

# PRODUCT SPECIFICATION

## 2.8" TFT LCD MODULE

**MODEL: T028240320-B2WMN-001 Ver:1.1**

**ROHS**

< ◇ > 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	2018.04.17	ZDT	Initial Release	
1.1	2018.11.12	ZDT	Add Weight Add Current Consumption Modify Backlight Characteristics Modify Optical Characteristics Modify Outline Drawing	P4 P5 P5 P6 P24

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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)	2.8"	
LCD type	IPS TFT	
Display Mode	Transmissive /Normally Black	
Resolution	240 RGB x 320	Pixels
View Direction	Full view	Best Image
Module Outline	50(H) x 69.2(V) x 2.5 (T) (Note1)	mm
Active Area	43.2 (H) x 57.6 (V)	mm
Pixel Size	180 x180	um
Pixel Arrangement	R.G.B. Vertical Stripe	
Polarizer Surface Treatment	Anti-glare	
Display Colors	262K	
Interface	SPI + 18 bit RGB (default)	
With or without touch panel	Without	
Driver IC	ILI9341V	-
Operating Temperature	<b>-20~70</b>	°C
Storage Temperature	<b>-30~80</b>	°C
Weight	14	g

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

## 3. Absolute Maximum Ratings

V<sub>SS</sub>=0V, Ta=25°C

Item	Symbol	Min.	Max.	Unit
Supply Voltage	Logic	-0.3	4.6	V
	Analog	-0.3	4.6	V
Storage temperature	T <sub>STG</sub>	-30	+80	°C
Operating temperature	T <sub>OP</sub>	-20	+70	°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	Logic	IOVCC	1.65	2.8	3.3	V
	Analog	VCI	2.5	2.8	3.3	V
Logic Low input voltage		$V_{IL}$	GND	-	$0.3 \cdot IOVCC$	V
Logic High input voltage		$V_{IH}$	$0.7 \cdot IOVCC$	-	IOVCC	V
Logic Low output voltage		$V_{OL}$	GND	-	$0.2 \cdot IOVCC$	V
Logic High output voltage		$V_{OH}$	$0.8 \cdot IOVCC$	-	IOVCC	V
Current Consumption All White	Logic	$I_{CC+ IIN}$	-	15	-	mA
	Analog					

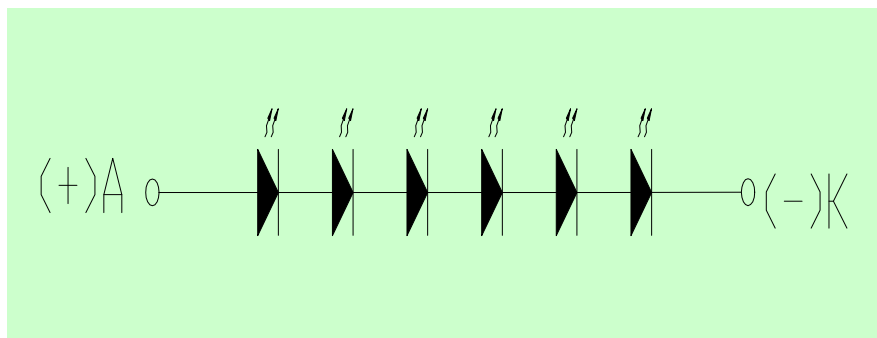
#### 5. Backlight Characteristic

##### 5.1. Backlight Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	$V_F$	$T_a=25\text{ }^\circ\text{C}$ , $I_F=20\text{mA/LED}$	16.8	<b>18</b>	20.4	V
Forward Current	$I_F$	$T_a=25\text{ }^\circ\text{C}$ , $V_F=3.2\text{V/LED}$	-	<b>20</b>	-	mA
Power dissipation	$P_D$		-	<b>360</b>	-	mW
Uniformity	Avg		-	80	-	%
LED working life( $25\text{ }^\circ\text{C}$ )	-		-	30,000	-	Hrs
Drive method	Constant current					
LED Configuration	6 White LEDs in string					

Note1: LED life time defined as follows: The final brightness is at 50% of original brightness.  
The environmental conducted under ambient air flow, at  $T_a=25 \pm 2\text{ }^\circ\text{C}$ ,  $60\%RH \pm 5\%$ ,  $I_F=20\text{mA/LED}$ .

##### 5.2. Backlighting circuit



#### 6. Touch Screen Panel Specifications

Without TP

## 7. Optical Characteristics

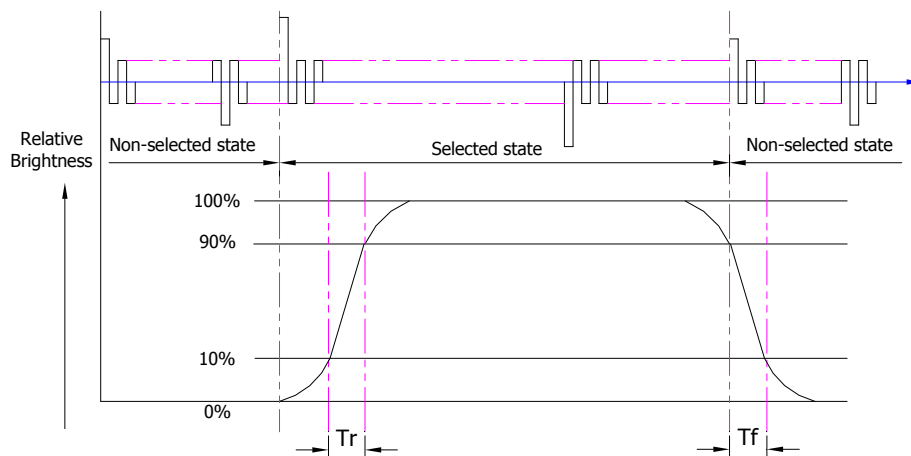
### 7.1. Optical Characteristics

Ta=25°C, VCI=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 $\theta_x = \phi_y = 0^\circ$	400	500	-	cd/m <sup>2</sup>
	Contrast ratio(See 7.3)	CR		600	800	-	
	Response time (See 7.2)	TR+TF		-	30	40	ms
	Chromaticity Transmissive (See 7.5)	Red	X <sub>R</sub>	0.593	0.643	0.693	
			Y <sub>R</sub>	0.281	0.331	0.381	
		Green	X <sub>G</sub>	0.243	0.293	0.343	
			Y <sub>G</sub>	0.577	0.627	0.677	
		Blue	X <sub>B</sub>	0.092	0.142	0.192	
			Y <sub>B</sub>	0.006	0.056	0.106	
	White	X <sub>W</sub>	0.236	0.286	0.336		
Y <sub>W</sub>		0.279	0.329	0.379			
Viewing Angle (See 7.4)	Horizontal	$\theta_{x+}$	-	80	-	Deg.	
		$\theta_{x-}$	-	80	-		
	Vertical	$\phi_{y+}$	-	80	-		
		$\phi_{y-}$	-	80	-		
NTSC Ratio(Gamut)			-	70	-	%	

### 7.2. Definition of Response Time

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



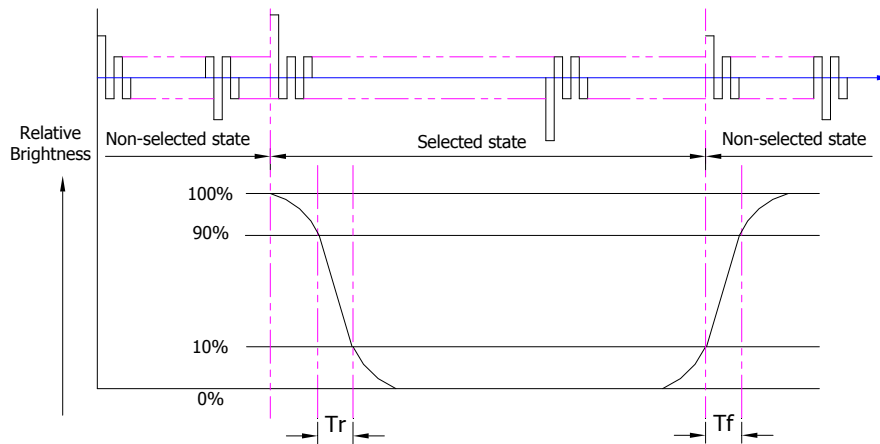
Tr is the time it takes to change from non-selected stage with relative luminance 10% to selected state with relative luminance 90%;

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

### 7.2.2. Normally White Type (Positive)



Tr is the time it takes to change from non-selected state 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

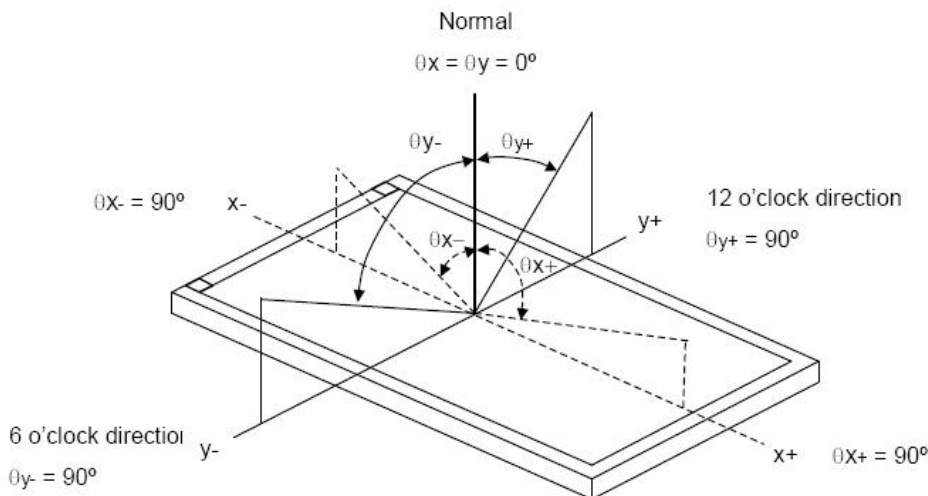
Contrast is measured perpendicular to display surface in reflective and transmissive mode.

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



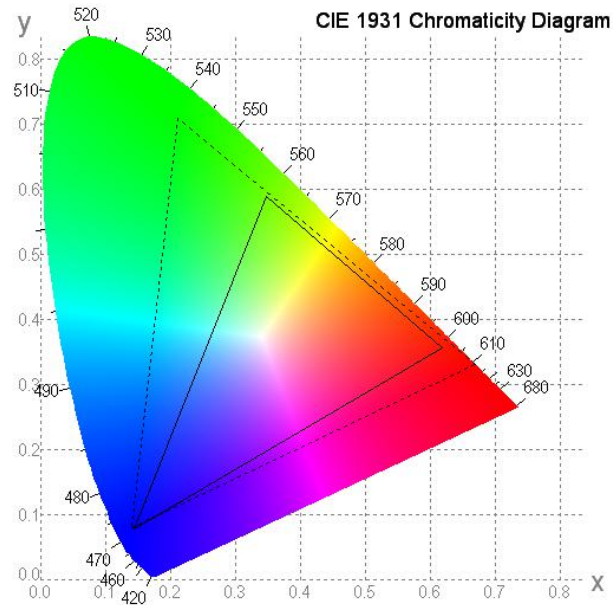
Measuring machine: LCD-5100 or EQUI

### 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)

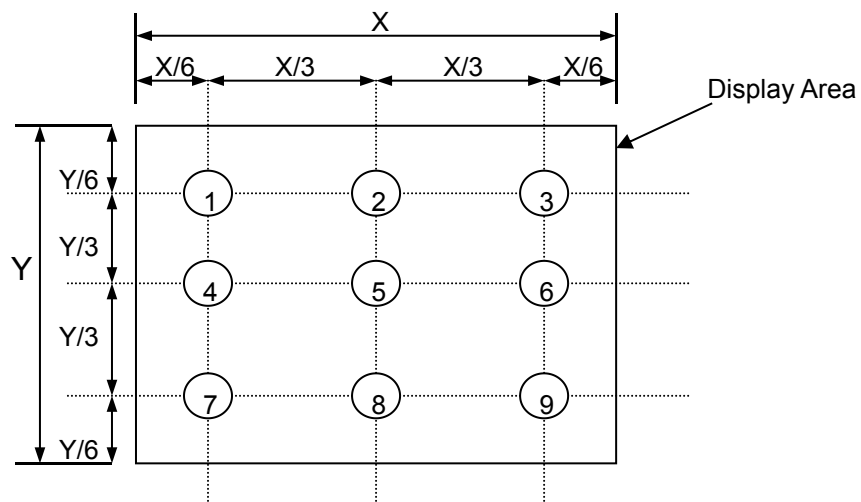


### 7.6. Definition of Surface Luminance, Uniformity and Transmittance

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

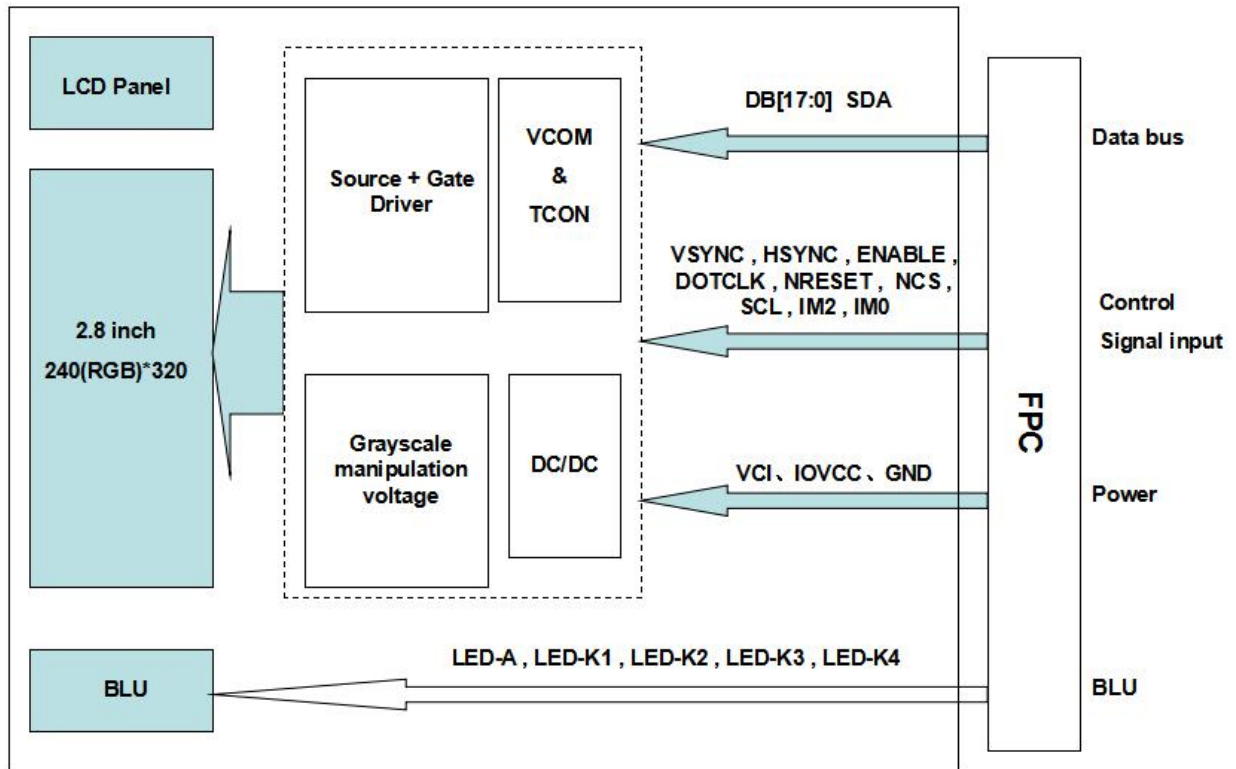
- 7.6.1. Surface Luminance:  $L_V = \text{average} (L_{P1}:L_{P9})$
- 7.6.2. Uniformity =  $\text{Minimal} (L_{P1}:L_{P9}) / \text{Maximal} (L_{P1}:L_{P9}) * 100\%$
- 7.6.3. Transmittance =  $L_V \text{ on LCD} / L_V \text{ on Backlight} * 100\%$

Note: Measuring machine: BM-7





## 8. Block Diagram and Power Supply

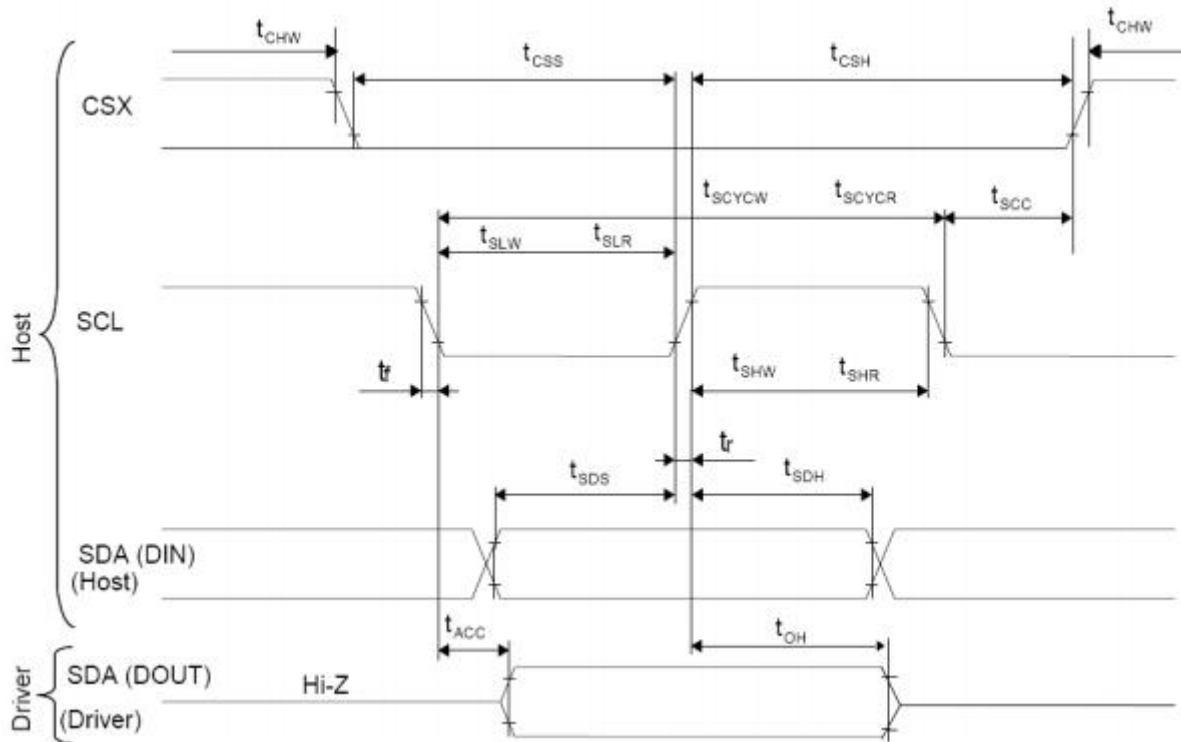


## 9. Interface Pins Definition

No.	Symbol	Function			
1	LED-A	Anode for back light driver voltage			
2	LED-K1	Cathode for back light driver voltage			
3	LED-K2	Cathode for back light driver voltage			
4	LED-K3	Cathode for back light driver voltage			
5	LED-K4	Cathode for back light driver voltage			
6	SDA	Serial data input pin.			
7	VSYNC	Vertical Sync Signal			
8	HSYNC	Horizontal Sync Signal			
9	IM2	IM2	IM0	Select the MPU system interface mode	PIN in used
10	IM0	1	1	3-wire 9-bit data serial interface I	SDA: In/OUT
11	ENABLE	Data Enable signal.			
12	GND	Ground.			
13	NRESET	Reset pin.			
14	DB17	Data bus.			
15	DB16	Data bus.			
16	DB15	Data bus.			
17	DB14	Data bus.			
18	DB13	Data bus.			
19	DB12	Data bus.			
20	DB11	Data bus.			
21	DB10	Data bus.			
22	DB9	Data bus.			
23	DB8	Data bus.			
24	DB7	Data bus.			
25	DB6	Data bus.			
26	DB5	Data bus.			
27	DB4	Data bus.			
28	DB3	Data bus.			
29	DB2	Data bus.			
30	DB1	Data bus.			
31	DB0	Data bus.			
32	NC	No connection.			
33	NC	No connection.			
34	SCL	Serial Clock			
35	NCS	Chip select signal. Low: chip can be accessed.			
36	DOTCLK	Pixel clock signal			
37	GND	Ground.			
38	VCI	Analog power supply.			
39	IOVCC	Digital IO Pad power supply.			
40	NC	No connection.			

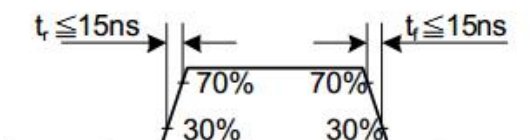
## 10. Characteristics

### 10.1. Display Serial Interface Timing Characteristics (3-line SPI system)

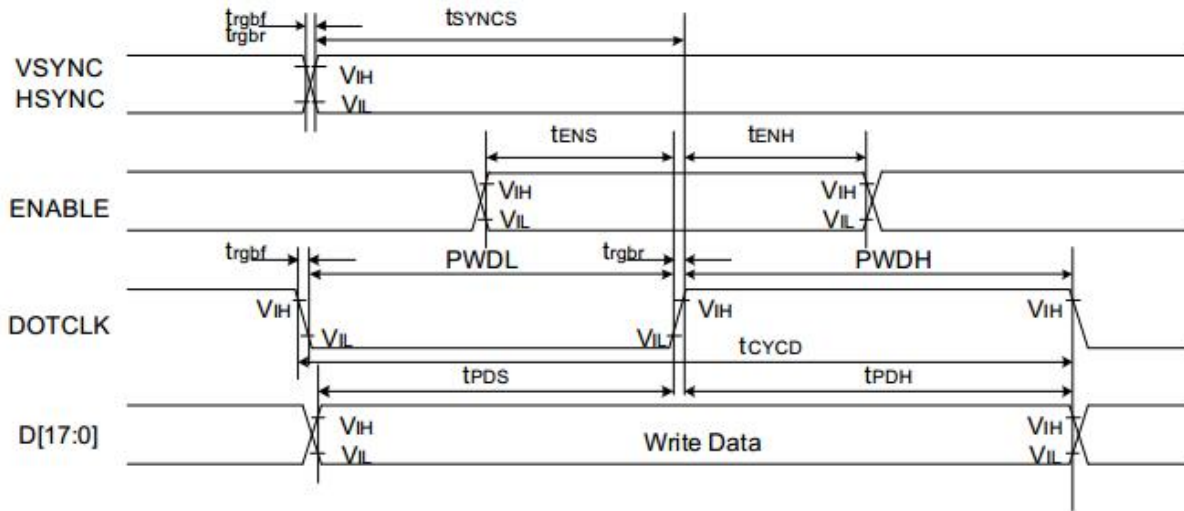


Signal	Symbol	Parameter	min	max	Unit	Description
SCL	tscycw	Serial Clock Cycle (Write)	100	-	ns	
	tshw	SCL "H" Pulse Width (Write)	40	-	ns	
	tslw	SCL "L" Pulse Width (Write)	40	-	ns	
	tscyrcr	Serial Clock Cycle (Read)	150	-	ns	
	tshr	SCL "H" Pulse Width (Read)	60	-	ns	
SDA / SDI (Input)	tsds	Data setup time (Write)	30	-	ns	
	tsdh	Data hold time (Write)	30	-	ns	
SDA / SDO (Output)	tacc	Access time (Read)	10	-	ns	
	toh	Output disable time (Read)	10	50	ns	
CSX	tsc	SCL-CSX	20	-	ns	
	tch	CSX "H" Pulse Width	40	-	ns	
	tc	CSX-SCL Time	60	-	ns	
	tcsh		65	-	ns	

Note:  $T_a = 25^\circ\text{C}$ ,  $V_{DDI}=1.65\text{V to }3.3\text{V}$ ,  $V_{CI}=2.5\text{V to }3.3\text{V}$ ,  $AGND=VSS=0\text{V}$

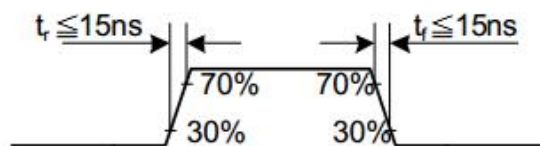


### 10.2.Parallel 18/16/6-bit RGB Interface Timing Characteristics

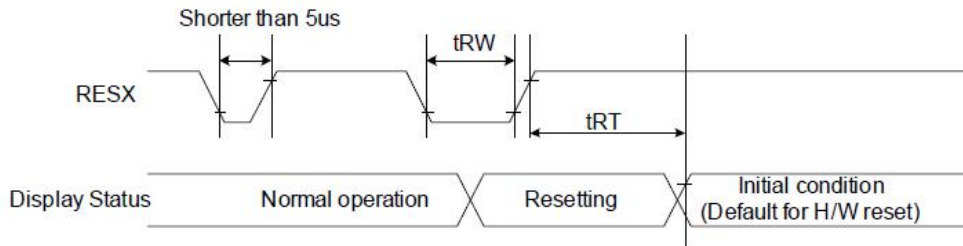


Signal	Symbol	Parameter	min	max	Unit	Description	
VSYNC / HSYNC	$t_{syncs}$	VSYNC/HSYNC setup time	15	-	ns	18/16-bit bus RGB interface mode	
	$t_{synch}$	VSYNC/HSYNC hold time	15	-	ns		
DE	$t_{ens}$	DE setup time	15	-	ns		
	$t_{enh}$	DE hold time	15	-	ns		
D[17:0]	$t_{pos}$	Data setup time	15	-	ns		
	$t_{pdh}$	Data hold time	15	-	ns		
DOTCLK	PWDH	DOTCLK high-level period	15	-	ns		
	PWDL	DOTCLK low-level period	15	-	ns		
	$t_{cycd}$	DOTCLK cycle time	100	-	ns		
	$t_{rgb}, t_{rgb}$	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns		
VSYNC / HSYNC	$t_{syncs}$	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		
	$t_{pdh}$	Data hold time	15	-	ns		
DOTCLK	PWDH	DOTCLK high-level pulse period	15	-	ns		
	PWDL	DOTCLK low-level pulse period	15	-	ns		
	$t_{cycd}$	DOTCLK cycle time	50	-	ns		
	$t_{rgb}, t_{rgb}$	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns		

Note:  $T_a = -30$  to  $70$  °C,  $V_{DDI}=1.65V$  to  $3.3V$ ,  $V_{CI}=2.5V$  to  $3.3V$ ,  $AGND=VSS=0V$



## 11. Reset input timing



Signal	Symbol	Parameter	Min	Max	Unit
RESX	tRW	Reset pulse duration	10		uS
	tRT	Reset cancel		5 (note 1,5)	mS
				120 (note 1,6,7)	mS

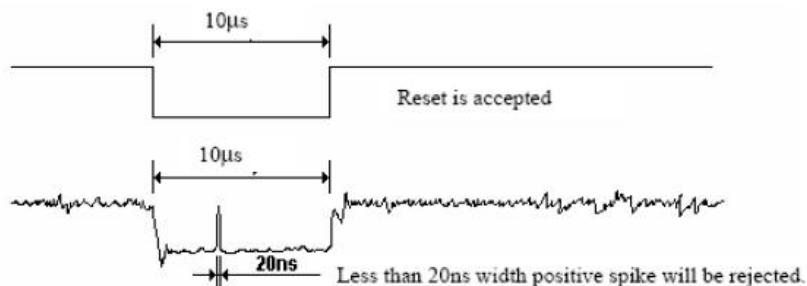
Note 1: The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NV memory to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

Note 2: Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below: -

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 10us	Reset
Between 5us and 10us	Reset starts

Note 3: During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode.) And then return to Default condition for Hardware Reset.

Note 4: Spike Rejection also applies during a valid reset pulse as shown below:



Note 5: When Reset applied during Sleep In Mode.

Note 6: When Reset applied during Sleep Out Mode.

Note 7: It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

## 12. Quality Assurance

### 12.1.Purpose

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

### 12.2.Standard for Quality Test

#### 12.2.1 Sampling Plan:

GB2828.1-2012

Single sampling, general inspection level II

#### 12.2.2 Sampling Criteria:

Visual inspection: AQL 1.5%

Electrical functional: AQL 0.65%.

#### 12.2.3 Reliability Test:

Detailed requirement refer to Reliability Test Specification.

### 12.3.Nonconforming Analysis & Disposition

#### 12.3.1 Nonconforming analysis:

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

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

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

#### 12.3.2 Disposition of nonconforming:

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

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

### 12.4.Agreement Items

Shall negotiate with customer if the following situation occurs:

12.4.1 There is any discrepancy in standard of quality assurance.

12.4.2 Additional requirement to be added in product specification.

12.4.3 Any other special problem.

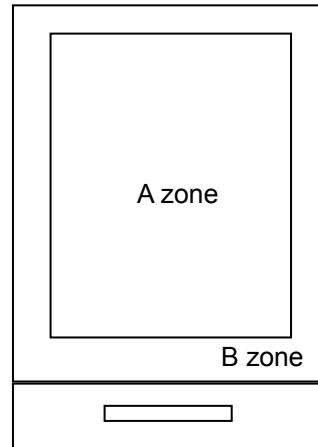
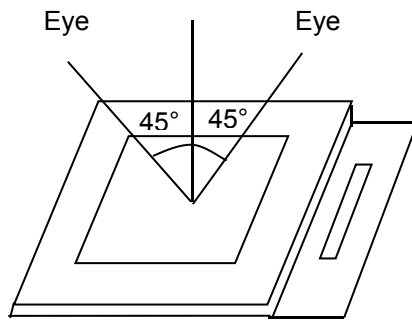
### 12.5.Standard of the Product Visual Inspection

#### 12.5.1 Appearance inspection:

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

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

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



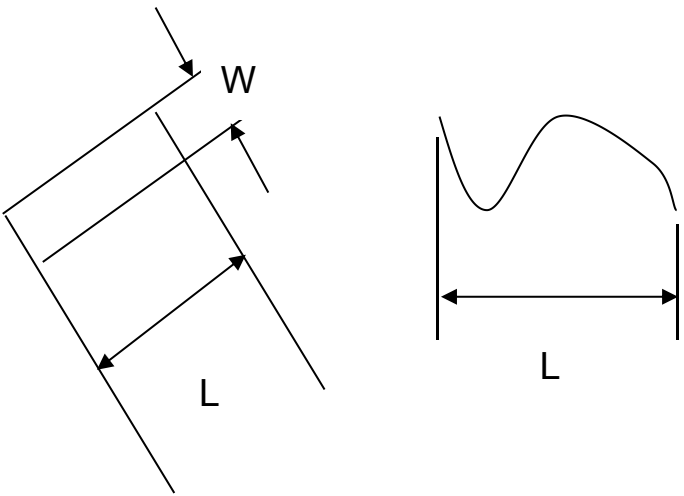
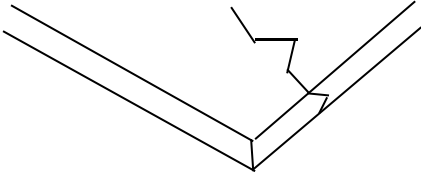
12.5.2 Basic principle:

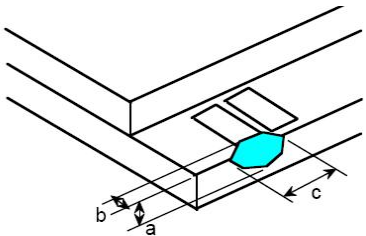
12.5.2.1 A set of sample to indicate the limit of acceptable quality level must be discussed by both us and customer when there is any dispute happened.

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

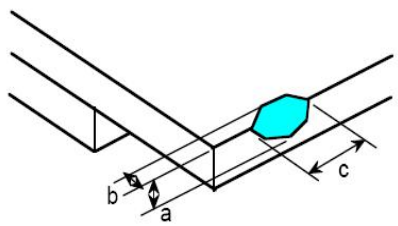
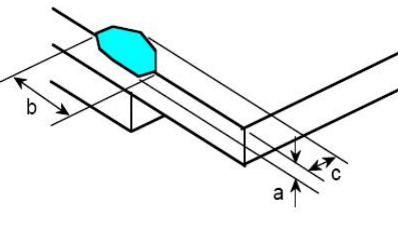
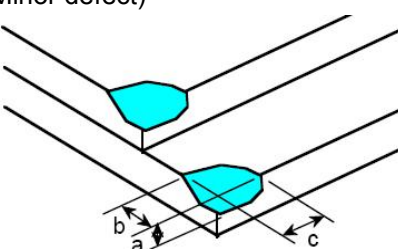
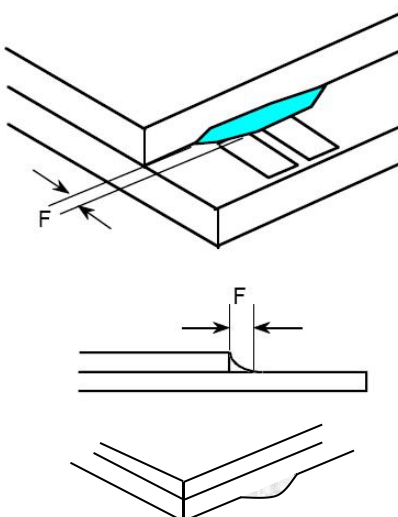
12.6. Inspection Specification

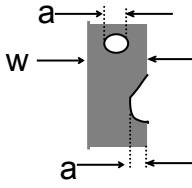
No.	Item	Criteria (Unit: mm)																		
01	Black / White spot Foreign material (Round type) Pinholes Stain Particles inside cell. (Minor defect)	<p><math>\phi = (a + b) / 2</math></p>	<table border="1"> <thead> <tr> <th>Size \ Area</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td><math>\phi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

03	<p>Black and White line Scratch Foreign material (Line type) (Minor defect)</p>	 <table border="1" data-bbox="539 750 1165 1097"> <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 .5</math></td> <td><math>0.03 &lt; W \leq 0.5</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>0</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	$L \leq .5$	$0.03 < W \leq 0.5$	3	$L \leq 2.5$	$0.05 < W \leq 0.10$	2	/	$0.1 < W$	0	Total		3
Length	Width	Acc. Qty																		
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/	$0.1 < W$	0																		
Total		3																		
04	<p>Glass Crack (Minor defect)</p>	 <p>Crack is potential to enlarge, any type is not allowed.</p>																		

05	<p>Glass Chipping Pad Area: (Minor defect)</p> 	<table border="1" data-bbox="869 1713 1340 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	$a < \text{Glass Thickness}$	
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$c < 3.0, b < 1.0$	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 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	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	PCB	<p>15.1 No distortion or contamination on PCB terminals. 15.2 All components on PCB must same as documented on the BOM/component layout. 15.3 Follow IPC-A-600F.</p>										
16	Soldering	Follow IPC-A-610C standard										

17	Electrical Defect (Major defect)	<p>The below defects must be rejected.</p> <p>17.1 Missing vertical / horizontal segment, 17.2 Abnormal Display. 17.3 No function or no display. 17.4 Current exceeds product specifications. 17.5 LCD viewing angle defect. 17.6 No Backlight. 17.7 Dark Backlight. 17.8 Touch Panel no function.</p>
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Remark: LCD Panel Broken shall be rejected. Defect out of LCD viewing area is acceptable.

**12.7.Classification of Defects**

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

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

**12.8.Identification/markings criteria**

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

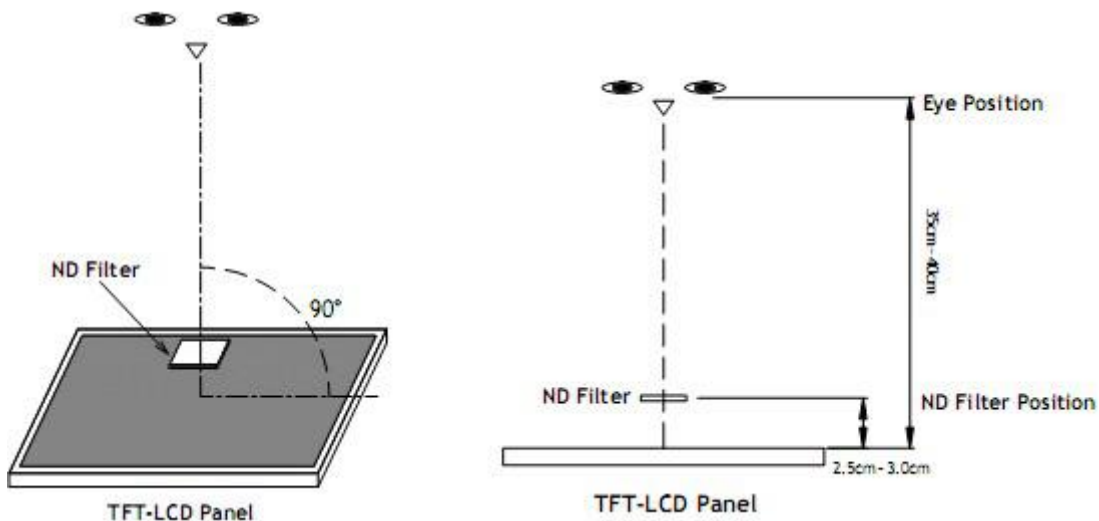
**12.9.Packaging**

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

12.9.2 Modules inside package box should have compliant mark.

12.9.3 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 350mm ± 50mm.

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 350mm ± 50mm.

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

### 13. 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	<b>50°C, 90%RH, 96Hrs</b>	2	GB/T2423.3-2006
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	-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.	2	GB/T5170.14-2009
8	Electrical Static Discharge	Air: ±4KV 150pF/330 Ω 5 times Contact: ±2KV 150pF/330 Ω 5 times	2	GB/T17626.2-2006
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.

## 14. Precautions and Warranty

### 14.1. Safety

- 14.1.1. 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.
- 14.1.2. Since the liquid crystal cells are made of glass, do not apply strong impact on them. Handle with care.

### 14.2. Handling

- 14.2.1. Reverse and use within ratings in order to keep performance and prevent damage.
- 14.2.2. 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.

### 14.3. Storage

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

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

#### 14.4.1. Pins of LCD and Backlight

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

#### 14.4.1.2. Recommended Soldering Conditions

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

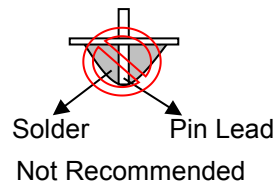
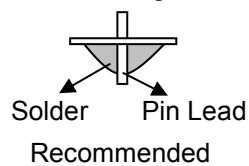
Maximum Solder Temperature: 370 °C

Maximum Solder Time: 3s at the maximum temperature

Recommended Soldering Temp: 350±20 °C

Typical Soldering Time: ≤3s

#### 14.4.1.3. Solder Wetting



#### 14.4.2. Pins of EL

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

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

#### 14.4.2.3. Recommended Soldering Conditions

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

Recommended Solder Temperature: 270~290 °C

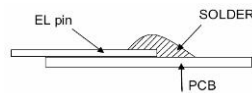
Typical Soldering Time: ≤2s

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

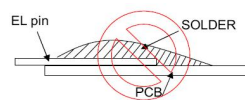
14.4.2.4. No horizontal press on the EL leads during soldering.

14.4.2.5. 180° bend EL leads three times is not allowed.

#### 14.4.2.6. Solder Wetting

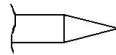


Recommended

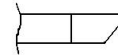


Not Recommended

#### 14.4.2.7. The type of the solder iron:

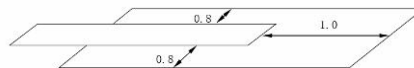


Recommended



Not Recommended

#### 14.4.2.8. Solder Pad



### 14.5. Operation

- 14.5.1. Do not drive LCD with DC voltage
- 14.5.2. Response time will increase below lower temperature
- 14.5.3. Display may change color with different temperature
- 14.5.4. Mechanical disturbance during operation, such as pressing on the display area, may cause the segments to appear "fractured".
- 14.5.5. Do not connect or disconnect the LCM to or from the system when power is on.
- 14.5.6. Never use the LCM under abnormal condition of high temperature and high humidity.
- 14.5.7. 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.
- 14.5.8. 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.

### 14.6. Static Electricity

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

### 14.7. Limited Warranty

- 14.7.1. Our warranty liability is limited to repair and/or replacement. We will not be responsible for any consequential loss.
- 14.7.2. 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
- 14.7.3. 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.

## 15. Packaging

TBD

### 16. Outline Drawing

