Futaba

AN-E-3268

APPLICATION NOTE

VACUUM FLUORESCENT DISPLAY MODULE

GRAPHIC DISPLAY MODULE

GP1212A02A

FUTABA GP1212A02A is a graphic display module using a FUTABA 256×64 VFD.
Consisting of a VFD, display drivers and a control circuit, the module can be driven by connecting to the host system through I^2C, USB2.0 or RS-232C.
Japanese font ROM is installed in this product.

⚠ 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, 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 polyswitch.
- 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.

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1. FEATURES

1-1. High quality and long life can be achieved with FUTABA VFD.

1-2. CPU and the power supply circuit are built into this product.

1-3. It is lightness, and a thin type according to the adoption of CIG.

1-4. It is easy to display graphic by serial communications in accordance with I^2C, USB2.0 or RS-232C.

1-5. Japanese font ROM is installed in this product, and the character representation is possible according to the input of Shift JIS code.

2. GENERAL SPECIFICATIONS

2-1. Outer dimension, Weight, (Refer to FIGURE-1)

Table-1

Item	Specification	Unit
Outer dimension	(W) 159.0 ±1.0 (H) 50.0±1.0 (T) 21.2 Max.	mm
Weight	130	g

2-2. Display specification

Table-2

Item	Specification	Unit
Display area	115.1(W)×28.7(H)	mm
Number of pixels	256(W)×64(H)	dots
Dot size	0.35(W)×0.35(H)	mm
Dot pitch	0.45(W)×0.45(H)	mm
Illumination color	Green (λp=505nm)	–

2-3. Environmental conditions

Table-3

Item	Symbol	MIN	MAX	Unit
Operating temperature	*T*opr	-40	+85	°C
Storage temperature	*T*stg	-40	+85	°C
Operating humidity (Note)	*H*pr	20	85	%
Storage humidity (Note)	*H*sg	20	90	%
Vibration (10~55Hz)	–	–	4	G
Shock	–	–	40	G

Note) Avoid operations and/or storage in moist environmental conditions.

2-4. Absolute maximum ratings

Table-4

Item	Symbol	MIN	MAX	Unit
Supply voltage (VBUS)	Vcc1	-0.3	6.0	Vdc
Supply voltage	Vcc2	-0.3	6.0	Vdc
Input signal Voltage (I^2C)	V_{IS}	-0.3	Vcc2+0.3	Vdc
Input signal voltage (RS-232C)	V_{IS}	-30	+30	V
Input signal voltage (USB)	V_{IS}	-0.3	+3.6	V

2-5. Recommended operating conditions

Table-5

Item	Symbol	MIN	TYP	MAX	Unit
Supply voltage (VBUS)	Vcc1	4.75	5.0	5.25	Vdc
Supply voltage	Vcc2	4.75	5.0	5.25	Vdc
Input Signal Voltage (I^2C)	V_{IH}	0.8Vcc1	—	Vcc2	Vdc
	V_{IL}	0	—	0.2Vcc2	
Input Signal Voltage (RS-232C)	V_{IH}	2.0	—	—	V
Input Signal Voltage (RS-232C)	V_{IL}	—	—	0.8	V
Input Differential Sensitivity (USB)	V_{DI}	0.2	—	—	V

2-6. Electrical, optical characteristics

Table-6

Item	Symbol	Conditions	MIN	TYP	MAX	Unit
Supply current (Note1)	Icc1	Vcc1＝5.0V (VBUS)	—	100	120	mA
Power consumption	—		—	0.5	0.60	W
Supply current (Note1)	Icc2	$Vcc2$=5.0V All on	—	950	1400	mA
Power consumption	—		—	4.75	7.00	W
Luminance (Note2)	L		625	1250	—	cd/m^2
High-level output voltage (I^2C)	V_{OH}	Vcc2＝5.0V	4.5	—	Vcc2	Vdc
Low-level output voltage (I^2C)	V_{OL}	Vcc2＝5.0V	0	—	0.5	Vdc
High level output voltage (RS-232C)	V_{OH1}	I_{OH}＝-20uA	5.5	7	—	V
Low level output voltage (RS-232C)	V_{OL1}	I_{OL}＝-20uA	—	-6	-5	V
High level output voltage (USB)	V_{OH1}	I_{OH}＝-200uA	2.8	—	—	V
Low level output voltage (USB)	V_{OL1}	I_{OL}＝-2mA	—	—	0.3	V

Note1) The surge current can be appox.5 times of specified maximum supply current at power on.
Note2) It indicates the value at 100% luminance adjustment level.

3. BASIC FUNCTIONS

3-1. INTERFACE

3-1-1. I^2C

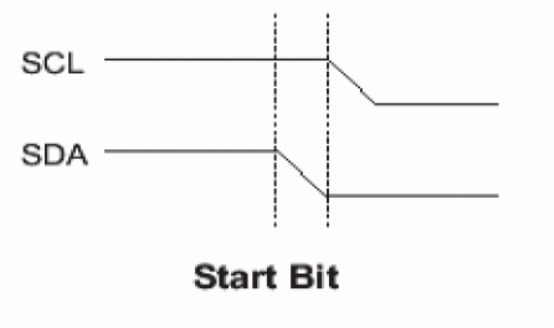
The I^2C interface supports write command only.

If the bit following device address is set “1”, The controller IC will not assert ACK

A) Start condition

The START signal is generated only by the master device.

A high-to-low transition of SDA while SCL is high is start condition, which must precede any other command.

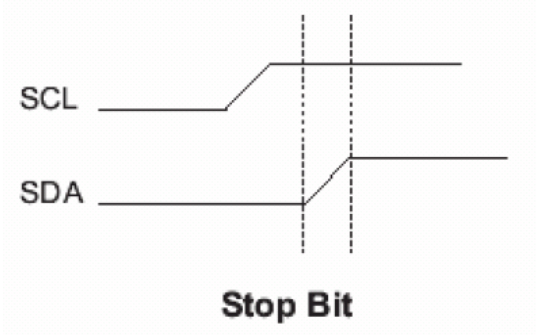


B) Stop condition

The Stop signal is generated only by the master device.

A low-to-high transition of SDA while SCL is High is a stop condition.

After a read sequence, the stop command will place the controller IC in initial state.

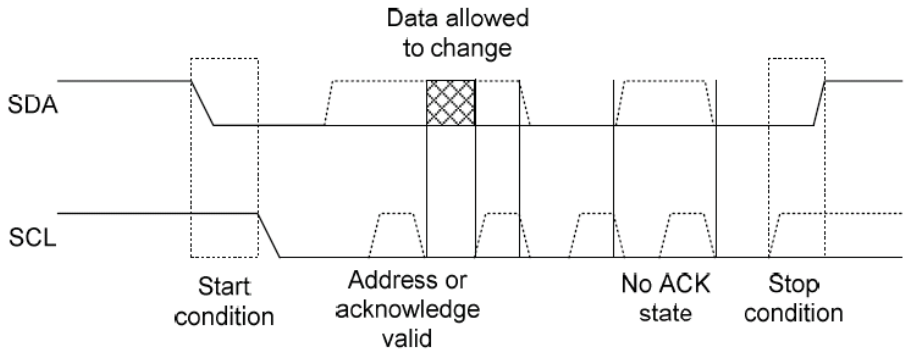


C) Acknowledge

All addresses and data words are serially transmitted to and from the controller IC in 8-bit words.

The controller IC sends a zero to acknowledge that it has received each word.

This happens during the ninth clock cycle.



D) Device addressing

The Controller IC requires an 8-bit device address word following a start condition to enable the chip for a write operation.

The seven bits are the SW 1 to 7 device address bits for the controller IC.

If the comparison of the device address succeeds, the controller IC will output a zero at ACK bit. If not, the chip will return to a standby state.

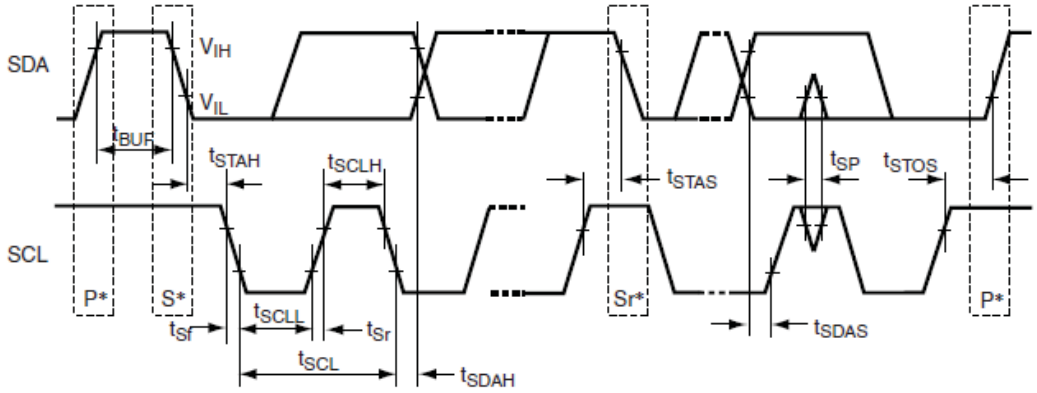
The R/W bit must set to "0" because controller IC only supports write command.

If the bit following device address is set "1", the controller IC will not assert ACK.

E) I^2C BUS Interface timing

Table-7

Item	Symbol	Min.	Typ.	Max.	Unite
SCL input cycle time	t_{SCL}	2300	-	-	ns
SCL input high width	t_{SCLH}	720	-	-	ns
SCL input low width	t_{SCLL}	1000	-	-	ns
SCL and SDA input fall time	t_{Sf}	-	-	300	ns
SCL and SDA input spike pulse removal time	t_{SP}	-	-	60	ns
SDA input bus-free time	t_{BUF}	700	-	-	ns
Start condition input hold time	t_{STAH}	420	-	-	ns
Retransmission start condition input setup time	t_{STAS}	420	-	-	ns
input	t_{STOS}	420	-	-	ns
Data-input setup time	t_{SDAS}	160	-	-	ns
Data-input hold time	t_{SDAH}	0	-	-	ns
Capacitive load of SCL and SDA	C_b	0	-	400	pF
SCL and SDA output fall time	t_{Sf}	-	-	300	ns



*If illegal data is sent, the module will not send back ACK.
In that case, please send legal data from command of sending failure.

3-1-2. RS-232C

A) Data reception

A module processes the reception data, assuming the state of reception prohibition by disabled RTS signal, when data is transferred to the module.
After processing the data, the module can be ready to receive next data by enabled RTS signal.
The RTS signal is controlled on the module side.

B) Communication error

a) When transferred data cannot be received properly at host system by the reason of the transmission failure, the module makes it the transmitted data.
b) In case of the command reception, when the overrun or the flaming error occurs, the command is ignored.
c) In case of the display data reception, when the overrun or the flaming error occurs, the display data is ignored.
d) In case of the command reception, when the parity error occurs, the command is ignored.
e) In case of the display data reception, when the parity error occurs, the display data is ignored.
f) When an illegal command is received, the command is ignored.

3-1-3. USB

Interface function

This module will communicate with the USB 2.0 interface (Full speed) if the USB cable is plugged. The communication with USB is based on HID class.
VFD Control Protocol uses HID report.
HID report consists of the byte number of sending data and the sending data.
For HID, the report of data (IN or OUT) is fixed-length
The sum of data size and data is declared in HID Report Descriptor.
The data size means the size of sending or receiving data. (Max 63.)
So the report can send or receive 63bytes data max.

Following is type of report.
|Data Size (8) | Data (8) [63] |

[Example]
Brightness adjustment (100%)
04 1B 4A 44 35 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00

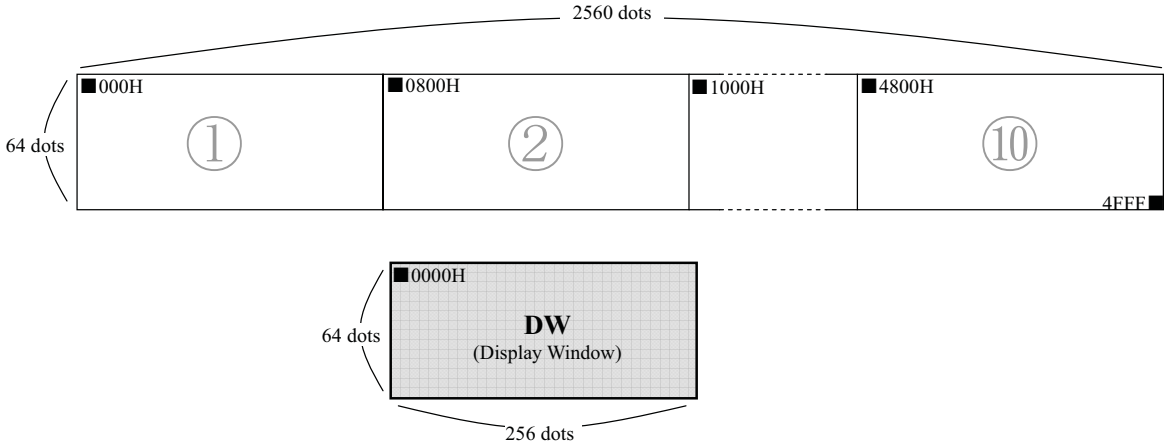
When the host needs the data (IN stage), more than 64bytes can be requested.
If the length of response from VFD is over 63bytes, Data Size sets 64.
If Data Size is 64, the host must read next data.

*If illegal data is sent, the module will send back NACK.
In that case, please send legal data from command of sending failure.

3-2. Display memory

3-2-1. Relationship DW (Display Window) and display memory

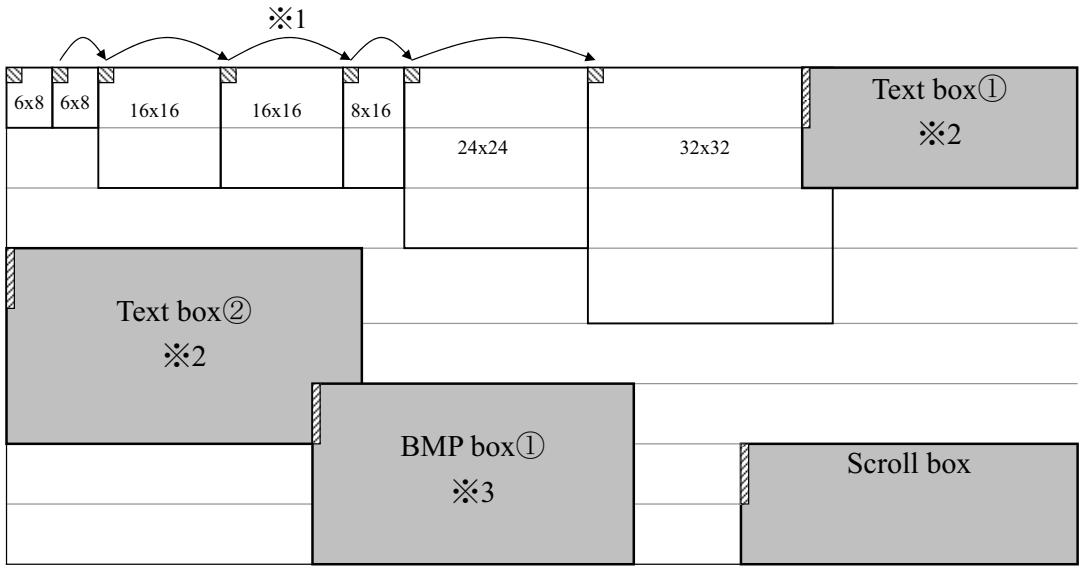
This module includes Data memory of 10 screen and DW. It realizes displaying the DW area. Data memory is copied to setting the BMP box.



3-2-2. Display data

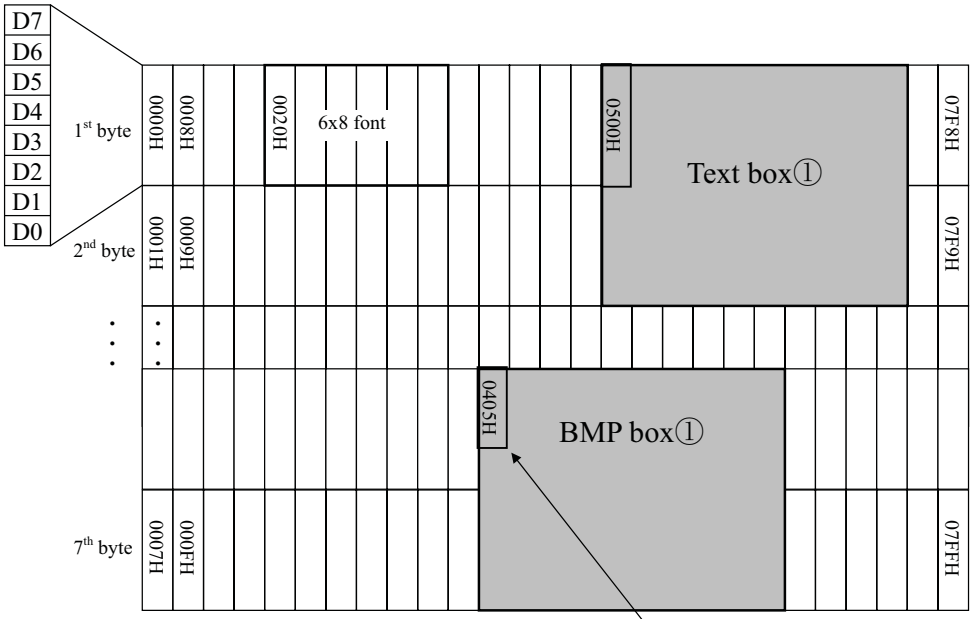
To write a data to the Data memory is two ways. One-way, the write-in address is appointed and writes a text and BMP data. Another way, Text or BMP box appoint and write a text and BMP data.

- If there is a data to write-in address, the new data will be written. The existing data is removed, and display the input new data. But if scroll have stated, the data isn't over-write
- If it writes a text data to appointed an address, the cursor move to right by one character. (※1)
- Box size are specified by the 1 dot horizontally and 8dots vertically. Text box can be defined up to 3 boxes, BMP box can be defined up to 3 boxes, and Scroll box can be defined up to 1 box.
- Character in the Text box can be reverse and blink, and can be used command of BS, CR, and LF. (※2)
- BMP data in the BMP box can be reverse and blink, and can be displayed to transfer the data from Data memory and DW. The definition data in the Flash ROM (FROM) can be displayed to transfer to the Data memory and the DW. (※3)

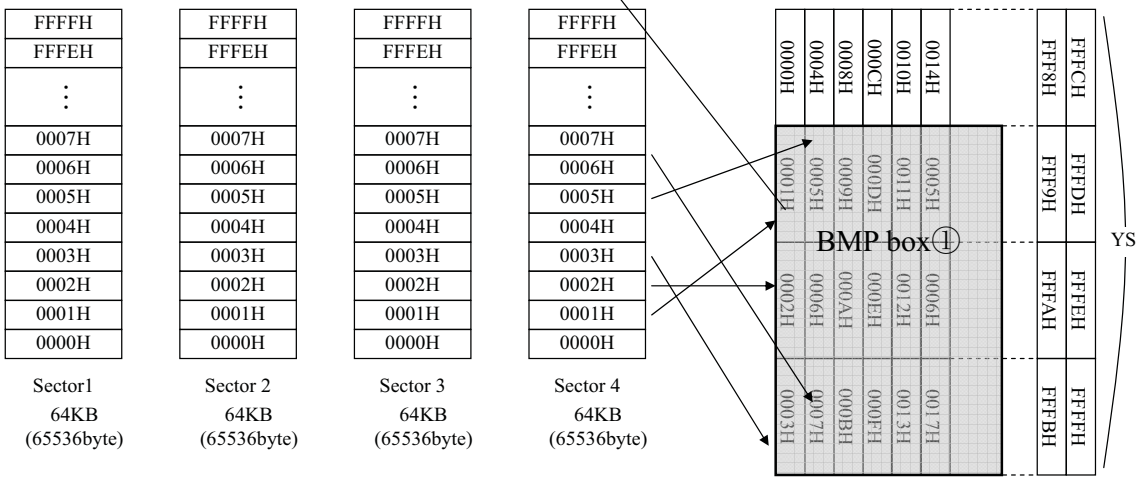


3-2-3. Address data of DW

To set position of Text box, BMP box or Scroll box, an address of top left corner dots (8 vertical dots and a horizontal dot) should be specified in bytes. Each box is valid in DW.



3-2-4. Address and data of FROM



Relationship between FROM and Address of definition BMP data is refer to the upper explanation.
Sector is 64KB, It Include 4 sector.

- BMP data definition is performed per 64KB, the new data will be written to the FROM after existing data of all FROM area is removed. Therefore, the existing data, which will be not re-written, are set to FFH.
- Although a configuration of register data, a vertical data size (YS) is necessary in case of retrieving the data.
- In case data is retrieved from FROM to BMP box, a selection of sector, specifies of address, setting YS are necessary.

Ex. upper explanation　　Sector＝4、Start address＝0001H、YS＝4

The data that stored in FROM address (0001H) of sector 4 is written to the top left corner of「BMP BOX①」（0405H）.

4. Command

4-1. General setting command

No	Command name	Code	Function
1	Clear display	1BH,4AH,43H,44H	Display memory all clear.
2	Dimming	1BH,4AH,44H,Ps	Brightness level setting. Ps：30H(0%)～35H(100%)　6stage
3	RESET	1BH,4AH,52H,53H	Return to default setting
4	VFD Power ON/OFF	1BH,4AH,42H,Ps	Control of the power supply for VFD Ps=30H(Power OFF)、31H(Power ON)
5	BMP data input	1BH,4AH,Pm,aL,aH, Ps,nL,nH,Pd…Pd	The BMP data is written Pm=30H(DW)、31H(Data memory) aL,aH：Address　Ps：direction of writing nL,nH：Number of data
6	Character address setting	1BH,4AH,57H,Pm,aL,aH	Setting a number of DW and address Pm=30H(DW)、31H(Data memory) aL,aH：Address
7	Font size select	1BH,4AH,46H,Pf	Setting the font size　Pf：font size
8	Character display	XX　(XX)	1byte code (ANK) 2byte code (Shift-JIS)
9	Character modify	1BH,4AH,6DH,Ps,Pb	Character modify. Reveres and Magnified Ps=30H(normal)、31H(reveres) Pb＝30H(normal) 31H(Double size letter in horizontal) 32H(Double size letter in horizontal and vertical)
10	Clock setting	1BH,6BH,53H,Pd,Ph,Pm	Setting the clock data. Pd：Day of the week　Ph：hour　Pm：minute
11	Clock display	1BH,6BH,55H,Ps,aL,aH,Pf	Clock is displayed. Ps：Display type select　aL,aH：Address Pf：Font size select
12	Clock display cancel	1BH,6BH,3DH,58H	Clock display is canceled.

4-2. Text box group

No	Command name	Code	Function
1	Text box setting	1BH,5BH,54H,Pn, aL,aH,Pq,Pf,Pc,Pl	Setting the font size and number of line. Pn：Number of box(No.①～③) aL,aH：DW address Pq：Shift of ±4dot at a setting address Pf=30H：6x8 dot Pf=31H：8x16 dot and 16x16 dot Pf=32H：12x24dot and 24x24 dot Pf=33H：16x32dot and 32x32 dot Pc：Number of digit　Pl：Number of line
2	Text box select	1BH,5BH,48H,Pn	Select the text box. Pn：Number of Text box(No.①～③)
3	Text box modify	1BH,5BH,4DH,Ps,Pb	Character modify in the text box. Reveres and Magnified Ps=30H(normal)、31H(reveres)、32H(blink) Pb=30H(normal)、 31H(Double size letter in horizontal)　※1
4	Clear display	1BH,5BH,32H,4AH	Display clear in the Text box　※1
5	Back Space (BS)	08H	The cursor moves to left by one character ※1
6	Line Feed (LF)	0AH	The cursor moves to 1 lower line　※1
7	Carriage Return (CR)	0DH	The cursor moves to left end of same line　※1
8	Delete to end of line	1BH,5BH,30H,4BH	Delete from cursor to right end of line.　※1
9	Set virtual cursor	1BH,5BH,Py,3BH,Px,48H	Setting the cursor position　※1

※1　This command effects in the Text box.

4-3. BMP box group

No	Command name	Code	Function
1	BMP box setting	1BH,5CH,42H,Pn, aL,aH,Pw,Ph	BMP box size setting Pn：Nnumber of box(No.①～③) aL,aH：DW address Pw：BMP box width Ph：BMP box height
2	BMP box select	1BH,5CH,48H,Pn	Select the BMP box. Pn：Number of box(No.①～③)
3	BMP box clear	1BH,5CH,32H,4AH	Display clear in the BMP box.
4	BMP box modify	1BH,5CH,4DH,Ps	Character modify in the BMP box. Reveres and Magnified Ps=30H(normal)、31H(reveres)、32H(blink)
5	Transfer the BMP data from Data memory	1BH,5CH,44H,aL,aH,	Transfer the BMP data to Data memory aL,aH：Data memory address
6	Transfer the BMP data from the FROM to the BMP box	1BH,5CH,46H,Se, aL,aH,YS	Transfer the BMP data to FROM. Se：Number of sector aL,aH：FROM address YS：BMP data defined Y size.(by 8dots)
7	BMP data input in the BMP box	1BH,5CH,5DH,nL,nH,Pd …Pd	BMP data is written in the BMP box. nL,nH：Number of data

4-4. Scroll box group

No	Command name	Code	Function
1	Scroll box setting	1BH,5DH,53H,aL,aH, Pw,Ph	Setting the Scroll box size. aL,aH：DW address Pw：Text box width Ph：Text box height
2	Text scroll setting	1BH,5DH,42H,Pf,Pl	Setting the font size and number of line. Pf：Font size　Pl：Number of line
3	Character setting of Text scroll	1BH,5DH,43H, Pl,Pn,Pd…Pd	Setting the scroll character by every line. Pl：Number of line Pn：Number of character
4	BMP scroll setting (Data memory)	1BH,5DH,44H, aL,aH,wL,wH	BMP scroll setting in the Data memory. aL,aH：Address of Data memory wL,wH：Horizontal size of scroll
5	BMP scroll setting (FROM)	1BH,5DH,46H,Se, aL,aH,YS,wL,wH	BMP scroll setting in the FROM. Se：Number of sector　aL,aH：FROM address YS：BMP data defined Y size.(by 8dots) wL,wH：Horizontal size of scroll
6	Scroll start	1BH,5DH,3EH, Pm,Pn,Ps,Pb,	Scroll start Pm=30H(Text scroll)、31H(BMP scroll) Pn：Number of scroll Ps：Scroll speed Pb：Blank time between scroll
7	Scroll stop	1BH,5DH,3DH,58H,	Scroll stop

4-5. FROM group・Other

No	Command name	Code	Function
1	BMP data definition (FROM)	1BH,6AH,53H, Se,nL,nH, Pd…Pd	Define the BMP data to the FROM Se：Number of sector nL,nH：Number of definition byte
2	BMP data delete (FROM)	1BH,6AH,41H,Se	Delete the BMP data to the FROM Se：Number of sector
3	Transfer the BMP data from the FROM to the Data memory	1BH,6AH,55H,aL,aH, Pw,Ph,Se,bL,bH,YS	Transfer the BMP data from the FROM to the Data memory aL,aH：Transferred address Pw：BMP image display (width) Ph：BMP image display (height) Se：Number of sector bL,bH：Transfer address YS：BMP data defined Y size.(by 8dots)
4	User definable font Definition (RAM)	1BH,6AH,47H,Pf, cL,(cH),Pd...Pd	Define the User definable font to the RAM Pf：Font size cL,(cH)：User definable font code Pd：User definable font data
5	User definable font Store / Transfer / Delete (RAM⇔FROM)	1BH,6AH,45H,Ps	User definable font Stored / Transfer / Delete Ps=30H (Store) Ps=31H (Transfer) Ps=32H (Delete)
6	Macro Processing Definition in FROM	1BH,6AH,6DH,Ps, nL,nH,Pd…Pd	Define the macro to the FROM. Ps=30H(Normal)、31H(Reset and start) nL,nH：Number of definition byte
7	Macro start／stop／clear	1BH,6AH,64H,Ps	Macro in the FROM, Start／Delete／Stop Ps=30H(Delete)、31H(Start)、32H(Stop)
8	Macro wait	1BH,6AH,77H,Ps	Wait setting in the macro. Ps：Wait time (x approx 0.1s)
9	ID code	1BH,6AH,49H,44H	Send the ID code
10	Blink setting	1BH,6AH,42H,Ps	Blink setting in the Text box and the BMP box Ps=30H (0.5s)、31H (1s)、32H(1.5s)

*Don't input undefined command, or data outside of range to the parameter of command.
*I^2C interface supports write command only. Please don't use read from module.

4-1. General setting command

4-1-1. Clear display

【Code】1BH,4AH,43H,44H

【Function】Display memory all clear

- All the displayed character is erased. The write-in position and every box modify is not changed
- If scrolling or blinking, scroll and blink are stopped and clear display.
- Data memory, FROM and User definable font data are no effect.

4-1-2. Dimming

【Code】1BH,4AH,44H,Ps

【Function】Luminance can be adjusted into six levels by using this function.

- When the module is turned on, it is set to dimming level 5 (100%).

Ps = Luminance setting

【Definable area】Ps = 30H ：Luminance 0%

Ps = 31H ：Luminance 32%

Ps = 32H ：Luminance 45%

Ps = 33H ：Luminance 54%

Ps = 34H ：Luminance 79%

Ps = 35H ：Luminance 100% (Default)

4-1-3. RESET

【Code】1BH,4AH,52H,53H

【Function】Returns to default setting.

- The other command is not receive until this command complete. Please don't send the any data from a host during "BUSY"
- Delete the User definable font to the RAM.
- If the VFD Power Off, VFD Power turn ON after the RESET command.
- In the case of USB connection, please re-negotiate after RESET command.

4-1-4. VFD Power ON/OFF

【Code】1BH,4AH,42H,Ps

【Function】Control of the power supply for VFD

- If VFD power ON or OFF, at interval of 10s or more.
- When the VFD power off, VFD display is turn off, but the module can receive a data and process.
- When the VFD power off, scroll is stop. And when the VFD power on, scroll is restart.

Ps = VFD Power control

【Definable area】Ps = 30H：VFD Power OFF

Ps = 31H：VFD Power ON (Default)

4-1-5. BMP data input

【Code】1BH,4AH,Pm,aL,aH,Ps,nL,nH,Pd…Pd

【Function】The BMP data is written in the DW(Display Window) or the Data memory.

Pm= DW or Data memory

aL = DW lower byte

aH = DW upper byte

Ps = Direction of writing

nL = number of BMP data length lower byte

nH = number of BMP data length upper byte

Pd = BMP data

* If X direction is selected as Ps and data is written in the last address, the data in the last address is overwritten with the remaining data.

【Definable area】Pm = 30H：DW

Pm = 31H：Data memory

0000H ≦ aL + aH * 100 ≦ 07FFH (DW)

0000H ≦ aL + aH * 100 ≦ 4FFFH (Data memory)

Ps = 30H：Y direction

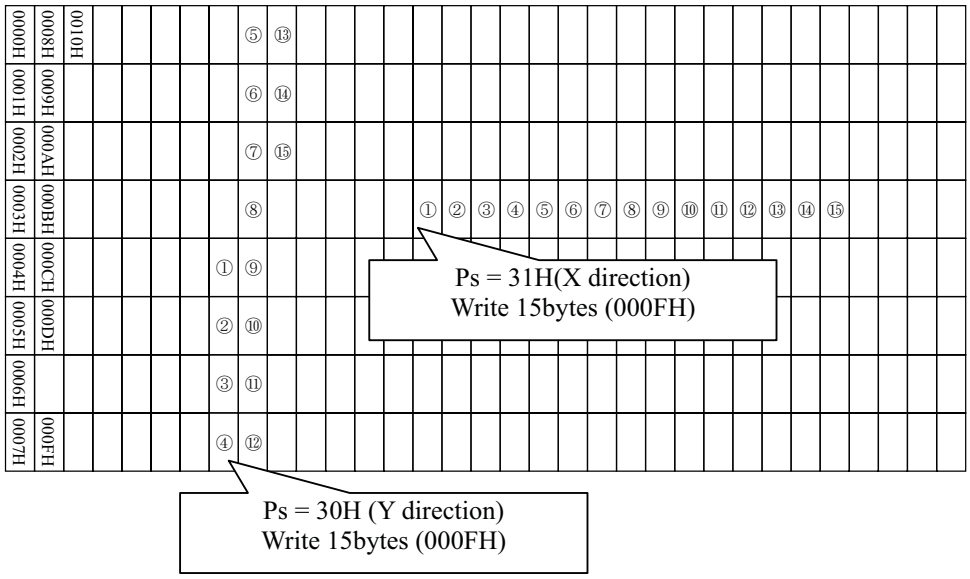
Ps = 31H：X direction

0001H ≦ nL + nH * 100 ≦ 0100H (DW、X direction)

0001H ≦ nL + nH * 100 ≦ 0800H (DW、Y direction)

0001H ≦ nL + nH * 100 ≦ 0A00H (Data memory、X direction)

0001H ≦ nL + nH * 100 ≦ 5000H (Data memory、Y direction)



4-1-6. Character address setting

【Code】1BH,4AH,57H,Pm,aL,aH

【Function】Setting a character data write-in address.

Pm = DW or Data memory

aL = Lower byte of Data memory

aH = Upper byte of Data memory

【Definable area】0000H ≦ aL + aH * 100 ≦ 07FFH (DW)

0000H ≦ aL + aH * 100 ≦ 4FFFH (Data memory)

Ps = 30H：DW

Ps = 31H：Data memory

4-1-7. Font size select

【Code】1BH,4AH,46H,Pf

【Function】Setting the font size

Pf = Font size

【Definable area】Pf = 30H：6x8 dot

Pf = 31H：8x16dot and 16x16 dot

Pf = 32H：12x24 dot and 24x24 dot

Pf = 33H：16x32 dot and 32x32 dot

4-1-8. Character data input

【Code】XX (XX)

【Function】Display the character. The character data is written by ANK (1 byte code) or Shift-JIS (2 byte code). The cursor moves automatically to right by 1 character.

- If the write-in position exists at the right end, it is fixed at the right end and the character in right end is overwritten after receiving next character code.
- If the write-in position is outside display memory after the specified dot writing, the write-in position is not moved. In this case, the text can be imperfect.

【Definable area】 1 byte code：ANK

2 byte code：Shift-JIS

4-1-9. Character modify

【Code】1BH,4AH,6DH,Ps,Pf

【Function】Setting the reverse and magnified by character

- This command doesn't effects the data in the Text box and Scroll box.

Ps = Reverse

Pb = Magnified

【Definable area】Ps = 30H ：Normal (not reverse)

Ps = 31H ：Reverse

Pb = 30H ：Normal size

Pb = 31H ：Double size letter in horizontal.

Pd = 32H ：Double size letter in horizontal and vertical.

4-1-10. Clock setting

【Code】1BH,6BH,53H,Pd,Ph,Pm

【Function】Setting the clock data. The setting data is cleared, if the Reset command is input or power is turned off.

Pd = Day of the week

Ph = hour

Pm = minute

【Definable area】

Pd = 00H：Sunday

Pd = 01H：Monday

・・・

Pd = 06H：Saturday

・ Clock setting is canceled, when Pd is input value that is larger than 07H, or Ph is input value that is larger than 18H,or Pm is input value that is larger than 3CH.

4-1-11. Clock display

【Code】1BH,6BH,55H,Ps,aL,aH,Pf

【Function】Clock is displayed. The display position and the font size can be freely decided.

Ps = Display type select

aL,aH = Address

Pf = Font size select

【Definable area】

Ps = 00H：24hour	Ex.[12:34]
Ps = 01H：24hour + day of the week	Ex.[Wed._12:34]
Ps = 10H：12hour	Ex.[PM_00:34]
Ps = 11H：12hour + day of the week	Ex.[Wed._PM_00:34]

Pf = 30H：6x8 dot

Pf = 31H：8x16dot

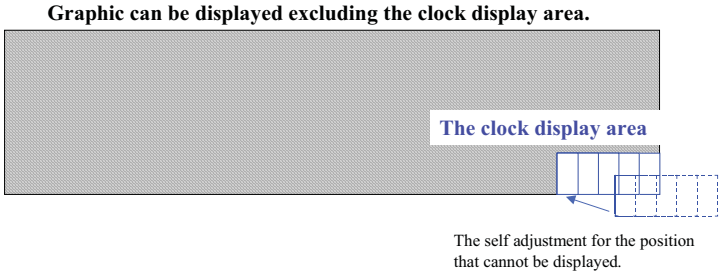
Pf = 32H：12x24 dot

Pf = 33H：16x32 dot

・When the clock data is not input, clock is not displayed.

・The clock display is maintained until Clock display cancel・Clear display・RESET command is input or power is turned off.

・Excluding the clock display area can be input other display commands.



4-1-12. Clock display cancel

【Code】1BH,6BH,3DH,58H

【Function】Clock display is canceled.

4-2. Text box group

4-2-1. Setting the Text box

【Code】1BH,5BH,54H,Pn,aL,aH,Pq,Pf,Pc,Pl

【Function】Setting the Text box. Text box can be defined up to 3 boxes. Text box position is defined the address. (aL,aH)

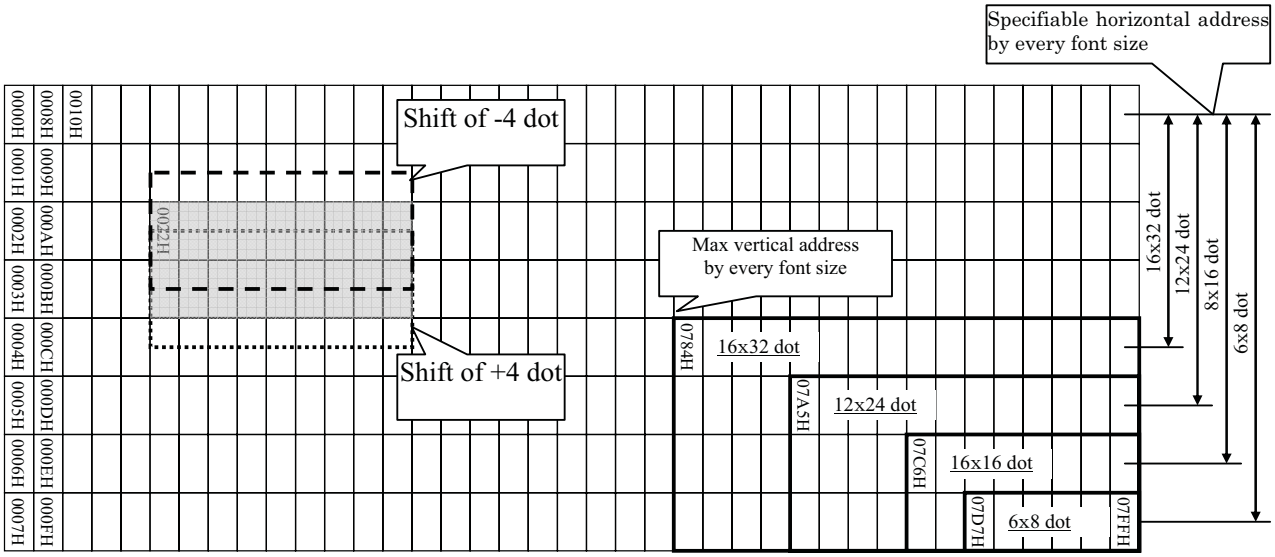
- To write data in Text box, execution " Text box select " command is necessary.
- Definable digit (Pc) and line (Pl) are due to the font size. Number of digit is counted to number of bytes. (If the 4 characters are displayed with 16x16 dots, Pc=08H)
- If the write-in text data is sent over text box, the write-in position is not moved from right endpoint (one-byte character). The data of over text box is overwritten in the endpoint.

Pn = Number of text box
aL = Lower address of DW
aH = Upper address of DW
Pq = Shift of ±4 dot at a setting address
Pf = Font size
Pc= Number of the digit
Pl = Number of the line

【Definable area】

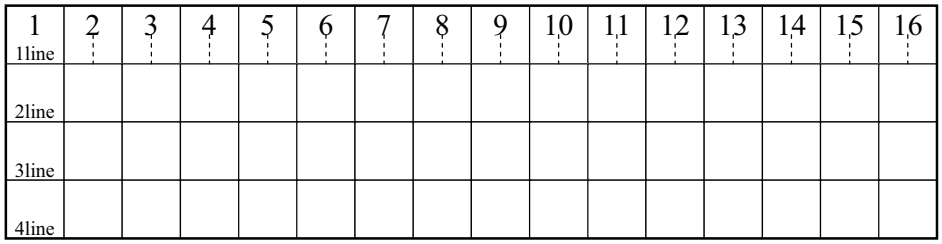
Pn = 31H ：Text box①
Pn = 32H ：Text box②
Pn = 33H ：Text box③
Pq = 30H：Setting address (no shift)
Pq = 31H：Shift of +4 dot at a setting address
Pq = 32H：Shift of -4 dot at a setting address

Pf	Font size	aL + aH * 100	Pc	Pl
30H	6x8 dot	0000H～07D7H	Max 42 digit 01H～2AH	Max 8 line 01H～08H
31H	8x16 dot 16x16 dot	0000H～07C6H	Max 32 digit (1 byte code) 01H～20H	Max 4 line 01H～04H
32H	12x24 dot 24x24 dot	0000H～07A5H	Max 21 digit (1 byte code) 01H～15H	Max 2 line 01H～02H
33H	16x32 dot 32x32 dot	0000H～0784H	Max 16 digit (1 byte code) 01H～10H	Max 2 line 01H～02H



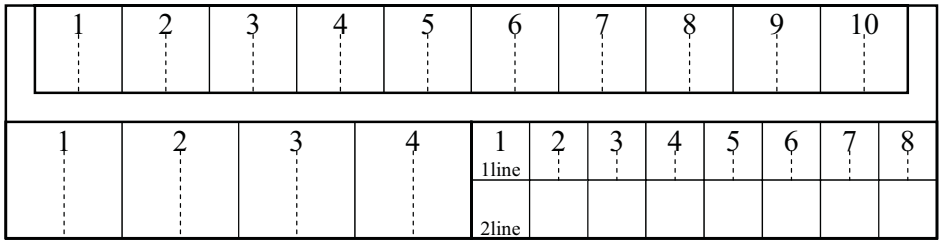
Ex. Setting the text box

Ex1）



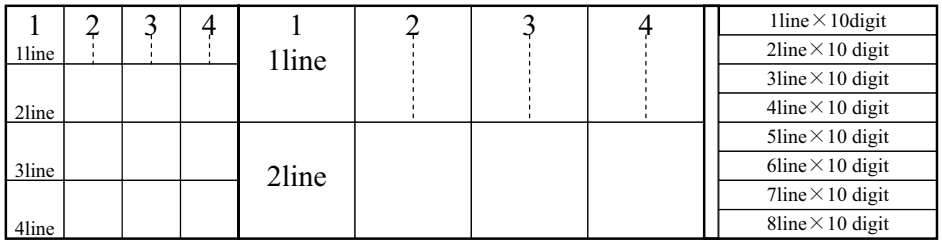
Text box①：16x16 dot 16 digit 4 line　(Pf=31H, Pc=20H, Pl=04H)

Ex2）



Text box①：24x24 dot 10 digit 1 line　(Pf=32H, Pc=14H, Pl=01H)
Text box②：32x32 dot 4 digit 1 line　(Pf=33H, Pc=08H, Pl=01H)
Text box③：16x16 dot 8 digit 2 line　(Pf=31H, Pc=10H, Pl=02H)

Ex3）



Text box①：16x16 dot 4 digit 4 line　(Pf=31H, Pc=08H, Pl=04H)
Text box②：32x32 dot 4 digit 2 line　(Pf=33H, Pc=08H, Pl=02H)
Text box③：6x8 dot 10 digit 8 line　(Pf=30H, Pc=0AH, Pl=08H)

4-2-2. Text box select

【Code】1BH,5BH,48H,Pn

【Function】Select the Text box.

- Execution " Text box select " is necessary before "Setting the Text box ".
- In case of writing by the specified dot writing, it is necessary to cancel this command.
- In case of input text data to DW after this command, Text box selection is released.

【Definable area】

Pn = 30H ：Remove the Text box
Pn = 31H ：Text box①
Pn = 32H ：Text box②
Pn = 33H ：Text box③

The commands from 4-2-3 to 4-2-9 are valid in selected Text box. Without selecting Text box, these commands are invalid.

4-2-3. Text modify

【Code】1BH,5BH,4DH,Ps,Pb

【Function】Setting the Reverse, Blink, and Magnified in the selected text box.

- This command doesn't effects the other Text box. If the selected text box remove, modify setting is removed.
- Does not affect to the character already displayed.

【Definable area】Ps = 30H ：Normal (Remove reverse and blink)
Ps = 31H ：Reverse
Ps = 32H ：Blink
Pb = 30H ：Normal size
Pb = 31H ：Double size letter in horizontal

4-2-4. Display Clear

【Code】1BH,5BH,32H,4AH

【Function】The displayed characters in selected text box are erased.
The write-in position is not changed.

4-2-5. Back space

【Code】08H

【Function】The write-in position is shifted to the left one digit and displaying screen is not changed. This command is ignored when write-in position is on the least significant digit.

4-2-6. Line Feed

【Code】0AH

【Function】The write-in position is shifted to the next row on the same digit position. When the write-in position is on the bottom row, the displayed character is scrolled up to the upper row and all characters on the bottom row are cleared. The write in position is not changed.

4-2-7. Carriage return

【Code】0DH

【Function】The write-in position is shifted to the most significant digit of the same row. When the write-in position is on the most significant digit, this is ignored.

4-2-8. Delete to end of line

【Code】1BH,5BH,30H,4BH

【Function】The displayed characters from the write-in position to the end on the same row are erased. The write-in position is not shifted.

4-2-9. Set virtual cursor

【Code】1BH,5BH,Py,3BH,Px,48H

【Function】The write-in position is shifted with line(Py), digit (Px) . (It is based on the half size letter of the font)

- If input the 1BH, 5BH, 48H, 27H, the write-in position is shifted with Home position (left-top).
- 30H regard as 31H, if the data (Py, Px) is over range; the cursor is shifted with the max of line, the max of digit.（If Py is more than 38H, this command is ignored and next character code 2byte is ignored.）
- If input value of 10 or more as digit (Px), Px in the command is necessary by two bytes. (Example Px=10,Py=1: 1BH,5BH,31H,3BH,31H,30H,48H)

4-3. BMP box group

4-3-1. Setting the BMP box

【Code】1BH,5CH,42H,Pn,aL,aH,Pw,Ph

【Function】Setting the BMP box. BMP box can be defined the 3 area to DW. The position of BMP box is set based on the address of DW.

- To write data in BMP box, " BMP box select " is necessary.
- Specifiable horizontal size is 256dot (100H) MAX. If horizontal size specify 256dot, Pw = 00H

Pn = Number of a BMP box
aL = Lower byte of address
aH = Upper byte of address
Pw = BMP box width
Ph = BMP box height

【Definable area】Pn = 31H ：BMP box①
Pn = 32H ：BMP box②
Pn = 33H ：BMP box③
0000H ≦ aL + aH * 100 ≦ 07FFH
01H ≦ Pw ≦ 00H (=100H)
01H ≦ Ph ≦ 08H

4-3-2. BMP box select

【Code】1BH,5CH,48H,Pn

【Function】Select of BMP box

- Execution "BMP box select " is necessary before "Setting the Text box ".
- In case of writing by the specified dot writing, it is necessary to cancel this command.

【Definable area】Pn = 30H ：Remove the BMP box
Pn = 31H ：BMP box①
Pn = 32H ：BMP box②
Pn = 33H ：BMP box③

4-3-3. Display clear in the BMP box

【Code】1BH,5CH,32H,4AH

【Function】Display clear in the BMP box

4-3-4. BMP box modify

【Code】1BH,5CH,4DH,Ps

【Function】Reverse and blink Setting the selected BMP box.

- This command doesn't effects the other BMP box. If the selected BMP box remove, modify setting is removed

【Definable area】Ps = 30H ：Normal
Ps = 31H ：Reverse
Ps = 32H ：Blink

4-3-5. Data memory transfer

【Code】1BH,5CH,44H,aL,aH

【Function】BMP data transfer from Data memory to DW.

・ Although source data is updated, data in BMP box is not updated. To reflect the update, re-executing this command is necessary.

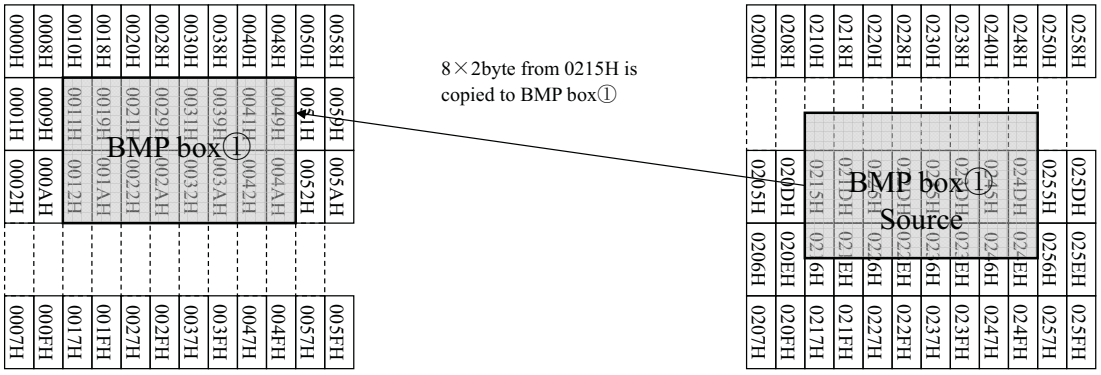
aL = Lower byte of address

aH = Upper byte of address

【Definable area】0000H ≦ aL + aH * 100 ≦ 4800H

Ex.) BMP box①setting address：0011H size：8×2byte

BMP box source setting address：0215H



4-3-6. Transfer the BMP data from the FROM to the BMP box

【Code】1BH,5CH,46H,Se,aL,aH,YS

【Function】Transfer the BMP data from the selected sector of FROM.

・ If the Data memory is re-written, does not affect to the already transferred data. If the transferred data renew, resend this command.

Se = Number of sector

aL = Lower byte of address

aH = Upper byte of address

YS = BMP data defined Y size.

【Definable area】Se = 31H：Sector 1

Se = 32H：Sector 2

Se = 33H：Sector 3

Se = 34H：Sector 4

0000H ≦ aL + aH * 100 ≦ F800H

01H ≦ YS ≦ 08H = 8 byte (64dot)

4-3-7. Input BMP data in the BMP box

【Code】1BH,5CH,5DH,nL,nH,Pd…Pd

【Function】BMP data is written the BMP box

・ Number of definable data is due to BMP box size. If the data is over range, the over range data is rewritten the final address.

・ Even if re-sending this command after sending data less than BMP box area, it is impossible to add to data.

nL = Lower byte of number of definition byte

nH = Upper byte of number of definition byte

Pd = BMP data

【Definable area】Pn：BMP box size (Pw×Ph)

4-4. Scroll box group

4-4-1. Setting the Scroll box

【Code】1BH,5DH,53H,aL,aH,Pw,Ph

【Function】Setting the scroll box. The scroll box can be defined the 1 area to DW.

The position of Scroll box is set based on the address of the address of display memory.

- If display will be scroll, at first, it needs setting this command.
- Specifiable horizontal size is 256dot (100H) MAX. If horizontal size specify 256dot, Pw = 00H
- Scroll box can be specified only the DW.

aL = Lower byte of address
aH = Upper byte of address
Pw = Scroll box width
Ph = Scroll box height

【Definable area】0000H ≦ aL + aH * 100 ≦ 07FFH
01H ≦ Pw ≦ 00H (=100H)
01H ≦ Ph ≦ 08H

4-4-2. Setting the Text scroll

【Code】1BH,5DH,42H,Pf,Pl

【Function】Setting the font size and number of scroll to Text scroll.

- Setting the Text scroll, after Setting the Scroll box.
- Definable line (Pl) is due to the font size. If the Number of line (Pl) is defined to out of definable area, the command is ignored.

Pf = Font size
Pl = Number of line

【Definable area】Pf = 30H：6x8 dot (01H ≦ Pl ≦ 08H)
Pf = 31H：8x16 dot and 16x16 dot (01H ≦ Pl ≦ 04H)
Pf = 32H：12x24 dot and 24x24 dot (01H ≦ Pl ≦ 02H)
Pf = 33H：16x32 dot and 32x32 dot (01H ≦ Pl ≦ 02H)
01H ≦ Pl ≦ 08H

4-4-3. Character setting of Text scroll

【code】1BH,5DH,43H,Pl,Pn,Pd…Pd

【Function】Character setting of Text scroll by every line.

- Number of character is counted, ANK is 1byte, and Shift-JIS is 2byte.
- Definable the character data is 100 characters to all ANK, or 50 characters to all Shift-JIS.

Pl = Number of line
Pn = Number of digit
Pd = Character data

【Definable area】01H ≦ Pl ≦ 08H
01H ≦ Pn ≦ 64H

4-4-4. BMP scroll setting (Data memory)

【Code】1BH,5DH,44H,aL,aH,wL,wH

【Function】Setting the data in the Data memory to BMP scroll.

aL = Lower byte of Data memory address

aH = Upper byte of Data memory address

wL = Lower byte of scroll length

wH = Upper byte of scroll length

【Definable area】0000H ≦ aL + aH * 100 ≦ 4FFFH

0000H ≦ wL + wH * 100 ≦ 0A00H

4-4-5. BMP scroll setting (FROM)

【Code】1BH,5DH,46H,Se,aL,aH,YS,wL,wH

【Function】Setting the data in the FROM to BMP scroll.

Se = number of sector

aL = Lower byte of Data memory address

aH = Upper byte of Data memory address

YS = Y-direction size to FROM image

wL = Lower byte of scroll length

wH = Upper byte of scroll length

【Definable area】Se = 31H：Sector 1

Se = 32H：Sector 2

Se = 33H：Sector 3

Se = 34H：Sector 4

0000H ≦ aL + aH * 100 ≦ FFFFH

01H ≦ YS ≦ 08H = 8 byte (64dot)

0000H ≦ wL + wH * 100 ≦ 2000H

4-4-6. Scroll start

【Code】1BH,5DH,3EH,Pm,Pn,Ps,Pb

【Function】Scroll start. Define the number of scroll, scroll speed and scroll gap time.

- Endless scroll when the number of scroll is 00H. If scroll stop, input the scroll stop command.
- In executing scroll, it is impossible to change the data of scroll.
- If access FROM command is executed in scroll executing, scroll display has possibilities of not smooth.

Pm = Text scroll or BMP scroll

Pn =Number of scroll

Ps =Scroll speed

Pb =Blank time between scroll

【Definable area】Pm = 30H：Text scroll

Pm = 31H：BMP scroll

00H ≦ Pn ≦ FFH (00H : Endless)

Ps = 30H ：1dot ／ approx 20ms

Ps = 31H ：1dot ／approx 40ms

Ps = 32H ：1dot ／approx 60ms

00H ≦ Pb ≦ FFH

4-4-7. Scroll stop

【Code】1BH,5DH,3DH,58H

【Function】Scroll stop.

4-5. FROM group・Other

4-5-1. Define the BMP data to FROM

【Code】1BH,6AH,53H,Se,nL,nH, Pd…Pd

【Function】Define the BMP data to FROM.

- Define the BMP data to FROM, after delete the BMP data to FROM.
- Every sector includes 64KB in FROM, BMP data definition is performed per 64KB.
- The MAX value of Specifiable number of definition is 65536 byte (10000H). If number of definition is 65536byte, nH nL = 00 00H

Se = Number of sector
nL = Lower byte of number of definition byte
nH = Upper byte of number of definition byte
Pd = Definition data

【Definable area】Se = 31H：Sector1
Se = 32H：Sector2
Se = 33H：Sector3
Se = 34H：Sector4
0000H ≦ nL + nH * 100 ≦ FFFFH

4-5-2. Delete the BMP data to FROM

【Code】1BH,6AH,41H,Se

【Function】Delete the BMP data to specified sector in the FROM.

Se = Number of sector

【Definable area】Se = 31H：Sector1
Se = 32H：Sector2
Se = 33H：Sector3
Se = 34H：Sector4

4-5-3. Transfer the BMP data from the FROM to the Data memory

【Code】1BH,6AH,55H,aL,aH,Pw,Ph,Se,bL,bH,YS

【Function】Transfer the BMP data from the FROM

aL：Lower address of transfer to
aH：Upper address of transfer to
Pw：BMP image display (width)
Ph：BMP image display (height)
Se：Number of sector
bL：Lower address of transfer from the FROM
bH：Upper address of transfer from the FROM
YS：BMP data defined Y size (by 8 dots)

【Definable area】0000H ≦ aL + aH * 100 ≦ 4FFFH
01H ≦ Pw ≦ 00H (=100H)
01H ≦ Ph ≦ 08H
Se = 31H：Sector1、Se = 32H：Sector2、Se = 33H：Sector3、Se = 34H：Sector4
0000H ≦ bL + bH * 100 ≦ FFFFH
01H ≦ YS ≦ 08H = 8 byte (64dot)

4-5-4. Define the User definable font (RAM)

【Code】1BH,6AH,47H,Pf,cL,(cH),Pd…Pd

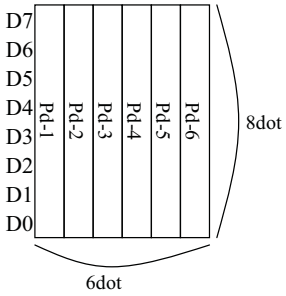
【Function】Define the User definable font into RAM. A maximum 16 characters can be defined within each font size.

- The User definable fonts are displayed the defined code. It is a same process to normal fonts.
- The User definable fonts are valid until they redefined, Reset command, or the power off.
- If define the user definable font over 16 characters, at first defined user definable font is removed
- If the defined code is specified, existing data is re-written.
- If the 16x16, 24x24, 32x32 size define, it must specify the “cH”

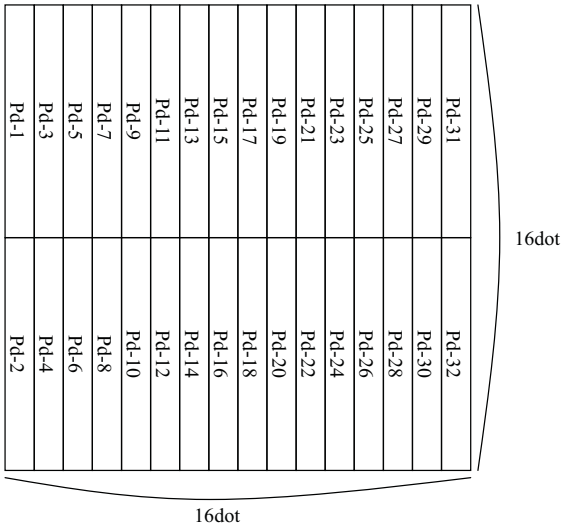
Pf = Font size
cL = Lower byte of User definable font code
cH = Upper byte of User definable font code
Pd = Definition data

【Definable area】Pf = 30H：6x8 dot (Pd=6 byte)
Pf = 31H：8x16 dot (Pd=16 byte)
Pf = 32H：12x24 dot (Pd=36 byte)
Pf = 33H：16x32 dot (Pd=64 byte)
Pf = 34H：16x16 dot (Pd=32 byte)
Pf = 35H：24x24 dot (Pd=72 byte)
Pf = 36H：32x32 dot (Pd=128 byte)
cL = ANK code (Pf=30H~33H：1 byte code)
cL,cH = Shift-JIS code (Pf=34H~36H：2 byte code)

Pd 6x8 dot



Pd 16x16 dot



4-5-5. User definable font store / transfer / delete

【Code】1BH,6AH,45H,Ps

【Function】Store, transfer, or delete the User definable font to FROM.

- Define the user definable font, after the user definable font is stored
- The user definable font store is stored the all defined user definable font data.
- The use definable font delete is deleted the all defined to FROM and RAM user definable font data.

Ps = store / transfer / delete

【Definable area】Ps = 30H：Store

Ps = 31H：Transfer

Ps = 32H：Delete

4-5-6. Define the Macro

【Code】1BH,6AH,6DH,Ps,nL,nH, Pd…Pd

【Function】Define the command and data as Macro to FROM

- If select the execution at a reset, FROM macro execution at a reset. These macros are executed continuously.
- Please don't define the following commands

RESET, Define the macro, Macro Execution / stop / delete

Ps = Select of start

nL = Number of definition lower byte

nH = Number of definition upper byte

Pd = Definition data

【Definable area】Ps = 30H：Normal macro

Ps = 31H：Execution at a reset

0000H ≦ nL + nH * 100 ≦ FFF0H

4-5-7. Macro execution／stop／delete

【Code】1BH,6AH,64H,Ps

【Function】To defined the macro to FROM execute／stop／delete

- Macro is stopped the Macro stop command. Don't send without Macro stop, when the Macro processing.
- If it didn't define the Macro, Macro doesn't not execute.
- Normal macro execute only one cycle, when the macro is end, the module send the ID code to Host system.(except I^2C interface)

Ps = Macro execution／stop／delete

【Definable area】Ps = 30H：Delete the Macro

Ps = 31H：Macro execution

Ps = 32H：Macro stop

4-5-8. Macro wait

【Code】1BH,6AH,77H,Ps

【Function】Wait time setting in the Macro processing.

- This command is valid at the macro.
- 0.1s/01H

  Ps = Wait time

【Definable area】00H ≦ Ps ≦ FFH (0.0s～25.5s)

4-5-9. ID code

【Code】1BH,6AH,49H,44H

【Function】Send the ID code to the Host system. ID code is software version.

- In I^2C interface, ID code isn't supported.

Ex. Software version is "00.10".

STX	Software Version (00.10)	ETX
02H	30H,30H,2EH,31H,30H	03H

4-5-10. Blink setting

【Code】1BH,6AH,42H,Ps

【Function】Setting the blink cycle to Text box and BMP box.

- Control the blink cycle with this command to every box.
- If the blink start, setting the blink by every box.

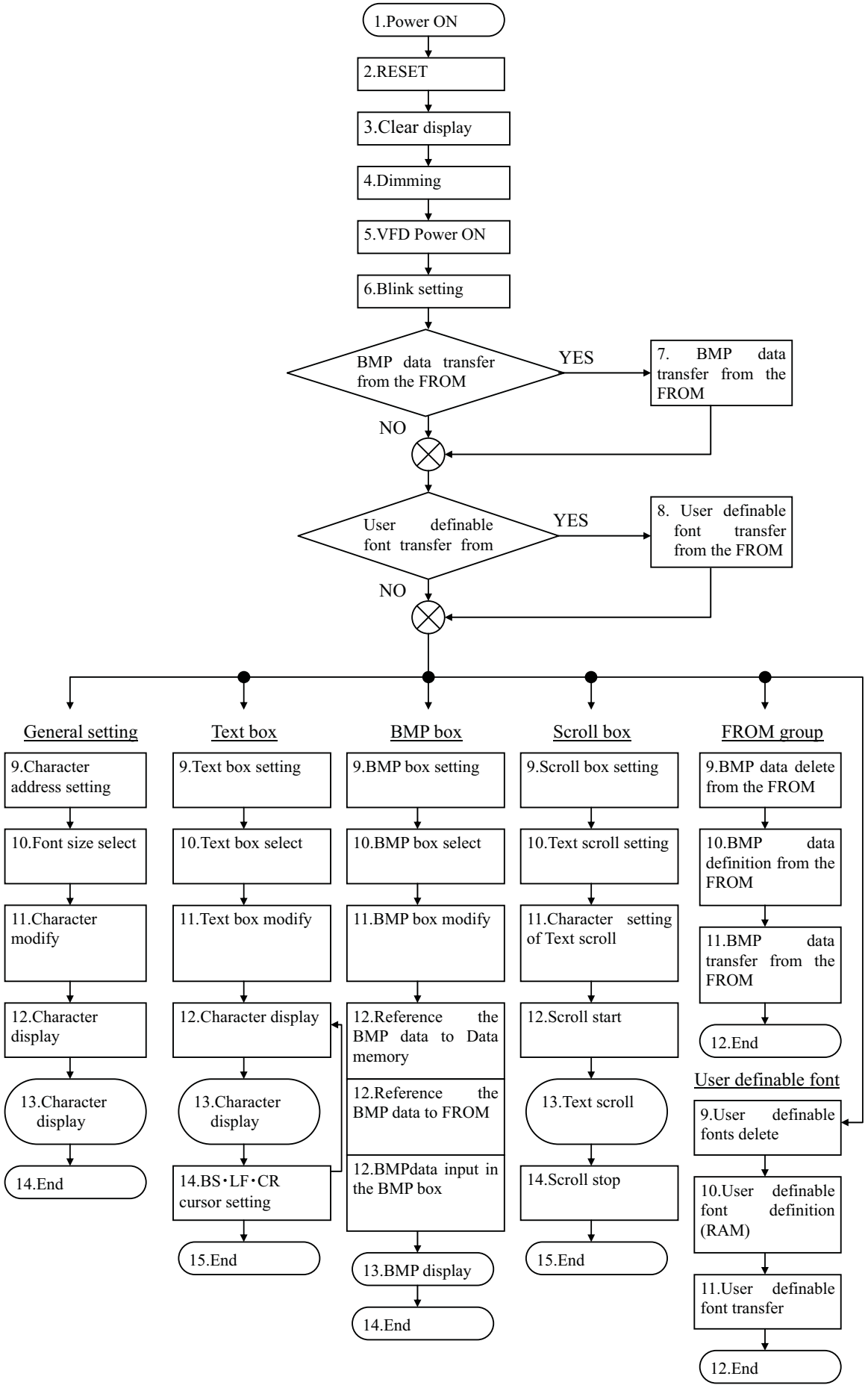
  Ps = Blink cycle

【Definable area】Ps = 30H：approx 0.5s

Ps = 31H：approx 1s

Ps = 32H：approx 1.5s

4-6. For example of command sequence



5. The test function

5-1. The display test

The display test starts when one of the following is executed.

a) When the J6 is short.

b) When both signal line connections RTS-CTS and RXD-TXD are connected.

The screen shows the following test patterns.

1) All dots are turned on. ⋯Check the Anode and Grid Open, and check the uneven display.

2) Horizontal lines in every one line are turned on ⋯Check the Grid short.

3) Vertical lines in every four line are turned on. ⋯Check the Anode short.

4) All dots are turned on.

6. INTERFACE CONNECTION

6-1. Connector pin assignment

CN1 (I^2C) 5267-04A-X (MOLEX) Table-8

Pin No	Signal	Description
1	5V	Power supply*
2	SCL	Input
3	SDA	Input/Output
4	GND	GND*

CN2 (RS-232C) 5267-06A-X (MOLEX) Table-9

Pin No	Signal	Description
1	RTS	Output
2	CTS	Input
3	GND	GND*
4	RXD	Input data
5	TXD	Output data
6	+5V	Power supply*

CN3(USB) 5267-07A-X (MOLEX) Table-10

Pin No	Signal	Description
1	VBUS (+5V)	USB Power
2	D＋	USB D＋
3	D －	USB D －
4	GND	GND*
5	FG	Frame GND
6	GND	GND*
7	+5V	Power supply*

*The wire rods of “Power supply” and “GND” are recommended to be AWG#26.

6-2. Interface configuration

6-2-1. I^2C

The module is operated as a slave by I^2C interface either in 'slave receive' or 'slave transmit' mode with a fixed address of 70H. (Baud-rate is Max 400kHz)

6-2-2. RS-232C

Table-11

Signal level	RS-232C serial communication
Data transfer format	Un-synchronous and bi-directional communication
Data length	8bits (LSB first)
Parity bit	EVEN/ODD/NON (Initial setting: NON)
Start bit	1 bit
Stop bit	1 bit
Baud rate	38400/19200/9600bps (Initial setting: 9600bps)

6-2-3. USB

Table-12

Signal level	USB2.0 compliant
Data transfer format	USB2.0 compliant
BUS Speed	Full Speed
End point	EP0：Control Transfers EP3：Interrupt Transfers(IN)
Vendor ID	1008H
Product ID	1015H

6-3. RS-232C Jumper setting

The following Table-13 indicates the Jumper setting for Baud-rate/Parity/self test.

Table -13

Circuit sign	Function	Initial setting
J1	Baud-rate	Open
J2		Open
J3	Parity select	Open
J4		Open
J5	Initialization*	Short
J6	Self-test	Open

* Please do not change.

6-3-1.Baud-rate setting

It is possible to select a baud rate 9600 to 38400bps by the combination of the J1 and J2 as shown below. (Initial setting: 9600bps)

Table -14

J1	Open	Short	Open
J2	Open	Open	Short
Baud-rate (bps)	9600	19200	38400

6-3-2. Parity select

It is possible to set parity bit by the combination of the J3 and J4 as shown below.
(Initial setting: Parity NON)

Table -15

J3	Open	Open	Short	Short
J4	Open	Short	Open	Short
Parity setting	NON	—	EVEN	ODD

6-3-3. Self-test

Either self-test mode or normal mode, the J6 has to be set at power on.
It starts the self-test when the J6 is short, at power on.
To release the test mode, the module has to be turned off and the J6 has to be set Open.
(Initial setting: Normal)

Table -16

J6	
Short	Open
Self-test	Normal mode

6-4. USB Descriptor Specifications

Standard Device Descriptor

Table -17

Offset	Field	Description	Size [byte]	Value	Comment
0	bLength	Size of descriptor in bytes	1	12H	
1	bDescriptorType	DEVICE Descriptor Type	1	01H	
2	bcdUSB	USB Release Number in BCD	2	0200H	Rev.2.0
4	bDeviceClass	Class code	1	00H	
5	bDeviceSubClass	Subclass code	1	00H	
6	bDeviceProtocol	Protocol code	1	00H	
7	bMaxPacketSize	Maximum packet size for endpoint zero	1	40H	64 bytes
8	idVendor	Vendor ID	2	1008H	Futaba
10	idProduct	Product ID	2	1015H	GP1212A02*
12	bcdDevice	Device release number in BCD	2	0100H	1.00
14	iManufacturer	Indexof string descriptor describing manufacturer	1	01H	
15	iProduct	Index of string descriptor describing product	1	02H	
16	iSerialNumber	Index of string descriptor describing the device's serial number	1	00H	
17	bNumConfigurations	Number of possible configurations	1	01H	

Standard Configuration Descriptor Table -18

Offset	Field	Description	Size [byte]	Value	Comment
0	bLength	Size of this descriptor in bytes	1	09H	
1	bDescriptorType	CONFIGURATION Descriptor Type	1	02H	
2	wTotalLength	Total length of data returned for this configuration	2	0022H	34 bytes
4	bNumInterfaces	Number of interfaces supported by this configuration	1	01H	
5	bConfigurationValue	Value to use as an argument	1	01H	
6	iConfiguration	Index of string descriptor describing this configuration	1	00H	
7	bmAttributes	Configuration characteristics	1	C0H	Bus powered Disable Remove Wakeup
8	MaxPower	Maximum power consumption	1	FAH	500mA

Interface Descriptor (#1) Table -19

Offset	Field	Description	Size [Byte]	Value	Comment
0	bLength	Size of this descriptor in bytes	1	09H	
1	bDescriptorType	INTERFACE Descriptor Type	1	04H	
2	bInterfaceNumber	Number of this interface	1	00H	VFD Control
3	bAlternateSetting	Value used to select this alternate setting	1	00H	
4	bNumEndpoints	Number of endpoints used by this interface	1	01H	
5	bInterfaceClass	Class code	1	03H	HID
6	bInterfaceSubClass	Subclass code	1	00H	
7	bInterfaceProtocol	Protocol code	1	00H	
8	iInterface	Index of string descriptor describing this interface	1	02H	

HID Descriptor (#1) Table -20

Offset	Field	Description	Size [Byte]	Value	Comment
0	bLength	Size of HID descriptor	1	09H	
1	bDescriptorType	HID descriptor type	1	21H	HID Class descriptor
2	bcdHID	HID class specification	2	0110H	HID Revision 1.10
4	bCountry	Country code of the localized hardware	1	00H	Not defined
5	bNumDescriptors	Number of class descriptors	1	01H	1 report descriptor
6	bDescriptor Type	Type of class descriptor	1	22H	
7	wReportLength	Descriptor length	2	0027H	39 bytes

Endpoint Descriptor (#1) Table -21

Offset	Description	Size [Byte]	Value	Comment
0	Size of this descriptor in bytes	1	07H	
1	ENDPOINT Descriptor Type	1	05H	
2	The address of the endpoint on the USB device described by this descriptor	1	83H	EP3, IN
3	The endpoint's attributes	1	03H	Interrupt Transfer
4	Maximum packet size this endpoint	2	0040H	
6	Interval for polling endpoint for data transfers	1	04H	4[ms]

HID Report Descriptor (#1) Table-22

Part	Value (HEX)
Usage Page (Vendor-defined),	06 7F FF
Usage (VFD_CONTROL),	09 06
Collection (Application),	A1 01
Usage (VFD_DATA_SIZE),	09 80
Logical Minimum (0),	15 00
Logical Maximum (255),	26 FF 00
Report Size (8),	75 08
Report Count (1),	95 01
Input (Data,Variable,Absolute),	81 02
Usage (VFD_DATA_INPUT),	09 81
Report Count (63),	95 3F
Input (Data,Variable,Absolute),	81 02
Usage (VFD_DATA_SIZE),	09 80
Report Count (1),	95 01
Output (Data,Variable,Absolute),	91 02
Usage (VFD_DATA_OUTPUT),	09 82
Report Count (63),	95 3F
Output (Data,Variable,Absolute),	91 02
End Collection	C0

Table-23

Description	Value (HEX)
VFD_CONTROL	06
VFD_DATA_SIZE	80
VFD_DATA_INPUT	81
VFD_DATA_OUTPUT	82

String Descriptor Table-24

No	Part	Description	Value
No.0	bLength	Length	0x04
	bDescriptorType	Type=STRING	0x03
	bSting	LangID (English US)	0x0409
No.1	bLength	Length	0x0E
	bDescriptorType	Type=STRING	0x03
	bSting	Manufacturer	Futaba
No.2	bLength	Length	0x22
	bDescriptorType	Type=STRING	0x03
	bSting	Product	121X VFD DISPLAY

MECHANICAL DRAWING

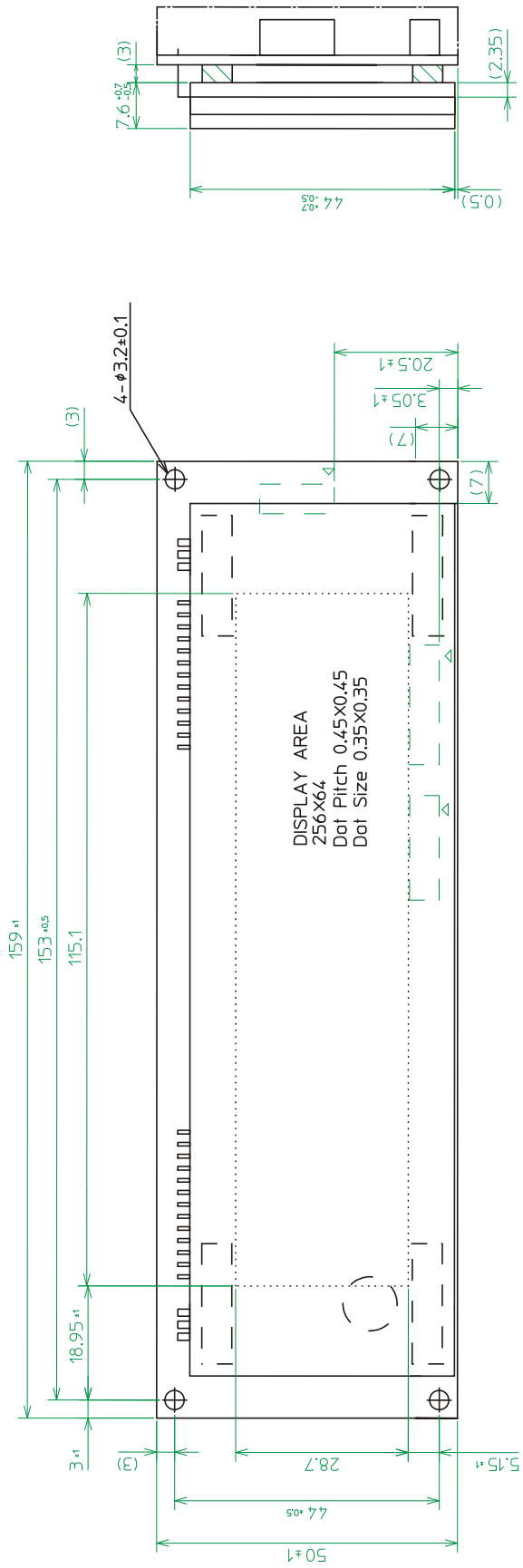
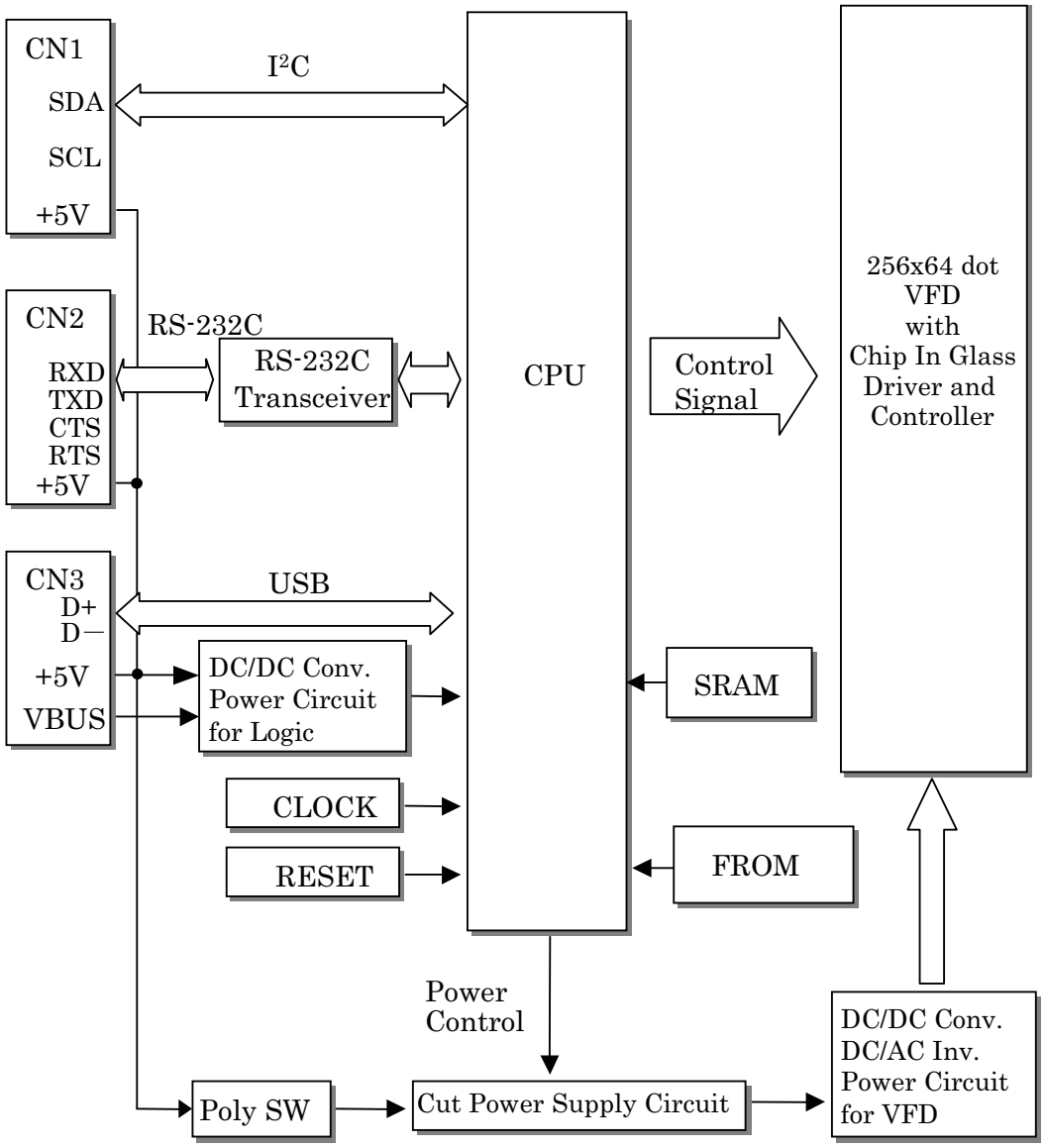


FIGURE-1

BLOCK DIAGRAM

FIGURE-2



Japanese font (shift JIS) Table-25