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# M0220MD-202MDAR1-3

## Dot-matrix Character Vacuum Fluorescent Display Module

M-	VFD Module
0220-	2 lines x 20 characters
M-	Model
D-	Dot-Matrix
202MDA-	Character size = 3.68mm x 8.78mm
R-	<b>RoHS Compliant</b>
1-3	Parallel interface (M6800)

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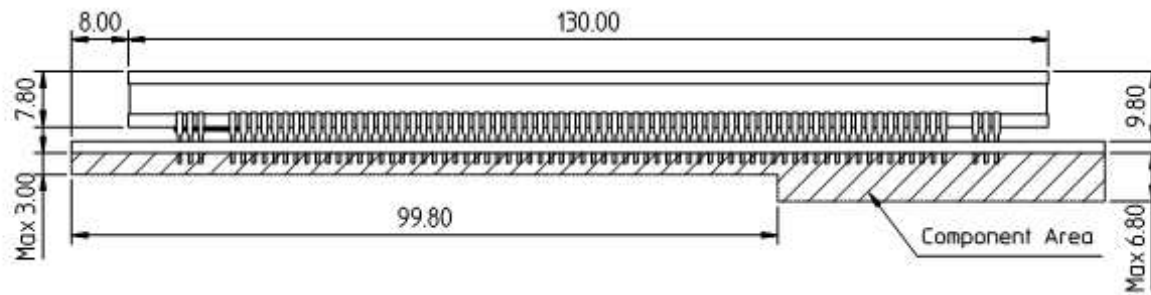
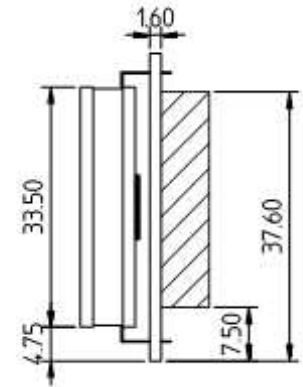
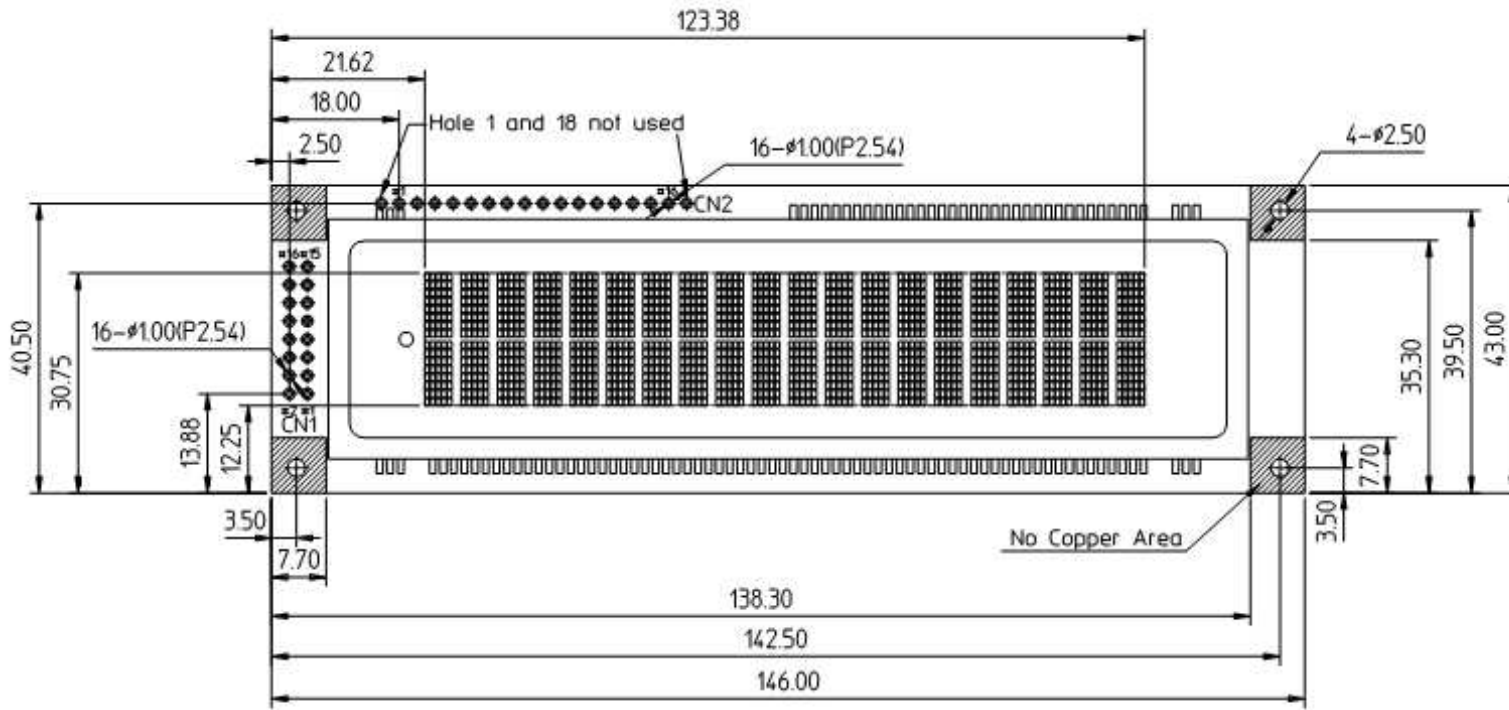
## Document Revision History

Revision	Date	Description	Changed by
0	3/21/2005	Initial Release	
1	9/21/2009	Updated Driver version, modified vf glass pins	CL
2	12/4/2009	Reduce pixel size to increase brightness and lifetime	CL

## Functions and Features

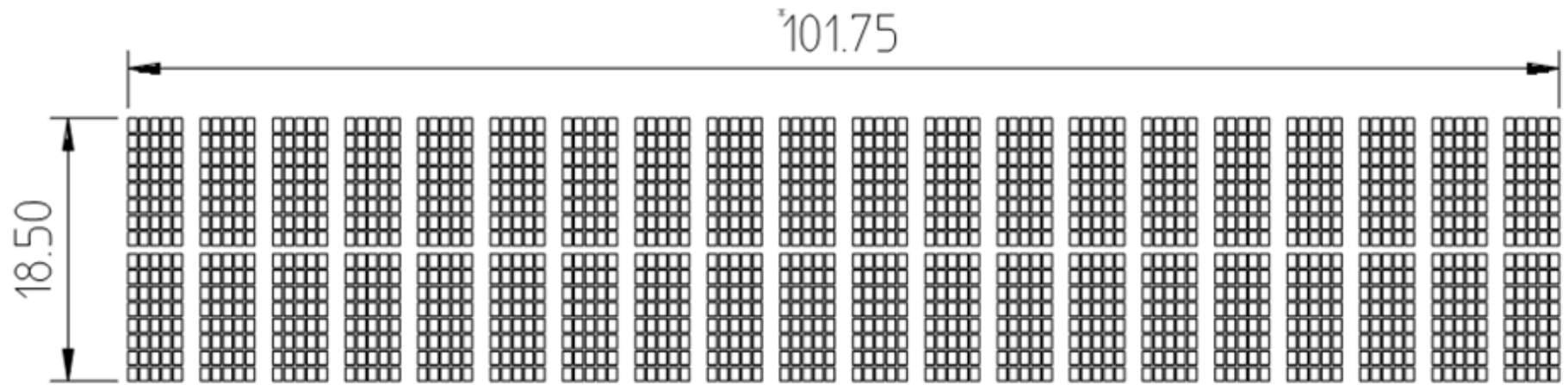
- 2 lines x 20 characters
- Built-in controller
- Built-in VF AC power supply
- 5.0V power supply
- 5x8 dots with cursor
- Parallel interface (Serial interface selectable by jumpers)

# Mechanical Drawing



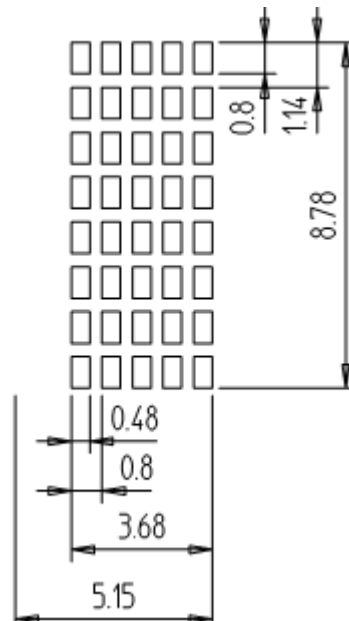
- Unit: mm
- Tolerances unless otherwise specified:
  - Mount Hole Size: +/-0.3
  - Others:
    - Length < 10.0: +/-0.5
    - Length ≥ 10.0: +/-1.0

# Pattern Detail



◎ Color of Illumination ◎

· Green (G. :x=0.250,y=0.439) ----- All Patterns.



## Pin Description (parallel interface)

Pin No.	Symbol	External Connection	Function Description
1	VSS	Power Supply	Ground
2	VDD	Power Supply	Power supply for logic (+5.0V)
3	NC (/RST)	- (MPU)	No Connect (if JP2 is short, PIN3 = Active LOW reset signal)
4	RS	MPU	Register select signal RS=1: DATA RS=0: COMMAND
5	R/W	MPU	Read/Write select signal RW=1: READ RW=0: WRITE
6	E	MPU	Operation enable signal Falling Edge Triggered
7-10	DB0 – DB3	MPU	Four low order bi-directional three-state data bus lines. These four are not used during 4-bit operation
11-14	DB4 – DB7	MPU	Four high order bi-directional three-state data bus lines.

Recommended LCD connector: 2.54mm pitch pins

## Pin Description (optional serial interface)

Pin No.	Symbol	External Connection	Function Description
1	VSS	Power Supply	Ground
2	VDD	Power Supply	Power supply for logic (+5.0V)
3	SI/SO	MPU	Serial Data In, data out
4	STB	MPU	Serial Strobe signal
5	NC	-	No Connect
6	SCK	MPU	Serial Clock signal
7-14	NC	-	No Connect

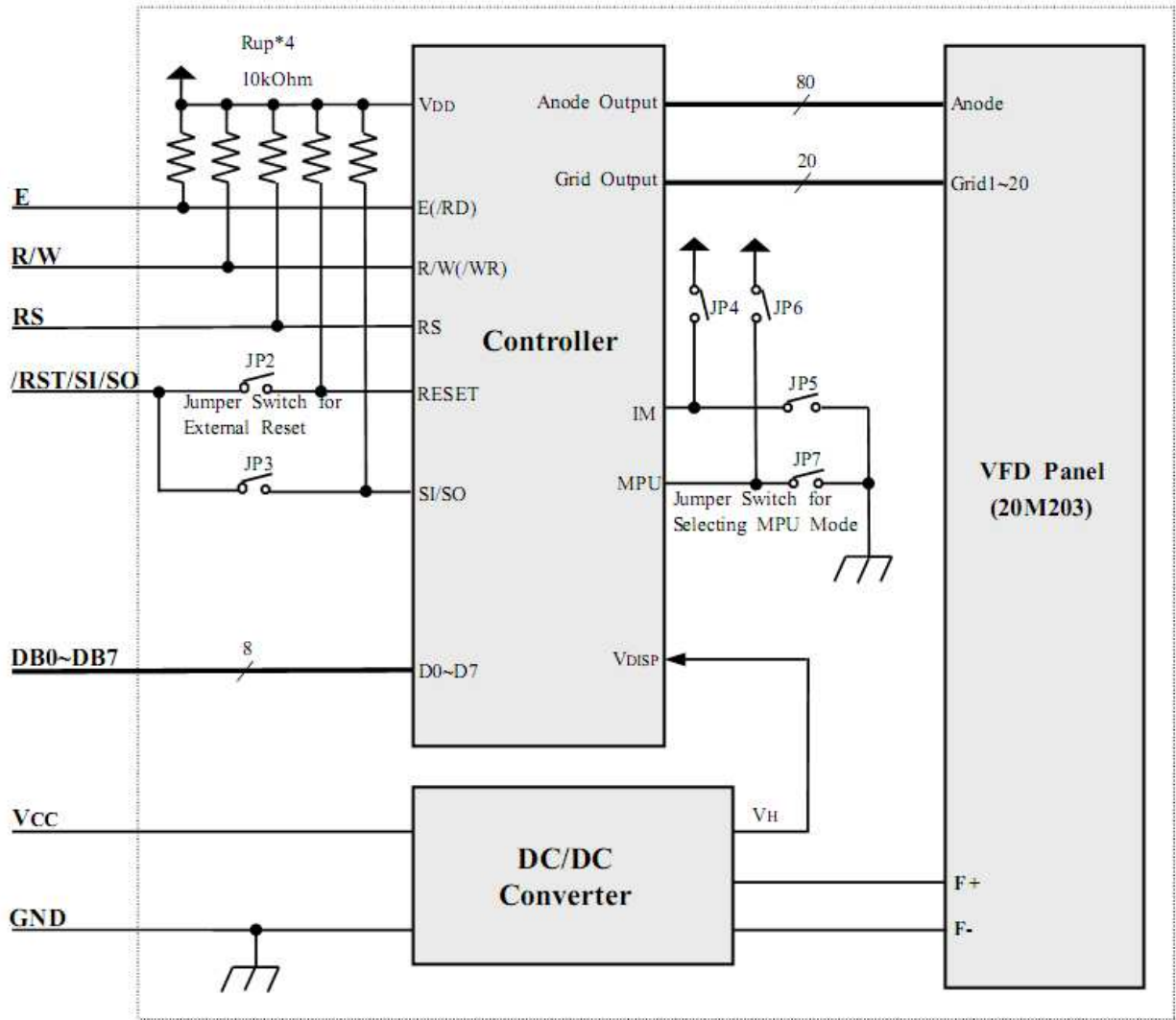
Recommended LCD connector: 2.54mm pitch pins

## Jumper Settings (Default Parallel M68 mode)

Mode	JP2	JP3	JP4	JP5	JP6	JP7
Serial	Open	Short	Open	Short	Open	Short
Parallel (I80)	*1	Open	Short	Open	Open	Short
Parallel (M68)	*1	Open	Short	Open	Short	Open

\*1) JP2 short enables PIN3 as external reset. JP2 open disables reset.

# Block Diagram

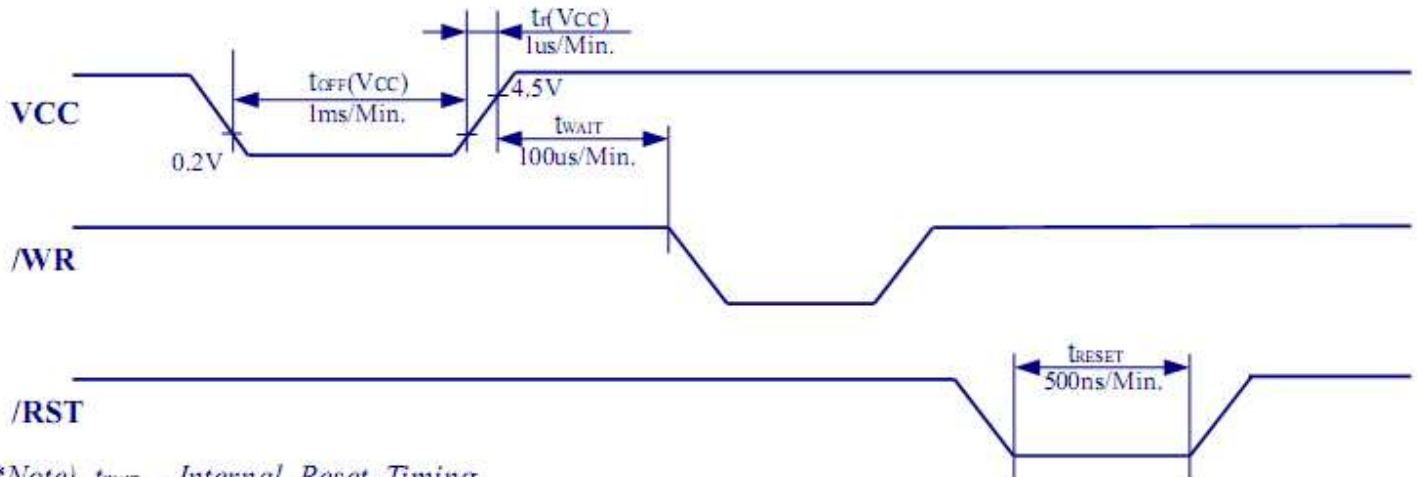


## Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Temperature Range	Vop		-40	-	+85	°C
Storage Temperature Range	Vst		-50	-	+95	°C
Operating Humidity	Hop		0	-	85	%
Storage Humidity	Hst		0	-	90	%
Vibration	-	10~55Hz	-	-	4	G
Shock	-		-	-	40	G
Supply Voltage	VDD		4.5	5.0	5.5	V
Supply Current (*Note)	IDD	Ta=25°C VDD=5.0V	-	290	435	mA
Luminance	L		350	500	-	cd/m <sup>2</sup>
"H" Level input	Vih		2.2	-	VDD	V
"L" Level input	Vil		0	-	0.6	V
"H" Level output	Voh		2.4	-	-	V
"L" Level output	Vol		-	-	0.4	V

\*Note: In-rush current can be approx 10 times the specified supply current at power up.

## Power-on Timing



\*Note)  $t_{WAIT}$  - Internal Reset Timing

## Controller Information

Built-in PT6314 controller. Download specification at [http://www.newhavendisplay.com/app\\_notes/PT6314.pdf](http://www.newhavendisplay.com/app_notes/PT6314.pdf)



## Table of Commands

Instructions	Control		Instruction Code								Descriptions	
	RS	R/W	D7	D6	D5	D4	D3	D2	D1	D0		
Display Clear	0	0	0	0	0	0	0	0	0	0	1	Clears all display and sets DD-RAM address 0 in address counter.
Cursor Home	0	0	0	0	0	0	0	0	0	1	*	Sets DD-RAM address 0 in ACC. Also returns the display being shifted to the original position. DD-RAM contents remain unchanged.
Entry Mode Set	0	0	0	0	0	0	0	0	1	I/D	S	Sets the cursor direction and specifies display shift. These operations are performed during writing/reading data.
Display ON/OFF Control	0	0	0	0	0	0	1	D	C		B	Sets all display ON/OFF (D), cursor ON/OFF (C), cursor blink of character position (B).
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	*	*	*	Shifts display or cursor, keeping DD-RAM contents.
Function Set	0	0	0	0	1	IF	N	*	BR1	BR0		Sets data length (IF), number of display lines(N), Set brightness level(BR1,BR0)
CG-RAM Address Set	0	0	0	1	ACG (CG-RAM Address)							Sets the CG-RAM address.
DD-RAM Address Set	0	0	1	ADD (DD-RAM Address)							Sets the DD-RAM address.	
Busy Flag and Address Counter Reading	0	1	BF	ACC (Address Counter)							Reads busy flag (BF) and address counter (ACC).	
Data Writing to CG- or DD-RAM	1	0	Character Code							Writes data into CG-RAM or DD-RAM.		
Data Reading from CG- or DD-RAM	1	1	Character Code							Reads data from CG-RAM or DD-RAM.		
<b>REMARKS:</b>	* I/D = 1: Increment * I/D = 0: Decrement  * DD-RAM: Display Data RAM * CG-RAM: Character Generator RAM * ACG: CG-RAM Address * ADD: DD-RAM Address * ACC: Address Counter										* IF = 1: 8-bit Operation * IF = 0: 4-bit Operation  * N = 1: 2 Lines Display * N = 0: 1 Line Display  * BR1, BR0 = 00: 100%, 01: 75%, 10: 50%, 11: 25%  * BF = 1: Busy (Internally operating) * BF = 0: Not busy (Instruction acceptable)	

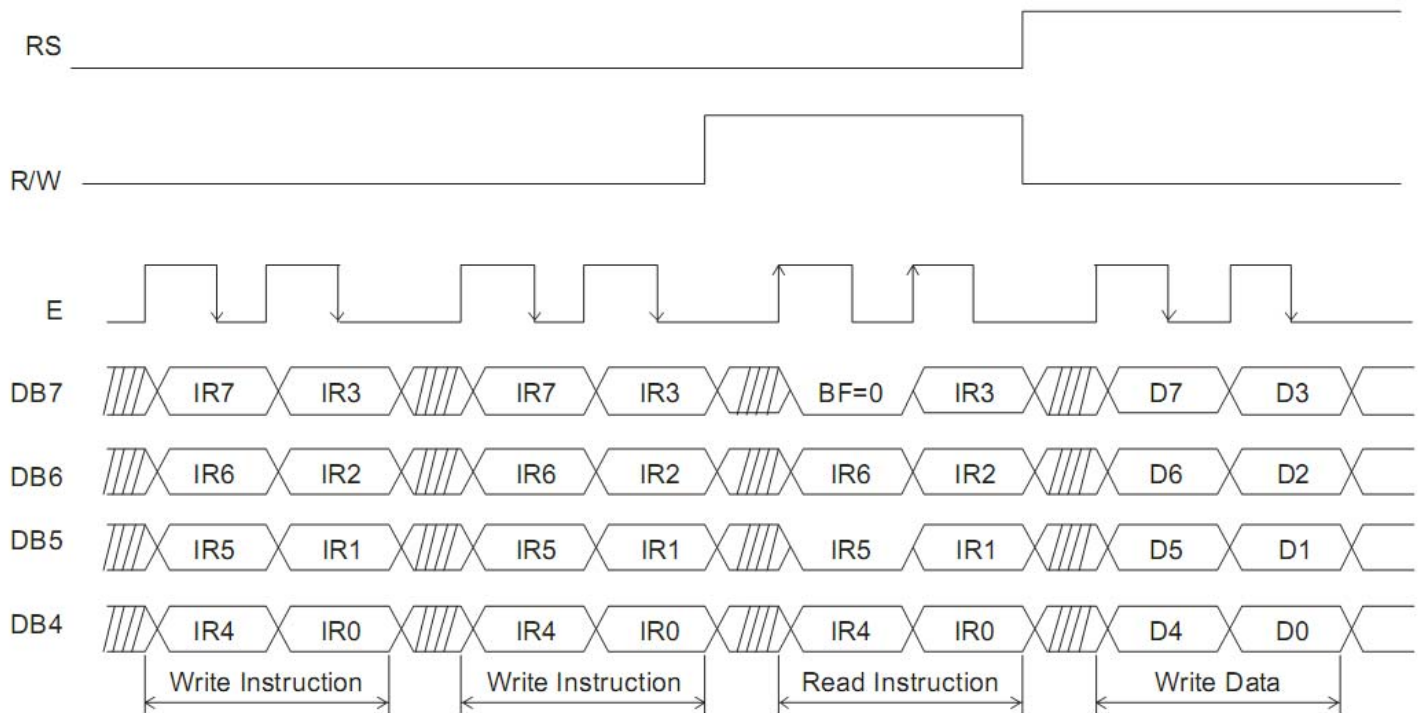
## Display character address code:

	1st Column	2nd Column	3rd Column	.....	19th Column	20th Column
1st ROW	00 Hex	01 Hex	02 Hex	.....	12 Hex	13 Hex
2nd ROW	40 Hex	41Hex	42 Hex	.....	52 Hex	53 Hex

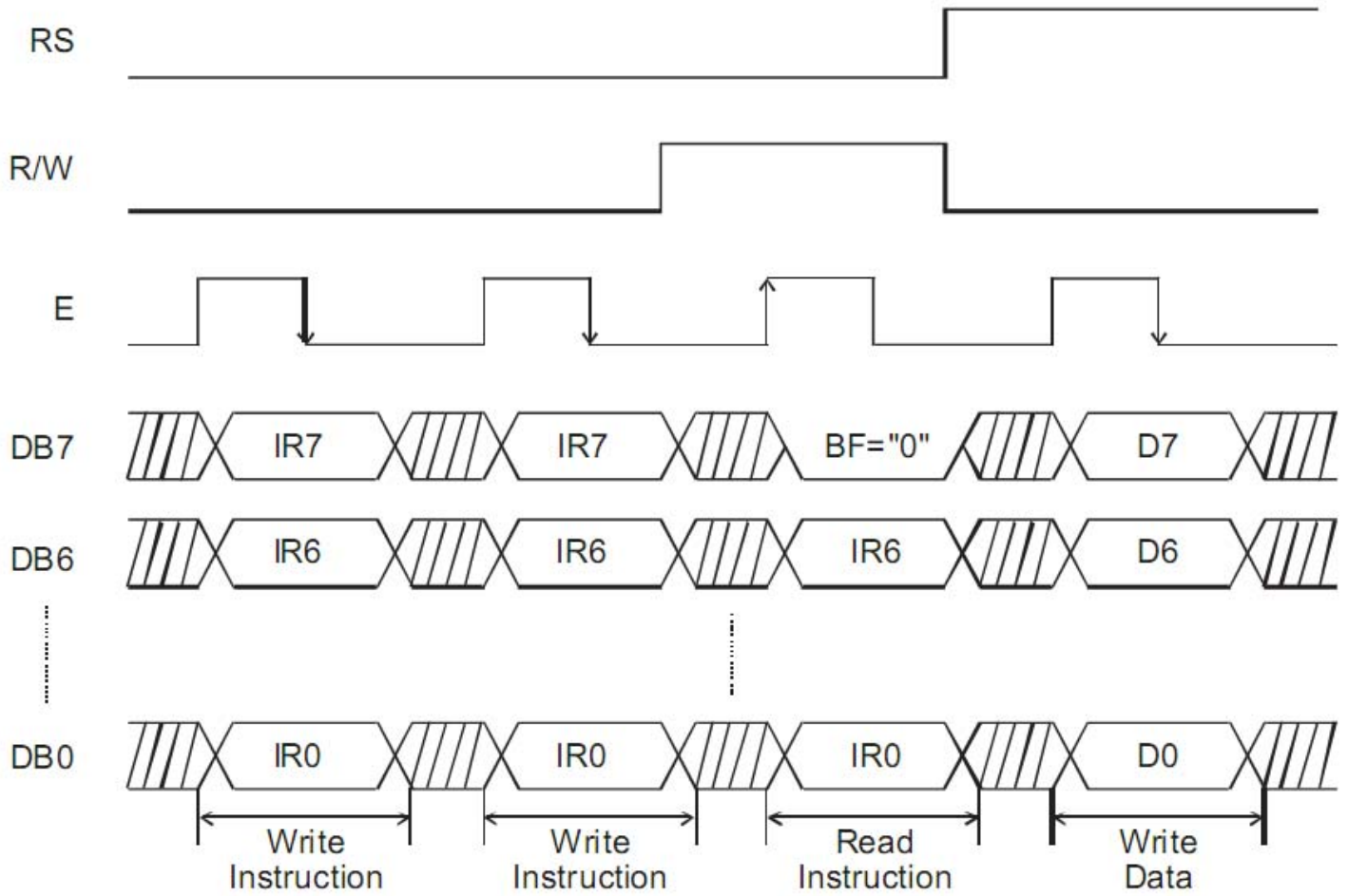
## M68 Parallel Interface:

The PT6314 can interface with the CPU in 4-bits or 8-bits. Note that the internal registers are composed of 8 bits. During data transfer in 4-bit mode, DB4-DB7 performs the data transfer operation two times, DB0-DB3 should be tied HIGH or LOW.

### 4-bit Data Transfer (M68):



8-bit Data Transfer (M68):



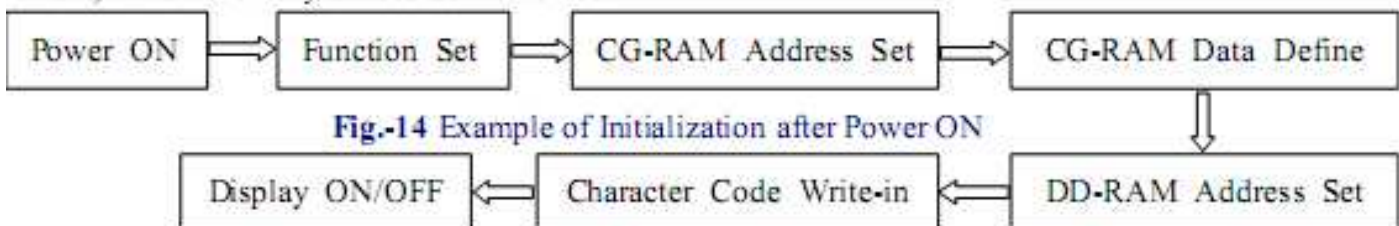
# Built-in Font Table

Upper Nibble	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	
Lower Nibble	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	CC-RAM (#1)																
0 0 0 1	1	CC-RAM (#2)																
0 0 1 0	2	CC-RAM (#3)																
0 0 1 1	3	CC-RAM (#4)																
0 1 0 0	4	CC-RAM (#5)																
0 1 0 1	5	CC-RAM (#6)																
0 1 1 0	6	CC-RAM (#7)																
0 1 1 1	7	CC-RAM (#8)																
1 0 0 0	8	CC-RAM (#1)																
1 0 0 1	9	CC-RAM (#2)																
1 0 1 0	A	CC-RAM (#3)																
1 0 1 1	B	CC-RAM (#4)																
1 1 0 0	C	CC-RAM (#5)																
1 1 0 1	D	CC-RAM (#6)																
1 1 1 0	E	CC-RAM (#7)																
1 1 1 1	F	CC-RAM (#8)																

## Example Initialization after Power ON

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
Power ON										Wait for 100 us
0	0	0	0	1	1	1	*	0	0	Function set: - Data length: 8 bits - Display line No.: 2 lines - Brightness: 100%
0	0	0	1	0	0	0	0	0	0	CG-RAM address set to 00H
1	0	*	*	*	D	D	D	D	D	Writes data into CG-RAM (the user-definable characters) 64 bytes in total (8 characters)
		.....								
		*	*	*	D	D	D	D	D	
0	0	1	0	0	0	0	0	0	0	DD-RAM address set to 00H (the first column of upper line)
1	0	D	D	D	D	D	D	D	D	Writes data into DD-RAM (choose the character codes to display in upper line) Totally 20 bytes in the upper line (20 characters)
		.....								
		D	D	D	D	D	D	D	D	
0	0	1	1	0	0	0	0	0	0	DD-RAM address set to 40H (the first column of lower line)
1	0	D	D	D	D	D	D	D	D	Writes data into DD-RAM (choose the character codes to display in lower line) Totally 20 bytes in the lower line (20 characters)
		.....								
		D	D	D	D	D	D	D	D	
0	0	0	0	0	0	1	1	0	0	Display ON, Cursor OFF, Cursor blink OFF

\*Note): D is the binary data to be written-in.



**Fig.-14** Example of Initialization after Power ON

## Quality Information

Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	+80°C , 48hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C , 48hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the high thermal stress for a long time.	+70°C 48hrs	2
Low Temperature Operation	Endurance test applying the electric stress (voltage & current) and the low thermal stress for a long time.	-20°C , 48hrs	1,2
High Temperature / Humidity Operation	Endurance test applying the electric stress (voltage & current) and the high thermal with high humidity stress for a long time.	+40°C , 90% RH , 48hrs	1,2
Thermal Shock resistance	Endurance test applying the electric stress (voltage & current) during a cycle of low and high thermal stress.	0°C,30min -> +25°C,5min -> +50°C,30min = 1 cycle 10 cycles	
Vibration test	Endurance test applying vibration to simulate transportation and use.	10-55Hz , 15mm amplitude. 60 sec in each of 3 directions X,Y,Z For 15 minutes	3
Static electricity test	Endurance test applying electric static discharge.	VS=800V, RS=1.5kΩ, CS=100pF One time	

**Note 1:** No condensation to be observed.

**Note 2:** Conducted after 4 hours of storage at 25°C, 0%RH.

**Note 3:** Test performed on product itself, not inside a container.

## Precautions for using LCDs/LCMs

See Precautions at [www.newhavendisplay.com/specs/precautions.pdf](http://www.newhavendisplay.com/specs/precautions.pdf)

## Warranty Information and Terms & Conditions

[http://www.newhavendisplay.com/index.php?main\\_page=terms](http://www.newhavendisplay.com/index.php?main_page=terms)