



**Display Future Ltd**

www.displayfuture.com

## **LCD MODULE SPECIFICATION**

**Model: DF-GLN0122LW-H1**

**This module uses ROHS materials**

### **For customer acceptance**

Customer		date
Approved		
Comments		

The standard product specification may change without prior notice in order to improve performance or quality. Please contact Display Future Ltd for updated specification and product status before design for the standard product or release of the order.

Revision	1.0
Engineering	
Date	2018/02/1
Our Reference	

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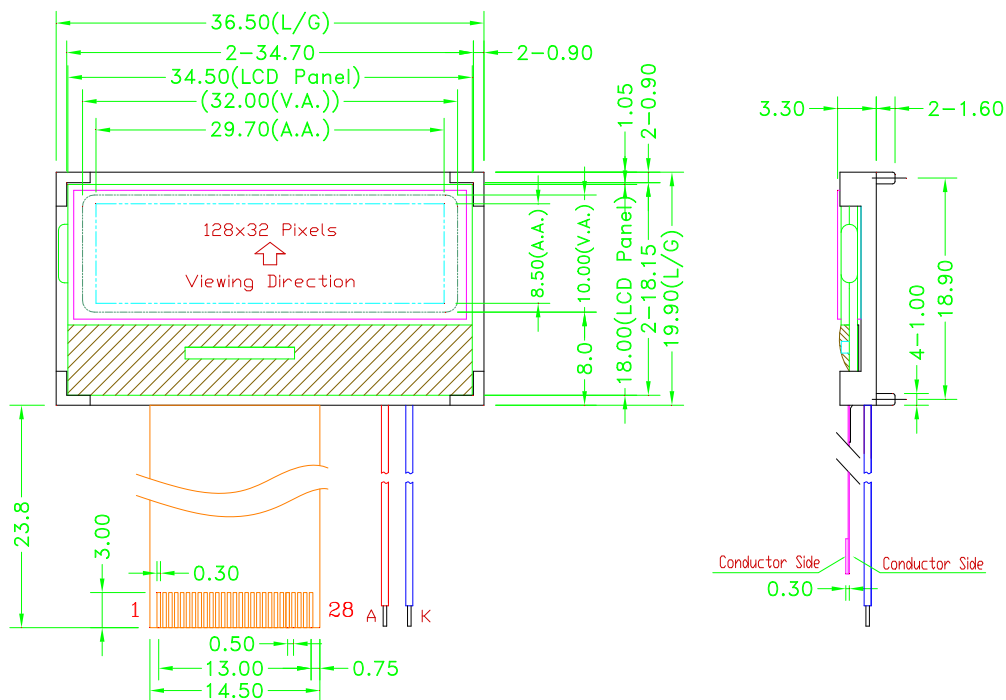
# 1. Basic Specifications

## 1.1 Display Specifications

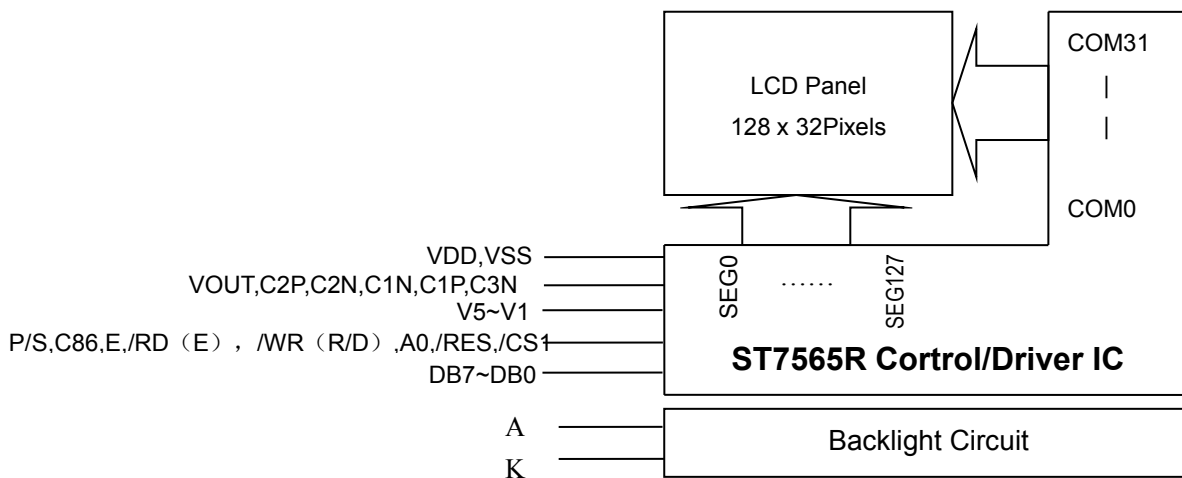
- 1>LCD Display Mode : FSTN, Positive, Transflective
- 2>Viewing Angle : 6H
- 3>Driving Method : 1/33 Duty, 1/6 Bias
- 4>Backlight : White

## 1.2 Mechanical Specifications

- 1>Outline Dimension : 36.5x 19.9 x 4.9mm (See attached Outline Drawing for Details)



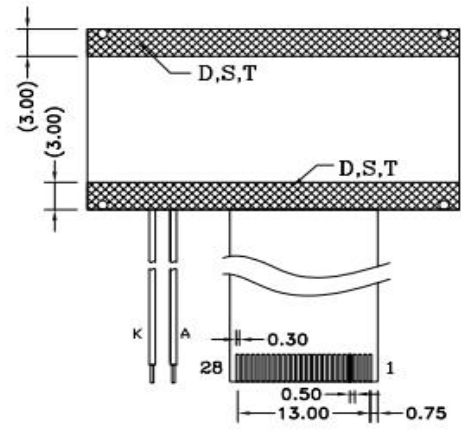
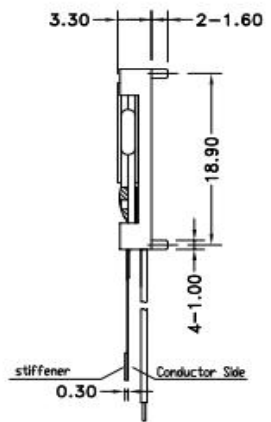
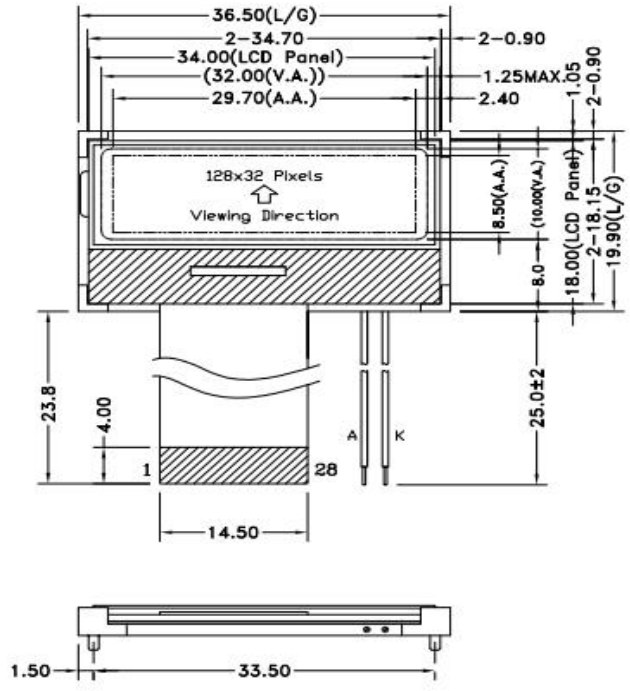
## 1.3 Circuit Diagram



## 1.4 Terminal Function

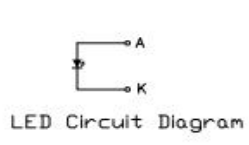
Pin No.	Pin Name	Function
1	VDD	Power supply
2	P/S	This pin configures the interface to be parallel mode or serial mode. P/S = "H": Parallel data input/output. P/S = "L": Serial data input.
3	C86	This is the MPU interface selection pin. C86 = "H": 6800 Series MPU interface. C86 = "L": 8080 Series MPU interface.
4~8	V5~V1	This is a multi-level power supply for the liquid crystal drive. The voltage Supply applied is determined by the liquid crystal cell, and is changed through the use of a resistive voltage divided or through changing the impedance using an op. amp. Voltage levels are determined based on Vss, and must maintain the relative magnitudes shown below. $V1 \geq V2 \geq V3 \geq V4 \geq V5$
9	C2P	When internal DC-DC voltage converter is used, external capacitor is connected between these pins.
10	C2N	
11	C1N	
12	C1P	
13	C3N	
14	VOUT	Positive voltage supply pin of the chip.
15	VSS	Negative power supply,0V
16~23	DB7~DB0	8bit Date bus, D7 : serial data input (SI) ; D6 : the serial clock input (SCL)
24	/RD (E)	<ul style="list-style-type: none"> <li>When connected to 8080 series MPU, this pin is treated as the "/RD" signal of the 8080 MPU and is LOW-active. The data bus is in an output status when this signal is "L".</li> <li>When connected to 6800 series MPU, this pin is treated as the "E" signal of the 6800 MPU and is HIGH-active. This is the enable clock input terminal of the 6800 Series MPU.</li> </ul>
25	/WR (R/W)	When R/W = "H": Read. When R/W = "L": Write.
26	A0	This is connect to the least significant bit of the normal MPU address bus, and it determines whether the data bits are data or command. A0 = "H":Indicates that D0 to D7 are display data. A0 = "L": Indicates that D0 to D7 are control data
27	/RES	Reset input pin
28	/CS1	Chip selection input

1.5 Product Outline



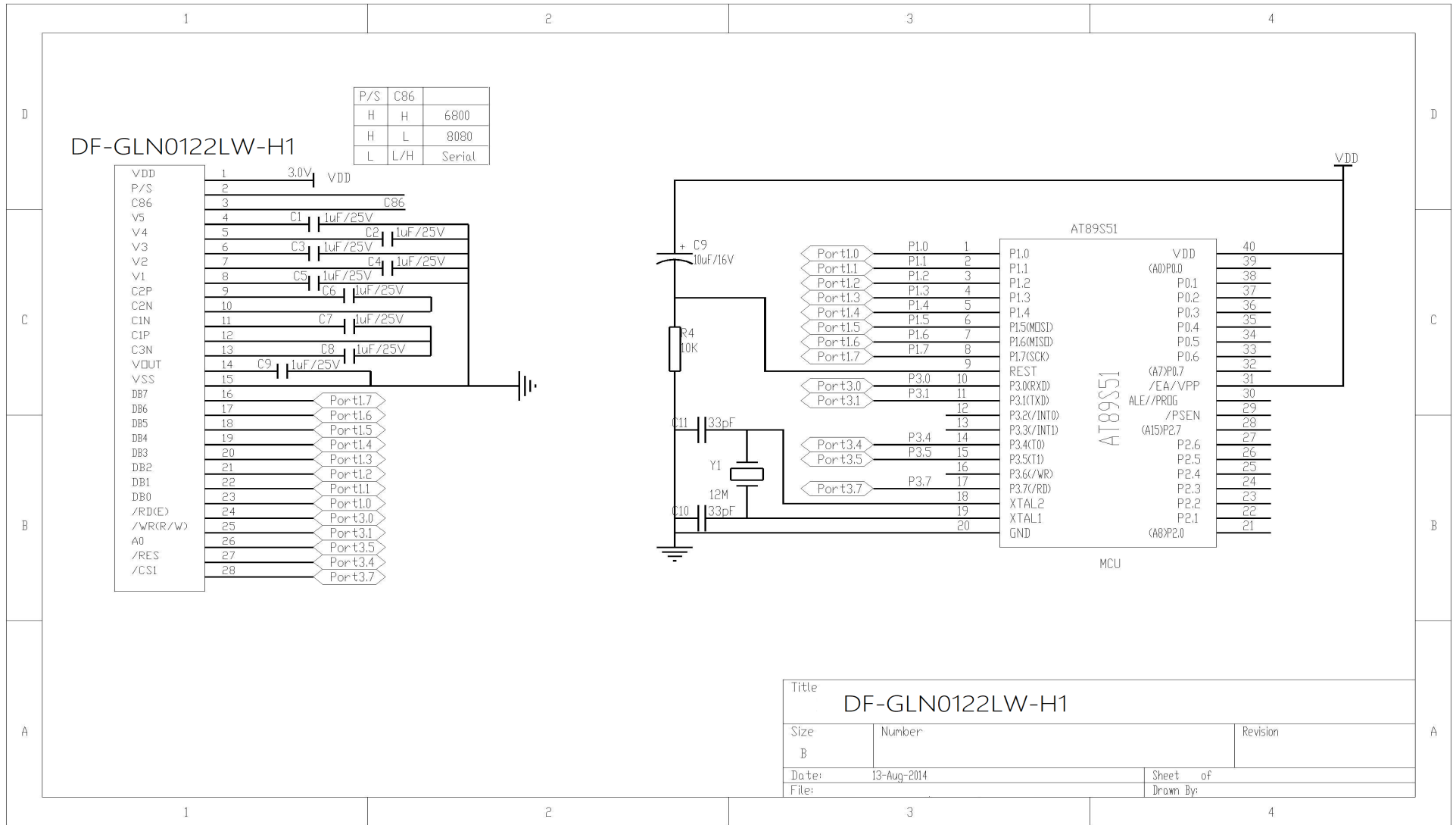
PIN	SYMBOL	PIN	SYMBOL
1	VDD	15	VSS2
2	PS	16	DB7
3	CB6	17	DB6
4	V5	18	DB5
5	V4	19	DB4
6	V3	20	DB3
7	V2	21	DB2
8	V1	22	DB1
9	CAP2P	23	DB0
10	CAP2N	24	/RD(E)
11	CAP1N	25	/WR(R/W)
12	CAP1P	26	AO
13	CAP3P	27	/RES
14	VOUT	28	/CS1

- Note:
- \*1. LCD Display Type : FSTN, Positive, Transmissive
  - \*2. Viewing Direction : 6H
  - \*3. Duty : 1/33; Bias : 1/6
  - \*4. Operating Voltage : 3.0V
  - \*5. Operating Temperature : -20°C~70°C
  - \*6. Storage Temperature : -30°C~80°C
  - \*7. Control/Drive IC : ST7565
  - \*8. Backlight : White LED(If = 15mA TYP. Vf = 3.0V±0.2)



<b>Display Future Ltd</b>			
Dwg Title		DF-GLN0122LW-H1	
Dwg No.		Date	
		2012-03-14	
Scale	Unit	Tol.	±0.3
	mm		
Drawn	Checked	Approved	

1.6 Schematic Diagram



## 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

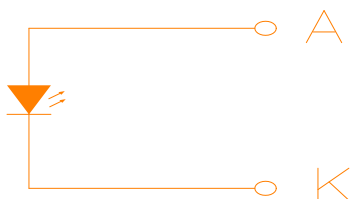
V<sub>SS</sub> = 0V, Top = 25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Operating Voltage	V <sub>DD</sub>	3.0	3.3	3.6	V	V <sub>DD</sub>
Input High Voltage	V <sub>IH</sub>	0.8 x V <sub>DD</sub>	-	V <sub>DD</sub>	V	/CS1,/RES,A0,E , R/W,D0~D7,C86
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
Operation Current	I <sub>op</sub>	100	-	220	μA	V <sub>DD</sub> =3.0V
Sleep mode	I <sub>DD</sub>	-	0.1	4	μA	Ta=25°C
Standby mode	I <sub>DD</sub>	-	5	10	μA	Ta=25°C

### 3.2 LED Backlight Circuit

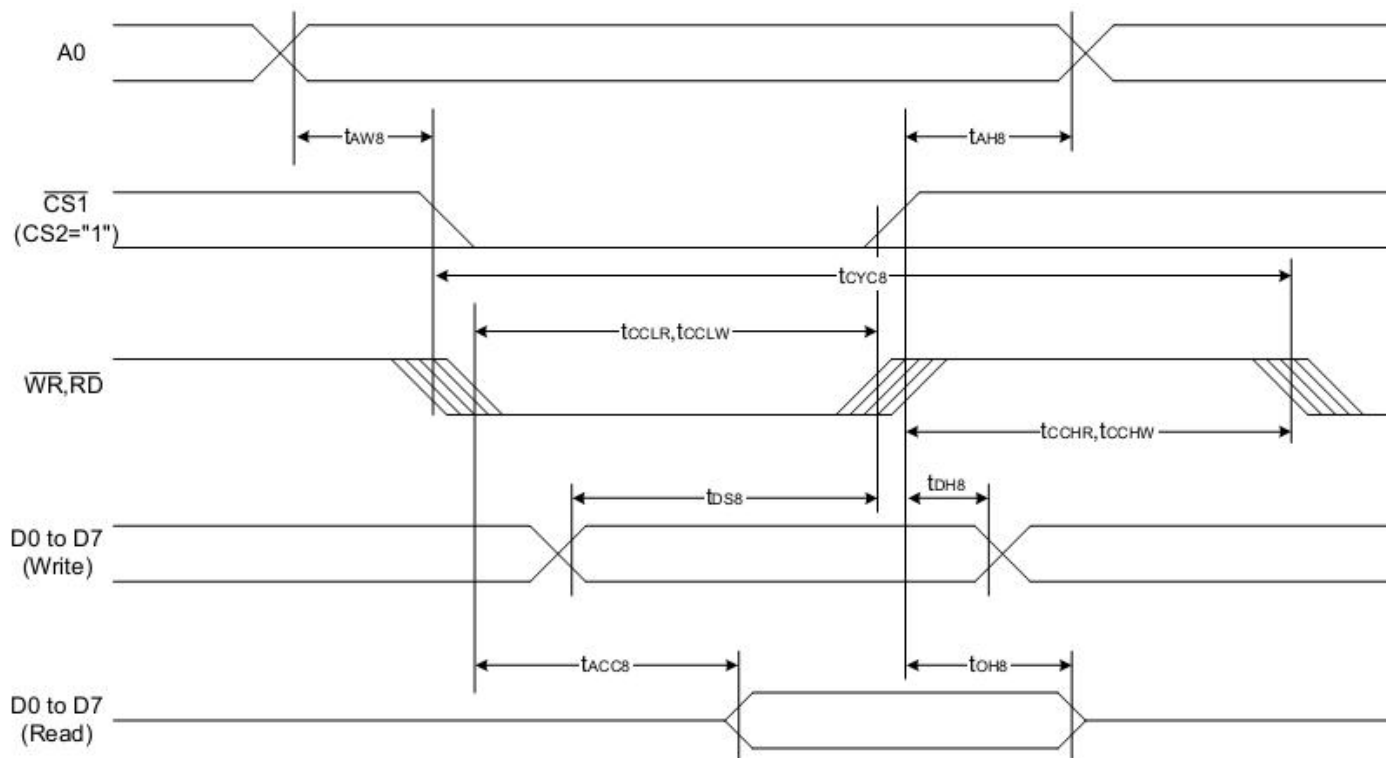
V<sub>SS</sub> = 0V, Top = 25°C

Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Forward Voltage	V <sub>f</sub> BLA	-	3.0	-	V	V <sub>DD</sub>
Forward Current	I <sub>f</sub> BLA	-	10	15	mA	V <sub>DD</sub>



### 3.3 AC Characteristics

#### 3.3.1 8080 Mode System Bus Timing



V<sub>ss</sub> = 0V, Top = 25°C

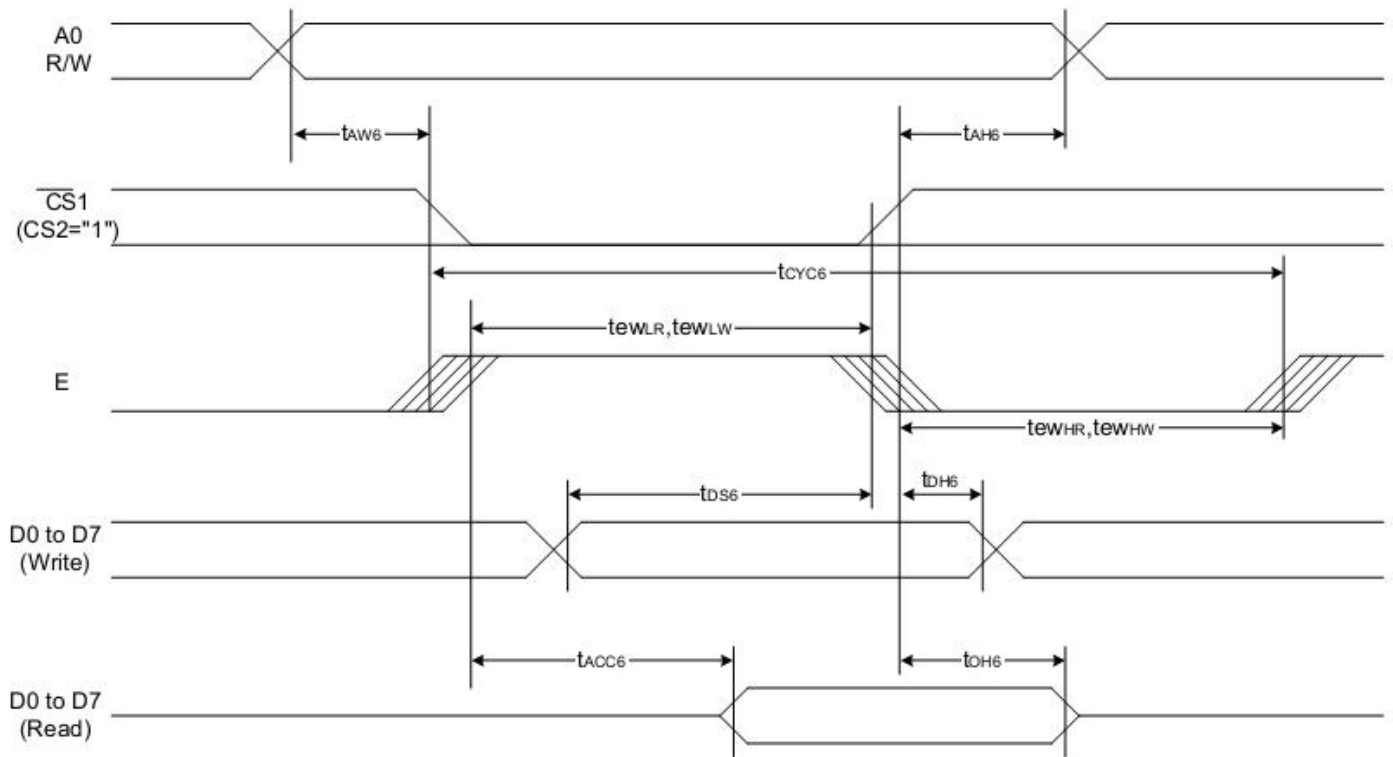
Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
System cycle time	Tcyc8	500	-	-	ns	-
Address setup time(A0)	Taw8	10	-	-	ns	-
Address hold time(A0)	Tah8	10	-	-	ns	-
Control Low Pulse wide(/RD)	tcclr	275	-	-	ns	-
Control Low Pulse wide(/WR)	tcclw	275	-	-	ns	-
Control High Pulse wide(/RD)	tcchr	225	-	-	ns	-
Control High Pulse wide(/WR)	tcchw	225	-	-	ns	-
Data setup time	Tds8	50	-	-	ns	-
Data hold time	Tdh8	10	-	-	ns	-
/RD access time(*a)	Tacc8	-	-	200	ns	-
Output disable time(*a)	Tch8	15	-	150	ns	-

**Note:**

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



3.3.2 6800 Mode System Bus Timing



Vss = 0V, Top = 25°C

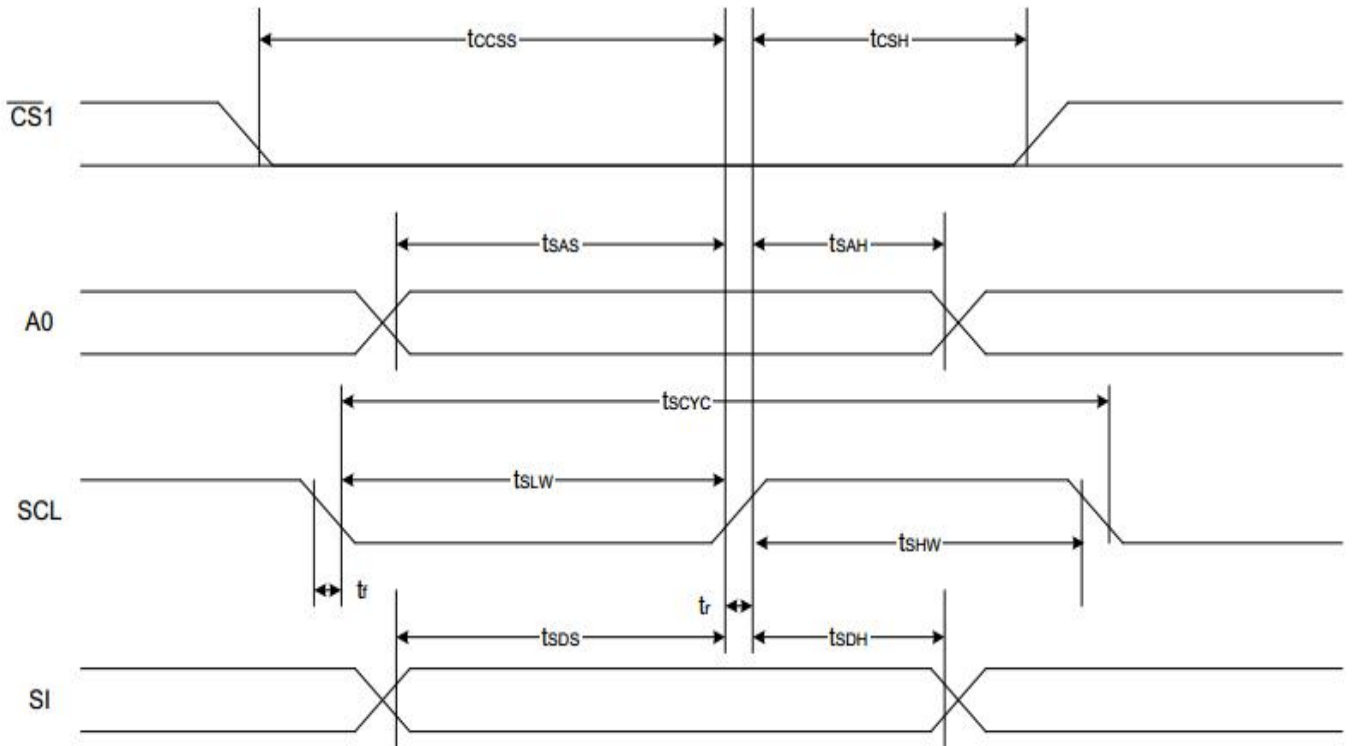
Items	Symbol	MIN.	TYP.	MAX.	Unit	Condition
System cycle time	Tcyc6	500	-	-	ns	-
Address setup time(A0)	Taw6	10	-	-	ns	-
Address hold time(A0)	Tah6	10	-	-	ns	-
Control Low Pulse wide(/RD)	tcclr	275	-	-	ns	-
Control Low Pulse wide(/WR)	tcclw	275	-	-	ns	-
Control High Pulse wide(/RD)	tcchr	225	-	-	ns	-
Control High Pulse wide(/WR)	tcchw	225	-	-	ns	-
Data setup time	Tds6	50	-	-	ns	-
Data hold time	Tdh6	10	-	-	ns	-
/RD access time(*a)	Tacc6	-	-	200	ns	-
Output disable time(*a)	Tch6	15	-	150	ns	-

Note:

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

\*b. CL = 100pF

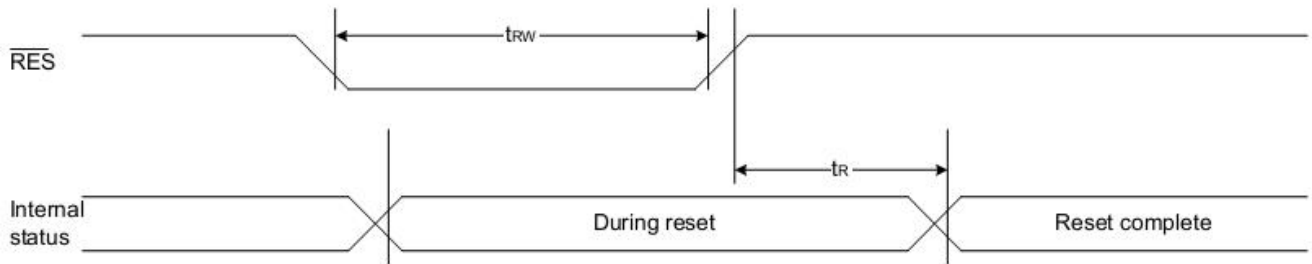
3.3.3 Serial Mode Interface



( $V_{DD} = 3.3V, T_a = -30$  to  $85^{\circ}C$ )

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
4-line SPI Clock Period	SCL	$T_{scyc}$		50	—	ns
SCL "H" pulse width		$T_{shw}$		25	—	
SCL "L" pulse width		$T_{slw}$		25	—	
Address setup time	A0	$T_{sas}$		20	—	
Address hold time		$T_{sah}$		10	—	
Data setup time	SI	$T_{sds}$		20	—	
Data hold time		$T_{sdh}$		10	—	
CS-SCL time	CS	$T_{css}$		20	—	
CS-SCL time		$T_{csh}$		40	—	

### 3.4 Reset Timing



(VDD = 3.3V, Ta = -30 to 85°C)

Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		tR		—	—	1.0	us
Reset "L" pulse width	/RES	tRW		1.0	—	—	us

Table 37

(VDD = 2.7V, Ta = -30 to 85°C)

Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		tR		—	—	2.0	us
Reset "L" pulse width	/RES	tRW		2.0	—	—	us

Table 38

(VDD = 1.8V, Ta = -30 to 85°C)

Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		tR		—	—	3.0	us
Reset "L" pulse width	/RES	tRW		3.0	—	—	us

**Note:**

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

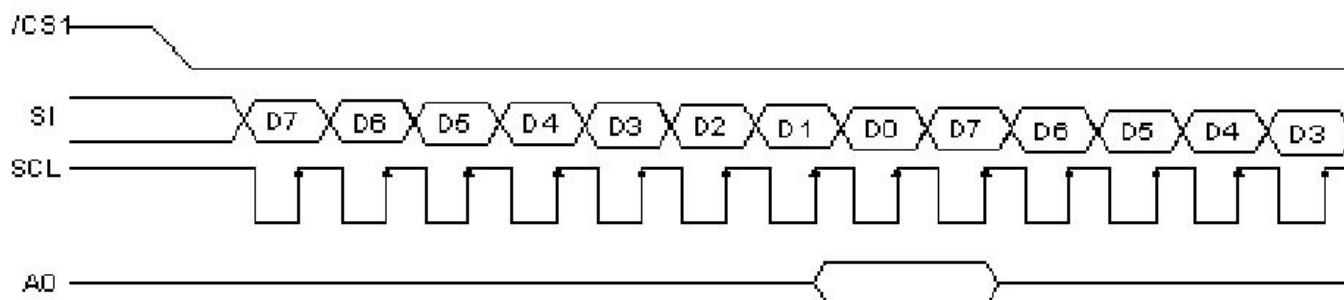
## 4. Function specifications

### 4.1 The Parallel Interface

Shared	6800 Mode		8080 Mode		Function
A0	R/W	E	/RD	/WR	
H	H	H	L	H	Reads the display data
H	L	H→L	H	L → H	Writes the display data
L	H	H	L	H	Status read
L	L	H→L	H	L → H	Write Command data

## 4.2 The Serial Interface

When the serial interface has been selected then when the chip is in active state the serial data input(SI) and the serial clock(SCL) can be received. The serial data is read from the serial data input pin in the rising edge of the serial clock . When "A0"="H", the data is display data, and when "A0"="L", the data is command.



## 4.3 Basic Setting

To drive the LCD module correctly and provide normally display, please use the following setting

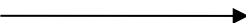
- 1> ADC = 0 (normal)
- 2> SHL select = 1(reverse)
- 3> LCD Bias Select = 1/9
- 4> Initial Display Line = 0
- 5> Entire Display ON/OFF = OFF(normal)
- 6> Reverse Display ON/OFF = OFF(normal)
- 7> Set Power Control Set:
  - Voltage follower = ON,voltage converter = ON,Voltage regulator = ON
- 8> Display ON/OFF =ON

## 4.4 Resetting the LCD module

The LCD module should be initialized bu using /RES terminal.

While turning on the VDD and VSS power supply, maintain /RES terminal at LOW level, After the Power supply stabilized, release the reset terminal(/RES = High)

**4.5 Display Memory Map**

Page address	data	LCD Display (front view)	
0	D0 : D7	<div style="border: 1px solid black; padding: 10px; display: inline-block;"> <b>128 × 32</b> </div>	
1	D0 : D7		
2	D0 : D7		
3	D0 : D7		
Column Address			

4.6 Display Commands

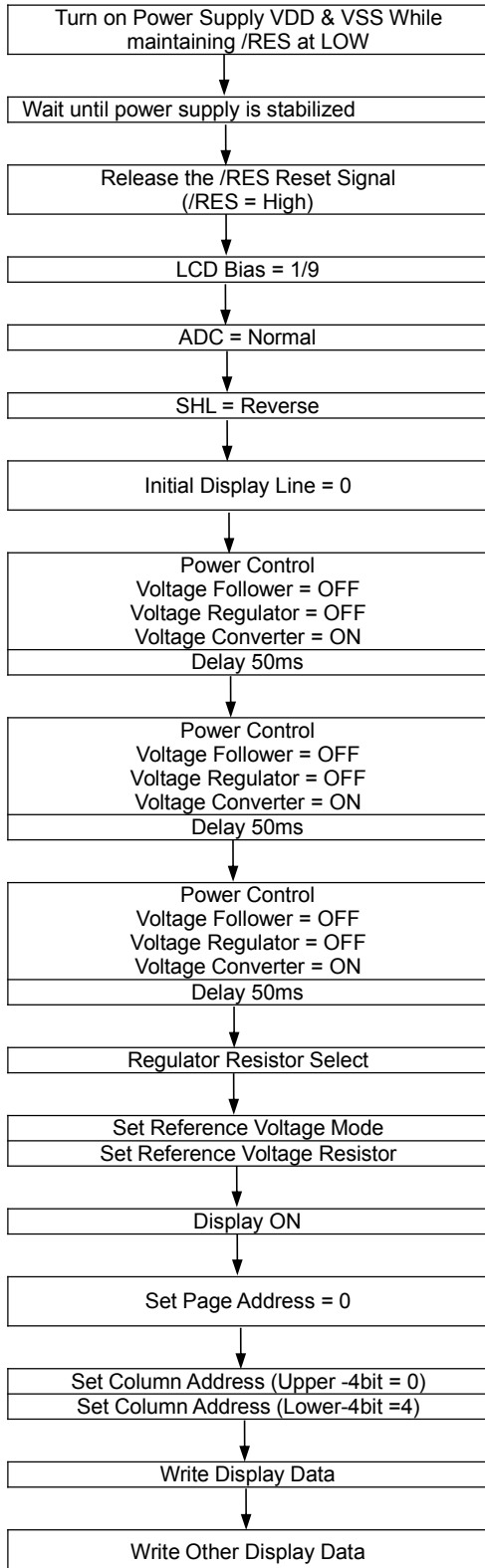
No.	Instructions	Code											Function
		A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1	D0	
1	Display ON/OFF	0	1	0	1	0	1	0	1	1	1	DON	DON=0,display off DON=1,display on
2	Display start line set	0	1	0	0	1	Display start address						Set the display RAM display start line address
3	Set Page Address	0	1	0	1	0	1	1	Page address				Set the display RAM Page address
4	Ser Column Address (Upper-4 bits)	0	1	0	0	0	0	1	Col. Add				Set the upper-4-bit of column address counter
	Ser Column Address (Lower-4 bits)	0	1	0	0	0	0	0	Col. Add				Set the low-4-bit of column address counter
5	Read Staus	0	0	1	Status				0	0	0	0	Read the status data
6	Write Display Data	1	1	0	Write Data								Write data into the display RAM
7	Read Display Data	1	0	1	Read Data								Read data from the display RAM
8	ADC Select	0	1	0	1	0	1	0	0	0	0	ADC	Set the display RAM address SEG output Correspondence ADC = 0,Normal. ADC = 1,Reverse
9	Normal/Reverse Display	0	1	0	1	0	1	0	0	1	1	REV	REV = 0, Normal REV = 1, Reverse
10	Entire Display ON/OFF	0	1	0	1	0	1	0	0	1	0	EON	EON = 0, Normal EON = 1, Entire display ON
11	Set LCD Bias	0	1	0	1	0	1	0	0	0	1	BIAS	Bias = 0, 1/9 Bias Bias = 1, 1/7 Bias
12	Set Read-Modify-Write	0	1	0	1	1	1	0	0	0	0		Enter the "Read-Modify-Write" mode
13	Reset Read-Modify-Write	0	1	0	1	1	1	0	1	1	1		Clear the "Read-Modify-Write" mode
14	Reset	0	1	0	1	1	1	0	0	0	1		Resets the LCD module
15	SHL S elect	0	1	0	1	1	0	0	SHL	*	*	*	Set the COM scanning direction SHL = 0, Normal SHL = 1, Flipped in y-direction * = don't care terms
16	Power Control Set	0	1	0	0	0	1	0	1	VC	VR	VF	Set the power circuit operation mode VF : LCD Supply Voltage Follower VR : LCD Supply Voltage Regulator VF : LCD Supply Voltage Converter (1 = ON, 0 = OFF)
17	Regulator Resistor Select	0	1	0	0	0	1	0	0	Ratio			Set the built-in resistor ratio (Rb/Ra)
18	Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	1	Set reference voltage mode
	Electronic volume register set	0	1	0	*	*	Electronic Control value					Set reference voltage register	
19	Power Save		-	-	-	-	-	-	-	-	-		Compound instruction Display OFF + Entire Display ON
20	NOP	0	1	0	1	1	1	0	0	0	1	1	Non-operation command

Note:

\*a. For the details of the Display Commands, please refer to ST7565R data sheet

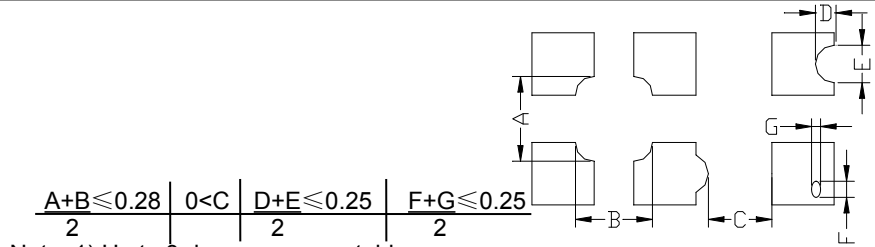
4.7 Basic Operating Sequence

Initialization Sequence



Code Function										hex	Note
A0	D7	D6	D5	D4	D3	D2	D1	D0			
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	See AC Characteristics section for timing details
0	1	0	1	0	0	0	1	0	0	A2H	LCD Characteristics
0	1	0	1	0	0	0	0	0	0	A0H	No flip on x-direction (SEG)
0	1	1	0	0	1	0	0	0	0	C8H	Flip on y- direction (COM)
0	0	1	0	0	0	0	0	0	0	40H	i.e. Display RAM "Page 0-D0" Matched to top line of the LCD
0	0	0	1	0	1	1	0	0	0	2CH	Turn on the internal Voltage Converter and wait until VOUT stable
-	-	-	-	-	-	-	-	-	-	-	
0	0	0	1	0	1	1	1	0	0	2EH	Turn on the internal Voltage Regulator and wait until VOUT stable
-	-	-	-	-	-	-	-	-	-	-	
0	0	0	1	0	1	1	1	1	0	2FH	Turn on the internal Voltage Follower and wait until VOUT stable
-	-	-	-	-	-	-	-	-	-	-	
0	0	0	1	0	0	1	0	1	1	25H	Set the built-in resistor ratio to middle
0	1	0	0	0	0	0	0	1	1	81H	Set to the middle of the range it may be adjusted For achieving the best display contrast
0	0	0	1	0	0	0	1	0	0	22H	
0	1	0	1	0	1	1	1	1	1	AFH	Turn on the LCD display
0	1	0	1	1	0	0	0	0	0	B0H	Specify the display data RAM page address to 00H
0	0	0	0	1	0	0	0	0	0	10H	Specify the display data RAM column address to 00H
0	0	0	0	0	0	1	0	0	0	01H	
1	Display Data									-	-

## 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 direct 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.

## 7. Packaging Specifications

7.1 Packaging Material						
No	Item	Dimensions (mm)	1PCS Weight (KG)	Quantity	Total Weight	
1	LCM	36.5*19.9*3.3	0.012	900	10.8	
2	PE Bag	100*80	0.001	900	0.9	
3	Foam Rubber Cushion	310*170	0.0175	12	0.21	
4	Partition Al	310*170*100	0.30	6	1.8	
5	Product Box	330*180*120 (neutral packing)	0.45	6	2.7	
6	Carton	480*390*330 (neutral packing)	0.9	1	0.9	
7	Tape			AR		
8	Label Specifications			1		
9	Label Rohs			1		
10	Label ESD			1		

7.2. Total LCD Weight in carton: 17.3 KG±10%

7.3. Packaging Specifications and Quantity:

(1) Quantity Of Spacer: A1\*6

(2) Total LCM quantity in carton: quantity per box 150\* no of boxes 6 = 900

