SPECIFICATIONS FOR OLED MODULE

RoHS COMPLIANT

MODEL NO.

BL1602AM-ERNJU68J$

VER.02

FOR MESSRS:

_____

ON DATE OF:

_____

APPROVED BY:

_____

BOLYMIN, INC.

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History of Version

Version	Contents	Date	Note
01	NEW VERSION	2019/8/30	SPEC.
02	Coding system modify	2019/10/29	Page 4

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1.Numbering System

B	L	1602	AM	-	E	R	N	J	U	68J	$	
0	1	2	3		4	5	6	7	8	9	10	11

0	Bolymin	B			
1	Module Type	L	OLED		
2	Format	1602	16 character type,2lines		
3	Version No.	AM			
	-				
4	LCD Color	L	OLED/Green	E	OLED/Yellow
		W	OLED/White	R	OLED/RED
		K	OLED/BLUE		
5	LCD Type	R	Positive/reflective		
6	Backlight type/color	N	No backlight		
7	CGRAM Font	J	English/Japanese Font	E	English/European Font
		B	English/Japanese/European	C	English/Cyrillic Font
8	View Angle /Operation Temperature	U	6:00/Ultra wide Temperature	H	6:00 /Wide Temperature
9	Special Code	3	3 voltage logic power supply	N	Positive voltage for LCD
		20K	RS 232 I/F	20C	I2C I/F
		20I	SPI I/F	68J	6800 mode,8-bits
		68K	6800 mode,4-bits	80J	8080 mode,8-bits
		80K	8080 mode,4-bits		
10	RoHS	$			
11	Customer Code	00 0 ~ 99 0 、AA 0 ~ ZZ 0			

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2.General Specification

(1) Mechanical Dimension

Item	Standard Value	Unit
Number of Characters	16 characters× 2 Lines	dots
Module dimension (L*W*H)	80.0 x36.0 x 9.1	mm
View area	58.22 x 13.52	mm
Active area	56.22 x 11.52	mm
Dot size	0.57 x 0.67	mm
Dot pitch	0.60 x 0.70	mm
Character size (L x W)	2.97x 5.57	mm
Character pitch (L x W)	3.55x 5.95	mm

(2) Controller IC: Compatible with PT0066
IC Equivalent (compatible) HD44780, KS0066 , SPLC780 , ST7066 , AIP31066

3.Absolute Maximum Ratings

Item	Symbol	Condition	Min	Typ.	Max	Unit
Operating Temperature	TOP		-40	---	+80	℃
Storage Temperature	TST		-40	---	+90	℃
Supply Voltage(Logic)	VDD		-0.3	---	5.5	V
Input Voltage	VI		-0.3	---	5.5	V
Operating life time		80cd/m²	---	100000	---	Hrs

Note 1: All the above voltages are on the basis of “VSS = 0V”.
Note 2: When this module is used beyond the above absolute maximum ratings, permanent breakage of the module may occur.
Note 3:Ta = 25°C, 25% Checkerboard.
Software configuration follows section actual application example Initialization.
End of lifetime is specified as 50% of initial brightness reached. The average operating lifetime at room temperature is estimated by the accelerated operation at high temperature conditions..

4.Electrical Characteristics

(Ta=25℃)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage (VDD)	VDD	—	2.8	5.0	5.3	V
Input High Vol	V_{IH}	—	$0.7V_{DD}$	—	V_{DD}	V
Input Low Vol	V_{IL}	—	0	—	$0.3V_{DD}$	V
Output High Vol	V_{OH}	—	$0.7V_{DD}$	—	V_{DD}	V
Output Low Vol.	V_{OL}	—	—	—	0.3VDD	V
Supply Current (*)	IDD	—	—	30	—	mA

Note : VDD=5.0V, 25% Display Area Turn on 100 cd/m2.
When random texts pattern is running, averagely, about 1/4 of pixels will be on.

5.Optical Characteristics

Item	Min.	Typ.	Max.	Unit
View Angle	—	Free	—	deg
Dark Room contrast		>10000:1		—
CIE x,y (Color: Yellow)	(0.46,0.45)	(0.50,0.49)	(0.54,0.53)	
Brightness	—	100	—	cd/m2

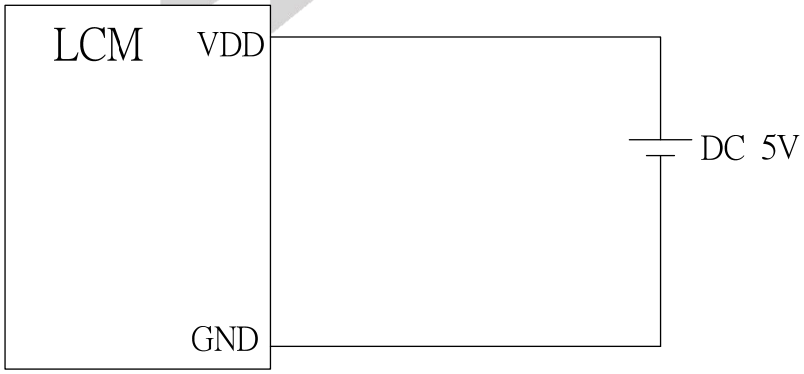
6.Interface Pin Function

Pin No	Symbol	Level	Description
1	VSS	0V	Ground
2	VDD	5.0V	Supply Voltage for logic**.**
3	NC	-	No connect.
4	RS	H/L	H:DATA, L:Instruction code
5	R/W	H/L	H:Read(MPU→Module)L:Write(MPU→Module).
6	E	H/L	Chip enable signal.
7	DB0	H/L	Data bit 0.
8	DB1	H/L	Data bit 1.
9	DB2	H/L	Data bit 2.
10	DB3	H/L	Data bit 3.
11	DB4	H/L	Data bit 4.
12	DB5	H/L	Data bit 5.
13	DB6	H/L	Data bit 6.
14	DB7	H/L	Data bit 7.
15	NC	-	No connection
16	NC	-	No connection

Default: 6800 interface 8 bit/4bit (STD)
Optional:I2C

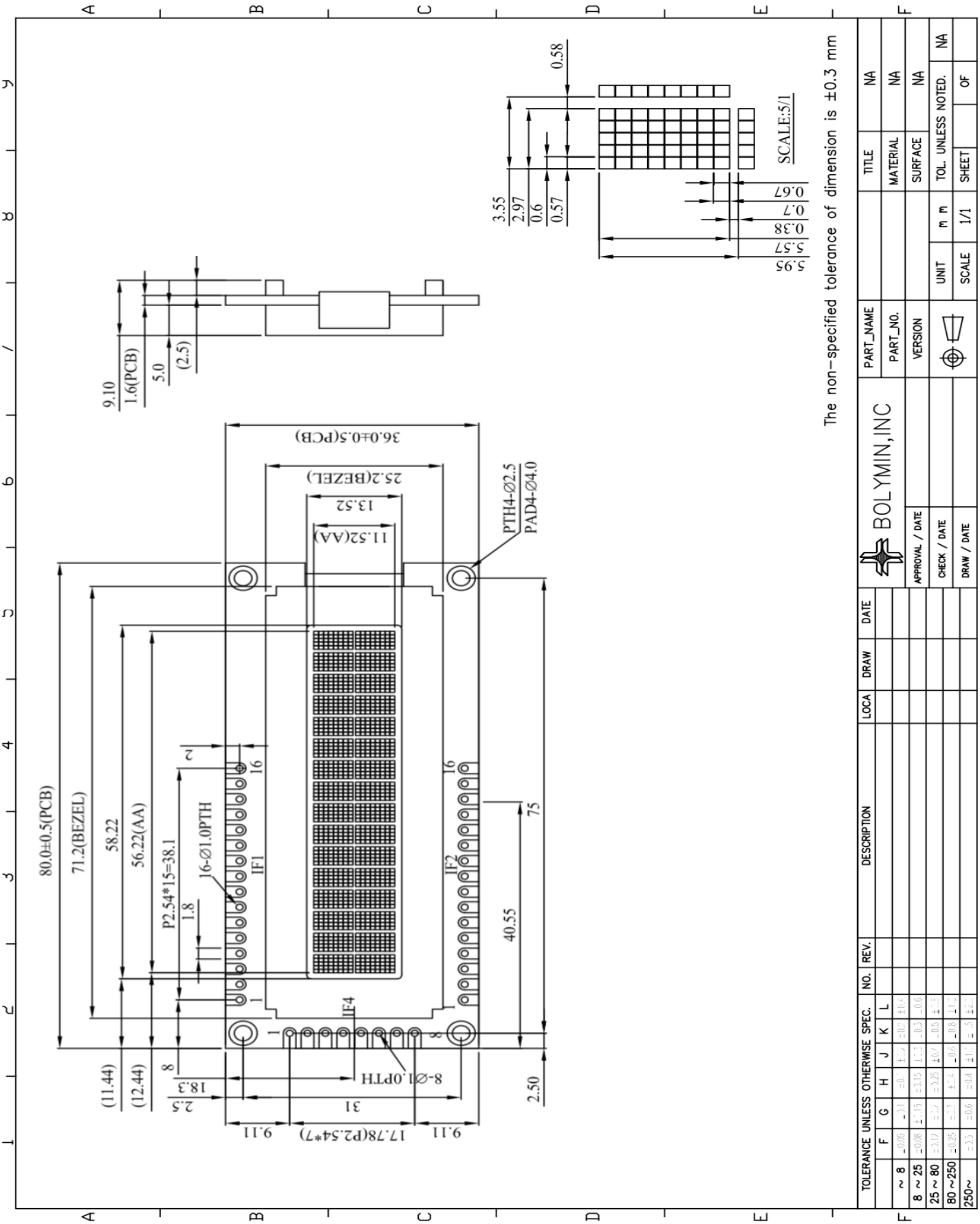
7.Power supply for LCD Module

＊LCM operating on "DC 5.0V " input with built-in positive voltage



8.Drawing& Block Diagram

8.1 Drawing



9. Controller Data

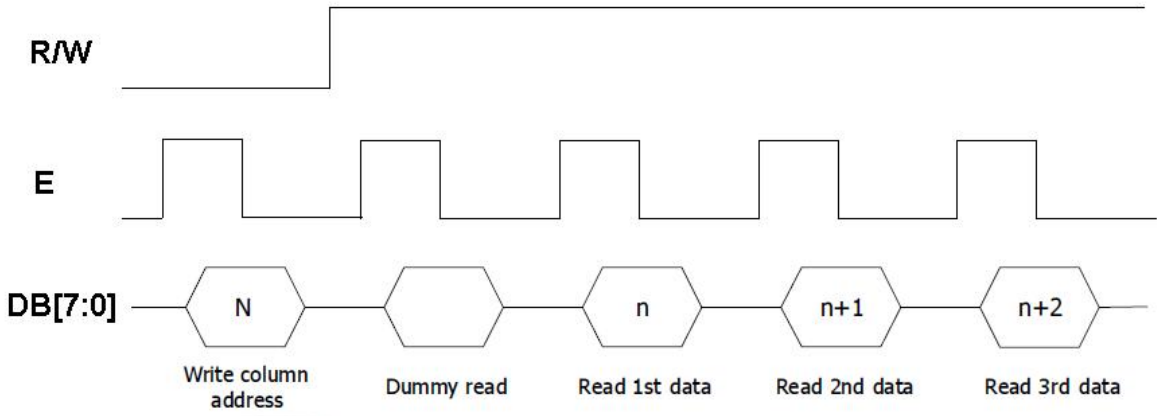
9.1 MPU Parallel 6800-series Interface

The parallel interface consists of 8 bi-directional data pins (DB[7:0]), R/W, RS, E.
A LOW in R/W indicates WRITE operation and HIGH in R/W indicates READ operation.
A LOW in RS indicates COMMAND read/write and HIGH in RS indicates DATA read/write.
The E input serves as data latch signal. Data is latched at the falling edge of E signal.

Function	E	R/W	RS
Write command	↓	L	L
Read status	↓	H	L
Write data	↓	L	H
Read data	↓	H	H

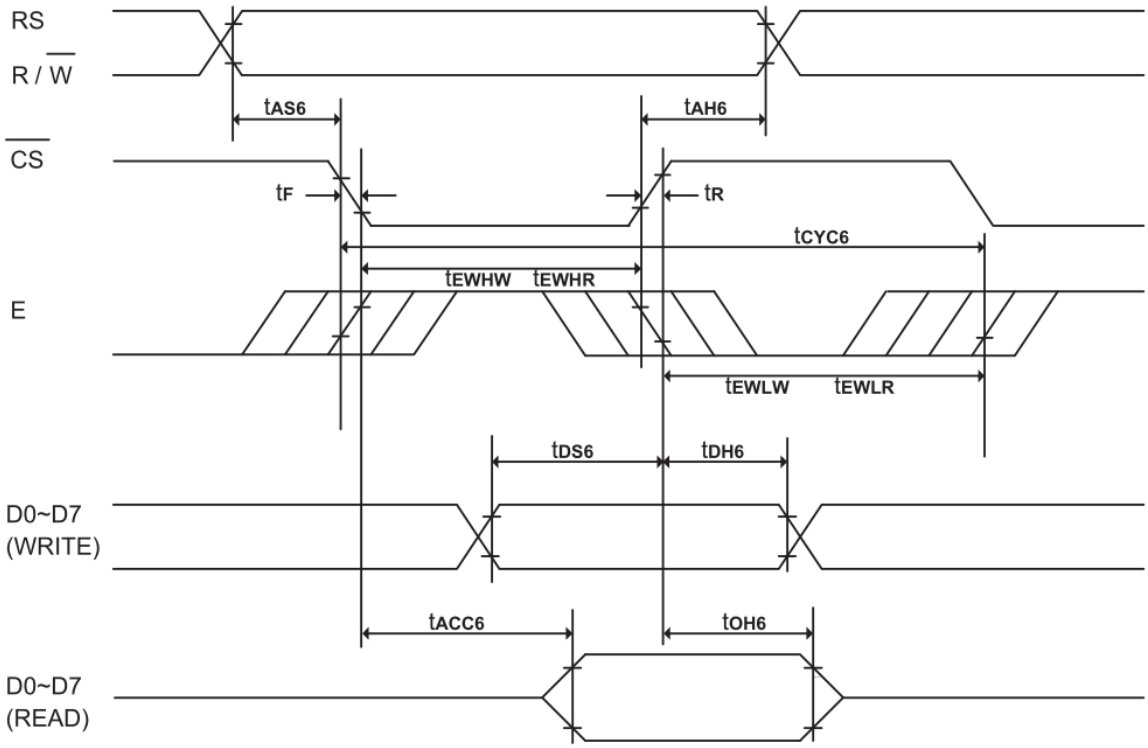
Control pins of 6800 interface

In order to match the operating frequency of display RAM with that of the microprocessor,some pipeline processing is internallyperformed which requires the insertion of a dummy read before the first actual display data read.



Data read back procedure - insertion of dummy read

9.2 System buses Read/Write Characteristics
(For the 6800 Series Interface MPU)



	Parameter	Min.	Typ.	Max.	Unit	Condition
tCYC6	System cycle time	500	-	-	ns	
tAS6	Address setup time	0	-	-	ns	
tAH6	Address hold time	0	-	-	ns	
tDS6	Data setup time	66	-	-	ns	
tDH6	Data hold time	25	-	-	ns	
tOH6	Output disable time	16	-	140	ns	CL = 100pF
tACC6	Access time	-	-	280	ns	CL = 100pF
tEWHW	Enable H pulse width (Write)	166	-	-	ns	
tEWHR	Enable H pulse width (Read)	200	-	-	ns	
tEWLW	Enable L pulse width (Write)	166	-	-	ns	
tEWLR	Enable L pulse width (Read)	166	-	-	ns	
tR	Rise time	-	-	25	ns	
tF	Fall time	-	-	25	ns	

9.3 Display Control Instruction

Instruction	Instruction Code										Description
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
Clear Display	0	0	0	0	0	0	0	0	0	1	Clear entire display area.(POR = 01H)
Return Home	0	0	0	0	0	0	0	0	1	—	Counter with DDRAM address 00H. (POR = 10H)
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	SH	Assign cursor moving direction and enable the shift of entire display.
Display ON/OFF Control	0	0	0	0	0	0	1	D	C	B	Set display (D), cursor (C), and blinking of cursor (B) on/off control bit.(POR = 08H)
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	—	—	Shift display or move cursor..
Function Set	0	0	0	0	1	DL	N	F	—	—	Set number of display line (N), and character font (F). (POR = 30H)
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter.
Read Busy Flag and Address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Read Busy Flag (BF) and Address Counter (POR = 00H)
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data to CG RAM or DD RAM. (POR= 00H)
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from CG RAM or DD RAM. (POR = 00H)

The LCD display Module is built in a LSI controller, the controller has two 8-bit registers, an instruction register (IR) and a data register (DR).

The IR stores instruction codes, such as display clear and cursor shift, and address information for display data RAM (DDRAM) and character generator (CGRAM). The IR can only be written from the MPU. The DR temporarily stores data to be written or read from DDRAM or CGRAM. When address information is written into the IR, then data is stored into the DR from DDRAM or CGRAM. By the register selector (RS) signal, these two registers can be selected.

RS	R/W	Operation
0	0	IR write as an internal operation (display clear, etc.)
0	1	Read busy flag (DB7) and address counter (DB0 to DB7)
1	0	Write data to DDRAM or CGRAM (DR to DDRAM or CGRAM)
1	1	Read data from DDRAM or CGRAM (DDRAM or CGRAM to DR)

Busy Flag (BF)

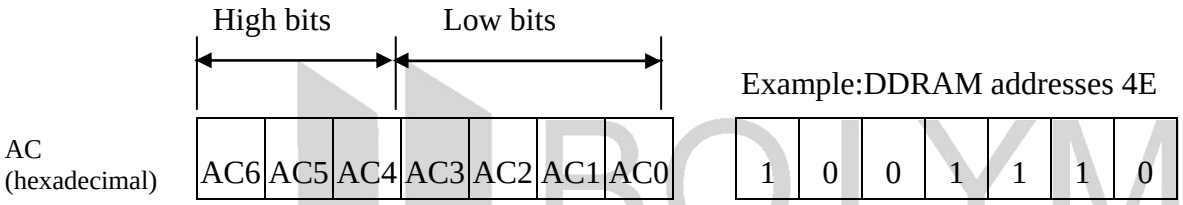
When the busy flag is 1, the controller LSI is in the internal operation mode, and the next instruction will not be accepted. When RS=0 and R/W=1, the busy flag is output to DB7. The next instruction must be written after ensuring that the busy flag is 0.

Address Counter (AC)

The address counter (AC) assigns addresses to both DDRAM and CGRAM

Display Data RAM (DDRAM)

This DDRAM is used to store the display data represented in 8-bit character codes. Its extended capacity is 80×8 bits or 80 characters. Below figure is the relationship between DDRAM addresses and positions on the liquid crystal display.



DDRAM Address

Display position DDRAM address

1	2	3	4	5	6	7	8	9	10	11	12	13	14	14	16
00	01	02	03	04	05	06	07	40	41	42	43	44	45	46	47

Example: 1-Line by 16-Character Display

Character Generator ROM (CGROM)

The CGROM generate 5×8 dot character patterns from 8-bit character codes. See Table 2.

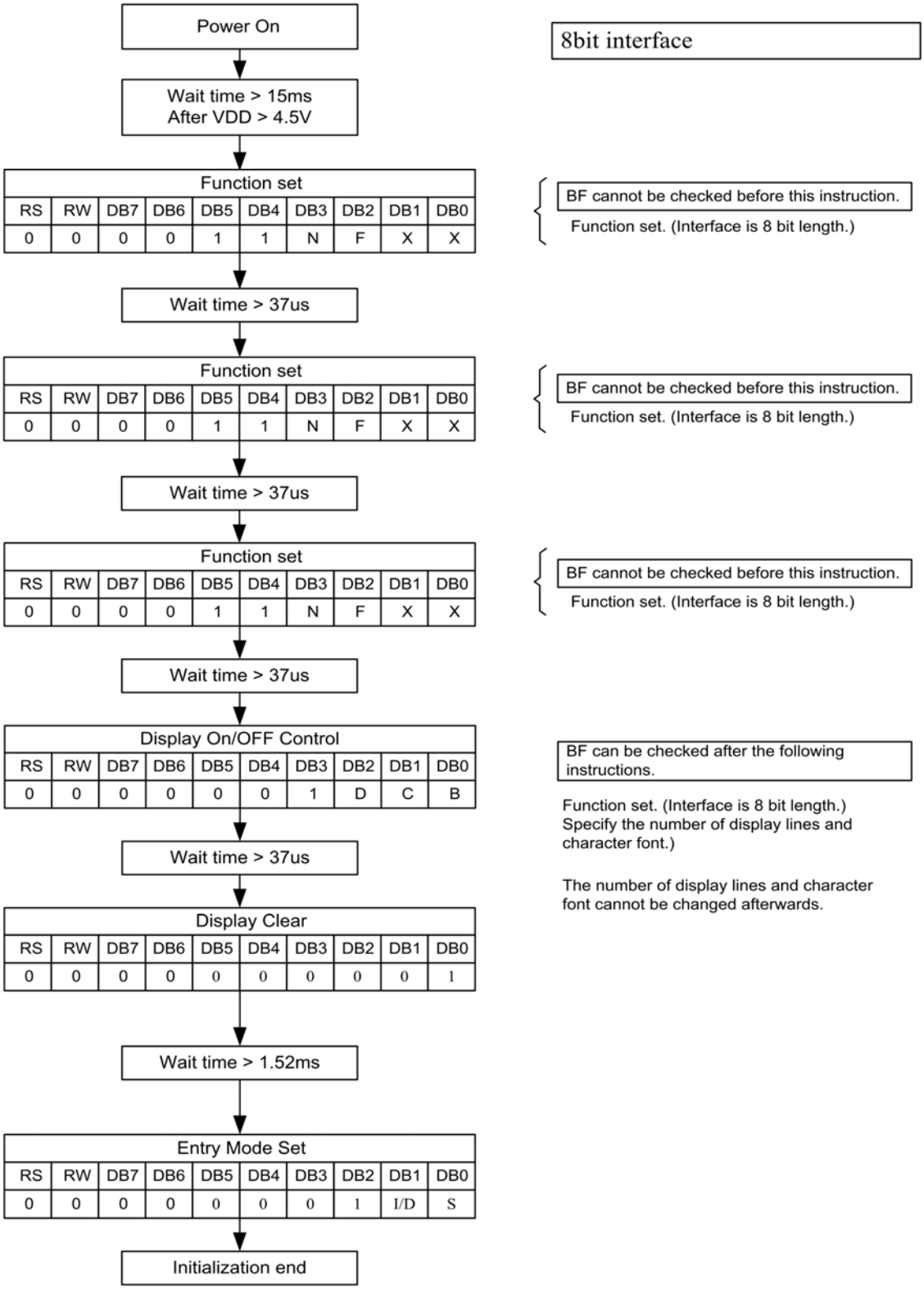
Character Generator RAM (CGRAM)

In CGRAM, the user can rewrite character by program. For 5×8 dots, eight character patterns can be written.

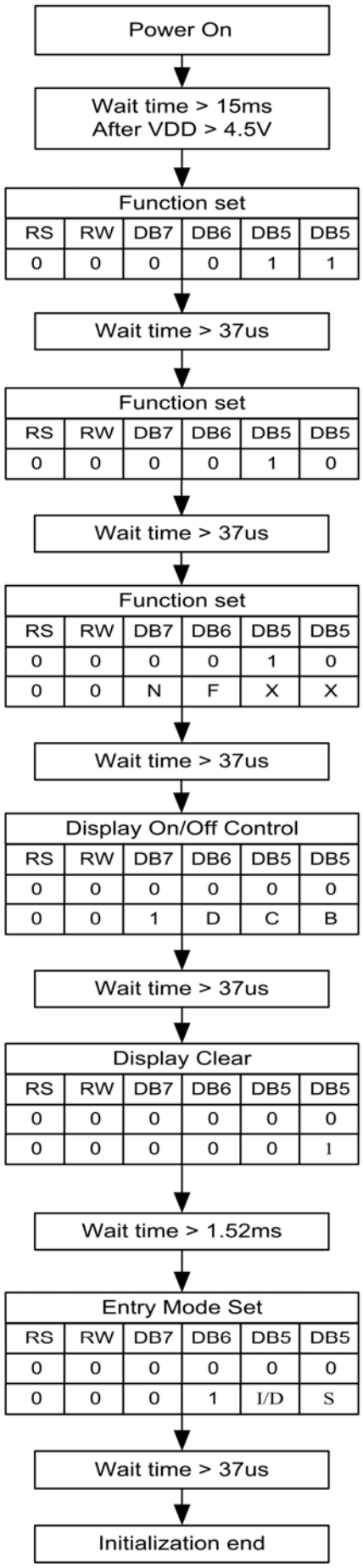
Write into DDRAM the character code at the addresses shown as the left column of table 1. To show the character patterns stored in CGRAM.

9.4 Initializing software of LCM

8 bit interface mode



4 bit interface mode



BF cannot be checked before this instruction.
Function set. (Interface is 8 bit length.)

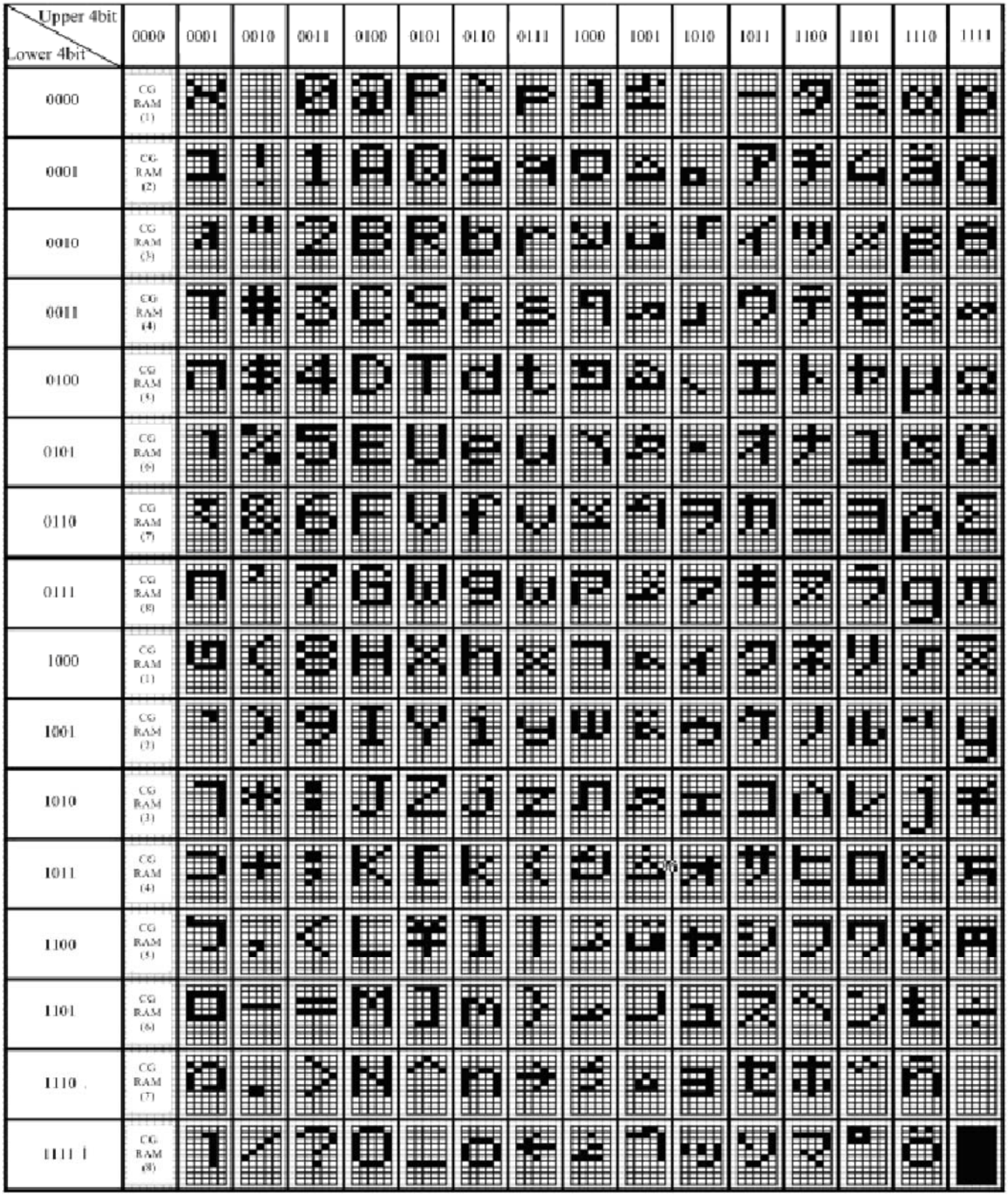
BF cannot be checked before this instruction.
Function set. (Interface is 4 bit length.)

BF cannot be checked before this instruction.
Function set. (Interface is 4 bit length.)

BF can be checked after the following instructions.

Function set. (Interface is 4 bit length.)
Specify the number of display lines and character font.)

The number of display lines and character font cannot be changed afterwards.

10. Built-in CGROM (Character Generator ROM)

ENGLISH_JAPANESE