DOT MATRIX VFD MODULE M202MD07HB

INSTRUCTION MANUAL

GENERAL DESCRIPTION

Futaba Vacuum Fluorescent Display Module M202MD07HB, with Futaba VFD 202-MD-07GR 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 aesthetic pleasing VFD makes the module desirable for application in office equipments, such as electronic typewriters, computer terminals, measuring equipment, etc.

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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-four character fonts consisting of alphabets, numeral, and other symbols can be displayed.

1-3. By using dimming function, luminance can be controlled into six levels.

1-4. Since a DC / DC converter is included, only 5Vdc 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, 7812.5 9600, 15625, 31250 and 62500 bps.

2. GENERAL SPECIFICATIONS

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

TABLE-1

Item	Specification	Unit
Outer Dimension	(L) 190±0.5 (W) 64±0.5 (T) 25 MAX	mm
Weight	210	g

2-2. SPECIFICATIONS OF THE DISPLAY PANEL (Refer APPENDIX-4)

TABLE-2

Item	Specification	Unit
Display area	146.1×29.0	mm
Number of digits	20digits(5×7)×2rows	-
Digits size (H×W)	10.5×5.5	mm
Digits pitch (H×W)	15.5×7.4	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}	-0.3	6.5	Vdc
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	V_{CC}	-	4.5	5.0	5.5	Vdc
H-level input voltage	V_{IH}	$V_{CC}=5$Vdc	3.5	-	5.0	V
L-level input voltage	V_{IL}	$V_{CC}=5$Vdc	0	-	1.5	V

2-6. ELECTRICAL CHARACTERISTICS

TABLE-6

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply current	I_{CC}	$V_{CC}=5$Vdc All dots on	-	1.0	1.5	A
Power consumption	-		-	5.0	-	W
Luminance	L		350 (102)	700 (204)	-	cd/m^2 (fL)
H-level input current	I_{IH}	$V_{CC}=5.5$Vdc $V_{IH}=5.5$V	-	-	1	μA
L-level input current	I_{IL}	$V_{CC}=5.5$Vdc $V_{IL}=0$V	-0.22	-0.11	-0.05	mA
H-level output voltage	V_{OH}	$V_{CC}=4.5$Vdc $I_{OH}=-0.5$mA	3.6	-	-	V
L-level output voltage	V_{OL}	$V_{CC}=4.5$Vdc $I_{OL}=0.5$mA	-	-	0.9	V

3. FUNCTIONS

The module has the functions such as data and control code write, self test, and external rest function. (See TABLE-7)

TABLE-7

	$\overline{TEST}$	$\overline{SEL}$	$\overline{WR}$	RXD	Functions
Parallel and Serial interface	L	H or L	H or L	H or L	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 : No connection
↑ : Low to high transition
* : RXD (Serial input)

THE BASIC FUNCTIONS

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 the data.
(When the data is under processing, the BUSY signal is "H".)
The display character form follows equivalent to ASCII (Alphabets, Numeral, and Symbols etc.).
After a character is written in, the write-in position will be shifted to the right one digit automatically.
A character data is written in to the right end of second row, the write-in position will move to the left end of first row.
Then new character data is written in to the left end of first row, all displayed characters will be cleared except new one.
The above action can be executed, only when the BUSY signal is "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)	ALD	:	All Display	:	(0F HEX)
(6)	DP	:	Display Position	:	(10 HEX)
(7)	DC	:	Cursor Mode	:	(17 HEX)
(8)	TON	:	Triangle Mark On	:	(18 HEX)
(9)	TOF	:	Triangle Mark Off	:	(19 HEX)
(10)	TFF	:	Triangle Mark All Off	:	(1A HEX)
(11)	RST	:	Reset	:	(1F HEX)

(1) DIM (Dimming)

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

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

TABLE-8

Dimming Level	Data
100%	FF HEX
80%	80 HEX
60%	60 HEX
40%	40 HEX
20%	20 HEX
0%	00 HEX

(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 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) 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.

(6) 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 10 HEX 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
First row	00 HEX	13 HEX
Second row	14 HEX	27 HEX

(7) DC (Cursor Mode)

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

1 byte (17HEX)	+	1 byte
(DC command Code)		(Select Mode Data)

TABLE-9

Select Mode	Data
Lighting	FF HEX
Blinking	88 HEX
No Lighting	00 HEX

The cursor is always displayed at the write-in position.
The cursor is formed by the five dots 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 (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 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.

(8) TON (Triangle Mark On)

This command is Triangle Mark control code.
After writing 18 HEX, the successive another HEX byte of data will be accepted as the turn on position.

The most significant digit	The least significant digit
14 HEX	27 HEX

(9) TOF (Triangle Mark Off)

This command is Triangle Mark control code.
After writing 19 HEX, the successive another HEX byte of data will be accepted as the turn off position.

The most significant digit	The least significant digit
14 HEX	27 HEX

(10) TFF (Triangle Mark All Off)

All the Triangle Mark displayed are erased.

(11) 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 $\overline{TEST}$ 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, $\overline{TEST}$ must be set to "H".

3-4. EXTERNAL RESET

An external reset is accomplished by hold the connector pin No.8 low for at least 2.0μ second. 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%.

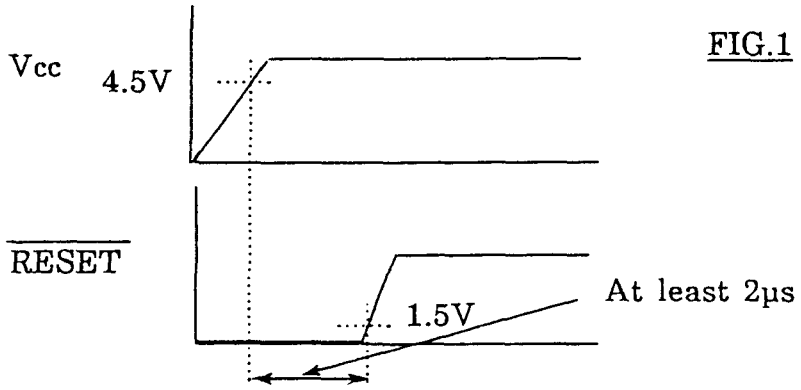


FIG.1

3-5. SELECTION OF INPUT MODE

TABLE-11 shows the combinations 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).

3-5-1. PARALLEL INPUT

Data or control command is to be written at the low-to-high transition of $\overline{WR}$ (L→H), when $\overline{SEL}$="L", and $\overline{TEST}$="H".

3-5-2. SERIAL INPUT

The module accepts the ten bit data string as a data, first "L" level data as a start bit, second to ninth 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 ignores and not displayed on the module.
It is possible to choose eight kinds of baud rate by J1~J3, as shown below.

TABLE-10

J1		OPEN	SHORT	OPEN	SHORT
J2		OPEN	OPEN	SHORT	SHORT
J3	SHORT	62500	31250	15625	7812.5
	OPEN	9600	4800	2400	1200

BAUD RATE SELECTION

4. INTERFACE CONNECTION

4-1. CONNECTOR PIN CONNECTION

Connector : HIF3E-20PA-2.54DS (HIROSE) or equivalent
Socket : 3421-6000SC (3M) or equivalent

TABLE-11

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

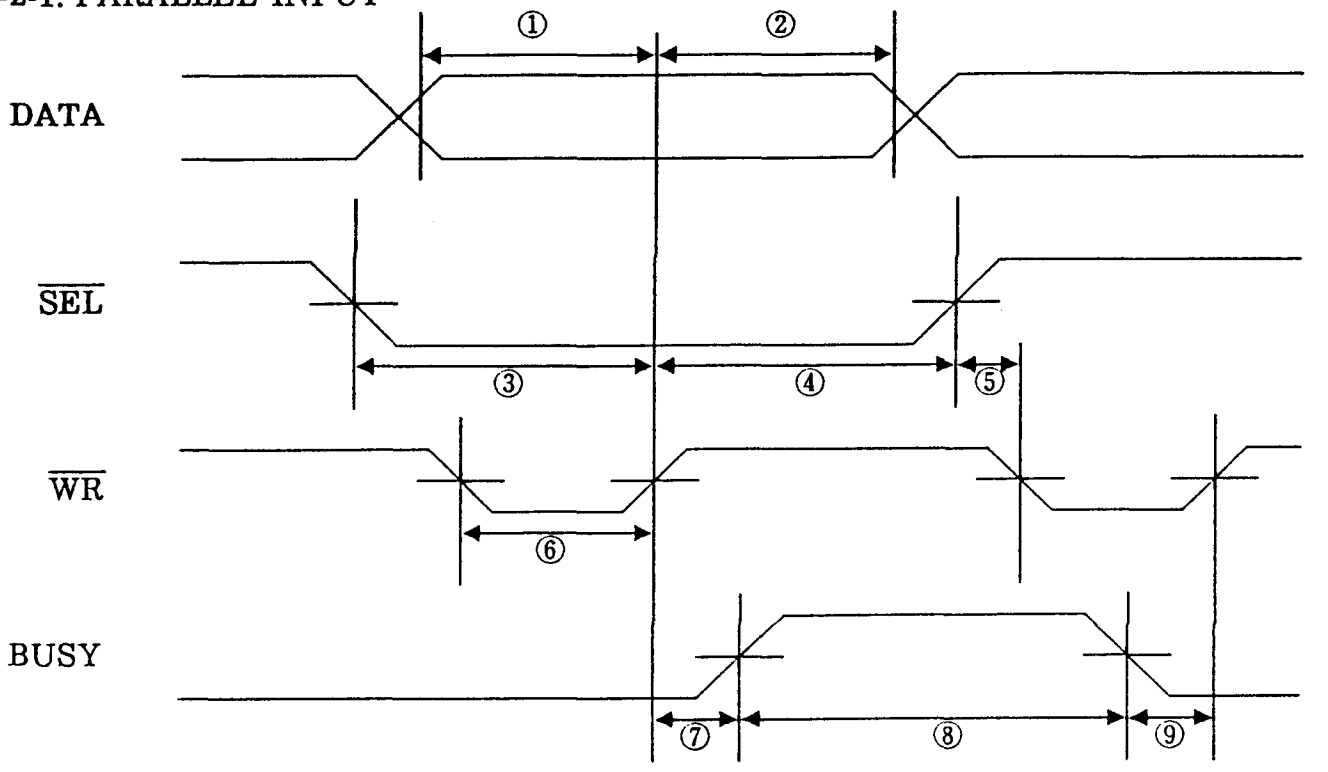
NC : No connection
○ : Connection

CONNECTOR PIN CONNECTION

4-2. WRITE IN TIMING

Please be sure the BUSY signal is into "L", When the data will be written in.

4-2-1. PARALLEL INPUT

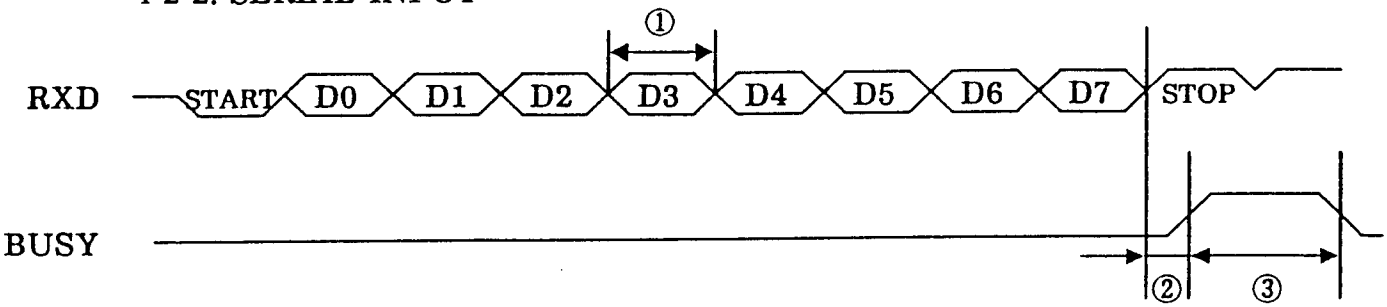


WRITE IN TIMING

TABLE12

		Min.	Max.	Note
①	tsu(DATA)	50ns	–	
②	th(DATA)	100ns	–	
③	tsu($\overline{\text{SEL}}$)	50ns	–	
④	th($\overline{\text{SEL}}$)	50ns	–	
⑤	twait($\overline{\text{WR1}}$)	50ns	–	
⑥	tpw($\overline{\text{WR}}$)	50ns	–	
⑦	tdelay	–	150ns	
⑧	twait(BUSY)	–	45μs	
⑨	twait($\overline{\text{WR2}}$)	1μs	–	

4-2-2. SERIAL INPUT



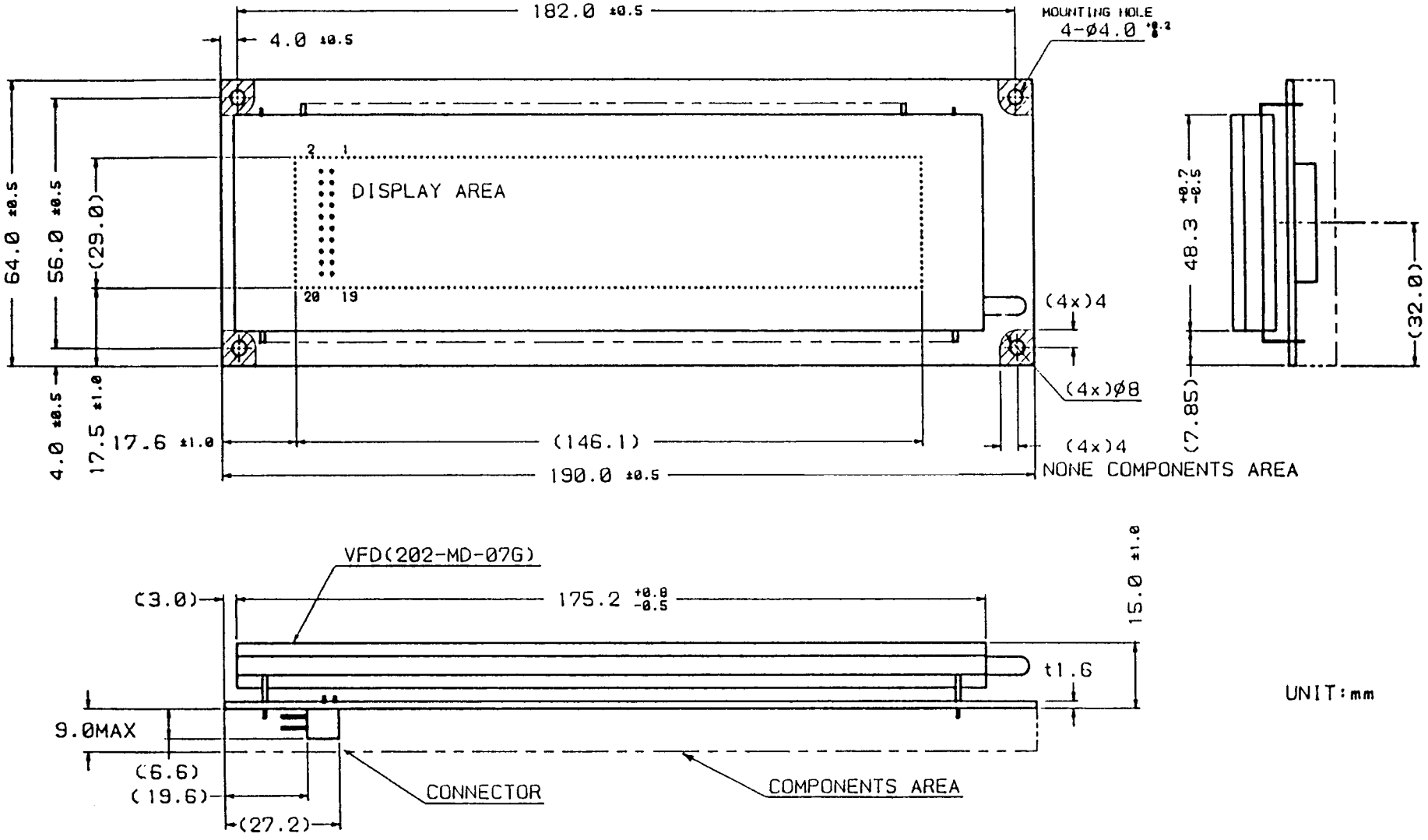
WRITE IN TIMING

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

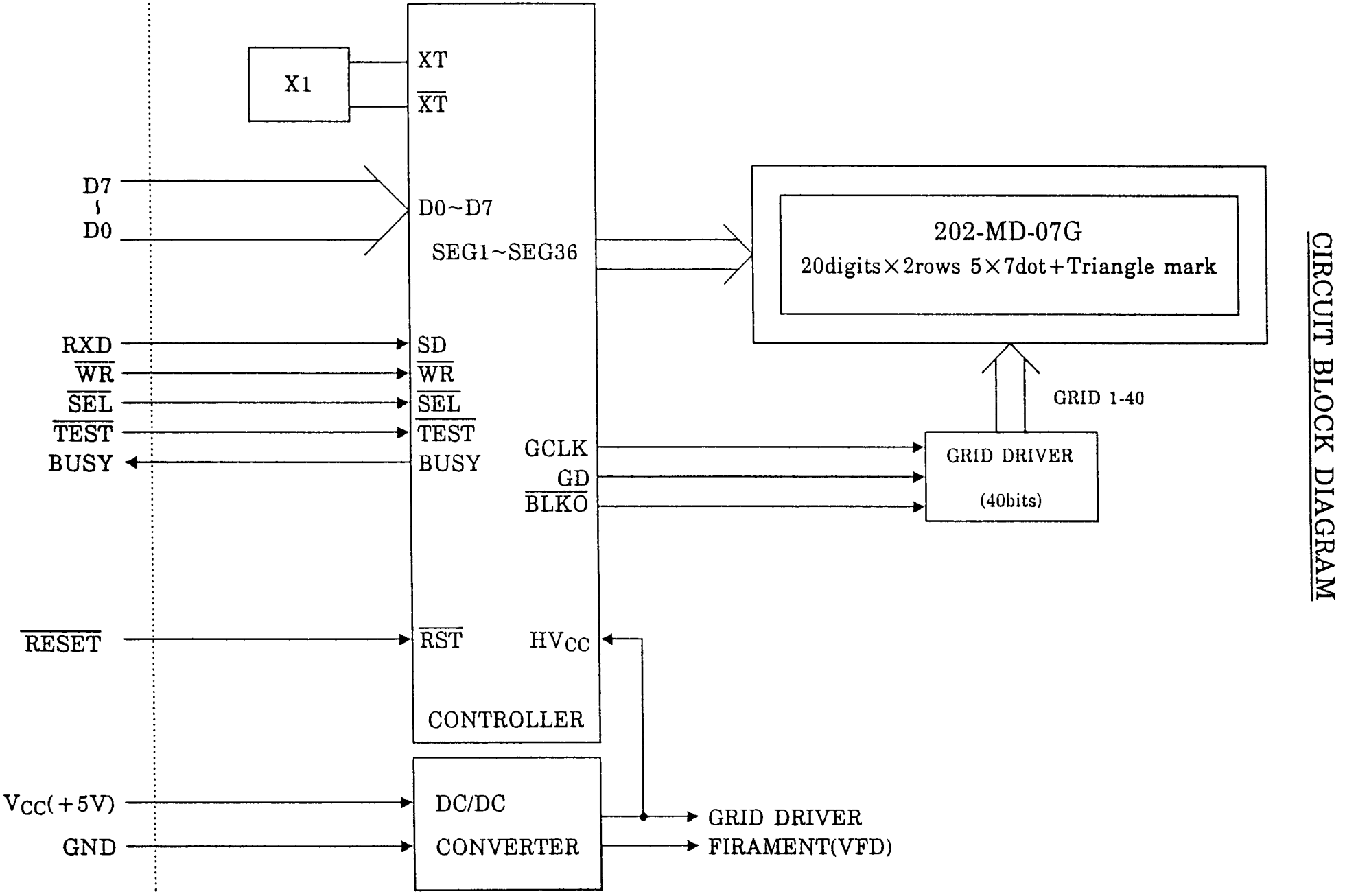
② t(DATA) / 2 [μs]
(Busy becomes "H" at the center of stop bit.)

③ t(WAIT) : 2~45[μs]

OUTER DIMENSIONS



UNIT: mm



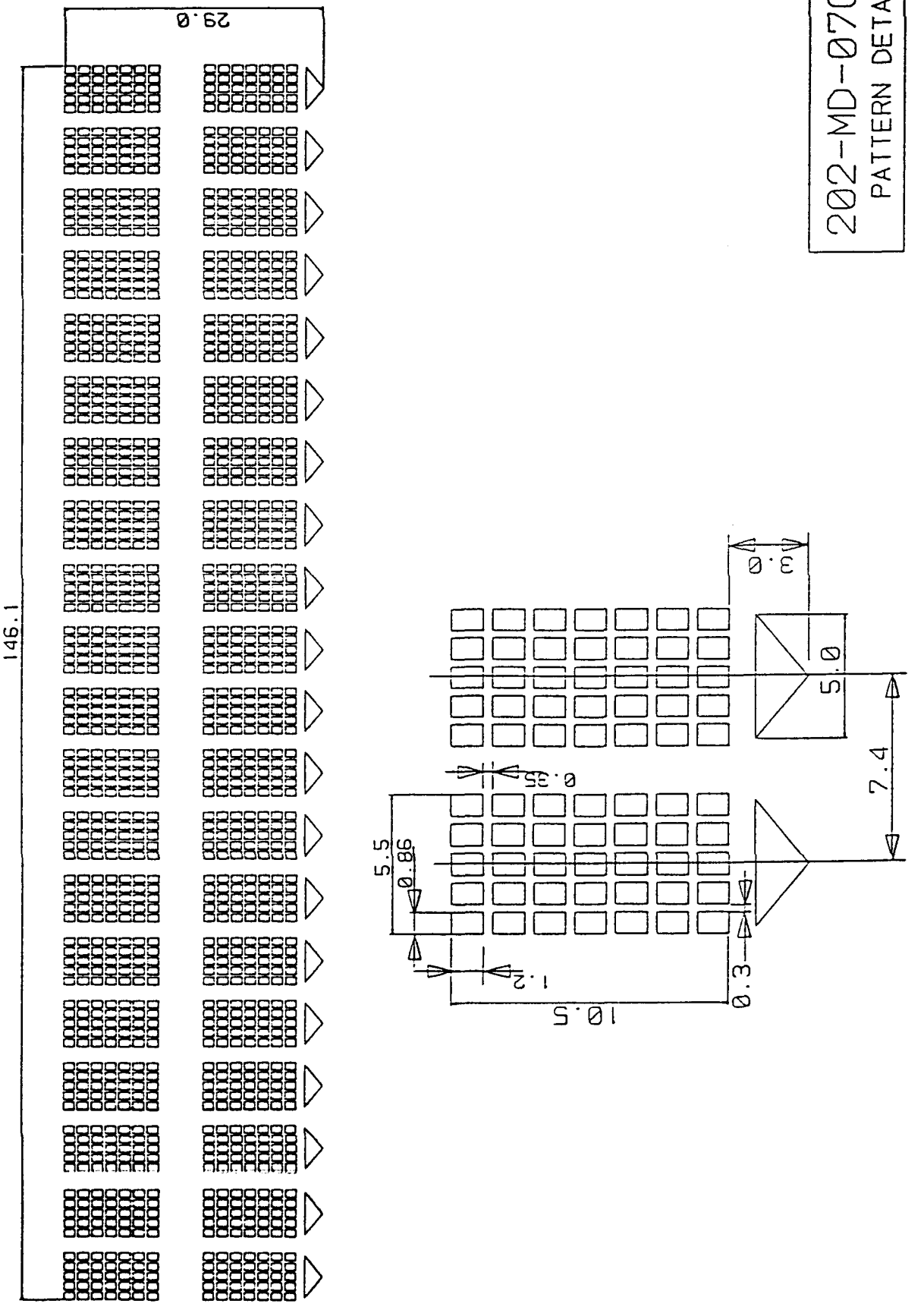
CIRCUIT BLOCK DIAGRAM

DISPLAY CHARACTER CODE

	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 0 0 1	1																
0 0 1 0	2																
0 0 1 1	3																
0 1 0 0	4	DIM															
0 1 0 1	5																
0 1 1 0	6																
0 1 1 1	7		DC														
1 0 0 0	8	BS	TON														
1 0 0 1	9	HT	TOF														
1 0 1 0	A		TFF														
1 0 1 1	B																
1 1 0 0	C																
1 1 0 1	D	CLR															
1 1 1 0	E																
1 1 1 1	F	ALD	RST														SP

SP : SPACE

DISPLAY PATTERN DETAIL



5. WARRANTY

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

6. CAUTIONS FOR OPERATION

6-1. Since VFD is 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. 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 confirm there is no noise affection.)

6-5. 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.

6-6. The fuse is mounted on the module as circuit protection.

6-7. 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 :

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

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