

# PRODUCT SPECIFICATION

## 6.2" TN TFT LCD MODULE

MODEL: T062800480-A1TMN-001 Ver:1.1



< ◇ > 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
1.0	2017.10.13	ZDT	Initial Release	
1.1	2018.04.26	ZFY	Modify many details	P21/P22

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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)	6.2"	
LCD type	TN TFT	
Display Mode	Normally White/Transmissive	
Resolution	800 RGB x 480	Pixels
View Direction	12 O'clock	Best Image
Gray Scale Inversion Direction	6 O'clock	
Module Outline	155.2(H) x 88.2 (V) x 5.0(T) (Note1 )	mm
Active Area	137.52 (H) x 77.23(V)	mm
Pixel Size	171.9 (H) x 160.9(V)	um
Pixel Arrangement	R.G.B Vertical Stripe	
Display Colors	16.7M	
Interface	24-bit RGB interface	
With or Without Touch Panel	Without	
Operating Temperature	<b>-20~70</b>	°C
Storage Temperature	<b>-30~80</b>	°C
Weight	TBD	g

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

## 3. Absolute Maximum Ratings

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

Item	Symbol	Min.	Max.	Unit
Supply Voltage	VDD	3.2	3.6	V
Storage temperature	$T_{STG}$	-30	+80	°C
Operating temperature	$T_{OP}$	-20	+70	°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.

## 4. DC Characteristics

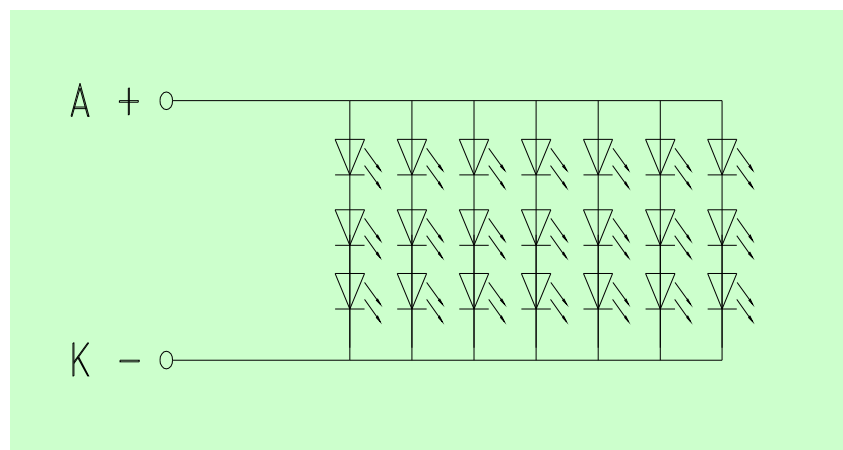
Item	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	VCC	2.7	3.3	3.6	V
	AVCC	6.5	-	13.5	
Logic Low input voltage	V <sub>IL</sub>	0	-	0.3*VCC	V
Logic High input voltage	V <sub>IH</sub>	0.7*VCC	-	VCC	V
Logic Low output voltage	V <sub>OL</sub>	-	-	GND+0.4	V
Logic High output voltage	V <sub>OH</sub>	VCC-0.4	-	-	V
Current Consumption	I <sub>CC+I<sub>IN</sub></sub>	-	TBD	-	mA
All Black					
	Analog				

## 5. Backlight Characteristic

### 5.1. Backlight Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Backlight Voltage	V <sub>LED</sub>	Ta=25 °C, I <sub>F</sub> =20mA/LED	-	<b>9.3</b>	-	V
Backlight Current	I <sub>LED</sub>	Ta=25 °C, V <sub>F</sub> =3.1V/LED		<b>140</b>		mA
Power dissipation	P <sub>D</sub>			1302		mW
Uniformity	Avg		-	80	-	%
Drive method	<b>Constant current</b>					
LED Configuration	21 White LEDs(3 LEDs in one string and 7 groups in parallel)					

### 5.2. Backlighting circuit



## 6. Touch Screen Panel Specifications

Without TP

## 7. Optical Characteristics

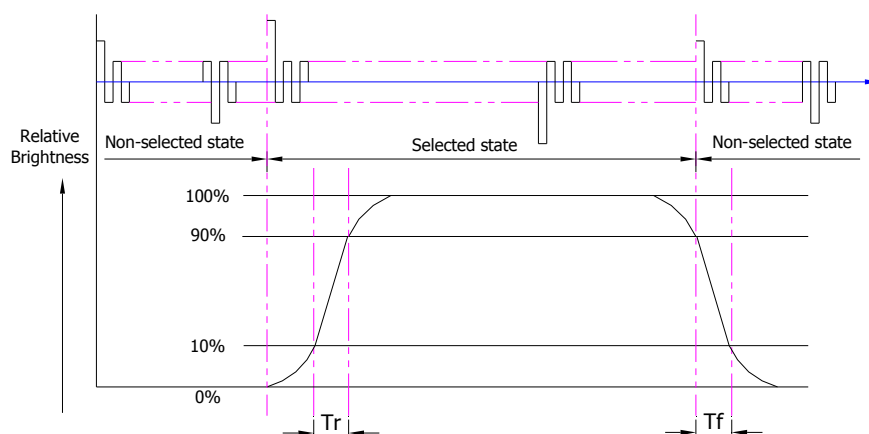
### 7.1. Optical Characteristics

Ta=25°C

	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 $\theta_x = \phi_y = 0^\circ$	300	380	-	cd/m <sup>2</sup>	
	Contrast ratio(See 7.3)	CR		-	600	-		
	Response time (See 7.2)	TR+TF		-	40	-	ms	
	Chromaticity Transmissive (See 7.5)	Red	XR	Center CR $\geq 10$		TBD		
			YR			TBD		
		Green	XG			TBD		
			YG			TBD		
		Blue	XB			TBD		
			YB			TBD		
	White	XW		TBD				
YW			TBD					
Viewing Angle (See 7.4)	Horizontal	$\theta_{x+}$	Center CR $\geq 10$	60	75	-	Deg.	
		$\theta_{x-}$		60	75	-		
	Vertical	$\phi_{y+}$		55	70	-		
		$\phi_{y-}$		55	70	-		
	NTSC Ratio(Gamut)			-	50	-	%	

### 7.2. Definition of Response Time

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

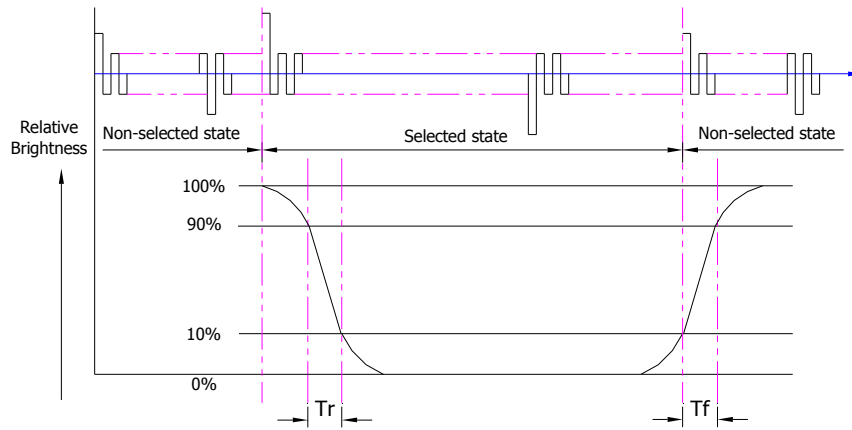


$T_r$  is the time it takes to change from non-selected stage with relative luminance 10% to selected state with relative luminance 90%;

$T_f$  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

7.2.2. 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

7.3. Definition of Contrast Ratio

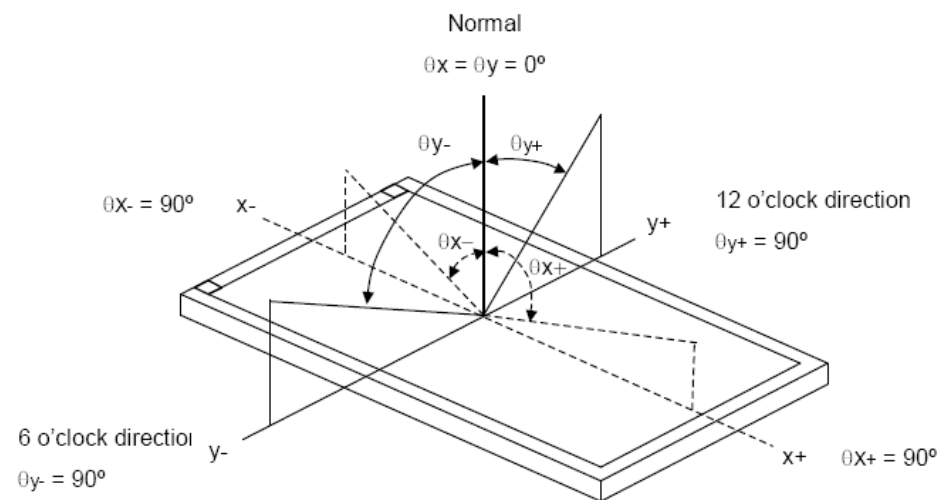
Contrast is measured perpendicular to display surface in reflective and transmissive mode.

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

7.4. Definition of Viewing Angles



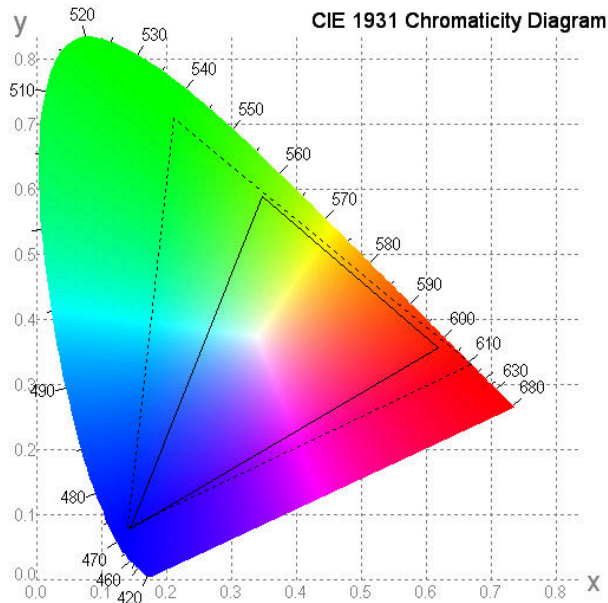
Measuring machine: LCD-5100 or EQUI

### 7.5. 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)



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

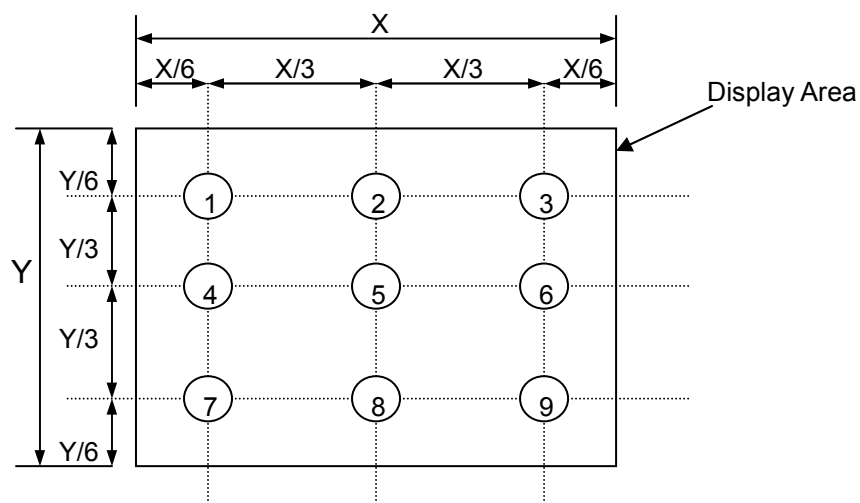
Using the transmissive mode measurement approach, measure the white screen luminance of the display panel and backlight.

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

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

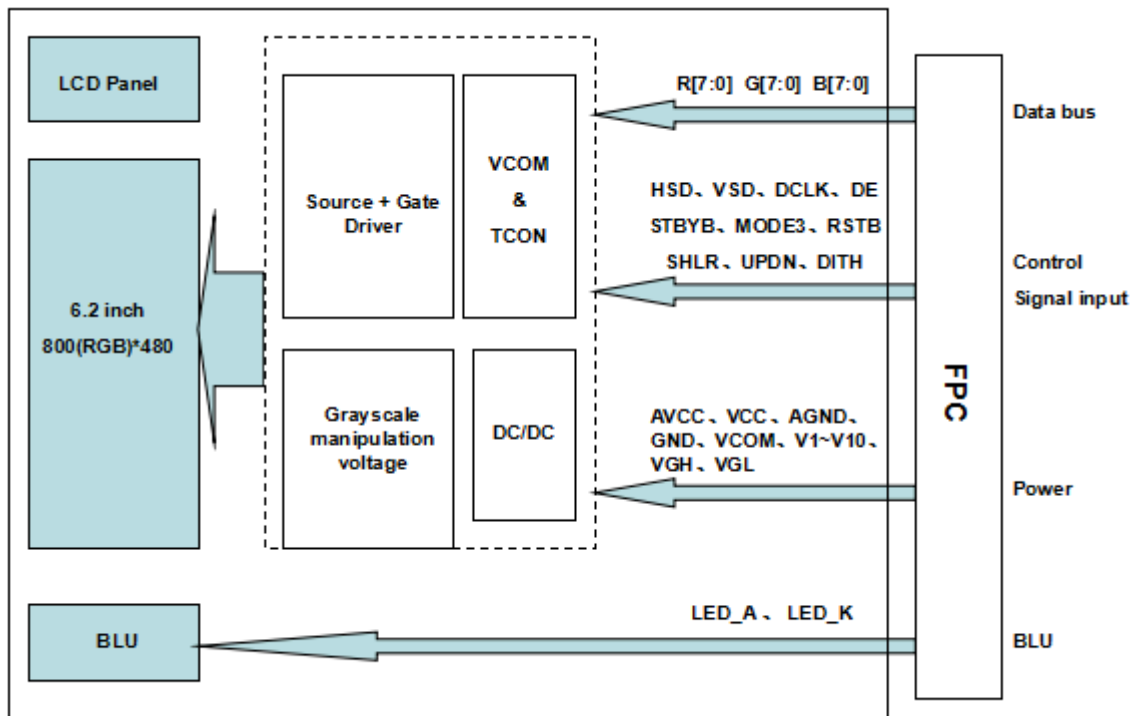
7.6.3. Transmittance =  $L_V$  on LCD /  $L_V$  on Backlight \* 100%

Note: Measuring machine: BM-7





## 8. Block Diagram and Power Supply



**9. Interface Pins Definition**

No.	Symbol	Function	Remark
1	AGND	Analog Ground	
2	AVCC	Analog Power	
3	VCC	Digital Power	
4	R0	RED DATA	
5	R1	RED DATA	
6	R2	RED DATA	
7	R3	RED DATA	
8	R4	RED DATA	
9	R5	RED DATA	
10	R6	RED DATA	
11	R7	RED DATA	
12	G0	GREEN DATA	
13	G1	GREEN DATA	
14	G2	GREEN DATA	
15	G3	GREEN DATA	
16	G4	GREEN DATA	
17	G5	GREEN DATA	
18	G6	GREEN DATA	
19	G7	GREEN DATA	
20	B0	BLUE DATA	
21	B1	BLUE DATA	
22	B2	BLUE DATA	
23	B3	BLUE DATA	
24	B4	BLUE DATA	
25	B5	BLUE DATA	
26	B6	BLUE DATA	
27	B7	BLUE DATA	
28	DCLK	CLOCK SIGNAL	
29	DE	DATA ENABLE	
30	HSD	HORIZONTAL SYNC INPUT IN RGB MODE	
31	VSD	VERTICAL SYNC INPUT IN RGB MODE	
32	MODE3	DE/SYNC mode select MODE3=H: DE mode( normally pull high) MODE3=L: HSD/VSD mode	
33	RSTB	Global reset pin.Active low to enter reset state. Suggest to connecting with an RC reset circuit for stability. Normally pull high. (RC circuit :R=10K $\Omega$ , C=1uF))	
34	STBYB	Standby mode,normally pull high STBYB="1",norma operation STBYB="0",timming control ,soruce driver will turn off,all output arehigh-Z	

35	SHLR	Source right or left sequence control SHLR=H: right shift, Left Right SHLR=L: left right, Right Left NC	
36	VCC	Digital Power	
37	UPDN	Gate up or down scan control UPDN=H: up shift, Down Up UPDN=L: down shift, Up Down	
38	GND	Digital Ground	
39	AGND	Analog Ground	
40	AVCC	Analog Power	
41	VCOM	For external VCOM DC input	
42	DITH	Dithering setting DITH="H" 6-bit resolution (last 2 bits of input data truncated) DITH="L" 8-bit resolution (default setting)	
43	NC	Not connect For Test	
44	NC	Not connect	
45	V10	Gamma correction voltage reference	
46	V9	Gamma correction voltage reference	
47	V8	Gamma correction voltage reference	
48	V7	Gamma correction voltage reference	
49	V6	Gamma correction voltage reference	
50	V5	Gamma correction voltage reference	
51	V4	Gamma correction voltage reference	
52	V3	Gamma correction voltage reference	
53	V2	Gamma correction voltage reference	
54	V1	Gamma correction voltage reference	
55	NC	Not connect	
56	VGH	Positive Power for TFT	
57	VCC	Digital Power	
58	VGL	Negative Power for TFT	
59	GND	Digital Ground	
60	NC	Not connect	

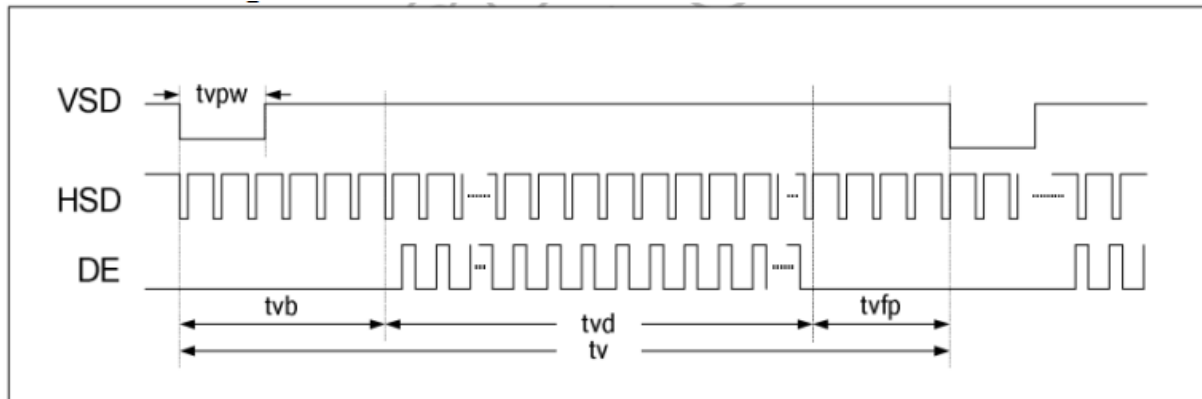
## 10. AC Characteristics and Timing

### 10.1.AC Electrical Characteristics

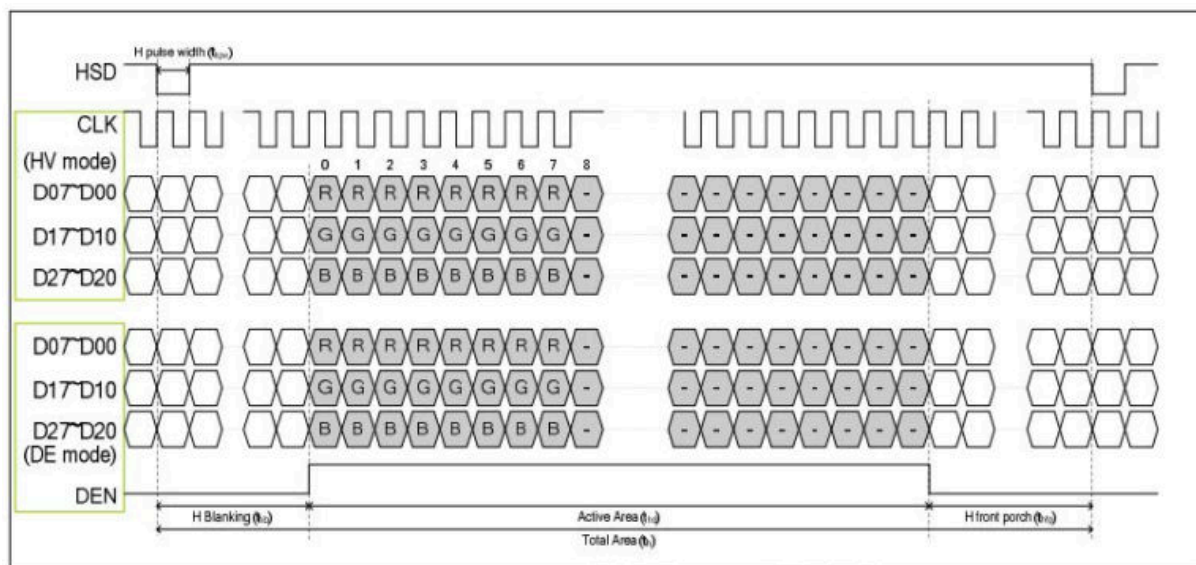
Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
HS setup time	$T_{hst}$	8	-	-	ns
HS hold time	$T_{hhd}$	8	-	-	ns
VS setup time	$T_{vst}$	8	-	-	ns
VS hold time	$T_{vhd}$	8	-	-	ns
Data setup time	$T_{dsu}$	8	-	-	ns
Data hold time	$T_{dhd}$	8	-	-	ns
DE setup time	$T_{esu}$	8	-	-	ns
DE hold time	$T_{ehd}$	8	-	-	ns
VDD Power On Slew rate	$T_{POR}$	-	-	20	ms
RSTB pulse width	$T_{Rst}$	10	-	-	us
CLKIN cycle time	$T_{cph}$	20	-	-	ns
CLKIN pulse duty	$T_{cwh}$	40	50	60	%
Output stable time	$T_{sst}$	-	-	6	us

### 10.2.Display Data Input Timing

Vertical Input Timing:



Horizontal Input Timing:



I Horizontal timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Horizontal Display Area	thd	800			DCLK
DCLK frequency	fclk	-	30	50	MHz
One Horizontal Line	th	889	928	1143	DCLK
HS pulse width	thpw	1	48	255	DCLK
HS Back Porch (Blanking)	thb	88			DCLK
HS Front Porch	thfp	1	40	255	DCLK
DE mode Blanking	th-thd	85	128	512	DCLK

I Vertical timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Vertical Display Area	tvd	480			T <sub>H</sub>
VS period time	tv	513	525	767	T <sub>H</sub>
VS pulse width	tvpw	3	3	255	T <sub>H</sub>
VS Back Porch (Blanking)	tvb	32			T <sub>H</sub>
VS Front Porch	tvfp	1	13	255	T <sub>H</sub>
DE mode Blanking	tv-tvd	4	45	255	T <sub>H</sub>

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## 11. Quality Assurance

### 11.1. Purpose

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

### 11.2. Standard for Quality Test

#### 11.2.1 Sampling Plan:

GB2828.1-2012

Single sampling, general inspection level II

#### 11.2.2 Sampling Criteria:

Visual inspection: AQL 1.5%

Electrical functional: AQL 0.65%.

#### 11.2.3 Reliability Test:

Detailed requirement refer to Reliability Test Specification.

### 11.3. Nonconforming Analysis & Disposition

#### 11.3.1 Nonconforming analysis:

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

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

11.3.1.3 If can not finish the analysis on time, customer will be notified with the progress status.

#### 11.3.2 Disposition of nonconforming:

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

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

### 11.4. Agreement Items

Shall negotiate with customer if the following situation occurs:

11.4.1 There is any discrepancy in standard of quality assurance.

11.4.2 Additional requirement to be added in product specification.

11.4.3 Any other special problem.

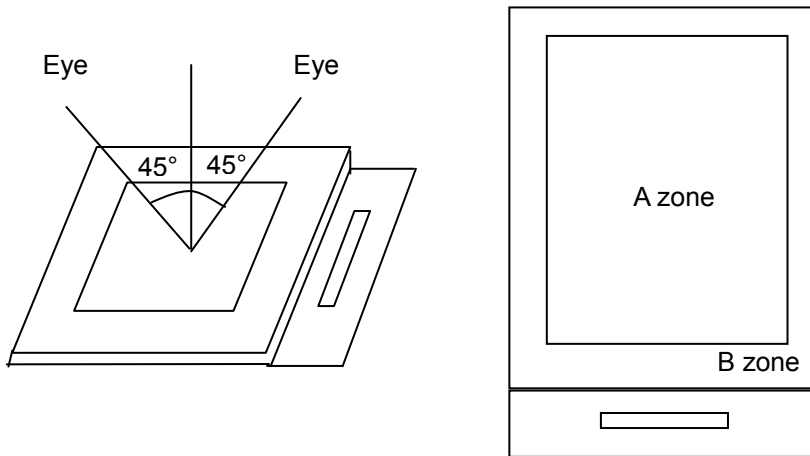
### 11.5. Standard of the Product Visual Inspection

#### 11.5.1 Appearance inspection:

11.5.1.1 The inspection must be under illumination about 1000 – 1500 lx, and the distance of view must be at 30cm ± 2cm.

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

11.5.1.3 Definition of area: A Zone: Active Area, B Zone: Viewing Area,

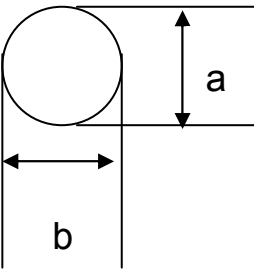


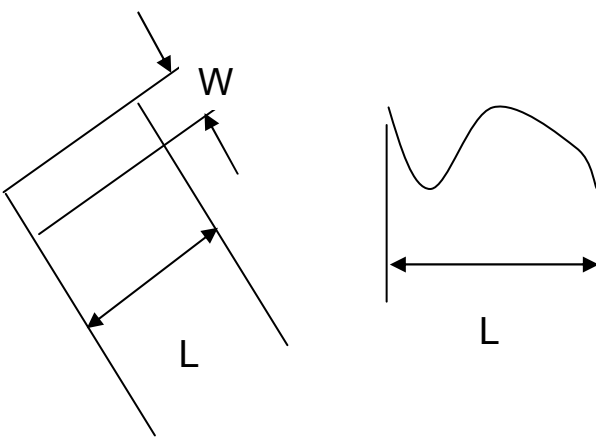
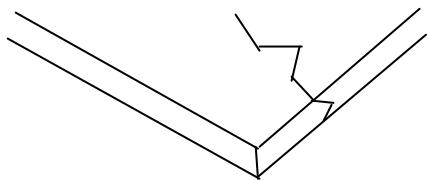
11.5.2 Basic principle:

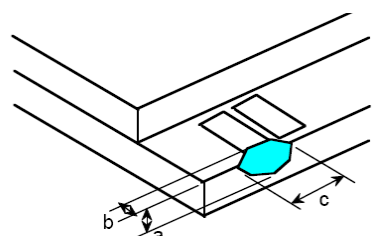
11.5.2.1 A set of sample to indicate the limit of acceptable quality level must be discussed by both us and customer when there is any dispute happened.

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

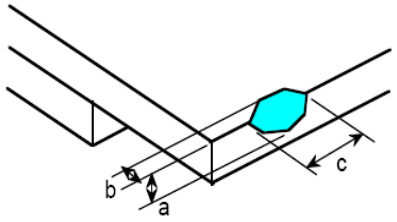
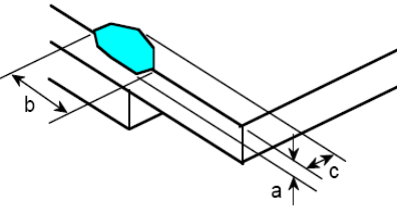
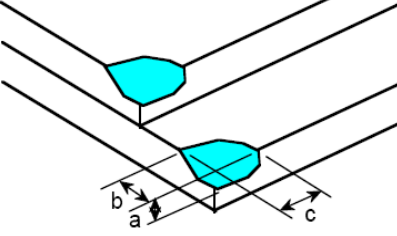
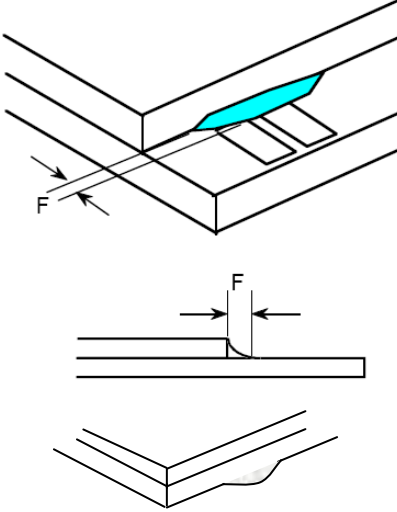
11.6. Inspection Specification

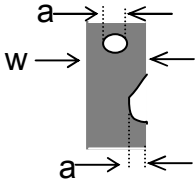
No.	Item	Criteria (Unit: mm)																		
01	Black / White spot Foreign material (Round type) Pinholes Stain Particles inside cell. (Minor defect)	 <p><math>\phi = (a + b) / 2</math> Distance between 2 defects should more than 5mm apart.</p>	<table border="1"> <thead> <tr> <th>Size</th> <th>Area</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\phi \leq 0.20</math></td> <td></td> <td>Ignore</td> </tr> <tr> <td><math>0.20 &lt; \phi \leq 0.50</math></td> <td></td> <td><math>N \leq 3</math></td> </tr> <tr> <td><math>0.50 &lt; \phi</math></td> <td></td> <td>0</td> </tr> </tbody> </table>	Size	Area	Acc. Qty	$\phi \leq 0.20$		Ignore	$0.20 < \phi \leq 0.50$		$N \leq 3$	$0.50 < \phi$		0					
Size	Area	Acc. Qty																		
$\phi \leq 0.20$		Ignore																		
$0.20 < \phi \leq 0.50$		$N \leq 3$																		
$0.50 < \phi$		0																		
02	Electrical Defect (Minor defect)	<table border="1"> <thead> <tr> <th rowspan="2">Bright dot</th> <th>Display Area</th> <th>Total</th> <th rowspan="3">Note1</th> </tr> </thead> <tbody> <tr> <td><math>N \leq 2</math></td> <td><math>N \leq 2</math></td> </tr> <tr> <th>Dark dot</th> <td><math>N \leq 4</math></td> <td><math>N \leq 4</math></td> </tr> <tr> <th>Total dot</th> <td><math>N \leq 4</math></td> <td><math>N \leq 4</math></td> </tr> <tr> <th>Mura</th> <td colspan="2">Not visible through 5% ND filters.</td> <th>Note2</th> </tr> </tbody> </table> <p>Remark: 1. Bright dot caused by scratch and foreign object accords to item 1.</p>			Bright dot	Display Area	Total	Note1	$N \leq 2$	$N \leq 2$	Dark dot	$N \leq 4$	$N \leq 4$	Total dot	$N \leq 4$	$N \leq 4$	Mura	Not visible through 5% ND filters.		Note2
Bright dot	Display Area	Total	Note1																	
	$N \leq 2$	$N \leq 2$																		
Dark dot	$N \leq 4$	$N \leq 4$																		
Total dot	$N \leq 4$	$N \leq 4$																		
Mura	Not visible through 5% ND filters.		Note2																	

03	Black and White line Scratch Foreign material (Line type) (Minor defect)	 <table border="1" data-bbox="598 750 1220 1019"> <thead> <tr> <th>Length</th> <th>Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td>/</td> <td><math>W \leq 0.1</math></td> <td>Ignore</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.1 &lt; W \leq 0.2</math></td> <td>3</td> </tr> <tr> <td><math>L &gt; 2.5</math></td> <td><math>0.2 &lt; W</math></td> <td>0</td> </tr> <tr> <td colspan="2">Total</td> <td>3</td> </tr> </tbody> </table> <p data-bbox="539 1052 1423 1131">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	/	$W \leq 0.1$	Ignore	$L \leq 2.5$	$0.1 < W \leq 0.2$	3	$L > 2.5$	$0.2 < W$	0	Total		3
Length	Width	Acc. Qty															
/	$W \leq 0.1$	Ignore															
$L \leq 2.5$	$0.1 < W \leq 0.2$	3															
$L > 2.5$	$0.2 < W$	0															
Total		3															
04	Glass Crack (Minor defect)	 <p data-bbox="539 1444 1173 1489">Crack is potential to enlarge, any type is not allowed.</p>															

05	Glass Chipping Pad Area: (Minor defect)	 <table border="1" data-bbox="869 1724 1332 1892"> <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" style="text-align: center;"><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" style="text-align: center;"><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" style="text-align: center;"><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>. (w: 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 748"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\phi \leq 0.30</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.30 &lt; \phi \leq 0.50</math></td> <td><math>N \leq 2</math></td> </tr> <tr> <td><math>0.50 &lt; \phi</math></td> <td><math>N=0</math></td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\phi \leq 0.30$	Ignore	$0.30 < \phi \leq 0.50$	$N \leq 2$	$0.50 < \phi$	$N=0$
Diameter	Acc. Qty									
$\phi \leq 0.30$	Ignore									
$0.30 < \phi \leq 0.50$	$N \leq 2$									
$0.50 < \phi$	$N=0$									
12	Dent on Polarizer (Minor defect)	<table border="1" data-bbox="743 801 1214 972"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\phi \leq 0.25</math></td> <td>Ignore</td> </tr> <tr> <td><math>0.25 &lt; \phi \leq 0.50</math></td> <td><math>N \leq 4</math></td> </tr> <tr> <td><math>0.50 &lt; \phi</math></td> <td>None</td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\phi \leq 0.25$	Ignore	$0.25 < \phi \leq 0.50$	$N \leq 4$	$0.50 < \phi$	None
Diameter	Acc. Qty									
$\phi \leq 0.25$	Ignore									
$0.25 < \phi \leq 0.50$	$N \leq 4$									
$0.50 < \phi$	None									
13	Bezel	<p>13.1 No rust, distortion on the Bezel. 13.2 No visible fingerprints, stains or other contamination.</p>								
14	Touch Panel	<p>D: Diameter W: width L: length 14.1 Spot: <math>D &lt; 0.25</math> is acceptable <math>0.25 \leq D \leq 0.4</math> 2dots are acceptable and the distance between defects should more than 10 mm. <math>D &gt; 0.4</math> is unacceptable 14.2 Dent: <math>D &gt; 0.40</math> is unacceptable 14.3 Scratch: <math>W \leq 0.03</math>, <math>L \leq 10</math> is acceptable, <math>0.03 &lt; W \leq 0.10</math>, <math>L \leq 10</math> is acceptable Distance between 2 defects should more than 10 mm. <math>W &gt; 0.10</math> is unacceptable.</p>								
15	LCD Ripple	<p>Touch the touch panel, cannot see the LCD ripple. Pen: R 0.8mm silicon rubber. Operation Force:100g</p>								
16	PCB	<p>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.</p>								
17	Soldering	Follow IPC-A-610C standard								

18	Electrical Defect (Major defect)	<p>The below defects must be rejected.</p> <p>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.</p>
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Remark: LCD Panel Broken shall be rejected. Defect out of LCD viewing area is acceptable.

### 11.7. Classification of Defects

11.7.1 Visual defects (Except no / wrong label) are treated as minor defect and electrical defect is major.

11.7.2 Two minor defects are equal to one major in lot sampling inspection.

### 11.8. Identification/marketing criteria

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

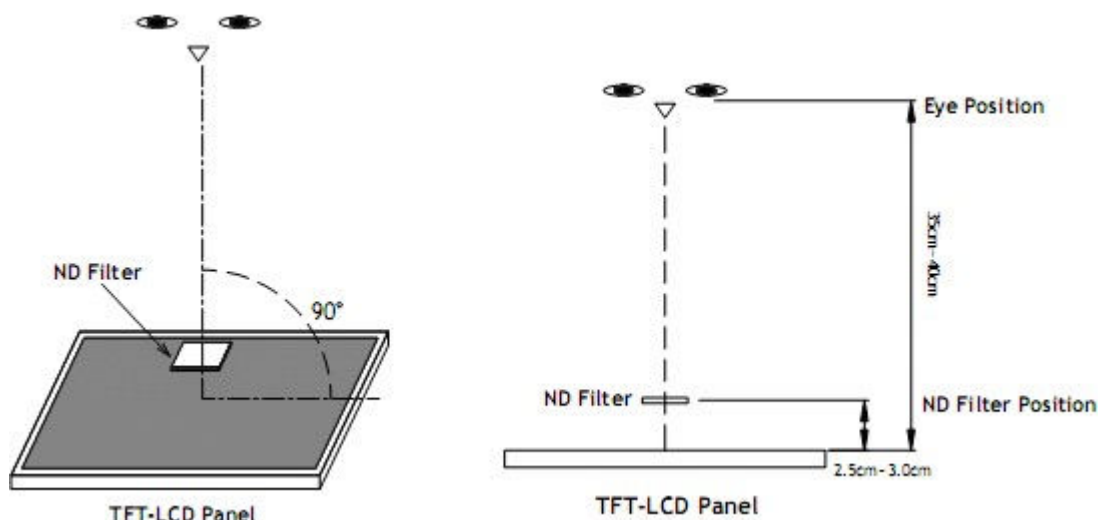
### 11.9. Packaging

11.9.1 There should be no damage of the outside carton box, each packaging box should have one identical label.

11.9.2 Modules inside package box should have compliant mark.

11.9.3 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.

## 12. Reliability Specification

No	Item	Condition	Quantity	Criteria
1	High Temperature Operating	<b>70°C, 72Hrs</b>	2	GB/T2423.2-2008
2	Low Temperature Operating	<b>-20°C, 72Hrs</b>	2	GB/T2423.1-2008
3	High Humidity	<b>50°C, 90%RH, 72Hrs</b>	2	GB/T2423.3-2006
4	High Temperature Storage	<b>80°C, 72Hrs</b>	2	GB/T2423.2-2008
5	Low Temperature Storage	<b>-30°C, 72Hrs</b>	2	GB/T2423.1-2008
6	Thermal Cycling Test	-20°C, 30min~70°C, 30min, 10 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.	2	GB/T5170.14-2009
8	Electrical Static Discharge	Air: ±8KV 150pF/330 Ω 5 times Contact: ±4KV 150pF/330 Ω 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. No deflection cosmetic and operational function allowable.

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

## 13. Precautions and Warranty

### 13.1. Safety

13.1.1 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.

13.1.2 Since the liquid crystal cells are made of glass, do not apply strong impact on them. Handle with care.

### 13.2. Handling

13.2.1 Reverse and use within ratings in order to keep performance and prevent damage.

13.2.2 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.

### 13.3. Storage

13.3.1. Do not store the LCD module beyond the specified temperature ranges.

13.3.2. Strong light exposure causes degradation of polarizer and color filter

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

#### 13.4.1 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

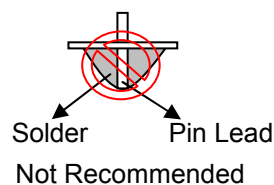
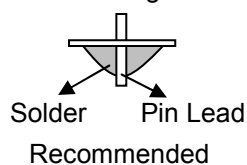
Maximum Solder Temperature: 370℃

Maximum Solder Time: 3s at the maximum temperature

Recommended Soldering Temp: 350±20℃

Typical Soldering Time: ≤3s

13.4.1.3 Solder Wetting



#### 13.4.2 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℃

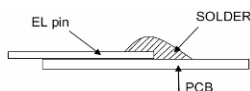
Typical Soldering Time: ≤2s

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

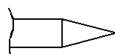


Recommended

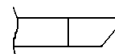


Not Recommended

#### 13.4.2.7 The type of the solder iron:

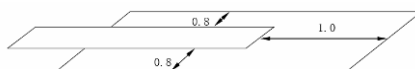


Recommended



Not Recommended

#### 13.4.2.8 Solder Pad



### 13.5. Operation

- 13.5.1. Do not drive LCD with DC voltage
- 13.5.2. Response time will increase below lower temperature
- 13.5.3. Display may change color with different temperature
- 13.5.4. Mechanical disturbance during operation, such as pressing on the display area, may cause the segments to appear "fractured".
- 13.5.5. Do not connect or disconnect the LCM to or from the system when power is on.
- 13.5.6. Never use the LCM under abnormal condition of high temperature and high humidity.
- 13.5.7. 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.
- 13.5.8. 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.

### 13.6. Static Electricity

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

### 13.7. Limited Warranty

- 13.7.1 Our warranty liability is limited to repair and/or replacement. We will not be responsible for any consequential loss.
- 13.7.2 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.
- 13.7.3 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.

## 14. Packaging

TBD

15. Outline Drawing

