DOT MATRIX VFD MODULE M202SD01HA
INSTRUCTION MANUAL

GENERAL DESCRIPTION

Futaba Vacuum Fluorescent Display Module M202SD01HA, with Futaba VFD 202-SD-01GK display, produces 20 digits on 2 rows.
Each character is displayed in 5×7 dot matrix.
Consisting of a VFD, one chip controller, 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, such as electronic typewriters, computer terminals, measuring equipment, etc.

CONTENTS

1. FEATURES

1-1. One chip controller is equipped on the module and it realizes intelligent terminal.
The module can be connected to the system bus directly.

1-2. Two hundred and twenty-three character fonts consisting of alphabets, katakanas, numeral and other symbols can be displayed.

1-3. By using dimming function, brightness can be controlled into 5 levels.

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

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

1-6. Compact, light weight and thin design by using SMART (Surface Mount And Reflow Technology) provides excellent built-in capability.

1-7 Either parallel or serial input interface can be selected.
In case of serial input, it is possible to choose 1200, 2400, 4800, and 9600 bps.

2. GENERAL SPECIFICATIONS

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

TABLE-1

Item	Specification	Unit
Outer Dimension	(L) 100±1 (W) 35±1 (T) 26.3 MAX.	mm
Weight	80	g

2-2. SPECIFICATIONS OF THE DISPLAY PANEL

TABLE-2

Item	Specification	Unit
Display area	69.7×12.92	mm
Number of digits	20digits(5×7)×2rows	-
Digits size (H×W)	4.16×2.25	mm
Digits pitch (H×W)	8.76×3.55	mm
Color of illumination	Green(505nm)	-

2-3. ENVIRONMENT CONDITIONS

TABLE-3

Item	Symbol	Min.	Max.	Unit
Operating temperature	Topr	-20	+70	°C
Storage temperature	Tstg	-20	+70	°C
Operating humidity	Hopr	20	85	%
Storage humidity	Hstg	20	90	%
Vibration (10 to 55 Hz)	-	-	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}	-	6.5	V
Input signal voltage	V_{IS}	-0.3	5.5	V

2-5. 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}	$V_{CC}=5V$	$0.7V_{CC}$	–	–	V
L-level Input voltage	V_{IL}	$V_{CC}=5V$	–	–	$0.3V_{CC}$	V

2-6. ELECTRICAL CHARACTERISTICS

TABLE-6

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply current	I_{CC}	$V_{CC}=5V$ All on	–	250	350	mA
Power consumption	–		–	1.3	–	W
Luminance	L		340 (100)	690 (200)	–	cd/m^2 (fL)
H-level input current	I_{IH}	$V_{CC}=5.5V$	–	–	1	μA
L-level input current	I_{IL}	$V_{CC}=5.5V$	-0.22	-0.11	-0.05	mA
H-level output voltage	V_{OH}	$V_{CC}=4.5V$ $I_{OH}=-0.5mA$	3.6	–	–	V
L-level output voltage	V_{OL}	$V_{CC}=4.5V$ $I_{OL}=0.5mA$	–	–	0.9	V

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

3. FUNCTION

The module has the functions such as data and control code write, SELF-TEST, and power-on reset function. (See TABLE-7)

TABLE-7

	$\overline{\text{TEST}}$	$\overline{\text{SEL}}$	$\overline{\text{WR}}$	$\overline{\text{RXD}}$	Function
Parallel and Serial interface	L	H or L	H or L	H or L	Self test
Parallel interface	HorNC	L	$\uparrow$	NC	Data and control code write in
Serial interface	HorNC	NC	NC	*	Data and control code write in

L : Low level (0V)
H : High level (5V)
NC : non connection
$\uparrow$: Low to high transition
* : RXD (Serial input)

THE BASIC FUNCTION

3-1. 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 data.
(When data is under processing, the BUSY signal is high "H".)
In case of parallel input, data or control command is to be written at the low-to-high transition of $\overline{\text{WR}}$(L→H), when $\overline{\text{SEL}}$=low "L", and $\overline{\text{TEST}}$=high "H".
The display character from follows equivalent to JIS-6220 (Alphabets Katakanas and Symbols etc.).
After a character is written in, the write-in position 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 codes are available as follows.
The details will be explained from the next page.

(1) DIM	:	Dimming	:	(04 HEX)
(2) BS	:	Back Space	:	(08 HEX)
(3) HT	:	Horizontal Tab	:	(09 HEX)
(4) CLR	:	Clear	:	(0D HEX)
(5) DP	:	Display Position	:	(10 HEX)
(6) DC	:	Cursor Mode	:	(17 HEX)
(7) ALD	:	All Display	:	(0F HEX)
(8) RST	:	Reset	:	(1F HEX)

DATA WRITE-IN

Write-in position will be shifted to the right after new character data is written-in.

A character data is written-in to the right end of 2nd row, the write-in position will move to the left end of 1st row.

Then new character data is written-in to the left end of 1st row, all displayed characters will be cleared except new one.

(1) DIM (Dimming)

The brightness can be controlled into six levels by using this function. After writing 04H, the following dimming data is written to change the brightness out put.

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

TABLE-8

Dimming Level	Data
100%	FFH
80%	80H
60%	60H
40%	40H
20%	20H
0%	00H

(2) BS (Back Space)

The write-in position is shifted to the left one digit, and the character previously displayed on the digit will be cleared.
When the write-in position is on the most significant digit of the second row, the write-in position moves to the least significant digit of the first row.
When the write-in position is on the most significant digit of the first row, the write-in position moves to the least significant digit of the second row.

(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 of the first row, the write-in position will move to the most significant digit of the second row.
When the write-in position is on the least significant digit of the second row, the write-in position will move to the most significant digit of the first row.

(4) CLR (Clear)

All the characters displayed are erased, the write-in position moves to the most significant digit of the first row.
But the Dimming level and Cursor Mode are kept.

(5) DP (Display Position)

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

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

(6) DC (Cursor Mode):

- After writing 17HEX, another HEX byte mentioned under is written to change the cursor mode.

1byte + 1byte

(DC5 command Code) (Select Mode Data)

TABLE-9

Select Mode	Data
Lighting	FFH
Blinking	88H
No Lighting	00H

The cursor is always displayed at the write-in position.
The cursor is formed by the 5dots located the bottom of 5×7 dot matrix character font.
The cursor will be displayed as an over writing mode and the behavior of the cursor under the lighting mode and blinking mode are explained below.

① lighting mode
When the non displayed position is assigned as a write-in position, the cursor will be displayed there.
But, the position that already one of the character located is assigned, this character will be eliminated and the cursor will be displayed.

② blinking mode
The cursor will be repeated ON and OFF every 0.3 second when the non displayed position is selected for the write-in position.
And the position of the character already located is selected is selected (as a write-in position), the character and the cursor will be displayed alternately.

③ no lighting mode
The no lighting mode means that the cursor will not be displayed.
When the power is turned on, no lighting mode will be selected automatically.
Therefore, if the cursor is required, DC command shall be sent to select the cursor lighting or blinking mode.

(7) ALD (All Display)

The full dots in all digits are displayed.
The dimming level is set for 100%.
To release this mode, the module is turned off or the RST command shall be written.

(8) RST (Reset)

Resetting the module.
All the characters displayed are erased, then the write-in position will be set on the most significant digit of the first row.
The displaying status is the same as the power on reset, and cursor mode is set for no lighting mode, the dimming level is set for 100%.

3-3. SELF-TEST

When the $\overline{\text{TEST}}$ terminal is kept into "L" (connector pin #16 to be connected to GND.)the SELF-TEST starts.
Then the display shows characters, Alphabets, 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, $\overline{\text{TEST}}$ must be set to "H".

3-4. POWER ON RESET

When the module is turned, the display and the memory are cleared and the module is initialized.
The cursor mode is set for no lighting mode, and the dimming level is set for 100%.
When an external reset function is required, please contact Futaba sales office for further information.

3-5. SELECTION OF INPUT MODE

TABLE-11 shows the combination of the signal lines for the parallel or serial input.
It is needed to choose one of the combinations before operation.
Unused signal lines are to be open (internally pulled up).
In case of serial input, it is possible to choose four kinds of baud rate by J1~J2, as shown below.

TABLE-10

J1	OPEN	SHORT	OPEN	SHORT
J2	OPEN	OPEN	SHORT	SHORT
baud rate	9600	4800	2400	1200

BAUD RATE SELECTION

4. INTERFACE CONNECTION

4-1. CONNECTOR PINCONECTION

Connector : A1-20PA-2.54DSA(HIROSE)or equivalent
Socket : 3421-6000SL (3M) 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

CONNECTOR PINCONNECTION

4-2. WRITE-IN TIMING (See FIG.2)

Please be sure the BUSY signal is into "L", when the data will be written in.
In case of the serial input, the module accepts the 10 bit data string as a data, first "L" level data as a start bit, 2nd to 9th data as an input data and the last "H" level data as a stop bit.
When these data are not received exactly, they will be ignored and not displayed on the module.

4-2-1. PARALLEL INPUT

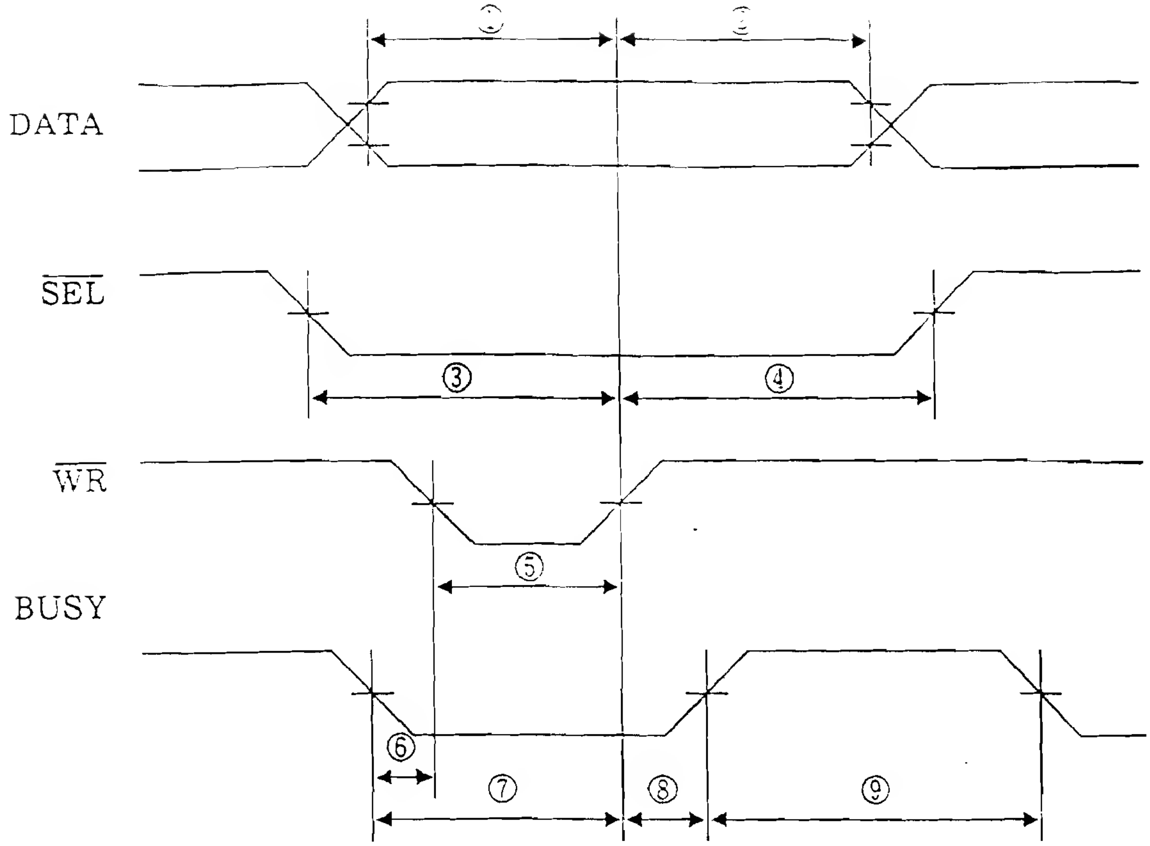
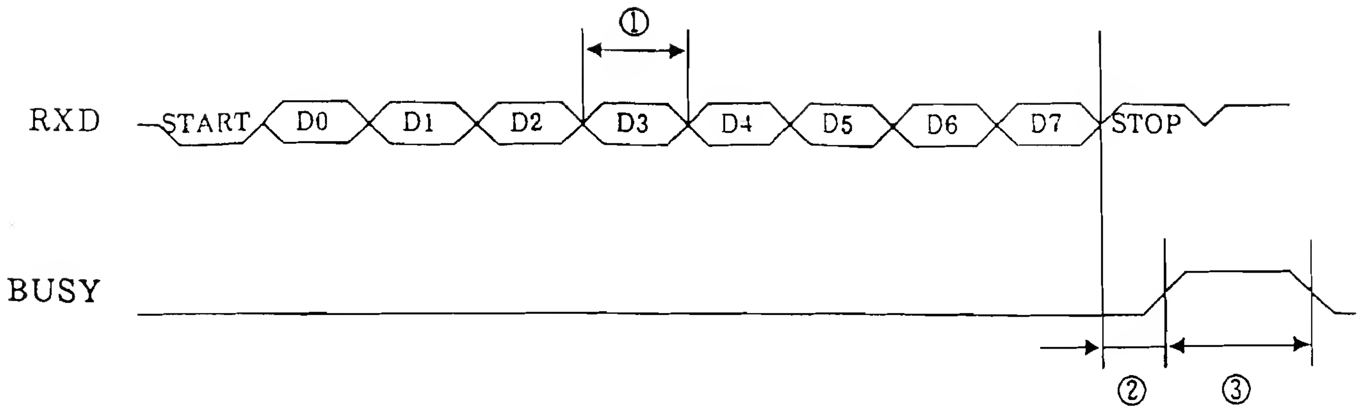


FIG. 1 WRITE - IN TIMING

		Min.	Max.	Note
①	tsu (DATA)	50 ns	–	
②	th (DATA)	100 ns	–	
③	tsu (SEL)	50 ns	–	
④	th (SEL)	50 ns	–	
⑤	tpw (WR)	50 ns	–	
⑥	twait (1)	0 ns	–	
⑦	twait (2)	1 μs	–	
⑧	tdelay	–	150 ns	
⑨	twait (3)	–	45μs	

4-2-2. SERIAL INPUT



① t(DATA) = 10^6/baud rate[μs]
(This depends on the selection of the baud rate.)

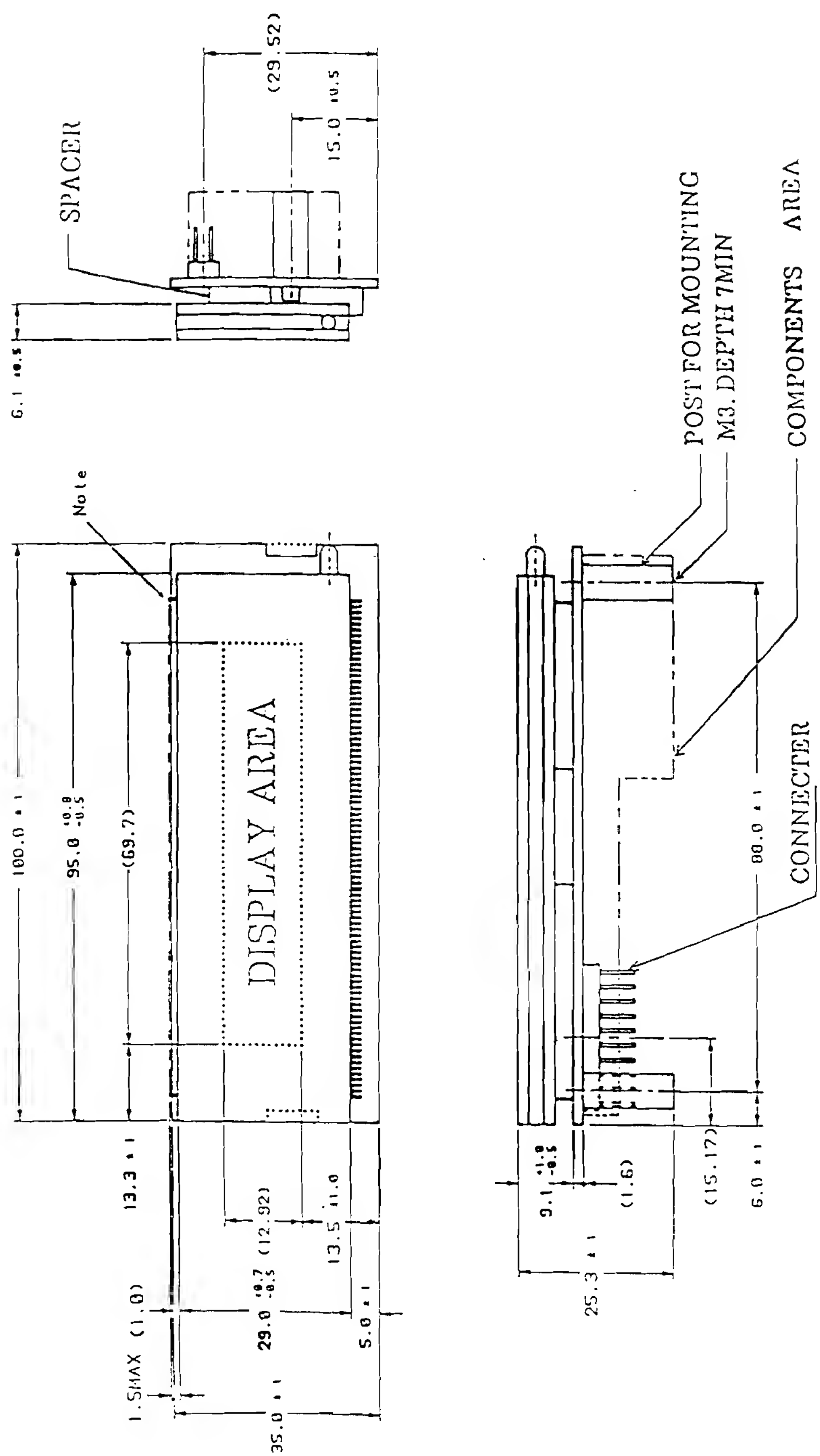
② t(DATA) /2 [μs]
(Busy becomes "H" at the center of stop bit.)

③ t(WAIT) : 2~45[μs]

FIG.2 WRITE-IN TIMING

M202SD01HA MECHANICAL DRAWING

APPENDIX-1

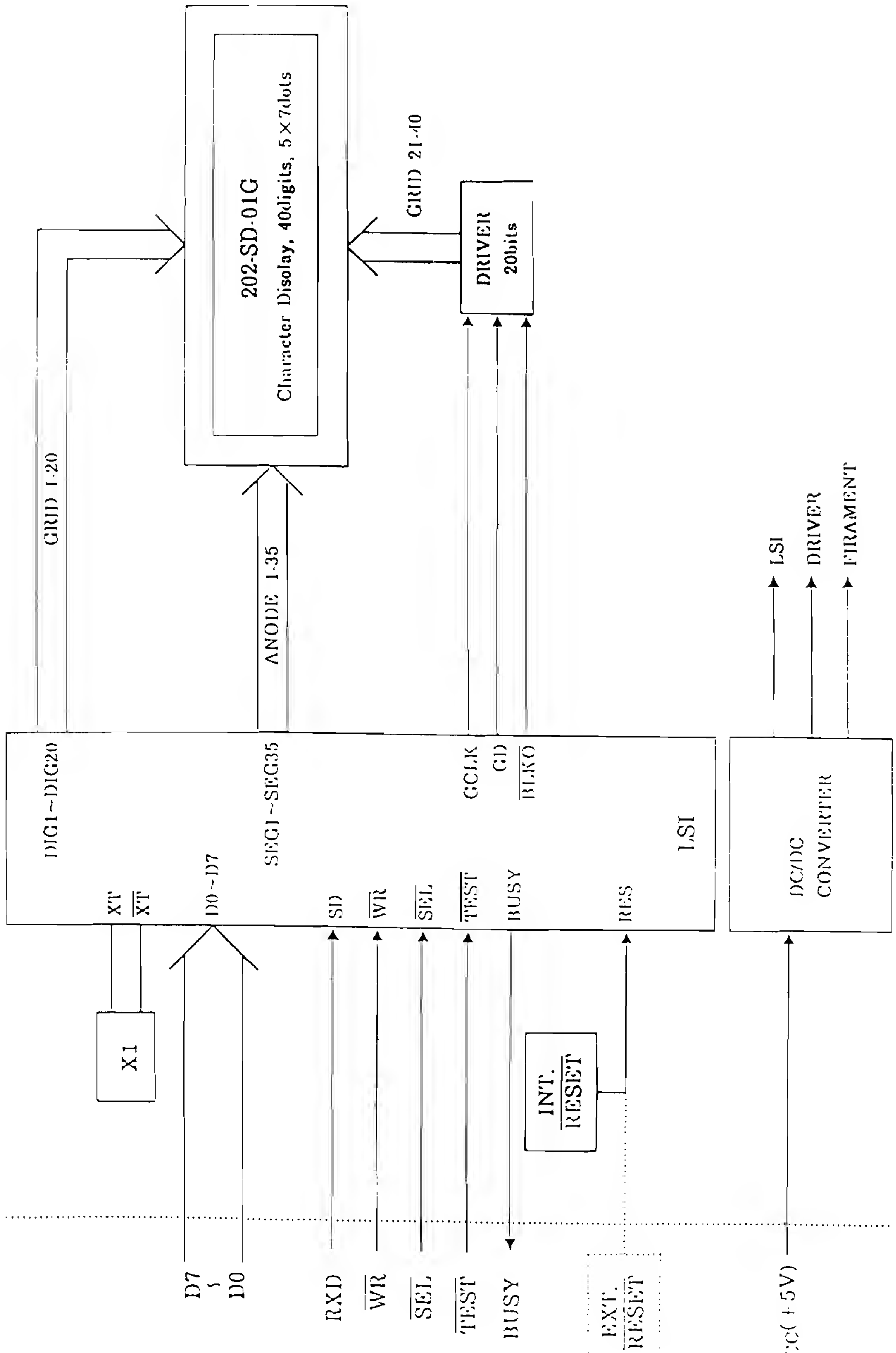


UNIT:mm

Note) Avoid touching to any conductors (such as chassis, metal case, etc.), because the leads are alive electrically.

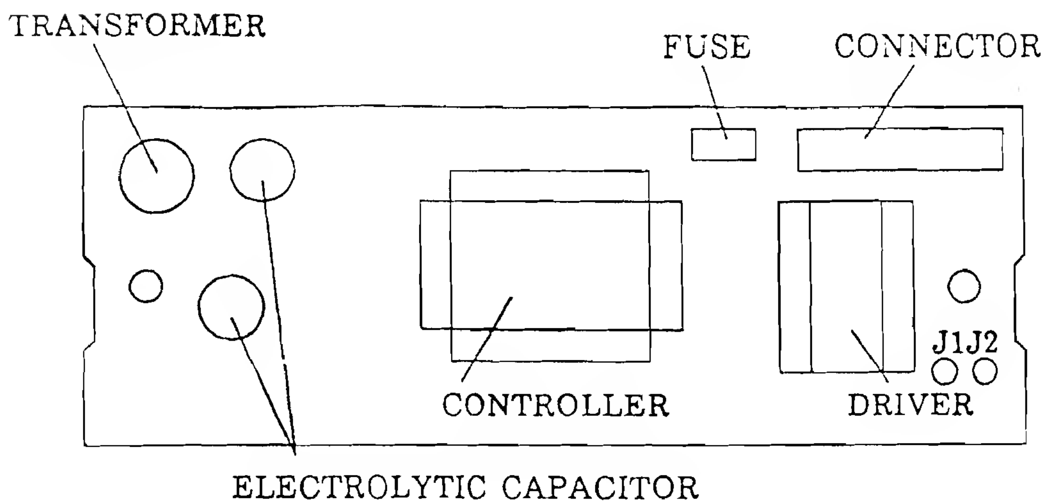
M202SD01HA CURCUIT BLOCK DIAGRAM

APPENDIX-2



M202SD01HA THE LOCATION OF COMPONENTS

APPENDIX-3



M202SD01HA DISPLAY CHARACTER CODE

APPENDIX-4

	D7	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	D6	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
	D5	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
	D4	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
D3 D2 D1 D0		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0 0 0 0	0		DP	SP	0	@	P	`	p	α	£	|	ー	タ	ミ	↑	≦
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0 0 1 1	3			#	3	C	S	c	s	⊿	∽	」	ウ	テ	モ	円	≡
0 1 0 0	4	DIM		$	4	D	T	d	t	ε	∫	、	エ	ト	ヤ	円	年
0 1 0 1	5			%	5	E	U	e	u	η	Ж	・	オ	ナ	ユ	日	千
0 1 1 0	6			&	6	F	V	f	v	θ	ä	ヲ	カ	ニ	ヨ	月	÷
0 1 1 1	7		DC	'	7	G	W	g	w	λ	┤	ァ	キ	ヌ	ラ	火	→
1 0 0 0	8	BS		(	8	H	X	h	x	μ	≗	ィ	ク	ネ	リ	木	Ä
1 0 0 1	9	HT		)	9	I	Y	i	y	π	ö	ゥ	ケ	ノ	ル	水	Ö
1 0 1 0	A			*	:	J	Z	j	z	ρ	×	ェ	コ	ハ	レ	金	Ü
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SP : SPACE

5. WARRANTY

This display module is guaranteed for 1 year after shipment form 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.

6-3. 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.

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

10-5. If the start up time of the supply voltage is slow, the controller may not be reset.
The supply voltage must be risen up to the specified voltage level within 30msec.

10-6. 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.).

10-7. When power supply is turned off, the capacitor does not discharge immediately.
The high voltage applied to the VFD must not contact the controller IC. (The shorting of the mounted components within 30seconds after power off may cause damage.)

REMARKS

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

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