



# HTG16032G-31W-22C05-V01

产品名称 (Product name) : 黑白点阵 COG  
型 号 (Model) : HTG16032G-31W-22C05-V01  
编 号 (EDC number) : 10200350  
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深圳市鑫洪泰电子科技有限公司

Shenzhen Hot Display Technology Co.,Ltd

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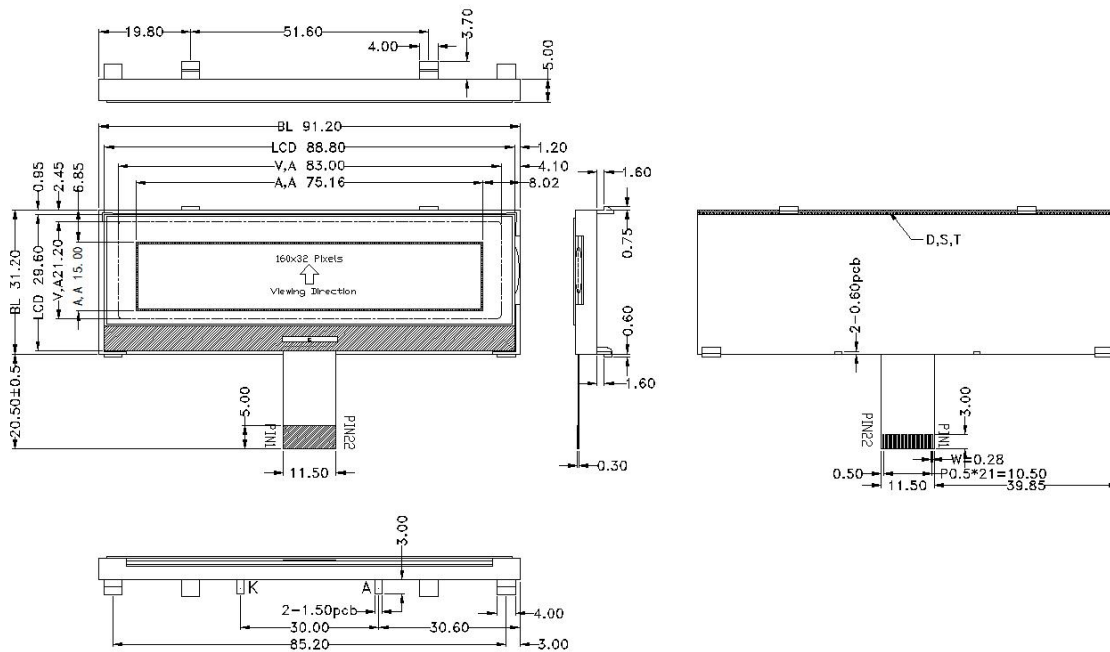
# 1. Basic Specifications

## 1.1 Display Specifications

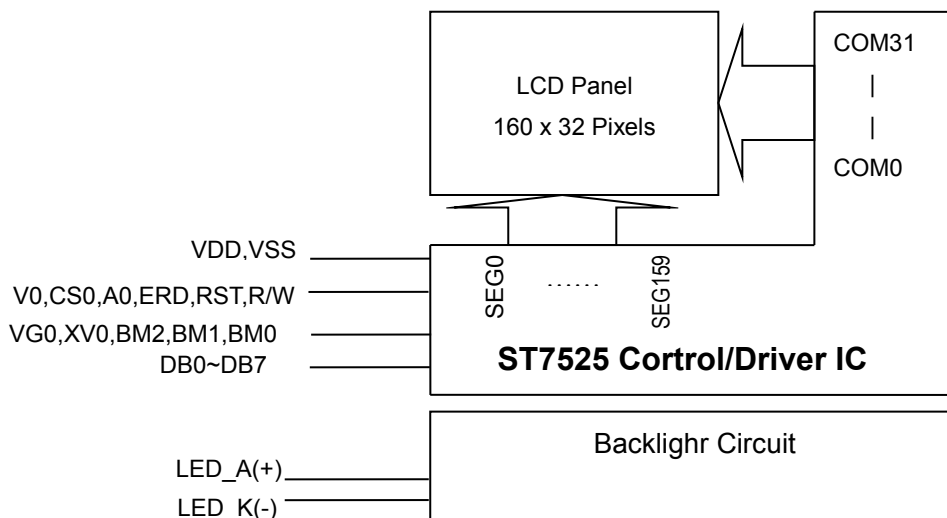
- 1>LCD Display Mode : FSTN, Positive, Transflective
- 2>Viewing Angle : 6H
- 3>Driving Method : 1/32 Duty, 1/6 Bias
- 4>Backlight : WHITE LED

## 1.2 Mechanical Specifications

- 1>Outline Dimension : 91.2x 31.2x 5.0mm (See attached Outline Drawing for Details)



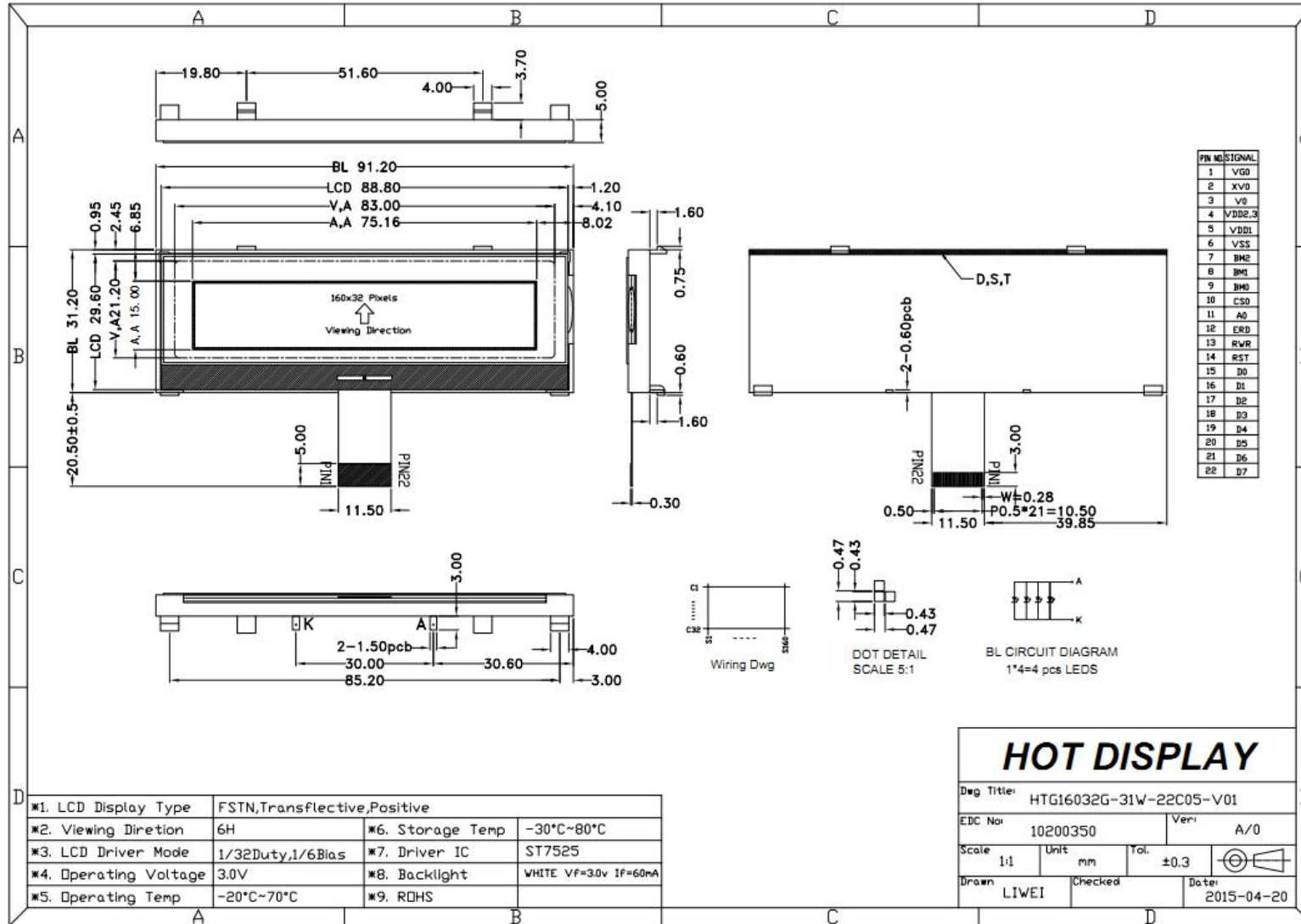
## 1.3 Circuit Diagram



**1.4 Terminal Function**

Pin No.	Pin Name	Function																									
1	VG0	LCD driving voltage for segments.																									
2	XV0	LCD driving voltage for commons at positive frame.																									
3	V0	LCD driving voltage for commons at negative frame																									
4	VDD2	Analog power																									
5	VDD1	Digital power																									
6	VSS	Negative power supply,0V																									
7	BM2	Microprocessor interface select pins. <table border="1"> <thead> <tr> <th>D7</th> <th>BM2</th> <th>BM1</th> <th>BM0</th> <th>Interface Mode</th> </tr> </thead> <tbody> <tr> <td>H</td> <td>--</td> <td>L</td> <td>L</td> <td>4-line serial interface</td> </tr> <tr> <td>H</td> <td>--</td> <td>L</td> <td>H</td> <td>I<sup>2</sup>C serial interface</td> </tr> <tr> <td>D7</td> <td>H</td> <td>H</td> <td>L</td> <td>8-bit 8080 parallel interface</td> </tr> <tr> <td>D7</td> <td>H</td> <td>H</td> <td>H</td> <td>8-bit 6800 parallel interface</td> </tr> </tbody> </table>	D7	BM2	BM1	BM0	Interface Mode	H	--	L	L	4-line serial interface	H	--	L	H	I <sup>2</sup> C serial interface	D7	H	H	L	8-bit 8080 parallel interface	D7	H	H	H	8-bit 6800 parallel interface
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H	--		L	H	I <sup>2</sup> C serial interface																						
D7	H	H	L	8-bit 8080 parallel interface																							
D7	H	H	H	8-bit 6800 parallel interface																							
8	BM1																										
9	BM0																										
		Note : The un-used pins are marked as "--" and should be fixed to "H" or "L" by VDD1 or VSS1.																									
10	CS0	Chip selection input																									
11	A0	It determines whether the access is related to data or command. A0= "H" : Indicates that D[7:0] are display data. A0= "L" : Indicates that D[7:0] are control data. There is no A0 pin in I2C interface and should fix to "H" by VDD1.																									
12	ERD	Read/Write execution control pin. When parallel interface is selected: <table border="1"> <thead> <tr> <th>MPU Type</th> <th>ERD</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>6800 series</td> <td>E</td> <td>                             Read/Write control input pin.                              R/W="H": When E is "H", D[7:0] are in an output status.                              R/W="L": Signals on D[7:0] are latched at the falling edge of E signal.                         </td> </tr> <tr> <td>8080 series</td> <td>/RD</td> <td>                             Read enable input pin.                              When /RD is "L", D[7:0] are in output status.                         </td> </tr> </tbody> </table>	MPU Type	ERD	Description	6800 series	E	Read/Write control input pin. R/W="H": When E is "H", D[7:0] are in an output status. R/W="L": Signals on D[7:0] are latched at the falling edge of E signal.	8080 series	/RD	Read enable input pin. When /RD is "L", D[7:0] are in output status.																
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13	RWR	Read/Write execution control pin. When parallel interface is selected: <table border="1"> <thead> <tr> <th>MPU Type</th> <th>RWR</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>6800 series</td> <td>R/W</td> <td>                             Read/Write control input pin.                              R/W="H": read.                              R/W="L": write.                         </td> </tr> <tr> <td>8080 series</td> <td>/WR</td> <td>                             Write enable input pin.                              Signals on D[7:0] will be latched at the rising edge of /WR signal.                         </td> </tr> </tbody> </table>	MPU Type	RWR	Description	6800 series	R/W	Read/Write control input pin. R/W="H": read. R/W="L": write.	8080 series	/WR	Write enable input pin. Signals on D[7:0] will be latched at the rising edge of /WR signal.																
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14	RST	Reset input pin. When RST is "L", internal initialization is executed.																									
15-22	DB0-DB7	8bit Date bus																									

## 1.5 Product Outline



## 2. Absolute Maximum Ratings

Items	Symbol	MIN.	MAX.	Unit	Condition
Supply Voltage	V <sub>DD</sub>	-0.3	+3.6	V	V <sub>SS</sub> = 0V
Input Voltage	V <sub>IN</sub>	-0.3	V <sub>DD</sub> +0.3	V	V <sub>SS</sub> = 0V
Operating Temperature	T <sub>OP</sub>	-20	+70	°C	No Condensation
Storage Temperature	T <sub>st</sub>	-30	+80	°C	No Condensation

## 3. Electrical Characteristics

### 3.1 DC Characteristics

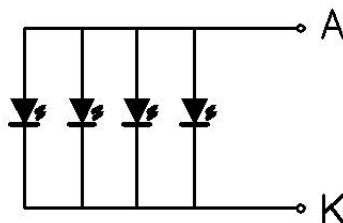
V<sub>SS</sub> = 0V, Top = 25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Operating Voltage	V <sub>DD</sub>	2.8	3.0	3.3	V	-
Input High Voltage	V <sub>IH</sub>	0.8 x V <sub>DD</sub>	-	V <sub>DD</sub>	V	
Input Low Voltage	V <sub>IL</sub>	V <sub>SS</sub>	-	0.2 x V <sub>DD</sub>	V	
Output High Voltage	V <sub>OH</sub>	0.8 x V <sub>DD</sub>	-	V <sub>DD</sub>	V	D0~D7
Output Low Voltage	V <sub>OL</sub>	V <sub>SS</sub>	-	0.2 x V <sub>DD</sub>	V	D0~D7
LCD Operation Current	I <sub>op</sub>	-	100	150	μA	V <sub>DD</sub> =5.0
Sleep Current	I <sub>sl</sub>	-	0.1	5	μA	T <sub>a</sub> = 25°C
Standby Mode	I <sub>DD</sub>	-	5	10	μA	T <sub>a</sub> = 25°C
Response time	Turn on	-	200	300	ms	T <sub>a</sub> = 25°C
	Turn off	-	200	350		

### 3.2 LED + Backlight Circuit

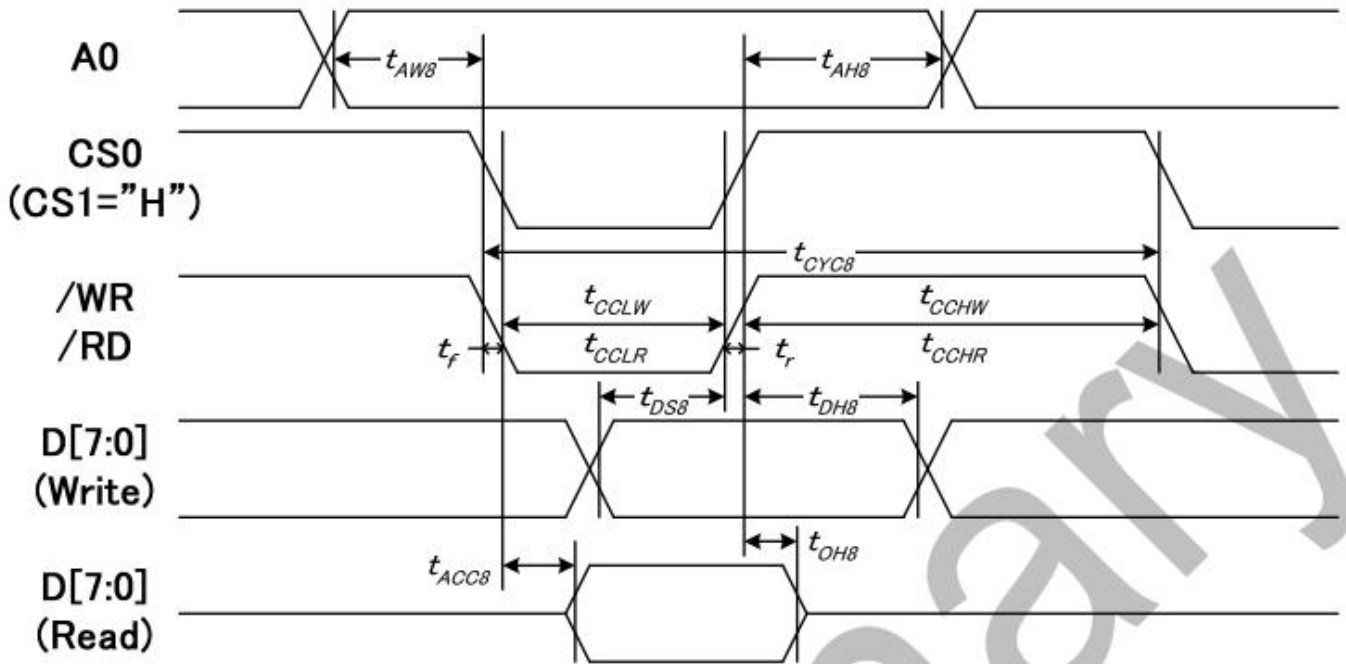
V<sub>SS</sub> = 0V, Top = 25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Forward Voltage	V <sub>f</sub> BLA	-	3.0	-	V	Without Resister
Forward Current	I <sub>f</sub> BLA	-	60	-	mA	-



### 3.3 AC Characteristics

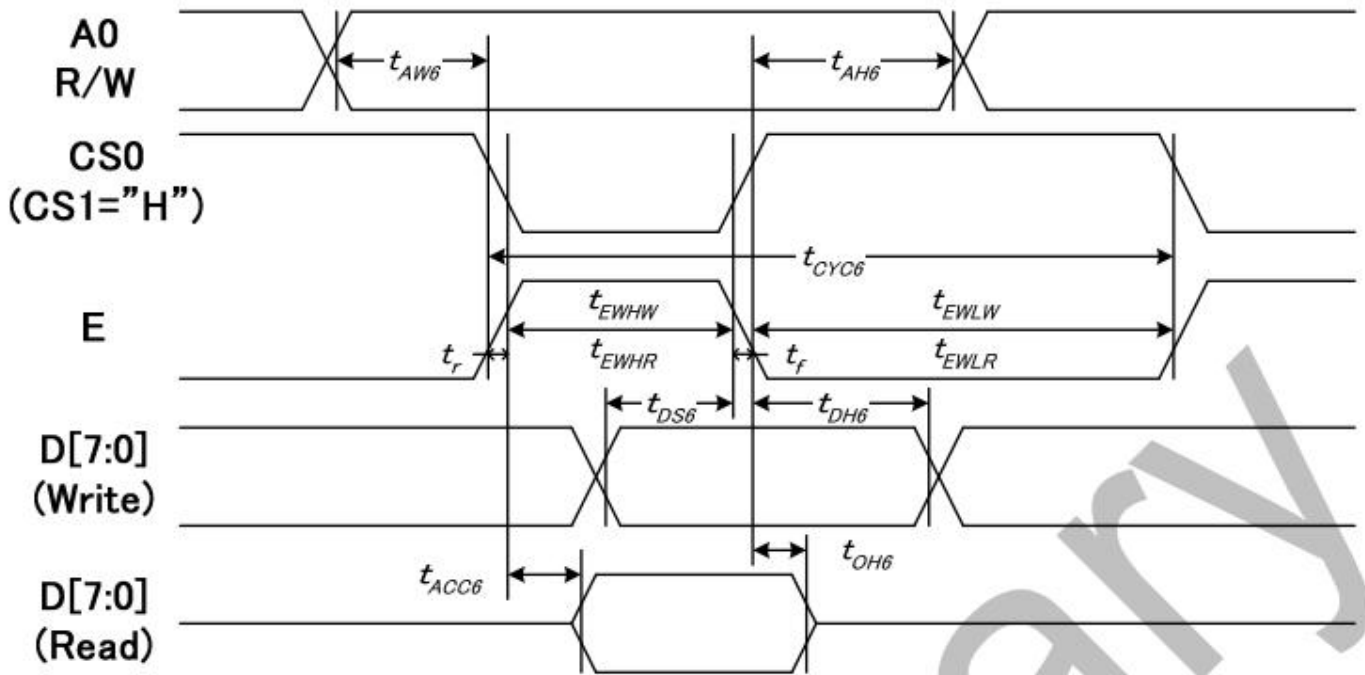
#### 3.3.1 8080 Mode System Bus Timing



**Note:**

\*a. all timing is specified using 20% and 80% of VDD1 as the reference.

3.3.2 6800 Mode System Bus Timing

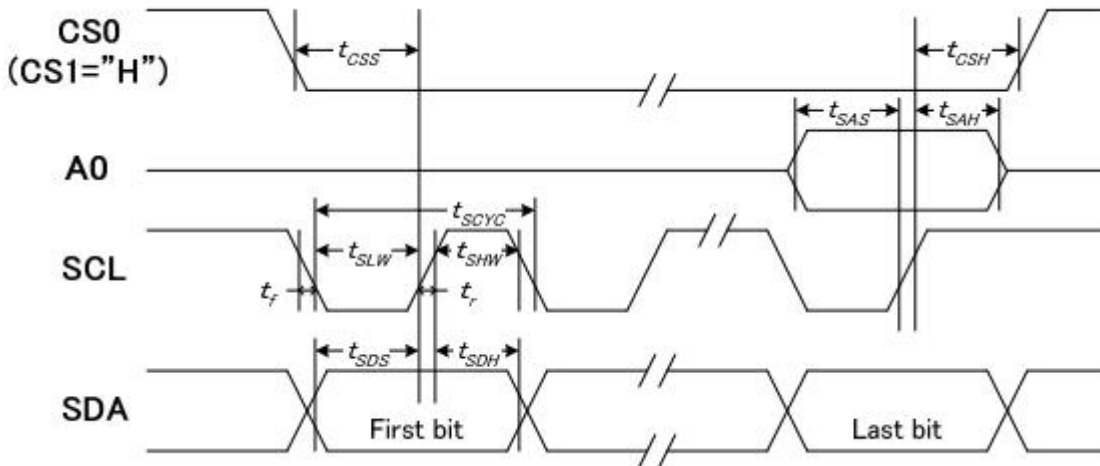


Note:

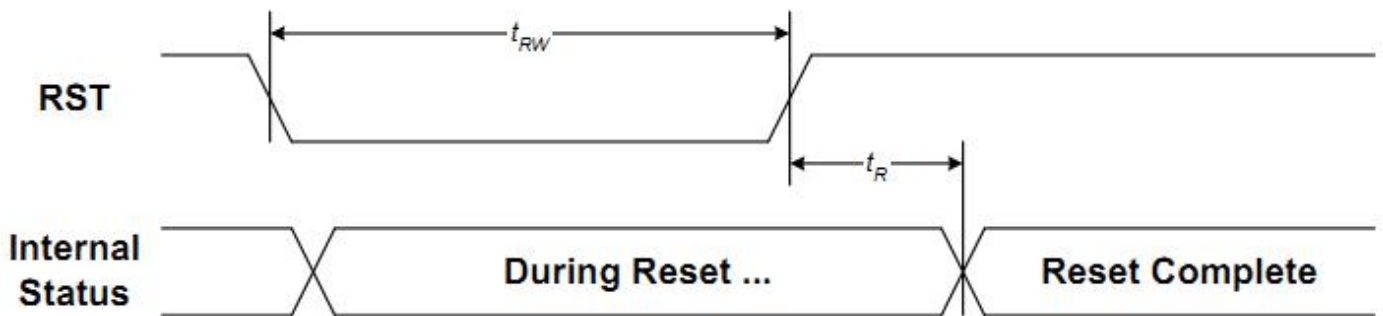
\*a. all timing is specified using 20% and 80% of VDD1 as the reference.



### 3.3.3 4-line SPI Mode



### 3.4 Reset Timing



## 4. Function specifications

### 4.1 The Parallel Interface

The 8-bit bi-directional data bus is used in parallel interface and the type of MPU is selected by BM[2:0] as shown in Table 2. The data transfer type is determined by signals of A0, ERD and RWR as shown in Table 3.

**Table 2. Microprocessor Selection for Parallel Interface**

BM2	BM1	BM0	CS0	CS1	A0	ERD	RWR	D[7:0]	MPU Interface
H	H	L	CS0	CS1	A0	/RD	/WR	D[7:0]	8080-series
H	H	H				E	R/W	D[7:0]	6800-series

**Table 3. Parallel Data Transfer**

Common	6800-series		8080-series		Description	
	A0	E (ERD)	R/W (RWR)	/RD (ERD)		/WR (RWR)
	H	H	H	L	H	Display data read out
	H	H	L	H	L	Display data write
	L	H	H	L	H	Internal status read
	L	H	L	H	L	Writes to internal register (instruction)

### Setting Serial Interface

Interface	CS0	CS1	A0	ERD	RWR	D[7:0]
4-Line SPI	CS0	CS1	A0	--	--	D[7:5]=fix to "H", D[4]=SCL, D[3:1]=SDA, D[0]=SCL
I <sup>2</sup> C	SA0	SA1	--	--	--	D[7:5]=fix to "H", D[4]=SCL, D[3:2]= SDA_ OUT, D[1]=SDA_ IN, D[0]=SCL, CS[1:0]=SA[1:0]. Refer to I <sup>2</sup> C interface.

\* The un-used pins are marked as "--" and should be fixed to "H" by VDD1.

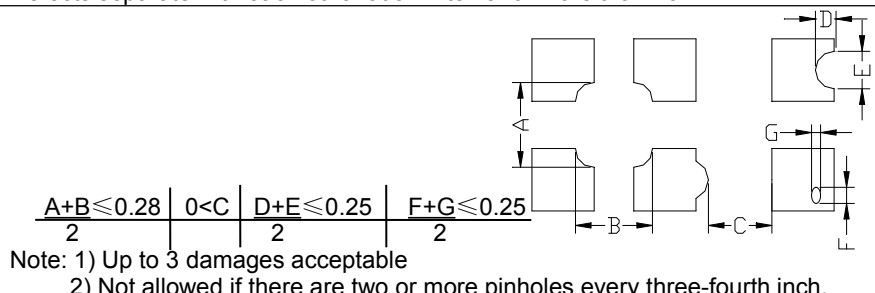
Note:

1. The option setting to be "H" should connect to VDD1.
2. The option setting to be "L" should connect to VSS1.

## 4.2 Display Commands

Command Table											
INSTRUCTION	A0	R/W (RWR)	COMMAND BYTE								DESCRIPTION
			D7	D6	D5	D4	D3	D2	D1	D0	
Write Data	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data to DDRAM
Read Data	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from DDRAM Only for parallel interface and I <sup>2</sup> C
Read Status Byte (parallel interface)	0	1	ID0	MX	MY	WA	DE	0	0	0	Read status byte Only for parallel interface
			0	0	0	0	0	0	ID2	ID1	
Set Column Address LSB	0	0	0	0	0	0	CA3	CA2	CA1	CA0	Set column address of RAM
Set Column Address MSB	0	0	0	0	0	1	CA7	CA6	CA5	CA4	
Set Scroll Line	0	0	0	1	SL5	SL4	SL3	SL2	SL1	SL0	Specify line address for the 1 <sup>st</sup> display line of DDRAM (vertical scrolling)
Set Page Address	0	0	1	0	1	1	PA3	PA2	PA1	PA0	Set page address of RAM
Set Contrast	0	0	1	0	0	0	0	0	0	1	2-byte instruction. Set Vop voltage
			EV7	EV6	EV5	EV4	EV3	EV2	EV1	EV0	
Set Partial Screen Mode	0	0	1	0	0	0	0	1	0	PS	PS=1: Enable partial mode
Set RAM Address Control	0	0	1	0	0	0	1	AC2	AC1	AC0	Set column and page address behavior
Set Frame Rate	0	0	1	0	1	0	0	0	FR1	FR0	Set frame frequency
Set All Pixel ON	0	0	1	0	1	0	0	1	0	AP	Set all display segments on
Set Inverse Display	0	0	1	0	1	0	0	1	1	INV	Set inverse display
Set Display Enable	0	0	1	0	1	0	1	1	1	PD	PD=0: Chip is in power down mode
Scan Direction	0	0	1	1	0	0	0	MY	MX	0	Set COM and SEG scan direction
Software Reset	0	0	1	1	1	0	0	0	1	0	Set software reset
NOP	0	0	1	1	1	0	0	0	1	1	No operation
Set Bias	0	0	1	1	1	0	1	0	BR1	BR0	Set internal bias circuit
Set COM End	0	0	1	1	1	1	0	0	0	1	2-byte instruction. Set display duty
			--	--	CEN5	CEN4	CEN3	CEN2	CEN1	CEN0	
Partial Start Address	0	0	1	1	1	1	0	0	1	0	Set partial start for partial display screen
			--	--	DST5	DST4	DST3	DST2	DST1	DST0	
Partial End Address	0	0	1	1	1	1	0	0	1	1	Set partial end for partial display screen
			--	--	DEN5	DEN4	DEN3	DEN2	DEN1	DEN0	
Test Control	0	0	1	1	1	1	0	0	0	0	Set test command table
			--	--	--	--	--	--	H1	H0	

## 5. Inspection Standards

Item	Criterion for defects	Defect type
1) Display on inspection	(1) Non display (2) Vertical line is deficient (3) Horizontal line is deficient (4) Cross line is deficient	Major
2) Black / White spot	Size $\Phi$ (mm) Acceptable number $\Phi \leq 0.3$ Ignore (note) $0.3 < \Phi \leq 0.45$ 3 $0.45 < \Phi \leq 0.6$ 1 $0.6 < \Phi$ 0	Minor
3) Black / White line	Length (mm) Width (mm) Acceptable number $L \leq 10$ $W \leq 0.03$ Ignore $5.0 \leq L \leq 10$ $0.03 < W \leq 0.04$ 3 $5.0 \leq L \leq 10$ $0.04 < W \leq 0.05$ 2 $1.0 \leq L \leq 10$ $0.05 < W \leq 0.06$ 2 $1.0 \leq L \leq 10$ $0.06 < W \leq 0.08$ 1 $L \leq 10$ $0.08 < W$ follows 2) point defect Defects separate with each other at an interval of more than 20mm	Minor
4) Display pattern	 <p>Note: 1) Up to 3 damages acceptable 2) Not allowed if there are two or more pinholes every three-fourth inch.</p>	Minor
5) Spot-like contrast irregularity	Size $\Phi$ (mm) Acceptable Number $\Phi \leq 0.7$ Ignore (note) $0.7 < \Phi \leq 1.0$ 3 $1.0 < \Phi \leq 1.5$ 1 $1.5 < \Phi$ 0 Note: 1) Conformed to limit samples. 2) Intervals of defects are more than 30mm.	Minor
6) Bubbles in polarizer	Size $\Phi$ (mm) Acceptable Number $\Phi \leq 0.4$ Ignore (note) $0.4 < \Phi \leq 0.65$ 2 $0.65 < \Phi \leq 1.2$ 1 $1.2 < \Phi$ 0	Minor
7) Scratches and dent on the polarizer	Scratches and dent on the polarizer shall be in the accordance with "2) Black/white spot", and "3) Black/White line".	Minor
8) Stains on the surface of LCD panel	Stains which cannot be removed even when wiped lightly with a soft cloth or similar cleaning.	Minor
9) Rainbow color	No rainbow color is allowed in the optimum contrast on state within the active area.	Minor
10) Viewing area encroachment	Polarizer edge or line is visible in the opening viewing area due to polarizer shortness or sealing line.	Minor
11) Bezel appearance	Rust and deep damages that are visible in the bezel are rejected.	Minor
12) Defect of land surface contact	Evident crevices that are visible are rejected.	Minor
13) Parts mounting	(1) Failure to mount parts (2) Parts not in the specifications are mounted (3) For example: Polarity is reversed, HSC or TCP falls off.	Minor
14) Part alignment	(1) LSI, IC lead width is more than 50% beyond pad outline. (2) More than 50% of LSI, IC leads is off the pad outline.	Minor
15) Conductive foreign matter (solder ball, solder hips)	(1) $0.45 < \Phi$ , $N \geq 1$ (2) $0.3 < \Phi \leq 0.45$ , $N \geq 1$ , $\Phi$ : Average diameter of solder ball (unit: mm) (3) $0.5 < L$ , $N \geq 1$ , $L$ : Average length of solder chip (unit: mm)	Minor
16) Bezel flaw	Bezel claw missing or not bent	Minor
17) Indication on name plate (sampling indication label)	(1) Failure to stamp or label error, or not legible.(all acceptable if legible) (2) The separation is more than 1/3 for indication discoloration, in which the characters can be checked.	Minor

## 6. Handling Precautions

### 6.1 Mounting method

A panel of LCD module made by our company consists of two thin glass plates with polarizers that easily get damaged. And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board (PCB), extreme care should be used when handling the LCD modules.

### 6.2 Cautions of LCD handling and cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Trichlorotrifluoroethane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Ketene
- Aromatics

### 6.3 Caution against static charge

The LCD module uses C-MOS LSI drivers. So we recommend you:

Connect any unused input terminal to  $V_{dd}$  or  $V_{ss}$ . Do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

### 6.4 Packaging

- Module employs LCD elements, and must be treated as such. Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity.

### 6.5 Caution for operation

It is an indispensable condition to drive LCD module within the limits of the specified voltage since the higher voltage over the limits may cause the shorter life of LCD module.

-An electrochemical reaction due to DC (direct current) causes LCD undesirable deterioration so that the uses of DC (direct current) drive should be avoided.

-Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD module may show dark color in them. However those phenomena do not mean malfunction or out of order of LCD module, which will come back in the specified operating temperature.

### 6.6 Storage

In the case of storing for a long period of time, the following ways are recommended:

- Storage in polyethylene bag with the opening sealed so as not to enter fresh air outside in it. And with not desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping the storage temperature range.
- Storing with no touch on polarizer surface by any thing else.

### 6.7 Safety

-It is recommendable to crash damaged or unnecessary LCD into pieces and to wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.

-When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well at once with soap and water.