

VACUUM FLUORESCENT DISPLAY MODULE

ENGINEERING PROPOSAL

GP1219A01A

EVALUATION

- ACCEPTED WITHOUT ANY CHANGE
- THE FOLLOWING CHANGE IS REQUIRED

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Engineering Group

Electronic Components Division

Futaba Corporation

ISSUED BY

Yasuo Ohno

CHECKED BY

CHECKED BY

APPROVED BY

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. 106V) 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. FEATURES

GP1219A01A is a graphic display module using a FUTABA 256x64dots VFD.

The module will support the interface of USB 2.0 communications.

The module don't include character ROM, the customer will compile the character by themselves (from main system).

Since a DC/DC converter is included, 19V DC and 5V(VBUS)power source is required to operate the module.

2. GENERAL SPECIFICATIONS

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

Table-1

Item	Specification	Unit
Outer dimension	(W) 220.0±1.0	mm
	(H) 70±1.0	
	(T) 26.6 Max.	
Weight	Approx.320	g

2-2.Display specification

Table-2

Item	Specification	Unit
Display area	163.74(W)×40.22(H)	mm
No. of pixels	256(W)×64(H)	dots
Dot size	0.54(W)×0.53(H)	mm
Dot pitch	0.64(W)×0.63(H)	mm
Illumination color	Green ($\lambda_p=505\text{nm}$)	–

2-3. Environmental conditions

Table-3

Item	Symbol	MIN	MAX	Unit
Operating temperature	T_{opr}	-20	+70	°C
Storage temperature	T_{stg}	-20	+70	°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	V_{cc1}	-0.3	6.0	Vdc
Supply voltage	V_{cc2}	-0.3	24.7	Vdc
Input signal voltage	V_{IS}	-0.3	+3.6	V

2-5. Recommended operating conditions

Table-5

Item	Symbol	MIN	TYP	MAX	Unit
Supply voltage	V_{cc1}	4.75	5.0	5.25	Vdc
Supply voltage	V_{cc2}	17.1	19.0	20.9	Vdc
Input Differential Sensitivity	V_{DI}	0.2	–	–	V

2-6. Electrical, optical characteristics

Table-6

Item	Symbol	Conditions	MIN	TYP	MAX	Unit
Supply current ^(Note1)	I_{cc1}	$V_{cc1} = 5.0V$ (VBUS)	–	100	120	mA
Power consumption	–		–	0.5	0.65	W
Supply current ^(Note1)	I_{cc2}	$V_{cc2} = 19.0V$	–	400	600	mA
Power consumption	–		–	7.60	11.4	W
Luminance ^(Note2)	L		500	1000	–	cd/m ²
High level output voltage	V_{OH}	$I_{OH} = -200\mu A$	2.8	–	–	V
Low level output voltage	V_{OL}	$I_{OL} = -2mA$	–	–	0.3	V

Note1) The surge current can be approx.5 times of specified maximum supply current at power on.

Note2) It indicates the value at 100% luminance adjustment level.

4. COMMAND

The following are all commands of the module.

Table-7

No.	Command description	Command code
1	Clear display	1BH,5BH,32H,4AH
2	Dimming	1BH,5CH,3FH,4CH,44H,Ps
3	Display Data Input	1BH,5BH,Pc,Px,Py,Pn,Ps,Pd...Pd
4	Display Position Setting	1BH,5BH,DW,Px,Py
5	Screen Mode	1BH,5CH,3FH,4CH,53H,Ps
6	Single line scroll	1BH,5CH,3FH,4CH,48H,Pm,3BH,Pl,3BH,Pt, 3BH,Pn,3BH,Pd...Pd
7	Horizontal scroll on all lines Scroll mode select command	1BH,5CH,3FH,4CH,4DH,53H
	Horizontal scroll on all lines Display mode set	1BH,5CH,3FH,4CH,4DH,pm,3BH,pl,3BH, pt,3BH,pn,3BH,pd...pd
	Horizontal scroll on all lines Scroll start command	1BH,5CH,3FH,4CH,4DH, 47H
	Horizontal scroll on all lines Release command of scroll mode	1BH,5CH,3FH,4CH,4DH,45H
8	Descriptor control	1BH,5CH,3FH,44H,53H,Ps...Ps
9	Descriptor blink control	1BH,5CH,3FH,44H,42H,Ps...Ps
10	Firmware Revision Read	1BH,5BH,63H,46H,52H
11	ID Read	1BH,5BH,63H,49H,44H
12	Power Supply Monitor	1BH,5BH,63H,50H,4DH

Other codes except the above are ignored.

4-1. Clear display (1BH,5BH,32H,4AH)

All the displayed character are erased. The write-in position is not changed.

4-2. Dimming (1BH,5CH,3FH,4CH,44H,Ps)

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

The following one byte data, after writing 1BH 5CH 3FH 4CH 44H, is written to change dimming level.

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

Table-8

Ps	Luminance(%)
0 (30H)	0
1 (31H)	31.6
2 (32H)	45.0
3 (33H)	58.8
4 (34H)	79.4
5 (35H)	100

4-3. Display Data Input (1BH,5BH,Pc,Px,Py,Pn,Ps,Pd...Pd)

The display data is written in the memory map.

The writing start position is specified by A[7:0] and O[6:0].

One row increment is done in the direction of Y axis at the time of each data writing.

As for the writing position, when the writing position does the increment in the direction of Y axis up to the number specified by C[6:0], one-line increment is done in the direction of X axis.

At that time, Y axis coordinates at the writing position return to Y axis coordinates at the starting position.

The writing position is [X,127] and when the increment is done in the direction of Y axis, the following writing position is [X,0].

When the increment is done by [255,Y] in the direction of X axis, the writing position is the following writing position [0 , O[6:0]].

		MSB				LSB			
		b7	b6	b5	b4	b3	b2	b1	b0
Pc	1st byte	1	1	1	1	0	0	0	0
Px	2nd byte	A7	A6	A5	A4	A3	A2	A1	A0
Py	3rd byte	*	06	05	04	03	02	01	00
Pn	4th byte	*	C6	C5	C4	C3	C2	C1	C0
Ps	5th byte	*	*	*	*	E3	E2	E1	E0
	6th byte	F7	F6	F5	F4	F3	F2	F1	F0
Pd	7th byte	D7	D6	D5	D4	D3	D2	D1	D0

Pc: F0H

Px: A[7:0] Start X position

A7	A6	A5	A4	A3	A2	A1	A0	X position
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1
0	0	0	0	0	0	1	0	2
...								...
1	1	1	1	1	1	0	1	253
1	1	1	1	1	1	1	0	254
1	1	1	1	1	1	1	1	255

Py: O[6:0] Start Y position

O6	O5	O4	O3	O2	O1	O0	Y position
0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	1
0	0	0	0	0	1	0	2
...							...
1	1	1	1	1	0	1	125
1	1	1	1	1	1	0	126
1	1	1	1	1	1	1	127

Pn: C[6:0] Length for return

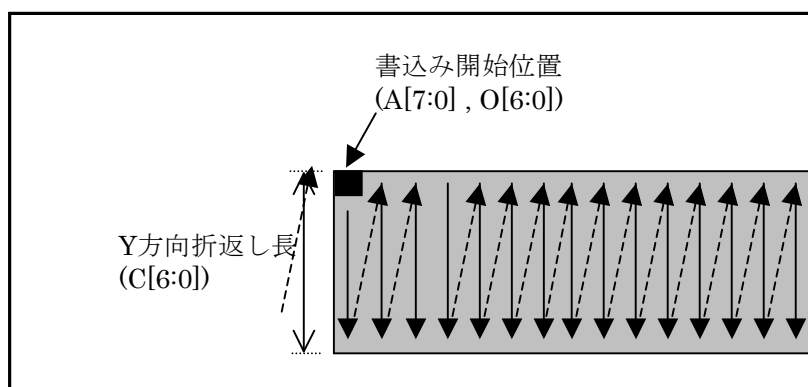
C6	C5	C4	C3	C2	C1	C	Y length for return
0	0	0	0	1	1	1	8
0	0	0	1	1	1	1	16
0	0	1	0	1	1	1	24
...							...
1	1	0	1	1	1	1	112
1	1	1	0	1	1	1	120
1	1	1	1	1	1	1	128

Ps: E[3:0] F[7:0] Program Data Length(Byte)

E3	E2	E1	E0	F7	F6	F5	F4	F3	F2	F1	F0	Data Size
0	0	0	0	0	0	0	0	0	0	0	1	1
0	0	0	0	0	0	0	0	0	0	1	0	2
0	0	0	0	0	0	0	0	0	0	1	1	3
...												...
0	1	1	1	1	1	1	1	1	1	1	1	2047
1	0	0	0	0	0	0	0	0	0	0	0	2048

Pd: D[7:0]

256 × 128 dot RAM



4-4. Display Position Setting(1BH,5BH,Dw,Px,Py)

The display position is extracted from the memory map by this command.

DW1 or DW2 is selected by the register of DW.

(1,1) position "DSA" of the display area is specified by H 8:0 and I 7:0.

X position and I 7:0 show Y position in H 8:0.

Please refer to the following for the memory map.

Please set DSA1 and DSA2 to the same position.

[Memory Map]

RAM for the display data of 256×128 dots in length in side is built into this VFD.

In the command of "Display data writing", data is written in this memory map.

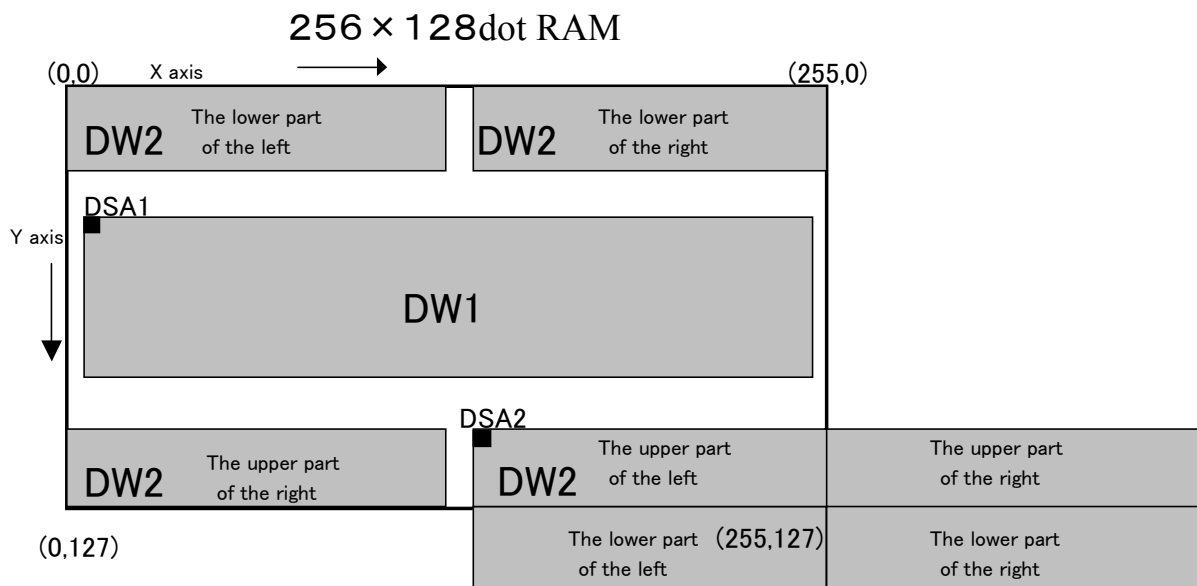
" 256×64 dots" of this specification is assumed to be DW, and DW is extracted from the written data.

Pixel (0,0) on the left of DW becomes DSA.

The position of DSA is specified by the command of "DW display position setting" from among the memory map.

DW and DSA have two (DW1, DW2, DSA1, and DSA2) respectively.

When the protruding area is specified from the memory map DW, the area that protrudes in the lower side is extracted on on the right side the left the protruding area. (Refer to DW2 for the figure below.)



[Command]

	MSB				LSB			
	b7	b6	b5	b4	b3	b2	b1	b0
Dw	1	1	0	DW	0	0	0	0
Px	H7	H6	H5	H4	H3	H2	H1	H0
Py	*	I6	I5	I4	I3	I2	I1	I0

初期値 default
00h
00h

DW

DW	DW select
0	DW1(DSA1)
1	DW2(DSA2)

Px: H[7:0]

H7	H6	H5	H4	H3	H2	H1	H0	X position
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1
0	0	0	0	0	0	1	0	2
...								...
1	1	1	1	1	1	0	1	253
1	1	1	1	1	1	1	0	254
1	1	1	1	1	1	1	1	255

Py: I[6:0]

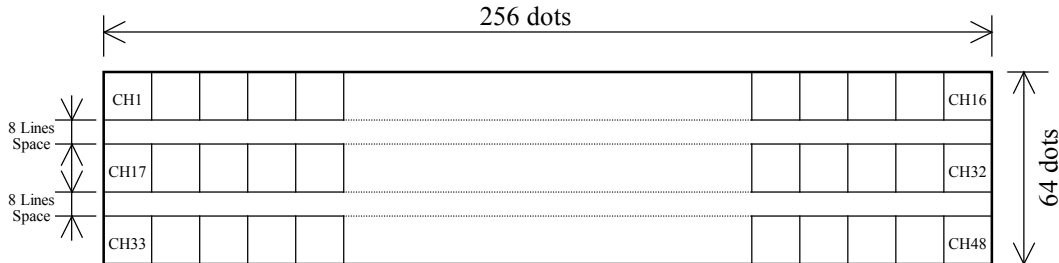
I6	I5	I4	I3	I2	I1	I0	Y position
0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	1
0	0	0	0	0	1	0	2
...							...
1	1	1	1	1	0	1	125
1	1	1	1	1	1	0	126
1	1	1	1	1	1	1	127

4-5. Screen mode (1BH,5CH,3FH,4CH,53H,Ps)

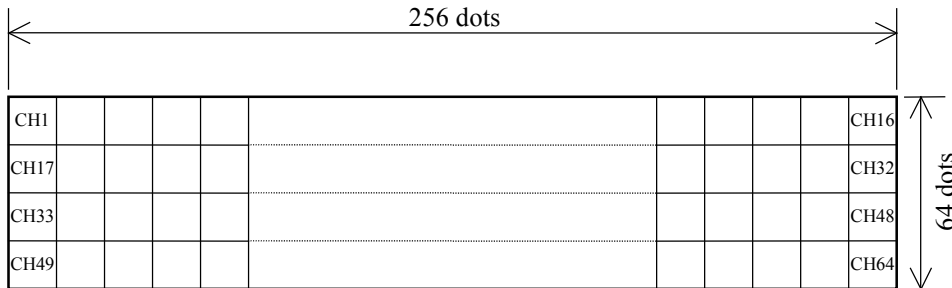
Table -9

Ps	Screen mode	Note
1(31H)	16×16dots, 8×16dots 3rows	
2(32H)	16×16dots, 8×16dots 4rows	default
3(33H)	4×7(Indicator)+16×16dots 3rows,8×16dots 3rows	
4(34H)	16×16dots 3rows,8×16dots 3rows+4×7(Indicator)	

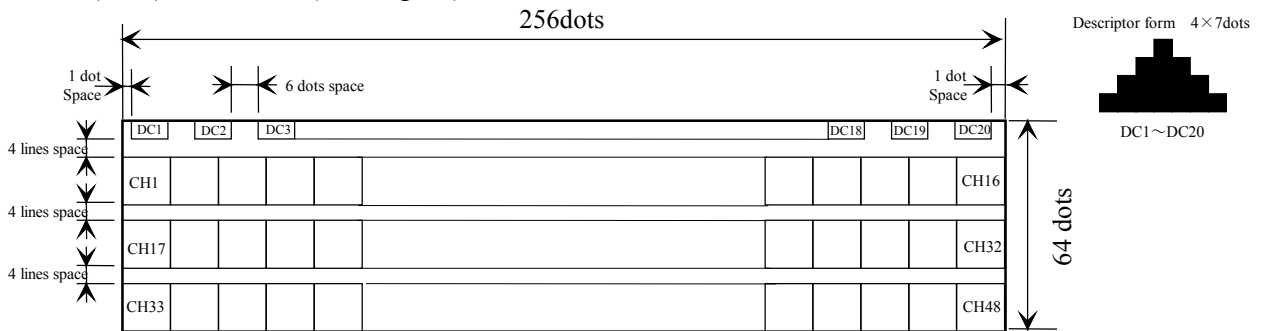
Ps=1 (31H) / 16×16dots, 8×16dots with 3 rows



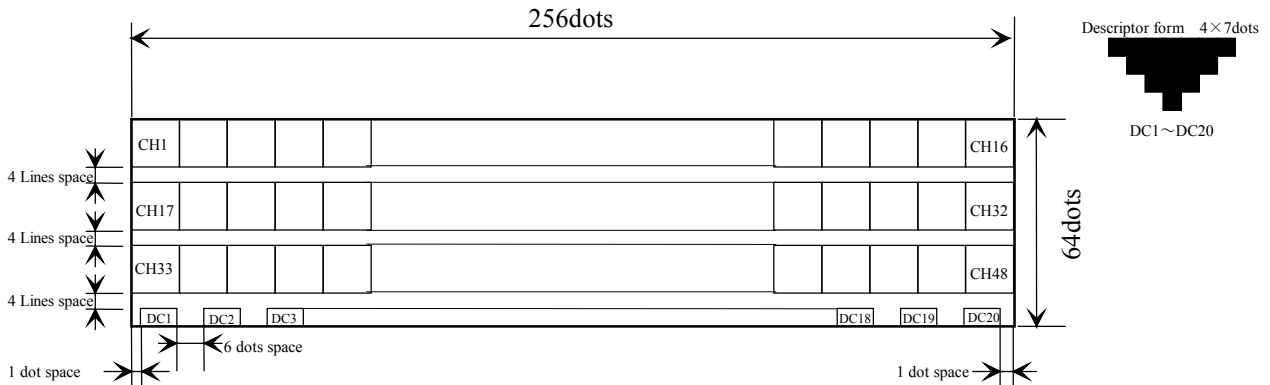
Ps=2 (32H) / 16×16dots, 8×16dots with 4 rows



Ps=3 (33H) / 4×7dots(Descriptor)+16×16dots, 8×16dots with 3 rows



Ps=7 (37H) / 16×16dots, 8×16dots with 3 rows + 4×7dots(Descriptor)



4-6. Single line scroll (1BH,5CH,3FH,4CH,48H,Pm,3BH,Pl,3BH,Pt,3BH,Pn,3BH,Pd...Pd)

Table -10

Pm	Screen mode set 1 (31H) : 16×16dots, 8×16dots, 3rows 2 (32H) : 16×16dots, 8×16dots, 4rows 3 (33H) : Upward descriptor+16×16 8×16 3rows(Descriptor fixation) 4 (34H) : Downward descriptor+16×16 8×16 3rows(Descriptor fixation)
Pl	Select a row to be scrolled 1 ~ 3 (31H~33H) : Pm=1,3,4 1 ~ 4 (31H~34H) : Pm=2
Pt	Scroll speed select 1 (31H) : 40mS/1 line 2 (32H) : 80mS/1 line 3 (33H) : 160mS/1 line
Pn	The number of scroll dots. Max.16384dot
Pd	Data

The basic function for scrolling

- 1) When a character is displayed on the line selected for the scroll mode, all displaying characters and the display mode set command are erased.
- 2) A character is scrolled by closed loop until the cancellation command is selected.
In this case, a same message is scrolled repeatedly with no space.
- 3) A screen is scrolled to the left from the right dot by dot.
- 4) The range of the display of being scrolled is defined according to the screen mode setting.
- 5) The command is canceled, when Pn = 00H
After canceled, displayed characters are cleared and the write-in position moves to the most significant digit of the row.
- 6) The command can be executed in a single line only.
- 7) A character's display mode set command (reverse/blink mode etc.) can be added with the display data frame.
In case the command is written twice or more in one scroll data frame, the first command is only valid and others are ignored.
- 8) When a message data are changed, this command has to be set again.
While scrolling, a user definable font command is not available.

4-7. Horizontal scroll on all lines (exclusive mode)**4-7-1. Scroll mode select command (1BH,5CH,3FH,4CH,4DH,53H)**

Horizontal scroll on all lines mode can be selected. It maintains display conditions (e.g. screen mode, cursor position etc.) set before this command is executed.

All commands except the following the release command are ignored.

Scroll start command should be executed, when start scrolling

4-7-2. Release command of scroll mode (1BH,5CH,3FH,4CH,4DH,45H)

To be released Horizontal scroll on all lines mode.

Display conditions set before this command is executed are reset again.

4-7-3. Display mode set (1BH,5CH,3FH,4CH,4DH,Pm,3BH,Pl,3BH,Pn,3BH,Pd...Pd)

Table-11

Pm	Screen mode set (Other screen modes except the following are invalid.) 1(31H) : 16 × 16dots, 8 × 16dots, 3rows
Pl	Select a row to be scrolled 1 ~ 3 : (31H ~ 33H) pm=1
Pt	Scroll speed select 1(31H) : 10mS/1 line 2(32H) : 20mS/1 line
Pn	The number of scroll dots.
Pd	Data

a) Other codes except the above are ignored.

b) The latest display mode set as above becomes effective in one screen scroll setting before scroll start command is executed.

4-7-4. Scroll start command (1BH,5CH,3FH,4CH,4DH, 47H)

The screen can be started scrolling.

All commands except the scroll release command are ignored.

note) Space data is written in the other rows except the selected with pl code.

4-8. Descriptor control (1BH,5CH,3FH,44H,53H,Ps...Ps)

This command is disregarded at the time of Screen mode selection of only for Screen mode 3 and 4 others.

Ps each bit 1: Lighting, 0:putting out lights

Table-12

Ps	b7	b6	b5	b4	b3	b2	b1	b0
1 byte	'1' fixed	'1' fixed	'1' fixed	'1' fixed	DC1	DC2	DC3	DC4
2 byte	'1' fixed	'1' fixed	'1' fixed	'1' fixed	DC5	DC6	DC7	DC8
3 byte	'1' fixed	'1' fixed	'1' fixed	'1' fixed	DC9	DC10	DC11	DC12
4 byte	'1' fixed	'1' fixed	'1' fixed	'1' fixed	DC13	DC14	DC15	DC16
5 byte	'1' fixed	'1' fixed	'1' fixed	'1' fixed	DC17	DC18	DC19	DC20

This command is disregarded when Screen Mode differs.

When you publish a descriptor control command, please be sure to input 5 bytes of data specified by Ps.

4-9. Descriptor blink control (1BH,5CH,3FH,44H,42H,Ps...Ps)

This command is disregarded at the time of Screen mode selection of only for Screen mode 3 and 4 others.

The turned-on descriptor is blinked, when the descriptor is not on, it is this command disregard. Ps is the same as the above-mentioned descriptor allotment Table-14.

Blink time is the same as display attribute blink time.

Ps each bit 1: Blink, 0:blink release (after release is turned on)

note) When it specifies zero times by the descriptor control command at the time of a descriptor blink, the light is put out and a blink also cancels a display compulsorily. In 1 specification, a blink is canceled and it lights up.

4-10. Firmware Revision Read (1BH,5BH,63H,46H,52H)

This command is a request for the Retail Display to return a identifier.

The Retail Display returns 5bytes that identifies code.

Table-13

Soft ware version (00.01) 30H,30H,2EH,31H,30H
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4-11. ID Read(1BH,5BH,63H,49H,44H)

This command is a request for the Retail Display to return a identifier.

The Retail Display returns 10bytes that identifies code.

Table-14

GP1219A01A 47H,50H,31H,32H,31H,39H,41H,30H,31H,41H

4-12. Power Supply Monitor(1BH,5BH,63H,50H,4DH)

The state of the power supply of VFD is returned to the host.

[Power on]

Table-15

ON 4FH,4EH

[Power off]

Table-16

OFF 4FH,46H,46H

5. THE TEST FUNCTION**5-1.The display confirmation**

When the module is turned on, all dots are turned on for 500 mS.

5-2. The display test

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

When the J5 is short.

The screen shows the following test patterns.

- 1) All dots is turned on.
- 2) Horizontal lines in every one line are turned on.
- 3) Vertical lines in every four line are turned on.
- 4) All dots is turned on.

6. INTERFACE CONNECTION

6-1. Connector pin assignment

Connector(CN1) DF1B-5P-2.5DS (HIROSE ELECTRIC CO.,LTD.)

Table-17

Pin No	Signal	Description
1	VBUS	USB Power
2	D-	USB D-
3	D+	USB D+
4	GND	GND
5	FG	Frame GND

Connector(CN2) DF1B-4P-2.5DS (HIROSE ELECTRIC CO.,LTD.)

Table-18

Pin No	Signal	Description
1	NC	NC
2	+19V	Power
3	NC	NC
4	GND	GND

Note) These are signals of the VFD module.

6-2. USB Descriptor Specifications

Standard Device Descriptor

Table-19

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	100EH or 100FH	GP1219A01A
12	bcdDevice	Device release number in BCD	2	0100H	1.00
14	iManufacturer	Index of 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-20

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	003BH	59 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-21

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-22

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	bReportType	Type of class descriptor	1	22H	REPORT descriptor
7	wReportLength	Descriptor length	2	0027H	39 bytes

Endpoint Descriptor (#1)

Table-23

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-24

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-25

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

String Descriptor

Table-26

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

6-3. JAMPER

The following Table-27 indicates the JAMPER setting for baud rate/Parity/self test.

Table-27

JAMPER	Function	Initial setting
J5	Self test	—

— : Open ○ : Short

6-3-1. The self-test

Either self test mode or normal mode, the J5 has to be set at power on.

It starts the self-test when the J5 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-28

J5	
○	—
Self-test	Normal

— : Open

○ : Short

7. ENVIRONMENTALLY CONSCIENTIOUS

This VFD Module complies with RoHS Directive.

8-1. With respect to EU RoHS Directive

This product does not contain more of each banned 6 materials (cadmium, hexavalent chromium, lead, mercury, polybrominated biphenyl: PBB and polybrominated diphenyl ether :PBDE) than is stipulated in the standard , or comply wit the exempting items. Materials and components of electrical and electronic equipment(EEE) which conform to Article 4 of EU RoHS are exempt from EU RoHs Directive.

8-2. With respect to Chinese RoHS

This product contains “lead and its compound” from among restricted 6 materials (cadmium, hexavalent chromium, lead, mercury, polybrominated biphenyl: PBB and polybrominated diphenyl ether :PBDE).

This product does not contain more of each restricted materials except “lead and its compound” than is stipulated in Chinese RoHS.

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

< Indication of information on containing EHS >

*Areas of its location : Vacuum Fluorescent Tube(VFD)

*Containing chemical material : Lead and its compound

*Environmental protection use period : 10 years

*Reason for containing : Due to no materials to substitute them under the current technology

CIRCUIT BLOCK DIAGRAM

FIGURE-2

