

# MACH-12.8-19201080-AWMN-03

## Ver:1.0

### TFT (Thin-Film-Transistor) Color Liquid Crystal Display Module

< ◇ > Preliminary Specification

< ◆ > Finally Specification

CUSTOMER'S APPROVAL	
CUSTOMER :	
SIGNATURE:	DATE:

APPROVED BY	PM REVIEWED	PD REVIEWED	PREPARED BY



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**Revision History**

Revision	Date	Originator	Detail	Remarks
Ver 1.0	20230322		Initial Release	

## Table of Contents

No.	Item	Page
1.	General Description .....	5
2.	Module Parameter .....	5
3.	Absolute Maximum Ratings .....	7
4.	DC Characteristics .....	8
5.	Backlight Characteristic .....	8
5.1.	Backlight Characteristic .....	8
6.	Optical Characteristics .....	9
6.1.	Optical Characteristics .....	9
6.2.	Definition of Response Time .....	10
6.3.	Definition of Contrast Ratio .....	11
6.4.	Definition of Viewing Angles .....	11
6.5.	Definition of Color Appearance .....	11
6.6.	Definition of Surface Luminance, Uniformity and Transmittance .....	12
7.	Block Diagram and Power Supply .....	13
8.	Interface Pins Definition (Connector Type: 196479-40041-3) .....	14
9.	AC Characteristics .....	16
9.1.	ON-OFF conditions for supply voltage .....	16
9.2.	Timing .....	16
10.	Quality Assurance .....	18
10.1.	Purpose .....	18

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10.2. Standard for Quality Test.....	18
10.3. Nonconforming Analysis & Disposition .....	18
10.4. Agreement Items .....	18
10.5. Standard of the Product Visual Inspection .....	19
10.6. Inspection Specification .....	19
10.7. Classification of Defects.....	24
10.8. Identification/marketing criteria .....	24
10.9. Packing.....	24
11. Reliability Specification .....	25
12. Precautions and Warranty .....	26
12.1. Safety .....	26
12.2. Handling .....	26
12.3. Storage.....	26
12.4. Metal Pin (Apply to Products with Metal Pins) .....	26
12.5. Operation.....	27
12.6. Static Electricity .....	27
12.7. Limited Warranty .....	28
13. Packaging .....	29

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## 1. General Description

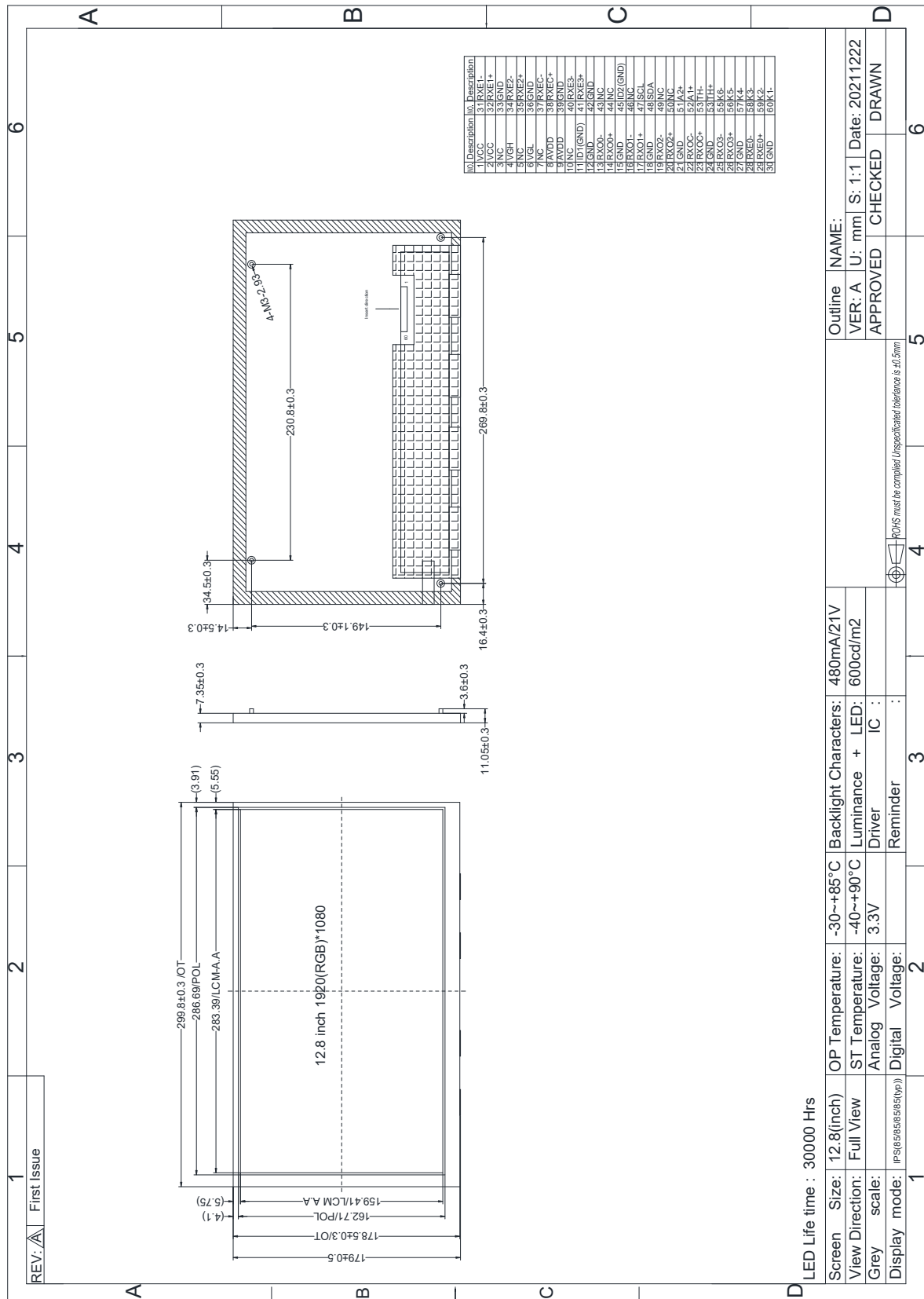
The specification is a transmissive type color active matrix liquid crystal display (LCD) which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT-LCD panel, driver ICs , and a backlight unit.

## 2. Module Parameter

Features	Details	Unit
Display Size(Diagonal)	12.8"	
LCD type	IPS TFT	
Display Mode	Transmissive /Normally Black	
Resolution	1920 RGB x 1080	Pixels
View Direction	FULL View	Best Image
Module Outline	299.8(H) x 179(V) x7.35(T) (Note1 )	mm
Active Area	283.39(H) x 159.41(V)	mm
Pixel Pitch	49.2*3(H) x 147.6 (V)	um
Pixel Arrangement	RGB Vertical stripe	
Polarizer Surface Treatment	Anti-glare	
Display Colors	16.7M	
Interface	LVDS	
Driver IC	-	
With or without the touch panel	Without	
Operating Temperature	<b>-30~85</b>	°C
Storage Temperature	-40~90	°C
Weight	525	g

Note 1: Inclusive hooks, posts, FFC/FPC tail etc.

## 2.1. Outline Drawing



### 3. Absolute Maximum Ratings

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table.

$V_{SS}=0V$ ,  $T_a=25^{\circ}C$

Item	Symbol	Min.	Max.	Unit
Supply Voltage	LCD_VDD	-0.3	3.6	V
Storage temperature	$T_{STG}$	-40	90	$^{\circ}C$
Operating temperature	$T_{OP}$	-30	85	$^{\circ}C$

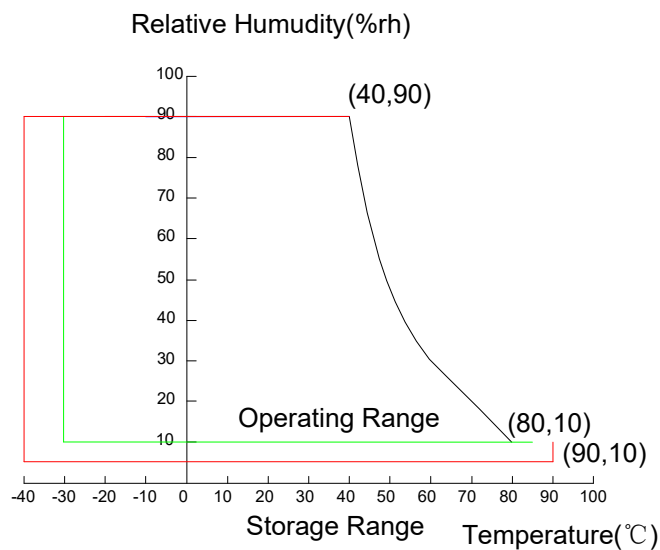
Note 1: If  $T_a$  below  $50^{\circ}C$ , the maximal humidity is 90%RH, if  $T_a$  over  $50^{\circ}C$ , absolute humidity should be less than 60%RH.

Note 2: The response time will be extremely slow when the operating temperature is around  $-10^{\circ}C$ , and the back ground will become darker at high temperature operating.

Note 3: These range above is maximum value not the actual operating temperature . Actual Operating temperature is no more than 40. and temperature refers to the LCM surface temperature ;

Note 4: The manufacturer is not responsible for product problems beyond the use conditions.

Note 5: Temperature and relative humidity range are shown in the figure below. Wet bulb temperature should be  $39^{\circ}C$  . max. and no condensation of water.



## 4. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	LCD_VDD	3	3.3	3.6	V
Logic Low input voltage	V <sub>IT+</sub>	-	-	+100	mV
Logic High input voltage	V <sub>IT-</sub>	-100	-	-	mV
	I <sub>DD</sub>	-	TBD	-	mA

Note 1: All of the voltage listed above are with respect to GND = 0v

Note 2: Device is subject to be damaged permanently if stresses beyond those absolute maximum rating listed above

## 5. Backlight Characteristic

### 5.1. Backlight Characteristic

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V <sub>F</sub>	T <sub>a</sub> =25 °C	18.9	<b>21</b>	23.8	V
Forward Current	I <sub>F</sub>	-	-	<b>480</b>		mA
Power dissipation	P <sub>D</sub>	-	-	<b>10080</b>		mW
Uniformity	Avg	-	70	80	-	%
LED working life(25°C)	-		30,000		-	Hrs
Drive method	Constant current					
LED Configuration						

Note1: LED life time defined as follows: The final brightness is at 50% of original brightness.

The environmental conducted under ambient air flow, at T<sub>a</sub>=25±2 °C, 60%RH±5%, I<sub>F</sub>=20mA.



## 6. Optical Characteristics

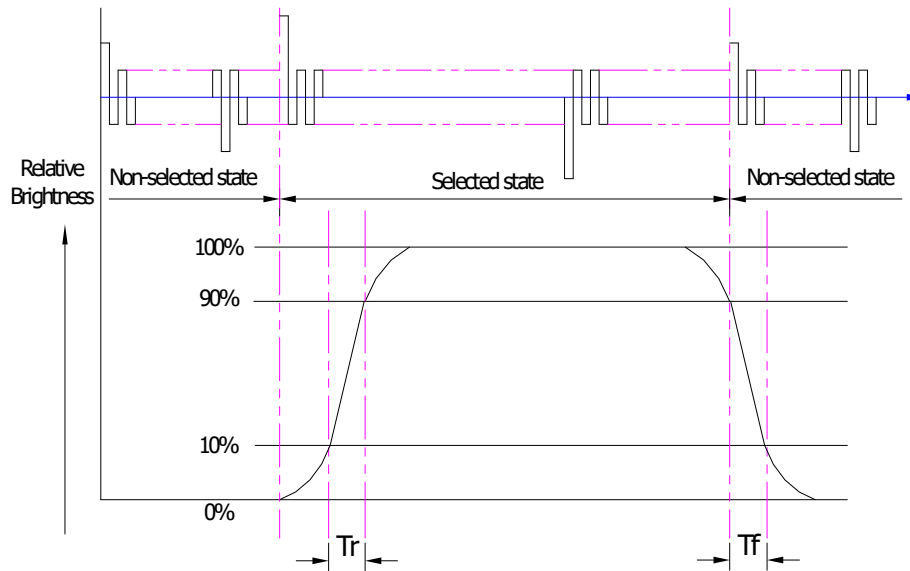
### 6.1. Optical Characteristics

Ta=25°C, DVDD=3.3V

Backlight On (Transmissive Mode)	Item		Symbol	Condition	Specification			Unit
					Min.	Typ.	Max.	
	Luminance on TFT( $I_f$ =60mA/LED)		Lv	Center CR≥10	480	600	-	cd/m²
	Contrast ratio(See 6.3)		CR		900	1000	-	
	Response time (See 6.2)		TR+TF		-	30	40	ms
	Chromaticity Transmissive (See 6.5)	Red	X <sub>R</sub>		0.610	0.660	0.710	
			Y <sub>R</sub>		0.268	0.318	0.368	
		Green	X <sub>G</sub>		0.212	0.262	0.312	
			Y <sub>G</sub>		0.520	0.570	0.620	
		Blue	X <sub>B</sub>		0.088	0.138	0.188	
			Y <sub>B</sub>		0.033	0.083	0.133	
		White	X <sub>W</sub>	-	-	-		
			Y <sub>W</sub>	-	-	-		
	Viewing Angle (See 6.4)	Horizontal	θ <sub>X+</sub>	Center CR≥10		85	-	Deg.
			θ <sub>X-</sub>			85	-	
Vertical		φ <sub>Y+</sub>			85	-		
		φ <sub>Y-</sub>			85	-		
NTSC Ratio(Gamut)					-	-	%	

## 6.2. Definition of Response Time

### 6.2.1. Normally Black Type (Negative)

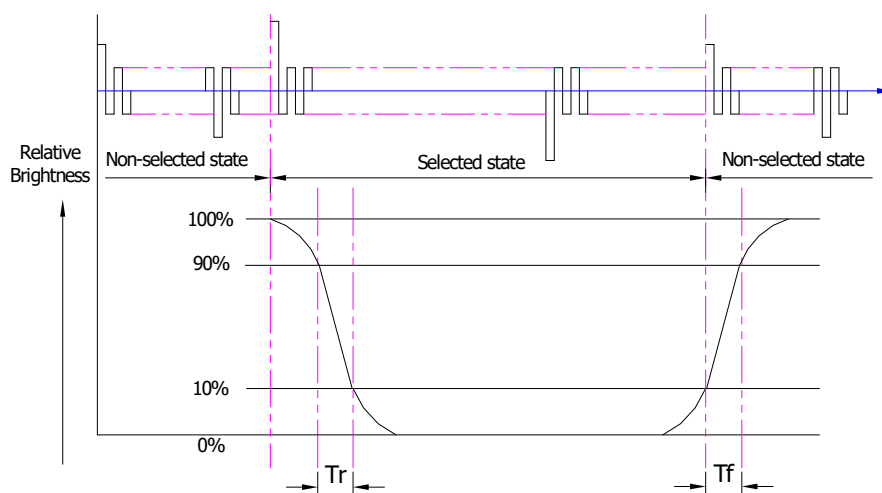


$T_r$  is the time it takes to change from non-selected stage with relative luminance 10% to selected state with relative luminance 90%;

$T_f$  is the time it takes to change from selected state with relative luminance 90% to non-selected state with relative luminance 10%.

Note: Measuring machine: LCD-5100

### 6.2.2. Normally White Type (Positive)



$T_r$  is the time it takes to change from non-selected stage with relative luminance 90% to selected state with relative luminance 10%;

$T_f$  is the time it takes to change from selected state with relative luminance 10% to non-selected state with relative luminance 90%;

Note: Measuring machine: LCD-5100 or EQUI

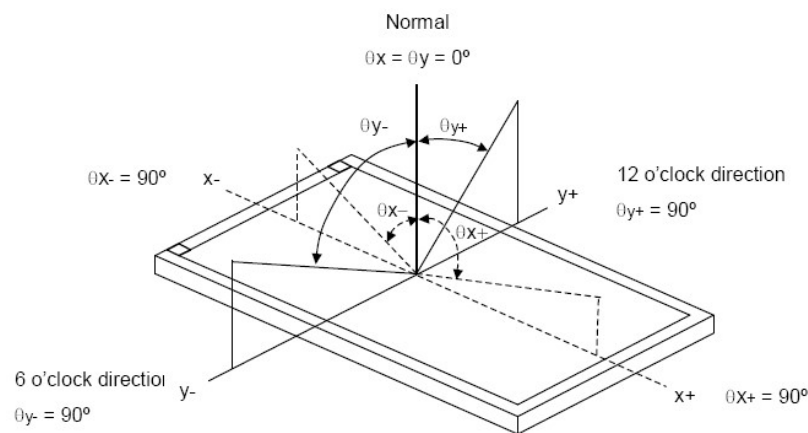
### 6.3. Definition of Contrast Ratio

Contrast is measured perpendicular to display surface in reflective and transmissive mode. The measurement condition is:

Measuring Equipment	Eldim or Equivalent
Measuring Point Diameter	3mm//1mm
Measuring Point Location	Active Area centre point
Test pattern	A: All Pixels white
	B: All Pixel black
Contrast setting	Maximum

Definitions: CR (Contrast) = Luminance of White Pixel / Luminance of Black Pixel

### 6.4. Definition of Viewing Angles



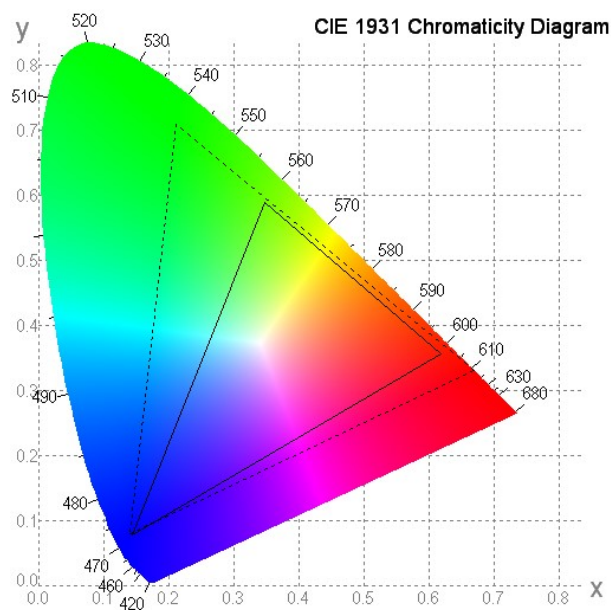
Measuring machine: LCD-5100 or EQUI

### 6.5. Definition of Color Appearance

R,G,B and W are defined by (x, y) on the IE chromaticity diagram

NTSC=area of RGB triangle/area of NTSC triangleX100%

Measuring picture: Red, Green, Blue and White (Measuring machine: BM-7)



## 6.6. Definition of Surface Luminance, Uniformity and Transmittance

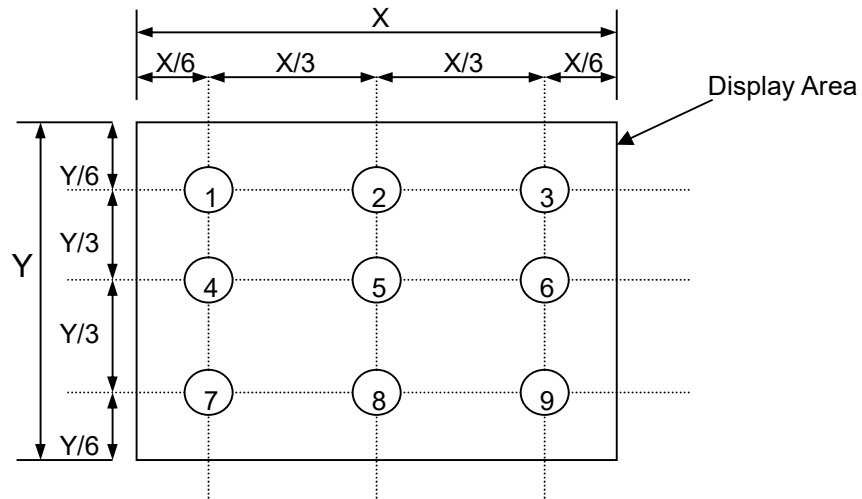
Using the transmissive mode measurement approach, measure the white screen luminance of the display panel and backlight.

6.6.1. Surface Luminance:  $L_V = \text{average } (L_{P1}:L_{P9})$

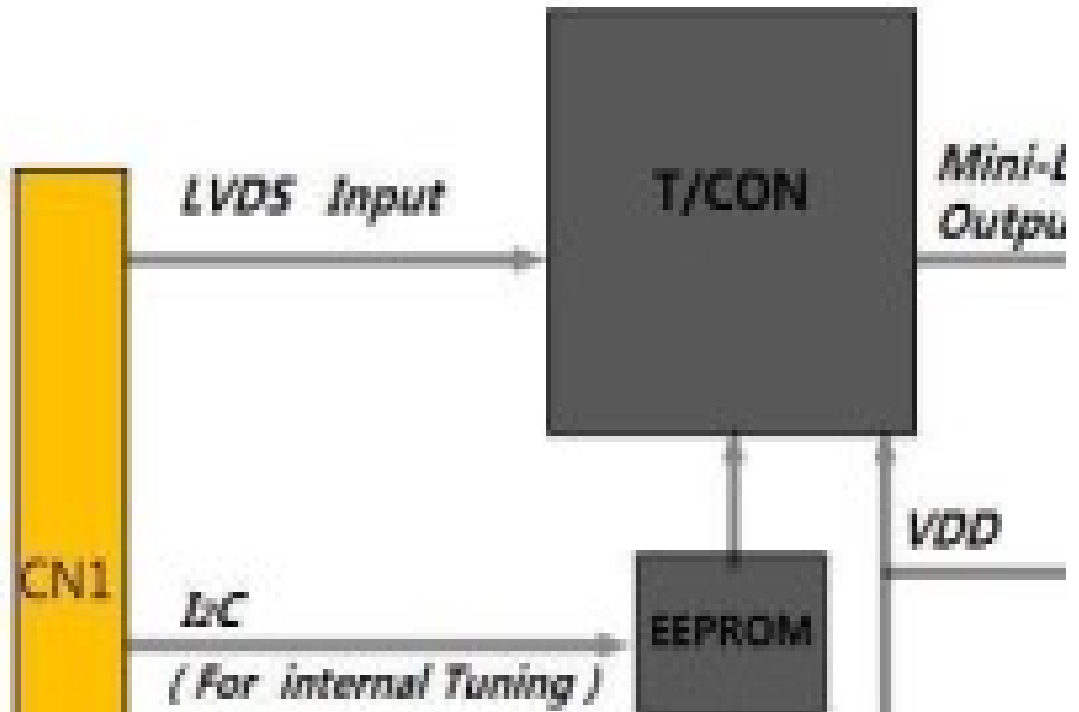
6.6.2. Uniformity = Minimal ( $L_{P1}:L_{P9}$ ) / Maximal ( $L_{P1}:L_{P9}$ ) \* 100%

6.6.3. Transmittance =  $L_V$  on LCD /  $L_V$  on Backlight \* 100%

Note: Measuring machine: BM-7



## 7. Block Diagram and Power Supply



## 8. Interface Pins Definition (Connector Type: 196479-40041-3)

The Recommended connector is FH28K-60S-0.5SH

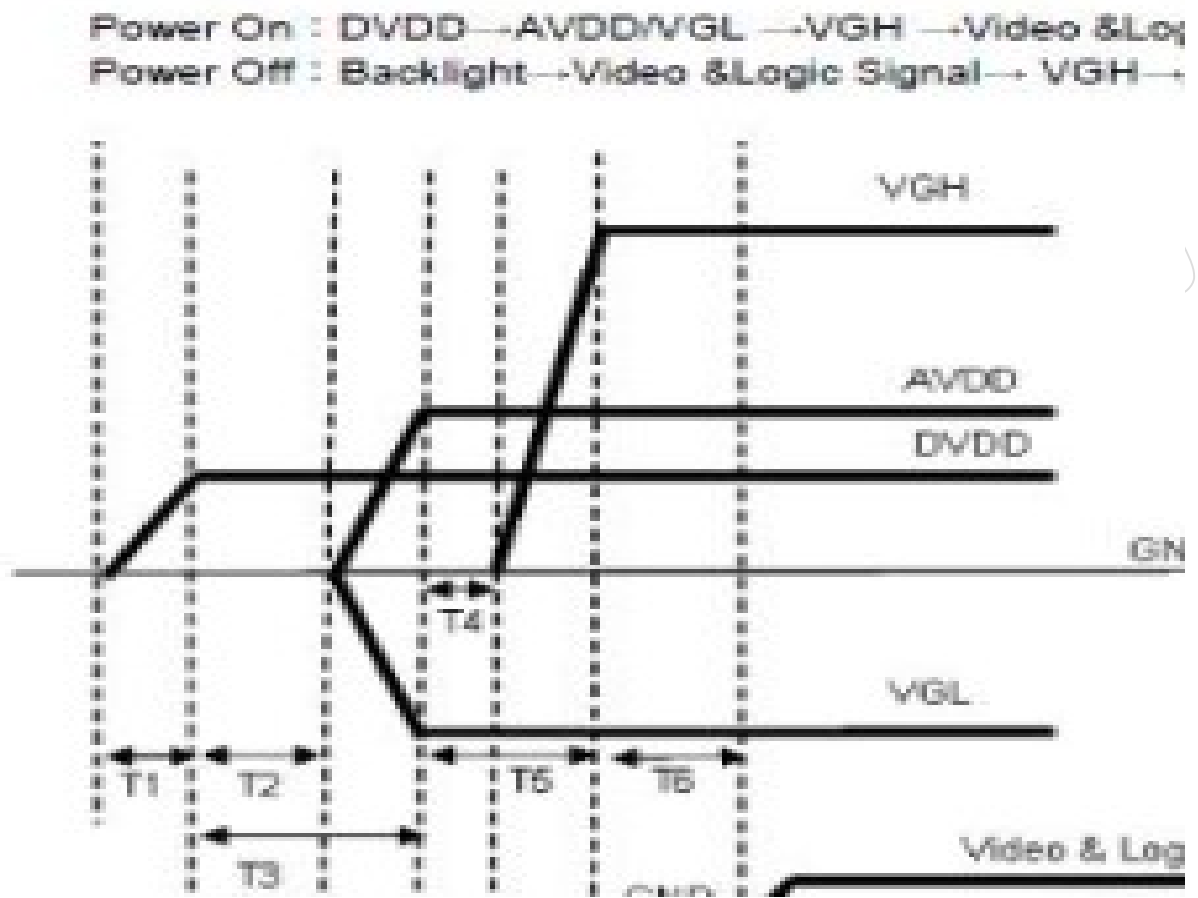
The connector interface pin assignments are listed in  
Table 5: Pin Assignments for

Pin No.	Symbol	
1	VCC	Power supply for logic
2	VCC	Power supply for logic
3	NC	Not Connected
4	VGH	High level supply for ga
5	NC	Not connected
6	VGL	Low level supply for ga
7	NC	Not connected
8	AVDD	Power supply for analog
9	AVDD	Power supply for analog
10	NC	Not Connected
11	ID1(GND)	ID1 pin ,GND level
12	GND	Ground
13	RX00-	LVDS Receiver Signal(-
14	RX00+	LVDS Receiver Signal(-
15	GND	Ground
16	RX01-	LVDS Receiver Signal(-
17	RX01+	LVDS Receiver Signal(-

39	GND	Ground
40	RXE3-	LVDS Receiver Signal(-)
41	RXE3+	LVDS Receiver Signal(+)
42	GND	Ground
43	NC	Not connected
44	NC	Not connected
45	ID2(GND)	ID2 pin , GND level
46	NC	Not connected
47	SCL	Not connected if not use
48	SDA	Not connected if not use
49	NC	Not connected

9. AC Characteristics

9.1. ON-OFF conditions for supply voltage

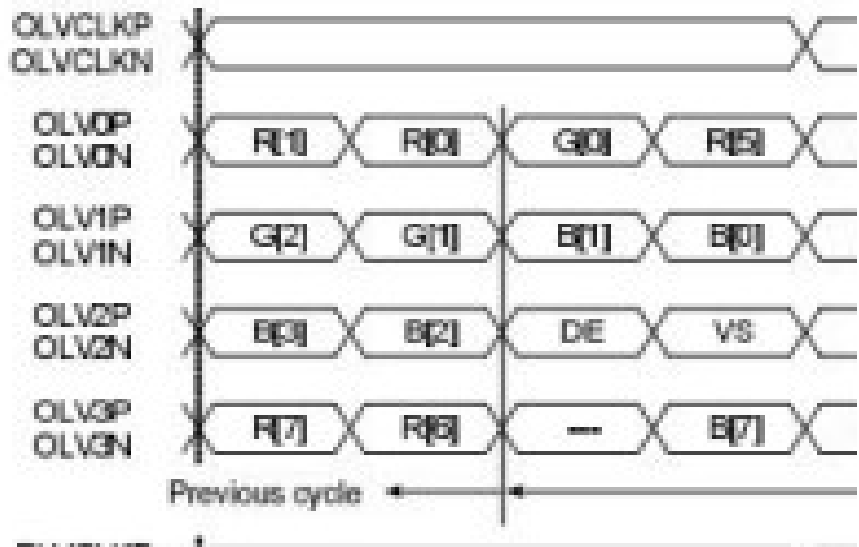


9.2. Timing

Parameter	Symbol	Min.	Max.
Clock frequency	RxFCLK	-	70MHz
Horizontal Display Area	thd	-	1024
HS Period	th	-	200ns
HS Blanking	Thb+thfp	-	200ns



# LVDS Input Signal Format



## **10. Quality Assurance**

### **10.1.Purpose**

This standard for Quality Assurance assures the quality of LCD module products supplied to customer.

### **10.2.Standard for Quality Test**

#### 10.2.1. Sampling Plan:

GB2828.1-2012

Single sampling, general inspection level II

#### 10.2.2. Sampling Criteria:

Visual inspection: AQL 1.5%

Electrical functional: AQL 0.65%.

#### 10.2.3. Reliability Test:

Detailed requirement refer to Reliability Test Specification.

### **10.3.Nonconforming Analysis & Disposition**

#### 10.3.1. Nonconforming analysis:

10.3.1.1. Customer should provide overall information of non-conforming sample for their complaints.

10.3.1.2. After receipt of detailed information from customer, the analysis of nonconforming parts usually should be finished in one week.

10.3.1.3. If cannot finish the analysis on time, customer will be notified with the progress status.

#### 10.3.2. Disposition of nonconforming:

10.3.2.1. Non-conforming product over PPM level will be replaced.

10.3.2.2. The cause of non-conformance will be analyzed. Corrective action will be discussed and implemented.

### **10.4.Agreement Items**

Shall negotiate with customer if the following situation occurs:

10.4.1. There is any discrepancy in standard of quality assurance.

10.4.2. Additional requirement to be added in product specification.

10.4.3. Any other special problem.

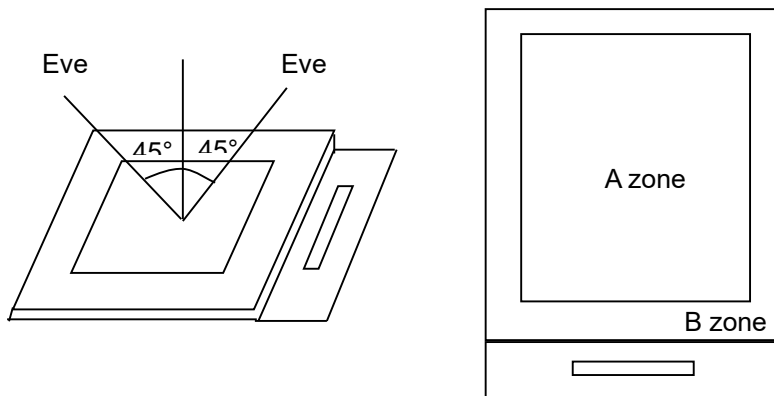
## 10.5. Standard of the Product Visual Inspection

### 10.5.1. Appearance inspection:

10.5.1.1. The inspection must be under illumination about 1000 – 1500 lx, and the distance of view must be at 30cm  $\pm$  2cm.

10.5.1.2. The viewing angle should be 45° from the vertical line without reflection light or follows customer's viewing angle specifications.

10.5.1.3. Definition of area: A Zone: Active Area, B Zone: Viewing Area,



### 10.5.2. Basic principle:

10.5.2.1. A set of sample to indicate the limit of acceptable quality level must be discussed by both us and customer when there is any dispute happened.

10.5.2.2. New item must be added on time when it is necessary.

## 10.6. Inspection Specification

These inspection standards shall be applied to LCD Module supplied by INNOLUX Optoelectronics Corporation. This model is only used in CE product, if it is used in other product applications; it still adopts this copy of specification. If there are any other product applications such as handwriting recognition, Industrial use, Medical use, Aerospace usage and so on, the specifications should be negotiated separately.

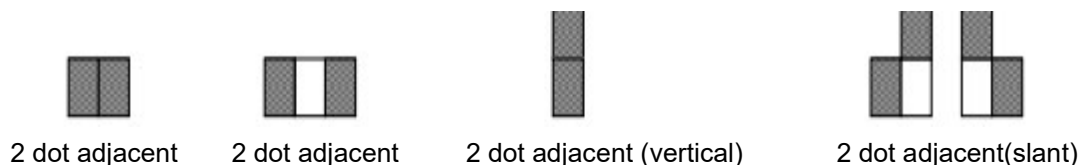
### 01 Definition of dot defect induced from the panel inside

a) Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

b) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

c) 2 dot adjacent = 1 pair = 2 dots

Picture:



No.	Display Inspection		
02	Items		Criteria (Unit: mm)
	Bright dot	Random	$N \leq 3$
		2 dots adjacent	$N \leq 0$
		3 dots adjacent	$N \leq 0$
	Dark dot	Random	$N \leq 4$
		2 dots adjacent	$N \leq 0$
		3 dots adjacent	$N \leq 0$
	Total bright dot and dark dot		$N \leq 6$
	Distance	Minimum Distance Between dark dots Minimum Distance Between dark and bright dots	5mm
Tiny bright dot			visible through 5% ND filter $D \leq 0.3\text{mm}$ , Ignore $0.3\text{mm} < D \leq 0.5\text{mm}$ , $N \leq 4$ Distance $\geq 5\text{mm}$
Display failure (V-line/Cross line etc)			
Mura/Waving/Hot spot		Not visible through 6% ND filter in 50% gray or judge by limit sample if necessary	

\*Note: Defect which is on the Black Matrix (outside of Active Area) are not considered as a defect.

No.	Appearance & Display inspection	
03	Items	Criteria (Unit: mm)
	Foreign Black/White/Bright Spot (Display & Appearance)	$D \leq 0.3\text{mm}$ , Ignore, $0.3\text{mm} < D \leq 0.5\text{mm}$ , $N \leq 4$ Distance $\geq 5\text{mm}$ , It is shown in Fig. 2.
	Foreign Black/White/Bright Line (Display & Appearance)	$W \leq 0.07\text{ mm}$ , Ignore $0.07 < W \leq 0.1\text{ mm}$ $L \leq 5.0\text{ mm}$ , $N \leq 4$ It is shown in Fig. 3.
	Polarizer Dent/Air Bubble	$D \leq 0.3\text{mm}$ , Ignore $0.3\text{mm} < D \leq 0.5\text{mm}$ , $N \leq 4$ Distance $\geq 5\text{mm}$
	Polarizer Scratches	$W \leq 0.07\text{ mm}$ , Ignore $0.07 < W \leq 0.1\text{mm}$ $L \leq 5.0\text{ mm}$ , $N \leq 4$

Notes: If any specific defect is not included in the above defect table, this defect should be judged by INX/ODM/Brand customer discussion.

1. W: Width                      3. D: Average Diameter  
2. L: Length                  4. N: Count

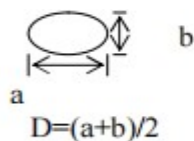
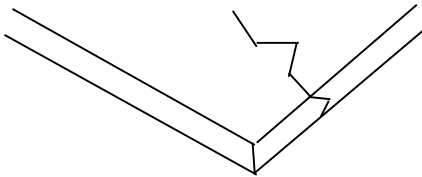
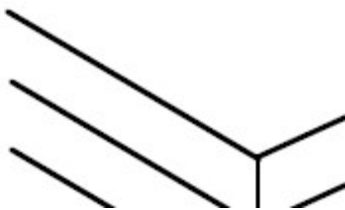

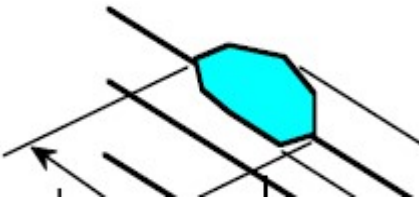


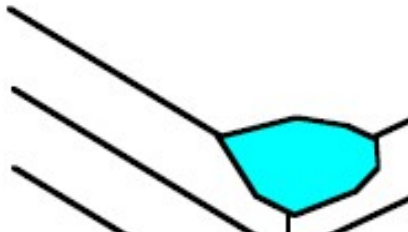
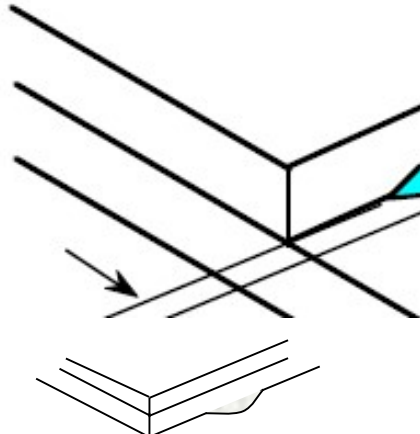
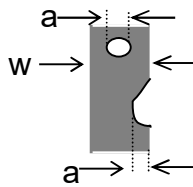
Fig. 2



W: width, L : length

Fig. 3

No.	Item	Criteria (Unit: mm)										
04	Glass Crack (Minor defect)	<div></div> <p>Crack is potential to enlarge, any type is not allowed.</p>										
05	Glass Chipping Pad Area: (Minor defect)	<div></div> <table><tr><th>Length and Width</th><th>Acc. Qty</th></tr><tr><td>c &gt; 3.0, b&lt; 1.0</td><td>1</td></tr><tr><td>c&lt; 3.0, b&lt; 1.0</td><td>3</td></tr><tr><td colspan="2">a&lt;Glass Thickness</td></tr></table>	Length and Width	Acc. Qty	c > 3.0, b< 1.0	1	c< 3.0, b< 1.0	3	a<Glass Thickness			
Length and Width	Acc. Qty											
c > 3.0, b< 1.0	1											
c< 3.0, b< 1.0	3											
a<Glass Thickness												
06	Glass Chipping Rear of Pad Area: (Minor defect)	<div></div> <table><tr><th>Length and Width</th><th>Acc. Qty</th></tr><tr><td>c &gt; 3.0, b&lt; 1.0</td><td>1</td></tr><tr><td>c&lt; 3.0, b&lt; 1.0</td><td>2</td></tr><tr><td>c&lt; 3.0, b&lt; 0.5</td><td>4</td></tr><tr><td colspan="2">a&lt;Glass Thickness</td></tr></table>	Length and Width	Acc. Qty	c > 3.0, b< 1.0	1	c< 3.0, b< 1.0	2	c< 3.0, b< 0.5	4	a<Glass Thickness	
Length and Width	Acc. Qty											
c > 3.0, b< 1.0	1											
c< 3.0, b< 1.0	2											
c< 3.0, b< 0.5	4											
a<Glass Thickness												
07	Glass Chipping Except Pad Area: (Minor defect)	<div></div> <table><tr><th>Length and Width</th><th>Acc. Qty</th></tr><tr><td>c &gt; 3.0, b&lt; 1.0</td><td>1</td></tr><tr><td>c&lt; 3.0, b&lt; 1.0</td><td>2</td></tr><tr><td>c&lt; 3.0, b&lt; 0.5</td><td>4</td></tr><tr><td colspan="2">a&lt;Glass Thickness</td></tr></table>	Length and Width	Acc. Qty	c > 3.0, b< 1.0	1	c< 3.0, b< 1.0	2	c< 3.0, b< 0.5	4	a<Glass Thickness	
Length and Width	Acc. Qty											
c > 3.0, b< 1.0	1											
c< 3.0, b< 1.0	2											
c< 3.0, b< 0.5	4											
a<Glass Thickness												

08	<p>Glass Corner Chipping: (Minor defect)</p> 	<table><tr><th>Length and Width</th><th>Acc. Qty</th></tr><tr><td><math>c &lt; 3.0, b &lt; 3.0</math></td><td>Ignore</td></tr><tr><td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td></tr></table>	Length and Width	Acc. Qty	$c < 3.0, b < 3.0$	Ignore	$a < \text{Glass Thickness}$			
Length and Width	Acc. Qty									
$c < 3.0, b < 3.0$	Ignore									
$a < \text{Glass Thickness}$										
09	<p>Glass Burr: (Minor defect)</p> 	<table><tr><th>Length</th><th>Acc. Qty</th></tr><tr><td><math>F &lt; 1.0</math></td><td>Ignore</td></tr></table> <p>Glass burr don't affect assemble and module dimension.</p>	Length	Acc. Qty	$F < 1.0$	Ignore				
Length	Acc. Qty									
$F < 1.0$	Ignore									
10	<p>FPC Defect: (Minor defect)</p> 	<p>10.1 Dent, pinhole width <math>a &lt; w/3</math>. (w: circuitry width.)</p> <p>10.2 Open circuit is unacceptable.</p> <p>10.3 No oxidation, contamination and distortion.</p>								
11	<p>Bubble on Polarizer (Minor defect)</p>	<table><tr><th>Diameter</th><th>Acc. Qty</th></tr><tr><td><math>\varphi \leq 0.30</math></td><td>Ignore</td></tr><tr><td><math>0.30 &lt; \varphi \leq 0.50</math></td><td><math>N \leq 4</math></td></tr><tr><td><math>0.50 &lt; \varphi</math></td><td><math>N = 0</math></td></tr></table>	Diameter	Acc. Qty	$\varphi \leq 0.30$	Ignore	$0.30 < \varphi \leq 0.50$	$N \leq 4$	$0.50 < \varphi$	$N = 0$
Diameter	Acc. Qty									
$\varphi \leq 0.30$	Ignore									
$0.30 < \varphi \leq 0.50$	$N \leq 4$									
$0.50 < \varphi$	$N = 0$									

12	Dent on Polarizer (Minor defect)	<table><tr><td>Diameter</td><td>Acc. Qty</td></tr><tr><td><math>\varphi \leq 0.25</math></td><td>Ignore</td></tr><tr><td><math>0.25 &lt; \varphi \leq 0.50</math></td><td><math>N \leq 5</math></td></tr><tr><td><math>0.50 &lt; \varphi</math></td><td>None</td></tr></table>	Diameter	Acc. Qty	$\varphi \leq 0.25$	Ignore	$0.25 < \varphi \leq 0.50$	$N \leq 5$	$0.50 < \varphi$	None
Diameter	Acc. Qty									
$\varphi \leq 0.25$	Ignore									
$0.25 < \varphi \leq 0.50$	$N \leq 5$									
$0.50 < \varphi$	None									
13	Bezel	13.1 No rust, distortion on the Bezel. 13.2 No visible fingerprints, stains or other contamination.								
14	Touch Panel	D: Diameter W: width L: length 14.1 Spot: $D < 0.25$ is acceptable $0.25 \leq D \leq 0.4$ 2dots are acceptable and the distance between defects should more than 10 mm. $D > 0.4$ is unacceptable 14.2 Dent: $D > 0.40$ is unacceptable 14.3 Scratch: $W \leq 0.03$ , $L \leq 10$ is acceptable, $0.03 < W \leq 0.10$ , $L \leq 10$ is acceptable Distance between 2 defects should more than 10 mm. $W > 0.10$ is unacceptable.								
15	LCD Ripple	Touch the touch panel, cannot see the LCD ripple. Pen: R 0.8mm silicon rubber. Operation Force:120g								
16	PCB	16.1 No distortion or contamination on PCB terminals. 16.2 All components on PCB must same as documented on the BOM/component layout. 16.3 Follow IPC-A-600F.								
17	Soldering	Follow IPC-A-610C standard								
18	Electrical Defect (Major defect)	The below defects must be rejected. 18.1 Missing vertical / horizontal segment, 18.2 Abnormal Display. 18.3 No function or no display. 18.4 Current exceeds product specifications. 18.5 LCD viewing angle defect. 18.6 No Backlight. 18.7 Dark Backlight. 18.8 Touch Panel no function.								

Remark: LCD Panel Broken shall be rejected. Defect out of LCD viewing area is acceptable.

### 10.7. Classification of Defects

- 10.7.1. Visual defects (Except no / wrong label) are treated as minor defect and electrical defect is major.
- 10.7.2. Two minor defects are equal to one major in lot sampling inspection.

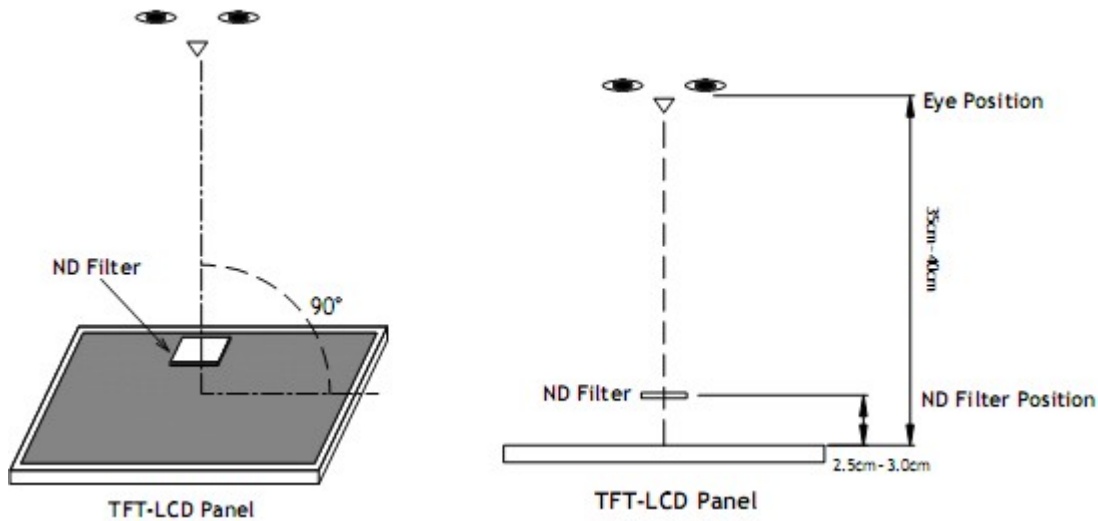
### 10.8. Identification/marketing criteria

Any unit with illegible / wrong /double or no marking/ label shall be rejected.

### 10.9. Packing

- 10.9.1. There should be no damage of the outside carton box, each packaging box should have one identical label.
- 10.9.2. Modules inside package box should have compliant mark.
- 10.9.3. All direct package materials shall offer ESD protection.

**Note1:** Bright dot is defined as the defective area of the dot is larger than 50% of one sub-pixel area.



**Bright dot:** The bright dot size defect at black display pattern. It can be recognized by 2% transparency of filter when the distance between eyes and panel is  $350\text{mm} \pm 50\text{mm}$ .

**Dark dot:** Cyan, Magenta or Yellow dot size defect at white display pattern. It can be recognized by 5% transparency of filter when the distance between eyes and panel is  $350\text{mm} \pm 50\text{mm}$ .

**Note2:** Mura on display which appears darker / brighter against background brightness on parts of display area.



## 11. Reliability Specification

No	Item	Condition	Quantity	Criteria
1	High Temperature Operating	85℃, 120Hrs	2	GB/T2423.2-2008
2	Low Temperature Operating	-30℃, 120Hrs	2	GB/T2423.1-2008
3	High Humidity	60℃, 90%RH, 120Hrs	2	GB/T2423.3-2006
4	High Temperature Storage	90℃, 120Hrs	2	GB/T2423.2-2008
5	Low Temperature Storage	-40℃, 120Hrs	2	GB/T2423.1-2008
6	Thermal Cycling Test	-30℃, 60min~85℃, 60min, 20 cycles.	2	GB/T2423.2-2012
7	Packing vibration	Frequency range: 10Hz~50Hz Acceleration of gravity: 5G X, Y, Z 30 min for each direction.	2	GB/T5170.1-2009
8	Electrical Static Discharge	Air: $\pm 8\text{KV}$ 150pF/330 $\Omega$ 5 times Contact: $\pm 4\text{KV}$ 150pF/330 $\Omega$ 5 times	2	GB/T17626.2-2006
9	Drop Test (Packaged)	Height: 80 cm, 1 corner, 3 edges, 6 surfaces.	2	GB/T2423.8-1995

Note1. After the reliability test, the product only guarantee function normally without any fatal defect (non-display, line defect, abnormal display). All the cosmetic specification is judged before the reliability test.

Note2. Total current Consumption should be below double of initial value.

Note3. One product only can borne one item of reliability test. Can not take same single one product to do different reliability test .

Note4. All adjustment of display are performed after temperature of product back to room temperature and under static situation for 2 hrs.

Note5. Under no condensation of dew

## 12. Precautions and Warranty

### 12.1. Safety

- 12.1.1. The liquid crystal in the LCD is poisonous. Do not put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.
- 12.1.2. Since the liquid crystal cells are made of glass, do not apply strong impact on them. Handle with care.

### 12.2. Handling

- 12.2.1. Reverse and use within ratings in order to keep performance and prevent damage.
- 12.2.2. Do not wipe the polarizer with dry cloth, as it might cause scratch. If the surface of the LCD needs to be cleaned, wipe it swiftly with cotton or other soft cloth soaked with petroleum IPA, do not use other chemicals.

### 12.3. Storage

- 12.3.1. Do not store the LCD module beyond the specified temperature ranges.
- 12.3.2. Strong light exposure causes degradation of polarizer and color filter

### 12.4. Metal Pin (Apply to Products with Metal Pins)

#### 12.4.1. Pins of LCD and Backlight

13.4.1.1 Solder tip can touch and press on the tip of Pin LEAD during the soldering

#### 13.4.1.2 Recommended Soldering Conditions

Solder Type: Sn96.3~94-Ag3.3~4.3-Cu0.4~1.1

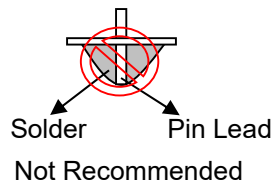
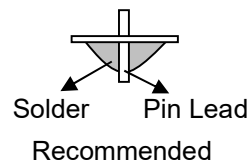
Maximum Solder Temperature: 370 °C

Maximum Solder Time: 3s at the maximum temperature

Recommended Soldering Temp: 350±20 °C

Typical Soldering Time: ≤3s

#### 13.4.1.3 Solder Wetting



#### 12.4.2. Pins of EL

13.4.2.1 Solder tip can touch and press on the tip of EL leads during soldering.

13.4.2.2 No Solder Paste on the soldering pad on the motherboard is recommended.

#### 13.4.2.3 Recommended Soldering Conditions

Solder type: Nippon Alimit Leadfree SR-34, size 0.5mm

Recommended Solder Temperature: 270~290 °C

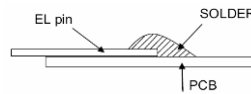
Typical Soldering Time: ≤2s

Minimum solder distance from EL lamp (body): 2.0mm

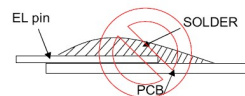
13.4.2.4 No horizontal press on the EL leads during soldering.

13.4.2.5 180° bend EL leads three times is not allowed.

13.4.2.6 Solder Wetting

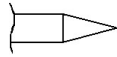


Recommended

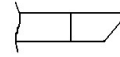


Not Recommended

13.4.2.7 The type of the solder iron:

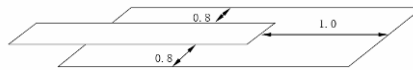


Recommended



Not Recommended

13.4.2.8 Solder Pad



## 12.5. Operation

- 12.5.1. Do not drive LCD with DC voltage
- 12.5.2. Response time will increase below lower temperature
- 12.5.3. Display may change color with different temperature
- 12.5.4. Mechanical disturbance during operation, such as pressing on the display area, may cause the segments to appear "fractured".
- 12.5.5. Do not connect or disconnect the LCM to or from the system when power is on.
- 12.5.6. Never use the LCM under abnormal condition of high temperature and high humidity.
- 12.5.7. Module has high frequency circuits. Sufficient suppression to the electromagnetic interface shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.
- 12.5.8. Do not display the fixed pattern for long time (we suggest the duration time not longer than half an hour) because it may develop image sticking due to the TFT structure.

## 12.6. Static Electricity

- 12.6.1. CMOS LSIs are equipped in this unit, so care must be taken to avoid the electro-static charge, by ground human body, etc.
- 12.6.2. The normal static prevention measures should be observed for work clothes and benches.
- 12.6.3. The module should be kept into anti-static bags or other containers resistant to static for storage.

## **12.7. Limited Warranty**

- 12.7.1. Our warranty liability is limited to repair and/or replacement. We will not be responsible for any consequential loss.
- 12.7.2. If possible, we suggest customer to use up all modules in six months. If the module storage time over twelve months, we suggest that recheck it before the module be used.
- 12.7.3. After the product shipped, any product quality issues must be feedback within three months, otherwise, we will not be responsible for the subsequent or consequential events.

## 13. Packaging

TBD