

# **Oriental Technology International Co., Limited**

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## **SPECIFICATION FOR LCM MODULE**

**MODULE NO.:**

**LCM12864A-FF50-06**

**REVISION NO.:     A**

Customer Approval:

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	SIGNATURE
PREPARED BY	
VERIFIED BY	
APPROVED BY	



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# 1. SPECIFICATIONS

## 1.1 Features

Item	Standard Value
Display Type	128 X 64 DOTS
LCD Type	FSTN Positive Transflective
Driver Condition	LCD Module : 1/64Duty , 1/9Bias
Viewing Direction	6 O'clock
Backlight Type	White SIDE Light
Interface	8-bit MPU interface
Driver IC	AIP31107E+AIP31108E*2

## 1.2 Mechanical Specifications

Item	Standard Value	Unit
Outline Dimension	75(L) * 52.7(W) * 8.5(T)	mm
Viewing Area	60(L) * 32.6( W)	mm
Dot size	0.39(W) × 0.39(H)	mm
Dot pitch	0.43(W) × 0.43(H)	mm
Character size	-----	mm

## 1.3 Absolute Maximum Ratings

Item	Symbol	Condition	Min.	Max.	Unit
System Power Supply Voltage	VDD	-	4.5	5.5	V
LCD Driver Supply Voltage	VLCD	-	-0.3	+9.0	V
Input Voltage	V <sub>IN</sub>	-	-0.3	VDD + 0.3	V
Operating Temperature	T <sub>OP</sub>	-	-20	70	°C
Storage Temperature	T <sub>ST</sub>	-	-30	80	°C
Storage Humidity	H <sub>D</sub>	Ta < 40 °C	20	90	%RH

## 1.4 Backlight Characteristics

LCD Module LED Backlight

Electrical / Optical Characteristics

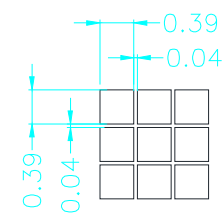
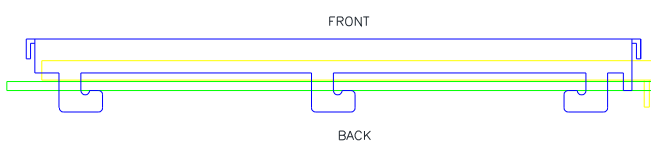
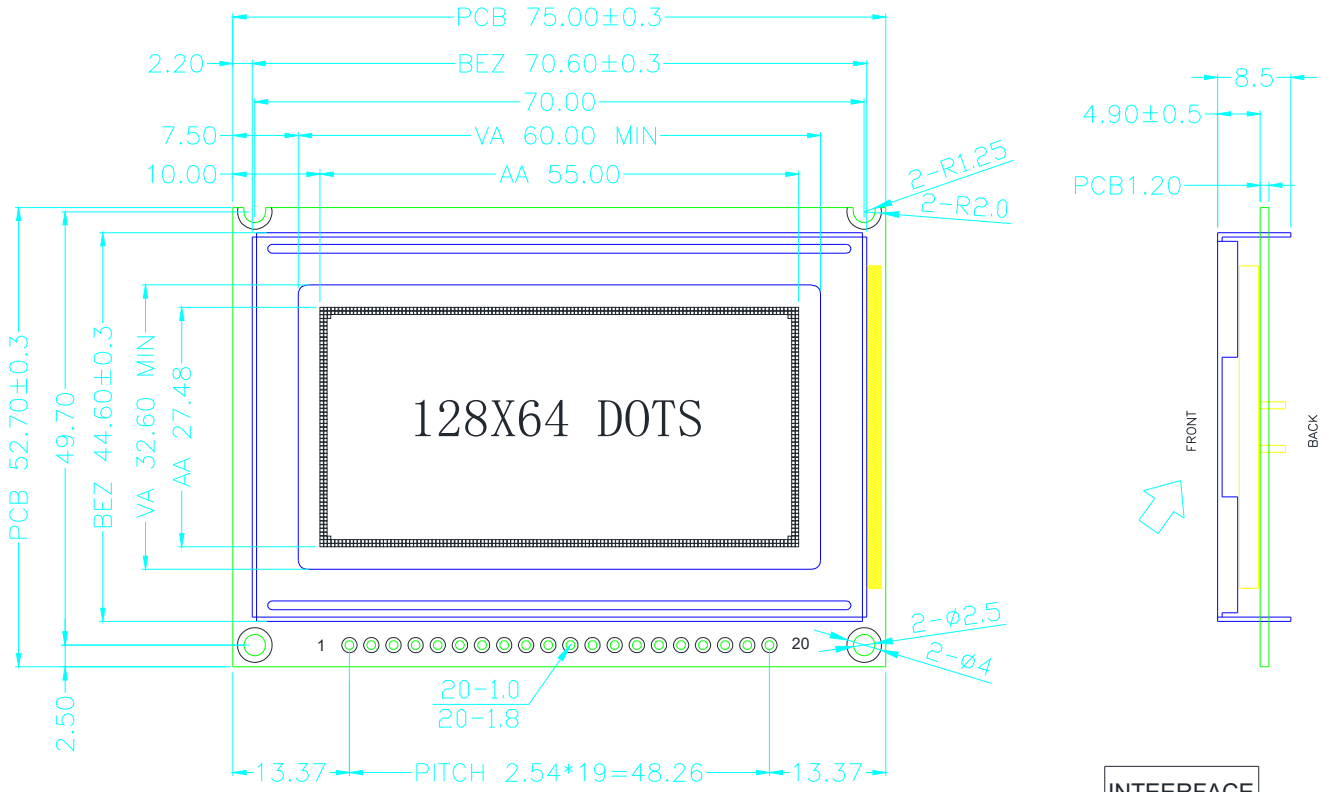
Ta =25°C

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Forward Voltage	Vf	If=80mA	3.1	3.3	3.5	V
Reverse Voltage	VR	---			5	V
Life Time	---			30K	---	Hr
Wavelength	$\lambda d$	If=80mA	--	--	--	nm
Luminous Intensity	IV	If=80mA	250	300		cd/m <sup>2</sup>
Uniformity	$\Delta\%$	IvMin / IvMax *100%	--	80	-	%
Color	White					

# 2. MODULE STRUCTURE

## 2.1 Counter Drawing

### 2.1.1 LCM Mechanical Diagram



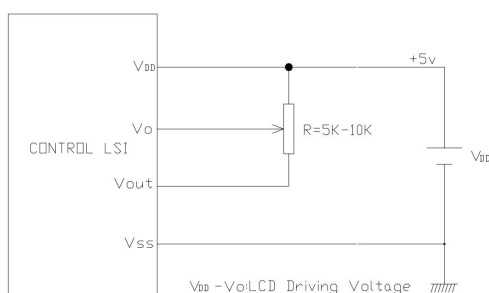
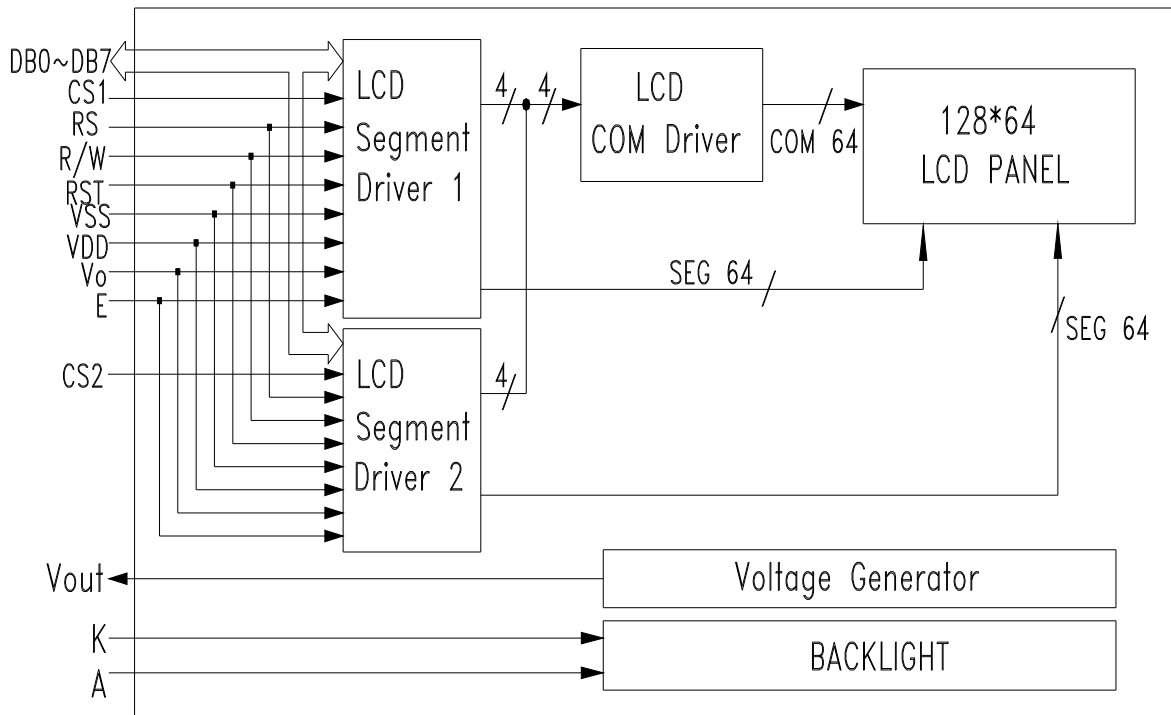
DOTS SIZE  
SCALE 10:1

INTERFACE	
1	VDD (5V)
2	GND
3	VO
4	DB0
5	DB1
6	DB2
7	DB3
8	DB4
9	DB5
10	DB6
11	DB7
12	CS1
13	CS2
14	/RST
15	R/W
16	D/I
17	E
18	VEE
19	LEDA
20	LEDK

- NOTES :
- |   |  |
|---|--|
| 1. LCD TYPE:  | FSTN, TRANSFLECTIVE/POSITIVE                     |
| 2. OPERATING VOLTAGE:   | VDD=5.0V , Vop=8.5V                              |
| 3. VIEWING DIRECTION:   | 6 O'CLOCK  |
| 4. DRIVE METHOD:  | 1/64 Duty, 1/9 Bias                              |
| 5. OPERATING TEMP:  | -20°C TO +70°C                                   |
| 6. STORAGE TEMP:  | -30°C TO +80°C                                   |
| 7. CONNECTOR TAPE:  | COB+ZEBRA  |
| 8. DRIVER IC:   | AIP31107E+AIP31108E*2 (temperature compensation) |
| 9. BACKLIGHT:   | 4 PCS LED WHITE VI=80mA                          |
| 10. ALL sub-parts and materials of the parts, must comply with the RoHS instructions of EU. |  |

## 2.2 Interface Pin Description

No.	Symbol	Function
1	VDD	Supply Voltage for Logic (+5V )
2	VSS	Ground (0V)
3	VO	Contrast Adjustment
4--11	DB0—DB7	Data Bus
12	/CS1	Chip Select active “L”
13	/CS2	Chip Select active “L”
14	/RST	Reset signal , active “L”
15	R/W	Read/Write Select
16	D/I	Data/Instruction Select
17	E	Enable Signal
18	VEE(Vout)	Built in Voltage generator
19	LED_A	LED Power Supply +(3.3V)
20	LED_K	LED Power Supply -(0V)



## 2.3 Timing Characteristics

DC Characteristics ( $V_{DD}=4.5\sim 5.5V$ ,  $V_{SS}=0V$ ,  $V_{DD}-V_{EE}=8\sim 17V$ ,  $T_a=-30\sim +85^\circ C$ )

Characteristic	Symbol	Condition	Min	Typ	Max	Unit	Note
Input High Voltage	$V_{IH1}$	-	$0.7V_{DD}$	-	$V_{DD}$	V	*1
	$V_{IH2}$	-	2.0	-	$V_{DD}$	V	*2
Input Low Voltage	$V_{IL1}$	-	0	-	$0.3V_{DD}$	V	*1
	$V_{IL2}$	-	0	-	0.8	V	*2
Output High Voltage	$V_{OH}$	$I_{OH}=-200\mu A$	2.4	-	-	V	*3
Output Low Voltage	$V_{OL}$	$I_{OL}=1.6mA$	-	-	0.4	V	*3
Input Leakage Current	$I_{LKG}$	$V_{IN}=V_{SS}\sim V_{DD}$	-1.0	-	1.0	$\mu A$	*4
Three-state(OFF) Input Current	$I_{TSL}$	$V_{IN}=V_{SS}\sim V_{DD}$	-5.0	-	5.0	$\mu A$	*5
Driver Input Leakage Current	$I_{DIL}$	$V_{IN}=V_{EE}\sim V_{DD}$	-2.0	-	2.0	$\mu A$	*6
Operating Current	$I_{DD1}$	During Display	-	-	100	$\mu A$	*7
	$I_{DD2}$	During Access Access Cycle=1MHz	-	-	500	$\mu A$	*7
On Resistance	$R_{ON}$	$V_{DD}-V_{EE}=15V$ $I_{I/O,LOAD}=0.1mA$	-	-	7.5	$K\Omega$	*8

## AC Characteristics

### (1) Clock Timing

Characteristic	Symbol	Min	Typ	Max	Unit
CLK1, CLK2 Cycle Time	$t_{CY}$	2.5	-	20	$\mu S$
CLK1 'LOW' Level Width	$t_{WL1}$	625	-	-	ns
CLK2 'LOW' Level Width	$t_{WL2}$	625	-	-	
CLK1 'HIGH' Level Width	$t_{WH1}$	1875	-	-	
CLK2 'HIGH' Level Width	$t_{WH2}$	1875	-	-	
CLK1-CLK2 Phase Difference	$t_{D12}$	625	-	-	
CLK2-CLK1 Phase Difference	$t_{D21}$	625	-	-	
CLK1, CLK2 Rise Time	$t_R$	-	-	150	
CLK1, CLK2 Fall Time	$t_F$	-	-	150	

### (2) Display Control Timing

Characteristic	Symbol	Min	Typ	Max	Unit
FRM Delay Time	$t_{DF}$	-2	-	+2	$\mu S$
M Delay Time	$t_{DM}$	-2	-	+2	$\mu S$
CL 'LOW' Level Width	$t_{WL}$	35	-	-	$\mu S$
CL 'HIGH' Level Width	$t_{WH}$	35	-	-	$\mu S$

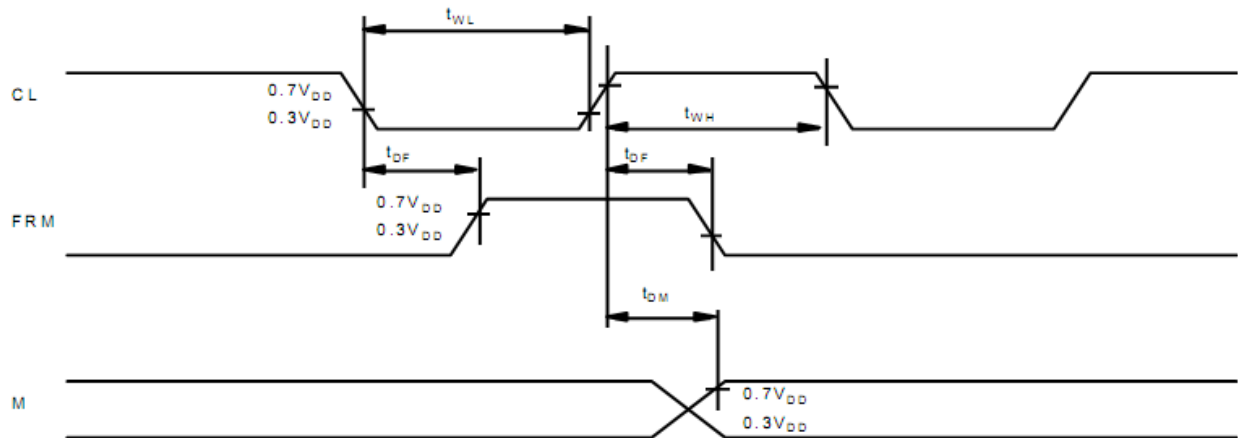


Fig 2. Display control signal waveform



### (3) MPU Interface

Chatacteristic	Symbol	Min	Typ	Max	Unit
E Cycle	$t_C$	1000	-	-	ns
E High Level Width	$t_{WH}$	450	-	-	ns
E Low Level Width	$t_{WL}$	450	-	-	ns
E Rise Time	$t_R$	-	-	25	ns
E Fall Time	$t_F$	-	-	25	ns
Address Set-Up Time	$t_{ASU}$	140	-	-	ns
Address Hold Time	$t_{AH}$	10	-	-	ns
Data Set-Up Time	$t_{DSU}$	200	-	-	ns
Data Delay Time	$t_D$	-	-	320	ns
Data Hold Time (Write)	$t_{DHW}$	10	-	-	ns
Data Hold Time (Read)	$t_{DHR}$	20	-	-	ns

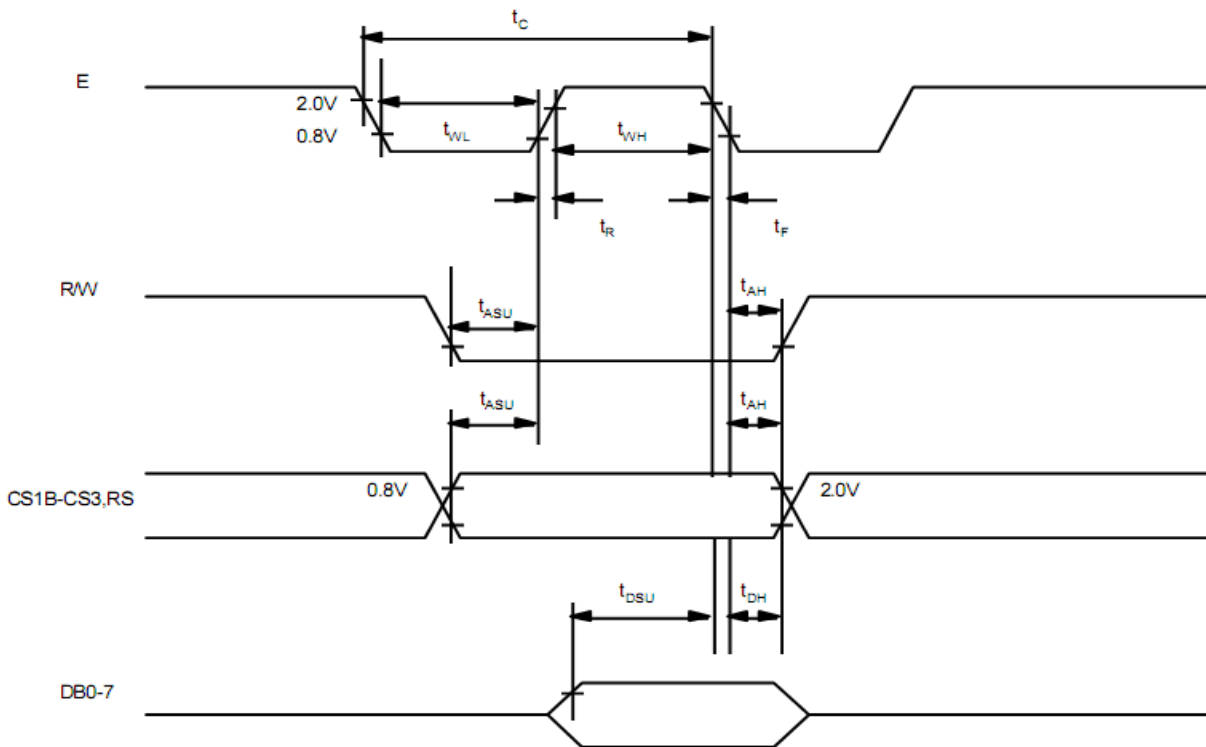


Fig 3. MPU write timing

### 4. Reset

Reset can be initialized system by setting RSTB terminal at low level when turning power on, receiving instruction from MPU. When RSTB becomes low, following procedure is occurred.

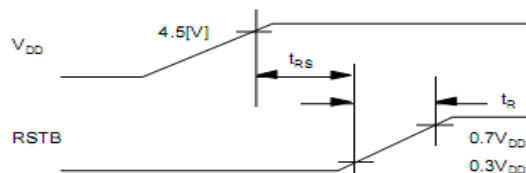
1. Display off
2. Display start line register become set by 0.(Z-address 0)

While RSTB is low, any instruction except status read can be accepted. Reset status appers at DB4. After DB4 is low, any instruction can be accepted.

The Conditions of power supply at initial power up are shown in table 1.

Table 1. Power Supply Initial Conditions

Item	Symbol	Min	Typ	Max	Unit
Reset Time	$t_{RS}$	1.0	-	-	us
Rise Time	$t_R$	-	-	200	ns



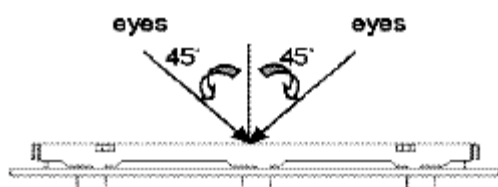
## 2.4 Instruction Table

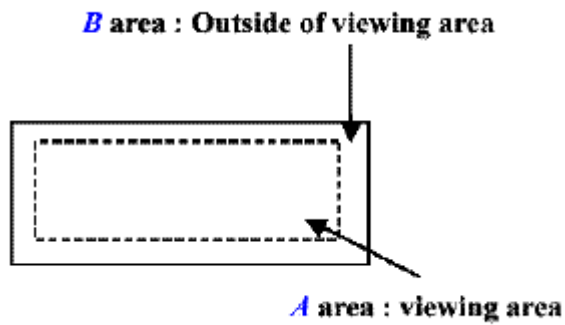
### ◆ Display Control Instruction

Instruction	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Function	
Display ON/OFF	L	L	L	L	H	H	H	H	H	L/H	Controls the display on or off. Internal status and display RAM data is not affected. L:OFF, H:ON	
Set Address	L	L	L	H	Y address (0~63)						Sets the Y address in the Y address counter.	
Set Page (X address)	L	L	H	L	H	H	H	Page (0~7)			Sets the X address at the X address register.	
Display Start Line	L	L	H	H	Display start line (0~63)						Indicates the display data RAM displayed at the top of the screen.	
Status Read	L	H	B U S Y	L	O N / O F F	R E S E T	L	L	L	L	Read status. BUSY L: Ready H: In operation ON/OFF L: Display ON H: Display OFF RESET L: Normal H: Reset	
Write Display Data	H	L	Write Data									Writes data (DB0:7) into display data RAM. After writing instruction, Y address is increased by 1 automatically.
Read Display Data	H	H	Read Data									Reads data (DB0:7) from display data RAM to the data bus.

## 2.5 Inspection Specification

- ◆ Inspection Standard : MIL-STD-105E Table Normal Inspection Single Sampling Level II .
- ◆ Equipment : Gauge、MIL-STD、Powertip Tester、Sample
- ◆ Defect Level : Major Defect AQL 0.4; Minor Defect AQL 1.5 .
- ◆ OUT Going Defect Level : Sampling .
- ◆ Manner of appearance test :
  - (1). The test be under 40W×2 fluorescent light ' and distance of view must be at 30 cm.
  - (2). The test direction is base on about around 45° of vertical line. (Fig. 1)
  - (3). Definition of area . (Fig. 2)

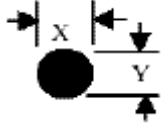
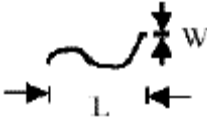


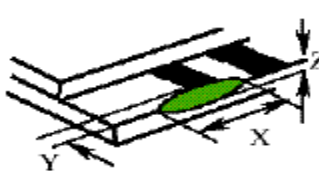


◆ Specification:

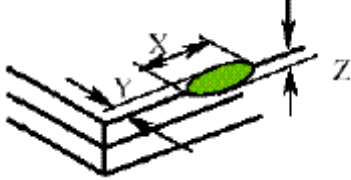

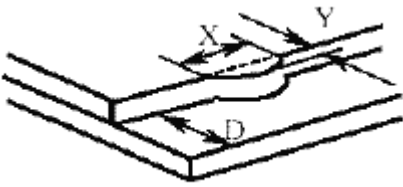
NO	Item	Criterion	level
01	Product condition	1.1 The part number is inconsistent with work order of Production.	Major
		1.2 Mixed production types.	Major
		1.3 Assembled in inverse direction.	Major
02	Quantity	2.1 The quantity is inconsistent with work order of production.	Major
03	Outline dimension	3.1 Product dimension and structure must conform to Structure diagram.	Major
04	Electrical Testing	4.1 Missing line character, dot and icon.	Major
		4.2 No function or no display.	Major
		4.3 Output data is error.	Major
		4.4 LCD viewing angle defect.	Major
		4.5 Current consumption exceeds product specifications.	Major
05	Black or white dot, scratch, contamination Round type	5.1 Round type: 5.1.1 display only : • White and black spots on display $\leq 0.25\text{mm}$ , no more than Four white or black spots present. • Densely spaced : NO more than two spots or lines within 3mm	Minor

◆ Specification :

NO	Item	Criterion	level
05	<p>Black or white dot、scratch、contamination Round type</p>  <p><math>\Phi = (x+y)/2</math></p> 	<p>5.1.2 Nom-display :</p> <p>Dimension (diameter : <math>\Phi</math>) Acceptance(Q'ty)</p> <p><math>\Phi \leq 0.10\text{mm}</math> Accept no dense</p> <p><math>0.10\text{mm} &lt; \Phi \leq 0.20\text{mm}</math> 3</p> <p><math>0.20\text{mm} &lt; \Phi \leq 0.25\text{mm}</math> 2</p> <p>Total 4</p> <p>5.1.3 Line type: Dimension (diameter : <math>\Phi</math>) Acceptance (Q'ty)</p> <p>Length width A area B area ---</p> <p><math>w \leq 0.03\text{mm}</math> Accept no dense Don't count</p> <p><math>L \leq 3.0\text{mm}</math> <math>0.03\text{mm} &lt; \Phi \leq 0.05\text{mm}</math> 4</p> <p>Don't count</p> <p><math>L \leq 2.5\text{mm}</math> <math>0.05\text{mm} &lt; \Phi \leq 0.075\text{mm}</math></p> <p>Don't count</p> <p>---</p> <p><math>w &gt; 0.075\text{mm}</math> As round type</p>	Minor

06	Polarizer Bubble	<p>Dimension (diameter : <math>\Phi</math>)</p> <p>A area</p> <p>Acceptance(Q'ty)</p> <p>B area  <math>\Phi \leq 0.20\text{mm}</math>  Accept no dense  Don't count</p> <p><math>0.20\text{mm} &lt; \Phi \leq 0.50\text{mm}</math>  3  Don't count</p> <p><math>0.50\text{mm} &lt; \Phi \leq 1.00\text{mm}</math>  2  Don't count</p> <p><math>\Phi &gt; 1.00\text{mm}</math>  0  Don't count</p> <p>Total quantity  4  Don't count</p>	Minor
07	The crack of glass	<p>● Glass Crack:  7.1 Crack on the circuit of electrode terminal :</p>  <p>X  Y  Z</p> <p>Front  <math>X \leq 1/5 a</math>  <math>Y \leq 1/2 D</math>  <math>Z \leq t</math></p> <p>Back</p> <p>Neglect</p>	Minor

◆ Specification :

NO	Item	Criterion	Level
07	<p>The crack of glass</p> <p>X: The length of Crack</p> <p>Y: The width of crack</p> <p>Z: The thickness of crack</p> <p>D: terminal length</p> <p>T: The thickness of glass</p> <p>A : The length of glass</p>	<p>● Glass Crack:</p> <p>7.2 General glass crack and corner edge:</p> <p>7.2.1</p>  <p>X Y Z Neglect Out A area Neglect</p> <p>7.2.2</p>  <p>X Y Z Neglect Out A area Neglect</p>	Minor
	<p>7.3 Glass remain:</p>  <p>X Y Neglect <math>\leq 1/3 d</math></p>	Minor	

◆Specification :

NO	Item	Criterion	Level
07	<p>The crack of glass</p> <p>X: The length of Crack</p> <p>Y: The width of crack</p> <p>Z: The thickness of crack</p> <p>D: terminal length</p> <p>T: The thickness of glass</p> <p>A : The length of glass</p>	<p>7.4 Corner crack and medial crack:</p> <p>Crack can't enter viewing area <math>\leq 1/2t</math>  <math>\leq 1/5a</math></p> <p>Crack can't exceed the half of width of SP width of SP <math>1/2t &lt; Z \leq 2t</math></p>	Minor
08	Backlight elements	<p>8.1 Backlight can't work normally.</p> <p>8.2 Backlight doesn't light or color is wrong.</p> <p>8.3 Illumination source flickers when lit.</p>	Major
09	General appearance	<p>9.1 pin type must match type in specification sheet</p> <p>9.2 No short circuits in components on PCB or FPC</p> <p>9.3 Product packaging must the same as specified on packaging specification sheet.</p> <p>9.4 The folding and peeled off in polarizer are not acceptable</p> <p>9.5 The PCB or FPC between B/L assembled distance (PCB or FPC) is <math>\leq 1.5\text{mm}</math></p>	Major