

Noritake **itron**

Vacuum Fluorescent Display

Module Specification

Model: GU256X32-8500

Specification No: DS-849-0001-00

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1. General Description

- 1.1 Construction: A 256x32 dot BD-VFD single board display module consisting of an 8 bit micro-computer, character generator and a DC/DC converter.
- 1.2 Features: Simultaneous display of graphic and Traditional Chinese characters.
(Please refer to the Character cord table "DS-849-0002-XX")
Flexible Display and Editing Functions.
Compact design due to the application of a BD-VFD tube
- 1.3 Dimensions: See attached drawings

2. Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Logic Input Voltage	VI	-0.5	—	Vcc +0.3	V	—
Power Supply Voltage	Vcc	0	—	6.5	VDC	—

3. Electrical Characteristics

Measurement Conditions: 25°C / Vcc=5.0V

Parameter		Symbol	Min.	Typ.	Max.	Unit	Condition
Logic Input Voltage	"H"	VIH	4.0	—	—	VDC	IIH= 2 μA
	"L"	VIL	—	—	1.0		III= - 600 μA
Logic Output Voltage	"H"	VOH	4.7	—	—	VDC	IOH= - 300 μA
	"L"	VOL	—	—	0.3		IOL= 300 μA
Reset Input Voltage	"H"	VRH	4.0	—	—	VDC	IRH= 5 μA
	"L"	VRL	—	—	0.6		IRL= - 600 μA
Power Supply Voltage		Vcc	4.75	5.00	5.25	VDC	—
Power Supply Current		Icc	—	750	900	mA	VCC=+5V, All dots ON
			—	600	750		VCC=+5V, All dots OFF

Notes:

The rise time of Vcc should not exceed 100 ms.

Icc may peak at power up may be more than twice the normal operating current

4. Optical Specifications

- Number of dots: 8192 (256x32)
 Display area: 166.25 mm x 20.65mm (X x Y)
 Dot size: 0.5 mm x 0.5 mm (X x Y)
 Dot pitch: 0.65 mm x 0.65 mm (X x Y)
 Luminance: 350cd/m² (Min)
 Color of illumination: Green (Blue Green)

5. Environmental Specifications

- Operating temperature: -40 to +85°C
 Storage temperature: -40 to +85°C
 Storage humidity: 20 to 80 % R.H(Non Condensation)
 Vibration: 10-55-10Hz, all amplitude 1mm, 30Min., X-Y-Z (Non operating)
 Shock: 539m/s² 10mS (Non operating)

6. Description of Bus and Signals

This module has serial and 2 types of parallel interface.

Type of interface can be selected by jumper settings Refer to 11 on page # 20 for details.

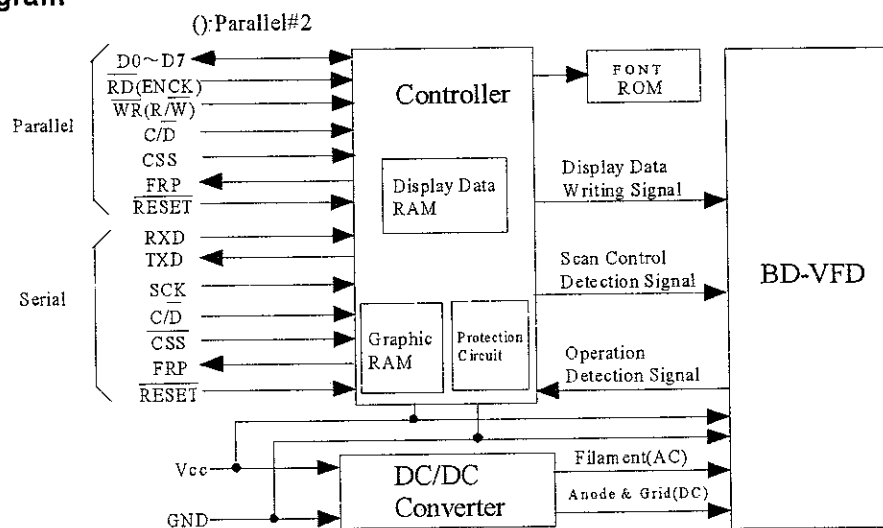
6.1 Parallel Interface

Data Line	Function
D0 ~ D7	Data Bus (Input / Output)
WR (RW)	Parallel #1: Write Signal, Parallel #2: RW (Input)
RD (ENCK)	Parallel #1: Read Signal, Parallel #2: ENCK (Input)
CSS	Chip Select (Input)
C/D	Command / Data Select Signal (Input) C/D = "1" ... Command C/D = "0" ... Data
FRP	Frame Pulse Signal (Output)
RESET	RESET="0" Reset (Input)
Vcc	Power Supply
GND	Ground

6.2 Serial Interface

Data Line	Function
RXD	Serial Input
TXD	Serial Output
SCK	Clock (Input)
CSS	Chip Select (Input)
C/D	Command / Data Select Signal (Input) C/D = "1" ... Command C/D = "0" ... Data
FRP	Frame Pulse Signal (Output)
RESET	RESET="0" ... Reset (Input) Active Low
Vcc	Power Supply
GND	Ground

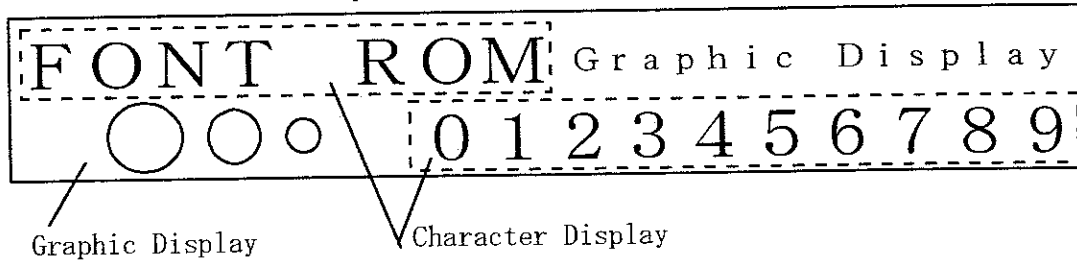
7. Block Diagram



8.0 Display Screen

The Display screen consists of 8,192 dots arranged as 256 by 32 dots. It is divided into 64 display area blocks of 16 by 8 dots each. Each display area block can be assigned to GRAM or DDRAM by the Display Area Set command. Refer to Section 9 5 (page # 10) Display Area Set. The combination display of characters and graphics is possible by using this function described in the following figure. All display area blocks are set as DDRAM area as default.

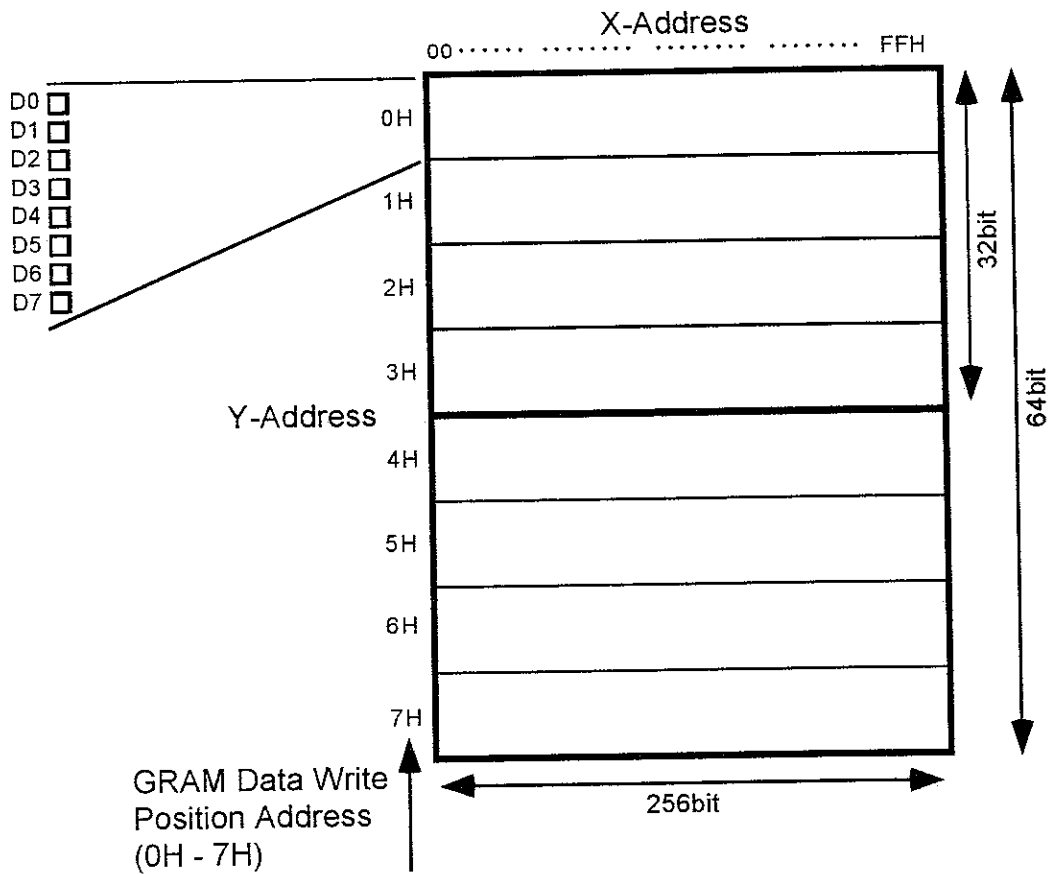
Example: 256x32 dots Display Screen



8.1 Graphic Display (GRAM)

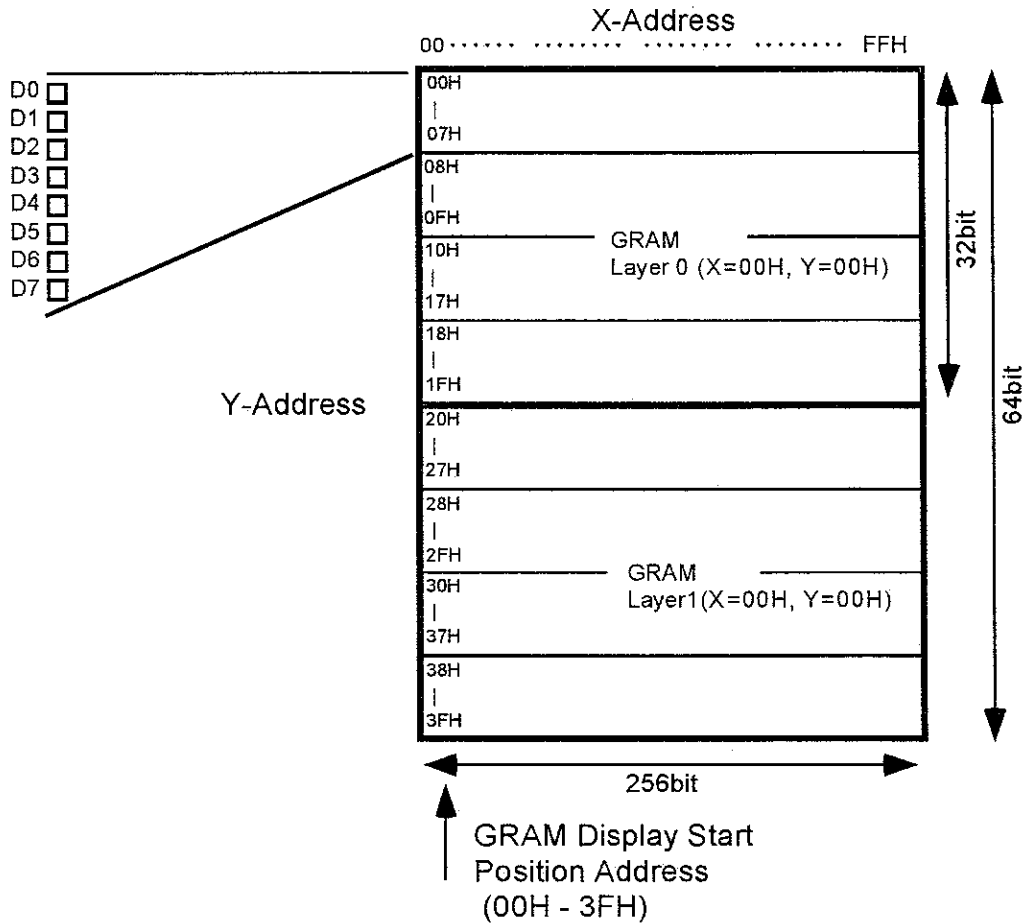
GRAM consists of 16,384 bits arranged in 256 by 64 bit blocks with access is structured as 8 bits of vertical data. The detail of GRAM is as follows:

GRAM Data Write Position Address



8.1 Cont'd

GRAM Display Start Position Address



This module has 2 layers - Layer 0 and Layer 1. Each layer in this display consists of 256 by 32 dots. Display merging using these 2 layers can be done with the Display ON/OFF command. Refer to 9.2 on page # 8 for details

Layer 0 has an area of 256x32 dots that starts from top left point defined by the GRAM Start Position Address. The area of Layer 1 is the next 256x32 dots.

When the value of the GRAM Start Position Address X overflow = FFH, the next position goes to 00H. When the value of the GRAM Start Position Address Y overflow = 3FH, the next position goes to 00H.

For example:

If the GRAM Start Position Address is set as X=02H, Y=08H, the area of Layer 0 is as follows;

X=02H,03H,04H FFH,00H,01H
Y=08H,09H 26H, 27H

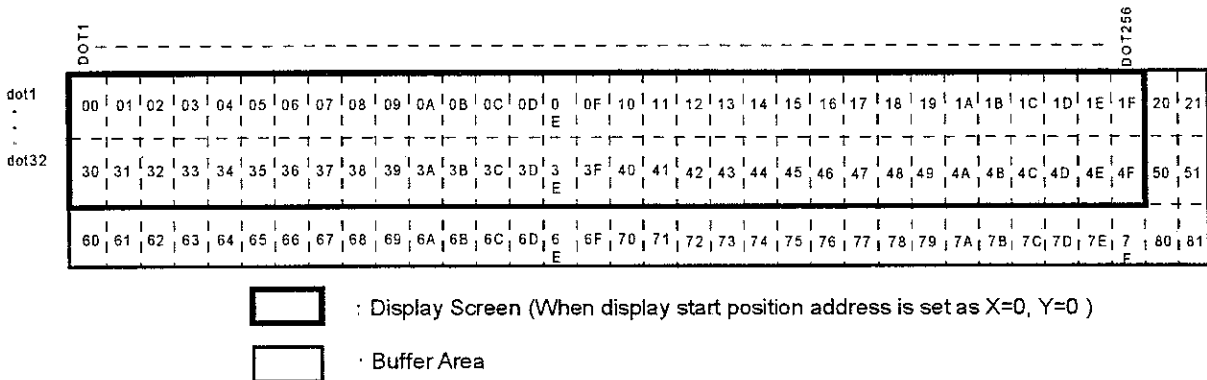
In this case, the area of Layer1 is as follows;

X=02H,03H,04H FFH,00H,01H
Y=28H,29H 06H,07H

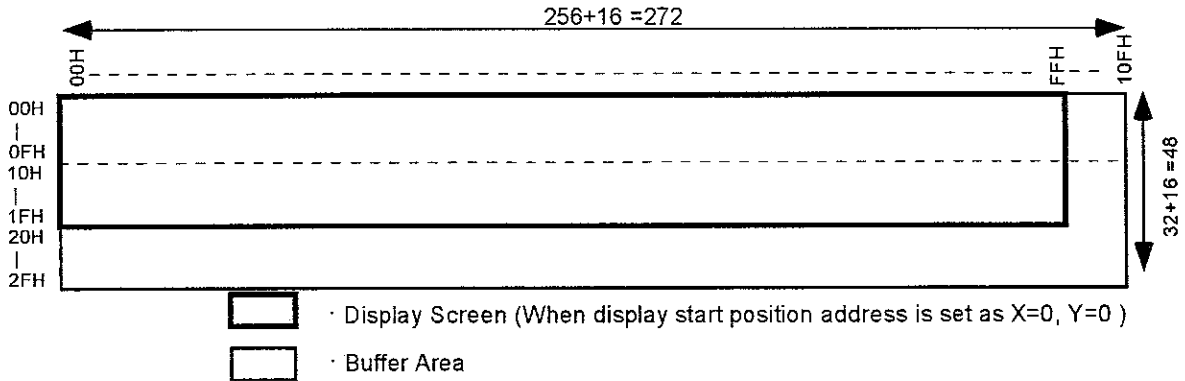
8.2 Character Display (DDRAM)

The DDRAM consists of "blocks" of either 16x16 dots, or 8x16 dots. This equates yields a width of either 17 (16 pixels x 16 pixels), or 34 (8 x 16) characters x 3 lines. When 8 bits of data is sent twice, a character code can be written in a memory. The detail of DDRAM is as follows:

The DDRAM Data Write Position Address:



The DDRAM Display Start Position Address



When the value of the DDRAM Start Position Address X = Overflow 10FH, the next position goes to 00H. Also, when value of the DDRAM Start Position Address Y = Overflow 2FH, the next position goes to 00H.

For example:

In the case of a DDRAM Start Position Address of X=30H, Y=20H, the Display screen area is as follows;

X=30H, 31H, 32H..... 10FH, 00H, 01H.....1DH, 1EH, 1FH
 Y=20H, 21H2FH, 00H, 01H .. 0EH, 0FH

9. Function
9.1 Commands

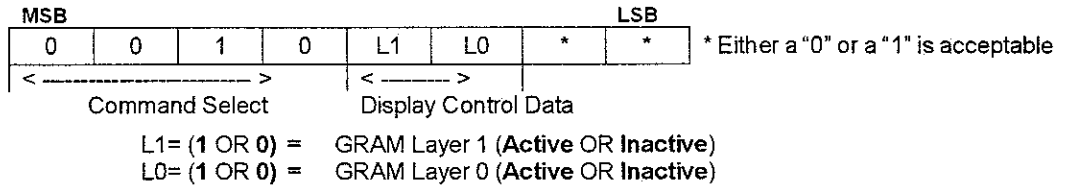
Command	C/D	D7	D6	D5	D4	D3	D2	D1	D0	Comments	
Display ON/OFF	1	0	0	1	0	L1	L0	*	*	1st Byte	Display ON/OFF Control, 2 Byte Command
		DS	GS	DRV	GRV	AND	EXOR	*	*	2nd Byte	
Brightness Set	1	0	1	0	0	BW3	BW2	BW1	BW0	1 Byte	1 Byte Command
Display Clear	1	0	1	0	1	G1C	G0C	DC	HM	1 Byte	1 Byte Command
Display Area SET	1	0	1	1	0	*	*	1	*	1st Byte	Display Area is assigned 3 Byte Command
		*	*	*	*	*	(A2~A0)			2nd Byte	
0	D7	D6	D5	D4	D3	D2	D1	D0	3rd Byte		
Data Write Position Address Set	1	0	1	1	0	1	*	0	*	1st Byte	Character Display Address Set, 2 Byte Command
		DDRAM Address (DDA7~DDA0)								2nd Byte	
	1	0	1	1	0	0	1	0	*	1st Byte	Graphic Display X-Address Set, 2 Byte Command
		GRAM X-Address (GXA7~GXA0)								2nd Byte	
1	0	1	1	0	0	0	0	*	1st Byte	Graphic Address Y-Address Set, 2-Byte Command	
	*	*	*	*	0	GYA2	GYA1	GYA0	2nd Byte		
Display Start Position Address Set	1	0	1	1	1	*	*	*	*	1st Byte	Graphic Display Horizontal Shift, 2-Byte Command
		XA7	XA6	XA5	XA4	XA3	XA2	XA1	XA0	2nd Byte	
	1	1	0	1	1	UD	S1	S0	*	1 Byte	Graphic Display Vertical Shift, 1 Byte Command
	1	1	0	1	0	*	*	*	AD8	1st Byte	Character Display Horizontal Shift, 2 Byte Command
		AD7	AD6	AD5	AD4	AD3	AD2	AD1	AD0	2nd Byte	
1	1	0	0	1	UD	S1	S0	*	1 Byte	Character Display Vertical Shift, 1 Byte Command	
Address Mode Set	1	1	0	0	0	*	IGX	IGY	*	1 Byte	Address Increment, 1 Byte Command
Address Read	1	1	1	0	1	1	0	*	*	1st Byte	Character Display (DDRAM) Horizontal And Vertical Display Start Address, 3 Byte Command
		VD6	VD5	VD4	VD3	VD2	VD1	VD0	HD8	2nd Byte	
		HD7	HD6	HD5	HD4	HD3	HD2	HD1	HD0	3rd Byte	
	1	1	1	0	1	0	1	*	*	1st Byte	Graphic Display (GRAM) Horizontal And Vertical Display Start Address, 3 Byte Command
		*	VG6	VG5	VG4	VG3	VG2	VG1	VG0	2nd Byte	
HG7	HG6	HG5	HG4	HG3	HG2	HG1	HG0	3rd Byte			
ROM Transfer	1	1	1	1	0	*	*	*	*	1st Byte	Copy character in the Font ROM, 3 Byte Command
		AD19	AD18	AD17	AD16	AD15	AD14	AD13	AD12	2nd Byte	
		*	AD10	AD9	AD8	AD7	AD6	AD5	AD4	3rd Byte	
Data Write	0	WRITE DATA									Writes Data Char. Data is 2 Byte, Graphic Data is 1 Byte

* Either a "0" or a "1" is acceptable

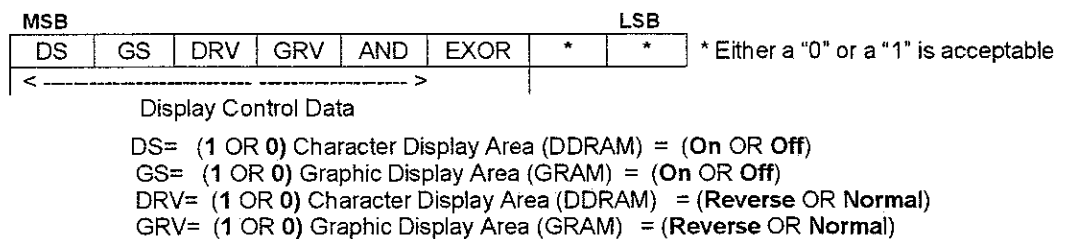
9.2 Display On/Off ($\overline{C/D}$ = "1")

The GRAM Layer is selected with the 1st Byte of data. DDRAM (On/Off), GRAM (On/Off), DDRAM (reverse or normal modes), GRAM (reverse or normal modes) and display merge are selected by the 2nd Byte. Reverse mode toggles the representation of green in the foreground and black in the background to the exact opposite - green to back and black to the foreground. This is similar to the concept of reverse video

1st Byte:



2nd Byte:



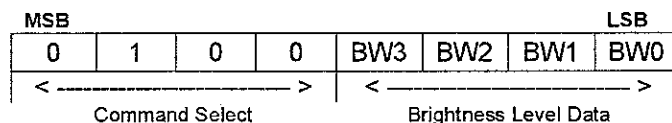
DS="0", GS= "0": Stand-by mode

1st Byte		2nd Byte		Action
L1	L0	AND	EXOR	
*	*	1	*	AND Display of Layer 1 & 0
*	*	0	1	EXOR Display of Layer 1 & 0
1	1	0	0	OR Display of Layer 1 & 0
1	0	0	0	Only Layer1 selected for display
0	1	0	0	Only Layer0 selected for display
0	0	0	0	Graphic Display Off

* Either a "0" or a "1" is acceptable

9.3 Brightness Set ($\overline{C/D}$ = "1")

The Brightness level of the display screen can be scaled by the following four bit control. Please note that the brightness is consistent across the illuminated pixels. There is no scaling of individual pixels. The display self-initializes to 100% brightness.



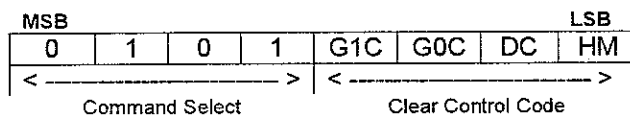
9.3 Cont'd

Brightness levels are set by the following:

BW3	BW2	BW1	BW0	Brightness Level
0	0	0	0	100%(Light)
0	0	0	1	94%
0	0	1	0	87%
0	0	1	1	81%
0	1	0	0	75%
0	1	0	1	69%
0	1	1	0	62%
0	1	1	1	56%
1	0	0	0	50%
1	0	0	1	44%
1	0	1	0	37%
1	0	1	1	31%
1	1	0	0	25%
1	1	0	1	19%
1	1	1	0	12%
1	1	1	1	6%(Dark)

9.4 Display Clear (C/D= "1") This command clears the GRAM and DDRAM.

This command should always be applied at power on or reset. In the period of 1mS following the issue of this command, the module requires internal processing and does not accept any commands



To clear the GRAM area, G1C or G0C bit must be asserted. By asserting HM bit, both data write position address and display start position address which selected by G1C, G0C, DC also be reset.

HM = (1 or 0) equals (Initialize data write position address and display start position address or Not initialize)

G1C= (1 or 0) equals (GRAM area 1 is cleared or GRAM area 1 not cleared)

G0C= (1 or 0) equals (GRAM area 0 cleared or GRAM area 0 not cleared)

GRAM area 1: X= 00H-FFH, Y=0H – 3H (Display data write position address)

GRAM area 2: X= 00H-FFH, Y=4H – 7H (Display data write position address)

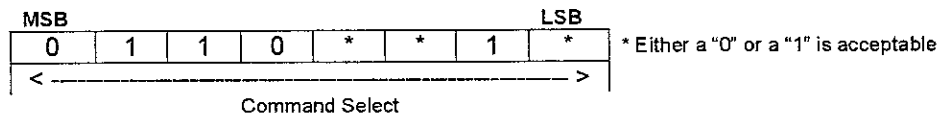
DC= (1 or 0) equals (DDRAM cleared or DDRAM not cleared)

Example to clear both layers: 0101 1111

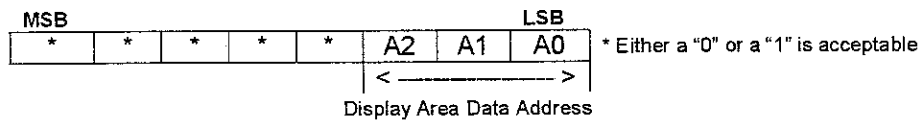
9.5 Display Area Set (C/D="1")

This command sets the display area block as Graphic Display (GRAM) or Character display (DDRAM). Setup is performed by 3-byte command. A data-write position address set is required after switching display area, and before character or graphic data writing.

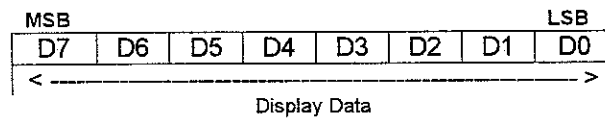
1st Byte: (C/D="1") Command Select



2nd Byte: (C/D="1") Display Area Data Address Select

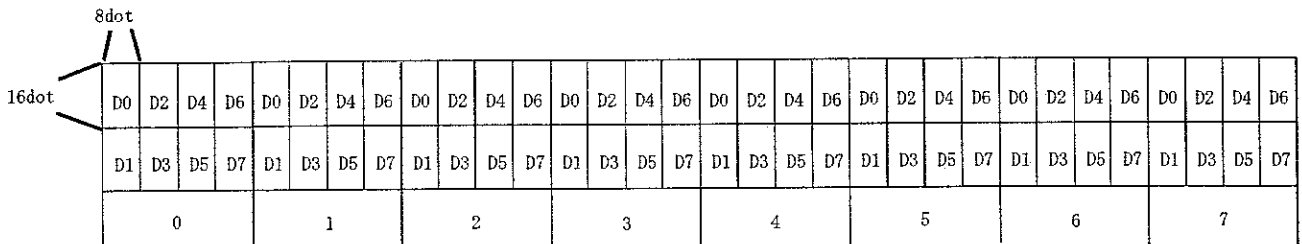


3rd Byte: (C/D="0") Display Area Block Select



D0 to D7 = "1": Graphic Display (GRAM)
 D0 to D7 = "0": Character Display (DDRAM)

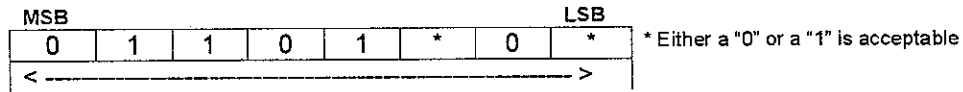
Display area block is assigned as follows on a screen



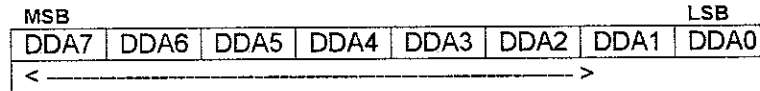
Display Area Data Address (0 ~ 7H)

9.6 DDRAM Data Write Position Address Set (Character Display) ($\overline{C/D}="1"$)

1st Byte: Command Select



2nd Byte: DDRAM Data Write Position Address



The data write position address of DDRAM expressed with 8 bits (00Hex-81Hex) of DDA0-DDA7 is specified, and a character code is inputted after the 2nd Byte. Not to set addresses other than a sphere. Right end cannot write a 16x16 dots font in the place which is vacant only as for 8x16 dots. Refer to 8.2 Character Display (DDRAM) on Page #6

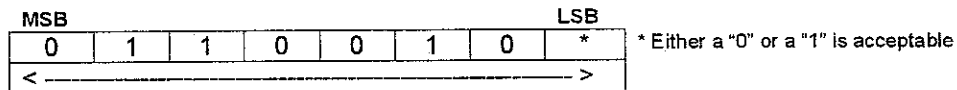
9.7 GRAM Data Write position Address Set (Graphic Display) ($\overline{C/D}="1"$)

This command specifies both X & Y data write position address.

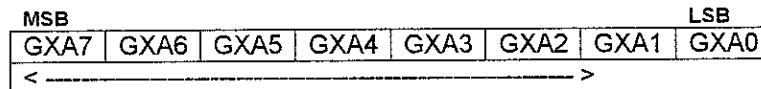
9.7.1 GRAM Data Write Position X Address Set

Data write position X address of GRAM expressed with 8 bits (00Hex-FFHex) is specified. Refer to 8.1 Graphic Display (GRAM) on Page #4.

1st Byte: Command Select



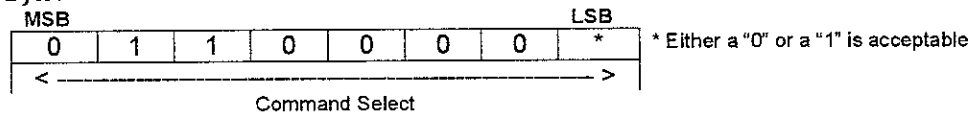
2nd Byte: GRAM Data Write Position X Address



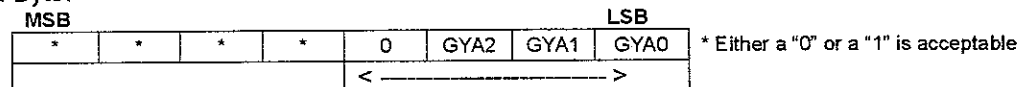
9.7.2 GRAM Data Write Position Y Address Set

Data write position Y address of GRAM expressed with 4 bits (0Hex-7Hex) is specified

1st Byte:



2nd Byte:

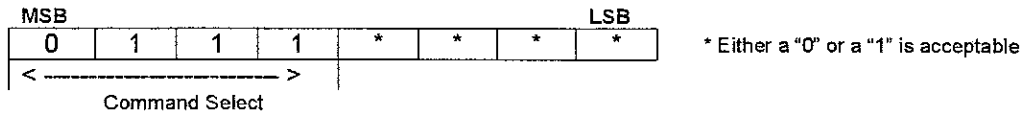


9.8 GRAM Display Start Position Address Set ($\overline{C/D}$ ="1")

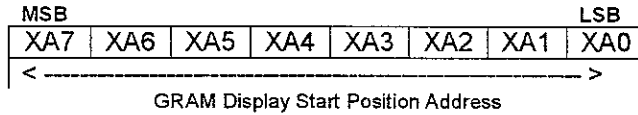
9.8.1 Horizontal Shift

This command specifies the address that a display pattern can be positioned to by 8 bits (00Hex to FFHex). DDRAM display area is not influenced. This is equivalent to an offset in the X-axis.

1st Byte:

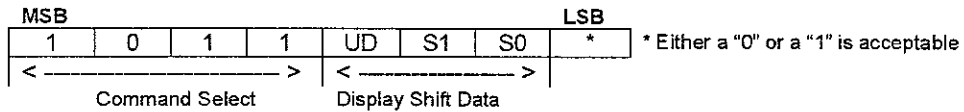


2nd Byte:



9.8.2 Vertical Shift

This is equivalent to an offset Y-axis.

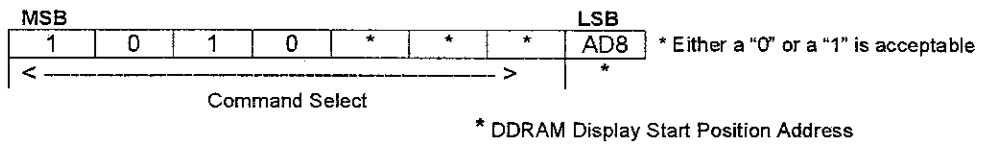


UD= "1": Display scrolled up.
 UD= "0": Display scrolled down.
 S1= "0", S0= "1": Display shift by 8 dots.
 S1= "1", S0= "0": Display shift by 1 dot.
 S1= "1", S0= "1": Display shift by 2 dots.

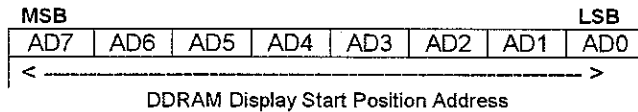
9.9 DDRAM Display Start Position Address Set ($\overline{C/D}$ ="1")

9.9.1 Horizontal Shift

1st Byte:

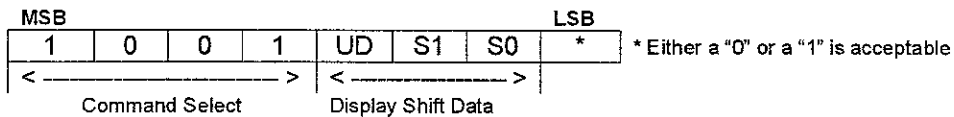


2nd Byte:



This command specifies the address that a display pattern can be positioned to by 9 bits (000Hex to 10FHex), and where the GRAM display area is not influenced. The Display start address is expressed as in the table that follows on the next page. A screen scrolls by setting a display start address with 00H and 01H one by one, and shifting in the horizontal direction.

9.9.2 Vertical Shift ($\overline{C/D}$ ="1")

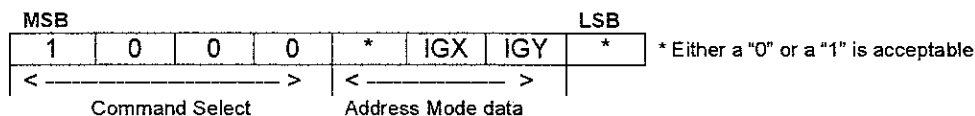


Y-axis display shift of DDRAM display area is controlled

UD= "1": Display scrolled up.
 UD= "0": Display scrolled down.
 S1= "0", S0= "1": Display shift by 8 dots.
 S1= "1", S0= "0": Display shift by 1 dot.
 S1= "1", S0= "1": Display shift by 2 dots.

9.10 Address Mode Set ($\overline{C/D}="1"$)

This command specifies the GRAM data write position address auto increment mode



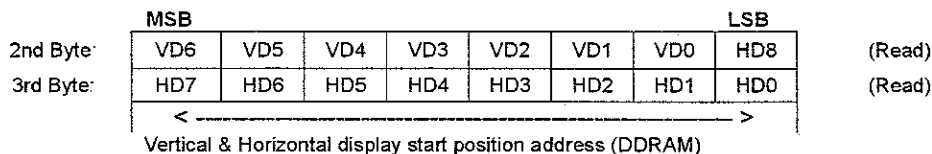
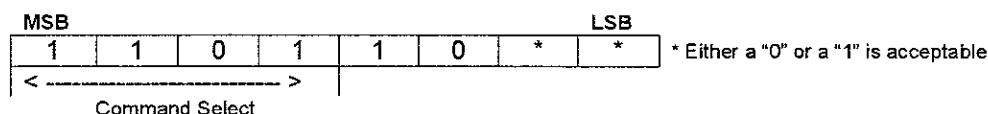
IGX = "1": X-Address +1(increment) when writing to GRAM (It not affect to Y-Address.)
 IGX = "0": GRAM X address fixed mode
 IGY = "1": Y-Address +1(increment) when writing to GRAM (It not affect to X-Address)
 IGY = "0": GRAM Y address fixed mode.

9.11 Address Read ($\overline{C/D}="1"$)

This command reads both vertical and horizontal display start position addresses of DDRAM or GRAM (Refer to 8 - Display Screen on Page #4) On the parallel interface, the data bus outputs the address until \overline{CSS} goes high after the READY signal goes active (Parallel #1: $\overline{RD}=\text{LOW}$, Parallel #2: $\overline{RW}=\text{HIGH}$). The Data bus becomes an input when other On the serial interface, TXD outputs the data from SCK rising after command is issued until the \overline{CSS} goes high Refer to 10 Interface on Page #17

9.11.1 Vertical and Horizontal display start position address of character display (DDRAM)

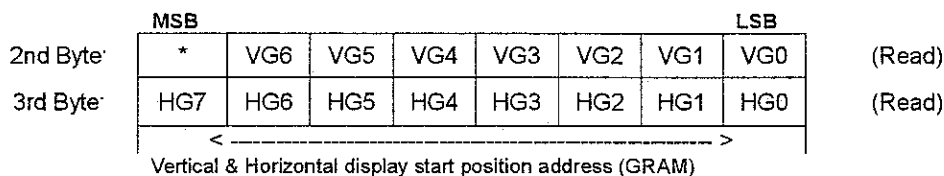
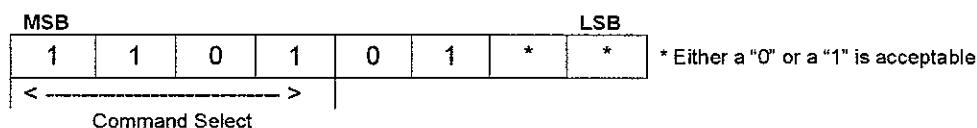
1st Byte:



VD0 to VD6: Vertical display start position address
 HD0 to HD8: Horizontal display start position address

9.11.2 Vertical and Horizontal display start position address of graphic display (GRAM)

1st Byte:

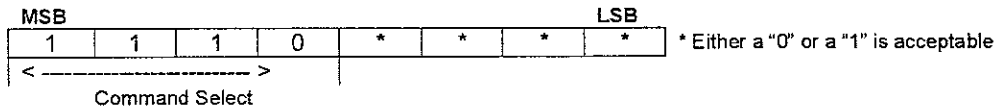


VG0 to VG6: Vertical display start position address
 HG0 to HG7: Horizontal display start position address

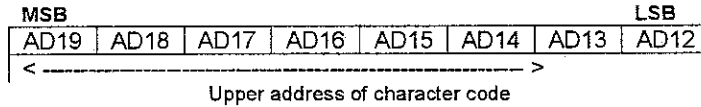
9.12 ROM Transfer (C/D="1")

This command copies the character font data in the Font ROM to the GRAM data write position address. Because transfer starts when RAM access completes, it is necessary to wait Min. 400uS. Also, it is not necessary to have the distinction of 16x16 dots, or 8x16 dots, and GRAM data write position address is automatically incremented.

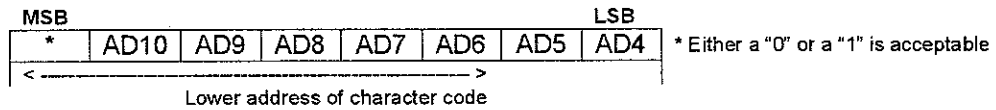
1st Byte:



2nd Byte:

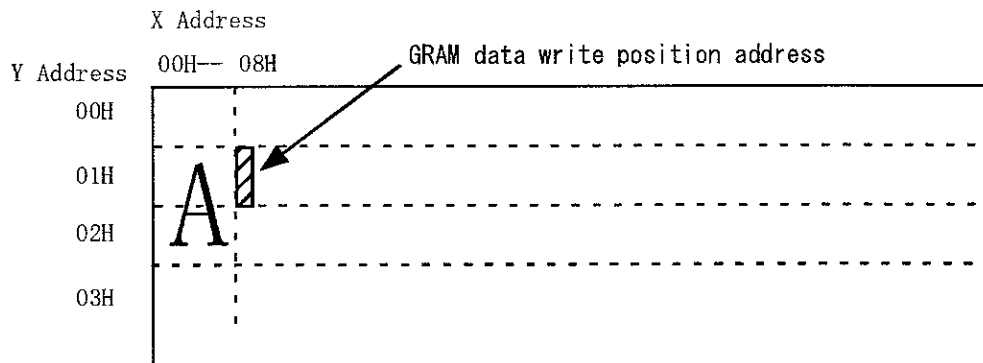


3rd Byte:



Example: To show "A" (in 8x16 dot format) character as following.

GRAM data write position address is X=00H, Y=01H .
 GRAM data write position address after copying character is X=08H, Y=01H
 (In case of 16x16 dots character: X=10H, Y=01H)



9.13 Data Write (C/D="0")

9.13.1 Write to Character Display (DDRAM)

The DDRAM can be written by setting a DDRAM data write position address with 2-byte writing. The 1st Byte is the upper address of character code, and the 2nd Byte is the lower address. For example, "02Hex" is sent to the 1st Byte and "0DHex" is sent to the 2nd Byte to display "A". At this time, the 2nd Byte is sent with the 1st Byte. An 8x16 dot font is also performed. Moreover, since an 8x16 dot font has 8 dots and 16 dots, a 16x16 dot font in a horizontal direction and a character is packed and displayed when a 16x16 dots font and a 8x16 dot font are mixed. The DRAM data write position moves to the right automatically by 8 dots in case of writing 8x16 dot font, and moves to the right automatically by 16dots in case of writing if 16x16dot font. Then, when it comes to right end, it returns to left end on same line after writing the font for the right end.

Refer to Character code table.

Font	Code
8x16 dots	2B20h - 2F7Fh
16x16 dots	0000h - 277Fh 3000h - 7F7Fh

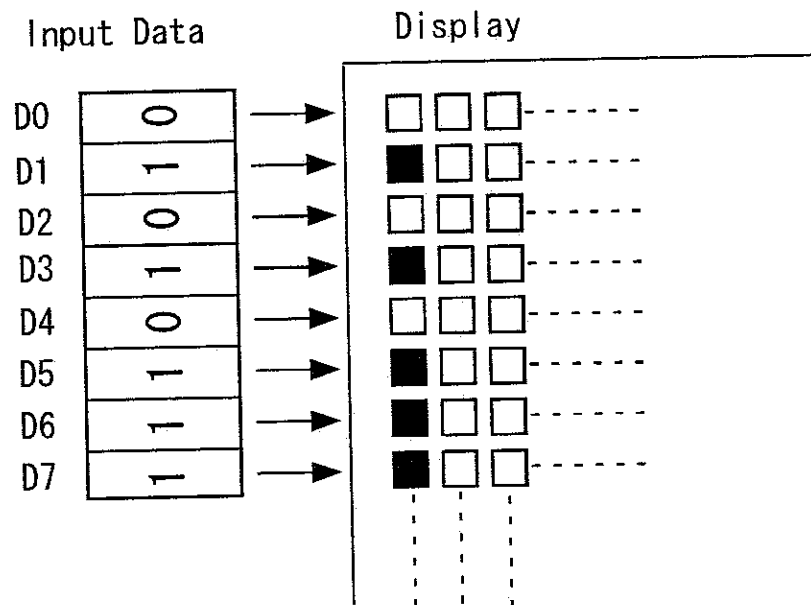
The 16x16dots font of 8000h - FFFFh except the font of AB00h - AFFFh is displayed as same as the font of 0000h - 7FFFh.

9.13.2 Write to Graphic Display (GRAM)

Can be written into GRAM by setting GRAM X or Y data write position address.

Example:

Writing "EA Hex" sets "D1, 3, 5, 6, 7 =1" and "D0, 2, 4 =0".



■ : Display ON

9.14 Default Status at Reset

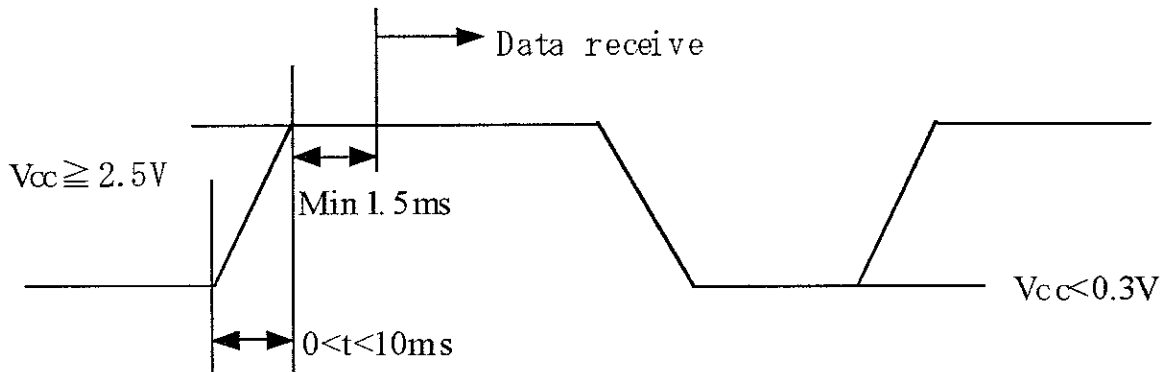
When the reset is applied, the display self-initializes into the following status:

GRAM Layer:	Layer (0)
Display ON/OFF:	Display (Off)
Display Area:	All DDRAM (Character display area)
Data write position address:	To set the "00" of DDRAM address
Display start position address:	To set the X=0 Y=0 of DDRAM address
Address Mode:	DDRAM increment mode
GRAM X-address:	Fixed mode
GRAM Y-address:	Fixed mode
Brightness Level:	100% Brightness

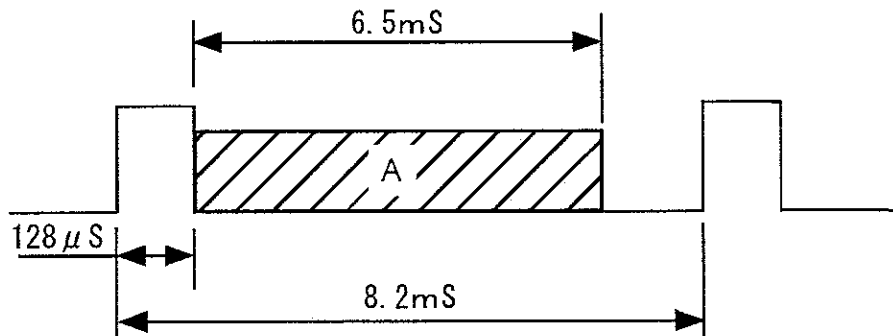
The following precautions should be observed at power on, and after a reset:

External Reset: After V_{CC} reaches 2.5V, the Reset level is "Low" for more than 1.5mS.

Power-Up: The following sequence occurs:



9.15 FRP (Frame Pulse)

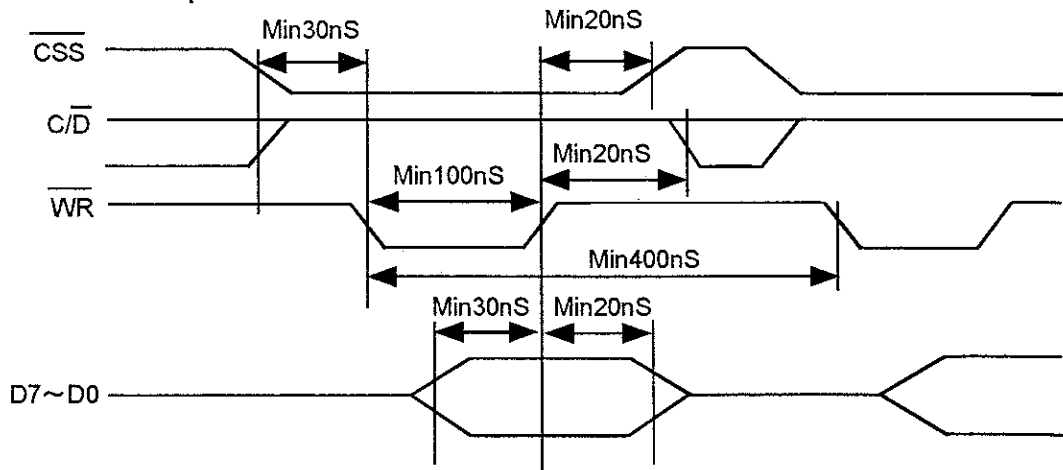


An FRP signal is triggered each time the display is refreshed by the module from its own memory. Smooth scrolling can be achieved by synchronizing the change of display start address with of the FRP signal from module. The area marked as "A" is optimal for writing commands

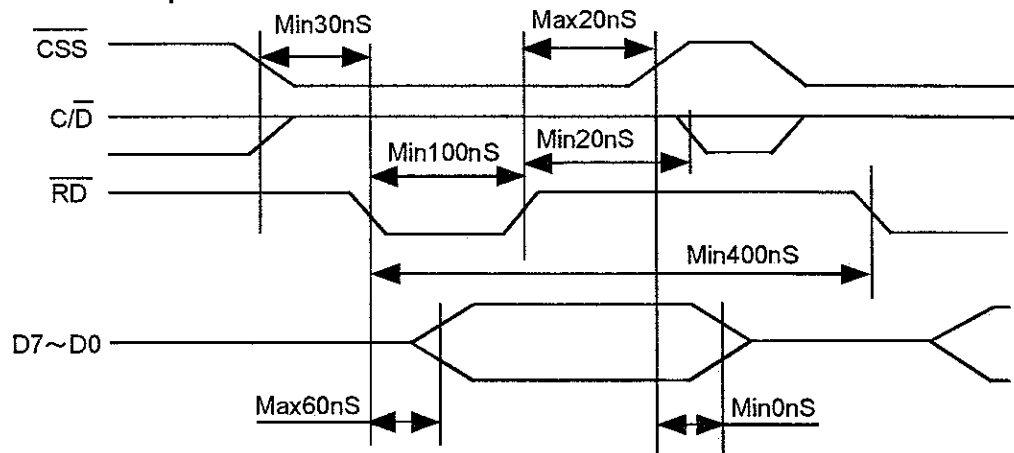
10. Interface

10.1 Parallel Interface (Parallel #1)

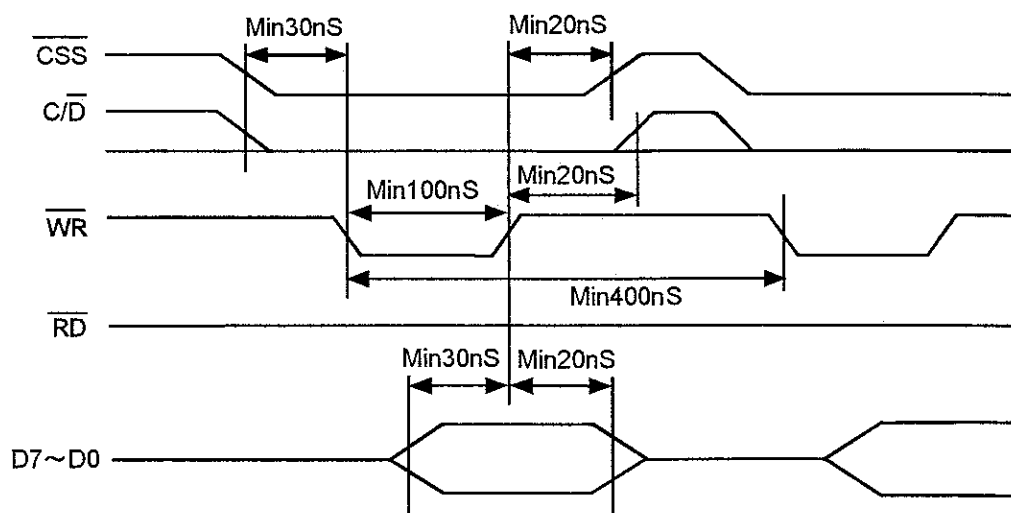
10.1.1 Command Write operation



10.1.2 Command Read operation

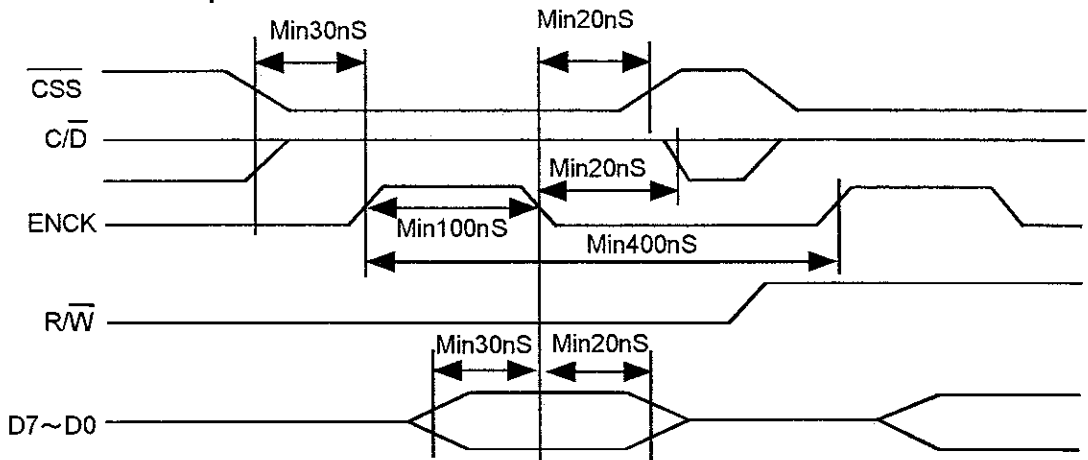


10.1.3 Data Write operation

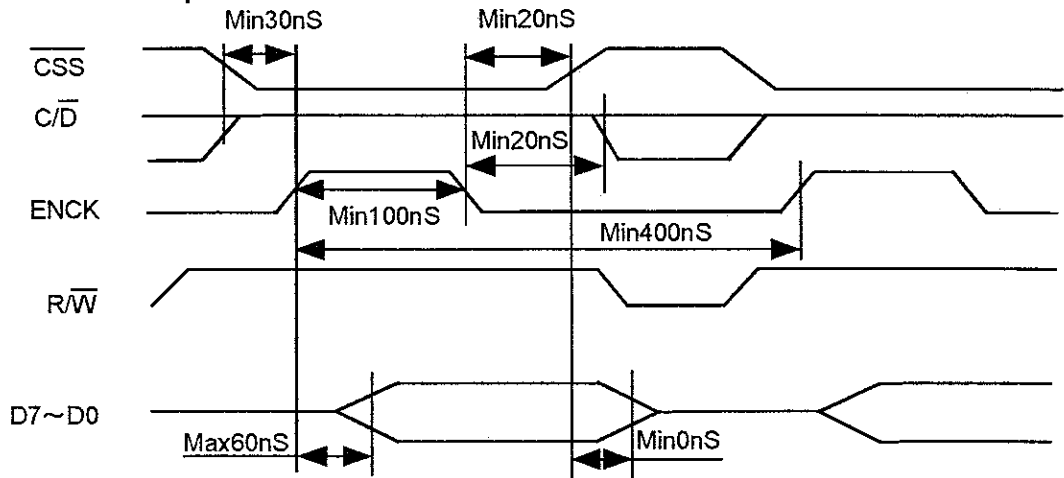


10.2 Parallel Interface(Parallel #2)

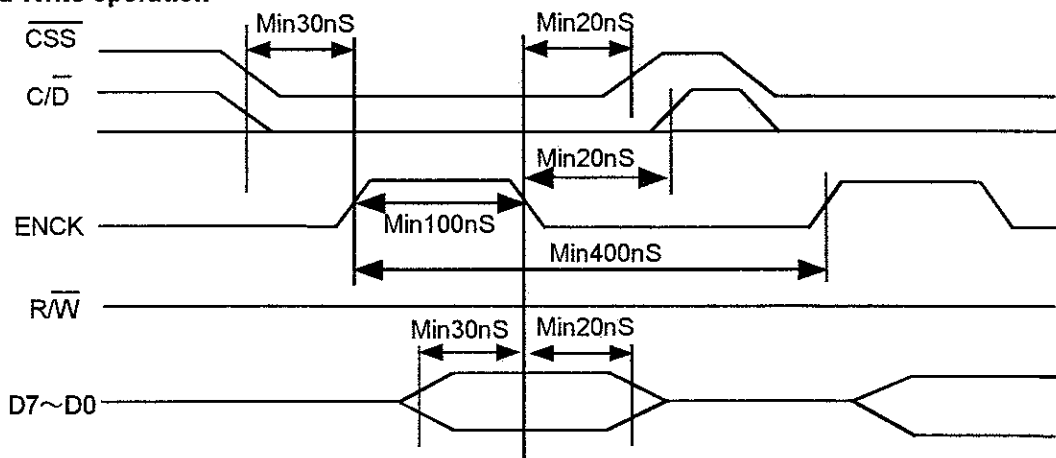
10.2.1 Command Write operation



10.2.2 Command Read operation

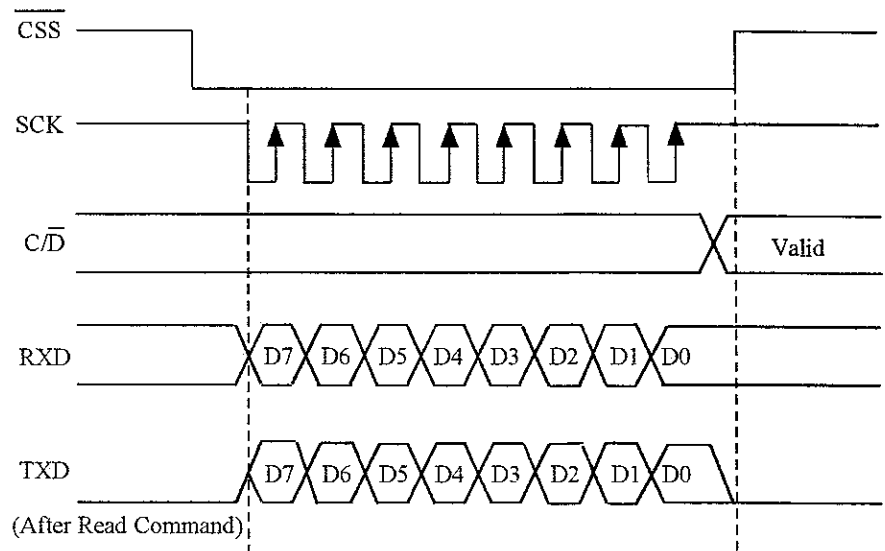


10.2.3 Data Write operation

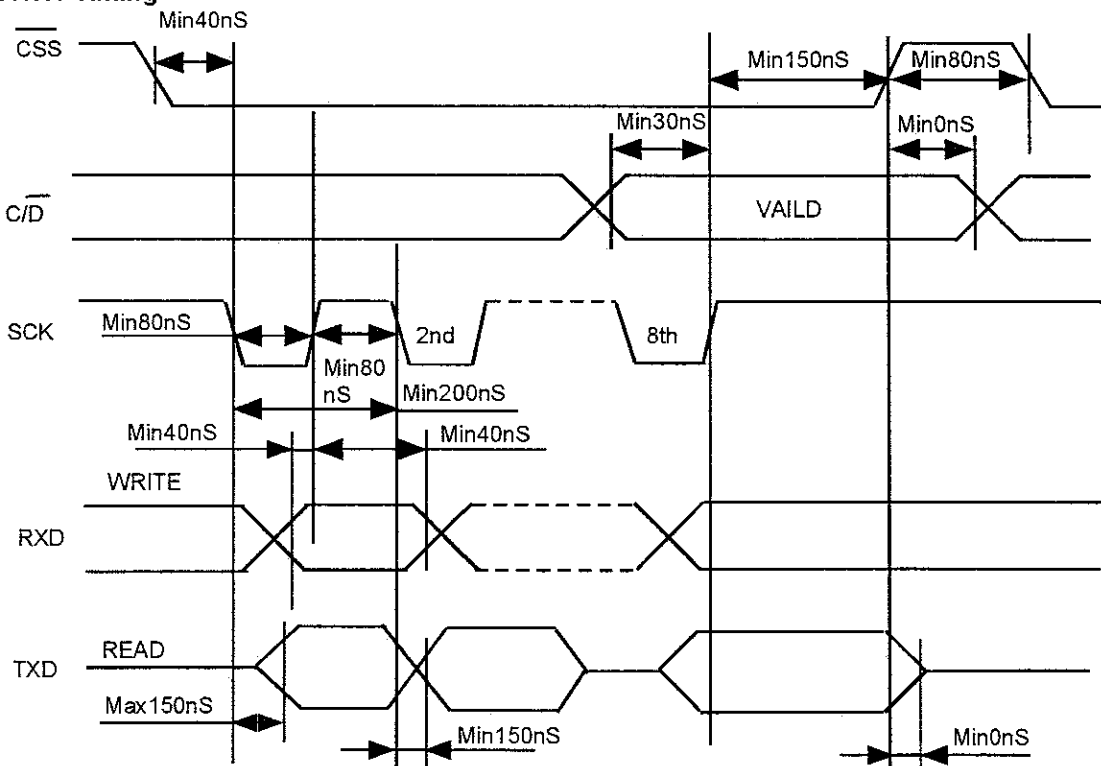


10.3 Serial Interface

To use the serial interface of this module, (**RXD, TXD and SCK**) will be activated by **CSS= "L"**. The internal shift registers and counters will be reset by **CSS= "H"**. Serial data is transferred from MSB to LSB (D7->D0) on the rising edge of SCK. After the 8th clock edge, the data stream is converted to 8 bit parallel data. Recognition of the RXD input as either data or command is determined by C/D on the 8th pulse SCK.



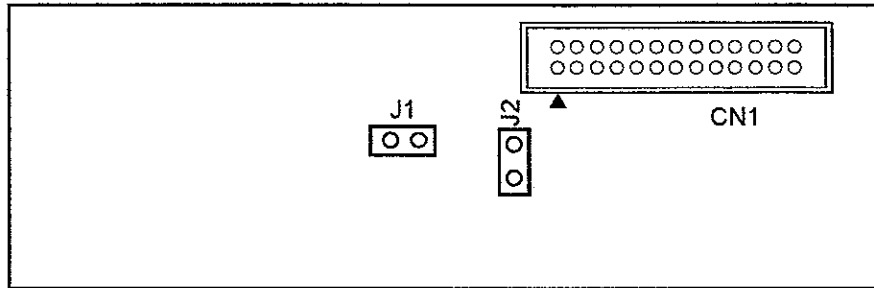
10.3.1 Timing



11. Jumper

11.1 Jumper Position

Component side of board



11.2 Jumper Setting (Must be done when power is OFF)

	J1	J2	Function
Interface	0	X	Serial Interface
	1	1	Parallel #1 Interface (Default)
	1	0	Parallel #2 Interface

1: Open

0: Short

X: Open or Short

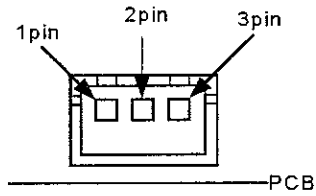
12. Pin Assignment *(See connector diagrams below)*

12.1 Signal Connection

Pin No	Description		
	Parallel #1	Parallel #2	Serial
1	D7	D7	×
3	D6	D6	×
5	D5	D5	×
7	D4	D4	×
9	D3	D3	×
11	D2	D2	×
13	D1	D1	TXD
15	D0	D0	RXD
17	\overline{WR}	$\overline{R\overline{W}}$	×
19	$\overline{C/D}$	$\overline{C/D}$	$\overline{C/D}$
21	\overline{RD}	ENCK	SCK
23	\overline{CSS}	\overline{CSS}	\overline{CSS}
25	FRP	FRP	FRP

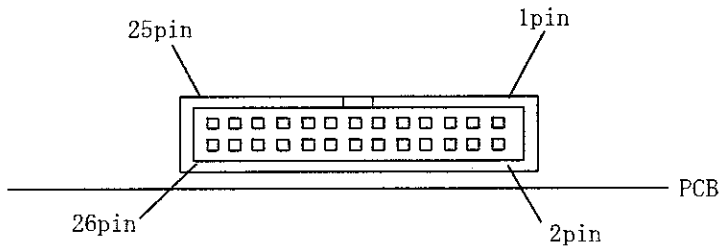
Pin No	Description		
	Parallel #1	Parallel #2	Serial
2	GND	GND	GND
4	GND	GND	GND
6	GND	GND	GND
8	GND	GND	GND
10	GND	GND	GND
12	GND	GND	GND
14	GND	GND	GND
16	GND	GND	GND
18	GND	GND	GND
20	GND	GND	GND
22	GND	GND	GND
24	GND	GND	GND
26	\overline{RESET}	\overline{RESET}	\overline{RESET}

12.2 Power Connectors



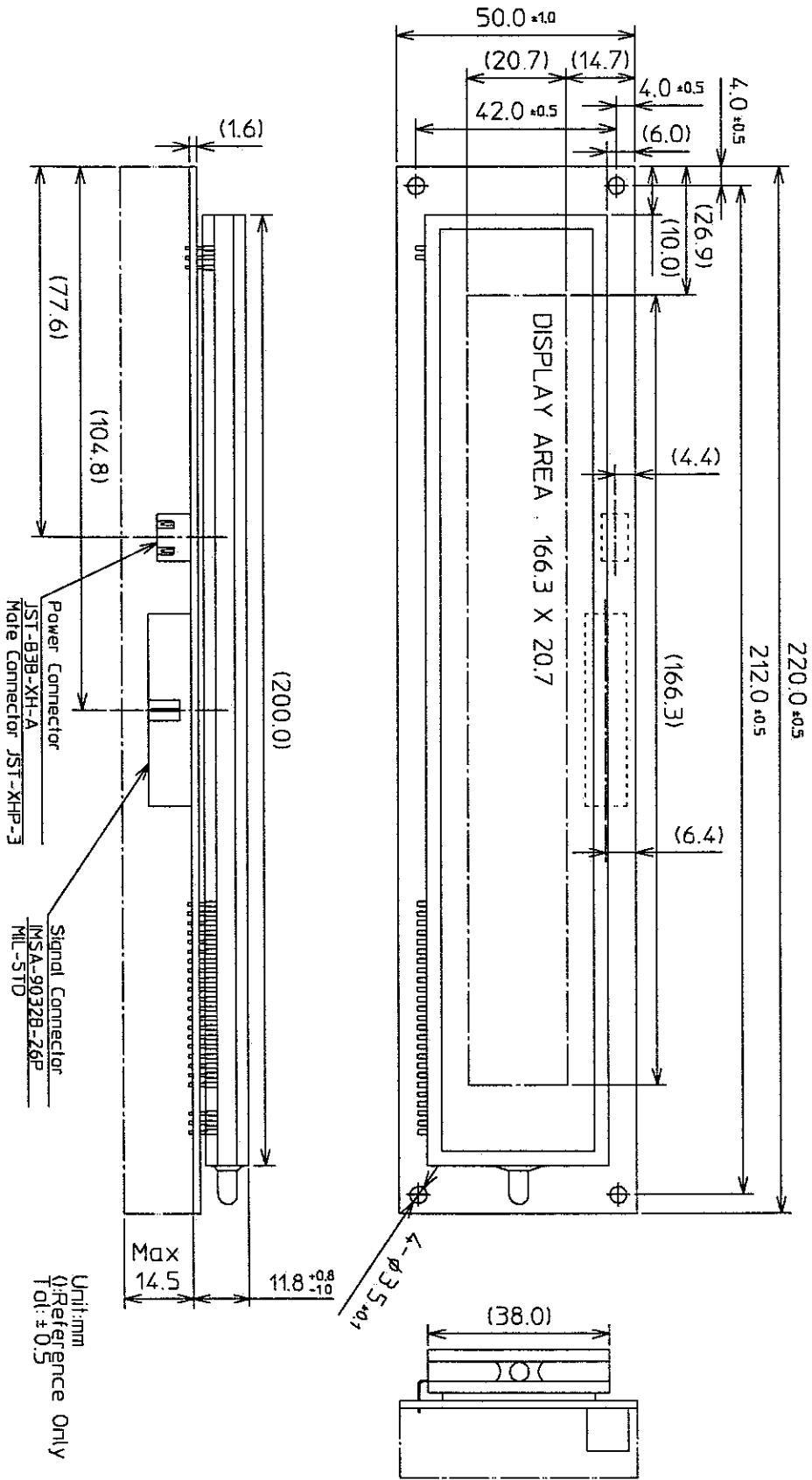
Power Connector:
JST: B3B-XH-A or equivalent

Pin No.	Description
1	Vcc
2	Test (Factory Only)
3	GND



Data Connector
IMSA: 9032B-26P or Equivalent

13. Outline Dimension



Important Precautions

- All VFD Modules contain MOS-LSI's ICs. Anti-Static handling is required.
- A VF Display is made with Soda-Lime glass. Heavy shock loads exceeding 55G, thermal shock greater than 10°C/minute, or a direct blow to the glass surface - especially to the EXHAUST PIPE; may CRACK the glass.
- Do not apply excessive pressure or torque to the display. When the factory builds the system frame, a slight gap between the display glass face and the front panel is necessary to avoid a contact failure of the lead pins of the display. Excessive pressure or torque will make the glass CRACK around the lead pins of the display.
- Neither the DATA CONNECTOR nor the POWER CONNECTOR should be connected or disconnected while power is applied. As is often the case with most subsystems, caution should be exercised in selectively disconnecting power to a computer-based system. The module receives high logic on its strobe lines as random signals to all data ports. Removal of the primary power with logic signals applied may damage input circuitry.
- Stress exceeding the specification listed under the Absolute Maximum Ratings may cause PERMANENT DAMAGE of the modules.
- The +5 Vdc power line must be regulated completely since all control logic depends on this line. Do not apply a slow start power supply. Provide sufficient output current to avoid INRUSH CURRENT loading the power supply or stagger the power up of system devices.
- *The Data cable length between the module and the host system is recommended to be **less than 300 mm** to eliminate noise.
- Do not place the module on a conductive surface (metal or ESD conductive) immediately after power off. Large filter capacitors on the module store energy and require more than 1 min. of discharging time to avoid a short circuit condition.
- When power is not applied for more than 2 months, several hours of operation under the test mode may help the stability of the brightness of the VFD.
- A fixed (static) message displayed longer than 5 hours continuously may cause phosphor burn-in. Some methods of avoiding this include: a sleep mode and "wake-up" event or periodically shifting the display pattern or periodically reversing the mode of green/black.
- The module contains a high voltage power source (70 Vdc). Handle with caution when power is applied.