

DOCUMENT NUMBER AND REVISION

**CG12864A09-01 REV. B**  
(FFPNNHEG-06-ST-NSC)

DOCUMENT TITLE:  
**SPECIFICATION**  
**OF**  
**LCD MODULE TYPE**

CUSTOMER	集美电子
MODEL NUMBER	<b>CG12864A09-01</b>
CUSTOMER APPROVAL	
DATE	

DEPARTMENT	NAME	SIGNATURE	DATE
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**DOCUMENT REVISION HISTORY 1:**

DOCUMENT REVISION		DATE	DESCRIPTION	CHANGED BY	CHECKED BY
FROM	TO				
	A	2004.12.10	First Release.	ZHU LING JUN	LI HUA MING
A	B	2006.03.10	Items 1 to 2 were updated. 1)(Page 5, Figure 1) The module specification was updated. 2)(Page 16, Point 6) The Quality Units was updated.	ZHU LING JUN	LI HUA MING

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## Specification of LCD Module Type Item No.: CG12864A09-01

### 1. General Description

- 128 x 64 Dots FSTN Positive Transflective Dot Matrix LCD Module.
- Viewing Angle: 6 O'clock direction.
- Driving duty: 1/65 Duty, 1/9 bias.
- 'SITRONIX' ST7565V-G LCD Controller & Driver or equivalent.
- Chip-On-Glass (COG).
- High-speed 8-bit MPU interface or Serial interface.
- Power Supply: +3.0V.
- FPC.

### 2. Mechanical Specifications

The mechanical detail is shown in Fig. 1 and summarized in Table 1 below.

Table 1

Parameter	Specifications	Unit
Outline dimensions	39.1(W) x 33.0(H) x 2.0(D)(Exclude FPC, Include LCD end seal)	mm
	39.1(W) x 53.0(H) x 2.0(D)(Include FPC, Include LCD end seal)	
Viewing area	33.8(W) x 22.2(H)	mm
Display format	128 x 64 dots	-
Dot size	0.225(W) x 0.285(H)	mm
Dot spacing	0.015(W) x 0.015(H)	mm
Dot pitch	0.240 (W) x 0.300(H)	mm
Weight:	TBD	grams

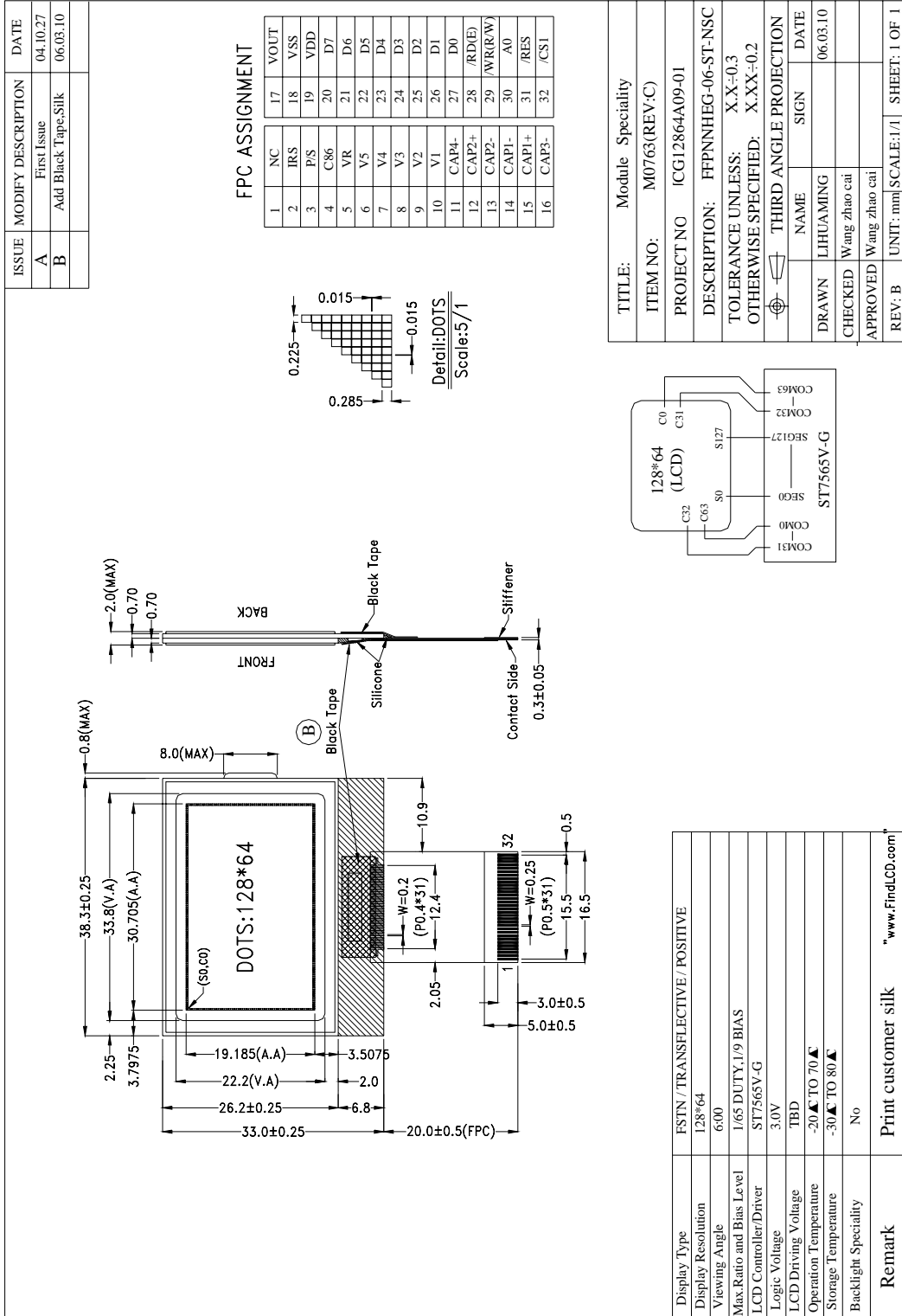
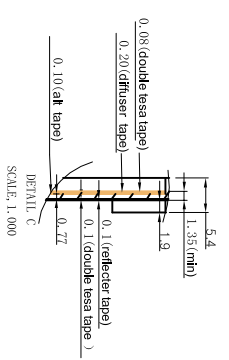
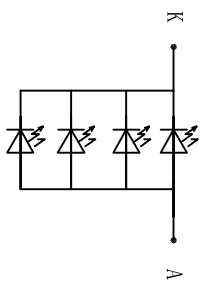
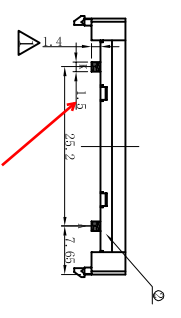
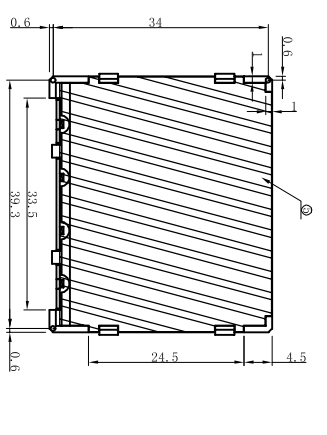
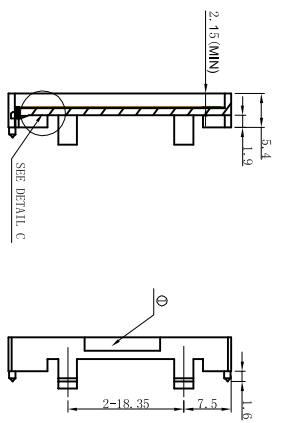
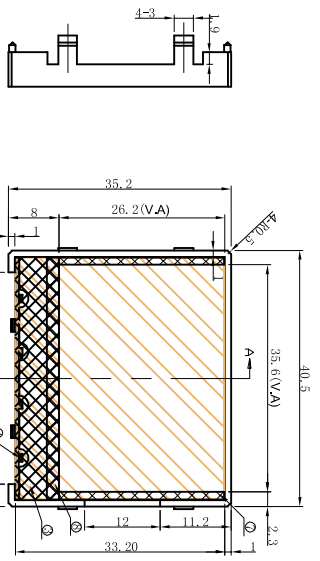
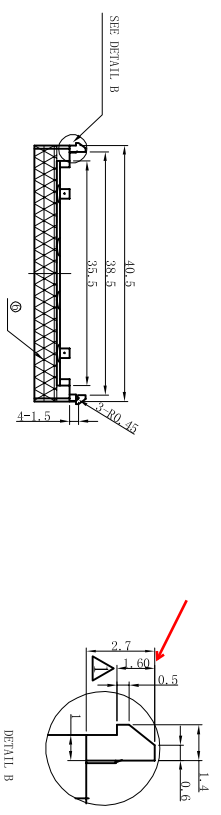


Figure 1: Module Specification

EDITION:(版本号)	A
EDITION:(版本号)	A
Revis by:(承认)	
Confirm by:(审查)	
Measured by:(设计)	李绍华



- Notes:  
 备注:  
 1. Unit:mm.  
 单位:mm  
 2. Do not scale drawing.  
 未按比例出图  
 3. Modification rev. number.  
 Δ为修改痕迹  
 4. Without tolerance is ±0.2  
 未标公差为±0.2  
 5. BLUE WAVELENGTH:465-475nm  
 蓝光波长为465-475纳米  
 6. V=3.21A@ 20V.  
 电压为3.21A@20V  
 7.RATE≥70%;Lv≥40cd/m<sup>2</sup>  
 效率≥70%;亮度≥40cd/m<sup>2</sup>  
 PBF5230X/PBF5230X/m2

REV(标记)	DATE(日期)	DESCRIPTION(描述)	NO.(序号)	QUANTITY(数量)
Δ	04.12.02	更改A.K高度和钩子结构	1	1
			2	1
			3	1
			4	4
			5	1
			6	1
			7	1
			8	1

Customer Name: 集美电子  
 Approval Date: 承认日期  
 Please Confirm This Drawing On/Before 请签回此图

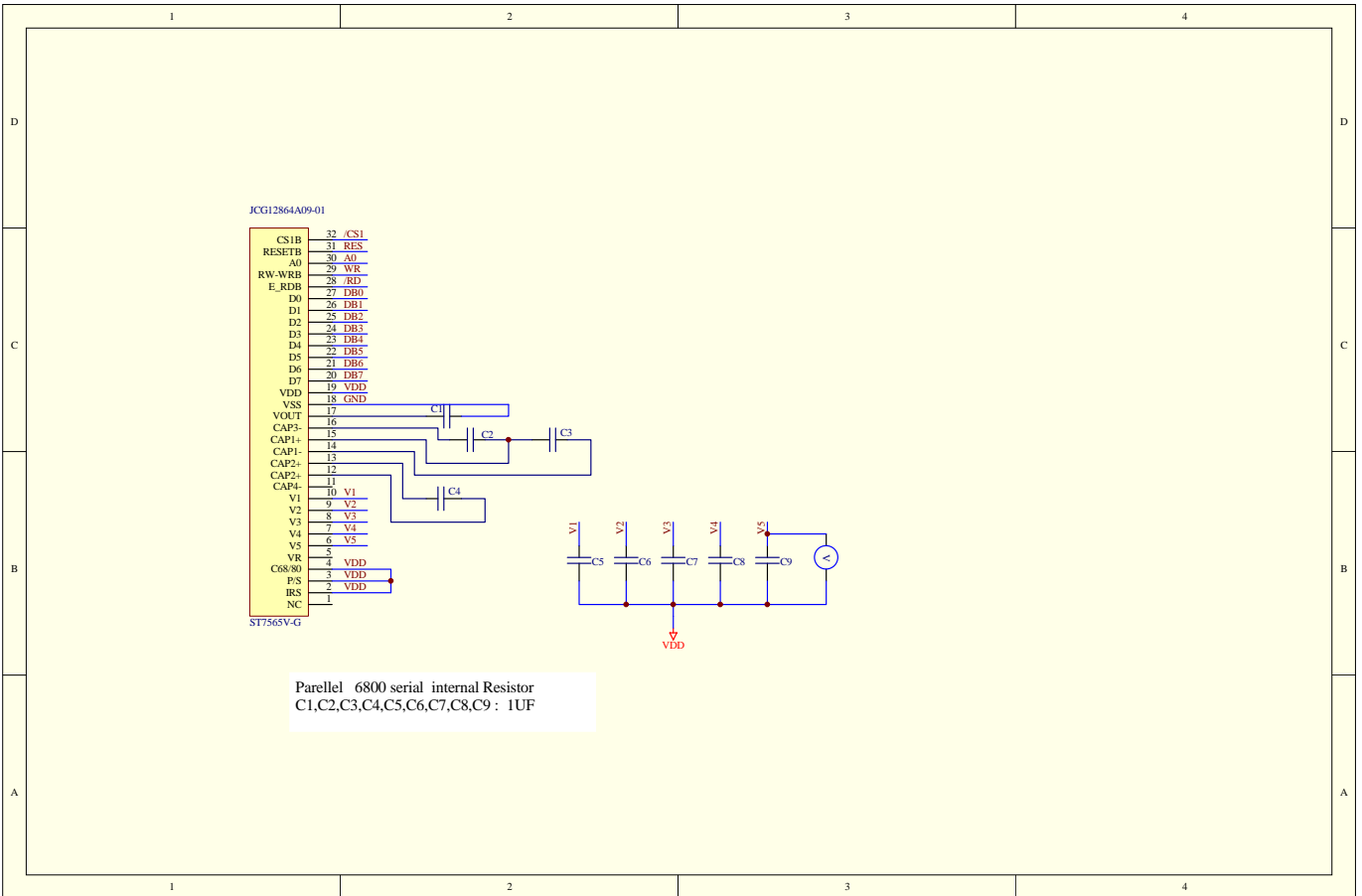


Figure 2: Recommend Outer circuit

### 3. Interface signals

Table 2(a)

Pin No.	Symbol	Description										
1	NC	No connection.										
2	IRS	This terminal selects the resistors for the V5 voltage level adjustment. IRS = "H": Use the internal resistors IRS = "L": Do not use the internal resistors. The V5 voltage level is regulated by an external resistive voltage divider attached to the VR terminal.										
3	P/S	This is the parallel data input/serial data input switch terminal. P/S = "H": Parallel data input. P/S = "L": Serial data input.										
4	C86	This is the MPU interface switch terminal. C86 = "H": 6800 Series MPU interface. C86 = "L": 8080 MPU interface.										
5	VR	Output voltage regulator terminal. Provides the voltage between VDD and V5 through a resistive voltage divider. IRS = "L": the V5 voltage regulator internal resistors are not used . IRS = "H": the V5 voltage regulator internal resistors are used .										
6	V5	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 VDD, and must maintain the relative magnitudes shown below. VDD (= V0) $\cong$ V1 $\cong$ V2 $\cong$ V3 $\cong$ V4 $\cong$ V5 When the power supply turns ON, the internal power supply circuits produce the V1 to V4 voltages shown below. The voltage settings are selected using the LCD bias set command.										
7	V4											
8	V3											
9	V2											
10	V1											
			<table border="1"> <thead> <tr> <th>LCD bias</th> <th>V1</th> <th>V2</th> <th>V3</th> <th>V4</th> </tr> </thead> <tbody> <tr> <td>1/9 bias</td> <td>(1/9) x V5</td> <td>(2/9) x V5</td> <td>(7/9) x V5</td> <td>(8/9) x V5</td> </tr> </tbody> </table>	LCD bias	V1	V2	V3	V4	1/9 bias	(1/9) x V5	(2/9) x V5	(7/9) x V5
LCD bias	V1	V2	V3	V4								
1/9 bias	(1/9) x V5	(2/9) x V5	(7/9) x V5	(8/9) x V5								
11	CAP4-	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP2+ terminal.										
12	CAP2+	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP2- terminal.										
13	CAP2-	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP2+ terminal.										
14	CAP1-	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP1+ terminal.										
15	CAP1+	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP1- terminal.										
16	CAP3-	DC/DC voltage converter. Connect a capacitor between this terminal and the CAP1+ terminal.										



Table 2(b)

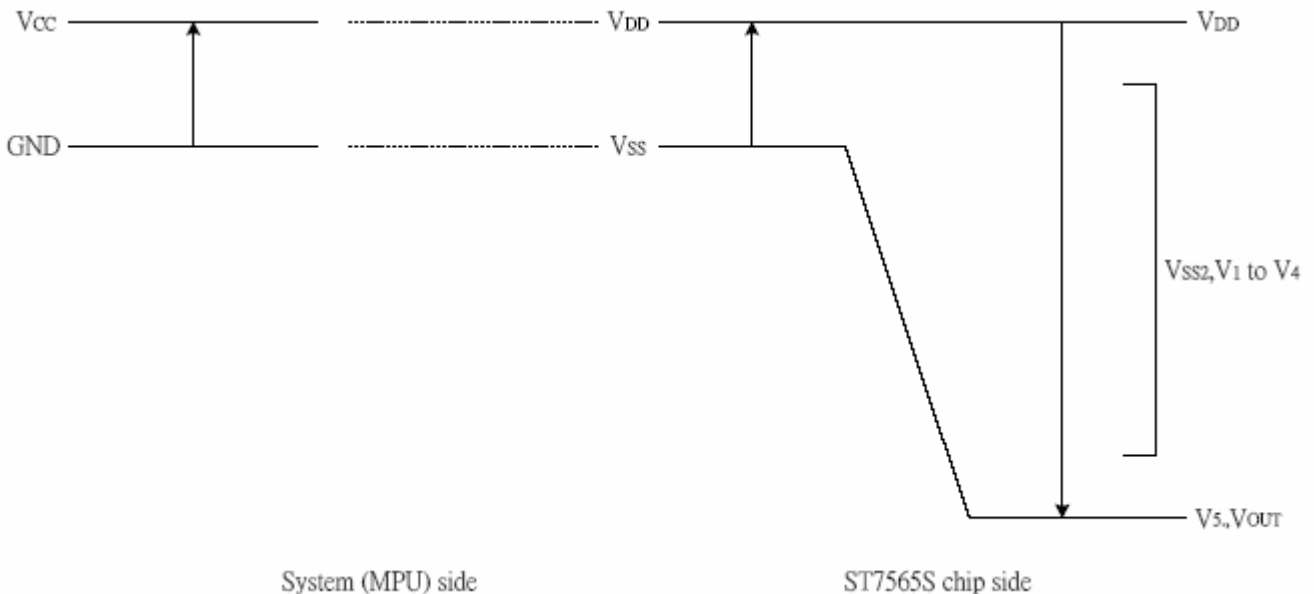
Pin No.	Symbol	Description
17	VOUT	Voltage converter input / output pin.
18	VSS	Ground (0V).
19	VDD	Power supply for logic.
20	D7	This is an 8-bit bi-directional data bus that connects to an 8-bit or 16-bit standard MPU data bus. When the serial interface is selected (P/S = "L") : D7: serial data input (SI); D6 : the serial clock input (SCL). D0 to D5 are set to high impedance. When the chip select is not active, D0 to D7 are set to high impedance.
21	D6	
22	D5	
23	D4	
24	D3	
25	D2	
26	D1	
27	D0	
28	/RD(E)	When connected to an 8080 MPU, this is active LOW. (E) This pin is connected to the /RD signal of the 8080 MPU, and the ST7565V series data bus is in an output status when this signal is "L". When connected to a 6800 Series MPU, this is active HIGH. This is the 6800 Series MPU enable clock input terminal.
29	/WR(R/W)	When connected to an 8080 MPU, this is active LOW. (R/W) This terminal connects to the 8080 MPU /WR signal. The signals on the data bus are latched at the rising edge of the /WR signal. When connected to a 6800 Series MPU: This is the read/write control signal input terminal. When R/W = "H": Read. When R/W = "L": Write.
30	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 a command. A0 = "H": Indicates that D0 to D7 are display data. A0 = "L": Indicates that D0 to D7 are control data.
31	/RES	When /RES is set to "L," the settings are initialized. The reset operation is performed by the /RES signal level.
32	/CS1	This is the chip select signal.

**4. Absolute Maximum Ratings**

**4.1 Electrical Maximum Ratings (Ta = 25 °C)**

Table 3

Parameter	Symbol	Min.	Max.	Unit
Power Supply voltage (Logic)	VDD -VSS	-0.3	+5.0	V
Power Supply voltage	VSS2	-4.0	-1.8	V
Power Supply voltage	V5, VOUT	-18.0	+0.3	V
Power Supply voltage	V1, V2, V3, V4	V5	+0.3	
Input voltage range	VIN	-0.3	VDD+0.3	V
Output voltage	VO	-0.3	VDD+0.3	V



Note:

The modules may be destroyed if they are used beyond the absolute maximum ratings.

1. All voltage values are referenced to VSS = 0V.
2. Insure that the voltage levels of V1, V2, V3, and V4 are always such that  $VDD \cong V1 \cong V2 \cong V3 \cong V4 \cong V5$ .

## 4.2 Environmental Condition

Table 4

Item	Operating Temperature (Topr)		Storage Temperature (Tstg)		Remark
	Min.	Max.	Min.	Max.	
Ambient Temperature	-20°C	+70°C	-30°C	+80°C	Dry

## 5. Electrical Specifications

### 5.1 Typical Electrical Characteristics

At Ta = 25 °C, VDD = 3.0V±0.1V, VSS=0V.

Table 5

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage (Logic)	VDD-VSS		2.9	3.0	3.1	V
Supply voltage (LCD)	VLCD = VDD-V5	VDD =+3.0V, Note 1	8.8	9.0	9.2	V
Input signal voltage For A0, D0 to D5, D6 (SCL), D7 (SI), /RD (E), /WR (R/W), /CS1, C86, /RES, IRS, P/Spins.	V <sub>IH</sub>	“H” level	0.8VDD	-	VDD	V
	V <sub>IL</sub>	“L” level	VSS	-	0.2VDD	V
Supply Current (Logic & LCD)	IDD	Note 1	-	0.3	0.45	mA

Note 1: There is tolerance in optimum LCD driving voltage during production and it will be within the specified range.

## 5.2 Timing Specifications

At  $T_a = -20\text{ }^\circ\text{C}$  To  $+70\text{ }^\circ\text{C}$ ,  $V_{DD} = +3.0\text{V} \pm 0.1\text{V}$ ,  $V_{SS} = 0\text{V}$ .

Refer to Fig. 3, the bus timing diagram for Read / write timing chart (8080-series MPU).

Table 6

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	$t_{AH8}$		0	—	Ns
Address setup time		$t_{AW8}$		0	—	
System cycle time		$t_{CYC8}$		240	—	
Enable L pulse width (WRITE)	WR	$t_{CCLW}$		100	—	
Enable H pulse width (WRITE)		$t_{CCHW}$		100	—	
Enable L pulse width (READ)	RD	$t_{CCLR}$		140	—	
Enable H pulse width (READ)		$t_{CCHR}$		100	—	
WRITE Data setup time	D0 to D7	$t_{DS8}$		40	—	
WRITE Address hold time		$t_{DH8}$		10	—	
READ access time		$t_{ACC8}$	$CL = 100\text{ pF}$	—	70	
READ Output disable time		$t_{OH8}$	$CL = 100\text{ pF}$	5	50	

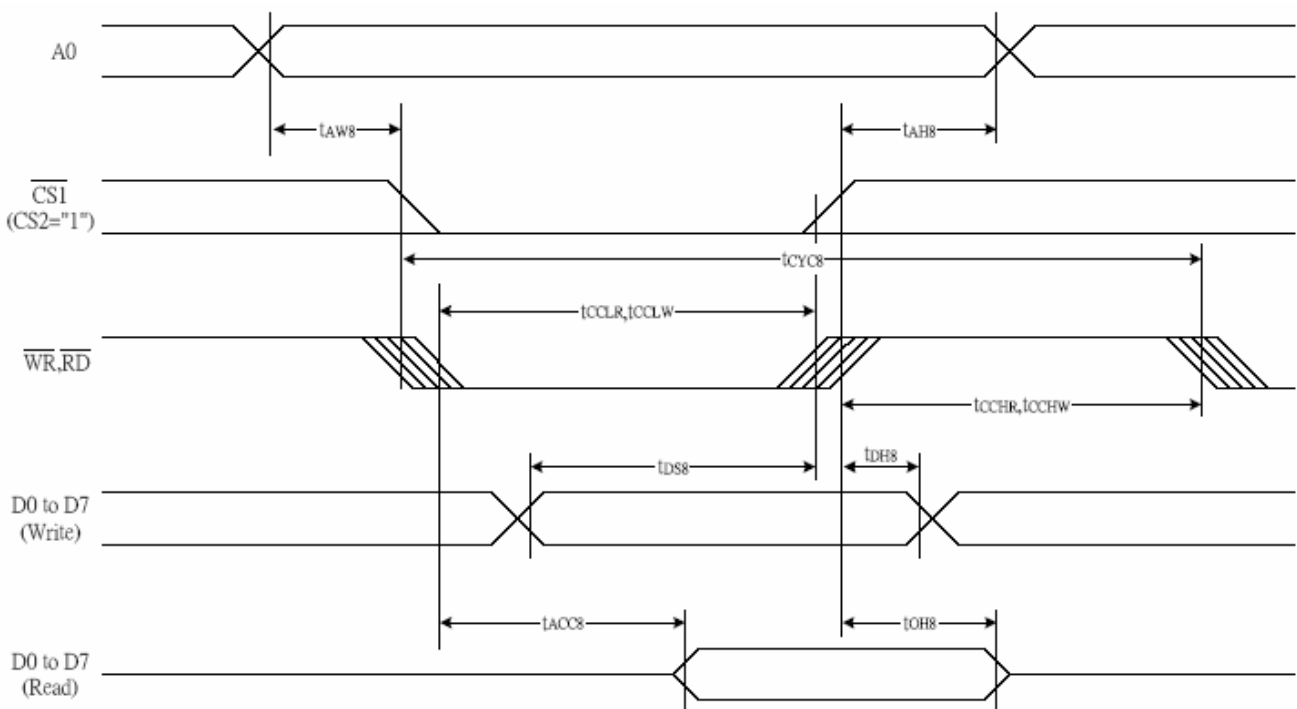


Figure 3: Read / write timing chart (8080-series MPU)

At  $T_a = -20\text{ }^\circ\text{C}$  To  $+70\text{ }^\circ\text{C}$ ,  $V_{DD} = +3.0\text{V} \pm 0.1\text{V}$ ,  $V_{SS} = 0\text{V}$ .

Refer to Fig. 4, the bus timing diagram for Read / write timing chart (6800-series MPU).

Table 7

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	$t_{AH6}$		0	—	ns
Address setup time		$t_{AW6}$		0	—	
System cycle time		$t_{CYC6}$		240	—	
Enable L pulse width (WRITE)	WR	$t_{EWLW}$		100	—	
Enable H pulse width (WRITE)		$t_{EWHW}$		100	—	
Enable L pulse width (READ)	RD	$t_{EWLR}$		100	—	
Enable H pulse width (READ)		$t_{EWHR}$		140	—	
WRITE Data setup time	D0 to D7	$t_{DS6}$		40	—	
WRITE Address hold time		$t_{DH6}$		10	—	
READ access time		$t_{ACC6}$	$CL = 100\text{ pF}$	—	70	
READ Output disable time		$t_{OH6}$	$CL = 100\text{ pF}$	5	50	

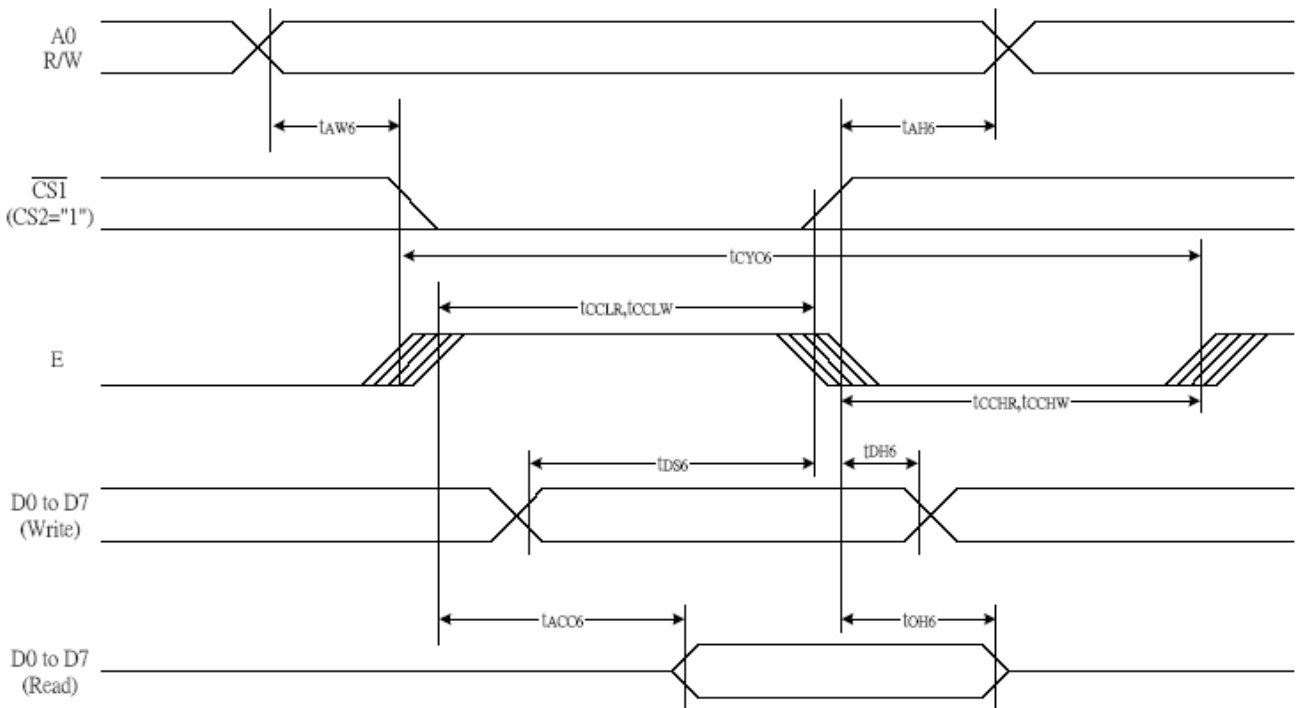


Figure 4: Read / write timing chart (6800-series MPU)

At  $T_a = -20\text{ }^\circ\text{C}$  To  $+70\text{ }^\circ\text{C}$ ,  $V_{DD} = +3.0\text{V} \pm 0.1\text{V}$ ,  $V_{SS} = 0\text{V}$ .

Refer to Fig. 5, the bus timing diagram for Serial Interface.

Table 8

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial Clock Period	SCL	$T_{scyc}$		100	—	ns
SCL "H" pulse width		$T_{shw}$		50	—	
SCL "L" pulse width		$T_{slw}$		50	—	
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	—	

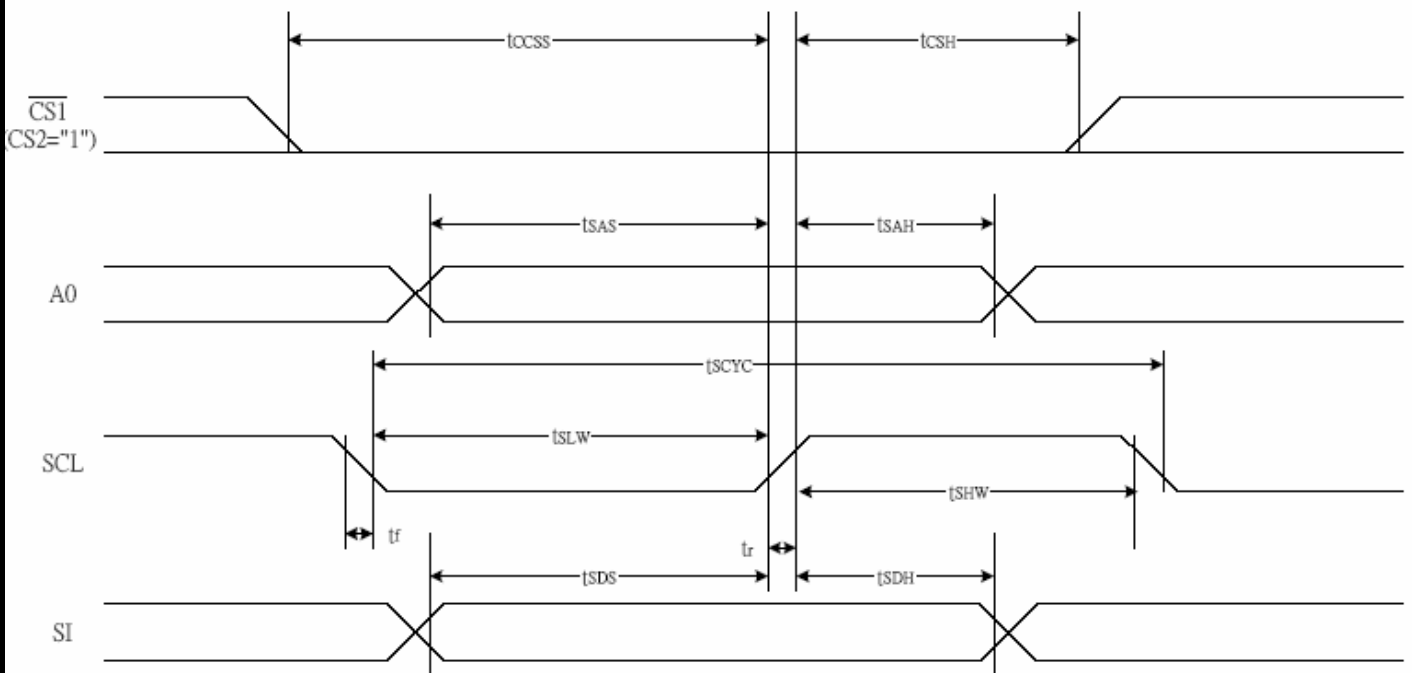


Figure 5: Read/Write timing for Serial Interface

At Ta = -20 °C To +70 °C, VDD = +3.0V±0.1V, VSS = 0V.  
Refer to Fig. 6, the bus timing diagram for reset timing.

Table 9

Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		t <sub>R</sub>		—	—	1.0	us
Reset "L" pulse width	/RES	t <sub>RW</sub>		1.0	—	—	us

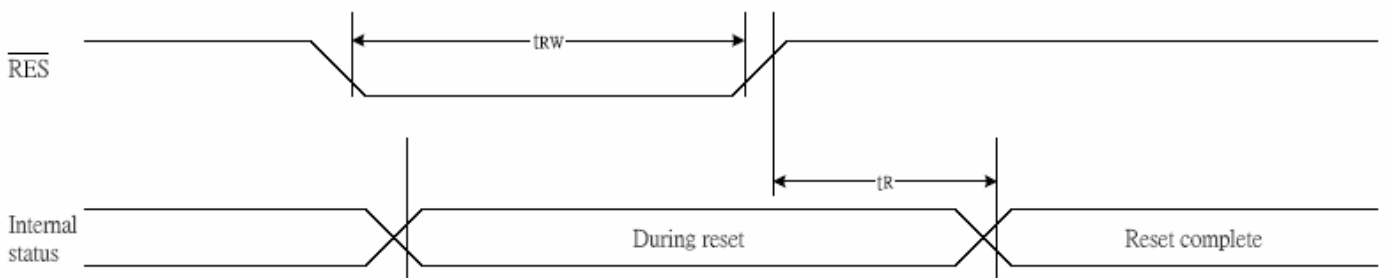


Figure 6: Reset Timing

## 5.3 Instruction Table

Table 10

Command	Command 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	0	1	LCD display ON/OFF 0: OFF, 1: ON
(2) Display start line set	0	1	0	0	1	Display start address						Sets the display RAM display start line address	
(3) Page address set	0	1	0	1	0	1	1	Page address				Sets the display RAM page address	
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address. Sets the least significant 4 bits of the display RAM column address.	
(4) Column address set lower bit	0	1	0	0	0	0	0	Least significant column address					
(5) Status read	0	0	1	Status				0	0	0	0	0	Reads the status data
(6) Display data write	1	1	0	Write data								Writes to the display RAM	
(7) Display data read	1	0	1	Read data								Reads from the display RAM	
(8) ADC select	0	1	0	1	0	1	0	0	0	0	0	1	Sets the display RAM address SEG output correspondence 0: normal, 1: reverse
(9) Display normal/reverse	0	1	0	1	0	1	0	0	1	1	0	1	Sets the LCD display normal/reverse 0: normal, 1: reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0	1	Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	0	0	1	0	1	Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565V)
(12) Read/modify/write	0	1	0	1	1	1	0	0	0	0	0	0	Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	1	0	1	1	1	0	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	0	1	0	Internal reset
(15) Common output mode select	0	1	0	1	1	0	0	0	*	*	*	*	Select COM output scan direction 0: normal direction 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode			Select internal power supply operating mode	
(17) V <sub>s</sub> voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio(Rb/Ra) mode	
(18) Electronic volume mode set Electronic volume register set	0	1	0	1	0	0	0	0	0	0	0	1	Set the V <sub>s</sub> output voltage electronic volume register
(19) Static indicator ON/OFF Static indicator register set	0	1	0	1	0	1	0	1	1	0	0	1	0: OFF, 1: ON Set the flashing mode
(20) Booster ratio set	0	1	0	1	1	1	1	1	0	0	0	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
(21) Power saver													Display OFF and display all points ON compound command
(22) NOP	0	1	0	1	1	1	0	0	0	0	1	1	Command for non-operation
(23) Test	0	1	0	1	1	1	1	*	*	*	*	*	Command for IC test. Do not use this command



## 6. Quality Units

### 1.0 Purpose

This standard for quality assurance should define the quality of LCD module products to customer

### 2.0 Scope

This document defines general provisions as well as inspection standards for LCD module supplied  
except of those with special requirements from customer.

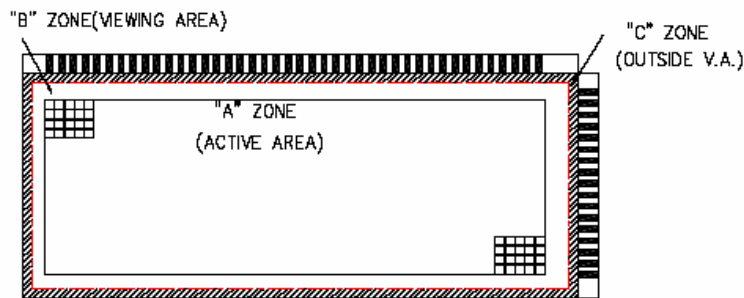
### 3.0 Definition

#### 3.1 Definition of area

A Zone: Active area.

B Zone: Viewing area.

C Zone: Outside Viewing area.



#### 3.2 Definition of size

Large size(L): Less than or equal to 1 Pcs / 7 " ×14 " unit glass.

Middle size(M): 2~6 Pcs / 7 " ×14 " unit glass.

Small size(S): more than 6 Pcs/7 " ×14 " unit glass.

## 4.0 Quality Specification

### 4.1 Conditions of Cosmetic Inspection

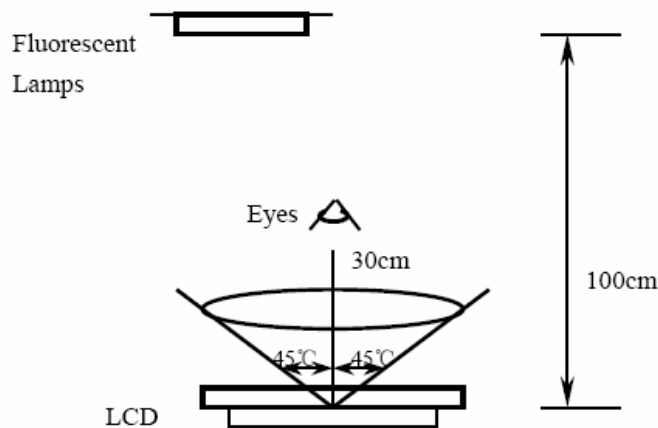
4.1.1 Tests should be conducted under the following conditions:

Ambient temperature:  $22 \pm 5^\circ\text{C}$ .

Ambient humidity:  $65 \pm 20\%RH$ .

Ambient Luminance: 20 watts fluorescent lamp.

An appearance test should be conducted by human sight at approximately 30 cm distance from the LCD module under fluorescent light. Distance between LCD and fluorescent lamps should be 100 cm or more. Viewing direction for inspection is  $45^\circ$  from vertical against LCD.



4.1.2 When test the model of transmissive product must add the reflective plate.

### 4.2 Sampling plan

Unless otherwise agreed in written, the sampling inspection shall be applied to the incoming inspection of customer.

- 📖 Lot size: Quantity of shipment lot per model.
- 📖 Sampling type: Normal inspection, single sampling.
- 📖 Sampling Level: Level II.
- 📖 Sampling table: GB/T2828.1. (GB-national standard of China.)

### 4.3 Classification of defects and Acceptable quality level

Defects and classified as either a major or minor defect defined as bellows:

- 📖 Major defect: It is a defect that is likely to result in failure or to reduce materially the usability of the product for the intended function.
- 📖 Minor defect: It is a defect that will not result in functioning problem with deviation classified.

The AQL for major and minor defects is defined as follows:

Partition	Definition	AQL
Major defect	Functional defective as product.	0.4
Minor defect	Satisfy all functions as product but not satisfy cosmetic standard.	1.0

### 4.4 Applicable instrument

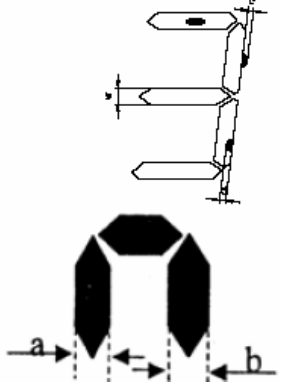
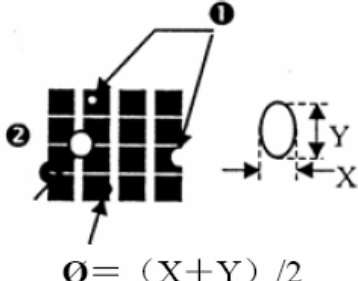

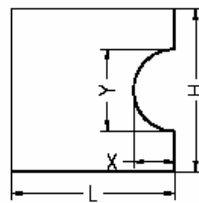
- 📖 LCD module tester.
- 📖 Multimeter.
- 📖 Caliper.
- 📖 Defect size filming standard.


#### 4.5 Inspection quality criterion

##### 4.5.1 LCD panel part.

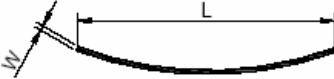
The inspection specification as following list:

Classify	Item	Description of defects	Inspection criterion	Drawing specification	
Major defect	1. Non-display.	Product no function.	Not accept.		
	2. LCD with wrong view direction.	Difference in Spec.	Not accept.		
	3. Segment missing.	Part or all pattern do not light up.	Not accept.		
	4. Occur high current.	Current exceed designed value.	Not accept.		
	5. LC leakage.	LC does not fulfill the glass cell.	Not accept.		
	6. Deviation from drawing.	LCM Dimension difference from drawing and over tolerance	According to dimensions noted in the specification.		
	7. Wrong type applied.	Wrong polarizer attachment.		Not accept.	
		Pin attached wrong type applied.		Not accept.	
8. Incorrect pins quantity	Pin attached wrong quantity applied.		Not accept.		

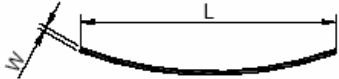
<p>Minor defect</p>	<p>9. Pattern deformation</p>	<p>Segment fatter or smaller.</p>	<p>Reject if <math>c</math> or <math>d \leq 1/4 - 1/5W</math> Or refer to the defect specimen. <math>W</math> = Segment width</p> <p>Reject if <math> a-b  \leq 1/4a</math>. Or refer to the defect specimen. <math>a</math> = Segment width</p>																													
<p>Minor defect</p>	<p>10. Pinholes</p>	<p>black spot/ white spot at activated state.</p>	<p>1. Large size LCD</p> <table border="1"> <thead> <tr> <th>Diameter (mm)</th> <th>Accept QTY</th> </tr> </thead> <tbody> <tr> <td><math>\varnothing \leq 0.15</math></td> <td>Not count</td> </tr> <tr> <td><math>0.15 \leq \varnothing \leq 0.30</math></td> <td>5</td> </tr> <tr> <td><math>0.30 &lt; \varnothing \leq 0.40</math></td> <td>2</td> </tr> <tr> <td><math>\varnothing &gt; 0.40</math></td> <td>0</td> </tr> </tbody> </table> <p>2. Middle size LCD</p> <table border="1"> <thead> <tr> <th>Diameter (mm)</th> <th>Accept QTY</th> </tr> </thead> <tbody> <tr> <td><math>\varnothing \leq 0.10</math></td> <td>Not count</td> </tr> <tr> <td><math>0.10 &lt; \varnothing \leq 0.20</math></td> <td>3</td> </tr> <tr> <td><math>0.20 &lt; \varnothing \leq 0.30</math></td> <td>1</td> </tr> <tr> <td><math>\varnothing &gt; 0.30</math></td> <td>0</td> </tr> </tbody> </table> <p>3. Small size LCD</p> <table border="1"> <thead> <tr> <th>Diameter (mm)</th> <th>Accept QTY</th> </tr> </thead> <tbody> <tr> <td><math>\varnothing \leq 0.1</math></td> <td>Not count</td> </tr> <tr> <td><math>0.10 &lt; \varnothing \leq 0.20</math></td> <td>2</td> </tr> <tr> <td><math>\varnothing &gt; 0.20</math></td> <td>0</td> </tr> </tbody> </table> <p>4. Only allow one defect in one segment. Accept <math>X, Y \leq 2/3L, H</math> (<math>X, Y = (\text{Max } X, Y)</math>) .</p> <p>5. The nearest distance allowed between two pinholes is 20mm.</p>	Diameter (mm)	Accept QTY	$\varnothing \leq 0.15$	Not count	$0.15 \leq \varnothing \leq 0.30$	5	$0.30 < \varnothing \leq 0.40$	2	$\varnothing > 0.40$	0	Diameter (mm)	Accept QTY	$\varnothing \leq 0.10$	Not count	$0.10 < \varnothing \leq 0.20$	3	$0.20 < \varnothing \leq 0.30$	1	$\varnothing > 0.30$	0	Diameter (mm)	Accept QTY	$\varnothing \leq 0.1$	Not count	$0.10 < \varnothing \leq 0.20$	2	$\varnothing > 0.20$	0	 <p><math>\varnothing = (X + Y) / 2</math></p>  
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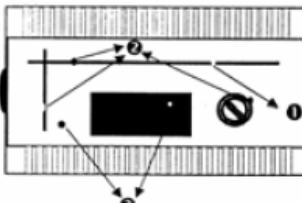
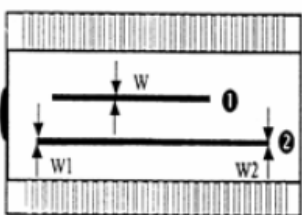
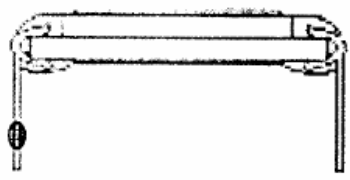
<p>Minor defect</p>	<p>11.Blemishes and foreign matters.</p>	<p>Black spot/ dust on LCD. (non-display)</p>	<p>Positive panel:</p> <p>1. A zone.</p> <p>(1) Large size LCD Accept if can't find at 1m distance and will not enlarge under electronic test.</p> <p>(2) Middle size LCD</p> <table border="0"> <tr> <td>Diameter (mm)</td> <td>Accept QTY</td> </tr> <tr> <td><math>\varnothing \leq 0.1</math></td> <td>Not count</td> </tr> <tr> <td><math>0.10 &lt; \varnothing \leq 0.20</math></td> <td>2</td> </tr> <tr> <td><math>0.20 &lt; \varnothing \leq 0.30</math></td> <td>1</td> </tr> <tr> <td><math>\varnothing &gt; 0.30</math></td> <td>0</td> </tr> </table> <p>(3) Small size LCD</p> <table border="0"> <tr> <td>Diameter (mm)</td> <td>Accept QTY</td> </tr> <tr> <td><math>\varnothing \leq 0.1</math></td> <td>Not count</td> </tr> <tr> <td><math>0.10 &lt; \varnothing \leq 0.15</math></td> <td>2</td> </tr> <tr> <td><math>0.15 &lt; \varnothing \leq 0.20</math></td> <td>1</td> </tr> <tr> <td><math>\varnothing &gt; 0.20</math></td> <td>0</td> </tr> </table> <p>2. B zone.</p> <p>1.5 times of acceptable largest diameter size of Zone A.</p> <p>3. C area Not count.</p> <p>Negative panel:</p> <p>1. A zone.</p> <p>(1) Large size LCD</p> <table border="0"> <tr> <td>Diameter (mm)</td> <td>Accept QTY</td> </tr> <tr> <td><math>\varnothing \leq 0.15</math></td> <td>Not count</td> </tr> <tr> <td><math>0.15 &lt; \varnothing \leq 0.30</math></td> <td>3</td> </tr> <tr> <td><math>0.30 &lt; \varnothing \leq 0.40</math></td> <td>1</td> </tr> <tr> <td><math>\varnothing &gt; 0.40</math></td> <td>0</td> </tr> </table> <p>(2) Middle size LCD</p> <table border="0"> <tr> <td>Diameter (mm)</td> <td>Accept QTY</td> </tr> <tr> <td><math>\varnothing \leq 0.1</math></td> <td>Not count</td> </tr> <tr> <td><math>0.10 &lt; \varnothing \leq 0.20</math></td> <td>2</td> </tr> <tr> <td><math>\varnothing &gt; 0.20</math></td> <td>0</td> </tr> </table> <p>(3) Small size LCD</p> <table border="0"> <tr> <td>Diameter (mm)</td> <td>Accept QTY</td> </tr> <tr> <td><math>\varnothing \leq 0.1</math></td> <td>Not count</td> </tr> <tr> <td><math>0.10 &lt; \varnothing \leq 0.15</math></td> <td>2</td> </tr> <tr> <td><math>\varnothing &gt; 0.15</math></td> <td>0</td> </tr> </table>	Diameter (mm)	Accept QTY	$\varnothing \leq 0.1$	Not count	$0.10 < \varnothing \leq 0.20$	2	$0.20 < \varnothing \leq 0.30$	1	$\varnothing > 0.30$	0	Diameter (mm)	Accept QTY	$\varnothing \leq 0.1$	Not count	$0.10 < \varnothing \leq 0.15$	2	$0.15 < \varnothing \leq 0.20$	1	$\varnothing > 0.20$	0	Diameter (mm)	Accept QTY	$\varnothing \leq 0.15$	Not count	$0.15 < \varnothing \leq 0.30$	3	$0.30 < \varnothing \leq 0.40$	1	$\varnothing > 0.40$	0	Diameter (mm)	Accept QTY	$\varnothing \leq 0.1$	Not count	$0.10 < \varnothing \leq 0.20$	2	$\varnothing > 0.20$	0	Diameter (mm)	Accept QTY	$\varnothing \leq 0.1$	Not count	$0.10 < \varnothing \leq 0.15$	2	$\varnothing > 0.15$	0	 <p style="text-align: center;"><math>\varnothing = (X + Y) / 2</math></p>
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Minor defect	Blemishes and foreign matters.	Black spot/ dust on LCD . (non-display)	<p>2. B area.</p> <p>(1) Large size LCD</p> <table border="0"> <tr> <td>Diameter (mm)</td> <td>Accept QTY</td> </tr> <tr> <td><math>\varnothing \leq 0.15</math></td> <td>Not count</td> </tr> <tr> <td><math>0.15 &lt; \varnothing \leq 0.40</math></td> <td>3</td> </tr> <tr> <td><math>0.40 &lt; \varnothing \leq 0.50</math></td> <td>1</td> </tr> <tr> <td><math>\varnothing &gt; 0.50</math></td> <td>0</td> </tr> </table> <p>(2) Middle size LCD</p> <table border="0"> <tr> <td>Diameter (mm)</td> <td>Accept QTY</td> </tr> <tr> <td><math>\varnothing \leq 0.1</math></td> <td>Not count</td> </tr> <tr> <td><math>0.10 &lt; \varnothing \leq 0.20</math></td> <td>2</td> </tr> <tr> <td><math>0.20 &lt; \varnothing \leq 0.25</math></td> <td>1</td> </tr> <tr> <td><math>\varnothing &gt; 0.25</math></td> <td>0</td> </tr> </table> <p>(3) Small size LCD</p> <table border="0"> <tr> <td>Diameter (mm)</td> <td>Accept QTY</td> </tr> <tr> <td><math>\varnothing \leq 0.1</math></td> <td>Not count</td> </tr> <tr> <td><math>0.10 &lt; \varnothing \leq 0.20</math></td> <td>2</td> </tr> <tr> <td><math>\varnothing &gt; 0.20</math></td> <td>0</td> </tr> </table> <p>3. C zone</p> <p>Not count.</p> <p>The nearest distance allowed between two black spot is 20mm.</p>	Diameter (mm)	Accept QTY	$\varnothing \leq 0.15$	Not count	$0.15 < \varnothing \leq 0.40$	3	$0.40 < \varnothing \leq 0.50$	1	$\varnothing > 0.50$	0	Diameter (mm)	Accept QTY	$\varnothing \leq 0.1$	Not count	$0.10 < \varnothing \leq 0.20$	2	$0.20 < \varnothing \leq 0.25$	1	$\varnothing > 0.25$	0	Diameter (mm)	Accept QTY	$\varnothing \leq 0.1$	Not count	$0.10 < \varnothing \leq 0.20$	2	$\varnothing > 0.20$	0	
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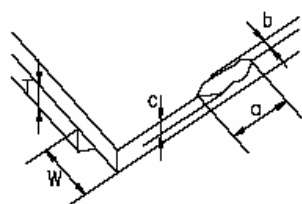
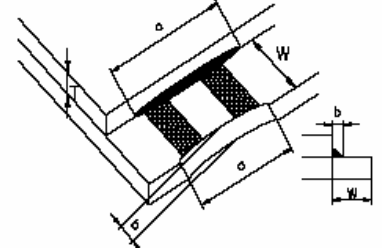
<p>Minor defect</p>	<p>12.Black lines and scratches.</p>	<p>Scratch on glass or polarizer surface. And foreign linear matters in LCD.</p>	<p>Positive panel: 1. A 、 B zone. (1) Large size LCD Diameter (mm)      Accept QTY     W≤0.02              Not count 0.02&lt;W≤0.03,L ≤ 5      3 0.03&lt;W≤0.05,L ≤ 3      2 0.02&lt;W≤0.03,L &gt; 5      0 0.03&lt;W≤0.05,L &gt; 3      0 W&gt; 0.05 As the spot criteria.  (2) Middle size LCD Diameter (mm)      Accept QTY     W≤0.02              Not count 0.02&lt;W≤0.03,L ≤ 3      2 0.03&lt;W≤0.05,L ≤ 2      2 0.02&lt;W≤0.03,L &gt; 3      0 0.03&lt;W≤0.05,L &gt; 2      0 W&gt; 0.05 As the spot criteria.  (3) Small size LCD Diameter (mm)      Accept QTY     W≤0.02              Not count 0.02&lt;W≤0.03,L ≤ 2      2 0.03&lt;W≤0.05,L ≤ 1      1 0.02&lt;W≤0.03,L &gt; 2      0 0.03&lt;W≤0.05,L &gt; 1      0 W&gt; 0.05 As the spot criteria. 2. C zone Not count.</p>	
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Minor defect	Black lines and scratches.	Scratch on glass or polarizer surface. And foreign linear matters in LCD.	<p>Negative panel: 1. A 、 B zone.</p> <p>(1) Large size LCD Diameter (mm)    Accept QTY     <math>W \leq 0.02</math>            Not count <math>0.02 &lt; W \leq 0.03, L \leq 4</math>    3 <math>0.03 &lt; W \leq 0.05, L \leq 3</math>    2 <math>0.02 &lt; W \leq 0.03, L &gt; 4</math>    0 <math>0.03 &lt; W \leq 0.05, L &gt; 3</math>    0 <math>W &gt; 0.05</math> As the spot criteria.</p> <p>(2) Middle size LCD Diameter (mm)    Accept QTY     <math>W \leq 0.02</math>            Not count <math>0.02 &lt; W \leq 0.03, L \leq 3</math>    2 <math>0.03 &lt; W \leq 0.05, L \leq 2</math>    1 <math>0.02 &lt; W \leq 0.03, L &gt; 3</math>    0 <math>0.03 &lt; W \leq 0.05, L &gt; 2</math>    0 <math>W &gt; 0.05</math> As the spot criteria.</p> <p>(3) Small size LCD Diameter (mm)    Accept QTY     <math>W \leq 0.02</math>            Not count <math>0.02 &lt; W \leq 0.03, L \leq 3</math>    2 <math>0.02 &lt; W \leq 0.03, L &gt; 3</math>    0 <math>W &gt; 0.03</math> As the spot criteria.</p> <p>2. C zone Not count.</p>	
Minor defect	13.Scratch on PI coating.	PI coating scratched.	The visible scratch of A zone can not accepted at 30cm view distance.	
Minor defect	14.Rainbow	Arches, circular or parallel colorful spread.	According to the limit specimen.	
Minor defect	15.Bubbles or wrinkles in polarizer	Bubbles or wrinkles between polarizer and glass.	According to black spot/ foreign material specification.	

Minor defect	16. Position of polarizer attachment	16.1 Wrong polarizer attachment in position or dimension.	Polarizer protruding from edge of glass and exceeding/ within the maximum external dimension of LCD.	
Minor defect	17. Ink printing defect	17.1 Ink line/ pattern broken	Not accept.	
		17.2 Ink pattern/ line jagged.	Accept if the thick or thin part is less than or equal to 25% segment width or according to the limit specimen.	
		17.3 Light leakage	When activated with current white light appears in the position of pinhole or scratch due to ink printing misalignment. According to the pinhole specification.	
Minor defect		17.4 Ink printing pattern/ line uneven	Reject if the thick or thin is more than $1/2W$ . Reject when $W1 - W2 \leq 1/3W$ .	
Minor defect	18. Pin defect.	18.1 Corrosion or foreign material on terminal legs.	Pin incoming defect: oxidized, damage (including pins plating damaged), excess epoxy on bottom glass or terminal legs. Not accept.	
Minor defect		18.2 Pin deviation over tolerance	According to the specification.	

Minor defect	19. Chipped glass on comer		19.1 Chip in lead contact area.	a	b	c	Accept QTY	
				$a \leq 3\text{mm}$ ( $L \geq 5\text{mm}$ )	$b \leq 1/2W$	$c \leq T$	2	
			$a < 1/2L$ ( $L < 5\text{mm}$ )	$b \leq 1/2W$	$c \leq T$	2		
			19.2 Others	a	b	c	Accept QTY	
			not exceed 1/2 width of seal		$c \leq T$	2		
Minor defect	20. Glass chip on edge		a	b	c	Accept QTY		
			$a \leq 3\text{mm}$	not exceed 1/2 width of seal	$c \leq 3/4T$	2		
Minor defect	21. Chipped electrode pad	21.1 Glass chip on ITO edge	COG and TAB product.	a	b	c	Accept QTY	
			$a \leq 2\text{mm}$ (and not exceed 3 ITO terminal)	$b \leq W/5$	$T > 0.7\text{mm}$ $c \leq 1/2T$ $T \leq 0.7\text{mm}$ $c \leq T$ .	2		
Minor defect			Others	a	b	c	Accept QTY	
				$a \leq 3\text{mm}$ (and not exceed 4 ITO terminal)	$b \leq W/4$	$c \leq T$	2	

Minor defect	21.2 Glass chip on ITO back	COG and TAB product.	a	b	c	Accept QTY	
			$a \leq 3\text{mm}$	$b \leq W/4$	$T > 0.7\text{mm}$ $c \leq 1/2T$ $T \leq 0.7\text{mm}$ $c \leq T$	2	
		Others	a	b	c	Accept QTY	
			$a \leq 5\text{mm}$	$b \leq W/4$	$c \leq T$	2	
Minor defect	22.Mechanical damage.	Extended crack inspector shall attempt to remove the chip with tweezers, re-evaluate if the remaining defect is still a crack or a chip.	B		Accept QTY		
			$b \leq 1/5W$		2		
Minor defect	23.Glass cracks		Not accept				

Remark;

The minimum space between any 2 defects (spot, dirt) should more than 20mm, and Max. allowed defect QTY in total:

Large size LCD : Zone A:  $\leq 5/\text{unit}$ , Zone B:  $\leq 5/\text{unit}$ ;

Middle size LCD : Zone A:  $\leq 3/\text{unit}$ , Zone B:  $\leq 3/\text{unit}$ ;

Small size LCD: Zone A:  $\leq 2/\text{unit}$ , Zone B:  $\leq 2/\text{unit}$ .

#### 4.5.2 Other part

The inspection specification as following list:

NO	Items	Criterion of defects	AQL
1	Backlight	1.Lumination source flickers. 2.Using spot, lines and contamination standard of LCD to judge the spots or scratches defect on backlight. 3.Not allow unlighted on backlight. 4.Colour and luminance of backlight should correspond its specification.	Major Minor Major Major
2	PCB, COB	1.COB seal may not have pinholes larger than 0.2mm or contamination. 2.COB seal surface may not have pinholes through to the IC. 3.The height of the COB should not exceed the height indicated in the assembly diagram. 4.Beyond 2mm of the seal area, there may not have sealant on the PCB. 5.No oxidation or contamination on PCB connector. 6.Parts on PCB should correspond the characteristic, and not allow wrong parts, missing parts or additional parts. 7.The jumper on the PCB should correspond to the characteristic. 8.The solder which gets on bezel, LED pad, zebra pad or screw hole pad should be smoothed down.	Minor Minor Major Minor Minor Major Minor Major
3	Soldering	1.No unmelted solder pastes on the PCB. 2.No cold solder joints, solder connection missing, oxidation of solder. 3.No short circuits in components on PCB.	Minor Minor Minor
4	General Appearance	1.No oxidation, contamination, curves ,cracks or bends on interface Pin of TCP. 2.No solder residue or solder balls on product. 3.The IC on the TCP may not be damaged. 4.The residual rosin or tin oil of soldering (component or chip component) is not turned into brown or black color. 5.Packing method correspond the specification. 6.Dimension and structure correspond the specification sheet. 7.No dirt and break on the heat seal.	Minor Minor Major Minor Major Major Major

## 5. Reliability

Standard specification for reliability of LCD Module

ITEM	Condition		Criterion
High temperature operation	+70°C 8h		Total current consumption should be below double of initial value.  Cosmetic defects should not be happened.
Low temperature operation	-20°C 8h		
Humidity	Storage	40°C 93%RH 24h	
	Operation	40°C 93%RH 8h	
High temperature storage	+80°C 10h		
Low temperature storage	-30°C 10h		
Thermal shock storage	-20°C → +70°C 60min → 60min 5 cycle		
Vibration (Package state)	50Hz 0.7mm 30min in each direction (X, Y, Z).		
Falling test (Packaged state)	Weight ≥ 15kg; Falling height: 80cm. Weight < 15kg; Falling height: 100cm.		

## 6. Quality Assurance

**6.1** DISPLAYS will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with the LCM specification, for a period of one year from the date of shipment. Confirmation of such date shall be based on freight documents.

No warranty can be granted if any of the precautions stated in handling LCD and LCD Modules above have been disregarded.

**6.2** In returning the LCD and LCD Modules, they must be properly packaged and there should be detailed description of the failures or defects. Broken glass, scratches on polarizers, mechanical damages as well as defects that are caused by accelerated environmental tests are excluded from warranty.

## 7. Precautions in Use of LCM

### 1. Handling of LCM

1.1 Don't give external shock.

1.2 Liquid crystal is chemical hazardous substance. Once the liquid crystal inside it leaks out, be sure not to get any in your mouth. If the liquid is adhered your skin or clothes etc, wash it off using soap and water thoroughly and immediately.

1.3 Don't apply excessive force on the display surface.

1.4 Don't scratch and dirty polarizer of covering the display surface of the LCD module.

1.5 In order to prevent static electricity from destructing, be sure to wear gauntlet that is tested up to grade.

### 2. Storage

2.1 Store in dark places and do not expose to sunlight or fluorescent light. Keep the temperature between 0°C and 40°C and the humidity lower than 60%RH.

2.2 Storage in a clean environment, free-dust and well ventilated.

2.3 Storage in anti-static electricity container.

### 3. Soldering

3.1 The soldering temperature is 260±5°C and soldering Time should be less than 3 sec, and soldering iron power should be less than 30w.

3.2 Re-soldering: no more than 3 times.

3.3 The soldering point should be further than 1.6 mm from body.

“GEMINI Technology Co., LTD. reserves the right to change this specification.”

- END -