

PRODUCT SPECIFICATION

2.1" TN TFT LCD MODULE

MODEL: IPS021B101A

Ver:1.0

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	2018.11.16	ZDT	Initial Release	

Table of Contents

No.	Item	Page
1.	General Description.....	4
2.	Module Parameter.....	4
3.	Absolute Maximum Ratings.....	4
4.	DC Characteristics.....	5
5.	Backlight Characteristic.....	5
	5.1. Backlight Characteristic.....	5
	5.2. Backlighting circuit.....	5
6.	Optical Characteristics.....	6
	6.1. Optical Characteristics.....	6
	6.2. Definition of Response Time.....	6
	6.3. Definition of Contrast Ratio.....	7
	6.4. Definition of Viewing Angles.....	7
	6.5. Definition of Color Appearance.....	8
	6.6. Definition of Surface Luminance, Uniformity and Transmittance.....	8
7.	Block Diagram and Power Supply.....	9
8.	Interface Pins Definition.....	10
9.	AC Characteristics.....	11
	9.1. DPI interface characteristics.....	11
	9.2. Reset input timing.....	13
	9.3. Power On/Off Timing.....	14
10.	Quality Assurance.....	16
	10.1. Purpose.....	16
	10.2. Standard for Quality Test.....	16
	10.3. Nonconforming Analysis & Disposition.....	16
	10.4. Agreement Items.....	16
	10.5. Standard of the Product Visual Inspection.....	16
	10.6. Inspection Specification.....	17
	10.7. Classification of Defects.....	21
	10.8. Identification/marketing criteria.....	21
	10.9. Packing.....	21
11.	Reliability Specification.....	22
12.	Precautions and Warranty.....	23
	12.1. Safety.....	23
	12.2. Handling.....	23
	12.3. Storage.....	23
	12.4. Metal Pin (Apply to Products with Metal Pins).....	23
	12.5. Operation.....	24
	12.6. Static Electricity.....	24
	12.7. Limited Warranty.....	24
13.	Packaging.....	25
14.	Outline Drawing.....	26

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)	2.1"	
LCD type	IPS TFT	
Display Mode	Normally black /Transmissive	
Resolution	480 RGB x 480	Pixels
View Direction	Full viewing	Best Image
Module Outline	58.81(H) x 63.18(V) x 2.5 (T) (Note1)	mm
Active Area	53.208 (H) x53.208(V)	mm
Pixel Pitch	110.85(H) x 110.85(V)	um
Pixel Arrangement	R.G.B. Vertical Stripe	
Polarizer Surface Treatment	Anti-Glare	
Display Colors	16.7M	
Interface	18-bit MCU interface	
Driver IC	HX8369B	-
With or Without Touch Panel	Without	
Operating Temperature	-20~70	°C
Storage Temperature	-30~80	°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
	VDD	-0.3	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	VDD	2.5	2.8	4.8	V	
Logic Low input voltage	V _{IL}	0	-	0.3*VDD	V	
Logic High input voltage	V _{IH}	0.7*VDD	-	VDD	V	
Logic Low output voltage	V _{OL}	0	-	0.2*VDD	V	
Logic High output voltage	V _{OH}	0.8*VDD	-	VDD	V	
Current Consumption All White	Logic	I _{CC+} I _{IN}	-	TBD	-	mA
	Analog					

5. Backlight Characteristic

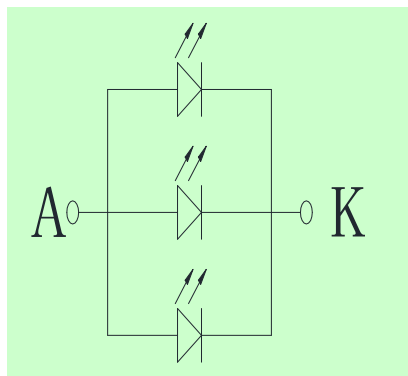
5.1. Backlight Characteristic

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward Voltage	V _F	T _a =25 °C, I _F =20mA/LED	2.8	3.2	3.4	V
Forward Current	I _F	T _a =25 °C, V _F =3.2V/LED	-	60	-	mA
Power dissipation	P _D	-	-	192	-	mW
Uniformity	Avg	-	-	80	-	%
LED working life(25°C)	-	-	-	30000	-	Hrs
Drive method	Constant current					
LED Configuration	3 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_a=25±2 °C, 60%RH±5%, I_F=20mA/LED.

5.2. Backlighting circuit



6. Optical Characteristics

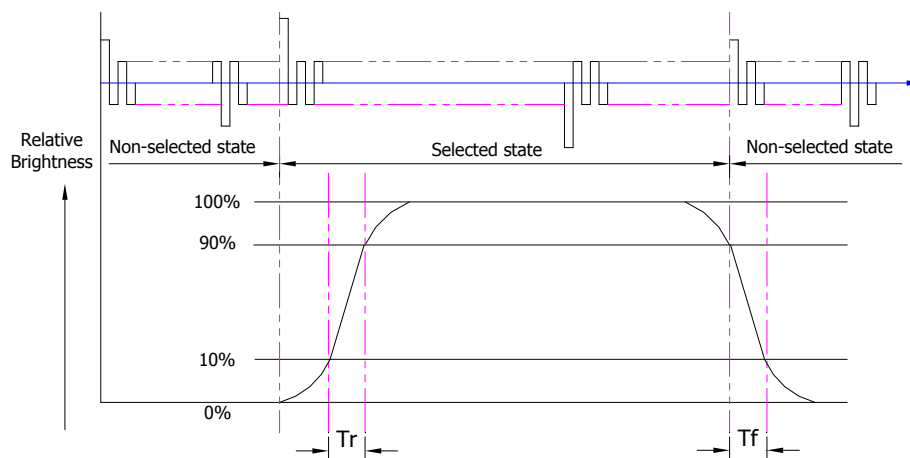
6.1. Optical Characteristics

 $T_a=25^{\circ}\text{C}, V_{DD}=2.8\text{V}$

	Item	Symbol	Condition	Specification			Unit									
				Min.	Typ.	Max.										
Backlight On (Transmissive Mode)	Luminance on TFT($I_f=20\text{mA/LED}$)	Lv		200	250	-	cd/m ²									
	Contrast ratio(See 6.3)	CR		-	1000	-										
	Response time (See 6.2)	TR	$\theta=0^{\circ}$	Center CR ≥ 10	-	30	35	ms								
		TF														
	Chromaticity Transmissive (See 6.5)	Red	X _R	$\theta=0^{\circ}$	Center CR ≥ 10	-	TBD	-								
			Y _R													
		Green	X _G						-	TBD	-	-				
			Y _G													
		Blue	X _B										-	TBD	-	-
			Y _B													
	White	X _W	-	TBD	-	-										
		Y _W														
	Viewing Angle (See 6.4)	Horizontal					θ_{X+}	Center CR ≥ 10	-	70	85	-				
θ_{X-}																
Vertical		φ_{Y+}					-						70	85	-	
		φ_{Y-}														
NTSC Ratio(Gamut)	-	$\theta=0^{\circ}$	-	70	-	%										

6.2. Definition of Response Time

6.2.1. Normally Black Type (Negative)

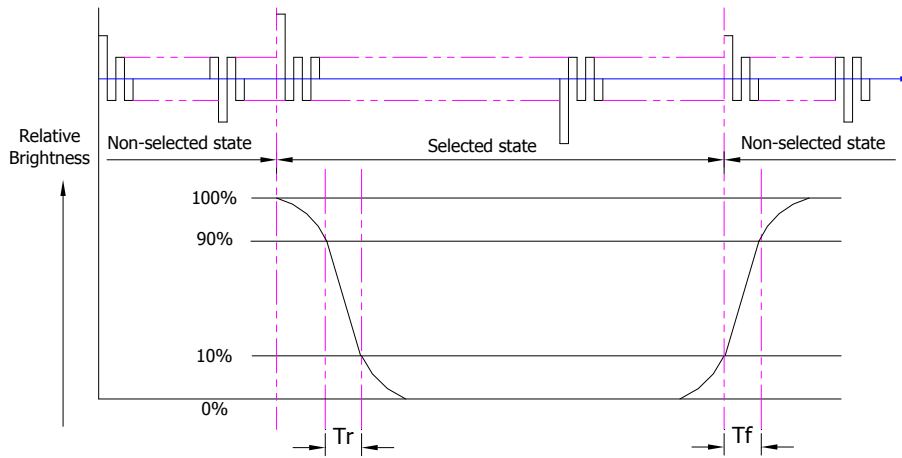


Tr is the time it takes to change from non-selected state with relative luminance 10% to selected state with relative luminance 90%;

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 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

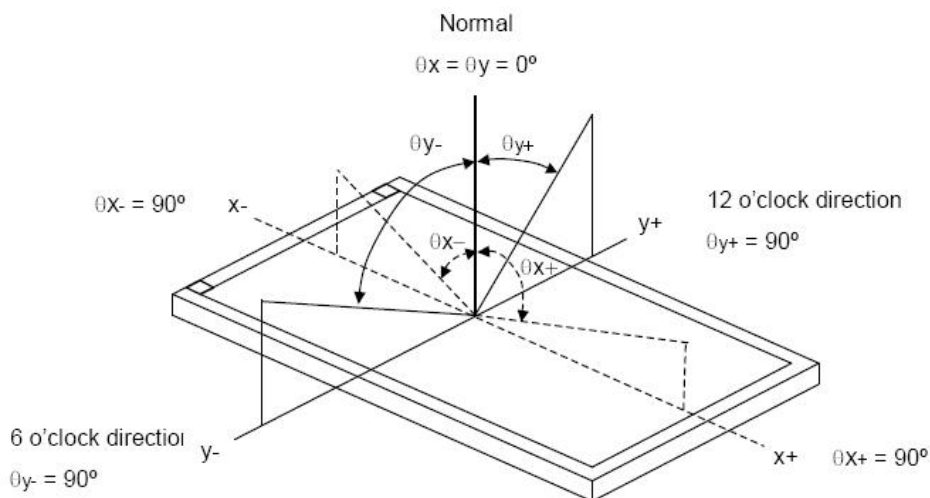
6.3. Definition of Contrast Ratio

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



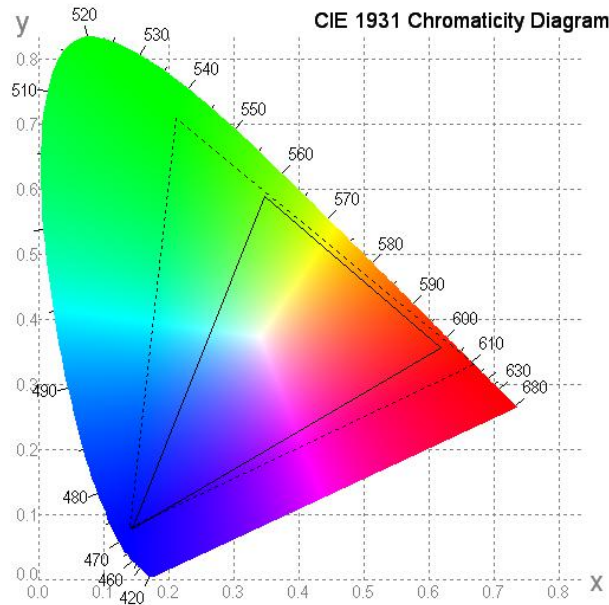
Measuring machine: LCD-5100 or EQUI

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)

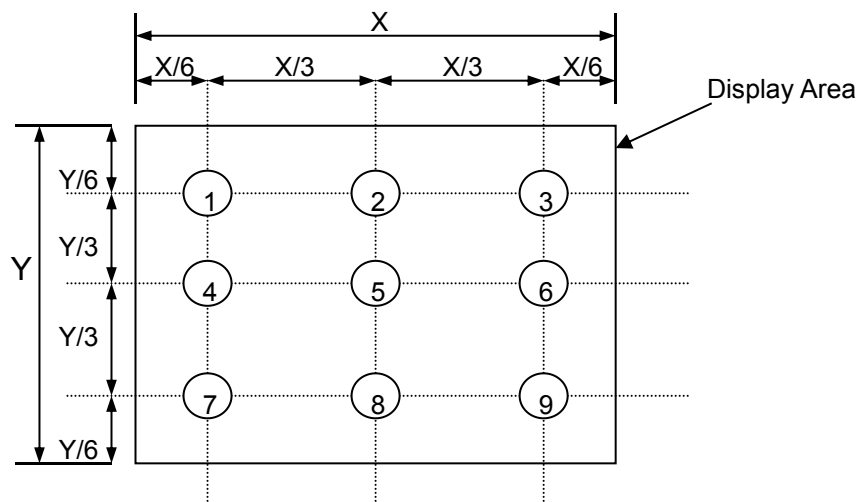


6.6. Definition of Surface Luminance, Uniformity and Transmittance

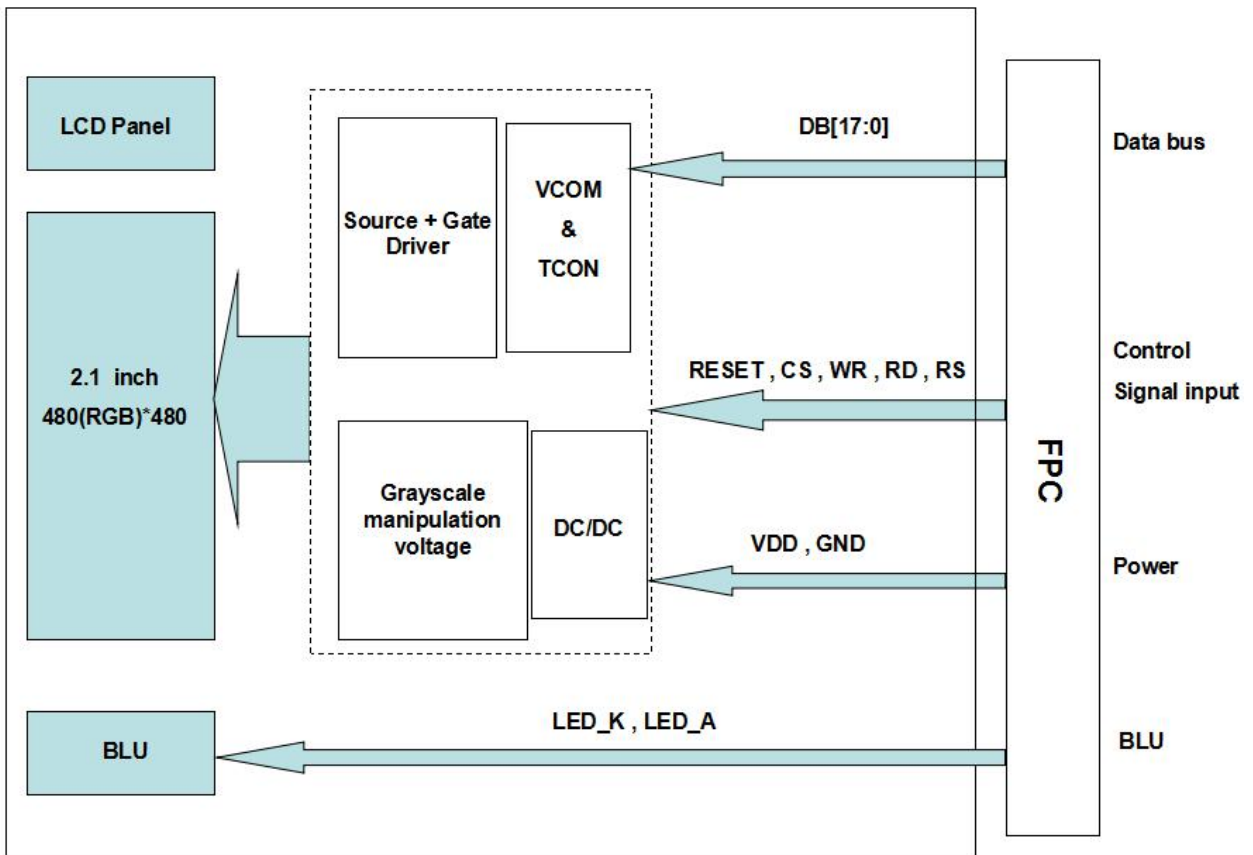
Using the transmissive mode measurement approach, measure the white screen luminance of the display panel and backlight.

- 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

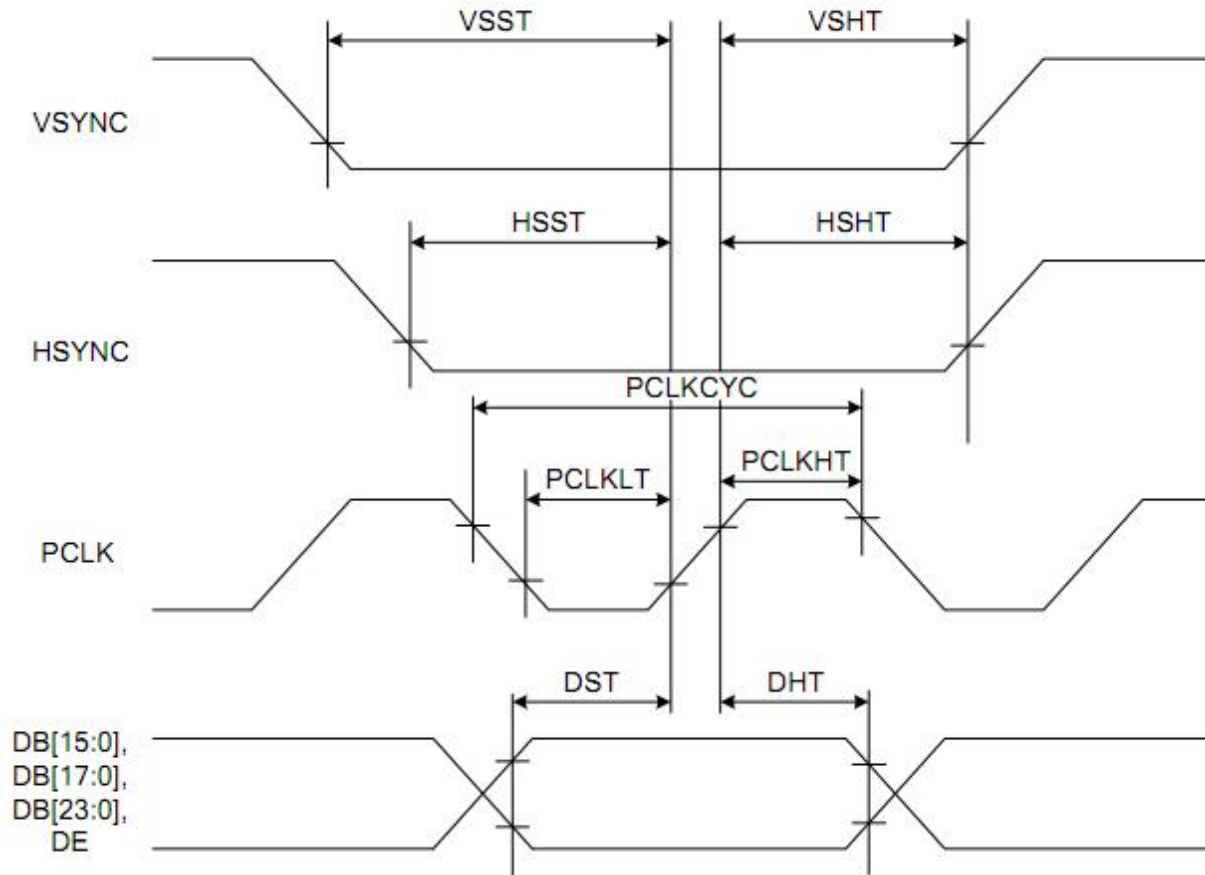


8. Interface Pins Definition

No.	Symbol	Function	Remark
1	NC	No connection	
2	GND	Ground	
3	VDD	Power supply	
4	NC	No connection	
5	RESET	Reset signal	
6	GND	Ground	
7	DB17	Bata bus	
8	DB16	Bata bus	
9	DB15	Bata bus	
10	DB14	Bata bus	
11	DB13	Bata bus	
12	DB12	Bata bus	
13	DB11	Bata bus	
14	DB10	Bata bus	
15	DB9	Bata bus	
16	DB8	Bata bus	
17	DB7	Bata bus	
18	DB6	Bata bus	
19	DB5	Bata bus	
20	DB4	Bata bus	
21	DB3	Bata bus	
22	DB2	Bata bus	
23	DB1	Bata bus	
24	DB0	Bata bus	
25	GND	Ground	
26	RD	Read signal	
27	WR	Write signal	
28	RS	A register select signal	
29	CS	Chip select signal	
30	GND	Ground	
31	LED_K	Led cathode	
32	LED_A	Led anode	

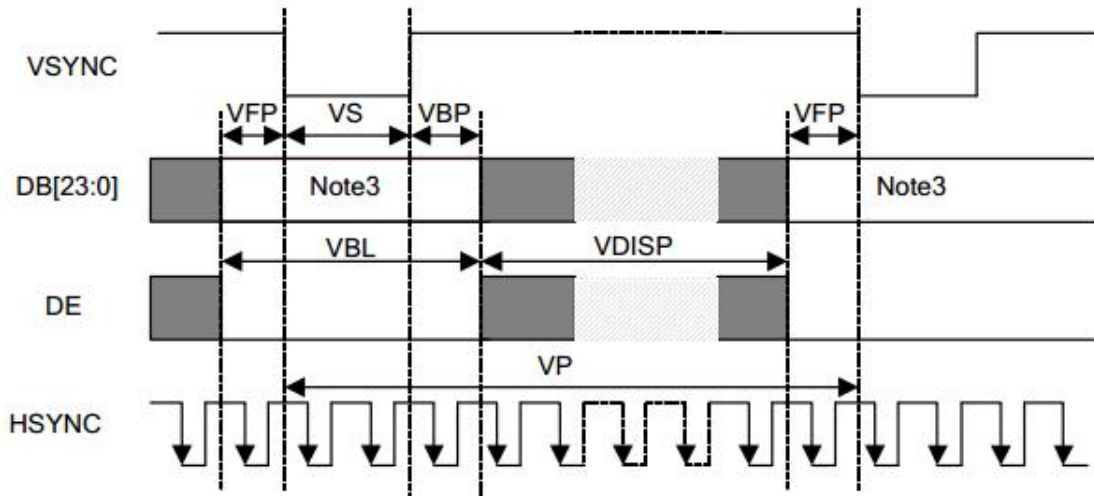
9. AC Characteristics

9.1. DPI interface characteristics

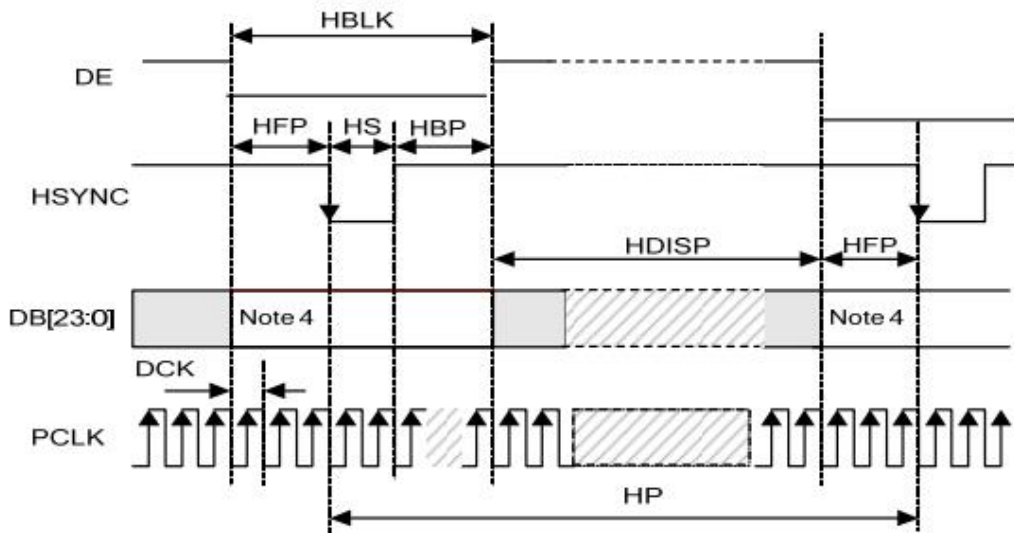


Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Vertical sync. setup time	VSST	-	5	-	-	ns
Vertical sync. hold time	VSHT	-	5	-	-	ns
Horizontal sync. setup time	HSST	-	5	-	-	ns
Horizontal sync. hold time	HSHT	-	5	-	-	ns
Pixel clock cycle when RGB I/F is running	PCLKCYC (480x854)	VRR ⁽³⁾ = Min. 50 Hz Max. 70 Hz	21.6	-	34.3	MHz
			29.1	-	46.2	ns
	PCLKCYC (480x800)	VRR ⁽³⁾ = Min. 50 Hz Max. 70 Hz	20.3	-	32.2	MHz
			31	-	49.2	ns
PCLKCYC (360x640)	VRR ⁽³⁾ = Min. 50 Hz Max. 70 Hz	12.4	-	20.3	MHz	
		49.2	-	80.6	ns	
Pixel clock low time	PCLKLT	-	5	-	-	ns
Pixel clock high time	PCLKHT	-	5	-	-	ns
Data setup time DB[23:0]	DST	-	5	-	-	ns
Data hold time DB[23:0]	DHT	-	5	-	-	ns

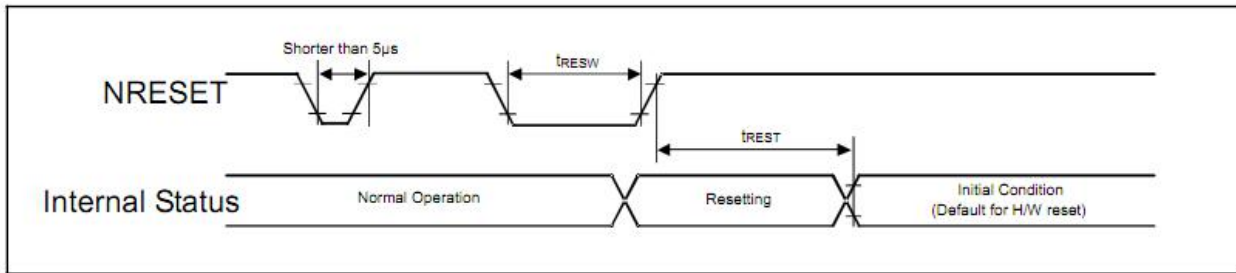
Vertical Timings for RGB I/F



Horizontal Timings for RGB I/F



9.2. Reset input timing



Symbol	Parameter	Related pins	Min.	Typ.	Max.	Note	Unit
t_{RESW}	Reset low pulse width ⁽¹⁾	NRESET	10	-	-	-	µs
t_{REST}	Reset complete time ⁽²⁾	-	5	-	-	When reset is applied during Sleep In mode	ms
		-	120	-	-	When reset is applied during Sleep Out mode	ms

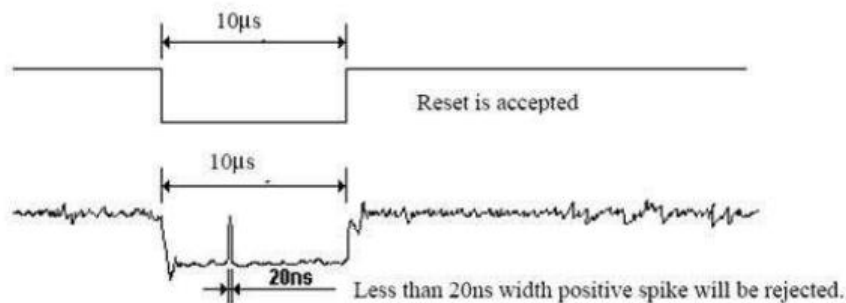
Note: (1) Spike due to an electrostatic discharge on NRESET line does not cause irregular system reset according to the table below.

NRESET Pulse	Action
Shorter than 5 µs	Reset Rejected
Longer than 10 µs	Reset
Between 5 µs and 10 µs	Reset Start

(2) 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 returns to Default condition for H/W reset.

(3) During Reset Complete Time, ID2 value in OTP will be latched to internal register during this period. This loading is done every time when there is H/W reset complete time (t_{REST}) within 5ms after a rising edge of NRESET.

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

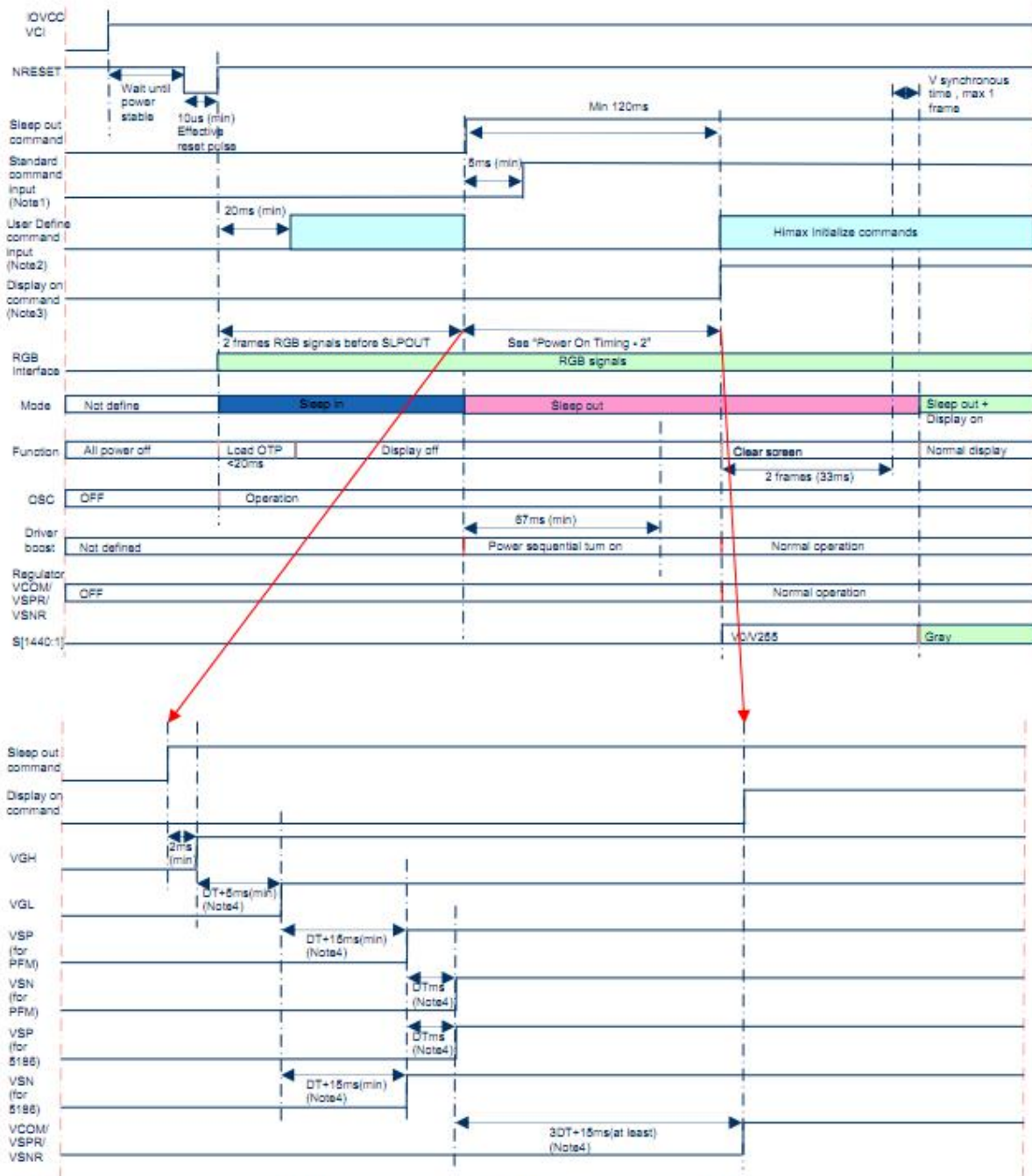


(5) When Reset is applied during Sleep In Mode.

(6) When Reset is applied during Sleep Out Mode.

(7) It is necessary to wait 5msec after releasing NRESET before sending commands. Also Sleep Out command cannot be sent for 120msec.

9.3. Power On/Off Timing



Note1:
 "Standard" command except "01h" & "10h" command must wait 5ms after "Sleep out" command then can be sent. "01h" & "10h" command must wait 100ms after "Sleep out" command then can be sent.

Note2:
 "User Define" command must be sent "B9h" first then other commands can be available.

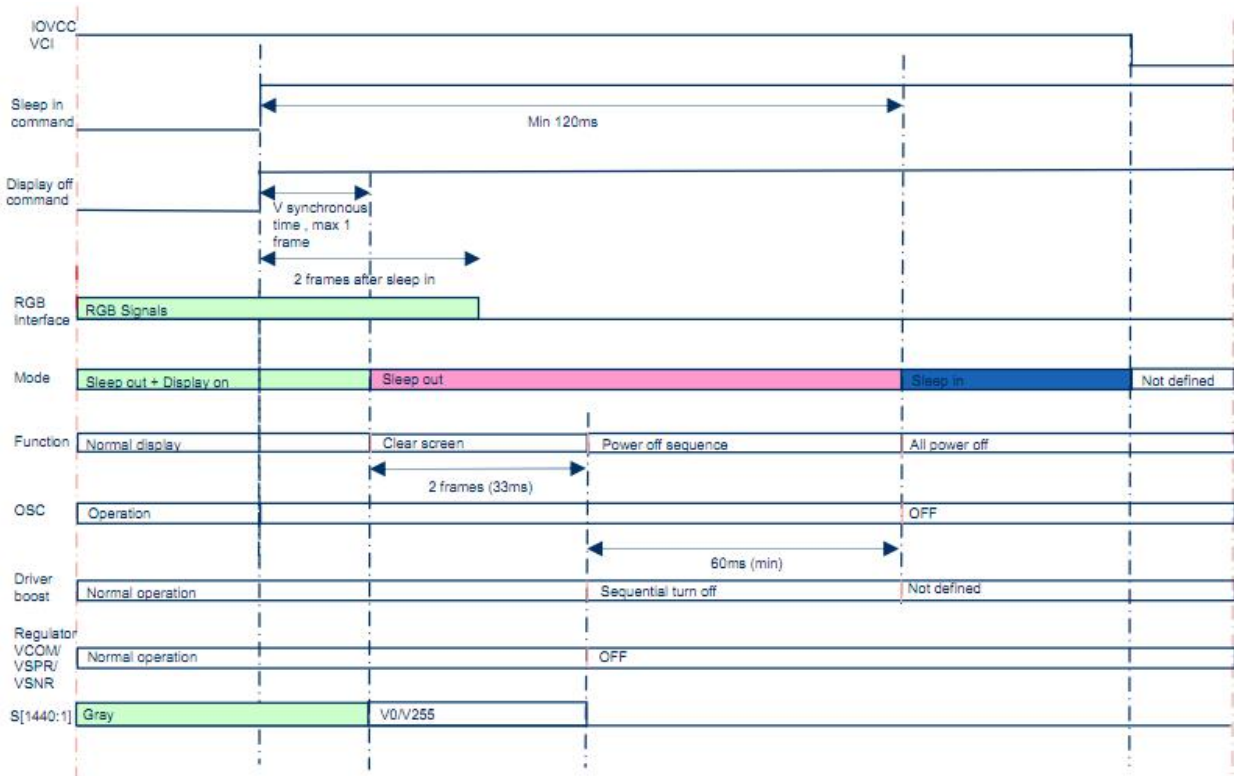
Note3:
 "Display on" command must send after "User Define" command or at the same time.

Note4:

DT1: Delay time of power on and power off sequence.		
DT1	DTs	Delay time of power on and power off sequence on
0	0	5ms
0	1	10ms
1	0	15ms
1	1	30ms

Default DT=5ms

Power On Timing



Power Off Timing

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.

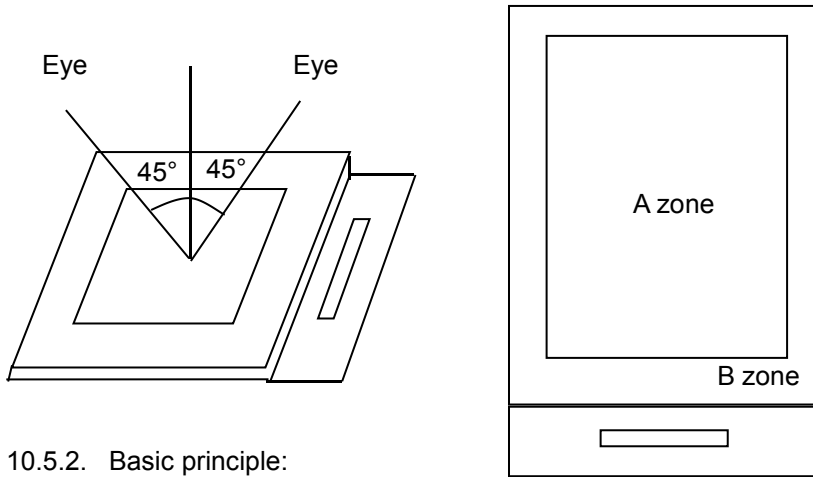
10.5. Standard of the Product Visual Inspection

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,



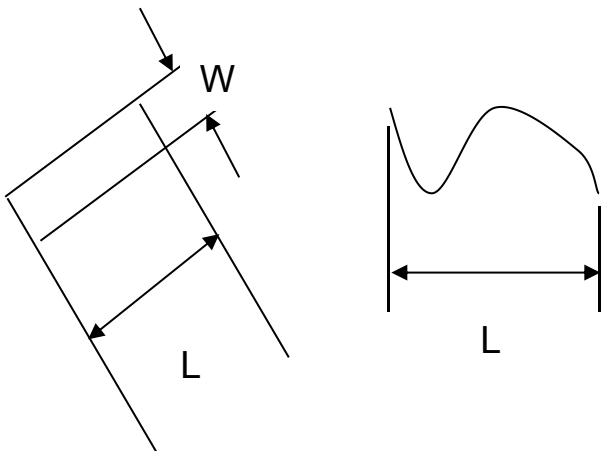
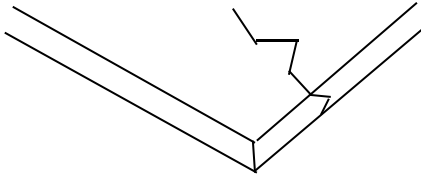
10.5.2. Basic principle:

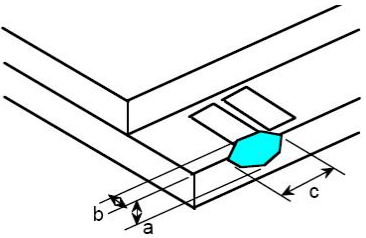
10.5.2.1. A set of sample to indicate the limit of acceptable quality level must be discussed by both us and customer when there is any dispute happened.

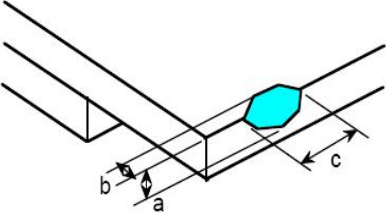
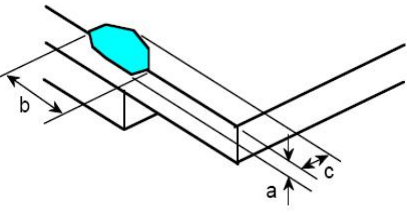
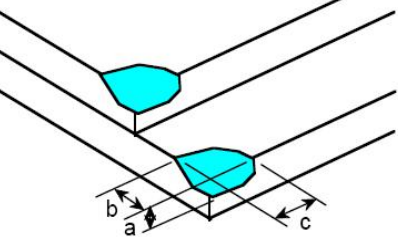
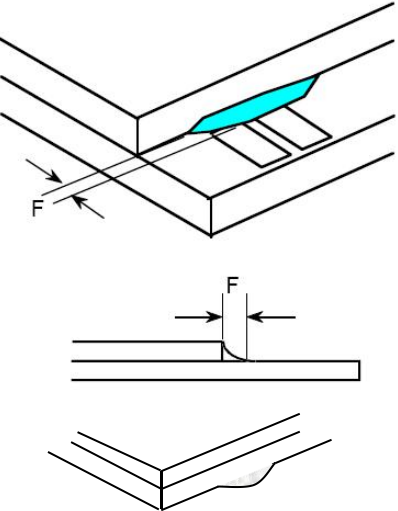
10.5.2.2. New item must be added on time when it is necessary.

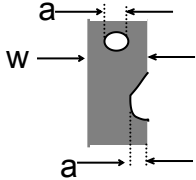
10.6. Inspection Specification

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

<p>03</p>	<p>Black and White line Scratch Foreign material (Line type) (Minor defect)</p>	 <table border="1" data-bbox="566 784 1189 1097"> <thead> <tr> <th>Length</th> <th>W dth</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td>/</td> <td>$W \leq 0.03$</td> <td>Ignore</td> </tr> <tr> <td>$L \leq 2.5$</td> <td>$0.03 < W \leq 0.05$</td> <td>3</td> </tr> <tr> <td>$L \leq 2.5$</td> <td>$0.05 < W \leq 0.10$</td> <td>2</td> </tr> <tr> <td>/</td> <td>$0.1 < W$</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	W dth	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	/	$0.1 < W$	0	Total		3
Length	W dth	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																		
/	$0.1 < W$	0																		
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="853 1713 1332 1892"> <thead> <tr> <th>Length and Width</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td>$c > 3.0, b < 1.0$</td> <td>1</td> </tr> <tr> <td>$c < 3.0, b < 1.0$</td> <td>3</td> </tr> <tr> <td colspan="2">$a < \text{Glass Thickness}$</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>$c > 3.0, b < 1.0$</td> <td>1</td> </tr> <tr> <td>$c < 3.0, b < 1.0$</td> <td>2</td> </tr> <tr> <td>$c < 3.0, b < 0.5$</td> <td>4</td> </tr> <tr> <td colspan="2" style="text-align: center;">$a < \text{Glass Thickness}$</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>$c > 3.0, b < 1.0$</td> <td>1</td> </tr> <tr> <td>$c < 3.0, b < 1.0$</td> <td>2</td> </tr> <tr> <td>$c < 3.0, b < 0.5$</td> <td>4</td> </tr> <tr> <td colspan="2" style="text-align: center;">$a < \text{Glass Thickness}$</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>$c < 3.0, b < 3.0$</td> <td>Ignore</td> </tr> <tr> <td colspan="2" style="text-align: center;">$a < \text{Glass Thickness}$</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>$F < 1.0$</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											

<p>10</p>	<p>FPC Defect: (Minor defect)</p> 	<p>10.1 Dent, pinhole width $a < w/3$. (w: circuitry width.) 10.2 Open circuit is unacceptable. 10.3 No oxidation, contamination and distortion.</p>										
<p>11</p>	<p>Bubble on Polarizer (Minor defect)</p>	<table border="1"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td>$\phi \leq 0.20$</td> <td>Ignore</td> </tr> <tr> <td>$0.20 < \phi \leq 0.30$</td> <td>4</td> </tr> <tr> <td>$0.30 < \phi \leq 0.50$</td> <td>1</td> </tr> <tr> <td>$0.50 < \phi$</td> <td>None</td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\phi \leq 0.20$	Ignore	$0.20 < \phi \leq 0.30$	4	$0.30 < \phi \leq 0.50$	1	$0.50 < \phi$	None
Diameter	Acc. Qty											
$\phi \leq 0.20$	Ignore											
$0.20 < \phi \leq 0.30$	4											
$0.30 < \phi \leq 0.50$	1											
$0.50 < \phi$	None											
<p>12</p>	<p>Dent on Polarizer (Minor defect)</p>	<table border="1"> <thead> <tr> <th>Diameter</th> <th>Acc. Qty</th> </tr> </thead> <tbody> <tr> <td>$\phi \leq 0.20$</td> <td>Ignore</td> </tr> <tr> <td>$0.20 < \phi \leq 0.30$</td> <td>4</td> </tr> <tr> <td>$0.30 < \phi \leq 0.50$</td> <td>1</td> </tr> <tr> <td>$0.50 < \phi$</td> <td>None</td> </tr> </tbody> </table>	Diameter	Acc. Qty	$\phi \leq 0.20$	Ignore	$0.20 < \phi \leq 0.30$	4	$0.30 < \phi \leq 0.50$	1	$0.50 < \phi$	None
Diameter	Acc. Qty											
$\phi \leq 0.20$	Ignore											
$0.20 < \phi \leq 0.30$	4											
$0.30 < \phi \leq 0.50$	1											
$0.50 < \phi$	None											
<p>13</p>	<p>Bezel</p>	<p>13.1 No rust, distortion on the Bezel. 13.2 No visible fingerprints, stains or other contamination.</p>										
<p>14</p>	<p>Touch Panel</p>	<p>D: Diameter W: width L: length 14.1 Spot: $D < 0.25$ is acceptable $0.25 \leq D \leq 0.4$ 2dots are acceptable and the distance between defects should more than 10 mm. $D > 0.4$ is unacceptable 14.2 Dent: $D > 0.40$ is unacceptable 14.3 Scratch: $W \leq 0.03$, $L \leq 10$ is acceptable, $0.03 < W \leq 0.10$, $L \leq 10$ is acceptable Distance between 2 defects should more than 10 mm. $W > 0.10$ is unacceptable.</p>										
<p>15</p>	<p>PCB</p>	<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>										
<p>16</p>	<p>Soldering</p>	<p>Follow IPC-A-610C standard</p>										

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.

10.7. Classification of Defects

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

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

10.8. Identification/marketing criteria

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

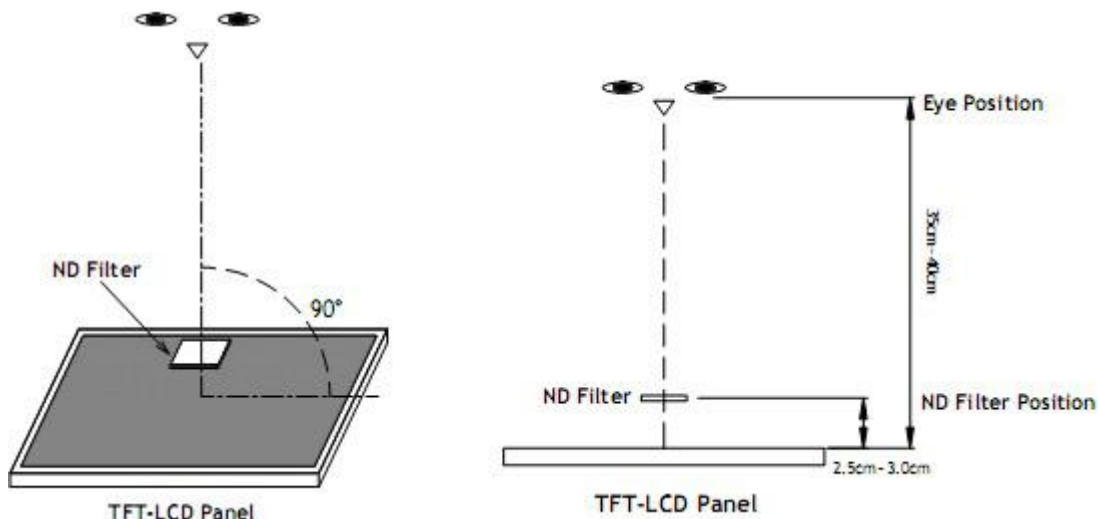
10.9. Packing

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

10.9.2. Modules inside package box should have compliant mark.

10.9.3. All direct package materials shall offer ESD protection.

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



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

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

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

11. Reliability Specification

No	Item	Condition	Quantity	Criteria
1	High Temperature Operating	70°C, 96Hrs	2	GB/T2423.2-2008
2	Low Temperature Operating	-20°C, 96Hrs	2	GB/T2423.1-2008
3	High Humidity	50°C, 90%RH, 96Hrs	2	GB/T2423.3-2006
4	High Temperature Storage	80°C, 96Hrs	2	GB/T2423.2-2008
5	Low Temperature Storage	-30°C, 96Hrs	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: $\pm 4KV$ 150pF/330 Ω 5 times Contact: $\pm 2KV$ 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.

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

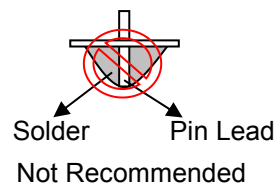
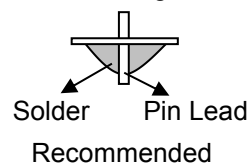
Maximum Solder Temperature: 370 °C

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

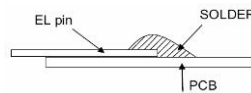
Typical Soldering Time: ≤2s

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

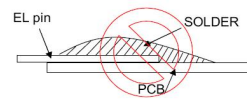
12.4.2.4. No horizontal press on the EL leads during soldering.

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

12.4.2.6. Solder Wetting

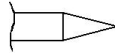


Recommended

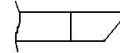


Not Recommended

12.4.2.7. The type of the solder iron:

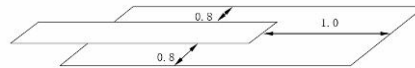


Recommended



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

