

APPLICATION NOTE

VACUUM FLUORESCENT DISPLAY MODULE

GRAPHIC DISPLAY MODULE

GP1238A01A

FUTABA GP1238A01A is a graphic display module using a FUTABA 192×16 VFD.

It consists of a driver, a control circuit and power source.

The module can be connected directly to the bus line of the host system CPU.

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.103V) 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.

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1. FEATURES

- 1-1. High quality and long life can be achieved with FUTABA VFD.
- 1-2. Compact and light-weight unit by using packed display drivers and one-chip VFD control.
- 1-3. Driven through a simple interface.
- 1-4. High speed 8bit data write-in capability.

2. GENERAL SPECIFICATIONS

2-1. DIMENSIONS, WEIGHT (Refer to FIG-3)

Table-1

Item	Specification	Unit
Outer Dimensions	(L) 180 ± 1.0	mm
	(W) 40 ± 1.0	
	(T) 24.1 Max.	
Weight	100	g

2-2. SPECIFICATIONS OF THE DISPLAY PANEL

Table-2

Item	Specification	Unit
Display Area	124.6×10.2	mm
Number of Dots	192×16	Dot
Dot Pitch	0.65×0.65	mm
Dot Size	0.4×0.4	mm
Color Illumination	Green($\lambda_p=505\text{nm}$)	—
Luminance	500 Typ.	cd/m ²

(Note)

By using a filter, uniform color ranging from blue to orange (including white) can be obtained.

2-3. ENVIRONMENT CONDITIONS

Table-3

Item	Symbol	Min.	Max.	Unit
Operating Temperature	<i>T</i> _{opr}	-20	+70	°C
Storage Temperature	<i>T</i> _{stg}	-20	+70	°C
Operating Humidity	<i>H</i> _{opr}	20	85	%
Storage Humidity	<i>H</i> _{stg}	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}	-0.4	6.0	V _{dc}
Input Signal Voltage	V _{IS}	0.5	V _{CC1} +0.5	V

2-5. RECOMMENDED OPERATING CONDITIONS

Table-5

Item	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	V _{CC1}	4.5	5.0	5.5	V _{dc}
H-Level Input Voltage	V _{IH}	2.2	—	—	V
L-Level Input Voltage	V _{IL}	—	—	0.8	V

2-6. ELECTRICAL CHARACTERISTICS

Table-6

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Current ^(Note 1)	I _{CC1}	V _{CC} = 5.0V _{dc} All on	—	0.8	1.2	A
Power Consumption	—		—	4	6	W
Luminance	L		250	500	—	cd/m ²
H-Level output Voltage	V _{OH}	V _{CC} = 4.5V I _{OH} = -2mA	3.8	—	—	V
L-Level output Voltage	V _{OL}	V _{CC} = 4.5V I _{OL} = 3.2mA	—	—	0.4	V

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

3. BASIC FUNCTIONS

3-1. FUNCTION TABLE

Table-7

$\overline{CS}$	$\overline{WR}$	$\overline{RD}$	$C/\overline{D}$	Mode
L	↑	H	H	Command Write-in
L	↑	H	L	Data Write-in
L	H	L	H	—
L	H	L	L	Data Read-out

3-2. FUNCTION OF SIGNAL LINES

Table-8

Signal	I/O	Function
D0~D7	I/O	Data Bus
$\overline{WR}$	I	Write Signal
$\overline{RD}$	I	Read Signal
$\overline{CS}$	I	Chip Select Signal
$C/\overline{D}$	I	Command / Data Select Signal $C/\overline{D} = "H"$: Command, $C/\overline{D} = "L"$: Data
INT	O	Frame Signal (One output pulse per one display frame)
Vcc1	—	+5V
GND	—	GND

3-3. COMMAND TABLE

This module has the 32k bytes for display memory (S-RAM).

It is used as display memories which capable to have two display memories. And each one can be displayed independently and ON/OFF controlled as well. Also each screen can be composed (OR,EX-OR and AND).

The followings are all commands of this module.

Table-9

Command (C/D = "H")	Setting Data (C/D = "L")	Function
00H	–	Screen 1 & 2 are Displayed off
01H	–	Screen 1 is Displayed on
02H	–	Screen 2 is Displayed on
03H	–	Screen 1 & 2 are Displayed on
04H	–	Write/Read address is automatically incremented
05H	–	Write/Read address is holed
06H	–	Unused
07H	–	Screen 2 select
08H	D0 ~ D7	Display data write-in
09H	D0 ~ D7	Display data read-out
0AH	D0 ~ D7	Setting lower address for Screen 1 started
0BH	D0 ~ D4	Setting upper address for Screen 1 started
0CH	D0 ~ D7	Setting lower address for Screen 2 started
0DH	D0 ~ D4	Setting upper address for Screen 2 started
0EH	D0 ~ D7	Setting lower address of Write/Read
0FH	D0 ~ D4	Setting upper address of Write/Read
10H	–	OR display of Screen 1 & 2
11H	–	EX-OR display of Screen 1 & 2
12H	–	AND display of Screen 1 & 2

Note) "–" in the above table is shown that the setting data is not needed.

3-4. FUNCTION OF COMMANDS

① Screen Display on/off control (00H ~ 03H)

The latest command becomes effective.

At power on, screen 1 and 2 are set to display off mode. Therefore, the display on mode command should be written in, after display pattern data. (If it is executed in order, random pattern may be displayed.)

② Screen OR/EX-OR/AND Display Select (10H ~ 12H)

The latest command becomes effective.

When these commands are executed, in advance, a "07H" command is needed to be executed (screen 2 is enabled to display.)

③ Setting of Write/Read Address Mode (04H,05H)

These commands select either the write/read address is incremented automatically or is held after data write/read.

④ Screen 2 select (07H)

This command is enabled screen 2 to displayed.

⑤ Data Write/Read (08H,09H)

After executing the Write/Read address setting command, this command shall be executes.

At executing the data Read, the first byte is invalid. Dummy read is necessary. The correct data can be read from the second byte.

⑥ Setting of Display Start Address (0AH ~ 0DH)

The display start address is just pointed to the left and the top line of the display area.

Screen 1 and 2 can be independently set the display start address each other. This address is divided to the two portion with upper (five bits) and lower (eight bits) address, and lower address shall be set first, then set the upper address.

The smooth scroll of displaying can be achieved by synchronizing with the Change of display address by the INT signal at every frame.

⑦ Setting of Write/Read Address (0EH,0FH)

This command is set the write/read address of displaying data, This address is divided the two portion with upper (five bits) and lower (eight bits) address, and lower address shall be set first, then set the upper address. And only the upper address is available to be changed independently. When the lower address is changed, it is required to change the both address.

4. RELATIONSHIP OF THE DISPLAY AREA TO ADDRESS AND DATA

The following map is shown in the case of 0000H of display start address. The actual display area is the part of enclosing with the solid line of FIG-1.

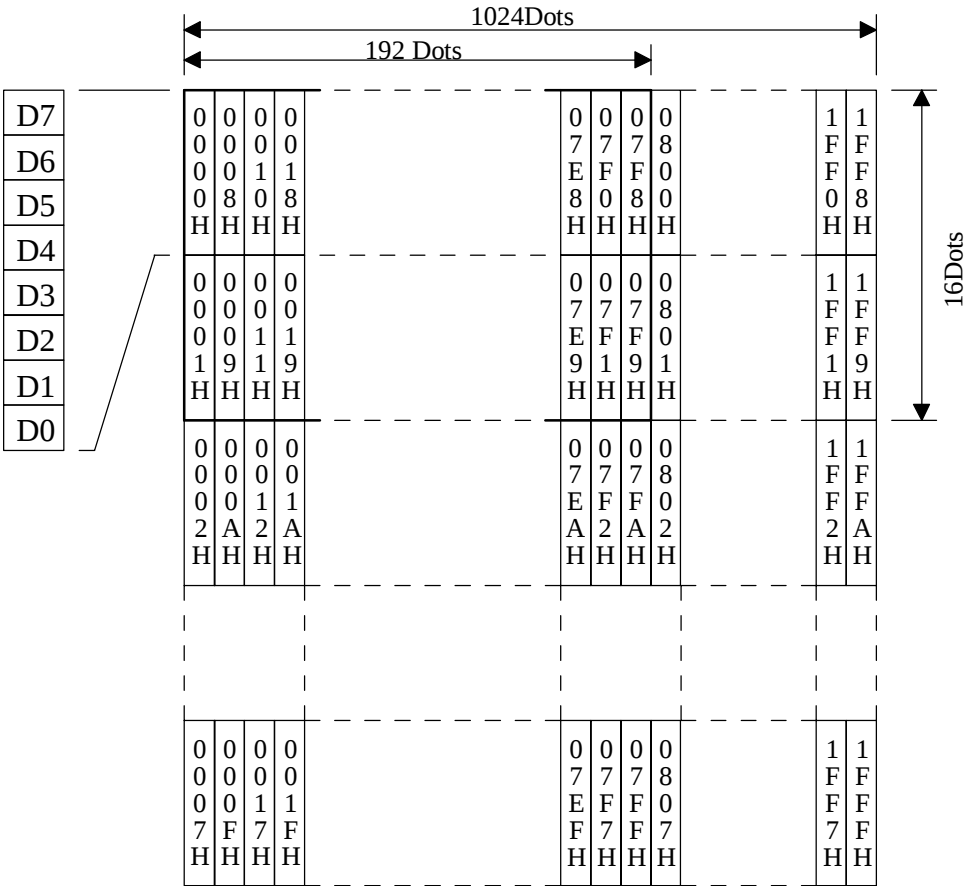


FIG-1 Position of display dot to address and data

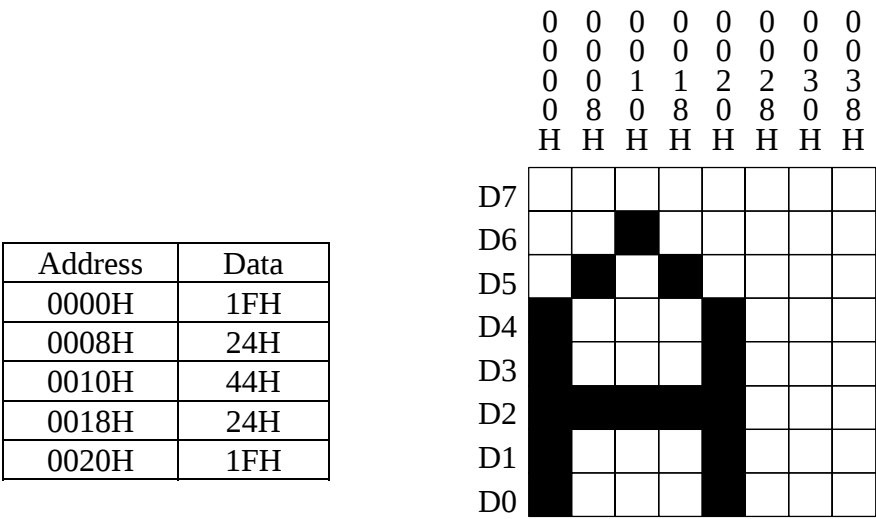


FIG-2 Data Write-in

5. INTERFACE CONNECTION

5-1. CONNECTOR PIN ASSIGNMENT

Connector : IL-402-20S-SIL-SA (JAE)

FFC : 1mm Pitch 20 pin

Connector Pin Assignment

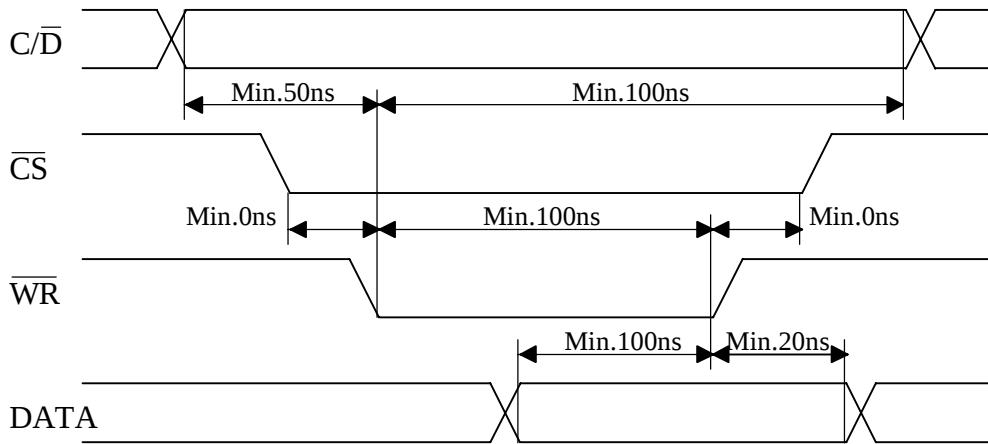
Table-10

Pin No.	Description	Pin No.	Description
1	D0	2	D1
3	D2	4	D3
5	D4	6	D5
7	D6	8	D7
9	GND	10	INT
11	WR	12	RD
13	CS	14	C/D
15	5V	16	5V
17	5V	18	GND
19	GND	20	NC

All GND terminal are connected together on the PWB.

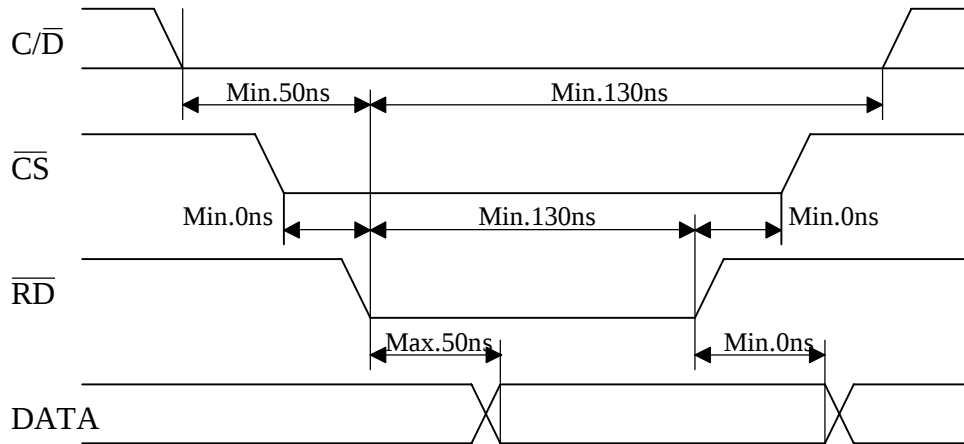
5-2. TIMING CHART FOR WRITE-IN AND READ-OUT

(1) Write-in timing



Note). The time of each one byte access is necessary with 2 μ s min.

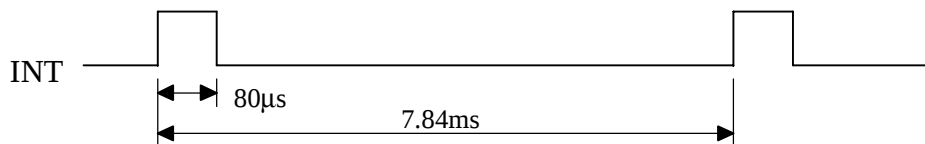
(2) Read-out timing



Note). The time of each one byte access is necessary with 2 μ s min.

(3) INT Signal

The module generates INT signal output at refresh period of approximately 7.84msec. Smooth text scroll can be obtained by synchronizing data input with INT signal. A start address should be set up during "H"(80 μ s) period of INT signal.



6. THE ENVIRONMENTAL SPECIFICATIONS FOR THIS PRODUCT

6-1. 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.

6-2. 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

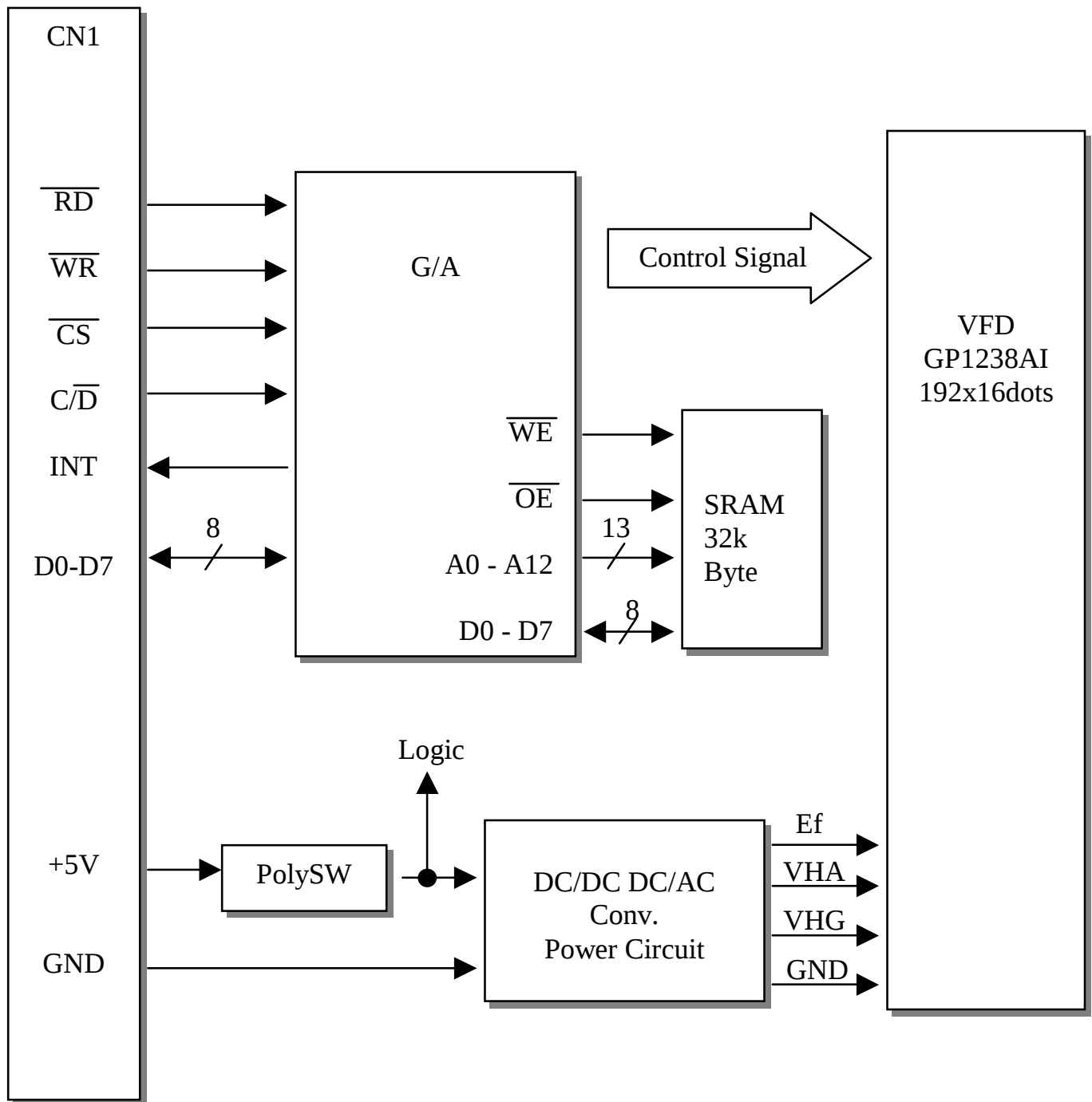
*Time limit of use for environmental protection : 10 years

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

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CIRCUIT BLOCK DIAGRAM

FIG-4



7. WARRANTY

This display module is guaranteed for 1 year after the shipment from FUTABA.

8. CAUTIONS FOR DETERMINING AND EXPORTING REGULATED GOODS OR SERVICES

This product does not correspond to the goods or services regulated by Japan's Foreign Exchange and Foreign Trade Law. If this product is combined with other products in order to make equipment, whether this product is regulated or not is judged by such newly made equipment. We ask you to determine by yourself whether the equipment corresponds to the regulated goods when this product is incorporated in the equipment.

We also ask you to confirm that this product will not be incorporated in any weapon or used for manufacturing any weapon.

If you export or re-export this product, we recommend you to adopt measures for appropriate export procedures, if any.

9. CAUTIONS FOR OPERATION

9-1. 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.

9-2. The DC/DC converter generates approximately 103Vdc, avoid touching it with bare hands, or to other circuits.

9-3. Avoid using the module where excessive noise interface is expected.

Noise affects the interface signal and causes 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.)

9-4. When power is turned off, the capacitor will not discharge immediately.

Avoid touching IC and others.

The shorting of the mounted components within 30 sec., after power off, may cause damage.

9-5. When fixed pattern is displayed for a long time, you may see uneven luminance.

It is recommended to change the display patterns sometimes in order to keep best display quality.

9-6. DC/DC converter is equipped on the module, the surge current may be approximately 5 times the specified supply current at the power on.

REMARKS :

The specification is subject to change without prior notice.

Your consultation with FUTABA sales office is recommended for the use of this module.