Futaba®

AN-E-2246

APPLICATION NOTE

VACUUM FLUORESCENT DISPLAY MODULE

CHARACTER DISPLAY MODULE

M202SD08GS

GENERAL DESCRIPTION

Futaba Vacuum Fluorescent Display M202SD08GS, with Futaba VFD 202-SD-08GK display, produces 20 digits on 2 rows.
Each character is displayed in 5×7 dot matrix with the cursor under it.
Consisting of a VFD, microcomputer, driver IC, the module can be connected directly to the system bus, thus simplifying interfacing.
The bright and aesthetically pleasing VFD makes the module desirable for application in office equipments, computer terminals, measuring equipment, etc.

⚠ 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.55V) 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. Using one chip computer, the module can be connected to the system bus directly.

1-2. Two hundred fourteen different characters consisting of alpha-numeric and other symbols can be displayed.

1-3. By using dimming function, brightness can be controlled into four levels.

1-4. Since a DC-DC converter is included, only a 5V power source is required to operate the module.

1-5. High quality reliability and long life can be achieved with FUTABA VFD.

1-6. Either parallel or serial mode can be selected as the data input.
Serial baud-rate is set on 9600bps, and it can be selected 4800,2400,1200bps with jumper.

1-7. The module's compact, light and thin mechanical sizing allows for maximum mounting flexibility.

2. GENERAL SPECIFICATIONS

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

Table-1

Item	Specification	Unit
Outer Dimension	(W) 155±1 (H) 43±1 (T) 20.6 Max. (except the connector)	mm
Weight	Approx. 100	g

2-2. SPECIFICATIONS OF THE DISPLAY PANEL

Table-2

Item	Specification	Unit
Display Area	17.5(H)×102.3(W)	mm
Number of Digits	20digits(5×7dot+cursol)×2rows	—
Dot Pitch (H×W)	0.75(H)×0.75(W)	mm
Dot Size (H×W)	0.5(H)×0.5(W)	mm
Color of Illumination	Green(λp=505nm)	—

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	*T*opr	-20	+70	℃
Storage Temperature	*T*stg	-40	+85	℃
Operating Humidity (note)	*H*opr	20	85	%
Storage Humidity (note)	*H*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*cc	—	7.0	V
Input Signal Voltage	V_{IS}	-0.3	*V*cc+0.3	V

2-5. RECOMMENDED OPERATING CONDITIONS

Table-5

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage	Vcc	－	4.5	5.0	5.5	V
H-Level Input Voltage	V_{IH}	Vcc＝5.0V	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	Icc	Vcc＝5.0V All on	－	350	500	mA
Power Consumption	－		－	1.75	2.5	W
Luminance	L		340	690	－	cd/m^2
H-Level Output Voltage	V_{OH}	Vcc＝5.0V I_{OH}＝-2.6mA	2.4	－	－	V
L-Level Output Voltage	V_{OL}	Vcc＝5.0V I_{OL}＝12mA	0.25	－	0.4	V

Note) The surge current can be approx.10 times the specified supply current at power on.

3. FUNCTION

The module has data and control code write, self test and power on reset functions.

3-1. DATA AND CONTROL CODE WRITE-IN

Table-7

	$\overline{TEST}$	$\overline{SEL}$	$\overline{WR}$	RXD	Function
Parallel and Serial Interface	L	X	X	X	Self Test
Parallel Interface	H or NC	L	↑	NC	Data and control code write in
Serial Interface	H or NC	NC	NC	*	Data and control code write in

L : Low Level(0V)
H : High Level(5V)
NC : Non Connection
↑ : Low to high Transition
* : RXD (Serial Input)
X : Low or High

Table-7 DATA AND CONTROL CODE WRITE-IN

When the data is being written in, the BUSY signal is active which indicates that the module is processing the data.
(When the data is under processing, the BUSY signal is high "H".)
The display character form follows equivalent to ASCII (Alphabet, Numeric and Symbols etc.).
After display character is written in, the cursor will be shifted to the right one digit automatically.
The above action can be executed, only when the BUSY signal is low "L".

3-2. CONTROL CODE

The control are available as follows.
The details will be explained on the next page.

(1)	DIM	:	Dimming	(04 HEX)
(2)	BS	:	Back Space	(08 HEX)
(3)	HT	:	Horizontal Tab	(09 HEX)
(4)	LF	:	Line Feed	(0A HEX)
(5)	CR	:	Carriage Return	(0D HEX)
(6)	DP	:	Display Position	(10 HEX)
(7)	DC1	:	Normal Display Mode	(11 HEX)
(8)	DC2	:	Vertical Scroll Mode	(12 HEX)
(9)	DC3	:	Cursor ON Mode	(13 HEX)
(10)	DC4	:	Cursor OFF Mode	(14 HEX)
(11)	RST	:	Reset	(1F HEX)

(1)DIM (Dimming):

Brightness can be controlled into four levels by using this function.
After writing 04H, next one HEX byte as below mentioned is written to change the brightness out put.

1 byte	+	1 byte
(DIM command code), 04H		Dimming level data

Table-8

Dimming level	Data
100 %	FFH
60 %	60H
40 %	40H
20 %	20H

(2)BS (Back Space):

DC1 Mode …… The cursor position (write-in Position) is shifted to the left one digit. (beyond this point, the position of cursor is identical with write-in position of the display, unless otherwise specified. Under DC4 Mode, the cursor will not show up.)
When the cursor is on the most significant digit of the second row, the cursor moves to the least significant digit of the first row.
When the cursor is on the most significant digit of the first row, the cursor moves to the least significant digit of the second row.

DC2 Mode …… The same as above.

(3)HT (Horizontal Tab):

DC1 Mode …… The cursor position is shifted to the right one digit.
When the cursor is on the least significant digit of the first row, the cursor moves to the most significant digit of the second row.
When the cursor is on the least significant digit of the second row, the cursor moves to the most significant digit of the first row.

DC2 Mode …… When the cursor is on the least significant digit of the second row, the characters displayed in the second row are shifted up to the first row and the cursor moves to the most significant digit of the second row. Subsequently, the second row is cleared.

(4)LF (Line Feed):

DC1 Mode …… The cursor moves up or down to another row staying on the same line.

DC2 Mode …… When the cursor is in the second row, the character displayed there, is shifted up to the first row, leaving the cursor at its present position, then the second row is cleared.
When the cursor is in the first row, the same as DC1 Mode operation.

(5)CR (Carriage Return):

DC1 Mode …… The cursor moves to the most significant digit of the same row.

DC2 Mode …… The same as DC1 Mode operation.

(6)DP (Display Position):

Instead of writing the character from the first digit, the write-in starting position can be pointed by using this function.
After writing 10HEX to prepare module for this command, another HEX byte is written to specify the position desired.
A third byte representing data is then sent.

	The most significant digit	The least significant digit
1st row	00 HEX	13 HEX
2nd row	14 HEX	27 HEX

DC1-DC6 selects the display mode.

(7)DC1 (Normal Display Mode):

After writing a character, the cursor is shifted to the right one digit automatically.
When the cursor is on the least significant digit of the first row, the cursor moves to the most significant digit of the second row.
When the cursor is on the least significant digit of the second row, the cursor moves to the most significant digit of the first row.

(8)DC2 (Vertical Scroll Mode):

After writing the characters up to the least significant digit of the second row, all the characters displayed in the second row are shifted to the upper row (first row), clearing the second row.
When the power is turn on, this DC2 Mode is selected, and will be held until another mode is selected.

(9)DC3 (Cursor ON Mode):

The cursor is displayed. When the power is turn on, this DC3 Mode is selected and will be held until another mode (DC4) is selected.

(10) DC4 (Cursor OFF Mode):

The cursor won't be displayed.

(11) RST (Reset):

Resetting the module.
All the characters displayed are erased, then the write-in position (cursor position) is set on the most significant digit of the first row.
The displaying status is the same as the Power on Reset.
The display mode is set for DC2. The cursor mode is set for DC3.

3-3. SELF-TEST

$\overline{TEST}$ ="L" (connector pin #16 is connected to GND.) starts the Self-Test.
Then the display shows all characters, Alphabet, Numeric and symbols, in that order.
Forty (2×20) characters are displayed at a time.
Using this mode, neither data write-in nor control code write-in is allowed.
To release this mode, $\overline{TEST}$ must be set to "H".

3-4. POWER ON RESET

When the module is turned on, the display and the memory are cleared and the module is initialized.
The display mode is set for DC2, and the cursor mode is set for DC3.
The font table is set for DC6.

3-5. SELECTION OF INPUT MODE

Table-10 shows the combinations of the signal lines for the parallel or serial input. Users must choose of the combinations.
Unused signal lines are to be open (internally pulled up).

・Serial Input

Baud rate is selected by J1～J2.

J1, J2 } Baud rate select

Table-9

J1	short	open	short	open
J2	short	short	open	open
Baud rate	1200bps	2400bps	4800bps	9600bps

Note) J1 and J2 are opened when a module is shipped.

Table-9 BAUD RATE SELECTION

4. INTERFACE CONNECTION

4-1. CONNECTOR PIN CONNECTION

Connector : A1-20PA-2.54DSA (HIROSE) or equivalent
Socket : HIF3BA-20D-2.54R (HIROSE) or equivalent

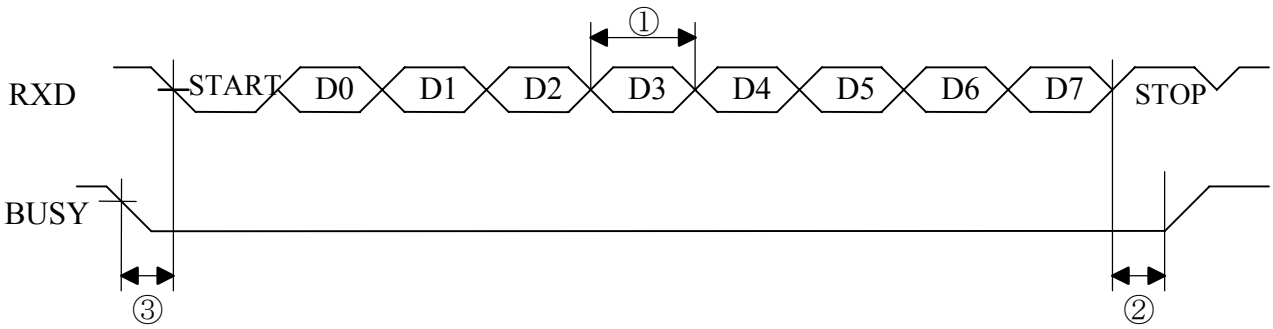
Table-10

Pin No.	Signal	Serial In	Parallel In	Pin No.	Signal	Serial In	Parallel In
1	D7	NC	○	2	+5V	○	○
3	D6	NC	○	4	+5V	○	○
5	D5	NC	○	6	+5V	○	○
7	D4	NC	○	8	GND	○	○
9	D3	NC	○	10	GND	○	○
11	D2	NC	○	12	GND	○	○
13	D1	NC	○	14	GND	○	○
15	D0	NC	○	16	$\overline{\text{TEST}}$	○	○
17	$\overline{\text{WR}}$	NC	○	18	$\overline{\text{SEL}}$	NC	○
19	RXD	○	NC	20	BUSY	○	○

NC : No-Connection
○ : Connection

4-2. WRITE-IN TIMING

4-2-1. Serial Input



① t(DATA) $=10^6$/Baud rate [μs]
(This depends on the selection of the baud rate)
② t(DATA) /2 [μs] (BUSY becomes "H" at the center of stop bit.)
③ t(WAIT) : 0 min. [μs]

FIG 1. TIMING FOR WRITE-IN

4-2-2. Parallel Input

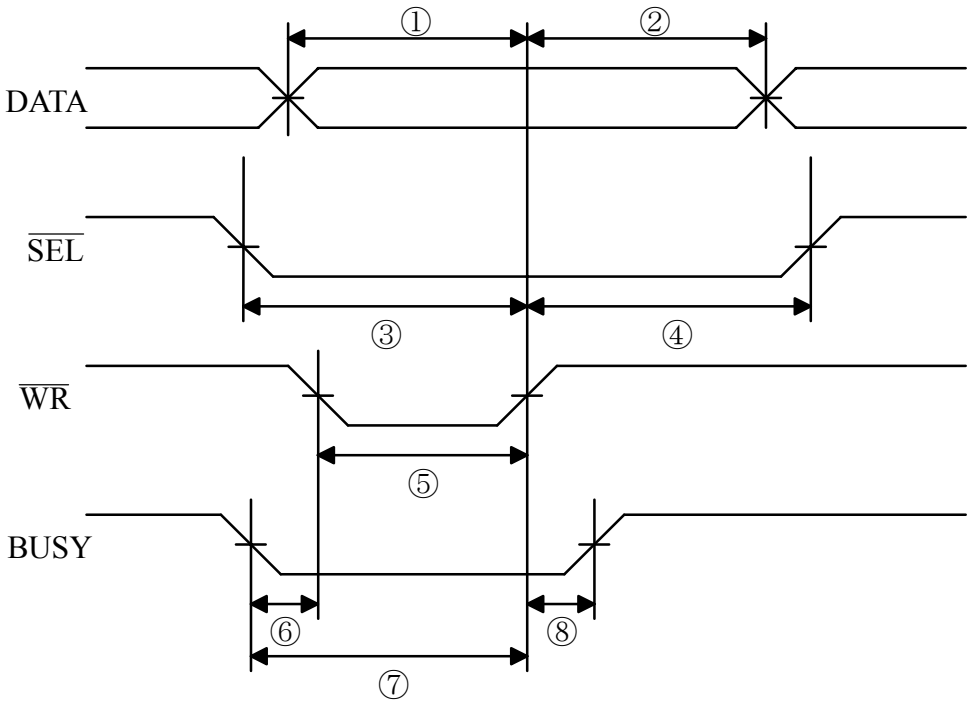


FIG.2. WRITE-IN TIMING

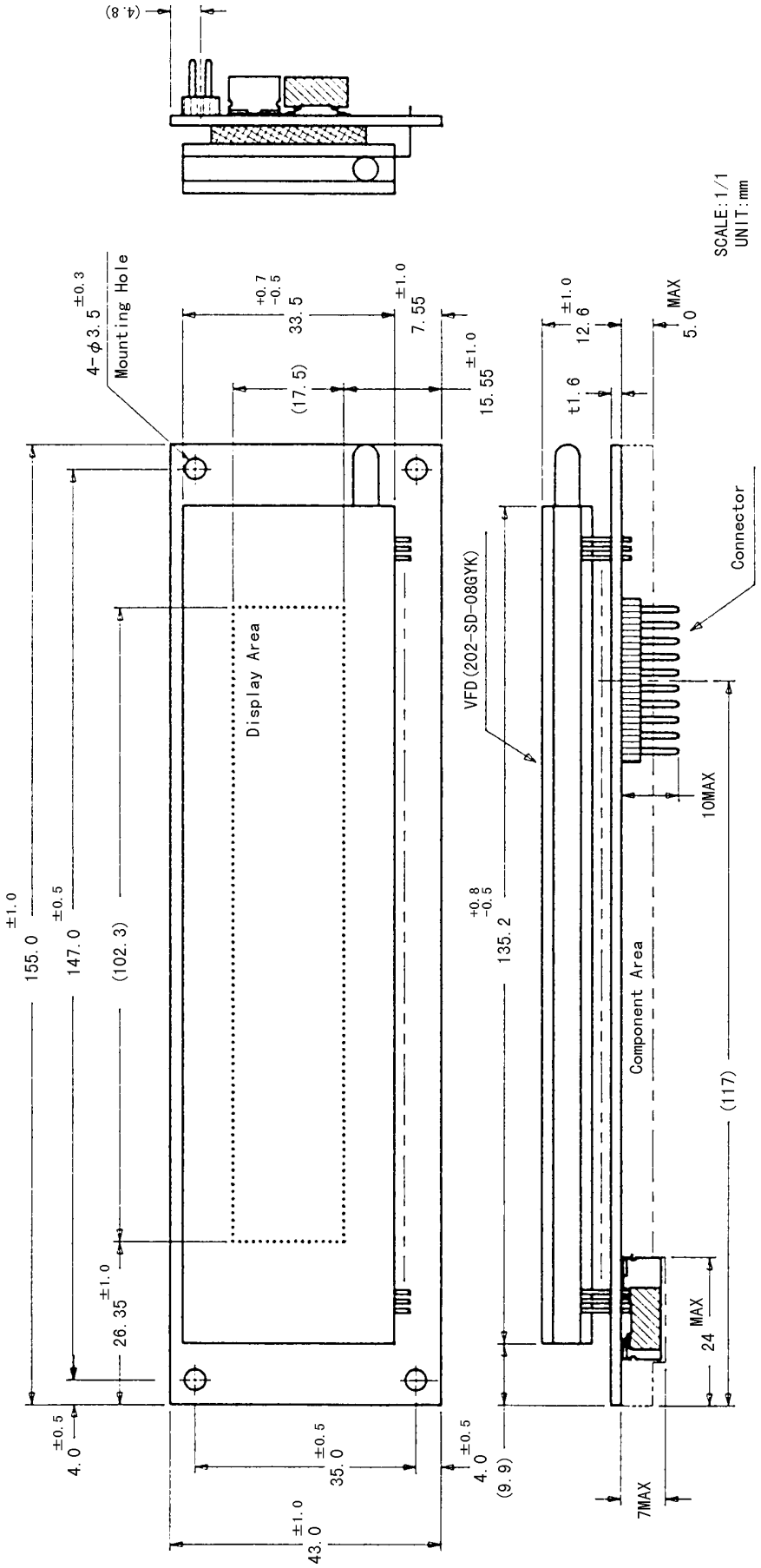
WR

Table-11

		Min.	Max.	Note
①	*t*su(DATA)	50ns	—	
②	*t*h(DATA)	50ns	—	
③	*t*su(SEL)	50ns	—	
④	*t*h(SEL)	50ns	—	
⑤	*t*pw(WR)	50ns	—	
⑥	*t*wait(1)	0ns	—	
⑦	*t*wait(2)	250ns	—	For Min. 250ns, WR should not be active (positive H), after BUSY is "L".
⑧	*t*delay	—	50ns	

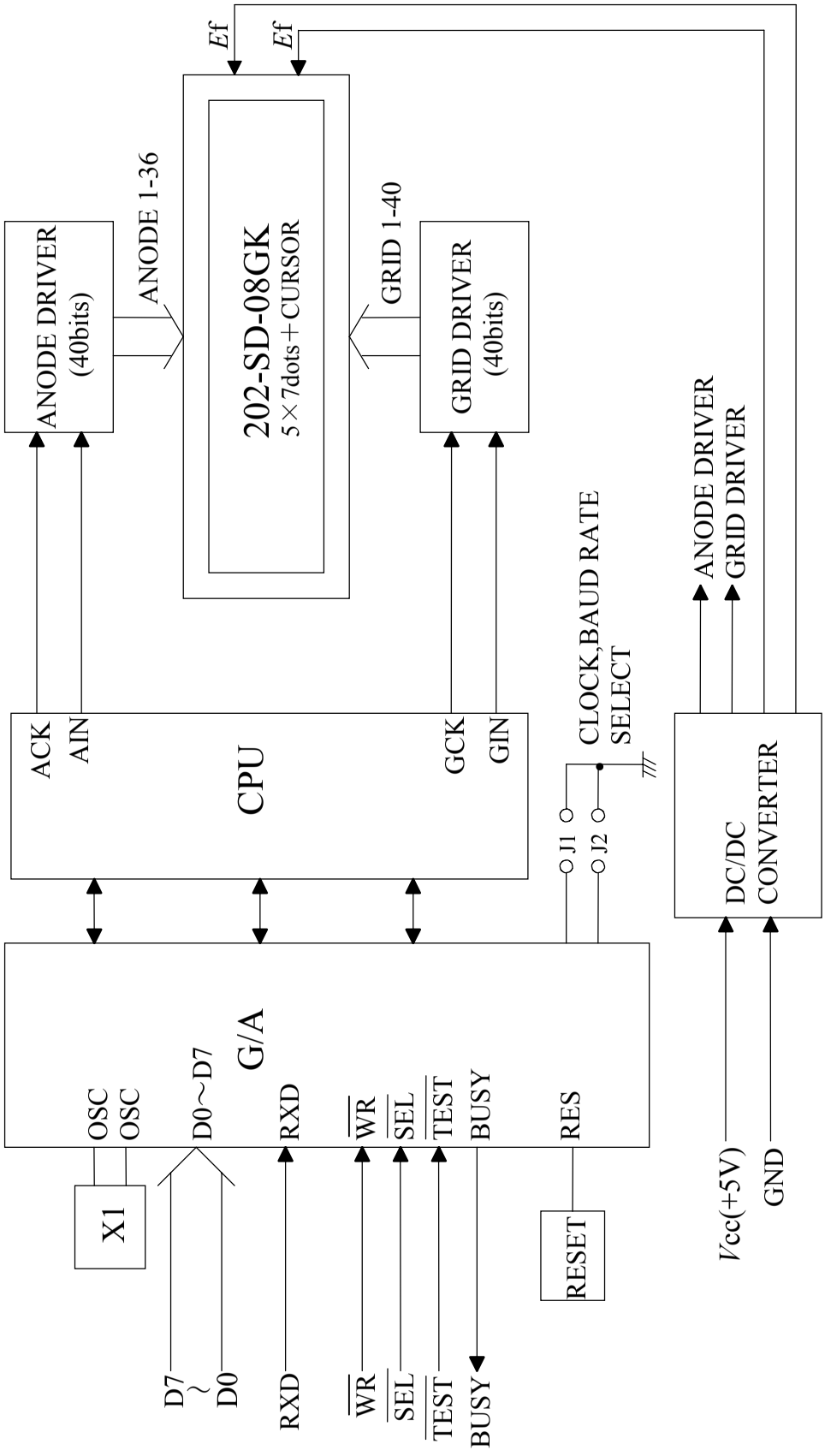
M202SD08GS MECHANICAL DRAWING

FIGURE-1



M202SD08GS CIRCUIT BLOCK DIAGRAM

FIGURE-2



M202SD08GS DISPLAY CHARACTER CODE (Europe Font)

FIGURE-3

D7 D6 D5 D4 / D3 D2 D1 D0		0 0 1 0	0 0 1 1	0 1 0 0	0 1 0 1	0 1 1 0	0 1 1 1	1 0 0 0	1 0 0 1	1 0 1 0	1 0 1 1	1 1 0 0	1 1 0 1	1 1 1 0	1 1 1 1
		2	3	4	5	6	7	8	9	A	B	C	D	E	F
0 0 0 0	0	SP													
0 0 0 1	1														
0 0 1 0	2														
0 0 1 1	3														
0 1 0 0	4														
0 1 0 1	5														
0 1 1 0	6														
0 1 1 1	7														
1 0 0 0	8														
1 0 0 1	9														
1 0 1 0	A														
1 0 1 1	B														
1 1 0 0	C														
1 1 0 1	D														
1 1 1 0	E														
1 1 1 1	F														

SP : SPACE

5. WARRANTY

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

6.OPERATING RECOMMENDATIONS

6-1. Avoid applying excessive shock or vibration beyond the specification for this module.

6-2. Since VFDs are made of glass material, careful handling is important.
Avoid applying any shock to the exhaust chip of the display, it may easily to break.

6-3. Applying lower voltage than specified may cause non activation for the selected pixels.
Conversely, higher voltage may cause non-selected pixels to be activated.
If users observe the above phenomenon, check the voltage level of the power supply.

6-4. Avoid plugging or unplugging the interface connection with the power on.

6-5. If the start up time of the supply voltage is slow, the CPU may not be reset.
The supply voltage must be risen up to a specified voltage level within 30msec.

6-6. Avoid using the module where excessive noise interference 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 contact FUTABA engineering.).

6-7. When power supply is turned off, the capacitor isn't discharged immediately.
The high voltage applied to the VFD must not contact the controller IC.
(The shorting of the mounted components within 30sec. after power off may cause damage.)

6-8. The module equips a fuse. When some abnormality happen such as open/short circuit, defective component, the fuse will be blown and it will be prevented from accident.

REMARKS:

This specification is subject to change without prior in order improve the design and quality.
Your consultation with FUTABA sales office is recommended for the use of this module.