VACUUM FLUORESCENT DISPLAY MODULE

SPECIFICATION

MODEL :CU40046MCPB-S33A

CUSTOMER

SPECIFICATION NO. :DS-127-0000-01
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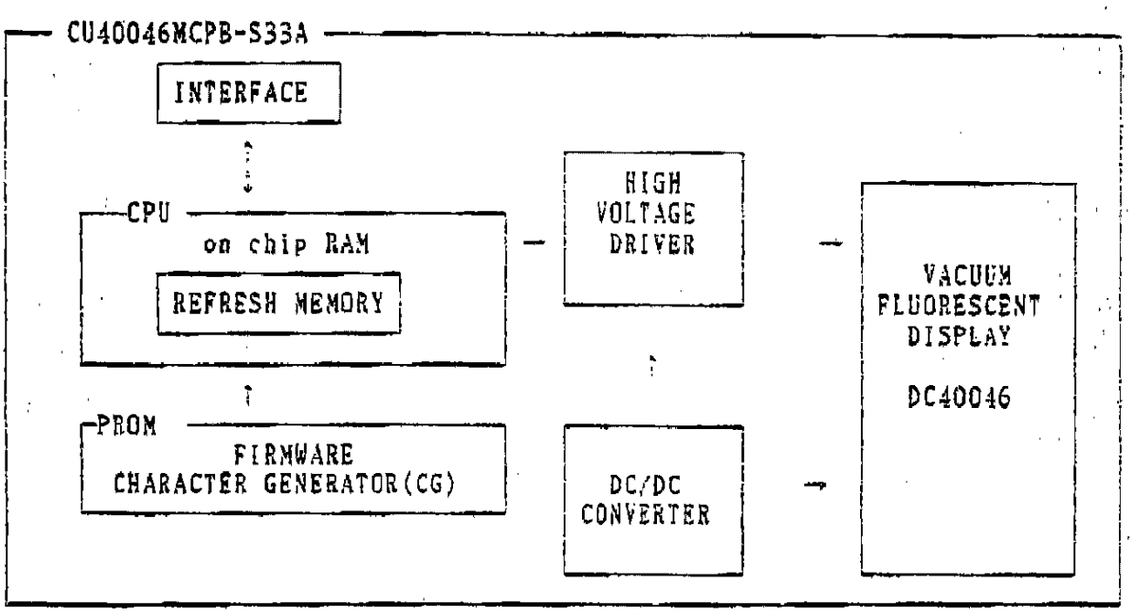
JAPAN

1.0 General Description

1.1 Application: Readout of computer, microcomputer communication terminal and automatic instruments.

1.2 Construction: Single board display module consists of 160 character (4x40)VFD, refresh memory, character generator, control circuit and DC/DC converter and all necessary control logics. Interface level is TTL compatible and module can be connected to the cpu bus of jost directly.



1.3 Drawing : See attached drawings.

2.0 Absolute Maximum Ratings

Power Supply voltage ---------- Vcc: +7V_{DC}
Logic Input Voltage ------ Vin: +5.5V_{DC}

3.0 Electrical Ratings

Parameter	Symbol	MIN.	TYP.	MAX.	UNIT
Power supply voltage	VCC	4.75	5.0	5.25	V_{DC}

4.0 Electrical Characteristics

PARAMETER		SYMBOL	MIN	TYP	MAX	UNIT	CONDITION
INPUT VOLTAGE	H	V_{IH}	2.0	-	-	V_{DC}	
	L	V_{IL}	-	-	0.8		
OUTPUT VOLTAGE	H	V_{OH}	2.7	-	-	V_{DC}	I_{OH} = 400uA
	L	V_{OL}	-	-	0.4		I_{OL} = 1, 6 a A
Reset	H	V_{IH}(R)	5.0	-	-	V_{DC}	V_{CC} = 5.0V
	L	V_{IL}(R)	-	-	0.5		
Supply current	???		-	1.3	1.5	A_{DC}	V_{CC} = 5.0V Test Mode
			-	1.4	1.6	A_{DC}	V_{CC} = 5.0V All dots turned on

Slow start power supply may Cause erroneous operation.
I_{CC} might be anticipated more than 2 times figure of above table at power on rush.

5.0 Optical Specifications

Number of characters : 160(4 line x 40 chrs)
Matrix format : 5 x 7 dot character with cursor
Display area : 188.55 mm x 30.8 mm(X x Y)
Character size : 3.25 mm x 5.0 mm(X x Y)

Character pich	**:**	**4.75 mm x 8.1 mm (X x Y)**
Dot size	**:**	**0.45 mm x 0.5 mm(X x Y)**
Dot pitch	**:**	**0.7 mm x 0.75 mm(X x Y)**
Luminance	**:**	**350 Cd/m^2 1OofL MIN.**
Color of illumination	**:**	**Blue-green**

6.0 Environmental Specifications

Operating temperature	**:**	**-10 to +65°C**
Storage temperature	**:**	**-40 to +85°C**
Operating humidity	**:**	**20 to 80% R.H (Non Condensed)**
Vibration	**:**	**10 to 55Hz 10Gmax**
	:	**3 direction. 3G min each**
Shock	**:**	**40G 9msec**

Vibration and shock tests shall be performed under the non-operating condition

7.0 Functional Descriptions

This module provides the functions of 8 Bit parallel data write and read, command write and serial data.
Each control data and character fonts are shown in table 1 to table 3. They can be written by parallel data write and serial data write. Once character data is written, the writing position is incremented automatically.
All data and command write should be done during BUSY line is low. All data read proceeded by ESC or commands should be done after BUSY line is low.
In the parallel data write, interfacing is set to the data bus of 180 series when jumper wire JH is open (as is from factory) and it can be change to meat to M68 series by shorting of jumper wire JH, Location of jumper wire JH shows in Para 10.

JH open (180 series)

\CS	\RD	\WR	A0	Function	BUS direction
0	1	?	0	Character data write	Module ← Host
0	1	?	1	Command data write	Module ← Host
0	0	1	X	Data read	Module → Host
1	X	X	X	No operation	Module X Host

? rising edge of pulse X: don’t care

JH short (M68 series)

\CS	EN	R/W	A0	Function	BUS direction
0	?	0	0	Character data write	Module ← Host
0	?	0	1	Command data write	Module ← Host
0	1	1	X	Data read	Module → Host
1	X	X	X	No operation	Module X Host

? Falling edge of pulse X : don't care

Note: The control lines \RD and EN or \WR and R/W are coincided in the data connector.

7.1 Character and control code set

7.1.1 International Font

D7 D6 D5 D4	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
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	@	P	`	p								
0 0 0 1	1	DC1	!	1	A	Q	a	q								
0 0 1 0	2	DC2	"	2	B	R	b	r								
0 0 1 1	3	DC3	#	3	C	S	c	s								
0 1 0 0	4	DC4	$	4	D	T	d	t								
0 1 0 1	5	DC5	%	5	E	U	e	u								
0 1 1 0	6	DC6	&	6	F	V	f	v								
0 1 1 1	7	CG0	'	7	G	W	g	w								
1 0 0 0	8	BS	(	8	H	X	h	x								
1 0 0 1	9	HT	)	9	I	Y	i	y								
1 0 1 0	A	LF	*	:	J	Z	j	z								
1 0 1 1	B	VT	ESC	;	K	[	k	{								
1 1 0 0	C	FF	,	<	L	\	l	|							
1 1 0 1	D	CR	-	=	M	]	m	}								
1 1 1 0	E	CLR	.	>	N	^	n	~								
1 1 1 1	F		/	?	O	_	o									

Table 1

7.1.2 International character and KATAKANA character Font

D7 D6 D5 D4		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
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	@	P	`	p								
0 0 0 1	1		DC1	!	1	A	Q	a	q								
0 0 1 0	2		DC2	"	2	B	R	b	r								
0 0 1 1	3		DC3	#	3	C	S	c	s								
0 1 0 0	4		DC4	$	4	D	T	d	t								
0 1 0 1	5		DC5	%	5	E	U	e	u								
0 1 1 0	6		DC6	&	6	F	V	f	v								
0 1 1 1	7		CG0	'	7	G	W	g	w								
1 0 0 0	8	BS	CG1	(	8	H	X	h	x								
1 0 0 1	9	HT	CG2	)	9	I	Y	i	y								
1 0 1 0	A	LF		*	:	J	Z	j	z								
1 0 1 1	B	VT	ESC	+	;	K	[	k	{								
1 1 0 0	C	FF		,	<	L	\	l	|							
1 1 0 1	D	CR		-	=	M	]	m	}								
1 1 1 0	E	CLR		.	>	N	^	n	~								
1 1 1 1	F			/	?	O	_	o									

Table 2

7.1.3 International character and Russian character Font

D7 D6 D5 D4		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
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	@	P	`	p								
0 0 0 1	1		DC1	!	1	A	Q	a	q								
0 0 1 0	2		DC2	"	2	B	R	b	r								
0 0 1 1	3		DC3	#	3	C	S	c	s								
0 1 0 0	4		DC4	$	4	D	T	d	t								
0 1 0 1	5		DC5	%	5	E	U	e	u								
0 1 1 0	6		DC6	&	6	F	V	f	v								
0 1 1 1	7		CG0	'	7	G	W	g	w								
1 0 0 0	8	BS	CG1	(	8	H	X	h	x								
1 0 0 1	9	HT	CG2	)	9	I	Y	i	y								
1 0 1 0	A	LF		*	:	J	Z	j	z								
1 0 1 1	B	VT	ESC	+	;	K	[	k	{								
1 1 0 0	C	FF		,	<	L	\	l	|							
1 1 0 1	D	CR		-	=	M	]	m	}								
1 1 1 0	E	CLR		.	>	N	^	n	~								
1 1 1 1	F			/	?	O	_	o									

Table 3

7.2 Control Data Write

Detail of control data are shown in this clause. The term "Cursor" is the same meaning of "Writing Position".

7.2.1 BS: Back Space (08 Hex)
The cursor moves one character to the left.
At the left end, the cursor moves to the above right end.
No moves at the top of left end.

7.2.2 HT: Horizontal Tab (09 Hex)
The cursor moves one character to the right.
At the right end, the cursor moves to the left end on next line.
At the bottom of right end, it depends upon DC1 and DC3 mode.
DCl : The cursor moves to the top of left end.
DC2 : Within this mode, all displayed characters are scrolled up one line. The cursor moves to the bottom of left end and all written characters on the top line are disappeared.
The bottom line is cleared.

7.2.3 LF: Line Feed (0A Hex)
The cursor moves to the same position on the next line.
At the bottom line, it depends upon DC1 and DC2 mode.
DCl : The writing position moves to the same position on the top line.
DC2 : The displayed characters are scrolled up one line. The characters top line are disappeared. The cursor keeps the same column position and the bottom line is cleared.

7.2.4 VT: Vertical Tab (OB Hex)
The cursor moves to the same position on the above line.
At the top line, it moves to the bottom.

7.2.5 FF: Form Feed (OC Hex)
The writing position moves to the top of left end.

7.2.6 CR: Carriage Return (OD Hex)
The writins position moves to the left end on the same line.

7.2.7 CLR: Clear (0E Hex)
All written characters are cleared. The cursor doesn't move.

7.2.8 DC1: Device Control 1 (11 Hex) .... Character over write mode
DC2: Device Control 2 (12 Hex) .... Scroll up mode
Alternative LINE ENDING MODE is specified by DC1 and DC2 when control data HT or LF or character data is written. Just after the power on, DCl is selected (Default Mode).

7.2.9 DC3 : Device Control 3 (13 Hex) .... Cursor is displayed on underline.
DC4 : Device Control 4 (14 Hex) .... Cursor it turned to invisible.
DC5 : Device Control 5 (15 Hex) .... Cursor is displayed as blinking all dot character.
DC6 : Device Control 6 (16 Hex) .... Cursor is displayed as a blinking underline.
Above four codes control the cursor rendition. DC3 is default mode. The mode is maintained until other mode is selected. The blinking speed can be varied by ESC sequence. (see para. 7.2.11 ESC-6)

7.2.10 CGO Character bank 0 (17, Hex) International character font
CG1 Character bank 1 (13, Hex) International character font and KATAKANA character font.
CG.2 Character bank 2 (19 Hex) International character font and Russian character font.
These data selected Character Bank. Just after power on, CGO is selected (Default Mode). Any desired characters from those 3 tables can be displayed in the screen by the bank selection.

7.2.11 ESC : Escape (1B Hex)
The character or data strings succeeding of ESC code control the various functions such as user definable font, cursor addressing, screen luminance control, selection of data writing mode, start and stop of self diagnostic mode, blink speed control, initialize. selection of underline display mode, selection of character blinking and command execution.

1. User Definable Font (UDF)

User's desired fonts can be defined by software. The Fonts will be memorized in RAM of the CPU.

Syntax : ESC (1B Hex) + (43 Hex) + chr + PT1 + PT2 + PT3 + PT4 + PT5
Any 5 x 7 dot patterns consisted of data form PT1 thru PT5 can be stored in the character code location specified by chr.
Maximum number of UDF are 12 characters at once. Storing more than 12 will kill the oldest font. However, within the 12 character codes where already defined by UDF. The over-write-latest font replaces the former font.

1st byte : ESC (15 HeD
2nd byte : "C" (43 'Hex)
3rd byte : chr (00 Hex to FF Hex)
Specify the character code location from 00 Hex to FF Hex by chr. If chr overlaps the control codes such as BS, HT, etc., the control function will be lost. And therefore, overlap to the ESC code may not avail further UDF.
4th to 8th byte: PT1 thru PT5
Specify ON or OFF of 36 dot position (5 x 7 dot + underline). Following table shows the relation of dot position and the data formation.
(“1” = dot turn on "0"= dot turn off)

	7(MSB)	6	5	4	3	2	1	0(LSB)
4th byte	P22	P24	P26	P28	P30	P32	P34	UL
5th byte	P6	P8	P10	P12	P14	P16	P18	P20
6th byte	P29	P31	P33	P35	X	X	P2	P4
7th byte	P13	P15	P17	P19	P21	P23	P25	P27
8th byte	X	X	P1	P3	P5	P7	P9	P11

UL : Underline X: don’t care

Following is the dot assignment.

P1	P2	P3	P4	P5
P6	P7	P8	P9	P10
P11	P12	P13	P14	P15
P16	P17	P18	P19	P20
P21	P22	P23	P24	P25
P26	P27	P28	P29	P30
P3l	P32	P33	P34	P35
U L				

After execution of above sequence, a defined font will be stored in the character code location "chr"(Hex)

Following is an example of UDF sequence.
Example: "!" dot pattern should be stored in character code location A0 Hex.

Desired Dot Pattern

		0		
		0		
		0		
		0		
		0		

Turn on dot number

P3
P8
P13
P18

P33

Byte/Bit	7	6	5	4	3	2	1	0	HEX
4th Byte	0	0	0	0	0	0	0	0	00(PT1)
5th Byte	0	1	0	0	0	0	1	0	42(PT2)
6th Byte	0	0	1	0	0	0	0	0	20(PT3)

7th Byte	1	0	0	0	0	0	0	0	80(PT4)
8th Byte	0	0	0	1	0	0	0	0	10(PT5)

Then Syntax should be written: 1B + 43 + A0 + 00 + 42 + 20 + 80 + 10 (Hex)

2. Cursor Moving

The cursor can be moved any position of the screen by following ESC sequence.

Syntax: ESC(1B Hex) + "H"(48 Hex) + 1 Byte data

	Left Most Column	Next Column		Right Most Column
top line	00	01	.....	27
2nd line	28	29	.....	4F
3rd line	50	51	.....	77
bottom line	78	79	.....	9F

(A0 ~ FF Hex = non-operation)

3. Luminance Control

The screen luminance can be varied by following ESC sequence.
Just after power on or reset, the screen luminance is set to 100%.

Syntax : ESC(1B Hex) + "L"(4C Hex) + 1 Byte Data

Data = 00 Hex to 3F hex approx. 25%
40 Hex to 7F Hex approx. 50%
80 Hex to BF Hex app7px. 75%
CO Hex to FF Hex 100%. (default)

4. Selection of Writing Mode

Alternative Flickerless Mode and Quick Write Mode can be selected by following ESC sequence.

Syntax ESC(1B Hex) + "S"(53 Hex) .... Flickerless Mode
ESC(1B Hex) + "E"(45 Hex) .... Quick Write Mode (Default)

Within Flickerless mode, although BUSY might become longer, flicker less-high speed-continuous-data write can be achieved since refreshing of the screen has priority over the data acceptance.

Quick data write with minimum BUSY time will be given by Quick Write Mode since the data acceptance has the priority over the refreshing of the screen. Within this mode, continuous high speed data write may cause flicker display.

Note:
When serial data write with high speed baud rate at Flickerless Mode, it may have the read error of the data. Busy check within Flickerless or setting to the Quick Write Mode is recomended for serial data write. Just after power on or reset. Quick Write Mode is selected until other mode is set.

5. Self Diagnostic Function

Start or stop of Test Mode and memory check of RAM and ROM can be done by following ESC sequence.

Syntax : ESC(1B Hex) + "R"(52 Hex) .... Test Mode will be started
ESC(1B Hex) + "N"(4E Hex) .... Test Mode will be stopped
ESC(1B Hex) + "M"(4D Hex) .... Memory (RAM and ROM) will be checked and its result be sent to the host thru the data bus as following data format;

bit 2 to 7 : not assigned, do not care
bit 1 : 1= possess ROM error 0= no ROM error
bit 0 : 1= possess RAM error 0= no RAM error

Within Test Mode, all stored ROM fonts are displayed in the screen one by one automatically. Font displaying speed can be varied by Speed control ESC sequence. Test Mode also can be started by T0=”0” at the time of power on or reset. Not possible to stop, however, by sending of ESC + "N" command.

6. Blink Speed Control
Blinking speed of cursor and character font displaying speed at self test mode can be varied by following ESC sequence.

Syntax : ESC(1B Hex) + "T"(54 Hex) + 1 Byte Data

Data = 00,FF Hex 128
FE,FD Hex 127
FC,FB Hex 126
02,01 Hex 1

Period of Plinkins = Data Value x 22 msec. At Power on default, 32 (40 Hex) is set to the data.

7. Initialize
All displayed characters and all setting factors are cleared by following ESC sequence.

Syntax : ESC(1B Hex) + “I"(49 Hex)

Execution of above sequence, module is reset to same state after power on.

8. Selection of underline mode
Underline is displayed by writing the following data.

Syntax : ESC(1B Hex) + "U"(55 Hex) ... underline display mode select
+ "W"(57 Hex) ... underline display mode cancel

9. Selection of character blinking
Characters are blinked by the following data write.

Syntax : ESC(1B Hex) + "B"(42 Hex) ... characters blinking mode select
+ “A"(41 Hex) ... characters blinking mode cancel

10. Command execution
Command write is executed. (see Para 7.3)

Syntax : ESC(1B Hex) + "X"(58 Hex) + 1BYte data (Command Code)

7.3 Command Data Write

All input data is defined as the command when A0 line is “High".
The following commands are provided.

7.3.1 Cursor Moving (00 Hex - 9F Hex)

Cursor can be moved any character position in the screen by giving of 1 byte data as follows.

	Left Most Column	Next Column		Right Most Column
top line	00	01	.....	27
2nd line	28	29	.....	4F
3rd line	50	51	.....	77
bottom line	78	79	.....	9F

7.3.2 Cursor Position Read (F0 Hex)

Cursor Position can be read by following 1 byte positioning data.

	Left Most Column	Next Column		Right Most Column
top line	00	01	.....	27
2nd line	28	29	.....	4F
3rd line	50	51	.....	77
bottom line	78	79	.....	9F

7.3.3 Data Read at Cursor (Fl Hex)

Data at cursor can be read by sending the command of F1 Hex.
1 byte data of character code will be sent back to the host through the data bus.

7.3.4 Data Read at Cursor + HT (F2 Hex)

Data at cursor can be read by sending the command of F2 Hex.
And HT is executed.
1 byte data of character code will be sent back to the host through the data bus.

7.3.5 Character Insert (F3 Hex)

Character at cursor and following characters move one to right by sending the command of F3 Hex. The right most character will be overflowed. One space is written at cursor position. Cursor doesn't move.

7.3.6 Character Delete (F4 Hex)

Character at cursor is deleted and following characters move one to left by sending the command of F4 Hex. One space is written at right most. Cursor doesn't move.

7.3.7 Line Insert (F5 Hex)

Line with cursor and following lines scroll one line up by sending the
command of F5 Hex. On the line with cursor is cleared and settled at left most. The bottom line is overflowed.

7.3.8 Line Delete (F6 Hex)

Line with cursor is deleted and following lines scroll one line up by sending the command F6 Hex. On the bottom line is cleared. Cursor doesn't move.

7.3.9 Reset (FF Hex)

The module can be reset by sending the command of FF Hex.
All displayed characters and all set factors are cleared. This is the same status just after the power on.

7.4 Data Read

After Data Read commands (F0,F1,F2 Hex) to the Display Module, the Data Read should be executed during the BUSY=”O".

7.5 Test Mode

If T0="O" at power-on time, the Display Module selects Test Mode and all stored ROM fonts are displayed on the screen one by one.
In this mode, Data Write and Command Write are not accepted.

7.6 Blanking

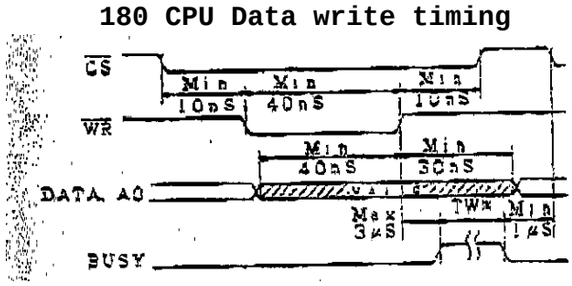
The display will be OFF at \BL="O".
The Display Module's memory is maintained.

8.0 Timing

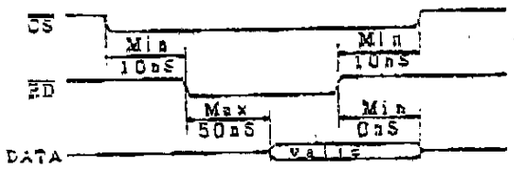
8.1 Parallel Interface Timing

The following Timing Charts show Data Write and Data Read timing of CPU type 180 series and M68 series. Address and date bus can be directly connected to 180 series or M68 series which might be characterized by a jumper wire on the board.
(See Para 10.0 Jumper Wires)
180 series is selected from the factory.

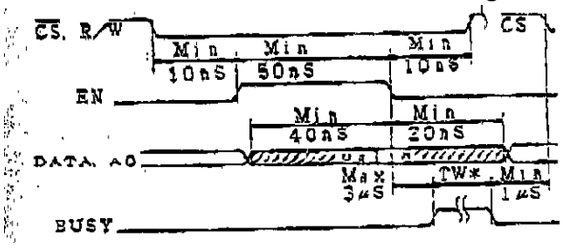
180 CPU Data write timing



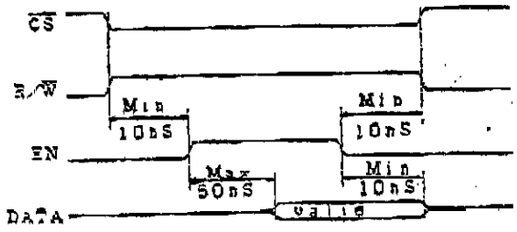
180 CPU Data read timing



M68 CPU Data write timing



M68 CFU Data read timing



Tw* : See Para 9.0 BU5Y TIME

8.2 Serial Interface Timing

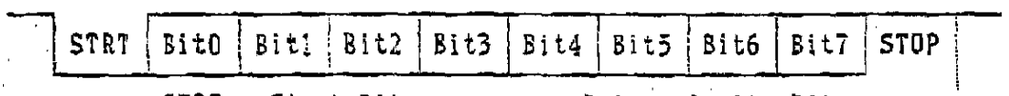
Serial data write. asynchronous-8bit TTL level is also acceptable through a center pin of the power connector or "TO" signal connector. Following baud rates can be selected by combination of the Jumper wires. (See Paragraph 10.0 Jumper wires)

300,600, 1200, 2400, 4800, 9600, 19200 BPS

parity bit - even, odd and non parity are selected by 2 jumper wires. (See Paragraph 10.0 Jumper wires)

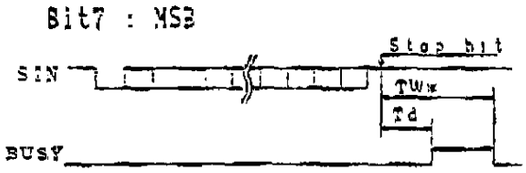
Serial data form with even or odd parity

Serial data form with non-parity



STRT : Start Bit
Bit0 : LSB
Prty : Parity Bit
STOP : Stop Bit

Bit7 : MSB



Td: 30uS(Typ.) at Quick Write Mode
30uS(Min.) ~ 500uS(Max.) at Flickerless Mode

TW* : See Para 9.0 BUSY TIME

Reset Timing

Above chart shows the reset timing.
Reset pulse (active low) should be longer than 1 msec.
It is required at least 100 msec to accept the data after reset pulse

9.0 BUSY TIME

Input data or command execution times (TW*) at "Quick write mode" are shown as follows.

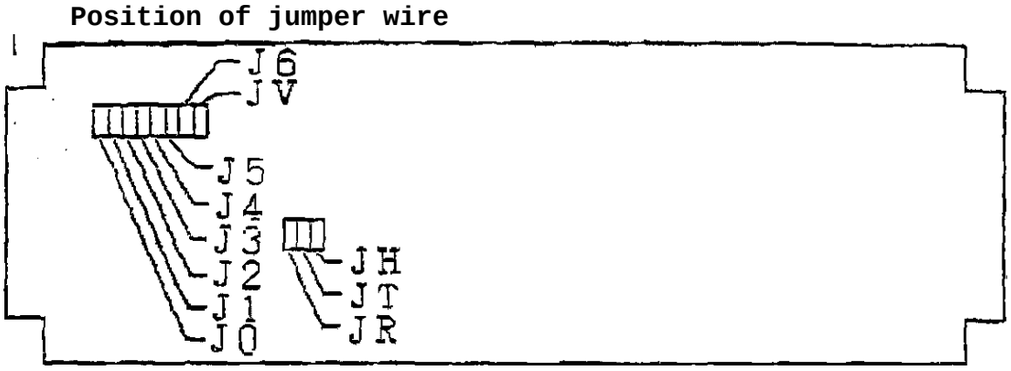
DATA WRITE			Execution Time (TW*)		Data Writing Mode
			DC1 Mode	DC2 Mode	
Character data write HT,LF			180us	1.0ms	Quick Write Mode
BS,VT,FF,CR DC1~6, CG0~2			180us		
CLR			1ms		
ESC	1st byte		180us		
	2nd byte	"C"	100us		
		"I"	1.6ms		
		"M"	50ms		
		Except "C", "I" and "M"	140us		
	3rd byte ~		140us		

COMMAND WRITE	Execution Time (TW*)		Data Writing Mode
	DC1 Mode	DC2 Mode	
00 Hex~9F Hex	100us		Quick Write Mode
F0 Hex F1 Hex			
F2 Hex	120us	1.0ms	
F3, F4 Hex	750us		
F5, F6 Hex	900us		
FF Hex	1.6ms		

Above execution times are only talking about, "Quick Data Write" as mentioned. Within Flikerless Mode. Approximately 2 to 15 times Of above table should be considered. Operating with Flickerless mode, therefore, always watching of BUSY line is recommended.

10.0 Jumper Wires

Position of jumper wire

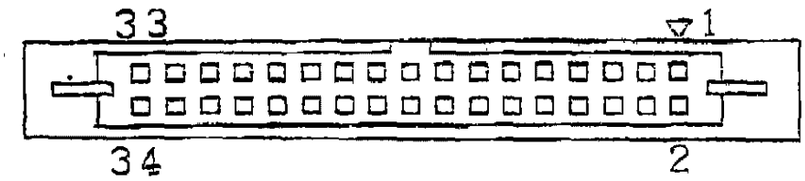


Jumper Function Table

Jumper	Function	Setting @ Factory
JT	Don't touch	
J6 J5 J4	BPS Select of serial data (J6.J5.J4)=(0,0,0): 300 BPS (1,0,0):2400 BPS (0,0,1): 300 BPS (1,0,1):4800 BPS (0,1,0): 600 BPS (1,1,0):9600 BPS (0,1,1):1200 BPS (1,1,1):19.2K BPS	ALL 1
J3 J2	Parity of serial data (J3,J2)=(0,X):Non Parity (1,0):Odd Parity (1,1):Even Parity	ALL 1
J1	Don't touch	
J0	Select Default Mode of Character Fonts (0)=:JlS Fonts(CGI) (1):international Fonts(CGO)	1
JH	Select parallel interface type 1: 180 type 0: M68 type	1
JR	Don't touch	
JV	Don't touch	

0 : Short 1 : 0pen X : Don’t care

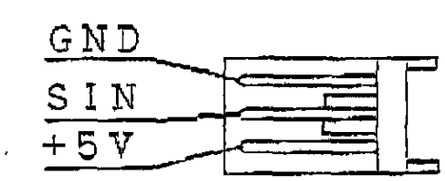
11.0 Connector Pin assignment
11.1 Data Connector



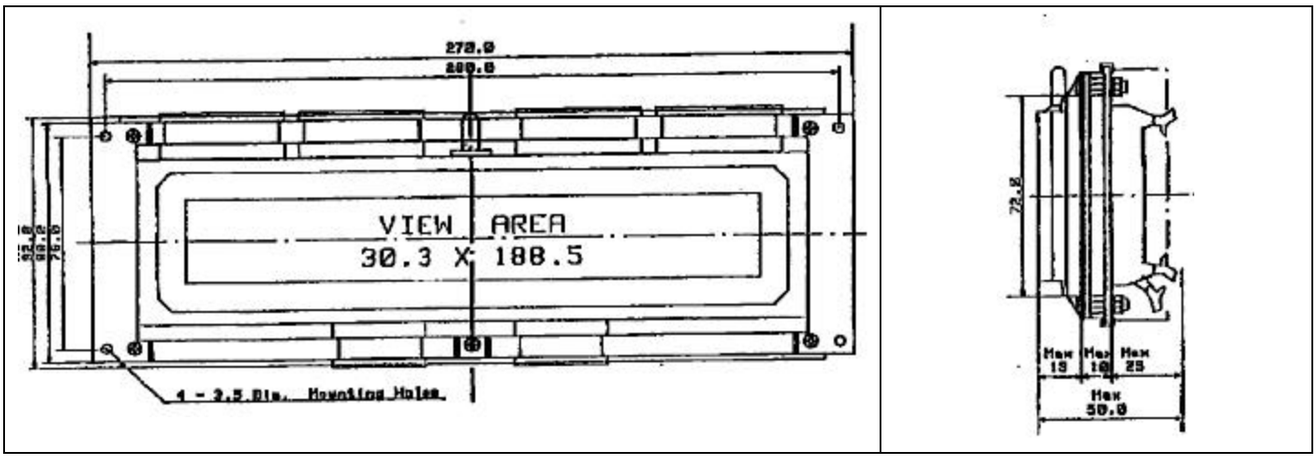
No	Signal
1	D7
3	D6
5	D5
7	D4
9	D3
11	D2
13	D1
15	D0
17	\WR (R\W)
19	A0
21	\RD (EN)
23	\CS
25	TO(SIN)
27	BUSY
29	\BL
31	\RESET
33	NC

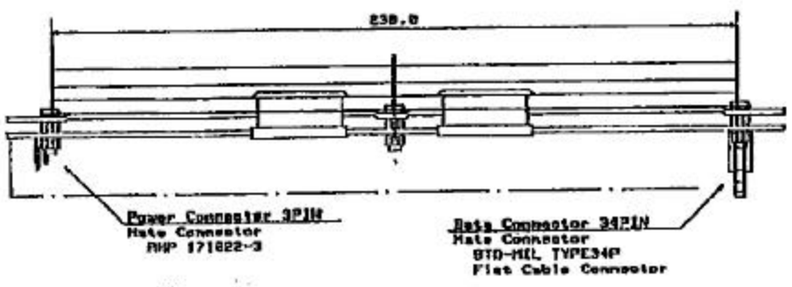
No.	Signal
2	GND
4	GND
6	GND
8	GND
10	GND
12	GND
14	GND
16	GND
18	GND
20	GND
22	GND
24	GND
26	GND
28	GND
30	GND
32	GND
34	GND

11.2 Power connector



12.0 Outline dimension





Attached Accessory:
Power Connector AMP 171822-3

Optional Accessory:
Power Connector Receptacle with 50 cm Cable
Order No. PCC-0301-050
Signal Connector 3M 3414-6500SC
Signal Connector Receptacle with 50 cm Cable
Order No. FSC-3431-050

IMPORTANT PRECAUTIONS

* **All VFD Modules contain MOS LSI's or IC's. Anti-Static handling procedures are always required.**

* **VF Display consists of Soda-lime glass. Heavy shock more than 100 G, thermal shock greater than 10°C/minute. direct hit with hard material to the glass surface especially to the EXHAUST PIPE -- May CRACK the glass.**

* **Do not PUSH the display strongly. At mounting to the system frame, slight gap between display glass face and front panel is necessary to avoid a contact failure of lead pins of display. Twist or warp mounting will make the glass CRACK around the lead Pin of display.**

* **Neither DATA CONNECTOR or POWER CONNECTOR should be connect or disconnected while power is applied.**
  As is often the case with most subsystems, caution should be exercised in selectively disconnecting power within a computer based system. The modules receive high logic on strobe lines as random signals on all data Ports. Removal Of Primary Power with logic signals applied may damage input circuitry.

* **Stress more than specification listed under the Absolute Maximum Ratings may cause PARMANENT DAMAGE of the modules.**

* **+5 volts Power line must be regulated completely since all control logics are depended on this line.**
  DO not apply slow-start power. Provide sufficient output current power source to avoid trouble of RUSH CURRENT at Power on. (At least output current of double figure of Icc. listed on the specification of each module, is required.)

* **Data cable length between module and host system is recommended within 500 mm to free from a mis-operation caused by noise.**

* **Do not place the module on the conductive plate just after the power off. Due to big capacitors on the module, more than 1 min. of discharging time is required to avoid the failure caused by shorting of power line.**