Futaba®

AN-E-3155A

APPLICATION NOTE

VACUUM FLUORESCENT DISPLAY MODULE

GRAPHIC DISPLAY MODULE

GP1009C10A

GENERAL DESCRIPTION

FUTABA GP1009C10A is a graphic display module using a FUTABA 240×64 VFD.
Consisting of a VFD, display drivers and a control circuit, the module can be driven by connecting to the host system through a simple interface.

⚠ 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 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.

CONTENTS

1. FEATURES

1-1. Compact and light-weight unit using flat packed display drivers and one-chip VFD controller.

1-2. Driven through a simple interface.

1-3. High speed 8 bit data write-in capability.

1-4. Brightness adjustment available by software.

2. GENERAL SPECIFICATIONS

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

Table-1

Item	Specification	Unit
Outer Dimensions	(L) 160±1 (W) 70±1 (T) 36 Max	mm
Weight	400 Max	g

2-2. OPTICAL CHARACTERISTICS

Table-2

Item	Specification	Unit
Display Area	107.9×28.7	mm
Number of Dots	240×64	Dot
Dot Pitch (H×W)	0.45×0.45	mm
Dot Size (H×W)	0.35×0.35	mm
Color of Illumination	Green (λp=505nm)	–

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

2-3. ENVIRONMENT CONDITION

Table-3

Item	Symbol	Min.	Max.	Unit
Operating Temperature	*T*opr	0	+70	°C
Storage Temperature	*T*stg	-20	+70	°C
Operating Humidity	*H*opr	20	85	%
Storage Humidity	*H*stg	20	90	%
Vibration (10 to 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	7.0	Vdc
	*V*cc2	-0.3	14.4	Vdc
Input Signal Voltage	V_{IS}	-0.3	*V*cc1+0.3	V

2-5. RECOMMENDED OPERATING CONDITIONS

Table-5

Item	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	Vcc1	4.5	5.0	5.5	Vdc
	Vcc2	10.8	12.0	13.2	Vdc
H-Level Input Voltage	V_{IH}	2.0	–	–	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	Icc1	Vcc1=5.0Vdc Vcc2=12Vdc	–	0.1	0.15	A
	Icc2		–	0.5	0.6	A
Power Consumption	–		–	6.5	–	W
Luminance	L		100	200	–	cd/m^2
H-Level Output Voltage	V_{OH}	Vcc1=4.5Vdc I_{OH}=-2mA	4.1	–	–	V
L-Level Output Voltage	V_{OL}	Vcc1=4.5Vdc I_{OL}=6mA	–	–	0.4	V

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

3. BASIC FUNCTION
   3-1. Data write-in
   3-2. Data Read-out
   3-3. Selection of Displaying Page
   3-4. Brightness Adjustment

Table-7

Address	$\overline{CS}$	$\overline{MREQ}$	$\overline{WR}$	$\overline{RD}$	Mode
n000H~n77FH	L	L	L	H	Write-in
n000H~n77FH	L	L	H	L	Read-out
(n+1)000H~(n+1)77FH	L	L	L	H	Page Selection
(n+1)800H~(n+1)FFFH	L	L	L	H	Brightness Adjustment
×	H	×	×	×	Display

(Note 1) "n" in the table represents the figure of 0 to E, even number of the hexadecimal system.
(Note 2) × = irrelevant (any input, including transitions)

3-1. DATA WRITE-IN

The display area corresponds to a 2k bytes area memory map.
Write-in data operates with 8 bits at a time.

Write-in of 8 bits data to addresses of n000H thru n77FH occurs when
$\overline{CS}$="L", $\overline{WR}$="L", $\overline{MREQ}$="L" and $\overline{RD}$="H".

Data "H"=ON (light on), Data "L"=OFF (light off).

Relationship of the display dot to address and data is shown in FIG.1 and FIG.2.

3-2. DATA READ-OUT

The 8 bits data of the displayed pattern can be read-out by selecting address of n000H thru n77FH when $\overline{CS}$="L", $\overline{MREQ}$="L", $\overline{WR}$="H" and $\overline{RD}$="L".

Relationship of the display dot to address and data

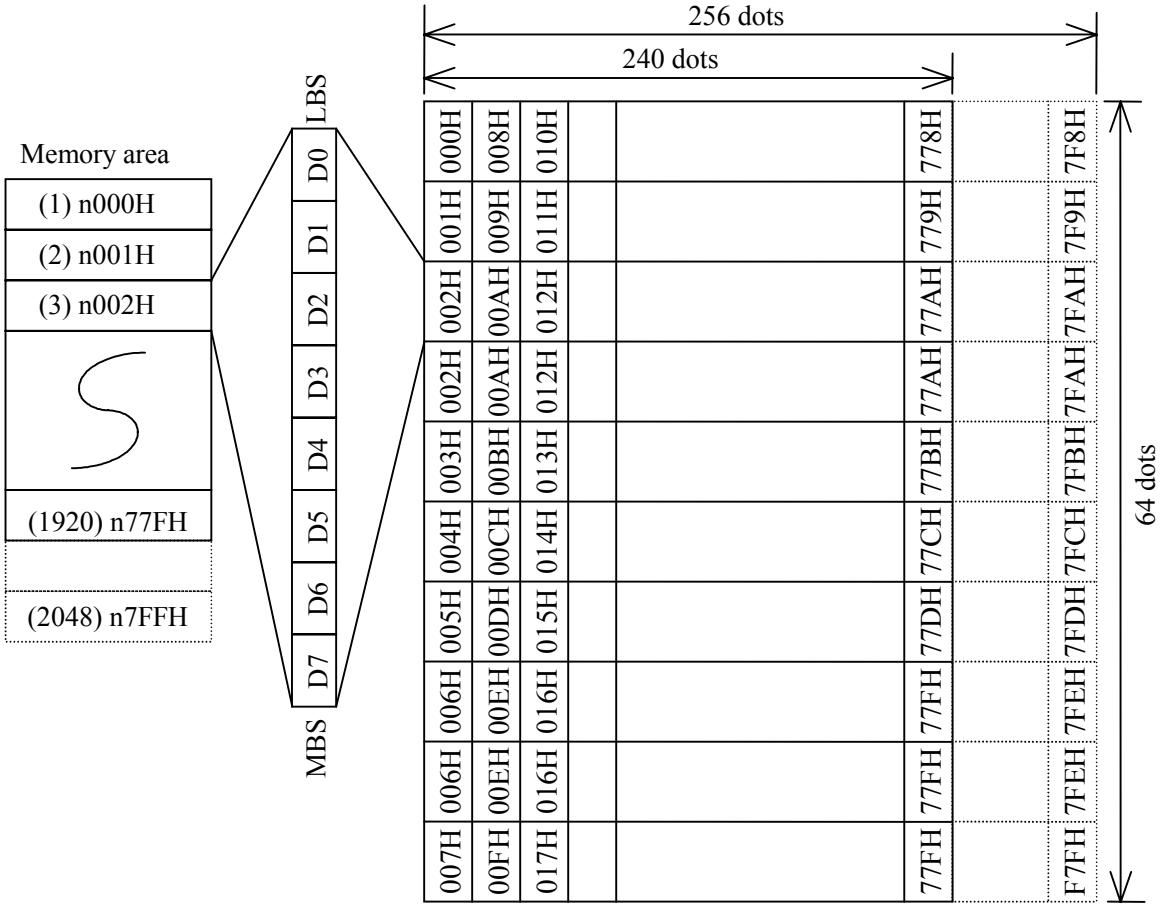


FIG.1 DISPLAY DOT TO ADDRESS AND DATA

Note) The memory area of n780H to n7FFH can not be used for displaying information and should be filled with zero's at power on.

Example of data write-in

To display a letter A on the left top of the screen, data are input in the following way.

Address	Data
n000H	F8H
n008H	24H
n010H	22H
n018H	24H
n020H	F8H

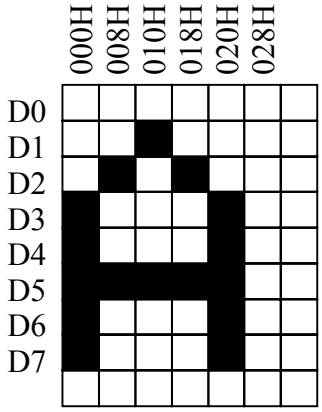


FIG.2 EXAMPLE OF DATA WRITE-IN

3-3. DISPLAY PAGE

This module is equipped with 4 displaying pages.

The desired page can be selected by writing-in any 1 byte to addresses of (n+1)000H thru (n+1)7FFH when $\overline{CS}$="L", $\overline{MREQ}$="L", $\overline{WR}$="L" and $\overline{RD}$="H".

In this case, the data of D7 thru D4 becomes invalid.

Table-8

D3	D2	D1	D0	Mode
×	×	L	L	Displaying page 0.
×	×	L	H	Displaying page 1.
×	×	H	L	Displaying page 2.
×	×	H	H	Displaying page 3.
L	L	×	×	RD/WR allowed for page 0.
L	H	×	×	RD/WR allowed for page 1.
H	L	×	×	RD/WR allowed for page 2.
H	H	×	×	RD/WR allowed for page 3.

3-4. LUMINANCE ADJUSTMENT

Input data (01H~0FH) allows brightness to be adjusted in 15 uniform levels.

Adjustment is performed by writing-in any 1 byte to address of (n+1)800H thru (n+1)FFFH, when $\overline{CS}$="L", $\overline{MREQ}$="L", $\overline{WR}$="L" and $\overline{RD}$="H".

The data of D7 thru D4 becomes invalid.

Table-9

D3	D2	D1	D0	Hex	Luminance(%)
H	H	H	H	F	100.00
H	H	H	L	E	87.50
H	H	L	H	D	81.25
H	H	L	L	C	75.00
H	L	H	H	B	68.25
H	L	H	L	A	62.50
H	L	L	H	9	56.25
H	L	L	L	8	50.00
L	H	H	H	7	43.75
L	H	H	L	6	37.50
L	H	L	H	5	31.25
L	H	L	L	4	25.00
L	L	H	H	3	18.75
L	L	H	L	2	12.50
L	L	L	H	1	6.25
L	L	L	L	0	0

4. CONNECTOR PIN CONNECTION

4-1. CONNECTOR PIN ASSIGNMENT

(1) Connector to Power Supply (CN 1)

Connector : 5045-04A (MOLEX)

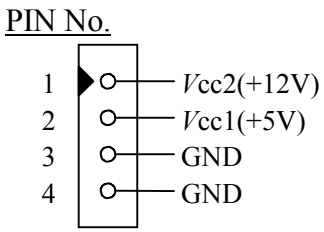
Applicable Connector : 5251-04 (MOLEX) or equivalent

(2) Connector for Signal (CN 2)

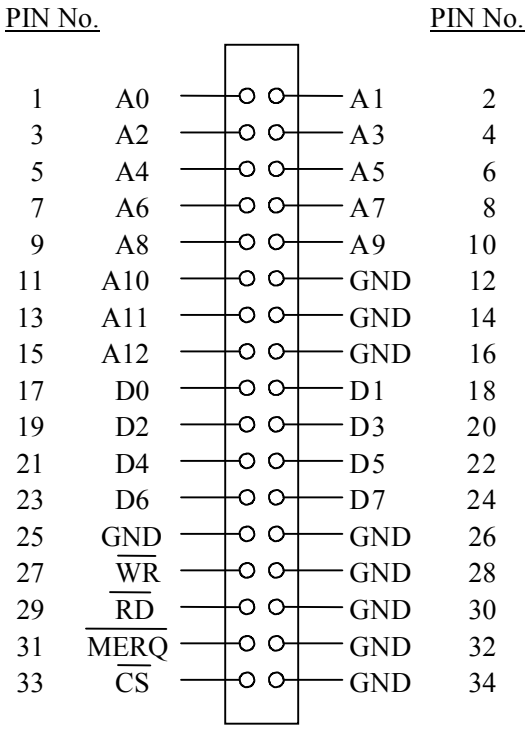
Connector : HIF3FC-34PA-2.54DSA (HIROSE)

Applicable Connector : HIF3BA34D-2.54R (HIROSE) or equivalent

Connector to Power Supply (CN1)



Connector to Signal (CN2)



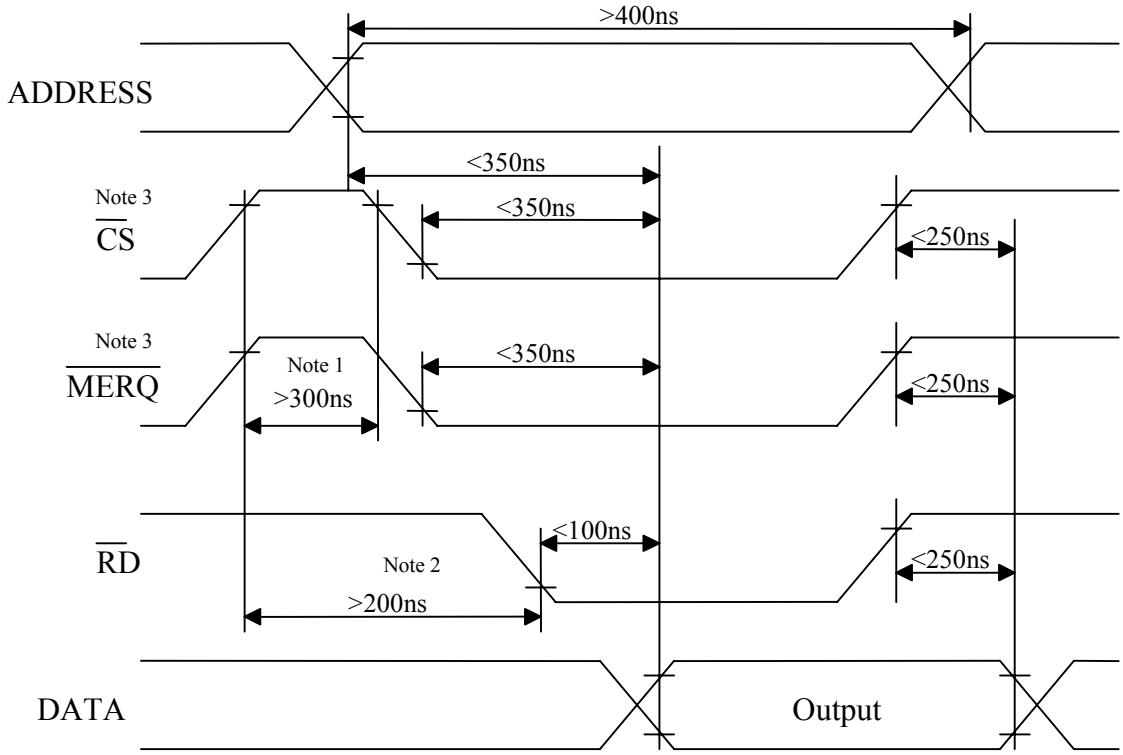
Note)

All GND terminal of CN1 and CN2 are connected together on the PCB.

FIG.3 CONNECTOR PIN ASSIGNMENT

4-2. TIMING CHART FOR WRITE-IN AND READ-OUT

(1) Read - out



(2) Write-in

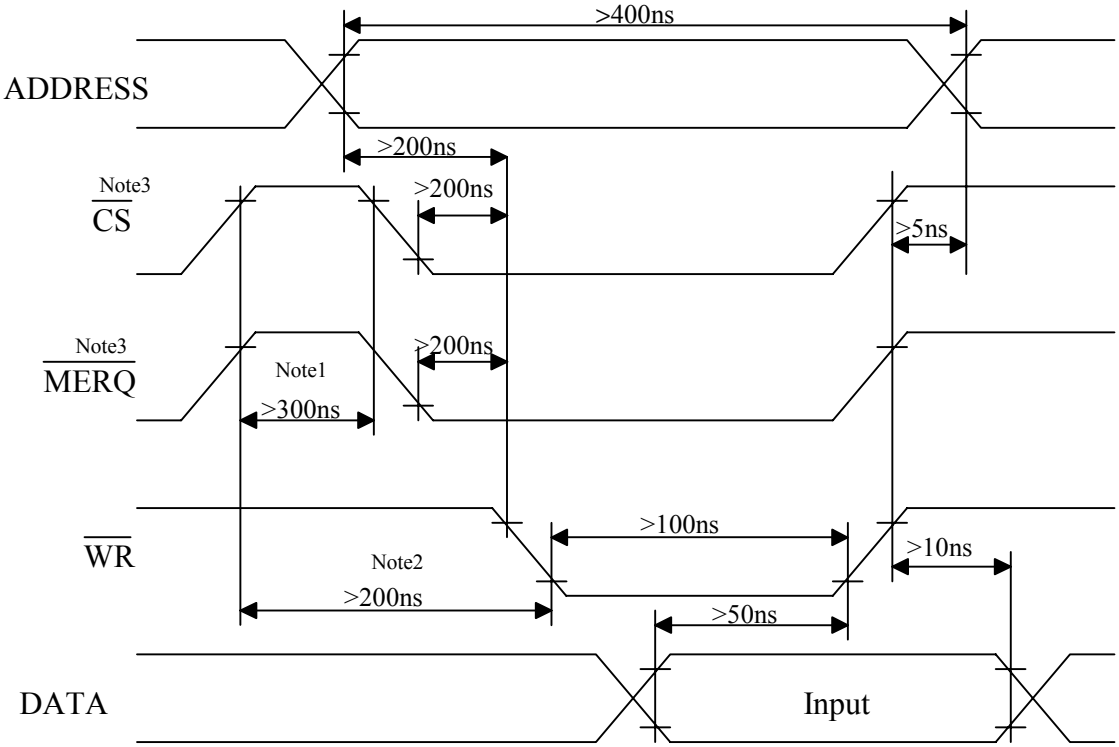


FIG.4 TIMING CHART FOR WRITE-IN AND READ-OUT

Note 1) At each one byte access, the hold-time of high level of $\overline{CS}$ or $\overline{MREQ}$ signal is necessary.

Note 2) Several units are controlled by the $\overline{CS}$ signal, $\overline{RD}$ or $\overline{WR}$ signal shall be kept high-level for 200ns after the rising edge of $\overline{CS}$ signal.

Note 3) Don't apply less than 300 nsec. low signal to $\overline{CS}$ and $\overline{MREQ}$ at the same time.

4-3. INTERFACE CONNECTION

This module can be connected to the host system CPU bus.

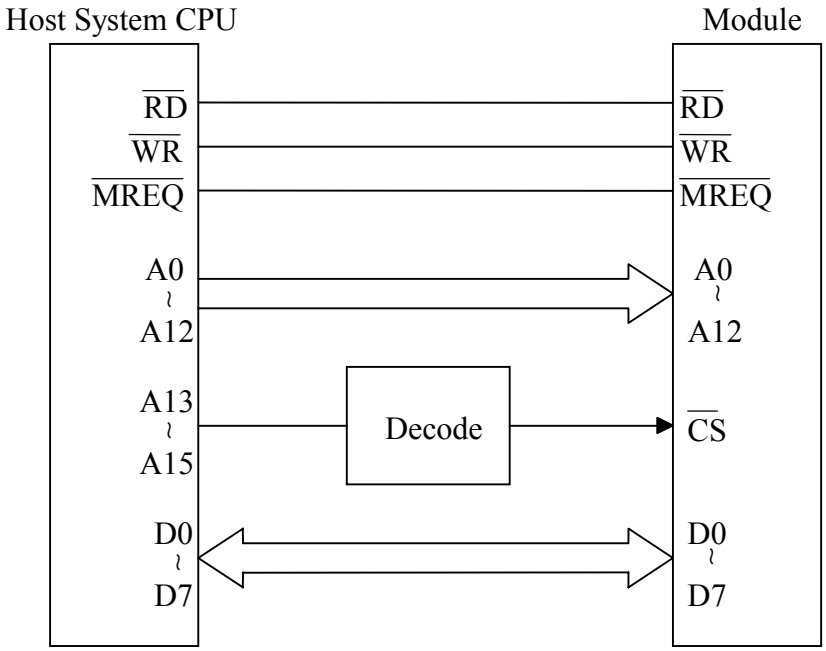


FIG.5 INTERFACE CONNECTION

4-4. ADDRESS DECODING

The module requires the allocation of 8k bytes of memory.

Memory allocation is performed using the chip select signal ($\overline{CS}$) which is obtained by the combination of addresses A13 thru A15.

Table-10

A15	A14	A13	Memory Area for Module Drive
0	0	0	0000H~1FFFH
0	0	1	2000H~3FFFH
0	1	0	4000H~5FFFH
0	1	1	6000H~7FFFH
1	0	0	8000H~9FFFH
1	0	1	A000H~BFFFH
1	1	0	C000H~DFFFH
1	1	1	E000H~FFFFH

4-5. EXAMPLE OF DRIVING MODULE

Initial setting by the host CPU is required for page selection and brightness adjustment at power on.

[Example] Using Z80 as the host CPU, module driving is explained.

(1) By allocating the addresses 8000H thru 9FFFH(8k byte) to the memory area the following division will result: (Ref.page) (3-7)

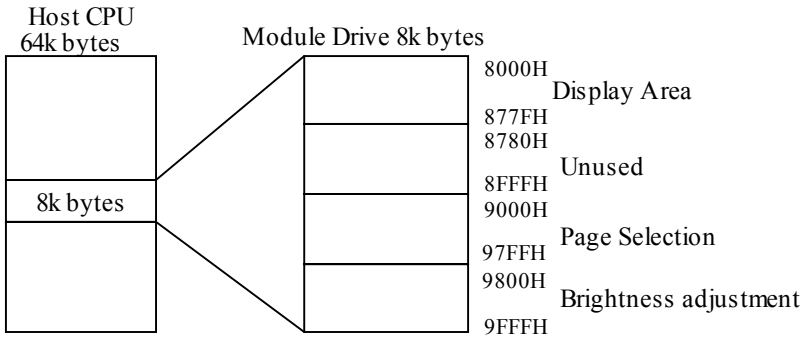
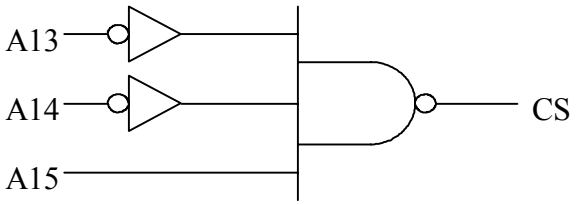


FIG.6 EXAMPLE OF DRIVING MODULE

(2) To generate the CS signal: (3-7)

→ To make $\overline{CS}$ signal, $\overline{CS}$="L" when A15="H", A14=A13="L".



(3) Power on (*V*cc1, *V*cc2 -CN1) (2-6,3-3)

→ Page 0 is selected, but nothing will be displayed.
unless execute (5).

(4) Write-in 00H to 8000H thru 89EEH. (3-1)

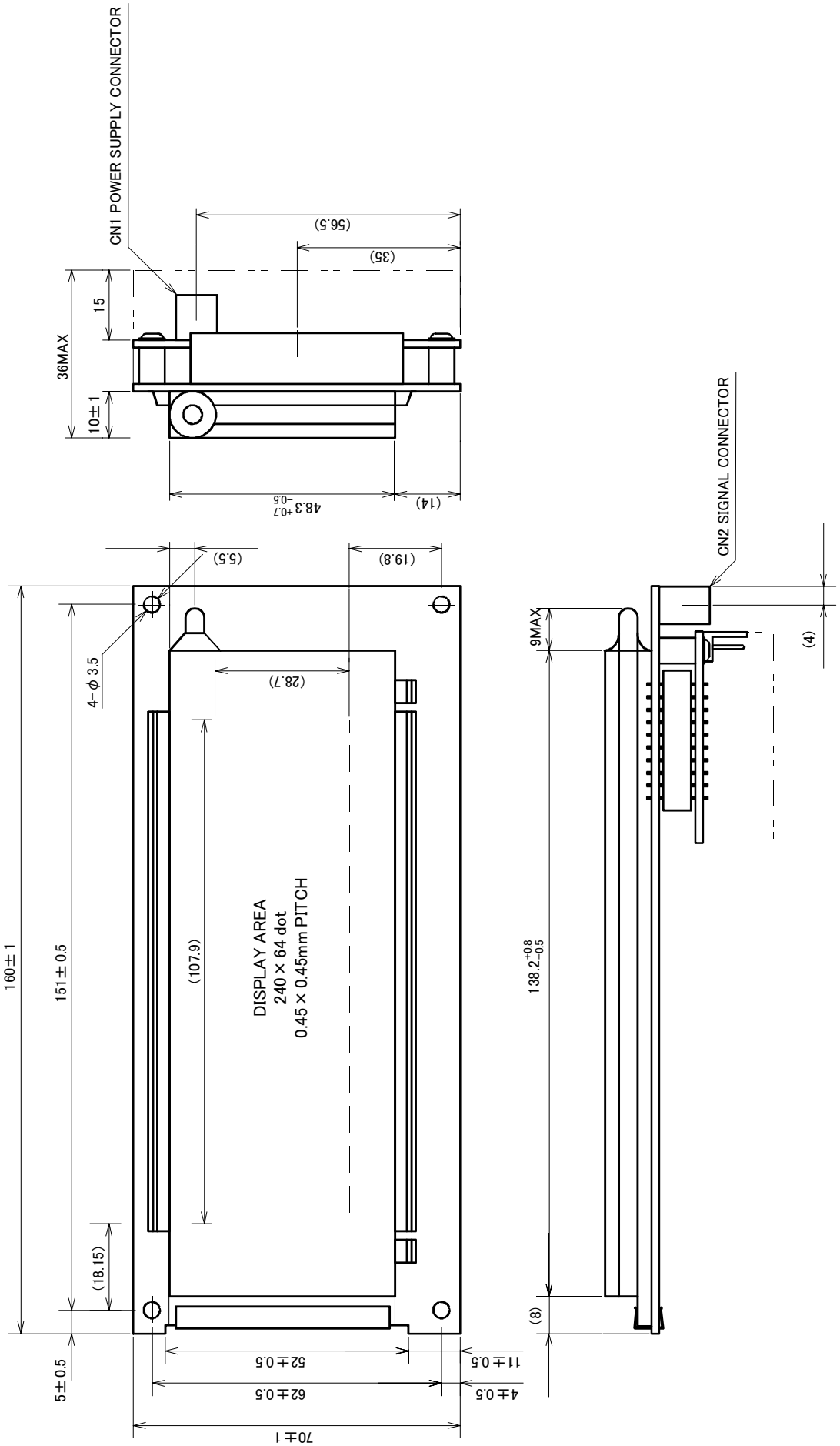
→ If this is eliminated, Random pattern will be displayed.

(5) Write-in 0FH to 9800H. (3-4)

→ Brightness adjustment is 100% (the typical rated brightness).

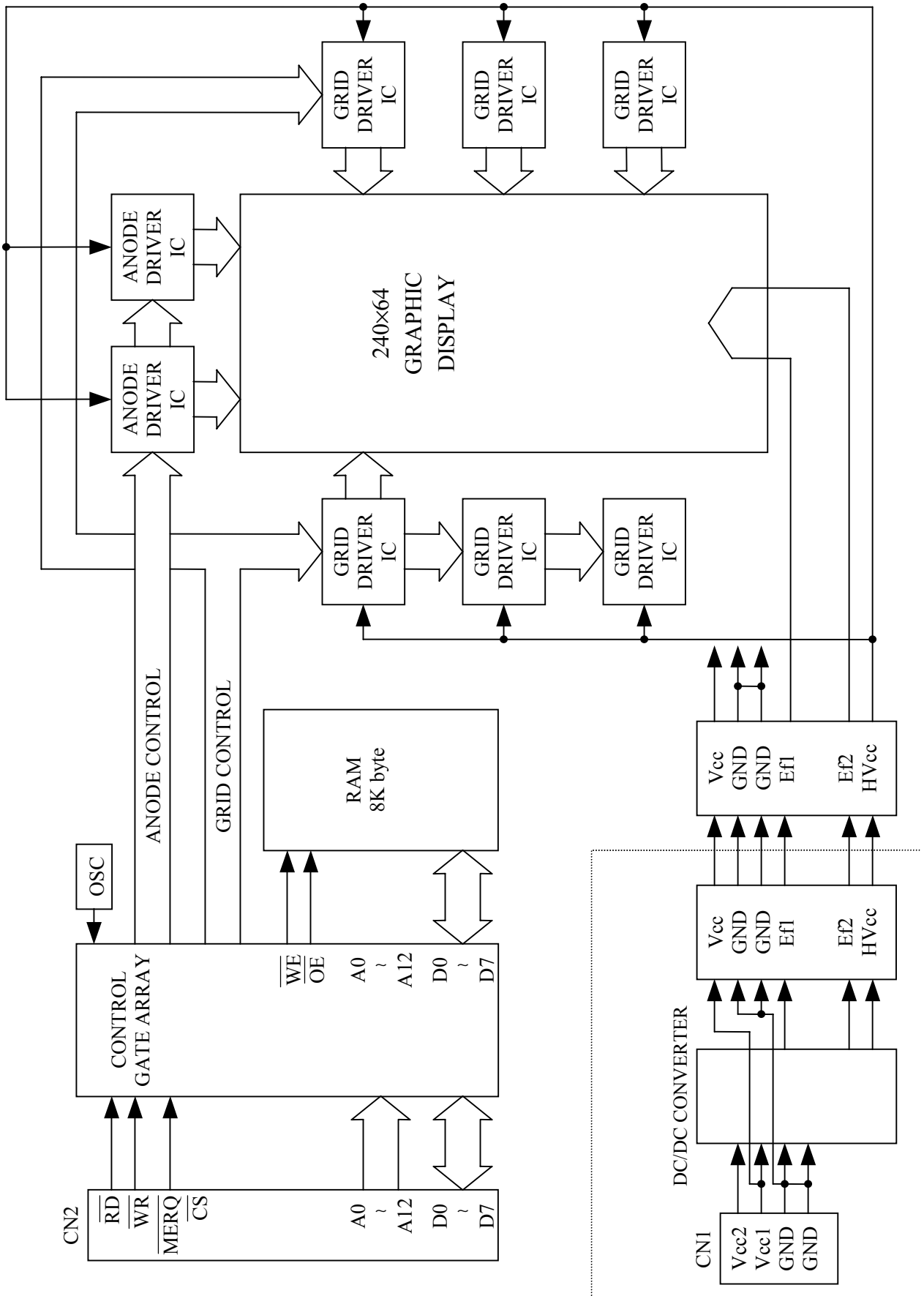
GP1009C10A　OUTER DIMENSIONS

FIGURE-1



GP1009C10A　CIRCUIT BLOCK DIAGRAM

FIGURE-2



5. WARRANTY

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

6. CAUTIONS FOR OPERATION

6-1. Since VFDs are made of glass material.
Avoid applying excessive shock or vibration beyond the specification for the module.
Careful handing is essential.

6-2. 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.

6-3. Avoid plugging or unplugging the interface connection with the power on.

6-4. DC/DC converter is equipped on the module, the surge current may be approximately 5 times the specified supply current at the power on.

6-5. The DC/DC converter generated approximately 100Vdc, avoid touching it with bare hands, ot to other circuits.

6-6. 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 50cm.
(When the longer cable is required, please confirm there is no noise affection.)

6-7. 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.

6-8. The fuse is mounted on the module as circuit protection.
If the fuse blown, the problem shall be solved first and change the fuse.

6-9. 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.

REMARKS :

The specification is subject to change without prior notice.
Your consultation with FUTABA sales office is recommended for the use of this module.