

Specification  
of  
Vacuum Fluorescent Display Module

Model: CU20026MCPB-S32A

Revision

Ltr	Date	Description	Chk	Apprvd
-	'87.Apr.21	Initial issue		
2	'87.Jul.02	Revised Model Number CU20026MCPB-SnA -> CU20026MCPB-S32A		
3	'87.Oct.19	Revised Character Fonts (Table 1) Revised Para 4.0 Electrical Characteristics Supply Current ICC TYP 0.6 -> 0.45A MAX 0.8 -> 0.6A	M.N M.N M.N	
4	'88.Feb.29	Revised Para 8.1.1 8) ESC Reserved memory size five -> eight Revised Para 8.0 and 8.1 Added Para 8.3 and 12.0 Performed all pages	M.N	
5	'88.Apr.26	Revised Para 8.0, 10.0, 11.0, 12.0, 14.0 and 15.0		

## 1.0 General Description

1.1 Application Readout of computer, Micro-computer, communication terminal and automatic instruments.

1.2 Construction Single board display module consists of 40 character VPD, refresh memory, character generator, control circuit and DC/DC converter.

1.3 Outline dimension : See attached drawing.

## 2.0 Absolute Maximum Ratings

Power Supply Voltage	V <sub>CC</sub>	+7.0 VDC
Logi Input Voltage	V <sub>IN</sub>	+5.5 VD

## 3.0 Electrical Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power supply voltage	V <sub>CC</sub>	4.75	5.00	5.25	VDC

## 4.0 Electrical Characteristics

PARAMETER		SYMBOL	MIN	TYP	MAX	UNIT	CONDITION
INPUT VOLTAGE	H	V <sub>IH</sub>	2.4	-	V <sub>CC</sub>	VDC	V <sub>CC</sub> = 5V
	L	V <sub>IL</sub>	0	-	0.4	VDC	V <sub>CC</sub> = 5V
OUTPUT VOLTAGE	H	V <sub>OH</sub>	2.8	-	-	VDC	I <sub>OH</sub> = -400μA
	L	V <sub>OL</sub>	-	-	0.4	VDC	I <sub>OL</sub> = 1.6mA
SUPPLY CURRENT		I <sub>CC</sub>	-	0.45	0.6	A	V <sub>CC</sub> = 5V Operates all dots in all character positions

Note: Power-on delay of V<sub>CC</sub> shall be within 30ms. I<sub>CC</sub> might be anticipated more than 2 times of above table at power on rush.

## 5.0 Optical Specifications

Number of character : 40 (2 line x 20 chrs)  
Matrix format : 5 x 7 dot character with under line  
Display area : 100.2 mm x 16.0 mm (length x height)  
Character size : 3.3 mm x 5.05 mm (length x height)  
Character pitch : 5.1 mm (center to center)  
Line pitch : 9.95 mm  
Dot size : 0.5 mm x 0.55 mm  
Dot pitch : 0.7 mm x 0.75 mm (center to center)  
Luminance : 700 cd/m<sup>2</sup> (200 fl) typ.  
Color of luminance : Blue-green

## 6.0 Environmental Specifications

Operating temperature : 0 to +60°C  
Storage temperature : -40 to +70°C  
Operating humidity : 20 to 80% r.H.

## 7.0 Mechanical Strength

Vibration Test : Frequency : 10-55-10 Hz  
Sweep time : 1 minute  
Amplitude : 2mm (Fixed log)  
Direction : X, Y, & Z (3 directions)  
Times : 30 Min. for each direction

Shock Test : Acceleration : 100G  
Duration : 9.0 msec  
Direction : X, Y, Z (3 directions)  
Times : Three (3) times for each direction

The test shall be done at no operating and no any mechanical and electrical failures should be found after the tests.

## 8.0 Functional Descriptions

This VFD Module will provide the functions of DATA WRITE, COMMAND WRITE, DATA READ and DISPLAY RESET.

RD	WR	A0	CS	FUNCTION	Direction of DATA Bus
1	↑	0	0	DATA write	HOST to Module
1	↑	1	0	COMMAND write	HOST to Module
0	1	X	0	DATA read	Module to HOST

### 8.1 Data write

8.1.1 Data write is executed at ↑ edge of WR pulse while RD="1" and CS=A0="0". This module accepts 160 ASCII characters and 11 control codes listed in Table 1. Eight desired fonts may be alternated into character code of 00 Hex to FF Hex in table 1 with ESC(1B Hex) code. See 5) ESC.

Generally, the cursor automatically moves to right by one character position after execution of data write.

Control codes are defined as follows:

(The term of "CURSOR" means the writing position.)

1) **HT**: Horizontal Tab (09 Hex)

DC1 Mode: When the cursor is on the right most position of the bottom line, all characters on the bottom line shifted to one line up, and cursor is positioned to the left most position of the bottom line. At this time, all positions of the bottom line are cleared for a new line.

DC2 Mode: Same as DC1 Mode

2) **CR**: Carriage Return (0D Hex)

DC1 Mode: The cursor is positioned on the left most position of the same line.

DC2 Mode: Same as DC1 Mode.

3) **DC1**: Normal Mode (Default Mode 11 Hex)

After a character is written, the position of the cursor is automatically shifted to the right by one character position. When the cursor is on the right most position, the cursor is shifted to the left most position of the bottom line. When the cursor is on the right most position of the bottom line, the cursor is shifted to the left most position of the top line.

4) **DC2**: Horizontal Scroll Mode (12 Hex)

When the cursor reaches at the right end, the next data write makes the cursor overflowed, further data writes shift all displayed characters to left by one, and those new characters are written at right most position.

5) **ESC**: The following ESC code assigns eight desired fonts into any character positions from 00 Hex to FF Hex of table 1. RAM of the module reserves eight-character-size of Memory for these new characters. Seven-byte data succeeding this ESC code alternates present character font to new font desired.

1<sup>st</sup> byte: 1B Hex

2<sup>nd</sup> byte: Definition of character code.

Definable character codes are available from 00 Hex to FF Hex of table 1. If the character code of control characters as HT, CR, etc, is selected for new character, the module displays new character instead of control action.

Caution that definition of 1B Hex(ESC) character code kills ESC function there after.

3<sup>rd</sup> -- 7<sup>th</sup> byte: Formation of character font.

Each dot data of 5 x 7 is defined with following table. Figures in the table are corresponded to each dot position of 5 x 7. The dots to be lighted shall be specified as "1" (active high).

Table 1

BYTE	D7	D6	D5	D4	D3	D2	D1	D0
3 <sup>rd</sup>	8	7	6	5	4	3	2	1
4 <sup>th</sup>	16	15	14	13	12	11	10	9
5 <sup>th</sup>	24	23	22	21	20	19	18	17
6 <sup>th</sup>	32	31	30	29	28	27	26	25
7 <sup>th</sup>	*	*	*	*	*	35	34	33

\*= "0" (low)

After execution of above sequence, new character defined will be displayed by defined character code.

Display dot 5 x 7 DOT

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35

Example: Definition of new character "!" by character code of 21 Hex:

Dot pattern

		○		
		○		
		○		
		○		
		○		
		○		

Specify each dot

Byte/Bit	7	6	5	4	3	2	1	0	Hex
3 Byte	1	0	0	0	0	1	0	0	84
4 Byte	0	0	0	1	0	0	0	0	10
5 Byte	0	0	0	0	0	0	1	0	02
6 Byte	0	0	0	0	0	0	0	0	00
7 Byte	0	0	0	0	0	0	0	1	01

Then syntax should be written: 1B + 21 + 84 + 10 + 02 + 00 + 01(Hex)

6) **LC** Luminance Control (17 Hex)

Displayed characters in the area defined by two byte data succeeding LC (17 Hex) have luminance Level A, and the other area has Luminance Level B. The underline luminance is also varied same as the character. Luminance Level attributes to the characters, not to the character position, and it can be defined for multiple strings.

Luminance level A : Standard brightness.

Luminance Level B : 40% of Luminance level A.

Left most position ..... right most position

1st line	00 Hex	.....	13 Hex
2nd line	14 Hex	.....	27 Hex

7) **CLC** Cancel Luminance Control (18Hex)

All displayed characters have Luminance Level A.

8) **CB** Character Blink (19 Hex)

Displayed characters in the area defined by two byte data succeeding CB (19Hex) become blinking. Blinking is only given to the characters, not for under lines. Blinking attributes to the characters, not for character position.

9) **CCB** Cancel Character Blink (1A Hex)

Stops characters Blink.

10) **UL** Under Line (1C Hex)

Under Lines are belonged to displayed characters in the area defined by two byte data succeeding UL(1C Hex) and it can be defined for multiple strings.

11) **CUL** Cancel Under Line (1D Hex)

Cancels all under lines.



## 8.2 Command Write

Command write is executed at ↑ edge of WR pulse while CS="0" and RD=A0="1". This module has tree(3) commands as follows:

- 00XX XXXX: Sets the cursor on 00XX XXXX(binary) position.  
The cursor is positioned at left most position by 0000 0000. When more than the number of characters(40) is specified, the cursor will not move.
- 0100 0000: (40 Hex) Software reset of the first line.  
All character position of the first line are filled with SP (20 Hex)-characters. The cursor position is set on the left most position in the case of the cursor in the first line. The cursor does not move when it is in the 2nd line.
- 0100 0001: (41 Hex) Software reset of the second line.  
All character position of the second line are filled with SP (20Hex)-characters. The cursor position is set on the left most position in the case of the cursor in the second line. The cursor does not move when it is in the first line.

## 8.3 Data Read

The data or the command from the host system will be stored into the output buffer of the module at every write cycle. To read the output buffer may use for an error check of transferred data.

## 8.4 Hardware Reset

RESET="1" makes the module initialized as follows:

1. All character positions are filled with SP (20Hex) characters.
2. The cursor position is set on the left most position of the top line.
3. DC1 mode is selected.
4. Alternated characters specified by ESC code are cancelled, and standard characters in character generator are selected.
5. Luminance level is set to level A.

Reset signal is active high and shall be maintained 50ms or longer. No input is executed within 100ms after reset pulse or reset command. (See Timing chart)

### 8.5 BUSY signal

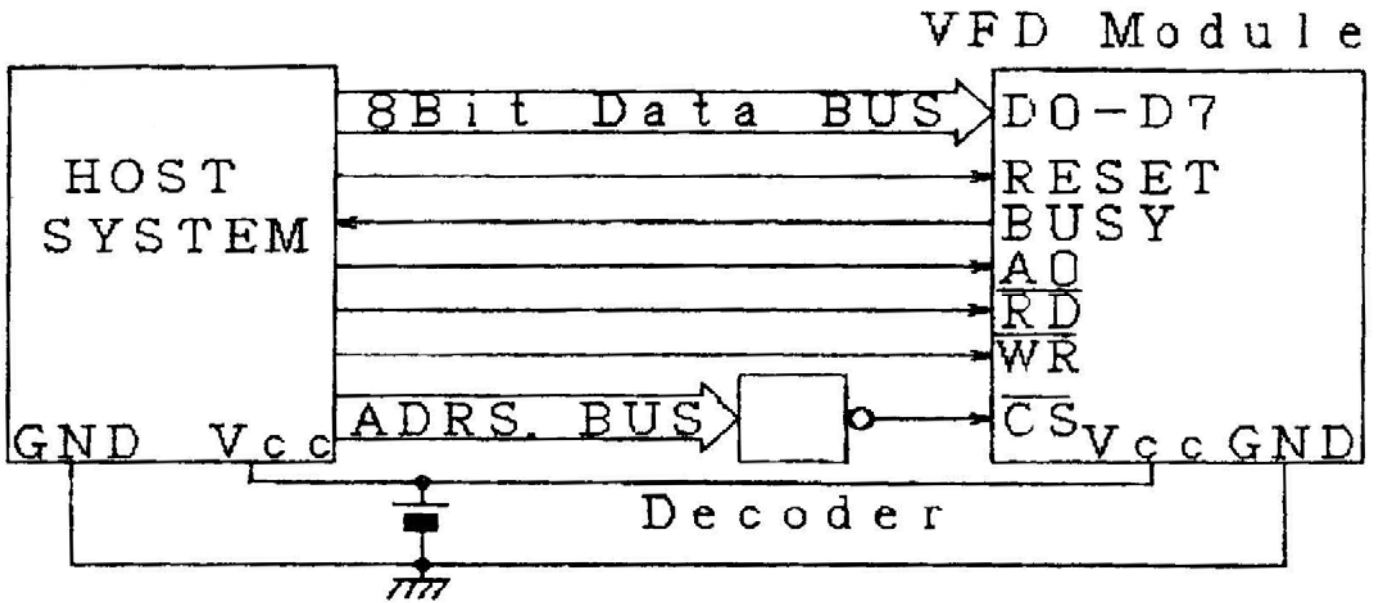
During the executing time of Data write and command write, the BUSY signal from display module will be HIGH.

### 9.0 Character fonts

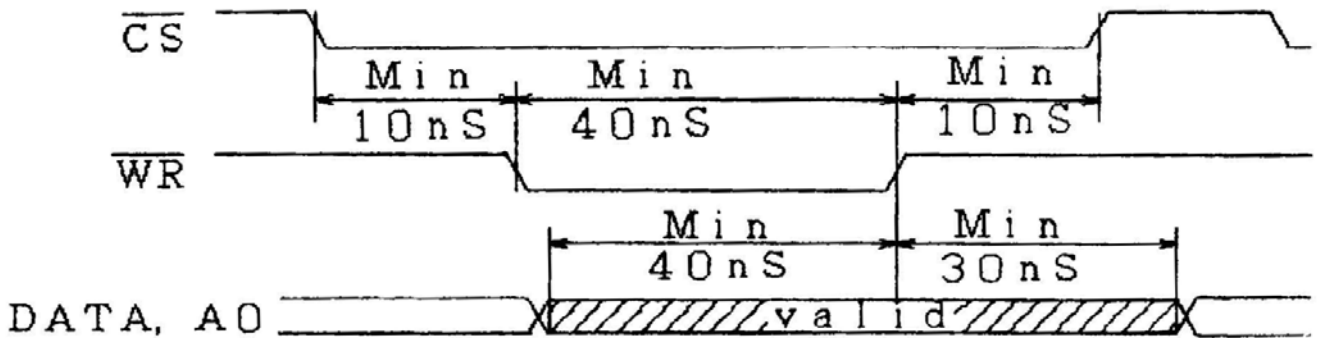
Table 1

				D7	0	0	0	0	0	0	0	0	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	0
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			SP	0	0	P	'	#			0	0	a	w			
0	0	0	1	1		DC1	!	1	A	0	a	a			1	1	b	n			
0	0	1	0	2		DC2	"	2	B	R	b	r			2	2	e	U			
0	0	1	1	3			#	3	C	S	c	s			3	3	i	o			
0	1	0	0	4			\$	4	D	T	d	t			4	°	L	/			
0	1	0	1	5			%	5	E	U	e	u			5	~	m	Δ			
0	1	1	0	6			&	6	F	U	f	u			6	2	n	∞			
0	1	1	1	7		LC	'	7	G	U	g	u			7	3	p	∞			
1	0	0	0	8		CLC	(	8	H	K	h	k			8	X	r	A			
1	0	0	1	9	HT	CB	)	9	I	Y	i	y			9	+	r	o			
1	0	1	0	A		CCB	*	A	J	Z	j	z			1	≤	w	U			
1	0	1	1	B		ESC	+	B	K	E	k	e			1	≥	x	ä			
1	1	0	0	C		UL	,	C	L	N	l	n			1	↑	r	ö			
1	1	0	1	D	CR	CUL	-	D	M	I	m	i			1	↓	a	o			
1	1	1	0	E			.	E	N	↑	n	↑			1	+	Σ	T			
1	1	1	1	F			/	F	O	↓	o	↓			1	←	o	■			

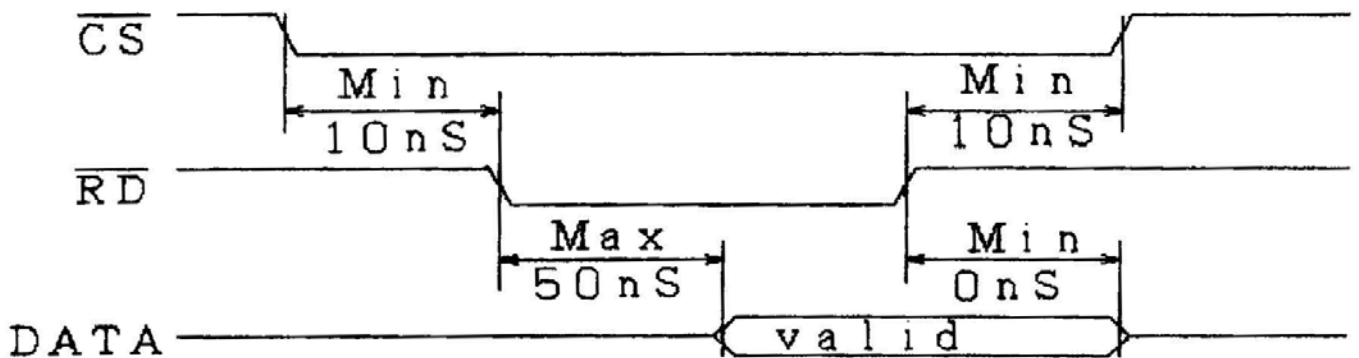
10.0 Interface Example



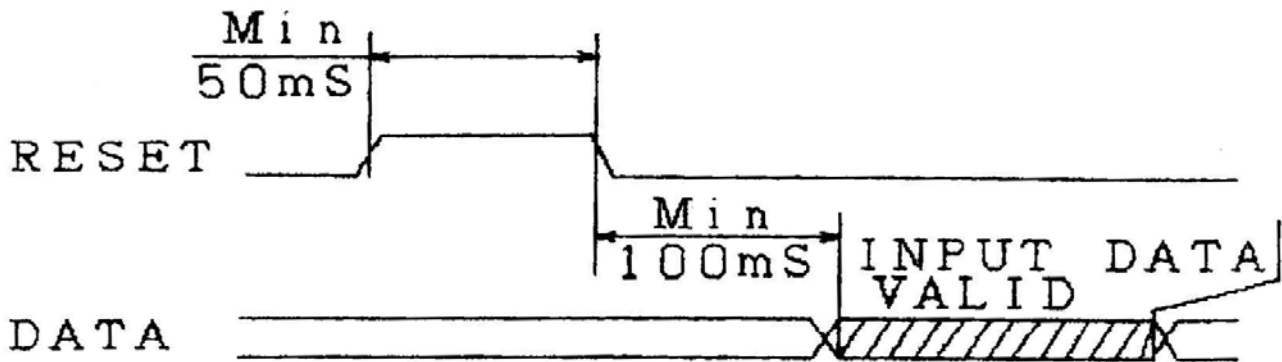
11.0 Data & Command Write Timing



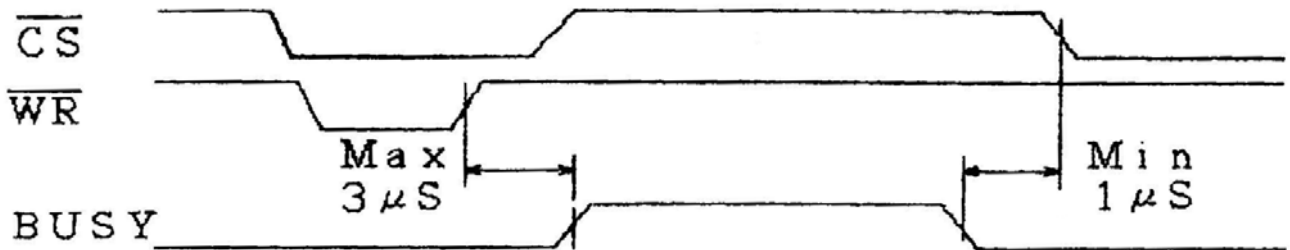
12.0 Data Read Timing



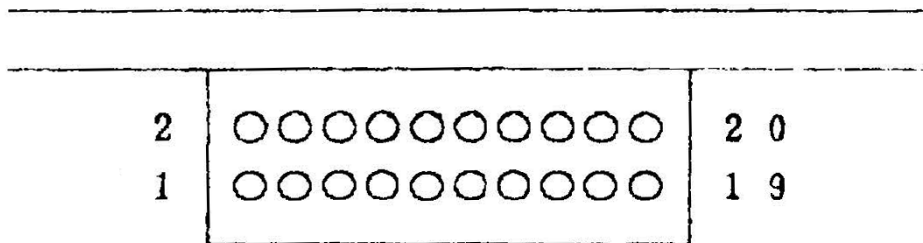
### 13.0 Reset Timing



### 14.0 Busy Timing



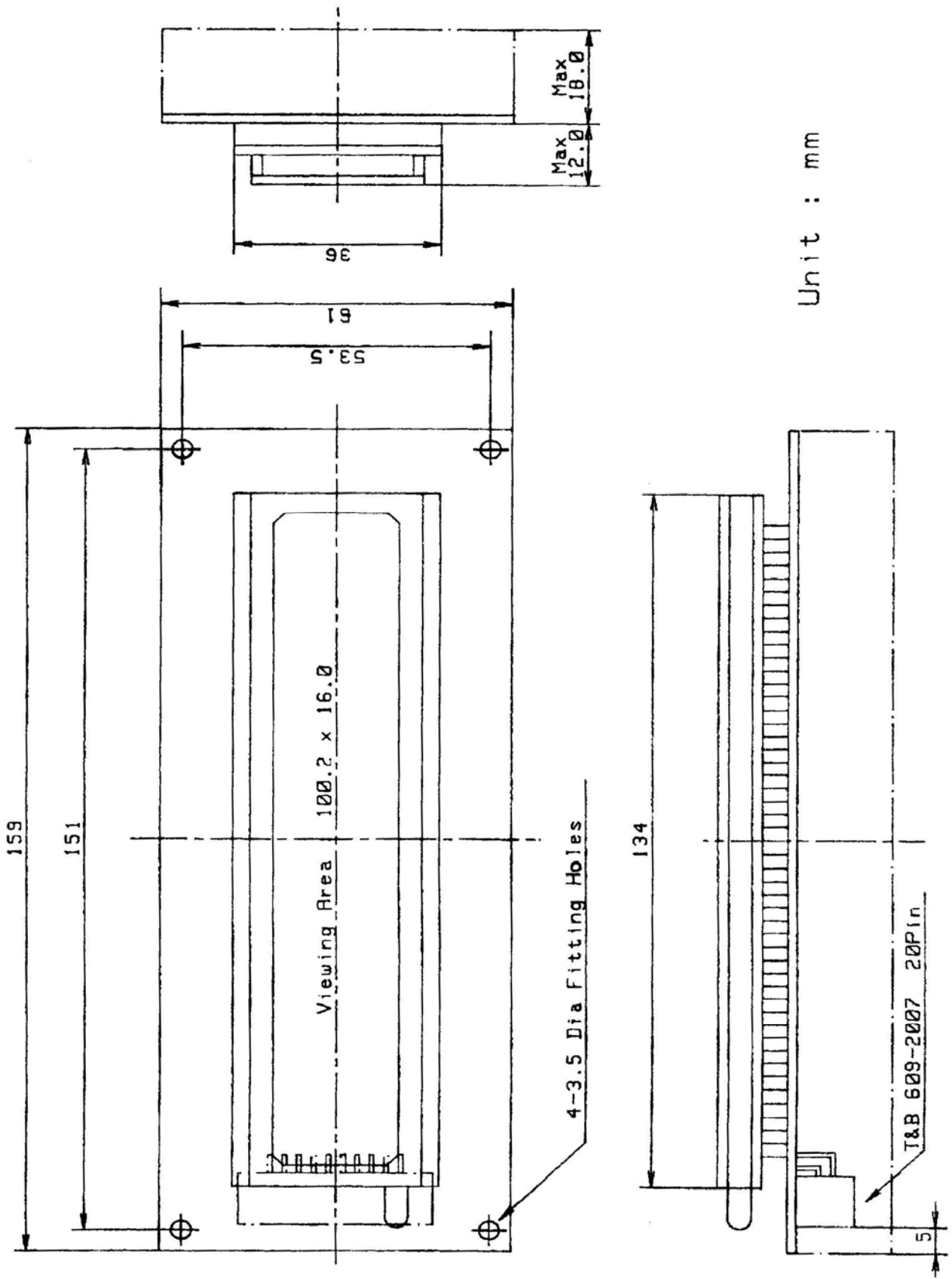
### 15.0 Pin Connection



△

No	Sig	No	Sig	No	Sig	No	Sig
1	GND	11	WR	2	Vcc	12	Reset
3	GND	13	D7	4	Vcc	14	D6
5	GND	15	D5	6	Vcc	16	D4
7	A0	17	D3	8	Busy	18	D2
9	RD	19	D1	10	CS	20	D0

16.0 Outline dimension



Unit : mm