Futaba®

AN-E-2221A

APPLICATION NOTE

VACUUM FLUORESCENT DISPLAY MODULE

CHARACTER DISPLAY MODULE

M204LD01AA

GENERAL DESCRIPTION

Futaba Vacuum Fluorescent Display Module M204LD01AA, with Futaba VFD 204-LD-01GN display, produces 20 digits on 4 rows.
Each character is displayed in 5×7 dot matrix.
Consisting of a VFD, microcomputer, driver IC, the module can be connected directly to the system bus, thus simplifying interfacing.
The bright aesthetic pleasing VFD makes the module desirable for application in office equipments, such as electronic typewriters, 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. 50V) 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. Microcomputer 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. Since a DC/DC converter is included, only 5Vdc power source is required to operate the module.

1-4. High quality and reliability, also long life can be achieved with FUTABA VFD.

2. GENERAL SPECIFICATIONS

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

Table-1

Item	Specification	Unit
Outer Dimensions	(W) 290.0±1 (H) 100.0±1 (T) 40 Max. (Without connector)	mm
Weight	Approx. 830	g

2-2. SPECIFICATIONS OF THE DISPLAY PANEL

Table-2

Item	Specification	Unit
Display Area (W×H)	202.0×54.2	mm
Number of Digits	20 digits(5×7dot)×4 rows	–
Digits Size (W×H)	7.25×11.3	mm
Digits Pitch (W×H)	10.25×14.3	mm
Dot Size (W×H)	1.2×1.32	mm
Color of Illumination	Green (λp=505nm)	–

2-3. ENVIRONMENT CONDITIONS

Table-3

Item	Symbol	Min.	Max.	Unit
Operating Temperature	*T*opr	-5	+60	°C
Storage Temperature	*T*stg	-20	+70	°C
Operating Humidity (*1)	*H*opr	20	85	%
Storage Humidity (*1)	*H*stg	20	95	%
Vibration (10~55Hz)	–	–	4	G
Shock	–	–	40	G

*1) Avoid operations and or storage in moist environmental conditions.

2-4. ABSOLUTE MAXIMUM RATINGS

Table-4

Item	Symbol	Min.	Max.	Unit
Supply Voltage	Vcc	-0.3	7.0	V
Input Signal Voltage	V_{IS}	-0.3	Vcc+0.3V	V

2-5. RECOMMENDED OPERATING CONDITIONS

Table-5

Item	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	Vcc	4.5	5.0	5.5	Vdc
H-Level Input Voltage	V_{IH}	2.4	—	—	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=5.0Vdc All ON	–	2.2	2.7	A
Power Consumption	–		–	11	13.5	W
Luminance	L		300	600	–	cd/m^2
H-Level Input Current	I_{IH}	Vcc=5.5V V_{IH}=2.4V V_{IL}=0.8V	–	–	20	μA
L-Level Input Current	I_{IL}		–	–	-0.57	mA
H-Level Output Voltage	V_{OH}	Vcc=5.0V I_{OH}=-2mA I_{OL}=8mA	3.6	–	–	V
L-Level Output Voltage	V_{OL}		–	–	0.9	V

3. FUNCTIONS

The module has data and control code write-in, test mode, and power on reset function.

3-1. DATA AND CONTROL CODE WRITE IN

Table-7

$\overline{SS}$	$\overline{WR}$	$\overline{RD}$	A_0	$\overline{BL}$	$\overline{RESET}$	$\overline{TEST}$	BUSY	FUNCTION	DATA BUS DIRECTION	
									HOST	MODULE
0	0-1	1	0	–	1	1	0	Data Write-in	⟶	⟶
0	0-1	1	1	–	1	1	0	Command Write-in	⟶	⟶
0	1	0	–	–	1	1	0	Data Read-out	⟵	⟵
–	–	–	–	0	1	1	0	Blanking		
–	–	–	–	–	0	–	–	Reset		
–	–	–	–	–	1	0	0	Test Mode		

THE BASIC FUNCTION

When the data 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 "1".)
The data or control command is to be written in at the rising edge of $\overline{WR}$ (0→1), when A_0= "0".
After a 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 "L".

3-2. CONTROL CODE

The control codes are available as follows.

(1) BS : Back Space (08HEX)
DC1 Mode: The write in position is shifted to the left one digit.
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 fourth row.
DC2 Mode: The same as above.

(2) HT : Horizontal Tab (09HEX)
DC1 Mode: 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 moves to the most significant digit of the second row.
When the write in position is on the least significant digit of the fourth row, the write in position moves to the most significant digit of the first row.
DC2 Mode: The write in position is shifted to the right one digit. When the write in position is on the least significant digit of the fourth row, the characters displayed in the fourth row are shifted up to the third row and the write in position moves to the most significant digit of the fourth row.
Subsequently, the fourth row is cleared.

(3) LF : Line Feed (0AHEX)
DC1 Mode: The write in position moves down to another row staying same line.
DC2 Mode: All the characters displayed in the second to fourth rows are shifted up to the upper row, clearing the fourth row.

(4) CR : Carriage Return (0DHEX)
DC1 Mode: When the write in position moves to the most significant digit of the same row.
DC2 Mode: The same as DC1 mode operation.

(5) VT : Vertical Tab (0BHEX)
DC1 Mode: The write in position is shifted up to one row.
When the write in position is in the first row, it moves to the fourth row.
DC2 Mode: The same as DC1 mode operation.

(6) CLR : Clear (0CHEX)
The display and the memory are cleared.

(7) ESC : Escape (1BHEX)
The write in starting position can be pointed by using this function.

1BHEX (Control code)	+	1 byte (Vertical position)	+	1 byte (Horizontal position)

First byte (Vertical)

0000	0000	: 00HEX	(1st row)
0000	0001	: 01HEX	(2nd row)
0000	0000	: 02HEX	(3rd row)
0000	0011	: 03HEX	(4th row)

Next byte (Horizontal)

0000	0000	: 00HEX	(1st digit)
0001	0011	: 13HEX	(20th digit)

(8) DC1 : Normal Display Mode (11HEX)
After writing a character, the write in position is shifted to the right one digit automatically.
When the write in position on the least significant digit of the first row, the write in position moves to the most significant digit of the second row.
When the write in position is on the least significant digit of the fourth row, the write in position moves to the most significant digit of the first row.
When the module is turned on, this DC1 mode is selected and will be held until another mode (DC2) is selected.

(9) DC2 : Vertical Scroll Mode (12HEX)
After writing a character up to the least significant digit of the fourth row, all the characters displayed in the second to fourth rows are shifted up to the upper row, clearing the fourth row.

COMMAND (A_0 = “1”)

0000 0000 (00 HEX) 0100 1111 (4F HEX)	Write in position 0000 0000 (00 HEX), Home position Left / Right 1st row 00 HEX 13 HEX 2nd row 14 HEX 27 HEX 3rd row 28 HEX 3B HEX 4th row 3C HEX 4F HEX
1111 0000 (F0 HEX)	The command makes possible read the write in position.
1111 0001 (F1HEX)	The command makes possible to read the character code on the write in position.
0000 0010 (F2 HEX)	The command makes possible to read the character code on the write in position and write in position is shifted to the right one digit.
1111 0011 (F3 HEX)	Insert Character Mode The write in position character and behind characters are shifted to the right one digit, then write in position is cleared.
1111 0100 (F4 HEX)	Delete Character Mode The write in position is cleared, then the write in position characters and behind characters are shifted to the left one digit.
1111 0101 (F5 HEX)	Insert row Mode The write in position row and the under rows are shifted down to the one row. The write in position row is cleared and write in position is set o the most significant digit of the same row.
1111 0110 (F6 HEX)	Delete row Mode The write in position row is cleared and the under rows are shifted up to the one row. The write in position isn’t changed.
1111 1111 (FF HEX)	Reset The same as Power on Reset mode.

3-3. TEST MODE

$\overline{\text{TEST}}$ =“0” (connector pin #25 is connected to GND) starts the self test.
Then the display shows all characters, Alphabet, Numeral, and Symbol, in that order.
80 (20×4) 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 “1”.

3-4. RESET

$\overline{\text{RESET}}$ =“0” (connector pin #31 is connected to GND) same as Power on Reset mode.
To release this mode, $\overline{\text{RESET}}$ must be set to “1”.

3-5. 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. INTERFACE CONNECTION

4-1. DATA CONNECTOR

Connector (Header) : HIF3BA-34PA-2.54DSA (HIROSE)
Socket : HIF3BA-34D-2.54R (HIROSE)

Table-10

Pin No.	SIGNAL	Pin No.	SIGNAL
1	D7	2	GND
3	D6	4	GND
5	D5	6	GND
7	D4	8	GND
9	D3	10	GND
11	D2	12	GND
13	D1	14	GND
15	D0	16	GND
17	$\overline{WR}$	18	GND
19	A_0	20	GND
21	$\overline{RD}$	22	GND
23	$\overline{SS}$	24	GND
25	$\overline{TEST}$	26	GND
27	BUSY	28	GND
29	$\overline{BL}$	30	GND
31	$\overline{RESET}$	32	GND
33	NC	34	GND

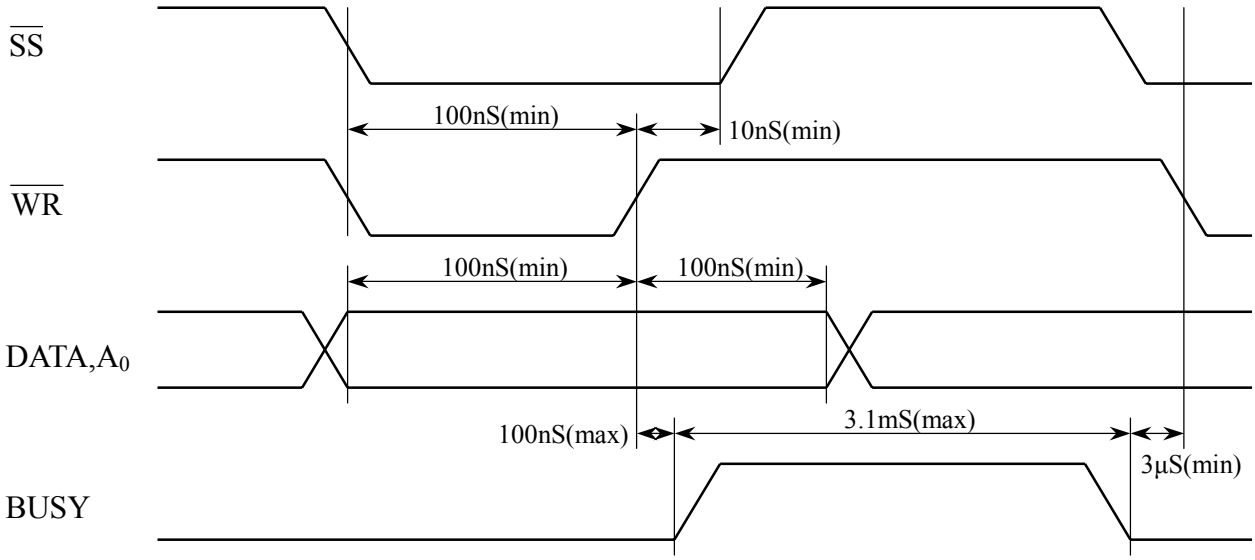
4-2. POWER CONNECTOR

Terminal : 1.25YS3A

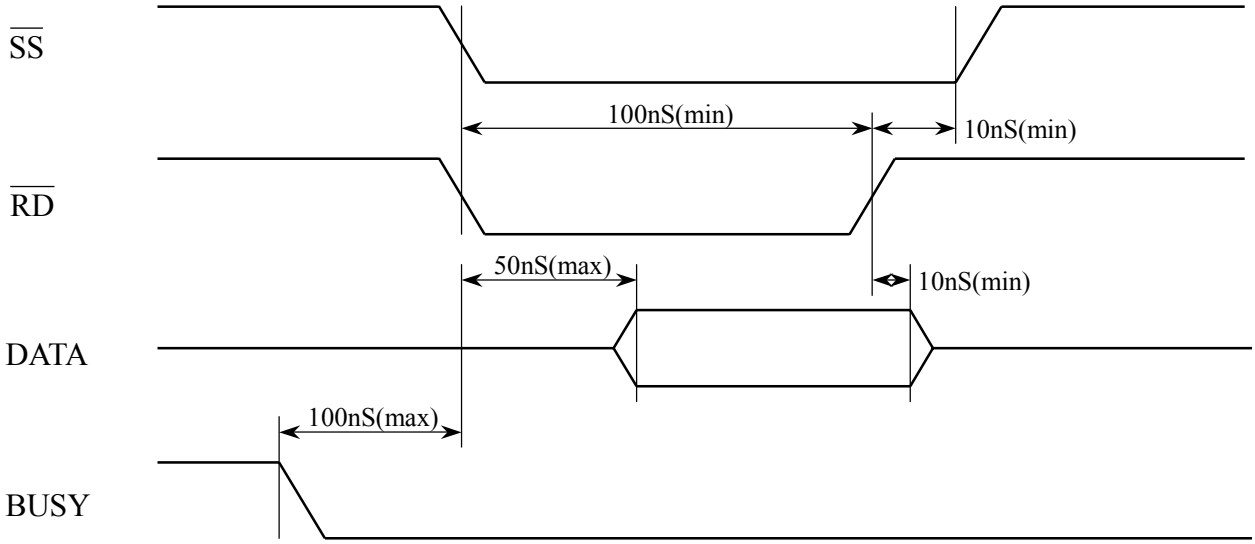
Table-11

Pin No.	CONNECTION	CABLE
1	5V (Vcc)	VSF0.75 (RED)
2	GND	VSF0.75 (BLUE)

4-3. WRITE IN TIMING

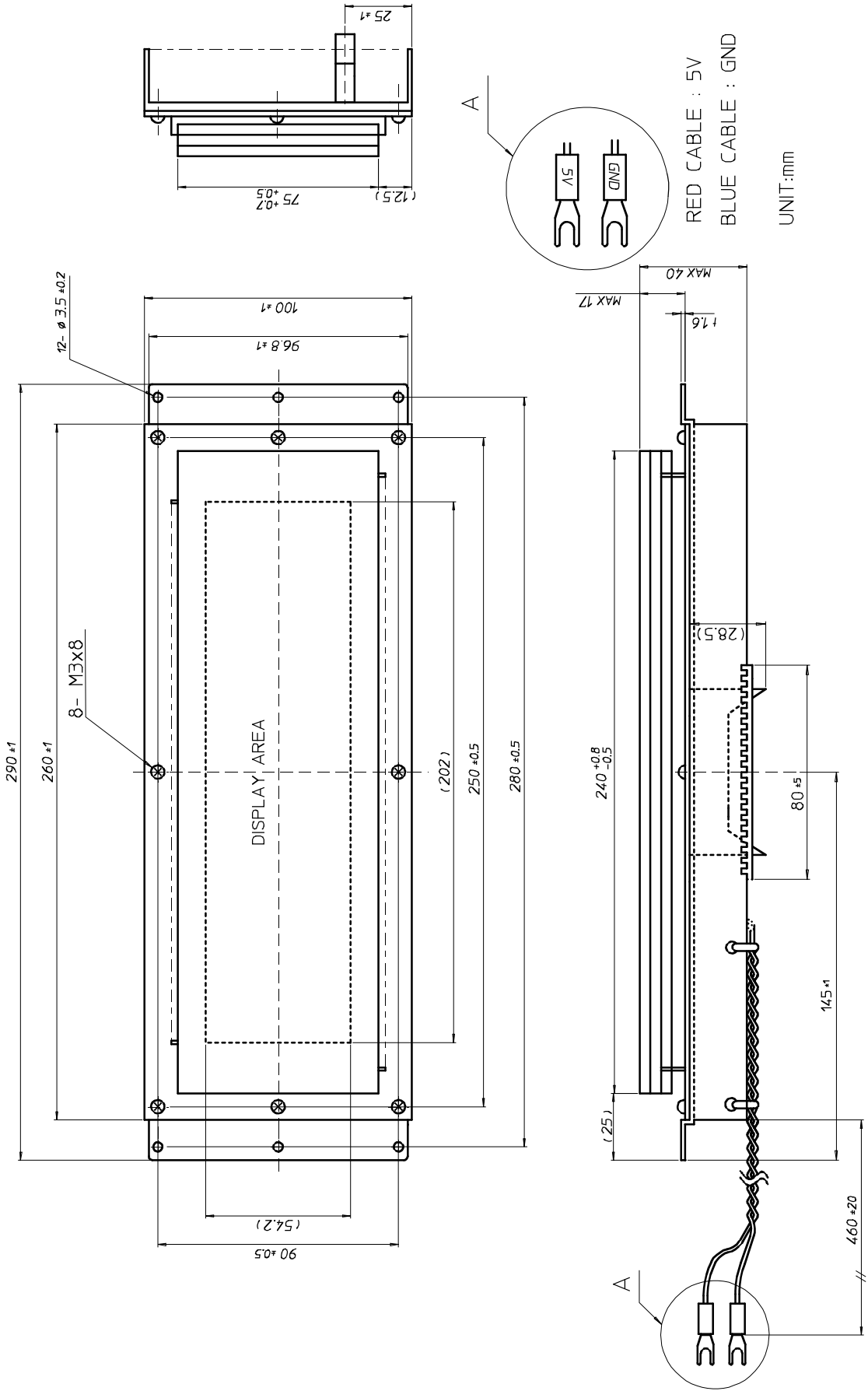


4-4. READ TIMING



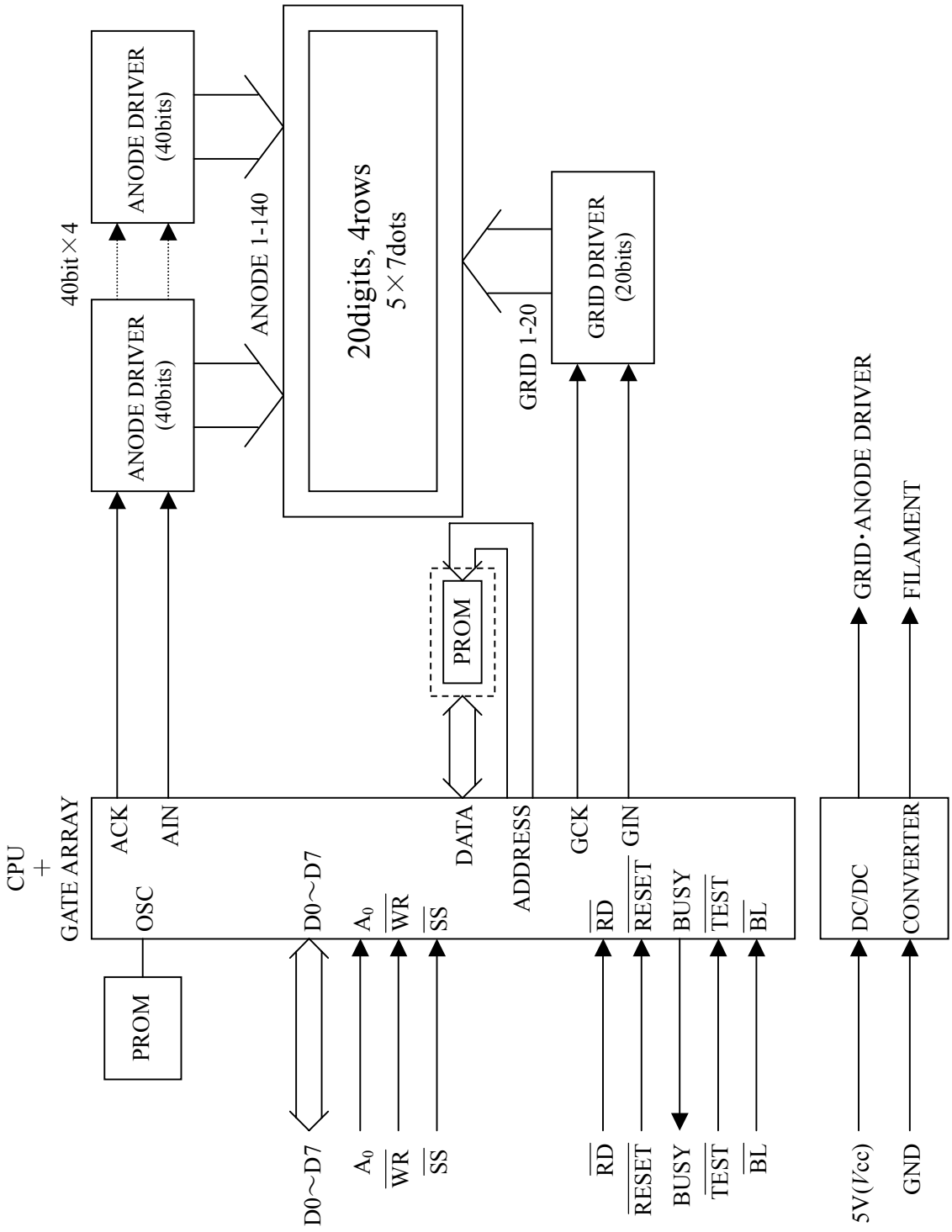
M204LD01AA MECHANICAL DRAWING

FIGURE-1



M204LD01AA　CIRCUIT BLOCK DIAGRAM

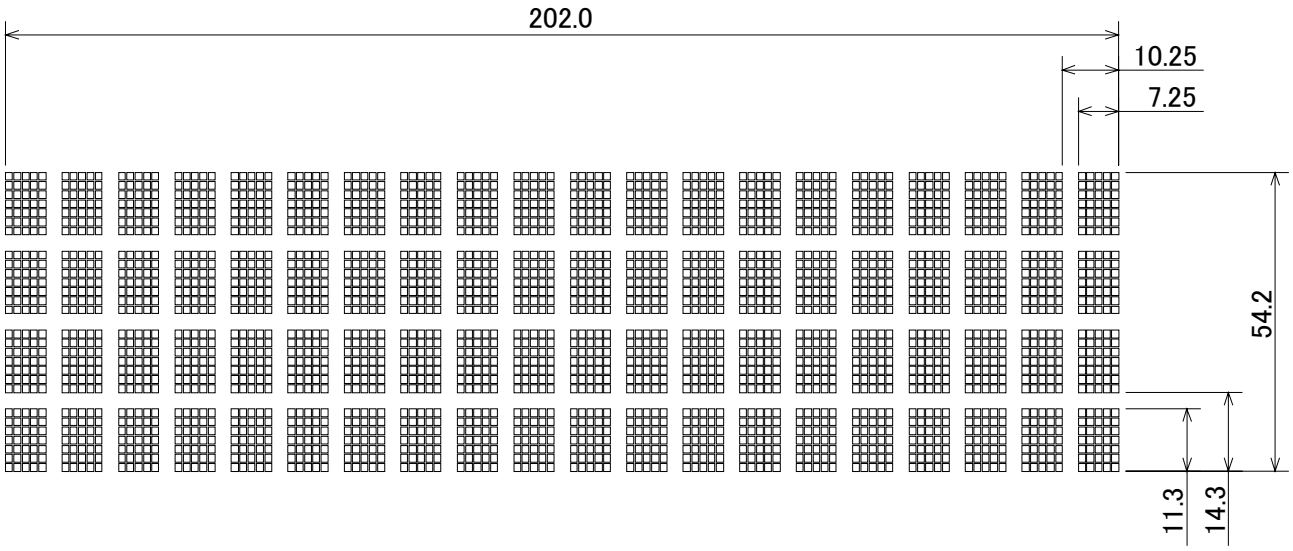
FIGURE-2

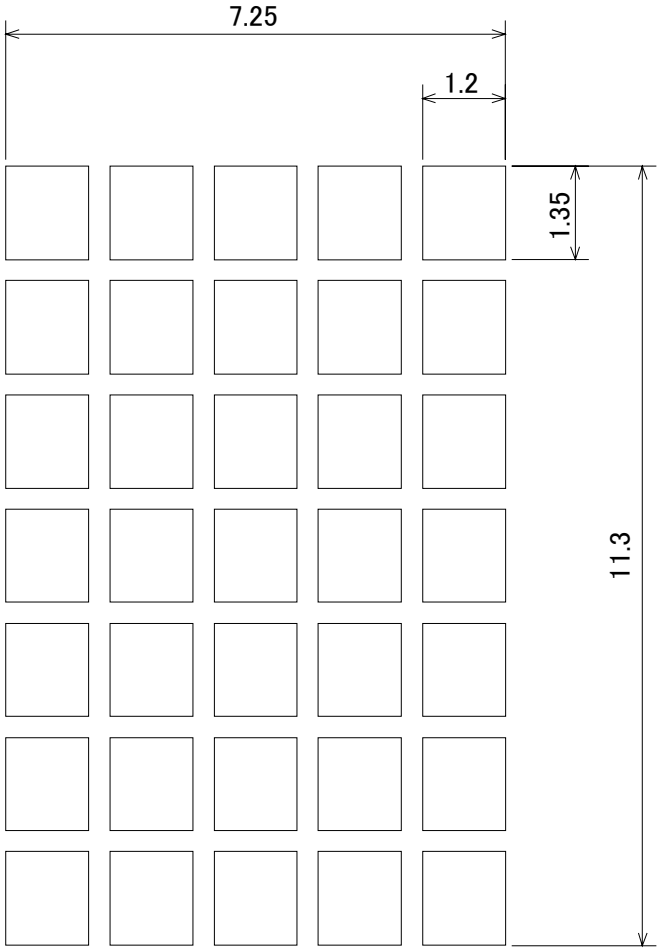


M204LD01AA　DISPLAY PATTERN FIGURE

FIGURE-3

Unit : mm





M204LD01AA DISPLAY CHARACTER CODE

FIGURE-4

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0			SP													
1		DC1														
2		DC2														
3																
4																
5																
6																
7																
8	BS															
9	HT															
A	LF															
B	VT	ESC														
C	CLR															
D	CR															
E																
F																

SP:SPACE

5. WARRANTY

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

6. CAUTIONS FRO 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. Avoid using the module where excessive noise interference is expected.
Noise affects the interface signal and cause 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 discharge immediately.
Avoid touching IC and others.
The shorting of the mounted components within 30 sc., 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.
Your consultation with FUTABA sales office is recommended for the use of this module.