Futaba®

REV.-

VACUUM FLUORESCENT DISPLAY MODULE

ENGINEERING PROPOSAL

GP1202B02B

EVALUATION
☐ ACCEPTED WITHOUT ANY CHANGE
☐ THE FOLLOWING CHANGE IS REQUIRED

JULY 17, 2013

Engineering Group

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⚠ Important Safety Notice

Please read this note carefully before using the product.

Warning

- The module should be disconnected from the power supply before handling.
- The power supply should be switched off before connecting or disconnecting the power or interface cables.
- The module contains electronic components that generate high voltages (approx. 59 V) which may cause an electrical shock when touched.
- Do not touch the electronic components of the module with any metal objects.
- The VFD used on the module is made of glass and should be handled with care. When handling the VFD, it is recommended that cotton gloves be used.
- The module is equipped with a circuit protection fuse.
- Under no circumstances should the module be modified or repaired. Any unauthorized modifications or repairs will invalidate the product warranty.
- The module should be abolished as the factory waste.

1. Summary

1-1. This vacuum fluorescent display (VFD) module consists of a 160×64 number of pixels, 0.4×0.4 pitch dot matrix display.

1-2. This module supports RS-232 communication interface.

1-3. Since a DC-DC/AC converter is equipped, only 5Vdc power source is required to operate the module.

1-4. The module includes flash ROM for international font, Simplified Chinese, Traditional Chinese, Japanese, and Korean can be displayed.

2. General Specification

2-1. DIMENSIONS, WEIGHT (Refer to FIGURE-1)

Table-1

Item	Specification	Unit
Outer Dimensions	Length 110.0±1 Width 47.0±1 Thickness 22.4	mm
Weight	Approx. 70	g

2-2. SPECIFICATION OF THE DISPLAY PANEL

Table-2

Item	Specification	Unit
Display area dimension	63.9(row)×25.5(column)	mm
Display content	160(row)×64(column)	Dot
Dot size	0.3(row)×0.3(column)	mm
Dot pitch	0.4(row)×0.4(column)	mm
Color illumination	Green (λp=505nm)	—

2-3. ENVIRONMENT CONDITIONS

Table-3

Item	Symbol	Min.	Max.	Unit
Operation Temperature	*T*opr	-40	+85	℃
Storage Temperature	*T*stg	-40	+85	℃
Operation Humidity(Note)	*H*opr	20	85	%
Storage Humidity(Note)	*H*stg	20	90	%
Vibration (10～55Hz)	—	—	4	G
Shock	—	—	40	G

Note) Avoid moist environmental conditions.

2-4. ABSOLUTE MAXIMUM ELECTRICAL RATINGS

Table-4

Item	Symbol	Min.	Max.	Unit
Supply Voltage	*V*cc	-0.3	+6.5	Vdc
Input Signal Voltage	V_{IS}	-20	+20	Vdc

2-5. RECOMMEND OPERATING CONDITIONS

Table-5

Item	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	*V*cc	4.5	5.0	5.5	Vdc
H-Level Input Voltage	V_{IH}	5	—	15	V
L-Level Input Voltage	V_{IL}	-15	—	-5	

2-6. ELECTRICAL, OPTICAL CHARACTERISTICS UNDER STANDARD OPERATING CONDITIONS

Table-6

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Current (Note 1)	*I*cc	*Vcc*=5.0V All on	—	570	700	mA
Power Consumption	—		—	2.85	3.5	W
Luminance (Note 2)	*L*		450	900	—	cd/m^2
H-Level Output Voltage	V_{OH}	*Vcc*=5.0V	5	—	10	V
L-Level Output Voltage	V_{OL}	*Vcc*=5.0V	-10	—	-5	V

Note 1) The surge current can be approx. 5 times the supply current (Max.) at power on.

Note 2) The luminance level is set at 100% luminance value.

3. Function description

3-1. Interface

Signal receiving condition

The receiving buffer of module CPU has 128 byte. If the remained buffer is 64 byte or less, the RTS signal is disabled (BUSY). If the remained buffer is128 byte or more, the RTS signal is enabled (READY). The RTS signal is controlled by VFD module.

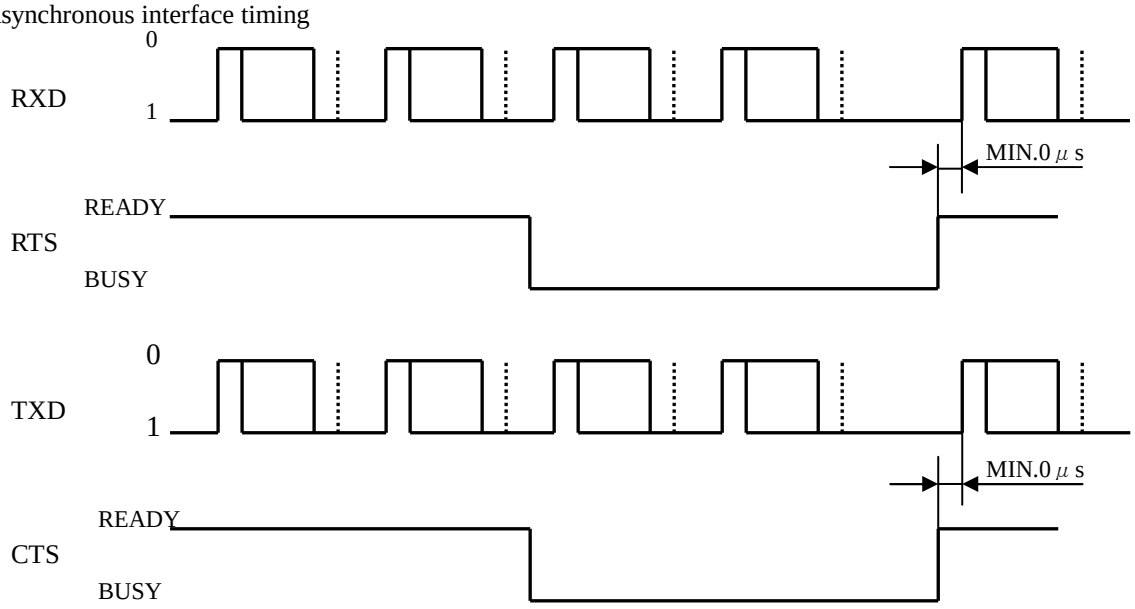
Effectiveness of RTS signal changing

Table-7

RTS Change	1(READY)→0(RTS)	0(RTS)→1(READY)
Condition	The remained buffer is 64 byte or less.	The remained buffer is over 128 byte or more.

3-1-1. Asynchronous interface

※Asynchronous interface timing



Communication condition

Table-8

Baud Rate	9,600 or 19,200 or 38,400 or 115,200bps （※）
Parity	NON/ODD/EVEN（※）
Format	Start(1bit)+Data(8bit)+Stop(1bit)
Handshake	RTS

（※）Initial setting of Baud Rate：38,400bps.

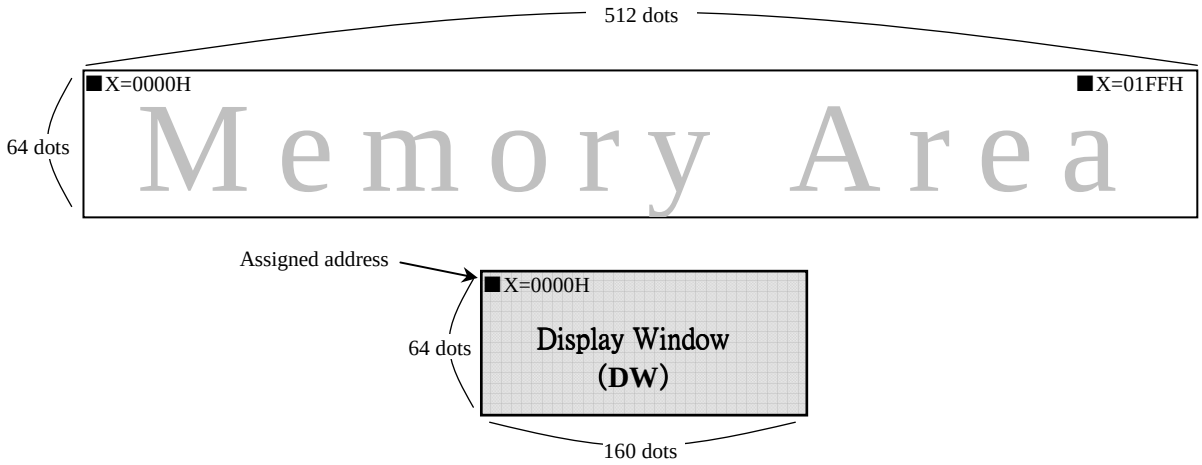
（※）Initial setting of parity：NON.

（※）The change is set up through connector.

3-2. Display memory

3-2-1.Memory position and Display Window (DW)

The module has memory area as following. It realizes displaying the Display Window (DW).



3-2-2. Display Data

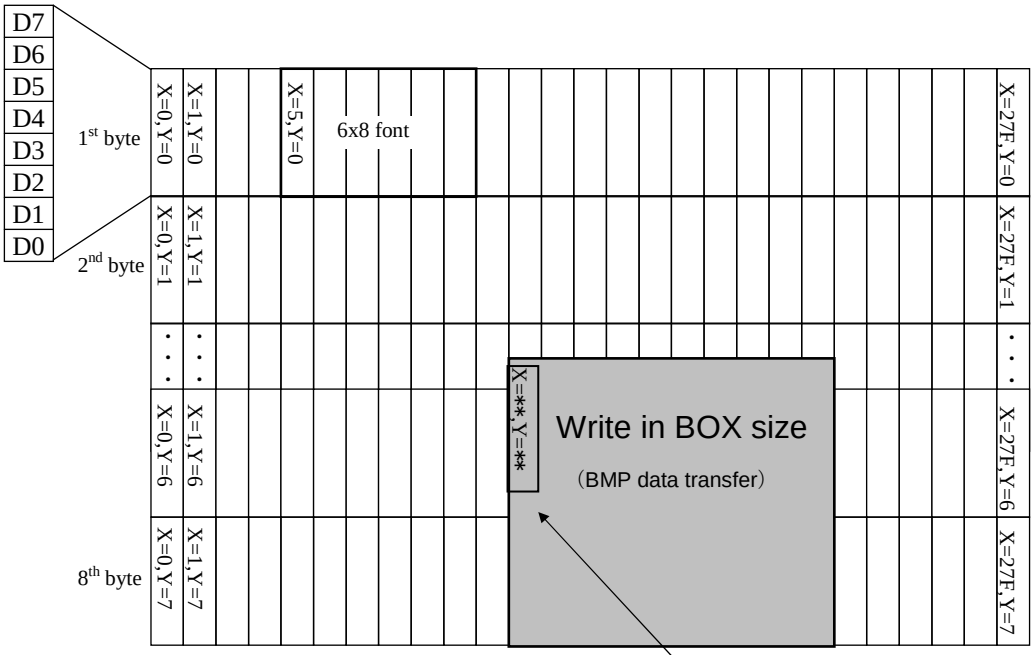
To display data, it is needed to write data into the memory and transfer DW to position of write data.

The methods of writing data in memory area are the method of writing text or BMP data write and copying the registered data of FROM.

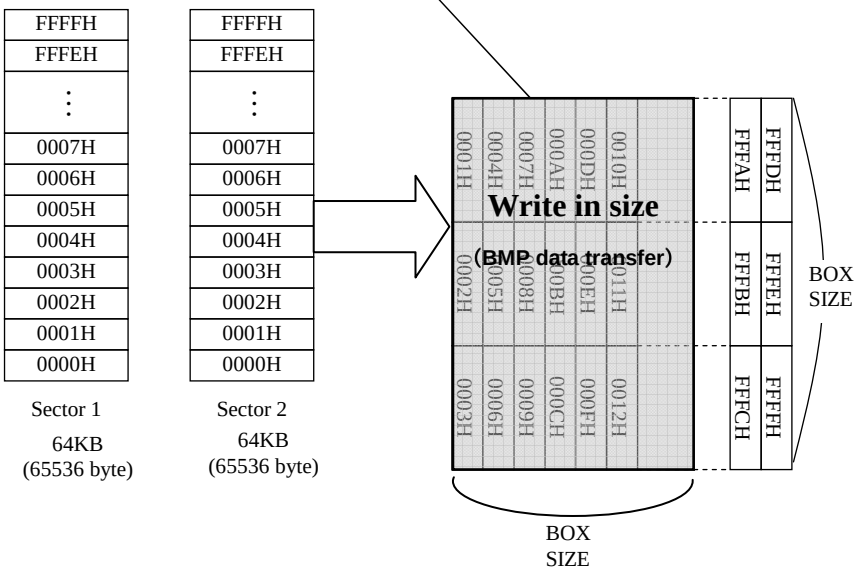
- If there is already data to write in the address, the new data is overwritten.
- When write in text data, please assign the address of the upper left position of font data.
- After writing text data, the cursor position moves to right by one character size.

3-2-3.Memory address and data

To set address or write data, an address of top left corner dots (8 vertical dots and horizontal dot) should be specified in bytes.



3-2-4. FROM address and data



The relation between BMP data registered address and data of FROM as above. The sector has 64KB capacity. Sector 1 and Sector 2 are available.

BMP data definition is performed per 64KB. If the data is less than 64KB, the rest of the memory space will be written in as FFH.

Command List

Sort	Command	Byte	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	Default (Power ON)
Basic	Reset	2	1Bh	0Bh										—
	Memory Clear	2		0Ch										—
	Dimming Set	3		20h	Dimming Set									FFh
	Power ON／OFF	3		21h	Power ON/OFF									PW=1(Power ON)
	Display Position Set	4		22h	Position									DSA=0
					X Upper	X Lower								
	Blink Set	4		23h	Blink Mode	Blink Time								Bm=0(No blink)
	BMP Write data	9～Variable		2Eh	Upper Left Position			Size			Write Data (1～4096 byte)			—
					X Upper	X Lower	Y	X Upper	X Lower	Y				
	BMP Data Read	11		2Fh	Position			Size				Flash Start Address		—
					X Upper	X Lower	Y	X Upper	X Lower	Y	Block	Upper	Lower	
Text	Cursor Position	5	1Bh	30h	Position									cX=0,cY=0
					X Upper	X Lower	Y							
	Language Set	3		32h	Language Set									La =0(Simplified)
	Text Size Set	3		33h	Font Size Appointment									—
	User Definable Font Set	3		34h	User Definable Font ON／OFF									Ga = 0 (User Definable Font OFF)
	Half-width Text or User Definable Font	1	20h-7Fh											—
	Full-width Text	2	80h-FDh	00h-FFh										—
	Full-width User Definable Font	2	FEh	A1h-B0h										—
Scrool Box Initial Setting	Scroll Box Size Set	8	1Bh	40h	Upper Left Position			Size						sX = 0, sY = 0
					X Upper	X Lower	Y	X Upper	X Lower	Y				
	Scroll Speed Set	3		41h	Scroll Speed									S = 0(2 x speed)
Text Scroll	Text Scroll Write	4～Variable	1Bh	50h	Scroll Text Length	Text Data(1～64byte)								—
	Text Scroll Write Start	2		51h										—
FROM Register	Switch Of FROM Register	2	1Ah	A0h										—
	Release From FROM Register	2		A1h										—
	BMP Data wtrite	Variable		A2h	Block	Register Data		BMP Register Data (1～65535 byte)						—
						Upper	Lower							
	User Definable Font Register(16X16 Font)	Variable		A3h	Register Text	1 character equals 32 byte(16x2)x Register text(1~16 characters)								—
	User Definable Font Register(8X16 Font)	Variable		A4h	Register Text	1 character equals 17 byte(8x2 + address(1))x Register text(1~16 characters)								—
	User Definable Font Register(6X8 Font)	Variable		A5h	Register Text	1 character equals 7 byte(6x1 + address(1))x Register text(1~16 characters)								—
	FROM Data Clear	2		A7h	Choice									—

4-1. Command detail

Following is the details of each command.

Command name：Software Reset

Code：1Bh,0Bh

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Bh	1st	0	0	0	1	1	0	1	1	
0Bh	2nd	0	0	0	0	1	0	1	1	Software Reset

Function：Following data as initial

Dimming Parameter	：	05h(5/5)
Power ON/OFF	：	PW=1(Power ON)
Display position setting	：	DSA=0
Blinking mode	：	Bm=0(No Blink)
Cursor position	：	cX=0,cY=0
Language setting	：	La=0(Simplified Chinese)
Font setting	：	Fo=0(16×16 Dot Mode)
User definable font setting	：	Ga=0(User definable font OFF)
Scroll box position	：	pX=0,pY=0
Scroll box size	：	sX=0,sY=0
Scroll speed setting	：	S=0(double speed)
Scroll text	：	256 byte all clear
Scroll byte	：	sL=0(1byte)
Memory	：	All 00h

Command name：Memory Map Clear

Code：1Bh,0Ch

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Bh	1st	0	0	0	1	1	0	1	1	
0Ch	2nd	0	0	0	0	1	1	0	0	Memory Map Clear

Function：Memory Map data all become 0.

Command name：Dimming Set

Code：1Bh,20h,D

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Bh	1st	0	0	0	1	1	0	1	1	
20h	2nd	0	0	1	0	0	0	0	0	Dimming Setting Command
D	3rd	D7	D6	D5	D4	D3	D2	D1	D0	Dimming

3rd byte	D7	D6	D5	D4	D3	D2	D1	D0	Dimming Value
	0	0	0	0	0	0	0	0	0% Light Off
	0	0	0	0	0	0	0	1	25% Dark
	0	0	0	0	0	0	1	0	50%
	0	0	0	0	0	0	1	1	75%
	0	0	0	0	0	1	0	0	100% Bright(Initial)

Function：Set value of VFD dimming (brightness) .

Command name：VFD Power ON/OFF
Code：1Bh,21h,PW

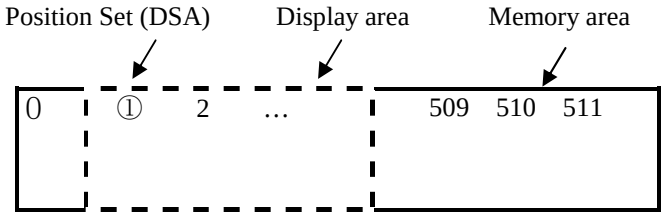
		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Bh	1st	0	0	0	1	1	0	1	1	
21h	2nd	0	0	1	0	0	0	0	1	Power setting command
PW	3rd	*	*	*	*	*	*	*	PW	Power ON/OFF

Function：VFD power ON/OFF controller command. If PW=0, VFD power is OFF, if PW=1, VFD power is ON.
・The state of display power ON/OFF is valid until next command of power or soft reset.

Command name：Display position Set
Code：1Bh,22h,DSA

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Bh	1st	0	0	0	1	1	0	1	1	
22h	2nd	0	0	1	0	0	0	1	0	Display position set
DSA	3rd	*	*	*	*	*	*	*	DSA8	
	4th	DSA7	DSA6	DSA5	DSA4	DSA3	DSA2	DSA1	DSA0	

Function：Set display position of memory area.
・Display starting position : Set (DSA[8..0]) as leftmost of display position.



※Impossible to set Y direction.

Command name：Blink Set
Code：1Bh,23h,BM,Bt

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Bh	1st	0	0	0	1	1	0	1	1	
23h	2nd	0	0	1	0	0	0	1	1	Blink setting command
BM	3rd	*	*	*	*	*	*	BM1	BM0	Blink mode
Bt	4th	Bt7	Bt6	Bt5	Bt4	Bt3	Bt2	Bt1	Bt0	Blanking time

3rd byte

BM1	BM0	Blink Mode
0	0	No Blink
0	1	ON/OFF invert Blink
0	*	All OFF/Display Blink

Function：Control display blink(ON/OFF).
・Set blink pattern by blink mode(BM[2..0]).
・Display switch by (Bt[7..0]+1) ×approx. 500ms.
・The condition is valid until next Blink Set, software Reset or hardware Power OFF.

Command name：BMP data Write
Code：1Bh,2Eh,pX,pY,sX,sY,Date

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Bh	1st	0	0	0	1	1	0	1	1	
2Eh	2nd	0	0	1	0	1	1	1	0	BMP data Write command
pX	3rd	*	*	*	*	*	*	*	pX8	Write start position left-side
	4th	pX7	pX6	pX5	pX4	pX3	pX2	pX1	pX0	
pY	5th	*	*	*	*	*	pY2	pY1	pY0	Write start position up-side
sX	6th	*	*	*	*	*	*	*	sX8	Width of Write size
	7th	sX7	sX6	sX5	sX4	sX3	sX2	sX1	sX0	
sY	8th	*	*	*	*	*	sY2	sY1	sY0	Height of Write size
Data	9th ~									Write data (sX+1)×(sY+1) byte

3rd / 4th byte

pX8	pX7	pX6	pX5	pX4	pX3	pX2	pX1	pX0	Start write on left position
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	1
0	0	0	0	0	0	0	1	0	2
				:					:
1	1	1	1	1	1	1	1	0	510
1	1	1	1	1	1	1	1	1	511

5th byte

pY2	pY1	pY0	Start write on top position
0	0	0	address position0
0	0	1	address position 1
0	1	0	address position 2
	:		:
1	1	0	address position 6
1	1	1	address position 7

6th / 7th byte

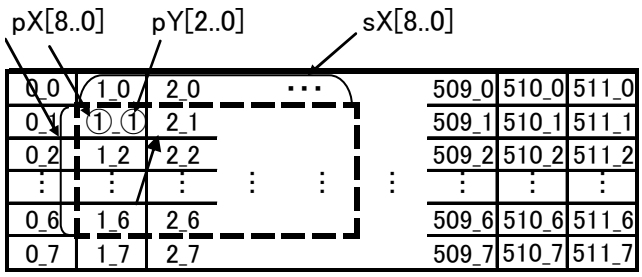
sX8	sX7	sX6	sX5	sX4	sX3	sX2	sX1	sX0	Width of Write size
0	0	0	0	0	0	0	0	0	1 dot
0	0	0	0	0	0	0	0	1	2 dot
0	0	0	0	0	0	0	1	1	3 dot
				:					:
1	1	1	1	1	1	1	1	0	511 dot
1	1	1	1	1	1	1	1	1	512 dot

8th byte

sY2	sY1	sY0	Height of Write size
0	0	0	8 dot
0	0	1	16 dot
0	1	0	24 dot
	:		:
1	1	0	56 dot
1	1	1	64 dot

Function：BMP data is written at memory area.

- Write data is written vertically from write start position (pX[8..0]_pY[2..0]). After writing height size (sY[2..0]), the write position shifts to a line on the right.
- The command is completed after writing data horizontally amount of write width size (sX[8..0]).
- If write area is over the memory area of the right side(pX=511), the write position is displaced to memory area left end (pX=0) after write until memory area right end (pX=1023).
- When writing area is over the memory area of the below side (pY=7),the write position is displaced to memory top (pY=0) after write until memory area lower end (pY=7).
- If font size is 8x16, it is no display when write data in seventh row (Y=7).



Command name：BMP data Read
Code：1Bh,2Fh,pX,pY,sX,sY,B,Fr

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Bh	1st	0	0	0	1	1	0	1	1	
2Fh	2nd	0	0	1	0	1	1	1	1	BMP data Read command
pX	3rd	*	*	*	*	*	*	*	pX8	Start write on left position
	4th	pX7	pX6	pX5	pX4	pX3	pX2	pX1	pX0	
pY	5th	*	*	*	*	*	pY2	pY1	pY0	Start write on top position
sX	6th	*	*	*	*	*	*	*	sX8	Width of Write size
	7th	sX7	sX6	sX5	sX4	sX3	sX2	sX1	sX0	
sY	8th	*	*	*	*	*	sY2	sY1	sY0	Height of Write size
B	9th	*	*	*	*	*	*	B1	B0	Block
Fr	10th	Fr15	Fr14	Fr13	Fr12	Fr11	Fr10	Fr9	Fr8	Start address of FROM for read
	11th	Fr7	Fr6	Fr5	Fr4	Fr3	Fr2	Fr1	Fr0	

3rd / 4th byte

pX8	pX7	pX6	pX5	pX4	pX3	pX2	pX1	pX0	Start write on left position
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	1
0	0	0	0	0	0	0	1	0	2
				:					:
1	1	1	1	1	1	1	1	0	510
1	1	1	1	1	1	1	1	1	511

5th byte

pY2	pY1	pY0	Start write on top position
0	0	0	0
0	0	1	1
0	1	0	2
	:		:
1	1	0	6
1	1	1	7

6th / 7th byte

sX8	sX7	sX6	sX5	sX4	sX3	sX2	sX1	sX0	Width of Write size
0	0	0	0	0	0	0	0	0	1 dot
0	0	0	0	0	0	0	0	1	2 dot
0	0	0	0	0	0	0	1	0	3 dot
				:					:
1	1	1	1	1	1	1	1	0	511 dot
1	1	1	1	1	1	1	1	1	512 dot

8th byte

sY2	sY1	sY0	Height of Write size
0	0	0	8 dot
0	0	1	16 dot
0	1	0	24 dot
	:		:
1	1	0	56 dot
1	1	1	64 dot

9th～11th byte

B1	B0	Fr15	Fr14	Fr13	・・・	Fr2	Fr1	Fr0	FROM collect address
0	0	0	0	0		0	0	0	000000h
0	0	0	0	0		0	0	1	000001h
0	0	0	0	0		0	1	0	000002h
				:					:
1	1	1	1	1		1	1	0	03FFFEh
1	1	1	1	1		1	1	1	03FFFFh

03FFFFh－FROM storage address(B[1..0],Fe[15..0])≧Write size width (sX)× Write size height (sY)

Function：The data is transferred to memory area from storage address of FROM(B[1..0],Fe[15..0]).

・BMP data registered in assigned position of FROM is written vertically from write start position (pX[8..0]_pY[2..0]). After writing height size (sY[2..0]), the write position shifts to a line on the right.

・The command is completed after writing data horizontally amount of write width size (sX[8..0]).

・If FROM address is BMP area (03FFFFh), writing data is ended at the time.

Command name：Cursor position Set
Code：1Bh,30h,cX,cY

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Bh	1st	0	0	0	1	1	0	1	1	
30h	2nd	0	0	1	1	0	0	0	0	Cursor position setting command
cX	3rd	*	*	*	*	*	*	*	cX8	x position
	4th	cX7	cX6	cX5	cX4	cX3	cX2	cX1	cX0	
cY	5th	*	*	*	*	*	cY2	cY1	cY0	y position

Function：Set write text position of cursor.

- In the display area, the cursor position is set in x, y position (cX[8..0],cY[2..0]).

Command name：Language Set
Code：1Bh,32h,La

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Bh	1st	0	0	0	1	1	0	1	1	
32h	2nd	0	0	1	1	0	0	1	0	Language setting command
La	3rd	*	*	*	*	*	*	*	La	

3rd byte

La	Language set
0	Simplified Chinese
1	Traditional Chinese
2	Japanese
3	Korea

Function：Language of text data is set to Simplified Chinese, Traditional Chinese, Japanese or Korea.

- This command is effective for Text Write Mode and Text Scroll Mode.
- This command does not influence already displayed data.

Command name：Text size Set
Code：1Bh,33h,Fo

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Bh	1st	0	0	0	1	1	0	1	1	
33h	2nd	0	0	1	1	0	0	1	1	
Fo	3rd	*	*	*	*	*	*	*	Fo	

3rd byte

Fo	Font setting
0	16×16 size font
1	6×8 size font

Function：Font size of Text data is set.

- This command is effective for Text Write Mode and Text Scroll Mode.
- This command does not influence already displayed data.

Command name：User definable font ON/OFF Set
Code：1Bh,34h,Ga

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Bh	1st	0	0	0	1	1	0	1	1	
34h	2nd	0	0	1	1	0	1	0	0	User definable font ON/OFF
Ga	3rd	*	*	*	*	*	*	*	Ga	

3rd byte

Ga	User definable font set
0	User definable font disable
1	User definable font enable

Function: User definable font ON/OFF command. (Only for 6x8 and 8x16 character.)

- This command is effective for Text Write Mode and Text Scroll Mode.
- This command does not influence already displayed data.

Write One-byte font (or one-byte user definable font)：20h～7Fh

- If first byte is 20h~7Fh, the cursor is set to the upper left of font, and an one-byte font is written in the memory area.
- This mode is reflected to Language, Text Size and User definable font ON/OFF.
- If the code which carried out User definable font registration is specified, User definable fonts are displayed. If the codes other than User definable font registration are specified, build-in fonts are displayed.
- Text size is the value set up in text size mode.
- A cursor moves by one character after writing text data.

Write Two-byte font：80h～FD**h**

- If first Byte is 80**h～FD**h, after obtaining the 2nd byte, Two-byte font is written in memory area.
- This mode is reflected to Language and Text Size.
- If text size is set font 6x8, this command is taken as the illegal command.
- A cursor moves by one character after writing text data.
- Don’t specify the area where the build-in fonts are not registered.

Write Two-byte User definable font：FEA1h～FEB0h

- If first byte is FEh, after obtaining the second byte, Two-byte user definable font is written in memory area.
- This mode is reflected to Language, Text Size and User definable font ON/OFF.
- If the User definable font set is OFF, text data is written as blank character.
- If text size is set font 6x8, this command is taken as the illegal command.
- A cursor moves by one character after writing text data.
- Don’t specify the outside of the User definable font registration area range.

Command name: Scroll box Set
Code：1Bh,40h,pX,pY,sX,sY

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Bh	1st	0	0	0	1	1	0	1	1	
40h	2nd	0	1	0	0	0	0	0	0	Scroll box size setting command
pX	3rd	*	*	*	*	*	*	*	pX8	Left position of box
	4th	pX7	pX6	pX5	pX4	pX3	pX2	pX1	pX0	
pY	5th	*	*	*	*	*	pY2	pY1	pY0	Upper position of box
sX	6th	*	*	*	*	*	*	*	sX8	Width of box size
	7th	sX7	sX6	sX5	sX4	sX3	sX2	sX1	sX0	
sY	8th	*	*	*	*	*	sY2	sY1	sY0	Height of box size

3rd / 4th byte

pX8	pX7	pX6	pX5	pX4	pX3	pX2	pX1	pX0	Left position of box
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	1	1
0	0	0	0	0	0	0	1	0	2
				:					:
1	1	1	1	1	1	1	()	1	509
1	1	1	1	1	1	1	1	()	510
1	1	1	1	1	1	1	1	1	511

5th byte

pY2	pY1	pY0	Upper position of box
0	0	0	0
0	0	1	1
0	1	0	2
	:		:
1	1	0	6
1	1	1	7 (※Only 6*8 font size)

6th / 7th byte

sX8	sX7	sX6	sX5	sX4	sX3	sX2	sX1	sX0	Width of box size
0	0	0	0	0	0	0	0	0	1 dot
0	0	0	0	0	0	0	0	1	2 dot
0	0	0	0	0	0	0	1	0	3 dot
				:					:
0	1	0	0	1	1	1	1	1	158 dot
0	1	0	1	0	0	0	0	0	159 dot
0	1	0	1	0	0	0	0	1	160 dot

8th byte

Height of box size	
Font size 8*16	16 dot
Font size 6*8	8 dot

Function: Scroll box is set

Text is scrolled by BOX size set by this command.
Setting with scroll box position (pX[8..0],pY[2..0]) and box size (sX[8..0],sY[2..0]) in this command.
If other command is inputted during scroll mode, the scroll is stopped.
If the scroll box is changed during scroll mode, it is necessary to write a text or BMP data into memory area again even if its data is same.
The BOX position can be assigned only the inside of display area (MAX 160 dot).

Command name: Setting of scroll speed
Code：1Bh,41h,S

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Bh	1st	0	0	0	1	1	0	1	1	
41h	2nd	0	1	0	0	0	0	0	1	Scroll speed setting command
S	3rd	*	*	*	*	S3	S2	S1	S0	Speed Set

3rd byte

S3	S2	S1	S0	Speed
0	0	0	0	1 dot / approx 10ms(2x speed)
*1h ~ 1Fh				1 dot / (S[3..0])×approx. 20ms)

Function: Scroll speed is set

The scroll speed is rough standard.

Command name: Text scroll character Set
Code：1Bh,50h,tL

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Bh	1st	0	0	0	1	1	0	1	1	
50h	2nd	0	1	0	1	0	0	0	0	Write scroll text
tL	3rd	tL7	tL6	tL5	tL4	tL3	tL2	tL1	tL0	Text data length (byte)
Data	4th ～									Scroll text data

Function: Text scroll character is set.

Command name: Text scroll start.
Code：1Bh,51h

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Bh	1st	0	0	0	1	1	0	1	1	
51h	2nd	0	1	0	1	0	0	0	1	Text scroll start command

Function: Text scroll start command.

・If other command is inputted during scroll mode, the scroll is stopped immediately.

Command name: Enable FROM register mode.
Code：1Ah,A0h

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Ah	1st	0	0	0	1	1	0	1	0	
A0h	2nd	1	0	1	0	0	0	0	0	Enable FROM register mode

Function: Switch to FROM register mode.

- The display and VFD power is OFF during FROM register mode.
- Only first command after module power on can be effective.

Command name: Disable FROM register mode.
Code：1Ah,A1h

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Ah	1st	0	0	0	1	1	0	1	0	
A1h	2nd	1	0	1	0	0	0	0	1	Disable FROM register mode

Function: Disable FROM register mode and switch to normal mode, after software reset.

- The command is effective only when FROM register mode.

Command name：Define the BMP data to FROM
Code：1Ah,A2h,B,Fw,Data

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Ah	1st	0	0	0	1	1	0	1	0	
A2h	2nd	1	0	1	0	0	0	1	0	Define the BMP data command
B	3rd	*	*	*	*	*	*	B1	B0	Block
FW	4th	Fw15	Fw14	Fw13	Fw12	Fw11	Fw10	Fw9	Fw8	Length of Write data (byte)
	5th	Fw7	Fw6	Fw5	Fw4	Fw3	Fw2	Fw1	Fw0	
Data	6th ～									Write data (1～65536 byte)

3rd byte

B1	B0	Write block
0	0	Block 0
0	1	Block 1
1	0	Block 2
1	1	Block 3

4th / 5th byte

Fw15	Fw14	Fw13	Fw12	・・・	Fw3	Fw2	Fw1	Fw0	Write data length (byte)
0	0	0	0		0	0	0	0	1byte
0	0	0	0		0	0	0	1	2 byte
0	0	0	0		0	0	1	0	3 byte
				:					:
1	1	1	1		1	1	1	0	65535 byte
1	1	1	1		1	1	1	1	65536 byte

Function: Define the BMP data to FROM.

- The BMP data (Fw[15..0]) is written from address 0000h of each block (B[1..0]) of FROM.
- Define the BMP data to FROM, after delete the BMP data to FROM.
- The registered in BMP data can be displayed when data transfer.
- This command is effective only when FROM register mode.

Command name：Define the user definable font(16×16 font)
Code：1Ah,A3h,Fb,Data

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Ah	1st	0	0	0	1	1	0	1	0	
A3h	2nd	1	0	1	0	0	0	1	1	Logged mode of user definable font (16×16 font)
Fb	3rd	*	*	*	*	Fb3	Fb2	Fb1	Fb0	Logged of text number
Data	4th ～									Write in data 1 text=32byte×(Fb+1)

Function：Define the user definable font of16×16 dot.

- The address of FROM is written in order from FEA1h to FEB0h.
- The data of font is written in order from the start address(d1).
  (Refer to user definable font register table.)
- Define the BMP data to FROM, after delete the BMP data to FROM.
- This command is effective only when FROM register mode.
- The User definable font can be displayed on condition that User definable font ON/OFF command is “ON”.

Command name：Define the user definable font(8×16 font)
Code：1Ah,A4h,Fb,Ra,Data

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Ah	1st	0	0	0	1	1	0	1	0	
A4h	2nd	1	0	1	0	0	1	0	0	Define the user definable font (8×16 font)
Fb	3rd	*	*	*	*	Fb3	Fb2	Fb1	Fb0	The number of register font
Ra	4rd	*	Ra6	Ra5	Ra4	Ra3	Ra2	Ra1	Ra0	Register address
Data	5th ～									Write data 1 text=16byte

Function：Define the user definable font of 8×16 dot.

- The address of 00h～1Fh is not available.
- The data of font is written in order from the start address(d1).
  (Refer to user definable font register table.)
- Define the BMP data to FROM, after delete the BMP data to FROM.
- This command is effective only when FROM register mode.
- The User definable font can be displayed on condition that User definable font ON/OFF command is “ON”.

Command name：Define the user definable font(6×8 font)
Code：1Ah,A5h,Fb,Ra,Data

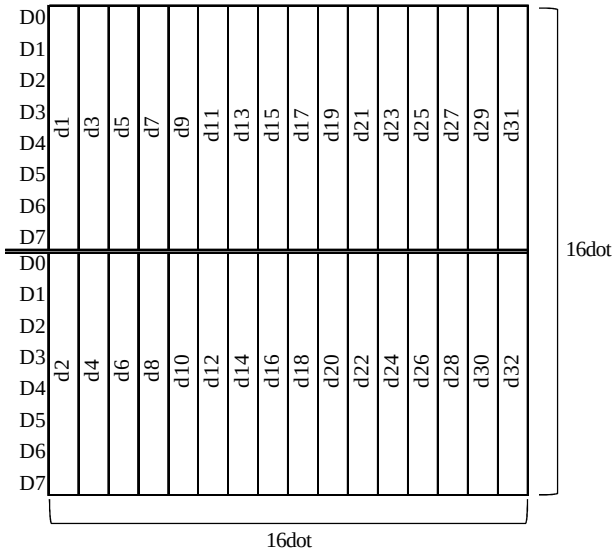
		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Ah	1st	0	0	0	1	1	0	1	0	
A5h	2nd	1	0	1	0	0	1	0	1	Define the user definable font (6×18 font)
Fb	3rd	*	*	*	*	Fb3	Fb2	Fb1	Fb0	The number of register font
Ra	4rd	*	Ra6	Ra5	Ra4	Ra3	Ra2	Ra1	Ra0	Register address
Data	5th ～									Write data 1 text=6byte

Function：Define the user definable font of 6×8 dot.

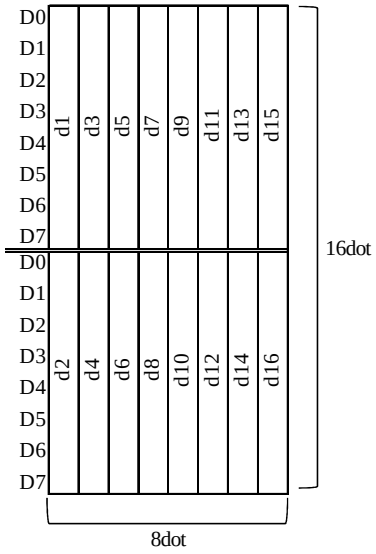
- The address of 00h～1Fh is not available.
- The data of font is written in order from the start address(d1).
  (Refer to user definable font register table).
- Define the BMP data to FROM, after delete the BMP data to FROM.
- This command is effective only when FROM register mode.
- The User definable font can be displayed on condition that User definable font ON/OFF command is “ON”.

< User definable font register table >

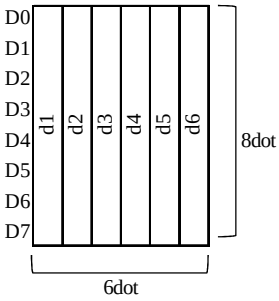
16×16 font



8×16 font



6×8 font



Command name：FROM data clear
Code：1Ah,A7h,DF

		MSB							LSB	
Code	Byte	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	Note
1Ah	1st	0	0	0	1	1	0	1	0	
A7h	2nd	1	0	1	0	0	1	1	1	FROM data clear command
DF	3rd	*	*	*	*	*	*	0	DF	Clear content

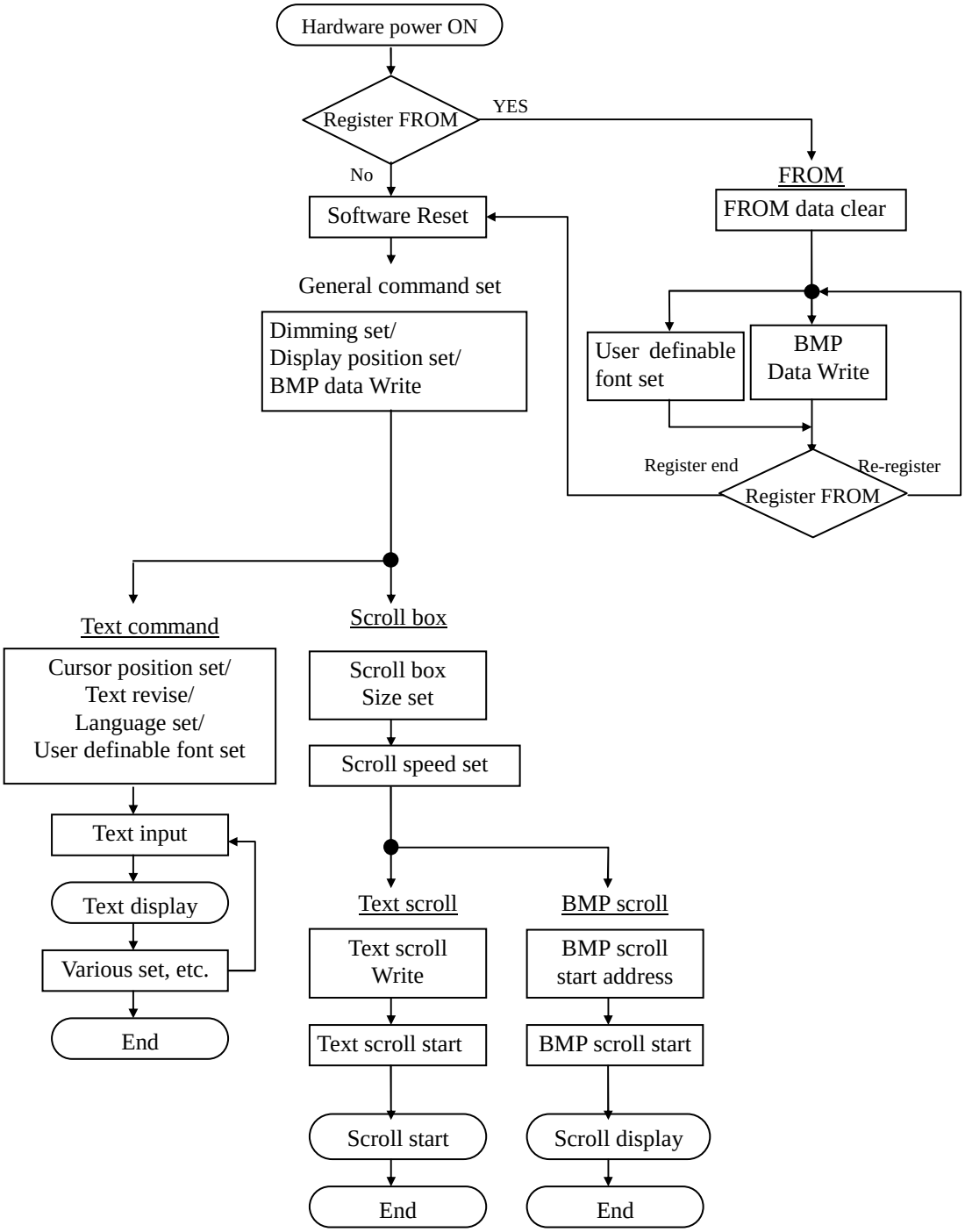
3rd byte

DF	Clear content
0	BMP data field
1	User definable font field

Function：Clear the registered BMP or User definable font data in FORM.

- It is necessary to execute this command before defining the User definable font.
- This command is effective only when FROM register mode.

Example of command sequence



(※) FROM register mode : Only first command after hardware power ON can be effective.
(※) In order to malfunction wrong action, please keep signal steady after hardware power ON.
(※) It takes approx 10sec to clear FROM data. If receive buffer default is full during FROM clear, “BUSY” is outputted until processing of data is finished.

5. Interface

5-1. Connecter

CN1 (RS-232) ϕ 1.1mm hole 6Pin(2.54mm pitch)

Table-9

Pin No.	Signal	Note
1	+5V	+5V
2	TXD	Data
3	RXD	Data
4	RTS	Data
5	CTS	Data
6	GND	GND

6. Communication specification

6-1. Asynchronous serial interface

Table-10

Signal level	5V
Data transfer method	Asynchronous full-duplex
Data bit length	8 bit(LSB first)
Parity bit	NON/EVEN/ODD
Start bit	1 bit
Stop bit	1 bit
Transfer speed	115,200/38,400/19,200/9,600bps(Initial 38,400bps)

6-2. Resistance jumper

The setting of jumper refers to the followings. The setting of jumper is read at VFD module power ON.

Table-11

Jumper No.	Function	Initial setting
J1	Setting of parity bit	J1 no mount
J2		J2 no mount
J3	Setting of baud rate	J3 no mount
J4		J4 mount

6-2-1.Setting of parity bit

Parity bit is set by J1 and J2. (Initial value of parity is NON.)

Table-12

Parity	J1	J2
NON	no mount	no mount
ODD	Mount	no mount
EVEN	no mount	mount

6-2-2.Setting of baud rate

Baud rate is set by J3 and J4. (Initial value of baud rate is 38,400bps.)

Table-13

Baud rate	J3	J4
9,600	no mount	no mount
19,200	Mount	no mount
38,400	no mount	mount
115,200	Mount	mount

7. The environmental specifications for this product

The product applies to RoHS.

7-1. With respect to EU RoHS Directive

The contained amount of six prohibited substances in this product, which are cadmium, hexavalent chromium, lead, mercury, polybrominated biphenyl:PBB and polybrominated diphenyl ether :PBDE, is less than the permitted level stipulated in the EU RoHS Directive, or these substances are not included in the Directive.

The substances excluded are based on Article 4 of the EU RoHS Directive.

7-2. With respect to Chinese RoHS

This product contains only “lead and its compound” from among six controlled substances, which are cadmium, hexavalent chromium, lead, mercury, polybrominated biphenyl:PBB and polybrominated diphenyl ether :PBDE.

The contained amount of the controlled substances except lead and its compound in this product is less than the level stipulated in the Chinese RoHS.

As for the display of information on containing EHS, please refer to the following.

< Display of information on containing EHS >

*Product and part the substances are contained: Vacuum Fluorescent Display (VFD)

*Chemical materials contained: Lead and its compound

*Time limit of use for environmental protection: 10 years

*Reason for containing the substances: No materials are available except them under the current technology.

8. CAUTIONS FOR OPERATION

8-1. Since VFD is made of glass material, avoid applying excessive shock or vibration beyond the specification for the module. Careful handing is essential.

8-2. Applying lower voltage than the specified may cause non activation for selected pixels.
Conversely, higher voltage may cause non-selected pixel to be activated.
If such a phenomenon is observed, check the voltage level of the power supply.

8-3. If the startup time of the supply voltage is slow, the controller may not be reset.
The supply voltage must be risen up to specified voltage level within 30msec.

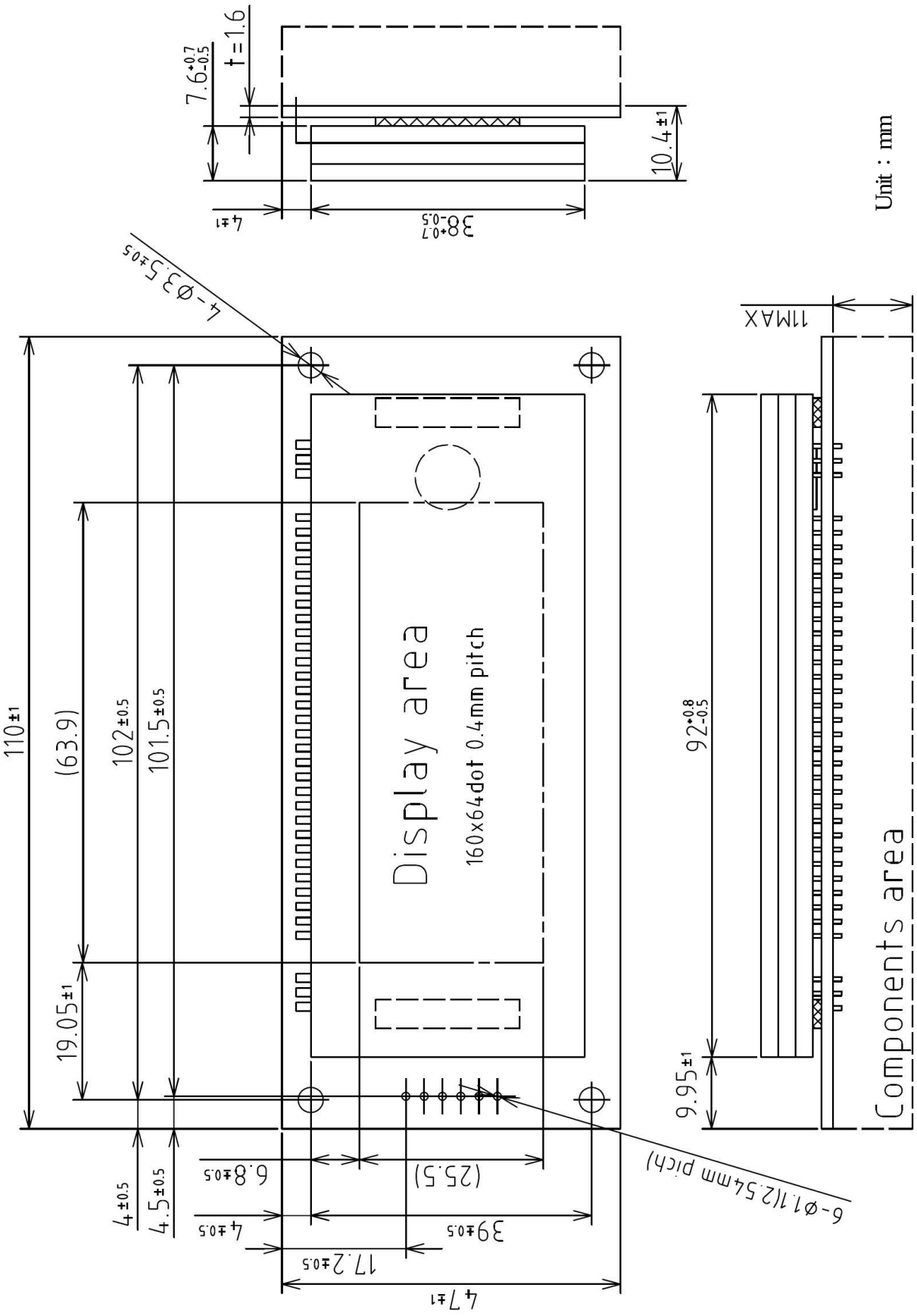
8-4. DC/DC converter is equipped on the module, the surge current may be approximately 5 times the specified supply current at the power on.

8-5. Avoid using the module where excessive noise interface is expected. Noise affects the interface signal and cause improper operation. Keep the length of the interface cable less than 30cm.(When the longer cable is required, please confirm there is no noise affection.)

8-6. When fixed pattern is displayed for long time, you may see uneven luminance. It is recommended to change the display patterns sometimes in order to keep best display quality.

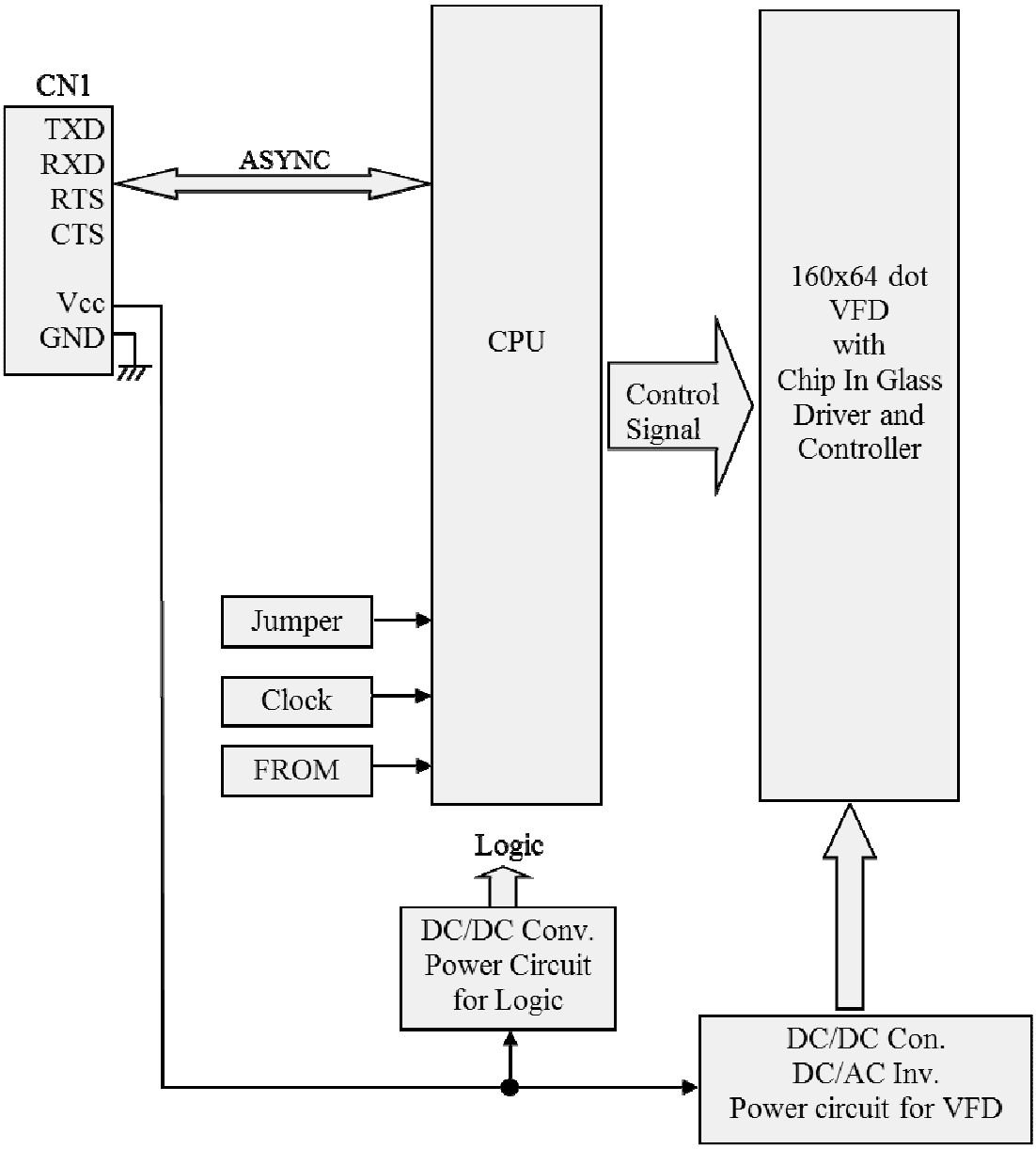
Mechanical Drawing

FIGURE-1



Block Diagram

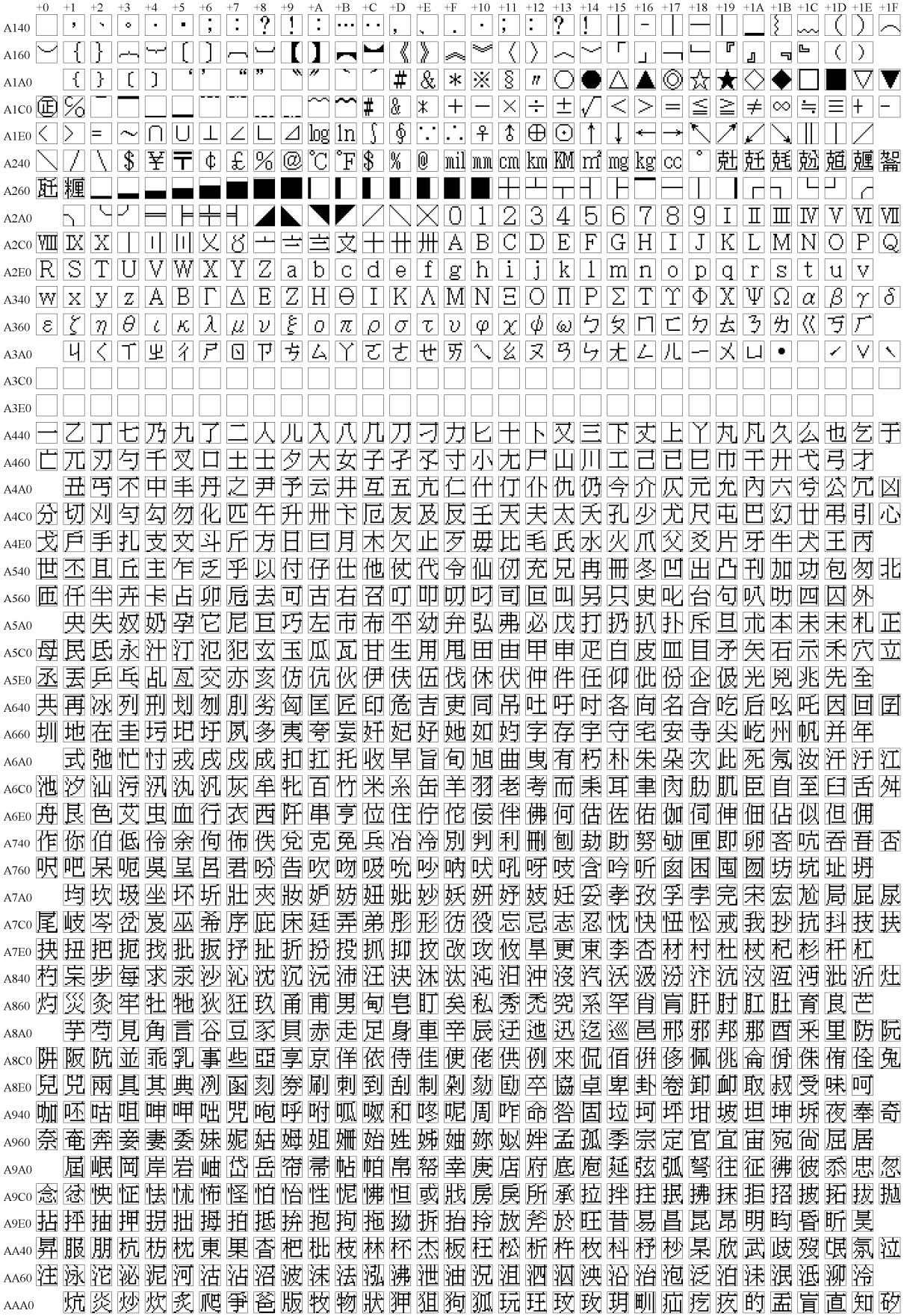
FIGURE-2



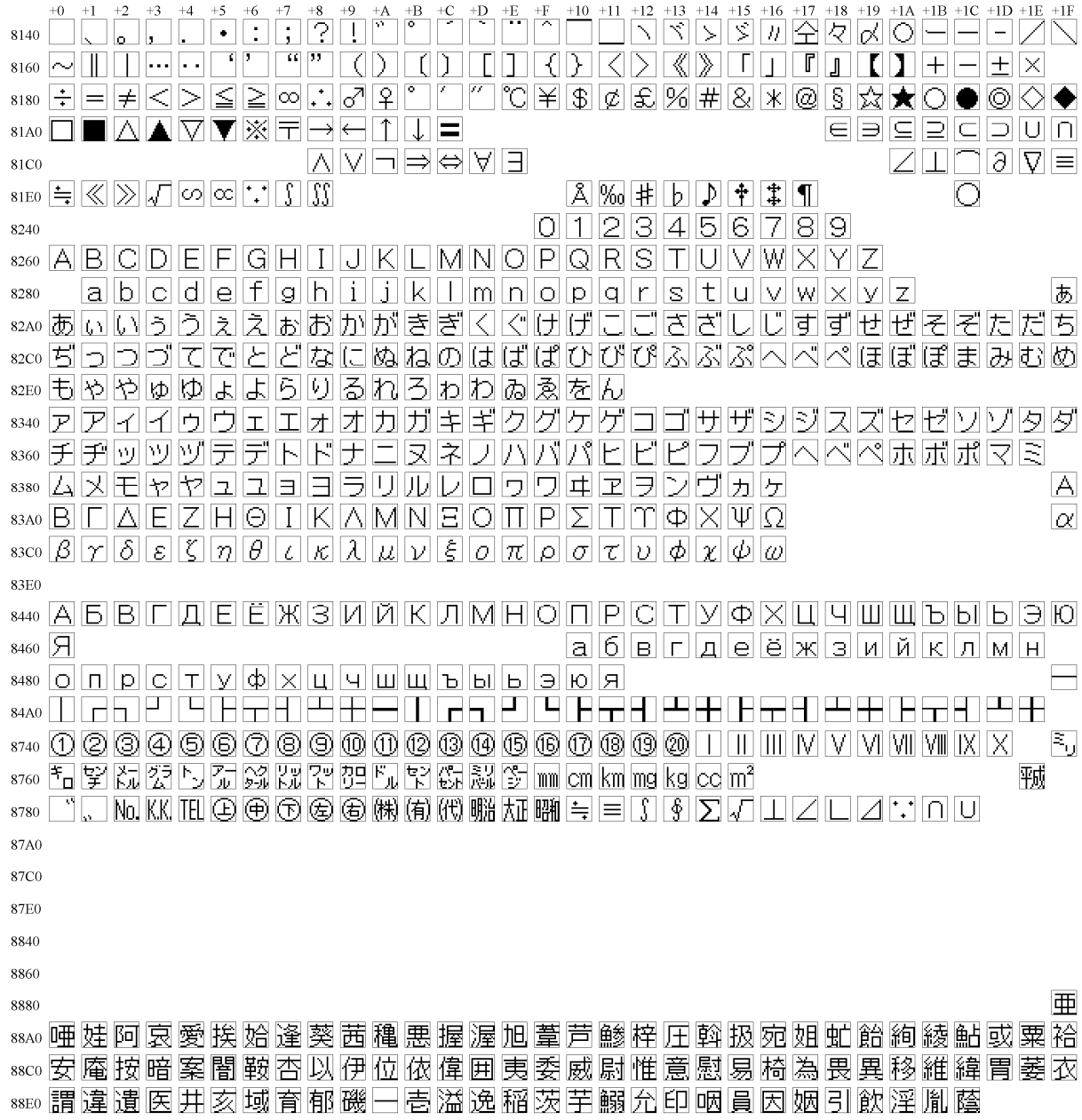
DISPLAY CHARACTER CODE

(a) Simplified Chinese (GB2312)

(b) Traditional Chinese（Big5）



(c)日本語（Shift-JIS）



(d)韓国語(KSC5601)