VACUUM FLUORESCENT DISPLAY MODULE

ENGINEERING PROPOSAL

M20SD03GS

EVALUATION

☐ ACCEPTED WITHOUT ANY CHANGE

☐ THE FOLLOWING CHANGE IS REQUIRED.

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FUTABA CORPORATION

VFD MODULE GROUP

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1. SCOPE

This specification applies to the VFD module manufactured by FUTABA Corp.

2. GENERAL DESCRIPTION

FUTABA reserves the right to make change at any time in order to improve design and to supply the best product possible.

3. GENERAL SPECIFICATIONS

3-1. DIMENSIONS, WEIGHT (Refer APPENDIX-1)

Table-1

Item	Specification	Unit
Outer Dimension	(W) 150±1 (H) 31±1 (T) 18.6 Max. (except the connector)	mm
Weight	Approx. 60	g

3-3. SPECIFICATIONS OF THE DISPLAY PANEL

Table-2

Item	Specification	Unit
Display Area	5.0(H)×92.8(W)	mm
Number of Digits	20digits(5×7dot)×1row	—
Digits Size (H×W)	4.7	mm
Digits Pitch	5.0(H)×3.5(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.

3-4. ENVIRONMENT CONDITIONS

Table-3

Item	Symbol	Min.	Max.	Unit
Operating Temperature	*T*opr	0	+50	℃
Storage Temperature	*T*stg	-20	+70	℃
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.

3-5. ABSOLUTE MAXIMUM RATINGS

Table-4

Item	Symbol	Min.	Max.	Unit
Supply Voltage	V_{CC}	—	7.0	V
Input Signal Voltage	V_{IS}	-0.4	5.5	V

3-6. RECOMMENDED OPERATING CONDITIONS

Table-5

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage	V_{CC}	—	4.5	5.0	5.5	V
H-Level Input Voltage	V_{IH}	V_{CC}=5.0V	2.0	—	—	V
L-Level Input Voltage	V_{IL}		—	—	0.8	V

3-7. ELECTRICAL CHARACTERISTICS

Table-6

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Current	I_{CC}	V_{CC}=5.0V All on	—	150	250	mA
Power Consumption	—		—	0.75	1.25	W
Luminance	L		340 (100)	690 (200)	— (—)	cd/m^2 (fL)
H-Level Input Current	I_{IH}	V_{CC}=5.0V	—	—	20	μA
L-Level Input Current	I_{IL}	V_{CC}=0V	—	—	-0.36	mA
H-Level Output Voltage	V_{OH}	V_{CC}=5.0V I_{OH}=-2.6mA	2.4	—	—	V
L-Level Output Voltage	V_{OL}	V_{CC}=5.0V I_{OH}=12mA	0.25	—	0.4	V

Note) The surge current can be approx. 2~3 times the specified supply current at power on.

4. FUNCTION

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

4-1. DATA AND CONTROL CODE WRITE-IN

Table-7

$\overline{TEST}$	$\overline{WR}$	$\overline{SEL}$	FUNCTION
H or NC	L→H	L	Data and control code write in
L	—	—	Self Test Mode

L : LOW Level
H : HIGH Level
NC : OPEN

Table-7 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 data or control command is to be written in at the rising edge of $\overline{WR}$="L"→"H", when $\overline{SEL}$="L".
The display character from follows equivalent to ASCII (Alphabets, 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 the BUSY signal is low "L".

4-2. 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	:	Auto Carriage Return Mode	(11 HEX)
(8)	DC2	:	Over Write Mode	(12 HEX)
(9)	DC3	:	Horizontal Scroll Mode	(13 HEX)
(10)	DC4	:	Reset	(1F HEX)

(1) DIM (Dimming) :

Brightness can be controlled into four levels by using this function.
After writing 04H, another HEX byte mentioned under 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) :

The write-in position (cursor position) is shifted to the left one digit.
When the write-in position is on the most significant digit, this command is ignored.

(3) HT (Horizontal Tab):
The write-in position is shifted to the right one digit.
When the write-in position is on the least significant digit, the command is ignored.

(4) LF (Line Feed):
All the characters displayed are erased.
The write-in position remains on the present digit.

(5) CR (Carriage Return):
All the characters displayed are erased and the write-in position is shifted to the most significant digit.

(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 Data 10 HEX, the successive one byte of data will be accepted as the display position. The BUSY status must be low "L".

The most significant digit	The least significant digit
00 HEX	13 HEX

DC1-DC3 selects the write-in mode after a data is written to the least significant digit.

(7) DC1 (Auto Carriage Return):
All The characters displayed are erased, then write-in position is set on the most significant digit.
When a character is written to the least significant digit, the write-in position stays on this digit.
When the next data is written-in, all the characters displayed are erased, and this character is written to the significant digit.
Then the write-in position is set on the second digit.

(8) DC2 (Over Write Mode):
The write-in position is fixed on the least significant digit.

(9) DC3 (Horizontal Tab):
All the characters displayed are shifted to the left one digit, and a new character is written on the least significant digit.
The write-in position is fixed on this digit.

(10) RST (Reset) :
Resetting the module.
All the characters displayed are erased, then the write-in 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 DC1.

4-3. 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.

Twenty 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".

4-4. 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 DC1.

4-5. SELECTION OF INPUT MODE

Table-9 shows the combinations of the signal lines for the parallel or serial input. Users must choose of the combinations.

Unused signal line are to be open (internally pulled up).

・Serial Input

Baud rate is selected by J1～J2.

J1, J2 } baud rate select

Table-10

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

Table-10 BAUD RATE SELECTION

5. INTERFACE CONNECTION

5-1. CONNECTOR PIN CONNECTION

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

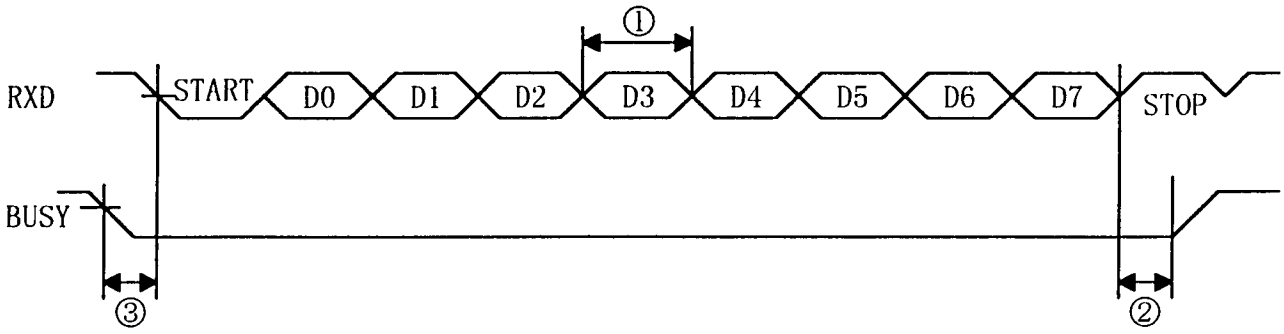
Table-11

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

5-2. WRITE-IN TIMING

5-2-1. 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

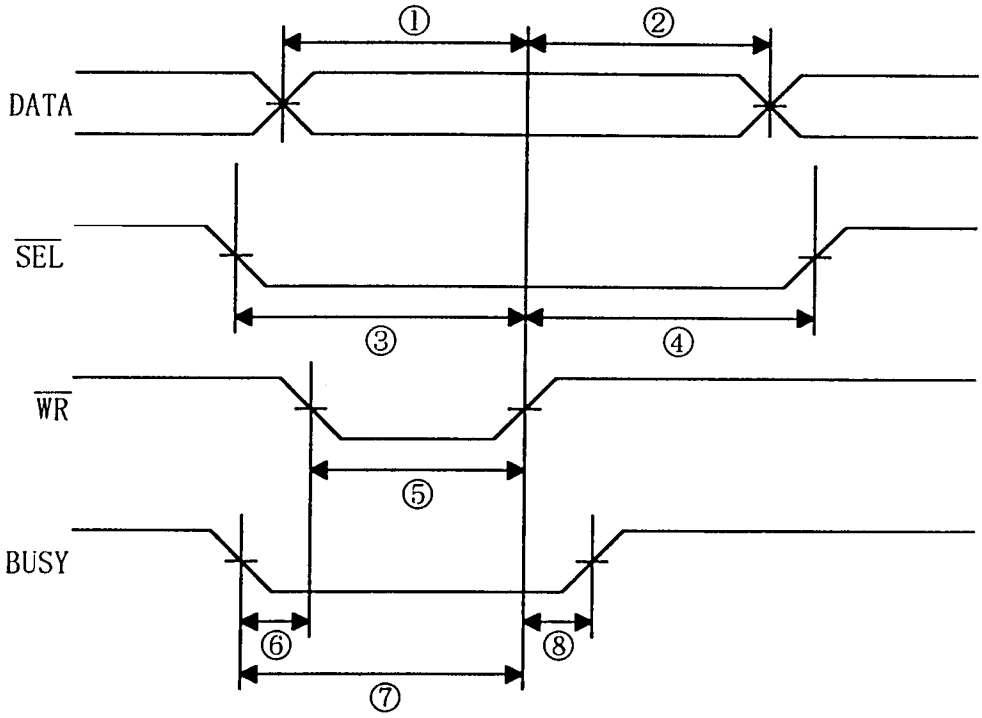
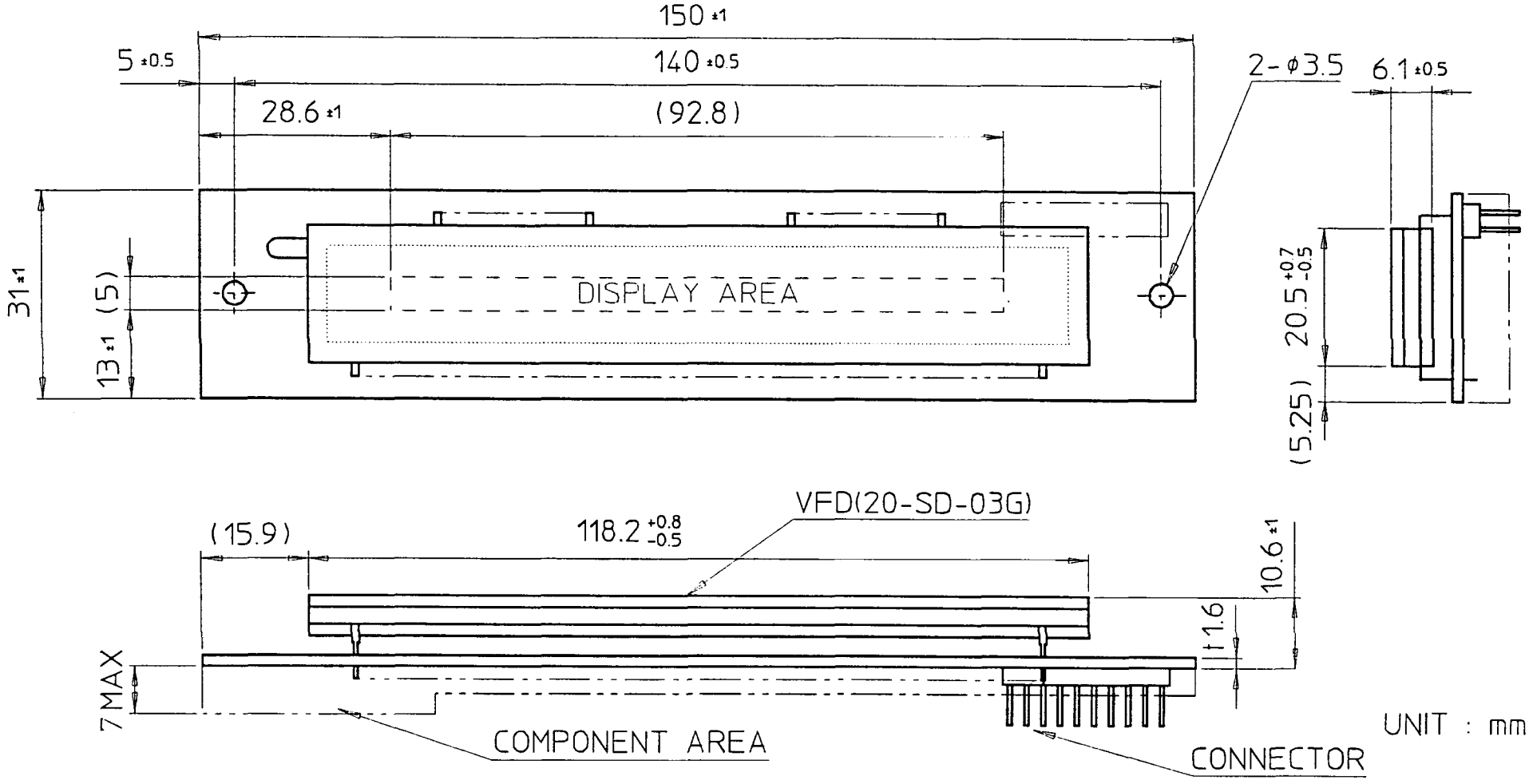


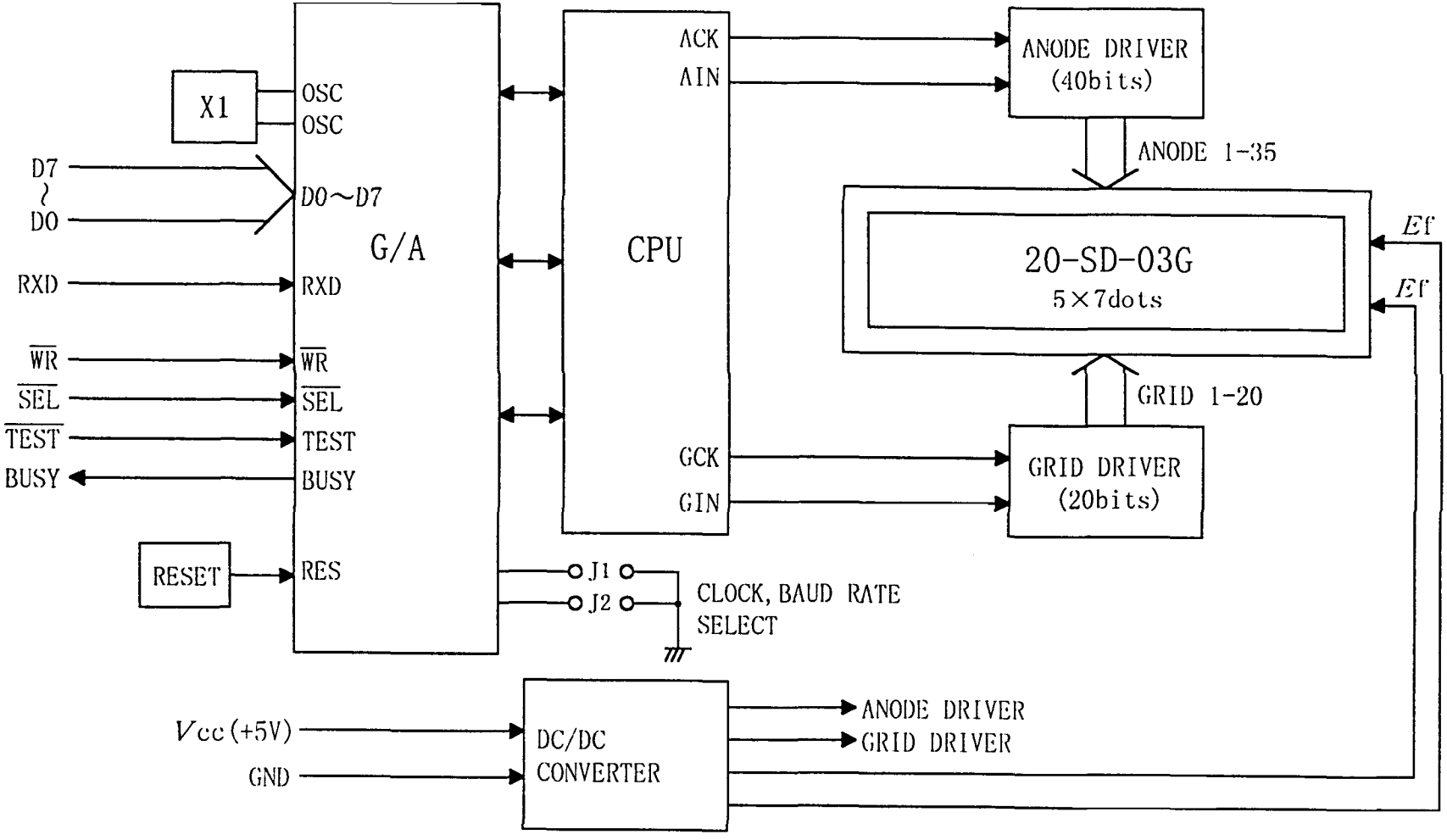
FIG. 2. WRITE-IN TIMING

Table-12

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



M20SD03GS MECHANICAL DRAWING



M20SD03GS CIRCUIT BLOCK DIAGRAM

M20SD03GS DISPLAY CHARACTER CODE (European Font)

D7 D6 D5 D4 / D3 D2 D1 D0	0 0 0 0	0 0 0 1	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
	0	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

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.