SPECIFICATION
FOR
LCM Module

MODULE No:	KD101FHFID030-01
CUSTOMER:	

STARTEK	INITIAL	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

CUSTOMER	INITIAL	DATE
APPROVED BY		

Revision History

Date	Rev. No.	Page	Summary
2022.06.16	V1.0	ALL	FIRST ISSUE

Contents

1.1 TFT Features....4
1.2 Mechanical Information....4
2. Block Diagram....5
3. Outline dimension....6
4. Input terminal Pin Assignment....7
4.1 TFT PIN Define....7
5. LCD Optical Characteristics....9
5.1 Optical specification....9
6. Electrical Characteristics....12
6.1 Absolute Maximum Rating....12
6.2 DC Electrical Characteristics....12
6.3 LED Backlight Characteristics....13
7. Signal Timing Specifications....15
7.1 MIPI Timing....15
7.2 Power ON/OFF Sequence....17
7.1 MIPI Timing....15
7.2 Power ON/OFF Sequence....17
7.2.1 Power on Timing Sequence....17
7.2.2 Power off Timing Sequence....18
7.3 Reset Iput Timing....18
8. LCD Module Out-Going Quality Level....20
8.1 VISUAL & FUNCTION INSPECTION STANDARD....20
8.1.1 Inspection conditions....20
8.1.3 Sampling Plan....21
8.1.4 Criteria (Visual)....22
9. Reliability Test Result....27
10. Cautions and Handling Precautions....27
10.1 Handling and Operating the Module....27
10.2 Storage and Transportation....27
11. Packing....28

* Description

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorpho us silicon TFT as a switching device. This module is composed of a Transmissive type TFT-LCD Pan el, driver circuit,back-light unit. The resolution of a 10.1'TFT-LCD contains 1200x1920 pixels, and can display up to 16.7M colors.

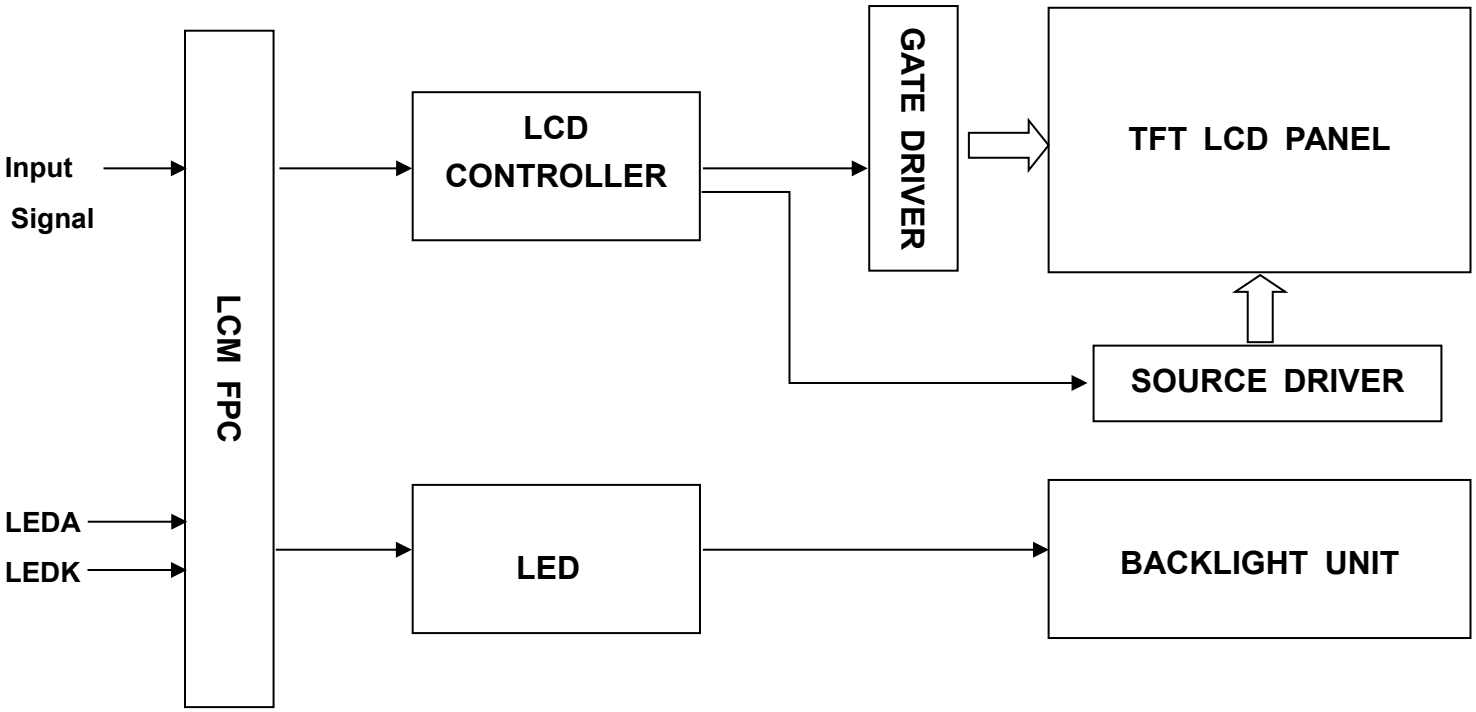
1.1 TFT Features

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	135.36(H)*216.58(V) (10.1 inch)	mm	
Driver element	TFT active matrix	-	
Display colors	16.7M	colors	
Number of pixels	1200(RGB)*1920	dots	
Pixel arrangement	RGB vertical stripe	-	
Pixel pitch	0.1128(H)*0.1128(V)	mm	
Viewing angle	ALL VIEW	o'clock	
Controller IC	HX8279D	-	
LCM Interface	4 LANE MIPI	-	
Operating temperature	-10～+50	℃	
Storage temperature	-20～+60	℃	

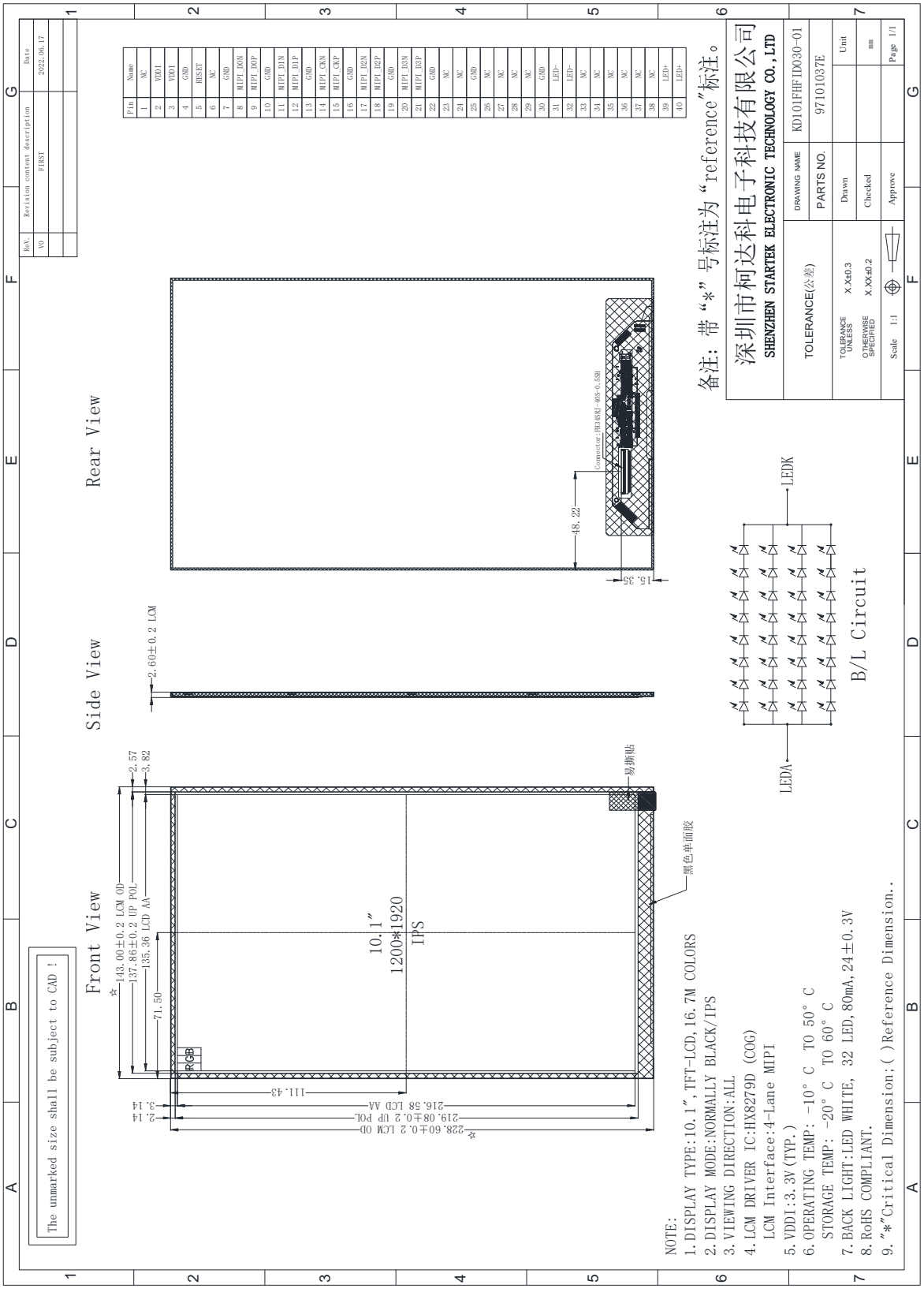
1.2 Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	-	143.00	-	mm	
	Vertical(V)	-	228.60	-	mm	
	Depth(D)	-	2.60	-	mm	
Weight		-	171	-	g	

2. Block Diagram



3. Outline dimension



4. Input terminal Pin Assignment

4.1 TFT PIN Define

NO.	SYMBOL	DISCRIPTION	I/O
1	NC	--	--
2	VDDIN	Power suppy 3.3V	P
3	VDDIN		
4	GND	Ground	P
5	RESET	Global reset signal	I
6	NC	--	--
7	GND	Ground	P
8	MIPI_0N	MIPI data input.	I
9	MIPI_0P		
10	GND	Ground	P
11	MIPI_1N	MIPI data input.	I
12	MIPI_1P		
13	GND	Ground	P
14	MIPI_CKN	MIPI clock input.	I
15	MIPI_CKP		
16	GND	Ground	P
17	MIPI_2N	MIPI data input.	I
18	MIPI_2P		
19	GND	Ground	P
20	MIPI_3N	MIPI data input.	I
21	MIPI_3P		
22	GND	Ground	P
23	NC	--	--
24	NC	--	--
25	GND	Ground	P
26	NC	--	--
27	NC	--	--
28	NC	--	--
29	NC	--	--
30	GND	Ground	P

31	LED-	LED Cathode	P
32	LED-	LED Cathode	P
33	NC	--	--
34	NC	--	--
35	NC	--	--
36	NC	--	--
37	NC	--	--
38	NC	--	--
39	LED+	LED Anode	P
40	LED+	LED Anode	P

5. LCD Optical Characteristics

5.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	Θ=0 Normal viewing angle	800	1000	--		
Response time	Rising	$T_{R+}T_F$		--	25	50	msec	
	Falling							
Uniformity		S(%)		54	59	--	%	
Color Filter Chromacicity	White	W_X		-0.04	0.283	+0.04		
		W_Y			0.307			
	Red	R_X			0.618			
		R_Y			0.361			
	Green	G_X			0.310			
		G_Y			0.562			
	Blue	B_X			0.149			
		B_Y			0.057			
Viewing angle	Hor.	ΘL	CR>10	--	85	--		
		ΘR		--	85	--		
	Ver.	ΘU		--	85	--		
		ΘD		--	85	--		
Option View Direction		ALL VIEW						

*The data comes from the LCD specification.

Measuring Condition

Measuring surrounding : dark room

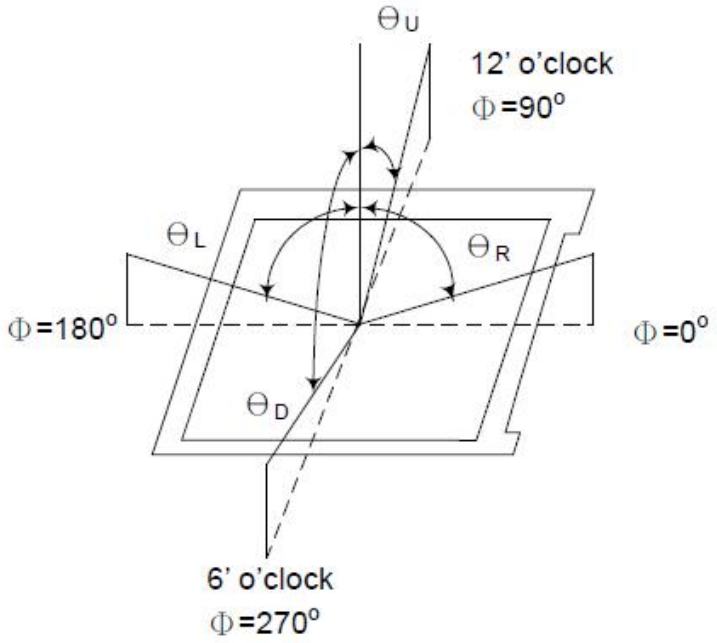
Ambient temperature : 25±2°C

15min. warm-up time.

Measuring Equipment

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

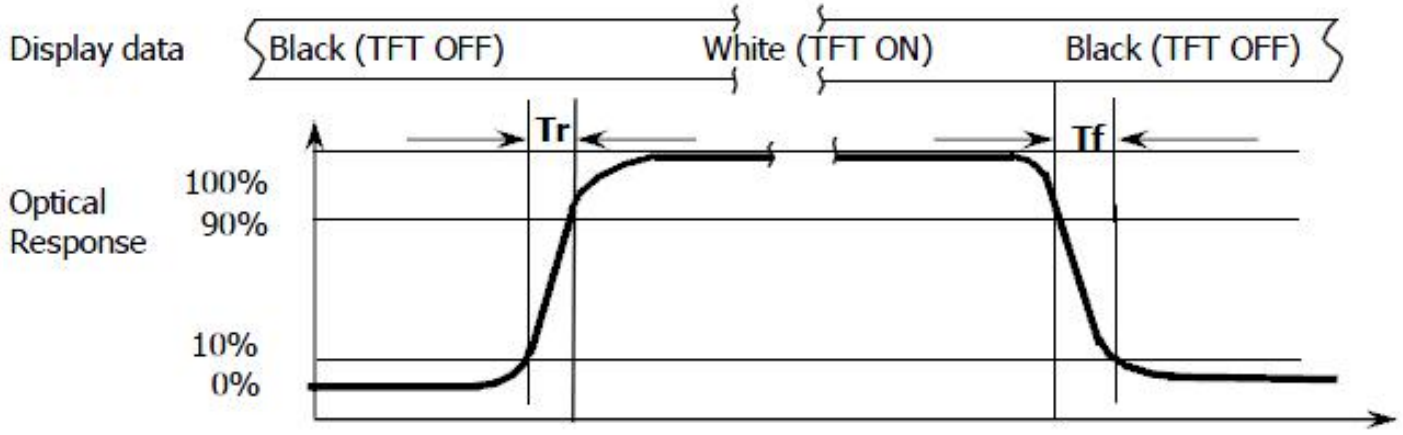
Note (1): Definition of Viewing Angle :



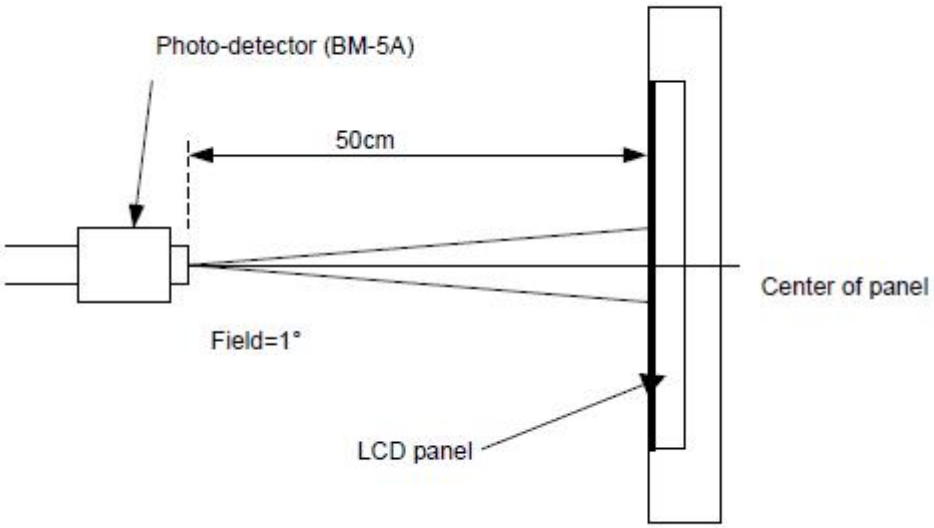
Note (2): Definition of Contrast Ratio(CR) :measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3): Response Time



Note (4): Definition of optical measurement setup



6. Electrical Characteristics

6.1 Absolute Maximum Rating

Characteristics	Symbol	Min.	Max.	Unit	Note
Digital Supply Voltage	VDD	-0.3	5.5	V	Note1
Operating temperature	T_{OP}	-10	+50	℃	
Storage temperature	T_{ST}	-20	+60	℃	

NOTE1: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

6.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	VDD	3.0	3.3	3.6	V	
Normal mode Current	IDD	--	130	260	mA	
Level input voltage	V_{IH}	0.7*VDD	--	VDD	V	
	V_{IL}	GND	--	0.3*VDD	V	

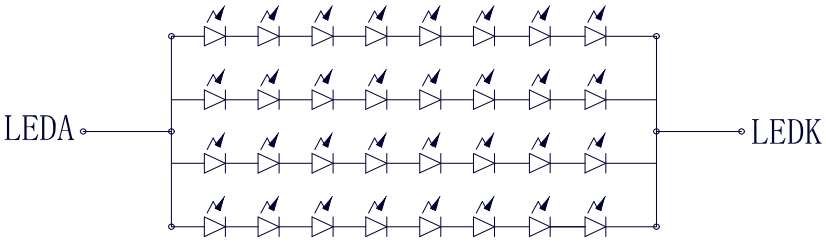
6.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 32 chips LED

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Forward Current	I_F	60	80	--	mA	
Forward Voltage	V_F	--	24	--	V	
LCM Luminance	LV	--	380	--	cd/m2	Note3
LED life time	Hr	--	50000	--	Hour	Note1,2
Uniformity	Avg	80	--	--	%	Note3

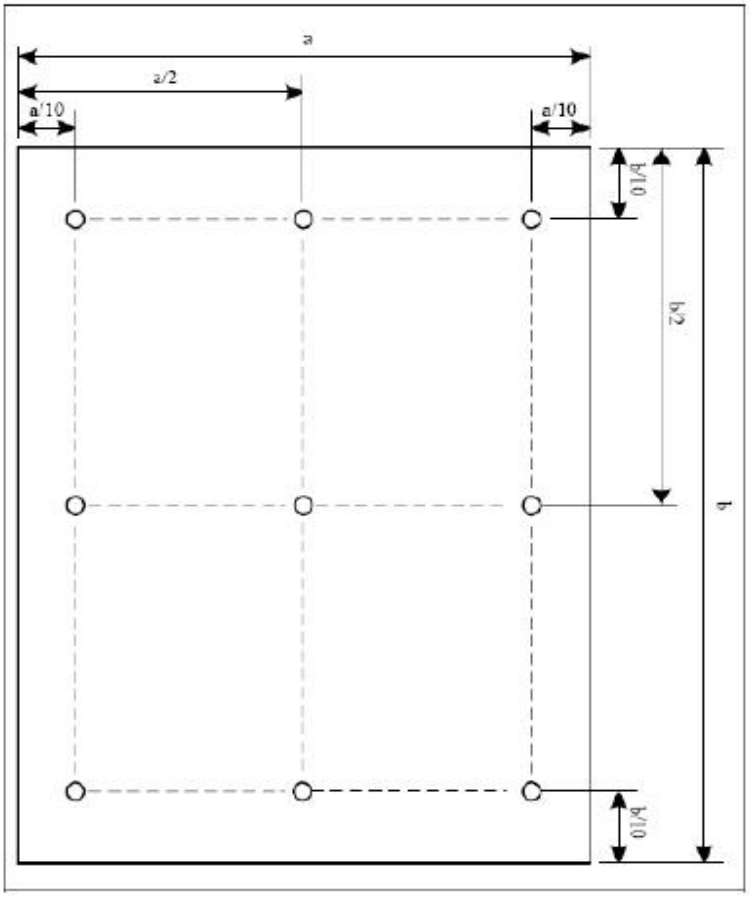
Note1: LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3 ℃, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and IL=80mA. The LED lifetime could be decreased if operating IL is larger than 80mA. The constant current driving method is suggested.



B/L Circuit

Note (3) Luminance Uniformity of these 9 points is defined as below:



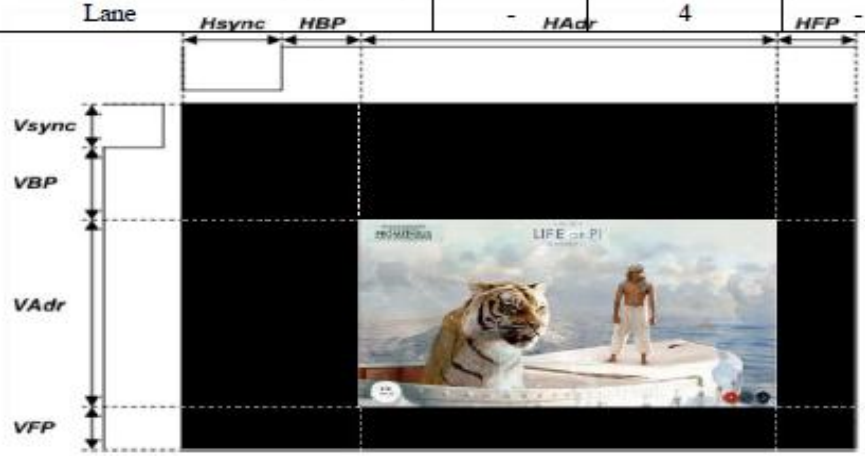
$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

$$\text{Luminance} = \frac{\text{Total Luminance of 9 points}}{9}$$

7. Signal Timing Specifications

7.1 MIPI Timing

ITEM			SYNBOL	min	typ	max	UNIT
LCD	Frame Rate		-	-	60	-	Hz
	Pixels Rate		-	156.8	156.8	159.9	MHz
Timing	Mipi CLK	Frequency	fCLK	490	490	498	MHz
		Period	Tclk	2.01	2.04	2.04	ns
	Horizontal	Horizontal total time	tHP	1343	1343	1366	t_{CLK}
		Horizontal Active time	tHadr		1200		t_{CLK}
		Horizontal Pulse Width	tHsync	1	1	1	t_{CLK}
		Horizontal Back Porch	tHBP	32	32	32	t_{CLK}
		Horizontal Front Porch	tHFP	110	110	133	t_{CLK}
	Vertical	Vertical total time	tvp	1946	1946	1951	t_H
		Vertical Active time	tVadr		1920		t_H
		Vertical Pulse Width	tVsync	1	1	1	t_H
		Vertical Back Porch	tVBP	14	14	14	t_H
		Vertical Front Porch	tVFP	11	11	16	t_H
Bit Rate			TX SPD (MBPS)	980	980	995	Mbps
Lane			-	-	4	-	Lane



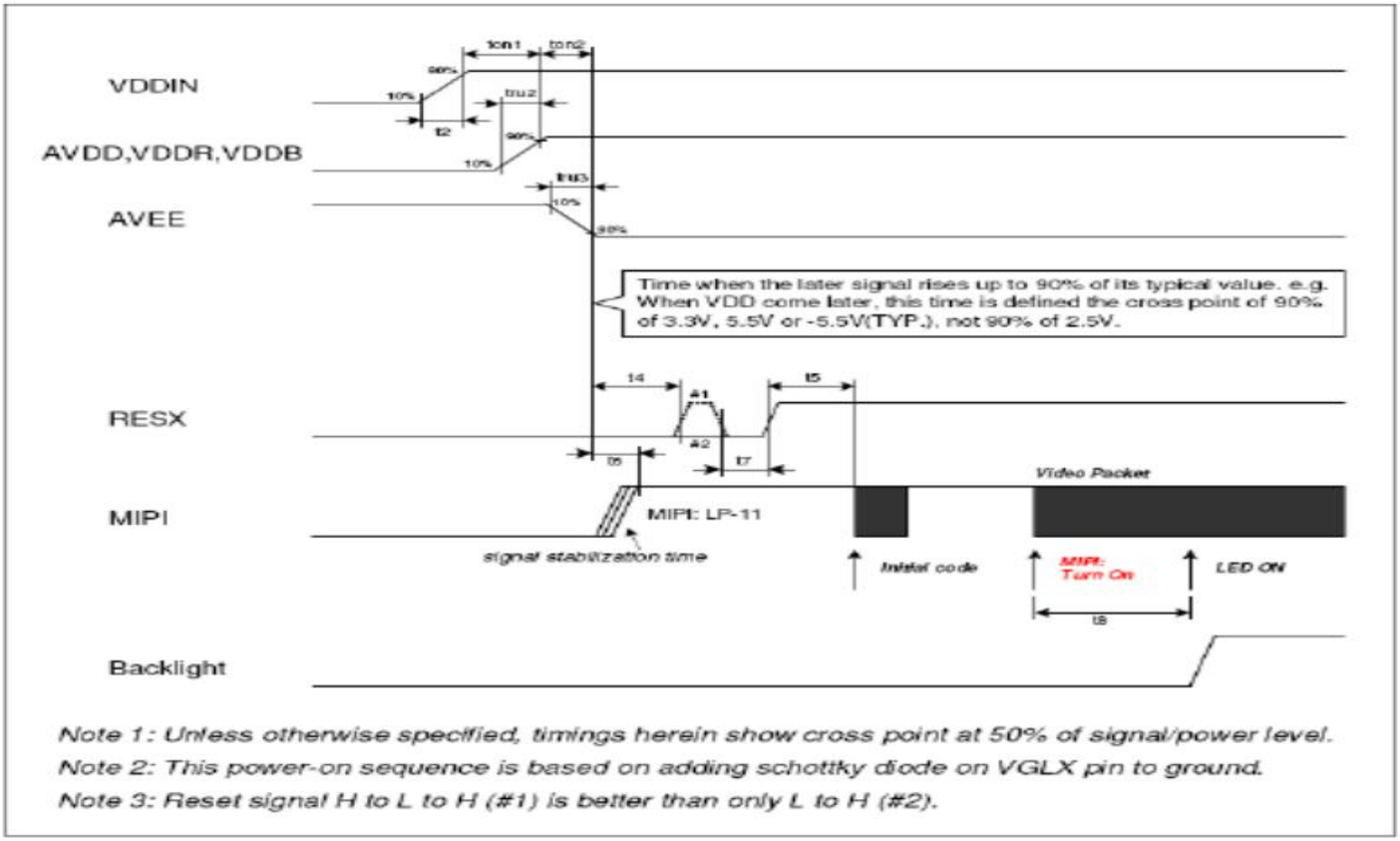
	MCU (Master) Display Module (Slave)
Clock Lane+/-	Unidirectional Lane ■ Clock Only ■ Escape Mode(ULPS Only)
Data Lane0+/-	Bi-directional Lane ■ Forward High-Speed ■ Bi-directional Escape Mode ■ Bi-directional LPDT
Data Lane1+/-	Unidirectional ■ Forward High speed
Data Lane2+/-	Unidirectional ■ Forward High speed
Data Lane3+/-	Unidirectional ■ Forward High speed

The connection between host device and display module is as reference.

7.2 Power On/Off Sequence

7.2.1. Power on Timing Sequence:

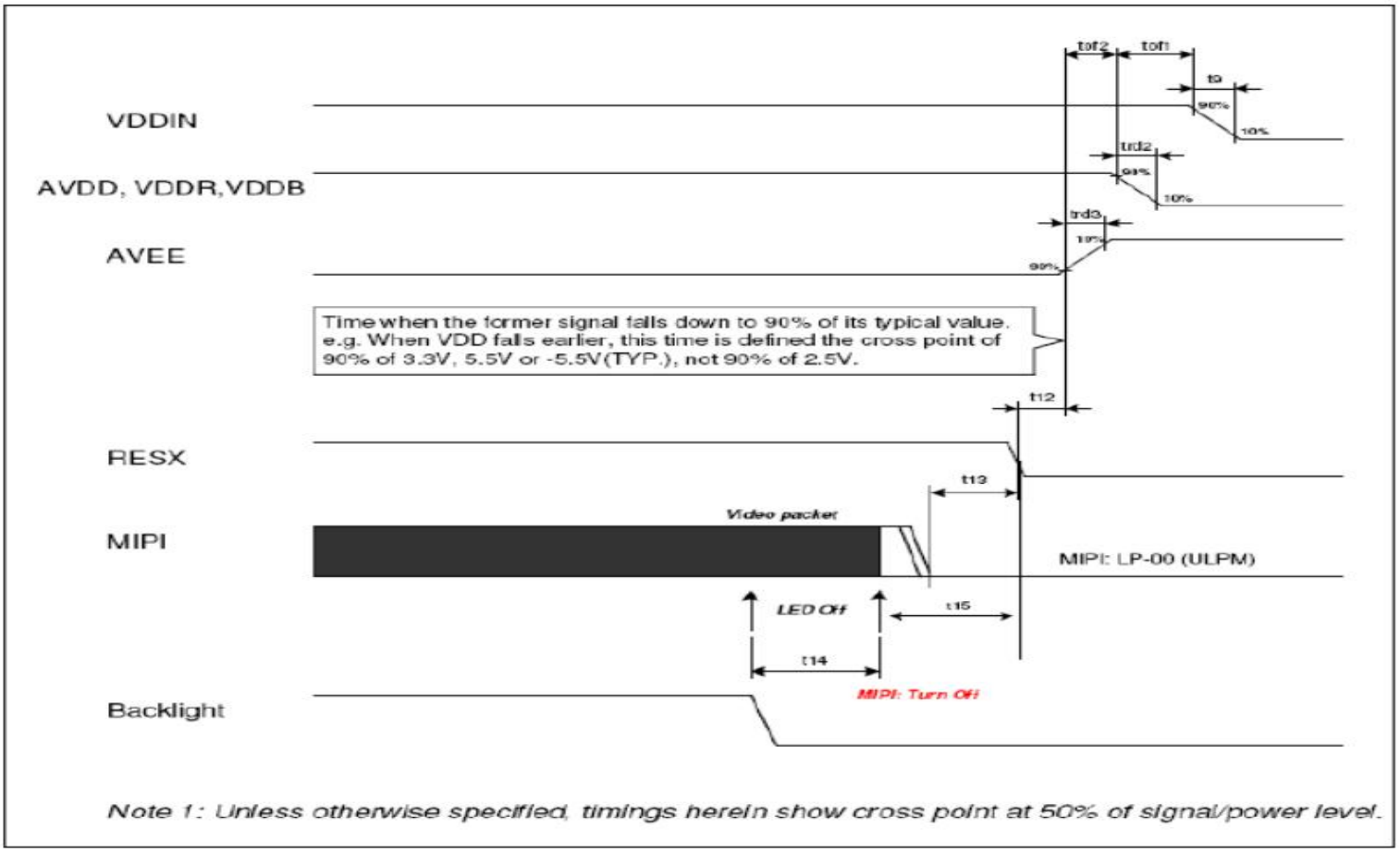
VDD=3.3V



Note 1: Unless otherwise specified, timings herein show cross point at 50% of signal/power level.
Note 2: This power-on sequence is based on adding schottky diode on VGLX pin to ground.
Note 3: Reset signal H to L to H (#1) is better than only L to H (#2).

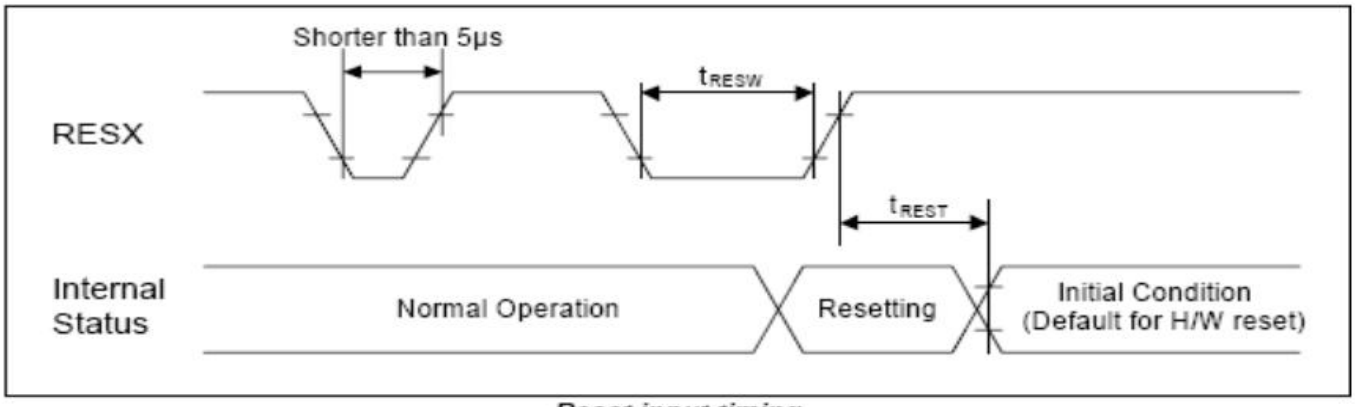
Symbol	Value			Unit	Remark
	Min.	Typ.	Max.		
ton1		No limit		ms	
ton2		0(Note)		ms	
ton3		No limit	-	ms	
ton4		No limit	-	ms	
t2			150	µs	
tru1			150	µs	
tru2			150	µs	
tru3			150	µs	
tru4			150	µs	
t4	40	-	-	ms	
t5	120			ms	
t6	0			ms	
t7	10			µs	
t8	8			VS	Keep data more than 8 frames (VS)

7.2.2 Power off Timing Sequence



Symbol	Value			Unit	Remark
	Min.	Typ.	Max.		
t9	150			µs	
tof1		No limit		ms	
tof2		0(Note)	-	ms	
tof3		No limit	-	ms	
tof4		No limit		ms	
trd1	150			µs	
trd2	150			µs	
trd3	150			µs	
trd4	150			µs	
t12	0		-	ms	
t13	0			ms	
T14	0			ms	
T15	10			ms	

7.3 Reset Iput Timing



Reset input timing

(VDDI=1.7~1.9V, VCI=3.0 to 3.6V, GND=0V,Ta = -30 to 70°C)

Signal	Symbol	Parameter	MIN	TYP	MAX	Unit	Description
RESX	tRESW	Reset "L" pulse width (Note 1)	10	-	-	µs	
	tREST	Reset complete time (Note 2)	-	-	5	ms	When reset applied during Sleep In Mode
			-	-	120	ms	When reset applied during Sleep Out Mode and Note 5

Note 1) 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 5µs	Reset Rejected
Longer than 10µs	Reset
Between 5µs and 10µs	Reset Start

Note 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 return to Default condition for H/W reset.

Note 3) During Reset Complete Time, values in OTP memory 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 RESX.

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

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

8. LCD Module Out-Going Quality Level

8.1 VISUAL & FUNCTION INSPECTION STANDARD

8.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

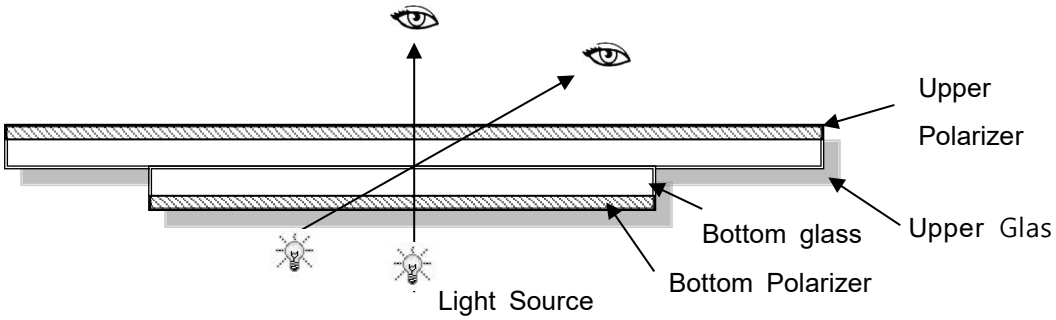
Temperature : 25±5℃

Humidity : 65%±10%RH

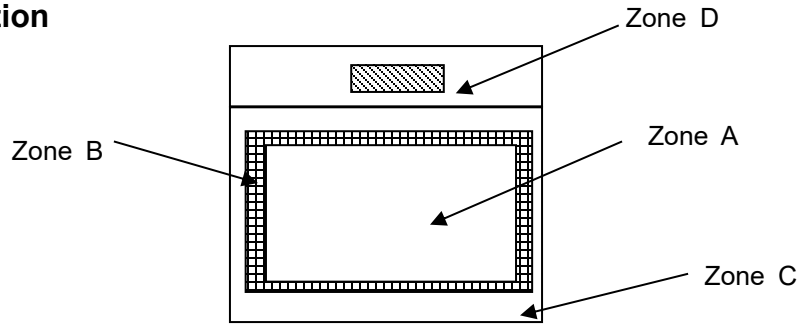
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



8.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C Cover (Zone A+Zone B) which can not be seen after assembly by customer .)

Zone D : IC Bonding Area

Note:

As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or ap pearance after assembly by customer

8.1.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class Ⅱ

AQL:

Major defect	Minor defect
0.65	1.5

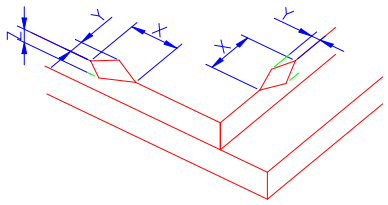
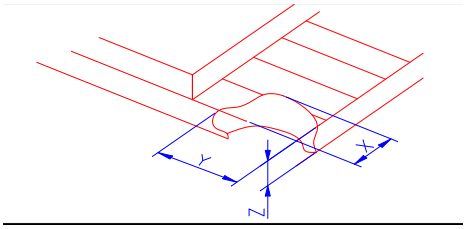
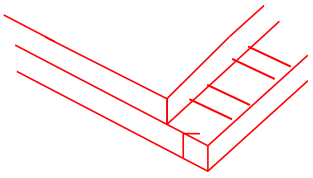
LCD: Liquid Crystal Display , LCM: Liquid Crystal Module, CTP: Capacitive Touch Panel

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. etc	Major
2	Missing	Missing components and etc	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed,deformation and etc	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Spot/Line defect	Light dot,Dim spot,(Note1) Polarizer Air Bubble, Polarizer accidented spot and etc	
6	Soldering appearance	Good soldering , Peeling off is not allowed and etc	
7	LCD/Polarizer	Black/White spot/line, scratch, crack, etc.	

Note1: a) Light dot：Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

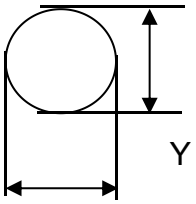
b) Dim dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.

8.1.4 Criteria (Visual)

<table>
<tr><th>Number</th><th>Items</th><th>Criteria(mm)</th></tr>
<tr><td rowspan="3">1.0 LCD Crack/Broken
NOTE:
X: Length
Y: Width
Z: Height
L: Length of ITO,
T: Height of LCD</td><td>(1) The edge of LCD broken</td><td> 
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr></table></td></tr>
<tr><td>(2)LCD corner broken</td><td> 
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table></td></tr>
<tr><td>(3) LCD crack</td><td> 
Crack
Not allowed</td></tr>
</table>

2.0

Spot defect



Φ=(X+Y)/2

① light dot (black/white spot , pinhole, stain, etc.)

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.15	Ignore	Ignore	
0.15<Φ≤0.25	3(distance≧10mm)		
0.25<Φ≤0.4	2(distance≧10mm)		
Φ>0.4	0		

② Dim spot (light leakage、dent、dark spot, etc)

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.15	Ignore	Ignore	
0.15<Φ≤0.25	3(distance≧10mm)		
0.25<Φ≤0.4	2(distance≧10mm)		
Φ>0.4	0		

③ Polarizer accidented spot

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.2<Φ≤0.5	2(distance≧10mm)		
Φ>0.5	0		

④Polarizer Bubble

Zone / Size (mm)	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.2<Φ≤0.4	2(distance≧10mm)		
Φ>0.4	0		

3.0 LCD Pixel defect

Pixel bad points

Item	Zone A	Acceptable Qt
Bright dot	Random	N≤2
	2 dots adjacent	N≤0
	3 dots adjacent	N≤0
Dark dot	Random	N≤3
	2 dots adjacent	N≤0
	3 dots adjacent	N≤0
Distance	1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot.	5mm
Total bright and dark dot		N≤4

Note:

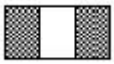
A) Bright dot：Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

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

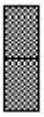
C) 2 dot adjacent = 1 pair = 2 dots

Picture:

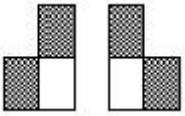
2 dot adjacent



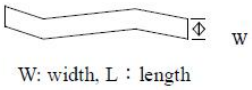
2 dot adjacent



2 dot adjacent (vertical)



2 dot adjacent (slant)

<table>
<tr>
<td>4.0</td>
<td>Line defect (LCD /Polarizer backlight black/white line, scratch, stain)
 

N：Count</td>
<td>
<table>
<tr><th rowspan="2">Width(mm)</th><th rowspan="2">Length(mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.05</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.05<W≤0.06</td><td>L≤5.0</td><td colspan="2">N≤3</td></tr>
<tr><td>0.06<W≤0.08</td><td>L≤4.0</td><td colspan="2">N≤2</td></tr>
<tr><td>W>0.08</td><td colspan="4">Define as spot defect</td></tr>
</table>
</td>
</tr>
<tr>
<td>5.0</td>
<td>Electronic Components SMT.</td>
<td>Not allow missing parts，solderless connection，cold solder joint，mismatch，The positive and negative polarity opposite</td>
</tr>
<tr>
<td>6.0</td>
<td>Display color& Brightness.</td>
<td>1. Color：Measuring the color coordinates, The measurement standard according to the datasheet or samples.
2. Brightness：Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples.</td>
</tr>
<tr>
<td>7.0</td>
<td>LCD Mura/Waving/ Hot spot</td>
<td>Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary.</td>
</tr>
</table>

Criteria (functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed
5	CTP no function	Not allowed

9. Reliability Test Result

Item	Condition	Inspection after test
High Temperature Operating	50℃,96H	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Non-display; 3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value.
Low Temperature Operating	-10℃, 96HR	
High Temperature Storage	60℃, 96HR	
Low Temperature Storage	-20℃, 96HR	
High Temperature & High Humidity Operating	+60℃, 90% RH ,96 hours.	
Thermal Shock (Non-operation)	-20℃,30 min ↔ 60℃,30 min, Change time:5min 20CYC.	
ESD test	C=150pF, R=330,5points/panel Air:±8KV, 5times; Contact:±6KV, 5 times; (Environment: 15℃~35℃, 30%~60%).	
Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) (Package condition).	
Box Drop Test	1 Corner 3 Edges 6 faces,80㎝(MEDIUM BOX)	

Remark:

1.The test samples should be applied to only one test item.

2.Sample size for each test item is 5~10pcs.

3.For Damp Proof Test, Pure water(Resistance > 10MΩ) should be used.

4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.

5.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

10. Cautions and Handling Precautions

10.1 Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly.
Do not warp or twist the module during assembly work.
(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
(4) Do not allow drops of water or chemicals to remain on the display surface.
If you have the droplets for a long time, staining and discoloration may occur.
(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.
Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.
(8) Protect the module from static; it may cause damage to the CMOS ICs.
(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
(10) Do not disassemble the module.
(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
(12) Pins of I/F connector shall not be touched directly with bare hands.
(13) Do not connect, disconnect the module in the “Power ON” condition.
(14) Power supply should always be turned on/off by the item 6.1 Power On Sequence &6.2 Power Off Sequence

10.2 Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 ℃ and relative humidity of less than 70%
(2) Do not store the TFT-LCD module in direct sunlight.
(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.
In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.

(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

11. Packing

----TBD----------