

OKI

MASK164

User's Manual

**4-Bit Microcontroller MSM64164-XXX
Mask Option Support Tool**

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Preface

This manual is prepared to describe the procedure for operating the mask option data file generator MASK164, which is used to create mask option data from the LCD segment data of MSM64164, a CMOS 4-bit microcontroller.

You are recommended to use this manual in conjunction with the following documents.

- : User's Manual for MSM64162
 - description of the MSM64162 hardware
 - description of the MSM64162 software
- : User's Manual for MSM64164
 - description of the MSM64164 hardware
 - description of the MSM64164 software
- : User's Manual for Cross Assembler ASM64X
 - description of operating procedure for the ASM64X assembler
 - description of the ASM64X assembly language
- : User's Manual for EASE64162/164
 - description of the program development support system for MSM64162/164

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General

☆ This chapter describes the general concept and use of MASK164.

Chapter 1: General

1. Mask Option Data File Generator MASK164

The mask option data file generator MASK164 is a program to generate mask option data files in INTEL HEX format according to the specification of each mask option for CMOS 4-bit microcontroller MSM64164, OKI. The mask option data to be created include:

- 1 Assignment of the LCD segment terminals (L0 to L33) to Port, Com and Seg
- 2 Assignment of the LCD segment terminals to display registers
- 3 Operating voltage
- 4 Existence of X'tal CG

The values set for the above mask option data will be recorded in the space with the specified address in the INTEL HEX formatted file.

Figure 1-1 shows the operating modes of MASK164.

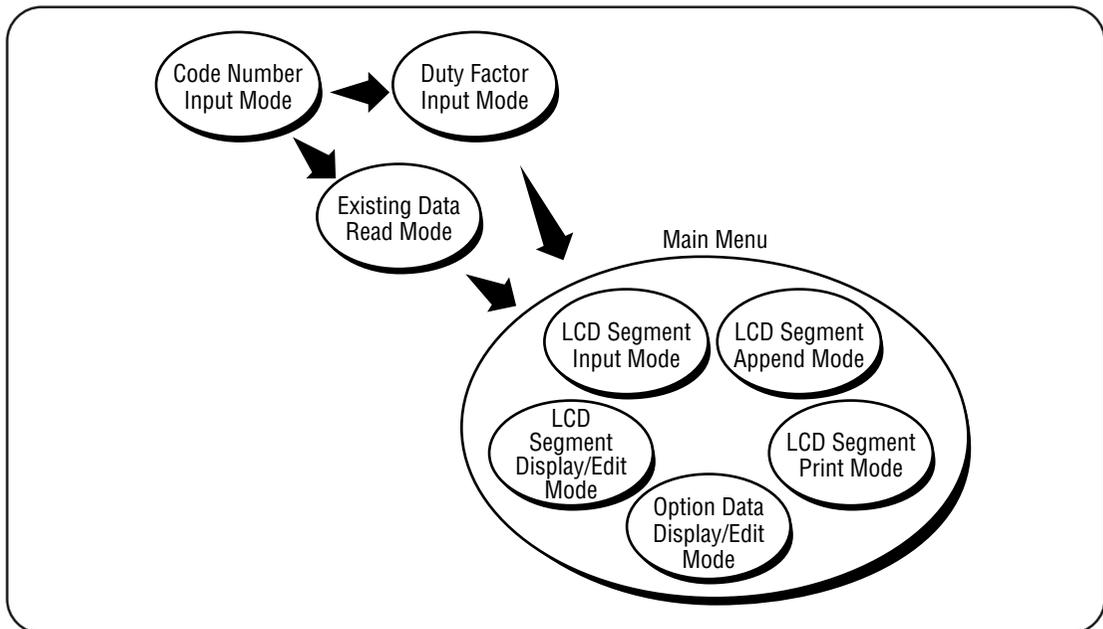


Figure 1-1 Block Diagram of MASK164

2. Mask Option Data Files

If you enter the mask option data described in Section 1., the mask option data file generator MASK164 will generate 15 data files. Figure 1-2 shows the process in which the mask option data files are generated.

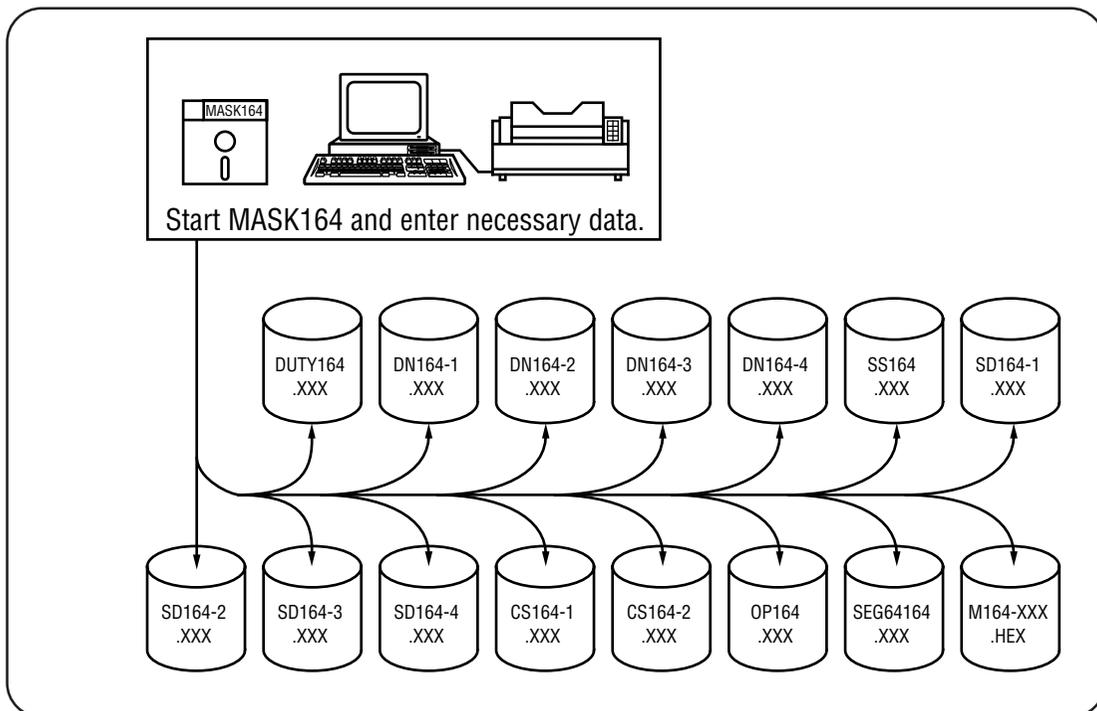


Figure 1-2 Mask Option Data File Generating Process

In Figure 1-2,  represents a data file generated by MASK164. The above mentioned INTEL HEX formatted mask option data file is represented as file M164-XXX.HEX. The use of those data files is explained in the next section.

NOTE "XXX" in each file name in Figure 1-2 represents a code number. See "To Enter Chip Attributes" for detail of the code numbers.

3. Use of Mask Option Data Files

The INTEL HEX formatted files generated by the mask option data file generator MASK164 (hereinafter, referred to as HEX files) are used to prepare the mask data required to manufacture MSM64164 and debug the application programs generated with the in-circuit emulator EASE 64162/164.  SEE NOTE-1

Figure 1-3 shows the successive works related to mask option data generation.

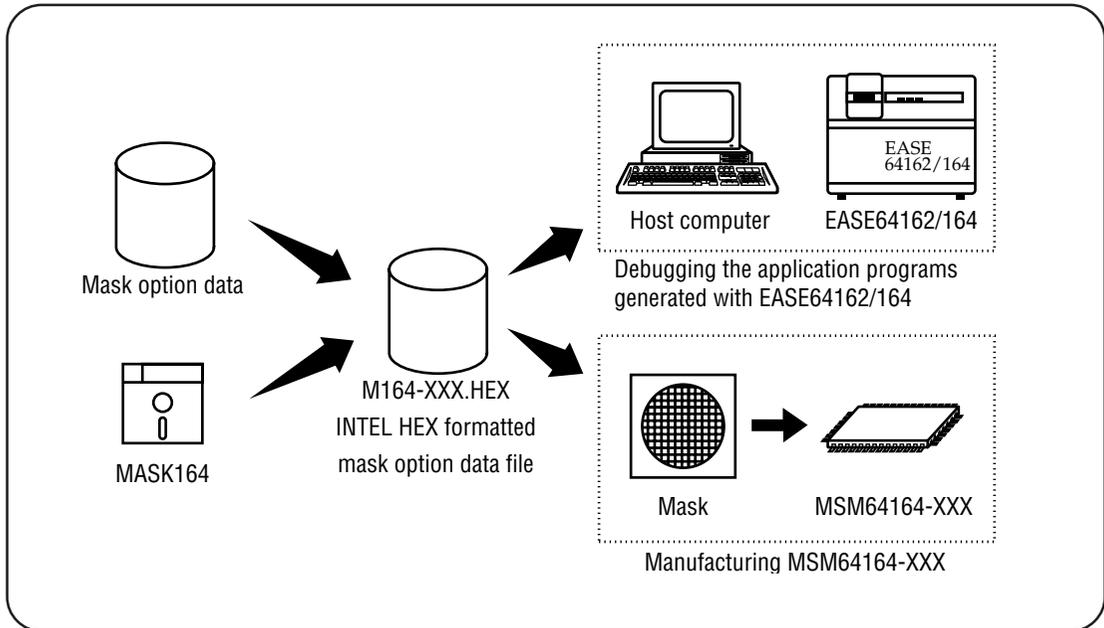


Figure 1-3 Use of Mask Option Data Files



Among the information included in the INTEL HEX formatted mask option data file generated by MASK164, the information related to the assignment of segment terminals to Port, Common and Segment, and to the display registers will be used for debugging the application programs generated with the in-circuit emulator EASE64162/164. Accordingly, it should be noted that the operating voltage and the existence of X'tal CG can't be checked while debugging the application programs generated by the in-circuit emulator EASE64162/164. Use the command LODM to transfer the content of the mask option data file into EASE64162/164. See User's Manual for EASE64162/164 for detail.

Operating Procedure for MASK164

☆ This chapter minutely describes the practical procedure to operate the mask option data file generator MASK164.

Chapter 2: Operating Procedure for MASK164

1. To Start MASK164

1.1 Operating Environment

MASK164 can be started under the following condition.

MS-DOS (version 3.1 or higher) is provided as the operating system.
Free area of more than 40 Kbytes is provided.  SEE NOTE-1
The printer is available.  SEE NOTE-2



Of the "40 Kbytes", about 30 Kbytes is for the main unit of MASK164 (MASK164.EXE) and about 10 Kbytes is for the memory area to record the generated files.



Never fail to verify that the printer, if used, is ready before starting the program.

1.2 To Start the Program MASK164

Start the mask option data file generator MASK164 in the procedure as shown below.

1. Turn on the main switch of the personal computer to start MS-DOS.
2. Start the mask option data file generator MASK164.

You can start the mask option data file generator MASK164 from the directory containing the mask option data file generator MASK164.EXE or another directory.

- (1) To start from the directory containing MASK164.EXE,
Enter as follows in response to the DOS prompt.

```
A>MASK164 
```

- (2) To start from another directory,
Enter the same as shown above if the environment variable PATH includes the directory containing MASK164.EXE. Enter as follows if it doesn't.

```
A>path-name ¥ MASK164 
```

3. The following message will appear on the screen of the console and then you can enter the code number.

```
MSM64164 Mask Option Generator Version X.XX XXX XXXX  
Copyright (C) XXXX. OKI Electric Ind. Co., Ltd.  
  
[Code Number] : MSM64164-_  
_
```

MASK164 can be started with the above steps 1 to 3.



See Section 1.3 "Chip Attributes" for the code numbers to be entered in the page displayed in the step 3.

1.3 Chip Attributes

Once MASK164 is started, you should enter the chip attributes used to define the name of the file to be read or generated, as mentioned in the step 3 of Section 1.2 "To Start the Program MASK164".

Enter the chip attributes as follows.

1. Enter the code number.

When MASK164 is started, it will display the following message showing that you are now in the code number input mode.

```
MSM64164 Mask Option Generator Version X.XX XXX XXXX
Copyright (C) XXXX. OKI Electric Ind. Co., Ltd.
[Code Number] : MSM64164-    
```

Enter an integer of three digits in the underlined position. The entered value will be a part of the file name or extension.

If you enter only one or two digit(s), 00 or 0 will be added before the digit(s) so that the entered value will be regarded as three-digits value.

Only press the  key to terminate the MASK164 program and return to the DOS mode.



[Code Number] : MSM64164-123 

Entering as above, the name of the file to be generated will be such as
M164-123.HEX and
SEG64164.123



[Code Number] : MSM64164-7 

Entering as above, the name of the file to be generated will be such as
M164-007.HEX and
SEG64164.007

2. The following message will appear if the directory doesn't contain the file corresponding to the code number entered in the step 1. Otherwise, proceed to the step 4.

```
SEG64164.XXX is New File
```

3. Enter the duty factor. MASK164 will ask you to enter the duty factor after displaying the above message.

```
[Input Duty] : 1/2:2, 1/3:3, 1/4:4 →     
```

You can use the following combinations of keys to enter the duty factor.

```
2  : Sets the duty factor to 1/2.
3  : Sets the duty factor to 1/3.
4  : Sets the duty factor to 1/4.
 : Sets the duty factor to the default of 1/4.
```

The entered value will be stored in the file DUTY164.XXX.

4. The file SEG64164.XXX corresponding to the code number entered in the step 1 will be read from the current directory. It won't be read if the current directory contains the file from the beginning. (See Step 2)

SEG64164.XXX File Reading ...



SEG64164.XXX, OP164.XXX and DUTY164.XXX will be read in this step.

5. After the duty factor is entered or the reading of the file SEG64164.XXX is completed, the main menu page will be shown and you can select an operation mode from the menu.

2. Selection on the Main Menu

2.1 Main Menu

After the chip attributes are defined, the mask option data file generator MASK164 will display the main menu page as shown below, enabling you to select the operation mode.

```
<<MSM64164 Mask Option Generator>>
- MENU -
1 : Create LCD Segment
2 : Append LCD Segment
3 : Display and Edit LCD Segment
4 : Display and Edit Option Data
5 : Print LCD Segment
6 : MS-DOS
7 : Exit

Select (1-7) → _
```

You can select the operation mode by entering the desired number from 1 to 7 in the underlined area.

MASK164 will act as follows according to the entered number.

```
1 : Creates the LCD segment mask option data table.
2 : Adds new data to an existing LCD segment mask option data table.
3 : Displays/edits the LCD segment mask option data table.
4 : Displays/edits the option data.  SEE NOTE-1
5 : Prints out the LCD segment mask option data table.
6 : Starts the command processor COMMAND.COM.
7 : Terminates the program MASK164.
```

See the description on the next page for details of each operation mode.



Option data includes the operating voltage and the existence of X'tal CG.

2.2 To Create an LCD Segment Assignment Table

In this mode, you can enter the segment data for each segment number in the LCD mask option data table.

Select "1" in the main menu page, and the following page will appear.

[[SEGMENT INPUT MODE]]

<< MSM64164 - XXX >>  SEE NOTE-1

** SEGMENT No.Lx **  SEE NOTE-1

Now you are in the segment data input mode.

1. Select Com, Seg or Port.

Com / Seg / Port →

You can enter one of the above three in the underlined position. The following combinations of keys can be used for the entry.

C		: Assigns the segment terminal to the common output.
S		: Assigns the segment terminal to the segment output.
P		: Assigns the segment terminal to the port output.  SEE NOTE-2
.		: Makes the segment terminal unavailable until another assignment is specified.
		: Makes the segment terminal unavailable until another assignment is specified, similarly to ".".
_		: Returns to the last assignment.
/		: Terminates the segment assignment mode and proceeds to the option data input mode.

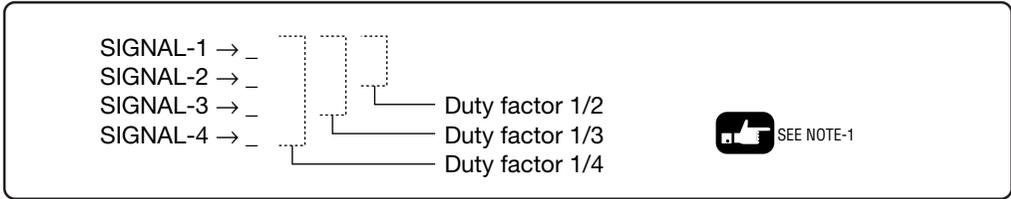


"XXX." will be replaced by the code number entered in the step 1 in Section 1.3. "No.Lx" will be replaced by the current segment number. The segment number must be equivalent to or smaller than 33.



You can enter "P", i.e. assign the segment terminal to the port output, only when the segment number is equivalent to or larger than 26.

2. Enter the LCD segment name (SIGNAL).



You can enter the segment name in the underlined position. Each segment name shall consist of up to six alphanumerals. Addition to the alphanumerals to represent the segment name, you can use the following combinations of keys.

- : Makes the segment unavailable.
- : You can jump to the next segment terminal, omitting the successive segment name entries.
- : You can go back to the segment assignment mode (selection of Com, Seg or Port) for the same segment terminal.
- : Terminates the segment name input mode and proceeds to the option data input mode.



If you select "C" in the step 1, i.e. the segment terminal is assigned to the common output, the segment names shall be as follows.

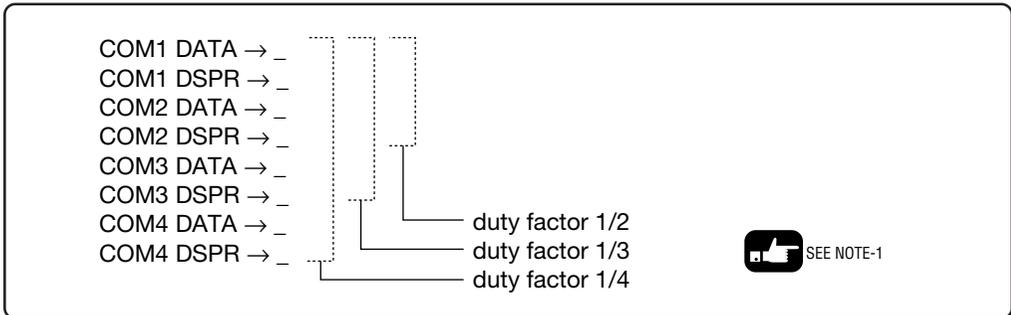
- SIGNAL-1 : "COM1"
- SIGNAL-2 : "COM2"
- SIGNAL-3 : "COM3"
- SIGNAL-4 : "COM4"

If you select "P" in the step 1, i.e. the segment terminal is assigned to the port output, you need to enter only for SIGNAL-1.



The number of the signals to be entered depends on the duty factor. With the duty factor 1/2 for example, two signals of SIGNAL-1 and SIGNAL-2 will be available.

3. Define the registers for the data to be indicated (enter DATA and DSPR).

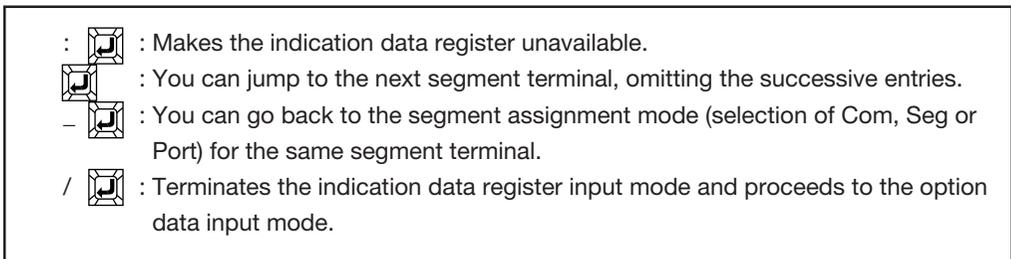


You can enter the segment data in each underlined position following DATA and the display register number in each of those following DSPR.

The segment data shall be a lower case alphabet from a to d.

The display register number shall be a number from 0 to 30 in decimal representation.

Additional to the above characters, you can use the following combinations of keys.



If you select "C" in the step 1, MASK164 will skip this step.
 If you select "P" in the step 1, you need to enter only for COM1DATA and COM1DSPR.
 In this case, the display register number shall be 0 or 1.



The number of the data registers to be defined depends on the duty factor. With the duty factor 1/2 for example, two registers for COM1 and COM2 will be available.

4. Determine the operating voltage.

After entering all the necessary data for segment terminals in the steps 1 to 3 or terminating with "/", you will be asked to determine the operating voltage and the existence of X'tal CG.

[[SEGMENT INPUT MODE]]

<< MSM64164 - XXX >>

Voltage of Power Supply (1.5v : 0 / 3v : 1)

Input → _

You can use one of the following key entries to determine the operating voltage.

0  : Sets the operating voltage to 1.5 V.

1  : Sets the operating voltage to 3 V.

 : You can jump to the X'tal CG existence determination mode.
The operating voltage will be set to the default of 1.5 V.

/  : Terminates the operating voltage determination mode.

5. Determine whether the X'tal CG exists or not.

X'tal CG Existence (Nonexist : 0 / Exist : 1)

Input → _

You can use one of the key entries shown on the next page to determine the X'tal CG existence.

0  : Makes the X'tal internal CG unavailable. (requires external CG)

1  : Makes the X'tal internal CG available.

 : Terminates the X'tal CG availability definition mode, making the X'tal internal CG unavailable.

-  : You can go back to the operating voltage input mode.

/  : Terminates the X'tal CG availability definition mode.

6. Save the file.

After entering all necessary data in the steps 1 to 5 as described above, MASK164 will show this message asking whether you will create the file or not.  SEE NOTE-1

File Create? (Y/N) → _

You can use one of these two keys.

"Y"  : You will create the file.
"N"  : You won't create the file.

If you key in "Y", MASK164 will show this message and start saving the file.

File Creating...

When MASK164 completes the saving of the file, it will show this message and return to the main menu page.

HEX.file M164_XXX.HEX Created



This procedure is used not only in file create mode to create a new LCD segments assignment table but also in add and display/edit mode to add to or display/edit an existing one. Once a file is created or updated, you don't need to execute this procedure until the content of it is given any changes.

2.3 To Add New Data to the LCD Segment Assignment Table

Adding procedure is essentially the same with the creating procedure described in Section 2.2 except that it is used to read out the segment data once saved in a file and enter additional data in it.

Select "2" in the main menu page, and the page as shown below will appear.

```

[[ SEGMENT APPEND MODE ]]

<< MSM64164 - XXX >>
** SEGMENT No.Lx **
    
```

"SEGMENT No.Lx" represents the next number of the last entered segment terminal number. Having entered all the segments before the file is saved, you will begin with the last segment number 33.

See Section 2.2 "To Create an LCD Segment Assignment Table".

2.4 To Display/Edit the LCD Segment Assignment Table

MASK164 will display the entered or read segment data in unit of 10 in table format. If any data is to be edited, you can specify the segment terminal number of that data.

Select "3" in the main menu page, and the page as shown in the next page will appear.

```

[[ DISPLAY & EDIT MODE ]]

<<MSM64164 - XXX>>          - Segment Data -          Page 1
    
```

SEG	SIGNAL	C/S/P	COM1		COM2		COM3	
			DATA	DSPR	DATA	DSPR	DATA	DSPR
L0	XXX/ XXX/ XXX	S	a	26	b	12	c	17
L1	/ / .	.	.	.	.	.	.	.
L2	/ / .	.	.	.	.	.	.	.
L3	/ / .	.	.	.	.	.	.	.
L4	/ / .	.	.	.	.	.	.	.
L5	/ / .	.	.	.	.	.	.	.
L6	/ / .	.	.	.	.	.	.	.
L7	/ / .	.	.	.	.	.	.	.
L8	/ / .	.	.	.	.	.	.	.
L9	/ / .	.	.	.	.	.	.	.

```

Edit Number (Next : CR, Back : -, To Menu : /) → _
    
```

You can use these combinations of keys in this mode.

numeric  : Displays the segment data corresponding to the entered segment terminal number. You can enter a number from 0 to 9 in this case.

-  : You can go back to the previous page of the page currently displayed.

 : Displays the next 10 segment data.

/  : You can go back to the main menu page.

Typing a numeral key and , MASK164 will display the segment data corresponding to the entered segment terminal number and show the page to ask you to select Com, Seg or Port as shown in the next page.



The page shown above lists the data with segment numbers 0 to 9 in 1/3 duty.

[[DISPLAY & EDIT MODE]]

<<MSM64164 - XXX>>

SEG	SIGNAL	C/S/P	COM1		COM2		COM3	
			DATA	DSPR	DATA	DSPR	DATA	DSPR
LX	XXX/ XXX/ XXX	S	a	26	b	12	c	17

Com / Seg / Port → _


SEE NOTE-1

The procedure used in this mode is almost the same as the one shown in Section 2.2 "To Create an LCD Segment Assignment Table" except that you can skip the current entry to the next one by entering  (space) .



Enter  in this position.

Com / Seg / Port → ___ NOT CHANGE

SIGNAL-1 → ← Enter the next entry.

When you reach the last page or terminate the input mode by entering "/", MASK164 will ask whether you will update the file or not using the same prompt shown in the step 6 in Section 2.2 if the content of the file data has any change.



"LX" represents the entered segment number. Entering the segment number 10 for example, "L10" will be indicated in this position.

2.5 To Display/Edit the Option Data

In this mode, you can make the once entered or read option data displayed on the screen. Select "4" in the main menu page, and this page will appear.

[[OPTION DATA EDIT MODE]]

<<MSM64164 - XXX>> - Option Data -

Voltage of Power Supply	X'tal CG Existence
(0 : 1.5v / 1: 3.0v)	(0 : Nonexist / 1 : Exist)
X	X

Edit Option Data? (Y/N) → _

You can use one of these combinations of keys to enter in this page.

"Y"  : You can go into the option data input mode.

"N"  : You can escape from the option data input mode.

If you key in "Y" , MASK164 will show the following page to ask you to determine the operating voltage.

[[OPTION DATA EDIT MODE]]

<< MSM64164 - XXX >>

Voltage of Power Supply (1.5v : 0 / 3v : 1)

Input → _

See the step 4 in Section 2.2 "To Create an LCD Segment Assignment Table" for the keys to be used in this mode. Note that keying in  will hold the predefined voltage without change in this mode while it will set it to 1.5 V in the step 4 in Section 2.2.

Then, MASK164 will show this prompt to ask you to define the X'tal CG existence.

X'tal CG Existence (Nonexist : 0 / Exist : 1)

Input → _

See the step 5 in Section 2.2 "To Create an LCD Segment Assignment Table" for the keys to be used in this mode. Note that keying in  will hold the predefined value without change in this mode, similarly to the operating voltage, while it will set it to 1.5 V in the step 4 in Section 2.2.

If you change any data, MASK164 will ask you whether you will create a file or not.

File Create? (Y/N)→ _

You can use one of these combinations of keys to enter in this page.

"Y"  : You will create a file.

"N"  : You won't create a file.

2.6 To Print Out the LCD Segment Assignment Table

In this mode, you can print out the once entered or read LCD mask option data. Select "5" in the main menu page, and this message will be shown.

*** Setup Printer & Hit Anykey !! ***

You should verify that the printer is ready. After making sure that the printer is available, press any one key, and MASK164 will start printing the mask option table.



If you press the key with the printer not ready, the key entry may be rejected. Therefore, make sure that the printer is ready before instructing MASK164 to print out the mask option table.

2.7 Shell Function

Select "6" in the main menu page to start the command processor COMMAND.COM. The system needs to have free area with sufficient capacity for the program to be executed, in order to activate this shell function. Resident part of MASK164.XXX requires the memory area of about 30 Kbytes. Therefore, the total capacity required when shell function is additionally used will be:

30 Kbytes + capacity of COMMAND.COM

Enter as follows to terminate the COMMAND.COM program.

A > EXIT 

2.8 To Terminate MASK164

Select "7" in the main menu page to terminate MASK164.



Never fail to check the data you have entered or updated are saved before terminating the program.

Files

☆ This chapter describes the mask option data files to be generated by MASK164.

Chapter 3: Files

1. Mask Option Data Files

The mask option data file generator MASK164 generates fifteen data files as shown below. "XXX" in the file name represents the code number entered in the step 1 in Section 1.3, Chapter 2.

SEG64164.XXX	SD164_1.XXX
DUTY164.XXX	SD164_2.XXX
OP164.XXX	SD164_3.XXX
DN164_1.XXX	SD164_4.XXX
DN164_2.XXX	SS164.XXX
DN164_3.XXX	CS164_1.XXX
DN164_4.XXX	CS164_2.XXX
SEG164_XXX.HEX	

Each of the files stores the following data.

1.1 File SEG64164.XXX

This file stores the segment data related to all the segment terminals. It will be read by MASK164.

1.2 File DUTY164.XXX

This file stores the duty factors entered as a chip attribute. It will be read by MASK164.

1.3 File OP164.XXX

This file stores the option data (the operating voltage and the existence of the X'tal CG). It will be read by MASK164.

1.4 File DN164_1.XXX

This file stores the display register numbers for COM1.

1.5 File DN164_2.XXX

This file stores the display register numbers for COM2.

1.6 File DN164_3.XXX

This file stores the display register numbers for COM3.

1.7 File DN164_4.XXX

This file stores the display register numbers for COM4.

1.8 File SD164_1.XXX

This file stores the segment data for COM1.

1.9 File SD164_2.XXX

This file stores the segment data for COM2.

1.10 File SD164_3.XXX

This file stores the segment data for COM3.

1.11 File SD164_4.XXX

This file stores the segment data for COM4.

1.12 File SS164.XXX

This file stores the segment attributes data.

1.13 File CS164_1.XXX

This file stores the common select data for VDD, VPC, VPS, VNC, VNS and VSS. These symbols represent the voltage level at specified points on the MSM64164 chip.

1.14 File CS164_2.XXX

This file stores the common select data for CON, COF, POLS, POLC, TDC1, PON and POF. These symbols represent the LCD display control signals for the MSM64164 chip.

1.15 File SEG164_XXX.HEX

This file is the INTEL HEX formatted file generated from the above files 1.3 to 1.14. It will be loaded on EASE64162/164.

2. The Mask Option Data Related to the Addresses

Table 3-1 shows the assignment of the mask option data related to the addresses in the INTEL HEX file.

Table 3-1 The mask Option Data Related to the Addresses

3

Address	Data Stored
0H to 021H	Display register number for COM1
100H to 121H	Display register number for COM2
200H to 221H	Display register number for COM3
300H to 321H	Display register number for COM4
400H to 421H	Segment data for COM1
500H to 521H	Segment data for COM2
600H to 621H	Segment data for COM3
700H to 721H	Segment data for COM4
800H to 821H	Segment attributes data
900H to 921H	High order 6 bits of the common select data
A00H to A21H	Low order 7 bits of the common select data
B00H	Option data

Appendixes

Appendixes

Appendix-1: Data Tables

Table AP-1 Display Register Number Data Table

DSPR	AD4	AD3	AD2	AD1	AD0	DSPR	AD4	AD3	AD2	AD1	AD0
00	0	0	0	0	0	16	1	0	0	0	0
01	0	0	0	0	1	17	1	0	0	0	1
02	0	0	0	1	0	18	1	0	0	1	0
03	0	0	0	1	1	19	1	0	0	1	1
04	0	0	1	0	0	20	1	0	1	0	0
05	0	0	1	0	1	21	1	0	1	0	1
06	0	0	1	1	0	22	1	0	1	1	0
07	0	0	1	1	1	23	1	0	1	1	1
08	0	1	0	0	0	24	1	1	0	0	0
09	0	1	0	0	1	25	1	1	0	0	1
10	0	1	0	1	0	26	1	1	0	1	0
11	0	1	0	1	1	27	1	1	0	1	1
12	0	1	1	0	0	28	1	1	1	0	0
13	0	1	1	0	1	29	1	1	1	0	1
14	0	1	1	1	0	30	1	1	1	1	0
15	0	1	1	1	1						

This table is used to create the files DN164_1.XXX, DN164_2.XXX, DN164_3.XXX and DN164_4.XXX. The HEX files are associated with the data at the addresses 0H to 321H.

Table AP-2 Segment Data Table

	DATA	D7	D6	D5	D4	D3	D2	D1	D0
DSPR even number	a	0	0	0	0	0	0	0	1
	b	0	0	0	0	0	0	1	0
	c	0	0	0	0	0	1	0	0
	d	0	0	0	0	1	0	0	0
DSPR odd number	a	0	0	0	1	0	0	0	0
	b	0	0	1	0	0	0	0	0
	c	0	1	0	0	0	0	0	0
	d	1	0	0	0	0	0	0	0

This table is used to create the files SD164_1.XXX, SD164_2.XXX, SD164_3.XXX and SD164_4.XXX. The HEX files are associated with the data at the addresses 400H to 721H.

Table AP-3 Segment Attributes Data Table

Attributes of segment terminals	S4	$\overline{S4}$	S3	$\overline{S3}$	S2	$\overline{S2}$	S1	$\overline{S1}$
Used as COM1	0	1	0	1	0	1	1	0
Used as COM2	0	1	0	1	1	0	0	1
Used as COM3	0	1	1	0	0	1	0	1
Used as COM4	1	0	0	1	0	1	0	1
Used as 1/4 duty segment	0	0	0	0	0	0	0	0
Used as 1/3 duty segment	0	1	0	0	0	0	0	0
Used as 1/2 duty segment	0	1	0	1	0	0	0	0
Used as PORT	0	1	0	1	0	1	0	0
Not used	0	1	0	1	0	1	0	1

This table is used to create the file SS164.XXX.

The HEX files are associated with the data at the addresses 800H to 821H.

Table AP-4 Common Select Data Table

C/S/P	VDD	VPC	VPS	VNC	VNS	VSS	CON	COF	POLS	POLC	TDC1	PON	POF
C	0	1	0	1	0	0	1	0	0	1	0	0	1
S	0	0	1	0	1	0	0	1	1	0	0	0	1
P	1	0	0	0	0	1	0	1	0	0	1	1	0
Not used	0	1	0	1	0	0	1	0	0	1	0	0	1

CS164_1.XXX data

CS164_2.XXX data

This table is used to create the file CS164_1.XXX and CS164_2.XXX.

The HEX files are associated with the data at the addresses 900H to A21H.

Table AP-5 Option Data Table

Operating voltage	VS	X'tal CG	CG
1.5 V	0	nonexist	0
3.0 V	1	exist	1

This table is used to create the file OP164.XXX.

The HEX files are associated with the data at the addresses B00H.

Appendix-2: Entries in Mask Option Tables

-1/3 duty-

SEG	SIGNAL			C/S/P	COM1		COM2		COM3	
					DATA	DSPR	DATA	DSPR	DATA	DSPR
L0	L1/	9A/	1C	S	a	10	a	08	c	00
L1	L2/	1B/	1G	S	b	10	b	00	c	01
L2	1A/	1F/	1E	S	a	00	b	01	a	01
L3	2B/	2C/	L10	S	b	02	c	02	b	09
L4	2A/	2G/	2D	S	a	02	c	03	d	02
L5	2F/	2E/	.	S	b	03	a	03	.	00
L6	3B/	3C/	L11	S	b	04	c	04	c	09
L7	3A/	3G/	3D	S	a	04	c	05	d	04
L8	L3/	3F/	3E	S	c	10	b	05	a	05
L9	L4/	4B/	.	S	d	10	b	06	.	00
L10	4A/	4G/	4C	S	a	06	c	07	c	06
L11	4F/	4E/	4D	S	b	07	a	07	d	06
L12	L5/	L6/	L7	S	a	26	b	26	c	26
L13	./	./	COM3	C	.	00	.	00	.	00
L14	./	./	.	.	.	00	.	00	.	00
L15	./	./	.	.	.	00	.	00	.	00
L16	./	./	.	.	.	00	.	00	.	00
L17	./	./	.	.	.	00	.	00	.	00
L18	./	./	.	.	.	00	.	00	.	00
L19	./	COM2/	.	C	.	00	.	00	.	00
L20	COM1/	./	.	C	.	00	.	00	.	00
L21	L8/	8E/	8F	S	d	26	a	17	b	17
L22	8D/	8G/	8A	S	d	16	c	17	a	16
L23	8C/	8B/	7A	S	c	16	b	16	a	14
L24	7D/	7E/	7F	S	d	14	a	15	b	15
L25	L14/	7C/	7G	S	c	19	c	14	c	15
L26	6E/	6F/	7B	S	a	13	b	13	b	14
L27	6D/	6G/	6A	S	d	12	c	13	a	12
L28	L13/	6C/	6B	S	b	19	c	12	b	12
L29	5E/	5F/	1D	S	a	11	b	11	d	00
L30	5D/	5G/	5A	S	d	10	c	11	a	10
L31	L12/	5C/	5B	S	a	19	c	10	b	10
L32	10D/	10A/	L9	S	c	18	a	18	a	09
L33	10F/	9F/	9D	S	b	18	b	08	c	08

Voltage of Power Supply	X'tal CG Existence
(0 : 1.5v / 1 : 3.0v)	(0 : Nonexist / 1 : Exist)
0	0

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Appendix-2: Entries in Mask Option Tables

-1/4 DUTY-

SEG	SIGNAL				C/S/P	COM1		COM2		COM3		COM4	
						DATA	DSPR	DATA	DSPR	DATA	DSPR	DATA	DSPR
L0	COM1/	/	/	.	C	.	00	.	00	.	00	.	00
L1	8A/	8B/	10B/	10A	S	a	10	b	10	b	14	a	14
L2	8F/	8G/	10F/	8C	S	b	11	c	11	b	15	c	10
L3	8E/	8D/	9C/	9B	S	a	11	d	10	c	12	b	12
L4	DEGREE/	19/	9G/	9A	S	d	09	d	11	c	13	a	12
L5	7B/	7C/	9F/	9H	S	b	08	c	08	b	13	d	13
L6	7A/	7G/	9J/	7D	S	a	08	c	09	b	29	d	08
L7	7F/	6B/	14B/	14C	S	b	09	b	06	b	14	c	14
L8	6A/	6G/	6D/	RECALL	S	a	06	c	07	d	06	a	28
L9	4A/	4G/	4D/	SPL	S	a	04	c	05	d	04	d	15
L10	4F/	4E/	HAND/	20	S	b	05	a	05	d	17	c	30
L11	3B/	3C/	BUZZER/	TMR	S	b	02	c	02	c	29	d	28
L12	3A/	3G/	3D/	12B	S	a	02	c	03	d	02	b	10
L13	3F/	3E/	BELL/	STW	S	b	03	a	03	d	29	b	1C
L14	17/	18/	2C/	RPT	S	b	30	a	30	c	00	d	19
L15	2A/	2B/	2G/	2D	S	a	00	b	00	c	01	d	00
L16	1B/	2F/	2E/	12A	S	b	26	b	01	a	01	a	10
L17	/	COM2/	/	.	C	.	00	.	00	.	00	.	00
L18	/	/	COM3/	.	C	.	00	.	00	.	00	.	00
L19	1ADEG/	24/	11ADEG/	11C	S	a	26	d	27	a	27	c	27
L20	12D/	1C/	11B/	12E	S	d	10	c	26	b	27	a	11
L21	12C/	P/	12F/	12G	S	c	10	d	26	b	11	c	11
L22	13E/	4C/	ALM/	13F	S	a	13	c	04	c	28	b	13
L23	13D/	4B/	13A/	13G	S	d	12	b	04	a	12	c	13
L24	13C/	5/	MEMO/	13B	S	c	12	d	07	d	01	b	12
L25	14E/	6F/	6E/	14F	S	a	15	b	07	a	07	b	15
L26	14D/	6C/	14A/	14G	S	d	14	c	06	a	14	c	15
L27	15E/	7E/	21/	15F	S	a	17	a	09	d	30	b	17
L28	15D/	15G/	9I/	15A	S	d	16	c	17	a	29	a	16
L29	15C/	15B/	9E/	9D	S	c	16	b	16	a	13	d	12
L30	16E/	16F/	10E/	22	S	a	19	b	19	a	15	d	13
L31	16D/	16G/	10D/	16A	S	d	18	c	19	d	14	a	18
L32	16C/	16B/	10G/	10C	S	c	18	b	18	c	15	c	14
L33	/	/	/	COM4	C	.	00	.	00	.	00	.	00

Voltage of Power Supply	X'tal CG Existence
(0 : 1.5v / 1 : 3.0v)	(0 : Nonexist / 1 : Exist)
1	1