

# PRODUCT SPECIFICATION

## 1.3" IPS TFT LCD MODULE MACHT013240240-A2WMN-001 Ver: 1.2



- < ◇ > Preliminary Specification
- < ◆ > Finally Specification

CUSTOMER'S APPROVAL	
CUSTOMER :	
SIGNATURE:	DATE:

APPROVED BY	PM REVIEWED	PD REVIEWED	PREPARED BY

### Revision History

Revision	Date	Originator	Detail	Remarks
1.0	2019.06.25	ZDT	Initial Release	
1.1	2020.10.22	ZJW	Modify Module Parameter Modify Optical Characteristics Modify AC Characteristics Modify Inspection Specification Modify Reliability Specification Modify Outline Drawing	P4 P6 P11/P12 P17 P19 P23
1.2	2022.11.02	LQ	Add Weight Add Current Consumption Modify Optical Characteristics Modify Outline Drawing(C)	P4 P5 P6 P23

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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)	1.3"	
LCD type	IPS TFT	
Display Mode	Transmissive /Normally black	
Resolution	240 RGB x240	Pixels
View Direction	Full view	Best Image
Module Outline	35.6 (H) x 38.1 (V) x 1.56 (T) (Note1 )	mm
Active Area	32.4(H) x 32.4(V)	mm
Pixel Size	135(H) x 135(V)	um
Pixel Arrangement	RGB Vertical stripe	
Display Colors	262K	
Interface	3-Line SPI+RGB interface	
With or without touch panel	Without	
Driver IC	GC9A01	-
Operating Temperature	<b>-20~70</b>	°C
Storage Temperature	<b>-30~80</b>	°C
Weight	4	g

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

## 3. Absolute Maximum Ratings

GND=0V, Ta=25°C

Item	Symbol	Min.	Max.	Unit
Supply Voltage	VDD	-0.3	4.6	V
Storage temperature	T <sub>STG</sub>	<b>-30</b>	<b>+80</b>	°C
Operating temperature	T <sub>OP</sub>	<b>-20</b>	<b>+70</b>	°C

Note 1: If Ta below 50°C, the maximal humidity is 90%RH, if Ta over 50°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°C, and the back ground will become darker at high temperature operating.

#### 4. DC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	
Supply Voltage	VDD	2.5	2.8	3.3	V	
Logic Low input voltage	V <sub>IL</sub>	GND	-	0.3*VDD	V	
Logic High input voltage	V <sub>IH</sub>	0.7*VDD	-	VDD	V	
Logic Low output voltage	V <sub>OL</sub>	GND	-	0.2*VDD	V	
Logic High output voltage	V <sub>OH</sub>	0.8*VDD	-	VDD	V	
Current Consumption All White	Logic	I <sub>CC+ IIN</sub>	-	8	-	mA
	Analog					

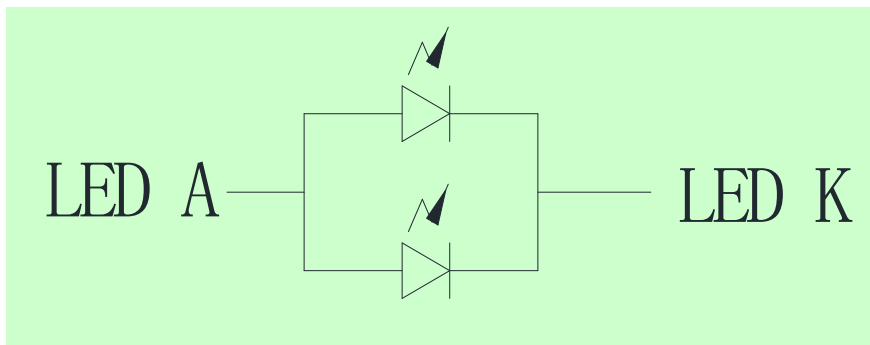
#### 5. Backlight Characteristic

##### 5.1. Backlight Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V <sub>F</sub>	T <sub>a</sub> =25 °C, I <sub>F</sub> =20mA/LED	2.8	<b>3.0</b>	3.4	V
Forward Current	I <sub>F</sub>	T <sub>a</sub> =25 °C, V <sub>F</sub> =3.0V/LED	-	<b>40</b>	-	mA
Power dissipation	P <sub>D</sub>		-	<b>120</b>	-	mW
Uniformity	Avg		-	80	-	%
LED working life(25°C)	-		-	30,000	-	Hrs
Drive method	<b>Constant current</b>					
LED Configuration	2 White LEDs in parallel					

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/LED.

##### 5.2. Backlighting circuit



## 6. Optical Characteristics

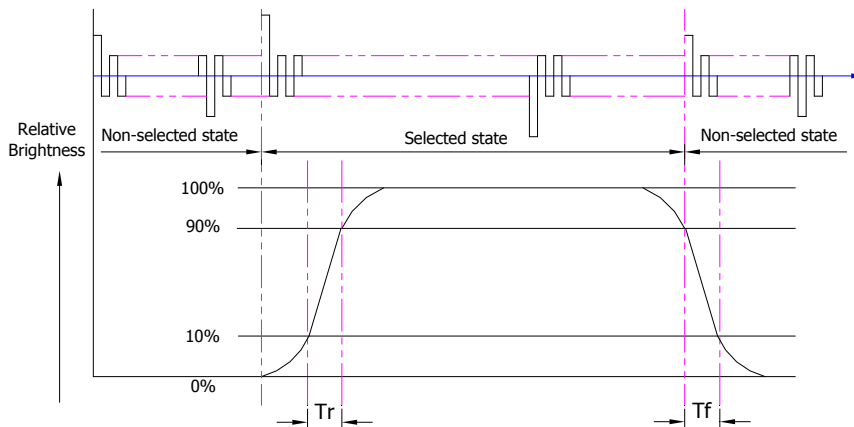
### 6.1. Optical Characteristics

Ta=25°C, VDD=2.8V

	Item	Symbol	Condition	Specification			Unit	
				Min.	Typ.	Max.		
Backlight On (Transmissive Mode)	Luminance on TFT( $I_f=20\text{mA/LED}$ )	Lv	Normally viewing angle $\theta_x = \phi_y = 0^\circ$	432	540	-	cd/m <sup>2</sup>	
	Contrast ratio(See 6.3)	CR		900	1100	-		
	Response time (See 6.2)	TR+TF		-	30	35	ms	
	Chromaticity Transmissive (See 6.5)	Red	X <sub>R</sub>	Center CR≥10	0.592	0.642	0.692	
			Y <sub>R</sub>		0.286	0.336	0.386	
		Green	X <sub>G</sub>		0.307	0.357	0.407	
			Y <sub>G</sub>		0.557	0.607	0.657	
		Blue	X <sub>B</sub>		0.085	0.135	0.185	
			Y <sub>B</sub>		0.036	0.086	0.136	
	White	X <sub>W</sub>	0.271	0.321	0.371			
Y <sub>W</sub>		0.303	0.353	0.403				
Viewing Angle (See 6.4)	Horizontal	$\theta_{x+}$	Center CR≥10	80	85	-	Deg.	
		$\theta_{x-}$		80	85	-		
	Vertical	$\phi_{y+}$		80	85	-		
		$\phi_{y-}$		80	85	-		
NTSC Ratio(Gamut)				55	60	-	%	

### 6.2. Definition of Response Time

#### 6.2.1. Normally Black Type (Negative)

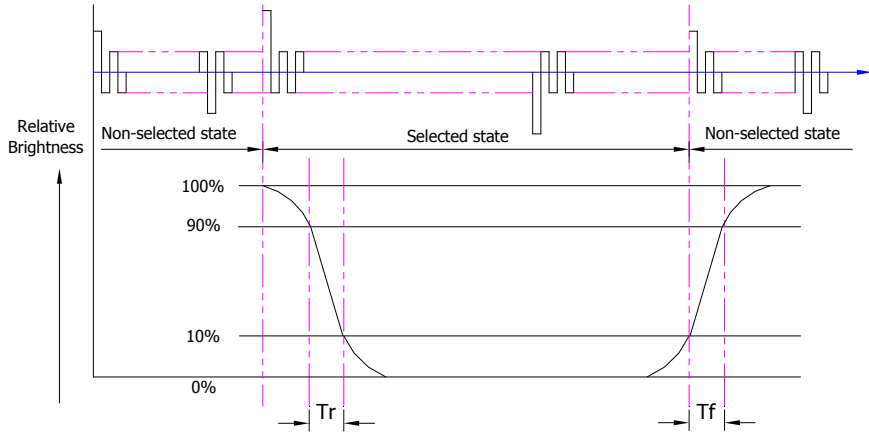


Tr is the time it takes to change from non-selected stage with relative luminance 10% to selected state with relative luminance 90%;

Tf 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)



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

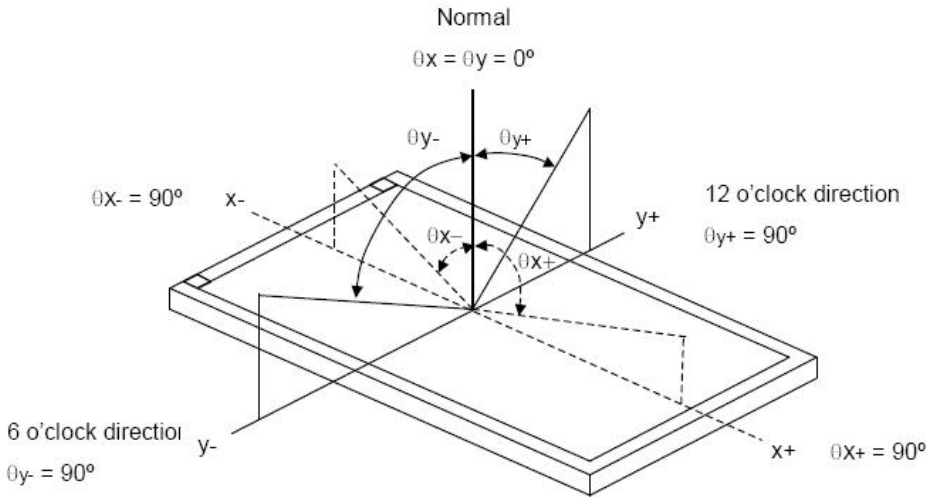
6.3. Definition of Contrast Ratio

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



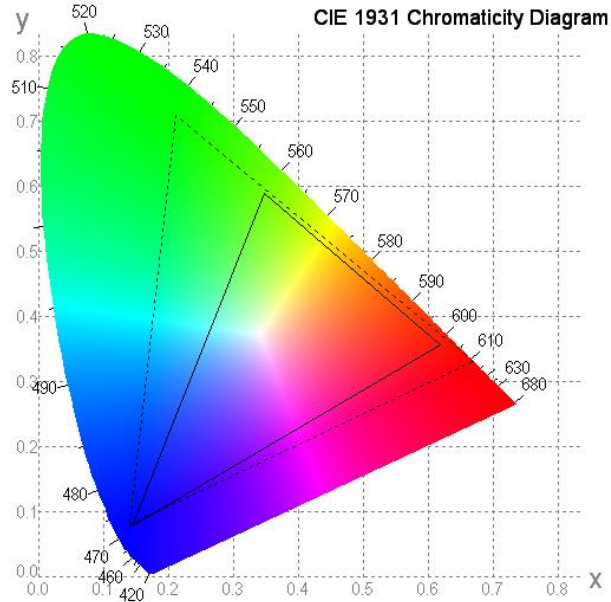
Measuring machine: LCD-5100 or EQUI

**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**

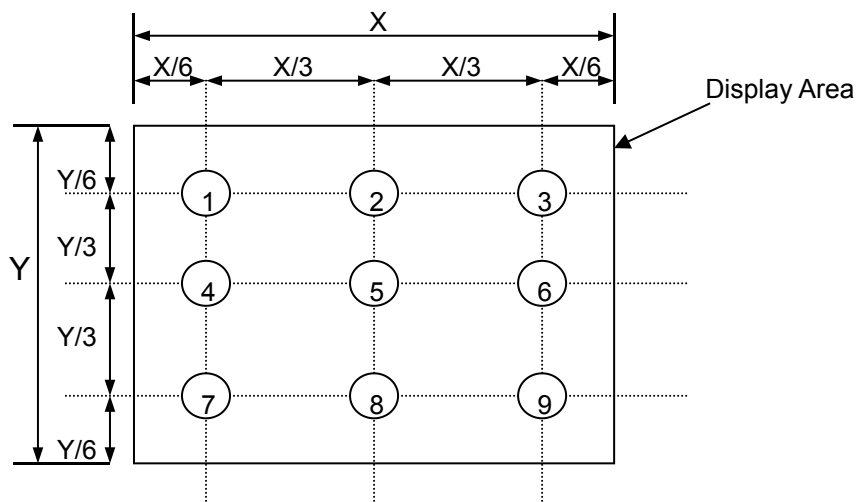
Using the transmissive mode measurement approach, measure the white screen luminance of the display panel and backlight.

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

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

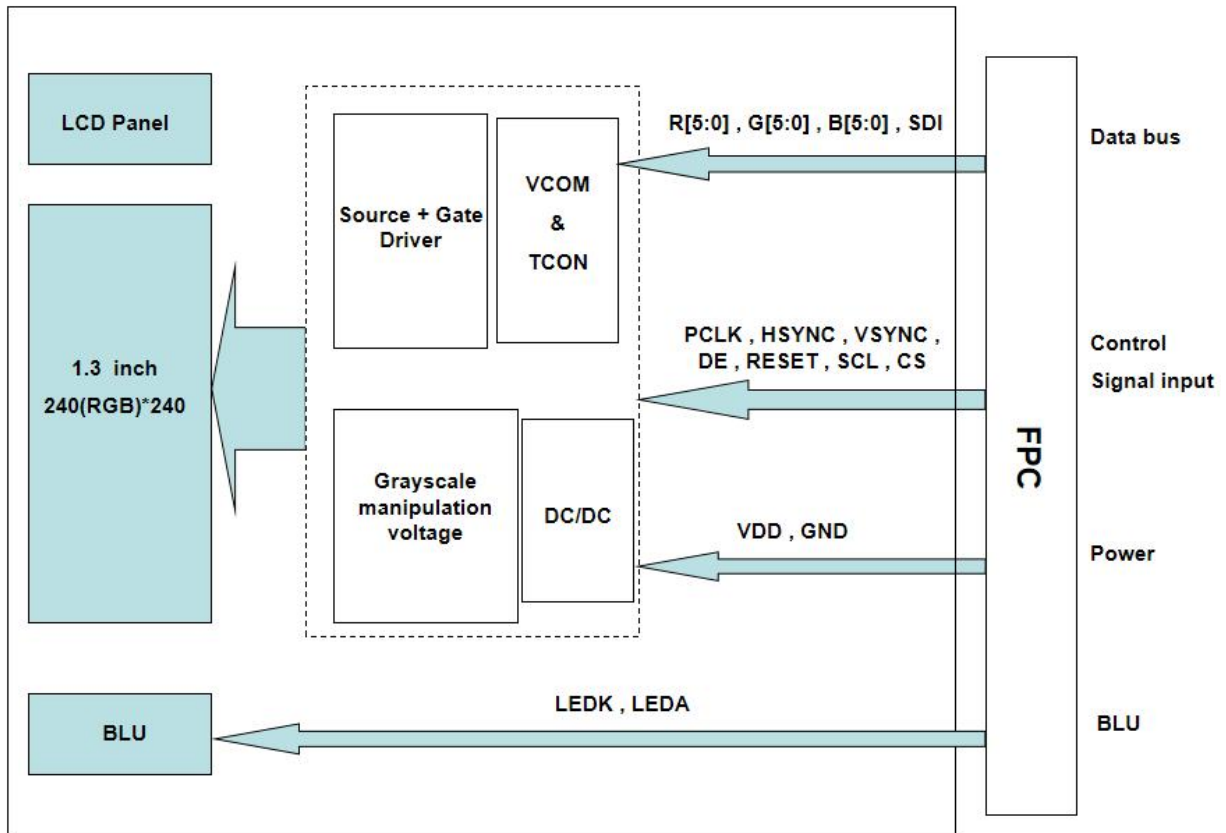
6.6.3. Transmittance =  $L_V \text{ on LCD} / L_V \text{ on Backlight} * 100\%$

Note: Measuring machine: BM-7





## 7. Block Diagram and Power Supply

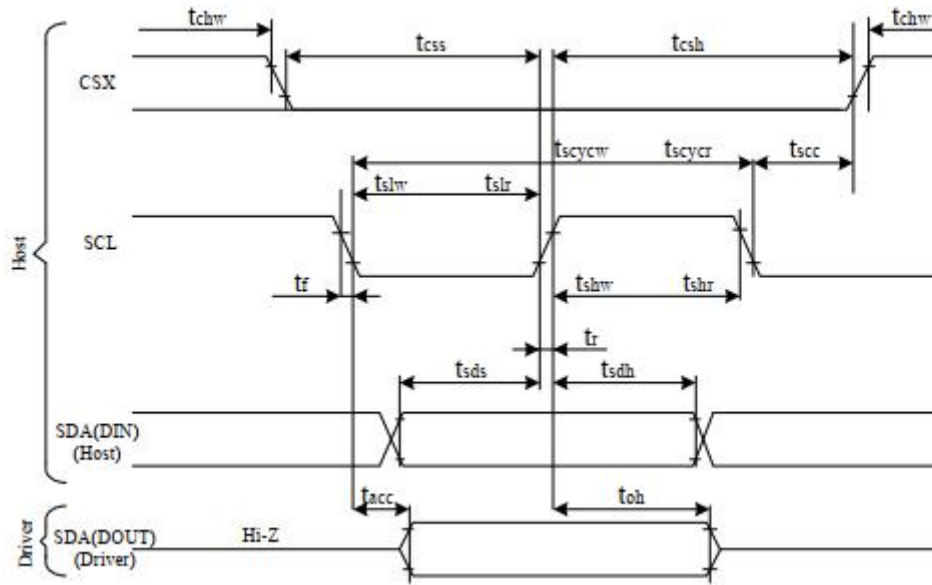


## 8. Interface Pins Definition

No.	Symbol	Function	Remark
1	LEDK	Led cathode	
2	LEDA	Led anode	
3	VDD	Power supply	
4	GND	Ground	
5	R0	Red data signal	
6	R1	Red data signal	
7	R2	Red data signal	
8	R3	Red data signal	
9	R4	Red data signal	
10	R5	Red data signal	
11	G0	Green data signal	
12	G1	Green data signal	
13	G2	Green data signal	
14	G3	Green data signal	
15	G4	Green data signal	
16	G5	Green data signal	
17	B0	Blue data signal	
18	B1	Blue data signal	
19	B2	Blue data signal	
20	B3	Blue data signal	
21	B4	Blue data signal	
22	B5	Blue data signal	
23	GND	Ground	
24	PCLK	Clock signal to sample each data	
25	GND	Ground	
26	HSYNC	Horizontal synchronizing signal	
27	VSYNC	Vertical synchronizing signal	
28	DE	Input data enable control.	
29	RESET	Reset pin	
30	SCL	Serial Clock	
31	CS	Chip select signal	
32	SDI	Serial Data Input	

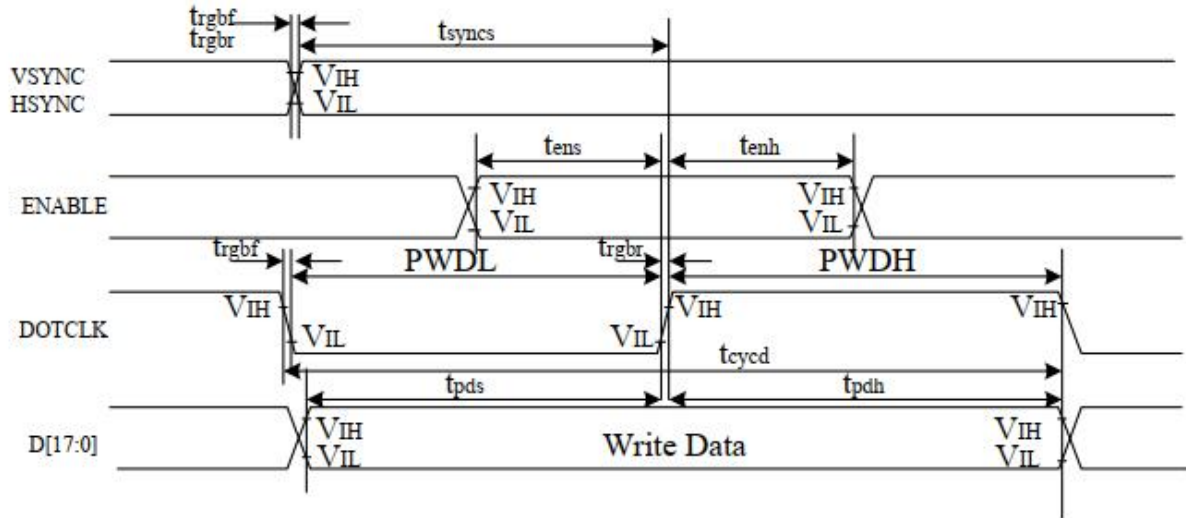
## 9. AC Characteristics

### 9.1. Serial Interface Characteristics (3-line serial)



Signal	Symbol	Parameter	min	max	Uni t	Description
SCL	tscycw	Serial Clock Cycle (Write)	10	-	ns	
	tshw	SCL "H" Pulse Width (Write)	5	-	ns	
	tslw	SCL "L" Pulse Width (Write)	5	-	ns	
	tscycr	Serial Clock Cycle (Read)	150	-	ns	
	tshr	SCL "H" Pulse Width (Read)	60	-	ns	
	tslr	SCL "L" Pulse Width (Read)	60	-	ns	
SDA/SDI (Input)	tsds	Data setup time (Write)	5	-	ns	
	tsdh	Data hold time (Write)	5	-	ns	
SDA/SD0(Outp )	tacc	Access time (Read)	10	-	ns	
CSX	tacc	SCL-CSX	10	-	ns	
	tchwr	CSX "H" Pulse Width	10	-	ns	
	tcsw	CSX-SCL Time	20	-	ns	
	tcsh		40	-	ns	

## 9.2. RGB Interface Characteristics



Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC/HSYN C	$t_{syncs}$	VSYNC/HSYNC setup time	15	-	ns	18/16-bit bus RGB interface mode
	$t_{synch}$	VSYNC/HSYNC hold time	15	-	ns	
DE	$t_{ens}$	DE setup time	15	-	ns	
	$t_{enh}$	DE hold time	15	-	ns	
D[17:0]	$t_{pos}$	Data setup time	15	-	ns	
	$t_{pdh}$	Date hold time	15	-	ns	
DOTCLK	$PWDH$	DOTCLK high-level period	15	-	ns	
	$PWDL$	DOTCLK low-level period	15	-	ns	
	$t_{cyed}$	DOTCLK cycle time	100	-	ns	
	$trgbr, trgbf$	DOTCLK, HSYNC, VSYNC rise/fall time	-	15	ns	
VSYNC/HSYN C	$t_{syncs}$	VSYNC/HSYNC setup time	15	-	ns	6-bit bus RGB interface mode
	$t_{synch}$	VSYNC/HSYNC hold time	15	-	ns	
DE	$t_{ens}$	DE setup time	15	-	ns	
	$t_{enh}$	DE hold time	15	-	ns	
D[17:0]	$t_{pos}$	Data setup time	15	-	ns	
	$t_{pdh}$	Date hold time	15	-	ns	
DOTCLK	$PWDH$	DOTCLK high-level pulse period	15	-	ns	
	$PWDL$	DOTCLK low-level pulse period	15	-	ns	
	$t_{cyed}$	DOTCLK cycle time	100	-	ns	
	$trgbr, trgbf$	DOTCLK, HSYNC, VSYNC rise/fall time	-	15	ns	

## 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.

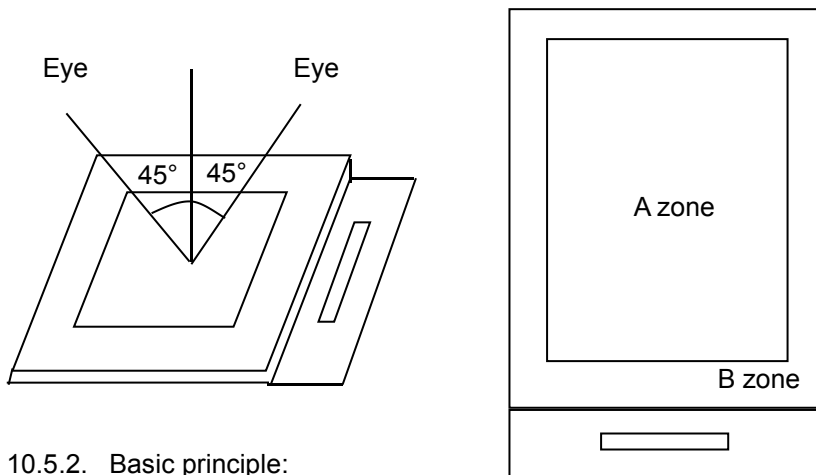
### 10.5.Standard of the Product Visual Inspection

#### 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 ± 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,



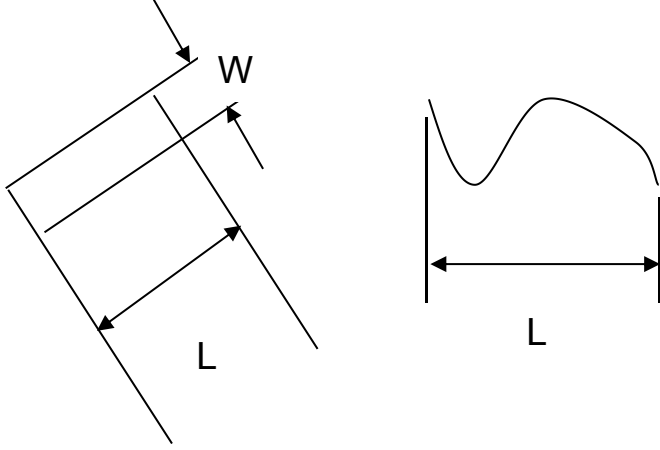
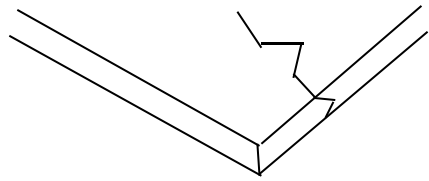
10.5.2. Basic principle:

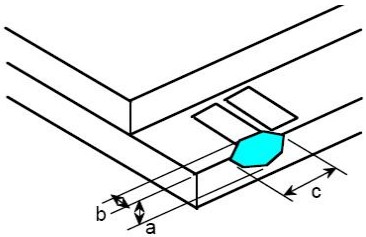
10.5.2.1. A set of sample to indicate the limit of acceptable quality level must be discussed by both us and customer when there is any dispute happened.

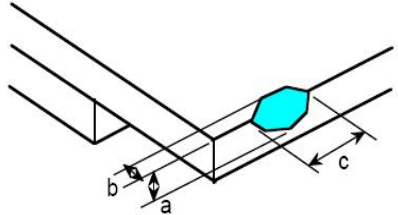
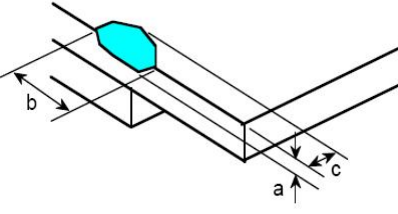
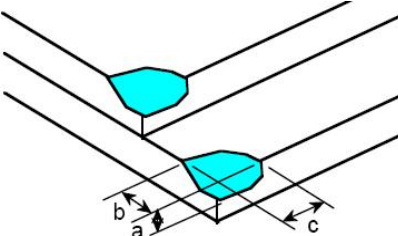
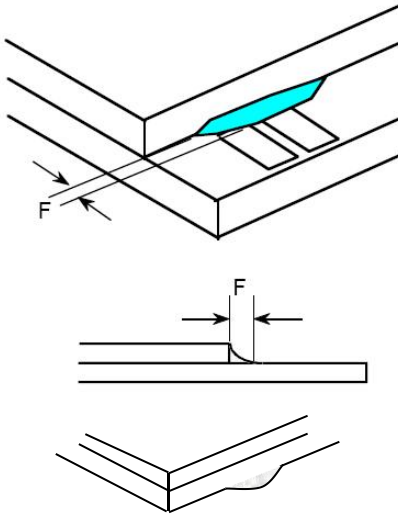
10.5.2.2. New item must be added on time when it is necessary.

### 10.6. Inspection Specification

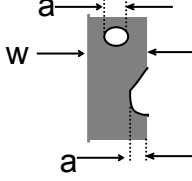
No.	Item	Criteria (Unit: mm)																			
01	Black / White spot Foreign material (Round type) Pinholes Stain Particles inside cell. (Minor defect)	$\phi = (a + b) / 2$ Distance between 2 defects should more than 3mm apart.	<table border="1"> <thead> <tr> <th>Size \ Area</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\phi \leq 0.10</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.10 &lt; \phi \leq 0.15</math></td> <td>2</td> </tr> <tr> <td><math>0.15 &lt; \phi \leq 0.25</math></td> <td>1</td> </tr> <tr> <td><math>0.25 &lt; \phi</math></td> <td>0</td> </tr> <tr> <td><b>Total</b></td> <td><b>2 no include <math>\phi \leq 0.10</math></b></td> </tr> </tbody> </table>	Size \ Area	Acc. Qty	$\phi \leq 0.10$	Ignore	$0.10 < \phi \leq 0.15$	2	$0.15 < \phi \leq 0.25$	1	$0.25 < \phi$	0	<b>Total</b>	<b>2 no include <math>\phi \leq 0.10</math></b>						
			Size \ Area	Acc. Qty																	
$\phi \leq 0.10$	Ignore																				
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$0.25 < \phi$	0																				
<b>Total</b>	<b>2 no include <math>\phi \leq 0.10</math></b>																				
02	Electrical Defect (Minor defect)	<table border="1"> <thead> <tr> <th></th> <th>Display Area</th> <th>Total</th> <th rowspan="3">Note1</th> </tr> </thead> <tbody> <tr> <td><b>Bright dot</b></td> <td><b>0</b></td> <td><b>0</b></td> </tr> <tr> <td><b>Dark dot</b></td> <td><b>N ≤ 2</b></td> <td><b>N ≤ 2</b></td> </tr> <tr> <td><b>Total dot</b></td> <td><b>N ≤ 2</b></td> <td><b>N ≤ 2</b></td> <td></td> </tr> <tr> <td><b>Mura</b></td> <td colspan="2"><b>Not visible through 5% ND filters.</b></td> <td>Note2</td> </tr> </tbody> </table>		Display Area	Total	Note1	<b>Bright dot</b>	<b>0</b>	<b>0</b>	<b>Dark dot</b>	<b>N ≤ 2</b>	<b>N ≤ 2</b>	<b>Total dot</b>	<b>N ≤ 2</b>	<b>N ≤ 2</b>		<b>Mura</b>	<b>Not visible through 5% ND filters.</b>		Note2	Remark: 1. Bright dot caused by scratch and foreign object accords to item 1.
	Display Area	Total	Note1																		
<b>Bright dot</b>	<b>0</b>	<b>0</b>																			
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<b>Mura</b>	<b>Not visible through 5% ND filters.</b>		Note2																		

<p>03</p>	<p>Black and White line Scratch Foreign material (Line type) (Minor defect)</p>	 <table border="1" data-bbox="558 705 1181 1019"> <thead> <tr> <th>Length</th> <th>Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td>/</td> <td><math>W \leq 0.03</math></td> <td>Ignore</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td>3</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.05 &lt; W \leq 0.10</math></td> <td>2</td> </tr> <tr> <td>/</td> <td><math>0.1 &lt; W</math></td> <td></td> </tr> <tr> <td colspan="2">Total</td> <td>3</td> </tr> </tbody> </table> <p>Distance between 2 defects should more than 3mm apart. Scratches not viewable through the back of the display are acceptable.</p>	Length	Width	Acc. Qty	/	$W \leq 0.03$	Ignore	$L \leq 2.5$	$0.03 < W \leq 0.05$	3	$L \leq 2.5$	$0.05 < W \leq 0.10$	2	/	$0.1 < W$		Total		3
Length	Width	Acc. Qty																		
/	$W \leq 0.03$	Ignore																		
$L \leq 2.5$	$0.03 < W \leq 0.05$	3																		
$L \leq 2.5$	$0.05 < W \leq 0.10$	2																		
/	$0.1 < W$																			
Total		3																		
<p>04</p>	<p>Glass Crack (Minor defect)</p>	 <p>Crack is potential to enlarge, any type is not allowed.</p>																		

<p>05</p>	<p>Glass Chipping Pad Area: (Minor defect)</p> 	<table border="1" data-bbox="869 1556 1340 1736"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &gt; 3.0, b &lt; 1.0</math></td> <td>1</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 1.0</math></td> <td>3</td> </tr> <tr> <td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </table>	Length and Width	Acc. Qty	$c > 3.0, b < 1.0$	1	$c < 3.0, b < 1.0$	3	$a < \text{Glass Thickness}$	
Length and Width	Acc. Qty									
$c > 3.0, b < 1.0$	1									
$c < 3.0, b < 1.0$	3									
$a < \text{Glass Thickness}$										

<p>06</p>	<p>Glass Chipping Rear of Pad Area: (Minor defect)</p> 	<table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &gt; 3.0, b &lt; 1.0</math></td> <td>1</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 1.0</math></td> <td>2</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 0.5</math></td> <td>4</td> </tr> <tr> <td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </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	$a < \text{Glass Thickness}$	
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											
$a < \text{Glass Thickness}$												
<p>07</p>	<p>Glass Chipping Except Pad Area: (Minor defect)</p> 	<table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>c &gt; 3.0, b &lt; 1.0</math></td> <td>1</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 1.0</math></td> <td>2</td> </tr> <tr> <td><math>c &lt; 3.0, b &lt; 0.5</math></td> <td>4</td> </tr> <tr> <td colspan="2"><math>a &lt; \text{Glass Thickness}</math></td> </tr> </tbody> </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	$a < \text{Glass Thickness}$	
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											
$a < \text{Glass Thickness}$												
<p>08</p>	<p>Glass Corner Chipping: (Minor defect)</p> 	<table border="1"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <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> </tbody> </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											
$a < \text{Glass Thickness}$												
<p>09</p>	<p>Glass Burr: (Minor defect)</p> 	<table border="1"> <thead> <tr> <th>Length</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>F &lt; 1.0</math></td> <td>Ignore</td> </tr> </tbody> </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>. (<math>w</math>: circuitry width.) 10.2 Open circuit is unacceptable. 10.3 No oxidation, contamination and distortion.</p>										
11	Bubble on Polarizer (Minor defect)	<table border="1" data-bbox="743 577 1214 790"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\varphi \leq 0.20</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.20 &lt; \varphi \leq 0.30</math></td> <td>4</td> </tr> <tr> <td><math>0.30 &lt; \varphi \leq 0.50</math></td> <td>1</td> </tr> <tr> <td><math>0.50 &lt; \varphi</math></td> <td>None</td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\varphi \leq 0.20$	Ignore	$0.20 < \varphi \leq 0.30$	4	$0.30 < \varphi \leq 0.50$	1	$0.50 < \varphi$	None
Diameter	Acc. Qty											
$\varphi \leq 0.20$	Ignore											
$0.20 < \varphi \leq 0.30$	4											
$0.30 < \varphi \leq 0.50$	1											
$0.50 < \varphi$	None											
12	Dent on Polarizer (Minor defect)	<table border="1" data-bbox="743 840 1214 1052"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\varphi \leq 0.20</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.20 &lt; \varphi \leq 0.30</math></td> <td>4</td> </tr> <tr> <td><math>0.30 &lt; \varphi \leq 0.50</math></td> <td>1</td> </tr> <tr> <td><math>0.50 &lt; \varphi</math></td> <td>None</td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\varphi \leq 0.20$	Ignore	$0.20 < \varphi \leq 0.30$	4	$0.30 < \varphi \leq 0.50$	1	$0.50 < \varphi$	None
Diameter	Acc. Qty											
$\varphi \leq 0.20$	Ignore											
$0.20 < \varphi \leq 0.30$	4											
$0.30 < \varphi \leq 0.50$	1											
$0.50 < \varphi$	None											
13	Bezel	<p>13.1 No rust, distortion on the Bezel. 13.2 No visible fingerprints, stains or other contamination.</p>										
14	PCB	<p>14.1 No distortion or contamination on PCB terminals. 14.2 All components on PCB must same as documented on the BOM/component layout. 14.3 Follow IPC-A-600F.</p>										
15	Soldering	Follow IPC-A-610C standard										
16	Electrical Defect (Major defect)	<p>The below defects must be rejected. 16.1 Missing vertical / horizontal segment, 16.2 Abnormal Display. 16.3 No function or no display. 16.4 Current exceeds product specifications. 16.5 LCD viewing angle defect. 16.6 No Backlight. 16.7 Dark Backlight. 16.8 Touch Panel no function.</p>										

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.

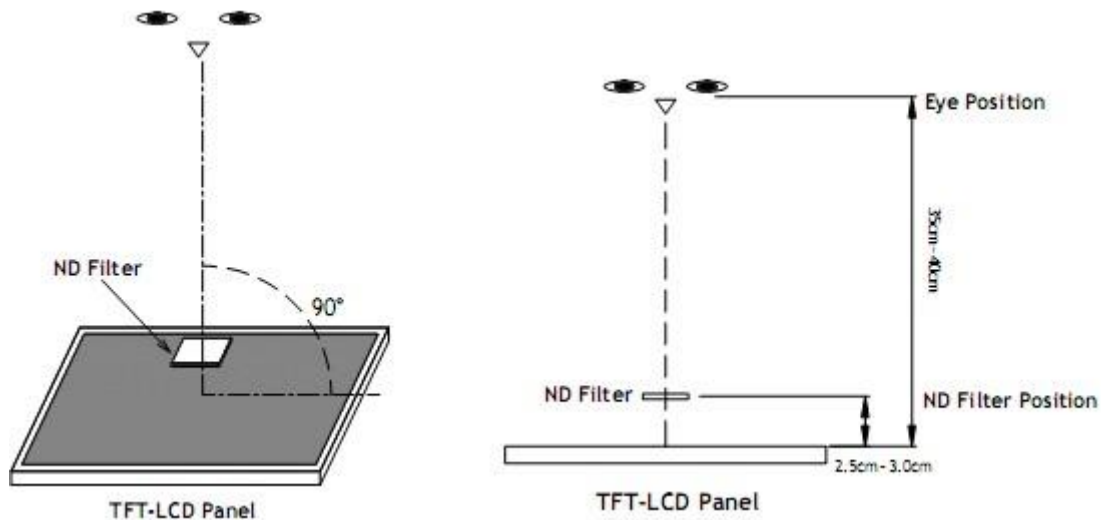
## 10.8. Identification/marketing criteria

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

## 10.9. Packaging

- 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	<b>70°C, 96Hrs</b>	2	GB/T2423.2-2008
2	Low Temperature Operating	<b>-20°C, 96Hrs</b>	2	GB/T2423.1-2008
3	High Humidity Storage	<b>50°C, 90%RH, 96Hrs</b>	2	GB/T2423.3-2016
4	High Temperature Storage	<b>80°C, 96Hrs</b>	2	GB/T2423.2-2008
5	Low Temperature Storage	<b>-30°C, 96Hrs</b>	2	GB/T2423.1-2008
6	Thermal Cycling Test Storage	-20°C, 60min~70°C, 60min, 20 cycles.	2	GB/T2423.22-2012
7	Packing vibration	Frequency range:10Hz~50Hz Acceleration of gravity:5G X, Y, Z 30 min for each direction.	-	GB/T5170.14-2009
8	Electrical Static Discharge	Air: ±4KV 150pF/330 Ω 5 times Contact: ±2KV 150pF/330 Ω 5 times	2	GB/T17626.2-2018
9	Drop Test (Packaged)	Height:80 cm,1 corner, 3 edges, 6 surfaces.	-	GB/T2423.8-1995

Note1. No defection cosmetic and operational function allowable.

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

## 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

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

#### 12.4.1.2. Recommended Soldering Conditions

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

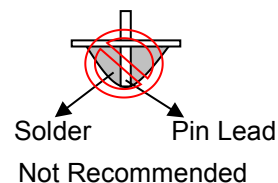
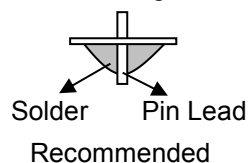
Maximum Solder Temperature: 370 °C

Maximum Solder Time: 3s at the maximum temperature

Recommended Soldering Temp: 350±20 °C

Typical Soldering Time: ≤3s

#### 12.4.1.3. Solder Wetting



#### 12.4.2. Pins of EL

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

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

#### 12.4.2.3. Recommended Soldering Conditions

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

Recommended Solder Temperature: 270~290 °C

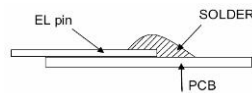
Typical Soldering Time: ≤2s

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

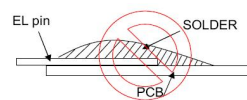
12.4.2.4. No horizontal press on the EL leads during soldering.

12.4.2.5. 180° bend EL leads three times is not allowed.

12.4.2.6. Solder Wetting

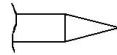


Recommended

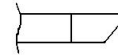


Not Recommended

12.4.2.7. The type of the solder iron:

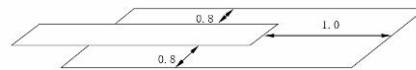


Recommended



Not Recommended

12.4.2.8. 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 time not longer than one 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

14. Outline Drawing

