Syntax Error)	The data was written in an invalid format.
N (Segment No. Select Error)	The segment number outside the specifiable range was specified.
R (RAM Address Select Error)	The segment memory address or data bit outside the specifiable range was specified.
D (Duplication Error)	The same data (SEG port No., segment memory address, or data bit) was specified more than once.
Out Port Set Error	The output specifications were not set in units of two ports.

4.5 Sample File

■ Example of segment option source file

```

; LCD SEGMENT DECODE TABLE
0      680      681      690      691      S
1      692      693      6A0      6A2      S
2      6A3      6A1      682      683      S
3      6B0      6B1      6B2      6B3      S
4      640      641      650      651      S
5      652      653      660      662      S
6      663      661      642      643      S
7      670      671      672      673      S
8      600      601      610      611      S
9      612      613      620      622      S
10     623      621      602      603      S
11     630      631      632      633      S
12     5C0      5C1      5D0      5D1      S
13     5D2      5D3      5E0      5E2      S
14     5E3      5E1      5C2      5C3      S
15     5F0      5F1      5F2      5F3      S
16     580      581      590      591      S
17     592      593      5A0      5A2      S
18     5A3      5A1      582      583      S
19     5B0      5B1      5B2      5B3      S
20     540      541      550      551      S
21     552      553      560      562      S
22     563      561      542      543      S
23     570      571      572      573      S
24     500      501      510      511      S
25     512      513      520      522      S
26     523      521      502      503      S
27     530      531      532      533      S
28     4C0      4C1      4D0      4D1      S
29     4D2      4D3      4E0      4E2      S
30     4E3      4E1      4C2      4C3      S
31     4F0      4F1      4F2      4F3      S
32     480      481      490      491      S
33     492      493      4A0      4A2      S
34     4A3      4A1      482      483      S
35     4B0      4B1      4B2      4B3      S
36     440      441      450      451      S
37     452      453      460      462      S
38     463      461      442      443      S
39     470      471      472      473      S
40     400      401      410      411      S
41     412      413      420      422      S
42     423      421      402      403      S
43     430      431      432      433      S
44     6C0      6C1      6C2      6C3      S
45     6D0      6D1      6D2      6D3      S
46     6E0      ---      ---      ---      C
47     6E1      ---      ---      ---      C

```

5 ICE CONTROL SOFTWARE ICS6008

5.1 ICS6008 Outline

The In-Circuit Emulator (S5U1C62000H) connects the target board produced by the user via the evaluation board (S5U1C60N08E) and performs real time target system evaluation and debugging by passing through the RS-232C from the host computer and controlling it. The operation on the host computer side and ICE (S5U1C62000H) control is done through the ICE Control Software ICS6008.

The ICS6008 has a set of numerous and highly functional emulation commands which provide sophisticated break function, on-the-fly data display, history display, etc., and so perform a higher level of debugging.

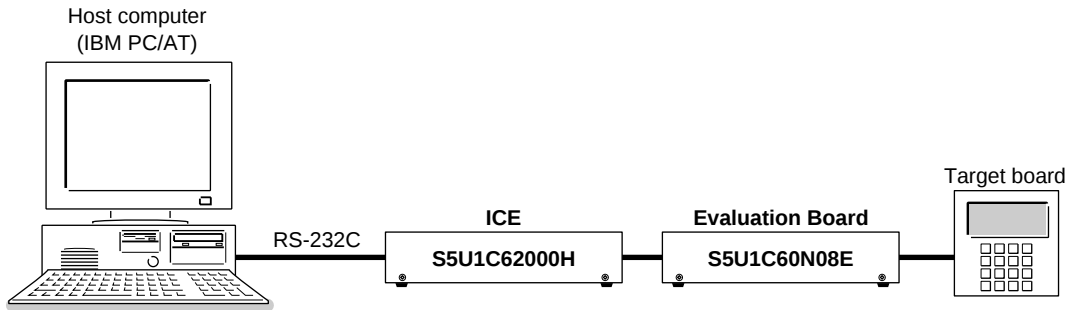


Fig. 5.1.1 Debugging system using ICE

 The functions of the ICE and commands are same as for the S1C62 Family. Refer to the "S1C62 Family Development Tool Reference Manual" for details.

5.2 ICS6008 Restrictions

Take the following precautions when using the ICS6008.

■ ROM Area

The ROM area is limited to a maximum address of 0FFFH. Assigning data above the 0FFFH address causes an error.

■ RAM Area

The RAM area is limited to a maximum address of 3FFH. However, as the following addresses are in the unused area, designation of this area with the ICE commands produces an error.

Unused area: 240H–2CFH and 2D1H–2DFH (when 040H–06FH has been specified as the segment data memory through the mask option)
 270H–2CFH and 2D1H–2DFH (when 240H–26FH has been specified as the segment data memory through the mask option)

(Refer to the "S1C60N08/60R08 Technical Manual" for details.)

■ Undefined Code

The SLP instruction is not specified for the S1C60N08 and so cannot be used.

■ OPTLD Command

In the ICS6008, OPTLD command can be used.

This command is used to load HEX files (function option data and segment option data for LCD) in the evaluation board memory with the ICE.

Load of function option data: #OPTLD, 1, C008XXX 

Load of segment option data: #OPTLD, 2, C008XXX 

OPTLD

READ HEXA DATA FILE

Format	#OPTLD, 1, <file name> [] ... (1) #OPTLD, 2, <file name> [] ... (2)
Function	(1) Load function option HEX file in the evaluation board function option data memory. It is HEX file output by the function option generator and has intel HEX format. (2) Load segment option HEX file in the evaluation board segment option data memory. It is HEX file output by the segment option generator and has intel HEX format.
Examples	#OPTLD, 1, C008XXX [] C008XXXF.HEX file is loaded in the function option data memory. #OPTLD, 2, C008XXX [] C008XXXS.HEX file is loaded in the segment option data memory.

5.3 ICS6008 Quick Reference

■ Starting command and input/output files

 indicates the Return key.

Execution file: ICS6008.BAT (ICS6008W.EXE)

Starting command: ICS6008 (ICS6008W) 

Input file: C008XXXL.HEX (Object file, low-order)
C008XXXH.HEX (Object file, high-order)
C008XXXD.HEX (Data RAM file)
C008XXXC.HEX (Control file)

Output file: C008XXXL.HEX (Object file, low-order)
C008XXXH.HEX (Object file, high-order)
C008XXXD.HEX (Data RAM file)
C008XXXC.HEX (Control file)

■ Display example

```

*** E0C6008 ICE CONTROL SOFTWARE. --- Ver 3.01 ***

EEEEEEEEEE PPPPPPPP SSSSSSS 00000000 NNN NNN
EEEEEEEEEE PPPPPPPPPP SSS SSSS 000 000 NNNN NNN
EEE PPP PPP SSS SSS 000 000 NNNNN NNN
EEE PPP PPP SSS 000 000 NNNNN NNN
EEEEEEEEEE PPPPPPPPPP SSSSSS 000 000 NNN NNN NNN
EEEEEEEEEE PPPPPPPP SSSS 000 000 NNN NNNNN
EEE PPP SSS 000 000 NNN NNNNN
EEE PPP SSS SSS 000 000 NNN NNN
EEEEEEEEEE PPP SSS SSS 000 000 NNN NNN
EEEEEEEEEE PPP SSSSSS 00000000 NNN NN

      (C) COPYRIGHT 1991 SEIKO EPSON CORP.

* ICE POWER ON RESET *
* DIAGNOSTIC TEST OK *
#

```

Start-up message

When ICS6008 is started, the start-up message is displayed, and a self-test is automatically performed. ICS6008 commands are awaited when the program is properly loaded and the # mark is displayed.

Debugging can be done by entering command after the # mark.

The ICS6008 program is terminated by entering the Q (Quit) command.

Note Confirm that the cables connected properly, then operate the ICS6008.

■ Error messages

Error message	Meaning	Recover procedure
* COMMUNICATION ERROR OR ICE NOT READY *	ICE is disconnected or power is OFF.	Switch OFF the host power supply, connect cable, and reapply power. Or switch ON power to ICE.
* TARGET DOWN (1) *	Evaluation board is disconnected. (Check at power ON)	Switch OFF power to ICE, and connect the evaluation board. Then, apply power to ICE.
* TARGET DOWN (2) *	Evaluation board is disconnected. (Check at command execution)	Switch OFF power to ICE, and connect the evaluation board. Then, apply power to ICE.
* UNDEFINED PROGRAM CODE EXIST *	Undefined code is detected in the program loaded from ROM or FD.	Convert ROM and FD data with the cross assembler, then restart the ICE.
* COMMAND ERROR *	A miss occurs by command input.	Reenter the proper command.
(No response after power on)	The ICE-to-HOST cable is disconnected on the host side.	Switch OFF the host power supply, connect cable, and reapply power.

■ ICE commands

Item No.	Function	Command Format	Outline of Operation
1	Assemble	#A,a 	Assemble command mnemonic code and store at address "a"
2	Disassemble	#L,a1,a2 	Contents of addresses a1 to a2 are disassembled and displayed
3	Dump	#DP,a1,a2 	Contents of program area a1 to a2 are displayed
		#DD,a1,a2 	Content of data area a1 to a2 are displayed
4	Fill	#FP,a1,a2,d 	Data d is set in addresses a1 to a2 (program area)
		#FD,a1,a2,d 	Data d is set in addresses a1 to a2 (data area)
5	Set Run Mode	#G,a 	Program is executed from the "a" address
		#TIM 	Execution time and step counter selection
		#OTF 	On-the-fly display selection
6	Trace	#T,a,n 	Executes program while displaying results of step instruction from "a" address
		#U,a,n 	Displays only the final step of #T,a,n
7	Break	#BA,a 	Sets Break at program address "a"
		#BAR,a 	Breakpoint is canceled
		#BD 	Break condition is set for data RAM
		#BDR 	Breakpoint is canceled
		#BR 	Break condition is set for evaluation board CPU internal registers
		#BRR 	Breakpoint is canceled
		#BM 	Combined break conditions set for program data RAM address and registers
		#BMR 	Cancel combined break conditions for program data ROM address and registers
		#BRES 	All break conditions canceled
		#BC 	Break condition displayed
		#BE 	Enter break enable mode
		#BSYN 	Enter break disable mode
8	Move	#BT 	Set break stop/trace modes
		#BRKSEL,REM 	Set BA condition clear/remain modes
9	Data Set	#MP,a1,a2,a3 	Contents of program area addresses a1 to a2 are moved to addresses a3 and after
		#MD,a1,a2,a3 	Contents of data area addresses a1 to a2 are moved to addresses a3 and after
10	Change CPU Internal Registers	#SP,a 	Data from program area address "a" are written to memory
		#SD,a 	Data from data area address "a" are written to memory
10	Change CPU Internal Registers	#DR 	Display evaluation board CPU internal registers
		#SR 	Set evaluation board CPU internal registers
		#I 	Reset evaluation board CPU
		#DXY 	Display X, Y, MX and MY
		#SXY 	Set data for X and Y display and MX, MY

Item No.	Function	Command Format	Outline of Operation
11	History	#H,p1,p2	Display history data for pointer 1 and pointer 2
		#HB	Display upstream history data
		#HG	Display 21 line history data
		#HP	Display history pointer
		#HPS,a	Set history pointer
		#HC,S/C/E	Sets up the history information acquisition before (S), before/after (C) and after (E)
		#HA,a1,a2	Sets up the history information acquisition from program area a1 to a2
		#HAR,a1,a2	Sets up the prohibition of the history information acquisition from program area a1 to a2
		#HAD	Indicates history acquisition program area
		#HS,a	Retrieves and indicates the history information which executed a program address "a"
		#HSW,a	Retrieves and indicates the history information which wrote or read the data area address "a"
12	File	#RF,file	Move program file to memory
		#RFD,file	Move data file to memory
		#VF,file	Compare program file and contents of memory
		#VFD,file	Compare data file and contents of memory
		#WF,file	Save contents of memory to program file
		#WFD,file	Save contents of memory to data file
		#CL,file	Load ICE set condition from file
		#CS,file	Save ICE set condition to file
		#OPTLD,1,file	Load function option data from file
13	Coverage	#OPTLD,2,file	Load segment option data from file
14	ROM Access	#CVD	Indicates coverage information
		#CVR	Clears coverage information
15	Terminate ICE	#RP	Move contents of ROM to program memory
		#VP	Compare contents of ROM with contents of program memory
		#ROM	Set ROM type
16	Command Display	#Q	Terminate ICE and return to operating system control
17	Self Diagnosis	#HELP	Display ICE instruction
18		#CHK	Report results of ICE self diagnostic test

means press the RETURN key.

6 MASK DATA CHECKER MDC6008

6.1 MDC6008 Outline

The Mask Data Checker MDC6008 is a software tool which checks the program data (C008XXXH.HEX and C008XXXL.HEX) and option data (C008XXXF.DOC and C008XXXS.DOC) created by the user and creates the data file (C6008XXX.PAn) for generating mask patterns. The user must send the file generated through this software tool to Seiko Epson.

Moreover, MDC6008 has the capability to restore the generated data file (C6008XXX.PAn) to the original file format.

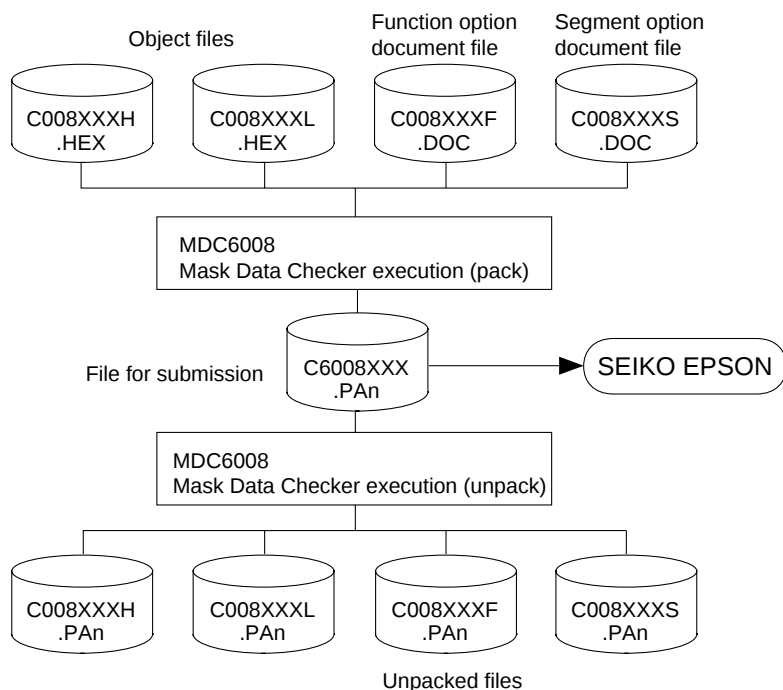


Fig. 6.1.1 MDC6008 execution flow

☞ The operating method is same as for the S1C62 Family. Refer to the "S1C62 Family Development Tool Reference Manual" for details.

6.2 MDC6008 Quick Reference

■ Starting command and input/output files

Execution file: MDC6008.EXE

Starting command: **MDC6008** ☐

☐ indicates the Return key.

Input file:	C008XXXL.HEX (Object file, low-order)	] When packing
	C008XXXH.HEX (Object file, high-order)	
	C008XXXF.DOC (Function option document file)	
	C008XXXS.DOC (Segment option document file)	
	C6008XXX.PAn (Packed file)	
Output file:	C6008XXX.PAn (Packed file)	When packing
	C008XXXL.PAn (Object file, low-order)	] When unpacking
	C008XXXH.PAn (Object file, high-order)	
	C008XXXF.PAn (Function option document file)	
	C008XXXS.PAn (Segment option document file)	

■ Display examples

```

*** E0C6008 PACK / UNPACK PROGRAM Ver 2.00 ***

EEEEEEEEEE PPPPPPPP SSSSSSS 00000000 NNN NNN
EEEEEEEEEE PPPPPPPP SSS SSS 000 000 NNN NNN
EEE PPP PPP SSS SSS 000 000 NNN NNN
EEE PPP PPP SSS SSS 000 000 NNN NNN
EEEEEEEEEE PPPPPPPP SSSSSSS 000 000 NNN NNN
EEEEEEEEEE PPPPPPPP SSSSSSS 000 000 NNN NNN
EEE PPP SSS SSS 000 000 NNN NNN
EEE PPP SSS SSS 000 000 NNN NNN
EEEEEEEEEE PPP SSSS SSS 000 000 NNN NNN
EEEEEEEEEE PPP SSSSSSS 00000000 NNN NN

(C) COPYRIGHT 1990 SEIKO EPSON CORP.

--- OPERATION MENU ---

      1. PACK
      2. UNPACK

PLEASE SELECT NO.?
```

```

--- OPERATION MENU ---

      1. PACK
      2. UNPACK

PLEASE SELECT NO.? 1

C008XXX.H.HEX -----+
C008XXX.L.HEX -----+
C008XXX.F.DOC -----+
C008XXX.S.DOC -----+
|
|----- C6008XXX.PAn (PACK FILE)

PLEASE INPUT PACK FILE NAME (C6008XXX.PAn) ? C60080A0.PA0 ... (2)

C0080A0.H.HEX -----+
C0080A0.L.HEX -----+
C0080A0.F.DOC -----+
C0080A0.S.DOC -----+
|
|----- C60080A0.PA0
```

Note Don't use the data generated with the -N option of the Cross Assembler (ASM6008) as program data. If the program data generated with the -N option of the Cross Assembler is packed, undefined program area is filled with FFH code. In this case, following message is displayed.

```
WARNING: FILLED <file_name> FILE WITH FFH.
```

```

--- OPERATION MENU ---

      1. PACK
      2. UNPACK

PLEASE SELECT NO.? 2

PLEASE INPUT PACKED FILE NAME (C6008XXX.PAn) ? C60080A0.PA0 ... (2)

      +----- C0080A0H.PA0
      |
      +----- C0080A0L.PA0
C60080A0.PA0 -----+
      |
      +----- C0080A0F.PA0
      |
      +----- C0080A0S.PA0
```

Start-up message

When MDC6008 is started, the start-up message and operation menu are displayed. Here, the user is prompted to select operation options.

Packing of data

- (1) Select "1.PACK" in the operation menu.
- (2) Enter the file name.

After submitting the data to Seiko Epson and there is a need to re-submit the data, increase the numeric value of "n" by one when the input is made.

(Example: When re-submitting data after "C6008XXX.PA0" has been submitted, the pack file name should be entered as "C6008XXX.PA1".)

With this, the mask file (C6008XXX.PAn) is generated, and the MDC6008 program will be terminated.
Submit this file to Seiko Epson.

Unpacking of data

- (1) Select "2.UNPACK" in the operation menu.
- (2) Enter the packed file name.

With this, the mask data file (C6008XXX.PAn) is restored to the original file format, and the MDC6008 program will be terminated.

Since the extension of the file name remains as "PAn", it must be renamed back to its original form ("HEX" and "DOC") in order to re-debug or modify the restored file.

■ Error messages

Program data error

Error Message	Explanation
1. HEX DATA ERROR : NOT COLON.	There is no colon.
2. HEX DATA ERROR : DATA LENGTH. (NOT 00-20h)	The data length of 1 line is not in the 00-20H range.
3. HEX DATA ERROR : ADDRESS.	The address is beyond the valid range of the program ROM.
4. HEX DATA ERROR : RECORD TYPE. (NOT 00)	The record type of 1 line is not 00.
5. HEX DATA ERROR : DATA. (NOT 00-FFh)	The data is not in the range between 00H and 0FFH.
6. HEX DATA ERROR : TOO MANY DATA IN ONE LINE.	There are too many data in 1 line.
7. HEX DATA ERROR : CHECK SUM.	The checksum is not correct.
8. HEX DATA ERROR : END MARK.	The end mark is not : 00000001FF.
9. HEX DATA ERROR : DUPLICATE.	There is duplicate definition of data in the same address.

Function option data error

Error Message	Explanation
1. OPTION DATA ERROR : START MARK.	The start mark is not "\OPTION". (during unpacking) *
2. OPTION DATA ERROR : OPTION NUMBER.	The option number is not correct.
3. OPTION DATA ERROR : SELECT NUMBER.	The option selection number is not correct.
4. OPTION DATA ERROR : END MARK.	The end mark is not "\\END" (packing) or "\\END" (unpacking).*

Segment option data error

Error Message	Explanation
1. SEGMENT DATA ERROR : START MARK.	The start mark is not "\SEGMENT". (during unpacking) *
2. SEGMENT DATA ERROR : DATA.	The segment data is not correct.
3. SEGMENT DATA ERROR : SEGMENT NUMBER.	The SEG No. is not correct.
4. SEGMENT DATA ERROR : SPEC.	The output specification of the SEG terminal is not correct.
5. SEGMENT DATA ERROR : END MARK.	The end mark is not "\\END" (packing) or "\\END" (unpacking).*

File error

Error Message	Explanation
1. <File_name> FILE IS NOT FOUND.	The file is not found or the file number set in CONFIG.SYS is less than 10.
2. PACK FILE NAME (File_name) ERROR.	The packed input format for the file name is wrong.
3. PACKED FILE NAME (File_name) ERROR.	The unpacked input format for the file name is wrong.

System error

Error Message	Explanation
1. DIRECTORY FULL.	The directory is full.
2. DISK WRITE ERROR.	Writing on the disk is failed.

* | sometimes appears as ¥, depending on the personal computer being used.

APPENDIX A. S1C60N08 INSTRUCTION SET

Classification	Mne- monic	Operand	Operation Code												Flag				Clock	Operation
			B	A	9	8	7	6	5	4	3	2	1	0	I	D	Z	C		
Branch instructions	PSET	p	1	1	1	0	0	1	0	p4	p3	p2	p1	p0					5	NBP ← p4, NPP ← p3~p0
	JP	s	0	0	0	0	s7	s6	s5	s4	s3	s2	s1	s0					5	PCB ← NBP, PCP ← NPP, PCS ← s7~s0
		C, s	0	0	1	0	s7	s6	s5	s4	s3	s2	s1	s0					5	PCB ← NBP, PCP ← NPP, PCS ← s7~s0 if C=1
		NC, s	0	0	1	1	s7	s6	s5	s4	s3	s2	s1	s0					5	PCB ← NBP, PCP ← NPP, PCS ← s7~s0 if C=0
		Z, s	0	1	1	0	s7	s6	s5	s4	s3	s2	s1	s0					5	PCB ← NBP, PCP ← NPP, PCS ← s7~s0 if Z=1
		NZ, s	0	1	1	1	s7	s6	s5	s4	s3	s2	s1	s0					5	PCB ← NBP, PCP ← NPP, PCS ← s7~s0 if Z=0
	JPBA		1	1	1	1	1	1	1	0	1	0	0	0					5	PCB ← NBP, PCP ← NPP, PCSH ← B, PCSL ← A
	CALL	s	0	1	0	0	s7	s6	s5	s4	s3	s2	s1	s0					7	M(SP-1) ← PCP, M(SP-2) ← PCSH, M(SP-3) ← PCSL+1 SP ← SP-3, PCP ← NPP, PCS ← s7~s0
	CALZ	s	0	1	0	1	s7	s6	s5	s4	s3	s2	s1	s0					7	M(SP-1) ← PCP, M(SP-2) ← PCSH, M(SP-3) ← PCSL+1 SP ← SP-3, PCP ← 0, PCS ← s7~s0
	RET		1	1	1	1	1	1	0	1	1	1	1	1					7	PCSL ← M(SP), PCSH ← M(SP+1), PCP ← M(SP+2) SP ← SP+3
	RETS		1	1	1	1	1	1	0	1	1	1	1	0					12	PCSL ← M(SP), PCSH ← M(SP+1), PCP ← M(SP+2) SP ← SP+3, PC ← PC+1
	RETD	l	0	0	0	1	l7	l6	l5	l4	l3	l2	l1	l0					12	PCSL ← M(SP), PCSH ← M(SP+1), PCP ← M(SP+2) SP ← SP+3, M(X) ← l3~l0, M(X+1) ← l7~l4, X ← X+2
System control instructions	NOP5		1	1	1	1	1	1	1	1	0	1	1					5	No operation (5 clock cycles)	
	NOP7		1	1	1	1	1	1	1	1	1	1	1					7	No operation (7 clock cycles)	
	HALT		1	1	1	1	1	1	1	1	0	0	0					5	Halt (stop clock)	
Index operation instructions	INC	X	1	1	1	0	1	1	1	0	0	0	0					5	X ← X+1	
		Y	1	1	1	0	1	1	1	1	0	0	0	0					5	Y ← Y+1
	LD	X, x	1	0	1	1	x7	x6	x5	x4	x3	x2	x1	x0					5	XH ← x7~x4, XL ← x3~x0
		Y, y	1	0	0	0	y7	y6	y5	y4	y3	y2	y1	y0					5	YH ← y7~y4, YL ← y3~y0
		XP, r	1	1	1	0	1	0	0	0	0	0	r1	r0					5	XP ← r
		XH, r	1	1	1	0	1	0	0	0	0	1	r1	r0					5	XH ← r
		XL, r	1	1	1	0	1	0	0	0	1	0	r1	r0					5	XL ← r
		YP, r	1	1	1	0	1	0	0	1	0	0	r1	r0					5	YP ← r
		YH, r	1	1	1	0	1	0	0	1	0	1	r1	r0					5	YH ← r
		YL, r	1	1	1	0	1	0	0	1	1	0	r1	r0					5	YL ← r
		r, XP	1	1	1	0	1	0	1	0	0	0	r1	r0					5	r ← XP
		r, XH	1	1	1	0	1	0	1	0	0	1	r1	r0					5	r ← XH
		r, XL	1	1	1	0	1	0	1	0	1	0	r1	r0					5	r ← XL
		r, YP	1	1	1	0	1	0	1	1	0	0	r1	r0					5	r ← YP
		r, YH	1	1	1	0	1	0	1	1	0	1	r1	r0					5	r ← YH
		r, YL	1	1	1	0	1	0	1	1	1	0	r1	r0					5	r ← YL
	ADC	XH, i	1	0	1	0	0	0	0	0	i3	i2	i1	i0	↕	↕			7	XH ← XH+i3~i0+C
		XL, i	1	0	1	0	0	0	0	1	i3	i2	i1	i0	↕	↕			7	XL ← XL+i3~i0+C
		YH, i	1	0	1	0	0	0	1	0	i3	i2	i1	i0	↕	↕			7	YH ← YH+i3~i0+C
		YL, i	1	0	1	0	0	0	1	1	i3	i2	i1	i0	↕	↕			7	YL ← YL+i3~i0+C

Classification	Mne- monic	Operand	Operation Code								Flag			Clock	Operation					
			B	A	9	8	7	6	5	4	3	2	1			0	I	D	Z	C
Index operation instructions	CP	XH, i	1	0	1	0	0	1	0	0	i3	i2	i1	i0		↑	↓	7	XH-i3~i0	
		XL, i	1	0	1	0	0	1	0	1	i3	i2	i1	i0		↑	↓	7	XL-i3~i0	
		YH, i	1	0	1	0	0	1	1	0	i3	i2	i1	i0		↑	↓	7	YH-i3~i0	
		YL, i	1	0	1	0	0	1	1	1	i3	i2	i1	i0		↑	↓	7	YL-i3~i0	
Data transfer instructions	LD	r, i	1	1	1	0	0	0	r1	r0	i3	i2	i1	i0				5	r ← i3~i0	
		r, q	1	1	1	0	1	1	0	0	r1	r0	q1	q0				5	r ← q	
		A, Mn	1	1	1	1	1	0	1	0	n3	n2	n1	n0				5	A ← M(n3~n0)	
		B, Mn	1	1	1	1	1	0	1	1	n3	n2	n1	n0				5	B ← M(n3~n0)	
		Mn, A	1	1	1	1	1	0	0	0	n3	n2	n1	n0				5	M(n3~n0) ← A	
		Mn, B	1	1	1	1	1	0	0	1	n3	n2	n1	n0				5	M(n3~n0) ← B	
	LDPX	MX, i	1	1	1	0	0	1	1	0	i3	i2	i1	i0				5	M(X) ← i3~i0, X ← X+1	
		r, q	1	1	1	0	1	1	1	0	r1	r0	q1	q0				5	r ← q, X ← X+1	
	LDPY	MY, i	1	1	1	0	0	1	1	1	i3	i2	i1	i0				5	M(Y) ← i3~i0, Y ← Y+1	
		r, q	1	1	1	0	1	1	1	1	r1	r0	q1	q0				5	r ← q, Y ← Y+1	
LBPX	MX, l	1	0	0	1	1	7	16	15	14	13	12	11	10			5	M(X) ← l3~l0, M(X+1) ← l7~l4, X ← X+2		
Flag operation instructions	SET	F, i	1	1	1	1	0	1	0	0	i3	i2	i1	i0	↑	↑	↑	↑	7	F ← F∨i3~i0
	RST	F, i	1	1	1	1	0	1	0	1	i3	i2	i1	i0	↓	↓	↓	↓	7	F ← F∧i3~i0
	SCF		1	1	1	1	0	1	0	0	0	0	0	1		↑		7	C ← 1	
	RCF		1	1	1	1	0	1	0	1	1	1	1	0		↓		7	C ← 0	
	SZF		1	1	1	1	0	1	0	0	0	0	1	0		↑		7	Z ← 1	
	RZF		1	1	1	1	0	1	0	1	1	1	0	1		↓		7	Z ← 0	
	SDF		1	1	1	1	0	1	0	0	0	1	0	0		↑		7	D ← 1 (Decimal Adjuster ON)	
	RDF		1	1	1	1	0	1	0	1	1	0	1	1		↓		7	D ← 0 (Decimal Adjuster OFF)	
	EI		1	1	1	1	0	1	0	0	0	1	0	0		↑		7	I ← 1 (Enables Interrupt)	
DI		1	1	1	1	0	1	0	1	0	1	1	1		↓		7	I ← 0 (Disables Interrupt)		
Stack operation instructions	INC	SP	1	1	1	1	1	1	0	1	1	0	1	1				5	SP ← SP+1	
	DEC	SP	1	1	1	1	1	1	0	0	1	0	1	1				5	SP ← SP-1	
	PUSH	r	1	1	1	1	1	1	0	0	0	0	r1	r0				5	SP ← SP-1, M(SP) ← r	
		XP	1	1	1	1	1	1	0	0	0	1	0	0				5	SP ← SP-1, M(SP) ← XP	
		XH	1	1	1	1	1	1	0	0	0	1	0	1				5	SP ← SP-1, M(SP) ← XH	
		XL	1	1	1	1	1	1	0	0	0	1	1	0				5	SP ← SP-1, M(SP) ← XL	
		YP	1	1	1	1	1	1	0	0	0	1	1	1				5	SP ← SP-1, M(SP) ← YP	
		YH	1	1	1	1	1	1	0	0	0	1	0	0				5	SP ← SP-1, M(SP) ← YH	
		YL	1	1	1	1	1	1	0	0	0	1	0	0				5	SP ← SP-1, M(SP) ← YL	
		F	1	1	1	1	1	1	0	0	0	1	0	1				5	SP ← SP-1, M(SP) ← F	
		POP	r	1	1	1	1	1	1	0	1	0	0	r1	r0				5	r ← M(SP), SP ← SP+1
	XP	1	1	1	1	1	1	0	1	0	1	0	0				5	XP ← M(SP), SP ← SP+1		
	XH	1	1	1	1	1	1	0	1	0	1	0	1				5	XH ← M(SP), SP ← SP+1		
	XL	1	1	1	1	1	1	0	1	0	1	1	0				5	XL ← M(SP), SP ← SP+1		
YP	1	1	1	1	1	1	0	1	0	1	1	1				5	YP ← M(SP), SP ← SP+1			

APPENDIX A. S1C60N08 INSTRUCTION SET

Classification	Mne- monic	Operand	Operation Code										Flag				Clock	Operation		
			B	A	9	8	7	6	5	4	3	2	1	0	I	D			Z	C
Stack operation instructions	POP	YH	1	1	1	1	1	1	0	1	1	0	0	0					5	YH← M(SP), SP← SP+1
		YL	1	1	1	1	1	1	0	1	1	0	0	1					5	YL← M(SP), SP← SP+1
		F	1	1	1	1	1	1	0	1	1	0	1	0	↑	↓	↑	↓	5	F← M(SP), SP← SP+1
	LD	SPH, r	1	1	1	1	1	1	1	0	0	0	r1	r0					5	SPH← r
		SPL, r	1	1	1	1	1	1	1	1	0	0	r1	r0					5	SPL← r
		r, SPH	1	1	1	1	1	1	1	0	0	1	r1	r0					5	r← SPH
		r, SPL	1	1	1	1	1	1	1	1	0	1	r1	r0					5	r← SPL
Arithmetic instructions	ADD	r, i	1	1	0	0	0	0	r1	r0	i3	i2	i1	i0	★	↑	↓	7	r← r+i3~i0	
		r, q	1	0	1	0	1	0	0	0	r1	r0	q1	q0	★	↑	↓	7	r← r+q	
	ADC	r, i	1	1	0	0	0	1	r1	r0	i3	i2	i1	i0	★	↑	↓	7	r← r+i3~i0+C	
		r, q	1	0	1	0	1	0	0	1	r1	r0	q1	q0	★	↑	↓	7	r← r+q+C	
	SUB	r, q	1	0	1	0	1	0	1	0	r1	r0	q1	q0	★	↑	↓	7	r← r-q	
		SBC	r, i	1	1	0	1	0	1	r1	r0	i3	i2	i1	i0	★	↑	↓	7	r← r-i3~i0-C
	r, q		1	0	1	0	1	0	1	1	r1	r0	q1	q0	★	↑	↓	7	r← r-q-C	
	AND	r, i	1	1	0	0	1	0	r1	r0	i3	i2	i1	i0		↑		7	r← r∧i3~i0	
		r, q	1	0	1	0	1	1	0	0	r1	r0	q1	q0		↑		7	r← r∧q	
	OR	r, i	1	1	0	0	1	1	r1	r0	i3	i2	i1	i0		↑		7	r← r∨i3~i0	
		r, q	1	0	1	0	1	1	0	1	r1	r0	q1	q0		↑		7	r← r∨q	
	XOR	r, i	1	1	0	1	0	0	r1	r0	i3	i2	i1	i0		↑		7	r← r∨i3~i0	
		r, q	1	0	1	0	1	1	1	0	r1	r0	q1	q0		↑		7	r← r∨q	
	CP	r, i	1	1	0	1	1	1	r1	r0	i3	i2	i1	i0		↑	↓	7	r-i3~i0	
		r, q	1	1	1	1	0	0	0	0	r1	r0	q1	q0		↑	↓	7	r-q	
	FAN	r, i	1	1	0	1	1	0	r1	r0	i3	i2	i1	i0		↑		7	r∧i3~i0	
		r, q	1	1	1	1	0	0	0	1	r1	r0	q1	q0		↑		7	r∧q	
	RLC	r	1	0	1	0	1	1	1	1	r1	r0	r1	r0		↑	↓	7	d3← d2, d2← d1, d1← d0, d0← C, C← d3	
	RRC	r	1	1	1	0	1	0	0	0	1	1	r1	r0		↑	↓	5	d3← C, d2← d3, d1← d2, d0← d1, C← d0	
	INC	Mn	1	1	1	1	0	1	1	0	n3	n2	n1	n0		↑	↓	7	M(n3~n0)← M(n3~n0)+1	
	DEC	Mn	1	1	1	1	0	1	1	1	n3	n2	n1	n0		↑	↓	7	M(n3~n0)← M(n3~n0)-1	
	ACPX	MX, r	1	1	1	1	0	0	1	0	1	0	r1	r0	★	↑	↓	7	M(X)← M(X)+r+C, X← X+1	
	ACPY	MY, r	1	1	1	1	0	0	1	0	1	1	r1	r0	★	↑	↓	7	M(Y)← M(Y)+r+C, Y← Y+1	
	SCPX	MX, r	1	1	1	1	0	0	1	1	1	0	r1	r0	★	↑	↓	7	M(X)← M(X)-r-C, X← X+1	
	SCPY	MY, r	1	1	1	1	0	0	1	1	1	1	r1	r0	★	↑	↓	7	M(Y)← M(Y)-r-C, Y← Y+1	
	NOT	r	1	1	0	1	0	0	0	r1	r0	1	1	1		↑		7	r← r̄	

Abbreviations used in the explanations have the following meanings.

Symbols associated with registers and memory

A	A register
B	B register
X	XHL register (low order eight bits of index register IX)
Y	YHL register (low order eight bits of index register IY)
XH	XH register (high order four bits of XHL register)
XL	XL register (low order four bits of XHL register)
YH	YH register (high order four bits of YHL register)
YL	YL register (low order four bits of YHL register)
SP	Stack pointer SP
SPH	High-order four bits of stack pointer SP
SPL	Low-order four bits of stack pointer SP
MX, M(X)	Data memory whose address is specified with index register IX
MY, M(Y)	Data memory whose address is specified with index register IY
Mn, M(n)	Data memory address 000H–00FH (address specified with immediate data n of 00H–0FH)
M(SP)	Data memory whose address is specified with stack pointer SP
r, q	Two-bit register code r, q is two-bit immediate data; according to the contents of these bits, they indicate registers A, B, and MX and MY (data memory whose addresses are specified with index registers IX and IY)

r		q		Register specified
r1	r0	q1	q0	
0	0	0	0	A
0	1	0	1	B
1	0	1	0	MX
1	1	1	1	MY

Symbols associated with program counter

NBP	New bank pointer
NPP	New page pointer
PCB	Program counter bank
PCP	Program counter page
PCS	Program counter step
PCSH	Four high order bits of PCS
PCSL	Four low order bits of PCS

Symbols associated with flags

F	Flag register (I, D, Z, C)
C	Carry flag
Z	Zero flag
D	Decimal flag
I	Interrupt flag
↓	Flag reset
↑	Flag set
↕	Flag set or reset

Associated with immediate data

p	Five-bit immediate data or label 00H–1FH
s	Eight-bit immediate data or label 00H–0FFH
l	Eight-bit immediate data 00H–0FFH
i	Four-bit immediate data 00H–0FH

Associated with arithmetic and other operations

+	Add
-	Subtract
^	Logical AND
∨	Logical OR
⊕	Exclusive-OR
★	Add-subtract instruction for decimal operation when the D flag is set

APPENDIX B. TROUBLESHOOTING

Tool	Problem	Remedy measures
ICE S5U1C62000H	Nothing appears on the screen, or nothing works, after activation.	Check the following and remedy if necessary: • Is the RS-232C cable connected correctly? • Is the RS-232C driver installed? • Is MODE.COM on the disk? • Is the execution file correct? PC-DOS ICS6008W.EXE • Is the DOS version correct? PC-DOS Ver. 2.1 or later • Is the DIP switches that set the baud rate of the main ICE unit set correctly? • Is the fuse of the ICE cut off?
	The ICE fuse cut immediately after activation.	Check the following and remedy if necessary: • Are connectors F1 and F5 connected to the evaluation board correctly? • Is the target board power short-circuiting?
	<ILLEGAL VERSION ICE6200> appears on the screen immediately after activation.	The wrong version of ICE is being used. Use the latest version.
	<ILLEGAL VERSION PARAMETER FILE> appears on the screen immediately after activation.	The wrong version of ICS6008P.PAR is being used. Use the latest version.
	Immediate values A (10) and B (11) cannot be entered correctly with the A command.	The A and B registers are reserved for the entry of A and B. Write 0A and 0B when entering A (10) and B (11). <i>Example:</i> LD A, B Data in the B register is loaded into the A register. LD B, 0A Immediate value A is loaded into the B register.
	<UNUSED AREA> is displayed by the SD command.	This message is output when the address following one in which data is written is unused. It does not indicate problem. Data is correctly set in areas other than the read-only area.
	You can not do a real-time run in break-trace mode.	Since the CPU stops temporarily when breaking conditions are met, executing in a real-time is not performed.
	Output from the evaluation board is impossible when data is written to the I/O memory for Buzzer and Fout output with the ICE command.	Output is possible only in the real-time run mode.
SOG6008	An R error occurs although the address is correctly set in the segment source file.	Check the following and remedy if necessary: • Does the address symbol use capital letters? • Are the output ports set for every two terminals?

Tool	Problem	Remedy measures
ASM6008	An R error occurs although the final page is passed.	The cross assembler is designed to output "R error" every time the page is changed. Use a pseudo-instruction to set the memory, such as ORG or PAGE, to change the page. See "Memory setting pseudo-instructions" in the cross assembler manual.
MDC6008	Activation is impossible.	Check the following and remedy if necessary: • Is the number of files set at ten or more in OS environment file CONFIG.SYS?
Evaluation board S5U1C60N08E	The evaluation board does not work when it is used independently.	Check the following and remedy if necessary: • Has the EPROM for F.HEX and S.HEX been replaced by the EPROM for the target? • Is the EPROM for F.HEX and S.HEX installed correctly? • Is the appropriate voltage being supplied? (5V DC, 3A, or more) • Are the program ROMs (H and L) installed correctly? • Is data written from address 4000H? (When the 27C256 is used as the program ROM)
	Target segment does not light.	Check the following and remedy if necessary: • Is an EPROM with an access time of 250 ns or less being used for S.HEX.

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